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Proposal: Modify the Estuary Management Plan to permit dredging in a Natural Aquatic zone
Comments of Michael Graybill to the City of Coos Bay Community Development Department
Applicant: Jordan Cove Energy Company
March 20, 2019

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March 22, 2019

To whom it may concern

In response to a public notice and request for comments, I attach comments on the application by Jordan Cove Energy Company to modify the Coos Bay Estuary management plan in order to secure various land use authorizations to expand the width of the deep draft navigation channel into a p portion of the estuary presently designated for high level natural conservation purposes.

The Jordan Cove Energy Project L.P. has applied to the City for a Comprehensive Plan Map Amendment to the Coos Bay Estuary Management Plan to 1) change the designation of approximately 3.3 acres from 52-NA to DDNC-DA; 2) change text in the Comprehensive Plan to take a reasons exception to statewide planning goal 16 to authorize the proposed map amendment; 3) an Estuarine and Coastal Shoreline Uses and Activities Permit for "New and Maintenance Dredging" in the DDNC-DA Estuarine Zone; and 4) an Estuarine and Coastal Shoreline Uses and Activities Permit to allow an accessory temporary dredge transport pipeline in the 52-NA, 53-CA, 54-DA and 55-CA Estuarine Zones.

I am aware that the proposal before your city is centered on a portion of the work associated with only one of four proposed Navigation Reliability Improvement (NRI) dredge areas associated with the Jordan Cove Energy project. I understand that only one of the proposed dredge areas falls within the city of Coos Bay's jurisdictional boundaries (NRI-4) and that material dredged from the proposed NRI in your jurisdiction is planned to be transported out of your jurisdiction and disposed of in the jurisdiction of the City of North Bend. While your city's analysis and decision making may be inclined to address land use considerations related to a portion of one of the four proposed NRIs, be assured that estuarine ecosystem will need to address the impacts associated with all four of the proposed dredge areas, regardless of the political jurisdictions in which the proposed work will be conducted.

Your city is charged with implementing a portion of the Coos Bay Estuary Management Plan; a plan developed to support the coordinated conservation and development of the entire estuarine system. There is no doubt that the work associated with the Jordan Cove Project spans multiple jurisdictions. It is my belief that the three jurisdictions charged with implementing the provisions of the Coos Bay Estuary Management Plan should be conducting their analysis and respective permit reviews in a coordinated manner.

As a participant and supporter of the CBEMP's development and implementation, I can assure you that the founders of the plan expected land use decisions related to estuary development to be coordinated by all the political jurisdictions fortunate enough to include a portion of the estuary within their boundaries. This proposal is a test case for Oregon's land use planning framework. The CBEMP was developed as a special area management plan to protect against a fragmented "death by a thousand cuts" decision making framework. This outcome can only be avoided through open coordination with the other jurisdictions also involved in reviewing other aspects of the activities proposed for your jurisdiction that also necessitates work in other jurisdictions also charged with implementing the provisions of the CBEMP.

The information and analysis that I have attached to this cover letter addresses all four of the NRIs proposed for the Coos Estuary by this applicant. The information provided to you by the applicant has treated all four NRI areas in a similar matter. I contest the applicant's "batch processing" approach to securing land use authorizations for the various NRIs because this approach ignores the unique attributes (and zoning designations) of each of the four locations. For this reason, and the other reasons outlined in the attached analysis and supporting exhibits, I hope you also find reasons to question the applicant's approach and to deny the applicant's requests.

Exhibit 12 is the staff analysis developed by Land Council Of Governments (LCOG) in support of the City of Coos Bay Planning department's analysis of the proposed NRI-4 land use requests. I am grateful to the LCOG and the City staff for making this report available for public review. The attached Adobe acrobat file version of the LCOG staff analysis identified as Exhibit 12 includes my own annotations, comments, and responses to the findings and analysis in the staff report. Please also consider these comments as my own in addition to the comments I have provided in the draft narrative that follows this cover letter.

Thank you for providing the opportunity to comment.
Sincerely

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Proposal: Modify the Estuary Management Plan to permit dredging in a Natural Aquatic zone
Comments of Michael Graybill to the City of Coos Bay Community Development Department
Applicant: Jordan Cove Energy Company
March 20, 2019

The following comments address land use application requests submitted by Jordan Cove Energy (the applicant) to the planning departments of Coos County and the City of Coos Bay. The applicant has requested various land use zoning changes in order to enable the Jordan Cove Energy Project to dredge four portions of the Coos Estuary referred to as "Navigation Reliability Improvements" or NRIs.

Comments specific to one or more of the NRIs will be identified as such. Comments directed specifically to NRI-4 are intended to address specific aspects of the application materials submitted to the City of Coos Bay Planning department. Comments directed specifically to NRIs 1-3 are intended to address specific aspects of the application materials submitted to the Coos County planning department Comments that do not call out one or more specific NRI are intended to address the applications under review by both the Coos County and City of Coos Bay planning departments.

The applications related to the NRIs fail to address major issues associated with the proposed changes. Examples of some of the key findings addressed by my comments are summarized in the numbered list that follows. Additional analysis is provided in the narrative section that follows this summary list as well as annotated comments embedded in Exhibit 12 associated with these comments.

1. The applicant has failed to address the cumulative impacts of multiple environmental stressors associated with the overall activities needed to render the NRIs of use.

2. The applicant's assertions regarding the productivity of sub tidal habitats are inadequately substantiated.

    The applications universally under estimate the scale of the likely impacts
    The applications universally understate the duration of the likely impacts

3. Noise impacts associated with the proposed work not adequately addressed.

4. Impacts to diving waterfowl and other living resources dependent on portions of the estuary in the vicinity of the proposed NRIs are not considered but are a likely consequence of the proposed actions. Examples of impacted species include but are not limited to Surf Scoter, Pacific, Red-Throated, and Common Loon, Western, Red Necked, and Eared Grebe, Greater Scaup, Common Goldeneye, Brant Goose, Pacific herring, Dungeness crab, Eulachon and sand shrimp.

5. The applications do not adequately address the telegraphic effects of the proposed work on adjoining portions of the estuary including but not limited to increased wave impacts to adjacent sub tidal and intertidal shoreland habitats.

6. The applications do not adequately address the telegraphic impacts linked to Increased wave and hydrodynamic impacts to eelgrass and surf grass habitats adjacent to the NRI's

7. The applications do not adequately address the specific dredging methods to be employed or the potential shore side impacts associated with mobilization and demobilization of dredging equipment.

8. The applications do not adequately address the potential impacts of the dredging operations and dredged material transfer operations to Marine mammals including, California Sea Lions, Harbor Porpoises, Killer Whales and resident breeding population of Harbor Seals.

9. The proposed work does not appear to be necessary for the type of navigation proposed by the applicant.

10 The Public Benefits of the project are not adequately substantiated.

11 The applications do not address potential safety considerations resulting from modifying the hydrodynamic characteristics of the navigation channel. Expansion of the width of the navigation channel as a result of the construction of the NRI has potential to enhance the propagation of tidal and tsunami wave energy in the estuary posing a potential increased threat of harm to people and property in the estuary and impacts to living resources resulting from alterations of the salinity characteristics of the estuary.

12 No mitigation has been proposed it offset anticipated and likely impacts associated with the proposed work.

Dredging of the existing navigation channel would remove an estimated 580,000 to 700,000 cubic yards of material and would construct a temporary pipeline on the channel bottom for several miles to remove the dredged material. Following initial construction of the NRIs, maintenance dredging at the slip, access channel, and navigation channel (NRI areas) would require dredging of between 34,600 – 37,700 cubic yards of material annually and additional dredging of the navigation channel of between 27,900 – 49,800 cubic yards of material every three years. (U.S. Army Corps of Engineers. Public Notice Application for Permit and to Alter Federally Authorized Projects. 60-day notice. NWP-2017-41. 22 May 2018. P. 3-6.)

Initial construction dredging and periodic maintenance dredging will directly and permanently remove benthic organisms, such as worms, clams, and shrimp, from the bottom of the bay. Crabs, shrimp, clams, oysters, and fish could become entrained in the operation of the dredging equipment.

The Coos Bay Estuary Management Plan requirements of Policy 5(I) implement and mimic the language of Statewide Planning Goal 16, Implementation Requirement 2:

"Dredging and/or filling shall be allowed only:

> a. If required for navigation or other water-dependent uses that require an estuarine location or if specifically allowed by the applicable management unit requirements of this goal; and,
> b. If a need (i.e., a substantial public benefit) is demonstrated and the use or alteration does not unreasonably interfere with public trust rights; and
> c. If no feasible alternative upland locations exist; and,
> d. If adverse impacts are minimized.

> Other uses and activities which could alter the estuary shall only be allowed if the requirements in (b), (c), and (d) are met."

The proposed work will result in unacceptable cumulative impacts to estuarine habitats associated with the dredged material excavation, transfer and disposal operations. (see application exhibit 4 page 2)

This commenter recognizes that the material to be dredged from the four NRIs in the jurisdictions of the City of Coos Bay and the unincorporated portions of Coos County lie within the area encompassed by the Coos Bay Estuary Management Plan (CBEMP). It should be noted that an additional land use authorization in the jurisdictional boundaries of the City of North Bend will also be needed before it will be possible to transfer the materials dredged from the NRI dredge areas to the proposed upland dredged material disposal areas designated "APCO 1" and "APCO 2". Transfer of material dredged from the NRIs will require the installation of up to 5 pilings in an estuarine intertidal eelgrass bed in the city of North Bend near the APCO dredged material disposal area. Therefore, it is not possible to accomplish the sediment removal (dredging) work proposed in the NRIs in the absence of concurrence and land use approvals for aspects of the NRI dredging work taking place within the North Bend city limits. (See page 12 Exhibit 1 Draft Resource Report Supplement Navigation Reliability Improvements Jordan Cove Energy Project July 2017).

The applicant states the pilings will be installed at the North Bend dredged material transfer location on a temporary basis. There will doubtless be disturbance to the eelgrass during piling installation as well as piling removal. In materials provided to the Federal Energy Regulatory Commission and to the Oregon Department of State Lands, the applicant states that the material dredged from the NRI during expected triennial maintenance operations will also be spoiled at the APCO disposal site. No discussion is provided to determine if a piling supported pipeline system will also need to be installed at this location in order to transfer dredged material produced during maintenance operations to the APCO site.

If it becomes necessary to install and remove 4-5 temporary pilings each time the need arises to transfer material produced during maintenance dredging of the the NRI sites to the APCO sites, it is likely the eelgrass beds adjacent to the APCO dredged material transfer pipeline route will be exposed to repeated disturbances associated with repeated installation and removal of the "temporary" pilings necessary to elevate the dredge pipe above the eelgrass surface. The cumulative effects of the disturbance associated with regular, and repeated installation and removal of pilings in these eelgrass beds would likely result in long term decline and loss of eelgrass habitats in the vicinity of the proposed work.

Placement and operation of dredged material transfer pipeline and associated booster pumps is imprecisely described rendering it impossible to provide an accurate assessment of the applicability of the proposed work to the various estuary zoning districts to be crossed by the dredged material transfer pipeline (see application exhibit 4 page 3)

In a description of the operations associated with NRI Dredge Area #1 the applicant states that two sediment transfer booster pumps "*may*" be required to pump dredged material a distance of 8.2 miles from the excavation site to the APCO disposal area. The applicant further states the booster pumps will be located "as required" on a barge *"or"* on pile supported platforms. The applicant further states that materials associated with dredging *"if used"* will be removed. Because the methods to be employed are not clearly defined, it is difficult if not impossible to provide an objective assessment of the possible impacts associated with the work.

As a way to demonstrate why the applicant's imprecise characterization of the operations precludes an objective analysis of the ecological impacts as well as the zoning implications of the proposed work, I offer a few illustrative, but not exhaustive examples:

1. The airborne noises generated by the construction and installation of a pile supported platform support for a booster pump will be different from the noise associated with mooring a barge supported booster pump.

2. During excavation and dredge material transfer operations, noise propagated into the water from dredge cutter heads and sediment transfer booster pumps mounted on floating, barge mounted supports can reasonably be expected to differ significantly from the noise propagated into the water from the same booster pumps supported above the water surface by a pile supported platform. The type of dredged material transfer pipeline used also has potential to influence the manner in which noises are propagated from the pipe. Thick walled plastic pipe is likely to have different acoustic characteristics than metallic pipe. Similarly, the noise associated with a suction cutter head dredge can reasonably be expected to be dissimilar to the noise associated with a clam shell type dredge or excavator type dredge. Other dredging operations requiring removal of bedrock in this estuary have necessitated the use of explosives to fracture the bedrock prior to removal from the estuary bottom. Certainly, dredging operations that necessitate the use of explosives will have acoustic characteristics that differ from other possible methods the applicant suggested might be used to construct the NRIs

3. The ecological consequences associated with the locations selected for individual booster pump installations are *very* place sensitive. In order to assess potential ecological and zoning implications of this proposal, the number, location, and methods used to install, operate, maintain and remove each of the pumping stations must be clearly specified. The applications provide no information regarding the specific number or proposed locations of the booster pump stations. For example, the proposed dredged material transfer pipeline route will cross sections of the estuary that support two important harbor seal haul out and pupping locations. In addition, resident harbor seals forage and mate in the waters of the estuary in the vicinity of the proposed NRIs.

The varied zoning districts within the Coos Bay Estuary Management Plan provide evidence that the resource values of varying locations within the bay are distinct and not homogeneous. This example is provided to demonstrate that placement of a booster pump immediately adjacent to a seal pupping and haul out site will have different considerations and potential impacts than a similar pump placed at a distance from that same haul out site and pupping locations. Further, certain zoning districts within the CBEMP may impose limits on installation of pile supported structures but may place differing limits on mooring barges in that same zone. Prior to issuance of any authorizations or approvals, the planning departments should require the applicant to provide information with sufficient detail to enable the departments and other reviewers to conduct an analysis of the ecological and land use implications of the proposed activities.

The applications provide only a qualitative characterization of underwater and airborne sounds to be produced by the proposed work. No quantitative characterization of the nature of sounds (e.g. time of day, frequency, intensity, periodicity) produced by the proposed dredging operations is provided to enable an objective assessment of the potential impacts to resources in the vicinity of the proposed work. Much of the dredging and sediment handling work associated with the construction of the proposed NRIs will take place immediately adjacent to areas of the estuary zoned "NA" and "CA" which prioritize protection for living resources. These factors must be considered during review of these applications as they hold potential to conflict with the management objectives of the various zoning districts in the vicinity of the proposed activities. Provisions of Goal 15 and the Coos Bay Estuary Management plan require authorizing jurisdictions to confirm that the proposed work is compatible with the intended management objectives of adjoining zoning units. It is not possible to determine if the proposed work is compatible with the management objectives of the CA and NA zones because insufficient information has been provided in order to enable this type of determination to be made.

The applicants should be required to provide additional information regarding direct mortality impacts to listed fish and marine organisms from the proposed NRI dredging and sediment transfer activities in Coos Bay. The proposed hydraulic cutterhead dredge method will entrain juvenile fish, including threatened salmonids, as well as benthic organisms critical to salmon diets. Mechanical sediment removal methods employing excavators or clamshell dredges would not have the same fish entrainment impacts, but Jordan Cove has not specified the actual methods to be used. Therefore, it is not possible to evaluate the potential impacts of the proposed work.

Pacific Eulachon (also known as candlefish) utilize Coos Bay and may be present in the estuary during NRI construction and maintenance operations. Eulachon typically spend three to five years in saltwater before returning to freshwater to spawn in late winter through mid-spring. Eulachon are a small fish that are rich in calories and important to marine and freshwater food webs, as well as commercial and recreational fisheries and indigenous people from Northern California to Alaska. The application does not adequately assess potential impacts to this species as a result of the dredge and fill operations proposed in Coos Bay.

Similarly, the peak period of non-breeding waterfowl use in the Coos Estuary is during the period between September and May. The period of peak waterfowl activity overlaps with the ODFW in water dredging work window. The applicant has stated its intention to conduct dredging operations during the in-water work window to minimize impacts to listed Coho salmon, but this will require work likely to result in maximal disturbance to waterfowl and other species whose life cycles are focused on the bay during the September to May time period.

The lower portion of the estuary in the vicinity of NRI area 1 and NRI area 2 is a particularly important winter feeding area for Surf Scoters and other diving ducks. The species that frequent this portion of the estuary are benthic feeders and must dive from the surface and swim to the bottom of the estuary where they forage on clams and other benthic organisms. The distinct, localized distribution of diving ducks in the estuary is strongly correlated to the occurrence of bedrock benthic subtidal habitats known to occur in this portion of the estuary. It is highly likely that Surf Scoters foraging in the lower portions of the estuary are targeting sub tidal rock bottom habitats in the estuary as a preferred feeding area. The dredging work in NRI 1 and NRI 2 will involve removal of bedrock habitats in the immediate area of the greatest observed wintering resting and feeding aggregations of Surf Scoters and diving ducks in the Coos Estuary. Similar patterns of diving bird use of the lower estuary that are correlated with rock substrate sub tidal habitats also occur for other species including Red Necked, Western and Eared Grebes, Common, Red Throated and Pacific Loons, and Pigeon Guillemots.

Dredging the bedrock portions of the estuary in NRI areas 1-3 will result in the deepening of a sub tidal rock substrate that appears to be a preferred foraging habitat for multiple species of diving waterfowl. In addition to the direct displacement of waterfowl on the bay surface by dredging equipment and activities, the newly dredged bedrock areas will be fully defaunated thereby diminishing the limited portion of the estuary bottom being targeted by this species. Finally, even if the biota occupying the rock substrates to be impacted by the rock dredging activities, the recovered biota will be at a significantly deeper portion of the sub tidal zone of the estuary and will be more difficult to access by diving, benthic feeding birds.

Multiple marine mammal protection act covered species are present in the proposed area of work. Marine mammals, especially pinnipeds, are sensitive to noise disturbances. Jordan Cove proposes install steel piles for the dredge material transfer operations in North Bend as well as possible pilings to support booster pumps along the dredged material transfer pipeline route. Previous rock dredging work conducted by the US Army Corps of Engineers in the vicinity of NRI areas 1-3 employed an excavator mounted on a jack up barge to fracture bedrock sediments which were subsequently brought to the surface using a clamshell dredge. These materials were transferred to the disposal area via barges and scows. This prior experience suggests that excavators mounted on jack up barges have been previously employed to excavate bed rock materials in the vicinity of the NRIs in the lower portion of the estuary. the applicant makes no reference to the potential use of Jack up Barges as a dredging method. Should this method be required, the support legs and mooring points to position the Jack up Barge will likely result in bottom disturbances that are not address by the applications and will produce sounds not addressed by the application (For a recent review of the impacts of sound on marine mammals see https://www.aquaticmammalsjournal.org/index.php?option=com_content&view=article&id=1886:marine-mammal-noise-exposure-criteria-updated-scientific-recommendations-for-residual-hearing-effects&catid=174&Itemid=326).

Benthic organisms that are vital to the natural dynamic processes and productivity of the Coos estuary reside in recognized high-quality, Natural Aquatic and Conservation Aquatic areas that would be permanently altered by the proposed action. In soft sediment dredging areas within the NRIs Dredging activities would also degrade the habitat of the native estuarine shrimp species including mud shrimp. Estuarine shrimp are especially sensitive to the kind of disturbance caused by the proposed dredged material transfer pipeline. Mud shrimp are already impacted by an introduced parasitic isopod called *Orthione griffenis* (https://theworldlink.com/news/local/invader-kills-off-mud-shrimp/article_fa08c2d9-47e9-5cb6-83d3-6bad07ec3bdf.html) Estuarine shrimp are filter feeders and are important components of the diet of juvenile Harbor seals, shorebirds and waterfowl. As a result, degrading habitat for shrimp could further diminish the ecological integrity of the estuarine system.

Oregon's Biocriteria standard is intended to assess the total impact to a biological community, including multiple stressors and cumulative effects. OAR 340-041-0011 provides that "Waters of the State shall be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities." DEQ's regulations define "without changes in the resident biological community" to mean "no loss of ecological integrity when compared to natural conditions at an appropriate reference site or region". (OAR 340-041-0002). "Ecological integrity" means "the summation of chemical, physical and biological integrity capable of supporting and maintaining a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitat for the region." (OAR 340-041-0002). In this way, the Biocriteria standard complements the other environmental quality standards.

Based on all of the potential impacts to aquatic species, marine mammals, and fish associated with the proposed action, the applicants have failed to demonstrate that the project is consistent with the protection and conservation of Oregon's waters as required in statewide planning Goal 16. Therefore, the requested actions should be denied.

The applicant has failed to address the cumulative impacts of multiple environmental stressors associated with the overall activities needed to render the NRIs of use.

While the applicant suggests that all impacts would be temporary and localized, the significant re-shaping of Coos Bay and waterway and shoreland crossings from the dredged material transfer pipeline, together with ongoing maintenance operations and discharges, would result in permanent and/or chronic cumulative detrimental changes in the resident biological communities and fundamental circulation and salinity characteristics in the estuary.

The significant difference the proposed dredging here makes for navigation in Coos Bay is primarily that it introduces a whole new category of deep draft channel users (LNG tankers) that are more complex and hazardous than other forms of commercial navigation. The effects of operation should be considered because the application raises those effects on operation as the core purpose of the channel dredging.

The utility of the proposed NRIs will only be fully realized if the proposed Jordan Cove Energy Project is built. Construction of the new LNG terminal will require dredging in a 17-acre portion of the estuary to connect the proposed LNG carrier berth to the existing Coos Bay Federal navigation channel. The full realization of the potential benefits being used by the applicant to justify the proposed work rely on the construction and operation of the proposed LNG terminal Therefore, the impacts associated with the construction and operation of the terminal should also be considered a component of the impacts associated with the construction of the NRIs.

Applicants Fail to Demonstrate Public Benefits to Navigation from NRI Dredging

According to the applications, the NRI dredging would not change allowable vessel dimensions, but would allow navigation of the Federal Navigation Channel at higher windspeeds. The applications state that, according to JCEP modeling, the navigation reliability improvements would increase the volume of LNG that might shipped by about 38,000 tonnes/ year if the proposed terminal is constructed as currently envisioned.

During oral testimony the applicant has repeatedly asserted that the proposed NRIs will make the use of the channel safer, more efficient, and more cost effective for all large merchant vessel types calling on the Coos estuary. Project proponents have provided testimony that vessel arrivals and departures can be delayed by a variety of conditions including; ocean wave height and swell direction, wind speed and direction, and visibility including fog, rain, darkness and mist. The applicant has stated that the NRIs would specifically enable vessel transits in the navigation channel that are limited by certain types of windy conditions. However, the applicant has not provided any empirical evidence or quantitative analysis to demonstrate what percentage of the total vessel transit delays are caused by exceedance of wind limitations imposed by the existing channel configuration. Reviewers are left with no objective means to judge what portion of all current transit delays would be removed as a result of construction of the NRIs.

The improvements proposed here are a response to a private need for channel dredging, not a public one. The applicants have not demonstrated that the NRI dredging will meaningfully improve navigation conditions for vessels other than the LNG carriers proposed by the applicants. LNG carriers are taller and longer than other vessels currently using this estuary making them more vulnerable to wind related navigation challenges. The application includes letters of support from the Coos Bay Pilots Association and Roseburg Forest Products that provide no quantitative analysis and rely heavily upon information from the applicant. City and County planning department reviews should consider the direct, personal, and financial interests at stake while reviewing the support letters provided by the applicant.

The proposed NRIs may reduce a navigation hazard but may not necessarily improve overall safety in the harbor.

It is not clear that dredging the margins of the channel at the turns will improve safety for vessels transiting the channel. Pilots currently manage risk and achieve safe passage in the existing channel by limiting ship operations to conditions suitable for safe passage of vessels. Following the proposed NRI construction, pilots will make crossings using the same margins of safety as before; the difference is that those margins could be achieved in higher wind conditions than before. While the turns resulting from the NRI dredging may be wider, they will be taken at higher wind speeds, resulting in the same margin of safety from the pilot's perspective.

It is not possible to determine if allowing bar crossings by LNG vessels under windier conditions would result in safer overall navigation. If wind is the primary factor among the suite of factors responsible for transit delays, construction of the NRIs may potentially serve to increase the potential number of large vessel transits possible in the Coos Estuary. However, if other factors such as ocean swell height, wind induced sea state and tides impose controlling limitations on large vessel transits into and out of the estuary, construction of the NRIs could have no impact whatsoever on transit delays or the overall annual vessel transit capacity of the navigation channel.

Review of this application requires a coordinated process to address the entire suite of land use applications related to the construction and maintenance of all 4 NRIs. The applicant has made it clear that in order to attain the asserted navigation reliability improvements it will be necessary to construct all four of the proposed NRIs. This application only seeks land use authorization to construct a portion of the total NRIs. Reviewers should recognize that the navigation benefits asserted by the applicant will not be attainable unless all four NRIs are constructed. As a result, the request for land use approval of a subset of the total number of NRIs addressed by this application will not attain the improvements sought by the applicant. No individual jurisdiction (City of North Bend, City of Coos Bay, Coos County) will have authority to authorize construction and maintenance of all 4 NRIs. The only rational way to objectively evaluate the environmental, economic, and social consequences of the proposed work is to consider the proposal to construct and maintain all 4 NRI as a single proposal. This type of coordinated decision making is the fundamental objective of the Coos Bay Estuary Management Plan and is a requirement of Goal 2 of Oregon's statewide planning program.

Inherent in the purpose of the project, however, is that the proposed NRI dredging will more readily accommodate new and extensive LNG carrier vessel traffic. Vessel routing from the open ocean over the bar, up the estuary to the proposed LNG marine slip is a hazardous maneuver that will impair navigation for all other users under the best circumstances. The locations and extent of NRI and channel dredging in the Coos Bay estuary has immediate and direct implications for vessels transiting the navigation channel. Aside from the turns that are the subject of the NRI dredging, the navigation channel contains numerous important turns and components also having very little room for error. For example, the entrance and first river bend, as well as the entrance to the marine slip, require precise maneuvers and pose hazards that will not be addressed by the construction of the NRIs. In spite of these and other considerations, The US Coast Guard captain of the Port overseeing navigation safety has determined that the navigation channel in the Coos Estuary is suitable for LNG marine traffic as it currently exists. (Exhibit 11).

Earthquake and/or tsunami response during or following dredging operations is not addressed in the applications, imposing an additional public safety and navigation liability of the project. During initial construction, anchored dredges and dredged material transfer pipelines deployed through the bay would be at risk during a tsunami or earthquake event, potentially posing an additional hazard to others in the form of drifting debris and impairment to search and rescue operations. Following construction, the expanded channel width and depth will enable tsunami wave trains to propagate more freely in the estuary potentially exposing people and properties to greater risk of inundation and harm.

CBEMP Policy 5 pertains estuarine fill and removal as follows:
I. Local government shall support dredge and/or fill only if such activities are allowed in the respective management unit, and:

a. The activity is required for navigation or other water-dependent use that requires an estuarine location or, in the case of fill for non-water-dependent uses, is needed for a public use and would satisfy a public need that outweighs harm to navigation, fishing, and recreation, as per ORS 541.625(4) and an exception has been taken in this Plan to allow such fill.
b. A need (i.e., a substantial public benefit) is demonstrated and the use or alteration does not unreasonably interfere with public trust rights.
c. No feasible alternative upland locations exist; and
d. Adverse impacts are minimized.
e. Effects may be mitigated by creation, restoration, or enhancement of another area to ensure that the integrity of the estuarine ecosystem is maintained.
f. The activity is consistent with the objectives of the Estuarine Resources Goal and with other requirements of state and federal law, specifically the conditions in ORS 541.615 and Section 404 of the Federal Water Pollution Control Act (P.L.92-500).[359]

The applicant has failed to demonstrate the need for the project as required by CBEMP Policy #5 (b) of the CBEMP

The applicant asserts that the proposed activity, (e.g. dredging one 3.3-acre area in NRI dredge area 4 in the city of Coos Bay or three NRI Dredge areas in Coos County), is required for navigation. The stated purpose of the proposed action is to improve reliability and efficiency of navigation for existing deep draft vessels by reducing the existing navigation constraints at the key turns ("Dredge Areas") in the Federal Navigation Channel (Exhibit 10 PDF page number 114). However, in a Letter of Recommendation prepared by US Coast Guard Captain W. R. Timmons dated 10 May 2018 (Exhibit 11) The captain of the Port sector Columbia River states:

> *"Based on a comprehensive review of Jordan Cove's WSA, and after consultation with State and Local port stakeholders, I recommend that the Coos Bay Channel Be considered suitable for LNG marine traffic".*

Captain Timmons' analysis is a supplement to his previous Letter of Recommendation (LOR) dated May 10, 2018, that conveyed his recommendation on the suitability of the Coos Bay Ship Channel for liquefied natural gas (LNG) marine traffic associated with the Jordan Cove LNG (JCLNG) export terminal project Coos Bay, Oregon. It documents the processes followed in analyzing JCLNG's Waterway Suitability Assessment (WSA) and the suitability of the waterway for LNG marine traffic.

The Captain of the Port's letters of recommendations and determinations of waterway suitability appear to refute the applicant's assertion that the proposed NRIs are needed. No reference is made to the need to excavate the proposed Navigation Reliability Improvements in the Letter of Recommendation or the attached materials included with the Coast Guard letter of Recommendation (Exhibit 11). The planning commissions should find that that applicant has not substantiated a need to exceed the recommendations of the USCG Captain of the Port's assessment that the current configuration of the navigation channel is suitable for deep draft vessel traffic including LNG marine traffic.

The applicant has failed to adequately demonstrate the cumulative impacts of proposed NRI construction and maintenance will result in a substantial Public benefit as required by CBEMP Policy #5 (b) and Statewide planning Goal 16.
The applicant has stated that the proposed work will provide a public benefit. The Port of Coos Bay and the US Army Corps of Engineers are public agencies with longstanding and widely recognized status as public entities that work in this estuary to support navigation proposals that serve public purposes. The purpose underlying the initial creation of the Port of Coos Bay in 1909 was described by G.B. Case in his review of the history of the Port of Coos Bay. Case states: *"Improvement of the channels in the bay beyond project specifications was the immediate result of the formation of a new organization in the area, the Port of Coos Bay."* (See pages 54 and 55 in Chase, G.B. "The history of the Port of Coos Bay 1852-1952 University of Oregon, December 1983). The Port of Coos Bay and the US Army Corps of Engineers are the primary partners in the Coos Estuary who have maintained the federal navigation channel and advocated for navigation projects having public benefits since Congress recognized it as a Federal Navigation Project in the 1880's. If there is a public benefit to this project, it is not clear why the applicant and sole proponent of the NRI proposal is a private party and why neither of the traditional public entities charged with implementing navigation improvement projects in the public's interest are leading the effort to create and maintain the NRIs. Jordan Cove is the sole entity identified as advancing the NRI project and is the sole party identified as bearing the cost to construct and maintain the NRIs. That Jordan Cove Energy, a private entity, is the project applicant and that Jordan Cove alone has expressed an intent to singularly bear responsibility for the construction and maintenance of the proposed NRIs, raises questions related to the existence of any bona fide public benefits of the project.

At the request of the Port of Coos Bay, the US Army Corps of Engineers is currently evaluating a proposal to deepen and widen the federal navigation channel the scope of which will exceed and subsume all of the "navigation reliability improvements" that are the subject of the present application. As of early 2019, the applicant has provided over $4 million and has and committed and additional $3.5 million dollars via an agreement with the Port of Coos Bay to support 2019 costs associated with preparation of the EIS for the Federal Navigation Channel Expansion Project.

The applicant's decision to propose the development of the NRIs concurrently with the work being conducted by the Port of Coos Bay and the US Army Corps of Engineers has generated a huge workload for city and county and state governments and has placed a large, additional burden on members of the public interested in participating in the decision-making process. In addition to the FERC EIS, and the

USACE EIS, the DSL wetland fill and removal program, and DEQ Clean Water Act 401 water quality certification permit programs that are reviewing the Jordan Cove proposal, there are no less than 5 city and county land use permits and public hearings in play at this time. Any one of the aforementioned state or federal permit process outcomes hold potential to fundamentally change the scope of the project rendering the proposed zoning authorizations being considered by the land use hearings associated with the NRIs moot or redundant.

Oregon land use Goal 16 establishes priorities for management of estuarine resources as follows.

The general priorities (from highest to lowest) for management and use of estuarine resources as implemented through the management unit designation and permissible use requirements listed below shall be:

1. Uses which maintain the integrity of the estuarine ecosystem;
2. Water-dependent uses requiring estuarine location, as consistent with the overall Oregon Estuary Classification;
3. Water-related uses which do not degrade or reduce the natural estuarine resources and values;
4. Nondependent, nonrelated uses which do not alter, reduce or degrade estuarine resources and values.

The applicant fails to acknowledge, describe or evaluate the impacts to multiple fundamental habitats and estuarine processes that maintain the integrity of this estuary that could be altered by the proposed land use changes.

Notable among the habitats and processes that provide the foundational support required to maintain the integrity of the estuary include processes and habitats essential to sustaining the existing natural resource-based economies in this community.

As an illustrative example: the annual ex-vessel commercial Dungeness crab landings in Oregon are valued at over $300 million dollars. Ex vessel commercial crab landings in Coos Bay alone are worth $30 million dollars. Each year, tens of millions of pea-sized larval Dungeness crabs enter this estuary every year to feed and metamorphose from planktonic organisms suspended in the water column to tiny “first instars” that begin life as crawling crabs that, in three years’ time, become the adult, market sized crabs that support the most valuable commercial and recreational fishery in Oregon. (Exhibit 7).

The Coos Bay region is also renowned for its recreational Dungeness crab fishery. Estimates from the 2007-2011 period found a minimum of 10,661 to a maximum of 15,023 crabbing trips were made in Coos Bay from April to October per year. Crabbing in Coos Bay is one of the most valuable recreational opportunities in the region and draws considerable number of people to the estuary from local and out of area locations. The commercial and recreational Dungeness crab fishery is of considerable economic significance especially for the community of Charleston.

It is understandable that, in the interest of obtaining the permits, the applicant; a midstream energy company, has hired expert consultants to obtain any permits needed to develop the Jordan Cove LNG export facility. These teams of “experts” contracted to secure the necessary permits, somehow managed to “overlook” the importance of the estuarine habitats for larval and juvenile Dungeness crabs and other fundamental processes taking place in the areas to be impacted by the NRI dredge work. In this example, the recruitment of Dungeness crabs is intimately tied to the most valuable fishery in Oregon. It is unconscionable that the applicant failed to recognize a need to mention such an important, and well documented process known to occur in the vicinity of the proposed work. It appears Dungeness crab recruitment was not mentioned because it didn’t happen to be referenced in a land use zoning ordinance that hasn’t been updated in over 40 years. The applicant’s blatant omission of evidence related to the ecological values and processes in this estuary is the aspect of the applicant’s approach that is the greatest, and most egregious shortcoming of the application.

Cumulative impacts of multiple environmental stressors

Estuaries are the most biologically productive ecosystems on earth but they are not beyond ecosystem collapse or major regime shifts (https://www.researchgate.net/publication/258614033_Regime_shifts_in_muddy_estuaries_tidal_response_to_river_deepening_and_canalization). There is bona-fide cause for concern that the cumulative impacts of historic, present day, and anticipated unavoidable natural and cultural stressors pose very real threats to the processes that maintain integrity, health, and continued viability of the Coos Estuarine ecosystem. Unexplained species disappearances, nonnative species introductions, and the occurrence of harmful algal blooms in this and other estuaries and coastal systems are examples of regime shifts having potentially deleterious consequences. A very active area of ecological research related to estuaries deals with better understanding “tipping points” in systems with multiple quasi stable states. (Exhibit 8).

The proposal to construct the proposed NRIs should not be considered in isolation. The sole basis to justify the need to construct the NRIs is in order to accommodate large vessels associated with the proposed construction of the JCEP export terminal. Although only individual elements of the overall Jordan Cove Energy Project may fall within the aegis of any one local jurisdiction’s land use program, including but not limited to the current proposals for the NRI dredging work, it must be considered that these NRIs will not be needed unless the related proposal to dredge 17 acres of intertidal and sub tidal habitats to create a navigation access channel is also approved. Thus, although the City of Coos Bay may be reviewing a permit application limited to one NRI comprising 3 acres within the portion of the CBEMP that falls within its jurisdiction, the actual scope of the work proposed must include consideration that approval of the land use requests by this applicant are connected to and will require significant direct alteration of over 30 acres of estuarine habitats within the area covered by the CBEMP that contribute to maintaining the integrity of the estuarine ecosystem.

Oregon’s Goal 16 requires uses that maintain the integrity of the ecosystem shall be given priority over other uses. The natural aquatic and conservation aquatic habitats in the Coos Estuary have been previously recognized as necessary in order to maintain the integrity of the estuarine ecosystem. The applicant has proposed a water dependent activity which, while a bona fide use of the estuary, must be subservient to uses that maintain the integrity of the ecosystem. In this case the CBEMP has determined that the best use of the portions of estuary bearing the NA and CA zoning areas is to support important ecosystem functions essential to the maintenance of ecosystem functions.

Proposal: Modify the Estuary Management Plan to permit dredging in a Natural Aquatic zone
Comments of Michael Graybill to the City of Coos Bay Community Development Department
Applicant: Jordan Cove Energy Company
March 20, 2019

The applicants assertion that the sub tidal habitats to be impacted by the construction and maintenance of the NRIs are low productivity habitats is false and unsubstantiated
The applicant has repeatedly characterized the sub tidal areas to be impacted by the proposed NRI dredging work as relatively low value by comparing these habitats to Intertidal marsh habitats. The physical, chemical and biological processes in an estuary are intricately interconnected. Despite the dated nature of the scientific research available at the time the CBEMP's development, research finds available at that time clearly established the interconnected and interdependent nature of estuarine habitats in estuaries. It is a well-established fact that ALL the habitats in an estuary are interconnected high-performance habitats (Exhibit 9). Estuaries in Oregon are small compared to many other regions in this state, but people familiar with these systems universally recognize them as high-performance systems having no parallel.

I offer an automotive analogy that might help to clarify. Estuarine habitats might best be compared to the "formula one" racers or "fuel dragsters" of the automotive world. To carry the analogy forward, the relative Salt marsh vs sub tidal habitat estuarine habitat productivity characterizations that the applicants have offered is not unlike trying to compare the relative values of a top tier stock car to those of a top tier formula race car. Both have value and both are outstanding performers in their class, but it is inappropriate to state that one is more valuable (i.e. more productive) than the other. Different classes of estuarine habitats, like differing classes of race vehicles, each operate in totally different contexts and their performance characteristics must, by necessity, be measured by different metrics.

The applicant has pointed out that Salt marshes are highly productive intertidal estuarine habitats, but it is a false premise compare the relative worth of a deep-water sub tidal habitat using the standards used to measure the worth (productivity) of an intertidal salt marsh. The salt marshes and deep-water habitats of the Coos Estuary are two distinct but interconnected high performance components of a highly productive system. No consultant on this planet will ever convince me that the deep-water habitats of this estuary that are the subject of the NRI zone change application are "low value" because they aren't as productive as a salt marsh. Over 45 years ago, the authors of the resource reports that served as the foundation for the CBEMP clearly recognized the tremendous productivity and complex interdependence of estuarine habitats. Today we understand those linkages and the remarkable productivity of these habitats even more clearly than when the CBEMP was developed in the final quarter of the last century (Exhibit 3 Page 2).

Even though the Coos Estuary is the second largest estuary in our state, (Exhibit 3 Page 2) it is still quite small in human terms. Oregon's complex, small-area systems are vulnerable to high consequence alterations in performance by natural events as well as development projects having relatively small spatial "footprints". A few acres of habitat impact in this estuary holds potential to have large scale ecological consequences. These systems are so complex, and our state of understanding is so feeble that it is not possible to anticipate how a relatively small alteration will shift the biophysical processes in the estuary. In spite if this uncertainty and the current state of understanding it is assured that every element of the current system is contributing to and influencing the function and integrity of the entire system as a whole.

This application has proposed to shift the balance of uses in this system yet again by moving a substantial portion of the remaining unaltered habitats in this already highly altered estuarine system from the most highly protected, low-impact zoning designation in the estuary to the most intensive, high-disturbance zoning designation. In the case of NRI-4 in the City of Coos Bay, the proposed change represents the second diminution of the spatial extent of estuary zone 52-NA. The area was previously reduced in spatial extent to accommodate an extension of the airport runway. The overall proposal being advanced by the project applicant will require a third diminution of zone 52-NA in order to undertake dredging work designed to mitigate for impacts to eelgrass communities resulting from the excavation of a 17-acre portion of the estuarine shoreline of the bay side of the north spit under the jurisdiction of Coos County. If the proposed NRI-4 application is approved a clear pattern of erosion of the spatial extent of one of the largest Natural Aquatic zones in the estuary will be established calling to question the fundamental relevance of the most highly protected zoning designation in this estuary.

The applicant has proposed no mitigation for the impacts associated with the proposed work. Even though the applicant proposes to convert an aggregate total of 25 acres of sub tidal habitat currently bearing a CA or NA designation to a DDNC-DA designation, no proposal has been made to identify a similar area of the estuary currently bearing the DDNC-DA designation and convert it to CA or NA status. Such an action would at least infer an acknowledgement of the value of the habitat functions to be lost as a result of the construction and maintenance work in zones currently designated for the highest levels of protection.

If the governing bodies responsible for ruling on the NRI land use authorizations associated with the proposed NRIs choose to issue a permit for the proposed work, the issuing agency/ies should consider including a condition in the permit requiring the applicant mitigate for the loss of estuarine functions in the proposed NRIs by identifying a similar habitat area currently within the DDNC-DA zone and proposing it be rezoned from DDNC-DA to CA or NA.

The applicant has not adequately characterized or evaluate the probable telegraphic impacts of the proposed work. The analysis of impacts should be based on verifiable factual information in order to assess the likely consequences of the proposed work on other Aquatic and shoreland zoning districts in the estuary.

The alterations proposed within the "footprint" of the proposed NRI dredging work will have telegraphic impacts that will influence the physical and biotic processes in adjacent areas and beyond. I offer the following illustrative example to demonstrate this point:

The soft sediment environments of an estuary are deposited in response to physical, chemical, and biological processes. Important first order physical forces defining the bathymetry and distribution and delivery of sediments in the Coos Estuary are; Ocean derived tidal currents, wind waves and fresh water inputs.

The sheltered margins of an estuary can be thought of as energy dissipation "machines". Mobile suspended and bedload sediments derived from ocean and terrestrial sources are introduced to the estuarine basin where they encounter lower energy levels than their sources. Suspended sediments reaching the calmest, most sheltered off channel areas settle out of the water column and build up along the shoreline. In time, the sediment surface builds up to a sufficient level to support marsh vegetation which, in turn, accelerates the sediment accretion rates in this habitat. But the sediment accumulation in the shallowest portions of the estuary would not be possible in the absence of the adjacent slightly lower elevation tideflats that serve to dissipate the wind and wave energy of the adjoining water. In this fashion, shallow water benthic habitats are derived from and protected by the adjoining deeper water sediment platform below it. This energy dissipation dynamic continues into deeper and deeper portions of the estuary including the soft substrate sub tidal areas adjacent to the tideflats in the vicinity of the proposed NRIs.

In this way, the naturally occurring topography and distribution of the sediments in the Coos and other estuaries are a manifestation of the long-term average influences of the physical forces acting upon them. A proposal to cut away the margin of a sub tidal soft sediment horizon as will take place by the construction of the NRIs 3 and 4 will have the effect of exposing the sediments adjoining the work to higher physical forces that would have been dissipated by the area within the dredging footprint. Through time the disequilibrium conditions created by the NRI sediment removal will telegraph across the sediments adjoining the dredged area. The sediments newly exposed to the new physical conditions created by the dredging will respond at rates which depend on the nature of the sediment type (e.g. cohesive or non-cohesive) as well as the levels of physical forcing experienced in the vicinity of the dredging (e.g. enhanced tidal currents and wind waves, vessel displacement wakes and prop wash).

When the Coos Bay channel entrance was initially dredged in the 1800's the deepening of the channel entrance and the construction of the jetty structures diminished the wave energy dampening and dissipation characteristics of the ocean entrance and allowed larger, higher energy wave forces to enter the lower portion of the estuary. Following the construction of the South Jetty in 1924-28, the open water and shoreline areas in the Fossil Point area of the bay experienced intensified wave energy that resulted in sediment resuspension and shoreline erosion in the lower portion of the estuary. G. B. Case (1983 pages 78-79) characterized the change as follows:

> *"Soon after the South Jetty reached a length where its effects began to be felt, in 1926, strong ocean swells appeared inside the bay, a phenomenon which had not previously occurred at Coos Bay. From a practical standpoint the swells inside the bay created a navigational problem of considerable importance. Before the South Jetty funneled swells into the bay, shipping could depend only on the water depth varying only with the tides; now that was complicated by the swells which might subtract as much as five feet from the channel depth as they passed under a vessel. At Pigeon Point Reef this meant that a loaded vessel might be dashed against the rocky bottom by wave action. To the bend in the middle of the cut and the rock bottom (at Pigeon Point) were now added the swells which began to appear after the South Jetty was in progress. "*

The aforementioned illustrative example demonstrates that channel modifications carry with them the potential to produce telegraphic effects in the estuary miles distant from the location of the actual work. Because the proposed Navigation Reliability Improvements will expand the dimensions of the channel, it will diminish the energy dampening characteristics of the channel enabling higher energy forcing to propagate upstream and over the adjoining sediments of the Natural Aquatic and Conservation Aquatic zones. Expanding the width and depth of the channel thalweg will serve to decrease the frictional characteristics of the water flowing in the channel enabling larger volumes of tide water to propagate in the estuary. This larger volume of water will have a greater capacity to resuspend unconsolidated sediments that were previously deposited in the lower energy conditions the preceded the channel widening. The scale of proposed channel modification is related to the scale of the telegraphic impacts and the rate at which sediment resuspension and redistribution occur in response to the modification. High rates of sediment resuspension hold potential to impact benthic communities of organisms and suspended sediment concentrations (turbidity and total suspended solids).

As another example, channel morphology changes linked to NRI dredging will permanently alter the manner in which tides and tsunamis propagate within the estuary. The permanent physical changes to the channel associated with the NRIs holds significant public health and safety impairment consequences that should be considered during the review of these applications. It is important for reviewers assure that the proposed dredging will not jeopardize public health and safety or expose the public to heightened risk exposure.

Sediment processes in response to disturbance play out at varying rates in estuaries. Research has demonstrated that a single storm event can be responsible for delivering as much as 60% of the total annual sediment and nutrient load from the watershed into the adjoining waterways. (Jennifer Tank, 2019 Ruth Patrick Award recipient plenary award acceptance presentation; American Society of Limnology and Oceanography meeting, San Juan Puerto Rico 25 February, 2019). Similarly, the sediment pulse associated with hydraulic mining during the California gold rush resulted in a dramatic acceleration of sediment accumulation and marsh progradation in the San Francisco Bay estuary.

In contrast to the aforementioned high rates of sediment flux, the surface elevations of the tide flats in the Haynes inlet and North Slough of the Coos Estuary are still responding to the construction of the causeways that traverse the mouths of these inlets decades after the causeways were constructed. As another locally relevant example of decade scale sediment responses to estuarine habitat alteration, the tidal channel and adjoining tideflats in the remaining tidally influenced portions of the Pony Slough Inlet are still responding to the fill placed in the upper reaches of Pony slough and at the entrance to the inlet. This response is clearly visible on the aerial photo of Pony Slough in the North Bend City Council Chambers.

These examples demonstrate that the spatial scale of telegraphic impacts and rate at which habitats respond to dredging and filling activities is both scale and location dependent. First order physical hydrologic processes will unquestionably change conditions experienced by sediments adjoining the proposed NRI dredge sites. Prior work in this estuary demonstrates that some but not all of the impacts of the proposed dredging work will be centered on habitats within and immediately adjacent to the proposed NRI dredging locations. However, it is also reasonable to expect that some impacts associated with the construction and maintenance of the proposed NRI’s will be felt at locations in the estuary outside the immediate area of the proposed work.

Reviewers of these applications should also consider the consequences that the proposed NRI dredging will have on the available sediment pool as well as the potential sediment supply in the regions of the estuary that will be the subject of sediment removal. For example, the sediments that comprise the mostly sandy and silty sediment pool in the 52 NA tract to be impacted by the proposed construction and maintenance of NRI-4 was likely derived by a combination of aeolian deposition and redistribution of ocean derived dune sands and upland an ocean derived bedload sand transport from the channel bottom. A smaller fraction of the existing sediment pool in area 52-NA may have been the result of suspended sediment deposition processes but the generally coarse grained characteristics of the sediments in this area suggest that deposition of suspended sediments is a less significant contribution to the total sediment volume in this portion of the estuary.

Removing sediment from the portion of the estuary in the vicinity of the 52 NA Zone by constructing and maintaining NRI-4 will diminish the total pool of sediments in this portion of the estuary that presently support the sub tidal intertidal and shoreland areas in this portion of the estuary. In order to understand the long term consequences this sediment removal may have on the adjoining habitats it is necessary to consider the likely sources of sediments that necessitate the need for post construction maintenance dredging as well as the likely sources of sediment inputs to this area that might potentially offset the losses associated with inititial construction and maintenance dredging sediment removal processes associated with the NRI.

The two most likely sources of new sandy sediment inputs to the sediment pool in the 52-NA region of the estuary are bedload sediments from the channel bottom and erosion of the Pleistocene dune formation on the shore segment adjacent to area 52-NA. The two most likely sources of sandy sediments that necessitate the regular dredging associated with the maintenance of NRI -4 are bedload sediments in the navigation channel or sandy sediments derived from the residual sediment pool in area 52-NA.

Maintenance dredging activities in the existing federal navigation channel can reasonably be considered as diminishing the potential sediment source available to supply new sediments to Area 52-NA. Construction of houses and other developments on the shoreline Pleistocene dune segment will place a premium on reducing erosion of the sand bluff adjoining Area 52-NA. These protective actions will also diminish the potential for this as a source of new sediments to the Area 52-NA sediment pool.

Because there are no significant stream or river systems draining into Area 52-NA and because ongoing maintenance dredging and shoreline protection efforts are serving to diminish the two most likely contemporary sediment supply sources to Area 52-NA it is reasonable to consider that the sediment supply supporting the estuarine functions in Area 52-NA is highly limited. Construction of the airport runway extension blocked off a tidal channel that connected Area 52 NA to the tideflat sediment pool lying north of the Airport. This connection and supply source no longer exists.

Construction of NRI-4 will eat into the sediment pool of Area 52-NA that was deposited by physical processes that either no longer exist or are significantly diminished. Should the sediments to be removed through maintenance dredging of NRI-4 be derived from the stored sediment pool in Area 52-NA it will have the long-term effect of progressively diminishing the sediment pool in area 52-NA over time, progressively lowering the entire sediment platform in this "sediment starved" portion of the estuary. This process will play out over a decadal time scale and my not be perceptible in the absence of careful analysis but this does not overcome that this process is highly likely to be exacerbated as a result of the construction and maintenance of the proposed NRI that adjoins Area 52-NA.

This analysis demonstrates that telegraphic impacts to zoning districts that adjoin the proposed work can be expected to occur with a reasonably high level of certainty. The applicant has not provided any evidence to examine the potential impacts of the proposed work on the sediment processes that define the habitat structure in the adjoining portions of the estuary.

The applicant has used research findings to support its assertion that impacts to the habitats and organisms in the vicinity of the proposed NRIs will be temporary in nature. However, this research is not applicable to the circumstances associated with the proposed work.

The Natural Aquatic and Conservation Aquatic districts in the area of the proposed NRIs were designated following the first ever estuary wide review of natural resource information about the Coos Estuary. The primary work leading to the characterization of the various zoning districts embodied in the CBEMP was compiled in the mid 1970's. These works are included as Exhibits 1-3 of these comments. The 1978-1979 analysis of the natural resources of the Coos Bay Estuary compiled by Cyndi Roye (exhibit 3) was specifically commissioned to inform the establishment of the zoning districts that are, to this day, memorialized in the CBEMP. The title of the document is; *"Technical assistance to local planning staffs in fulfilling the requirements of the LCDC estuarine resources goal."* Roye's report stands as the first ever attempt to create a compendium of existing information related to the physical and biological characteristics of the Coos Estuary.

The Roye 1978-79 document provided herein as Exhibit 3 represents a significant work that provides an accurate compilation of best available information pertaining to the Coos Estuary at the time the Coos Bay Estuary Management Plan was being developed. Importantly, the document provides an objective analysis of the biological characteristics of various locations throughout Coos estuary and includes recommendations on how various locations should be designated to fit within the then recently adopted Objectives and management units of Statewide planning goal 16.

Exhibit 3 provides detailed bibliographic information to some of the literature cited in the Coos Bay Estuary Management Plan. Of note in that regard is the work by "Jefferts 1977" which is frequently cited in the applicant's NRI land use applications. The applicant frequently cites Jefferts's work to substantiate the applicant's assertion that disturbances to the benthic communities within the footprint of the NRI dredge areas will be temporary and therefore do not warrant mitigation or further consideration in the context of a land use compatibility analysis.

The full citation for "Jefferts 1977" cited by the applicant is as follows: Jefferts, K. 1977 *The vertical distribution of infauna: a comparison of dredged and undredged areas in Coos Bay Oregon:* The citation is a 45 page-long thesis manuscript submitted in partial fulfillment of a M.S. degree at Oregon State

University. The only habitat types addressed by Jefferts involved unconsolidated soft bottom sediments.

At the time Jefferts' work was conducted, large areas of the Coos estuary were classified as polluted. Roye noted that the species composition of both dredged and undredged areas were reflective of biological community assemblages expected to be found in polluted areas. In addition, Roye and others describe the existence of other physical disturbances such as grounding by log rafts and burial by mill effluents and waste products as factors influencing species composition of undredged areas (see Exhibits 2 and 3).

Roye suggests (Exhibit 3 page 21) that the findings of Jefferts 1977 and others may reflect the fact that that the "undredged" habitats that Jefferts used as the basis of his comparison to the "dredged" habitats each supported benthic infaunal species coummunities characteristic of polluted areas. Because Jefferts' work did not control for other factors such as pollution that might have been responsible for his observed results, his findings should be regarded as inconclusive and certainly insufficient to be used as the singular work to substantiate the applicant's repeated assertion that biological communities in the NRI dredged areas will recover from the dredging activities within a period of a year and therefore impacts of the work should be considered temporary.

Although "Jefferts 1977" is one of the only documents cited in the CBEMP, its applicability to the work proposed in NRI areas 3 and 4 may only be marginally applicable because NRI areas 3 and 4 are not exposed to the same highly polluted and poor water quality conditions that occurred at the time Jefferts conducted his work in the Coos Estuary. The benthic communities in the vicinity of NRI Dredge areas 3 and 4 are likely more biologically diverse and likely to contain species with different life history characteristics than the pollutant disturbance benthic biological communities that Jefferts examined. The recovery trajectories of diverse, undisturbed benthic communities may be substantially different than the less species rich communities capable of surviving in polluted, poor water quality conditions and regular physical disturbances such as smothering by log rafts or pulp mill effluents.

Further, the applicant's citation of Jefferts 1977 should be fully rejected as an indefensible basis for its assertion that the sub tidal habitats in NRI areas 1 and 2 will recover rapidly following initial and maintenance dredging work. The sub tidal benthic habitats to be impacted by the proposed dredging work in NRI 1 and 2 are primarily bedrock (Exhibit 6 Table 1). Jefferts' study never considered bedrock habitats. In the absence of any other data to substantiate the rate at which biota associated with bedrock habitats will recover following dredging, or respond to periodic disturbance associated with maintenance dredging, the applicant's assertion that the bedrock habitats to be impacted by dredging work in NRI 1 and 2 will rapidly recover is wholly unsupported by any type of evidence.

The ecology of a keystone species of the biological community associated with the bedrock habits in the vicinity of NRI dredge areas 1 and 2 has been described in an elegant PhD dissertation by John William Evans in 1966. Evan's doctoral dissertation is entitled "*The ecology of the Rock-Boring clam Penitella penita (Conrad 1837)".* Evans conducted a series of experiments at various locations in southern Oregon. The primary field site for his work was the intertidal rock flats that adjoin the sub tidal rock bottom habitats in the vicinity of NRI dredge areas 1 and 2 in the Coos Estuary.

The group of animals which live buried in hard marine substrates is known as the endolithic community. Rock-boring bivalves are primarily responsible for initiating and maintaining the community because they excavate most of the burrows into which the other members will move after the borers' death. (Exhibit 4 page 1). The scope of the Evan's work included the following topics: (1) an analysis of the factors controlling valve and burrow morphology; (2) an analysis of growth and burrowing rates in rocks of different hardness; (3) a description of the sexual cycle, larval life and settlement; and (4) a discussion of the general ecology of the endolithic community.

In this document, the following terminology is used to describe the fauna of hard marine bottoms: Animals living on the surface of rock occupy the epilithion, those partially embedded occupy the mesolithion, and those wholly embedded occupy the endolithion. The endolithic community is that of animals inhabiting the endolithion. The boring activity of *P. penita* is primarily responsible for developing the endolithion as a possible habitat. The conical holes drilled by this animal form dwellings for a large number of nestling animals which move into the empty burrows after the pholads' death. (Exhibit 4 Pages 86-87).

Rock boring clams attach themselves in crevices which they may enlarge by movements of the valves. At Fossil Point *Penitella penita* is the most numerous and most widely distributed rock borer along the eastern Pacific coast (Exhibit 4 Page 87). *Penitella gabbi, Zirfaea pilsbryi,* and *Penitella turnerae* were also found quite commonly at Fossil Point. Together, these three species made up about 10 per cent of the living pholads in the lower bench at Fossil Point. Another species, *Nettastomella rostrata* was found, but only rarely. (Exhibit 4 page 9)

The vertical distribution of *P. penita* is also broad. In the area of Coos Bay, Oregon, it is found as high as + 3 feet in the hard substrate intertidal zone and extends down into the subtidal zone. Kofoid (1927) reported that *Pholadidea penita* (*Penitella penita*) were dredged in rocks at a depth of 50 fathoms in San Francisco Bay. (Exhibit 4 page 3). Therefore, it is highly likely that the subtidal rock substrates in NRI dredge areas 1 and 2 also support populations of *P. penita.*

Pholads including *P. penita*, being filter feeders, derive their food from the overlying water. (Exhibit 4 Page 87). As a result, it is necessary for the animal's siphons to maintain a connection to the overlying waters. Examples of barnacles completely occluding burrow entrances were also found. The enclosed pholad was of course dead. It is not known whether the barnacle covered the entrance hole before or after the death of the clam. Animals can survive sand burial for at least 5 months and anaerobic conditions for unknown periods of time. Growth during these periods however is inhibited. (page 80)

Growth in most mollusks may be indeterminate. However, growth of *Penitella penita* certainly terminates abruptly with the change from the active rock boring phase to the adult condition. Once a callum on the shell is deposited, boring movements are impossible and growth ceases. Normally sexual maturity in mollusks is reached quite early and reproduction continues throughout the remainder of the life span. In *Penitella penita* gonad maturation coincides with the end of the burrowing growth period. For the most part, active animals involved in boring rock are sexually immature. Nothing is known of the physiological trigger that sets off the apparently irreversible metamorphosis, (Exhibit 4 Page 103) Once metamorphosis has begun, the animal transitions from the drilling phase of its lifecycle to the post drilling phase. This metamorphosis is an irreversible process. (Exhibit 4 Page 78)

Evans suggested that rock hardness and other environmental factors as well as possible population level genetic factors play a role in determining the age of first reproduction of *P. penita.* The fact that the new shell deposited by South Jetty animals translocated to Fossil Point was thinner than normal, and that the shell deposited by Fossil Point animals translocated to the South Jetty was thicker than normal, suggests that the morphological differences are acquired due to environmental differences. He concluded that *P. Penita* can reach adult size within 3 years. (Exhibit 4 page 72).

Little is known about the relationship of *P. penita* to other members of the endo-, epi-, and mesolithic communities. The importance of various predators and nestlers as causes of death and the sequence of organisms that inhabit the vacated burrows was not known at the time Evans conducted his work. It is likely that the endo-,epi-and mesolithic communities in the vicinity of the lower bay contribute to the suite of organisms being targeted by the diving birds that seasonally aggregate near and forage over the sub tidal portions of the estuary having rock substrates.

A single square meter of rock substrate is capable of supporting in excess of 1,000 adult sized rock boring clams (Page 96). At Fossil Point the empty burrows eventually become filled with sand and mud, vertical burrows filling more quickly than horizontal burrows. Most of the silt-filled burrows are occupied by a terebellid worm, *Thelepus sp*., and its commensal scale worm, *Halosydna brevisetosa*. *Thelepus* appears to extract CaC03 from the pholad valves and deposit at least part of it as a chalky layer on the inside of its parchment burrow. The valves of the dead pholad are gradually dissolved completely. (Page 88) The empty burrows left after the death of pholads are filled by a number of nestling animals, which make up the remainder of the endolithic community

The utilization efficiency by pholad clams of freshly exposed rock for 12, 16, and 20 months at Fossil Point increased at most depths with increased duration of rock exposure.(Page 97) This suggests that additional settlement and growth by rock boring clams on freshly exposed substrates continues for a period of at least 20 months following exposure to newly exposed rock.

The applicant has suggested that in the initial time following construction, maintenance dredging of the proposed NRIs will be necessary every 1-3 years. (Exhibit 5 page 51). After this initial post construction maintenance dredging phase, the applicant suggests it may be possible to decrease the frequency of maintenance dredging. The applicant has proposed to “overdredge” rock substrates encountered in both vertical and horizontal directions in NRIs 1-3 in order to facilitate subsequent maintenance dredging by suction dredges (Exhibit 6 Page 10). Overdredging decreases the likelihood that the drag arm suction heads of a hopper dredge will be damaged by an encounter with the rock substrate.

The applicant’s proposed post construction NRI maintenance dredging schedule provides important insight into the potential impacts of the dredging work on the substrate and the biological communities in the proposed NRI dredge areas:

1. The volumes of maintenance dredging required following initial construction suggests that sediment inflow rates into the NRI dredging “footprint” will be greater in the years immediately

following initial excavation of the NRIs. It is likely that a primary sediment source responsible for the increased rate of post construction sediment influx will be from the Natural Aquatic and Conservation Aquatic Zones immediately adjoining the newly constructed NRIs. The volumes of material to be dredged from the NRIs following initial construction can reasonably be considered a proxy for the telegraphic disturbance of the protected habitats adjacent to the proposed NRI dredge areas.

As previously described, it is likely that the telegraphic disturbance of the adjoining protected estuarine habitat zones associated with the NRI dredging will continue for years and possibly decades following construction of the NRIs but at a slower rate. This diminished rate of disturbance to the adjacent conserved areas is evidenced by the applicant's suggestion that the frequency of post construction "maintenance" dredging of the NRIs will diminish following the initial, higher frequency post construction dredging phase.

2. The proposed over dredging in the areas where rock is encountered and the reference to maintenance dredging using hopper suction dredges suggests the applicant expects the post dredging substrate in bedrock areas of NRI dredge areas 1-3 to become covered with sand following completion of the initial dredging. This will have the effect of changing the substrate surface in the NRI areas from rock to sand. The applicant has not addressed this fundamental impact in the analysis provided in the application, even though changing the substrate in the NRIs from sand to rock will have profound and permanent consequences for the impacted biota.

These abovementioned observations provide evidence to refute the applicant's assertion that impacts to habitats within the NRI dredge areas will recovery rapidly following dredging activities and will therefore be temporary in nature and acceptable overall.

The underlying rationale that led to the area SW of the N. Bend airport being designated as "52-NA" estuary zone is found in Roye's 1978-1979 report to the Coos County planning department. Roye's recommendation for the bay subsystem habitats in the vicinity of NRI 4 states:

> *"The large flats southwest of the North Bend Airport and the Jordan Cove area should be considered major tracts and protected accordingly (LCDC 1977)."* (Exhibit 3 page 59)

The current "52-Natural Aquatic" zoning in this portion of the estuary is a clear reflection of Roye's recommendation. The current application represents the second proposal to diminish the area of this "major tract". A previous proposal involved the extension of the N Bend airport runway into this tract. Approval of the runway extension resulted in a diminishment of the total area of the bay designated as Natural Aquatic. The current application will further diminish the Natural Aquatic area and potential ecological value of this same tract; a tract that was identified as a high value area with natural resource values worthy of the highest level of protection as long ago as 1978.

The applicant has centered the analysis to support the proposed code and map changes based on a demonstration that changing the NA designation to Deep Draft Navigation will be compatible with the adjoining Deep Draft Zone. While I do not dispute that a compatibility analysis of this aspect of the proposed action is warranted, I assert that the burden of proof also rests on the applicant is to substantiate why it is acceptable to remove the priority protective status of a portion of the estuary identified as having resource values worthy of the highest level of protection. The applicant has failed to provide evidence to substantiate known and anticipated impacts that the proposed actions will have on protected status portions of the estuary.

The applicant has advanced a rationale that it is acceptable to diminish the area of the protected sub tidal regions of the bay bearing Conservation Aquatic and Natural Aquatic designations on the basis that the proposed changes represent a small portion of the total sub tidal habitats in the estuary. This argument is insufficient because each of the sub tidal habitats has unique characteristics that cannot responsibly be compared to other sub tidal regions of the estuary.

As illustrative example, Baldwin et a 1977 states" *"The rocky intertidal habitat below Fossil Point in Barview is also a unique habitat with respect to the rest of Coos Bay, and should be considered environmentally sensitive. It is more similar to rocky habitats found on Cape Arago than within an estuary, because of its exposure to ocean swells."* (Exhibit 2 Page 28) Thus, impacts to estuarine habitats in this region should not be considered as a tiny percentage of the total area of sub tidal habitats because the rocky sub tidal habitats in the vicinity of NRI dredge area 1 are only found in a very limited region of the estuary.

The navigation reliability improvements land use applications that are in review by the city of Coos Bay and Coos County planning departments will significantly alter a total of about 25 acres of sub tidal habitats. This total does not include an additional the 20 odd acres of intertidal that will be dredged from the shore of the estuary to connect the ship berthing area to the navigation channel. I think most anyone would agree that changing the zoning on 22 acres of farmland in Marion or Harney counties, might have a relatively small impact on the total of land dedicated to this use. But when I consider that the aggregate area of all the sub tidal bedrock habitats in all 23 Oregon estuaries may not even encompass an area of 150 acres, and further consider that the current proposal holds potential to permanently impact 10 or 15 acres of this total, I trust (hope) that reviewers of these land use applications might also share my concern that a decision of this magnitude should be avoided if at all possible and only considered with an abundance of caution and only if the action driving the need to impact these habitats at this scale is absolutely essential and thoroughly vetted.

The applicant has not demonstrated a robust need to justify the scale of impacts that the proposed work holds for sub tidal bedrock habitats. The applicant's approach to treat all 4 NRI dredge areas that each occupy distinct areas of the estuary collectively because each location has the shared characteristics of being at a bend in the adjoining navigation channel is caviler at best and demonstrates a profound lack of interest on behalf of the applicant in conducting a robust characterization of potential ecological consequences of the proposed work.

During my career and 40-year tenure as a resident of this community, I have seen any number of economic development/estuary modification proposals come and go. Virtually all of the proposals originate with some promise of expanded economic activity/prosperity that is offered up to justify one form or another of impact to or alteration of the estuary. An unfortunately large fraction of the projects attempted in this estuary have failed deliver the hoped-for economic benefits. Sadly, in this estuary, there is an embarrassingly large list of projects that were deemed consistent with the estuary management plan, were duly permitted by the appropriate agencies, and constructed (estuary impacts and all) only to fail for economic reasons and never deliver the hoped-for benefits. As evidence to illustrate this observation I offer examples on the North spit that include the "Anadromous Inc. Salmon ranching operation, the Port of Coos Bay's "Tee Dock" and the Port of Coos Bay's "Barge Slip"

This estuary is pock marked by economic ventures that produced wetland impacts but never penciled. I'm upset by this proposal because there is an abundance of evidence to suggest that this project is a high-risk economic venture that carries with it a large, long lasting and potentially high consequence "ecological footprint". The bedrock that this company is proposing to dredge in NRI 1 and NRI 2 are marine fossil bearing deposits from the Miocene-Pliocene boundary making them somewhere between 8 and 13 million years old. Once this bedrock is dredged from the bottom of this estuary, it will be gone forever. So too will the fossil rich paleontological record that is embedded in the bedrock of the marine sediments to be dredged be destroyed. Once bedrock is removed, it cannot be replaced.

Elsewhere, the applicant has stated the proposed facility will have a project lifespan of around 30 years. I seriously question this estimate but even if true, the 5.7 million cubic yards of sediment that the applicant plans to stack on the shoreline of the north spit and the 580,000 to 700,000 cubic yards of bedrock and sand it plans to dredge from the 4 NRIs and stack on the dredged spoils from a long forgotten project already piled on APCO site next to the Hwy 101 bridge, will persist in this landscape for centuries following the closure of this plant.

This proposal holds so many downside consequences for this ecosystem and the community that depends on it that I feel compelled to offer this analysis to you on the hope that it will serve to discourage you from approving a poorly articulated, inadequately substantiated proposal that is in the wrong place at the wrong time.

I genuinely fear that this estuary and the community that depends on its biological productivity may not be able to handle the truly frightening specter of Ocean acidification, eutrophication, and other stressors; let alone yet one more 5.7 million cubic yard dredging "insult" that, if developed, may well be followed by the 18 million cubic yard dredging proposal being advanced by the port of Coos Bay with the near total financial support to the Jordan Cove proponents.

Thank you again for providing me with the opportunity to comment on the proposed applications. I await and opportunity to comment during the forthcoming rebuttal process.

Kind Regards

Michael Graybill
63840 Fossil Point Road
Coos Bay OR 97420

EXHIBIT 1

Jordan Cove Energy Project L.P.

Draft Resource Report Supplement

Navigation Reliability Improvements

Jordan Cove Energy Project

July 2017

CONTENTS

TABLES

FIGURES

ACRONYMS

CBEMP	Coos Bay Estuary Management Plan
CS	Cutter Suction
CY	Cubic Yards
DMMP	Dredge Material Management Plan
DSL	Oregon Department of State Lands
EFH	Essential Fish Habitat
EFU	Exclusive Farm Use
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
GRI	Geotechnical Resources Inc.
HMT	Highest Measured Tide
JCEP	Jordan Cove Energy Project, L.P.
JCLNG	Jordan Cove LNG, LLC
LNG	Liquefied Natural Gas
MLLW	Mean Lower Low Water
mtpa	Million Tons Per Annum
NWP	Nationwide Permit Number
ODFW	Oregon Department of Fish and Wildlife
OIPCB	Oregon International Port of Coos Bay
PCBs	Polychlorinated Biphenyls
PCGP	Pacific Connector Gas Pipeline, LP
Pilots	Coos Bay Pilots Association
RM	River Mile
RR	Resource Report
U.S.	United States
US-101	U.S. Highway 101
USACE	U.S. Army Corps of Engineers

1 OVERVIEW AND PROJECT DESCRIPTION

Jordan Cove Energy Project, L.P. ("JCEP") is seeking authorization from the Federal Energy Regulatory Commission ("FERC" or "Commission") under Section 3 of the Natural Gas Act to site, construct, and operate a natural gas liquefaction and liquefied natural gas ("LNG") export facility ("LNG Terminal"), located on the bay side of the North Spit of Coos Bay, Oregon. JCEP will design the LNG Terminal to receive a maximum of 1,200,000 dekatherms per day of natural gas and produce a maximum of 7.8 million tons per annum ("mtpa") of LNG for export. The LNG Terminal will turn natural gas into its liquid form via cooling to about -260º Fahrenheit, and in doing so it will reduce in volume to approximately 1/600th of its original volume, making it easier and more efficient to transport.

In order to supply the LNG Terminal with natural gas, Pacific Connector Gas Pipeline, LP ("PCGP") is proposing to contemporaneously construct and operate a new, approximately 229-mile-long, 36-inch-diameter natural gas transmission pipeline from interconnections with the existing Ruby Pipeline LLC and Gas Transmission Northwest LLC systems near Malin, Oregon, to the LNG Terminal ("Pipeline," and collectively with the LNG Terminal, the "Project"). PCGP will submit a contemporaneous application to FERC that will include its own set of resource reports with references to certain materials in the LNG Terminal resource reports.

The Supplemental Report ("Report") provided herein documents the dredging activities to improve navigational reliability for the LNG Carriers. In January 2017, the Coos Bay Pilots Association ("Pilots") submitted a Joint Permit Application to the United States ("U.S.") Army Corps of Engineers ("USACE") and Oregon Department of State Lands ("DSL"). Nationwide Permit Number ("NWP") 2016-265 was assigned by USACE; File Number 59929-RP was assigned by DSL.

In June 2017 and after extensive discussion among USACE, the Commission, the Oregon International Port of Coos Bay ("OIPCB") and Pilots, JCEP decided to combine the dredging activities proposed by the Pilots with the activities of the proposed JCEP natural gas liquefaction and LNG export facility, the LNG Terminal. Therefore, Pilots withdrew applications NWP 2016-265 and 59929-RP from USACE and DSL, respectively, on June 1, 2017.

This Report has been prepared in accordance with FERC filing requirements under Section 3 of the Natural Gas Act to site, construct, and operate the proposed LNG Terminal. The information provided below is based on the proposed dredging activities and impact analysis originally prepared for the Pilots' Joint Permit Application to USACE and DSL. In many cases, the environmental analysis for these dredging activities is similar to the draft resource reports submitted to FERC for the JCEP LNG Terminal to date under Docket No. PF17-4-000. Where analysis has been addressed in a JCEP Resource Report ("RR"), this Report references the respective JCEP RR.

The information provided here will be integrated into the Final FERC Application.

General description

JCEP plans to excavate four submerged areas lying adjacent to the federally-authorized Coos Bay Navigation Channel ("Channel"). These minor enhancements will allow for transit of LNG vessels of similar overall dimensions to those listed in the July 1, 2008 USCG Waterway Suitability Report, but under a broader weather window. This allows for greater navigational efficiency and reliability to enable JCEP to export the full capacity of the optimized design production of 7.8 million metric tons per annum from the LNG Terminal.

The total volume of material to be dredged by these excavations is approximately 700,000 cubic yards. All of the dredged material will be disposed of in three potential upland disposal sites located at APCO Island (west), APCO Mainland (east), and the Kentuck Project site. The dredge areas are named Dredge Area 1 to 4 and located adjacent to the Channel roughly between River Mile ("RM") 2 to RM 7 respectively, as depicted in Figure 1.1-1 or RR1. The APCO Island and APCO Mainland sites, together, are referred to as the "APCO sites."

1. Enhancement #1 – Coos Bay Inside Range channel and right turn to Coos Bay Range: Excavation at this site will reduce the constriction to vessel passage at the inbound entrance to Coos Bay Inside Range for any ship making the 95 degree turn from the Entrance Range through the Entrance Turn and Range. JCEP proposes to widen the Coos Bay Inside Range channel from the current 300 feet to 450 feet, thereby making it easier for all vessels transiting the area to make this turn. In addition, the total corner cutoff on the Coos Bay Range side will be lengthened from the current 850 feet to about 1,400 feet from the turn's apex.
2. Enhancement #2 – Turn from Coos Bay Range to Empire Range channels: The current corner cutoff distance from the apex of this turn is about 500 feet, making it difficult for vessels to begin turning sufficiently early to be able to make the turn and be properly positioned in the center of the next channel range. JCEP proposes to widen the turn area from the Coos Bay Range to the Empire Range from the current 400 feet to 600 feet at the apex of the turn and lengthen the total corner cutoff area from the current 1000 feet to about 3500 feet.
3. Enhancement #3 – Turn from the Empire Range to Lower Jarvis Range channels: JCEP proposes to add a corner cut on the west side in this area that will be about 1,150 feet, thereby providing additional room for vessels to make this turn.
4. Enhancement #4 – Turn from Lower Jarvis Range to Jarvis Turn Range channels: JCEP proposes to widen the turn area here from the current 500 feet to 600 feet at the apex of the turn and lengthen to total corner cutoff area of the turn from the current 1,125 feet to about 1,750 feet thereby allowing vessels to begin their turn in this area earlier.

Dredge methods

Two methods of dredging are identified as the most practical, given the historical dredging practices in the region, the material types being dredged, and the location and condition of the placement sites. The two principal dredging methods are: (1) mechanical dredging via clamshell or excavator; and (2) hydraulic cutter suction ("CS") dredging. The selected contractor will likely choose which of these options will be used at each dredge location.

Mechanical dredging methodology would consist of either a crane barge with a clamshell bucket or an excavator mounted on a barge. Although an excavator is better suited for dredging in-situ soft rock with its higher breakout capacities, a mechanical dredge could be outfitted with a heavy duty rock clamshell bucket with pick point teeth for rock dredging, as was employed during Coos Bay channel deepening activities in 1996. The mechanical dredge might need to chisel the harder rock if the clamshell bucket is not heavy enough to break out the rock. After excavation, the rock material would be placed in a scow or on a deck barge and transported, with the assistance of a tugboat, to a suitable location near the upland disposal site for offloading.

Hydraulic dredging methodology would consist of a CS dredge. The CS dredge buries a rotating cutterhead into the sediment (and potentially into soft rock) to break up material, then suctions a water-sediment slurry into a scow for transit to the disposal site for offloading, or pumps the slurry directly to the disposal site via a submerged or floating pipeline where dewatering would occur.

Placement of dredge material at the APCO sites or the Kentuck Project site would be through one of the following three methods:

- Discharge of a hydraulically dredged slurry from a pipeline, pumped directly from the dredge areas;
- Pumped offloading of dredged material from a scow (with the material dredged using either a hydraulic CS dredge or a clamshell); and
- Mechanical offloading of dredged material from a scow (with the material dredged using either a hydraulic CS dredge or a clamshell).

Hydraulically dredged (or offloaded) material would be transported via pipeline and discharged within containment berms at both APCO sites and/or the Kentuck Project site if deemed feasible. Dredging activities include placement of a discharge pipeline string on the bottom of the channel between the disposal area shore crossing and the first deepening location. Navigation markers will be used where the dredge slurry pipeline temporarily crosses the Channel. The pipeline will be elevated at fixed locations to feed booster pumps. The booster pumps will be located on barges, moored on the eastern side of the Channel and used to move the dredge slurry toward the APCO sites for disposal.

The dredge slurry pipeline will be elevated before the dredge material is discharged at the APCO sites in order to minimize impacts to eelgrass. The pipeline will be supported on steel piles that span a band of eelgrass on the northern shore of the APCO sites. While several piles (e.g., five piles) may need to be located in the eelgrass area, the crossing is at the narrowest band of eelgrass on the northern shore of the island portion of the APCO sites. The piles will be installed using vibration equipment; however, an impact hammer may could be required if resistance is met. The temporary piling will be removed once all dredging operations are completed. A similar dredge spoil placement methodology would be employed if material is placed hydraulically at the Kentuck Project site.

A containment berm would be constructed around the perimeter of both sites with earthmoving equipment using onsite material and, where practical, incoming dredged material to build up the perimeter berms. Alternatively, dredged material could be mechanically offloaded from a scow and placed at either of the three disposal sites. Mechanical offloading, using a clamshell, excavator, or crane, reduces the amount of water discharged into the site, allowing direct placement of the material without an explicit need for containment berms. At present, there are no available berthing locations at either of the sites; therefore, use of the mechanical offloading method would require the construction of a short trestle (or land fill outcropping) for offloading of material.

Management of dredge material at the APCO sites will require the construction of a single-lane permanent bridge, and temporary bridge to construct the permanent bridge, to access the site by heavy equipment including, but not limited to, excavators, dump trucks, and bulldozers. A permanent single-span bridge that is 20 feet long and nearly 40.5 feet wide will span a tidal mudflat and be constructed for the purpose of providing access to and from the disposal site. It will include an 8-foot-wide sidewalk on the bridge deck. The bridge will include two concrete abutments on pile-supported footings and be placed above the Highest Measured Tide (“HMT”). Material-stabilized earth walls extending landward from the abutments will eliminate the need for fill material to extend below the HMT or wetlands.

Construction of the new single-span bridge will begin with construction of a temporary work bridge. The temporary work bridge will be approximately 30 feet wide and 280 feet long and have seven 40-foot spans. The temporary work bridge will be placed north of the proposed permanent bridge. It is likely that the temporary work bridge will use three steel piles per bent, and have a steel frame and a steel or concrete bridge deck. The temporary work bridge will begin and end in dry land. The end bents will be outside the HMT boundary, while five of the interior bents, including fifteen steel piles, will be installed below HMT. Steel pile will be driven and pulled with a vibratory hammer to minimize potential barotrauma impacts to fish. The piles may be tested with impact pile drivers to determine if they are properly set. The temporary work bridge approaches and access road will be gravel. The temporary work bridge will be in place for less than 24 months. The steel plate girders for the new bridge will be assembled and installed onsite. Precast deck panels will be installed between each of the four steel girders, and a cast-in-place concrete deck will be poured over the steel girders and deck.

2 RESOURCE REPORT 2 – WATER

2.1 Groundwater Existing Resources

Significant groundwater resources are not present at the proposed dredging locations or disposal sites. Therefore, additional groundwater information will not be provided.

2.1.1 Water Supply Wells

Water supply wells are not found at the APCO sites. Domestic water supply wells at the Kentuck Project site have already been described in RR 7 for the LNG Terminal.

2.2 Groundwater Impacts and Mitigation

No new groundwater impacts are anticipated, and therefore new mitigation will not be needed.

2.3 Surface Water Existing Resources

2.3.1 Contaminated Sediments

Potential contaminant issues will be described in the final RR 7.

2.3.2 Public Watershed Areas

The APCO sites and Kentuck Project site are not in a public watershed area.

2.3.3 Floodplains

Coos Bay, including the proposed dredging locations and the shoreline around the APCO sites, are in the Federal Emergency Management Agency ("FEMA") floodplain zone AE. This zone designation is described in RR 2. Dredging will not result in a rise in the flood elevation. Dredge disposal at the APCO sites would be above the areas designated as floodplain zone AE.

2.3.4 Hydrostatic Test Water and Water for Dust Suppression

The dredging activities do not entail additional hydrostatic test water needs. Dust suppression is not anticipated to be an issue at the dredge disposal sites and therefore will not be discussed further in this report.

2.3.5 Sensitive Surface Waters

Coos Bay is considered a "Sensitive Surface Water" in RR 2 for the LNG Terminal, in which the waterbody characteristics are described appropriately to cover the new dredging areas. The four locations to be dredged consist of deep subtidal habitats (below -15 feet Mean Lower Low Water ["MLLW"] elevation), which are ecologically low-productive habitats within Coos Bay. The Coos Bay shoreline along the north side of the APCO sites contains a combination of salt marsh, intertidal sand/mudflats, and eelgrass habitats, with sand/mudflats being the predominant habitat type.

2.4 Waterbody Construction and Mitigation Procedures

All four enhancement locations will be dredged to a controlled depth to match the adjacent Channel, currently -37 feet MLLW. The dredging contractor will perform an advanced maintenance dredge and incidental overdredge to the -37 feet MLLW depth based on normal USACE practice for dredging in Coos Bay.

Channel side slopes are designed at a ratio of three horizontal to one vertical in sandy material, and one horizontal to one vertical in rock. Dredging in rock includes a 25-foot horizontal offset outward from the proposed enhancement limit to allow for safe future maintenance dredging.

Several dredging methods can be used, depending on the type of material, site constraints, and availability of dredge equipment at the time of operations. A detailed discussion of dredging and material disposal methods is provided in the Dredge Material Management Plan ("DMMP") (see Appendix H.7 of RR 7).

In brief, dredging methods could include:

- Mechanical dredging (crane barge with a clamshell bucket or an excavator mounted on a barge), and
- Hydraulic cutter suction (i.e., CS) dredging.

Hydraulic dredging will require transport of the dredge slurry material via pipeline directly to the upland confined disposal sites at North Bend, at RM 10 of the Channel, directly across the Pony Slough from the Southwest Oregon Regional Airport. Hydraulic dredging with a slurry pipeline for disposal will require a slurry pipeline along the Channel, landing the pipeline to the north of the onshore disposal areas.

The permanent bridge has been configured to minimize temporary wetland and tidal waters impacts to the greatest extent practicable and avoid permanent wetland impacts. This bridge design proposes only temporary impacts to tidal waters of Coos Bay. Temporary impacts are estimated to have a duration of less than 24 months.

The slurry pipeline will be routed around the toe of the northern and western perimeter of the APCO Island site and across the temporary access bridge to the APCO Mainland site. Between four and ten wye valves will be used to control the discharge into either the APCO Island site or the Mainland site, and also to provide multiple discharge locations within each disposal area. A booster pump will be required at the shore crossing to provide sufficient energy to discharge the slurry over the perimeter levee at the APCO Island site.

At the outset of disposal, in-situ material will be moved with heavy equipment to form a perimeter levee in each disposal area. The dike will be required to be maintained approximately 4 feet above the internal elevation of the disposal area, thus providing approximately 2 feet of ponding to allow settling of sediments from the dredge slurry. An additional 2 feet will be provided for freeboard. As the disposal progresses, incoming material (having fallen out of suspension) will be moved with the heavy equipment to form an incrementally higher perimeter levee.

Mitigation measures to avoid and minimize potential temporary dredging-related impacts to Coos Bay and associated shoreline habitats would follow the same plans as those identified in RR 2 (e.g., FERC Wetland and Waterbody Construction and Mitigation Procedures) and RR 7 (e.g., FERC Upland Erosion Control, Revegetation, and Maintenance Plan).

A similar dredge spoil placement and disposal site management will be followed at the Kentuck Project site.

2.5 Wetlands Existing Resources

Freshwater wetlands are found along portions of the perimeter of the APCO sites, primarily near the toe of slope of the in-situ dredge spoil side slopes, above tidal influence. These wetlands are primarily palustrine scrub-shrub wetlands dominated by Hooker's willow (*Salix hookeriana*), which is typical of Oregon coastal wetlands.

2.6 Construction and Operation Impacts to Wetlands

Freshwater wetlands are not anticipated to be impacted by construction and operations. These areas will be marked as necessary and purposefully avoided.

3 RESOURCE REPORT 3 – FISH, WILDLIFE, AND VEGETATION

3.1 Fisheries and Other Aquatic Resources

The Aquatic Action Area for analysis of impacts to fisheries and other aquatic resources includes the estuarine and marine analysis areas, which are described in RR 3, Section 3.1, and shown in RR 3 Figure 3.1-1. The dredging activities will take place within the estuarine analysis area only; therefore, fisheries and aquatic resources within the marine analysis area will not be discussed in this Report.

3.1.1 Fishery Classification

The navigation reliability improvements will take place entirely within the estuarine fishery. Existing estuarine fishery conditions are detailed in RR 3, Section 3.1.1.1.1. Estuarine habitat potentially affected by the navigation reliability improvements includes subtidal habitat, eelgrass habitat, and intertidal sand/mudflat habitat. Information is included in the discussion below for the dredge areas and around the APCO Island site. No other changes are anticipated.

3.1.1.1 Existing Habitat Resources

3.1.1.1.1 Subtidal Habitat

Subtidal habitat in the Coos Bay estuary consists of deep subtidal and shallow subtidal habitat. All for dredge areas are located entirely within deep subtidal habitat adjacent to the Channel. Deep subtidal habitat is described in RR 3, Section 3.1.1.1.1.4.

3.1.1.1.2 Eelgrass Habitat

Eelgrass habitat is located adjacent to the APCO Mainland site, the Kentuck Project site, and the APCO Island site, in the area where the dredge pipeline would be brought onshore. Eelgrass habitat is described in RR 3, Section 3.1.1.1.1.3.

3.1.1.1.3 Intertidal/Sand/Mudflat Habitat

The temporary access bridge between the APCO Mainland site and the APCO Island site will span a tidal mudflat. Intertidal/sand/mudflat habitat is described in Section 3.1.1.1.1.1 of RR 3.

3.1.2 Fisheries of Special Concern

Existing conditions for Fisheries of Special Concern are detailed in RR3, Section 3.1.2. No changes are anticipated.

3.1.3 Marine Mammals

The only marine mammals that could potentially be affected by the dredging activities are those frequently known to be present within the Coos Bay estuary. These would include harbor seal, California sea lion, steller sea lion, and harbor porpoise. Existing conditions for marine mammals are detailed in Section 3.1.3 of RR 3; no changes are anticipated.

3.1.4 Construction and Operation Impacts to Fisheries and Other Aquatic Resources

The dredging activities would take place in deep subtidal habitat, which is generally less productive than shallower habitats in the Coos Bay estuary. Aquatic organisms in deep subtidal habitat at the four dredge areas include benthic organisms such as worms, mollusks, echinoderms, and crustaceans, which will be directly impacted by dredging. Impacts to these organisms are expected to be similar to those described in RR 3, Section 3.1.4.1, Direct Mortality of Marine Organisms. Impacts would be temporary and would not have population-level effects on benthic organisms in Coos Bay.

Eelgrass habitat adjacent to the APCO Island site could be affected by the placement of a temporary steel cradle to support the slurry pipeline where it spans the eelgrass beds. The impacts to eelgrass habit would be limited, because the overall footprint of the cradle on the seafloor will be limited to five piles, and the pipeline will cross the eelgrass beds at their narrowest point. Impacts will be temporary, because all piles will be removed once dredging operations are completed.

Essential Fish Habitat ("EFH") for Pacific salmon species will be affected by dredging activities, but it is expected to recover to pre-dredging conditions within one month to one year (FERC 2015). No other effects to EFH are expected beyond those described in Section 3.1.4.2 of RR 3.

The dredging activities would result in increased turbidity within the estuarine analysis area. The overall impacts resulting from increased turbidity, and the species potentially affected, would be similar to those described for dredging of the LNG carrier slip, access channel, and berm in Section 3.1.4.3 of RR 3. Whenever possible, a CS dredge will be used to minimize the amount of turbidity generated. It is anticipated that the increases in turbidity from the dredging activities will be temporary and localized, and will be taking place in an area where the increased turbidity would not depart substantially from ambient turbidity levels. Additionally, the restriction of construction activities to the in-water work window of October 1 through February 15, when salmonid species abundance is lower, will reduce the likelihood of impacts to these species. Increases in turbidity could also occur during the driving of the temporary piles that will support the steel cradle and slurry pipeline spanning the eelgrass beds. This turbidity is anticipated to be highly localized due to the nature of the work. Should turbidity increase above ambient background levels more than 200 feet from pile-driving activities, best management practices would be employed to reduce turbidity. Turbidity associated with pile driving for the temporary work bridge at the APCO sites is not anticipated to result in impacts to aquatic organisms. Any turbidity generated from pile driving will be highly localized and relatively isolated from the rest of the bay.

Noise generation from construction of the steel cradle to support the slurry pipeline as it spans the eelgrass beds would likely create temporary acoustic disturbances. The placement of a bridge connecting the APCO Mainland and APCO Island sites would also be likely to generate acoustic impacts from the use of an impact hammer. The potential effects on marine organisms would be similar to those described in Section 3.1.4.4 of RR 3. If sound levels are determined to exceed regulatory thresholds or guidelines, sound attenuation measures would be used in accordance with National Marine Fisheries Service guidelines to minimize potential affects to fish and marine organisms from higher-intensity sound waves in the water column. Construction activities would be conducted during the Oregon Department of Fish and Wildlife ("ODFW")-approved in-water work window, when sensitive life stages of Endangered Species Act ("ESA")-listed fish are not typically present in the bay, which would further minimize the potential for adverse impacts.

Any accidental spills or leaks of petroleum products or other toxic discharges from dredging equipment or vessels could result in impacts to water quality and aquatic species in the short term. However, the dredging and material transport vessels will be carrying relatively small volumes of petroleum compared to the vessels that regularly travel through Coos Bay. Given the low probability of a spill, the preventive measures, such as the implementation of a spill prevention plan, and the relatively small volume of fuel onboard vessels utilized for the dredging activities, large-scale or long-term negative impacts are not anticipated from spills and/or toxic discharges.

In general, the impacts to aquatic organisms associated with dredging, upland dredge disposal, and access to the APCO Island site would be similar to those describe in RR 3 sections: 3.1.4.1, Direct Mortality of Marine Organisms; 3.1.4.2, Loss of Benthic and Shoreline Habitat (including EFH); 3.1.4.3, Sedimentation and Turbidity Levels; 3.1.4.4, Acoustic Effects (APCO sites access bridge); 3.1.4.5, Chemical and Hydrocarbon Contamination; and 3.1.4.13, Mitigation, Enhancement, and Protection Measures. No mitigation is proposed.

3.2 Wildlife

3.2.1 Wildlife Existing Resources

Existing conditions for wildlife at the APCO Mainland site and Kentuck Project site are detailed in Section 3.2.1 of RR 3; no other changes are anticipated. The former dredge disposal site on the APCO Island site consists of a mosaic of upland herbaceous and shrub habitat, which has been classified as Category 4. Wildlife species at the APCO Island site are similar to those described for the APCO Mainland site in Section 3.2.1.5.2.1 of RR 3.

3.2.2 Construction and Operation Impacts to Wildlife

Dredging, upland dredge spoils disposal, and construction of the access bridge to the APCO Island site during implementation of the dredging activities all have the potential to impact wildlife. The APCO Island site contains wetlands and sensitive vegetation species and care will be taken to avoid these areas during construction. The potential general impacts of these activities on wildlife would be similar to those described in Sections 3.2.2.1.1, Habitat Loss; 3.2.2.1.2, Displacement and Direct Mortality; and 3.2.2.1.3, Noise in RR 3. No additional impacts would be expected.

3.2.3 Unique and Sensitive Wildlife and Habitat

Unique and sensitive wildlife and habitat present within the vicinity of the proposed dredging activities would be the same as those described in Section 3.2.3 of RR 3. Impacts associated with dredging, upland dredge disposal, and access to the APCO Island site would not differ substantially from those described in Section 3.2.3 of RR 3, because there are no significant or sensitive wildlife habitats at the APCO Island site that provide unique breeding, rearing, nesting, or calving areas; migration routes; or high-quality cover or forage areas.

3.3 Vegetation

3.3.1 Vegetation Existing Resources

Existing vegetation conditions at the APCO Mainland site and the Kentuck Project site are detailed in Section 3.3 of RR 3; no other changes to the affected environment at these sites are anticipated. The APCO Island site is a former dredge spoils disposal site dominated by herbaceous and shrubland vegetative associations and characterized by an abundance of non-native weedy species, including European beachgrass (*Ammophila arenaria*) and Scotch broom (*Cystisus scoparius*).

3.3.2 Construction and Operation Impacts to Vegetation

Impacts associated with upland dredge disposal at the APCO Mainland site and the Kentuck Project site and with the access to the APCO Island site would largely be related to the displacement of existing vegetative communities and disturbance associated with the dredge slurry pipeline. The APCO Island site has been designated as a natural area and, as such, disposal options would avoid areas of sensitive vegetation. Temporary vegetation impacts would be limited to a dredge slurry pipeline corridor approximately 20 feet wide. The corridor would be located in the field by the dredging contractor to minimize impacts to vegetation and aquatic resources. Impacts are anticipated to be less than three months in duration, during late fall to winter, while dredging activities are ongoing. Much of the upland vegetation at the disposal site will be dormant during this time. Any areas disturbed by placement of dredge spoils will be reseeded or replanted with native vegetation upon removal of the dredge slurry pipeline.

Temporary impacts to shoreline vegetation could occur where the pipeline approaches the APCO Island site. The shoreline in this area primarily consists of unvegetated sand, transitioning to beach grass. Temporary impacts could include disturbance of wetland and/or riparian vegetation, and the placement of temporary fill.

Sensitive habitats such as eelgrass and wetlands would be avoided to the maximum extent possible. Any unavoidable impacts to eelgrass or wetlands would be temporary in nature and impacted areas would be restored to pre-construction conditions at the conclusion of the dredging activities.

3.4 Endangered, Threatened, and Special Status Species

The Aquatic Action Area includes the estuarine and marine analysis areas (see RR 3, Figure 3.1-1). The dredging activities would take place within the estuarine analysis area only, and therefore endangered, threatened, and special status species within the marine analysis area will not be discussed in this Report.

3.4.1 Endangered, Threatened, and Special Status Species Existing Resources

Existing conditions for endangered, threatened, and special status species at the APCO Mainland site and the Kentuck Project site are detailed in RR 3; no other changes are anticipated. The APCO Island site is largely characterized by herbaceous and shrub communities dominated by non-native species; however, populations of Point Reyes bird's beak (*Cordylanthus maritimus ssp. Palustris*), a federal species of concern and state endangered species, are present on the site. In addition, the federally threatened western snowy plover (*Charadrius alexandrines nivosus*) has been known to infrequently use dredge spoil sites as nesting habitat.

3.4.2 Construction and Operation Impacts to Endangered, Threatened, and Special Status Species

Impacts on endangered, threatened, and special status species associated with dredging, upland dredge disposal, and access to the APCO Island site would largely be similar to those described generally for fish, wildlife, and vegetation above. As noted above, the APCO Island site has been designated as a natural area and, as such, disposal options would be required to take this into account by avoiding wetland habitat areas and areas of sensitive vegetation.

Direct and indirect effects from construction on ESA-listed fish would likely be due to turbidity, potential chemical contamination, acoustic effects from pile driving, and interim habitat loss (as discussed in Section 3.4.2.1 of RR 3). Completing in-water work during the ODFW October 1 to February 15 in-water work window would result in fewer ESA-listed fish being exposed to the activities and serve to minimize, but not eliminate, exposure to direct adverse conditions.

Direct and/or adverse impacts to ESA-listed wildlife species are not anticipated as part of the dredging activities. These species either do not utilize the dredging area, or are present on only rare or infrequent occasions. If any ESA-listed bird, marine mammal or turtle species were present in the vicinity of ongoing dredging activities, they could avoid these areas during active dredging.

Effects to ESA-listed species and/or critical habitat from the placement of dredged material at the APCO Island site are not anticipated. No listed species or suitable habitat are considered to be present at the APCO Island site. Best management practices will be implemented to ensure that dredged material is confined to the disposal and offloading sites and that sediments have been removed from any decant water leaving the site.

Dredging operations would take place within the ODFW in-water work window, which is outside of the nesting period for western snowy plovers, thereby lessening the potential for impacts on this species during nesting. Placement of dredge spoils at the APCO Island site could create nesting habitat for western snowy plover. Creation of nesting habitat for plovers at the APCO Island site is considered undesirable, because it could result in dispersal of existing breeding populations on the North Spit to an area where they could be more susceptible to nest predations. Additionally, any habitat created would be temporary, as opposed to the permanent habitat available on the North Spit. Consultation with the U.S. Fish and Wildlife Service would be undertaken in order to avoid and minimize potential impacts on snowy plover from the placement of dredge spoils at the APCO Island site, and to minimize the potential for plovers to use the site.

4 RESOURCE REPORT 4 – CULTURAL RESOURCES

Resource Report 4 addresses the Project's existing conditions, potential impacts, and associated mitigation associated with regards to cultural resources, including providing a summary of communication with relevant federally recognized Tribes. The APCO sites have been previously surveyed, and previous cultural resources studies conducted in the vicinity of these sites were reviewed in connection with the 2015 Final Environmental Impact Statement for the JCEP LNG Terminal. No historical or archaeological resources were identified. Historic photographs suggest that the APCO Island site is a constructed landform, and there is little likelihood that cultural resources would be present on or near the current ground surface. Should there be any ground disturbance that extends below the depth of fill to create this landform, however, additional survey may be needed to identify potential deeply buried archaeological resources.

Likewise, there is a potential need for additional cultural studies at the APCO Mainland site, should there be any ground disturbance that extends below the depth of fill to create this landform; that need is currently being evaluated.

Finally, additional cultural resources studies may be needed depending on the specific location and method of offloading dredged deposits at the Kentuck Project site. Archaeological fish weirs are known to be buried in the mud flats immediately west of Kentuck Slough and could be impacted during placement and use of the discharge pipeline.

Additional cultural studies will be performed and included as deemed necessary.

5 RESOURCE REPORT 5 – SOCIOECONOMICS

In general, RR 5 covers the existing socioeconomic conditions related to dredging activities and thus adequately assesses the impacts to population, environmental justice populations, housing, employment, revenues, tourism, and recreation related to dredging activities within the JCEP Project Area. Due to the temporary duration of the work and the comparatively small number of temporary workers that may be required (approximately 30 to 75), no additional analysis is needed in this Report.

Future maintenance dredging would be combined and included in the maintenance dredging of other locations within the port undertaken by JCEP or other marine terminals or by the Port Authority as a whole, and therefore would not require additional workers for long-term operations.

6 RESOURCE REPORT 6 – GEOLOGICAL RESOURCES

6.1 Geologic Setting

The general geologic setting for the navigation reliability improvements is described in Section 6.1 of RR 6. The APCO Mainland site and Kentuck Project site are adequately described in RR 6. This section describes geological resources related to the APCO Island site. No changes to the geologic setting are anticipated.

6.2 Blasting

No blasting will be required during dredging activities, because the subsurface materials within the Dredge Areas consist of sand and soft rock.

6.3 Mineral Resources

The affected environment for mineral resources at the APCO Mainland site and Kentuck Project site is described in Section 6.4.2 of RR 6. No mineral resources are known to be present at the APCO Island site, and the placement of dredge materials at the site is not expected to affect any known or potential mineral resources or the recovery of any mineral resources.

6.4 Geologic and Other Natural Hazards

Potential geologic and other natural hazards at the APCO sites and the Kentuck Project site would be the same as those described for the JCEP Project Area generally in RR 6, Section 6.4.1, Seismic Hazards; Section 6.4.2, Landslides; Section 6.4.3, Ground Subsidence; and Section 6.4.4, Other Natural Hazards. No other changes are expected.

6.5 Facilities in Seismic Risk Areas

Facilities in seismic risk areas are addressed in a site-specific seismic hazard study for the LNG Terminal site, which is provided in Appendix B.6. of RR 6. The proposed bridge that would connect the APCO Mainland site and APCO Island site will be included in this study.

6.6 Paleontology

Existing conditions and impacts associated with paleontological resources are detailed in Section 6.6 of RR 6. There are no additional known paleontological resources that will be impacted by the dredging activities or placement of dredged materials at the APCO Island site.

6.7 Geotechnical Investigations

The results of geotechnical investigations performed in support of the LNG Terminal are summarized in Section 6.7 of RR 6. The results of separate geotechnical investigations conducted at the APCO Island site will be summarized in the final updated resource report.

7 RESOURCE REPORT 7 – SOILS

7.1 Pipeline

Not applicable.

7.2 Aboveground Facilities

Aboveground facilities consist of the in-water dredging activities and associated upland dredge disposal sites at APCO Island, APCO Mainland, and Kentuck. A permanent bridge connecting the APCO Island site and the APCO Mainland site is also proposed.

7.2.1 Soils Existing Conditions

The APCO Island and Mainland sites are composed of past dredge fill material. The APCO Mainland portion has been used for industrial purposes, primarily log storage; it contains graveled areas; and it has been graded so that it is relatively flat. The APCO Island site has been used only for dredge disposal and has hummocky topography. A Phase 1 Environmental Site Assessment was conducted for the APCO Sites (SHN 2013). The Phase 1 Environmental Site Assessment determined that the past dredge materials placed at APCO should be considered a Recognized Environmental Condition, because it is unknown where the dredge materials came from within the bay, and therefore there is the potential for contaminants to be present due to historic industrial activities in and around the bay that could have contaminated sediments prior to dredging. A Phase 2 Environmental Site Assessment will be conducted to further assess hazardous materials risks at this site.

Dredge Areas 1 through 4 are situated at the edge of the Channel in deep-water habitat (below -15 feet MLLW) and occur roughly between RM 2 and RM 7. Material within the Channel from the entrance to RM 7.0 consists of relatively clean, fine-to-medium grained, loose-to-dense sand, underlain by a very soft and closely fractured siltstone and extremely soft-to-soft weathered sandstone (GRI 2011). Generally, the rock is above the proposed dredging depths at Dredge Areas 1 and 2, and below the dredged depths at Dredge Areas 3 and 4 (except in a highly localized area in the upper layers, near RM 6).

7.2.2 Soil Descriptions

The APCO sites consist of soil type Udorthents level (map unit symbol 57). This map unit is on floodplains, marshes, and tidal flats along major streams, bays, and estuaries. It consists of areas that have been filled and leveled for commercial and industrial uses. Slopes are 0 to 1 percent. The areas on marsh and tidal flats are made up of dredging spoil, dune sand, and wood chips. Drainage, permeability, and other physical properties vary considerably.

The proposed Dredge Areas are located in deep subtidal areas and are mapped simply as "water" by the soil survey. The OIPCB has collected sediment samples within dredge areas as part of its Channel Modification Project; these will be made available to JCEP.

7.2.3 In-Water Sediment Sampling and Analysis Program

Historic boring logs from the Channel were evaluated to provide a dredged sediment characterization. Subsurface exploration within the Channel was performed by Geotechnical Resources Inc. ("GRI") in 2005 and 2007. More recently, geotechnical site investigations were carried out by GRI in 2011 and 2016. Additional analyses for submittal to the Portland Sediment Evaluation Team are underway.

Material within the Channel from the entrance to RM 7.0 consists of relatively clean, fine-grained sand underlain by extremely soft-to-soft weathered sandstone (rock) (GRI 2011). An interface profile was developed using various geophysical measurements and overwater borings (DEA 2010). Based on this profile, a majority of the sediment within Dredge Areas 1 and 2 consists of rock; Dredge Area 3 has a small rock pinnacle, less than 3 percent of the total volume for that location; and all of the sediment in Dredge Area 4 consists of sand.

7.2.4 Soil Contamination

As previously noted, a Phase 1 Environmental Site Assessment was conducted for the APCO sites and identified the dredge materials as a Recognized Environmental Condition. A Phase 2 Environmental Site Assessment will be conducted to further assess hazardous material risks at the APCO sites. Potential sources of soil contamination at the Kentuck Project site are detailed in Section 7.2.4 of RR 7.

7.3 Impacts of Construction and Operation on Soils

7.3.1 Pipeline

Not applicable.

7.3.2 Aboveground Facilities

The APCO Island site, APCO Mainland site, and Kentuck Project site will be used for dredge disposal of rock and sand. Based on current sediment evaluation, dredge material is clean, and therefore special provisions for disposal of contaminated sediment will likely be unnecessary. A Phase 1 investigation of in-situ materials at the APCO sites noted the potential for contaminants to be present. A Phase 2 investigation is underway and will determine whether contaminants are actually present, and if they are, what the proper handling requirements are. Use of in-situ material at the APCO sites to support dredging activities (e.g., perimeter dikes) will need take into consideration the results of the Phase 2 investigation.

At the outset of disposal, in-situ material will be moved with heavy equipment to form a perimeter dike in each disposal area. The dike will be required to be maintained at approximately 4 feet above the internal elevation of the disposal area in order to provide approximately 2 feet of ponding, thus allowing for settling of sediments from the dredge slurry. An additional 2 feet will be provided for freeboard. As the disposal progresses, incoming material (having fallen out of suspension) will be moved with the heavy equipment to form an incrementally higher perimeter levee. Dredge placement will alternate between the APCO Island

and APCO Mainland sites to maximize residence time and ensure that water quality standards are met.

Management of dredge material at the APCO sites will require access to the site by heavy equipment including, but not limited to, excavators, dump trucks, and bulldozers as described in Section 1 (Overview and General Description) of this report.

The Kentuck Project site will follow similar site management procedures for dredge disposal.

7.3.3 Dredging

Proposed dredging will take place at four locations. The location, habitat type, nature of material, and estimated volumes at each of the four sites are summarized in Table 1.

Table 1: Capital Dredge Summary

Dredge Area	*Approx. River Mile*	*Habitat Type (Cowardin Class)*	*Rock (cu. yds.)*	*Sand (cu. yds.)*	*Total (cu. yds.)*
1	2	Deep subtidal (Estuarine, subtidal, unconsolidated bottom –E1UB)	390,200	0	390,200
2	4	Deep subtidal (Estuarine, subtidal, unconsolidated bottom –E1UB)	195,000	20,100	215,100
3	6	Deep subtidal (Estuarine, subtidal, unconsolidated bottom –E1UB)	700	25,600	26,300
4	6 to 7 (Jarvis Turn)	Deep subtidal (Estuarine, subtidal, unconsolidated bottom –E1UB)	0	28,000	28,000
Total			585,900	73,700	659,600

(Note: Volumes are rounded up to the nearest 100 cubic yards.)

Several dredging methods could be used depending on the type of material, site constraints, and availability of dredge equipment at the time of operations. A detailed discussion of dredging and material disposal methods is provided in the DMMP.

In brief, methods are similar to those described for the access channel in previously submitted RR 7 and could include the following:

- Mechanical dredging (crane barge with a clamshell bucket or an excavator mounted on a barge), and
- Hydraulic CS dredging.

Continual shoaling in the Channel requires periodic maintenance dredging. USACE Portland District generally performs successive maintenance dredging activities at selected navigation project sites every one to three years, depending on the rate of shoaling. As described in the DMMP, similar shoaling and maintenance needs have been estimated for the four Dredging Areas. Maintenance dredging is estimated to be 31,300 cubic yards ("CY") per year. Maintenance dredging material will consist primarily of course-grained material with some silt, and is proposed for disposal at the APCO sites.

7.4 Consultations

A formal decision from the Portland Sediment Evaluation Team is pending regarding the suitability of dredge material for disposal.

7.5 Mitigation

Mitigation measures will follow the same plans identified in RR 7 (e.g., FERC Upland Erosion Control, Revegetation, and Maintenance Plan). Containment of dredge spoils, construction, operation, and removal of any structures (e.g., temporary work bridge) will be included in the overall JCEP plans.

8 RESOURCE REPORT 8 – LAND USE, RECREATION, AND AESTHETICS

8.1 Land Use

This section of the supplement to RR 8 describes the location, ownership, existing and proposed land uses, and zoning of the area of the dredging activities within the Channel, APCO Island site, APCO Mainland site, and the Kentuck Project site.

8.1.1 Aboveground Facilities

A detailed description of all aboveground facilities is included in RR 1. In addition, RR 1 contains U.S. Geological Survey maps and aerial photographs of the project components and facilities.

8.1.1.1 Site Locale

The Channel is located in Coos Bay. The APCO sites are bounded by Coos Bay on the north and U.S. Highway 101 (“US-101”) on the east, and are part of a larger 86.32-acre parcel at 25S13W10TL0100000. The Kentuck Project site is on the western shore of Coos Bay at the mouth of Kentuck Slough, to the west of North Cardinal Mark 11 along the Channel, including parts of T25S, R12W, Section 6, Tax Lots 100, 700, and 799; and T25S, R13W, Section 6, Tax Lots 100, 300, 400, and 500. Figure 1 shows the three sites.

8.1.1.2 Land Ownership

The Channel is maintained by the USACE. The bay is considered waters of the State, with the bottom of the bay owned by the Oregon DSL. APCO Coos Properties, LLC owns the APCO sites. Fort Chicago Holdings II US LLC owns the Kentuck Project site.

8.1.1.3 Existing Land Use

Existing land use is described in RR 8: the four dredging areas are within the Coos Bay waterway and Channel; the APCO sites currently are not actively used; and the Kentuck Project site is currently used for pasture.

8.1.1.4 Permanent Land Use

Permanent land use is described in the Overview and Project Description section of this Report. The four dredging areas would be part of the Channel, which is used by deep-draft commercial ships and barges, a commercial fishing fleet, and recreational boats. The APCO sites and Kentuck Project site would be used for deposition of dredge material.

8.1.1.5 Temporary Land Use

The temporary land use would be in the same sites as described in the permanent land use section above.

8.1.1.6 Zoning

The Coos Bay Estuary Management Plan ("CBEMP") is described in RR 8.

Dredge Area 1 is designated 59-CA, Dredge Area 2 is 2-NA, and Dredge Area 3 is 3-DA. All three are within the local jurisdiction of Coos County. Dredge Area 4, the Jarvis Turn, is within the local jurisdiction of the City of Coos Bay and is designated is 52-NA. These four CBEMP designations allow only limited dredging. JCEP proposes to request a Comprehensive Plan Map amendment in both Coos County and the City of Coos Bay to change the designations of all four Dredge Areas to DDNC-DA (Deep Draft Navigation Channel), which allows dredging subject to special conditions. The proposed dredging also would require conditional use permits in both jurisdictions. JCEP attended a pre-application conference with the City of Coos Bay Community Development Department staff members on February 2, 2017, to discuss Dredge Area 4 and a pre-application meeting with Coos County staff members on January 26, 2017 to discuss Dredge Areas 1, 2, and 3.

The APCO sites are zoned M-H (City of North Bend 2016a). JCEP attended a pre-application conference with the City of North Bend Community Development Department staff members on April 14, 2017, to discuss the APCO sites. The proposed permanent bridge is an expressly allowed use in the M-H zone, but would require a Type II Estuarine and Coastal Shoreland authorization. As part of the review, JCEP would request an interpretation from the City of North Bend that fill placement in the upland portions of the APCO sites is an activity that does not require a land use authorization (City of North Bend 2005).

Approximately 0.32 acre of the northwest corner of the APCO Island site has an Airport Clear Zone overlay. The overlay prohibits residential development and public access facilities and has a 35-foot height limit. It limits noise, glare, landfills, communication towers, water impoundments, and wetlands. Since the proposed use of the APCO Island site includes none of these, it is consistent with the overlay, and is expected to meet all applicable standards and criteria (City of North Bend 2005).

Both sites are surrounded by the Special Flood Hazard Area - FEMA Zone AE (City of North Bend 2016b), and approximately 0.8 acre of the project area would encroach into the Special Flood Hazard Area: 0.77 acre for the bridge and 0.03 acre for the site entranceway. Properties within the Special Flood Hazard Area are designated with the City Floodplain Zone (F-P). The APCO Island and APCO Mainland sites would require a City of North Bend development permit that demonstrates compliance with the F-P standards, including plans certified by a registered professional engineer (City of North Bend 2005).

Both APCO sites are within the City of North Bend's Enterprise Zone and Urban Renewal District (City of North Bend no date). The Coos Bay Enterprise Zone includes portions of the City of North Bend, the City of Coos Bay, and Coos County. It is set to expire in 2025 (Coos County Assessor 2015). Enterprise zones temporarily abate new property taxes to induce job-creating investments. The APCO sites are designated for heavy manufacturing in the North Bend Urban Renewal Plan (Beckendorf Associates Corp. 1994). The APCO sites are the Urban Renewal Plan's Development Management Unit, which is considered prime industrial land, and are not suitable for water-dependent use because of strong currents (City of North Bend no date).

The Kentuck Project site has the CBEMP designations Natural Aquatic (13B-NA, 15-NA), Development Aquatic (14-DA), and Rural Shorelands (15-RS). Most of the property is in the Coos County Exclusive Farm Use ("EFU") designation. It includes small portions of Coos County Forest (F) and Rural Residential (RR-2) designations, as well. "Dredge material disposal and restoration" is a use that is permitted outright in EFU (Coos County 1985). Dredge material disposal in Rural Shorelands (15-RS) may be permitted subject to special and general conditions and requires a conditional use permit. No dredge material will be placed within areas located within the bay or CBEMP zoning areas: Natural Aquatic Upper Bay and (13B-NA, 15-NA), and Development Aquatic Upper Bay (14-DA).

Construction, operation, and maintenance of the dredging activities will be executed in accordance with all applicable permits and approvals.

8.1.2 Facility Abandonment/Replacement

Facility abandonment/replacement is detailed in RR 8.

8.2 Residential and Commercial Areas

8.2.1 Planned Residential and Commercial Areas

Resource Report 8 covers the area of the dredging activities. No additional information or analysis is needed.

8.2.2 Existing Residences and Buildings

There are no buildings on or within 50 feet of the limits of disturbance on the APCO sites (City of North Bend 2017). Resource Report 8 covers the proposed dredging activities and contains information about the Kentuck Project site. No additional information or analysis is needed.

8.3 Public Land, Recreation, and Other Designated or Special Use Areas

Resource Report 8 report covers dredging activities. No additional information or analysis is needed for this section, which encompasses: public or conservation land; natural, recreational, or science areas; and agency and landowner consultation.

The APCO sites and Kentuck Project site are on privately owned land, and no recreational activities would be allowed within the property boundaries.

8.3.1 Agency and Landowner Consultation

Agency contacts made in the preparation of RR 8 include discussions with various agency representatives of Coos County and the City of North Bend concerning planning, development, and zoning. Discussions with federal and state representatives were also conducted. The APCO sites' landowners have been contacted (Table 8.3-2 in RR 8 lists contact information).

8.3.2 Impacts and Mitigation

Use of the Channel would permanently affect approximately 27 acres; use of the APCO sites would permanently affect approximately 40 acres; and use of the Kentuck Project site would permanently affect approximately 145 acres, for a total of approximately 212 acres. These activities would have no significant adverse impacts on existing land use. Dredging outside the Channel would require a comprehensive plan and text amendment and conditional use permits in both Coos County (Dredge Areas 1, 2, and 3) and the City of Coos Bay (Dredge Area 4), as described in the Zoning section above.

The APCO sites are zoned for industrial use. JCEP would request an interpretation from the City of North Bend that the uses associated with the dredge material placement would be consistent and compatible with existing zoning on the APCO sites as part of the Type II Estuarine and Coastal Shoreland authorization and flood permit.

No land-use-related mitigation would be required.

An adjacent project, led by the OIPCB, is being permitted to widen and deepen the Federal Navigation Channel. If the OIPCB project is approved, the Channel modifications would subsume the dredging activities and subsequent future maintenance dredging for this project.

8.4 Contaminated or Hazardous Waste Sites

Contaminated and hazardous waste site are detailed in the RR 7 and RR 12 supplements; no further analysis is required.

8.5 Coastal Zone Management Areas

Coastal Zone Management Areas are detailed in RR 8. No further analysis is required.

8.6 Visual Resources

Visual resources will be evaluated in the final version of RR 8. Permanent changes to the visual environment at the four proposed Dredge Areas are not anticipated. Permanent changes to the visual environment could occur at the APCO Island site.

8.7 Applications for Right-of-Way and Other Uses

Construction, operation, and maintenance of the dredging activities will be executed in accordance with all applicable permits and approvals. Comprehensive Plan and map amendments and conditional use permits will be filed with the City of Coos Bay and Coos County.

9 RESOURCE REPORT 9 – AIR AND NOISE QUALITY

Temporary air and noise impacts associated with the dredging activities are discussed in the following section. No long-term operational impacts are anticipated.

9.1 Air Quality

Existing ambient air quality and regulatory requirements applicable to the area surrounding the proposed dredging activities are discussed in Section 9.1 of RR 9. No additional information is necessary.

9.2 Noise Quality

Existing ambient noise levels and regulatory requirements applicable to the area surrounding the proposed dredging activities are discussed in Section 9.2 of RR 9. No additional information is necessary.

9.3 Environmental Consequences

Air quality impacts associated with the dredging activities would be similar to those described in Section 9.3.1.1 of RR 9. These would result from emissions generated by dredging equipment, pumps, and earthmoving equipment used to spread the dredge spoils across the APCO sites and the Kentuck Project site. Air quality impacts would be temporary in duration and limited to the period of active dredging and dredge spoils placement. No long-term impacts are expected.

Noise impacts associated with the dredging activities would be similar to those described in Section 9.3.1.1 of RR 9, and would result from operation of the dredging and earthmoving equipment, and the use of an impact hammer to set piles for the temporary construction bridge. Noise impacts would be temporary, and limited to the period of active dredging and dredge spoils placement. No long-term impacts are expected.

10 RESOURCE REPORT 10 – ALTERNATIVES

The Pilots were consulted to determine whether dredge area improvements are needed along the Channel to achieve the required level of channel availability to efficiently lift and transport the increased LNG throughput of the optimized facility design. The Pilots used the latest sounding data, data from vessel transit position tracking systems (Portable Pilot Units or PPU's), the results of computerized simulations of the Coos Bay Port channel, and years of site-specific pilotage experience to determine the areas where improvements to the existing channel are needed most. The proposed channel dredge prism design is then influenced by environmental impact considerations, normal dredging practice and the physical characteristics (i.e., length, beam, and draft) of the vessels transiting the bay, both today and in the near term future.

Environmental factors impacting channel availability include wind, current, fog, tide level and offshore wave height. Marine winds from the north, south, and west push against the side of the vessel during the transit, forcing the vessel to the eastern and southern sides of the existing navigation channel.

Larger vessels are influenced more noticeably by wind due to their increased hull wind surface area. Additionally, longer and wider vessels have less maneuverability space in the existing navigation channel, simply because they occupy more of the channel and cannot turn as quickly as smaller vessels. Therefore, ocean going LNG vessels require a larger turning radius that is facilitated by the four areas of dredge enhancements proposed by JCEP.

11 RESOURCE REPORT 11 – RELIABILITY AND SAFETY

Resource Report 11 adequately addresses reliability and safety issues potentially associated with the dredging and upland dredge spoil disposal activities.

12 RESOURCE REPORT 12 – PCB CONTAMINATION

Soils and sediments contaminated by Polychlorinated Biphenyls ("PCBs") are not applicable, because no compressor stations are being modified as part of the JCEP Project Area or the dredging and upland dredge spoil disposal activities.

13 RESOURCE REPORT 13 – ADDITIONAL INFORMATION

No additional information needs to be provided.

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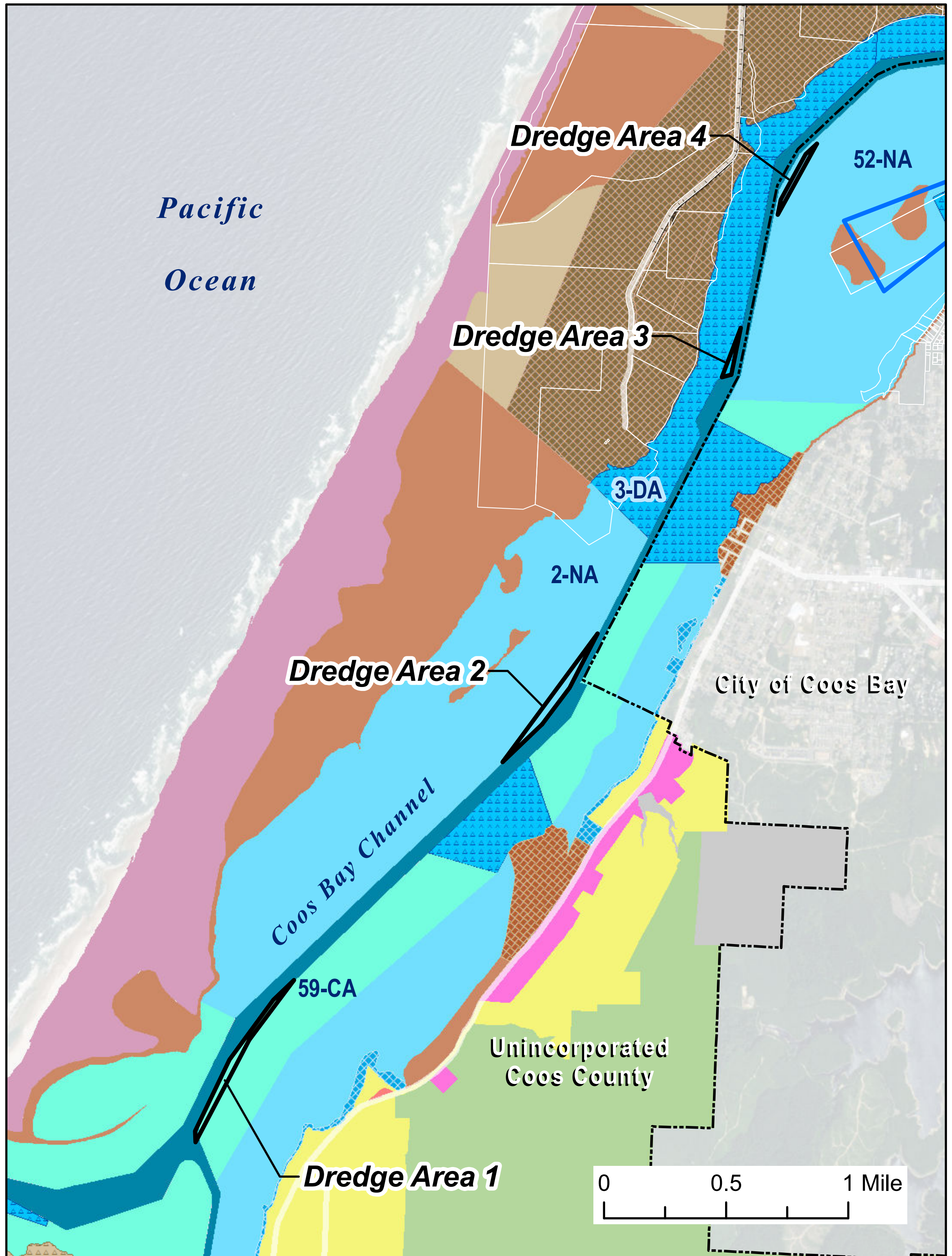
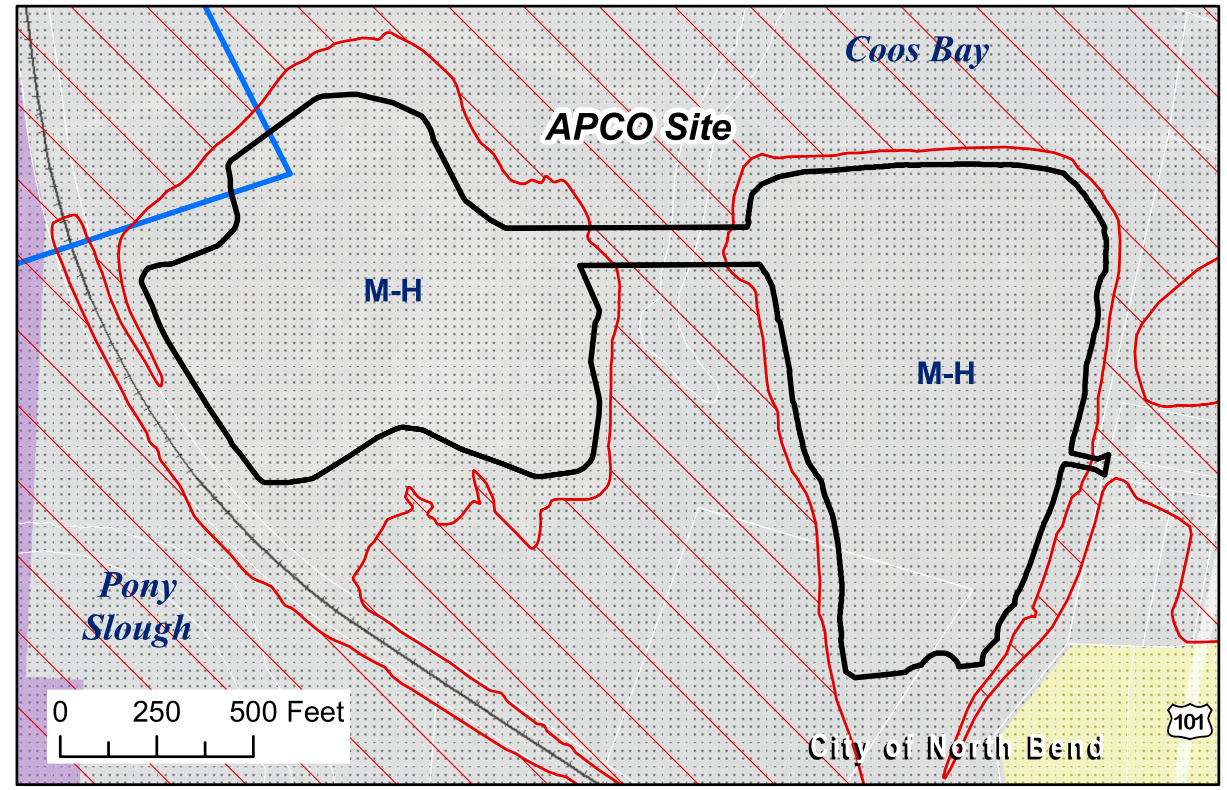




Coos Bay Estuary Management Plan (CBEMP) Designations

Aquatic Area
- Natural Aquatic
- Conservation Aquatic
- Development Aquatic
- Urban Development Area
- Deep Draft Navigation Channel

Shoreland Area
- Natural Shoreland Area
- Conservation Shoreland Area
- Rural Shoreland Area
- Development Shoreland
- Urban Water-Dependent Area
- Water-Dependent Development Shorelands

Coos County Zoning Designations
- Commercial
- Controlled Development
- Exclusive Farm Use
- Forest
- Industrial
- Recreation
- Rural Center
- Rural Residential
- Urban Residential

North Bend Zoning Designations
- Airport Zone
- Industrial
- Single Family Residential

- Airport Clear Zone
- Special Flood Hazard Area - FEMA Zone AE

Jordan Cove Energy Project, L.P.

N

JCEP Project Area

City Limits

Parcel Line
(shown in white)

Note: Only zones that overlap the Project Area are labeled

Data Sources: Coos County, Coos County Assessor's Office, City of North Bend

Jordan Cove Energy Project

Figure 1

Zoning Designations

EXHIBIT 2

6/15/79

0057

COOS COUNTY PLANNING DEPARTMENT

COOS BAY ESTUARY

INVENTORY AND STUDY

Prepared by

David Brunsman - Frank Ratti
Staff Estuary Planners

With the assistance of the Coos County Planning Department Staff

David Richey - Planning Director

JUNE , 1979

TABLE OF CONTENTS

(Copies of these maps are available at the Coos County Planning Department)

This study was financially aided by a grant from the Land Conservation & Development Commission.

INTRODUCTION

Coos Bay is the largest estuary existing totally within the boundaries of the State of Oregon. It is vitally important to the people of the region as a major shipping port on the West Coast. It is designated as a deep-draft development estuary by the Oregon Department of Land Conservation and Development (LCDC 1977) in order to promote and preserve its use as an industrial port. The environmental resources of Coos Bay are also vitally important to the local people and their economy. The LCDC action (1977) to classify the estuary as a deep-draft port does not intend to preclude the existence of the natural habitats of Coos Bay. Areas of conservation and preservation (Natural Management Units) are also to be designated within the estuary.

The purpose of this paper is to list criteria and establish priorities for determining critical natural and development areas of the estuary and its shorelands. A balanced view of industrial and environmental concerns is intended in the study. Information has been gathered from the existing literature on the Coos Bay estuary, and also to a large extent from interviews with local individuals representing various interests and viewpoints.

Important natural areas and water-dependent use sites as addressed in the Coastal Goals (LCDC 1975) are identified within the Coos Bay estuary. The estuary has also been divided into study units of similar physical, biological, and development characteristics to aid in the eventual establishment of management units in the comprehensive plan. It is hoped that this inventory and study by the Coos County Planning Department will be valuable in the continuing evolution and implementation of the Coos Bay Estuary Comprehensive Plan.

CRITERIA FOR ESTUARINE MANAGEMENT UNITS

The estuarine resources goal of the Statewide Planning Goals and Guidelines (LCDC 1975) states that major tracts of salt marsh, tideflats, and seagrass and algal beds, shall be preserved in natural management units as a minimum inclusion. The preservation and protection of these habitats is important, because they are the sites where many of the beneficial functions of estuaries take place.

Salt Marsh

In Coos County estuary, the area of salt marsh has been greatly reduced over the past hundred years. It has been estimated that over 90% of pre-European settlement salt marsh area has been lost to tidegates, dikes, and fill (Baldwin, et. al. 1977). Most of the land was taken for agriculture, but much was filled for industrial, recreational, and residential use. In any case, little salt marsh remains in Coos Bay estuary, making almost every remaining tract in the estuary a major tract.

Salt marshes have several functions that are critically important to estuaries. They are among the highest yield vegetative producers on earth, higher than intensively managed agricultural land (Hoffnagle and Olson 1974). Some of the marsh plants are eaten directly by insects, birds, and mammals. Most of the vegetation however, dies and decays into organic particles called detritus, which has great significance in the estuarine system. This detritus is the primary source of food for most clams and other filter feeding invertebrates. The salt marsh supplies a continuous source of food, in contrast with the seasonally varying supply of phytoplankton in the water column.

Other benefits from salt marshes are due to its physical structure. The marsh acts as a storage area for flood water and storm tides. Marshes also moderate water temperatures in the estuary. The cool marine waters are warmed in the shallow channels, which enables the rearing and spawning of certain crabs, clams, and fish to occur. The salt marsh can also act as a filter for pollutants, especially domestic sewage (Hoffnagle, et.al. 1976). Nutrients from the sewage are removed and oxidized by bacteria in the marsh, and returned after a period of time in a form useable to estuarine organisms. The salt marsh generally acts as a trap of nutrients and sediments from upland streams. The accretion of sediments in salt marshes impedes the filling of estuary tidelands and channels. Marsh vegetation along channel banks stabilizes shoreland from erosion.

The marsh is a nesting habitat for rails and marsh wrens, a fishing ground for herons, and a hunting area for several birds of prey. The marsh also serves as a habitat for several small mammals including the vagrant shrew and larger mammals such as deer, raccoon, and beaver.

Tideflats

Tideflats are the lands between mean lower low water and mean higher high water by the definition used in LCDC documents (1975). These lands are generally represented by the Tideland map of Coos Bay, (Oregon Division of State Lands (DSL) 1973a). Coos Bay has a total acreage of 12,380, of which 6,300 acres are tideland area (DSL 1973a).

It shows that 15 percent of the original tidelands in the bay have been filled. The substrate of tidelands can vary from rock to sand to a very soft mud. Each of these bottom types supports different kinds of animals underneath and upon its surface.

Tidelands are important as the home for the abundant animal life within the estuary. The bay clams that can be harvested easily exist on the tideflats along with great numbers of burrowing worms, crustaceans, and molluscs. These animals utilize the detritus produced in the salt marshes and also filter algae from the water. The small worms and crustaceans become the diet of larger crabs and fishes that are of direct importance to man. The tidelands, like marshes, also have functions that influence the physical and chemical conditions of estuaries. Sediments absorb organic material from passing water, and microbes decompose it into useable nutrients of ammonia, nitrates and organic phosphates (Odum 1970). Tidelands function to moderate water temperatures and thus provide optimum habitat for spawning and rearing of estuarine organisms. Tidelands also provide food and resting area for shorebirds and some terrestrial mammals.

Eelgrass and Algal Aquatic Beds

Eelgrass and algal beds are vegetative cover on tracts of tideland. which enhance their values for productivity and animal habitat. Eelgrass, Zostera marina, has minor importance as a direct food item. It supports a variety of small animals that live attached to its leaves. Eelgrass serves as specific habitat for several fish species, especially the bay pipefish, and is used by Pacific herring for a spawning ground (Gaumer, Demory and Osis 1973). It has been recognized as the major diet of a few birds, notably the Black Brant (Carl 1963). The major importance of eelgrass is the same as salt marsh, the contribution of organic plant matter to the estuary, which decomposes to useful food particles for filter feeders such as clams. Eelgrass also absorbs nitrogen and phosphorus nutrients from the sediment through its roots and releases them through its leaves back into the estuary system (Thayer, Wolfe, and Williams 1975). Physical functions of eelgrass retard currents and prevent erosion of sediment.

Algal beds are also very important producers of food material for estuarine animal populations. Sea urchins and periwinkles are common animals that feed directly on algae. Ninety percent of the algal production becomes either dissolved or particulate food (Mann 1973). Eelgrass and algal beds occur on a variety of tideland substrates. Their presence enhances the value of tidelands. Coos Bay has large beds of eelgrass on mud-sand sediment and beds of kelp on rocky substrate.

The vegetative production of aquatic beds and marshes in estuaries are the fundamental food supply for the rest of the organisms in the system primarily through detritus food chains. All fisheries, recreational and commercial, depend upon this production to support the species desirable to man.

Other Environmental Criteria

Other environmental resources must be considered in addition to marsh, tideland and aquatic beds. Significant populations of marine organisms such as clam and crustacean beds are to be conserved as estuarine resources (LCDC 1975). Also noted as inventory requirements are specific habitats such as nesting sites, spawning grounds, juvenile rearing areas and adult feeding areas of fish and wildlife species.

The extent of previous habitat alteration and current use influence habitat quality. The potential for aquaculture, commercial harvest, and recreation are also considered to be inventory criteria that determine habitat importance. The accessibility of the habitats on the estuary for these uses is also taken into account to establish the importance of each site.

The entire estuary system operates as an interrelated and interdependent system. Man's activities in the estuary, on the shoreland, and up the rivers have effects upon the quality of estuarine life. It is sometimes arbitrary to place values on individual sites in the estuary, but this must be done to implement land use planning goals.

The criteria for determining the significance of estuarine habitats is the quantity and quality of each habitat. Quantity of habitats can be measured in acreage or productivity. Quality can be attached to specific uses of a habitat, its uniqueness in the bay, and the extent of its degradation. The habitat types of marsh, tidelands, and aquatic beds are listed (LCDC 1975), as primary criteria in determining habitat importance, because they are the most important sources of food production in the estuary. The presence of a clam bed is also a primary criteria for the determination of habitat importance for tide flats. Qualitative data are used as secondary criteria to differentiate among tracts of the same habitat type.

LCDC ESTUARINE RESOURCES GOAL REQUIREMENTS FOR MANAGEMENT UNIT DESIGNATIONS (1975)

Natural   At least all major tracts of:

Saltmarsh

Tideflats

Seagrass beds

Algal beds

<u>Conservation</u> Smaller significant habitats:

Fringing marsh

Small tideflats

Fringing aquatic beds

Narrow shores (especially with clams present)

Clam or oyster beds (not classed natural)

Partially altered habitats (e.g. marsh with restricted flushing)

<u>Development</u>

Deep water near shore

Navigation channels

Subtidal inwater dredge disposal sites

Areas of minimal biological productivity (e.g. diked, rip-rapped shores)

Areas of at least significance are considered to be those areas of greatest existing degradation of habitat by human activities or natural factors. Minimal significance is attached to areas of low production of bethnic plants or animals having little potential for restoration or enhancement. Frequently maintained channels are also in the category of minimal biological significance.

CRITERIA FOR COASTAL SHORELANDS MANAGEMENT DESIGNATIONS

The Coastal Shorelands Goal (LCDC 1975) has a set of criteria for placing values upon shorelands, which is different from criteria for estuarine lands. Important habitats for fish and wildlife species remain a primary consideration for protection. Included in shoreland habitats for wildlife protection are bird nesting sites, riparian vegetation, fresh water marshes and seasonally flooded agricultural lands, which serve as resting area for migrating waterfowl. Historical and archeological sites from Indian and pioneer eras of Oregon history are identified as well as significant aesthetic resources.

Water-dependent human activities on shorelands are also given value and priority in planning land use designations. Sites for deep draft moorage, shallow draft marinas, aquaculture and fish processing, and recreational access to the estuary are among coastal shorelands inventory requirements. Criteria from LCDC estuary and shoreland goals (1975) are applied to the existing uses on the estuary toward the end of identifying and protecting sites for water-dependent uses. Water-dependent uses can range from recreational to industrial developments, but the common criterium among water-dependent uses is that they can be carried out only on, in, or adjacent to water areas, because the use requires access to the water body.

LCDC COASTAL SHORELANDS GOAL REQUIREMENTS FOR COASTAL SHORELANDS USES (1975)

Protection of Natural Values

Major marshes

Significant wildlife habitat

Coastal headlands

Exceptional aesthetic resources

Protection for Water-Dependent Recreational, Commercial, and Industrial Uses in Urban and Urbanizable Land

Deep water close to shore (with supporting land facilities suitable for ship and barge facilities)

Potential for aquaculture

Potential marina sites

Potential for recreational use of water or riparian resources

Appropriate Uses in Rural Areas

Farm use

Forest product propagation

Private and public water-dependent recreation developments

Aquaculture

Commercial and industrial water-dependent uses (water-related uses if county finds need cannot be accommodated in urban and urbanizable areas)

Major and Minor Subdivisions (if county finds need cannot be accommodated upland or in urban or urbanizable areas, and compatible with objectives of protection of riparian habitat)

Single family residences (on existing lots)

The relationship between shorelands and estuarine lands in the coastal goals (LCDC 1975) requires that adjacent land use designations shall be compatible with one another. Shorelands are given higher priority for development uses than estuarine lands. However, the highest development priority on shorelands is for water-dependent uses. In all cases, the designation of shoreland zones depend upon the management unit of the adjacent estuarine lands.

CRITERIA FOR BEACHES AND DUNES MANAGEMENT DESIGNATIONS

The Beaches and Dunes Goal (LCDC 1975) seeks to protect significant wildlife habitat in dunes such as younger stabilized dunes and wet deflation plains, and also to limit development in hazardous areas such as active foredunes or open dune sand (USDA Soil Conservation Service 1975). Another major concern is to preserve the existing fresh water table in the dune areas. A dilemma exists in planning development in dune areas. The dilemma is the fact that the habitats with soils stable enough for building structures happen to be prime habitat for wildlife, while areas of minimal wildlife significance have unstable soils hazardous for building structures (Table 1). Conditionally stabilized dunes, which have been planted with European beachgrass, and dredge spoil sites are generally the best sites for industrial use in the beaches and dunes area. Beaches and dunes habitats have been identified in Coos County Planning Department's Background Document #1 (1978). Particularly important wildlife habitats on North Spit are identified on the estuary inventory maps that are part of this report.

LCDC BEACHES AND DUNES GOAL REQUIREMENTS FOR COASTAL BEACHES AND DUNES USE (1975)

Beaches and dune land uses shall be based on the capabilities and limitations of these areas to sustain different levels of activity or development. Factors taken into account are to protect areas of critical environmental concern; areas having scenic, scientific, or biological importance; and areas containing significant wildlife habitat (Table 1).

The necessary relationship between the activities on beaches and dunes and the activities on estuarine lands in the coastal goals (LCDC 1975) is that there adjacent land use designations shall be compatible with each other. Beaches and dunes are given higher priority for development use than estuarine lands. However, development is given lower priority in beach and dune areas than on other shorelands. Protection of critical habitats is the highest priority in all of the state coastal goals. However, the Beaches and Dunes Goal broadens the scope of concern with conditions and restrictions upon development in areas with hazards or soils limitations. The following table illustrates the relationships between various types of beach and dune habitat types and the activities for which they are best suited.

TABLE 1 DESCRIPTION OF OREGON COASTAL BEACHES AND DUNES HABITAT TYPES (USDA SOILS CONSERVATION)

Habitat Type	Stability of Soil	Vegetation Cover	Wildlife Use	Physical Hazards	Recreation Potential	Development Potential
Open Dune Sand	Unstable	None	Travel	Buried Trees Quicksand	Excellent Off-road Vehicles	Poor
Active Dune Hummocks	Unstable	Pioneer Species	Bird Variety	Quicksand	Excellent	Poor
Active Foredunes	Unstable	European Beach Grass	Shorebirds Snowy Plover	Visual Barrier	Fair	Poor
Foredunes	Conditionally Stable	Spare Growth Local Species	Shorebirds Snowy Plover	Tsunamis	Fair	Poor
Open Dune Sand Conditionally Stable	Conditionally Stable	Planted European Beach Grass	Few Species	--------	Poor	Fair
Dune Complex	Conditionally Stable	Planted European Beach Grass	Few Species	--------	Poor	Fair
Younger Stab-ilized Dunes	Stable	Native Grass to Woody Species	Habitat for a great var-iety of species	Depth of Water Table Permeability of soil;	Wildlife Observation	Good (Conditional)
Older Stabil-ized Dunes	Stable	Forest Species	Great Variety	Steep Slope; Water Table; Permeability;	Wildlife Observation	Good (Conditional
Older Foredune	Stable	Forest Species	Great Variety	Steep Slope; Water Table; Permeability;	Wildlife Observation	Good (Conditional
Wet Deflation Plains	----------	Grass; Shrub Sedge and Rush	Great Variety	Failing Sewerage	Wildlife Observation	Poor
Wet Interdun	----------	Varies from Shrub to Open	Great Vari	Failing Sewerage	Wildlife Observation	Fair (nditional)

SUMMARY

Criteria for the designation of estuarine management units, and shorelands, beaches and dunes land use priorities are taken from LCDC Statewide Planning Goals and Guidelines (1975) and adapted to the inventory of data for Coos Bay Estuary. Land use designations on shorelands shall be compatible with estuarine management units. Development has a higher priority on shorelands than estuarine lands, although the highest development priorities are water-dependent (1st) and water-related uses (2nd) in all development areas.

The map inventory of Coos Bay Estuary (CCPD 1979) presents the data necessary to designate management units and potential land uses in Coos Bay Estuary and shorelands. These maps were prepared using the information outlined in this report as the criteria for the estuary inventory.

ESTUARY RESOURCES INVENTORY

An inventory of estuarine resources, environmental and socio-economic has been prepared for Coos Bay estuary in a map format (See inventory maps of Coos Bay Estuary I-IX; Coos County Planning Department (CCPD 1979). Environmental inventories include estuarine habitats, clam beds, and fish and wildlife habitats in the estuary study area. Socio-economic inventories identify existing land uses and potential water-dependent and water-related uses. Other data which bridge environmental and socio-economic categories are areas of habitat alteration due to human activities and historical, archeological, and aesthetic resources. Basic physical data such as hydrology, hydrography and water quality are addressed in the Coos County Comprehensive Plan Background Document #1 (CCPD 1978). These inventories present several types of data for each site in the estuary.

It is relatively easy to list and collect types of data needed for an inventory of estuary resources, but is more difficult to establish priorities for how all the information can be analyzed to derive land use decisions. The difficulty lies in the fact that there are no established methods to compare environmental with social or economic values. The criteria developed in this paper are derived from LCDC Statewide Planning Goals and Guidelines (1975). Criteria from these Goals are adapted to the existing data base available for Coos Bay estuary.

COOS BAY ESTUARY INVENTORY MAPS

Map I: Clam Beds in the Coos Bay Estuary

The primary source of data on clam beds in Coos Bay estuary is an Oregon Institute of Marine Biology survey of distributions of bottom dwelling invertebrates (USDI 1971). Although this data is almost ten years old, it is the only study to date that has surveyed the entire bay. Additional data on clam beds are from the Oregon Department of Fish and Wildlife clam surveys (Gaumer 1978). The ODFW has made detailed surveys of bay clam distributions in South Slough and the lower bay below Jordan Cove. Their data includes population density information, although their survey has not yet covered the entire bay.

There are three major criteria that determine major clam beds in the estuary. Clam beds with active recreational use or with great potential, if access were improved, are very important. Most recreational clam beds occur below the railroad bridge and in South Slough, although softshell clams are dug along the causeways in Haynes Inlet and North Slough. A second criteria of clam bed importance is its use and potential for commercial clamming or shellfish aquaculture. At this time commercial harvest is closed above Sitka Dock by the State Board of Health. There may be potentially suitable clam beds for commercial harvest in subtidal areas of the lower bay and in South Slough. South Slough at this time is the center of oyster aquaculture. Finally, large beds of productive clam species, such as Tellina and Macoma, that are not necessarily of recreational or commercial importance, do contribute signifantly to the productivity of the estuary. The large tideflats in the upper east bay contain tremendous numbers of these species.

The major limitation of the clam beds map is that subtidal areas of the bay have not been adequately surveyed. It is known that the greatest density of gaper and cockle clams exists beneath the tidelands in some areas (Gaumer 1978). The subtidal beds are thought to be major spawning stocks in Oregon estuaries. Further study will have to be made to identify major subtidal beds in Coos Bay estuary.

Map II; Crustacean Habitats in the Coos Bay Estuary

The source of data for crustacean habitats are the same as for clam beds. Oregon Institute of Marine Biology (USDI 1971) made a general survey that covered the entire bay, while the ODFW (Gaumer 1978) made a more detailed survey of mud and ghost shrimp that covers the lower bay. Information on grey shrimp and dungeness crab was given by ODFW (1979a).

Mud shrimp and ghost shrimp habitats are important areas for commercial and recreational harvest of bait. Corophium aphipod distribution shows important tideland areas for rearing of juvenile salmonids. The distributions of dungeness crab and grey shrimp demonstrate the complexity of the estuarine system. These species are mobile and migrate according to salinity. Seasonal changes in fresh water flow and daily changes in tidal flow determine the extent of salinity penetration into the estuary. Both species have been collected to the heads of tide in Coos Bay tributaries certain times of the year.

The major limitation of the crustacean habitat map is inadequate data in subtidal areas. Another limitation is the generalized nature of some of its data, which makes the map less applicable to site specific decisions than substrate and aquatic vegetation mapping.

MapIIIa: Estuarine Habitats in Coos Bay (1"=3000')

Map IIIb: Estuarine Habitats in Lower Coos Bay and South Slough (1"-1500')

The source of these maps is the ODFW Habitat map of Coos Bay (1978a), which was based on the Oregon Estuarine Habitat Classification System (ODFW 1978b). This system categorized estuarine lands according to tidal exposure (water regime), physiography (class), and substrate type (subclass). The original habitat map was made from a compilation of existing data, the use of aerial photography, and field surveys by ODFW personnel. The habitat map of the entire bay (IIIa) is reduced in scale from the original source. The map of the lower bay and South Slough is reproduced exactly at the scale presented by ODFW.

The habitat maps can be used to identify all tracts of salt marsh, tideflat, and aquatic beds. Their limitation is that there is no differentiation of major tracts of these habitat types. Criteria for identifying major tracts of estuarine habitat types are discussed earlier in this inventory paper. The habitat maps can become the primary tool for evaluating habitat importance, because it is the most current and accurate presentation of data that covers the entire estuary. As with other inventory maps the least available information is on the subtidal lands of the estuary.

Map IV a; Map IV b: Fish & Wildlife in the Coos Bay Estuary

These maps are a summary of several ODFW maps that identify areas of critical importance for fish and wildlife species. The resulting maps describe important functions of each area to these species. Even though most of these species may be found at almost any site in the entire estuary, the maps were meant to focus on the uses of each area that are of primary importance or are particularly threatened. Some designations are site specific such as bald eagle nests, heron rookeries, and snowy plover habitat. Other uses are more generalized such as shorebird and fish habitat. Nesting sites need to be entirely protected from disturbance. Shorebird and waterfowl habitat can exist adjacent to development as long as their actual area remains unaltered. Juvenile salmonids, herring, and flatfish need particular habitats and high water quality to rear successfully in the estuary, so those environments should be protected and enhanced for these species. Striped bass seem to be able to thrive in more degraded habitats such as Isthmus Slough. Surf smelt, top smelt, embiotocid perch and many other fish species (Table 2) are more ubiquitous species in the estuary, and occur from the mouth to the head of tide during summer. The preservation of the diversity and abundance of these species is more dependent upon the maintenance of overall environmental quality and estuary production than specific area protection.

More specific data on individual species could not be mapped, but their distributions are included in species lists of fish (Table 2) and birds (Table 3).

The limitation of these maps is that the species are all highly mobile and thus judgement of the importance of particular habitats to them can be subjective. Qualitative information on these maps can be used as justification for differentiating the importance of tracts of the same habitat type in the estuary. This data may also be used to assist in the identification of restoration and mitigation projects such as enhancing striped bass habitat in Isthmus Slough or returning former salmon spawning streams back to production in South Slough.

Map V: Habitat Alteration Caused by Human Activity

The habitat alteration map is a synthesis of data by the estuary planners of the Coos County Planning Department. Each designation is based on separate criteria and implies certain existing environmental conditions. Each area of the estuary is designated with the category of alteration that is thought to have had the greatest influence upon its present condition. Some data are specific, such as filled lands (DSL 1973), diked lands (Hoffnagle and Olson 1974), and dredging (United States Army Corps of Engineers [USACE] 1976). Other designations are based on findings from studies of historic changes in the Coos Bay estuarine environment. Log storage is cited as the major contributing factor to alteration of Isthmus Slough and Coos River. Diking of marshlands for agricultural use has had major impacts in Catching Slough.

Siltation and accretion of sediments have been the major forms of alteration on the East Bay tide flats and also in Pony Slough, North Slough and Haynes Inlet. Siltation in East Bay is attibuted to erosion of uplands in the Coos River drainage basin primarily due to poor logging practices (Dicken, Johannessen and Hanneson 1961). However, siltation in Pony Slough, North Slough, and Haynes Inlet is significantly accelerated by the lack of circulation in them. Their narrow entrances cause poor flushing of suspended sediments, which get trapped inside their basins. The habitat alteration map implies that siltation on East Bay tideflats can be reduced by improving upriver land use practices, while the other three basins with siltation problems may be enhanced by restoration projects which increase circulation between them and the bay.

Table 2 Distribution of Fish Species in Coos Bay Estuary

Common Name (species)	SUBSYSTEM Marine 0-3 Mi	Lower Bay 3-9 Mi	Upper Bay 9-17 Mi	Riverine 17-30 Mi
Leopard Shark (Triakis semifasciata)	x			
Longnose Lancet Fish (Alepisaurus ferox)	x			
White Seabass (Cynoscion noblis)	x			
Pomfret (Bramajaponica)	x			
*Redtail Surfperch (Amphistichus rhodoterus)	x			
Wolf-eel (Anarrhichthys ocellatus)	x			
Copper Rockfish (Sebastes caurinus)	x			
Rock Greenling (Hexagrammos lagocephalus)	x			
Tidepool Sculpin (Oligocottus maculosus)	x			
Mosshead Sculpin (Clinocottus globiceps)	x			
Fluffy Sculpin (Oligocottus snyderi)	x			
Tubenose Poacher (Pallasina barbata)	x			
Longnose skate (Raja rhina)	x	x		
Whitebait smelt (Allosmerus elongatus)	x	x		
Eulachon (Thaleichthys pacificus)	x	x		
Penpoint Gunnel (Apodichthys flavidus)	x	x		
Pacific Sandlance (Ammodytes hexapterus)	x	x		
Bocaccio (Sebastes paucispinis)	x	x		
Cabezon (Scorpaenichthys marmoratus)	x	x		
Tubesnout (Aulorhynchus flavidus)	x	x		
Spiny Dogfish (Squalus acanthias)	x	x	x	
White Sturgeon (Acipenser transmontanus)	x	x	x	
Northern Anchovy (Engraulis mordax)	x	x	x	
Longfin Smelt (Spirinchus thaleichthys)	x	x	x	
Pacific Tomcod (Microgadus proximus)	x	x	x	
Surfsmelt (Hypomesus pretiosus)	x	x	x	
*Striped Seaperch (Embiotoca lateralis)	x	x	x	
*Walleye Surfperch (Hyperprosopon asgenteum)	x	x	x	
*White Seaperch (Phanerodon furcatus)	x	x	x	
*Pile Perch (Rhacochilus vacca)	x	x	x	
High Cockscomb (Anoplarchus purpurescens)	x	x	x	
Arrow Goby (Clevelandia ios)	x	x	x	
Pacific Pompano (Peprilus simillimus)	x	x	x	
Black Rockfish (Sebastes melanops)	x	x	x	
Kelp Greenling (Hexagrammos decagrammus)	x	x	x	
*Lingcod (Ophiodon elongatus)	x	x	x	
Padded Sculpin (Artedius fenestralis)	x	x	x	
Buffalo Sculpin (Enophyrs bison)	x	x	x	

0072

Kelp Greenling (Hexagrammos decagrammus)	x	x	x	
Lingcod (Ophiodon elongatus)	x	x	x	
Padded Sculpin (Artedius fenestralis)	x	x	x	0073
Buffalo Sculpin (Enophyrs bison)	x	x	x	
Sand Sole (Psettichthys melanostichus)	x	x	x	
Pacific Lamprey (Entosphenus tridentatus)	x	x	x	x
Green Sturgeon (Acipenser medirostris)	x	x	x	x
American Shad (Alosa sapidissima)	x	x	x	x
Pacific Herring (Clupea harengus pallasi)	x	x	x	x
Chum Salmon (Oncorhynchus keta)	x	x	x	x
Coho Salmon (Oncorhynchus kisutch)	x	x	x	x
Chinook Salmon (Oncorhynchus tshawytscha)	x	x	x	x
Cutthroat Trout (Salmo clarki)	x	x	x	x
Rainbow Trout (Salmo gairdneri)	x	x	x	x
Topsmelt (Atherinops affinis)	x	x	x	x
Bay Pipefish (Syngnathus griseolineatus)	x	x	x	x
Striped Bass (Morone saxatilis)	x	x	x	x
*Shiner Perch (Cymatogaster aggregata)	x	x	x	x
*Silver Surfperch (Hyperprosopon ellipticum)	x	x	x	x
Snake Prickleback (Lumpenus sagitta)	x	x	x	x
Saddleback Gunnel (Pholis ornata)	x	x	x	x
Pacific Staghorn Sculpin (Leptocottus armatus)	x	x	x	x
Speckled Sandab (Citharichthys stigmaeus)	x	x	x	x
English Sole (Parophrys vetulus)	x	x	x	x
Starry Flounder (Platichthys stellatus)	x	x	x	x
Bay Goby (Lepidogobius lepidus)		x	x	
Threespine Stickleback (Gasterosteus aculeatus)		x	x	x
Prickly Sculpin (Cottus asper)		x	x	x
Redside Shiner (Richardsonius balteatus)				x
Speckled Dace (Rhinichthys osculus)				x
Largescale Sucker (Catostomus macrocheilus)				x

x=species present according to summer sampling by Cummings and Schwarts (1971)

* Embiotocid Perch

Sources: Cummings and Schwartz 1971
Hostick 1974
Compiled by Cyndi Roye, ODFW, 1979

Table 3. Census of Winter Birds on Coos Bay Estuary.

STUDY UNITS (see page 19)

SPECIES	Sanctuary	Cape Arago	1	2	3	4	5+6	7	8	9	10+11	11+12	TOTAL
Common Loon	x	M	x	x	x	x	x		x		x		193
Arctic Loon	M		x	x									6
Red-throated Loon	x	x	x	M	x		x	x					15
Red-necked Grebe							M						4
Horned Grebe	x	x	x	M	x		x	x					109
Eared Grebe							M						2
Western Grebe	x	x	x	M	x		x	x	x	x	x	x	168
Pied-billed Grebe	x		x		M		x		x		x		14
Double-crested Cormorant	x	M	x	x	x		x	x	x	x	x	x	173
Brandt's Cormorant		x	M					x					4
Pelagic Cormorant		M	x	x	x		x		x				64
Cormorant, Sp.			M						x				26
Great Blue Heron	x	x	x	x	M	x	x	x	x	x	x	x	134
Cattle Egret										M			2
Great Egret				x			x		x	x	x	M	37
Snowy Egret							M						1
Green Heron						x					x		2
Black-crowned Night Heron						x			M				19
American Bittern							M						1
Whistling Swan			x	M		x							45
Black Brant		M			M								10
White-fronted Goose						M							1
Mallard	x			x			M		x		x		76
Gadwall				x			M						390
Pintail	x						M	x			x		219
Green-winged Teal							M	x					46
American Widgeon				x			x	M	M		x		72
*European Widgeon				M						x			3
*Northern Fulmar		M											3
*Shearwater, Sp.		M											2
*Canada Goose										M			1
Northern Shoveler							M						8
Wood Duck							M				x		4
Redhead				x				M					227
Ring-necked Duck							M						7
Canvasback				x			x	M		x		x	291
Greater Scaup			M	x	x			x					124
Lesser Scaup	M			x	x		x						89
Common Goldeneye				M	x		x			x			47
Bufflehead	M		x	x	x		x	x		x			214
*Oldsquaw				M									1
Harlequin Duck		M											2
White-winged Scoter		x	x	M	x		x	x		x			244
Surf Scoter	x	M		x	x	x	x	x	x				345
Black Scoter		M	x	x	x								11
Ruddy Duck	x			M	x		x	x					122
Hooded Merganser	x									M	x	x	5
Common Merganser					M				x				3
Red-breasted Merganser	x	x	x	x	x		M						75
Duck, Sp.			M				x						19
White-tailed Kite						x						M	5
Sharp Shinned Hawk	M	x						x	x			x	9
Cooper's Hawk	M							x		x			7
Accipiter, Sp.			M										1
Red-tailed Hawk	M					x	x	x			x	x	11
Rough-legged Hawk												M	12
Buteo, Sp.										M			2
Bald Eagle										M			1
Marsh Hawk						M	x	x				x	6
Merlin			x	x		M							3
American Kestrel	x			x				x		x	x	M	24
*Peregrine Falcon				M									1
• Ruffed Grouse	x	x											2
Ring-necked Pheasant							M						1
Virginia Rail	x						x					M	6
American Coot	x		x		M	x	x	x	x	x	x	x	522

STUDY UNITS (see page 19)

SPECIES	Sanctuary	Cape Arago	1	2	3	4	5+6	7	8	9	10+11	11+12	TOTAL
Black Oystercatcher		M	x		x								15
Semipalmated Plover					x								10
Snowy Plover				M									5
Killdeer	x	x	x		x	x		x		x	x	M	481
Black-bellied Plover	x		x	x	x		x	x				M	75
Surfbird		x	x		M								108
Ruddy Turnstone			x		M		x						5
Black Turnstone		x	x		M			x					238
Common Snipe						x			M	x		x	135
Spotted Sandpiper									x			M	6
Lesser Yellowlegs										M			3
Rock Sandpiper		M											17
Least Sandpiper		x		x			x			M	x		358
Dunlin	x			x	x		x	x				M	11,334
Long-billed Dowitcher							M					x	55
Western Sandpiper	x			M	x		x	x		x	x		693
Sanderling	x	x	x	M	x	x	x			x			514
*Whimbrel			M										2
*Marbled Godwit				x				M					13
Sandpiper, Sp.	x		x				M						288
[illegible]l Phalarope	x	x	x	x	x	M		x		x			251
Northern Phalarope				x	x						x		3
Glaucous-winged Gull	x	x	x		x	x	x	M	x		x	x	209
Western Gull	x	x	x	M	x	x		x	x				626
Herring Gull	x	x	x	x	x				x	M	x		1,301
Thayer's Gull					x		M		x				5
California Gull		x		x				x					3
Ring-billed Gull				M			x	x	x		x	x	133
Mew Gull		x	x		x		x	M	x		x	x	54
Bonaparte's Gull			x		x		x	x		M		x	109
Black-legged Kittiwake		M											6
Gull, Sp.	x		x		x	x	x		x	x	x	M	2,400
*Sabine's Gull		M											1
*Common Murre		M											43
*Alcid, Sp.				M									3
*Pigeon Guillemot		M											1
*Rhinoceros Auklet		M											2
Cassin's Auklet		M											3
Rock Dove					x				M				44
Mourning Dove	M												1
Barn Owl							M						1
Great-horned Owl	M												1
Snowy Owl				M									1
Short-eared Owl						M							1
Anna's Hummingbird						M	x						4
[illegible]mingbird, Sp.						x			x				2
Belted Kingfisher	M	x	x	x	x		x	x	x	x	x	x	44
Common Flicker	x		x	M			x	x		x		x	106
Red-shafted Flicker	x	x		x	x	x			x		x		86
Pileated Woodpecker	x										x		2
Yellow-bellied Sapsucker	x		x			x			x		x		9
Hairy Woodpecker	M		x			x			x		x		9
Downy Woodpecker		x	x			x			x		x	x	9
Stellar's Jay	M	x	x		x		x		x	x		x	65
Common Raven	x					x			x	x		M	11
Common Crow	M	x	x	x	x	x	x	x	x	x	x	x	728
Black-capped Chickadee		x		M	x	x	x	x	x			x	98
Chestnut-backed Chickadee	x	M	x	x	x		x	x	x			x	114
[illegible]mmon Bushtit						M	x	x	x				135
White-breasted Nuthatch												M	1
Red-breasted Nuthatch	x	x	x	x	x				x			M	54
Brown Creeper						M							1
Wrentit	M	x	x		x	x	x	x	x	x	x	x	204
Winter Wren	x	M	x	x	x	x	x	x	x		x	x	92
Bewick's Wren	x		x	x		x	x	M	x	x		x	20
Long-billed Marsh Wren				M		x		x		x			14

STUDY UNITS (see page 19)

SPECIES	Sanctuary	Cape Arago	1	2	3	4	5+6	7	8	9	10+11	11+12	TOTAL
American Robin	x	M	x	x	x	x	x	x	x	x	x	x	552
Varied Thrush	x	M	x	x	x	x	x	x	x	x	x	x	237
Hermit Thrush	x	x	x	M		x	x	x	x	x	x		65
*Western Bluebird	M												
Golden-crowned Kinglet	x	M	x		x	x		x	x			x	193
Ruby-crowned Kinglet	x	x	x		x	x	x	x	M	x		x	137
Water Pipit							M			x			19
Cedar Waxwing									M				6
Northern Shrike				x		x	x	x				x	5
Loggerhead Shrike									M				1
Starling	x	x	x	x	x	x	x	x	x	x	x	M	8,088
Hutton's Vireo		x									x		4
Yellow-rumped Warbler	x	x	x	x	x	x	x	x			x	x	1,448
Myrtle Warbler							M						5
Audubon's Warbler					x				M				95
Townsend's Warbler					x		x	x	M		x		13
Palm Warbler							M						1
Black and White Warbler									M				1
*Wilson's Warbler					M								1
House Sparrow			M		x		x		x				56
Western Meadowlark			x	M		x	x	x	x			x	42
Red-winged Blackbird				x	x	M							28
Brewer's Blackbird	x				x		x	x		x	x	M	295
*Evening Grosbeak		M											2
Purple Finch			M							x			16
House Finch				x	x	x	M	x	x		x	x	90
Pine Siskin	x	x	x	x	M	x	x	x	x	x		x	739
American Goldfinch			x	x		x	x	M	x			x	79
Red Crossbill	x	M						x					36
Rufous-sided Towhee	M	x	x	x	x	x	x	x	x	x	x	x	62
Slate-colored Junco									x		M		8
Oregon Junco	x	x	x	x	x	x	x	M	x	x	x	x	887
Savannah Sparrow									M				1
White-crowned Sparrow		x	x	x	x	M	x	x	x			x	225
Golden-crowned Sparrow	x	x	x	x		x	M	x	x		x	x	54
Fox Sparrow	x	x	x	x	x	x	x	M	x	x	x	x	239
Lincoln's Sparrow			x		x					x		M	6
Song Sparrow	x	x	x	x	x	x	x	M	x	x	x	x	318
*Lapland Longspur				M									2

x - Species sited in Study Unit.

M - Study Unit in which the largest number of individuals were counted.

SOURCE: Coos Bay Christmas Bird Count
December 17, 1977, Audubon Society-Cape Arago Chapter

* Additional Species counted on the 1978 Christmas Count
December 17, 1978, Audubon Society-Cape Arago Chapter

The remaining two designations, shoreland development and relatively undisturbed habitat, refer to the intensity of use and the long term impact of human activity on estuarine lands. The tidelands along the North Spit below the railroad bridge are relatively undisturbed compared to the tidelands across the bay on the eastern shore. Docks, wharfs, pilings, marinas, storm drains, sewage effluents, seafood processing discharges, and urban runoff are some of the consequences of shoreland development that have altered the estuarine environment. The impact of these is greatest in their immediate location and diminishes with increasing distance from them. The dredged channel is a barrier between the opposite shores. The tidelands of North Spit and South Slough were designated as undisturbed habitat, because the population density in these areas is not as dense as on the developed shoreland of the bay, and because use of these areas is not as intense. South Slough may have some influence from shoreland development such as coliform and organic waste from Charleston area, but it has the most potential of any area in the Coos Bay estuary to remain undisturbed.

This map may be used as additional criteria to identify areas of significant biological value. It also may be used to identify areas of restoration or projects of mitigation. The subjective and broad nature of some of the criteria of alterations on the map make them useful only as secondary tools in designating important tracts of estuarine land.

Map VI: Existing Use Inventory for Coos Bay Estuary

Sources of the existing land use inventory map are aerial photography (U.S.G.S. Eros Data Center 1974) and an existing land use field survey (Coos County Land Use Inventory Team 1978). The existing use map may be used as data for identifying areas suitable for development on the estuary and shorelands. The map is limited by its scale, and so prevents site specific designations. The scale of the map also does not allow commercial uses to be designated, because they are often interspersed among industrial and residential areas.

Map VII: Potential Water-Dependent Uses in the Coos Bay Estuary

This map compiles data and proposals from several different sources. Deep water close to shore with supporting land transport facilities is taken from the Existing Uses Inventory (Map VI), U.S. Army Corps of Engineers channel data (1976), and proposals from industrial interests in the County. The areas include sites on the North Spit, Sitka Dock, North Bend Airport, North Point, Coos Bay-North Bend Waterfront, Eastside dredge spoil sites, and Graveyard Point. The Airport Site is mentioned as a possible deep draft ship docking if its present use is ever replaced by a new airport.

The potential for aquaculture designation includes suitable areas for several types of aquaculture. At the present time only oyster farming and salmon ranching operations are economically and environmentally feasible in Coos Bay. (Jambor & Ritelle, 1977). Oyster farming is currently limited to South Slough, because the upper bay above Sitka Dock is closed to commercial shellfish harvest by the

State Board of Health. The presence of high counts of fecal coliform bacteria due to sewage is the cause of the shellfish closure.

Data from DEQ Estuary and Shellfish Sanitation Program (1979) shows a marked increase of fecal coliform counts above Station 8 (River Mile 11.5), which is in the shipping channel at North Bend, opposite the mouth of the Cooston-Willanch Channel. The average coliform concentration at stations below this point in the estuary have been within acceptable standards for shellfish growing areas over the past three years (Table 4). It may be feasible to re-open tideflats north of Cooston Channel and Willanch Inlet to oyster growing and harvest.

When the shellfish closure is lifted by the State Board of Health, there are proposals for intense oyster culture activities on the tideflats of East Bay, Haynes Inlet, and North Slough (Stanwood 1979). The other alternative for expanding shellfish harvest would be a shellfish depuration (purification) facility in the bay South of Sitka Dock (Furfari 1976).

At present three salmon release-recapture permits are issued for Coos Bay by the Oregon Department of Fish & Wildlife. Weyerhaeuser (Ore-Aqua) on North Spit can release 20 million chum, 10 million coho, and 10 million chinook. Anadromous on Jordan Point can release 5 million coho and 5 million chinook, while a private citizen, Calvin Heckard, can release 5 million chum salmon into Catching Slough (Netbay 1979). If these operations are economically successful there will be more permit applicants in the future.

Other types of aquaculture operations are not now feasible but may become so as the technology or markets develop. Clam culture and seeding is being done on the East Coast, and research is currently being done at Oregon State University to spawn the local bay clams (Breese 1979). Pond culture of anadromous fish is common in Oregon, while in other parts of the world marine species such as sole, sardine, and shrimp are raised in contained environments (Bardach 1979). Pond aquaculture is proposed on North Spit at the site of the Menasha pulp mill effluent holding pond after it is restored (Elfving 1979). There is also future potential for marine polyculture (e.g., raising oyster, clam and mussels together); (Tenore, et al. 1973), and recycling nutrients from waste water treatment into an aquaculture system (Ryther, et al. 1975).

Areas for water dependent recreational uses are primarily major clam beds of the bay clam species, principle sport fishing and hunting areas. The tideflats in the lower bay on North Spit, "crabflats" across the channel from Empire to Barview, and the airport tideflats are very productive for gaper and cockle clams, but the general public has limited access to them. Existing boat launch sites indicate the closest access points to the clam beds for boaters (Oregon State Game Commission 1968). There are proposals for additional boat ramps on North Spit and the Coos River. Important areas for waterfowl hunters are North Slough, Haynes Inlet, and Bull Island Marsh. Included as riparian resources are the Barview State Wayside, the Charleston County Fishing Dock, and the Charleston Triangle. The upper bay has a lack of sites designated

TABLE 4. DEQ FECAL COLIFORM DATA FOR COOS BAY (DEQ 1979).

STATION		MEAN CONCENTRATIONS OF FECAL COLIFORM* 1978	1977	1976	1975
SOUTH SLOUGH SHELLFISH SANITATION PROGRAM (IBM CODE 14-12)					
1	150 yds. east of flashing light at entrance of South Slough opposite fisherman's coop	(44)** 17.5	(3) 11.7	(3) 23.0	(12) 22.4
2	15 yds.east of 3rd (Southernmost) moorage flot at Charleston Small Boat Basin	(48) 44.5	(3) 192.0	(3) 119.0	(12) 69.6
4	channel, 50 yds. east of Hallmark Fisheries dock, Charleston	(49) 35.4	(3) 28.7	(3) 15.5	(12) 111.0
5	channel, 20 yds.west of Hanson's Landing docks, Charleston	(46) 37.1	(3) 373.0	(3) 20.3	(12) 29.1
7	channel, 250 yds, south of Collver Point	(46) 18.3	(3) 41.7	(3) 31.7	(12) 36.0
8	channel, 0.3 miles southwest of Station 7, 50 yds. west of bank	(39) 14.3	(3) 6.7	(3) 17.8	(12) 20.8
11	Joe Ney Road Bridge	(43) 44.8	(3) 36.3	(3) 28.5	(12) 120.0
COOS BAY SHELLFISH SANITATION PROGRAM (IBM CODE 14-10)					
1	green light #7,1/4 mile north of Fossil Point	(51) 9.0	(3) 5.3	(3) 5.0	(12) 15.0
2	red light #10,1/4 mile north of Pigeon Point	(51) 10.0	(3) 5.0	(3) 3.2	(12) 26.7
4	red light #16,1/4 mile north of Empire Dock	(51) 25.7	(3) 7.3	(3) 15.0	(12) 63.9
5	green light#23,opposite Henderson Marsh	(50) 21.5	(3) 5.3	(3) 15.3	(12) 22.4
6	black can#27,1/4 mile west of Railroad Bridge	(50) 38.2	(3) 7.3	(3) 84.0	(12) 51.9
7	green light#35,mouth of Kentuck Slough	(50) 58.1	(3) 11.0	(3) 46.3	(12) 85.4
8	red light#36,opposite north Cooston-Willanch channel	(50) 107.0	(3) 12.0	(3) 114.0	(12) 149.0
9	Coos Bay Yacht Club,opposite mouth of McCurdy Marina	(51) 214.	(3) 48.3	(3) 563.0	(12) 109.0
10	shipping channel, opposite mouth of Marshfield channel	(48) 244.0	(3) 450.0	(3) 60.1	(12) 136.0
11	red light,1 mile up Marshfield channel	(47) 156.0	(3) 82.0	(3) 90.7	(12) 267.0
13	Coalbank Slough at Hwy.101 Bridge	(50) 172.0	(3) 247.0	(3) 182.0	(12) 261.0
14	Isthmus Slough at Eastside Bridge	(51) 92.3	(3) 399.0	(3) 102.0	(12) 56.8
15	Isthmus Slough at Coos City Bridge	(49) 68.4	(3) 157.0	(3) 141.0	(12) 64.3

* Most Probable Number/1000 ml. In marine and estuarine shellfish growing waters the median concentration shall not exceed 70/1000ml (CCPD 1978; ALWO APPENDIX-B).

**Number of Samples

for recreational use of riparian resources. Particularly there is a documented need for such sites in the urban areas of Coos Bay, North Bend, and Eastside (Oregon Department of Transportation 1978). There is substantial boating and bank fishing in Pony Slough, Upper Isthmus Slough, and Coos River for striped bass, shad, and salmon.

Potential marina sites include moorage for sport boats, small commercial trollers, and larger commercial vessels (less than 90'). The site inventory is taken from the "Coastal Acres Exceptions Process" (Coos-Curry Council of Government 1979). That task force ignored potential sites for trawling vessels over 90 feet and also did not look for marina sites above the Highway 101 bridge. The Coos Bay dock site (#18) in the upper bay may be good for future morrage of the largest fishing vessels, while a major small boat basin is proposed in Coalbank Slough (Elfving, 1979).

Map VIII: Shoreland Resources on the Coos Bay Estuary

Shoreland resources are included under the criteria for protection of natural values of shorelands (LCDC 1975). Major marshes, both salt and fresh, are considered in the Estuary and Shorelands Goals as natural resources. The major marshes in Coos Bay are Henderson Marsh, North Slough, Pony Slough, Bull Island, in Eastside, in Coalbank Slough and in Isthmus Slough. Coastal headlands are also considered unique and important natural resources. Coos Head is the only headland on the estuary, and it is a significant aesthetic and biological resource in addition to its uniqueness. Several archeological sites and historical buildings exist on the shorelands of the estuary (Oregon Coastal Conservation and Development Commission 1973). Archeological sites are not precisely identified in order to protect them from disturbance, but their exact locations are recorded in the Oregon Archeological Survey (1979).

Riparian vegetation extends in a band from 10 to 75 feet wide along shorelands of waterways. The riparian floral community is different in species composition from upland vegetation. Species include Sitka spruce, red alder, red cedar, hemlock, big leaf maple, vine maple, and willow (Wilsey and Ham, 1978). The riparian strip is important as a buffer between upland development and the water body. It retards bank erosion and moderates water temperature. It is also significant resting, nesting, and feeding habitat of birds and mammals. In Coos Bay estuary there are significant sections of riparian vegetation in South Slough, Haynes Inlet, East Bay, and Isthmus Slough.

The visual and aesthetic resources of the estuary are also shorelands resources. The criteria of these designations are uninhibited views of natural settings and panoramic views of large expanses of the bay that are available from public highways. The corridors into Coos Bay from the north and south on Highway 101 are important visual resources as well as views of the bay from McCullough Bridge. Some settings of industry and shipping against the natural background of the bay are also of aesthetic importance.

Map IX: Industrial Concerns and Transportation Systems in Coos Bay

The industrial concerns on Coos Bay estuary were presented on a map of water-dependent critical industrial areas to the Coos County Board of Commissioners by a group of Coos County industrialists.

It covers all areas of existing and potential industrial development of any kind, but does not differentiate low intensity uses such as aquaculture from heavy industrial uses of a deep draft port.

Other information on this map includes the deep draft channel, shallow draft channel, airport facilities, railroad lines, major highways, secondary roads, corporate boundaries of cities, private, corporate, and Port property lines in North Spit, and sewage treatment plants. The accessability of transportation systems is a key factor in the siting of industrial facilities.

COOS BAY ESTUARY STUDY UNITS

The Estuary Study Units are estuarine and adjacent shoreland environments within the Coos Bay estuary that exhibit similar existing and potential physical, biological and development characteristics. The boundaries indicated do not necessarily designate an abrubt change in habitat but rather are readily definable landmarks. While not necessarily at the scale of the final management unit designations, it is possible that some management units may include an entire study unit and that some study units might be divided into several management categories.

In the accompanying working papers site-specific economic and environmental concerns are addressed within each study unit.

The following Estuary Study Units address all of the Coos Bay estuary to heads-of-tide:

1. LOWER SOUTH SLOUGH (Charleston, Joe Ney Slough, and South Slough to the Sanctuary boundary at Valino Island)

The South Slough, dominated by marine tidal influence and with a separate watershed from the rest of the estuary, has a wide variety of intertidal and subtidal habitats and a great diversity of marine species. Much of the impact of the intensive fisheries development in Charleston is localized within this study unit.

2. LOWER COOS BAY WEST (North and west of the channel from the North Jetty to the South end of the Port property on North Spit)

The southern intertidal portion of North Spit is characterized by highly productive tideflats influenced by high salinity. Except for potential dredge spoils disposal at the southern tip of North Spit, this study unit is less subjected to existing or proposed development pressures than the rest of the North Spit.

3. LOWER COOS BAY EAST (South and east of the channel from the South Jetty to the mill at Empire)

The extensive tideflats on the east side of the lower bay are also characterized by a range of marine habitat types and a wide diversity of species, but this area has been more obviously impacted by shoreland development than the preceding study unit.

4. MID COOS BAY WEST (North and west of the channel from the southern end of the Port property to the Railroad Bridge)

With the exception of the extensive tideflats of Jordan Cove, this study unit is characterized by a narrow, sandy intertidal area and a deep water channel near the shore.

5. MID COOS BAY EAST (South and east of the channel from the mill at Empire to the Railroad Bridge)

This area is distinguished by limited accessibility to the waterfront, due to steep cliffs in the residential area and the siting of the North Bend Airport.

6. PONY SLOUGH

This 280 acre tract of tideland has a separate watershed and is almost completely surrounded by urban uses. Impact of development is localized.

7. NORTH SLOUGH/HAYNES INLET (North and east from the causeways)

These sloughs are served by separate watersheds, but are similar in the habitats they provide as well as in their restricted flushing capabilities.

8. UPPER COOS BAY WEST (South and west of the channel from the Railroad Bridge to the Chandler Bridge on the Coos River and both sides of the channel in Lower Isthmus Slough to the Eastside Bridge)

This area, which includes most of the Coos Bay/North Bend waterfront as well as the Eastside Peninsula, is predominately comprised of developed and developable land adjacent to a shipping channel.

9. UPPER COOS BAY EAST (North and east of the channel from the Railroad Bridge to Catching Slough)

The east bay is the largest tideland area of Coos Bay, with large tracts of productive mudflats and large salt marsh islands. Upland uses are predominately residential.

10. LOWER ISTHMUS SLOUGH (Eastside Bridge to Davis Slough)

The impacts of log storage are probably most apparent in this study unit, and the primary upland use along the western shore continues to be the wood products industry.

11. UPPER ISTHMUS SLOUGH (Davis Slough to the head-of-tide; Coalbank Slough; Shinglehouse Slough; Davis Slough; Catching Slough)

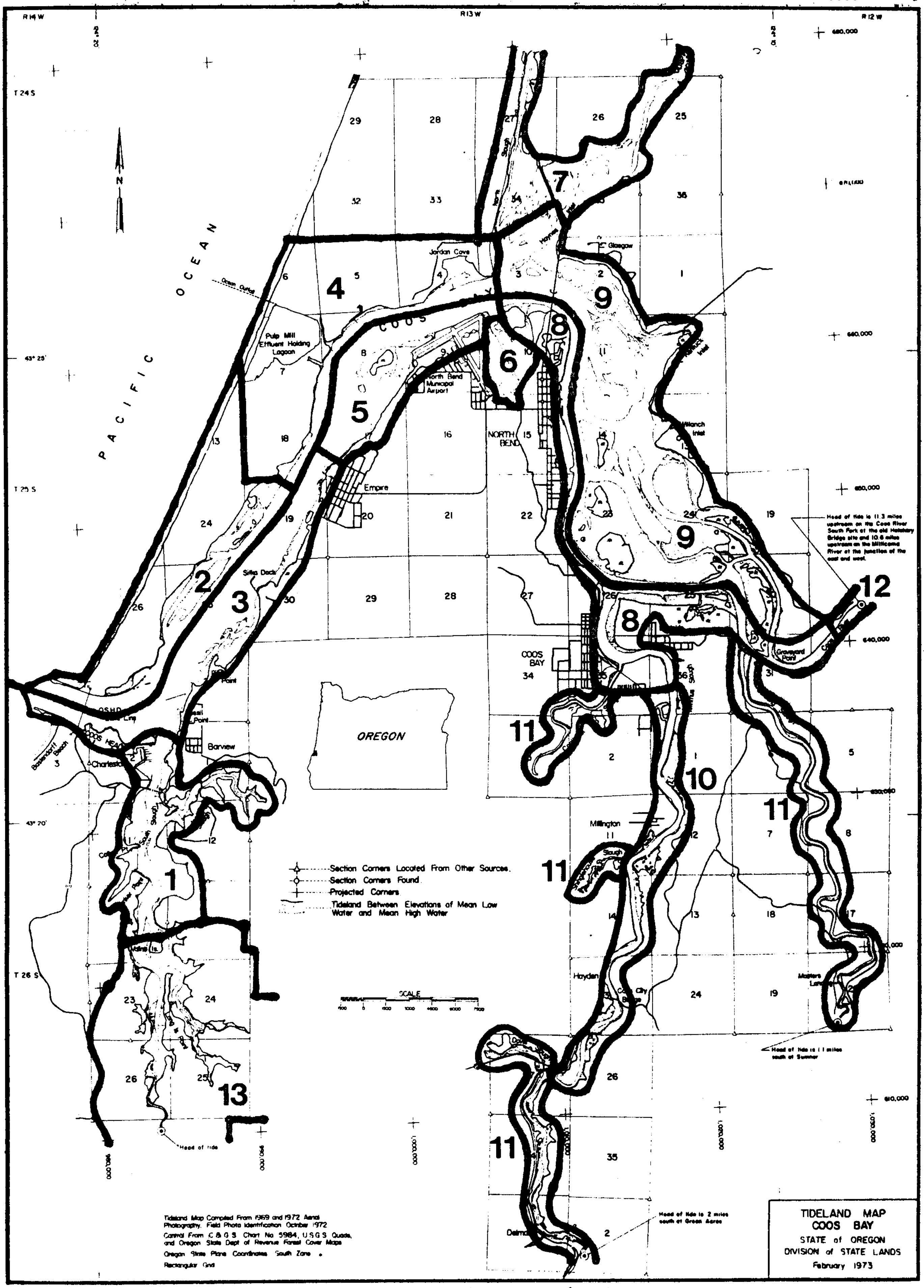
Though most of these waterways have historically been used for water transport; they are currently less degraded than Lower Isthmus Slough and are productive components of the estuarine system.

12. COOS AND MILLICOMA RIVER (Chandler Bridge to the heads-of-tide)

The riverine environment is more influenced by freshwater than the sloughs of the bay.

13. SOUTH SLOUGH ESTUARINE SANCTUARY (4,400 acre tract of tidelands and watershed of upper South Slough south of Valino Island)

The estuarine lands and a portion of the watershed of upper South Slough have been recognized on the Federal, State and local levels of government as the most pristine environment of Coos Bay estuary, and have been set aside for restoration to a natural condition.



COOS BAY ESTUARY STUDY UNITS

COOS COUNTY PLANNING DEPT.
JUNE 1979

THE IMPORTANCE OF THE COOS BAY ESTUARY TO THE ECONOMY OF COOS COUNTY

The importance of the Coos Bay Estuary to the economy of Coos County has several aspects. As one of the largest export ports on the west coast, and as the world's largest volume lumber export port, the Port of Coos Bay provides a valuable service to the region and a multitude of job opportunities for local residents. A large sport and commercial fishing fleet is based in Coos Bay, as well as the fish processing facilities necessary to utilize nearby marine resources. The estuary provides an important habitat for several commercially valuable fish and shellfish, an aspect that may become increasingly more important economically with the development of the bay's aquaculture potential. The estuarine system, in conjunction with the nearby ocean beaches and the Oregon Dunes National Recreation area, forms a base for a growing tourist industry.

While the price and availability of gasoline will certainly be a factor in the continuing health and viability of the tourist oriented sector of the economy, industrial development must recognize and be sensitive to the unique range of visual and recreational resources that can make a visit to Coos Bay an attractive and memorable experience, from clam beds to large ships at anchor.

The 200 mile offshore limit of U.S. jurisdiction has led to increased local concern for an expansion of fish processing capabilities to include hake, or Pacific whiting, and other underutilized species. A successful return of anadromous fish released by local aquaculture facilities must also be considered, as these will be harvested by the releasing facility or landed by local commercial and sport fisherman. The need for increased commercial moorage in the 30'-90' range is currently being studied in the exceptions process for the proposed Coastal Acres marina expansion. A waiting list of vessels requesting moorage space is an indicator of current needs, but fisheries resources and fishing boats are both fairly mobile. Specific moorage and processing needs will likely be dependent upon the timing of the development of similar proposed facilities at other Oregon ports. Boat building and repair is a growing local industry addressing the range of demand from small log handling craft to the larger vessels fishing the North Pacific.

Projected growth of the timber industry on Coos Bay is surrounded by questions, foremost of which is the availability of the supply of raw material. The Baldwin study cites Corps of Engineers projections that anticipate a large decline in log exports, a modest decline in products; timber; plywood; linerboard; pulp and paper moving to foreign and domestic ports and a continued growth in chip exports. (Baldwin 1977a). There seems to be a consensus that timber harvest levels will decline over the next 20-30 years with a replenished resource base again available early in the next century for sustained yield management.

Population projections can be a useful tool in attempts to quantify expected industrial growth requirements. Combining Portland State University Center for Population Research figures for expected growth with Bonneville Power Administration civilian labor force participation rate projections shows a projected 1990 civilian labor force of 35,526 in Coos County. A 6% rate of unemployment would leave a total employment of 33,400, requiring 9860 new jobs by 1990. Using existing urban percentages of total population, plus an assignment of the unincorporated area jobs to cities, it can be determined that 6575 additional jobs will be the upper limit needed for the Coos Bay/North Bend/Eastside area if the growth continues at recent rates. Of these jobs, 2859 can be expected to be in manufacturing and 3716 in non-manufacturing employment sectors. While it is not likely that all of these manufacturing jobs would be in heavy industry (60-70% is a basic relationship, though in the past up to 90% of those engaged in manufacturing in the county have been employed by the forest products industry), this will give use a fairly generous base for the following considerations. One set of standards shows an average of 8 workers per gross acre of heavy industrial land. (De Chiara and Koppelman 1975).

Figures for the Portland area show an average of 10 workers per acre in the lumber and wood products industry, though local industry officials feel more comfortable with a figure of 5 workers per acre, in part a reflection of the large land area demands of log and chip storage. This represents industrial acreage requirements for expected growth, ranging from a low of 286 acres to a high of 572 acres over the next 10 years.

Other factors that must be considered in a determination of industrial growth potential are the possible shift in export log loading from waterside to shoreside for economic reasons, the trend toward relocating saw log storage from water to land and the possible limitation of deep draft activities to the lower bay below the railroad bridge. The latter scenario is a possibility because of a lack of horizontal clearance at the railroad bridge, the lack of space for facilities expansion at most upper bay sites, and the problem of spoils disposal associated with deep draft channel maintenance in the upper bay. Relocating existing upper bay industrial uses would require 56 acres in the next 10-15 years up to a maximum of 146 acres, not including land for administration, customs, equipment storage and repair, employee amenities and parking. (Baldwin 1977a). Though the records show a modest increase in petroleum product arrivals through the Port of Coos Bay, any expansion could conceivably be planned in conjunction with other uses as a means of conserving waterfront land. (Baldwin 1977a).

90% of the tidal wetlands have been removed from the Coos Bay estuary by filling or diking, (Hoffnagle & Olson 1974), thus it is hoped that necessary industrial growth can take place without reducing the effective area of the estuary.

Some general criteria for industrial siting are:

1. Convenient access to a range of transportation facilities.

2. Access to labor force, raw materials supply and market.

3. An adequate amount of suitable land, free from foundation and drainage problems with a sufficient reserve for growth.

4. Adequate and reliable utilities; water; waste disposal, power and fuel.

5. Protection from encroachment of residential and other land uses.

6. Location minimizing impact on neighboring non-industrial land uses. (De Chiara & Koppelman 1975)

Dividing the bay and adjacent shorelands into study units designated on the accompanying map, some of the more site-specific industrial concerns can be looked at.

1. LOWER SOUTH SLOUGH (Charleston/Joe Ney Slough and South Slough to the Sanctuary boundary at Valino Island)

The Port-owned sport and commercial fishing terminal cannot meet current moorage needs, and a boat basin expansion project is currently in the exception process. A breakwater extension and groin are proposed at Charleston to better protect the boat basin and channel. Five large fish processing plants make this a major fish processing center on the coast. Other current uses include some small-scale boat building and at least one oyster farm.

2. LOWER COOS BAY WEST (North and West of the channel from the North Jetty to the south end of the Port property on North Spit)

A jetty staging area is required near the end of the spit for off-loading of rock barges for jetty maintenance. The east side of the end of the spit is seen as an important dredge spoil disposal site, possible filling the eroded area defined by the breakwater. The remainder of this study area is in extensive tidal flats and aquatic vegetation beds and is considered unsuitable for extensive waterfront development in the Baldwin study. (Baldwin 1977a)

3. LOWER COOS BAY EAST (South and East of the channel from the South Jetty to the mill at Empire)

A jetty staging area at the end of North Spit is required for future work on the South jetty. Sitka Dock, currently undeveloped and on the market, is a prime industrial site with deep channel access potential. The narrow shorelands to the north and south of Sitka Dock are addressed in the Baldwin study as being unsuitable for extensive waterfront development. (Baldwin 1977a). The Empire bay front is currently industrial and any further development potential should be explored and maximized, including the possibility of tourist recreational facilities.

4. MID COOS BAY WEST (North and West of the channel from the South end of the Port property to the Railroad Bridge)

The existing Ore-Aqua/Weyerhaeuser aquaculture site might be seen as the initial phase of a comprehensive fisheries development of at least a portion of the port property. North of this site is Port property on undeveloped fill, served by road and adjacent to deep draft channel. Some expansion of the fill to the west, at least to the existing road, might be possible to maximize development at this site. The narrow, sandy intertidal zone is an important habitat for juvenile salmonids and certain flatfish but is perhaps of lesser biological significance than the extensive tidal flats to the south of the Port property or in Jordan Cove.

Proposals for the eventual use of the effluent-holding lagoon include pond aquaculture, restoration to wildlife habitat and dredge spoils disposal.

The land from the port property to Henderson Marsh is held by the Corps of Engineers and Menasha and could be developed in a manner related to and supportive of both existing dock facilities at the Roseburg Lumber site and proposed dock facilities on the Port property with a minimum impact on the adjacent estuarine shore. Henderson Marsh and the adjacent heron rookery to the north should be protected as an important wildlife habitat. The NS5 fill site adjacent to the marsh is currently developed in part as a log storage area for the Menasha pulp mill. The stabilized dunes between the fill site and the Roseburg Lumber site are heavily logged over and probably of minor biological significance, but the terrain could provide serious obstacles to development.

The Roseburg Lumber site, an area of more than 200 acres, has an existing chip facility and deep channel access. The three large buildings not in use and the channel access make this an excellent site for development.

Jordan Cove is identified in the Baldwin study as an area considered unsuitable for extensive water front development because of its physical and biological nature. (Baldwin 1977a). The northwest edge of Jordan Cove was once the site of an important Coos Indian village, according to local descendants of that tribe who feel that the development of North Spit will destroy or prevent access to traditional religious sites. However, with over 200 acres of undeveloped Port property and several hundred acres held by Menasha and Roseburg Lumber that are not in conflict, it seems that realistic development needs can be met without compromising sensitive areas.

The existing Menasha pulp mill site and the existing Anadromous aquaculture site have rail access, though deep channel access might be difficult because of their proximity to the railroad bridge.

5. MID COOS BAY EAST (South and East of the channel from the mill at Empire to the Railroad Bridge)

The cliffs that extend from the mill to the airport preclude industrial development of the waterfront. The existing airport is a major feature of this area and is currently incapable of serving larger jet aircraft because of restricted runway length. If the airport was to be relocated, this would be an excellent site for industrial development.

6. PONY SLOUGH

Though large tracts of wetlands in Pony Slough have been filled for commercial development, the remaining intertidal areas have a high biological importance, especially to the large winter population of migrating birds and waterfowl that find protection here from storms and hunting pressures. The Baldwin study recognizes this area as unsuitable for extensive waterfront development. (Baldwin 1977a). North Bend has, in the past, seen this area as a potential marina site.

7. NORTH SLOUGH/HAYNES INLET (North and East from the causeways)

Most of this area is characterized by poorly flushed tidelands. Any alteration of the North Spit causeway to meet increased traffic demands should include more openings for improved flushing of the slough.

The railroad right-of-way borders North Slough on the west and presently serves some small scale sand mining close to the North Spit causeway. Industrial development along this right-of-way will probably be limited by its proximity to the Oregon Dunes National Recreation Area and by the unstable nature of the encroaching active sand dunes. Any development would have to be sensitive to the visual resources of this entry corridor into the Coos Bay area.

A small existing boatyard on Haynes Inlet is the only existing marine industrial development in this predominately residential area.

8. UPPER COOS BAY WEST (South and West of the channel from the Railroad Bridge to the Chandler Bridge on the Coos River, and both sides of the channel in Lower Isthmus Slough to the Eastside Bridge)

The filled areas at North Point, between the railroad bridge and the highway bridge, have a high industrial potential hindered only be inadequate road access. The small water area in the midst of these fills has marina potential and might also eventually be considered as a dredge spoils disposal site because of degradation by wind-blown sand from the adjacent unstabilized fill.

A portion of the area below and immediately east of the highway bridge is currently being used by a rock products company. The potential for development of the remainder of this site as well as the narrow strip of land along the bay extending south to the Menasha plywood mill should be explored, including the possibility of increased public recreational access, with a concern for the impact on adjacent residential uses.

The North Bend/Coos Bay waterfront has the fewest conflicts for maximized industrial development with both railroad and deep channel access. With the exception of the Eastside peninsula, much of the area is presently developed, though not in every case by water-dependent or water-related uses, and further development might be limited by the lack of adequate back-up space.

The waterfront at downtown Coos Bay is relatively undeveloped at present, and might provide a suitable moorage location for large commercial fishing boats.

9. UPPER COOS BAY EAST (North and East of the channel from the Railroad Bridge to Catching Slough)

This area is primarily a marine production area with a tradition of log storage on Cooston and Marshfield channels. At least three spoil islands are located in this area, with the two largest not yet at full capacity.

Upland uses along the east side of the bay are predominately residential and Pierce Point, without channel access or adequate road access, would seem to face severe obstacles to future development, especially in light of the apparent local opposition. Currently a small part of Pierce Point is committed to a diverse marine industrial use that includes a boatworks, salvage operation and potential oyster processing site.

The likelihood of an unfavorable economic cost/benefit ratio of a maintained channel to Kentuck Inlet would seem to rule out the further development of this existing site as a major barge-loading facility.

The Baldwin study shows most of this area to be unsuitable for extensive waterfront development. (Baldwin 1977a)

Christianson ranch, a large undeveloped spoils disposal site at Graveyard Point, has access to the Coos River, an existing shallow draft channel. The site has a high potential for low to medium intensity industrial development, but concern must be shown for the impact on adjacent residential areas, public roads, and utilities.

10. LOWER ISTHMUS SLOUGH (Eastside Bridge to Davis Slough)

The maintained 15' channel depth to Millington and the current use of much of the west side of the slough by water-related industry underscore the importance of the waterway for marine transport and storage with industrial development as a favored upland use between the slough and Highway 101.

Development interests should consider the impact on several large existing tracts of salt marsh. Also, because of the Highway 101 route into Coos Bay from the south, development must be aesthetically pleasing or an adverse impact may be felt by local tourist industry.

11. UPPER ISTHMUS SLOUGH(Davis Slough to head of tide); COALBANK SLOUGH; SHINGLEHOUSE SLOUGH; DAVIS SLOUGH; CATCHING SLOUGH

These are not industrially developed at present and are important as natural areas in a diversified estuarine system. Existing upland uses are primarily residential, agricultural and forest.

A proposed 1100 boat marina development on Coalbank Slough will be dependent upon satisfactory solutions to problems presented by the existing highway and railroad bridges.

12. COOS RIVER AND MILLICOMA RIVER(Chandler Bridge to the heads-of-tide)

The maintained channel supports a traditional log transport and storage system.

13. SOUTH SLOUGH ESTUARINE SANCTUARY (4,400 acre tract of tidelands and watershed of upper South Slough south of Valino Island)

Current uses include farming and forestry on privately held land within the Sanctuary, though eventually the commercial use of the Sanctuary might be limited to oystering. As a research tool, the Sanctuary designation could be of benefit to the long-term economic health of the Coos Bay Estuary.

INVENTORY OF IMPORTANT ENVIRONMENTAL AREAS OF THE COOS BAY ESTUARY

Dividing the bay and adjacent shorelands into study units designated on the accompanying map, some of the more site-specific environmental concerns can be discussed:

1. LOWER SOUTH SLOUGH (Charleston, Joe Ney Slough, and South Slough to the Sanctuary boundary at Valino Island)

The South Slough is dominated by marine tidal influence and has a separate watershed from the rest of the estuary. It has a wide variety of intertidal and subtidal habitats and a great diversity of marine species. Much of the impact of the intense fisheries development in Charleston is localized within this study unit. The area south of the Charleston Bridge acts as a buffer between the development of Charleston and the South Slough Estuarine Sanctuary.

The most controversial estuarine area is the Charleston Triangle, the site of the proposedCoastal Acres commercial boat basin project. The major environmental objection to the alteration of that site is its importance as a clam bed to recreational clam diggers. South of the Charleston Bridge are extensive productive tideflats and undredged channels. There are major clam beds on these tideflats with limited public access (CCPD 1978; R-32). Joe Ney Slough is not as pristine as the rest of South Slough due to more intensive shoreland development, although the major oyster aquaculture operation in Coos Bay is located there. Under the present ruling by the State Board of Health, the South Slough has the greatest potential as an oyster growing area in the Coos Bay estuary.

The shorelands of Lower South Slough vary in values from high economic value for water-dependent use sites in Charleston to high natural value of riparian vegetation along shorelands south of the Charleston Bridge. South Slough is rich in water fowl, shorebird, and terrestrial bird species that utilize riparian habitat. A particularly critical habitat is the heron rookery near Collver Point (McMahon 1974). The low density rural residential areas of South Slough are significant habitat for terrestrial wildlife, but also contribute some degradation to the estuarine water quality. The commercial and industrial development in Charleston is located primarily on filled lands, which have minimal biological significance. The Lower South Slough also has high economic and social value for recreation.

Fishing and clamming access are important tourist attractions in Charleston, while across the channel the Barview State Wayside is an important undeveloped recreation site to local residents.

2. LOWER COOS BAY WEST (North and West of the channel from the North Jetty to the south end of the Port property on North Spit)

The lower portion of the North Spit is characterized by highly productive tideflats with predominant influence of high salinity marine waters. The tidelands are adjacent to the deep draft channel.

The tideflats contain major clam beds, but access is limited to boats and 4-wheel drive vehicles. The tideflats contain significant algal and eelgrass beds and are also rearing habitat for juvenile salmonids and flatfish. This area is also important as a potential aquaculture or commercial shellfish harvest site south of the Shellfish Closure line.

The shorelands of the southern end of North Spit are predominantly open dune areas conditionally stabilized by beach grass and wet interdune areas (CCPD:1978; BD-3). The most critical habitat is the younger stabilized dunes at the site of the Old Coast Guard station. These forested dunes contain a heron rookery and are a crucial habitat for North Spit wildlife (USDA Soil Conservation Service 1975). Conditionally stabilized dune areas are not as critical as wildlife habitat and may be suitable for dredge spoils. Wet interdune areas are important wildlife and water fowl habitat. The ocean beaches and foredunes of the lower North Spit are important as nesting area for the snowy plover, which is classified as a threatened species by the Oregon Department of Fish and Wildlife. Also, Indian burial grounds and village sites are located on the bay side of the lower North Spit. Precise location of sites is recorded in the state archeological inventory (Oregon Archeological Survey 1979 (CS-27)).

3. LOWER COOS BAY EAST (South and East of channel from the South Jetty to the mill at Empire)

The tideflats on the east side of the lower bay are also characterized by a range of habitat types and a wide diversity of species. Clam beds south of Sitka Dock are available for commercial harvest of shellfish, while "crabflats" clam beds north of Sitka Dock are productive enough for intense recreational harvest, but have limited accessibility. The sand spit in front of Charleston channel is the site of the only razor clam bed within the estuary. It will be temporarily removed by the construction of the Charleston breakwater extension, but may be repopulated with razor clams as the sand bar accumulates again behind the new breakwater (USACE 1979). The rocky intertidal habitat below Fossil Point in Barview is also a unique habitat with respect to the rest of Coos Bay, and should be considered environmentally sensitive (Baldwin, et al. 1977). It is more similar to rocky habitats found on Cape Arago than within an estuary, because of its exposure to ocean swells.

The most important shoreland natural resource in this study unit is Coos Head. It is an aesthetic resource as well significant bird habitat. Shorelands from Barview to Empire have been altered by residential and commercial development. The new sewerage line from Charleston to the Empire sewage treatment plant should improve estuarine water quality. In the future the east shore of the lower bay may have significant aquaculture potential. A fish release facility has been proposed at Tarheel Reservoir. The lower bay may be a good site for a shellfish purification facility for shellfish grown in polluted areas of the upper bay. The Empire Sewage Treatment Facility may also be a prime site for future aquaculture operations that use recycled nutrients from domestic waste disposal systems.

4. MID COOS BAY WEST (North and West of the channel from the Southern end of the Port property to the Railroad Bridge)

This portion of the estuary along North Spit is a narrow strip of sandy shore adjacent to the deep draft channel, except for Jordan Cove. The sandy tideland is particularly important as a rearing habitat for juvenile flatfish, especially English Sole (Hostick 1975). Jordan Cove is a major tideflat which contains major clam beds and minor tracts of algae and eelgrass. It is also the site of a documented Indian village site and burial ground (Oregon Archeological Survey 1979 (CS-26)).

The shorelands of the upper North Spit are the most important environmental resources of this study unit. Henderson Marsh is one of the most important natural areas in Coos County (Oregon Natural Heritage Program 1977). The major portion of the marsh is a fresh water deflation plain marsh (USDA Soil Conservation Service 1977), and is the home or feeding site of several threatened bird species including bald eagles, ospreys, peregrine falcons, snowy owls, whistling swans and merlins. The southern area of the marsh is affected by tidal flooding and contains some salt marsh plant species, which contribute nutrients to the estuary. An endangered plant species for Oregon, the Salt Marsh Birds Beak (Cordylanthus Maritimus) is found in Henderson Marsh (Oregon Natural Heritage Program 1977). Also associated with Henderson Marsh is a large heron rookery in a grove of Sitka Spruce at the head of the marsh. There are forests of cedar and spruce on younger stabilized dunes in the area , that support a great variety of wildlife. Local Indian tribes claim access to and protection of the habitat of the eagle and the other birds of prey and the traditional gathering places of certain plants used for religious ceremonies. They claim protection through the American Indian Religious Freedom Act (P.L. 95-341, 92 Stat. 469) (Coos, Lower Umpqua, Siuslaw Indian Tribes, Inc. 1979).

The Menasha effluent holding lagoon presently is an area of minimal biological significance. However, as the need for this type of facility diminishes, the pond has significant potential to be restored to wildlife habitat.
Another potential future use of the lagoon might be pond aquaculture operations such as shrimp or pond-reared trout.

Other wet interdune areas besides Henderson Marsh area also important to wildlife. Waterfowl and shorebirds use the wet deflation plain areas south of the pulp mill lagoon during their winter migrations. Open dune sand areas south of the pulp mill lagoon are less important wildlife habitat (USDA Soil Conservation Service 1977).

5. MID COOS BAY EAST (South and East of the channel from the mill at Empire to the Railroad Bridge)

This area is distinguished by limited accessibility to the water front due to steep cliffs in the residential area and the siting of the North Bend Airport.

The major tidelands of this study unit are the extensive tide-flats at the west end of the airport runway. These flats contain large beds of softshell clams and have been the site of a commercial bait shrimp operation. Complex circulation patterns and input of organic material from the North Bend sewage treatment plant creates a variety of substrate types from sand to mud and supports significant tracts of eelgrass and red algae (Baldwin, et al. 1977). The channel between the dredge spoil island and the airport runway contains a significant portion of the tidal flow of the bay.

The shoreland environment in the vicinity of Empire and North Bend consists of younger stabilized dunes and open dune sand (CCPD 1979;BD-3). Areas of open sand may present some hazards to building. There are major archeological and historical sites in Empire. A Coos Indian village site and cemetery and Empire pioneer cemetery are located south of the mouth of Chickses Creek (Oregon Archeological Survey 1979). There is also the site of Empire City Fort on the Empire shoreland (CCPD 1978; S-9). There are existing boat ramps at Empire and at the east end of the North Bend Ariport (CCPD 1978; R-26).

6. PONY SLOUGH

This 280 acre tract of tideland is a small portion of the former area of Pony Slough. At one time, the land of North Bend Airport, Pony Village Shopping Center, and North Point were part of the tidelands of Pony Slough. Although circulation has been restricted through its mouth and surrounding development has caused some habitat degradation, the tideland of Pony Slough is still one of the most important waterfowl and shorebird habitats in the Coos Bay estuary. It is designated as a waterfowl refuge from hunting by the Oregon Department of Fish and Wildlife. Major tracts of eelgrass exist in Pony Slough in addition to the 35 acres of low sandy marsh and 16 acres of immature high marsh on the western side (Hoffnagle and Olson 1974). Pony Slough is also an important feeding area for striped bass and juvenile salmonids. Pony Slough represents an important natural area in close proximity to an urban area.

7. NORTH SLOUGH/HAYNES INLET(North and East from the Causeways)

These sloughs are served by separate watersheds, but are similar in the habitats they provide as well as in their restricted flushing capabilities. Both North Slough and Haynes Inlet have productive mud flats with large beds of clams and crustaceans. Softshell clams are taken by recreational clam diggers, expecially in the tideflats beside the causeways. Both areas are important to feeding striped bass and juvenile salmonids and are significant shorebird and waterfowl habitat. Haynes Inlet contains extensive tracts of eelgrass, while North Slough has significant tracts of marsh along its western shore from the causeway north. These include 23.0 acres of low sandy marsh, 18.0 acres of diked marsh, 7.0 acres immature high marsh (Hoffnagle and Olson 1974. Hoffnagle and Olson stated that marshes in the North Slough are some of the finest in the Coos Bay system, in terms of both extent and condition. Akins and Jefferson (1974) singled out North Slough as particularly significant: "The North Slough is of particular significance as a visual asset...The marshes and associated dunes constitute one of the most characteristic and scenic landscapes available to the traveler." 0097

North Slough marshes are bordered on the west side by open dunes (CCPD 1978; BD-3), which may present considerable hazards to structural developments. The eastern shoreland along Highway 101 has significant segments of riparian vegetation.

There has been accelerated deposition of sediments in North Slough and Haynes Inlet due to poor circulation. The construction of causeways with inadequate culverting has created the situation. Restorative actions are possible to improve circulation over these tideflats. These tideflats may become prime oyster farming lands if the siltation problem is corrected and if commercial harvest restrictions are removed by the State Board of Health, or if a shellfish depuration (purification) site is designated in the lower bay to remove potential toxins from oysters grown up-bay.

Other critical concerns in this study unit are the continuation of native salmon runs up North Slough and protection of the bald eagle and their nesting site above the southern shoreland of Haynes Inlet.

8. UPPER COOS BAY WEST (South and West of the channel from the Railroad Bridge to the Chandler Bridge on the Coos River and both sides of the channel in Lower Isthmus Slough to the Eastside Bridge)

The estuarine environment of this study unit consists of fringing tideland of minimum biological significance adjacent to the deep draft channel. The ship channel requires frequent maintenance dredging of fine particle sediments which are difficult to dispose. There is one major tract of undiked high salt marsh in Eastside that exists between adjacent diked marshes that are designated for dredge spoils.

The tideland in the midst of the North Point dredge spoils is of less biological significance than Pony Slough. However, restorative actions could connect the two basins to improve sediment flushing and enhance tideland production.

Shoreland resources include North Bend and Coos Bay marine commercial and industrial development and large ship docks. There are several areas of dredge spoil and other vacant land that have high potential for water-dependent development.

9. UPPER COOS BAY (North and East of the channel from the Railroad Bridge to Catching Slough)

The east bay is the largest tideland area of Coos Bay. It is characterized by large tracts of productive mud flats, several vegetated spoils islands, and large salt marsh islands.

One of the largest contiguous tracts of eelgrass in the state exists from the mouth of Kentuck Inlet to the McCullough Bridge to the north and to Willanch Inlet to the south (Baldwin, et al, 1977). There are several minor tracts of salt marsh at the head of Kentuck Inlet, which are remnants of 175 acres that were formerly salt marsh before diking (Hoffnagle and Olson 1974). On Willanch Inlet, 110 acres of salt marsh were lost to diking, leaving the small tracts presently fringing its mouth(Hoffnagle and Olson 1974). The clam beds of these tideflats produce softshell clams and an abundance of other smaller species of importance to estuarine productivity. Bull Island is one of the major salt marshes of the estuary. It is primarily immature high marsh with small portions of low silt marsh, sedge marsh, and high ground. The Bull Island Marsh includes several tracts of marsh from the junction of Coos River to Pierce Point. There are also three spoils islands east of the Coos Bay channel, which have vegetated upland areas and extensive borders of low salt marsh. The Oregon Department of Fish and Wildlife has designated these as important shorebird habitat.

Shorelands are primarily residential and forest land with some slopes between 15-30% (Oregon Department of Geology and Mineral Industries 1975). The riparian habitat along the shoreline is an important wildlife habitat. Bald eagles that nest above Haynes Inlet use the riparian habitat for feeding and resting.

10. <u>LOWER ISTHMUS SLOUGH</u>(Eastside Bridge to Davis Slough)

The estuarine lands of lower Isthmus Slough are essentially a degraded habitat due to the activity of log storage. There are three large tracts of tideland north of Davis Slough, which are used for log storage, that also have small areas of low salt marsh and eelgrass. Water quality is affected, but still supports a variety of fish and shellfish. Striped bass are caught by bank and boat anglers in this slough. There is good angler access.

The west side of Isthmus Slough supports dense residential and intense marine industrial uses. The east shore is steep hillside supporting less dense residential development forest tracts and a large farm at the Coos City Bridge. The contrast of industrial and natural uses in Isthmus Slough provides a visual resource to travelers entering Coos Bay along the north bound highway entrance corridor. This balance and harmony of environments is a powerful expression of the life style of Coos Bay.

11. <u>UPPER ISTHMUS SLOUGH</u>(Davis Slough to the head of tide), <u>COALBANK SLOUGH, SHINGLEHOUSE SLOUGH, DAVIS SLOUGH, CATCHING SLOUGH</u>

Most of these estuarine areas have been used historically for log rafting, but each area has some natural features that are less degraded than lower Isthmus Slough. In upper Isthmus Slough the mud flats produce more abundant <u>Corophium</u> amphipod beds than in lower Isthmus Slough, because logs have not recently been stored upon them (Zegers 1978). <u>Corophium</u> are important in the diet of juvenile salmon that emerge from salmon spawning grounds up Davis Slough. It is also believed that striped bass may spawn in upper Isthmus Slough, because first year juveniles have been seined there (ODFW 1979).

Davis Slough, Shinglehouse Slough, and upper Isthmus Slough all have significant tracts of undiked marsh contributing nutrients to the estuary. Shinglehouse Slough contains 80 acres of sedge marsh, while across the Isthmus Slough channel is a 180 acre tract of immature high marsh (Hoffnagle and Olson 1974). Along both shores of Isthmus Slough south of Davis Slough are 143 acres of immature marsh and 83 acres of bullrush and sedge marsh (Hoffnagle and Olson 1974). These tracts are among the largest acreages of undiked marsh in the estuary. These marshes help maintain the water quality of Isthmus Slough and are an integral part of the aesthetic appeal of the Slough as an entrance corridor.

Another important environmental aspect of upper Isthmus Slough is the strip of riparian vegetation that exists along the eastern shore. It acts as a temperature, erosional, and visual buffer to the hills behind it that have been recently clearcut. This riparian habitat is important to wildlife that use this waterway.

Coalbank Slough has two large marshes which add significantly to its environmental value. Both are formerly diked marshes, which have been breached. The larger marsh has become channelized and may be classified as a sedge marsh (Hoffnagle and Olson 1974). The smaller tract, 25 acres, has a more restricted tidal flow. Both are remnants of a once much larger marsh. They are important visual resources to the residents of the City of Coos Bay, who live on the hills overlooking Coalbank Slough.

Catching Slough is a channel which has fringing border of mud, eelgrass, and marsh along its entire length. There is salmon spawning activity at its head and striped bass feed along its length. Seven hundred acres of Catching Slough marsh have been lost through diking for agricultural use (Hoffnagle and Olson 1974).

In this study unit most shorelands are separated by dikes from the uplands, many of which are public road beds. Land forms are forested hills and agricultural plains.

12. <u>COOS AND MILLICOMA RIVERS</u> (Chandler Bridge to the heads-of-tide)

There are fringing mud shores bounded by rip-rap and road beds along the Coos River to its head of tide. The estuarine environment is more influenced by fresh water in the Coos River than in the sloughs of the bay. American shad and striped bass use this portion of the estuary for spawning, feeding and rearing. The tidal portion of Coos River is an important area for the rearing of juvenile salmonids. The major portion of the Coos Bay wild stocks of salmonids migrate through the Coos River to spawning grounds. There is a lack of information about the riverine portion of the estuary. Most of its length is not mapped by the Division of State Lands. There is no information about its productivity. Data about plankton production and other food sources for its fish population are needed.

There are large tracts of agricultural land behind dikes along the Coos River. These lands are valuable to migrating waterfowl during the winter and as scenic open spaces for local residents besides their value as agriclutural resources.

13. SOUTH SLOUGH ESTUARINE SANCTUARY (4,400 acre tract of tidelands and watershed of upper South Slough south of Valino Island)

The estuarine lands and a portion of the watershed of Upper South Slough have been recognized on the Federal, State and local levels of government as the most pristine environment of Coos Bay estuary. It has been set aside for restoration to a natural condition for the purpose of research, education, and low intensity recreation. It is now in the process of being completely purchased through the Oregon Division of State Lands and managed by the South Slough Estuarine Sanctuary Management Commission. Eventually the most intensive use of the estuarine lands may be oyster farming operations, which have traditionally been located there. South Slough Estuarine Sanctuary Management Commission has requested a separate management unit designation other than those covered in natural, conservation, and development categories. Therefore, it has been included in this report as a separate study unit.

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EXHIBIT 3

FINAL REPORT

ESTUARY INVENTORY PROJECT
OREGON

PROJECT TITLE: Technical assistance to local planning staffs in fulfilling the requirements of the LCDC estuarine resources goal.

JOB TITLE: Natural resources of Coos Bay estuary

PROJECT PERIOD: February 1978 - June 1979

Prepared by: Cyndi Roye

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PREFACE

This report is one of a series prepared by the Oregon Department of Fish and Wildlife (ODFW) which summarizes the physical and biological data for selected Oregon estuaries. The reports are intended to assist coastal planners and resource managers in Oregon fulfilling the inventory and comprehensive plan requirements of the Land Conservation and Development Commission's Estuarine Resources Goal (LCDC 1977).

A focal point of these reports is a habitat classification system for Oregon estuaries. The organization and terminology of this system are explained in volume 1 of the report series entitled "Habitat Classification and Inventory Methods for the Management of Oregon Estuaries."

Each estuary report includes some general management and research recommendations. In many cases ODFW has emphasized particular estuarine habitats or features that should be protected in local comprehensive plans. Such protection could be achieved by appropriate management unit designations or by specific restrictions placed on activities within a given management unit. In some instances ODFW has identified those tideflats or vegetated habitats in the estuary that should be considered "major tracts", which must be included in a natural management unit as required by the Estuarine Resources Goal (LCDC 1977). However, the reports have not suggested specific boundaries for the management units in the estuary. Instead, they provide planners and resource managers with available physical and biological information which can be combined with social and economic data to make specific planning and management decisions.

INTRODUCTION

Coos Bay, the estuary of the Coos River, is the site of a unique set of dynamic interactions involving its tributaries, the basin through which they flow, and the ocean (Fig. 1). In historic times man has altered conditions of the estuary more rapidly than expected in nature. Future actions will continue to modify the bay, and only carefully made decisions will insure that Coos Bay continues its history as a biologically productive multiple-use estuary.

Coos Bay has been classified as a deep-draft development estuary by LCDC (1977). Under Statewide Planning Goal 16 (LCDC 1977) the local comprehensive plan will designate estuarine areas as distinct water use management units. In a deep-draft development estuary such management units must include natural, conservation, and development units.

This report is a summary of available information for Coos Bay. It addresses the bay as a system, identifying processes occurring throughout the bay, and as a set of subsystems, smaller geographic areas which are functionally or physiographically distinct. Recommendations are made concerning certain areas or processes. The report is intended to provide information useful to planners, biologists, and citizens during the designation of management units and use policies.

THE COOS BAY ESTUARINE SYSTEM

Physical Characteristics

Dimensions

Several authors have used different methods in estimating the surface area of Coos Bay (Table 1).

Table 1. Reported surface areas of Coos Bay (Percy et al. 1974).

Reference	Surface area (acres)	Measured at	Tidelands Acres	Tidelands Percentage	Submerged Acres	Submerged Percentage
Johnson 1972	10,973	HW				
"	8,242	MSL				
"	5,810	LW				
Marriage 1958	9,543	area affected by by tidal action	4,569	48		
Oregon Division of State Lands (DSL) 1973	12,380	MHW	6,200	50	6,180	50

DSL (1973) estimates that 6,200 acres (50% of the surface area) is submersible land (between high water and mean low water) and 6,180 acres (50%) is submerged land (below MLW). Using these figures, Coos Bay, although larger, compares closely to Tillamook Bay in ratio of submersible to submerged land (Table 2).

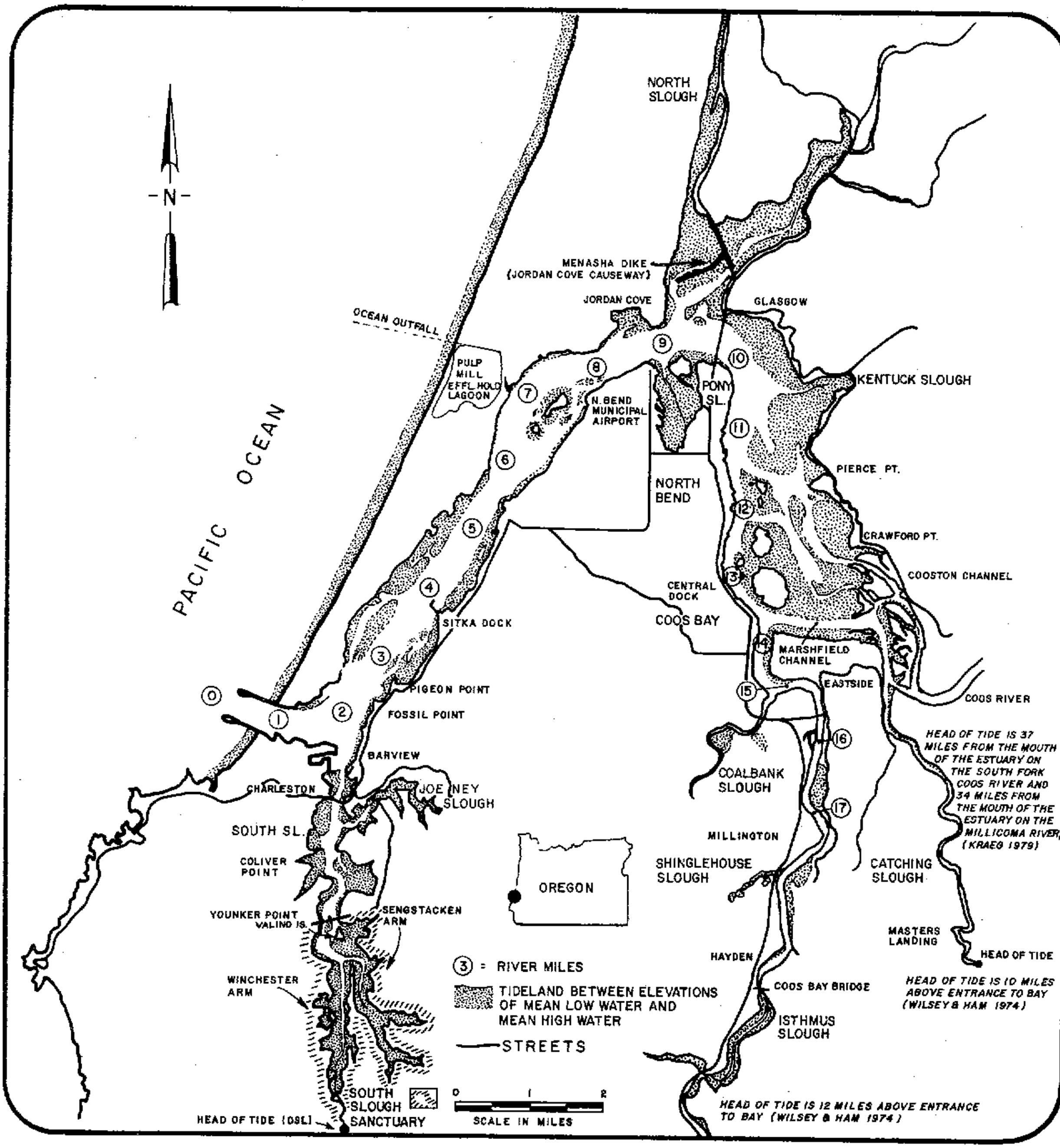

Fig. 1. Coos Bay estuary (base map from DSL 1973).

Table 2. Ratios of tideland (MHW to MLW) to submerged land (below MLW) (estimated from DSL 1973).

Sand Lake	3.0	Nehalem	0.87
Siletz	1.9	Alsea	0.84
Netarts	1.9	Coquille	0.64
Salmon River	1.6	Yaquina	0.53
Nestucca	1.4	Siuslaw	0.57
Necanicum	1.2	Columbia	0.35
Tillamook	1.0	Rogue	0.31
Coos Bay	1.0	Umpqua	0.25
		Chetco	0.13

Even the most extensive estimate of surface area (12,380 acres) covers only the area to mean high water. Much tidal marsh extends above this level and is therefore excluded in all available estimates. By including only the high marshes, at least 1,000 acres could be safely added to that estimate (Hoffnagle and Olson 1974).

Tributaries

About 30 tributaries enter Coos Bay from its 605 mi^2 drainage basin (Fig. 2) (Percy et al. 1974). The major tributary is the Coos River which is formed by the confluence of the Millicoma River and the South Fork Coos River. Head of tide extends up the South Fork Coos River approximately 32 miles from the mouth of the estuary and 34 miles from the mouth of the estuary up the Millicoma River (Kreag 1979). Other streams which contribute a much smaller amount of fresh water to the estuary enter through Catching, Isthmus, Pony, South, North, and Kentuck sloughs and Haynes Inlet. Gradients of the principal tributaries are slight for several miles allowing tidal effects to extend a considerable distance [Oregon State Water Resources Board (OSWRB) 1963]. Head of tide has been recorded for some of these slough systems, and in others the extent of salt water intrusion is limited by a tidegate, which acts as the effective head of tide under most conditions of flow. Information available on drainage areas of tributaries and location of heads of tide is summarized in Table 3.

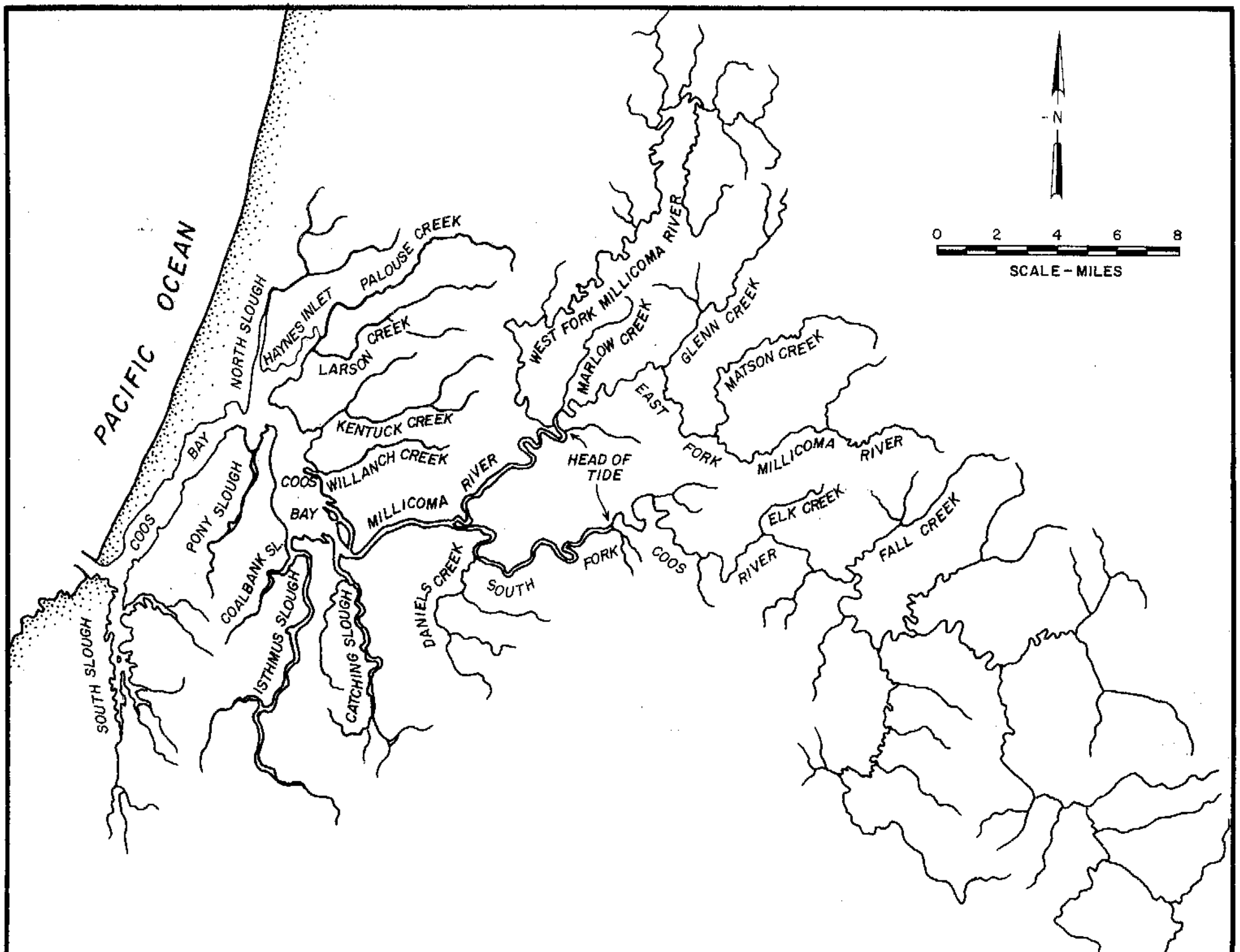

Fig. 2. Coos Bay drainage basin (USDI 1971).

Table 3. Drainage area and head of tide for Coos Bay tributaries.

Tributary	Drainage area (mi^2)	Head of tide (miles from entrance of tributary to main bay)
Coos River	415[a]	
Catching Sl.		10 mi[c]
Coalbank Sl.	6.2[a]	
Haynes Inlet	11[a]	
Isthmus SL		12 mi[c]
Kentuck	17[a]	
North	12.8[a]	
Willarch	7.8[a]	
South Sl.	26[b]	

[a] *OSWRB 1963*
[b] *Stevens, Thompson and Runyon, Inc. (STR) 1974*
[c] *Wilsey & Ham 1974*

Physiography

The physiography of Coos Bay is complex. From its mouth the narrow lower portion of the bay runs southwest to northeast to about river mile (RM) 9, measured from the mouth of the estuary. The main channel then swings to the south and the bay widens into an area of broad tidal flats. Sloughs branch off near the estuary mouth and at several locations in the upper bay. The Coos River enters the upper bay in its southeast corner about 17 mi from the mouth of the estuary. Johnson (1972) states the width at the mouth is 2,060 feet, and the average width of the bay at low tide is 1,200 feet.

Currently the U. S. Army Corps of Engineers (USACE) maintains a dredged ship channel from the entrance to RM 15 (Isthmus Slough). The channel is 45 ft deep and 700 ft wide at the entrance bar and decreases to 35 ft deep and 300 ft wide at RM 1. These dimensions continue to RM 9. From there the channel is 35 ft deep, 400 ft wide to RM 15. Two wide turning basins and an anchorage basin are located at North Bend, near the mouth of Coalbank Slough, and at RM 5.5 respectively. Shallower channels are also dredged by the USACE in the Coos River, the South Fork Coos River, the Millicoma River, and in South Slough connecting Charleston boat basin to the Coos Bay channel. Private concerns maintain a channel in Isthmus Slough to RM 17 (USACE 1976).

The physiography of the Coos estuary has been significantly altered by man. Prior to alterations, the channel across the bar at the entrance to Coos Bay was 10 ft deep and 200 ft wide (USACE 1975). The channel wound to the north with a depth of about 11 ft and width of 200 ft to the town of North Bend, then gradually decreased in width to 50 ft and in depth to 6 ft at Marshfield. Shoals were numerous.

Extensive filling and diking in the main bays, sloughs, and tributaries have changed the form and consequently the function of the estuary. Channel shifts and areas of accelerated erosion and deposition have been noted

(Dicken et al. 1961; Aagard et al. 1971). Other major alterations include the North and South jetties, the Charleston breakwater, and the Charleston small boat basin.

Bottom topography

Coos Bay shares several features with other drowned river valley estuaries. It has a "V"-shaped cross section, a relatively shallow and gently-sloping bottom, and a fairly uniform increase in depth toward the mouth (Baker 1978 [citing Schubel 1971]). NOS charts provide soundings in the navigable portions of the estuary (NOS 1978). Soundings of the bay following completion of the USACE Deep-Draft Navigation Project are available from the Portland District Engineer.

Bottom topography of South Slough can be determined from soundings made in 1977 (USACE 1977). Topography of most other shallow portions of the bay is less well known. Contours showing tidal levels such as MLLW and ELW are generally unavailable.

Water discharge

Fresh water inflow into the Coos estuary is measured only on the West Fork of the Millicoma River. Estimates of total fresh water flow at the mouth are made from extrapolations of these data. Estimated average annual discharge at the mouth of Coos Bay is 2.2 million acre-feet of fresh water (Percy et al. 1974). Using this figure as an average, a yearly maximum of 3,044,000 ac-ft and minimum of 1,560,000 ac-ft may be estimated from data presented in Percy et al. (1974) for the mouth.

Records from 1933-63 show that January is the wettest month at North Bend, averaging 9.9 in of precipitation, and July is the driest with an average 0.38 in (USACE 1975). According to USACE (1975) freshwater inflow may vary from 100,000 cubic feet per second (cfs) in winter to 100 cfs in summer. Arneson (1976) measured an even lower inflow of 35.3 cfs during September of 1973.

Runoff follows the pattern of precipitation. Soils provide a minimum of water retention, and snowfall is light so that a significant snow pack does not form (OSWRB 1963). Figure 3 suggests a one month lag in discharge response to precipitation.

Range of tide

The USACE (1978) states that mean tidal range is 6.7 ft above mean lower low water (MLLW) at the entrance to Coos Bay and 6.9 ft above MLLW at the city of Coos Bay. Predicted extreme range is 10.5 ft above MLLW. Extreme low water (ELW) is predicted to be -3.0 ft below MLLW.

Tidal range predictions are made by the National Oceanic and Atmospheric Administration (NOAA) and are based on data taken over 40 years ago (Arneson 1976). Arneson found that measured ranges at the entrance were slightly greater than predicted ranges for all seasons, although the error was usually

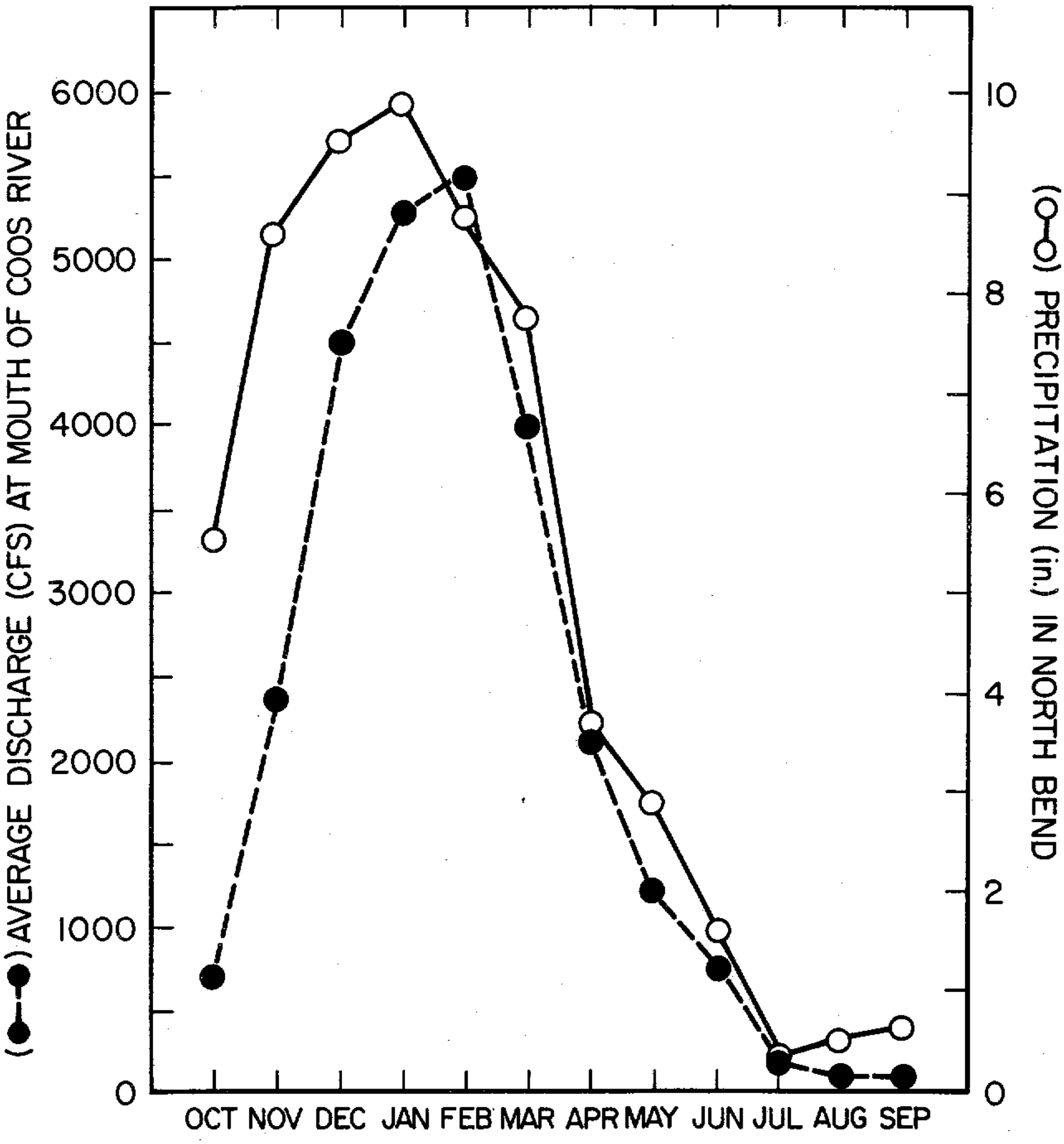

Fig. 3. Precipitation in North Bend (USACE 1975) and average monthly discharge of Coos River at the mouth (OSWRB 1963).

less than 15% . At the city of Coos Bay, Arneson (1976) consistently measured higher tidal ranges than those predicted by NOAA. He states that unusually high ranges may be attributed to river flow.

Arneson (1976) hypothesizes that tidal ranges greater than predicted mainly resulted from fill placed in the bay. Large fills have been placed on the tidelands of the upper bay, near the airport, and at Eastside since the predictions were made. Although the channel was deepened concurrently, the resulting cross-section may be more hydraulically efficient so that dampening of the tidal wave is less (Arneson 1976). The effect of further channel deepening has not been assessed.

Tidal prism

Johnson (1972) based his calculation of the tidal prism of Coos Bay (1.86 x 10^9 ft^3) on a mean tide range of 5.2 ft multiplied by a mean surface area between high and low water of 10,973 acres. The accuracy of these figures may be questionable. Compared to values for other Oregon estuaries shown in Table 4, Coos Bay is most similar to Tillamook Bay in volume of saltwater exchange.

Table 4. Coos Bay tidal prism compared with selected Oregon estuaries.[a]

Estuary	Tidal prism (ft^3)	Ratio of other estuaries to Coos Bay
Coos Bay	1.86 x 10^9*	1.0
Tillamook	2.49 x 10^9	1.3
Umpqua	1.18 x 10^9*	0.6
Yaquina	8.35 x 10^9*	0.45
Alsea	5 x 10^8*	0.3
Nehalem	4.28 x 10^8*	0.2
Siletz	3.5 x 10^8	0.2
Netarts	3.3 x 10^8	0.2
Siuslaw	2.76 x 10^8	0.2
Nestucca	1.8 x 10^8*	0.1
Coquille	1.32 x 10^8	0.07
Sand Lake	8.2 x 10^7	0.4

[a] *Values indicated by * are from Johnson (1972). All other estimates are calculated by Starr (1979) from DSL (1973).*

Time of tide

Both the high and low tides occur progressively later upbay from the mouth. Lag time at some locations seems to vary with seasonal changes in river flow (Arneson 1976). Arneson's study shows that lag times are variable and difficult to predict for different locations in the estuary.

Arneson (1976) compared his tidal measurements to predictions made by NOAA. For the mouth he discovered actual tides to be within 20 minutes of predications 80% of the time and to generally be earlier than predicted. At Coos Bay tides occurred considerably earlier than predicted. Only 25% of measured tides were within 20 minutes of NOAA predictions.

Arneson suggests the earlier tides at Coos Bay could be attributed to increases in mean channel depth that have occurred subsequent to the tidal predictions. Shallow wave theory predicts that the tidal wave should move faster at increased depth. Measurements have not been made since completion of channel deepening associated with the Deep-Draft Navigation Project. This further depth increase could allow the tidal wave to travel even faster.

Tidal circulation

The USACE (1975) states that the average tidal current at Coos Bay is 2.0 knots (3.4 ft per sec) and that flood currents of 3.5 knots (5.9 fps) have been reported. Arneson (1976) mentions that ebb currents as high as 5.0 knots (8.4 fps) have been measured, although maximum ebb measured during his study was 2.4 knots (4.0 fps).

Arneson (1976) studied the relationships of flow and velocity to maximum and minimum tidal heights to determine the character of the tidal wave. His data (Table 5) reveal that the wave is neither a true standing nor progressive wave. The tide resembles a cooscillating wave in which the tidal wave is reflected at the head of the estuary and the resulting tidal motion is the sum of the incident and reflected waves. However, studies of tidal ranges and lag times of high and low water as one progresses up the mouth show that the cooscillation theory does not strictly define Coos Bay. The complex geometry of the bay and the fact that one may consider tributaries both as sources and as inertial forces contributes to this complexity (Arneson 1976). The response of the tidal phenomena to further changes in estuarine geometry is difficult to predict.

Mixing

Burt and McAllister (1959) used a salinity gradient approach to describe mixing in Coos Bay. They classified the bay as well mixed for all months except November, when the estuary was partly mixed. They also specified a secondary classification of partly mixed for January, March, and June. Arneson (1976) applied the salinity gradient approach and the approach developed by Simmons (Dyer 1973), which uses a ratio of river flow to tidal prism, to data which he collected in 1973 and 1974. Results are shown in Fig. 4.

Both the flow ratio and salinity gradient methods classify the entire estuary as one mixing type. Arneson (1976) used salinity profiles to depict conditions along the main channel of the bay (Fig. 4). He finds a consistent change in mixing patterns occurring between RM 14 and 15 in Marshfield Channel, not far from the entrance of Coos River into the wide, shallow tidal flat area of the bay. It also appears that RM 8-9 is a zone of change. This may also be related to shape changes that occur there.

Table 5. Flow and velocity phase results (Arneson 1976).

		Phase lag following low or high water[a]						
		Entrance (RM 1.06)		Coos River (RM 15)		Isthmus Slough (RM 14.22)		
Date	Tide	Flow	Velocity	Flow	Velocity	Flow	Velocity	Range (m)
Sept. 12, 1973 (Summer)	Flood	78°	78°	148°	126°	156°	129°	1.79
	Ebb	87°	81°	100°	130°	--	--	-1.82
Dec. 18, 1973 (Fall)	Flood	--	--	--	--	--	--	1.33
	Ebb	81°	87°	--	--	90°	49°	-2.15
Mar. 22, 1974 (Winter)	Flood	--	--	113°	95°	128°	--	1.71
	Ebb	84°	78°	124°	156°	92°	112°	-1.89
June 11, 1974 (Spring)	Flood	114°	127°	168°	122°	--	--	1.71
	Ebb	88°	90°	168°	162°	88°	74°	-1.07

[a] *360° = 1 tidal cycle of 12.42 hours*

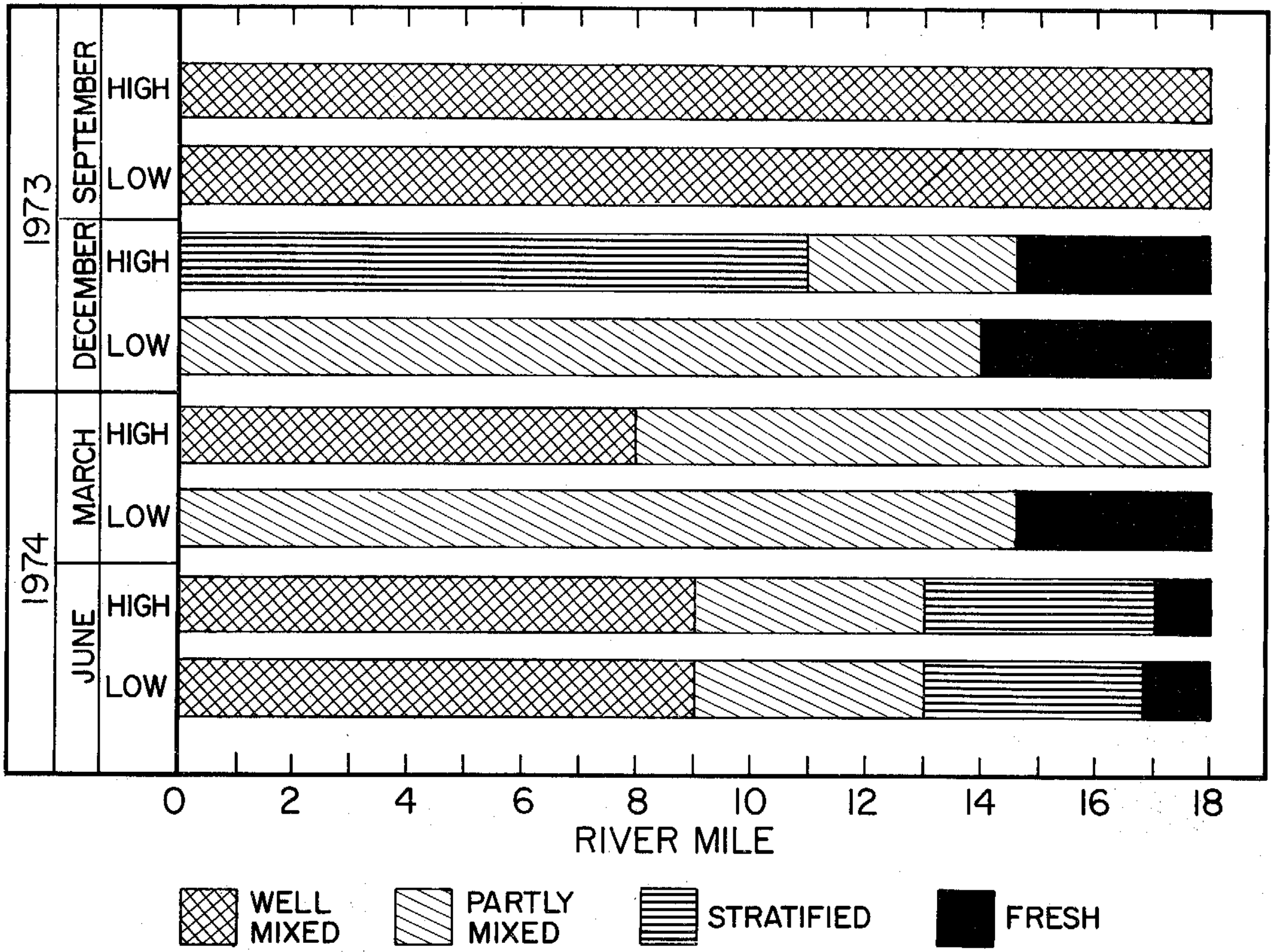

Fig. 4. Coos Bay mixing characteristics (Arneson 1976).

Flushing

Using the modified tidal prism method Arneson (1976) calculated flushing times for several points in the estuary (Table 6). His calculations for a point 27 miles from the mouth of the estuary ranged from 13.4 days at a time of high river flow and tidal range to 48.5 days at low flow and low tidal range. Although these estimates are based on only a few measurements, they demonstrate that flushing takes a number of days even under optimum flow.

Table 6. Calculated flushing rates using the modified tidal prism method (Arneson 1976).

Date	Tidal Range (ft)	Flow (cfs)	Flushing time (days)		
			RM 7.6	RM 17.3	RM 27.0
Sept. 13, 1973	7.9	28	9.7	22.9	40.3
Dec. 19, 1973	5.9	3,814	6.2	11.8	13.4
Mar. 23, 1974	7.2	1,074	8.2	14.4	15.9
June 12, 1974	3.3	431	19.0	41.3	48.5

Temperature

The temperature of Coos Bay undergoes both seasonal and diurnal fluctuations. Fresh water inflow and tidal currents are the main factors affecting temperature distribution in the estuary (Arneson 1976). Coastal upwelling causes offshore surface temperatures to be coldest during summer (Bourke et al. 1971). River temperatures are coldest in winter and warmest during summer and fall (Arneson 1976). DEQ (1978) data show that temperatures in the estuary have reached extremes of 35.6°F and 73.4°F. Seasonal temperature fluctuations are greater upbay than near the mouth of the estuary, reflecting that fluctuations in tributary temperatures are more extreme than those of the ocean.

Arneson (1976) plotted temperature vs RM for the data he collected in 1973 and 1974 (Figs. 5 and 6). His data show large longitudinal variations in September and June when entering fresh water was warmest. June data also show vertical gradients because a greater amount of fresh water was entering at that time. High tide profiles each show a significant increase at RM 8, which Arneson attributes to solar heating of the shallow water over the large tideflats of the upper bay.

In December and March the ocean and entering fresh water were nearly the same temperature so profiles were almost identical. DEQ (1978) data show that fresh water temperatures may be much colder than ocean temperatures. Different profiles would be expected under those conditions.

In summer, low streamflows and poor circulation cause high temperatures in some areas of the bay (STR 1974). High temperatures physiologically stress aquatic life. STR (1974) list high temperature as a water quality problem in Coos River, Millicoma River, North Slough, Catching Slough, and Isthmus Slough.

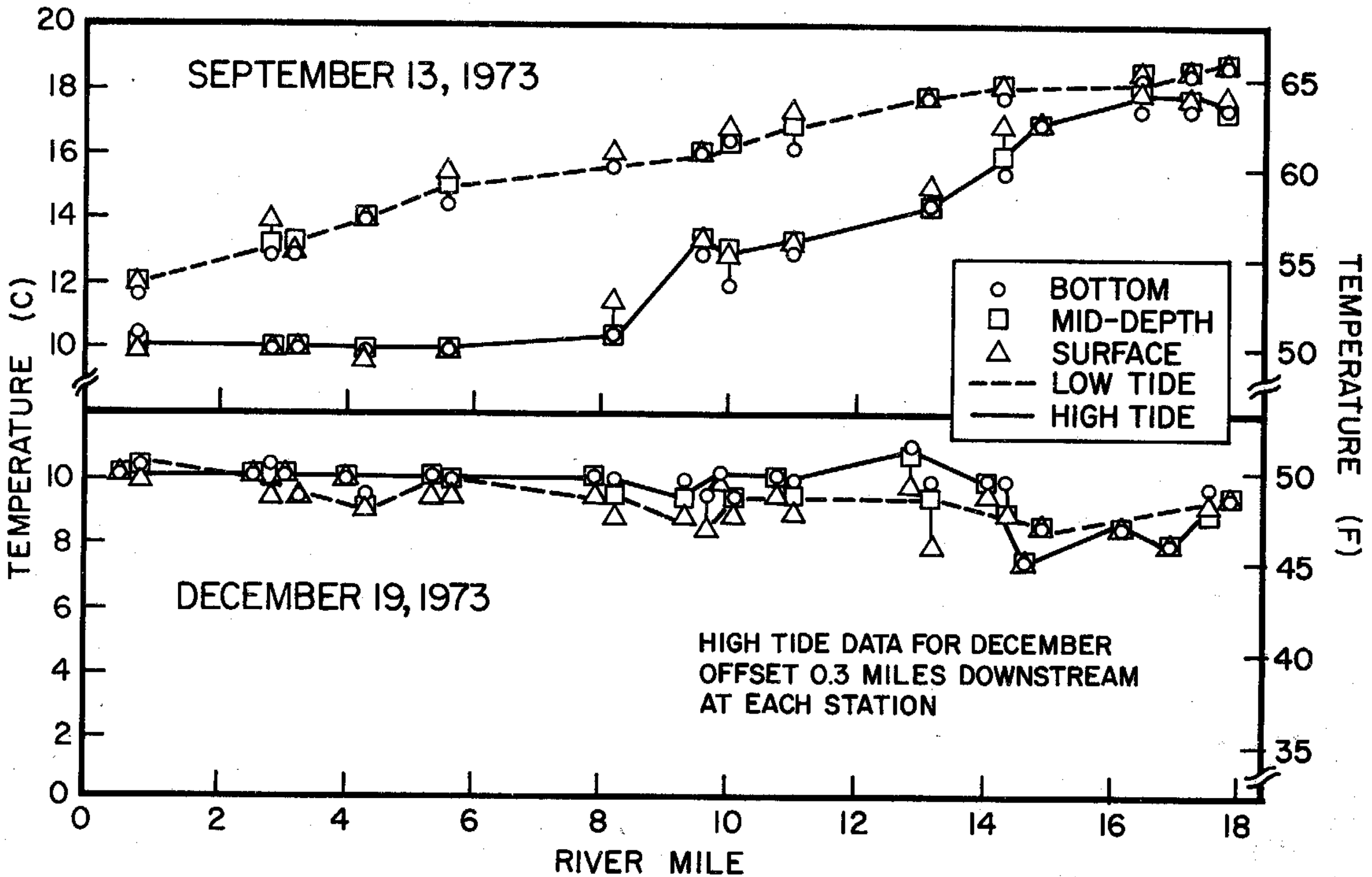

Fig. 5. Temperature vs. river mile, Coos Bay, September 13 and December 19, 1973 (Arneson 1976).

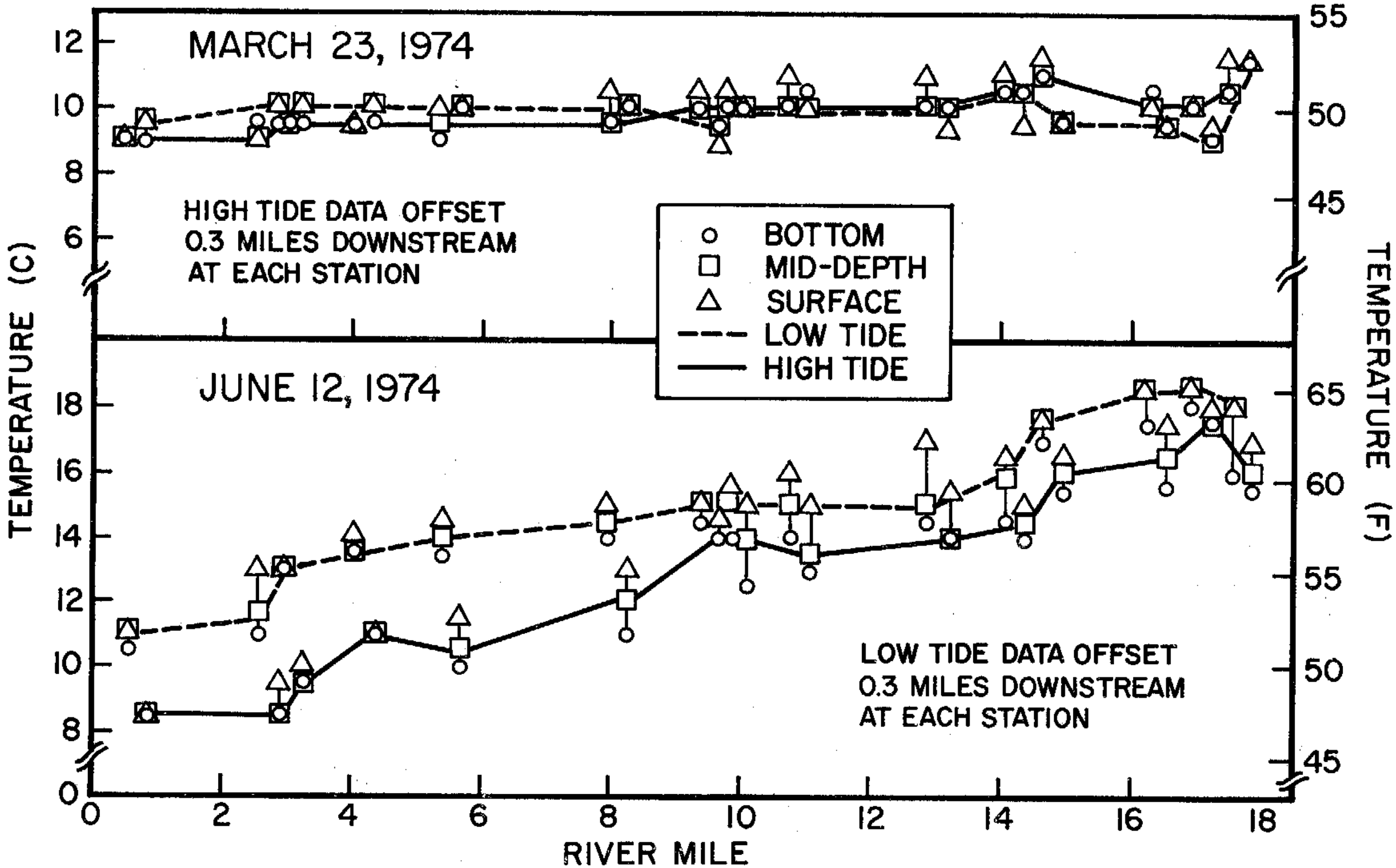

Fig. 6. Temperature vs. river mile, Coos Bay, March 23 and June 12, 1974 (Arneson 1976).

Dissolved oxygen

Dissolved oxygen (DO) is measured by DEQ as part of their regular water quality monitoring program. Others who have measured DO in conjunction with specific projects include Arneson (1976), STR (1974), and Slotta et al. (1973).

DEQ data show DO levels below the 6 mg/l standard occasionally at various locations in the bay (DEQ 1978). Measurements below standards were more frequent above RM 13 and in Isthmus Slough. STR (1974) data generally concur. Arneson (1976) sampled seasonally in 1973 and 1974. His limited data show that DO concentrations were slightly higher in December and March than in June and September. Lowest levels were recorded from Isthmus Slough. DO concentrations below the standard can kill resident fish and invertebrates and prevent migrants from utilizing the area.

Arneson (1976) mentions that DO depressions during fall have been attributed to low fresh water inflow and waste loading caused by offshore upwelling of low DO water and input of organic material, such as seafood industry waste water and bark from stored logs.

Arneson (1976) also noted supersaturation in the Coos River and in Catching Slough during June which he attributes to photosynthetic activity. Arneson attributed supersaturation observed near the mouth in December to reaeration aided by wave action.

Turbidity

Arneson (1976) found, with only a few exceptions, that low tide turbidity levels were higher than high tide levels. He interpreted this to mean that the primary cause of turbidity in Coos Bay is the sediment carried in by fresh water entering the bay. High tide turbidities increase from the mouth upstream during all seasons although this increase is very slight during times of low runoff.

USACE (1975) states the average turbidity in the bay ranges from 20 to 49 Jackson Turbidity Units. Slotta et al. (1973) found that below RM 12 dredging does not significantly increase turbidities. Above RM 12 post-dredging levels of 500 JTU have been recorded. North Slough and the area near Empire Mill are mentioned by the USACE (1975) as areas of high turbidity. Discharge of industrial waste water is listed as a probable cause of these high turbidities by STR (1974). USACE (1975) states that highest turbidity levels measured by STR in 1972 were 2,400 JTU during high tide at the site of log-dumping operations at the Empire Mill. The clearest waters were found at the entrance and near North Bend (USACE 1975).

DEQ standards specify that no more than a 10% cumulative increase in natural turbidities is allowed except for certain DEQ approved limited duration activities (OAR 340-41-325).

Coliform

DEQ has measured fecal coliform counts which exceed standards for commercial shellfish growing areas occasionally below RM 8.75 in the bay and frequently above this point. Counts exceeding general standards are frequent above RM 11.5. With a few exceptions, coliform counts in South Slough have been within shellfish area standards. STR (1974) has measured counts above the standard upbay of Jordon Point in the main bay, in North Slough, Isthmus Slough, and Catching Slough. The bay has been closed to commercial shellfish harvest above Sitka Dock by the State Health Division (Osis and Demory 1976).

Major causes of high coliform counts include improper disinfection of sewage plant effluents, inadequate subsurface disposal systems, and livestock (STR 1974).

Sediments

Coos Bay is an aggrading system--more sediment enters the bay than is removed by natural forces (USACE 1975). Prior to the channel deepening for the Deep-Draft Navigation Project, an annual average of 1.65 million yd^3 of material was removed from Coos Bay by the USACE (1976) to maintain navigation channels.

Sediments entering the bay include

1. materials, primarily silts, derived from erosion of the drainage basins of tributary streams;

2. marine sands carried into the bay by littoral drift;

3. dune sands which are blown into the bay even though the dunes have been partially stabilized by vegetation;

4. sands from wind erosion of the sandstone cliffs of the lower bay and South Slough.

The material from the entrance to RM 12 is predominantly fine sand. No shift to smaller grain size has been observed in that section following dredging. From RM 12 to RM 15 channel, sediments are primarily silts, clays, and organic fines, and the composition shifts to smaller grain sizes after dredging. Above RM 15 sediments are silty (USACE 1975).

Sedimentation is controlled by hydrology. Arneson (1976) has applied the concept of realms of deposition used by Kulm and Byrne (1976) for Yaquina Bay to the Coos. He hypothesizes a marine and a transition realm extends to RM 12 and a fluviatile realm exists above RM 12. Percy et al. (1974) estimate an average of 72,000 tons of sediment enters the bay from its drainage basin annually.

Known areas of sediment deposition in Coos Bay include the entrance to Charleston Channel, the area adjacent to disposal islands west of the North Bend Airport, Jordan Cove, east of the upper Coos Bay Channel, and at the mouths of Pony Slough, North Slough, and Haynes Inlet (USACE 1976).

In the lower portions of Coos Bay, material removed from the channel is deposited in in-bay disposal sites. During recent years the amount of material has been constant and shoaling has recurred at the same sites. USACE (1976) hypothesizes that a semi-closed sediment transport system has been operating from RM 2 to RM 12. Sediments originating upstream of RM 15 were thought to have been trapped between RM 12 and RM 15 where the channel was dredged by the Corps. Sediments from the ocean were thought to accumulate mainly below RM 2. Below RM 2 and RM 12 sediments were thought to result from redistribution of existing sediments in a cycle of removal of material from the channel, disposal of dredged material adjacent to the channel, and gradual infilling of the channel (USACE 1976). Effects of channel deepening on this sytem are unknown.

Most studies of the sediment chemistry of Coos Bay have been related to dredging and disposal of dredged material (STR 1972; Slotta et al. 1973; Arneson 1976). STR (1972) determined that sediments below RM 10 met standards for inwater disposal, whereas all materials above RM 10 failed to meet those standards. Above RM 10 volatile solids increased (Arneson 1976). USACE (1975) found the area above RM 12 in the estuary exceeded EPA standards for grease and oil, volatile solids, nitrogen, and phosphorus.

Biological Characteristics

The biology of Coos Bay has been the subject of numerous studies, including those by individual students and classes at Oregon Institute of Marine Biology (OIMB), by OSU students and faculty, and by ODFW personnel. Most of the studies are descriptive in nature. Quantitative studies of productivity and population dynamics are generally lacking.

Phytoplankton

The USACE (1975) has summarized work done by several authors on the summer phytoplankton of Coos Bay (Kilburn 1961; Ednoff 1970; Ide 1970; McGowan and Lyons 1973). Diatoms are the principal members of Coos Bay's planktonic flora. There appears to be a continuum of species from the ocean to the upper bay containing two species assemblages and a transition zone. The transition zone lies between RM 5 and 9 and is an area of high species diversity and productivity (McGowan and Lyons 1973). *Chaetoceros, Skeletonema,* and *Thalassiosira* predominate in the lower bay, while *Melosira* and *Skeletonema* are found in the upper bay.

OIMB is currently taking quantitative measurements of phytoplankton in South Slough. Preliminary results indicate definite seasonal and tidal changes in species composition.

Macroalgae

The algal flora of Coos Bay is not well described. Most of the existing information is derived from qualitative studies by Sanborn and Doty (1944) and OIMB (1970). The USACE (1975) states that attached algae are probably found throughout the bay on solid substrates and that very few marine algae are restricted to the bay environment and not found in other locations along the Pacific Coast.

The greatest variety of algal species is found near the mouth of the estuary where hard substrates providing significant attachment sites and moderate wave action support a flora similar to that of the protected outer coast (Sanborn and Doty 1944). Along the main channel there is a change from a strictly marine to a brackish water flora.

Small subtidal kelp (*Nereocystis leutkeana*) beds are located in the lower sections of the estuary, and free-floating, seasonally occurring mats of green algae sometimes cover large areas of the upper bay (Ednoff 1970).

Productivity studies of the algae of Coos Bay have not been done.

Seagrasses

Two seagrasses occur in Coos Bay--eelgrass (*Zostera marina*) and ditchgrass (*Ruppia* sp.) (USACE 1975). Approximately 1,400 acres of lower intertidal and shallow subtidal tideflats are covered by eelgrass meadows (Akins and Jefferson 1973). Large contiguous beds of eelgrass occur in the lower and upper bay, in North and South Sloughs, and in Haynes Inlet. George M. Baldwin and Associates et al. (1977) state that the eelgrass meadows of the upper bay are among the largest in the state. In the lower reaches of the estuary eelgrass often occurs in pure stands, whereas in upper, less saline, areas it is often accompanied by ditchgrass.

Tidal marsh

Tidal marsh generally occurs from lower high tide inland to the line of non-aquatic vegetation and includes both salt marsh and tidally influenced fresh marsh. The U.S. Department of the Interior (USDI 1971) states that marsh vegetation in Coos Bay developed where broad, low gradient flats of soft sediment were not too strongly stressed by waves or currents. Large present day marshes are located at the mouth of Coos River and in the slough systems--North Slough, Pony Slough, Kentuck Inlet, Isthmus Slough, and Coalbank Slough. Fringing marshes have developed along the shoreline of the main channel near Empire, around the spoil islands of the lower and upper bay, and along the undisturbed shorelines of South Slough.

Using a classification adapted from Jefferson (1975) and estimating an error of less than 10%, Hoffnagle and Olson (1974) calculated the marsh acreage of Coos Bay (Table 7). Akins and Jefferson (1973) have given a figure of 2,738 ac. of marsh for Coos Bay.

Table 7. Area of Coos Bay marshes (Hoffnagle and Olson 1974).

Marsh type	Area (acres)
Low silt marsh	71.6
Low sand marsh	289.1
Immature high marsh	1000.5
Mature high marsh	97.5
Sedge marsh	353.5
Bullrush and sedge marsh	149.8
Surge plain	285.0
Total undiked marsh	1951.9
Total diked marsh	2942.9

Prior to human alterations of the estuary and its drainage basin, vast marshes occupied the upper bay and slough systems. Hoffnagle ad Olson (1974) estimate that 90% of the salt marshes of this estuary have been diked or filled to accomodate expansion of industry or residential areas and for agriculture and for dredged material disposal sites. Eilers (1974) indicates that of the 14 estuaries examined, Coos Bay marshes have been the most severely disturbed by human activities.

Marsh species and types present in Coos Bay resemble those found in other Oregon estuaries to the north and in the Coquille to the south. Akins and Jefferson (1973) noted that south of the Coquille there is a distinct change in vegetation and marsh types.

Hoffnagle et al. (1976) studied six marsh sites in Coos Bay. The group estimated those marshes produced over 1,050,000 gm/acre/year of plant material and considered this figure to be an underestimate. Their data suggest higher marshes are more productive than lower marshes. Bullrush and sedge were found to be particulary productive species. Productivity alone may be insufficient evidence to judge the importance of a marsh. The palatability of marsh plants to consumer organisms and the importance of the plant to detritus production are examples of other considerations (Hoffnagle et al. 1976).

According to Hoffnagle and Olson (1974), "The salt marsh and bacterial and clinging forms associated with its detritus comprise a base of production for the Coos Bay Estuary, providing food and habitat for commerical fish, bivalves, crab, birds, and mammals, and life in Coos Bay in general." The marsh serves as a buffer between shorelands and estuarine waters, preventing or minimizing erosion, flooding, and pollution. Jefferson (1974) indicates that flooding poses a greater potential hazard to shorelands because vast areas of Coos Bay marshes have been diked. Areas constructed on filled marsh are the most susceptible to flooding.

Zooplankton

McGowan and Lyons (1973) directed a short sampling program during the summer of 1973. Their data show a decreasing number of zooplankton taxa along the axis of Coos Bay with increasing distance from the ocean. The lower bay appeared to have a species assemblage which included neritic zooplankters carried in by tidal action and resident species which maintained reproductive populations. Peak zooplankton numbers occurred near Empire in an area of high chorophyll values. Different species were found in the upper bay and in Coos River.

Quantitative information on Coos Bay zooplankton is sparse, and seasonal species distributions are unknown.

Invertebrates

A wide variety of ecological niches are available to invertebrates in the Coos Bay estuary. Differing substrates provide a range of attachment sites and sediments in which to burrow from the solid rock of Fossil Point to the silty, highly organic mud of Isthmus Slough. In addition to substrate variations, differing salinities, temperatures, dissolved oxygen, and other physical factors provide even more variation in conditions.

Subtidal invertebrate populations of the dredged ship channel have been studied by Parr (1974), Slotta et al. (1974), and Jefferts (1977). Jefferts (1977) found the channel infauna of the lower portions of the estuary to be more diverse than that of the upper bay channel. Species of the upper bay, such as the polychaete *Streblospio benedicti*, are generally widespread and opportunistic. Parr (1974) hypothesizes that the fauna of the upper channel are adapted to dredging and that the "weed" species occurring there require frequent disturbance to maintain their competitive advantage.

A qualitative overview of the intertidal macroinvertebrates in Coos Bay was conducted by OIMB in 1970. Many other workers have concentrated on certain taxa or on limited geographic areas of the bay. Distribution of *Corophium*, an important crustacean in the diet of salmonids and other fishes, is shown in Fig. 7. ODFW has surveyed intertidal clam and shrimp distribution in some areas and is completing surveys in other areas (Gaumer 1978) (Fig. 8-15). Hartmann and Reish (1950 described the annelid fauna of the bay with notes on distribution, and Queen (1930) studied the decapod crustaceans of the bay.

Commercially and recreationally harvested invertebrates include several species of clams, the Dungeness and red rock crabs, oysters, bay mussels, ghost shrimp, kelp worms, and mud shrimp.

Clams. Principal species of clams harvested in Coos Bay are gapers (*Tresus capax*), cockles (*Clinocardium nuttallii*), butter clams (*Saxidomus giganteus*), littlenecks (*Protothaca staminea*), softshell clams (*Mya arenaria*), and razor clams (*Siliqua patula*). Of these, all but the softshell clams are restricted in distribution to areas below the railroad bridge (RM 9). These clam species are all filter feeders. Salinity, substrate, and water circulation probably play significant roles in limiting distribution (USACE 1975).

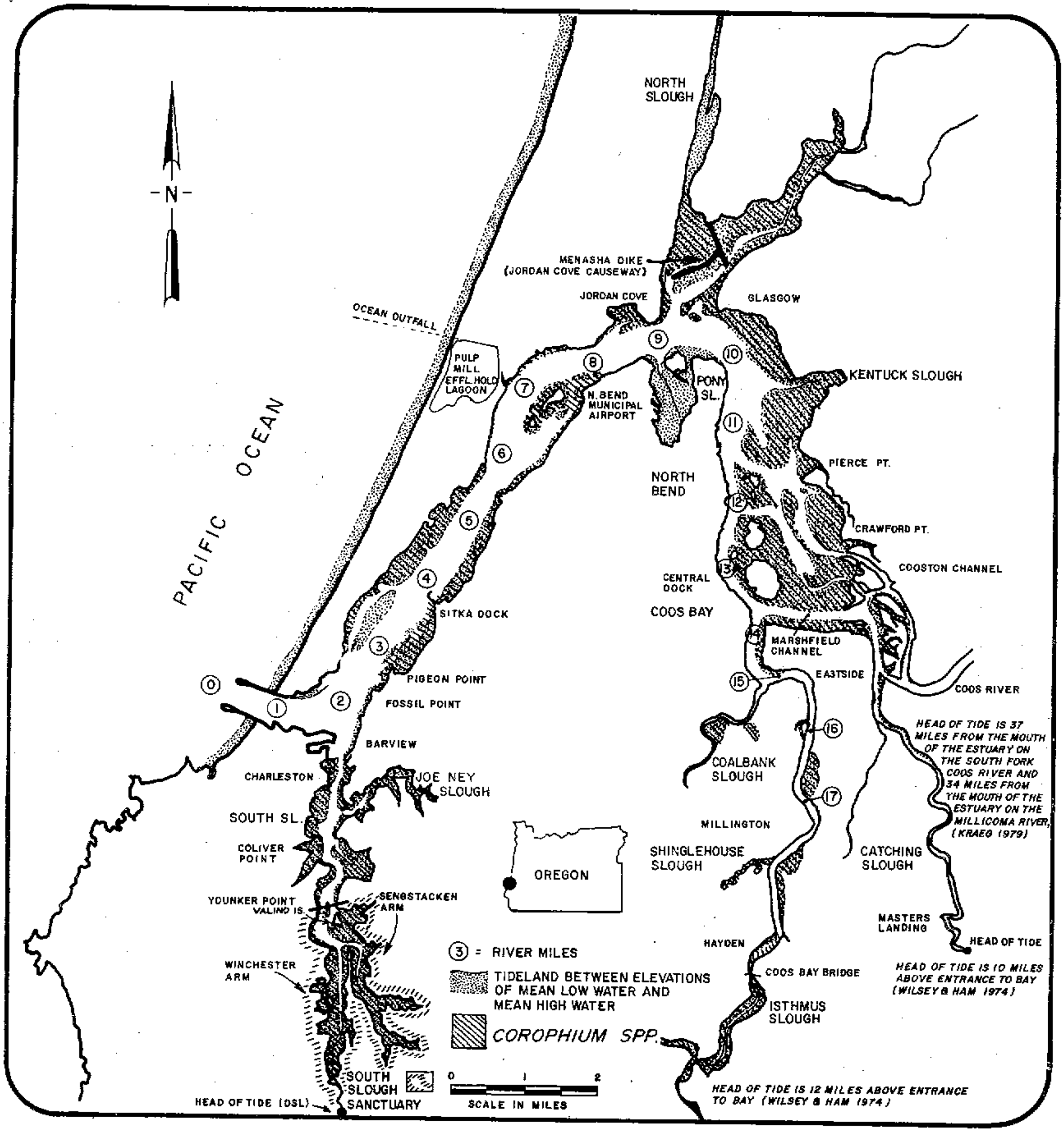

Fig. 7. *Corophium* distribution in Coos Bay (Coos Bay Planning Department 1979).

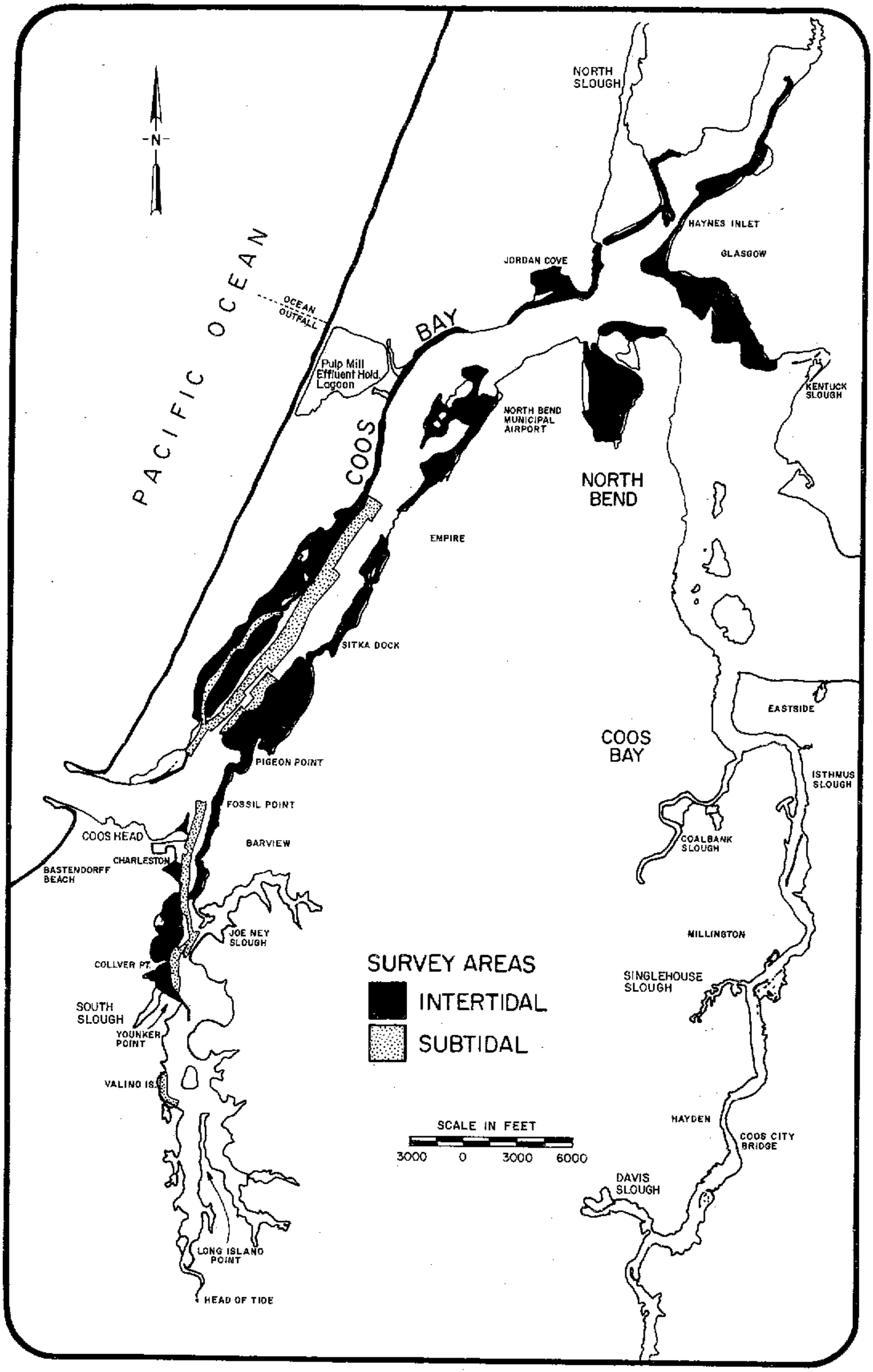

Fig. 8. Areas surveyed for clam and shrimp distribution (Gaumer 1978).

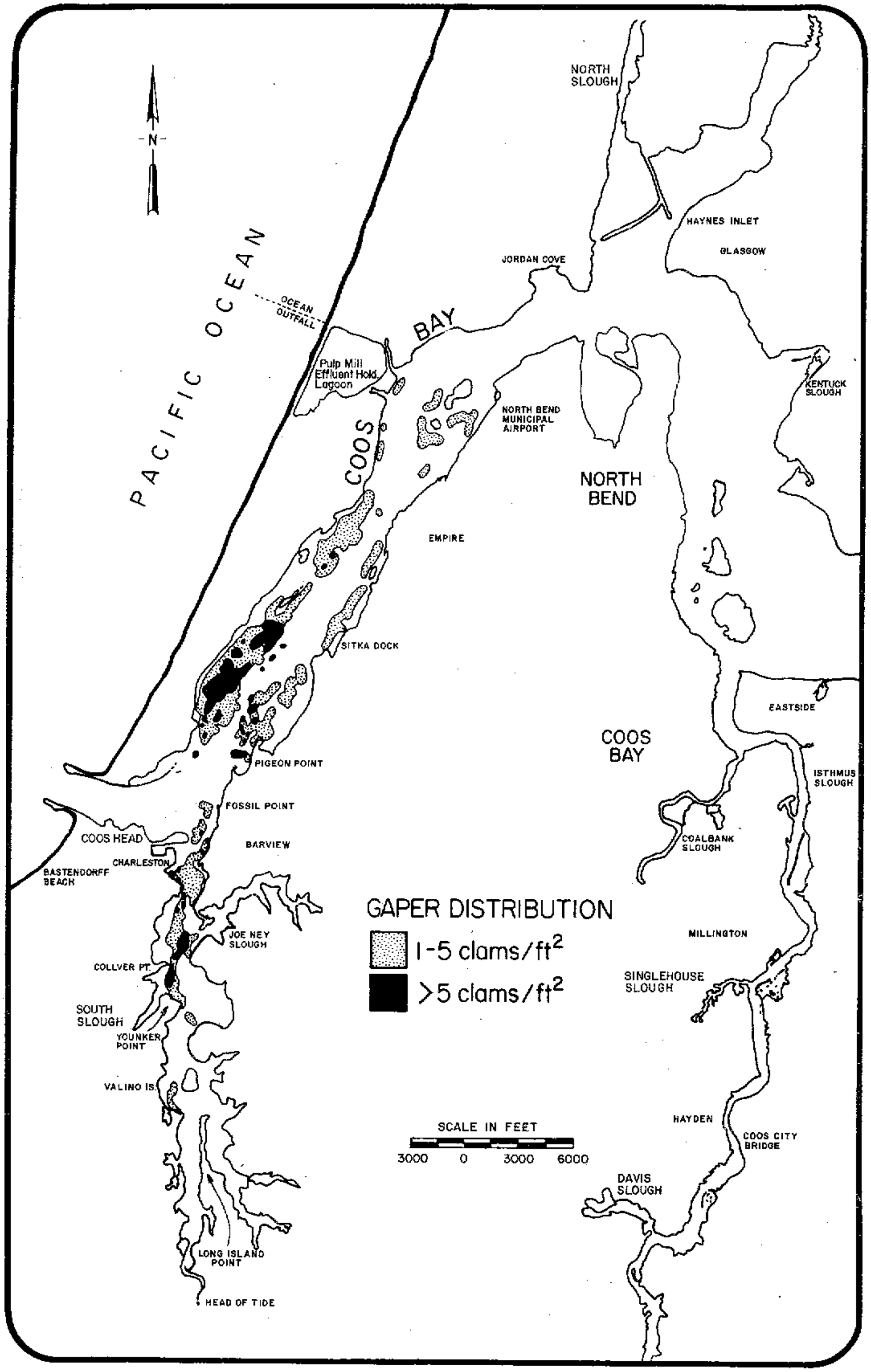

Fig. 9. Gaper distribution in Coos Bay (Gaumer 1978).

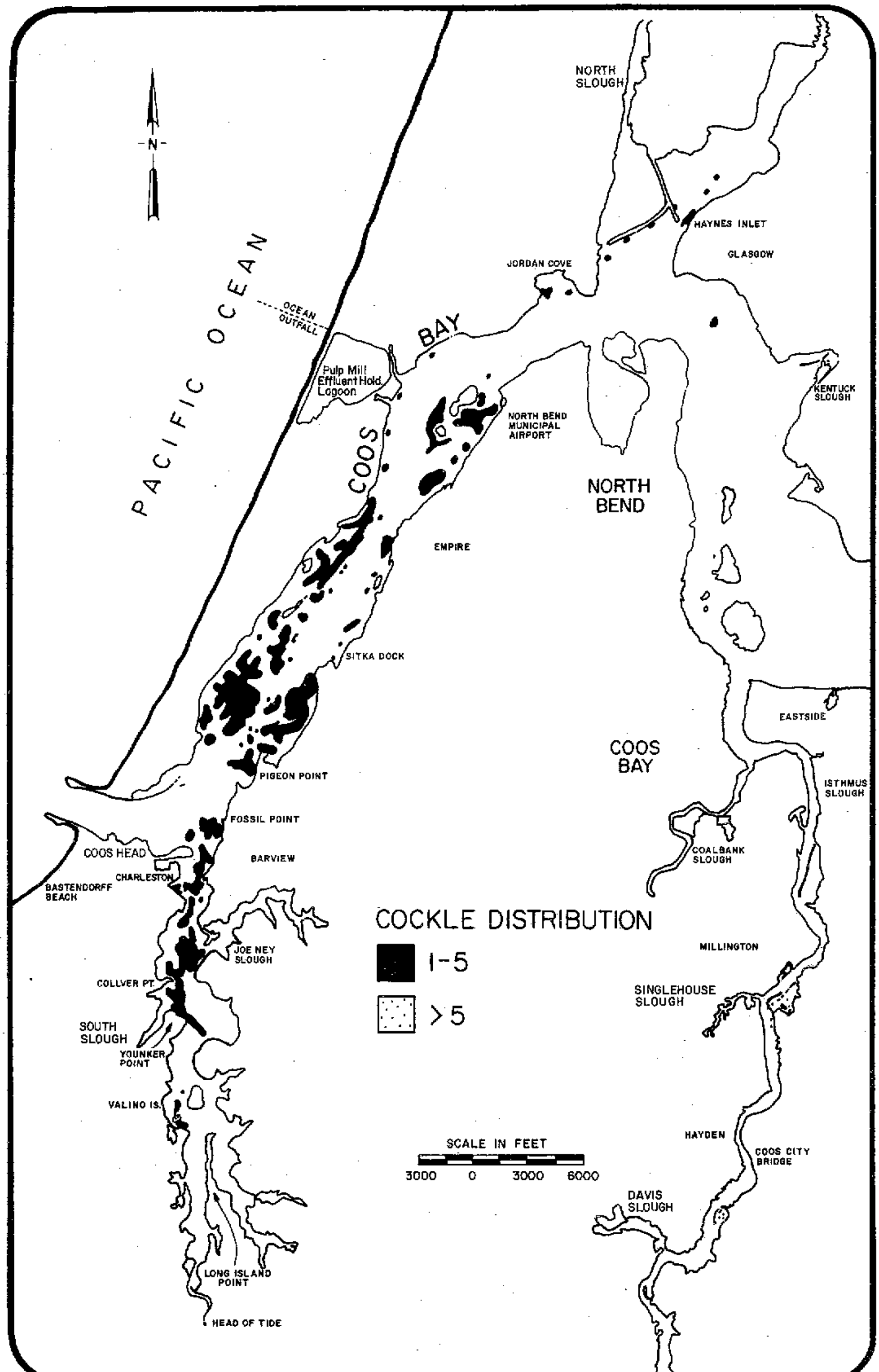

Fig. 10. Cockle distribution in Coos Bay (Gaumer 1978).

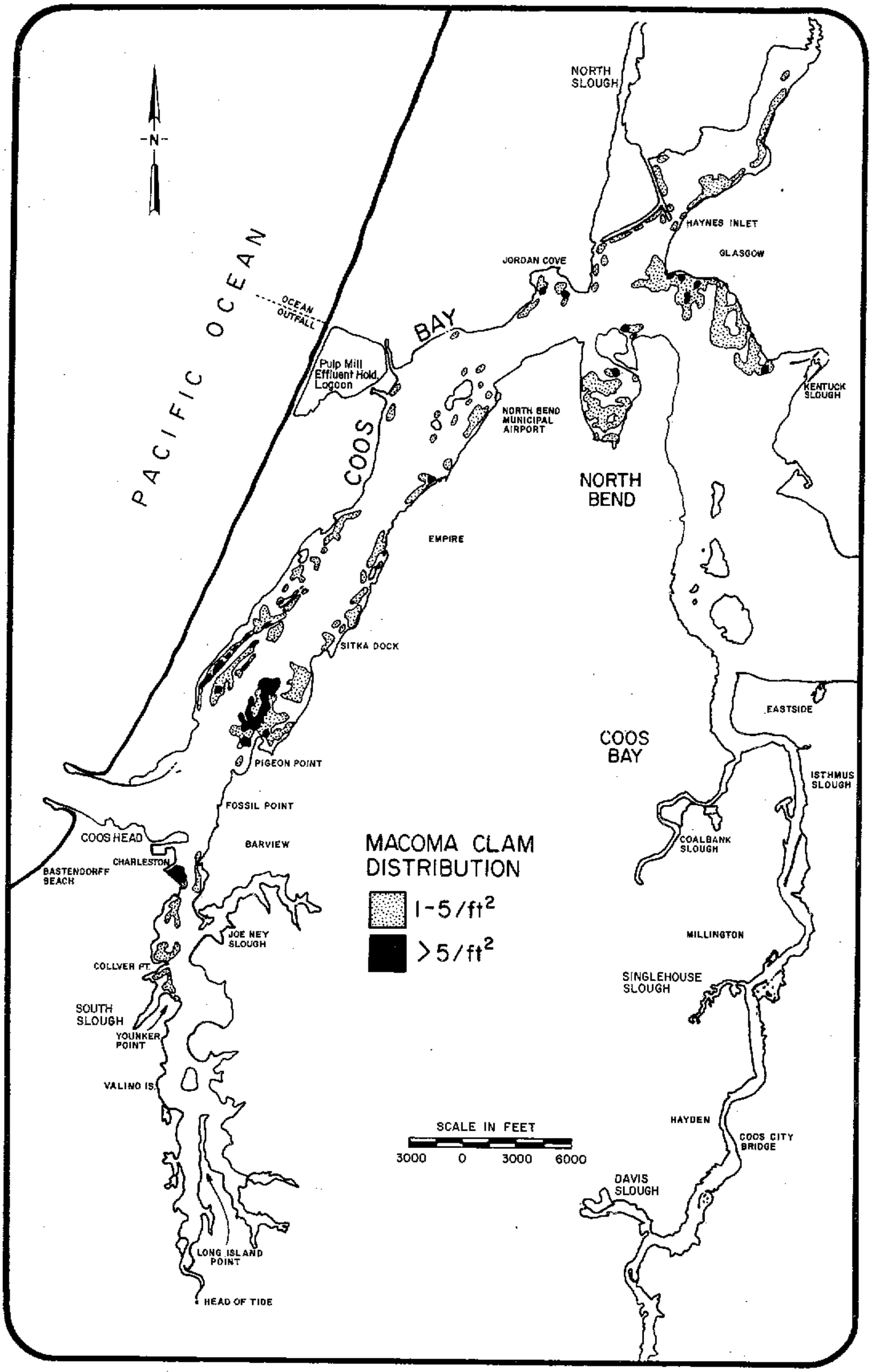

Fig. 11. Macoma (*Macoma irus, M. nasuta and M. balthica*) distribution in Coos Bay (Gaumer 1978).

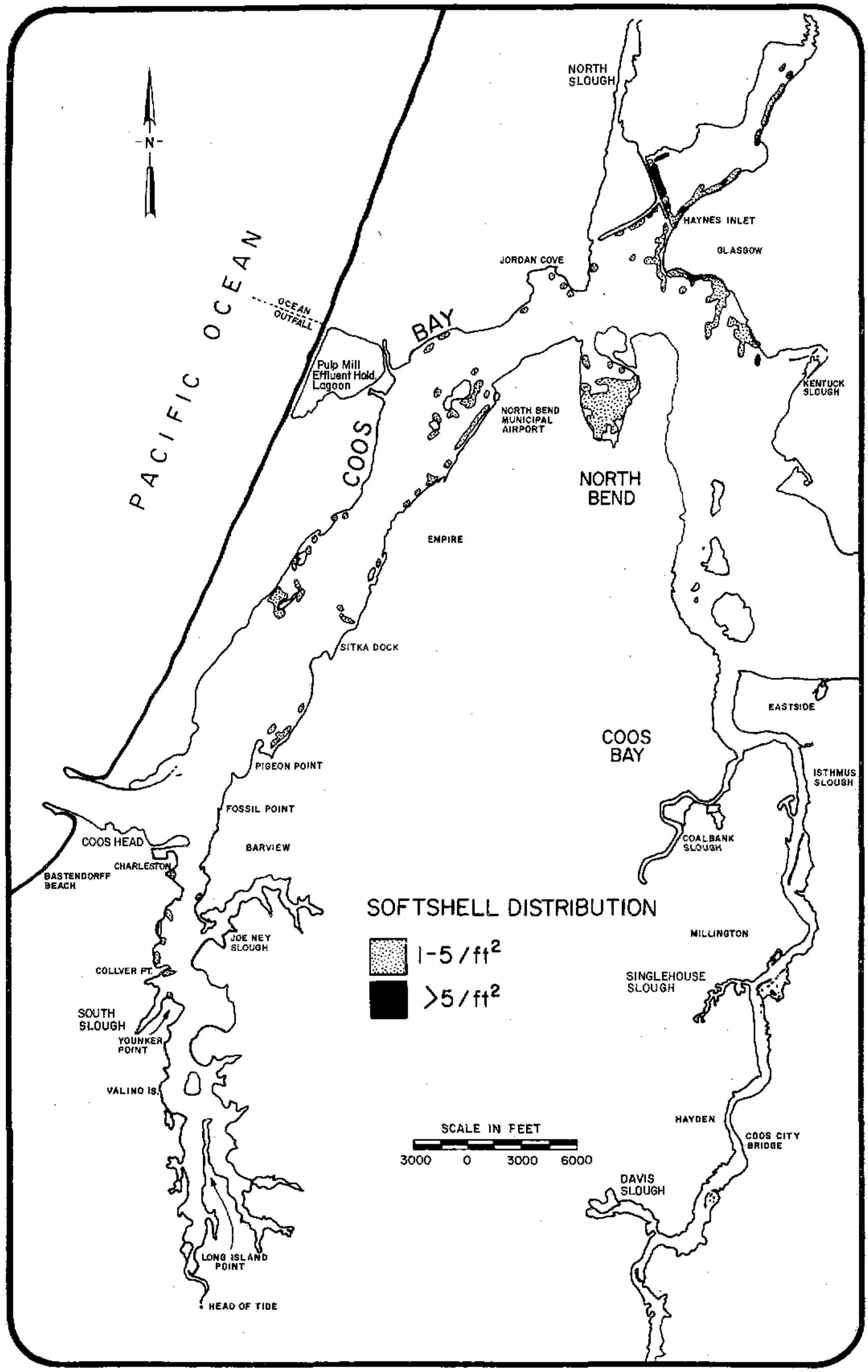

Fig. 12. Softshell distribution in Coos Bay (Gaumer 1978).

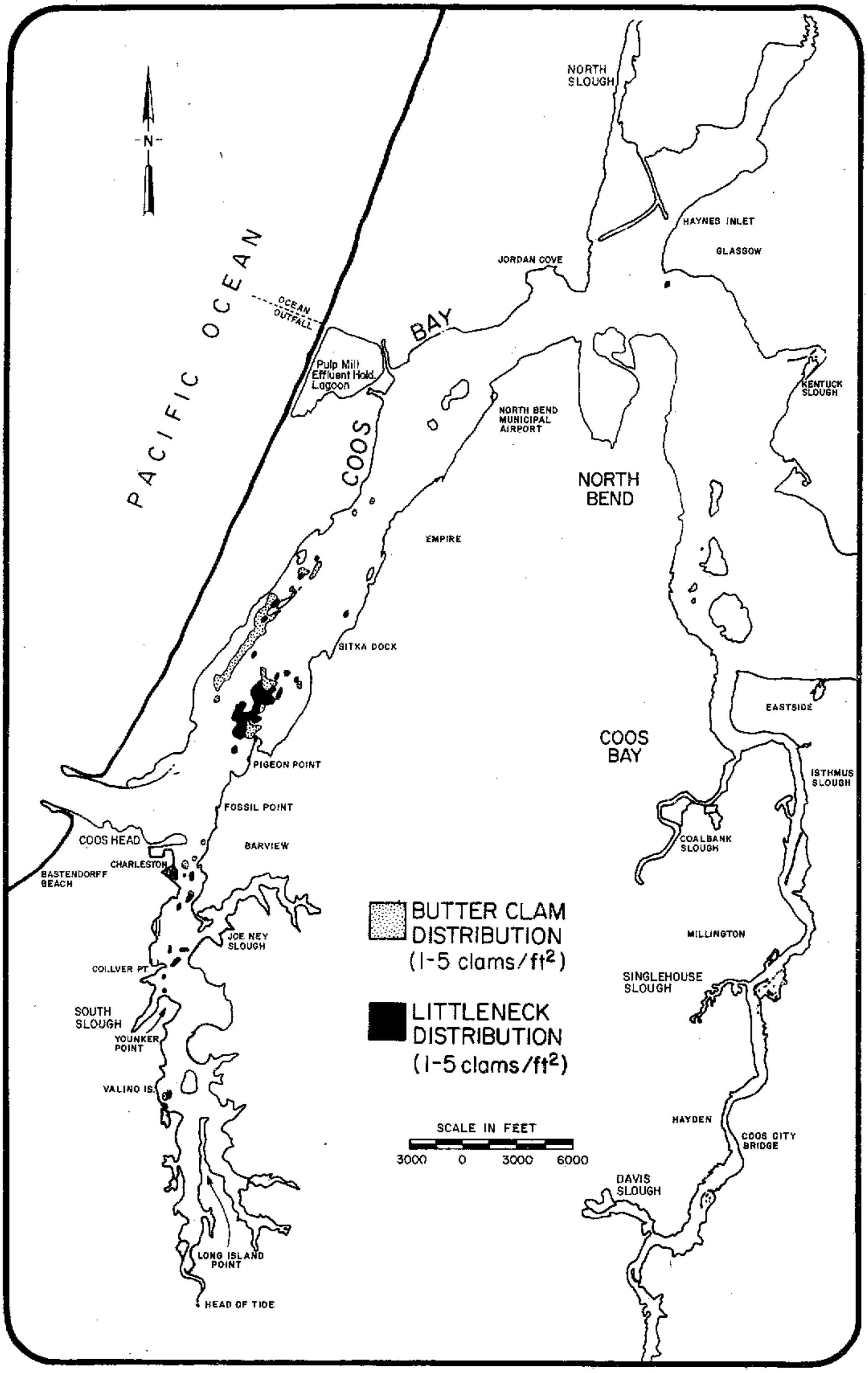

Fig. 13. Butter clam and littleneck distribution in Coos Bay (Gaumer 1978).

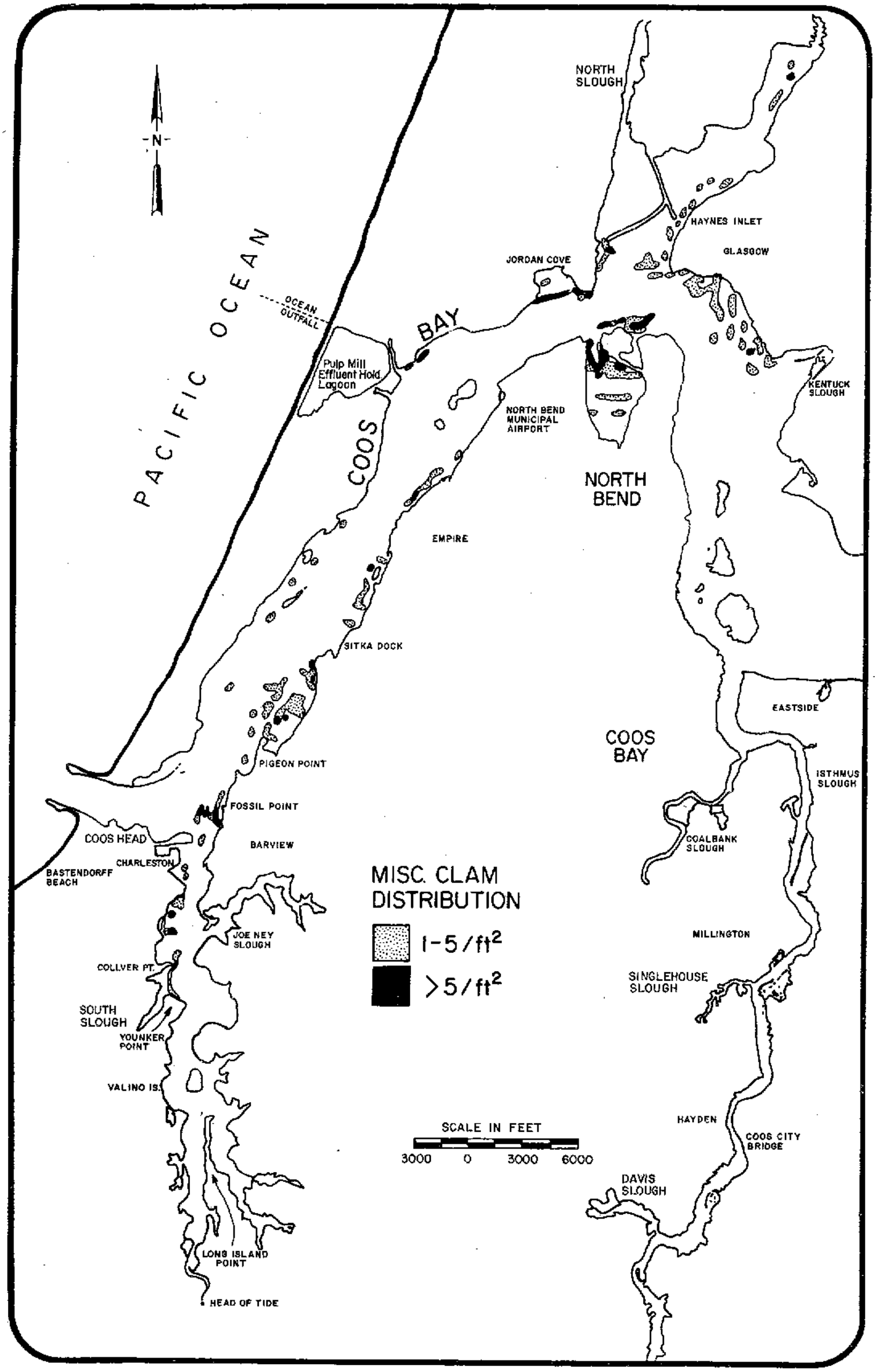

Fig. 14. Miscellaneous clam (California softshell, bodega, paddock, jackknife and rockclams) distribution in Coos Bay (Gaumer 1978).

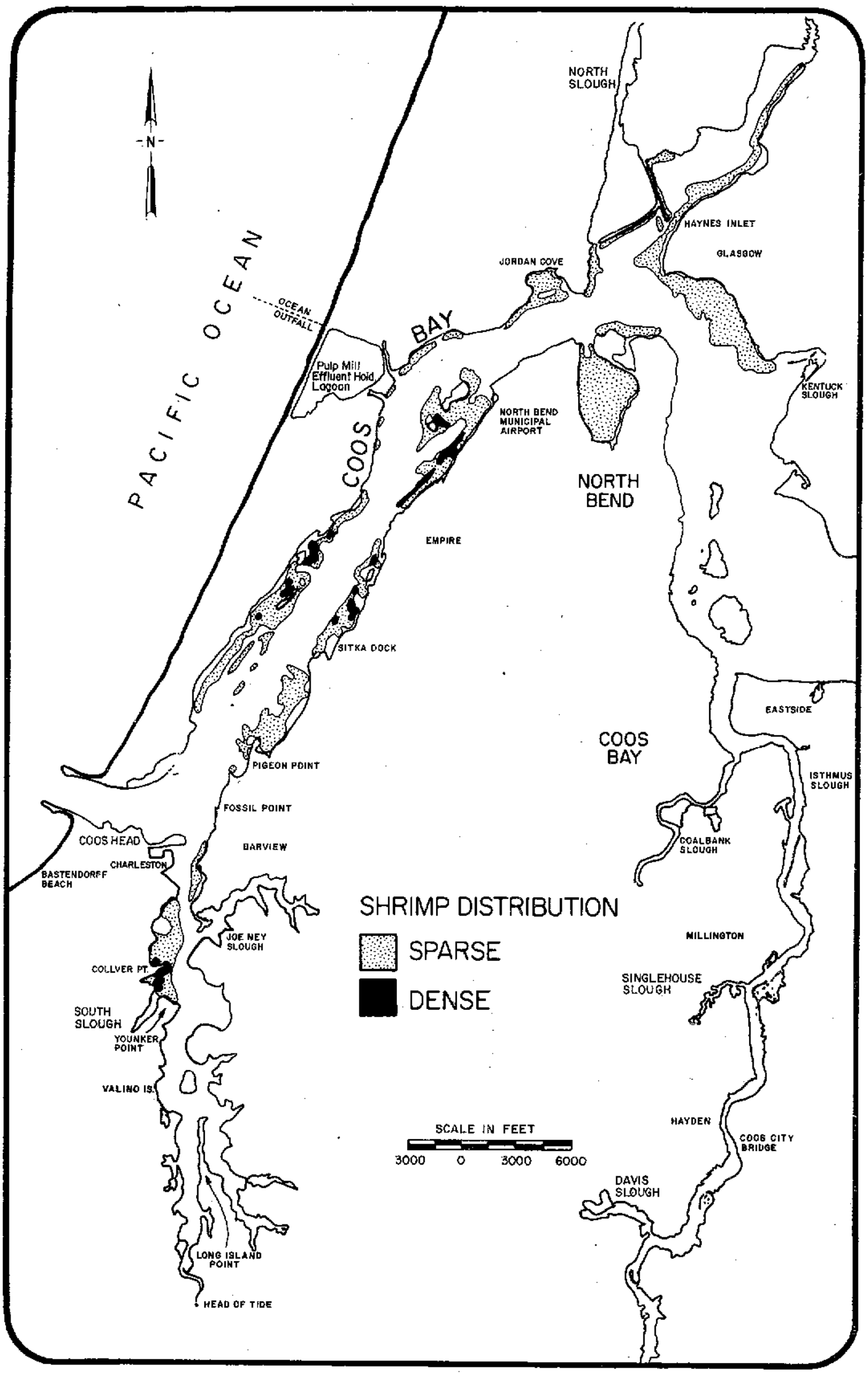

Fig. 15. Shrimp distribution in Coos Bay (Gaumer 1978).

Preliminary ODFW studies indicate that Coos Bay has extensive subtidal clam beds, including large beds of gapers and cockles (Gaumer and Lukus 1976). Principal beds are in the lower bay and lower South Slough. In 1976 one subtidal bed was investigated by ODFW to determine the feasibility of a commercial clam fishery (Gaumer and Halstead 1976). The 48-acre bed off Pigeon Point contained approximately 26.4 million clams, principally gapers and Irus clams (*Macoma inquinata*). Mean size of butter, cockle, littleneck and gaper clams was larger for each species than in a similar study in Yaquina Bay (Gaumer and Halstead 1976). A commercial harvest of 55,482 lb of gapers was taken from the Coos Bay site in 1975-76.

A 1971 estuarine resource use survey (Gaumer et al. 1973) showed that the greatest numbers of clams were taken from tideflats adjacent to North Spit and Pigeon Point and the flats just south of Charleston bridge. Menasha Dike, which separates North Slough from the main bay ranked second. Of the areas surveyed, the Menasha Dike above the railroad bridge was the principal site of softshell clam harvest. Some resource use information on major recreational clam species is contained in Table 8.

Table 8. Clam catch by tideflat users, 1971 (Gaumer et al 1973).

Clam species	Number taken	% of invertebrate tideflat catch	Primary digging area	Secondary digging area
Gaper	107,907	35.3	North Spit	Pigeon Point
Cockle	53,250	17.5	Charleston Flat	North Spit
Butter	53,288	17.4	Pigeon Point	North Spit
Softshell	45,101	14.8	Menasha Dike	North Bend
Native littleneck	15,482	5.1	Pigeon Point	Boat Basin

Razor clams maintain a fluctuating population on a wave-washed sand spit immediately north of the Charleston breakwater where they are taken recreationally (USACE 1978).

Crabs. Both Dungeness (*Cancer magister*) and red rock (*C. productus*) crabs are taken recreationally in Coos Bay. In 1971 crabs accounted for over 80% of the recreational boat fishing catch with Dungeness crabs alone accounting for 76.7% of the catch (Gaumer, Demory, and Osis 1973). Dungeness crabs are also fished commercially within Coos Bay. In-bay crab landings fluctuate, as do those of the ocean, but an average of 11,441 lb were landed from Coos Bay in 1971-74 (personal communication, Darrel Demory, ODFW, May 8, 1979). Of the 31,000 lb landed from Oregon bays in 1977, Demory (personal communication) estimates that 15,000-18,000 lb were from Coos Bay.

Both species of crabs are found subtidally throughout the bay (USACE 1975). Waldron (1958) states that Dungeness crabs have a preference for sandy or muddy bottoms, although they may be found on almost any bottom. Gaumer et al. (1973) found the lower bay to be the primary site of recreational crab fishing.

Fish Commission of Oregon studies (Waldron 1958) have shown that while crabs do move between bays and the ocean, and from bay to bay, 84% of the crabs tagged in bays were recovered within four miles of the tagging site.

The importance of the estuary as rearing ground for crabs is not understood (USACE 1975). Large numbers of crab larvae (megalops) are found in Coos Bay in late spring and early summer and are also found offshore at that time of year (Waldron 1958). Samll (0.8-2 in) Dungeness crabs are found abundantly in the upper reaches of the estuary. Hunter (1973) has shown that small Dungeness crabs seem to be more tolerant of low salinities than are large individuals.

Several other crab species inhabit the bay including the freshwater crab (*Rhithropanopeus harrissi*) of the upper bay and the shore crabs (*Pachygrapsus crassipes* and *Hemigrapsus nusus*) of rocky intertidal areas.

Oysters. While native oysters (*Ostrea lurida*) no longer inhabit Coos Bay, Pacific oysters (*Crassostrea gigas*) are grown commercially in the bay. All existing Coos Bay oyster leases are in South Slouth (Fig. 16). In 1976, 144.08 acres of oyster ground were leased in Coos Bay. About 40% (57 ac.) were actually in production at that time. Osis and Demory (1976) listed a potential ground acreage of 525 ac and indicated that siltation problems account for much of the land remaining unused. Excessive fresh water and heavy siltation sometimes cause oyster mortality in Coos Bay during winter.

The potential oyster culture area of Coos Bay extends upstream from the mouth to the lower reaches of Haynes and North Sloughs, but high bacterial counts have forced closure of commercial areas above Sitka Dock. Jambor and Rilette (1977) note the area open to oyster harvest is only about one-half of the useable oyster tideland.

According to Jambor and Rilette (1977), DEQ officials state that because high bacterial counts in Coos Bay are mainly caused by dairy and wild animal stocks, little improvement is expected. Purification of shellfish grown in polluted waters (depuration) may be one way to increase acreage in Coos Bay used for commercial oyster culture (ODFW 1976; Jambor and Rilette 1977). However, other factors such as existing clam beds and navigation rights may limit expansion of oyster culture.

Other invertebrates. Other invertebrates taken by recreationists in Coos Bay include ghost shrimp (*Callianassa californiensis*), and mud shrimp (*Upogebia pugettensis*), kelp worms (*Nereis* spp.) (Fig. 15) (Gaumer et al. 1973), and lug worms (*Abarenicola pacifica*) (personal communication, Reese Bender, ODFW, March 10, 1979). These organisms are frequently used as bait. The shrimp are primarily taken from tideflats of the lower bay while the worms are harvested in greatest abundance from Menasha Dike (Gaumer et al. 1973).

Fish

At least 66 species of fish are known to use the Coos Bay estuary (Cummings and Schwartz 1971). Fish distribution has been studied during summer months (Cummings and Schwartz 1971; Ednoff 1970) and seining efforts by ODFW in 1977 and 1978 have added further information regarding seasonal use of the bay (personal communication, Reese Bender and Bill Mullarkey, ODFW, April 4, 1979)

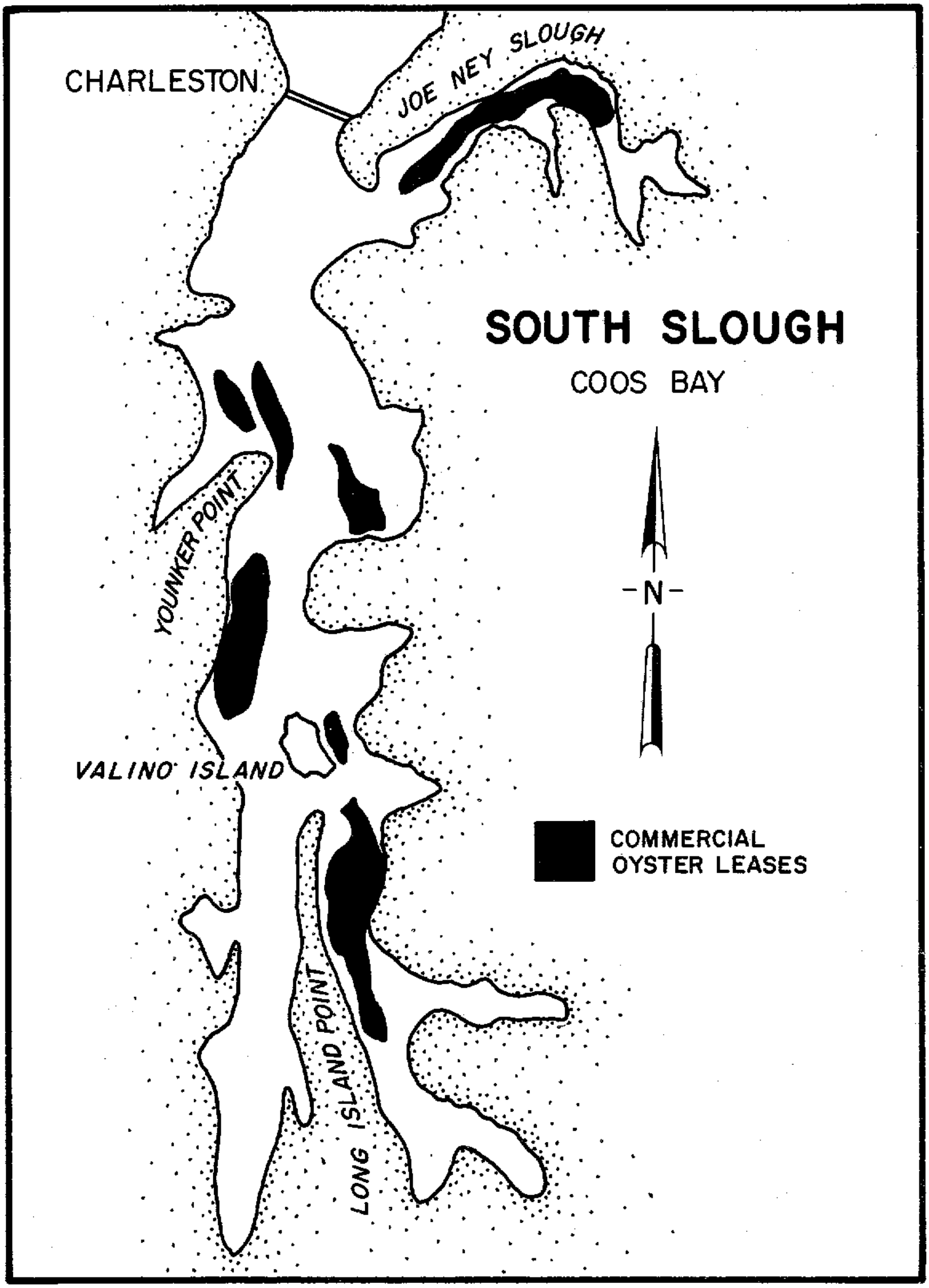

Fig. 16. Commercial oyster leases in Coos Bay (Jambor and Rilette 1977).

(Table 9), but documentation of the use of specific areas and habitats by fish species is lacking.

The greatest variety of species is found in the lower parts of the estuary (Cummings and Schwartz 1971), while the greatest numbers of fish, captured during the same sampling program, were taken near the mouth of the Joe Ney Slough and just west of Jordan Point (Hostick 1975). One might expect those species requiring high salinities to reach the upper most extent of their ranges in the bay during summer and those species requiring low salinities to extend further downbay during periods of high runoff.

The Coos system supports stocks of fall chinook salmon, coho salmon, steelhead, and searun cutthroat trout. Chum salmon are seen occasionally. Records show that a sizeable population of fall chinook salmon once inhabited the Coos system (Cleaver 1951). Gillnet catches declined from an average of 200,000 lb between 1923 and 1930 to 36,000 lb between 1930 and 1940. After the building of splash dams on the South Fork Coos River in 1941, the population declined substantially (personal communication, Al McGie, ODFW, January 17, 1979). Since removal of the dams in 1957, the population has recovered so that now approximately 5,000 chinook spawn in Coos River and its tributaries (personal communication, Bill Mullarkey, ODFW, April 14, 1979). Based on historic records, a spawning population of at least 12,000 chinook is possible when the recovery of spawning grounds and reaccumulation of spawning gravel is complete (personal communication, Mullarkey). Information on salmonids is summarized in Table 10.

In 1978 anglers caught 1,145 chinook and 24,000 coho salmon in the ocean sport fishery offshore from Coos Bay. In late summer chinook and coho are caught from the jetties. A boat fishery develops in late August in the upper bay and river and continues through the fall. In 1977, a year of drought, 604 salmon over 24 inches were caught in the Coos and Millicoma rivers, and Bender (pers. comm.) estimates another 600 jacks may have been caught. A cutthroat fishery of unknown catch also occurs in the river.

Three private hatcheries have obtained permits from ODFW for salmon release/ recapture operations (Table 11). ODFW has begun an evaluation of the private hatchery programs in Coos Bay to determine the periods and areas of residence and food habits of hatchery and wild salmonids.

Coos Bay also supports a large population of striped bass. Commercial fishing for bass has been closed in Coos Bay since 1975, but prior to the 60s, the striped bass fishery on the Coos was surpassed on the West Coast only by that of the Sacramento River in California (Hutchison 1962). Currently an active sport fishery occurs on a population of unknown size. Stripers are taken throughout the year at various places in the bay. Upriver migration of striped bass occurs in several runs from May until July. After spawning the fish move back into the bay to feed, seeking the deeper holes and channel. Although a few may go to the ocean, most of the fish probably stay in the bay all year (personal communication, Al McGie, ODFW, July 10, 1979). Young fish appear to stay upriver until the end of their first year of life.

Table 9. Distribution of fish species by subsystem (Cummings and Schwartz 1971; Hostick 1975, and Mullarkey and Bender 1979).

	Subsystem[a]								
Species	Marine (RM 0-3)	Lower Bay (RM 3-9)	Upper Bay (RM 9-17)	Riverine (RM 17-30)	South Slough	North Slough	Haynes Inlet	Isthmus Slough	Catching Slough
Leopard shark *(Triakis semifasciata)*	X								
Longnose lacetfish *(Alepisaurus richardsoni)*	X								
White seabass *(Cynoscion nobilis)*	X								
Pomfret *(Brama rayi)*	X								
Redtail surfperch *(Amphistichus rhodoferus)*	X								
Wolf-eel *(Anarrhichthys ocellatus)*	X								
Copper rockfish *(Sebastodes caurinus)*	X								
Rock greenling *(Hexagrammos superciliosus)*	X								
Tidepool sculpin *(Oligottus maculosus)*	X	X							
Mosshead sculpin *(Clinocottus globiceps)*	X								
Fluffy sculpin *(Oligottus snyderi)*	X								
Tubenose poacher *(Pallasina barbata)*	X								
Longnose skate *(Raja rhina)*	X	X							
Whitebait smelt *(Allosmerus elongatus)*	X	X							

Table 9. Continued.

Species	Marine (RM 0-3)	Lower Bay (RM 3-9)	Upper Bay (RM 9-17)	Riverine (RM 17-30)	South Slough	North Slough	Haynes Inlet	Isthmus Slough	Catching Slough
				Subsystem[a]					
Eulachon *(Thaleichthys pacificus)*	X	X							
Penpoint gunnel *(Apodichthys flaridus)*	X	X							
Pacific sandlance *(Ammodytes hexapteros)*	X	X							
Bocaccio *(Sebastodes paucispinis)*	X	X		X					
Cabezon *(Scorpaenichthys marmoratus)*	X	X		X					
Tubesnout *(Aulorhynchus flaudius)*	X	X		X					
Spiny dogfish *(Squalus acanthias)*	X	X	X						
White sturgeon *(Acipenser transmontanus)*	X	X	X						
Northern anchovy *(Engraulis mordax)*	X	X	X	XXF					
Longfin smelt *(Spirinchus dilatus)*	X	X	X						
Pacific tomcod *(Microgadus proximus)*	X	X	X						
Surf smelt *(Hypomesus pretiosus)*	X	X	X	F					
Striped seaperch *(Embiotoca lateralis)*	X	X	X	XX					
Walleye surfperch *(Hyperprosopon argenteum)*	X	X	X	XXF					
White seaperch *(Phanerodon furcatus)*	X	X	X	XX					

Table 9. Continued.

Species	Marine (RM 0-3)	Lower Bay (RM 3-9)	Upper Bay (RM 9-17)	Riverine (RM 17-30)	South Slough	North Slough	Haynes Inlet	Isthmus Slough	Catching Slough
	Subsystem[a]								
Pile Perch *(Rhacochilus vacca)*	X	X	X	XX					
High cockscomb *(Anoplarchus purpurescens)*	X	X	X						
Arrow goby *(Clevelandia ios)*	X	X	X						
Pacific pompano *(Palometa simillima)*	X	X	X						
Black rockfish *(Sebastodes melanops)*	X	X	X	XX					
Kelp greenline *(Hexagrammos decagrammus)*	X	X	X	XX					
Lingcod *(Ophiodon elongatus)*	X	X	X	XX					
Padded sculpin *(Artedius fenestralis)*	X	X	X						
Buffalo sculpin *(Enophys biason)*	X	X	X						
Sand sole *(Psettichthys melanostichus)*	X	X	X						
Pacific lamprey *(Lompetra tridentata)*	X	X	X	X					
Green sturgeon *(Acipenser medirostris)*	X	X	X	X					
American shad *(Alosa sapidissima)*	X	X	X	X	XF	X		X	XX
Pacific herring *(Clupea harengus pallasi)*	X	X	X	X	X			X	
Chum salmon *(Oncorhynchus keta)*	X	X	X	X					

Table 9. Continued.

Species	Subsystem[a]								
	Marine (RM 0-3)	Lower Bay (RM 3-9)	Upper Bay (RM 9-17)	Riverine (RM 17-30)	South Slough	North Slough	Haynes Inlet	Isthmus Slough	Catching Slough
Coho salmon *(Oncorhynchus kisutch)*	X	X	X	X	F				
Chinook salmon *(Oncorhynchus tsawytcha)*	X	X	X	XF	XF				
Cutthroat trout *(Salmo clarki)*	X	X	X	XF					
Rainbow trout *(Salmo gairdneri)*	X	X	X	X					
Topsmelt *(Atherinops affinis)*	X	X	X	X	XX		X	XX	
Bay pipefish *(Syngnathus griseolineatus)*	X	X	X	X	X		X		
Striped bass *(Roccus saxatilis)*	X	X	X	X					
Shiner perch *(Cymatogaster aggregata)*	X	X	X	XE	XXE	X	X	XX	X
Silver surfperch *(Hyperprosopon ellipticum)*	X	X	X	XE	XXF			XX	
Snake prickleback *(Lumpenus sagitta)*	X	X	X	X	XX			X	
Saddleback gunnel *(Pholis ornata)*	X	X	X	X					
Pacific staghorn sculpin *(Leptoccotus armatus)*	X	X	X	XF	XXF	X	X	XX	XX
Speckled sanddab *(Citharichthys stigmaeus)*	X	X	X	X	XX				
English sole *(Parophrys retulus)*	X	X	X	X	XX				
Starry flounder *(Platichthys stellatus)*	X	X	X	XF	XF	X	X	X	XX

Table 9. Continued.

Species	Subsystem[a] Marine (RM 0-3)	Lower Bay (RM 3-9)	Upper Bay (RM 9-17)	Riverine (RM 17-30)	South Slough	North Slough	Haynes Inlet	Isthmus Slough	Catching Slough
Bay goby *(Lepidogobius lepidus)*		X	X						
Threespine stickleback *(Gasterosteus aculeatys)*		X	X	XF			X	XX	XX
Prickly sculpin *(Cottus asper)*		X	X	X					
Redside shiner *(Richardsonius balteatus)*				X	F				
Speckled dace *(Rhinichthys osculus)*				X					
Largescale sucker *(Catostomus machrochelius)*				X					

[a] *Pony Slough not included in sources used.*
X= species present according to summer sampling by Cummings and Schwartz (1971).
F= species present in ODFW 1977 seine samples. Applies only to South Slough and Riverine because data from other areas was combined by authors.

Table 10. Salmonid use of Coos Bay (Thompson etal 1972; Bender and Mullarkey 1979).

Species	Estimated population	Time of spawning migration	Spawning peak	Juvenile use of estuary	State releases
Fall chinook salmon	5,000	Sept.-Jan.	Nov.	Feb.-Oct.	--
Coho salmon	8,300	Oct.-Feb.	Dec.	Mar.-Jun.	--
Chum salmon	incidental				
Steelhead	5,000	Nov.-Apr.	Jan.-Mar.	Mar.-Jun.	100,000
Cutthroat trout	3,500	Aug.-Jan.	unknwon	entire yr.	10,000

Table 11. Private hatchery permits for Coos Bay (Cummings 1977).

Hatchery	Total permit	Permits by species		
		Chinook	Coho	Chum
Weyerhaeuser	40,000,000	10,000,000	10,000,000	20,000,000
Anadromous	10,000,000	5,000,000	5,000,000	
Calvin Heckard				5,000,000

Shad are fished commercially in Coos Bay from April 20 to June 21. A five-year (1973-77) average of 19,310 lbs of shad was taken from Coos Bay. Sport fishermen take shad from the South Coos River and Millicoma River from mid April through June by trolling from boats.

Shad tagged in the Coos River have been recovered from the Umpqua and Coquille rivers, but evidence suggests each of these rivers supports its own population of shad (Mullen 1974). Mullen (1974) estimated from tagging studies a population of over 50,762 shad in the Coos River system. However, shad too small to be caught in the gillnets were not included in the estimate.

Shad enter the bay from the ocean in the spring months and start to appear in the commercial gill net fishery when it opens in April. Spawning usually occurs in May and June in upper tidal areas of the Coos and Millicoma rivers. Juvenile shad rear in the Coos and Millicoma rivers throughout the summer. Shad begin to appear in seine hauls in lower Coos Bay during August (pers. comm., Bender). Most of the juveniles enter the ocean in the fall.

In 1978 a conservative estimate of 145 tons of herring spawned in Coos Bay between 0.6 and 13.7 miles from the mouth (Miller and McRae 1978). Spawning occurs from January through April, and herring remain in the bay through summer (pers. comm., Bender). Three areas heavily used during the 1978 spawn were Fossil Point (eelgrass, algae, rocks), lower North Spit (eelgrass), and the Ford Dock near Jordan Cove (pilings) (Miller and McRae 1978). Jackson (1979) observed heavy spawns on lower North Spit, south of Clam Island in 1979. It is possible that timing of the herring spawn is influenced by freshwater runoff so that spawning occurs farther downbay during high runoff periods (Miller and McRae 1978).

Shiner perch, redtail surfperch, striped seaperch, black rockfish, and kelp greenling are among the other fish inhabiting the bay in large numbers which are taken by sport anglers (Gaumer et al. 1973).

Distribution maps for major species have been prepared by the Coos County Planning Department.

Mammals

Resident marine mammals in the estuary are limited to the harbor seal (*Phoca vitulina*) and the harbor porpoise (*Phocoena phocoena*) (personal communication, Mike Graybill, OIMB, March 15, 1979). Approximately 120 harbor seals haul out in the Pigen Point area of Coos Bay. They use the bay for feeding, primarily on bait fish such as herring and eulachon, and have been sighted in both the upper and lower bay. There is evidence that lower North Spit serves as a pupping area (pers. comm., Graybill). Harbor porpoises live in the lower estuary where they are seen frequently from RM 1 to 3.

Non-resident marine mammals occasionally sighted in the bay include California sea lions (*Zalophus californianus*), Stellar sea lions (*Eumetopias jubata*), and rarely California gray whales (*Eschrichtius gibbosu*) and killer whales (*Orciniis orca*).

River otters are common in the Coos and Millicoma rivers (pers. comm., Bender) and have been seen in the Crawford Point area (pers. comm., Graybill) and in South Slough (Magwire 1976a). The population size is unknown.

A variety of mammals are found in Coos Bay salt marshes. Raccoon, bobcat, muskrat, mink, weasel, fox, coyote, black-tailed deer (Magwire 1976a), and striped skunk (Pinto 1972) are found in the salt marshes, and beaver are found in areas of inflowing fresh water (Magwire 1976a). The marsh is only part of the range of animals, and their abundance depends primarily on how remote and undisturbed the community is (Magwire 1976a).

The major small mammals of the marshes are vagrant shrews and deer mice. The deer mouse is most abundant in the high marsh and tends to remain close to the terrestrial environment, while the shrew uses lower marshes and is often near logs or debris. Other species of mice, shrews, voles, and the black rat use the marshes in lesser numbers. These small mammals serve as primary and secondary consumers in the terrestrial food chain (Magwire 1976a).

Birds

Although a thorough study of the use of the estuary by bird populations has not been published, observations by individuals and groups provide information on seasonal use and abundance of bird species at Coos Bay. USACE (1975) abstracted a list of birds using the bay from information published by U.S. Department of the Interior (1971). Magwire (1976a) has summarized observations by Wampole (1959), Fawver and Wampole (1971), McGie (1976), and Richer (1976). Table 12 presents a compilation of this information. In addition, a census of birds of the greater Coos Bay area is made each December by the local chapter of the National Audubon Society.

Table 12. Bird use of Coos Bay estuary (key on p. 46).

	Subsystems				Habitats			Subsystems or Specific Areas											
Species	Marine & Lower Bay	Upper Bay	Riverine	Channel	Unconsolidated Shores & Flats	Rocky Shores	Tidal Marsh	Coos Head		Fossil Point to Pigeon Point		Empire		Pony Slough		Haynes Inlet		Metcalf *Salicornia* Marsh	
								W	S	W	S	W	S	W	S	W	S	W	S
Arctic loon (*Gavia arctica*)	FWSp			U				0	U	C	U	U						C	
Red-throated loon (*G. stellata*)	FWSP			U				0	0			0				0	0	0	
Red-necked grebe (*Podiceps grisegena*)	FWSp			U						0		C		0					
Brown pelican (*Pelecanus occidentalis*)	F			U				0	0										
Brandt's cormorant (*Phalacrocorax penicillatus*)	Res			C															
Pelagic cormorant (*P. pelagicus*)	Res			C				A	A	0	0	0				0	0		
Black brant (*Branta nigricans*)	Sp			A[1]	A[1]			0		A	A	R				A		U	
Harlequin duck (*Histrionicus histrionicus*)	FWSp			R		R		0	R					R		R			
Oldsquaw (*Clangula hyemalis*)	W			R				0	R										
Common scoter (*Oidemia nigra*)	W			U								R							
Surf scoter (*Melanitta perspicillata*)	FWSp			A				A	U	A	C	A	A	U	U			A	A
Red-breasted merganser (*Mergus serrator*)	FWSp			U				0	0	U		C	U	U		U			
Surfbird (*Aphriza virgata*)	FWSp					C		C	0										
Ruddy turnstone (*Arenaria interpres*)	M					U							R						

Table 12 continued.

	Subsystems			Habitats				Subsystems or Specific Areas											
Species	Marine & Lower Bay	Upper Bay	Riverine	Channel	Unconsolidated Shores & Flats	Rocky Shores	Tidal Marsh	Coos Head		Fossil Point to Pigeon Point		Empire		Pony Slough		Haynes Inlet		Metcalf *Salicornia* Marsh	
								W	S	W	S	W	S	W	S	W	S	W	S
Red phalarope (*Phalaropus fulicarius*)	M			R															
Northern phalarope (*Lobipes lobatus*)	M			C										R					
Glaucous-winged gull (*Larus glaucescens*)	FWSp			C								C				O			
Herring gull (*L. argentatus*)	FW			U				O				A	A	C					
California gull (*L.californicus*)	FW			U										R					
Mew gull (*L. canus*)	FWSp			C				C	U			C	O	C	O				
Heerman's gull (*L. heermanni*	SF			C				O	U								O		
Bonaparte's gull (*L. philadephia*)	M			C				C	U				O		O		O		
Blacklegged kittiwake (*Rissa tridactyla*)	FWSp			R				O	O										
Caspian tern (*Hydroprogne caspia*)	M			U					R						R				
Common Murre (*Uria aalge*)	Res			A				U	A			O	U		U				
Marbled Murrelet (*Brachyramphus marmoratum*)	Res			R						C		C		C		U		C	C
Horned grebe (*Podiceps auritus*)	FWSp	FWSp		C															
American wigeon (*Mareca americana*)	W	W		A	A		A							A		A			

Table 12 continued.

Species	Subsystems: Marine & Lower Bay	Subsystems: Upper Bay	Subsystems: Riverine	Subsystems: Channel	Habitats: Unconsolidated Shores & Flats	Habitats: Rocky Shores	Habitats: Tidal Marsh	Coos Head W	Coos Head S	Fossil Point to Pigeon Point W	Fossil Point to Pigeon Point S	Empire W	Empire S	Pony Slough W	Pony Slough S	Haynes Inlet W	Haynes Inlet S	Metcalf *Salicornia* Marsh W	Metcalf *Salicornia* Marsh S
Black-bellied plover *(Squatarola squatarola)*	FWSp	FWSp			C		C	R						C	U			R	
Semi-palamated plover *(Charadrius semipalmatus)*	M	M			C							U		U	U				
Snowy plover *(C. alexandrinus)*	Res	Res			R														
Whimbrel *(Numenius phaeopus)*	F	F			U														
Spotted sandpiper *(Actitus macularia)*	F	F				U			O						U				
Dunlin *(Erolia alpina)*	WSp	WSp			A			O	O	C	O	C	C	A	A			O	O
Sanderling *(Crocethia alba)*	FWSp	FWSp			C							C	C	O					
Baird's sandpiper *(Erolia bairdii)*	F			F	R														
Western sandpiper *(Ereunetes mauri)*	FWSp	FWSp			A														
Least sandpiper *(Erolia minutilla)*	FWSp	FWSp			A														
Willet *(Catoptrophorus semipalmatus)*	M	M			U		U												
Western gull *(Larus occidentalis)*	Res	Res		A						C		C		U		C	U	C	C
Common tern *(Sterna hirundo)*	M	M		U					R						R				
Pigeon guillemot *(Cepphus columba)*	S	S		C				U	A		U		U		U				C

Table 12 continued.

Species	Subsystems				Habitats			Subsystems or Specific Areas											
	Marine & Lower Bay	Upper Bay	Riverine	Channel	Unconsolidated Shores & Flats	Rocky Shores	Tidal Marsh	Coos Head		Fossil Point to Pigeon Point		Empire		Pony Slough		Haynes Inlet		Metcalf *Salicornia* Marsh	
								W	S	W	S	W	S	W	S	W	S	W	S
Common loon (*Gavia immer*)	FWSp	FWSp	FWSp	C				A	C	C	O	C	O	C	O	C	O	C	
Pied-billed grebe (*Podiceps dominicus*)	W	W	W	R				O	R					O		O	O	U	
Western grebe (*Aechmophorus occidentalis*)	FWSp	FWSp	FWSp	C															
Double-crested cormorant (*Phalacrocorax auritus*)	FWSp	FWSp	FWSp	C				C	U	A		U		C		O	O	U	
Common goldeneye (*Bucephala clangula*)	W	W	W	C			U	O				U		R		U		R	
Bufflehead (*B. albeola*)	W	W	W	C				O		C		U		C		C		C	
Marsh hawk (*Circus cyaneus*)	Res	Res	Res				U		O					O					
Bald eagle (*Haliaeetus leucocephalus*)	Res	Res	Res				R	R	R							R			
Red-tailed hawk (*Buteo jamaicensis*)	FWSp	FWSp	FWSp				U												
Great Blue heron (*Ardea herodias*)	Res	Res	Res		U		C	U	U	U	U	U		C	C	C	C	C	C
Green heron (*Butorides virescens*)	Res	Res	Res		U		U								O				
American coot (*Fulica americana*)	FWSp	FWSp	FWSp	A			A	U	O	C	C	C	C	A		A		O	
Killdeer (*Charadrius vociferus*)	Res	Res	Res		C			U	U	U		C	C	C	C	U			
Belted kingfisher (*Megaceryle alcyon*)	Res	Res	Res	C								U	U	C	C			C	C

Table 12 continued.

Species	Subsystems: Marine & Lower Bay	Upper Bay	Riverine	Habitats: Channel	Unconsolidated Shores & Flats	Rocky Shores	Tidal Marsh	Subsystems or Specific Areas: Coos Head		Fossil Point to Pigeon Point		Empire		Pony Slough		Haynes Inlet		Metcalf *Salicornia* Marsh	
								W	S	W	S	W	S	W	S	W	S	W	S
Whistling swan (*Olor columbianus*)		W					R							R					
Canada goose (*Branta canadensis*)		M					R	O											
Pintail (*Anas acuta*)		FW		A										A	C	A			
Gadwall (*A. strepera*)		FW					U							A					
Shoveler (*Spatula clypeata*)		FW		U	U									C					
Green-winged teal (*Anas carolinensis*)		FW		C	C									A	C	A	O		
Redhead (*Aythya americana*)		W		C										O					
Canvasback (*A. valisineria*)		W		C										A		C			
Blue-winged teal (*Anas discors*)		M		R															
Snowy egret (*Leucophoyx thula*)		W					R							R					
Virginia rail (*Rallus limicola*)		SpSF					U												
Long-billed curlew (*Numenius americanus*)		M			R		R							U					
Marbled godwit (*Limosa fedoa*)		FW			U									O					
Greater yellowlegs (*Totanus melanoleucus*)		FWSp			U									C	O				

Table 12 continued.

Species	Subsystems: Marine & Lower Bay	Subsystems: Upper Bay	Subsystems: Riverine	Subsystems: Channel	Habitats: Unconsolidated Shores & Flats	Habitats: Rocky Shores	Habitats: Tidal Marsh	Coos Head		Fossil Point to Pigeon Point		Empire		Pony Slough		Haynes Inlet		Metcalf *Salicornia* Marsh	
								W	S	W	S	W	S	W	S	W	S	W	S
Lesser Yellowlegs *(Totanus flavipes)*		M(F)			R														
Short-billed dowitcher *(Limnodromus griseus)*		M			U									C	C		O		
Long-billed dowitcher *(L. scolopaceus)*		M(F)			R														
Pectoral Sandpiper *(Erolia melanotos)*		M(F)					R							R					
Knot *(Calidris canutus)*		M			U		U												
American bittern *(Botaurus lentiginosus)*		Res	Res				R												
Common egret *(Casmerodius albus)*		FWSp	FWSp				C							U					
Black-crowned night heron *(Nycticorax nycticorax)*		FWSp	FWSp		U														
Sora rail *(Porzana carolina)*		SpS	SpS				R												
Common snipe *(Capella gallinago)*		Res	Res		U		U							U					
Ring-billed gull *(Larus delawarensis)*		FWSp (Res)	FWSp (Res)		C							C	C	C	C	U	U		
Mallard *(Anas platrhynchos)*			FW	A	C		C							A	C	A			
Ring-necked duck *(Aythya collaris)*			W	R										R					
Common merganser *(Mergus merganser)*			Res	U												R			

Table 12 continued.

	Subsystems				Habitats			Subsystems or Specific Areas											
Species	Marine & Lower Bay	Upper Bay	Riverine	Channel	Unconsolidated Shores & Flats	Rocky Shores	Tidal Marsh	Coos Head		Fossil Point to Pigeon Point		Empire		Pony Slough		Haynes Inlet		Metcalf *Salicornia* Marsh	
								W	S	W	S	W	S	W	S	W	S	W	S

Key:

Seasonal Use:

F Fall
W Winter
Sp Spring
S Summer
M Migrant
Res Resident
(Res) Some residents

Abundance:

A = Abundant
$\geq$ 50/day/observer

C = Common
10-49/day/observer

U = Uncommon
0-9/day/observer

R = Rare
$\leq$ 5/day/observer
(includes very rarely sighted species)

Key:

Seasonal Use:

W = Oct. - Mar.
S = Apr. - Sept.

Abundance:

A = Abundant
$\geq$ 50/day/observer

C = Common
1-50/day/observer

U = Uncommon
Not seen each day

O = Occasional

R = Rare
Not seen every year

[1] *Eelgrass beds*

Table 12 continued.

Species noted by Magwire 1976 but not by USACE 1975	C H		F Pt, P Pt		Emp		P Sl		H I		MM	
	W	S	W	S	W	S	W	S	W	S	W	S
Yellow-billed loon *(Garia adamsii)*		R										
Eared grebe *(Podiceps caspicus)*		0	C		0		0	0	C	0	C	
Emperor goose *(Anser albifrons)*											R	
White-fronted goose *(Philacte canagica)*							R					
European wigeon *(Mareca penelope)*							R					
Hooded merganser *(Lophodytes cucullatus)*									R			
Turkey vulture *(Cathartes aura)*	0	U						0				
Osprey *(Pandron haliaetus)*		0						0	0			
Black oystercatcher *(Haematopus bachmani)*	U	0										
Wandering tattler *(Heteroscelus incanun)*	U	0										
Rock sandpiper *(Erolia ptilocnemis)*		0										
Forster's tern *(Sterna forsteri)*		R										
Common crow *(Corvus brachyrhychos)*					C	C	C	C	C	C	C	C

Coos Bay is located in the Pacific Flyway for migratory waterfowl. USDI (1971) lists marshes, tideflats, and open water as prime bird habitats with some birds relying entirely on one habitat type and others using a variety of habitats.

Ducks, geese, loons, gulls, murres, and terns use the open water for resting but are commonly found near food sources in shallow water (USDI 1971). Thompson, Smith, and Lauman (1972) state mallard, pintail, wigeon, and coot are the most abundant waterfowl of the area. Surf and white-winged scoters are also found in large numbers. Waterfowl are abundant in November through March with peak populations occurring in December. USDI (1971) states that Coos Bay has 575,000 waterfowl-use days annually and 1,350 hunter-use days. The protected Pony Slough and Haynes Inlet areas receive particularly heavy use by waterfowl.

COOS ESTUARINE SUBSYSTEMS

The Coos Bay estuary can be divided into marine, bay, riverine and slough subsystems based on sediments, habitats, and geographic location (Fig. 17). Physical and biological characteristics of each subsystem are a result of the relative influence of ocean water, river water, and currents. Although the subsystems do not function independently, a separate discussion of each of the subsystems is used in considering management options.

Marine Subsystem

The marine subsystem is defined as the area between the mouth of the Coos Bay estuary and RM 2.5 (Fig. 17). The vigorous wave action it experiences helps to create and maintain the unique habitats found in this subsystem.

Alterations to the marine subsystem have been numerous. The natural channel across the Coos Bay bar averaged 10 ft in depth and 200 ft in width. The first alteration was a half-tide jetty just upbay from Fossil Pt. constructed in 1880 (USACE 1973). The North Jetty was constructed in the 1890s and reconstructed in the late 1920s, when the South Jetty was built (Lizarraga-Arciniega and Komer 1975). The entrance channel has recently been dredged to 45 ft deep and 700 ft wide at the outer bar and gradually decreases to 35 ft deep and 300 ft wide at RM 1. Previously, the depth was maintained at 40 ft over the entrance bar and 30 ft at RM 1 (USACE 1975).

The entrance channel is exposed to high waves generated by local coastal storms and swells from Pacific Ocean storms (USACE 1973). Waves up to 27 ft occur during major storms (USACE 1973). Mean tidal range at the bar is 6.7 ft with predicted extremes of 10.5 ft above MLLW and 3 ft below MLLW.

During 1973-74, high tide salinities at the mouth ranged from 30.5 ppt at the surface in December to 33.9 ppt at both surface and bottom in June (Arneson 1976). Even during periods of high runoff, high tide salinity at the mouth is similar to that of the ocean. Low tide extremes of 13.0 ppt at the surface in December and 3.33 ppt in September demonstrate the dilution effect of high runoff (Arneson 1976). Vertical salinity profiles from 1973-74 show the mouth was well mixed in June and September, stratified at high tide and partially

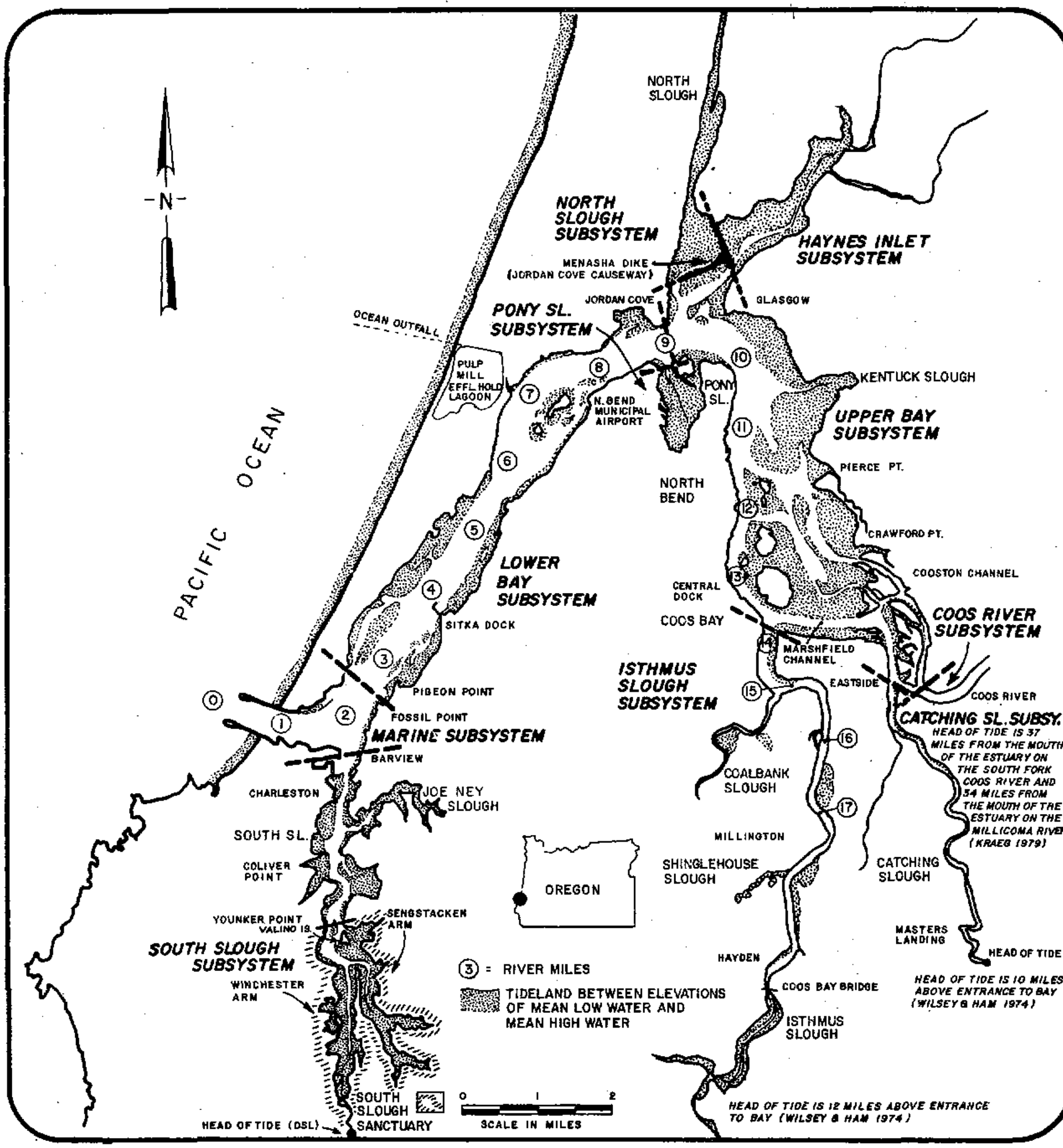

Fig. 17. Coos Bay estuarine subsystems.

mixed at low tide in December, and well mixed at high tide and partially mixed at low tide in March (Arneson 1976).

In general, the water quality of the marine subsystem is good. Temperature generally is similar at high tide to that of offshore waters and may be somewhat influenced by the temperature of the inflowing river waters at low tide (Arneson 1976). Low dissolved oxygen has occasionally been measured by DEQ near the mouth, and a DO depression was also observed by Arneson (1976) during his fall low tide measurements. Waste water from seafood processing which is discharged subtidally into the marine subsystems and upwelling of offshore waters low in dissolved oxygen may be contributing factors to low DO near the mouth (Arneson 1976).

Dredging records show that most of the materials removed from the entrance are clean sands, probably of marine origin (USACE 1975). Dredged material from this area is normally disposed at sea. Spoil from the Charleston area to about RM 10 is disposed in the estuary. The shorelines to the north and south of the entrance advanced following construction of the jetties, probably as an adjustment to a new equilibrium in an area that is experiencing no net north-south sand transport along the beaches (Lizarraga-Arciniega and Komar 1975).

Habitats and species

The marine subsystem has an exceptional diversity of habitats, including sand, cobble, boulder, and bedrock shores; sand and sand-mud flats; algal beds on unconsolidated bottoms and on bedrock; eelgrass; and subtidal unconsolidated bottom (Fig. 18).

Habitats of the north shore of the marine subsystem include the artificial boulder shores of the jetty, a narrow cobble shore, sandy shores and flats, and a flat of sand-mud substrate (Fig. 18). Little is known of the biology of this area. Seining studies have shown large numbers of Pacific herring, surfsmelt, whitebait smelt, shiner perch, and silver surfperch in the area (Hostick 1975). Feeder coho salmon have been found using the sandy area just inside the jetty. This area is just below a very productive portion of the lower bay subsystem and the salmon may be feeding on material carried in the water column as it ebbs from the productive flats (personal communication, Bill Mullarkey, ODFW, May 15, 1979).

The south shore habitats of the marine subsystem include jetty boulders, bedrock shores below the cliffs of Coos Head, small sandy shores, the boulders of the Charleston breakwater, and a transient sand bar west of the Charleston channel (Fig. 18).

The area north of the Charleston breakwater is inhabited primarily by a few species of molluscs and annelids. The sand bar west of the Charleston channel contains the only in-bay population of razor clams on the southern Oregon coast. This clam bed is heavily used by recreational diggers (USACE 1978). USACE has proposed an extension of the Charleston breakwater near the sand spit to stabilize the Charleston channel. The Corps Environmental Impact Statement for this project (USACE 1978) states the clam population will survive the planned modification.

The cliffs of Coos Head, which provide nesting areas for pelagic cormorants, kingfishers, and swallows, and the tidal sand flat west of Charleston channel, whch has the only in-bay population of razor clams on the south coast, should be protected in order to maintain the diversity of habitats within Coos Bay and among Oregon estuaries.

Use policies of the marine subsystem should strive to protect water quality. It may be appropriate to restrict discharge of effluent at low tide during times of low river flow or high water temperature.

Lower Bay Subsystem

The lower bay subsystem extends along the main channel from RM 2.5 to the railroad bridge at RM 9 (Fig. 17). Although still under considerable oceanic influence, it is not as strongly affected by wave action as is the marine subsystem.

Salinity extremes recorded by DEQ in this subsystem were 34.0 ppt and 10.7 ppt at a station 1/4 mile north of Pigeon Point, compared to 34.2 ppt and 3.7 ppt at a station 1/4 mile west of the railroad bridge. During 1973-74 surface salinity from RM 2.9 to RM 8.3 at one time differed as little as 0.3 ppt at high tide during periods of low flow to as much as 14.4 ppt at high tide during periods of high flow (Arneson 1976). Surface salinity changed from 24.7 ppt to 11.5 ppt between high and low tides during high flow at RM 2.9 (Arneson 1976).

Salinity gradients indicated the lower bay was well mixed at times of low flow. During high flow the subsystem was stratified at high tide and partly mixed at low tide. During intermediate flows (March), it was partially mixed at low tide and well mixed at high tide.

Dissolved oxygen levels measured at DEQ monitoring stations in the lower bay have been above the minimum standards required for estuarine waters during the 70s (DEQ 1978). However, one sample taken near a log dump in Empire showed very low DO and high turbidity (STR 1974, USACE 1975).

Coliform counts exceeding standards for commercial shellfish harvest and even exceeding general health standards have frequently been measured at DEQ Station 6, 1/4 mile west of the railroad bridge (DEQ 1978). Counts exceeding standards at other DEQ stations in the lower bay are infrequent. Two sewage treatment plants discharge waste from the east side of the lower bay near Empire and near Pony Slough.

Pollutants discharged in the lower bay may not be rapidly flushed through the estuary. Flushing times ranged from 6.2 days in December to 19 days in June 7.6 miles from the mouth (Arneson 1976).

The sediments of the lower bay are predominantly marine sands (Arneson 1976) and probably include sands blown into the bay from the dunes.

Habitats and species

Subtidal habitats of the lower bay include the unconsolidated bottom of the dredged ship channel and adjacent area and aquatic beds in shallower areas (Fig. 18). The substrate is primarily sand (USACE 1975, Jefferts 1977). Shell and wood mixed with sand have also been reported at RM 7, 8, and 9 (Jefferts 1977).

The major alteration to the subtidal lower bay is channel dredging and associated in-bay spoil disposal. Disposal sites for the recently completed deep draft dredging project were adjacent to the channel at about RM 3, between RM 4 and 5, just below RM 6, and between RM 8 and 9.

Biological information on the subtidal lower bay is incomplete. Jefferts (1977) has examined infauna of the dredged ship channel, and ODFW has surveyed clam populations of some subtidal areas (Gaumer 1978).

Surveys west of the channel between RM 4 and 6 show scattered distributions of gaper and cockle clams and densities of 1-5 clams/ft^2 (Figs. 9 and 10) (Gaumer 1978). Butter clams were found in only a few locations in the survey area (Fig. 13) (Gaumer 1978). A 48 ac subtidal area off Pigeon Point was thoroughly surveyed to evaluate its potential for commercial clam harvest (Gaumer 1976). Population estimates for that bed were 5,648,700 gapers, 202,200 cockles, 843,000 littlenecks, and 809,200 butters (Gaumer and Halstead 1976). The bed produced a commercial gaper harvest of 11,931 lb in 1977 and 27,505 lb in 1978.

The infauna of the lower bay dredged channel has numerous species representing many groups of animals (Jefferts 1977). The fauna is more diverse and less likely to be composed of cosmopolitan species than the upper reaches of the dredged channel. Both numbers of species and numbers of individuals were found to decrease with depth in the sediment. Jefferts (1977) concluded that dredging has a relatively minor influence on the fauna of the lower reaches of the estuary, which primarily reflect the coarse sediment type rather than the effects of mechanical disturbance.

The intertidal habitats of the west side of the lower bay include large aquatic beds, sand-mud flats, sand shores, and small marshes (Fig. 18). Between RM 2.5 and 6, flats prevail. From RM 6 to RM 8 there is a narrow sand shore, and between RM 8 and 9 lies Jordan Cove with its flats, aquatic beds, and fringe of marsh.

The southwestern portions of the lower bay has been altered through the disposition of dredge spoils which form "Clam Island" and which have raised some of the shoreline above tidal level. The eelgrass beds are quite extensive and the flats are probably the most productive clamming areas in the bay. Gaper clams occur in densities of greater than 5/ft^2 over much of the area (Fig. 9) (Gaumer 1978). Cockles, butter clams, and native littlenecks are also widely distributed over the flats but occur in lesser density than the gapers (Figs. 10 and 13). Softshell clams are not found in the southernmost flat but occur from Clam Island northward (Fig. 12) (Gaumer 1978).

The southern flat was by far the most prolific site for recreational gaper harvest during a 1971 ODFW survey (Gaumer et al. 1973). Substantial numbers of cockles and butter clams were also taken there.

Fast current

Above RM 6 the narrow sandy shore drops off quickly into the subtidal zone. Current through this portion of the bay is swift and scours the shores so that attached vegetation is absent. Five pile dikes were placed along this shore to retard erosion and prevent further curvature of the ship channel (USACE 1973). While this area appears barren in comparison to the flats to the south, it is an important feeding area for Englis sole, topsmelt, surfsmelt, herring, northern anchovy, and coho and chinook salmon (pers. comm., Mullarkey). Many of these fish feed on material in the water column from productive areas adjacent. Gut content analysis of salmon seined in sandy areas during August 1978 showed larval fishes were the main diet during the period sampled (pers. comm., Bender).

Jordan Cove lies between RM 8 and 9. Recreationally important clams are scarce, but ghost shrimp occur in moderate density over the entire area of flats and aquatic beds (Fig. 15). Softshell clams are sparsely distributed around the edges of the flats, and smaller species of clams are scattered across the cove (Gaumer 1978).

Just west of the railraod bridge at Jordan Point is a sandy area where ODFW repeatedly seines large numbers of fish (pers. comm., Bender and Mullarkey). The site was highest in numbers of individuals and second in numbers of species taken during seining efforts in 1970 (Hostick 1975).

Below Sitka Dock on the east side of the lower bay, there are broad algal and eelgrass beds on a sand-mud substrate with three large areas of cobble, where dredeged materials have been deposited. The cobbles form a habitat that is unique in the bay and may add niches for colonization by marine life. A high density of marine species, primarily rockfish, have been consistently found there in recent ODFW surveys (pers. comm., Bender).

Gaper clams are much less dense here than on the west side of the bay (Gaumer 1978), but the area provided recreational diggers with the second highest number of gapers taken in 1971 (Gaumer 1973). Butter clams are found among the cobbles of the spoil site (Gaumer 1978), and the Pigeon Point flat was by far the most productive butter clam area in 1971 (Gaumer 1973). Pigeon Point was also the prime site for the harvest of littleneck clams (Gaumer 1973). Ghost shrimp are also common in the area (Gaumer 1978).

The large eelgrass beds of the Pigeon Point area are of particular significance in providing food for migratory black brant. Harbor seals use one of the spoils disposal sites as a haul out area (pers. comm., Graybill). A historic seal haul out area is also located on the western shore of the lower bay just below the Ore-Aqua salmon ranching facility.

The tideflat habitats near Sitka Dock were significantly degraded by waste discharge from the Coos Head Pulp Mill which operated until 1971. Biological productivity has been increasing since closure of the mill (George M. Baldwin and Associates et al. 1977). A dense eelgrass meadow has become established southwest of the mill site, and gaper, tellen (*Tellina* sp.), cockle, *Macoma* spp., and softshell clams occur there (George M. Baldwin and Associates et al. 1977). Studies of the recovery of the flat have not been undertaken. The area is under private ownership and is not available to the public for recreation.

North of Sitka Dock, ghost shrimp, tellens, *Macoma* spp., and softshells inhabit the sand-mud flats and eelgrass beds. Flats there provided the greatest number of ghost shrimp to diggers of the areas surveyed in 1971 but were used much less heavily than the Pigeon Point flats (Gaumer 1973). Limited access and the clam distribution may influence the use pattern.

The narrow north shore of Empire, which is affected by storage of logs at the Cape Arago Lumber Company Mill, gradually widens into the broad complex of flats, aquatic beds, and small marshes southwest of North Bend Municipal Airport (Fig. 18). Qualitative studies show that the area is inhabited by softshell clams, tellens, *Macoma* spp., and polychaete worms (Figs. 12, 14, and 11). A quantitative study of the area has recently been completed and will be available through LCDC (Gonor 1979).

Several fish species are found in the lower bay nad marine subsystems (Table 9). Other species, such as English sole are most abundant in the lower bay, although they may be found further upbay. Sampling during the summer of 1970 showed that juvenile chinook salmon and lingcod were most common at lower bay sites (Hostick 1975; Cummings and Schwartz 1971).

Most of the fish species of Coos Bay use the flats of the lower bay at some time during the year (Cummings and Schwartz 1971). Habitat has considerable bearing on types of fish present. Vegetated areas appear to exhibit greater species diversity and are preferred by surfperch, pipefish, snake prickleback, gunnel species, and starry flounder (pers. comm., Mullarkey). Many of the species are found in greatest numbers over the sandy substrates (pers. comm., Mullarkey).

The aquatic beds adjacent to the North Spit, the Roseburg Lumber Co. dock, and the aquatic beds of Jordan Cove on the west side of the lower bay and the aquatic beds to the north and south of Sitka Dock are prime herring spawning areas (Jackson 1979; Miller and McRae 1978).

A salmon release-recapture facility (Oregon Aqua Foods) is located at about RM 5.5 on the west side of the bay. Another facility, Anadromous Inc., is located at Jordan Pt. at the extreme eastern border of the lower and upper bay subsystems (Fig. 17).

The lower bay was by far the most popular boat angling area in surveys conducted in 1971 (Gaumer et al. 1973). Dungeness crabs represented 80% of the catch. Black rockfish, red rock crab, perch species, and kelp greenling were also taken in large numbers (Gaumer et al. 1973).

Most of the bird species of Coos Bay may be found in the lower bay, and several species have their prime distributions in the lower bay and marine subsystems (Table 12). The more abundant of these birds include Brandt's cormorants, pelagic cormorants, black brant, surf scoters, northern phallaropes, western gulls, glaucous-winged gulls, mew gulls, Heerman's gulls, Bonaparte's gulls, and common murres. A variety of migrant and wintering shorebirds feed on the exposed intertidal mud flats.

Recommendations

The lower bay between RM 2.5 and RM 5 is an area of exceptional natural productivity and a prime aesthetic and recreational resource. The tideflats, eelgrass, and algal beds along the western shore of this region should be considered as major tracts, which require inclusion in a natural designation as described by the LCDC Estuarine Resources Goal (1977).

Although the sandy shore between RM 6 and 8 on the western side of the bay appears unproductive because it does not have attached vegetation, it is a valuable habitat for certain species of fish. Any development occurring there should preserve the sandy substrate and water quality of the area. Use of pilings may be appropriate in the area unless subsequent reduction in current velocity changes the quality of the substrate.

Sitka Dock at about RM 3.8 is located along the eastern shore of the productive lower bay. The adjacent area was formerly degraded by waste discharges, but some evidence suggests that the nearby tidal flats are recovering. Upland uses near the Sitka Dock area are primarily residential. The location of the dock within a prime natural and recreational resource area makes the area unsuitable for industrial development, but water-dependent recreational development would appear to be appropriate.

A public boat ramp, fish processing plant, oil company docks, and a mill are located on the eastern shore at Empire. These developments contribute to degradation of the habitats. Habitat restoration or further development for water-dependent uses, preferably constructed on pilings, are possibilities for this area.

The large flats southwest of the North Bend Airport and the Jordan Cove area should be considered major tracts and protected accordingly (LCDC 1977).

In-bay spoiling of material dredged from the channel between RM 3 and RM 10 should be discontinued. This activity reduces the tidal prism and further increases filling of the estuary, which is already accelerated from upstream activities. Habitat is irreversibly lost, even with mitigation. Suitable areas should be located for upland or offshore spoil disposal.

Upper Bay Subsystem

In the upper bay subsystem Coos Bay broadens into a complex of wide shallow tidal flats adjacent to the main dredged ship channel (Fig. 18). It extends from the railroad bridge at RM 9 to the southeastern corner of Bull Island at RM 17 (Fig. 17).

Massive alterations have occurred in the upper bay. The dredged ship channel runs along the west side of the bay, and industrial activity for the Port of Coos Bay is centered there. The channel between RM 9 and the mouth of Isthmus Slough is 35 ft deep and 400 ft wide. A turning basin 35 ft deep, 800 ft wide, and 1000 ft long is at RM 12. Filling of tidelands has occurred along the western shore, south of Marshfield Channel at Eastside, and on the major tideflats, where dredged materials form several spoil islands. Much of the filling has occurred to dispose dredged material and to provide sites for industrial development. The upper bay also receives industrial wastes and is a site of log storage and handling.

The upper bay receives freshwater inflow from Coos River, Catching, Isthmus, Kentuck, and North sloughs, and Haynes and Willanch inlets. Measurements at the mouth of Kentuck Slough indicate salinity extremes of 33.7 ppt and 3.0 ppt, while extremes measured at the mouth of Marshfield Channel were 33.7 ppt and 0.5 ppt (DEQ 1978). The organisms of the upper bay are exposed to low salinity during freshets, but the water is saline during low flows.

Extreme tidal currents of 4 ft/s have been measured at North Bend, and mean currents are about 1 ft/s (Aagard et al. 1971). Mean seaward velocity of river dishcarge passing a cross section between North Bend and Pierce Pt. is less than 0.1 ft/s at times of low runoff and 3-4 ft/s during peak runoff. Seaward ebbs of 6-8 ft/s during periods of high runoff have been predicted (Aagard 1971).

Wave development over the tideflats of the upper bay is limited by the short fetch and shallow water. Before recent channel deepening, phase changes indicated high dampening of the tidal wave in the upper bay as tidal energy was spent in turbulent mixing over the wide tideflats (Blanton 1964). Mixing in the main bay was probably sufficient so that stagnation causing anoxic conditions did not occur in the main bay (Aagard et al. 1971). The effect of recent channel deepening on tidal circulation has not been evaluated.

Sediments of the upper bay main channel are sandy from RM 9 to RM 10.5, shell from RM 10.5 to RM 12, and mud from RM 12 to RM 15 (USACE 1975). The main channel adjacent to Coos Bay is the area of most active deposition of river sediments (Aagard et al. 1971). Prior to channel deepening, RM 12-15 have been dredged every three years with an average of 450,000 yd^3 of sediment removed annually (USACE 1976). Sediments removed from the main channel above RM 12 do not pass EPA pollution standards for in-water disposal of materials. The sediments of the upper bay tidal flats are primarily silty with some areas of sand near the spoils islands. Wood debris overlies the sediments in many areas (Ednoff 1970).

During the past century the Coos River has changed its course through the upper bay (Aagard et al. 1971). Formerly the main flow of the river was east of Bull Island. At the northern end of Bull Island, it bifurcated into the East Channel and the main Marshfield Channel. At that time, Catching Slough had a large tidal prism and strong tidal flushing.

Splash damming, log transportation, and dredging have increased the size of the channel to the south of Bull Island (the Cutoff) so that it now carries the main flow of the river. As recently as 1970 the channel northwest of Bull Island has been deepening and eroding the tip of the island. From 1944 to 1970 the Cooston and East channels have been stable with minimal channel migration and sedimentation (Aagard et al. 1971). The tendency for channel migration does exist, and changes in hydrographic conditions, such as major dredging projects, may have unpredicted effects on shifting river channels.

Elutriate tests of core and water samples indicate that the main ship channel above RM 12 is polluted (USACE 1976). Coliform counts at DEQ stations in the upper bay during the 70s have frequently been higher than general standards for estuarine waters. In the main shipping channel, the frequency of violations increased from the station at the mouth of Kentuck Slough to the station at the mouth of Marshfield Channel (DEQ 1978). Dissolved oxygen less than the 6 ppm standard for estuarine waters was also measured with increasing frequency (DEQ 1978). STR (1974) attributed coliform problems to the presence of municipal sewage treatment plants and DO problems to municipal sewage treatment plants, industrial wastes, and log storage.

Habitats and species

Subtidal areas of the upper bay include the deep draft dredged ship channel; the shallowly dredged Marchfield, Cooston, and East channels; and the smaller channels draining the tidal flats (Fig. 18). Most of the information available on the upper bay subtidal concerns the dredged ship channel. The ship channel presents an altered environment for colonization by estuarine species. Maintenance dredging, propellor wash, and anchor drag frequently resuspend sediments so that little attached vegetation can grow (Parr 1974).

The benthic fauna of the dredged channel represents a community that has become adapted to the stresses of frequent sediment disruption (Parr 1974). Patches of substrate missed during dredging may be important to re-establishment of benthic organisms (Slotta et al. 1974).

Streblospio benedicti, an annelid, is the dominant organism in the upper bay subtidal area (Parr 1974; Jefferts 1977). Species most frequently encountered by Parr (1974) were

Annelids:

Streblospio benedicti
Pseudopolydora kempi
Polydora ligni
Eteone lighti
Capitella (capitata) ovincola
Notomastus (Clistomastus) tenuis
Glycinde armigera

Bivalves:

Macoma inconspicua
Clinocardium nuttallii
Mya arenaria
Modiolus sp.

Pycnogonids:

Achelia nudiuscula
Achelia chelata

Amphipods:

Corophium salmonis
Corophium spinicorne
Anisogammarus ramellus

These taxa are frequently reported in the literature to be associated with polluted environments (Parr 1974). Jefferts (1977) postulated that in the upper reaches of the estuary, the high water, organic content of the sediment, and the reduced grain size have a deleterious effect on faunal diversity and depth of distribution of organisms in the sediment.

Distribution of fish and of mobile invertebrates, such as crabs, in the dredged channel has not been adequately studied. Seining near the channel in 1970 revealed that shiner perch, silver surfperch, American shad, and English sole use the area in addition to a number of less freqeuntly captured species. More silver surfperch were captured per haul at this location than in other seining sites on the estuary.

Anglers catch pile perch, striped seaperch, and white seaperch from the Coos Bay waterfront (Gaumer et al. 1973). Thirty-eight species of fish have been recorded using the upper bay during the summer (Cummings and Schwartz 1971). Many of the fish probably feed over the tidal flats and congregate in the channels at low tide.

The intertidal area of the upper bay is composed of broad, shallow tidal flats, eelgrass beds, and tidal marshes (Fig. 18). George M. Baldwin and Associates et al. (1977) calculated that tidal flats composed predominantly of mud occupied about 4.5 mi^2. Sand occurs near the spoil islands, and wood debris is common on the southern portion of the flats. A huge eelgrass-tide-flat complex stretches from the Jordan Cove causeway south to the Marshfield Channel. The northern two-thirds of this area is an extensive eelgrass meadow, the largest in Coos Bay and one of the largest in Oregon (George M. Baldwin and Associates et al. 1977). Development has altered intertidal habitats along the shoreline of Coos Bay and North Bend. Studies of invertebrate distribution and abundance have not been conducted.

At least 10 species of annelids, 10 species of molluscs, and 13 species of crustaceans have been recorded from the muddy upper bay tidal flats (USACE 1975). The sea hare (*Aglaja diomeda*) has been recorded in the bay only from upper bay eelgrass beds, and the distribution of the freshwater crab is the upper bay and riverine areas.

The only clam taken recreationally which inhabits the upper bay in large numbers is the softshell, although small cockles have also been reported there. Lugworms and ghost shrimp are the other upper bay invertebrates sought by recreationists. McConnaughey et al. (1971) divided the tidal flats and eel-grass beds into four smaller subunits in their study. Biomass results of the most common species are summarized in Table 13. Animals were the most diverse and abundant within the dense eelgrass beds. Softshells and Dungeness crabs were found in much greater concentrations in the dense eelgrass, but certain invertebrates, such as the ghost shrimp and the false mya (*Cryptomya californica*) preferred sandier substrates and areas of less eelgrass.

Log storage over the flats and channels of th upper bay is common. Log storage areas have been mapped by the Coos County Planning Department. A DEQ study (Zegers 1978) of the impact of logs grounding on tideflats at low tide included sampling sites in the Cooston Channel of the upper bay. There was a large reduction in the number of total organisms (including annelids, arthropods, and molluscs) per unit area in grounding areas compared to adjacent control sites.

It is possible to cultivate oysters (*Crassotrea gigas*) in the upper bay, but commercial harvest there is prohibited because of poor water quality.

The upper bay tidal flats are an important feeding area for shad and striped bass (Cummings and Schwartz 1971). Adult shad may spend several weeks there, and bass can be found there most of the year. Juvenile salmonids also use the area for feeding. Among the most numerous fish found in the upper bay were shiner perch, silver surfperch, shad, topsmelt, starry flounder, and English sole (Hostick 1975).

Table 13. Average sample composition (g/m^2) of most common macrofaunal invertebrates in upper bay tidal flats and eelgrass beds (McConnaughey et al. 1971)

Organism	Subunit I	II	III	IV
Mya arenaria	3.02	0.97	17.28	39.20
Tellina salmonea	1.69	3.95	2.02	2.27
Macoma baltica	0.71	1.95	0.91	0.61
Others	0.77	0.07	4.51	0.65
Clam Total	6.19	6.94	24.72	42.73
Nereis brandti	1.25	2.89	1.60	5.42
Heteromastus f.	2.26	2.48	1.88	2.49
Eteone lighti	0.53	1.04	1.62	1.08
Others	0.87	0.66	1.04	1.91
Worm Total	4.91	7.07	6.14	10.90
Corophium s.	0.71	2.62	2.05	3.53
Anisogammarus c.	0.24	0.00	0.05	0.32
Haustorius sp.	0.01	0.01	0.03	0.01
Others	0.10	0.00	0.00	0.05
Amphipod Total	1.06	2.63	2.13	3.91
Cancer magister	0.00	0.00	0.00	1.55
Callianassa c.	0.34	0.00	1.56	0.00
Tectibranch (?)	0.07	0.16	0.01	0.49
Biomass Total	12.97	16.75	34.72	59.85
Number of Samples	38	16	9	11

I. Near spoil islands, sandy substrate, high elevation
II. Mud without eelgrass
III. Areas with sparse to medium density eelgrass
IV. Areas with dense eelgrass covering.

The upper bay has not been studied as a discrete unit with regard to bird use. Western grebes, pintails, canvasbacks, buffleheads, killdeer, snipe, sandpipers, sanderlings, dunlins, herring gulls, and Bonaparte's gulls were among the more abundant birds sighted in the area during the 1977 and 1978 Audubon Christmas Bird Counts. Graybill (1978) noted a particularly large population of sandpipers on the flats of the upper bay.

In general, the upper bay intertidal area is inhabited by fewer species than either the lower bay or marine subsystems. Jefferts (1977) states "The number of species present in a community is roughly inversely proportional to the degree of environmental uncertainty." The physiological stresses of salinity and temperature fluctuations in the upper bay as well as the presence of pollution and mechanical disturbance tend to produce a community that is physically controlled. Although fewer species are present in such a community, individuals may be numerous, occur in high biomass, and be important to the overall estuarine food chain. For example, *Corophium spinicorne*, the dominant upper bay amphipod, is abundant and is important in the diet of juvenile salmonids during their seaward migration (personal communication, Paul Reimers, ODFW, March 18, 1979).

Present marshes of the upper bay subsystem are located along the eastern side of the bay at the mouths of Kentuck Slough and Willanch Inlet, on the Coos River delta islands and adjacent shores, on the northeastern portion of the Eastside peninsula, and on the spoil islands east of the main ship channel (Fig. 18). Acreage of upper bay undiked marshes was estimated by Hoffnagle and Olson (1974):

Low sand marsh	46.3
Low silt marsh	3.8
Sedge march	22.1
Immature high marsh	416.4
Mature high marsh	44.8

Most of the marsh area of Kentuck and Willanch inlets has been lost through diking (Johannessen 1961, Hoffnagle and Olson 1974). Original diking along the upper portion of Kentuck Inlet was extended and a bridge and tidegate installed. Marsh rapidly invaded the tideflat below this diking (Johannessen 1961). The diked area is currently used for a golf course. In Willanch Inlet about 100 acres have been diked and are used for agriculture, leaving only about 6 acres as marsh (Hoffnagle and Olson 1974).

Extensive marshes currently exist in the Coos River delta and on the shore across the East Channel. Marshland there has increased since the 1800s (Johannessen 1961), probably because of increased siltation (Hoffnagle et al. 1976). The marshes are primarily immature high marsh with *Deschampsia caespitosa, Carex lyngbyei,* and *Triglochin maritima* the dominant plants (Hoffnagle et al. 1976).

The marsh along the shore east of the delta islands was studied by Hoffnagle et al. (1976). The site showed rapid increase in biomass from April to a maximum in June. This site was second in net primary productivity of six marshes studied in Coos Bay with a productivity of 1007.85 $g/m^2/yr$.

Invertebrates of the Bull Island study site included the sea anemone (*Nematostella* sp.), polychaetes, crustaceans, and molluscs. The number of species reported was intermediate between a site in lower South Slough and one in North Slough (Hall 1976). Fish taken from the site include shiner perch, Pacific staghorn sculpin, starry flounder, gunnel, bay pipefish, and coho salmon. The most common birds noted were the great blue heron, barn swallow, long-billed marsh wren, and song sparrow (Magwire 1976).

In the vicinity of Eastside, diking began before 1980 (Johannessen 1961). About half of the mature high marsh remaining in Coos Bay is in Eastside (Hoffnagle and Olson 1974). Low sand marshes have colonized the edges of these islands (Hoffnagle and Olson 1974).

Losses of marshland in the upper bay have been extensive. Large areas of Kentuck and Willanch inlets, at Graveyard Pt., on the Eastside peninsula, and near sea level in the cities of Coos Bay and North Bend have been diked or filled for agriculture, industry, and dredge spoil disposal.

Recommendations

The marshes of the Coos River delta islands constitute major tracts of salt marsh, which should be included in a natural management unit as required by the Estuarine Resources Goal (LCDC 1977).

The entire eastern side of the upper bay from Jordan Point to Bull Island and west to the shipping channel is a vast complex of flats, marshes, and eelgrass beds, providing valuable habitat and a rich source of organic material for the entire estuary. George M. Baldwin and Associates et al. (1977) note "the condition of this area is critical for the overall production of the Coos Bay Estuary. Because of its biological importance, the area as a whole should be considered environmentally sensitive." The area should be managed as a single ecological unit. It definitely encompasses major tracts of tideflat and seagrass as discussed in the LCDC Estuarine Resources Goal (1977) and should be managed accordingly.

The tidal flats of the upper bay are feeding grounds for fish, including the anadromous salmonids, striped bass, and American shad. Productivity of these flats should be maintained and increased through restoration of their surface area, including removal of stored logs which ground on the flats.

Habitats along the main channel adjacent to the cities of Coos Bay and North Bend have been altered. Water-dependent uses in these areas are appropriate. Unnecessary pilings should be removed and water quality should be considered in future development. The Cooston Channel is a main artery for the passage of fish between the river and ocean. It should remain unobstructed.

South Slough Subsystem

South Slough enters the main body of Coos Bay near Coos Head, less than 2 mi from the estuary mouth (Fig. 17). It may have once been a separate estuary with its own opening to the ocean. The slough has a drainage basin of 26 mi^2 (STR 1974). Because of its proximity to the ocean, South Slough receives more marine influence than the other slough subsystems. Its north-south orientation makes it particularly susceptible to strong north-northwest winds.

The slough bifurcates into the western Winchester arm and the eastern Sengstacken arm. Major tributaries include Joe Ney and Day creeks from the east; John B. and Talbot creeks, which flow into the Sengstacken arm; and Winchester Creek, which flows into the Winchester arm.

The upper reaches of South Slough (Fig. 17) have been set aside as a research sanctuary to preserve an unaltered site for studies to improve our ability to properly manage estuarine systems. The South Slough Sanctuary was the first of its kind in the nation.

Fresh water inflow into the slough has not been measured directly. Freshwater runoff from the South Slough drainage basin has been estimated from the precipitation and runoff measured in two nearby drainage basins (Harris et al. 1979). Monthly average values ranged from 6 cfs in August to 232 cfs in February. Monthly extremes of 1 cfs and 445 cfs were estimated. Further calculations yielded a representative tidal prism of 3.3×10^8 ft^3 and implied that mixing is thorough and flushing of fresh water is rapid (Harris et al. 1979). Salinity gradients for stations at the mouth of the slough and at Younker Pt. also show the lower slough is well mixed throughout the year (Arneson 1976).

A breakwater separates South Slough from the main body of Coos Bay. A project to extend the jetty to provide additional protection to boats moored in the Charleston boat marina is currently underway. A 10-ft deep, 50-ft wide channel is maintained between the main bay channel and the Charleston Bridge. The Charleston Small Boat Basin is also dredged to dimensions of 500 ft x 900 ft in lower South Slough (USACE 1978). Studies of bottom topography have been conducted by USACE (1978) and a mathematical model, verified by field measurements, of tidal elevations, current velocities, and circulation in South Slough under calm wind and wave conditions has been constructed (USACE 1978). Bathymetric charts are on file at the offices of the South Slough Estuarine Sanctuary. Although DEQ maintains 11 water quality stations in South Slough, most of them are in the lower portion of the slough. Stations have recently been established farther up the slough in conjunction with the South Slough Estuarine Sanctuary, so comparisons should soon be possible.

At the entrance to South Slough, DEQ (1978) has measured salinity extremes of 35.3 ppt and 14.6 ppt. Extremes 0.3 miles south of Collver Pt. were 33.3 ppt and 6.3 ppt. The data suggest that highly saline water extends far into the slough at periods of low flow and that water at the head is fresh at times of high flow.

Dissolved oxygen at the stations monitored by DEQ is generally above minimum standards for estuarine waters (DEQ 1978). Arneson's data (1976) show slight depressions in DO at Younker Pt. in March and at the Charleston Bridge in December relative to surrounding stations.

Several coliform measurements greater than 70 mpn have been taken by DEQ (1978) within the Charleston Small Boat Basin and at the Joe Ney Slough Bridge. Recent work by Plotnick (1979) suggests that improper disposal of sewage from boats may be a problem in the boat basin. Septic tank leakage from dwellings not yet hooked up to the Charleston sanitary district sewage disposal system are another source of coliform. Sampling for coliform in the upper reaches of the slough has only recently begun. Counts in the Sengstacken arm are within standards for shellfish harvest, while those in the Winchester arm often exceed those standards. Livestock waste may elevate coliform counts in the upper reaches of the slough (personal communication, Delane Munson, Manager of South Slough Sanctuary, February 15, 1979).

An examination of the sediment characteristics of volatile solids, Kjeldahl nitrogen, grease and oil, and total sulfides showed that, although the outer boat basin is more exposed to flushing action, it is more highly polluted than the inner basin (Slotta and Noble 1977).

South Slough is an area of sediment deposition. Sediment movement is generally seaward and deposition occurs where movement is obstructed, such as at Valino Island and in regions of large cross sectional area (Baker 1978).

Strong winds may be a factor in sediment resuspension in South Slough as wave bases disturb the bottom (Baker 1978).

Baker (1978) found that most of the sediments of South Slough are a mixture of medium to fine sand eroded from the terrace shorelands and coarse to medium silt from fluvial input. Silty sands are the dominant sediment type over tideflats and in the channels toward the head of the slough. The uppermost reaches are generally silt. Organic content of slough sediments ranged from 0.00 ppt in channel sands to 19.77 ppt in tideflat silts (Baker 1978).

Drainage from Joe Ney Sanitary Landfill was reported to have been increasing sedimentation in South Slough, but recent measures seem to have alleviated the problem (pers. comm., Munson). Logging activities have occurred in the drainage basin which may have obscured the effects of the landfill.

Habitats and Species

The habitats of South Slough show the most variation of any slough subsystem within Coos Bay (Fig. 18). The marine influence, the coarse sediments found in the lower portions of the slough, and the relatively undisturbed nature of the upper portion provide habitats for more species of invertebrates and fish than are found in the other slough subsystems.

South Slough has a irregular shoreline, which leads to a high shoreline to surface area ratio. The area has many diverse habitats. Below the Charleston Bridge are flats of mixed substrate, intertidal and subtidal eelgrass beds, riprapped shores, sandy shores, and only a small amount of marsh. Between the bridge and Valino Island are, in addition to most of the above habitats, a small amount of bedrock shore, sandy bars, and much larger marshes. Above Valino Island the substrate becomes more silty and marshes are more prominent. Eelgrass in the channels extends far up the slough.

Because of the proximity to the ocean and its varied habitats, the number of species inhabiting South Slough is high. Ednoff (1970) recorded more total species from the mud in South Slough than in any other portion of the bay. Polychaetes and molluscs were most diverse in South Slough, but crustaceans were most diverse in the lower bay.

A rich intertidal infauna was also found by Jefferts (1977), who recorded 26 polychaetes, 10 bivalves, 4 harpacticoid copepods, and 7 amphipods. Jefferts' uppermost South Slough station had the lowest diversity of any station sampled. This station was in a backwater with a high concentration of volatile solids, a high water content in the substrate, and was dominated by a few opportunistic species. In these respects, it resembled stations in the upper bay, although the faunal assemblage was different.

Most clambeds used by recreational diggers in South Slough are north of Valino Island. Gaper, butter, cockle, littleneck, and softshell clams are taken from the tide flats. Four South Slough sites provided a total of 22.6% of the marine animals taken by tideflat users in Coos Bay in a 1971 survey (Gaumer et al. 1973). While the clam bed just south of the Charleston Bridge provided the greatest number of clams of the South Slough flats surveyed, the flat just south of the existing boat basin (the Charleston Triangle) had the highest catch per unit effort (Gaumer 1973). Clam resources of this flat have been surveyed in greater detail (Gaumer 1978). Estimates of the populations of recreationally harvested clams occurring there are 1,333,000 gapers, 348,000 cockles, 289,000 native littlenecks, 119,000 butters, and 50,000 softshells. Estimate of the total clam population was 10,078,000 (Gaumer 1978).

Of major significance is the use of South Slough for commercial oyster culture. The only oyster leases in Coos Bay are on South Slough. Leases are scattered on Joe Ney Slough and South Slough proper, except for the Winchester arm (Fig. 16). Oysters can be grown in areas throughout the estuary, but health restrictions due to poor water quality prohibit commercial oyster leases in most of the estuary.

Many of the 995 acres of undiked tidal marsh in South Slough are fringing marshes at scattered points along the slough's edges, especially in inlets and coves (Hoffnagle and Olson 1974). The largest expanses of marsh are found at the heads of various inlets and on the flats just south of the Charleston Bridge and just south of Valino Island. Low sandy marsh and immature high marsh are the major marsh types of the slough (Hoffnagle and Olson 1974).

Several areas in South Slough are reverting to marsh following the breaching of dikes or as a result of tidegate failure. Regions at the head of the Winchester arm are inundated only during high water or very high tides as a result of tidal damming of streams. These areas are termed "surge plain marshes" by Hoffnagle and Olson (1974).

The only area of bullrushes in South Slough is along part of the north bank of Joe Ney Slough (Hoffnagle and Olson 1974). At the head of Joe Ney Slough is a large, tidegated freshwater marsh with dense stands of cattail (*Typha latifolia*) (Hoffnagle and Olson 1974). Studies of this marsh site as a potential mitigation site for alterations in other portions of the estuary have been conducted and results will be available from LCDC (Gonor et al. 1979).

Two South Slough marshes of differing character were studied in detail by Hoffnagle et al. (1976). The marsh site at the upper end of the slough was vegetated primarily by *Carex lyngbyie* and *Distichlus spicata*. Its net primary productivity was estimated at 764.81 $g/m^2/yr$. A low sandy marsh in the Henry Metcalf Estuarine Preserve just south of the Charleston bridge was the other study site (Hoffnagle et al. 1976). The marine influence experienced by this marsh is probably responsible for the diversity of species observed there. Bird observations near the Metcalf marsh are summarized in Table 12.

As in other portions of the bay, the habitats of South Slough have been altered by human use. The lower slough has been a site of rapid change accompanying a growing fishing industry. The construction of the Charleston Breakwater, dredging of the channel and of the small boat basin, and filling of adjacent tidelands have all occurred within the past 25 years. In the middle and upper slough, oyster culture has added a habitat to the intertidal area. Although there have been splash dams and dikes in the upper slough, recent developments have been few.

Recommendations

While generally one would choose to concentrate development in the lower South Slough, certain features of the area deserve special attention. Of 6,200 acres of submersible land in Coos Bay, 6% of the clams harvested were from the 11.5 ac area frequently referred to as the "Charleston Triangle". Because of the density of clam populations at this site and its recreational value, it should be protected. The flats south of Charleston Bridge on the west bank also receive heavy recreational use.

Generally, the diversity of organisms present in lower South Slough and the recreational capacity of the area suggest maintaining as much diversity of habitats and uses as possible. On the east side of the lower slough is the Barview State Wayside, an areas used by recreationists. The site should be maintained for these uses.

The values of South Slough marshes accrue primarily because of the long involuted shore and many fringing marshes. Development should be planned to leave the marshes undisturbed. Although individual marshes are small, the total marsh area makes a significant contribution to the primary productivity of the estuary. The low sandy marsh just south of the Charleston Bridge on the Metcalf Preserve is the closest marsh to the mouth of the bay and is a unique habitat as a marsh under marine influence.

South Slough is the only area within Coos Bay where legal commercial oyster harvest currently takes place. That use must be carefully protected. Oyster land and water quality should be protected for oyster growth. Proper sewage disposal and management of upland uses to minimize sedimentation are particularly important for oyster production.

There are several sites in South Slough appropriate for restoration, including formerly diked areas in the upper slough and in Joe Ney Slough. Habitat improvements should be considered on the east side of the channel from north of Peterson's Seafoods to the mouth of Joe Ney Slough, where discharge of sewage and industrial pollutants has occurred.

The use of Sough Slough Sanctuary an an unaltered site for research presupposes that it will remain undeveloped and its habitats and water quality will be protected. South Slough is very directly influenced by marine waters that enter through the mouth of the bay and slough and flow through the extensive development in the Charleston area. It is imperative that existing uses and new development north of the sanctuary not degrade the water quality of the sanctuary. Approval of new development north of the South Slough should be contingent upon evidence that the development will not adversely impact the water quality of the sanctuary.

Pony Slough Subsystem

Pony Slough branches south from the main bay between RM 8 and 9. Formerly a triangular embayment, its shape has been altered by filling. Presently a narrow mouth gradually opens into a wide tidal flat which is divided by a channel. The slough is about 1 mile long and the widest point is slightly more than 1/2 mile.

Hydrological studies of Pony Slough are limited. Freshwater discharge from Pony Creek is controlled at dams on Upper and Lower Pony reservoirs. Since 1975, USCS has monitored water discharge below the lower reservoir. Records for Water Year 1976 show a total freshwater discharge of 3,010 ac-ft. Flow ranged from a minimum of 0.08 cfs in May, June, July, and September and to a maximum of 26 cfs in December (USGS 1977). Summer mean flow was between 0.27 and 1.42 cfs, and the winter mean was between 4.33 and 13.6 cfs. Water discharge doesn't necessarily coincide with precipitation because of the controlling dams.

Information regarding salinity is limited to a single set of samples taken during August 1970. These measurements showed salinities in the main channel were 30.6 ppt at the mouth and 27.9 ppt at the Virginia Blvd. Bridge on an incoming tide and 23.4 ppt at the mouth and 5.5 ppt at the bridge on the outgoing tide (Horstmann et al. 1970). This demonstrates that considerable variation can occur over one tidal cycle. Interstitial salinities fluctuate less, and standing water on the marsh may become hypersaline because of evaporation (Horstmann et al. 1970).

The sediments of Pony Slough tidal flats are mostly mud and mixed sand-mud near the channels and marsh edges (Horstmann et al. 1970). A reducing layer at depths varying from 0.2 to 11.8 in was present over most of the slough area sampled.

Water quality of Pony Slough has not been examined. Domestic waste and waste water from an adjacent car wash enter the slough. In the spring of 1970, a large accidental discharge of raw sewage entered the slough from a nearby waste treatment plant (Horstmann et al. 1970). The effects of this discharge have not been studied.

Pony Slough has a long history of human alteration. Filling for the Southern Pacific Railroad began in 1917 in the northeastern section of the slough. During World War II, 240 ac. were filled for the North Bend Municipal Airport. In 1958 filling for Pony Village shoping center began, and in 1960 filling occurred north of Virginia Street in North Bend. The southeastern portion of the slough is bordered by residences, the southern side by commercial enterprises, and the North Bend Municipal Airport lies along the western border (Fig. 17). A public boat launch is located near the mouth on the western side. Several waste outfalls empty into the slough.

Habitats and Species

Habitats of Pony Slough include subtidal areas with unconsolidated bottoms and eelgrass and intertidal mud flats, sand-mud flats, eelgrass beds, algal beds and marshes (Fig. 18).

Benthic diatoms were ubiquitous on Pony Slough tideflats and are probably a major source of productivity (Horstmann et al. 1970). Mats of green algae (*Chaetomorpha cannabinna* and *Rhizoclonium* spp.) covered large areas of the tidal flats. Blue-green algae were noted on the eastern edges of the mud flats, and brown algae (*Fucus* sp.) was present on hard substrates and in the marshes.

Dense eelgrass is distributed along the intertidal area near the slough entrance and through part of the main channel. The various types of plant communities in Pony Slough show that the area remains an important producer of organic material for Coos Bay despite extensive alterations by filling. Fringes of high marsh also occur on the east and west margins of the slough and an expanse of low sand marsh occurs on the west side (Hoffnagle and Olson 1974). Most of the marsh vegetation lies between 5.5 and 7.5 ft above MLLW (MacDonald 1967).

The plant community of the low marsh at Pony Slough is composed primarily of *Salicornia virginica* and *Distichlis spicata* (Hoffnagle et al. 1976). *Deschampsia caespitosa* and *Spergularia marina* were also noted (Hoffnagle et al. 1976). These plants evidence a change in species composition since Johannessen studied the marsh 1961. He recorded *Scirpus validus* as a significant member of the flora and did not record any *Distichlis spicata* (Johannessen 1961).

The Pony Slough marsh increases in biomass from April to July (Hoffnagle et al. 1976). Net primary productivity was lower than that of North and South slough marshes probably because of the perennial *Saliconria virginica*, which has high biomass but a low rate of production. The marshes of Pony Slough were the lowest in elevation of the marshes studied by Hoffnagle et al. (1976). Dead standing shoots disappeared quickly probably because of the frequency of inundation. *Salicornia*, although lower in productivity, is an important detritus source, and its woody perennial form stabilizes soil (Hoffnagle et al. 1976).

The Pony Slough mud flat is populated primarily by burrowing mudflat organisms (Hoffnagle et al. 1970). *Corophium spinicorne*, an important amphipod in the diet of juvenile salmonids, is widely distributed over Pony Slough tideflats. Lugworms, ghost shrimp, and clams (*Mya arenaria, Cryptomya californica*) also occur, often in very high densities (Horstmann et al. 1970). Dungeness crabs are found in lower intertidal and subtidal areas. Tideflat users harvest softshell clams and ghost shrimp at Pony Point to the west of the entrance to Pony Slough, but this accounted for only a small percentage of tideflat use on Coos Bay (Gaumer et al. 1973).

Most sampling for fishes in Pony Slough has been by otter trawl because the soft muddy substrate makes beach seining difficult. However, ODFW has seined in the lower slough for the past three years. Eleven species occur in Pony Slough (Rousseau 1972). The slough is an important striped bass feeding area. Adult striped bass feed over much of the tideflats at high tide and move in and out of the slough with the tides. Pony Slough is a popular bass angling area from May through September.

Over 100 species of birds use Pony Slough. The slough harbors the largest concentrations of wintering birds in the estuary (Rousseau 1972). Peak numbers of 7,000-9,000 wigeon and other waterfowl and shorebirds have been noted (Rousseau 1972). Thornburgh (1979) conducted weekly surveys from June 1978 to June 1979 (Table 14).

The protection from southerly winter storms offered by the sheltered Pony Slough is probably a major reason for its heavy use by waterfowl. ODFW manages Pony Slough as a refuge, where hunting is prohibted.

Table 14. Peak counts of birds occurring in Pony Slough between June 1978 and March 1979 in numbers greater than 100 per observation period (Thornburgh 1979).

	Number	Time of observed peak
Dabbling Ducks		
American Wigeon	3,526	Nov.
Pintail	1,943	Jan.
Green-winged Teal	872	Dec.
Gadwall	330	Jan.
Shoveler	209	Jan.
Diving Ducks		
Canvasback	648	Dec.
Plovers		
Killdeer	204	Jan.
Semipalmated Plover	177	July
Black-bellied Plover	151	Mar.
Medium-sized Waders		
Dowitch	220	Sept.
Sandpipers		
Dunlin	2,808	Nov.
Western Sandpiper	1,577	Sept.

Recommendations

Pony Slough is a very important striped bass feeding area in Coos Bay. It is an area of high plant and animal productivity and a critical waterfowl and shorebird habitat, which harbors the largest concentrations of wintering birds in the estuary. The entire slough should be managed as a single unit. Most of Pony Slough is a major tract of intertidal land as described in the LCDC Estuarine Resources Goal (1977) and should be managed accordingly.

In its present condition Pony Slough provides valuable and scenic open space and natural resources to the urban North Bend area and could be used in satisfying state land use Planning Goal 5 (LCDC 1977).

North Slough Subsystem

North Slough extends approximately 3 mi north from the main body of Coos Bay at RM 9 (Jefferson 1975). The slough has a watershed of 8,190 ac (OSWRB 1963). Freshwater inflow from North Creek has not been measured. Although there is a tidegate at the slough's north end, near Highway 101, it may be too high in elevation to provide good flood drainage relief (OSWRB 1963). Upland plants are found adjacent to the channel before the slough crosses under Highway 101 (Hoffnagle and Olson 1974). The lands to the east of the highway are tidegated and diked but may be of sufficient elevation to be unaffected by salt water (Hoffnagle and Olson 1974).

The hydrography of North Slough has not been studied. The Jordan Cove Causeway separates the slough from full exposure to the main bay. The dike system undoubtedly reduces tidal circulation in the slough and may be accelerating sediment deposition. The Southern Pacific railroad bed parallels the western perimeter and acts as a dike, separating the slough from the dunes and forming a barrier between salt and fresh water marshy areas.

Sediments of North Slough are fine silts and broken shells (STR 1974). Sand from the dunes is also carried into the slough by the wind. These sands sometimes clog the channel at the tidegate (OSWRB 1963). Derelict logs occur on both sides of the slough and wood chips are found under the mud surface near the mouth (Baker et al. 1970).

Water quality samples are limited to a single set of samples taken in the summer of 1971 (STR 1974). Results showed high temperatures, high coliform counts, and excessive turbidity. Temperature problems were thought to occur because of low summer stream flows and incomplete mixing. Livestock and log storage were possible sources of turbidity, and livestock waste was thought to account for the high coliform counts. Log storage no longer takes place in North Slough. A municipal water treatment plant is located on North Slough, but wastes are not discharged into the slough from this plant.

The invertebrates of North Slough tidal flats include the molluscs *Mya arenaria, Crytpomya californica, Tellina salmonea, T. Buttoni, Macoma nasuta,* and *M. balthica* (Baker et al. 1970). Softshell clams and *T. salmonea* are widely distributed in the lower, broader regions of the slough. *C. californica, Macoma nasuta* and *T. Buttoni* are found near the causeway. *Macoma balthica* is found in the narrower portion of this area. The softshell clam is the only mollusc taken by recreational diggers in this area. The Jordan Cove Causeway yielded by far the most softshell clams to recreationists in Coos Bay of areas surveyed in 1971 (Gaumer et al. 1973).

Other invertebrates with wide distributions on North Slough flats include spionid worms, (*Eteone* spp.), ribbon worms (*Paranemertes* spp. and *Cerebratulus* spp.), lugworms, bamboo worms (*Heteromastes* spp.), amphipods (*Corophium* spp.), crangonid shrimp (*Crago* spp.) (USACE 1975), and Dungeness crab (Baker et al. 1970). Ghost shrimp are found only near the causeway, and shore crab (*Hemigrapsus oregonensis*) are associated with the riprap shores. Ghost shrimp and lugworms are collected from North Slough flats by recreationists.

American shad, shiner perch, staghorn sculpin, and starry flounder were found during 1970 sampling in the slough (Cummings and Schwartz 1971). Boat and shore angling for striped bass occurs in the slough May through September. There is an upstream fishery for coho salmon which spawn in North Creek (pers. comm., Bender and Mullarkey).

Large numbers of dunlin have been observed on North Slough tideflats, and North Slough has been identified as a great blue heron feeding area (McMahon 1974). North Slough is a major feeding and resting area for redheads and other ducks.

Of particular significance in North Slough are the marshes. Large, intact, diverse marshes occur there (Akins and Jefferson 1974). Jefferson (1975) described the marshes of North Slough as the "most complete and diverse mosaic of salt marsh plant communities in all stages of succession and with ecotones to freshwater, forest, and sand dunes."

Marsh acreage mapped by Hoffnagle and Olson (1974) included 7 ac. of immature high marsh, 138.5 ac. of sedge marsh, 18 ac. of bullrush-sedge marsh and 23 ac. of low sand marsh. Of six sites studied on Coos Bay, the site on North Slough, which was an almost pure stand of *Scirpus validus*, had the highest standing crop and net primary productivity (Hoffnagle et al. 1976). The plant *Cordelanthus maritima*, which is rare in Oregon, is found within the immature high marsh of North Slough (Hoffnagle and Olson 1974). *Cotula coronopifolia*, an introduced species which thrives in areas of wood and bark accumulation, is quite common (Hoffnagle et al. 1976).

Shiner perch and staghorn sculpin were found adjacent to North Slough marshes. Harpacticoid copepods, insect larvae, small bivalves and *Corophium* spp. were major items in their diet (Hoffnagle et al. 1976).

In addition to barn swallows, long-billed marsh wrens, and song sparrows, the uncommon Virginia rail has been sighted in North Slough marshes and nesting areas for this bird were observed there by Magwire (1976b).

Recommendations

The marshes of North Slough represent major tracts as described in the LCDC Estuarine Resources Goal (1977) and should be protected (Jefferson 1975). Because these diverse marshes have remained relatively unaltered, they could serve as valuable research natural areas for baseline studies of natural processes in undisturbed ecosystems. They are particularly well suited to studies of dune encroachment, impacts of drift logs, and recovery from log storage (Jefferson 1975).

North Slough includes suitable sites for habitat restoration. Removal of derelict logs would increase the surface area available for estuarine production.

Placement of culverts beneath the Jordan Cove Causeway would increase tidal circulation to North Slough and might reverse the accelerated sediment accretion.

Haynes Inlet Subsystem

Haynes Inlet extends about 2-1/2 mi northeast from its entrance into Coos Bay just east of North Slough (Fig. 17). It has a watershed of 7,120 ac (OSWRB 1963), which is drained by Larson and Palouse creeks.

Haynes Inlet was once broad at its mouth, gradually narrowing to a system of narrow, meandering channels at its head. Larson and Palouse creeks once contained large tidal marshes and had substantial tidal prisms. Currently the mouth has been greatly restricted by the Highway 101 causeway. Marshlands on both major creeks have been diked for agricultural use, and stream flows are controlled by tidegates, which reduce the total tital prism of the inlet.

Hydrological studies of freshwater inflow and tidal circulation have not been made. Data on the water quality of Haynes Inlet is lacking, and only minimal biological information is available.

Habitats of Haynes Inlet include subtidal channels with unconsolidated bottoms; intertidal flats of sand, mud, and sand-mud mixed; eelgrass beds; low marsh; high marsh; and sand shores (Fig. 18).

In a brief qualitative survey, invertebrates of the Haynes Inlet mudflats were similar to those recorded in North Slough included (Rischen and Danielson 1970). Additional species not recorded in North Slough included several species of amphipods and the nudibranch *Hermissenda crassicornis*. The California papershell, *Lyonsia californica*, has not been recorded elsewhere in Coos Bay. An oyster farm operated there before construction of the Highway 101 Causeway. The presence of shells suggest that cockles once inhabited the sea.

Fish seined in Haynes Inlet include threespined stickleback, shiner perch, topsmelt, bay pipefish, staghorn sculpin, and starry flounder, all species with wide distributions in Coos Bay (Hostick 1975) (Table 9). Bender (pers. comm.) noted that large numbers of anchovies occur near the mouth of the inlet in September and October. Boat angling for striped bass is popular in Haynes Inlet in May through September. Shiner perch, pile perch, and striped seaperch are also taken there by shore anglers. Larson and Palouse creeks are both productive coho and steelhead streams (pers. comm., Bender). Larson Creek is used to chart coho population trends in coastal streams. It has the highest number of spawning coho of the 3 creeks surveyed by ODFW in the Coos system. A sport fishery for coho develops in October and continues until the end of steelhead season (pers. comm., Bender).

Haynes Inlet is heavily used by waterfowl. The most abundant winter species include black brant, American wigeon, ruddy duck, American coot, pintail, greenwinged teal, and mallard (Magwire 1976b). Few species appear to use the area in summer, but great blue heron are common (Magwire 1976b) and use the inlet as a feeding area (McMahon 1974).

Several hundred acres of salt marsh have been diked for agricultural use in Haynes Inlet (Hoffnagle and Olson 1974). About 150 acres of marsh remain, including immature high marsh, sedge marsh, bullrush-sedge marsh, and one of the few areas of low silty marsh mapped in Coos Bay (Hoffnagle and Olson 1974).

The watershed of Haynes Inlet has a fairly high level of both agriculture and logging (Wilsey and Ham 1974). Other human uses of the slough and adjacent uplands include a small mill and log dump, residences, light commercial use near the mouth, and a boat launch and wayside (Wilsey and Ham 1974).

Recommendations

Haynes Inlet was classlified as an area of moderate marine biological value and high terrestrial biological value by Wilsey and Ham (1974). Of particular significance are the salt marshes of the upper end of the inlet, which are listed by Jefferson (1975) as an area that should be protected for primary production in Coos Bay.

The Highway 101 causeway has changed tidal circulation within Haynes Inlet and may be contributing to accelerated accretion. It may be advisable to increase ciruclation with the main bay through a system of culverts. Leaking tidegates, especially the one controlling the entrance to Larson Creek, have necessitated recent diking to protect agricultural land from salt water intrusion. Dike material should be obtained from upland sources rather than from the adjacent channel to protect water quality and bottom characteristics, which are important for anadromous fish using these streams.

Isthmus Slough Subsystem

Isthmus Slough is a very long, narrow body of water which enters the upper southwest corner of Coos Bay at about RM 13.8 (Fig. 17). Head of tide is about 12 mi up the slough (Wilsey and Ham 1974). The drainage area of Isthmus Slough is 32 mi^2 (Arneson 1976), and major tributaries include Coalbank Slough, Shinglehouse Slough, Davis Slough, and Noble Creek.

In Isthmus Slough the deep draft navigation channel extends to RM 15 at a depth of 35 ft and width of 400 ft. Near the mouth of Coalbank Slough a turning basin has recently been enlarged to 700 ft by 1,000 ft. Major shipping activities occur in this area of the bay. A shallower channel 22 ft deep and 150 ft wide extends from RM 15 to Millington at RM 17. It is privately maintained and used primarily for log transport (USACE 1976).

Freshwater flow has been calculated for Isthmus Slough using drainage basin area and precipitation averages (Arneson 1976). In 1973-74 minimum flow was estimated at 1.4 cfs in September 1973 and maximum flow at 304 cfs. Extreme salinities of 30.6 ppt and 4.7 ppt have been measured at the Eastside Bridge over the slough. Salinities at the Coos City Bridge measured 30.2 ppt and 0.3 ppt (DEQ 1978). Downstream from Eastside a minimum salinity of 0.2 ppt has been measured, which probably indicates the influence of fresh water from Coos River.

Salinity profiles show Isthmus Slough to be well mixed at essentially all times of the year (Arneson 1976). In December, when some portions of the estuary were stratified, Isthmus Slough was well mixed at high tide and essentially fresh water at low tide (Arneson 1976). The well mixed condition of the slough may be attributed to limited freshwater inflow (Arneson 1976), even though diking has greatly reduced the tidal prism in the slough (Aagard 1971). Water temperatures as low as 46.4°F have been recorded in Isthmus Slough, while maximum temperatures of 73.4°F have occurred at upstream stations (DEQ 1978).

Isthmus Slough receives heavy industrial use for shipping, waste disposal, and log handling and storage. These uses combined with minimal flushing (Arneson 1976) and low freshwater inflow cause dissolved oxygen to be lowest in

Isthmus Slough of the stations measured in Coos Bay (DEQ 1978). DEQ data show that DO improved from 1974 to 1978, but measurements less than the minimum standards for estuarine waters still occur(DEQ 1978). USACE (1976) reports Isthmus and Coalbank sloughs are moderately to heavily polluted according to EPA standards.

High coliform counts have been recorded in Isthmus Slough. Of the stations measured by DEQ, the most frequent and severe violations occurred in Coalbank Slough and downbay from Coalbank (DEQ 1978). At the upper stations coliform less frequently exceeded standards for general health but was often over the maximum for commercial shellfish harvesting areas.

Sediments of Isthmus Slough are river-born silts (Arneson 1976). Although winter freshets do aid flushing, the slow currents of the slough and general lack of fresh water inflow contribute to the deposition of fine material (Arneson 1978). Wood chips and bark also occur in the substrate of much of the slough. Anerobic sediments are found in most areas (Thompson 1971).

Habitats and Species

The habitats of Isthmus Slough are predominantly the unconsolidated bottom in the channel, muddy shores which are sometimes covered by eelgrass beds, and marshes (Fig. 18). Log rafts are often stored and ground along the tidal flats. Consequently, the exact location of aquatic beds and marshes is subject to change as vegetation is removed and reestablishes itself.

A survey of organisms of Isthmus Slough, primarily those of the tidal flats, was conducted by Thompson (1971). Algae noted in the slough include the green (*Enteromorpha tubulosa*), reds (*Gracilaria* spp., *Antithamnion* spp., *Platythamnion* spp., *Polysiphonia* spp., and *Gigartina* spp.), and the brown (*Fucus* spp.). *Ruppia* is found in increasing abundance in aquatic beds toward the southern end of the slough in less saline water.

Invertebrates primarily include crustacean arthropods and polychaete worms. Only six molluscs are recorded from Isthmus Slough. The softshell clam is the only species taken recreationally. Historical notes show softshells were once more abundant than at present (Thompson 1971).

The arthropods found in the slough are the shrimp *Crago franciscorum* and the crabs *Cancer magister, Rhithropanopeus harrisii,* and *Hemigrapsis oregonensis* (Thompson 1971). At least eight species of amphipods and isopods are also found. The amphipods were primarily in channels under algae, and in eelgrass beds. *Anisogammarus confervicolus* became less dense with increased temperature and decreased salinity. *Corophium* spp. were found farther into freshwater than *Anisogammarus*.

The most abundant polychaete worms were the nereids, *Nereis brandti* and *N. limnicola*. *Heteromastis filiformis* and *Capitella (Capitata) ovincola* were found in reducing layers, and ampharetids and spionids were found throughout the slough. Many of the annelids found have been termed pollution indicators.

At least 11 species of fish have been seined from Isthmus Slough (Table 9).

Adult coho salmon have been seined in Coalbank Slough, and a spawning run of coho occurs in tributaries of Isthmus Slough and in Davis Slough (pers. comm., Mullarkey and Bender).

Historically Isthmus Slough has been used by striped bass which tend to seek out deep holes and channels (pers. comm., Bender). Isthmus Slough was a prime striped bass fishing area until low DO and chemical wastes apparently prevented all use of the slough by striped bass. Conditions have improved somewhat and bass are again showing up. Several age classes of stripped bass have been found south of Davis Slough which have not recently been seen in other portions of Coos Bay (pers. comm., Mullarkey and Bender). It is possible this area is critical to the bass at certain stages of their life cycle (pers. comm., Bender). In February and March striped bass fishing is popular from the banks of Isthmus Slough.

Many of the marshes in Isthmus Slough have been eliminated by diking, filling, and log storage. In Coalbank Slough alone, marshes occupied 597 ac. in 1892, and now only 57.0 ac. remain (Hoffnagle and Olson 1974). The major marshes of Isthmus Slough occur along its banks and in Coalbank, Shinglehouse, and Davis sloughs. Marshes of Coalbank Slough include a 25 ac. marsh separated from the channel by a dike with culverts and a 35 ac. marsh partially bordered by an old dike. These marshes have characteristics of sedge marshes and immature high marshes, but *Carex lyngbyei* is the dominant species present (Hoffnagle and Olson 1974).

Along the main channel of Isthmus Slough south of the mouth of Coalbank Slough lies the estuary's largest expanse of low silty marsh, which is returning to its former state after being diked (Hoffnagle and Olson 1974). Sedge and immature high marshes occur along the main Isthmus Slough channel south of the silty marsh, and bullrush-sedge marsh occurs at the south end of Isthmus Slough (Hoffnagle and Olson 1974). Sedge marshes occur in Shinglehouse Slough, and Davis Slough has marshes of bullrush and sedge. Total undiked marsh acreage of Isthmus Slough and its tributaries is 431.8 ac., which contains 62.8 ac. of sedge marsh, 64.6 ac. of low silt marsh, 219.0 ac. of immature high marsh, and 85.4 ac. of bullrush and sedge marsh.

Recommendations

Hoffnagle and Olson (1974) estimated that 90% of the total acreage of Coos Bay marshes have been lost to filling or other causes since 1892. It is therefore critical that remaining marsh lands be protected from filling and diking in order to maintain habitat diversity in the estuary, as well as the flow of organic material to and from marsh communities. Significant tracts of salt marsh remain in Coalbank and Shinglehouse sloughs and should be preserved for primary production (Jefferson 1975).

Much of Isthmus Slough can be considered degraded habitat, and restoration measures should be undertaken to restore water quality and biological production. The acreage of tide flats impacted by grounding log rafts should be minimized. Log rafts should be removed from intertidal areas wherever feasible. The inventory of logs stored in the slough at any given time and the length of residence of stored logs should not exceed the minimum levels required to keep pace with mill production. All unused pilings, derelict logs, and wood debris should be removed. Breaching of several partially diked areas of Isthmus Slough should improve circulation, water quality, and the flow of materials between these areas and the other portion of the subsystem. The 35-ac. marsh in Coalbank Slough and the low silty marsh east of the channel just south of Eastside should also be considered for restoration through dike removal.

Increased circulation to the 25-ac. Coalbank Slough marsh should be considered to improve the exchange of organic materials with the remainder of the estuary.

Davis Slough and the section of Isthmus Slough above it should remain free of log storage or other uses which would further degrade water quality in the subsystem. Log storage has been gradually phased out in upper Isthmus and Davis sloughs, and during the same period water quality has improved significantly. This recovery and the poor circulation in these upper reaches suggest the area may be particularly important in maintaining the water quality of Isthmus Slough.

Catching Slough Subsystem

Catching Slough enters the main body of Coos Bay just west of the mouth of Coos River (Fig. 17). It is fed by several small streams and is about 10 mi long from its mouth to its head (Wilsey and Ham 1974).

In the late 1800s, Catching Slough was an area of vast tidal marshes and a large tidal prism. Strong tidal flushing was responsible for maintaining depths of 18 to 20 ft at the confluence of the Catching Slough channel and the Marshfield Channel. By the 1940s diking of Catching Slough for agricultural purposes had decreased tidal transport and velocity through Marshfield Channel (Aagard 1971).

Little is known of the physical or biological processes of Catching Slough. Freshwater inflow is unmeasured, but STR (1974) state that because of low summer flow, tidal circulation during summer in Catching Slough is a simple exchange of water from the main bay.

In a single series of summer water quality samples, high temperatures, probably resulting from low summer flows, were noted (STR 1974). Fecal coliform increased from the mouth toward the head of the slough (STR 1974) and could be expected to be greater at times of high runoff.

Habitats of Catch Slough include the subtidal channel, narrow muddy shores, eelgrass or ditchgrass beds, fringing tidal marshes, and rip-rapped shores (Fig. 18). Typically these habitats occur in narrow bands zoned from lowest to highest as listed. The tidal marshes are the only Catching Slough habitat that have been studied.

Tidal marshes of Catching Slough once totalled 1,600 ac., but through extensive alterations for agricultural use, only fringing marshes of bullrush and sedge totalling less than 50 ac. remain (Hoffnagle and Olson 1974).

Distribution of invertebrates in Catching Slough has not been studied. Large numbers of juvenile American shad have been seined from Catching Slough

(Hostick 1974). Coho salmon and steelhead spawn in the upper reaches of the slough (pers. comm., Mullarkey and Bender). Other fish seined from the slough include species with wide distributions in the upper bay and sloughs, such as shiner perch, staghorn sculpin, threespine stickleback, starry flounder, and bay pipefish (Cummings and Schwartz 1971). Water in the upper part of the slough apparently is sufficiently fresh to maintain significant numbers of largescale suckers. Recent gill netting surveys by ODFW have shown the area is also used by striped bass.

Recommendations

Materials needed for dike repair should be obtained from upland sources rather than by dredging in the slough. Dredging can convert productive intertidal areas into less productive subtidal habitats and degrade surrounding habitats. Consideration should be given to restoring a portion of the large amount of diked tidal land to estuarine production. Derelict pilings previously used for log storage should also be removed.

Catching Slough supports good runs of coho salmon in Catching, Selander, and Wilson creeks. Recent sampling suggests the slough may also be an important area for 5- and 6-year-old striped bass. Isthmus Slough is the only other area where concentrations of this age group of striped bass have been found, but Isthmus Slough may be unsuitable for the fish during the summer due to low DO. Water quality in Catching Slough should be maintained and improved for fish and other organisms dependent upon the area. Catch Slough has good potential for recreational fishing, and public use may be improved with increased access.

Coos Riverine Subsystems

There are several riverine subsystems in the Coos Bay estuary, including the Coos and the South Fork Coos rivers and Millicoma river, which enters the Coos River. Tidewater extends more than 11 mi upstream from the boundary of the upper bay subsystem (Fig. 17) on the South Fork Coos and 10.6 mi upstream on the Millicoma River (Wilsey and Ham 1974).

The riverine subsystems provide important fish habitats. Shad are entirely dependent on the area during the first 6-12 months of life and part of their second year. Coho and steelhead can be found in the spring enroute to their spawning grounds. The Coos system is a major freshwater rearing area for chinook, especially during their first year. Juvenile cutthroat also rear in the system, and adults return in late summer to spawn. The lower portions are also used by starry flounder and staghorn sculpin. Prickly sculpin and shiner perch occur in the upper portions. Other species found in the riverine subsystems include red-sided shiners and largescale suckers. Shiner perch and largescale suckers are important forage fish for striped bass (pers. comm., Bender).

This section of the estuary is a popular fishing area for shad (May-July), striped bass (year-round), cutthroat (August-October), coho and chinook (September-November), and steelhead (November-March). Commercial shad fishing takes place on the lower Millicoma, South Fork Coos, and throughout the Coos River.

Recommendations

Generally there is little specific information on other biological and physical characteristics of the riverine subsystems. The habitat map (Fig. 18) does not depict habitats far beyond the upper bay subsystem. However, the Coos riverine subsystems are similar to the tidewater areas of other coastal rivers, and many of the same general considerations should be made in developing management strategies.

The Coos Bay riverine subsystems should be managed as units to prevent the piecemeal destruction of shoreland habitats. Riprap, bulkheads, and docks can destroy riparian vegetation, which is important for fish and terrestrial animals. Docks can reduce the productivity of aquatic plants by shading. Riparian vegetation should be protected as suggested in the implementation of the LCDC Coastal Shorelands Goal (LCDC 1977). New homes and other structures should be placed a sufficient distance from the shore so that bank stabilization measures are not required. This will also help reduce flooding and erosion caused by encroachment into the floodway fringe. Non-structural solutions to erosion and flooding are also encouraged in the LCDC Coastal Shorelands Goal. Bank stabilization should only be allowed as part of an overall stream corridor management plan.

Dredging during July and August will have the least detrimental impact on the riverine fisheries. Spawning and larval development of shad and striped bass occur in the spring (April-June). After September, the tidewater sections are used extensively for sport fishing.

Pollutants discharged into the riverine sections of estuaries can be particularly detrimental to estuarine water quality since flushing times are extremely long much of the year, and all material from the upper estuary may affect the rest of the system downstream. Adequate waste treatment facilities are needed to prevent pollution of the riverine subsystem. Particular care must be excercised to prevent oxygen depletion and high water temperatures, which can stress fish, and to maintain minimum stream flows. Logging and other activities which cause erosion within the riverine subsystems and in the upper watershed should be carefully regulated to prevent rapid filling, which has occurred in many Oregon estuaries as a result of these activities.

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EXHIBIT 4

THE ECOLOGY OF THE ROCK-BORING CLAM

Penitella penita (Conrad 1837)

by

JOHN WILLIAM EVANS

A THESIS

Presented to the Department of Biology
and the Graduate School of the University of Oregon
in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy

June 1966

APPROVED ______________________

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(cont.)

An Abstract of the Thesis of

John William Evans for the degree of Doctor of Philosophy

in the Department of Biology to be taken June 1966

Title: The Ecology of the Rock-Boring Clam Penitella penita

Approved: ______________________________
Peter W. Frank

Penitella penita is a rock-boring clam found along the Pacific coast of North America.

The clams were sampled in substrates of differing hardness. Some experimental work on growth rate was done by planting animals in artificial burrows but in natural sites, in both their native and other rock types.

Observations made by Turner (1954-1955) on the effect of rock hardness on valve morphology were confirmed and extended.

Burrow shape appears controlled by a number of factors: erosion, substrate hardness, crowding and others.

Estimates of growth rates were arrived at by a number of methods, including valve size analysis of young animals from rocks exposed for a known length of time, analysis of size increase of animals replanted for an 11-1/2 month period. When the duration of time between deposition of successive growth bands was estimated, growth rate could also be estimated by analysis of growth band counts.

The growth rate of animals transplanted to softer than native rock was unexpectedly high whereas, in the converse case, growth rate was lower than normal. This suggests the possible existence of ecotypes in this species.

INTRODUCTION

The group of animals which live buried in hard marine substrates is known as the endolithic community (Kühnelt 1951). Rock-boring bivalves are primarily responsible for initiating and maintaining the community because they excavate most of the burrows into which the other members will move after the borers' death. In areas where no rock-borers exist, this community is necessarily absent.

Yonge (1963) states that seven groups of bivalves have independently taken to rock-boring. Hiatella (Saxicava) (Hunter 1940), Tridacna (Yonge 1936), Botula and Lithophaga (Yonge 1955) are all attached, at least initially, by byssus threads. Yonge (1955) claims that in these animals the habit of boring was preceded by that of nestling. The animals attach themselves in crevices which they may enlarge by movements of the valves.

Petricola (Duval 1963a and Yonge 1958), Platydon cancellatus (Yonge 1951) and the family Pholadidae have, according to Yonge (1961), evolved from forms that were originally deep burrowers in soft substrates. The pholads are the most efficient rock-borers in that they can penetrate rock far harder than can the other mechanical borers. They are also the most highly modified morphologically.

Most of the literature on marine borers before 1954 was compiled and annotated by Clapp and Kenk (1963). Most of their extensive volume (1136 pp.) is devoted to the economically important wood-borers, notably the shipworms, Teredinidae, and the wood-boring isopod Limnoria. Studies on rock-boring clams of the family Pholadidae have been mainly concerned with their morphology, taxonomy and methods of boring. Very little detailed work has been done on the ecology of these animals.

The most extensive work to date on the Pholadidae is by Turner (1954, 1955); she discussed the morphology, systematics, distribution and ecology of members of this family that occur in the western Atlantic and eastern Pacific. Gomoiu and Müller (1962) studied in detail a benthic association dominated by Barnea candida in the Black Sea. Numbers and biomass measurements of 56 species were made and the roles of the more important members were discussed. Duval (1963) described some of the ecological conditions that control the distribution of Petricola pholadiformis, and other aspects of its natural history.

Penitella penita (Conrad 1837), often incorrectly referred to in the literature as Pholadidea penita, is the most common and best known of the pholads in the eastern Pacific (Turner 1955). The geographical distribution of P. penita, according to Turner (1955), is from Bering Island, Siberia, south as far as Bahia San Bartolome, Baja California. Ricketts and Calvin (3rd ed.,p.232) place the southern end of the range at Ecuador.

The vertical distribution of P. penita is also broad. In the area of Coos Bay, Oregon, it is found as high as + 3 feet in the intertidal zone and extends down into the subtidal zone. Kofoid (1927) reported that Pholadidea penita (Penitella penita) were dredged in rocks at a depth of 50 fathoms in San Francisco Bay.

Another factor influencing distribution is the presence of a suitable substrate, i.e., rock of suitable hardness and homogeneous texture. According to Lloyd (1897) _P. penita_ does poorly in clay, preferring shale and sandstone of the open coast. Granites, conglomerates, and other very hard rocks are not bored.

During the summer of 1962 a preliminary examination was made of rocks heavily bored by _P. penita_. Observations on the effects of crowding posed a number of problems about the ecology and behavior of the animal. What kind of sensory mechanism enables it to avoid breaking into neighboring burrows? What is the effect of crowding on succession and subsequent settlement in the area?

Correlations between valve size and burrow length indicated that the surface rock was being eroded at a rate fast enough to affect the life span of the individual animal. This raised two questions. What is the rate of erosion in the area, and what is the relative importance of physical and biological causes of erosion?

As research progressed, the scope of the study came to include the following topics: (1) an analysis of the factors controlling valve and burrow morphology; (2) an analysis of growth and burrowing rates in rocks of different hardness; (3) a description of the sexual cycle, larval life and settlement; and (4) a discussion of the general ecology of the endolithic community.

MATERIALS AND METHODS

The tools required to carry out this work were on the whole very simple. Much of the field work involved quarrying pholad-infested rock with a sledge-hammer and cold chisels. The rocks or specimens were then removed to the laboratory where more careful dissection could be done. Most measurements were made with a vernier caliper.

The following measurements were made on the valves. (1) "Length" was measured from the tip of the beak to the most posterior point of the valve, not including the siphonoplax or callum. (2) "Depth" was measured as a straight line from the dorsal to the ventral extremities of the umbonal ventral sulcus. (3) "Growth band" counts were made by drawing a line from the umbone down the ventral sulcus on the outside surface of the shell, this line was divided into 1 cm-long sections, and the number of growth bands were counted between each mark, starting from the umbone. In most cases part of the umbonal reflection had to be removed, because it obscured the dorsal part of the sulcus.

In order to assess the effect of rock hardness on valve and burrow morphology it was necessary to determine the hardness of rock samples from the three areas. A method was devised which would measure relative hardness. A drill press was set at low speed, about 575 rpm. The drill had a constant downward thrust of 15 lbs maintained by a pulley and weight arrangement attached to the vertical feed lever. A constant drilling time of 2 seconds was obtained with the aid of a photographic timer; the actual time was slightly longer since the drill slowed down and stopped while the pressure was still on. A 1/4-inch "Cyclotwist" tungsten carbide masonry bit was used to drill the holes.

The shape of the burrow of P. penita was studied by casting a plastic mold of its cavity. The base of the burrow was opened and the enclosed clam removed, measured, and preserved. The burrow was then cleaned, and the entrance opening blocked with wax. Liquid casting resin was then poured into the open base of the burrow. When the resin had hardened the rock was broken away from the plastic. From the mold the following measurements were taken: (1) total length, (2) minimum diameter (the diameter at the entrance of the burrow), (3) maximum diameter, (4) effective length (measured from minimum diameter to maximum diameter), (5) diameter halfway between maximum and minimum diameter (Fig. 15).

The sexual cycle of P. penita was studied over a 2-year period. The visceral masses of 295 adult and 90 actively boring animals were fixed in either Gilson's or F.A.A. fixative. The sections were stained in buffered azure eosin stain.

During the first half of August 1962, the edge of the lower bench at Fossil Point (see Study Areas) was cleared of pholad-infested rock by splitting off the superficial 15 to 30 cm of rock. An area 50 ft long and about 2 ft deep was cleared at the 0-ft tide level.

The purpose of this was threefold: to establish the period of the year during which settlement takes place, to examine factors affecting settling density, and to follow the growth rate of P. penita.

To establish the season at which maximum settling takes place, freshly exposed rock was collected at bi-monthly intervals from August 1963 to June 1964, from August to November 1964, and from June to August 1965. The surface area of the rock sample was estimated and then all pholads that could be located were extracted and measured.

The growth rate was studied by collecting samples of rock exposed for progressively longer periods of time. Samples of rock originally exposed on August 10, 1963 were collected 2-1/2, 4-1/2, 6-1/2, 8, 10, 12, 16, and 21 months later. The surface area was estimated, all animals were measured, and where possible, separated according to species.

Because of the large number of young animals processed, and because length could be measured much more quickly and accurately than depth, length measurements were used primarily in these studies. Because of the small deviation of the length to depth ratio at any particular size, it appears to make little difference which parameter is used in measuring active animals.

Data on factors affecting settling density were collected incidentally to the growth rate study. Density was related to the condition and orientation of the rock surface.

Growth rate and behavior of individual animals were studied by the replant method. Active animals were removed from the rock, their length and depth were measured and they were replaced in cylindrical holes of known diameter and length. The entrance of the hole was plugged with a polyethylene collar (Fig. 1). The size of the entrance could be set at 3, 6, 12, or 18 mm in diameter. The animals were collected about 11-1/2 months later, and the growth rate was analyzed.

FIGURE 1

Penitella penita in South Jetty rock. Replanted August 9, 1964; collected July 13, 1965. Dot indicates valve size when planted.

Note - Rock was split to make the burrow visible, the polyethylene plug has been cut to show 6 mm entrance. The straight sided burrow was drilled by a star drill. Rounded base was enlarged by the clam.


METRIC

A method for growing P. penita in unconfined conditions was also devised. Young active P. penita were suspended inside test tubes by mono-filament lines which extended from the polyethylene plugs to the sides of the valves. These test tubes were in turn sunk into holes in the rock at Fossil Point and the animals were left to grow.

Standard statistical procedures were used for the most part. Procedures involving analysis of variance and covariance were used extensively.

STUDY AREAS AND SUBSTRATES

Penitella penita was collected at approximately zero tide level from three areas on the Oregon Coast: the north side of Cape Blanco, the south side of South Jetty at Coos Bay, Oregon (Fig. 2), at Fossil Point in Coos Bay (Fig. 3). [Fossil Point is misplaced 1/4 mile to the N.E. on the Empire, Oregon Topographic Sheet, 1944. Because of this, the writer has inadvertently referred to this misplaced area as Fossil Point. Some residents call the writer's area "Pigeon Point."] The first two sites are protected outer coast areas, whereas the latter area is in a bay protected from surf action.

Penitella penita was the only pholad found at South Jetty and Cape Blanco. At Fossil Point on the other hand *Penitella gabbi*, *Zirfaea pilsbryi*, and *Penitella turnerae* (Evans, Fisher 1966) are found quite commonly. Together, these three species make up about 10 per cent of the living pholads in the lower bench at Fossil Point. Another species, *Nettastomella rostrata* is found, but only rarely.

At Fossil Point, which was the principal work area, there are two flat intertidal benches. The horizontal surface of the upper bench is 5 to 6 ft above datum level. The western edge of the upper bench, adjoins the lower bench, the surface of which is between the + 1- and 0-ft level. Further north and west the edge of the lower bench drops off rapidly to the sandy bottom. Most of the work was done on the steep edges of these two benches.

South Jetty is a jetty protecting the mouth of Coos Bay. It extends in a westerly direction about a half mile into the sea from Coos Head.

FIGURE 2

South Jetty (oblique view)

Arrow indicates approximate position of rocks where animals were collected and replanted.

Approximate scale 10 m to 1 cm.

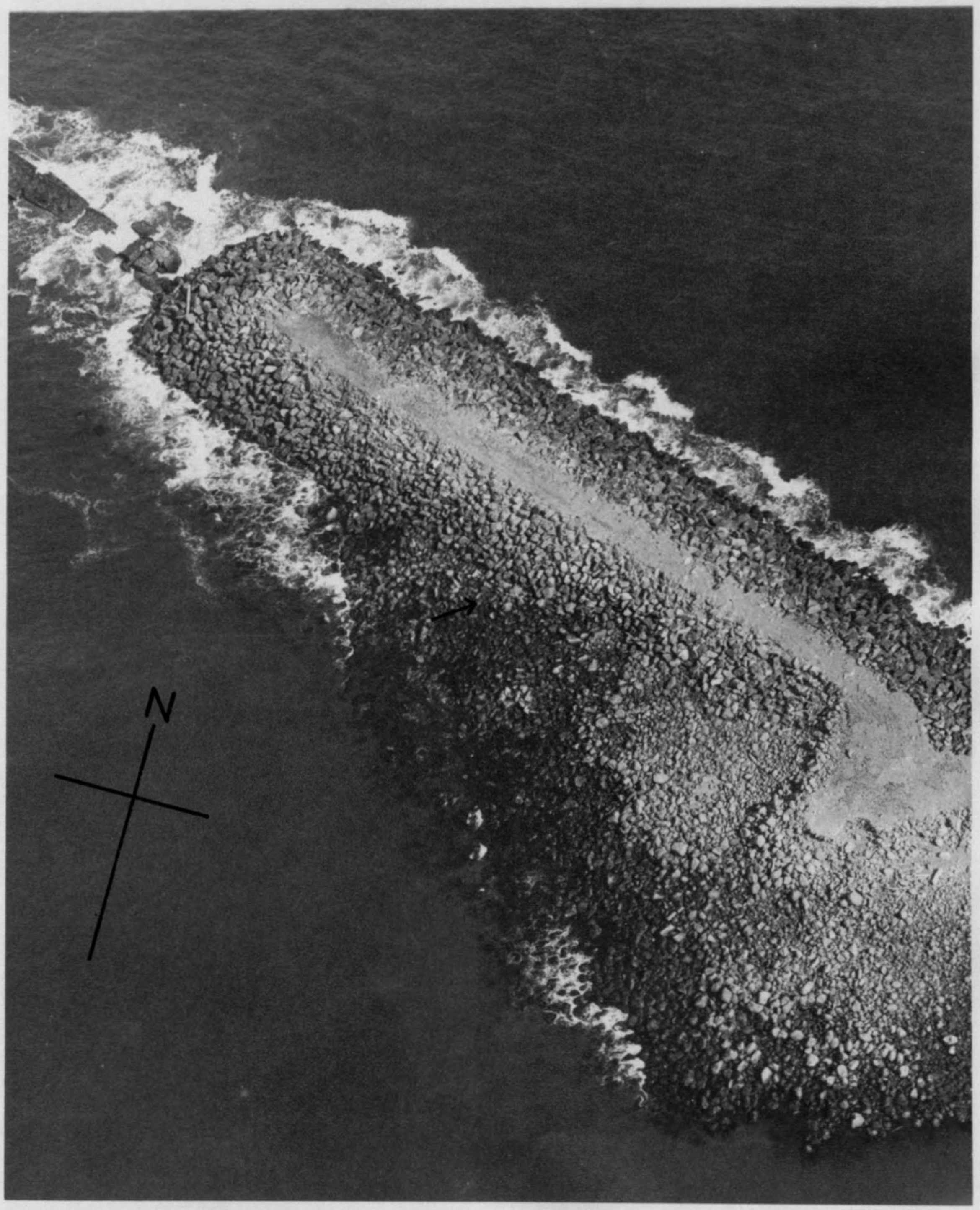
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FIGURE 3

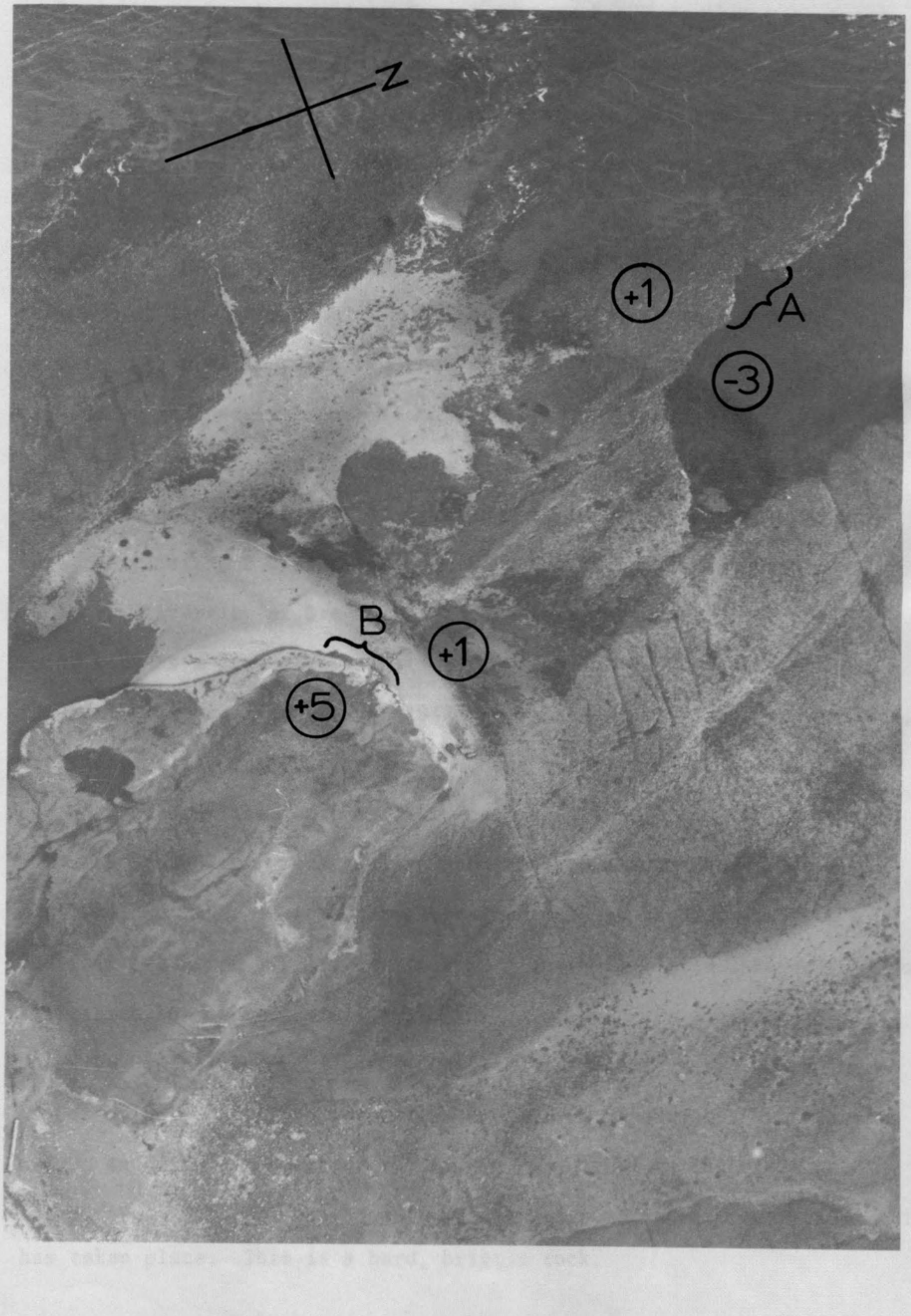
Fossil Point

A - Part of lower bench used for settlement, growth rate and replant studies.

B - Part of Upper Bench used for replant study.

+1 - Height of surface in intertidal in feet.

Scale 6.8 m to 1 cm.


Z
+1
A
-3
B
+1
+5

The jetty has been rebuilt several times. The population of clams studied there were boring into Tyee sandstone boulders that were transported to the area about 40 years ago. How long they have been exposed at their present level could not be ascertained. The animals from this location were collected from a moderately exposed area at about 0-ft level.

Cape Blanco, the westernmost promontory of the Oregon coast, was the site of the third population. The clams there were found boring into very hard sedimentary bed rock at about 0-ft tide level in very exposed to moderately exposed conditions.

The rocks of these three areas were examined as whole specimens and thin sections by Dr. L. R. Kittleman of the Museum of Natural History, University of Oregon, and Dr. B. B. Van Diver of the Department of Geology, University of Oregon. All three are sandstone. The Fossil Point rock is a graywacke sandstone from the Empire Formation, of early to middle Pliocene age (Weaver 1942). It is very soft and fine-grained, with an argillaceous (clayey) matrix, there is little or no chlorite and no recrystallization or silicification.

The South Jetty rock is Tyee Sandstone of middle Eocene Age (Baldwin 1964, p. 25). It is a coarse-grained arkosic sandstone with a moderate amount of argillaceous matrix. There is little chlorite and no silicification or recrystallization.

The Cape Blanco rock is of Jurassic or Cretaceous age according to Dott (1962). It is a metagraywacke. Grain size ranges from fine to medium in different parts of the rock. The matrix is chloritic and silicified. The rock has been brecciated and recemented, recrystallization has taken place. This is a hard, brittle rock.

The grains of these rocks are mostly quartz, chert, and feldspar, which have a hardness on the Mohs scale of between 6 and 7. Since pholads apparently bore solely by a rasping mechanical action, their aragonite teeth, with a hardness of about 3.5, could not be expected to wear down the particles themselves but rather to dislodge them from the softer matrix. Ease of boring depends not on the mineral hardness of the particles but on friability, that is the firmness with which the particles are held together by the matrix; this will be called hardness in this paper.

Geologists apparently have developed no standard methods for measuring the hardness of sedimentary rocks. Several investigators working with other rock borers have improvised methods for measuring relative rock hardness. Kofoid (1927) mentions a crushing method of testing the quality of cement bored by P. penita. Hunter (1949) measured the hardness of rocks bored by two species of Hiatella by grinding them on a lapidary wheel (Comparative ease of abrasion=volume of rock abraded/ unit time). Duval (1963) developed a method for measuring hardness of the soft rocks bored by Petricola pholadiformis which involved the repeated and uniform scraping of a weighted steel bar across the rock sample and measuring the depth of the groove after a certain number of abrasions.

In this study the relative hardness was determined by measuring the depth of holes drilled under conditions of constant time and force. The results are tabulated in Table 1.

TABLE 1

Hardness of rocks.

	No. of holes	Average depth (mm)	SE (mm)	Derived hardness scale	Adjusted hardness scale
Fossil Point	15	12.1	0.4	1	1
South Jetty	15	7.2	0.5	1.7	2
Cape Blanco	15	3.2	0.3	3.8	4

A hardness scale was established from the results of the drilling experiments. The Fossil Point rock was assigned a hardness of 1. The scale consists of a ratio: depth of penetration for Fossil Point rock to depth of penetration in other rock. South Jetty rock has a derived hardness of 1.7 and Cape Blanco rock a hardness of 3.8.

The test overestimates the hardness of the softest rock because as the hole depth increases the drilling efficiency decreases from interference by the powdered rock around the drill. This becomes especially noticeable in holes deeper than 10 mm. For this reason, and for simplicity, the hardness scale has been adjusted, making South Jetty rock twice as hard, and Cape Blanco rock four times as hard as Fossil Point rock.

The Cape Blanco rock apparently owes its hardness to the chloritic and siliceous matrix which binds the particles firmly together. The reason the South Jetty sandstone is harder than Fossil Point rock is not obvious from its lithology.

ORIENTATION AND LITERATURE REVIEW

This chapter is designed to serve as an introduction to the specialized morphology, behavior and general ecology of the group.

Morphology

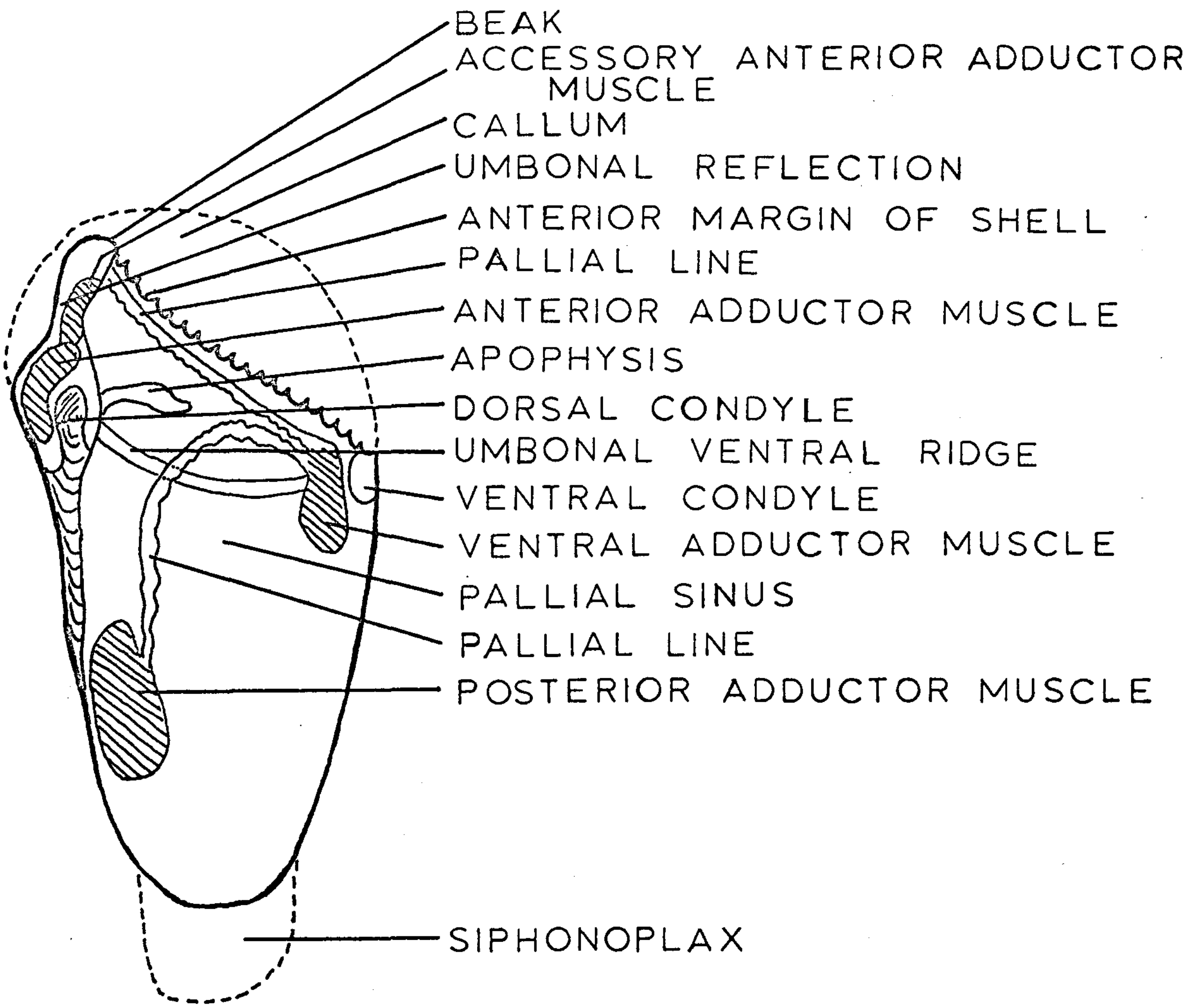
The morphology of the Pholadidae has been treated many times in the scientific literature. Turner (1954, 1955) has described in detail the morphology of western Atlantic and eastern Pacific pholads. Purchon (1955) described the functional morphology of several of the British Pholadidae.

Certain modifications of the basic bivalve plan adapt pholads to the rock boring habit. These modifications are especially well-developed in those pholads like *Penitella penita* that are able to bore into hard rock (Lloyd 1897, Purchon 1955).

The most significant modification is the elimination of the ligament and the rearrangement of the adductor muscles (Fig 4). In most other bivalves, contraction of the adductor muscles serves only to close the valves upon each other. This movement is opposed by the elasticity of the ligament or resilium which serves to open the valves when the adductors relax. In pholads the ligament has been wholly eliminated in those species adapted for boring in hard substrate and is only a vestigial structure in others (Purchon 1955). Comparatively complicated movements of the valves are controlled solely by muscular activity. There are two antagonistic muscle pairs: the posterior adductor opposes the accessory anterior adductor with the dorsal and ventral condyles acting as fulcra, the

FIGURE 4

Diagrammatic drawing of interior of left valve of *Penitella penita*. Dotted structures present only in nonboring adult.


BEAK
ACCESSORY ANTERIOR ADDUCTOR MUSCLE
CALLUM
UMBONAL REFLECTION
ANTERIOR MARGIN OF SHELL
PALLIAL LINE
ANTERIOR ADDUCTOR MUSCLE
APOPHYSIS
DORSAL CONDYLE
UMBONAL VENTRAL RIDGE
VENTRAL CONDYLE
VENTRAL ADDUCTOR MUSCLE
PALLIAL SINUS
PALLIAL LINE
POSTERIOR ADDUCTOR MUSCLE
SIPHONOPLAX

anterior adductor opposes the ventral adductor with the dorsal condyle acting as the fulcrum. The anterior adductor muscle is able to open the valves because it has moved to an external position. The mantle, which extends dorsally between the anterior part of the two valves and out over the outside, lays down a layer of nacreous shell upon which the anterior adductors insert. This flap of shell is the "umbonal reflection."

The foot is large, cylindrical and quite muscular. The principal point of insertion of the foot muscle is on the apophysis, a special rib-like extension of the valve which curves down under the umbo (Fig 5). The foot extends anteriorly and ventrally through a large pedal gape, and adheres to the rounded base of the burrow with a suction grip. On the anterior ventral edge of the valves, sharp, toothlike projections are deposited periodically, a new set with each period of shell deposition. These rasp the bottom of the burrow and are the main boring tool. The foot serves to push or pull the animal a short distance up and down the burrow, and also to rotate it. MacGinitie (1935) observed the boring movements of Zirfaea by placing them in test tubes or jars of clay in the laboratory. He observed that the rasping teeth are pressed against the burrow during the down stroke. This action is accomplished by contraction of two large muscles, the anterior adductor which spreads the ventral edge of the valves and the posterior adductor which spreads the beaks (Fig 5 upper). During the upward movement the valve edges are removed from contact with the sides of the burrow by contraction of the small accessory anterior adductor and the small ventral adductor (Fig 5 lower). Ross (1859) made essentially the same observations on the boring activity of Pholas.

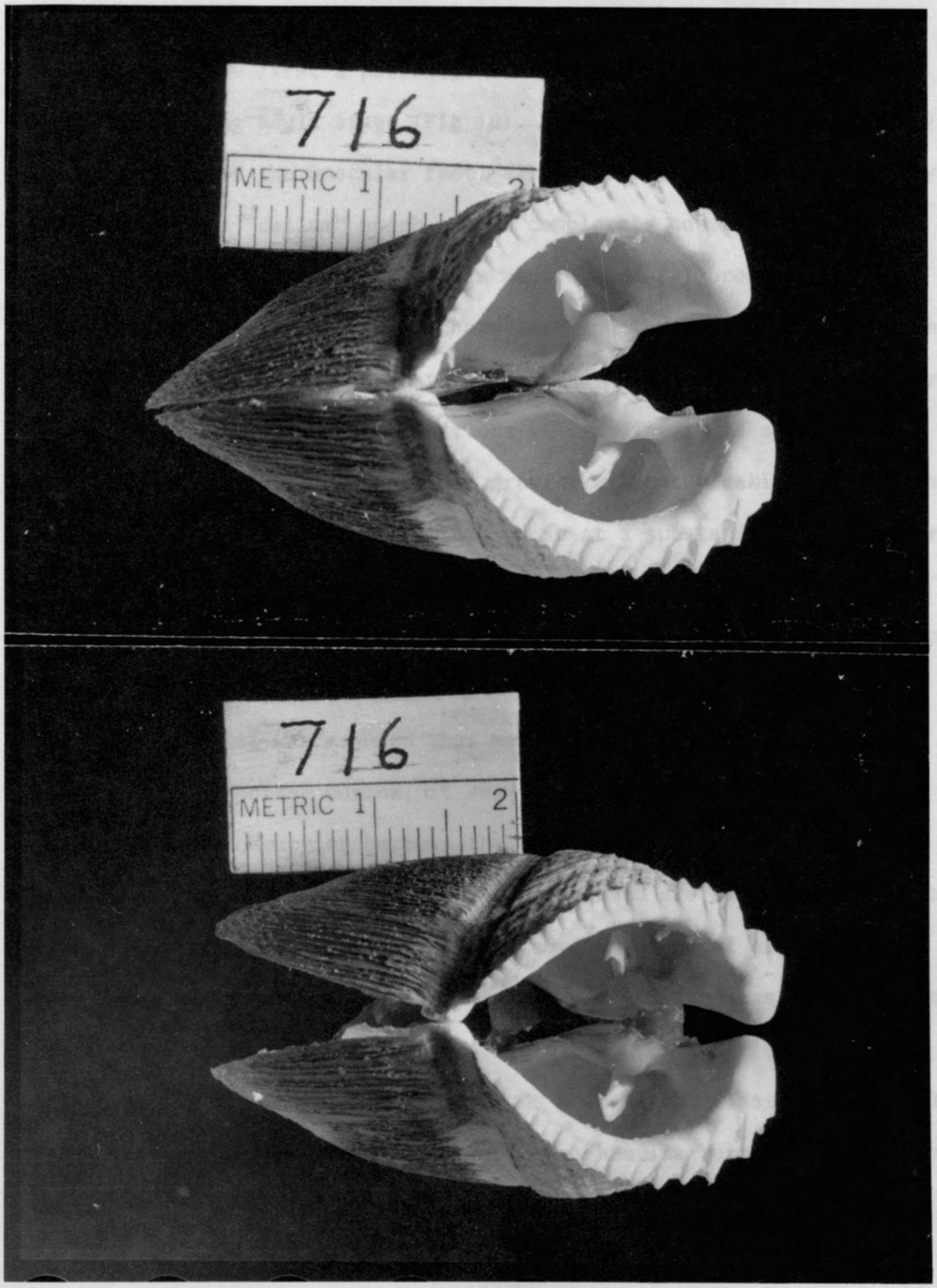
FIGURE 5

Upper

Ventral view of valves showing position when posterior adductor muscle is contracted.

Lower

Ventral view of valves showing position when accessory anterior adductor muscle is contracted.


716
METRIC 1 2
716
METRIC 1 2

The life cycle of P. penita after settlement is divided into two distinct stages: first a period of active boring (Fig 5, 12) followed by the non-boring adult stage (Fig 10). The metamorphosis involves (1) the resorption of the muscular foot, (2) the deposition of an accessory shell plate, the "callum" which almost completely covers the anterior gape and the dorsal extension of the mantle, and (3) production of a pair of chitinous flaps, the "siphonoplax", on the posterior ends of the valves. Animals which reach mature size and metamorphose spontaneously are called "adults". Under conditions of crowding it is sometimes impossible for the animal to continue growing without breaking into neighboring burrows; these animals metamorphose at a substandard size and are known as "stenomorphs" (Bartsch 1923).

Two criteria were used to differentiate adult clams from stenomorphs. If the base of the burrow of a metamorphosed animal was within 1 mm of another burrow, it was assumed that metamorphosis was induced by the proximity of the other burrow, it was therefore classified as a stenomorph. Animals occupying burrows the bases of which are further than 1 mm from other burrows, and which have metamorphosed are assumed to have done so spontaneously and are classified as adults. A total of 180 animals from Fossil Point were classified in this way and the size distribution of actives, stenomorphs and adults were plotted on a percentage basis (Fig 6). The largest stenomorphs should probably be classified as adults since the proximity of their burrows to neighboring burrows may be coincidental.

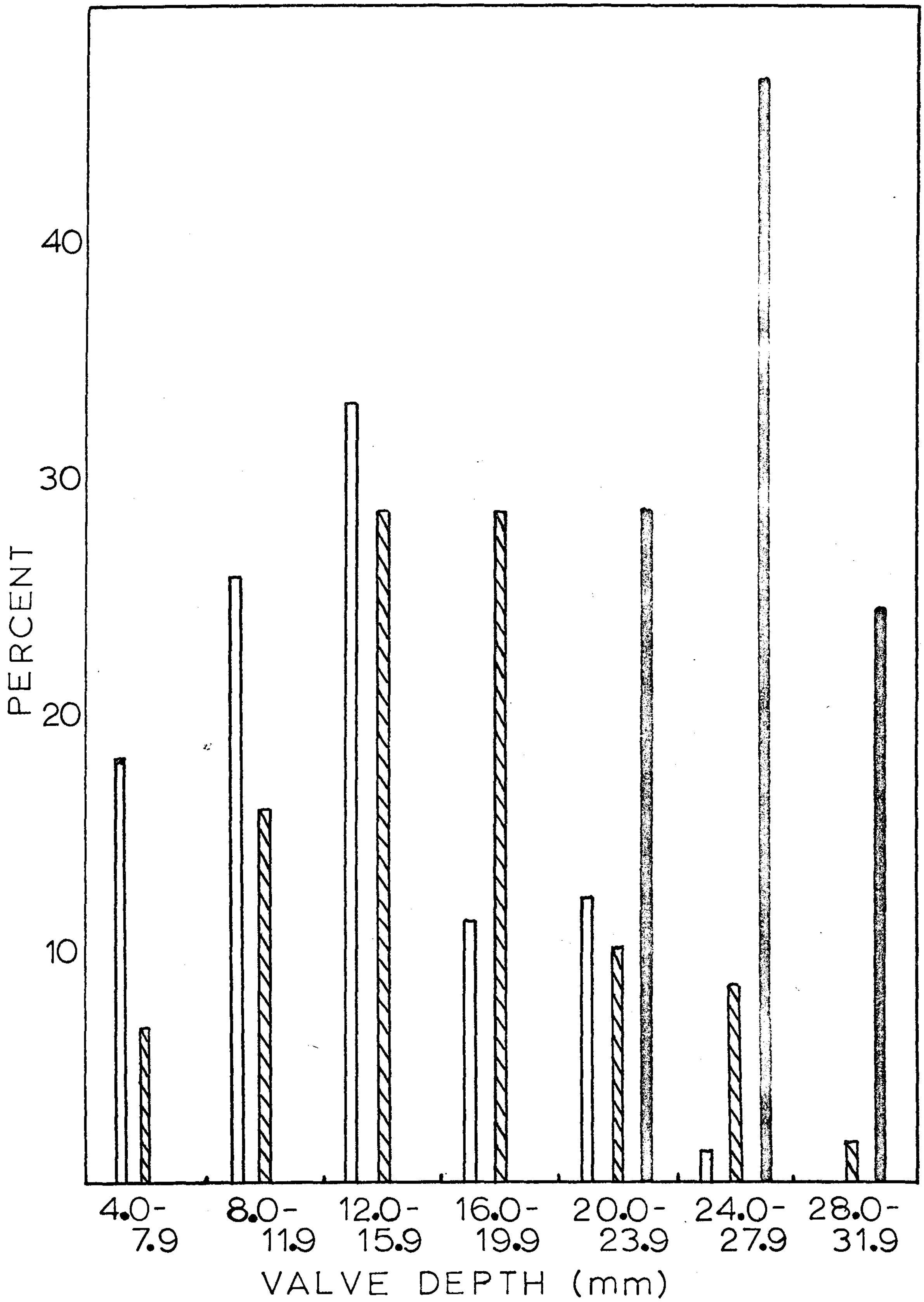
FIGURE 6

Size distribution of *Penitella penita* from old undisturbed rock at Fossil Point.

Active

Stenomorph

Adult


40
30
PERCENT
20
10
4.0-
7.9
8.0-
11.9
12.0-
15.9
16.0-
19.9
20.0-
23.9
24.0-
27.9
28.0-
31.9
VALVE DEPTH (mm)

If only the valves are available for study, it is assumed that any metamorphosed animal above 25 mm in depth is adult and that those below 20 mm in depth are stenomorphs.

Substrates inhabited by Pholadidae

The members of the family Pholadidae are all obligatory borers. Different members of the family have definite preferences for certain types of substrate. *Martesia* and *Xylophaga* are restricted mainly to wood. *Zirfaea* prefers salt marsh peat and stiff mud, whereas *Penitella* and *Parapholas* bore into much harder shales and sandstones (Turner 1954). Rock borers prefer homogeneous substrates and avoid conglomerates containing hard fragments (Amemiya and Ohsima 1933; Kofoid 1927; Hunter 1949).

General description of burrow

Pholad burrows are conical in shape with a small entrance and a rounded bottom (Fig 14, 15). The burrow is relatively straight in uncrowded situations, but crowding may cause it to twist considerably (Fig 32). Settling occurs on both horizontal and vertical surfaces. The burrows orient more or less perpendicularly to the surface, with some tendency to slope downwards in horizontal burrows.

Sexual cycle

Sexual activity within the family Pholadidae is extremely variable. Larviparous and oviparous forms are known (Bouchard-Chantreaux 1879, Duval 1963b). Dioecious, protandric hermaphrodites and alternating hermaphrodites have been described by Nagabhushanam (1962a), Ganapati and Nagabhushanam (1953, 1955), Moore (1947), Pelseneer (1926), Sigerfoos (1895) and Duval (1963b). Spawning may occur throughout most of the year or at specific times of rising or falling water temperatures (Duval 1963b, Ganapati and Nagabhushanam 1955, Moore 1947).

Period of maximum settlement

Nothing seems to be known concerning the settlement season of *P. penita* or any other pholad except *M. striata*, which settles throughout the year in Indian waters, with a maximum from March to June and a minimum in October (Nagabhushanam 1962b).

Factors affecting settlement

Thorson (1946) observed that *Zirfaea crispata* larvae are able to delay metamorphosis if a proper substratum is not available. Nagabhushanam, in a series of studies on factors influencing settling in *Martesia striata*, *Teredo* and *Bankia*, has shown: (1) *Martesia* shows a gregarious behavior since it settles three times more densely on previously settled boards than on controls (Nagabhushanam 1959a), (2) *Martesia* and *Teredo* settle 10 times more densely on wood blocks covered with a primary film (undefined) than on blocks lacking this film (Nagabhushanam 1959b), (3) settlement of *Teredo*, *Bankia* and *Martesia* was inhibited by the accumulation of fouling material. Infestation was 10 times heavier on panels that were kept scraped clean (Nagabhushanam 1960), (4) *Martesia* settled in all light ranges except total darkness. It preferred to settle on the underside of horizontal surfaces and less on more vertical surfaces (Nagabhushanam 1959c).

Growth rate

Only two studies have been made on the growth rates of rock-boring pholads. MacGinitie and MacGinitie (1949) calculated (method unknown) that *P. penita* could bore a burrow 1 inch in diameter and 5 to 6 inches deep in 5 or 6 years, and Prié (1884) claimed that *Pholas dactylus* can bore at the rate of about 4 inches in 5-1/2 years. These observations are relatively meaningless because no measure of substrate hardness is given. Turner (1954) states that the growth rate in pholads varies greatly and depends largely upon hardness of the substrate and the amount of crowding.

OBSERVATIONS AND RESULTS

Morphological variations as related to age

Numerous variations in morphological and dimensional features of the valves can be related to changes in age and variations in certain environmental factors, the chief of which appears to be rock hardness.

Change in ratio: length to depth as size increases

Huxley (1932, p. 4) gives log Y = log b + K log X as the formula for allometry. Any variables conforming to this formula will fall along a straight line if plotted on a double logarithmic grid.

The lengths and depths of valves of 150 active *P. penita* from Fossil Point were plotted on a double logarithmic grid (Fig 7).

A test for linearity suggests that the allometric relationship holds as a first approximation ($P < 0.05$). However, from the data, the hypothesis that a straight line adequately represents the relation between the variables must be rejected if a criterion of significance greater than 95% is applied. The valves of newly settled animals (Fig 21) are nearly round, while large *P. penita* from Fossil Point (Fig 12, top) are slightly more than twice as long as they are deep. Most young animals approach this latter shape rather earlier than they would if the change in shape was truly allometric.

Change in ratio:valve length to depth with metamorphosis

When active animals stop boring and metamorphose, the ratio:valve length to depth increases owing to an elongation of the posterior end of the valve.

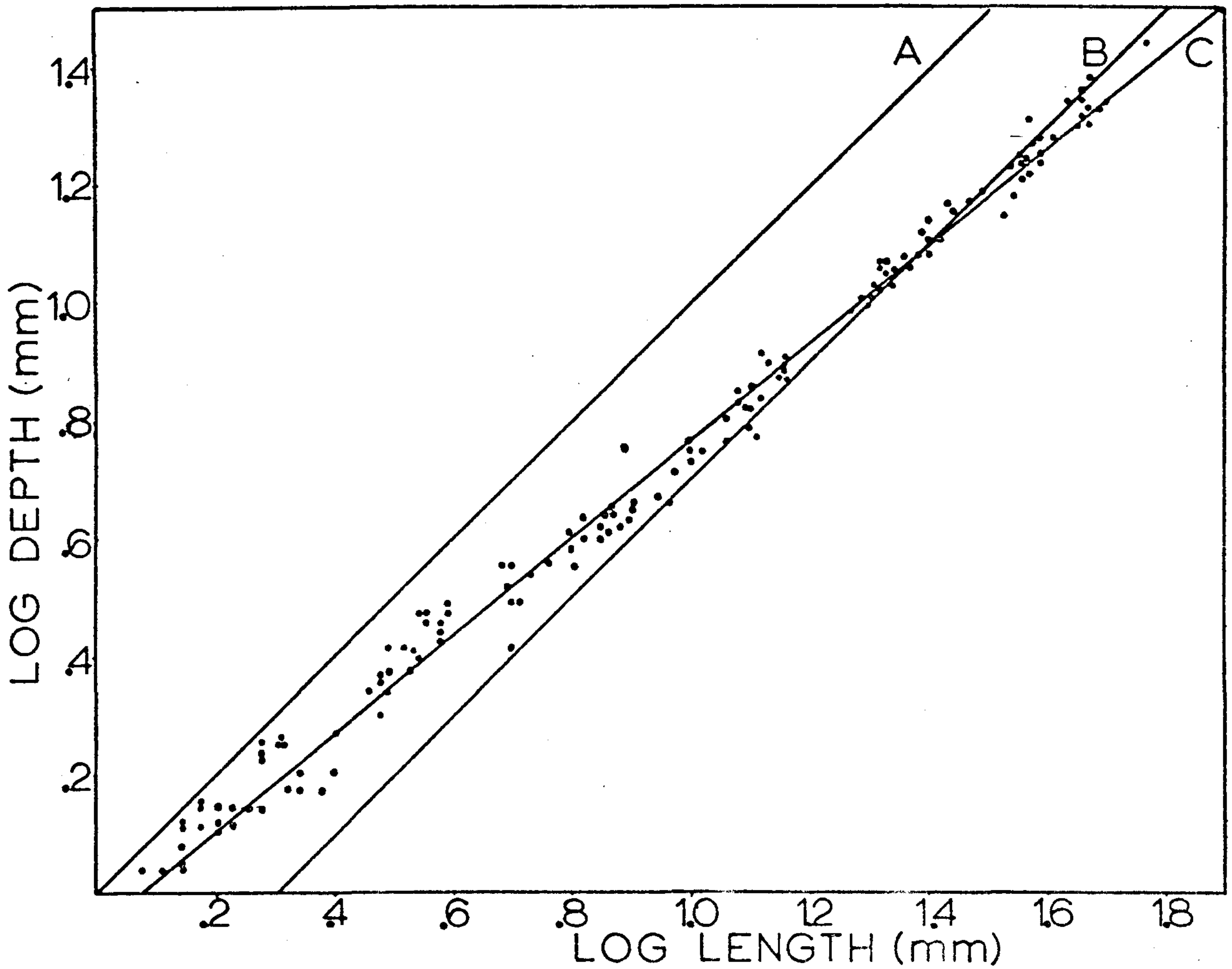
FIGURE 7

Valve depth and length of active Penitella penita from Fossil Point plotted to show allometric change in valve shape with growth.

Line A = 1:1 ratio

Line B = 2:1 ratio

Line C = Regression line


LOG DEPTH (mm)
.2
.4
.6
.8
1.0
1.2
1.4
LOG LENGTH (mm)
.2
.4
.6
.8
1.0
1.2
1.4
1.6
1.8
A
B
C

Valve length and depth in populations of actives, adults, and stenomorphs from Fossil Point were compared by analysis of covariance. This showed that one line is insufficient for all observations ($P<0.01$). The slopes, however, are not significantly different (Fig 8). Thus valve shape varies significantly between these groups, active animals being shorter for a given depth.

Shell deposition during adult period

Clapp (1925) stated that stenomorphic teredos which cannot grow because of crowding continue to lay down denticulated ridges and increase valve thickness. This observation raised the question of whether shell deposition in pholads continues after metamorphosis.

Three hypotheses must be considered before the question can be answered: first, that metamorphosis is irreversible and that once the animal becomes adult it cannot grow or bore further into the rock; second, that burrow shape is fairly constant in any particular rock type; and third, that erosion is wearing away the surface rock at a rate fast enough to shorten significantly the burrow of an animal during its adult life. Evidence for these hypotheses will be presented later. If they are true, the relative age of an adult can be estimated by comparing the size of the animal with the length of its burrow. The smaller this ratio, the greater the amount of erosion which has taken place and therefore the longer the animal has been a nonboring adult.

FIGURE 8

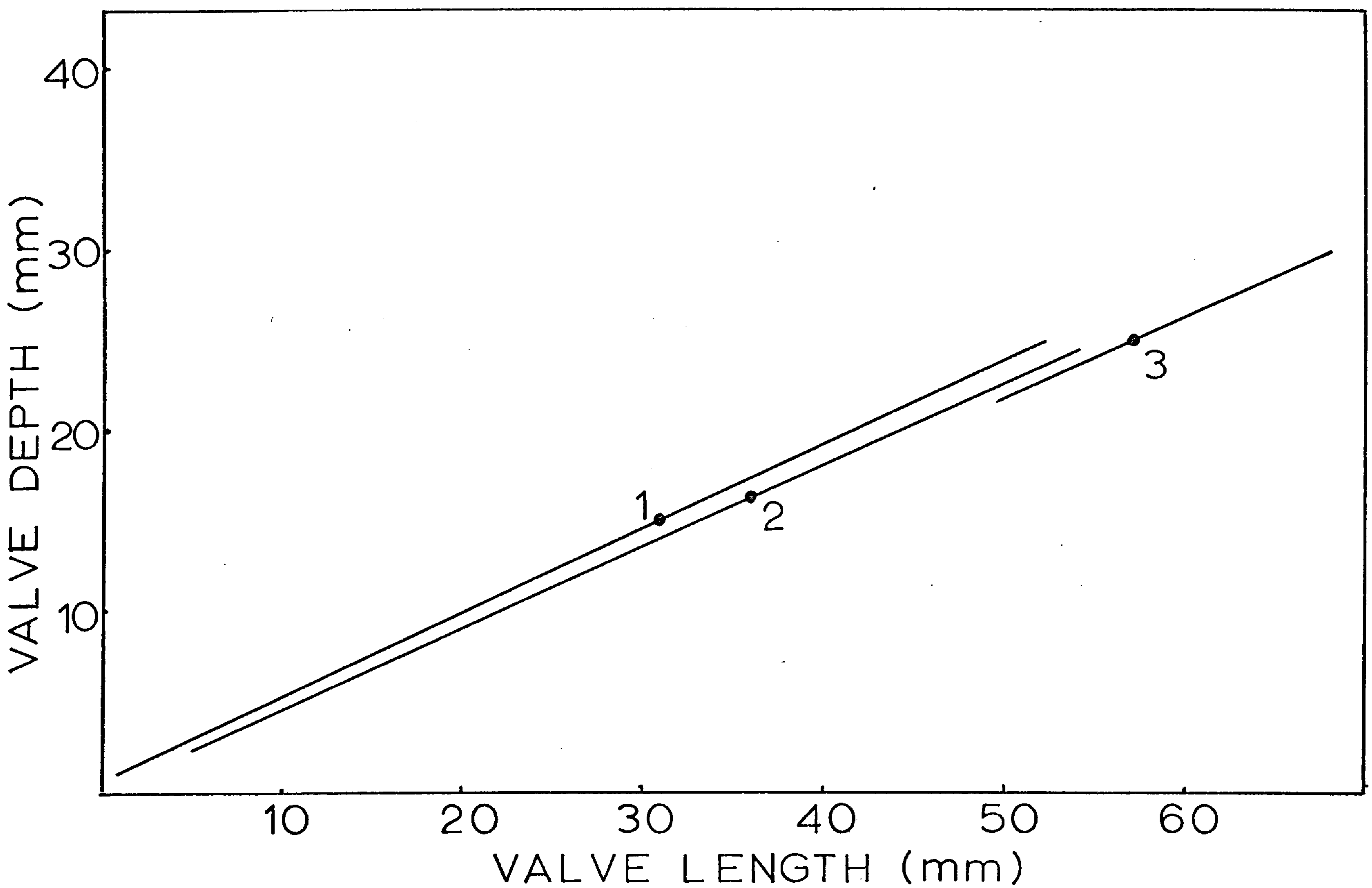
Change of valve shape of <u>Penitella penita</u> from Fossil Point as related to condition of animal.

Regression line 1 = Active

Regression line 2 = Stenomorph

Regression line 3 = Adult

—●— indicates mean value of each ratio, the length of the line indicates approximately the size range of each class.


VALVE DEPTH (mm)
40
30
20
10
VALVE LENGTH (mm)
10
20
30
40
50
60
1
2
3

A population of 55 adult animals, all measuring more than 50 mm in length, was divided into three categories according to burrow length. Sixteen animals had short burrows with a ratio:burrow length to valve depth between 2.5 and 3.99, twenty-five had medium length burrows with a ratio:4.0 to 5.49, and fourteen had long burrows with a ratio:5.5 to 6.99.

If shell deposition continues after metamorphosis, then the valve weight of animals with short burrows should be greater than the valve weight of animals of equivalent size with long burrows.

Valve depth and valve weight of animals with long and short burrows were compared by analysis of covariance (Fig 9). One regression line was inadequate ($P<0.05$). Since older animals from short burrows are significantly heavier than younger animals from long burrows, it follows that $CaCO_3$ is deposited during the adult period.

Morphological variations induced by substrate differences

Johnston (1850) observed that *Pholas dactylus* from soft sandstone have thin valves whereas those from hard rock have thick irregular valves. Purchon (1955) indicated that those species of Pholadidae that bore in hard rock develop more robust valves than those inhabiting soft rock.

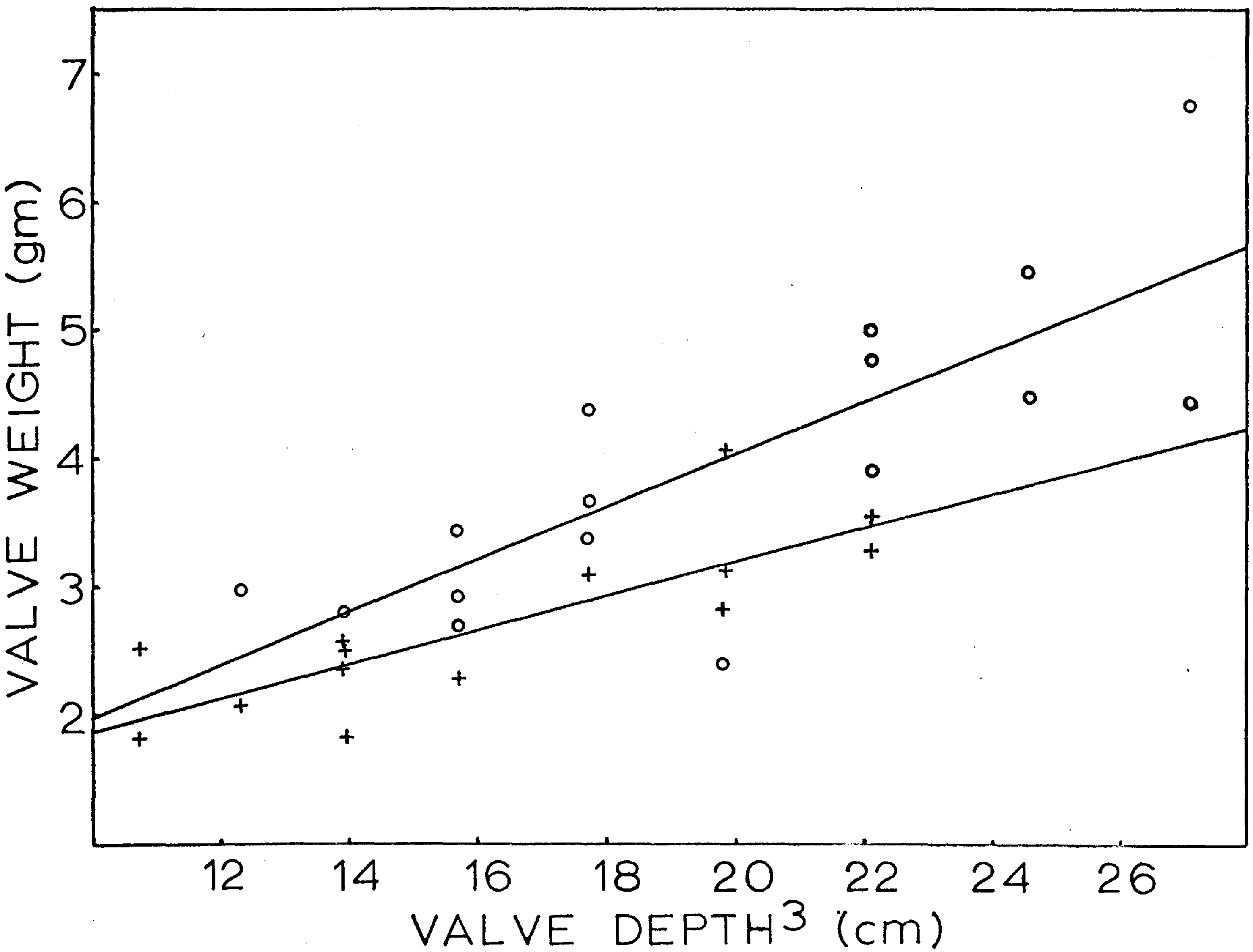
Duval (1963) in her study of *Petricola pholadiformis* concluded that greater variation in the ratio of valve length to breadth occurred among animals taken from the least suitable habitats, i.e. rock too hard (chalk) or too soft (like plasticine).

Turner (1954, 1955) noted the relationship between substrate hardness and valve morphology and growth rate. In the cases of *Penitella*

FIGURE 9

Shell deposition during adult period.

Valve weight and valve depth of adult <u>Penitella penita</u> are plotted to compare those from long burrows +++ (burrow length : valve depth = 5.5 to 6.9) and those from short burrows ooo (burrow length : valve depth = 2.5 to 3.99).



7
6
5
4
3
2
VALVE WEIGHT (gm)
12
14
16
18
20
22
24
26
VALVE DEPTH3 (cm)

penita and Zirfaea crispata, she noted that the valves of animals from softer substrates are thinner, more elongate, and show evidence of more rapid growth (wider spacing of the growth bands) than those of animals from hard substrates.

In this study populations of P. penita were collected from three different locations, and the morphological variations were analyzed. Although environmental differences may exist between these three areas, it is theorized that the morphological differences observed are principally induced by differences in rock hardness (Table 1).

Kofoid (1927) studied Teredo from three areas in San Francisco Bay and attempted to relate the morphological variations to observed environmental differences such as salinity and temperature variations. Although certain morphological variations could be related to these environmental differences, he found that, for the population as a whole, the variations within groups were greater than the variations between groups. Significant differences in salinity, and temperature variations did not cause significant differences in Teredo morphology. I took no measurements of temperature or salinity variations, but have assumed, rightly or wrongly, that their effect on valve morphology is insignificant.

Valve size of adults as related to rock hardness

Populations of adult P. penita from Fossil Point, South Jetty and Cape Blanco were compared by analysis of variance. The means of valve depth were different in the three populations ($P < 0.01$). P. penita spontaneously becomes adult at a small size in the softest rock at Fossil

Point and at progressively larger sizes in South Jetty and Cape Blanco rock. (Table 2, Fig 10).

Valve shape as related to rock hardness

The relationships of valve length to depth in active animals from the three areas were compared by analysis of covariance (Fig 11). Animals more than 15 mm in length were used, so that the picture would not be confused by the allometric shape changes that were seen in smaller animals. *P. penita* from the soft Fossil Point rock were longer ($P < 0.01$) at any given depth than animals from the harder rock of South Jetty and these in turn were longer than those from the hardest rock from Cape Blanco (Fig 12). For example, active animals from Fossil Point, South Jetty and Cape Blanco, each with a depth of 20 mm, will have an average length of 42 mm, 35 mm, and 29 mm, respectively. It is also of interest that the slopes of the three lines were different ($P < 0.01$).

Valve weight as related to rock hardness

The relationships between valve size and weight in active animals from the three areas were compared by analysis of covariance. Because shape changes so radically in different rocks, valve profile (length x depth) was used as an indication of animal size rather than valve depth or length.

Animals from the soft Fossil Point rock were lighter in weight ($P < 0.01$) than those from South Jetty, which were in turn lighter than those from Cape Blanco. The slopes of these three lines were different ($P < 0.01$) (Fig 13).

TABLE 2

Relation between rock hardness and adult size

Area	Fossil Point	South Jetty	Cape Blanco
Relative rock hardness	1	2	4
Mean valve depth of adult *P. penita*	25.5mm	32.5mm	40.0mm
SE	0.368mm	0.579mm	0.766mm
N	48	48	30

FIGURE 10

Shows average sized adult *Penitella penita* from Fossil Point, South Jetty, Cape Blanco. (Top to bottom) scale 1.6 x.

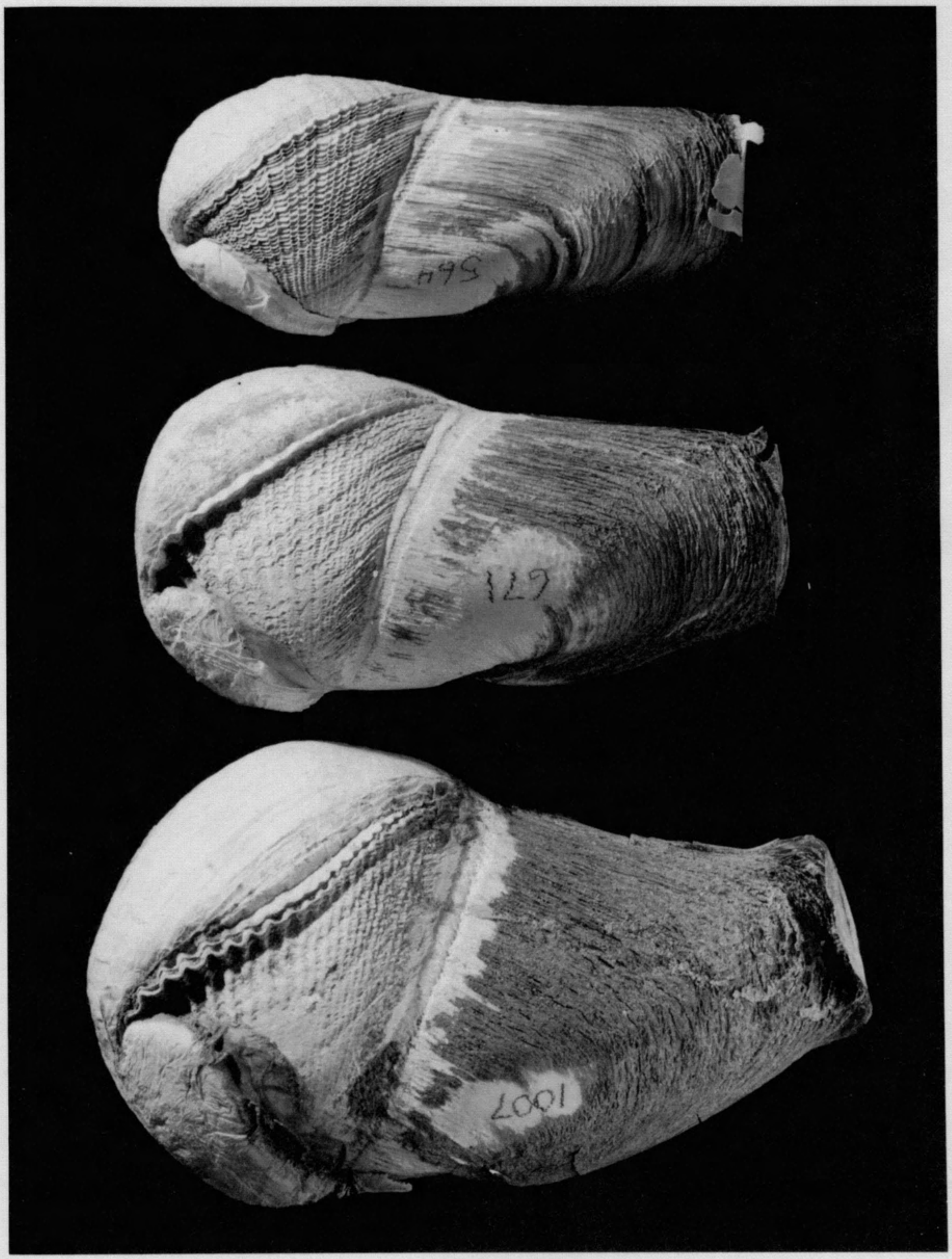

564
671
1007

FIGURE 11

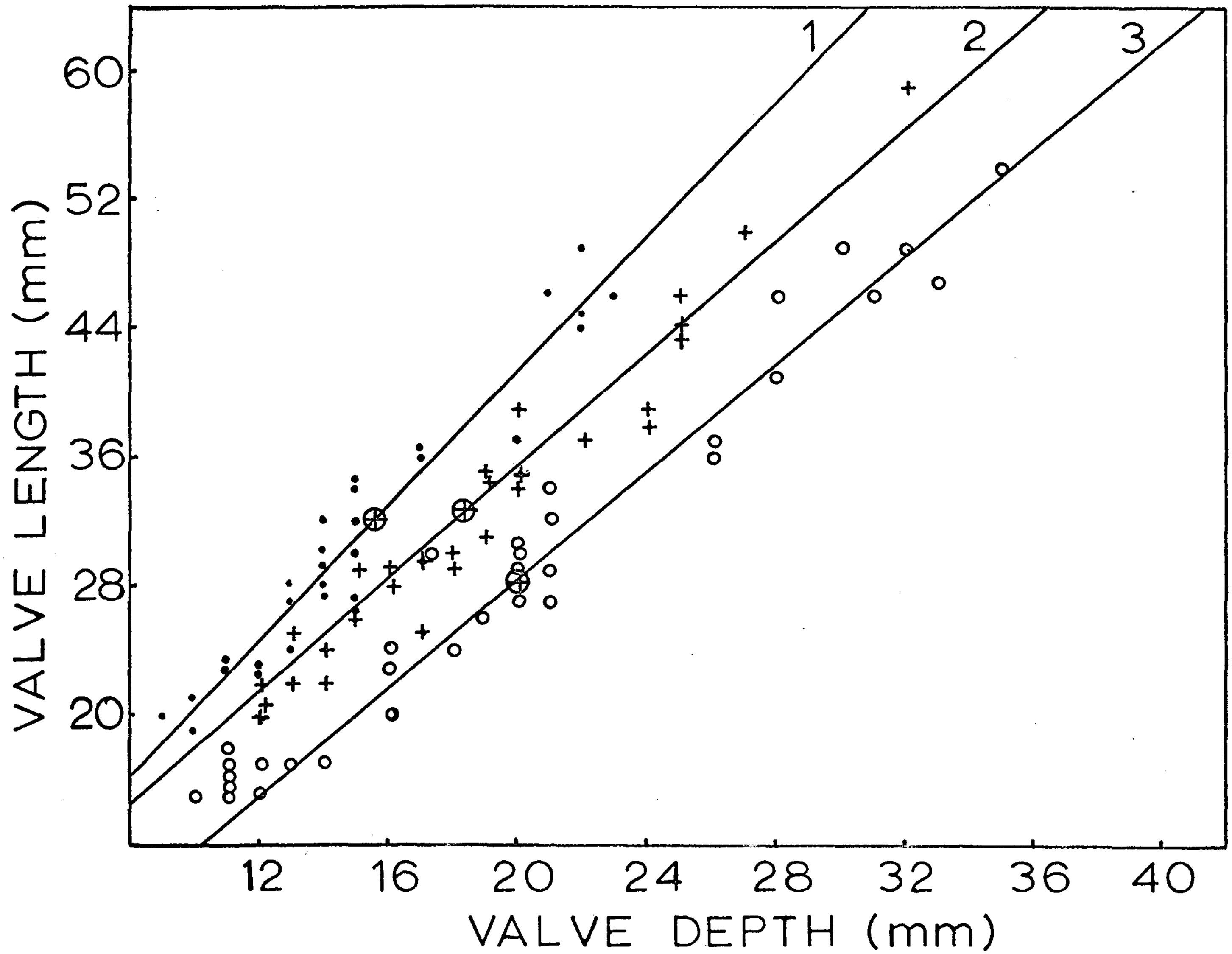
Relationship of valve length to valve depth of active animals from different areas.

Fossil Point (. . . . regression line 1)

South Jetty (+ + + + regression line 2)

Cape Blanco (o o o o regression line 3)

⊕ indicates mean values.


1
2
3
60
52
44
36
28
20
12
16
20
24
28
32
36
40
VALVE LENGTH (mm)
VALVE DEPTH (mm)

0252

FIGURE 12

Valves of active *Penitella penita*.

Top - Fossil Point animal

Middle - South Jetty animal

Bottom - Cape Blanco animal

Compare shape and width of growth lines.

Scale 2.5 x

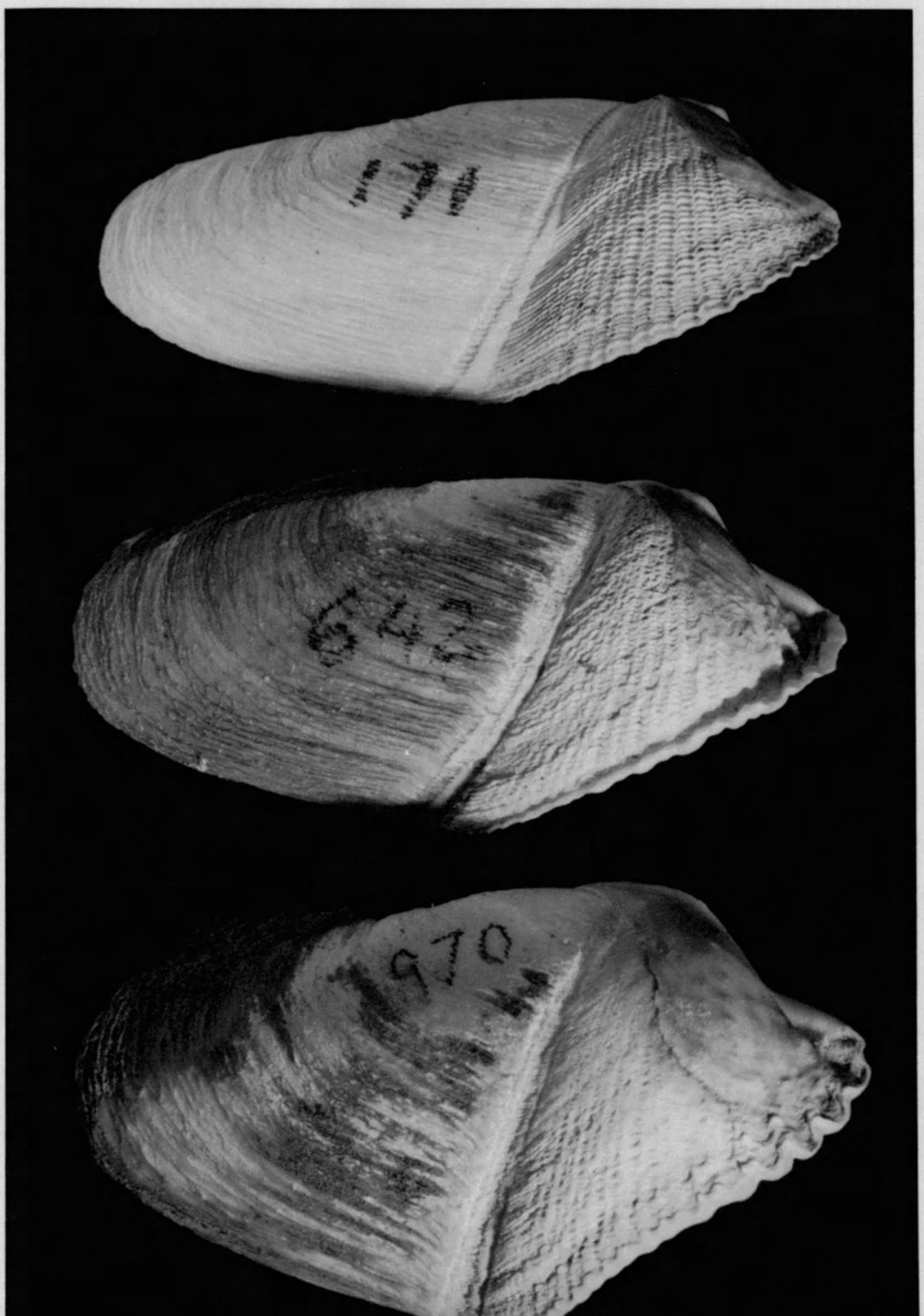

642
1970

FIGURE 13

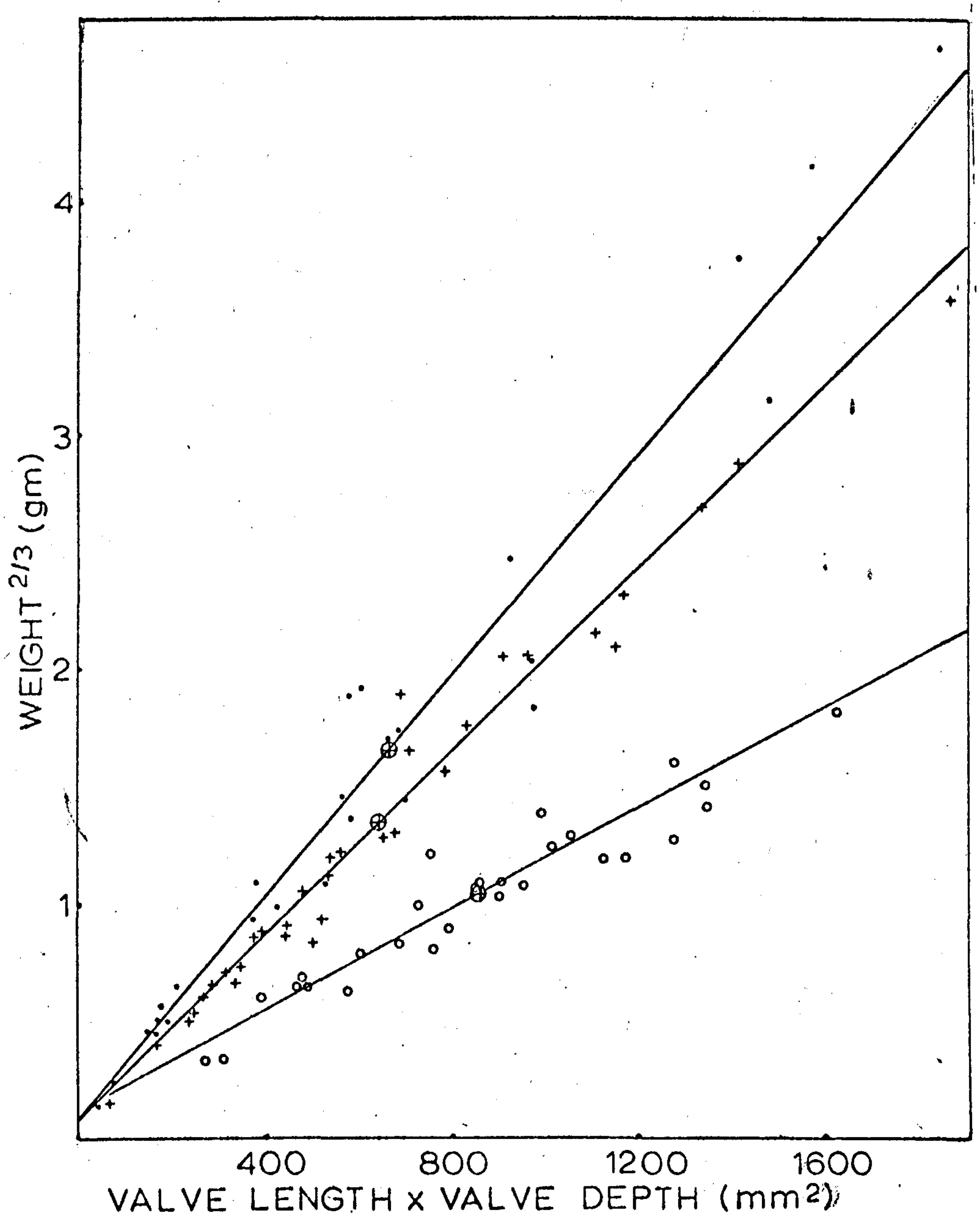
Relationship between weight of the valves and rock hardness. All animals are active Penitella penita.

.. Animals from Cape Blanco relative rock hardness = 4

++ Animals from South Jetty relative rock hardness = 2

oo Animals from Fossil Point relative rock hardness = 1

⊕ Average values



WEIGHT 2/3 (gm)
1
2
3
4
400
800
1200
1600
VALVE LENGTH x VALVE DEPTH (mm2)

Analysis of burrow shape

As *Penitella penita* bores into the rock it leaves behind a record of its movements. From an analysis of the shape of a number of burrows in the three major areas of study, certain inferences can be drawn about the factors that influence burrow shape and about the activity of the enclosed animal.

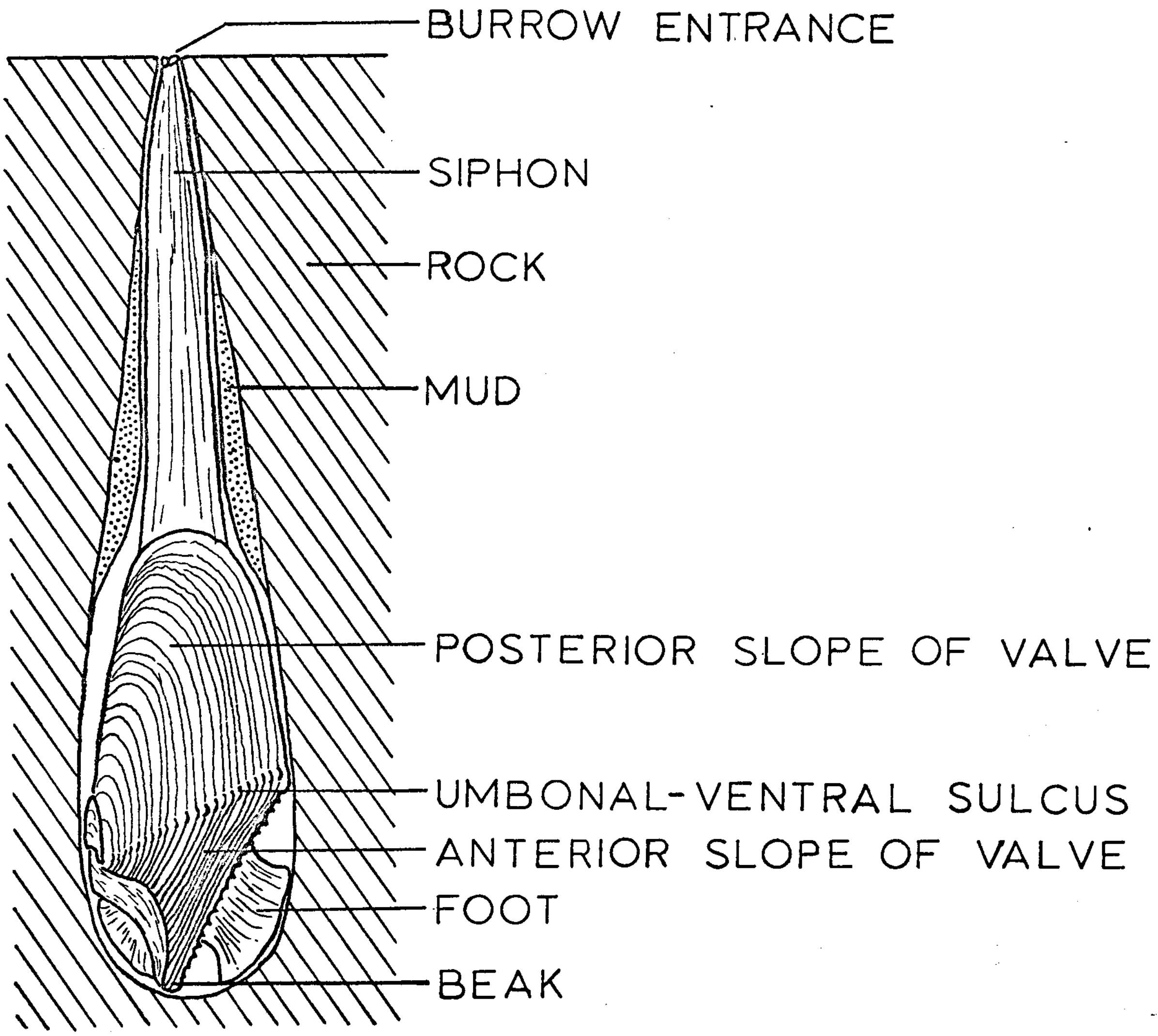
The method of constructing accurate molds of the burrows, and the measurements taken from these molds have already been described. It should be noted that the shape of a burrow occupied by the living animal differs from that of the burrow that was bored by the animal. This difference is due to mud being deposited along the wall of the burrow, mostly in the region just posterior to the valves (Fig 14). This mud appears to be plastered to the wall of the burrow by mucus from the siphon. It was cleaned out by pouring sodium hypocholorite solution into the freshly opened burrow. This dissolved the adhesive mucus, allowing the mud to fall away from the burrow wall.

Although the burrows may twist, they are essentially conical in shape, with a small entrance and large rounded bottom. The shape of this cone can best be described by calculating the apex angle. For more precision the angles of the upper and lower half were computed separately. Comparison of these two measurements was useful in clarifying some of the processes controlling burrow shape.

The angle of the apex cone is calculated by the formula $\tan \emptyset =$ (maximum diameter - minimum diameter)/(2 x length). The angle equals 1/2 the apex angle of the cone. By taking the middle diameter, $\tan \emptyset$

FIGURE 14

Diagram of Penitella penita in burrow, showing mud which is plastered onto the walls just posterior to the valves.


BURROW ENTRANCE
SIPHON
ROCK
MUD
POSTERIOR SLOPE OF VALVE
UMBONAL-VENTRAL SULCUS
ANTERIOR SLOPE OF VALVE
FOOT
BEAK

can be calculated for the upper and lower half of the burrow. (Within the ranges used, there is a sufficiently linear relationship between Ø and tan Ø that tan Ø will not be transformed to Ø).

Basic burrow shape

The basic burrow is that resulting from a young active animal boring into uncrowded rock. This shape depends to a large extent on the hardness of the substrate. Erosion, crowding and action of the siphon impose secondary modifications on this basic shape.

At the beginning of this study, I postulated that the basic burrow had a perfectly conical shape (Fig 15a). This means that the ratio of tan Ø lower half of burrow to tan Ø upper half of burrow equals 1. The actual basic burrow of Fossil Point animals was described from a study of burrows of 18 young active animals (19 months maximum) growing in uncrowded conditions. The ratio of tan Ø lower half of burrow to tan Ø upper half of burrow was 0.737, SE = 0.0477. This difference from the expected value is due to two departures from the perfect cone: the angle decreases near the base of the burrow, and the angle, in burrows of young animals, is excessive in the first centimeter (Fig 15b). The larger angle at the entrance appears related to the shorter more tumid shape of the very small animals (Fig 21).

Effect of substrate hardness on burrow angle

The tan Ø of burrows from the three study areas were compared by analysis of variance (Table 3). The means of the three populations were different ($P<0.01$). In harder rock the angle is larger (Fig 16). The

FIGURE 15

A. Theoretical burrow showing measurements made on burrow molds.

B. Actual shape of a burrow occupied by a young active animal in uncrowded rock.

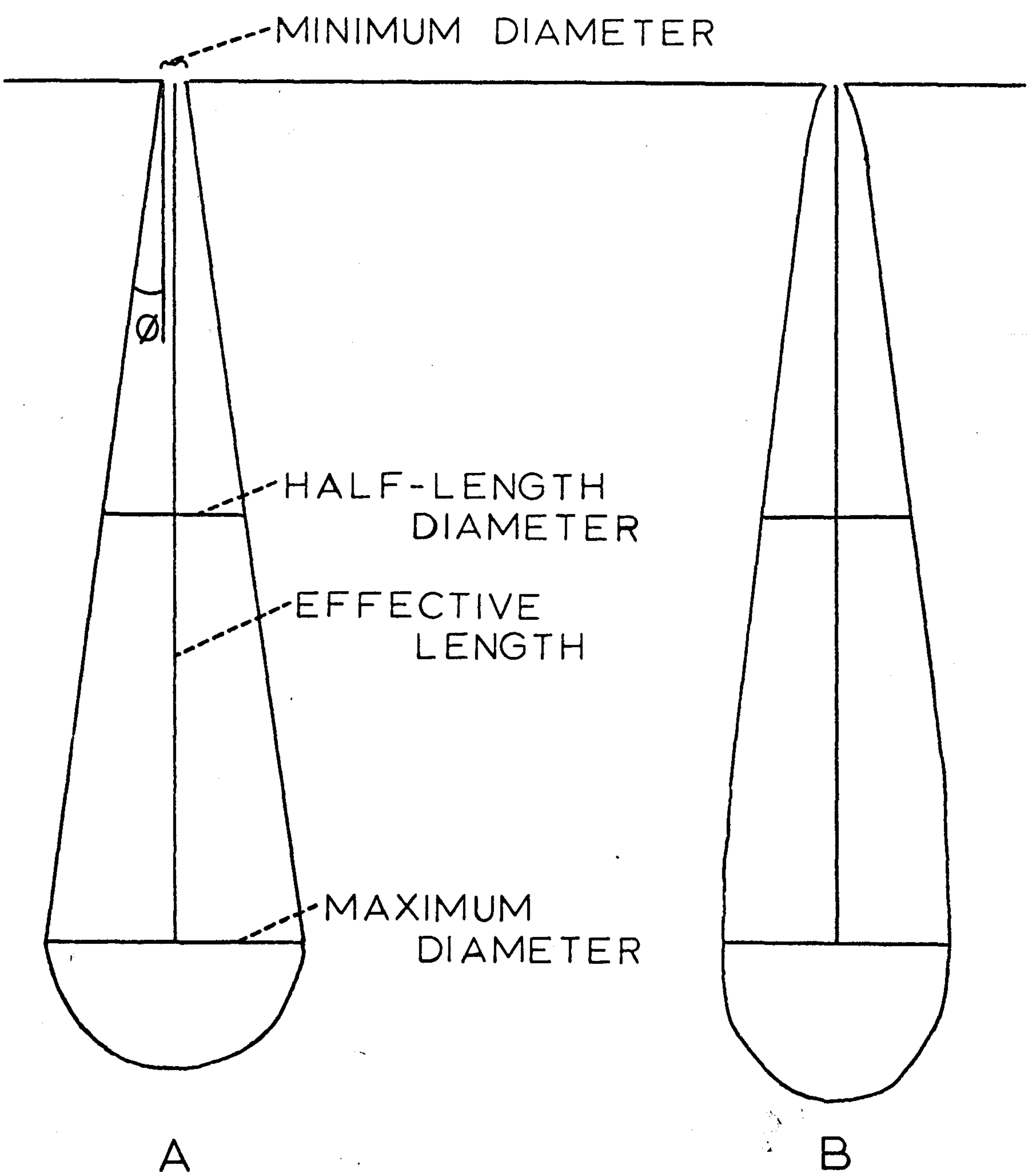

MINIMUM DIAMETER
Ø
HALF-LENGTH DIAMETER
EFFECTIVE LENGTH
MAXIMUM DIAMETER
A
B

TABLE 3

Relation between rock hardness and burrow angle

	Fossil Point Crowded	Fossil Point 19-month animals	South Jetty	Cape Blanco
Rock Hardness adjusted scale	1	1	2	4
Average tan Ø	0.091	0.098	0.148	0.207
SE	0.012	0.0035	0.020	0.021
N	51	17	18	17

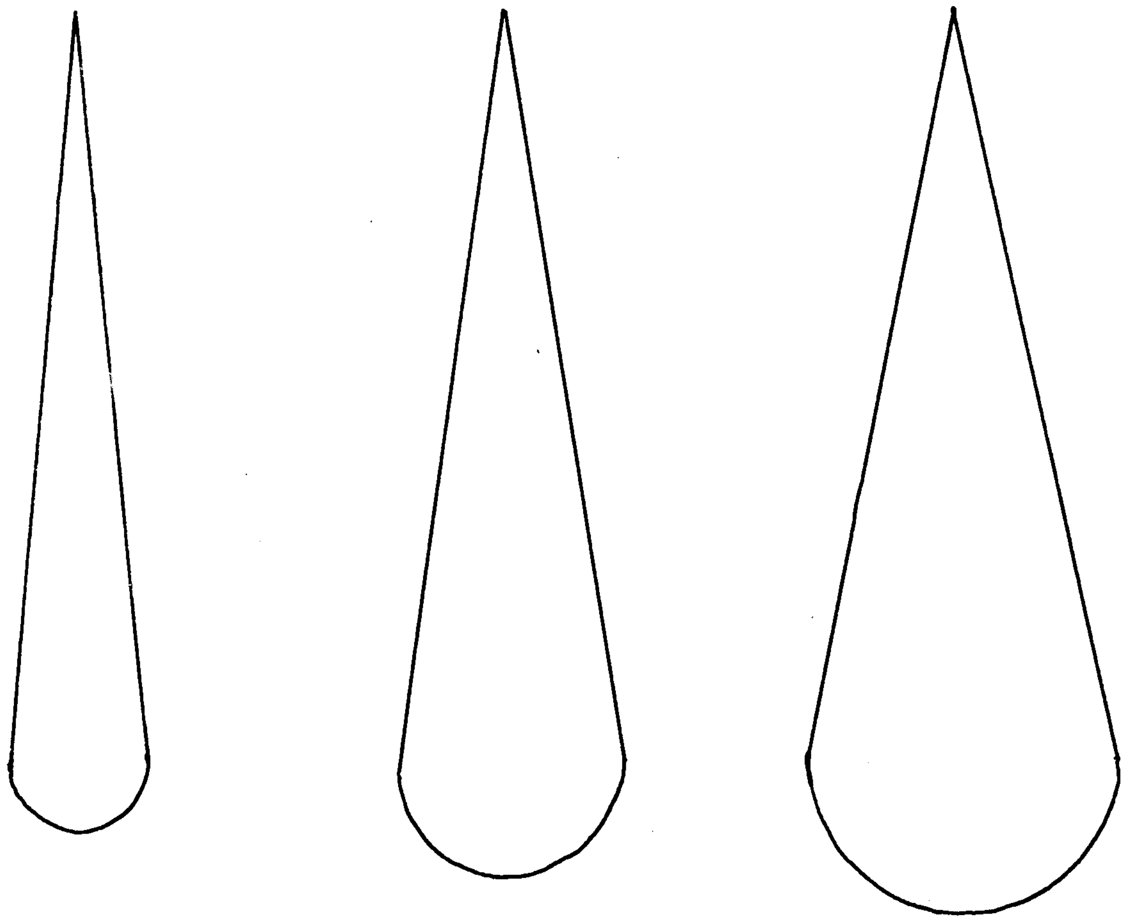
FIGURE 16

Model burrows. Tan Ø same as in table 3.

A = Fossil Point

B = South Jetty

C = Cape Blanco



A B C

reason for this is not completely understood, but appears to be related to the shorter more tumid shape of animals in harder rock.

Effect of crowding on burrow shape

Because of their ability to avoid obstructing burrows, animals in crowded situations usually have twisted burrows. It sometimes happens that an animal is hemmed in by parallel burrows, and in these cases the burrow may elongate without increase in diameter, thus decreasing tan $\emptyset$ in this part of the burrow. Evidence for this was obtained when the ratio: effective burrow length to valve depth was compared from crowded and uncrowded Fossil Point rock (Table 4). This shows that for equivalent-sized active animals, the burrows in crowded rock are, on the average, longer than those from uncrowded rock. Notice also that the SE is twice as great in the crowded rock, which points out the fact that for any given animal in crowded rock, conditions might be either cramped or uncrowded. As a result a random sample of burrows from crowded rock in Table 4 gives a lower average ratio than could be obtained by choosing only animals from cramped conditions. In extreme crowding, the animals are hemmed in from all sides and no further boring is possible without their breaking into another burrow. This causes metamorphosis regardless of animal size. This is the cause of stenomorph formation.

Enlargement of the entrance diameter with growth and age

The entrance diameter of the burrow of a pholad must be enlarged as the animal grows, so that there is sufficient room for the siphon to emerge. The opening must be large enough to allow the clam to circulate sufficient sea water for survival and growth.

TABLE 4

Burrow shape of active animals

	Fossil Point Crowded	Fossil Point 19-month animals	South Jetty	Cape Blanco
Mean valve depth	14.5	12.2		
Mean ratio: Effective burrow length/ valve depth	4.5	4.1	3.6	1.9
SE of ratio	.31	.15	.21	.09
N	16	17	7	6

The fact that the entrance does enlarge with age is easily established. The original entrance diameter measures about 0.5 mm, the diameter of the newly settled clam. The average entrance diameter of 17 pholads, not more than 19 months old, was 2.8 mm (SE = 0.15 mm).

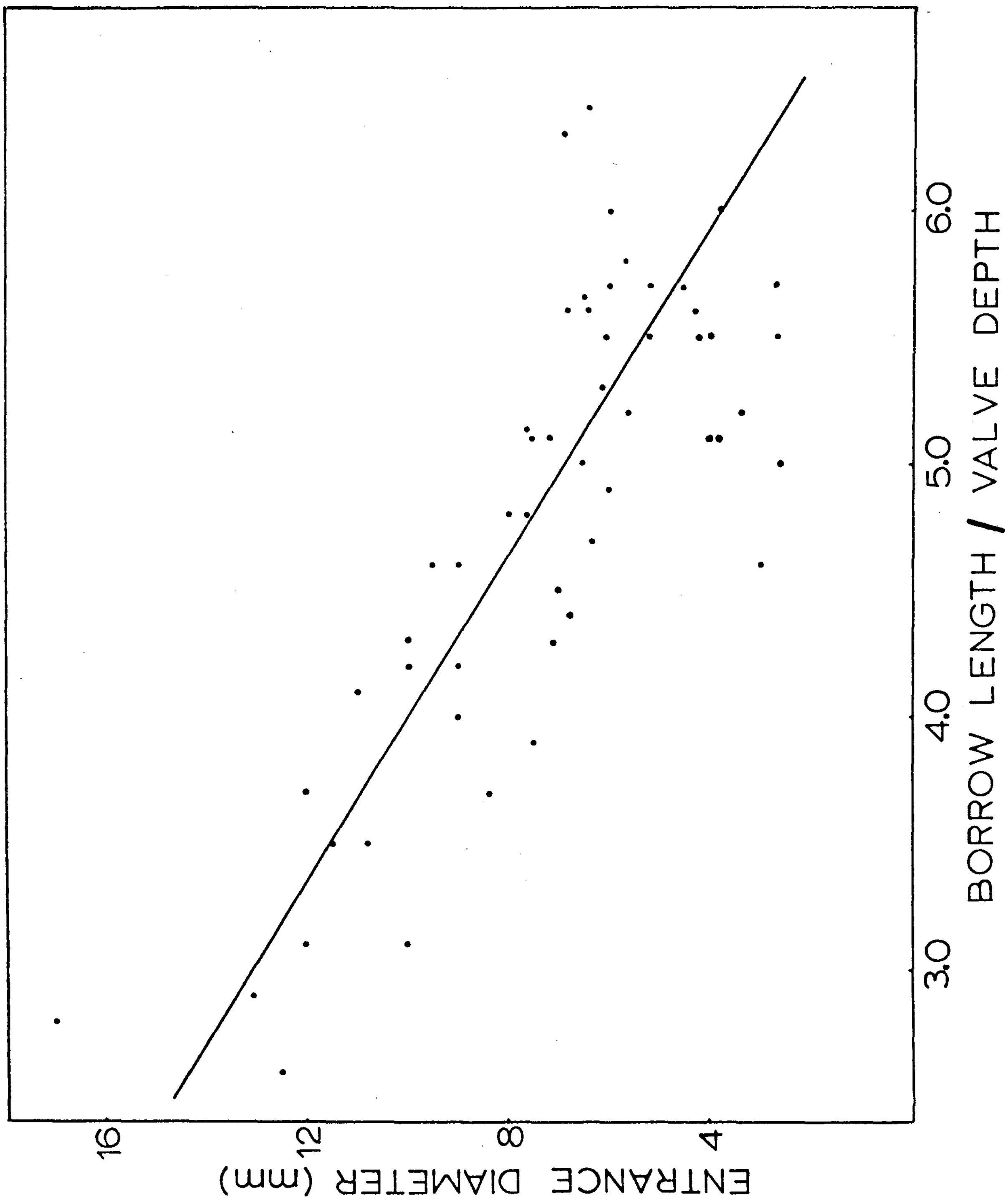
Russell and Yonge (1936) suggested that the entrances of pholad burrows are enlarged by some chemical activity of the siphon. It is unlikely that the animals at Fossil Point enlarge their entrance in this way because of the argillaceous nature of the matrix. Two other processes appear to account for entrance enlargement: mechanical abrasion by the siphon and the shortening of the burrow by erosion.

Erosion, by removing surface rock, truncates the burrow and thereby enlarges the entrance diameter. This is illustrated graphically by plotting entrance diameter of adult animals against the ratio of valve depth to burrow length. A negative regression line results (Fig 17). Animals with relatively long burrows have smaller burrow entrances than those with relatively short burrows.

The effect of mechanical abrasion by the siphon would be to enlarge the entrance diameter without concurrent shortening of the burrow. As noted previously during the first 19 months of life in the rock the opening of the burrow increased in diameter by about 2.3 mm. The approximate rate of surface erosion of the surrounding rock, due to physical factors, can be estimated. Stainless steel screws were placed in the rock, flush with the surface, at the time that the rock was originally exposed in August 1963. Two years later, the height that the screws were raised above the surface was measured. The average amount of erosion

FIGURE 17

Relationship between the relative burrow length of adult *Penitella penita* from Fossil Point and the burrow entrance diameter.


ENTRANCE DIAMETER (mm)
16
12
8
4
BORROW LENGTH / VALVE DEPTH
3.0
4.0
5.0
6.0

was 1.00 mm (SE = 0.24 mm, N = 19). This means that erosion by truncating the burrows cannot account for the increase in size of the burrow openings. Most of this increase must be due to the mechanical abrasive action of the siphon.

Relationship of size and condition of animal to burrow length

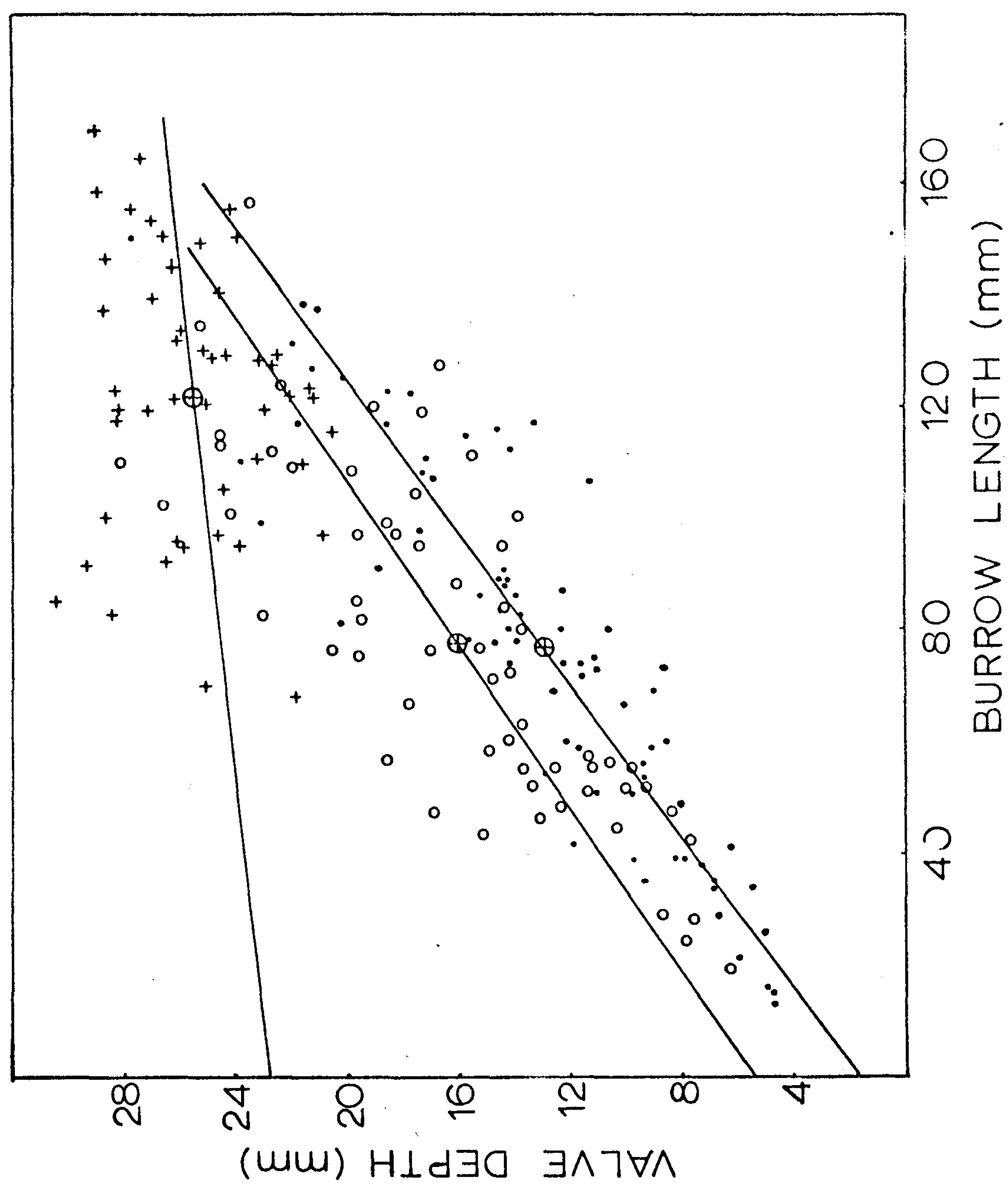
When valve depth is plotted against total burrow length (Fig 18), an interesting difference between the regression lines for actives, stenomorphs and adults, becomes apparent. Active animals, since they must bore deeper into the rock in order to grow, show a close direct correlation between valve depth and burrow length. By contrast, no such relationship holds for the adults. The burrows of these animals are shorter than expected in active animals of the same size, and there is considerable variation in burrow length for any particular size; the slope of the regression line is almost zero. This reduction in burrow length is due to various erosive forces which wear away the surface rock, thus shortening the burrow. Although erosion acts to shorten all of the burrows, its effect is most noticeable in non-boring adults because the burrow is not simultaneously being elongated. Old adults are more likely to have short burrows than young adults. The fact that the valves of adults in short burrows are heavier than those of adults in long burrows (Fig 9) also supports the contention that the former are older.

The life expectancy of adult pholads is not known. It is limited by the time it will take for erosion to shorten the burrow to such an extent that it becomes untenable. Animals probably become more subject to predation as the burrow becomes progressively shorter. Very few

FIGURE 18

Relationship between burrow length and size and condition of the animal. All _Penitella penita_ from Fossil Point.

- • Active animal
- + Stenomorphs
- O Adults


VALVE DEPTH (mm)
28
24
20
16
12
8
4
BURROW LENGTH (mm)
40
80
120
160

animals at Fossil Point have burrows shorter than three times the valve depth. However, at Coos Head, live, adult animals can be found whose valves are protruding from the surface of the rock. Starfish, which are common in the former but not the latter area, may prey on pholads with shortened burrows, though they have never been observed to do so.

The burrows of stenomorphs are also shorter than could be expected in active animals. A correlation does exist between burrow length and valve depth, but it is not as precise as with active animals. The regression line nearly parallels that of the actives. It should be noted that these animals were defined as stenomorphs because of the proximity of their burrow base to another burrow. It is more than likely that most of the stenomorphs 24 mm or larger changed spontaneously and therefore should be classified as adults.

Growth studies

Knowledge of the growth rate and the factors controlling growth rate is basic to the understanding of the autecology of any organism. Haskin (1954) described three standard methods of estimating growth rate of mollusks; interpretation of growth interruption lines on the valves, size frequency analysis for year classes, and release and recovery of marked individuals.

The first method was not useful initially, in the case of *P. penita*, because the time interval between growth interruption lines was not known. However, the replant studies and growth band counts of 1-year-old animals gave some indication of the time factor, and rough calculations of the time interval required to reach mature size were made on animals from the three areas (Table 6).

Year classes cannot be identified because the growth rate of individuals is variable, being controlled by crowding and rock hardness, and because the settlement period is very extended.

A modified mark and recapture procedure, the "replant method," was developed for calculating the growth rate of individuals under specific conditions (replant experiments).

Most of the aging and growth rate studies on marine wood boring mollusks have relied on the use of test boards exposed for known periods of time, after which the boards were collected and the animals removed and measured. Instead of boards, freshly cleared areas of rock on the edge of the lower bench at Fossil Point were used. Analysis of the size distribution of populations of young clams collected from these rock surfaces yielded data on growth rates. The advantages of this method are that conditions are close to natural, the complicating effect of crowding is not important, and growth rates of early stages can be calculated.

The problems of estimating growth rates of borers by this method were discussed by Kofoid (1927) in his work on *Teredo*. I quote from page 231.

> The average individual rate of boring under a given set of conditions is difficult to determine because of the practical impossibility of knowing accurately the time at which any specimen had entered the wood. As attachment of larvae occurs over a considerable period of time, individuals of varying sizes and ages occur together in the same timber. To include the smaller specimens in the calculations involves the error of the differential time element; while to consider only the largest specimens does not give a fair average.

In this study, each age sample was divided into five subgroups with respect to size. The mean for each quintile was calculated and a family of curves was plotted (Fig 19). Bias is introduced here because a greater proportion of large than of small animals is recovered. The upper quintile, containing the largest animals, is assumed to be made up of animals which settled soon after August 10, 1963, the date of the original exposure. The lowest curve probably represents recent settling. The three intermediate quintiles represent a mixture in varying proportions, of animals that settled soon after the original exposure and those that settled subsequently. The upper limits of the growth rate curve are obtained from the first quintile. However, the lower limits are obscured by subsequent settlement. It appears that the growth rate starts to decrease after 10 months. The low value observed between 10 and 12 months is probably due to a combination of decreased growth rate during this period and sampling error from variability of the settling sites.

If growth rate remains relatively constant, the age at which animals reach adult size at Fossil Point can be calculated by extrapolating from results during the first 21 months for the upper quintile. On this basis, animals reach adult size after 34 to 40 months of growth.

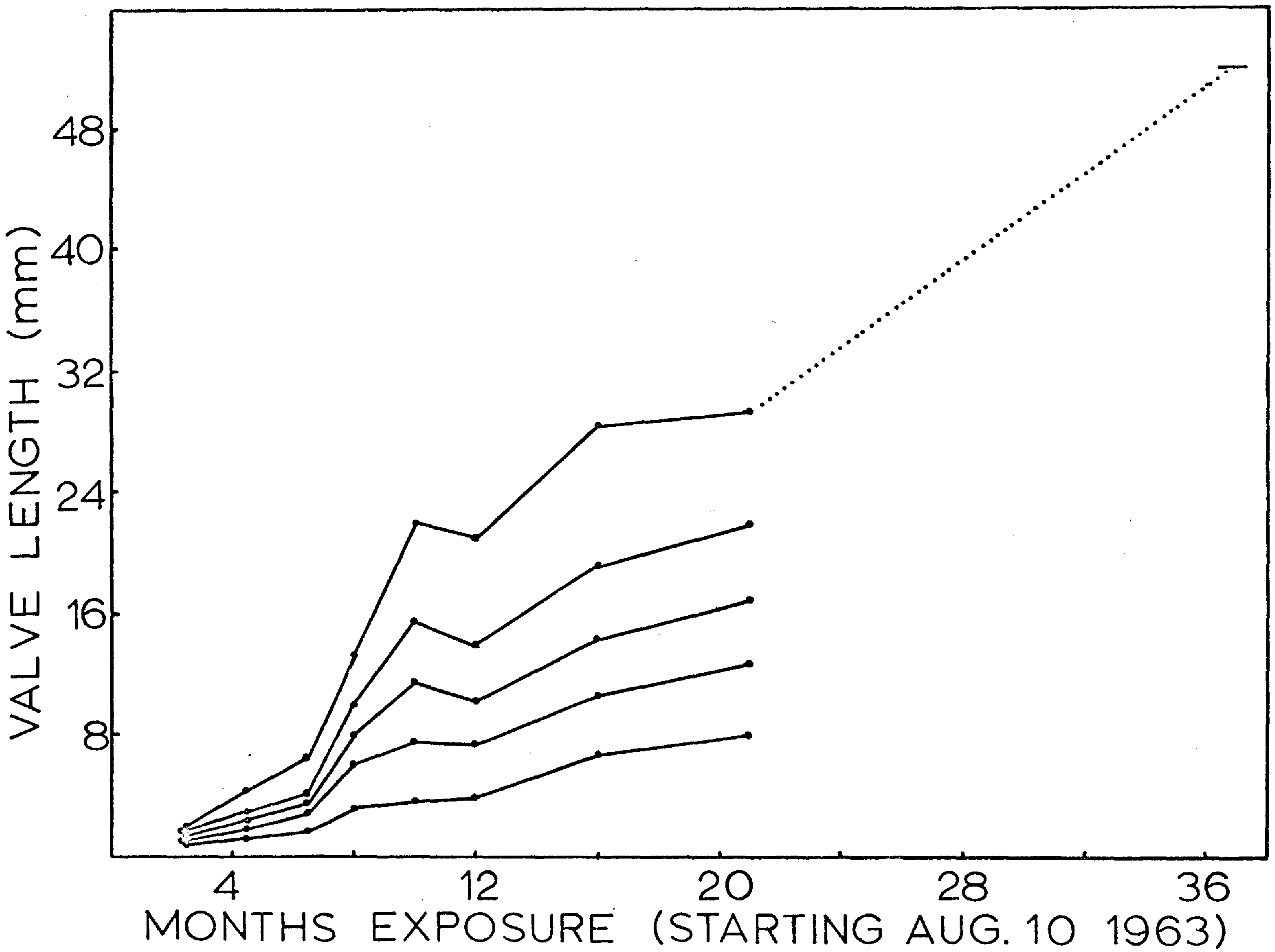
Calculations based on growth band counts (Table 6) give results somewhat less than this (average 30 months). Extrapolations of data from the replant experiments indicate that Fossil Point *P. penita* may become adult in as little as 28 months, but on the average within 36 months.

FIGURE 19

Growth rate of young Penitella penita at Fossil Point.

Each sample was divided according to size, into five equal quintiles, the mean value of each quintile is plotted.

The dotted line is an approximate extrapolation of the upper quintile to show expected age at adult size.


VALVE LENGTH (mm)
48
40
32
24
16
8
4
12
20
28
36
MONTHS EXPOSURE (STARTING AUG. 10 1963)

Growth bands

Growth interruption lines represent periods of growth stoppage preceded and followed by periods of growth. Haskin (1954) discussed the use of growth interruption lines for estimating growth rate. He stated that this was an unreliable method unless the interval between growth interruption lines was established by analysis of growth rates of marked animals. He also claims that growth checks can be caused by a number of normal and abnormal environmental factors. Only if the growth checks occur at regular intervals, can growth interruption lines be used for ageing or for calculation of growth rates. In this study the term "growth band" will be used to indicate the layer of shell between two growth interruption lines. In the Pholadidae a growth band probably represents a cyclic period of shell deposition followed by active boring. During the period of shell deposition, the mantle extends beyond the margins of the valves and deposits a new layer of shell. In the region of the pedal gape it extends laterally to deposit the sharp grinding teeth. During this time there is probably no boring activity. This period of quiescence is followed by a period of active boring; there is probably no shell deposition during this time. Nothing is known about the relative length of the active and quiescent periods.

Effect of animal size on width of growth bands

The number of growth bands per cm of umbonal ventral sulcus varies with the size of the animal when the bands were deposited. The number of growth bands in the first cm averaged almost twice as many as those in the fourth cm (Table 5). In any one animal there are places where growth bands are wide, followed by areas where they are narrow. No regular pattern could be observed that would indicate yearly cycles.

Duration of growth cycle

Lindsay (1913) suggested that the formation of growth lines on the valves of rock-boring mollusks may have some relation to tidal or lunar periods, thus affording a means of ascertaining the age of animals and the speed of boring. Some of the data collected during this study supported this hypothesis, whereas other data did not.

The total number of growth bands of 10 young animals, close to but not exceeding 1 year of age, were counted. The mean value was 59.3, SE = 2.19, indicating that a new growth band is deposited on the average, every 6.2 days during the first year.

A count of the growth bands of a 2.5 month animal (Fig 21) indicates that the maximum interval between deposition of growth bands is 7.5 days.

The number of growth bands deposited per year decreases with increased age. Under good conditions active animals between 1 and 2 years of age deposited between 18 and 28 (mean 21) growth bands when replanted for nearly a year at both Fossil Point and South Jetty (Fig 29). One *Penitella turnerae* hung in a test tube at Fossil Point for 8 weeks deposited 4 growth bands. Older animals therefore can deposit a growth band every 14 days, possibly corresponding to a lunar period. Under disturbed or unfavorable conditions the formation of growth bands is inhibited for short or extended periods of time. Evidence for this was obtained from the results of the replant experiments. Animals in row 7 of the

TABLE 5

Counts of growth bands of specimens from three rock types (only the first 4 cm of umbonal ventral sulcus are considered)

Area		1st cm	2nd cm	3rd cm	4th cm	Total of first 4 cm
Fossil Pt. (N = 13)	Average no. of Growth Bands	35.8	26.6	18.5	14.2	95.2
	SE	1.09	1.02	1.10	0.57	2.55
South Jetty (N = 14)	Average no. of Growth Bands	34.8	39.1	32.0	22.9	128.7
	SE	1.67	1.54	1.11	0.62	3.12
Cape Blanco (N = 7)	Average no. of Growth Bands	120.6	92.6	81.7	70.0	364.3
	SE	7.93	8.43	13.46	11.02	37.24

upper bench survived 5 months of sand burial, but deposited no new growth bands during the burial period. The few animals (over 18 mm depth) which survived replanting in burrows with 3 mm entrance diameters grew little (Fig 28) and deposited few growth bands (Fig 29).

Effect of substrate hardness on width of growth bands and growth rates

The growth rate of *P. penita*, which inhabits snug burrows of its own manufacture, is intimately related to its boring rate, since only by enlargement of the burrow during the period of active boring can it increase the size of the valve. The question arises, is the growth rate limited primarily by the animal's ability to enlarge its burrow or by other factors? In order to answer this question, we must know the width of growth bands deposited by animals when they were not under confinement and compare this value with the width of growth bands deposited by animals under natural conditions.

Width of growth bands deposited under unconfined conditions

The average width of 16 growth bands which were deposited by 4 *P. penita* while they were suspended in test tubes at Fossil Point was 0.93 mm SE 0.043.

Some of the South Jetty animals were replanted in too large artificial burrows. The growth bands deposited immediately after replanting were abnormally wide, averaging about 1 mm in width. When the animal again filled its burrow, the width of the growth bands fell to normal (Fig 20). The width of the growth bands deposited under unconfined conditions depends on unmeasured and unknown factors.

Growth Band width measured in ventral umbonal sulcus.

FIGURE 20

Penitella penita replant animal from South Jetty. The wide growth bands were deposited immediately after the animal was planted in its artificial burrow which was too large for it. Once the animal grew to fill its burrow the width of the bands fell to normal.

Scale 6.8 x

Width of growth bands deposited under natural conditions

The number of growth bands in the first four cm of the umbonal ventral sulcus of animals from the three areas differed significantly ($P < 0.01$) (Table 5). The average width of the growth bands in the 4th cm of the umbonal ventral sulcus of animals from Fossil Point is 0.7 mm, from South Jetty 0.4 mm, and from Cape Blanco 0.14 mm.

When the widths of the growth bands from the naturally confined and unconfined animals are compared, it can be seen that in the soft Fossil Point rock, growth is not limited to any great extent by the boring rate. On the other hand, at South Jetty the growth rate is probably slowed down considerably (2 to 3 times) because of an inability to enlarge the burrow at a sufficiently rapid rate. On the assumption that the growth rate in unconfined conditions at Cape Blanco is about the same as at Fossil Point and South Jetty, the growth rate at Cape Blanco is greatly retarded (6 to 7 times) by the rock hardness.

Estimation of time required to reach adult size

As previously reported, approximately 26 growth bands were deposited in a year under the best conditions of the replant experiment at Fossil Point and South Jetty. This held for animals 10 mm in depth or larger. Very young animals deposit growth bands at a faster rate, averaging 60 during the first year at Fossil Point. If it is theorized that these values hold for all three areas, the growth rate and the time required for an animal to reach mature size can be calculated by the equation: (Total growth bands - 60/26= N-1 years) (Table 6).

The average number of years required to reach maturity at Fossil Point according to this estimate (30 months) is somewhat lower than other

TABLE 6

Years required to reach adult stage calculated by
(Total no. growth bands - 60 growth bands)/26 = N - 1 years

Fossil Point			South Jetty			Cape Blanco		
Valve Depth mm	Total Growth Bands	Years to Become Adult	Valve Depth mm	Total Growth Bands	Years to Become Adult	Valve Depth mm	Total Growth Bands	Years to Become Adult
28.7	119	3.3	28.1	141	4.1	41.2	488	17.5
29.5	115	3.1	32.8	186	5.8	32.7	457	16.3
26.9	91	2.2	37.4	136	3.9	45.4	443	15.7
28.6	95	2.3	31.8	170	5.2	36.5	397	14.0
26.3	88	2.1	34.5	147	4.3	41.9	430	15.2
24.6	85	2.0	40.7	200	6.4	36.3	790	29.1
28.7	97	2.4	32.9	158	4.8	28.6	522	18.8
29.1	93	2.3	33.2	173	5.3			
26.1	111	3.0	28.9	153	4.6			
29.0	102	2.6	32.3	159	4.8			
25.7	98	2.5	28.8	133	3.8			
31.1	94	2.3	31.0	159	4.8			
			34.2	168	5.2			
			32.2	177	5.5			
Average valve depth = 27.8 mm			Average valve depth = 32.8			Average valve depth = 37.5		
Average no. years to become adult = 2.5 years			Average no. years to become adult = 4.9 years			Average no. years to become adult = 18.0 years		

estimates (i.e., from young animals and replant studies, 34 to 40 months). According to this estimate, animals reach adult size at South Jetty and Cape Blanco in 4.5 and 18 years respectively. The greater amount of time required to reach adulthood is partly explained by the larger size of adults in harder rock, but mostly by the narrower growth bands.

Comparison of growth rates

If it is assumed that the interval between deposition of growth bands is constant in the three areas, the relative growth rate of medium-sized active animals can be estimated. The average numbers of growth bands in the 3rd and 4th cm of the umbonal ventral sulcus, the portion of the valve deposited by the mediun to large active animals, may be compared (Table 7). On this assumption, South Jetty animals grow 0.6 times as fast as Fossil Point animals whereas Cape Blanco animals grow only 0.2 times as fast.

Sexual cycle

Over a period of two years the visceral masses of a total of 297 adult and 91 active animals were collected and prepared for histological examination (Appendix 2).

Fossil Point was the most intensively studied area. There was good correspondence between the 1963-64 sexual cycle and the 1964-65 cycle. Likewise at any particular time of year there was good correspondence between the sexual condition of adults from Fossil Point and those from other areas along the coast.

Active animals, throughout the season, were either completely immature(i.e.,although gonad tubules were found, no gametes were present)

TABLE 7

Estimation of relative growth rate

Area	Fossil Point	South Jetty	Cape Blanco
Average no. growth bands in 3rd and 4th cm of umbonal ventral sulcus	33	55	152
Relative growth rate	33/33 = 1.0	33/55 = 0.6	33/152 = 0.2
N	13	14	7

or partially mature (i.e., although gonad tubules with active looking gametes were present they were never abundant and were widely scattered through the visceral mass). Larger active animals are more likely to have scattered gonadal tubules than small ones.

Animals in metamorphosis were usually in a partially mature condition. With few exceptions, adult animals, regardless of size, were in a fully mature condition (i.e., many large tubules filled with mature-looking gametes) from about June through November. In December, there is some evidence that spawning is taking place. Some of the females seem to be partially spawned out. Many of the males have tubules filled with degenerating sperm. By January some of the females have spawned out tubules whereas eggs in the others are irregular in shape and there is considerable cellular debris between them, indicating that they are beginning to degenerate. By February most of the animals are completely spawned out, or the unspawned gametes have been resorbed and the males are showing early signs of regeneration. In March, the gonads of adult animals are beginning to regenerate. They are about half regenerated in April and the gonads are fully regenerated by June. There is some evidence that there was partial spawning in early July 1964, since the gonads of nine animals collected on July 23 were partly regenerated.

Penitella penita is dioecious. In all of the animals examined there was no evidence of change of sex. There are significantly more males (60%) than females ($P < 0.01$).

Larval period

In a personal communication, K. W. Ockelmann, of the Marine Biological Laboratory, Helsingor, Denmark, states that he has no precise data on the length of the pelagic larval life of pholads, but that it may be rather long. Moore (1947) states that Matesia striata in Australian waters spends about one month as a plankter. If further study bears out the observation that spawning of P. penita occurs in December and January and that most settling occurs from June through August, a 6- to 8-month larval period would be indicated.

Season of maximum settlement

Rock samples exposed for 2-month periods at various times during the year were examined for newly settled pholads. The data (Table 8) are incomplete and possibly unreliable because it was very difficult to locate the newly settled animals (Fig 21), which average less than 0.5 mm in length and are buried in algae-coated rock. Further variability was introduced because exact duplication of settling site conditions could not be achieved.

At almost any time of year some settlement can be demonstrated; however, the peak period of settlement is apparently June, July, and August. The smallest newly settled animals measured approximately 0.3 mm in length and depth. These animals have already partially buried themselves in the rock surface. No animals were found unburied on the rock surface, probably because of the washing treatment that the rocks were subjected to before they were examined.

It seems probable that August marks the end of a major settlement period. Rocks exposed between August 10 and October 4, 1964, received no larval settlement. However, rocks exposed between August 13 and November 2, 1963, received the largest observed settlement. It is of

TABLE 8

Intensity of larval settling

Period of exposure begins	Period of exposure ends	Duration of exposure	Approximate surface area of rock cm^2	Total no. of animals	No. of animals per 100 cm^2	Mean length
8/10/63	11/2/63	2 1/2	1,500	105	8	1.51 mm
11/2/63	12/29/63	2	1,500	5	0.3	.68 mm
12/29/63	2/23/64	2	1,520	0	0	-------
2/23/64	4/16/64	2	2,000	20	1	0.58 mm
4/16/64	6/10/64	2	450	15	3.3	--------
8/10/64	10/4/64	2	1,000	0	0	--------
6/27/65	8/4/65	1 1/4	450	15	3.3	0.65 mm

FIGURE 21

Young *Penitella penita* in Fossil Point rock. Maximum age 2-1/2 months. Length of valve approximately 1.5 mm.

Note that approximately 15 growth bands can be counted on the shell. The animal was probably about 0.33 mm long at the time of settlement. Therefore 5 of the bands were deposited prior to, and 10 after, settlement. Hence, the maximum interval between deposition of growth bands is 7.5 days.

interest that the average size of this population was considerably greater than the average size of other 2-month samples (Table 8). This can be partly explained by the somewhat longer exposure period, by assuming that most of the settlement occurred soon after the initial exposure, and because larvae settling towards the end of a settling period are probably larger than those settling early in the settlement period (Bayne 1965).

Thorson (1946) states that success of larval settlement of sessile marine bottom animals is notably irregular. It is possible that in August 1963, settlement of *P. penita* was particularly heavy. It may be pertinent to note that settlement of the purple sea urchin, *Strongylocentrotus purpuratus*, was particularly successful in nearby Sunset Bay during the summer of 1963.

Factors affecting settling density

During the collection of samples for the study of growth rates, it was noticed that the density of animals per unit area varied considerably. Even on virtually uniform surfaces, density differences occured. No tests were made to determine if the distribution was random or clumped.

One environmental variable that seemed to be related to settlement density is light. Settlement on surfaces facing approximately southeast was compared with those facing northeast (Table 9). The former surfaces quickly developed a heavy algal coating, presumably from the greater esposure to light, whereas the latter surfaces remained relatively free of algae but supported a heavy population of *Balanus crenatus*. The density of *P. penita* was greater on the northeast barnacle-encrusted surfaces than on the algae-coated surfaces.

TABLE 9

Settlement density as related to surface direction

Area (cm^2)	N	Southeast face algae covered	Northeast face barnacle covered	Exposure time (mo.)	Animals per 100 cm^2
50	44		x	2 1/2	88.0
70	3	x		2 1/2	4.3
190	21		x	6 1/2	11.0
350	16	x		6 1/2	4.6
800	353		x	8	44.1
800	157	x		8	19.6

This indicates that conditions required by settling pholads are similar to those suitable for B. crenatus settlement. It also seems likely that either algal cover or high light intensity inhibits settlement of both barnacles and pholads. (See Nagabhushanam 1960, 1959c, Isham et al. 1951 on taxis of marine larvae.)

Interference between barnacles and newly settled pholads

A certain amount of interference occurs during, and for a short time after settling, between young pholads and barnacles. If a pholad settles close to newly settled barnacles, it runs a risk of having its entrance occluded by the laterally expanding base of the barnacle. The pholad siphon, however, appears to be able to dissolve the edge of the barnacle and thus distort its symmetry (Fig 22).

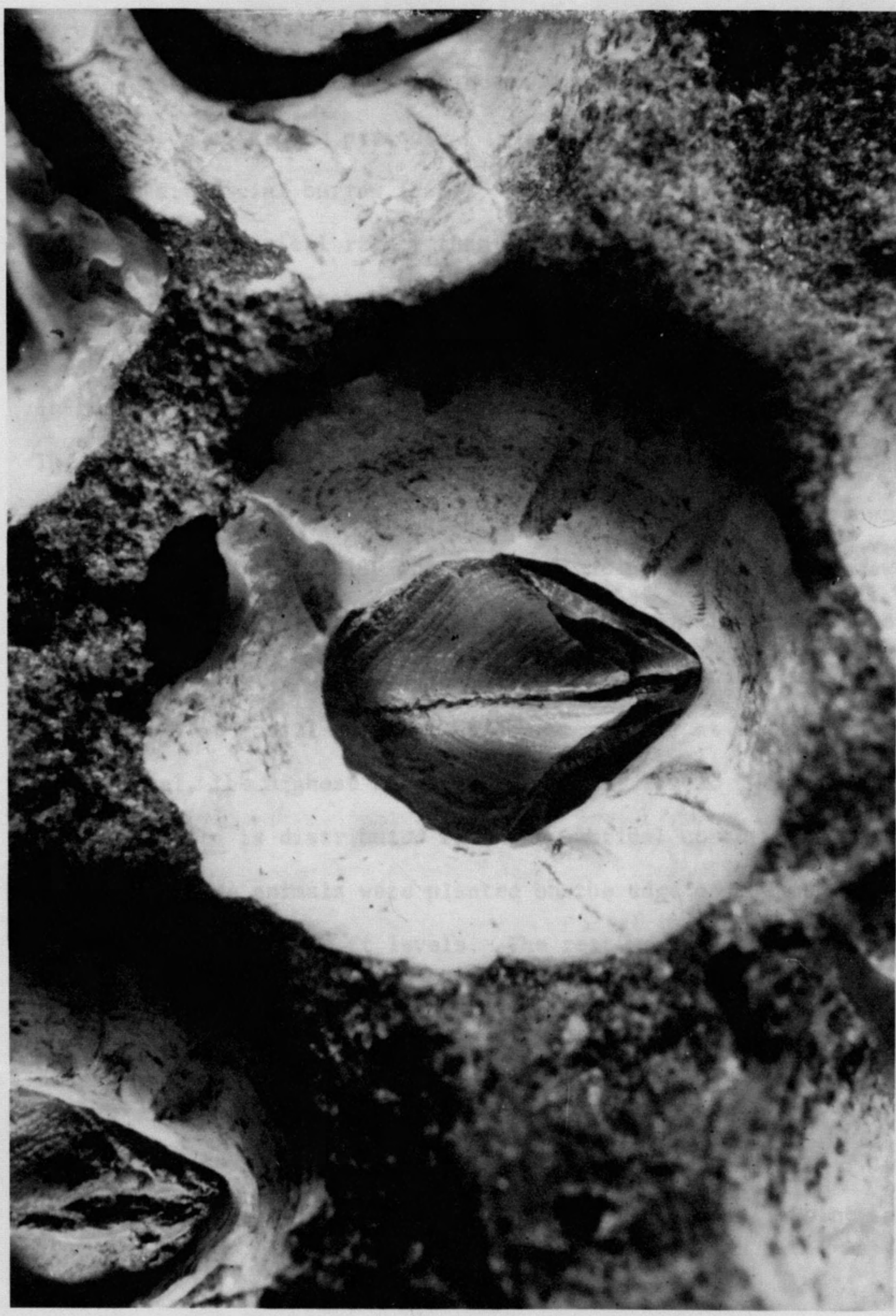
Examples of barnacles completely occluding burrow entrances were also found. The enclosed pholad was of course dead. It is not known whether the barnacle covered the entrance hole before or after the death of the clam.

Replant experiments

The replant experiments were designed primarily to provide data on growth rates of older animals. Individual growth rates were calculated by measuring animals before they were placed in and after they had been removed from artificial burrows which the animals occupied for a period of about 11 1/2 months. A number of experimental variables such as entrance diameter, height in intertidal, and substrate hardness were introduced while setting up the experiment; others (e.g., sand burial)

FIGURE 22

The distorted edge of the top central barnacle is caused by the young pholad siphon which emerged from the hole at the right. The siphon may have the ability to dissolve $CaCO_3$.



were accidentally added during its course. Analysis of these variables yielded data on such varied subjects as morphogenesis, growth, survival, and duration of growth periods.

The artificial burrow (Fig 1) differs from the natural burrow in that it is cylindrical rather than conical and that the outer end is blocked by a rather sharply sloping polyethylene plug which has a fixed entrance diameter. How do the animals react to these abnormal conditions? In general, it appears that they adapt themselves very well and rapidly. The polyethylene plugs do not prevent the siphons from extending to the surface expect in some cases of large animals inhabiting burrows with 3 mm entrances. Initially the shape of the burrow base is somewhat abnormal but this is quickly adjusted when the animal begins to bore.

A total of 180 Fossil Point animals were replanted in 10 horizontal rows at Fossil Point. The lowest row was at about the -2- ft tidal level, the highest at about the +4- ft level. Normally in this area _P. penita_ is distributed from the subtidal up to the +2- ft level.

Sixty-nine animals were planted on the edge of the upper bench in the +1-, +2-, +3-, +4- ft levels. The rest were planted in the lower bench at or below the 0- ft level. For a number of reasons the results of replant experiments from the two areas will be treated separately.

At South Jetty, 11 South Jetty animals and 6 Fossil Point animals were replanted in a rock at about the 0-ft level. Conversely, 6 South Jetty animals were replanted in the lower bench, Fossil Point, at the 0-ft level.

Maximum growth rate of replants at Fossil Point

In the lower bench at Fossil Point the greatest size increase was found among animals that were originally 15.5 to 17.5 mm in depth and that were planted in burrows with 6 mm diameter entrances (Fig 24). In 11 1/2 months valves of these animals (still active) had increased in depth between 7.7 and 9.4 mm, about 50% increase.

From these data certain inferences can be drawn about the number of months required for *P. penita* to reach adult size at Fossil Point. When the above animals were originally planted, they were probably less than 2 years old. Animals of this size were commonly found in the 21 month exposed rock (Fig 19). The final depth of these animals ranged from 23 to 27 mm, which is well within the size range at which *P. penita* becomes adult spontaneously at Fossil Point. This suggests that *P. penita* can easily reach adult size within 3 years. It is conceivable that a rapidly growing individual could reach adult size in as little as 27 months. Since some 16-month-old animals measure up to 18 mm in depth. These time periods are in close agreement with growth rate estimates calculated from both growth band counts (Table 6) and from extrapolation of growth rates of populations of young animals of known maximum age (Fig 19).

Effect of entrance diameter on growth rate

When the Fossil Point animals, which were replanted in the lower bench, are separated into three groups according to the diameter of the entrance (3, 6, or 12 mm), some conclusions can be drawn as to the effect of entrance diameter on growth rate and survival.

<u>Three mm entrance diameter</u> (Fig 23). The total mortality in this group was 50%, mostly among the larger animals with depths of 19 to 24 mm. Most of these animals probably died of suffocation or starvation soon after being replanted. No growth took place in these animals. The few surviving large animals remained active or became adult, but in either case grew very little. Most of the few medium-sized animals (original valve depth 16.5 to 18.5 mm) survived and grew moderately before becoming adult. Most of the small animals (original valve depth 11 to 13 mm) survived and grew, increasing in depth about 7 mm during the 11 1/2 month period.

<u>Six mm entrance diameter</u> (Fig 24). The mortality among animals with 6 mm burrow entrances was only 8.5%. At least one of the three dead <u>P</u>. <u>penita</u> probably died as a result of predation by the flatworm <u>Stylochus</u>. All animals originally larger than 17 mm in valve depth became adult during the experimental period, after growing an average of 3 mm in depth. Most of the smaller animals (original valve depth 15 to 17 mm) remained active and grew an average of 8.5 mm.

<u>Twelve mm entrance diameter</u> (Fig 25). Originally, all of these animals had a valve depth of over 17 mm, and all that survived became adult during the 11 1/2 month period. The mortality of the group was 15%.

From these observations it is concluded that under replant conditions a 3 mm entrance diameter is just adequate until the animal reaches about 18 mm in valve depth, after which the siphon is so constricted that insufficient water is circulated to provide enough food and oxygen for growth and survival. A 6 mm entrance is large enough for any size of animal in the Fossil Point area. The question of whether mortality from

FIGURE 23

Growth and survival of P. penita replanted for about 11-1/2 months in Fossil Point rock. Entrance diameter 3 mm.

•	Active alive	condition at end of experiment
○	Active dead	
+	Adult alive	

P.g. Penitella gabbi

Try to combine 圖 23, 24, 25

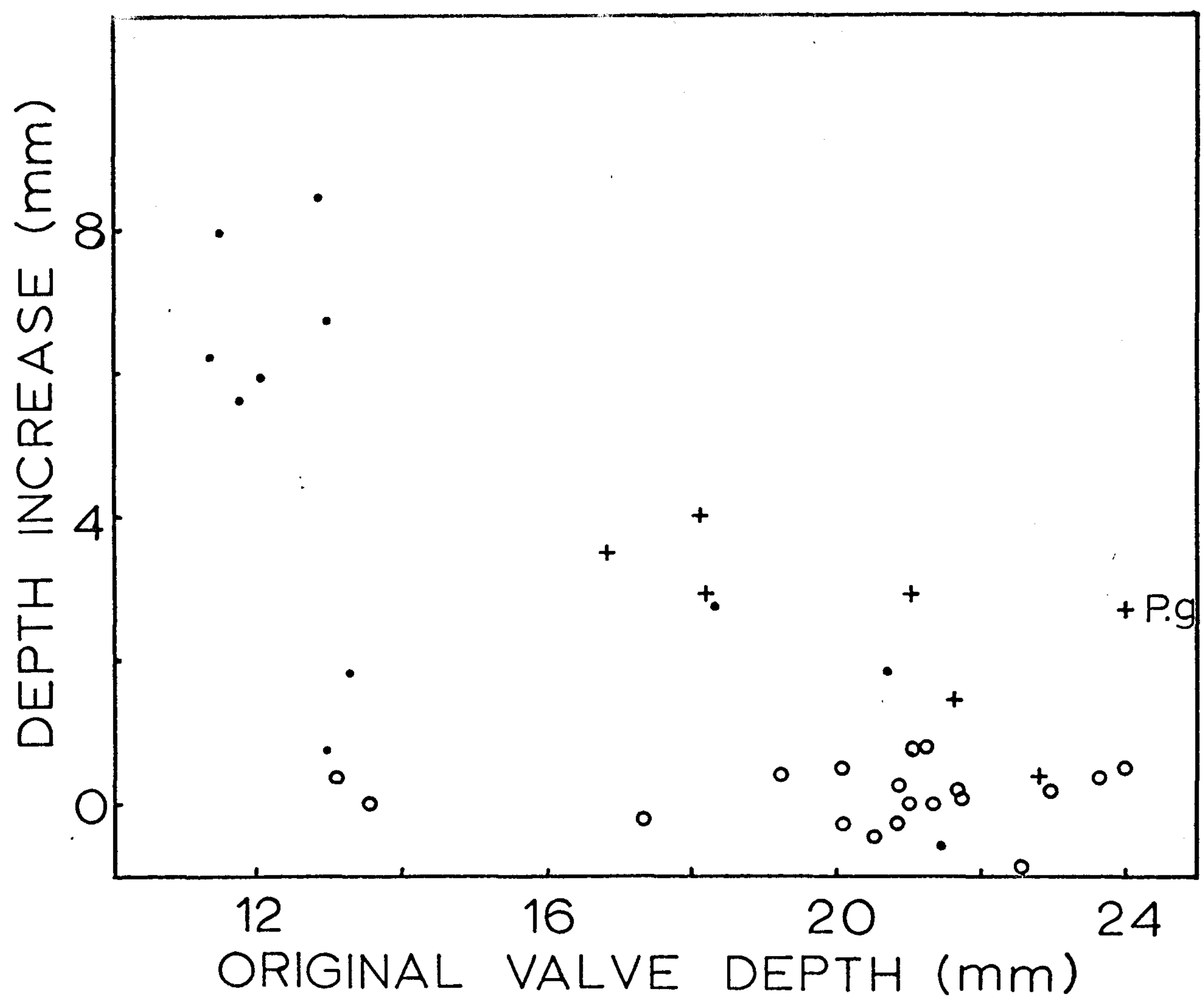


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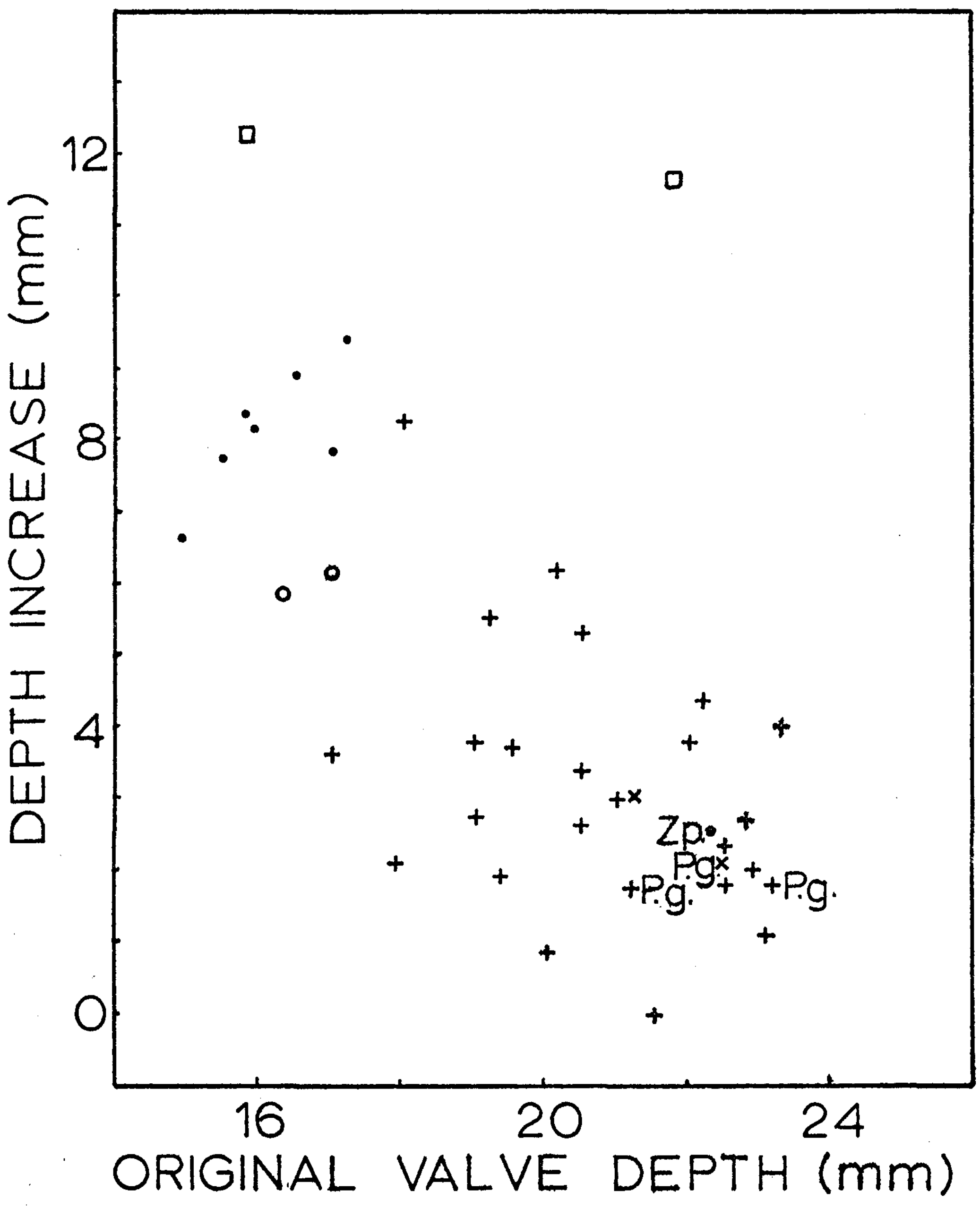
FIGURE 24

Growth and survival of *P. penita* replanted for about 11-1/2 months in Fossil Point rock. Entrance diameter 6 mm.

•	Active alive	condition at end of experiment
○	Active dead	
+	Adult alive	
×	Adult dead	
□	Changing alive	

P.g. = *Penitella gabbi*

Z.p. = *Zirfaea pilsbryi*



Explain extra large changing animals

FIGURE 25

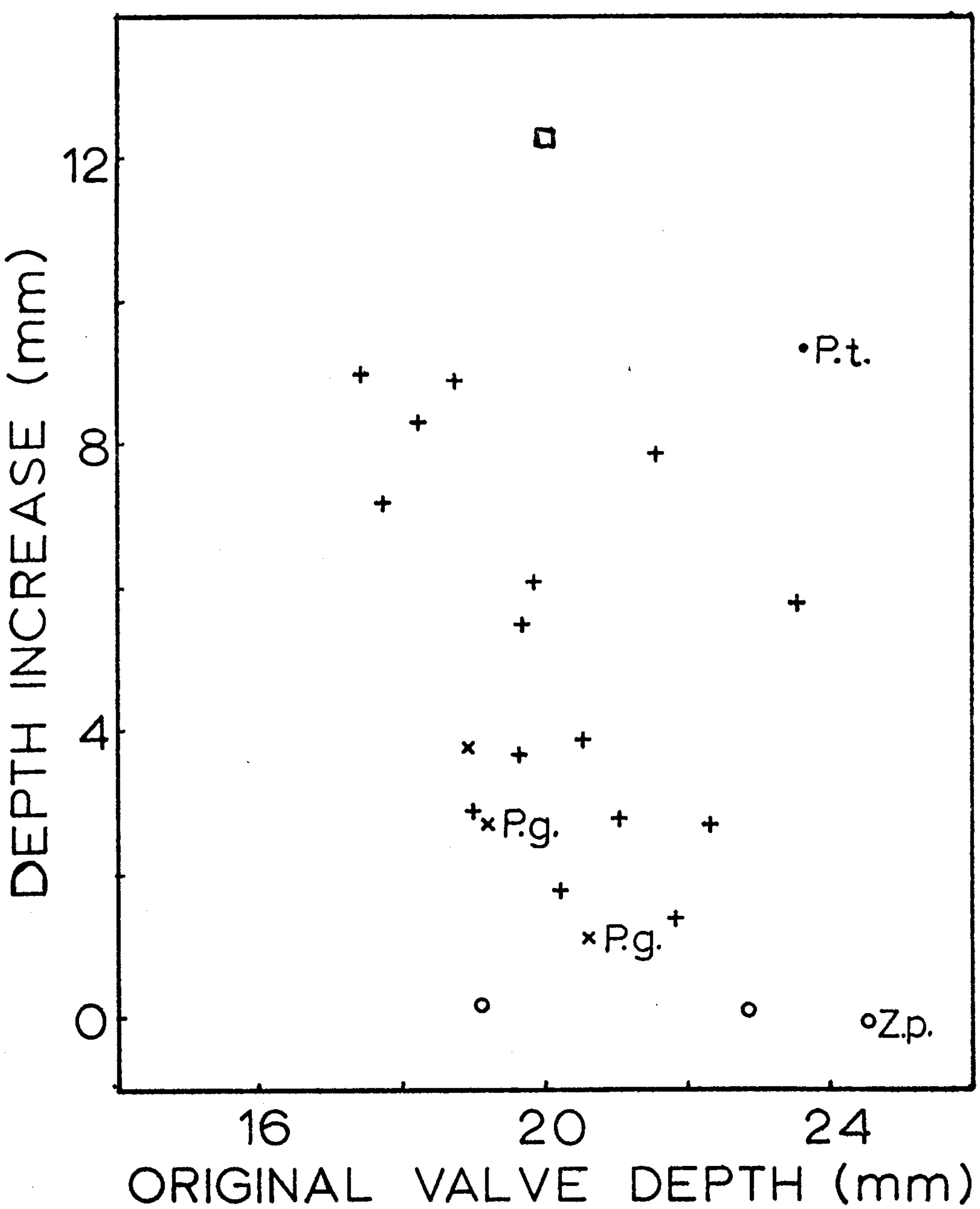
Growth and survival of P. penita replanted for about 11-1/2 months in Fossil Point rock, entrance diameter 12 mm.

•	Active alive	condition at end of experiment
○	Active dead	
+	Adult alive	
×	Adult dead	
◻	Changing alive	

P.g. = Penitella gabbi

P.t. = Penitella turnerae

Z.p. = Zirfaea pilsbryi


DEPTH INCREASE (mm)
12
8
4
0
16
20
24
ORIGINAL VALVE DEPTH (mm)
P.t.
P.g.
P.g.
Z.p.

predation is greater in burrows with larger entrances cannot be answered at this time.

Factors inducing animals to metamorphose

Under uncrowded conditions P. penita became adult spontaneously within a specific size range that depends on the area in which they live (Table 2). Whether these differences are due to genetic factors, substrate hardness, or other environmental factors is not known. The size at which an individual becomes adult in any particular area is controlled to a certain extent by the diameter of the burrow entrance. Evidence for this comes from two sources; natural populations and replant animals.

The burrows of 53 mature adult P. penita from Fossil Point were examined. Four had entrance diameters 3 mm or smaller. The valve depths of the animals inhabiting these burrows (21 to 23 mm) were well below the average size for mature adults (25.5 mm). Since the animals were apparently not forced to metamorphose by crowding, it is probable that the substandard size is due to the narrowness of the entrance.

All Fossil Point animals replanted in burrows with 6 or 12 mm entrances became adult after 11 1/2 months if their original depth exceded 18 mm. The amount of growth that takes place before the animal metamorphoses is highly variable. However, there is a slight tendency for the smaller animals to grow more than the larger. Animals in burrows with a 12 mm entrance diameter grow more before becoming adult than those in burrows with 6 mm entrances ($P<0.01$). This may be due to the fact that food gathering is more efficient in animals with larger burrow entrances.

In the replant experiments, poor conditions, such as insufficiently large entrance diameter, sand burial and anaerobic conditions, inhibit growth but do not induce animals smaller than 20 mm to metamorphose. Crowding is the only known factor which will cause stenomorphs to form. Stenomorphs, whether complete or only in the process of changing, could not be induced to become active and bore again by replacing them in fresh uncrowded rock. Apparently once metamorphosis has begun, it is an irreversible process.

Morphology of the replanted animals

Animals which resumed active boring and remained active throughout the replant period maintained their normal shape except for a slight enlargement of the posterior ventral edges. Larger animals, which became adult without enlarging the artificial burrow, developed abnormally (Fig 26a). During the final period of lateral shell deposition (while the animal is metamorphosing) the margins of the valves are extended so as to fill the available space. As a result, in abnormal straight-sided burrows, the posterior ventral edges of the valves are extended more than usual, giving the animal a cylindrical rather than conical shape. Yonge (1951), in his study of the California mudstone borer, *Platyodon cancellatus*, observed that the greatest amount of growth occurs in the direction of least resistance.

Results of replant experiment in the upper bench

These replants were originally intended to complement those of the lower bench and to test the effect on growth rate of higher placement in the intertidal zone. Unfortunately the bottom half of this experimental

FIGURE 26

Modified morphology of some of the replants. Adult animals assume the shape of the burrow they inhabit.

a) 535 Did not enlarge burrow after replanting

b) 510 Enlarged burrow after replanting

c) 563 Normal animal

Scale 2 x


535
510

area was covered with sand by the middle of February. Records were kept of the approximate state of the sand at monthly intervals. It appears that row 7 was buried at least 5 months and row 8 at least 3 months; row 9 was partly buried up to 3 months and row 10 was never buried. Conditions in row 7 appeared anaerobic (the rock surface was black with sulfides and foul smelling) when the sand was shovelled away on July 15th. Barnacles on the rock surface survived some sand burial, but those below row 8 were all dead. The growth data for the four rows (Fig 27) indicate the following: (1) that animals can survive for a year in row 10, 2 ft above the normal vertical distribution. The growth rate, however, is much less than in similar animals planted in the lower bench or even in those that have been buried up to 3 months in rows 9 and 8. (2) Animals can survive sand burial for at least 5 months and anaerobic conditions for unknown periods of time. Growth during these periods however was inhibited.

Effect of substrate hardness on growth rate

The growth rates were compared in four classes of animals that had remained alive and active during 11 1/2 months of the replant period. The four classes are (1) Fossil Point animals in the lower bench of Fossil Point; (2) South Jetty animals in South Jetty rock; (3) Fossil Point animals in South Jetty rock; (4) South Jetty animals in the lower bench of Fossil Point. The data were kept separate for animals in burrows with 3 mm and 6 mm entrances (Fig 28). Growth bands were recorded (Fig 29). The different growth rates can be clearly seen in Figure 30.

Although the number of animals involved is rather low, the results seem to be clear. In the 6 mm entrance diameter group, South Jetty

FIGURE 27

Growth data from replant experiment in the upper bench of Fossil Point.

Row	Intertidal level	Sand burial
10	+ 4 ft	none
9	+ 3 ft	mid March - June partial cover
8	+ 2 ft	mid March to June
7	+ 1 ft	mid Feb. - July 15th

•	Alive Active
+	Alive Adult
±	Alive Adult, but changing or changed when replanted
×	Changing
⊙	Dead Active
⊕	Dead Adult

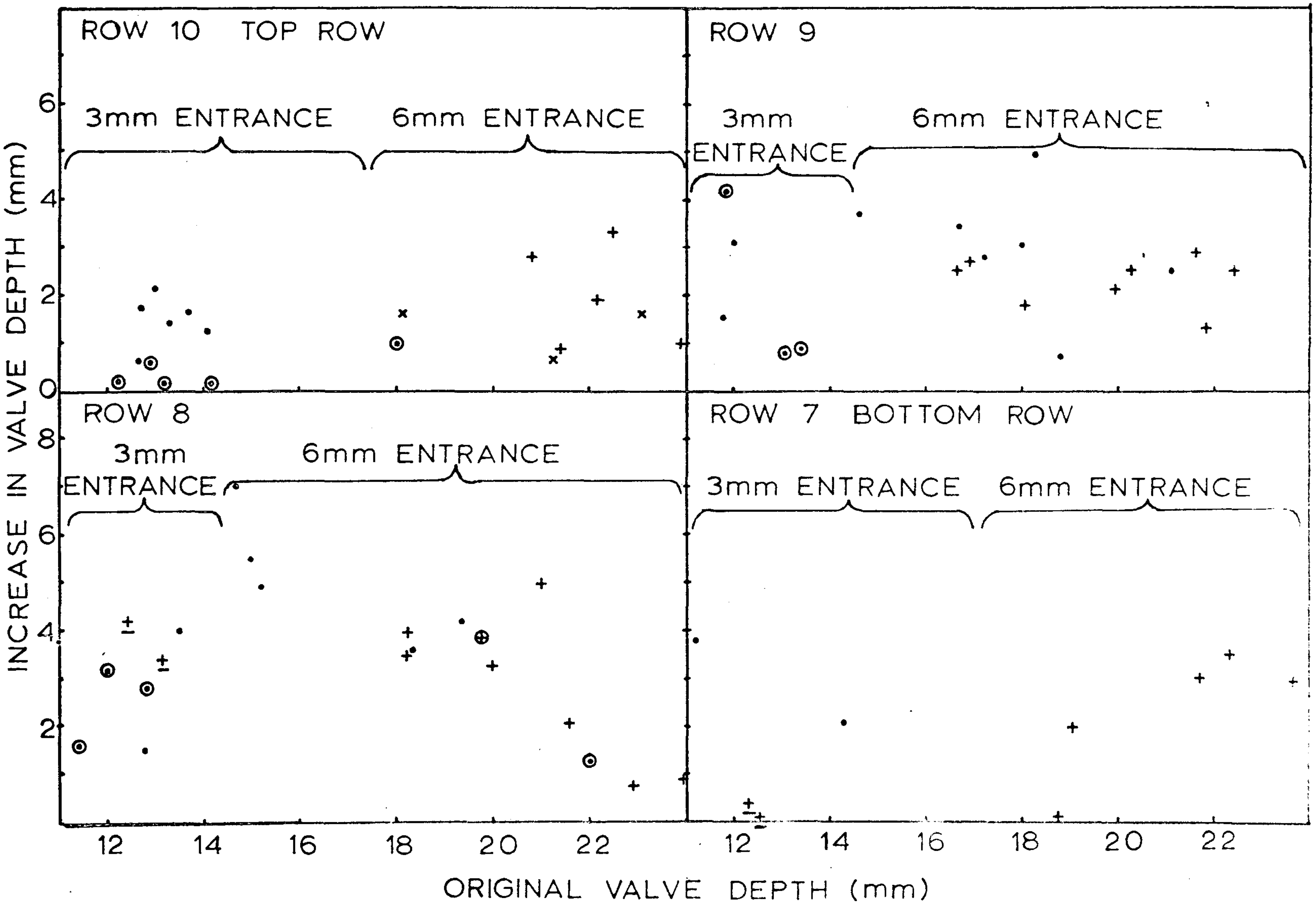

ROW 10 TOP ROW
3mm ENTRANCE
6mm ENTRANCE
ROW 9
3mm ENTRANCE
6mm ENTRANCE
ROW 8
3mm ENTRANCE
6mm ENTRANCE
ROW 7 BOTTOM ROW
3mm ENTRANCE
6mm ENTRANCE
INCREASE IN VALVE DEPTH (mm)
ORIGINAL VALVE DEPTH (mm)
0
2
4
6
8
12
14
16
18
20
22

FIGURE 28

Growth rate of replant animals as related to rock hardness and original location in which the animal was growing.

- • Fossil Point animal in Fossil Point rock.
- + South Jetty animal in South Jetty rock.
- ⊙ Fossil Point animal in South Jetty rock.
- ⊕ South Jetty animal in Fossil Point rock.

LP = Entrance plug lost during experiment.

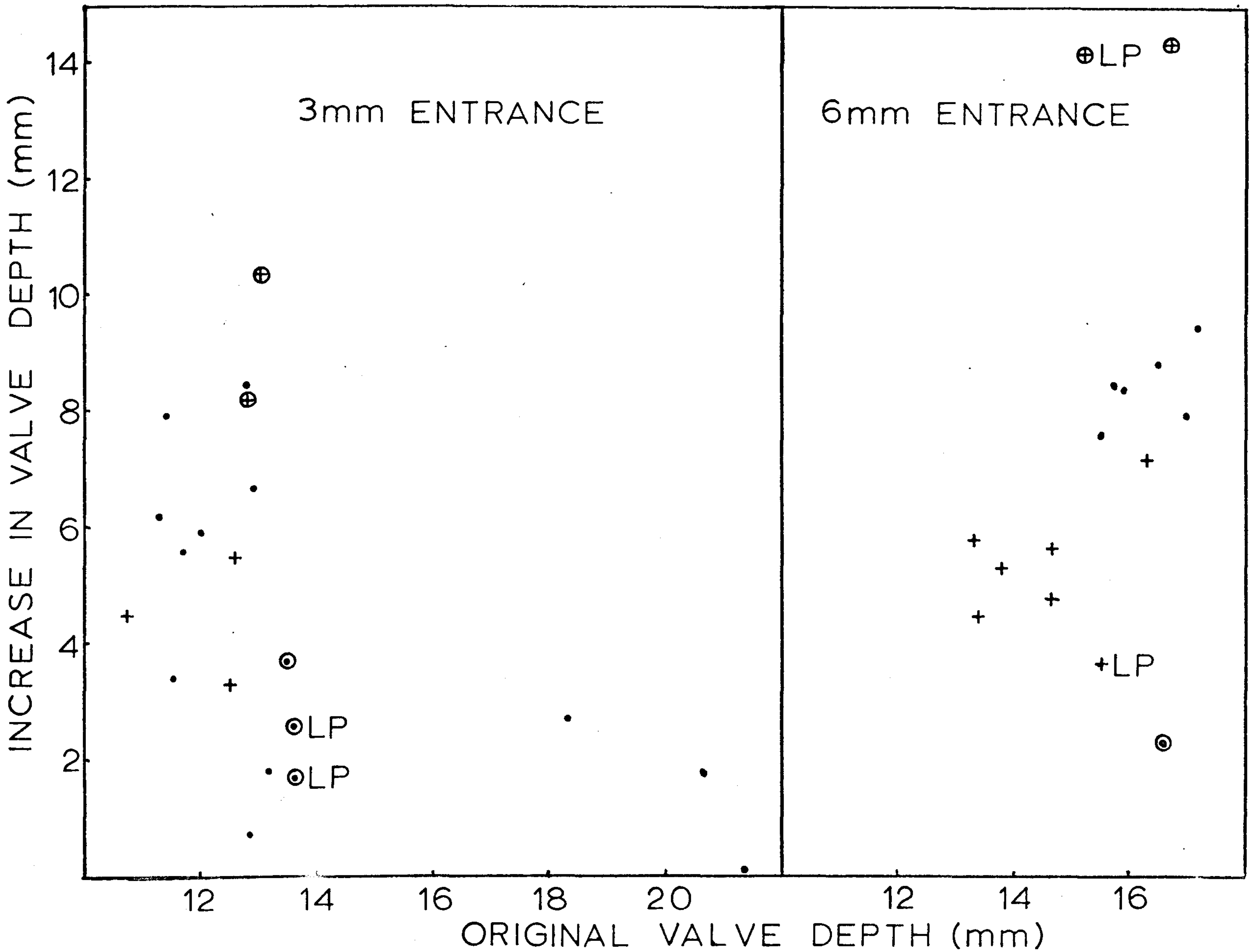

3mm ENTRANCE
6mm ENTRANCE
INCREASE IN VALVE DEPTH (mm)
ORIGINAL VALVE DEPTH (mm)
LP
2
4
6
8
10
12
14
16
18
20

FIGURE 29

Number if growth bands deposited during 11-1/2 month experimental period as related to substrate hardness and area of origin.

- • Fossil Point animal in Fossil Point rock.
- + South Jetty animal in South Jetty rock.
- ⊙ Fossil Point animal in South Jetty rock.
- ⊕ South Jetty animal in Fossil Point rock.

LP = Entrance plug lost during experiment.

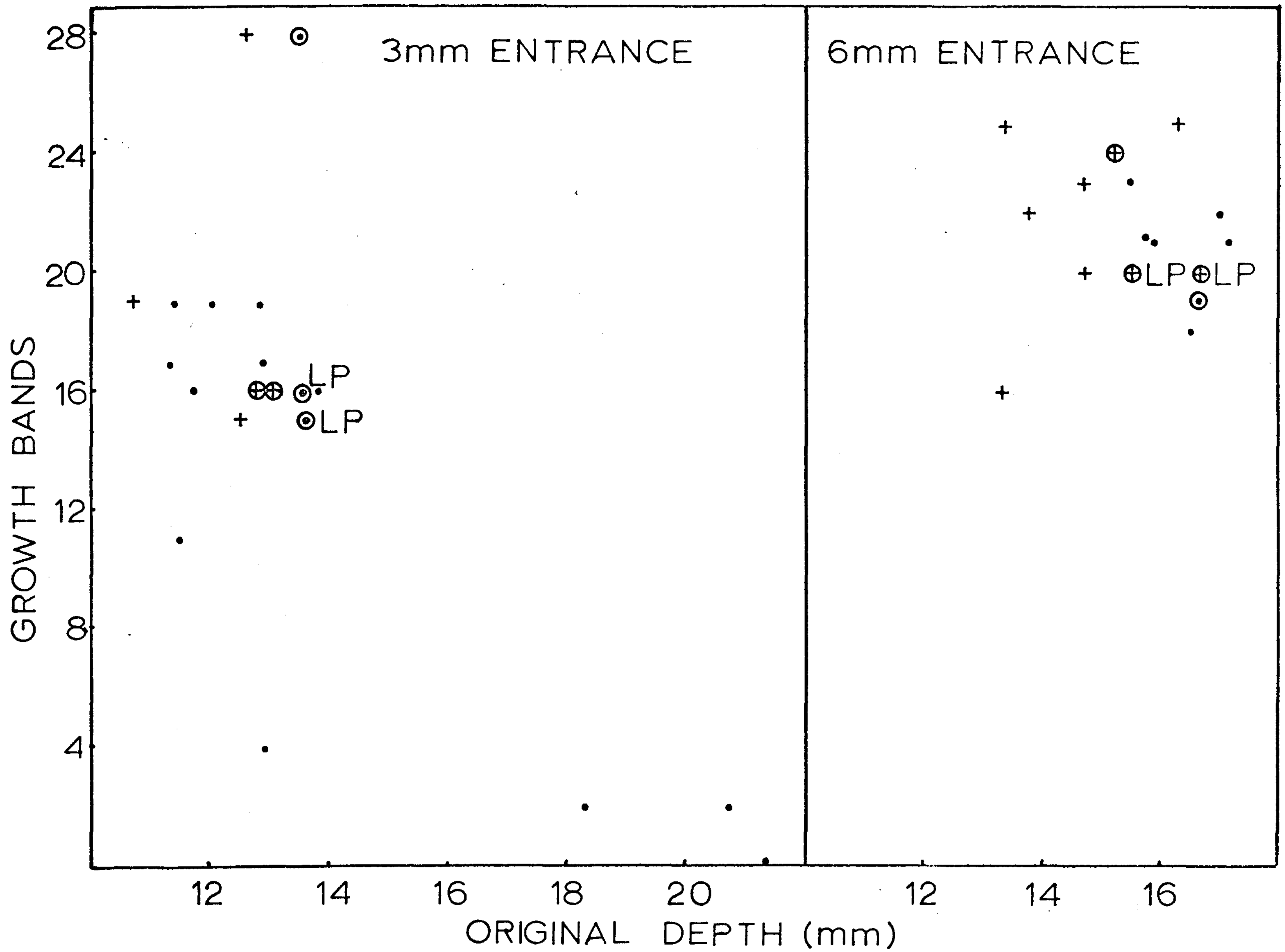

3mm ENTRANCE
6mm ENTRANCE
GROWTH BANDS
ORIGINAL DEPTH (mm)
LP
LP
LP
LP
28
24
20
16
12
8
4
12
14
16
18
20
12
14
16

FIGURE 30

Effect of substrate hardness on growth of *Penitella penita* replanted for about 11-1/2 months. Arrows indicate size when experiment began.

777 South Jetty animal replanted in South Jetty rock

741 Fossil Point animal replanted in Fossil Point rock

724 South Jetty animal replanted in Fossil Point rock

771 Fossil Point animal replanted in South Jetty rock

Scale 2 x


724
772
771
741

animals in their native rock grow on an average 0.63 times as fast as Fossil Point animals in their native rock. This is close to the relative growth rate value (0.6) estimated by comparing the number of growth bands in the 3rd and 4th cm of the umbonal ventral sulcus (Table 7). In all four categories the average number of growth bands is about the same (21.0 at Fossil Point and 21.6 at South Jetty) for the 11 1/2 month period (Fig 29).

The very few animals that were successfully transplanted to a different rock type present an interesting contrast. Thin-shelled Fossil Point animals transplanted to hard South Jetty rock grew with less than half the speed of normal South Jetty animals. That part of the valve deposited during the replant period was thicker than the original valve. The number of growth bands was, however, about the same (19).

South Jetty animals transplanted to Fossil Point rock grew very rapidly, 1.7 times as fast as normal Fossil Point animals. Again, the average number of growth bands (22) was about the same.

The results of animals with 3 mm entrance diameter (Fig 29,30) are similar. The growth rates of most of the groups are considerably lower than those of animals in burrows with 6 mm entrances. The numbers of growth bands in general are somewhat lower also. This depression of growth rate and number of growth bands is probably due to the small size of the entrance.

The overcompensation of growth rate, as observed in South Jetty animals transplanted to Fossil Point rock, and the slow growth in the reverse experiment can be explained on either a genetic or an environmental basis. In the first case, the two populations are considered to be genetically different, the South Jetty morph inherently having a heavier shell and greater boring powers than the Fossil Point morph. The other possibility is that the two populations are genetically identical, differences in morphology and boring powers being acquired characteristics.

The larval period of *P. penita* is probably quite long, allowing for a thorough mixing of larval populations from the various areas. The fact that no South Jetty morphs are found at Fossil Point, where their greater strength would give them an advantage over native Fossil Point animals, speaks against a genetic difference between the populations. The fact that the new shell deposited by South Jetty animals at Fossil Point was thinner than normal, and that deposited by Fossil Point animals at South Jetty was thicker than normal, suggests that the morphological differences are acquired due to environmental differences. The sustained overcompensation of growth exhibited by the South Jetty animals in Fossil Point rock on the other hand, suggests that South Jetty animals are inherently more vigorous borers than Fossil Point animals. The possibility that this is an effect of its early milieu seems remote considering the small size at which the animals were transplanted.

The role of Penitella penita in the Pacific coast endolithic community

Kühnelt (1951) suggested the following terminology to describe the fauna of hard marine bottoms: animals living on the surface of rock occupy the epilithion, those partially embedded occupy the mesolithion, and those wholly embedded occupy the endolithion. The endolithic community is that of animals inhabiting the endolithion.

Penitella penita is the most numerous and most widely distributed rock borer along the eastern Pacific coast (Coan 1964; Turner 1955). It is found both subtidally and intertidally, on exposed coasts and protected bays wherever rock of suitable hardness is available. The boring activity of P. penita is primarily responsible for developing the endolithion as a possible habitat. The conical holes drilled by this animal form dwellings for a large number of nestling animals which move into the empty burrows after the pholads' death.

There appears to be little interaction between the organisms of the epilithion and P. penita except at the time of settling, when surface encrustations can inhibit settlement. Pholads, being filter feeders, derive their food from the overlying water. Botula californiensis, inhabiting the mesolithion, interferes with P. penita by settling in its burrow entrances or boring laterally into burrows. The interference caused is sometimes enough to kill P. penita.

The only animal that has been observed to prey on P. penita at both Fossil Point and South Jetty is the flatworm Stylochus sp. Pearse and Wharton (1938) report that S. inimicus is a predator of oysters. Stylochus can enter remarkably narrow holes. For example, a flatworm about 32 mm by 16 mm was found inside a burrow, the entrance of which was only 1.8 mm in diameter. Stylochus consumes the flesh of Penitella and leaves the valves in place. It often lays eggs on the inside of the burrow and valves.

The empty burrows left after the death of pholads are filled by a number of nestling animals, which make up the remainder of the endolithic community.

At Fossil Point the empty burrows eventually become filled with sand and mud, vertical burrows filling more quickly than horizontal burrows. Most of the silt-filled burrows are occupied by a terebellid worm, Thelepus sp., and its commensal scale worm, Halosydna brevisetosa. Thelepus appears to extract $CaCO_3$ from the pholad valves and desposit at least part of it as a chalky layer on the inside of its parchment burrow. The valves of the dead pholad are gradually dissolved completely.

Dead replant animals which were placed horizontally in vertical faces collected little silt during the 11 1/2 months of exposure. Usually these burrows were unoccupied but occasionally they contained nereid worms. The valves showed some, but not extensive, dissolution.

Occasionally bivalves such as Schizothaerus nuttallii, Petricola carditoides, Macoma nasuta and Irus lamellifer are found nestling in pholad burrows at Fossil Point. Addicott (1963) found fossil Tresus nuttallii (Schizothaerus nuttallii) nestling in P. penita burrows in rock of late Pleistocene age.

Just as the epifauna on exposed rocky shores is richer and more varied than in the muddy bays, so too the endolithic community in rocks exposed to the open ocean is more diverse. No attempt was made to compile a comprehensive list of organisms occupying this habitat, but the obvious forms were collected and identified (Table 10). On the open coast, 26 taxa were observed as compared with 9 at Fossil Point.

Pholads as agents of coastal erosion

Coastal erosive factors fall into two categories, biological and physical. The physical factors, which include wave action, sand scouring and solution, vary in their erosive power according to exposure and to

TABLE 10

Nestlers inhabiting vacated pholad burrows

Open coast	Fossil Point	Major taxa	Species
X		Coelenterata	Anthopleura artemisia
	X		Diadumene (Sagartia) leucolena
X	X	Annelida	Thelepus sp.
X	X		Halosydna brevisetosa
X			Serpula sp.
X			Eupolymnia heterobranchia
X			Ramex sp.
X			Pista elongata
X			Schizobranchia sp.
X			Distylia rugosa
X			Idanthersus sp.
X			Demonax medius
X		Sipunculoidea	Phascolosoma agassizii
X			Dendrostomum pyroides
X		Crustacea	Pachycheles rudis
X			Oedignathus inermis
X			Spirontocaris palpator
X			Betaeus harfordi
X		Mollusca	Crepidula nummaria
	X		Irus lamellifer
X			Trimusculus (Gadinia) reticulatus
	X		Schizothaerus nuttallii
	X		Petricola carditoides
X	X		Macoma nasuta
X			Protothaca staminea
X			Entodesma saxicola
X	X		Saxicava sp.
X			Kellia suborbicularis
	X		Botula californiensis
X		Urochordata	Pyura haustor

the chemical nature of the coast line. Chalk and limestone are more subject to solution than graywacke and granites. The biological factors include organisms like gastropods (Emery 1941) and chitons, which rasp algae from rock surfaces, a variety of chemical borers which attack carbonate rocks and mechanical borers which, like pholads, can attack both carbonate and noncarbonate rocks.

Because of the protected nature of the area and the chemical composition of the rock, I believe that at Fossil Point biological factors are much more important in erosion than the physical factors. One source of evidence for this belief is the slow rate of erosion due to physical factors acting by themselves. Rock around stainless steel screws placed in freshly exposed rock at the zero ft tide level in August 1963 was only eroded an average of 1 mm 2 years later.

Reid (1907) estimated that chalky, subtidal benches off the Norfolk coast were subsiding at a rate of 1 inch per year because of erosion caused by boring organisms. Jehu (1918) estimated erosion in the same area at about 1/2 inch per year. The rate of erosion at Fossil Point caused by borers cannot be estimated at this time. However, indirect evidence indicates that the bench must be eroding much faster than the 0.5 mm per year rate caused by physical factors alone. The burrows of some living, adult animals appear to have been shortened by as much as 8 cm, and it is inconceivable that these animals could live 160 years.

The upper bench at Fossil Point clearly shows the comparative effect of biological and physical factors working together and physical factors working alone. Pholads inhabit only the lower half of the bench, (up to the +2 ft tidal level). The lower half is undercut, leaving the upper half jutting out (Fig 31). Hodgkin (1964) observed the same undercutting phenomenon on limestone benches but attributed it to the fact that the lower surface of the rock was exposed to the dissolving effect of sea water for more time than the upper portion.

At Fossil Point biological erosion can be ascribed to two bivalve families, Mytilidae and Pholadidae. The mytilid, *Botula californiensis*, probably has little erosive effect in this area, because of its relatively small size and low numbers. The Pholadidae, especially *Penitella penita*, the commonest form, are mainly responsible for rock destruction. The surface 7 to 10 cm are thoroughly riddled with burrows (Fig 32). This causes considerable weakening of the surface rock. The greatly weakened rock structure is probably crumbled by wave action and other physical factors. Erosion probably proceeds in a piecemeal fashion, rather than evenly over the whole surface.

Succession in the endolithic community

Hunter (1949) noted that bivalve boring is cyclic. An individual will only penetrate a relatively short distance into the rock. New borings will continue to be started until the outer layers of rock are honeycombed. A point will be reached where no further settlement or growth can take place without meeting interference from other burrows. If the greatly weakened surface rock were not removed by the mechanical action of the sea, the population numbers would with time decline towards extinction. However, erosion which probably proceeds in a piecemeal fashion, exposes fresh rock on which larvae can settle. An especially

FIGURE 31

Upper bench, Fossil Point, showing undercutting. Top of bench is at about +5 ft tidal level. Pholads bore actively up to about the +2 ft level.

Notice the rocks (foreground) which have broken off the flat face (center right) about 9 months previously.

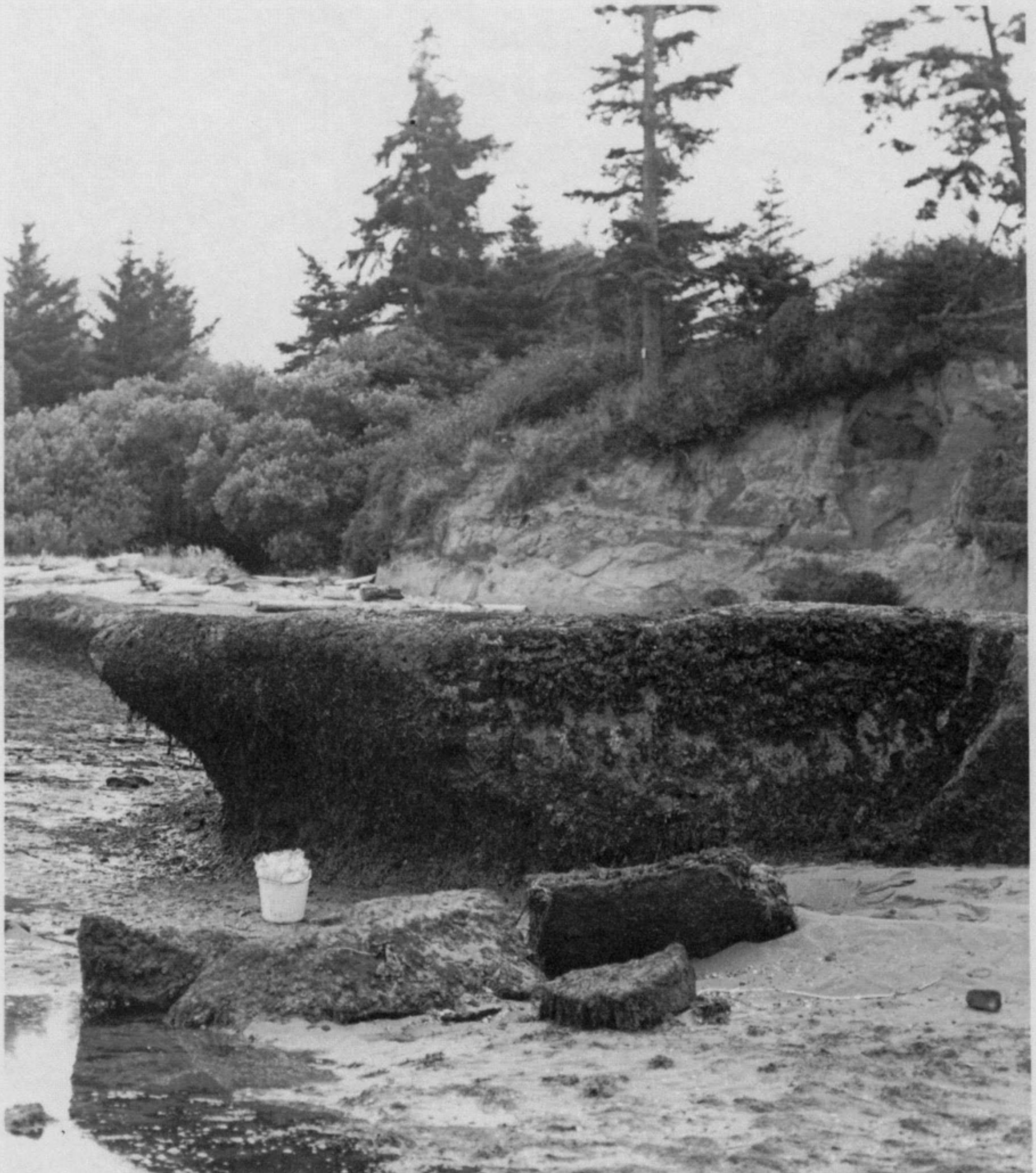
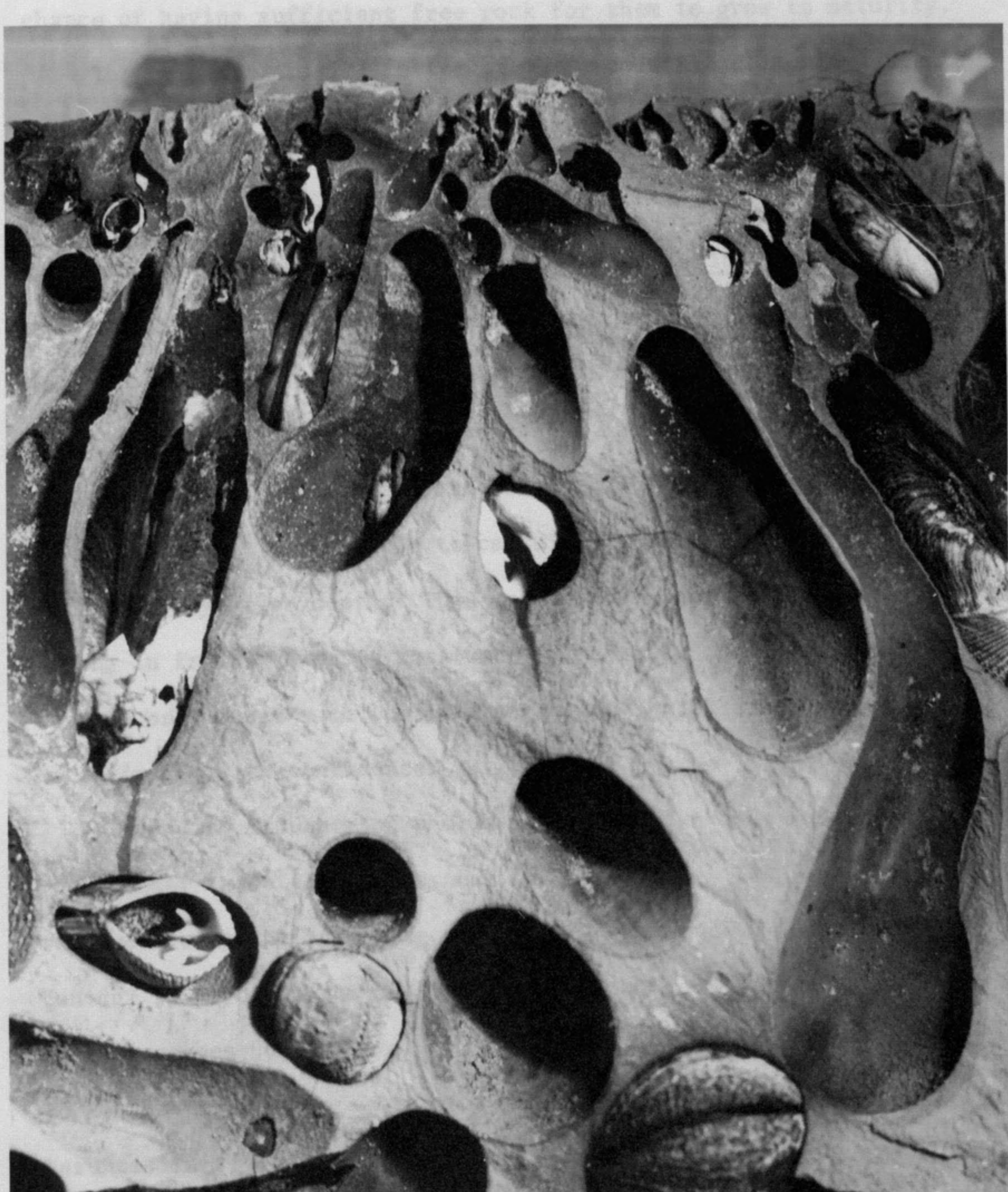


FIGURE 32

Photograph of a section of rock, collected near Newport, Oregon, to show crowded conditions. Rock from Fossil Point is crowded to a similar degree.

Scale Natural size



good site for new settlement is opened up when old large burrows are shortened to such an extent that the nestlers are washed out. Into this cup-shaped depression, several young pholads can settle with a reasonable chance of having sufficient free rock for them to grow to maturity.

The primary limiting factor of the endolithic community appears to be space rather than food, which is available to some extent throughout the year.

Carrying capacity and utilization efficiency

Since pholads weaken the rock by their boring activity, it is of interest to know the proportion of rock that is actually removed at any depth. This can be estimated indirectly by counting and measuring the animals removed from a known area of rock. With a knowledge of the burrow shape, it is possible to calculate the area required by each animal at any given depth. This method only works with young animals boring in freshly exposed rock under reasonably uncrowded conditions because only under such conditions can the length and shape of the burrow be estimated with confidence.

The maximum number of pholads that can live in a square meter of rock, under these conditions, can be calculated. This value will be referred to as the "carrying capacity" of the rock. Because of the conical shape of the burrow, carrying capacity decreases as depth in the rock increases; also, since the angle of the cone increases in harder rock, the carrying capacity at any given depth decreases as substrate hardness increases.

Under hypothetical conditions of maximum utilization the burrows (all of one size) would have to be arranged in a honeycomb pattern. Each animal occupies a hexagonal area.

In order to calculate the area required by an animal at any particular depth it is first necessary to be able to estimate its valve depth. This can be done if the ratio of effective burrow length to valve depth of active animals is known. The value of this ratio varies with differences in substrate hardness and differences in the age and crowding condition in a given rock (Table 4).

Since the animal is somewhat loose in its burrow, valve depth is not a true measure of the diameter of the burrow. The valve depths of 17 active Fossil Point animals were compared with the maximum diameters of their burrows. The burrows averaged 0.9 mm larger than the depth of the valves (maximum 1.4 mm, minimum 0.4 mm). Also when calculating the area occupied by the animal one must take into account the fact that *P. penita* usually does not approach closer than 1 mm to a neighboring burrow. Therefore, 1 mm must be added to the burrow diameter to correct for wall thickness. The area required by an animal at any particular depth in the rock is therefore equal to a hexagon with an inscribed circle, the diameter of which equals the valve depth plus 1.9 mm to correct for space in the burrow and wall thickness. This diameter will be called the "effective diameter" of the animal.

The carrying capacity is obtained by dividing the area of the hexagon into one meter^2. The theoretical carrying capacity of different areas and depths is shown in Table 11.

TABLE 11

Theoretical Carrying Capacity

Rock depth (cm)	Fossil Point Crowded	Fossil Point 19-month animals	South Jetty	Cape Blanco
1	68,493	62,893	52,356	22,222
2	29,240	24,814	20,491	7,519
4	9,881	8,439	6,784	2,182
6	4,995	4,239	3,327	1,029
8	2,967	2,521	1,977	596
10	1,982	1,669	1,309	389
12	1,411	1,186	932	277*
14	1,071	891	694*	201
16	821*	690	539	156
18	658	550	429	124

* Maximum observed burrow length

Utilization efficiency

The efficiency with which the rock space is being utilized is determined by comparing the carrying capacity at a given depth with the actual number of animals that have reached or passed that depth.

The number of animals living at or below a given depth in the rock is assumed to be the number of animals that are equal to or larger than the mean theoretical size for that depth. This mean valve depth can be calculated for any particular burrow depth and substrate if the average ratio of effective burrow length to valve depth is known. For young animals (19 months maximum) at Fossil Point this ratio = 4.1.

The utilization efficiency of rock exposed for 12, 16, and 20 months at Fossil Point was calculated (Table 12). As expected, it increased at most depths with increased duration of rock exposure.

Boring behavior and probable sensory mechanism

Crowding is very common in pholad communities. Because the burrows increase in diameter as they become deeper, many more clams can settle at the surface than can live deep in the rock. An actively boring *P. penita* does not penetrate into neighboring burrows. When its base approaches within about 1 mm of a neighboring burrow, it will not bore further in that direction. Under such conditions it either turns to avoid the obstructing burrow, or, if there is no clear rock in another direction, ceases to bore entirely.

This ability to avoid neighboring burrows is a behavioral characteristic shared by most of the mechanically boring bivalves, including the Teredinidae, Pholadidae and others. However, exceptions to this rule

TABLE 12

Utilization efficiency using burrow shape of 19-month-old Fossil Point animal as standard. (ratio: effective burrow length to valve depth = 4.1)

A = Calculated effective burrow length cm = (Valve depth x 4.1)
B = Approximate carrying capacity at this depth in Fossil Point rock exposed 19 months.
C = Number animals/m^2 at or larger than given valve depth 12 month exposure
D = " " " " " " " " " " 16 " "
E = " " " " " " " " " " 20 " "

Valve depth cm	A	B	C	%utilization	D	%utilization	E	%utilization
.4	1.64	35000	2244	6.4	----	------------	3603	10.3
.6	2.46	16900	1333	7.9	2719	16.1	2897	17.1
.8	3.28	11400	815	7.1	1820	16.0	2164	19.0
1.0	4.10	8000	370	4.6	1180	14.8	1438	18.0
1.2	4.92	5800	133	2.3	683	11.8	890	15.3
1.4	5.74	4700	22	.5	401	8.5	432	9.2
1.6	6.56	3300			168	5.1	178	5.4
1.8	7.38	2900			53	1.8	41	1.4
2.0	8.20	2400			18	.8		

occasionally occur. Kofoid (1927) observed that occasionally one Teredo burrow passed directly through another. He sugests that the first animal was dead before the second entered its burrow, as otherwise it would doubtless have been able to protect itself by thickening its wall of nacre. Hunter (1949) observed that burrows of Hiatella occasionally intersect. Turner (1955) shows wood damaged by Martesia striata and Teredo. Apparently, M. striata makes no effort to avoid Teredo tubes. During my observations of many thousands of pholads and burrows, only one clear case of burrow intersection has been observed.

Botula californiensis, which sometimes nestles in the entrances of pholad burrows and sometimes bores actively, appears to make no effort to avoid other burrows. It has often been observed intruding into pholad burrows.

The sensory mechanism that enables borers to detect nearby burrows is not known, but one can hypothesize something of its nature from indirect evidence. The only sensory mechanisms that seem possible are either chemical, or vibratory. The latter seems more likely since P. penita avoids burrows regardless of their contents.

It is easy to imagine that the vibrations which result from the valves rasping the burrow walls during the boring movements could be monitored by the pholad. The intensity of these vibrations would increase as the thickness of the wall decreased. The actively boring P. penita turns to avoid a neighboring burrow when it approaches within about 1 mm; this implies that the sensory system is directional in nature. Proximity to a nearby burrow apparently inhibits boring activity when the animal has its ventral anterior side towards that burrow, but not when its dorsal side is towards it. If a number of burrows surround the active animal, boring is inhibited completely because the ventral anterior side would receive strong feedback vibrations whichever way it turns. This complete inhibition of boring apparently triggers the start of metamorphosis, which results in a stenomorph.

DISCUSSION

In this study a number of aspects of the biology of Penitella penita have been examined. Interpretations of the individual analysis and experiments will be found in the main text. In this section, only the general ideas that have developed from this work and possibilities for future research will be discussed.

Differences in substrate hardness cause modifications in valve morphology and in growth rates. Animals from harder rock grow more slowly than those from soft rock. This has been observed before and is expected. However, the change in growth rate is not directly proportional to the difference in substrate hardness, animals from harder rock growing faster than would be expected. The heavier valves and proportionately larger muscles of animals in hard rock account for this increased boring vigor. Whether this difference in boring vigor is due to environmental conditioning or to genetic differences within the species cannot be decided at this time. With the methods for replanting well established, it should be possible to design experiments to answer this question.

Details of the boring behavior are not completely known. The relative duration of the periods of active boring and shell deposition of Penitella are presently being studied by Dr. Edmond Smith (personal communication). It would be of interest to know some of the factors that control the duration of the growth cycle.

The importance of Pholads as agents of erosion in areas of heavy infestation seems beyond question; however, no information is as yet available on (1) the relative importance of the physical and biological eroders and how these factors interact, (2) how fast erosion proceeds in the heavily infested, undisturbed rock. If information were available on the latter point in any particular area, it would be possible to estimate roughly the age of adult animals and also to predict maximum life expectancy. Conversely, if the age of adult animals could be calculated, the rate of erosion in that area could then be estimated by measurement of burrow truncation. The fact that adult animals continue to deposit shell after becoming adult may be useful in this respect.

Growth in most mollusks may be indeterminate. However, growth of Penitella penita certainly terminates abruptly with the change from the active to the adult condition. Once the callum is deposited, boring movements are impossible and growth ceases. Normally sexual maturity in mollusks is reached quite early and reproduction continues throughout the remainder of the life span. In Penitella penita gonad maturation coincides with the end of the growth period. For the most part, active animals are sexually immature.

The factors that initiate metamorphosis are only partly understood. Crowding certainly induces stenomorph formation; if other environmental factors are involved, they are not known. The size at which larger animals metamorphose to adults is probably determined in part genetically and in part environmentally. In any area, adult size varies within a certain range. The size of an animal within this range appears directly related to the size of the burrow entrance diameter. Animals in burrows with small entrances are probably less efficient at gathering food than those with large entrances. Therefore, it is possible that within the adult size range metamorphosis is controlled by the food-gathering ability of the animal. In different areas, the average adult size increases as the rock hardness increases. Whether this is a general phenomenon is not known.

Nothing is known of the physiological trigger that sets off the apparently irreversible metamorphosis. No detailed work has been done on the changes that take place at the histological level during metamorphosis. It may be of interest to follow the changes that take place in the cells of the dorsal extension of the mantle. Before adulthood, these cells secrete no $CaCO_3$ but start to deposit it at the onset of metamorphosis.

P. penita avoid boring into neighboring burrows by turning or by ceasing to bore altogether. This implies that they are equipped with a sensory system by which they can detect the presence and position of nearby burrows. I have hypothesized that this system is vibratory in nature, the animal monitors the reflection of its own boring noises. This sensory system has not been located. Knowledge of its morphology and physiology would make it possible to investigate in more detail the factors that cause stenomorph formation. This information could have practical application in the control of such economically important borers as Martesia striata and the Teredinidae.

Nothing definite is known about how the siphon of P. penita enlarges its burrow nor how it dissolves the edge of obstructing barnacles. The siphon of P. penita may dissolve $CaCO_3$ in a manner similar to the $CaCO_3$ dissolution observed in Lithophaga and the boring gastropod Urosalpinx cinerea.

Little is known about the relationship of P. penita to other members of the endo-, epi-, and mesolithic communities. The importance of various predators and nestlers as causes of death and the sequence of organisms that inhabit the vacated burrow is not known.

Penitella penita, P. gabbi, P. turnerae and Zirfaea pilsbryi all inhabit a similar ecological niche in the same area. There may be competition between these forms for settlement space and space to grow. No attempt has been made to account for the broader distribution and greater abundance of P. penita.

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Appendix # 1

Mineral composition of the valve.

Penitella penita was found in substrates that differed considerably in hardness. *P. gabbi*, *P. turnerae*, *Zirfaea pilsbryi* were only found in the softest (Fossil Point) rock. In an attempt to provide an explanation for this different distribution it was hypothesized that the mineral composition of the valves might be different.

Necker (1839) claimed that the valves of *Pholas crispata* (*Zirfaea crispata*) consist of aragonite. Aragonite, the orthorhombic allomorph of $CaCO_3$, is harder that calcite. Stenzel (1963) reported that the oyster shell is primarily composed of calcite with five small areas of aragonite located where the muscles insert and in the resilium. The mineral composition of valves of *P. penita* from Fossil Point, South Jetty and Cape Blanco and of *P. turnerae*, and *Z. pilsbryi* from Fossil Point were analysed by X-ray diffraction technique. The X-ray spectrographs were made by Mr. Wallace Johnson, Geology Department and analysed by Dr. L. R. Kittleman of the Museum of Natural History, both of the University of Oregon. All samples were composed almost entirely of aragonite.

Mineral composition, therefore, cannot be used to explain the different distributions of the Pholadidae.

APPENDIX 2b

Sexual Condition of Active P.penita

ed	Fossil Point imm.	M.	F.	South Jetty imm.	M.	F.	Other Areas	imm.	M.	F.	Sexual Condition
3							Sunset Bay, Ore.	1			Scattered immature tubules
3	1										Scattered immature tubules.
3							Cape Blanco		1		Scattered tubules, mostly immature, a few with sperm
	16	6	1								All very immature except two which have scattered tubules with mature sperm
3	4	4	1								All immature except one with scattered tubules containing mature eggs
	10	2									Immature
4							Gold Beach		2	1	One immature male, one immature male with regeneration and sperm in scattered tubules, one regenerating female
4							Rocky Point	1			Immature
4				7	3	3					Immature or with moderately scattered tubules which contain mature gametes
				11	3	5					Immature or with scattered tubules containing mature gametes. The larger actives are more likely to have gametes.
4				2	1						Immature or with gametes in scattered tubules
5	1			1		1					Immature or spawned out
5			1		1						Scattered tubules, male spawned out, female regenerating.
	32	12	3	21	8	9		2	3	1	Total number of actives - 91

APPENDIX 2a

Sexual Condition of Adult P penita

ted	Fossil Point # M.	# F.	South Jetty # M.	# F.	Other areas	# M.	# F.	Sexual Condition of Most Animals
63					Makah Bay, Wash.	1	1	Regenerating tubules.
63	51	34						All mature except 2 females which have scattered tubules with few eggs. 3 changing animals with immature tubules.
63	18	8						All mature except one female that looked spawned out.
63	5	6						Mature, except one changing female with scattered tubules.
63	8	7						Mature, except 2 females and one male which show few scattered tubules and rather immature development. 1 male looks spawned out.
64	5	8						All spawned out or partially so. One male with fairly full tubules filled with degenerating sperm.
64					Sunset Bay, Ore.	4	3	All but one female appear to be entirely or partly spawned out. The old sperm and eggs appear to be degenerating. Early regeneration of the tubule wall is taking place. No regional differences.
64					Windy Pt.,Ore.	1	1	
64					Gold Beach, Ore.	3	1	
64					Rocky Pt., Ore.	2	3	
64					Cape Blanco, Ore.		2	
64	12	6						Middle regeneration.
64	6	4						Advanced regeneration.
64	6	3						Middle regeneration.
64					Cape Blanco, Ore.	1	4	Advanced regeneration, except 1 female immature, early regeneration.
64			11	10				All mature, crowded tubules, except 2 females with fewer scattered tubules.
64			3	3				2 males mature crowded, 1 with scattered tubules. 2 females mature crowded, 1 with scattered tubules.
64	4	4	4	4				The males from both areas have large tubules which are filled with broken down, degenerating sperm. The females are either fully mature or partially spawned out.
65	3	5	2	1				Females vary from spawned out to full tubules, eggs look somewhat degenerate. One male was spawned out, others had degenerating sperm in tubules.
65	3	2	3	3				Females were spawned out. Males - early regeneration, a few sperm in tubule, most of tubule in immature regenerating condition.
65	3	2	4	2				Females were in early regenerating condition. Males were mostly in early regeneration.
65	4	3						Both sexes were in early to middle regeneration.
	128	92	27	23		12	15	Total Adults = 297

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EXHIBIT 5

Jordan Cove Energy Project L.P.

Resource Report No. 1

General Project Description

Jordan Cove Energy Project

September 2017

Responses to FERC's August 11th Comment List

Agency	Agency Comment #	Agency Comment	Response Summary
USACE	1	General: The comments below were developed after a review of the applicant's draft Resource Report (RR) 1 filed with the Federal Energy Regulatory Commission (FERC) per filing PF17-04-000 on March 10, 2017, and through pre-application discussions with the applicant. The comments below are not exhaustive and future project changes may affect the context and timing of future comments related to the applicant's proposal. The U.S. Army Corps of Engineers (Corps) Portland District Regulatory Branch anticipates the applicant's RR filings and supporting information will fully describe the scope of work proposed to support our evaluation.	No response required.
USACE	1.1	· To assist the Corps and FERC in identifying the project scope of analysis under the NEPA, and subsequently, the scopes of analysis for Section 106 of the National Historic Preservation Act (NHPA), and Section 7 of the Endangered Species Act (ESA) please identify the information below. All areas used for staging or to support the construction of the project should be identified. The work proposed at those sites should be described in sufficient detail to allow full consideration of the impact of the proposed action in the context of NEPA, NHPA, ESA, the CWA 404(b)(1) Guidelines, our public interest review (PIR), and other relevant and required laws and statutes. For example:	See RR1 Sections 1.2 through 1.5.
USACE	1.1.1	o If the Box Car Hill site will be used to meet the purpose and need of the project please identify this in the RR filings;	See Sections 1.3.1, Table 1.4-1, and 1.5.10

Agency	Agency Comment #	Agency Comment	Response Summary
USACE	1.1.2	o Please identify all locations and configurations of all additional laydown areas. JCLNG states they may lease portions of existing industrial laydown yards within a 30-mile radius of the site to limit further development footprint on the North Spit.	See Section 1.3.1 and 1.5.10
USACE	1.1.3	o Please identify the location of the “Preserved Sand Dune Area”;	Not referenced in the Resource Report
USACE	1.1.4	o Please identify if any freshwater mitigation sites would be developed for the project;	There will not be any freshwater mitigation sites. See Section 1.3.9
USACE	1.1.5	o Please identify if the North Pointe site would be utilized for the project in any capacity;	North Pointe is now called APCO sites 1 and 2. See comment USACE 1.1.
USACE	1.1.6	o Please identify if Ocean Dredged Material Disposal Site (ODMDS) F would be utilized by JCLNG to dispose through maintenance dredging; § If so, please identify if ODMDS F requires expansion to receive future dredged material. § If not, please identify the location and configuration of upland or other in-water disposal sites which would possess the disposal capacity to accommodate future dredged material management required from the construction of the facility.	ODMDS will not be used.
USACE	1.2	· To assist the Corps and FERC in assessing the environmental and cultural resources impact of the project please identify how dredge slurry water and dredged material would be contained on the South Dunes and LNG terminal site during construction. Please identify all areas where ground disturbance (primarily excavation) would occur on each of these sites. Please provide drawings outlining how containment berms or cells would be oriented, to include their lengths and widths.	Section 1.5.3.3 is added. See Appendix H.7 and N.7 to provide details.
USACE	1.3	· To assist the Corps and FERC in analyzing the environmental/navigation impact of the project please identify the size, configuration, and location of all vessels to be moored at the LNG terminal site and/or Kentuck Slough before, during, or after site construction. Please identify the length of time each of these vessels would occupy the waterway.	Section 1.5.5.1 is added. Detailed description of applicable marine equipment mobilization, duration and location of activity will be provided with subsequent filing.

Agency	Agency Comment #	Agency Comment	Response Summary
USACE	1.4	· To assist the Corps and FERC in assessing the environmental impact of the project please identify if water levels would increase, and to what extent, in Kentuck Slough due to the construction of the Kentuck Mitigation Site. Please identify if freshwater wells would be affected by expanding the current head of saltwater in Kentuck Slough.	See Appendix D.2 for potential wells impacts.
USACE	1.5	· To assist the Corps in identifying where all jurisdictional activities would occur please provide a comprehensive stormwater management plan identify where all stormwater outfalls would be located. If outfalls protrude over the mean high water mark of Coos Bay, or would be constructed in jurisdictional wetlands, Corps Regulatory will be required to track these project components and evaluate their aquatic resource impacts.	See Appendix J.2.
USACE	1.6	· Please clarify that earthwork to prepare the site for construction of FERC-jurisdictional activities or activities subject to FERC environmental review, or other actions requiring federal authorization, would not occur until after the FERC renders a federal decision.	Confirmed. The statement is added to 1.5.1
NMFS	4.1	Are there other known buyers of the 6.3 mpta that remains after the sale of 1.5 mpta to JERA Co. Inc.? If so, where are they located?	Section 1.2.2 has been updated to reflect this comment.
NMFS	4.2	What are the total number of acres of wetlands impacted by the JCE portion of the action? The report discusses the expansion of the Kentuck mitigation site and the accrued benefit to offset impacts. It would be good to identify the impacts that will occur. Table 1.4-1 may be a good place to put this information.	See Table 2.3-1.

Agency	Agency Comment #	Agency Comment	Response Summary
NMFS	4.3	Describe whether all constructed access and utility corridors, haul roads, access roads and parking lots have stormwater collection and treatment systems.	See Appendix J.2.
NMFS	4.4	How many piles will be utilized for the tug dock?	Drawing "Tug Berth Pile and Pile Cap Plan, J1-000-MAR-LAY-KBJ-03001.07" to be added to Appendix K.13.1 – Marine Facility Drawings.
NMFS	4.5	Is the Corps permit for maintenance dredging part of this proposed action?	See Table 1.6-1 for a list permits required.
NMFS	4.6	What type of fender piles will be used for the Material Offloading Facility (MOF)?	See section 1.3.6.6.
NMFS	4.7	Explain what type of piles (concrete, steel, or other?) are proposed for the breasting dolphins and mooring dolphin platforms.	See section 1.3.6.4.
NMFS	4.8	We will need to know (at least in BA) what form of shoreline protection will be utilized to address potential impacts in the BA.	Information will be included in the BA to the extent necessary. See Section 1.5.5.2.
EPA	1	**Purpose and Need** The EIS should include a clear and concise statement of the underlying purpose and need for the proposed project, consistent with the implementing regulations for NEPA (see 40 CFR 1502.13). In presenting the purpose and need for the project, the EIS should reflect not only the FERC's purpose, but also the broader public interest and need. In supporting the statement of purpose and need, we recommend discussing the proposed project in the context of the larger energy market, including existing export capacity and export capacity under application to the Department of Energy, and clearly describe how the need for the proposed action has been determined.	To be addressed in the EIS (see Resource Report 1).

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	2	**Alternatives Analysis** NEPA requires evaluation of reasonable alternatives, including those that may not be within the jurisdiction of the lead agency1. A robust range of alternatives will include options for avoiding significant environmental impacts. The EIS should "rigorously explore and objectively evaluate all reasonable alternatives"2 by developing a screening process. The screening process should rate each alternative against a set of pre-determined criteria. Each alternative should then be analyzed for its level of impact on a resource (e.g. no effect, negligible effect, minor effect, major effect, significant effect). Only the alternative which effectively meets or best meets all of the screening criteria should be recommended as the preferred alternative. The EIS should provide a clear discussion of the reasons for the elimination of alternatives which are not evaluated in detail.	To be addressed in the EIS (see Resource Report 10).
EPA	3	**Environmental Consequences** According to 40 CFR Part 1502.1, an Environmental Impact Statement, "…shall provide full and fair discussion of significant environmental impacts and shall inform decision makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the environment." In order to facilitate a full and fair discussion on significant environmental issues, we encourage the FERC to establish thresholds of significance for each resource of concern, and to analyze environmental consequences in a clear, repeatable manner. For each action, a series of questions should be considered: 1) What is the action? 2) What is the intensity or extent of impacts? 3) Based on identified thresholds, is that significant? If an impact of the action is significant, then the EIS must contain appropriate mitigation measures.	To be addressed in the EIS (see all Resource Reports).

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	4	**Water Quality** In order to adequately address water quality issues, the EPA recommends the EIS identify water bodies likely to be impacted by the project, the nature of the potential impacts, and the specific discharges and pollutants likely to impact those waters (addressing both Section 402 and 404 discharges and potential impairments to water quality standards). We also recommend the EIS disclose information regarding relevant Total Maximum Daily Load allocations, the water bodies to which they apply, water quality standards and pollutants of concern. Clean Water Act Section 303(d) listed waters should not be further degraded. If additional pollutant loading is predicted to occur to a 303(d) listed stream as a result of a project, the EIS should include measures to control existing sources of pollution to offset pollutant additions. Consider implementing watershed or aquatic habitat restoration activities to compensate for past impacts to water resources, particularly in watersheds with 303(d) listed waters where development may have contributed to impairments through past channelization, riverine or floodplain encroachments, sediment delivery during construction, and other activities that may have affected channel stability, water quality, aquatic habitat, and designated waterbody uses. Provisions for anti-degradation of water quality apply to water bodies where water quality standards are presently being met. We recommend the EIS describe how antidegradation provisions would be met.	To be addressed in the EIS (see Resource Report 2).

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	5	**Hydrostatic Test Water** Hydrostatic testing of pipelines and tanks will be required to verify their integrity. We recommend that the EIS identify the water sources and withdrawal rates that would be required for hydrostatic testing. We recommend that the EIS identify and describe the location of these water sources (surface areas, depth, volumes, withdrawal rates, and project requirements). For each water source, we recommend that the EIS discuss the presence of any anadromous and/or resident fish species, including a discussion of any direct and cumulative impacts to fisheries resources. In addition, we recommend that the locations of discharge to land and/or surface waters, and discharge methods be specified in the EIS. Emphasis should be placed on minimizing interbrain transfers of water to the maximum extent practicable in order to minimize the risk of mobilizing invasive species. We recommend that the EIS describe the mitigation measures and control devices that would be implemented to minimize environmental impacts.	To be addressed in the EIS. See Resource Reports 2 and 3.

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	6	**Source Water Protection** Public drinking water supplies and/or their source areas often exist in many watersheds. Source water areas may exist within watersheds where the pipeline and associated facilities would be located. Source waters are streams, rivers, lakes, springs, and aquifers used as supply for drinking water. Source water areas are delineated and mapped by the states for each federally-regulated public water system. The 1996 amendments to the Safe Drinking Water Act require federal agencies to protect sources of drinking water for communities. As a result, state agencies have been delegated responsibility to conduct source water assessments and provide a database of information about the watersheds and aquifers that supply public water systems. Since construction, operation, and maintenance of a buried natural gas pipeline may impact sources of drinking water, the EPA recommends that the FERC work with the Oregon Department of Environmental Quality to identify source water protection areas. Typical databases contain information about the watersheds and aquifer recharge areas, the most sensitive zones within those areas, and the numbers and types of potential contaminant sources for each system. We recommend that the EIS identify source water protection areas within the project area, activities (e.g., trenching and excavation, water withdrawal, etc.) that could potentially affect source water areas, potential contaminants that may result from the proposed project and mitigation measures that would be taken to protect the source water protection areas.	To be addressed in the EIS (see Resource Report 2).

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	7	**Wetlands and Aquatic Habitats** In the EIS, we recommend describing aquatic habitats in the affected environment (e.g., habitat type, plant and animal species, functional values, and integrity) and the environmental consequences of the proposed alternatives on these resources. Impacts to aquatic resources should be evaluated in terms of the areal (acreage) or linear extent to be impacted and by the functions they perform. The proposed activities will require a Clean Water Act Section 404 permit from the Army Corps of Engineers. For wetlands and other special aquatic sites, the Section 404(b)(1) guidelines establish a presumption that upland alternatives are available for non-water dependent activities. The 404(b)(1) guidelines require that impacts to aquatic resources be (1) avoided, (2) minimized, and (3) mitigated, in that sequence. We recommend the EIS discuss in detail how planning efforts (and alternative selection) conform with Section 404(b)(1) guidelines sequencing and criteria. In other words, we request the FERC show that impacts to wetlands and other special aquatic sites have been avoided to the maximum extent practicable. The EPA also recommends the EIS discuss alternatives that would avoid wetlands and aquatic resource impacts from fill placement, water impoundment, construction, and other activities before proceeding to minimization/ mitigation measures.	To be addressed in the EIS (see Resource Report 2).

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	8	The EPA recommends the EIS describe all waters of the U.S. that could be affected by the project alternatives, and include maps that clearly identify all waters within the project area. We also request the document include data on acreages and channel lengths, habitat types, values, and functions of these waters. As discussed above, projects affecting waters of the U.S. may need to comply with CWA Section 404 requirements. If project alternatives involve discharge of dredged or fill material into waters of the U.S., the EIS should include information regarding alternatives to avoid the discharges or how potential impacts caused by the discharges would be minimized and mitigated. This mitigation discussion would include the following elements: · acreage and habitat type of waters of the U.S. that would be created or restored; · water sources to maintain the mitigation area; · re-vegetation plans, including the numbers and age of each species to be planted, as well as special techniques that may be necessary for planting; · maintenance and monitoring plans, including performance standards to determine mitigation success; · size and location of mitigation zones; · mitigation banking and/or in lieu fees where appropriate; · parties that would be ultimately responsible for the plan's success; and · contingency plans that would be enacted if the original plan fails. Where possible, mitigation should be implemented in advance of the impacts to avoid habitat losses due to the lag time between the occurrence of the impact and successful mitigation.	To be addressed in the EIS (see Resource Report 2).

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	10	**Dredging** Resource Report 1 (page 9) indicates EPA Ocean Disposal Site F will not be needed to accommodate dredged materials generated during construction. This is because dredged material will be disposed onsite and off-site at the Kentuck mitigation project. The use of the Kentuck site relies upon assumptions that 1) the Kentuck site can accommodate 300,000 cy of dredged material; 2) the dredged material will be of the appropriate composition to support estuarine and some freshwater habitat; and 3) the dredged material will be conducive to the re-establishment of historical drainage patterns. We have some concern that if any of these assumptions are incorrect, there may be a need to identify other upland disposal locations or a need to identify an ocean disposal option. In this event, the applicant would need to plan for the completion of a dredged material management plan (DMMP). If the applicant does not have certainty about the viability of the Kentuck site as an upland disposal location, this uncertainty needs to be acknowledged in the EIS, and alternative disposal sites should be identified. If one of those potential disposal sites is an ocean disposal site, the EIS should also acknowledge the need for a DMMP and commit to a timeline for completing that DMMP.	See Appendix N.7.

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	11	We also note that the project summary in the NOI includes “enhancements to the existing Coos Bay Navigation Channel at four turns.” We do not see this channel enhancement referenced in Resource Report 1 or 2, so it is not clear what activity these enhancements would entail. The EIS should disclose what, if any, dredging would be required to accomplish the proposed enhancements, and where that dredged material would be placed. As noted above, should ocean disposal be pursued, the applicant would need to plan for the completion of a dredged material management plan (DMMP). In addition, as noted in Resource Report 2 (page 13), Section 14 of the Rivers and Harbors Act of 1899 and codified in 33 USC 408 (commonly referred to as “Section 408”) authorizes the U.S. Army Corps of Engineers (USACE) to grant permission for the alteration or occupation or use of a Corps civil works project if the Secretary determines the activity will not be injurious to the public interest and will not impair the usefulness of the project. A Section 408 authorization is required prior to any modification of a federal civil works project. JCEP is coordinating with USACE regarding the proposed access channel from the navigation channel to the LNG terminal. Similar coordination should be undertaken and documented in the EIS for the proposed channel enhancements if they result in modifications to the federal navigation channel.	See Section 1.3.7 and Appendix N.7.

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	12	**Maintenance Dredging** Jordan Cove Energy Project Resource Report 1 (Section 1.5.4.1) states that in the first ten years of operation of the LNG Terminal, about 360,000 cy of material would need to be removed to maintain the proper depth of the access channel and slip, while in the next ten years about 330,000 cy would need to be removed. The recommended maintenance is to conduct dredging about every 3 years, with about 115,000 cy of material removed for the first 12 years of operation. After that, maintenance dredging could be done every 5 years with up to 160,000 cy of materials removed. The Resource Report goes on to say that Authorization for, and upland location of disposal of maintenance dredge materials will be the subject of future approvals. It does not offer specific upland locations, which would be suitable for sediment disposal. It is the EPA's perspective that because maintenance dredging is a connected action4, impacts associated with maintenance dredging should be fully analyzed within the EIS. This should include an assessment of upland disposal locations; their viability; their capacity; the methodology that would be used to stockpile/stabilize sediment; and the potential for that sediment to be used beneficially.	See Response to Scoping Comments, page 10

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	13	**Air Quality/Emissions** The EPA recommends the EIS provide a detailed discussion of ambient air conditions (baseline or existing conditions), National Ambient Air Quality Standards, criteria pollutant nonattainment areas, and potential air quality impacts of the proposed project (including cumulative and indirect impacts). Such an evaluation is necessary to assure compliance with State and Federal air quality regulations, and to disclose the potential impacts from temporary or cumulative degradation of air quality. The EPA recommends the EIS describe and estimate air emissions from potential construction, operation, and maintenance activities, including emissions associated with LNG carriers at berth. The analysis should also include assumptions used regarding the types of fuel burned and/or the ability for carriers to utilize dockside power (i.e. cold ironing). Emissions at berth are of particular relevance because the deep draft LNG carriers would be required to remain docked between high tides. We also recommend proposing mitigation measures in the EIS to address identified emissions impacts. The EPA supports incorporating mitigation strategies to minimize fugitive dust and toxic emissions, as well as emission controls for particulate matter (PM) and ozone precursors for construction-related activity. We recommend best management practices, all applicable requirements under local or State rules, and the following additional measures be incorporated into the EIS, a Construction Emissions Mitigation Plan, and ultimately the Record of Decision. See EPA's Clean Construction USA website for additional information.5	Ambient air conditions, NAAQS, and criteria pollutant nonattainment areas are discussed in section 9.3 and Table 9.3-1 of PCGP RR9. Potential air quality impacts (direct) are discussed in section 9.7 of PCGP RR9. Cumulative and indirect impacts are discussed in section 10. Construction emissions are estimated and discussed for the pipeline in section 9.7.1 of PCGP RR9.

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	14	*Fugitive Dust Source Controls:* – Stabilize open storage piles and disturbed areas by covering and/or applying water or chemical/organic dust palliative where appropriate. This applies to both inactive and active sites, during workdays, weekends, holidays, and windy conditions. – Install wind fencing, and phase grading operations, where appropriate, and operate water trucks for stabilization of surfaces under windy conditions. – When hauling material and operating non-earthmoving equipment, prevent spillage, and limit speeds to 15 miles per hour (mph). Limit speed of earth-moving equipment to 10 mph. – Replant any permanently exposed lakebed with native plantings. This would serve to control dust while minimizing the colonization of invasive species and restoring natural ecosystem processes.	To be addressed in the EIS (see Resource Report 9).
EPA	15	*Mobile and Stationary Source Controls*: – Reduce use, trips, and unnecessary idling of heavy equipment. – Maintain and tune engines per manufacturer's specifications to perform EPA certification levels, where applicable, and to perform at verified standards applicable to retrofit technologies. Employ periodic, unscheduled inspections to limit unnecessary idling and to ensure that construction equipment is properly maintained, tuned, and modified consistent with established specifications. – Prohibit any tampering with engines and require continuing adherence to manufacturer's recommendations. – If practicable, lease new, clean equipment meeting the most stringent of applicable Federal or State Standards. – Utilize EPA-registered particulate traps and other appropriate controls where suitable, to reduce emissions of diesel particulate matter and other pollutants at the construction site. – Limit vehicle speeds on unpaved roads to 15 mph.	Mobile and stationary source controls during construction are discussed in section 9.7.1 of PCGP RR9.

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	16	*Administrative Controls*: – Identify all commitments to reduce construction emissions and incorporate these reductions into the air quality analysis to reflect additional air quality improvements that would result from adopting specific air quality measures. – Identify where implementation of mitigation measures is deemed to be not implementable due to economic infeasibility and provide comparable determinations for other similar projects as justification for this decision. – Prepare an inventory of all equipment prior to construction, and identify the suitability of add-on emission controls for each piece of equipment before groundbreaking. (Suitability of control devices is based on: whether there is reduced normal availability of the construction equipment due to increased downtime and/or power output, whether there may be significant damage caused to the construction equipment engine, or whether there may be a significant risk to nearby workers or the public.) – Meet EPA diesel fuel requirement for off-road and on-highway (i.e., 15 ppm), and where appropriate use alternative fuels such as natural gas and electric. – Develop construction traffic and parking management plan that minimizes traffic interference and maintains traffic flow. – Identify sensitive receptors in the project area, such as children, elderly, and infirm, and specify the means by which you will minimize impacts to these populations. For example, locate construction equipment and staging zones away from sensitive receptors and fresh air intakes to buildings and air conditioners.	Mobile and stationary source controls during construction are discussed in section 9.7.1 of PCGP RR9.

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	17	**Biological Resources, Habitat and Wildlife** The EPA recommends the EIS identify all petitioned and listed threatened and endangered species under the Endangered Species Act, as well as critical habitat, which might occur within the project area. We also recommend the EIS identify and quantify which species or critical habitat might be directly, indirectly, or cumulatively affected by each alternative and mitigate impacts to those species. The EPA recommends that the FERC continue to work with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. The EPA also recommends the FERC continue to coordinate with the Oregon Department of Fish and Wildlife to ensure that State sensitive species are adequately addressed within the analysis and that current and consistent surveying, monitoring, and reporting protocols are applied in protection and mitigation efforts. The EPA recommends the EIS also identify species listed under the Marine Mammal Protection Act. Marine barge/vessel traffic may result in potential conflicts with threatened and/or endangered marine mammals and their migration patterns and routes. We also recommend the EIS describe the barge/vessel traffic schedule, patterns and marine transportation routes, as well as the migration period, patterns, and routes of potentially affected marine mammals. The direct, indirect and cumulative impacts from barge/vessel traffic on marine mammals, threatened and endangered species, critical habitats, and subsistence resources should be analyzed in the EIS.	To be addressed in the EIS (see Resource Report 3).

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	18	**Land Use Impacts** Land use impacts would include, but not be limited to, disturbance of existing land uses within construction work areas during construction and creation of permanent right-of-ways for construction, operations, and maintenance of the pipeline and above ground facilities. The EPA recommends the EIS document all land cover and uses within the project corridor, impacts by the project to the land cover and uses, and mitigation measures that would be implemented to reduce the impacts. The primary impact of construction on forests and other open land use types would be the removal of trees, shrubs, and other vegetation. Although these can be regenerated or replanted, their reestablishment can take up to 20 years or more, making the construction impacts to these resources long term and in some cases permanent. The impact on forest land use, for example, in the permanent rightof-way areas would be a permanent change to open land. We recommend the EIS describe the impacts to forest and open land use types, indicate if the impacts would be permanent or temporary, and state measures that would be taken to compensate landowners for loss of their resources because of the project. If the project would cross sensitive areas then the EIS should specify the areas, indicate impacts to the areas, and document any easement conditions for use of the areas, including mitigation measures.	To be addressed in the EIS (see Resource Reports 3 and 8).

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	19	**Invasive Species** The establishment of invasive nuisance species has become an issue of environmental and economic significance. The EPA recommends consideration of impacts associated with invasive nuisance species consistent with E.O. 13112 Invasive Species. In particular, construction activities associated with buried pipelines which disturb the ground may expose areas and could facilitate propagation of invasive species. Mitigation, monitoring and control measures should be identified and implemented to manage establishment of invasive species throughout the entire pipeline corridor right-of-way. We recommend the EIS include a project design feature that calls for the development of an invasive species management plan to monitor and control noxious weeds, and to utilize native plants for restoration of disturbed areas after construction. If pesticides and herbicides will be applied during construction, operation, and maintenance of the project, we recommend that the EIS address any potential toxic hazards related to the application of the chemicals, and describe what actions will be taken to assure that impacts by toxic substances released to the environment will be minimized. Ballast water from barges/vessels is a major source of introducing non-native species into the marine ecosystems where they would not otherwise be present. Non-native species can adversely impact the economy, the environment, or cause harm to human health. Impacts may include reduction of biodiversity of species inhabiting coastal waters from competition between non-native and native species for food and resources. We recommend the EIS discuss potential impacts from non-native invasive species associated with ballast water and identify mitigation measures to minimize adverse impacts to the marine environment and human health.	See Section 3.1.4.11. To be addressed in the EIS.

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	20	**Hazardous Materials/Hazardous Waste/Solid Waste** The EPA recommends EIS address potential direct, indirect, and cumulative impacts of hazardous waste from construction and operation of the proposed project. The document should identify projected hazardous waste types and volumes, and expected storage, disposal, and management plans. It should identify any hazardous materials sites within the project's study area and evaluate whether those sites would impact the project in any way.	See Appendix O.7. To be addressed in the EIS.
EPA	21	**Seismic and Other Risks** Construction and operation of the proposed facility and pipeline may cause or be affected by increased seismicity (earthquake activity) in tectonically active zones. We recommend the EIS identify potentially active and inactive fault zones where the proposed pipeline may cross. This analysis should discuss the potential for seismic risk and how this risk will be evaluated, monitored, and managed. A map depicting these geologic faults should be included in the EIS. The construction of the proposed project must use appropriate seismic design and construction standards and practices. Ground movement on these faults can cause a pipeline to rupture, resulting in discharge of gas and subsequent explosion. Particular attention should be paid to areas where the pipeline may cross areas with high population densities. Mitigation measures should be identified in the EIS to minimize effects on the pipeline due to seismic activities.	See Resource Report 6 and 11 for seismic discussion. To be addressed in the EIS.

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	22	**Blasting Activities** During project construction, blasting may be required in certain areas along the pipeline route corridor and adjacent facilities, resulting in increased noise and related effects to local residents, and disruption and displacement of bird and wildlife species. We recommend the EIS discuss where blasting in the project area would be required, blasting methods that would be used, and how blasting effects would be controlled and mitigated. Noise levels in the project area should be quantified and the effects of blasting to the public and to wildlife should also be evaluated in the EIS. We recommend that a Blasting Management Plan be developed and the environmental impacts evaluated in the EIS.	To be addressed in the EIS.
EPA	23	**National Historic Preservation Act** Consultation for tribal cultural resources is required under Section 106 of the National Historic Preservation Act. Historic properties under the NHPA are properties included in the National Register of Historic Places or meet the criteria for the National Register. Section 106 of the NHPA requires a federal agency, upon determining that activities under its control could affect historic properties, consult with the appropriate State Historic Preservation Officer /Tribal Historic Preservation Officer. Under NEPA, any impacts to tribal, cultural, or other treaty resources must be discussed and mitigated. Section 106 of the NHPA requires that federal agencies consider the effects of their actions on cultural resources, following regulation in 36 CFR 800.	See Resource Report 4. To be addressed in the EIS.

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	24	**Environmental Justice and Impacted Communities** In compliance with NEPA and with Executive Order (EO) 12898 on Environmental Justice, actions should be taken to conduct adequate public outreach and participation which ensures the public and Native American tribes understand the possible impacts to their communities and trust resources. EO 12898 requires each Federal agency to identify and address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations, low-income populations, and Native American tribes.6 The EPA also considers children, the disabled, the elderly, and those of limited English proficiency to be potential Environmental Justice communities due to their unique vulnerabilities. According to the Council on Environmental Quality, when determining whether environmental effects are disproportionately high and adverse, agencies should consider the following factors: 7 – Whether environmental effects are or may be having an adverse impact on minority populations, low-income populations, or Indian tribes that appreciably exceeds or is likely to appreciably exceed those on the general population or other appropriate comparison group – Whether the disproportionate impacts occur or would occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards.	See Resource Report 5. To be addressed in the EIS.

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	25	**Socioeconomic Impacts** Council on Environmental Quality Regulations at 40 CFR 1500-1508 state that the "human environment" is to be "interpreted comprehensively" to include "the natural and physical environment and the relationship of people with that environment" (40 CFR 1508.14). Consistent with this direction, agencies need to assess not only "direct" effects, but also "aesthetic, historic, cultural, economic, social, or health" effects, "whether direct, indirect, or cumulative" (40 CFR 1508.8). Social impact assessment variables point to measurable change in human population, communities, and social relationships resulting from a development project or policy change. We suggest that the EIS analyze the following social variables: – Population Characteristics – Community and Institutional Structures – Political and Social Resources – Individual and Family Changes – Community Resources Impacts to these social variables should be considered for each stage of the project (development, construction, operation, decommissioning). With regard to the construction and operation phase of the project, we recommend the analysis give consideration to how marine traffic might change, and how this may affect commercial or recreational use on the bay and travel over the bar. We also recommend the EIS consider potential pressure on local resources and infrastructure associated with the construction worker housing at the South Dunes site.	See Resource Reports 5 and 8.

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	26	**Coordination with Tribal Governments** Executive Order 13175, Consultation and Coordination with Indian Tribal Governments (November 6, 2000), was issued in order to establish regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications, and to strengthen the United States government-to-government relationships with Indian tribes. The EIS should describe the process and outcome of government-to-government consultation between the FERC and tribal governments within the project area, issues that were raised, and how those issues were addressed in the selection of the proposed alternative.	To be included in the EIS.
EPA	27	**Indirect Impacts** Per CEQ regulations at CFR 1508.8(b), the indirect effects analysis "may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems." The 2012 report from the Energy Information Administration8 states that, "natural gas markets in the United States balance in response to increased natural gas exports largely through increased natural gas production." That report goes on to say that about three-quarters of that increase production would be from shale resources. We believe it is appropriate to consider available information about the extent to which drilling activity might be stimulated by the construction of an LNG export facility on the west coast, and any potential environmental effects associated with that drilling expansion.	See Response to Scoping Comments, page 8.

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	28	**Cumulative Impacts** The cumulative impacts analysis should identify how resources, ecosystems, and communities in the vicinity of the project have already been, or will be affected by past, present, or future activities in the project area. These resources should be characterized in terms of their response to change and capacity to withstand stresses. Trends data should be used to establish a baseline for the affected resources, to evaluate the significance of historical degradation, and to predict the environmental effects of the project components. For the cumulative impacts assessment, we recommend focusing on resources of concern or resources that are "at risk" and /or are significantly impacted by the proposed project, before mitigation. For this project, the FERC should conduct a thorough assessment of the cumulative impacts to aquatic and biological resources (including eel grass and plover habitat), air quality, and commercial and recreational use of the bay. We believe the EIS should consider the Port of Coos Bay Channel Modification Project (http://www. portofcoosbay.com/channel-deepening) as reasonably foreseeable for the purposes of cumulative effects analysis. The EPA also recommends the EIS delineate appropriate geographic boundaries, including natural ecological boundaries, whenever possible, and should evaluate the time period of the project's effects. For instance, for a discussion of cumulative wetland impacts, a natural geographic boundary such as a watershed or sub-watershed could be identified. The time period, or temporal boundary, could be defined as from 1972 (when the Clean Water Act established section 404) to the present. Please refer to CEQ's "Considering Cumulative Effects Under the National Environmental Policy Act"9 and the EPA's "Consideration of Cumulative Impacts in EPA Review of NEPA Documents"10 for assistance with identifying appropriate boundaries and identifying appropriate past, present, and reasonably foreseeable future projects to include in the analysis.	See Appendix B.1 To be addressed in the EIS.

Agency	Agency Comment #	Agency Comment	Response Summary
EPA	29	**Mitigation and Monitoring** On January 21, 2011, CEQ issued final guidance on the Appropriate Use of Mitigation and Monitoring. This guidance seeks to enable agencies to create successful mitigation planning and implementation procedures with robust public involvement and monitoring programs. We recommend the EIS include a discussion and analysis of proposed mitigation measures and compensatory mitigation under CWA §404. The EIS should identify the type of activities which would require mitigation measures either during construction, operation, and maintenance phases of this project. To the extent possible, mitigation goals and measureable performance standards should be identified in the EIS to reduce impacts to a particular level or adopted to achieve an environmentally preferable outcome. Mitigation measures could include best management practices and options for avoiding and minimizing impacts to important aquatic habitats and to compensate for the unavoidable impacts. Compensatory mitigation options could include mitigation banks, in-lieu fee, preservation, applicant proposed mitigation, such as the Kentuck project. Care should be taken to ensure consistency with the Compensatory Mitigation for Losses of Aquatic Resources; Final Rule (33 CFR Parts 325 and 332 and 40 CFR Part 230). A mitigation plan should be developed in compliance with 40 CFR Part 230 Subpart J 230.94, and included in the EIS. An environmental monitoring program should be designed to assess both impacts from the project and mitigation measures being implemented are effective. We recommend the EIS identify clear monitoring goals and objectives, such as what parameters are to be monitored, where and when monitoring will take place, who will be responsible, how the information will be evaluated, what actions (contingencies, triggers, adaptive management, corrective actions, etc.) will be taken based on the information. Furthermore, we recommend the EIS discuss public participation, and how the public can get information on mitigation effectiveness and monitoring results.	To be addressed in the EIS.

Agency	Agency Comment #	Agency Comment	Response Summary
NMFS	1	There is substantial information in this report that will be valuable for the Biological Assessment (BA) and subsequent consultation. As stated in Resource Report 1, page 6: The watershed boundary is the first subdivision of a sub-basin and considered the most appropriate to provide the context for management through description and understanding of specific ecosystem conditions and capabilities and to offer a consistent format for reporting results of analysis (Forest Service and BLM 2003)". The effects of the project, including the Compensatory Mitigation Plan should be discussed in detail (turbidity, temperature, hydrostatic testing Riparian areas, etc.) on a watershed basis, and then integrated on a population scale. Will need to not only address effects to the species but how the project will affect critical habitat and if the project will/will not contribute to the limiting factors for each species. As the biological assessment (BA) is developed, please keep in mind the need to assess the effects to both the species and the Physical and Biological Features of critical habitat using the following criteria: **Proximity** – the geographic relationship between the project element of action and the species/designated critical habitat. **Probability** – the likelihood that the species or habitat will be exposed to the biotic or abiotic effects of the project element or action to the indicator. **Magnitude** – the severity and intensity of the effect. **Distribution** – the geographic area in which the disturbance would occur (this may be several small effects or one large effect). **Frequency** – how often the effect would occur **Duration** – how long the effect would last. Potential categories include; short term events whose effects subside immediately (pulse effect); sustained, long-term effect, or chronic effect whose effects persist (press effect); and permanent event(s) that sets a new threshold for a species' environment (threshold effect). **Timing** – when the effect would occur in relation to the species' life-history patterns. **Nature** – effects of the action on elements of a species life cycle, population size or variability, or distribution; or on the physical and/or biological features of critical habitat, including direct and indirect effects. The better the effects are assessed as described above, the more likely delays in Endangered Species Act consultations will be avoided. Similarly, finalization of reports/appendices and mitigation plans with their references prior to the BA will help avoid consultation delays. Please note for critical habitat, the term primary constituent elements (PCEs) is no longer used; use the term physical and biological features (PBFs).	Applicant-Prepared Draft Biological Assessment. Anticipated delivery is November 2017

Agency	Agency Comment #	Agency Comment	Response Summary
FERC	General 1	General Requests: Ensure that the acres of impact to the various resources are reported as "construction impacts" and "operational impacts."	See various resource report sections, including JCEP and PCGP Tables 1.4-1 and 1.2-1, respectively.
FERC	General 2	General Requests: The list and names of the "Project facilities/activities" as well as the acres affected by each facility/activity presented in Table 1.4-1 are not consistent with the names and values presented in the various tables found in Resource Reports 2 through 9 (e.g., see Table 8.1-2). Review and ensure that the nomenclature used for Project facilities/activities and the estimated acres disturbed are consistent between the various reports.	Draft Resource reports were submitted in a staggered fashion leading to some discrepancies in nomenclature and areas. Reports have been standardized.
FERC	General 3	General Requests: Include the impacts that would occur to all resources as a result of the Kentuck mitigation efforts in the various impact tables and discussions found in the Resource Reports.	Impacts to resources due to Kentuck Project have been included in the Resource Reports.
FERC	NRI 1	Include a schedule for constructing the various components of the planned Navigation Reliability Improvements project (e.g., initial dredging, temporary and permanent bridge construction, slurry/dredge-material placement, and maintenance dredging).	In water work will take place between first half 2019 and end of 2022 during in water work windows. On shore work will take place to support the in water work activity.
FERC	NRI 2	Include the following details regarding the planned dredging for the Navigation Reliability Improvements project: a. an analysis (including supporting modeling) of the turbidity plume that would occur as a result of dredging; b. a characterization of the material to be dredged to verify that the constituents and material grain size meet the requirements for the planned disposal; and c. information on the length and location of the slurry pipeline that would be placed on the estuary bottom and used to transport slurry from the dredging areas to the disposal areas.	Resource Report 2 addresses these concerns. The Hydrodynamic model update with the commented outputs will be available in October 2017.
FERC	NRI 3	Include an estimate of the average and peak employment totals and identify the share of the workforce expected to be hired locally (i.e., within daily commuting distance of work areas).	See Resource Report 5, Section 5.1.4

Agency	Agency Comment #	Agency Comment	Response Summary
FERC	NRI 4	Include an estimate of the payroll and local expenditures for the Navigation Reliability Improvements project.	Resource Report 5 analysis addresses payroll and local expenditures. The payroll and local expenditures is estimated at <0.5% of the analysis.
FERC	NRI 5	Include the acres of vegetation and habitats (including eelgrass, mudflats, estuarine areas, and/or other communities) that would be affected during the various components of the planned Navigation Reliability Improvements project (e.g., initial dredging, temporary and permanent bridge construction, slurry/dredge-material placement, and maintenance dredging).	These acreages have been updated and included in the analysis.
FERC	NRI 6	Include a discussion of the Phase 2 Environmental Site Assessment (ESA) that would be conducted to assess hazardous materials at the APCO disposal sites. This discussion should address the type of contaminants that would be characterized, any previous regulatory involvement, and the specific timing of the Phase 2 ESA activities in relation to the planned project.	This has been completed, see Appendix J.7.
FERC	NRI 7	Clarify what is being referred to in Section 7.2.1 when discussing "the rock above the proposed dredging depths." Specify the depths of the dredge areas and include a figure (or figures) showing the relative depths.	Section 3.3.2 and Table 3-2 of Appendix N.7 for dredge material characteristics.
FERC	NRI 8	Clarify and further describe the "small rock pinnacle" noted for Dredge Area 3 and clarify if the other material (beyond the small rock pinnacle) in this area consists of sand.	Section 3.3.2 and Table 3-2 of Appendix N.7 for dredge material characteristics.
FERC	1	Include in Section 1.3 a description of the Meteorological Station that is shown on Figures 1.1-1 and 1.2-1. Confirm that the impacts resulting from construction and operation of this facility are included in the land requirements described in Section 1.4 and in Resource Reports 2 through 10; if these impacts are not included, include them.	A description and impacts from the Meteorological Station have been included in the listed Resource Reports.

Agency	Agency Comment #	Agency Comment	Response Summary
FERC	2	Include additional detail on the intended use of the APCO Site and specific activities that would take place at these sites during construction. The outline of the APCO Site as shown on Figures 1.2-1 and 1.3-10 suggests there would be a dock or water-side component to its use; be sure to include a description of activities associated with the dock that is suggested by these figures.	See sections 1.3.7, 1.5.5.2, 1.5.6 of RR1foradditional detail.
FERC	3	Include a table in Resource Report 1 that lists every plan that has been developed and/or will be developed as part of this Project (e.g., the various mitigation plans, development plans, construction plans, transportation plans, etc.). Include a column that indicates if the specific plan has been finalized, or when the plan would be finalized if it has not been completed to date, and the review of the plans by appropriate agencies.	See Table 1.6-1 for approvals and permits required. See table at end of comment matrix for list of plans.
FERC	4	Include a description of how contaminated soils at the South Dunes site would be removed and disposed of.	See Contaminated Media Management Plan, Appendix X.7.
FERC	5	Include additional justification to support the statement and conclusions that disposal of dredged materials at off-site disposal areas would not result in adverse impacts.	This wording has been removed.
FERC	6	Verify that all dredged materials to be placed at the Kentuck Mitigation Site would be transported via marine barges, and that a slurry pipeline and decant water return pipeline would not be used.	Dredged material for Kentuck would be transported via barge to a transfer location. From the transfer location to Kentuck the dredge material will be transported via dredge line. See Figure 1.4-1 and Section
FERC	7	Include a description of how concrete waste water generated during construction would be disposed of.	See Appendix X.7, Erosion and Sediment Control Plan.
FERC	8	Identify and ensure the size (in acres) of the Kentuck Mitigation Site is consistent throughout the various resource reports.	Reviewed and updated throughout.
FERC	9	Revise the cumulative impact analysis' Geographic Scope for Geological Resource Hazards, Soils/Sediments, Land Use, and Recreation to use the Hydrologic Unit Code 10 watershed.	Cumulative scope analysis updated for Sediments, Land Use and Recreation. A more practical buffer was utilized for geologic and soils geographic scope. See Appendix B.1.

Agency	Agency Comment #	Agency Comment	Response Summary
FERC	10	Resource Report 1 states that water used for hydrostatic testing "will be obtained from a combination of commercial and municipal sources, private supply wells, and surface water sources." Include the volumes that would be withdrawn from each source, as well as the total amount of water use for all project activities (e.g., concrete washouts, site work, hydrostatic testing of LNG storage tanks and piping systems, initial fill of firewater tanks, and workforce housing). Also include the amount of water use annually for operation of the LNG Terminal.	Section 1.5.8.8 has been updated. See Appendix B.2 and Table 2.1-1 for volumes.

JCEP List of Plans

Resource Report Appendix	Plan	Date to FERC (and main regulating agency)
Notes: Appendix references are to the FERC Certificate application and provided unless otherwise noted. Authorizations and approvals are listed in Table 1.6-1.		
Appendix F.2	SPCC - Construction	
Appendix G.2	SPCC - Operations	
Appendix J.2	Storm Water Management Plan	
Appendix M.2	Compensatory Wetland Mitigation Plan	
Appendix H.7	Erosion and Sediment Control Plan	
Appendix N.7	Dredge Material Management Plan	
Appendix O.7	Contaminated Media Management Plan	

PCGP List of Plans/Reports/Applications that Have Been or Will Be Submitted

Resource Report Appendix	Report/Plan/Study/Application	Date to FERC (and main regulating agency)
Appendix Q.2	Thermal Impacts Assessment	
Appendix R.2	Mine Hazards Evaluation and Mercury Testing at the Red Cloud, Mother Lode, Nivinson, and Elkhorn Mining Groups	
Appendix S.2	Potential for natural-occurring mercury mineralization to enter the aquatic environment between M.P. 109 and East Fork Cow Creek	
Appendix T.2	Channel Migration and Scour Analysis	
Appendix U.2	HGM Report	
Appendix V.2	Hydrostatic Test Plan	
Appendix H.3	Blasting and Helicopter Noise Analysis & Mitigation	
Appendix I.3	Fish Salvage Plan	
Appendix B.4	Cultural Resources Survey and Evaluation Reports	
Appendix E.4	Unanticipated Discovery Plan	
JCEP Resource Report 5	ECONorthwest Reports	
Appendix A.6	Geologic Hazards and Mineral Resources Report	
Appendix B.6	Paleontology Assessment of Pacific Connector Gas Pipeline Project BLM Lands	
Appendix D.8	Communications Study	
Appendix J.9	Air permit application, Klamath Compressor Station	
Appendix K.9	Waterbody Crossing Noise Studies	
Other Applications		
JPA		October
	Wetland and Waterbody Mitigation Plan	
	Large Woody Debris Plan	
	Water Quality Criteria Assessment	
	Thermal Mitigation Trading Approach	
	Wetland Delineation Report	
SF-299/POD		October
NPDES/1200-C/Stormwater		
CZM		
	ODFW Fish Passage	Spring 2018
	ODFW Blasting	Spring 2018
	OWRD Water Withdrawal	Spring 2018
APDBA		November
	Conservation Measures	
	Compensatory Mitigation Plan	
	ESA Avoidance and Minimization Plans	
APDBA	MMPA Application	November
APDBA	Migratory Bird Conservation Plan	November
EIS	Management Indicator Species	FS Document
EIS	Biological Evaluation	FS Document
EIS	Aquatic Conservation Strategy Analysis	FS Document
Biological Survey Reports		Dec-Jan 2018
Survey and Manage Reports		Dec-Jan 2018

JCEP LNG TERMINAL PROJECT

Resource Report 1 - General Project Description

MINIMUM FILING REQUIREMENTS	See the Following Resource Report Section :
1. Provide a detailed description and location map of the project facilities – 18 CFR § 380.12(c)(1)	Section 1.3 Figure 1.1-1
2. Describe any non-jurisdictional facilities that would be built in association with the project – 18 CFR § 380.12(c)(2)	Section 1.9
3. Provide current original U.S. Geological Survey 7.5-minute-series topographic maps with mileposts showing the project facilities – 18 CFR § 380.12(c)(3)	Figure 1.3-10
4. Provide aerial images or photographs or alignment sheets based on these sources with mileposts showing the project facilities – 18 CFR § 380.12(c)(3)	Figure 1.3-9
5. Provide plot/site plans of compressor stations showing the location of the nearest noise-sensitive areas within 1 mile – 18 CFR § 380.12(c)(3,4)	Figure 1.1-2 and Resource Report 9
6. Describe construction and restoration methods – 18 CFR § 380.12(c)(6)	Section 1.5
7. Identify the permits required for construction across surface waters – 18 CFR § 380.12(c)(9)	Section 1.8 Table 1.6-1
8. Provide the names and address of all affected landowners and certify that all affected landowners will be notified as required in § 157.6(d) – 18 CFR § 380.12(c)(10)	Section 1.8.1.1 Appendix A.1 (to be provided in a subsequent filing)

INFORMATION OFTEN MISSING AND RESULTING IN DATA REQUESTS	See the Following Resource Report Section:
• Describe all authorizations required to complete the proposed action and the status of applications for such authorizations, including actual or anticipated submittal and receipt dates.	Section 1.8 and Table 1.6-1
• Provide plot/site plans of all aboveground facilities that are not completely within the right-of-way.	Figure 1.1-2
• Provide detailed typical construction right-of-way cross-section diagrams for each proposed right-of-way configuration showing information such as widths and relative locations of existing rights-of-way, new permanent rights-of-way, and temporary construction rights-of-way. Clearly identify any overlap of existing rights-of-way for projects involving collocation. Identify by pipeline facility and milepost where each right-of-way configuration would apply.	Figure 1.1-5

INFORMATION OFTEN MISSING AND RESULTING IN DATA REQUESTS	See the Following Resource Report Section:
• Summarize the total acreage of land affected by construction and operation of the project.	Table 1.4-1
• Describe cathodic protection system; include associated land requirements as appropriate.	Not Applicable
• Describe construction and restoration methods for offshore facilities as well as onshore facilities.	Section 1.5
• For proposed abandonments, describe how the right-of-way would be restored, who would own the site or right-of-way after abandonments, who would be responsible for facilities that would be abandoned in place, and whether landowners were given the opportunity to request removal.	Not Applicable
• If Resource Report 5, Socioeconomics is not provided, provide the start and end dates of construction, the number of pipeline spreads that would be used, and the workforce per spread.	Section 1.5.1
• If project includes construction in the federal offshore area, include in the discussion of required authorizations and clearances the status of consultations with the Bureau of Ocean Energy Management, Regulation and Enforcement. File with the Bureau of Ocean Energy Management, Regulation and Enforcement for right-of-way grants at the same time or before filing the Federal Energy Regulatory Commission application.	Not Applicable
• For project involvement the import or export of natural gas/liquefied natural gas and construction of liquefied natural gas facilities, include in the discussion of required authorizations and clearances the status of consultations and authorizations required from the U.S. Department of Energy, U.S. Coast Guard, and the Federal Aviation Administration, as applicable.	Section 1.8 and Table 1.6-1
• Send two (2) additional copies of topographic maps and aerial images/photographs directly to the environmental staff of the Office of Energy Projects.	Figures 1.3-9 and 1.3-10
• Provide an electronic copy of the landowner list directly to the FERC environmental staff (check with FERC staff for required format).	Appendix A.1

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TABLES

FIGURES

APPENDICES

ACRONYMS

$\mu g/Nm^3$	Micrograms per Normal Cubic Meter
ACC	Air Cooled Condenser
API	American Petroleum Institute
BOG	Boil-off Gas
Bcf/d	Billion Standard Cubic Feet Per Day
CBEMP	Coos Bay Estuary Management Plan
CBNBWB	Coos Bay-North Bend Water Board
CCM	Concrete Cellular Mattress
CEMS	Continuous Emissions Monitoring System
CO_2	Carbon Dioxide
cy	Cubic Yards
DCS	Distributed Control System
DLCD	Oregon Department of Land Conservation and Development
DOE	United States Department of Energy
DOE/FE	United States Department of Energy Office of Fossil Energy
DOT	United States Department of Transportation
Dth/d	Dekatherms Per Day
EIA	Energy Information Administration
ERP	Emergency Response Plan
ESD	Emergency Shutdown System
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FGS	Fire and Gas Systems
FYE	Full Year Equivalent
gpm	Gallons Per Minute
H	Horizontal
H_2S	Hydrogen Sulfide
HIPPS	High Integrity Pressure Protection System
HMT	Highest Measured Tide
HRSG	Heat Recovery Steam Generator
ICSS	Instrument Control and Safeguarding System
I/O	Input/Output
IWWP	Industrial Waste Water Pipeline
JCEP	Jordan Cove Energy Project, L.P.
kV	Kilovolt
LNG	Liquefied Natural Gas
LOI	Letter of Intent
LOR	Letter of Recommendation
m^3	Cubic Meter
m^3/hr	Cubic Meter Per Hour
mcy	Million Cubic Yards
MMscfd	Million Standard Cubic Feet per Day
MLLW	Mean Lower Low Water
mtpa	Million Tonnes Per Annum
MOF	Material Offloading Facility
MW	Megawatt
NAVD88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act

NFPA	National Fire Protection Association
NGA	Natural Gas Act
NMFS	National Marine Fisheries Service
O&M	Operations and Maintenance
ODEQ	Oregon Department of Environmental Quality
ODSL	Oregon Department of State Lands
PCGP	Pacific Connector Gas Pipeline, LP
PHE	Powerhouse Enclosure
PLF	Product Loading Facility
ppbv	Parts Per Billion Volume
ppmv	Parts Per Million Volume
psig	Pounds Per Square Inch Gauge
PSV	Pressure Safety Valve
RFP	Roseburg Forest Products Company
SIS	Safety Instrumented Systems
SMR	Single Mixed Refrigerant
SORSC	Southwest Oregon Regional Safety Center
STG	Steam Turbine Generator
Tcf	Trillion Cubic Feet
TPP	Transpacific Parkway
TMBB	Temporary Material Barge Berth
US 101	U.S. Highway 101
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey
V	Vertical
WSA	Waterway Suitability Assessment
WSR	Waterway Suitability Report

1.0 INTRODUCTION

Jordan Cove Energy Project, L.P. ("JCEP") is seeking authorization from the Federal Energy Regulatory Commission ("FERC" or "Commission") under Section 3 of the Natural Gas Act ("NGA") to site, construct, and operate a natural gas liquefaction and liquefied natural gas ("LNG") export facility ("LNG Terminal"), located on the bay side of the North Spit of Coos Bay, Oregon. JCEP will design the LNG Terminal to receive a maximum of 1,200,000 dekatherms per day ("Dth/d") of natural gas and produce a maximum of 7.8 million metric tons per annum ("mtpa") of LNG for export. The LNG terminal will turn natural gas into its liquid form via cooling to about -260^{o}F, and in doing so it will reduce in volume to approximately 1/600th of its original volume, making it easier and more efficient to transport.

In order to supply the LNG Terminal with natural gas, Pacific Connector Gas Pipeline, LP ("PCGP") is proposing to contemporaneously construct and operate a new, approximately 229-mile-long, 36-inch-diameter natural gas transmission pipeline from a point of origin near the intersection of the Ruby Pipeline LLC ("Ruby") and Gas Transmission Northwest LLC ("GTN") systems to the LNG Terminal ("Pipeline," and collectively with the LNG Terminal, the "Project"). PCGP will submit a contemporaneous application to FERC that will include its own set of resource reports with references to certain materials in the LNG Terminal resource reports.

FERC's National Environmental Policy Act ("NEPA") review process requires that an applicant submit an Environmental Report consisting of up to 13 individual resource reports. While the LNG Terminal and the Pipeline are interrelated projects, this Resource Report 1 provides a description of only the LNG Terminal and its purpose and need, as well as a specific description of the LNG Terminal facilities and certain non-jurisdictional facilities. This resource report also includes a description of the benefits to the local LNG Terminal area, land requirements, construction and operation procedures, and applicable regulatory approvals and coordination, as well as the current construction schedule for the LNG Terminal. Additionally, Appendix B.1 provides a discussion of the potential cumulative impacts that may result when the environmental effects associated with the Project are added to the impacts associated with other past, present, or reasonably foreseeable future actions.

The general location of the proposed LNG Terminal is shown on Figure 1.1-1. Also, Figure 1.1-2 includes a general layout of the proposed LNG Terminal and surrounding area and identifies the names of various geographic areas referenced in the resource reports.

This resource report is consistent with and meets or exceeds all applicable FERC filing requirements. A checklist showing the status of FERC's filing requirements for Resource Report 1 (18 CFR § 380.12) is included before the table of contents.

1.1 STATEMENT OF PURPOSE AND NEED

The Project is a market-driven response to the burgeoning and abundant natural gas supply in the US Rocky Mountain and Western Canada markets, and the growth of international demand, particularly in Asia.

The overall Project purpose and need is to construct a natural gas liquefaction and deep-water export terminal capable of receiving and loading ocean-going LNG carriers, in order to export natural gas derived from a point near the intersections of the GTN Pipeline system and Ruby Pipeline system.

The Pipeline origin near the intersection of the GTN Pipeline system and Ruby Pipeline system is strategically located to give reliable and secure supplies of natural gas from two natural gas supply basins – one in the U.S. Rocky Mountains (through the existing Ruby Pipeline) and a second in western Canada (through the existing GTN Pipeline) – capable of delivering volumes of at least 1,200,000 Dth/d in order to support export of 7.8 mtpa of LNG.

The LNG Terminal, proposed to be located on the bay side of the North Spit of Coos Bay, would support receipt, liquefaction, storage, and loading of LNG onto ocean-going LNG carriers for delivery to export markets giving those supplies an efficient and cost-effective outlet. The Pipeline is needed to transport natural gas from near the intersection of the GTN Pipeline system and Ruby Pipeline system to the LNG Terminal.

1.2 PROJECT SUMMARY

1.2.1 Background

On September 4, 2007, JCEP filed an application with FERC to construct and operate an LNG import terminal at Coos Bay, Oregon, in Docket No. CP07-444-000. That same day, PCGP, in Docket No. CP07-441-000, filed an application with FERC to construct and operate a natural gas sendout pipeline connecting the JCEP LNG import terminal with existing natural gas transportation systems. In May 2009, FERC produced a final environmental impact statement ("FEIS") for Docket Nos. CP07-441-000 and CP07-444-000. The Commission authorized both the import terminal and the natural gas sendout pipeline on December 17, 2009. On April 16, 2012, the Commission vacated the previously issued certificates for the LNG import terminal in Docket No. CP07-444-000 and the associated sendout pipeline in Docket No. CP07-441-000.

On May 21, 2013, JCEP filed an application seeking authorization for its proposed LNG export terminal on the North Spit of Coos Bay in Coos County, Oregon, in Docket No CP13-483-000. PCGP filed its companion application with FERC for the supply pipeline to the proposed terminal on June 6, 2013, in Docket No. CP13-492-000. FERC conducted an extensive environmental review of both applications, issuing an FEIS in September 2015. On March 11, 2016, the Commission denied the applications for certificates in Docket Nos. CP13-483-000 and CP13-492-000, without prejudice to JCEP's and PCGP's refiling of new applications.

On January 23, 2017, JCEP and PCGP requested approval to participate in FERC's pre-filing review process to assist in the identification and proper assessment of issues and to obtain input on the development of the environmental resource reports. FERC granted this request on February 10, 2017, and assigned Docket No. PF17-4-000.

JCEP currently anticipates that construction for the Project would begin in the first half of 2019, with a target in-service date in the first half of 2024. Major differences between the 2013 and 2017 export terminal proposals are further described below.

1.2.2 Market Demand and Economic Support for the Project

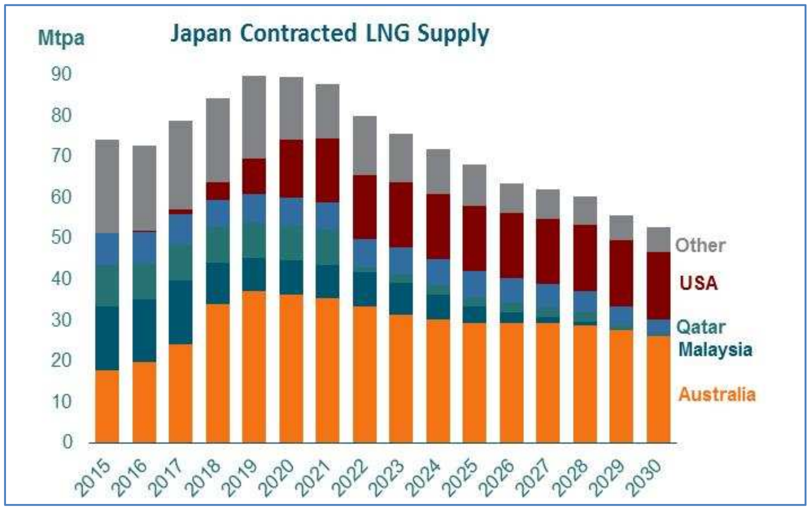
The Project would provide clean burning natural gas to Asian markets, which would reduce the amount of oil, gas, and nuclear generation currently being used in these markets and increase cleaner-burning supplies to other commercial and residential markets. The Project would also provide new market access for natural gas producers in the Rocky Mountains and Western Canada. These producers have seen their access to markets in the eastern and central regions of the United States and Canada erode with the development and ramp-up of natural gas from the Marcellus and Utica shales.

Two large under-utilized pipeline systems, the Ruby Pipeline and the GTN Pipeline, already exist to transport natural gas from these large gas supply basins to the Malin hub in southern Oregon. The Pipeline would be able to access these supplies and transport them to the LNG Terminal for export.

Global LNG Market Demand and Supply

Demand for LNG is expected to grow 4% to 5% per year between 2015 and 2030, and LNG demand growth has exceeded expectations recently. While many expected the market to be oversupplied in 2016, demand in Asia and the Middle East absorbed the increase in supply from Australia and the U.S. Chinese imports of LNG increased 33% in 2016 over the prior year, and India saw an increase of 25% over the same period. There were also six new importing countries in 2016 (Colombia, Egypt, Jamaica, Jordan, Pakistan and Poland), bringing the total number of LNG importing countries to 35. Shortages in domestic gas supplies in Egypt, Jordan and Pakistan led those countries to be among the fastest growing importers, importing a total of 13.9 million tons of LNG in 2016 during their first year of imports.

Despite the resurgent LNG demand, global LNG prices fell dramatically over the last two years following the slump in oil prices. This has led to new LNG supply projects being deferred or cancelled, and it will undoubtedly lead to a tightening of the global market post 2020. With few new supply projects and strong demand growth driven by India, China and Southeast Asia, the market is expected to recover by 2023, and LNG demand is expected to almost double by 2030, requiring an incremental 150 mtpa of new supply by the end of the next decade.



(Wood Mackenzie, 2016)

U.S. LNG exports are one of the lowest cost supply sources in the world and are expected to maintain their competitive advantage going forward due to the size and quality of the upstream natural gas resources in North America and the availability of infrastructure. Projects such as JCEP and PCGP on the west coast of the US offer a particular strategic advantage in being able to supply the strong Asian market demand with shorter shipping distances relative to other US export projects. The distance from the Port of Coos Bay to Tokyo Bay requires nine days shipping as compared to 22 days from the Gulf of Mexico utilizing the Panama Canal.

The Japanese Demand

Demand in Japan is not dependent upon demand growth but is driven by the re-balancing of the supply portfolios held by Japanese companies. Twenty-five percent of Japan's long term contracts expire between 2020 and 2025. U.S. LNG exports to Japan are positive from a number of standpoints. Japan is the most important U.S. ally in Asia, and increased U.S. imports will strengthen this alliance and improve the balance of trade between these two countries.

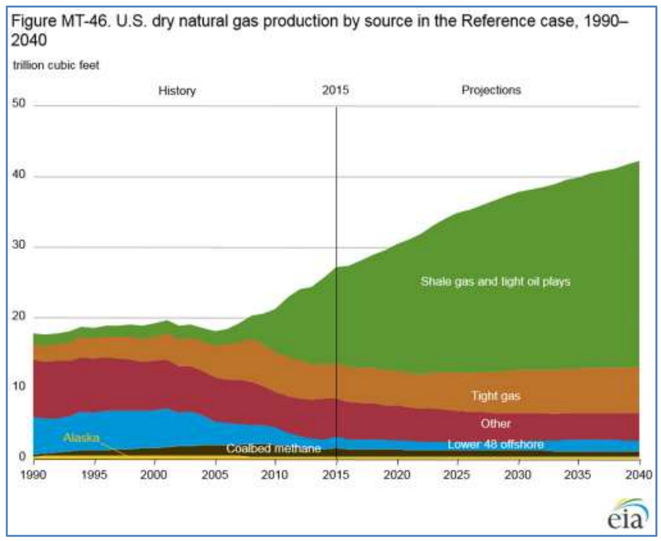
The graph below shows the current and predicted Japanese contracted LNG supply and demonstrates the increasing demand from US export supplies.

On March 22, 2016, JCEP announced that it had executed a preliminary agreement with JERA Co., Inc., the largest LNG buyer in the world, for the acquisition of at least 1.5 mtpa of LNG capacity from the Project. JERA was formed on April 1, 2015, and is a joint venture between Tokyo Electric Power Company and Chubu Electric Power Company, two of the largest Japanese power utilities. The joint venture was formed to combine the international energy assets of the two companies, including energy procurement and shipping. At formation, JERA had 40 mtpa of LNG supplies under contract. Following the announcement of the JERA agreement, JCEP announced the execution of a preliminary agreement with ITOCHU Corporation, a significant Japanese investment and trading firm, for the procurement of 1.5 mtpa of LNG capacity from the Project.

Negotiations continue with other LNG buyers for the balance of the marketed plant capacity.

U.S. and Canadian Market Supply

The development of ultra-tight shales and siltstones through horizontal drilling and hydraulic fracking has revolutionized the U.S. and Canadian long-term natural gas outlook. Resource estimates continue to climb as new and advanced exploration, well drilling, completion and stimulation technologies allow access to and delineation of more technically recoverable natural gas resources. The U.S. Energy Information Agency ("EIA") is an independent agency of the U.S. Federal Statistical System responsible for collecting, analyzing, and disseminating energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment. As of January 1, 2014, the EIA estimated there were 2,136 trillion cubic feet ("Tcf") of technically recoverable natural gas resources yet to be delineated in the U.S., with natural gas from shale plays an increasingly large part of the mix. The Potential Gas Committee sponsored by the Colorado School of Mines in its biennial resource assessment estimated that at the end of 2014 technically recoverable resources were 2,515 Tcf. When combined with EIA's estimate of proved natural gas reserves of 308 Tcf of dry gas at the end of 2015, total U.S. natural gas resources are estimated at 2,444 Tcf to 2,823 Tcf, or approximately 100 years of natural gas supply at current rates of consumption.



(EIA, 2017)

Of particular importance to the Project, the U.S. Geological Survey ("USGS") upgraded its assessment of technically recoverable natural gas resources in the Mancos Shale in the Piceance Basin of Colorado to 66 Tcf as compared to the USGS' 2003 assessment of 1.6 Tcf. The Piceance Basin is a key natural gas province that can be sourced by the Project through the Ruby pipeline.

The graph below shows natural gas production in the Piceance Basin, one of the supply basins within the U.S. Rockies.

Technically recoverable natural gas resources from the Western Canadian Sedimentary Basin ("WCSB"), which the Project can access via the GTN pipeline system exceeds 1,000 Tcf with 449 Tcf of this from the Montney Formation as estimated in a joint report by the Canadian National Energy Board, the British Columbia Oil and Gas Commission, the Alberta Energy Regulator and the British Columbia Ministry of Natural Gas Development published in November 2013.

In May 2014, the U.S. Department of Energy Office of Fossil Energy ("DOE/FE") announced its intention to undertake an updated economic study in order to gain a better understanding of how potential U.S. LNG exports between 12 and 20 Bcf/d could affect the public interest i.e. could exports impact natural gas availability and pricing in the U.S.

Specifically, DOE/FE commissioned the EIA to update its 2012 LNG Export Study. This document is titled Effect of Increased Levels of Liquefied Natural Gas Exports on U.S. Energy Markets, dated October 2014 (USEIA 2014). Further, DOE/FE determined that it would follow the EIA Study with an additional study that would evaluate the macroeconomic impacts of the exports evaluated in the EIA Study and directed the National Energy Technology Laboratory to facilitate this additional analysis. To carry out this task, The Center for Energy Studies at Rice University's Baker Institute and Oxford Economics were commissioned on behalf of the DOE/FE to undertake a scenario-based assessment of the macroeconomic impact of alternative levels of U.S. LNG exports under different assumptions for U.S. resource endowment, U.S. gas demand, and the international market environment. This document is titled The Macroeconomic Impact of Increasing U.S. LNG Exports ("Economic Study"), dated October 29, 2015 (USDOE 2015).

As related by the Economic Study, the outlook on North American gas supplies has undergone a dramatic reversal since 2008, when the general consensus was that supplies would be insufficient to keep pace with growing demand and that foreign-sourced LNG would need to be imported. As discussed above, the Economic Study identifies shale gas production growth as the biggest contributor to overall gas supply abundance due to the ramp-up in production of natural gas extracted from ultralow permeability and ultralow porosity shale formations in the U.S. The development and continuing improvement of hydraulic fracturing technology have led to increasingly efficient shale gas production, and shale gas production "has grown in less than a decade to comprise about one-half of U.S. domestic production" (USDOE 2015). Estimates of dry natural gas resources in the U.S. have likewise grown, reflecting significantly increased estimates of shale gas resources. The EIA's Annual Energy Outlook 2016 ("AEO 2016") (USEIA 2016) estimates that total U.S. dry natural gas production was 27.2 Tcf in 2015. Of this total amount of production for 2015, it is estimated that 13.6 Tcf, or 50 percent, came from shale gas and tight oil plays. Based on the AEO 2016 Reference Case, total U.S. dry natural gas production is projected to increase to 42.1 Tcf by 2040, of which approximately 69 percent is derived from shale gas and tight oil plays, leading the share of U.S. dry natural gas production growth (see EIA graph above).

The Economic Study also states that gas production will continue to grow steadily throughout the forecast period to 2040, as "the majority of the increase in LNG exports is accommodated by expanded production rather than reductions in domestic demand, a result that reflects the very elastic long-run supply curve in North America" (USDOE 2015). The Economic Study also states that increased production will also have a positive spillover to "key suppliers of the sector such as machinery and engineering services, and rising employment in the gas sector also leads to increased demand for goods and services more broadly" (USDOE 2015). Indeed, the growth potential is enhanced by the fact that the reduced geologic risk and resulting reliability of shale gas discovery and production make it responsive to demand and by the fact that the presence of natural gas liquids in some shale formations creates an added incentive for development.

For the demand outlook, the Economic Study projects steady growth, driven by demand in the industrial and power-generation sectors in the near term, and continued growth in power generation longer term. This projected growth is “driven by emerging environmental policies that target the use of coal” (USDOE 2015). Additionally, the AEO 2016 Reference Case estimates that total U.S. natural gas consumption will increase from 27.5 Tcf in 2015 to 34.4 Tcf in 2040. The AEO 2016 Reference Case also estimates that the U.S. will become a net exporter of natural gas in 2018 and that “growing natural gas production from shale gas and tight oil formations at relatively low prices support an increase in U.S. LNG exports of 6.7 Tcf from 2015-40” (USEIA 2016). Even as both domestic demand and net exports are projected to grow throughout the forecast period, U.S. natural gas production is sufficient to meet these increases. As technology improves in the development of shale resources, higher rates of recovery at lower costs occur.

According to both the Economic Study and the AEO 2016 report, growing natural gas demand in the industrial and electric power sectors and increasing exports of LNG place upward pressure on U.S. natural gas pricing. While this is occurring, the AEO 2016 report notes that improvements in drilling technology allow production to keep pace with demand, “resulting in relatively stable prices throughout the projection period.” Examples of technology improvements include better rigs and drill bits, resulting in lower unit costs and the expansion of tight and shale gas formations. The Economic Study expects higher U.S. gas production and increased profitability of U.S. gas producers to “typically exceed the negative impacts of higher domestic natural gas prices associated with increased LNG exports” (USDOE 2015).

The Economic Study concludes that the overall macroeconomic impact of increasing U.S. LNG exports from 12 Bcf/d to 20 Bcf/d is marginally positive. “In aggregate the size of the economy is little changed in the long run, with GDP less than 0.1 percent ($7.7 billion USD annually in today’s prices) higher on average over 2026-2040 than in the 12 Bcf/d export case” (USDOE 2015). While an increase in LNG exports from the U.S. will yield small declines in output for some energy-intensive industries, such as cement, concrete, and glass, “the estimated impact on sector output is very small compared to expected sector growth to 2040” (USDOE 2015). Also, since most of any U.S. LNG exports would be derived from increased extraction rather than diverted natural gas supplies, “other sectors benefit from increasing U.S. LNG exports, especially the industries that supply the natural gas sector or benefit from the capex needed to increase production. This includes some energy-intensive sectors such as cement and helps offset some of the impact of higher energy prices” (USDOE 2015). These conclusions are also consistent with the results from the EIA Study, which determined that “increasing LNG exports leads to higher economic output, as measured by real gross domestic product, as increased energy production spurs investment. This higher economic output is enough to overcome the negative impact of higher domestic energy prices over the projection period” (USEIA 2016).

Natural Gas Systems Transmission Capacity

Based on the supply projections above, there is both adequate gas supply in western Canada and the U.S. northern Rocky Mountains, as well as adequate demand in multiple Asian markets (Japan, Korea, China, etc.), to support the Project purpose and need.

In order to connect the necessary natural gas feedstock of 1,200,000 Dth/d to the LNG Terminal for export of 7.8 mtpa, sufficient transmission system supply and diversity are required. Both GTN Pipeline and Ruby Pipeline can support the feed gas requirement of the Project based on current flows to date on their respective systems. In addition, given the current timing of when contracts roll off on GTN and Ruby, there is ample supply from those two systems when gas is needed.

Pipeline transmission system subscription (volume reserved within the pipeline total capacity) and available capacity are provided in Table 1.2-1. This table depicts the shortage of available gas subscription capacity of the Williams Northwest Pipeline ("NWP") system and how it is not sufficient for the Project demand. While NWP can supply gas from Sumas for delivery at Stanfield, the amount of available capacity for Stanfield Delivery (227,846 Dth/d) is substantially less (approximately 80% less) than the required feedstock for the terminal (1,200,000 Dth/d). NWP can also deliver gas from the U.S. Rockies, however, this supply is highly seasonal. During summer, there is approximately 536,040 Dth/d available; during the peak winter months, this capacity is almost fully utilized (as an example, on Feb 1, 2017, only 70,000 Dth/d were available).

A connection from a point near the intersections of the Ruby Pipeline and the GTN Pipeline would provide more than sufficient capacity to access the aforementioned gas markets utilizing existing infrastructure and avoiding impacts to domestic use of the gas resources.

Table 1.2-1

Pipeline Capacity Available for New Long-Term Contracts

		Operating Capacity	Subscribed Capacity	Available Capacity
		Dth/d	**Dth/d**	**Dth/d**
Ruby Pipeline				
	Opal Receipt	1,500,000	819,534	680,466
Williams Northwest (NWP)				
	Sumas Receipt	1,314,750	1,113,815	200,935
	Opal- Stanfield (summer)	655,000	118,960	536,040
	Opal- Stanfield (winter)	655,000	584,993	70,007
	Stanfield Delivery	244,560	16,714	227,846
GTN				
	Kingsgate Receipt	2,812,440	2,047,243	765,197

Data extracted from EBB's of GTN, NWP and Ruby effective 08/21/2017 and Opal – Stanfield (winter) extracted from NWP's EBB effective 02/01/2017.

1.2.3 Current LNG Terminal Proposal

The design of the proposed LNG Terminal reflects several enhancements from the prior proposal in Docket No. CP13-483-000. These changes will result in an enhanced system design and a reduction in overall environmental impacts. Hydrocarbon processing and combustion, including pre-treatment, will be located on Ingram Yard in an effort to create a more efficient footprint and operating aspects of the facility. The LNG Terminal will now utilize a direct drive configuration by relocating the gas turbines adjacent to the refrigerant compressors, thereby eliminating the need for the South Dunes Power Plant and associated transmission line, making the facility simpler, more efficient, and easier to operate. The workforce housing facility has been consolidated onto the South Dunes Site reducing land and traffic impacts in the area of the previously proposed location at the North Point Site in North Bend adjacent to the suburb of Simpson Heights. The Southwest Oregon Regional Safety Center ("SORSC") building has been relocated to the northeast portion of the South Dunes Site and the Fire Department has been relocated to the Access and Utility Corridor, both relocations further reducing land and wetland impacts while improving emergency response time.

The Project under Docket No. CP13-483-000 included the 420-megawatt ("MW") South Dunes Power Plant. Within the current proposal, the Project proposes to use direct combustion-turbine liquefaction-drive instead of motor liquefaction-drive driven by electric power provided by the South Dunes Power Plant. A direct drive configuration is simpler, more efficient and easier to operate; and results in a number of reductions in environmental impact, including:

- Eliminates hydrocarbon processing combustion equipment from the South Dunes Site, which results in a single compact and consolidated facility process area on Ingram Yard;
- Eliminates the need for a railroad spur road overpass, reducing wetland impacts;
- Reduces combustion-turbine count from six to five, and maintains, and in some cases reduces, point source air emissions from the existing conditions permitted by the Oregon Department of Environmental Quality ("ODEQ");
- Reduces water consumption by 1 million gallons per day by eliminating the need for gas turbine water injection;
- Increases the distance from the nearest noise-sensitive receptors;
- Eliminates impacts on estuarine wetlands on the South Dunes Site;
- Allows for relocation of the workforce housing facility to the South Dunes Site addressing community concerns and significantly reducing workforce traffic movements on U.S. Highway 101 ("US 101") during the working week; and
- Allows for the relocation of the SORSC building to the northeast corner of the South Dunes Site and the elimination of 1 acre of wetland impacts.

In addition to the above enhancements, the following changes have been made to the design and construction of the LNG Terminal:

- Fire and other emergency incident response time has been improved by splitting the Fire Department building from the SORSC building and relocating the fire department to the Access and Utility Corridor from the South Dunes Site.
- The design now incorporates black-start capability reducing impacts from the Project on local utilities by eliminating the need to draw and export electricity from the local grid for operations, except the SORSC building. Limited temporary construction power within the capacity of the existing grid system will be utilized.
- The expansion of the Kentuck Mitigation Site from 33 acres to a more comprehensive Kentuck Project encompassing over 100 acres of wide-ranging habitat of mudflats, salt marsh, willowed scrub/shrubs and fish structures addressing a number of the key limiting factors Coho salmon face in this region, which will assist in the species' removal from the endangered species list
- The excavation of four submerged areas lying adjacent to the federally-authorized Coos Bay Navigation Channel ("Channel"). These minor enhancements (approximately 700,000 cubic yards) will allow for transit of LNG vessels of similar overall dimensions to

those listed in the July 1, 2008 U.S. Coast Guard ("USCG") Waterway Suitability Report, but under a broader weather window.

Table 1.2-2 – Major Changes from CP13-483-000 for the JCEP LNG Terminal Facilities

Element[1]	Proposed Design	Reasons for the Changes
Elements Deleted From the Project		
Firewater Ponds	The firewater ponds have been deleted from the design and replaced with two firewater tanks.	Reduces footprint, increased sanitation and fulfills multiple uses.
Gas Compressor Area	Gas compression is not included in the proposed design.	Gas compression is not required in the current design.
South Dunes Power Plant	The South Dunes Power Plant and the South Dunes Site Control Room (Control Room #2) have been eliminated.	Liquefaction will now be powered directly by gas-fired turbines, rather than by electric motors that previously would have required electricity generated at a separate, onsite power plant. Reduced footprint due to bringing development boundary south of Old Jordan Cove Road.
South Dunes Power Plant	The railroad spur bridge on the northwest corner of the South Dunes Site has been eliminated.	Due to decrease in footprint size from the South Dunes Power Plant the existing rail line does not need to be shifted. Reduces wetland impacts.
Access and Utility Corridor	The 115kV overhead power transmission lines from the South Dunes Power Plant to the JCEP Facility have been deleted as the South Dunes Power Plant has been eliminated.	Transmission of high voltage electric power is no longer necessary due to direct turbine drive configuration.
Access and Utility Corridor	The backup pilot gas line to the South Dunes Power Plant has been deleted as the South Dunes Power Plant has been eliminated.	No process fuel gas is required on South Dunes due to deletion of the South Dunes Power Plant.

Table 1.2-2 – Major Changes from CP13-483-000 for the JCEP LNG Terminal Facilities

Element[1]	Proposed Design	Reasons for the Changes
Access and Utility Corridor	The access bridge from South Dunes to the LNG Terminal in the Utility Access corridor east of Jordan Cove Road and the Roseburg Forest Products rail spur has been deleted.	Fire department has been relocated to Utility and Access Corridor negating the need for an access route provided by the bridge.
North Point Workforce Housing	The Workforce Housing Facility has been moved from North Point and relocated to the South Dunes Site.	Addresses community concerns and reduces workforce traffic movements on US 101 during the work week.
Site F offshore dredge disposal site	Site F will no longer be used for construction Dredged Material Disposal; instead dredged material will be disposed on-site and off-site at the Kentuck Project.	The Project has been cut and fill balanced across the LNG Terminal Site, the Kentuck Project and the APCO sites; so Site F is no longer necessary for construction related or maintenance dredge material disposal.
SORSC	The SORSC building has been relocated beside the administration building in the northeast corner of the South Dunes Site. No fill will be placed on the previous site of the SORSC.	SORSC has been relocated, reduces wetland impacts.
Elements Added to the Project		
Navigational Reliability Improvements	Excavate four areas adjacent to federal navigational channel.	Widens operational weather window of carrier transits.
Off-site Temporary Construction Laydown and Staging Areas	Additional construction laydown area may be required off-site on brownfield land suitably zoned for laydown and staging purposes, at the RFP property, Box Car Hill, Port Laydown Site and APCO properties.	Facilitation of safe and efficient construction methods.
Black Start Capability	Black start capacity implemented by two diesel generators.	Avoids drawing on local grid. Reduces impact on local utilities.

Table 1.2-2 – Major Changes from CP13-483-000 for the JCEP LNG Terminal Facilities		
Element[1]	**Proposed Design**	**Reasons for the Changes**
Slip and Access Channel– Lay Berth	An emergency lay berth for LNG carriers has been added to the west side of the marine slip. Dedicated access road on western boundary added for emergency lay berth access.	In response to USCG concerns, the emergency lay berth was added to mitigate the scenario of where to berth a temporarily disabled LNG tanker during port call.
Access and Utility Corridor	The Access and Utility Corridor will include additional lines for the fire water supply to Admin and SORSC buildings; power and data to the admin building.	Separate fire water protection systems and power generation on South Dunes were removed with deletion of South Dunes Power Plant.
South Dunes Site	Added helicopter pad adjacent to the proposed SORSC building.	Agency requirement in ERP process.
Elements Modified in the Project		
Terminal Site Access	Previous primary site access was from Transpacific Parkway. Now, primary site access is from Jordan Cove Road with secondary access from Transpacific Parkway.	Improved access safety and operability
LNG Transfer Line/Loading Platform	LNG design loading rate has increased to 12,000m^3/hr. This was previously 10,000m^3/hr.	Decreased loading time. Still in compliance with PHMSA Vapor Dispersion requirements.
Liquefaction Process Area	The previous design included four liquefaction trains and the current proposal includes five liquefaction trains.	Five liquefactions trains efficiently match the gas turbine driver sizes selected.
Liquefaction Process Area	The LNG production capacity of the LNG Terminal has been increased to 7.8 mtpa. This was previously 6.8 mtpa.	Liquefaction production capacity increased to reflect the production output expected with the site-specific ambient conditions.
Liquefaction Process Area	Liquefaction will now be powered directly by gas-fired turbines, rather than by electric motors that required electricity generated at a separate, onsite power plant.	Reduced equipment count and increased efficiency.
Liquefaction Process Area	Reduction of the number of gas turbines from six to five.	Five liquefactions trains efficiently match the gas turbine driver sizes selected.

Table 1.2-2 – Major Changes from CP13-483-000 for the JCEP LNG Terminal Facilities

Element[1]	Proposed Design	Reasons for the Changes
Liquefaction Process Area	Water injection is no longer required on the gas turbines, saving approximately 1 million gallons of water a day.	Replaced with inlet chilling to meet same liquefaction power requirements.
On-site Laydown Areas	On-site laydown areas have been reconfigured.	Facilitation of safe and efficient construction methods.
Flare Area	There will be three separate flare systems: one for warm (wet) reliefs, one for cold, cryogenic (dry) reliefs, and one marine flare for low-pressure cryogenic relief. The low-pressure cryogenic relief fully enclosed ground flare (marine flare) has been located at the southwest side of the LNG tank area. The warm and cold flare systems have been combined into one multi-point ground flare and moved to the northwest corner of Ingram Yard. These were previously positioned north of the refrigerant storage area and in the South Dunes Power Plant area.	Evaluation of loading and LNGC requirements led to marine flare addition. Gas processing area relocation from South Dunes allowed consolidation of warm and cold flares,
Barge Berth	The barge berth has been renamed to Material Offloading Facility and will also include a temporary material barge berth within the footprint of the slip	Slight reconfiguration to facilitate safer and more efficient unloading.
Gas Processing Area	Gas conditioning is now located on Ingram Yard and consists of a single train. The gas processing area was formerly located at the South Dunes Site.	Consolidate all gas processing near the liquefaction area and reduces footprint by using only one train instead two in the prior design.
South Dunes Site - Grading	The grading of the South Dunes Site has been modified to avoid impacts to estuarine wetlands.	Eliminates impacts on estuarine wetlands on the South Dunes Site.

Table 1.2-2 – Major Changes from CP13-483-000 for the JCEP LNG Terminal Facilities

Element[1]	Proposed Design	Reasons for the Changes
Stormwater Pond/Laydown	The stormwater pond at South Dunes Site has been modified to a dry detention area and laydown area has been expanded.	Stormwater pond modification due to reduction in impermeable surface area at South Dunes Site.
Slip and Access Channel - Access Channel	The access channel walls will be sloped to meet the existing bottom contours. Approximate slope of 3:1 will be used.	Increased usable footprint for other facilities and improved navigation.
Slip and Access Channel - Marine Slip Basin	Approximately 5.7 million cubic yards of material will be removed to create the marine slip basin. Approximately 1.23 million cubic yards will be land based excavation (dry upland material) and the remaining 4.07 million cubic yards will be wet material.	Optimized cut and fill balancing.
Slip and Access Channel - LNG Carriers	The number of ship calls at the LNG vessel berth has increased to 110 to 120. This number was previously 90 to 100.	Increase in LNG production capacity from 6.8 mtpa to 7.8 mtpa.
LNG Unloading Berth Dune	Previously this area was to be recontoured post-construction. Now, the area will not be recontoured post-construction.	Optimized cut and fill balancing.
Pacific Connector Gas Pipeline Meter Station	The location has been shifted slightly northeast on the South Dunes Site.	Maximize land utilization, safe access and efficient operations.
Southwest Oregon Regional Safety Center	SORSC building has been relocated to the northeast corner of the South Dunes Site and separated fire department to Access and Utility Corridor.	Reduces wetland impacts.
Access and Utility Corridor	The fire department has been relocated to the Access and Utility Corridor	Improves emergency response time. Reduces wetland impact at former location near SORSC building location.

Table 1.2-2 – Major Changes from CP13-483-000 for the JCEP LNG Terminal Facilities

Element[1]	Proposed Design	Reasons for the Changes
Access and Utility Corridor	The 2-foot and 10-foot shoulders have been retained. The road itself will increase to a 36-foot-wide permanent roadway at grade.	Increases accessibility.
Control Building/Maintenance Building	Footprint has changed.	Efficient operational footprint.
Refrigerant Storage Area	Capacity and area are the same. The site has shifted to the interior of the LNG Terminal.	Increases distance to property boundary
Site Elevations	Site elevation variances have decreased. Site elevations are different in multiple areas.	Improved constructability and operational layout. Site elevations comply with functional and operational requirements.
Kentuck Project	Kentuck Mitigation Site expanded from 33 acres to a more comprehensive Kentuck Project encompassing over 100 acres of wide-ranging habitat.	A more comprehensive project has been developed.
Elements Unmodified in the Project		
Liquefaction Process	The liquefaction process is unchanged and still utilizes a single mixed refrigerant circuit with a two-stage compressor and a refrigerant exchanger.	
LNG Tank Area	The construction design and storage volume of the LNG storage tanks is unchanged at 160,000m^3 full containment type each.	
Gas Processing Area	Feed gas supply remains unchanged. Pipeline quality feed gas will be supplied to the facility via the 36-inch-diameter Pacific Connector Gas Pipeline.	

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Table 1.2-2 – Major Changes from CP13-483-000 for the JCEP LNG Terminal Facilities

Element[1]	Proposed Design	Reasons for the Changes
Gas Processing Area	The pre-treatment of pipeline feed gas before it enters the liquefaction process is unchanged. The feed gas still undergoes mercury (Hg) and acid gas (CO_2 and H_2S) removal and dehydration to remove moisture.	
Slip and Access Channel - LNG Vessel Berth	The size of LNG carrier that can be accommodated by the LNG berth is unchanged at 89,000m^3 to 217,000m^3.	
Slip and Access Channel - LNG Loading Arms	The number and size of the LNG loading arms at the LNG berth remain unchanged at three 16-inch diameter loading arms plus one 16-inch diameter vapor return arm.	
Preserved Wetlands Area	Unchanged	
Industrial Wastewater Pipeline Relocation	Unchanged	
Mill Casino Off-site Parking	Unchanged	
Myrtlewood Off-site Parking	Unchanged	
Eelgrass Mitigation Site	Unchanged	

In addition to meeting the statement of purpose and need discussed in Section 1, construction and completion of the Project would result in these additional benefits:

- Of the $9.8 billion spent constructing the Project, approximately $2.88 billion will be spent directly at Oregon businesses. Furthermore, the Project will directly pay Oregon resident workers about $1.5 billion in compensation. Non-residents working on the Project's construction and paying income taxes to Oregon will earn about $650 million in labor compensation.
- Statewide, due to all of the direct, indirect, and induced impacts, 43,233 full-year equivalents ("FYEs") would be supported by construction of the Project. Those impacts will arise from project spending and the spending of the Project's construction workers and staff. Wages, salaries, and benefits for those 43,233 FYEs will total almost $3.4 billion.
- During operations, 200 workers will be directly employed in Oregon for the LNG Terminal and offices in Coos Bay and Portland. Total labor compensation in 2024 for the LNG Terminal and offices will be about $44.8 million. The LNG Terminal, supporting

marine operations and the Portland office will spend $67.0 million, $29.2 million, and $2.8 million a year, respectively, for goods and services from Oregon suppliers, for a total of $99.1 million.

- In 2024, PCGP will employ 15 workers in Oregon and spend $3.1 million on wages, benefits, and other employee compensation costs. Purchases of goods and services from Oregon businesses for the Pipeline will total about $8.7 million in 2024.
- Through JCEP's and PCGP's annual purchases of goods and services from Oregon businesses and household spending by employees, it will support an additional 1,567 jobs in Oregon, $95.8 million in additional labor income, and $235.2 in additional output for Oregon businesses.
- Additional investment in and modernization of the Port of Coos Bay, which was once the largest timber port in the world but has seen utilization and investment steadily decline over time. JCEP would directly invest in improving marine-related infrastructure and capability, such as the procurement of four state-of-the-art tractor tugs with firefighting, active ship escort and emergency towing and rescue capability, procurement and set up of a private vessel traffic information system.
- The Project will contribute to the fiscal health of local communities through property taxes and through a local Community Enhancement Plan ("CEP") in Coos County. For PCGP, property taxes are anticipated to average approximately $20.0 million a year for school districts and other local districts to be shared between Coos, Douglas, Jackson, and Klamath counties. For JCEP, the cities of Coos Bay and North Bend, along with Coos County and the Port of Coos Bay, will oversee a community fund to implement the CEP, which once in operations will amount to approximately $40 million per year, on average, during the initial 15 years of operations.

Resource Report 5 contains a more detailed description of the CEP and other socioeconomic benefits of the Project

1.3 PROJECT LOCATION AND DESCRIPTION OF FACILITIES

JCEP proposes to site, construct, and operate a new LNG export terminal on the bay side of the North Spit of Coos Bay in southwest Oregon. The general location of the proposed LNG Terminal is shown on Figure 1.1-1. The proposed LNG Terminal will be located in unincorporated Coos County, Oregon, primarily within land owned by Fort Chicago LNG II U.S. L.P., an affiliate of JCEP, across two contiguous parcels (Ingram Yard and South Dunes) which are connected by an Access and Utility Corridor (shown on Figure 1.1-2). The primary site for the LNG Terminal is about 7.5 miles up the existing Federal Navigation Channel, approximately 1,000 feet north of the city limit of North Bend, in Coos County, Oregon, more than 1 mile away from the nearest residence.

The proposed LNG Terminal will be located near the Pacific Ocean in the coastal lowlands ecozone. The primary site is a combination of brownfield decommissioned industrial facilities, an existing landfill requiring closure, and some open land covered by grasslands and brush (including some wetlands), as well as an area of forested dunes. Portions of the primary site have also previously been used for disposal of dredged material.

Land ownership as well as land use and zoning requirements are discussed in section 1.4.

1.3.1 LNG Terminal Components and Facilities

In addition to the operational LNG Terminal site comprised of South Dunes, Ingram Yard, and the Access and Utility Corridor, the LNG Terminal will include several construction facilities located near the primary site. The location of all construction facilities is shown on Figure 1.1-1 and Figure 1.3-1, including the following:

- South Dunes Site (includes construction and operational facilities, including the Workforce Housing Facility and the non-jurisdictional SORSC)
- Ingram Yard (includes construction and operational facilities, including LNG tanks, liquefaction equipment and the slip and access channel)
- Access and Utility Corridor (includes construction and operational facilities, including the non-jurisdictional fire department)
- Meteorological Station (operational facility)
- Industrial Wastewater Pipeline ("IWWP") (non-jurisdictional facility)
- Dredge Area 1, 2, 3, and 4 and dredge line(construction area)
- Transpacific Parkway ("TPP")/US 101 Intersection Widening (construction area)
- Boxcar Hill (construction area)
- Roseburg Forest Products ("RFP") Laydown Sites (construction area)
- Port Laydown Site (construction area)
- APCO Sites 1 and 2 (dredge material disposal area and construction area)
- Myrtlewood Offsite Park and Ride (temporary construction facility)
- Mill Casino Offsite Park and Ride (temporary construction facility)
- Kentuck Project (environmental area including mitigation site)
- Eelgrass Mitigation Site (mitigation site)

The LNG Terminal will receive a maximum of 1,200,000 Dth/d of natural gas from the Pipeline and produce a maximum of 7.8 mtpa of LNG for export. The LNG Terminal will receive natural gas from the Pipeline, process the gas, liquefy the gas into LNG, store the LNG, and load the LNG onto ocean-going LNG carriers at its marine dock. The main operational components of the LNG Terminal are shown on Figure 1.1-2 (Plot Plan of the LNG Terminal) and include a connection to the Pipeline metering station, gas inlet facilities, a gas conditioning plant, an access and utility corridor, liquefaction facilities (including five liquefaction trains), two full-containment LNG storage tanks, an LNG loading line, LNG loading facilities, a marine slip, and an access channel for LNG carriers. The interface point between the Pipeline and the LNG Terminal occurs at the flange immediately downstream of the metering station located on the South Dunes Site. Sections 1.3.3 through 1.3.7 of this document describe all of the main LNG Terminal operational components downstream of this interface point.

All FERC jurisdictional permanent facilities are described in detail within Sections 1.3.3 through 1.3.8. Temporary construction facilities and areas are described in detail in Section 1.5. FERC non-jurisdictional facilities are described in detail in Section 1.9. Site elevations and tsunami protection for the LNG Terminal facilities are discussed in section 1.3.2. Required maps and plans are discussed in section 1.3.9.

All LNG Terminal facilities and components will be constructed in accordance with governing regulations, including the regulations of the USCG for Liquefied Natural Gas Waterfront Facilities, 33 CFR Part 127; the U.S. Department of Transportation ("DOT") Federal Safety Standards for Liquefied Natural Gas Facilities, 49 CFR Part 193; and the National Fire Protection Association ("NFPA") Standard 59A for LNG facilities, and the codes and standards referenced therein.

1.3.2 Site Elevations and Tsunami Protection

Site elevations (see Table 1.5-1) are selected to mitigate flooding due to storm surge, estuarine flooding, and tsunami. Tsunami hazard, because it is the most critical of these hazards, typically dictates the minimum elevation. Elevations have been selected to cater for life safety in case of an event that exceeds the design-level tsunami, and to ensure that the facility remains functional and operational in case of the design-level tsunami.

The design-level tsunami is consistent with the criteria given in Resource Report 6 – Geological Resources. Numerous hydrodynamic modelling efforts and studies (CHE 2017; MAN 2017) have demonstrated that the minimum elevation required to mitigate the design-level tsunami is +34.5 feet using the North American Vertical Datum of 1988 ("NAVD88").

Typically, and due to the functional requirements of the facility, the facility will be at or above +46 feet. Exceptions include the LNG tanks and water-dependent facilities such as the marine terminal and Material Offloading Facility ("MOF"). The parts of the marine facilities that are normally occupied or operational will typically be at an elevation of 34.5 feet or greater, whereas normally unoccupied/non-operational parts of the marine facilities may be at a lower elevation.

The LNG storage tanks, which are founded at approximately +27 feet, will be surrounded by a tertiary protective berm approximately +46 feet high. The design tsunami inundation elevation is determined to be no more than 34.5 ft. The design provides for continuous protection by way of the containment berms at an elevation no less than +46 ft high allowing the LNG storage tanks to be founded below 34.5 ft. The protective berm will be designed to contain the contents of a single LNG storage tank.

Given the seismicity of the site, soil type, and subsequently the need for shallow sloping berms, berm elevations greater than +46 ft are not considered practical and would not fit within the physical constraints of the site.

Life safety is provided for by tsunami evacuation muster points at the Ingram Yard and South Dunes Site, which will be at elevations significantly greater than the design-level tsunami and consistent with the basis for current inundation (DOGAMI 2012a) and evacuation maps (DOGAMI 2012b) for the cities of Coos Bay and North Bend. Parts of buildings, such as the SORSC building, operations building and fire department have been identified as "shelter-in-place" for essential personnel in case of tsunami events. As such, these buildings will also be elevated to ensure they are above the design-level tsunami and consistent with the tsunami evacuation muster points discussed above.

1.3.3 Gas Inlet Facilities and Gas Conditioning

1.3.3.1 Gas Inlet Facilities and Metering

Pipeline quality feed gas will be supplied to JCEP via the Pipeline. The interface point between the Pipeline and LNG Terminal occurs at the flange immediately downstream of the metering skid located on the South Dunes Site.

Inlet pipeline metering facilities consist of a pipeline pig receiver, inlet filter/separator, and flow meter, which are in the PCGP scope. The pipe connecting the metering station to the liquefaction facilities will be buried from South Dunes through the Utility and Access Corridor, and then will resurface within the LNG Terminal facility at Ingram Yard.

A High Integrity Pressure Protection System ("HIPPS") will be installed, in a 2 x 100 percent configuration, downstream of the metering station and upstream of any piping branches with the exception of the fuel supply for start-up and LNG storage tank vacuum breaker.

Additionally, a feed inlet heater will provide heating of the high pressure feed gas on cold days to prevent formation of natural gas hydrates resulting from Joule-Thomson cooling when gas pressure is let down by the pressure reduction unit or units. A pressure reduction unit functions as an inlet pressure control station before the gas enters the gas conditioning unit.

1.3.3.2 Gas Conditioning Train

The feed gas from the pipeline meter station will be treated before the gas enters the liquefaction trains. A Gas Conditioning train, in a 1 x 100 percent configuration, will be provided and will include a system for mercury removal via sulfur impregnated activated carbon, carbon dioxide ("CO_2") and other acid gases removal via an amine system, and dehydration via a molecular sieve adsorbent system.

Mercury is first removed to prevent corrosion in downstream cryogenic aluminum equipment and minimize exposure of other equipment and vent streams to mercury contamination. The feed gas will then be treated by passing through the acid gas removal unit to remove CO_2 to prevent freezing in the liquefaction process. Trace amounts of hydrogen sulfide ("H_2S") and other sulfur species will also be removed.

The amine solution of the acid gas removal process saturates the dry feed gas with water. The dehydration system removes the water content of the feed gas to prevent water freeze out in the liquefaction process.

Figures 1.3-2 and 1.3-3 provide simplified block flow diagrams of the major components of the proposed gas conditioning train. The sections below describe the mercury removal, acid gas removal and dehydration systems in further detail.

1.3.3.2.1 Mercury Removal

Mercury is removed via adsorption onto sulfur-impregnated activated carbon beds, in a 3 x 33 percent configuration, in order to prevent cold box corrosion during gas liquefaction and to minimize the exposure of other equipment and vent streams to mercury contamination. The mercury removal beds will be located downstream of the inlet filter/separator and upstream of the amine contactor, and will reduce the amount of mercury in the treated pipeline gas down to less than 0.01 micrograms per Normal cubic meter ("$\mu g/Nm^3$").

The life of the mercury removal beds is designed to be three years, assuming a mercury concentration in the feed gas of 0.05 parts per billion by volume ("ppbv"). Spent catalyst from the mercury removal vessels will be removed periodically and sent off-site for disposal by a licensed hazardous waste management contractor.

1.3.3.2.2 Acid Gas Removal

Acid gas removal involves a closed-loop system that circulates a promoted methyl-diethanolamine solution to absorb CO_2 and sulfur species from the feed gas. The process reduces the feed gas CO_2 concentration from a maximum of approximately 2 percent on a molar basis to less than 50 parts per million on a volumetric basis ("ppmv").

The CO_2 removed from the feed gas is to be vented to the atmosphere, but the vent stream must first be treated for co-absorbed contaminants. To limit emissions, absorbed H_2S and other sulfur species in the vent stream will be thermally oxidized after passing through the sulfur scavenger unit. Co-absorbed hydrocarbons, including benzene, toluene, ethylbenzene, and xylenes, will also be combusted and destroyed in the thermal oxidizer.

1.3.3.2.3 Dehydration

The water removal system is located immediately downstream of the acid gas removal system and employs four molecular sieve adsorption beds. The water removal system will reduce water in the treated feed gas to less than 0.1 ppmv. At any time, two beds will be in adsorption mode, one bed will be in regeneration/cooling mode, and one bed will be on stand- by. Regeneration of a bed involves passing dehydrated heated feed gas through it, in an up-flow direction, which drives the adsorbed water out of the bed. This water-loaded regeneration gas is then cooled to condense and remove the water, which is collected and recycled back into the acid gas removal system. This regeneration gas is then compressed and recycled upstream of the dehydration units. The regenerated bed will then be cooled by non-heated dehydrated feed gas until a low enough temperature is achieved to place it back into adsorption service.

1.3.4 Liquefaction Facilities

1.3.4.1 Liquefaction Trains

The LNG Terminal includes five liquefaction trains utilizing the Black & Veatch proprietary PRICO® LNG technology to produce a maximum of 7.8 mtpa (1,077 MMscf/d) of LNG production net, after deduction for Boil-Off Gas ("BOG") generation. Each liquefaction train will have an anticipated maximum annual capacity of 1.56 mtpa (215.5 MMscf/d). The nominal annual capacity may be less than this value due to annual ambient temperature variation, planned non-major facility maintenance outages, unplanned facility outages, and degradation of the combustion gas turbines.

The PRICO® LNG technology (see Figure 1.3-4) utilizes a single mixed refrigerant ("SMR") circuit with a two-stage compressor and a brazed aluminum refrigerant exchanger. The dry treated gas from the gas conditioning train is divided equally among the five liquefaction trains. In each liquefaction train, the dry treated gas stream flows into a refrigerant exchanger where it is turned into liquid by cooling it to approximately -260ºF with the mixed refrigerant. The refrigerant exchanger consists of multiple brazed aluminum heat exchanger cores arranged in parallel inside a perlite insulated cold box. An aerial cooling system (fin-fan) rejects heat from the mixed refrigerant that is gained from the liquefaction of feed gas and compression. The cold box is purged with nitrogen gas to prevent moisture intrusion and eliminate the potential for a flammable atmosphere inside.

The refrigeration cycle is a closed-loop process that utilizes a single-body, two-stage refrigerant compressor. An aero-derivative combustion turbine directly provides the power to drive the refrigerant compressor. Exhaust-gas waste heat recovery in the form of steam generation maximizes the overall thermal efficiency of the LNG Terminal.

Heavy hydrocarbons (generally referred to as C5+ components) will be removed from the feed gas before the final liquefaction step to meet the LNG specification and prevent possible freezing at subcooled temperatures. Section 1.3.4.2 describes the process for removing heavy hydrocarbons.

1.3.4.2 Heavies Removal

Heavy hydrocarbons or "heavies" will be removed from the feed gas before the final liquefaction step in order to meet the LNG specification and prevent possible freezing at subcooled temperatures. The system will be designed to remove the most likely-to-freeze components—benzene and octane—to less than 1 ppmv while recovering as much of the C4 and lighter molecules as economically as possible into the gas going to the final liquefaction step.

The total volume of heavies removed across the range of feed compositions is not enough to produce economically viable natural gas liquids product for sale or export; however, it will be blended into the fuel gas stream, so no tankage or disposal logistics need to be considered.

1.3.4.3 Refrigerant Makeup System

For many technologies, refrigerant losses occur from the closed-loop refrigeration loops primarily due to normal compressor seal leakage. However, the Black & Veatch patented seal gas recovery system will be utilized to minimize the refrigerant losses to flare by returning the normal leakage to the refrigerant compressor suction. Even with seal gas recovery, the refrigeration loop components must be replenished periodically to normal operation inventory levels. The hydrocarbons that provide make-up to the SMR circuit used in the liquefaction trains cannot be generated on-site (with the exception of methane, which comes from the treated feed gas), and will be delivered to the LNG Terminal via ISO containers or qualified trucks and stored in pressurized vessels for intermittent makeup to the SMR circuit.

1.3.5 LNG Storage and Containment

The LNG will be stored in two full-containment insulated LNG storage tanks, each of which is designed for a working capacity of 160,000 cubic meters ("m^3") (42,232,000 gallons) of LNG. Each tank will have a primary 9 percent nickel inner tank and a secondary concrete outer containment wall with a steel vapor barrier.

The LNG storage tanks will have top connections only with piping that will permit top and bottom filling. Top filling operation will be done via a spray device/splash plate in order to obtain flashing and mixing of the LNG as it combines with LNG inventory. The bottom loading operation will be achieved via a standpipe to ensure effective mixing. The separated flash vapor combines with vapors from tank displacement and heat leak and flows to the boil-off gas compressors for use as a fuel.

The two full-containment LNG storage tanks are each equipped with three fully submerged LNG in-tank pumps, each rated for approximately 2,400 cubic meters per hour ("m^3/hr"), and one spare well, fully piped and instrumented. LNG is pumped, using five of the six installed pumps, to the marine berth and into an LNG carrier at a normal loading rate of 12,000 m^3/h. An LNG transfer line will connect the shore-based storage system with the LNG loading system. A smaller recirculation, "keep cool" line is provided from the LNG storage tank area to the marine berth in order to maintain the LNG transfer piping at cryogenic temperatures to avoid excessive boil-off losses and potential damage from thermal cycling between carrier arrivals.

LNG spills will be contained, and the bermed area around the LNG storage tanks will gravity drain to an LNG impoundment basin. An LNG spill containment trench will also collect any LNG from spills outside of the bermed area around the LNG storage tank area and gravity drain to the same LNG impoundment basin. A separate LNG trench and impoundment basin located near the marine loading system will also be provided to collect any LNG spills from the LNG transfer line or the recirculation line that would be located south of the liquefaction trains; this separate impoundment is required due to slope requirements to allow effective gravity drainage that cannot be achieved with a single impoundment basin. The LNG impoundment basins will include sump pumps to pump out rain water. In accordance with 49 CFR § 193.2173, the water removal system will have the capacity to remove water at a rate of 25 percent of the maximum predictable collection rate from a storm of ten-year frequency and one-hour duration. The discharged rainwater will be piped to the oily waste system.

1.3.6 Marine Facilities

1.3.6.1 Overview

The LNG Terminal will include a single-use marine slip dedicated to supporting LNG exports. The east side of the slip will be utilized for the LNG carrier-loading berth and LNG loading facilities. Berths for tugboats and security vessels will be located on the north side of the slip. An emergency lay berth will be provided on the west side of the slip to allow for berthing a temporarily disabled LNG carrier in an emergency. This berth will have no product loading facility, but it will comply with and be designed to meet all of the safety and security standards of the Oil Companies International Marine Forum ("OCIMF") and the USCG. THE MOF will be constructed outside of the slip to deliver construction and maintenance components of the LNG facility that are too large or heavy to be delivered by road or rail.

The LNG carrier loading berth will be capable of accommodating LNG carriers with a cargo capacity range of 89,000 m^3 to 217,000 m^3. The USCG Letter of Recommendation ("LOR") and Waterway Suitability Report ("WSR") currently allows LNG carriers up to 148,000 m^3 to dock at the LNG Terminal berth.

1.3.6.2 Access Channel

Access to the marine slip will be via a newly constructed access channel that will connect the slip to the Federal Navigation Channel at approximate Channel Mile 7.3 at the beginning of the confluence between the Jarvis Turn and the Upper Jarvis Range A. The access channel will flare from the narrowest portion at the mouth of the slip, with a minimum width of 780 feet, to the intersection with the Federal Navigation Channel with an approximate width of 2,200 feet. The proposed access channel will allow for the safe transit of vessels between the berth and the Federal Navigation Channel, and allow the safe turning of vessels during an inbound transit so that the LNG carrier can be backed into the slip and berthed bow out, according to industry best practice requirements.

The total access channel would cover approximately 22 acres below the Highest Measured Tide (HMT) elevation of 10.26 feet (NAVD88). The walls of the access channel would be sloped to meet the existing bottom contours at an angle of approximately 3 feet horizontal to 1 foot vertical (3:1). The marine slip and access channel will have a minimum depth of -45 feet below the mean lower low water ("MLLW" (-45.97 feet NAVD 88)) to ensure minimum under-keel clearance is achieved for the safe maneuvering and berthing of loaded LNG carriers. An allowance over and above the minimum depth will be made for advanced maintenance dredge and incidental over-dredge, in accordance with industry best practices. Dredging of the access channel would affect about 15 acres of currently existing deep subtidal area below -15.3 feet in depth below MLLW.

1.3.6.3 Marine Slip

The new marine slip will be constructed by excavating an existing upland area. The majority of the marine slip will be excavated from existing uplands owned by JCEP. Part of the marine slip would be constructed within state waters of Coos Bay to the MLLW line, for which the Port has obtained an easement from the ODSL.

The slip will be bounded on the east and west sides by sheet pile walls, creating a vertical face to support mooring structures. The northern side of the slip will be sloped to meet the existing bottom contours at an angle of 3 feet horizontal to one foot vertical (3:1). The inside dimensions at the toe of the slope of the slip will measure a minimum of 800 feet between the vertical sheet pile walls along the east/west axis, and approximately 1,500 feet and 1,200 feet along the western and eastern boundaries, respectively. Figure 1.3-5 shows a plot plan of the marine slip. The slip is sized to provide the flexibility needed to safely maneuver an LNG carrier from the access channel into the slip when another LNG carrier is already berthed on the east or west sides and for tugs to move a temporarily disabled LNG vessel away from the loading berth on the east side of the slip to the emergency lay berth on the west side of the slip if necessary.

1.3.6.4 LNG Carrier Berths

The marine facilities will include two LNG carrier berths, an Emergency Lay Berth and a Product Loading Berth. Each berth consists of a number of elements: the sheet pile wall, mooring structures and breasting structures. In general, the LNG loading berth will be about 1,280 feet long between the centers of the end mooring structures, and 312 feet long from the center of the northernmost breasting structure to the center of the southernmost breasting structure. Figure 1.3-6 shows the elevation view of the LNG berth.

1.3.6.4.1 Sheet Pile Walls

The physical berth will be constructed of steel sheet piles to support surface structures (i.e., the loading area) or provide the foundation for the breasting and mooring structures. Under the loading facility, the wall will extend from the bottom of the slip at elevation -45.97 (minimum) to approximate elevation +34.5 (NAVD88). This face will extend north and south to capture the outermost breasting structures and then turn to the east, creating a setback wall for the remainder of the slip.

1.3.6.4.2 Mooring Structures

Mooring and breasting (see Section 1.3.6.4.3) structures will be provided at both the loading berth and the emergency lay berth for the safe breasting, berthing, and mooring of the LNG carriers docked at either berth.

Six mooring structures (three on each side of the LNG berth centerline) will be used to secure the LNG carrier at both the LNG loading berth and the emergency lay berth. The structures will be behind the sheet pile wall, set back approximately 145 feet from the face of each berth. These structures will have concrete platforms founded on steel pilings and will each have remote release mooring hooks with capstans, as well as all required equipment and instrumentation for safe mooring operations.

1.3.6.4.3 Breasting Structures

There will be four breasting structures located adjacent to the product loading facility ("PLF"); two will be located north of the PLF and two to the south. Like the mooring structures, each breasting structure will have a concrete platform founded on steel pilings and will have remote release mooring hooks with capstans, as well as all required equipment and instrumentation for safe mooring operations. Each breasting structure will also support a fender assembly sized to absorb and distribute berthing and mooring loads for the full range of LNG carriers that the LNG berth is designed for, thus preventing damage to the LNG carriers or the LNG berth. The fender system will allow the carriers to be moored a safe distance off the vertical face of the sheet pile wall. The emergency lay berth will have four breasting structures with fenders and capstans spaced equally about the mid-ship. There will be additional breasting fender structures, two to the north and two to the south of the main breasting structures, for a total of eight. The exact number, type, and location of the breasting structures for the emergency lay berth will be defined during detail design to meet OCIMF requirements for non-parallel vessel approach and the full range of vessel sizes.

1.3.6.4.4 Product Loading Facility

The PLF utilizes a pile-supported concrete slab that provides structural support to the marine loading arms, terminal gangway, and other ancillary equipment. The PLF is designed to support a number of elements that facilitate the safe transfer of LNG product between the LNG facility and the LNG carriers.

The PLF will be constructed on top of the sheet pile wall at approximate elevation +34.5, and will be about 130 feet long and 86 feet wide. The foundation will be reinforced concrete supported by steel pilings.

The transfer equipment consists of four marine loading arms and ancillary equipment. There will be two dedicated liquid loading arms, one hybrid arm, and one ship vapor return arm to meet the design loading rate of 12,000 m^3/h. The hybrid arm will be designed for dual service capable of transferring LNG to the LNG carriers or returning vapor from the LNG carriers to the BOG vapor management system. During normal operation the hybrid arm will be used in liquid service along with the two liquid arms, and the vapor return arm will be used to return vapor to the BOG vapor management system.

The loading arms are designed with swivel joints to provide the required range of movement between the LNG carrier and the shore connections. Each arm will be fitted with a hydraulically interlocked double ball valve and powered emergency release coupling to isolate the arm and the LNG carrier in the event of an emergency condition in which rapid disconnection of the connected arms is required. Each arm will be fully balanced in the empty condition by a counterweight system and maneuvered by hydraulic cylinder drives. A mezzanine-type elevated steel platform will be installed for maintenance of the triple-swivel assembly of the arms.

LNG spill containment will be accomplished by a concrete curbed and sloped area that will contain any LNG spillage and allow the spill to safely flow away from the loading area through the LNG spill collection trench to the marine area LNG impoundment basin.

Additional structures at the LNG loading berth will include an LNG carrier gangway, area lighting facilities, aids to navigation, firewater monitors, and a dry chemical firefighting system.

1.3.6.5 Emergency Lay Berth

An emergency lay berth on the west side of the slip will be provided with facilities to safely moor a temporarily disabled LNG carrier. Berthing facilities will be supported by the west side sheet pile wall with a top-of-wall elevation of approximately +20 feet (NAVD 88). The lay berth will have pile-supported breasting structures with fenders extending above the vertical sheet pile and mooring structures on the land side of the sheet pile. A grated platform with a gangway will be placed behind the berthing breasting structures to allow for safe access and egress from the disabled LNG carrier at berth. Support infrastructure will include an access road down from the area of the tug berth building, duct bank with cabling for powering the mooring hooks and capstans, and limited lighting of the ship access area.

Along the western property line, but on the Project side of the Henderson Property buffer zone, a tsunami flow control wall will be constructed. The flow control wall shall be of sufficient height and strength to prevent overtopping into Henderson Property and limit the drag due to the tsunami current loads on LNG carriers within the marine slip. The wall height shall be approximately 34.5 feet and determined in accordance with the design tsunami criteria. The wall will run from the southwest side of the LNG tank impoundment area down to the entrance to the slip.

1.3.6.6 Material Offloading Facility

The MOF will be constructed to deliver components of the LNG Terminal that are too large or heavy to be delivered by road or rail. The MOF will cover about 3 acres on the southeast side of the slip, adjacent to the RFP (Figure 1.3-5). The MOF will be constructed using the same sheet pile wall system as the LNG loading berth and the emergency lay berth. The top of the MOF will be at elevation approximately +13.0 feet (NAVD88), and the bottom of the exposed wall will be at the access channel elevation. The MOF will provide approximately 450 feet of dock face for the mooring and unloading of a variety of vessel types.

During construction of the LNG Terminal, in addition to receiving equipment and large modules (upwards of 6,000 short tons) by break bulk cargo carriers, roll on roll off cargo carriers, and barges, the MOF will allow other bulk materials to be delivered by sea to minimize impacts on the local road network. After project construction, the MOF will be retained as a permanent feature of the LNG Terminal to support maintenance and replacement for large equipment components that are too large to be transported by rail and road.

1.3.6.7 Tug Berth

The tug berth at the north side of the marine slip will accommodate four tugboats, as well as two sheriff's boats and six other visitor boats with similar characteristics as the sheriff's boats. For design purposes, the tugs are assumed to be 80-metric-ton bollard pull boats approximately 100 feet long with a beam of 40 feet. The basis for the sheriff's boat is the Willard USCG Long Range Interceptor. The tug dock will generally be about 470 feet long and 18 feet wide; in addition, there is 360 feet of 8-foot-wide floats for mooring and accessing the security vessels.

The tug dock will be concrete supported by steel piles. The security vessel docks will be precast concrete floats anchored by steel pile. The security boat dock will support two separate boat houses. The tug dock will be accessible from land by a pile-founded trestle, thus allowing vehicle and pedestrian access for service and support of operations. An onshore tug operations building will provide storage, meeting, and sanitary facilities for the crews of the tug and security boats.

1.3.6.8 Vessel Transit

LNG carriers would access the LNG Terminal through a waterway for LNG marine traffic, which is defined by the USCG for the Project as extending from the outer limits of the U.S. territorial waters 12 nautical miles off the coast of Oregon, and up the existing Federal Navigation Channel about 7.5 miles to the LNG Terminal.

The Project's plans for the LNG carriers calling on the LNG Terminal and their transit route in Coos Bay, as described below, are primarily within the jurisdiction of the USCG. Because the USCG has authorized carriers of approximately 950 feet length, 150 feet beam, and loaded draft of 40 feet (nominal 148,000 m^3)[2] as the size of LNG carrier, the LNG Terminal could generate a maximum of 120 LNG carrier calls per year, although the average is expected to be between 110 and 120 LNG carriers per year. The actual number of LNG carriers per year will be dependent on the capacity of the LNG carriers calling on the LNG Terminal and the actual output production of the LNG Terminal. The LNG loading berth is designed so that it could

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[2] Depending upon the approved LNG containment system type, carriers with these approximate dimensions may range in LNG cargo capacity from 135,000 m^3 to 170,000 m^3.

accommodate LNG carriers up to 217,000 m^3 if larger-sized carriers were to be authorized by the USCG in the future, resulting in a reduced number of LNG carrier calls each year.

The total average LNG carrier port time is estimated to be approximately 36 hours, assuming there are no delays caused by natural environmental conditions. This estimate includes the 1.5 hours transit time from the Pilot boarding to arrival at the LNG loading berth to the Pilot drop-off at departure, time of mooring, unmooring and cast off, the bulk LNG loading time of approximately 15 hours (using the 12,000 m^3/hr loading rate), and the 8 hours of time waiting for the next available high tide cycle needed for safe departure and transit of the Federal Navigation Channel.

The LNG carrier transit route is shown in Figure 1.3-7. An LNG ship traffic study conducted by Moffatt & Nichol International (M&N 2006) concluded that the additional LNG carrier traffic associated with the Project can be accommodated in the Port and the Federal Navigation Channel. The ship traffic conditions in the Port that existed when the LNG carrier traffic study was conducted have not changed.

Resources, such as high bollard pull tractor tugs and pilots, will be required to handle the planned number of LNG carriers. JCEP has committed to provide the following marine resources as identified by the USCG in the current version of the WSR:

- Four (three operation, one standby) 80-bollard-ton tractor tugs with Class 1, firefighting capability;
- A Port differential Global Positioning System navigation system for use by the Pilots and LNG carrier bridge team while transiting the channel en route to the Project;
- Physical Oceanographic Real Time System to provide real-time channel water level, current, and weather data;
- A Vessel Traffic Information System consisting of an Automatic Identification System receiver, 2 land-based radars, and 12 low light cameras (with zoom, pan, and tilt) to monitor the transit of the LNG carriers while in Coos Bay;
- Emergency response notification system;
- Installation of private navigation aids (e.g., channel centerline range markers); and
- Gas detection capability along the LNG carrier waterway transit route.

1.3.7 Navigational Reliability Improvements

JCEP plans to excavate four submerged areas lying adjacent to the federally-authorized Channel. These minor enhancements will allow for transit of LNG vessels of similar overall dimensions to those listed in the July 1, 2008 USCG Waterway Suitability Report, but under a broader weather window. This allows for greater navigational efficiency and reliability to enable JCEP to export the full capacity of the optimized design production of 7.8 mtpa from the LNG Terminal.

The total volume of capital dredge material from these excavations is approximately 700,000 cubic yards. Dredge material may be distributed between APCO 1 and APCO 2 upland disposal sites, or placed entirely at APCO 2 if shown to be feasible. The dredge areas are named Dredge Area 1 to 4 and located adjacent to the Channel roughly between River Mile ("RM") 2 to RM 7 respectively, as depicted in Figure 1.1-1.

1. Enhancement #1 – Coos Bay Inside Range channel and right turn to Coos Bay Range: Excavation at this site will reduce the constriction to vessel passage at the inbound entrance to Coos Bay Inside Range for any ship making the 95 degree turn from the Entrance Range through the Entrance Turn and Range. JCEP proposes to widen the

Coos Bay Inside Range channel from the current 300 feet to 450 feet, thereby making it easier for all vessels transiting the area to make this turn. In addition, the total corner cutoff on the Coos Bay Range side will be lengthened from the current 850 feet to about 1,400 feet from the turn's apex.

2. Enhancement #2 – Turn from Coos Bay Range to Empire Range channels: The current corner cutoff distance from the apex of this turn is about 500 feet, making it difficult for vessels to begin turning sufficiently early to be able to make the turn and be properly positioned in the center of the next channel range. JCEP proposes to widen the turn area from the Coos Bay Range to the Empire Range from the current 400 feet to 600 feet at the apex of the turn and lengthen the total corner cutoff area from the current 1000 feet to about 3500 feet.
3. Enhancement #3 – Turn from the Empire Range to Lower Jarvis Range channels: JCEP proposes to add a corner cut on the west side in this area that will be about 1,150 feet, thereby providing additional room for vessels to make this turn.
4. Enhancement #4 – Turn from Lower Jarvis Range to Jarvis Turn Range channels: JCEP proposes to widen the turn area here from the current 500 feet to 600 feet at the apex of the turn and lengthen to total corner cutoff area of the turn from the current 1,125 feet to about 1,750 feet thereby allowing vessels to begin their turn in this area earlier.

Maintenance materials will be disposed of in the upland dredge disposal sites located on the APCO site 1 and APCO site 2 and management of the dredge areas would be the responsibility of Jordan Cove.

1.3.8 Terminal Support Systems

1.3.8.1 Vapor Handling System

BOG is primarily generated from the LNG storage and loading system, and consists of flash gas from the LNG product stream entering the LNG flash drum, vapors from the heat leak into the LNG storage tanks, piping and pump systems, vapor displaced as the LNG storage tanks are filled, and vapor return from the LNG carrier during LNG loading. The BOG will be consumed as fuel. Two BOG compressor trains are included to compress the vapor from LNG storage tank pressure to fuel gas pressure. The mode of operation of the liquefaction plant when not loading an LNG carrier is known as "holding mode." The mode of operation during LNG carrier loading is known as "loading mode." One BOG compression train will be operating continuously to handle holding mode BOG volumes; the second will be needed only during loading mode or during an off-design condition that results in increased BOG generation.

During normal operation, fuel gas will be supplied from BOG and vaporized heavy hydrocarbon streams, and supplemented with gas from the inlet pipeline upstream of the gas conditioning train. After mixture in the high-pressure fuel gas mixing drum, this high-pressure fuel gas stream primarily feeds the combustion gas turbines to drive the refrigerant compressors. Some high-pressure fuel gas is let down from the high-pressure fuel gas header to the low-pressure fuel gas knockout drum before going to other smaller consumers, such as thermal oxidizer, duct burners, and flare pilots.

Normally, a small amount of makeup to the high-pressure fuel from the pipeline feed gas is required to meet demands; if the BOG/heavies mixture results in excess fuel for the demand, it can be recycled upstream of the amine unit and re-liquefied.

1.3.8.2 Steam System

The LNG Terminal will use steam as a heat transfer fluid for process heating. High pressure steam is provided to the facility from Heat Recovery Steam Generators ("HRSGs"), which utilize waste heat from refrigerant compressor driver exhaust gases. High-pressure steam supplies the gas conditioning train and Steam Turbine Generators ("STGs"), where the steam pressure is let down from 725 pounds per square inch gauge ("psig") to produce low-pressure steam at 50 psig per gas conditioning needs and the balance is further dropped to a vacuum pressure and generates electricity for the plant. Any low-pressure steam requirement in excess of this can be made up by "de-superheating" a letdown of high-pressure steam. Process condensate is de-aerated and treated, and then returned to the cycle as boiler feed-water for the HRSGs. An auxiliary boiler is available to provide high-pressure steam to meet the requirements for one STG and any additional steam required for when the facility is not producing LNG.

1.3.8.3 Instrument Air

Instrument air will be provided through compression and drying packages. Air will be compressed in two x 100 percent centrifugal compressors. There will be one additional compressor with the ability to provide essential instrument air duty. Air will be dried in two x 100 percent air dryer packages, with each package containing four air dryers designed for full, continuous operation. During operations, one dryer will be in absorption mode while the other dryer regenerates. Instrument air will be used for pneumatic control of automated instrumentation, utility air, and supply for nitrogen generation.

1.3.8.4 Utility Air

Utility air will be used for normal maintenance activities (utility stations, control panel purges, building purges, etc.). Utility air will be dried with the instrument air but will be supplied throughout the facility from a separate header. The utility air header will be provided with a pressure regulator and on-off valve to shut off flow if the main header pressure drops to the minimum for proper functioning of actuators.

1.3.8.5 Nitrogen

Nitrogen will be provided through vaporization of liquid nitrogen and a pressure swing adsorption site generation package unit. Pressure swing adsorption units use swings in pressure to separate nitrogen from air; the pressure swing adsorption swings from high pressure, where nitrogen is adsorbed from air, to low pressure, where it is desorbed. Liquid nitrogen will be the only source of nitrogen used for refrigerant makeup, while the site-generated nitrogen will supply continuous utility users, such as compressor seals, cold box purges and LNG loading arm swivel joints, as well as intermittent users, such as LNG loading arm purges and utility stations. Nitrogen packages will be sized to fulfill peak demand and to handle the maximum expected instantaneous flow.

1.3.8.6 Utility and Potable Water System

An interconnect to the Coos Bay-North Bend Water Board ("CBNBWB") potable water pipeline will be used for all normal operational water needs in the LNG Terminal, which includes fire water makeup, utility water used for such items as equipment and area cleaning, and potable water required to supply buildings and eyewash/safety shower stations.

Utility water is fed to the demineralized water package, but storage of utility water will be combined with fire water supply in the fire water tanks.

The CBNBWB raw water pipeline (in addition to the potable water pipeline) will be used for construction water, including LNG tank hydrotesting. The pipeline tap at the LNG Terminal site will remain connected after construction, but there are no normal operational uses anticipated for this raw water supply.

Resource Report 2 provides the estimated potable and raw water demand during the construction and operation of the LNG Terminal.

1.3.8.7 Fire Suppression System

Fire suppression and protection measures will be provided to ensure the safety of personnel and property. Fire water systems at the LNG Terminal including fire water supply storage tanks, stationary fire water pumps, fire hydrant mains, fixed water spray systems, automatic sprinkler extinguishing systems, high expansion foam system, and remotely controlled monitored spray systems will meet the requirements of 49 CFR Part 193, NFPA 59A, American Petroleum Institute ("API") 2510, API 2510A, and 33 CFR Part 127.

The function of the fire water system is to provide water under pressure to the fire hydrants, monitors, and fixed water suppression systems throughout the LNG Terminal. The fire water supply will also be used to provide water for on-site firefighting trucks. The fire suppression distribution piping network will comprise the following:

- Underground fire water mains;
- Aboveground fire water hydrant mains;
- Fixed fire water sprinkler and spray systems;
- Fixed high-expansion foam systems;
- Portable fire suppression equipment;
- Appurtenances, including all piping and valves connecting the pumps and water supply to the plant fire suppression systems; and
- Hydrants and monitors.

The main fire water supply for the LNG Terminal is provided by two x 100 percent capacity aboveground atmospheric storage tanks (located in the Access and Utility Corridor), which allow for redundancy if one of the tanks is unavailable. This redundancy is an acceptable precautionary measure for preparing for fire water tank repairs, in accordance with NFPA 22, and to perform regular maintenance and inspection of fire water tanks in accordance with NFPA 25. Water supply for the two fire water tanks is potable water from the local CBNBWB.

The fire water tanks are dual-service supply tanks and will provide the standpipe system to ensure dedicated fire water volume for fire protection systems. Each tank will hold a minimum usable capacity of 3,240,000 gal to supply four hours of fire water supply for the Maximum Probable Fire Water Demand, which is the demand for the largest fire scenario including 1,000 gpm hose stream allowance in accordance with NFPA 59A. Providing four hours of water supply is in accordance with API 2510 which exceeds the two hours of water supply required by NFPA 59A. The atmospheric tank design will follow API Standard 650 and NFPA 22.

The fire water distribution network will be supplied via four x 33 percent capacity fire water pumps. One fire pump will be electric motor driven while three will be diesel engine driven to ensure at least three pumps remain available in the event of power failure. Two x 100 percent electric-motor-driven jockey pumps will be provided to maintain pressure in the main fire water distribution system. The entire pump installation will be designed in accordance with NFPA 20 and the fire water distribution network will be designed in accordance with NFPA 24.

Further fire water system details can be found in Resource Report 13 (Section 13.38.1).

1.3.8.8 Flare, Relief, and Blowdown System

Flare systems are a necessary safety feature of all LNG export facilities. The LNG Terminal will have three separate flare systems for pressure relief plant-protection conditions: one for warm (wet) reliefs, one for cold, cryogenic (dry) reliefs, and one for low-pressure cryogenic reliefs from the marine loading system. The "warm" relief loads are separated to ensure that wet fluids cannot freeze in the header if there were a cryogenic relieving event. The "cold" and "marine" relief loads are separated to ensure that the relief of near-atmospheric pressure vapors is not affected by back-pressure in the header if an unrelated release were to occur.

The warm and cold flares will both be within a multi-point enclosed ground flare, while the marine flare will be an enclosed cylindrical ground flare. A small pilot with electronic ignition is provided on each flare.

The flare system will be used only during plant-protection situations, maintenance activities, cases of purging and gassing-up an LNG carrier, and initial commissioning/start-up.

1.3.8.9 Stormwater and Wastewater Systems

The LNG facility and marine LNG loading area will include various drainage elements to manage segregated networks for contaminated and uncontaminated water from designated areas. Liquid effluent from the LNG facility and marine LNG loading area consists mainly of water from rainfall, protection of equipment with fire water, processing areas, storage areas, domestic areas, and utilities units. Water from all oil-filled equipment in LNG spill impounding basins will be pumped by submersible pumps to the oily water treatment system.

Stormwater from areas other than LNG spill impounding basins will be collected in a system of stormwater swales, a buried storm water system, infiltration basins, and other treatment facilities. Stormwater facility overflow outfalls will ultimately connect to Coos Bay. The initial runoff from all storms of a two-year return period and 24-hour duration or less will be infiltrated. Excess stormwater during storms of longer return periods will be allowed to overflow to the slip. Stormwater from some low elevation areas will be treated with cartridge filters and released to the slip.

Stormwater collected in areas that are potentially contaminated with oil or grease will be pumped or will flow to the oily water system. The oily water system will flow to the oily water separator package(s) before being treated and discharged to the IWWP.

The facility will be designed to provide drainage of surface water to designated areas for disposal in accordance with 49 CFR § 193.2159. Stormwater collection and treatment facilities will be designed to meet regulatory requirements from the National Marine Fisheries Service ("NMFS") and ODEQ.

A stormwater management plan ("SWMP") is provided in Resource Report 2.

1.3.8.10 Sewage and Sanitary Waste Treatment

Sanitary waste from the northwest guard house and tug building will be directed to a holding tank. A sanitary waste contractor will remove the contents of the tank as necessary and dispose of the contents at authorized disposal sites through the sanitary waste contractor's permits. Sanitary waste from the remainder of buildings will be treated by a packaged treatment system. The effluent will be directed to the IWWP. Solids will be removed from the packaged treatment system periodically by a sanitary waste contractor and will be disposed of at authorized disposal sites through the sanitary waste contractor's permits.

1.3.8.11 Hazard Detection and Response

Safety controls, including hazard detection and response systems, are briefly summarized below. The Project will contain "passive" and "active" hazard prevention and mitigation systems and controls.

Passive systems will generally include those that do not require human intervention, such as spill drainage and collection systems, ignition source control, and fireproofing. Thermal proofing will be considered for application to support structures, components, and equipment, as required, to maintain structural stability in a fire hazard zone, cryogenic spill zone, or area where a failure could affect a safety-related system, provide additional fuel to a fire, or cause additional damage to the unit or facility.

Active systems normally are either automatic or require some action by an operator. Active fire control systems and equipment will consist of a looped, underground fire water distribution piping system serving hydrants, fire water monitors, hose reels, water-spray, or deluge and sprinkler systems. Active spill control systems will include fixed high-expansion foam and dry chemical systems. They will also include portable and wheeled fire extinguishers that employ dry chemicals and CO_2. Fire protection in buildings will generally consist of smoke detectors, flame detectors, portable fire extinguishers, sprinkler systems, and an emergency shutdown ("ESD") system.

Process instruments will routinely monitor for potentially hazardous conditions. Specialized automatic hazard detection and alarm notification devices will be installed to provide an early warning. The Project will also contain hazard detectors designed to sense a variety of conditions, including combustible gas, low temperatures (LNG spill), smoke, heat, and flame. Each of these detector systems will trigger visual and audible alarms at specific site locations and in the control room areas to facilitate effective and immediate response.

The safety of the LNG carriers while docked and loading is a major design consideration for hazard detection and response. Safety measures include ESD spill containment and provisions to protect piping from the effects of surges. In addition, JCEP will have a Fire Department with three pumping trucks, one ladder truck, and one hazardous materials truck that can be mobilized to attend to a fire in the facility in less than 4 minutes.

1.3.8.12 Process Control System

Operators will control and monitor the facility through a distributed control system ("DCS"). Vendor-supplied packaged units with local control panels and numerous field-mounted instruments will be connected to remote Input/Output ("I/O") cabinets located throughout the facility. These remote I/O cabinets interface with the DCS controllers through cabling run through the plant to the control room. The DCS also includes a local historian that historicizes all process data on-site. Overall plant process control and monitoring will be performed at consoles located in the central control room, with monitoring capabilities from the remote I/O rooms. Other machine monitoring and control systems such as those used for the refrigerant compressors will have local control panels but will also be linked to the DCS and central control room.

In addition to the DCS, independent Safety Instrumented Systems ("SIS") and Fire and Gas Systems ("FGS") will be employed to monitor hazardous conditions and provide emergency shutdown capability. The SIS will utilize separate, dedicated controllers to control safety functions such as those that are required for emergency shutdown safety functions. DCS controllers will monitor the present value of a designated process parameter and adjust actuated control valves to maintain the process setpoint. Limits will be defined to alert operators of deviation away from setpoint, and the SIS will take action if further deviation occurs. The FGS will permit activation of critical firefighting equipment from the control room and will utilize various flame, smoke, and temperature detectors as well as sirens, beacons, and manual alarm call points.

1.3.8.13 Electrical Systems

JCEP plans to obtain limited power from the regional electric grid for the SORSC and temporary construction activities as described in Section 1.9. With the exception of the SORSC, the LNG Terminal facilities will be islanded (with black-start capability) and will not have the means, infrastructure, or need to import or export power during operations.

The total power requirements for the LNG Terminal are 39.2 MW (holding mode) and 49.5 MW (loading mode). Electrical power will be via two 30 MW STGs and one spare 30 MW STG. The steam is efficiently generated by HRSGs using exhaust from the refrigerant compressor combustion turbine drivers. A black-start auxiliary boiler will be used to generate steam for power when gas turbines are not in operation. In addition, there are two standby diesel generators for the LNG facility and two for the SORSC. The facility will not be connected to the local grid, and will not import or export power. Two switchgear buses, in a main-tie-main configuration, will be connected to the STGs (minimum of one turbine to each bus). These switchgear buses will feed the plant distribution 13.8 kilovolt (“kV”) switchgear, 6.9 kV switchgear and motor control center, and 480-volt switchgears and motor control center buses located throughout the plant. The plant distribution buses will contain two 6.9 kV essential power buses that power all of the essential plant loads. The LNG facility diesel generators have 100 percent redundancy and are connected to the 6.9 kV essential power buses.

1.3.8.14 Buildings

Buildings and structures required for the operation of the LNG Terminal facility include:

- Administration building;
- SORSC building;
- Fire department;
- Operations building/control room/laboratory/first aid facility;
- Main gate guard house and security building;
- Secondary entrance security gate/terminal guard building;
- Plant warehouse/receiving building;
- Maintenance building;
- Tugboat, storage, and crew building;
- Lube oil, paint and compressed gas storage;
- Water treatment building;
- Inspection station shelter;
- Fire water pump buildings;
- Fire water valve houses;
- Marine control room building;
- Electrical powerhouses;
- Equipment shelters/buildings;
- Analyzer buildings;

The siting of occupied buildings will be evaluated for overpressure, toxic release, and fire hazards. Occupied buildings will be sited in accordance with industry standards. Loads, analysis, design, and construction will be in accordance with all statutory and regulatory requirements.

1.3.8.15 Lighting System

The lighting levels will be based on API standards. Lighting around equipment and facilities where routine maintenance activities could occur on a 24-hour basis would range from 1 to 20 foot-candles, with 20 foot-candle lighting levels within the compressor enclosures.

General process area lighting would be kept to a minimum, on the order of 2 foot-candles. Access and Utility Corridor lighting for the LNG Terminal would be 0.4 foot-candle. Perimeter security would be on the order of 1.3 foot-candles, using evenly spaced 400 watt floodlights. As a point of reference, 20 foot-candles is close to the indoor lighting in a typical home, 2 foot-candles is typical of that found in a store parking lot, and 0.4 foot-candle is typical of residential street lighting. The final lighting plan would be developed during detailed design.

Only lighting required for operation and maintenance, safety, security, and meeting Federal Aviation Administration requirements would be used on the LNG storage tanks. The light will be localized to minimize off-site effects.

1.3.8.16 Access and Utility Corridor, Haul Road, Access Roads, and Parking Lots

The Access and Utility Corridor will be constructed between Ingram Yard and the South Dunes Site. The corridor will be approximately 1 mile long. It will be located entirely on property owned by JCEP. The Access and Utility Corridor will cover about 26 acres. A typical cross-section diagram for the Access and Utility Corridor is illustrated in Figure 1.3-8.

The primary purpose of the Access and Utility Corridor is to provide a conduit for the underground feed gas supply to the LNG Terminal and a number of utility services required between the LNG Terminal and South Dunes. Utilities in the corridor will include underground power lines, fire water supply, communications lines, and metering skid control lines.

The full length of the corridor will be used during construction for the movement of equipment and materials. The road will be used to haul materials excavated from the Ingram Yard to the South Dunes Site and the RFP property. Use of the corridor for mass earth moving will reduce impacts to the TPP and the existing RFP facility.

The western portion of the Access and Utility Corridor between the LNG Terminal and Jordan Cove Road will be paved and provide primary permanent access; it will include two lanes into the LNG Terminal and a single lane out. The remainder of the corridor, east of Jordan Cove Road, will be provided with a crushed rock track for infrequent maintenance access. Paved access between the South Dunes Site and the western portion of the Access and Utility Corridor will be provided by the existing Jordan Cove Road. A two-lane access road will be provided to the northwest of Ingram Yard to provide emergency, marine terminal, and occasional maintenance access from the TPP.

To the west of the Access and Utility Corridor and within the secured footprint of the LNG Terminal will be the guard house, security building, firefighting facility, operations building, warehouse building, maintenance building, and parking for operations personnel. Both the South Dunes Site and Ingram Yard will be provided with sufficient parking.

1.3.9 Mitigation Measures and Environmental Project

JCEP has worked with agencies since the inception of the Project to identify measures to enhance the environment or avoid, minimize, or mitigate for adverse environmental effects. Such measures include the Kentuck Project (that includes wetland mitigation for both JCEP and PCGP) and the Eelgrass Mitigation Site within the Coos Bay.

The potential environmental impacts of the Project, along with proposed mitigation measures, are detailed in Resource Reports 2 through 12.

1.3.10 Location Maps, Detailed Route Maps, and Plot/Site Plans

In addition to Figure 1.1-1, Figures 1.3-9 and 1.3-10 show the regional location of the LNG Terminal facilities on a USGS topographic map and an aerial map, respectively.

LNG Terminal plot plans are displayed on Figure 1.1-2 (Plot Plan of the LNG Terminal).

A typical cross-section diagram for the Access and Utility Corridor is illustrated in Figure 1.3-8.

Additional maps, illustrations, and plans of LNG Terminal components are found throughout the environmental resource reports, including the detailed design plans contained in Resource Report 13 (Engineering and Design Material).

1.4 LAND REQUIREMENTS AND LAND USE

Table 1.4-1 summarizes the land requirements for the facilities proposed as part of the LNG Terminal. Land requirements for each component of the LNG Terminal are described below.

1.4.1 Land Ownership, Existing Land Use, and Zoning

During construction of the LNG Terminal and related facilities, approximately 740 acres would be disturbed. Approximately 200 acres would be retained for operational facilities. JCEP owns about 295 acres at the LNG Terminal site, with additional temporary construction areas leased from other private landowners. Table 1.4-1 lists the land requirements for the LNG Terminal.

TABLE 1.4-1

Summary of Land Requirements for the LNG Terminal

Area	Land Area (acres)
OPERATIONAL PROJECT FACILITIES (FIGURE 1.3-1) (1)	
Terminal Site Access	3.4
Refrigerant Storage Area	3.0
LNG Loading	10.2
Liquefaction Process Area	12.1
LNG Tank Area	28.2
Flare Area	3.4
MOF	3.2
Gas Processing Area	5.5
Slip and Access Channel	74.2
Utilities	5.7
Admin Building	4.6
Access and Utility Corridor	25.8
PCGP M&R Station	1.7
Heavy Truck Haul Route	16.2
Meteorological Station and Access Road	1.6
Operational Project Facilities	**198.7(3)**

TABLE 1.4-1

Summary of Land Requirements for the LNG Terminal

Area	Land Area (acres)
NON-JURISDICTIONAL FACILITIES (2)	
Southwest Oregon Regional Safety Center (SORSC)	5.4
Fire Department	0.8
Non-jurisdictional Facilities	**6.3(3)**
CONSTRUCTION AND ENVIRONMENTAL AREAS (FIGURE 1.3-1)	
Laydown (Ingram Yard)	28.7
Laydown (RFP)	82.6
Laydown, Workforce Housing Facility and Parking (South Dunes)	71.5
TPP/US 101 Intersection	5.1
Industrial Wastewater Pipeline	15.2
Ingram Yard Perimeter	1.8
South Dunes Perimeter	7.6
Eelgrass Mitigation Area and Dredge Line (environmental area)	33.4
Boxcar Hill Laydown and Parking Area	19.9
Hydraulic Dredge Pipeline (Ingram Yard to South Dunes)	8.0
Kentuck Project and Dredge Line (environmental area)	135.6
Navigation Reliability Improvement Areas 1-4 and Dredge Line	35.6
APCO Site 1	20.4
APCO Site 2 and Transfer Line	20.2
Port Laydown Site	33.2
Myrtlewood Facility Park and Ride	6.5
Mill Casino Park and Ride	6.4
Construction Areas	**531.7(3)**
TOTAL PROJECT AREA	**736.7(3)**

TABLE 1.4-1 Summary of Land Requirements for the LNG Terminal	
Area	Land Area (acres)
(1) These are the operational acres required. These acres are also required for construction. (2) These are required operational acres. These acres are also required for construction. (3) The totals reflect rounded numbers.	

Virtually all of the upland elements of the LNG Terminal are on privately owned lands. No federal lands would be utilized for the LNG Terminal. The majority of the waterway for LNG vessel marine traffic and the access channel to the LNG Terminal would be located in Coos Bay. The bottom of the bay outside the Federal Navigation Channel is owned by the State of Oregon and managed by the ODSL.

The LNG Terminal would be located on the bay side of the North Spit, about 7.5 miles up the existing Federal Navigation Channel, approximately 1,000 feet north of the city limit of North Bend, in Coos County, Oregon. The various components of the LNG Terminal, except for the waterway for LNG vessel traffic in Coos Bay, are illustrated on Figure 1.1-2.

The LNG Terminal would be within Section 5, Township (T.) 25 South (S.), Range (R.) 13 West (W.), shown on Coos County Assessor's map as tax lots 100/200/300. The zoning for the LNG Terminal site is established in the Coos County Comprehensive Plan, which includes the Coos Bay Estuary Management Plan ("CBEMP"). The current Comprehensive Plan and zoning designations allow for the development of the LNG Terminal. No zone or Comprehensive Plan map amendments will be required for development of the LNG Terminal. The necessary land use entitlements are limited to the receipt of discretionary permits that implement the applicable Comprehensive Plan and zone map designations.

The LNG Terminal, slip, and access channel are located within the aquatic and shoreline segments of the CBEMP. The access channel and inter-tidal portion of the slip fall within zoning districts 5 and 6 – Development Aquatic (5-DA and 6-DA). The purpose of the 6-DA zone is to provide areas for navigation and other water-dependent uses. The upland portions of the LNG Terminal are located within the Coastal Shorelands Boundary and are designated districts 5 and 6 – Water Dependent Development Shorelands (5-WD and 6-WD). The purpose of zoning district 6-WD is to protect the shoreline and provide areas suitable for water-dependent industrial uses. On August 30, 2016, the Coos County Board of County Commissioners approved JCEP's request for a conditional use permit to site and construct an LNG Terminal. The Port obtained a removal-fill permit from ODSL to dredge an access channel that will connect the LNG Terminal slip to the Federal Navigation Channel within Coos Bay.

Historically, the LNG Terminal tract was once part of the Henderson Ranch, which dates back to the 1860s. In the 1880s, the Henderson Ranch was acquired by the Luse family, who later sold it to the Southern Oregon Improvement Company. William Luse was the son of H.H. Luse, who founded the first sawmill at Empire in 1856 (Dodge 1898). William Luse, John Henderson, Henry Barrett, Sam Crawford, and James Jordan were all acquaintances who married native Coos women, sought refuge on the North Spit, and were tangentially involved in the operation of the stage line from Jarvis Landing north along the beach to the Umpqua River. The Peterson family operated a dairy farm in the area in the early twentieth century, and continued to run cattle on the North Spit until the late 1950s (Byram 2006a). The terminal tract, then referred to as the Ingram Yard, was acquired by the Menasha Wood Ware Corporation and sold to Weyerhaeuser in 1981. The Ingram Yard was used for log sorting and disposal of debris from operation of the mill. In the early 1970s, the USACE deposited materials dredged during maintenance of the Federal Navigation Channel at the Ingram Yard.

JCEP proposes to construct and operate an approximately 1-mile Access and Utility Corridor between the Ingram Yard and the South Dunes Site, in the Northeast (NE) Quarter of Section 5, T.25S., R.13W., and Northwest (NW) Quarter of Section 4. This corridor would be north of the existing RFP property, on land JCEP acquired from Weyerhaeuser. On the south side of the Access and Utility Corridor, adjacent to the eastern boundary of the LNG Terminal tract, JCEP would install support buildings, including the terminal control building, and a warehouse and maintenance building. Table 1.4-2 shows the support buildings proposed for the JCEP LNG Terminal. Historically, this parcel was once part of the Henry Barrett and Sam Crawford Ranch and the James Jordan Ranch, which were established in the 1860s and consolidated by the Luse family in the 1880s.

TABLE 1.4-2

Support Buildings for the JCEP LNG Terminal

Building Location / Function	**Approx. Floor Area (ft²) / Eaves Height (ft.)**	**Form of Construction**	**Other Additional Elements**
South Dunes / Southwest Oregon Regional Safety Center	26,110 / 15	Type 1 – Engineered stick built building with interior finishes.	One story, architect designed.
South Dunes / Administration Building	24,769 / 15	Type 2 – Pre-engineered metal building with interior finishes.	One story.
Access Corridor / Fire Department	21,560 / 14-28	Type 2 – Pre-engineered metal building with interior finishes.	Two story.
Access Corridor / Operation Building	41,590 / 18-36	Type 2 – Pre-engineered metal building with interior finishes.	Two story building will include the Control Room, Laboratory and First Aid Facility.
Access Corridor / Plant Warehouse/Receiving Building	30,000 / 28	Type 2 – Pre-engineered metal building with interior finishes.	One story with mezzanine.
Access Corridor / Maintenance Building	30,000 / 28	Type 2 – Pre-engineered metal building with interior finishes.	One story with mezzanine.
LNG Terminal / Tugboat,	2,664 / 17	Type 2 – Pre-engineered	One story.

TABLE 1.4-2

Support Buildings for the JCEP LNG Terminal

Building Location / Function	**Approx. Floor Area (ft²) / Eaves Height (ft.)**	**Form of Construction**	**Other Additional Elements**
Storage and Crew Building		metal building with interior finishes.	
Access Corridor / Inspection Station Shelter	4,950 / 23	Type 3 – Pre-engineered metal building without finishes.	One story, roof only.
Access Corridor / Chemical Storage and Hazardous Waste Storage Building	4,200 / 23	Type 3 – Pre-engineered metal building without finishes.	One story storage facility with air exchange handling units and wet sprinkler system to store hazardous materials such as paints, oils, greases, etc. for the facility
LNG Terminal / Water Treatment Building	9,188 / 23	Type 3 – Pre-engineered metal building without finishes.	One story.
Access Corridor / Guard House and Security Building	960 / 12	Type 4 – Pre-manufactured metal building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	One story.
LNG Terminal & South Dunes / Auxiliary Guard Buildings	360 / 12	Type 4 – Pre-manufactured metal building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	One story.
LNG Terminal / Marine Control Building	2,030 / 12	Type 4 – Pre-manufactured metal building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	One story.
LNG Terminal / Firewater	104 / 9 (x10)	Type 4 – Pre-manufactured metal	One story.

TABLE 1.4-2

Support Buildings for the JCEP LNG Terminal

Building Location / Function	**Approx. Floor Area (ft²) / Eaves Height (ft.)**	**Form of Construction**	**Other Additional Elements**
Valve Housing (x22).	372 / 10 (x10) 787 / 14 (x2)	building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	
LNG Terminal / Firewater Pump Housing (x1).	1,328 / 9 (x1)	Type 4 – Pre-manufactured metal building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	One story, Two Buildings.
LNG Terminal / Powerhouse Housing (x12)	3,600 / 12 (x5) 4,284 / 12 (x1) 1,689 / 12 (x1) 4,480 / 12 (x1) 3,500 / 12 (x1) 2,000 / 12 (x3)	Type 4 – Pre-manufactured metal building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	One story.
LNG Terminal / Continuous Emissions Monitoring Systems Housing (x7)	120 / 8	Type 4 – Pre-manufactured metal building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	One story.
LNG Terminal / Backup Generator Housing (x2)	188 / 9	Type 4 – Pre-manufactured metal building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	One story.
LNG Terminal / VFD Housing (x2)	1,800 / 12	Type 4 – Pre-manufactured metal building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	One story, one each for the BOG and the LNG tank expander. Currently area of VFD for LNG tank expander is unknown.
LNG Terminal / Analyzer	120 / 8	Type 4 – Pre-	One story.

TABLE 1.4-2

Support Buildings for the JCEP LNG Terminal

Building Location / Function	Approx. Floor Area (ft²) / Eaves Height (ft.)	Form of Construction	Other Additional Elements
Housing (x1)		manufactured metal building. Completely fabricated, utilities installed and brought to site in one piece and set on foundation.	
LNG Terminal – BOG Compressor Shelter (x1)	7,225 / 45	Type 5 – Pre-engineered metal building with roof and partial side panels only.	One story shelter will provide weather protection for compressor/motor, lube oil consoles and maintenance cranes.
LNG Terminal – Refrigerant Compressor Shelters (x5)	3,233 / 64	Type 5 – Pre-engineered metal building with roof and partial side panels only.	One story shelter will provide weather protection for compressor, lube oil consoles and maintenance cranes.
LNG Terminal – Air Compressor Shelter (x1)	1,800 / 30	Type 5 – Pre-engineered metal building with roof and partial side panels only.	One story shelter will provide weather protection for compressor/motor, lube oil consoles and maintenance cranes.
LNG Terminal / Steam Turbine Generator Shelter (x3)	3,150 / 45	Type 5 – Pre-engineered metal building with roof and partial side panels only.	One story shelter will provide weather protection for turbine/generator, lube oil consoles and maintenance cranes.
LNG Terminal / Boiler Feed Water Pump Shelter (x1)	1,800 / 30	Type 5 – Pre-engineered metal building with roof and partial side panels only.	One story shelter will provide weather protection for pump/motors and maintenance cranes.

The eastern portion of the LNG Terminal on the South Dunes Site is the site of the former linerboard mill property. This location is primarily zoned industrial and would include administration buildings, a workforce housing facility, and the metering station.

JCEP would also lease about 83 acres of industrial land within the existing 229-acre RFP property for temporary construction staging activities. The haul road and dredge slurry and return water lines from the slip, to be used temporarily during construction of the terminal, would also cross RFP industrial land. The proposed relocations of the IWWP and the raw water pipeline would be routed along the existing TPP (the road on the north side of the LNG Terminal). The relocations of the water lines would impact about 23 acres of industrial land and less than half an acre of forest land during construction.

JCEP has proposed mitigating the loss of wetlands within the design of the Kentuck Project.

The Kentuck Project would cover about 140 acres of uplands, some of which will constitute JCEP and PCGP wetland mitigation, on the eastern shore of Coos Bay at the mouth of Kentuck Slough. Kentuck Project is to the east of North Cardinal Mark 11 along the Federal Navigation Channel, including parts of Sections 6 and 7, T.25S, R.12W, tax lots 100/799 and Sections 1 and 12, T.25S, R.13W tax lots 400/100. Formerly, this was the Kentuck Golf Course, zoned for Recreation (REC) and Forest (F). However, on September 23, 2009, the Coos County Board of Commissioners rezoned this land to Exclusive Farm Use (EFU), and amended the Coos County Comprehensive Plan for this tract from Recreation and Forest use to Agriculture. On August 30, 2016, the Coos County Board of County Commissioners granted JCEP's request for a conditional use permit to allow for mitigation and restoration within Segment 15-RS of Rural Shore lands identified in the CBEMP. This property is currently owned by JCEP.

The waterway for LNG vessel marine traffic would traverse 7.5 miles of the existing Federal Navigation Channel within Coos Bay. The Federal Navigation Channel is zoned "Deep-Draft Navigation Channel" in the CBEMP. The Federal Navigation Channel, which is generally 300 feet wide and 37 feet deep, is maintained by the USACE on behalf of the Port. It is used by deep-draft commercial ships and barges, a commercial fishing fleet, and recreational boats. Also within Coos Bay, adjacent to the Southwest Oregon Regional Airport, would be the Eelgrass Mitigation Site, which would cover approximately 7.5 acres of open water and bay bottom, with approximately 33 acres used during construction for work area and dredge lines.

On the north side of the McCullough Bridge, the Project would make improvements to the intersection of US 101 with the TPP, in accordance with its Transportation Impact Analysis. See Resource Report 5 for more information regarding the Transportation Impact Analysis.

JCEP proposes to use two temporary off-site parking lots during construction for commuting workers not residing at the worker housing at the South Dunes Site. One lot, approximately 6 acres, would be at the Mill Casino in the city of North Bend and is zoned Heavy Industrial (M-H). A parking lot likely is permitted outright, although the use is not specifically listed (North Bend City Code Chapter 18.44010). The other lot, approximately 6 acres, would be at the Myrtlewood Facility along US 101 near the community of Hauser. It is in Coos County jurisdiction and zoned Industrial (IND). "Parking lot/structure" is a use that is permitted outright (Coos County Zoning and Land Development Ordinance 4.4.200 (27)). Resource Report 8 contains a more detailed description of land use for all off site areas.

Construction and operation of the LNG Terminal and related facilities should have no significant adverse impacts on existing land use. JCEP's facilities would be consistent and compatible with existing zoning. The LNG Terminal tract is zoned for water-dependent industrial use and the adjacent South Dunes Site is zoned for industrial use. JCEP has obtained or is in the process of obtaining local and state permits necessary for use of the Project component areas (see Table 1.4-1).

1.4.2 Land Use Effects

Virtually all of the LNG Terminal's upland elements are on privately owned lands. The majority of the waterway for LNG vessel marine traffic and the access channel to the LNG Terminal would be located in Coos Bay, considered to be waters of the State, with the bottom of the bay managed by ODSL. The waterway is zoned “Deep-Draft Navigation Channel,” and LNG vessel traffic would be consistent with this use. The access channel and inter-tidal portion of the slip are zoned Development Aquatic; the upland portions of the LNG Terminal are zoned Water Dependent Development Shorelands; and the South Dunes Site with administration buildings and workforce housing facility is zoned Industrial. Therefore, the LNG Terminal would be consistent with these water-dependent industrial uses. JCEP has received all of the necessary conditional use permits, and a Land Use Compatibility Statement.

The nearest residential structure to the proposed LNG Terminal is about 1.1 miles to the southeast, while the closest commercial buildings are part of the existing RFP industrial operation adjacent to the proposed LNG Terminal site.

The LNG Terminal and the western 52 miles of the pipeline route would be within Oregon’s Designated Coastal Zone. JCEP and PCGP will submit an application to the Oregon Department of Land Conservation and Development (“DLCD”) to obtain a coastal zone consistency determination. Construction will not be allowed to proceed until after the Oregon DLCD makes a finding that the Project is consistent with the Coastal Zone Management Act.

The LNG Terminal and the South Dunes Site will be located on the bay side of the North Spit of Coos Bay, Oregon, located in unincorporated Coos County and to the north of the Cities of North Bend and Coos Bay, Oregon. A plot plan of the construction facilities is shown in Figure 1.3-1. A summary of the land areas affected by the construction and operation of the LNG Terminal is provided in Table 1.4-1 and shown on Figures 1.1-1 and 1.3-1.

During construction, approximately 740 acres will be disturbed. Of the approximately 740 acres, 295 acres will be within the land owned by Fort Chicago LNG II U.S. L.P., an affiliate of JCEP. The remaining 455 acres outside of the land owned by Fort Chicago LNG II U.S. L.P. will be used for temporary construction areas and will be leased from private owners. Specifically, an additional area of about 83 acres will be leased on the RFP property and used for temporary construction areas including office, laydown, fabrication, craft break/lunchroom, parking, a heavy equipment truck haul route, and a slurry/decant water pipeline route. In addition, approximately 23 acres for the industrial wastewater line and raw water/water line relocation (Figure 1.4-1) will be in an existing utility easement on land owned by the Port.

Following construction, approximately 200 acres on the LNG Terminal and South Dunes Site will be required for the operational facilities.

The slip will be constructed on land owned by Fort Chicago LNG II U.S. L.P. JCEP will construct the slip and the LNG carrier and tug berths.

The access channel will be on land owned by the State of Oregon. JCEP will obtain an easement from the State of Oregon for the use and maintenance of the access channel. JCEP will construct the access channel.

1.5 CONSTRUCTION METHODS AND RESTORATION

1.5.1 Schedule

To meet an in-service date of the first half of 2024, construction activities for the Project are expected to begin in the first half of 2019 after the issuance of a FERC order and other applicable permits and approvals. Construction of the LNG Terminal and slip is expected to take five years. All in-water work, including placement of material to construct the MOF, dredging, and specifically that required to remove the berm separating the slip and the access channel will occur during the allowable in-water work window (October 1 through February 15).

1.5.2 Construction Procedures

This section describes the general procedures proposed by JCEP for construction of the LNG Terminal facilities.

Under the provisions of the Natural Gas Pipeline Safety Act of 1968, as amended, JCEP would design, construct, operate, and maintain the LNG Terminal facilities in accordance with the U.S. DOT's/Pipeline and Hazardous Materials Safety Administration's Liquefied Natural Gas Facilities: Federal Safety Standards (49 CFR Part 193). The loading facilities and any appurtenances located between the LNG carriers and the last valve immediately before the LNG storage tank would be required to comply with applicable sections of the USCG regulations in Waterfront Facilities Handling Liquefied Natural Gas (33 CFR Part 127).

JCEP would construct the LNG Terminal facilities in accordance with its project-specific Erosion and Sediment Control Plan (ESCP); its Upland Erosion Control, Revegetation, and Maintenance Plan ("JCEP's Plan"); and its Wetland and Waterbody Construction and Mitigation Procedures ("JCEP's Procedures"). JCEP has adopted the FERC's Plan and Procedures (May 2013 versions), as modified for the Project, into JCEP's Plan and Procedures as modified for this Project; therefore, there are no differences between JCEP's and FERC's Plan and Procedures. In addition, JCEP has prepared a Construction Spill Plan and Operations Spill Prevention Control and Countermeasures Plan. Resource Report 2 contains further information regarding the Erosion and Sediment Control Plan and Spill Prevention Control and Countermeasures Plans.

JCEP's proposed LNG Terminal and associated aboveground facilities would be constructed in various phases. A description of the key elements of construction is provided below.

1.5.3 Site Preparation – Demolition and Clearing

Site preparation will commence with demolition, clearing and removal and relocation of existing functional and redundant infrastructure to enable earthworks to progress. During this time, the IWWP and several existing utilities will be relocated, as discussed in Section 1.9. Other demolition and clearing activities include the following:

- Hydrocarbon contaminated soils - The South Dunes Site contains small areas of hydrocarbon contaminated soils remaining after the decommissioning of the former Weyerhaeuser paper mill. The contamination is located in the vicinity of the proposed site for the permanent buildings and would likely be disturbed during possible soil improvement activities. Following further delineation work, JCEP will develop a disposal plan for the approval of ODEQ and will dispose of the contaminated soils.
- Clearing - The dune areas at the LNG Terminal site currently contain low-grade timber. Before mobilizing earthmoving equipment, the trees will be felled and selectively processed for commercial timber. Scrub and stumps from across the site will be processed into mulch for use during construction operations. Wildlife monitoring will be

undertaken before and during tree felling and site clearing activities according to the relevant regulations and permitting requirements.

1.5.3.1 Site Preparation – MOF and TMBB Construction and Material Deliveries

Final transportation of materials, supplies, and staff to the Project site will be undertaken by a combination of road, marine transport, and rail. The kinds of materials and the mode of delivery to the site will depend on the origin, size, and weight of the material. The larger and heavier pieces of equipment can be delivered only by marine transport, and for that reason, JCEP will be constructing the MOF.

Until the ability to deliver materials by marine transport is made available, the logistical difficulties presented within southwestern Oregon will mean that the majority of equipment will need to be delivered by road. Therefore, the MOF will be completed as early as possible in order to reduce the impacts of road haulage on the local community and environment. Once constructed, the MOF will facilitate the receipt of large equipment, modules and general cargo.

That said, the MOF construction cannot be completed in a single in-water work window and as such, to take advantage of marine deliveries as early as possible in the project, a Temporary Material Barge Berth ("TMBB") will be constructed in the existing shoreline within the slip footprint. The TMBB will be removed when the berm in which it sits is excavated. The TMBB will be utilized until the MOF is able to receive materials.

The MOF will be placed at the southeastern corner of the slip, and will utilize the area dredged for the slip and access channel. The berth area behind the sheet pile walls will be used as the dock surface. Heavy equipment haul roads will be constructed from the MOF face to the process area of the site.

Although marine transport is preferable, JCEP anticipates that some bulk materials, such as temporary buildings, construction equipment, steel reinforcement, pipe spools, cable drums, and insulation, will be delivered by road, according to the construction schedule, in order to minimize laydown requirements.

An existing rail line is located adjacent to the Project site and will be utilized where infrastructure restrictions allow. The rail line, which has been acquired by the Port, is now called the Coos Bay Rail Link and currently services the RFP facility adjacent to the proposed leased construction laydown areas.

Traffic surveys have been conducted of the anticipated construction-related traffic, and measures have been proposed to mitigate adverse effects of that traffic including upgrade of the intersection with US 101. These impacts and mitigation will be discussed in detail in Resource Report 5 - Socioeconomics.

MOF and TMBB construction will be sequenced as follows, and as shown in Figure 1.5-1 and Figure 1.5-2:

- In the first available in-water work window (October 1 to February 15), earthwork equipment consisting of a small excavator and 40-ton articulated trucks will cut soil from the southern portion of the existing dune. Clean sand will be placed within the channel to create a work platform extending outside the MOF footprint. Slopes will be temporarily stabilized to protect sandy material from tidal erosion.
- In the same in-water work window, earthwork equipment consisting of a small excavator and 40-ton articulated trucks will cut soil from the shoreline area near the face of the emergency lay berth. A section large enough to receive and moor the end of an ocean-going barge will be removed. The excavator will cut down to elevation -12 MLLW and

create a channel to deeper water. The material will be placed on site. Following the excavation work, a crane will drive between 6 and 10 mooring piles (depending on final design parameters). These pile will be removed during the berm excavation to open the slip.

- Using the placed fill to locate construction equipment, sheet piles will be driven as a land-based activity without further impact to the marine environment. As this work will now be out of the water, it will take place outside of the annual in-water work window.
- In the next available in-water work window, a clam-shell dredge operation will remove all material from the front of the MOF to achieve operational depth requirements. After the sheet piles have relaxed, a topping-off operation behind the sheetpile wall to approximate elevation +13 (NAVD88) will occur before concrete, rock, and mooring structures are placed on top of the MOF. Later in the same in-water work window the fender piles will be installed in front of the sheetpile wall to make it fully operational.

1.5.3.2 Site Preparation – Earthworks

Earthworks will require removal of topsoil and storage for re-use, cut (excavation and dredging), fill (placement of excavated material), and grading of nearly 10 million cubic yards (“mcy”) of material to the approximate elevations detailed in Table 1.5-1.

TABLE 1.5-1

JCEP LNG Terminal Elevations

Facility	Critical Minimum Elevation Required (ft)	Finished Grade Elevation (ft)	Critical Elevation
Marine Terminal (Typical)	34.5	34.5	Design Level Tsunami (L1)
LNG Tanks	34.5	27*	Design Level Tsunami (L1)
*LNG Tank Protection/Containment Berm	34.5	46	Design Level Tsunami (L1)
Liquefaction Trains	34.5	46	Design Level Tsunami (L1)
Gas Conditioning	34.5	46	Design Level Tsunami (L1)
Corridor and Roseburg Forestry Products	34.5	46 to 66	Design Level Tsunami (L1)
South Dunes (Typical)	32	63 to 70	Design Level Tsunami (L1)
Tsunami Evacuation Muster (Terminal)	60	60	Life Safety Tsunami (XXL1)
Tsunami Evacuation Muster (South Dunes)	52	65	Life Safety Tsunami (XXL1)
Operations Building	60	60	Life Safety Tsunami (XXL1)
Fire Department	60	60	Life Safety Tsunami (XXL1)
SORSC Building	52	65	Life Safety Tsunami (XXL1)

* The design tsunami inundation elevation is determined to be approximately 34.5 feet. LNG tanks which are founded at approximately +27 feet will be surrounded entirely by a tertiary protective berm at an elevation of approximately +46 feet high. The continuous protection provided by the containment berm allows the LNG tanks to be founded below the design tsunami elevation.

The upland earthworks phase will require the handling of large volumes of material. This phase of the works is highly mechanized and will require periods of 24-hour operation. The Project will implement specific safety measures to control person/machine interfaces, including a temporary traffic overpass that will be constructed to segregate traffic travelling to and from the RFP facility from the large, off-road haul trucks and equipment, as detailed in Figure 1.5-3.

A detailed site preparation study has been undertaken to ensure all material can be accommodated within the Site and thus prevent any potential impacts of off-site disposal.

Approximately 2.2 mcy of material will be moved by hydraulic means, either using an upland dredge from the future slip area or a marine dredge from the access channel, as described in more detail within Section 1.5.4.

The planned rehabilitation of the Kentuck Golf Course into Coho salmon habitat will require approximately 300,000 CY of material to be transported from the dredge activities adjacent to the slip area to the Kentuck Project Site via marine transport barges.

Boiler ash previously disposed on the site of the LNG Terminal will be relocated to the South Dunes Site, where it will be buried within the fill.

The following erosion prevention best management practices will be employed to ensure local, state, and federal laws and regulations are met:

- Slopes stabilized by means of hydro seed, gravel, wood chips, or erosion control blankets;
- Existing vegetation preserved by limiting the amount of area disturbed during construction and maintaining existing vegetation on areas not disturbed by construction;
- Sediment protection devices set on all storm drains, catch basins, and other storm water conveyance structures that are susceptible to sediment collection;
- Temporary seeding performed to re-establish the vegetative cover on a disturbed area to prevent erosion of exposed soils;
- Compost wood chips or peat cover placed on disturbed areas to absorb wind and rain forces, and to develop an excellent growing medium for vegetation; and
- Maintenance of best management practices by a dedicated crew will be ongoing through all phases of construction.

1.5.3.3 Site Preparation – Dredge Placement

Dredge spoils will be contained within berms constructed of dry material in the spoil areas. The containment areas and berms will be sized to accommodate the dredge material delivery method and the project schedule. For dredged material delivered by truck the wet material will be allowed to dry or decant within the containment area. Dredged material from the cutter-suction dredged will be suspended in water and pumped to the containment area. At a low point within the containment area a vertical riser will be installed that will allow decant water to escape the spoil area via a pipe, to be collected and pumped back to the slip via a decant return line. The dredge discharge pipe will be relocated frequently to allow for the even distribution of dredge spoils and the collection and removal of decant water.

1.5.3.4 Site Preparation – Soil Improvement

The subsurface conditions at the site require soil improvement before any structures can be built for the LNG facilities. These conditions include peat, clay, buried driftwood, and liquefiable soil, which could cause excessive settlement and stability concerns or issues associated with liquefiable soils should a seismic event occur.

Liquefiable soils are present throughout the LNG Terminal site, and their depths vary with the location. The liquefiable soils at Ingram Yard and along the Access and Utility Corridor have been delineated in distinct soil layers from the groundwater table to a maximum of approximately elevation -30 feet (NAVD88). At the LNG Terminal and the Access and Utility Corridor, the liquefiable layers are predicted to extend below the dunes present on the site. At the South Dunes Site, liquefaction is estimated in a soil zone that starts at the groundwater table and extends to variable depths from elevation 0 feet to approximately elevation -25 feet (NAVD88).

Peat is present under the non-dune portions of Ingram Yard (locations are detailed in Figure 1.5-4). The peat is generally understood to be located close to or just below the groundwater table at depths of about 7 to 15 feet below the existing grade, and has an estimated thickness of approximately 2 feet. At the South Dunes Site, the peat is generally understood to be located in the central portion of the site, as shown on Figure 1.5-5. The estimated peat thickness is generally 2 feet, except for one area where the peat is up to 4 feet thick. The level of decomposition of the material in the peat layer is variable, with wood in the form of branch-size material and wood chips dispersed throughout much of the peat layer. The long-term secondary consolidation settlement from the peat layer is estimated to be up to 7 inches.

A layer of clay has been identified in the South Dunes Site, as shown on Figure 1.5-5. The thickness of the clay layer is estimated to range from 0.3 feet up to 2.5 feet and would likely cause settlement by consolidation of up to 7 inches due to the fill placed on the South Dunes Site. Clay has not been identified at Ingram Yard or Access and Utility Corridor.

There are several areas in the South Dunes Site that are detailed on Figure 1.5-5 where accumulations of buried driftwood are estimated to be present. The driftwood will decompose over time, causing settlement of soils overlying the driftwood. Buried driftwood has not been identified at Ingram Yard or Access and Utility Corridor.

A detailed review of the potential methods of soil improvement has been undertaken, and a number of these proven methods could be employed for the Project, depending on the results of the final site investigations planned for 2018. Some of these methods are:

- Soil Densification Method 1 – Vibro-compaction will be the principal method utilized to condition soils that are believed to show potential for soil liquefaction under seismic activity. This method consists of driving a vibration device, assisted by compressed air and water, into the sand layers to compact the soils.
- Soil Densification Method 2 – Sand compaction piles are technically comparable to vibro-compaction; however, the availability of resources and resulting commercial variances will likely preclude their use.
- Organic Material Treatment Method 1 – Dry excavation and removal will be favored for larger peat deposits where localized dewatering would not impact the adjacent wetland bodies.
- Organic Material Treatment Method 2 – Adjacent to wetlands, wet excavation and removal will be tried, and based on the trials, it will be used only where a good quality result can be ensured.
- Organic Material Treatment Method 3 – Soil mixing, with pre-excavation, above organic material will be utilized in instances when the extent of the addition of binder can be minimized to achieve the necessary result, or where wet excavation does not prove acceptable.

1.5.4 Anchor Bolts Down – Civil Work

Geotechnical studies have been completed to determine the properties of the existing subsurface soils and to identify the foundation design criteria and solutions (see Resource Report 13).

1.5.4.1 Piling

A number of piling solutions will be utilized on the Project, and will include driven and replacement pile systems. Typically, conventional pipe pile, sheet pile, or drilled piles will be used where required for earth retaining structures and deep foundations. It is anticipated that soil improvements will be sufficient to provide the bearing capacity for typical design loads. If additional bearing or lateral resistance is required to resist extraordinary/seismic lateral loads, it is likely that driven pipe pile foundations will be used. Driven piles will typically be driven to a depth that provides the required resistance and in some instances may require predrilling to reach the desired depth.

Given the seismic loading requirements and the height of the walls required for the marine slip, a steel sheet pile system is proposed for construction of the marine slip. The sheet pile system uses interlaced sheet piles in a U-shaped configuration to provide better overturning and sliding resistance than conventional sheet pile walls. In some instances, predrilling may be required to reach the desired depth. See Section 1.5.5.3 for more details.

1.5.4.2 Underground Services

Underground utility work consists of storm drains, gravity drains, utilities, fire water, process piping, and duct banks. The main fire water header, raw water supply, and feed gas supply will be close to the permanent roadways and temporary haul roads. Early completion of underground work will facilitate completion of site grading for stormwater control, completion of plant roadways, and installation of foundations and aboveground work.

Underground work will be closely coordinated with the mass earthwork movements to install as much of the piping and duct bank as possible while the site is still being brought to grade. Areas where piping densities are higher will be left open as fill work continues. This sequencing will minimize the amount of trenching, trenching depth, and double handling of fill material as well as the overall duration of the work.

Ground improvement operations will precede underground utility work in all cases. Work adjacent to roadways will be completed before the road base course. Installation of underground pipe in the corridor between the Ingram Yard and South Dunes Site will be sequenced around the construction and use of the corridor as a haul road. Underground pipe testing will be completed in segments to allow backfill operations to follow.

1.5.4.3 Foundations

The foundations for all equipment and structures, including the LNG storage tanks, process equipment, and pipe racks, will use either a shallow or deep foundation system. Typically, shallow isolated or raft foundations will be used unless the design requires the use of deep foundations. All foundation loads, analysis, design, and construction will be in accordance with statutory and regulatory requirements. Where required, foundations will be evaluated and designed to mitigate the hazards associated with settlement, bearing capacity, overturning, sliding, buoyancy, erosion, and scour.

Major foundation work will generally follow the installation of piling and underground utilities.

Formwork for foundations will comprise a mix of metal form systems and job-built wooden forms. Rebar will be fabricated off-site, delivered, and tied into place on-site. LNG containment basins will utilize sheet pile cofferdams. Seal slabs will be poured to prevent ground water infiltration. Formwork for the interior walls and shoring will be designed and stamped by a Professional Engineer. The sheet piles will serve as the outer form of the sump and remain in place (and be cut off below grade) or be pulled at a later date.

A concrete batch plant will be established within the LNG Terminal site or construction laydown areas to supply the LNG Terminal's needs. Local aggregate sources have been investigated and have been found to have deficiencies (chert inclusions) that preclude their use for concrete. Regional sourcing of on-spec aggregates has been confirmed. A concrete washout area will be located adjacent to the batch plant to allow for containment and disposal of waste water related to concrete batching operations. The disposal of concrete waste water will follow all necessary environmental regulations.

1.5.4.4 Restoration and Civil Finishes

Areas disturbed by construction of the LNG Terminal will be stabilized with temporary erosion controls until construction is complete, unless they are covered by equipment, gravel or other covering.

Following construction, the site will be brought up to final grade, and best management practices will be applied to prevent erosion. To minimize the potential for erosion, JCEP has modified the FERC's Upland Erosion Control, Revegetation, and Maintenance Plan (JCEP's Plan) and Wetland and Waterbody Construction and Mitigation Procedures (JCEP's Procedures), thereby creating Project-specific Plan and Procedures. A copy of JCEP's Plan and Procedures is in Appendix H.7 of Resource Report 7.

Final grading and surfacing will consist of gravel-surfaced areas, asphalt-surfaced areas, concrete-paved surfaces, anchored reinforced vegetation system and vegetated areas utilizing salvaged topsoil and mulch.

1.5.5 Marine Facilities

1.5.5.1 Marine Equipment for Construction

A variety of marine equipment will be utilized for this project in the course of dredging and placing slope protection. There are two types of dredging operations with different equipment, clamshell and cutter-suction. Below is a description of the indicative equipment that will be used, exact details will finalized during detailed design and may be impacted by market availability.

The apron excavation, berm removal and slope protection will be completed with a derrick barge with an approximate capacity of 180 tons. The derrick barge will use anchors for station keeping. The barge will be supported by dredge tender for positioning and a crew boat. The crane will have both standard and flat-bottom eco-buckets for digging operations and a rock box for placing slope protection. Spoils will be placed on one of three flat deck barges with approximately 15,000 sq ft. of deck space. A tug boat of nominal capacity 1,500 hp will shuttle the spoil barges to the MOF where the dredge spoils will be transferred to trucks for placement on the project site For the material being delivered to the Kentuck Project, the same tug will deliver the deck barges for unloading and return the empties.

The dredging of the slip will be completed using a barge mounted cutter-suction dredge of nominal capacity 3000 hp. The dredge will be delivered by ocean-going barge to the channel, then partially disassembled and pulled over the berm into slip area. The dredge will pump the dredge spoils to the Roseburg fill area. The dredge will be serviced by a dredge tender and a crew boat.

Slope protection within the slip area, prior to berm removal, will be installed using land based cranes and a crawler craned mounted on a flexi float barge within the slip. A crawler crane will use a rock box to pick slope protection materials off the bank and place the material working from the toe of slope up. This crane may also be used to service concrete work and equipment installation throughout the slip.

Other marine equipment may include boats for survey, personnel movement and the shuttling of supplies. A variety of tug boats may also be called upon from the local area that will vary in size and role depending on availability.

1.5.5.2 Dredging and Shore Protection

For the capital dredging, about 5.7 mcy of material will be removed to create the slip basin and access channel. Of this, about 1.4 mcy would be dry excavated and about 4.3 mcy would be wet dredged. It is proposed that excavated and dredged material be distributed between Ingram Yard, Roseburg Site, the South Dunes Site and Kentuck. Approximately another 0.7 mcy will be removed to facilitate the navigation reliability improvements and is proposed to be placed at either APCO1 or APCO2 or distributed between the two sites. Modelling conducted by Coast and Harbor Engineering (Attached to Resource Report 2), estimates future maintenance dredge requirements of approximately 34,600 CY/year to 37,700 CY/year. The proposed advanced maintenance dredge interval is three years, resulting in upwards of about 115,000 CY of material removed per maintenance interval. It is proposed that maintenance dredge material be distributed between the upland sites; APCO Sites 1 and 2 and will be the subject of additional future approvals. Refer to Resource Report 2, the Dredge Material Management Plan in appendix N.7 of Resoucre Report 7 and Section 7.3.2 of Resource Report 7 for more information.

During the “fresh water” construction phase of the slip about 2.2 mcy of material would be dredged in the pocket behind a temporary construction berm, as shown in Figure 1.5-5. About 1.4 mcy of material would be dredged from the bay during construction of the access channel between the Federal Navigation Channel and the proposed LNG Terminal marine slip. During the “salt water” construction phase of the slip, about 0.7 mcy (Slip + Berm) of material would be dredged during removal of the temporary construction berm and finish dredging of the marine slip of which about 0.3 mcy may be used for the Kentuck mitigation project. Alternatively, the 0.3 mcy required to facilitate the Kentuck Project may be sourced from the salt water dredge taken from the access channel.

The northern slip face will be armored after the slip is dredged but before the temporary construction berm is removed. The temporary construction berm will remain unarmored as it will be removed during the later stages of slip construction.

The estimated excavated and dredged material volumes and their proposed placement locations are summarized in Table 1.5-2 and further described in subsequent sections below.

Table 1.5-2			
Estimated Excavated and Dredged Material Volumes			
Facility	**Construction Phase**	**Volume (mcy)**	**Disposition Sites**
Slip	Upland Excavation	1.4	Ingram Yard, Corridor, South Dunes
	Fresh Water Dredge	2.2	Ingram Yard, Corridor, South Dunes, Roseburg site
	Salt Water Dredge	0.2	Ingram Yard, Corridor, South Dunes, Roseburg site
Protective Berm	Upland Excavation	0.03	Ingram Yard, Corridor, South Dunes
	Salt Water Dredge	0.5	Ingram Yard, Corridor, South Dunes, Kentuck
Access Channel	Upland Excavation	0.004	Ingram Yard, Corridor, South Dunes, Roseburg site
	Salt Water Dredge	1.4	Ingram Yard, Corridor, South Dunes, Roseburg site
Navigational Reliability Improvements	Salt Water Dredge	0.7	APCO Site 1 / APCO Site 2

For details with regards to shore protection, see Section 1.5.5.7 below.

1.5.5.3 Construction of Sheetpile Wall

The sheetpile system will serve as a retaining wall for the shoreline on the east and west sides. The east side will support the LNG carrier loading facility and associated berthing and mooring facilities. The sheetpile system will be designed to support the dead loads of the soils and structures, and the live loads of the LNG carrier at berth and LNG transfer equipment, and is also designed to meet the seismic criteria for the facility and water-imposed loads. The west side will provide an emergency lay berth and the sheetpile system will be designed to support the dead loads of the soils and structures and the live loads of the LNG carrier at berth.

The sheetpile wall system consists of face sheet piles for retaining the soils as well as tail-walls for anchorage of the retaining wall. All sheet piles and tail-walls will be driven from the land while the slip construction activities are isolated from Coos Bay.

1.5.5.4 Slip Construction

To minimize the impacts of construction of the marine facilities on fisheries, reduce the total period of estuary turbidity, and extend the time available for construction, a two-phase construction methodology will be used to construct the slip. The basic concept of the two-phase construction methodology is to excavate (either wet or dry) the majority of the slip area and construct the structures while maintaining a natural physical barrier between the excavated/dredged slip and the water of Coos Bay (see Figure 1.5-2). This methodology will be accomplished by retaining a natural earthen berm to provide a physical partition between the water of Coos Bay and the Freshwater construction activities for the marine facilities. This construction methodology will allow year-round work on the northern portion of the slip without being in contact with or causing an impact to the waters of Coos Bay. The remaining open water work will include excavating the access channel (including area around MOF), excavation/dredging of the berm area, and MOF fender piles. This work will be constructed during periods when fisheries considerations allow in-water work, between October 1 and February 15.

1.5.5.4.1 Dry Excavation

The existing natural ground surface is at an elevation of approximately +20 feet NAVD88. The water table across the slip occurs at an elevation of approximately +10 feet NAVD88. All excavated material above an elevation of approximately +10 feet NAVD88 will be removed by conventional earthmoving equipment such as excavators, scrapers, bulldozers, and front-end loaders. A berm will be maintained as a barrier to the bay during this construction phase. The permanent north slope will be of 2.5 Horizontal ("H") to 1 Vertical ("V") (2.5H:1V). The same slope will be maintained on the slip side of the temporary berm to preserve the integrity of the berm during excavation and dredging, as shown in Figure 1.5-2. Excavation during this step will remove only material that is essential for creating the slip and constructing upland structures. Contouring of the slip perimeter above +10 feet NAVD88 will be performed during this step.

The volume of material to be excavated and dredged from the slip, including berm, is 4.3 mcy as shown in Table 1.5-2. The material will be placed on Ingram Yard, the Utility and Access Corridor, South Dunes and the Roseburg site.

Excavated material will be hauled by trucks to upland sites; Ingram Yard, Access/Utility Corridor, South Dunes and Roseburg. The excavated material truck haul route will go to the north of the slip through Ingram Yard and then follow the route of the Access and Utility Corridor to the South Dunes Site. The route will not cross the Trans Pacific Parkway at any time, and the only potential conflict will be with chip truck traffic to the RFP wood chip facility, which will be mitigated by construction of a traffic overpass. The excavated material truck haul route will be on JCEP or RFP owned land.

1.5.5.4.2 Slip Dredging

Excavators will be used to remove material down to elevation 0.0 feet NAVD88 to build the dredge launch pad. The channel will be roughly 300 foot by 200 foot and be 10 feet deep. The launch pond preferably will be located near the slip perimeter and road access. The material will be moved to the upland disposal sites by trucks, as described in the previous section.

The dredge barge will be delivered by ocean-going barge to the channel, then pulled over the berm to facilitate hydraulic dredging of the slip. All of the material to be excavated that is located at or below the level of the water table will be removed by means of hydraulic dredging and transported to the RFP Site. Detailed scheduling efforts during detailed design may require placement at the South Dunes Site, however, no off-site disposal is anticipated.

A hydraulic transport pipeline will connect the dredge or dredges to the South Dunes Site, and a decant water return pipeline will return the water to the slip area or purpose-built decant basin. The hydraulic dredges, which are capable of transporting a slurry of 30 percent solids by weight at a flow rate of 6,000 gallons per minute ("gpm") or greater, will create an ever-increasing dredge prism that will, in the end, create the fully defined slip within the confines of the berm. The hydraulic dredges are capable of dredging to the final slip depth.

The slurry pipeline used for hydraulic transportation of excavated materials going to South Dunes (including the decant water return line) will follow the shoreline of the RFP property until the point where it follows the route of the future Access and Utility Corridor. Slurry lines going to

RFP will be routed through Ingram Yard to the Access and Utility Corridor and then turn south into the RFP property. The pipes will run along the ground and be braced as necessary. In the area of the RFP chip ship berth, the pipeline will be placed on the rip-rap along the shoreline, so that it does not affect the docking and loading of the chip ships. The pipeline will be able to span any affected wetlands or waterbodies without the need to place any structures in the wetlands or waterbodies. At all points along the pipeline route where the slurry pipeline could rupture and the contents could potentially enter the waters of Coos Bay, secondary containment will be provided around the slurry pipeline.

The slurry pipeline and decant water return pipelines will be made of 18- to 20-inch-diameter fused polypropylene (seamless) pipe. The decant water return pipeline will be placed along, and directly adjacent to, the slurry pipeline (no spacing between the two pipelines). The decant water pipeline will be used to convey the decanted water from the settling areas back to the dredge pond. When the hydraulic transport has been completed, the pipelines will be drained, flushed with clean water, and cut apart only in those areas where any residual material in the pipeline could not potentially be released into the bay, wetlands, or other waterbodies. The pipeline will be removed by the contractor and taken off-site for reuse, recycling, or disposal in a permitted landfill. Since the pipelines will be on existing developed surfaces (grassed, paved, graveled, and rip-rap area of the RFP property) and areas to be developed for the Project (Access and Utility Corridor), post-construction restoration will include reseeding of grassed areas that were disturbed by the location of the pipelines on the grassed area.

1.5.5.4.3 Access Channel Dredging

The volume of material to be dredged from the access channel is 1.4 mcy as shown in Table 1.5-1. The material may be placed on Ingram Yard, the Access and Utility Corridor, RFF property and the South Dunes Site. This portion of work is open to Coos Bay and therefore will be performed during the annual in-water work window from Oct 1st to Feb 15th.

The access channel dredging will utilize a barge mounted crane with clamshell bucket and material barges as detailed in Section 1.5.5.1. The channel dredging will occur during the second available in water work window. The operation will start at the MOF to facilitate the relaxation of the sheets and will continue until all material between the berm and the navigation channel is removed. It is expected that dredging will occur around the clock to finish in the available timeframe.

Material will be loaded into material barges from the clamshell. When full, the barges will be towed to shore and the material transferred to trucks for placement at the available upland sites as determined by the final schedule.

1.5.5.4.4 Driving of Piling for Marine Structures

All of the marine piling for the tug dock will be driven “in-the-dry” and, as such, piles will be driven prior to or concurrent with the dredging of the slip. Land-based mobile cranes with pile-driving equipment will be located in the slip excavation as it approaches the top of pile elevation. All piles required for the LNG loading foundation, and all mooring and berthing structures for the NG and emergency berths are behind the sheetpile walls and will be driven on dry land.

1.5.5.4.5 Slope Armoring

The northern slip face will be armored with rip rap to protect the slope from scour. The armor will be placed with a combination of land based and barge mounted equipment. See Section 1.5.5.1 for more details. The south slip face created by the berm will remain unarmored, because it will be removed to create the final configuration of the slip and the access channel.

The sequence for pile driving, slope dressing, and armoring may vary depending upon the means and methods chosen by the contractor performing the work.

1.5.5.5 Connection of Slip to the Channel

Details of each of the steps involved during connection of the slip to the Channel are outlined below.

1.5.5.5.1 Breaching and Removing the Berm

Once all of the fresh water construction is complete, work will begin on breaching and removing the berm (500,000 cy) and completing the remaining area of the slip. This work will be in-water work and occur during the October 1 to February 15 window. Dredging may be conducted from both the Coos Bay side and the slip side to reduce the duration of the breaching and removal activity. Material will be removed by hydraulic dredge or clam-shell dredge. A portion of the material (approximately 300,000 cy) may be transported to the Kentuck Project to be used as fill. The remainder will be placed at the South Dunes Site. The temporary piles used at the TMBB will be removed at this time as well.

1.5.5.5.2 Final Contouring and Slope Armoring

Removing the berm will open the slip to Coos Bay. Additional dredging to contour the access channel will complete the construction dredging activities. Armoring of the remaining unarmored slip side slopes will be completed. Although not anticipated at this time, any additional in-water structures required to complete the slip and associated in-water structures will be installed. In-water work will be performed during the allowable construction window between October 1 and February 15.

1.5.5.5.3 Restoration

Following the excavation activities, all areas within the project footprint, including exposed slopes, will be protected from erosion and stabilized with an erosion protection system and/or an approved seed mixture specified as being capable of surviving in highly permeable, xeric regimes, binding loose sand, and withstanding burial and deflation from aeolian processes (For more information see Resource Report 7).

The slurry and decant water return pipelines will be removed as described above. Any areas that are disturbed by the haul truck or pipelines route that do not become part of the Access and Utility Corridor, will be restored to pre-construction condition.

The route of the slurry/decant water return pipelines on the developed RFP property will not require restoration, because the pipelines will be placed on areas that are graveled, concrete, or rip-rapped. If there are any areas of the route where ground disturbance occurs, these areas will be returned to pre-construction conditions.

1.5.5.6 LNG Carrier Loading Facilities

The LNG carrier loading facilities will be constructed once the installation of the eastern sheet pile wall system is complete. All of the loading facilities will be on the shore side of the slip, with no facilities located in the water of the slip. The platform with the loading arms (inclusive of the loading and vapor return arms) will be installed on a concrete pad located at the edge of the slip. The foundation of the pad will contain a number of piles to provide a stable foundation for the loading arm platform. Separate piles, typically steel pipe piles, will be driven for the breasting and mooring structure platforms. The loading arm platform will be constructed on columns raised from the concrete pad and accessed through stairways. The LNG transfer piping will be located over LNG troughs that will contain any spills and divert the LNG to a containment basin.

The LNG carrier loading facilities will be constructed using land-based equipment to install the required structural elements for the loading platform and mooring structures. Installation of berth piping and equipment, and hookup and commissioning of the loading system and utilities will follow.

1.5.5.7 Shoreline Protection

The LNG basin shoreline will be protected from scour and erosion using stone or a cement based rip rap. Extensive hydrodynamic modeling (by CHE) has indicated that LNG carrier and tug propeller scour protection will not be required on the east side of the slip (See Resource Report 2, Section 2.2.6.1.3 for more details). The North Slope will be protected against scour from the toe to above the water line (See RR6, Section 6.4.4.4.5). Above the waterline, alternative scour (and wind/rain erosion) protection systems for less frequent events will be provided using any number of potential techniques including; concrete cellular mattresses, grout-injected geotextile fabric mattresses (fabriform) and/or geotextile reinforced vegetative planting.

1.5.6 Navigational Reliability Improvements

JCEP plans to excavate four submerged areas lying adjacent to the federally-authorized Channel. The total volume of material to be dredged by these excavations is approximately 700,000 cubic yards (Table 1.5-2).

Two methods of dredging are identified as the most practical, given the historical dredging practices in the region, the material types being dredged, and the location and condition of the placement sites. The two principal dredging methods are:

(1) mechanical dredging via clamshell or excavator; and

(2) hydraulic cutter suction (“CS”) dredging.

Mechanical dredging would consist of either a crane barge with a clamshell bucket or an excavator mounted on a barge. Although an excavator is better suited for dredging in-situ soft rock with its higher breakout capacities, a mechanical dredge could be outfitted with a heavy duty rock clamshell bucket with pick point teeth for rock dredging, as was employed during Coos Bay channel deepening activities in 1996. The mechanical dredge might need to chisel the harder rock if the clamshell bucket is not heavy enough to break out the rock. Upon excavation, the dredge material is proposed to be transported via a submerged dredge pipe adjacent to the navigation channel and placed directly at the APCO sites. Alternatively, dredge material may be placed in a scow or on a deck barge and transported, with the assistance of a tugboat, to a suitable location near the upland disposal site for offloading.

Hydraulic dredging would consist of a CS dredge. The CS dredge buries a rotating cutterhead into the sediment (and potentially into soft rock) to break up material, then suctions a water-sediment slurry into a scow for transit to the disposal site for offloading, or pumps the slurry directly to the disposal site via a submerged or floating dredge pipe where dewatering would occur.

Placement of dredge material at the APCO sites would be through one of the following three methods:

- Discharge of a hydraulically dredged slurry from a dredge pipe, pumped directly from the dredge areas;

- Pumped offloading of dredged material from a scow (with the material dredged using either a hydraulic CS dredge or a clamshell); and
- Mechanical offloading of dredged material from a scow (with the material dredged using either a hydraulic CS dredge or a clamshell).

Hydraulically dredged (or offloaded) material would be transported via dredge pipe and discharged within containment berms at APCO Sites. Dredging activities include placement of a discharge pipeline string on the bottom of the channel between the disposal area shore crossing and the first deepening location. Navigation markers will be used where the dredge pipe temporarily crosses the Channel. The pipe will be elevated at fixed locations to feed booster pumps. The booster pumps will be located on barges, moored on the eastern side of the Channel and used to move the dredge slurry toward the APCO sites for disposal.

The dredge pipe will be elevated before the dredge material is discharged at APCO Sites in order to minimize impacts to eelgrass. The pipeline will be supported on steel piles that span a band of eelgrass on the northern shore of the APCO sites. While several piles (e.g., five piles) may need to be located in the eelgrass area, the crossing is at the narrowest band of eelgrass on the northern shore of the island portion of the APCO sites. The piles will be installed using vibration equipment; however, an impact hammer could be required if resistance is met. The temporary piling will be removed once all dredging operations are completed.

A containment berm would be constructed around the perimeter with earthmoving equipment using onsite material and, where practical, incoming dredged material to build up the perimeter berm. Alternatively, dredged material could be mechanically offloaded from a scow. Mechanical offloading, using a clamshell, excavator, or crane, reduces the amount of water discharged into the site, allowing direct placement of the material without an explicit need for containment berms. At present, there are no available berthing locations; therefore, use of the mechanical offloading method would require the construction of a short trestle (or land fill outcropping) for offloading of material.

Management of dredge material at the APCO site will require the construction of a single-lane permanent bridge, and temporary bridge to construct the permanent bridge, to access the site by heavy equipment including, but not limited to, excavators, dump trucks, and bulldozers. A permanent single-span bridge that is 200 feet long and nearly 40.5 feet wide will span a tidal mudflat and be constructed for the purpose of providing access to and from the disposal site. It will include an 8-foot-wide sidewalk on the bridge deck. The bridge will include two concrete abutments on pile-supported footings and be placed above the Highest Measured Tide (“HMT”). Material-stabilized earth walls extending landward from the abutments will eliminate the need for fill material to extend below the HMT or wetlands.

Construction of the new single-span bridge will begin with construction of a temporary work bridge. The temporary work bridge will be approximately 30 feet wide and 280 feet long and have seven 40-foot spans. The temporary work bridge will be placed north of the proposed permanent bridge. It is likely that the temporary work bridge will use three steel piles per bent, and have a steel frame and a steel or concrete bridge deck. The temporary work bridge will begin and end in dry land. The end bents will be outside the HMT boundary, while five of the interior bents, including fifteen steel piles, will be installed below HMT. Steel pile will be driven and pulled with a vibratory hammer to minimize potential barotrauma impacts to fish. The piles may be tested with impact pile drivers to determine if they are properly set. The temporary work bridge approaches and access road will be gravel. The temporary work bridge will be in place for less than 24 months. The steel plate girders for the new bridge will be assembled and installed onsite. Precast deck panels will be installed between each of the four steel girders, and a cast-in-place concrete deck will be poured over the steel girders and deck.

1.5.7 LNG Storage Tank Construction

The description below provides an outline of the construction sequence for the erection of the seismically isolated double-containment LNG storage tanks.

1.5.7.1 Concrete Work

Foundation Slab - Before the base slab is installed, there will be a levelling pad poured to ensure a level working surface for the base slab. The slab installation will be performed in sections. The first activity will be to form, install rebar, and pour the outer sections, and then the interior sections. Forming of the pedestals for the bearings will follow the bottom slab pours. During installation of the seismic isolation bearings, the upper slab shoring and formwork will be started. The upper slab pour sequence will be the same as for the bottom slab and only occur after the bottom slab has cured enough to achieve the proper compressive strength. The same work sequence will follow for the second tank.

Formwork Fabrication - A jump-form system will be utilized for the concrete walls. The jump forms will be assembled on-site from pre-fabricated panels. The wall will be straight without any taper to minimize complexity until the top ring beam is installed. The top ring beam will require a modification to the inside formwork to allow for the installation of the compression ring.

Rebar Fabrication - The rebar will be pre-assembled into mats on-site prior to installation. There will be two assembly areas set up, each within the radius of both tower cranes. The rebar for the ring beam will be tied in place.

Wall Construction - The walls will be constructed in quarter-sections. Wall pouring will start once the outer sections of the elevated slab have cured adequately. The pre-assembled rebar mats will be lifted into place. The rebar crews will be installing the post-tensioning ducts with each mat of rebar. Embeds for attachment of the vapor liner will be installed in this operation as well. The formwork will then be erected, and the concrete will be poured. To facilitate construction, tower cranes, placing booms, and pump trucks will be used.

Ring Beam - The ring beam will be partially completed before raising the roof. Mechanical couplers will be utilized to allow for an effective tie-in to the roof structure. Once the steel roof structure is air raised and welded to the compression ring, the ring beam will be finished as it is tied into the concrete on the roof. The post-tensioning ducts in the ring beam will be stressed before the roof is poured.

Concrete Roof - Once the steel roof structure is welded in place, the rebar will be installed on the structure. Concrete placing booms will be utilized for the roof pours.

1.5.7.2 Steel Plate Work

Tank Floor - The floor is the first steel plate activity (the first steel layer on the concrete) that can start without interfering with the concrete work. Once the concrete outer wall is high enough, the temporary roof supports will be installed. A freestanding support at the center of the dome roof and knee brace style supports at the perimeter of the roof will be installed high enough off the floor to allow access under the roof. The outer tank roof assembly starts once these supports are installed. The roof petals are lifted into the tank using a large crawler crane and set onto their temporary supports. While the assembly of the petals is occurring, the concrete crews will continue to install rebar and formwork, and pour concrete for the outer wall, as shown in Figure 1.5-6.

Dome Roof - The dome roof is composed of pre-fabricated petals that are assembled and welded on temporary supports on the floor of the tank (Figure 1.5-6). An aluminum suspended deck forms the top of the inner tank and is installed once the temporary supports are removed. This includes all openings and nozzles between the inner and outer tanks. Insulation is placed on the suspended deck for installation later. JCEP will utilize a specialty air lift subcontractor for raising the roof. The pressure required to lift the dome roof is about 0.5 psi. Once the roof reaches the compression ring, fit-up of the roof to the compression ring is completed and welding starts. Once the roof is secured, the tank is depressurized and the door plate is removed to provide access inside the tank to complete welding of the roof to the underside of the compression ring. The safety of the workers is the number one priority. Absolutely no one will be allowed to go inside the tank until all of the required checks have been performed and the tank has been declared safe to enter. The top of the ring beam will be poured as the welding on the underside of the compression ring is being performed. Before pouring the roof, the door plate is re-installed and the pressure is re-applied. During the pour and cure, no work can be performed in the interior of the tank because it remains under pressure.

Example of Wall Liner and Floor Insulation - After the door plate is re-opened, the outer wall liner plate and floor insulation can start. The plates are double jointed lengthwise and tacked to the embedded steel that was placed in the wall forms. Plates are then seal welded together to form the vapor barrier. Similarly, plates are installed on the elevated slab that forms the bottom of the tank. Precise welding procedures are followed to ensure a quality weld and (non-destructive examination is performed as a quality check. Scissor lifts and aerial work platforms are used for access. While the wall liner plates are being installed, insulation of the floor begins. A layer of leveling concrete is placed on the floor liner plate, followed by layers of damp proofing, cellular glass block, and floor plate. Thermal corner protection will be installed to ensure that heat leakage stays within the design parameters.

Inner Tank - The inner tank will be erected using a hydraulic rough terrain crane inside the tank. The door plate design will take into consideration the width and height of the equipment that needs to access the interior of the tank. The first piece of the inner tank is the annular bottom plate. Once the annular bottom plate is welded, the inner tank shell erection can begin. Until the last course of the inner tank is installed and welded, the floor cannot be completed because of the utilization of the crane in the center of the tank. The crews will utilize a gondola for access between the wall liner and the inner tank shell for welding. After all equipment is removed, the final floor plates, inner door, and outer door are installed.

1.5.7.3 Tank Pressure Test

A hydrostatic test of the inner tank will be carried out in accordance with API 620 Section R.6 using fresh water. The outer tank will be pneumatically tested in accordance with API 620 Section R.7.

Test water will be transferred between tanks and disposed of according to the methods described in Section 1.5.8.8.

1.5.7.4 Tank Insulation

Floor – The floor will be insulated as described for the wall liner above.

Inner Wall - Once the inner wall quality check is completed, a hoist will be used to install the liner insulation on the inner tank wall. Stainless steel wire is used to tie the insulation layer along the inner tank wall.

Suspended Deck - The suspended deck is insulated with a glass fiber blanket after the installation of the perlite in between the wall liner and the inner tank wall.

Perlite - This portion of the work will be performed by a specialty perlite installation subcontractor. The perlite will be filled through the roof nozzles into the annulus between the wall liner and the inner tank plates.

1.5.7.5 Purging

Once the insulation is completed, the outer temporary construction opening will be closed, and an air compressor will introduce dry air into the inner tank and dome space. Nitrogen will then be introduced and vented through a roof nozzle.

1.5.8 Anchor Bolts Up – Mechanical, Electrical and Finishes

Construction of the pipe racks, terminal buildings, major mechanical equipment, process and utility piping, and electrical equipment and instrumentation will follow the concrete foundation work. These facilities will be completed and pre-commissioned in readiness for mechanical completion.

1.5.8.1 Module Installation

The process facilities will be composed of both modularized and stick-built structures. Because the Project site must utilize water delivery for the major equipment, large modularized structures can also be delivered, providing the Project access to overseas fabrication yards. Modularized structures allow for major portions of the work to be fabricated off-site before the civil and concrete work is completed, which will allow labor requirements to be balanced with availability and reduce overall impacts in the local community.

The modules will be delivered to the site mechanically complete, with all coatings, proofing, and insulation fully installed. The unitized design of the modules for the Project allows for the stick-built portion of the work to proceed independent of the delivery of the modules. This decoupling of the stick-built work from the modules allows the off-module work to proceed in a productive and uninterrupted manner right up to the start of testing and commissioning activities.

The work to connect the modules is minimal, because the unitized design requires a limited number of tie points.

The process equipment modules include five identical modules for the liquefaction trains, an LNG handling module, three gas conditioning modules (one each for AGRU, dehydration, and mercury removal units), and the LNG loading module. The majority of pipe racks will also be modularized. The design of the modules allows them to be off-loaded directly from the Self-Propelled Modular Trailers to their foundations, or picked up and set by crane. The site plot plan and sequencing of the module installation has been designed to provide flexibility in the module delivery schedule while minimizing the impact of module installations to ongoing site activities. Figure 1.5-7 outlines the planned installation sequence for the modules. The delivery and installation of the first pipe rack modules will begin shortly after the completion of the MOF, where all modules will be unloaded before they are moved to the site. Before the installation of the modules, all underground and foundation construction will be complete to the furthest extent practical.

The approach of the foundation design and construction schedule is to minimize the overlapping of the civil and concrete trades with the structural, mechanical, and electrical and instrumentation trades once the modules are in position. The module installation begins with the pipe rack modules along the liquefaction trains and in the LNG tank area, and is followed by the modules in the utility and refrigerant make-up areas. The pipe rack modules at the intersection of the liquefaction and utility areas will be held out until the modules and other major equipment have passed through this area. The equipment modules, starting with the LNG handling module, will be installed next. The installation of the LNG handling module will be followed by the liquefaction modules, alternating with the gas conditioning modules until all module installations are complete. The detailed installation sequence has been coordinated between the module fabrication schedule, logistics plan, required cargo arrangement on each transportation vessel, and the site construction schedule.

1.5.8.2 Steelwork Erection

Many of the structures needed for the LNG Terminal are not suited for modularization, and will therefore be stick-built on-site. Steel shapes will be fabricated with all finish painting, galvanizing, and fire/coldproofing shop-applied. All stick-built steel will be fabricated with bolted connections to facilitate erection. Stick-built structures include:

- STG and flare area pipe racks;
- STG shelters;
- LNG train pipe racks;
- LNG refrigerant compressor shelters;
- Shelters for BOG compressors, air compressors, and boiler feed pumps;
- Pre-engineered buildings; and
- Miscellaneous sleeper racks, equipment platforms, T-stands, and vapor barriers will make up the balance of the steel erection work at the site.

Pipe racks will be erected in levels to facilitate pipe installation. This work will be highly orchestrated between the trades. Equipment shelters over rotating equipment include a bridge crane and architectural paneling on the roof with partially enclosed walls. After shelter erection, JCEP will commission and certify the overhead cranes and place them into service for use in erecting the piping and other work inside the shelter. The cranes will be inspected and recertified by the vendor at turnover.

1.5.8.3 Mechanical Equipment Installation

Key process equipment utilized for the LNG Terminal will be installed in the modules. However, a significant element has been excluded, specifically the major rotating equipment and long-lead items. The mechanical equipment that will be installed on-site includes:

- Refrigerant compressors and combustion turbine drives;
- Heat recovery steam generators;
- BOG compressors;
- Steam turbine generators;
- Air-cooled condensers;

- Thermal oxidizer;
- Prefabricated equipment buildings;
- Electrical powerhouses;
- Fire water pumps;
- Guard shacks, Continuous Emissions Monitoring Ssystem (“CEMS”) buildings, and firewater valve houses;
- Pressure vessels and tanks;
- Pumps;
- Miscellaneous vendor skids;
- Field-erected tanks; and
- Flares – warm, cold, marine.

1.5.8.4 Major Stick-Built Equipment

Refrigerant Compressors and Combustion Turbine Drivers – Equipment will be skid-mounted by the vendor and fully assembled, tested, and disassembled prior to shipping. The compressor, turbine, control equipment, lube oil pumps and reservoir, and associated piping are included in this package and will be installed on-site. After the large pieces are set, the building steel will be erected. Remaining vendor piping and accessories for the compressor/combustion turbine will then be installed.

Heat Recovery Steam Generators (HRSGs) – Units will arrive with the tube bundles installed in the casing section at the shop. The casing sections will be up-righted and lifted into place on the foundation with crawler cranes. Casework splice plates and interior liner plates will be installed and seal welded. The stack will be then be installed. The steam drum, tube bundle jumpers, down-comers, and drain piping will follow.

BOG Compressors – Equipment will be skid-mounted and set using a large crawler crane. The electric drivers will be fully assembled but likely not be shipped on the skid and will require installation in the field. Installation of accessory skids, lube oil piping, and coolers will follow. After the large pieces are set, the building steel will be erected.

Steam Turbine Generators (STGs) – Each piece of equipment will have its own baseplate and foundation. The STGs will be set with a large crawler crane. After the large pieces are set, the building steel will be erected. The accessory modules sit outside the shelter and will be set by crane. Lube oil piping and remaining accessories will be installed after the steel.

Air Cooled Condensers – Equipment is fabricated as an A-frame-type steam condenser. Each STG will have its own independent ACC. The fan cells will be pre-assembled at ground level and lifted into place upon stick-built steel legs with a large crawler crane. After the cells are in place, the A-frame panels will be pre-assembled and lifted into place along with the collector pipe and steam header on top. The connecting ductwork back to the axial flow turbines will be pre-assembled and set by crane.

Thermal Oxidizer – Equipment will arrive in several pieces. The combustion chamber sections will have shop-installed refractory. The sections will be preassembled and set by crane. Combustion air ductwork and FD fan will be installed and sealed. Finally, the stack will be erected. Burners, other accessories, and joint insulation will follow.

Prefabricated Equipment Buildings – Units will arrive via truck or ship depending on the final sourcing. In general, these units will be fully completed building shells with equipment, lighting, controls, etc. fully installed and tested. These will be set by crane and secured to a concrete foundation.

Electrical Powerhouses – These units are too large to ship fully assembled and will come in two to six sections, depending on the amount of electrical equipment contained. These buildings will set directly on pipe piles that are roughly 8 feet above finished grade. After the pieces are set, the shell splice plates will be installed and sealed, and electrical jumpers installed. The HVAC systems will be installed and commissioned on temporary power to provide climate control for the electrical equipment.

Shop Fabricated Vessels and Tanks – Equipment will be set by crane. Equipment will be dressed out with insulation, platforms, pipe support and piping, cable tray, etc. at site before setting.

The amine regenerator will be lifted with a large crawler crane and will require another crawler crane for tailing.

The amine contactor and regenerator vessels will have the internal trays shop-installed. The amine contactor is too heavy to set with the cranes currently planned for the Project and instead a specialty heavy lift subcontractor and equipment will set it. Packing will be installed at site during pre-commissioning just before degreasing of the AGRU. Pumps will be installed as the piping work progresses through each area.

Pumps – The pumps in the LNG impoundment basins and waste water sump will be installed and commissioned on temporary power early in the Project schedule, because they handle storm water from all of the concrete paved areas under LNG service lines.

Miscellaneous vendor skids – There are numerous miscellaneous vendor packages and skidded equipment that will be installed around the site as the work progresses. Setting will utilize forklifts, mobile cranes, and even permanent overhead bridge cranes.

Field Erected Tanks – There are two large field-erected tanks on the site for fire water service. A specialty tank erection subcontractor will be utilized for this work.

Flares – There are two ground flares on the LNG Terminal: one (warm and cold flare) multipoint enclosed ground flare and one (marine flare) cylindrical enclosed ground flare. Both will be field-erected on-site.

1.5.8.5 Heavy Lifting and Heavy Transport

A Heavy Lift and Haul Plan will be prepared for safely receiving, transporting, and installing all major equipment and modules. The plan focuses on the movement and lifting of major equipment and modules that require extra attention due to physical configuration, size, and weight. The plan concentrates on the movement of the major module assemblies from the MOF to the Project site. The heavy lift portion of the plan focuses on the crane equipment sizing, lift plan categorization (critical or general lifts), preliminary critical lift plans, crane pad design, and plot plan locations for major crane operations. Each type of heavy haul or lifting operation will require a specific level of planning, coordination, and approval prior to field execution.

1.5.8.6 Piping

While piping will be a major component of off-site modules, there remains a significant amount of stick-built piping work on-site, including:

- Lower density pipe racks and sleeper racks;

- Piping coming off of modules to field-installed equipment;
- Piping in field-erected buildings;
- Module-to-module interconnections;
- Module ship loose spools;
- Piping associated with site-erected tanks, mechanical systems, and equipment installations, including vendor-supplied piping; and
- Inspection and testing.

Early piping installation will focus on the stick-built portions in the STG rack and the LNG load-out rack. These racks will install steel and piping in alternating layers. This method allows for unencumbered access to the work and no overhead obstructions for crane-setting material. Remaining piping work will commence as available work faces open up from equipment or module setting.

1.5.8.7 Piping Fabrication

Stick-built piping and pipe supports will be fabricated into spools and finish painted off-site to minimize the need for on-site fabrication labor and facilities. This work will be contracted to a union fabrication shop located in the U.S. in accordance with the Project Labor Agreement.

1.5.8.8 Pressure Testing

Pressure testing, wherever possible, will be hydrostatic; however, pneumatic testing of piping systems and pressure equipment will take place in cases where residual water would impact subsequent operations.

A project-specific pneumatic test procedure that adheres to all applicable jurisdictional safety, and code requirements will be developed and implemented. Pneumatic pressure testing is performed only when hydrostatic testing is not an option due to system configuration and/or potential contamination issues. Safety is of primary concern with such testing. Engineering will perform stored energy and safe distance calculations per ASME PCC-2, with exclusion zones clearly communicated and monitored to manage the potential dangers associated with pneumatic pressure testing.

Potable and raw water sourced from the CBNBWB will be used for pressure testing of piping systems, unless restricted by piping metallurgy. Given the climatic conditions in southern Oregon, no additives are anticipated for freeze or other protection.

Water used in pressure testing will be locally discharged, following testing and the approval of ODEQ, to the stormwater system for infiltration or discharged to the IWWP according to the applicable National Pollutant Discharge Elimination System permit requirements. To initiate this process, JCEP would submit a formal request accompanied with information on the type of testing to be conducted, the source of the water, the chemicals to be added to the hydrotest water (if any), the potential for the test water to acquire contaminants during the hydrotest, and the types of chemical analyses to be conducted on the hydrotest water prior to discharge to ensure that JCEP meets ODEQ’s discharge requirements.

1.5.8.9 Closure Welds

All welds will be subject to pressure testing unless that testing will put personnel or equipment in danger of injury or damage. In these circumstances a closure weld will be approved, and the requirements of ASME B31.3-2014 345.2.3 will apply. A Project-specific procedure will be developed to describe the controls that will be implemented for closure welds.

1.5.8.10 Electrical and Instrumentation

Electrical and instrumentation work includes:

- Temporary construction power;
- Underground raceway (duct bank) installation;
- Grounding infrastructure installation;
- Aboveground raceway (cable tray, channel tray, conduit) installation;
- Wire and cable installation (cable pulling, glanding, testing, and termination);
- Equipment installation (large pre-fabricated and smaller field equipment);
- Instrumentation (instruments, Instrument Control and Safeguarding System (“ICSS”));
- Specialty systems (lighting, cathodic protection, lightning protection); and
- Security and telecommunications.

Modules - Electrical and instrumentation cabling installed on the modules will terminate in a combination of power terminal boxes, instrument junction boxes and remote I/O cabinets for the ICSS scope. These terminal cabinets will be the tie-in point between the modules and the site cables. At the module yard, electrical equipment and instruments will be installed along with the cabling to the terminal cabinets. Before shipment to the site, cable verification and some equipment pre-testing will be done. Pipe rack and equipment modules will have cable tray pre-installed.

Underground - Electrical and instrumentation underground work consists of duct bank and grounding systems. The duct bank system will provide pathways for the electrical circuits where pipe rack or structural steel is not available for use of a cable tray. Duct bank is also used to provide redundant pathways for the fiber optic networks and to connect the main process site and the South Dunes Site (SORSC and administration) buildings. Electrical vaults will be placed strategically to provide pull points for some of the longer cable. Site grounding will also be phased and coordinated with civil and structural scopes of work. The site grounding is generally in a grid configuration that also has ground wire ties bonded to steel and equipment above the ground.

Aboveground - Most of the electrical and instrumentation work will follow along in the sequence with the piping, mechanical equipment, and module installation. As mechanical equipment is set and the pipe rack is built, cable tray and channel will be installed to provide a pathway for the power, control, and instrumentation circuits. Cable tray will generally be installed on the top level of the pipe rack except where it transitions from beneath the elevated powerhouse enclosures. Cable tray covers will be provided as necessary to protect installed cables from damage. The channel tray provides a transition from the cable tray to the circuit termination point.

As the equipment and pipe rack modules are placed in the field, home run cables between the modules and the local powerhouse enclosure (“PHE”) will be installed and terminated at the module terminal cabinets. The homerun cables will consist of multi-conductor power cable, instrument and control cable, and fiber optic cabling. All medium-voltage circuits are pulled from the source directly to equipment located on modules rather than to module terminal cabinets.

The medium-voltage distribution backbone will extend out from the facility auxiliary powerhouse to the PHEs and support buildings. The cabling will travel both on cable tray and through the duct bank systems. The plant fiber optic backbone will follow the same pathways except that it will originate at the operations building. Redundancy has been provided by routing the redundant fiber through a different pathway if possible. In some areas, the redundant fiber is routed in the same cable tray as the primary fiber, but the redundant fiber is installed in aluminum conduit to provide a secondary pathway. Because the PHE is the origination point for the majority of circuits, cable reels will be set up at the PHE and pulled out to the plant loads and equipment.

In addition to power, instrumentation, and fiber backbone circuits, cable through the pathways will be provided to power field-installed electrical equipment and lighting and receptacles. Process area, roadway, and general site lighting and receptacle power installation will follow the structural installations. The lighting and receptacle cable will utilize armored cable both underground and above the ground. After installation, all cable in cable tray will be secured to the tray.

<u>Equipment</u> - The main electrical equipment is the prefabricated electrical buildings (PHEs) that are pre-packaged with the majority of the electrical and control equipment installed at the manufacturer's facility. They will be shipped to the site in sections and installed, as discussed in the Mechanical Equipment Installation section above. Final scope to assemble the PHEs will be a composite mechanical and electrical crew. The powerhouses will be elevated and cable tray will be installed underneath the buildings to provide a route for the cabling after they are set in place. Other site-installed equipment includes large pad-mounted transformers, generators for emergency/backup power for critical systems, and miscellaneous field panels and transformers. Equipment installed in classified areas will meet the required area hazardous classification.

1.5.8.11 Instrumentation and Control

<u>Instrumentation</u> - The instrumentation work will include instrument installation, instrument stands, process and air tubing and supports, CEMS, and sample systems. The instruments and tubing will be installed following equipment and piping installation. Factory-calibrated instruments will be procured that meet the area hazardous classification requirements. Enclosures for instruments will be provided where the anticipated operating temperature range exceeds the instrument operating range. As instruments are installed, their associated cable will be pulled and terminated.

<u>Integrated Control and Safeguarding Systems</u> - The ICSS will be made up of the process control systems, the safety instrumented systems, and the fire and gas systems. Each system will be independent of the others. Redundancy within these systems has been provided. The ICSS equipment will be installed within the plant control room located at the operations building. This equipment will be made up of workstations, cabinets, and consoles. In addition, DCS cabinets will be installed in the powerhouses and in the process areas as required. Fiber optic cabling will be used for the main backbone of the system as well as to field- installed remote I/O cabinets. Field devices will be hardwired back to either remote I/O cabinet or an instrument junction box. The cabinets will then be wired back to DCS cabinets located at the PHE. The integration of multiple plants systems including machine monitoring, continuous emissions monitoring, and LNG sampling will be part of the ICSS.

<u>Specialty Systems</u> - The electrical and instrumentation work includes the following specialty systems:

- Lightning protection system;

- Heat trace system;
- Cathodic protection system for buried piping; and
- Leak detection.

Generally, the installation of these systems will follow the same sequence as the main electrical and instrumentation scope; therefore, when a particular area has electrical and instrumentation cable installed, it would also include the scope for these other specialty systems. The unique nature of these systems has special vendor technical requirements for installation and testing.

Security and Telecommunications - Security and telecommunications wire, cable, and devices will be installed following the base project schedule as facilities or areas of the plant become available. Whereas outside on the site, the security and telecommunications pathways are the same as electrical (underground or in cable tray, as applicable to the plant area), inside the buildings, the cabling for the security and telecommunications systems generally will be in open pathways. The equipment will be from quality manufacturers with a proven track record. JCEP will utilize a specialty telecommunications systems integrator. This specialty subcontractor will procure the selected equipment and begin assembly and programming for a Factory Acceptance Test of the systems that will be performed off-site at the system integrator's facility before equipment is shipped to the site.

Generally, the equipment will be provided rack-mounted, and complete factory acceptance-tested racks will be shipped to the site for installation in facilities. Once the racks are installed, final device terminations can be done on-site. The performance of each device will be verified before Site Acceptance Testing begins. JCEP recognizes the importance of communication with multiple stakeholders for the security and telecommunications scope, particularly with respect to the SORSC and Fire Department, which will house facilities for JCEP as well as for other state and federal entities.

1.5.9 Temporary Workforce Housing and Bussing, and Logistics

JCEP has responded to community concerns regarding potential impacts that the influx of the temporary workforce may have on housing availability and pricing. JCEP has planned a holistic approach to workforce housing that strikes a balance between community impacts and community benefits. Measures include modularization to lower peak labor, hiring local employees who do not require temporary housing, utilizing existing hotel, motel, and RV Parks as well as potential future privately developed accommodations, and a JCEP full-service workforce housing facility located at the South Dunes Site.

A Workforce Housing and Bussing and a Logistics Plan will be developed to address issues related to the housing and transportation of workers to and from the Project. Resource Report 5 includes additional information regarding socioeconomic impacts of the workforce housing, bussing, and logistics of the LNG Terminal.

This plan will also detail steps to minimize the impact of the additional traffic from construction by utilizing off-site parking lots for worker travel by bus to and from the LNG Terminal site each day.

1.5.9.1 Workforce Housing Facility

The workforce housing facility was originally planned for the North Point Site in North Bend adjacent to the suburb of Simpson Heights. After consultation with the community and further design development of the facility, an alternate site on the South Dunes Site has been allocated.

The workforce housing facility will house personnel, primarily tradesman and supervision who do not live within the community or within private accommodations. The current plan is for a facility that can be built out in 100-bed phases, from an initial 200 to a maximum of 700 with all common facilities built out in the first phase. An example layout is provided in Figure 1.5-8.

Parking will be provided on-site, and shuttle buses to and from local communities will reduce traffic on the road network after working hours.

After completion of construction and commissioning activities the entire facility would be decommissioned and removed from the site.

1.5.9.2 Off-site Parking

To further reduce the traffic along the main US 101 commuter route through local communities, park-and-ride facilities will be established to bus employees to the LNG Terminal site from locations north and south of the US 101 McCullough Bridge (Mill Casino and Myrtlewood Facility). Private RV parks that house sufficient personnel will also be serviced by dedicated buses subject to demand.

1.5.10 Temporary Facilities and Construction Laydown Areas

Temporary facilities and construction laydown areas will be required during construction of the LNG Terminal to house construction offices, crafts lunchrooms, warehousing, equipment maintenance, and laydown of materials after delivery to the site. These facilities have been located to maximize use of land owned by JCEP within the overall site boundary and minimize impact on wetland environments through use of brownfield land, suitably zoned for industrial purposes, at the RFP property, Box Car Hill, Port Laydown Site and APCO properties.

1.5.11 Kentuck Project

Construction activities at the Kentuck Project include earthwork and civil infrastructure improvements to re-establish connection to the former golf course site.

Because the Kentuck Slough has subsided approximately two to three feet from its historical profile as a result of diking and drainage, earthwork activities will include importing approximately 300,000 cubic yards of dredge sand from the LNG Terminal site to raise the subgrade to a profile conducive to establishing appropriate estuarine and some freshwater habitats. JCLNG anticipates that imported dredge sand will be mobilized to the site by barge (main haul) and dredge pipe (from barge to site) to minimize traffic and safety impacts to the local road system. Historical drainage patterns will be re-established to the extent practical given site constraints.

Civil infrastructure improvements include constructing a new bridge in East Bay Drive to allow tidal exchange between Kentuck Inlet and the Kentuck Project; improving the existing dike separating the site from Kentuck Slough; constructing a new muted tidal regulator (i.e., “fish friendly” tide gate) in the upper portion of the Kentuck Project to redirect a portion of Kentuck Slough flows into the Kentuck Project; and raising the profile of East Bay Drive and approximately 1,900 lineal feet of Golf Course Lane to be above the zone of tidal influence. A fish-friendly culvert or other structure will be constructed within Golf Course Lane to allow passage into the drainage above the former golf course irrigation sump pond.

Construction will require a variety of temporary structures and detour facilities to isolate work areas from aquatic resources and provide access to adjacent private property. The proposed work would also remove to the greatest extent practicable relic golf course facilities such as fencing, ditches, foot bridges, and culverts.

1.5.12 TPP/US 101 Intersection Widening

Traffic surveys and studies of projected construction traffic have determined that the intersection of highway 101 and the TPPwill need to be improved.

The proposed design will provide a turning lane to manage traffic entering highway 101 from the west and automated traffic control.

1.6 OPERATION AND MAINTENANCE

1.6.1 LNG Terminal Facilities

The LNG Terminal will be operated and maintained in accordance with DOT Federal Safety Standards for LNG Facilities (49 CFR Part 193) and NFPA 59A standard. In addition, the marine facilities will be operated and maintained in accordance with the USCG regulations for LNG Waterfront Facilities, 33 CFR Part 127.

Operations and Maintenance ("O&M") procedures will be developed to promote personnel safety and plant operability. Details of all procedures and training associated with the LNG Terminal will be developed during the detailed design phase.

The O&M procedures for the LNG Terminal will be developed to comply with the applicable requirements of:

- 49 CFR Part 193 Subpart F – Operations and NFPA 59A. This will include policies for operating procedures, monitoring of operations, emergency procedures, personnel safety, and investigation of failures, communication systems, and operating records.
- 49 CFR Part 193 Subpart G – Maintenance and NFPA 59A. This will include policies for maintenance procedures, fire protection, isolating and purging, repairs, control systems, corrosion control, and maintenance records.
- 49 CFR Part 193 Subpart J – Security and NFPA 59A Annex C – Security. This will include policies for security procedures, protective enclosures, security communications, and security monitoring and warning signs.
- 33 CFR Part 105 – Maritime Security: Facilities. This will include policies for security procedures, communication systems and procedures, and security monitoring of access points to the LNG Terminal.
- 33 CFR Part 127 – Waterfront Facilities Handling Liquefied Natural Gas and Liquefied Hazardous Gas. This will include policies for development of operations and emergency manuals for the LNG marine transfer area.

All permanent O&M personnel employed at the LNG Terminal will undergo thorough training for their assigned duties and will be sufficiently qualified to operate the LNG Terminal in accordance with the requirements of 49 CFR Part 193, Subpart H – Personnel Qualifications and Training, and also the operating, maintenance, and personnel training requirements of NFPA 59A. JCEP will ensure that personnel are trained in accordance with applicable requirements of the USCG, DOT, Oregon Department of Energy, Oregon State Fire Marshall, Coos Bay, and Coos County Fire Department.

JCEP will prepare and submit an Emergency Response Plan ("ERP") to be approved by FERC prior to any final approval to begin construction. The ERP will establish the procedures for responding to specific emergencies that could occur at the LNG Terminal as well as procedures for emergency situations that could affect the public along the LNG carrier transit routes. The

ERP will include a comprehensive training program in emergency management for all JCEP LNG Terminal employees as well as the supporting emergency management agencies.

The LNG Terminal will be staffed with about 180 full-time equivalent direct employees. The LNG Terminal will be operated on a permanent 24-hour basis, 365 days a year. Full-time staff will conduct routine maintenance and minor overhauls. Major overhauls and other major maintenance would be handled by bringing in personnel specifically trained to perform the required tasks. All scheduled and unscheduled maintenance will be entered into a computerized maintenance management system.

1.7 FUTURE PLANS AND ABANDONMENT

The proposed action does not include the abandonment of existing FERC jurisdictional facilities.

JCEP does not anticipate abandonment of the proposed LNG Terminal facility in the foreseeable future (less than 30 years). Robust construction techniques and proper maintenance and operating procedures can result in LNG facilities whose useful life surpasses their design life.

1.8 PERMITS, APPROVALS, AND CONSULTATIONS

Construction, operation, and maintenance of the Project will be executed in accordance with all applicable permits and approvals. Applicable permits and approvals for the LNG Terminal are summarized in Table 1.6-1 along with the schedule and status for filing of all major applications or appropriate documentation.

Table 1.6-1 Major Permits, Approvals, and Consultations for the LNG Terminal

Agency	Permit/Approval	Contact	Filing Date	Approval/ Anticipated Approval
Federal				
U.S. Department of Energy (DOE)	Order Granting Long Term, Multi-Contract Authorization to Export Natural Gas to Free Trade Agreement Nations under Section 3 of the Natural Gas Act	Amy Sweeney (202) 586-2627 1000 Independence Ave., SW Room 3E-052 Washington, D.C. 20585	September 2011	Received December 7, 2011[3]
	Order Conditionally Granting Long-Term Multi-Contract Authorization To Export Liquefied Natural Gas To Non-Free Trade Agreement Nations under Section 3 of the Natural Gas Act.	Amy Sweeney (202) 586-2627 1000 Independence Ave., SW Room 3E-052 Washington, D.C. 20585	March 2012	Conditionally received March 24, 2014[1]
Federal Energy Regulatory Commission	Section 7 of the Natural Gas Act – issuance of Certificate of Public Convenience and Necessity	John Peconom (202) 502-6352	September 2017	November 2018

[3] JCEP will submit an amendment to the FTA authorization and pending non-FTA authorization to reflect the new export capacity of the LNG Terminal and will confirm receipt of such authorizations prior to construction.

Jordan Cove Energy Project, L.P.

Table 1.6-1 Major Permits, Approvals, and Consultations for the LNG Terminal				
Agency	**Permit/Approval**	**Contact**	**Filing Date**	**Approval/ Anticipated Approval**
	Section 3 of the Natural Gas Act – order granting Section 3 authorization	888 First St., NE Washington, D.C. 20426	September 2017	November 2018
FERC (as lead agency)	National Historic Preservation Act § 106 Review/Memorandum of Agreement among federal agencies, consulting parties, and SHPO	Paul Friedman (202) 502-8059 888 First St., NE Washington, D.C. 20426	September 2017	November 2018
FERC (as lead agency)	National Environmental Policy Act Review - EIS	John Peconom (202) 502-6352 888 First St., NE Washington, D.C. 20426	September 2017	August 2018
U.S. Army Corps of Engineers	Clean Water Act – issuance of permit under Section 404 to allow placement of dredge or fill material into waters of the United States Section 10 of the Rivers and Harbors Act – permit issued to allow structures or work in or affecting navigable waters of the United States	Tyler Krug Regulatory Project Manager 541-756-2097 tyler.j.krug@usace.army.mil North Bend Field Office 2201 N. Broadway, Suite C North Bend, OR 97459	October 2017	November 2018

Table 1.6-1 Major Permits, Approvals, and Consultations for the LNG Terminal

Agency	Permit/Approval	Contact	Filing Date	Approval/ Anticipated Approval
	Section 408 of the Clean Water Act – issuance of permit allowing the occupation or alteration of Army Corps of Engineers civil works projects	Marci Johnson U.S. Army Corps of Engineers P.O. Box 2946 Portland, OR 97285 (503) 808-4765	September 2017	November 2018
U.S. Coast Guard (USCG)	Letter of Recommendation and Letter of Recommendation Analysis under the Ports and Waterway Safety Act	Captain Timmons USGS Sector Columbia River 2185 SE 12th Place Warrenton, Oregon 97146	April 2006	December 2017
U.S. Fish and Wildlife Service	Endangered Species Act – consultation under Section 7 and issuance of biological opinion	Joe Zisa 503-231-6179 joe_zisa@fws.gov Oregon Fish and Wildlife Office 2600 SE 98th Ave., Ste. 100 Portland, OR 97266	September 2017	November 2018
	Fish and Wildlife Coordination Act – consultation with federal agencies to prevent loss or damage to wildlife resources		September 2017	November 2018
	Migratory Bird Treaty Act Review		September 2017	

Table 1.6-1 Major Permits, Approvals, and Consultations for the LNG Terminal

Agency	Permit/Approval	Contact	Filing Date	Approval/ Anticipated Approval
National Marine Fisheries Service	ESA Section 7 Consultation – issuance of biological opinion	Chuck Wheeler Fisheries Biologist 541-957-3379 chuck.wheeler@noaa.gov 2900 Stewart Parkway Roseburg, OR 97471	September 2017	November 2018
	Magnuson-Stevens Fishery Conservation and Management Act consultation on Essential Fish Habitat		September 2017	November 2018
	Marine Mammal Protection Act – Issuance of Incidental Harassment Authorization	Jordan Carduner 1315 East West Highway Silver Spring, MD 20910	October 2017	November 2018
Federal Aviation Administration (FAA)	Determination of No Hazard to Air Navigation pursuant to 14 CFR Part 77.	Dan Shoemaker 1601 Lind Ave SW Renton, WA 98055 (425) 227-2791	October 2017	Prior to Construction
USDOI Bureau of Land Management	Mineral Leasing Act – issuance of Right-of-Way Grant Mineral Leasing Act – issuance of Temporary Use Permit	Miriam Liberatore Planning and Environmental Coordinator 541-618-2412 mliberat@blm.gov 3040 Biddle Road Medford, OR 97504	October 2017	November 2018

Table 1.6-1 Major Permits, Approvals, and Consultations for the LNG Terminal				
Agency	**Permit/Approval**	**Contact**	**Filing Date**	**Approval/ Anticipated Approval**
	Federal Land Policy and Management Act - Amendments to Resource Management Plans			
USDA Forest Service	Mineral Leasing Act - Right-of-Way Grant Letter of Concurrence	David Krantz PCGP Project Manager 541-618-2082 dkrantz@fs.fed.us 3040 Biddle Road Medford, OR 97525	October 2017	November 2018
	Federal Land Policy and Management Act - Amendments to Existing Forest Plans			
USDI Bureau of Reclamation	Right-of-Way Grant Letter of Concurrence	Lila Black 541-880-7510 lblack@usbr.gov Klamath Basin Area Office 6600 Washburn Way Klamath Falls, OR 97603	October 2017	November 2018
	Letter of Consent covering lands on which BOR has reserved rights or acquired easements			
Tribal				

Table 1.6-1 Major Permits, Approvals, and Consultations for the LNG Terminal				
Agency	**Permit/Approval**	**Contact**	**Filing Date**	**Approval/ Anticipated Approval**
Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians	FERC to consult with the Tribes under NHPA Section 106	Ms. Stacy Scott 541-888-9577x7513 sscott@ctclusi.org 1245 Fulton Avenue Coos Bay, OR 97420	FERC to initiate after receipt of applications	November 2018
Coquille Indian Tribe		Kassandra Rippee 541-756-0904x10216 kassandrarippee@coquilletribe.org 3050 Tremont Street North Bend, OR 97459		
Cow Creek Band of Umpqua Indians		Mr Dan Courtney (541) 672-9405 dlcourtney5431@msn.com 2371 Stephens Street, Suite 500 Roseburg, OR 97470		
The Klamath Tribes		Mr. Perry Chocktoot Culture & Heritage Director 541-783-2219x159 Perry.Chocktoot@klamathtribes.com P.O. Box 436 Chiloquin, OR 97624		

Table 1.6-1 Major Permits, Approvals, and Consultations for the LNG Terminal				
Agency	**Permit/Approval**	**Contact**	**Filing Date**	**Approval/ Anticipated Approval**
Confederated Tribes of the Siletz Indians		Mr. Robert Kentta Cultural Resources Director 541-444-2532 rkentta@ctsi.nsn.us P.O. Box 549 Siletz, OR 97380		
Confederated Tribes of the Grand Ronde Community		David Harrelson 503-879-1630 david.harrelson@grandronde.org 9615 Grand Ronde Road Grand Ronde, OR 97347		
State				
Oregon Division of State Parks Office of Historic Preservation	National Historic Preservation Act – Section 106 Consultation	John Pouley Assistant State Archaeologist 503-986-0675 john.pouley@oregon.gov 725 Summer St. NE, #C Salem, OR 97301	Initiated by FERC upon receipt of application	November 2018
Oregon Department of Environmental Quality	CWA 401 Water Quality Certification	Mary Camarata 541-687-7435 camarata.mary@deq.state.or.us	October 2017	October 2018
	Clean Air Act – issuance of Title V Operating Air Permit		To be filed one year after operation.	Within 1 year of filing

Table 1.6-1 Major Permits, Approvals, and Consultations for the LNG Terminal

Agency	Permit/Approval	Contact	Filing Date	Approval/ Anticipated Approval
	Clean Water Act – issuance of permit under the National Pollutant Discharge Elimination System ("NPDES") - 1200A General Permit for Concrete Batch Plant	165 East 7th Ave., Ste. 100 Eugene, OR 97401	Prior to construction	Prior to construction
	Clean Water Act – issuance of NPDES - 1200-C General Permit for any Contiguous Sites		Prior to construction	October 2018
	Clean Water Act – issuance of NPDES Wastewater Permit for current site conditions – allows discharge of treatment of leachate from landfill through the ocean outfall		Renewed July 26, 2015. Expires June 30, 2020	Issued
	CWA 402 NPDES Construction Stormwater Permit		Prior to construction	Prior to construction

Table 1.6-1 Major Permits, Approvals, and Consultations for the LNG Terminal				
Agency	**Permit/Approval**	**Contact**	**Filing Date**	**Approval/ Anticipated Approval**
	CWA 402 NPDES Operating Stormwater Permit		Prior to operation	Prior to operation
	CWA 402 NPDES Water Pollution Control Facility (WPCF) – Hydrostatic Test Water		Prior to operation	Prior to operation
	Type B NSR Air Permit for LNG Terminal		Updated filed September 2017	Approved June 2015/October 2018
	Air Contaminant Discharge Permit for Compression Facilities		Modifying pending application October 2017	October 2018
Oregon Department of Water Resources	Permit to Appropriate Water	Jerry K. Sauter Water Rights Program Analyst 503-986-0817 jerry.k.sauter@state.or.us Water Right Services Division 725 Summer Street NE, Ste. A Salem, OR 97301	Prior to operation	Prior to operation
Oregon Department of Fish and Wildlife	In-Water Blasting Permit Fish Passage	Sarah Reif Energy Coordinator, Wildlife Division 503-947-6082 sarah.j.reif@state.or.us 4034 Fairview Industrial Drive SE Salem, OR 97302	October 2017	October 2018

Table 1.6-1 Major Permits, Approvals, and Consultations for the LNG Terminal

Agency	Permit/Approval	Contact	Filing Date	Approval/ Anticipated Approval
	Fish Passage Approval	Greg Apke 4034 Fairview Industrial Dr. SE Salem, OR 97302 503-947-6228 Greg.d.apke@state.or.us	December 2017	October 2018
Oregon Department of Transportation	State Highway Crossing Permit	Roger B. Allemand Permit Specialist – District 8 541-774-6360 roger.b.allemand@odot.state.or.us Dave Wells Permit Specialist – District 7 541-957-3588 david.wells@odot.state.or.us	Prior to construction	Prior to construction
	Railroad Flagging Permit		Prior to Construction	Prior to construction
	Oversize Load Permit		Prior to Construction	Prior to construction
	Overweight Load Permit		Prior to Construction	Prior to construction
	Street Use Permit		Prior to Construction	Prior to construction
Oregon Department of State Lands	Joint Permit with the USACE Removal/Fill Permit	Bob Lobdell 503-986-5282 bob.lobdell@state.or.us 775 Summer Street NE, Ste. 100 Salem, OR 97301	October 2017	October 2018
	Proprietary easements and licenses for land access and gravel use		October 2017	October 2018

Table 1.6-1 Major Permits, Approvals, and Consultations for the LNG Terminal				
Agency	**Permit/Approval**	**Contact**	**Filing Date**	**Approval/ Anticipated Approval**
	Wetland Report Concurrence	Lynne McAllister Jurisdiction Coordinator 503-986-5300 lynne.mcallister@state.or.us 775 Summer Street NE, Ste. 100 Salem, OR 97301	October 2017	October 2018
Oregon Department of Land Conservation and Development	Coastal Zone Management Consistency Determination	Elizabeth Ruther 503-934-0029 elizabeth.j.ruther@state.or.us 635 Capitol Street, Suite 150 Salem, Oregon 97301-2540	November 2017	October 2018
Oregon Department of Forestry	Operate Mechanical Equipment Written Plan & Alternate Plan	Josh Barnard Field Support Unit Manager 503-945-7493 josh.w.barnard@oregon.gov 2600 State Street, Bldg. A Salem, OR 97310	Prior to Construction	Prior to Construction
Oregon State Building Codes Division (BCD)	Building Permits – for various permanent structures.	Mark Long (503) 373-7235	Prior to Construction	Prior to Construction

Table 1.6-1 Major Permits, Approvals, and Consultations for the LNG Terminal

Agency	Permit/Approval	Contact	Filing Date	Approval/ Anticipated Approval
BCD	Temporary Building Permit – for any temporary structures.	Mark Long (503) 373-7235	Prior to Construction	Prior to Construction
Oregon State Historic Preservation Office (SHPO)	Section 106 Consultation	John O. Pouley 503-986-0675	September 2017	November 2018
County				
City of North Bend Planning Department	Conditional Use Permit (for pipeline in City of North Bend)	Chelsea Schnabel City Planner City of North Bend (541) 756-8535 cschnabel@northbendcity.org 835 California Avenue North Bend, OR 97459	October 2017	May 2018
Coos County Planning Department	Conditional Use Permit	Jill Rolfe 541-396-7770 jrolfe@co.coos.or.us Coos County Planning Department 225 N. Adams Coquille, OR 97423		Approved 2016
Douglas County Planning Department	Conditional Use Permit	Cheryl Goodhue Planning Department 541-440-4289 cagoodhu@co.douglas.or.us Douglas County Courthouse Justice Building – Room 106 Roseburg, OR 97470		Approved 2010 and 2014

Table 1.6-1 Major Permits, Approvals, and Consultations for the LNG Terminal

Agency	Permit/Approval	Contact	Filing Date	Approval/ Anticipated Approval
Klamath County Planning Department	Conditional Use Permit – Compressor Station	Mark Gallagher Planning Director 541-883-5121x3064 mgallagher@co.klamath.or.us 305 Main Street Klamath Falls, OR 97601		Approved 2015

In December 2011, the U.S. Department of Energy ("DOE") authorized exports by JCEP from the LNG Terminal to Free Trade Agreement nations. In March 2014, the DOE conditionally authorized exports by JCEP from the LNG Terminal to Non-Free Trade Agreement nations. In 2012, the Project received all local Coos County approvals for the LNG Terminal (except the building permit that will be obtained when construction is to commence), including some import facility permits that were amended for the JCEP LNG Terminal Project and permits that were obtained anew for the currently proposed Project. Coos County approvals were superseded by the LNG Export Terminal Omnibus package submitted and approved in 2016. An ODSL removal/fill permit was issued for the slip and access channel; the removal/fill permit will remain in effect through Project permitting. There is also a current ODEQ Air Contaminant Discharge Permit (ACDP) that requires modifications to reflect the optimized design. The Project will not otherwise rely on permits or approvals obtained in connection with the previously proposed import facility or export facility.

JCEP has actively participated in the Waterway Suitability Assessment ("WSA") process with the USCG to ensure that the LNG Terminal is in full compliance with all safety and security regulations applicable to LNG carrier transits and the WSA will be updated via the annual update process to reflect the changes discussed in Section 1.3.6.8. In connection with the import facility, JCEP had submitted to the USCG a Letter of Intent ("LOI") pursuant to 33 CFR §127.007, and its preliminary WSA, as required by the Commission's regulations (18 CFR § 157.21(a)(1) and (d)(12)). The USCG issued a WSR and an LOR for the Federal Navigation Channel, finding that the channel can be made suitable for LNG marine traffic if a number of conditions are met. In connection with the export facility proposal, JCEP notified the USCG Captain of the Port that any changes created by the Project would be addressed in the annual WSA update. The Captain of the Port affirmed this approach and requested that the LOI, the WSA, and the Emergency Response Plan be amended to reflect any design changes or updates to the Project. The WSA for the year 2012 was updated to provide for the loading of LNG at the LNG Terminal. The LOI likewise was updated. Copies of the LOI Update, and all related correspondence with USGG were filed with FERC on January 23, 2017 as part of the Request for Approval of Pre-Filing Review; however, as stated in the correspondence, the WSA and its transmittal are considered to be Security Sensitive Information and therefore have been submitted solely to the USCG.

Approved permits and related agency communications are included as appendices to Resource Report 8 – Land Use, Recreation and Aesthetics. Moving forward, permit applications and agency correspondence will by heavily informed and influenced by past work on the export project. In some cases, agency communications have been ongoing. Specifically, communications with the NMFS regarding the Kentuck Project have continued, and JCEP will continue to engage with other agencies such as ODSL, USACE, NMFS, and ODEQ regarding permit applications.

Major permit and approval actions for the LNG Terminal involving multiple regulatory agencies will include environmental reviews by the FERC for authorization of the LNG Terminal under Section 3 of the NGA, the USACE for permits in or affecting navigational water, discharges of dredged or fill material, and occupation or alterations of civil works projects, the NMFS and FWS for a Biological Opinion under the Endangered Species Act, NMFS for the Marine Mammal Protection Act authorization, the Oregon DLCD for a coastal zone management consistency determination, the ODSL for an Oregon Removal/Fill Law permit, and the ODEQ for an Air Quality Permit, and Water Discharge and Water Quality Permit.

1.8.1.1 Affected Landowners

Property owners within both a one-half-mile radius and a one-mile radius of the LNG Terminal site (defined as the distance from the center of the southernmost LNG storage tank) have been notified.

All of the activities associated with the LNG Terminal will occur on land owned by Fort Chicago LNG II U.S. L.P., an affiliate of JCEP or land leased from adjacent landowners. Adjacent landowners—Oregon International Port of Coos Bay, Roseburg Forest Products Company, Weyerhaeuser NR Company, ODSL, Oregon Dunes National Recreation Area, and the U.S. Bureau of Land Management were contacted. The names and mailing addresses of landowners within both a one-half-mile and a one-mile radius of the Project site are listed in Appendix A.1.

Landowners adjacent to remote sites (e.g. park and ride facilities) will be contacted once JCEP have secured lease agreements.

1.9 NON-JURISDICTIONAL FACILITIES

The siting, construction, and operation of the LNG Terminal involves facilities that do not fall under the Commission's jurisdiction. These include the SORSC and fire department, communication lines and utility connections, and LNG vessel traffic.

Under certain circumstances, non-jurisdictional facilities may be subject to FERC's environmental review. In making this determination, FERC requires applicants to address four factors that indicate the need for FERC to do an environmental review of project-related non-jurisdictional facilities. These factors include:

1. Whether or not the regulated activity comprises "merely a link" in a corridor-type project (such as a transportation or utility transmission project);
2. Whether there are aspects of the non-jurisdictional facility in the immediate vicinity of the regulated activity that affect the location and configuration of the regulated activity;
3. The extent to which the entire project will be within FERC's jurisdiction; and
4. The extent of cumulative federal control and responsibility.

Analysis of the factors listed above weighs against the FERC treating the SORSC and fire department, communication lines and utility connections, and LNG vessel traffic as a jurisdictional component of the LNG Terminal.

1.9.1 LNG Carriers

LNG to be exported from the LNG Terminal to overseas markets would be transported in carriers specially designed and built for that task. JCEP expects that its LNG Terminal would be visited by about 110 to 120 LNG carriers per year. These carriers, chartered by JCEP's customers, would be loaded with LNG at the LNG Terminal and would deliver the cargo to overseas markets. LNG carriers would be under the ownership and control of third parties, not JCEP, and would not be regulated by the FERC. As per JCEP agreements with its customers, the third-party owners and operators of the LNG carriers calling at the LNG Terminal would have to comply with U.S. regulatory requirements governing LNG carriers and with JCEP's terminal regulations and requirements in order to be granted access to the Port and to JCEP's

LNG Terminal. Although JCEP does not currently have any information about the exact LNG carriers that would be used to transport the LNG from the LNG Terminal, the current USCG WSR and LOR limit the size of LNG carriers that would call at the LNG Terminal to carriers of approximately 950 feet in length, 150 feet in breadth, and 40 feet loaded drafts (nominal 148,000 m^3 capacity). Neither the exact destinations for the LNG cargo nor the specific routes across the Pacific Ocean to customers that would be taken by LNG carriers are known, outside of the waterway within 12 miles of the Oregon Coast.

1.9.2 Southwest Oregon Regional Safety Center (SORSC)

JCEP will construct a building dedicated to managing safety and security in the event of emergencies for incident management and response known as the SORSC. The SORSC will be home to:

- Jordan Cove Security Center;
- Coos County Dispatch Center;
- Coos County Emergency Operations Center; and
- Offices for various businesses and agencies.

The SORSC will be located adjacent to the LNG Terminal administration building on the South Dunes Site. Although this building does not come under the jurisdiction of the FERC, this environmental report analyzes potential impacts resulting from its construction.

1.9.3 Fire Department

JCEP will construct a standalone fire department building to be located in the Access and Utility Corridor adjacent to the LNG Terminal fire water tanks. The fire department will house Jordan Cove Fire Department chief and staff. Electric power for operation of the fire department building will be provided from the LNG Terminal. Although this building does not come under the jurisdiction of the FERC, this environmental report analyzes potential impacts resulting from its construction.

1.9.4 Utilities

Various communication and utility connections, abandonments, and relocations, which do not come under the jurisdiction of the FERC, will be necessary to support the construction and operation of the LNG Terminal, SORSC, and fire department. Associated construction activities that will occur within the proposed LNG Terminal or within the existing easements located on both sides of TPP from South Dunes to the lagoon site are included in discussions of temporary impacts within this environmental report.

Electrical power for LNG Terminal temporary construction activities and for permanent operation of the SORSC will be provided by the local distribution company (PacifiCorp) through a connection to an existing power line located adjacent to the TPP southwest of Ingram Yard.

Three communication connections, from existing networks, will be required to support the operation of the LNG Terminal, fire department, and SORSC. One fiber optic connection will be provided by ORCA Communications; one fiber optic connection will be provided by LS Networks; and one telecommunications connection will be provided by Frontier. An existing Frontier telecommunications cable will be relocated from the proposed LNG Terminal site to easements along the TPP for subsequent tie-in to the LNG Terminal, SORSC, and fire department. In addition, an existing ORCA fiber optic cable that is currently located aboveground along TPP will be relocated underground within an easement along TPP for subsequent tie-in to the LNG Terminal, SORSC, and Fire Department. The LS networks cable will be extended from Hauser along US 101 and TPP to the Terminal Site.

Portions of existing CBNBWB potable water and raw water pipelines will be relocated to easements along the TPP or abandoned in place (see Figure 1.4-1) in order to construct the LNG Terminal. In addition, an interconnect to an existing CBNBWB potable water pipeline will be used for all normal operational water needs in the LNG Terminal, SORSC, and fire department, as well as most construction water needs. The tie-point to the 12-inch diameter potable water pipeline will be located near the north-west corner of the LNG Terminal along the south side of the TPP. A connection to an existing CBNBWB 8-inch diameter raw water pipeline will also be used for construction water, including LNG tank hydrotesting. The raw water pipeline tap, to be located near the north-west corner of the LNG Terminal on the north side of the TPP, will remain connected after construction, but there are no normal operational uses anticipated for this raw water supply.

Portions of the existing IWWP will be relocated or abandoned in place (see Figure 1.4-1) in order to construct the LNG Terminal. Currently, the IWWP carries water from the two existing bio-solids ponds to the existing ocean outfall via the lagoon site that is northwest of the proposed LNG Terminal. Occasionally the water passing through the IWWP is supplemented by water purchased from CBNBWB to maintain permitted pH levels in the Lagoon system and ensure the ocean outfall remains open. The IWWP will be relocated to an easement along TPP to connect the lagoon site to both Ingram Yard and South Dunes Site. Several connections will be made to the relocated IWWP to serve LNG Terminal construction and LNG Terminal, SORSC, and fire department operation.

All proposed permanent and temporary utility connections are detailed in Figure 1.4-1.

1.10 CUMULATIVE IMPACT ANALYSIS

The Cumulative Impact Analysis for the Project (LNG Terminal and Pipeline) is provided in Appendix B.1.

1.11 REFERENCES

Dodge, O. 1898. Pioneer History of Coos and Curry Counties, OR. Capital Printing Co., Salem, OR.

U.S. Department of Energy. 2015. The Macroeconomic Impact of Increasing U.S. LNG Exports, prepared by Leonardo Technologies, Inc., Oxford Economics, and Center for Energy Studies at Rice University's Baker Institute for Public Policy under DOE National Energy Technology Laboratory (NETL) Contract Number DE-FE0004002. October.

U.S. Energy Information Administration. 2014. Effect of Increased Levels of Liquefied Natural Gas Exports on U.S. Energy Markets. October 2014. Washington, D.C.

U.S. Energy Information Administration. 2012. Effect of Increased Natural Gas Exports on Domestic Energy Markets. January 19, 2012. Washington, D.C.

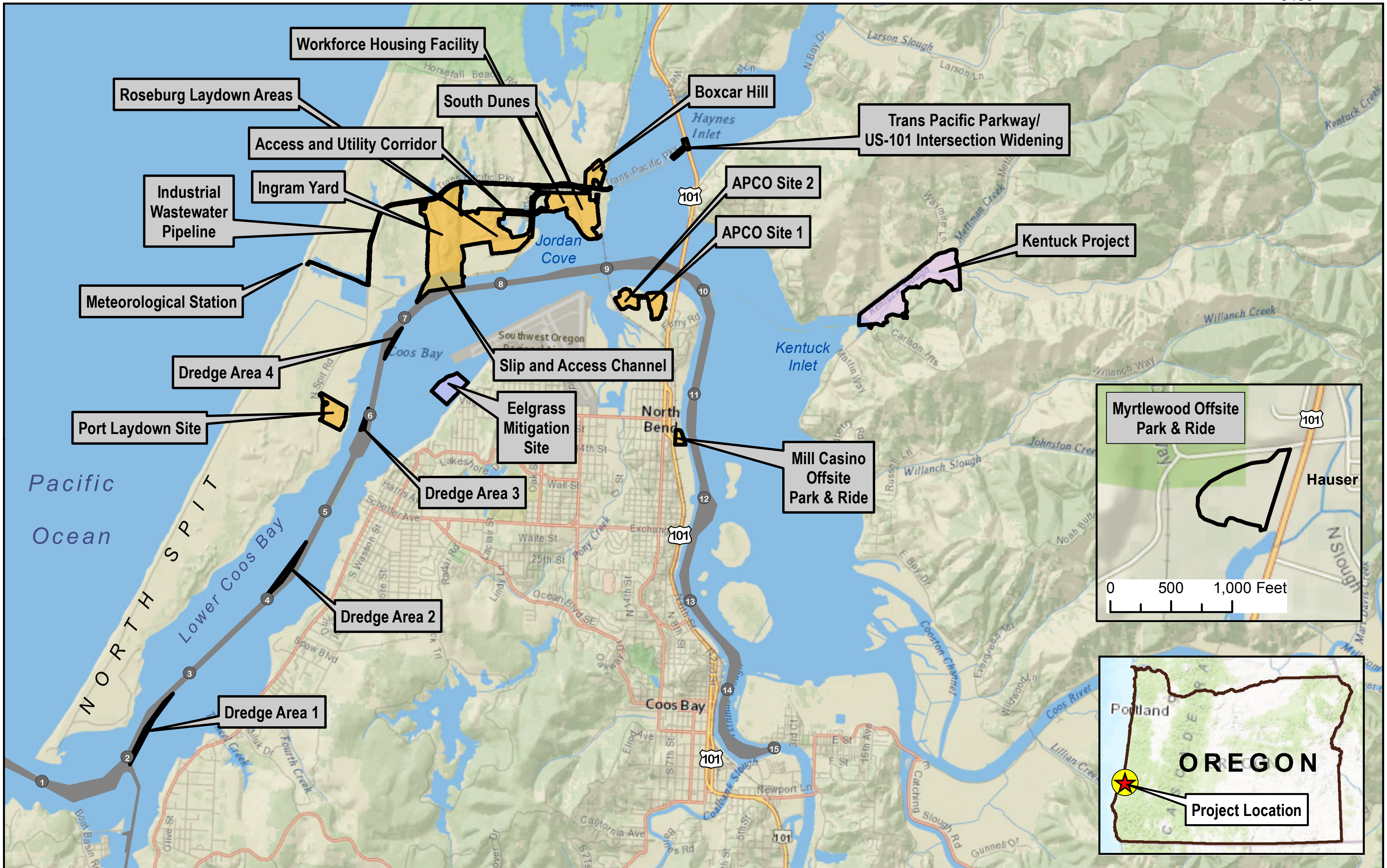
U.S. Energy Information Administration. 2016. Annual Energy Outlook 2016 with Projections to 2040. August 2016. Washington, D.C.

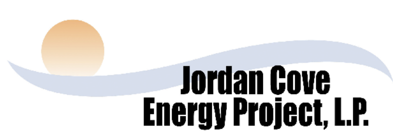
Wood Mackenzie. 2016. Japanese Contracted LNG Supply. Retrieved using LNG Tool, September 2, 2016.

FIGURES

Figure 1.1-1

Project Location Map





N

0 1 Mile

JCEP Project Area
Mitigation Site
Federal Navigation Channel
River Mile

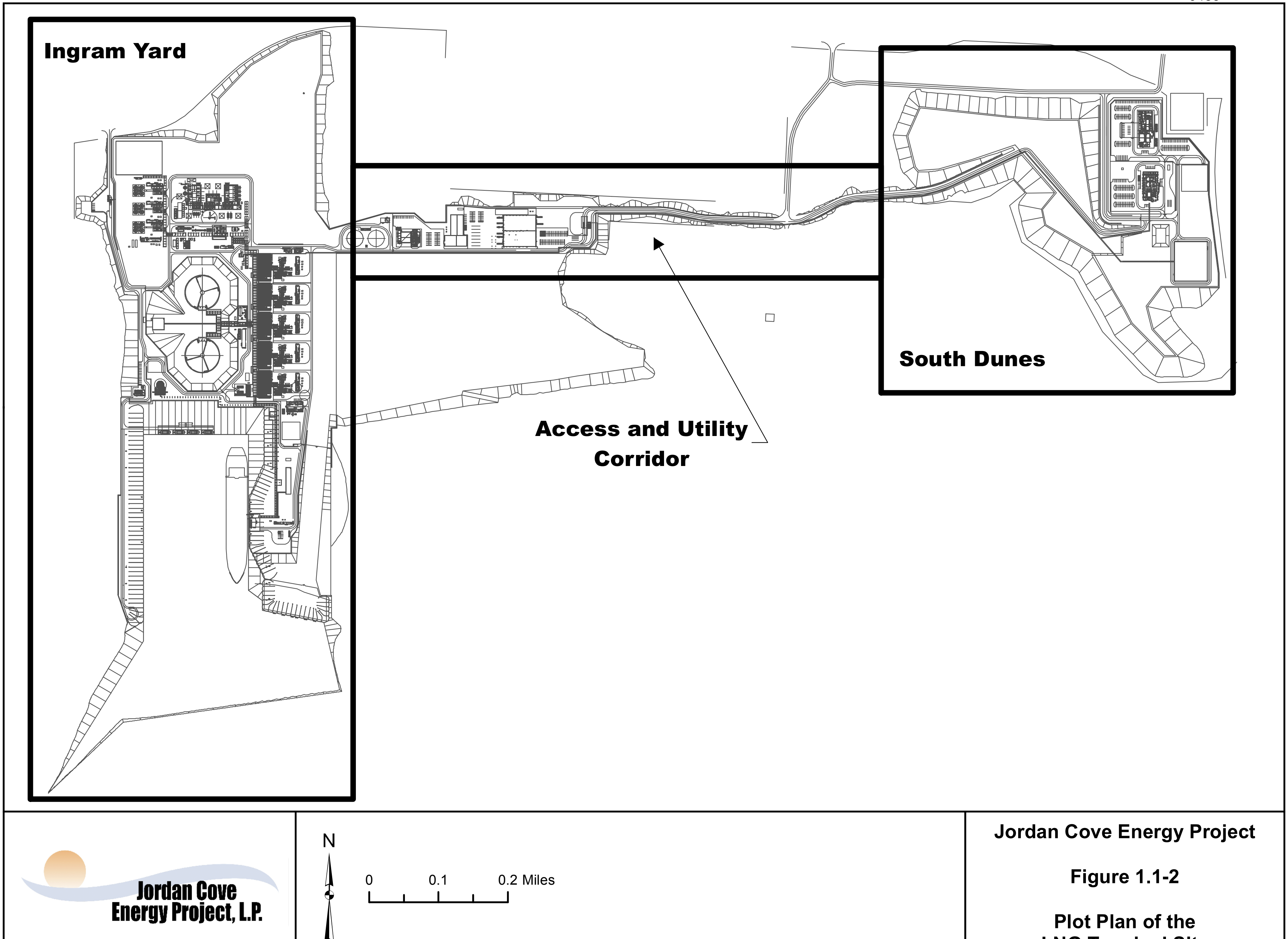
Jordan Cove Energy Project

Figure 1.1-1

Project Location Map

Figure 1.1-2

Plot Plan of the LNG Terminal



Jordan Cove Energy Project, L.P.

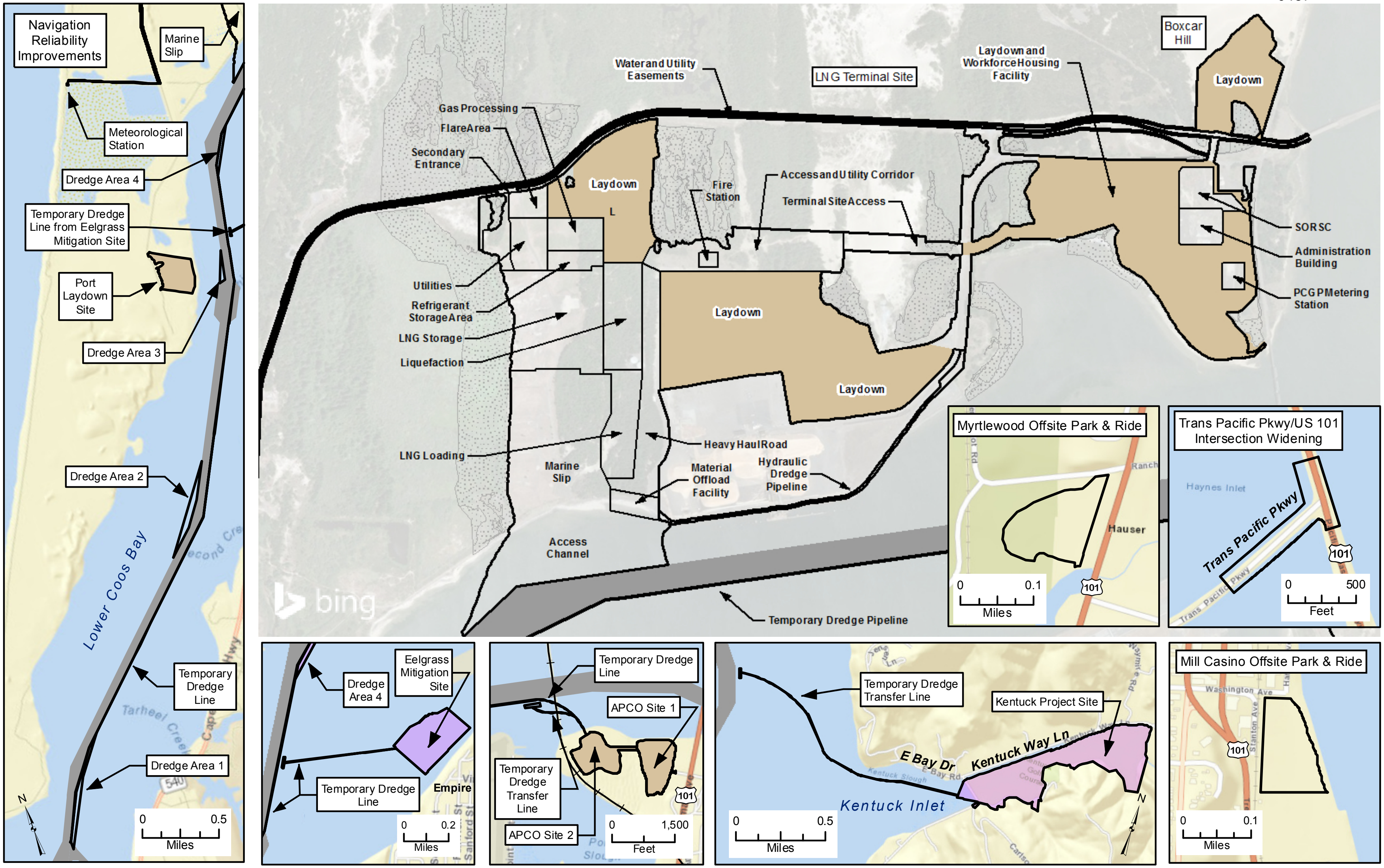
Jordan Cove Energy Project

Figure 1.1-2

Plot Plan of the LNG Terminal Site

Figure 1.3-1

Plot Plan of the Construction Facilities



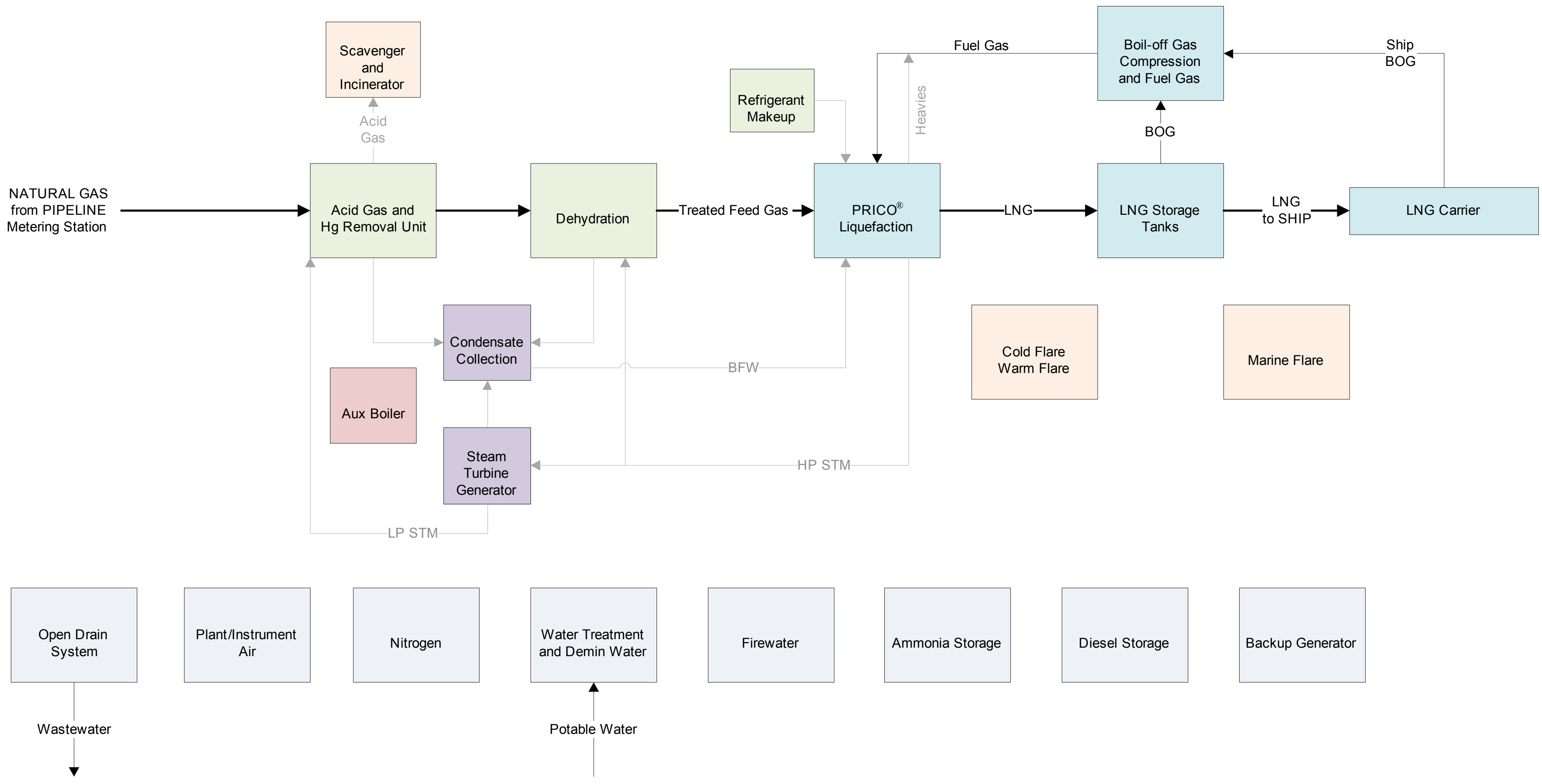
Jordan Cove Energy Project, L.P.

Jordan Cove Energy Project

Figure 1.3-1

Plot Plan of Construction Facilities

Figure 1.3-2
Block Flow Diagram



Jordan Cove Energy Project, L.P.

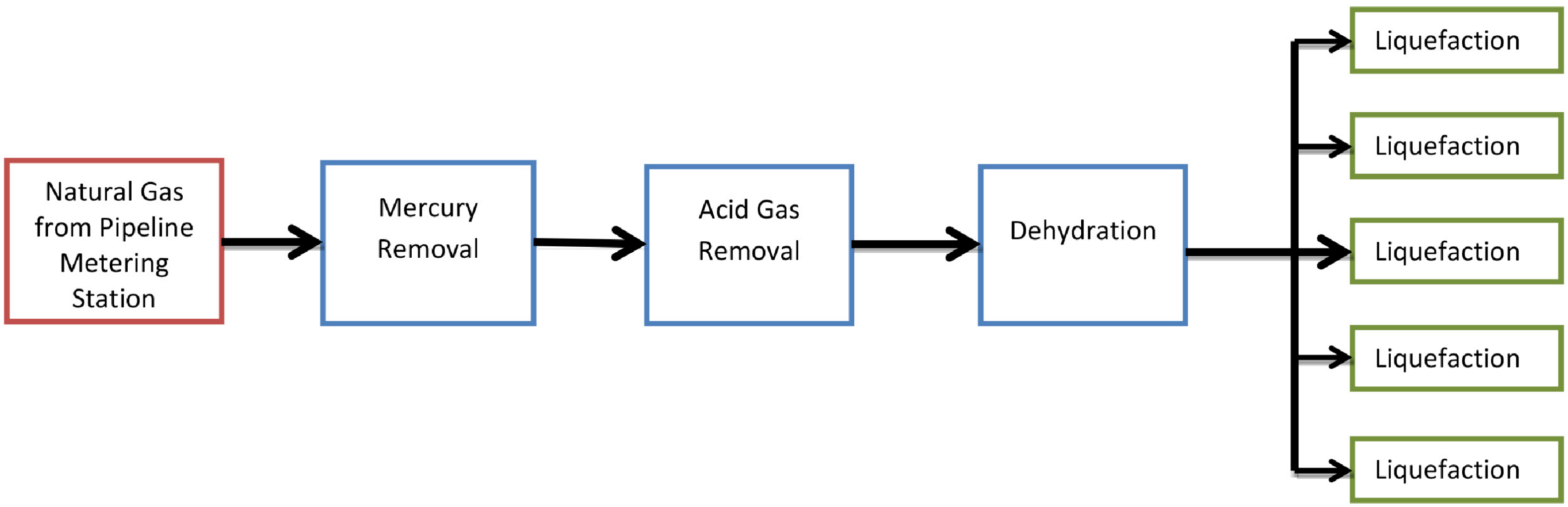
Jordan Cove Energy Project

Figure 1.3-2

Block Flow Diagram

Figure 1.3-3

Gas Conditioning Train



Jordan Cove Energy Project, L.P.

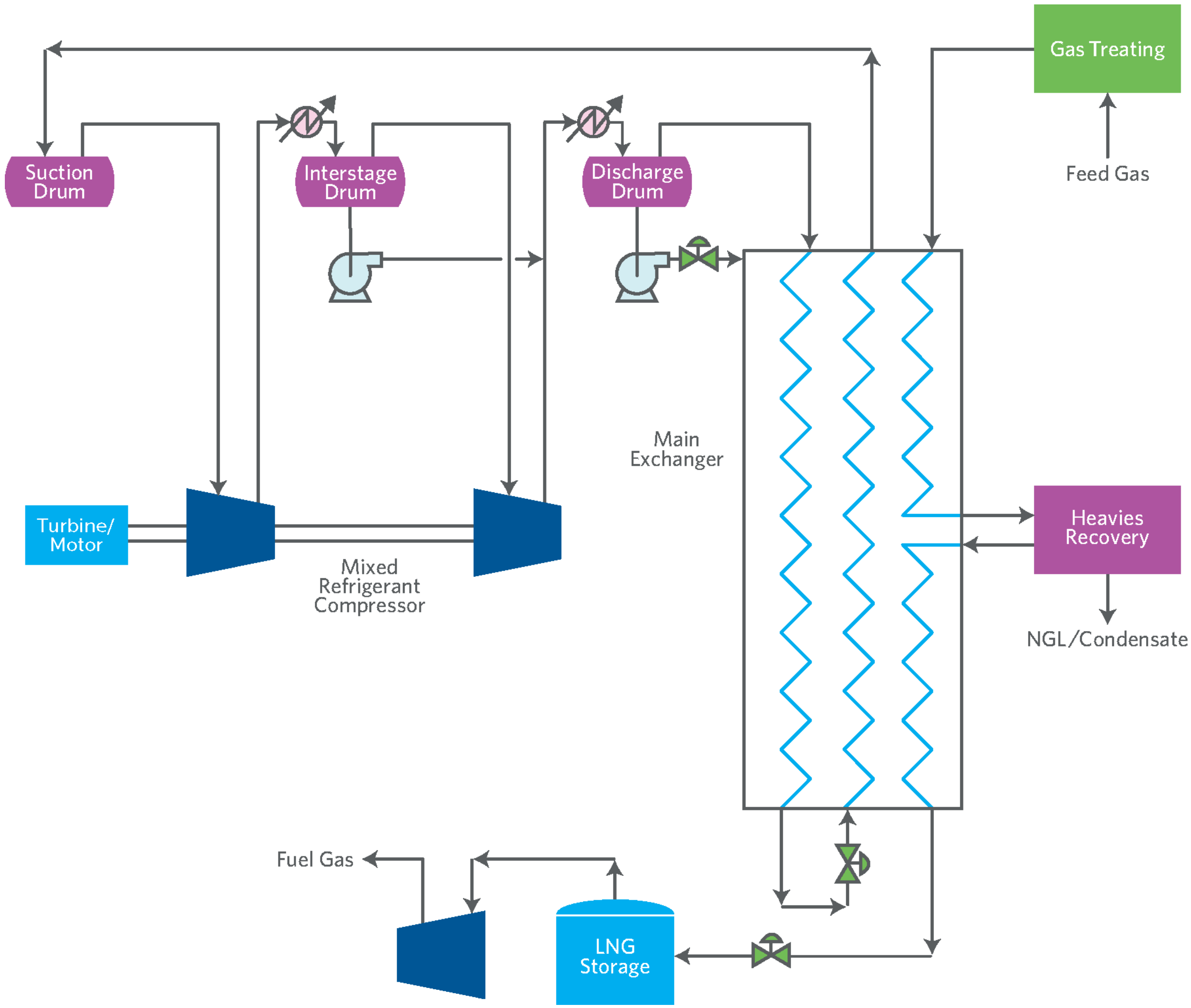
Jordan Cove Energy Project

Figure 1.3-3

Gas Conditioning Train

Figure 1.3-4

PRICO LNG Process



Jordan Cove Energy Project, L.P.

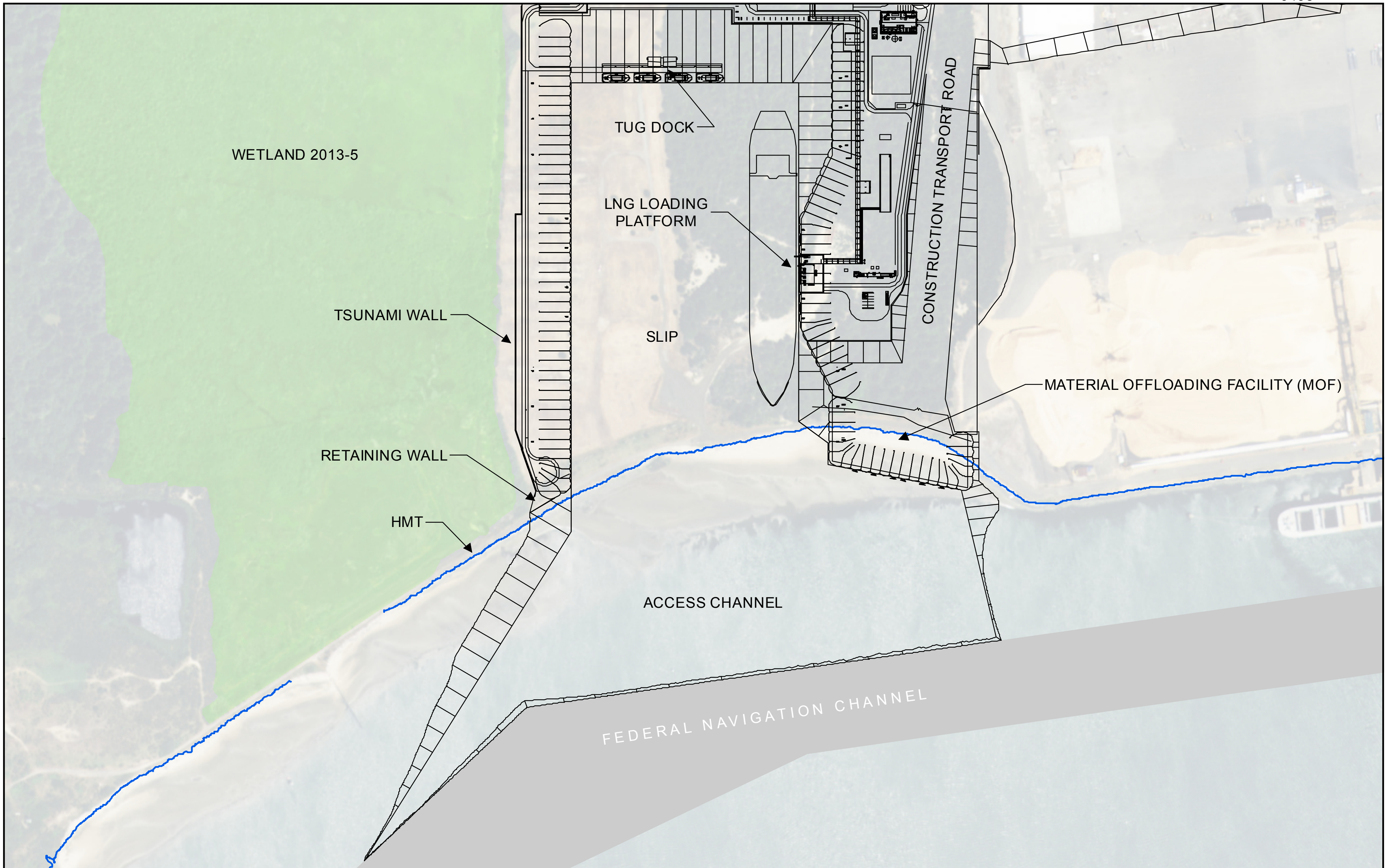
Jordan Cove Energy Project

Figure 1.3-4

PRICO LNG Process

Figure 1.3-5

Plot Plan of Marine Facilities



Jordan Cove Energy Project, L.P.

N

0 250 500 Feet

Federal Navigation Channel

Highest Measured Tide (HMT) (10.26 ft NAVD88)

Delineated Wetland

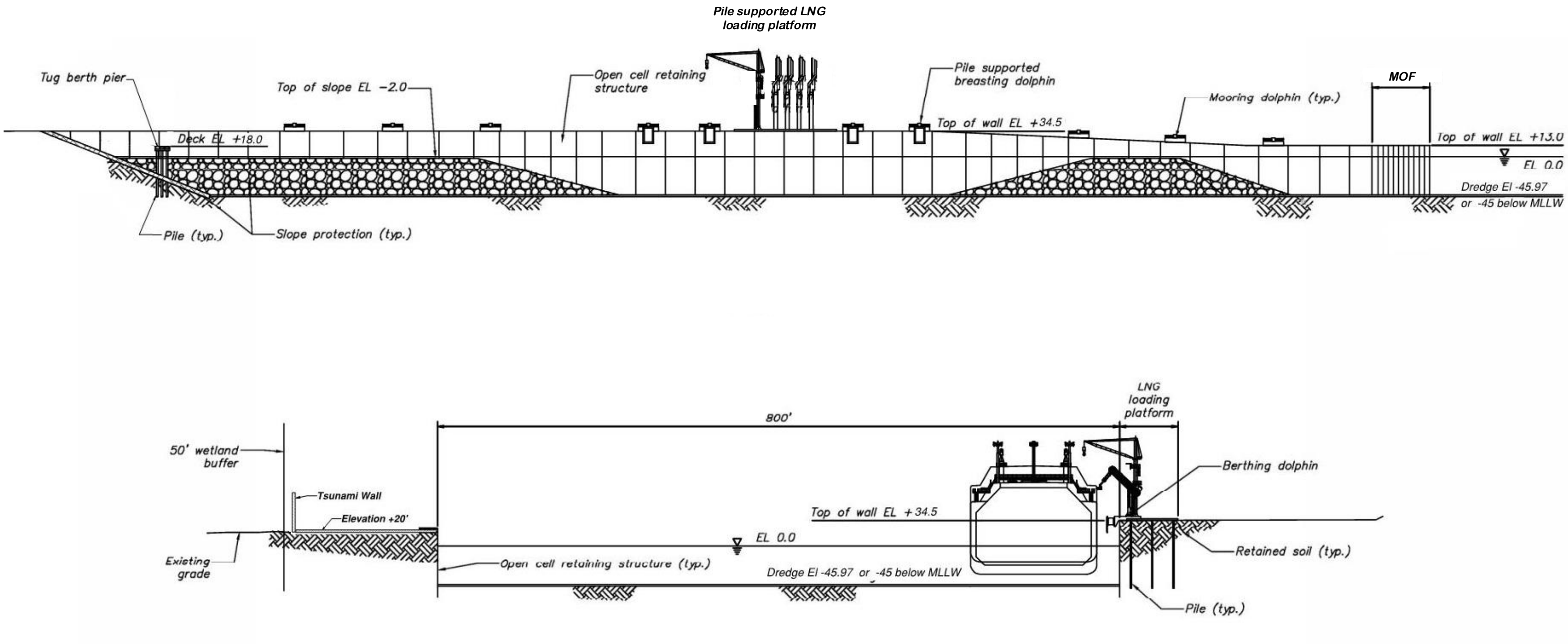
Jordan Cove Energy Project

Figure 1.3-5

Plot Plan of Marine Facilities

Figure 1.3-6

Marine Berth Elevation View



All elevations are to the NAVD88 datum

NOT TO SCALE

Jordan Cove Energy Project, L.P.

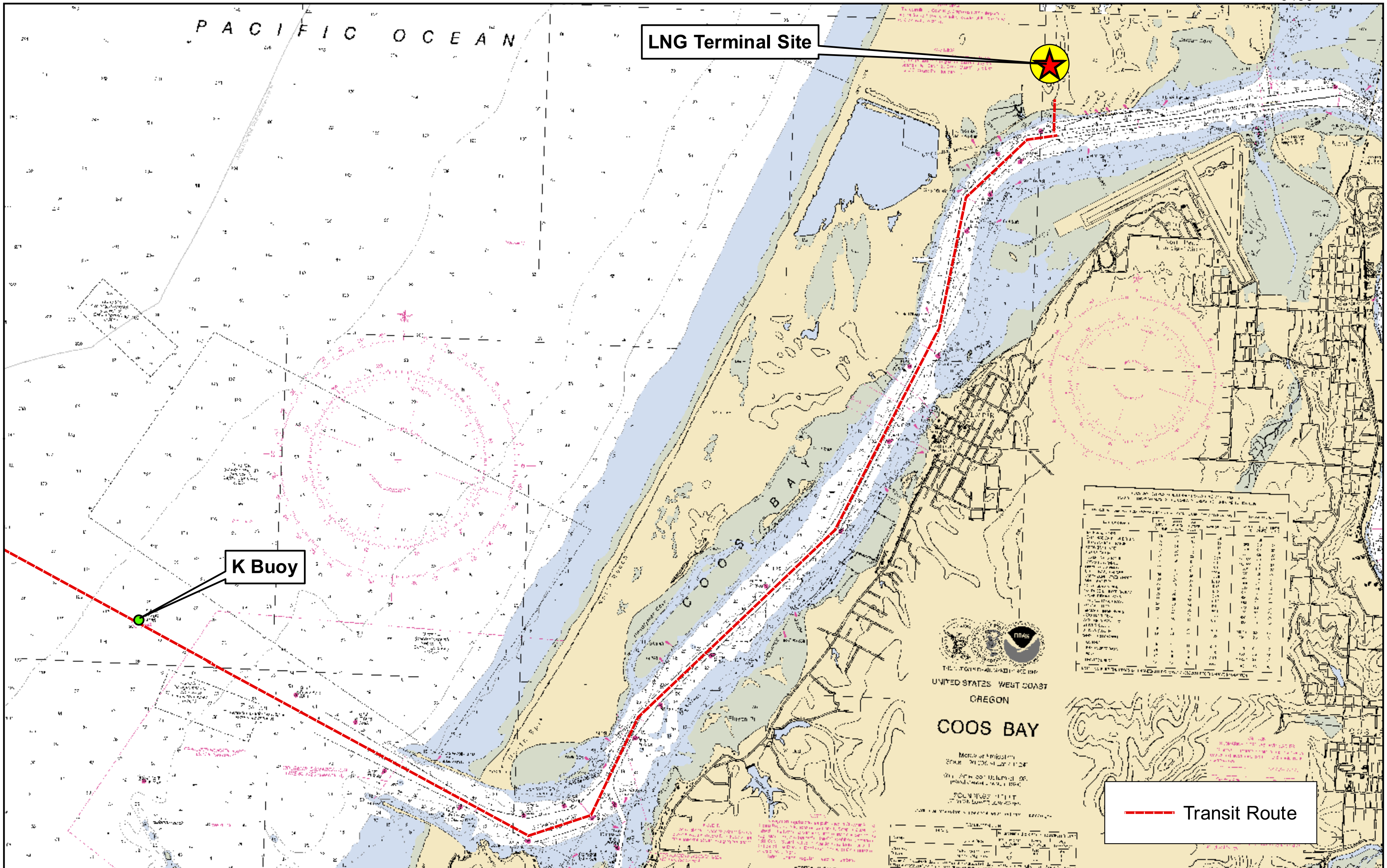
Jordan Cove Energy Project

Figure 1.3-6

Marine Berth Elevation View

Figure 1.3-7

LNG Carrier Transit Route



Jordan Cove Energy Project, L.P.

N

0 0.55 1.1 Mile

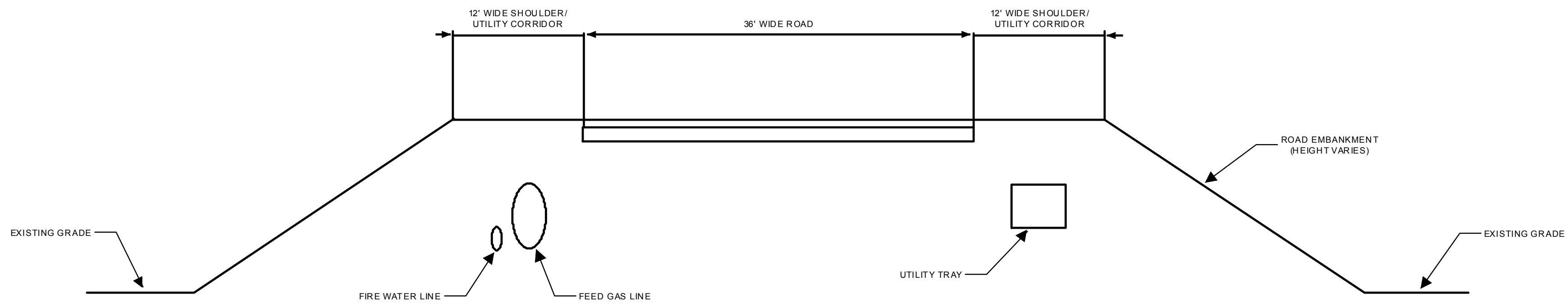
Data Sources: NOAA/NOS/Office of Coast Survey, Oregon GEO, USACE

Jordan Cove Energy Project

Figure 1.3-7

LNG Ship Transit Route

Figure 1.3-8
Cross Section Drawing of the Access and Utility Corridor



Jordan Cove Energy Project, L.P.

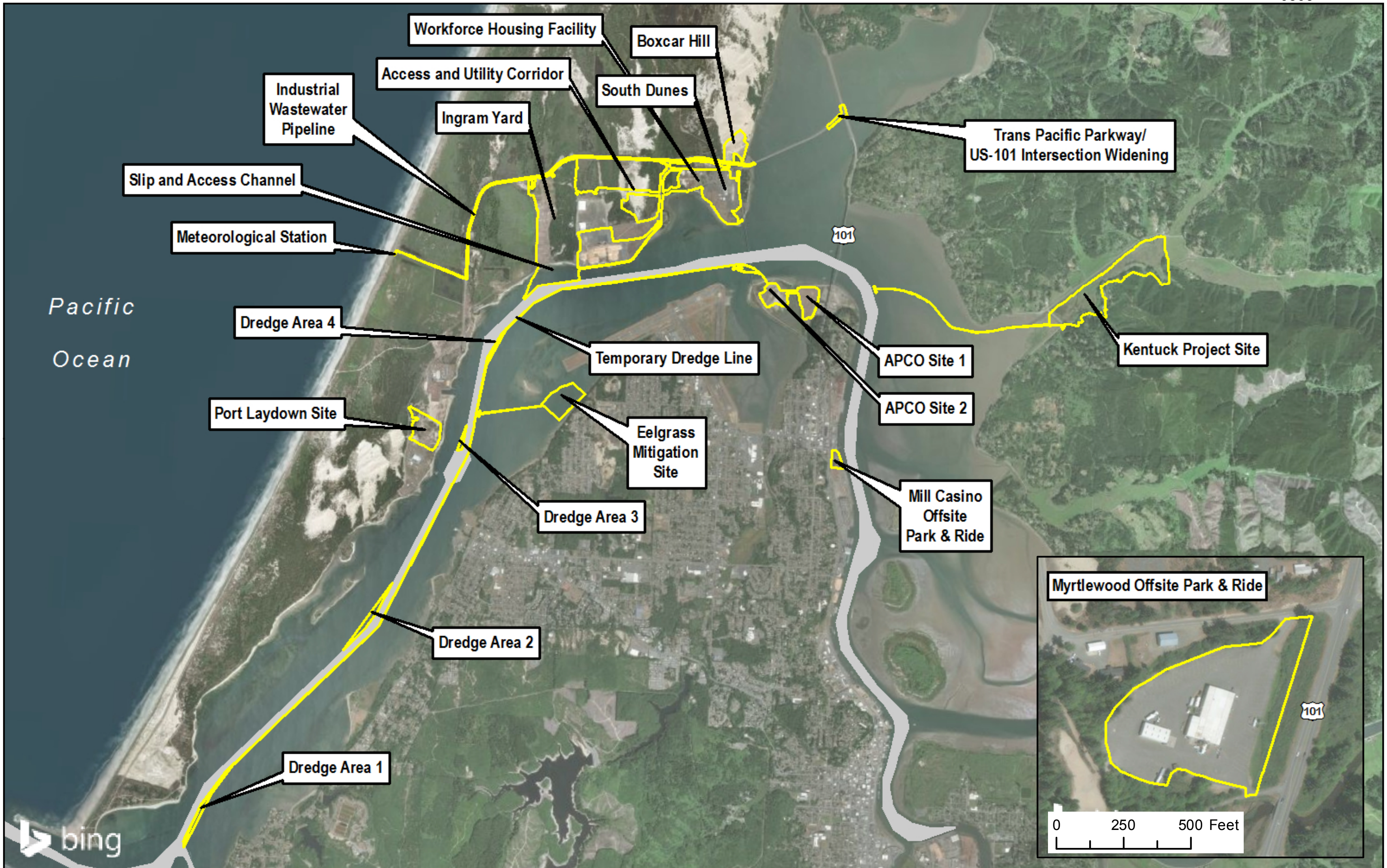
NOT TO SCALE

Jordan Cove Energy Project

Figure 1.3-8

Cross Section Drawing of the Access and Utility Corridor

Figure 1.3-9
Aerial Photography of the JCEP LNG Terminal Site



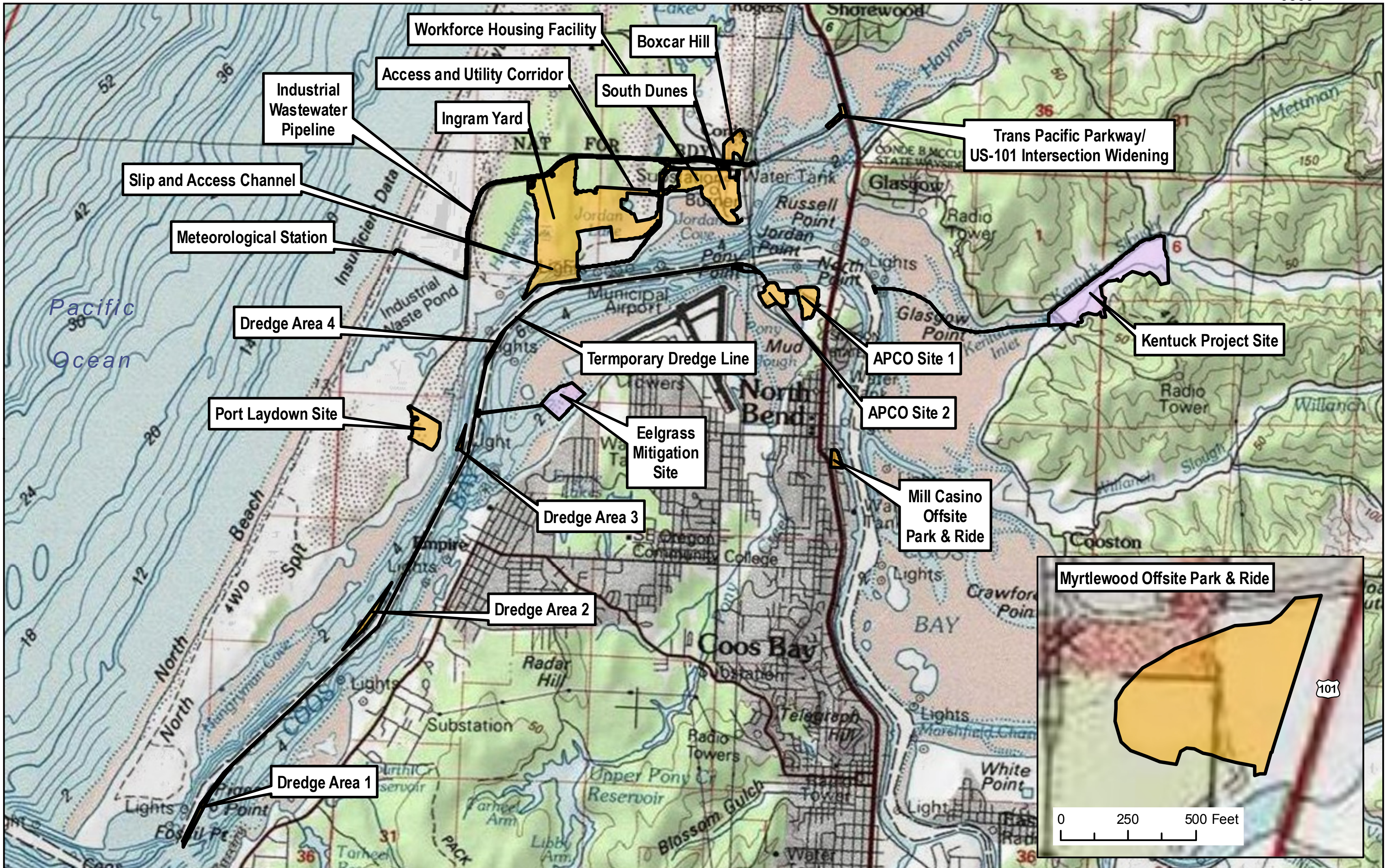
Jordan Cove Energy Project, L.P.

Jordan Cove Energy Project

Figure 1.3-9

Aerial Photography of the Project Site

Figure 1.3-10
USGS Topographic Map of the JCEP LNG Terminal Site



Jordan Cove Energy Project, L.P.

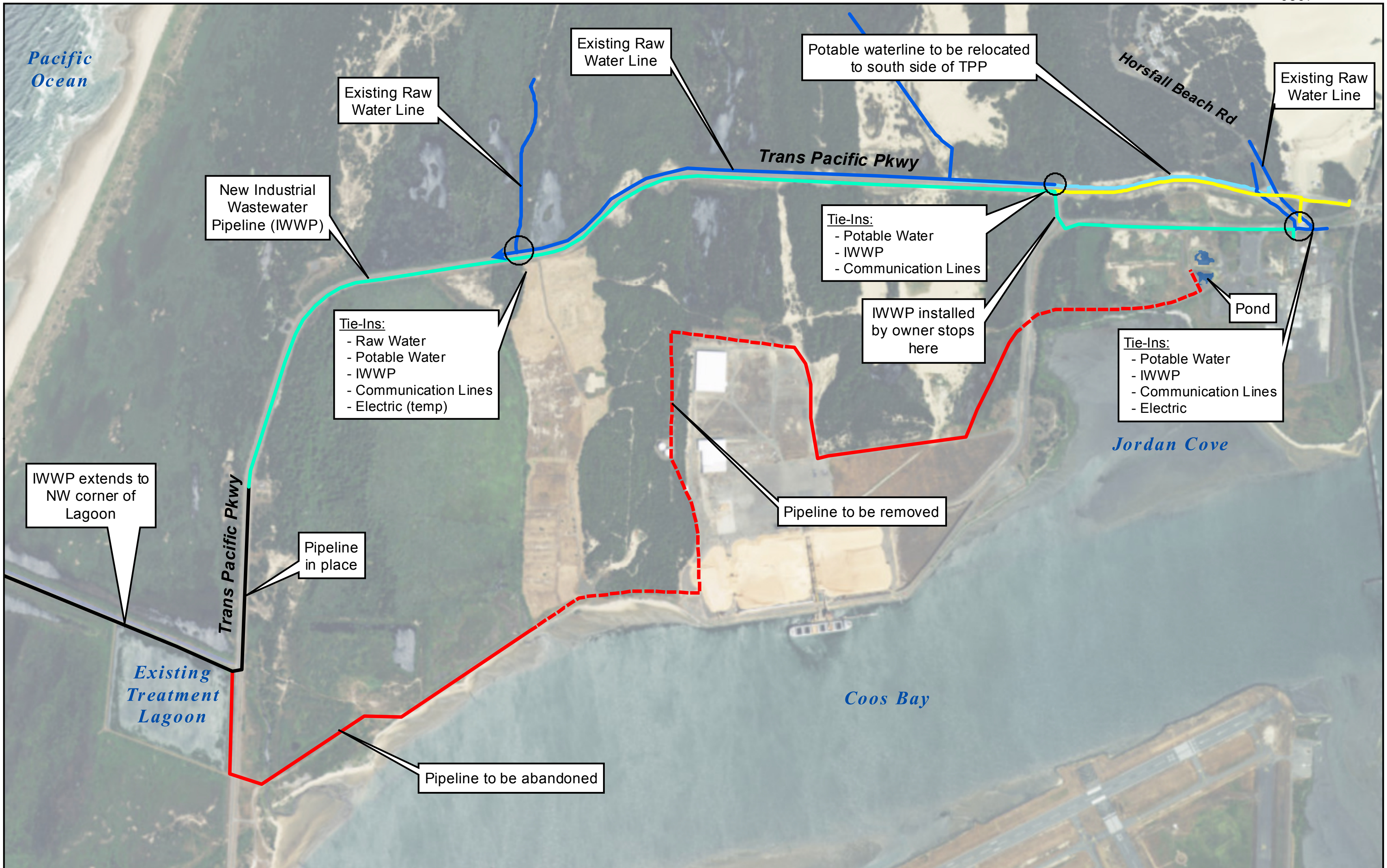
Jordan Cove Energy Project

Figure 1.3-10

USGS Topographic Map of the Project Site

Figure 1.4-1

Industrial Wastewater Pipeline and Water Pipelines Relocation



Jordan Cove Energy Project, L.P.

N

0 0.1 0.2 Miles

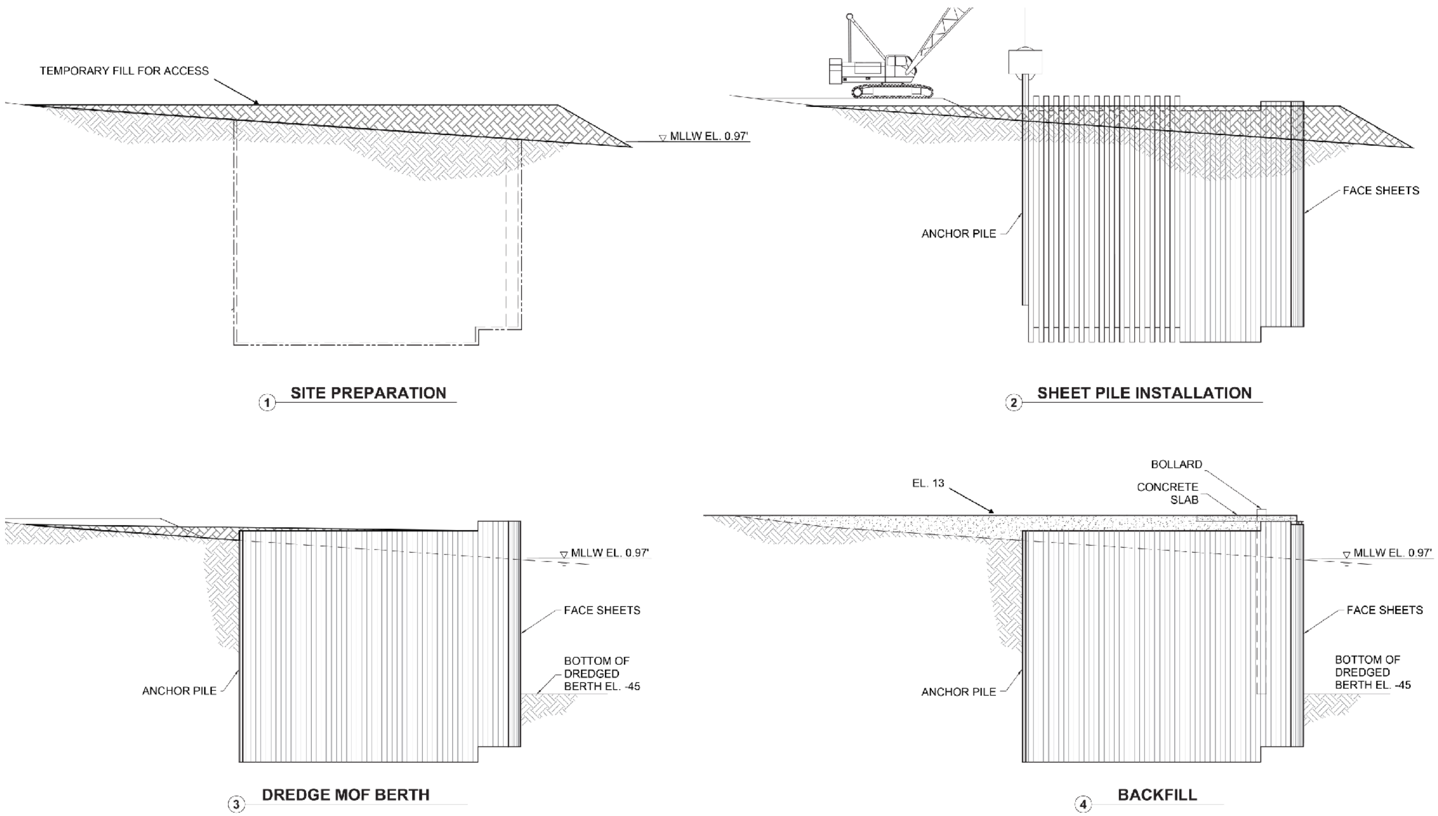
New Industrial Wastewater Pipeline (IWWP)	Existing Potable Water Line
Relocated Potable Water Line	Existing IWWP
Existing Raw Water Line	IWWP to be Removed
	IWWP to be Abandoned

Jordan Cove Energy Project

Figure 1.4-1

Industrial Wastewater Pipeline, Water Pipelines Relocation and Utility Tie-Ins

Figure 1.5-1
MOF Construction



Jordan Cove Energy Project, L.P.

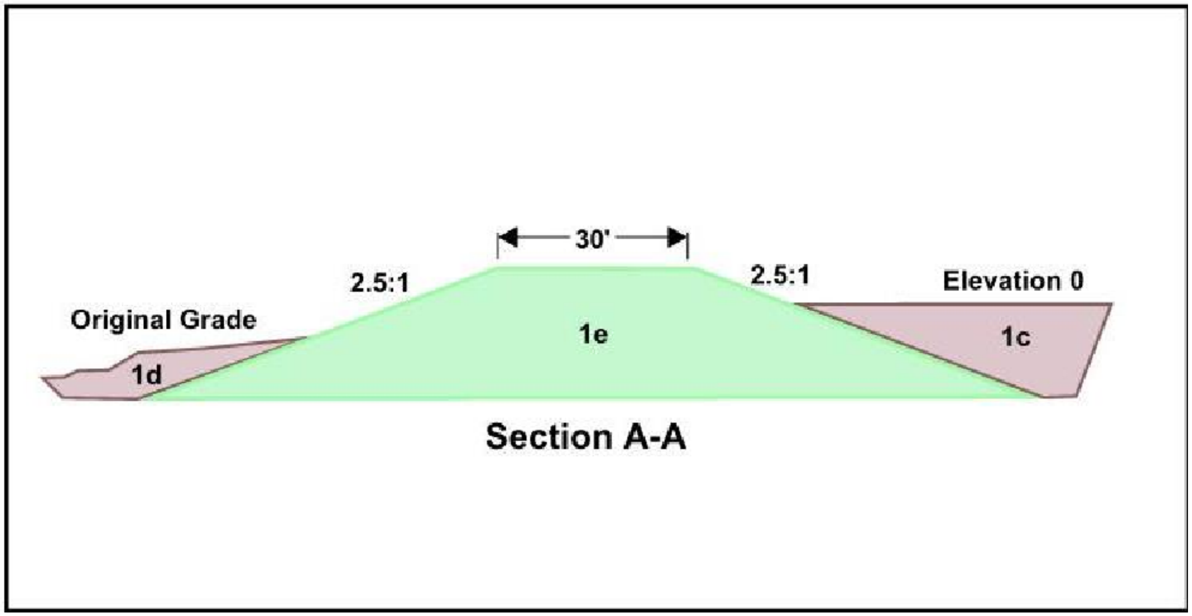
Jordan Cove Energy Project

Figure 1.5-1

MOF Construction

Figure 1.5-2

Earthwork Traffic Segregation



NOT TO SCALE

Jordan Cove Energy Project, L.P.

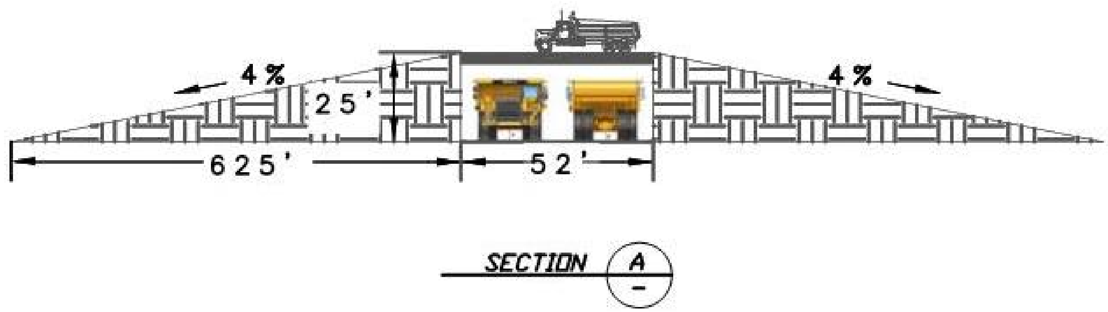
Jordan Cove Energy Project

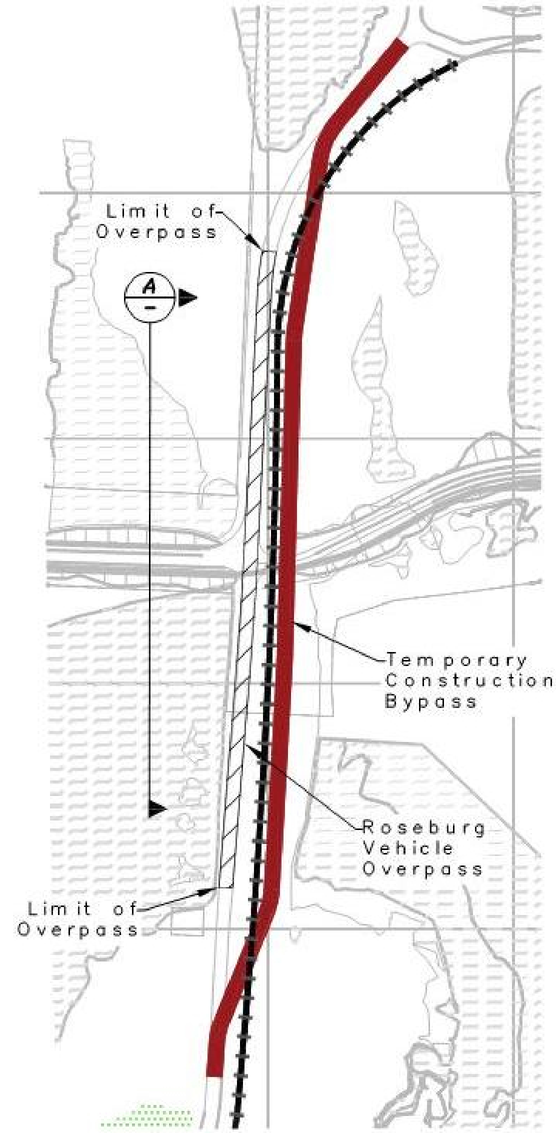
Figure 1.5-2

Conceptual Layout of Slip Construction Berm

Figure 1.5-3

Peat Location – Terminal Site





Jordan Cove Energy Project, L.P.

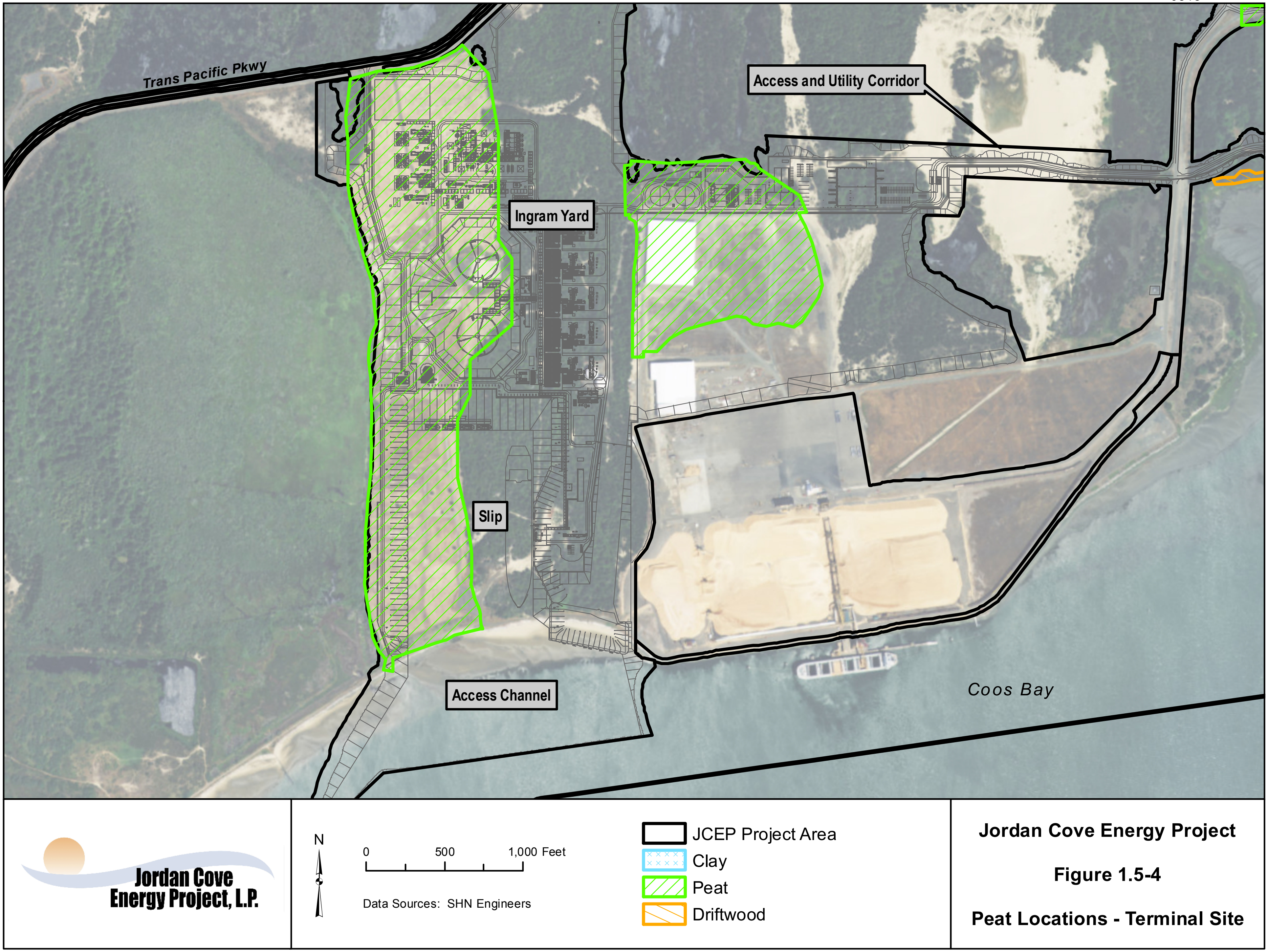
Jordan Cove Energy Project

Figure 1.5-3

Earthwork Traffic Segregation

Figure 1.5-4

Peat, Driftwood, and Clay Locations – South Dunes



Jordan Cove Energy Project, L.P.

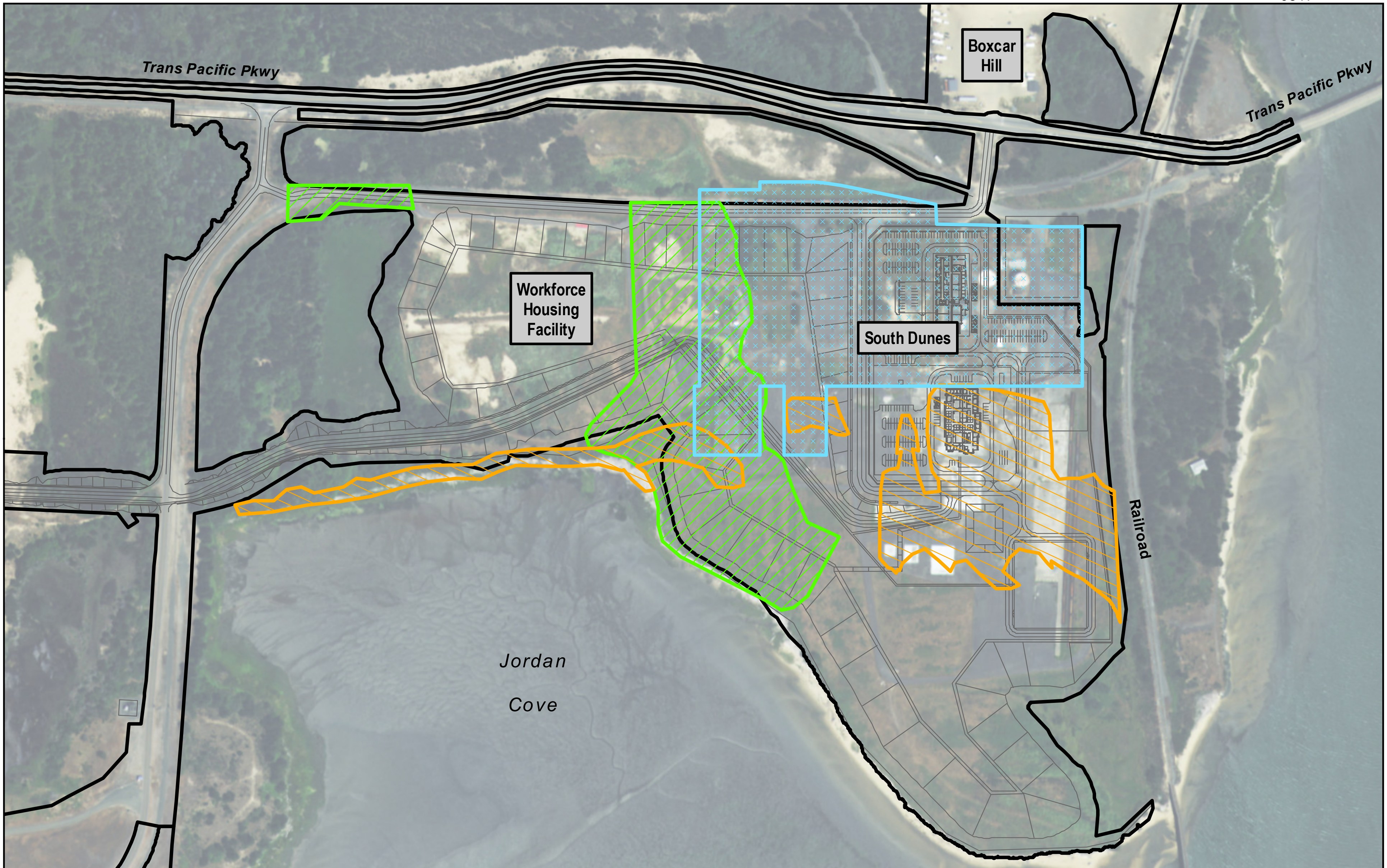
Jordan Cove Energy Project

Figure 1.5-4

Peat Locations - Terminal Site

Figure 1.5-5

Conceptual Layout of Slip Construction Berm



Jordan Cove Energy Project

Figure 1.5-5

Peat, Driftwood, and Clay Locations - South Dunes

Figure 1.5-6
Installation of Roof Petals

Jordan Cove Energy Project, L.P.

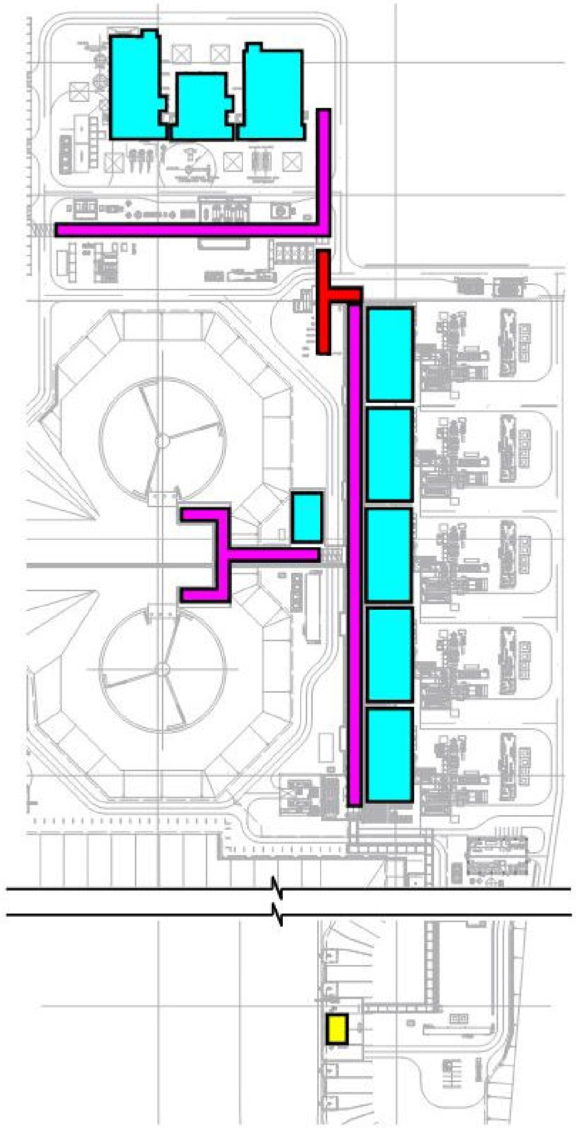
Jordan Cove Energy Project

Figure 1.5-6

Installation of Roof Petals

Figure 1.5-7

Example of Module Installation Phasing



Module Sequence Phase I: *Pipe rack modules in Liquefaction, Tank, Utility & Refrigerant Make-up areas installed.*

Module Sequence Phase II: *LNG Loadout Module installed at Marine Berth*

Module Sequence Phase III: *Equipment Modules installed starting with LNG Loadout Module, continued by the Liquefaction Train Modules with the Gas Conditioning modules alternating in.*

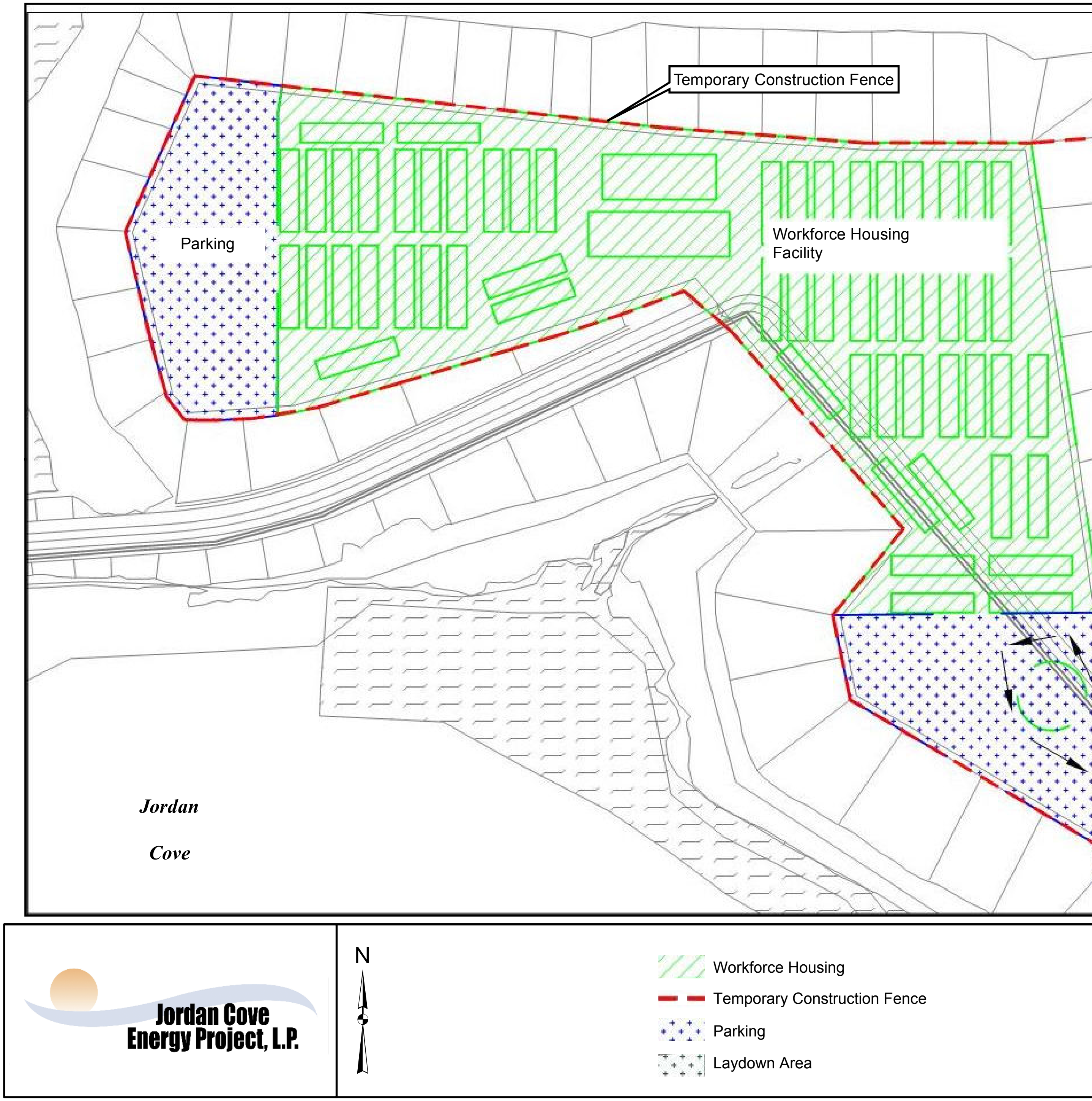
Module Sequence Phase IV: *Remaining Pipe Rack modules installed at intersection*

Jordan Cove Energy Project, L.P.	NOT TO SCALE	**Jordan Cove Energy Project** **Figure 1.5-7** **Example of Module Installation Phasing**

Figure 1.5-8

Workforce Housing Facility – South Dunes

(to be provided in subsequent filing)



Jordan Cove Energy Project

Figure 1.5-8

Worker's Camp Layout

Figure 1.9-1
Proposed utility connections

(to be provided in subsequent filing)

Figure 1.10-1

USGS Topographic Map of the JCEP LNG Terminal Project Site

Figure 1.10-2

Aerial Photography of the JCEP LNG Terminal Project Site

APPENDICES

APPENDIX A.1

Stakeholder List

Landowner List is enclosed under separate cover and marked

Contains Privileged Information—Do Not Release (CUI//PRIV)

Agency/Organization	Point of Contact	Title	Address
Landowners - Private			
Landowner lists, including contact information, are filed under seal as confidential and privileged.			
Federally Recognized Indian Tribes			
Confederated Tribes of Coos, Lower Umpqua & Siuslaw Indians			1245 Fulton Ave. Coos Bay, OR 97420
Confederated Tribes of Coos, Lower Umpqua & Siuslaw	Stacey Scott	Tribal Historic Preservation Officer	1245 Fulton Ave. Coos Bay, OR 97420
Confederated Tribes of Coos, Lower Umpqua & Siuslaw	Scott Wheat	Lawyer	1245 Fulton Ave. Coos Bay, OR 97420
Confederated Tribes of Coos, Lower Umpqua & Siuslaw	Phillip White	Director of Intergovernmental & External Affairs	1245 Fulton Ave. Coos Bay, OR 97420
Confederated Tribes of Coos, Lower Umpqua & Siuslaw	Chairman Ingersoll	Chairman, Position 3	1245 Fulton Ave. Coos Bay, OR 97420
Confederated Tribes of the Grande Ronde			9615 Grand Ronde Road Grand Ronde OR 97347
Confederated Tribes of the Grande Ronde	David Harrelson	Tribal Historic Preservation Officer	9615 Grand Ronde Road Grand Ronde OR 97347
Confederated Tribes of the Grande Ronde	Reynold L. Leno	Chairman	9615 Grande Ronde Road, Grande Ronde OR 97347
Confederated Tribes of Siletz Indians			201 SE Swan Ave. PO Box 549 Siletz, OR 97380
Confederated Tribes of Siletz Indians	Robert Kentta	Cultural Resource Program Director	202 SE Swan Ave. PO Box 549 Siletz, OR 97380
Confederated Tribes of Siletz Indians	Mike Kennedy	Natural Resource Manager	203 SE Swan Ave. PO Box 549 Siletz, OR 97380
Confederated Tribes of Siletz Indians	Stan Van de Wetering	Aquatic Program Leader	204 SE Swan Ave. PO Box 549 Siletz, OR 97380
Confederated Tribes of Siletz Indians	Brenda Bremner	General Manager	205 SE Swan Ave. PO Box 549 Siletz, OR 97380

Confederated Tribes of Siletz Indians	Delores Pigsley	Chairperson	206 SE Swan Ave. PO Box 549 Siletz, OR 97380
Cow Creek Band of Umpqua Tribe of Indians			2371 NE Stephens Street Roseburg, OR 97470
Cow Creek Band of Umpqua Tribe of Indians	Jason Robison	Natural Resource Management Director	2371 NE Stephens Street Roseburg, OR 97470
Cow Creek Band of Umpqua Tribe of Indians	Tim V. Redenburg	Forestry Director	2371 NE Stephens Street Roseburg, OR 97470
Cow Creek Band of Umpqua Tribe of Indians	Dan Courtney	Chairman	2371 NE Stephens, Suite 100 Roseburg, OR 97470
Cow Creek Band of Umpqua Indians	Jessie Plueard	Cultural Programs Manager & THPO	2371 NE Stephens Street, Suite 500 Roseburg, OR 97470
Coquille Indian Tribe			3049 Tremont Street North Bend, OR 97549
Coquille Indian Tribe	Kassandra Rippee	Tribal Historic Preservation Officer	3049 Tremont Street North Bend, OR 97549
Coquille Indian Tribe	Bridgett Wheeler	Cultural Resource Program Director	3049 Tremont Street North Bend, OR 97549
Coquille Indian Tribe	Brenda Meade	Chairperson	3049 Tremont Street North Bend, OR 97549
Coquille Indian Tribe	Don Ivy	Chief	3049 Tremont Street North Bend, OR 97549
The Klamath Tribes			PO Box 436 501 Chiloquin Blvd. Chiloquin, OR 97624
The Klamath Tribes	Don Gentry	Chairman	PO Box 436 501 Chiloquin Blvd. Chiloquin, OR 97624
The Klamath Tribes	Perry Chocktoot	Tribal Historic Preservation Officer	PO Box 436 501 Chiloquin Blvd. Chiloquin, OR 97624
Regulatory Agencies			
Federal Agencies			
Federal Energy Regulatory Commission (FERC)	John Peconom	Pre-filing Project Manager	888 First Street NE Washington, DC 20426

U.S. Department of the Interior	Jeff Bernstein	Attorney-advisor	620 Main St. #201 Portland, OR 97205
Department of Energy	Amy Sweeney	Director, Division of Natural Gas	Office of Regulation and International Engagement Office of Fossil Energy 1000 Independence Ave., SW Washington, DC 20585
US Army Corps of Engineers	Shawn Zinszer	Deputy Chief, Regulatory Branch	PO Box 2946 Portland, OR 97204-3495
US Army Corps of Engineers	Tyler Krug	Regulatory Project Manager	2201 N. Broadway Suite C North Bend, OR 97459
US Army Corps of Engineers	Teena Monical	Chief, Permits	PO Box 2946 Portland, OR 97204-3495
US Army Corps of Engineers	Marci Johnson	Section 408 PM	PO Box 2946 Portland, OR 97208
Bureau of Land Management	Cathy Harris	Program Manager	20 M St. SE Washinton DC 20500
Bureau of Land Management	Miriam Liberator	Planning and Environmental Coordinator	3040 Biddle Road Medford, OR 97504
Bureau of Land Management	Leslie A. Frewing	Planning Coordinator	1220 SW 3rd Ave. Portland, OR 97204 Mailing address: PO Box 2965 Portland, OR 97208
Bureau of Land Management	Diann Rasmussen	Land Realty Specialist	1220 SW 3rd Ave. Portland, OR 97204 Mailing address: PO Box 2965 Portland, OR 97208
Bureau of Land Management	Lenore Heppler	Branch Chief - Land, Minerals and Energy Resources	1220 SW 3rd Ave. Portland, OR 97204 Mailing address: PO Box 2965 Portland, OR 97208

US Forest Service	David Krantz	Project Manager	3040 Biddle Rd. Medford, OR, 97504
US Forest Service	Kristen Bonanno	Regional Energy Coordinator	1220 SW 3rd Ave. Portland, OR 97204
US Forest Service	Eric Johnston	Assistant Director Natural Resources	1220 SW 3rd Ave. Portland, OR 97204
Bureau of Reclamation	Lila Black	Realty Specialist	6600 Washburn Way Klamath Falls, OR 97603
Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA)	Buddy Seccor	Engineering and Research Division	1199 New Jersey Avenue, SE Washington, DC, 20590
Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA)	Sentho White	Engineering and Research Division	1200 New Jersey Avenue, SE Washington, DC, 20590
US Coast Guard	Captain William Timmons	Captain of the Port	2185 SW 12th Place Warrenton, OR 97146-9311
US Coast Guard	Laura Springer	Project Officer	6767 N. Basin Avenue Portland, OR 97217-3992
USCG Sector North Bend, OR	Captain Michael T. Trimpert	Sector Commander	Maple Leaf North Bend, OR 97459
Federal Aviation Administration (FAA)	Dan Shoemaker	Airspace Specialist; Seattle Obstruction Evaluation Group	1601 Lind Ave. SW, Renton, WA 98057
US Fish and Wildlife Service	Joe Zisa	Division Supervisor: Energy, Infrastructure, and Ecosystems Services Division	2600 SE 98th Ave. #100 Portland, OR 97266
US Department of Agriculture - Forest Service	Wes Yamamoto	Project Manager	Umpqua National Forest, 2900 NW Steward Parkway Roseurg, OR 97470
National Marine Fisheries Service	Jordan Carduner	NOAA Fisheries Office of Protected Resources; Permits and Conservation Division	1315 East West Hwy Silver Spring, MD, 20910
National Oceanic and Atmospheric Administration (NOAA) Fisheries	Ken Phippen	Lead of Oregon Coast Branch	2900 NW Steward Pkwy. Roseburg, OR, 97471
National Oceanic and Atmospheric Administration (NOAA) Fisheries	Chuck Wheeler	Fisheries Biologist	2900 Steward Pkwy. Roseburg, OR, 97471

State Agencies			
Oregon Department of State Lands	Gerry Hutson	Proprietary Coordinator-Aquatic Resource Management	775 Summer St NE, Suite 100 Salem, OR 97301
Oregon Department of State Lands	Jim Paul	Agency Director	775 Summer St NE, Suite 100 Salem, OR 97301
Oregon Department of State Lands	Bob Lobdell	Aquatic Resource Coordinator - Curry, Coos, Jackson	775 Summer St NE, Suite 100 Salem, OR 97301
Oregon Department of State Lands	Lynne McAllister	Jurisdiction Coordinator	775 Summer Street NE, St. 100 Salem, OR 97301
Oregon Department of State Lands	Eric Metz	Planning & Policy Manager - Aquatic Resource Management Program	775 Summer Street NE, St. 100 Salem, OR 97301
Oregon Department of Environmental Quality	Mary Camarata	Project Manager	165 E. 7th Ave, Suite 100 Eugene, OR, 97401
Oregon Department of Land Conservation and Development	Elizabeth Ruther	Federal Consistency Coordinator	635 Capitol Street NE, Suite 150 Salem, OR, 97301-2540
Oregon Department of Land Conservation and Development	Patty Snow	Ocean and Coastal Services Division Manager	636 Capitol Street NE, Suite 150 Salem, OR, 97301-2540
Oregon Department of Land Conservation and Development	Dave Perry	South Coast Representative	636 Capitol Street NE, Suite 150 Salem, OR, 97301-2540
Oregon Department of Fish and Wildlife	Sarah Reif	Energy Coordinator	4034 Fairview Industrial Drive SE Salem, OR, 97302
Oregon Department of Fish and Wildlife	Greg Apke	Fish Passage Coordinator	4034 Fairview Industrial Drive SE Salem, OR, 97302
Oregon Department of Fish and Wildlife	Chris Claire	Habitat Protection Biologist in SW Oregon	4035 Fairview Industrial Drive SE Salem, OR, 97302
Oregon Department of Fish and Wildlife	Jon Germond	Habitat Program Manager	4036 Fairview Industrial Drive SE Salem, OR, 97302
Oregon State Historic Preservation Office (SHPO)	Christine Curran	Division Director, Heritage Programs	725 Summer Stree NE, Suite C Salem, OR, 97301
Oregon State Historic Preservation Office (SHPO)	John Pouley	Assistant State Archaeologist	725 Summer Stree NE, Suite C Salem, OR, 97301

Oregon State Historic Preservation Office (SHPO)	Jessica Gabriel	Historic Preservation Specialist	726 Summer Stree NE, Suite C Salem, OR, 97301
Oregon Department of Energy	Deanna Henry	Director - Health, Safety, and Secturity	550 Capitol Street NE, 1st Floor Salem, OR 97301
Oregon Department of Energy	Todd Cornett	Assistant Director	550 Capitol Street NE, 1st Floor Salem, OR 97301
Oregon Department of Energy	Sean Mole	Federal Projects Coordinator	550 Capitol Street NE, 1st Floor Salem, OR 97301
Oregon Department of Energy	Ken Niles	Assistant Director	550 Capitol Street NE, 1st Floor Salem, OR 97301
Oregon Department of Energy/Oregon State Historic Preservation Office (SHPO)	Dennis Griffin	State Archeaologist	550 Capitol Street NE, 1st Floor Salem, OR 97301
Oregon Department of Transportation Region 3	Frank Reading	SW Oregon Region Manager	3500 NW Stewart Parkway, Roseburg, OR 97470
Oregon Department of Justice	Chuck Cogburn	Director	1162 Court St, NE, Salem, OR 97301-4096
Oregon Department of Aviation	Jeff Caines	Aviation Planner	3040 25th St., SE Salem, OR 97302-1125
Oregon Building Codes Division	Chris Huntington	Deputy Administrator	1535 Edgewater St., NW, Salem, OR 97304
Oregon Building Codes Division	Mark Long	Director	1535 Edgewater St., NW, Salem, OR 97304
Oregon Building Codes Division	Shane Sumption	Building Services Manager	1535 Edgewater St., NW, Salem, OR 97304
Oregon Water Resources Department	Greg Wacker	Watermaster	Watermaster District 19 Coos County Courthouse Coquille, OR 97423
Oregon Water Resources Department	Jerry Sauter	Water Rights Program Analyst	725 Summer Street NE, Ste. A Salem, OR, 97301
Oregon Department of Forestry	Josh Barnard	Field Support Unit Manager	2600 State Street, Bldg A Salem, OR 97310
Local Agencies			
Coos County Planning Department	Jill Rolfe	Planning Director	225 N. Adams Street Coquille, OR, 97423
Douglas County Planning Department	Keith Cubic	Planning Director	Justice Building, Douglas County Courthouse, Room 106 Roseburg, OR, 97470

Klamath County Planning Department	Mark Gallagher	Planning Director	305 Main Street Klamath Falls, OR 97601
City of North Bend	Mike Stebbins	City Attorney	745 California Street P.O. Box 1006 North Bend, OR 97459
City of North Bend	Terence O'Connor	City Administrator	North Bend, OR
City of Coos Bay	Roger Craddock	City Aministrator	Coos Bay, OR
Port Authority of Coos Bay	John Burns	CEO	125 Central Ave Suite 300 Coos Bay, OR 97420-0311
Douglas County Commission	Kevin Potter	Director, IT, Facilities, Land, Radio departments	1036 SE Douglas Ave Roseburg, OR 97470
Southern Oregon Regional Airport	Theresa Cook	Executive Director	1100 Airport Lane, North Bend, OR 97459
Elected Officials			
Federal Elected Officials			
Office of Senator Ron Wyden (OR)			221 Dirksen Senate Office Building Washington, DC 20510
Office of Senator Jeff Merkley (OR)			313 Hart Senate Office Building Washington, DC 20510
Office of Congressman Peter DeFazio (OR)			2134 Rayburn Office Building Washington, DC 20515
Office of Congressman Greg Walden (OR)			2185 Rayburn House Office Building Washington, DC 20515
Office of Congressman Kurt Schrader (OR)			2431 Rayburn House Office Building Washington, DC 20515
Office of Senator John Barrasso (WY)			307 Dirksen Senate Office Building Washington, DC 20510
Office of Senator Cory Gardner (CO)			354 Russell Senate Office Building Washington, DC 20510
Office of Senator Mike Enzi (WY)			379A Senate Russell Office Building Washington, DC 20510
Office of Senator Michael Bennet (CO)			261 Russell Senate Office Building Washington, DC 20510
Office of Senator Lisa Murkowski (AK)			709 Hart Senate Office Building Washington, DC 20510

Office of Senator Orrin Hatch (UT)			104 Hart Office Building Washington, DC 20510
Office of Senator Mike Lee (UT)			361A Russell Senate Office Building Washington, DC 20510
Office of Rep. Scott Tipton (CO)			218 Cannon House Office Building Washington, DC 20515
Office of Rep. Ken Buck (CO)			1130 Longworth House Office Building Washington, DC 20515
Office of Rep. Doug Lamborn (CO)			2402 Rayburn House Office Building Washington, DC 20515
Office of Rep. Mike Coffman (CO)			Rayburn House Office Building Room 2443 Washington, DC 20515
Office of Rep. Ed Perlmutter (CO)			1410 Longworth House Office Building Washington, DC 20515
Office of Rep. Rob Bishop (UT)			123 Cannon Building Washington, DC 20515
Office of Rep. Jason Chaffetz (UT)			2236 Rayburn House Office Building Washington, DC 20515
Office of Rep. Chris Stewart (UT)			323 Cannon House Office Building Washington, DC 20515
Office of Rep. Mia Love (UT)			217 Cannon House Office Building Washington, DC 20515
Office of Senator Lisa Murkowski (AK)			709 Hart Senate Office Building Washington, DC 20510
Rocky Mountain Congressional Offices (WY, UT, CO)			354 Russell Senate Office Building Washington, DC 20510
State Elected Officials			
Office of Gov. Kate Brown			State Capitol Building 900 Court Stree NE, 160 Salem, OR 97301
Office of State Senator Arnie Roblan	Arnie Roblan	Senator	900 Court St. NE, S-417 Salem, OR 97301
Office of State Senator Herman Baertschiger	Herman Baertschiger	Senator	900 Court St. NE, S-403 Salem, OR 97301

Office of State Senator Jeff Kruse	Jeff Kruse	Senator	900 Court St. NE, S-315 Salem, OR 97301
Office of State Senator-elect Alan DeBoer	Alan DeBoer	Senator-elect	900 Court St. NE, S-421 Salem, OR 97301
Office of State Senator-elect Dennis Linthicum	Dennis Linthicum	Senator-elect	900 Court St. NE, S-305 Salem, OR 97301
Office of State Representative Caddy McKeown	Caddy McKeown	Representative	900 Court St. NE, H-476 Salem, OR 97301
Office of State Representative Duane Stark	Duane Stark	Representative	900 Court St. NE, H-372 Salem, OR 97301
Office of State Representative Carl Wilson	Carl Wilson	Representative	900 Court St. NE, H-390 Salem, OR 97301
Office of State Representative Sal Equivel	Sal Equivel	Representative	900 Court St. NE, H-483 Salem, OR 97301
Office of State Representative Mike McLane	Mike McLane	Representative	900 Court St. NE, H-395 Salem, OR 97301
Office of State Representative Dallas Heard	Dallas Heard	Representative	900 Court St. NE, H-386 Salem, OR 97301
Office of State Representative-David Brock Smith	David Brock Smith	Representative	900 Court St., NE, H-379, Salem, OR 97301
Local Elected Officials			
Coos County Commission	Bob Main	Commissioner	250 N Baxter St. Coquille, OR 97423
Coos County Commission	John Sweet	Commissioner	251 N Baxter St. Coquille, OR 97423
Coos County Commission	Melissa Cribbins	Commissioner	252 N Baxter St. Coquille, OR 97423
Coos County Assessor	Steve Jansen	Assessor	252 N Baxter St. Coquille, OR 97423
Douglas County Commission	Tim Freeman	Commissioner	1036 SE Douglas Ave. RM 217 Roseburg, OR 97470
Douglas County Commission	Chris Boice	Commissioner	1037 SE Douglas Ave. RM 217 Roseburg, OR 97470
Douglas County Commission	Gary Leif	Commissioner	1038 SE Douglas Ave. RM 217 Roseburg, OR 97470

Jackson County Commission	Colleen Roberts	Commissioner	Jackson County Courthouse 10 S Oakdale Ave. Room 214 Medford, OR 97501
Jackson County Commission	Rick Dyer	Commissioner	Jackson County Courthouse 10 S Oakdale Ave. Room 214 Medford, OR 97501
Jackson County Commission	Bob Strosser	Commissioner	Jackson County Courthouse 10 S Oakdale Ave. Room 214 Medford, OR 97501
Klamath County Commission	Kelley Minty Morris	Commissioner	Klamath County Commissioners 305 Main St #224, Klamath Falls, OR 97601
Klamath County Commission	Donnie Boyd	Commissioner	Klamath County Commissioners 305 Main St #224, Klamath Falls, OR 97602
Klamath County Commission	Derrick DeGroot	Commissioner	Klamath County Commissioners 305 Main St #224, Klamath Falls, OR 97602
Community Organizations			
Bay Area Chamber of Commerce			145 Central Ave. Coos Bay, OR 97420
Roseburg Area Chamber of Commerce			410 SE Spruce St. Roseburg, OR 97420
Reedsport/Winchester Bay Chamber of Commerce			2741 Frontage Road Reedsport, OR 97467
Medford/Jackson Chamber of Commerce			101 East 8th Street Medford, OR 97501
Klamath County Chamber of Commerce			205 Riverside Drive, Suite A Klamath Falls, OR 97601
BOOST Southwest Oregon			434 NW6th Ave., #302, Portland, OR 97209
South Coast Development Council, Inc.			50 Central Ave., Suite A Coos Bay, OR 97420
The Partnership for Economic Development In Douglas County			522 SE Washinton Ave., Ste 107, Roseburg, OR 97420

Coos Bay Pilots Organization			686 N. Front Street Coos Bay, OR 97420
Bay Area Hospital			1775 Thompson Road Coos Bay, OR 97420
CCD Regional Development - Roseburg Branch			522 SE Washington Ave. Suite 111A Roseburg, OR 97470
CCD Regional Development - North Bend Branch			2455 Maple Leaf PO Box 444 North Bend, OR 97459
Coos Curry Housing Authority			1700 Monroe Street North Bend, OR 97459
Bandon Kiwanis Club			PO Box 1763 Bandon, OR 97411
Klamath County Economic Development Association			205 Riverside Drive, Suite E Klamath Falls, OR 97601
Southwestern Oregon Community College			1988 Newmark Ave. Coos Bay, OR 97420
Oregon Business Development Department			775 Summer St. NE, Suite 200 Salem, OR 97301
South Coast Education Service District			1350 Teakwood Ave. Coos Bay, OR 97420
Non-Governmental Organizatins, Local Sepcial Interest and Advocacy Groups			
The Ark			755 S. 7th Street Coos Bay, OR 97420
Reedsport Church of God, Project Blessing Food Pantry			2191 Birch Avenue Reedsport, OR 97467
South Umpqua Historical Society			Pioneer-Indian Museum PO Box 1112 421 SW 5th Street Canyonville, OR 97417
South Coast Family Harbor			250 Hull St. Coos Bay, OR 97420 Mailing address: PO Box 413

Bay Area Enterprises			200 North Ross Street Coos Bay, OR 97420
Southwest Oregon Workforce Investment Board			990 S 2nd St. Coos Bay, Or 97420
North Bend Senior Center			1470 Airport Lane North Bend, OR 97459
JPR Foundation, Inc. Holly Theatre Restoration Project			1250 Siskiyou Blvd Ashland, OR 97520
THE House			745 Koos Bay Blvd. PO Box 418 Coos Bay, OR 97420
South Coast Hospice & Palliative Care Services			1620 Thompson Road Coos Bay, OR 97420
Coos County Airport District dba Southwest Oregon Regional Airport			1100 Airport Lane Notth Bend, OR 97411
Star of Hope			657 Newmark Ave. Coos Bay, OR 97420
Southwest Oregon Veterans Outreach			Pony Village Mall, Suite 212 1611 Virginia Ave. Box 406 North Bend, OR 97459
The Friendly Kitchen			1771 W. Harvard Ave. Roseburg, OR 974711
Lighthouse School			62858 Highway 101 Coos Bay, OR 97420
Nancy Devereux Center			1200 Newmark Ave. Coos Bay, OR 97420
Citizens Against LNG			PO Box 1113 North Bend, OR 97459
Rogue Riverkeeper			PO Box 102 Ashland, OR 97520
Rogue Climate			PO Box 1980 Phoenix, OR 97535
Southern Oregon Climate Action Now (SOCAN)			7113 Griffin Lane Jacksonville, OR
Southern Oregon Rising Tide (SORT)			

League of Women Voters			PO Box 8555 Medford, OR 97501
Emergency Responders			
Douglas County Emergency Management			1036 SE Douglas Avenue Roseburg, OR 97470
Jackson County Sheriff's Office			5179 Crater Lake Hwy. Central Point, OR 97502
Klamath County Emergency Management			305 Main Street (Mailing) 2543 Shasta Way (Physical) Klamath Falls, OR 97603
Klamath County Emergency Management			305 Main Street (Mailing) 2543 Shasta Way (Physical) Klamath Falls, OR 97603
Coos County Sherriff's Office			250 N. Baxter Coquille, OR 97423
Coos County Emergency Response			250 N. Baxter Coquille, OR 97423
Coos Bay Sherriff's Office			City Hall, 500 Central Ave. Coos Bay, OR 97420
North Bend Sherriff's Office			PO Box "B" 835 California Avenue North Bend, OR 97459
North Bend Fire Department			PO Box "B" 835 California Avenue North Bend, OR 97460
North Bay Fire Department			1880 McPherson Ave., North Bend, OR 97459
Charleston Fire Department			92342 Cape Arago Hwy. Coos Bay, OR 97420
Hauser Fire Department			93622 Viking Ln. North Bend, OR 97459
Oregon State Police			1499 Airport Lane North Bend, OR 97459
State Fire Marshall			3565 Trelstad Ave., SE Salem, OR 97317

Malin Rural Fire Protection District			2307 3rd Street and Hwy 50 Malin, OR 97632 PO Box 195
Labor/Trades - State and National			
United Association of Jorneyment and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada			3 Park Place Annapolis, Maryland 21401
Oregon Building and Construction Trades Council			3535 SE 86th Ave, Portland, OR 97266
Washington Building and Construction Trades Council			Olympia, WA
Int'l Brotherhood of Electrical Workers Local 112			2637 W. Albany St., Kennewick, WA 99336
Int'l Brotherhood of Electrical Workers Local 280			PO Box 404, Tangent, OR 97389
Int'l Brotherhood of Electrical Workers Local 659			4480 Rogue Valley Hwy. Ste. 3, Central Point, OR 97502
Int'l Brotherhood of Electrical Workers Local 932			3427 Ash St. North Bend, OR 97459
Elevator Constructors Local 23			12067 NE Glenn Widing Dr., Ste 108, Portland, OR
Glass Workers Local 740			11105 NE Sandy Blvd.,Portland, OR
Ironworkers Local 29			11620 NE Ainsworth Cir #200, Portland, OR
Ironworkers Local 516			11620 NE Ainsworth Cir #200, Portland, OR
Ironworkers District Council - Pacific NW			110 Main St., Ste. 100, Edmonds, WA 98020
Laborers Local 737			17230 NE Sacramento St., Portland, OR
Painters Local 10			11105 NE Sandy Blvd., Portland, OR
Painters Local 724/1277			Salem, OR
Painters District Council No. 5			6770 E. Marginal Way S.Bldg E-321, Seattle, Washington
Plumbers and Steamfitters Local 290			20210 SW Teton Ave., Tualatin, OR
Roofers Local 49			5032 SE 26th Ave.,Portland, OR
Sheet Metal Local 16			2379 NE 178th Ave.,Portland, OR
Sprinkler Fitters Local 669			7050 Oakland Mills Rd.,#100,Columbia, MD
Joint Council of Teamsters Local 37			1872 NE 162nd Ave.,Portland, OR
Teamsters Local 162 - Auto Truck Drivers			1850 NE 162nd Ave.,Portland, OR
Teamsters Local 206			1860 NE 162nd Ave, Portland, Oregon
Operating Engineers Local 701			555 1st St.,Gladstone, OR
Pacific Northwest Regional Council of Carpenters			25120 Pacific Hwy S #200, Kent, WA

Media - Local and State			
The World			350 Commercial St. Coos Bay, OR
The Register Guard			3500 Chad Drive Eugene, OR, 97408
The Mail Tribune			P.O. Bos 1108 Medford, OR, 97501
The Herald & News			2701 Foothaills Blvd. Klamath Falls, OR, 97601
The News-Review			345 NE Winchester ST Roseburg, OR, 97470
The Oregonian			1500 SW First Avenue Portland, OR, 97201
Oregon Public Broadcasting			7140 SW Macadam Avenue Portland, OR, 97219
Southern Oregon Business Journal			703 Divot Loop Sutherlin, OR, 97479
Bloomberg			
KQEN Radio Station			1445 W Harvard Ave Roseburg, OR, 97471
Argus Media			
Natural Gas Intel			22648 Glenn Dr., St.305, Sterling, VA 20164
The Grant Junction Daily Sentinel			734 S 7th St., Grand Junction, CO 81501
Sentinel			61 E 1s St., Coquille, OR 97423
KCBY			3451 Broadway St., North Bend, OR 97459
Politico			1000 Wilson Blvd, 8th Floor Arlington, VA 22209

APPENDIX B.1

Cumulative Impact Analysis

EXHIBIT 6

Michael Graybill
63840 Fossil Point Road,
Coos Bay OR 97420

15 January 2019

To whom it may concern:

This cover letter and the narrative contained in this transmittal are submitted in response to a solicitation for comments on a joint permit application issued by the Oregon Department of State Lands (DSL) on 7 November, 2018. The relevant DSL reference number is "60697 Revised". The permit application was submitted to the Department of State Lands by Jordan Cove Energy Project L.P. The work proposed in the Joint Permit Application will support the proposed construction of a Liquefied Natural Gas Export terminal and a 229-mile-long high-pressure natural gas pipeline to supply the liquefaction terminal to be constructed on the shore of the Coos Estuary in Oregon.

The comments attached to this letter are based on my review of the materials presented in the DSL joint permit application. I have structured the comments in a format that I hope will assist personnel responsible for making decisions on the permit. The comments included in this document are primarily directed a part one of the application materials which address aspects of the LNG terminal and LNG transport elements of the project. My comments do not include a review of aspects of the natural gas transport pipeline as there was insufficient time to conduct an analysis of this aspect of the project. The comments and examples provided herein are not exhaustive but should provide illustrative examples of salient features of the material presented in the application to substantiate why the permit application fails to meet the criteria for issuance of a permit as outlined in ORS 196.800 -196.990, OAR 141-085-0506 – OAR 141-085-0550 and other policies and practices governing the activities of the Department. **The information and analysis of the application provided in these comments support a decision to deny the permit as requested by the applicant.**

Comments attached to this letter are presented in thematic chapters in order to facilitate your review. The chapters relate to discreet aspects of the activities encompassed in the DSL joint permit application. A description of the chapter headings follows:

Chapter 1 Introduction and overview of comments including reasons to substantiate a **decision to deny** issuance of the requested fill and removal permit based on DSL joint permit application
Chapter 2 Comments regarding proposed dredged material transport and disposal
Chapter 3 Comments on the proposed wetland impact mitigation actions
Chapter 4 Comments on the proposed navigation access channel
Chapter 5 Comments on the proposed navigation reliability improvement actions
Chapter 6 Comments relating to proposed horizontal directional drilling operations
Chapter 7 Comments regarding the feasibility of the work proposed.
Chapter 8 Comments regarding the Access and Utility Corridor

Chapter 9 Comments regarding wetland impacts not discussed in the application
Chapter 10 Comments regarding the pile dike rock apron
Chapter 11 Comments regarding the marine slip and tanker berth
Chapter 12 Comments regarding the impacts to recreation, fishing and public uses
Chapter 13 Comments regarding errors, omissions and insufficiencies of the application.
Chapter 14 Marine slip tsunami considerations
Chapter 15 Environmental Justice Considerations.

The analysis and the examples provided in these comments should provide ample evidence to substantiate a decision to deny the permit request. Thank you for providing an opportunity to comment on the proposed work. If you have any questions or require additional analysis in order to support a decision to deny this permit, please do not hesitate to contact me.

Kind Regards

Michael Graybill
Cell: 541 294-8235
mhodbill@gmail.com

Comments of Michael Graybill in response to DSL joint permit application and call for comments on a proposal from Jordan Cove Energy Project L.P. to the Oregon Department of State Lands on 7 November 2018.

Chapter 1: INTRODUCTION AND OVERVIEW OF COMMENTS INCLUDING REASONS TO SUBSTANTIATE A DECISION TO DENY ISSUANCE OF THE PERMIT

Permits and authorizations sought regarding work proposed in DSL joint permit application should be denied for the reasons listed in this and subsequent chapters of this document.

1. Pending actions by other permitting agencies may render parts or the entirety of this request moot.

A decision to approve the work described in the permit application may potentially pre-empt or conflict with two comprehensive National Environmental Policy Act (NEPA) decision making processes related to this project. Both reviews are in progress and will address aspects of the work described in the DSL permit application subject the federal NEPA evaluations. The Federal Energy Regulatory Commission (FERC) is in the process of preparing an Environmental Impact Statement (EIS) in response to a request initiated by the same applicant who submitted DSL joint permit application 60697. As required by NEPA, the EIS being prepared by FERC will include a thorough analysis of alternatives to the proposed action. Although this application is also subject to an analysis of alternatives by DSL as outlined in OAR 131-085-0565 and ORS 196.600 – 196.99 the DSL joint permit application lacks an analysis of alternatives of salient aspects of the proposed work. The Records of Decision resulting from the FERC EIS and a second EIS being prepared by the USACE to evaluate options to deepen and widen the Federally authorized navigation channel in the Coos Estuary may render some, or all, of the proposed actions included in this permit application moot or unviable. No action on this permit should be taken that would pre-empt or be inconsistent with implementation of the actions embodied by the forthcoming Records of Decisions linked to the FERC EIS and USACE EIS referenced above. The only action available to assure that an agency decision on this permit application does not pre-empt or conflict with the forthcoming Records of Decision is to deny the permit and the authorization requests embodied in it.

2. Information presented in the application may not represent the entirety of the project's impacts; the application does not adequately demonstrate that the work proposed has "independent utility".

The Department of State Lands should thoroughly evaluate the "independent utility" of this permit application prior to issuing a permit decision (see OAR 141-085-0565). Several factors raise questions related to the independent utility of this permit application. One factor is the fact that in 2018, the applicant paid $4 million to the Port of Coos Bay to support the evaluation of a plan to deepen and widen the federal navigation channel in the Coos Estuary. The EIS being prepared by the US Army Corps of Engineers is being conducted at the request of the Port of Coos Bay but the applicant of DSL permit 60697 is financing costs related to the preparation of the EIS in large measure. When the applicant's financial support of a proposal to expand the Federal navigation channel is coupled with the applicant's proposal to construct a marine slip capable of berthing LNG carriers that significantly exceed the current maximum vessel size authorized by the US Coast Guard, it is reasonable to question if the full scope of the project includes expanding the Federal navigation channel in addition to the work proposed in the DSL joint permit application. If authorized, expansion of the Federal Navigation Channel may involve dredging up to 15 million cubic yards of sediment and bedrock from the Coos Estuary and disposal of dredged material on the seabed in or near the boundary of the state territorial sea. The EIS for the Federal Navigation Channel expansion project is the project referenced in comment 1 (above). Additional comments regarding the request to construct a marine slip to accommodate vessels larger than those permitted by the US Coast Guard for the current federal navigation channel are included in specific chapters following these general comments.

It is reasonable for a reviewer to question the full scope of the applicant's plan to develop an LNG export terminal in the Coos Estuary. The DSL is required to determine if a permit application has "independent utility" (OAR 141-085-0565 (3)(a). If a bona fide nexus exists between the work outlined in DSL joint permit application 60697 and the proposal to deepen and widen the federal navigation channel in the Coos Estuary, permit 60697 should be denied because it fails to demonstrate that the requested work outlined in the application has "independent utility" as referenced in OAR 141-085-0565.

3. Reasonable alternatives to the actions proposed have not been identified or evaluated. In some proposed actions having impacts to wetlands, no alternatives to the proposed action have been enumerated or evaluated.

The DSL joint permit application fails to provide a thorough articulation and analysis of practicable alternatives to numerous actions having significant potential impacts to the wetlands and waters of the state. Oregon Revised Statutes and Administrative rules obligate DSL to first consider options that avoid or minimize impacts to wetlands and waterways. Numerous actions outlined in the application with potentially serious permanent impacts are presented without any articulation or analysis of alternatives to the proposed actions. The information presented in the DSL joint permit application lacks sufficient detail and analysis to enable reviewers to determine if, or how, the applicant determined the actions proposed most effectively avoid or minimize environmental and social impacts while addressing the stated need for the project. An incomplete list of illustrative examples is provided below. Additional examples are outlined in Chapters 2-13:

a) The site selection analysis used to substantiate the preferred location at the port of Coos Bay failed to consider Humboldt Bay California as a potential export terminal alternative. Using Google maps, the straight line distance between the proposed Malin Oregon natural gas transport hub and the port of Coos Bay, Oregon is approximately 172 miles. The straight line distance between the Malin, Oregon gas pipeline hub and the port of Humbolt Bay, California is approximately 163 miles. Both Ports have similar transport distances to possible LNG import destinations in Asia. As an example the distance to Tokyo Japan from Humboldt Bay is 4,950 miles. The distance from Coos Bay is 4,870 miles. The Federal navigation channel in Humboldt bay is maintained by the US Army Corps of Engineers at a depth of 38' and a width of 400'; larger than the navigation channel in the Coos Estuary thus exceeding the necessary navigation channel specifications defined by the applicant:
https://www.spn.usace.army.mil/LinkClick.aspx?fileticket=3_WqkYwno-o%3d&portalid=68
I found no reference to Humboldt Bay in the analysis of alternative sites even though this site appears to have some of the attributes used to evaluate other potential sites.

b) The analysis of alternatives used by the applicant is not comprehensive or robust. The applicant appears to have structured the analysis of alternative site locations by choosing locations in Oregon and Washington and then applying selection criteria to assure that the locations evaluated are less desirable than the Jordan Cove site. The DSL application materials related to site selection could readily be interpreted as having been reverse engineered to substantiate the foregone conclusion that the Ingram yard site is the only suitable location. The analysis of alternatives used to substantiate the selection of Coos Bay as the only suitable site capable of meeting the stated purpose of the project is inadequate because the analysis fails to include at least one potential alternative location in the analysis.

c) The scope and complexity of individual elements of this project involve wetland impacts that exceed the entire scope and complexity of many individual permit applications submitted to the Department. As presented, the application lacks sufficient information to enable reviewers to determine if individual work elements proposed are the alternatives that most effectively avoid or minimizs impacts to wetlands. No permit should be issued until the applicant has demonstrated that the impacts to wetlands of the individual tasks outlined in the proposed work are unavoidable. The material provided in the application has failed to pass this test and the permit should be denied.

d) I was unable to locate any discussion of alternatives related to the design of the navigation access channel, the pile dike rock apron, the eelgrass mitigation site selection or the analysis of alternative approaches to the proposed partial dike removal strategy that is the basis of the Kentuck wetland mitigation project design.

e) I have structured my comments to address individual project elements so it is possible to evaluate the full scope of each project element having potential to impact wetlands and waterways. The hope is that this approach will facilitate a thorough evaluation of each project element including the description of the need for action proposed, the analysis of alternatives to the proposed actions considered to avoid or minimize wetland impacts and the actions to be taken to compensate for unavoidable impacts.

4. The size of the facility required to meet the purpose of the project has not been adequately substantiated.

The statement of need to construct a liquefaction facility having an annual capacity of 7.8 million tonnes per annum is inadequately substantiated in the DSL joint permit application. It is not possible to determine if all of the impacts to wetlands and waterways associated with the proposal (including but not limited to the need for the navigation reliability improvements or the pile dike rock apron) are required to meet the stated purpose of the project.

OAR 141-085-0550 (5) (f) requires:

"(f) A description of the project purpose and need for the removal or fill. All projects must have a defined purpose or purposes and the need for removal or fill activity to accomplish the project purpose must be documented. *The project purpose statements and need for the removal or fill documentation must be specific enough to allow the Department to determine whether the applicant has considered a reasonable range of alternatives*." (emphasis added)

Section (3) of the application Project purpose and need (Page 2) states:

"The Project is a market driven response to the burgeoning and abundant natural gas supply in the US Rocky Mountains and Western Canada markets and the growth of international demand, particularly in Asia. The overall Project purpose and need is to construct a natural gas liquefaction and deep-water export terminal capable of receiving and loading ocean-going Liquified Natural Gas (LNG) carriers, in order to export natural gas derived from a point near the intersections of the GTN Pipeline system and Ruby Pipeline System."

The project purpose statement does not specify the amount of LNG required to meet the purpose. An earlier planning stage for this same LNG facility in Coos Bay considered 6.8 mtpa of LNG a sufficient quantity to satisfy the need and purpose of the project. The difference between a proposed LNG facility having a proposed 6.8 mtpa capacity and a 7.8 mtpa capacity appears to have significant and avoidable impacts on Oregon wetlands and waterways. In order to attain the expanded 7.8 mtpa export capacity proposed, the applicant has stated there is now a "need" to excavate approximately 580,500 cubic yards of sub tidal estuarine sediments at 4 locations along the margin of the Federal Navigation Channel These are collectively referred to as "navigation reliability improvements"(NRI's) [See Table 1.1-1 (Page 10) of Resource Report 1 submitted to the FERC September 2017 and Table 6.1 (page 36) of Joint permit application]

Other examples to illustrate how the it may be possible to attain the purpose of the project while avoiding or minimizing numerous impacts to the wetlands contained in the permit application are outlined in the chapters that follow this introduction. **The authorization sought by this application should be denied because insufficient information has been provided to enable reviewers and permitting agencies to conduct the requisite evaluation needed to determine if the impacts are required to attain the project purpose.**

5. Some of the actions proposed may be not be feasible or practical.

Based on the information provided in the DSL joint permit application, the applicant proposes work that may not be technically feasible. Examples include but are not limited to: a) The APCO dredged material disposal sites may lack the capacity to handle the total project lifespan volumes of sediments identified by the applicant to be delivered to those sites. b) The plan to mitigate the permanent destruction of an eelgrass bed proposes to create an eelgrass bed by dredging a sump-like feature in an intertidal sand flat to an elevation that may persist for the three year time span of the modeling studies conducted by the applicant but are not likely to persist on a permanent basis. c) The horizontal directional drilling under the Coos estuary to accommodate passage of the 36"diameter gas delivery pipeline was considered but deemed technically infeasible in a previous application to the Federal Energy Regulatory Commission. The applicant has not demonstrated how a directional drilling operation once deemed infeasible is now possible. A previous application by Jordan Cove to FERC proposed laying the gas transmission pipeline across the bay using an open cut and burial process that had huge potential wetland impacts. If a permit is issued as requested, and the proposed horizontal directional drilling operation is found to be infeasible, the agency is likely to receive a permit request from the applicant to lay the pipeline across the Coos Estuary using means that do not involve horizontal directional drilling. Until solid evidence is provided that the issue identified in the comments above and elsewhere in the comments that follow, including evidence that the proposed horizontal directional drilling is feasible and will be the only method used traverse the estuary, no permit should be issued. Should the agency decide to issue a permit, absolute conditions should be included that preclude permit revision requests to lay the pipeline across the estuary that involve disturbance to wetlands that are not listed in the original permit application.

6. The proposal includes avoidable impacts to wetlands

Elements of the proposed work may result in avoidable or unnecessary levels of impacts to the environment and existing economic activities including fishing and recreation. Examples of these include, but are not limited to: a.) The temporary dredged material transport pipelines proposed by the applicant may interrupt the movement of marine mammals, fish and invertebrates, and interfere with commercial oyster mariculture operations. b.) The need to construct a dredge loading and unloading facility to transport sediments from the proposed eelgrass mitigation site to the proposed APCO dredged material disposal sites #1 and #2 has not been be justified sufficiently to substantiate the impacts these facilities may have on the environment. c.) The applicant has not provided adequate information to justify the proposed size, shape and alignment of the navigation channel approach and marine slip. D) The applicant has not adequately justified the need for the Navigation Reliability Improvements. A reasonable alternative exists that eliminates the need for the Navigation Reliability Improvements. Additional analysis to support this is provided in later chapters of these comments.

7. Information essential to an objective assessment of wetland impacts is missing or inadequate.

Elements of the application lack adequate detail to objectively evaluate the potential impacts of the proposed work. Examples of the insufficiency of the application include but are not limited to: a) The absence of reference to the materials used and volumes of sediments and fluids produced by the horizontal directional drilling operations intended to carry the Trans Pacific Pipeline under the Coos Estuary. b) I was unable to locate any reference to a plan to manage the production, handling, transport, and disposal of the directional drilling borehole cuttings and fluids. c) The eelgrass mitigation area is listed as a 9.3 acre site but only 3.4 acres of the site will be planted with eelgrass. The proposal does not provide an adequate description of likely impacts to the wetlands surrounding the area to be planted that may result from site preparation and eelgrass planting activities.

8. Risks associated with the LNG transport project element are not adequately addressed.

If constructed the proposed natural gas transportation and export facility and its associated components (gas transport, LNG production, LNG transport) will introduce an avoidable, high risk activity adjacent to a major Oregon coastal population center in a wetland rich physical setting that is not suited to accommodate this kind of inherently dangerous activity. The proposed fill and removal activities work will enable the construction of a Liquefied Natural Gas export facility at a location in the Coos Estuary with known and avoidable risk attributes. Jordan Cove Energy, LP. Is a member of the Society of International Gas Tanker and Terminal Operators. Despite this membership, and despite the analysis of alternative sites provided by the applicant, the location of proposed facility is not consistent with recommended industry standards for siting and development of LNG facilities advocated by the Society of International Gas Tanker and Terminal Operators (See Information paper No. 14 entitled: "Site Selection and Design for LNG Ports and Jetties with views on Risk Limitation during port navigation and cargo operations" published in 1997 by the Society of International Gas Tanker and Terminal Operators Ltd., ISBN: 1 85609 129 5).

Specifically, the marine slip and access channel site selected by the applicant is inherently unsafe and the applicant's questionable analysis of its suitability should be rejected because it fails to consider numerous site attributes essential to deciding if the proposed site is a feasible location for the proposed LNG production facility. The applicant's proposal includes several inconsistencies with the industry recommended standards included in the SIGGTO document. These inconsistencies include, but are not limited to:

a.) The proposed facility is situated on the outside corner of a bend in a navigation channel that supports large deep draft vessel traffic upstream from the proposed facility.

b.) the configuration of the navigation channel connecting the proposed LNG liquefaction facility and tanker berth to the open waters of the ocean includes several risk factors. The entrance to the existing navigation channel is routinely subject to extreme ocean conditions that preclude large vessel transits to and from the harbor. The weather limited use of the Federal Navigation Channel has previously contributed to the grounding and total loss of a large bulk cargo vessel (MV New Carissa) while she waited at sea for suitable conditions in the navigation channel to permit entrance to the Coos Estuary.

c) The estimated transit time between the LNG tanker berth and the open waters of the Pacific is 90 minutes. The long transit time to safe open water is inconsistent with the short escape route transit times to open water recommended by the tank vessel shipping industry in the document referenced above.

d) The inbound and outbound route of the navigation channel requires transiting vessels to navigate a sharp, 90-degree bend that is flanked on the outside of the curve by a rocky bottom and shoreline. This likely grounding area is a populated area that includes housing for US Coast Guard Emergency services personnel and is the location of campus of the University of Oregon's institute of Marine Biology. I have personally witnessed one grounding of a large bulk cargo vessel that failed to negotiate the bend in the channel near Charleston/Barview. Earlier in 2018, a commercial salmon fishing vessel sat hard aground for three weeks on the rock training jetty on the South Eastern tip of the North Jetty at the channel entrance. In a prior year, an inbound 85-foot-long commercial trawl vessel capsized on the Coos Bay bar. The incident involved crewmember fatalities. The capsized vessel was carried into the estuary by an incoming tide before it sunk and came to rest on the bottom near the landward end of the North Jetty. The sunken vessel lay at the margin of the Federal navigation channel for nearly a year creating a navigation hazard to all transiting vessels until salvors refloated and removed the wreck.

The LNG transport element of this project involves vessels much larger than many of the deep draft vessels that currently call on this port. The nature of the risks associated with transporting a hazardous cargo such as LNG stand in stark contrast to the nature of the risks posed by the bulk cargo wood product vessels that currently and have historically used the Coos Bay Navigation channel. A deliberate or accidental grounding or breach of a large LNG cargo vessel in the Coos Bay Federal Navigation channel involving a cargo containment failure holds potential to result in an uncontrolled release of a highly dangerous cargo that poses profound and predictable risks to the environment, wetlands, and the surrounding human population. These risks are unprecedented and avoidable.

e) The – 37' MLLW maintenance depth of the federal navigation channel when combined with the 12-meter (39.3') draft authorized in the US Coast Guard waterway suitability analysis cited by the applicant and the requisite 10% of draft under keel clearance depth means the Federal Navigation channel will only be suitable for LNG vessel transits during tides greater than 5.9'MLLW. This means that berthed LNG tank vessels will be "trapped" at the berth and unable to transit the estuary during emergencies when tidal elevations in the estuary are below 5.9'. Any rational analysis that includes consideration of public welfare and safety should require the applicant to address the risks identified above as well as the risks identified elsewhere in this report. The applicant should be required to consider alternative terminal siting scenarios that reduce or eliminate the risks to people and the environment that are embedded in the applicant's proposal. **No permits should be issued until an analysis of the cumulative risks of all aspects of the Natural gas transport pipeline, the LNG production terminal and the LNG transportation operations is conducted**.

9. The full scope of the project does not appear to be addressed by the application. <u>The independent utility of the proposed work is suspect,</u> and the full scope of the project may not be feasible because it may exceed some practical physical limits of the Coos Estuary.

The applicant has expressed an intent to construct an LNG production facility and berth for LNG vessels that exceeds the present-day operational specifications of the navigation channel by proposing an access channel, slip and vessel berth configuration capable of handling vessels larger than those currently authorized by the US Coast Guard for this port. Resource report 1 (Sept 2017 document page 22) states:

> *"The LNG carrier loading berth will be capable of accommodating LNG carriers with a cargo capacity range of 89,000 cubic meters to 217,000 cubic meters. The USCG Letter of Recommendation ("LOR") and Waterway Suitability Report ("WSR") currently allows LNG carriers up to 148,000 cubic meters to dock at the LNG Terminal berth".*

Unless it is the intent of the applicant to berth vessels with cargo capacities up to 217,000 cubic meters, it is not clear why it would propose to build a berth capable of handling vessels of this size. The Coast Guard has determined the maximum safe size LNG vessel characteristics for the Coos Bay Navigation channel and vessels having cargo capacities of 217,000 cubic meters are well beyond the current limits imposed by the navigation channel. It appears the only feasible way for the port of Coos Bay to safely accommodate vessels of the size proposed by the applicant is to deepen and widen the navigation channel beyond the current specifications. Preliminary estimates suggest deepening and widening the navigation channel to safely accommodate LNG with capacities up to 217,000 cubic meters will involve removal of approximately 15,000,000 cubic yards of material from the Coos Estuary. This significant volume of dredging is not referenced in the DSL Joint application even though it appears to be essential to the attainment of the design specifications of the facilities described in this application.

Concurrent with this fill and removal application, Jordan Cove Energy (the applicant) is also supporting work to deepen and widen the Coos Bay Federal navigation channel, but no reference to the proposed navigation channel expansion work has been included in the Joint Permit application currently being reviewed by DSL. With the encouragement of and over $4 million of 2018 financial support provided by the Jordan Cove LNG terminal project proponents, the Port of Coos Bay has recently (2017) submitted a request to the US Army Corps of Engineers to examine the feasibility of deepening and widening the federal navigation channel in the Coos Estuary. The US Army Corps of Engineers has initiated NEPA EIS Scoping for this proposed work and a draft EIS for this study is in preparation.

It is premature to predict the outcome of the most recent EIS process initiated by the Port as the draft EIS is currently in preparation. It is reasonable to state that the feasibility of dredging the channel to the depth and width necessary to accommodate very large LNG cargo carriers of the size desired by the LNG terminal proponents will be greatly influenced by the geology and physical configuration of the Coos Estuary. The Coos Bay Navigation channel expansion EIS process being conducted by the USACE should help to determine if using the Federal Navigation Channel for large LNG tank vessels of the size preferred by the project applicant (up to 217,000 cubic meters cargo capacity) is within or beyond the practical physical and geological limitations imposed on the port of Coos Bay. Thus, it is premature to consider issuing a permit to construct a marine slip and navigation access channel as proposed in application.

It is reasonable to infer that in order to use the stated vessel design capacity of the LNG carrier berth proposed by the applicant, a description of the overall scope of the project should include a statement of the necessity to expand the depth and width of the existing navigation channel. The failure of the applicant to note that deepening and widening the navigation channel will be necessary in order to attain the design specifications of the access channel, marine slip and LNG loading berth, raises questions related to the independent utility of the project description and work proposed in this joint permit application**. No permit should be issued in the absence of an affirmative determination of the *independent utility* of the proposal as described in OAR 141-085-0565 (3) (a). If expansion of the channel *is* required to realize the design capacity of the proposed LNG carrier berth the current proposal should be denied because it fails to demonstrate that the project has independent utility, Further, if a determination is made that expansion of the navigation channel is required in order to realize the design capacity of the terminal, no permit should be issued before the federal navigation channel EIS being conducted by the US Army Corps of Engineers is completed and determines that the channel expansion required by this project is feasible.**

10. Comprehensive risk benefit evaluations of the proposed work are being conducted that should inform DSL's evaluation of the proposal and assessment of the project's feasibility and its impacts to wetlands and waterways.

It is irresponsible to exclude the pending draft findings of evaluations being prepared by the Federal Energy Regulatory Commission and the US Army Corps of Engineers from the Joint Permit application review process. The actions impacting wetlands and waterways that are the focus of this permit application represent a subset of the total cumulative impacts attributable to the larger project activities. The work proposed in this permit is linked to other impacts that are beyond the central focus of the wetland regulations germane to the jurisdiction of the DSL that are the focus of DSL joint permit application. But these evaluations will certainly address issues related to the design and feasibility of the project that should be incorporated into the DSL permit process. For example; the scope of the DSL review of the Pacific Connector Pipeline is primarily focused on impacts to wetlands and waterways associated with the construction and installation of a high-pressure natural gas pipeline along the proposed 229-mile-long pipeline route (DSL wetland and waterway permit program). Aspects of design, alignment, and construction methods and purchase and sale agreements being reviewed as part of the EIS have significant bearing on determining the feasibility of the entire project. These essential aspects of the proposed gas pipeline, terminal and LNG transportation systems, even if built in compliance with DSL requirements, are largely beyond the scope this application. Similarly, the proposed navigability improvements associated with this project are being reviewed (in part) through the regulatory lens limiting the scope of the analysis of impacts. Wetland impacts linked to the proposed marine slip, navigation access channel, and navigation reliability improvements will be evaluated primarily on the basis of on how the proposed changes will impact certain wetland uses and values, recreational uses, fish, and fisheries. The fact that the proposed navigation related projects and wetland impacts will facilitate the transport of a cargo type that exposes thousands of people to a new, low-probability, high-consequence risk environment may not receive the rigorous evaluation deserving of this use by the current permit review process.

The cumulative impacts of the proposed gas pipeline, LNG production terminal and LNG transport system are in the process of being more thoroughly evaluated by two federal agencies: FERC (the evaluation of the proposed LNG terminal and pipeline project including the cumulative impacts of the project) and USACE (the evaluation of the proposal to deepen and widen the federally authorized navigation channel). The forthcoming EIS documents should include a thorough articulation and evaluation of the cumulative impacts of the proposed work as directed by NEPA. It is premature and unreasonable to consider issuance of a DSL fill and removal permit prior to or without consideration of the completion of these studies.

11. Evaluation of alternatives that avoid or minimize impacts to wetlands.

A permit should not be issued without a robust analysis of alternatives to the plan proposed by the applicant. The DSL joint permit application provides an insufficient analysis of alternatives to numerous significant aspects of the proposed work. This permit application should be characterized as incomplete or insufficient until the application includes requisite analysis of alternatives articulated in Oregon Statutes and administrative rules. The analysis of alternatives method is a widely used and legally required method to compare relative impacts of proposed approaches to avoiding and minimizing the social and environmental impacts of a proposed activity. DSL is required to evaluate approaches to projects that avoid or minimize impacts to wetlands while addressing the need for the project and must base permit decisions on an analysis of alternatives. DSL joint permit application completely lacks the requisite analysis of alternatives decision-making structure for several salient aspects of the project. Instead the DSL joint permit application solicits comments on a single, “take-it-or-leave-it” option. **This application is insufficient at best. If a permit is issued in response to this application, the action by the permitting agency is potentially in violation of existing policy and law. The permit should be denied because it lacks sufficient information to support an objective decision-making process that is consistent with prevailing law and procedure germane to a project of this nature**.

At a future time, the applicant should be granted permission to re-apply on the condition that any re-submitted application include requisite information in a format that enables regulatory agencies and the public to evaluate, select or reject any action/s proposed by the applicant. Information presented to agency by the applicant must be sufficient to enable the agency to comply with appropriate state and federal statutes and regulations. The information presented in the DSL joint permit application fails to meet this standard. The application should be denied or remanded to the applicant with specific instructions directing the applicant to address the insufficiencies of the current application. Should the applicant submit an application that includes sufficient information to enable an objective analysis of impacts of the proposed work, the revised/resubmitted application should be circulated to the public for comment.

The applicant has provided the DSL with a technical memorandum (pages 276-296) intended as an analysis of alternatives to avoid or minimize impacts to wetlands. While the technical report demonstrates the applicant has considered some measures to avoid or minimize impacts to wetlands, the factors considered in the technical memorandum fail to adequately evaluate several substantive alternatives to the project that may substantially reduce impacts to wetlands that the applicant has deemed "unavoidable". Examples of alternative approaches that should be considered include but are not limited to:

1. A no action alternative is required to be considered by Federal agencies and should also be evaluated by state agencies reviewing this proposal.
2. Alternatives involving liquification terminal configurations with capacities other than the 7.8 million tons per annum should be evaluated. The applicant has inadequately substantiated need for the facility to produce 7.8 mtpa in order to meet the project purpose. LNG terminals with production capacities of less than 7.8 tons per annum are currently under construction elsewhere and a facility with a smaller capacity than that proposed by the applicant should be enumerated and evaluated. An LNG export terminal Coos Estuary having a smaller annual production capacity only slightly smaller than that proposed by the applicant the holds potential to meet the stated purpose of the project (build a west coast terminal to export LNG to Pacific Rim nations) while simultaneously avoiding the need to construct and maintain the navigation reliability Improvement projects proposed by the applicant. This alternative alone could avoid permanently impacting over 26 acres of estuarine wetlands by eliminating the need to dredge over 584,000 cubic yards of estuarine habitat during construction and regularly disturbing important sub tidal estuarine habitats through maintenance dredging operations.
3. Additional alternative terminal designs/capacities/operations that do not require construction or maintenance dredging of the Navigation Reliability Improvements proposed by the applicant should be enumerated and evaluated.
4. Alternatives to the navigation channel approach proposed by the applicant should be enumerated and evaluated including designs that do not require the fill associated with the construction of the pile dike Rock apron proposed by the applicant.
5. Alternatives to the berth configurations proposed by the applicant and
6. Alternatives to the Kentuck Slough Wetland mitigation actions proposed by the applicant.

12. Aspects of the work proposed in the DSL permit application may be rendered moot and unnecessary as a result of reviews of this project being conducted by other agencies.

Oregon Statute Requires the Department of State Lands to consider alternatives that avoid, minimize impacts to wetlands but broader aspects of this project are currently being reviewed by other agencies. This broader review and analysis is likely to result in a modification of the project described in the DSL application. Section 6.1 (Page 86) states the applicant it is seeking authorization from the

Federal Energy Regulatory Commission (FERC) under section 3 of the Natural Gas Act. The FERC evaluation will include a mandatory analysis of alternatives to the proposed project as well as an evaluation of the project's feasibility. A Draft EIS is being prepared by FERC and is slated for release sometime in Spring of 2019. The EIS being conducted by FERC is required by federal law to consider a range of alternatives to the proposed work and consider a range of impacts that include but are not limited to the wetland impacts analysis being conducted by DSL in response to this application. It is possible that one or more of the proposed actions included in the DSL fill and removal permit application will be rendered moot by the environmental impact analysis being conducted by the FERC. **At minimum, DSL should take no action on the Jordan Cove Energy Project proposal before considering the outcome of alternatives analysis being conducted by the FERC**

13. **This project appears to be inconsistent with the Governor's executive order on Environmental Justice and should be reviewed by the Governors Environmental justice task force as part of the permit review process.**

When state agencies make decisions that affect our environment it is critical that low-income and minority populations are not disproportionately affected. The Environmental Justice Task Force (EJTF) was created by the 2007 Legislature to help protect Oregonians from disproportionate environmental impacts on minority and low-income populations (Senate Bill 420). The EJTF encourages state agencies to give all people knowledge and access to improve decisions that affect environment and the health of all Oregonians.

This project holds potential to disproportionately impact minority and low income populations. Elements of the project bear the signature characteristics that are the focus of the Governor's executive order12898 on Environmental Justice. The astoundingly voluminous, disjointed and highly technical manner in which material is presented in the application, severely limits or precludes non-technical and language challenged individuals from conducting a reasonable evaluation of the potential impacts of the project. This application is not accessible to an audience having an average or below average English proficiency. **This document is inaccessible to many readers including low income and minority individuals likely to be impacted by the actions proposed.**

The impacted resources are important to minority populations and low-income residents in the vicinity of the proposed work. The pipeline route and LNG liquification facility and LNG shipping channel work will impact the traditional homelands and culturally significant landscapes of six federally recognized tribes. The streams, wetlands, shoreline, intertidal resources, and sub tidal habitats continue are used as locations for fishing, gathering and transportation by native American and low-income residents. Other LNG terminals have been proposed in other Oregon Locations but the communities in those areas rejected the proposals as infeasible because these (less disadvantaged?) communities were unwilling to accept the risks associated with LNG production and transport. The application remains the only viable proposal in Oregon and it is notable that this remaining proposal hold potential to differentially impact low income, minority and linguistically challenged populations

The considerable safety risks associated with this project hold potential to be disproportionately borne by communities identified by the Environmental Justice Task Force and Executive order 12898. No permit should be issued until a plain language version of the proposed work is available and a

thorough and objective evaluation of how the proposed work will impact economically, linguistically and culturally disadvantaged populations.

Comments of Michael Graybill in response to DSL joint permit application and call for comments on a proposal from Jordan Cove Energy Project L.P. to the Oregon Department of State Lands on 7 November 2018

<u>Chapter 2:</u> **COMMENTS REGARDING DREDGED MATERIAL TRANSPORT AND DISPOSAL**

The application from Jordan Cove Energy Project L.P. to the Oregon Department of State Lands has many aspects that substantiate a decision to deny the permit requested by the applicant. Examples include, but are not limited to:

1. **The APCO 1 &2 dredged material disposal sites have not been fully evaluated to determine if the sites can feasibly accommodate the proposed uses as disposal areas for an estimated 1,824,300 cubic yards of dredged material.** The APCO sites are slated to receive material excavated from the initial dredging of NRI's and eelgrass mitigation areas, and the material derived from maintenance dredging of the slip, access channel and NRI's for the life of the project (see pages 883-886). On page 849 the consultant states: *"However, disposal of all capital material at APCO Site 2 is contingent upon assessments of slope stability, the ability to ensure an adequate residence time, and safe access for equipment".* I was not able to locate any additional information related to the proposed APCO dredged material disposal sites to confirm that the sites possess the requisite attributes to determine if it is, in fact, feasible for to use the sites for the proposes proposed.

As stated above, applicant has proposed that in addition to the material dredged during initial construction of the NRI's and eelgrass mitigation area, material derived from maintenance dredging of the NRI's, the slip, and the access channel will also be placed at APCO sites 1 & 2. (Page 874). Assuming a 30 year project lifespan, the applicant has provided an estimate for the volume of maintenance material to be dredged from the slip and access channel, *"The total anticipated volume of maintenance material that will be dredged over a 30-year period is approximately 0.98 mcy*" (page873) and for the Navigation reliability improvements: *"The total dredging volume required over the 30 year planning horizon is approximately 200,000 cy"* (page 874). Thus, in addition to the 584,300 cubic yards of material to be placed at the APCO 1 and 2 sites during initial NRI construction activities (page872), and the 40,000 cubic yards of material dredged from the eelgrass mitigation site (page 864), the APCO disposal sites must also be capable of spoiling and additional 1.2 million cubic yards of material produced over an expected 30 year project lifespan. The combined total of material from all sources is 1.82 million cubic yards.

A variety of factors may control the likely maximum sediment holding capacity of the APCO #1 and #2 dredged material disposal sites. They include, but are not limited to:

a.) The mechanical shear strength of stacked unconsolidated sediments may set the upper volume limit of the sites. Unconsolidated sediments can only be stacked so high within a defined basal "footprint". The angle of repose of unconsolidated sediments will set the upper limit of volume if sediments are stacked to maximally utilize the basal area "footprints" of APCO areas #1 and #2.

b.) Estuarine soil loading characteristics underlying the dredged material disposal sites may set the upper limit of the mass that can be supported without deforming the underlying plastic estuarine sediments. At other locations in the Coos Estuary (e.g. Eastside) it has been necessary to discontinue use of dredged material disposal sites adjoining the federal navigation channel because additional weight loading on the estuarine soils underlying that dredged material disposal area would result in displacement of sub surface estuarine soils into the adjoining navigation channel. A similar situation may also impose mechanical soil loading limits at the APCO disposal sites.

The applicant's dredged material management plan(DMMP) (Pages 843-909) includes a three factor (technical, logistical, and environmental) site selection feasibility analysis. The feasibility determination of the APCO 1 & 2 disposal sites to accommodate the uses proposed was based on a series of assumptions that require additional confirmation. Several of the assumptions raise serious questions as to the overall geotechnical capacity of the APCO sites to handle the total volume of material destined for the sites. **No permit should be issued before the applicant provides evidence to demonstrate that it is feasible to use the APCO dredge material disposal for volumes of material the applicant has proposed to deposit on these sites.**

2**. The dredged material management plan feasibility analysis was also based on multiple unconfirmed assumptions including assumptions that:**

a) It will be possible to use a hydraulic suction cutter dredge to excavate the anticipated volume of 505,500 cubic yards of bedrock from the NRI's (page 872) and

b) it will be possible to transport fragmented bedrock spoils via pipeline using the proposed 8-mile-long hydraulic dredged material pipeline and booster pump system. (see section 5.2 Page 903)

The consultant's report in Attachment E raises serious questions that the proposed methods of sediment excavation and transport will be feasible for the large volumes of bedrock associated with the NRI's in the lower bay.

The application is vague and non-committal regarding the actual methods that will be used to excavate and transport bedrock sediments from the NRI sites. Hydraulic suction cutter dredge and pipeline transfer are listed as the preferred methods, but information provided by the consultant raises serious questions regarding the ability of hydraulic dredging and pumping systems to handle the bedrock in the NRIs. Alternative excavation and transport methods are discussed in notable detail, but references throughout the discussion are couched with terms like "could be used" Other rock excavation methods discussed involve barge mounted clamshell dredges, drop chisels, or excavators that load rock onto barges or scows for transport to the disposal site.

In spite of the questionable feasibility of excavating and transporting bedrock using a hydraulic dredge and pipeline system, the only method proposed to transfer sediments across the intertidal zone near the APCO sites is via a hydraulic transfer pipeline. Alternative, mechanical material transfer methods are mentioned in the DMMP but the discussion includes explicit reference to substantial additional wetlands impacts associated with mechanical transfer. If a hydraulic dredge and pipeline system will not work to excavate and move sediments from the NRI dredge sites to the area near the APCO sites, requiring alternative dredge methods that use barge transportation instead, it is reasonable to question if the proposal to hydraulically pump this same dredged bedrock rock material from the temporary barge berth moored adjacent to the APCO disposal site up slope, and into the APCO decant ponds perched atop the existing fill will be a suitable method. **No permit should be issued until unresolved questions related to the methods used to: a) excavate bedrock sediments from the NRI's, b) transport these rock sediments to the APCO offloading site and c) transfer dredged bedrock across the intertidal zone adjacent to the APCO site up and into the APCO dredged material decant ponds.**

3. **Alternatives to dredged material transport**

The applicant has proposed to transport 300,000 cubic yards of mechanically excavated sand sediment from the natural berm at the shoreline of the marine slip via barge or scow to a temporary barge mounted hydraulic sediment transfer pipeline system moored in 20' of water near the Mill Casino in North Bend. Material offloaded at this pumping station will be transported via a 24" in pipeline to a decant pond in the Northwestern corner of the proposed Kentuck Slough Mitigation area. The applicant claims this is the only feasible means of transferring these sediments to the mitigation area. Land-based transfer methods were considered but ruled out over concerns that increased truck traffic on East bay road was unacceptable. The applicant failed to mention that routine commercial truck traffic is a primary and customary use of East Bay road. A rock quarry located at the upper end of Kentuck Slough is one of the primary sources of aggregate products for the Southern coast. Quarry operations create regular traffic by loaded aggregate trucks including articulated tractor trailers equipped with tandem 20 cubic yard belly dump trailers. In addition to trucks coming from and going to the quarry, East bay road is also actively used as a log haul road.

On the morning of 7 January 2019, I spent 1.5 hours observing vehicle use of East Bay Road and wildlife use of the proposed Kentuck Slough mitigation site. Quarry trucks and log trucks were by far the most frequent vehicles using East Bay Road in the period between 9:30 am and 10:45 am. I estimate that over 30 trucks passed the intersection of Kentuck Way and East Bay drive while less than 20 passenger vehicles used the road. Using 40 cubic yard capacity transport equipment to haul material (similar to the equipment already in use), a preliminary analysis suggests it should be possible to deliver 300,000 cubic yards of material in 7,500 round trips. As an example; if one considers a one-year, 8 hour per day, 5 day per week work schedule, land-based delivery should not result in an appreciable increase in traffic above the levels currently occurring along this route. Land based transport of dewatered fill material to the Kentuck site can eliminate most if not all of the estuarine wetland impacts associated with the barge and pipeline delivery system proposed by the applicant.

No permit to permit transfer dredged sediments to the Kentuck slough mitigation site via pipeline should be issued until the applicant conducts a more thorough analysis of the feasibility of transporting dewatered sediments to the site via upland routes.

4. Page 102 (section 6.2.7 Attachment A) indicates a Temporary Dredge Off-loading Area will be constructed adjacent to the federal navigation channel NW of the APCO #2 site. The only material explicitly designated to be transported to the APCO sites via dredge are 46,535 cubic yards of dredged sediments derived from dredging work associated with the construction of the eelgrass mitigation site [Section 6.2.9.2 (Page 110)]. With the possible exception of the inconclusive methods associated with dredging the bedrock from the NRI sites, all other sediments destined for the APCO #1 and #2 are to proposed be delivered to the APCO sites via hydraulic pipeline. The work associated with the Navigation Reliability Improvement projects proposes to route a 24" pipeline right past the proposed temporary dredge loading area in the channel to the west of the eelgrass mitigation site (Figure 12, page 47). Sediment dredged from the eelgrass mitigation site will need to be transported distances similar to the distance sediments derived from NRI dredge area #3 and a much shorter than the transport distances for NRI dredge areas #1 and #2. It is not stated why materials derived from the NRI dredge areas will be transported from the excavation locations via pipeline but the sediments from the eelgrass mitigation area will be transported by a combination of hydraulic pipelines and waterborne scow/barge.

If the pipelines installed to transfer sediments from the NRI areas are suitable for transporting sediments greater distances than the transport distance required for the eelgrass mitigation site, the applicant should evaluate the feasibility of using the pipeline installed to transport sediments from the NRI areas to the APCO disposal site to also transport sediments from the eelgrass mitigation site. Using the temporary NRI sediment transport pipeline to also transport sediment from the eelgrass mitigation site could potentially eliminate the need to construct temporary barge loading and offloading facilities to complete the mitigation area sediment transport work.

The Horizontal Directional Drilling (HDD) operations required to route the Pacific Connector Pipeline under the Coos estuary are expected to produce an estimated minimum of 3,900 cubic yards of excavated sediment. I was unable to determine if the DSL joint permit specifies where excavated sediments will be brought to the surface during the HDD operations or where those sediments will be spoiled. Further, the DSL joint permit application does not discuss estimated volumes, chemical characteristics or how fluids associated with the HDD operations will be treated and disposed of, it can be assumed that sediments and drilled fluids will be brought to the surface in the vicinity of two or more of the proposed inbound and outbound pipeline HDD surface penetrations; 1) a site near the shoreline of Kentuck Slough; 2) two sites in the vicinity of the South end of the Hwy. 101 bridge over the Coos Estuary and; 3) one site at the proposed Pacific Connector pipeline terminus at the South Dunes LNG terminal location. Two of the HDD surfacing locations are in the vicinity of the APCO dredged material disposal sites. The DSL joint permit application does not specify if materials derived from the HDD operations will be spoiled at the APCO sites in addition to the aforementioned sources to be deposited there. Because the proposed HDD operations will take place in close proximity to the shoreline of the estuary, and because HDD operations will produce a considerable volume of drilled sediment and drilling fluids, an operations and management plan for the HDD operations should be made available for agency and public review before a permit is issued. No permit should be issued before a robust characterization of materials to be produced and methods used to dispose the material produced by the HDD operations is provided

Comments of Michael Graybill in response to DSL joint permit application and call for comments on a proposal from Jordan Cove Energy Project L.P. to the Oregon Department of State Lands on 7 November 2018

CHAPTER 3: COMMENTS ON PROPOSED WETLAND COMPENSATORY MITIGATION MEASURES.

1. The Compensatory Wetland Mitigation proposed for impacted eelgrass habitats will not replace the functions of the impacted eelgrass habitat.

The Off-Site, In-Kind compensatory mitigation plan proposed to address impacts to eelgrass habitats has design attributes that raise serious questions regarding the long-term viability of the proposal. The impacted eelgrass bed is positioned on a sloping tidal and sub tidal channel margin with uninterrupted access to deeper water habitats. The proposed CWM for eelgrass will create a "stranded" intertidal eelgrass habitat isolated from deeper water at low tide. The lower limit of the impacted eelgrass community is likely controlled by water depth. The proposed CWM does not have these functional attributes.

2. **In Kind replacement of impacted estuarine habitats other than eelgrass is possible but was adequately considered.**

As proposed, the compensatory wetland mitigation (CWM) for all project related (pipeline, terminal and LNG transport) wetland impacts deemed unavoidable by the applicant will be addressed at two locations; a 100-acre diked wetland at the mouth of the Kentuck Slough on the Coos Estuary and a 9.3-acre tideflat situated 500 yards south of the western extent of the SW Oregon Airport runway. This centralized "all in one place" compensatory mitigation strategy has been substantiated, in-part, on the basis that wetland impacts occurring along the 230-mile-long pipeline route involve multiple impact locations with limited individual spatial extents.

I concur that the circumstances associated with the pipeline pose challenges to the more ecologically preferable On-Site, In-Kind replacement methods of compensatory mitigation. However, the circumstances regarding wetland impacts in the Coos Estuary are not the same as those along the pipeline route. The Off-Site, Out-of-Kind compensatory mitigation proposed for impacted estuarine wetland habitats other than eelgrass is a less ecologically preferable method than a strategy the involves In-Kind replacement of wetland functions and values. [See OAR **141-085-0510** Definitions (30):"Ecologically or Environmentally Preferable" means compensatory mitigation that has a higher likelihood of replacing functions and values or improving water resources of this state]. **Opportunities to replace the types of estuarine wetland functions and values that this project will remove via In-Kind mitigation exist in the Coos Estuary and should be more thoroughly examined before issuance of a permit.** For example the applicant could consider excavation of prior filled tidelands to replace tideflat and eelgrass habitat instead of proposed Kentuck and eelgrass mitigation actions.

3. **By far, the greatest impacts to wetlands encompassed by this project will take place at the sites chosen to conduct compensatory mitigation for impacts to wetlands**!

Alternative mitigation sites and approaches that minimize impacts to wetlands should be identified and prioritized over the preferred mitigation proposals proposed by the applicant. **No permit should be issued until a comprehensive analysis of alternative mitigation strategies having fewer wetland impacts is undertaken.**

Table 6.1 (page 38) entitled "Removal-Fill Wetland and Waters Impacts Summary Table" includes a section entitled "Freshwater Wetlands". The table identifies impacts to 11 discreet freshwater wetlands having a total area of 1.911 acres to be impacted by the project. The table infers it is a precise and comprehensive accounting of all wetland impacts. It includes an accounting of fill and removal associated with installation of fence posts in wetland K and even provides calculations on the volume of fill to be placed on a .001-acre wetland to a depth of 68 feet. However, Table 6.1 fails to include reference to and account for 100 acres of existing fresh water wetlands at the Kentuck Mitigation site (page 88) that will be permanently impacted by the proposed mitigation action. This same table also fails to include reference to the 9.3 acres of existing estuarine tideflat habitats (page 88) that will be impacted by the construction of the proposed eelgrass mitigation area.

Table 6.1 also fails to include reference to the wetland impacts associated with the installation of the Pacific Connector gas pipeline along the margin of Kentuck Slough. (see pages 1160 and 1176). I was unable to find a description of how the pipeline will be installed across the wetlands at Kentuck Slough, but it is reasonable to presume that open cut trench type installation methods will be involved. It is also reasonable to presume that pipeline installation and its associated wetland impacts will occur prior to the wetland enhancement actions proposed as compensatory wetland mitigation at this same location. By prioritizing Off-Site Out-of-Kind mitigation and selecting the Kentuck Slough Site over other in-Kind compensatory wetland mitigation options at other locations, the applicants appear to have circumvented the need to account for and mitigate for the considerable wetland impacts associated with placement of over 1,500 yards of natural gas pipeline in wetlands at Kentuck Slough.

The Kentuck site includes a notable wetland impact that was not part of the analysis used to justify the selection of the Kentuck site as the preferred alternative (if there ever were alternatives). A wetland impact entirely unrelated to the impacts of the project that is an outcome of the inadequate and questionable methods used to identify the Kentuck site as the one and only preferred location to be used to compensate for the entirety of project related wetland impacts, is a requirement to permanently fill a .85-acre forested wetland at the margin of the Kentuck site The compensatory mitigation actions planned for Kentuck resulted in the "unavoidable" need to fill these wetlands. The justification given is to protect the septic tanks of adjacent property owners (Pages 102- 1105). A map of the location of the forested wetland at the Kentuck site that will be filled in order to protect septic tanks of adjacent property owners is on page 1176. **The need to fill and permanently destroy an.85-acre forested wetland to protect a couple of septic tanks would not be necessary if an alternative, more ecologically preferable site or suite of sites were chosen to perform the required compensatory mitigation work (See 4. Below).**

4. **Alternatives designed to meet the project goal that avoid or minimize impacts to wetlands have not been adequately evaluated.**

The current owners of the Jordan Cove energy project purchased the project from a sequence of several companies that owned the project since it began over 10 years ago. Pembina didn't buy a natural gas export facility, they bought the idea of one and paid real cash for the idea. The only tangible things Pembina purchased were the background project development consultant reports, some easement contracts and all the permit work done by the company that sold Pembina the idea. It is not surprising that Pembina is reluctant to consider alternatives to the project concepts they purchased when they bought this company, they paid good money for the prior work! Because Pembina recently purchased an eelgrass mitigation plan focused on a 9.3-acre plot of DSL tideland, does not mean that plan is feasible or practicable. A “preferred” alternative is not necessarily a feasible or practicable one. The eelgrass mitigation plan provides reviewers with objective criteria in which to evaluate the process used to evaluate alternative sites and the rationale underlying the site selected as the preferred alternative.

In contrast to the transparent alternatives analysis used to identify the preferred location for the eelgrass mitigation, I was not able to find any comparable analysis of alternatives to substantiate why the Kentuck Slough site was selected to mitigate non-eelgrass wetland impacts linked to the proposed terminal construction and the gas pipeline. The only alternatives analysis I was able to find is a single sentence statement on page 1123 as follows: “The proposed Kentuck Project site was selected partly through the same investigation of eelgrass sites”. As a result, it is not possible to determine if the Kentuck site and the proposed actions for the site represent the alternative that maximally avoids or minimizes wetland impacts. As articulated elsewhere in these comments, it is not likely that the actions proposed by the applicant represent the approach that minimizes wetland impacts. The applicant has proposed compensatory mitigation actions for wetland impacts that can be avoided by design changes, site selections and alternative construction methods that have not been articulated or evaluated. It is important to emphasize that the locations proposed as the “preferred alternative” compensatory mitigation sites require wetland impacts that could be avoided by pursuing alternative mitigation locations and actions (e.g. shape of navigation access channel, annual production capacity of LNG terminal, avoidance of need for NRI’s).

Other less impactful, ecologically preferable approaches to the applicant’s proposed compensatory mitigation appear to be available. The proposed navigation channel access, pile dike rock apron, and the Navigation reliability improvements involve substantial avoidable wetland impacts that are also discussed in Chapters of this document related to those aspects of the project. **No permit should be issued without an analysis of alternatives to the proposed wetland mitigation actions.**

5. **Use of sand as fill at Kentuck tidal marsh wetland restoration site should not be used to adjust the grade of the wetland surface.**

The applicant proposes to spoil 300,000 cubic yards of aeolian dune sand excavated from a portion of the sand berm at Ingram yard on the wetlands of the Kentuck slough (Page 1132) a description of how this material will be distributed on the site or a satisfactory description of the underlying rationale describing why fill from this location was chosen to achieve the restoration objectives at the Kentuck site.

Section 2.1 entitled “Actions Concerning the Location of the Discharge” Page 280 includes the following statement

> *While not previously used as a dredge disposal site, the Kentuck Project is also characterized by substrates consisting of interbedded layers of sand and silt beneath an approximately 1-to 2-foot-thick surface layer of fill. Dredge material is composed largely of sand and silty sand, similar to the existing substrate at these sites.*

In this statement, and in statements presented on page 1123, the applicant appears to justify the use of porous, unconsolidated sediment as part of the plan to restore a tidal marsh habitat at the Kentuck

Slough site by noting the sand fill previously spoiled on the top of the historic cohesive salt marsh soils and the presence of salt marsh vegetation along the Coos Bay North Spit. This is not a sufficient justification to substantiate the placement of sand fill on an estuarine tidal marsh restoration site in that portion of the estuary.

The applicant has noted that approximately 1-2' of sand fill appears to have been previously deposited on the natal wetland soils at Kentuck. The applicant then characterizes the vegetative communities at the site as "degraded". It is entirely possible that the "degraded" conditions at the site are the result of the historic introduction of the sand fill. Introduction of additional sand derived from the Ingram Yard dune site to adjust grades at Kentuck holds potential to diminish the likelihood that the grading and planting treatments proposed will successfully restore the desired historic estuarine tidal marsh wetland conditions. The applicant has stated the soils in the Kentuck inlet are predominantly silts and loams [Coquille silt loam and Nestucca silt loam (page 1123)]. These finer, more cohesive sediments have completely different characteristics than the sandy, no cohesive soil types proposed to be used by the applicant as part of the salt marsh restoration mitigation actions.

Because the proposed fill material does not match the historic wetland soil type that is the target of the proposed restoration work at this location, **use of sand fill at the restoration site should be strictly limited to non-wetland restoration aspects of the actions proposed for the Kentuck site such as elevating the golf course road, and temporary fill for access roads and construction of water control structures.**

By the applicant's own admission, the application fails to provide a description of salient aspects of the proposed mitigation work needed for permit reviewers and members of the public to evaluate project design. Page 1123 includes the following statement:

> *"Site construction methods, including timing and approaches to material import and dewatering, top soil salvage, mass grading, channel construction, erosion control measures, etc. will be prepared as part of final design with documentation provided to ODSL and other agencies either prior to permit issuance or as a condition of permits.*

6. The applicant should be required to evaluate a restoration treatment alternative that involves the total removal of the levee along the margin of Kentuck Creek.

Following the dike breach tidal reflooding restoration actions planned for the site at East Bay drive, the levee along Kentuck Creek will continue to impair the function of the partially reflooded wetland. The soils in the existing levee are likely to contain heavy, cohesive silts and muds similar to the historic soils in the vicinity. In contrast to the actions proposed by the applicant, complete removal of the Kentuck Creek levee will increase the total wetland area to be restored by removing the footprint of the levee, restore lost hydrological linkages between Kentuck Creek and its associated wetlands, reduce the volume of fill material needed to be brought to the site from remote locations by eliminating the need to construct the "new and improved Kentuck levee" described on page 1176, and will provide a soil source to adjust the elevation of treated wetland areas that more closely matches the historic estuarine marsh soil type/s than the imported sand fill proposed by the applicant. Alternative methods to protect properties upstream from Kentuck reflooded wetlands could involve relocating the existing tidegate under East Bay Drive further upstream.

7. The proposed gas transmission pipeline route traverses most of the length of the proposed Kentuck Mitigation site. The wetland fill and removal impacts associated with the installation of the pipeline are not adequately addressed in the application.

I was unable to identify a rationale underling the decision to route the pipeline through the Kentuck Slough wetlands or installation details for the pipeline segment that traverses the Kentuck site, but it is reasonable to consider that installation of the pipeline will impact existing wetlands at the site as installation will take place prior to work proposed as mitigation actions. Further, as part of the proposed restoration plan, the applicant has proposed to construct a “proposed new improved Kentuck levee location” (page 1176) parallel to the proposed pipeline route. No rationale has been given for the need to even retain the existing Kentuck levee to achieve the restoration outcomes at Kentuck let alone providing a rationale to construct a “new improved levee” as part of the compensatory wetland mitigation actions focused at this location. Although I was not able to locate a discussion of the need to retain and expand the existing levee at Kentuck, I can think of no reasonable wetland restoration objective that supports a decision to expand the Kentuck levee. It is not difficult to envision that the “new improved Kentuck levee” might work remarkably well as a service road for the pipeline that runs parallel to it. It may be just as appropriate to refer to the so named “new improved Kentuck levee” as the “Kentuck slough pipeline service road”. No mitigation is proposed for the wetland impacts associated with pipeline installation or the maintenance road/new improved levee at the Kentuck Slough location.

8. The applicant’s characterization of the existing wetlands at Kentuck as “degraded” should be compared critically to the functions and values of the existing wetlands at the Kentuck site.

The mosaic of fresh water wetlands and open water areas that currently comprise the entirety of the proposed Kentuck slough mitigation area is clearly an artifact of historic diking and draining practices. However, the applicant has grossly underrepresented the functions and values of the existing wetlands at Kentuck. The area supports high tide resting areas for shorebirds, feeding areas for waterfowl, is occupied by beavers and other wetland dependent species. The area is not a uniform wetland type but a complex mosaic of wetland types with various dominant vegetative species and seasonal open water habitats.

No permit should be issued without a more thorough analysis of the functions and values of the existing fresh water wetlands that will be impacted by the applicant’s proposal to reestablish estuarine tidal hydrology to the Kentuck wetlands as a compensatory wetland mitigation action. Page 1126 includes a brief hydrogeomorphic characterization of the vegetative communities, but this characterization is insufficient to discuss other ecological aspects of the functions and values of the Kentuck wetland complex

I visited the Kentuck slough site on 6 January 2019. During an informal, 30-minute mid-morning survey of the site using vantage points along road margin of East Bay Drive and Golf Course lane, I observed, active use of the site by approximately 30 Pintail Ducks, 10 Mallard Ducks, 50 American Widgeons, over 100 Canada Goose, American Shovelers, Pied Billed Grebes, Greater Yellowlegs, Roosting and feeding Red Shouldered Hawks, American Coots and numerous species of passerine birds including crows, jays, sparrows, titmice and wrens. In addition, I observed fresh evidence that the site is being used by beavers (gnawed willow stumps) and river otters or raccoons (scat at the shoreline containing shellfish remains. In its present condition, the site could readily be considered a birding hotspot on the margin of the Coos estuary and a wetland of local if not regional significance. In the flooded portion of the estuary to the west of the east bay road segment that crosses Kentuck slough I observed a single Western Grebe and a greater yellowlegs. It is clear that these two wetland habitats are serving very different functions and values. The fresh water functions and values to be lost as a result of the restoration treatments proposed in this application cannot be overlooked and should not be underestimated. **Priority should be given to identifying potential sites that satisfy the compensatory wetland mitigation requirements of the agency that have fewer impacts to existing wetland functions and values than those that would occur at the Kentuck site should the proposed actions be permitted.**

The Kentuck site is a diked and drained tidal wetland that likely historically supported a mosaic of intertidal mudflats, tidal channels and emergent tidal marsh habitats that had an unimpaired connection to the adjoining portions of the estuary. The fresh water wetlands that occur at the Kentuck site at present are doubtless a result of the the changes to the hydrology of the area within the areas surrounded by the dikes around the perimeter of the proposed mitigation area. One of the dikes functions to isolate the wetlands from the influences of Kentuck Creek and the other major dike functions to isolate the wetlands from the adjoining estuary. Today, whatever estuarine wetland functions that may have once occurred there have been fully replaced by fresh water wetland functions and values. The present-day wetlands that occur throughout the site are supported by the fresh water hydrology that presently influences the site. The former, historic estuarine wetland mosaic at the Kentuck site has been replaced with a functioning freshwater wetland mosaic. The estuarine functions that once occurred at the site might be better characterized as "absent" than "degraded". The longstanding hydrologic modifications linked to the diking and tide gating of the Kentuck estuarine wetlands did not degrade the estuarine habitats they impacted, they virtually eliminated them.

Given the current use of the site by wetland dependent species such as shorebirds, waterfowl, beavers etc., it is inaccurate to characterize the fresh water wetland habitats that presently occupy the Kentuck site as "degraded". The applicant has pointed to the presence of nonnative vegetation as in indication of the degraded condition of the wetlands at the site (page 1126) but DSL compensatory wetland mitigation policy states that "Simply having a high cover of non-native or invasive vegetation does not qualify the site as degraded" (DSL Removal fill guidebook Chapter 8 page 8-14 https://www.oregon.gov/dsl/WW/Documents/Removal_Fill_Guide.pdf)

Thus, the proposed actions at Kentuck Slough should be characterized as involving the permanent destruction of approximately 100 acres of functioning fresh water wetland habitats. This reviewer recognizes that this site was designated as a "medium priority mitigation area" when the Coos Bay Estuary management plan was developed in the 1980's. At the time the site was identified as a potential mitigation area, it was managed as a golf course and active measures were in place to dewater the site to the greatest extent possible (as evidenced by the high-volume dewatering pump system in the SW corner of the site). It has been over a decade since active dewatering of the site was practiced. In the years that golf course operations ceased at the site wetland conditions have returned with vigor. The wetland conditions on the site when "the approximately 100-acre historical flood terrace was delineated as an emergent wetland (palustrine emergent Cowardin class) plant community dominated by lawn grasses, with scattered native and ornamental tree plantings" (page 1126) virtually all of the ornamental tree planting have have died and the grasses and forbs bear little resemblance to a lawn.

When taking the impacts to the existing wetlands at Kentuck into account, the compensatory mitigation plan for estuarine wetland impact actions proposed by the applicant at Kentuck will result in a *larger* aerial extent of fresh water wetland impacts than the combined total of freshwater wetland impacts associated with the construction of the pipeline, terminal and shipping channel.

Considering the substantial impacts to existing wetlands associated with the proposed eelgrass and Kentuck slough mitigation actions, no permit should be issued until the applicant demonstrates that the mitigation sites chosen are the sites having the least impacts to existing wetlands. Other sites on the shore of the Coos estuary do not have the same wetland functions and values as those found at the Kentuck wetlands. As an illustrative example, there are numerous prior filled estuarine wetland sites that support few or no existing wetlands that should be evaluated and could be restored to estuarine function. These include but should not be limited to filled historic estuarine tidelands in the vicinity of Pony Slough including but not limited to the APCO sites, the dredged material disposal islands across from the downtown districts of North Bend and Coos Bay and filled estuarine tidelands in the Empire district. Some of the example locations cited above hold greater potential for In-Kind compensatory mitigation. It may not be possible nor necessary to identify a single site meeting all the compensatory estuarine wetland mitigation needs. In light of the substantial impacts associated with the Kentuck and eelgrass mitigation sites, a more thorough and critical analysis of multi-site mitigation alternatives should be required as part of the analysis. **Prior to issuance of a permit, DSL should require the applicant to identify and reevaluate other locations suitable the compensatory wetland mitigation activities associated with this project. The applicant should be required to include but limit this evaluation to an examination of restoring tidal hydrology to prior filled tidelands in the Coos Estuary that are not currently functioning as wetlands.**

9. Some impacted wetlands in the area of the proposed facilities on the North Spit appear to have the characteristics of "Interdunal wetlands" that DSL has identified as wetlands of special conservation concern (https://www.oregon.gov/dsl/WW/Documents/wetland_cons_concern.pdf).

DSL mitigation policies appear to require "In Kind" mitigation for these wetlands types. The current wetland mitigation plan does not appear to propose "In-Kind" mitigation for the impacts to these wetlands. DSL should determine of any of the wetlands identified on the North spit or along the pipeline route are classified as wetlands of conservation concern. In-Kind mitigation should be required for impacted wetlands along the pipeline route and in the vicinity of the facilities in Coos Bay that fall under the category of "wetlands of conservation concern".

10. Zoning of the proposed eelgrass mitigation site may prohibit dredging required by the eelgrass mitigation plan.

The proposed eelgrass mitigation site and at least one of the four proposed Navigation Reliability Improvement sites occupy a portion of the estuary classified as "52-Natural Aquatic" in the Coos Bay Estuary Management Plan. This same zoning designation is also identified in the City of Coos Bay's Land Use Ordinance 312. The compensatory mitigation actions proposed for eelgrass will involve dredging approximately 46,535 cubic yards of sediment from this zoning district. A similar volume of dredging will be required for the Navigation Reliability Improvements.

In the absence of necessary land use permits, the mitigation actions described in this section should be designated as "not-feasible" because dredging, as proposed by the applicant, is explicitly prohibited in the 52-Natural Aquatic zoning district of the Coos Estuary. Zoning compliance authorization to undertake the proposed eelgrass mitigation dredging work will likely require amendment of the Coos Bay Estuary Management Plan and the City of Coos Bay's land use ordinance. Both the estuary Management Plan and the City land use ordinance are part of Oregon's Coastal Zone Management plan that has been acknowledged by the US Department of Commerce under provisions of the Federal Coastal Zone Management Act. **No permit should be authorized for the above described work prior to the applicant demonstrating that the proposed work is a permitted land use in the area proposed. Should DSL choose to issue a fill and removal permit for the proposed work, the permit should, at minimum, be conditioned on the applicant's ability to obtain requisite land use authorizations.**

Comments of Michael Graybill in response to DSL joint permit application and call for comments on a proposal from Jordan Cove Energy Project L.P. to the Oregon Department of State Lands on 7 November 2018

CHAPTER 4: ACCESS CHANNEL COMMENTS.

Introduction

Construction of the access channel will result in the removal of approximately 1.9 million cubic yards of material from approximately 22 acres of estuarine wetland habitats (page 860). This total encompasses not less than 1.25 acres of intertidal, 4.25 acres of shallow sub-tidal, and 17.7 acres deep-water estuarine habitats that include unvegetated intertidal and sub tidal flats, .06 acres of tidal salt marsh and 2.26 acres of eelgrass meadow habitat [table 6-2 (pages 36-39)]. Of all the various elements in this project, the access channel represents the single project element having the greatest spatial and long-term wetland impacts. As such, **the design of the access channel should be reviewed critically and alternative designs that reduce or minimize wetland impacts should be given explicit attention.**

1..**No justification is given to substantiate the orientation or shape of the access channel footprint and no mention is made of other access channel orientations or shapes considered.** Section 6.2.1 includes a one sentence statement regarding the purpose of the Access channel (page 91):

> *"The access channel and slip will be configured and oriented so that LNG carriers can dock safely, away from other ship traffic in the FNC, and to facilitate emergency egress."*

The remaining portion of the paragraph includes a description of the general shape, perimeter dimensions and depth of the proposed access channel. Section 6.2.1 substantiates the proposed depth of the access channel but fails to substantiate the orientation or size and shape of the perimeter of the channel.

It is necessary to substantiate and critically evaluate the shape of the access channel perimeter because this single project element is responsible for the largest wetland impacts associated with the construction of the LNG facility. It is particularly important to evaluate and substantiate the configuration and orientation of the western flank of the access channel in part because the proposed configuration will necessitate the construction of a pile dike rock apron at the top of the cut line of the western flank of the access channel. When considered alone, the pile dike rock apron is a project element having significant permanent impacts to estuarine wetland habitats and habitat function and values.

Alternative channel configurations or designs having potentially fewer wetland impacts should be proposed and evaluated. Because the applicant has given no indication that other access channel orientations, configurations or construction methods were considered and rejected, it is not possible for reviewers to determine if the access channel configuration proposed is the design having the least wetland impacts while still addressing the stated purpose of the channel. DSL statutes and rules require applicants to propose and evaluate alternative project designs in order to determine identify and select the project design that avoids or minimizes impacts to wetlands. **The applicant has failed to demonstrate that the requisite alternatives analysis has been conducted regarding the design of the access channel.** As an illustrative example, it is reasonable to question if a minor adjustment to the orientation of the slip or the angle of the western flank of the access channel or the slope angle between the access channel and the adjoining tideflats might eliminate the need to construct the rock apron while still accomplishing the stated purpose of the access channel. **No permit should be issued unless the applicant conducts the requisite analysis of alternative designs needed to affirm that the proposed design is the best option to minimize or avoid wetland impacts.**

2. Maintenance dredging of the proposed access channel following construction is expected to produce 115,000 cubic yards every three years or 160,000 every five years. Initial access channel construction dredging work is described in Section 6.2.1.1 (page 92). Material removed from the access channel is to be transported to the APCO dredged material disposal site. During initial construction, materials to be deposited at the APCO sites will be transferred via pipeline, barges or scows to a temporary barge equipped with a hydraulic dredged material transfer pump and pipeline system. It appears there will be a need to operate a dredged material transfer system at the APCO sites during initial construction and then every three years thereafter. I was unable to find a plan for the mobilization and demobilization of the temporary barge berth and hydraulic sediment transfer system at the APCO dredged material disposal site. The application notes that special measures will be required to protect the eelgrass beds in the vicinity of the dredged material transfer pipeline connecting the material offloading barge and the APCO sites. If this transfer system will be mobilized and mobilized every three years, eelgrass beds in the vicinity are likely be impacted by this periodic ongoing disturbance. **No permit should be issued until the applicant provides a plan outlining the intended process used to mobilize and demobilize the sediment transfer system at the APCO dredged material disposal site.**

3. Reference is made to how rock material excavated from the access channel will be handled following excavation but **no description of the type/s, anticipated volumes or the methods used to excavate rock encountered during access channel construction is provided**. Other sections of the application indicate rock excavation will require blasting to fragment bedrock encountered in some of the Navigation Reliability Improvement areas, but the description of rock volumes and methods used for rock excavation, transport, and disposal from the access channel is not specified [Section 3.5.2 **No permit should be issued before the applicant clarifies the volume of rock expected to be encountered during access channel construction. The applicant should also be required to specify methods used to excavate and transfer rock encountered during construction of the access channel to the designated disposal area.**

4. A narrative description of the dimensions of the access channel is provided in Section 6.2.1 (page 91) entitled "Access channel". **The applicant states design details regarding the access channel are provided in Attachment D.2. However, the drawings presented in attachment D.2 do not contain any design details for the access channel (pages 420-421).** The drawings in attachment D.2 are titled "Conceptual Layout of Slip construction Berm". The only information in attachment D.2 relates to the design of the Temporary barrier berm and the Temporary Barge slip. A plan view drawing of the access channel can be found on page 859 of the application but this drawing is not referenced in the narrative description related to this project element. **The applicant should be required to provide the omitted access channel design detail information in order for the agency to complete its review of the application.**

5. Reviewers are directed to Table 6-2 for additional information related to the construction of the access channel but the manner in which information is presented in table 6-2 makes it difficult to readily determine the aggregate total area of wetland habitats to be impacted as a result of the construction of

this project element or other individual project elements such as the rock pile apron. (also see comments related to the rock pile apron and editorial insufficiencies related to table 6-2 elsewhere in these comments). A partial description of the total acreages of wetland types impacted by the proposed access channel configuration is provided on page 860 of the application but this description is not referenced in the description of the project. Reviewers are left to search around in the 1,600-page document for relevant information. This is unacceptable and provides editorial barriers to discourage all but the most committed reviewers who are conversant in the jargon laden, highly technical and poorly organized presentation of subject matter in the application.

Comments of Michael Graybill in response to DSL joint permit application and call for comments on a proposal from Jordan Cove Energy Project L.P. to the Oregon Department of State Lands on 7 November 2018.

CHAPTER 5: COMMENTS ON THE PROPOSED NAVIGATION RELIABILITY IMPROVEMENTS

1. DSL should deny the applicant's request to construct the proposed "Navigation Reliability improvements" because it appears possible to attain 99.5% of the stated purpose of the project without excavating the proposed "Navigation Reliability Improvements".

The projected "loss" of production at the proposed liquefaction facility is based on an insufficiently demonstrated requirement that the capacity of the facility must be 7.8 mtpa in order to satisfy the Project's purpose and need.

OAR 141-085-0550 lists Application Requirements for Individual Permits. Section (2) states:

> ***(2) Complete and Accurate Information Required****. Failure to provide complete and accurate information in the application may be grounds for administrative closure of the application file or denial, suspension or revocation of the authorization.*

OAR 141-085-0550 (5) (f) requires

> "(f) A description of the project purpose and need for the removal or fill. All projects must have a defined purpose or purposes and the need for removal or fill activity to accomplish the project purpose must be documented. *The project purpose statements and need for the removal or fill documentation must be specific enough to allow the Department to determine whether the applicant has considered a reasonable range of alternatives*." (emphasis added)

Section (3) of the application Project purpose and need (Page 2) states:

> *"The Project is a market driven response to the burgeoning and abundant natural gas supply in the US Rocky Mountains and Western Canada markets and the growth of international demand, particularly in Asia. The overall Project purpose and need is to construct a natural gas liquefaction and deep-water export terminal capable of receiving and loading ocean-going Liquified Natural Gas (LNG) carriers, in order to export natural gas derived from a point near the intersections of the GTN Pipeline system and Ruby Pipeline System."*

2. The application does not state why the design capacity of the proposed LNG liquefaction plant must produce 7.8 million tonnes per annum (mtpa) in order to attain the project purpose.

Table 1.2.2 (page 11) of Resource Report 1 submitted to the FERC September 2017 is entitled "Major Changes from CP13-483-000 for the JCEP LNG Terminal Facilities" and states *"The LNG production capacity of the LNG Terminal has been increased to 7.8 mtpa. This was previously 6.8 mtpa*". It appears that the revised 7.8mtpa capacity of the proposed LNG export facility may have been established in part by assessing the currently available capacity of two existing natural gas transmission pipelines; (GTN and Ruby See Page 7 Resource Report 1). When the Ruby and GTN pipelines were constructed, their design capacity was likely established without any consideration of the natural dynamics of the Coos Estuary or impacts to wetlands and waterways of the state of Oregon. It also appears that at one point in the planning stage for an LNG facility in Coos Bay having the same purpose, the applicant considered 6.8 mtpa of LNG a sufficient quantity to satisfy the need and purpose of the project.

3. The difference between a proposed LNG facility having a proposed 6.8 mtpa capacity and a 7.8 mtpa capacity appears to have significant and avoidable impacts on Oregon wetlands and waterways.

In order to attain the expanded 7.8 mtpa export capacity, the applicant has stated there is a new "need" to excavate approximately 580,500 cubic yards of sub tidal estuarine sediments at four locations along the margin of the Federal Navigation Channel These are collectively referred to as "navigation reliability improvements"(NRI's) [See Table 1.1-1 (Page 10) of Resource Report 1 submitted to the FERC September 2017 and Table 6.1 (page 36) of Joint permit application]

The application states:

> "*…without the Navigation Reliability Improvements, the LNG facility would not be able to optimize its production capacity and export 7.8 mtpa of LNG and therefore would not fully satisfy the project purpose….. Modeling showed that without the NRIs in place, the greater delays imposed by the Pilots on LNG ship transits of the channel due to environmental conditions would result in a potential loss of production at the facility equal to about 38,000 tonnes of LNG. This would result in a direct loss of revenue of about $8.0 million per year for the facility."* (page 2)

Increasing the LNG production capacity from 6.8 to 7.8 mtpa will enable the applicant to use a larger percentage of the uncommitted capacity of the GTN and Ruby pipelines. However, by increasing the proposed annual LNG production capacity of the terminal from 6.8 mtpa to 7.8 mtpa, the applicant states it then becomes necessary to excavate the NRI's in order to safely ship an unsubstantiated increase in the proposed production volume of LNG.

The applicant is proposing it is necessary to excavate 584,500- 700,000 cubic yards of sub tidal estuarine habitat to permanently modify sub tidal estuarine habitats at the margin of the federal navigation channel in the Coos estuary in order to fully utilize a proposed facility designed to export 7,800,000 tons of LNG per annum. The sole justification for the need to excavate the "Navigation Reliability Improvements" is based on a weather dependent navigation model projection that estimates it is possible to export up to 7,762,000 metric tons of LNG per annum in the absence of the NRIs. [7,800,000 mtpa (proposed capacity) minus 38,000 mtpa (modeled annual "loss" of production in absence of proposed NRIs) equals 7,762,000 mtpa].

Using information provided in the DSL Fill and Removal Permit application, the applicant has suggested that an export facility having a capacity of 7.762 mtpa (99.5% of the proposed expanded 7.8 mtpa capacity) could be constructed without the need to excavate and routinely dredge the NRI's. Information provided to the FERC in September 2017 Resource report 1 further suggests a plant having a capacity of 6.8 mtpa is sufficient to satisfy the purpose and need of the Project. A primary objective of Oregon Fill and Removal statute is to avoid or minimize the need to engage in fill and removal activities in waters of the state. The applicant has not adequately proposed or evaluated alternatives designed to avoid or minimize the need to dredge the estuary in order to meet the stated purpose and need of the project. **A permit to excavate the proposed NRIs should not be issued unless the applicant adequately demonstrates the project's purpose and need could not be met by constructing a facility with a production capacity that does not require modifications to the federal navigation channel.**

The proposed Navigation Reliability Improvement (NRI) work will entail the excavation, mobilization and transport of approximately 700,000 cubic yards of bedrock and unconsolidated sediment. Material dredged from the four areas is to be transferred as a liquid slurry via a 24" diameter pipeline to a disposal site (APCO sites 1 and 2) in the vicinity of the Hwy 101 Bridge in North Bend. The maximum estimated pipeline length is approximately 8.3 miles. The pipeline will be laid at the bottom of the Federal navigation channel connecting each of the four NRI dredge areas to the APCO sediment disposal sites. Dredging work tied to this aspect of the JCEP is estimated to directly impact 35.4 acres of subtidal estuarine habitat.

Additional examples of the insufficiency of this portion of the application include, but are not limited to:

4. **Compensatory mitigation to address temporary and permanent impacts to affected habitats is not fully addressed**.

Although the application states that 35.4 acres of subtidal estuarine habitat will be directly impacted because of the NRI dredging work, the application does not mention how the impacts to these habitats will be mitigated. In some situations, the proposed dredging work will convert subtidal soft bottom habitat to a bedrock sub-tidal hard bottom habitat. In all situations, the proposed initial impacts will require follow-on maintenance dredging work that will result in regular disturbance to the biological communities that interact with these habitats. In the absence of the proposed work, the sub tidal habitats adjacent to the Federal navigation channel would not experience direct impacts related to excavation, or ongoing disturbance related to maintenance dredging. The proposed NRI dredging work will impact sub tidal habitats that are not currently subjected to dredging. The impacts of initial dredging and subsequent maintenance dredging will disrupt the function of these habitats for an indefinite period of time into the future. It is unlikely that the impacts resulting from the proposed dredging work will have a positive effect on the environment. It is more likely that the dredging work will have a detrimental effect on the ecological functions and values of the wetland habitats in the proposed NRI dredge areas. The nature and extent of the negative effects on subtidal habitats in the proposed NRI dredge areas should be characterized.

This reviewer recognizes that current DSL fill and removal guidelines do not require compensatory mitigation for deep sub-tidal habits. However, this should not preclude DSL from considering the impacts associated with dredging and altering these habitats when the agency weighs the proposed benefits of the project against the overall impacts to public uses, wildlife, fish and public trust water resources. Although not required under current regulations, a plan designed to mitigate these impacts could be developed to characterize the wetland functions and values that would be impacted because of the planned construction and maintenance of the proposed NRI's. The plan could articulate the steps needed to replace the functions and values to be lost. A proposed mitigation plan would better enable the agency to determine the extent of impacts to public resources resulting from the proposed NRI's.

2. **The estimated NRI sediment volumes to be dredged are not consistently specified.**

The narrative project description of the NRI's on Page 100 (6.2.5.1) estimates dredged volumes to be approximately 590,000 cubic yards. However, Resource Report 1 (document page 26, pdf page 67) states *"The total volume of capital dredge material from these excavations is approximately 700,000 cubic yards."* Elsewhere in the application, the aggregated total of the estimated sediment volumes listed for each individual dredge area is 583,400 cubic yards (350,200 cy for area 1, 184,000 cy for area 2, 25,200 cy for area 3, and 24,000 cy for area 4). This is a volume estimate discrepancy of 116,600 cubic yards! Is the volume to be dredged 700,000 cubic yards as per info on page 4, 583,400 cubic yards as per info on page 5, or some other unspecified amount? If 700,000 cubic yards of bedrock and unconsolidated sediment is proposed to be dredged, transported, and spoiled at an upland disposal site as part of the NRI component of the JCEP proposal, the applicant should be required to provide consistent estimates of the volume of material to be dredged and spoiled. Accurate information is essential to determining if the disposal area has sufficient capacity to handle the material to be dredged. **Based on the information provided in the DSL joint permit application it is not possible to accurately determine the volume of material to be dredged, transported and disposed of by this aspect of the proposal. The applicant should be required to specify the locations of all sediment removal areas and provide accurate estimates of sediment volumes for each location to be disturbed. No permit should be issued in the absence of this information.**

3. A substantial portion of the total volume of material to be dredged in NRI Dredge areas #1 and #2 is bedrock. These dredge areas are situated up to 8.3 miles from the proposed dredged material disposal areas. The information in the DSL joint permit application states "Dredging will be accomplished with mechanical or hydraulic methods." However, the DSL joint permit application does not state the type of mechanical methods or equipment that will be used to excavate the bedrock sediments identified in Dredge areas #1 and #2. Further, the DSL joint permit application does not include information regarding the feasibility of pumping dredged bedrock sediments via a hydraulic pipeline up to 8.3 miles in length to the proposed upland disposal area. The proposal to transport dredged sediments via a 24" pipeline suggests that bedrock fragments to be transported will have a maximum particle dimension of something less than 24" overall. Does this mean that excavated bedrock fragments will be ground to a dimension suitable for transfer as a liquid slurry? Will the appropriate fractured bedrock particle sizes be produced on the seafloor by the dredge cutter head or will unsorted fractured bedrock particles be brought to the surface and sized for transport by some other means? Information regarding specific methods to be employed for bedrock excavation work is essential to asses potential water quality related impacts of this work. For example, a rotating rock cutter head capable of fracturing bedrock with particle sizes sufficient for pipeline transport is likely to produce more suspended sediments during dredging than a mechanical scoop type excavator that raises larger rock fragments to the surface that are subsequently fractured to a size sufficient for transport as a liquid slurry. These distinctions have significant water quality and habitat impact implications.

Until the applicant provides specific information regarding the mechanical methods to be used to fracture and excavate the bedrock encountered in the course of implementing the NRI dredging work, it is not possible to assess the potential impacts that these activities have on the environment. It is essential for permit reviewers to have sufficient information to asses if the methods proposed to handle, transport, and dewater spoiled dredged material are feasible or pose unnecessary, avoidable risks to the environment and economic activities in the vicinity of the project. **No permit should be issued until the applicant provides sufficient information to enable regulatory agencies and the public to clearly understand the specific methods to be used to excavate, transport, spoil, and dewater the bedrock sediments encountered in the Navigation Reliability improvement dredge areas.**

4. Transporting irregularly shaped freshly fractured rock particles via an 8.3-mile-long pipeline would seem to hold greater potential risk for pipeline clogging and sediment transport system failures than using a similar sized system used to transport finer, sandy and silty sediments. **The applicant should provide evidence to demonstrate that the proposed hydraulic pipeline transport method is feasible and is the most appropriate transport method for the type of bedrock sediments that will be encountered in the NRI dredge areas.**

5. **There is potential for booster pump and temporary dredge material transfer pipeline interactions with marine mammals including harbor seals, Steller sea lions, California sea lions and Orcas.** The Marine Mammal Protection Act requires activities that may impact marine mammals to be identified and appropriate permits for take to be issued if appropriate. The application states that "Booster pumps would be required to move material to the disposal sites." The number, location, and configuration of these pump stations is not described in the DSL joint permit application. The proposed NRI sediment transport pipeline route traverses a large segment of the estuary. While much of the pipeline will rest on the bottom, it is assumed that the booster pump stations will operate on the water surface with inflow and outflow pipeline segments rising from the bottom to the pump stations at the surface along the pipeline route. The proposed NRI pipeline route will run past at least two known harbor seal haul out and pupping sites. Consideration of marine mammal haul out sites should be given when specifying the locations and operation of sediment transfer pipes and pump stations. Pump stations should not be permitted in locations where the above bottom inflow and outflow pipeline segments interrupt the unrestrained ingress and egress routes used by seals to access the haul out and pupping areas. In addition, no portion of the sediment transport pipeline that rests on the bottom should be permitted if it interrupts the free movement of marine mammals using the area. NRI Dredge areas #2 and #3 appear to be closest to the aforementioned harbor seal haul out and pupping areas. In areas where dredging activities take place in the vicinity of a marine mammal haul out site, activities that disrupt the normal behavior of animals using the haul out sites should not be permitted.

Comments of Michael Graybill in response to DSL joint permit application and call for comments on a proposal from Jordan Cove Energy Project L.P. to the Oregon Department of State Lands on 7 November 2018.

CHAPTER 6: COMMENTS RELATED TO PROPOSED HORIZONTAL DIRECTIONAL DRILLING OPERATIONS

The applicant proposes to use horizontal directional drilling (HDD) to pull a 36 inch diameter high pressure welded steel pipeline under a tidally influenced portion of the Coos River. Examples of the insufficiency of the application include, but are not limited to:

1. The applicant proposes to use HDD as the preferred method of installing the natural gas transfer pipeline under the Coos Estuary. This method, however, was previously deemed to be infeasible by the applicant in a previous iteration of this project reviewed by the Federal Energy Regulatory Commission. Additional discussion related to the feasibility of the proposed use of Horizontal directional drilling is included in Chapter 7 of these comments.

2. Horizontal directional drilling will involve the removal of sediments including drilling fluids from the borehole in order to make way for the pipe intended to fill the excavated space. Although the application provides no discussion of the volume or nature of the sediments to be brought to the surface by these operations, the distances proposed to be horizontally drilled, and the diameter of the pipeline to be routed through the borehole, enable a sufficiently robust minimum estimate of the volume of the sediment that will be brought to the surface as a result of the HDD operations to demonstrate the need for the applicant to provide a more robust characterization of, and evaluation of the HDD operations wherever they will be used during pipeline construction.

The following analysis is derived from information provided by the applicant:

> Minimum borehole size;
> 36” diameter (7.07 square feet)
>
> Minimum estimated aggregate length of HDD boreholes to be drilled in Spread 1 of the pipeline route; 14,850 lineal feet including;
>
> > 4,250 lineal feet for Coos Bay West borehole (drawing 38)
> > 9,000 lineal feet for Coos Bay East borehole (drawing 39)
> > 1,600 lineal feet for Coos River (drawing 40)
>
> Estimated minimum volume of sediment to be brought to the surface in Spread 1 of the pipeline route as a result of proposed HDD activities = Cross sectional area of borehole x length of borehole.
> 7.07 SQ FT x 14,850 LF = 104.989 cubic feet (Approximately 3,888 cubic yards)

If the above analysis is an accurate approximation of the proposed HDD work in spread 1, nearly 4,000 cubic yards of raw sediments will be brought to the surface by the HDD operation in spread 1 of the proposed pipeline route alone. If improperly handled, this volume of sediment holds potential to impact wetlands and water quality during construction and disposal. **The volume, composition, condition, handling, treatment if necessary, and disposal of sediments brought to the surface by HDD operations along the pipeline route must be elucidated in order to adequately asses any potential impacts to the**

surrounding environment or other health and safety related matters. The permit should be denied until adequate information pertaining to the proposed HDD operations.

3. The DSL joint permit application provides a coarse resolution map indicating the landfall locations of the HDD boreholes but it does not provide sufficient information to characterize which shorelines will be used as the base for the HDD operations. For example, the estimated 9,000 lineal foot borehole under the east portion of the Coos Estuary will likely require set down and assembly areas for the 9,000-foot-long pipeline segment that will be assembled and pulled through the borehole. In addition, the HDD boring equipment is likely to require an unspecified area to accommodate drilling equipment, drilling lubricating fluid storage and handling areas as well as areas for on-site sediment storage and dewatering/treatment. If sediments will be transported away from the drilling location additional area will likely be required at the drill site to load and transport sediments and liquids produced at the site.

4. The volumes, characteristics, handling and disposal procedures associated with fluids to be added or produced as part of the HDD operations should be elucidated in order to enable the objective risk and benefit analysis required by this permit, NEPA, Section 404 of the CWA, and Section 408 of the Rivers and Harbors Act and provisions of the ESA.
No permit should be issued without ample opportunity for the permitting agencies and the public to review and evaluate a detailed plan that addresses the aforementioned and other issues related to the HDD activities proposed by the applicant. The current application lacks sufficient information to provide an adequate evaluation of the potential risks and/or benefits to wetlands and waterways of a pipeline route requiring the level of HDD work proposed. **The permit application should be denied unless additional information is provided to enable a robust evaluation of the proposed activity.**

Comments of Michael Graybill in response to DSL joint permit application and call for comments on a proposal from Jordan Cove Energy Project L.P. to the Oregon Department of State Lands on 7 November 2018.

CHAPTER 7: COMMENTS ON PROJECT FEASIBILITY AND SITE SELECTION

A *feasible* project includes design elements and attributes that assure a proposed project's purpose and the benefits linked to its purpose are attainable as described. **No permit requiring impacts to wetlands or public uses of waterways should be issued for projects that are not feasible** (i.e. not feasible = unable to achieve the stated purpose/s and benefit/s of the project that are used to justify the impacts to wetlands and waterways associated with the project). Several aspects of the Jordan Cove project raise questions related to the feasibility of the work proposed. For illustrative purposes, a partial list of examples is provided below:

1. Introduction, context, and importance of assuring this project is feasible.

The wetlands waterways and shoreline of the Coos Estuary bear more than ample evidence of historic human modifications resulting in regulated and unregulated dredging and filling activities that have impacted wetlands. Many of the historic dredging and filling activities in the Coos Estuary preceded the adoption of wetland conservation policies including the fill and removal program statutes administered by DSL, and numerous state and federal wetland and watershed conservation and restoration programs. Today, fewer than 10% of the original tidal salt marsh habitats remain in the Coos Estuary. The other 90% of the original tidal marshes have been altered by these historic diking and filling activities. (see "History of estuarine wetland development and alteration: What have we wrought" ME Boule, KF Bierly - Northwest Environmental Journal, 1987)

The wetlands and waterways of the Coos Estuary also bear a conspicuous legacy of historic dredging and filling projects undertaken *following* the adoption of the wetland Fill and Removal statutes implemented by DSL and undertaken with wetland fill and removal permits issued by DSL. Several of these permitted projects failed to achieve the originally proposed project purposes and benefits. Examples of permitted wetland fill and removal projects in the Coos Estuary that resulted in wetland impacts but never attained the proposed project purpose/s include but are not limited to: 1) A barge slip constructed in the 1980's by the Port of Coos Bay on the North Spit. 2). A "T" dock on the North Spit of the Coos Estuary and 3). A salmon aquaculture facility on the North Spit of the Coos Estuary. Each of these examples involved wetland and waterway impacts that were deemed by the permit applicants to be unavoidable in order to satisfy the stated purposes and needs of the project. When DSL and other agencies issued permits, the wetland impacts and loss of public uses were considered acceptable when the stated project purposes and benefits were weighed against these impacts. For various reasons, the cited examples never attained the project purposes or addressed the "needs" identified in the permit applications.

Thus, the agency authorized the project permit holders to impact Oregon's waterways in order to accommodate the purported benefits associated with these projects. The impacts to the wetlands and waterways came about, but the benefits that were supposed to have offset those impacts have yet to be realized as originally proposed. It is reasonable to conclude that these projects *failed* because one or more aspects of the project was not feasible. Because permitting agencies issued permits for projects that turned out to be *not* feasible, these permitted projects resulted in unnecessary, unsubstantiated, and avoidable impacts to Oregon's wetlands and waterways.

Feasibility factors considered by this review

No less than four factors contribute to determining the feasibility of a proposed project. A brief description of the factors considered in this review is presented below and is followed by a more detailed analysis of how these factors relate to a determination of the feasibility of the Jordan Cove Energy Project.

a. *Factors related to technical feasibility*: A project should not be considered feasible if aspects of the proposed work are not technically achievable.

Examples of technical feasibility include but are not limited to compliance with applicable laws and regulations, ability to accomplish the wetland restoration actions and achieve the wetland restoration/mitigation outcomes proposed. At least one of the examples of the permitted projects listed above appears to have been infeasible because of technical design flaw considerations. The salmon ranching aquaculture facility operations were infeasible because lower than planned for numbers of returning adults could not justify continued operations. The technical infeasibility was further reinforced following the adoption of the wild fish management policy by the Oregon Department of Fish and Wildlife. The facility closed not long after it was built and has remained inoperable to this day. The wetland impacts associated with the long disused aquaculture facility's fish ladder persist to this day.

Construction methods proposed must achieve desired functions and outcomes in order for a project to be feasible. Examples of technical considerations associated with the Jordan Cove proposal that raise questions regarding the likely feasibility of the project include but are not limited to: 1.) the hydraulic suction cutter dredging method for bedrock removal and transport, 2.) horizontal directional drilling for pipeline under the estuary, 3.) the capacity of APCO dredged material disposal site to accommodate total volume of material proposed for this site

b. *Factors related to operational feasibility*: A project should not be considered feasible if the economic factors underlying the project's purpose result in the disuse of the project or if the project lacks interested users.

One or more of example projects listed above appear to have been infeasible in part for operational reasons. None of the hoped-for barge customers ever came to use the barge slip. None of the hoped-for vessel traffic ever came to use the "T" dock. In order for a project to be feasible, the project must be designed to operate in a manner that enables the attainment of the stated purpose. Examples of operational aspects of the Jordan Cove project that raise questions regarding the operational feasibility of the project include but are not limited to: 1.) demonstration that the applicant has secured a guaranteed feed gas supply capable of producing the annual volume of LNG product proposed. 2.) Demonstrated assurance that the applicant has identified and secured agreements with customers committed to purchasing and shipping LNG produced at the LNG terminal. 3.) Demonstration of continued favorable market conditions during life of project . 4.) Availability of the types and sizes of vessels required to transport the LNG produced by the terminal.

c. *Factors related to safety and protection of public welfare*. A project should not be considered feasible if attainment of the project purpose exposes the public to undue risks.

d. ***Factors related to the independent utility of the project*****. A project should not be considered feasible if impacts to wetlands and public waterways** ***in addition*** **to the impacts stated by the project proponent are required to attain the stated purposes and benefits of the project.**

COMMENTS RELATED TO THE TECHNICAL FEASIBILITY OF THE WORK PROPOSED IN THE DSL FILL AND REMOVAL PERMIT APPLICATION SUBMITTED BY THE JORDAN COVE ENERGY PROJECT.

1. **It may not be feasible to place all the dredged material spoils at the APCO dredge material disposal areas.**

The APCO 1 &2 dredged material disposal sites have not been fully evaluated to determine if the sites can feasibly accommodate the proposed uses as disposal areas for an estimated 1,824,300 cubic yards of material excavated from the initial dredging of NRI's and eelgrass mitigation areas, as well as the material derived from maintenance dredging of the slip, access channel and NRI's for the life of the project (see pages 883-886). On page 849, the consultant states: *"However, disposal of all capital material at APCO Site 2 is contingent upon assessments of slope stability, the ability to ensure an adequate residence time, and safe access for equipment".* I was not able to locate any additional information related to the proposed APCO dredged material disposal sites to confirm that the sites posses the requisite attributes to determine if they are in fact feasible for the uses proposed.

The applicant has proposed that in addition to the material dredged during initial construction of the NRI's, material derived from maintenance dredging of the NRI's, the slip, and the access channel will be placed at APCO sites 1 & 2. (Page 874). I was unable to find applicant-provided information related to the expected life of the project but assuming a 30 year project lifespan, the applicant has provided an estimates for the volume of maintenance material to be dredged from the slip and access channel: *"The total anticipated volume of maintenance material that will be dredged over a 30-year period is approximately 0.98 mcy*" (page873) and for the Navigation reliability improvements: *"The total dredging volume required over the 30 year planning horizon is approximately 200,00 cy"* (page 874). In addition to the 584,300 cubic yards of material to be placed at the APCO 1 and 2 sites produced by initial NRI construction activities (page872), and the 40,000 cubic yards of material dredged from the eelgrass mitigation site (page 864), the APCO disposal sites must also be capable of spoiling an additional 1.2 million cubic yards of project maintenance dredged material produced over an expected 30 year project lifespan. The combined total of material from all sources is 1.82 million cubic yards.

The applicant's dredge material management plan (Pages 843-909) includes a three factor (technical, logistical, and environmental) site selection feasibility analysis. The feasibility determination of the APCO 1&2 disposal sites to accommodate the uses proposed was based on a series of assumptions that require additional confirmation. Several of the assumptions relate to the overall geotechnical capacity of the APCO sites handle the total volume of material destined for the sites. **The applicant has not demonstrated that it will be feasible to use the APCO sites to receive the volume of material proposed to be spoiled at those locations. No permit should be issued until the applicant demonstrates that the APCO sites are suitable for the proposed uses.**

2. **The recommended method of hydraulic dredging and transfer for the Navigation Reliability Improvements (see section 5.2 Page 903) is not likely to be a feasible method to excavate the bedrock in the NRI sites.**

The four dredging areas encompassed by the navigation reliability Improvements will require dredging approximately 584,300 cubic yards of material, of which 505,500 cubic yards is rock and 78,800 cubic yards is sand (page 872). The applicant proposes to transfer all material dredged from the navigation reliability improvement sites to the APCO disposal site by a hydraulic pipeline. The DMMP feasibility analysis is based on multiple unconfirmed assumptions including assumptions that it will be possible to use a hydraulic suction cutter dredge to excavate the anticipated volume of 505,500 cubic yards of bedrock from the NRI's, and that it will be possible to transport the fragmented bedrock via a 8-mile-long hydraulic dredged material pipeline system.

It is clear the consultant who prepared the DMMP was not confident about the feasibility of the applicant's preferred hydraulic suction cutter dredging and pipeline sediment transfer system. The Dredge Material Management plan narrative includes numerous references that cast doubt on feasibility of using hydraulic excavation and transport methods for the NRI work. The consultant's report (page 872) states: *"Two methods of dredging are identified as the most practical, given the historical dredging practices in the region, the material types being dredged, and the location and condition of the placement sites: (1) mechanical dredging via clamshell or excavator; and (2) hydraulic cutter suction dredging".* On pages 875 and 876, the consultant includes information that can readily be interpreted as suggesting methods other than the hydraulic excavation and transport proposed may be more feasible:

- "*For the navigation reliability improvements, the mechanical dredge would be outfitted with a heavy-duty clamshell."* This statement suggests it may not even be feasible to use conventional clamshell dredge to excavate the bedrock encountered in the NRIs.
- "*Although an excavator is better suited for dredging in-situ soft rock with its higher breakout capacities, outfitting the mechanical dredge with the heavy-duty rock clamshell bucket with pick point teeth would support rock dredging. The mechanical dredge might need to chisel the harder rock if the clamshell bucket is not heavy enough to break out the rock".* This statement suggests it may not even be feasible to dredge the rock from the NRI's using a heavy-duty clamshell dredge equipped with pick point teeth and it may be necessary to use other means to loosen the rock in order to excavate it. Blasting was also listed as a possible means of fragmenting the bedrock.
- *"For the navigation reliability improvements, after excavation, the sand or rock material would be placed in a scow or on a deck barge and transported, with the assistance of a tugboat, to a suitable Temporary Dredge Off-Loading Area."* This statement suggests it may not be feasible to transport dredged rock material using the proposed 8-mile-long hydraulic transfer pipeline.
- *"However, mechanical offloading would require the scow or barge be moored at an appropriate berth with an appropriate depth of water (approximately 25 feet). Where this may not be feasible, either because of eelgrass impacts or the length of trestle required, hydraulic offloading would be considered as an alternative".* This statement suggests it may not be feasible to offload scows laden with fractured rock and transfer them to the APCO 1&2 disposal sites using the hydraulic pipeline transfer system proposed by the applicant.

- *"Hydraulic dredging is most efficient when working with fine materials and sands since they are easily held in suspension. Coarser materials, including gravel, may be hydraulically dredged; however, these materials require a greater demand of pump power and can cause excessive wear on pumps and pipes".* This statement suggests it is not likely to be feasible to transport fractured rock sediments using the hydraulic dredge material transport pipelines system proposed by the applicant.
- *"For the navigation reliability improvements, which includes soft rock (sandstone and siltstone) at Dredging Areas #1 and #2, a 27-30 inch size hydraulic dredge (depending on available equipment on the West coast) is assumed to allow for sufficient cutter-head power for cutting into the rock".* The assumptions included in this statement suggest the consultant was unwilling or unable to confirm that this method would be feasible.

3. The feasibility of the proposed horizontal directional drilling (HDD) has not been demonstrated.

The applicant proposes to use HDD as the preferred method of installing the natural gas transfer pipeline under the Coos Estuary. This method was previously deemed to be infeasible by the applicant in a previous proposal to the Federal Energy Regulatory Commission. A reference to the applicant's prior claim that it is not feasible to use HDD methods to lay the pipeline across the estuary, appears in the DSL permit application Table A *entitled "Jordan Cove LNG project and Pacific Connector Pipeline Project SEF level 1 site history information and Pipeline stream Crossing Information"* (Page 1016). This table states the project will involve excavating 29,486 cubic yards of sediment from the Coos estuary in order to place 12,845 lineal feet of gas pipeline in the bay using a crossing method called "Wet Open-cut" The rationale given is *"Wet open cut only feasible practical in bay crossing method"*. The applicant now claims the HDD under the estuary is technically feasible but has not provided additional material to demonstrate feasibility. If a permit is issued and it is found that HDD it is not feasible, the applicant is likely to approach the agency seeking permission to lay the pipeline across the estuary using the wet open cut trench methods previously proposed. This method will have dramatic and unacceptable impacts on estuarine wetland habitats, water quality, commercial oyster production, and special status species. **No permit should be issued until the applicant provides information to demonstrate the technical feasibility of the propose Horizontal Directional Drilling methods described in the application.**

4. The proposed eelgrass mitigation work may not be feasible as proposed because current zoning does not permit dredging in the area identified by the applicant and because the physical conditions of the proposed mitigation work may not permanently persist in the landscape.

Work proposed in the Coos Estuary will take place in the political jurisdictions of the cities of Coos Bay and North Bend and Coos County. Actions proposed will need to comply with the zoning and land use regulations administered by these jurisdictions. Resource report 1 includes a discussion of zoning and land use requirement but fails to mention the zoning of the proposed eelgrass mitigation area. The only reference this reviewer found is a statement in Resource report 1 (Sept 2107 Resource report 1 document page 41) as follows: *"Also within Coos Bay, adjacent to the Southwest Oregon Regional Airport, would be the Eelgrass Mitigation Site, which would cover approximately 7.5 acres of open water and bay bottom, with approximately 33 acres used during construction for work area and dredge lines."* The proposed eelgrass mitigation work requires dredging in an area designated in the Coos Bay Estuary Management Plan as "Natural Aquatic-52". (see map on page 864). Dredging is not permitted in Natural Aquatic -52 zones by Coos County or the City of Coos Bay zoning and land use ordinances. Resource report 1 makes no reference that the applicant has requested or has obtained the zoning and land ordinance changes required to conduct the eelgrass mitigation work as proposed.

A detailed description of the likely infeasibility of the eelgrass mitigation actions to permanently persist in the landscape are described in chapter 3 of these comments.

No permit should be issued before the applicant demonstrates that zoning of the proposed eelgrass mitigation area will permit the dredging related work proposed as part of compensatory wetland mitigation actions to address permanent impacts to eelgrass and that the dredging will create physical conditions at the eelgrass mitigation site that will permanently persist in the landscape.

5. The project may not be feasible because it poses undue risks to the safety of people and property in the vicinity of the project.

Safety considerations have been used by the applicant to justify the unavoidable necessity of certain project related wetland impacts. The applicant has listed multiple safety considerations as essential design elements of the project. Examples include, but are not limited to:

a. Safety factors used to justify impacts to wetlands and waterways associated the export terminal siting and design.

- Need to place fill on wetlands to elevate facility above the tsunami inundation zone.
- Need to use a slip and access channel berth design as opposed to constructing an over water jetty type berth having fewer wetland impacts
- Need to choose a site to address aircraft and aviation operational safety
- Need to place fill to create multiple access roads into the facility
- Need for liquefaction facility to addresses heat and radiation safety standards
- Need to widen the Trans Pacific parkway at the Hwy 101 junction.
- Need to site the SORC in the immediate vicinity of the liquefaction facility

b. Safety factors used to justify impacts to wetlands and waterways associated with LNG transport system.

- Need for the Navigation Reliability improvements
- Need for a disabled tanker berth
- Need for access channel size and depth
- Need for escort tug and safety zone around transiting ships

c. Safety factors used to justify impacts to wetlands and waterways associated with natural gas pipeline transport system

- Need to control vegetation along pipeline corridor
- Need to site pipeline route in certain locations.

The applicant has determined that the project would not be feasible if certain safety design factors were not included (e.g. see page 245 for discussion of need to fill wetlands to raise facilities above tsunami levels and to fill wetlands to construct two entrances to the plant for emergency reasons). The applicant cites various safety standards and documents to substantiate the necessity that safety related aspects of the project design necessitate wetland impacts. One such document is listed in Attachment B.1 on Page 248 of the application under the section entitled "10.5 References". the document, hereinafter referred to as "SIGTTO 1997" is cited as follows:

Society of International Gas Tanker and Terminal Operators (SIGTTO). 1997. Site Selection and Design for LNG Ports and Jetties (Information Paper No. 14) http://www.sigtto.org/publications/publications-and-downloads.

The SIGTTO 1997 document focuses on the elimination of LNG spillages both at the ship/shore interface and in the navigational approach channels. The paper concentrates on issues which can be solved when an LNG terminal is being designed. The paper establishes a basis for safe terminal design and considers safety factors in the port approach. The following excerpts from the SIGTTO 1997 publication relate to the safety and thereby the inherent feasibility of the terminal site selected by the applicant:

- *"At the time of site selection, the level of marine risk is determined by the position chosen for the terminal and this is especially true for terminals handling hazardous cargoes such as LNG". (SIGTTO 1997 page 4)*
- *"… risks identified during planning should be controlled by suitable equipment and pre-arranged procedures. This should include the on-going need to keep other industry or populations remote from the plant". (SIGTTO Page 4)*
- *"However, whatever remote frequencies may be tolerated for a smaller release, there is no acceptable frequency for a large release". (SIGTTO Page 4)*
- *"In essence, the issue being addressed is how to best minimize port risks by design factors at the start of a project". (SIGTTO Page 4).*

The applicant makes frequent reference to safety requirements associated with the LNG liquefaction terminal component of the project. **The SIGTTO document referenced above also includes several additional safety considerations related to the suitability/safety/feasibility of the preferred site proposed by the applicant that were not discussed by the applicant.** Example of safety factors included in these industry guidelines include but are not limited to the following:

Chapter 5 (page 5) of the SIGTTO 1997 document addresses the "Development of LNG Standards" and directs readers to a discussion of *"The references mentioned in chapter 6 direct port designers to construct jetties handling hazardous cargoes in remote areas where other ships do not pose a (collision) risk and where any gas escape cannot affect local populations". (SIGGTO Page 5).*

Even though the applicant cites the SIGTTO safety standards to justify certain wetland impacts associated with the "preferred alternative" site chosen, the applicant's "preferred alternative" does not appear to meet the important safety standard referenced above. An estimated 17,000 people live within the area that may be impacted by an accidental or intentional release and ignition of vaporized LNG at the terminal site or along the proposed LNG tank vessel route. The proximity of a population this large to the proposed facility poses safety risks that appears to be inconsistent with recommended LNG industry and US Coast Guard safety standards.

No public agency should issue a permit for a project that will expose the public to unnecessary safety risks. DSL should consider safety aspects of the project as a component of its assessment of project feasibility whether or not those safety considerations have been identified by the project applicant. **In spite of the applicant's contention that the "preferred site alternate" is a feasible location for the proposed work, the site appears to include fundamental and unresolved safety considerations that raise questions regarding the practical feasibility of using the Port of Coos Bay as a location for an LNG export facility**. In addition, references to the safety of the ship-based LNG transport component of the project are limited to discussion of the Navigation Reliability Improvements and a justification of unavoidable wetland impacts linked to the proposed width of the marine slip. The application does not provide information or analysis regarding the safety of LNG vessels while in transit between the LNG liquefaction and loading facility and the Federal navigation channel entrance, or during operational emergencies such as accidental groundings and vessel fires, or extreme hydro-meteorological events including but not limited to storms, earthquakes, or tsunamis. Further information from the SIGGTO document states:

- *"From a navigational standpoint … the paper suggests that while the human controls called upon during ship manoeurving deserve high ranking, of themselves, they can never be considered one-hundred percent secure; this is because questions of human error can prevail." (SIGGTO Page 4)*
- *" … in some circumstances, such as a large LNG release close to a populated area, it may be impossible to devise a realistic contingency plan because of the nature of the problem" (SIGGTO Page 5)*

6. As proposed, it will not feasible for LNG vessels to transit the navigation channel at any time other than during tides greater than 6' 3" above MLLW.

Stated another way, the existing Federal navigation channel is *unsuitable* for LNG vessel traffic most of the time because the tide height is *lower* than 6' 3" most of the time. The navigation suitability determination conducted by the applicant, and approved by the US Coast Guard, has demonstrated that vessel transit conditions occur in the Coos Estuary that are suitable for scheduled transits of vessels having a 12-meter draft. However, the suitability study does not address safety concerns associated with a possible need to make unscheduled, emergency use of the channel, such as those encountered during the arrival of sea waves from remote or local seismic events, or from accidents, or deliberate acts of terrorism.

The Federal navigation channel is maintained at -37 'below mean low-low water. The 12-meter draft approved by the Coast Guard for LNG vessels equates to 39 feet 4 inches. The Coast Guard requires an additional depth amounting to 10% of the vessel draft for under keel clearance. That's 3.9 feet = 3'11". Thus, the minimum depth required to safely operate an LNG vessel having a draft of 12 meters is 39' 4" + 3' 11" = 43' 3". To attain the required depth of 43' 3" the Federal navigation channel needs and additional 6' 3" of tide water on top of the 37' Federal navigation channel depth which is measured from the mean low-low water mark. 37'+ 6' 3" = 43' 3".

The need for 43 feet 3 inches of depth to transit an LNG tanker in the Federal navigation channel means that ANY time the tide elevation in the Coos Estuary is lower than 6'3" it will not be feasible for an LNG carrier to safely use the Federal navigation channel. I have not done the calculations on the percentage of time that unsuitable tide elevations are below 6'3" in Coos Bay, but simple (and verifiable) answers to this question are "a lot of the time" or "most of the time". On the day I wrote this (January 16, 2019) however there were 22 hours when the tide elevation was lower than 6'3" in Coos Bay. It is not necessary to evoke a tsunami scenario to point to the safety related risks associated with the inability of a vessel to use the channel for emergencies or other unscheduled transits. One only needs to consider that moving a vessel (for any reason) into the channel at tide elevations lower than 6' 3" is *not* feasible. Vessels will be "trapped" at the berth by the tide most of the time. This observation supports the applicant's need to dredge the berth and access channel to 49' because doing so will create the only location in the estuary having sufficient draft to keep a vessel from grounding during periods of low tide. This observation also supports the observation that full design-scale operation of the LNG terminal will require deepening and widening the Federal Navigation channel raising questions related to the **independent utility** of the work described in this application. Subsequent to the issuance of this permit, it is highly likely that the applicant will approach DSL and the US Army Corps of engineers with a proposal to expand the Federal navigation channel. The applicant's unstated but reasonably anticipated request for authorization to further impact wetlands by expanding the Federal navigation channel will doubtless be justified in the name of safety and economic expediency, but leaves questions related to the independent utility of the current application unresolved.

6. If attainment of full design capacity of the project requires deepening and widening the Federal Navigation Channel, it may not be feasible because the requisite channel expansion work may exceed some practical physical limits of the Coos Estuary.

The geologic setting and physical configuration of the Coos Estuary impose practical limits on the nature and scale of maritime activities suited to this port. The proposed use of the Federal navigation channel is conceivably at or beyond several of these practical physical limits. The current Federal navigation channel is maintained at a depth of -37' MLLW. Work in the 1990's to expand the Federally navigation channel to its currently authorized operating depth and configuration involved excavation of substantial quantities of bedrock in the lower reaches of Coos Bay.

The applicant has expressed an intent to construct an LNG production facility and berth for LNG vessels that exceed the present-day operational specifications of the navigation channel by proposing an access channel, slip and vessel berth configuration capable of handling vessels larger than those currently authorized by the US Coast Guard for this port. With the encouragement of and over $4 million of financial support provided by the LNG terminal project proponents, the Port of Coos Bay has recently (2017) submitted a request to the US Army Corps of Engineers to examine the feasibility of deepening and widening the Federal navigation channel in the Coos Estuary. The US Army Corps of Engineers has initiated NEPA EIS Scoping for this proposed work and a draft EIS for this study is in preparation.

The EIS for the most recent (1993) Federal navigation channel deepening project evaluated options to excavate the channel up to 3 feet deeper than the currently approved depth of -37' MLLW. This prior analysis clearly demonstrates that work to expand the Federal navigation channel beyond its currently authorized configuration will require removal of tens of millions of cubic yards of additional sand and bedrock sediments. The Port of Coos Bay's current EIS request would involve deepening and widening the federal navigation channel well beyond the scale evaluated in the studies conducted in the early 1990's that identified the physical challenges and prohibitive costs associated with dredging into the bedrock underlying the bottom of the estuary.

It is premature to predict the outcome of the most recent EIS process initiated by the Port as the draft EIS is currently in preparation. It is reasonable to state that the feasibility of dredging the channel to the depth and width necessary to accommodate very large LNG cargo carriers of the size desired by the LNG terminal proponents will be greatly influenced by the geology and physical configuration of the Coos Estuary. The Coos Bay Navigation channel expansion EIS process being conducted by the USACE should help to determine if using the Federal Navigation Channel for large LNG tank vessels of the size preferred by the project applicant [up to 217,000 cubic meters cargo capacity Resource report 1 (Pages 56 and 63)] is within or beyond the practical physical and geological limitations imposed on the port of Coos Bay. Thus, **it is premature to consider issuing a permit to construct a marine slip and navigation access channel as proposed in application. The DSL permit request should be denied.**

Comments of Michael Graybill in response to DSL joint permit application and call for comments on a proposal from Jordan Cove Energy Project L.P. to the Oregon Department of State Lands on 7 November 2018.

CHAPTER 8: COMMENTS ON THE PROPOSED ACCESS AND UTILITY CORRIDOR

The applicant has proposed to construct an elevated earth fill causeway connection between the LNG liquefaction facility on the Ingram yard property and other facilities located on the South Dunes property. The causeway will cross two of the largest wetlands in the terminal area. In several instances, the renderings of structures in the permit application fail to provide information critical to an objective assessment of impacts on wetlands. They include but are not limited to:

1. Figure 6.1-16 (Page 79) includes cross section C-C showing placement of fill on top of wetland 2013-6 and 2013-2. The information on the length and location of section C-C is insufficient, and the applicant should be required to modify the section to provide additional information needed to evaluate the impacts to the wetlands in this figure. While the northerly limit of Section C-C begins in the central portion of wetland 2013-6, the southerly limit of section C-C stops at the northerly margin of wetland 2013-2. As a result, it is not possible to determine the relationships between the surface elevations of these wetlands. Also, the location of section C-C does not make it possible to determine the surface elevation or topography of Wetland 2013-2 or the elevation of the proposed 36"-diameter culvert connecting wetland 2013-6 and wetland 2013-2. **The applicant should be required to provide a new section enabling permit reviewers to better evaluate the relative heights of these wetlands and important aspects of the proposed 36" diameter culvert.**

2. Figure 6.1.5 (Page 68) proposes to install a 36" diameter culvert having a length of approximately 200' to connect wetland 2013-6 and Wetland 2012-2. On page 282 the applicant states the culvert *"will aid in maintaining water circulation and faunal movement following construction".* Further on page 282 the applicant states *"A culvert connecting Wetland 2012-2 with Wetland 2013-6 will provide passage for amphibians, small mammals, and other organisms, and will restore a surface water connection between these wetlands that currently does not exist".* Presumably this culvert will be buried under the access and utility corridor. The application does not state the elevation at which will the culvert be placed relative to the soil surface or the annual variation water surface elevations in these wetlands. As a result, **it is not possible for a reviewer to evaluate the likelihood that the culvert connectivity approach proposed by applicant is feasible or will attain the stated functions**.

The applicant has stated that a surface water connection between wetlands 2013-6 and 2012-2 does not currently exist. What then is the need for or value of placing a culvert to establish a surface water connection? Do the seasonal changes of water surface elevations of these wetlands vary in sync with or independently of one another? What are the existing ground water linkages between these wetlands and how will the construction of the access and utility corridor impact these linkages? Is the intent of the culvert to replace hydrological links between the wetlands that will be impacted by the construction of the Access and Utility corridor? Will the ends of the culvert be permanently submerged? What are the expected water surface elevations, water depths and flows anticipated in the culvert? How was the size and placement of the culvert determined? **Unless substantial flows are expected to exchange and refresh the water in the culvert, dissolved oxygen levels of water and sediment in the culvert may be diminished or fully depleted during periods of low flux creating a passage barrier for aquatic organisms**. **Alternately, during periods where the ends of the culvert are fully submerged by**

seasonal variations in surface water elevations, the culvert may have limited or no value or function as a passage corridor for the "small mammals" identified by the applicant.

The size and proximity of these wetlands to one another suggests that terrestrial, amphibious, and avian species utilizing these wetlands are able to move freely between them in their current condition. How will the construction and operation of the Access and Utility corridor impact movements of terrestrial, amphibious, avian and aquatic species between these wetlands? As the construction of the Access and Utility Corridor is highly unlikely to enhance the connectivity of these wetlands, their functions and values are likely to be degraded during and following construction of the Access and Utility Corridor. **DSL should require the applicant to more explicitly address the degradation of functions and values of these wetlands resulting from the construction of the access and utility corridor**

3. Drawing number DS3218 (page 1075) indicates a bridge having a length of approximately 425' traversing an area of wetlands. This map appears to be in the vicinity of the "Access and Utility Corridor" referenced elsewhere in the permit application. While the wetlands identified in the vicinity of the bridge on Drawing number DS3218 are not specified, they appear to be in the same location as wetlands designated elsewhere in the application as wetland 2013-6 and 2013-2. A portion of the bridge span in Drawing number DS3218 appears to traverse the location of a proposed 36'diameter culvert designed to provide connectivity between wetlands 2013-6 and 2013-2 (page 79). The application thus includes two alternative solutions to protecting wetlands while constructing an Access and Utility Corridor over the most extensive fresh water wetlands found on the LNG terminal site. One alternative proposes an access and utility corridor that incorporates a 425' long bridge crossing over wetlands 2013-6 and 2013-2 (page 1075). The current, "preferred" alternative advanced by the applicant proposes to abandon the bridge wetland crossing proposal and replace a 425'-long bridge with an earth berm causeway atop the wetland with a 36" diameter culvert underneath it. **The applicant should be required to substantiate why the previously planned bridge over the wetlands has been abandoned and replaced with a plan that has greater impacts to wetland functions and values.**

A possible rationale to support Jordan Cove's decision to not build a bridge on the Access and Utility corridor may be found in Table 1.2.2 (page 10) of Resource Report 1 submitted to the FERC September 2017. The table is entitled "Major Changes from CP13-483-000 for the JCEP LNG Terminal Facilities". The applicant identifies that the design in CP13-483-000 included an access bridge from the South Dunes to the LNG Terminal in the Utility Access corridor and proposes to delete the bridge from the design. The reason given to delete the bridge provided in table 1.1-2 is based on a proposed change in the location of the fire department. No reference is made to the impact of this proposed change on wetlands underlying the Access and Utility corridor. Clearly this design change holds potential to impact the wetlands in the vicinity of the Access and Utility Corridor.

In order to address DSL's permit review criteria, applicants must provide an analysis of alternatives designed to avoid or minimize impacts to wetlands. Although this reviewer was unable to locate any analysis of alternatives to the proposed solution to construct an access and utility corridor consisting of an earth fill causeway with 36" diameter wetland connection culvert, the materials provided by the applicant appear to provide an alternative to the proposed work. Although a more thorough analysis is warranted, it appears reasonable to conclude that a 425' long bridge span above two adjoining wetlands holds potential to have significantly less impact on wetland functions and values than the earth fill causeway affixed with a 36” diameter culvert; the action proposed by the applicant. DSL should not issue a permit until the applicant has enumerated and evaluated alternatives to the proposed solution. DSL should not issue a permit that includes proposed actions that fail to avoid or minimize impacts to wetlands to the maximum practicable extent. **An Access and Utility corridor that incorporates a bridge over adjacent wetlands is very likely to have fewer spatial impacts and impacts to wetland function as and values than a permanent earth fill and culvert.**

4. The proposed Access and Utility corridor may impact wetlands of conservation concern

The Oregon Department of State Lands has identified interdunal wetlands as a wetland type of Conservation concern (https://www.oregon.gov/dsl/WW/Documents/wetland_cons_concern.pdf) The wetlands impacted by the proposed access and utility corridor appear to resemble this wetland type.

Section 6.1.2 entitled “Site Preparation and Ground Improvements” (Page 89) states the finished grade elevations for the Access and Utility Corridor well be *“approximately +46 to 66 feet NAVD”.* This section further defines Ground improvement actions to be taken as:

> *“Ground improvements refer to the removal of an organic layer of soil, followed by vibratory compaction of the subsurface sand below and on the perimeters of the project design footprint. Any ground improvements will occur within the JCEP Project Area and under the toe of the slope. Site work will begin with grubbing and removal of the organic layer, followed by sand vibratory compaction, which includes filling localized compacted areas with sand to make the soils more dense. Compaction may be followed by excavation and deep soil mixing or peat removal in areas containing peat to reduce settlement. Ground improvements will result in temporary impacts where they affect wetlands and overall are not anticipated to affect wetland hydrology”.*

Wetlands 3013-2 and 2013-6 almost certainly share a common groundwater source known as the dunes aquifer. Sands in the dune system were deposited by aeolian processes that other investigators have characterized. Vertical and horizontal water infiltration rates through these wind deposited sand sediments are considerably different with the difference being attributed to the shape and orientation of the wind deposited sand particles. The dune sand system in the vicinity of the terminal appears to have substantially greater horizontal flux rates through the accumulated sediments than the vertical flux rates. The “deep soil mixing” and “sand-vibratory compaction” sitework prior to the construction of the access and utility corridor is likely to alter the horizontal groundwater flux rate that is fundamental to the function of these wetlands. **No permit should be issued before an evaluation of how the site work and associated construction of the access and utility corridor is likely to alter or impact the ground water system that supports wetlands 2013-2 and 2013-6.**

Comments of Michael Graybill in response to DSL joint permit application and call for comments on a proposal from Jordan Cove Energy Project L.P. to the Oregon Department of State Lands on 7 November 2018.

CHAPTER 9: IMPACTS TO WETLANDS NOT ADEQUATELY DISCUSSED IN THE APPLICATION.

Introduction:

As proposed, the project will result in longstanding and avoidable post project "Legacy Impacts" to wetlands following the end of the project.

Dredging and filling involves earthwork. The Coos Bay estuary bears the scars of 150 years of projects that, for one reason or another included a need to dredge, drain or fill its wetlands or waterways. The shoreline is scattered with wetlands stacked under dozens of feet of sediments dredged from the channel, it has miles and miles of dikes and tidegates that altered huge sections of estuarine wetland habitats. Over the years no less than ten projects involved digging mud and sand from the channel bottom to make the Federal navigation channel ever deeper and wider in the name of commerce and economic development. The last time the channel was expanded we ran out of sand and encountered the bedrock that underlies the bottom of the bay. At some point there has to be a limit. Will that limit be when 100% of the shoreline is lined with steel sheet piling and rock revetments? Will that limit come when all the wetlands have been impacted? The marshes of the Coos estuary stand at 90% impacted, 10% remaining.

The current project is the next in this 150-year string of projects that have dug, filled, drained and most recently chiseled away at the bedrock bottom and shoreline of this estuary. This proposal is the first major proposal in many years to further reduce the remaining area of intertidal and shallow sub tidal tideflats by digging yet another hole in the side of the estuary in the name of economic development. The project proposes to dig out a new portion of the estuary and stack it up on a former piece of the estuary that has already had sediments dredged from the bottom in support of some now long forgotten economic development project. There is a pattern here. Economic development projects come and go but the legacy of their wetland impacts and the cumulative loss of the benefits once provided by those wetlands continues long after the hoped for economic benefits of a project are gone. While it is difficult for me to believe, the proponents of this project anticipate it will have a lifespan of 25 years. The earthwork required to achieve the benefits of this limited term project lifespan will persist for many centuries after the project has come and gone.

The only way the DSL Director can issue a permit to impact wetlands is if the benefits of the project offset the impacts to Oregon's wetlands and waterways. The DSL Director also has the authority to place conditions on any wetland fill and removal permit the agency issues. Time will tell if this project produces the hoped-for benefits being advanced by this project's proponents, but one thing is certain; at some point in the future this project will end, and its promised benefits will end too. When the benefits of a project that impact wetlands end, the only thing that will remain is the impacts to the wetlands that the project produced.

We need to end the time where wetland impacts having timespans greater than two years are considered "permanent" wetland impacts. DSL has the ability to distinguish long term but reversable impacts from "permanent" impacts. Greater consideration to measures designed to minimize impacts to wetlands must be given prior to granting permission to permanently impact wetlands. We now live in a time where it is possible to restore longstanding historically impacted wetland habitats. This is evidenced by the applicant's proposed wetland mitigation plan to restore a historically impacted wetland. The community of Coos Bay is home to two organizations that have been pioneers in the field of wetland and watershed restoration; The South Slough National Estuarine Research Reserve and the Coos Watershed Association.

When the public benefit that a project provides comes to an end, the party responsible for any long term but reversable impacts to those wetlands should be required to restore the wetland functions that occurred there before the start of the project. **If DSL is compelled to issue a permit for this project, a time dependent condition should be placed on the permit. At the end of the project, when the benefits of the project that justified the impacts to wetland are no longer being realized, the permit holder should be required, at minimum, to restore the long term impacted wetlands to a pre-impact condition.**

Although only certain types of wetlands impacted by this project will require compensatory mitigation under DSL fill and removal program rules, large additional areas of wetlands associated with this project will be impacted even if state laws do not require compensatory mitigation to offset those impacts. Those impacts should not be overlooked or undervalued in the agency's analysis of impacts. Attachment I (pages 1078-1349) includes an extensive and detailed discussion of project impacts requiring compensatory mitigation. The discussion and analysis in the section is so extensive that it might lead one to believe that this section is a comprehensive accounting for all the wetland impacts associated with this project. Attachment "I" however is not a comprehensive accounting for all wetland impacts associated with this project.

Oregon's fill and removal law only requires compensatory mitigation for impacts to certain types of wetlands (such as vegetated marshes). Other types of impacts to wetlands such as sub-tidal estuarine habitats do not benefit from the protective compensatory mitigation provisions of the fill and removal law. This exemption from required compensatory mitigation should not be construed as meaning that these wetlands do not also provide public benefits or support recreation or fisheries; attributes that DSL is obliged to protect on behalf of the public. The exemption from compensatory mitigation requirements should also not preclude these impacts from being included in DSL's evaluation of the cumulative impacts to wetlands associated with this project. A large proportion of the total wetland impacts associated with this project involve impacts to functioning wetland types that do not currently require compensatory mitigation. The lack of a requirement for compensatory mitigation should not exempt the applicant from providing a full analysis of all anticipated wetland impacts. DSL should not overlook the totality of impacts to wetlands while evaluating the costs and benefits of the project. **DSL should, as part of its permit review, consider that the proposed benefits of the project will impact large spatial areas of sub tidal estuarine wetland habitats in addition to the wetland impacts requiring mitigation that are the focus of much of the permit application.**

The applicant fails to adequately address how the proposed construction of the LNG terminal facilities will impact ground and surface water flux between the Dunes aquifer and the receiving waters and wetlands of the adjoining Coos Estuary. Domain boundaries of models, and model simulations that I have been able to find in materials submitted by the applicant are primarily concerned with potential flux of salt water toward the fresh water aquifer resulting from withdrawal of fresh water from the aquifer. The models and narrative discussion fail to adequately discuss the impacts of changes of fresh water fluxes from the fresh water aquifer to the habitats and wildlife of the adjoining estuary resulting from construction and operation of the North Spit LNG terminal.

Issues with potential impacts to wetlands of the North Spit to be considered include, but are not limited to:
1. The proposal to stack and dewater dredged sediments above the water table at the Jordan Cove and South Dunes LNG Terminal areas will alter rainwater infiltration and seasonal groundwater recharge dynamics that support wetlands in the vicinity of the project.

2. Deposition and dewatering of sediments dredged from the navigation reliability improvement sites at the APCO #1 and #2 dredged material disposal sites will initially elevate the soil surface a minimum of 37 to 49 feet above the existing soil surface elevations at these sites. These activities hold potential impact ground water quality and seasonal groundwater recharge dynamics of wetlands in the vicinity of the dredged material disposal sites.

3. **Proposed work in the Jordan Cove plant area a will impact the hydrology and the wetlands in the area.**

Prior to planned placement and dewatering of sediments above the existing grades at in the LNG terminal area, the applicant proposes to excavate, dewater, compact and stabilize soils that will underly the LNG terminal structures (see Section 6.1.2 page 89). Excavation and dewatering actions are aimed at removing lenses of unstable peat and clay from the sediment horizons underlying the locations of LNG terminal structures. Proposed soil dewatering operations involve constructing a network of shallow water wells that will be installed and operated in the project areas to be excavated prior to final grading and facility construction. The objective is to compact and stabilize the soil below proposed LNG terminal structures. Aspects of the soil stabilization dewatering well network are described in Resource Reports submitted to the FERC *"The dewatering system will consist of well points having 12-inch-diameter slotted polyvinyl chloride (PVC) screens, extending from 20 feet below natural grade to 50 feet below natural grade. Well points will be spaced approximately 200 feet apart. Each well point will be fitted with a 5- to 7.5-horsepower pump. KBJ anticipates that a maximum of 22 pumps will be required at any one time during the project."* Water pumped from the soil stabilization sites will be spilled onto the soils at other locations in the project area where it is expected to infiltrate into the porous soils and reenter the groundwater system of the Dunes Aquifer.

Ground water exposed during fresh water phase of excavation of the proposed marine slip will also be pumped away from the excavation site to facilitate sediment removal using conventional land-based excavation and sediment transportation methods. When the water table in the fresh water excavation phase of slip construction is exposed to a point where conventional excavation methods are no longer viable, excavation equipment and land-based sediment transport to disposal areas will be replaced with floating dredge equipment and liquid sediment slurry pipeline sediment transfer methods. Piped sediments will be pumped to sediment disposal areas within the terminal area where they will be dewatered. The following description of the coupled surface and ground water system known as the Dunes Aquifer is derived and excerpted from a report entitled: "Ground-Water Availability from a Dune - Sand Aquifer Near Coos Bay and North Bend Oregon" by M.A. Jones, US Geological Survey open file Report 90-563. Portland OR 1992:

Hydrogeology (Page 4):
The Dune Sand aquifer is about 13 miles long and 1.5 miles wide. The aquifer is bounded to the west by the Pacific Ocean, the shore of the Coos estuary to the south, Tenmile Creek to the north and the North Slough of the Coos Estuary to the east. The total area of the Holocene Dune sand deposit that contains the aquifer is 19.5 square miles. The surface of the groundwater aquifer is exposed as a one quarter to one half mile wide deflation plane east of the foredune that fronts the Ocean along the entire length of the aquifer. "This flat plane is commonly saturated as a result of seasonal ground-water fluctuations…"

Hydrogeologic Framework (Page 5):
"The Dune-sand aquifer is generally on the order of 100 feet thick. Maximum thickness is about 200 feet in the area near Horsfall and Spirit Lakes…"

"The thickness of the deposit varies because of differences in the surface topography and the altitude of the base of the deposit. The surface topography of this deposit ranges from 60 feet below sea level in the offshore region of the study area to over 100 feet above sea level in areas of the bare sand ridges. The altitude of the base of this deposit ranges from 180 feet below sea level in the area of Horsfall and Spirit Lakes to a few feet above sea level in the northeastern part of the study area (fig. 4). "

Figure 4.(Page 6):
The base of the Holocene-age sand dune aquifer deposit in the vicinity of the proposed Jordan Cove LNG terminal is between 80-110 feet below sea level.

Ground water levels and Movement (Page 9)
A series of lakes lie just to the north of the proposed LNG terminal location. In addition, a series of wells operated by the Coos Bay North Bend Water Board are used to provide a supply industrial and domestic water. As a result of the use of the aquifer by a municipal water authority, Water levels in the lakes and in an extensive series of wells have been carefully studied through the years.

"Water levels in the lakes are and expression of the water table and are continuous with the dune aquifer (Robinson, 1974)…." "Seasonal variations of water levels in the lakes and the wells are similar" "Historically, the lakes have been observed to have varied 3 to 6 feet."

"Water table contours in figure 8 indicate that ***the general direction of ground-water flow in the dune aquifer is towards*** *the Pacific Ocean,* ***Coos Bay, (emphasis added)*** *North Slough, and Tenmile Creek. Horizontal ground-water gradients North of Beal Lake are as much as 50 feet per mile from east to west. South of Beale Lake,* ***the ground water flows*** *eastward toward North Slough, westward toward the Pacific Ocean, and* ***southward*** *through or beneath Horsfall and Spirit Lakes* ***toward Coos Bay with gradients from 10 to 30 feet per mile." (emphasis added)***

The Jones 1992 description of the Dunes aquifer in the reference above, as well as descriptions of the aquifer included in the materials submitted by the applicant, clearly demonstrate that there is a significant horizontal flux of fresh water from the Dunes aquifer into the Coos Estuary in the region of the proposed Jordan Cove LNG terminal. The North Spit area is a porous sand system underlain by impervious sediments. Importantly, the western and southern boundaries of the aquifer drain into the tidally influenced wetlands of the Coos estuary to the south and east and the marine waters of the

Pacific to the west. It is important to state that the lateral boundaries of the Dunes aquifer in the vicinity of the estuarine shoreline are not bounded by impervious materials. Further, it is also important to note that horizontal flux rates of water in the aquifer are far greater than the vertical flux rates.

The seasonal flux of fresh surface and ground water moving from the dune aquifer into the estuary likely plays a role in the seasonal surface topography of the water table that supports wetlands on the North Spit. These dynamics include the timing of the seasonal expression of the water table above and below the existing land surface topography and the wetlands that are associated with these seasonal variations. Further, the unconstrained link of the aquifer to the adjoining estuarine tideflats likely plays an important habitat defining role in seasonal estuarine interstitial soil pour salinities of the intertidal and sub tidal wetlands exposed to the horizontal flux of ground water. The estuarine wetlands that receive water from the dune aquifer supports biota including mollusks, fish, and plants that are likely responding to seasonal variations of fresh ground water discharges into the estuary from the Dune aquifer.

The Applicant proposes to install several thousand lineal feet of steel sheet pile bulkhead along the shoreline of the estuary in the vicinity of the LNG loading berth, disabled vessel lay berth, and material offloading facility (Resource report 1 Figure 1.3-6) The overall length of the sheet piling bulkhead is not fully described but based on proposed dredging depths of the slip and access channel and the bollard heights and hard arm elevations necessary to clear the deck heights of the LNG tankers sheet piling bulkhead lengths can reasonably expected to be on the order of 100' - 150'. Dredged sediment surface depths in the berthing area are proposed to approach 50 feet below mean low-low water and are to project an additional 35 feet above the ordinary high water level. It will be necessary to drive the sheet piling into the sediments well below the level of the dredged sediment surface meaning creating a barrier that is impervious to water movement that extends over most if not all of the entire height of the dune aquifer water column along the length of the proposed sheet piling bulkheaded estuarine shoreline.

Construction of the sheet pile bulkhead at the LNG terminal will likely serve to alter groundwater flux in the direction of the estuary along the length of the shoreline to be bulkheaded with sheet piling. The alteration of fresh water flux to the estuary holds potential to increase interstitial estuarine sediment pore water salinity resulting in a negative impact to biota occupying the site that is adapted to existing conditions of unrestrained fresh water flux into the estuary from the dune aquifer.

Alteration of fresh water flux into the estuary resulting from the installation of an impervious sheet pile bulkhead will also likely alter the duration of the and height of the seasonal expression of the water table above the surface of the North Spit wetlands in the vicinity of the project. **Modification of submergence times and water depths of seasonally flooded fresh water wetlands in the project area resulting from changes to horizontal movement of ground water in the dune aquifer should be examined prior to issuance of a permit.**

4. Implications for rainwater infiltration and aquifer recharge

The depth and porosity of sediments overlying the dune aquifer that supports wetlands in the vicinity of the terminal play a role in defining the rate of rainwater infiltration and aquifer recharge. Actions proposed by the applicant are likely to alter infiltration rates impacting wetland functions dependent on the current conditions**.** Studies cited by the project applicant indicate that vertical ground water flux rates are as much as 200 times slower than horizontal measured horizontal flux rates. This appears to be linked to the sediment particle shape and particle orientation tied to the Holocene aeolian and littoral sediment transport and deposition processes that created the North Spit of Coos Bay. Issues involved include but are not limited to:

- The applicant proposes to dramatically increase the sediment surface elevations overlying the dune aquifer at several locations in the LNG terminal area and the area overlying the water table under the APCO #1 and #2 sediment disposal areas. **The proposed surface elevation changes are likely to alter the rate of delivery of rainwater to the underlying aquifer and the wetlands supported by the aquifer.**

- The removal of peat and clay sediments, and compaction and stabilization of soils underlying structures of the proposed facility hold potential to alter the vertical and horizontal flux rates of ground water in where soil stabilization treatments are proposed.

- Construction of the berthing area is proposed to include installation of 6,000 pilings including replacement and displacement type pilings. Placement of large numbers of pilings also holds potential to alter horizontal flux of ground water. Pilings can also alter vertical flux rates by creating vertical pathways that facilitate the flux of water.

- Construction of roads, parking areas and structures will cover the existing dune surface groundwater recharge area with impervious surfaces that will alter the volume, location and rate of delivery of rainwater to the underlying aquifer and the wetlands they support.

5. **Effects on Henderson Marsh**

The proposed marine slip area overlays a historic portion of Henderson Marsh, one of the only North Spit locations to discharge surface water into the estuary. I found no discussion of how the proposed activities are likely to impact surface water discharges entering the estuary from the Henderson marsh area. **The DSL permit review should include a consideration of how the proposed activities will impact ground and surface water discharge characteristics entering and emanating from the Henderson Marsh wetland complex.**

I was unable to find a detailed description of the vessel slip construction sequence. The sequencing of sheet pile installation and excavation work holds potential to either accelerate or diminish the rate, timing, and volume of fresh water movement from the dune aquifer into the adjoining estuarine wetland habitats. For example, if construction of the temporary barge landing precedes installation of the sheet piling perimeter of the fresh water portion of the slip, the horizontal flux of fresh water from the dune aquifer through the temporary berm could be expected to increase as a result of removal of soils in the fresh water slip construction area.

If the fresh water phase of the slip construction involves excavation of sediments below the water table, prior to sheet pile installation, flux of fresh water through the berm into the adjoining estuarine wetland habitats can be expected to increase. Conversely, if the fresh water phase of slip construction involves extensive pumping and dewatering of the slip excavation area, the surface elevations of the water table in the vicinity of the slip area will be lowered, as a result of the construction work. This holds potential to impact the seasonal dynamics of the Henderson marsh wetlands that adjoin and underly the project site as well as the estuarine salt marsh and tideflat wetlands adjacent to the construction area.

6. **Reduction of aquifer discharge due to dredging for the slip**

Wetlands in the Dune system are closely linked to the groundwater of the dunes aquifer. Excavation of the 20 plus-acre slip will decrease the area available for groundwater recharge in southern portion of the Dune aquifer because once the slip is excavated, rain falling on the slip will fall directly into the estuary instead of onto the present-day land cover and into the aquifer. The area in the vicinity of the proposed project area receives an average of 65 inches of rain per year. The 22-acre reduction in the size of the aquifer is likely to result in and annual reduction of 119-acre feet of fresh water input to the dune aquifer. **The anticipated permanent annual volume of water lost to the aquifer is not insignificant and the DSL should include the loss of groundwater aquifer recharge among the negative impacts to water resources linked to the applicant's proposal**.

7. **Degradation of the dunes aquifer and associated wetlands**

Spoiling and dewatering saturated estuarine sediments on sites overlying the dune aquifer holds potential to introduce salt containing estuarine water into the underlying fresh water portions of the dune aquifer. Further, the porosity and permeability characteristics of the sediments to be dredged from the estuary and placed atop the wind deposited sediments of the project site are likely to differ substantially from the native Holocene dune soils at the site. *The DSL review of the application should include consideration that dredged estuarine sediment soil pore water salinities could degrade the water quality in the dune aquifer.* **The DSL review should also include consideration of how sediments placed above the dune aquifer might alter or degrade the infiltration characteristics and ground water recharge characteristics of the dune aquifer and the wetlands that are supported by the aquifer.**

8. **The DSL review of the proposal should include consideration of changes to vertical and horizontal fresh water flux rates into the dune aquifer and its associated wetlands as well as the adjoining wetlands of the Coos estuary during the various construction phases of the slip, and LNG terminal facilities** including but not limited to:

1. the fresh water excavation phase of the slip while the temporary shoreline berm is in place,
2. during the construction and operation of the temporary barge berth,
3. during dredging of the fresh water portion of the slip prior to installation of the sheet piling bulkhead
4. following placement of the sheet piling bulkhead
5. during soil stabilization sediment dewatering work,

6. following compaction and stabilization of sediments underlying structures,
7. following installation of the 6,000 replacement and displacement pilings
8. during and following dredged material deposition and dewatering of terrestrial and estuarine sediments placed on top of existing soil surfaces above the dune aquifer
9. following removal of the temporary shoreline berm,
10. following excavation of the navigation channel approach and turning basin.

Comments of Michael Graybill in response to DSL joint permit application and call for comments on a proposal from Jordan Cove Energy Project L.P. to the Oregon Department of State Lands on 7 November 2018.

CHAPTER 10: COMMENTS REGARDING THE PILE DIKE ROCK APRON

No permit to construct the Pile Dike Rock Apron should be issued until sufficient information is provided to assess the impacts of the pile dike rock apron structure. There are numerous examples where the permit has insufficient information about the Pile Dike Rock Apron. They include but are not limited to:

1. There is insufficient information in section part F Page 12 which indicates a total fill below the highest measured tide at 39,483 Cubic Yards. Does this fill volume include the fill material to be placed during construction of the pile dike rock apron? Does this fill volume include the fill material to be placed on wetlands at the Kentuck Slough Wetland mitigation site?

2. Table 6.1 Wetland Impacts Summary table (Page 36) identifies wetland habitat types to be permanently impacted by the placement of rock fill to construct the Pile Dike Rock Apron. It is not possible to determine the total volume of permanent fill material required to be placed in order to construct the Pile Dike Rock Apron. Permanent sand and fill material associated with the Pile Dike Rock Apron structure is noted in 4 locations in the “Impact Description” of Table 6.1; 1).Coos Bay intertidal mudflat /sand, 2).Coos Bay Shallow Subtidal,3).Coos Bay Eelgrass, and 4).Coos Bay Deep Subtidal. The manner in which information regarding the Pile Dock Rock Apron is presented in Table 6.1 makes it difficult if not impossible to discern the volume of permanent fill to be placed on “Mudflats” habitat types in order to construct the Rock Pile Apron. Further, it is not possible to understand how the “Total Mudflats” fill volume of 37,789 cubic Yards was derived from the volume estimates presented in the column above this sub-total. permanent estuarine mudflat fill was determined as the numbers presented under the “Permanent Fill” column in the Estuarine Mudflat section of table 6.1

3. Page 88 includes a description of the pile dike rock apron as a rock fill structure approximately 50’ wide, 3’ thick and 1,100 feet long. The description on page 88 estimates the total rock volume required to construct the pile dike rock apron at 6,500 cubic yards. The description does not clearly state the types and areas of estuarine habitats to be impacted by the structure. Further the description on page 88 does not provide enough detail to determine how the uppermost surface of the rock apron structure will compare to the adjacent undisturbed sediment surface. For example, will the unconsolidated estuarine sediments in the footprint of the structure be excavated prior to placement of the rock fill so that upon completion of construction, the upper surface of the fill is flush with the surrounding undisturbed sediment surface or will the rock be placed on top of the existing sediment surface thereby creating a 3’ tall rock berm that runs roughly perpendicular to the prevailing currents in the area? Unless additional design information is provided, it is not possible to reasonably asses the likely impacts of the structure to the wetlands directly within the footprint of the structure or the telegraphic impacts of the structure on adjoining wetlands

4. The applicant states the proposed purpose of the rock apron is to protect pile dike structure 7.3 owned by the US Army Corps of Engineers. The structure is vulnerable to failure from anticipated sediment erosion and channel migration at the margin of the proposed Navigation access channel. The applicant has stated that excavation of the navigation access channel will have telegraphic impacts to

the estuary substrate adjacent to the cut line of the dredging operations as the sediments at the margin of the dredged area adjust to the newly dredged channel margin. The pile dike structure was constructed many years ago to reduce erosion, longshore sediment transport and retreat of the natural shoreline of the estuary in the vicinity of proposed work. Construction of the proposed LNG tanker berth and the navigation access channel will likely change the nature shoreline processes in the vicinity of the pile dike structure which may render the original function of the pile dike 7.3 moot. Has the applicant or the Corps of engineers determined if the pile dike structure will have any function following the construction of the navigation channel access? No permit should be granted to construct the proposed rock apron until it is affirmed that it is necessary to protect this potentially redundant structure. Is the intent of the Rock apron to replace the function of Pile dike 7.3 or does pile dike 7.3 serve some other function that must be protected?

5. The proposed Pile Dike Rock Apron is a significant structure with potentially significant impacts to wetlands and estuarine processes, functions and values in the vicinity. In the absence of any other work proposed by the applicant the need for this structure should be thoroughly evaluated. Further, in order to fulfill its statutory charges, DSL should require the applicant to provide design solutions that avoid or minimize the need to place this fill. Alternatives to the proposed action to construct the pile dike rock apron should be enumerated and thoroughly evaluated before any permit is issued to construct this structure as proposed.

Examples of possible alternate approaches that should be evaluated include but are not limited to

1. Possible elimination/removal of pile dike 7.3.
2. Possible relocation of pile die 7.3 to a location not impacted by the anticipated channel margin equilibration processes.
3. Possible modification of the slope of the proposed Navigation Access Channel margin so that post construction channel migration/equilibration is taken into consideration thereby eliminating the need to protect pile dike 7.3 using the methods proposed.
4. Possible realignment of the dredge cut line of the navigation access channel to accommodate post construction slope adjustments before they place pile dike 7.3 at risk
5. Possible design and construction of a new/replacement pile dike structure at the current location after navigation access channel margin construction equilibration subsides in the vicinity of the current pile dike.

A 3' tall, 1,100-foot-long rock barb structure projecting from the intertidal shoreline into the sub tidal portion of the estuary holds potential to impact recreation, navigation, estuarine wetland functions and values, and wildlife in the vicinity of the structure. In addition to the Rock Fill described above, Page 111 includes a reference the design of the Pile Dike Rock Apron that also includes extending the LNG berthing slip sheet pile bulkhead at the northwest corner of the access channel an additional 100' to minimize slope cut back at this location. *No permit should be issued for this structure before thoroughly evaluating the impacts identified above*.

Table 6.1. includes an erroneous and inaccurate characterization of the wetland impacts associated with the construction of the rock apron. Under the column heading "Impact Description", references to the "rock apron" appears in three sections: "Mudflats", "Vegetated Shallows", and "Deep Subtidal". The narrative description of the rock apron presented on page 88 of the application describes

the it as a linear structure created by placing rock and boulder fill on top of undisturbed intertidal and sub tidal habitats along the western margin of the cut line of the access channel. The Mudflat section of Table 6.1 does not identify any permanent fill material placement associated with the rock apron. Only temporary fill is referenced in the mudflat section. Fill associated with the construction of the rock apron is clearly intended to be permanent. It impossible to determine the area of non-eelgrass and non-deep-water habitat types that will be impacted or the volume of material to be placed on emergent marsh, unvegetated intertidal, and shallow sub tidal habitats using the information presented in table 6.1.

Table 6.1 does not provide a complete description of fill associated with the construction of the proposed rock apron. Further, Table 6.1 lacks a complete description of the types and aerial extent of the habitats that will be impacted as a result of the construction of the rock apron. As a result, it is not possible to conduct a thorough, objective assessment of the impacts to wetland habitats associated with the construction of the rock apron. The information regarding this project element is incomplete. No permit should be issued until the applicant provides sufficient information about this project element to enable an objective assessment of its impacts.

Comments of Michael Graybill in response to DSL joint permit application and call for comments on a proposal from Jordan Cove Energy Project L.P. to the Oregon Department of State Lands on 7 November 2018.

CHAPTER 11: COMMENTS ON THE PROPOSED NAVIGATION ACCESS CHANNEL AND MARINE SLIP

1. Alternatives to the proposed orientation and configuration of the navigation channel access and marine slip are not sufficiently documented in the permit application.

The applicant has provided documentation leading to a decision to select the Ingram yard as the location of the proposed marine slip. However, after the site was identified as the preferred location, the proposal to dredge 5.7 million cubic yards of sediment in the LNG terminal area described in the DSL joint permit application is presented single “take-it-or-leave-it” option. This approach is inconsistent with the explicit directives of the DSL wetlands and waterways permitting program. No permit should be issued without the analysis of alternatives approach mandated by Oregon statutes and administrative rules including an evaluation of approaches designed to avoid or minimize impacts to wetlands.

2. Dredging of the access channel and slip

The drawings that accompany the application show that the access channel will be dredged to 49 feet but will join the Federal Navigation channel that is only 37 feet in depth. This 12-foot difference will mean that the access channel and slip will involve excavation of a sump-like feature next to the Federal Navigation channel. Two consequences are likely from this difference. Water and bedload sediments may potentially become “trapped” in this sump-like excavation. If flushing rates are poor, water in the sump may become hypoxic thus influencing water quality and living marine resources. Bedload sediments from the Federal Navigation channel will move into the newly dredged access channel and slip and reduce its depth, meaning that additional maintenance dredging will become necessary.

There are proposed mitigation actions in associated with the construction of the navigation access channel and marine slip aspects of the project. However, no mitigation is proposed for the permanent impacts to the subtidal estuarine habitats that will be impacted by the Navigation Reliability Improvements (NRI) that are also part of this application. No justification is provided to explain the necessity to mitigate the impacts to some estuarine habitats but not others.

3. **The Navigation channel access and slip proposed by the applicant appears to be designed to accommodate vessels that are substantially larger than what is needed to satisfy the stated purpose and need of the project.**

The applicant has proposed a marine slip designed (among other things) to berth and load LNG carrier vessels with cargo capacities between 89,000 cubic meters and 217,000 cubic meters. [See Table 1.1-1 of Resource Report 1 (page 10) submitted to the FERC September 2017 entitled “Major Changes from CP13-483-000 for the JCEP LNG Terminal Facilities”]. A 2008 Waterway Suitability Report prepared by the US Coast Guard and referenced by the applicant has established a limit for the draft, beam and length of vessels that can be safely operated in the Federal Navigation Channel of the Port of Coos Bay. The DSL fill and removal application [section (5) project specific criteria and alternatives analysis (pages 10 - 11)] states:

> *"The WSR (USCG 2008) was reviewed and assessed for the project and the assessment determined that the Federal Navigation Channel was suitable for transit by a 148,000 cubic meter cargo capacity LNG carrier (JCEP et. al. 2017). The current Federal Navigation Channel navigational depth of -37 ft. MLLW is thus generally considered sufficient for the sizes of LNG carriers that would likely be serving the proposed LNG facility.*

The USCG has established an upper limit for LNG carriers using the Coos Bay Federal Navigation channel with overall dimensions of 950 feet in length x 150 feet beam x 40 feet draft with a nominal LNG cargo capacity of 148,000 m³ ships (page 278). However, the application states: *"The size of LNG carrier that can be accommodated by the LNG berth is unchanged at 89,000 cubic meters to 217,000 cubic meters*". [Table 1.2-2 (pages 10) of September 2017 Resource Report 1 to the FERC entitled "Major Changes from CP13-483-000 for the JCEP LNG Terminal Facilities"]

In contrast to the nominal dimensions and capacities of the vessels authorized by the US Coast Guard, the nominal dimensions of a "Q-Flex" design membrane type LNG tank vessel with a cargo capacity of 216,200 cubic meters; similar to the capacity proposed by the applicant, are; 1,033.5 feet in length x 164.04 feet beam x 41.01 feet draft. Similarly, the nominal dimensions of a 4 tank "Moss type" LNG tank vessel with a cargo capacity of 217,000 cubic meters are; 1,033 feet in length, x 164 feet beam x 39.37 feet draft.

The Navigation channel access and slip proposed by the applicant appears to be designed to accommodate vessels that are substantially larger than what is needed to satisfy the stated purpose and need of the project. While the US Coast Guard has determined 148,000 cubic meter cargo capacity LNG vessels can safely navigate the Federal navigation channel, the applicant is seeking DSL authorization to construct a loading berth designed to accommodate vessels having cargo capacities up to 217,000 cubic meters; 47 % larger than authorized by the US Coast Guard waterway suitability report. The applicant has not adequately substantiated the need to construct a navigation access channel and slip designed to accommodate LNG tank vessels with overall dimensions and cargo capacities 47% larger than the largest vessels that can safely navigate the Federal Navigation Channel. Attachment B.1 (page 240) states:

> *"The U.S. Army Corps of Engineers ("USACE") suggested that JCEP examine the possibility of a smaller marine slip at the LNG Terminal. The USACE believes that the size of the marine slip could be reduced because the USCG's Waterway Suitability Assessment and Letter of Recommendation limited the size of LNG vessels calling on the LNG Terminal to no larger than 148,000 cubic meters ("m3") in capacity)".*

The applicant rejects this suggestion stating that the US Coast Guard has determined that the proposed slip width of 800' is justified in order to safely maneuver LNG carriers at the berth. The applicant fails to substantiate the need for the North-South linear dimensions of the berth. 217,000 cubic meter cargo capacity vessels are approximately 85 feet longer than vessels having a capacity of 148,000 cubic meters. An 800'-wide marine slip designed to accommodate vessels with a maximum length of 950 feet instead of vessels with a length of 1,033 feet is likely to require less sediment disturbance. It appears possible to reduce the volume of material to be dredged and filled by constructing a "shorter" 800'-wide slip sized to accommodate the largest vessels that can safely transit the navigation channel.

DSL removal fill permit evaluation criteria requires applicants to demonstrate proposed alternatives designed to minimize unavoidable impacts to wetlands and waters of the state. The elements of this project involving the largest volumes of sediment disturbance are associated with the construction of the marine slip and the navigation access channel. It is reasonable to infer that a building a marine slip 85' shorter along its north to south axis than the one proposed will enable the purpose of the project to be attained while reducing the volume of material to be excavated and spoiled.

The applicant has provided information to substantiate why the terminal location was selected but by proposing a single design for the marine slip and access channel, the applicant has failed to demonstrate that the proposed design of the navigation access channel and marine slip is the alternative that maximally avoids and minimizes impacts to wetlands as required by DSL fill and removal program guidelines.

Similarly, the configuration, orientation, and overall dimensions of the navigation access channel are presented as a single "take-it-or-leave-it" alternative. (Figure 6.1-4 page 67). The applicant has proposed an access channel configuration that originates on the westerly flank of the slip and projects in a southwesterly line across the intertidal and sub-tidal areas to the south of the "Henderson Property" wetlands (Figure 6.1-4 page 67) that adjoin the western side of the marine slip. The interface of the western extent of the dredged cutline of the Access Channel and the existing estuarine sediment surface is expected to move in a westerly direction following initial excavation [See Resource report 1: (Figure 1.3-5), Plot plan of marine facilities]. This post-dredging "equilibration" process is anticipated to impact a pile dike rock apron built and maintained by the US Army Corps of Engineers. A minor adjustment of the shape or orientation of the western flank of the navigation access channel holds potential to eliminate the need for this entire structure. Additional analysis of the Pile Dike Rock Apron is detailed in Chapter 10 of this document. Additional analysis of the navigation access channel is provided in Chapter 4 of this document.

Comments of Michael Graybill in response to DSL joint permit application and call for comments on a proposal from Jordan Cove Energy Project L.P. to the Oregon Department of State Lands on 7 November 2018.

CHAPTER 12: COMMENTS OF THE PROPOSED PROJECT ON IMPACTS TO NAVIGATION, RECREATION AND FISHING

OAR 141-085-0565 outlines the Department determinations and considerations in Evaluating Individual Permit applications;

> Excerpt from OAR 141-085-0565:
> (3) Department Determinations. The Department will issue a permit if it determines the project described in the application:
> (a) Has independent utility;
> (b) *Is consistent with the protection, conservation and best use of the water resources of this state* as specified in ORS 196.600 to 196.990; and
> (c) *Would not unreasonably interfere with the paramount policy of this state to preserve the use of its waters for navigation, fishing and public recreation*, when the project is on state-owned lands. (emphasis added)

The comments that follow should demonstrate that if implemented as proposed, the project will result in significant, unreasonable negative impacts on the use of Coos Bay waters for navigation, fishing and public recreation.

1. LNG vessel traffic in Coos Bay will unreasonably limit access to in-bay crab fishing areas.

Most recreational and all commercial crab fishing in the estuary is undertaken using rings. Deploying a string of baited crab rings and then requiring fishers to vacate the deployment area leaving the rings unattended for 30 minutes around slack high tide while an LNG tanker and its associated safety zone passes will seriously diminish the effectiveness of one of the most important methods used to capture crabs in the Coos Estuary. For bay crabbing, as the tide approaches slack high water it is important to check rings on a more frequent basis as this is the time of greatest crab movement and feeding activity. Because crab rings do not retain crabs while the ring is at rest on the bottom, the only way to capture crabs using rings is to bring them rapidly to the surface while actively feeding crabs are present on the baited ring. In contrast to a recreational fishery using traps, the effectiveness of capture using crab rings is based on the frequency upon which the rings, once deployed, are recovered/brought rapidly to the surface. Requiring rings to "soak" for a period of 30 minutes or more will not improve their capture success rate. If transiting LNG carriers require recreational fishers to leave deployed rings unattended for 30 minutes, this requirement will likely render this type of harvest method infeasible/impractical.

Virtually all boat based recreational crab fishing takes place within a two-hour time period centered over slack high water (http://www.scod.com/cities/crabs/crabbing.html). Depending on the number of fishers aboard, it is not uncommon for boat based recreational fishers in Coos Bay to deploy a string of rings or traps consisting of 6, 9,or 12 rings or traps per vessel. It typically takes several minutes to recover, clear, and redeploy each crab ring or trap in a string. It is common practice for recreational fishers to deploy a string a rings or traps one hour before the slack tide, and check/tend individual rings and traps continuously during the ensuing leadup to slack high water and during the hour following the slack high water. A 30-minute interruption caused by a transiting LNG carrier at in the peak period of fishing activity having a 2 hour feasible time window centered over high tide can readily and reasonably be characterized as a *major* disruption of one of the most important (and valuable) recreational uses of the Coos Estuary.

Requiring recreational vessels to clear long established and preferred crab fishing areas for a half hour to accommodate the passage of an LNG tank vessel will greatly disrupt and interfere with both recreational and commercial crab fishing in the Coos Estuary. While the application describes a moving 500-yard security/safety zone surrounding LNG vessels transiting the estuary, the application does not say where recreational vessels involved in recreational crabbing and fishing activities will be required to go (page 10). The description of areas of the estuary of importance to commercial and recreational crabbers in the Coos Estuary presented on page 10 is an incomplete list. Perhaps the most important area for commercial bay crabbers is a region of the estuary on the margin of the Federal Navigation channel which parallels the south edge of the North Jetty. (https://myodfw.com/articles/where-crab-clam-coos-bay) The Federal navigation channel makes its closest approach to the North Jetty in this region of the bay. Crabbers working in the area between the North Jetty and the Federal navigation channel will be unable to vacate the moving 500-yard safety/security safety zone surrounding a transiting LNG vessel as there is not room to move away from the channel without grounding on the rock jetty. The applicant fails to identify important crab fishing locations in the lower bay where small vessel operators that may become “trapped” between the shore and the moving safety/security zone of an LNG vessel transiting the Federal navigation channel.

Recreational and commercial crabbers and boaters operating vessels to the North and West of the Federal navigation channel required to vacate the moving safety/security zone of a transiting LNG vessel may be faced with a choice of grounding their vessel in the natural shallows at the margin of the bay or on rock revetment structures at the margin of the bay. The other choice available to vessel operators working in areas to the north and west of the federal navigation channel that lack sufficient space to vacate the moving safety/security zone of a transiting LNG carrier is to cross the navigation channel in front of the path of the oncoming LNG vessel. The north Jetty and the shoreline of the North Spit are within the 500-yard safety/vessel exclusion zone of the Federal Navigation channel in numerous locations meaning that these locations are unsuitable for use as refuge/safety areas for recreational vessels to muster during the passage of an LNG vessel. As a result, it may be necessary for recreational vessels to cross the navigation channel in advance of an LNG tanker passage in order to find a suitable muster area that is outside the 500-yard LNG vessel safety/vessel exclusion zone.

2. The description of impacted resources fails to identify the lower bay as a location used by recreational boat operators, paddle sport enthusiast and commercial shellfish harvesters. These recreational and commercial activities will also be impacted by the passage of LNG carriers transiting the bay. Specifically:

a.) The description of impacted resources fails to identify the lower bay on the inside of the North Jetty as a popular recreational surfing spot, particularly during high and near slack outgoing tides, commonly in the winter months or periods of high ocean surf conditions. Surfers access this location by off highway vehicles via the North Spit or by paddling across the estuary from shore points in Charleston.

Surfing in the lower bay is typically associated with winter periods of large ocean swells and strong fresh water runoff. Transiting LNG tank vessels will impact surfing in this location.

b.) The description of impacted resources fails to identify the area of the lower bay, including the area between the Jetties at the entrance to the channel as an important location for recreational salmon fishing in the lower estuary. The practice of "mooching the Bar" is widespread in the fall season and is centered almost exclusively around the hour before and the hour following slack high water. The Transiting LNG vessels will

c.) A commercial crab fishery exists in the lower portion of the bay including the area between the north and south Jetties. This fishery uses commercial crab "rings". Unlike commercial crab traps, deployed crab rings lie flat on the bottom permitting both legal and sub-legal sized crabs unimpaired freedom to enter and depart the ring while deployed. For rings to capture crabs, they must be regularly pulled swiftly to the surface requiring regular tending to fish effectively. The in-bay commercial crab fishery is currently limited to weekdays. In contrast, the recreational crab fishery is permitted year-round, all days of the week.

d.) Sub tidal clam populations in the lower bay have historically been subject to commercial and recreational harvest by fishers employing scuba. The lower bay is also a popular location for boat based recreational scuba divers. Both commercial and recreational scuba diving in the estuary are highly tide dependent activities centered on periods of slack water high and low tides. The safety exclusion zone surrounding LNG vessels transiting the federal navigation channel will impact the ongoing recreational and commercial use of the estuary by scuba divers.

3. LNG vessel traffic in Coos Bay will unreasonably Impact ocean based fisheries.

For a variety of reasons, including fishing seasons and ocean conditions, individual boats involved in commercial fisheries including but not limited to the crab, salmon and pink shrimp work as a fleet. This means that when the season is open and weather conditions are right, many (most?) of the boats in the fishery all head out to sea together. When crab season begins, it looks like a parade in front of my house with boats streaming out of the harbor one after another. Particularly in winter, during commercial crab season, when weather imposes more limitations on the bar than any other time of year, boats at sea work their crab pots while watching the weather conditions decline. Members of the fleet are talking with one another and everyone is paying attention to bar conditions and the tides.

Particularly in declining and marginal weather conditions, the vessels at sea in the commercial fleet all begin to head home around the same time. The previous outbound parade of boats reverses direction and the whole fleet heads for the bar. It can take the entire window of suitable incoming high tide conditions on the bar for the fleet to get back into the harbor. When the tide reverses and begins to ebb, conditions on the bar degenerate rapidly and in a matter of minutes the bar conditions can change from marginal to impassable. Boats that miss this window are forced to ride out the storm at sea until the next high flood tide.

There is not sufficient time to add an LNG ship transit to this scenario without having negative impacts on the existing use of the navigation channel by fishers. If the bar is closed for a half an hour over the high flood tide, to accommodate passage of an LNG carrier made up to multiple tractor tugs, somebody is going to get stuck at sea in bad weather conditions. JCEP has stated the total time required for an LNG carrier to transit between the harbor entrance and the proposed berth is 90 minutes and that no individual location in the estuary will be impacted for more than 30 minutes. Roughly one third to one half of the LNG carrier's total transit time will occur when LNG vessels transit the lower portion of the bay that is also used by commercial and recreational vessels based in the Charleston harbor. Taking a half hour chunk out of the extremely limited time that the commercial fleet uses to cross the bar to enable an LNG tanker to transit the bar will only have negative impacts on fisheries. Those impacts are serious and potentially life threatening.

The Dungeness crab fishery in Oregon has been characterized as a "derby fishery". During the first days and weeks of the season, a substantial portion of the total annual commercial crab landings are caught in the first days and weeks of the season. Having gear in the water for "the first pull" is critically important. In the days just prior to the start of the commercial crabbing season, fisheries management agencies provide a very narrow window of time for commercial fishers to set out their gear before the first pull of the season. Smaller vessels in the fleet must make multiple trips to sea in order to get all their gear in the water. Thus, in the days leading up to the opening of the commercial crab season and in the days and weeks immediately following the season opening, there are hundreds of commercial vessel crossings over the Coos Bay Bar by boats loaded to capacity with crab pots and live crab. The restrictions imposed by LNG carriers transiting the lower portion of the Coos Bay federal navigation channel will result in significant, quantifiable, negative impacts on use of the channel by commercial fishing vessels. These impacts are not consistent with DSL's duty under OAR 141-085-0565. **The permit should be denied because the work proposed will result in unreasonable interference with use of state waters for fishing and recreation.**

4. LNG vessel traffic in Coos Bay will unreasonably Impact recreation.

Kayaking and stand up paddle boarding are increasingly popular recreational pursuits in the lower portion of the estuary during calm water conditions. Paddle craft operators using the lower portion of the estuary embark for shore launch points on the margin of the bay near the Charleston Marina Complex. It is not uncommon to see Kayak fishers transit the Federal navigation channel between the submerged training jetty near the entrance of the Charleston Channel (known locally as "the cribs") to shore points on the bay shore of the North Spit. Transiting LNG carriers will disrupt this increasingly popular recreational activity.

Construction of the access channel will impact access to and use of the estuary shoreline. The proposed access channel and berth will create an impassable barrier of deep water where an intertidal shoreline currently exists. The shoreline to be impacted will be very near the BLM boat ramp on the North Spit. This facility was developed specifically to encourage recreational access. Shore based fishers and beachcombers currently use the shoreline area of the proposed access channel for recreation. **Construction of the access channel and marine terminal will permanently impact shoreline access and recreational activities associated with the shoreline.**

Comments of Michael Graybill in response to DSL joint permit application and call for comments on a proposal from Jordan Cove Energy Project L.P. to the Oregon Department of State Lands on 7 November 2018.

CHAPTER 13: COMMENTS REGARDING ERRORS, OMISSIONS, AND INSUFFICIENCIES CONTAINED IN THE APPLICATION MATERIALS AND THE UNACCEPTABLE WAY MATERIAL HAS BEEN PRESENTED FOR THE PUBLIC REVIEW COMMENT PROCESS

1. DSL should reject the application on the basis that the materials presented in the application are not presented in a manner suitable for public review and comment.

The overwhelming volume of material included in the application review documents lacks the basic editorial structure needed for reviewers to navigate within and between elements of the documents provided for review, and includes, unnecessary, redundant, erroneous, and unrelated information that interferes with or precludes a thorough, efficient review of the project elements related to the DSL removal fill permit program. The 3,638 pages of material provided for public review and comment in the fill and removal permit application is a complex and disjunct assemblage of documents generated over several years of correspondence and consulting contracts. The quantity and format of materials presented for public review is unrealistic and overwhelming. The presentation of thousands of pages of material precludes adequate opportunity to evaluate a coherent characterization of this project by reviewers lacking familiarity with technical documents and precludes thorough, efficient review by non-affiliated technical experts in the time allotted for public comment.

Some of the documents provided for review describe project elements proposed by previous iterations of this project that have been supplanted and made redundant by newer, revised proposals. Other documents include comparisons of how the activities currently proposed compare to previous proposals that are no longer under consideration. Including descriptions of previously preferred alternatives no longer under consideration only serves to make it more difficult for reviewers to discern and evaluate the actions encompassed by the current version of the permit application.

There are so many redundancies, and layers of appendices and cross references within the application materials that is difficult, if not impossible, to consistently and accurately cite a document reference or page number in review comments. Inclusion of redundant, extraneous and superfluous information makes review of the document cumbersome more laborious. The following examples are included to illustrate the unrealistic quantity of material presented for public comment and the unwieldly presentation of information in the application materials:

1. The application contains a table of contents but the table of contents of the 3,638-page application fails to include page number references forcing reviewers to scroll through a very large document to find individual references cited in the application materials.

2. In the absence of page numbers provided by the applicant in some (but not all) of the application materials, I used the DSL permit application page numbers assigned by the Adobe Acrobat reader application to reference information in the application cited in my comments. As an example, the "Project Description in Attachment A.5 of Part 1 of the application can be found on page 125 of the Adobe Acrobat reader program .pdf document provided by DSL even though this particular attachment has page numbers at the bottom of the page. In this case, the printed

page number at the bottom of the "Project Description" presented as Attachment A.5 is "page 4". I cited this section in my comments as "(Page 125)".

3. The application includes "Attachment E: (Dredge Material Management Plan)" which consists of "F" Appendices. "Attachment F.1" immediately follows Appendix "F" of Attachment E (page 994). Attachment F.1 includes some tables presented with numerical designations (e.g. table 4 on page 1010) while other tables in the attachment F.1 bear letter designations (e.g. Table A on page 1016)

4. Attachment B.1. (Resource Report 10 pages 217-275) makes extensive reference to information contained in "Resource Report 1" but does not provide the referenced information in the application. This citation requires permit reviewers to find the information contained in Resource Report 1 on the FERC document directory. The html address given for Resource Report 1 provided in the permit application leads to a FERC document library page listing links to 40 or so PDF documents having coded titles. In order to find "Resource Report 1", it is necessary to search through the list of document links in the library until Resource Report 1 is discovered. This is not acceptable. All information required to describe the proposed project should be included in the application materials. The application should be rejected because it is incomplete. No permit should be issued until all relevant information pertaining to the potential impacts of the project is presented in the application.

5. Resource Report 1 (referenced in the DSL permit application but retrieved from the FERC Document library and viewed as a .pdf file) includes a table of contents that includes page number references and numbered pages throughout the document. Page number references in my comments related to Resource Report 1 use the printed page numbers included the archived document, not the page numbers assigned by the Adobe Acrobat reader used to access the document.

6. I accessed on the FERC document library on December 24th, 2018 to look at "Appendix B.1 Cumulative impacts Analysis" of "Resource Report 1" referenced in the DSL application. The appendix did not contain any narrative other than the cover sheet. Has a cumulative effects analysis been conducted for this project? If not, when will this analysis be completed? It is not possible to evaluate the cumulative effects of the project without this analysis. It should not be the responsibility of permit reviewers to perform a cumulative effects analysis. This should be the responsibility of the applicant. DSL should not issue a permit until the applicant provides a cumulative impacts analysis of wetland impacts for the project that is accessible to comment upon.

7. It is not possible to easily differentiate the surface types indicated in the key on the map presented in Attachment H: Site Restoration Plan (page 1070). Further, no Legend/Key is provided on any of the subsequent detailed maps making it necessary to scroll back and forth between the map on Page 1070 that includes a legend/key. This may be appropriate for a paper document but it is not appropriate for an electronic file format document.

8. The first section of Table 6.1 [entitled "Wetland Impacts" (page 36)] is a category bearing the heading "Mudflats". The table includes the following three entries for habitats that are not classified as mudflats:

- The first row in this section is titled “Wetland APC-A2”
- The third row of this table is titled “Coos Bay Salt marsh @ AC”
- Row ten under the “Mudflat section is titled “Coos Bay Salt Marsh @ TMBB”

The “Mudflats” impacts section includes erroneous totals because they incorporate non-mudflat, emergent wetland habitats in the summary totals. The application should be rejected because it contains erroneous information.

9. Table 6.1 includes a column heading “Sheet No. ID” but no information is presented in the area under the column. Additional inaccuracies, omissions and insufficiencies in Table 6.1 are described in my comments related to the Pile Dike Rock Apron.

10. The narrative related to the construction of the Access and Utility Corridor [Section 6.2.3.1 entitled “Constructions means and methods (page 97)] includes the following statement:

> *“Areas where ground improvements and/or disturbance will occur in wetlands outside the toe of slope will be restored to pre-project conditions following construction, per the Site Restoration Plan detailed in Attachment H.”*

Attachment H (Pages 1069-1077) is entitled “Site Restoration Plan”. However, the entire attachment includes a series of 8 plan view drawings, each bearing the title; “Surfacing Site Plan”. Information presented in Attachment H incidentally identifies the locations of existing wetlands but nothing in the attachment shows anything related to restoration of wetlands on the site. The primary information content of the drawings is related to identifying the materials that will be used to treat the surfaces of areas to be filled. Therefore, the content presented in attachment H appears to have nothing to do with the stated title of the attachment. No other description of the site restoration plan was found making it impossible to conduct an objective evaluation of this aspect of the proposed work. **No permit should be issued in the absence of a site restoration plan that provides and explicit description of the measures that will be taken to restore individual impacted wetlands. Further, any permit issued should include performance requirements and standards to confirm that wetlands impacted by construction activities have been restored to an agreed upon pre-project condition.**

11. The narrative related to the construction of the Access and Utility Corridor [Section 6.2.3.1 entitled “Constructions means and methods (page 97)] also includes the following statement:

> *“Additional measures for avoiding and minimizing impacts to wetlands and waters are discussed further under Section 6.C, below*.”

A search of the document for the phrase “Section 6.C” indicates the application document includes two references to this phrase; 1) the reference cited above and 2) a use of the phrase on Page 92 describing the construction means and methods used to dredge the access channel. Here, Section 6.2.1.1 includes the following text:

> *“Dredging methods described for the access channel will be generally similar to those that will be used in other dredge areas associated with the Project, including those for the Navigation Reliability Improvements and Eelgrass Mitigation site. Activities taking place at those sites are described in further detail in Section 6.C below*.”

No other reference to Section 6.C was found in the application. The application appears to be incomplete and it certainly appears to have serious editorial shortcomings. Reviewers are sent on a wild goose chase to search for references cited in the application materials that cannot be found. In one case, an entire attachment fails to provide information referenced in the document and in the stated title of the attachment (See discussion of Attachment "H" above).

The failure of Attachment H to provide the wetland restoration actions referenced on page 97 and the failure to include the information regarding eelgrass impacts referenced on page 92 are examples of how this application fails to provide essential information related to construction impacts to wetlands. **As presented, this application lacks sufficient information to enable an objective reviewer to determine the likely impacts to wetlands associated with the proposed work. DSL should not issue a permit in the absence of this essential information. The permit request should be denied or a decision to issue a permit should be postponed or conditioned on the applicant's resubmission of a revised application that addresses the demonstrated and unacceptable level of content and editorial deficiencies in the application as presented.**

12. The application includes no less than 16 references to "Table 6-1". A document search of the phrase "Table 6-1" provides the following citations that include a reference to "Table 6-1":

1. Page 4 *"Wetland impact quantities are provided in Table 6-1."*

2. Page 7 *"Quantities for impacts to vegetated shallows are provided in Table 6-1".*

3. Pages 12 and 13 include four references to Table 6.1 under Section 6 E of the application form which requires applicant to describe "Fill Volumes and Dimensions (if more than 4 impact sites, include a summary table as an attachment)". Because the project involves impacts to more than 4 sites, the applicant directs reviewers to *"See Table 6-1, Wetlands and Water Impact Summary Table"*

5. Page 14 of the DSL application form includes section (8) entitled "Impacts, Restoration/rehabilitation, Compensatory Mitigation. Part "A" of section 8 requires applicants to "Describe unavoidable environmental impacts that are likely to result from the proposed project. Include permanent, temporary, direct, and indirect impacts." The first sentence of the applicant's response under this section directs reviewers to *"See Table 6-1 for detail on the extent of Project specific unavoidable permanent impacts to wetlands and waters resulting from construction of the LNG Terminal."*

6. Page 29 is a table of contents for Part 1 of the Removal Fill Permit Application. Table 6-1 is listed as *"Wetlands and Water Impact Summary Table"*

7. Pages 35 is a cover sheet for Table 6-1 entitled "Wetland and Water Impact Summary Table" However, the table that follows on pages 36 and 37 is entitled "*Table* ***6.1*** *Wetland impacts*" (emphasis added). See text following this tabulation for additional discussion related to table 6.1.

8. Page 94 is a description of the wetland and waterway impacts associated with the construction of the Temporary Materials Barge Beth. The first sentence directs reviewers to

table 6-1 as follows: *"Fill and removal impacts will result from construction of the TMBB and access channel. These impacts are detailed in Table 6-1,"*

9. Page 94 is a description of the wetland and waterway impacts associated with the construction of the Marine Offloading Facility. The first sentence directs reviewers to table 6-1 as follows: *"Construction of the MOF will result in permanent fill and removal impacts within Coos Bay, as detailed in Table 6-1".*

10. Page 97 is a description of the wetland and waterway impacts associated with the construction of the Access and Utility Corridor. Reviewers are directed to table 6-1 as follows: *"The construction will result in permanent and temporary impacts to Wetlands 2013-6 and 2012-2 west of Jordan Cove Road, and Wetlands C and E east of Jordan Cove Road, as detailed in Table 6-1"*

11. Page 99 is a description of the wetland and waterway impacts associated with the construction of the South Dunes site. The first sentence directs reviewers to table 6-1 as follows: *"Wetland impacts associated with development of the South Dunes site are detailed in Table 6-1"*

12. Page 101 is a description of the wetland and waterway impacts associated with the construction of the Navigation Reliability Improvements. The final sentence directs reviewers to table 6-1 as follows: *"The wetland and waterway impacts associated with the NRIs are detailed in Table 6-1"*

13. Page 102 is a description of the wetland and waterway impacts associated with the construction of the Trans Pacific Parkway widening. The final sentence directs reviewers to table 6-1 as follows: *"Embankment widening and placement of riprap below HMT elevation will result in permanent impacts to unvegetated mudflats, as detailed in Table 6-1"*

14 Page 111 is a description of the wetland and waterway impacts associated with the construction of the pile dike rock apron. Reviewers directed to table 6-1 for a detailed list of impacts

15. Page 854 is a Table of Contents to a consultant's report which lists Table 6-1 as *"Preferred Material Management Alternative for Construction Activities"*

16. Page 904 *"Table 6-1 outlines the preferred material management alternative for excavation and dredging of the slip and access channel and the Navigation Reliability Improvement areas adjacent to the Federal Navigation Channel."*

A document search for the phrase "Table 6-1" reveals **the only table in the document bearing the designation "Table 6-1" on page 905**. The Title of Table 6-1 on page 905 is *"Preferred Material Management Alternative for Construction Activities".* The table lists the volume of material that will be excavated from the slip and access channel during a "Fresh water Dredging Phase" and a "Salt Water Dredging Phase". A row at the bottom of the table that includes the phrase *"Eel grass Mitigation Dredging"* is the only explicit reference to wetlands contained in the table. No additional explicit reference to wetlands or wetland impacts is included in Table 6-1.

This reviewer later discovered that the application also includes a table bearing the designation **Table 6.1" (not 6-1)** found on Pages 36 and 37 of the application. "Table 6.1" on pages 36 and 37 is not identified while searching the document for the phrase "Table 6-1" even though the document makes 16 references to the table in this manner. After an unnecessary effort to find the cited reference for Table 6-1, reviewers are compelled to deduce that Table 6.1 appears to contain the information referenced in citations 1-16 outlined above.

Because the Table of Contents and the bulk of the application materials lack page references, and because the document includes multiple editorial insufficiencies, reviewers are required to expend extraordinary effort to confirm the content and assertions embodied in the application. In this case a period (as in "Table 6.1") substituted for a dash (as in "Table 6-1") in a reference to a table made it nearly impossible to locate information cited on numerous occasions in the document using the Adobe acrobat search tool. It took approximately three hours for this reviewer to conduct the nearly meaningless analysis listed above and to reach the nearly insignificant determination described above. This infuriating distraction and others described in this chapter detract reviewer's attention from an objective analysis of the work proposed and its associated impacts on wetlands. Instead, reviewers are compelled to wade through a poorly organized document that includes erroneous, improperly indexed, fragmented, and at times meaningless content. **The permit should be denied because the organizational structure of the document precludes an efficient, objective assessment of the proposed work and its associated wetland impacts.**

13. Section (4) Description of Resources in the Project Area (page 7), Part (3) describes mudflats in the project area. The application states:

"Mudflat resources within the JCEP Project Area are described in the wetland delineation reports for the JCEP Project Area that are included in Attachments C.1 to C.8 and Figures 4.1-1 to 4.1-7. Quantities for impacts to mudflats are provided in ***the Bulk Upload Template (Table 4.2).****" (emphasis added)*

A word search of the permit application failed to identify the phrases "Bulk Upload Template" or "Table 4.2" that included any information regarding mudflats at any other location in the document other than the reference cited above. As a result, it was not possible for me or other reviewers to verify the content of the cited document or evaluate the quantities of impacts to mudflats tied to this proposal.

14. A four-sentence long description is provided to describe the mudflats in the vicinity of Ingram Yard (page 7). The description contains the following statement: *"Plant life is not typically abundant along these intertidal mudflats and adjacent shallow subtidal areas."* It stands to reason that vegetation on a mudflat would be sparse because mudflats are intertidal and sub-tidal estuarine habitats defined in part by the absence of vegetation. If vegetation was abundant on these intertidal areas, they would not be classified as mudflats. The statement contributes nothing to the understanding of the resources in the project area. Unvegetated estuarine intertidal and sub tidal mudflats are among the most extensive resources to be impacted in the area of the navigation access channel. At minimum, the narrative description of the resources should include information regarding the area of the habitat or the size of the resource.

15. Page 7 of the permit application [(4) Description of Resources in the Project Area] includes a two-paragraph section with the heading "4. VEGETATED SHALLOWS". Paragraph two contains the following statement: *"Vegetated shallows within the JCEP Project Area where a concurrence has not been issued*

are described in the wetland delineation reports that are included as Attachments C.9 to C.13. Quantities for impacts to vegetated shallows are provided in Table 6-1."

16. A search of the permit application for the phrase "Attachment C.9" takes reviewers to a document bearing the heading "Attachment C.9" on page 366 of the permit application. Attachments C.9 (page 366) and C.10 (page 368) appear to be $437 permit review invoices issued by Heather Howard at the Department of State Lands issued on April 18th and 19th of 2018.

17. Attachment C.11 (pages 370-389) appears to be a description of a paved portion of tax lot 800 that functions as the parking lot for the Myrtlewood RV park. In addition to the irrelevant attachments reference above, Attachment C.11 also appears to be irrelevant as it contributes nothing to the description of "Vegetated Shallows" in the project area. Inclusion of these and other irrelevant documents in the permit application requires permit reviewers to spend precious time searching the permit application and reviewing documents that contribute little if anything to an understanding of the scope of the project and the potential impacts of the proposed actions on wetlands of the state. I will long remember reading Attachment C.11; a 19-page-long report prepared by a 4-person consulting team whose collective efforts confirmed that a paved parking area contains no wetlands! I was little comforted (and cynically humored) to learn that when the lead author visited the paved parking lot described in Attachment C.11, he characterized the conditions of parking area in the report as follows: *"Normal conditions were present throughout the study area."* [see "2. site alterations" Attachment C.11 page 371). I must confess that even though Attachment C.11 borders on the absurd, I must support the consultant's determination in this otherwise useless document that the month of July represents the dry season.

18. Attachment C.12 (pages 390 -405) is a wetland delineation report for an estuarine shoreline and intertidal area to the north of the APCO 2 dredged material disposal area. A word search of this attachment for the phrase "vegetated shallows" found no use of the term "vegetated shallows". Similarly, none of the other attachments referenced on page 7 under the heading "vegetated shallows". Contain the phrase "vegetated shallows". Thus, in contrast to the applicant's claim that the attachments referenced in paragraph 2 under the heading "(4) VEGETATED SHALLOWS" contain information about vegetated shallows, these attachments contain no information about vegetated shallows and contribute nothing to a characterization of vegetated shallows in the project area. This is but one more example illustrating that this application includes an unacceptable level of irrelevant and unnecessary information, dead end citations, in a byzantine document structure that is enough to drive even the most dedicated and objective content reviewers to distraction. The sloppy, unacceptable manner that information is presented in this document is more than a distraction; it really pisses me off! Yeah, and Happy New Year too! While I understand that DSL is not responsible for the timing of the issuance of the public notices for permit applications, the fact that the applicant dropped this permit application on DSL on the eve of the winter holiday season is not lost on me. Forcing the public to review this poorly prepared, 3,638-page permit over the holiday season in order for the agency to comply with a mandated permit review response period is an irritant that is difficult to view as a coincidence and does little to curry the favor of this reviewer!

19. Another example of the amateurish, unacceptable organization of the information presented in the application document: Document section heading number 6.2.1.1 is found on page 92 but document

section heading number 3.5.2 is found on Page 134. This irrational and incoherent document indexing system precludes any coherent search of the document.

20. Table A of Part 1 Attachment F.1 Attachment A (what kind of irrational/incoherent editorial document structure is that?) (Page 1016) is headed *"Jordan Cove LNG Project and Pacific Connector Pipeline Project - SEF level 1 site History Information and pipeline Stream Crossing Information".* Table A Includes a reference to a 12, 845.19 foot - long wet open-cut pipeline crossing of the Coos Estuary at milepost 2.92R that involves an estimated excavated volume of 29,496 cubic yards. This table also mentions states; *"Wet open cut only feasible practical in bay crossing method".* If wet cut pipe installation is the proposed method that will be used to install the LNG supply pipe across the estuary, then the permit application should explicitly discuss impacts and mitigation measures to address the impacts. If Open Wet Cut pipe installation will not be used, all reference to it should be deleted so that reviewers are not required to address potential impacts of extraneous superfluous information.

21. Resource Report 1 (pdf page 164) includes a cover page for a figure entitled: *"Figure 1.5-5 Conceptual Layout of Slip Construction Berm".* However, the figure that follows the cover page is entitled: *"Figure 1.5-5 Peat, Driftwood, and Clay Locations - South Dunes".*

It is unrealistic to expect members of the lay public, or independent expert subject matter reviewers, to be forced into reviewing the inadequately indexed, disjointed, extraneous, and redundant material presented in the application documents. The application should be rejected as incomplete because it lacks adequate structure to enable efficient public review and comment.

Comments of Michael Graybill in response to DSL joint permit application and call for comments on a proposal from Jordan Cove Energy Project L.P. to the Oregon Department of State Lands on 7 November 2018.

CHAPTER 14: COMMENTS REGARDING TSUNAMI IMPACTS AT THE MARINE SLIP

Project plans for tsunami impacts

FERC Resource Report 1 is referenced on page 119 of Attachment A entitled A.2 General project description. Amazingly, in contrast to the absence of numbers in Part 1 of the permit application Resource Report 1 includes page numbers! Fancy that eh? Well, on document page 24, (.pdf page 65) Under a section entitled "1.3.6.5 Emergency Lay Berth" the applicant includes the following description of a tsunami wall to be built along the western flank of the marine slip.

> *"Along the western property line, but on the Project side of the Henderson Property buffer zone, a tsunami flow control wall will be constructed. The flow control wall shall be of sufficient height and strength to prevent overtopping into Henderson Property and limit the drag due to the tsunami current loads on LNG carriers within the marine slip. The wall height shall be approximately 34.5 feet and determined in accordance with the design tsunami criteria. The wall will run from the southwest side of the LNG tank impoundment area down to the entrance to the slip."*

On document page 64 of resource report 1, Section 1.3.6.4.1 the applicant provides the following description of an 80.5-foot-tall sheet pile wall to be constructed as the foundation and mooring structures for the LNG carrier loading berth. Section 1.2.6.4.1 in its entirety reads as follows:

> *The physical berth will be constructed of steel sheet piles to support surface structures (i.e., the loading area) or provide the foundation for the breasting and mooring structures. Under the loading facility, the wall will extend from the bottom of the slip at elevation -45.97 (minimum) to approximate elevation +34.5 (NAVD88). This face will extend north and south to capture the outermost breasting structures and then turn to the east, creating a setback wall for the remainder of the slip.*

The narrative describing the 34.5' wall designed to deflect incoming water from an anticipated tsunami does not specify the base elevation of the wall, so it is not possible to determine the design height tsunami because the narrative did not specify the vertical reference datum (mean sea level? Mean of the Higher High water? North American Vertical Datum? Above the top of the backfilled sheet pile bulkhead on the western flank of the marine slip?). However, Resource report 1 figure 1.3.6 provides elevation views of the marine berth suggesting the tsunami wall will be built on top of an earth surface graded to an elevation of +20' (NAVD 88). Thus, it is reasonable to conclude that the elevation of the top of the tsunami wall will be approximately 54.5' above NAVD 88.

Given that other facilities at the terminal will be constructed atop earth fill with elevations approximately 46-60 feet, it is reasonable to assume the design tsunami runup elevation is approximately 60' above MHHW. On the eastern side of the marine slip, the top of the sheet pile wall of the loading berth will project to an approximate above water elevation of 34.5". The narrative also lacks a reference to the vertical datum. But Illustration 1.3.6 of resource report 1 includes reference to NAVD 88 as the vertical datum benchmark. It appears that tsunami wave events having runup elevations above 34.5' NAVD 88 will overtop the eastern flank of the slip at the LNG loading berth and marine offloading facility.

The waterway suitability analysis conducted by the US Coast Guard has determined the federal navigation channel is suitable for vessels having drafts up to 12 meters (39.5'). because no explicit reference to the base vertical datum used for the tsunami wall and the sheet pile berth walls is provided, it is not possible to precisely determine how a berthed vessel and the berth will function during a tsunami event having a projected runup that approximates or potentially exceeds the height of the mooring and breasting structures that will be used to secure the vessel to the berth during loading operations. The potential exists that during a design height tsunami event having a runup height of 60 feet, the top of the vessel berth will begin to approach the total draft of the LNG carrier at the berth. It is reasonable to assume that a water height flux of this magnitude will exceed the design strengths of the mooring structures and mooring lines used to secure the vessel to the berth.

Certainly, in order to accommodate water surface elevation changes of this magnitude, it will be necessary for ship personnel to be on hand to adjust mooring lines to accommodate these changes. During a locally generated tsunami event, there is a reduced chance that personnel will be on hand to manage lines during the initial or subsequent tsunami waves. The Society of International Gas Terminal and Tanker Operators (SIGTTO) states that exposure of a moored LNG carrier to wave heights having significant heights exceeding 1.5 meters and periods greater than 9 seconds could break a ship's mooring lines. Thus, it is highly likely that the absence or lack of adequate personnel to tend lines during a tsunami event will result in mooring line or mooring structure failures leading to an untethered vessel adrift in the slip.

Tsunami events involve multiple wave sequences. Should an initial water surge event break the mooring lines, subsequent tsunami surges are likely to wash an unmoored vessel ashore or aground. Tsunami wave trains include both peak runup and runout events. Runout periods can produce much lower water levels than those regularly experienced. In addition to the extraordinary risky circumstances posed by a 60' wave runup event a runout event of low water also poses significant risks to berthed vessels and vessels in transit. Because the non-emergency channel depth conditions in the Coos Estuary limit vessel traffic in the navigation channel to tide elevations greater than 6', there will be frequent time periods where the channel will not have sufficient depth to enable safe transit by an LNG carrier. This may limit the ability of an LNG carrier to gain access to open water in response to a remotely generated tsunami.

As an example to highlight the lack of suitability of the Coos Bay navigation channel to provide and adequate escape route to open water, consider an earthquake event in Alaska having an estimated Coos Bay tsunami arrive time of approximately 4 hours: Should the aforementioned earthquake occur on 16 January 2019, conditions in the Coos Bay federal navigation channel will be unsuitable for LNG vessel transits for a period of 22 hours. (see tide table for 16 January 2019). Although emergency responders would have sufficient notice directing mariners to disembark and seek refuge in deep water, a berth LNG carrier would be "trapped" at the berth unable to make transit because there would be insufficient water depths in the channel to safely transit from the berth to the open waters of the Pacific.

The current channel configuration may be suitable for scheduled high water transits of LNG carriers, but it is unsuitable as a means of emergency egress for LNG carriers on a daily basis. Some periods of unsuitable conditions persist for continuous periods of up to 22 hours in a single day. I don't know about you, but I'd be willing to stick my neck out and say that **the Coos Bay Navigation channel is not suitable for the proposed activity because it lacks sufficient conditions to provide for safe emergency egress between the terminal and the open water of the Pacific.**

Comments of Michael Graybill in response to DSL joint permit application and call for comments on a proposal from Jordan Cove Energy Project L.P. to the Oregon Department of State Lands on 7 November 2018.

CHAPTER 15: COMMENTS REGARDING THE ENVIRONMENTAL JUSTICE RAMIFICATIONS OF THE PROPOSAL

This project appears to be inconsistent with the Governor's executive order on Environmental Justice and should be reviewed by the Governors Environmental justice task force as part of the permit review process.

When state agencies make decisions that affect our environment it is critical that low-income and minority populations are not disproportionately affected. The Environmental Justice Task Force (EJTF) was created by the 2007 Legislature to help protect Oregonians from disproportionate environmental impacts on minority and low-income populations (Senate Bill 420). The EJTF encourages state agencies to give all people knowledge and access to improve decisions that affect environment and the health of all Oregonians

This project holds potential to disproportionately impact minority and low-income populations. Elements of the project bear the signature characteristics that are the focus of the Governor's executive order12898 on Environmental Justice. The astoundingly voluminous, disjointed and highly technical manner in which material is presented in the application, severely limits or precludes non-technical and limited language proficiency individuals from conducting a reasonable evaluation of the potential impacts of the project. This application is *not* accessible to an audience having an average or below average English proficiency. **This document is inaccessible to many readers including low income and minority individuals likely to be impacted by the actions proposed.**

The impacted resources are important to minority populations and low-income residents in the vicinity of the proposed work. The pipeline route and LNG liquification facility and LNG shipping channel work will impact the traditional homelands and culturally significant landscapes of six federally recognized tribes. The streams, wetlands, shoreline, intertidal resources, and sub tidal habitats are used as locations for fishing, gathering and transportation by native American and low-income residents. Other LNG terminals have been proposed in other Oregon locations but the communities in those areas rejected the proposals as infeasible because these (less disadvantaged?) communities were unwilling to accept the risks associated with LNG production and transport. The Jordan Cove LNG project remains the only viable proposal in Oregon. It is notable that this remaining proposal holds potential to differentially impact low income, minority and linguistically challenged populations

The considerable safety risks associated with this project (see Chapter 7 Feasibility considerations) also hold potential to be disproportionately borne by communities identified by the Environmental Justice Task Force and Executive order 12898.

No permit should be issued until a plain language version of the proposed work is available and a thorough and objective evaluation of how the proposed work will impact economically, linguistically and culturally disadvantaged populations.

EXHIBIT 7

Predicting the Future Commercial Catch of Dungeness Crabs.

3 authors:

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USING MEGALOPAE ABUNDANCE TO PREDICT FUTURE COMMERCIAL CATCHES OF DUNGENESS CRABS (*CANCER MAGISTER*) IN OREGON

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ABSTRACT

We explore the possibility of predicting the commercial catch of Dungeness crabs (*Cancer magister*) from the abundance of returning megalopae. In the first six years of a nine-year time series (1997–2001, 2006–2009), there is a strong relationship between megalopal abundance and Oregon commercial catch, and early spring transitions led to higher numbers of returning megalopae. During this period, we could make reasonable predictions of commercial catch. In the last three years (2007–2009), megalopal abundance ranged from 1.2 to 2.4 million animals. The previous relationship between megalopal abundance and commercial catch is unlikely to hold given these huge abundances; density-dependent factors should lead to an asymptotic relationship between the number of returning megalopae and commercial catch and, if this holds, commercial catch should be predictable. The high abundances of megalopae do not appear to be due to improved larval growth conditions, but significant correlations between megalopal abundances and hydrographic and climatic indices suggest that reduced northward and enhanced southward transport during the pelagic phase may have contributed to the huge returns.

INTRODUCTION

This research explores the possibility of predicting the commercial catch of Dungeness crabs (*Cancer magister*) from a measure of the number of megalopae returning to shore. The data presented were collected during two periods. Data in the first year (1997) was part of a Masters thesis (Johnson and Shanks 2002) and during the next four years (1998–2001) were collected as part of the Pacific Northwest Coastal Ecosystem Regional Study (PNCERS) (Roegner et al. 2007). There was a hiatus of four years due to a lack of funding and then, with support from the Oregon Dungeness Crab Commission, the time series was restarted in 2006 and has continued to the present.

Methods, data and the initial model relating the numbers of settlers to the commercial catch were presented in a previous paper (Shanks and Roegner 2007). Following a description of the Dungeness crab life history and fishery in the California Current, which is based upon the review by Wild and Tasto (1983), the results and conclusions from the Shanks and Roegner study will be presented. In this present paper, the last four years of data will be combined with this initial time series and reanalyzed.

The following presentation of Dungeness crab life history relates to the the California Current portion of the species range; the species range extends up into coastal Alaska and here the life history characteristics are different (Swiney and Shirley 2001). In the California Current system mating occurs in spring during a female's molt. Males can mate with multiple females. Females store sperm until egg extrusion in the fall. Egg development takes three to four months with hatching occurring sometime in winter (Strathmann 1987). There are five zoeae stages and a megalopal stage. The larval period is from three to four months (Strathmann 1987). Larvae hatch close to shore and, as they develop, they move further offshore. By the late zoeae stages, many if not most larvae are present in waters beyond the continental shelf (Wild and Tasto 1983). In Oregon, megalopae begin returning to shore in spring and returning megalopae are usually present until October or November (Roegner et al. 2007). The daily abundance of megalopae at the shore (as measured with light traps, see Methods) is highly pulsed; pulses are one to several orders of magnitude larger than abundances between pulses. Pulses tend to occur between spring and neap tides suggesting that shoreward transport of megalopae is due to the internal tides (Roegner et al. 2007). In Oregon waters, crabs reach sexual maturity in about 1.5 years and male crabs enter the fishery at about four years of age (Wild and Tasto 1983).

The following description of the history of the Dungeness crab fishery is taken from the review by Wild and Tasto (1983). The commercial fishery for Dungeness crab began in San Francisco Bay in 1848. Initially, the fishery was entirely within the Bay, but within several decades this fishing ground was over-fished and the fishery moved to waters between the Golden Gate and the Farallon Islands. There was a steady increase in landings through the 1880s at which time landings began to drop and crabs became scarce. To protect the fishery, the California State Board of Fish Commissioners lim-

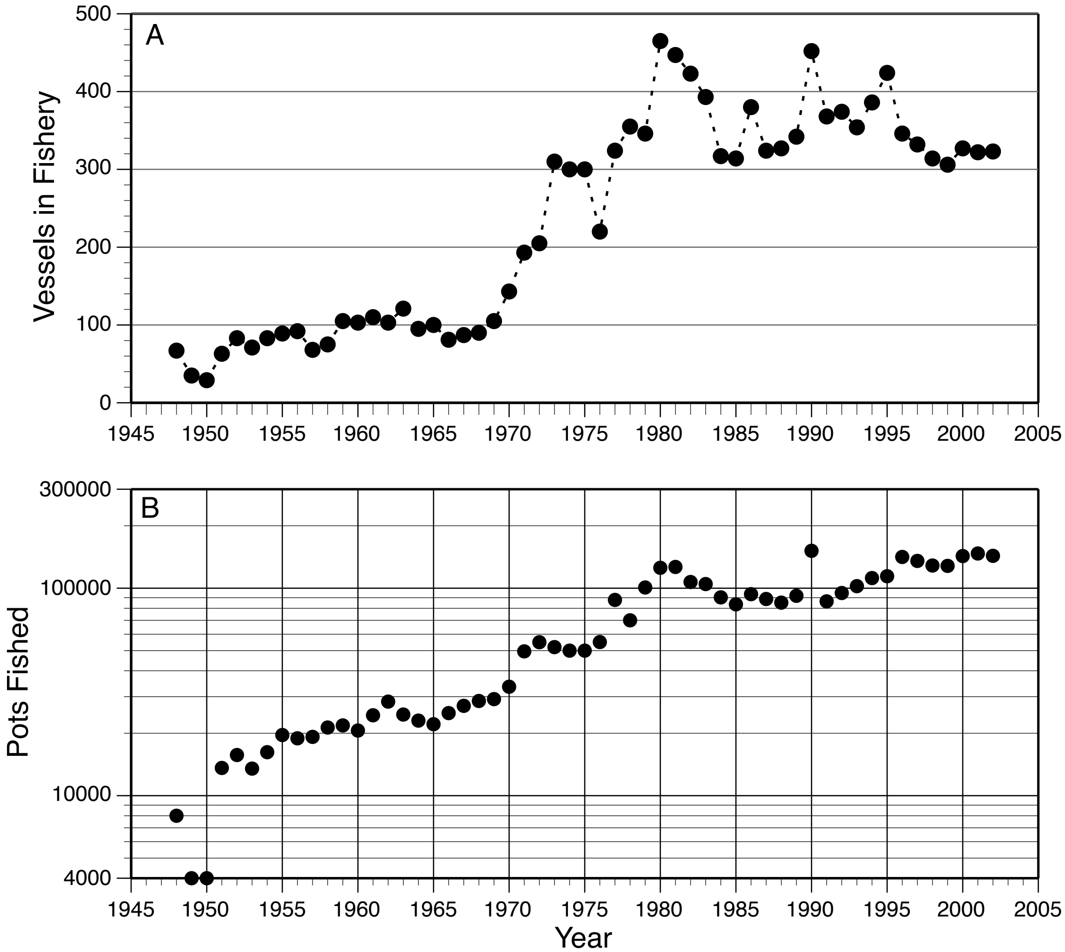

Figure 1. (A) Number of vessels participating in Oregon Dungeness crab fishery from 1947–2004 and (B) the number of crab pots fished over the same period (data are from the Oregon Department of Fish and Wildlife).

ited the catch to male crabs in 1897. The intense fishing pressure, however, continued to cause a decline in the population and additional restrictions were placed on the fishery. In 1903 the fishery was closed during September and October to prevent fishing when males are molting. In 1905 a size limit was placed on male crabs and in 1907 the size limit was increased to limit the take of female crabs (male crabs are significantly larger than female crabs). In addition, the larger size limit allows male crabs several opportunities to mate before they enter the fishery. These basic regulations, with minor changes, have been utilized in Dungeness crab fisheries throughout the California Current system. Starting in 1915, fish dealers were required to keep records of their transactions (landings). As the fishery expanded north into Oregon and Washington, similar record keeping was instigated in these states. These records provide an excellent time series of the commercial catch of Dungeness crabs in the California Current.

During the first half of the 20th century, the fishery expanded northward and the number of boats fishing crab increased. During the 1970s, following the initiation of the 200-mile economic exclusion zone, there was a rapid increase in the crab fishing fleet. For example, in Oregon (data from Oregon Dept. of Fish and Wildlife), the fishing fleet fluctuated around 100 boats during the 1960s. Between 1970 and 1975, the fleet increased to 300 boats and has remained between 300 and >400 boats since (fig. 1). During the 1960s, the fleet fished around 30 thousand crab pots, but > 100,000 pots have been fished since the growth of the fleet (fig. 1). Fishing pressure on Dungeness crabs is intense and has been since at least the 1970s. By the close of the fishing season, > 90% of the legal-sized crabs (four-year olds) have been caught and, as a consequence, annual catch is a good measure of the abundance of the four-year old cohort (Hackett et al. 2003). Despite the intense fishing pressure there is no indication that the crab population is suffering from overfishing. That is, while the size of the commercial catch has fluctuated over the years, there is no apparent downward trend in the size of the commercial catch (pers. obs.); the fishery appears to be

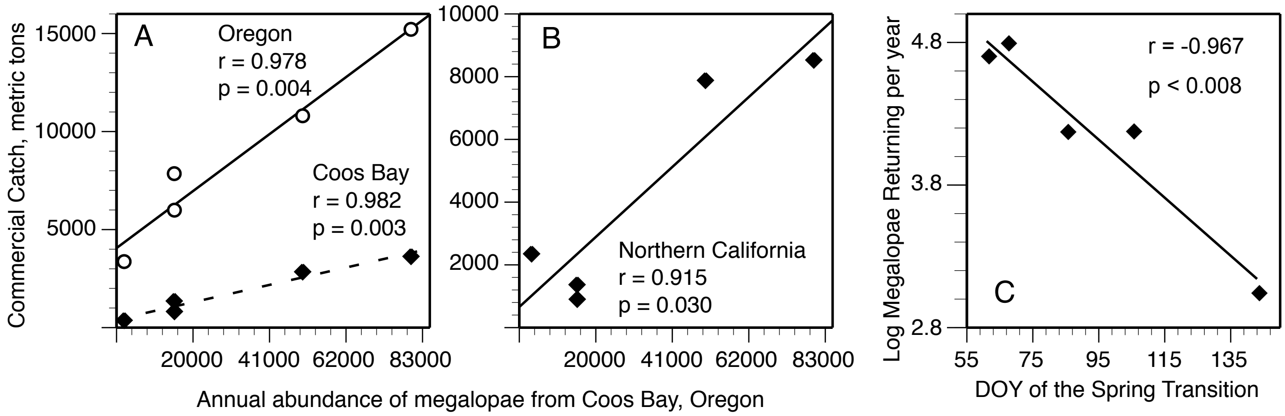

Figure 2. (A and B) The annual abundance of megalopae returning to Coos Bay, Oregon as measured as the sum of the daily catch of megalopae to a light trap plotted against the commercial catch landed in Coos Bay, all Oregon, and Northern California lagged four years to account for the growth of the megalopae to a legal-sized crab. (C) The day of the year of the spring transition plotted against the annual abundance of megalopae returning to Coos Bay, Oregon. Data are re-plotted from Shanks and Roegner (2007).

sustainable. A likely explanation for this is that the regulations limit the impact of the fishery on the reproductive output of the population.

Between 1997 and 2001, the annual return of megalopae to the shore as measured by the number of megalopae caught in light traps in Coos Bay, Oregon varied from 1000 in 1997 to nearly 80,000 in 2001. The number of returning megalopae was significantly, positively, and linearly correlated with the commercial crab landings in Coos Bay four years later (fig. 2), and was significantly correlated to landings in all Oregon and Northern California, and was nearly significantly correlated to landings in central California (Shanks and Roegner 2007). These correlations suggested three conclusions: (1) The size of the commercial catch (four-year old year cohort) was set by the relative success of the larvae as measured by the abundance of returning megalopae, (2) Over this range of returning megalopae, there were no obvious density-dependent effects; the relationship was linear, and (3) Whatever was driving the annual success of larvae was a process or processes consistent over a large portion of the West coast.

Off Oregon, larvae hatch in winter and move offshore during development such that by the megalopal stage most larvae are off the continental shelf. The timing of the pulsed return of megalopae to the shore suggests that shoreward transport is due to the internal tides, a hydrographic phenomena characteristic of the shelf (Roegner et al. 2009). Hence, the first step in the shoreward migration of megalopae appears to be transport from waters off the shelf back onto the shelf at which point internal tides could cause shoreward transport. We hypothesized that the spring transition might transport megalopae back onto the continental shelf. The spring transition occurs when winter winds from the south (downwelling favorable) are replaced by spring/summer upwelling favorable winds from the north. During this transition, the Davidson Current, which is present on the shelf during winter is replaced by the California Current moving back onto the shelf and the north winds begin the seasonal cycle of upwelling. These dramatic seasonal changes in the current regime might transport megalopae from waters seaward of the shelf onto the shelf. The spring transition varies from as early as March to as late as July. We hypothesized that if the transition was early (March), Dungeness crab larvae would spend a minimum time in the plankton and the return would be large. In contrast, if the transition was late (June or July) then larvae would spend additional months in the plankton during which a variety of mechanisms might cause increased mortality and the return of megalopae should be smaller. The day of the year of the spring transition was significantly correlated with the number of returning megalopae; when the transition was early, the return was large and, when it was late, the return was smaller (fig. 2). Interestingly, the return of the larvae of several taxa of nearshore or intertidal decapods (Shanks and Roegner 2007) and fishes (Shanks and Pfister 2009), species with larvae that remain close to shore during their development, had an opposite relationship with the date of the spring transition; in these taxa, when the transition was early, the return was low and when it was late, it was higher.

METHODS

A detailed description of the sampling methods used from 1997 to 2001 can be found in Shanks and Roegner (2007). Very similar sampling methods have been used since the time series was restarted in 2006. Using a light trap (fig. 3) placed in the Charleston small boat harbor in Coos Bay, Oregon crab megalopae were captured daily from roughly the beginning of April through September

Figure 3. Light trap used to sample megalopae in Coos Bay, Oregon. The trap consists of a clear plastic water bottle into which are placed a number of funnels. The light source is a fluorescent lamp powered by an outlet on the dock.

or October (Shanks and Roegner 2007). At the beginning of this study we sampled three replicate traps per day, but we found that the daily catch in these replicates was quite similar and that the greatly increased work required to process three replicates each day was unwarranted (Roegner et al. 2007; Shanks and Roegner 2007). The total number of megalopae captured in each settlement season was used as an index of the abundance of megalopae returning to the coast.

When a daily sample was < 2000 either the entire sample was counted or it was split using standard methods and then counted. Starting in 2007, the daily and annual abundance of megalopae increased dramatically with daily catches during pulses in the range of 10s of thousands of megalopae (5 to 10 liters of megalopae). We could not efficiently count these huge samples. To estimate the number of megalopae, we carefully drained off the water, weighted the entire sample, and then divided by the weight of 100 megalopae.

To test the hypothesis that population size is limited by the number of returning megalopae, we correlated the index of settling megalopae to the size of the Oregon commercial catch landed four years later. The Oregon Department of Fish and Wildlife provided commercial catch data.

We compared the index of settling megalopae with a variety of climate indices and oceanographic parameters. We correlated the index of settling megalopae to the date of the spring transition. The spring transition is apparent as an abrupt drop from high winter coastal sea levels following a period of steady winds from the north (Strub et al. 1987). As the date of the spring transition, we used the date on which sea level dropped 100 mm below the annual average and stayed there for at least seven days (Strub et al. 1987). We used sea level data for Crescent City, California obtained from the University of Hawaii Sea Level Center (http:/ilikai.soest.hawaii.edu). The strength of winter upwelling was estimated from summed monthly averages of the upwelling index for 42°N (http://www.pfeg.noaa.gov/pr). We correlated the index of settling megalopae with the Pacific Decadal Oscillation (PDO, http://jisao.washington.edu/pdo/PDO.latest), the North Pacific Gyre Oscillation (NPGO, http://eros.eas.gatech.edu/npgo/data/NPGO.txt), the Northern Oscillation Index (NOI, http://www.pfeg.noaa.gov/products/PFEL/modeled/indices/NOIx/noix_download.html?indx=NOI&time=1948+to+present&Submit=Show+List+%28entire+series%29), the East Pacific North Pacific index (EP/NP, http://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.Indices/.NHTI/) and the North Pacific index (NP, http://www.cgd.ucar.edu/cas/jhurrell/npindex.html). With the NP index we used the sum of the values from December through February, months when this index shows high inter-annual variability (Trendberth and Hurrell 1994). For all other indices we used the sum of the index from January through July, the entire pelagic larval period for Oregon crabs.

Starting in 2007, the return of megalopae increased dramatically. One possible cause of the large jump in

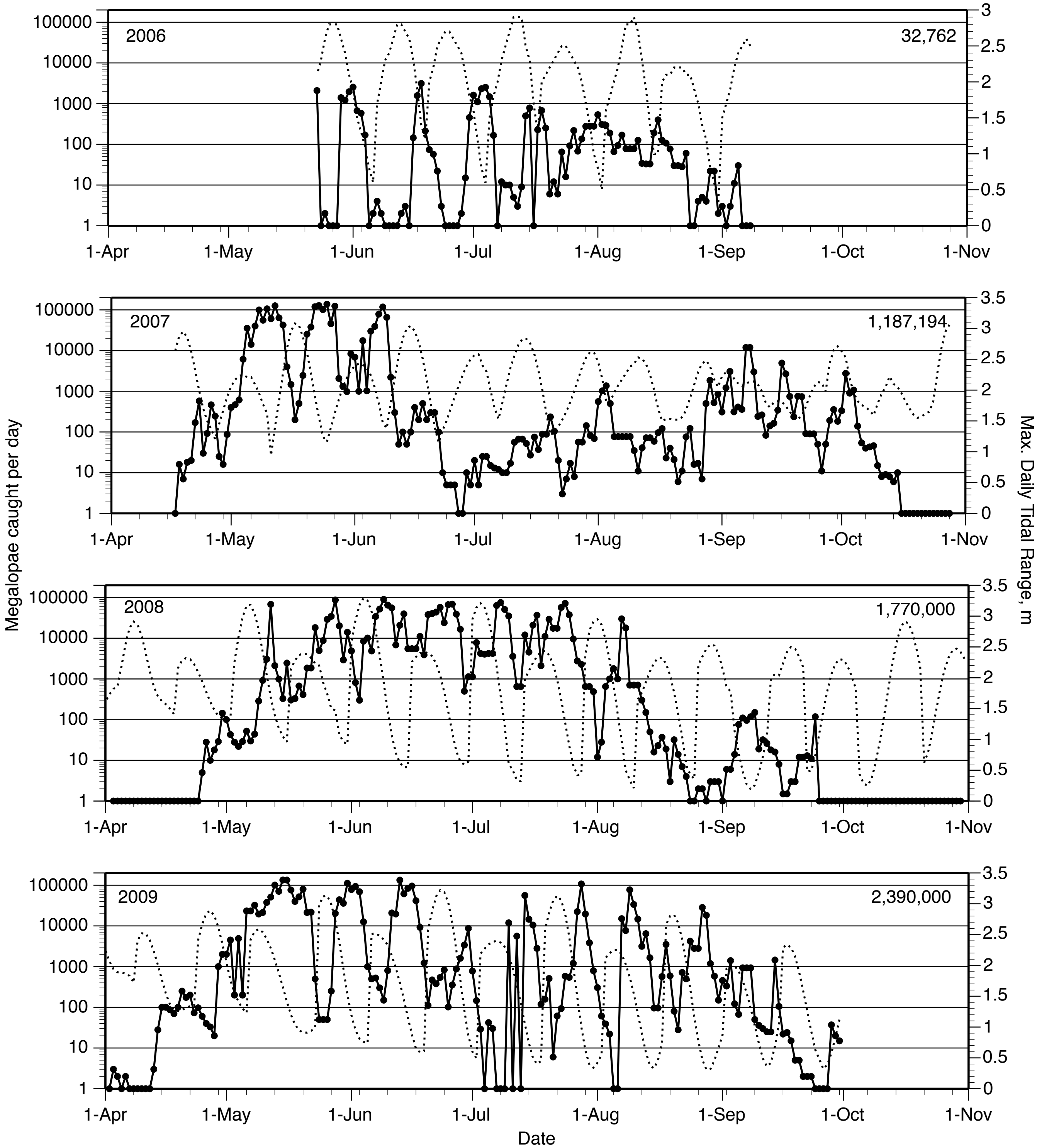

Figure 4. The daily catch of megalopae (solid line and circles) to a light trap in Coos Bay, Oregon during the 2006, 2007, 2008, and 2009 recruitment seasons plotted with the maximum daily tidal range (dotted line). Number in the upper right hand corner of each graph is the total number of megalopae caught each year.

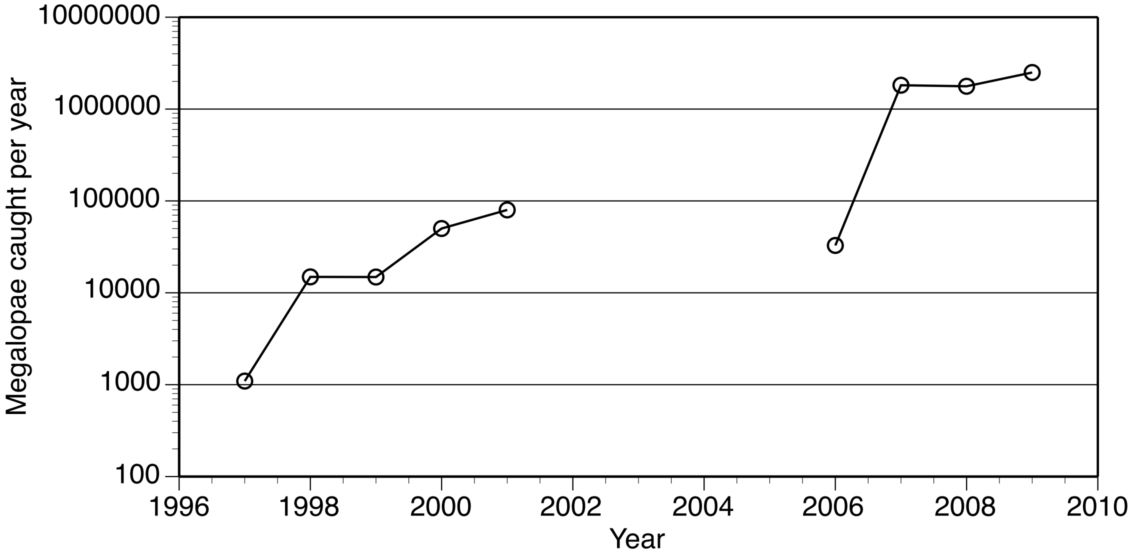

Figure 5. The annual catch of megalopae plotted by year. Prior to 2007, the annual catch ranged from 1000 to 80,000, but from 2007 onward, catch jumped to 1.2 to 2.4 million megalopae.

annual return might be that the at-sea larval growth conditions were better in 2007–2009. If this were the case, we hypothesized that the returning megalopae may be larger in these years than in previous years. To test this hypothesis, we measured the length of megalopae caught on a number of days (about 20) during each recruitment season. Early in the recruitment season, when megalopae were abundant, we measured at least 100 haphazardly-selected animals (i.e., the first 100 animals removed from a sample), but late in the season, when returns were much lower, fewer individuals were available to be measured. In the data from the first six years of sampling, about a quarter of the dates had <100 animals, but in the last three years few dates had <100 animals. During the late season, we either used dates when we could measure at least 10 animals or combined adjacent dates to get at least 10 animals to measure. Length (tip of rostral spine to back of the carapace; DeBrosse et al. 1990) was measured using an ocular micrometer in a dissecting microscope.

One possible consequence of the very high settlement rates of 2007–2009 is that growth rates of juvenile crabs may have been slowed due to intense competition. To investigate this possibility, we measured the sizes (carapace width) of juvenile crabs photographed by an Oregon Department of Fish and Wildlife (ODFW) ROV deployed off Cape Perpetua, Oregon in August of 2007. The average size of these crabs was compared to historical size data for similar aged crabs.

RESULTS

The daily abundance of returning megalopae was highly pulsed (fig. 4). Significant negative cross correlations between the maximum daily tidal range and daily catch, with lags around –1 to –4 days, suggest that peak catches tended to occur between the neap and the spring tides as had been seen previously (Roegner et al. 2007).

In 2006, on the first day of trap deployment, over 2,000 megalopae were caught suggesting that the trap was deployed after the start of the recruitment season. Total catch in the light trap during the first three completely sampled pulses in 2006 averaged around 7,000 individuals suggesting that the first pulse may have been under sampled by about 5,000 animals. In 2007–2009, initial daily catches were between 0 and 10 individuals for at least several days before the first large pulse suggesting that the trap was deployed prior to the beginning of the recruitment season.

The total catch of megalopae in 2006 was similar to catches from previous years, 32,762 megalopae (figs. 4 and 5): given that the start of the season was missed, the annual return of megalopae was probably around 37,000. After 2006, the total annual catch was far larger than in any previous year; total catches in 2007, 2008, and 2009 were 1.2, 1.7, and 2.4 million megalopae, respectively (figs. 4 and 5). During the fortnightly pulses, daily catches ranged from 10s of thousands to > 100,000 individuals. These annual catches were >10X larger than the previous largest annual catch of around 80,000 megalopae (2001). Over nine years of sampling, the total annual return of megalopae varied by a factor of > 1,000 (fig. 5).

Of the last four years of sampling, we have both the annual catch of megalopae and an estimate of the year class strength from the fishery only for 2006 year of megalopae return. Given the past relationship between

TABLE 1

Predicted and observed Oregon commercial catch of Dungeness crab. Predictions were based on the models in Shanks and Roegner (2007) that utilized the date of the spring transition or the total number of megalopae caught in Coos Bay, Oregon during the annual recruitment season (roughly April through September).

Crab fishing year	Date of the spring transition 4 yrs earlier	Oregon predicted catch (lbs) using spring transition date	Oregon predicted catch (lbs) using catch of megalopae	Oregon observed catch (lbs)	Deviation from predicted catch (lbs) (% off)
2005–2006	14 March 2002	27,000,000		27,600,000	–600,000 (2%)
2006–2007	8 May 2003	12,000,000		15,400,000	–3,400,000 (28%)
2007–2008	4 March 2004	28,000,000		12,300,000	–15,700,000 (212%)
2008–2009	13 July 2005	5,500,000		12,500,000	+7,000,000 (127%)
2009–2010	22 April 2006	16,000,000	21,000,000	24,100,000	+8,000,000 or +3,000,000 (33 or 12%)
2010–2011	11 March 2007	26,000,000	>500,000,000		
2011–2012	29 March 2008	18,000,000	>500,000,000		
2012–2013	29 March 2008	18,000,000	>500,000,000		

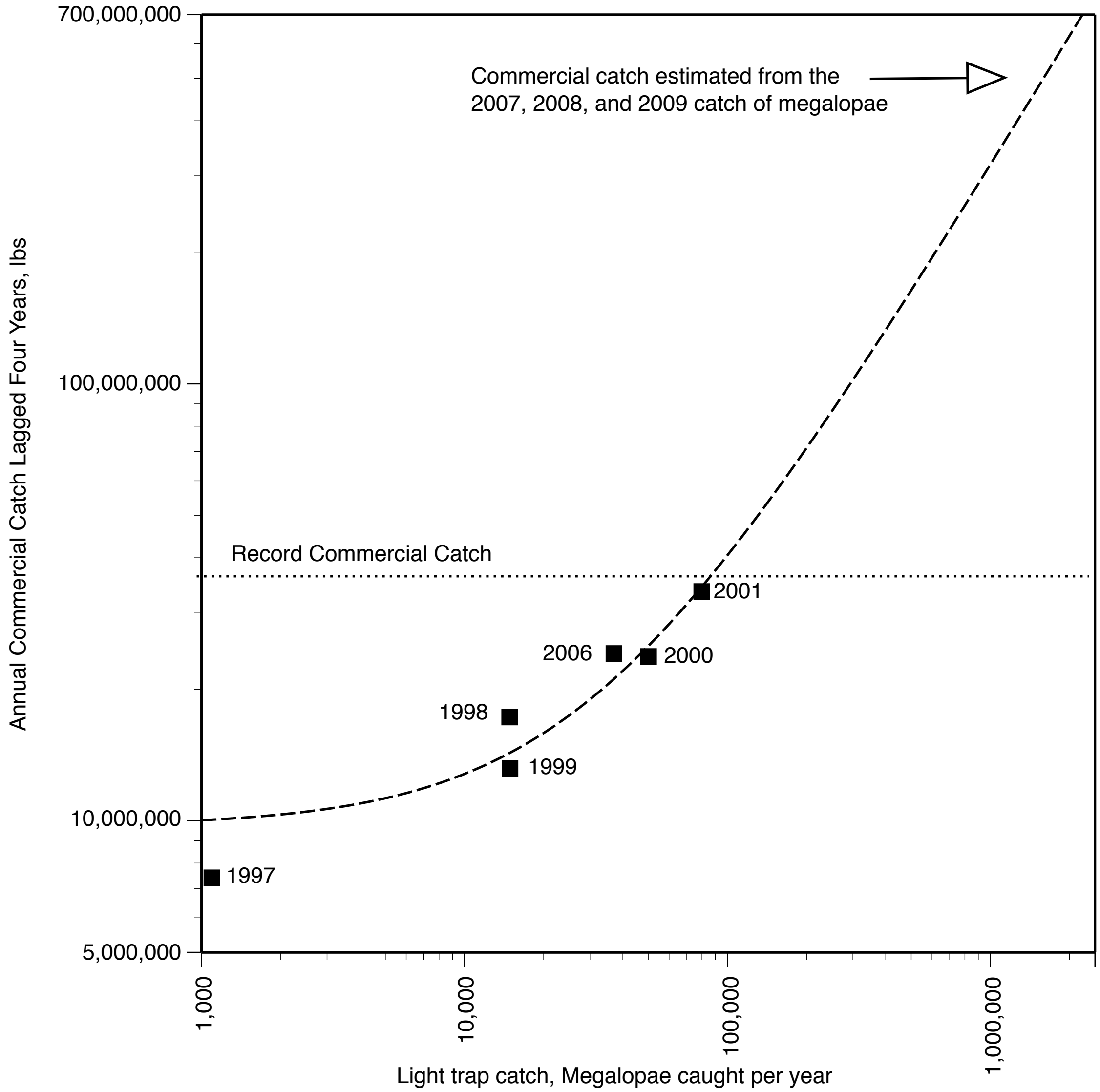

Figure 6. The annual light trap catch of megalopae plotted against the annual commercial catch of Dungeness crabs landed in Oregon lagged four years. From 2007 to 2009, the annual catch of megalopae ranged from 1.2 to 2.4 million individuals. Megalopae that settled during these years have yet to enter the fishery. The arrow indicates the approximate size of the commercial catch if the significant relationship (R^2 = 0.943, n=6, p< 0.01) for the years 1997 to 2001 and 2006 between the number of returning megalopae and commercial catch were applied. The commercial catch would be > 10 times larger than the current record commercial catch (indicated by the dashed line).

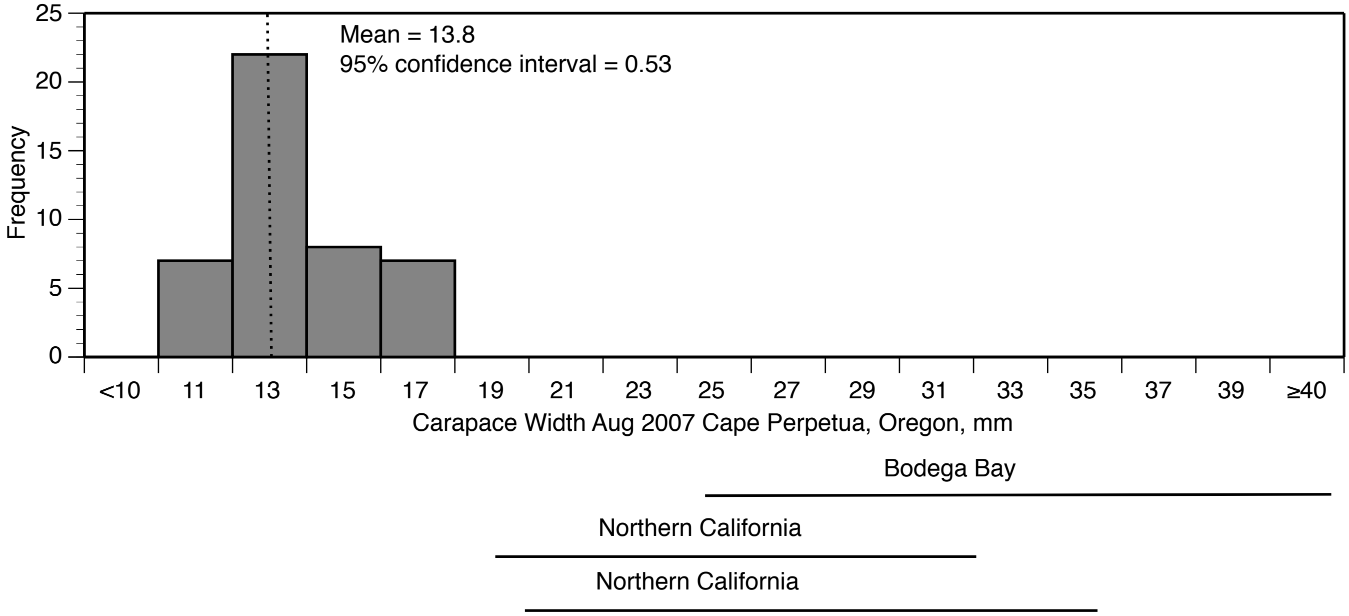

Figure 7. Size frequency distribution of juvenile crabs in August off Cape Perpetua, Oregon. Data are from an ROV video collected by the Oregon Dept. of Fish and Wildlife. The lines below this graph are size ranges for similarly aged juveniles reported in other studies in the California Current (Wainwright and Armstrong 1993).

returning megalopae and commercial catch, the predicted commercial catch generated by the 2006 return of megalopae was 21,000,000 lbs (tab. 1), and the observed commercial catch as of the submission of this paper (1 June 2010) was 22,937,111 lbs. Historically, by this date ≈95% of the annual commercial catch has been landed, suggesting that the total catch for the 2009/2010 fishing season will ultimately be ≈24,100,000 lbs; similar to the catch predicted from the number of returning megalopae. We now have six years in which we have both the total return of megalopae and commercial catch (fig. 6) and the relationship between these two variables remains remarkably strong ($R^2 = 0.932$, n=6, $p < 0.01$). At least within the range of 1,000 to 100,000 returning megalopae, the number of returning megalopae appears to be an excellent predictor of the commercial catch four years later, but will this relationship hold in the future given the recent huge returns of megalopae?

Using the present relationship between returning megalopae and commercial catch, we estimate that the future commercial catches generated by these huge returns of megalopae would be on the order of 500,000,000 lbs (fig. 6). Given that historically the largest commercial catch was 33,000,000 lbs, it is highly unlikely that such large commercial catches will occur; density-dependent effects, mortality due to predation and starvation and reduced growth rates, will likely modify the relationship between returning megalopae and commercial catch. Without systematic sampling of new-recruits as they grow into fishable-sized crabs, we have little evidence that can be used to investigate density dependence.

The 2007 ROV video from ODF&W provides one set of data. The video was shot in August off Cape Perpetua, Oregon. The average density of juveniles was 174 m^{-2} (n= 24, SE = 25, range 25 to 405 m^{-2}). These very high densities could lead to intense competition for food and reduced growth rate of juveniles. Using close-up images from the video, we generated a size frequency distribution of carapace widths (fig. 7). In August, the average juvenile was 13.8 mm wide (95% confidence interval = 0.5 mm), significantly smaller (10 to 20 mm smaller) than the reported sizes of similarly aged new-recruits within the California Current (Wainright and Armstrong 1993). The small size of the 2007 recruits is consistent with the hypothesis that competition for food was retarding their growth. It may take longer than four years for these recruits to enter the fishery.

What might have caused the huge return of megalopae in the last three years? There are at least three possibilities; mortality of larvae due to predation was much lower, growing conditions were much better than in previous years, and ocean currents were highly favorable and returned more larvae to the coast. There is not enough information on the predators of zoeae and megalopae of Dungeness crabs to address the first possibility, but we have some data with which we can investigate the other two potential causes.

If growth conditions during larval development were better during the last three years, then returning megalopae in these years may be significantly larger than in the years with smaller returns. We measured the sizes of megalopae over the recruitment season in 1998, 1999,

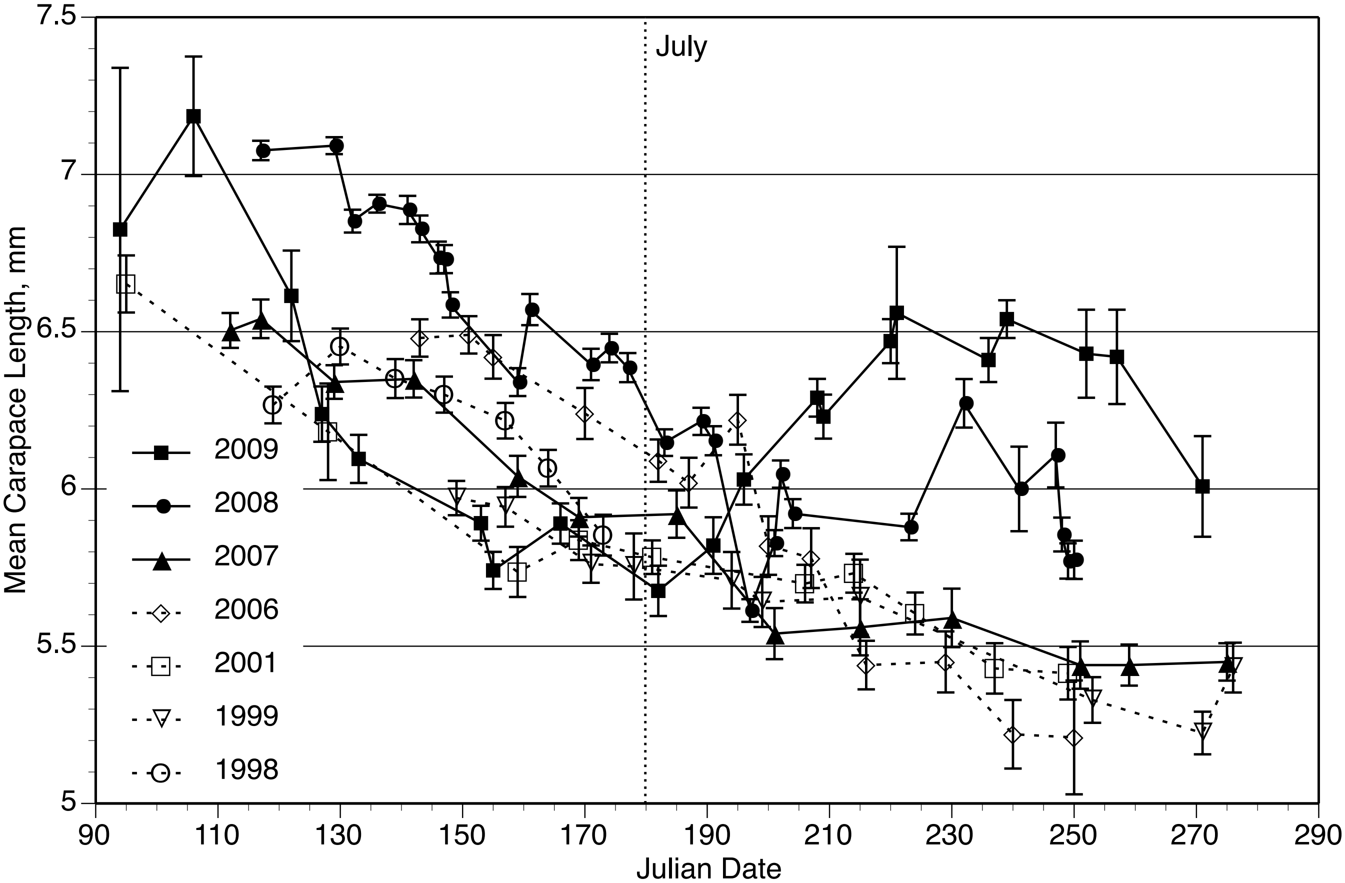

Figure 8. Mean carapace lengths (± 95% confidence interval) of megalopae caught in light traps placed in Coos Bay, Oregon plotted by Julian date. Closed symbols indicate years with very large (> 1 million) annual returns of megalopae and open symbols are years with < 100,000 megalopae returning.

2001, and 2006 through 2009 (1997 and 2000 samples were unavailable). In each year, the largest megalopae were caught at the beginning of the season and returning megalopae decreased in size over the summer (fig. 8). If improved pelagic growth conditions translate into larger returning megalopae, then we would expect to see the size curves from the last three years (closed symbols, fig. 8) located above curves from years with smaller catches (open symbols, fig. 8). The size curve for megalopae from 2007, the first year of huge returns, is co-located with curves for years of lower catch. The curve for 2008 is mostly above curves for the lower catch years, and at the very beginning and toward the end of 2009, megalopae were larger than those from years with lower catches, however, in the middle of the 2009 season, megalopae size was similar to that seen in the years with lower catches. While there are interesting patterns in these data, the results do not clearly support the hypothesis that returning megalopae were significantly larger in years with very high returns than in those with lower returns. If size of returning megalopae is a reflection of pelagic growth conditions then the data do not support the hypothesis that recent huge returns of megalopae were due to improved larval growth conditions.

We investigated a variety of hydrographic and climatic indices that might relate to the ocean transport of Dungeness crab larvae. Shanks and Roegner (2007) found a clear negative relationship between the day of the year of the spring transition and the number of returning megalopae. This relationship held through 2006 (R^2=0.943, n=6, $P<0.01$), but data points from the last three years of very large catches sit far above this relationship (fig. 9A). The East Pacific/North Pacific (EP/NP) index was negatively related to the number of returning megalopae, the relationship was significant through 2006 (R^2=0.734, n=6, $P<0.05$), and data points from the last three years sit well above this significant relationship (fig. 9B). Using all the data, the Pacific Decadal Oscillation (PDO) was significantly negatively related to the number of returning megalopae (R^2=0.532, n=9, $P<0.05$) with the PDO explaining about 50% of the variation in the catch of megalopae (fig. 9C). Using all the data, the summed monthly winter upwelling index was not significantly related to

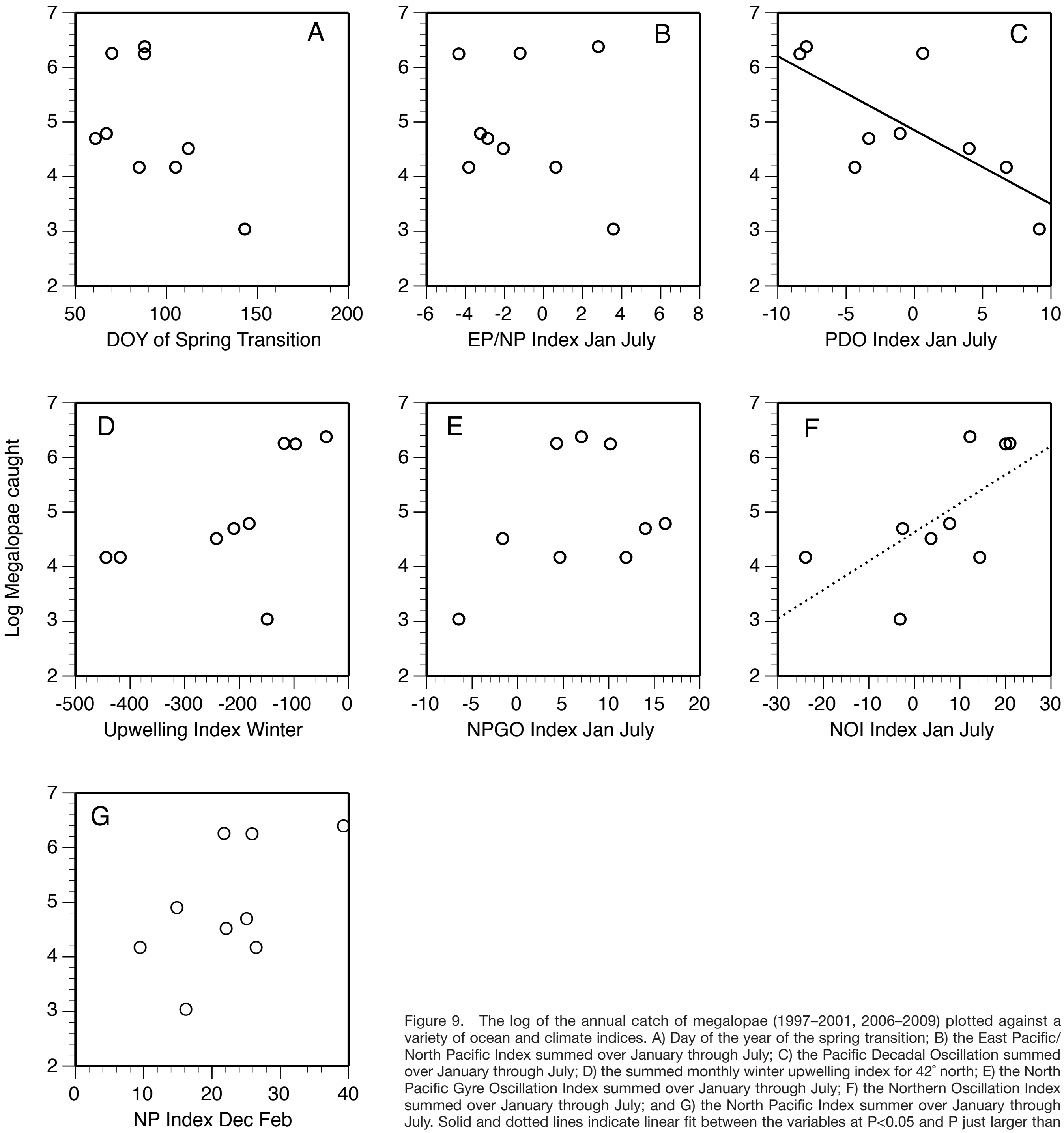

Figure 9. The log of the annual catch of megalopae (1997–2001, 2006–2009) plotted against a variety of ocean and climate indices. A) Day of the year of the spring transition; B) the East Pacific/North Pacific Index summed over January through July; C) the Pacific Decadal Oscillation summed over January through July; D) the summed monthly winter upwelling index for 42° north; E) the North Pacific Gyre Oscillation Index summed over January through July; F) the Northern Oscillation Index summed over January through July; and G) the North Pacific Index summer over January through July. Solid and dotted lines indicate linear fit between the variables at P<0.05 and P just larger than 0.05, respectively.

the number of returning megalopae (fig. 9D), with the one outlier point (1997) removed, however, the relationship is highly significant (R^2=0.782, n=8, P<0.01). The remaining indices were positively related to the number of returning megalopae. Neither the North Pacific Gyre Oscillation (NPGO) index nor the North Pacific index were significantly related to the number of returning megalopae (figs. 9E and G), but the relationship between the Northern Oscillation Index (NOI) and the number of returning megalopae was significant at the 0.10 level, but not at 0.05 (R^2=0.417, n=9, P=0.060).

DISCUSSION

In years when the number of returning megalopae was less than about 100,000, the index of returning megalopae has been a good predictor of commercial catch four years in the future. The technique for monitoring returning megalopae, a light trap in Charleston marina, is simple and cost effective. In addition, the time series has revealed fascinating and previously unobserved huge variations in annual larval success.

During the last three years, we have measured annual returns of megalopae in the millions; > ten times more megalopae returned in each of these years than in any previous year and, in fact, during settlement pulses, a day's catch was often larger than the entire annual catch in previous years. How these huge catches relate to the future commercial catch will not be clear until these recruits begin entering the fishery in fishing year 2010/2011, but the size of the commercial catch during the last two fishing seasons (2007/2008 and 2008/2009) offers some indication of what may occur.

We currently have two means of predicting the future commercial catch of Dungeness crabs. We can predict the commercial catch from the number of returning megalopae, but, given the strong relationship between returning megalopae and the day of the year of the spring transition, we can also predict commercial catch from the spring transition date. During the period when we did not have support to maintain sampling, this relationship was used to predict the commercial catch for the 2007/2008 and 2008/2009 fishing seasons (tab. 1). Given the early spring transition in 2004, the 2007/2008 season should have produced a large commercial catch, but the catch was only average. In contrast, the very late spring transition in 2005 (tab. 1) should have produced a very small commercial catch in the 2008/2009 season, but the catch in this year was much larger than predicted.

While we did not have light traps deployed in 2004, we did subjectively monitor recruitment. During this summer, there were vast numbers of megalopae around the docks in Coos Bay and, on sand flats near the docks, there were swarms of juvenile crabs. On a rising tide, at the water's edge, there was a continuous band of juvenile crabs 10 or more cm wide migrating into the intertidal zone to feed. The abundance of megalopae and juveniles suggests that the number of returning megalopae in 2004 was likely comparable to that in the last three years; we strongly suspect that the larval return in 2004 was in the millions. The observed juvenile densities were very high and likely led to stiff competition for food. The juveniles in the Cape Perpetua video were significantly smaller than the size of similarly aged juveniles reported in the literature (Wainright and Armstrong 1993). Off Oregon it typically takes four years for crabs to grow from larvae to commercial sized crabs, but, if densities on the bottom are high, competition may slow growth enough that some recruits may take five years to enter the fishery. The lower than predicted commercial catch in the 2007/2008 fishing season could be due to crabs taking five rather than four years to enter the fishery and the higher than predicted catch in the 2008/2009 fishing season might be due to an influx of five year old crabs that settled in 2004 subsidizing the commercial catch. The current model relationship between the number of returning megalopae and the commercial catch is based upon a four year lag between new settlers and commercial catch; obviously, if it takes four or five years for settlers to enter the fishery this model relationship breaks down and a new model will have to be developed.

The argument presented in the previous paragraph is, obviously, speculative; we will have to wait for the crabs that settled in the last three years to grow and enter the fishery before we can begin to develop an understanding of the relationship between huge settlement events and the size of the commercial catch. In addition, insights from the 2004 settlement event may not be applicable. In 2004, we had one apparently very high settlement year followed probably by a very poor settlement year (2005), but in the current situation we have three very high settlement years (2007, 2008, and 2009) in a row; repeated very strong settlement years would likely exacerbate density-dependent effects.

The most likely relationship between the number of megalopae and the commercial catch is that above some number of returning megalopae the relationship will be asymptotic (Caley et al. 1996). The earlier significant relationship between the number of returning megalopae and the future commercial catch would be the portion of the graph leading to the asymptote and would describe conditions under which the adult population is set by the relative success of the larvae. The current relationship between the huge returns of megalopae and the commercial catch will likely delineate an asymptote and would describe conditions under which settlement is so high that adult population size is not set by the relative success of the larvae, but by the relative success of the recruits; when the returns of megalopae are very high, density dependent effects will likely strongly influence the adult population size. This type of relationship between the annual return of larvae and the eventual size of the commercial catch is exactly what has been seen in the fishery for the Western Australian rock lobster (*Panulirus cygnus*) (Phillips 1986; Caputi et al. 1995). We will not know if this is true until we see how many adults are caught in the future; the first commercial catch from the recent large returns occurs in the 2010/2011 fishing year and will continue for several more years. If the relationship between the number of megalopae returning and the commercial catch is asymptotic then we should be able to predict the commercial catch with this more complete model relationship between number of returning megalopae and the size of the commercial catch.

Density dependent effects can take several forms, e.g., competition for food, increased predation, and the spread of diseases or parasites. The very high densities of recruits seen in the 2007 ROV video off Cape Perpetua, Oregon and their small size suggests that competition for food was reducing their growth rate. Competition for food may eventually lead to starvation or slower growth may lead to a longer period of vulnerability to predators on small crabs. Settling megalopae are preyed upon by young of the year Dungeness crabs (Fernandez et al. 1993; Fernandez 1999) as well as by predators of small crustaceans such as crabs and fish (Armstrong et al. 1995; Visser et al. 2004). Predation on Dungeness crab recruits has received some attention in estuarine habitats (Armstrong et al. 1995; Visser et al. 2004), but studies do not appear have taken place in coastal subtidal habitats. High densities of new-recruits could lead to predators, which do not normally prey on Dungeness crab recruits to target the bounty. This has not been investigated. Very high densities of recruits might also lead to the rapid spread of diseases or parasites, but this has also not been investigated.

What might have caused the amazingly large larval returns of the last three years? Ocean conditions were clearly far more favorable either to the survival of Dungeness crab larvae during their pelagic development or their return to the coast. As pointed out earlier, we know too little about predation on crab larvae to speculate on the contribution of decreased predation as a cause for the large returns of megalopae. We tested the hypothesis that the growing conditions may have been better during the past three years by assuming the sizes of returning megalopae were an indication of growing conditions; larger megalopae would indicate better growing conditions. Megalopae from the last three years were not consistently larger than megalopae from years with lower returns suggesting that, if our assumed relationship between megalopae sizes and growing conditions is correct, then growth conditions during the pelagic phase were not markedly better during the years of huge returns than those with lower returns.

While the size data do not indicate that growth conditions likely varied between years with higher and lower larval returns, the size data are curious. In all years, megalopae were largest at the start of the settlement season and, generally, decreased in size over the course of the spring and summer (fig. 8). It is not clear what might be causing this seasonal size decrease. Off Oregon, larval release is in winter and the larval period is about three months. If larval returns in Oregon are due to larval production from Oregon, then larval returns should end by July, but megalopae continue to settle into October and even November (fig. 4). By July, coastal flow is from the north suggesting that the source of these late summer settlers is to the north. Populations north of Oregon spawn later in the year (Strathmann 1987) and a limited set of measurements suggests that megalopae to the north (Washington and Puget Sound) are smaller than those caught off Oregon (DeBrosse et al. 1990). The very small megalopae caught at the end of the 2006 settlement season were similar in size to those from Puget Sound. The variation in size of megalopae over the settlement season may be due, at least in part, to different larval sources, but why source might affect megalopae size is unknown.

Larval transport may also affect the number of megalopae returning to the Oregon coast. From 1997 through 2006, the timing of the spring transition was clearly related to the number of settlers, suggesting that shoreward transport generated by the spring transition played a substantial role in determining larval success. In the last three years, however, this relationship is no longer true. We investigated the relationship between the number of settlers and a number of ocean and climate indices. Several of these correlations were either significant (summed PDO Jan. – July) or nearly so (summed winter upwelling index, and summed NOI Jan. – July) (fig. 9), and each of these climate or hydrographic variables can be interpreted as indicators of the amount of southward flow along the West coast. The PDO correlates with the amount of water from the North Pacific Drift that enters either the Gulf of Alaska (positive PDO) or the California Current (negative PDO) (Minobe and Mantua 1999); in years when more water is deflected to the California Current the return of megalopae was higher. The summed winter upwelling index indicates both the amount of water forced off- or onshore by the winds, but also the amount of wind-driven north- or southward flow over the shelf; during the winter months, when Dungeness crab larval are pelagic, weaker downwelling-favorable winds (less offshore and northward flow) led to higher numbers of returning megalopae. Positive (negative) values of the NOI tend to be associated with La Niña (El Niño) events, stronger (weaker) upwelling favorable winds along the West coast, and cooler (warmer) sea surface temperatures in the California Current (Schwing et al. 2002); higher returns of megalopae tended to occur when the NOI was more positive indicating more flow from the north. Tentatively—the time series of returning megalopae is short—these correlations suggest that when northward flow during the winter is weak or southward flow during the Dungeness crab larval development period is stronger, more megalopae return to the Oregon coast.

How might north/south flow during the pelagic larval phase affect the number of returning megalopae? Along the Oregon coast, larvae hatch during winter probably within several miles of shore (Wild and Tasto 1983). As development progresses, larvae are found progressively further from shore such that by late zoeae stages they are found seaward of the continental shelf (Wild and Tasto 1983). Early larval stages are, thus, in shelf waters in winter and will be transported northward by the Davidson Current. Northward transport will continue until larvae migrate off the shelf and into the southward flowing California Current present beyond the shelf. The amount of northward vs. southward transport the larvae will experience will be dependent on the amount of time spent in the Davidson Current vs. California Current and current speeds. Given the speed at which drifters are carried northward by the Davidson Current (Austin and Barth 2002), larvae released off Oregon may be transported to Vancouver Island before they migrate seaward of the continental shelf. If larvae experience enough northward transport, they may actually be carried north of the California Current in which case these larvae would settle well to the north of their release site, supplementing the Dungeness crab population along the coast of Vancouver Island. In addition, the amount of southward transport they may experience within the California Current may not compensate for the Davidson Current northward transport, which would again lead to larvae settling to the north of their release point. Whether larvae released in Oregon waters settle to the north or south or settle in Oregon waters may be dependent on the relative transport by the Davidson and California Currents.

The characteristics of the larval stage in Dungeness crabs (e.g., winter spawning, long larval duration, larvae present in the waters over the shelf and beyond, and recruitment to the benthos in spring and summer) are not unique to this species, but are characteristics shared by most shelf/slope species of fish and benthic crustaceans (Shanks and Eckert 2005). Hence, the relative amounts of northward and southward transport as well as processing affecting cross-shelf transport experienced by larvae of these species during their pelagic development may be amongst the critical factors determining the annual larval return at a site.

ACKNOWLEDGEMENTS

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EXHIBIT 8

COMMENTARY

Predicting tipping points in complex environmental systems

John C. Moore[a,b,1]

Ecologists have long recognized that ecosystems can exist and function in one state within predictable bounds for extended periods of time and then abruptly shift to an alternate state (1–5). Desertification of grasslands, shrub expansion in the Arctic, the eutrophication of lakes, ocean acidification, the formation of marine dead zones, and the degradation of coral reefs represent real and potential ecological regime shifts marked by a tipping point or threshold in one or more external drivers or controlling variables within the system that when breached causes a major change in the system's structure, function, or dynamics (6–9). Large or incremental alterations in climate, land use, biodiversity (invasive species or the overexploitation of species), and biogeochemical cycles represent external and internal drivers that when pushed too far cross thresholds that can could lead to regime shifts (Fig. 1). Seeing the tipping point after the fact and ascribing mechanisms to the change is one thing; predicting them using empirical data has been a challenge. The difficulty in predicting tipping points stems from the large number of species and interactions (high dimensionality) within ecological systems, the stochastic nature of the systems and their drivers, and the uncertainty and importance of initial conditions that the nonlinear nature of the systems introduce to outcomes. In PNAS, Jiang et al. (10) confront these issues using a dimension-reduction framework that uses empirical data from 59 complex multidimensional plant–pollinator mutualistic networks, some of which contain scores of species and interactions, to develop simpler 2D models for studying and predicting tipping points.

General system theory is replete with examples of tipping points and regime shifts and approaches that have been developed to study them. Ecologists have used these ideas to identify and predict tipping points and explain the mechanisms behind them in real-world situations using a combination of models and observations from long-term datasets or short-term experiments (11–13). Time-series data may reveal an abrupt change or shift system. Simplified models of the system that include the essential components,

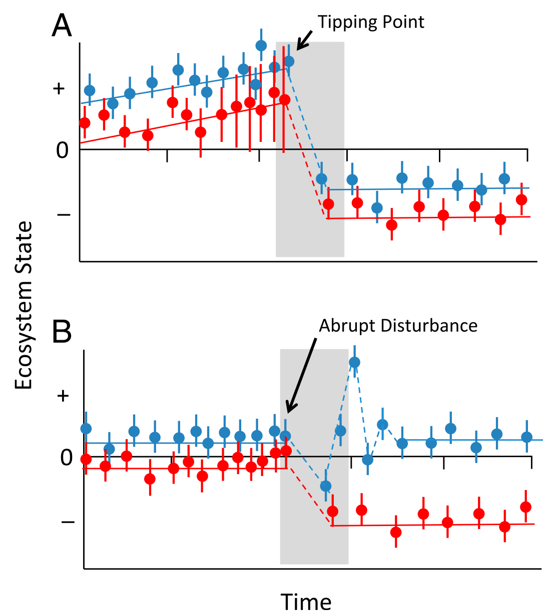

Fig. 1. Tipping points and ecological regime shifts are difficult to predict. *A* and *B* represent hypothetical time series of the trajectories of the mean and variation about the mean of variables of interest or the states of different ecosystem (blue and red), while the shaded gray area represents the transition region. (*A*) An external driver is incrementally changing and altering the state of the each ecosystem until a threshold is breached, representing tipping point after which the ecosystems transition to new states. The blue and red ecosystems both exhibit a change in state that tracks the incremental change in driver, but the blue ecosystem provides no early warning of approaching the tipping points, while the red exhibits an early warning in the form of increased variation about its mean state. (*B*) Both ecosystems possess relatively stable states until an abrupt disturbance occurs which initially alters their states. The blue ecosystem recovers from the disturbance and returns to its original state, while the red ecosystem is pushed beyond a tipping point and transitions to an alternate state.

interactions, and drivers and an element of stochasticity are constructed. The initial conditions of the models are informed by first principles and the empirical

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See companion article on page E639.

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data, the drivers are incrementally or dramatically altered, and the ensuing changes to the system are recorded. This approach has shown conflicting outcomes. For certain types of ecological systems an analysis of the model and real-world time series reveals that there are indeed leading indicators of regime shifts in the form of increases in the variance of populations or process variables (e.g., decomposition and mineralization) or changes in the underlying dynamics of the system. Other types of models, particularly those that have multiple attractors or the potential for chaos, exhibit abrupt changes with no advanced warning in the time series.

Jiang et al. (10) studied tipping points with an approach that utilizes first principles and empirical data to describe the dynamics of 59 complex plant–pollinator networks (real networks) that vary in the number of species (plants and pollinators) and interactions and then used the information to construct a simple 2D analog (2D reduced network) containing only a plant and pollinator. For each of the 59 real networks the population dynamics of each of the plants and pollinators within the network were described by a set of first-order, nonlinear (ODEs). The ODEs included intrinsic growth rates for plants and pollinators, terms for intraspecific and interspecific competition among the plants and among the pollinators, a function for mutualistic interactions that saturate as both partners increase in abundance (akin to a Holling type II functional response in a predator–prey system), a specific death rate of the pollinator, and immigration terms for plants and pollinators. For the 2D reduced networks the empirical data are used to reduce the complexity of the system to two dimensions in the form of a set of two nonlinear ODEs describing the dynamics of the pollinators and the plants that were based on averages of the population sizes and parameter values used to construct the real networks.

To study tipping points, two resilience functions—one based on the fraction of removed pollinators and the interactions that they engaged in and one based on the decay rate of individual species—were calculated to account for the disappearance of pollinators and concomitant mutualistic interactions they engage in and the increase in species loss in a deteriorating environment, respectively. Remarkably, the 2D reduced models accurately reflected the average population densities and responses of plants and pollinators captured in the 59 real networks. In cases where incremental increases in the resilience functions with and without stochastic disturbances did and did not generate tipping points in the 59 real networks the 2D reduced networks followed suit. In all cases the 2D model accurately predicted the tipping point, although its accuracy was dependent on the method of averaging that was used for the parameters describing the mutualistic interaction strengths of the plants and pollinators.

Jiang et al. (10) then argue that these results indicate that the low dimension and tractable 2D reduced network models captured the dynamics of the high dimension and not tractable 59 real network models with both slow and abrupt changes in environmental conditions sufficiently to study the emergence of tipping points. Eigenvalue-based stability analyses of parameter regimes that did not possess tipping points generated steady-state population estimates consistent with the simulations. A closer examination of the parameter regimes that did generate tipping points could tie the thresholds to changes in specific parameters. When the resilience function was incrementally increased to reflect the removal of pollinators from the system and the intrinsic rates of growth for plants and pollinators were low the system exhibited a tipping point with dynamic behavior without hysteresis behavior. When the resilience function based on the decay rate (death rate) of the pollinators was increased, the tipping point exhibited hysteresis behavior.

The approach presented by Jiang et al. (10) provides a framework to study tipping points not limited to plant–pollinator systems but across a variety of complex systems. There are a couple of important implications. First, simple models have been criticized for lacking sufficient information (read complexity) to capture the complexity and nuances of the contexts of individual systems to address challenges. However, the insights that simple models can provide when informed by and used in conjunction with more complex empirically based models as shown here can be invaluable. Their work should not be interpreted to say that all systems can be reduced to two dimensions but rather should challenge us to discern the utilities of simple versus complicated models of complex systems. Second, this approach could be very useful in understanding the thresholds that precipitate regime shifts in environmental systems and their connections to human well-being (2). For example, Rockström et al. (14) applied the concept of ecological thresholds when proposing nine planetary boundaries based on the key Earth system process of climate change, ocean acidification, stratospheric ozone depletion, freshwater use, land-system change, atmospheric aerosol loading, alteration of biogeochemical (N and P) cycles, and the rate of biodiversity loss as concomitant control variables and thresholds. They argued that transgressing one or more "may be deleterious or even catastrophic due to the risk of crossing thresholds that will trigger non-linear, abrupt environmental change [read ecological regime shift] within continental- to planetary-scale systems." However, for many boundaries, the positioning of the boundary is unclear. The dimension-reduction approach advanced by Jiang et al. (10) provides a means of establishing and studying these boundaries.

Acknowledgments

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EXHIBIT 9

Estuarine Productivity

David L. Correll

Pritchard (1967) defined an *estuary* as "a semi-enclosed coastal body of water which has a free connection with the open sea and within which sea water is measurably diluted by fresh water from land drainage." Estuaries are generally believed to be unusually productive. They have a mean primary production of 1,500 g/m^2/year (dry matter) as compared to only 125 for open ocean, 360 for continental shelf waters, 400 for lakes and streams, and 650 for cultivated land (Whitaker and Likens 1975). Not only are estuaries very productive in the trophic level or biological energy flow sense, but they are productive also by virtue of their essential role as spawning and nursery grounds for many migratory species of marine fish and as feeding and resting areas for many species of water birds (Milne and Dunnet 1972).

In this review I will address the following questions.: Which biota enable estuaries to maintain high productivity? What are the mechanisms by which an estuary is able to maintain the environmental conditions favorable to high productivity?

THE PARTICLE PRODUCERS

Estuaries, like all ecosystems, are dependent on the functions of primary production, primary consumption, predation, and decomposition. However, many of the biota are best described as particle producers and particle consumers (or filter feeders). It is difficult to relate these two groups to the traditional primary producer/primary consumer categories. Thus, for example, bacteria serve several roles other than as decomposers. Bacteria break down higher plant materials and scavenge dissolved and particulate organic matter. In the process, bacteria produce high cell populations (particulates). Bacteria also break down large detrital materials into very fine particles, suitable for utilization by filter feeders. Thus, bacteria also play a role as particle producers.

An attempt to diagram the estuarine energy flow pattern is shown in Fig. 1. Instead of the classical trophic level energy or biomass pyramid, this pyramid is composed of three segments (particle pool, particle consumers, and predators), with areas approximating their energy flow rates. A number of important features are built into the diagram to point out problems in our understanding of estuarine, and perhaps other, food chains. Estuarine vascular plants, in general, are not harvested to any great extent by herbivores, but are subjected to microbial breakdown into suspended and dissolved organic matter, producing microbial cells in the process.

A very dilute but important and rapidly metabolized pool of dissolved organic matter is utilized primarily by bacteria. The pool is also replenished with incompletely assimilated organic matter as food is passed along the pyramid toward its apex. Thus, an oyster filter feeding on particles will release pseudofeces, which when subjected to microbial action will yield some dissolved organic matter, some microbial cells, and some residual particles.

Which Primary Producers Are Most Important?

The primary producers of this system are vascular plants and algae. The vascular plants include submerged plants in the shallow open water areas of the estuary, emergent plants in the tidal marshes, and upland plants on the drainage basin of the estuary. The algae include phytoplankton in the open water basin of the estuary, benthic algal thalli in the shallows, and the algal constituents of the periphyton (a microbial community that coats all underwater surfaces in the marshes and shallows).

What are the relative contributions of each of these groups of primary producers to the energetics and food chains of the estuary? A factor which complicates answering this question is the variability of estuaries morphometrically, meteorologically, chemically, and biologically. However, the energy content of organic matter from upland runoff and from tidal marsh exports is quite modest in comparison to the *in situ* photosynthetic activity in the estuary proper.

In the Rhode River, a subestuary of Chesapeake Bay, phytoplankton produced 2,090 g dry wt/m^2/year, whereas upland runoff released only 6 g dry wt/m^2 of estuary per year (Correll 1975). In the Georgia tidal marshes and the adjacent estuarine waters, recent studies of the δ ^{13}C values for various biota and suspended organic particles indicate that tidal marsh animals are feeding on emergent vascular plant detritus (Haines 1976a). They also indicate that the bulk

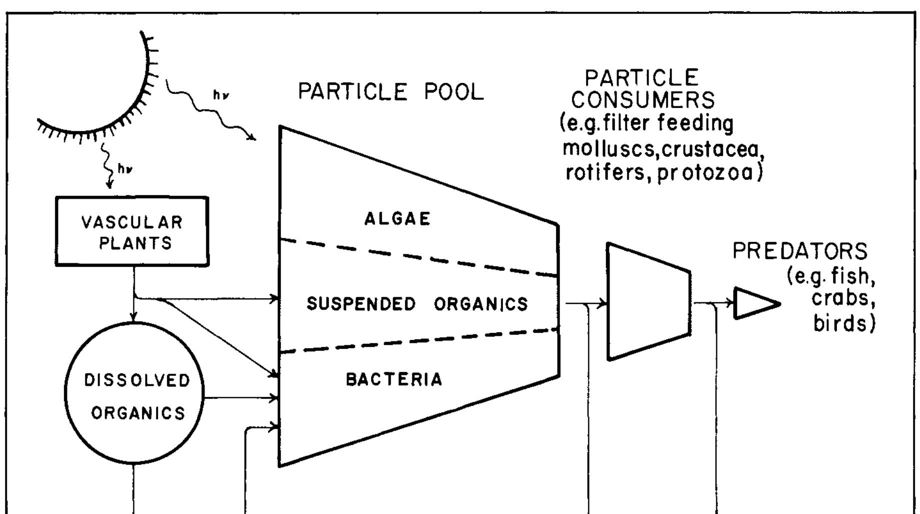

Fig. 1. A schematic representation of the estuarine food web.

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of the suspended organic particles in open estuarine waters is derived from phytoplankton (Haines 1976b).

In two tidal marshes on the York River subestuary of Chesapeake Bay, the export of organic matter was measured directly in monthly, intensive tidal cycle studies. When both tidal flux and chemical composition were measured (Axelrad et al. 1976), these marshes were found to export 227 and 284 g total organic carbon/m^2/year, respectively, to the estuary. In the Patuxent River subestuary of Chesapeake Bay, Heinle and Flemer (1976) found tidal marshes exported only 60 to 135 g dry wt/m^2. Much of this was the result of ice scouring in late winter.

A tidal marsh/mudflat system on the shore of Narragansett Bay was found to export essentially none (less than 1%) of its productivity to Narragansett Bay (Nixon and Oviatt 1973). This system exported only 23.8 g dry wt/m^2 from the tidal marshes to the mudflats and even less to the estuary. Worldwide, estuaries cover between three and four times the area of their associated tidal marshes (Woodwell et al. 1973). Thus, their yield of organic matter to the estuary, per square meter of estuary, is only 25 to 33% of the values quoted above.

These studies indicate that the upland and tidal marsh communities are not as important sources of estuarine organic matter as scientists previously believed them to be. Instead of being very "leaky," these communities have evolved mechanisms to retain and utilize their primary production. This view diverges from a previous one in which the tidal marshes were depicted as providing large amounts of detritus to the estuary and, in effect, were the cause of high estuarine productivity (e.g., Odum and deLaCruz 1967, Teal 1962).

These earlier studies were qualitatively correct; their ballpark estimates for rates of export for organic matter per marsh surface area were reasonable. However, when put in perspective with total estuarine primary productivity, they are a minor contribution. Marine and estuarine fish do use tidal marshes as spawning and nursery grounds and utilize marsh biota. When they return to the estuary, they transport an increment of predator-level biomass, the production of which required approximately 100 times as much primary producer biomass. However, most of the nutrients, carbon, and energy used in their production remained within the tidal marsh community.

If upland drainage and tidal marsh exports are not major sources of energy to the open water basins of estuaries, which sources are important? Undoubtedly, phytoplankton are usually the most important estuarine primary producers in terms of absolute amounts of product. Periphyton, benthic thalloid algae, and submerged vascular plants can only exist in very shallow water in most estuaries, since turbidity limits light penetration to a few meters.

In the Rhode River, periphyton growth rates averaged about 300 g dry wt/m^2/year in favorable shallows as compared to 2,090 for phytoplankton in the estuarine basin (Correll 1975). Submerged vascular plants in the same system are currently not abundant but were of much greater importance as little as 10 years ago (Southwick and Pine 1975). In shallow estuaries, such as Rhode River, these plants carried out in previous times almost as much primary production as phytoplankton do now.[1]

Recent drastic fluctuations and decreases in vascular plant populations have also been reported for the lower Chesapeake (Orth 1976), the Waddenzee (Den Hartog and Polderman 1975), and the Mediterranean coast of France (Peres and Picard 1975). The determination of the causes of this widespread decline in the population of submerged vascular plants is one of the most urgent research problems in the biology of estuaries. In terms of habitat function, these submerged plants form dense beds, which are very important as nursery grounds and protective cover for estuarine animals.

In summary, at the present time the most important primary producers in estuaries seem to be phytoplankton, and submerged vascular plants take an important but secondary role. Periphyton and benthic thalloid algae provide significant amounts of productivity in shallow water areas. In addition, relatively small amounts of organic matter are transferred to the estuary from tidal marshes and uplands.

Which Algae Are Most Important?

To determine which algae are most important, the net productivity of various phytoplankton must be considered. Unfortunately, not many publications have data which directly address this topic in estuaries. In the Rhode River, the distribution of biomass or standing crop between eight commonly occurring classes of algae and two categories of abundant but taxonomically ill-defined algae (the microflagellates and the nanoplankton) was complex and constantly changing (Correll et al. 1975). Dinoflagellates usually dominated the biomass, and the sum of the microflagellate and nanoplankton biomass fluctuated between 1 and 36% of the total. These values were determined by direct microscopy of fixed plankton samples taken over an entire year.

Rates of incorporation of ^{14}C-bicarbonate into the cell structure of various phytoplankton species were determined by autoradiography on the same populations (Faust and Correll 1977). The rates of carbon fixation per biomass, at the species level, varied by one to several orders of magnitude within each population studied, and the higher values were consistently associated with the smaller species. Thus, there is a tendency toward overemphasis on the productivity of the larger species when biomass provides the only data available.

In a one-year study of the phytoplankton of Narragansett Bay, cell counts for various species were done by direct microscopy, and carbon fixation was measured for four size fractions, separated by filtration (Durbin et al. 1975). Chain-forming diatoms of sizes over 20 μm dominated the biomass of spring and fall blooms, whereas flagellates dominated the summer populations. Algae of sizes less than 20 μm were the most important primary producers on an annual basis.

In Chesapeake Bay, nanoplankton of less than 10 μm were reported in one study to be responsible for over 90% of the phytoplankton carbon fixation (McCarthy et al. 1974); in another study they accounted for the great majority of cells and 65–75% of the plankton primary production (Van Valkenburg and Flemer 1974). One reason estuarine productivity is normally high is probably the high algal diversity. As physical and chemical environmental conditions shift, which normally occurs continually in the estuary, various sectors of the population have near optimum conditions and respond with high specific productivity rates.

The Relationship Between Algae and Bacteria

A strong relationship between phytoplankton and planktonic bacteria population dynamics has been observed by

[1]Charles H. Southwick, Department of Pathobiology, Johns Hopkins University, Baltimore, MD, personal communication, May 1975.

several workers. In a one-year study of the Rhode River, algal and bacterial cell numbers had a high positive correlation (Faust and Correll 1976), and the metabolic activity of algal and bacterial cells also were highly correlated (Faust and Correll 1977). Furthermore, the metabolism and biomass of English Channel algae and bacteria have been found closely correlated (Derenbach et al. 1974). A field and laboratory study of the interactions between algal and bacterial populations in the Schlei Fjord indicated selective positive and negative species interactions (Rieper 1976). Ukeles and Bishop (1975) found evidence that bacteria enhanced algal growth in laboratory cultures by releasing stimulatory substances from substrates.

Bacterial particle productivity is important. Derenbach, Le, and Williams (1974) found this heterotrophic particle productivity to be from 1 to 30% as high as the phytoplankton primary production in the English Channel. Faust and I (1976) found bacterial biomass to vary from 2 to over 100% of the phytoplankton biomass present in the Rhode River estuary.

THE PARTICLE CONSUMERS

The particle consumers include benthic mollusks, zooplankton, larval and juvenile fish and invertebrates, adult filter-feeding fish, and certain benthic invertebrates such as bryozoa and polychaetes. Harvests from Chesapeake Bay in 1971 included 13.6 kg fresh weight/ha/year for oysters and clams and 132 kg/ha/year for members of the filter-feeding shad family (Roberts et al. 1975). In the Patuxent River subestuary of Chesapeake Bay, Heinle (1966) estimated copepod productivity to be about 365 kg/ha/year. Of course, very high values of harvest are sometimes found for concentrated shellfish beds, but the fact that they may feed on particulates from a much larger area must be kept in mind.

Milne and Dunnett (1972) reported a total net production of the mussel *Mytilus edulis* at one station in the Ythan estuary, located 20 km north of Aberdeen on the North Sea, to be 400 kg dry wt/ha/year. Walne (1972) reported harvests of benthic mollusks to vary from 300 to 7,800 kg fresh weight/ha/year for a series of United Kingdom estuaries and concluded that a reasonably productive estuary can yield a harvest of about 100–200 kg dry wt/ha/year of mussels. Berrie (1972) reported a production of 50 to 120 kg dry wt/ha/year for bivalves, 75 to 134 for porifera, and 16 to 37 for bryozoans in the River Thames estuary, for a total benthic particle consumer net productivity of 214 to 233 kg dry wt/ha/year.

These are comparisons of harvest and "production" numbers; harvest by man probably never exceeds half of production in open estuaries. When Milne and Dunnett (1972) analyzed the utilization of mussel net productivity in the Ythan estuary, they found man harvested only 34%, while birds harvested the rest. The net productivity of particle consumers in Chesapeake Bay is probably about 150 to 300 kg dry wt/ha/year, whereas some estuaries in the United Kingdom have net productivities of perhaps double these figures.

How do these particle consumer productivities compare with particle production rates? In the Rhode River estuary, phytoplankton production (2,090 g dry wt/m^2/year) plus bacterial particle production (e.g., 10% of algal) plus upland runoff and tidal marsh "leakage" (approximately 100 g dry wt/m^2/year) plus particulates from submerged vascular plants (approximately 200 g dry wt/m^2/year) total 2.6 kg dry wt/m^2/year or 26,000 kg/ha/year. This is about 100 times our estimate for Chesapeake Bay particle consumer productivity.

However, the Rhode River is probably more productive than most open parts of Chesapeake Bay by a factor of at least two. Furthermore, there is an overlap between particle producer and consumer categories. For example, copepods are particle consumers, which are, in turn, consumed by particle consumers like ctenophores (Roberts et al. 1975) or menhaden (McHugh 1967).

THE PREDATORS

The most clearcut predators in estuaries are aquatic birds, some of the finfish, and some species of crabs. Of course, most predatory species are really somewhat omnivorous, especially under duress. In their study of the Ythan estuary, Milne and Dunnet (1972) conducted an extensive predator investigation and found 53 species of bird and 22 species of fish predators. They found that of the net production of mussels, eider consumed 21%; oyster catchers, 13%; and gulls, 16%. They reported the following average annual biomass of predators (in kg fresh wt/ha): redshank, 0.3; turnstone, 0.04; shelduck, 0.5; eider, 10; flounder, 125; gobies, 3. These standing crops of predator total about 14 kg dry wt/ha. Net productivity values were probably of the same magnitude as the average annual standing crops.

In Chesapeake Bay in 1971 (Roberts et al. 1975), nonfilter-feeding finfish harvests were 8.2 kg fresh wt/ha, and blue crabs *(Callinectes sapidus)* were 32 kg fresh wt/ha, for a total commercial harvest of about 4 kg dry wt/ha/year. These values must be revised upward to 8-12 to adjust from harvest to net production, and they do not include the production of waterfowl, herons, etc.

Berrie (1972) reported predatory fish gross production (bleak and roach) in the River Thames estuary to be 120 kg dry wt/ha/year. Most of this production was by fish of less than one year age, with less than 1% of the population weighing over 20 g fresh weight. The production of fish over one year old was 36 kg dry wt/ha/year.

No careful, quantitative bird predation studies have been reported for the River Thames or Chesapeake Bay. Thus, estuarine predator net productivity seems to vary from 10 to possibly as much as 50 kg dry wt/ha/year.

MECHANISMS FOR MAINTAINING HIGH PRODUCTIVITY

If, normally, most (80–90%) of the photosynthate is due to the *in situ* primary production of phytoplankton and submerged vascular plants, what are the conditions that allow such high *in situ* primary productivity? One factor is the presence of favorable levels and suitable ratios of all the necessary plant growth nutrients. The seawater that mixes into the estuary to create brackish conditions contains more than adequate levels of such plant nutrients as calcium, magnesium, sulfur, potassium, and trace elements. Normally, fixed nitrogen and phosphorus are the two limiting nutrient factors in seawater. Runoff from estuarine watersheds is relatively rich in these two nutrients and creates a gradient from high to low concentrations as one moves toward the sea (Correll 1975, Pomeroy et al. 1972, Rochford 1951).

What, then, prevents these plankton and their high nutrient contents from being flushed out to sea? The plankton are gradually flushed down the estuary; at the same time, they tend to settle toward the bottom. They carry a large proportion of the nitrogen and phosphorus, which they have assimilated in the surface waters, along with them to the bot-

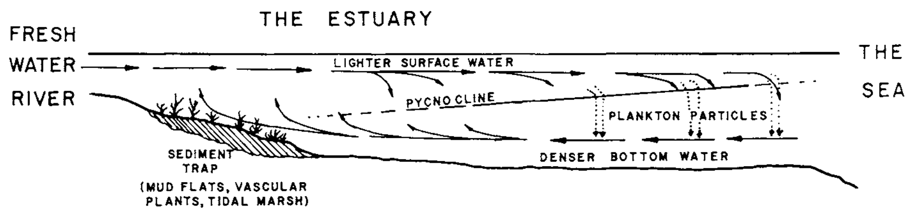

Fig. 2. Schematic diagram of nutrient conserving and modulating mechanisms in estuaries, including the two-layered salt-wedge; plankton circulation pattern; the sediment trap; the tidal marsh, vascular plant "nutrient pump"; and deep bottom sediment modulators.

tom. Typical estuaries maintain a "salt wedge" of intruding seawater on the bottom (Fig. 2), producing a surface flow of fresher water and a counterflow of more brackish, heavier water (Bowden 1967). These layers are separated by density variations due to both salt concentration and temperature differences. Estuarine ecologists believe this countercurrent of more brackish water is largely responsible for nutrient "trapping" or conservation in estuaries (Ketchum 1967, Odum 1971). Both living and dead particulates, which settle through the pycnocline or zone of maximum vertical density differential into the countercurrent, are carried upestuary along with their nutrient contents.

Another factor in this transport is the fact that the countercurrent layer tends to become anaerobic, especially near the bottom in warm weather. When this happens, high levels of nutrients, especially phosphorus, are solubilized from the bottom sediments. As the countercurrent moves upestuary, it gradually mixes into the upper layer through the action of turbulence induced by wind, tides, and friction between the opposing currents.

Some biota use the countercurrent to disperse their progeny and to avoid, to some extent, being swept out to sea. Examples are the blue crab and croaker, which spawn at the mouth of Chesapeake Bay (Cronin and Mansueti 1971). Moreover, phytoplankton are sometimes carried upestuary in the countercurrent and repopulate the upper estuary.

At times, when nutrients are high in upper estuary surface waters, they tend to be taken up rapidly in tidal marshes, mudflats, and bottom sediments (Correll et al. 1975). At times of low nutrient concentrations in estuarine surface water, a net release of nutrients occurs (Gardner 1975). Overall, in the long term, very little nutrient is trapped or released from these reservoirs; in the short term, however they act as nutrient filters or modulators (Axelrad et al. 1976, Bender and Correll 1974). The marshes also tend to trap particulate nitrogen and phosphorus, convert them to orthophosphate, ammonia, dissolved organic phosphorus, and nitrogen, which are then exported back to the open waters of the estuary (Axelrad et al. 1976).

Estuaries are measurably diluted by land runoff, which delivers high concentrations of mineral particulates derived from land erosion. The Rhode River estuary receives about 1.2 metric tons per ha of estuary of mineral particulates per year from land runoff (Correll et al. 1976). When a freshwater river flows into an estuary, the current velocity drops, the pH and ionic composition of the water are altered, and all but the fine clay fraction of the mineral particulates are deposited in a rather short distance. This zone is called the sediment trap (Fig. 2). In Rhode River, the sediments are deposited in this zone at an average rate of about 11 tons per ha/year. In general, this process sequentially produces tidal mudflats, low tidal marshes, high tidal marshes, and finally fast land. The sediments that are deposited and the organic matter and nutrients that are carried with them form very rich bottom sediments, since they resulted from topsoil erosion on the watershed.

At the tidal-mudflat stage of sedimentation, these areas can support large populations of submerged vascular plants. These plants are believed to have the capability of acting as nutrient "pumps" between surface water and bottom sediments. Thus, on the one hand, they can take up nutrients from the sediments and lose them to the water via death and decomposition, leaching from leaves, herbivorous activity, or perhaps by direct excretion. On the other hand, their leaves can take up nutrients directly from the water, at least under some conditions, and translocate them to their roots. Dense eelgrass (*Zostera marina*) beds in the Izembek Lagoon of Alaska take up phosphorus from bottom sediments at the rate of 166 mgP/m^2/day and excrete it into the tidal waters as orthophosphate at the rate of 62 mgP/m^2/day (McRoy and Barsdate 1970, McRoy et al. 1972). This eelgrass nutrient pump activity brought about significant diel fluctuations in overlying surface water and sediment interstitial water phosphorus concentrations.

Thus, estuaries maintain high productivity by maintaining high nutrient levels in bottom sediments and water column. This is done by nutrient/plankton trapping via the "salt wedge" countercurrent and the nutrient-modulating actions of tidal marshes, bottom sediments, and submerged vascular plants.

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EXHIBIT 10

AGENDA ITEM SUMMARY

To: City of Coos Bay

From: Lane Council Governments (LCOG) Contact:
Henry Hearley, Assistant Planner, 541-682-3089, hhearley@lcog.org
Jacob Callister, Principal Planner, 541-682-4114, jcallister@lcog.org

RE: Jordan Cove Energy Project – Navigational Reliability Improvements

BACKGROUND/CONTEXT

The applicant, Jordan Cove Energy Project, proposes dredging, or "Navigational Reliability Improvements" (NRIs) within the Coos Bay Deep Draft Navigational Channel. The applicant's intent is to increase the operational window to safely transit any vessel through the Channel. The NRIs, which are described in more detail in the staff report (Page 2), are designed to increase the environmental operating windows for all ships entering Coos Bay by softening critical turns, relocating aids to navigation and reducing the required Channel directional changes. Minimizing delay is a clearly identified need. Various marine terminal businesses within Coos Bay require assurances that terminals can efficiently accommodate larger dimension bulk carriers in the future.

The Coos Bay Estuary Management Plan (CBEMP) addresses compliance with Statewide Planning Goal 16 - Estuarine Resources. Goal 16 requires that all areas within an estuary be classified into management units in the estuary management plan. There are three "aquatic" management units in the CBEMP: Natural Aquatic (NA), Conservation Aquatic (CA) and Development Aquatic (DA). This application proposes an amendment to change an area of the Coos Bay Estuary from Natural Aquatic (NA), which is more restrictive, to Development Aquatic (DA), which is less restrictive.

The staff report (Page 1 & 2) provides more detailed background and context for the application

APPLICANT'S REQUEST

JCEP proposes dredging at four locations in the Channel. The dredging is referred to as Navigation Reliability Improvements (NRIs). Three of the proposed NRIs are within Coos County and one (Dredge Area #4) is within the City of Coos Bay. The applicant is proposing the following applications to that end:

1. **A map amendment to the Coos Bay Estuary Management Plan to change the designation of approximately 3.3 acres from 52-NA to DDNC-DA;**
2. **A text amendment to the City of Coos Bay Comprehensive Plan to take a reasons exception to Statewide Planning Goal 16 Estuarine Resources to authorize the map amendment;**
3. **An estuarine and coastal shoreline uses and activities permit for "New and Maintenance Dredging" in the DDNC-DA Estuarine Zone; and**
4. **An estuarine and coastal shoreline uses and activities permit to allow an accessory temporary dredge transport pipeline in the 52-NA, 53-CA, 54-DA, and 55-CA Estuarine Zones.**

PLANNING COMMISSION PROCEDURE
The nature of the applications are quasi-judicial, for which the Planning Commission typically issues a decision. This application package includes what is called a post-acknowledgment plan (text) amendment, however. State law requires that the local governing body (in this case City Council) take final action to approve any post-acknowledgment (text) plan amendment.

On March 21, 2019, the City of Coos Bay Planning Commission will hold a public hearing on the Jordan Cove Application Package (#187-18-000153). The Commission will hear testimony, will eventually deliberate and will eventually forward a recommendation to the Coos Bay City Council. The City Council will receive, review and evaluate the Planning Commission's recommendation and will hold a second hearing and ultimately issue a decision on the applications.

ANALYSIS & STAFF REPORT
The City of Coos Bay contracted with the Lane Council of Governments (LCOG) to conduct a neutral analysis and prepare and accompanying staff report for the Jordan Cove NRI application. Decisions and conclusions on the application lie with the City's decision making bodies. LCOG's analysis is intended to provide guidance in making findings and conclusions for the applications.

KEY CRITERIA
This summary outlines a number of what LCOG and City of Coos Bay staff identified as "key criteria." Key criteria are those that staff feel the Planning Commission will benefit from additional context for. The attached staff report addresses all approval criteria (criteria outlined on Page 4).

KEY CRITERIA -- IMPACTS AND MITIGATION
Numerous criteria relevant to the applications require evidence of compatibility, of the public's best interest or of adequate mitigation of impacts. Following is a list of several key areas where this criterion is called out and some context for the responses and potential findings:

Criteria	Report Page Ref.	Summary
CBMC 17.360.060 (A)(2), OAR 660-004-0020(2)(c)&(d), OAR 660-004-0022(8)(f), CBEMP Policy #4a	Page 8 Page 16 Page 19 Page 29	The applicant submitted a memo prepared by their contractor, David Evans and Associates, which describes, in detail, the dredging proposed. It also includes discussion of impacted wildlife, and proposed mitigation measures. Staff highly recommends that Planning Commissioners review this important memo in its entirety prior to the March 21st hearing. It is found at **Attachment A, Exhibit 5.** The memo addresses, among other things, water quality, physical characteristics, noise, deep subtidal areas, living resources (including threatened and endangered species), recreation and aesthetics.

KEY CRITERIA -- GOAL 16 EXCEPTION
Statewide Planning Goal 16 Estuarine Resources, requires that the City of Coos Bay *"recognize and protect the unique environmental, economic, and social values of each estuary and associated wetlands; and to protect, maintain, where appropriate develop, and where appropriate restore the long-term environmental, economic, and social values, diversity and benefits of Oregon's estuaries."*

As noted, to obtain a balance of uses, the CBEMP divides all estuaries into three aquatic management units: Natural, Conservation, and Development. The proposed NRI site is currently in the 52-NA natural aquatic unit. In this natural aquatic zone, dredging is not a permitted use. The applicant seeks to amend the CBEMP to apply the DDNC-DA (a development aquatic unit) designation to the proposed NRI site in order to allow the dredging necessary to complete the NRIs. A Goal 16 exception is required to rezone the NRI site to a DDNC-DA development site.

State statute and rules outline a process for justifying exceptions to Goals, including Goal 16:

Criteria	Report Page Ref.	Summary
OAR 660-004-0020(1)	Page 14	If there are adequate reasons, then an exception can be granted
OAR 660-004-0020(2)	Page 14 Page 14 Page16 Page 16	Four standards apply: ***a. Reasons justify why the state policy embodied in the applicable goals should not apply.*** (See OAR 660-004-0022) ***b. Areas that do not require a new exception cannot reasonably accommodate the use.*** ***c. The long-term environmental, economic, social and energy consequences resulting from the use at the proposed site with measures designed to reduce adverse impacts are not significantly more adverse than would typically result from the same proposal being located in areas requiring a goal exception other than the proposed site.*** **d.** ***The proposed uses are compatible with other adjacent uses or will be so rendered through measures designed to reduce adverse impacts.***
OAR 660-004-0022	Page 17	Outlines types of reasons that may or may not be used to justify certain types of uses not allowed on resource lands. Must meet one of the criteria (1-8). Applicant has proposed consistency with two avenues (criteria)).
OAR 660-004-0022(1)	Page 18	The applicant must demonstrate a need for the proposed use/activity based on "special features or qualities" and based on requirements of one or more State Planning Goals 3 to 19.
OAR 660-004-0022(8)	Page 19	A Goa 16 specific exception to the requirement limiting dredging in an area that is currently designated, in accordance with Goal 16, as a natural management unit. The applicant has indicated the exception is justified because approval of the application will authorize dredging to maintain adequate depth to safely and more reliably permit continuation of the present level of navigation.
CBEMP -- Policies #5, #4, #4a	Pages 24 - 30	The applicant notes, and staff agree, that LUBA has held, and the Court of Appeals has affirmed, that when a goal exception is taken to facilitate proposed development, any comprehensive plan policies that implement the goal for which the exception is taken no longer govern that development. The Applicant requests an exception to Goal 16 to facilitate dredging in a natural management unit. Policy #4, #4a and portions of Policy #5 implement Goal 16 and are, therefore, not applicable. Despite this assertion, the applicant has addressed the necessary criteria at Policies #4, #4a and #5.

CONDITIONS OF APPROVAL
Key criteria are often addressed with Conditions of Approval. The following conditions are currently proposed by staff for the applications:

<u>Condition of Approval #1</u>: Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall provide the City of Coos Bay with a spill prevention and response plan addressing the potential any unanticipated oil spill or toxic discharge for review and approval.

<u>Condition of Approval #2</u>: Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall provide evidence to the Coos Bay Community Development Director, of compliance with the requirements of the enclosed MOA, CRPA, and UDP as agreed upon and signed by JCEP and the Confederated Tribes of Coos, Lower, Umpqua, and Siuslaw Indians.

<u>Condition of Approval #3</u>: Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall obtain, and provide evidence to the Coos Bay Community Development Director, of all necessary DSL and Federal Section 404 authorizations. JCEP shall provide the City with copies of these approved authorizations for the record.

<u>Condition of Approval #4</u>: City of Coos Bay Public Works has identified an existing utility that is installed under the Bay in the vicinity of the proposed navigational reliability improvements. Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall provide evidence to the Coos Bay Community Development Director, that the proposed dredging activity shall not impact this existing utility.

<u>Condition of Approval #5</u>: As a general condition, and in the event that additional analysis or circumstance reveals relevant and previously unknown or unmapped shoreland resources, all dredging activity must remain consistent with CBEMP Policy #17 - Protection of "Major Marshes" and "Significant Wildlife Habitat" in Coastal Shorelands.

STAFF CONCLUSION
Staff recommends that the Planning Commission carefully review the application itself (attached to the staff report), the application criteria, and the responses contained within the staff report. Based on the evidence in the record, it is staff's initial conclusion that the applicable criteria can be met with the conditions of approval proposed.

ACTION BY THE PLANNING COMMISSION
After the hearing and the record are closed, the Planning Commission will deliberate on the applications. The Planning Commission will not render a decision on this matter. They will provide a recommendation to the City Council. Although Commission deliberations can be general to the applications, there should be separate motions and votes on recommendations for each of the four requested applications.

CITY OF COOS BAY
Community Development Department

500 Central Avenue
Coos Bay, OR 97420

541.269.8918
www.coosbay.org

STAFF REPORT

Type III – Land Use Process
Jordan Cove Energy Project – Navigational Reliability Improvements

STAFF: Henry Hearley, Assistant Planner, Lane Council of Governments (LCOG)
Jacob Callister, Principal Planner, LCOG
Carolyn Johnson, Community Development Administrator, City of Coos Bay

REVIEW BODY: Planning Commission

HEARING DATE/TIME: Thursday, March 21, 2019 at 6:00 p.m.

LOCATION: Coos Bay City Council Chambers, 500 Central Avenue, Coos Bay, Oregon

APPLICANT/OWNER: Jordan Cove Energy Project L.P. (JCEP)
Attention: Meagan Masten, 111 SW 5th Avenue, Suite 100, Portland, OR, 97204

APPLICANT'S REPRESENTATIVE: Perkins Coie LLP, 1120 NW Couch Street, Tenth Floor, Portland, OR 97209
Attention: Seth King

SUBJECT PROPERTY: T 25S R 13W Sections 8, 17, 19, 30; T 25R 14W Sections 25, 35, 36.

SUBJECT: LAND USE APPLICATION #187-18-000153 – Jordan Cove Energy Project Navigation and Efficiency and Reliability of the Coos bay Deep Draft Navigation Channel

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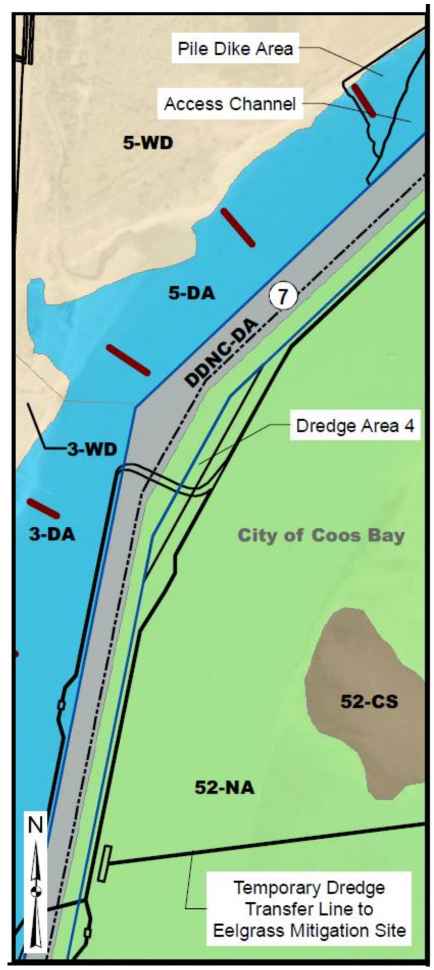
I. BACKGROUND/CONTEXT

The Coos Bay Deep Draft Navigation Channel (Channel) serves a vital purpose in providing the only safe vessel access to and from Coos Bay and the Pacific Ocean for marine terminals located along the Bayfront. The Channel was initially authorized in 1899 and since then has undergone ten modifications. Most recently, the Channel was expanded from -35 feet to -37 feet in 1997 to allow for the safe navigation and transit of Coos Bay for the size of ships prevalent during that time period. Over the last 20 years the dimensions and tonnage of ships serving terminals in Coos Bay has increased. The size of vessels typically calling on Coos Bay terminals has increased from an average of 45,422 Metric Tonnes to an average of 52,894 Metric Tonnes with a projected near-term vessel size of 70,400 Metric Tonnes. Currently, environmental conditions, including wind, fog, and currents, coupled with the increasing ship size explained above, have caused the

Coos Bay Pilots Association ("Pilots") to impose more limiting restrictions on when vessels may safely transit the Channel. These restrictions, in turn, cause significant delays and increased pressure on the Pilots to navigate ships through the Channel. Delays are measured in the total transit time, from the time the vessel arrives off the coast of Coos Bay until it returns offshore after calling at its local Coos Bay destination. These delays generally decrease the efficiency and competitiveness of maritime commerce on a global scale, thereby jeopardizing continued success for maritime commerce in Coos Bay. Minimizing delay is a pressing need because companies that utilize the port of Coos Bay have identified potential new customers in Asia that desire to export cargo using bulk carriers that are slightly larger than the ships typically calling today. Various marine terminal businesses within Coos Bay require assurances that terminals can efficiently accommodate larger dimension bulk carriers in the future.



The Coos Bay Estuary Management Plan (CBEMP)
To comply with Statewide Planning Goal 16 Estuarine Resources, Coos County, City of Coos Bay and City of North Bend developed the CBEMP. It was adopted and acknowledged in 1984. Goal 16 requires that all areas within an estuary be classified into management units in the estuary management plan. There are three "aquatic" management units in the CBEMP: Natural Aquatic (NA), Conservation Aquatic (CA) and Development Aquatic (DA). This application proposes an amendment to change an area of the Coos Bay Estuary from Natural Aquatic (NA) to Development Aquatic (DA).

According to the CBEMP, Natural Aquatic areas are managed for resource protection preservation and restoration. They place severe restrictions on the intensity and types of uses and activities allowed within them. Natural Aquatic areas include tidal marshes, mud-sand flats, seagrass and algae beds that, because of a combination of factors such as size, biological productivity and habitat value, play a major role in the functioning of the estuarine ecosystem. Natural Aquatic areas also include ecologically important subtidal areas.

Development Aquatic areas are managed for navigation and other water-dependent uses, consistent with the need to minimize damage to the estuarine system. Some water-related and other uses may be allowed, as specified in each respective unit. Development Aquatic areas include areas suitable for deep or shallow-draft navigation (including shipping and access channels or turning basins), sites and mining or mineral extraction areas, and areas adjacent to developed or developable shorelines which may need to be altered to provide navigational access or create new land areas for water-dependent uses.

Dredging
Dredging, or "Navigational Reliability Improvements" (NRIs), could increase the operational window to safely transit any vessel through the Channel. The NRIs, which are described in more

detail below, are designed to increase the environmental operating windows for all ships entering Coos Bay by softening critical turns, relocating aids to navigation and reducing the required Channel directional changes. The NRIs are designed to reduce entry and departure delays and allow for more efficient vessel transits through the Channel for the size of vessels entering the Port today.

All work associated with the NRIs will take place during the approved in-water work period for Coos Bay (October 1 to February 15). The applicant notes that JCEP will place initial and future dredged material derived from the NRI Sites at the APCO 1 and 2 sites near the southern terminus of the U.S. Highway 101 McCullough Bridge. These sites are located in the City of North Bend; JCEP will file a separate application with that City to authorize disposal of these dredge spoils in these locations. If dredging by hydraulic methods, JCEP will utilize a 24- to 36-inch temporary dredge pipeline to transport the dredged material to the disposal sites on the bottom or horizontal extent of the Channel to reduce potential conflicts with vessel navigation. The maximum distance from the NRIs to the APCO sites is approximately 8.3-miles. The dredge line is illustrated in Attachment A, Exhibit 6. Booster pumps would be required to move the material to the disposal sites through the pipeline.

The NRIs will facilitate economic opportunities, including access to emerging opportunities to export products with today's larger vessels, including bulk carriers. Although log export vessels serving the upper bay are smaller, the proposed enhancements also benefit these vessels by broadening the tidal and environmental windows for transiting the Channel, providing an enhanced margin of safety and improved efficiency in the loaded vessel departure schedule. Both Roseburg Forest Products and the Pilots have submitted letters of support for the NRIs. See Attachment A, Exhibit 3. For JCEP and its LNG terminal, the NRIs will allow for transit of LNG vessels of similar overall dimensions to those listed in the July 1, 2008 United States Coast Guard ("USCG") Waterway Suitability Report, the USCG Letter of Recommendation dated May 10, 2018 and USCG letter confirmation dated November 7, 2018 see Attachment A, Exhibit 4, but under a broader range of weather conditions, specifically higher wind speeds. As a result, JCEP estimates that, upon completion of the NRIs, JCEP will be able to export the full capacity of the optimized design production of the LNG Terminal on a consistent annual basis.

II. APPLICANT'S REQUEST

JCEP proposes dredging at four locations in the Channel. Three of the proposed NRIs are within Coos County and one (Dredge Area #4) is within the City of Coos Bay. The applicant is proposing the following application to that end:

(1) A map amendment to the Coos Bay Estuary Management Plan to change the designation of approximately 3.3 acres from 52-NA to DDNC-DA;
(2) A text amendment to the City of Coos Bay Comprehensive Plan to take a reasons exception to Statewide Planning Goal 16 Estuarine Resources to authorize the map amendment;
(3) An estuarine and coastal shoreline uses and activities permit for "New and Maintenance Dredging" in the DDNC-DA Estuarine Zone; and
(4) An estuarine and coastal shoreline uses and activities permit to allow an accessory temporary dredge transport pipeline in the 52-NA, 53-CA, 54-DA, and 55-CA Estuarine Zones.

III. APPLICABLE CRITERIA

Coos Bay Development Code (CBMC) *(Page 5, Page 21)*
17.360.010-Comprehensive Plan Amendment
17.360.020-Initiation of Amendment
17.360.060-Appeal Criteria
17.352.010-Estuarine/Coastal Shore Activities

Coos Bay Comprehensive Plan (CBCP) *(Page 6)*
Section 7.1 Natural Resources and Hazards Strategies NRH.8 and NRH.9
Section 8.3 Land Use and Community Development Planning Strategies LU.4, LU.5 and LU.7
Section 7.5 Economic Development

Coos Bay Estuary Management Plan (CBEMP) Policies ***(****Page 13, Page 21)*
DDNC-DA Zone – General Conditions for Approval of "New and Maintenance Dredging"
DDNC-DA Zone – Special Conditions for Approval of "New and Maintenance Dredging"
CBEMP Policy #17 – Protection of "Major Marshes" and "Significant Wildlife Habitat" in Coastal Shorelines
CBEMP Policy #18 – Protection of Historical and Archaeological Sites within Coastal Shorelands
CBEMP Policy #5 – Estuarine Fill and Removal

Statewide Planning Goals *(Page 8)*
Goal 1: Citizen Involvement
Goal 2: Land Use Planning
Goal 6: Air, Water and Land Resources Quality
Goal 9: Economic Development
Goal 12: Transportation
Goal 13: Energy Conservation
Goal 16: Estuarine Resources

Reasons Exceptions (Oregon Revised Statute and Oregon Administrative Rules) *(Page 14)*
ORS 197.732 – Goal Exceptions
OAR 660-004-0020- Criteria for Goal 16 exceptions
OAR 660-004-0022- Criteria for Goal 2 exceptions

IV. NOTICES AND REFERRALS

Notice:
On March 1, 2019 notice was mailed to surrounding property owners along the shoreline adjacent to the proposed NRIs site. The CBMC doesn't outline specific noticing requirements for a subject property located in a body of water. City staff mirrored the notice approach used by Coos County for the three associated NRI dredge sites being concurrently evaluated. The County mailed notice to bayfront properties adjacent to the proposed NRIs. The City mailed notice to bayfront properties within the City Limits.
Notice was also sent to concerned parties that contacted city staff indicating they would like to receive notice. Notice was also published in "*The World*", on February 28, 2019.

Staff provided required notice to DLCD for a post acknowledgement plan amendment on February 12, 2019. Staff have also been in touch with DLCD's Goal 16 specialist, Matt Spangler.

Referrals:
On March 1, 2019, referral notice was sent to the following governmental/utility/tribal agencies for a request for comment on the application: Department of Land Conservation and Development (DLCD), Department of State Lands (DSL), Coos Bay North Bend Water Board, NW Natural, Pacific Corp, Coos County, City of Coos Bay, Oregon International Port of Coos Bay, and Confederated Tribes of Coos, Lower, Umpqua and Siuslaw Indians and Coquille Tribe.

City of Coos Bay Public Works issued a comment indicating that the proposed dredging appears to be at or near Station 280+00 (Figure 1 of 9). The City has an existing utility line at or near this station installed under the Bay. Staff recommends the proposed dredging shall not impact this existing utility line; this requirement is noted as a condition of approval in Section VIII of this staff report.

City of Coos Bay Public Works also requested that it be the responsibility of the applicant to ensure that all applicable resource agency permits and approvals are obtained prior to commencement of any work. Staff recommends the condition to obtain appropriate permits prior to any proposed dredging activities (Page 25). This and all conditions of approval can be found in Section VIII of this staff report.

V. CRITERIA FOR COMPREHENSIVE PLAN MAP AMENDMENT

17.360.010 Comprehensive Plan Amendment

A. The boundaries of the Comprehensive Plan map designations and the Comprehensive Plan text may be amended as provided in CBMC 17.360.020 of this title.

Staff Response: The subject property lies within the Coos Bay Estuary, and falls under the ownership of the DSL, the applicant has requested and received permission to file this land use application with the City of Coos Bay. The DSL letter is included in the application (Attachment A) as Exhibit 8, Page 1 of 4. The application includes a request for an exception to Goal 16, requiring a comprehensive plan text amendment.

B. The City may amend its Comprehensive Plan and/or plan map. The approval body shall consider the cumulative effects of the proposed Comprehensive Plan and/or map amendments on other zoning districts and uses within the general area. Cumulative effects include sufficiency of capital facilities services, transportation, zone and location compatibility, and other issues related to public health and safety and welfare the decision making body determines to be relevant to the proposed amendment.

Staff Response: The applicant notes that the cumulative effects of such an amendment would include facilitating an increase in safety and efficiency of navigation in the Channel. Another cumulative effect of the applicant's proposal is to augment transportation in the bay. The application is not expected to have cumulative effects on the sufficiency of capital facilities services, or health and welfare. Staff notes that it is unclear to what extent the approval body must "consider" cumulative effects. Staff also notes that, due to the requirement only to "consider" cumulative effects, the application could not be denied based solely on a potential finding that the amendment has associated cumulative effects.

17.360.020 Initiation of Amendment

Amendments of the Comprehensive Plan text or map, zoning map, or this title may be initiated by the following:

A. A Type III application, CBMC 17.130.100, Procedures, by one or more owners of the property proposed to be changed or reclassified consistent with the adopted Comprehensive Plan; or

B. A Type IV legislative process, CBMC 17.130.110, Procedures, by motion of the Planning Commission and adoption by the City Council.

Staff Response: The underlying landowner of the subject property is DSL, which has given the applicant permission to file this application as seen in Attachment A, Exhibit 8, Page 1 of 4. The application is quasi-judicial in nature because it involves a single landowner, a limited geographic area, is not City-initiated, and concerns the application of existing policies to a specific set of facts. Because state law requires local governing bodies to take final action to approve any post-acknowledgment (text) plan amendment (*Housing Land Advocates v. City of Happy Valley, Or LUBA (LUBA No. 2016-031, May 23, 2016*), and the final decision on the application must be rendered by the Coos Bay City Council (after a hearing before the Planning Commission). Following the Planning Commission public hearing, City Council will hold a public hearing on the application.

17.360.060 Approval Criteria

A. For a Type III or Type IV review, the City Council shall approve the proposal upon findings that:

1. The proposed amendment is consistent with the applicable policies of the Comprehensive Plan or that a significant change in circumstances requires an amendment to the plan or map,

Staff Response: The application to change the CBCP designation of the NRI Site from 52-NA to DDNC-DA is consistent with the applicable policies of the Coos Bay Comprehensive Plan. Consistency with specific applicable policies is outlined below:

Section 7.1, Natural Resources and Hazards, Strategy NRH.8
Coos Bay shall encourage the preservation and protection of riparian vegetation as an important fish and wildlife habitat and as a viable means of flood control by enactment of appropriate property development ordinances providing protection by establishing buffer strips along waterways, along designated HUD floodways, with the exception of navigable waterways. This strategy recognizes that such land use practices are necessary (1) to preserve the area's natural resources, and (2) to eliminate unnecessary drainage and erosion problems often accompanying development.

Staff Response: The proposal does not include any impacts to City of Coos Bay shoreline habitat or riparian areas. The applicant anticipates possible temporary, but not permanent, impacts to shoreline habitat, including to riparian vegetation in the areas where the applicant plans to offload dredged material for processing, but they are not located within the Coos Bay city limits. The applicant notes that they will comply with any regulations the

City has implemented in accordance with its obligation to "encourage" preservation of riparian vegetation.

Section 7.5 Economic Development

Goal 1, Policy 1.5 – Support and cooperate with community and regional partners to encourage economic growth.

Staff Response: Approval of the proposed NRIs will primarily benefit large vessels that are navigating to and from the International Port of Coos Bay (Port). The Port itself is located outside of city limits, but is an important regional entity that facilitates mass export and import of goods and commodities overseas and thus serves as a key driver of economic development for Coos Bay and regions beyond. The proposed NRIs support community and regional partners and economic growth as the goal describes.

Goal 6, Policy 6.1, 6.2 – Maximize the potential uses and benefits the waterfront and deep-water port offers to the city and region as a whole; Support the Port of Coos Bay In its development efforts for transportation linkage and to develop a deep-draft channel to accommodate large cargo vessels and increase shipping activities and water-dependent uses.

Staff Response: Staff concur with the applicant's assertion that the purpose of this application is to facilitate increased navigational safety and efficiency for large vessels in the Channel. Increased safety and efficiency maximize the Channel's economic benefits for the City and region as a whole by allowing increased economic input and output.

Section 8.3 Land Use and Community Planning Strategy LU.4
Coos Bay shall not make major revisions to this Comprehensive Plan more frequently than every two years, if at all possible. "Major revisions" are those that have widespread and immediate impact beyond the subject area under consideration. The city recognizes that wholesale approval of frequent major revisions could ruin the integrity of the Plan.

Staff Response: Staff concurs with the applicant's assertion that the proposal does not constitute a "major revision" to the CBCP. The proposed text amendment directly addresses only the NRI site. The proposal will not, from a land development/conservation aspect have a widespread and immediate impact beyond the dredge site.

Section 8.3 Land Use and Community Planning Strategy LU.5
Coos Bay may make minor changes to this Comprehensive Plan on an infrequent basis as need and justification arises. "Minor changes" are those which do not have significant impact beyond the immediate area of the property under consideration. The city recognizes that wholesale approval of frequent minor changes could ruin the integrity of this Plan.

Staff Response: The proposed changes relate exclusively to an isolated and undeveloped area and can be considered "minor changes." The staff report presents the argument that the need for the amendments has been justified.

Section 8.3 Land Use and Community Planning Strategy LU.7
Coos Bay shall anticipate that conflicts may arise between the various plan implementation strategies contained in the Plan when applying the policies to specific situations. To resolve these conflicts, if and when such may occur, Coos Bay shall consider the long term environmental, economic, social, and energy consequences expected to result from applying one strategy in place of others, then to select and apply the strategy that results in maximum public benefit as supported by findings of fact. This strategy is based on the recognition that a viable conflict resolution process is essential to the success of any comprehensive plan.

Staff Response: The application will not cause conflicts between CBCP implementation strategies. The application is consistent with all policies of the CBCP.

2. The proposed amendment is in the public interest; and

Staff Response: The proposed amendment to the CBCP serves the public interest by creating safer and more efficient navigation in the Channel, thereby promoting economic activity in the City of Coos Bay consistent with Comprehensive Plan Goal 1 Policy 1.5 and Goal 6, Policies 6.1 and 6.2. Promoting navigational safety and efficiency has support beyond the applicant, as indicated through letters of support submitted with the application materials (Attachment A, Exhibit 3). The applicant has provided a response addressing environmental concerns potentially associated with the public interests (Attachment A, Exhibit 5)). Staff agrees with the applicant's assertion that the long term economic, environmental, social and energy consequences of dredging elsewhere do not present materially different outcomes.

3. Approval of the amendment will not result in a decrease in the level-of-service for capital facilities and services identified in the Coos Bay Capital Improvement Plan(s).

Staff Response: Staff agree with the applicant's assertion that the application will not result in a decrease in the level-of-service for any identified capital facilities and/or services identified in the Coos Bay capital improvement plan.

Statewide Planning Goals

Statewide Planning Goals noted below are pertinent to the subject application.

Goal 1: Citizen Involvement – to develop a citizen involvement program that insures the opportunity for citizens to be involved in all phases of the planning process.

Staff Response: The City of Coos Bay has adopted, within its Development Code, a program for post-acknowledgment plan amendments. The CBMC has been acknowledged by LCDC. This staff report has touched on the required notice that has been issued. That program also includes the hearings that will take place to address the application.

As noted earlier state law requires the local governing body to take final action to approve any post-acknowledgment comprehensive plan amendment before it can become final. The City will schedule the application for final action by the City Council after the Planning Commission's initial recommendation. The City plans to apply its Type III process in CBMC 17.30.100 to review and decide upon the Application, subject to also providing for a hearing and final decision on the Application by the City Council. Upon doing so, the City will have complied with Goal 1. These procedures provide opportunity for citizen involvement in all phases of the application.

Goal 2: Land Use Planning – to establish a land use planning process and policy framework as basis for all decisions and actions related to use of land and to assure an adequate factual base for such decisions and actions.

Staff Response: Goal 2 requires establishing a land use planning process and policy framework as a basis for all land use decisions and requires an adequate factual base for all land use decisions. In the present case, the provisions of the CBMC and the ORS establish the land use planning process and policy framework for considering the application. Further, the applicant has submitted materials, including narrative and supporting documentation, in the application asserting consistency with applicable approval criteria.

Goal 2 requires that the City coordinate its review and decision on the application with appropriate government agencies. In its review of the application, the City has provided referral notice to affected government agencies with an opportunity to comment on the proposal.

Goal 3: Agricultural Lands – to maintain and preserve agricultural lands.

Staff Response: The NRI site does not include any agricultural lands. Goal 3 is not applicable to this application.

Goal 4: Forest Lands

Staff Response: The NRI site does not include any forest lands. Goal 4 is not applicable to this application.

Goal 5: Natural Resources, Scenic and Historic Areas, and Open Spaces

Staff Response: Based on the information available to staff, the NRIs do not include any inventoried Goal 5 resources.

Goal 6: Air, Water and Land Resources Quality – To maintain and improve the quality of the air, water and land resources of the state.

Staff Response: There are no administrative rules governing Goal 6; it relies entirely on state and federal regulations for direction and implementation. Staff believe it is reasonable to find that the applicant will comply with federal and state environmental standards in the future if and when federal and state permits for dredging are secured. The applicant's narrative indicate that JCEP has applied for state and federal approval of dredging activities at the NRI site. Staff agree with the applicant that there is no indication that JCEP is precluded as a matter of law from obtaining approval of these applications.

The applicant also notes that the proposed map amendments do not alter existing City protections provided by the CBEMP restricting dredging activities, which protections have been previously deemed consistent with Goal 6.

Additionally, the applicant has submitted a biological assessment completed by the consultant David Evans and Associates (DEA). In its report (Attachment A, Exhibit 5), DEA indicates Best Management Practices (BMPs) will be employed. The applicant identifies BMPs that will be utilized with the proposed dredging as a way to minimize impacts, a discussion of the BMPs can be found in Attachment A, Exhibit 5 (Page 7).

Goal 7: Areas Subject to Natural Hazards. – To protect people and property from natural hazards.

Staff Response: Goal 7 requires local governments to identify and plan for natural hazard areas and coordinate their natural hazard plans and programs with state agencies. The proposed uses and activities will not increase the likelihood of damage to people or property. The level of risk for equipment and lives, with respect to natural hazards is perhaps lower, but certainly no greater than the current activities associated with the Port and the Bay.

Goal 8: Recreational Needs – To satisfy the recreational needs of the citizens of the state and visitors, and where appropriate, to provide for the siting of necessary recreational facilities including destination resorts.

Staff Response: The proposed NRI site does not involve recreation or inventoried recreational areas, facilities or opportunities. Staff note that Coos Bay supports recreational activities. The applicant provided a summary of the recreational activities that take place in the Coos Bay Estuary, and indicated that all three boat ramps that provide access to the estuary will remain open during the proposed dredging activities, as well as an announcement to the boating community via a local notice to mariners provided through notification to the United States Coast Guard. The report in its entirety can be found in this staff report as Attachment A, Exhibit 5 (Page 10). The application is consistent with Goal 8.

Goal 9: Economic Development – To provide adequate opportunities throughout the state for a variety of economic activities vital to the health, welfare and prosperity of Oregon's citizens.

Staff Response: The applicant is proposing NRIs to one site within the City's jurisdiction that in turn will facilitate a broader operational window, and increase safety and efficient of transit, in the Channel. The navigational reliability improvements have the ability to offer economic prospects to the City and region as a whole. The application is consistent with this goal.

Goal 10: Housing – To provide for the housing needs of the citizens of the state.

Staff Response: Goal 10 is not applicable to this application.

Goal 11: Public Facilities and Services –

Staff Response: The applicant's proposal does not involve or affect public facilities and service as framework for development. Goal 11 is not applicable to this application.

Goal 12: Transportation – To provide and encourage a safe, convenient and economic transportation system.

Staff Response: The applicant's proposal is consistent with Goal 12 because it advances the Goal 12 objective of facilitating the flow of goods and services in an effort to strengthen the local and regional economy. In the case of the applicant, the NRIs help the flow of goods and services by reducing transit time of goods to the market, the decrease of time vessels wait off-shore for Port conditions to improve, the reduction of fuel, and overall safety and efficiency. The application is consistent with this goal.

Goal 13: Energy Conservation – To conserve energy.

Staff Response: The applicant's proposal is consistent with Goal 13 because the proposed NRIs increase the safety and efficiency of vessel transit through the Channel, and thus increase the operational window. The increase of the operational window reduces the time vessels spend waiting to enter the Channel which increases the efficiency of material transportation and reduction of energy waste from inefficiency of transportation. The application is consistent with this goal.

Goal 14: Urbanization – To provide for an orderly and efficient transition from rural to urban land use.

Staff Response: Goal 14 is not applicable to this application.

Goal 15: Willamette River Greenway

Staff Response: Goal 15 is not applicable to this application.

Goal 16: Estuarine Resources - To recognize and protect the unique environmental, economic, and social values of each estuary and associated wetlands; and to protect, maintain, where appropriate develop, and where appropriate restore the long-term environmental, economic, and social values, diversity and benefits of Oregon's estuaries.

Staff Response: The Coos Bay Estuary Management Plan (CBEMP) is a refinement plan to the Coos Bay Comprehensive Plan and implements Goal 16 for the City of Coos Bay. The CBEMP divides all estuaries into three aquatic management units: Natural, Conservation, and Development. The proposed NRI site is currently zoned 52-NA, which is a natural aquatic unit. In the 52-NA natural aquatic zone, dredging is not a permitted use. The applicant seeks to amend the CBEMP to apply the DDNC-DA (a development aquatic unit) designation to the proposed NRI site in order to allow the dredging necessary to complete the NRIs. A Goal 16 exception is required to rezone the NRI site to a DDNC-DA development site. The requested goal exception is specifically addressed on Page 14 of this report.

Goal 17: Coastal Shorelands - To conserve, protect, where appropriate, develop and where appropriate restore the resources and benefits of all coastal shorelands, recognizing their value for protection and maintenance of water quality, fish and wildlife habitat, water-dependent uses, economic resources and recreation and aesthetics. The management of these shoreland areas shall be compatible with the characteristics of the adjacent coastal waters; and to reduce the hazard to human life and property, and the adverse effects upon

water quality and fish and wildlife habitat, resulting from the use and enjoyment of Oregon's coastal shorelands.

Staff Response: The proposed NRI site does not include any designated coastal shorelands. The proposed dredge transport pipeline will not impact shorelands within the City of Coos Bay. Goal 17 is not applicable to this application.

Goal 18: Beaches and Dunes –

Staff Response: The proposed NRI site does not include any designated beaches or dunes. Goal 18 is not applicable to this application.

Goal 19: Ocean Resources -

Staff Response: The proposed NRI site does not include or abut any ocean resources.

Specific Proposed Amendments to the CBEMP

The following are the exact text amendments the applicant is proposing to the CBEMP.

***

CITY OF COOS BAY TEXT AMENDMENTS ASSOCIATED WITH JORDAN COVE ENERGY PROJECT L.P. APPLICATIONS FOR NAVIGATION RELIABILITY IMPROVEMENTS

(1) AMENDMENT TO COOS BAY ESTUARY MANAGEMENT PLAN

"**5. DESIGNATION OF SITE-SPECIFIC MANAGEMENT SEGMENTS, USES AND ACTIVITIES**

"AUTHORIZED NAVIGATION CHANNELS

"LOWER BAY/UPPER BAY AQUATIC UNIT

"DEEP-DRAFT NAVIGATION CHANNEL (35' authorized draft)
MANAGEMENT CLASSIFICATION – DA

"PROJECT DESCRIPTION:
"The entrance and lower bay section includes a federally-authorized project extending from the Entrance Bar at the outer (western) extremity of the jetties to the railroad bridge at Bay Mile 9.0 north of Pony Slough. The project specifies a 45-foot deep channel with 'suitable' width across the Entrance Bar, a 35-foot deep by 300-foot wide channel to the railroad bridge, an Anchorage Basin at Bay Mile 3.5 (southwest of Sitka Dock), a Buoy Storage Area between Sitka Dock and Pigeon Point (not part of federal project), a Turning Basin north of Empire at Bay mile 6.0, a widened turn area from Lower Jarvis Range to Jarvis Turn Range channels southwest of Bay mile 7.0 to a 41-foot deep MLLW elevation (including 37-foot deep channel, two-foot over-dredge allowance, and two-foot advanced maintenance allowance) (see EXCEPTION #), and the Anchorage Basin southwest of Roseburg Lumber Co. at Bay mile 7.5. In-bay disposal sites are located off of Coos Head ('G') and North Bend Airport ('D'). Two other in-bay disposal sites at Bay Miles 4 and 5 are included in this segment.

"The upper bay section includes a federally-authorized project from the railroad bridge (Mile 9.0) to Isthmus Slough at Bunker Hill (Mile 15.0). The federal project involves a navigation channel 35 feet deep by 300 to 400 feet wide, and Turning Basins at North Bend (Mile 12.0) and Coalbank Slough (Mile 14.5).

***

As a result of the applicant's request a small amendment will be required in the Coos Bay Comprehensive Plan that references the approved site-specific exception:

(2) AMENDMENT TO COOS BAY COMPREHENSIVE PLAN 2000, VOLUME III, PART 3, TO ADD EXCEPTION #__ - AQUATIC UNIT 52-NA/DEVELOPMENT UNIT DDNC-DA - NAVIGATION RELIABILITY IMPROVEMENTS

Chapter 3.2, Site-Specific Exceptions, is hereby amended by adding Exception #__ as follows:

[INSERT FINDINGS UPON ADOPTION]

VI. CRITERIA FOR GOAL 16 REASONS EXCEPTION

OAR 660-004-0020

(1) If a jurisdiction determines there are reasons consistent with OAR 660- 004-0022 to use resource lands for uses not allowed by the applicable Goal or to allow public facilities or services not allowed by the applicable Goal, the justification shall be set forth in the comprehensive plan as an exception. As provided in OAR 660-004-0000(1), rules in other divisions may also apply.

Staff Response: In their application the applicant requests an exception to Goal 16 for the proposed NRI dredge site# 4. The applicant must meet four standards of Goal 2 (Part II(c), outlined below (2) (a) –(d). A discussion of the reasons justifying a Goal 16 exception for the proposed dredging activity (consistent with OAR 660-004-0022) follows, on Page 17. The applicant has advanced a finding that calls out the "extremely restrictive, unavoidable turn" associated with proposed NRI site as the "*special features or qualities that necessitate its location on or near the proposed exception site.*" The applicant has submitted testimony in the form of "letters of support" that are in favor of the proposed use for the issues indicated in this staff report.

(2) The four standards in Goal 2 Part II(c) required to be addressed when taking an exception to a goal are described in subsections (a) through (d) of this section, including general requirements applicable to each of the factors:

(a) "Reasons justify why the state policy embodied in the applicable goals should not apply." The exception shall set forth the facts and assumptions used as the basis for determining that a state policy embodied in a goal should not apply to specific properties or situations, including the amount of land for the use being planned and why the use requires a location on resource land;

Staff Response: The applicant has identified the "reasons" that "*justify why the state policy embodied in the applicable goals should not apply.*"

The applicant asserts that the proposed 3.3 acre NRI site located in the Channel is in need of improvement in order to facilitate safer and more efficient navigation. The applicant indicates that the proposed use must be located where mapped because this is where the navigational reliability improvements are most needed.

Staff discussion of exception reasons is included in detail on Page 17of this report, in the response to OAR 660-004-0022.

(b) "Areas that do not require a new exception cannot reasonably accommodate the use." The exception must meet the following requirements:

Staff Response: Applicant identifies the proposed NRI site as location-specific. The proposed location of the NRI site is the only site JCEP can make the proposed necessary improvements to increase safety and efficient of vessel navigation in the Channel. The applicant asserts that the identified site is at a location in the Channel where there is an extremely restrictive, unavoidable turn in the Channel. This turn is responsible for significant delays in vessel transit in the Channel. The applicant states in their narrative, that JCEP could widen other areas of the Channel to improve navigational efficiency, but the proposed navigational reliability improvement site, is the location most in need of improvement to achieve the results in improved efficiency and safety of navigation required within the Channel. There are no other areas that could accommodate the proposed use/activity.

(A) The exception shall indicate on a map or otherwise describe the location of possible alternative areas considered for the use that do not require a new exception. The area for which the exception is taken shall be identified;

Staff Response: As explained above, the proposed NRI area is location-specific and the applicant indicates it would not be possible to locate them anywhere that does not require a new exception. A map of the proposed NRI is included as "Dredge Area 4" in Attachment A, Exhibit 1, Page 1 of 4.

(B) To show why the particular site is justified, it is necessary to discuss why other areas that do not require a new exception cannot reasonably accommodate the proposed use. Economic factors may be considered along with other relevant factors in determining that the use cannot reasonably be accommodated in other areas. Under this test the following questions shall be addressed:

(i) Can the proposed use be reasonably accommodated on resource land that would require an exception, including the destiny of uses on non-resource land? If not, why not?

(ii) Can the proposed use be reasonably accommodated on resource land that is already irrevocably committed to non-resource uses not allowed by the applicable goal, including resource land in existing unincorporated communities, or by increasing the density of uses on committed lands? If not, why not?

(iii) Can the proposed use be reasonably accommodated inside an urban growth boundary? If not, why not?

(iv) Can the proposed use be reasonably accommodated without the provisions of a proposed public facility or service? If not, why not?

Staff Response: The applicant states the proposed NRI areas are location-specific. These are the specific geographic locations where the channel is constrained. The applicant notes that in any case, it is not possible for JCEP to locate them anywhere that does not require a new exception. The proposed use does not relate to a public facility in the Channel, and will not require any additional public facilities or services to construct.

(C) The "alternative areas" standard in paragraph B may be met by a broad review of similar types of areas rather than a review of specific alternative sites. Initially, a local government adopting an exception need assess only whether those similar types of areas in the vicinity could not reasonably accommodate the proposed use. Site specific comparisons are not required of

a local government taking an exception unless another party to the local proceeding describes specific sites that can more reasonably accommodate the proposed use. A detailed evaluation of specific alternative sites is thus not required unless such sites are specifically described, with facts to support the assertion that the sites are more reasonable, by another party during the local exceptions proceeding.

Staff Response: The Applicant has indicated, and staff agrees, that the proposed NRI area is location-specific, as such; it is not possible for JCEP to locate them anywhere that does not require a new exception.

(c) "The long-term environmental, economic, social and energy consequences resulting from the use at the proposed site with measures designed to reduce adverse impacts are not significantly more adverse than would typically result from the same proposal being located in areas requiring a goal exception other than the proposed site." The exception shall describe: the characteristics of each alternative area considered by the jurisdiction in which an exception might be taken, the typical advantages and disadvantages of using the area for a use not allowed by the Goal, and the typical positive and negative consequences resulting from the use at the proposed site with measures designed to reduce adverse impacts. A detailed evaluation of specific alternative sites is not required unless such sites are specifically described with facts to support the assertion that the sites have significantly fewer adverse impacts during the local exceptions proceeding. The exception shall include the reasons why the consequences of the use at the chosen site are not significantly more adverse than would typically result from the same proposal being located in areas requiring a goal exception other than the proposed site. Such reasons shall include but are not limited to a description of: the facts used to determine which resource land is least productive, the ability to sustain resource uses near the proposed use, and the long-term economic impact on the general area caused by irreversible removal of the land from the resource base. Other possible impacts to be addressed include the effects of the proposed use on the water table, on the costs of improving roads and on the costs to special service districts;

Staff Response: The long-term economic, environmental, social and energy costs of widening other areas of the Channel that JCEP could feasibly widen are not materially different from the same consequences of making the improvements at the identified location.

(d) "The proposed uses are compatible with other adjacent uses or will be so rendered through measures designed to reduce adverse impacts." The exception shall describe how the proposed use will be rendered compatible with adjacent land uses. The exception shall demonstrate that the proposed use is situated in such a manner as to be compatible with surrounding natural resources and resource management or production practices. "Compatible" is not intended as an absolute term meaning no interference or adverse impacts of any type with adjacent uses.

Staff Response: The proposed NRI site is located immediately adjacent to the existing Channel. The adjacent uses to the Channel are transit of large vessels that currently call on the Port. The adjacent land use designation is Deep Draft –Development Aquatic (DA) unit.

According to the CBEMP, DA units "*include areas suitable for deep or shallow-draft navigation (including shipping and access channels or turning basins), sites and mining or mineral extraction areas, and areas adjacent to developed or developable shorelines which may need to be altered to provide navigational access or create new land areas for water-dependent uses."* Additionally, the applicant's consultant (DEA) has submitted an environmental impacts report (Attachment A, Exhibit 5) that outlines plans to reduce adverse environmental impacts upon the waters of the Bay and Channel. This includes performing capital and maintenance dredging during the ODFW-approved in-water work window (October 1 to February 15) to reduce impacts to sensitive life stages of fish in the bay, using various dredging methods to minimize the effects on water turbidity within the bay, and applying best management practices associated with dredging (including cutter head suction, clamshell, and hopper dredging) to reduce turbidity effects. As a result of those methods JCEP expects increased water turbidity as a result of the NRIs to be temporary and limited to the immediate vicinity of dredging operations. The application is consistent with this criterion.

(3) If the exception involves more than one area for which the reasons and circumstances are the same, the areas may be considered as a group. Each of the areas shall be identified on a map, or their location otherwise described, and keyed to the appropriate findings.

Staff Response: The applicant's proposal seeks an exception to Goal 16 for one NRI site within the City's jurisdiction. The remaining three sites fall outside of City jurisdiction. To see a map of the proposed navigational reliability areas see Attachment A, Exhibit 1, Page 1 of 4, included in this staff report. This criterion does not apply.

ANALYSIS OF OAR 660-004-0022

OAR 660-004-0022 addresses, in greater detail, the *"types of reasons that may or may not be used to justify certain types of uses not allowed on resource lands."* Consistency with any one of the ten alternatives outlined in OAR 660-004-0022 provides sufficient justification for a "reasons" exception. In seeking an approval of a Goal 16 exception as requested in this application, the applicant's representative advances two avenues in which a Goal 16 exception may be approved. The applicant proposes that the application meets the criteria for a goal exception under the general exceptions as indicated in OAR 660-004-0020(1); The applicant proposes that the application also meets the criteria for a goal exception through a second avenue under OAR 660-004-0022(8)(b).

Following is the staff response for both of these criteria.

OAR 660-004-0022

Reasons Necessary to Justify an Exception Under Goal 2, Part II(c

An exception under Goal 2, Part II(c) may be taken for any use not allowed by the applicable goal(s) or for a use authorized by a statewide planning goal that cannot comply with the approval standards for that type of use. The types of reasons that may or may not be used to justify certain types of uses not allowed on resource lands are set forth in the following sections of this rule. Reasons that may allow an exception to Goal 11 to provide sewer service to rural lands are described in OAR 660-011-0060. Reasons that may allow transportation facilities and improvements that do not meet the requirements of OAR 660-012-0065 are provided in OAR 660-012-0070. Reasons that rural lands are irrevocably committed to urban levels of development are provided in OAR 660-014-0030. Reasons that may justify the

establishment of new urban development on undeveloped rural land are provided in OAR 660-014-0040.

(1) For uses not specifically provided for in this division, or in OAR 660-011-0060, 660-012-0070, 660-014-0030 or 660-014-0040, the reasons shall justify why the state policy embodied in the applicable goals should not apply. Such reasons include but are not limited to the following:

(a) There is a demonstrated need for the proposed use or activity, based on one or more of the requirements of Goals 3 to 19; and either

(A) A resource upon which the proposed use or activity is dependent can be reasonably obtained only at the proposed exception site and the use or activity requires a location near the resource. An exception based on this paragraph must include an analysis of the market area to be served by the proposed use or activity. That analysis must demonstrate that the proposed exception site is the only one within that market area at which the resource depended upon can reasonably be obtained; or

(B) The proposed use or activity has special features or qualities that necessitate its location on or near the proposed exception site.

Staff Response: Under OAR 660-004-0022(1) the applicant must demonstrate a need for the proposed use/activity based on requirements of one or more State Planning Goals 3 to 19. In the applicant's case, the demonstrated need for the proposed NRI site is based primarily on Goal 9 (Economic Development) and 12 (Transportation). As explained in the applicant's narrative, structural restrictions on the Channel cause significant transit delays and unduly increase directional changes during transit through the Channel. Delays are measured in the total transit time, from the time the vessel arrives off the coast of Coos Bay until it returns offshore. Minimizing delay is a pressing need because companies that utilize the Port have identified new customers in Asia that desire to export cargo using bulk carriers that are slightly larger than the ships typically calling on the Port today. The Applicant points out there are various marine terminal businesses within Coos Bay that require assurances that terminals can efficiently accommodate larger dimension bulk carriers in the future. The proposed NRIs will allow companies to secure emerging opportunities to export products using today's larger vessels, including bulk carriers of up to 299.9 meters (983.3 feet) in length, 49 meters (160.8 feet) in beam, and 11.9 meters (39 feet) in draft. The applicant has included, in its application, a letter from the US Coast Guard to JCEP, indicating Coos Bay Pilots can safely and successfully maneuver carriers of up to 299.9 X 49m X 11.9 dimensionally while transiting the Channel. The letter is included in this staff report as Attachment A, Exhibit 4 (Page 15).

In their narrative, the Applicant asserts that JCEP and the Coos Bay Pilots believe the proposed navigational reliability improvement site is essential to achieve the required number of LNG vessel transits needed to lift the JCEP design annual LNG production volume. Excessive delays in LNG carrier transit in the Channel, to and from the LNG terminal, could result in a shore storage tank topping situation, requiring JCEP to curtail LNG production. The Coos Bay Pilots letter of support for the proposed NRI is included in this staff report as Attachment A, Exhibit 3, (Page 2). The proposed NRI will fulfill a demonstrated need for continued and enhanced shipping within the Bay; consistent with the policy objectives of Goals 9 and 12.

(8) Goal 16 – Other Alterations or Uses: An exception to the requirement limiting dredge and fill or other reductions or degradations of natural values to water-dependent uses or to the natural and conservation management unit requirements limiting alterations and uses is justified, where consistent with ORS chapter 196, in any of the circumstances specified in subsections (a) through (e) of this section:

Staff Response: The applicant also provided a response to the reasons exception alternative OAR 660-004-0022(8)(b). This is a specific exception to the requirement limiting dredging in an area that is currently designated, in accordance with Goal 16, as a natural management unit. The applicant has indicated the exception is justified because approval of the application will authorize dredging to maintain adequate depth to safely and more reliably permit continuation of the present level of navigation.

(b) Dredging to maintain adequate depth to permit continuation of the present level of navigation in the area to be dredged.

Staff Response: The applicant proposes dredging to maintain adequate depth to permit continuation of the presently authorized level of navigation at the proposed NRI site which is called out as an exception that is justified in subsection (8)(b), above. Most recently, the Channel was expanded from -35 feet to -37 feet in 1997. The proposed improvements are designed to increase the environmental operating window for all vessels entering the Bay by softening critical turns, relocating navigational aids to navigation, and reducing the required Channel directional changes. In turn, the proposed dredging will reduce entry and departure delays and allow for more efficient vessel transits through the Channel for the size of vessels calling on the Port today.

The applicant notes that, for JCEP, the proposed navigational reliability improvements will allow for transit of Liquid Natural Gas (LNG) vessels of similar overall dimensions to those listed in the July 1, 2008 US Coast Guard (USCG) Waterway Suitability Report, the USCG Letter of Recommendation dated May 10, 2018 and USCG letter confirmation dated November 7, 2018, but under a broader range of weather conditions, specifically higher wind speeds. As a result JCEP estimates that upon completion of the proposed navigational reliability improvement site, JCEP will be able to export the full capacity of the optimized design production of the LNG terminal on a consistent basis. For these reasons, the applicant advances a proposal that the dredging associated with the navigational reliability improvement will maintain adequate depth to permit continuation of the presently allowed level of navigation, and allow that navigation to occur more efficiently, safely and reliably. The aforementioned letters are included in this staff report as Attachment A, Exhibit 4.

(f) In each of the situations set forth in subsections (8) (a) to (e) of this rule, the exception must demonstrate that the proposed use and alteration (including, where applicable, disposal of dredged materials) will be carried out in a manner that minimizes adverse impacts upon the affected aquatic and shoreland areas and habitats.

<u>Staff Response:</u> The applicant indicates in their application that they will complete the proposed NRIs at the site in a manner that minimizes adverse impacts upon the affected aquatic and shoreland areas and habitats. The applicant plans to perform the proposed dredging during the Oregon Department of Fish and Wildlife (ODFW) approved in-water work window (October 1 to February 15) to reduce impacts to sensitive life stages of fish in the Bay.

Additionally, related to dredging practices and methods, the applicant indicates in their application that JCEP will use various dredging methods (described in Attachment A, Exhibit 5) to minimize the effects of the NRIs on water turbidity within the Bay. JCEP will use best management practices (including cutter head suction, clamshell, and hopper dredging) associated with dredging to reduce turbidity effects, and as a result of those methods JCEP expects any increased water turbidity as a result of the NRIs to be temporary and limited to the immediate vicinity of dredging operations. The applicant notes that dredging and material transport vessels will carry small volumes of petroleum in comparison to large bulk carriers and Panamax vessels that regularly traverse Coos Bay. JCEP will use best management practices to avoid and minimize spills or discharges during dredging operations and dredged material transport.

The applicant has not indicated what specific precautions they will take to minimize the risk of toxic discharges, or oil spills, but has indicated in Attachment A, Exhibit 5, (Page 8) they will take preventative measures such as an implementation of a spill prevention plan. Staff have included a condition of approval relating to the specific measures to be taken by the applicant and/or their dredging contractor in the event of an oil spill or toxic discharge in the form of a spill prevention and response plan.

> ***<u>Condition of Approval #1</u>: Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall provide the City of Coos Bay with a Spill Prevention and Response Plan addressing the potential for any unanticipated oil spill or toxic discharge, for review and approval.***

Dredging equipment and material transport vessels related to the proposed NRI site may generate temporary noise disturbances; however the noise will be localized to the immediate dredging area. The applicant states they do not anticipate that noise levels will have more than temporary effects on the behavior of aquatic species in the area of the proposed NRI site. The applicant's consultant, DEA has evaluated the proposal and provided additional details on potential adverse impacts associated with the proposed dredging. The report is included in this staff report as Attachment A, Exhibit 5.

VII. CRITERIA FOR ESTUARINE AND COASTAL SHORELAND USES ACTIVITIES PERMIT

CBMC – 17.52.010 General

Uses and activities permitted by the Coos Bay Estuary Management Plan are subject to general and special conditions and policies to comply with statewide planning goals and the Coos Bay Estuary Plan as adopted by the city of Coos Bay. Compliance with these conditions and policies must be verified; therefore, all uses and activities under jurisdiction of the Coos Bay Estuary Management Plan must be reviewed.

<u>Staff Response:</u> The applicant is seeking an Estuarine and Coastal Shoreline Uses and Activities permit to allow New and Maintenance Dredging in the DDNC-DA Estuarine Zone. The existing 52-NA aquatic management unit is located immediately adjacent to the federally authorized DDNC. Additionally, the applicant seeks an Estuarine and Coastal Shoreline Uses and Activities permit to allow for an accessory temporary dredge transport pipeline in the 52-NA, 53-CA, 54-DA, and 55-CA management zones. The dredge line is described in a memo included in this staff report as Attachment A, Exhibit 5, and depicted in Exhibit 6. All of the above mentioned management zones are within the City of Coos Bay's jurisdiction. New and Maintenance dredging in the DDNC-DA are subject to general conditions (CBEMP Policies #17 and #18) and a special condition, the mitigation of adverse impacts as described in CBEMP Policy #5, which as a result triggers the consideration of CBEMP Policies #4 and #4a.

COOS BAY ESTUARY MANAGEMENT PLAN (CBEMP) POLICIES

Below are CBEMP Policies pertinent to the subject application.

CBEMP Policy #17 - Protection of "Major Marshes" and "Significant Wildlife Habitat" in Coastal Shorelands

Local government shall protect major marshes, significant wildlife habitat, coastal headlands, and exceptional aesthetic resources located within the Coos Bay Coastal Shorelands Boundary and included in the Plan inventory, except where exceptions allow otherwise. Local government shall consider:

A. "major marshes" to include areas identified in the Goal #17 "Linkage Matrix" and the Shoreland Values inventory map;

B. "significant wildlife habitats" coastal headlands and exceptional aesthetic resources to include those areas identified, on the map "Shorelands Values."

This strategy shall be implemented through:

A. Plan designations and use and activity matrices set forth elsewhere in the Plan that limit uses in these special areas to those that are consistent with protection of natural values, and

B. Through use of the "Shoreland Values" map that identifies such special areas and restricts uses and activities therein to uses that are consistent with the protection of natural values. Such uses may include propagation and selective harvesting of forest products consistent with the Oregon Forest Practices Act, grazing, harvesting wild crops, and low-intensity water-dependent recreation.

A. "major marshes" to include areas identified in the Goal #17 "Linkage Matrix" and the Shoreland Values Inventory map;

B. "Significant wildlife habitats," coastal headlands and exceptional aesthetic resources to include those areas identified on the map "Shoreland Values."

This strategy recognizes that special protective consideration must be given to key resources in coastal shorelands over and above the protection afforded such resources elsewhere in this Plan.

<u>**Staff Response:**</u> According to the Shoreland Values map, there are no inventoried resources at the proposed navigational reliability improvement site for which CBEMP Policy #17 requires protection. Despite this preliminary conclusion, staff propose that CBEMP Policy #17 be included as a general condition of approval for dredging associated with the NRI. It is added as a condition under Section VIII.

CBEMP Policy #18 - Protection of Historical and Archaeological Sites Within Coastal Shorelands.

Local government shall provide special protection to historic and archaeological sites located within the Coos Bay Coastal Shorelands Boundary, except where Exceptions allow otherwise. These sites are identified in the section entitled: "Coastal Shoreland Values Requiring Mandatory Protection" and on the "Special Considerations Map." Further, local government shall continue to refrain from widespread dissemination of site-specific information about identified archaeological sites.

This strategy shall be implemented by requiring review of all development proposals involving an archaeological or historical site to determine whether the project as proposed would protect the archaeological and historical values of the site.

The development proposal, when submitted, shall include a site development plan showing, at a minimum, all areas proposed for excavation, clearing and construction. Within three (3) working days of receipt of the development proposal, the local government shall notify the Coos, Siuslaw, Lower Umpqua Tribal Council in writing, together with a copy of the site development plan. The Tribal Council shall have the right to submit a written statement to the local government within ten (10) days of receipt of such notification, stating whether the project as proposed would protect the historical and archaeological values of the site, or if not, whether the project could be modified by appropriate measures to protect those values.

"Appropriate measures" may include, but shall not be limited to the following:

- **A.** **Retaining the historic structure in situ or moving it intact to another site; or**
- **B.** **Paving over the site without disturbance of any human remains or cultural objects upon the written consent of the Tribal Council; or**
- **C.** **Clustering development so as to avoid disturbing the site; or**
- **D.** **Setting the site aside for non-impacting activities, such as storage; or**
- **E.** **If permitted pursuant to the substantive and procedural requirements of ORS 97.750, contracting with a qualified archaeologist to excavate the site and remove any cultural objects and human remains, reinterring the human remains at the developer's expense; or**

F. Using civil means to ensure adequate protection of the resources, such as acquisition of easements, public dedications, or transfer of title.

If a previously unknown or unrecorded archaeological site is encountered in the development process, the above measures shall still apply. Land development activities which violate the intent of this strategy shall be subject to penalties prescribed in ORS 97.990 (8) and (9). Upon receipt of the statement by the Tribal Council, or upon expiration of the Tribal Council's ten-day response period, the local government shall conduct an administrative review of the development proposal and shall:

A. Approve the development proposal if no adverse impacts have been identified, as long as consistent with other portions of this plan, or

B. Approve the development proposal subject to appropriate measures agreed upon by the landowner and the Tribal Council, as well as any additional measures deemed necessary by the local government to protect the historical and archaeological values of the site. If the property owner and the Tribal Council cannot agree on the appropriate measures, then the governing body shall hold a quasi-judicial hearing to resolve the dispute. The hearing shall be a public hearing at which the governing body shall determine by preponderance of evidence whether the development project may be allowed to proceed, subject to any modifications deemed necessary by the governing body to protect the historical and archaeological values of the site.

This strategy recognizes that protection of historical and archaeological sites is not only a community's social responsibility, but is also legally required by Goal #17 and OBS 97.745. It also recognizes that historical and archaeological sites are non-renewable cultural resources.

Staff Response: The applicant notes that the Shoreland Values Map does not indicate any known inventoried resources in this location to consider under this policy. Through correspondence with staff, members of the Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indian (Tribes), asserted that the Shoreland Values inventory map is old (2002) and that there may be resources in the vicinity of the NRI Site. During the course of the proposed development there may be unanticipated discovery of cultural resources, remains, and/or objects. The applicant has included, in their submission, a copy of a Memorandum of Agreement (MOA) between JCEP and the Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indian (Tribes) addressing these circumstances, and more broadly, Policy 18. A copy of the signed MOA is included with this staff report as Attachment A, Exhibit 9. The MOA incorporates a Cultural Resources Protection Agreement (CRPA) entered between JCEP and the Tribes in July of 2018. The CRPA provides a process for the exchange of project-related information, confidentiality requirements, commitments to mitigation, monitoring agreements, agreements for the treatment of unanticipated discovery of cultural resources, site access agreements, and cost recovery agreements. The CRPA includes an Unanticipated Discovery Plan (UDP), which provides procedures in the event of an unanticipated discovery of historic properties, archeological objects, archaeological sites or human remains, funerary objects, sacred items, and items of cultural patrimony, during the construction and operation of the proposed temporary dredge transport pipeline.

Staff proposes the following condition of approval to ensure compliance with respect to Policy #18

<u>Condition of Approval #2</u>: Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall provide evidence of compliance with the requirements of the enclosed MOA, CRPA, and UDP as agreed upon and signed by JCEP and the Confederated Tribes of Coos, Lower, Umpqua, and Siuslaw Indians, as well as consistency with any other provisions of Policy #18 of the CBEMP.

CBEMP Policy #5 – Estuarine Fill and Removal

<u>Staff Response</u>: JCEP's new and maintenance dredging activities must be consistent with CBEMP Policy #5. The DDNC-DA zone allows new and maintenance dredging. Because the Application includes a Goal 16 exception, Policy #5 requires only that the Application comply with criteria D. and E., because, as expressly noted within the Policy, the findings for the Goal 16 exception suffice for this Application to comply with criteria A - C.

Dredging and/or filling shall be allowed only:

A. If required for navigation or other water-dependent uses that require an estuarine location or if specifically allowed by the applicable management unit requirements of this goal; and

<u>Staff Response:</u> Staff agrees with the applicant's finding that Policy #5 indicates if an application includes the request for a goal exception, findings for the goal exception shall be sufficient for this criterion. As indicated earlier in this staff report, the proposed NRIs are required for navigational purposes within the Channel.

B. If no feasible alternative upland location exists; and

<u>Staff Response:</u> Staff agrees with the applicant's finding that Policy #5 indicates if an application includes the request for a goal exception, findings for the goal exception shall be sufficient for this criterion. As indicated earlier in this staff report, the proposed location of the NRIs is the only site JCEP can make the proposed necessary improvements to increase safety and efficient of vessel navigation in the Channel.

C. If a pubic need (i.e., a substantial public benefit) is demonstrated and the use or alteration does not unreasonably interfere with public trust rights; and

<u>Staff Response:</u> Staff agrees with the applicant's finding that Policy #5 indicates if an application includes the request for a goal exception, findings for the goal exception shall be sufficient for this criterion. As indicated earlier in this staff report, the applicant's proposal serves a public need by creating safer and more efficient navigation in the Channel, thereby promoting economic activity in the City of Coos Bay.

D. If adverse impacts are minimized; and

Staff Response: Compliance with criterion D directs the applicant to demonstrate how adverse impacts will be minimized, pursuant to CBEMP Policy #4a. Strategies, and best practices proposed by the applicant to minimize adverse impacts are mentioned earlier in this staff report. Additionally, the memo included in this staff report as Attachment A, Exhibit 5, outlines in detail, the measures and practices proposed by the applicant to minimize adverse impacts. .

E. The activity is consistent with the objectives of the Estuarine Resources Goal and with other requirements of state and federal law, specifically the conditions in ORS 541.615

Staff Response: Compliance with criterion E directs the applicant to demonstrate that the proposed NRIs are "*consistent with the objectives of the Estuarine Resource Goal and with other requirements of state and federal law, specifically the conditions in ORS 541.615 and Section 404 of the Federal Water Pollution Control Act (P.L. 92-500)*." The applicant asserts that the NRIs are consistent with the objectives of Goal 16 (Estuarine Resources Goal) because they represent a balance of estuary uses, protecting the economic values of the estuary while minimizing adverse impacts of the dredging activity. Staff concur to the extent that adverse impacts will be minimized as proposed. The application is consistent with other requirements of state and federal law, including the conditions in Section 404 of the Federal Water Pollution Control Act, and the conditions of ORS 541.615 (renumbered ORS 196.810), which requires a permit from the DSL to remove any material from the beds or banks of waters of the state. The applicant asserts that JCEP acknowledges this obligation, and all necessary DSL and Federal Section 404 authorizations will be obtained as a condition precedent to dredging.

Staff proposes the following condition of approval to ensure compliance with Policy #5(E):

> ***Condition of Approval #3:* Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall obtain, and provide evidence of, all necessary DSL and Federal Section 404 authorizations. JCEP shall provide the City with copies of these approved authorizations for the record.**

Policy #5 (continued)

Other uses and activities which could alter the estuary shall only be allowed if the requirements in B, C, and D are met. All portions of these requirements may be applied at the time of plan development for actions identified in the Plan. Otherwise, they shall be applied at the time of permit review.

This strategy shall be implemented by the preparation of findings by local government documenting that such proposed actions are consistent with the Comprehensive Plan, and with criteria "a" through "e" above. However, where goal exceptions are included within this plan, the findings in the exception shall be sufficient to satisfy criteria "a" through "c" above. Identification and minimization of adverse impacts as required in "d" above shall follow the procedure set forth in Policy #4a. The findings shall be developed in response to a "request

for comment" by the Division of State Lands, which shall seek local government's determination regarding the appropriateness of a permit to allow the proposed action.

"Significant," as used in "other significant reduction or degradation of natural estuarine values," shall be determined by:

- **A.** **The U.S. Army Corps of Engineers through its Section 10 and 404 permit processes; or**
- **B.** **The Department of Environmental Quality for approvals of new aquatic log storage areas only; or**
- **C.** **The Department of Fish & Wildlife for new aquaculture proposals only.**

This strategy recognizes that Goal #16 limits dredging, fill, and other estuarine degradation in order to protect the integrity of the estuary.

Staff Response: CBEMP Policy #5 requires that other uses and activities which could alter the estuary only be allowed if the requirements in B, C, and D are met. The local government shall issue preparation of findings that such actions proposed by the applicant are consistent with the Comprehensive Plan, and with criteria "A" through "E" above. However, staff agrees with the applicant's finding that, where a goal exception is proposed as part of the request, the findings in the exception shall be sufficient to satisfy criteria "A" through "C" above. When addressing criteria "D", the applicant shall follow the procedure set forth in Policy #4a. Policy #4a outlines how resource capability consistency and impact mitigation is conveyed and insured for uses and activities within management units. Policy #4a is addressed specifically starting on Page 28.

CBEMP Policy #4 – Resource Capability Consistency and Impact Assessment

Local government concludes that all proposed actions (approved in this Plan) which would alter or potentially alter the estuarine ecosystem have been based upon a full consideration of the impacts of the proposed alteration, except for the following uses and activities:

A. Natural Management Units
- **Aquaculture**
- **Bridge crossings**
- **Log storage**

B. Conservation Management Units
- **Aquaculture**
- **Bulkheading**
- **Dike maintenance dredging**
- **High-intensity water-dependent recreation**
- **Log storage dredging**
- **Minor navigational improvements requiring dredging or fill**
- **Rip-rap**
- **Water intake or withdrawal and effluent discharge**

C. Development Management Units
- **Aquaculture**
- **Bulkheading (except for Aquatic Units #3DA, 5DA, and 6DA)**

- Dredging
- Fill
- Flow lane disposal of dredged material
- In-water structures
- Mining and mineral extraction
- New or expanded log storage
- Water-related and nondependent, nonrelated uses not requiring fill

D. Any other uses and activities which require the resource capability consistency test as a condition within a particular management unit or which could affect the estuary's physical processes or biological resources. Unless fully addressed during the development and adoption of comprehensive plans, actions, which would potentially alter the estuarine ecosystem, shall be preceded by a clear presentation of the impacts of the proposed alteration.

Unless fully addressed during the development and adoption of comprehensive plans, actions, which would potentially alter the estuarine ecosystem, shall be preceded by a clear presentation of the impacts of the proposed alteration.

For uses and activities requiring the resource capabilities test, a special condition is noted in the applicable management unit uses/activities matrix. A determination of consistency with resource capability and the purposes of the management unit shall be based on the following:

A. A description of resources identified in the plan inventory;

B. An evaluation of impacts on those resources by the proposed use (see impact assessment procedure, below); and

C. In a natural management unit, a use or activity is consistent with the resource capabilities of the area when either the impacts of the use on estuarine species, habitats, biological productivity and water quality are not significant or that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner to protect significant wildlife habitats, natural biological productivity, and values for scientific research and education.

D. In a conservation management unit a use or activity is consistent with the resource capabilities of the area when either the impacts of the use on estuarine species, habitats, biological productivity and water quality are not significant or that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner which conserves long-term renewable resources, natural biologic productivity, recreational and aesthetic values and aquaculture.

The impact assessment need not be lengthy or complex, but it should enable reviewers to gain a clear understanding of the impacts to be expected. It shall include information on:

A. The type and extent of alterations expected;

B. **The type of resource(s) affected;**

C. **The expected extent of impacts of the proposed alteration on water quality and other physical characteristics of the estuary, living resources, recreation and aesthetic use, navigation and other existing and potential uses of the estuary; and**

D. **The methods which could be employed to avoid or minimize adverse impacts.**

This policy is based on the recognition that the need for and cumulative effects of estuarine developments were fully addressed during the preparation of this Plan and that, except as otherwise stated above, no additional findings are required to meet Implementation Requirement #1 of LCDC Goal 16.

<u>**Staff Response:**</u> CBEMP Policy #4 requires findings demonstrating the public's need and gain that would warrant any modification or loss to the estuarine ecosystem, based upon a clear presentation of the impacts of the proposed alteration, as implemented in Policy #4a. None of the prerequisites to providing notice to state agencies under Policy #4a are triggered. Therefore, this policy, to the extent that it is applicable, requires the City to perform the impacts assessment consistent with CBEMP Policy #4.

The applicant asserts that CBEMP Policy #4 is not applicable to the Application pursuant to state law. The applicant notes that LUBA has held, and the Court of Appeals has affirmed, that "*[w]hen a goal exception is taken to facilitate proposed development, any comprehensive plan policies that implement the goal for which the exception is taken no longer govern that development.*" *Friends of Marion County, 59 Or LUBA at 350-351, aff'd 233 Or App at 488*. The Applicant requests an exception to Goal 16 to facilitate dredging in a natural management unit. As the last sentence of CBEMP Policy #4 clearly states, the purpose of this policy is to implement Goal 16. Staff agrees with this assertion by the Applicant.

Staff note that this project will require state and federal permits and an assessment of environmental impacts will be done.

CBEMP Policy #4a - Deferral of (A) Resource Capability Consistency Findings and (B) Resource Impact Assessments

Local government shall defer, until the time of permit application, findings regarding consistency of the uses/activities listed in Policy #4 with the resource capabilities of the particular management unit.

Additionally, the impact assessment requirement for those uses/activities as specified in Policy #4 shall be performed concurrently with resource capability findings above at the time of permit application.

This strategy shall be implemented through an Administrative Conditional Use process that includes local cooperation with the appropriate state agencies such that:

A. **Where <u>aquaculture</u> is proposed as a use, local government shall notify the <u>Oregon Department of Fish and Wildlife (ODFW)</u> in writing of the request, together with a map of the proposed site;**

B. **Where <u>log storage dredging</u> is proposed as an activity, local government shall notify the Oregon Department of Environmental Quality (DEQ) in writing of the request, together with a map of the proposed site.**

Within twenty (20) days of receipt of the notification, ODFW or DEQ, as appropriate, shall submit in writing to local government a statement as to whether the proposed use/activity will be consistent with the resource capabilities of the management segment, or if determined to be not consistent, whether the proposal can be made consistent through imposition of conditions on the permit. The appropriate state agency shall also perform the impact assessment required in Policy #4. If no statement is received from the affected state agency by the expiration of the twenty (2) day period, local government shall presume consistency of the proposal with the resources capabilities of the management segment, shall make findings appropriate to the presumption, and shall perform the assessment of impacts required by Policy #4.

For all other uses/activities specified above, local government shall determine appropriate findings whether the proposed use/activity is consistent with the resource capabilities of the management segment and shall perform the assessment of impacts required by Policy #4.

This strategy recognizes:

A. **That resource capability consistency findings and impact assessments as required by LCDC Goal #16 can only be made for the uses specified above at the time of permit application, and**

B. **That the specified state agencies have expertise appropriate to assist local government in making the required finding and assessments.**

This strategy is based upon the recognition that the need for and cumulative effects of estuarine developments were fully addressed during development of this Plan and that no additional findings are required to meet Implementation Requirement #1 of Goal #16.

<u>**Staff Response:**</u> As noted above, because neither aquaculture nor log storage dredging are proposed, none of the prerequisites to providing notice to state agencies under Policy #4a are triggered. Therefore, this policy requires the City to perform the impacts assessment consistent with CBEMP Policy #4. The City has completed that assessment, including the content of the memo included as Attachment A, Exhibit 5.

As with Policy #4, the applicant asserts that CBEMP Policy #4a is not applicable to the Application pursuant to state law. The applicant notes that LUBA has held, and the Court of Appeals has affirmed, that "[w]hen a goal exception is taken to facilitate proposed development, any comprehensive plan policies that implement the goal for which the exception is taken no longer govern that development." Friends of Marion County, 59 Or LUBA at 350-351, aff'd 233 Or App at 488. The Applicant requests an exception to Goal 16 to facilitate dredging in a natural management unit. As the last sentence of CBEMP Policy #4 clearly states, the purpose of this policy is to implement Goal 16. Staff agrees with this finding by the Applicant.

VIII. Conditions of Approval

Staff has identified and recommends the following conditions for Planning Commission and City Council consideration and Council action to authorize the project:

***Condition of Approval #1**: Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall provide the City of Coos Bay with a spill prevention and response plan addressing the potential any unanticipated oil spill or toxic discharge for review and approval.*

***Condition of Approval #2**: Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall provide evidence to the Coos Bay Community Development Director, of compliance with the requirements of the enclosed MOA, CRPA, and UDP as agreed upon and signed by JCEP and the Confederated Tribes of Coos, Lower, Umpqua, and Siuslaw Indians.*

***Condition of Approval #3**: Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall obtain, and provide evidence to the Coos Bay Community Development Director, of all necessary DSL and Federal Section 404 authorizations. JCEP shall provide the City with copies of these approved authorizations for the record.*

***Condition of Approval #4**: City of Coos Bay Public Works has identified an existing utility that is installed under the Bay in the vicinity of the proposed navigational reliability improvements. Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall provide evidence to the Coos Bay Community Development Director, that the proposed dredging activity shall not impact this existing utility.*

***Condition of Approval #5**: As a general condition, and in the event that additional analysis or circumstance reveals relevant and previously unknown or unmapped shoreland resources, all dredging activity must remain consistent with CBEMP Policy #17 - Protection of "Major Marshes" and "Significant Wildlife Habitat" in Coastal Shorelands.*

IX. Conclusion

Based on the evidence in the record, it is staff's conclusion that the applicable criteria can be met with the conditions of approval proposed.

X. Attachments

Attachment A: Application(s)

Exhibit 1: NRI (Dredge Detail)

Exhibit 2: Pre-Application Conference Notes

Exhibit 3: Support Letters (Roseburg Forest Products, Coos Bay Pilots Association, Port)

Exhibit 4: Jordan Cove LNG Coast Guard Letter of Recommendation/Analysis

Exhibit 5: Memo describing dredge work and impacts
Exhibits 6 & 7: Site and Context Maps
Exhibit 8: Property Owner (DSL) Certification and Consent
Exhibit 9: Memorandum of Agreement between JCEP and the Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians

Attachment B: Comprehensive Plan Update Map(s)

ATTACHMENT A

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VIA EMAIL ONLY

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Re: Concurrent Land Use Applications by Jordan Cove Energy Project L.P.
Coos Bay Estuary Navigation Reliability Improvements
City of Coos Bay File Nos. ___________

Dear Henry:

As you are aware, this office represents Jordan Cove Energy Project L.P. ("JCEP"), the applicant requesting City of Coos Bay ("City") approval of concurrent land use applications ("Applications") to authorize navigation reliability improvements on approximately 3.3 acres in the 52-NA estuary zone. This letter and its enclosures respond to your December 20, 2018 letter, which requested additional information about the Applications.

Enclosed please find an amended and restated application submittal, which we request that the City and the Lane Council of Governments ("LCOG") accept in place of the original submittal. The amended and restated submittal includes the complete application filing, which has been revised to include a revised application form, a revised application narrative, additional pages in Exhibit 1, and new Exhibits 7, 8, and 9. For convenience, we have also included a "track changes" version of the narrative showing the changes from the original version.

Further, thank you for raising the numbered questions that you did in your December 20, 2018 letter. JCEP responds to these questions below. The letter includes your numbered questions in bold followed by JCEP's responses.

1. Narrative Page 6 - CBMC - 17.215.020

Please include an update in your narrative to reflect the "Type III - with Council approval" approach that the City has agreed to pursue on the application.

RESPONSE: JCEP has included this update at pp. 6-7 of the revised narrative.

2. Narrative Page 7 - Approval Criteria

Please address the (Economic Development) Policy 1.5 of the CBCP

RESPONSE: JCEP has addressed this policy at pp. 8-9 of the revised narrative.

Although the CBEMP contains the policy language for Estuarine Resources, please address consistency with the stated Goal of the Estuarine Resources Element of the CBCP.

RESPONSE: For two reasons, the City should find that the Goal of the Estuarine Resources Element of the Coos Bay Comprehensive Plan ("CBCP") is not applicable to the Applications. First, in general, consistency with the CBCP goals is not an approval criterion for a plan amendment. *See* Coos Bay Development Code 17.215.060(1) (requiring consistency with the applicable policies of the comprehensive plan). Second, the CBCP Estuarine Resources Goal is not applicable because it implements Statewide Planning Goal ("Goal") 16, and JCEP is requesting an exception to Goal 16 as part of the Applications. *See Friends of Marion County v. Marion County*, 59 Or LUBA 323, 350-351, *aff'd* 233 Or App 488, 227 P3d 198 (2010) ("[w]hen a goal exception is taken to facilitate proposed development, any comprehensive plan policies that implement the goal for which the exception is taken no longer govern that development").

Please address the Land Use Policies: LU.4, LU.5 and LU.7 of the CBCP.

RESPONSE: JCEP has addressed these policies at pp. 9-10.

3. Narrative Page 9 - Statewide Planning Goal 1: Citizen Involvement

Please include an update in your response to reflect the "Type III - with Council approval" approach that the City has agreed to pursue on the application.

RESPONSE: JCEP has updated this response at pp. 11-12 of the revised narrative.

4. Narrative Page 10 - Statewide Planning Goal 6: Air, Water Land Resources Quality

Please clarify the following response;

> ***"Applicant anticipates that completing the NRIs will have effects upon air, water and land resources in the City, but these effects will be temporary, insignificant, or both, and Applicant will construct the NRIs using methods to protect these resources."***

This language seems contradictory (i.e. does the applicant anticipate that effects could be non-temporary or significant?). Do you feel comfortable stating that the applicant anticipates that "these effects will be both temporary and insignificant"?

RESPONSE: JCEP has revised its response to Goal 6 at p. 13 of the revised narrative to remove the passage in question.

5. Narrative Page 22 - OAR 660-004-0022(8)

Please clarify your response to this criterion. Goal 16 exception clarity is required for the relevance of 660-004-0022(8)(b) to the proposal. The provision describes permitting the *"continuation of the present level of navigation."* The response identifies the proposal as the *"minimum amount necessary to provide...channel depth...for enhanced navigation."*

RESPONSE: JCEP has clarified its response to OAR 660-004-0022(8)(b) at pp. 25-26 of the revised narrative.

The narrative also calls out 660-004-0022(8)(e) as being applicable. Please elaborate on the Goal 16 Exception applicability of this provision.

RESPONSE: The reference to OAR 660-004-0022(8)(e) in the narrative was a typographical error. OAR 660-004-0022(8)(e) explains how to justify an exception to alter or expand an existing public non-water-dependent use or a nonsubstantial fill for a private non-water-dependent use. The Applications do not request an exception for these uses/activities. Therefore, the City should find that OAR 660-004-0022(8)(e) is not applicable to the Applications.

6. Narrative Page 27 -

In the response at the very top of the page please clarify that, although prepared to address three NRIs, the application represented by the narrative addresses the approval of one NRI (Dredge Area 4).

RESPONSE: JCEP has made this clarification at p. 30 of the revised narrative.

7. Narrative related to the Coos Bay Estuarine Management Plan (CBEMP) Pages 28 - 37.

Review of your submitted application narrative revealed inconsistencies between the language of the CBEMP that was provided to LCOG and specific language that you responded to. Policy #5: Estuarine Fill and Removal is an example of language that appears inconsistent. Attached is the latest adopted version of the CBEMP. Please provide criteria responses in your narrative consistent with this version.

RESPONSE: JCEP has included the current version of the relevant CBEMP policies, and where appropriate, has updated its responses to same at pp. 32-43 of the revised narrative.

Thank you for your attention to the points in this letter. Please feel free to contact me with any further questions.

Very truly yours,

Seth J. King

Encls.

cc: Carolyn Johnson, City of Coos Bay (via email) (w/encls.)
Jake Callister, LCOG (via email) (w/encls.)
Steve Pfeiffer, Perkins Coie LLP (via email) (w/encls.)
Client (via email) (w/encls.)

City of Coos Bay
Community Development · 500 Central Avenue · Coos Bay, Oregon 97420
Telephone 541.269.1181 · Fax 541.269.8916 · coosbay.org

LAND USE DEVELOPMENT REVIEW APPLICATION

For Office Use Only	
STAFF CONTACT	PROJECT NO(S).

Type of Review (Please check all that apply):

- [ ] Annexation
- [ ] Appeal and Review
- [ ] Architectural Design Review
- [ ] Conditional Use
- [ ] Cultural Resources
- [X] Estuarine Use/Activities
- [ ] Home Occupation
- [X] Legislative/Text Amendment
- [ ] Lot Line Adjustment
- [ ] Partition
- [ ] Planned Unit Development
- [ ] Site Plan and Architectural Review
- [ ] Subdivision
- [ ] Temporary Use
- [ ] Vacation
- [ ] Variance
- [ ] Zone Change
- [X] Other Plan amendment

Pre-Application applications require a different application form available on the City website or at City Hall.

Site Location/Address:	Assessor's Map No./Tax Lot(s):
Coos Bay Estuary	Zoning: Multiple
	Total Land Area:

Detailed Description of Proposal:

Navigation reliability improvements in Coos Bay:
(1) Map amendment for approximately 3.3 aces from 52-NA to DDNC-DA;
(2) Text amendment to City of Coos Bay Comprehensive Plan to take reasons exception to Statewide Planning Goal 16; and
(3) Estuarine and Coastal Shoreline Uses and Activities Permit to allow dredging in DDNC-DA; temporary pipeline in 52-NA, 53-CA, 54-DA, and 55-CA; and buoy in 52-NA.

Applicant/Owner Name: Jordan Cove Energy Project L.P. (please print)
Phone:
Address: Attn: Meagan Masten, 111 SW 5th Avenue, Suite 1100
Email: mmasten@pembina.com
City State Zip: Portland, OR 97204

Applicant's Representative: Seth King (please print)
Phone: 503.727.2024
Address: Perkins Coie LLP, 1120 NW Couch Street, Tenth Floor
Email: sking@perkinscoie.com
City State Zip: Portland, OR 97209

1. Provide evidence that you are the owner or purchaser of the property or have the written permission of owner(s) to make an application.
2. Copy of the deed for the subject property.
3. Attach (a) a certified list of names and addresses of all owners of property within designated distance of the exterior boundaries of the subject property according to the latest adopted County tax role and (b) an assessor's map showing all lots and parcels of land within that area.
4. Address the Decision Criteria or Goals/Standards outlined in the Coos Bay Municipal Code chapter(s) related to your request.
5. Additional information: Date construction is expected to begin; estimated completion date of the total project and of individual segments; and anticipated future development.
6. **Ten (10) complete hard-copy sets** (single sided) of application & submitted documents must be included with this application. **One (1) complete set** of digital application materials must also be submitted electronically or on CD in Word format. Additional copies may be required as directed by the Coos Bay Director of Community Development.

The undersigned property owner(s) hereby authorizes the filing of this application, and authorizes on site review by authorized staff. I hereby agree to comply with all code requirements applicable to my application. Acceptance of this application does not infer a complete submittal. All amendments to the Coos Bay Development Code and to other regulations adopted after the application is approved shall be enforced where applicable. Approved applications and subsequent development is not vested under the provisions in place at the time of the initial application.

Natalie Eades	2/4/19	See application materials	
Applicant's signature	Date	Owner's signature ***(required)***	Date

BEFORE THE PLANNING COMMISSION AND

CITY COUNCIL OF THE CITY OF COOS BAY, OREGON

In the Matter of Requests to Improve the Navigation Efficiency and Reliability of the Coos Bay Deep Draft Navigation Channel Pursuant to the Following Applications: (1) Map Amendment to the Coos Bay Estuary Management Plan to Change the Designation of Approximately 3.3 Acres from 52-NA to DDNC-DA; (2) Text Amendment to the City of Coos Bay Comprehensive Plan to take a Reasons Exception to Statewide Planning Goal 16 to Authorize this Map Amendment; (3) Estuarine and Coastal Shoreline Uses and Activities Permit For "New And Maintenance Dredging" in the DDNC-DA Estuarine Zone; and (4) Estuarine and Coastal Shoreline Uses and Activities Permit to Allow an Accessory Temporary Dredge Transport Pipeline in the 52-NA, 53-CA, 54-DA, and 55-CA Estuarine Zones and an Accessory Buoy in the 52-NA Estuarine Zone.	**NARRATIVE IN SUPPORT OF THE APPLICATIONS FILED BY JORDAN COVE ENERGY PROJECT L.P.**

I. Land Use Requests.

Jordan Cove Energy Project L.P. ("JCEP") proposes to make navigation efficiency and reliability improvements to the City of Coos Bay ("City")-designated Coos Bay Deep-Draft Navigation Channel ("Channel") by dredging a submerged area lying adjacent to the existing Channel.[1] This dredging will allow for vessel transit under a broader

[1] JCEP is also proposing to widen and deepen the Channel in three additional locations, which are subject to the planning and zoning jurisdiction of Coos County. That request is outside the scope of this Application. JCEP is filing a separate land use application with Coos County to obtain authorization for the navigability enhancements at these other three locations.

weather window to enable JCEP to export the full capacity of the optimized design production of 7.8 metric tonnes per annum ("mtpa") from JCEP's liquefied natural gas ("LNG") terminal on the nearby North Spit.

JCEP submits the following concurrent applications (together, "Application") to the City to seek local land use authorization to complete these improvements to the Channel:

(1) Post-acknowledgment amendments to the Coos Bay Estuary Management Plan ("CBEMP") map to change the zoning designation of approximately 3.3 acres located approximately 2,700 feet from the end of the North Bend airport runway within the Coos Bay estuary ("Navigation Reliability Improvement Site" or "NRI Site") from 52-NA to DDNC-DA, as further depicted in Exhibit 1;

(2) A post-acknowledgment text amendment of the CBEMP, which is part of the City of Coos Bay Comprehensive Plan ("CBCP"), to take a reasons exception to Statewide Planning Goal ("Goal") 16 to authorize the rezone of the NRI Site to DDNC-DA;

(3) Estuarine and Coastal Shoreline Uses and Activities Permit in the DDNC-DA estuarine zone to allow new and maintenance dredging at the rezoned NRI Site. The activities at the NRI Site will be referred to in this narrative as the "NRIs;"

(4) Estuarine and Coastal Shoreline Uses and Activities Permit in the 52-NA, 53-CA, 54-DA, and 55-CA estuarine zones to allow a temporary pipeline to transport the dredge spoils from the NRI Site to approved disposal sites and a buoy as accessory uses to the primary dredging activity. JCEP is not seeking approval of the dredged materials disposal activity in conjunction with this Application.

This narrative provides the evidentiary basis and related analysis demonstrating how the Application satisfies the applicable approval criteria set forth in the Statewide Planning Goals ("Goals"), the Oregon Revised Statutes ("ORS"), the CBEMP, the CBCP, and the City of Coos Bay Development Code ("CBDC"). Based upon this evidence and argument, the City should approve the Application.

JCEP discussed this proposal with the City in a pre-application conference on February 2, 2017. A copy of the pre-application conference notes prepared by the City are included in Exhibit 2.

II. Description of Request.

A. Current Constraints on Utilizing the Channel.

The Channel serves a vital purpose because it provides the only safe vessel access to and from Coos Bay and the Pacific Ocean for marine terminals located along the Bayfront. The Channel was initially authorized in 1899 and since then has undergone ten modifications. Most recently, the Channel was expanded from -35 feet to -37 feet in 1997 to allow for the safe navigation and transit of Coos Bay for the size of ships prevalent during that time period. However, over the last 20 years the dimensions and tonnage of ships serving terminals in Coos Bay has increased. The size of vessels typically calling on Coos Bay terminals has increased from an average of 45,422 Metric Tonnes to an average of 52,894 Metric Tonnes with a projected near-term vessel size of 70,400 Metric Tonnes.

Currently, environmental conditions, including wind, fog, and currents, coupled with the increasing ship size explained above, have caused the Coos Bay Pilots Association[2] ("Pilots") to impose ever more limiting restrictions on when vessels may safely transit the Channel. These restrictions, in turn, cause significant delays and increased pressure on the Pilots to navigate ships through the Channel. Delays are measured in the total transit time, from the time the vessel arrives off the coast of Coos Bay until it returns offshore after calling at its local Coos Bay destination. These delays generally decrease the efficiency and competitiveness of maritime commerce on a global scale, thereby jeopardizing continued success for maritime commerce in Coos Bay. Minimizing delay is a pressing need because companies that utilize the port of Coos Bay have identified potential new customers in Asia that desire to export cargo using bulk carriers that are slightly larger than the ships typically calling today. Various marine terminal businesses within Coos Bay require assurances that terminals can efficiently accommodate larger dimension bulk carriers in the future.

B. How NRIs will Improve Navigation Efficiency and Reliability.

Dredging to complete the NRI Sites will increase the operational window to safely transit any vessel through the Channel. The NRIs, which are described in more detail

[2] The Pilots, regulated and approved by the State of Oregon, are responsible for supporting deep sea vessel Masters in navigating their vessels into and out of the Channel. Pilotage is mandatory in Oregon. The Pilots serve a vital function for maritime commerce in Coos Bay because they safely and efficiently guide vessels through the Channel (known as pilotage) using visual aids, radar, and other means. The Channel provides the only safe vessel access to marine terminals within Coos Bay. Pilots are trained to navigate the Channel and therefore have detailed knowledge of its bathymetric conditions and visual layout.

below, are designed to increase the environmental operating windows for all ships entering Coos Bay by softening critical turns, relocate aids to navigation and reduce the required Channel directional changes. The NRIs are designed to reduce entry and departure delays and allow for more efficient vessel transits through the Channel for the size of vessels entering the Port today.

The NRIs will allow companies to secure emerging opportunities to export products with today's larger vessels, including bulk carriers of up to 299.9 meters (983.3 feet) in length and 49 meters (160.8 feet) in beam and 11.9 meters (39 feet) in draft. Although log export vessels serving the upper bay are smaller, the proposed enhancements also benefit these vessels by broadening the tidal and environmental windows for transiting the Channel, providing an enhanced margin of safety and improved efficiency in the loaded vessel departure schedule. Both Roseburg Forest Products and the Pilots have submitted letters of support for the NRIs. *See* Exhibit 3.

For JCEP and its LNG terminal, the NRIs will allow for transit of LNG vessels of similar overall dimensions to those listed in the July 1, 2008 United States Coast Guard ("USCG") Waterway Suitability Report, the USCG Letter of Recommendation dated May 10, 2018 and USCG letter confirmation dated November 7, 2018 *see* Exhibit 4, but under a broader range of weather conditions, specifically higher wind speeds. As a result, JCEP estimates that, upon completion of the NRIs, JCEP will be able to export the full capacity of the optimized design production of the LNG Terminal on a consistent annual basis.

C. Description of Channel NRIs.

Maps and cross-sections of the NRI Site are included in Exhibit 1. In the City, the specific navigation improvements at the NRI Site consist of the following:

- NRI #4 (NRI #1 - #3 are subject to Coos County jurisdiction): JCEP proposes to widen the turn from Lower Jarvis Range to Jarvis Turn Range channels from the current 500 feet to 600 feet at the apex of the turn from the current 1,125 feet to about 1,750 feet, which will allow vessels to commence their turn in this area sooner.

The NRI Site would be dredged to a -37-foot MLLW elevation to match the current depth of the Channel. Dredging of the NRIs would include a two-foot over-dredge allowance and a two-foot advanced maintenance allowance (total depth: -41-feet MLLW). Channel side slopes would be constructed at a 4:1 horizontal to vertical slope. Notably, these improvements have been identified by the USCG as a required navigation risk mitigation measure for the JCEP terminal operations. *See* Letter of Recommendation from USCG dated May 10, 2018 in Exhibit 4.

D. Proposed Dredging and Accessory Activities.

JCEP will accomplish the Channel enhancements by dredging at each of the NRI Sites. Dredging would be accomplished with mechanical or hydraulic methods. The specific characteristics of the dredging are described in the memorandum from David Evans & Associates ("DEA") included in Exhibit 5.

All work associated with the NRIs will take place during the approved in-water work period for Coos Bay (October 1 to February 15).

JCEP will place initial and future dredged material derived from the NRI Sites at the APCO 1 and 2 sites near the southern terminus of the U.S. Highway 101 McCullough Bridge. These sites are located in the City of North Bend; JCEP will file a separate application with that city to authorize disposal of these dredge spoils in these locations.

If dredging by hydraulic methods, JCEP will utilize a 24- to 36-inch temporary dredge pipeline to transport the dredged material to the disposal sites on the bottom or horizontal extent of the Channel to reduce potential conflicts with vessel navigation. The maximum distance from the NRIs to the APCO sites is approximately 8.3-miles. The dredge line is illustrated in Exhibit 6. Booster pumps would be required to move the material to the disposal sites through the pipeline. A segment of the temporary dredge line is located in the City of North Bend; JCEP will file a separate application with that city to authorize that segment of the line. In conjunction with and as a result of the dredging activity, JCEP will place a buoy on the south side of the Channel in the City. The general location of the buoy is illustrated in Exhibit 7.

III. Applicable Approval Criteria.

The Application complies with all applicable approval criteria, as follows.

A. Comprehensive Plan Map Amendment

1. CBDC - 17.215.010 Comprehensive plan amendment.

(1) The boundaries of the comprehensive plan map designations and the comprehensive plan text may be amended as provided in CBDC 17.215.020.

(2) The city may amend its comprehensive plan and/or plan map. The approval body shall consider the cumulative effects of the proposed comprehensive plan and/or map amendments on other zoning districts and uses within the general area. Cumulative effects include sufficiency

of capital facilities services, transportation, zone and location compatibility, and other issues related to public health and safety and welfare the decision making body determines to be relevant to the proposed amendment.

<u>RESPONSE</u>: This Application requests an amendment of the CBCP map to change the CBCP designation of the NRI Site from 52-NA to DDNC-DA. The cumulative effects of such an amendment would be to facilitate an increase in safety and efficiency of navigation in the Channel, as described in Section II. of this narrative above. Therefore, the cumulative effect of the Application is to augment transportation in the bay. The Application is compatible with the zone because new and maintenance dredging is allowed in the DDNC-DA district (and because this Application requests a comprehensive plan map amendment to render the NRI Site with a DDNC-DA designation). The Application will not have cumulative effects on the sufficiency of capital facilities services, or health and welfare. Therefore, the City can find that the Application satisfies this criterion.

CBDC - 17.215.020 Initiation of Amendment

Amendments of the comprehensive plan text or map, zoning map, or this title may be initiated by the following:

(1) A Type III application, CBDC 17.130.100, Type III procedure, by one or more owners of the property proposed to be changed or reclassified consistent with the adopted comprehensive plan; or

(2) A Type IV legislative process, CBDC 17.130.110, Type IV procedure, by motion of the planning commission and adoption by the city council.

<u>RESPONSE</u>: The underlying landowner of the NRI Site, the Department of State Lands, has authorized the submittal of the Application. *See* <u>Exhibit 8</u>. Subsection (1) permits the landowner to initiate a plan text or map or zoning map amendment. The City should find that the Application has been correctly initiated pursuant to subsection (1) above.

Subsection (1) directs the City to follow the Type III review and decision-making procedures of CBDC 17.130.100 when reviewing the Application. These procedures typically apply to quasi-judicial applications and thus provide greater procedural protections to JCEP and members of the public. The Application is quasi-judicial in nature because it involves a single landowner, a limited geographic area, is not City-initiated, and concerns the application of existing policies to a specific set of facts.

Therefore, subject to one modification explained below, the City should review and decide upon the Application pursuant to the City's Type III procedures.

The modification is appropriate in this case in order to comply with state law. CBDC 17.130.100 ("Type III procedure") provides that a Type III application "will be considered at one or more public hearings before the city's planning commission." A Type III application does not as a matter of course go before the City Council. *See* CBDC 17.130.130(5)(c) (providing for City Council consideration of a Type III application but only in event of appeal). State law requires the local governing body to take final action to approve any post-acknowledgment comprehensive plan amendment before it can become final. *Housing Land Advocates v. City of Happy Valley*, __ Or LUBA __ (LUBA No. 2016-031, May 23, 2016). The Application includes a request for an exception to Goal 16, which is a request for a plan text amendment. Therefore, pursuant to *Housing Land Advocates*, the City should schedule the Application for final action by the City Council after the Planning Commission's initial decision.

In sum, the City should apply its Type III process in CBDC 17.30.100 to review and decide upon the Application, subject to also providing for a hearing and final decision on the Application by the City Council.

CBDC - 17.215.060 Approval Criteria

1) For a Type III or Type IV review, the city council shall approve the proposal upon findings that:

(a) The proposed amendment is consistent with the applicable policies of the comprehensive plan or that a significant change in circumstances requires an amendment to the plan or map;

<u>**RESPONSE**</u>**:** This Application to change the CBCP designation of the NRI Site from 52-NA to DDNC-DA is consistent with the applicable policies of the comprehensive plan.

CBCP Policies

NRH.8 Coos Bay shall encourage the preservation and protection of riparian vegetation as an important fish and wildlife habitat and as a viable means of flood control by enactment of appropriate property development ordinances providing protection by establishing buffer strips along waterways, along designated HUD floodways, with the exception of navigable waterways. This strategy recognizes that such land use practices are necessary (1)

to preserve the area's natural resources, and (2) to eliminate unnecessary drainage and erosion problems often accompanying development.

<u>RESPONSE</u>: JCEP anticipates possible temporary, but not permanent, impacts to shoreline habitat, including to riparian vegetation, where JCEP plans to offload dredged material for processing. These temporary impacts would be limited to a corridor approximately 10 feet wide. Furthermore, JCEP would locate this corridor in the field (location by the dredging contractor) to minimize impacts to vegetation and aquatic resources. Regardless, NRH.8 does not affirmatively obligate JCEP to take any action, but rather obligates the City to "encourage" preservation of riparian vegetation "by placing buffer strips along waterways, along designated HUD floodways, with the exception of navigable waterways." JCEP will comply with any regulations the City has implemented in accordance with its obligation to so "encourage" preservation of riparian vegetation. Therefore, the City can find that the Application complies with NRH.8.

NRH.9 Coos Bay shall cooperation with local, state, and federal agencies in conserving and protecting fish and wildlife habitat, open spaces, and aesthetic and scenic values encompassed by areas enclosed by the Coos Bay-North Bend Water Board, Empire Lakes, and Mingus Park. This strategy is not intended to prohibit development in these areas, but rather to ensure that if development occurs it takes into consideration the ability of the land to support such development, i.e., soils, topography, habitat, natural processes, etc. This strategy recognizes that these areas are particularly sensitive and valuable resources.

<u>RESPONSE</u>: This policy creates no affirmative obligations for JCEP. Therefore, it does not apply to the Application.

7.5 ECONOMIC DEVELOPMENT

Goal 1, Policy 1.5 Support and cooperate with community and regional partners to encourage economic growth.

<u>RESPONSE</u>: The Application requests navigation reliability improvements for the Channel, which will primarily benefit large vessels that are navigating to and from the International Port of Coos Bay ("Port"). The Port is located outside the City limits but is an important regional entity that facilitates mass export and import of goods and commodities overseas and thus serves as a key driver of economic development throughout southwest Oregon. As a result, approving the Application and facilitating the NRIs will support community and regional partners and encourage economic growth.

Goal 6, Policy 6.1, 6.2 **Maximize the potential uses and benefits the waterfront and deep-water port offers to the city and region as a whole; Support the Port of Coos Bay in its development efforts for transportation linkage and to develop a deep-draft channel to accommodate large cargo vessels and increase shipping activities and water-dependent uses.**

RESPONSE: The purpose of this Application is to allow the NRIs, which together with other improvements for which JCEP is seeking approval from Coos County, will facilitate increased navigational safety and efficiency for large vessels in the Channel, thereby maximizing the Channel's economic benefits for the City and region as a whole by allowing increased economic input and output. Therefore, the Application complies with these policies.

LU.4 **Coos Bay shall not make major revisions to this Comprehensive Plan more frequently than every two years, if at all possible. "Major revisions" are those that have widespread and immediate impact beyond the subject area under consideration. The city recognizes that wholesale approval of frequent major revisions could ruin the integrity of this Plan.**

RESPONSE: The Application does not request "major revisions" to the CBCP. The text amendment only directly affects the NRI Site, which is approximately 3.3 acres in size and is located at an isolated, undeveloped point adjacent to the Channel. Approval of the Application will not, from a land development/conservation perspective, have a widespread and immediate impact beyond the NRI Site. Therefore, the City should find that the Application complies with this policy.

LU.5 **Coos Bay may make minor changes to this Comprehensive Plan on an infrequent basis as need and justification arises. "Minor changes" are those which do not have significant impact beyond the immediate area of the property under consideration. The city recognizes that wholesale approval of frequent minor changes could ruin the integrity of this Plan.**

<u>RESPONSE</u>: The Application requests an exception to Goal 16 to facilitate navigation reliability improvements to an isolated, undeveloped area that is approximately 3.3 acres in size. From a land development perspective, approval of the Application will not, from a land development/conservation standpoint, have a widespread, immediate, or significant impact beyond the NRI Site, and it will not require additional changes to the Plan. Further, for the reasons explained in this narrative, the City should find that the need for the amendments has been justified. Therefore, the City should find that the Application requests "minor changes" to the CBCP.

LU.7 Coos Bay shall anticipate that conflicts may arise between the various plan implementation strategies contained in this plan when applying the policies to specific situations. To resolve these conflicts, if and when such may occur, Coos Bay shall consider the long term environmental, economic, social, and energy consequences expected to result from applying one strategy in place of others, then to select and apply the strategy that results in maximum public benefit as supported by findings of fact. This strategy is based on the recognition that a viable conflict resolution process is essential to the success of any comprehensive plan.

<u>RESPONSE</u>: Approval of the Application will not cause any conflicts between various CBCP implementation strategies. As explained in this narrative, the Application is consistent with all applicable policies of the CBCP and with the Goal exception criteria of the OAR. Therefore, the City should find that there is no need to resolve any conflicts in order to approve the Application.

For the above reasons, the City can find that the Application complies with the policies of the CBCP that apply to the Application.

(b) The proposed amendment is in the public interest; and

<u>RESPONSE</u>: The CBCP amendment that this Application seeks is in the public interest because it will result in increased navigational safety and efficiency for large vessels in the Channel, which will allow increased economic input and output to flow through the Channel, which in turn will be an economic boon to the City and the region. The Application complies with this criterion.

(c) Approval of the amendment will not result in a decrease in the level-of-service for capital facilities and services identified in the Coos Bay capital improvement plan(s).

<u>RESPONSE</u>: Approving this Application will not result in a decrease in the level-of-service for any identified capital facilities and/or services identified in the Coos Bay capital improvement plan. Therefore, the City can find that the Application complies with this criterion.

2. Statewide Planning Goals

Post-acknowledgment plan amendments must be in compliance with the Goals. ORS 197.175(2)(a); *1000 Friends of Oregon v. LCDC*, 301 Or 447, 724 P2d 268 (1986). The rezoning is a post-acknowledgment plan amendment. Therefore, the City's decision must explain why the rezoning is in compliance with the Goals. Alternatively, if a Goal is not applicable, the City must adopt findings explaining why that Goal is not applicable. *Davenport v. City of Tigard*, 22 Or LUBA 577, 586 (1992). The responses below provide findings explaining why the Application is in compliance with the Goals, or alternatively, why the Goals are not applicable to the Application.

Goal 1: Citizen Involvement.

To develop a citizen involvement program that insures the opportunity for citizens to be involved in all phases of the planning process.

<u>RESPONSE</u>: Goal 1 requires local governments to adopt and administer programs to ensure the opportunity for citizens to be involved in all phases of the planning process. The City has adopted such a program for PAPAs, and it is incorporated within the CBDC and has been acknowledged by LCDC. Among other things, the City's program requires notice to citizens, agencies, neighbors, and other interested parties followed by multiple public hearings before the City makes a decision on the Application. These procedures will provide ample opportunity for citizen involvement in all phases of the Application. The City should find that, upon compliance with its notice and hearing procedures, the City has reviewed the Application in a manner consistent with Goal 1. *See Wade v. Lane County*, 20 Or LUBA 369, 376 (1990) (Goal 1 is satisfied as long as the local government follows its acknowledged citizen involvement program).

In this case, as explained above in response to CBDC 17.215.020(1), the City would typically follow the Type III review and decision-making procedures of CBDC 17.130.100 when reviewing the Application. However, a modification to that process is appropriate in this case in order to comply with state law. CBDC 17.130.100 ("Type III procedure") provides that a Type III application "will be considered at one or more public hearings before the city's planning commission." The Application does not as a matter of course go before the City Council. *See* CBDC 17.130.130(5)(c) (providing for City Council consideration of a Type III application but only in event of appeal). The City should find that state law requires the local governing body to take final action to approve any post-acknowledgment comprehensive plan amendment before it can become final. *Housing Land Advocates*, __ Or LUBA at __ (LUBA No. 2016-031, May 23, 2016). The Application includes a request for an exception to Goal 16, which is a request for a plan text amendment. Therefore, pursuant to *Housing Land Advocates*, the City should schedule the Application for final action by the City Council after the Planning Commission's initial recommendation.

In sum, the City should apply its Type III process in CBDC 17.30.100 to review and decide upon the Application, subject to also providing for a hearing and final decision on the Application by the City Council. Upon doing so, the City should find that it has complied with Goal 1.

Goal 2: Land Use Planning.

To establish a land use planning process and policy framework as a basis for all decisions and actions related to use of land and to assure an adequate factual base for such decisions and actions.

<u>RESPONSE</u>: Goal 2 requires establishing a land use planning process and policy framework as a basis for all land use decisions and requires an adequate factual base for all land use decisions. In the present case, the provisions of the CBDC and the ORS establish the land use planning process and policy framework for considering the Application. Further, the enclosed materials, including this narrative, demonstrate that the Application satisfies all applicable approval criteria. As such, there is an adequate factual base for the City's decision.

Additionally, Goal 2 requires that the City coordinate its review and decision on the Application with appropriate government agencies. In its review of the Application, the City has provided notice and an opportunity to comment to affected government agencies, including nearby cities and the State Departments of Land Conservation and Development and Transportation.

The City should find that the Application is consistent with Goal 2.

Goal 3: Agricultural Lands.

To maintain and preserve agricultural lands.

<u>RESPONSE</u>: Goal 3 concerns agricultural lands. The NRI Site does not include any agricultural lands, and approval of the amendments will not impact any agricultural lands. Therefore, the City should find that Goal 3 is not applicable to the Application.

Goal 4: Forest Lands.

To conserve forest lands by maintaining the forest land base and to protect the state's forest economy by making possible economically efficient forest practices that assure the continuous growing and harvesting of forest tree species as the leading use on forest land consistent with sound management of soil, air, water, and fish and wildlife resources and to provide for recreational opportunities and agriculture.

RESPONSE: Goal 4 protects forest lands. The NRI Site does not include any forest lands, and approval of the amendments will not impact any forest lands. Therefore, the City should find that Goal 4 is not applicable to the Application.

Goal 5: Natural Resources, Scenic and Historic Areas, and Open Spaces.

To protect natural resources and conserve scenic and historic areas and open spaces.

RESPONSE: Goal 5 protects certain types of inventoried resources. The NRI Site does not include any inventoried Goal 5 resources, and approval of the Application will not impact any Goal 5 inventoried resources. Therefore, the City should find that Goal 5 is not applicable to the Application.

Goal 6: Air, Water and Land Resources Quality.

To maintain and improve the quality of the air, water and land resources of the state.

RESPONSE: Goal 6 requires comprehensive plans to follow multiple guidelines to conserve the quality of air, water and land resources in the state. In a post-acknowledgment plan amendment proceeding, in order to satisfy Goal 6, the City is only required to find that it is reasonable to expect that federal and state environmental standards will be met in the future when permits for the dredging are sought. *Nicita v. City of Oregon City*, 74 Or LUBA 176 (2016). For two reasons, the City should find that it is reasonable to expect that JCEP's proposed dredging will satisfy federal and state environmental standards. First, JCEP has applied for state and federal approval of dredging activities at the NRI Site, and there is no indication that JCEP is precluded as a matter of law from obtaining approval of these applications. Second, the proposed map amendments do not alter existing City protections provided by the CBEMP restricting dredging activities, which protections have been previously deemed consistent with Goal 6, and are addressed later in this narrative.

For the above reasons, the Application complies with Goal 6.

Goal 7: Areas Subject to Natural Hazards.

To protect people and property from natural hazards.

<u>RESPONSE</u>: Goal 7 requires local governments to identify and plan for natural hazard areas and coordinate their natural hazard plans and programs with state agencies. This Application complies with Goal 7 because it will not increase the likelihood of damage to people or property within the City from natural hazards.

Goal 8: Recreational Needs.

To satisfy the recreational needs of the citizens of the state and visitors, and where appropriate, to provide for the siting of necessary recreational facilities including destination resorts.

<u>RESPONSE</u>: Goal 8 does not apply to the Application because it does not involve recreation or inventoried recreation areas, facilities, or opportunities.

Goal 9: Economic Development.

To provide adequate opportunities throughout the state for a variety of economic activities vital to the health, welfare, and prosperity of Oregon's citizens.

<u>RESPONSE</u>: The Application complies with Goal 9. The purpose of the Application is to complete the NRIs, which in turn will facilitate a broader operational window, and increase safety and efficiency of transit, in the Channel. This will be a boon to the economic prospects for the City and the state because it will make the Channel safer and more efficient for productive economic enterprises of the kind that provide opportunities to Oregonians.

Goal 10: Housing.

To provide for the housing needs of the citizens of the state.

<u>RESPONSE</u>: Goal 10 and its implementing rules require each local government to inventory the supply of buildable residential lands and to ensure that the supply of such buildable lands meets the local government's anticipated housing needs. The Application will not affect the supply of residential lands in the City. Therefore, the City should find that the Application is consistent with Goal 10, to the extent it is applicable.

Goal 11: Public Facilities and Services.

To plan and develop a timely, orderly and efficient arrangement of public facilities and services to serve as a framework for urban and rural development.

RESPONSE: Goal 11 does not apply to the Application because the Application does not involve or affect public facilities and services as a framework for development.

Goal 12: Transportation.

To provide and encourage a safe, convenient and economic transportation system.

RESPONSE: The Application complies with Goal 12. Goal 12 directs local governments to plan transportation systems that consider all modes of transportation, including water, that facilitate the flow of goods and services so as to strengthen the local and regional economy, that conserve energy, and that avoid principal reliance on one mode of transportation. The Application furthers these goals by supporting safer and more efficient use of the Channel for water transportation. This safer and more efficient use of the Channel will conserve energy that is currently wasted when, outside the Channel's operational window, vessels wait outside the Channel, using fuel and adding time and expense to transit.

Goal 13: Energy Conservation.

To conserve energy.

RESPONSE: The Application complies with Goal 13. Goal 13 directs local governments to manage land use so as to maximize the conservation of all forms of energy. The Application will facilitate maximal energy conservation by increasing the safety and efficiency of vessel transit of the Channel, and by increasing the Channel's operational window. This will reduce the amount of time vessels spend waiting to enter and navigate the Channel, due to environmental conditions that exceed those required by the Pilots for a safe vessel transit, which will increase the efficiency of material transportation and reduce energy waste from inefficiency of transportation.

Goal 14: Urbanization.

To provide for an orderly and efficient transition from rural to urban land use.

RESPONSE: Goal 14 does not apply to the Application, which does not involve urban development on rural land.

Goal 15: Willamette River Greenway.

To protect, conserve, enhance and maintain the natural, scenic, historical, agricultural, economic and recreational qualities of lands along the Willamette River as the Willamette River Greenway.

<u>RESPONSE</u>: Goal 15 only applies to lands along the Willamette River. The Modification Sites are not located along the Willamette River or in the Willamette River Greenway. Approval of the amendments will not impact the Willamette River of the Willamette River Greenway. Therefore, the City should find that Goal 15 is not applicable to the Application.

Goal 16: Estuarine Resources.

To recognize and protect the unique environmental, economic, and social values of each estuary and associated wetlands; and to protect, maintain, where appropriate develop, and where appropriate restore the long-term environmental, economic, and social values, diversity and benefits of Oregon's estuaries.

…

MANAGEMENT UNITS

Diverse resources, values, and benefits shall be maintained by classifying the estuary into distinct water use management units. When classifying estuarine areas into management units, the following shall be considered in addition to the inventories:

1. Adjacent upland characteristics and existing land uses;

2. Compatibility with adjacent uses;

3. Energy costs and benefits; and

4. The extent to which the limited water surface area of the estuary shall be committed to different surface uses.

At a minimum, the following kinds of management units shall be established:

1. Natural -- in all estuaries, areas shall be designated to assure the protection of significant fish and wildlife habitats, of continued biological productivity within the estuary, and of scientific, research, and educational needs. These shall be managed to preserve the natural resources in recognition of dynamic, natural, geological, and evolutionary processes. Such areas shall include, at a minimum, all

major tracts of salt marsh, tideflats, and seagrass and algae beds. Permissible uses in natural management units shall include the following:

a. Undeveloped low-intensity, water-dependent recreation;

b. Research and educational observations;

c. Navigation aids, such as beacons and buoys;

d. Protection of habitat, nutrient, fish, wildlife, and aesthetic resources;

e. Passive restoration measures;

f. Dredging necessary for on-site maintenance of existing functional tidegates and associated drainage channels and bridge crossing support structures;

g. Riprap for protection of uses existing as of October 7, 1977, unique natural resources, historical and archaeological values; and public facilities; and

h. Bridge crossings.

Where consistent with the resource capabilities of the area and the purposes of this management unit the following uses may be allowed:

a. Aquaculture which does not involve dredge or fill or other estuarine alteration other than incidental dredging for harvest or benthic species or removable in-water structures such as stakes or racks;

b. Communication facilities;

c. Active restoration of fish and wildlife habitat or water quality and estuarine enhancement;

d. Boat ramps for public use where no dredging or fill for navigational access is needed; and

e. Pipelines, cables, and utility crossings, including incidental dredging necessary for their installation.

f. Installation of tidegates in existing functional dikes.

g. Temporary alterations.

h. Bridge crossing support structures and dredging necessary for their installation.

A use or activity is consistent with the resource capabilities of the area when either the impacts of the use on estuarine species, habitats, biological productivity and water quality are not significant or that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner to protect significant wildlife habitats, natural biological productivity, and values for scientific research and education.

2. Conservation -- in all estuaries, except those in the overall Oregon Estuary Classification which are classed for preservation, areas shall be designated for long-term uses of renewable resources that do not require major alteration of the estuary, except for the purpose of restoration. These areas shall be managed to conserve the natural resources and benefits. These shall include areas needed for maintenance and enhancement of biological productivity, recreational and aesthetic uses, and aquaculture. They shall include tracts of significant habitat smaller or of less biological importance than those in (1) above, and recreational or commercial oyster and clam beds are not included in (1) above. Areas that are partially altered and adjacent to existing development of moderate intensity which do not possess the resource characteristics of natural or development units shall also be included in this classification. Permissible uses in conservation management units shall be all uses listed in (1) above except temporary alterations. Where consistent with the resource capabilities of the area and the purposes of this management unit the following uses may be allowed:

a. High-intensity water-dependent recreation, including boat ramps, marinas and new dredging for boat ramps and marinas;

b. Minor navigational improvements;

c. Mining and mineral extraction, including dredging necessary for mineral extraction;

d. Other water dependent uses requiring occupation of water surface area by means other than dredge or fill;

e. Aquaculture requiring dredge or fill or other alteration of the estuary;

f. Active restoration for purposes other than those listed in 1(d).

g. Temporary alterations.

A use or activity is consistent with the resource capabilities of the area when ether the impacts of the use on estuarine species, habitats, biological productivity, and water quality are not significant or that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner which conserves long-term renewable resources, natural biologic productivity, recreational and aesthetic values and aquaculture.

3. Development -- in estuaries classified in the overall Oregon Estuary Classification for more intense development or alteration, areas shall be designated to provide for navigation and other identified needs for public, commercial, and industrial water-dependent uses, consistent with the level of development or alteration allowed by the overall Oregon Estuary Classification. Such areas shall include deep-water areas adjacent or in proximity to the shoreline, navigation channels, subtidal areas for in-water disposal of dredged material and areas of minimal biological significance needed for uses requiring alterations of the estuary not included in (1) and (2) above. Permissible uses in areas managed for water-dependent activities shall be navigation and water-dependent commercial and industrial uses. As appropriate the following uses shall also be permissible in development management units:

a. Dredge or fill, as allowed elsewhere in the goal;

b. Navigation and water-dependent commercial enterprises and activities;

c. Water transport channels where dredging may be necessary;

d. Flow-lane disposal of dredged material monitored to assure that estuarine sedimentation is consistent with the resource capabilities and purposes of affected natural and conservation management units.

e. Water storage areas where needed for products used in or resulting from industry, commerce, and recreation;

f. Marinas.

Where consistent with the purposes of this management unit and adjacent shorelands designated especially suited for water-dependent uses or designated for waterfront redevelopment, water-related and nondependent, nonrelated uses not requiring dredge or fill; mining and mineral extraction; and activities identified in (1) and (2) above shall also be appropriate. In designating areas for these uses, local

governments shall consider the potential for using upland sites to reduce or limit the commitment of the estuarine surface area for surface uses.

<u>RESPONSE</u>: Goal 16 requires that local governments divide all estuaries that Goal 16 protects into, at a minimum, the above "management units"--Natural, Conservation, and Development. The CBEMP complies with Goal 16 by creating and maintaining three "Aquatic Management Units" and seven "Shoreland Management Units" including the baseline Natural, Conservation, and Development management units that Goal 16 requires. The NRI Site is currently zoned 52-NA (a natural aquatic unit). This Application seeks to amend the CBEMP to apply the DDNC-DA (a development aquatic) management unit to the NRI Site in order to allow dredging necessary to complete the NRIs. Such dredging is not allowed in natural management units. Therefore, a Goal 16 exception is required to rezone the NRI Site to DDNC-DA.

Goal 17: Coastal Shorelands.

To conserve, protect, where appropriate, develop and where appropriate restore the resources and benefits of all coastal shorelands, recognizing their value for protection and maintenance of water quality, fish and wildlife habitat, water-dependent uses, economic resources and recreation and aesthetics. The management of these shoreland areas shall be compatible with the characteristics of the adjacent coastal waters; and

To reduce the hazard to human life and property, and the adverse effects upon water quality and fish and wildlife habitat, resulting from the use and enjoyment of Oregon's coastal shorelands.

<u>RESPONSE</u>: Goal 17 regulates coastal shorelands. The NRI Site does not include any designated coastal shorelands. Moreover, the proposed amendments will not impact any designated coastal shorelands. Therefore, the City should find that Goal 17 is not applicable to the Application.

Goal 18: Beaches and Dunes.

To conserve, protect, where appropriate develop, and where appropriate restore the resources and benefits of coastal beach and dune areas; and

To reduce the hazard to human life and property from natural or man-induced actions associated with these areas.

<u>RESPONSE</u>: Goal 18 concerns beaches and dunes. The NRI Site does not include any designated beaches or dunes. Moreover, the proposed amendments will not impact any designated beaches or dunes. Thus, the City should find that Goal 18 is not applicable to the Application.

Goal 19: Ocean Resources.

To conserve marine resources and ecological functions for the purpose of providing long-term ecological, economic, and social value and benefits to future generations.

RESPONSE: Goal 19 calls for the conservation of ocean resources. The NRI Site does not include or abut any ocean resources, and the proposed amendments will not impact any ocean resources. Therefore, the City should find that Goal 19 is not applicable to the Application.

For the above reasons, the City can find that the Application complies with the Goals.

B. Goal 16 "Reasons" Exception:

ORS 197.732

(2) A local government may adopt an exception to a goal if:

…

(c) The following standards are met:

(A) Reasons justify why the state policy embodied in the applicable goals should not apply;

(B) Areas that do not require a new exception cannot reasonably accommodate the use;

(C) The long term environmental, economic, social and energy consequences resulting from the use at the proposed site with measures designed to reduce adverse impacts are not significantly more adverse than would typically result from the same proposal being located in areas requiring a goal exception other than the proposed site; and

(D) The proposed uses are compatible with other adjacent uses or will be so rendered through measures designed to reduce adverse impacts.

RESPONSE: The above criteria are duplicative with the same criteria set forth in OAR 660-004-0020, which implements ORS 197.732. Therefore, this Application responds to the above criteria in the section immediately below that is devoted to OAR 660-004-0020. For the reasons explained below, the proposed exception complies with the administrative rules, and compliance with these administrative rules will ensure compliance with these statutory provisions.

OAR 660-004-0020

(1) If a jurisdiction determines there are reasons consistent with OAR 660-004-0022 to use resource lands for uses not allowed by the applicable Goal or to allow public facilities or services not allowed by the applicable Goal, the justification shall be set forth in the comprehensive plan as an exception. As provided in OAR 660-004-0000(1), rules in other divisions may also apply.

RESPONSE: This Application presents "reasons" (as set forth in more detail below) consistent with OAR 660-004-0022 why Goal 16 should not apply to the NRI Site. This Application proposes that the City set forth in its comprehensive plan the justification for a Goal 16 exception at the NRI Site. Therefore, this Application satisfies this approval criterion.

(2) The four standards in Goal 2 Part II(c) required to be addressed when taking an exception to a goal are described in subsections (a) through (d) of this section, including general requirements applicable to each of the factors:

(a) "Reasons justify why the state policy embodied in the applicable goals should not apply." The exception shall set forth the facts and assumptions used as the basis for determining that a state policy embodied in a goal should not apply to specific properties or situations, including the amount of land for the use being planned and why the use requires a location on resource land;

RESPONSE: This standard requires identifying "reasons" why the state policy in Goal 16 should not apply to the NRI Site. OAR 660-004-0022 identifies the types of "reasons" that may be used to justify the exception. JCEP's responses to that rule below justify the proposed Goal 16 exception.

OAR 660-004-0022

An exception under Goal 2, Part II(c) may be taken for any use not allowed by the applicable goal(s) or for a use authorized by a statewide planning goal that cannot comply with the approval standards for that type of use. The types of reasons that may or may not be used to justify certain types of uses not allowed on resource lands are set forth in the following sections of this rule. Reasons that may allow an exception to Goal 11 to provide sewer service to rural lands are described in OAR 660-011-0060. Reasons that may allow transportation facilities and improvements that do not meet the requirements of OAR 660-012-0065 are provided in OAR 660-012-0070. Reasons that rural lands are irrevocably committed to urban levels of development are provided in OAR 660-014-0030. Reasons that may justify the establishment of new urban development on undeveloped rural land are provided in OAR 660-014-0040.

(1) For uses not specifically provided for in this division, or in OAR 660-011-0060, 660-012-0070, 660-014-0030 or 660-014-0040, the reasons shall justify why the state policy embodied in the applicable goals should not apply. Such reasons include but are not limited to the following:

(a) There is a demonstrated need for the proposed use or activity, based on one or more of the requirements of Goals 3 to 19; and either

(A) A resource upon which the proposed use or activity is dependent can be reasonably obtained only at the proposed exception site and the use or activity requires a location near the resource. An exception based on this paragraph must include analysis of the market area to be served by the proposed use or activity. That analysis must demonstrate that the proposed exception site is the only one within the market area at which the resource depended upon can be reasonably obtained; or

(B) The proposed use or activity has special features or qualities that necessitate its location on or near the proposed exception site.

RESPONSE: The Application must show a "demonstrated need" for the proposed use or activity based on the requirements of one or more of Goals 3 to 19. The "demonstrated need" for the NRIs is based primarily on Goals 9 and 12. As explained in

Section II. of this narrative above, structural restrictions on the Channel cause significant transit delays and unduly increase required directional changes during transit through the Channel. Delays are measured in the total transit time, from the time the vessel arrives off the coast of Coos Bay until it returns offshore after calling at its local Coos Bay destination. These delays decrease the efficiency and competitiveness of maritime commerce on a global scale, thereby jeopardizing continued success for maritime commerce in Coos Bay. Minimizing delay is a pressing need because companies that utilize the port of Coos Bay have identified potential new customers in Asia that desire to export cargo using bulk carriers that are slightly larger than the ships typically calling today. Various marine terminal businesses within Coos Bay require assurances that terminals can efficiently accommodate larger dimension bulk carriers in the future. The NRIs will allow companies to secure emerging opportunities to export products with today's larger vessels, including bulk carriers of up to 299.9 meters (983.3 feet) in length, 49 meters (160.8 feet) in beam, and 11.9 meters (39 feet) in draft. With respect to the Liquefied Natural Gas ("LNG") facility that JCEP proposes to develop in the lower bay, JCEP and the Pilots believe the NRIs are essential to achieve the required number of LNG vessel transits needed to lift the JCEP design annual LNG production volume. Excessive delays in LNG carrier transit in the Channel, to and from the LNG terminal, could result in a shore storage tank topping situation, requiring JCEP to curtail LNG production.

The JCEP estimate that dredging to complete navigation efficiency and reliability improvements at the NRI Sites will allow JCEP to export the full capacity of the optimized design production of 7.8 mtpa from JCEP's LNG terminal on the North Spit. To satisfy this need, JCEP proposes the NRIs to improve the navigation efficiency and reliability for vessels transiting the Channel by widening an extremely restrictive, unavoidable turn in the Channel. The NRIs will fulfill a demonstrated need for continued and enhanced shipping within the Bay; consistent with the Policy objectives of Goals 9 and 12.

The Application must also provide "reasons" that "justify why the state policy embodied in the applicable goals should not apply." OAR 660-004-0022(1)(a)(B) provides that a sufficient "reason" is that the "proposed use or activity has special features or qualities that necessitate its location on or near the proposed exception site." That is the case here. JCEP seeks to improve navigation in the Channel and to do so has selected the NRI Site that corresponds to the area of the Channel in the City that is most in need of improvement in order to facilitate safer and more efficient navigation. Therefore, this Application provides reasons why the "proposed use or activity has special features or qualities that necessitate its location on or near the proposed exception site."

(8) Goal 16 - Other Alterations or Uses: An exception to the requirement limiting dredge and fill or other reductions or degradations of natural values to water-dependent uses or to the natural and conservation management unit requirements limiting alterations and uses is justified, where consistent with ORS chapter 196, in any of the circumstances specified in subsections (a) through (e) of this section:

<u>RESPONSE</u>: The Application seeks an exception to the requirement limiting dredging in an area that is currently designated, in accordance with Goal 16, as a natural management unit. As explained below, the exception is justified because the Application will authorize dredging to maintain adequate depth to permit continuation of the present level of navigation as contemplated by OAR 660-004-0022(8)(b).

…

(b) Dredging to maintain adequate depth to permit continuation of the present level of navigation in the area to be dredged.

<u>RESPONSE</u>: The Application proposes dredging to maintain adequate depth to permit continuation of the presently authorized level of navigation at the NRI Site. As background, the Channel was initially authorized in 1899 and since then has undergone ten modifications. Most recently, the Channel was expanded from -35 feet to -37 feet in 1997 to allow for the safe navigation and transit of Coos Bay for the size of ships prevalent during that time period.

However, as explained above, environmental conditions, including wind, fog, and currents have caused the Pilots to impose ever more limiting restrictions on when vessels may safely transit the Channel. These restrictions, in turn, cause significant delays and thus prevent the Channel from operating at maximum efficiency. Minimizing delay is a pressing need because companies that utilize the International Port of Coos Bay have identified potential new customers in Asia that desire to export cargo using bulk carriers through the Channel. Various marine terminal businesses within Coos Bay require assurances that the Channel can efficiently accommodate bulk carriers.

Dredging to complete the NRI Sites will increase the operational window to safely transit any vessel through the Channel. The NRIs are designed to increase the environmental operating windows for all ships entering Coos Bay by softening critical turns, relocating aids to navigation, and reducing the required Channel directional changes. The NRIs are designed to reduce entry and departure delays and allow for more efficient vessel transits through the Channel for the size of vessels entering the Port today.

For JCEP and its LNG terminal, the NRI enhancements will allow for transit of LNG vessels of similar overall dimensions to those listed in the July 1, 2008 USCG Waterway Suitability Report, the USCG Letter of Recommendation dated May 10, 2018 and USCG letter confirmation dated November 7, 2018 *see* Exhibit 4, but under a broader range of weather conditions, specifically higher wind speeds. As a result, JCEP estimates that, upon completion of the NRIs, JCEP will be able to export the full capacity of the optimized design production of the LNG Terminal on a consistent annual basis.

For these reasons, the dredging associated with the NRIs will maintain adequate depth to permit continuation of the presently allowed level of navigation, yet allow that navigation to occur more efficiently, safely, and reliably. This standard is met.

(f) In each of the situations set forth in subsections (7)(a) to (e) of this rule, the exception must demonstrate that the proposed use and alteration (including, where applicable, disposal of dredged materials) will be carried out in a manner that minimizes adverse impacts upon the affected aquatic and shoreland areas and habitats.

RESPONSE: JCEP will complete its proposed NRIs in a manner that minimizes adverse impacts upon the affected aquatic and shoreland areas and habitats. To complete the NRIs, JCEP will dredge within the Channel and adjacent to the Channel at the NRI Sites. JCEP will minimize adverse impacts for the reasons explained below.

JCEP plans to perform capital and maintenance dredging during the ODFW-approved in-water work window (October 1 to February 15) to reduce impacts to sensitive life stages of fish in the bay.

JCEP will use various dredging methods to minimize the effects of the NRIs on water turbidity within the Bay. JCEP will use best management practices (including cutter head suction, clamshell, and hopper dredging) associated with dredging to reduce turbidity effects, and as a result of those methods JCEP expects increased water turbidity as a result of the NRIs to be temporary and limited to the immediate vicinity of dredging operations. Furthermore, JCEP does not anticipate oil spills or toxic discharges to occur when constructing the NRIs, and JCEP will use precautions to avoid either. Dredging and material transport vessels will carry small volumes of petroleum in comparison to large bulk carriers and Panamax vessels that regular traverse Coos Bay. JCEP will use best management practices to avoid and minimize spills or discharges during dredging operations and dredged material transport, including the implementation of spill containment plans.

Dredging equipment and material transport vessels related to the NRIs may generate temporary noise disturbances. However, the noise will be localized to the immediate dredging area. JCEP does not anticipate that noise levels will have more than temporary effects on the behavior of aquatic species in the area of the NRI Sites.

JCEP's environmental consultant has further evaluated potential adverse impacts associated with the dredging activities and describes ways by which JCEP will minimize such adverse impacts. *See* DEA memorandum in Exhibit 5.

For these reasons, the City should find that the Application satisfies this standard.

(b) "Areas that do not require a new exception cannot reasonably accommodate the use." The exception must meet the following requirements:

RESPONSE: The NRIs are location-specific. Their purpose is to improve safety and navigational efficiency in the Channel. There are no other areas that could accommodate the use. Therefore, "areas that do not require a new exception cannot reasonably accommodate the use." The Application satisfies this criterion.

(A) The exception shall indicate on a map or otherwise describe the location of possible alternative areas considered for the use that do not require a new exception. The area for which the exception is taken shall be identified;

RESPONSE: As explained above, the NRIs are location-specific and it would not be possible for JCEP to locate them anywhere that does not require a new exception. Exhibit 1 identifies the NRI Site, which is the area where JCEP proposes to locate the exception. The Application satisfies this criterion.

(B) To show why the particular site is justified, it is necessary to discuss why other areas that do not require a new exception cannot reasonably accommodate the proposed use. Economic factors may be considered along with other relevant factors in determining that the use cannot reasonably be accommodated in other areas. Under this test the following questions shall be addressed:

(i) Can the proposed use be reasonably accommodated on resource land that would not require an

exception, including the density of uses on nonresource land? If not, why not?

(ii) Can the proposed use be reasonably accommodated on resource land that is already irrevocably committed to nonresource uses not allowed by the applicable Goal, including resource land in existing unincorporated communities, or by increasing the density of uses on committed lands? If not, why not?

(iii) Can the proposed use be reasonably accommodated inside an urban growth boundary? If not, why not?

(iv) Can the proposed use be reasonably accommodated without the provision of a proposed public facility or service? If not, why not?

RESPONSE: As explained above, the NRIs are location-specific and it would not be possible for JCEP to locate them anywhere that does not require a new exception. Whether or not the NRIs can be accommodated inside a UGB, they still require a Goal 16 exception and they still must be located at the NRI sites, so this question is not applicable to an analysis of whether alternative areas that do not require an exception cannot accommodate the NRIs. Moreover, the NRIs relate to a public facility and will not require any additional public facilities or services to construct. The Application satisfies this criterion.

(C) The "alternative areas" standard in paragraph B may be met by a broad review of similar types of areas rather than a review of specific alternative sites. Initially, a local government adopting an exception need assess only whether those similar types of areas in the vicinity could not reasonably accommodate the proposed use. Site specific comparisons are not required of a local government taking an exception unless another party to the local proceeding describes specific sites that can more reasonably accommodate the proposed use. A detailed evaluation of specific alternative sites is thus not required unless such sites are specifically described, with facts to support the assertion that the sites are more reasonable, by another party during the local exceptions proceeding.

<u>RESPONSE</u>: As explained above, the NRIs are location-specific and so it is not possible for JCEP to locate them anywhere that does not require a new exception. There are no "alternative areas" that can accommodate the NRIs. The Application satisfies this criterion.

(c) "The long-term environmental, economic, social and energy consequences resulting from the use at the proposed site with measures designed to reduce adverse impacts are not significantly more adverse than would typically result from the same proposal being located in areas requiring a goal exception other than the proposed site." The exception shall describe: the characteristics of each alternative area considered by the jurisdiction in which an exception might be taken, the typical advantages and disadvantages of using the area for a use not allowed by the Goal, and the typical positive and negative consequences resulting from the use at the proposed site with measures designed to reduce adverse impacts. A detailed evaluation of specific alternative sites is not required unless such sites are specifically described with facts to support the assertion that the sites have significantly fewer adverse impacts during the local exceptions proceeding. The exception shall include the reasons why the consequences of the use at the chosen site are not significantly more adverse than would typically result from the same proposal being located in areas requiring a goal exception other than the proposed site. Such reasons shall include but are not limited to a description of: the facts used to determine which resource land is least productive, the ability to sustain resource uses near the proposed use, and the long-term economic impact on the general area caused by irreversible removal of the land from the resource base. Other possible impacts to be addressed include the effects of the proposed use on the water table, on the costs of improving roads and on the costs to special service districts.

<u>RESPONSE</u>: The NRI Site is the only possible site at which JCEP can make the improvements necessary to increase the safety and efficiency of vessel navigation in the Channel. The NRI Site is a location that JCEP identified where, as explained above, there is an extremely restrictive, unavoidable turn in the Channel. This turn is responsible for significant delays in vessel transit in the Channel. Although JCEP could widen other areas of the Channel to improve navigational efficiency, the NRI Site is the site most in need of improvement to achieve the results in improved efficiency and safety of navigation, that is required within the Channel. Therefore, in order to improve the safety and efficiency of such transit, JCEP must widen the Channel at the locations of this turn (the NRI Site). There are no alternative sites requiring a Goal exception at which JCEP can make the necessary improvements. Moreover, the long-term economic, environmental, social and energy costs of widening other areas of the Channel that JCEP could feasibly widen (although doing so would not achieve the results in improved efficiency and safety of navigation that JCEP desires) are not materially different from the same consequences of making the NRIs at the NRI Site. All such areas are nearby each other and are within the Channel. Furthermore, the Channel itself is a fixed location that cannot be moved. Therefore, the City should find that the Application satisfies this criterion.

(d) "The proposed uses are compatible with other adjacent uses or will be so rendered through measures designed to reduce adverse impacts." The exception shall describe how the proposed use will be rendered compatible with adjacent land uses. The exception shall demonstrate that the proposed use is situated in such a manner as to be compatible with surrounding natural resources and resource management or production practices. "Compatible" is not intended as an absolute term meaning no interference or adverse impacts of any type with adjacent uses.

<u>RESPONSE</u>: The NRI Sites located immediately adjacent to the existing Channel. This criterion, therefore, requires JCEP to demonstrate that JCEP's proposal for the NRIs is designed to reduce adverse impacts on the waters of the Bay and the Channel, and to be compatible with the use of the Channel for transportation. The proposal is compatible with land uses in the Channel (including transit) because it involves dredging below the surface of the water for the purpose of increasing safety and efficiency in navigating the Channel. The proposal is compatible with land uses in the Channel because it is designed to make them easier and more effective. Furthermore, the proposal is designed to reduce adverse environmental impacts upon the waters of the bay and the Channel. *See* DEA memo included in <u>Exhibit 5</u>.

(3) If the exception involves more than one area for which the reasons and circumstances are the same, the areas may be considered as a group. Each of the areas shall be identified on a map, or their location otherwise described, and keyed to the appropriate findings.

<u>RESPONSE</u>: This Application seeks a Goal 16 exception for one NRI site in the City. The remaining NRI Sites are located outside of the City's jurisdiction. <u>Exhibit 1</u> includes a map that identifies the NRI Sites.

(4) For the expansion of an unincorporated community described under OAR 660-022-0010, including an urban unincorporated community pursuant to OAR 660-022-0040(2), the reasons exception requirements necessary to address standards 2 through 4 of Goal 2, Part II(c), as described in of subsections (2)(b), (c) and (d) of this rule, are modified to also include the following:

(a) Prioritize land for expansion: First priority goes to exceptions lands in proximity to an unincorporated community boundary. Second priority goes to land designated as marginal land. Third priority goes to land designated in an acknowledged comprehensive plan for agriculture or forestry, or both. Higher priority is given to land of lower capability site class for agricultural land, or lower cubic foot site class for forest land; and

(b) Land of lower priority described in subsection (a) of this section may be included if land of higher priority is inadequate to accommodate the use for any of the following reasons:

(A) Specific types of identified land needs cannot be reasonably accommodated on higher priority land;

(B) Public facilities and services cannot reasonably be provided to the higher priority area due to topographic or other physical constraints; or

(C) Maximum efficiency of land uses with the unincorporated community requires inclusion of lower priority land in order to provide public facilities and services to higher priority land.

<u>RESPONSE</u>: This Application does not seek to expand an unincorporated community. Therefore, these approval criteria do not apply to the Application.

C. Approval For Estuarine and Coastal Shoreland Uses and Activities Permit

1. CBDC

CBDC - 17.370.010 General

Uses and activities permitted by the Coos Bay estuary management plan are subject to general and special conditions and policies to comply with statewide

planning goals and the Coos Bay Estuary Plan as adopted by the city of Coos Bay. Compliance with these conditions and policies must be verified; therefore, all uses and activities under jurisdiction of the Coos Bay estuary management plan must be reviewed.

RESPONSE: CBDC 17.370.010 makes the general and special conditions of the CBEMP approval criteria for this Application. The DDNC-DA CBEMP zone allows new and maintenance dredging, which this Application seeks approval for, subject to general conditions (CBEMP Policies #17 and #18) and a special condition (mitigation of adverse impacts - CBEMP Policy #5). As explained below, CBEMP Policy #5, in turn, triggers consideration of CBEMP Policies #4 and #4a. Therefore, this Application addresses these policies.

JCEP also requests approval of an accessory temporary dredge line in the 52-NA, 53-CA, 54-DA, and 55-CA CBEMP management units. The dredge line is described in the DEA memo included in Exhibit 5, and it is depicted in the figures included in Exhibit 6. Finally, JCEP requests approval of an accessory buoy in the 52-NA management unit. The buoy is located south of the Channel and is depicted in Exhibit 7.

DDNC-DA Zone - General Conditions For Approval of "New and Maintenance Dredging"

CBEMP Policy #17 - Protection of "Major Marshes" and "Significant Wildlife Habitat" in Coastal Shorelands

Local government shall protect major marshes, significant wildlife habitat, coastal headlands, and exceptional aesthetic resources located within the Coos Bay Coastal Shorelands Boundary and included in the Plan inventory, except where exceptions allow otherwise. Local government shall consider:

A. "major marshes" to include areas identified in the Goal #17 "Linkage Matrix" and the Shoreland Values Inventory map;

B. "significant wildlife habitats," coastal headlands and exceptional aesthetic resources to include those areas identified on the map "Shoreland Values."

This strategy shall be implemented through:

A. plan designations and use and activity matrices set forth elsewhere in this Plan that limit uses in these special areas to those that are consistent with protection of natural values; and

B. through use of the "Shoreland Values" map that identifies such special areas and restricts uses and activities therein to uses that are consistent with the protection of natural values. Such uses may include propagation and selective harvesting of forest products consistent with the Oregon Forest Practices Act, grazing, harvesting wild crops, and low-intensity water-dependent recreation.

This strategy recognizes that special protective consideration must be given to key resources in coastal shorelands over and above the protection afforded such resources elsewhere in this Plan.

RESPONSE: According to the Shoreland Values map, there are no inventoried resources at the NRI Site for which Policy #17 requires protection. Therefore, CBEMP Policy #17 does not apply to JCEP's request for approval to complete the NRIs.

CBEMP Policy #18 - Protection of Historical and Archaeological Sites Within Coastal Shorelands

Local government shall provide special protection to historic and archaeological sites located within the Coos Bay Coastal Shorelands Boundary, except where Exceptions allow otherwise. These sites are identified in the section entitled: "Coastal Shoreland Values Requiring Mandatory Protection" and on the "Special Considerations Map." Further, local government shall continue to refrain from widespread dissemination of site-specific information about identified archaeological sites.

This strategy shall be implemented by requiring review of all development proposals involving an archaeological or historical site to determine whether the project as proposed would protect the archaeological and historical values of the site.

The development proposal, when submitted, shall include a site development plan showing, at a minimum, all areas proposed for excavation, clearing and construction. Within three (3) working days of receipt of the development proposal, the local government shall notify the Coos, Siuslaw, Lower Umpqua Tribal Council in writing, together with a copy of the site development plan. The Tribal Council shall have the right to submit a written statement to the local government within ten (10) days of receipt of such notification, stating whether the project as proposed would protect the historical and archaeological values of the site, or if not, whether the project could be modified by appropriate measures to protect those values.

"Appropriate measures" may include, but shall not be limited to the following:

A. Retaining the historic structure in situ or moving it intact to another site; or

B. Paving over the site without disturbance of any human remains or cultural objects upon the written consent of the Tribal Council; or

C. Clustering development so as to avoid disturbing the site; or

D. Setting the site aside for non-impacting activities, such as storage; or

E. If permitted pursuant to the substantive and procedural requirements of ORS 97.750, contracting with a qualified archaeologist to excavate the site and remove any cultural objects and human remains, reinterring the human remains at the developer's expense; or

F. Using civil means to ensure adequate protection of the resources, such as acquisition of easements, public dedications, or transfer of title.

If a previously unknown or unrecorded archaeological site is encountered in the development process, the above measures shall still apply. Land development activities which violate the intent of this strategy shall be subject to penalties prescribed in ORS 97.990(8) and (9). Upon receipt of the statement by the Tribal Council, or upon expiration of the Tribal Council's ten-day response period, the local government shall conduct an administrative review of the development proposal and shall:

A. approve the development proposal if no adverse impacts have been identified, as long as consistent with other portions of this plan, or

B. Approve the development proposal subject to appropriate measures agreed upon by the landowner and the Tribal Council, as well as any additional measures deemed necessary by the local government to protect the historical and archaeological values of the site. If the property owner and the Tribal Council cannot agree on the appropriate measures, then the governing body shall hold a quasi-judicial hearing to resolve the dispute. The hearing

> **shall be a public hearing at which the governing body shall determine by preponderance of the evidence whether the development project may be allowed to proceed, subject to any modifications deemed necessary by the governing body to protect the historical and archaeological values of the site.**

This strategy recognizes that protection of historical and archaeological sites is not only a community's social responsibility, but is also legally required by Goal #17 and ORS 97.745. It also recognizes that historical and archaeological sites are non-renewable cultural resources.

RESPONSE: The City has not inventoried any historical, cultural, and archaeological resources in the area of proposed development. Therefore, there are no known inventoried resources in this location to consider under this policy.

Notwithstanding this fact, JCEP recognizes that, during the course of development consistent with the Application, there may be unanticipated discovery of cultural resources, remains, and/or objects. To address this possibility, JCEP has coordinated with the Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians ("Tribes") to enter a memorandum of agreement ("MOA") addressing these circumstances, and more broadly, CBEMP Policy #18.

A copy of the signed MOA is included in Exhibit 9. The MOA incorporates a Cultural Resources Protection Agreement entered between JCEP and the Tribes ("CRPA"). The CRPA provides a process for the exchange of project-related information, confidentiality requirements, commitments to mitigation, monitoring agreements, agreements for the treatment of unanticipated discovery of cultural resources, site access agreements, and cost recovery agreements. The CRPA, in turn, incorporates an Unanticipated Discovery Plan ("UDP"), which provides procedures in the event of an unanticipated discovery of historic properties, archaeological objects, archaeological sites or human remains, funerary objects, sacred items, and items of cultural patrimony, during the construction and operation of the Pipeline. The CRPA and UDP are attached as exhibits to the MOA in Exhibit 9. In the MOA, JCEP and the Tribes expressly agreed that the CRPA and the UDP constitute appropriate measures under CBEMP Policy #18 that would protect the cultural, historical, and archaeological values of this development site. JCEP is willing to accept a condition of City approval of the Application requiring compliance with the MOA and its attachments.

Subject to the proposed condition, the City should find that the Application is consistent with CBEMP Policy #18.

DDNC-DA Zone - Special Condition For Approval of "New and Maintenance Dredging"

CBEMP Policy #5 - Estuarine Fill and Removal

Dredging and/or filling shall be allowed only:

A. If required for navigation or other water-dependent uses that requires an estuarine location or if specifically allowed by the applicable management unit requirements of this goal; and

B. If no feasible alternative upland location exists; and

C. If a public need (i.e., a substantial public benefit) is demonstrated and the use or alteration does not unreasonably interfere with public trust rights; and

D. If adverse impacts are minimized; and

E. The activity is consistent with the objectives of the Estuarine Resources Goal and with other requirements of state and federal law, specifically the conditions in ORS 541.615 and Section 404 of the Federal Water Pollution Control Act (P.L.92-500).

Other uses and activities which could alter the estuary shall only be allowed if the requirements in B, C, and D are met. All portions of these requirements may be applied at the time of plan development for actions identified in the Plan. Otherwise, they shall be applied at the time of permit review.

This strategy shall be implemented by the preparation of findings by local government documenting that such proposed actions are consistent with the Comprehensive Plan and with criteria "a" through "e" above. However, where goal exceptions are included within this plan, the findings in the exception shall be sufficient to satisfy criteria "a" through "c" above. Identification and minimization of adverse impacts as required in "d" above shall follow the procedure set forth in Policy #4a. The findings shall be developed in response to a "request for comment" by the Division of State Lands (DSL), which shall seek local government's determination regarding the appropriateness of a permit to allow the proposed action.

"Significant" as used in "other significant reduction or degradation of natural estuarine values", shall be determined by:

A. **The U.S. Army Corps of Engineers through its Section 10 and 404 permit processes; or**

B. **The Department of Environmental Quality (DEQ) for approvals of new aquatic log storage areas only; or**

C. **The Department of Fish and Wildlife for new aquaculture proposals only.**

This strategy recognizes that Goal #16 limits dredging, fill, and other estuarine degradation in order to protect the integrity of the estuary.

RESPONSE: JCEP's new and maintenance dredging activities must be consistent with CBEMP Policy #5. The DDNC-DA zone allows new and maintenance dredging. Furthermore, because the Application includes a Goal 16 exception, Policy #5 requires only that the Application comply with criteria D. and E. above, because, as expressly noted within the Policy, the findings for the Goal 16 exception suffice for this Application to comply with criteria A. - C.

Policy #5 directs that an applicant demonstrate compliance with criterion D. of Policy #5 (identification and minimization of adverse impacts) pursuant to the procedure set forth in CBEMP Policy #4a. Furthermore, Special Conditions for approval of new and maintenance dredging in the DDNC-DA zone provide that such dredging is allowed only "subject to finding that adverse impacts have been minimized." JCEP will minimize adverse impacts as summarized below, in response to CBEMP Policies #4 and #4a, and as further discussed in the DEA memo included in Exhibit 5.

JCEP will use various dredging methods to minimize the effects of the NRIs on water turbidity within the bay. JCEP will use best management practices (including cutter head suction, clamshell, and hopper dredging) associated with dredging to reduce turbidity effects, and as a result of those methods JCEP expects increased water turbidity as a result of the NRIs to be temporary and limited to the immediate vicinity of dredging operations. Furthermore, JCEP does not anticipate oil spills or toxic discharges to occur when constructing the NRIs, and JCEP will use precautions to avoid either. Dredging and material transport vessels will carry small volumes of petroleum in comparison to large bulk carriers and Panamax vessels that regular traverse Coos Bay. JCEP will use best management practices to avoid and minimize spills or discharges during dredging operations and dredged material transport, including the implementation of spill containment plans. JCEP plans to perform capital and maintenance dredging during the ODFW-approved in-water work window (October 1 to February 15) to reduce impacts to sensitive life stages of fish in the bay.

Criterion E. of Policy #5 requires that the NRIs are "consistent with the objectives of the Estuarine Resources Goal and with other requirements of state and federal law, specifically the conditions in ORS 541.615 and Section 404 of the Federal Water Pollution Control Act (P.L.92-500)." The NRIs are consistent with the objectives of Goal 16 (Estuarine Resources Goal) because they protect the economic values of the estuary while minimizing adverse impacts of the dredging activity. The Application is consistent with other requirements of state and federal law, including the conditions in ORS 541.615 and Section 404 of the Federal Water Pollution Control Act. ORS 541.615, which is now ORS 196.810, requires a permit from the Department of State Lands ("DSL") to remove any material from the beds or banks of waters of the state. JCEP acknowledges this obligation, and all necessary DSL and Federal Section 404 authorizations will be obtained as a condition precedent to dredging.

For these reasons, the City should find that JCEP's proposed new and maintenance dredging activities are consistent with CBEMP Policy #5.

Alternatively, the City should find that CBEMP Policy #5 is not applicable to the Application pursuant to state law. LUBA has held, and the Court of Appeals has affirmed, that "[w]hen a goal exception is taken to facilitate proposed development, any comprehensive plan policies that implement the goal for which the exception is taken no longer govern that development." *Friends of Marion County v. Marion County*, 59 Or LUBA 323, 350-351 (2009), *aff'd* 233 Or App 488, 227 P3d 198 (2010). The Application requests an exception to Goal 16 to facilitate dredging in a natural management unit. As the last sentence of CBEMP Policy #5 clearly states, the purpose of this policy is to implement Goal 16: "This strategy recognizes that Goal #16 limits dredging, fill, and other estuarine degradation in order to protect the integrity of the estuary." Accordingly, pursuant to the appellate decisions in *Friends of Marion County*, CBEMP Policy #5 is not applicable to the Application.

#4 Resource Capability Consistency and Impact Assessment

Local government concludes that all proposed actions (approved in this Plan) which would potentially alter the estuarine ecosystem have been based upon a full consideration of the impacts of the proposed alteration, except for the following uses and activities:

A. <u>Natural Management Units</u>

- Aquaculture
- Bridge crossings
- Log storage

B. <u>Conservation Management Units</u>

- Aquaculture
- Bulkheading
-Dike maintenance dredging
- High-intensity water-dependent recreation
- Log storage dredging
- Minor navigational improvements requiring dredging or fill
- New or expanded log storage
- Rip-rap
- Water intake or withdrawal and effluent discharge

C. <u>Development Management Units</u>

- Aquaculture
- Bulkheading (except for Aquatic Units #3-DA, 5DA, and 6DA)
- Dredging
- Fill
- Flow lane disposal of dredged material
- In-water structures
- Mining and mineral extraction
- New or expanded log storage
- Water-related and nondependent, nonrelated uses not requiring fill

D. Any other uses and activities which require the resource capability consistency test as a condition within a particular management unit or which could affect the estuary's physical processes or biological resources.

<u>Unless fully addressed during the development and adoption of comprehensive plans, actions which would potentially alter the estuarine ecosystem shall be preceded by a clear presentation of the impacts of the proposed alteration.</u>

For uses and activities requiring the resource capabilities test, a special condition is noted in the applicable management unit uses/activities matrix. A determination of <u>consistency with resource capability</u> and the purposes of the management unit shall be based on the following:

A. A description of resources identified in the plan inventory;

B. An evaluation of impacts on those resources by the proposed use (see impact assessment procedure, below); and

C. In a natural management unit, a use or activity is consistent with the resource capabilities of the area when either the impacts of the use on estuarine species, habitats, biological productivity and water quality are not significant or that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner to protect significant wildlife habitats, natural biological productivity, and values for scientific research and education.

D. In a conservation management unit, a use or activity is consistent with the resource capabilities of the area when either the impacts of the use on estuarine species, habitats, biological productivity, and water quality are not significant or that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner which conserves long-term renewal resources, natural biologic productivity, recreational and aesthetic values, and aquaculture.

An impact assessment need not be lengthy or complex, but it should enable reviewers to gain a clear understanding of the impacts to be expected. It shall include information on:

A. The type and extent of alterations expected;

B. The type of resource(s) affected;

C. The expected extent of impacts of the proposed alteration on water quality and other physical characteristics of the estuary, living resources, recreation and aesthetic use, navigation and other existing and potential uses of the estuary; and

D. The methods which could be employed to avoid or minimize adverse impacts.

This policy is based on the recognition that the need for and cumulative effects of estuarine developments were fully addressed during the preparation of this Plan and that, except as otherwise stated above, no additional findings are required to meet Implementation Requirement #1 of LCDC Goal 16.

<u>**RESPONSE**</u>**:** As required by CBEMP Policy #5, "[i]dentification and minimization of impacts shall follow the procedure set forth in Policy #4. JCEP has addressed the provisions of this policy in the DEA memo included in <u>Exhibit 5</u>. This memo is incorporated herein by reference.

Alternatively, the City should find that CBEMP Policy #4 is not applicable to the Application pursuant to state law. LUBA has held, and the Court of Appeals has affirmed, that "[w]hen a goal exception is taken to facilitate proposed development, any comprehensive plan policies that implement the goal for which the exception is taken no longer govern that development." *Friends of Marion County*, 59 Or LUBA at 350-351, *aff'd* 233 Or App at 488. The Application requests an exception to Goal 16 to facilitate dredging in a natural management unit. As the last sentence of CBEMP Policy #4 clearly states, the purpose of this policy is to implement Goal 16: "This policy is based on the recognition that the need for and cumulative effects of estuarine developments were fully addressed during the preparation of this Plan and that, except as otherwise stated above, no additional findings are required to meet Implementation Requirement #1 of LCDC Goal 16." Accordingly, pursuant to the appellate decisions in *Friends of Marion County*, CBEMP Policy #4 is not applicable to the Application.

#4a Deferral of (A) Resource Capability Consistency Findings and (B) Resource Impact Assessments

Local government shall defer, until the time of permit application, findings regarding consistency of the uses/activities listed in Policy #4 with the resource capabilities of the particular management unit.

Additionally, the impact assessment requirement for those uses/activities as specified in Policy #4 shall be performed concurrently with resource capability findings above at the time of permit application.

This strategy shall be implemented through an Administrative Conditional Use process that includes local cooperation with the appropriate state agencies such that:

A. Where <u>aquaculture</u> is proposed as a use, local government shall notify the <u>Oregon Department of Fish & Wildlife (ODFW)</u> in writing of the request, with a map of the proposed site;

B. Where <u>log storage dredging</u> is proposed as an activity, local government shall notify the <u>Oregon Department of Environmental Quality (DEQ)</u> in writing of the request, together with a map of the proposed site.

Within twenty (20) days of receipt of the notification, ODFW or DEQ, as appropriate, shall submit in writing to local government a statement as to whether the proposed use/activity will be consistent with the resource capabilities of the management segment, or if determined to be not consistent, whether the proposal can be made consistent through imposition of conditions on the permit. The

appropriate state agency shall also perform the impact assessment required in Policy #4. If no statement is received from the affected state agency by the expiration of the twenty (20) day period, local government shall presume consistency of the proposal with the resource capabilities of the management segment, shall make findings appropriate to the presumption, and shall perform the assessment of impacts required by Policy #4.

For all other uses/activities specified above, local government shall determine appropriate findings whether the proposed use/activity is consistent with the resource capabilities of the management segment and shall perform the assessment of impacts required by Policy #4.

This strategy recognizes:

A. that resource capability consistency findings and impact assessments as required by LCDC Goal #16 can only be made for the uses specified above at the time of permit application, and

B. that the specified state agencies have expertise appropriate to assist local government in making the required finding and assessments.

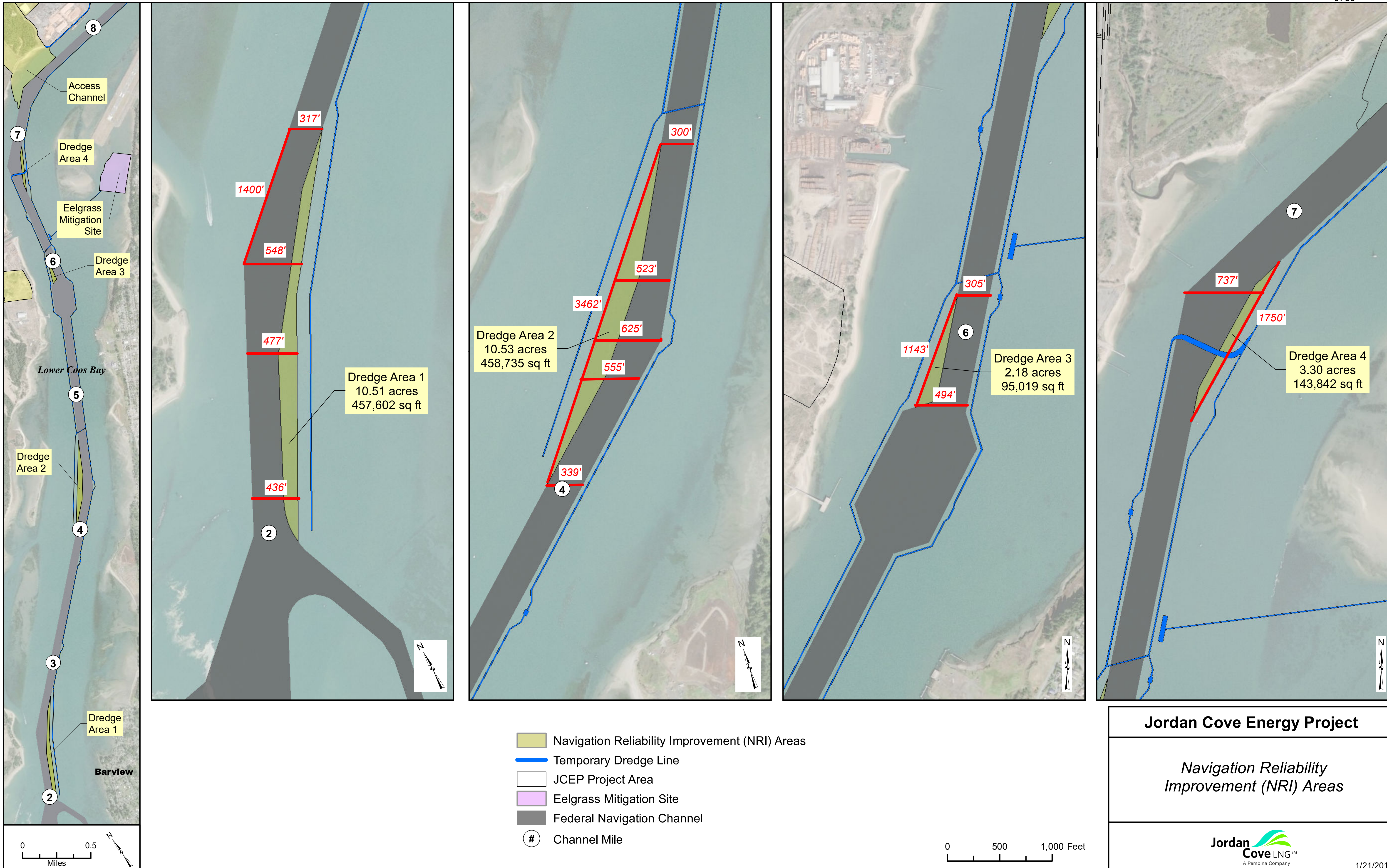
This strategy is based upon the recognition that the need for and cumulative effects of estuarine developments were fully addressed during development of this Plan and that no additional findings are required to meet Implementation Requirement #1 of Goal #16.

RESPONSE: As noted above, CBEMP Policy #4 requires findings demonstrating the public's need and gain that would warrant any modification or loss to the estuarine ecosystem, based upon a clear presentation of the impacts of the proposed alteration, as implemented in Policy #4a. None of the prerequisites to providing notice to state agencies under Policy #4a are triggered. Therefore, this policy requires the City to perform the impacts assessment consistent with CBEMP Policy #4. The City has completed that assessment above.

For an additional reason, the City should find that CBEMP Policy #4a is not applicable to the Application. LUBA has held, and the Court of Appeals has affirmed, that "[w]hen a goal exception is taken to facilitate proposed development, any comprehensive plan policies that implement the goal for which the exception is taken no longer govern that development." *Friends of Marion County*, 59 Or LUBA at 350-351, *aff'd* 233 Or App at 488. The Application requests an exception to Goal 16 to facilitate dredging in a natural management unit. As the last sentence of CBEMP Policy #4a clearly states, the purpose of this policy is to implement Goal 16: "This strategy is based upon the recognition that the need for and cumulative effects of estuarine developments were fully addressed during development of this Plan and that no additional findings are required to meet Implementation Requirement #1 of Goal #16." Accordingly, pursuant to the appellate decisions in *Friends of Marion County*, CBEMP Policy #4a is not applicable to the Application.

IV. Conclusion.

Based upon the above, the City should approve JCEP's requests: (1) to amend the CBEMP map to change the zoning designation of the NRI Site from 52-NA to DDNC-DA; (2) to amend the CBCP to take a reasons exception to Goal 16 to change the zoning designation of the NRI Site to DDNC-DA; (3) for Estuarine and Coastal Shoreline Uses and Activities Permit For "New And Maintenance Dredging" in the DDNC-DA estuarine zone; and (4) Estuarine and Coastal Shoreline Uses and Activities Permit to allow an accessory temporary dredge transport pipeline in the 52-NA, 53-CA, 54-DA, and 55-CA estuarine zones and an accessory buoy in the 52-NA estuarine zone.



Navigation Reliability Improvement (NRI) Areas
Temporary Dredge Line
JCEP Project Area
Eelgrass Mitigation Site
Federal Navigation Channel
Channel Mile

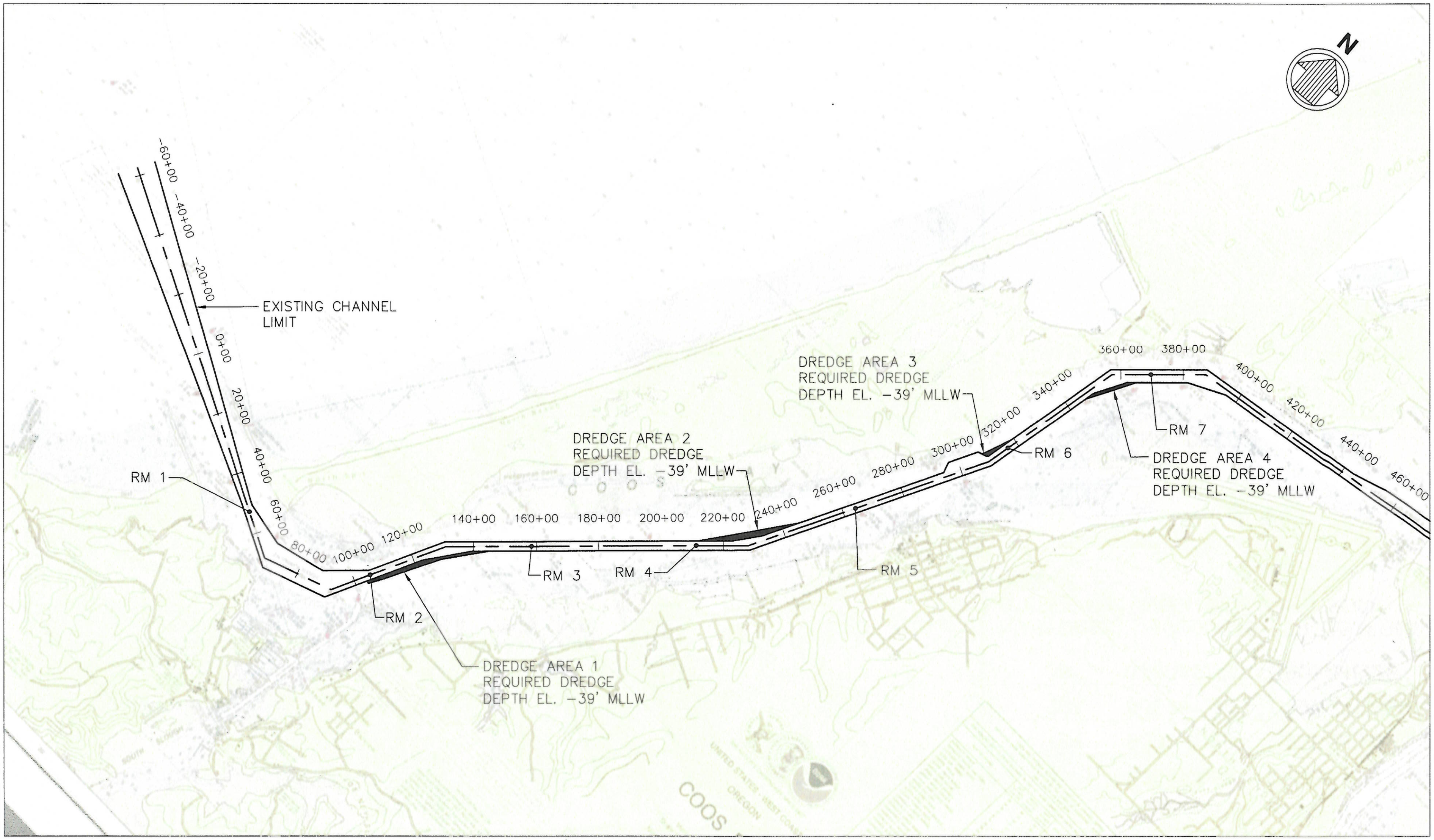
0 500 1,000 Feet

Jordan Cove Energy Project

Navigation Reliability Improvement (NRI) Areas

Jordan Cove LNG℠
A Pembina Company

1/21/2019



moffatt & nichol
SEATTLE, WASHINGTON

NAVIGATION RELIABILITY IMPROVEMENTS
FIGURE 1 OF 9

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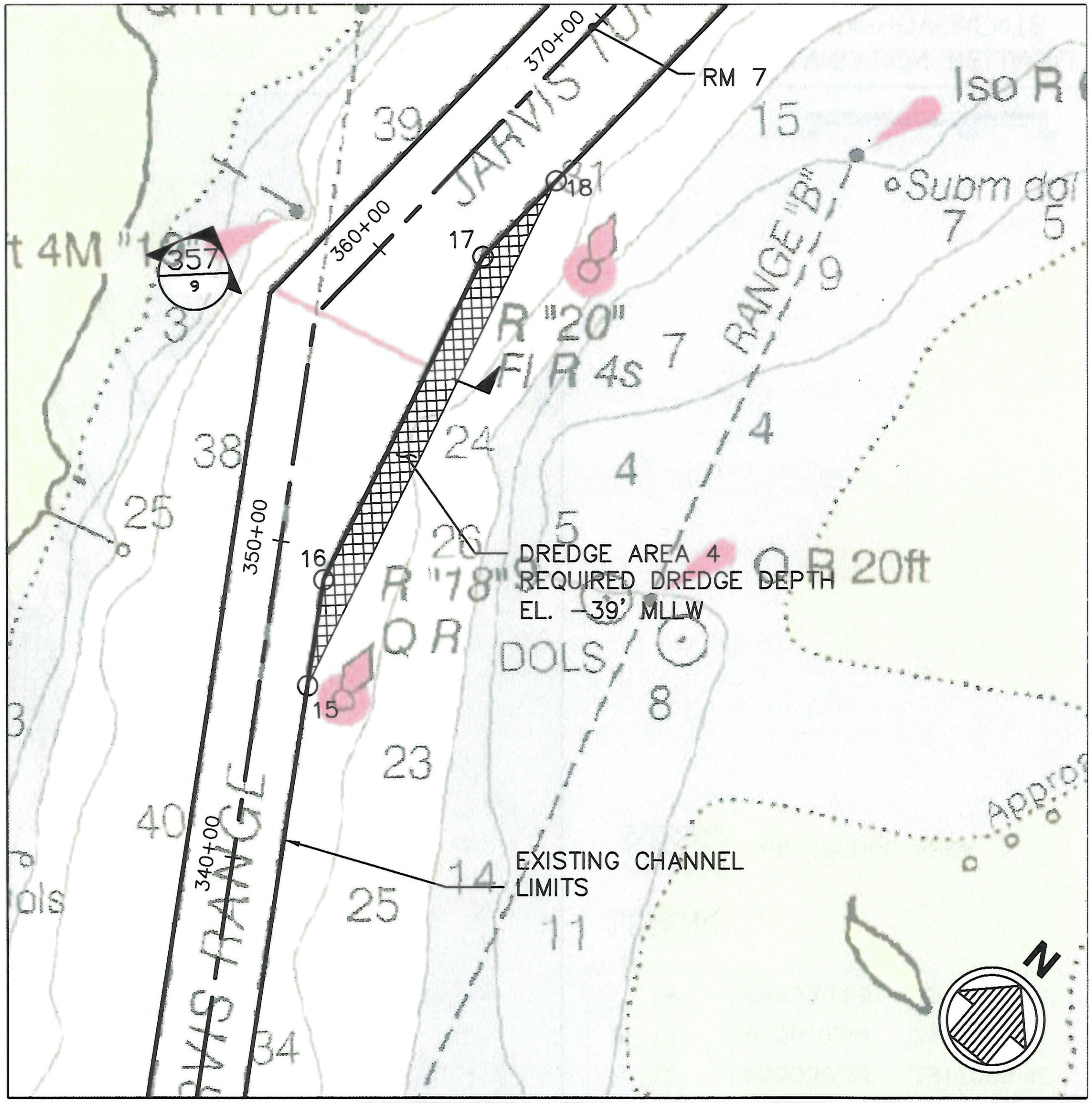
PART 1 JCEP: ATTACHMENT D.3

PROPOSED DREDGE COORDINATE TABLE

POINT #	NORTHING	EASTING
15	659067.23	3918213.13
16	659392.65	3918278.77
17	660377.49	3918823.24
18	660603.73	3919062.58

LEGEND

NRI DREDGE AREA



250 0 250 500

NOTES:
1. HORIZONTAL DATUM OREGON STATE PLANE SOUTH NAD83.
2. VERTICAL DATUM: MEAN LOWER LOW WATER (MLLW).

NRI = NAVIGATION RELIABILITY IMPROVEMENTS

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SEATTLE, WASHINGTON

NAVIGATION RELIABILITY IMPROVEMENTS

FIGURE 6 OF 9

J1-000-RGL-PM...-00003-00 Rev A

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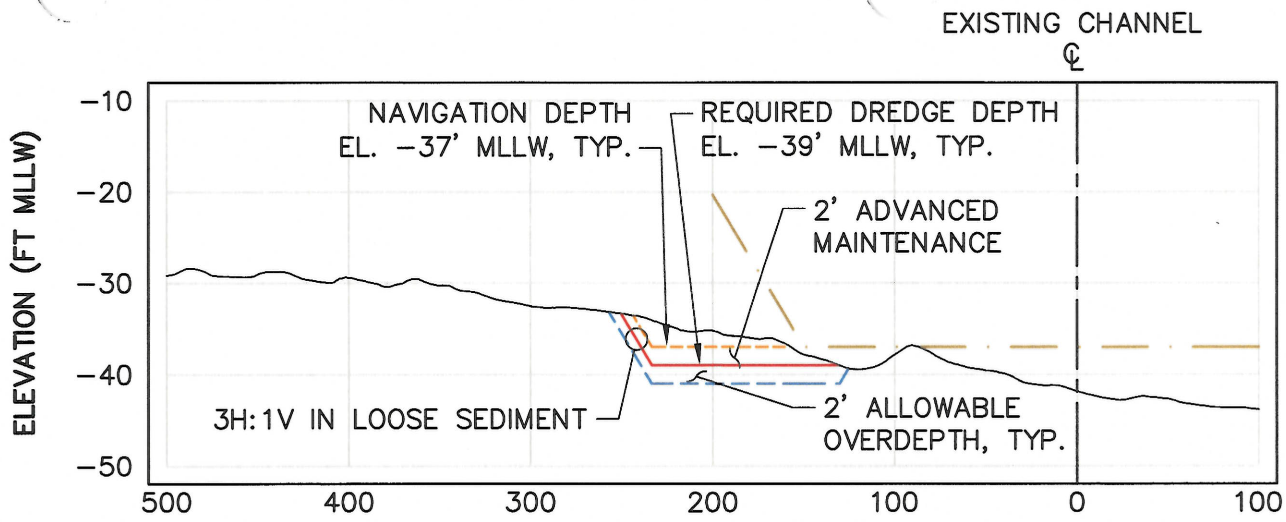
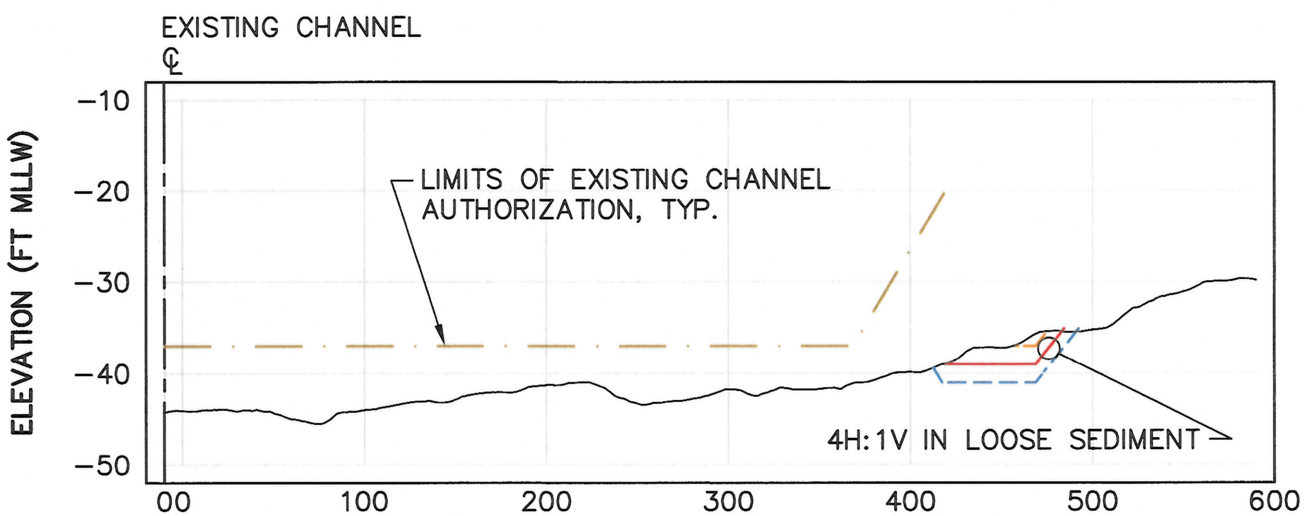


315
5
AREA 3 STA 315+00 (RM 6.0)



357
6
AREA 4 STA 357+00 (RM 6.8)

LEGEND

- MUDLINE
- EXISTING CHANNEL
- NRI REQUIRED DREDGE DEPTH (-39' MLLW)
- NRI NAVIGATION DEPTH (-37' MLLW)
- NRI ALLOWABLE OVERDEPTH

NRI = NAVIGATION RELIABILITY IMPROVEMENTS

10' 0' 10' 20'
VERTICAL SCALE

50' 0' 50' 100'
HORIZONTAL SCALE

NOTE: SECTION VIEWS FACE UPSTREAM.

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SEATTLE, WASHINGTON

NAVIGATION RELIABILITY IMPROVEMENTS
FIGURE 9 OF 9

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J1-000-RGL-PMT-DEA-00003-00 Rev A

CITY OF COOS BAY
Community Development Department

500 Central
Avenue Coos
Bay, OR 97420

541.269.8918
www.coosbay.org

PRE-APPLICATION CONFERENCE NOTES

CASE FILE#:	**187-ZON17-006**
LOCATION:	**Coos Bay Estuary, approximately 2,700 feet northwest of the end of the North Bend airport runway**
TYPE OF REQUEST:	**Comprehensive Plan and Text Amendment**
CITY STAFF ATTENDING:	**Eric Day, Tom Dixon, and Debbie Erler**
COUNTY STAFF ATTENDING:	**Jill Rolfe**
DATE OF PRE-APPLICATION:	**February 2, 2017**

All Coos Bay code chapters referenced in this report are available on the City's website at http://www.codepublishing.com/or/coosbay/.

1. <u>TYPE OF APPLICATION</u>

   Comprehensive Plan and Text Amendments (per CBMC 17.215)
   Estuarine and Coastal Shoreline Uses and Activities (per CBMC 17.370)

2. <u>PROCESS SUMMARY</u>

   The applicant will submit Comprehensive Plan Amendment and Text Amendment applications which require a Type IV review. Per the CBDC the hearing bodies will be the Planning Commission for a recommendation and the City Council for final decision.

   Review Process:
   - Pre-application conference (completed).
   - Application submittal.
   - Staff review for completeness (up to 30 days).
   - When application is determined to be technically complete, the application is considered to be vested.
   - Public notices are mailed/published and hearing dates are set before the Planning Commission and the City Council.
   - Staff report is prepared and made available to the applicant at least seven days before the date of the Planning Commission public hearing.
   - The Planning Commission will make a recommendation to the City Council for approval

or denial based upon the staff recommendation and the criteria found in the CBMC and the City's Comprehensive Plan.

- The City Council will make a final decision after a public hearing
- A Final Order and Ordinance is provided following the City Council decision

3. COMMUNITY DEVELOPMENT CODE AND COMPREHENSIVE PLAN

The applicant must address all standards of the applicable criteria for Plan Amendments and Zone Changes per CBMC 17.215.060. For the City of Coos Bay's review, the review is only for text and plan amendments but no zone change.

The applicant must address all application submittal requirements for the Estuarine and Coastal Shoreline Uses and Activities per CBMC 17.370.030.

The applicant must also describe proposed changes to estuary segments including both existing and proposed designations.

The applicant must address elements of the Coos Bay Comprehensive Plan pertaining to this project and address relevant State of Oregon Land Use Goals including Goal 6 – Air, Water and Land Resources Quality; Goal 9 – Economic Development; Goal 12 – Transportation; and Goal 16 Estuarine Resources.

4. ADDITIONAL REVIEW MATERIAL

The applicant should include supporting information including existing graphic portrayals of the channel section being considered, dredging cross sections of both width and depth profiles for areas of expansion or alteration, the quality and quantity of materials to be excavated, and final expected bathymetric contours for area of impact. In addition, information should be shared regarding potential impacts to the marine environment and how these impacts will be mitigated.

5. DOCUMENTATION REQUIRED FOR A COMPLETE APPLICATION

The following items are required to be submitted in only in a single form, along with a digital copy, for the main application:

- Application form signed by the owner and applicant, if applicable. In place of a signed application form the property owner may submit as a part of the application that they give the applicant permission to apply for the required land use applications in their place. This permission will not preclude the property owner from withdrawing consent at any time.
- Proof of ownership (Department of State Lands).

In addition, the following items are required to be submitted in ten collated sets in addition to a digital a copy:

- Application maps and narrative information as stipulated per CBMC 17.215.040 and 17.370.030,
- A narrative of the applicable State of Oregon Land Use Goals and Comprehensive Plan Goals and Policies, and
- Additional information that will provide reviewers and decision makers sufficient basis to weigh the criteria and render a decision.

5. APPLICATION FEES

Per the City fee resolution, the City will be collecting a $70.00/hr. fee for the review of this project as it is believed that City staff time will far outweigh the outlined fee(s) in the resolution for this type of review. The City will collect a $7,000.00 fee up front at time of application submittal. Should any additional fees be required they will be requested at that time. Should the City not exhaust the initial fee the unused portion will be returned to the applicant after the review is finalized.

The City may retain an outside land use consultant/attorney to aid in the review of this application. Should the City elect this approach the consultants fees will be passed along to the applicant for payment.

6. <u>TIME FRAME FOR REVIEW PROCESS</u>

Per State law, staff has 30 days to review the application submittal for technical completeness. If incomplete, the applicant will have 180 days from the date of the incomplete letter to submit additional information. Once deemed complete the application review shall not exceed 120 days for a final decision, including appeals to the City Council. Appeals to LUBA fall outside the 120 day review process.

NOTICE TO APPLICANTS:
The standards noted in this checklist are those which staff believes may be applicable to your proposal. Additional standards may also be determined applicable at the time of a development submittal. The burden is upon the applicant to review all applicable City documents and address all the relevant standards. The applicant should verify the fees prior to submitting application.

Roseburg
A Forest Products Company

July 26, 2018

Via Electronic Mail

TO: Department of State Lands

FROM: Roseburg Forest Products Co.

RE: **Letter of Support for the JCEP Navigation Reliability Improvements**

To whom it may concern,

Roseburg Forest Products Co. ("Roseburg") wishes to express its support for the excavation and widening of four submerged areas adjacent to the federally authorized Coos Bay Navigation Channel ("Channel"). These areas are collectively referred to by the Jordan Cove Energy Project ("JCEP") as the Navigation Reliability Improvements ("NRIs"). Roseburg supports this proposal because the NRIs will provide navigation enhancements that will increase the margin of safety available not only for vessels serving the proposed JCEP LNG Terminal, but for vessels serving Roseburg's terminal and other marine terminal facilities in Coos Bay.

The proposed NRIs will increase the operational window for safe vessel transit by approximately 20% according to analysis conducted by JCEP. The improvements are designed to reduce entry and departure delays which will allow for more efficient vessel transits through the Channel for the size of vessels calling at the Port of Coos Bay today as well as for vessels calling in the future. Minimizing delay is a pressing concern because Roseburg has identified potential new wood chip customers in Asia which will require using bulk carriers that are slightly larger than the ships typically calling today.

Upon completion of the proposed NRIs, the Channel will operate more efficiently and with an increased operational margin of safety. Without the proposed improvements, shipping commerce will be delayed or otherwise compromised. The potential for growth in shipping commerce in Coos Bay via larger ships will also be in jeopardy. Implementing the proposed improvements will help to ensure safe and efficient navigation for vessels calling at Roseburg's terminal and all other vessels transiting the Coos Bay Channel. The proposed NRIs are needed to ensure the current and future viability of maritime commerce in Coos Bay. Roseburg respectfully urges that these navigation improvements be granted favorable consideration.

Sincerely,

Richard

Roseburg Forest Products Co.

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Coos Bay Pilots Association

686 N. Front Street
Coos Bay, Oregon 97420
Tel. 541-267-6555

July 25, 2018

RE: Letter of Support from the Coos Bay Pilots Association for the Jordan Cove Energy Project's Navigation Reliability Improvements

To whom it may concern,

The Jordan Cove Energy Project ("JCEP") proposes to excavate and widen four submerged areas adjacent to the federally authorized Coos Bay Navigation Channel ("Channel"), collectively known as the Navigation Reliability Improvements (NRIs). The Coos Bay Pilots Association ("Pilots") supports this proposal because it provides navigation enhancements necessary to increase the margin of safety available to the Pilots and the vessel Master, in turn improving the efficiency and navigability of the Channel.

The Pilots, regulated and approved by the State of Oregon, are responsible for supporting deep sea vessel Masters in navigating their vessels into and out of the Channel. The Pilots serve a vital function for maritime commerce in Coos Bay by safely and efficiently guiding vessels through the Channel (known as pilotage) using visual aids, radar, and other means. The Channel provides the only safe vessel access to marine terminals located within Coos Bay. Pilots are specifically trained to navigate the Channel, possessing detailed local knowledge of its unique bathymetric conditions and visual references. Pilotage is mandatory in Oregon.

Marine terminal facilities in Coos Bay are grouped into two categories: 1) the lower bay terminals from the entrance up to River Mile ("RM") 9.0 and 2) the upper bay terminals upstream of RM 9.0. The railroad swing bridge at RM 9.0 limits the size of vessels that can pass through the bridge opening. Four terminals are currently in operation in the lower bay. The proposed JCEP LNG terminal site is also in the lower bay. Ten terminal and dock facilities are located in the upper bay. Currently, three of the terminals in the upper bay and one terminal in the lower bay can handle deep draft vessels.

The Channel was initially authorized in 1899 and has undergone ten subsequent modifications. Most recently, the Channel was deepened from -35 feet to -37 feet in 1997 to allow for safe navigation and transit by the size of ships prevalent at that time. Over the past 20 years, the dimensions and tonnage of ships serving terminals in Coos Bay have increased. Specifically, the size of vessels calling on Coos Bay terminals has increased from an average of 45,422 metric tonnes to an average of 52,894 metric tonnes with a projected near-term vessel size of up to 70,400 metric tonnes. Safety margin considerations due to environmental conditions, including wind, fog, tides, and currents, coupled with increasing ship size, have caused the Pilots to impose restrictions on when vessels may safely transit the Channel. These restrictions in turn cause significant delays and increase pressure on the Pilots. These types of delays decrease the efficiency and competitiveness of maritime commerce on a global scale, and jeopardize the continued success of maritime commerce in Coos Bay.

The Pilots believe the proposed NRIs are essential for achieving the required number of LNG vessel transits needed to lift the JCEP design annual LNG production volume. JCEP has informed the Pilots that excessive delays in LNG Carrier transits to and from the LNG terminal could result in a shore storage tank topping situation, requiring the project to curtail production of LNG. The Pilots also believe that, in addition to the JCEP LNG terminal, the NRIs will directly benefit other marine terminals in Coos Bay that currently handle deep draft vessels. Further, the NRIs have the potential to benefit any future marine terminal that may be constructed in the Port.

The Pilots estimate that completion of the proposed NRIs will increase the operational window for safe vessel transit by approximately 20%. Minimizing delay is a pressing concern because companies that utilize the port of Coos Bay have identified potential new customers in Asia that desire to export cargo using bulk carriers that are slightly larger than the ships typically calling today. Various marine terminal businesses, within Coos Bay, require enhanced assurances that terminals will be able to efficiently accommodate larger dimension bulk carriers in the near term.

The proposed NRIs are designed to reduce entry and departure delays and to allow for more efficient vessel transits through the Channel for the size of vessels entering the Port today. Although log export vessels serving the upper bay are smaller, the proposed enhancements also benefit these vessels by broadening the tidal and environmental windows for transiting the Channel, providing an enhanced margin of safety and improved efficiency in the loaded vessel departure schedule. The proposed actions are needed to ensure the current and future viability of maritime commerce in Coos Bay. The NRIs will allow companies to engage in emerging opportunities to export products with today's larger vessels, including bulk carriers of up to 223 meters (732 feet) in length and 40 meters (131 feet) in beam with a cargo carrying capacity up to 70,400 deadweight tonnes.

Upon completion of the proposed NRIs, the Channel will operate more efficiently and with an increased operational margin for vessels calling today as well as for JCEP LNG carriers and other vessels calling in the future. Without the proposed improvements, shipping commerce will continue to operate with the same narrow weather and tidal windows. Implementing the proposed improvements will help to ensure that the Pilots can continue to serve their role of providing safe and efficient navigation for all vessels transiting the Coos Bay Channel.

Respectfully,

George Wales

Captain George Wales
Coos Bay Pilots Association

Oregon's Seaport... Port of Coos Bay
OREGON INTERNATIONAL
Port of Coos Bay

October 30, 2018

via email

Mr. Robert Lobdell
Aquatic Resource Coordinator
Oregon Department of State Lands
775 Summer Street NE, Suite 100
Salem, OR 97301-1279

Re: Jordan Cove Energy - Navigation Reliability Improvements Project

Dear Mr. Lobdell:

On behalf of the Oregon International Port of Coos Bay ("OIPCB"), I would like to take the opportunity to offer our support for the proposal by the Jordan Cove Energy Project ("JCEP") to deepen and widen four submerged areas adjacent to the federally authorized Coos Bay Navigation Channel ("Channel").

We understand that JCEP is seeking local, state and federal authorizations to undertake this work, which is collectively referred to as the Navigation Reliability Improvements ("NRI"), including Removal-Fill authorization from the Department of State Lands. Specifically, the improvements are designed to reduce entry and departure delays to facilitate more efficient vessel transits through the Channel for the size of vessels calling at the Port of Coos Bay today as well as for likely larger vessels served by the Port in the future. Upon completion of the proposed NRIs, the Channel will operate more efficiently and with an increased operational margin of safety, which is necessary to ensure the current and future viability of maritime commerce in Coos Bay. The OIPCB supports these proposed Channel improvements because the navigation enhancements will increase the margin of safety available not only for vessels serving the proposed JCEP LNG Terminal, but, of equal importance to the Port, for vessels serving existing and future marine terminal facilities in Coos Bay.

For these reasons, the OIPCB respectfully urges that these navigation improvements be granted favorable consideration.

Sincerely,

Mr. John Burns
Chief Executive Officer
Oregon International Port of Coos Bay

U.S. Department of Homeland Security
United States Coast Guard

Captain of the Port
U. S. Coast Guard
Sector Columbia River

2185 SE 12th Place
Warrenton, Oregon 97146-9693
Staff Symbol: s
Phone: (503) 861-6211

16611
May 10, 2018

Director of Gas Environment and Engineering, PJ 11
Attn: Mr. Rich McGuire
Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

Dear Mr. McGuire:

This Letter of Recommendation (LOR) is issued pursuant to 33 Code of Federal Regulations (CFR) 127.009 in response to the Letter of Intent submitted by Jordan Cove Energy Project. L.P. (Jordan Cove) on January 9, 2017. Jordan Cove proposes to construct and operate the Jordan Cove LNG facility in Coos Bay, Oregon from which Liquefied Natural Gas (LNG) is proposed to be transferred in bulk to a vessel for export. This LOR conveys the Coast Guard's recommendation on the suitability of the Coos Bay Channel for LNG marine traffic as it relates to safety and security. In addition to meeting the requirements of 33 CFR 127.009, this LOR fulfills the Coast Guard's commitment for providing information to your agency under the Interagency Agreement signed in February 2004.

After reviewing the information in the applicant's Letter of Intent (LOI) and Waterway Suitability Assessment (WSA) with subsequent annual updates and completing an evaluation of the waterway in consultation with a variety of state and local port stakeholders, I recommend that the Coos Bay Channel be considered suitable for LNG marine traffic. My recommendation is based on review of the factors listed in 33 CFR 127.007 and 33 CFR 127.009. The reasons supporting my recommendation are outlined below.

On November 1, 2017, I completed a review of the WSA for the Jordan Cove Energy Project, submitted to the Coast Guard by KSEAS Consulting on behalf of Jordan Cove in February 2007. This review was conducted following the guidance provided in U.S. Coast Guard Navigation and Vessel Inspection Circular (NVIC) 01-2011, dated January 24, 2011. In conducting this review and analysis, I focused on the navigation safety and maritime security aspects of LNG vessel transits along the affected waterway. My analysis included an assessment of the risks posed by these transits and validation of the risk management measures proposed by the applicant in the WSA. During the review, I consulted a variety of stakeholders including the Area Maritime Security Committees, Harbor Safety Committees, State representatives, Pilot Organizations, and local emergency responders.

Based upon a comprehensive review of Jordan Cove's WSA, and after consultation with State and Local port stakeholders, I recommend that the Coos Bay Channel be considered suitable for accommodating the type and frequency of LNG marine traffic associated with this project.

The attached LOR Analysis contains a detailed summary of the WSA review process that has guided this recommendation. It documents the assumptions made during the analysis of Jordan Cove's WSA. It discusses details of potential vulnerabilities and operational safety and security measures that were analyzed during the review. The portion of the LOR Analysis which

addresses matters that affect maritime security is marked as Sensitive Security Information and is withheld from distribution.[1] The LOR Analysis sets forth the navigational safety and maritime security resource gaps that currently exist in, on, and adjacent to the waterway, including the marine transfer area of the proposed facility, and which, to the extent allowable under FERC's existing legal authority, may be addressed in its Commission Order if one is issued. To the extent implementation of specific mitigation measures fall outside the scope of FERC's legal authority, the applicant is expected to examine the feasibility of implementing such mitigation measures, in consultation with the Coast Guard and State and Local agencies as applicable.

This recommendation is provided to assist in the Commission's determination of whether the proposed facility should be authorized. This Letter of Recommendation is not an enforceable order, permit, or authorization that allows any party, including the applicant, to operate a facility or a vessel on the affected waterway. Similarly, it does not impose any legally enforceable obligations on any party to undertake any future action be it on the waterway or at the proposed facility. It does not authorize, nor in any way restrict, the possible future transit of properly certificated vessels on the Coos Bay Channel. As with all issues related to waterway safety and security, I will assess each vessel transit on a case by case basis to identify what, if any, safety and security measures are necessary to safeguard the public health and welfare, critical marine infrastructure and key resources, the port, the marine environment, and vessels. In the event the facility begins operation and LNG vessel transits commence, if matters arise concerning the safety or security of any aspect of the proposed operation, a Captain of the Port Order could be issued pursuant to my authority under the Ports and Waterways Safety Act of 1972, as amended by the Port and Tanker Safety Act of 1978, 33 U.S.C. § 1221 – 1232, among other authorities, to address those matters.

Please note that Enclosures (4) is Sensitive Security Information (SSI) and shall be disseminated, handled and safeguarded in accordance with 49 CFR Part 1520, "Protection of Sensitive Security Information."

If you have any questions on this recommendation, my point of contact is Lieutenant Commander Laura Springer. She can be reached at the address listed above, by phone at (503) 209-2468, or by email at Laura.M.Springer@uscg.mil.

Sincerely,

WRT

W. R. TIMMONS,
Captain, U. S. Coast Guard
Captain of the Port, Sector Columbia River

Enclosure (1) LOR Analysis
(2) LOR issued by Sector Portland on April 24, 2009
(3) U.S.C.G.'s Waterway Suitability Report for the Jordan Cove Energy Project
(4) LOR Analysis (SSI Portion)

[1] Documents containing SSI may be made available upon certification that the requestor has a need to know and appropriate document handling and non-disclosure protocols have been established.

Copy: Commander, Coast Guard District Thirteen (dp)
Commander, Pacific Area (PAC-54)
Commandant (CG-OES), (CG-ODO), (CG-FAC), (CG-741), (CG-CVC), (CG-ENG), (LNGNCOE)
Marine Safety Center (CG MSC)
Jordan Cove

UNITED STATES COAST GUARD

Jordan Cove LNG

ANALYSIS SUPPORTING THE LETTER OF RECOMMENDATION ISSUED BY COTP SECTOR COLUMBIA RIVER ON MAY 10, 2018

Enclosure (1)

Introduction

1. This analysis is a supplement to my Letter of Recommendation (LOR) dated May 10, 2018, that conveys my recommendation on the suitability of the Coos Bay Ship Channel for liquefied natural gas (LNG) marine traffic associated with the Jordan Cove LNG (JCLNG) export terminal project Coos Bay, Oregon. It documents the processes followed in analyzing JCLNG's Waterway Suitability Assessment (WSA) and the suitability of the waterway for LNG marine traffic.

2. For the purposes of this analysis, the following assumptions were made:

    a. The applicant is fully capable of, and would fully implement, any and all risk management measures identified in their WSA.
    b. The conditions of the port identified in the WSA fully and accurately describe the actual conditions of the port at the time of the WSA submission.
    c. The conditions of the port have not changed substantially during the analysis process.
    d. The applicant will fully meet all regulatory requirements including the development and submission of a Facility Security Plan, Emergency Manual, and Operations Manual.

3. The Port of Coos Bay is a deepwater port located in Coos Bay, Oregon on the Pacific Coast of the United States. The Port of Coos Bay offers easy access to Asian markets and facilitates the international movement of goods between the United States and Asia. The Port of Coos Bay is managed under the jurisdiction of the Portland Navigation District and has an authorized channel depth of 37 feet. The channel width is 300 nominal feet. The principal exports are logs, wood chips, lumber, and plywood. The Port of Coos Bay is currently conducting a feasibility study to examine widening and deepening its ship channel.

4. The Port of Coos Bay is approximately 173 nautical miles south of the Columbia River and 367 miles north of the entrance to San Francisco Bay. The Port has seen declining arrivals and is not currently heavily trafficked.

5. Inbound and outbound traffic density in the Port of Coos Bay is currently minimal. In the summer months and during fishing season there are a number of commercial fishing vessels working in the region. The maximum anticipated LNG Carrier port calls per year is expected to be around 120. These projections are based on a maximum nominal LNG output of 7.8 MTPA. Other traffic transiting through the Port of Coos Bay include fishing vessels, recreational vessels, and towing vessels.

6. The Terminal will be sited at the north end of the Coos Bay Channel near Jordan Cove. All Terminal facilities will be located within an approximately 200-acre parcel of land. The approximate locations of the coordinates of the facility are: 43 degrees-25.5' North and 124 degrees 15.7' West.

7. The U.S. Coast Guard regulates the port under the Maritime Transportation Security Act (MTSA), Security and Accountability for Every Port Act (SAFE Port Act), Ports and Waterways Safety Act (PWSA) and other laws applicable to maritime safety and security. U.S. Coast Guard regulated facilities in the area include chip terminals and fuel transfer facilities.

8. Ships entering or departing Coos Bay require a pilot. The Coos Bay Pilots are state licensed Oregon pilots responsible for ensuring the safe transit of vessels transiting through the Port of Coos Bay. They handle approximately 50 vessel transits through the Port of Coos Bay each year.

9. In order to support operations associated with the facility, the applicant will provide additional towing vessels as outlined in their WSA. All tractor tugs must be at least 80 Ton Astern Bollard or larger and equipped with Class 1 Fire Fighting equipment.

10. The applicant established an emergency response planning group in preparation for facility construction and operation in 2006. This group is tasked with education and preparedness concerning this facility. It must be noted that there are schools located in the zones of concern.

Impact to Coast Guard Operations

1. The U.S. Coast Guard is responsible for screening LNG Carriers transiting from foreign ports prior to arrival and will screen all vessels in accordance with existing policies and procedures. The vessels calling on the facility will be foreign flagged and the flag state is yet to be determined. I do not intend to require additional government conducted safety inspections beyond those which already apply to deep draft LNG vessels.

2. Facility and vessel inspection activities will be supported by Marine Safety Unit Portland personnel.

3. Limited access areas (LAA) associated with the project have yet to be established. Sector Columbia River will use risk based decision making and work with existing policy to determine the appropriate LAAs. The proposed LAA in enclosure (3) was not put out for regulatory review and is not in effect.

4. LNG is not considered oil and all vessels calling on the facility will be required to comply with non-tank vessel response plan requirements. The applicant is highly encouraged to work with the Area Committees established under the National Contingency Plan to address issues associated with response in Coos Bay.

5. The Facility will be in the Sector Columbia River Captain of the Port Zone and falls under the purview of the Federal Maritime Security Coordinator who is also the Sector Columbia River Captain of the Port. Specific issues related to this are outlined in Enclosure (4).

Figure 1. Jordan Cove Conceptual rendering of facility

Decision Making Process

1. The following factors regarding the condition of the waterway, vessel traffic, and facilities upon the waterway, were taken into consideration during the LOR process. The processes used are detailed in this section.

2. To ensure all regulatory processes were met, Sector Columbia River took a systematic approach in the WSA validation process. To streamline and ensure transparency, Sector Columbia River worked with Jordan Cove, the Consulting Group KSEAS, and port partners though a series of ad hoc meetings and a one day workshop.

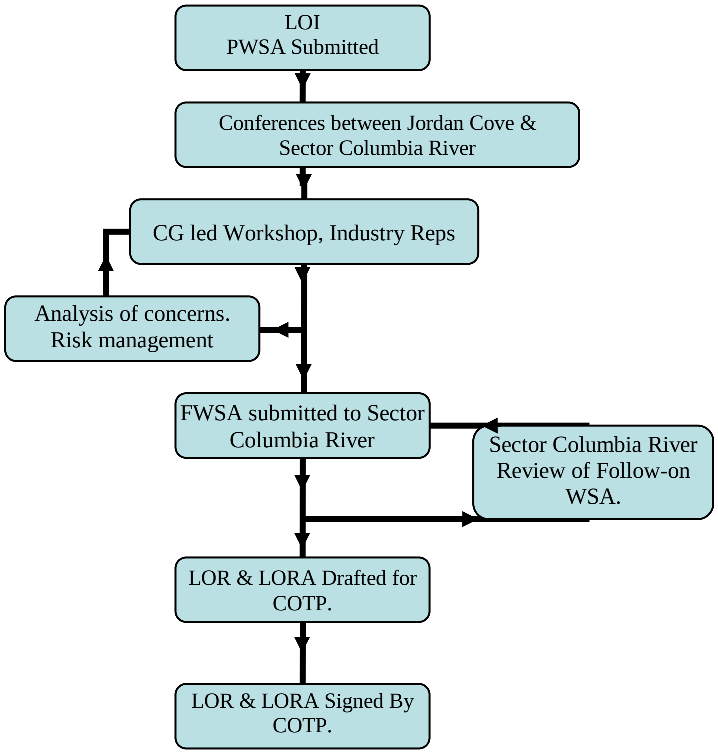


Figure 2 - LNG LOR Process
(Sector Columbia River)

3. NVIC 01-2011 provides guidance on the review and validation of a WSA. Applying NVIC 01-2011's procedural framework, my staff held several in-house reviews of the WSA, and facilitated discussions during a workshop held in Coos Bay, OR on October 16, 2017. The workshop included a wide range of participants, including representatives from; the USCG; Coos Bay Pilots Association; Port Authorities, the State of Oregon and law enforcement agencies.

Members	**Position/Role**
LCDR Laura Springer	Waterways Management Division Chief, MSU Portland
LCDR Ben Crowell	Surface Operations, Sector North Bend
LCDR Andrew Madjeska	Incident Management Division Chief, Sector Columbia River
LCDR Xochitl Castaneda	District Thirteen Prevention
Ms. Deanna Henry	Oregon Department of Energy
George Wales	Coos Bay Pilots
Richard Dybevik	Roseburg Forest Products
Doug Strain	Coos Bay Sheriff
Jim Brown	North Bend Fire Department
Doug Eberlein	Coos Bay Response Co-op (CBRC)
LT Ethan Lewallen	USCG LNG NCOE

Table 1 – Jordan Cove WSA Team 1 Nov 2017
(Port of Coos Bay)

4. The participants of this “ad-hoc” workshop, recommended by NVIC 01-2011, utilized their expertise on the physical characteristics and traffic patterns of the waterway, as well as their respective specialty knowledge of the marine environment, LNG, safety, security, and facility operations, to analyze the suitability of the waterway to support LNG marine traffic associated with JCLNG.

5. Participants considered the changes in the area’s safety and security dynamics which may result from the introduction of LNG ship traffic associated with the JCLNG Project. Jordan Cove used the American National Standards Institute (ANSI)/American Petroleum Institute (API) Standard 780 Security Risk Assessment (SRA) Methodology, as the basic approach for assessing risk. The standard was published in June of 2013 as a U. S. standard for security risk assessments on petroleum and petrochemical facilities. The standard is a tool used to evaluate all security risks associated with petroleum and petrochemical infrastructure and operations, and assists owners and operators through the process of conducting thorough and consistent SRAs. For security purposes, participants considered potential threats and consequences of intentional act of aggression to the facility and developed security measures to mitigate the risks.

    a. Please see Enclosure (4) if you have a need to know concerning the results of this

6. During the above mentioned workshop held in Coos Bay, OR on October 16, 2017, the ad-hoc working group also evaluated safety factors including the potential impacts of groundings, collisions, and allisions and thoroughly examined the simulator data presented in the WSA.

7. Each of the recommended risk management measures from enclosure (7) of NVIC 01-2011 were considered. In the WSA workshop, additional risks and recommendations were discussed related to a Cascadia Subduction Zone Earthquake and associated implications for the facility and region if a laden vessel was tied up at the layberth.

8. The ad-hoc working group considered each scenario along each transit segment and evaluated the causes of accidental or intentional events. The workshop analyzed the contributing factors for each scenario and their likelihood of occurrence given the adequacy of safety and security layers.

9. Sector Columbia River followed the checklist found in NVIC 01-2011 during the review. Through this review, Sector Columbia River clarified certain points in the WSA to ensure that the document contained accurate information and that references were applicable. With the 2017 update to the WSA, Jordan Cove has satisfied the requirements of the LOR process.

10. Based on my review of the WSA completed on November 1, 2017, and input from state and local port stakeholders, and taking into account previously reviewed expansion projects, I recommend to the Federal Energy Regulatory Commission

that the waterway in its current state be considered suitable for the LNG marine traffic associated with the proposed project.

11. This recommendation is contingent upon the applicant completing all actions outlined in the Waterways Suitability Assessment as submitted, and actions associated with subsequent annual updates, and completing all actions outlined in the most current WSA and actions under the control of the applicant from the July 1, 2008, Waterway Suitability Report.

Waterway Conditions Adjacent to the Facility

1. **Depth of Water**. The channel is currently maintained at a 37' depth.
2. **Tidal Range**. The tides of Coos Bay are of the mixed semi-diurnal type with paired highs and lows of unequal duration and amplitude. The tidal range increases upstream to the City of Coos Bay and the time difference between peak tides at the entrance and City of Coos Bay is about 40-90 minutes, depending on the location. The head of the tide is located at River Mile 27 on both the Millicoma and South Fork Coos Rivers. The tidal range is 7.5 feet near the open sea channel and 6.7 feet at the entrance to Charleston Harbor.

Table 2 Tidal Datums, Coos Bay, OR NOAA Tide Stations 9432895, 9432879, and 9432780

Tide Level	Abbreviation	Tide Level (ft) North Bend	Tide Level (ft) Empire	Tide Level (ft) Charleston
Tide Station ID #		9432895	9432879	9432780
Latitude		43º 24.6'N	43º 22.6'N	43º 20.7'N
Longitude		124º 13.1'W	124º 17.8'W	124º 19.3'W
Extreme High Water	EHW	-	-	+10.5
Mean Higher High Water	MHHW	+8.4	+7.7	+7.6
Mean High Water	MHW	+7.8	+7.1	+7.0
Mean Sea Level	MSL	+4.7	+4.2	+4.1
Mean Low Water	MLW	+1.3	+1.3	+1.3
Mean Lower Low Water	MLLW	+0.0	+0.0	+0.0
Extreme Low Water	ELW	-	-	-3.0

3. **Protection from High Seas**. The entrance to Coos Bay is similar to most harbors along the Pacific Coastline of Northern California, Oregon, and Washington. Strong winds are often experienced at North Bend on Coos Bay during the months of June, July, and August. These winds blow at 17 knots or greater 15-20 percent of the time and at 28 knots or greater 1 to 2 percent of the time. The harbor consists of a river estuary at the mouth of the Coos River. Sand and silt

from the river are carried out to the sea from this entrance. As a result of this material meeting the predominantly westerly seas and swells of the Pacific, a sandy ridge bar is formed at the mouth. This sand ridge causes the channel to be known as “a Bar Channel”. As such, a breaking bar does occur in this port.

4. **Natural Hazards**. The navigational hazards in the vicinity of the project site are rock jetties on either side of the channel entrance extending into the Pacific Ocean, and a submerged jetty which extends 50 yards off the east shore of Coos Bay. Discussions and simulations with the Coos Bay Pilots Association have shown that these hazards will not interfere with normal navigation and mooring operations and the applicant has developed transit mitigations to address this issue such as not bringing vessels in or leaving them at the lay berth during conditions that are not conducive to safe navigation i.e. restricted visibility, severe weather and and/or low tides.

5. **Fishing Vessels**. Heavy concentrations of fishing gear may be expected between December 1 and August 15, from shore to about 30 fathoms.

6. **Underwater Pipelines and Cables**. Based on current pipeline charts that are available, there are three cables which are submerged approximately 20 feet running across/underneath the channel in the vicinity of the town of Empire which is on the LNG Carrier transit route.

7. **Maximum Vessel Size by Dock**. The primary dock can accommodate a vessel with a maximum length of 300 meters, 52 meters in breadth, and a draft which can be accommodated by the existing channel. Although the facility dock is able to accommodate vessels drafting up to 12m (39ft), current channel draft is 11m (37ft) with future plans to dredge the channel to accommodate larger deep draft vessels. Jordan Cove Energy Project and the local pilots must ensure transiting LNG vessels are able to maintain 10% under keel clearance as required by JCEP's LNG Transit Management Plan.

    a. The dock must be able to accommodate all vessels calling on the facility.
    b. It must be equipped with adequate numbers of mooring hooks, fendering, and mooring dolphins.
    c. The mooring arrangement must also be able to accommodate safe working loads.
    d. In coordination with appropriate stakeholders, JCLNG must develop and implement vessel mooring/unmooring procedures to ensure safe and environmentally protective operations for LNG Carriers arriving and departing the JCLNG facility.

8. **Vessel Routing**. Included in the WSA, was a plan to divide the LNG Carrier transit route into five (5) inbound, one (1) loading at berth, and five (5) outbound segments. The total inbound transit from the Sea Buoy (pilot boarding area) to the terminal berth is approximately eight (8) miles and will take between 1.5 and 2.0

hours to berth, pilots will be transiting at around 4.5 knots. The route has been divided into segments in order to manage vessel traffic and increase the safety of LNG carrier transits. This was done in conjunction with the Coos Bay Pilots Association.

The route is reversed for outbound LNG Carrier transits with the exception of the turning/maneuvering basin which is bypassed on the outbound transit where the LNG Carrier is moved directly into the Coos Bay Ship Channel. The route and segments are shown in Figure 3.

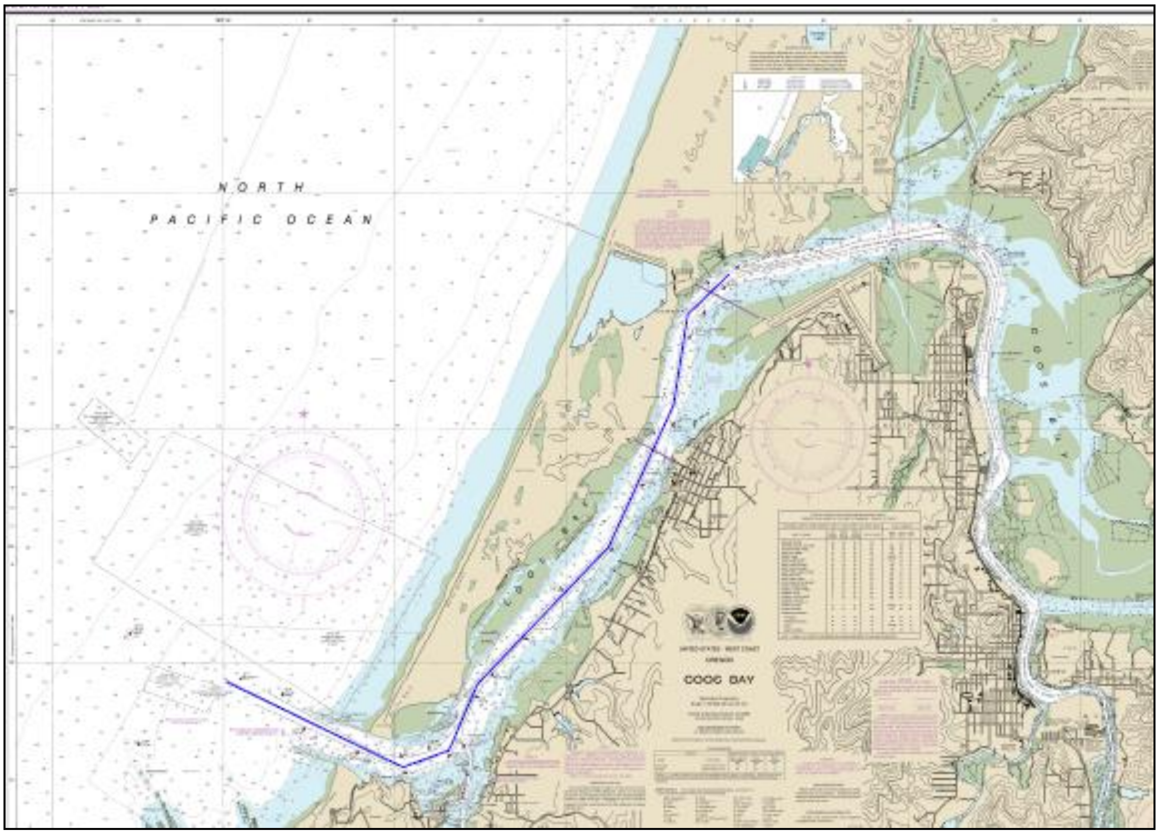


Figure 3. Overview of LNG Carrier Transit Route

9. **Vessel Operations –**LNG vessels will load cargo at the facility. 110-120 arrivals are expected at the facility annually with a dedicated fleet of LNG Carriers conducting cargo operations at the facility. A lay berth will be constructed to accommodate delays, repairs, and maintenance issues associated with Trans-Pacific Trade. Cargo operations will not be permitted at the lay berth and the applicant will outline procedures for the lay berth after the permitting process is complete.

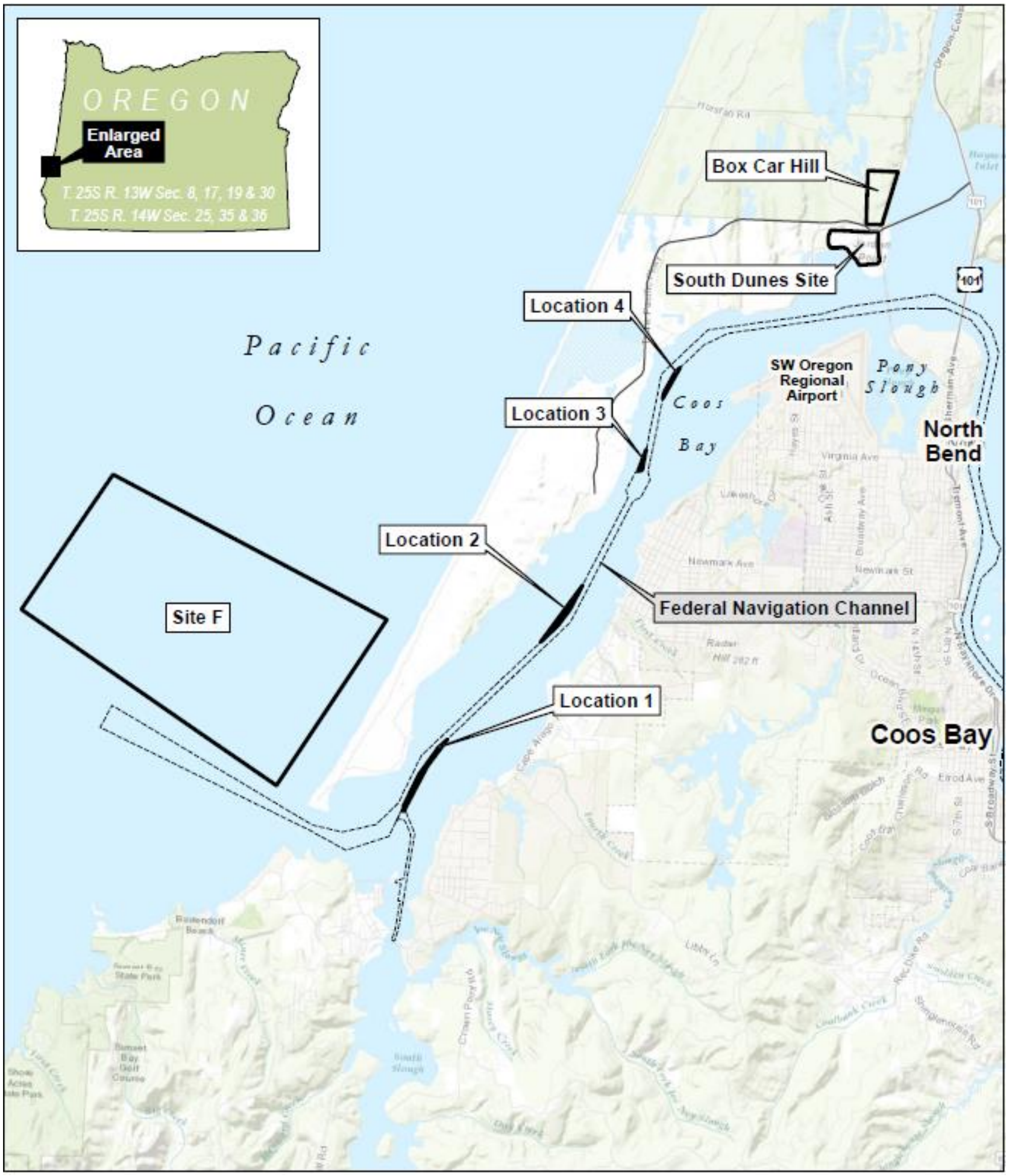


Figure 4. Channel Improvements

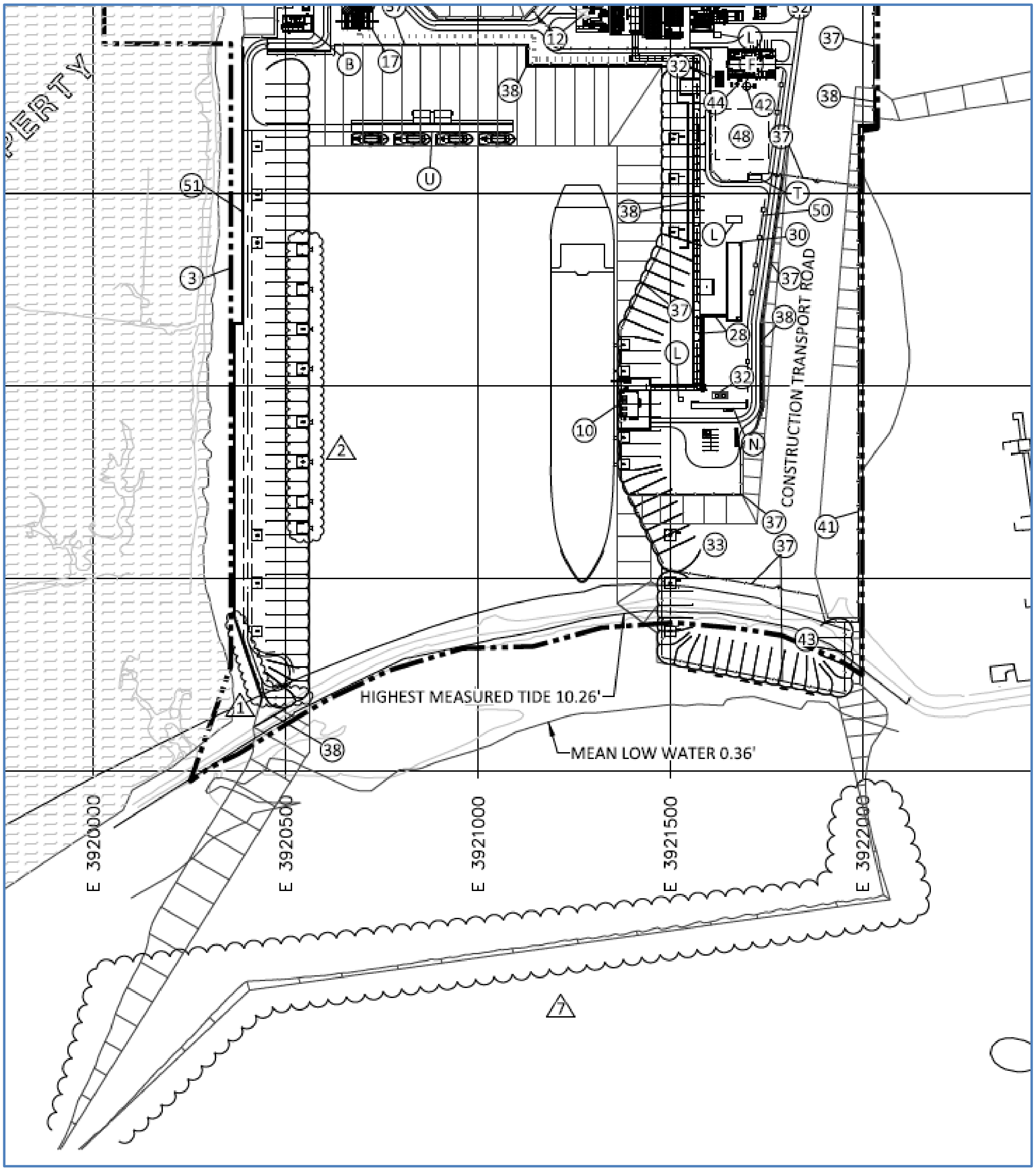


Figure 5. Dredging at the berth

U.S. Department of Homeland Security
United States Coast Guard

Captain of the Port
United States Coast Guard
Sector Columbia River

2185 SE 12th Place
Warrenton, OR 97146-9693
Staff Symbol: s
Phone: (503) 861-6206
Fax: (503) 861-6355

16611

NOV 07 2018

Tony Diocee, Vice President, Projects
Jordan Cove Energy Project, L. P.
5615 Kirby, Suite 500
Houston, TX 77005

Dear Mr Diocee:

The USCG Waterways Suitability Report provided to the Federal Energy Regulatory Commission (FERC) on July 1, 2008 and a subsequent Letter of Recommendation provided to FERC on May 10, 2018 required the applicant, Jordon Cove Energy Project, L.P. (JCEP), to conduct additional ship transit simulator studies for liquid natural gas (LNG) carriers that exceed a 148,000 m^3 spherical containment class vessel or for any increase in physical dimensions.

Since the initial Waterway Suitability Analysis was submitted to the USCG in 2007 LNG Tanker technology has improved and tanker sizes and capacities have changed. As a result, additional simulator studies were required. In response, JCEP conducted additional vessel transit simulations during September 26-27, 2018 using modern ship design and carrying capacities.

The simulated transits were piloted by the Coos Bay Pilots and witnessed by the USCG. They were conducted at California Maritime Academy in Vallejo, CA using a Transas Simulator. They were conducted to demonstrate that the Coos Bay Pilots can safely and successfully maneuver LNG carriers up to 299.9 x 49m x 11.9m dimensionally while transiting the channel.

These successful simulations expand the ability for Jordan Cove LNG to use any class of LNG carrier (membrane, Moss, or SBT) with physical dimensions equal to or smaller than observed during the simulated transits. JCEP will continue development of the Transit Management Plan and work with the Coos Bay Pilots in establishing any other operating parameters.

Sincerely,

J. C. SMITH
Commander, Sector Columbia River
Captain of the Port
Captain, U. S. Coast Guard

Enclosure: 1) Jordon Cove LNG Terminal Simulation Plan, September 2018
2) TRANSAS Simulation Printouts

Copy: FERC
Commander, Coast Guard District Thirteen (dp)
Commander, Pacific Area (PAC-54)
Commandant (CG-OES), (CG-ODO), (CG-FAC), (CG-741), (CG-CVC), (CG-ENG), (LNGNCOE)
Marine Safety Center (CG MSC)

DAVID EVANS AND ASSOCIATES INC.

MEMORANDUM

DATE: March 12, 2019

TO: Seth King, Steve Pfeiffer
Perkins Coie LLP
1120 N.W. Couch Street Tenth Floor
Portland OR 97209-4128

FROM: Gigi Cooper

SUBJECT: Federal Navigation Channel Dredge Area 4 – City of Coos Bay Land Use Permit Support

PROJECT: JLNG0003 112DE
Jordan Cove Energy Project – Regulatory Permitting

CC: Derik Vowels, Jordan Cove LNG

Perkins Coie LLP requested the following two work products from DEA to support the land use applications for the JCEP NRI #4:

- Explanation of how the NRI dredging work will be completed (timing, duration, equipment, materials) and how that work will affect users of the Bay; and

DEA response: Please see Attachment 1: Description of Dredging Work.

- Explanation of the environmental impacts of the NRI #4 by addressing the highlighted aspects of Coos Bay Estuary Management Plan Policies 4 and 5 (starting with 5 because it includes the cross-reference to 4, which, in turn, cross-references 4a).

DEA response: Please see Attachment 2: Responses to CBEMP Policies 4 and 5.

Please let me know if you have any questions.

Attachments/Enclosures: Attachment 1: Description of Dredging Work; Attachment 2: Responses to CBEMP Policies 4, 4a, 5
File Path: Document2

DEA Task:

- Explanation of how the NRI dredging work will be completed (timing, duration, equipment, materials) and how that work will affect users of the Bay.

Sources:

- Bill Gerken, PE, Moffatt & Nichol; Terry Stones, PE, David Evans and Associates, Inc.; and Pilots' Enhancement Narrative, April 20, 2017

DEA response:

Hydraulic dredging, the technique that would most likely be used, will employ a cutter suction dredge, in which material is loosened from its *in situ* state and lifted in suspension through a pipe system connected to a centrifugal pump that removes the material and pumps the slurry through a discharge pipeline. A rotating cutting apparatus (cutter head) is used around/ahead of the intake of a suction pipe to break up or loosen bottom material. The temporary dredge line for disposal will run up to approximately seven miles from the farthest location adjacent to but outside the Federal Navigation Channel (FNC). The pipeline would land at the north side of the upland confined disposal site denoted as APCO 2, in the City of North Bend, at approximately River Mile (RM) 9 of the FNC, near the southern terminus of the U.S. Highway 101 McCullough Bridge. The temporary dredge line would be approximately 24 to 30 inches in diameter and would be placed within a corridor of up to 50 feet in width. Corridors are designed to be wider than the dredge line to accommodate for inaccuracies and flexibility in dredge line placement, any shifting/settling of pipeline, and ability to accommodate variations in bathymetry. At the APCO disposal site, the material would be pumped onto the site in a slurry, decanted and dried within a containment dike system, and permanently stockpiled.

Construction of the temporary dredge line and dredging will occur during the ODFW in-water work window (IWWW) which occurs between October 1 and February 15, for three consecutive years. The duration over several years is required for material handling and dredge water decanting at the APCO 2 disposal site. Weather delays and/or equipment failures are not factored into the production rates and construction durations. Following completion of dredging, all in water pipelines, dredge equipment, and off-loading facilities if used, will be removed prior to the end of the IWWW in mid-February.

DEA Task:

- Explanation of the environmental impacts of the Dredge Area 4 by addressing the highlighted aspects of Coos Bay Estuary Management Plan Policies 4 and 5 below (starting with 5 because it includes the cross-reference to 4).

Sources:

- City of Coos Bay. No date. Coos Bay Estuary Management Plan, Management Framework: Definitions, Policies and Standards, and Plan Provisions. http://coosbay.org/uploads/PDF/Plans/Estuary_Plan_-_Vol_3.pdf
- David Evans and Associates, Inc., Coos Bay Pilots Association Navigation Efficiency Improvement Project Draft Biological Assessment, April 2017
- David Evans and Associates, Inc., Coos Bay Pilots Association Safety Enhancements Project Draft Biological Assessment, January 2017
- David Evans and Associates, Inc., FERC Resource Report 8: Land Use, Recreation, and Aesthetics, September 28, 2017
- David Evans and Associates, Inc., Visual Impact Assessment Report (Appendix to FERC Resource Report 8: Land Use, Recreation, and Aesthetics), September 14, 2017
- David Evans and Associates, Inc., USACE/DSL Joint Permit Application Removal-Fill for the Navigation Reliability Improvements, Box 4, #3, Recreation, October 2017
- King, Seth, Perkins Coie LLC, Draft narrative in support of the application (mainly for Derik Vowels' comments on consistency with the project removal/fill application)
- Moffatt & Nichol, Inc. 2016. Draft Technical Memorandum – Safety Enhancements to the Coos Bay Navigation Channel, Task 5 Turbidity Study Technical Memorandum.
- Oregon Department of Environmental Quality (ODEQ).2017b. ODEQ website for Total Maximum Daily Loads, South Coast Basin. Available online at: http://www.oregon.gov/deq/wq/tmdls/Pages/TMDLs-South-Coast-Basin.aspx. Accessed on September 7, 2017
- Oregon Department of Fish and Wildlife. 1979. Natural Resources of Coos Bay Estuary: Estuary Inventory Report. Vol. 2, No. 6., for Oregon Land Conservation and Development Commission.
- Pfeiffer, Steven L., Perkins Coie LLC, Purpose and Need Statement for Safety Enhancements to the Coos Bay Navigation Channel, May 2, 2016

DEA response:

Text from the City of Coos Bay's Coos Bay Estuary Management Plan, 3. Management Framework: Definitions, Policies and Standards, and Plan Provisions, Section 3.3 – Bay-Wide Policies, is shown in *italics*. Provisions that Perkins Coie requested a response from DEA are in black font; other provisions are shown in grey font.

#5 Estuarine Fill and Removal

Dredging and/or filling shall be allowed only:

A. *If required for navigation or other water-dependent uses that require an estuarine location or if specifically allowed by the applicable management unit requirements of this goal; and*

Response: The proposed activity, dredging one 3.3-acre area, is required for navigation. The purpose of the proposed action is to improve reliability and efficiency of navigation for existing deep draft vessels by reducing the existing navigation constraints at the key turn ("Dredge Area") in the Federal Navigation Channel (FNC). The proposed activity does not include fills for non-water-dependent uses.

B. *If no feasible alternative upland location exists; and*

C. *If a pubic need (i.e., a substantial public benefit) is demonstrated and the use or alteration does not unreasonably interfere with public trust rights; and*

D. *If adverse impacts are minimized; and*

Response: Please see responses to Policy #4, D.

E. *The activity is consistent with the objectives of the Estuarine Resources Goal and with other requirements of state and federal law, specifically the conditions in ORS541.615 and Section 404 of the Federal Water Pollution Control Act (P.L. 92-500).*

Other uses and activities which could alter the estuary shall only be allowed if the requirements in B, C, and D are met. All portions of these requirements may be applied at the time of plan development for actions identified in the Plan. Otherwise, they shall be applied at the time of permit review.

This strategy shall be implemented by the preparation of findings by local government documenting that such proposed actions are consistent with the Comprehensive Plan, and with criteria "a" through "e" above. However, where goal exceptions are included within this plan, the findings in the exception shall be sufficient to satisfy criteria "a" through "c" above. Identification and minimization of adverse impacts as required in "d" above shall follow the procedure set forth in Policy #4a. The findings shall be developed in response to a "request for comment" by the Division of State Lands, which shall seek local government's determination regarding the appropriateness of a permit to allow the proposed action.

Response: Please see responses to Policy #4, the following section D., below.

"Significant," as used in "other significant reduction or degradation of natural estuarine values," shall be determined by:

A. *The U.S. Army Corps of Engineers through its Section 10 and 404 permit processes; or*

B. *The Department of Environmental Quality for approvals of new aquatic log storage areas only; or*

C. *The Department of Fish & Wildlife for new aquaculture proposals only.*

This strategy recognizes that Goal #16 limits dredge, fill and other estuarine degradation in order to protect the integrity of the estuary.

4. RESOURCE CAPABILITY CONSISTENCY AND IMPACT ASSESSMENT

Local government concludes that all proposed actions (approved in this Plan) which would alter or potentially alter the estuarine ecosystem have been based upon a full consideration of the impacts of the proposed alteration, except for the following uses and activities:

[EXCERPT OMITTED because these proposed project actions do not fall under any of these exceptions, a through d]

D. Any other uses and activities which require the resource capability consistency test as a condition within a particular management unit or which could affect the estuary's physical processes or biological resources.

Response: Please see responses to 4. A. through D., immediately below.

Unless fully addressed during the development and adoption of comprehensive plans, actions, which would potentially alter the estuarine ecosystem shall be preceded by a clear presentation of the impacts of the proposed alteration.

For uses and activities requiring the resource capabilities test, a special condition is noted in the applicable management unit uses/activities matrix. A determination of consistency with resource capability and the purposes of the management unit shall be based on the following:

A. A description of resources identified in the plan inventory;

Response: Dredge Area 4 is designated 52-NA. The temporary dredge lines from Dredge Area 4 are in City of Coos Bay CBEMP designation 52-NA and DDNC. In 52-NA, temporary alterations may be allowed subject to "Special Conditions" presented following the use and activity matrix. A few of the special conditions are non-discretionary, but most require local judgment and discretion and that development of findings to support any final decision about whether or not to allow the use or activity. In DDNC, temporary alterations are permitted outright.

The Oregon Department of Fish and Wildlife Natural Resources of Coos Bay Estuary: Estuary Inventory Report (1979), describes the area:

Although the sandy shore between RM 6 and 8 on the western side of the bay appears unproductive because it does not have attached vegetation, it is a valuable habitat for certain species of fish. Any development occurring there should preserve the sandy substrate and water quality of the area. Use of pilings may be appropriate in the area unless subsequent reduction in current velocity changes the quality of the substrate.

Significant Habitat of Major Importance and other inventory maps. The Shoreland Values Requiring Mandatory Protection map (June 14, 1982) shows three categories of Significant Wildlife Habitat: freshwater wetlands, snowy plover habitat, and heron rookery. All of the mapped resources are on land. As these three categories of Significant Wildlife Habitat are all terrestrial, and this dredging project solely would occur within the waters of Coos Bay, the proposed project would not disturb any Significant Habitat of Major Importance that are Shoreland Values Requiring Mandatory Protection. Other mapped shoreland values are major marsh, archaeological sites, historical sites, and coastal headlands, which likewise are terrestrial and would not be disturbed.

The Significant Habitat of "Major" Importance Qualifying as Natural Management Units Under Estuarine Resources Goal (June 11, 1982), maps major salt marsh, seagrass and algae beds, intertidal flats, seagrass/algae beds and intertidal flats, and other significant habitat. These are terrestrial, not within the waters of Coos Bay, and eelgrass is to the east of Dredge Area 4, and none would be disturbed by this proposed project.

The Fish & Wildlife Habitats Map I shows anadromous fish distribution (salmon, steelhead, and cutthroat trout) throughout Coos Bay. It indicates a snowy plover nest site and a blue heron nest site on the North Spit, but neither are near, or would be affected by, the dredging project at Dredge Area 4. The Fish & Wildlife Habitats Map II (1980) shows elk and deer big game range and wetlands, all of which are terrestrial only.

The Crustacean Habitats map delineates areas of amphipod (*Corophium sp*.), ghost shrimp (*Neotrypaea californiensis*), and mud shrimp (*Upogebia pugettensis*). The Dredge Area 4 is not in a mapped crustacean habitat. Dredge Area 4 is near an amphipod habitat area on the North Spit, but dredging activities would not disturb it.

The Clam Beds and Oyster Leases map (August 5, 1981) shows clam beds on both sides of the FNC. Beds between RM 6 and RM 8 are directly adjacent to the existing FNC, but on the other side of it from Dredge Area 4. The Clam Species in the Coos Bay Estuary map indicates that these primarily are gaper (*Tresus capax*) clams.

The inventory document is from July 1984 and the maps are from 1980 and 1981, based on sources from the 1970s. At that time, few resource-specific inventories had been done, and conditions in the Bay have changed in the past 35 and 45 years. Therefore, the information in the inventory is not as useful as studies conducted specifically for the Jordan Cove project, including Dredge Area 4, within the past decade.

B. *An evaluation of impacts on those resources by the proposed use (see impact assessment procedure, below); and*

Response: Please see the responses to Policy #4, the following section, C., below.

C. *In a natural management unit, a use or activity is consistent with the resource capabilities of the area when either the impacts of the use on estuarine species, habitats, biological productivity and water quality are not significant or that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner to protect significant wildlife habitats, natural biological productivity, and values for scientific research and education.*

D. *In a conservation management unit a use or activity is consistent with the resource capabilities of the area when either the impacts of the use on estuarine species, habitats, biological productivity and water quality are not significant or that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner which conserves long-term renewable resources, natural biologic productivity, recreational and aesthetic values and aquaculture.*

The impact assessment need not be lengthy or complex, but it should enable reviewers to gain a clear understanding of the impacts to be expected. It shall include information on:

A. *The type and extent of alterations expected;*

Response: Dredge Area 4 Is the turn from Lower Jarvis Range to Jarvis Turn Range channels: JCEP proposes to widen the turn area here from the current 500 feet to 600 feet at the apex of the turn and lengthen to total corner cutoff area of the turn from the current 1,125 feet to about 1,750 feet thereby allowing vessels to begin their turn in this area earlier. A dredge material pipeline would carry dredge material from Dredge Area 4 to the APCO 2 disposal site, outside of City of Coos Bay jurisdiction.

B. The type of resource(s) affected;

Response: The resources evaluated are water quality including turbidity and discharges, physical characteristics including shoaling and shoreline erosion, noise, deep subtidal area, living resources, recreation, aesthetics, and navigation. The only affected resource would be the temporary disturbance for the removal of approximately 3.3 acres of deep subtidal area. Dredging would take place in deep subtidal habitat, which also provides habitat for benthic organisms such as worms, crustaceans, and mollusks. These activities would temporarily affect the macroinvertebrates that live within the substrate in these areas and move, rest, find shelter, and feed on the substrate and organic material. Additionally, the fish species that utilize these habitats could be temporarily affected. Dredging would result in increased turbidity within the estuarine analysis area. The restriction of construction activities to the in-water work window of October 1 through February 15, when salmonid species abundance is lower, would reduce the likelihood of impacts to these species. The substrate in these areas consists primarily of unvegetated sand and rock, and is therefore of low ecological value. The dredging project would temporarily increase water turbidity. It would be temporarily visible and may be audible.

C. The expected extent of impacts of the proposed alteration on water quality and other physical characteristics of the estuary, living resources, recreation and aesthetic use, navigation and other existing and potential uses of the estuary; and

Response:

Water quality. The Oregon Department of Environmental Quality's (ODEQ) Ambient Water Quality Monitoring Program and the Oregon Beach Monitoring Program (OBMP) monitor water quality. ODEQ has designated CWA Section 303(d) water quality limited segments within the Coos Bay watershed. The ODEQ is currently in the initial scoping and data collection phase for the preparation of a total maximum daily load (TMDL) limit for fecal coliform in the watershed. A TMDL is a planning tool that assesses the various sources of a constituent into a watershed and places achievable limits on those sources in order to accomplish water quality goals. The 2012 ODEQ Priorities and Schedule list targets year 2015 to start work on the Coos sub-basin TMDL (ODEQ 2014). The ODEQ website notes that a TMDL for the Coos Subbasin has been initiated, and is in the initial scoping and data collection phase (ODEQ 2017b).

Coos Bay from River Mile 0 to 7.8 is water quality limited for fecal coliform and shellfish growing is listed as a beneficial use, and a TMDL is needed (Category 5) (ODEQ 2016).

Mobilization of suspended sediment as a result of dredging operations can result in a reduction in light penetration and, consequently, a reduction in primary production within the affected area. Increases in suspended sediment can also affect the feeding patterns of benthic filter feeding organisms and the behavior of fish, while the settling of suspended particles can result in the burial of organisms and modifications to benthic substrate (FERC 2015).

Turbidity has not been identified as a water quality concern in Coos Bay. Within Coos Bay, ambient background turbidity levels taken at the Charleston Bridge station between April 2002 and December 2004 range between 10 milligram per liter and 27.3 milligram per liter during summer and winter, respectively (Moffatt & Nichol 2017). More recently, hourly turbidity readings taken at the North Spit-BLM boat ramp gauge were compiled between August 2013 and January 2015. Based on these data, the average natural turbidity level was calculated to be 40 mg/L at the North Spit-BLM boat ramp gauge (M&N 2016). JCEP expects increased water turbidity as a result of the Dredge Area improvements and during the driving of the temporary piles that will support the steel cradle and slurry pipeline spanning the eelgrass beds to be temporary and limited to the immediate vicinity of operations. Within 200 feet of dredging operations, turbidity levels decrease to ambient background levels (FERC 2015).

JCEP does not anticipate oil spills or toxic discharges to occur when constructing the Dredge Area improvements. The potential for spills and toxic discharges always exists when using dredging equipment. Any accidental spill or leak of petroleum products or other toxic discharges from dredging equipment or vessels could result in impacts to water quality and aquatic species in the short-term. However, the dredging vessels will be carrying relatively small volumes of petroleum (1,500 to 25,000 gallons) in comparison to the large bulk carriers and Panamax vessels (1.5 to 2 million gallons [NOAA 2016]) that regularly travel through Coos Bay. The fuel carried onboard the dredging vessels is low sulphur diesel, which is relatively light and will evaporate over time if spilled on the water. The bulk carrier vessels carry both low sulphur diesel and heavy fuel oil, the latter of which would have a much greater pollution impact if spilled on water. Given the low probability of a spill, preventive measures such as the implementation of a spill prevention plan, and the relatively small volume of fuel on board vessels utilized by the Project, large-scale or long-term negative impact are not anticipated from spills and/or toxic discharges.

Physical characteristics. According to sediment transport modeling of the proposed Dredge Area, shoaling in the dredged areas is not expected to differ from current shoaling totals for the existing FNC. Total shoaling was analyzed through existing conditions versus incorporating the proposed enhancements, and the difference in shoaling amounts after one and three years were negligible (Moffat and Nichol 2017). Thus, indirect effects to listed species and/or critical habitat are not expected to occur as a result of sediment transport or shoaling in Dredge Area 4. The dredging activity would not cause any shoreline erosion beyond natural waves, which is minimal.

Noise. Dredging equipment and material transport vessels related to the Dredge Area improvements may generate temporary noise disturbances. However, the noise will be localized to the immediate dredging area. While the noise temporarily could affect the behavior of aquatic species in the immediate vicinity and result in the displacement of noise-sensitive species during hours of operation, it is anticipated that any displaced species would resume their typical behavior patterns once dredging has ceased.

There could be potential temporary and short-term impacts from construction noise to people recreating on the North Spit, but distance, topography, coastal wind, and vegetation would help to minimize the noise from the dredging. City of Coos Bay does not have a noise ordinance.

Deep subtidal area. The entire 3.3-acre footprint of Dredge Area 4 is located in deep subtidal habitat. Deep subtidal habitats are not defined by any regulations (e.g., Clean Water Act Section 404 or Oregon Removal-Fill Law), but are cited in Roye (1979) and CBEAC (1984) as occurring below -15 feet MLLW and being generally less productive than shallower habitats in the Coos Bay estuary). The habitat in these locations is classified as deep subtidal, estuarine, unconsolidated bottom based on the Cowardin classification system (Cowardin et al. 1979). Deep subtidal habitat is classified as

Category 3 under ODFW's habitat categories, because it is "essential" to wildlife but is not "limited." This habitat is disturbed on an annual basis as part of USACE's maintenance dredging of the FNC.

A total of 846 acres of mapped deep subtidal habitat is located within lower Coos Bay. Permanent removal from Dredge Area 4 would be approximately 3.3 acres, or approximately 0.3 percent. The substrate in this area consists primarily of unvegetated sand and rock, and is therefore of low ecological value. In addition, the dredge lines would temporarily affect approximately 13 acres of deep subtidal habitat.

The dredging volumes in cubic yards (CY) for Dredge Area 4 are:

Location	Rock Volume (CY)	Sand Volume (CY)	Total Volume (CY)
Dredge Area 4 (RM ~7, Jarvis Turn)	0	24,900	24,900

(Moffatt & Nichol 2017)

Living resources. Dredging will remove sand in deep subtidal habitat, resulting in direct impacts to benthic organisms occupying the substrate, such as worms, mollusks, echinoderms and crustaceans, as well as organisms that feed on them. Removal of larvae and juvenile life stages of various species, including crustaceans, mussels and gastropods, is also anticipated. While these benthic organisms are not listed as threatened or endangered under the federal Endangered Species Act, they are an important food source for listed species. However, the effects to aquatic organisms would be temporary and localized, and will not have population-level effects. Recovery of benthic organisms to pre-dredging conditions can occur as quickly as one month post-dredging, but could take up to a year (FERC 2015).

The following protected species were identified as potentially occurring in the Coos Bay in the vicinity of Dredge Area 4:

Common name	Scientific name	Status
Protected fish species		
Eulachon – Southern Distinct Population Segment (DPS)	*Thaleichthys pacificus*	threatened
Green Sturgeon – Southern DPS	*Acipenser medirostris*	threatened
Oregon Coast Evolutionary Significant Unit (ESU) Coho Salmon	*Oncorhynchus kisutch*	threatened
Protected bird species		
Marbled murrelets	*Brachyramphus marmoratus*	threatened
Pacific Coast population of western snowy plover	*Charadrius alexandrinus nivosus*	threatened
Marine mammal species Protected under the MMPA but not federally listed		
Harbor seals	*Phoca vitulina*	N/A
California sea lions	*Zalophus californianus*	N/A
The eastern DPS of Steller sea lion	*Eumetopias jubatus*)	N/A
Northern elephant seals	*Mirounga angustirostris*	N/A
Harbor porpoises	*Phocoena*	N/A
Killer whale Eastern North Pacific Transient stock and Eastern North Pacific Offshore stock	*Orcinus orca*	N/A

The proposed dredging project has the potential to affect the ESA-listed fish and bird species identified in the table above. Dredging is expected to create localized, short-term spikes of high to moderate TSS and turbidity. Turbidity may affect marbled murrelet forage/prey species and their habitat. Effects to listed fish are expected to be slight due to the limited area affected in the bay and limitations on construction periods. While impacts such as behavioral and foraging changes are anticipated, these impacts will be limited to the immediate location of dredging activities and will be temporary in nature. Direct mortality of juvenile and adult life stages of ESA-listed fish is not anticipated, as they will likely be able to avoid areas being actively dredged and dredging would occur during the in-water work window when these species are less abundant. While foraging for benthic organisms in dredged areas will be affected, deep subtidal foraging habitat is not limited in Coos Bay and these areas are expected to recolonize and recover within a year of dredging. Dredging activities impacts to ESA-listed fish and birds would be temporary in nature and are not expected to adversely affect these species or their designated critical habitat.

The proposed dredging project has the potential to affect the marine mammals identified in the table above. Turbidity associated with dredging activities may temporarily affect behavior and foraging within the immediate vicinity of the dredge area.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended, requires that proposed projects with a federal nexus evaluate their impacts on habitat of commercially managed fish populations. Essential Fish Habitat (EFH) is identified and described based on areas where various life stages of each managed species commonly occur. EFH has been defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 USC 1802(10)). Coos Bay is designated as EFH for several Coastal Pelagic Species (CPS—includes Pacific sardine, northern anchovy, market squid, Pacific mackerel, and jack mackerel), West Coast Groundfish (includes more than 80 species of rockfish, flatfish, groundfish, sharks and skates), and two Pacific Salmon (Chinook, and coho). Dredging may adversely affect EFH for juvenile and adult fish from the three groups. This is based on the predicted levels of turbidity from dredging in Coos Bay relative to background levels, the short-term, localized, but ongoing exposure of fish to such conditions during up to four in-water work windows; and the periodic disturbance of benthic communities for about a year each dredge cycle.

Recreation. The USACE manages 245 acres on the North Spit, including the North Jetty at the mouth of Coos Bay. The BLM administers 1,864 acres on the North Spit, with 725 acres classified as an Area of Critical Environmental Concern and the remainder designated as a Special Recreation Management Area (SRMA), in recognition of the value of the area for outdoor recreation. The BLM boat launch facility and courtesy dock, which provide access to the Coos Bay estuary and are within the SRMA (BLM 2016). The primary recreational activities taking place within the Coos Bay estuary include boating, fishing, waterfowl hunting, wildlife viewing and bird watching, clamming, and crabbing.

Recreational boating takes place throughout Coos Bay, although most originates primarily near the towns of Charleston and Empire, where there are boat ramps. There is also a marina complex in Charleston and access points for canoeists and kayakers to the northeast in Haynes Inlet and North Slough. In addition to the Charleston boat ramp and Empire boat ramp, recreational boaters use the BLM North Spit boat ramp to access the bay. All three boat ramps would remain open during dredging. Dredging and dredge material transport will be limited in extent and avoidable by recreational craft participating in the fishery. Dredge operations and submerged temporary dredge line are not expected to impact recreational craft transit to upstream or downstream areas of Coos Bay or limit fishing except where work is actively occurring and in the associated safety area around work areas. Dredging activities will be announced to the boating community via a local notice to mariners provided through notification to the USCG. There would be no significant impact on recreational boating because dredging activities would be in a limited area, short-term, and temporary.

The main recreational catch species of fish in and around Coos Bay include coho and Chinook salmon. Other recreational catch species include American shad, shiner perch, redtail surf perch, striped sea perch, white sea perch, pile perch, black rockfish, lingcod, Cabezon, red Irish lord, Pacific staghorn sculpin, surf smelt, Pacific herring, Pacific tomcod, kelp and rock greenling, blue and cooper rockfish, halibut, and white sturgeon. Much of the recreational angling for salmon in Coos Bay occurs in late summer and fall, usually beginning in late summer at jetty areas and moving up the bay as fish move upstream. Recreational fishing for sturgeon occurs between the railroad bridge and the McCullough Bridge, and also above the McCullough Bridge. Dredging will occur concurrently with the recreational salmon fishery for approximately one month annually during construction. Dredging will observe the ODFW in-water work window of October 1 – February 15 and is expected to overlap with the salmon fishery primarily during the month of October.

Recreational clamming and crabbing activities occur in Coos Bay on a year-round basis, and they bring revenue to the region. All species of "bay clams" are found in Coos Bay, including butter (about 24 percent of the harvest), cockle (10%), gaper clams (6%), and native littleneck clams (1%). Clamming is conducted on the mud flats on the bay side of the North Spit up to NCM 6, Oregon Department of Fish and Wildlife (ODFW) regulations limit the amount a person can catch in a day to 20 clams, of which 12 may be gaper clams. Between March and September of 2008, a total of about 33,700 kilograms of clams were harvested in Coos Bay, making it the third most productive clamming estuary in the state (Ainsworth and Vance 2008).

Although shore crabbing in Coos Bay is done year-round, it is most productive during fall and winter. Crabbing is conducted from docks in Charleston and Empire, and from boats, particularly to the west of the FNC in the lower bay, on the bay side of the North Spit below NCM 7. Crabs are caught using traps, rings, or snares. While recreational crabbers in Oregon also harvest red rock crabs and Pacific rock crabs, Dungeness crabs are far more popular. A study that collected crabs near the RFP property found that 98 percent were Dungeness crabs, with far lesser counts of hairy shore crabs, red rock crabs, and non-native European green crabs (Yamada 2014). ODFW regulations limit individual daily catches of crabs to 12 male Dungeness larger than 146 millimeters across and 24 red crabs of any sex and size. Another study by ODFW found that between 2008 and 2011 an average of 158,650 pounds per year of Dungeness crabs were harvested from Coos Bay. During that same period an annual average of 14,710 recreational crabbing trips were taken to Coos Bay. The vast majority of the recreational crabbers (76 percent) came from 100 miles away or less (Ainsworth *et al*. 2012).

The west shore of the bay at Jordan Cove contains sand/mudflats, eelgrass beds, and a fringe of salt marsh that provide habitat for recreationally important ghost shrimp and mud shrimp. These shrimp are recreationally harvested at a number of locations throughout the bay, and are popular among anglers for use as bait.

<u>Aesthetics.</u> Dredging equipment and activities would be visible in Coos Bay. However, relative to existing tanker ship traffic in the Bay, and the existing operational ocean-going vessel loading facility at the RFP facility, the dredging is anticipated to be a minor visual impact, as well as limited in duration.

<u>Navigation.</u> The proposed navigation reliability improvement at Dredge Area 4 would have a beneficial impact on the current and future viability for maritime commerce in Coos Bay. The proposed enhancements to the FNC are designed to reduce entry and departure delays for vessel transit through the FNC for the size of vessels entering the Port today. Although log export vessels serving the upper bay are smaller, the proposed enhancements also benefit these vessels by broadening the tidal and environmental limit (wind and current) windows for transiting the FNC, which provides an enhanced margin of safety and improved efficiency in the loaded vessel departure schedule. The navigation reliability improvements also would allow companies to engage in emerging opportunities to export products with today's larger vessels.

During outbound transits it is difficult to make this 35-degree turn from the Jarvis Turn Range, which is 400 feet wide, to the Lower Jarvis Range, which is only 300 feet wide, due to the very short length of the existing corner cutoff of only 1125 feet. Widening the turn area from the current 500 feet to 600 feet at the apex of the turn and lengthening the total corner cutoff area of the turn from the current 1125 feet to about 1750 feet will allow the Pilots to commence their turn earlier. This will greatly improve the ability of today's larger ships to make this turn safely on a consistent basis.

D. The methods which could be employed to avoid or minimize adverse impacts.

Response:

<u>Water quality.</u> JCEP will use methods to minimize the effects of the navigation reliability improvements on water turbidity within the bay. Should turbidity levels remain above ambient background levels greater than 200 feet from dredging operations, BMPs will be employed in place to reduce turbidity levels further. JCEP would avoid and minimize oil spills or toxic discharges during dredging operations and dredged material transport, including the implementation of spill containment plans.

<u>Noise.</u> To minimize impacts to fish and wildlife, BMPs will be implemented to minimize the extent of noise generation to the maximum extent possible. However, it will not be possible to avoid noise generation entirely, but it would be temporary.

<u>Deep subtidal area and living resources.</u> JCEP plans to perform dredging during the ODFW-approved in-water work window for Coos Bay (October 1 to February 15) to reduce impacts to sensitive life stages of fish in the Bay. Due to the short time in which dredging would occur, benthic communities would be expected to recover.

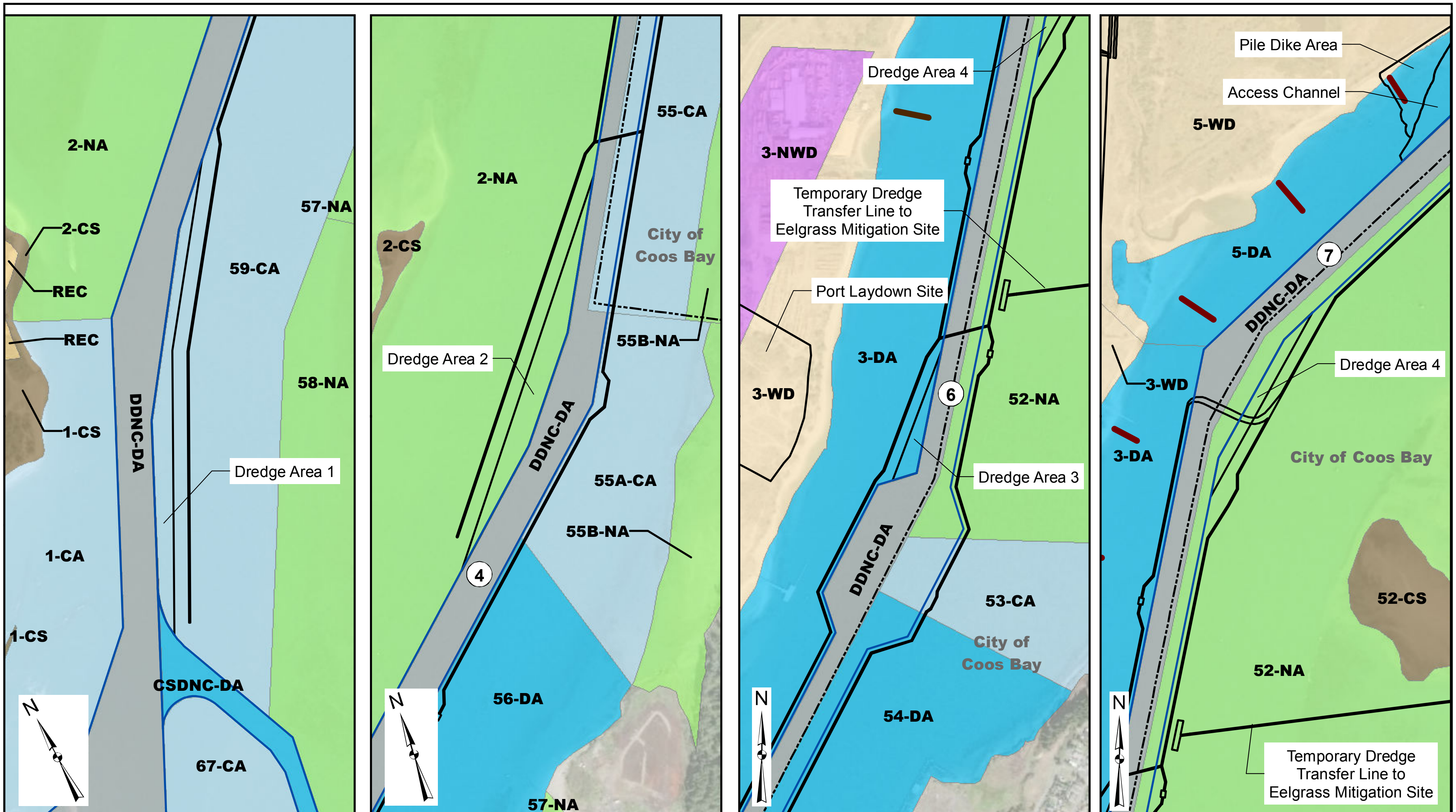
Recreation. The USCG and the OSMB would provide notices to boaters to avoid the area during the dredging activities, which would occur during the in-water work period from October 1 through February 15. All floating and submerged dredging equipment operating in the bay will be clearly marked with day signals and light signals at night accordance with the US Inland Rules of the Road. If the signage and notices are not sufficient to prevent recreational boating from avoiding the construction areas, some form of physical barrier, such as a continuous string of highly visible soft material floats, could be extended across the mouth of the slip or around the construction dredging area. Construction safety inspectors would also be responsible for warning any recreational boaters who enter the construction area. As the construction dredging area is limited in size, boaters could easily avoid the construction areas by moving to the opposite side of the bay.

Aesthetics. With minor relative impacts, no avoidance or minimization methods are needed.

Navigation. The sections of the pipeline that cross the FNC will be submerged on the FNC bottom to allow for vessel passage. The section(s) of floating pipeline would be temporarily removed to allow vessel passage.

This policy is based on the recognition that the need for and cumulative effects of estuarine developments were fully addressed during the preparation of this Plan and that, except as otherwise stated above, no additional findings are required to meet Implementation Requirement #1 of LCDC Goal 16.

Response: No response required.



JCEP Project Area
Existing Pile Dike
City Limits
Channel Mile
Federal Navigation Channel

CBEMP Aquatic Management Units
- Conservation Aquatic (CA)
- Deep Draft Navigation Channel (DDNC)
- Development Aquatic (DA)
- Natural Aquatic (NA)

CBEMP Shoreland Management Units
- Conservation Shorelands (CS)
- Water-Dependent Shorelands (WD)

Zoning (Coos County, 2018)
- Recreation (REC)

0 0.15 0.3 Miles

Jordan Cove Energy Project

JCEP Project Area Update - July 2018

CBEMP Zoning Navigational Reliability Improvement (NRI) Areas

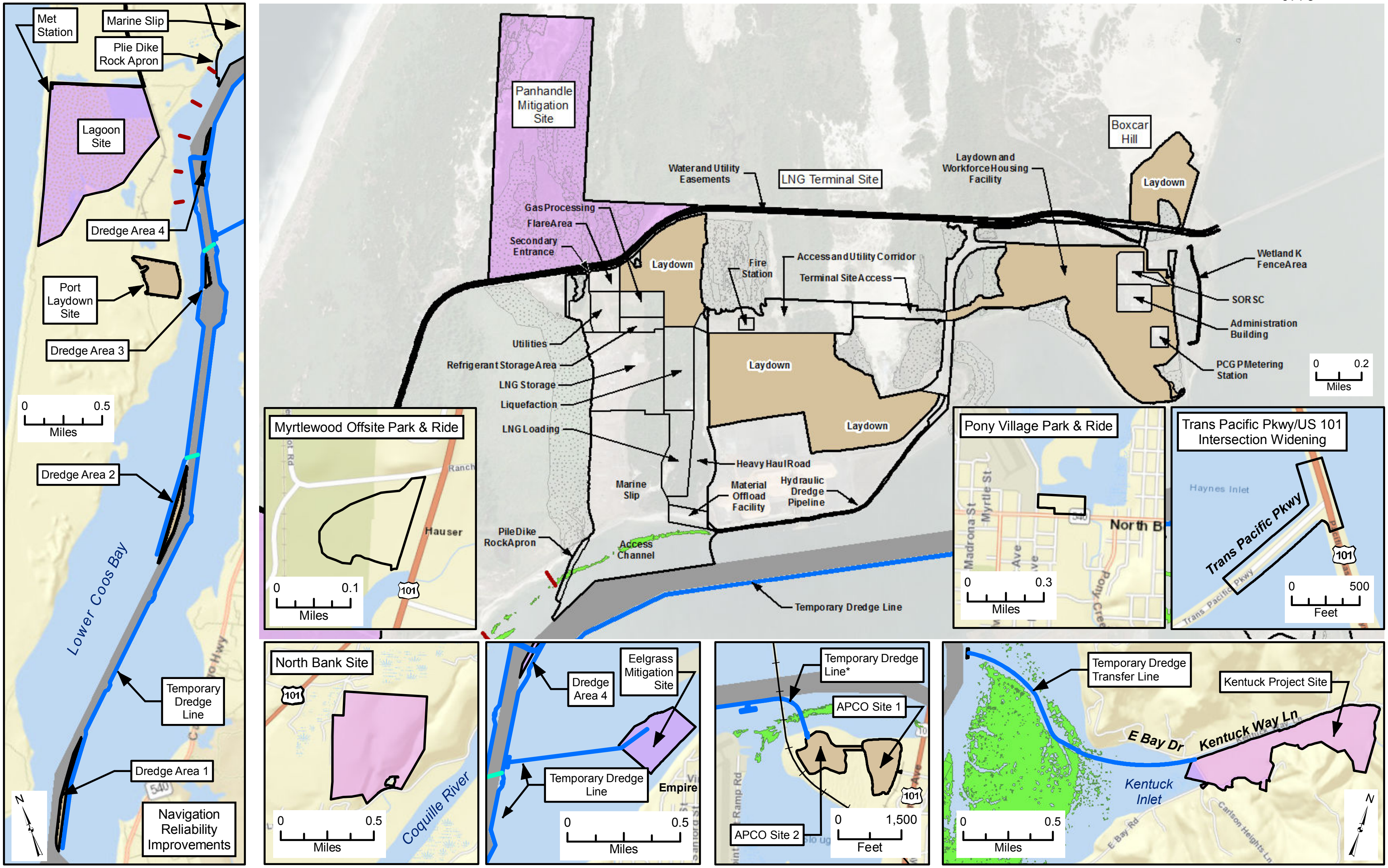
Jordan Cove LNG℠ 7/10/2018

FIGURE NO. 5

\\deainc.com\files\PROJECT\J\JLNG00000001\0600INFO\GS\Maps\Land Use\Perkins Coie CBEMP Zoning by Facility\Fig 4 CBEMP Zoning Temporary Dredge Line.mxd

J1-000-CIV-MAP-DEA-00001-01 Rev. C

Exhibit 6
Page 1 of 2



Jordan Cove Energy Project, L.P.

N

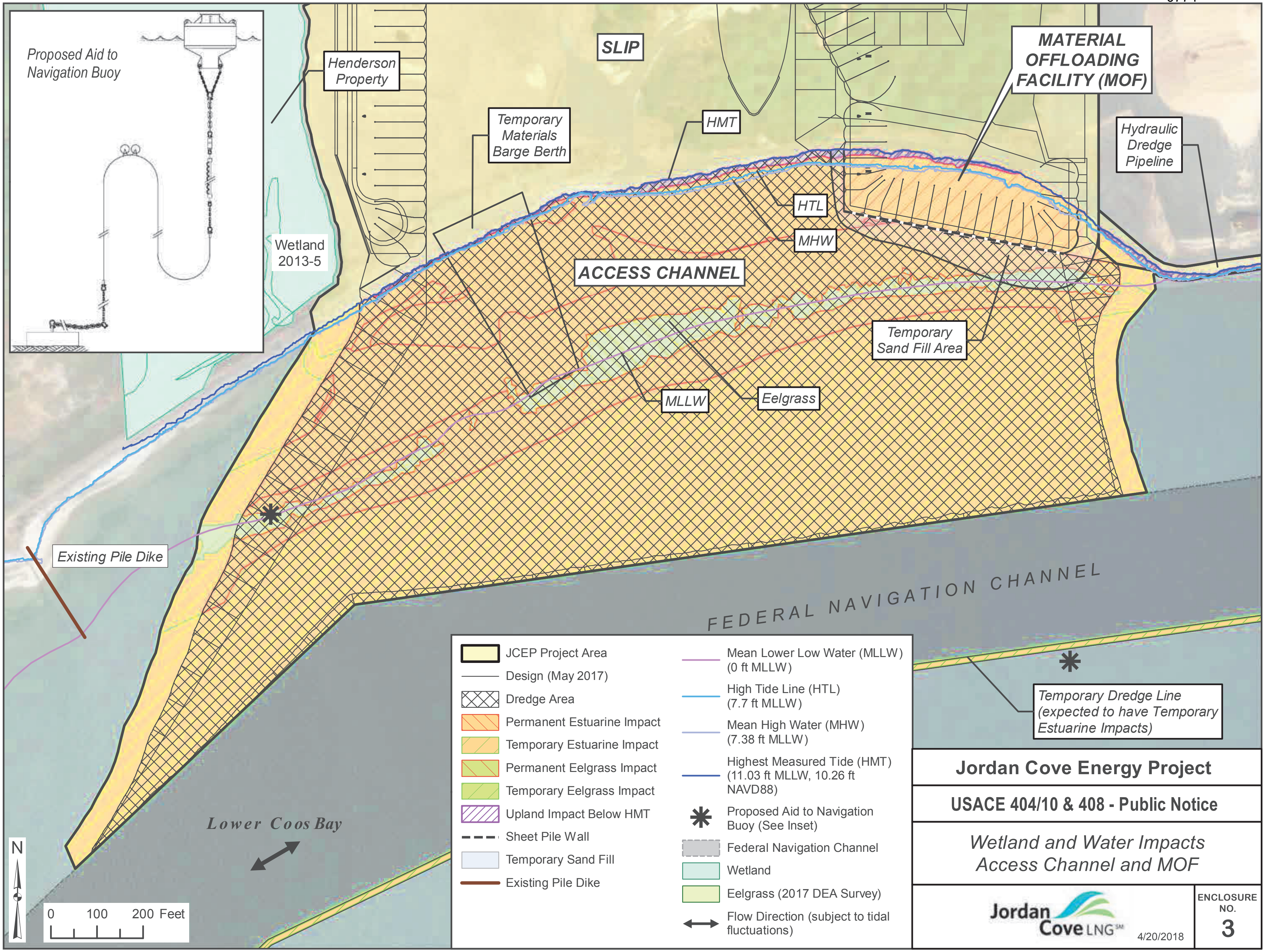
- JCEP Project Area
- Temporary Dredge Line (submerged/sunken)*
- Temporary Dredge Line (floating)
- Federal Navigation Channel
- Existing Pile Dike
- Work Area
- Mitigation Site
- Laydown Area
- Wetland
- Eelgrass

** The Temporary Dredge Line will be suspended where it crosses the eelgrass at the entrance to APCO Site 2*

Jordan Cove Energy Project

Figure 1.3-1

Plot Plan of Construction Facilities



Jordan Cove Energy Project

USACE 404/10 & 408 - Public Notice

Wetland and Water Impacts Access Channel and MOF

Jordan Cove LNG℠

4/20/2018

ENCLOSURE NO. 3

Exhibit 7

Page 1 of 1

PROPERTY OWNER CERTIFICATION AND CONSENT

I hereby certify that the Oregon Department of State Lands is the manager of those submerged and submersible non-trust lands in Coos Bay owned by the State of Oregon. I hereby approve Jordan Cove LNG, LLC to file land use applications with the City of Coos Bay ("City"), the City of North Bend, and Coos County ("County") for the following land use authorizations for uses and activities to be located and/or undertaken within our area of ownership, as depicted on attached Exhibit 1:

(1) Post-acknowledgment amendments to the Coos Bay Estuary Management Plan ("CBEMP") map at three Coos Bay locations in the City of Coos Bay and unincorporated Coos County depicted in Exhibit 1 to these Applications ("Navigation Reliability Improvement Sites" or "NRI Sites") to change the zoning designation of 59-CA, 2-NA, and 3-DA, to DDNC-DA;

(2) A post-acknowledgment amendment of the CBEMP, which is part of the Coos County Comprehensive Plan ("CCCP"), to take a reasons exception to Statewide Planning Goal ("Goal") 16 text amendment adopted of the CBEMP, which is part of the Coos County Comprehensive Plan ("CCCP"), in the form of a reasons exception to Statewide Planning Goal ("Goal") 16 to authorize the rezone of the NRI Sites to DDNC-DA;

(3) An amendment of the text of the Coos County Zoning and Land Development Ordinance ("CCZLDO") to clarify that the DDNC-DA designation is appropriate for application to area adjacent to, and not only within, the designated federal navigation channel;

(4) Administrative conditional use permit to authorize new and maintenance dredging at the NRI Sites in the DDNC-DA zone, as this Application proposes to amend those sites.

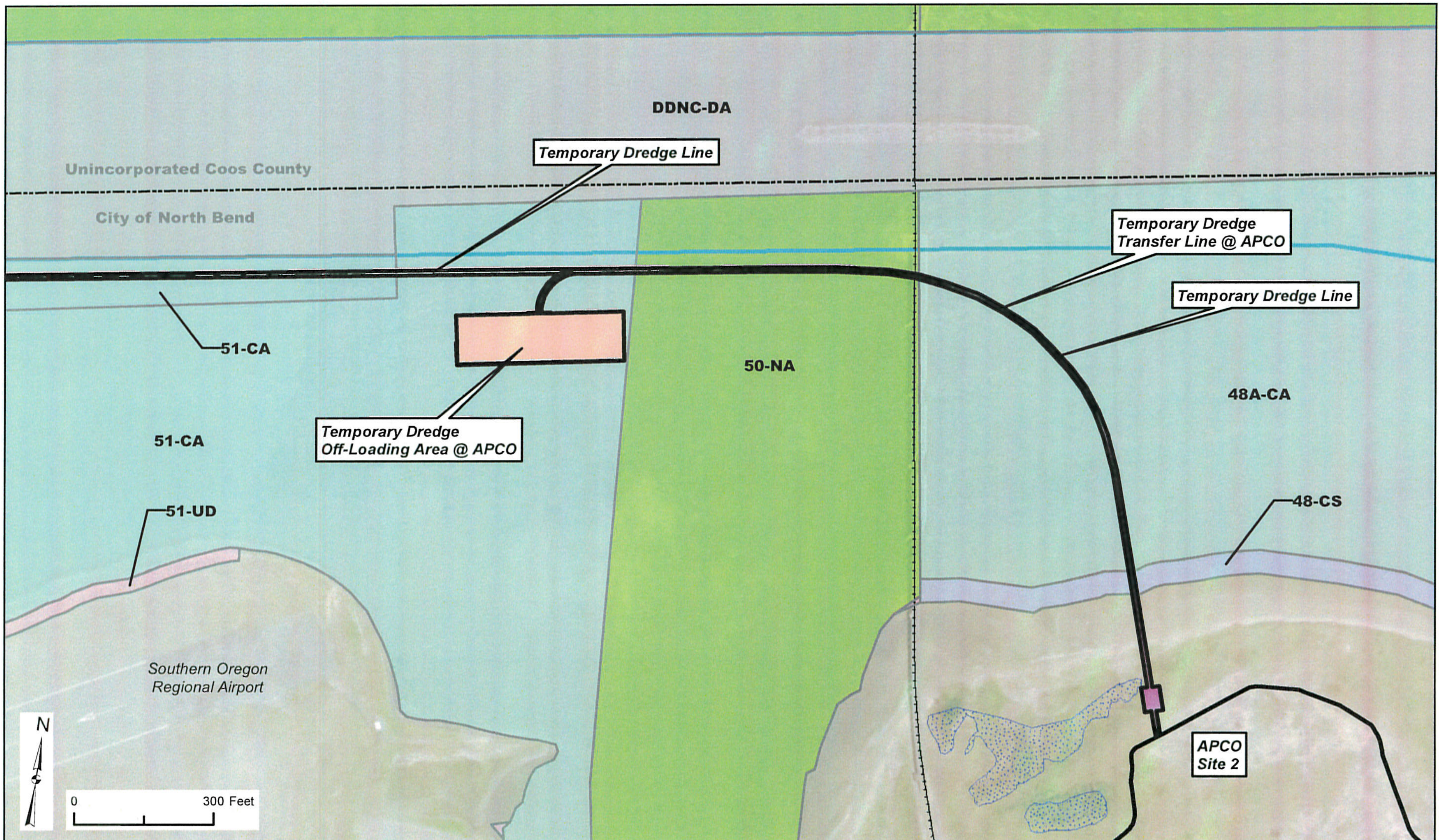
(5) Administrative authorization from the City of North Bend for the installation of temporary dredge material transport lines, an off-loading facility, and the placement of dredged material in an Industrial zone designation.

By: Vicki L Walker

Print Name and Title: Vicki L. Walker, Director, Oregon Department of State Lands

Date: 11/1/18

141336021.1



JCEP Project Area
Temporary Dredge Off-Loading Area @ APCO
Temporary Dredge Transfer Line @ APCO

CBEMP Aquatic Management Units
- Conservation Aquatic (CA)
- Deep Draft Navigation Channel (DDNC)
- Development Aquatic (DA)
- Natural Aquatic (NA)

CBEMP Shoreland Management Units
- Urban Development Area (UD)
- Conservation Shorelands (CS)

Wetland
Federal Navigation Channel
City Limits

Jordan Cove Energy Project

JCEP Project Area Update - August 2018

CBEMP Zoning
Temporary Dredge Transfer Line @ APCO

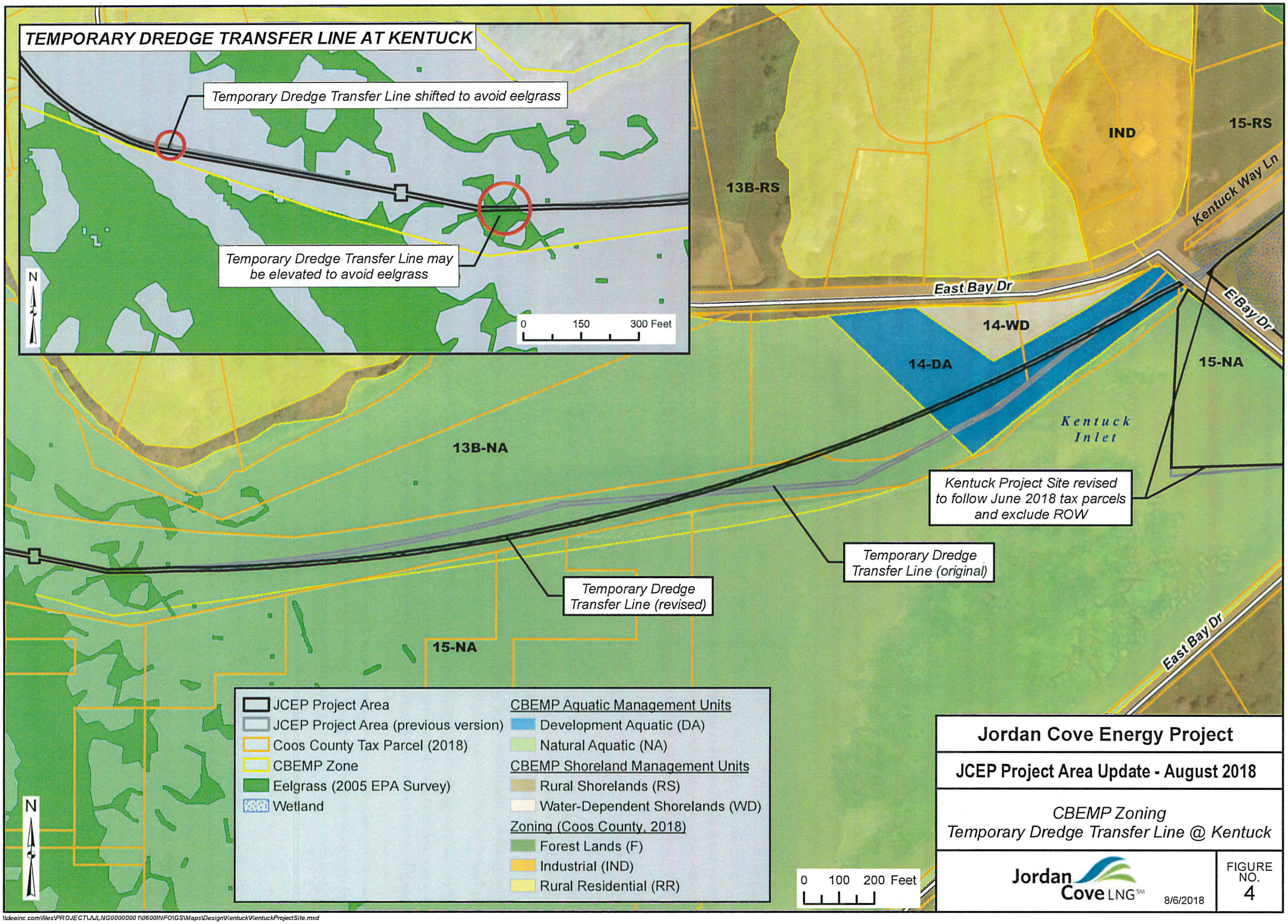
Jordan Cove LNG[SM]

8/6/2018

FIGURE NO. 3

\\deainc.com\files\PROJECT\J\JLNG00000001\0600INFO\GS\Maps\Design\APCO Temporary Dredge Transfer Line\APCO Temporary Dredge Transfer Line_CBEMP.mxd

J1-000-CIV-MAP-DEA-00001-01 Rev. C



Jordan Cove Energy Project

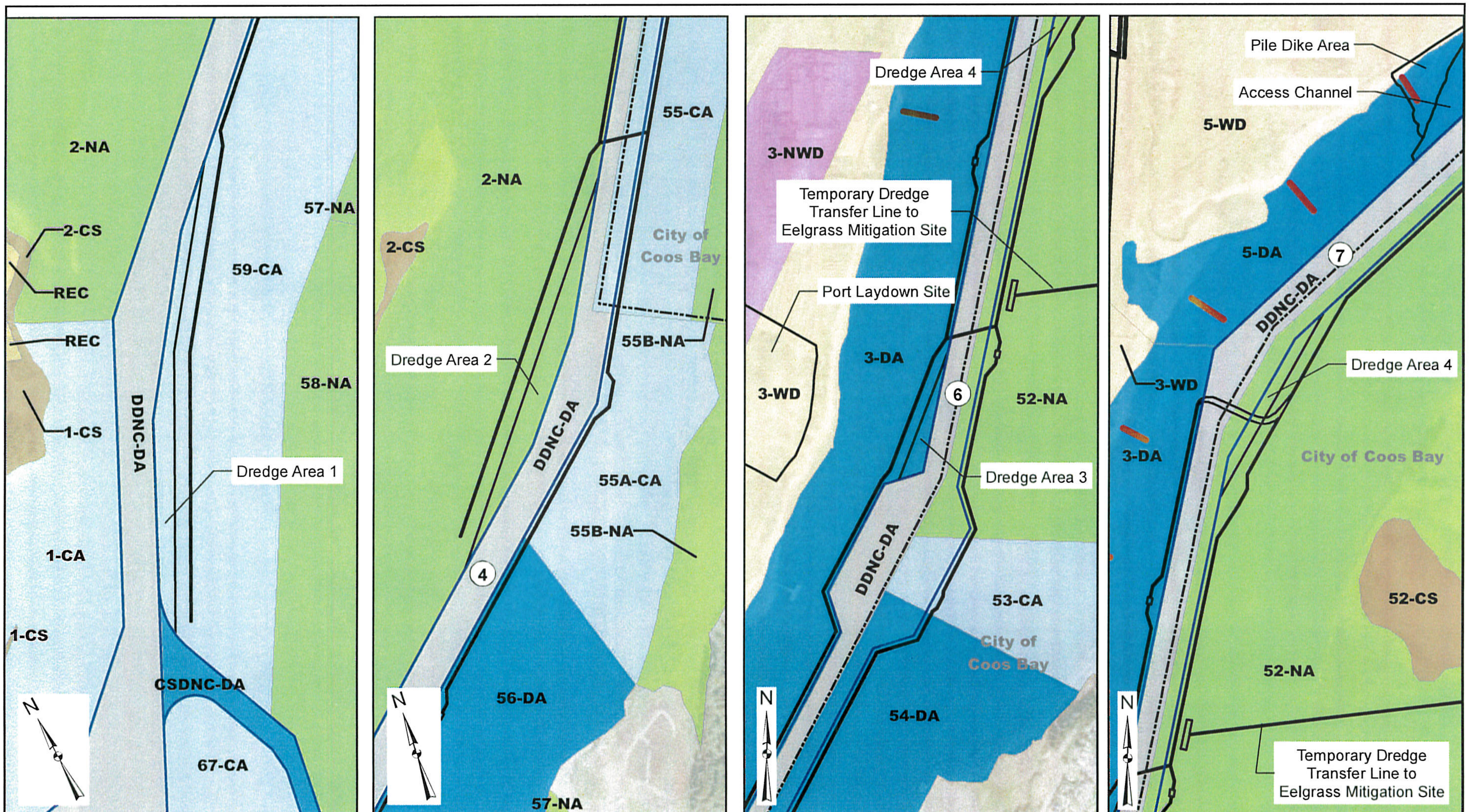
JCEP Project Area Update - August 2018

CBEMP Zoning
Temporary Dredge Transfer Line @ Kentuck

Jordan Cove LNG℠ 8/6/2018

FIGURE NO. 4

J1-000-CIV-MAP-DEA-00001-01 Rev. C



JCEP Project Area
Existing Pile Dike
City Limits
Channel Mile
Federal Navigation Channel

CBEMP Aquatic Management Units
Conservation Aquatic (CA)
Deep Draft Navigation Channel (DDNC)
Development Aquatic (DA)
Natural Aquatic (NA)

CBEMP Shoreland Management Units
Conservation Shorelands (CS)
Water-Dependent Shorelands (WD)

Zoning (Coos County, 2018)
Recreation (REC)

0 0.15 0.3 Miles

Jordan Cove Energy Project

JCEP Project Area Update - July 2018

CBEMP Zoning Navigational Reliability Improvement (NRI) Areas

Jordan Cove LNG℠ 7/10/2018

FIGURE NO. 5

J1-000-CIV-MAP-DEA-00001-01 Rev. C

MEMORANDUM OF AGREEMENT

BETWEEN:

JORDAN COVE ENERGY PROJECT L.P., PACIFIC CONNECTOR GAS PIPELINE, LP,

and

THE CONFEDERATED TRIBES OF COOS, LOWER UMPQUA AND SIUSLAW INDIANS

This Memorandum of Agreement ("MOA") is made and entered into by and between Jordan Cove Energy Project L.P., a Delaware limited partnership ("JCEP"), Pacific Connector Gas Pipeline LP a Delaware limited partnership ("PCGP") (JCEP and PCGP are hereinafter referred to as "Jordan Cove" or the "Applicant") and the Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians ("Tribe").

I. PURPOSE

The purpose of this MOA is to establish a process and substantive terms to implement Policy 18 of the Coos Bay Estuary Management Plan ("CBEMP") and parallel Coos County ("County") land use regulations applicable in areas outside of the Coos Bay Estuary to Jordan Cove's land use applications and approvals by Coos County and the City of North Bend ("City"). For purposes of this MOA, reference to "Policy 18" shall include both CBEMP Policy 18 and the land use regulations applicable outside of the Coos Bay Estuary. This MOA establishes the Parties' agreed upon "appropriate measures" to protect the cultural, archaeological and historical values of the sites where the Project (as defined below) will be built as required by CBEMP Policy 18. The Parties agree this MOA applies to both new applications requiring compliance with CBEMP Policy 18 and to existing approvals that have conditions requiring compliance with CBEMP Policy 18 or its implementing land use regulations.

II. BACKGROUND

JCEP proposes to construct, operate, and eventually decommission a liquefied natural gas ("LNG") export facility and supporting infrastructure to be located on the North Spit of Coos Bay, and PCGP proposes to construct, install, own and operate a 36-inch diameter gas pipeline and supporting infrastructure spanning 229-miles across Klamath, Jackson, Douglas, and Coos Counties in the State of Oregon ("the Pipeline") (the LNG Terminal and the Pipeline are collectively referred to as the "Project"), all as set forth in Jordan Cove's applications filed under

Sections 3 and 7 of the Natural Gas Act with the Federal Energy Regulatory Commission ("FERC") on September 21, 2017.

In 2015, Jordan Cove applied to Coos County for a conditional use permit to construct and operate a LNG export terminal at Jordan Cove, located on the North Spit at Coos Bay, located in Coos County ("LNG Facility"). The LNG Facility consists of a number of components, including (1) the LNG export terminal, (2) a marine slip and access channel, (3) a barge berth, (4) a gas processing center, and (5) a fire station and emergency training center, along with associated roads and utilities. The Project would also require significant dredging, dredge disposal, shoreline stabilization, and wetland impact mitigation.

The LNG Terminal, gas processing facility, and fire station and emergency training center will be located on upland areas zoned for industrial uses. Much of the port facilities (slip, barge berth, tugboat dock, etc.) will be located in coastal shoreland areas, which are generally zoned to allow for water-dependent uses. The marine slip and access channel will require dredging in Jordan Cove, designated a natural estuary, and Henderson March, a Statewide Planning Goal 5 (Natural Resources, Scenic and Historic Areas, and Open Spaces) inventoried wetland.

The Coos County Hearings Officer held a hearing on December 18, 2015. On May 2, 2016, the Hearings Officer issued a decision with recommendations to approve the applications. On August 16, 2016, the County Board of Commissioners held a public meeting to deliberate on the recommendations, and voted to adopt the Hearings Officer's finding as the County's decision, with minor modifications. The County's final decision was issued on August 30, 2016. An appeal was promptly filed with the Oregon Land Use Appeals Board ("LUBA Appeal"). The Tribe intervened in the LUBA Appeal.

On November 27, 2017, the LUBA issued its Final Opinion and Order ("FDO") and remanded the matter for the County to further address CBEMP Policy 18 in the context of Jordan Cove's conditional use permit application.

Jordan Cove has provided the Tribe with a Site Plan for the Project, as required by Policy 18, and the Parties agree that there are cultural, archaeological and historical sites identified on the County's adopted and acknowledged inventory located within the Project area, as more specifically listed or depicted in Attachment A. The Parties further agree that there is a potential for unknown or unrecorded cultural, archaeological and/or historical sites to be encountered within the Project area.

The Tribe and the Jordan Cove met, conferred and agreed upon appropriate measures to protect the cultural, historical and archaeological values of identified inventoried sites, together with unknown or unrecorded sites that may be encountered during construction within the Project area during construction ("Cultural Resources").

III. SUBSTANTIVE REQUIREMENTS

A. Standards

1. Policy 18 requires either no adverse impacts to cultural, historic and archeological sites within the Project area or the implementation of appropriate measures to protect the cultural, historical and archaeological values of such sites.

B. Parties Obligations

1. For any land use application for the Project that may adversely affect a Cultural Resources identified in Attachment A, Jordan Cove shall (i) submit to the County or City, as applicable, a detailed cultural resource survey prepared by an archaeologist meeting the Secretary of the Interior's Guidelines as defined in 36 CFR Part 61 Tribe regarding the nature and location of the Cultural Resource; (ii) an analysis of the impacts of the potential impacts to the Cultural Resource; and (iii) if necessary, a recommendation, after consulting with the Tribe, of appropriate measures to protect the cultural, archaeological and historical values of the Cultural Resource. If the Tribe and Jordan Cove are unable to agree upon the appropriate measures to protect such sites, either Party may invoke Section 3.11 of the Cultural Resources Protection Agreement.

2. Subject to the County imposing a condition on any approval requiring compliance with this MOA to ensure compliance with CBEMP Policy 18, the Tribe agrees that Jordan Cove's land use applications for the Project comply with CBEMP Policy 18.

3. The Parties agree that an executed copy of this MOA shall be entered into the County and/or City record for any land use applications or approvals where compliance with the CBEMP Policy 18 is at issue.

IV. APPROPRIATE MEASURES TO PROTECT CULTURAL, ARCHAEOLOGICAL AND HISTORICAL VALUES

A. The Parties have executed a comprehensive Cultural Resources Protection Agreement ("CRPA"), Attachment B, which is attached hereto and incorporated fully herein by this reference. The CRPA includes and incorporates several relevant attachments, including an Unanticipated Discovery Plan ("UDP"), which provides procedures in the event of an unanticipated discovery of historic properties, archaeological objects, archaeological sites or human remains, funerary objects, sacred items and items of cultural patrimony during the construction and operation of the Project.

B. The Parties agree that the CRPA and the UDP constitute "appropriate measures" under the CBEMP Policy 18 as the CRPA provides: a process for the exchange of project related information, confidentiality requirements, commitments to mitigation, monitoring agreements, agreements for the treatment of unanticipated discovery of Cultural Resources, site access agreements, and cost recovery agreements.

V. PERMIT CONDITIONS

A. The Parties agree that compliance with this MOA shall become a condition of any County and/or City issued land use permit for activities within the Project area that involve a Cultural Resource.

IN WITNESS WHEREOF, the Parties hereto have executed this MOA as of the last date written below.

______________________________ 7/26/18
DATE

for Jordan Cove Energy Project, L.P.
and Pacific Connector Gas Pipeline, LP

______________________________ ______________________________
Mark Ingersoll, Tribal Council Chairman **DATE**
CONFEDERATED TRIBES OF COOS,
LOWER UMPQUA AND SIUSLAW INDIANS

V. PERMIT CONDITIONS

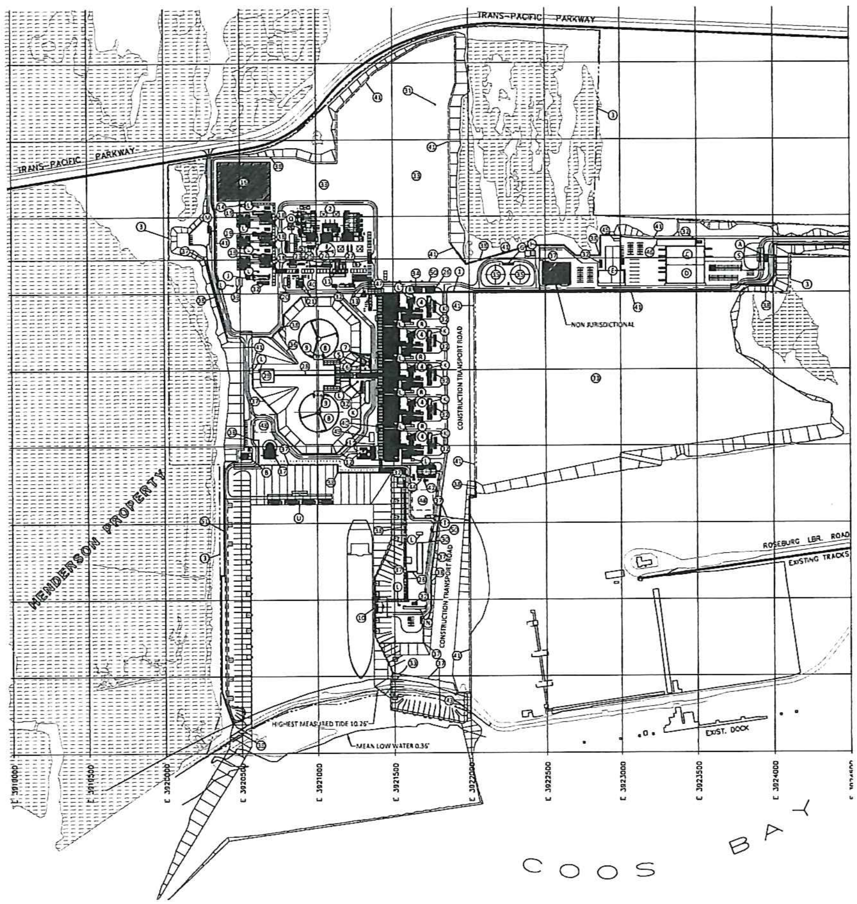
A. The Parties agree that compliance with this MOA shall become a condition of any County and/or City issued land use permit for activities within the Project area that involve a Cultural Resource.

IN WITNESS WHEREOF, the Parties hereto have executed this MOA as of the last date written below.

______________________________ ______________________________
DATE

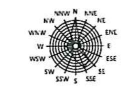
for Jordan Cove Energy Project, L.P.
and Pacific Connector Gas Pipeline, LP

______________________________ ______________________________
Mark Ingersoll, Tribal Council Chairman **DATE**
CONFEDERATED TRIBES OF COOS,
LOWER UMPQUA AND SIUSLAW INDIANS



ITEM	FACILITIES LEGEND
1	FEED GAS HEADER
2	GAS CONDITIONING TRAIN
3	PROPERTY BOUNDARY
4	LNG LIQUEFACTION TRAIN #1 THROUGH #5
5	LNG EXPANDER (WITH SHELTER)
6	LNG FLASH DRUM
7	LNG RUNDOWN PUMPS (WITH SHELTER)
8	LNG STORAGE TANK
9	LNG TANK PUMPS
10	LNG LOADING PLATFORM
11	REFRIGERANT MAKE-UP
12	LP/HP BOG COMPRESSORS (WITH SHELTER)
13	COLD FLARE KO DRUM
14	MULTI POINT GROUND FLARE KO DRUM
15	NOT USED
16	MULTI POINT GROUND FLARE
17	ENCLOSED GROUND FLARE - MARINE
18	BOP AUXILIARY POWER STG
19	BOP AUXILIARY POWER STG CONTROL ENCLOSURE
20	AUXILIARY BOILER
21	DEAERATOR / BFW PUMPS
22	NOT USED
23	PLANT / INSTRUMENT AIR PACKAGES
24	NITROGEN GENERATION PACKAGE
25	LIQUID N2 STORAGE / VAPORIZATION
26	AMMONIA STORAGE TANKS AND PUMPS
27	AMINE STORAGE
28	LNG DRAINAGE CHANNEL
29	PROCESS AREA LNG IMPOUND BASIN
30	MARINE AREA LNG IMPOUND BASIN
31	FREE FIELD SEISMOMETER SHELTER
32	TRANSFORMERS
33	CONSTRUCTION LAYDOWN AREA
34	DIESEL STORAGE
35	FIREWATER STORAGE TANKS
36	LNG TANK ACCESS ROAD
37	PLANT SECURITY FENCE
38	RETAINING WALL
39	BACKUP GENERATOR
40	PIPERACK
41	IMPERMEABLE VAPOR BARRIER
42	RO PRODUCT TANK
43	CONST. MARINE OFF-LOADING FACILITIES AREA (CONST. MOF)
44	DEMIN WATER STORAGE TANK
45	WASTEWATER TREATMENT PACKAGE PLANT
46	LAYDOWN AREA
47	DUMP CONDENSER
48	BURIED STORM WATER INFILTRATION CHAMBER
49	BOG VFD ENCLOSURE
50	PERMEABLE VAPOR BARRIER
51	TSUNAMI WALL (ELEVATION VARIES TO SUIT THE DESIGN TSUNAMI)
52	METEOROLOGICAL MAST LOCATED WEST OF THE SITE NEAR INDUSTRIAL WASTEWATER LAGOON

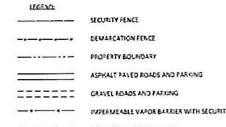
ITEM	FACILITIES LEGEND
A	MAIN GUARD HOUSE / SECURITY BUILDING
B	TUG FACILITY BUILDING
C	PLANT WAREHOUSE
D	MAINTENANCE BUILDING
E	OPERATIONS BUILDING (INCLUDES CONTROL ROOM)
F	WATER TREATMENT BUILDING
G	FACILITY FIREWATER PUMPS WITH BUILDING
H	LUBE OIL, PAINT AND COMPRESSED GAS STORAGE
J	FACILITY AUX POWERHOUSE ENCLOSURE
K	POWERHOUSE ENCLOSURE
L	FIREWATER VALVE HOUSE
M	SECONDARY ENTRANCE SECURITY GATE/TERMINAL GUARD BUILDING
N	MARINE POWERHOUSE ENCLOSURE
P	FIRE DEPARTMENT
Q	GC TRAIN 1 POWERHOUSE ENCLOSURE
R	CEMS BUILDING (HRSG PKG)
S	INSPECTION STATION SHELTER
T	MARINE AREA GUARD HOUSE
U	TUG BOAT BERTH

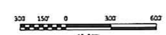


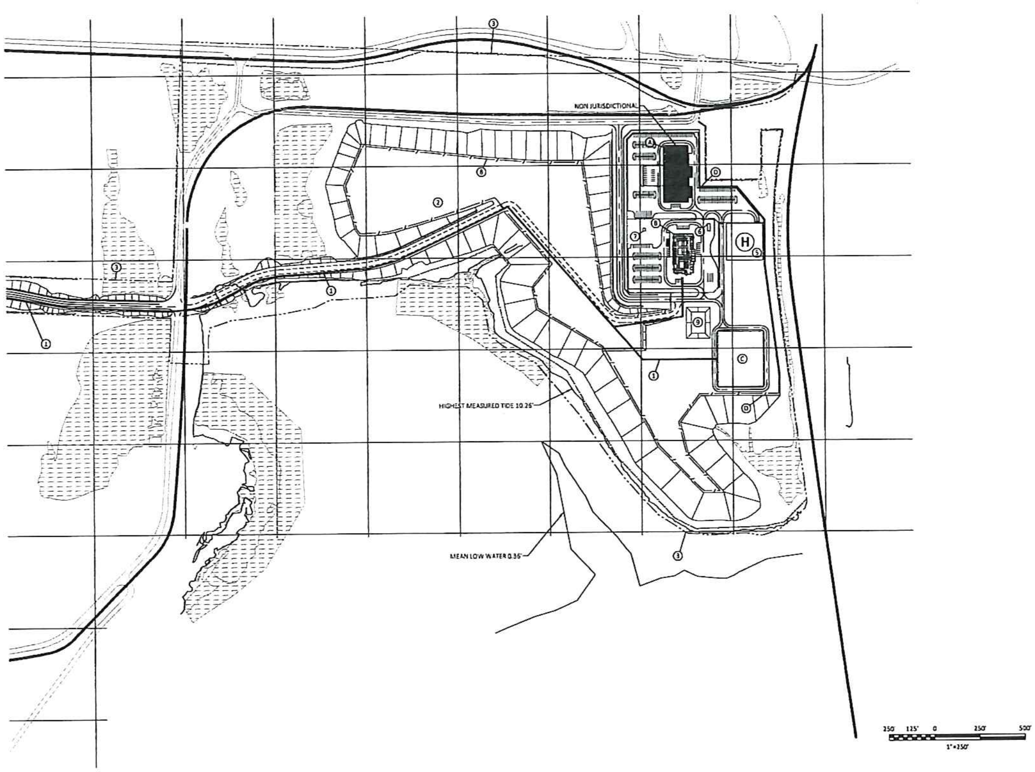
WIND ROSE - ANNUAL
NORTH BEND MUNICIPAL AIRPORT
(PERCENT OF TIME)

NOTES:
1. ELEVATIONS NOTED ARE NAVD88

LEGEND:

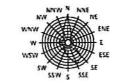






ITEM	FACIUTIES LEGEND
A	SORSC BUILDING
B	ADMINISTRATION BUILDING
C	GAS METERING STATION
D	RETAINING WALL

ITEM	FACIUTIES LEGEND
1	ACCESS AND UTILITY CORIDOR (SEE NOTE 3)
2	TEMPORARY CONSTRUCTION FACILITIES
3	PROPERTY BOUNDARY
4	PG&E SWITCHYARD EASEMENT
5	HELI-PAD
6	WASTEWATER TREATMENT PACKAGE PLANT
7	COMMUNICATIONS TOWER
8	PLANT SECURITY FENCE
9	VEGETATED INFILTRATION BASIN



WIND ROSE - ANNUAL
NORTH BEND MUNICIPAL AIRPORT
(PERCENT OF TIME)

NOTES

1. ELEVATIONS NOTED ARE NAVD88.
2. FOR OVERALL PLOT PLAN, SEE DRAWING 159930-0000-FG2000
3. THE ACCESS AND UTILITY CORRIDOR CONTAINS THE FOLLOWING BURIED LINES. CORRIDOR WILL BE ROUTED ON JCLNG LAND.
   - FEED GAS LINE
   - FIRE WATER SUPPLY TO ADMIN AND SORSC BUILDINGS
   - POWER TO ADMIN BUILDING
   - IT AND SECURITY TO ADMIN AND SORSC BUILDINGS
   - CONTROL CABLING FROM METERING STATION

LEGEND

SECURITY FENCE

DEMARCATION FENCE

ASPHALT PAVED ROADS AND PARKING

GRAVEL ROADS AND PARKING

CULTURAL RESOURCES PROTECTION AGREEMENT
BETWEEN
THE CONFEDERATED TRIBES OF COOS, LOWER UMPQUA AND SIUSLAW INDIANS
AND
JORDAN COVE ENERGY PROJECT LP
AND
PACIFIC CONNECTOR GAS PIPELINE L.P.

THIS CULTURAL RESOURCES PROTECTION AGREEMENT ("Agreement") is entered into as of this 20th day of July, 2018 ("Effective Date") by and between Jordan Cove Energy Project LP, a Delaware limited partnership ("JCEP") and Pacific Connector Gas Pipeline L.P., a Delaware limited partnership ("PCGP") (JCEP and PCGP are hereinafter referred to as "Jordan Cove"), and the Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians, a federally recognized Indian tribe ("CTCLUSI" or the "Tribe"). Jordan Cove and the Tribe are sometimes referred to herein individually as a "Party" and collectively as the "Parties."

I. RECITALS

WHEREAS, JCEP proposes to construct, operate, and eventually decommission a liquefied natural gas ("LNG") export facility and supporting infrastructure to be located on the North Spit of Coos Bay ("LNG Terminal"), and PCGP proposes to construct, install, own and operate a 36-inch diameter gas pipeline and supporting infrastructure spanning 229-miles across Klamath, Jackson, Douglas, and Coos Counties in the State of Oregon ("the Pipeline") (the LNG Terminal and the Pipeline are collectively referred to as the "Project"), all as set forth in Jordan Cove's applications filed under Sections 3 and 7 of the Natural Gas Act with the Federal Energy Regulatory Commission ("FERC") on September 21, 2017; and

WHEREAS, FERC is responsible for compliance with Section 106 of the National Historic Preservation Act, 16 U.S.C. § 470, ("NHPA"), which requires it to take into account the effects of its undertakings on historic properties by identifying the properties within a proposed undertaking's area of potential effects that are listed or eligible for listing in the National Register of Historic Places, 36 C.F.R. § 800.4, evaluate the effects of the proposed undertaking on those properties, *Id.* § 800.5, and if adverse effects are found, resolve such adverse effects through avoidance, minimization or mitigation. *Id.* At 800.6; and

WHEREAS, the Parties expect FERC, the State Historic Preservation Office ("SHPO") and other federal agencies will document compliance with the requirements of the NHPA through execution of a memorandum of agreement that will address resolution of any adverse effects identified within the "area of potential effects" for the Project; and

WHEREAS, Jordan Cove has developed, with input from the Tribe, SHPO and other federally recognized tribes, the plan and procedures addressing Unanticipated Discoveries of Cultural Resources and Human Remains, which outlines the procedures Jordan Cove will follow should Project construction result in the unanticipated or inadvertent discovery of archaeological sites, cultural resources or human remains; and

WHEREAS, the Tribe descends from the indigenous people who resided along the southern Oregon coast for countless generations, and

WHEREAS, the Tribe's ancestral territory extends from the mouth of Tenmile Creek (Lane County) in the north, south to Fivemile Point halfway between the mouths of Whiskey Run Creek and Cut Creek (coinciding with the border between Sections 30 and 31, Township 27 South, Range 14 West, Coos County), thence east to the crest of the Coast Range to Weatherly Creek on the Umpqua River ("Ancestral Territory"); and

WHEREAS, the LNG Terminal and a portion of the Pipeline run through the Tribe's Ancestral Territory; and

WHEREAS, the Tribe is deeply concerned by the potential effects of construction and operation of the LNG Terminal and the Pipeline on the Tribe's cultural resources; and

WHEREAS, cultural resources within the Jordan Cove Area include identified and unidentified but probable archaeological sites and items such as stone tools, fish traps, residential remains, cemetery remains, secondary deposits, historic bottle dumps, early frame houses, and mill works, dating from several thousand to less than one hundred years old, and all of which are a central part of the cultural heritage of the Tribe and of the region; and;

WHEREAS, during previous iterations of the Project, archaeological studies have been conducted and two archaeological sites were identified within the area of potential effects identified at that time – Sites 35CS221 and 35CS227 as requiring additional investigation; and

WHEREAS, as set forth in this Agreement, the Tribe will participate in the identification of potential adverse impacts to Site 35CS227, and the development of measures to avoid or mitigate any such impacts through design measures for the Project, and at least one archaeologist will monitor adjacent construction activities; and

WHEREAS, on July 31, 2006 through Resolution No. 2006-097, and again on July 29, 2015 through Resolution No. 2015-049 the Tribal Council designated the Jordan Cove Area as a Site of Tribal Cultural and Religious Significance; and

WHEREAS, construction, operation and decommissioning of the Project must take place in compliance with local, state and federal laws, including Section 106 of the NHPA, the National Environmental Policy Act (NEPA), the Native American Graves Protection and Repatriation Act (NAGPRA), Oregon laws regarding sites and artifacts (Oregon Revised Statutes (ORS) 358.905 *et seq.*), Oregon laws regarding Indian Graves and Protected Objects (ORS 97.740 *et seq.*; and the Coos Bay Estuary Management Plan; and

WHEREAS, the Parties seek to work cooperatively to avoid, minimize and, where appropriate, mitigate adverse effects to the Tribe's cultural resources from the Project Activities pursuant to the terms and conditions herein set forth.

NOW, THEREFORE, the Parties enter into this Agreement in a spirit of cooperation to provide a means by which the Parties can address the matters set forth in this Agreement with the goal of minimizing adverse effects to the Tribe's cultural resources arising from the construction, operation and decommissioning of the Project.

II. DEFINITIONS

2.1 "Applicable Law" means all applicable federal, state, and local laws, statutes, rules, regulations, codes, or ordinances, of a Governmental Authority.

2.2 "Archaeologist" means a scientist meeting all standards and requirements of the Secretary of the Interior set forth in 36 CFR Part 61, with a graduate degree in anthropology and the required experience to properly identify and record Cultural Resources.

2.3 "Area of Potential Effect" means that area delineated through the section 106 process for the Project.

2.4 "Cultural Resources" mean districts, sites, buildings, structures, Native American Human Remains and funerary objects, and all other physical objects that are significant to the Tribe's history, architecture, archeology and culture, including, but not limited to, historic properties and Traditional Cultural Properties to which the Tribe attaches religious and cultural significance.

2.5 "Curation" means the management and preservation of collections in accordance with the National Park Service's regulations in 36 CFR Part 79, unless otherwise agreed to in writing.

2.6 "Governmental Authority" means any (a) national, state, county, municipal or local government and any political subdivision thereof, (b) court or administrative tribunal, or (c) other governmental, quasi-governmental, judicial, public or statutory instrumentality, authority, body, agency, bureau or entity of competent jurisdiction.

2.7 "Ground Disturbing Activities" means any activity that compacts or disturbs the surface or subsurface within the Project Area. Ground Disturbance can be caused by the use of hand tools (shovels, pick axe, posthole digger, etc.), heavy equipment (excavators, backhoes, bulldozers, trenching and earthmoving equipment, etc.), and heavy trucks (large four-wheel drive trucks, dump trucks and tractor trailers, etc.). Trenching, bulldozing, excavating, scraping, vibrodensification, geo-piering and plowing are typical examples of Ground Disturbance Activities. Project types that usually involve Ground Disturbance include acquisition/demolition/relocation of structures; vegetation management; landslide stabilization; and infrastructure projects such as utilities, storm water management, and flood control.

2.8 "Mitigate" means to minimize the potential effects to Cultural Resources where avoidance is not reasonably practicable. This may include, but is not limited to, data recovery, Monitoring, or relocation or Curation of the Cultural Resource.

2.9 "Monitor" means observance of Project Activities by a person determined by CTCLUSI to be knowledgeable and qualified in identifying Cultural Resources.

2.10 "Native American Human Remains" means the physical remains or partial remains of the body of a person of established or probable Native American ancestry.

2.11 "Person" means an individual, entity, corporation, partnership, limited liability company, joint venture, association, or unincorporated association or Governmental Authority.

2.12 "Project Activities" means testing, pre-construction, construction, operation, and decommissioning Ground Disturbing Activities within the Project Area that are reasonably likely to have adverse effects on Cultural Resources.

2.13 "Project Area" means the area depicted on Exhibit "A" attached hereto, as it may be amended from time to time.

2.14 "Traditional Cultural Property" or "TCP" means a property that is either eligible for listing or listed on the National Register of Historical Places ("NRHP") based on its associations with the cultural practices, traditions, or beliefs, of the Tribe. TCPs are rooted in the Tribe's history and are important in maintaining the continuing cultural identity of the Tribe.

2.15 "Unanticipated Discovery" means the unintentional encounter or discovery of Cultural Resources or Human Remains.

2.16 "Unanticipated Discovery Plan" or "UDP" means the agreed-upon plan attached to the FERC Memorandum of Agreement resulting from the conclusion of the section 106 process, a draft of which is attached to this Agreement as Exhibit "B", or, until issuance of a certificate by the FERC, an agreed upon-plan that is required by a Governmental Authority as a condition of an authorization, certification, approval or permit associated with Project Activities, or, in the absence of an agreed-upon plan that is required by a Governmental Authority, Exhibit B.

III. STIPULATIONS

3.1 **Purpose**. This Agreement sets forth the terms and conditions governing:

(a) communication and information exchange protocols between the Parties;

(b) the Tribe's participation in the identification of Cultural Resources within the Project Area; assessment of adverse impacts to Cultural Resources; and the development of measures to avoid, minimize or mitigate any potential effects in accordance with Applicable Law, and;

(c) Monitoring of Cultural Resources during Project Activities; and

(d) reimbursement to the Tribe for reasonable costs associated with implementation of this Agreement in accordance with the terms of the cost reimbursement agreement attached hereto as Exhibit 'C" and to fund a full-time position within the Tribe's Historic Preservation Office in accordance with the terms of section 3.9.

3.2 Mitigation Preferences.

(a) Jordan Cove agrees to avoid adverse impacts to Cultural Resources to the extent reasonably practicable. If adverse impacts are unavoidable then Jordan Cove agrees to minimize or mitigate any potential impacts in accordance with Applicable Law and considering the preferences set out in subparagraph (b) of this Section 3.2.

(b) For Project Activities that may impact Cultural Resources, Jordan Cove shall, in accordance with Applicable Law, apply the following order of preference with respect to preferred mitigation methodologies:

(1) Avoiding the impact altogether by not taking a certain action or parts of an action;

(2) Minimizing impacts by limiting the degree or magnitude of the action and its implementation;

(3) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;

(4) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action, and;

(5) Compensating for the impact, including but not limited to the relocation or Curation of the Cultural Resource.

3.3 Communication and Information Sharing. The Parties agree to the following information sharing and communication protocols:

(a) Within thirty (30) days of execution of this Agreement, Jordan Cove will identify individuals who will be the primary contact(s) or their designated representative for the purposes of implementing this Agreement and principal(s) who will be responsible for overall compliance with the Agreement and resolving any disputes in accordance with the terms of this Agreement; CTCLUSI will identify tribal officials or representatives who will be the primary contact for the purposes of implementing this Agreement and principals responsible for resolving any disputes.

(b) Jordan Cove will provide CTCLUSI with complete copies of permit applications required for Project Activities and provide CTCLUSI an opportunity to comment on such permit applications pursuant to Applicable law.

(c) Prior to all Project Activities, Jordan Cove will seek CTCLUSI's expertise and opinions related to potential discovery of Cultural Resources in the Project Area and the need for Monitoring of the Project Activities. CTCLUSI shall provide such expertise and opinions to Jordan Cove pursuant to subsection (f) below.

(c) Jordan Cove will provide timely, good faith responses to, and will take into consideration all timely written comments received from CTCLUSI related to Cultural Resources that could be affected by Project Activities pursuant to the terms of this Agreement.

(d) Jordan Cove will provide CTCLUSI with a schedule for all Project Activities, updated at a minimum quarterly, identifying dates on which or by which comments or Monitoring would be required under the terms of this Agreement ("Project Activity Schedule").

(e) Jordan Cove principals and CTCLUSI principals, in each case identified in accordance with subsection (a) above, will meet not less than quarterly and in coordination with the submission of updated Project Activities schedules, to discuss such schedules. CTCLUSI shall identify which Project Activities require Monitoring or comments to be provided by CTCLUSI. At least once a year, during a meeting to be held in February, the principals shall also review progress under the Agreement and whether the Agreement needs to be amended.

(f) In addition to the Project Activity Schedule, prior to undertaking each Project Activity, Jordan Cove will provide CTCLUSI with a Project Activity Notice in a form substantially as included as Exhibit "D". CTCLUSI shall provide any response or comment to such Project Activity Notice pursuant to the schedule set out below:

1. Not less than thirty (30) days, unless such notification is not practicable, before commencing any Project Activities requiring a Monitor from

CTCLUSI, Jordan Cove will provide CTCLUSI with a Project Activity Notice describing the activity to be taken, timing and any other information reasonably necessary to facilitate CTCLUSI Monitoring of such Project Activity, such as the scope of equipment to be used and number of construction fronts. If there are any material changes to the plans set out in the Project Activity Notice, Jordan Cove agrees to provide CTCLUSI with an additional notice and opportunity to comment. In the event of an emergency, Jordan Cove agrees to provide CTCLUSI with a summary of the Project Activities undertaken during the emergency, as soon as practicable following conclusion of the emergency.

2. Within twenty (20) days of receiving the Project Activity Notice, CTCLUSI will submit to Jordan Cove any comments or concerns, including requests for additional investigations or surveys, related to the proposed Project Activity.

3. Within seven (7) days of receiving CTCLUSI's comments, Jordan Cove will provide CTCLUSI notice regarding any changes Jordan Cove decides to make to the proposed Project Activity based on CTCLUSI's comments.

(d) The Parties will use reasonable efforts to informally resolve disputes arising under this Section 3.3. Disputes arising under this Section 3.3 that cannot be informally resolved between the Parties shall be subject to the dispute resolution provisions of this Agreement.

(e) Jordan Cove agrees to provide notice to staff, contractors, and consultants engaged by Jordan Cove to undertake Project Activities that are reasonably likely to affect Cultural Resources of the provisions of this Agreement and Jordan Cove's responsibilities under this Agreement.

(h) Jordan Cove agrees to work with CTCLUSI to develop a cultural resources awareness and training program, which shall be utilized during the onboarding process for all employees and contractors engaged in Project Activities at the LNG Terminal.

3.4 Identification of Cultural Resources; Assessment and Resolution of Adverse Impacts

(a) The Parties agree to work cooperatively to identify Cultural Resources and to assess and resolve any adverse impacts thereto in compliance with this Agreement and Applicable Laws. To the extent of any conflict, the provisions of Applicable Laws shall control.

(b) The Parties agree that the scope of Cultural Resource identification efforts shall, to the extent allowed by Applicable Law, include reference to and use of ethnographic analysis reports.

3.5 Monitoring During Applicable Project Activities.

(a) CTCLUSI may have Monitors present at Project Activities. All Monitors may be required to execute an Access Agreement substantially in the form attached hereto as Exhibit "E" for access to any lands within the Project Area, other than federal lands, that are owned or controlled by Jordan Cove.

(b) JCEP and PCGP will permit Tribal staff members or designated representatives ("Tribal Monitors") to be present in the Project Area, at the Tribe's option, to monitor Applicable Project Activities, subject to applicable access, safety, and security rules and policies.

(c) Jordan Cove will ensure that (1) the Tribe is provided reasonable notice of Project Activities as set out in this Agreement, and (2) Tribal Monitor are granted reasonable access to the Project Area and any Project Activities as necessary to perform his or her duties as a Tribal Monitor. Jordan Cove shall provide to CTCLUSI the equipment set out in the Project Activity Notice.

(d) Tribal Monitor access to any portion of the Project Area shall be subject to all applicable security and safety rules, laws, and regulations, and Jordan Cove's and its contractors' security and safety policies, including requirements relating to the use of proper clothing and safety equipment, including safety glasses or goggles, masks, rebreathers, hazmat suits, hard hats, or safety vests, provided that Jordan Cove reserves the right for itself and its contractors to prohibit access to any portion of the Project Area by any Person, including any Tribal Monitors, in its sole and absolute discretion to the extent of any actual or threatened breach of any such rules, laws, regulations, or policies.

(e) Jordan Cove acknowledges that the Tribe may incur certain costs in connection with a qualified Tribal Monitor's archaeological and/or safety training directly related to monitoring activities hereunder. Jordan Cove will reimburse the Tribe for all reasonable costs associated with Monitoring activities, pursuant to the Cost Recovery Agreement between the Parties, which is attached hereto as Exhibit "C" and incorporated herein by this reference.

(f) Jordan Cove shall hold the Tribe and its officers and employees harmless from and against any and all claims, actions, liabilities, losses, damages, judgments, grants, costs, and expenses (including attorney's fees) arising out of injury or death to persons, or damage to property caused by the negligence of Jordan Cove, its officers, employees, agents, assigns, and subcontractors in the performance of obligations arising under this Agreement, provided the Tribe promptly notifies Jordan Cove in writing of any such claim, and provided that Jordan Cove shall have the exclusive right to control the defense.

(g) The Tribe shall hold Jordan Cove, its officers and employees harmless from and against any and all claims, actions, liabilities, losses, damages, judgments, grants, costs, and expenses (including attorney's fees) arising out of injury or death to persons, or damage to property caused by the negligence of the Tribe and its officials, employees, agents, and subcontractors in the performance of obligations arising under this Agreement, provided: (i) Jordan Cove promptly notifies the Tribe in writing of any such claim; (ii) the Tribe shall have the exclusive right to control the defense; and (iii) the amount does not exceed and is otherwise covered by the Tribe's liability insurance.

(h) The Tribe shall maintain, during the term and each renewal or extension of this Agreement, at its own expense, the following insurance: (i) statutory workers' compensation insurance or equivalent industrial accident insurance covering all employees as required by law; (ii) commercial automobile liability coverage (if the use of automobiles is required) for all owned, hired, borrowed, leased, or non-owned automobiles, providing bodily injury and property damage liability coverage with a combined single limit of $1,000,000; and (iii) commercial general liability insurance (including, but not limited to, premises operations, property damage, products/completed operations, contractual liability, and personal injury) with limits of at least $1,000,000 per occurrence/ $2,000,000 annual aggregate.

(i) Upon request of the Tribal Council, and subject to any necessary safety requirements, Jordan Cove shall allow reasonable site access to Tribal Council Members and to Tribal Council authorized Tribal cultural leaders, to perform ceremonies and blessings prior to a Tribal Council identified Ground Disturbing Activity.

3.6 Inadvertent Discoveries.

If Cultural Resources are discovered in the Project Area, including during Project Activities, Jordan Cove agrees to:

(a) Promptly inform the Tribe of the discovery; and

(b) Comply with the procedures and protocols set forth in the UDP, which is attached hereto as Exhibit "B" and incorporated herein by this reference. The Parties expect the UDP to remain substantially in the form as the document attached hereto as this document has been provided to FERC.

3.7 Confidentiality

For purposes of this Agreement, the Parties agree as follows:

(a) Tribal Confidential Information means all information whether written or oral, including ethnographic reports, provided by the Tribe to Jordan Cove regarding: potential burial sites, archeological objects, funerary objects or objects of cultural patrimony as defined by ORS 358.905, sacred or religious sites and traditional gathering locations.

(b) Jordan Cove Confidential Information means all information whether written or oral provided by Jordan Cove which it designates as confidential at the time the information is provided to the Tribe in furtherance of the activities under this agreement. Jordan Cove Confidential Information, includes, but is not limited to, technical reports, operations information, construction plans and similar information.

(c) Receiving Party means the party receiving Confidential Information.

(d) Disclosing Party means the party disclosing the Confidential Information.

(e) Confidential Information shall not include information that (i) is available in the public domain; (ii) was in the Receiving Party's possession prior to the date of this Agreement and not covered by any confidentiality requirements; (iii) the Receiving Party received from a third party who was not under any obligation of confidentiality with respect to the information.

(f) The Receiving Party will not disclose the Disclosing Party's Confidential Information and will maintain such information as confidential using practices no less stringent that the Receiving Party applies to its own confidential information. The Receiving Party agrees not to disclose Confidential Information without the prior written consent of the Disclosing Party; provided, however, the Receiving Party may disclose Confidential Information to the Receiving Party's affiliates, officers, directors, partners, employees, accountants, advisors, consultant and representatives (Related Persons) but only to the extent necessary for purposes of this Agreement. The Receiving Party shall be responsible for any acts or omissions of its Related Persons with respect to Confidential Information provided pursuant to the terms of this Agreement.

(g) If Jordan Cove or the Tribe become aware of a disclosure of Confidential Information in violation of the terms of this Agreement, the party making such discovery shall promptly notify the other party of such disclosure. Jordan Cove and the Tribe agree that the unauthorized disclosure of Confidential Information would cause irreparable harm that would be difficult to quantify. Accordingly, Jordan Cove and the Tribe agree the Disclosing Party would be entitled to injunctive relief in the event of a breach of this Agreement with respect to Confidential Information in addition to any other remedies that may be available to the Disclosing Party at law or in equity. The Receiving Party shall not contest the Disclosing Party's right to seek any such relief on the grounds that monetary damages would be available to compensate the Disclosing Party for any such breach.

(h) Nothing in this Agreement shall convey to either Party any rights in or to the Confidential Information, including any rights of ownership or license, whether arising under patent, copyright, trademark, trade secret or any other intellectual property or other proprietary right.

(i) Notwithstanding anything contained herein to the contrary, the commitments and obligations set forth in this Section 3.7 shall continue until the earlier to occur of Jordan Cove notifying the Tribe that (i) Project Activities are complete or (ii) the Project has been cancelled.

3.8 Funding of full time position. Jordan Cove agrees to provide in accordance with the terms of a separate agreement to be entered into between CTCLUSI and Jordan Cove within sixty (60) days of execution of this Agreement funding for a full-time position to assist CTCLUSI's Tribal Historic Preservation Office in carrying out CTCLUSI's obligations under this Agreement and other duties as assigned by CTCLUSI.

3.9 Governing Law. This Agreement shall be governed by and construed in accordance with the laws of the State of Oregon, without reference to conflicts of law rules, and the federal laws of the United States.

3.10 Dispute Resolution.

(a) All standards and procedures contained within Applicable Law pertinent to the provisions of this Agreement shall control.

(b) The Parties desire to prevent disputes regarding compliance with this Agreement whenever possible, and to quickly and effectively resolve disagreements when they arise. All disputes under this Agreement shall be considered Confidential Information and shall be subject to the provisions of Section 3.7, subject to Applicable Law.

(c) To the extent possible, the Parties will use reasonable efforts to negotiate a mutually agreeable resolution to any disagreements by the parties responsible for the day-to-day implementation of the provisions of this Agreement. In the event such parties are not able to resolve any disagreements within a reasonable period of time, the dispute shall be elevated to the principals designated under section 3.3(a) by either party providing written notice to the other party's principal.

(d) Upon receipt of a notice as set out in subparagraph (c) above, the principals agree to meet in person no later than ten (10) days after receipt of the notice, unless the Parties mutually agree to a different time and manner of meeting.

(e) The Principals will attempt, in good faith, to resolve the dispute between the Parties.

(f) If the parties are unable to resolve the disputed issues through joint discussions under this Section, either party may request arbitration by providing a written arbitration demand to the other party. The party on whom the demand is served shall have ten (10) days after receipt of the arbitration demand to advise the other party as to whether it will agree to arbitration.

(g) If the parties do not agree to arbitrate, then each party reserves the right to terminate this Agreement pursuant to Section 3.13, and/or to argue that failure to comply with this Agreement results in a violation of Applicable Law and any permits, certifications or approvals related to the Project.

(h) Arbitration shall be conducted in accordance with the Commercial Arbitration Rules of the American Arbitration Association ("AAA") or other mutually agreed-upon procedures. All arbitration hearings shall be held at Coos Bay, Oregon or such other place mutually agreed to by the Parties. If either Party fails to abide by such arbitration ruling, the Parties agree to enforce the arbitration award in Oregon state courts or any federal court having jurisdiction.

(i) In determining any matter(s) the arbitrators shall apply the terms of the Agreement, without adding to, modifying or changing the terms in any respect, and shall apply the laws of the State of Oregon.

(j) Prior to submitting to arbitration, the Parties may mutually agree to engage in mediation, in which case the Commercial Mediation Procedures of the AAA shall apply or other mutually agreed-upon procedures.

3.11 Limited Waiver of Sovereign Immunity

(a) CTCLUSI hereby grants an irrevocable, limited waiver of sovereign immunity to compel arbitration, once the Tribe has provided written notice to agree to arbitration pursuant to Subsection 3.11(f), and to enforcement of an arbitration award. Furthermore, for the sole and limited purpose of enforcement of any arbitration award, CTCLUSI expressly waives its sovereign immunity from suit by Jordan Cove, JCEP and PCGP and consents to be sued in the Oregon state courts or, if Oregon state courts lack jurisdiction over the suit, then in the United States District Court for the District of Oregon and appeals may be made to the United States Court of Appeals for the Ninth Circuit and the United States Supreme Court.

(b) Relief against the Tribe is specifically limited to the following actions and remedies:
  (1) Injunctive relief as necessary to enforce arbitration awards or orders pursuant to Section 3.10.
  (2) An Action to compel arbitration, once the Tribe has provided written notice to agree to arbitration pursuant to Subsection 3.10(f).

3.12 Term and Termination

(a) This Agreement shall be for a term of ten (10) years from the Effective Date unless extended upon the mutual written agreement of the Parties.

(b) This Agreement may be terminated by either Party by providing thirty (30) days written notice to the other Party. If this Agreement is terminated pursuant to this Section, then each party reserves all rights to argue that termination of this Agreement results in a violation of Applicable Laws and any permits, certifications or approvals related to the Project.

3.13 General Provisions.

(a) If any term or provision of this Agreement is held invalid, illegal or unenforceable by a court of competent jurisdiction for any reason, the Parties agree to modify such provision to the extent required to render it valid, legal, or enforceable, and the remainder of this Agreement shall in no way be affected and shall remain valid and enforceable for all purposes.

(b) All words in this Agreement shall be deemed to include any number or gender as the context or sense of this Agreement requires. The words "will," "shall," and "must" in this Agreement indicate a mandatory obligation subject to the terms hereof and Applicable Law. The use of the words "include," "includes," and "including" followed by one or more examples is intended to be illustrative and shall be deemed to be followed by the words "without limitation." The words "day" and "days" refer to calendar days unless otherwise stated. The words "month" and "months" refer to calendar months unless otherwise stated. The words "hereof", "hereto" and "herein" refer to this Agreement, and are not limited to the article, section, paragraph or clause in which such words are used.

(c) The headings and captions contained herein are for the purposes of convenience and reference only and are not to be construed as a part of this Agreement. All references to any Section in this Agreement are to Sections of this Agreement, unless otherwise noted.

(d) No third party shall be a beneficiary of a Party's rights or benefits under this Agreement, other than as expressly set forth herein.

(e) NOTWITHSTANDING ANYTHING CONTAINED HEREIN TO THE CONTRARY, IN NO EVENT SHALL EITHER PARTY BE LIABLE TO THE OTHER PARTY WITH RESPECT TO ANY CLAIM ARISING OUT OF OR RELATING TO THIS AGREEMENT FOR ANY SPECIAL, CONSEQUENTIAL, INCIDENTAL, OR INDIRECT LOSSES OR DAMAGES FROM ITS PERFORMANCE UNDER THIS AGREEMENT OR ANY FAILURE OF PERFORMANCE HEREUNDER OR RELATED HERETO, WHETHER ARISING OUT OF BREACH OF CONTRACT, TORT, STRICT LIABILITY OT OTHERWISE; provided, however, that the limitations of this clause (e) shall not apply to any rights to defense and indemnification of Jordan Cove, the Tribe or any other Indemnified Parties as provided elsewhere in this Agreement.

(f) Except as the Parties may otherwise agree in writing or as otherwise provided herein, each Party shall bear its respective fees, costs and expenses in connection with this Agreement and the transactions contemplated hereby.

(g) No waiver by any Party, whether express or implied, of any right under any provision of this Agreement shall constitute a waiver of such Party's right at any other time or a waiver of such Party's rights under any other provision of this Agreement unless it is made in writing. No failure by any Party hereto to take any action with respect to any breach of this Agreement or default by another Party shall constitute a waiver of the former Party's right to enforce any provision of this Agreement or to take action with respect to such breach or default or any subsequent breach or default by such latter Party.

(h) **Each Party acknowledges that it and its attorneys have been given an equal opportunity to draft, review, negotiate, and modify the terms and conditions of this Agreement and that any rule of construction to the effect that ambiguities or any other matters are to be resolved against the drafting party, or any similar rule operating against the drafter, shall not be applicable to the construction or interpretation of this Agreement.**

(i) This Agreement shall apply to Jordan Cove's successors and assigns.

(j) Any notice, demand, offer, or other written instrument required or permitted to be given pursuant to this Agreement shall be in writing signed by the Party giving such notice and shall be delivered by (1) hand, (2) same-day or overnight courier, (3) certified mail, return receipt requested, or (4) email to the other Party at the address set forth below:

i. If to the Tribe:

Confederated Tribes of Coos,

Lower Umpqua and Siuslaw Indians
1245 Fulton Avenue
Coos Bay, Oregon 97420
Attention: Tribal Council Chairman
E-mail: MCorvi@ctclusi.org (with CC to SScott@ctclusi.org and scott@wheatlawoffices.com)

ii. If to Jordan Cove:

Jordan Cove Energy Project L.P.
Pacific Connector Gas Pipeline L.P.
c/o Jordan Cove LNG L.L.C.
5615 Kirby Drive, Suite 500
Houston, Texas 77005
Attention: Manager Tribal Affairs
E-mail: (with a CC to neades@pembina.com)

Each Party shall have the right to change the place to which notice shall be sent or delivered by sending a written notice to the other Party in like manner. Notices, demands, offers or other written instruments shall be deemed to be received: (1) if delivered by hand, by same-day or overnight courier service, or certified mail on the date actually received at the address of the intended recipient; or (2) if sent by email, upon actual receipt.

[*Signature pages follow.*]

SIGNATORIES:

7/26/18

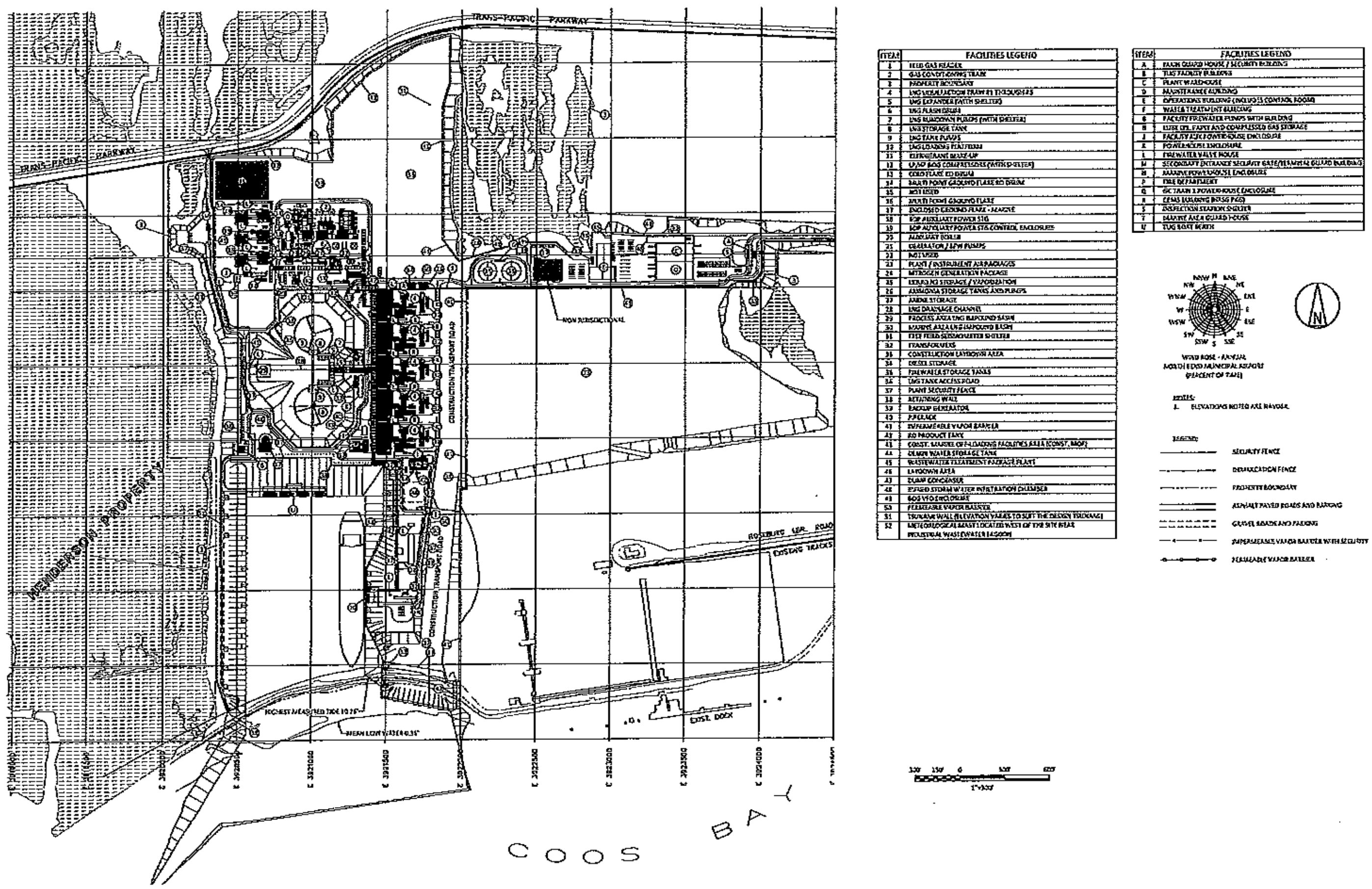
JORDAN COVE ENERGY PROJECT, LP Date
by its General Partner, Jordan Cove Energy Project, L.L.C.
and Pacific Connector Gas Pipeline, LP
by its General Partner, Pacific Connector Gas Pipeline, L.L.C.

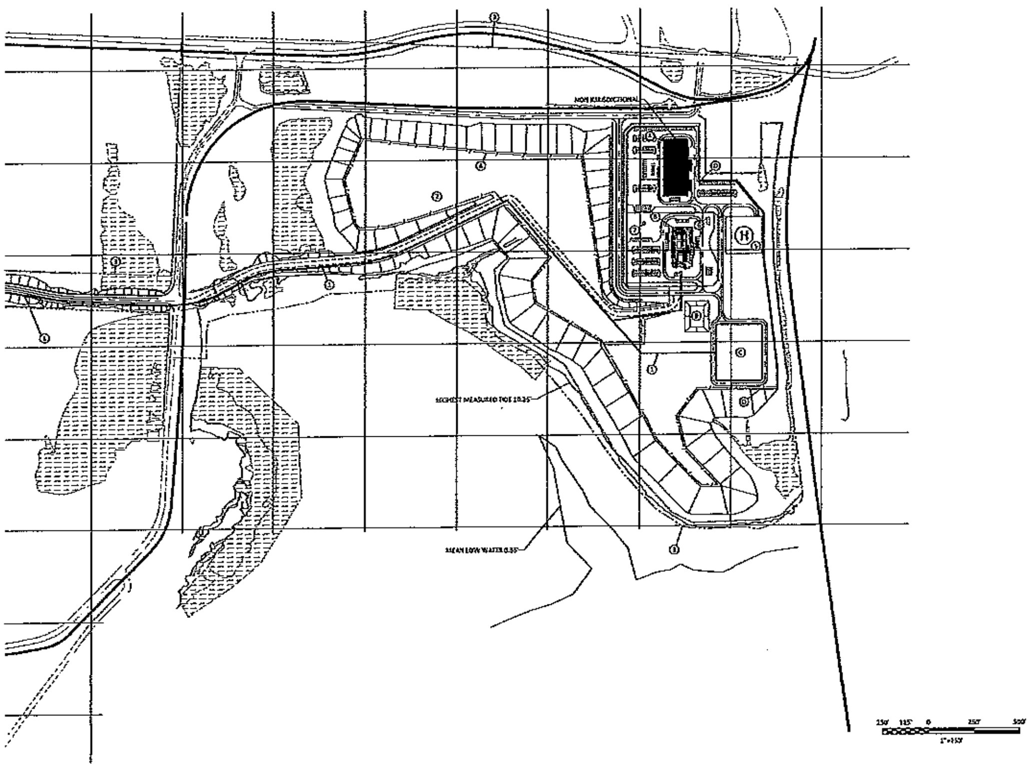
SIGNATORIES:

7-20-2018

Mark Ingersoll Date
Tribal Council Chairman
Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians

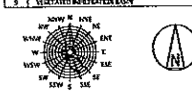
Exhibit A
Project Area


TRANS-PACIFIC PARKWAY
HENDERSON PROPERTY
CONSTRUCTION TRANSPORT ROAD
NON JURISDICTIONAL
EXISTING TRACKS
EXIST. DOCK
COOS BAY
FACILITIES LEGEND
ITEM
SECURITY FENCE
PROPERTY BOUNDARY
WIND ROSE - ANNUAL
(PERCENT OF TIME)
NOTES:
LEGEND:



ITEM	FACILITIES LEGEND
A	SOISC BUILDING
B	ADMINISTRATION BUILDING
C	GAS METERING STATION
D	RETAINING WALL

ITEM	FACILITIES LEGEND
1	ACCESS AND UTILITY CORRIDOR (SEE NOTE 3)
2	TEMPORARY CONSTRUCTION FACILITIES
3	PROPERTY BOUNDARY
4	PGE SWITCHYARD EASEMENT
5	HELIPAD
6	WASTEWATER TREATMENT PACKAGE PLANT
7	COMMUNICATIONS TOWER
8	PLANT SECURITY FENCE
9	VEGETATED INFILTRATION BASIN



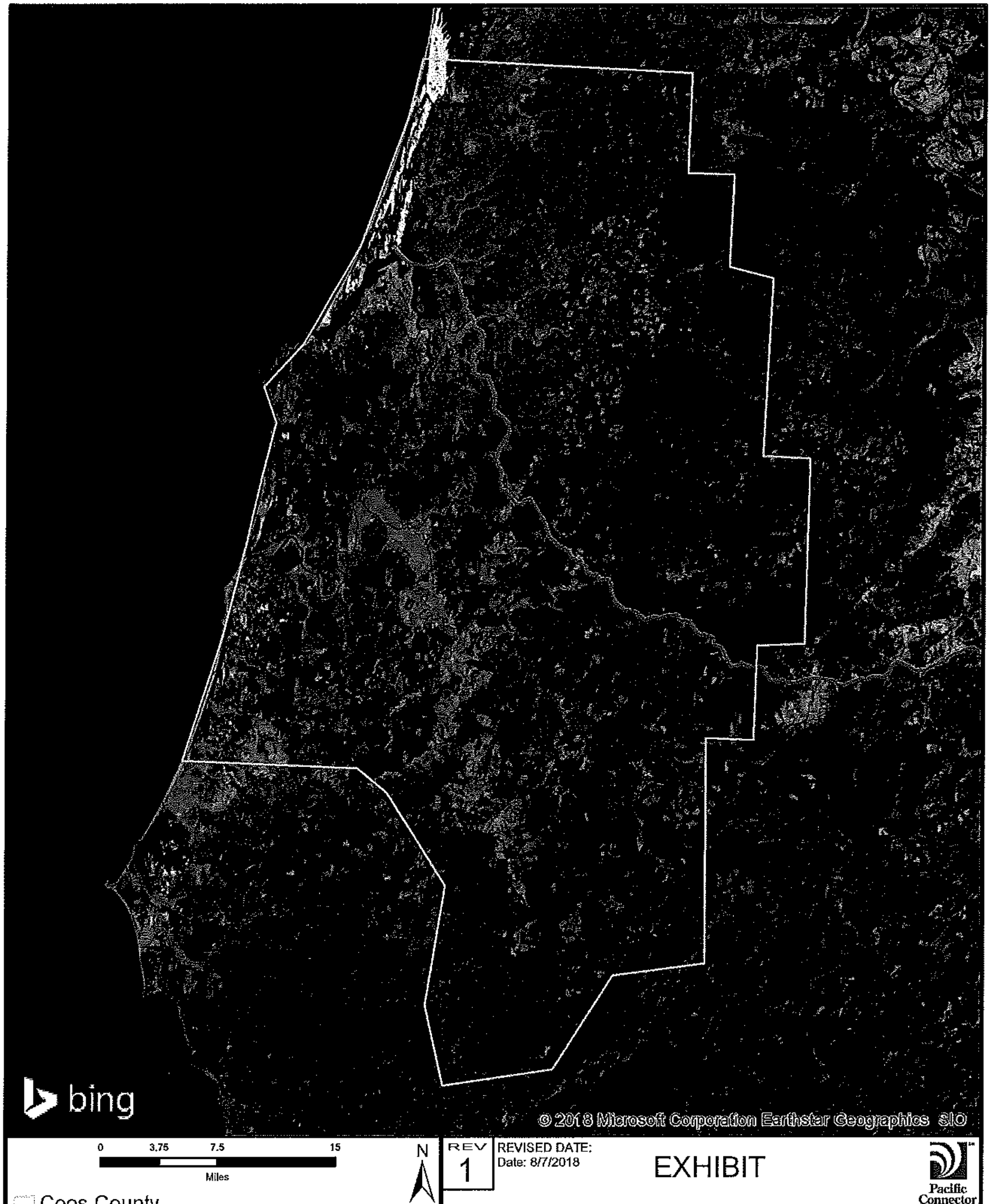
WIND ROSE - ANNUAL
NORTH BEND MUNICIPAL AIRPORT
(PERCENT OF TIME)

NOTES:

1. ELEVATIONS NOTED ARE NAVD88.
2. FOR OVERALL PLOT PLAN, SEE DRAWING 181930-0000-FG2000.
3. THE ACCESS AND UTILITY CORRIDOR CONTAINS THE FOLLOWING BURIED UTILS. CORRIDOR WILL BE ROUTED ON [illegible] LAND.
   - FEED GAS LINE
   - FIRE WATER SUPPLY TO ADMIN AND SOISC BUILDINGS
   - POWER TO ADMIN BUILDING
   - IT AND SECURITY TO ADMIN AND SOISC BUILDINGS
   - CONTROL CABLING FROM METERING STATION

LEGEND:

SECURITY FENCE
DEMARCATION FENCE
ASPHALT PAVED ROADS AND PARKING
GRAVEL ROADS AND PARKING



REV	REVISED DATE:
1	Date: 8/7/2018

EXHIBIT

PACIFIC CONNECTOR GAS PIPELINE, LP

MAP BOOK

COOS COUNTY, OREGON

Exhibit "B"
Unanticipated Discovery Plan

Jordan Cove LNG, LLC

DRAFT

Unanticipated Discovery Plan

Jordan Cove Energy Project

and

Pacific Connector Gas Pipeline Project

July 2018

Unanticipated Discovery Plan

1.0 Introduction

This document provides an Unanticipated Discovery Plan (UDP) that will be followed by Jordan Cove Energy Project, LP (JCEP) and Pacific Connector Gas Project, LP (PCGP) (JCEP and PCGP are collectively referred to as "Jordan Cove"). JCEP is seeking authorization from the Federal Energy Regulatory Commission (FERC) to site, construct and operate a natural gas liquefaction and liquefied natural gas (LNG) export facility on the North Spit of Coos Bay, Oregon (LNG Terminal). PCGP will simultaneously be seeking an authorization from FERC to construct and operate an approximately 229-mile long, 36-inch diameter natural gas transmission pipeline from near Malin, Oregon to the LNG Terminal (the LNG Terminal and Pipeline are collectively referred to as the "Project"). This UDP provides the procedures Jordan Cove, its personnel and consultants will follow in the event that unanticipated discoveries of historic properties, archaeological objects, archaeological sites, or human remains, funerary objects, sacred items and items of cultural patrimony are made during the construction and operation of the Project.

Potential unanticipated discoveries fall into two primary classes. The first class includes archaeological objects, materials or features such as hearths, pit features, or remains of dwellings. The second class consists of human remains, funerary objects, sacred items and items of cultural patrimony. The two classes are governed by different laws and regulations and require different treatment procedures.

Procedures for dealing with unanticipated discovery of human remains are outlined in Section 3.0, and procedures for dealing with the unanticipated discovery of archaeological objects are outlined in Section 4.0.

This UDP is intended to:

- Comply with applicable Federal and State and local laws and regulations – the National Historic Preservation Act of 1966, 16 U.S.C. § 470 and its implementing regulations at 36 CFR Part 800, 36 CFR Part 63; 36 CFR Part 61; the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA), 25 U.S.C. §§ 3001 *et. seq.* and its implementing regulations at 43 CFR Part 10; Archaeological Resources Protection Act of 1979, as amended and its implementing regulations at 36 CFR Part 296; Oregon Revised Statutes (ORS) 97.740-97.760 for Indian Graves and Protected Objects; ORS 358.905-358.961 for the Protection of Archaeological Objects and Sites; ORS 390.235 for Archaeological Permit Requirements; OAR 736-051-0080 through 0090 Administrative Rules for Oregon Archaeological Excavation Permits; the Government to Government Cultural Resource Cluster Group "Treatment of Native American Human Remains Discovered Inadvertently or Through Criminal Investigations on Private and Non-Federal Public Lands in Oregon"; and Federal Energy Regulatory Commission's Guidelines for Reporting on Cultural Resources Investigations for Pipeline Projects (July 2017);
- Describe to regulatory and review agencies the procedure Jordan Cove and its contractors will follow to address the unanticipated discovery of archaeological

objects, historic properties or human remains, funerary objects, sacred items and items of cultural patrimony; and

- Provide direction and guidance to Project personnel as to the proper procedure to be followed should an unanticipated discovery occur.
- Provide contact information for all parties that require notification – State police, LCIS, SHPO and affected Tribes.

2.0 Training and Orientation

Jordan Cove, in consultation with the FERC, will designate a Cultural Resources Coordinator (CRC) who will be responsible for all archaeological materials and historic properties-related activities on the Project. The CRC will be a professional archaeologist (meeting the Secretary of the Interior's Guidelines as defined in 36 CFR 61). For practical purposes, the CRC may designate an Environmental Inspector (EI) or other supervisor to provide notifications required under this UDP but may not delegate any of the CRC's other responsibilities, unless the EI is a professional archaeologist and meets the requirements of 36 C.F.R. Part 61, in which case the EI may act in the CRC's place if the CRC is unavailable. The CRC will provide archaeological/cultural resource orientation for Jordan Cove and advise construction contractors and personnel on the procedures to follow in the event that an unanticipated discovery is made. Training will occur as part of the pre-construction on-site training program for foremen, environmental inspectors (EIs), construction supervisors, and all other supervisory personnel who supervise any construction or inspection activities. Training will involve both general and detailed instructions regarding how to follow the requirements of the UDP, basic archaeological artifact and site identification, and an overview of the state and federal laws pertaining to the protection of archaeological resources. General instructions shall include:

- Ensure that all construction supervisors have contact information for the CRC.
- Stop work immediately if archaeological objects (artifacts, historic or prehistoric features [wells, privies, shell middens, etc.], bones, or any item suspected of being archaeological), funerary objects, sacred items and items of cultural patrimony are identified.
- Contact the construction supervisor immediately. The construction supervisor shall notify the CRC or its designee as soon as possible.
- Restrict access to the discovery.
- Drawings, photographs, or analysis will not be permitted without consultation and approval from the appropriate Indian Tribes.
- The discovery will not be shared with the media or individuals not pertinent to the assessment or protection of the remains.
- Comply with all unanticipated discovery procedures.
- Treat human remains, funerary objects, sacred objects, and objects of cultural patrimony with dignity and respect. Do not touch any human remains.
- A description of the potential penalties for failure to report discoveries or to comply with the procedures outlined in this UDP.
- The penalties that could be incurred by anyone who illegally collects or destroys any archaeological objects, archaeological sites, or historical artifacts, funerary

objects, sacred objects and objects of cultural patrimony and associated materials and/or their context.

3.0 Procedures for the Inadvertent Discovery of Human Remains or Burial Sites

Any human remains, burial sites, or burial related objects that are discovered during construction will at all times be treated with dignity and respect.

Pursuant to ORS 97.745(4), if suspected Native American remains are encountered on private or non-federal public lands, Jordan Cove will notify the state police, SHPO, the Oregon Commission on Indian Services (OCIS), the FERC, and the appropriate Indian Tribe(s) as soon as possible but in all cases, within twenty-four hours of the determination.

In accordance with NAGPRA, if the remains are found on federal lands, in addition to contacting those entities listed in the previous paragraph, the CRC will immediately contact the applicable federal land management agency in accordance with the requirements of 43 C.F.R. § 10.4. The federal land management agency will then be responsible for further contact with any appropriate Indian Tribes.

Indian Tribes that may have ancestral burial sites in the Project area include, but are not limited to, the Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians, the Confederated Tribes of Grand Ronde, the Confederated Tribes of Siletz, the Coquille Indian Tribe, the Cow Creek Band of Umpqua Tribe of Indians, and the Klamath Tribes.

The CRC will, in all cases of a potential discovery, complete a form or provide other written documentation acceptable to FERC and SHPO to document a potential discovery. The CRC and all EIs will comply with the following procedures:

A. If any Jordan Cove personnel or contractors believe he or she has made an unanticipated discovery of human remains (skeletal, teeth or hair), the remains will not be moved or disturbed, and the construction supervisor shall be immediately notified. The construction supervisor shall, in turn, immediately notify the CRC and the appropriate EI.

B. The CRC or its designee will be responsible for taking appropriate steps to protect the discovery. The construction activity that resulted in the exposure of the discovery will be immediately halted, followed, as soon as possible, by the cessation of all other ground-disturbing activity within 300 ft (91 m) of the discovery, unless a greater distance is required by SHPO to protect a discovery. Construction activities may continue elsewhere on the Project site. After all construction activity within 300 ft (91 m) of the discovery has been halted, the following steps will be taken to ensure that no further disturbance occurs to the discovery:

i) secure an area at least 300 ft (91 m) around the discovery using orange safety fencing or a similar material, as necessary;
ii) prevent vehicle traffic through the area immediately surrounding the discovery except as necessary to remove vehicles and equipment already present in the area;
iii) consult with the SHPO to determine whether a 24-hour guard is needed to ensure that the find is secure at all times or consult with the applicable federal land management agency if the lands are federal;

iv) limit access to the area surrounding the discovery to essential personnel, who will be identified by the CRC; and
v) If the remains are suspected to be Native American, no photographs will be allowed unless approval is provided by the appropriate Indian Tribe(s). If the state police determine the discovery to be a crime scene, then any photographs will be taken at the direction of the state police.

C. The CRC or its designee will immediately call the state police, SHPO, the LCIS, the appropriate Indian Tribe(s) and FERC, who will, according to their responsibilities, examine the discovery and determine whether it should be treated as a crime scene or as a human burial/cemetery. The CRC or its qualified designee will also have a physical anthropologist examine the discovery to concur with the coroner on whether the remains are human and whether or not they are contemporary. The physical anthropologist will have been previously agreed upon by the Indian Tribe(s). In the event of a disagreement between the coroner and the physical anthropologist, the opinion of the physical anthropologist shall control. A forensic anthropologist may also be required to determine whether the remains are of Native American ancestry. If the remains are determined to be or suspected to be of Native American ancestry, no photographs will be taken. If the discovery occurs on federal lands, the CRC will also immediately notify the applicable federal land management agency, and the Federal Land Archaeologist, if qualified to do so, will make, in consultation with the appropriate Indian Tribe(s), the determination as to whether the remains are human and of possible Native American ancestry. If the Federal Land Archaeologist is not qualified to determine whether the remains are human, the Federal Land Archaeologist will engage a forensic anthropologist or osteo-archaeologist, who shall consult with the appropriate Indian Tribes to determine whether the remains are of Native American ancestry. All work within 300 ft buffer around the discovery will halt until permission to resume work is provide by FERC, the SHPO or the applicable federal agency for finds on federal lands.

D. If the remains are determined to be non-human by the archaeologist and/or forensic anthropologist, and there are no archaeological objects identified in association with the remains, then the archaeologist or forensic anthropologist will inform the CRC, who will notify the Construction Superintendent that construction can resume. The CRC will complete the Discovery Form and take photographs of any find. The photographs shall be sufficient for a trained archaeologist to determine that the remains are not human by reviewing them. The Discovery Form and photographs shall be submitted to FERC, the SHPO and the appropriate Indian Tribe(s) within 15 days of the discovery.

E. If the remains are determined to be non-human by the archaeologist and/or forensic anthropologist, but associated with an archaeological site, the CRC shall follow the procedures identified in Section 4 below.

F. If the remains are determined to be human and associated with a crime scene by the appropriate county coroner, then the CRC shall immediately inform the Construction Superintendent to follow the coroner's protocol for removal of the remains. The CRC will complete the Discovery Form and take photographs of the find to the extent allowed by State law. The Discovery Form and photographs shall be submitted to FERC and the SHPO within 15 days of the discovery.

G. If the remains are determined to be human, not to be the result of criminal activity and not within an archaeological context, and not of Native American Ancestry, the CRC or its designee will notify the SHPO as soon as possible but in all cases within

24 hours. The SHPO will be kept informed of all discussions regarding the remains until their final status is resolved.

The CRC or its designee will contact the OCIS as well as all appropriate Indian Tribes and notify them of the discovery by phone or e-mail as soon as possible but in all cases within twenty-four hours of the discovery. The appropriate Indian Tribe(s) also will be notified in writing within three days of the discovery, and this notification shall include information on the site of the human remains along with the name of the person or agency in charge of the find.

H. If the remains are determined to be human, within an archaeological context, and of Native American ancestry, the CRC shall follow the steps in Section 4 subparagraphs (5) - (13) for the unanticipated discovery of an archaeological site and the following:

- Notifications to the appropriate agencies and Indian Tribes shall indicate that human remains have been identified.
- No photographs shall be taken of Native American human remains.
- No further assessment shall be conducted until a Tribal representative(s) is present.
- The public and non-essential personnel will be excluded from the site.
- The discovery will not be shared with the media or any individuals who are not required for the assessment and protection of the remains.
- The CRC shall request that the appropriate Indian Tribe(s) inform them of any requests they have regarding the treatment of the remains and such requests shall be honored to the greatest extent possible.
- Field investigations to determine the NRHP-eligibility of archaeological materials shall avoid contact with the human remains.
- The CRC will consult with the SHPO and appropriate Tribe(s) to develop field investigations designed to evaluate the potential for additional human remains to be present without disturbing them.
- The CRC will consult with the Construction Superintendent, the SHPO, and appropriate Tribe(s) to determine if the remains can be avoided by an alternative construction technique. If such a technique is possible, construction shall resume upon approval from SHPO and will be monitored by a professional archaeologist and the appropriate Indian Tribe(s) if they request to do so.
- If disturbance of the remains cannot be avoided and the remains are not part of a crime scene or are part of an historic cemetery, the CRC will consult with the SHPO and appropriate Indian Tribe(s), if applicable, or likely descendants to develop a treatment plan. The treatment plan will outline measure to be implemented, including addressing how the remains should be excavated, repatriated, reinterred and reported. The treatment plan will clearly state that Jordan Cove shall be responsible for all costs associated with implementation of an approved treatment plan. Human remains will not be permanently curated.
- If disturbance of the remains cannot be avoided and the remains are part of an archaeological site that will also be affected by construction, the CRC will consult with the SHPO and appropriate Tribe(s) to develop a treatment plan for the site that includes provisions for temporary curation, reporting, repatriation

and re-internment of the human remains and disposition of any artifacts. The treatment plan will be implemented after approval from the SHPO.

I. The FERC will consult with the appropriate Indian Tribes to determine best practices for handling human remains of Native American ancestry. No work is to take place 300 feet of the area of the delineated discovery until a treatment plan has been approved and implemented.

J. Jordan Cove will offer to compensate the appropriate Indian Tribe(s) for their time and expenses related to any activities associated with the implementation of this UDP. In the event Jordan Cove has entered into a cost recovery agreement with a Tribe addressing such costs, Jordan Cove will abide by the terms of such agreement.

K. Jordan Cove will be responsible for any reburial costs associated with any human remains encountered during construction of the Project that are not associated with a criminal site.

L. If multiple sets of remains are found, which are determined to be of Native American ancestry, Jordan Cove will consult with the appropriate Tribe(s) to determine the appropriate action, including rerouting around any such sites.

4.0 Procedures for the Inadvertent Discovery of Archaeological Objects or Sites

In Oregon, it is illegal to disturb an archaeological site or object on private or non-federal public land without obtaining an archaeological excavation permit (ORS 358.920[1] [a]). When archaeological objects or archaeological sites are identified inadvertently, this law applies once the discovery is determined to be archaeological. Similarly, federal laws prohibit the disturbance of archaeological resources on federal lands in the absence of a valid permit (43 C.F.R. §§ 7.5 and 7.6). The CRC and the EIs will be aware of and follow the procedures set out below:

A. If any Jordan Cove personnel or contractors believe he or she has found archaeological object or an archaeological site, all work within 100 ft (30 m) of the discovery will stop and the Construction Superintendent will be notified immediately. The Construction Superintendent shall notify the EI and the CRC or its designee as soon as possible but no later than within 24 hours of the discovery. The area of work stoppage will be adequate to provide for the security, protection, and integrity of the objects found and therefore may need to be greater than 100 ft depending on the nature of the find. Examples of archaeological objects include but are not limited to:

- i) An area of charcoal or charcoal-stained soil;
- ii) An arrowhead, stone tool, or stone flakes (chips);
- iii) A cluster of animal bones or burned rocks in association with stone tools or flakes (chips);
- iv) A cluster of tin cans, bottles, or other historic materials older than 50 years that have not previously been identified as objects that can be removed; or
- v) A dense pocket of shells.

B. The CRC or the EI onsite will make an initial determination regarding whether the discovery consists of an archaeological site and/or an archaeological object.

Appropriate Indian Tribes shall be notified of such determination. The CRC or EI shall prepare a report regarding the determination. The report shall be provided to Appropriate Indian Tribes for review and comment. If the CRC or EI initially determines it is not an archaeological site or object and an Indian Tribe disagrees, the SHPO shall make the final determination.

C. If it is determined that the discovery consists of archaeological objects or a site, the Construction Superintendent, CRC, and/or EI will take appropriate steps to protect the discovery site. At a minimum, the construction activity that resulted in the exposure of the discovery will be immediately halted, followed as soon as possible by the cessation of all other ground-disturbing activity within 100 ft (30 m) of the discovery. Vehicles, equipment, and unauthorized personnel will not be permitted to traverse the buffer zone around the site, provided, however, a travel corridor will be allowed along the edge of the buffer zone furthest removed from the discovery, provided that:

a) vehicles will not be allowed to pass closer than 45 ft from the discovery;

b) the edge of the travel corridor nearest the discovery will be secured using orange safety fencing or similar material; and

c) the CRC will consult with the SHPO to determine whether a 24-hour guard is needed to ensure that the find is secure at all times or if the discovery occurs on federal lands, the CRC will consult with the applicable federal land management agency regarding implementation of any security measures.

D. Work in the immediate area will not be re-started until treatment of the discovery has been completed and authorization to proceed has been provided by FERC and/or the SHPO as applicable, and after any required permits have been issued.

E. The buffer zone of 100 ft (30 m) will be established using orange safety fencing or a similar material.

F. The CRC or its qualified designee will arrange for the discovery to be evaluated by a professional archaeologist as soon as possible. The archaeologist must meet the Secretary of the Interior standards as described in 36 CFR Part 61. The appropriate Indian Tribe(s) shall be notified, afforded and opportunity to monitor the examination and provide comments on any written reports provided to Jordan Cove by the archaeologist. The professional archaeologist shall examine the find within 48 hours of notification. The archaeologist will recommend whether the discovery is potentially eligible for listing in the National Register of Historic Places (NRHP) pursuant to 36 CFR §800.4 and 36 CFR Part 63. The CRC will consider the archaeologist's conclusion, make its own recommendation, and then submit documentation, including any documentation or comments provided by an Indian Tribe(s), about the find, the archaeologist's recommendation and its recommendation to FERC, the SHPO and any appropriate Indian Tribe(s) for concurrence within 72 hours of receipt of the professional archaeologist's recommendation. The documentation will be in memorandum form with appropriate photographs included to facilitate FERC and SHPO's review of the conclusions reached.

G. If FERC, in consultation with the SHPO, Jordan Cove, and the appropriate Indian Tribe(s) determines that the discovery is eligible for listing under the NRHP ("NRHP-eligible") as a pre-contact deposit, FERC, Jordan Cove, the SHPO, and the appropriate Indian Tribe(s) will consult to determine if the Project will adversely affect the resource pursuant to 36 CFR 800.5.

H. If FERC, in consultation with the SHPO, Jordan Cove, and the appropriate Indian Tribe(s) determines that the discovery is not NRHP-eligible, then Jordan Cove will prepare a memorandum to this effect and deliver it to the SHPO and the FERC for concurrence. A copy will also be provided to the appropriate Indian Tribe(s). To the extent any Indian Tribe disagrees with the conclusions in such memorandum, the Indian Tribe reserves its rights pursuant to paragraph L below.

I. If FERC, in consultation with the SHPO, Jordan Cove, and the appropriate Indian Tribe(s) determines that the resource is NRHP-eligible and that the Project will have an adverse effect on it, Jordan Cove will first propose whether or not avoidance or minimization of adverse effects is possible via alternative construction techniques.

J. If it is determined that avoidance or minimization of adverse effects via alternative construction techniques to an NRHP-eligible site is not possible, then Jordan Cove will develop a treatment plan in consultation with the appropriate Indian Tribe(s), designed to mitigate the adverse effect pursuant to 36 CFR 800.6. Jordan Cove will consult with the FERC, SHPO, and the appropriate Indian Tribe(s) and follow state and federal regulations for applicable treatment measure(s). Jordan Cove will provide FERC, the SHPO and the appropriate Indian Tribe(s) with a draft treatment plan for review and comment. The SHPO will provide approval of the treatment plan, which will be implemented in accordance with any schedule set out in the plan. Treatment measures may include mapping, photography, subsurface testing and sample collection, complete data recovery, or other activities. Jordan Cove will provide a report on the methods, analysis, and results in compliance with 36 CFR 800.11 and in accordance with the treatment plan. The specific work plan and schedule for these procedures will be included in the treatment plan.

K. If FERC, in consultation with the SHPO, Jordan Cove, and the appropriate Indian Tribe(s) determines that the resource is NRHP-eligible but that the Project will not adversely affect it, then Jordan Cove will prepare a memorandum to this effect and deliver it to the SHPO and the FERC for concurrence and provide a copy to the appropriate Indian Tribe(s).

L. Jordan Cove will ensure that field investigations, research, analysis, reporting, and curation of any materials collected during these investigations are sufficiently funded and implemented and follow all federal and state guidelines and procedures. All treatment efforts shall be conducted under an Oregon permit for archaeological excavation (OAR 736-051-0080 through 0090).

M. If any Indian Tribe does not agree with the findings of the SHPO and Jordan Cove's archaeologist, such Tribe reserves the right to address its concerns with the Advisory Council on Historic Preservation pursuant to 36 C.F.R. Part 800, and otherwise reserves all rights under state and federal law to obtain relief.

N. Upon completion of the treatment plan, Jordan Cove will submit a summary report to the SHPO and appropriate Indian Tribe(s) within thirty (30) days of completion of the treatment plan. If archaeological data recovery is a component of the treatment plan, a full report will be submitted to the SHPO, appropriate Indian Tribes, and the OCIS in accordance with any schedule set out in the treatment plan.

5.0 Parties to Contact

Notice required under this UDP shall be made to those parties set out in the table below. Any party may update its contact information at any time. An effort will be made to update this information on an annual basis during the life of the Project.

Contacts for the Discovery of Archaeological Resources				
Organization	**Name**	**Role**	**Contact Information**	**Mailing Address**
Jordan Cove	To Be Determined	Cultural Resource Coordinator (CRC)	Office: Mobile: Email:	
Historical Research Associates	Bradley Bowden	Archaeological/Historical Consultant	Office: (503) 247-1319 Direct: (971) 386-2042 Mobile: (206) 898-5781 Email: bbowden@hrassoc.com	1825 SE 7th Ave, Portland, OR 97214
Oregon State Historic Preservation Office (SHPO)	Dr. Dennis Griffin	State Archaeologist	Office:(503) 986-0674 Fax: (503) 986-0793 Email: dennis.griffin@state.or.us	Heritage Conservation Division Oregon Parks and Recreation Dept., 725 Summer Street NE, Suite C, Salem, OR 97301-1266
Oregon State Historic Preservation Office (SHPO)	John Pouley	Assistant State Archaeologist	Office: (503) 986-0675 Fax: (503) 986-0793 Email: john.pouley@state.or.us	Heritage Conservation Division Oregon Parks and Recreation Dept., 725 Summer Street NE, Suite C, Salem, OR 97301-1266
Federal Energy Regulatory Commission (FERC)	Paul Friedman	FERC Cultural Resources Contact	Office: (202) 502-6353 Fax: (202) 208-0353 Email: paul.friedman@ferc.gov	888 First Street NE, Washington, D.C. 20426
Federal Energy Regulatory Commission (FERC)		Alternate FERC Contact	Office: Fax: (202) 208-0353 Email:	888 First Street NE, Washington, D.C. 20426
Federal Land Owners				
BLM Coos Bay District	William Kerwin	Archaeologist	Office: (541) 756-0100 Phone: (541)751-4306-3246 Email: wkerwin@blm.gov	1300 Airport Lane North Bend, OR 97459

Contacts for the Discovery of Archaeological Resources				
Organization	**Name**	**Role**	**Contact Information**	**Mailing Address**
BLM—Medford District	Cheryl Foster-Curley	Archaeologist	Office: (541) 618-2200 Phone: (541) 618-2280 Email: cfostercurley@blm.gov	3040 Biddle Road Medford, OR 97504
BLM—Roseburg District	Molly Casperson	Archaeologist	Office: (541) 440-4930 Phone: (541) 440-3284 Email: mcasperson@blm.gov	777 NW Garden Valley Blvd. Roseburg, OR 97471
BLM—Lakeview District: Klamath Falls Resources Area	Laird Naylor II	Archaeologist	Office: (541) 883-6916 Phone: (541) 885-4139 Email: lnaylor@blm.gov	2795 Anderson Avenue, Bldg. #25 Klamath Falls, OR 97603
Umpqua National Forest	Christopher Kelly	Heritage Program Manager/Tribal Liaison	Office: (541) 957-3200 Phone: (541) 957-3350 Email:	2900 NW Stewart Parkway, Roseburg, OR 97471
Rogue River – Siskiyou National Forest	Melissa Schroeder	Heritage Program Manager/Tribal Liaison	Office: (541) 618-2200 Phone: (541) 618-2077 Email:	3040 Biddle Road, Medford, OR 97504
Fremont – Winema National Forest	John Kaiser	Klamath Ranger District Forest Archaeologist	Office: (541) 883-6714 Phone: (541) 947-6260 Email:	2819 Dahlia Street Suite A, Klamath Falls, OR 97601
Fremont – Winema National Forest	Amy Gowen	Tribal Government Relations	Office: (541) 883-6741 Email:	
Bureau of Reclamation Klamath Basin	Adam Nickels	Archaeologist	Office: (541) 883-6935 Fax: (916) 978-5005 Phone (916) 978-5053 Email:	6600 Washburn, Klamath Falls, OR 97603

Contacts for the Discovery of Human Remains				
Organization	**Name**	**Role**	**Contact Information**	**Mailing Address**
Oregon State Police	Sergeant Chris Allori		Office: (503) 731-4717 Mobile: (503) 708-6461 Dispatch: (503) 731-3030	
Coos Bay Area Command State Police	Lieutenant Jeff Lewis		Office: (541) 888-2677 Email: jeffrey.lewis@state.or.us	
Oregon Medical Examiner's Office	Karen Gunson	Oregon State Medical Examiner	Office: (971) 673-8200	

Contacts for the Discovery of Human Remains				
Organization	**Name**	**Role**	**Contact Information**	**Mailing Address**
Oregon Medical Examiner's Office	Eugene Gray	Forensic Administrator	Office: (971) 673-8200 Email: Eugene.Gray@state.or.us	
Oregon Medical Examiner's Office	James Olson, M.D.	Deputy State Medical Examiner-Southern Region	Office: (541) 440-4453	
Tribal Contacts				
Oregon Commission on Indian Services (OCIS)	Karen Quigley	Executive Director	Office: (503) 986-1067 Fax: (503) 986-1071 Email: Karen.Quigley@state.or.us	900 Court Street NE, Rm. 167, Salem OR 97301-1347
Coquille Indian Tribe	Kassandra Rippee	THPO & Archaeologist	Office: (541) 756-0904 ext. 1216 Mobile: (541) 808-5554 Fax: (541) 756-0847 Email: kassandrarippee@coquilletribe.org	3050 Tremont Street, North Bend, OR 97459
Confederated Tribes of Coos, Lower Umpqua & Siuslaw Indians	Stacy Scott	THPO, Cultural Resources Protection Specialist	Office: (541) 888-7513 Mobile: (541) 297-5543 Fax: (541) 888-2853 Email: sscott@ctclusi.org	1245 Fulton Avenue, Coos Bay, OR 97420
Confederated Tribes of Grand Ronde	Briece Edwards	Deputy THPO	Office: (503) 879-2084 Fax: (503) 879-2126 Email: THPO@grandronde.org	9615 Grand Ronde Road, Grand Ronde, OR 97347
Confederated Tribes of Siletz	Robert Kentta	Cultural Resource Program Director	Office: (541) 444-2532 Home: (541) 444-2204 Mobile: (541) 351-0148 Fax: (541) 444-2307 Email: Rkentta@ctsi.nsn.us	PO Box 549, Siletz, OR 97380
Cow Creek Band of Umpqua Tribe of Indians	Jessie Plueard	THPO and Cultural Programs Manager	Office: (541) 677-5575 X5577 Fax: (541) 677-5574 Email: jpluard@cowcreek.com	2371 NE Stephens St. Suite 100, Roseburg OR 97470
The Klamath Tribes	Perry Chocktoot	Director of Culture and Heritage	Office: (541) 783-2219 X159 or (541) 891-5450 Fax: (541) 783-2764 x107 Email: perry.chocktoot@klamathtribes.com	PO Box 436, Chiloquin, OR 97624

EXHIBIT C - COST RECOVERY AGREEMENT

CONFIDENTIAL

Exhibit D

PROJECT ACTIVITY NOTICE

Notice Provided to CTCLUSI

Name: ______________________ Email: ______________________

Position: ______________________ Date: ______________________

Description of Project Activity

Date(s) and Time(s) of Project Activity: ______________________

Type of Project Activity and Equipment: ______________________

____

____

Location of Project Activity: ______________________

____

Equipment needed –

a. Provided by Jordan Cove:

b. Provided by CTCLUSI:

Safety Requirements for Any Monitors:

Monitors shall always require the following equipment and clothing to be worn at all times on site:

- Closed toed shoes, long pants and long sleeves;
- a hard hat;
- a safety vest (brightly colored with reflectors); and
- protective eyewear.

Additional Requirements for this Project Activity and site:

____

____

Response Required from CTCLUSI by: ______________________

Exhibit E
Access Agreement

SITE ACCESS AGREEMENT BETWEEN JORDAN COVE ENERGY PROJECT, L.P. AND THE CONFEDERATED TRIBES OF COOS, LOWER UMPQUA AND SUISLAW INDIANS

This SITE ACCESS AGREEMENT ("Agreement") is entered into on ________ ("Effective Date") by and between Jordan Cove Energy Project, L.P. ("Grantor") and _____________ ("Grantee") (collectively referred to herein as the "Parties") for the purposes of granting a right to access certain lands owned and operated by Grantor.

WHEREAS, Grantor owns real property located in Coos County, Oregon, on which Grantor intends to construct and operate a liquefied natural gas terminal ("Grantor's Property").

WHEREAS, Grantee desires to access Grantor's Property to observe Project Activities to be performed by _________ ("_______") on behalf of Grantor on Grantor's Property;

WHEREAS, this Agreement governs the right of access to Grantor's Property by Grantee.

NOW THEREFORE, in consideration of the foregoing premises and the mutual covenants contained herein and subject to the terms and conditions set forth below, Grantor and Grantee agree as follows:

1. **Grantor's Right to Grant Access.** Grantor has the authority to grant access to Grantor's Property.

2. **Right of Access.** Subject to the terms of this Agreement, Grantor hereby grants access to Grantee for the sole purpose of observing the Surveys.

3. **Conditions of Use of Grantor's Property.**

i. At all times while on Grantor's Property, Grantee shall comply with the instructions and safety requirements of Grantor or its designee.

ii. Grantee agrees to use only established routes for vehicular travel on Grantor's Property, if such routes exist.

iii. Existing gates shall be used and shall remain closed and secured, unless otherwise authorized by Grantor.

iv. The use of alcohol, drugs or the carrying of firearms on Grantor's Property by Grantee is strictly prohibited at all times.

4. **Indemnity**. Grantee shall indemnify, defend and hold harmless, Grantor, its affiliates, successors, assigns, employees, officers, directors, shareholders, contractors and agents ("Grantor Indemnitees") from and against any and all claims, actions, losses, costs, and damages arising out of injury or death to persons, or damage to property caused by the negligence or misconduct of the Tribe and its officials, employees, agents, and subcontractors in the performance of obligations arising under this Agreement, provided: (i) JCEP promptly notifies the Tribe in writing of any such claim; (ii) the Tribe shall have the exclusive right to control the defense; and (iii) the amount does not exceed and is otherwise covered by the Tribe's liability insurance. Grantor shall indemnify, defend and hold harmless, Grantee, its affiliates, successors, assigns, employees, officers, directors, shareholders, contractors and agents ("Grantee Indemnitees") from and against any and all claims, actions, losses, costs, and damages arising out of injury or death to persons, or damage to property caused by the negligence or misconduct of the Grantor and its officials, employees, agents, and subcontractors in the performance of obligations arising under this Agreement, provided the Tribe promptly notifies JCEP in writing of any such claim and JCEP shall have the exclusive right to control the defense. This indemnity provision survives termination of this Agreement.

5. **Termination.** This Agreement shall terminate upon completion of the Monitoring activities for which access has been granted or sooner if terminated in writing by either Party.

6. **Scope**. This Agreement constitutes the entire agreement between Grantor and Grantee regarding site access.

7. **Amendment.** This Agreement may not be changed, amended or modified except by instrument in writing signed by the Parties.

8. **Breach of this Agreement.** Grantee acknowledges and agrees that failure to adhere to any of the provisions of this Agreement by Grantee shall render this Agreement subject to cancellation by Grantor without further notice by Grantor. Failure of Grantor to cancel this Agreement upon discovery or notice of breach of the Agreement does not render the Agreement void nor does it negate Grantor's right to cancel the Agreement in the event of subsequent breaches by Grantee Personnel.

9. **Execution.** This Agreement may be executed in counterparts, and each counterpart shall for all purposes be an original, and all such counterparts shall together constitute one and the same Agreement.

[*Signature page follows.*]

IN WITNESS THEREOF, the parties hereto have caused this Agreement to be duly executed by their duly authorized officers, in accordance with their duly respective laws.

GRANTOR

JORDAN COVE ENERGY PROJECT, LP
by its General Partner, Jordan Cove Energy Project, L.L.C.

______________________________ Date:________________
Signature

____
Name (Print)

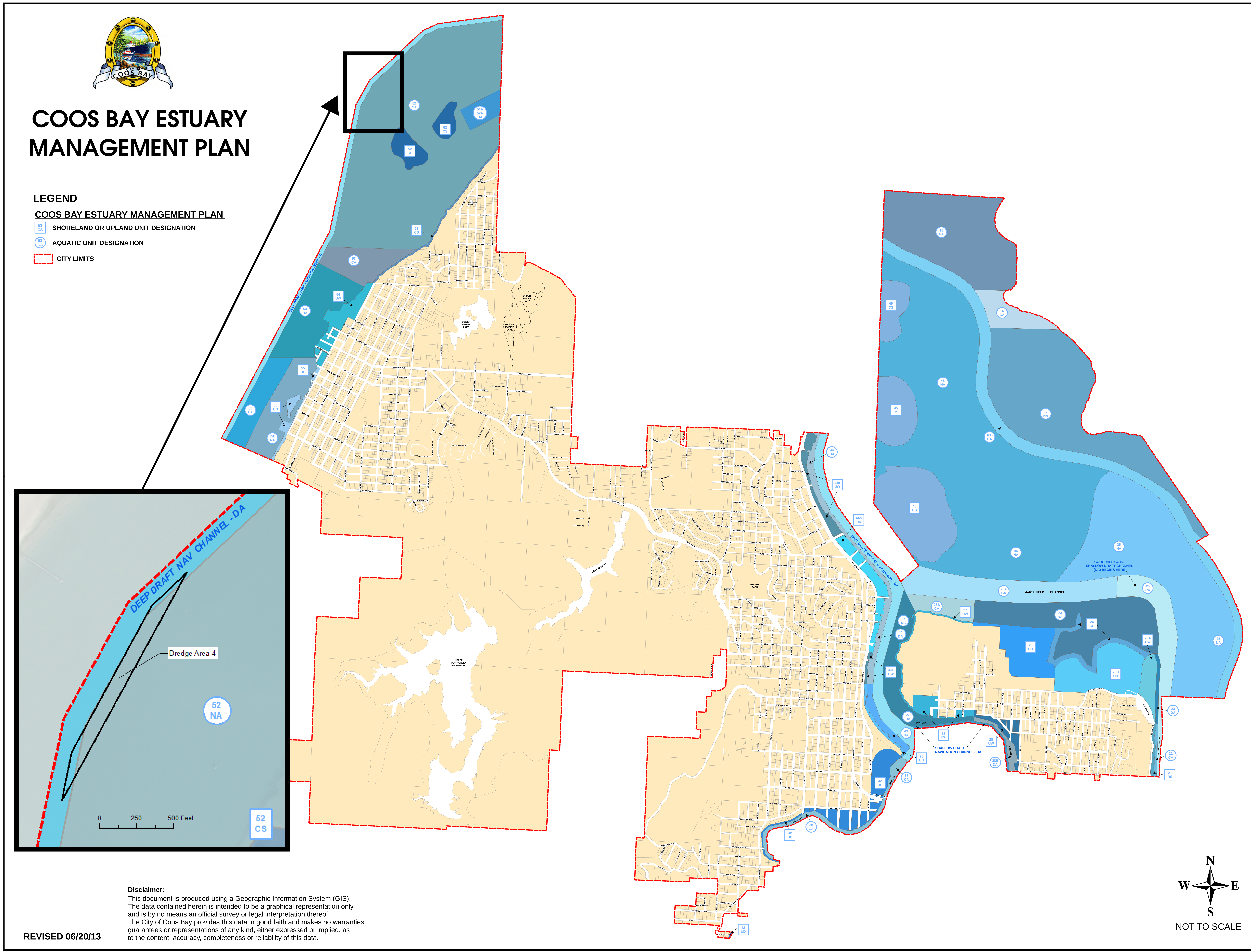
____
Title

GRANTEE

[NAME]

______________________________ Date:________________
Signature

____
Title


COOS BAY ESTUARY MANAGEMENT PLAN
LEGEND
COOS BAY ESTUARY MANAGEMENT PLAN
SHORELAND OR UPLAND UNIT DESIGNATION
AQUATIC UNIT DESIGNATION
CITY LIMITS
DEEP DRAFT NAV CHANNEL - DA
Dredge Area 4
52 NA
52 CS
0 250 500 Feet
MARSHFIELD CHANNEL
COOS-MILLICOMA SHALLOW DRAFT CHANNEL (DA) BEGINS HERE
SHALLOW DRAFT NAVIGATION CHANNEL - DA
DEEP DRAFT NAVIGATION CHANNEL - DA
Disclaimer:
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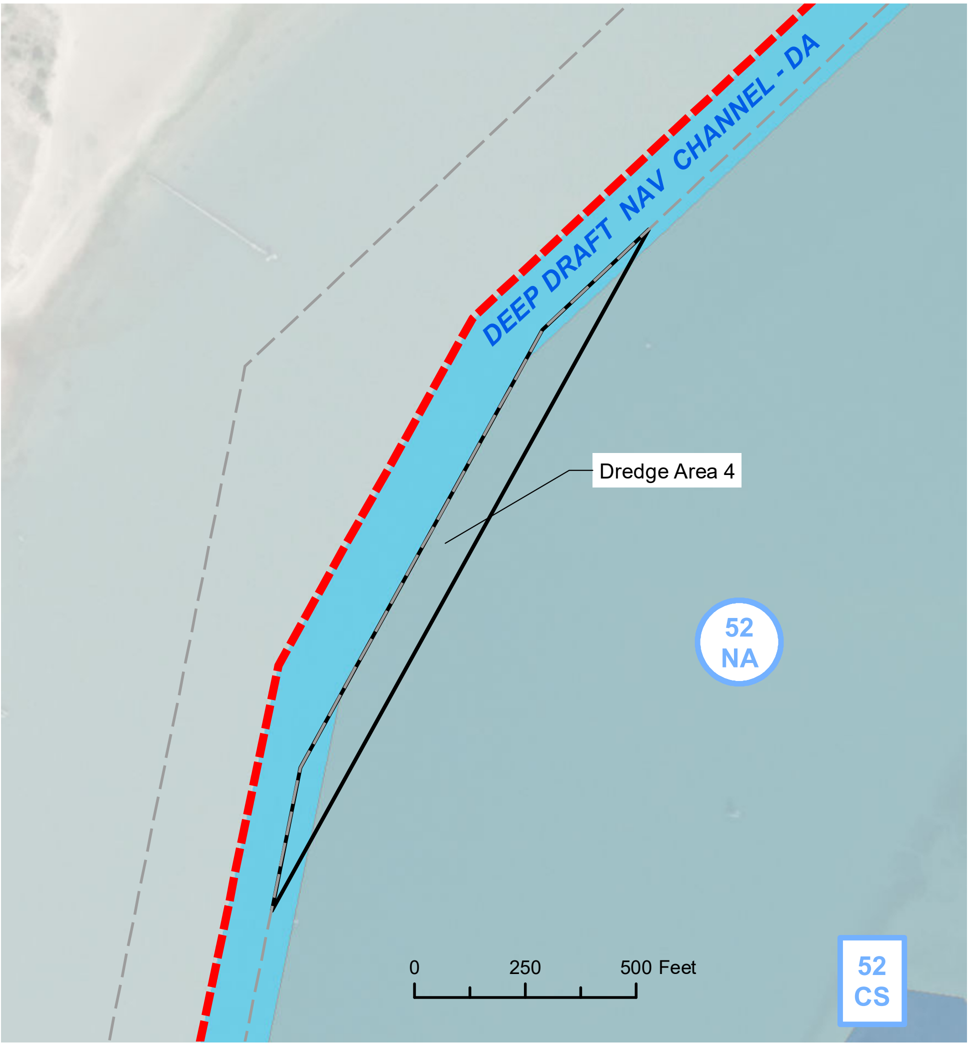

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Legend

CBEMP Aquatic Management Units

- Development Aquatic
- Natural Aquatic (NA)
- Conservation Shorelands (CS)
- NRI Dredge Area 4
- Federal Navigation Channel
- City Limits

Data Source: City of Coos Bay, Feb 2019

Jordan Cove Energy Project

Land Use Permit Application

City of Coos Bay CBEMP Zoning
Navigational Reliability Improvement (NRI)
Dredge Area 4

Jordan Cove LNG℠

2/13/2019

FIGURE NO.
1

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Legend

CBEMP Aquatic Management Units
- Development Aquatic
- Natural Aquatic
- Conservation Shorelands (CS)
- NRI Dredge Area
- Federal Navigation Channel
- City Limits

Data Source: City of Coos Bay, Feb 2019

Jordan Cove Energy Project

Land Use Permit Application

City of Coos Bay CBEMP Zoning
Navigational Reliability Improvement (NRI)
Dredge Area 4

Jordan Cove LNG℠ 2/8/2019

FIGURE NO. 1

ATTACHMENT B

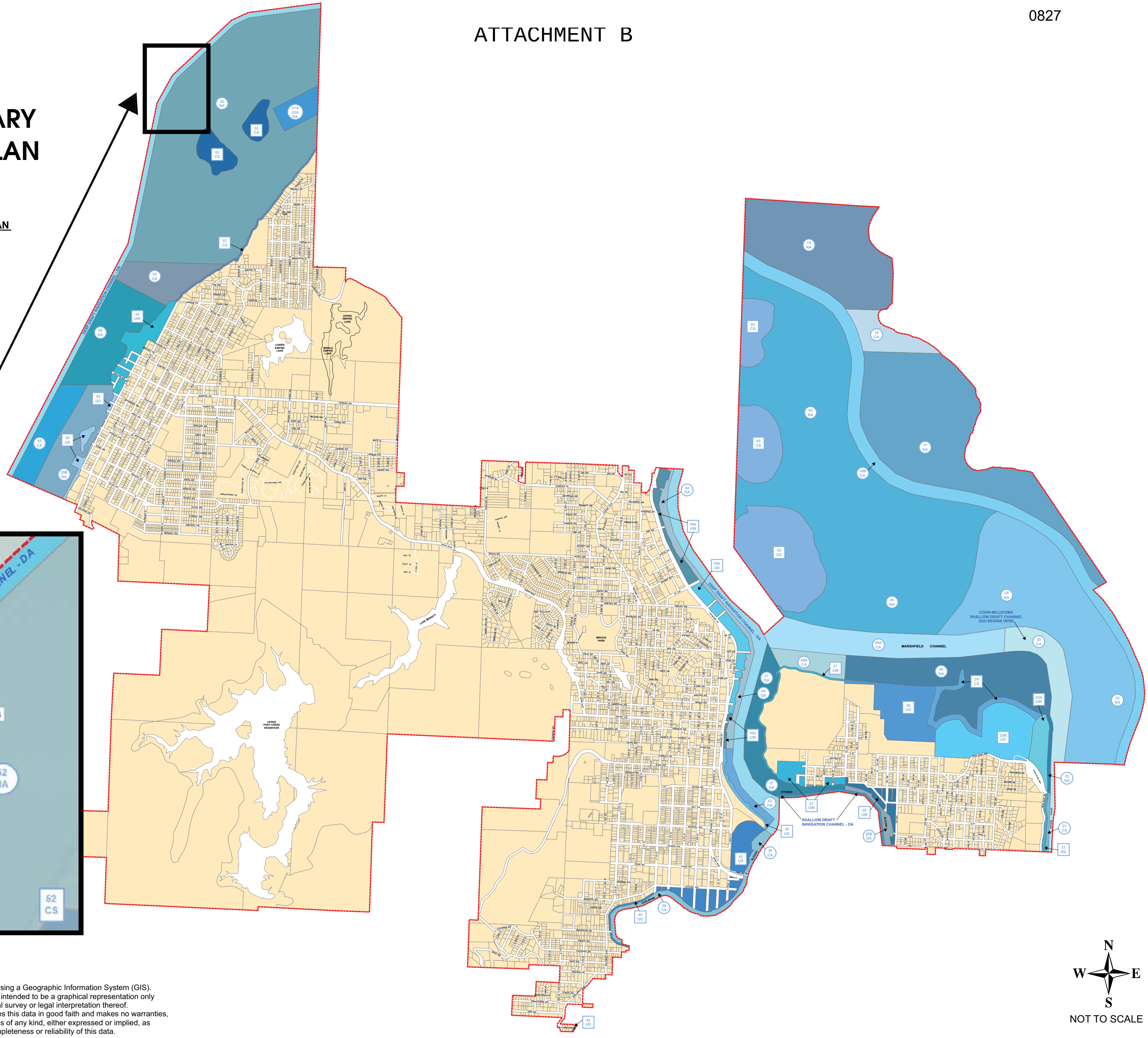
ATTACHMENT B

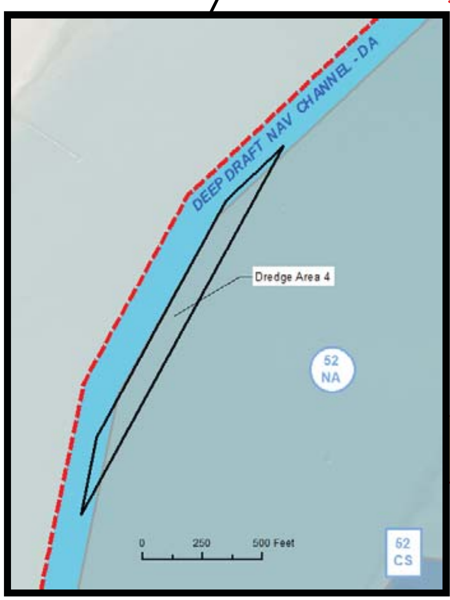
COOS BAY ESTUARY MANAGEMENT PLAN

LEGEND

COOS BAY ESTUARY MANAGEMENT PLAN

- SHORELAND OR UPLAND UNIT DESIGNATION
- AQUATIC UNIT DESIGNATION
- CITY LIMITS





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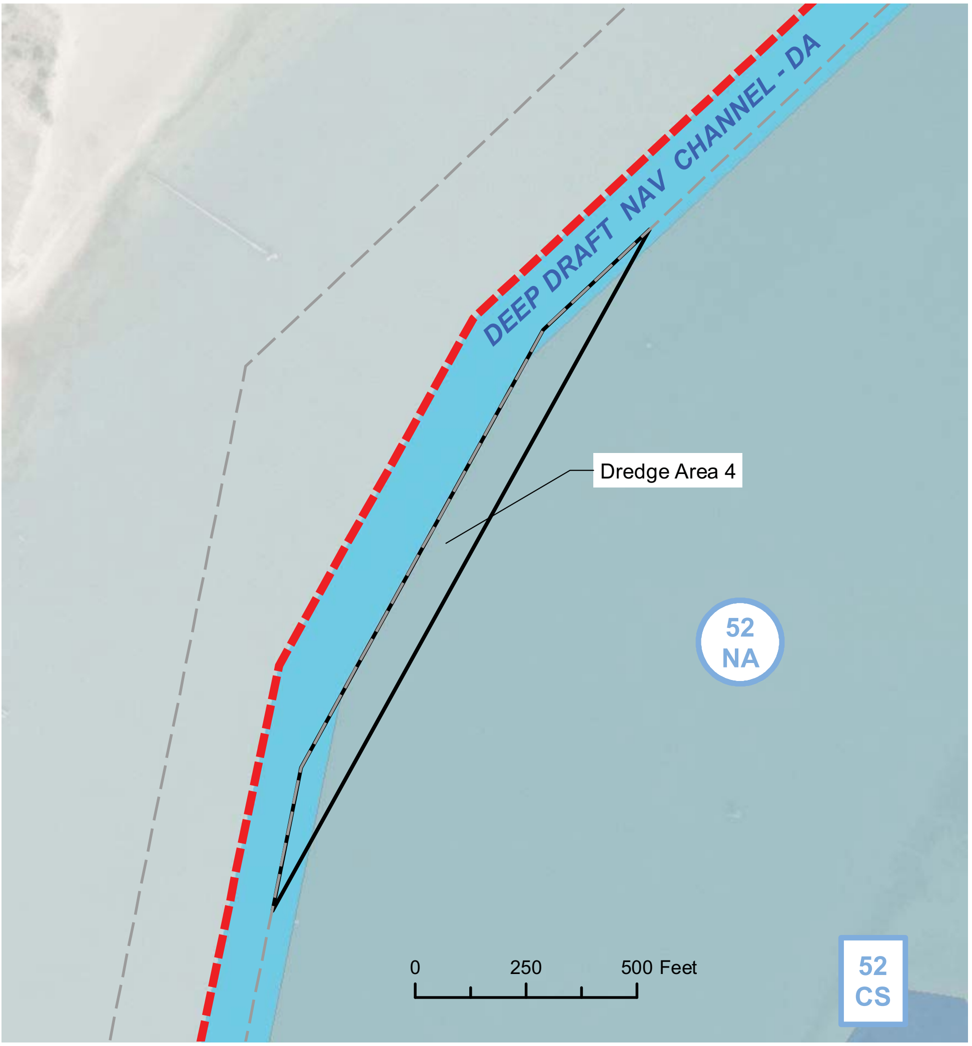

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CBEMP Aquatic Management Units
- Development Aquatic
- Natural Aquatic (NA)
- Conservation Shorelands (CS)

- NRI Dredge Area 4
- Federal Navigation Channel
- City Limits

Data Source: City of Coos Bay, Feb 2019

Jordan Cove Energy Project

Land Use Permit Application

City of Coos Bay CBEMP Zoning
Navigational Reliability Improvement (NRI)
Dredge Area 4

Jordan Cove LNG℠

2/13/2019

FIGURE NO. 1

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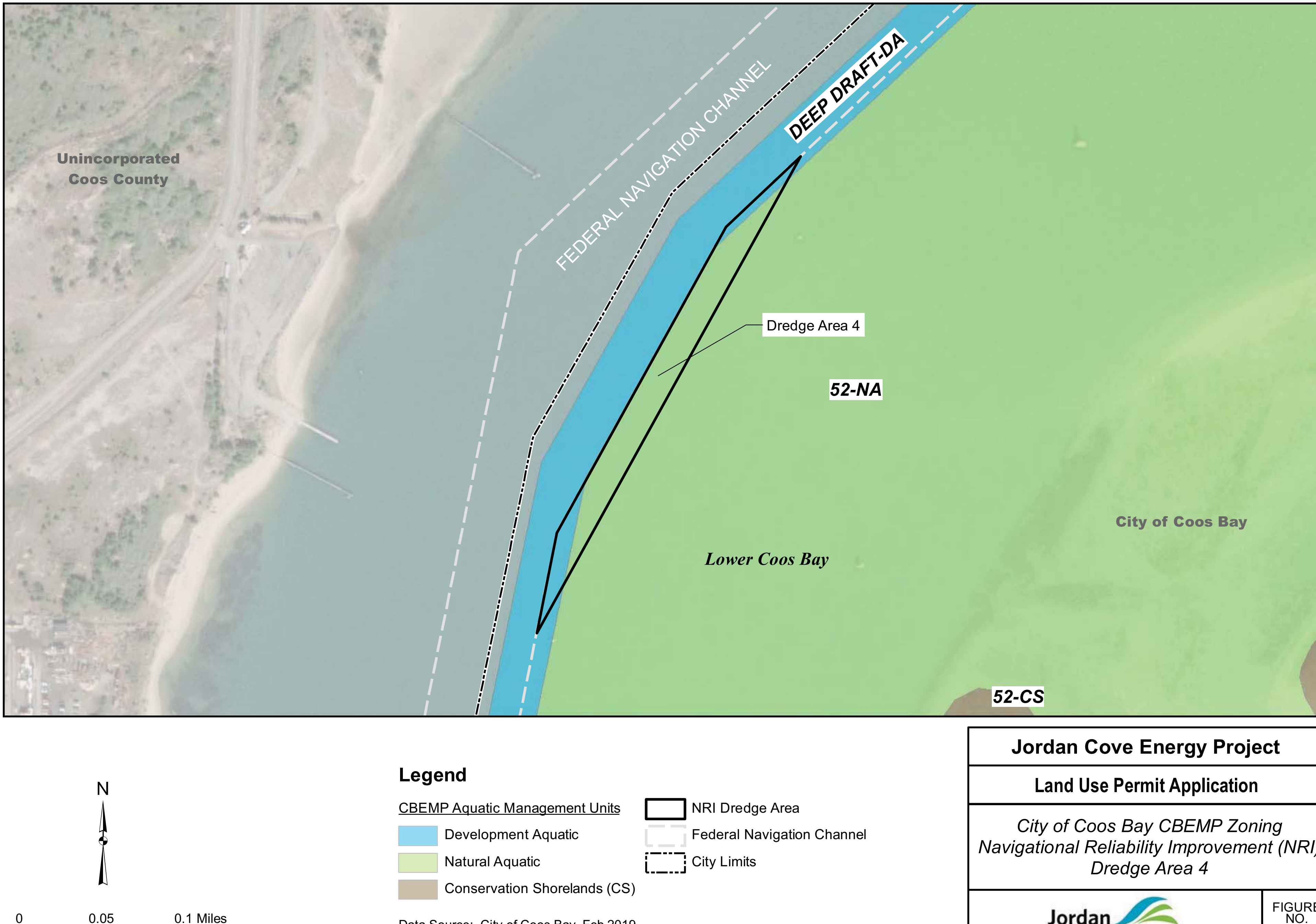

Legend

CBEMP Aquatic Management Units
- Development Aquatic
- Natural Aquatic
- Conservation Shorelands (CS)
- NRI Dredge Area
- Federal Navigation Channel
- City Limits

Data Source: City of Coos Bay, Feb 2019

Jordan Cove Energy Project

Land Use Permit Application

City of Coos Bay CBEMP Zoning
Navigational Reliability Improvement (NRI)
Dredge Area 4

Jordan Cove LNG℠ 2/8/2019

FIGURE NO. 1

EXHIBIT 11

U.S. Department of Homeland Security
United States Coast Guard

Captain of the Port
U. S. Coast Guard
Sector Columbia River

2185 SE 12th Place
Warrenton, Oregon 97146-9693
Staff Symbol: s
Phone: (503) 861-6211

16611
May 10, 2018

Director of Gas Environment and Engineering, PJ 11
Attn: Mr. Rich McGuire
Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

Dear Mr. McGuire:

This Letter of Recommendation (LOR) is issued pursuant to 33 Code of Federal Regulations (CFR) 127.009 in response to the Letter of Intent submitted by Jordan Cove Energy Project. L.P. (Jordan Cove) on January 9, 2017. Jordan Cove proposes to construct and operate the Jordan Cove LNG facility in Coos Bay, Oregon from which Liquefied Natural Gas (LNG) is proposed to be transferred in bulk to a vessel for export. This LOR conveys the Coast Guard's recommendation on the suitability of the Coos Bay Channel for LNG marine traffic as it relates to safety and security. In addition to meeting the requirements of 33 CFR 127.009, this LOR fulfills the Coast Guard's commitment for providing information to your agency under the Interagency Agreement signed in February 2004.

After reviewing the information in the applicant's Letter of Intent (LOI) and Waterway Suitability Assessment (WSA) with subsequent annual updates and completing an evaluation of the waterway in consultation with a variety of state and local port stakeholders, I recommend that the Coos Bay Channel be considered suitable for LNG marine traffic. My recommendation is based on review of the factors listed in 33 CFR 127.007 and 33 CFR 127.009. The reasons supporting my recommendation are outlined below.

On November 1, 2017, I completed a review of the WSA for the Jordan Cove Energy Project, submitted to the Coast Guard by KSEAS Consulting on behalf of Jordan Cove in February 2007. This review was conducted following the guidance provided in U.S. Coast Guard Navigation and Vessel Inspection Circular (NVIC) 01-2011, dated January 24, 2011. In conducting this review and analysis, I focused on the navigation safety and maritime security aspects of LNG vessel transits along the affected waterway. My analysis included an assessment of the risks posed by these transits and validation of the risk management measures proposed by the applicant in the WSA. During the review, I consulted a variety of stakeholders including the Area Maritime Security Committees, Harbor Safety Committees, State representatives, Pilot Organizations, and local emergency responders.

Based upon a comprehensive review of Jordan Cove's WSA, and after consultation with State and Local port stakeholders, I recommend that the Coos Bay Channel be considered suitable for accommodating the type and frequency of LNG marine traffic associated with this project.

The attached LOR Analysis contains a detailed summary of the WSA review process that has guided this recommendation. It documents the assumptions made during the analysis of Jordan Cove's WSA. It discusses details of potential vulnerabilities and operational safety and security measures that were analyzed during the review. The portion of the LOR Analysis which

addresses matters that affect maritime security is marked as Sensitive Security Information and is withheld from distribution.[1] The LOR Analysis sets forth the navigational safety and maritime security resource gaps that currently exist in, on, and adjacent to the waterway, including the marine transfer area of the proposed facility, and which, to the extent allowable under FERC's existing legal authority, may be addressed in its Commission Order if one is issued. To the extent implementation of specific mitigation measures fall outside the scope of FERC's legal authority, the applicant is expected to examine the feasibility of implementing such mitigation measures, in consultation with the Coast Guard and State and Local agencies as applicable.

This recommendation is provided to assist in the Commission's determination of whether the proposed facility should be authorized. This Letter of Recommendation is not an enforceable order, permit, or authorization that allows any party, including the applicant, to operate a facility or a vessel on the affected waterway. Similarly, it does not impose any legally enforceable obligations on any party to undertake any future action be it on the waterway or at the proposed facility. It does not authorize, nor in any way restrict, the possible future transit of properly certificated vessels on the Coos Bay Channel. As with all issues related to waterway safety and security, I will assess each vessel transit on a case by case basis to identify what, if any, safety and security measures are necessary to safeguard the public health and welfare, critical marine infrastructure and key resources, the port, the marine environment, and vessels. In the event the facility begins operation and LNG vessel transits commence, if matters arise concerning the safety or security of any aspect of the proposed operation, a Captain of the Port Order could be issued pursuant to my authority under the Ports and Waterways Safety Act of 1972, as amended by the Port and Tanker Safety Act of 1978, 33 U.S.C. § 1221 – 1232, among other authorities, to address those matters.

Please note that Enclosures (4) is Sensitive Security Information (SSI) and shall be disseminated, handled and safeguarded in accordance with 49 CFR Part 1520, "Protection of Sensitive Security Information."

If you have any questions on this recommendation, my point of contact is Lieutenant Commander Laura Springer. She can be reached at the address listed above, by phone at (503) 209-2468, or by email at Laura.M.Springer@uscg.mil.

Sincerely,

W. R. TIMMONS,
Captain, U. S. Coast Guard
Captain of the Port, Sector Columbia River

Enclosure (1) LOR Analysis
(2) LOR issued by Sector Portland on April 24, 2009
(3) U.S.C.G.'s Waterway Suitability Report for the Jordan Cove Energy Project
(4) LOR Analysis (SSI Portion)

[1] Documents containing SSI may be made available upon certification that the requestor has a need to know and appropriate document handling and non-disclosure protocols have been established.

Copy: Commander, Coast Guard District Thirteen (dp)
Commander, Pacific Area (PAC-54)
Commandant (CG-OES), (CG-ODO), (CG-FAC), (CG-741), (CG-CVC), (CG-ENG), (LNGNCOE)
Marine Safety Center (CG MSC)
Jordan Cove

UNITED STATES COAST GUARD

Jordan Cove LNG

ANALYSIS SUPPORTING THE LETTER OF RECOMMENDATION ISSUED BY COTP SECTOR COLUMBIA RIVER ON MAY 10, 2018

Enclosure (1)

Introduction

1. This analysis is a supplement to my Letter of Recommendation (LOR) dated May 10, 2018, that conveys my recommendation on the suitability of the Coos Bay Ship Channel for liquefied natural gas (LNG) marine traffic associated with the Jordan Cove LNG (JCLNG) export terminal project Coos Bay, Oregon. It documents the processes followed in analyzing JCLNG's Waterway Suitability Assessment (WSA) and the suitability of the waterway for LNG marine traffic.

2. For the purposes of this analysis, the following assumptions were made:

   a. The applicant is fully capable of, and would fully implement, any and all risk management measures identified in their WSA.
   b. The conditions of the port identified in the WSA fully and accurately describe the actual conditions of the port at the time of the WSA submission.
   c. The conditions of the port have not changed substantially during the analysis process.
   d. The applicant will fully meet all regulatory requirements including the development and submission of a Facility Security Plan, Emergency Manual, and Operations Manual.

3. The Port of Coos Bay is a deepwater port located in Coos Bay, Oregon on the Pacific Coast of the United States. The Port of Coos Bay offers easy access to Asian markets and facilitates the international movement of goods between the United States and Asia. The Port of Coos Bay is managed under the jurisdiction of the Portland Navigation District and has an authorized channel depth of 37 feet. The channel width is 300 nominal feet. The principal exports are logs, wood chips, lumber, and plywood. The Port of Coos Bay is currently conducting a feasibility study to examine widening and deepening its ship channel.

4. The Port of Coos Bay is approximately 173 nautical miles south of the Columbia River and 367 miles north of the entrance to San Francisco Bay. The Port has seen declining arrivals and is not currently heavily trafficked.

5. Inbound and outbound traffic density in the Port of Coos Bay is currently minimal. In the summer months and during fishing season there are a number of commercial fishing vessels working in the region. The maximum anticipated LNG Carrier port calls per year is expected to be around 120. These projections are based on a maximum nominal LNG output of 7.8 MTPA. Other traffic transiting through the Port of Coos Bay include fishing vessels, recreational vessels, and towing vessels.

6. The Terminal will be sited at the north end of the Coos Bay Channel near Jordan Cove. All Terminal facilities will be located within an approximately 200-acre parcel of land. The approximate locations of the coordinates of the facility are: 43 degrees-25.5' North and 124 degrees 15.7' West.

7. The U.S. Coast Guard regulates the port under the Maritime Transportation Security Act (MTSA), Security and Accountability for Every Port Act (SAFE Port Act), Ports and Waterways Safety Act (PWSA) and other laws applicable to maritime safety and security. U.S. Coast Guard regulated facilities in the area include chip terminals and fuel transfer facilities.

8. Ships entering or departing Coos Bay require a pilot. The Coos Bay Pilots are state licensed Oregon pilots responsible for ensuring the safe transit of vessels transiting through the Port of Coos Bay. They handle approximately 50 vessel transits through the Port of Coos Bay each year.

9. In order to support operations associated with the facility, the applicant will provide additional towing vessels as outlined in their WSA. All tractor tugs must be at least 80 Ton Astern Bollard or larger and equipped with Class 1 Fire Fighting equipment.

10. The applicant established an emergency response planning group in preparation for facility construction and operation in 2006. This group is tasked with education and preparedness concerning this facility. It must be noted that there are schools located in the zones of concern.

Impact to Coast Guard Operations

1. The U.S. Coast Guard is responsible for screening LNG Carriers transiting from foreign ports prior to arrival and will screen all vessels in accordance with existing policies and procedures. The vessels calling on the facility will be foreign flagged and the flag state is yet to be determined. I do not intend to require additional government conducted safety inspections beyond those which already apply to deep draft LNG vessels.

2. Facility and vessel inspection activities will be supported by Marine Safety Unit Portland personnel.

3. Limited access areas (LAA) associated with the project have yet to be established. Sector Columbia River will use risk based decision making and work with existing policy to determine the appropriate LAAs. The proposed LAA in enclosure (3) was not put out for regulatory review and is not in effect.

4. LNG is not considered oil and all vessels calling on the facility will be required to comply with non-tank vessel response plan requirements. The applicant is highly encouraged to work with the Area Committees established under the National Contingency Plan to address issues associated with response in Coos Bay.

5. The Facility will be in the Sector Columbia River Captain of the Port Zone and falls under the purview of the Federal Maritime Security Coordinator who is also the Sector Columbia River Captain of the Port. Specific issues related to this are outlined in Enclosure (4).

Figure 1. Jordan Cove Conceptual rendering of facility

Decision Making Process

1. The following factors regarding the condition of the waterway, vessel traffic, and facilities upon the waterway, were taken into consideration during the LOR process. The processes used are detailed in this section.

2. To ensure all regulatory processes were met, Sector Columbia River took a systematic approach in the WSA validation process. To streamline and ensure transparency, Sector Columbia River worked with Jordan Cove, the Consulting Group KSEAS, and port partners though a series of ad hoc meetings and a one day workshop.

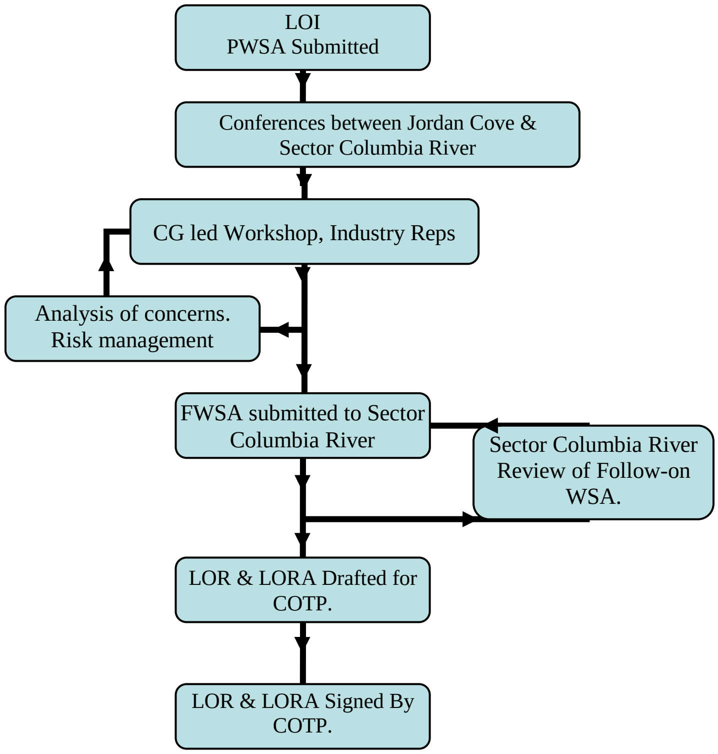

Figure 2 - LNG LOR Process
(Sector Columbia River)

3. NVIC 01-2011 provides guidance on the review and validation of a WSA. Applying NVIC 01-2011's procedural framework, my staff held several in-house reviews of the WSA, and facilitated discussions during a workshop held in Coos Bay, OR on October 16, 2017. The workshop included a wide range of participants, including representatives from; the USCG; Coos Bay Pilots Association; Port Authorities, the State of Oregon and law enforcement agencies.

Members	**Position/Role**
LCDR Laura Springer	Waterways Management Division Chief, MSU Portland
LCDR Ben Crowell	Surface Operations, Sector North Bend
LCDR Andrew Madjeska	Incident Management Division Chief, Sector Columbia River
LCDR Xochitl Castaneda	District Thirteen Prevention
Ms. Deanna Henry	Oregon Department of Energy
George Wales	Coos Bay Pilots
Richard Dybevik	Roseburg Forest Products
Doug Strain	Coos Bay Sheriff
Jim Brown	North Bend Fire Department
Doug Eberlein	Coos Bay Response Co-op (CBRC)
LT Ethan Lewallen	USCG LNG NCOE

Table 1 – Jordan Cove WSA Team 1 Nov 2017
(Port of Coos Bay)

4. The participants of this “ad-hoc” workshop, recommended by NVIC 01-2011, utilized their expertise on the physical characteristics and traffic patterns of the waterway, as well as their respective specialty knowledge of the marine environment, LNG, safety, security, and facility operations, to analyze the suitability of the waterway to support LNG marine traffic associated with JCLNG.

5. Participants considered the changes in the area’s safety and security dynamics which may result from the introduction of LNG ship traffic associated with the JCLNG Project. Jordan Cove used the American National Standards Institute (ANSI)/American Petroleum Institute (API) Standard 780 Security Risk Assessment (SRA) Methodology, as the basic approach for assessing risk. The standard was published in June of 2013 as a U. S. standard for security risk assessments on petroleum and petrochemical facilities. The standard is a tool used to evaluate all security risks associated with petroleum and petrochemical infrastructure and operations, and assists owners and operators through the process of conducting thorough and consistent SRAs. For security purposes, participants considered potential threats and consequences of intentional act of aggression to the facility and developed security measures to mitigate the risks.

    a. Please see Enclosure (4) if you have a need to know concerning the results of this

6. During the above mentioned workshop held in Coos Bay, OR on October 16, 2017, the ad-hoc working group also evaluated safety factors including the potential impacts of groundings, collisions, and allisions and thoroughly examined the simulator data presented in the WSA.

7. Each of the recommended risk management measures from enclosure (7) of NVIC 01-2011 were considered. In the WSA workshop, additional risks and recommendations were discussed related to a Cascadia Subduction Zone Earthquake and associated implications for the facility and region if a laden vessel was tied up at the layberth.

8. The ad-hoc working group considered each scenario along each transit segment and evaluated the causes of accidental or intentional events. The workshop analyzed the contributing factors for each scenario and their likelihood of occurrence given the adequacy of safety and security layers.

9. Sector Columbia River followed the checklist found in NVIC 01-2011 during the review. Through this review, Sector Columbia River clarified certain points in the WSA to ensure that the document contained accurate information and that references were applicable. With the 2017 update to the WSA, Jordan Cove has satisfied the requirements of the LOR process.

10. Based on my review of the WSA completed on November 1, 2017, and input from state and local port stakeholders, and taking into account previously reviewed expansion projects, I recommend to the Federal Energy Regulatory Commission

that the waterway in its current state be considered suitable for the LNG marine traffic associated with the proposed project.

11. This recommendation is contingent upon the applicant completing all actions outlined in the Waterways Suitability Assessment as submitted, and actions associated with subsequent annual updates, and completing all actions outlined in the most current WSA and actions under the control of the applicant from the July 1, 2008, Waterway Suitability Report.

Waterway Conditions Adjacent to the Facility

1. **Depth of Water**. The channel is currently maintained at a 37' depth.
2. **Tidal Range**. The tides of Coos Bay are of the mixed semi-diurnal type with paired highs and lows of unequal duration and amplitude. The tidal range increases upstream to the City of Coos Bay and the time difference between peak tides at the entrance and City of Coos Bay is about 40-90 minutes, depending on the location. The head of the tide is located at River Mile 27 on both the Millicoma and South Fork Coos Rivers. The tidal range is 7.5 feet near the open sea channel and 6.7 feet at the entrance to Charleston Harbor.

Table 2 Tidal Datums, Coos Bay, OR NOAA Tide Stations 9432895, 9432879, and 9432780

Tide Level	Abbreviation	Tide Level (ft) North Bend	Tide Level (ft) Empire	Tide Level (ft) Charleston
Tide Station ID #		9432895	9432879	9432780
Latitude		43º 24.6'N	43º 22.6'N	43º 20.7'N
Longitude		124º 13.1'W	124º 17.8'W	124º 19.3'W
Extreme High Water	EHW	-	-	+10.5
Mean Higher High Water	MHHW	+8.4	+7.7	+7.6
Mean High Water	MHW	+7.8	+7.1	+7.0
Mean Sea Level	MSL	+4.7	+4.2	+4.1
Mean Low Water	MLW	+1.3	+1.3	+1.3
Mean Lower Low Water	MLLW	+0.0	+0.0	+0.0
Extreme Low Water	ELW	-	-	-3.0

3. **Protection from High Seas**. The entrance to Coos Bay is similar to most harbors along the Pacific Coastline of Northern California, Oregon, and Washington. Strong winds are often experienced at North Bend on Coos Bay during the months of June, July, and August. These winds blow at 17 knots or greater 15-20 percent of the time and at 28 knots or greater 1 to 2 percent of the time. The harbor consists of a river estuary at the mouth of the Coos River. Sand and silt

from the river are carried out to the sea from this entrance. As a result of this material meeting the predominantly westerly seas and swells of the Pacific, a sandy ridge bar is formed at the mouth. This sand ridge causes the channel to be known as “a Bar Channel”. As such, a breaking bar does occur in this port.

4. **Natural Hazards**. The navigational hazards in the vicinity of the project site are rock jetties on either side of the channel entrance extending into the Pacific Ocean, and a submerged jetty which extends 50 yards off the east shore of Coos Bay. Discussions and simulations with the Coos Bay Pilots Association have shown that these hazards will not interfere with normal navigation and mooring operations and the applicant has developed transit mitigations to address this issue such as not bringing vessels in or leaving them at the lay berth during conditions that are not conducive to safe navigation i.e. restricted visibility, severe weather and and/or low tides.

5. **Fishing Vessels**. Heavy concentrations of fishing gear may be expected between December 1 and August 15, from shore to about 30 fathoms.

6. **Underwater Pipelines and Cables**. Based on current pipeline charts that are available, there are three cables which are submerged approximately 20 feet running across/underneath the channel in the vicinity of the town of Empire which is on the LNG Carrier transit route.

7. **Maximum Vessel Size by Dock**. The primary dock can accommodate a vessel with a maximum length of 300 meters, 52 meters in breadth, and a draft which can be accommodated by the existing channel. Although the facility dock is able to accommodate vessels drafting up to 12m (39ft), current channel draft is 11m (37ft) with future plans to dredge the channel to accommodate larger deep draft vessels. Jordan Cove Energy Project and the local pilots must ensure transiting LNG vessels are able to maintain 10% under keel clearance as required by JCEP's LNG Transit Management Plan.

   a. The dock must be able to accommodate all vessels calling on the facility.
   b. It must be equipped with adequate numbers of mooring hooks, fendering, and mooring dolphins.
   c. The mooring arrangement must also be able to accommodate safe working loads.
   d. In coordination with appropriate stakeholders, JCLNG must develop and implement vessel mooring/unmooring procedures to ensure safe and environmentally protective operations for LNG Carriers arriving and departing the JCLNG facility.

8. **Vessel Routing**. Included in the WSA, was a plan to divide the LNG Carrier transit route into five (5) inbound, one (1) loading at berth, and five (5) outbound segments. The total inbound transit from the Sea Buoy (pilot boarding area) to the terminal berth is approximately eight (8) miles and will take between 1.5 and 2.0

hours to berth, pilots will be transiting at around 4.5 knots. The route has been divided into segments in order to manage vessel traffic and increase the safety of LNG carrier transits. This was done in conjunction with the Coos Bay Pilots Association.

The route is reversed for outbound LNG Carrier transits with the exception of the turning/maneuvering basin which is bypassed on the outbound transit where the LNG Carrier is moved directly into the Coos Bay Ship Channel. The route and segments are shown in Figure 3.

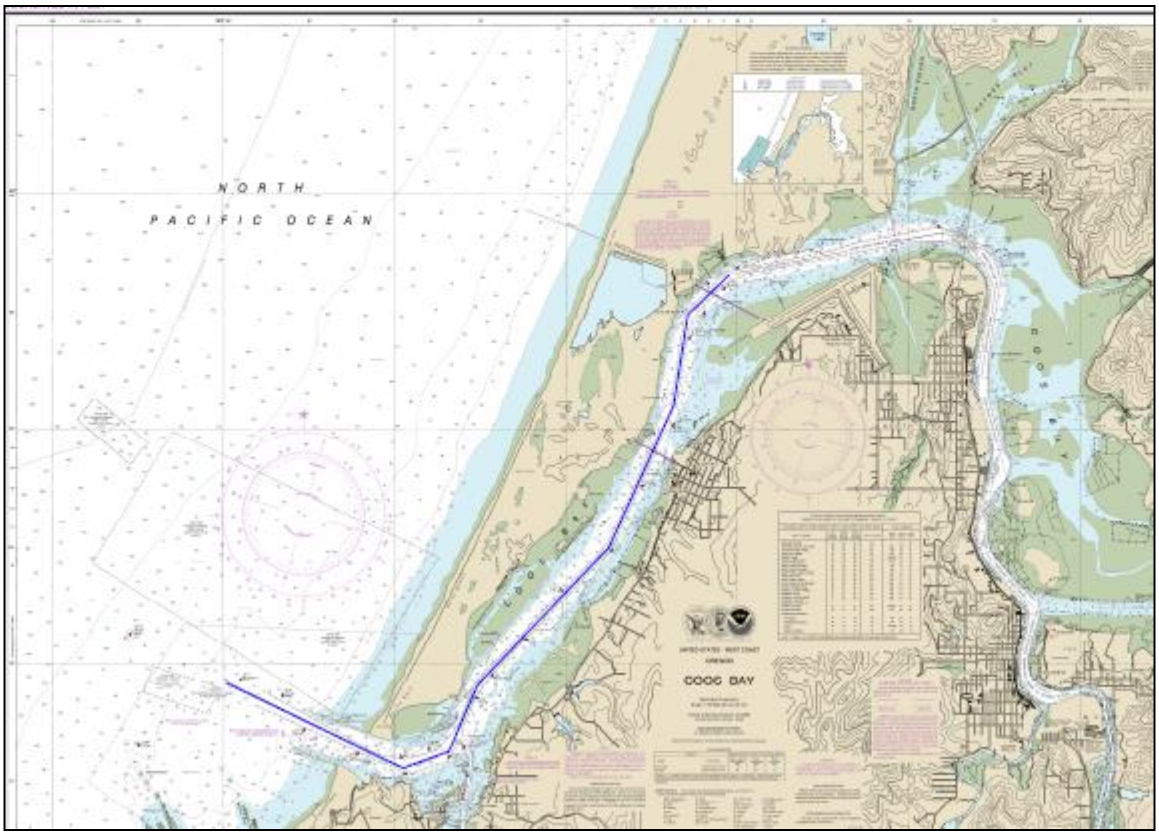

Figure 3. Overview of LNG Carrier Transit Route

9. **Vessel Operations –**LNG vessels will load cargo at the facility. 110-120 arrivals are expected at the facility annually with a dedicated fleet of LNG Carriers conducting cargo operations at the facility. A lay berth will be constructed to accommodate delays, repairs, and maintenance issues associated with Trans-Pacific Trade. Cargo operations will not be permitted at the lay berth and the applicant will outline procedures for the lay berth after the permitting process is complete.

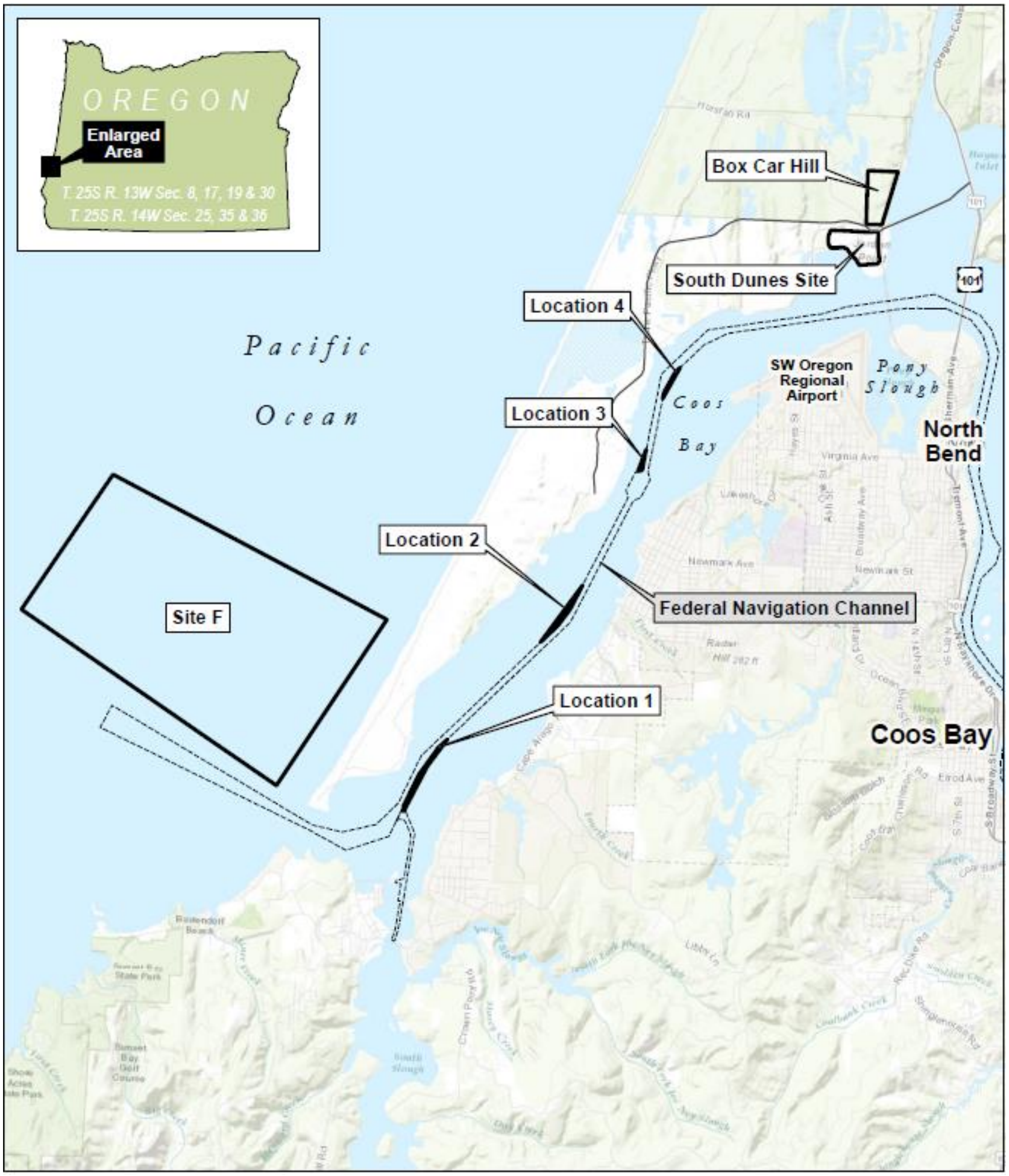

Figure 4. Channel Improvements

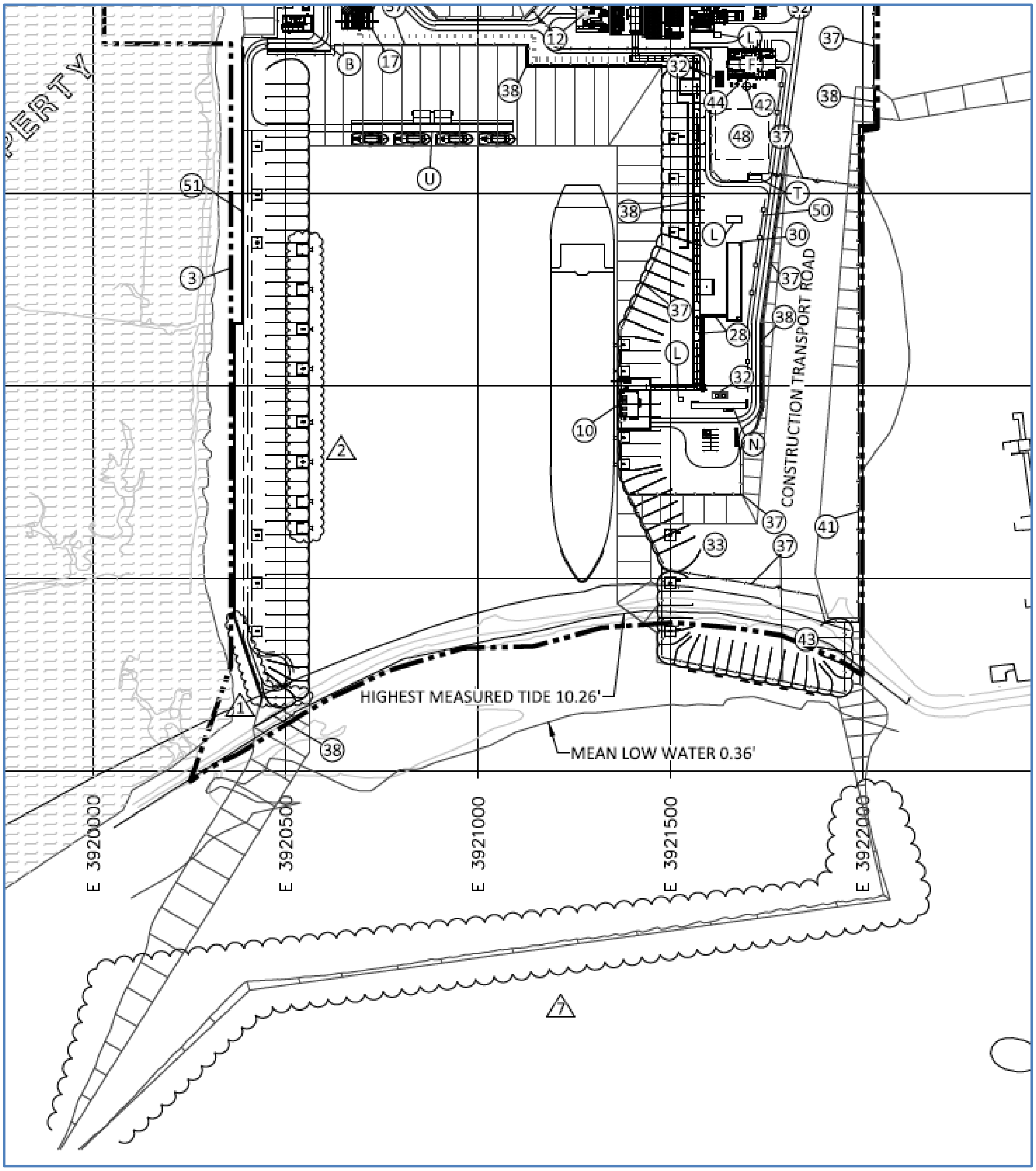

Figure 5. Dredging at the berth

U.S. Department of Homeland Security

United States Coast Guard

Commander
United States Coast Guard
Sector Portland

6767 N. Basin Avenue
Portland, Oregon 97217-3992
Phone: (503) 240-9374
Fax: (503) 240-9369
Russell.A.Berg@uscg.mil

16611/JORDAN COVE
April 24, 2009

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

LETTER OF RECOMMENDATION FOR JORDAN COVE LNG TERMINAL

Dear Ms. Bose:

This Letter of Recommendation (LOR) is issued pursuant to 33 C.F.R. § 127.009 in response to the Letter of Intent (LOI) submitted by Jordan Cove Energy Project, L.P. (Applicant) dated April 10, 2006 proposing to transport Liquefied Natural Gas (LNG) by ship to a proposed receiving terminal at Jordan Cove in Coos Bay, Oregon. It conveys the Coast Guard's determination on the suitability of Coos Bay for LNG marine traffic as it relates to safety and maritime security. In addition to meeting the requirements of 33 C.F.R. § 127.009, this letter also fulfills the Coast Guard's commitment for providing information to your agency under the Interagency Agreement signed in February 2004.

After reviewing the information in the applicant's LOI and completing an evaluation of the waterway in consultation with a variety of local port stakeholders, I have determined that the applicable portions of Coos Bay and its approaches are not currently suitable, but could be made suitable for the type and frequency of marine traffic associated with this project. My determination is based on review of the information provided in accordance with 33 C.F.R. § 127.007(d)(3) through (d)(6) and in consideration of the items listed in 33 C.F.R. § 127.009(b) through (d)(6). The reasons leading to my determination are outlined below.

On July, 1, 2008, I completed a review of the Applicant's Waterway Suitability Assessment (WSA) submitted in February 2007 by Kseas and Amergent Techs. This review was conducted following the guidance provided in U.S. Coast Guard Navigation and Vessel Inspection Circular (NVIC) 05-05. The review focused on navigation safety and maritime security risks posed by LNG marine traffic associated with the proposed Jordan Cove Energy Project and the measures needed to responsibly manage these risks. During the review, the Coast Guard consulted with a variety of stakeholders including an adhoc validation committee and the Area Maritime Security Committee. Following this review a Waterway Suitability Report (WSR) was issued in July 2008. The WSR identifies the requirements, conditions and risk mitigation measures to ensure the safe movement of these vessels.

The Applicant's WSA includes risk management strategies and associated measures that were developed for the safe navigation and security at each maritime security level, and that if properly implemented, sufficiently mitigate the identified risks associated with LNG vessel traffic for the proposed facility. These risk mitigation measures and strategies have been documented in the attached WSR. Based on my review and the full implementation by the Applicant of the measures outlined in their WSA and the attached WSR, I have determined that

LETTER OF RECOMMENDATION FOR JORDAN COVE ENERGY PROJECT LNG TERMINAL

Coos Bay leading up to Jordan Cove could be suitable for the type and frequency of LNG marine traffic associated with this project.

The final review and this letter are issued pursuant to NVIC 05-08, which replaced NVIC 05-05. NVIC 05-08 eliminated the term WSR and replaced it with "Letter of Recommendation (LOR) Analysis". For the purpose of clarity, the WSR is equivalent to the LOR Analysis. While this letter has no enforcement status, the determinations, analysis, and ultimate recommendation as to the suitability of this waterway as contained in this letter, would be referenced in concert with a Captain of the Port Order, should an LNG transit be attempted along this waterway without full implementation of the risk mitigation measures. Such an Order would be issued pursuant to my authority under the Ports and Waterways Safety Act of 1972, as amended by the Port and Tanker Safety Act of 1978, 33 U.S.C. § 1223, *et seq.*, among other authorities.

A copy of the LOR has been forwarded to the Applicant. Should the Applicant feel aggrieved by this decision, they may request reconsideration by me pursuant to 33 C.F.R. § 127.015(a). For your information, any request for reconsideration must be submitted in writing, within 30 days of receipt of this letter. The Applicant may also request an in person appeal if the written request would have an adverse impact on their operation.

If you have any questions, my point of contact is Mr. Russ Berg. He can be reached at the above address, phone number and e-mail.

Sincerely,

F. G. MYER
Captain, U. S. Coast Guard
Captain of the Port

Enclosures: (1) WSR
(2) WSR Supplementary Record (SSI, Not Releasable)

Copy: Jordan Cove Energy Project, L.P. w/o enclosures
Commandant, U. S. Coast Guard (CG-522, CG-541, CG-544) w/o enclosures
Commander, Thirteenth Coast Guard District (dl, dp) w/o enclosures
Commander, Coast Guard Pacific Area (Pp) w/o enclosures
Coast Guard Maintenance and Logistics Command Pacific (sm) w/o enclosures
Oregon Department of Energy w/o enclosures
Oregon Department of Fish and Wildlife w/o enclosures
Coos County Sheriff w/o enclosures
Coos Bay Fire Department w/o enclosures
Coos Bay Police Department w/o enclosures
North Bend Fire Department w/o enclosures
North Bend Police Department w/o enclosures

APPENDIX B

Jordan Cove's Letter of Intent and the U.S. Coast Guard's Waterway Suitability Report for the Jordan Cove Energy Project

ENCLOSURE(3)

Jordan Cove Energy Project, L.P.

April 10, 2006

Captain Patrick Gerrity
Commanding Officer
USCG Sector Portland
6767 N. Basin Ave.
Portland, Oregon 97217

RE: **Jordan Cove Energy Project**
Coos Bay, Oregon
Letter of Intent

Dear Captain Gerrity:

Under the requirements of 33 CFR 127.007, I am pleased to forward this LETTER OF INTENT (LOI) for the construction of an LNG receiving terminal located at Coos Bay, Oregon. As part of this proposal, I am attaching as Enclosure (1) a Preliminary Waterway Suitability Assessment (WSA), which has been completed using the guidance contained in Enclosure (2) of Navigation and Vessel Circular No. 05-05, (NVIC 05-05) dated June 14, 2005.

This Preliminary WSA has been prepared to meet the requirement to start the "Pre-Filing" process with the Federal Energy Regulatory Commission (FERC). It is understood that a "Follow-on" WSA will be required to be submitted to you as this project matures. The "Follow-on" WSA will clearly identify credible security threats and safety hazards to LNG transportation in this port, and will identify appropriate risk management measures, as well as addressing items of concern noted in the Preliminary WSA.

In accordance with the requirements contained in 33 CFR 127.007 (d), the following information is provided:

1. The name, address, and telephone number of the owner and operator:

Jordan Cove Energy Project
125 Central Avenue, Suite 380
Coos Bay, OR 97420
Attn: Robert L. Braddock
Phone: (541) 266-7510
Fax: (541) 269-1475
E-mail: bobbraddock@attglobal.net

The name, address and telephone number of the facility: (since the facility has not been constructed, the information is the same as in item 1 above.

Jordan Cove Energy Project
125 Central Avenue, Suite 380
Coos Bay, OR 97420
Attn: Robert L. Braddock
Phone: (541) 266-7510
Fax: (541) 269-1475
E-mail: bobbraddock@attglobal.net

2. Physical location of the facility: *This information is contained in Section 3.10 of the Preliminary WSA included as Enclosure (1) to this report.*

3. Description of the facility: *This information is contained in Section 3.10 of the Preliminary WSA included as Enclosure (1) to this report.*

4. LNG vessel characteristics and frequency of shipments to and from the facility: *This information is contained in Section 3.11 of the Preliminary WSA included as Enclosure (1) to this report.*

5. Charts showing waterway channels and identifying commercial, industrial, environmentally sensitive and residential areas in and adjacent to the waterway used by the LNG vessel en route to the facility, within 15.5 miles of the facility. *This information is contained in Sections 2.5, 3.1, 3.13, 3.14, 3.15 and 3.16 of the Preliminary WSA included as Enclosure (1) to this report.*

We understand the requirement to advise you in writing within 15 days if there are any changes to the information presented in this letter in paragraphs 1 – 5 above. We do not anticipate any construction starting in the next 60 days or LNG transfer operations in the next 12 months.

I trust the information provided meets all LETTER OF INTENT requirements. Please feel free to contact me at any time to discuss this proposal, or if you require any further documentation incident to this submission.

Sincerely,

Robert L. Braddock

Robert L. Braddock
Project Manager

ENCL: (1) Preliminary Waterway Suitability Assessment

U.S. Department of Homeland Security
United States Coast Guard

Commanding Officer
United States Coast Guard
Sector Portland

6767 N. Basin Avenue
Portland, OR 97217
Phone: (503) 240-9307
Fax: (503) 240-9586

16611
July 1, 2008

Lauren O'Donnell
Director of Gas – Environmental & Engineering, PJ-11
Federal Energy Regulatory Commission
888 First Street, N.E., Room 62-45
Washington, DC 20426

WATERWAY SUITABILITY REPORT FOR THE JORDAN COVE ENERGY PROJECT

Dear Ms. O'Donnell:

This Waterway Suitability Report (WSR) fulfills the Coast Guard's commitment under the Interagency Agreement among the Federal Energy Regulatory Commission (FERC), the Research and Special Programs Administration (RSPA), and the Coast Guard for the Safety and Security Review of the Waterfront Import/Export Liquefied Natural Gas Facilities that was signed in February 2004. Under this agreement, our agencies work together to ensure that both land and maritime safety and security risks are addressed in a coordinated and comprehensive manner. In particular, the Coast Guard serves as a subject matter expert on maritime safety and security issues.

On June 11, 2008, the Coast Guard completed a review of the Waterway Suitability Assessment (WSA) for the Jordan Cove Energy Project (JCEP) that was submitted in September of 2007. This review was conducted following the guidance provided in Navigation and Vessel Inspection Circular (NVIC) 05-05 of June 14, 2005. The review focused on the navigation safety and maritime security risks posed by LNG marine traffic, and the measures needed to responsibly manage these risks. During the review, the Coast Guard consulted a variety of stakeholders including state and local emergency responders, marine pilots, towing industry representatives, members of the Ports and Waterways Safety Committee and the Area Maritime Security Committee.

Based upon this review, I have determined that Coos Bay is not currently suitable, but could be made suitable for the type and frequency of LNG marine traffic associated with this proposed project. Additional measures are necessary to responsibly manage the maritime safety and security risks. The specific measures, and the resources needed to implement them, where applicable, are described below and in a separate supplementary report which is being provided to you under the terms and conditions established for handling Sensitive Security Information (SSI). This supplemental report includes a copy of the Jordan Cove Waterway Suitability Assessment. This determination is preliminary as the NEPA analysis has not yet been completed.

The following is a list of specific risk mitigation measures that must be put into place to responsibly manage the safety and security risks of this project. Details of each measure, including adequate support infrastructure, will need further development in consultation with the Coast Guard and state and local agencies through the creation of an Emergency Response Plan as well as a Transit Management Plan that clearly spell out the roles, responsibilities, and specific procedures for the LNG vessel and all agencies responsible for security and safety during the operation.

Navigational Measures:

LNG Tanker Size Limitations: Based on the Ship Simulation Study conducted by Moffatt & Nichol on March 17-20, 2008, the maximum size LNG tanker permitted to transit through the Port of Coos Bay is a spherical containment LNG carrier with the physical dimensions of a 148,000 m^3 class vessel. The ship dimensions used in the study reflect a length overall of 950 feet, beam of 150 feet and a loaded draft of 40 feet. The channel must demonstrate sufficient adequacy to receive LNG carriers for any single dimension listed. Consequently, prior to approving the transit of an LNG ship larger than 148,000 m^3, or any increase in the physical dimensions cited, additional simulator studies must be conducted in order to assure the sufficiency of the channel.

- Safety/Security Zone: A moving safety/security zone shall be established around the LNG vessel extending 500-yards around the vessel but ending at the shoreline. No vessel may enter the safety/security zone without first obtaining permission from the Coast Guard Captain of the Port (COTP). The expectation is that the COTP's Representative will work with the Pilots and patrol assets to control traffic, and will allow vessels to transit the Safety/Security zone based on a case-by-case assessment conducted on scene. Escort resources will be used to contact and control vessel movements such that the LNG Carrier is protected.

  While the vessel is moored at the facility there shall be a 150 yard security zone around the vessel, to include the entire terminal slip. In addition, while there is no LNG vessel moored, the security zone shall cover the entire terminal slip and extend 25-yards into the waterway.

  Resource Gap: Resources required to enforce the safety/security zone are discussed under Security Measures in the supplemental report.

- Vessel Traffic Management: Due to a narrow shipping channel, navigational hazards, and the proximity to populated areas, LNG vessels will be required to meet the following additional traffic management measures:
  - A Transit Management Plan must be developed in coordination with the Coos Bay Pilot Association, Escort Tug Operators, Security Assets and the Coast Guard prior to the first transit.
  - This plan must be submitted to the COTP no less than 6 months to initial vessel arrival, and followed by an annual review to ensure that it reflects the most current conditions and procedures.
  - For at least the first six months, all transits will be daylight only, unless approved in advance by the COTP.
  - The LNG Vessel must board Pilots at least 5 miles outside the sea buoy.
    - Overtaking or crossing the LNG tanker within the security zone is prohibited for the entire transit from the Coos Bay Sea Buoy to mooring the vessel at the LNG terminal.
  - Vessel transits and bar crossings will be coordinated so as to minimize conflicts with other deep draft vessels, recreational boaters, seasonal fisheries, and other Marine Events.
  - 24 hours prior to arrival, the Coast Guard, FBI, Coos Bay Pilot Association, Escort Tug Masters, and other Escort assets will meet to coordinate inbound and outbound transit details.

Resource Gaps: The Vessel Transit Management Plan must be approved by the COTP at least 60 days prior to the first vessel arrival.

- Vessel Traffic Information System /Vessel Traffic System: The Port of Coos Bay does not have the capacity to receive Automatic Identification System (AIS) signals. AIS receiving capability must be established and must have the capacity to be used by appropriate agencies, port authorities and ship husbandry companies. Additionally, the Port does not have any means for continuous monitoring the navigable waterway. In order to ensure vessel safety and security, a robust camera system capable of monitoring the entire transit route must be established. Due to weather concerns, these cameras must be equipped with the means to adequately monitor vessel traffic in wind, rain and fog conditions.

  Resource Gaps: AIS receiver and camera systems including necessary hardware, software, staffing and training. Camera system must have complete coverage of the entire transit route, capable of detecting vessel traffic in wind, rain, fog, and dark conditions. Equipment and access to data feed of video imagery must be provided to state and local emergency operations centers impacted by the project.

- Tug Escort and Docking Assist: Due to the confined channel and high wind conditions, each LNG Carrier must be escorted by two tractor tugs, which will join the vessel as soon as safe to do so. The primary tug will be tethered at the direction of the pilot. A third tractor tug is required to assist with turning and mooring. Based on the Ship Simulation Study conducted by Moffatt & Nichol on March 17-20, 2008, vessels are limited to transiting during periods of high tide and 25 knot winds or less. While unloading, all three tugs will remain on standby to assist with emergency departure procedures.

  All three tractor tugs must be at least 80 Ton Astern Bollard Pull or larger and equipped with Class 1 Fire Fighting equipment.

  Resource Gaps: Three 80 Bollard Ton Tractor Tugs with Class 1 Fire Fighting capability.

- Navigational Aids:
  - Based on the Ship Simulation Study conducted by Moffatt & Nichol on March 17-20, 2008, four aids to navigation must be added and eight aids to navigation relocated on the waterway (pg. 12-17).
  - Physical Oceanographic Real-Time System (PORTS) must be contracted with NOAA to provide real time river level, current and weather data.

- LNG Carrier familiarization training for Pilots and Tug Operators: Prior to the arrival of the first vessel, simulator training must be provided for pilots and tug operators identified as having responsibility for LNG traffic.

Safety Measures:

Emergency Response Planning: Regional emergency response planning is limited in the region. Emergency response planning resources will need to be augmented to adequately develop emergency response procedures and protocols as well as continuously update those plans as conditions change.

Resource Gap: To be determined in conjunction with local and regional response agencies through the Emergency Response Planning process.

- Vessel and Facility Inspections: LNG tankers and facilities are subject to (at a minimum) annual Coast Guard inspections to ensure compliance with federal and international safety, security and pollution regulations. In addition, LNG vessels and facilities are typically required to undergo a pre-arrival inspection, and transfer monitor.

  Resource Gap: Additional Coast Guard Facility and Vessel Inspectors.

- Shore-Side Fire-Fighting: Firefighting capability is limited in the area surrounding the proposed LNG terminal. Shore side firefighting resources and training will need to be augmented in order to provide basic protection services to the facility as well as the surrounding communities along the transit route.

  Resource Gap: To be determined in conjunction with local and regional response agencies through the Emergency Response Planning process.

- In-Transit Fire-Fighting: Firefighting capability is limited along the entire transit route for proposed LNG vessels.

  Resource Gap: A plan must be developed for managing underway firefighting, including provisions for command and control of tactical fire fighting decisions as well as financial arrangements for provision of mutual aid and identification of suitable locations for conducting fire fighting operations along the transit route. To be determined in conjunction with local and regional response agencies through the Emergency Response Planning process.

  Public Notification System and Procedures: Adequate means to notify the public along the transit route, including ongoing public education campaigns, emergency notification systems, and adequate drills and training are required. Education programs must be tailored to meet the various needs of all waterway users, including commercial and recreational boaters, local businesses, local residents, and tourists.

  Resource Gap: A comprehensive notification system, including the deployment of associate equipment and training, must be developed. To be determined in conjunction with local and regional response agencies through the Emergency Response Planning process.

- Gas Detection Capability: No gas detection capability exists at the Port of Coos Bay, along the transit route and at the site of the proposed facility. Emergency response personnel require appropriate gas detection equipment, maintenance, and training. Additionally, the use of fixed detection equipment will ensure accurate and expedited gas detection in the event of a large scale LNG release. The installation of these detectors at strategic points along the waterway must be developed.

Resource Gap: Gas Detectors, appropriate training, and maintenance infrastructure. To be determined in conjunction with local and regional response agencies through the Emergency Response Planning process.

[redacted]

- [redacted]
- [redacted]
- [redacted]

In the absence of the measures described in this letter and the resources necessary to implement them or changes in Coast Guard policy upon which the resource decisions are based, Coos Bay would be considered unsuitable for the LNG marine traffic associated with the Jordan Cove LNG Terminal. The applicant shall be required to submit an annual update to the Waterway Suitability Assessment to the Coast Guard which shall be revalidated by the COTP and AMSC. For further information, please contact Mr. Russ Berg of Coast Guard Sector Portland at (503) 240-9374.

Sincerely,

F. G. Myer
Captain, U.S. Coast Guard
Captain of the Port
Federal Maritime Security Coordinator

Copy: Thirteenth Coast Guard District (dp)
Coast Guard Pacific Area (Pp)
Commandant, Coast Guard Headquarter (CG-52), (CG-522), (CG-544)
Maintenance and Logistics Command Pacific (Sm)

EXHIBIT 12

AGENDA ITEM SUMMARY

To: City of Coos Bay
From: Lane Council Governments (LCOG) Contact:
Henry Hearley, Assistant Planner, 541-682-3089, hhearley@lcog.org
Jacob Callister, Principal Planner, 541-682-4114, jcallister@lcog.org
RE: Jordan Cove Energy Project – Navigational Reliability Improvements

BACKGROUND/CONTEXT

The applicant, Jordan Cove Energy Project, proposes dredging, or "Navigational Reliability Improvements" (NRIs) within the Coos Bay Deep Draft Navigational Channel. The applicant's intent is to increase the operational window to safely transit any vessel through the Channel. The NRIs, which are described in more detail in the staff report (Page 2), are designed to increase the environmental operating windows for all ships entering Coos Bay by softening critical turns, relocating aids to navigation and reducing the required Channel directional changes. Minimizing delay is a clearly identified need. Various marine terminal businesses within Coos Bay require assurances that terminals can efficiently accommodate larger dimension bulk carriers in the future.

The Coos Bay Estuary Management Plan (CBEMP) addresses compliance with Statewide Planning Goal 16 - Estuarine Resources. Goal 16 requires that all areas within an estuary be classified into management units in the estuary management plan. There are three "aquatic" management units in the CBEMP: Natural Aquatic (NA), Conservation Aquatic (CA) and Development Aquatic (DA). This application proposes an amendment to change an area of the Coos Bay Estuary from Natural Aquatic (NA), which is more restrictive, to Development Aquatic (DA), which is less restrictive.

The staff report (Page 1 & 2) provides more detailed background and context for the application

APPLICANT'S REQUEST

JCEP proposes dredging at four locations in the Channel. The dredging is referred to as Navigation Reliability Improvements (NRIs). Three of the proposed NRIs are within Coos County and one (Dredge Area #4) is within the City of Coos Bay. The applicant is proposing the following applications to that end:

1. **A map amendment to the Coos Bay Estuary Management Plan to change the designation of approximately 3.3 acres from 52-NA to DDNC-DA;**
2. **A text amendment to the City of Coos Bay Comprehensive Plan to take a reasons exception to Statewide Planning Goal 16 Estuarine Resources to authorize the map amendment;**
3. **An estuarine and coastal shoreline uses and activities permit for "New and Maintenance Dredging" in the DDNC-DA Estuarine Zone; and**
4. **An estuarine and coastal shoreline uses and activities permit to allow an accessory temporary dredge transport pipeline in the 52-NA, 53-CA, 54-DA, and 55-CA Estuarine Zones.**

PLANNING COMMISSION PROCEDURE

The nature of the applications are quasi-judicial, for which the Planning Commission typically issues a decision. This application package includes what is called a post-acknowledgment plan (text) amendment, however. State law requires that the local governing body (in this case City Council) take final action to approve any post-acknowledgment (text) plan amendment.

On March 21, 2019, the City of Coos Bay Planning Commission will hold a public hearing on the Jordan Cove Application Package (#187-18-000153). The Commission will hear testimony, will eventually deliberate and will eventually forward a recommendation to the Coos Bay City Council. The City Council will receive, review and evaluate the Planning Commission's recommendation and will hold a second hearing and ultimately issue a decision on the applications.

ANALYSIS & STAFF REPORT

The City of Coos Bay contracted with the Lane Council of Governments (LCOG) to conduct a neutral analysis and prepare and accompanying staff report for the Jordan Cove NRI application. Decisions and conclusions on the application lie with the City's decision making bodies. LCOG's analysis is intended to provide guidance in making findings and conclusions for the applications.

KEY CRITERIA

This summary outlines a number of what LCOG and City of Coos Bay staff identified as "key criteria." Key criteria are those that staff feel the Planning Commission will benefit from additional context for. The attached staff report addresses all approval criteria (criteria outlined on Page 4).

KEY CRITERIA -- IMPACTS AND MITIGATION

Numerous criteria relevant to the applications require evidence of compatibility, of the public's best interest or of adequate mitigation of impacts. Following is a list of several key areas where this criterion is called out and some context for the responses and potential findings:

Criteria	Report Page Ref.	Summary
CBMC 17.360.060 (A)(2), OAR 660-004-0020(2)(c)&(d), OAR 660-004-0022(8)(f), CBEMP Policy #4a	Page 8 Page 16 Page 19 Page 29	The applicant submitted a memo prepared by their contractor, David Evans and Associates, which describes, in detail, the dredging proposed. It also includes discussion of impacted wildlife, and proposed mitigation measures. Staff highly recommends that Planning Commissioners review this important memo in its entirety prior to the March 21st hearing. It is found at **Attachment A, Exhibit 5.** The memo addresses, among other things, water quality, physical characteristics, noise, deep subtidal areas, living resources (including threatened and endangered species), recreation and aesthetics.

KEY CRITERIA -- GOAL 16 EXCEPTION

Statewide Planning Goal 16 Estuarine Resources, requires that the City of Coos Bay *"recognize and protect the unique environmental, economic, and social values of each estuary and associated wetlands; and to protect, maintain, where appropriate develop, and where appropriate restore the long-term environmental, economic, and social values, diversity and benefits of Oregon's estuaries."*

As noted, to obtain a balance of uses, the CBEMP divides all estuaries into three aquatic management units: Natural, Conservation, and Development. The proposed NRI site is currently in the 52-NA natural aquatic unit. In this natural aquatic zone, dredging is not a permitted use. The applicant seeks to amend the CBEMP to apply the DDNC-DA (a development aquatic unit) designation to the proposed NRI site in order to allow the dredging necessary to complete the NRIs. A Goal 16 exception is required to rezone the NRI site to a DDNC-DA development site.

State statute and rules outline a process for justifying exceptions to Goals, including Goal 16:

Criteria	Report Page Ref.	Summary
OAR 660-004-0020(1)	Page 14	If there are adequate reasons, then an exception can be granted
OAR 660-004-0020(2)	Page 14 Page 14 Page16 Page 16	Four standards apply: ***a. Reasons justify why the state policy embodied in the applicable goals should not apply.*** (See OAR 660-004-0022) ***b. Areas that do not require a new exception cannot reasonably accommodate the use.*** ***c. The long-term environmental, economic, social and energy consequences resulting from the use at the proposed site with measures designed to reduce adverse impacts are not significantly more adverse than would typically result from the same proposal being located in areas requiring a goal exception other than the proposed site.*** **d.** ***The proposed uses are compatible with other adjacent uses or will be so rendered through measures designed to reduce adverse impacts.***
OAR 660-004-0022 OAR 660-004-0022(1) OAR 660-004-0022(8)	Page 17 Page 18 Page 19	Outlines types of reasons that may or may not be used to justify certain types of uses not allowed on resource lands. Must meet one of the criteria (1-8). Applicant has proposed consistency with two avenues (criteria)). The applicant must demonstrate a need for the proposed use/activity based on "special features or qualities" and based on requirements of one or more State Planning Goals 3 to 19. A Goa 16 specific exception to the requirement limiting dredging in an area that is currently designated, in accordance with Goal 16, as a natural management unit. The applicant has indicated the exception is justified because approval of the application will authorize dredging to maintain adequate depth to safely and more reliably permit continuation of the present level of navigation.
CBEMP -- Policies #5, #4, #4a	Pages 24 - 30	The applicant notes, and staff agree, that LUBA has held, and the Court of Appeals has affirmed, that when a goal exception is taken to facilitate proposed development, any comprehensive plan policies that implement the goal for which the exception is taken no longer govern that development. The Applicant requests an exception to Goal 16 to facilitate dredging in a natural management unit. Policy #4, #4a and portions of Policy #5 implement Goal 16 and are, therefore, not applicable. Despite this assertion, the applicant has addressed the necessary criteria at Policies #4, #4a and #5.

CONDITIONS OF APPROVAL

Key criteria are often addressed with Conditions of Approval. The following conditions are currently proposed by staff for the applications:

***Condition of Approval #1**: Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall provide the City of Coos Bay with a spill prevention and response plan addressing the potential any unanticipated oil spill or toxic discharge for review and approval.*

***Condition of Approval #2**: Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall provide evidence to the Coos Bay Community Development Director, of compliance with the requirements of the enclosed MOA, CRPA, and UDP as agreed upon and signed by JCEP and the Confederated Tribes of Coos, Lower, Umpqua, and Siuslaw Indians.*

***Condition of Approval #3**: Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall obtain, and provide evidence to the Coos Bay Community Development Director, of all necessary DSL and Federal Section 404 authorizations. JCEP shall provide the City with copies of these approved authorizations for the record.*

***Condition of Approval #4**: City of Coos Bay Public Works has identified an existing utility that is installed under the Bay in the vicinity of the proposed navigational reliability improvements. Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall provide evidence to the Coos Bay Community Development Director, that the proposed dredging activity shall not impact this existing utility.*

***Condition of Approval #5**: As a general condition, and in the event that additional analysis or circumstance reveals relevant and previously unknown or unmapped shoreland resources, all dredging activity must remain consistent with CBEMP Policy #17 - Protection of "Major Marshes" and "Significant Wildlife Habitat" in Coastal Shorelands.*

STAFF CONCLUSION

Staff recommends that the Planning Commission carefully review the application itself (attached to the staff report), the application criteria, and the responses contained within the staff report. Based on the evidence in the record, it is staff's initial conclusion that the applicable criteria can be met with the conditions of approval proposed.

ACTION BY THE PLANNING COMMISSION

After the hearing and the record are closed, the Planning Commission will deliberate on the applications. The Planning Commission will not render a decision on this matter. They will provide a recommendation to the City Council. Although Commission deliberations can be general to the applications, there should be separate motions and votes on recommendations for each of the four requested applications.

CITY OF COOS BAY
Community Development Department

500 Central Avenue
Coos Bay, OR 97420

541.269.8918
www.coosbay.org

STAFF REPORT

Type III – Land Use Process
Jordan Cove Energy Project – Navigational Reliability Improvements

STAFF:	Henry Hearley, Assistant Planner, Lane Council of Governments (LCOG) Jacob Callister, Principal Planner, LCOG Carolyn Johnson, Community Development Administrator, City of Coos Bay
REVIEW BODY:	Planning Commission
HEARING DATE/TIME:	Thursday, March 21, 2019 at 6:00 p.m.
LOCATION:	Coos Bay City Council Chambers, 500 Central Avenue, Coos Bay, Oregon
APPLICANT/OWNER:	Jordan Cove Energy Project L.P. (JCEP) Attention: Meagan Masten, 111 SW 5th Avenue, Suite 100, Portland, OR, 97204
APPLICANT'S REPRESENTATIVE:	Perkins Coie LLP, 1120 NW Couch Street, Tenth Floor, Portland, OR 97209 Attention: Seth King
SUBJECT PROPERTY:	T 25S R 13W Sections 8, 17, 19, 30; T 25R 14W Sections 25, 35, 36.
SUBJECT:	LAND USE APPLICATION #187-18-000153 – Jordan Cove Energy Project Navigation and Efficiency and Reliability of the Coos bay Deep Draft Navigation Channel

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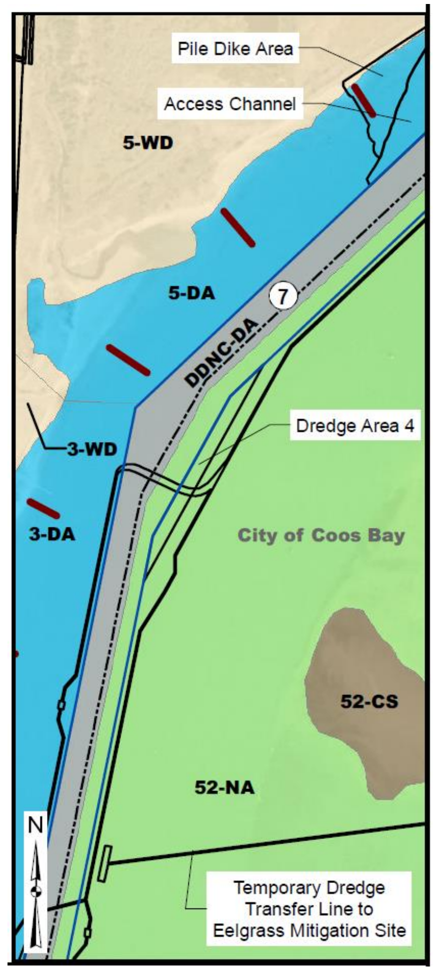
I. BACKGROUND/CONTEXT

The Coos Bay Deep Draft Navigation Channel (Channel) serves a vital purpose in providing the only safe vessel access to and from Coos Bay and the Pacific Ocean for marine terminals located along the Bayfront. The Channel was initially authorized in 1899 and since then has undergone ten modifications. Most recently, the Channel was expanded from -35 feet to -37 feet in 1997 to allow for the safe navigation and transit of Coos Bay for the size of ships prevalent during that time period. Over the last 20 years the dimensions and tonnage of ships serving terminals in Coos Bay has increased. The size of vessels typically calling on Coos Bay terminals has increased from an average of 45,422 Metric Tonnes to an average of 52,894 Metric Tonnes with a projected near-term vessel size of 70,400 Metric Tonnes. Currently, environmental conditions, including wind, fog, and currents, coupled with the increasing ship size explained above, have caused the

Coos Bay Pilots Association ("Pilots") to impose more limiting restrictions on when vessels may safely transit the Channel. These restrictions, in turn, cause significant delays and increased pressure on the Pilots to navigate ships through the Channel. Delays are measured in the total transit time, from the time the vessel arrives off the coast of Coos Bay until it returns offshore after calling at its local Coos Bay destination. These delays generally decrease the efficiency and competitiveness of maritime commerce on a global scale, thereby jeopardizing continued success for maritime commerce in Coos Bay. Minimizing delay is a pressing need because companies that utilize the port of Coos Bay have identified potential new customers in Asia that desire to export cargo using bulk carriers that are slightly larger than the ships typically calling today. Various marine terminal businesses within Coos Bay require assurances that terminals can efficiently accommodate larger dimension bulk carriers in the future.



The Coos Bay Estuary Management Plan (CBEMP)

To comply with Statewide Planning Goal 16 Estuarine Resources, Coos County, City of Coos Bay and City of North Bend developed the CBEMP. It was adopted and acknowledged in 1984. Goal 16 requires that all areas within an estuary be classified into management units in the estuary management plan. There are three "aquatic" management units in the CBEMP: Natural Aquatic (NA), Conservation Aquatic (CA) and Development Aquatic (DA). This application proposes an amendment to change an area of the Coos Bay Estuary from Natural Aquatic (NA) to Development Aquatic (DA).

According to the CBEMP, Natural Aquatic areas are managed for resource protection preservation and restoration. They place severe restrictions on the intensity and types of uses and activities allowed within them. Natural Aquatic areas include tidal marshes, mud-sand flats, seagrass and algae beds that, because of a combination of factors such as size, biological productivity and habitat value, play a major role in the functioning of the estuarine ecosystem. Natural Aquatic areas also include ecologically important subtidal areas.

Development Aquatic areas are managed for navigation and other water-dependent uses, consistent with the need to minimize damage to the estuarine system. Some water-related and other uses may be allowed, as specified in each respective unit. Development Aquatic areas include areas suitable for deep or shallow-draft navigation (including shipping and access channels or turning basins), sites and mining or mineral extraction areas, and areas adjacent to developed or developable shorelines which may need to be altered to provide navigational access or create new land areas for water-dependent uses.

Dredging

Dredging, or "Navigational Reliability Improvements" (NRIs), could increase the operational window to safely transit any vessel through the Channel. The NRIs, which are described in more detail below, are designed to increase the environmental operating windows for all ships entering Coos Bay by softening critical turns, relocating aids to navigation and reducing the required Channel directional changes. The NRIs are designed to reduce entry and departure delays and allow for more efficient vessel transits through the Channel for the size of vessels entering the Port today.

All work associated with the NRIs will take place during the approved in-water work period for Coos Bay (October 1 to February 15). The applicant notes that JCEP will place initial and future dredged material derived from the NRI Sites at the APCO 1 and 2 sites near the southern terminus of the U.S. Highway 101 McCullough Bridge. These sites are located in the City of North Bend; JCEP will file a separate application with that City to authorize disposal of these dredge spoils in these locations. If dredging by hydraulic methods, JCEP will utilize a 24- to 36-inch temporary dredge pipeline to transport the dredged material to the disposal sites on the bottom or horizontal extent of the Channel to reduce potential conflicts with vessel navigation. The maximum distance from the NRIs to the APCO sites is approximately 8.3-miles. The dredge line is illustrated in Attachment A, Exhibit 6. Booster pumps would be required to move the material to the disposal sites through the pipeline.

The NRIs will facilitate economic opportunities, including access to emerging opportunities to export products with today's larger vessels, including bulk carriers. Although log export vessels serving the upper bay are smaller, the proposed enhancements also benefit these vessels by broadening the tidal and environmental windows for transiting the Channel, providing an enhanced margin of safety and improved efficiency in the loaded vessel departure schedule. Both Roseburg Forest Products and the Pilots have submitted letters of support for the NRIs. See Attachment A, Exhibit 3. For JCEP and its LNG terminal, the NRIs will allow for transit of LNG vessels of similar overall dimensions to those listed in the July 1, 2008 United States Coast Guard ("USCG") Waterway Suitability Report, the USCG Letter of Recommendation dated May 10, 2018 and USCG letter confirmation dated November 7, 2018 see Attachment A, Exhibit 4, but under a broader range of weather conditions, specifically higher wind speeds. As a result, JCEP estimates that, upon completion of the NRIs, JCEP will be able to export the full capacity of the optimized design production of the LNG Terminal on a consistent annual basis.

II. APPLICANT'S REQUEST

JCEP proposes dredging at four locations in the Channel. Three of the proposed NRIs are within Coos County and one (Dredge Area #4) is within the City of Coos Bay. The applicant is proposing the following application to that end:

(1) A map amendment to the Coos Bay Estuary Management Plan to change the designation of approximately 3.3 acres from 52-NA to DDNC-DA;
(2) A text amendment to the City of Coos Bay Comprehensive Plan to take a reasons exception to Statewide Planning Goal 16 Estuarine Resources to authorize the map amendment;
(3) An estuarine and coastal shoreline uses and activities permit for "New and Maintenance Dredging" in the DDNC-DA Estuarine Zone; and
(4) An estuarine and coastal shoreline uses and activities permit to allow an accessory temporary dredge transport pipeline in the 52-NA, 53-CA, 54-DA, and 55-CA Estuarine Zones.

III. APPLICABLE CRITERIA

Coos Bay Development Code (CBMC) *(Page 5, Page 21)*
17.360.010-Comprehensive Plan Amendment
17.360.020-Initiation of Amendment
17.360.060-Appeal Criteria
17.352.010-Estuarine/Coastal Shore Activities

Coos Bay Comprehensive Plan (CBCP) *(Page 6)*
Section 7.1 Natural Resources and Hazards Strategies NRH.8 and NRH.9
Section 8.3 Land Use and Community Development Planning Strategies LU.4, LU.5 and LU.7
Section 7.5 Economic Development

Coos Bay Estuary Management Plan (CBEMP) Policies ***(****Page 13, Page 21)*
DDNC-DA Zone – General Conditions for Approval of "New and Maintenance Dredging"
DDNC-DA Zone – Special Conditions for Approval of "New and Maintenance Dredging"
CBEMP Policy #17 – Protection of "Major Marshes" and "Significant Wildlife Habitat" in Coastal Shorelines
CBEMP Policy #18 – Protection of Historical and Archaeological Sites within Coastal Shorelands
CBEMP Policy #5 – Estuarine Fill and Removal

Statewide Planning Goals *(Page 8)*
Goal 1: Citizen Involvement
Goal 2: Land Use Planning
Goal 6: Air, Water and Land Resources Quality
Goal 9: Economic Development
Goal 12: Transportation
Goal 13: Energy Conservation
Goal 16: Estuarine Resources

Reasons Exceptions (Oregon Revised Statute and Oregon Administrative Rules) *(Page 14)*
ORS 197.732 – Goal Exceptions
OAR 660-004-0020- Criteria for Goal 16 exceptions
OAR 660-004-0022- Criteria for Goal 2 exceptions

IV. NOTICES AND REFERRALS

Notice:
On March 1, 2019 notice was mailed to surrounding property owners along the shoreline adjacent to the proposed NRIs site. The CBMC doesn't outline specific noticing requirements for a subject property located in a body of water. City staff mirrored the notice approach used by Coos County for the three associated NRI dredge sites being concurrently evaluated. The County mailed notice to bayfront properties adjacent to the proposed NRIs. The City mailed notice to bayfront properties within the City Limits.
Notice was also sent to concerned parties that contacted city staff indicating they would like to receive notice. Notice was also published in "*The World*", on February 28, 2019.

Staff provided required notice to DLCD for a post acknowledgement plan amendment on February 12, 2019. Staff have also been in touch with DLCD's Goal 16 specialist, Matt Spangler.

Referrals:
On March 1, 2019, referral notice was sent to the following governmental/utility/tribal agencies for a request for comment on the application: Department of Land Conservation and Development (DLCD), Department of State Lands (DSL), Coos Bay North Bend Water Board, NW Natural, Pacific Corp, Coos County, City of Coos Bay, Oregon International Port of Coos Bay, and Confederated Tribes of Coos, Lower, Umpqua and Siuslaw Indians and Coquille Tribe.

City of Coos Bay Public Works issued a comment indicating that the proposed dredging appears to be at or near Station 280+00 (Figure 1 of 9). The City has an existing utility line at or near this station installed under the Bay. Staff recommends the proposed dredging shall not impact this existing utility line; this requirement is noted as a condition of approval in Section VIII of this staff report.

City of Coos Bay Public Works also requested that it be the responsibility of the applicant to ensure that all applicable resource agency permits and approvals are obtained prior to commencement of any work. Staff recommends the condition to obtain appropriate permits prior to any proposed dredging activities (Page 25). This and all conditions of approval can be found in Section VIII of this staff report.

V. CRITERIA FOR COMPREHENSIVE PLAN MAP AMENDMENT

17.360.010 Comprehensive Plan Amendment

A. The boundaries of the Comprehensive Plan map designations and the Comprehensive Plan text may be amended as provided in CBMC 17.360.020 of this title.

Staff Response: The subject property lies within the Coos Bay Estuary, and falls under the ownership of the DSL, the applicant has requested and received permission to file this land use application with the City of Coos Bay. The DSL letter is included in the application (Attachment A) as Exhibit 8, Page 1 of 4. The application includes a request for an exception to Goal 16, requiring a comprehensive plan text amendment.

B. The City may amend its Comprehensive Plan and/or plan map. The approval body shall consider the cumulative effects of the proposed Comprehensive Plan and/or map amendments on other zoning districts and uses within the general area. Cumulative effects include sufficiency of capital facilities services, transportation, zone and location compatibility, and other issues related to public health and safety and welfare the decision making body determines to be relevant to the proposed amendment.

Staff Response: The applicant notes that the cumulative effects of such an amendment would include facilitating an increase in safety and efficiency of navigation in the Channel. Another cumulative effect of the applicant's proposal is to augment transportation in the bay. The application is not expected to have cumulative effects on the sufficiency of capital facilities services, or health and welfare. Staff notes that it is unclear to what extent the approval body must "consider" cumulative effects. Staff also notes that, due to the requirement only to "consider" cumulative effects, the application could not be denied based solely on a potential finding that the amendment has associated cumulative effects

17.360.020 Initiation of Amendment

Amendments of the Comprehensive Plan text or map, zoning map, or this title may be initiated by the following:

A. A Type III application, CBMC 17.130.100, Procedures, by one or more owners of the property proposed to be changed or reclassified consistent with the adopted Comprehensive Plan; or

B. A Type IV legislative process, CBMC 17.130.110, Procedures, by motion of the Planning Commission and adoption by the City Council.

> **Staff Response:** The underlying landowner of the subject property is DSL, which has given the applicant permission to file this application as seen in Attachment A, Exhibit 8, Page 1 of 4. The application is quasi-judicial in nature because it involves a single landowner, a limited geographic area, is not City-initiated, and concerns the application of existing policies to a specific set of facts. Because state law requires local governing bodies to take final action to approve any post-acknowledgment (text) plan amendment (*Housing Land Advocates v. City of Happy Valley, Or LUBA (LUBA No. 2016-031, May 23, 2016*), and the final decision on the application must be rendered by the Coos Bay City Council (after a hearing before the Planning Commission). Following the Planning Commission public hearing, City Council will hold a public hearing on the application.

17.360.060 Approval Criteria

A. For a Type III or Type IV review, the City Council shall approve the proposal upon findings that:

1. The proposed amendment is consistent with the applicable policies of the Comprehensive Plan or that a significant change in circumstances requires an amendment to the plan or map,

> **Staff Response:** The application to change the CBCP designation of the NRI Site from 52-NA to DDNC-DA is consistent with the applicable policies of the Coos Bay Comprehensive Plan. Consistency with specific applicable policies is outlined below:

Section 7.1, Natural Resources and Hazards, Strategy NRH.8
Coos Bay shall encourage the preservation and protection of riparian vegetation as an important fish and wildlife habitat and as a viable means of flood control by enactment of appropriate property development ordinances providing protection by establishing buffer strips along waterways, along designated HUD floodways, with the exception of navigable waterways. This strategy recognizes that such land use practices are necessary (1) to preserve the area's natural resources, and (2) to eliminate unnecessary drainage and erosion problems often accompanying development.

> **Staff Response:** The proposal does not include any impacts to City of Coos Bay shoreline habitat or riparian areas. The applicant anticipates possible temporary, but not permanent, impacts to shoreline habitat, including to riparian vegetation in the areas where the applicant plans to offload dredged material for processing, but they are not located within the Coos Bay city limits. The applicant notes that they will comply with any regulations the

City has implemented in accordance with its obligation to "encourage" preservation of riparian vegetation.

Section 7.5 Economic Development

Goal 1, Policy 1.5 – Support and cooperate with community and regional partners to encourage economic growth.

<u>Staff Response:</u> Approval of the proposed NRIs will primarily benefit large vessels that are navigating to and from the International Port of Coos Bay (Port). The Port itself is located outside of city limits, but is an important regional entity that facilitates mass export and import of goods and commodities overseas and thus serves as a key driver of economic development for Coos Bay and regions beyond. The proposed NRIs support community and regional partners and economic growth as the goal describes.

Goal 6, Policy 6.1, 6.2 – Maximize the potential uses and benefits the waterfront and deep-water port offers to the city and region as a whole; Support the Port of Coos Bay In its development efforts for transportation linkage and to develop a deep-draft channel to accommodate large cargo vessels and increase shipping activities and water-dependent uses.

<u>Staff Response:</u> Staff concur with the applicant's assertion that the purpose of this application is to facilitate increased navigational safety and efficiency for large vessels in the Channel. Increased safety and efficiency maximize the Channel's economic benefits for the City and region as a whole by allowing increased economic input and output.

Section 8.3 Land Use and Community Planning Strategy LU.4
Coos Bay shall not make major revisions to this Comprehensive Plan more frequently than every two years, if at all possible. "Major revisions" are those that have widespread and immediate impact beyond the subject area under consideration. The city recognizes that wholesale approval of frequent major revisions could ruin the integrity of the Plan.

<u>Staff Response:</u> Staff concurs with the applicant's assertion that the proposal does not constitute a "major revision" to the CBCP. The proposed text amendment directly addresses only the NRI site. The proposal will not, from a land development/conservation aspect have a widespread and immediate impact beyond the dredge site.

Section 8.3 Land Use and Community Planning Strategy LU.5
Coos Bay may make minor changes to this Comprehensive Plan on an infrequent basis as need and justification arises. "Minor changes" are those which do not have significant impact beyond the immediate area of the property under consideration. The city recognizes that wholesale approval of frequent minor changes could ruin the integrity of this Plan.

<u>Staff Response:</u> The proposed changes relate exclusively to an isolated and undeveloped area and can be considered "minor changes." The staff report presents the argument that the need for the amendments has been justified.

Section 8.3 Land Use and Community Planning Strategy LU.7
Coos Bay shall anticipate that conflicts may arise between the various plan implementation strategies contained in the Plan when applying the policies to specific situations. To resolve these conflicts, if and when such may occur, Coos Bay shall consider the long term environmental, economic, social, and energy consequences expected to result from applying one strategy in place of others, then to select and apply the strategy that results in maximum public benefit as supported by findings of fact. This strategy is based on the recognition that a viable conflict resolution process is essential to the success of any comprehensive plan.

Staff Response: The application will not cause conflicts between CBCP implementation strategies. The application is consistent with all policies of the CBCP.

2. The proposed amendment is in the public interest; and

Staff Response: The proposed amendment to the CBCP serves the public interest by creating safer and more efficient navigation in the Channel, thereby promoting economic activity in the City of Coos Bay consistent with Comprehensive Plan Goal 1 Policy 1.5 and Goal 6, Policies 6.1 and 6.2. Promoting navigational safety and efficiency has support beyond the applicant, as indicated through letters of support submitted with the application materials (Attachment A, Exhibit 3). The applicant has provided a response addressing environmental concerns potentially associated with the public interests (Attachment A, Exhibit 5)). Staff agrees with the applicant's assertion that the long term economic, environmental, social and energy consequences of dredging elsewhere do not present materially different outcomes.

3. Approval of the amendment will not result in a decrease in the level-of-service for capital facilities and services identified in the Coos Bay Capital Improvement Plan(s).

Staff Response: Staff agree with the applicant's assertion that the application will not result in a decrease in the level-of-service for any identified capital facilities and/or services identified in the Coos Bay capital improvement plan.

Statewide Planning Goals

Statewide Planning Goals noted below are pertinent to the subject application.

Goal 1: Citizen Involvement – to develop a citizen involvement program that insures the opportunity for citizens to be involved in all phases of the planning process.

Staff Response: The City of Coos Bay has adopted, within its Development Code, a program for post-acknowledgment plan amendments. The CBMC has been acknowledged by LCDC. This staff report has touched on the required notice that has been issued. That program also includes the hearings that will take place to address the application.

As noted earlier state law requires the local governing body to take final action to approve any post-acknowledgment comprehensive plan amendment before it can become final. The City will schedule the application for final action by the City Council after the Planning Commission's initial recommendation. The City plans to apply its Type III process in CBMC 17.30.100 to review and decide upon the Application, subject to also providing for a hearing and final decision on the Application by the City Council. Upon doing so, the City will have complied with Goal 1. These procedures provide opportunity for citizen involvement in all phases of the application.

Goal 2: Land Use Planning – to establish a land use planning process and policy framework as basis for all decisions and actions related to use of land and to assure an adequate factual base for such decisions and actions.

Staff Response: Goal 2 requires establishing a land use planning process and policy framework as a basis for all land use decisions and requires an adequate factual base for all land use decisions. In the present case, the provisions of the CBMC and the ORS establish the land use planning process and policy framework for considering the application. Further, the applicant has submitted materials, including narrative and supporting documentation, in the application asserting consistency with applicable approval criteria.

Goal 2 requires that the City coordinate its review and decision on the application with appropriate government agencies In its review of the application, the City has provided referral notice to affected government agencies with an opportunity to comment on the proposal.

Goal 3: Agricultural Lands – to maintain and preserve agricultural lands.

Staff Response: The NRI site does not include any agricultural lands. Goal 3 is not applicable to this application.

Goal 4: Forest Lands

Staff Response: The NRI site does not include any forest lands. Goal 4 is not applicable to this application.

Goal 5: Natural Resources, Scenic and Historic Areas, and Open Spaces

Staff Response: Based on the information available to staff, the NRIs do not include any inventoried Goal 5 resources.

Goal 6: Air, Water and Land Resources Quality – To maintain and improve the quality of the air, water and land resources of the state.

Staff Response: There are no administrative rules governing Goal 6; it relies entirely on state and federal regulations for direction and implementation. Staff believe it is reasonable to find that the applicant will comply with federal and state environmental standards in the future if and when federal and state permits for dredging are secured. The applicant's narrative indicate that JCEP has applied for state and federal approval of dredging activities at the NRI site. Staff agree with the applicant that there is no indication that JCEP is precluded as a matter of law from obtaining approval of these applications.

The applicant also notes that the proposed map amendments do not alter existing City protections provided by the CBEMP restricting dredging activities, which protections have been previously deemed consistent with Goal 6.

Additionally, the applicant has submitted a biological assessment completed by the consultant David Evans and Associates (DEA). In its report (Attachment A, Exhibit 5), DEA indicates Best Management Practices (BMPs) will be employed. The applicant identifies BMPs that will be utilized with the proposed dredging as a way to minimize impacts, a discussion of the BMPs can be found in Attachment A, Exhibit 5 (Page 7).

Goal 7: Areas Subject to Natural Hazards. – To protect people and property from natural hazards.

Staff Response: Goal 7 requires local governments to identify and plan for natural hazard areas and coordinate their natural hazard plans and programs with state agencies. The proposed uses and activities will not increase the likelihood of damage to people or property. The level of risk for equipment and lives, with respect to natural hazards is perhaps lower, but certainly no greater than the current activities associated with the Port and the Bay.

Goal 8: Recreational Needs – To satisfy the recreational needs of the citizens of the state and visitors, and where appropriate, to provide for the siting of necessary recreational facilities including destination resorts.

Staff Response: The proposed NRI site does not involve recreation or inventoried recreational areas, facilities or opportunities. Staff note that Coos Bay supports recreational activities. The applicant provided a summary of the recreational activities that take place in the Coos Bay Estuary, and indicated that all three boat ramps that provide access to the estuary will remain open during the proposed dredging activities, as well as an announcement to the boating community via a local notice to mariners provided through notification to the United States Coast Guard. The report in its entirety can be found in this staff report as Attachment A, Exhibit 5 (Page 10). The application is consistent with Goal 8.

Goal 9: Economic Development – To provide adequate opportunities throughout the state for a variety of economic activities vital to the health, welfare and prosperity of Oregon's citizens.

Staff Response: The applicant is proposing NRIs to one site within the City's jurisdiction that in turn will facilitate a broader operational window, and increase safety and efficient of transit, in the Channel. The navigational reliability improvements have the ability to offer economic prospects to the City and region as a whole. The application is consistent with this goal.

Goal 10: Housing – To provide for the housing needs of the citizens of the state.

Staff Response: Goal 10 is not applicable to this application.

Goal 11: Public Facilities and Services –

Staff Response: The applicant's proposal does not involve or affect public facilities and service as framework for development. Goal 11 is not applicable to this application.

Goal 12: Transportation – To provide and encourage a safe, convenient and economic transportation system.

Staff Response: The applicant's proposal is consistent with Goal 12 because it advances the Goal 12 objective of facilitating the flow of goods and services in an effort to strengthen the local and regional economy. In the case of the applicant, the NRIs help the flow of goods and services by reducing transit time of goods to the market, the decrease of time vessels wait off-shore for Port conditions to improve, the reduction of fuel, and overall safety and efficiency. The application is consistent with this goal.

Goal 13: Energy Conservation – To conserve energy.

Staff Response: The applicant's proposal is consistent with Goal 13 because the proposed NRIs increase the safety and efficiency of vessel transit through the Channel, and thus increase the operational window. The increase of the operational window reduces the time vessels spend waiting to enter the Channel which increases the efficiency of material transportation and reduction of energy waste from inefficiency of transportation. The application is consistent with this goal.

Goal 14: Urbanization – To provide for an orderly and efficient transition from rural to urban land use.

Staff Response: Goal 14 is not applicable to this application.

Goal 15: Willamette River Greenway

Staff Response: Goal 15 is not applicable to this application.

Goal 16: Estuarine Resources - To recognize and protect the unique environmental, economic, and social values of each estuary and associated wetlands; and to protect, maintain, where appropriate develop, and where appropriate restore the long-term environmental, economic, and social values, diversity and benefits of Oregon's estuaries.

Staff Response: The Coos Bay Estuary Management Plan (CBEMP) is a refinement plan to the Coos Bay Comprehensive Plan and implements Goal 16 for the City of Coos Bay. The CBEMP divides all estuaries into three aquatic management units: Natural, Conservation, and Development. The proposed NRI site is currently zoned 52-NA, which is a natural aquatic unit. In the 52-NA natural aquatic zone, dredging is not a permitted use. The applicant seeks to amend the CBEMP to apply the DDNC-DA (a development aquatic unit) designation to the proposed NRI site in order to allow the dredging necessary to complete the NRIs. A Goal 16 exception is required to rezone the NRI site to a DDNC-DA development site. The requested goal exception is specifically addressed on Page 14 of this report.

Goal 17: Coastal Shorelands - To conserve, protect, where appropriate, develop and where appropriate restore the resources and benefits of all coastal shorelands, recognizing their value for protection and maintenance of water quality, fish and wildlife habitat, water-dependent uses, economic resources and recreation and aesthetics. The management of these shoreland areas shall be compatible with the characteristics of the adjacent coastal waters; and to reduce the hazard to human life and property, and the adverse effects upon

water quality and fish and wildlife habitat, resulting from the use and enjoyment of Oregon's coastal shorelands.

Staff Response: The proposed NRI site does not include any designated coastal shorelands. The proposed dredge transport pipeline will not impact shorelands within the City of Coos Bay. Goal 17 is not applicable to this application.

Goal 18: Beaches and Dunes –

Staff Response: The proposed NRI site does not include any designated beaches or dunes. Goal 18 is not applicable to this application.

Goal 19: Ocean Resources -

Staff Response: The proposed NRI site does not include or abut any ocean resources.

Specific Proposed Amendments to the CBEMP

The following are the exact text amendments the applicant is proposing to the CBEMP.

***

CITY OF COOS BAY TEXT AMENDMENTS ASSOCIATED WITH JORDAN COVE ENERGY PROJECT L.P. APPLICATIONS FOR NAVIGATION RELIABILITY IMPROVEMENTS

(1) AMENDMENT TO COOS BAY ESTUARY MANAGEMENT PLAN

"**5. DESIGNATION OF SITE-SPECIFIC MANAGEMENT SEGMENTS, USES AND ACTIVITIES**

"AUTHORIZED NAVIGATION CHANNELS

"LOWER BAY/UPPER BAY AQUATIC UNIT

"DEEP-DRAFT NAVIGATION CHANNEL (35' authorized draft)
MANAGEMENT CLASSIFICATION – DA

"PROJECT DESCRIPTION:

"The entrance and lower bay section includes a federally-authorized project extending from the Entrance Bar at the outer (western) extremity of the jetties to the railroad bridge at Bay Mile 9.0 north of Pony Slough. The project specifies a 45-foot deep channel with 'suitable' width across the Entrance Bar, a 35-foot deep by 300-foot wide channel to the railroad bridge, an Anchorage Basin at Bay Mile 3.5 (southwest of Sitka Dock), a Buoy Storage Area between Sitka Dock and Pigeon Point (not part of federal project), a Turning Basin north of Empire at Bay mile 6.0, a widened turn area from Lower Jarvis Range to Jarvis Turn Range channels southwest of Bay mile 7.0 to a 41-foot deep MLLW elevation (including 37-foot deep channel, two-foot over-dredge allowance, and two-foot advanced maintenance allowance) (see EXCEPTION #), and the Anchorage Basin southwest of Roseburg Lumber Co. at Bay mile 7.5. In-bay disposal sites are located off of Coos Head ('G') and North Bend Airport ('D'). Two other in-bay disposal sites at Bay Miles 4 and 5 are included in this segment.

"The upper bay section includes a federally-authorized project from the railroad bridge (Mile 9.0) to Isthmus Slough at Bunker Hill (Mile 15.0). The federal project involves a navigation channel 35 feet deep by 300 to 400 feet wide, and Turning Basins at North Bend (Mile 12.0) and Coalbank Slough (Mile 14.5).

***

As a result of the applicant's request a small amendment will be required in the Coos Bay Comprehensive Plan that references the approved site-specific exception:

(2) AMENDMENT TO COOS BAY COMPREHENSIVE PLAN 2000, VOLUME III, PART 3, TO ADD EXCEPTION #__ - AQUATIC UNIT 52-NA/DEVELOPMENT UNIT DDNC-DA - NAVIGATION RELIABILITY IMPROVEMENTS

Chapter 3.2, Site-Specific Exceptions, is hereby amended by adding Exception #__ as follows:

[INSERT FINDINGS UPON ADOPTION]

VI. CRITERIA FOR GOAL 16 REASONS EXCEPTION

OAR 660-004-0020

(1) If a jurisdiction determines there are reasons consistent with OAR 660- 004-0022 to use resource lands for uses not allowed by the applicable Goal or to allow public facilities or services not allowed by the applicable Goal, the justification shall be set forth in the comprehensive plan as an exception. As provided in OAR 660-004-0000(1), rules in other divisions may also apply.

Staff Response: In their application the applicant requests an exception to Goal 16 for the proposed NRI dredge site# 4. The applicant must meet four standards of Goal 2 (Part II(c), outlined below (2) (a) –(d). A discussion of the reasons justifying a Goal 16 exception for the proposed dredging activity (consistent with OAR 660-004-0022) follows, on Page 17. The applicant has advanced a finding that calls out the "extremely restrictive, unavoidable turn" associated with proposed NRI site as the "*special features or qualities that necessitate its location on or near the proposed exception site.*" The applicant has submitted testimony in the form of "letters of support" that are in favor of the proposed use for the issues indicated in this staff report.

(2) The four standards in Goal 2 Part II(c) required to be addressed when taking an exception to a goal are described in subsections (a) through (d) of this section, including general requirements applicable to each of the factors:

(a) "Reasons justify why the state policy embodied in the applicable goals should not apply." The exception shall set forth the facts and assumptions used as the basis for determining that a state policy embodied in a goal should not apply to specific properties or situations, including the amount of land for the use being planned and why the use requires a location on resource land;

Staff Response: The applicant has identified the "reasons that "*justify why the state policy embodied in the applicable goals should not apply.*"

The applicant asserts that the proposed 3.3 acre NRI site located in the Channel is in need of improvement in order to facilitate safer and more efficient navigation. The applicant indicates that the proposed use must be located where mapped because this is where the navigational reliability improvements are most needed.

Staff discussion of exception reasons is included in detail on Page 17of this report, in the response to OAR 660-004-0022.

(b) "Areas that do not require a new exception cannot reasonably accommodate the use." The exception must meet the following requirements:

Staff Response: Applicant identifies the proposed NRI site as location-specific. The proposed location of the NRI site is the only site JCEP can make the proposed necessary improvements to increase safety and efficient of vessel navigation in the Channel. The applicant asserts that the identified site is at a location in the Channel where there is an extremely restrictive, unavoidable turn in the Channel. This turn is responsible for significant delays in vessel transit in the Channel. The applicant states in their narrative, that JCEP could widen other areas of the Channel to improve navigational efficiency, but the proposed navigational reliability improvement site, is the location most in need of improvement to achieve the results in improved efficiency and safety of navigation required within the Channel. There are no other areas that could accommodate the proposed use/activity.

(A) The exception shall indicate on a map or otherwise describe the location of possible alternative areas considered for the use that do not require a new exception. The area for which the exception is taken shall be identified;

Staff Response: As explained above, the proposed NRI area is location-specific and the applicant indicates it would not be possible to locate them anywhere that does not require a new exception. A map of the proposed NRI is included as “Dredge Area 4” in Attachment A, Exhibit 1, Page 1 of 4.

(B) To show why the particular site is justified, it is necessary to discuss why other areas that do not require a new exception cannot reasonably accommodate the proposed use. Economic factors may be considered along with other relevant factors in determining that the use cannot reasonably be accommodated in other areas. Under this test the following questions shall be addressed:

(i) Can the proposed use be reasonably accommodated on resource land that would require an exception, including the destiny of uses on non-resource land? If not, why not?

(ii) Can the proposed use be reasonably accommodated on resource land that is already irrevocably committed to non-resource uses not allowed by the applicable goal, including resource land in existing unincorporated communities, or by increasing the density of uses on committed lands? If not, why not?

(iii) Can the proposed use be reasonably accommodated inside an urban growth boundary? If not, why not?

(iv) Can the proposed use be reasonably accommodated without the provisions of a proposed public facility or service? If not, why not?

Staff Response: The applicant states the proposed NRI areas are location-specific. These are the specific geographic locations where the channel is constrained. The applicant notes that in any case, it is not possible for JCEP to locate them anywhere that does not require a new exception. The proposed use does not relate to a public facility in the Channel, and will not require any additional public facilities or services to construct.

(C) The “alternative areas” standard in paragraph B may be met by a broad review of similar types of areas rather than a review of specific alternative sites. Initially, a local government adopting an exception need assess only whether those similar types of areas in the vicinity could not reasonably accommodate the proposed use. Site specific comparisons are not required of

a local government taking an exception unless another party to the local proceeding describes specific sites that can more reasonably accommodate the proposed use. A detailed evaluation of specific alternative sites is thus not required unless such sites are specifically described, with facts to support the assertion that the sites are more reasonable, by another party during the local exceptions proceeding.

Staff Response: The Applicant has indicated, and staff agrees, that the proposed NRI area is location-specific, as such; it is not possible for JCEP to locate them anywhere that does not require a new exception.

(c) "The long-term environmental, economic, social and energy consequences resulting from the use at the proposed site with measures designed to reduce adverse impacts are not significantly more adverse than would typically result from the same proposal being located in areas requiring a goal exception other than the proposed site." The exception shall describe: the characteristics of each alternative area considered by the jurisdiction in which an exception might be taken, the typical advantages and disadvantages of using the area for a use not allowed by the Goal, and the typical positive and negative consequences resulting from the use at the proposed site with measures designed to reduce adverse impacts. A detailed evaluation of specific alternative sites is not required unless such sites are specifically described with facts to support the assertion that the sites have significantly fewer adverse impacts during the local exceptions proceeding. The exception shall include the reasons why the consequences of the use at the chosen site are not significantly more adverse than would typically result from the same proposal being located in areas requiring a goal exception other than the proposed site. Such reasons shall include but are not limited to a description of: the facts used to determine which resource land is least productive, the ability to sustain resource uses near the proposed use, and the long-term economic impact on the general area caused by irreversible removal of the land from the resource base. Other possible impacts to be addressed include the effects of the proposed use on the water table, on the costs of improving roads and on the costs to special service districts;

Staff Response: The long-term economic, environmental, social and energy costs of widening other areas of the Channel that JCEP could feasibly widen are not materially different from the same consequences of making the improvements at the identified location.

(d) "The proposed uses are compatible with other adjacent uses or will be so rendered through measures designed to reduce adverse impacts." The exception shall describe how the proposed use will be rendered compatible with adjacent land uses. The exception shall demonstrate that the proposed use is situated in such a manner as to be compatible with surrounding natural resources and resource management or production practices. "Compatible" is not intended as an absolute term meaning no interference or adverse impacts of any type with adjacent uses.

Staff Response: The proposed NRI site is located immediately adjacent to the existing Channel. The adjacent uses to the Channel are transit of large vessels that currently call on the Port. The adjacent land use designation is Deep Draft –Development Aquatic (DA) unit.

According to the CBEMP, DA units "*include areas suitable for deep or shallow-draft navigation (including shipping and access channels or turning basins), sites and mining or mineral extraction areas, and areas adjacent to developed or developable shorelines which may need to be altered to provide navigational access or create new land areas for water-dependent uses.*" Additionally, the applicant's consultant (DEA) has submitted an environmental impacts report (Attachment A, Exhibit 5) that outlines plans to reduce adverse environmental impacts upon the waters of the Bay and Channel. This includes performing capital and maintenance dredging during the ODFW-approved in-water work window (October 1 to February 15) to reduce impacts to sensitive life stages of fish in the bay, using various dredging methods to minimize the effects on water turbidity within the bay, and applying best management practices associated with dredging (including cutter head suction, clamshell, and hopper dredging) to reduce turbidity effects. As a result of those methods JCEP expects increased water turbidity as a result of the NRIs to be temporary and limited to the immediate vicinity of dredging operations. The application is consistent with this criterion.

(3) If the exception involves more than one area for which the reasons and circumstances are the same, the areas may be considered as a group. Each of the areas shall be identified on a map, or their location otherwise described, and keyed to the appropriate findings.

Staff Response: The applicant's proposal seeks an exception to Goal 16 for one NRI site within the City's jurisdiction. The remaining three sites fall outside of City jurisdiction. To see a map of the proposed navigational reliability areas see Attachment A, Exhibit 1, Page 1 of 4, included in this staff report. This criterion does not apply.

ANALYSIS OF OAR 660-004-0022

OAR 660-004-0022 addresses, in greater detail, the "*types of reasons that may or may not be used to justify certain types of uses not allowed on resource lands.*" Consistency with any one of the ten alternatives outlined in OAR 660-004-0022 provides sufficient justification for a "reasons" exception. In seeking an approval of a Goal 16 exception as requested in this application, the applicant's representative advances two avenues in which a Goal 16 exception may be approved. The applicant proposes that the application meets the criteria for a goal exception under the general exceptions as indicated in OAR 660-004-0020(1); The applicant proposes that the application also meets the criteria for a goal exception through a second avenue under OAR 660-004-0022(8)(b).

Following is the staff response for both of these criteria.

OAR 660-004-0022

Reasons Necessary to Justify an Exception Under Goal 2, Part II(c

An exception under Goal 2, Part II(c) may be taken for any use not allowed by the applicable goal(s) or for a use authorized by a statewide planning goal that cannot comply with the approval standards for that type of use. The types of reasons that may or may not be used to justify certain types of uses not allowed on resource lands are set forth in the following sections of this rule. Reasons that may allow an exception to Goal 11 to provide sewer service to rural lands are described in OAR 660-011-0060. Reasons that may allow transportation facilities and improvements that do not meet the requirements of OAR 660-012-0065 are provided in OAR 660-012-0070. Reasons that rural lands are irrevocably committed to urban levels of development are provided in OAR 660-014-0030. Reasons that may justify the

establishment of new urban development on undeveloped rural land are provided in OAR 660-014-0040.

(1) For uses not specifically provided for in this division, or in OAR 660-011-0060, 660-012-0070, 660-014-0030 or 660-014-0040, the reasons shall justify why the state policy embodied in the applicable goals should not apply. Such reasons include but are not limited to the following:

(a) There is a demonstrated need for the proposed use or activity, based on one or more of the requirements of Goals 3 to 19; and either

(A) A resource upon which the proposed use or activity is dependent can be reasonably obtained only at the proposed exception site and the use or activity requires a location near the resource. An exception based on this paragraph must include an analysis of the market area to be served by the proposed use or activity. That analysis must demonstrate that the proposed exception site is the only one within that market area at which the resource depended upon can reasonably be obtained; or

(B) The proposed use or activity has special features or qualities that necessitate its location on or near the proposed exception site.

Staff Response: Under OAR 660-004-0022(1) the applicant must demonstrate a need for the proposed use/activity based on requirements of one or more State Planning Goals 3 to 19. In the applicant's case, the demonstrated need for the proposed NRI site is based primarily on Goal 9 (Economic Development) and 12 (Transportation). As explained in the applicant's narrative, structural restrictions on the Channel cause significant transit delays and unduly increase directional changes during transit through the Channel. Delays are measured in the total transit time, from the time the vessel arrives off the coast of Coos Bay until it returns offshore. Minimizing delay is a pressing need because companies that utilize the Port have identified new customers in Asia that desire to export cargo using bulk carriers that are slightly larger than the ships typically calling on the Port today. The Applicant points out there are various marine terminal businesses within Coos Bay that require assurances that terminals can efficiently accommodate larger dimension bulk carriers in the future. The proposed NRIs will allow companies to secure emerging opportunities to export products using today's larger vessels, including bulk carriers of up to 299.9 meters (983.3 feet) in length, 49 meters (160.8 feet) in beam, and 11.9 meters (39 feet) in draft. The applicant has included, in its application, a letter from the US Coast Guard to JCEP, indicating Coos Bay Pilots can safely and successfully maneuver carriers of up to 299.9 X 49m X 11.9 dimensionally while transiting the Channel. The letter is included in this staff report as Attachment A, Exhibit 4 (Page 15).

In their narrative, the Applicant asserts that JCEP and the Coos Bay Pilots believe the proposed navigational reliability improvement site is essential to achieve the required number of LNG vessel transits needed to lift the JCEP design annual LNG production volume. Excessive delays in LNG carrier transit in the Channel, to and from the LNG terminal, could result in a shore storage tank topping situation, requiring JCEP to curtail LNG production. The Coos Bay Pilots letter of support for the proposed NRI is included in this staff report as Attachment A, Exhibit 3, (Page 2). The proposed NRI will fulfill a demonstrated need for continued and enhanced shipping within the Bay; consistent with the policy objectives of Goals 9 and 12.

(8) Goal 16 – Other Alterations or Uses: An exception to the requirement limiting dredge and fill or other reductions or degradations of natural values to water-dependent uses or to the natural and conservation management unit requirements limiting alterations and uses is justified, where consistent with ORS chapter 196, in any of the circumstances specified in subsections (a) through (e) of this section:

Staff Response: The applicant also provided a response to the reasons exception alternative OAR 660-004-0022(8)(b). This is a specific exception to the requirement limiting dredging in an area that is currently designated, in accordance with Goal 16, as a natural management unit. The applicant has indicated the exception is justified because approval of the application will authorize dredging to maintain adequate depth to safely and more reliably permit continuation of the present level of navigation.

(b) Dredging to maintain adequate depth to permit continuation of the present level of navigation in the area to be dredged.

Staff Response: The applicant proposes dredging to maintain adequate depth to permit continuation of the presently authorized level of navigation at the proposed NRI site which is called out as an exception that is justified in subsection (8)(b), above. Most recently, the Channel was expanded from -35 feet to -37 feet in 1997. The proposed improvements are designed to increase the environmental operating window for all vessels entering the Bay by softening critical turns, relocating navigational aids to navigation, and reducing the required Channel directional changes. In turn, the proposed dredging will reduce entry and departure delays and allow for more efficient vessel transits through the Channel for the size of vessels calling on the Port today.

The applicant notes that, for JCEP, the proposed navigational reliability improvements will allow for transit of Liquid Natural Gas (LNG) vessels of similar overall dimensions to those listed in the July 1, 2008 US Coast Guard (USCG) Waterway Suitability Report, the USCG Letter of Recommendation dated May 10, 2018 and USCG letter confirmation dated November 7, 2018, but under a broader range of weather conditions, specifically higher wind speeds. As a result JCEP estimates that upon completion of the proposed navigational reliability improvement site, JCEP will be able to export the full capacity of the optimized design production of the LNG terminal on a consistent basis. For these reasons, the applicant advances a proposal that the dredging associated with the navigational reliability improvement will maintain adequate depth to permit continuation of the presently allowed level of navigation, and allow that navigation to occur more efficiently, safely and reliably. The aforementioned letters are included in this staff report as Attachment A, Exhibit 4.

(f) In each of the situations set forth in subsections (8) (a) to (e) of this rule, the exception must demonstrate that the proposed use and alteration (including, where applicable, disposal of dredged materials) will be carried out in a manner that minimizes adverse impacts upon the affected aquatic and shoreland areas and habitats.

<u>Staff Response:</u> The applicant indicates in their application that they will complete the proposed NRIs at the site in a manner that minimizes adverse impacts upon the affected aquatic and shoreland areas and habitats. The applicant plans to perform the proposed dredging during the Oregon Department of Fish and Wildlife (ODFW) approved in-water work window (October 1 to February 15) to reduce impacts to sensitive life stages of fish in the Bay.

Additionally, related to dredging practices and methods, the applicant indicates in their application that JCEP will use various dredging methods (described in Attachment A, Exhibit 5) to minimize the effects of the NRIs on water turbidity within the Bay. JCEP will use best management practices (including cutter head suction, clamshell, and hopper dredging) associated with dredging to reduce turbidity effects, and as a result of those methods JCEP expects any increased water turbidity as a result of the NRIs to be temporary and limited to the immediate vicinity of dredging operations. The applicant notes that dredging and material transport vessels will carry small volumes of petroleum in comparison to large bulk carriers and Panamax vessels that regularly traverse Coos Bay. JCEP will use best management practices to avoid and minimize spills or discharges during dredging operations and dredged material transport.

The applicant has not indicated what specific precautions they will take to minimize the risk of toxic discharges, or oil spills, but has indicated in Attachment A, Exhibit 5, (Page 8) they will take preventative measures such as an implementation of a spill prevention plan. Staff have included a condition of approval relating to the specific measures to be taken by the applicant and/or their dredging contractor in the event of an oil spill or toxic discharge in the form of a spill prevention and response plan.

> ***<u>Condition of Approval #1</u>: Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall provide the City of Coos Bay with a Spill Prevention and Response Plan addressing the potential for any unanticipated oil spill or toxic discharge, for review and approval.***

Dredging equipment and material transport vessels related to the proposed NRI site may generate temporary noise disturbances; however the noise will be localized to the immediate dredging area. The applicant states they do not anticipate that noise levels will have more than temporary effects on the behavior of aquatic species in the area of the proposed NRI site. The applicant's consultant, DEA has evaluated the proposal and provided additional details on potential adverse impacts associated with the proposed dredging. The report is included in this staff report as Attachment A, Exhibit 5.

VII. CRITERIA FOR ESTUARINE AND COASTAL SHORELAND USES ACTIVITIES PERMIT

CBMC – 17.52.010 General

Uses and activities permitted by the Coos Bay Estuary Management Plan are subject to general and special conditions and policies to comply with statewide planning goals and the Coos Bay Estuary Plan as adopted by the city of Coos Bay. Compliance with these conditions and policies must be verified; therefore, all uses and activities under jurisdiction of the Coos Bay Estuary Management Plan must be reviewed.

Staff Response: The applicant is seeking an Estuarine and Coastal Shoreline Uses and Activities permit to allow New and Maintenance Dredging in the DDNC-DA Estuarine Zone. The existing 52-NA aquatic management unit is located immediately adjacent to the federally authorized DDNC. Additionally, the applicant seeks an Estuarine and Coastal Shoreline Uses and Activities permit to allow for an accessory temporary dredge transport pipeline in the 52-NA, 53-CA, 54-DA, and 55-CA management zones. The dredge line is described in a memo included in this staff report as Attachment A, Exhibit 5, and depicted in Exhibit 6. All of the above mentioned management zones are within the City of Coos Bay's jurisdiction. New and Maintenance dredging in the DDNC-DA are subject to general conditions (CBEMP Policies #17 and #18) and a special condition, the mitigation of adverse impacts as described in CBEMP Policy #5, which as a result triggers the consideration of CBEMP Policies #4 and #4a.

COOS BAY ESTUARY MANAGEMENT PLAN (CBEMP) POLICIES

Below are CBEMP Policies pertinent to the subject application.

CBEMP Policy #17 - Protection of "Major Marshes" and "Significant Wildlife Habitat" in Coastal Shorelands

Local government shall protect major marshes, significant wildlife habitat, coastal headlands, and exceptional aesthetic resources located within the Coos Bay Coastal Shorelands Boundary and included in the Plan inventory, except where exceptions allow otherwise. Local government shall consider:

A. "major marshes" to include areas identified in the Goal #17 "Linkage Matrix" and the Shoreland Values inventory map;

B. "significant wildlife habitats" coastal headlands and exceptional aesthetic resources to include those areas identified, on the map "Shorelands Values."

This strategy shall be implemented through:

A. Plan designations and use and activity matrices set forth elsewhere in the Plan that limit uses in these special areas to those that are consistent with protection of natural values, and

B. Through use of the "Shoreland Values" map that identifies such special areas and restricts uses and activities therein to uses that are consistent with the protection of natural values. Such uses may include propagation and selective harvesting of forest products consistent with the Oregon Forest Practices Act, grazing, harvesting wild crops, and low-intensity water-dependent recreation.

A. "major marshes" to include areas identified in the Goal #17 "Linkage Matrix" and the Shoreland Values Inventory map;

B. "Significant wildlife habitats," coastal headlands and exceptional aesthetic resources to include those areas identified on the map "Shoreland Values."

This strategy recognizes that special protective consideration must be given to key resources in coastal shorelands over and above the protection afforded such resources elsewhere in this Plan.

<u>**Staff Response:**</u> According to the Shoreland Values map, there are no inventoried resources at the proposed navigational reliability improvement site for which CBEMP Policy #17 requires protection. Despite this preliminary conclusion, staff propose that CBEMP Policy #17 be included as a general condition of approval for dredging associated with the NRI. It is added as a condition under Section VIII.

CBEMP Policy #18 - Protection of Historical and Archaeological Sites Within Coastal Shorelands.

Local government shall provide special protection to historic and archaeological sites located within the Coos Bay Coastal Shorelands Boundary, except where Exceptions allow otherwise. These sites are identified in the section entitled: "Coastal Shoreland Values Requiring Mandatory Protection" and on the "Special Considerations Map." Further, local government shall continue to refrain from widespread dissemination of site-specific information about identified archaeological sites.

This strategy shall be implemented by requiring review of all development proposals involving an archaeological or historical site to determine whether the project as proposed would protect the archaeological and historical values of the site.

The development proposal, when submitted, shall include a site development plan showing, at a minimum, all areas proposed for excavation, clearing and construction. Within three (3) working days of receipt of the development proposal, the local government shall notify the Coos, Siuslaw, Lower Umpqua Tribal Council in writing, together with a copy of the site development plan. The Tribal Council shall have the right to submit a written statement to the local government within ten (10) days of receipt of such notification, stating whether the project as proposed would protect the historical and archaeological values of the site, or if not, whether the project could be modified by appropriate measures to protect those values.

"Appropriate measures" may include, but shall not be limited to the following:

- **A.** **Retaining the historic structure in situ or moving it intact to another site; or**
- **B.** **Paving over the site without disturbance of any human remains or cultural objects upon the written consent of the Tribal Council; or**
- **C.** **Clustering development so as to avoid disturbing the site; or**
- **D.** **Setting the site aside for non-impacting activities, such as storage; or**
- **E.** **If permitted pursuant to the substantive and procedural requirements of ORS 97.750, contracting with a qualified archaeologist to excavate the site and remove any cultural objects and human remains, reinterring the human remains at the developer's expense; or**

F. Using civil means to ensure adequate protection of the resources, such as acquisition of easements, public dedications, or transfer of title.

If a previously unknown or unrecorded archaeological site is encountered in the development process, the above measures shall still apply. Land development activities which violate the intent of this strategy shall be subject to penalties prescribed in ORS 97.990 (8) and (9). Upon receipt of the statement by the Tribal Council, or upon expiration of the Tribal Council's ten-day response period, the local government shall conduct an administrative review of the development proposal and shall:

A. Approve the development proposal if no adverse impacts have been identified, as long as consistent with other portions of this plan, or

B. Approve the development proposal subject to appropriate measures agreed upon by the landowner and the Tribal Council, as well as any additional measures deemed necessary by the local government to protect the historical and archaeological values of the site. If the property owner and the Tribal Council cannot agree on the appropriate measures, then the governing body shall hold a quasi-judicial hearing to resolve the dispute. The hearing shall be a public hearing at which the governing body shall determine by preponderance of evidence whether the development project may be allowed to proceed, subject to any modifications deemed necessary by the governing body to protect the historical and archaeological values of the site.

This strategy recognizes that protection of historical and archaeological sites is not only a community's social responsibility, but is also legally required by Goal #17 and OBS 97.745. It also recognizes that historical and archaeological sites are non-renewable cultural resources.

Staff Response: The applicant notes that the Shoreland Values Map does not indicate any known inventoried resources in this location to consider under this policy. Through correspondence with staff, members of the Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indian (Tribes), asserted that the Shoreland Values inventory map is old (2002) and that there may be resources in the vicinity of the NRI Site. During the course of the proposed development there may be unanticipated discovery of cultural resources, remains, and/or objects. The applicant has included, in their submission, a copy of a Memorandum of Agreement (MOA) between JCEP and the Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indian (Tribes) addressing these circumstances, and more broadly, Policy 18. A copy of the signed MOA is included with this staff report as Attachment A, Exhibit 9. The MOA incorporates a Cultural Resources Protection Agreement (CRPA) entered between JCEP and the Tribes in July of 2018. The CRPA provides a process for the exchange of project-related information, confidentiality requirements, commitments to mitigation, monitoring agreements, agreements for the treatment of unanticipated discovery of cultural resources, site access agreements, and cost recovery agreements. The CRPA includes an Unanticipated Discovery Plan (UDP), which provides procedures in the event of an unanticipated discovery of historic properties, archeological objects, archaeological sites or human remains, funerary objects, sacred items, and items of cultural patrimony, during the construction and operation of the proposed temporary dredge transport pipeline.

Staff proposes the following condition of approval to ensure compliance with respect to Policy #18

<u>Condition of Approval #2</u>: Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall provide evidence of compliance with the requirements of the enclosed MOA, CRPA, and UDP as agreed upon and signed by JCEP and the Confederated Tribes of Coos, Lower, Umpqua, and Siuslaw Indians, as well as consistency with any other provisions of Policy #18 of the CBEMP.

CBEMP Policy #5 – Estuarine Fill and Removal

<u>Staff Response</u>: JCEP's new and maintenance dredging activities must be consistent with CBEMP Policy #5. The DDNC-DA zone allows new and maintenance dredging. Because the Application includes a Goal 16 exception, Policy #5 requires only that the Application comply with criteria D. and E., because, as expressly noted within the Policy, the findings for the Goal 16 exception suffice for this Application to comply with criteria A - C.

Dredging and/or filling shall be allowed only:

A. If required for navigation or other water-dependent uses that require an estuarine location or if specifically allowed by the applicable management unit requirements of this goal; and

<u>Staff Response:</u> Staff agrees with the applicant's finding that Policy #5 indicates if an application includes the request for a goal exception, findings for the goal exception shall be sufficient for this criterion. As indicated earlier in this staff report, the proposed NRIs are required for navigational purposes within the Channel.

B. If no feasible alternative upland location exists; and

<u>Staff Response:</u> Staff agrees with the applicant's finding that Policy #5 indicates if an application includes the request for a goal exception, findings for the goal exception shall be sufficient for this criterion. As indicated earlier in this staff report, the proposed location of the NRIs is the only site JCEP can make the proposed necessary improvements to increase safety and efficient of vessel navigation in the Channel.

C. If a pubic need (i.e., a substantial public benefit) is demonstrated and the use or alteration does not unreasonably interfere with public trust rights; and

<u>Staff Response:</u> Staff agrees with the applicant's finding that Policy #5 indicates if an application includes the request for a goal exception, findings for the goal exception shall be sufficient for this criterion. As indicated earlier in this staff report, the applicant's proposal serves a public need by creating safer and more efficient navigation in the Channel, thereby promoting economic activity in the City of Coos Bay.

D. If adverse impacts are minimized; and

Staff Response: Compliance with criterion D directs the applicant to demonstrate how adverse impacts will be minimized, pursuant to CBEMP Policy #4a. Strategies, and best practices proposed by the applicant to minimize adverse impacts are mentioned earlier in this staff report. Additionally, the memo included in this staff report as Attachment A, Exhibit 5, outlines in detail, the measures and practices proposed by the applicant to minimize adverse impacts. .

E. The activity is consistent with the objectives of the Estuarine Resources Goal and with other requirements of state and federal law, specifically the conditions in ORS 541.615

Staff Response: Compliance with criterion E directs the applicant to demonstrate that the proposed NRIs are "*consistent with the objectives of the Estuarine Resource Goal and with other requirements of state and federal law, specifically the conditions in ORS 541.615 and Section 404 of the Federal Water Pollution Control Act (P.L. 92-500)*." The applicant asserts that the NRIs are consistent with the objectives of Goal 16 (Estuarine Resources Goal) because they represent a balance of estuary uses, protecting the economic values of the estuary while minimizing adverse impacts of the dredging activity. Staff concur to the extent that adverse impacts will be minimized as proposed. The application is consistent with other requirements of state and federal law, including the conditions in Section 404 of the Federal Water Pollution Control Act, and the conditions of ORS 541.615 (renumbered ORS 196.810), which requires a permit from the DSL to remove any material from the beds or banks of waters of the state. The applicant asserts that JCEP acknowledges this obligation, and all necessary DSL and Federal Section 404 authorizations will be obtained as a condition precedent to dredging.

Staff proposes the following condition of approval to ensure compliance with Policy #5(E):

> ***Condition of Approval #3:*** ***Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall obtain, and provide evidence of, all necessary DSL and Federal Section 404 authorizations. JCEP shall provide the City with copies of these approved authorizations for the record.***

Policy #5 (continued)

Other uses and activities which could alter the estuary shall only be allowed if the requirements in B, C, and D are met. All portions of these requirements may be applied at the time of plan development for actions identified in the Plan. Otherwise, they shall be applied at the time of permit review.

This strategy shall be implemented by the preparation of findings by local government documenting that such proposed actions are consistent with the Comprehensive Plan, and with criteria "a" through "e" above. However, where goal exceptions are included within this plan, the findings in the exception shall be sufficient to satisfy criteria "a" through "c" above. Identification and minimization of adverse impacts as required in "d" above shall follow the procedure set forth in Policy #4a. The findings shall be developed in response to a "request

for comment" by the Division of State Lands, which shall seek local government's determination regarding the appropriateness of a permit to allow the proposed action.

"Significant," as used in "other significant reduction or degradation of natural estuarine values," shall be determined by:

- **A.** **The U.S. Army Corps of Engineers through its Section 10 and 404 permit processes; or**
- **B.** **The Department of Environmental Quality for approvals of new aquatic log storage areas only; or**
- **C.** **The Department of Fish & Wildlife for new aquaculture proposals only.**

This strategy recognizes that Goal #16 limits dredging, fill, and other estuarine degradation in order to protect the integrity of the estuary.

Staff Response: CBEMP Policy #5 requires that other uses and activities which could alter the estuary only be allowed if the requirements in B, C, and D are met. The local government shall issue preparation of findings that such actions proposed by the applicant are consistent with the Comprehensive Plan, and with criteria "A" through "E" above. However, staff agrees with the applicant's finding that, where a goal exception is proposed as part of the request, the findings in the exception shall be sufficient to satisfy criteria "A" through "C" above. When addressing criteria "D", the applicant shall follow the procedure set forth in Policy #4a. Policy #4a outlines how resource capability consistency and impact mitigation is conveyed and insured for uses and activities within management units. Policy #4a is addressed specifically starting on Page 28.

CBEMP Policy #4 – Resource Capability Consistency and Impact Assessment

Local government concludes that all proposed actions (approved in this Plan) which would alter or potentially alter the estuarine ecosystem have been based upon a full consideration of the impacts of the proposed alteration, except for the following uses and activities:

A. Natural Management Units
- **Aquaculture**
- **Bridge crossings**
- **Log storage**

B. Conservation Management Units
- **Aquaculture**
- **Bulkheading**
- **Dike maintenance dredging**
- **High-intensity water-dependent recreation**
- **Log storage dredging**
- **Minor navigational improvements requiring dredging or fill**
- **Rip-rap**
- **Water intake or withdrawal and effluent discharge**

C. Development Management Units
- **Aquaculture**
- **Bulkheading (except for Aquatic Units #3DA, 5DA, and 6DA)**

- Dredging
- Fill
- Flow lane disposal of dredged material
- In-water structures
- Mining and mineral extraction
- New or expanded log storage
- Water-related and nondependent, nonrelated uses not requiring fill

D. Any other uses and activities which require the resource capability consistency test as a condition within a particular management unit or which could affect the estuary's physical processes or biological resources. Unless fully addressed during the development and adoption of comprehensive plans, actions, which would potentially alter the estuarine ecosystem, shall be preceded by a clear presentation of the impacts of the proposed alteration.

Unless fully addressed during the development and adoption of comprehensive plans, actions, which would potentially alter the estuarine ecosystem, shall be preceded by a clear presentation of the impacts of the proposed alteration.

For uses and activities requiring the resource capabilities test, a special condition is noted in the applicable management unit uses/activities matrix. A determination of consistency with resource capability and the purposes of the management unit shall be based on the following:

A. A description of resources identified in the plan inventory;

B. An evaluation of impacts on those resources by the proposed use (see impact assessment procedure, below); and

C. In a natural management unit, a use or activity is consistent with the resource capabilities of the area when either the impacts of the use on estuarine species, habitats, biological productivity and water quality are not significant or that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner to protect significant wildlife habitats, natural biological productivity, and values for scientific research and education.

D. In a conservation management unit a use or activity is consistent with the resource capabilities of the area when either the impacts of the use on estuarine species, habitats, biological productivity and water quality are not significant or that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner which conserves long-term renewable resources, natural biologic productivity, recreational and aesthetic values and aquaculture.

The impact assessment need not be lengthy or complex, but it should enable reviewers to gain a clear understanding of the impacts to be expected. It shall include information on:

A. The type and extent of alterations expected;

B. The type of resource(s) affected;

C. The expected extent of impacts of the proposed alteration on water quality and other physical characteristics of the estuary, living resources, recreation and aesthetic use, navigation and other existing and potential uses of the estuary; and

D. The methods which could be employed to avoid or minimize adverse impacts.

This policy is based on the recognition that the need for and cumulative effects of estuarine developments were fully addressed during the preparation of this Plan and that, except as otherwise stated above, no additional findings are required to meet Implementation Requirement #1 of LCDC Goal 16.

Staff Response: CBEMP Policy #4 requires findings demonstrating the public's need and gain that would warrant any modification or loss to the estuarine ecosystem, based upon a clear presentation of the impacts of the proposed alteration, as implemented in Policy #4a. None of the prerequisites to providing notice to state agencies under Policy #4a are triggered. Therefore, this policy, to the extent that it is applicable, requires the City to perform the impacts assessment consistent with CBEMP Policy #4.

The applicant asserts that CBEMP Policy #4 is not applicable to the Application pursuant to state law. The applicant notes that LUBA has held, and the Court of Appeals has affirmed, that "*[w]hen a goal exception is taken to facilitate proposed development, any comprehensive plan policies that implement the goal for which the exception is taken no longer govern that development.*" *Friends of Marion County, 59 Or LUBA at 350-351, aff'd 233 Or App at 488*. The Applicant requests an exception to Goal 16 to facilitate dredging in a natural management unit. As the last sentence of CBEMP Policy #4 clearly states, the purpose of this policy is to implement Goal 16. Staff agrees with this assertion by the Applicant.

Staff note that this project will require state and federal permits and an assessment of environmental impacts will be done.

CBEMP Policy #4a - Deferral of (A) Resource Capability Consistency Findings and (B) Resource Impact Assessments

Local government shall defer, until the time of permit application, findings regarding consistency of the uses/activities listed in Policy #4 with the resource capabilities of the particular management unit.

Additionally, the impact assessment requirement for those uses/activities as specified in Policy #4 shall be performed concurrently with resource capability findings above at the time of permit application.

This strategy shall be implemented through an Administrative Conditional Use process that includes local cooperation with the appropriate state agencies such that:

A. Where aquaculture is proposed as a use, local government shall notify the Oregon Department of Fish and Wildlife (ODFW) in writing of the request, together with a map of the proposed site;

B. **Where <u>log storage dredging</u> is proposed as an activity, local government shall notify the Oregon Department of Environmental Quality (DEQ) in writing of the request, together with a map of the proposed site.**

Within twenty (20) days of receipt of the notification, ODFW or DEQ, as appropriate, shall submit in writing to local government a statement as to whether the proposed use/activity will be consistent with the resource capabilities of the management segment, or if determined to be not consistent, whether the proposal can be made consistent through imposition of conditions on the permit. The appropriate state agency shall also perform the impact assessment required in Policy #4. If no statement is received from the affected state agency by the expiration of the twenty (2) day period, local government shall presume consistency of the proposal with the resources capabilities of the management segment, shall make findings appropriate to the presumption, and shall perform the assessment of impacts required by Policy #4.

For all other uses/activities specified above, local government shall determine appropriate findings whether the proposed use/activity is consistent with the resource capabilities of the management segment and shall perform the assessment of impacts required by Policy #4.

This strategy recognizes:

A. **That resource capability consistency findings and impact assessments as required by LCDC Goal #16 can only be made for the uses specified above at the time of permit application, and**

B. **That the specified state agencies have expertise appropriate to assist local government in making the required finding and assessments.**

This strategy is based upon the recognition that the need for and cumulative effects of estuarine developments were fully addressed during development of this Plan and that no additional findings are required to meet Implementation Requirement #1 of Goal #16.

<u>Staff Response:</u> As noted above, because neither aquaculture nor log storage dredging are proposed, none of the prerequisites to providing notice to state agencies under Policy #4a are triggered. Therefore, this policy requires the City to perform the impacts assessment consistent with CBEMP Policy #4. The City has completed that assessment, including the content of the memo included as Attachment A, Exhibit 5.

As with Policy #4, the applicant asserts that CBEMP Policy #4a is not applicable to the Application pursuant to state law. The applicant notes that LUBA has held, and the Court of Appeals has affirmed, that "[w]hen a goal exception is taken to facilitate proposed development, any comprehensive plan policies that implement the goal for which the exception is taken no longer govern that development." Friends of Marion County, 59 Or LUBA at 350-351, aff'd 233 Or App at 488. The Applicant requests an exception to Goal 16 to facilitate dredging in a natural management unit. As the last sentence of CBEMP Policy #4 clearly states, the purpose of this policy is to implement Goal 16. Staff agrees with this finding by the Applicant.

VIII. Conditions of Approval

Staff has identified and recommends the following conditions for Planning Commission and City Council consideration and Council action to authorize the project:

<u>Condition of Approval #1</u>: Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall provide the City of Coos Bay with a spill prevention and response plan addressing the potential any unanticipated oil spill or toxic discharge for review and approval.

<u>Condition of Approval #2</u>: Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall provide evidence to the Coos Bay Community Development Director, of compliance with the requirements of the enclosed MOA, CRPA, and UDP as agreed upon and signed by JCEP and the Confederated Tribes of Coos, Lower, Umpqua, and Siuslaw Indians.

<u>Condition of Approval #3</u>: Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall obtain, and provide evidence to the Coos Bay Community Development Director, of all necessary DSL and Federal Section 404 authorizations. JCEP shall provide the City with copies of these approved authorizations for the record.

<u>Condition of Approval #4</u>: City of Coos Bay Public Works has identified an existing utility that is installed under the Bay in the vicinity of the proposed navigational reliability improvements. Prior to the commencement of any dredging associated with an Estuarine and Coastal Shoreline Uses and Activities permit, JCEP shall provide evidence to the Coos Bay Community Development Director, that the proposed dredging activity shall not impact this existing utility.

<u>Condition of Approval #5</u>: As a general condition, and in the event that additional analysis or circumstance reveals relevant and previously unknown or unmapped shoreland resources, all dredging activity must remain consistent with CBEMP Policy #17 - Protection of "Major Marshes" and "Significant Wildlife Habitat" in Coastal Shorelands.

IX. Conclusion

Based on the evidence in the record, it is staff's conclusion that the applicable criteria can be met with the conditions of approval proposed.

X. Attachments

Attachment A: Application(s)

Exhibit 1: NRI (Dredge Detail)

Exhibit 2: Pre-Application Conference Notes

Exhibit 3: Support Letters (Roseburg Forest Products, Coos Bay Pilots Association, Port)

Exhibit 4: Jordan Cove LNG Coast Guard Letter of Recommendation/Analysis

Exhibit 5: Memo describing dredge work and impacts
Exhibits 6 & 7: Site and Context Maps
Exhibit 8: Property Owner (DSL) Certification and Consent
Exhibit 9: Memorandum of Agreement between JCEP and the Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians

Attachment B: Comprehensive Plan Update Map(s)

ATTACHMENT A

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February 4, 2019

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VIA EMAIL ONLY

Henry O. Hearley
Assistant Planner
Lane Council of Governments
859 Willamette Street
Suite 500
Eugene, OR 97401

Re: Concurrent Land Use Applications by Jordan Cove Energy Project L.P.
Coos Bay Estuary Navigation Reliability Improvements
City of Coos Bay File Nos. ___________

Dear Henry:

As you are aware, this office represents Jordan Cove Energy Project L.P. ("JCEP"), the applicant requesting City of Coos Bay ("City") approval of concurrent land use applications ("Applications") to authorize navigation reliability improvements on approximately 3.3 acres in the 52-NA estuary zone. This letter and its enclosures respond to your December 20, 2018 letter, which requested additional information about the Applications.

Enclosed please find an amended and restated application submittal, which we request that the City and the Lane Council of Governments ("LCOG") accept in place of the original submittal. The amended and restated submittal includes the complete application filing, which has been revised to include a revised application form, a revised application narrative, additional pages in Exhibit 1, and new Exhibits 7, 8, and 9. For convenience, we have also included a "track changes" version of the narrative showing the changes from the original version.

Further, thank you for raising the numbered questions that you did in your December 20, 2018 letter. JCEP responds to these questions below. The letter includes your numbered questions in bold followed by JCEP's responses.

1. Narrative Page 6 - CBMC - 17.215.020

Please include an update in your narrative to reflect the "Type III - with Council approval" approach that the City has agreed to pursue on the application.

RESPONSE: JCEP has included this update at pp. 6-7 of the revised narrative.

2. Narrative Page 7 - Approval Criteria

Please address the (Economic Development) Policy 1.5 of the CBCP

RESPONSE: JCEP has addressed this policy at pp. 8-9 of the revised narrative.

Although the CBEMP contains the policy language for Estuarine Resources, please address consistency with the stated Goal of the Estuarine Resources Element of the CBCP.

RESPONSE: For two reasons, the City should find that the Goal of the Estuarine Resources Element of the Coos Bay Comprehensive Plan ("CBCP") is not applicable to the Applications. First, in general, consistency with the CBCP goals is not an approval criterion for a plan amendment. *See* Coos Bay Development Code 17.215.060(1) (requiring consistency with the applicable policies of the comprehensive plan). Second, the CBCP Estuarine Resources Goal is not applicable because it implements Statewide Planning Goal ("Goal") 16, and JCEP is requesting an exception to Goal 16 as part of the Applications. *See Friends of Marion County v. Marion County*, 59 Or LUBA 323, 350-351, *aff'd* 233 Or App 488, 227 P3d 198 (2010) ("[w]hen a goal exception is taken to facilitate proposed development, any comprehensive plan policies that implement the goal for which the exception is taken no longer govern that development").

Please address the Land Use Policies: LU.4, LU.5 and LU.7 of the CBCP.

RESPONSE: JCEP has addressed these policies at pp. 9-10.

3. Narrative Page 9 - Statewide Planning Goal 1: Citizen Involvement

Please include an update in your response to reflect the "Type III - with Council approval" approach that the City has agreed to pursue on the application.

RESPONSE: JCEP has updated this response at pp. 11-12 of the revised narrative.

4. Narrative Page 10 - Statewide Planning Goal 6: Air, Water Land Resources Quality

Please clarify the following response;

> ***"Applicant anticipates that completing the NRIs will have effects upon air, water and land resources in the City, but these effects will be temporary, insignificant, or both, and Applicant will construct the NRIs using methods to protect these resources."***

This language seems contradictory (i.e. does the applicant anticipate that effects could be non-temporary or significant?). Do you feel comfortable stating that the applicant anticipates that "these effects will be both temporary and insignificant"?

RESPONSE: JCEP has revised its response to Goal 6 at p. 13 of the revised narrative to remove the passage in question.

5. Narrative Page 22 - OAR 660-004-0022(8)

Please clarify your response to this criterion. Goal 16 exception clarity is required for the relevance of 660-004-0022(8)(b) to the proposal. The provision describes permitting the *"continuation of the present level of navigation."* The response identifies the proposal as the *"minimum amount necessary to provide...channel depth...for enhanced navigation."*

RESPONSE: JCEP has clarified its response to OAR 660-004-0022(8)(b) at pp. 25-26 of the revised narrative.

The narrative also calls out 660-004-0022(8)(e) as being applicable. Please elaborate on the Goal 16 Exception applicability of this provision.

RESPONSE: The reference to OAR 660-004-0022(8)(e) in the narrative was a typographical error. OAR 660-004-0022(8)(e) explains how to justify an exception to alter or expand an existing public non-water-dependent use or a nonsubstantial fill for a private non-water-dependent use. The Applications do not request an exception for these uses/activities. Therefore, the City should find that OAR 660-004-0022(8)(e) is not applicable to the Applications.

6. Narrative Page 27 -

In the response at the very top of the page please clarify that, although prepared to address three NRIs, the application represented by the narrative addresses the approval of one NRI (Dredge Area 4).

RESPONSE: JCEP has made this clarification at p. 30 of the revised narrative.

7. Narrative related to the Coos Bay Estuarine Management Plan (CBEMP) Pages 28 - 37.

Review of your submitted application narrative revealed inconsistencies between the language of the CBEMP that was provided to LCOG and specific language that you responded to. Policy #5: Estuarine Fill and Removal is an example of language that appears inconsistent. Attached is the latest adopted version of the CBEMP. Please provide criteria responses in your narrative consistent with this version.

RESPONSE: JCEP has included the current version of the relevant CBEMP policies, and where appropriate, has updated its responses to same at pp. 32-43 of the revised narrative.

Thank you for your attention to the points in this letter. Please feel free to contact me with any further questions.

Very truly yours,

Seth J. King

Encls.
cc: Carolyn Johnson, City of Coos Bay (via email) (w/encls.)
Jake Callister, LCOG (via email) (w/encls.)
Steve Pfeiffer, Perkins Coie LLP (via email) (w/encls.)
Client (via email) (w/encls.)

City of Coos Bay
Community Development · 500 Central Avenue · Coos Bay, Oregon 97420
Telephone 541.269.1181 · Fax 541.269.8916 · coosbay.org

LAND USE DEVELOPMENT REVIEW APPLICATION

For Office Use Only	
STAFF CONTACT	PROJECT NO(S).

Type of Review (Please check all that apply):

- [ ] Annexation
- [ ] Appeal and Review
- [ ] Architectural Design Review
- [ ] Conditional Use
- [ ] Cultural Resources
- [X] Estuarine Use/Activities
- [ ] Home Occupation
- [X] Legislative/Text Amendment
- [ ] Lot Line Adjustment
- [ ] Partition
- [ ] Planned Unit Development
- [ ] Site Plan and Architectural Review
- [ ] Subdivision
- [ ] Temporary Use
- [ ] Vacation
- [ ] Variance
- [ ] Zone Change
- [X] Other Plan amendment

Pre-Application applications require a different application form available on the City website or at City Hall.

Site Location/Address:	Assessor's Map No./Tax Lot(s):
Coos Bay Estuary	Zoning: Multiple
	Total Land Area:

Detailed Description of Proposal:

Navigation reliability improvements in Coos Bay:
(1) Map amendment for approximately 3.3 aces from 52-NA to DDNC-DA;
(2) Text amendment to City of Coos Bay Comprehensive Plan to take reasons exception to Statewide Planning Goal 16; and
(3) Estuarine and Coastal Shoreline Uses and Activities Permit to allow dredging in DDNC-DA; temporary pipeline in 52-NA, 53-CA, 54-DA, and 55-CA; and buoy in 52-NA.

Applicant/Owner Name: Jordan Cove Energy Project L.P. Phone:
(please print)
Address: Attn: Meagan Masten, 111 SW 5th Avenue, Suite 1100 Email: mmasten@pembina.com
City State Zip: Portland, OR 97204

Applicant's Representative: Seth King Phone: 503.727.2024
(please print)
Address: Perkins Coie LLP, 1120 NW Couch Street, Tenth Floor Email: sking@perkinscoie.com
City State Zip: Portland, OR 97209

1. Provide evidence that you are the owner or purchaser of the property or have the written permission of owner(s) to make an application.
2. Copy of the deed for the subject property.
3. Attach (a) a certified list of names and addresses of all owners of property within designated distance of the exterior boundaries of the subject property according to the latest adopted County tax role and (b) an assessor's map showing all lots and parcels of land within that area.
4. Address the Decision Criteria or Goals/Standards outlined in the Coos Bay Municipal Code chapter(s) related to your request.
5. Additional information: Date construction is expected to begin; estimated completion date of the total project and of individual segments; and anticipated future development.
6. **Ten (10) complete hard-copy sets** (single sided) of application & submitted documents must be included with this application.
One (1) complete set of digital application materials must also be submitted electronically or on CD in Word format.
Additional copies may be required as directed by the Coos Bay Director of Community Development.

The undersigned property owner(s) hereby authorizes the filing of this application, and authorizes on site review by authorized staff. I hereby agree to comply with all code requirements applicable to my application. Acceptance of this application does not infer a complete submittal. All amendments to the Coos Bay Development Code and to other regulations adopted after the application is approved shall be enforced where applicable. Approved applications and subsequent development is not vested under the provisions in place at the time of the initial application.

Natalie Eades	2/4/19	See application materials	
Applicant's signature	Date	Owner's signature ***(required)***	Date

BEFORE THE PLANNING COMMISSION AND

CITY COUNCIL OF THE CITY OF COOS BAY, OREGON

In the Matter of Requests to Improve the Navigation Efficiency and Reliability of the Coos Bay Deep Draft Navigation Channel Pursuant to the Following Applications: (1) Map Amendment to the Coos Bay Estuary Management Plan to Change the Designation of Approximately 3.3 Acres from 52-NA to DDNC-DA; (2) Text Amendment to the City of Coos Bay Comprehensive Plan to take a Reasons Exception to Statewide Planning Goal 16 to Authorize this Map Amendment; (3) Estuarine and Coastal Shoreline Uses and Activities Permit For "New And Maintenance Dredging" in the DDNC-DA Estuarine Zone; and (4) Estuarine and Coastal Shoreline Uses and Activities Permit to Allow an Accessory Temporary Dredge Transport Pipeline in the 52-NA, 53-CA, 54-DA, and 55-CA Estuarine Zones and an Accessory Buoy in the 52-NA Estuarine Zone.

NARRATIVE IN SUPPORT OF THE APPLICATIONS FILED BY JORDAN COVE ENERGY PROJECT L.P.

I. Land Use Requests.

Jordan Cove Energy Project L.P. ("JCEP") proposes to make navigation efficiency and reliability improvements to the City of Coos Bay ("City")-designated Coos Bay Deep-Draft Navigation Channel ("Channel") by dredging a submerged area lying adjacent to the existing Channel.[1] This dredging will allow for vessel transit under a broader

[1] JCEP is also proposing to widen and deepen the Channel in three additional locations, which are subject to the planning and zoning jurisdiction of Coos County. That request is outside the scope of this Application. JCEP is filing a separate land use application with Coos County to obtain authorization for the navigability enhancements at these other three locations.

weather window to enable JCEP to export the full capacity of the optimized design production of 7.8 metric tonnes per annum ("mtpa") from JCEP's liquefied natural gas ("LNG") terminal on the nearby North Spit.

JCEP submits the following concurrent applications (together, "Application") to the City to seek local land use authorization to complete these improvements to the Channel:

(1) Post-acknowledgment amendments to the Coos Bay Estuary Management Plan ("CBEMP") map to change the zoning designation of approximately 3.3 acres located approximately 2,700 feet from the end of the North Bend airport runway within the Coos Bay estuary ("Navigation Reliability Improvement Site" or "NRI Site") from 52-NA to DDNC-DA, as further depicted in Exhibit 1;

(2) A post-acknowledgment text amendment of the CBEMP, which is part of the City of Coos Bay Comprehensive Plan ("CBCP"), to take a reasons exception to Statewide Planning Goal ("Goal") 16 to authorize the rezone of the NRI Site to DDNC-DA;

(3) Estuarine and Coastal Shoreline Uses and Activities Permit in the DDNC-DA estuarine zone to allow new and maintenance dredging at the rezoned NRI Site. The activities at the NRI Site will be referred to in this narrative as the "NRIs;"

(4) Estuarine and Coastal Shoreline Uses and Activities Permit in the 52-NA, 53-CA, 54-DA, and 55-CA estuarine zones to allow a temporary pipeline to transport the dredge spoils from the NRI Site to approved disposal sites and a buoy as accessory uses to the primary dredging activity. JCEP is not seeking approval of the dredged materials disposal activity in conjunction with this Application.

This narrative provides the evidentiary basis and related analysis demonstrating how the Application satisfies the applicable approval criteria set forth in the Statewide Planning Goals ("Goals"), the Oregon Revised Statutes ("ORS"), the CBEMP, the CBCP, and the City of Coos Bay Development Code ("CBDC"). Based upon this evidence and argument, the City should approve the Application.

JCEP discussed this proposal with the City in a pre-application conference on February 2, 2017. A copy of the pre-application conference notes prepared by the City are included in Exhibit 2.

II. Description of Request.

A. Current Constraints on Utilizing the Channel.

The Channel serves a vital purpose because it provides the only safe vessel access to and from Coos Bay and the Pacific Ocean for marine terminals located along the Bayfront. The Channel was initially authorized in 1899 and since then has undergone ten modifications. Most recently, the Channel was expanded from -35 feet to -37 feet in 1997 to allow for the safe navigation and transit of Coos Bay for the size of ships prevalent during that time period. However, over the last 20 years the dimensions and tonnage of ships serving terminals in Coos Bay has increased. The size of vessels typically calling on Coos Bay terminals has increased from an average of 45,422 Metric Tonnes to an average of 52,894 Metric Tonnes with a projected near-term vessel size of 70,400 Metric Tonnes.

Currently, environmental conditions, including wind, fog, and currents, coupled with the increasing ship size explained above, have caused the Coos Bay Pilots Association[2] ("Pilots") to impose ever more limiting restrictions on when vessels may safely transit the Channel. These restrictions, in turn, cause significant delays and increased pressure on the Pilots to navigate ships through the Channel. Delays are measured in the total transit time, from the time the vessel arrives off the coast of Coos Bay until it returns offshore after calling at its local Coos Bay destination. These delays generally decrease the efficiency and competitiveness of maritime commerce on a global scale, thereby jeopardizing continued success for maritime commerce in Coos Bay. Minimizing delay is a pressing need because companies that utilize the port of Coos Bay have identified potential new customers in Asia that desire to export cargo using bulk carriers that are slightly larger than the ships typically calling today. Various marine terminal businesses within Coos Bay require assurances that terminals can efficiently accommodate larger dimension bulk carriers in the future.

B. How NRIs will Improve Navigation Efficiency and Reliability.

Dredging to complete the NRI Sites will increase the operational window to safely transit any vessel through the Channel. The NRIs, which are described in more detail

[2] The Pilots, regulated and approved by the State of Oregon, are responsible for supporting deep sea vessel Masters in navigating their vessels into and out of the Channel. Pilotage is mandatory in Oregon. The Pilots serve a vital function for maritime commerce in Coos Bay because they safely and efficiently guide vessels through the Channel (known as pilotage) using visual aids, radar, and other means. The Channel provides the only safe vessel access to marine terminals within Coos Bay. Pilots are trained to navigate the Channel and therefore have detailed knowledge of its bathymetric conditions and visual layout.

below, are designed to increase the environmental operating windows for all ships entering Coos Bay by softening critical turns, relocate aids to navigation and reduce the required Channel directional changes. The NRIs are designed to reduce entry and departure delays and allow for more efficient vessel transits through the Channel for the size of vessels entering the Port today.

The NRIs will allow companies to secure emerging opportunities to export products with today's larger vessels, including bulk carriers of up to 299.9 meters (983.3 feet) in length and 49 meters (160.8 feet) in beam and 11.9 meters (39 feet) in draft. Although log export vessels serving the upper bay are smaller, the proposed enhancements also benefit these vessels by broadening the tidal and environmental windows for transiting the Channel, providing an enhanced margin of safety and improved efficiency in the loaded vessel departure schedule. Both Roseburg Forest Products and the Pilots have submitted letters of support for the NRIs. *See* Exhibit 3.

For JCEP and its LNG terminal, the NRIs will allow for transit of LNG vessels of similar overall dimensions to those listed in the July 1, 2008 United States Coast Guard ("USCG") Waterway Suitability Report, the USCG Letter of Recommendation dated May 10, 2018 and USCG letter confirmation dated November 7, 2018 *see* Exhibit 4, but under a broader range of weather conditions, specifically higher wind speeds. As a result, JCEP estimates that, upon completion of the NRIs, JCEP will be able to export the full capacity of the optimized design production of the LNG Terminal on a consistent annual basis.

C. Description of Channel NRIs.

Maps and cross-sections of the NRI Site are included in Exhibit 1. In the City, the specific navigation improvements at the NRI Site consist of the following:

- NRI #4 (NRI #1 - #3 are subject to Coos County jurisdiction): JCEP proposes to widen the turn from Lower Jarvis Range to Jarvis Turn Range channels from the current 500 feet to 600 feet at the apex of the turn from the current 1,125 feet to about 1,750 feet, which will allow vessels to commence their turn in this area sooner.

The NRI Site would be dredged to a -37-foot MLLW elevation to match the current depth of the Channel. Dredging of the NRIs would include a two-foot over-dredge allowance and a two-foot advanced maintenance allowance (total depth: -41-feet MLLW). Channel side slopes would be constructed at a 4:1 horizontal to vertical slope. Notably, these improvements have been identified by the USCG as a required navigation risk mitigation measure for the JCEP terminal operations. *See* Letter of Recommendation from USCG dated May 10, 2018 in Exhibit 4.

D. Proposed Dredging and Accessory Activities.

JCEP will accomplish the Channel enhancements by dredging at each of the NRI Sites. Dredging would be accomplished with mechanical or hydraulic methods. The specific characteristics of the dredging are described in the memorandum from David Evans & Associates ("DEA") included in Exhibit 5.

All work associated with the NRIs will take place during the approved in-water work period for Coos Bay (October 1 to February 15).

JCEP will place initial and future dredged material derived from the NRI Sites at the APCO 1 and 2 sites near the southern terminus of the U.S. Highway 101 McCullough Bridge. These sites are located in the City of North Bend; JCEP will file a separate application with that city to authorize disposal of these dredge spoils in these locations.

If dredging by hydraulic methods, JCEP will utilize a 24- to 36-inch temporary dredge pipeline to transport the dredged material to the disposal sites on the bottom or horizontal extent of the Channel to reduce potential conflicts with vessel navigation. The maximum distance from the NRIs to the APCO sites is approximately 8.3-miles. The dredge line is illustrated in Exhibit 6. Booster pumps would be required to move the material to the disposal sites through the pipeline. A segment of the temporary dredge line is located in the City of North Bend; JCEP will file a separate application with that city to authorize that segment of the line. In conjunction with and as a result of the dredging activity, JCEP will place a buoy on the south side of the Channel in the City. The general location of the buoy is illustrated in Exhibit 7.

III. Applicable Approval Criteria.

The Application complies with all applicable approval criteria, as follows.

A. Comprehensive Plan Map Amendment

1. CBDC - 17.215.010 Comprehensive plan amendment.

(1) The boundaries of the comprehensive plan map designations and the comprehensive plan text may be amended as provided in CBDC 17.215.020.

(2) The city may amend its comprehensive plan and/or plan map. The approval body shall consider the cumulative effects of the proposed comprehensive plan and/or map amendments on other zoning districts and uses within the general area. Cumulative effects include sufficiency

of capital facilities services, transportation, zone and location compatibility, and other issues related to public health and safety and welfare the decision making body determines to be relevant to the proposed amendment.

RESPONSE: This Application requests an amendment of the CBCP map to change the CBCP designation of the NRI Site from 52-NA to DDNC-DA. The cumulative effects of such an amendment would be to facilitate an increase in safety and efficiency of navigation in the Channel, as described in Section II. of this narrative above. Therefore, the cumulative effect of the Application is to augment transportation in the bay. The Application is compatible with the zone because new and maintenance dredging is allowed in the DDNC-DA district (and because this Application requests a comprehensive plan map amendment to render the NRI Site with a DDNC-DA designation). The Application will not have cumulative effects on the sufficiency of capital facilities services, or health and welfare. Therefore, the City can find that the Application satisfies this criterion.

CBDC - 17.215.020 Initiation of Amendment

Amendments of the comprehensive plan text or map, zoning map, or this title may be initiated by the following:

(1) A Type III application, CBDC 17.130.100, Type III procedure, by one or more owners of the property proposed to be changed or reclassified consistent with the adopted comprehensive plan; or

(2) A Type IV legislative process, CBDC 17.130.110, Type IV procedure, by motion of the planning commission and adoption by the city council.

RESPONSE: The underlying landowner of the NRI Site, the Department of State Lands, has authorized the submittal of the Application. *See* Exhibit 8. Subsection (1) permits the landowner to initiate a plan text or map or zoning map amendment. The City should find that the Application has been correctly initiated pursuant to subsection (1) above.

Subsection (1) directs the City to follow the Type III review and decision-making procedures of CBDC 17.130.100 when reviewing the Application. These procedures typically apply to quasi-judicial applications and thus provide greater procedural protections to JCEP and members of the public. The Application is quasi-judicial in nature because it involves a single landowner, a limited geographic area, is not City-initiated, and concerns the application of existing policies to a specific set of facts.

Therefore, subject to one modification explained below, the City should review and decide upon the Application pursuant to the City's Type III procedures.

The modification is appropriate in this case in order to comply with state law. CBDC 17.130.100 ("Type III procedure") provides that a Type III application "will be considered at one or more public hearings before the city's planning commission." A Type III application does not as a matter of course go before the City Council. *See* CBDC 17.130.130(5)(c) (providing for City Council consideration of a Type III application but only in event of appeal). State law requires the local governing body to take final action to approve any post-acknowledgment comprehensive plan amendment before it can become final. *Housing Land Advocates v. City of Happy Valley*, __ Or LUBA __ (LUBA No. 2016-031, May 23, 2016). The Application includes a request for an exception to Goal 16, which is a request for a plan text amendment. Therefore, pursuant to *Housing Land Advocates*, the City should schedule the Application for final action by the City Council after the Planning Commission's initial decision.

In sum, the City should apply its Type III process in CBDC 17.30.100 to review and decide upon the Application, subject to also providing for a hearing and final decision on the Application by the City Council.

CBDC - 17.215.060 Approval Criteria

1) For a Type III or Type IV review, the city council shall approve the proposal upon findings that:

(a) The proposed amendment is consistent with the applicable policies of the comprehensive plan or that a significant change in circumstances requires an amendment to the plan or map;

<u>**RESPONSE**</u>**:** This Application to change the CBCP designation of the NRI Site from 52-NA to DDNC-DA is consistent with the applicable policies of the comprehensive plan.

CBCP Policies

NRH.8 Coos Bay shall encourage the preservation and protection of riparian vegetation as an important fish and wildlife habitat and as a viable means of flood control by enactment of appropriate property development ordinances providing protection by establishing buffer strips along waterways, along designated HUD floodways, with the exception of navigable waterways. This strategy recognizes that such land use practices are necessary (1)

to preserve the area's natural resources, and (2) to eliminate unnecessary drainage and erosion problems often accompanying development.

<u>RESPONSE</u>: JCEP anticipates possible temporary, but not permanent, impacts to shoreline habitat, including to riparian vegetation, where JCEP plans to offload dredged material for processing. These temporary impacts would be limited to a corridor approximately 10 feet wide. Furthermore, JCEP would locate this corridor in the field (location by the dredging contractor) to minimize impacts to vegetation and aquatic resources. Regardless, NRH.8 does not affirmatively obligate JCEP to take any action, but rather obligates the City to "encourage" preservation of riparian vegetation "by placing buffer strips along waterways, along designated HUD floodways, with the exception of navigable waterways." JCEP will comply with any regulations the City has implemented in accordance with its obligation to so "encourage" preservation of riparian vegetation. Therefore, the City can find that the Application complies with NRH.8.

NRH.9 Coos Bay shall cooperation with local, state, and federal agencies in conserving and protecting fish and wildlife habitat, open spaces, and aesthetic and scenic values encompassed by areas enclosed by the Coos Bay-North Bend Water Board, Empire Lakes, and Mingus Park. This strategy is not intended to prohibit development in these areas, but rather to ensure that if development occurs it takes into consideration the ability of the land to support such development, i.e., soils, topography, habitat, natural processes, etc. This strategy recognizes that these areas are particularly sensitive and valuable resources.

<u>RESPONSE</u>: This policy creates no affirmative obligations for JCEP. Therefore, it does not apply to the Application.

7.5 ECONOMIC DEVELOPMENT

Goal 1, Policy 1.5 Support and cooperate with community and regional partners to encourage economic growth.

<u>RESPONSE</u>: The Application requests navigation reliability improvements for the Channel, which will primarily benefit large vessels that are navigating to and from the International Port of Coos Bay ("Port"). The Port is located outside the City limits but is an important regional entity that facilitates mass export and import of goods and commodities overseas and thus serves as a key driver of economic development throughout southwest Oregon. As a result, approving the Application and facilitating the NRIs will support community and regional partners and encourage economic growth.

Goal 6, Policy 6.1, 6.2 **Maximize the potential uses and benefits the waterfront and deep-water port offers to the city and region as a whole; Support the Port of Coos Bay in its development efforts for transportation linkage and to develop a deep-draft channel to accommodate large cargo vessels and increase shipping activities and water-dependent uses.**

RESPONSE: The purpose of this Application is to allow the NRIs, which together with other improvements for which JCEP is seeking approval from Coos County, will facilitate increased navigational safety and efficiency for large vessels in the Channel, thereby maximizing the Channel's economic benefits for the City and region as a whole by allowing increased economic input and output. Therefore, the Application complies with these policies.

LU.4 **Coos Bay shall not make major revisions to this Comprehensive Plan more frequently than every two years, if at all possible. "Major revisions" are those that have widespread and immediate impact beyond the subject area under consideration. The city recognizes that wholesale approval of frequent major revisions could ruin the integrity of this Plan.**

RESPONSE: The Application does not request "major revisions" to the CBCP. The text amendment only directly affects the NRI Site, which is approximately 3.3 acres in size and is located at an isolated, undeveloped point adjacent to the Channel. Approval of the Application will not, from a land development/conservation perspective, have a widespread and immediate impact beyond the NRI Site. Therefore, the City should find that the Application complies with this policy.

LU.5 **Coos Bay may make minor changes to this Comprehensive Plan on an infrequent basis as need and justification arises. "Minor changes" are those which do not have significant impact beyond the immediate area of the property under consideration. The city recognizes that wholesale approval of frequent minor changes could ruin the integrity of this Plan.**

<u>RESPONSE</u>: The Application requests an exception to Goal 16 to facilitate navigation reliability improvements to an isolated, undeveloped area that is approximately 3.3 acres in size. From a land development perspective, approval of the Application will not, from a land development/conservation standpoint, have a widespread, immediate, or significant impact beyond the NRI Site, and it will not require additional changes to the Plan. Further, for the reasons explained in this narrative, the City should find that the need for the amendments has been justified. Therefore, the City should find that the Application requests “minor changes” to the CBCP.

LU.7 **Coos Bay shall anticipate that conflicts may arise between the various plan implementation strategies contained in this plan when applying the policies to specific situations. To resolve these conflicts, if and when such may occur, Coos Bay shall consider the long term environmental, economic, social, and energy consequences expected to result from applying one strategy in place of others, then to select and apply the strategy that results in maximum public benefit as supported by findings of fact. This strategy is based on the recognition that a viable conflict resolution process is essential to the success of any comprehensive plan.**

<u>RESPONSE</u>: Approval of the Application will not cause any conflicts between various CBCP implementation strategies. As explained in this narrative, the Application is consistent with all applicable policies of the CBCP and with the Goal exception criteria of the OAR. Therefore, the City should find that there is no need to resolve any conflicts in order to approve the Application.

For the above reasons, the City can find that the Application complies with the policies of the CBCP that apply to the Application.

(b) The proposed amendment is in the public interest; and

<u>RESPONSE</u>: The CBCP amendment that this Application seeks is in the public interest because it will result in increased navigational safety and efficiency for large vessels in the Channel, which will allow increased economic input and output to flow through the Channel, which in turn will be an economic boon to the City and the region. The Application complies with this criterion.

(c) Approval of the amendment will not result in a decrease in the level-of-service for capital facilities and services identified in the Coos Bay capital improvement plan(s).

RESPONSE: Approving this Application will not result in a decrease in the level-of-service for any identified capital facilities and/or services identified in the Coos Bay capital improvement plan. Therefore, the City can find that the Application complies with this criterion.

2. Statewide Planning Goals

Post-acknowledgment plan amendments must be in compliance with the Goals. ORS 197.175(2)(a); *1000 Friends of Oregon v. LCDC*, 301 Or 447, 724 P2d 268 (1986). The rezoning is a post-acknowledgment plan amendment. Therefore, the City's decision must explain why the rezoning is in compliance with the Goals. Alternatively, if a Goal is not applicable, the City must adopt findings explaining why that Goal is not applicable. *Davenport v. City of Tigard*, 22 Or LUBA 577, 586 (1992). The responses below provide findings explaining why the Application is in compliance with the Goals, or alternatively, why the Goals are not applicable to the Application.

Goal 1: Citizen Involvement.

To develop a citizen involvement program that insures the opportunity for citizens to be involved in all phases of the planning process.

RESPONSE: Goal 1 requires local governments to adopt and administer programs to ensure the opportunity for citizens to be involved in all phases of the planning process. The City has adopted such a program for PAPAs, and it is incorporated within the CBDC and has been acknowledged by LCDC. Among other things, the City's program requires notice to citizens, agencies, neighbors, and other interested parties followed by multiple public hearings before the City makes a decision on the Application. These procedures will provide ample opportunity for citizen involvement in all phases of the Application. The City should find that, upon compliance with its notice and hearing procedures, the City has reviewed the Application in a manner consistent with Goal 1. *See Wade v. Lane County*, 20 Or LUBA 369, 376 (1990) (Goal 1 is satisfied as long as the local government follows its acknowledged citizen involvement program).

In this case, as explained above in response to CBDC 17.215.020(1), the City would typically follow the Type III review and decision-making procedures of CBDC 17.130.100 when reviewing the Application. However, a modification to that process is appropriate in this case in order to comply with state law. CBDC 17.130.100 ("Type III procedure") provides that a Type III application "will be considered at one or more public hearings before the city's planning commission." The Application does not as a matter of course go before the City Council. *See* CBDC 17.130.130(5)(c) (providing for City Council consideration of a Type III application but only in event of appeal). The City should find that state law requires the local governing body to take final action to approve any post-acknowledgment comprehensive plan amendment before it can become final. *Housing Land Advocates*, __ Or LUBA at __ (LUBA No. 2016-031, May 23, 2016). The Application includes a request for an exception to Goal 16, which is a request for a plan text amendment. Therefore, pursuant to *Housing Land Advocates*, the City should schedule the Application for final action by the City Council after the Planning Commission's initial recommendation.

In sum, the City should apply its Type III process in CBDC 17.30.100 to review and decide upon the Application, subject to also providing for a hearing and final decision on the Application by the City Council. Upon doing so, the City should find that it has complied with Goal 1.

Goal 2: Land Use Planning.

To establish a land use planning process and policy framework as a basis for all decisions and actions related to use of land and to assure an adequate factual base for such decisions and actions.

RESPONSE: Goal 2 requires establishing a land use planning process and policy framework as a basis for all land use decisions and requires an adequate factual base for all land use decisions. In the present case, the provisions of the CBDC and the ORS establish the land use planning process and policy framework for considering the Application. Further, the enclosed materials, including this narrative, demonstrate that the Application satisfies all applicable approval criteria. As such, there is an adequate factual base for the City's decision.

Additionally, Goal 2 requires that the City coordinate its review and decision on the Application with appropriate government agencies. In its review of the Application, the City has provided notice and an opportunity to comment to affected government agencies, including nearby cities and the State Departments of Land Conservation and Development and Transportation.

The City should find that the Application is consistent with Goal 2.

Goal 3: Agricultural Lands.

To maintain and preserve agricultural lands.

RESPONSE: Goal 3 concerns agricultural lands. The NRI Site does not include any agricultural lands, and approval of the amendments will not impact any agricultural lands. Therefore, the City should find that Goal 3 is not applicable to the Application.

Goal 4: Forest Lands.

To conserve forest lands by maintaining the forest land base and to protect the state's forest economy by making possible economically efficient forest practices that assure the continuous growing and harvesting of forest tree species as the leading use on forest land consistent with sound management of soil, air, water, and fish and wildlife resources and to provide for recreational opportunities and agriculture.

<u>RESPONSE</u>: Goal 4 protects forest lands. The NRI Site does not include any forest lands, and approval of the amendments will not impact any forest lands. Therefore, the City should find that Goal 4 is not applicable to the Application.

Goal 5: Natural Resources, Scenic and Historic Areas, and Open Spaces.

To protect natural resources and conserve scenic and historic areas and open spaces.

<u>RESPONSE</u>: Goal 5 protects certain types of inventoried resources. The NRI Site does not include any inventoried Goal 5 resources, and approval of the Application will not impact any Goal 5 inventoried resources. Therefore, the City should find that Goal 5 is not applicable to the Application.

Goal 6: Air, Water and Land Resources Quality.

To maintain and improve the quality of the air, water and land resources of the state.

<u>RESPONSE</u>: Goal 6 requires comprehensive plans to follow multiple guidelines to conserve the quality of air, water and land resources in the state. In a post-acknowledgment plan amendment proceeding, in order to satisfy Goal 6, the City is only required to find that it is reasonable to expect that federal and state environmental standards will be met in the future when permits for the dredging are sought. *Nicita v. City of Oregon City*, 74 Or LUBA 176 (2016). For two reasons, the City should find that it is reasonable to expect that JCEP's proposed dredging will satisfy federal and state environmental standards. First, JCEP has applied for state and federal approval of dredging activities at the NRI Site, and there is no indication that JCEP is precluded as a matter of law from obtaining approval of these applications. Second, the proposed map amendments do not alter existing City protections provided by the CBEMP restricting dredging activities, which protections have been previously deemed consistent with Goal 6, and are addressed later in this narrative.

For the above reasons, the Application complies with Goal 6.

Goal 7: Areas Subject to Natural Hazards.

To protect people and property from natural hazards.

<u>RESPONSE</u>: Goal 7 requires local governments to identify and plan for natural hazard areas and coordinate their natural hazard plans and programs with state agencies. This Application complies with Goal 7 because it will not increase the likelihood of damage to people or property within the City from natural hazards.

Goal 8: Recreational Needs.

To satisfy the recreational needs of the citizens of the state and visitors, and where appropriate, to provide for the siting of necessary recreational facilities including destination resorts.

<u>RESPONSE</u>: Goal 8 does not apply to the Application because it does not involve recreation or inventoried recreation areas, facilities, or opportunities.

Goal 9: Economic Development.

To provide adequate opportunities throughout the state for a variety of economic activities vital to the health, welfare, and prosperity of Oregon's citizens.

<u>RESPONSE</u>: The Application complies with Goal 9. The purpose of the Application is to complete the NRIs, which in turn will facilitate a broader operational window, and increase safety and efficiency of transit, in the Channel. This will be a boon to the economic prospects for the City and the state because it will make the Channel safer and more efficient for productive economic enterprises of the kind that provide opportunities to Oregonians.

Goal 10: Housing.

To provide for the housing needs of the citizens of the state.

<u>RESPONSE</u>: Goal 10 and its implementing rules require each local government to inventory the supply of buildable residential lands and to ensure that the supply of such buildable lands meets the local government's anticipated housing needs. The Application will not affect the supply of residential lands in the City. Therefore, the City should find that the Application is consistent with Goal 10, to the extent it is applicable.

Goal 11: Public Facilities and Services.

To plan and develop a timely, orderly and efficient arrangement of public facilities and services to serve as a framework for urban and rural development.

RESPONSE: Goal 11 does not apply to the Application because the Application does not involve or affect public facilities and services as a framework for development.

Goal 12: Transportation.

To provide and encourage a safe, convenient and economic transportation system.

RESPONSE: The Application complies with Goal 12. Goal 12 directs local governments to plan transportation systems that consider all modes of transportation, including water, that facilitate the flow of goods and services so as to strengthen the local and regional economy, that conserve energy, and that avoid principal reliance on one mode of transportation. The Application furthers these goals by supporting safer and more efficient use of the Channel for water transportation. This safer and more efficient use of the Channel will conserve energy that is currently wasted when, outside the Channel's operational window, vessels wait outside the Channel, using fuel and adding time and expense to transit.

Goal 13: Energy Conservation.

To conserve energy.

RESPONSE: The Application complies with Goal 13. Goal 13 directs local governments to manage land use so as to maximize the conservation of all forms of energy. The Application will facilitate maximal energy conservation by increasing the safety and efficiency of vessel transit of the Channel, and by increasing the Channel's operational window. This will reduce the amount of time vessels spend waiting to enter and navigate the Channel, due to environmental conditions that exceed those required by the Pilots for a safe vessel transit, which will increase the efficiency of material transportation and reduce energy waste from inefficiency of transportation.

Goal 14: Urbanization.

To provide for an orderly and efficient transition from rural to urban land use.

RESPONSE: Goal 14 does not apply to the Application, which does not involve urban development on rural land.

Goal 15: Willamette River Greenway.

To protect, conserve, enhance and maintain the natural, scenic, historical, agricultural, economic and recreational qualities of lands along the Willamette River as the Willamette River Greenway.

RESPONSE: Goal 15 only applies to lands along the Willamette River. The Modification Sites are not located along the Willamette River or in the Willamette River Greenway. Approval of the amendments will not impact the Willamette River of the Willamette River Greenway. Therefore, the City should find that Goal 15 is not applicable to the Application.

Goal 16: Estuarine Resources.

To recognize and protect the unique environmental, economic, and social values of each estuary and associated wetlands; and to protect, maintain, where appropriate develop, and where appropriate restore the long-term environmental, economic, and social values, diversity and benefits of Oregon's estuaries.

…

MANAGEMENT UNITS

Diverse resources, values, and benefits shall be maintained by classifying the estuary into distinct water use management units. When classifying estuarine areas into management units, the following shall be considered in addition to the inventories:

1. Adjacent upland characteristics and existing land uses;

2. Compatibility with adjacent uses;

3. Energy costs and benefits; and

4. The extent to which the limited water surface area of the estuary shall be committed to different surface uses.

At a minimum, the following kinds of management units shall be established:

1. Natural -- in all estuaries, areas shall be designated to assure the protection of significant fish and wildlife habitats, of continued biological productivity within the estuary, and of scientific, research, and educational needs. These shall be managed to preserve the natural resources in recognition of dynamic, natural, geological, and evolutionary processes. Such areas shall include, at a minimum, all

major tracts of salt marsh, tideflats, and seagrass and algae beds. Permissible uses in natural management units shall include the following:

a. Undeveloped low-intensity, water-dependent recreation;

b. Research and educational observations;

c. Navigation aids, such as beacons and buoys;

d. Protection of habitat, nutrient, fish, wildlife, and aesthetic resources;

e. Passive restoration measures;

f. Dredging necessary for on-site maintenance of existing functional tidegates and associated drainage channels and bridge crossing support structures;

g. Riprap for protection of uses existing as of October 7, 1977, unique natural resources, historical and archaeological values; and public facilities; and

h. Bridge crossings.

Where consistent with the resource capabilities of the area and the purposes of this management unit the following uses may be allowed:

a. Aquaculture which does not involve dredge or fill or other estuarine alteration other than incidental dredging for harvest or benthic species or removable in-water structures such as stakes or racks;

b. Communication facilities;

c. Active restoration of fish and wildlife habitat or water quality and estuarine enhancement;

d. Boat ramps for public use where no dredging or fill for navigational access is needed; and

e. Pipelines, cables, and utility crossings, including incidental dredging necessary for their installation.

f. Installation of tidegates in existing functional dikes.

g. Temporary alterations.

h. Bridge crossing support structures and dredging necessary for their installation.

A use or activity is consistent with the resource capabilities of the area when either the impacts of the use on estuarine species, habitats, biological productivity and water quality are not significant or that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner to protect significant wildlife habitats, natural biological productivity, and values for scientific research and education.

2. Conservation -- in all estuaries, except those in the overall Oregon Estuary Classification which are classed for preservation, areas shall be designated for long-term uses of renewable resources that do not require major alteration of the estuary, except for the purpose of restoration. These areas shall be managed to conserve the natural resources and benefits. These shall include areas needed for maintenance and enhancement of biological productivity, recreational and aesthetic uses, and aquaculture. They shall include tracts of significant habitat smaller or of less biological importance than those in (1) above, and recreational or commercial oyster and clam beds are not included in (1) above. Areas that are partially altered and adjacent to existing development of moderate intensity which do not possess the resource characteristics of natural or development units shall also be included in this classification. Permissible uses in conservation management units shall be all uses listed in (1) above except temporary alterations. Where consistent with the resource capabilities of the area and the purposes of this management unit the following uses may be allowed:

a. High-intensity water-dependent recreation, including boat ramps, marinas and new dredging for boat ramps and marinas;

b. Minor navigational improvements;

c. Mining and mineral extraction, including dredging necessary for mineral extraction;

d. Other water dependent uses requiring occupation of water surface area by means other than dredge or fill;

e. Aquaculture requiring dredge or fill or other alteration of the estuary;

f. Active restoration for purposes other than those listed in 1(d).

g. Temporary alterations.

A use or activity is consistent with the resource capabilities of the area when ether the impacts of the use on estuarine species, habitats, biological productivity, and water quality are not significant or that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner which conserves long-term renewable resources, natural biologic productivity, recreational and aesthetic values and aquaculture.

3. Development -- in estuaries classified in the overall Oregon Estuary Classification for more intense development or alteration, areas shall be designated to provide for navigation and other identified needs for public, commercial, and industrial water-dependent uses, consistent with the level of development or alteration allowed by the overall Oregon Estuary Classification. Such areas shall include deep-water areas adjacent or in proximity to the shoreline, navigation channels, subtidal areas for in-water disposal of dredged material and areas of minimal biological significance needed for uses requiring alterations of the estuary not included in (1) and (2) above. Permissible uses in areas managed for water-dependent activities shall be navigation and water-dependent commercial and industrial uses. As appropriate the following uses shall also be permissible in development management units:

a. Dredge or fill, as allowed elsewhere in the goal;

b. Navigation and water-dependent commercial enterprises and activities;

c. Water transport channels where dredging may be necessary;

d. Flow-lane disposal of dredged material monitored to assure that estuarine sedimentation is consistent with the resource capabilities and purposes of affected natural and conservation management units.

e. Water storage areas where needed for products used in or resulting from industry, commerce, and recreation;

f. Marinas.

Where consistent with the purposes of this management unit and adjacent shorelands designated especially suited for water-dependent uses or designated for waterfront redevelopment, water-related and nondependent, nonrelated uses not requiring dredge or fill; mining and mineral extraction; and activities identified in (1) and (2) above shall also be appropriate. In designating areas for these uses, local

governments shall consider the potential for using upland sites to reduce or limit the commitment of the estuarine surface area for surface uses.

RESPONSE: Goal 16 requires that local governments divide all estuaries that Goal 16 protects into, at a minimum, the above "management units"--Natural, Conservation, and Development. The CBEMP complies with Goal 16 by creating and maintaining three "Aquatic Management Units" and seven "Shoreland Management Units" including the baseline Natural, Conservation, and Development management units that Goal 16 requires. The NRI Site is currently zoned 52-NA (a natural aquatic unit). This Application seeks to amend the CBEMP to apply the DDNC-DA (a development aquatic) management unit to the NRI Site in order to allow dredging necessary to complete the NRIs. Such dredging is not allowed in natural management units. Therefore, a Goal 16 exception is required to rezone the NRI Site to DDNC-DA.

Goal 17: Coastal Shorelands.

To conserve, protect, where appropriate, develop and where appropriate restore the resources and benefits of all coastal shorelands, recognizing their value for protection and maintenance of water quality, fish and wildlife habitat, water-dependent uses, economic resources and recreation and aesthetics. The management of these shoreland areas shall be compatible with the characteristics of the adjacent coastal waters; and

To reduce the hazard to human life and property, and the adverse effects upon water quality and fish and wildlife habitat, resulting from the use and enjoyment of Oregon's coastal shorelands.

RESPONSE: Goal 17 regulates coastal shorelands. The NRI Site does not include any designated coastal shorelands. Moreover, the proposed amendments will not impact any designated coastal shorelands. Therefore, the City should find that Goal 17 is not applicable to the Application.

Goal 18: Beaches and Dunes.

To conserve, protect, where appropriate develop, and where appropriate restore the resources and benefits of coastal beach and dune areas; and

To reduce the hazard to human life and property from natural or man-induced actions associated with these areas.

RESPONSE: Goal 18 concerns beaches and dunes. The NRI Site does not include any designated beaches or dunes. Moreover, the proposed amendments will not impact any designated beaches or dunes. Thus, the City should find that Goal 18 is not applicable to the Application.

Goal 19: Ocean Resources.

To conserve marine resources and ecological functions for the purpose of providing long-term ecological, economic, and social value and benefits to future generations.

RESPONSE: Goal 19 calls for the conservation of ocean resources. The NRI Site does not include or abut any ocean resources, and the proposed amendments will not impact any ocean resources. Therefore, the City should find that Goal 19 is not applicable to the Application.

For the above reasons, the City can find that the Application complies with the Goals.

B. Goal 16 "Reasons" Exception:

ORS 197.732

(2) A local government may adopt an exception to a goal if:

…

(c) The following standards are met:

(A) Reasons justify why the state policy embodied in the applicable goals should not apply;

(B) Areas that do not require a new exception cannot reasonably accommodate the use;

(C) The long term environmental, economic, social and energy consequences resulting from the use at the proposed site with measures designed to reduce adverse impacts are not significantly more adverse than would typically result from the same proposal being located in areas requiring a goal exception other than the proposed site; and

(D) The proposed uses are compatible with other adjacent uses or will be so rendered through measures designed to reduce adverse impacts.

RESPONSE: The above criteria are duplicative with the same criteria set forth in OAR 660-004-0020, which implements ORS 197.732. Therefore, this Application responds to the above criteria in the section immediately below that is devoted to OAR 660-004-0020. For the reasons explained below, the proposed exception complies with the administrative rules, and compliance with these administrative rules will ensure compliance with these statutory provisions.

OAR 660-004-0020

(1) If a jurisdiction determines there are reasons consistent with OAR 660-004-0022 to use resource lands for uses not allowed by the applicable Goal or to allow public facilities or services not allowed by the applicable Goal, the justification shall be set forth in the comprehensive plan as an exception. As provided in OAR 660-004-0000(1), rules in other divisions may also apply.

RESPONSE: This Application presents "reasons" (as set forth in more detail below) consistent with OAR 660-004-0022 why Goal 16 should not apply to the NRI Site. This Application proposes that the City set forth in its comprehensive plan the justification for a Goal 16 exception at the NRI Site. Therefore, this Application satisfies this approval criterion.

(2) The four standards in Goal 2 Part II(c) required to be addressed when taking an exception to a goal are described in subsections (a) through (d) of this section, including general requirements applicable to each of the factors:

(a) "Reasons justify why the state policy embodied in the applicable goals should not apply." The exception shall set forth the facts and assumptions used as the basis for determining that a state policy embodied in a goal should not apply to specific properties or situations, including the amount of land for the use being planned and why the use requires a location on resource land;

RESPONSE: This standard requires identifying "reasons" why the state policy in Goal 16 should not apply to the NRI Site. OAR 660-004-0022 identifies the types of "reasons" that may be used to justify the exception. JCEP's responses to that rule below justify the proposed Goal 16 exception.

OAR 660-004-0022

An exception under Goal 2, Part II(c) may be taken for any use not allowed by the applicable goal(s) or for a use authorized by a statewide planning goal that cannot comply with the approval standards for that type of use. The types of reasons that may or may not be used to justify certain types of uses not allowed on resource lands are set forth in the following sections of this rule. Reasons that may allow an exception to Goal 11 to provide sewer service to rural lands are described in OAR 660-011-0060. Reasons that may allow transportation facilities and improvements that do not meet the requirements of OAR 660-012-0065 are provided in OAR 660-012-0070. Reasons that rural lands are irrevocably committed to urban levels of development are provided in OAR 660-014-0030. Reasons that may justify the establishment of new urban development on undeveloped rural land are provided in OAR 660-014-0040.

(1) For uses not specifically provided for in this division, or in OAR 660-011-0060, 660-012-0070, 660-014-0030 or 660-014-0040, the reasons shall justify why the state policy embodied in the applicable goals should not apply. Such reasons include but are not limited to the following:

(a) There is a demonstrated need for the proposed use or activity, based on one or more of the requirements of Goals 3 to 19; and either

(A) A resource upon which the proposed use or activity is dependent can be reasonably obtained only at the proposed exception site and the use or activity requires a location near the resource. An exception based on this paragraph must include analysis of the market area to be served by the proposed use or activity. That analysis must demonstrate that the proposed exception site is the only one within the market area at which the resource depended upon can be reasonably obtained; or

(B) The proposed use or activity has special features or qualities that necessitate its location on or near the proposed exception site.

<u>RESPONSE</u>: The Application must show a “demonstrated need” for the proposed use or activity based on the requirements of one or more of Goals 3 to 19. The “demonstrated need” for the NRIs is based primarily on Goals 9 and 12. As explained in

Section II. of this narrative above, structural restrictions on the Channel cause significant transit delays and unduly increase required directional changes during transit through the Channel. Delays are measured in the total transit time, from the time the vessel arrives off the coast of Coos Bay until it returns offshore after calling at its local Coos Bay destination. These delays decrease the efficiency and competitiveness of maritime commerce on a global scale, thereby jeopardizing continued success for maritime commerce in Coos Bay. Minimizing delay is a pressing need because companies that utilize the port of Coos Bay have identified potential new customers in Asia that desire to export cargo using bulk carriers that are slightly larger than the ships typically calling today. Various marine terminal businesses within Coos Bay require assurances that terminals can efficiently accommodate larger dimension bulk carriers in the future. The NRIs will allow companies to secure emerging opportunities to export products with today's larger vessels, including bulk carriers of up to 299.9 meters (983.3 feet) in length, 49 meters (160.8 feet) in beam, and 11.9 meters (39 feet) in draft. With respect to the Liquefied Natural Gas ("LNG") facility that JCEP proposes to develop in the lower bay, JCEP and the Pilots believe the NRIs are essential to achieve the required number of LNG vessel transits needed to lift the JCEP design annual LNG production volume. Excessive delays in LNG carrier transit in the Channel, to and from the LNG terminal, could result in a shore storage tank topping situation, requiring JCEP to curtail LNG production.

The JCEP estimate that dredging to complete navigation efficiency and reliability improvements at the NRI Sites will allow JCEP to export the full capacity of the optimized design production of 7.8 mtpa from JCEP's LNG terminal on the North Spit. To satisfy this need, JCEP proposes the NRIs to improve the navigation efficiency and reliability for vessels transiting the Channel by widening an extremely restrictive, unavoidable turn in the Channel. The NRIs will fulfill a demonstrated need for continued and enhanced shipping within the Bay; consistent with the Policy objectives of Goals 9 and 12.

The Application must also provide "reasons" that "justify why the state policy embodied in the applicable goals should not apply." OAR 660-004-0022(1)(a)(B) provides that a sufficient "reason" is that the "proposed use or activity has special features or qualities that necessitate its location on or near the proposed exception site." That is the case here. JCEP seeks to improve navigation in the Channel and to do so has selected the NRI Site that corresponds to the area of the Channel in the City that is most in need of improvement in order to facilitate safer and more efficient navigation. Therefore, this Application provides reasons why the "proposed use or activity has special features or qualities that necessitate its location on or near the proposed exception site."

(8) Goal 16 - Other Alterations or Uses: An exception to the requirement limiting dredge and fill or other reductions or degradations of natural values to water-dependent uses or to the natural and conservation management unit requirements limiting alterations and uses is justified, where consistent with ORS chapter 196, in any of the circumstances specified in subsections (a) through (e) of this section:

RESPONSE: The Application seeks an exception to the requirement limiting dredging in an area that is currently designated, in accordance with Goal 16, as a natural management unit. As explained below, the exception is justified because the Application will authorize dredging to maintain adequate depth to permit continuation of the present level of navigation as contemplated by OAR 660-004-0022(8)(b).

…

(b) Dredging to maintain adequate depth to permit continuation of the present level of navigation in the area to be dredged.

RESPONSE: The Application proposes dredging to maintain adequate depth to permit continuation of the presently authorized level of navigation at the NRI Site. As background, the Channel was initially authorized in 1899 and since then has undergone ten modifications. Most recently, the Channel was expanded from -35 feet to -37 feet in 1997 to allow for the safe navigation and transit of Coos Bay for the size of ships prevalent during that time period.

However, as explained above, environmental conditions, including wind, fog, and currents have caused the Pilots to impose ever more limiting restrictions on when vessels may safely transit the Channel. These restrictions, in turn, cause significant delays and thus prevent the Channel from operating at maximum efficiency. Minimizing delay is a pressing need because companies that utilize the International Port of Coos Bay have identified potential new customers in Asia that desire to export cargo using bulk carriers through the Channel. Various marine terminal businesses within Coos Bay require assurances that the Channel can efficiently accommodate bulk carriers.

Dredging to complete the NRI Sites will increase the operational window to safely transit any vessel through the Channel. The NRIs are designed to increase the environmental operating windows for all ships entering Coos Bay by softening critical turns, relocating aids to navigation, and reducing the required Channel directional changes. The NRIs are designed to reduce entry and departure delays and allow for more efficient vessel transits through the Channel for the size of vessels entering the Port today.

For JCEP and its LNG terminal, the NRI enhancements will allow for transit of LNG vessels of similar overall dimensions to those listed in the July 1, 2008 USCG Waterway Suitability Report, the USCG Letter of Recommendation dated May 10, 2018 and USCG letter confirmation dated November 7, 2018 *see* Exhibit 4, but under a broader range of weather conditions, specifically higher wind speeds. As a result, JCEP estimates that, upon completion of the NRIs, JCEP will be able to export the full capacity of the optimized design production of the LNG Terminal on a consistent annual basis.

For these reasons, the dredging associated with the NRIs will maintain adequate depth to permit continuation of the presently allowed level of navigation, yet allow that navigation to occur more efficiently, safely, and reliably. This standard is met.

(f) In each of the situations set forth in subsections (7)(a) to (e) of this rule, the exception must demonstrate that the proposed use and alteration (including, where applicable, disposal of dredged materials) will be carried out in a manner that minimizes adverse impacts upon the affected aquatic and shoreland areas and habitats.

RESPONSE: JCEP will complete its proposed NRIs in a manner that minimizes adverse impacts upon the affected aquatic and shoreland areas and habitats. To complete the NRIs, JCEP will dredge within the Channel and adjacent to the Channel at the NRI Sites. JCEP will minimize adverse impacts for the reasons explained below.

JCEP plans to perform capital and maintenance dredging during the ODFW-approved in-water work window (October 1 to February 15) to reduce impacts to sensitive life stages of fish in the bay.

JCEP will use various dredging methods to minimize the effects of the NRIs on water turbidity within the Bay. JCEP will use best management practices (including cutter head suction, clamshell, and hopper dredging) associated with dredging to reduce turbidity effects, and as a result of those methods JCEP expects increased water turbidity as a result of the NRIs to be temporary and limited to the immediate vicinity of dredging operations. Furthermore, JCEP does not anticipate oil spills or toxic discharges to occur when constructing the NRIs, and JCEP will use precautions to avoid either. Dredging and material transport vessels will carry small volumes of petroleum in comparison to large bulk carriers and Panamax vessels that regular traverse Coos Bay. JCEP will use best management practices to avoid and minimize spills or discharges during dredging operations and dredged material transport, including the implementation of spill containment plans.

Dredging equipment and material transport vessels related to the NRIs may generate temporary noise disturbances. However, the noise will be localized to the immediate dredging area. JCEP does not anticipate that noise levels will have more than temporary effects on the behavior of aquatic species in the area of the NRI Sites.

JCEP's environmental consultant has further evaluated potential adverse impacts associated with the dredging activities and describes ways by which JCEP will minimize such adverse impacts. *See* DEA memorandum in Exhibit 5.

For these reasons, the City should find that the Application satisfies this standard.

(b) "Areas that do not require a new exception cannot reasonably accommodate the use." The exception must meet the following requirements:

RESPONSE: The NRIs are location-specific. Their purpose is to improve safety and navigational efficiency in the Channel. There are no other areas that could accommodate the use. Therefore, "areas that do not require a new exception cannot reasonably accommodate the use." The Application satisfies this criterion.

(A) The exception shall indicate on a map or otherwise describe the location of possible alternative areas considered for the use that do not require a new exception. The area for which the exception is taken shall be identified;

RESPONSE: As explained above, the NRIs are location-specific and it would not be possible for JCEP to locate them anywhere that does not require a new exception. Exhibit 1 identifies the NRI Site, which is the area where JCEP proposes to locate the exception. The Application satisfies this criterion.

(B) To show why the particular site is justified, it is necessary to discuss why other areas that do not require a new exception cannot reasonably accommodate the proposed use. Economic factors may be considered along with other relevant factors in determining that the use cannot reasonably be accommodated in other areas. Under this test the following questions shall be addressed:

(i) Can the proposed use be reasonably accommodated on resource land that would not require an

exception, including the density of uses on nonresource land? If not, why not?

(ii) Can the proposed use be reasonably accommodated on resource land that is already irrevocably committed to nonresource uses not allowed by the applicable Goal, including resource land in existing unincorporated communities, or by increasing the density of uses on committed lands? If not, why not?

(iii) Can the proposed use be reasonably accommodated inside an urban growth boundary? If not, why not?

(iv) Can the proposed use be reasonably accommodated without the provision of a proposed public facility or service? If not, why not?

RESPONSE: As explained above, the NRIs are location-specific and it would not be possible for JCEP to locate them anywhere that does not require a new exception. Whether or not the NRIs can be accommodated inside a UGB, they still require a Goal 16 exception and they still must be located at the NRI sites, so this question is not applicable to an analysis of whether alternative areas that do not require an exception cannot accommodate the NRIs. Moreover, the NRIs relate to a public facility and will not require any additional public facilities or services to construct. The Application satisfies this criterion.

(C) The "alternative areas" standard in paragraph B may be met by a broad review of similar types of areas rather than a review of specific alternative sites. Initially, a local government adopting an exception need assess only whether those similar types of areas in the vicinity could not reasonably accommodate the proposed use. Site specific comparisons are not required of a local government taking an exception unless another party to the local proceeding describes specific sites that can more reasonably accommodate the proposed use. A detailed evaluation of specific alternative sites is thus not required unless such sites are specifically described, with facts to support the assertion that the sites are more reasonable, by another party during the local exceptions proceeding.

RESPONSE: As explained above, the NRIs are location-specific and so it is not possible for JCEP to locate them anywhere that does not require a new exception. There are no "alternative areas" that can accommodate the NRIs. The Application satisfies this criterion.

(c) "The long-term environmental, economic, social and energy consequences resulting from the use at the proposed site with measures designed to reduce adverse impacts are not significantly more adverse than would typically result from the same proposal being located in areas requiring a goal exception other than the proposed site." The exception shall describe: the characteristics of each alternative area considered by the jurisdiction in which an exception might be taken, the typical advantages and disadvantages of using the area for a use not allowed by the Goal, and the typical positive and negative consequences resulting from the use at the proposed site with measures designed to reduce adverse impacts. A detailed evaluation of specific alternative sites is not required unless such sites are specifically described with facts to support the assertion that the sites have significantly fewer adverse impacts during the local exceptions proceeding. The exception shall include the reasons why the consequences of the use at the chosen site are not significantly more adverse than would typically result from the same proposal being located in areas requiring a goal exception other than the proposed site. Such reasons shall include but are not limited to a description of: the facts used to determine which resource land is least productive, the ability to sustain resource uses near the proposed use, and the long-term economic impact on the general area caused by irreversible removal of the land from the resource base. Other possible impacts to be addressed include the effects of the proposed use on the water table, on the costs of improving roads and on the costs to special service districts.

RESPONSE: The NRI Site is the only possible site at which JCEP can make the improvements necessary to increase the safety and efficiency of vessel navigation in the Channel. The NRI Site is a location that JCEP identified where, as explained above, there is an extremely restrictive, unavoidable turn in the Channel. This turn is responsible for significant delays in vessel transit in the Channel. Although JCEP could widen other areas of the Channel to improve navigational efficiency, the NRI Site is the site most in need of improvement to achieve the results in improved efficiency and safety of navigation, that is required within the Channel. Therefore, in order to improve the safety and efficiency of such transit, JCEP must widen the Channel at the locations of this turn (the NRI Site). There are no alternative sites requiring a Goal exception at which JCEP can make the necessary improvements. Moreover, the long-term economic, environmental, social and energy costs of widening other areas of the Channel that JCEP could feasibly widen (although doing so would not achieve the results in improved efficiency and safety of navigation that JCEP desires) are not materially different from the same consequences of making the NRIs at the NRI Site. All such areas are nearby each other and are within the Channel. Furthermore, the Channel itself is a fixed location that cannot be moved. Therefore, the City should find that the Application satisfies this criterion.

(d) "The proposed uses are compatible with other adjacent uses or will be so rendered through measures designed to reduce adverse impacts." The exception shall describe how the proposed use will be rendered compatible with adjacent land uses. The exception shall demonstrate that the proposed use is situated in such a manner as to be compatible with surrounding natural resources and resource management or production practices. "Compatible" is not intended as an absolute term meaning no interference or adverse impacts of any type with adjacent uses.

<u>**RESPONSE**</u>**:** The NRI Sites located immediately adjacent to the existing Channel. This criterion, therefore, requires JCEP to demonstrate that JCEP's proposal for the NRIs is designed to reduce adverse impacts on the waters of the Bay and the Channel, and to be compatible with the use of the Channel for transportation. The proposal is compatible with land uses in the Channel (including transit) because it involves dredging below the surface of the water for the purpose of increasing safety and efficiency in navigating the Channel. The proposal is compatible with land uses in the Channel because it is designed to make them easier and more effective. Furthermore, the proposal is designed to reduce adverse environmental impacts upon the waters of the bay and the Channel. *See* DEA memo included in <u>Exhibit 5</u>.

(3) If the exception involves more than one area for which the reasons and circumstances are the same, the areas may be considered as a group. Each of the areas shall be identified on a map, or their location otherwise described, and keyed to the appropriate findings.

<u>**RESPONSE**</u>**:** This Application seeks a Goal 16 exception for one NRI site in the City. The remaining NRI Sites are located outside of the City's jurisdiction. <u>Exhibit 1</u> includes a map that identifies the NRI Sites.

(4) For the expansion of an unincorporated community described under OAR 660-022-0010, including an urban unincorporated community pursuant to OAR 660-022-0040(2), the reasons exception requirements necessary to address standards 2 through 4 of Goal 2, Part II(c), as described in of subsections (2)(b), (c) and (d) of this rule, are modified to also include the following:

(a) Prioritize land for expansion: First priority goes to exceptions lands in proximity to an unincorporated community boundary. Second priority goes to land designated as marginal land. Third priority goes to land designated in an acknowledged comprehensive plan for agriculture or forestry, or both. Higher priority is given to land of lower capability site class for agricultural land, or lower cubic foot site class for forest land; and

(b) Land of lower priority described in subsection (a) of this section may be included if land of higher priority is inadequate to accommodate the use for any of the following reasons:

(A) Specific types of identified land needs cannot be reasonably accommodated on higher priority land;

(B) Public facilities and services cannot reasonably be provided to the higher priority area due to topographic or other physical constraints; or

(C) Maximum efficiency of land uses with the unincorporated community requires inclusion of lower priority land in order to provide public facilities and services to higher priority land.

RESPONSE: This Application does not seek to expand an unincorporated community. Therefore, these approval criteria do not apply to the Application.

C. Approval For Estuarine and Coastal Shoreland Uses and Activities Permit

1. CBDC

CBDC - 17.370.010 General

Uses and activities permitted by the Coos Bay estuary management plan are subject to general and special conditions and policies to comply with statewide

planning goals and the Coos Bay Estuary Plan as adopted by the city of Coos Bay. Compliance with these conditions and policies must be verified; therefore, all uses and activities under jurisdiction of the Coos Bay estuary management plan must be reviewed.

RESPONSE: CBDC 17.370.010 makes the general and special conditions of the CBEMP approval criteria for this Application. The DDNC-DA CBEMP zone allows new and maintenance dredging, which this Application seeks approval for, subject to general conditions (CBEMP Policies #17 and #18) and a special condition (mitigation of adverse impacts - CBEMP Policy #5). As explained below, CBEMP Policy #5, in turn, triggers consideration of CBEMP Policies #4 and #4a. Therefore, this Application addresses these policies.

JCEP also requests approval of an accessory temporary dredge line in the 52-NA, 53-CA, 54-DA, and 55-CA CBEMP management units. The dredge line is described in the DEA memo included in Exhibit 5, and it is depicted in the figures included in Exhibit 6. Finally, JCEP requests approval of an accessory buoy in the 52-NA management unit. The buoy is located south of the Channel and is depicted in Exhibit 7.

DDNC-DA Zone - General Conditions For Approval of "New and Maintenance Dredging"

CBEMP Policy #17 - Protection of "Major Marshes" and "Significant Wildlife Habitat" in Coastal Shorelands

Local government shall protect major marshes, significant wildlife habitat, coastal headlands, and exceptional aesthetic resources located within the Coos Bay Coastal Shorelands Boundary and included in the Plan inventory, except where exceptions allow otherwise. Local government shall consider:

A. "major marshes" to include areas identified in the Goal #17 "Linkage Matrix" and the Shoreland Values Inventory map;

B. "significant wildlife habitats," coastal headlands and exceptional aesthetic resources to include those areas identified on the map "Shoreland Values."

This strategy shall be implemented through:

A. plan designations and use and activity matrices set forth elsewhere in this Plan that limit uses in these special areas to those that are consistent with protection of natural values; and

B. through use of the "Shoreland Values" map that identifies such special areas and restricts uses and activities therein to uses that are consistent with the protection of natural values. Such uses may include propagation and selective harvesting of forest products consistent with the Oregon Forest Practices Act, grazing, harvesting wild crops, and low-intensity water-dependent recreation.

This strategy recognizes that special protective consideration must be given to key resources in coastal shorelands over and above the protection afforded such resources elsewhere in this Plan.

RESPONSE: According to the Shoreland Values map, there are no inventoried resources at the NRI Site for which Policy #17 requires protection. Therefore, CBEMP Policy #17 does not apply to JCEP's request for approval to complete the NRIs.

CBEMP Policy #18 - Protection of Historical and Archaeological Sites Within Coastal Shorelands

Local government shall provide special protection to historic and archaeological sites located within the Coos Bay Coastal Shorelands Boundary, except where Exceptions allow otherwise. These sites are identified in the section entitled: "Coastal Shoreland Values Requiring Mandatory Protection" and on the "Special Considerations Map." Further, local government shall continue to refrain from widespread dissemination of site-specific information about identified archaeological sites.

This strategy shall be implemented by requiring review of all development proposals involving an archaeological or historical site to determine whether the project as proposed would protect the archaeological and historical values of the site.

The development proposal, when submitted, shall include a site development plan showing, at a minimum, all areas proposed for excavation, clearing and construction. Within three (3) working days of receipt of the development proposal, the local government shall notify the Coos, Siuslaw, Lower Umpqua Tribal Council in writing, together with a copy of the site development plan. The Tribal Council shall have the right to submit a written statement to the local government within ten (10) days of receipt of such notification, stating whether the project as proposed would protect the historical and archaeological values of the site, or if not, whether the project could be modified by appropriate measures to protect those values.

"Appropriate measures" may include, but shall not be limited to the following:

A. Retaining the historic structure in situ or moving it intact to another site; or

B. Paving over the site without disturbance of any human remains or cultural objects upon the written consent of the Tribal Council; or

C. Clustering development so as to avoid disturbing the site; or

D. Setting the site aside for non-impacting activities, such as storage; or

E. If permitted pursuant to the substantive and procedural requirements of ORS 97.750, contracting with a qualified archaeologist to excavate the site and remove any cultural objects and human remains, reinterring the human remains at the developer's expense; or

F. Using civil means to ensure adequate protection of the resources, such as acquisition of easements, public dedications, or transfer of title.

If a previously unknown or unrecorded archaeological site is encountered in the development process, the above measures shall still apply. Land development activities which violate the intent of this strategy shall be subject to penalties prescribed in ORS 97.990(8) and (9). Upon receipt of the statement by the Tribal Council, or upon expiration of the Tribal Council's ten-day response period, the local government shall conduct an administrative review of the development proposal and shall:

A. approve the development proposal if no adverse impacts have been identified, as long as consistent with other portions of this plan, or

B. Approve the development proposal subject to appropriate measures agreed upon by the landowner and the Tribal Council, as well as any additional measures deemed necessary by the local government to protect the historical and archaeological values of the site. If the property owner and the Tribal Council cannot agree on the appropriate measures, then the governing body shall hold a quasi-judicial hearing to resolve the dispute. The hearing

> **shall be a public hearing at which the governing body shall determine by preponderance of the evidence whether the development project may be allowed to proceed, subject to any modifications deemed necessary by the governing body to protect the historical and archaeological values of the site.**

This strategy recognizes that protection of historical and archaeological sites is not only a community's social responsibility, but is also legally required by Goal #17 and ORS 97.745. It also recognizes that historical and archaeological sites are non-renewable cultural resources.

RESPONSE: The City has not inventoried any historical, cultural, and archaeological resources in the area of proposed development. Therefore, there are no known inventoried resources in this location to consider under this policy.

Notwithstanding this fact, JCEP recognizes that, during the course of development consistent with the Application, there may be unanticipated discovery of cultural resources, remains, and/or objects. To address this possibility, JCEP has coordinated with the Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians ("Tribes") to enter a memorandum of agreement ("MOA") addressing these circumstances, and more broadly, CBEMP Policy #18.

A copy of the signed MOA is included in Exhibit 9. The MOA incorporates a Cultural Resources Protection Agreement entered between JCEP and the Tribes ("CRPA"). The CRPA provides a process for the exchange of project-related information, confidentiality requirements, commitments to mitigation, monitoring agreements, agreements for the treatment of unanticipated discovery of cultural resources, site access agreements, and cost recovery agreements. The CRPA, in turn, incorporates an Unanticipated Discovery Plan ("UDP"), which provides procedures in the event of an unanticipated discovery of historic properties, archaeological objects, archaeological sites or human remains, funerary objects, sacred items, and items of cultural patrimony, during the construction and operation of the Pipeline. The CRPA and UDP are attached as exhibits to the MOA in Exhibit 9. In the MOA, JCEP and the Tribes expressly agreed that the CRPA and the UDP constitute appropriate measures under CBEMP Policy #18 that would protect the cultural, historical, and archaeological values of this development site. JCEP is willing to accept a condition of City approval of the Application requiring compliance with the MOA and its attachments.

Subject to the proposed condition, the City should find that the Application is consistent with CBEMP Policy #18.

DDNC-DA Zone - Special Condition For Approval of "New and Maintenance Dredging"

CBEMP Policy #5 - Estuarine Fill and Removal

Dredging and/or filling shall be allowed only:

A. If required for navigation or other water-dependent uses that requires an estuarine location or if specifically allowed by the applicable management unit requirements of this goal; and

B. If no feasible alternative upland location exists; and

C. If a public need (i.e., a substantial public benefit) is demonstrated and the use or alteration does not unreasonably interfere with public trust rights; and

D. If adverse impacts are minimized; and

E. The activity is consistent with the objectives of the Estuarine Resources Goal and with other requirements of state and federal law, specifically the conditions in ORS 541.615 and Section 404 of the Federal Water Pollution Control Act (P.L.92-500).

Other uses and activities which could alter the estuary shall only be allowed if the requirements in B, C, and D are met. All portions of these requirements may be applied at the time of plan development for actions identified in the Plan. Otherwise, they shall be applied at the time of permit review.

This strategy shall be implemented by the preparation of findings by local government documenting that such proposed actions are consistent with the Comprehensive Plan and with criteria "a" through "e" above. However, where goal exceptions are included within this plan, the findings in the exception shall be sufficient to satisfy criteria "a" through "c" above. Identification and minimization of adverse impacts as required in "d" above shall follow the procedure set forth in Policy #4a. The findings shall be developed in response to a "request for comment" by the Division of State Lands (DSL), which shall seek local government's determination regarding the appropriateness of a permit to allow the proposed action.

"Significant" as used in "other significant reduction or degradation of natural estuarine values", shall be determined by:

A. The U.S. Army Corps of Engineers through its Section 10 and 404 permit processes; or

B. The Department of Environmental Quality (DEQ) for approvals of <u>new</u> aquatic log storage areas only; or

C. The Department of Fish and Wildlife for <u>new</u> aquaculture proposals only.

This strategy recognizes that Goal #16 limits dredging, fill, and other estuarine degradation in order to protect the integrity of the estuary.

<u>RESPONSE</u>: JCEP's new and maintenance dredging activities must be consistent with CBEMP Policy #5. The DDNC-DA zone allows new and maintenance dredging. Furthermore, because the Application includes a Goal 16 exception, Policy #5 requires only that the Application comply with criteria D. and E. above, because, as expressly noted within the Policy, the findings for the Goal 16 exception suffice for this Application to comply with criteria A. - C.

Policy #5 directs that an applicant demonstrate compliance with criterion D. of Policy #5 (identification and minimization of adverse impacts) pursuant to the procedure set forth in CBEMP Policy #4a. Furthermore, Special Conditions for approval of new and maintenance dredging in the DDNC-DA zone provide that such dredging is allowed only "subject to finding that adverse impacts have been minimized." JCEP will minimize adverse impacts as summarized below, in response to CBEMP Policies #4 and #4a, and as further discussed in the DEA memo included in <u>Exhibit 5</u>.

JCEP will use various dredging methods to minimize the effects of the NRIs on water turbidity within the bay. JCEP will use best management practices (including cutter head suction, clamshell, and hopper dredging) associated with dredging to reduce turbidity effects, and as a result of those methods JCEP expects increased water turbidity as a result of the NRIs to be temporary and limited to the immediate vicinity of dredging operations. Furthermore, JCEP does not anticipate oil spills or toxic discharges to occur when constructing the NRIs, and JCEP will use precautions to avoid either. Dredging and material transport vessels will carry small volumes of petroleum in comparison to large bulk carriers and Panamax vessels that regular traverse Coos Bay. JCEP will use best management practices to avoid and minimize spills or discharges during dredging operations and dredged material transport, including the implementation of spill containment plans. JCEP plans to perform capital and maintenance dredging during the ODFW-approved in-water work window (October 1 to February 15) to reduce impacts to sensitive life stages of fish in the bay.

Criterion E. of Policy #5 requires that the NRIs are "consistent with the objectives of the Estuarine Resources Goal and with other requirements of state and federal law, specifically the conditions in ORS 541.615 and Section 404 of the Federal Water Pollution Control Act (P.L.92-500)." The NRIs are consistent with the objectives of Goal 16 (Estuarine Resources Goal) because they protect the economic values of the estuary while minimizing adverse impacts of the dredging activity. The Application is consistent with other requirements of state and federal law, including the conditions in ORS 541.615 and Section 404 of the Federal Water Pollution Control Act. ORS 541.615, which is now ORS 196.810, requires a permit from the Department of State Lands ("DSL") to remove any material from the beds or banks of waters of the state. JCEP acknowledges this obligation, and all necessary DSL and Federal Section 404 authorizations will be obtained as a condition precedent to dredging.

For these reasons, the City should find that JCEP's proposed new and maintenance dredging activities are consistent with CBEMP Policy #5.

Alternatively, the City should find that CBEMP Policy #5 is not applicable to the Application pursuant to state law. LUBA has held, and the Court of Appeals has affirmed, that "[w]hen a goal exception is taken to facilitate proposed development, any comprehensive plan policies that implement the goal for which the exception is taken no longer govern that development." *Friends of Marion County v. Marion County*, 59 Or LUBA 323, 350-351 (2009), *aff'd* 233 Or App 488, 227 P3d 198 (2010). The Application requests an exception to Goal 16 to facilitate dredging in a natural management unit. As the last sentence of CBEMP Policy #5 clearly states, the purpose of this policy is to implement Goal 16: "This strategy recognizes that Goal #16 limits dredging, fill, and other estuarine degradation in order to protect the integrity of the estuary." Accordingly, pursuant to the appellate decisions in *Friends of Marion County*, CBEMP Policy #5 is not applicable to the Application.

#4 Resource Capability Consistency and Impact Assessment

Local government concludes that all proposed actions (approved in this Plan) which would potentially alter the estuarine ecosystem have been based upon a full consideration of the impacts of the proposed alteration, except for the following uses and activities:

A. <u>Natural Management Units</u>

- Aquaculture
- Bridge crossings
- Log storage

B. <u>Conservation Management Units</u>

- Aquaculture
- Bulkheading
-Dike maintenance dredging
- High-intensity water-dependent recreation
- Log storage dredging
- Minor navigational improvements requiring dredging or fill
- New or expanded log storage
- Rip-rap
- Water intake or withdrawal and effluent discharge

C. <u>Development Management Units</u>

- Aquaculture
- Bulkheading (except for Aquatic Units #3-DA, 5DA, and 6DA)
- Dredging
- Fill
- Flow lane disposal of dredged material
- In-water structures
- Mining and mineral extraction
- New or expanded log storage
- Water-related and nondependent, nonrelated uses not requiring fill

D. Any other uses and activities which require the resource capability consistency test as a condition within a particular management unit or which could affect the estuary's physical processes or biological resources.

<u>Unless fully addressed during the development and adoption of comprehensive plans, actions which would potentially alter the estuarine ecosystem shall be preceded by a clear presentation of the impacts of the proposed alteration.</u>

For uses and activities requiring the resource capabilities test, a special condition is noted in the applicable management unit uses/activities matrix. A determination of <u>consistency with resource capability</u> and the purposes of the management unit shall be based on the following:

A. A description of resources identified in the plan inventory;

B. An evaluation of impacts on those resources by the proposed use (see impact assessment procedure, below); and

C. In a natural management unit, a use or activity is consistent with the resource capabilities of the area when either the impacts of the use on estuarine species, habitats, biological productivity and water quality are not significant or that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner to protect significant wildlife habitats, natural biological productivity, and values for scientific research and education.

D. In a conservation management unit, a use or activity is consistent with the resource capabilities of the area when either the impacts of the use on estuarine species, habitats, biological productivity, and water quality are not significant or that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner which conserves long-term renewal resources, natural biologic productivity, recreational and aesthetic values, and aquaculture.

An impact assessment need not be lengthy or complex, but it should enable reviewers to gain a clear understanding of the impacts to be expected. It shall include information on:

A. The type and extent of alterations expected;

B. The type of resource(s) affected;

C. The expected extent of impacts of the proposed alteration on water quality and other physical characteristics of the estuary, living resources, recreation and aesthetic use, navigation and other existing and potential uses of the estuary; and

D. The methods which could be employed to avoid or minimize adverse impacts.

This policy is based on the recognition that the need for and cumulative effects of estuarine developments were fully addressed during the preparation of this Plan and that, except as otherwise stated above, no additional findings are required to meet Implementation Requirement #1 of LCDC Goal 16.

<u>RESPONSE</u>: As required by CBEMP Policy #5, "[i]dentification and minimization of impacts shall follow the procedure set forth in Policy #4. JCEP has addressed the provisions of this policy in the DEA memo included in <u>Exhibit 5</u>. This memo is incorporated herein by reference.

Alternatively, the City should find that CBEMP Policy #4 is not applicable to the Application pursuant to state law. LUBA has held, and the Court of Appeals has affirmed, that "[w]hen a goal exception is taken to facilitate proposed development, any comprehensive plan policies that implement the goal for which the exception is taken no longer govern that development." *Friends of Marion County*, 59 Or LUBA at 350-351, *aff'd* 233 Or App at 488. The Application requests an exception to Goal 16 to facilitate dredging in a natural management unit. As the last sentence of CBEMP Policy #4 clearly states, the purpose of this policy is to implement Goal 16: "This policy is based on the recognition that the need for and cumulative effects of estuarine developments were fully addressed during the preparation of this Plan and that, except as otherwise stated above, no additional findings are required to meet Implementation Requirement #1 of LCDC Goal 16." Accordingly, pursuant to the appellate decisions in *Friends of Marion County*, CBEMP Policy #4 is not applicable to the Application.

#4a Deferral of (A) Resource Capability Consistency Findings and (B) Resource Impact Assessments

Local government shall defer, until the time of permit application, findings regarding consistency of the uses/activities listed in Policy #4 with the resource capabilities of the particular management unit.

Additionally, the impact assessment requirement for those uses/activities as specified in Policy #4 shall be performed concurrently with resource capability findings above at the time of permit application.

This strategy shall be implemented through an Administrative Conditional Use process that includes local cooperation with the appropriate state agencies such that:

A. Where <u>aquaculture</u> is proposed as a use, local government shall notify the <u>Oregon Department of Fish & Wildlife (ODFW)</u> in writing of the request, with a map of the proposed site;

B. Where <u>log storage dredging</u> is proposed as an activity, local government shall notify the <u>Oregon Department of Environmental Quality (DEQ)</u> in writing of the request, together with a map of the proposed site.

Within twenty (20) days of receipt of the notification, ODFW or DEQ, as appropriate, shall submit in writing to local government a statement as to whether the proposed use/activity will be consistent with the resource capabilities of the management segment, or if determined to be not consistent, whether the proposal can be made consistent through imposition of conditions on the permit. The

appropriate state agency shall also perform the impact assessment required in Policy #4. If no statement is received from the affected state agency by the expiration of the twenty (20) day period, local government shall presume consistency of the proposal with the resource capabilities of the management segment, shall make findings appropriate to the presumption, and shall perform the assessment of impacts required by Policy #4.

For all other uses/activities specified above, local government shall determine appropriate findings whether the proposed use/activity is consistent with the resource capabilities of the management segment and shall perform the assessment of impacts required by Policy #4.

This strategy recognizes:

A. that resource capability consistency findings and impact assessments as required by LCDC Goal #16 can only be made for the uses specified above at the time of permit application, and

B. that the specified state agencies have expertise appropriate to assist local government in making the required finding and assessments.

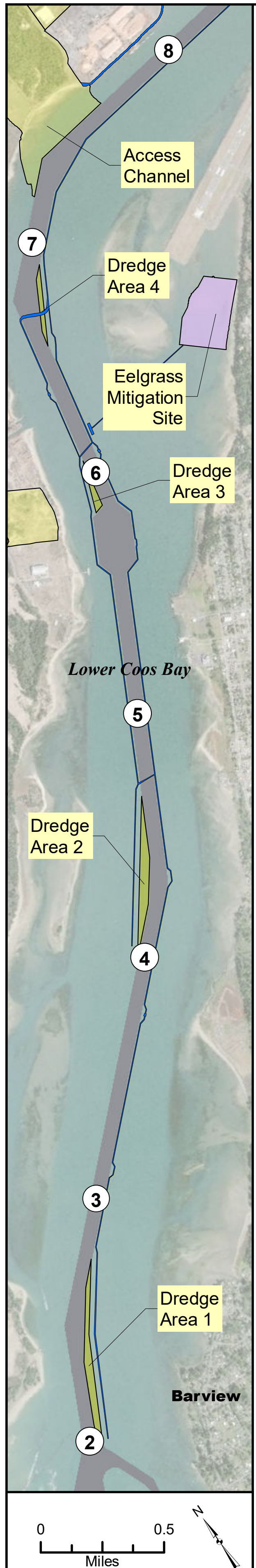
This strategy is based upon the recognition that the need for and cumulative effects of estuarine developments were fully addressed during development of this Plan and that no additional findings are required to meet Implementation Requirement #1 of Goal #16.

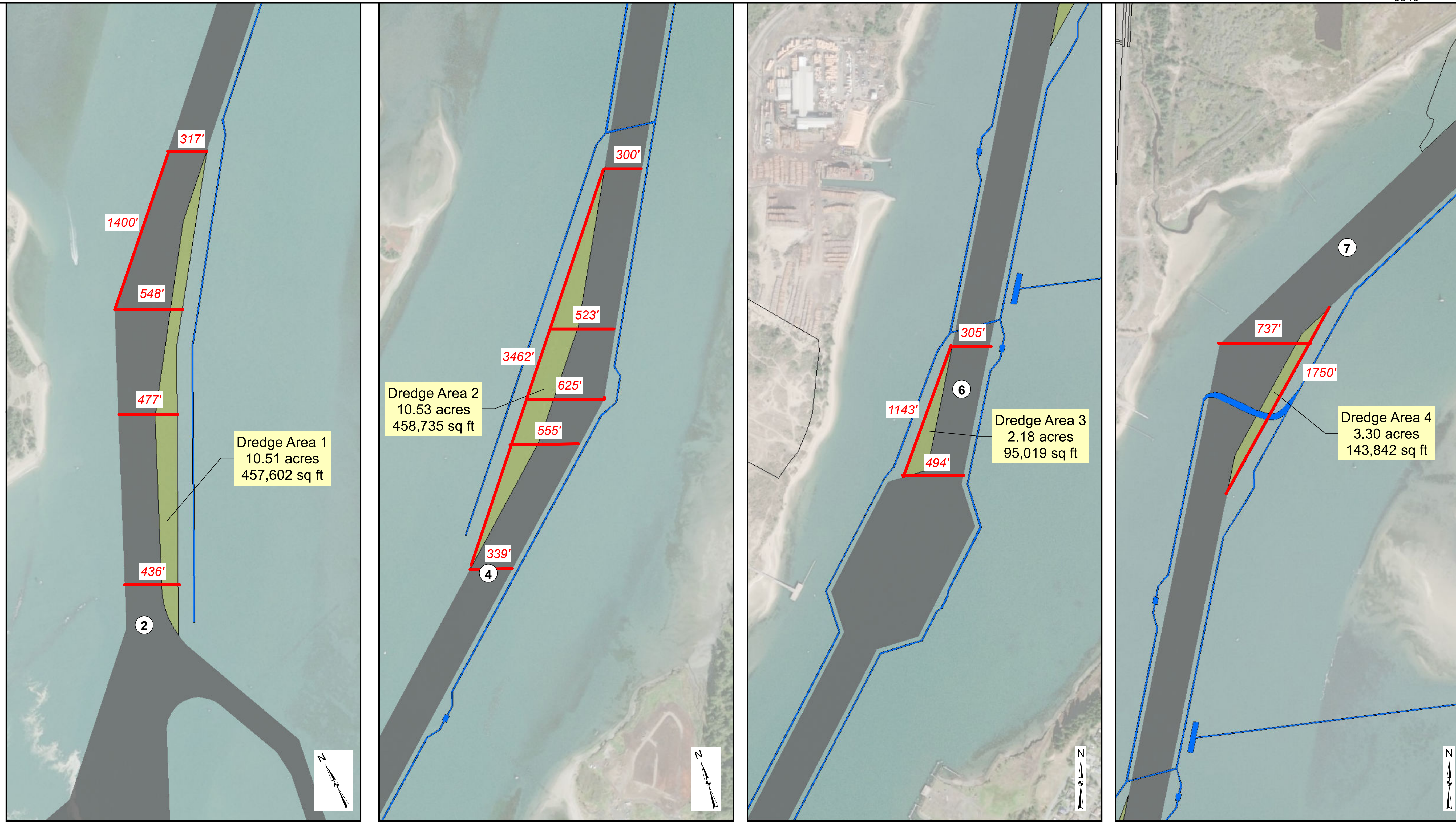
<u>RESPONSE</u>: As noted above, CBEMP Policy #4 requires findings demonstrating the public's need and gain that would warrant any modification or loss to the estuarine ecosystem, based upon a clear presentation of the impacts of the proposed alteration, as implemented in Policy #4a. None of the prerequisites to providing notice to state agencies under Policy #4a are triggered. Therefore, this policy requires the City to perform the impacts assessment consistent with CBEMP Policy #4. The City has completed that assessment above.

For an additional reason, the City should find that CBEMP Policy #4a is not applicable to the Application. LUBA has held, and the Court of Appeals has affirmed, that "[w]hen a goal exception is taken to facilitate proposed development, any comprehensive plan policies that implement the goal for which the exception is taken no longer govern that development." *Friends of Marion County*, 59 Or LUBA at 350-351, *aff'd* 233 Or App at 488. The Application requests an exception to Goal 16 to facilitate dredging in a natural management unit. As the last sentence of CBEMP Policy #4a clearly states, the purpose of this policy is to implement Goal 16: "This strategy is based upon the recognition that the need for and cumulative effects of estuarine developments were fully addressed during development of this Plan and that no additional findings are required to meet Implementation Requirement #1 of Goal #16." Accordingly, pursuant to the appellate decisions in *Friends of Marion County*, CBEMP Policy #4a is not applicable to the Application.

IV. Conclusion.

Based upon the above, the City should approve JCEP's requests: (1) to amend the CBEMP map to change the zoning designation of the NRI Site from 52-NA to DDNC-DA; (2) to amend the CBCP to take a reasons exception to Goal 16 to change the zoning designation of the NRI Site to DDNC-DA; (3) for Estuarine and Coastal Shoreline Uses and Activities Permit For "New And Maintenance Dredging" in the DDNC-DA estuarine zone; and (4) Estuarine and Coastal Shoreline Uses and Activities Permit to allow an accessory temporary dredge transport pipeline in the 52-NA, 53-CA, 54-DA, and 55-CA estuarine zones and an accessory buoy in the 52-NA estuarine zone.





Navigation Reliability Improvement (NRI) Areas
Temporary Dredge Line
JCEP Project Area
Eelgrass Mitigation Site
Federal Navigation Channel
Channel Mile

0 500 1,000 Feet

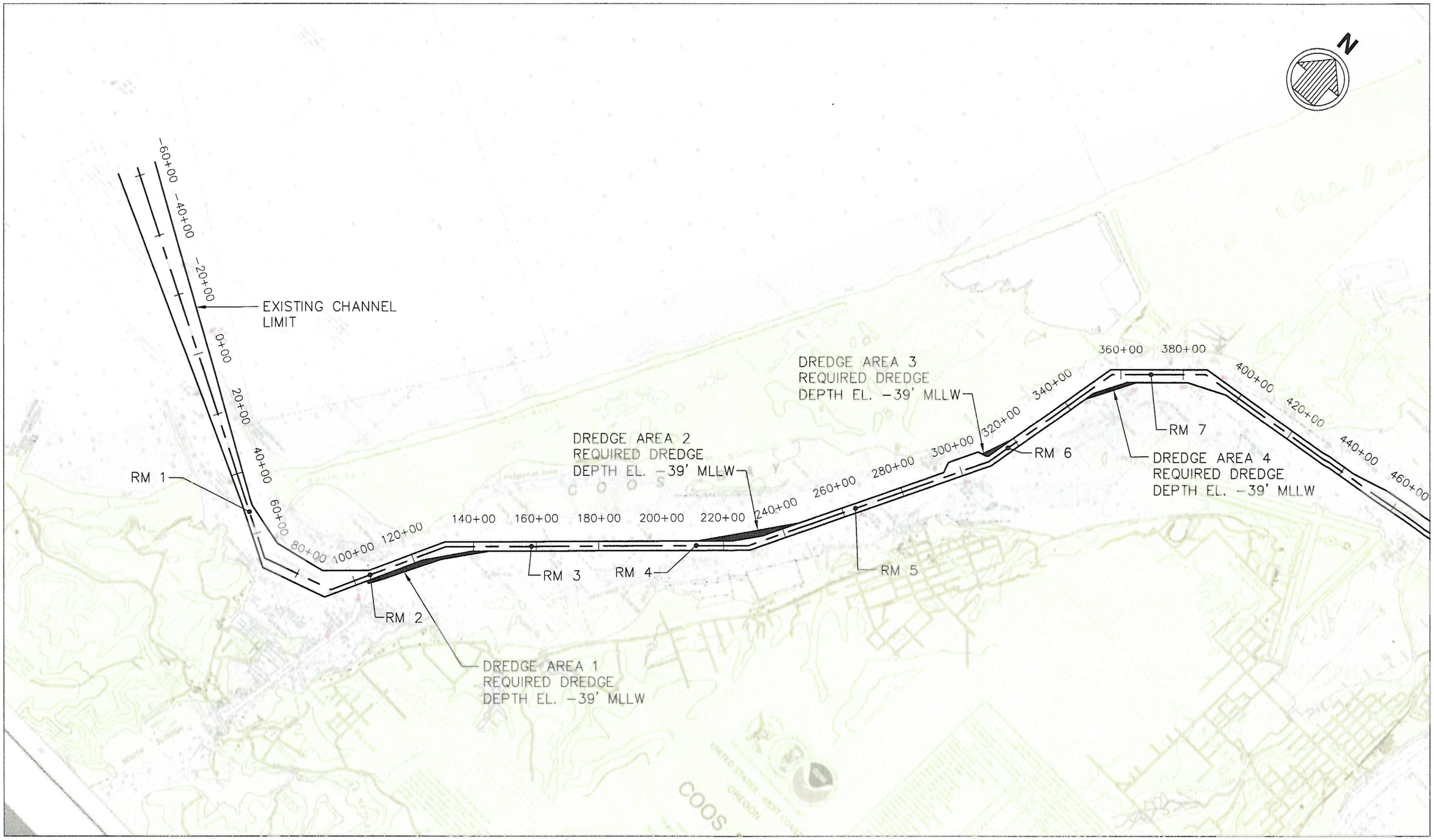
Jordan Cove Energy Project

Navigation Reliability Improvement (NRI) Areas

Jordan Cove LNG℠
A Pembina Company

1/21/2019

Exhibit 1
Page 1 of 4



moffatt & nichol
SEATTLE, WASHINGTON

NAVIGATION RELIABILITY IMPROVEMENTS
FIGURE 1 OF 9

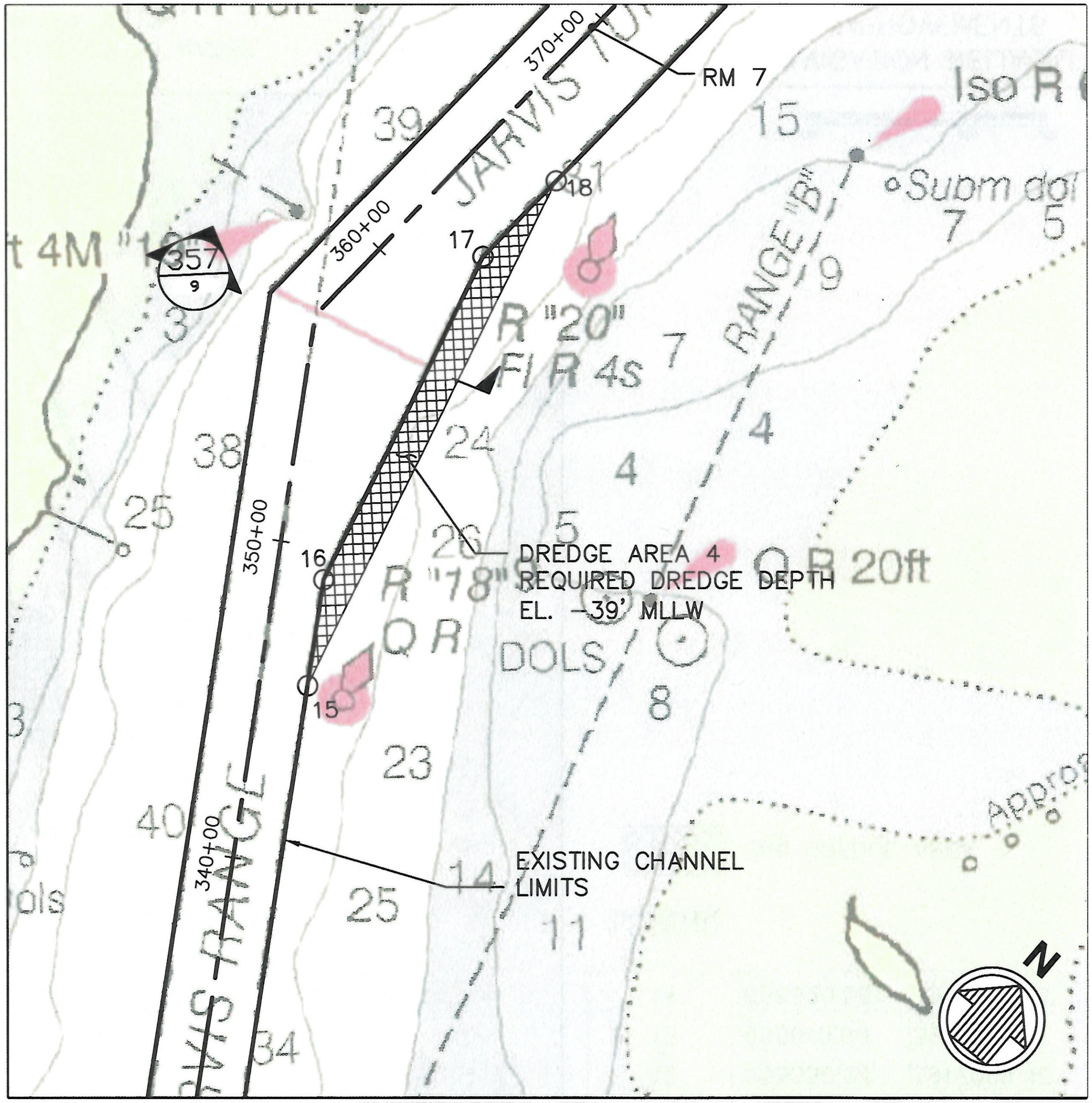
P:\9248\CADD\CGREENE\ACAD-MINORIMPROVEMENTS_161128_CGREENE-1A 9/1/2017 11:03 AM

PROPOSED DREDGE COORDINATE TABLE

POINT #	NORTHING	EASTING
15	659067.23	3918213.13
16	659392.65	3918278.77
17	660377.49	3918823.24
18	660603.73	3919062.58

LEGEND

NRI DREDGE AREA



250 0 250 500

NOTES:
1. HORIZONTAL DATUM OREGON STATE PLANE SOUTH NAD83.
2. VERTICAL DATUM: MEAN LOWER LOW WATER (MLLW).

NRI = NAVIGATION RELIABILITY IMPROVEMENTS

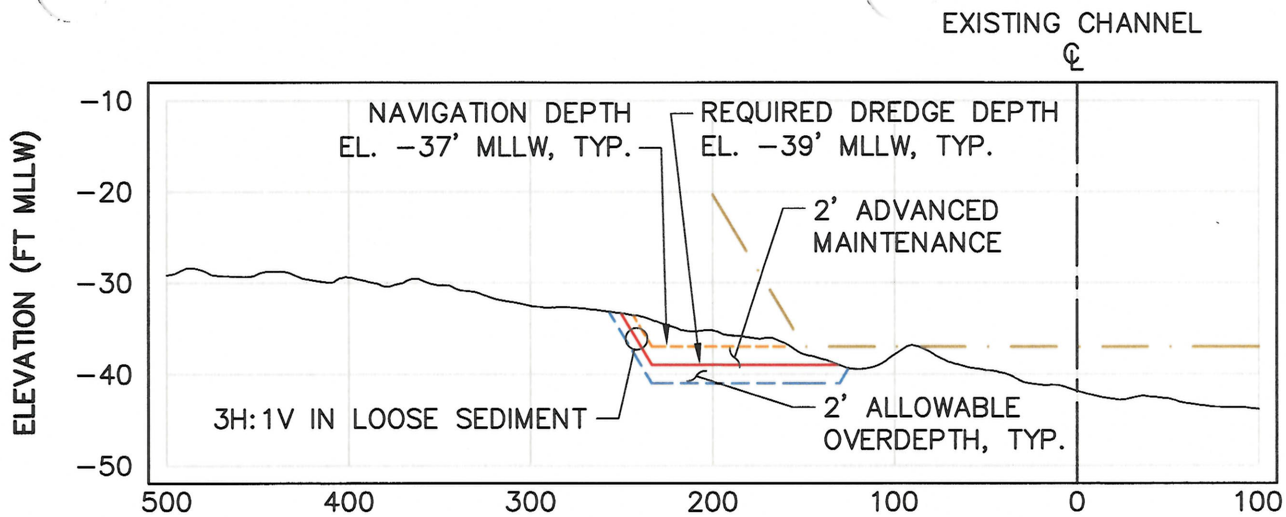
moffatt & nichol
SEATTLE, WASHINGTON

NAVIGATION RELIABILITY IMPROVEMENTS
FIGURE 6 OF 9

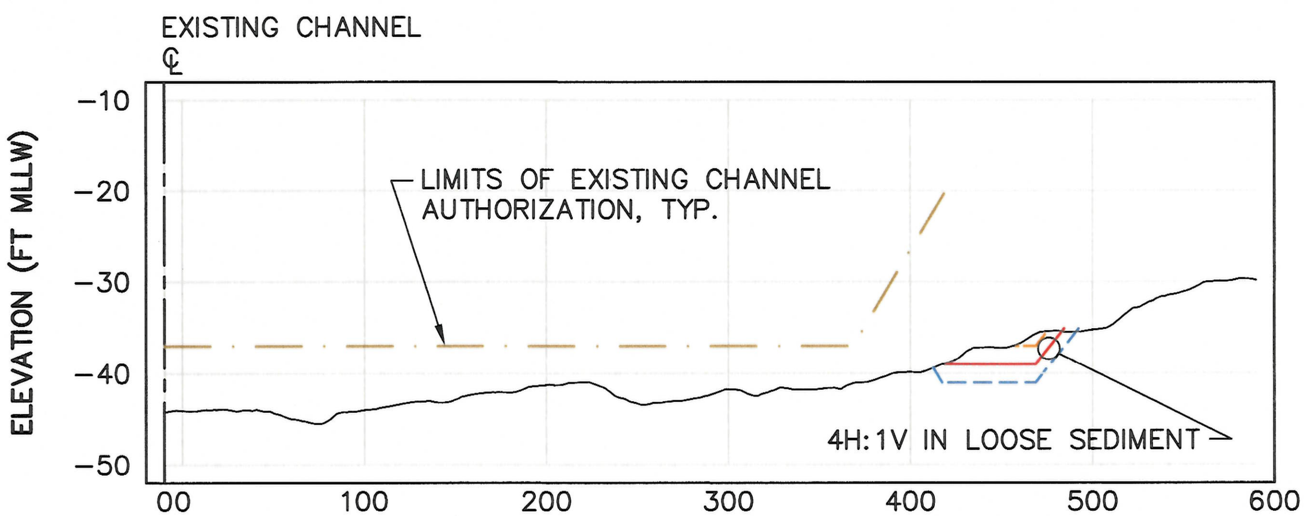
J1-000-RGL-PM -00003-00 Rev A

P:\9248\CADD\CGREENE\ACAD-MINORIMPROVEMENTS_161128_CGREENE-6A 9/1/2017 12:15 PM

PART 1 JCEP: ATTACHMENT E



315
5
AREA 3 STA 315+00 (RM 6.0)



357
6
AREA 4 STA 357+00 (RM 6.8)

LEGEND

- MUDLINE
- EXISTING CHANNEL
- NRI REQUIRED DREDGE DEPTH (-39' MLLW)
- NRI NAVIGATION DEPTH (-37' MLLW)
- NRI ALLOWABLE OVERDEPTH

NRI = NAVIGATION RELIABILITY IMPROVEMENTS

10' 0' 10' 20'
VERTICAL SCALE

50' 0' 50' 100'
HORIZONTAL SCALE

NOTE: SECTION VIEWS FACE UPSTREAM.

moffatt & nichol
SEATTLE, WASHINGTON

NAVIGATION RELIABILITY IMPROVEMENTS
FIGURE 9 OF 9

J1-000-RGL-PMT-DEA-00003-00 Rev A

CITY OF COOS BAY
Community Development Department

500 Central
Avenue Coos
Bay, OR 97420

541.269.8918
www.coosbay.org

PRE-APPLICATION CONFERENCE NOTES

CASE FILE#:	**187-ZON17-006**
LOCATION:	**Coos Bay Estuary, approximately 2,700 feet northwest of the end of the North Bend airport runway**
TYPE OF REQUEST:	**Comprehensive Plan and Text Amendment**
CITY STAFF ATTENDING:	**Eric Day, Tom Dixon, and Debbie Erler**
COUNTY STAFF ATTENDING:	**Jill Rolfe**
DATE OF PRE-APPLICATION:	**February 2, 2017**

All Coos Bay code chapters referenced in this report are available on the City's website at http://www.codepublishing.com/or/coosbay/.

1. <u>TYPE OF APPLICATION</u>

Comprehensive Plan and Text Amendments (per CBMC 17.215)
Estuarine and Coastal Shoreline Uses and Activities (per CBMC 17.370)

2. <u>PROCESS SUMMARY</u>

The applicant will submit Comprehensive Plan Amendment and Text Amendment applications which require a Type IV review. Per the CBDC the hearing bodies will be the Planning Commission for a recommendation and the City Council for final decision.

Review Process:

- Pre-application conference (completed).
- Application submittal.
- Staff review for completeness (up to 30 days).
- When application is determined to be technically complete, the application is considered to be vested.
- Public notices are mailed/published and hearing dates are set before the Planning Commission and the City Council.
- Staff report is prepared and made available to the applicant at least seven days before the date of the Planning Commission public hearing.
- The Planning Commission will make a recommendation to the City Council for approval

or denial based upon the staff recommendation and the criteria found in the CBMC and the City's Comprehensive Plan.

- The City Council will make a final decision after a public hearing
- A Final Order and Ordinance is provided following the City Council decision

3. COMMUNITY DEVELOPMENT CODE AND COMPREHENSIVE PLAN

The applicant must address all standards of the applicable criteria for Plan Amendments and Zone Changes per CBMC 17.215.060. For the City of Coos Bay's review, the review is only for text and plan amendments but no zone change.

The applicant must address all application submittal requirements for the Estuarine and Coastal Shoreline Uses and Activities per CBMC 17.370.030.

The applicant must also describe proposed changes to estuary segments including both existing and proposed designations.

The applicant must address elements of the Coos Bay Comprehensive Plan pertaining to this project and address relevant State of Oregon Land Use Goals including Goal 6 – Air, Water and Land Resources Quality; Goal 9 – Economic Development; Goal 12 – Transportation; and Goal 16 Estuarine Resources.

4. ADDITIONAL REVIEW MATERIAL

The applicant should include supporting information including existing graphic portrayals of the channel section being considered, dredging cross sections of both width and depth profiles for areas of expansion or alteration, the quality and quantity of materials to be excavated, and final expected bathymetric contours for area of impact. In addition, information should be shared regarding potential impacts to the marine environment and how these impacts will be mitigated.

5. DOCUMENTATION REQUIRED FOR A COMPLETE APPLICATION

The following items are required to be submitted in only in a single form, along with a digital copy, for the main application:

- Application form signed by the owner and applicant, if applicable. In place of a signed application form the property owner may submit as a part of the application that they give the applicant permission to apply for the required land use applications in their place. This permission will not preclude the property owner from withdrawing consent at any time.
- Proof of ownership (Department of State Lands).

In addition, the following items are required to be submitted in ten collated sets in addition to a digital a copy:

- Application maps and narrative information as stipulated per CBMC 17.215.040 and 17.370.030,
- A narrative of the applicable State of Oregon Land Use Goals and Comprehensive Plan Goals and Policies, and
- Additional information that will provide reviewers and decision makers sufficient basis to weigh the criteria and render a decision.

5. APPLICATION FEES

Per the City fee resolution, the City will be collecting a $70.00/hr. fee for the review of this project as it is believed that City staff time will far outweigh the outlined fee(s) in the resolution for this type of review. The City will collect a $7,000.00 fee up front at time of application submittal. Should any additional fees be required they will be requested at that time. Should the City not exhaust the initial fee the unused portion will be returned to the applicant after the review is finalized.

The City may retain an outside land use consultant/attorney to aid in the review of this application. Should the City elect this approach the consultants fees will be passed along to the applicant for payment.

6. <u>TIME FRAME FOR REVIEW PROCESS</u>

Per State law, staff has 30 days to review the application submittal for technical completeness. If incomplete, the applicant will have 180 days from the date of the incomplete letter to submit additional information. Once deemed complete the application review shall not exceed 120 days for a final decision, including appeals to the City Council. Appeals to LUBA fall outside the 120 day review process.

NOTICE TO APPLICANTS:
The standards noted in this checklist are those which staff believes may be applicable to your proposal. Additional standards may also be determined applicable at the time of a development submittal. The burden is upon the applicant to review all applicable City documents and address all the relevant standards. The applicant should verify the fees prior to submitting application.

Roseburg
A Forest Products Company

July 26, 2018

Via Electronic Mail

TO: Department of State Lands

FROM: Roseburg Forest Products Co.

RE: **Letter of Support for the JCEP Navigation Reliability Improvements**

To whom it may concern,

Roseburg Forest Products Co. ("Roseburg") wishes to express its support for the excavation and widening of four submerged areas adjacent to the federally authorized Coos Bay Navigation Channel ("Channel"). These areas are collectively referred to by the Jordan Cove Energy Project ("JCEP") as the Navigation Reliability Improvements ("NRIs"). Roseburg supports this proposal because the NRIs will provide navigation enhancements that will increase the margin of safety available not only for vessels serving the proposed JCEP LNG Terminal, but for vessels serving Roseburg's terminal and other marine terminal facilities in Coos Bay.

The proposed NRIs will increase the operational window for safe vessel transit by approximately 20% according to analysis conducted by JCEP. The improvements are designed to reduce entry and departure delays which will allow for more efficient vessel transits through the Channel for the size of vessels calling at the Port of Coos Bay today as well as for vessels calling in the future. Minimizing delay is a pressing concern because Roseburg has identified potential new wood chip customers in Asia which will require using bulk carriers that are slightly larger than the ships typically calling today.

Upon completion of the proposed NRIs, the Channel will operate more efficiently and with an increased operational margin of safety. Without the proposed improvements, shipping commerce will be delayed or otherwise compromised. The potential for growth in shipping commerce in Coos Bay via larger ships will also be in jeopardy. Implementing the proposed improvements will help to ensure safe and efficient navigation for vessels calling at Roseburg's terminal and all other vessels transiting the Coos Bay Channel. The proposed NRIs are needed to ensure the current and future viability of maritime commerce in Coos Bay. Roseburg respectfully urges that these navigation improvements be granted favorable consideration.

Sincerely,

Richard [signature]

Roseburg Forest Products Co.

P.O. Box 426 • North Bend, OR 97459 • Office: 541.756.4307 • Toll Free: 800.245.1115 • Fax: 541.756.2506 • www.Roseburg.com

Coos Bay Pilots Association

686 N. Front Street
Coos Bay, Oregon 97420
Tel. 541-267-6555

July 25, 2018

RE: Letter of Support from the Coos Bay Pilots Association for the Jordan Cove Energy Project's Navigation Reliability Improvements

To whom it may concern,

The Jordan Cove Energy Project ("JCEP") proposes to excavate and widen four submerged areas adjacent to the federally authorized Coos Bay Navigation Channel ("Channel"), collectively known as the Navigation Reliability Improvements (NRIs). The Coos Bay Pilots Association ("Pilots") supports this proposal because it provides navigation enhancements necessary to increase the margin of safety available to the Pilots and the vessel Master, in turn improving the efficiency and navigability of the Channel.

The Pilots, regulated and approved by the State of Oregon, are responsible for supporting deep sea vessel Masters in navigating their vessels into and out of the Channel. The Pilots serve a vital function for maritime commerce in Coos Bay by safely and efficiently guiding vessels through the Channel (known as pilotage) using visual aids, radar, and other means. The Channel provides the only safe vessel access to marine terminals located within Coos Bay. Pilots are specifically trained to navigate the Channel, possessing detailed local knowledge of its unique bathymetric conditions and visual references. Pilotage is mandatory in Oregon.

Marine terminal facilities in Coos Bay are grouped into two categories: 1) the lower bay terminals from the entrance up to River Mile ("RM") 9.0 and 2) the upper bay terminals upstream of RM 9.0. The railroad swing bridge at RM 9.0 limits the size of vessels that can pass through the bridge opening. Four terminals are currently in operation in the lower bay. The proposed JCEP LNG terminal site is also in the lower bay. Ten terminal and dock facilities are located in the upper bay. Currently, three of the terminals in the upper bay and one terminal in the lower bay can handle deep draft vessels.

The Channel was initially authorized in 1899 and has undergone ten subsequent modifications. Most recently, the Channel was deepened from -35 feet to -37 feet in 1997 to allow for safe navigation and transit by the size of ships prevalent at that time. Over the past 20 years, the dimensions and tonnage of ships serving terminals in Coos Bay have increased. Specifically, the size of vessels calling on Coos Bay terminals has increased from an average of 45,422 metric tonnes to an average of 52,894 metric tonnes with a projected near-term vessel size of up to 70,400 metric tonnes. Safety margin considerations due to environmental conditions, including wind, fog, tides, and currents, coupled with increasing ship size, have caused the Pilots to impose restrictions on when vessels may safely transit the Channel. These restrictions in turn cause significant delays and increase pressure on the Pilots. These types of delays decrease the efficiency and competitiveness of maritime commerce on a global scale, and jeopardize the continued success of maritime commerce in Coos Bay.

The Pilots believe the proposed NRIs are essential for achieving the required number of LNG vessel transits needed to lift the JCEP design annual LNG production volume. JCEP has informed the Pilots that excessive delays in LNG Carrier transits to and from the LNG terminal could result in a shore storage tank topping situation, requiring the project to curtail production of LNG. The Pilots also believe that, in addition to the JCEP LNG terminal, the NRIs will directly benefit other marine terminals in Coos Bay that currently handle deep draft vessels. Further, the NRIs have the potential to benefit any future marine terminal that may be constructed in the Port.

The Pilots estimate that completion of the proposed NRIs will increase the operational window for safe vessel transit by approximately 20%. Minimizing delay is a pressing concern because companies that utilize the port of Coos Bay have identified potential new customers in Asia that desire to export cargo using bulk carriers that are slightly larger than the ships typically calling today. Various marine terminal businesses, within Coos Bay, require enhanced assurances that terminals will be able to efficiently accommodate larger dimension bulk carriers in the near term.

The proposed NRIs are designed to reduce entry and departure delays and to allow for more efficient vessel transits through the Channel for the size of vessels entering the Port today. Although log export vessels serving the upper bay are smaller, the proposed enhancements also benefit these vessels by broadening the tidal and environmental windows for transiting the Channel, providing an enhanced margin of safety and improved efficiency in the loaded vessel departure schedule. The proposed actions are needed to ensure the current and future viability of maritime commerce in Coos Bay. The NRIs will allow companies to engage in emerging opportunities to export products with today's larger vessels, including bulk carriers of up to 223 meters (732 feet) in length and 40 meters (131 feet) in beam with a cargo carrying capacity up to 70,400 deadweight tonnes.

Upon completion of the proposed NRIs, the Channel will operate more efficiently and with an increased operational margin for vessels calling today as well as for JCEP LNG carriers and other vessels calling in the future. Without the proposed improvements, shipping commerce will continue to operate with the same narrow weather and tidal windows. Implementing the proposed improvements will help to ensure that the Pilots can continue to serve their role of providing safe and efficient navigation for all vessels transiting the Coos Bay Channel.

Respectfully,

George Wales

Captain George Wales
Coos Bay Pilots Association

Oregon's Seaport... Port of Coos Bay

OREGON INTERNATIONAL
Port of Coos Bay

October 30, 2018

via email

Mr. Robert Lobdell
Aquatic Resource Coordinator
Oregon Department of State Lands
775 Summer Street NE, Suite 100
Salem, OR 97301-1279

Re: Jordan Cove Energy - Navigation Reliability Improvements Project

Dear Mr. Lobdell:

On behalf of the Oregon International Port of Coos Bay ("OIPCB"), I would like to take the opportunity to offer our support for the proposal by the Jordan Cove Energy Project ("JCEP") to deepen and widen four submerged areas adjacent to the federally authorized Coos Bay Navigation Channel ("Channel").

We understand that JCEP is seeking local, state and federal authorizations to undertake this work, which is collectively referred to as the Navigation Reliability Improvements ("NRI"), including Removal-Fill authorization from the Department of State Lands. Specifically, the improvements are designed to reduce entry and departure delays to facilitate more efficient vessel transits through the Channel for the size of vessels calling at the Port of Coos Bay today as well as for likely larger vessels served by the Port in the future. Upon completion of the proposed NRIs, the Channel will operate more efficiently and with an increased operational margin of safety, which is necessary to ensure the current and future viability of maritime commerce in Coos Bay. The OIPCB supports these proposed Channel improvements because the navigation enhancements will increase the margin of safety available not only for vessels serving the proposed JCEP LNG Terminal, but, of equal importance to the Port, for vessels serving existing and future marine terminal facilities in Coos Bay.

For these reasons, the OIPCB respectfully urges that these navigation improvements be granted favorable consideration.

Sincerely,

Mr. John Burns
Chief Executive Officer
Oregon International Port of Coos Bay

125 West Central Avenue, Suite 300 | P.O. Box 1215 | Coos Bay, Oregon 97420-0311
Phone: 541-267-7678 | Fax: 541-269-1475 | email: portcoos@portofcoosbay.com | web: www.portofcoosbay.com

State of Oregon Representatives Offices: Tokyo, Japan – Oregon Japan Representative | Phone: 81-3-5430-0771 | Fax: 81-3-5430-0775
Seoul, Korea – Korea Representative Office | Phone: 82-2-753-1349 | Fax: 82-2-753-5154

U.S. Department of Homeland Security
United States Coast Guard

Captain of the Port
U. S. Coast Guard
Sector Columbia River

2185 SE 12th Place
Warrenton, Oregon 97146-9693
Staff Symbol: s
Phone: (503) 861-6211

16611
May 10, 2018

Director of Gas Environment and Engineering, PJ 11
Attn: Mr. Rich McGuire
Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

Dear Mr. McGuire:

This Letter of Recommendation (LOR) is issued pursuant to 33 Code of Federal Regulations (CFR) 127.009 in response to the Letter of Intent submitted by Jordan Cove Energy Project. L.P. (Jordan Cove) on January 9, 2017. Jordan Cove proposes to construct and operate the Jordan Cove LNG facility in Coos Bay, Oregon from which Liquefied Natural Gas (LNG) is proposed to be transferred in bulk to a vessel for export. This LOR conveys the Coast Guard's recommendation on the suitability of the Coos Bay Channel for LNG marine traffic as it relates to safety and security. In addition to meeting the requirements of 33 CFR 127.009, this LOR fulfills the Coast Guard's commitment for providing information to your agency under the Interagency Agreement signed in February 2004.

After reviewing the information in the applicant's Letter of Intent (LOI) and Waterway Suitability Assessment (WSA) with subsequent annual updates and completing an evaluation of the waterway in consultation with a variety of state and local port stakeholders, I recommend that the Coos Bay Channel be considered suitable for LNG marine traffic. My recommendation is based on review of the factors listed in 33 CFR 127.007 and 33 CFR 127.009. The reasons supporting my recommendation are outlined below.

On November 1, 2017, I completed a review of the WSA for the Jordan Cove Energy Project, submitted to the Coast Guard by KSEAS Consulting on behalf of Jordan Cove in February 2007. This review was conducted following the guidance provided in U.S. Coast Guard Navigation and Vessel Inspection Circular (NVIC) 01-2011, dated January 24, 2011. In conducting this review and analysis, I focused on the navigation safety and maritime security aspects of LNG vessel transits along the affected waterway. My analysis included an assessment of the risks posed by these transits and validation of the risk management measures proposed by the applicant in the WSA. During the review, I consulted a variety of stakeholders including the Area Maritime Security Committees, Harbor Safety Committees, State representatives, Pilot Organizations, and local emergency responders.

Based upon a comprehensive review of Jordan Cove's WSA, and after consultation with State and Local port stakeholders, I recommend that the Coos Bay Channel be considered suitable for accommodating the type and frequency of LNG marine traffic associated with this project.

The attached LOR Analysis contains a detailed summary of the WSA review process that has guided this recommendation. It documents the assumptions made during the analysis of Jordan Cove's WSA. It discusses details of potential vulnerabilities and operational safety and security measures that were analyzed during the review. The portion of the LOR Analysis which

addresses matters that affect maritime security is marked as Sensitive Security Information and is withheld from distribution.[1] The LOR Analysis sets forth the navigational safety and maritime security resource gaps that currently exist in, on, and adjacent to the waterway, including the marine transfer area of the proposed facility, and which, to the extent allowable under FERC's existing legal authority, may be addressed in its Commission Order if one is issued. To the extent implementation of specific mitigation measures fall outside the scope of FERC's legal authority, the applicant is expected to examine the feasibility of implementing such mitigation measures, in consultation with the Coast Guard and State and Local agencies as applicable.

This recommendation is provided to assist in the Commission's determination of whether the proposed facility should be authorized. This Letter of Recommendation is not an enforceable order, permit, or authorization that allows any party, including the applicant, to operate a facility or a vessel on the affected waterway. Similarly, it does not impose any legally enforceable obligations on any party to undertake any future action be it on the waterway or at the proposed facility. It does not authorize, nor in any way restrict, the possible future transit of properly certificated vessels on the Coos Bay Channel. As with all issues related to waterway safety and security, I will assess each vessel transit on a case by case basis to identify what, if any, safety and security measures are necessary to safeguard the public health and welfare, critical marine infrastructure and key resources, the port, the marine environment, and vessels. In the event the facility begins operation and LNG vessel transits commence, if matters arise concerning the safety or security of any aspect of the proposed operation, a Captain of the Port Order could be issued pursuant to my authority under the Ports and Waterways Safety Act of 1972, as amended by the Port and Tanker Safety Act of 1978, 33 U.S.C. § 1221 – 1232, among other authorities, to address those matters.

Please note that Enclosures (4) is Sensitive Security Information (SSI) and shall be disseminated, handled and safeguarded in accordance with 49 CFR Part 1520, "Protection of Sensitive Security Information."

If you have any questions on this recommendation, my point of contact is Lieutenant Commander Laura Springer. She can be reached at the address listed above, by phone at (503) 209-2468, or by email at Laura.M.Springer@uscg.mil.

Sincerely,

W. R. TIMMONS,
Captain, U. S. Coast Guard
Captain of the Port, Sector Columbia River

Enclosure (1) LOR Analysis
(2) LOR issued by Sector Portland on April 24, 2009
(3) U.S.C.G.'s Waterway Suitability Report for the Jordan Cove Energy Project
(4) LOR Analysis (SSI Portion)

[1] Documents containing SSI may be made available upon certification that the requestor has a need to know and appropriate document handling and non-disclosure protocols have been established.

Copy: Commander, Coast Guard District Thirteen (dp)
Commander, Pacific Area (PAC-54)
Commandant (CG-OES), (CG-ODO), (CG-FAC), (CG-741), (CG-CVC), (CG-ENG), (LNGNCOE)
Marine Safety Center (CG MSC)
Jordan Cove

UNITED STATES COAST GUARD

Jordan Cove LNG

ANALYSIS SUPPORTING THE LETTER OF RECOMMENDATION ISSUED BY COTP SECTOR COLUMBIA RIVER ON MAY 10, 2018

Enclosure (1)

Introduction

1. This analysis is a supplement to my Letter of Recommendation (LOR) dated May 10, 2018, that conveys my recommendation on the suitability of the Coos Bay Ship Channel for liquefied natural gas (LNG) marine traffic associated with the Jordan Cove LNG (JCLNG) export terminal project Coos Bay, Oregon. It documents the processes followed in analyzing JCLNG's Waterway Suitability Assessment (WSA) and the suitability of the waterway for LNG marine traffic.

2. For the purposes of this analysis, the following assumptions were made:

   a. The applicant is fully capable of, and would fully implement, any and all risk management measures identified in their WSA.
   b. The conditions of the port identified in the WSA fully and accurately describe the actual conditions of the port at the time of the WSA submission.
   c. The conditions of the port have not changed substantially during the analysis process.
   d. The applicant will fully meet all regulatory requirements including the development and submission of a Facility Security Plan, Emergency Manual, and Operations Manual.

3. The Port of Coos Bay is a deepwater port located in Coos Bay, Oregon on the Pacific Coast of the United States. The Port of Coos Bay offers easy access to Asian markets and facilitates the international movement of goods between the United States and Asia. The Port of Coos Bay is managed under the jurisdiction of the Portland Navigation District and has an authorized channel depth of 37 feet. The channel width is 300 nominal feet. The principal exports are logs, wood chips, lumber, and plywood. The Port of Coos Bay is currently conducting a feasibility study to examine widening and deepening its ship channel.

4. The Port of Coos Bay is approximately 173 nautical miles south of the Columbia River and 367 miles north of the entrance to San Francisco Bay. The Port has seen declining arrivals and is not currently heavily trafficked.

5. Inbound and outbound traffic density in the Port of Coos Bay is currently minimal. In the summer months and during fishing season there are a number of commercial fishing vessels working in the region. The maximum anticipated LNG Carrier port calls per year is expected to be around 120. These projections are based on a maximum nominal LNG output of 7.8 MTPA. Other traffic transiting through the Port of Coos Bay include fishing vessels, recreational vessels, and towing vessels.

6. The Terminal will be sited at the north end of the Coos Bay Channel near Jordan Cove. All Terminal facilities will be located within an approximately 200-acre parcel of land. The approximate locations of the coordinates of the facility are: 43 degrees-25.5' North and 124 degrees 15.7' West.

7. The U.S. Coast Guard regulates the port under the Maritime Transportation Security Act (MTSA), Security and Accountability for Every Port Act (SAFE Port Act), Ports and Waterways Safety Act (PWSA) and other laws applicable to maritime safety and security. U.S. Coast Guard regulated facilities in the area include chip terminals and fuel transfer facilities.

8. Ships entering or departing Coos Bay require a pilot. The Coos Bay Pilots are state licensed Oregon pilots responsible for ensuring the safe transit of vessels transiting through the Port of Coos Bay. They handle approximately 50 vessel transits through the Port of Coos Bay each year.

9. In order to support operations associated with the facility, the applicant will provide additional towing vessels as outlined in their WSA. All tractor tugs must be at least 80 Ton Astern Bollard or larger and equipped with Class 1 Fire Fighting equipment.

10. The applicant established an emergency response planning group in preparation for facility construction and operation in 2006. This group is tasked with education and preparedness concerning this facility. It must be noted that there are schools located in the zones of concern.

Impact to Coast Guard Operations

1. The U.S. Coast Guard is responsible for screening LNG Carriers transiting from foreign ports prior to arrival and will screen all vessels in accordance with existing policies and procedures. The vessels calling on the facility will be foreign flagged and the flag state is yet to be determined. I do not intend to require additional government conducted safety inspections beyond those which already apply to deep draft LNG vessels.

2. Facility and vessel inspection activities will be supported by Marine Safety Unit Portland personnel.

3. Limited access areas (LAA) associated with the project have yet to be established. Sector Columbia River will use risk based decision making and work with existing policy to determine the appropriate LAAs. The proposed LAA in enclosure (3) was not put out for regulatory review and is not in effect.

4. LNG is not considered oil and all vessels calling on the facility will be required to comply with non-tank vessel response plan requirements. The applicant is highly encouraged to work with the Area Committees established under the National Contingency Plan to address issues associated with response in Coos Bay.

5. The Facility will be in the Sector Columbia River Captain of the Port Zone and falls under the purview of the Federal Maritime Security Coordinator who is also the Sector Columbia River Captain of the Port. Specific issues related to this are outlined in Enclosure (4).

Figure 1. Jordan Cove Conceptual rendering of facility

Decision Making Process

1. The following factors regarding the condition of the waterway, vessel traffic, and facilities upon the waterway, were taken into consideration during the LOR process. The processes used are detailed in this section.

2. To ensure all regulatory processes were met, Sector Columbia River took a systematic approach in the WSA validation process. To streamline and ensure transparency, Sector Columbia River worked with Jordan Cove, the Consulting Group KSEAS, and port partners though a series of ad hoc meetings and a one day workshop.

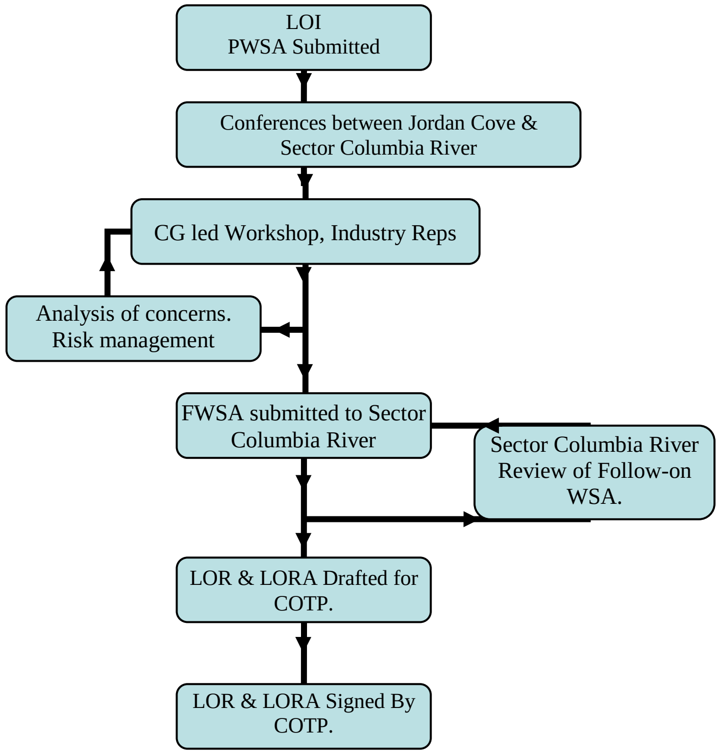


Figure 2 - LNG LOR Process
(Sector Columbia River)

3. NVIC 01-2011 provides guidance on the review and validation of a WSA. Applying NVIC 01-2011's procedural framework, my staff held several in-house reviews of the WSA, and facilitated discussions during a workshop held in Coos Bay, OR on October 16, 2017. The workshop included a wide range of participants, including representatives from; the USCG; Coos Bay Pilots Association; Port Authorities, the State of Oregon and law enforcement agencies.

Members	**Position/Role**
LCDR Laura Springer	Waterways Management Division Chief, MSU Portland
LCDR Ben Crowell	Surface Operations, Sector North Bend
LCDR Andrew Madjeska	Incident Management Division Chief, Sector Columbia River
LCDR Xochitl Castaneda	District Thirteen Prevention
Ms. Deanna Henry	Oregon Department of Energy
George Wales	Coos Bay Pilots
Richard Dybevik	Roseburg Forest Products
Doug Strain	Coos Bay Sheriff
Jim Brown	North Bend Fire Department
Doug Eberlein	Coos Bay Response Co-op (CBRC)
LT Ethan Lewallen	USCG LNG NCOE

Table 1 – Jordan Cove WSA Team 1 Nov 2017
(Port of Coos Bay)

4. The participants of this “ad-hoc” workshop, recommended by NVIC 01-2011, utilized their expertise on the physical characteristics and traffic patterns of the waterway, as well as their respective specialty knowledge of the marine environment, LNG, safety, security, and facility operations, to analyze the suitability of the waterway to support LNG marine traffic associated with JCLNG.

5. Participants considered the changes in the area’s safety and security dynamics which may result from the introduction of LNG ship traffic associated with the JCLNG Project. Jordan Cove used the American National Standards Institute (ANSI)/American Petroleum Institute (API) Standard 780 Security Risk Assessment (SRA) Methodology, as the basic approach for assessing risk. The standard was published in June of 2013 as a U. S. standard for security risk assessments on petroleum and petrochemical facilities. The standard is a tool used to evaluate all security risks associated with petroleum and petrochemical infrastructure and operations, and assists owners and operators through the process of conducting thorough and consistent SRAs. For security purposes, participants considered potential threats and consequences of intentional act of aggression to the facility and developed security measures to mitigate the risks.

    a. Please see Enclosure (4) if you have a need to know concerning the results of this

6. During the above mentioned workshop held in Coos Bay, OR on October 16, 2017, the ad-hoc working group also evaluated safety factors including the potential impacts of groundings, collisions, and allisions and thoroughly examined the simulator data presented in the WSA.

7. Each of the recommended risk management measures from enclosure (7) of NVIC 01-2011 were considered. In the WSA workshop, additional risks and recommendations were discussed related to a Cascadia Subduction Zone Earthquake and associated implications for the facility and region if a laden vessel was tied up at the layberth.

8. The ad-hoc working group considered each scenario along each transit segment and evaluated the causes of accidental or intentional events. The workshop analyzed the contributing factors for each scenario and their likelihood of occurrence given the adequacy of safety and security layers.

9. Sector Columbia River followed the checklist found in NVIC 01-2011 during the review. Through this review, Sector Columbia River clarified certain points in the WSA to ensure that the document contained accurate information and that references were applicable. With the 2017 update to the WSA, Jordan Cove has satisfied the requirements of the LOR process.

10. Based on my review of the WSA completed on November 1, 2017, and input from state and local port stakeholders, and taking into account previously reviewed expansion projects, I recommend to the Federal Energy Regulatory Commission

that the waterway in its current state be considered suitable for the LNG marine traffic associated with the proposed project.

11. This recommendation is contingent upon the applicant completing all actions outlined in the Waterways Suitability Assessment as submitted, and actions associated with subsequent annual updates, and completing all actions outlined in the most current WSA and actions under the control of the applicant from the July 1, 2008, Waterway Suitability Report.

Waterway Conditions Adjacent to the Facility

1. **Depth of Water**. The channel is currently maintained at a 37' depth.
2. **Tidal Range**. The tides of Coos Bay are of the mixed semi-diurnal type with paired highs and lows of unequal duration and amplitude. The tidal range increases upstream to the City of Coos Bay and the time difference between peak tides at the entrance and City of Coos Bay is about 40-90 minutes, depending on the location. The head of the tide is located at River Mile 27 on both the Millicoma and South Fork Coos Rivers. The tidal range is 7.5 feet near the open sea channel and 6.7 feet at the entrance to Charleston Harbor.

Table 2 Tidal Datums, Coos Bay, OR NOAA Tide Stations 9432895, 9432879, and 9432780

Tide Level	Abbreviation	Tide Level (ft) North Bend	Tide Level (ft) Empire	Tide Level (ft) Charleston
Tide Station ID #		9432895	9432879	9432780
Latitude		43º 24.6'N	43º 22.6'N	43º 20.7'N
Longitude		124º 13.1'W	124º 17.8'W	124º 19.3'W
Extreme High Water	EHW	-	-	+10.5
Mean Higher High Water	MHHW	+8.4	+7.7	+7.6
Mean High Water	MHW	+7.8	+7.1	+7.0
Mean Sea Level	MSL	+4.7	+4.2	+4.1
Mean Low Water	MLW	+1.3	+1.3	+1.3
Mean Lower Low Water	MLLW	+0.0	+0.0	+0.0
Extreme Low Water	ELW	-	-	-3.0

3. **Protection from High Seas**. The entrance to Coos Bay is similar to most harbors along the Pacific Coastline of Northern California, Oregon, and Washington. Strong winds are often experienced at North Bend on Coos Bay during the months of June, July, and August. These winds blow at 17 knots or greater 15-20 percent of the time and at 28 knots or greater 1 to 2 percent of the time. The harbor consists of a river estuary at the mouth of the Coos River. Sand and silt

from the river are carried out to the sea from this entrance. As a result of this material meeting the predominantly westerly seas and swells of the Pacific, a sandy ridge bar is formed at the mouth. This sand ridge causes the channel to be known as "a Bar Channel". As such, a breaking bar does occur in this port.

4. **Natural Hazards**. The navigational hazards in the vicinity of the project site are rock jetties on either side of the channel entrance extending into the Pacific Ocean, and a submerged jetty which extends 50 yards off the east shore of Coos Bay. Discussions and simulations with the Coos Bay Pilots Association have shown that these hazards will not interfere with normal navigation and mooring operations and the applicant has developed transit mitigations to address this issue such as not bringing vessels in or leaving them at the lay berth during conditions that are not conducive to safe navigation i.e. restricted visibility, severe weather and and/or low tides.

5. **Fishing Vessels**. Heavy concentrations of fishing gear may be expected between December 1 and August 15, from shore to about 30 fathoms.

6. **Underwater Pipelines and Cables**. Based on current pipeline charts that are available, there are three cables which are submerged approximately 20 feet running across/underneath the channel in the vicinity of the town of Empire which is on the LNG Carrier transit route.

7. **Maximum Vessel Size by Dock**. The primary dock can accommodate a vessel with a maximum length of 300 meters, 52 meters in breadth, and a draft which can be accommodated by the existing channel. Although the facility dock is able to accommodate vessels drafting up to 12m (39ft), current channel draft is 11m (37ft) with future plans to dredge the channel to accommodate larger deep draft vessels. Jordan Cove Energy Project and the local pilots must ensure transiting LNG vessels are able to maintain 10% under keel clearance as required by JCEP's LNG Transit Management Plan.

    a. The dock must be able to accommodate all vessels calling on the facility.
    b. It must be equipped with adequate numbers of mooring hooks, fendering, and mooring dolphins.
    c. The mooring arrangement must also be able to accommodate safe working loads.
    d. In coordination with appropriate stakeholders, JCLNG must develop and implement vessel mooring/unmooring procedures to ensure safe and environmentally protective operations for LNG Carriers arriving and departing the JCLNG facility.

8. **Vessel Routing**. Included in the WSA, was a plan to divide the LNG Carrier transit route into five (5) inbound, one (1) loading at berth, and five (5) outbound segments. The total inbound transit from the Sea Buoy (pilot boarding area) to the terminal berth is approximately eight (8) miles and will take between 1.5 and 2.0

hours to berth, pilots will be transiting at around 4.5 knots. The route has been divided into segments in order to manage vessel traffic and increase the safety of LNG carrier transits. This was done in conjunction with the Coos Bay Pilots Association.

The route is reversed for outbound LNG Carrier transits with the exception of the turning/maneuvering basin which is bypassed on the outbound transit where the LNG Carrier is moved directly into the Coos Bay Ship Channel. The route and segments are shown in Figure 3.

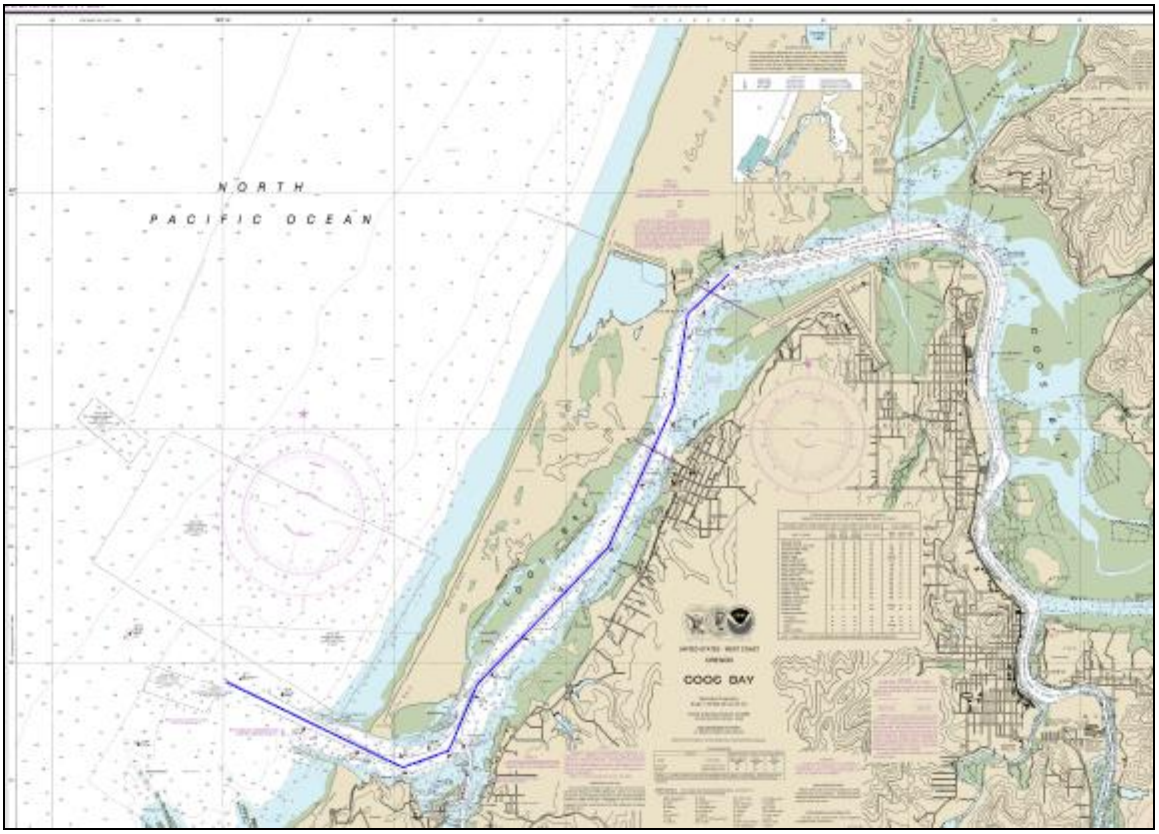


Figure 3. Overview of LNG Carrier Transit Route

9. **Vessel Operations –**LNG vessels will load cargo at the facility. 110-120 arrivals are expected at the facility annually with a dedicated fleet of LNG Carriers conducting cargo operations at the facility. A lay berth will be constructed to accommodate delays, repairs, and maintenance issues associated with Trans-Pacific Trade. Cargo operations will not be permitted at the lay berth and the applicant will outline procedures for the lay berth after the permitting process is complete.

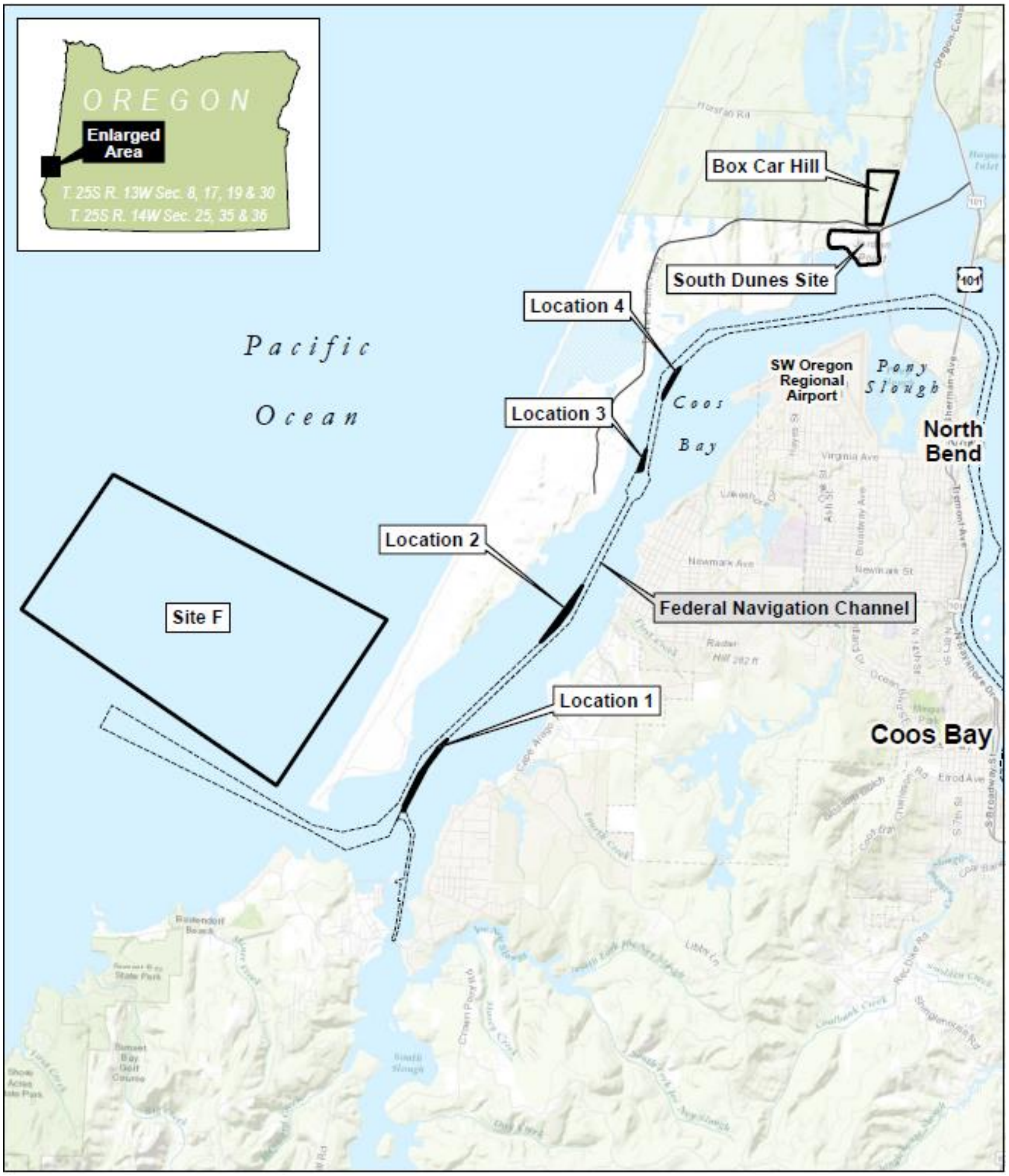


Figure 4. Channel Improvements

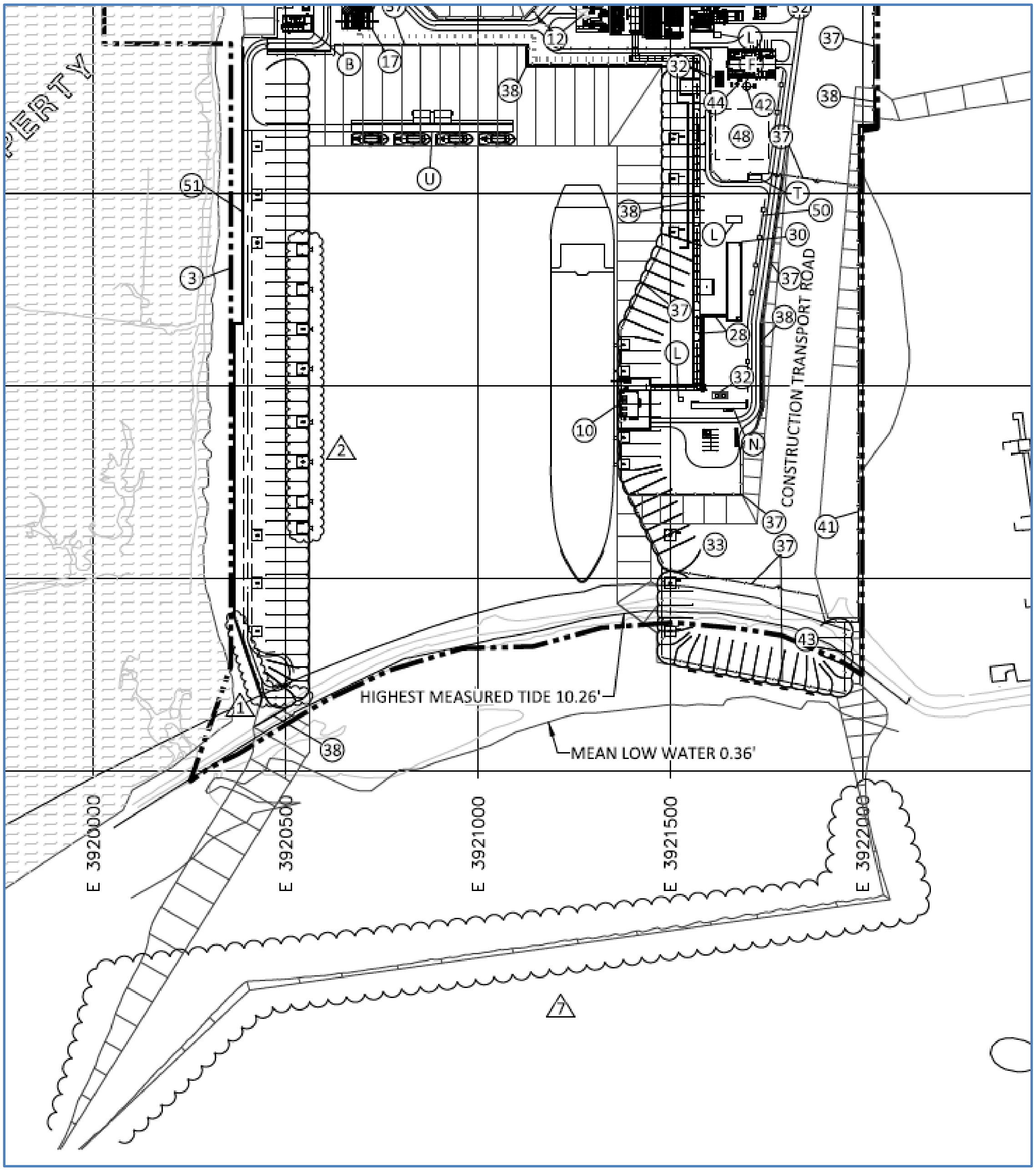


Figure 5. Dredging at the berth

U.S. Department of Homeland Security
United States Coast Guard

Captain of the Port
United States Coast Guard
Sector Columbia River

2185 SE 12th Place
Warrenton, OR 97146-9693
Staff Symbol: s
Phone: (503) 861-6206
Fax: (503) 861-6355

16611

NOV 07 2018

Tony Diocee, Vice President, Projects
Jordan Cove Energy Project, L. P.
5615 Kirby, Suite 500
Houston, TX 77005

Dear Mr Diocee:

The USCG Waterways Suitability Report provided to the Federal Energy Regulatory Commission (FERC) on July 1, 2008 and a subsequent Letter of Recommendation provided to FERC on May 10, 2018 required the applicant, Jordon Cove Energy Project, L.P. (JCEP), to conduct additional ship transit simulator studies for liquid natural gas (LNG) carriers that exceed a 148,000 m^3 spherical containment class vessel or for any increase in physical dimensions.

Since the initial Waterway Suitability Analysis was submitted to the USCG in 2007 LNG Tanker technology has improved and tanker sizes and capacities have changed. As a result, additional simulator studies were required. In response, JCEP conducted additional vessel transit simulations during September 26-27, 2018 using modern ship design and carrying capacities.

The simulated transits were piloted by the Coos Bay Pilots and witnessed by the USCG. They were conducted at California Maritime Academy in Vallejo, CA using a Transas Simulator. They were conducted to demonstrate that the Coos Bay Pilots can safely and successfully maneuver LNG carriers up to 299.9 x 49m x 11.9m dimensionally while transiting the channel.

These successful simulations expand the ability for Jordan Cove LNG to use any class of LNG carrier (membrane, Moss, or SBT) with physical dimensions equal to or smaller than observed during the simulated transits. JCEP will continue development of the Transit Management Plan and work with the Coos Bay Pilots in establishing any other operating parameters.

Sincerely,

J. C. SMITH
Commander, Sector Columbia River
Captain of the Port
Captain, U. S. Coast Guard

Enclosure: 1) Jordon Cove LNG Terminal Simulation Plan, September 2018
2) TRANSAS Simulation Printouts

Copy: FERC
Commander, Coast Guard District Thirteen (dp)
Commander, Pacific Area (PAC-54)
Commandant (CG-OES), (CG-ODO), (CG-FAC), (CG-741), (CG-CVC), (CG-ENG), (LNGNCOE)
Marine Safety Center (CG MSC)

DAVID EVANS AND ASSOCIATES INC.

MEMORANDUM

DATE: March 12, 2019

TO: Seth King, Steve Pfeiffer
Perkins Coie LLP
1120 N.W. Couch Street Tenth Floor
Portland OR 97209-4128

FROM: Gigi Cooper

SUBJECT: Federal Navigation Channel Dredge Area 4 – City of Coos Bay Land Use Permit Support

PROJECT: JLNG0003 112DE
Jordan Cove Energy Project – Regulatory Permitting

CC: Derik Vowels, Jordan Cove LNG

Perkins Coie LLP requested the following two work products from DEA to support the land use applications for the JCEP NRI #4:

- Explanation of how the NRI dredging work will be completed (timing, duration, equipment, materials) and how that work will affect users of the Bay; and

DEA response: Please see Attachment 1: Description of Dredging Work.

- Explanation of the environmental impacts of the NRI #4 by addressing the highlighted aspects of Coos Bay Estuary Management Plan Policies 4 and 5 (starting with 5 because it includes the cross-reference to 4, which, in turn, cross-references 4a).

DEA response: Please see Attachment 2: Responses to CBEMP Policies 4 and 5.

Please let me know if you have any questions.

Attachments/Enclosures: Attachment 1: Description of Dredging Work; Attachment 2: Responses to CBEMP Policies 4, 4a, 5
File Path: Document2

DEA Task:

- Explanation of how the NRI dredging work will be completed (timing, duration, equipment, materials) and how that work will affect users of the Bay.

Sources:

- Bill Gerken, PE, Moffatt & Nichol; Terry Stones, PE, David Evans and Associates, Inc.; and Pilots' Enhancement Narrative, April 20, 2017

DEA response:

Hydraulic dredging, the technique that would most likely be used, will employ a cutter suction dredge, in which material is loosened from its *in situ* state and lifted in suspension through a pipe system connected to a centrifugal pump that removes the material and pumps the slurry through a discharge pipeline. A rotating cutting apparatus (cutter head) is used around/ahead of the intake of a suction pipe to break up or loosen bottom material. The temporary dredge line for disposal will run up to approximately seven miles from the farthest location adjacent to but outside the Federal Navigation Channel (FNC). The pipeline would land at the north side of the upland confined disposal site denoted as APCO 2, in the City of North Bend, at approximately River Mile (RM) 9 of the FNC, near the southern terminus of the U.S. Highway 101 McCullough Bridge. The temporary dredge line would be approximately 24 to 30 inches in diameter and would be placed within a corridor of up to 50 feet in width. Corridors are designed to be wider than the dredge line to accommodate for inaccuracies and flexibility in dredge line placement, any shifting/settling of pipeline, and ability to accommodate variations in bathymetry. At the APCO disposal site, the material would be pumped onto the site in a slurry, decanted and dried within a containment dike system, and permanently stockpiled.

Construction of the temporary dredge line and dredging will occur during the ODFW in-water work window (IWWW) which occurs between October 1 and February 15, for three consecutive years. The duration over several years is required for material handling and dredge water decanting at the APCO 2 disposal site. Weather delays and/or equipment failures are not factored into the production rates and construction durations. Following completion of dredging, all in water pipelines, dredge equipment, and off-loading facilities if used, will be removed prior to the end of the IWWW in mid-February.

DEA Task:

- Explanation of the environmental impacts of the Dredge Area 4 by addressing the highlighted aspects of Coos Bay Estuary Management Plan Policies 4 and 5 below (starting with 5 because it includes the cross-reference to 4).

Sources:

- City of Coos Bay. No date. Coos Bay Estuary Management Plan, Management Framework: Definitions, Policies and Standards, and Plan Provisions. http://coosbay.org/uploads/PDF/Plans/Estuary_Plan_-_Vol_3.pdf
- David Evans and Associates, Inc., Coos Bay Pilots Association Navigation Efficiency Improvement Project Draft Biological Assessment, April 2017
- David Evans and Associates, Inc., Coos Bay Pilots Association Safety Enhancements Project Draft Biological Assessment, January 2017
- David Evans and Associates, Inc., FERC Resource Report 8: Land Use, Recreation, and Aesthetics, September 28, 2017
- David Evans and Associates, Inc., Visual Impact Assessment Report (Appendix to FERC Resource Report 8: Land Use, Recreation, and Aesthetics), September 14, 2017
- David Evans and Associates, Inc., USACE/DSL Joint Permit Application Removal-Fill for the Navigation Reliability Improvements, Box 4, #3, Recreation, October 2017
- King, Seth, Perkins Coie LLC, Draft narrative in support of the application (mainly for Derik Vowels' comments on consistency with the project removal/fill application)
- Moffatt & Nichol, Inc. 2016. Draft Technical Memorandum – Safety Enhancements to the Coos Bay Navigation Channel, Task 5 Turbidity Study Technical Memorandum.
- Oregon Department of Environmental Quality (ODEQ).2017b. ODEQ website for Total Maximum Daily Loads, South Coast Basin. Available online at: http://www.oregon.gov/deq/wq/tmdls/Pages/TMDLs-South-Coast-Basin.aspx. Accessed on September 7, 2017
- Oregon Department of Fish and Wildlife. 1979. Natural Resources of Coos Bay Estuary: Estuary Inventory Report. Vol. 2, No. 6., for Oregon Land Conservation and Development Commission.
- Pfeiffer, Steven L., Perkins Coie LLC, Purpose and Need Statement for Safety Enhancements to the Coos Bay Navigation Channel, May 2, 2016

DEA response:

Text from the City of Coos Bay's Coos Bay Estuary Management Plan, 3. Management Framework: Definitions, Policies and Standards, and Plan Provisions, Section 3.3 – Bay-Wide Policies, is shown in *italics*. Provisions that Perkins Coie requested a response from DEA are in black font; other provisions are shown in grey font.

#5 Estuarine Fill and Removal

Dredging and/or filling shall be allowed only:

A. *If required for navigation or other water-dependent uses that require an estuarine location or if specifically allowed by the applicable management unit requirements of this goal; and*

Response: The proposed activity, dredging one 3.3-acre area, is required for navigation. The purpose of the proposed action is to improve reliability and efficiency of navigation for existing deep draft vessels by reducing the existing navigation constraints at the key turn ("Dredge Area") in the Federal Navigation Channel (FNC). The proposed activity does not include fills for non-water-dependent uses.

B. *If no feasible alternative upland location exists; and*

C. *If a pubic need (i.e., a substantial public benefit) is demonstrated and the use or alteration does not unreasonably interfere with public trust rights; and*

D. *If adverse impacts are minimized; and*

Response: Please see responses to Policy #4, D.

E. *The activity is consistent with the objectives of the Estuarine Resources Goal and with other requirements of state and federal law, specifically the conditions in ORS541.615 and Section 404 of the Federal Water Pollution Control Act (P.L. 92-500).*

Other uses and activities which could alter the estuary shall only be allowed if the requirements in B, C, and D are met. All portions of these requirements may be applied at the time of plan development for actions identified in the Plan. Otherwise, they shall be applied at the time of permit review.

This strategy shall be implemented by the preparation of findings by local government documenting that such proposed actions are consistent with the Comprehensive Plan, and with criteria "a" through "e" above. However, where goal exceptions are included within this plan, the findings in the exception shall be sufficient to satisfy criteria "a" through "c" above. Identification and minimization of adverse impacts as required in "d" above shall follow the procedure set forth in Policy #4a. The findings shall be developed in response to a "request for comment" by the Division of State Lands, which shall seek local government's determination regarding the appropriateness of a permit to allow the proposed action.

Response: Please see responses to Policy #4, the following section D., below.

"Significant," as used in "other significant reduction or degradation of natural estuarine values," shall be determined by:

A. *The U.S. Army Corps of Engineers through its Section 10 and 404 permit processes; or*

B. *The Department of Environmental Quality for approvals of new aquatic log storage areas only; or*

C. *The Department of Fish & Wildlife for new aquaculture proposals only.*

This strategy recognizes that Goal #16 limits dredge, fill and other estuarine degradation in order to protect the integrity of the estuary.

4. RESOURCE CAPABILITY CONSISTENCY AND IMPACT ASSESSMENT

Local government concludes that all proposed actions (approved in this Plan) which would alter or potentially alter the estuarine ecosystem have been based upon a full consideration of the impacts of the proposed alteration, except for the following uses and activities:

[EXCERPT OMITTED because these proposed project actions do not fall under any of these exceptions, a through d]

D. Any other uses and activities which require the resource capability consistency test as a condition within a particular management unit or which could affect the estuary's physical processes or biological resources.

Response: Please see responses to 4. A. through D., immediately below.

Unless fully addressed during the development and adoption of comprehensive plans, actions, which would potentially alter the estuarine ecosystem shall be preceded by a clear presentation of the impacts of the proposed alteration.

For uses and activities requiring the resource capabilities test, a special condition is noted in the applicable management unit uses/activities matrix. A determination of consistency with resource capability and the purposes of the management unit shall be based on the following:

A. A description of resources identified in the plan inventory;

Response: Dredge Area 4 is designated 52-NA. The temporary dredge lines from Dredge Area 4 are in City of Coos Bay CBEMP designation 52-NA and DDNC. In 52-NA, temporary alterations may be allowed subject to "Special Conditions" presented following the use and activity matrix. A few of the special conditions are non-discretionary, but most require local judgment and discretion and that development of findings to support any final decision about whether or not to allow the use or activity. In DDNC, temporary alterations are permitted outright.

The Oregon Department of Fish and Wildlife Natural Resources of Coos Bay Estuary: Estuary Inventory Report (1979), describes the area:

> *Although the sandy shore between RM 6 and 8 on the western side of the bay appears unproductive because it does not have attached vegetation, it is a valuable habitat for certain species of fish. Any development occurring there should preserve the sandy substrate and water quality of the area. Use of pilings may be appropriate in the area unless subsequent reduction in current velocity changes the quality of the substrate.*

Significant Habitat of Major Importance and other inventory maps. The Shoreland Values Requiring Mandatory Protection map (June 14, 1982) shows three categories of Significant Wildlife Habitat: freshwater wetlands, snowy plover habitat, and heron rookery. All of the mapped resources are on land. As these three categories of Significant Wildlife Habitat are all terrestrial, and this dredging project solely would occur within the waters of Coos Bay, the proposed project would not disturb any Significant Habitat of Major Importance that are Shoreland Values Requiring Mandatory Protection. Other mapped shoreland values are major marsh, archaeological sites, historical sites, and coastal headlands, which likewise are terrestrial and would not be disturbed.

The Significant Habitat of "Major" Importance Qualifying as Natural Management Units Under Estuarine Resources Goal (June 11, 1982), maps major salt marsh, seagrass and algae beds, intertidal flats, seagrass/algae beds and intertidal flats, and other significant habitat. These are terrestrial, not within the waters of Coos Bay, and eelgrass is to the east of Dredge Area 4, and none would be disturbed by this proposed project.

The Fish & Wildlife Habitats Map I shows anadromous fish distribution (salmon, steelhead, and cutthroat trout) throughout Coos Bay. It indicates a snowy plover nest site and a blue heron nest site on the North Spit, but neither are near, or would be affected by, the dredging project at Dredge Area 4. The Fish & Wildlife Habitats Map II (1980) shows elk and deer big game range and wetlands, all of which are terrestrial only.

The Crustacean Habitats map delineates areas of amphipod (*Corophium sp*.), ghost shrimp (*Neotrypaea californiensis*), and mud shrimp (*Upogebia pugettensis*). The Dredge Area 4 is not in a mapped crustacean habitat. Dredge Area 4 is near an amphipod habitat area on the North Spit, but dredging activities would not disturb it.

The Clam Beds and Oyster Leases map (August 5, 1981) shows clam beds on both sides of the FNC. Beds between RM 6 and RM 8 are directly adjacent to the existing FNC, but on the other side of it from Dredge Area 4. The Clam Species in the Coos Bay Estuary map indicates that these primarily are gaper (*Tresus capax*) clams.

The inventory document is from July 1984 and the maps are from 1980 and 1981, based on sources from the 1970s. At that time, few resource-specific inventories had been done, and conditions in the Bay have changed in the past 35 and 45 years. Therefore, the information in the inventory is not as useful as studies conducted specifically for the Jordan Cove project, including Dredge Area 4, within the past decade.

B. An evaluation of impacts on those resources by the proposed use (see impact assessment procedure, below); and

Response: Please see the responses to Policy #4, the following section, C., below.

C. In a natural management unit, a use or activity is consistent with the resource capabilities of the area when either the impacts of the use on estuarine species, habitats, biological productivity and water quality are not significant or that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner to protect significant wildlife habitats, natural biological productivity, and values for scientific research and education.

D. *In a conservation management unit a use or activity is consistent with the resource capabilities of the area when either the impacts of the use on estuarine species, habitats, biological productivity and water quality are not significant or that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner which conserves long-term renewable resources, natural biologic productivity, recreational and aesthetic values and aquaculture.*

The impact assessment need not be lengthy or complex, but it should enable reviewers to gain a clear understanding of the impacts to be expected. It shall include information on:

A. The type and extent of alterations expected;

Response: Dredge Area 4 Is the turn from Lower Jarvis Range to Jarvis Turn Range channels: JCEP proposes to widen the turn area here from the current 500 feet to 600 feet at the apex of the turn and lengthen to total corner cutoff area of the turn from the current 1,125 feet to about 1,750 feet thereby allowing vessels to begin their turn in this area earlier. A dredge material pipeline would carry dredge material from Dredge Area 4 to the APCO 2 disposal site, outside of City of Coos Bay jurisdiction.

B. The type of resource(s) affected;

Response: The resources evaluated are water quality including turbidity and discharges, physical characteristics including shoaling and shoreline erosion, noise, deep subtidal area, living resources, recreation, aesthetics, and navigation. The only affected resource would be the temporary disturbance for the removal of approximately 3.3 acres of deep subtidal area. Dredging would take place in deep subtidal habitat, which also provides habitat for benthic organisms such as worms, crustaceans, and mollusks. These activities would temporarily affect the macroinvertebrates that live within the substrate in these areas and move, rest, find shelter, and feed on the substrate and organic material. Additionally, the fish species that utilize these habitats could be temporarily affected. Dredging would result in increased turbidity within the estuarine analysis area. The restriction of construction activities to the in-water work window of October 1 through February 15, when salmonid species abundance is lower, would reduce the likelihood of impacts to these species. The substrate in these areas consists primarily of unvegetated sand and rock, and is therefore of low ecological value. The dredging project would temporarily increase water turbidity. It would be temporarily visible and may be audible.

C. The expected extent of impacts of the proposed alteration on water quality and other physical characteristics of the estuary, living resources, recreation and aesthetic use, navigation and other existing and potential uses of the estuary; and

Response:

Water quality. The Oregon Department of Environmental Quality's (ODEQ) Ambient Water Quality Monitoring Program and the Oregon Beach Monitoring Program (OBMP) monitor water quality. ODEQ has designated CWA Section 303(d) water quality limited segments within the Coos Bay watershed. The ODEQ is currently in the initial scoping and data collection phase for the preparation of a total maximum daily load (TMDL) limit for fecal coliform in the watershed. A TMDL is a planning tool that assesses the various sources of a constituent into a watershed and places achievable limits on those sources in order to accomplish water quality goals. The 2012 ODEQ Priorities and Schedule list targets year 2015 to start work on the Coos sub-basin TMDL (ODEQ 2014). The ODEQ website notes that a TMDL for the Coos Subbasin has been initiated, and is in the initial scoping and data collection phase (ODEQ 2017b).

Coos Bay from River Mile 0 to 7.8 is water quality limited for fecal coliform and shellfish growing is listed as a beneficial use, and a TMDL is needed (Category 5) (ODEQ 2016).

Mobilization of suspended sediment as a result of dredging operations can result in a reduction in light penetration and, consequently, a reduction in primary production within the affected area. Increases in suspended sediment can also affect the feeding patterns of benthic filter feeding organisms and the behavior of fish, while the settling of suspended particles can result in the burial of organisms and modifications to benthic substrate (FERC 2015).

Turbidity has not been identified as a water quality concern in Coos Bay. Within Coos Bay, ambient background turbidity levels taken at the Charleston Bridge station between April 2002 and December 2004 range between 10 milligram per liter and 27.3 milligram per liter during summer and winter, respectively (Moffatt & Nichol 2017). More recently, hourly turbidity readings taken at the North Spit-BLM boat ramp gauge were compiled between August 2013 and January 2015. Based on these data, the average natural turbidity level was calculated to be 40 mg/L at the North Spit-BLM boat ramp gauge (M&N 2016). JCEP expects increased water turbidity as a result of the Dredge Area improvements and during the driving of the temporary piles that will support the steel cradle and slurry pipeline spanning the eelgrass beds to be temporary and limited to the immediate vicinity of operations. Within 200 feet of dredging operations, turbidity levels decrease to ambient background levels (FERC 2015).

JCEP does not anticipate oil spills or toxic discharges to occur when constructing the Dredge Area improvements. The potential for spills and toxic discharges always exists when using dredging equipment. Any accidental spill or leak of petroleum products or other toxic discharges from dredging equipment or vessels could result in impacts to water quality and aquatic species in the short-term. However, the dredging vessels will be carrying relatively small volumes of petroleum (1,500 to 25,000 gallons) in comparison to the large bulk carriers and Panamax vessels (1.5 to 2 million gallons [NOAA 2016]) that regularly travel through Coos Bay. The fuel carried onboard the dredging vessels is low sulphur diesel, which is relatively light and will evaporate over time if spilled on the water. The bulk carrier vessels carry both low sulphur diesel and heavy fuel oil, the latter of which would have a much greater pollution impact if spilled on water. Given the low probability of a spill, preventive measures such as the implementation of a spill prevention plan, and the relatively small volume of fuel on board vessels utilized by the Project, large-scale or long-term negative impact are not anticipated from spills and/or toxic discharges.

Physical characteristics. According to sediment transport modeling of the proposed Dredge Area, shoaling in the dredged areas is not expected to differ from current shoaling totals for the existing FNC. Total shoaling was analyzed through existing conditions versus incorporating the proposed enhancements, and the difference in shoaling amounts after one and three years were negligible (Moffat and Nichol 2017). Thus, indirect effects to listed species and/or critical habitat are not expected to occur as a result of sediment transport or shoaling in Dredge Area 4. The dredging activity would not cause any shoreline erosion beyond natural waves, which is minimal.

Noise. Dredging equipment and material transport vessels related to the Dredge Area improvements may generate temporary noise disturbances. However, the noise will be localized to the immediate dredging area. While the noise temporarily could affect the behavior of aquatic species in the immediate vicinity and result in the displacement of noise-sensitive species during hours of operation, it is anticipated that any displaced species would resume their typical behavior patterns once dredging has ceased.

There could be potential temporary and short-term impacts from construction noise to people recreating on the North Spit, but distance, topography, coastal wind, and vegetation would help to minimize the noise from the dredging. City of Coos Bay does not have a noise ordinance.

Deep subtidal area. The entire 3.3-acre footprint of Dredge Area 4 is located in deep subtidal habitat. Deep subtidal habitats are not defined by any regulations (e.g., Clean Water Act Section 404 or Oregon Removal-Fill Law), but are cited in Roye (1979) and CBEAC (1984) as occurring below -15 feet MLLW and being generally less productive than shallower habitats in the Coos Bay estuary). The habitat in these locations is classified as deep subtidal, estuarine, unconsolidated bottom based on the Cowardin classification system (Cowardin et al. 1979). Deep subtidal habitat is classified as

Category 3 under ODFW's habitat categories, because it is "essential" to wildlife but is not "limited." This habitat is disturbed on an annual basis as part of USACE's maintenance dredging of the FNC.

A total of 846 acres of mapped deep subtidal habitat is located within lower Coos Bay. Permanent removal from Dredge Area 4 would be approximately 3.3 acres, or approximately 0.3 percent. The substrate in this area consists primarily of unvegetated sand and rock, and is therefore of low ecological value. In addition, the dredge lines would temporarily affect approximately 13 acres of deep subtidal habitat.

The dredging volumes in cubic yards (CY) for Dredge Area 4 are:

Location	Rock Volume (CY)	Sand Volume (CY)	Total Volume (CY)
Dredge Area 4 (RM ~7, Jarvis Turn)	0	24,900	24,900

(Moffatt & Nichol 2017)

Living resources. Dredging will remove sand in deep subtidal habitat, resulting in direct impacts to benthic organisms occupying the substrate, such as worms, mollusks, echinoderms and crustaceans, as well as organisms that feed on them. Removal of larvae and juvenile life stages of various species, including crustaceans, mussels and gastropods, is also anticipated. While these benthic organisms are not listed as threatened or endangered under the federal Endangered Species Act, they are an important food source for listed species. However, the effects to aquatic organisms would be temporary and localized, and will not have population-level effects. Recovery of benthic organisms to pre-dredging conditions can occur as quickly as one month post-dredging, but could take up to a year (FERC 2015).

The following protected species were identified as potentially occurring in the Coos Bay in the vicinity of Dredge Area 4:

Common name	Scientific name	Status
Protected fish species		
Eulachon – Southern Distinct Population Segment (DPS)	*Thaleichthys pacificus*	threatened
Green Sturgeon – Southern DPS	*Acipenser medirostris*	threatened
Oregon Coast Evolutionary Significant Unit (ESU) Coho Salmon	*Oncorhynchus kisutch*	threatened
Protected bird species		
Marbled murrelets	*Brachyramphus marmoratus*	threatened
Pacific Coast population of western snowy plover	*Charadrius alexandrinus nivosus*	threatened
Marine mammal species Protected under the MMPA but not federally listed		
Harbor seals	*Phoca vitulina*	N/A
California sea lions	*Zalophus californianus*	N/A
The eastern DPS of Steller sea lion	*Eumetopias jubatus*)	N/A
Northern elephant seals	*Mirounga angustirostris*	N/A
Harbor porpoises	*Phocoena*	N/A
Killer whale Eastern North Pacific Transient stock and Eastern North Pacific Offshore stock	*Orcinus orca*	N/A

The proposed dredging project has the potential to affect the ESA-listed fish and bird species identified in the table above. Dredging is expected to create localized, short-term spikes of high to moderate TSS and turbidity. Turbidity may affect marbled murrelet forage/prey species and their habitat. Effects to listed fish are expected to be slight due to the limited area affected in the bay and limitations on construction periods. While impacts such as behavioral and foraging changes are anticipated, these impacts will be limited to the immediate location of dredging activities and will be temporary in nature. Direct mortality of juvenile and adult life stages of ESA-listed fish is not anticipated, as they will likely be able to avoid areas being actively dredged and dredging would occur during the in-water work window when these species are less abundant. While foraging for benthic organisms in dredged areas will be affected, deep subtidal foraging habitat is not limited in Coos Bay and these areas are expected to recolonize and recover within a year of dredging. Dredging activities impacts to ESA-listed fish and birds would be temporary in nature and are not expected to adversely affect these species or their designated critical habitat.

The proposed dredging project has the potential to affect the marine mammals identified in the table above. Turbidity associated with dredging activities may temporarily affect behavior and foraging within the immediate vicinity of the dredge area.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended, requires that proposed projects with a federal nexus evaluate their impacts on habitat of commercially managed fish populations. Essential Fish Habitat (EFH) is identified and described based on areas where various life stages of each managed species commonly occur. EFH has been defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (16 USC 1802(10)). Coos Bay is designated as EFH for several Coastal Pelagic Species (CPS—includes Pacific sardine, northern anchovy, market squid, Pacific mackerel, and jack mackerel), West Coast Groundfish (includes more than 80 species of rockfish, flatfish, groundfish, sharks and skates), and two Pacific Salmon (Chinook, and coho). Dredging may adversely affect EFH for juvenile and adult fish from the three groups. This is based on the predicted levels of turbidity from dredging in Coos Bay relative to background levels, the short-term, localized, but ongoing exposure of fish to such conditions during up to four in-water work windows; and the periodic disturbance of benthic communities for about a year each dredge cycle.

Recreation. The USACE manages 245 acres on the North Spit, including the North Jetty at the mouth of Coos Bay. The BLM administers 1,864 acres on the North Spit, with 725 acres classified as an Area of Critical Environmental Concern and the remainder designated as a Special Recreation Management Area (SRMA), in recognition of the value of the area for outdoor recreation. The BLM boat launch facility and courtesy dock, which provide access to the Coos Bay estuary and are within the SRMA (BLM 2016). The primary recreational activities taking place within the Coos Bay estuary include boating, fishing, waterfowl hunting, wildlife viewing and bird watching, clamming, and crabbing.

Recreational boating takes place throughout Coos Bay, although most originates primarily near the towns of Charleston and Empire, where there are boat ramps. There is also a marina complex in Charleston and access points for canoeists and kayakers to the northeast in Haynes Inlet and North Slough. In addition to the Charleston boat ramp and Empire boat ramp, recreational boaters use the BLM North Spit boat ramp to access the bay. All three boat ramps would remain open during dredging. Dredging and dredge material transport will be limited in extent and avoidable by recreational craft participating in the fishery. Dredge operations and submerged temporary dredge line are not expected to impact recreational craft transit to upstream or downstream areas of Coos Bay or limit fishing except where work is actively occurring and in the associated safety area around work areas. Dredging activities will be announced to the boating community via a local notice to mariners provided through notification to the USCG. There would be no significant impact on recreational boating because dredging activities would be in a limited area, short-term, and temporary.

The main recreational catch species of fish in and around Coos Bay include coho and Chinook salmon. Other recreational catch species include American shad, shiner perch, redtail surf perch, striped sea perch, white sea perch, pile perch, black rockfish, lingcod, Cabezon, red Irish lord, Pacific staghorn sculpin, surf smelt, Pacific herring, Pacific tomcod, kelp and rock greenling, blue and cooper rockfish, halibut, and white sturgeon. Much of the recreational angling for salmon in Coos Bay occurs in late summer and fall, usually beginning in late summer at jetty areas and moving up the bay as fish move upstream. Recreational fishing for sturgeon occurs between the railroad bridge and the McCullough Bridge, and also above the McCullough Bridge. Dredging will occur concurrently with the recreational salmon fishery for approximately one month annually during construction. Dredging will observe the ODFW in-water work window of October 1 – February 15 and is expected to overlap with the salmon fishery primarily during the month of October.

Recreational clamming and crabbing activities occur in Coos Bay on a year-round basis, and they bring revenue to the region. All species of “bay clams” are found in Coos Bay, including butter (about 24 percent of the harvest), cockle (10%), gaper clams (6%), and native littleneck clams (1%). Clamming is conducted on the mud flats on the bay side of the North Spit up to NCM 6, Oregon Department of Fish and Wildlife (ODFW) regulations limit the amount a person can catch in a day to 20 clams, of which 12 may be gaper clams. Between March and September of 2008, a total of about 33,700 kilograms of clams were harvested in Coos Bay, making it the third most productive clamming estuary in the state (Ainsworth and Vance 2008).

Although shore crabbing in Coos Bay is done year-round, it is most productive during fall and winter. Crabbing is conducted from docks in Charleston and Empire, and from boats, particularly to the west of the FNC in the lower bay, on the bay side of the North Spit below NCM 7. Crabs are caught using traps, rings, or snares. While recreational crabbers in Oregon also harvest red rock crabs and Pacific rock crabs, Dungeness crabs are far more popular. A study that collected crabs near the RFP property found that 98 percent were Dungeness crabs, with far lesser counts of hairy shore crabs, red rock crabs, and non-native European green crabs (Yamada 2014). ODFW regulations limit individual daily catches of crabs to 12 male Dungeness larger than 146 millimeters across and 24 red crabs of any sex and size. Another study by ODFW found that between 2008 and 2011 an average of 158,650 pounds per year of Dungeness crabs were harvested from Coos Bay. During that same period an annual average of 14,710 recreational crabbing trips were taken to Coos Bay. The vast majority of the recreational crabbers (76 percent) came from 100 miles away or less (Ainsworth *et al*. 2012).

The west shore of the bay at Jordan Cove contains sand/mudflats, eelgrass beds, and a fringe of salt marsh that provide habitat for recreationally important ghost shrimp and mud shrimp. These shrimp are recreationally harvested at a number of locations throughout the bay, and are popular among anglers for use as bait.

Aesthetics. Dredging equipment and activities would be visible in Coos Bay. However, relative to existing tanker ship traffic in the Bay, and the existing operational ocean-going vessel loading facility at the RFP facility, the dredging is anticipated to be a minor visual impact, as well as limited in duration.

Navigation. The proposed navigation reliability improvement at Dredge Area 4 would have a beneficial impact on the current and future viability for maritime commerce in Coos Bay. The proposed enhancements to the FNC are designed to reduce entry and departure delays for vessel transit through the FNC for the size of vessels entering the Port today. Although log export vessels serving the upper bay are smaller, the proposed enhancements also benefit these vessels by broadening the tidal and environmental limit (wind and current) windows for transiting the FNC, which provides an enhanced margin of safety and improved efficiency in the loaded vessel departure schedule. The navigation reliability improvements also would allow companies to engage in emerging opportunities to export products with today's larger vessels.

During outbound transits it is difficult to make this 35-degree turn from the Jarvis Turn Range, which is 400 feet wide, to the Lower Jarvis Range, which is only 300 feet wide, due to the very short length of the existing corner cutoff of only 1125 feet. Widening the turn area from the current 500 feet to 600 feet at the apex of the turn and lengthening the total corner cutoff area of the turn from the current 1125 feet to about 1750 feet will allow the Pilots to commence their turn earlier. This will greatly improve the ability of today's larger ships to make this turn safely on a consistent basis.

D. The methods which could be employed to avoid or minimize adverse impacts.

Response:

Water quality. JCEP will use methods to minimize the effects of the navigation reliability improvements on water turbidity within the bay. Should turbidity levels remain above ambient background levels greater than 200 feet from dredging operations, BMPs will be employed in place to reduce turbidity levels further. JCEP would avoid and minimize oil spills or toxic discharges during dredging operations and dredged material transport, including the implementation of spill containment plans.

Noise. To minimize impacts to fish and wildlife, BMPs will be implemented to minimize the extent of noise generation to the maximum extent possible. However, it will not be possible to avoid noise generation entirely, but it would be temporary.

Deep subtidal area and living resources. JCEP plans to perform dredging during the ODFW-approved in-water work window for Coos Bay (October 1 to February 15) to reduce impacts to sensitive life stages of fish in the Bay. Due to the short time in which dredging would occur, benthic communities would be expected to recover.

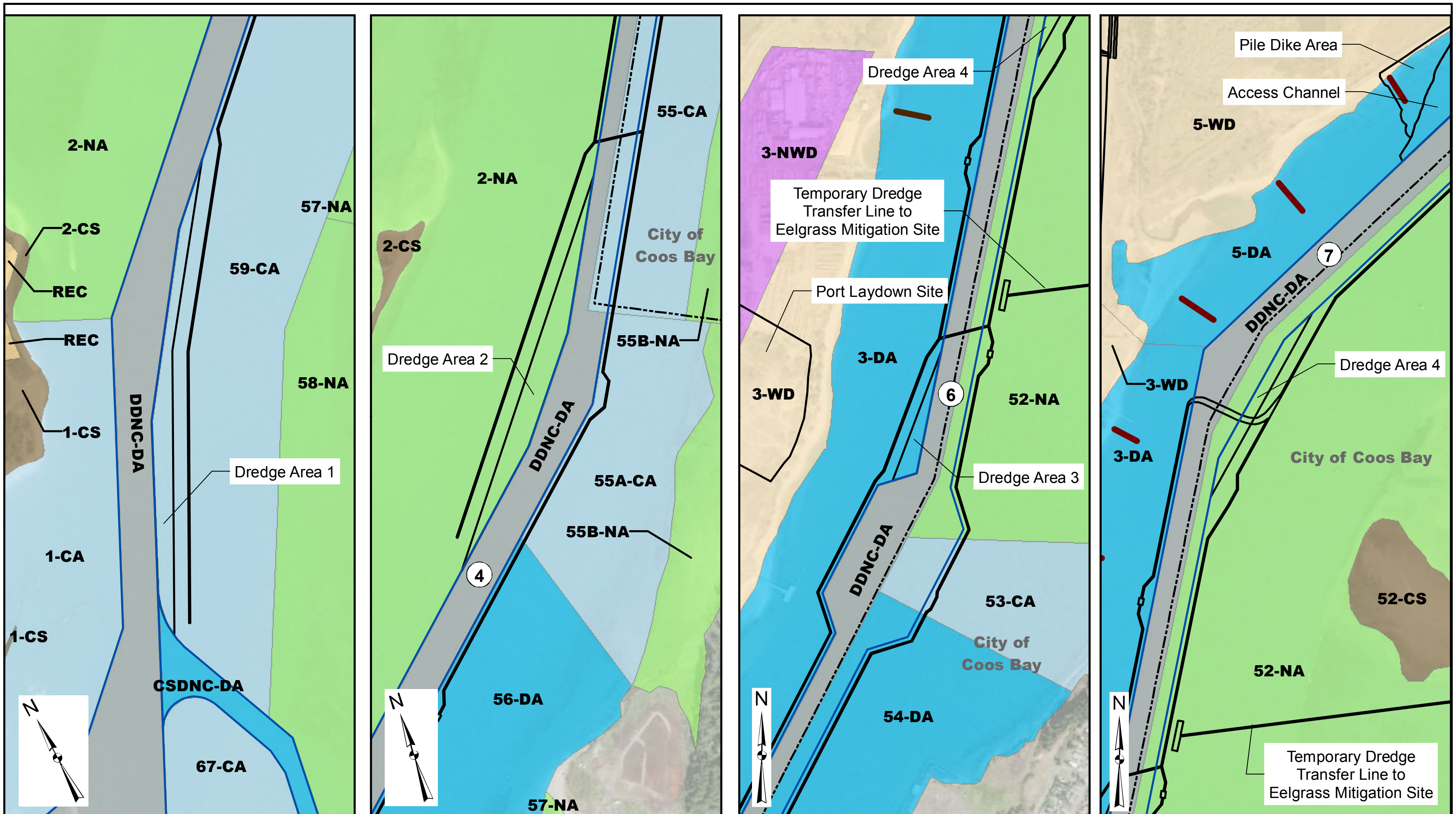
Recreation. The USCG and the OSMB would provide notices to boaters to avoid the area during the dredging activities, which would occur during the in-water work period from October 1 through February 15. All floating and submerged dredging equipment operating in the bay will be clearly marked with day signals and light signals at night accordance with the US Inland Rules of the Road. If the signage and notices are not sufficient to prevent recreational boating from avoiding the construction areas, some form of physical barrier, such as a continuous string of highly visible soft material floats, could be extended across the mouth of the slip or around the construction dredging area. Construction safety inspectors would also be responsible for warning any recreational boaters who enter the construction area. As the construction dredging area is limited in size, boaters could easily avoid the construction areas by moving to the opposite side of the bay.

Aesthetics. With minor relative impacts, no avoidance or minimization methods are needed.

Navigation. The sections of the pipeline that cross the FNC will be submerged on the FNC bottom to allow for vessel passage. The section(s) of floating pipeline would be temporarily removed to allow vessel passage.

This policy is based on the recognition that the need for and cumulative effects of estuarine developments were fully addressed during the preparation of this Plan and that, except as otherwise stated above, no additional findings are required to meet Implementation Requirement #1 of LCDC Goal 16.

Response: No response required.



JCEP Project Area
Existing Pile Dike
City Limits
Channel Mile
Federal Navigation Channel

CBEMP Aquatic Management Units
Conservation Aquatic (CA)
Deep Draft Navigation Channel (DDNC)
Development Aquatic (DA)
Natural Aquatic (NA)

CBEMP Shoreland Management Units
Conservation Shorelands (CS)
Water-Dependent Shorelands (WD)

Zoning (Coos County, 2018)
Recreation (REC)

0 0.15 0.3 Miles

Jordan Cove Energy Project

JCEP Project Area Update - July 2018

CBEMP Zoning Navigational Reliability Improvement (NRI) Areas

Jordan Cove LNG℠ 7/10/2018

FIGURE NO. 5

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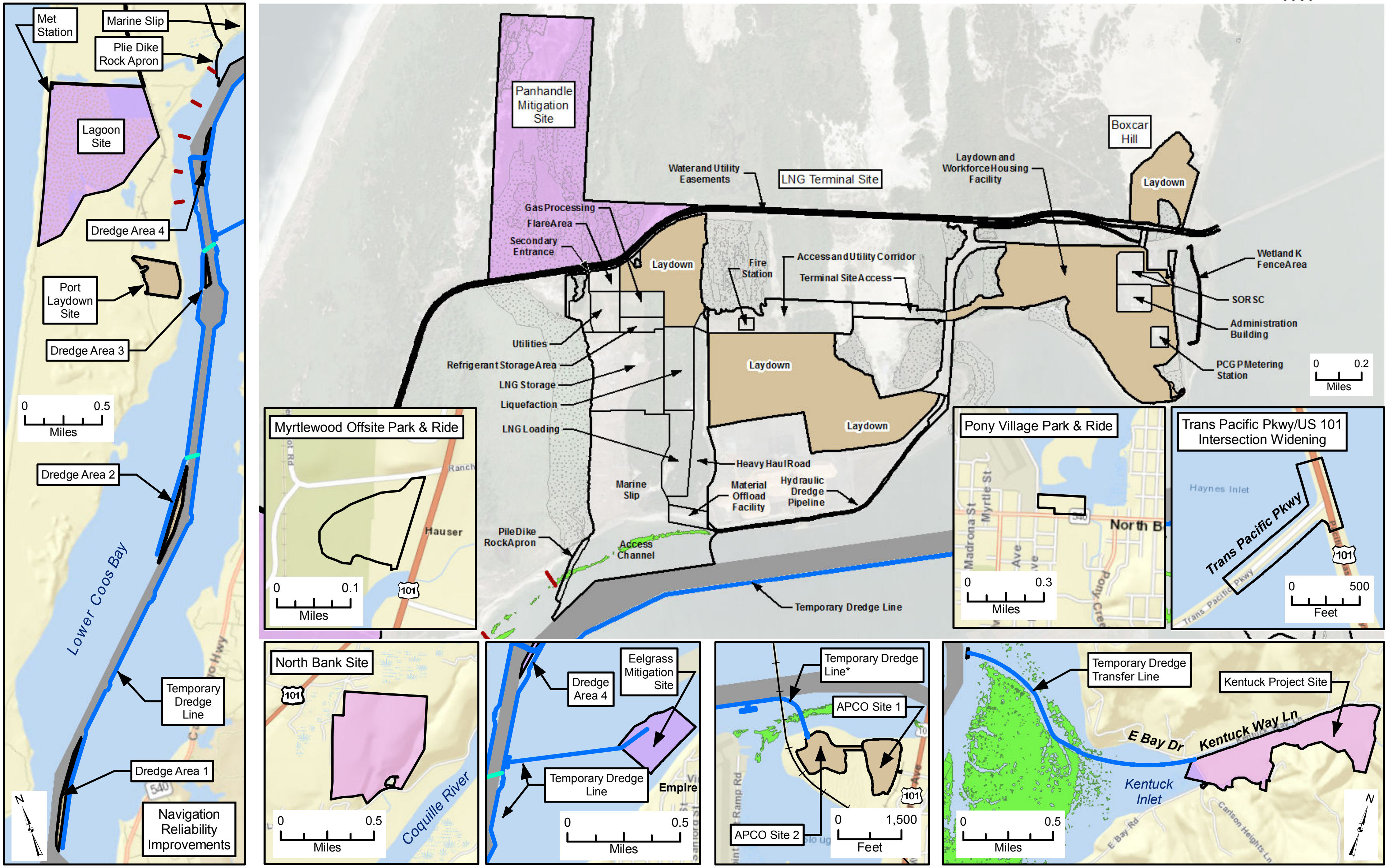
Exhibit 6
Page 1 of 2



Jordan Cove Energy Project, L.P.

N

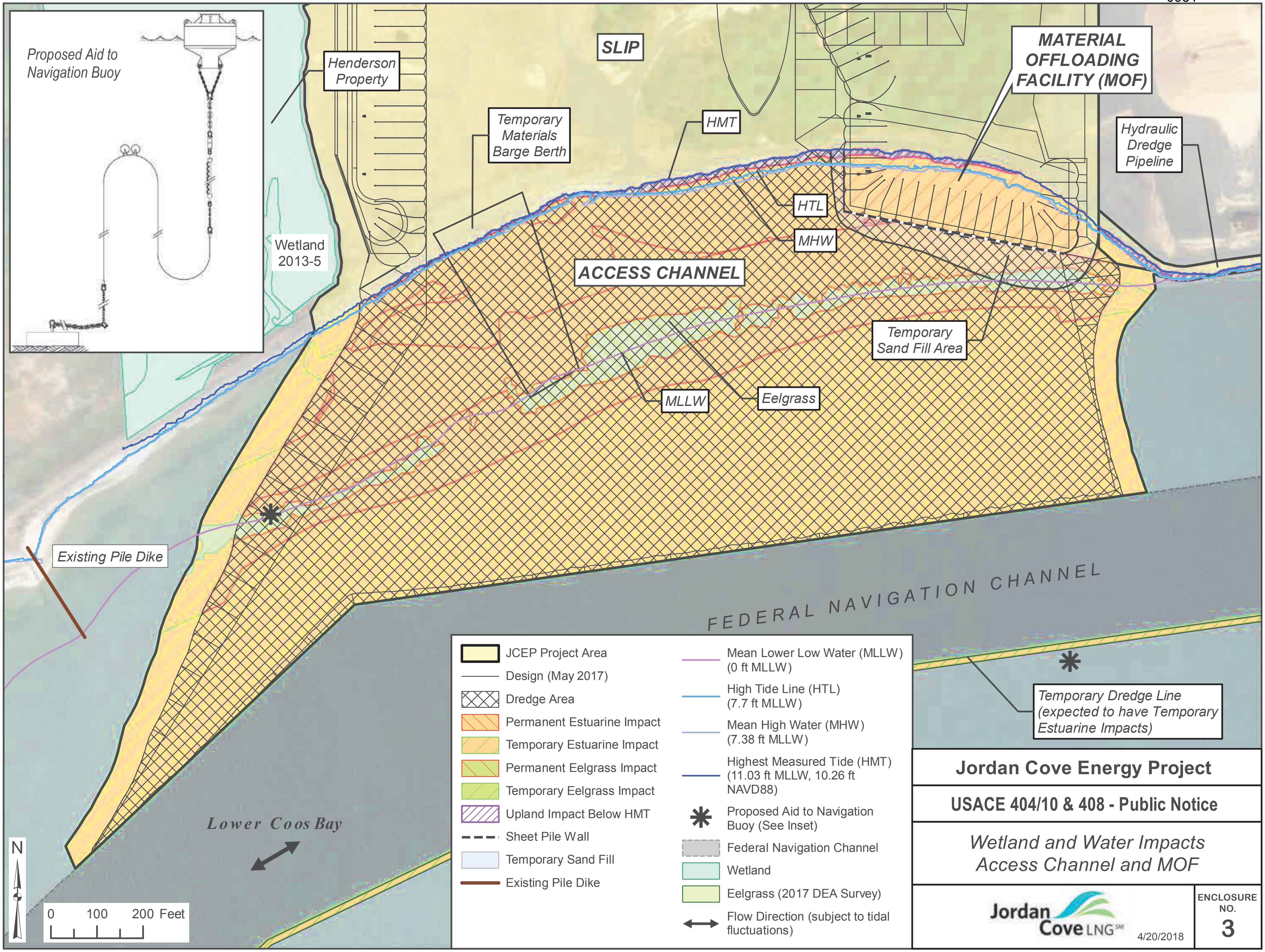
- JCEP Project Area
- Temporary Dredge Line (submerged/sunken)*
- Temporary Dredge Line (floating)
- Federal Navigation Channel
- Existing Pile Dike
- Work Area
- Mitigation Site
- Laydown Area
- Wetland
- Eelgrass

** The Temporary Dredge Line will be suspended where it crosses the eelgrass at the entrance to APCO Site 2*

Jordan Cove Energy Project

Figure 1.3-1

Plot Plan of Construction Facilities



Jordan Cove Energy Project

USACE 404/10 & 408 - Public Notice

Wetland and Water Impacts
Access Channel and MOF

Jordan Cove LNG℠

4/20/2018

ENCLOSURE NO. 3

Exhibit 7
Page 1 of 1

PROPERTY OWNER CERTIFICATION AND CONSENT

I hereby certify that the Oregon Department of State Lands is the manager of those submerged and submersible non-trust lands in Coos Bay owned by the State of Oregon. I hereby approve Jordan Cove LNG, LLC to file land use applications with the City of Coos Bay ("City"), the City of North Bend, and Coos County ("County") for the following land use authorizations for uses and activities to be located and/or undertaken within our area of ownership, as depicted on attached Exhibit 1:

(1) Post-acknowledgment amendments to the Coos Bay Estuary Management Plan ("CBEMP") map at three Coos Bay locations in the City of Coos Bay and unincorporated Coos County depicted in Exhibit 1 to these Applications ("Navigation Reliability Improvement Sites" or "NRI Sites") to change the zoning designation of 59-CA, 2-NA, and 3-DA, to DDNC-DA;

(2) A post-acknowledgment amendment of the CBEMP, which is part of the Coos County Comprehensive Plan ("CCCP"), to take a reasons exception to Statewide Planning Goal ("Goal") 16 text amendment adopted of the CBEMP, which is part of the Coos County Comprehensive Plan ("CCCP"), in the form of a reasons exception to Statewide Planning Goal ("Goal") 16 to authorize the rezone of the NRI Sites to DDNC-DA;

(3) An amendment of the text of the Coos County Zoning and Land Development Ordinance ("CCZLDO") to clarify that the DDNC-DA designation is appropriate for application to area adjacent to, and not only within, the designated federal navigation channel;

(4) Administrative conditional use permit to authorize new and maintenance dredging at the NRI Sites in the DDNC-DA zone, as this Application proposes to amend those sites.

(5) Administrative authorization from the City of North Bend for the installation of temporary dredge material transport lines, an off-loading facility, and the placement of dredged material in an Industrial zone designation.

By: Vicki L Walker

Print Name and Title: Vicki L. Walker, Director, Oregon Department of State Lands

Date: 11/1/18

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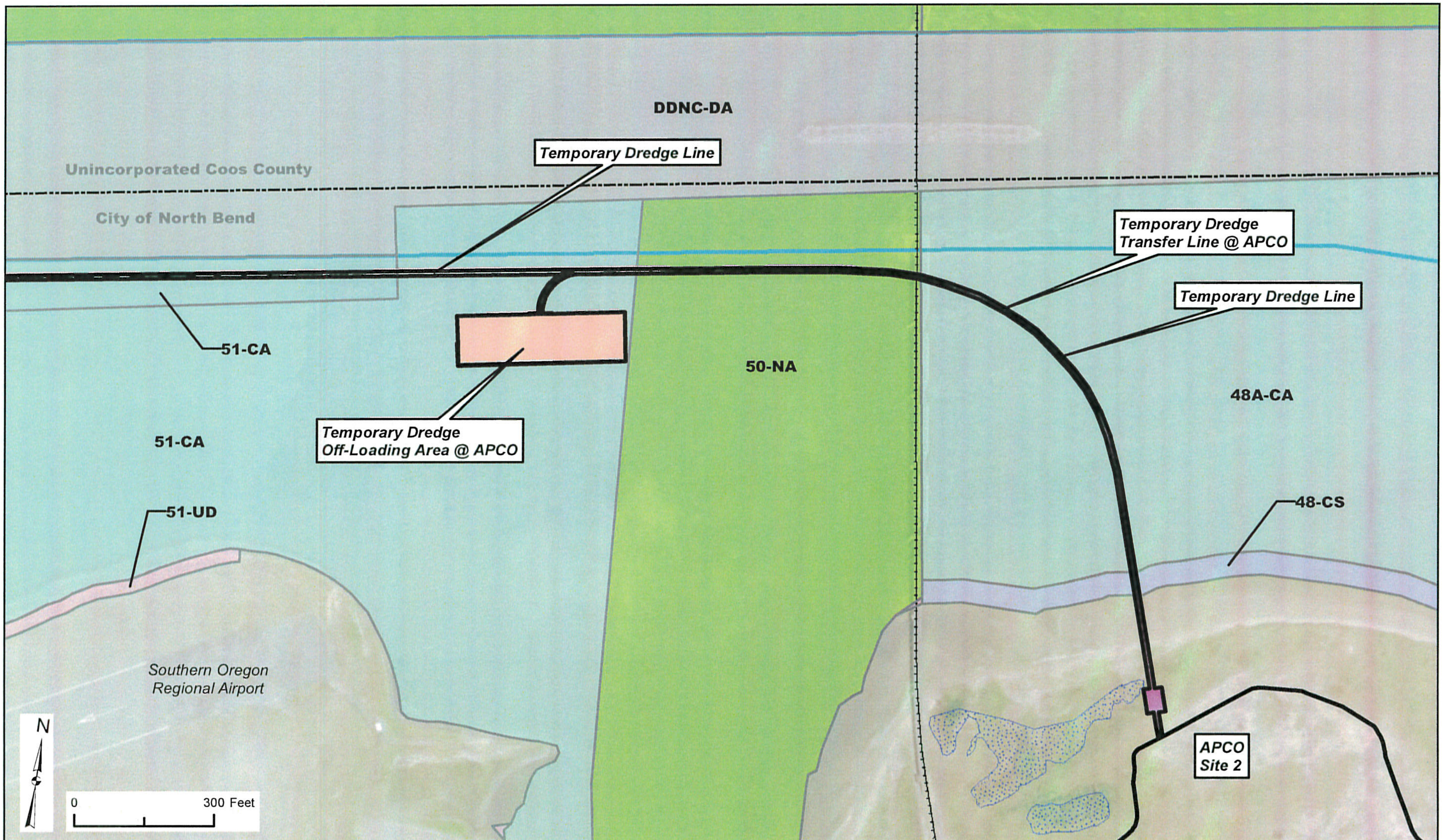

JCEP Project Area
Temporary Dredge Off-Loading Area @ APCO
Temporary Dredge Transfer Line @ APCO

CBEMP Aquatic Management Units
Conservation Aquatic (CA)
Deep Draft Navigation Channel (DDNC)
Development Aquatic (DA)
Natural Aquatic (NA)
CBEMP Shoreland Management Units
Urban Development Area (UD)
Conservation Shorelands (CS)

Wetland
Federal Navigation Channel
City Limits

Jordan Cove Energy Project

JCEP Project Area Update - August 2018

CBEMP Zoning
Temporary Dredge Transfer Line @ APCO

Jordan Cove LNG℠

8/6/2018

FIGURE NO. 3

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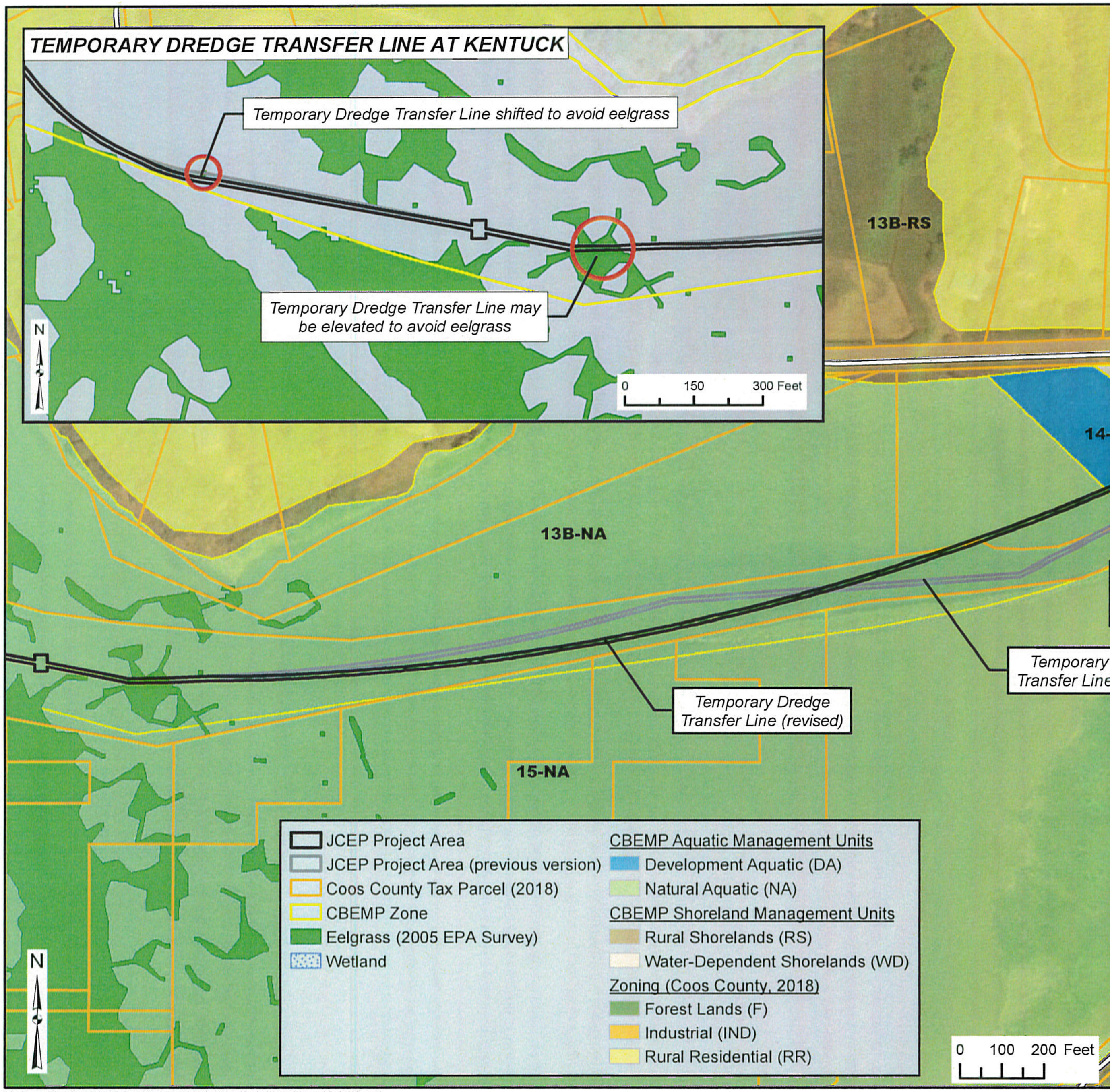

Jordan Cove Energy Project

JCEP Project Area Update - August 2018

CBEMP Zoning
Temporary Dredge Transfer Line @ Kentuck

Jordan Cove LNG℠ 8/6/2018

FIGURE NO. 4

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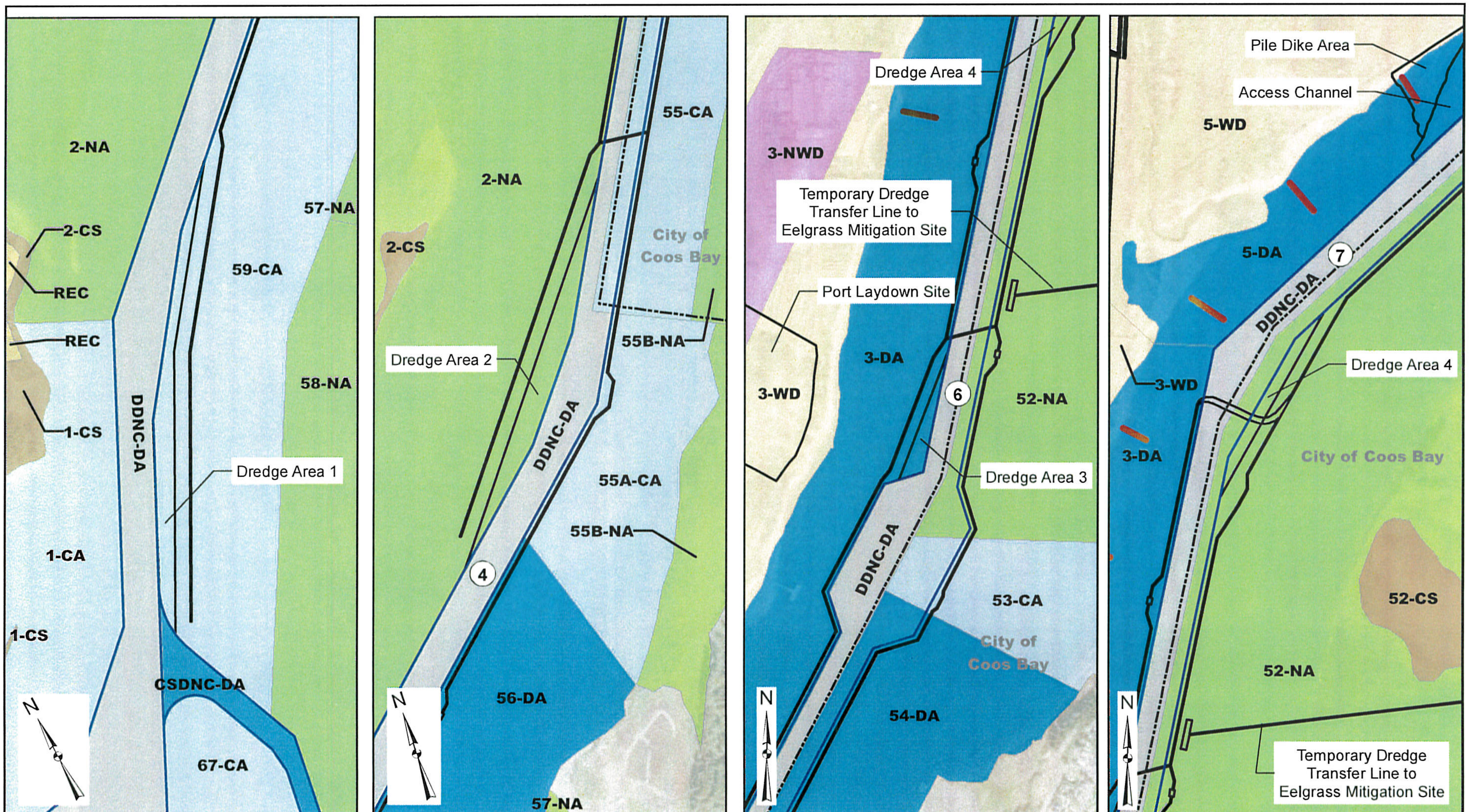
Exhibit 1
Page 2 of 3

Exhibit 8
Page 3 of 4



JCEP Project Area
Existing Pile Dike
City Limits
\# Channel Mile
Federal Navigation Channel

CBEMP Aquatic Management Units
Conservation Aquatic (CA)
Deep Draft Navigation Channel (DDNC)
Development Aquatic (DA)
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Zoning (Coos County, 2018)
Recreation (REC)

0 0.15 0.3 Miles

Jordan Cove Energy Project

JCEP Project Area Update - July 2018

CBEMP Zoning Navigational Reliability Improvement (NRI) Areas

Jordan Cove LNG℠ 7/10/2018

FIGURE NO. 5

\\deainc.com\files\PROJECTS\JLNG00000001\0600INFO\GS\Maps\Land Use\Perkins Core CBEMP Zoning by Facility\Fig 4 CBEMP Zoning Temporary Dredge Line.mxd

J1-000-CIV-MAP-DEA-00001-01 Rev. C

MEMORANDUM OF AGREEMENT

BETWEEN:

JORDAN COVE ENERGY PROJECT L.P., PACIFIC CONNECTOR GAS PIPELINE, LP,

and

THE CONFEDERATED TRIBES OF COOS, LOWER UMPQUA AND SIUSLAW INDIANS

This Memorandum of Agreement ("MOA") is made and entered into by and between Jordan Cove Energy Project L.P., a Delaware limited partnership ("JCEP"), Pacific Connector Gas Pipeline LP a Delaware limited partnership ("PCGP") (JCEP and PCGP are hereinafter referred to as "Jordan Cove" or the "Applicant") and the Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians ("Tribe").

I. PURPOSE

The purpose of this MOA is to establish a process and substantive terms to implement Policy 18 of the Coos Bay Estuary Management Plan ("CBEMP") and parallel Coos County ("County") land use regulations applicable in areas outside of the Coos Bay Estuary to Jordan Cove's land use applications and approvals by Coos County and the City of North Bend ("City"). For purposes of this MOA, reference to "Policy 18" shall include both CBEMP Policy 18 and the land use regulations applicable outside of the Coos Bay Estuary. This MOA establishes the Parties' agreed upon "appropriate measures" to protect the cultural, archaeological and historical values of the sites where the Project (as defined below) will be built as required by CBEMP Policy 18. The Parties agree this MOA applies to both new applications requiring compliance with CBEMP Policy 18 and to existing approvals that have conditions requiring compliance with CBEMP Policy 18 or its implementing land use regulations.

II. BACKGROUND

JCEP proposes to construct, operate, and eventually decommission a liquefied natural gas ("LNG") export facility and supporting infrastructure to be located on the North Spit of Coos Bay, and PCGP proposes to construct, install, own and operate a 36-inch diameter gas pipeline and supporting infrastructure spanning 229-miles across Klamath, Jackson, Douglas, and Coos Counties in the State of Oregon ("the Pipeline") (the LNG Terminal and the Pipeline are collectively referred to as the "Project"), all as set forth in Jordan Cove's applications filed under

Sections 3 and 7 of the Natural Gas Act with the Federal Energy Regulatory Commission ("FERC") on September 21, 2017.

In 2015, Jordan Cove applied to Coos County for a conditional use permit to construct and operate a LNG export terminal at Jordan Cove, located on the North Spit at Coos Bay, located in Coos County ("LNG Facility"). The LNG Facility consists of a number of components, including (1) the LNG export terminal, (2) a marine slip and access channel, (3) a barge berth, (4) a gas processing center, and (5) a fire station and emergency training center, along with associated roads and utilities. The Project would also require significant dredging, dredge disposal, shoreline stabilization, and wetland impact mitigation.

The LNG Terminal, gas processing facility, and fire station and emergency training center will be located on upland areas zoned for industrial uses. Much of the port facilities (slip, barge berth, tugboat dock, etc.) will be located in coastal shoreland areas, which are generally zoned to allow for water-dependent uses. The marine slip and access channel will require dredging in Jordan Cove, designated a natural estuary, and Henderson March, a Statewide Planning Goal 5 (Natural Resources, Scenic and Historic Areas, and Open Spaces) inventoried wetland.

The Coos County Hearings Officer held a hearing on December 18, 2015. On May 2, 2016, the Hearings Officer issued a decision with recommendations to approve the applications. On August 16, 2016, the County Board of Commissioners held a public meeting to deliberate on the recommendations, and voted to adopt the Hearings Officer's finding as the County's decision, with minor modifications. The County's final decision was issued on August 30, 2016. An appeal was promptly filed with the Oregon Land Use Appeals Board ("LUBA Appeal"). The Tribe intervened in the LUBA Appeal.

On November 27, 2017, the LUBA issued its Final Opinion and Order ("FDO") and remanded the matter for the County to further address CBEMP Policy 18 in the context of Jordan Cove's conditional use permit application.

Jordan Cove has provided the Tribe with a Site Plan for the Project, as required by Policy 18, and the Parties agree that there are cultural, archaeological and historical sites identified on the County's adopted and acknowledged inventory located within the Project area, as more specifically listed or depicted in Attachment A. The Parties further agree that there is a potential for unknown or unrecorded cultural, archaeological and/or historical sites to be encountered within the Project area.

The Tribe and the Jordan Cove met, conferred and agreed upon appropriate measures to protect the cultural, historical and archaeological values of identified inventoried sites, together with unknown or unrecorded sites that may be encountered during construction within the Project area during construction ("Cultural Resources").

III. SUBSTANTIVE REQUIREMENTS

A. Standards

1. Policy 18 requires either no adverse impacts to cultural, historic and archeological sites within the Project area or the implementation of appropriate measures to protect the cultural, historical and archaeological values of such sites.

B. Parties Obligations

1. For any land use application for the Project that may adversely affect a Cultural Resources identified in Attachment A, Jordan Cove shall (i) submit to the County or City, as applicable, a detailed cultural resource survey prepared by an archaeologist meeting the Secretary of the Interior's Guidelines as defined in 36 CFR Part 61 Tribe regarding the nature and location of the Cultural Resource; (ii) an analysis of the impacts of the potential impacts to the Cultural Resource; and (iii) if necessary, a recommendation, after consulting with the Tribe, of appropriate measures to protect the cultural, archaeological and historical values of the Cultural Resource. If the Tribe and Jordan Cove are unable to agree upon the appropriate measures to protect such sites, either Party may invoke Section 3.11 of the Cultural Resources Protection Agreement.

2. Subject to the County imposing a condition on any approval requiring compliance with this MOA to ensure compliance with CBEMP Policy 18, the Tribe agrees that Jordan Cove's land use applications for the Project comply with CBEMP Policy 18.

3. The Parties agree that an executed copy of this MOA shall be entered into the County and/or City record for any land use applications or approvals where compliance with the CBEMP Policy 18 is at issue.

IV. APPROPRIATE MEASURES TO PROTECT CULTURAL, ARCHAEOLOGICAL AND HISTORICAL VALUES

A. The Parties have executed a comprehensive Cultural Resources Protection Agreement ("CRPA"), Attachment B, which is attached hereto and incorporated fully herein by this reference. The CRPA includes and incorporates several relevant attachments, including an Unanticipated Discovery Plan ("UDP"), which provides procedures in the event of an unanticipated discovery of historic properties, archaeological objects, archaeological sites or human remains, funerary objects, sacred items and items of cultural patrimony during the construction and operation of the Project.

B. The Parties agree that the CRPA and the UDP constitute "appropriate measures" under the CBEMP Policy 18 as the CRPA provides: a process for the exchange of project related information, confidentiality requirements, commitments to mitigation, monitoring agreements, agreements for the treatment of unanticipated discovery of Cultural Resources, site access agreements, and cost recovery agreements.

V. PERMIT CONDITIONS

A. The Parties agree that compliance with this MOA shall become a condition of any County and/or City issued land use permit for activities within the Project area that involve a Cultural Resource.

IN WITNESS WHEREOF, the Parties hereto have executed this MOA as of the last date written below.

________________________________ 7/26/18
DATE

for Jordan Cove Energy Project, L.P.
and Pacific Connector Gas Pipeline, LP

________________________________ ________________________________

Mark Ingersoll, Tribal Council Chairman **DATE**
CONFEDERATED TRIBES OF COOS,
LOWER UMPQUA AND SIUSLAW INDIANS

V. PERMIT CONDITIONS

A. The Parties agree that compliance with this MOA shall become a condition of any County and/or City issued land use permit for activities within the Project area that involve a Cultural Resource.

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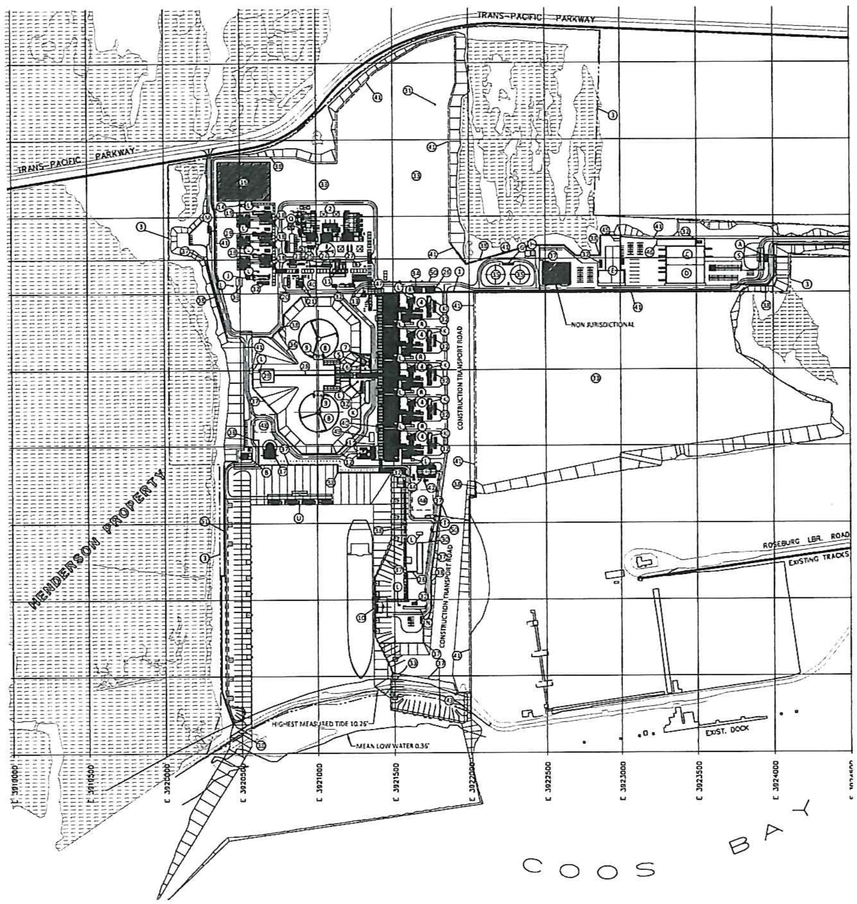
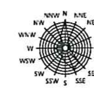
______________________________	______________________________
	DATE
for Jordan Cove Energy Project, L.P. **and Pacific Connector Gas Pipeline, LP**	
______________________________	______________________________
Mark Ingersoll, Tribal Council Chairman **CONFEDERATED TRIBES OF COOS,** **LOWER UMPQUA AND SIUSLAW INDIANS**	**DATE**



ITEM	FACILITIES LEGEND
1	FEED GAS HEADER
2	GAS CONDITIONING TRAIN
3	PROPERTY BOUNDARY
4	LNG LIQUEFACTION TRAIN #1 THROUGH #5
5	LNG EXPANDER (WITH SHELTER)
6	LNG FLASH DRUM
7	LNG RUNDOWN PUMPS (WITH SHELTER)
8	LNG STORAGE TANK
9	LNG TANK PUMPS
10	LNG LOADING PLATFORM
11	REFRIGERANT MAKE-UP
12	LP/HP BOG COMPRESSORS (WITH SHELTER)
13	COLD FLARE KO DRUM
14	MULTI POINT GROUND FLARE KO DRUM
15	NOT USED
16	MULTI POINT GROUND FLARE
17	ENCLOSED GROUND FLARE - MARINE
18	BOP AUXILIARY POWER STG
19	BOP AUXILIARY POWER STG CONTROL ENCLOSURE
20	AUXILIARY BOILER
21	DEAERATOR / BFW PUMPS
22	NOT USED
23	PLANT / INSTRUMENT AIR PACKAGES
24	NITROGEN GENERATION PACKAGE
25	LIQUID N2 STORAGE / VAPORIZATION
26	AMMONIA STORAGE TANKS AND PUMPS
27	AMINE STORAGE
28	LNG DRAINAGE CHANNEL
29	PROCESS AREA LNG IMPOUND BASIN
30	MARINE AREA LNG IMPOUND BASIN
31	FREE FIELD SEISMOMETER SHELTER
32	TRANSFORMERS
33	CONSTRUCTION LAYDOWN AREA
34	DIESEL STORAGE
35	FIREWATER STORAGE TANKS
36	LNG TANK ACCESS ROAD
37	PLANT SECURITY FENCE
38	RETAINING WALL
39	BACKUP GENERATOR
40	PIPERACK
41	IMPERMEABLE VAPOR BARRIER
42	RO PRODUCT TANK
43	CONST. MARINE OFF-LOADING FACILITIES AREA (CONST. MOF)
44	DEMIN WATER STORAGE TANK
45	WASTEWATER TREATMENT PACKAGE PLANT
46	LAYDOWN AREA
47	DUMP CONDENSER
48	BURIED STORM WATER INFILTRATION CHAMBER
49	BOG VFD ENCLOSURE
50	PERMEABLE VAPOR BARRIER
51	TSUNAMI WALL (ELEVATION VARIES TO SUIT THE DESIGN TSUNAMI)
52	METEOROLOGICAL MAST LOCATED WEST OF THE SITE NEAR INDUSTRIAL WASTEWATER LAGOON

ITEM	FACILITIES LEGEND
A	MAIN GUARD HOUSE / SECURITY BUILDING
B	TUG FACILITY BUILDING
C	PLANT WAREHOUSE
D	MAINTENANCE BUILDING
E	OPERATIONS BUILDING (INCLUDES CONTROL ROOM)
F	WATER TREATMENT BUILDING
G	FACILITY FIREWATER PUMPS WITH BUILDING
H	LUBE OIL, PAINT AND COMPRESSED GAS STORAGE
J	FACILITY AUX POWERHOUSE ENCLOSURE
K	POWERHOUSE ENCLOSURE
L	FIREWATER VALVE HOUSE
M	SECONDARY ENTRANCE SECURITY GATE/TERMINAL GUARD BUILDING
N	MARINE POWERHOUSE ENCLOSURE
P	FIRE DEPARTMENT
Q	GC TRAIN 1 POWERHOUSE ENCLOSURE
R	CEMS BUILDING (HRSG PKG)
S	INSPECTION STATION SHELTER
T	MARINE AREA GUARD HOUSE
U	TUG BOAT BERTH



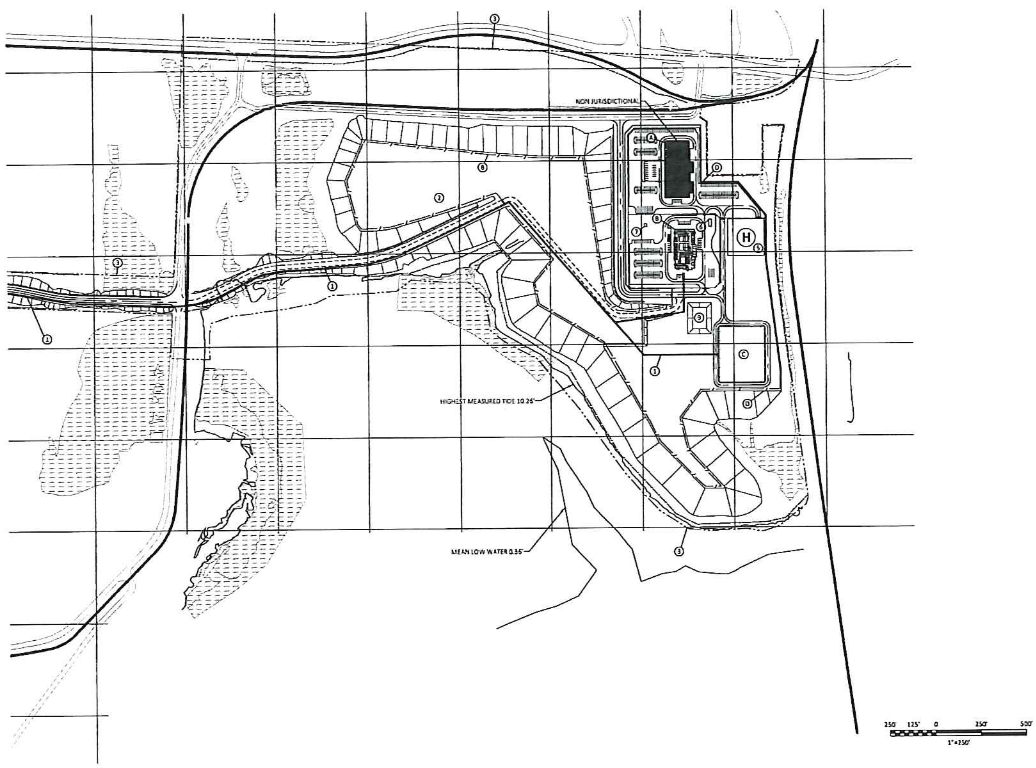
WIND ROSE - ANNUAL
NORTH BEND MUNICIPAL AIRPORT
(PERCENT OF TIME)

NOTES:
1. ELEVATIONS NOTED ARE NAVD88

LEGEND:

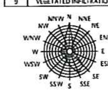
SECURITY FENCE
DEMARCATION FENCE
PROPERTY BOUNDARY
ASPHALT PAVED ROADS AND PARKING
GRAVEL ROADS AND PARKING
IMPERMEABLE VAPOR BARRIER WITH SECURITY
PERMEABLE VAPOR BARRIER

300 150' 0 300 600
1"=300'



ITEM	FACILITIES LEGEND
A	SORSC BUILDING
B	ADMINISTRATION BUILDING
C	GAS METERING STATION
D	RETAINING WALL

ITEM	FACILITIES LEGEND
1	ACCESS AND UTILITY CORIDOR (SEE NOTE 3)
2	TEMPORARY CONSTRUCTION FACILITIES
3	PROPERTY BOUNDARY
4	PG&E SWITCHYARD EASEMENT
5	HELI-PAD
6	WASTEWATER TREATMENT PACKAGE PLANT
7	COMMUNICATIONS TOWER
8	PLANT SECURITY FENCE
9	VEGETATED INFILTRATION BASIN



WIND ROSE - ANNUAL
NORTH BEND MUNICIPAL AIRPORT
(PERCENT OF TIME)

NOTES:

1. ELEVATIONS NOTED ARE NAVD88.
2. FOR OVERALL PLOT PLAN, SEE DRAWING 189930-0000-FG2000
3. THE ACCESS AND UTILITY CORRIDOR CONTAINS THE FOLLOWING BURIED LINES. CORRIDOR WILL BE ROUTED ON JCLNG LAND.
   - FEED GAS LINE
   - FIRE WATER SUPPLY TO ADMIN AND SORSC BUILDINGS
   - POWER TO ADMIN BUILDING
   - IT AND SECURITY TO ADMIN AND SORSC BUILDINGS
   - CONTROL CABLING FROM METERING STATION

LEGEND:

SECURITY FENCE

DEMARCATION FENCE

ASPHALT PAVED ROADS AND PARKING

GRAVEL ROADS AND PARKING

CULTURAL RESOURCES PROTECTION AGREEMENT
BETWEEN
THE CONFEDERATED TRIBES OF COOS, LOWER UMPQUA AND SIUSLAW INDIANS
AND
JORDAN COVE ENERGY PROJECT LP
AND
PACIFIC CONNECTOR GAS PIPELINE L.P.

THIS CULTURAL RESOURCES PROTECTION AGREEMENT ("Agreement") is entered into as of this 20th day of July, 2018 ("Effective Date") by and between Jordan Cove Energy Project LP, a Delaware limited partnership ("JCEP") and Pacific Connector Gas Pipeline L.P., a Delaware limited partnership ("PCGP") (JCEP and PCGP are hereinafter referred to as "Jordan Cove"), and the Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians, a federally recognized Indian tribe ("CTCLUSI" or the "Tribe"). Jordan Cove and the Tribe are sometimes referred to herein individually as a "Party" and collectively as the "Parties."

I. RECITALS

WHEREAS, JCEP proposes to construct, operate, and eventually decommission a liquefied natural gas ("LNG") export facility and supporting infrastructure to be located on the North Spit of Coos Bay ("LNG Terminal"), and PCGP proposes to construct, install, own and operate a 36-inch diameter gas pipeline and supporting infrastructure spanning 229-miles across Klamath, Jackson, Douglas, and Coos Counties in the State of Oregon ("the Pipeline") (the LNG Terminal and the Pipeline are collectively referred to as the "Project"), all as set forth in Jordan Cove's applications filed under Sections 3 and 7 of the Natural Gas Act with the Federal Energy Regulatory Commission ("FERC") on September 21, 2017; and

WHEREAS, FERC is responsible for compliance with Section 106 of the National Historic Preservation Act, 16 U.S.C. § 470, ("NHPA"), which requires it to take into account the effects of its undertakings on historic properties by identifying the properties within a proposed undertaking's area of potential effects that are listed or eligible for listing in the National Register of Historic Places, 36 C.F.R. § 800.4, evaluate the effects of the proposed undertaking on those properties, *Id.* § 800.5, and if adverse effects are found, resolve such adverse effects through avoidance, minimization or mitigation. *Id.* At 800.6; and

WHEREAS, the Parties expect FERC, the State Historic Preservation Office ("SHPO") and other federal agencies will document compliance with the requirements of the NHPA through execution of a memorandum of agreement that will address resolution of any adverse effects identified within the "area of potential effects" for the Project; and

WHEREAS, Jordan Cove has developed, with input from the Tribe, SHPO and other federally recognized tribes, the plan and procedures addressing Unanticipated Discoveries of Cultural Resources and Human Remains, which outlines the procedures Jordan Cove will follow should Project construction result in the unanticipated or inadvertent discovery of archaeological sites, cultural resources or human remains; and

WHEREAS, the Tribe descends from the indigenous people who resided along the southern Oregon coast for countless generations, and

WHEREAS, the Tribe's ancestral territory extends from the mouth of Tenmile Creek (Lane County) in the north, south to Fivemile Point halfway between the mouths of Whiskey Run Creek and Cut Creek (coinciding with the border between Sections 30 and 31, Township 27 South, Range 14 West, Coos County), thence east to the crest of the Coast Range to Weatherly Creek on the Umpqua River ("Ancestral Territory"); and

WHEREAS, the LNG Terminal and a portion of the Pipeline run through the Tribe's Ancestral Territory; and

WHEREAS, the Tribe is deeply concerned by the potential effects of construction and operation of the LNG Terminal and the Pipeline on the Tribe's cultural resources; and

WHEREAS, cultural resources within the Jordan Cove Area include identified and unidentified but probable archaeological sites and items such as stone tools, fish traps, residential remains, cemetery remains, secondary deposits, historic bottle dumps, early frame houses, and mill works, dating from several thousand to less than one hundred years old, and all of which are a central part of the cultural heritage of the Tribe and of the region; and;

WHEREAS, during previous iterations of the Project, archaeological studies have been conducted and two archaeological sites were identified within the area of potential effects identified at that time - Sites 35CS221 and 35CS227 as requiring additional investigation; and

WHEREAS, as set forth in this Agreement, the Tribe will participate in the identification of potential adverse impacts to Site 35CS227, and the development of measures to avoid or mitigate any such impacts through design measures for the Project, and at least one archaeologist will monitor adjacent construction activities; and

WHEREAS, on July 31, 2006 through Resolution No. 2006-097, and again on July 29, 2015 through Resolution No. 2015-049 the Tribal Council designated the Jordan Cove Area as a Site of Tribal Cultural and Religious Significance; and

WHEREAS, construction, operation and decommissioning of the Project must take place in compliance with local, state and federal laws, including Section 106 of the NHPA, the National Environmental Policy Act (NEPA), the Native American Graves Protection and Repatriation Act (NAGPRA), Oregon laws regarding sites and artifacts (Oregon Revised Statutes (ORS) 358.905 *et seq.*), Oregon laws regarding Indian Graves and Protected Objects (ORS 97.740 *et seq.*; and the Coos Bay Estuary Management Plan; and

WHEREAS, the Parties seek to work cooperatively to avoid, minimize and, where appropriate, mitigate adverse effects to the Tribe's cultural resources from the Project Activities pursuant to the terms and conditions herein set forth.

NOW, THEREFORE, the Parties enter into this Agreement in a spirit of cooperation to provide a means by which the Parties can address the matters set forth in this Agreement with the goal of minimizing adverse effects to the Tribe's cultural resources arising from the construction, operation and decommissioning of the Project.

II. DEFINITIONS

2.1 "Applicable Law" means all applicable federal, state, and local laws, statutes, rules, regulations, codes, or ordinances, of a Governmental Authority.

2.2 "Archaeologist" means a scientist meeting all standards and requirements of the Secretary of the Interior set forth in 36 CFR Part 61, with a graduate degree in anthropology and the required experience to properly identify and record Cultural Resources.

2.3 "Area of Potential Effect" means that area delineated through the section 106 process for the Project.

2.4 "Cultural Resources" mean districts, sites, buildings, structures, Native American Human Remains and funerary objects, and all other physical objects that are significant to the Tribe's history, architecture, archeology and culture, including, but not limited to, historic properties and Traditional Cultural Properties to which the Tribe attaches religious and cultural significance.

2.5 "Curation" means the management and preservation of collections in accordance with the National Park Service's regulations in 36 CFR Part 79, unless otherwise agreed to in writing.

2.6 "Governmental Authority" means any (a) national, state, county, municipal or local government and any political subdivision thereof, (b) court or administrative tribunal, or (c) other governmental, quasi-governmental, judicial, public or statutory instrumentality, authority, body, agency, bureau or entity of competent jurisdiction.

2.7 "Ground Disturbing Activities" means any activity that compacts or disturbs the surface or subsurface within the Project Area. Ground Disturbance can be caused by the use of hand tools (shovels, pick axe, posthole digger, etc.), heavy equipment (excavators, backhoes, bulldozers, trenching and earthmoving equipment, etc.), and heavy trucks (large four-wheel drive trucks, dump trucks and tractor trailers, etc.). Trenching, bulldozing, excavating, scraping, vibrodensification, geo–piering and plowing are typical examples of Ground Disturbance Activities. Project types that usually involve Ground Disturbance include acquisition/demolition/relocation of structures; vegetation management; landslide stabilization; and infrastructure projects such as utilities, storm water management, and flood control.

2.8 "Mitigate" means to minimize the potential effects to Cultural Resources where avoidance is not reasonably practicable. This may include, but is not limited to, data recovery, Monitoring, or relocation or Curation of the Cultural Resource.

2.9 "Monitor" means observance of Project Activities by a person determined by CTCLUSI to be knowledgeable and qualified in identifying Cultural Resources.

2.10 "Native American Human Remains" means the physical remains or partial remains of the body of a person of established or probable Native American ancestry.

2.11 "Person" means an individual, entity, corporation, partnership, limited liability company, joint venture, association, or unincorporated association or Governmental Authority.

2.12 "Project Activities" means testing, pre-construction, construction, operation, and decommissioning Ground Disturbing Activities within the Project Area that are reasonably likely to have adverse effects on Cultural Resources.

2.13 "Project Area" means the area depicted on Exhibit "A" attached hereto, as it may be amended from time to time.

2.14 "Traditional Cultural Property" or "TCP" means a property that is either eligible for listing or listed on the National Register of Historical Places ("NRHP") based on its associations with the cultural practices, traditions, or beliefs, of the Tribe. TCPs are rooted in the Tribe's history and are important in maintaining the continuing cultural identity of the Tribe.

2.15 "Unanticipated Discovery" means the unintentional encounter or discovery of Cultural Resources or Human Remains.

2.16 "Unanticipated Discovery Plan" or "UDP" means the agreed-upon plan attached to the FERC Memorandum of Agreement resulting from the conclusion of the section 106 process, a draft of which is attached to this Agreement as Exhibit "B", or, until issuance of a certificate by the FERC, an agreed upon-plan that is required by a Governmental Authority as a condition of an authorization, certification, approval or permit associated with Project Activities, or, in the absence of an agreed-upon plan that is required by a Governmental Authority, Exhibit B.

III. STIPULATIONS

3.1 **Purpose**. This Agreement sets forth the terms and conditions governing:

(a) communication and information exchange protocols between the Parties;

(b) the Tribe's participation in the identification of Cultural Resources within the Project Area; assessment of adverse impacts to Cultural Resources; and the development of measures to avoid, minimize or mitigate any potential effects in accordance with Applicable Law, and;

(c) Monitoring of Cultural Resources during Project Activities; and

(d) reimbursement to the Tribe for reasonable costs associated with implementation of this Agreement in accordance with the terms of the cost reimbursement agreement attached hereto as Exhibit 'C" and to fund a full-time position within the Tribe's Historic Preservation Office in accordance with the terms of section 3.9.

3.2 Mitigation Preferences.

(a) Jordan Cove agrees to avoid adverse impacts to Cultural Resources to the extent reasonably practicable. If adverse impacts are unavoidable then Jordan Cove agrees to minimize or mitigate any potential impacts in accordance with Applicable Law and considering the preferences set out in subparagraph (b) of this Section 3.2.

(b) For Project Activities that may impact Cultural Resources, Jordan Cove shall, in accordance with Applicable Law, apply the following order of preference with respect to preferred mitigation methodologies:

(1) Avoiding the impact altogether by not taking a certain action or parts of an action;

(2) Minimizing impacts by limiting the degree or magnitude of the action and its implementation;

(3) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;

(4) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action, and;

(5) Compensating for the impact, including but not limited to the relocation or Curation of the Cultural Resource.

3.3 Communication and Information Sharing. The Parties agree to the following information sharing and communication protocols:

(a) Within thirty (30) days of execution of this Agreement, Jordan Cove will identify individuals who will be the primary contact(s) or their designated representative for the purposes of implementing this Agreement and principal(s) who will be responsible for overall compliance with the Agreement and resolving any disputes in accordance with the terms of this Agreement; CTCLUSI will identify tribal officials or representatives who will be the primary contact for the purposes of implementing this Agreement and principals responsible for resolving any disputes.

(b) Jordan Cove will provide CTCLUSI with complete copies of permit applications required for Project Activities and provide CTCLUSI an opportunity to comment on such permit applications pursuant to Applicable law.

(c) Prior to all Project Activities, Jordan Cove will seek CTCLUSI's expertise and opinions related to potential discovery of Cultural Resources in the Project Area and the need for Monitoring of the Project Activities. CTCLUSI shall provide such expertise and opinions to Jordan Cove pursuant to subsection (f) below.

(c) Jordan Cove will provide timely, good faith responses to, and will take into consideration all timely written comments received from CTCLUSI related to Cultural Resources that could be affected by Project Activities pursuant to the terms of this Agreement.

(d) Jordan Cove will provide CTCLUSI with a schedule for all Project Activities, updated at a minimum quarterly, identifying dates on which or by which comments or Monitoring would be required under the terms of this Agreement ("Project Activity Schedule").

(e) Jordan Cove principals and CTCLUSI principals, in each case identified in accordance with subsection (a) above, will meet not less than quarterly and in coordination with the submission of updated Project Activities schedules, to discuss such schedules. CTCLUSI shall identify which Project Activities require Monitoring or comments to be provided by CTCLUSI. At least once a year, during a meeting to be held in February, the principals shall also review progress under the Agreement and whether the Agreement needs to be amended.

(f) In addition to the Project Activity Schedule, prior to undertaking each Project Activity, Jordan Cove will provide CTCLUSI with a Project Activity Notice in a form substantially as included as Exhibit "D". CTCLUSI shall provide any response or comment to such Project Activity Notice pursuant to the schedule set out below:

1. Not less than thirty (30) days, unless such notification is not practicable, before commencing any Project Activities requiring a Monitor from

CTCLUSI, Jordan Cove will provide CTCLUSI with a Project Activity Notice describing the activity to be taken, timing and any other information reasonably necessary to facilitate CTCLUSI Monitoring of such Project Activity, such as the scope of equipment to be used and number of construction fronts. If there are any material changes to the plans set out in the Project Activity Notice, Jordan Cove agrees to provide CTCLUSI with an additional notice and opportunity to comment. In the event of an emergency, Jordan Cove agrees to provide CTCLUSI with a summary of the Project Activities undertaken during the emergency, as soon as practicable following conclusion of the emergency.

2. Within twenty (20) days of receiving the Project Activity Notice, CTCLUSI will submit to Jordan Cove any comments or concerns, including requests for additional investigations or surveys, related to the proposed Project Activity.

3. Within seven (7) days of receiving CTCLUSI's comments, Jordan Cove will provide CTCLUSI notice regarding any changes Jordan Cove decides to make to the proposed Project Activity based on CTCLUSI's comments.

(d) The Parties will use reasonable efforts to informally resolve disputes arising under this Section 3.3. Disputes arising under this Section 3.3 that cannot be informally resolved between the Parties shall be subject to the dispute resolution provisions of this Agreement.

(e) Jordan Cove agrees to provide notice to staff, contractors, and consultants engaged by Jordan Cove to undertake Project Activities that are reasonably likely to affect Cultural Resources of the provisions of this Agreement and Jordan Cove's responsibilities under this Agreement.

(h) Jordan Cove agrees to work with CTCLUSI to develop a cultural resources awareness and training program, which shall be utilized during the onboarding process for all employees and contractors engaged in Project Activities at the LNG Terminal.

3.4 Identification of Cultural Resources; Assessment and Resolution of Adverse Impacts

(a) The Parties agree to work cooperatively to identify Cultural Resources and to assess and resolve any adverse impacts thereto in compliance with this Agreement and Applicable Laws. To the extent of any conflict, the provisions of Applicable Laws shall control.

(b) The Parties agree that the scope of Cultural Resource identification efforts shall, to the extent allowed by Applicable Law, include reference to and use of ethnographic analysis reports.

3.5 Monitoring During Applicable Project Activities.

(a) CTCLUSI may have Monitors present at Project Activities. All Monitors may be required to execute an Access Agreement substantially in the form attached hereto as Exhibit "E" for access to any lands within the Project Area, other than federal lands, that are owned or controlled by Jordan Cove.

(b) JCEP and PCGP will permit Tribal staff members or designated representatives ("Tribal Monitors") to be present in the Project Area, at the Tribe's option, to monitor Applicable Project Activities, subject to applicable access, safety, and security rules and policies.

(c) Jordan Cove will ensure that (1) the Tribe is provided reasonable notice of Project Activities as set out in this Agreement, and (2) Tribal Monitor are granted reasonable access to the Project Area and any Project Activities as necessary to perform his or her duties as a Tribal Monitor. Jordan Cove shall provide to CTCLUSI the equipment set out in the Project Activity Notice.

(d) Tribal Monitor access to any portion of the Project Area shall be subject to all applicable security and safety rules, laws, and regulations, and Jordan Cove's and its contractors' security and safety policies, including requirements relating to the use of proper clothing and safety equipment, including safety glasses or goggles, masks, rebreathers, hazmat suits, hard hats, or safety vests, provided that Jordan Cove reserves the right for itself and its contractors to prohibit access to any portion of the Project Area by any Person, including any Tribal Monitors, in its sole and absolute discretion to the extent of any actual or threatened breach of any such rules, laws, regulations, or policies.

(e) Jordan Cove acknowledges that the Tribe may incur certain costs in connection with a qualified Tribal Monitor's archaeological and/or safety training directly related to monitoring activities hereunder. Jordan Cove will reimburse the Tribe for all reasonable costs associated with Monitoring activities, pursuant to the Cost Recovery Agreement between the Parties, which is attached hereto as Exhibit "C" and incorporated herein by this reference.

(f) Jordan Cove shall hold the Tribe and its officers and employees harmless from and against any and all claims, actions, liabilities, losses, damages, judgments, grants, costs, and expenses (including attorney's fees) arising out of injury or death to persons, or damage to property caused by the negligence of Jordan Cove, its officers, employees, agents, assigns, and subcontractors in the performance of obligations arising under this Agreement, provided the Tribe promptly notifies Jordan Cove in writing of any such claim, and provided that Jordan Cove shall have the exclusive right to control the defense.

(g) The Tribe shall hold Jordan Cove, its officers and employees harmless from and against any and all claims, actions, liabilities, losses, damages, judgments, grants, costs, and expenses (including attorney's fees) arising out of injury or death to persons, or damage to property caused by the negligence of the Tribe and its officials, employees, agents, and subcontractors in the performance of obligations arising under this Agreement, provided: (i) Jordan Cove promptly notifies the Tribe in writing of any such claim; (ii) the Tribe shall have the exclusive right to control the defense; and (iii) the amount does not exceed and is otherwise covered by the Tribe's liability insurance.

(h) The Tribe shall maintain, during the term and each renewal or extension of this Agreement, at its own expense, the following insurance: (i) statutory workers' compensation insurance or equivalent industrial accident insurance covering all employees as required by law; (ii) commercial automobile liability coverage (if the use of automobiles is required) for all owned, hired, borrowed, leased, or non-owned automobiles, providing bodily injury and property damage liability coverage with a combined single limit of $1,000,000; and (iii) commercial general liability insurance (including, but not limited to, premises operations, property damage, products/completed operations, contractual liability, and personal injury) with limits of at least $1,000,000 per occurrence/ $2,000,000 annual aggregate.

(i) Upon request of the Tribal Council, and subject to any necessary safety requirements, Jordan Cove shall allow reasonable site access to Tribal Council Members and to Tribal Council authorized Tribal cultural leaders, to perform ceremonies and blessings prior to a Tribal Council identified Ground Disturbing Activity.

3.6 Inadvertent Discoveries.

If Cultural Resources are discovered in the Project Area, including during Project Activities, Jordan Cove agrees to:

(a) Promptly inform the Tribe of the discovery; and

(b) Comply with the procedures and protocols set forth in the UDP, which is attached hereto as Exhibit "B" and incorporated herein by this reference. The Parties expect the UDP to remain substantially in the form as the document attached hereto as this document has been provided to FERC.

3.7 Confidentiality

For purposes of this Agreement, the Parties agree as follows:

(a) Tribal Confidential Information means all information whether written or oral, including ethnographic reports, provided by the Tribe to Jordan Cove regarding: potential burial sites, archeological objects, funerary objects or objects of cultural patrimony as defined by ORS 358.905, sacred or religious sites and traditional gathering locations.

(b) Jordan Cove Confidential Information means all information whether written or oral provided by Jordan Cove which it designates as confidential at the time the information is provided to the Tribe in furtherance of the activities under this agreement. Jordan Cove Confidential Information, includes, but is not limited to, technical reports, operations information, construction plans and similar information.

(c) Receiving Party means the party receiving Confidential Information.

(d) Disclosing Party means the party disclosing the Confidential Information.

(e) Confidential Information shall not include information that (i) is available in the public domain; (ii) was in the Receiving Party's possession prior to the date of this Agreement and not covered by any confidentiality requirements; (iii) the Receiving Party received from a third party who was not under any obligation of confidentiality with respect to the information.

(f) The Receiving Party will not disclose the Disclosing Party's Confidential Information and will maintain such information as confidential using practices no less stringent that the Receiving Party applies to its own confidential information. The Receiving Party agrees not to disclose Confidential Information without the prior written consent of the Disclosing Party; provided, however, the Receiving Party may disclose Confidential Information to the Receiving Party's affiliates, officers, directors, partners, employees, accountants, advisors, consultant and representatives (Related Persons) but only to the extent necessary for purposes of this Agreement. The Receiving Party shall be responsible for any acts or omissions of its Related Persons with respect to Confidential Information provided pursuant to the terms of this Agreement.

(g) If Jordan Cove or the Tribe become aware of a disclosure of Confidential Information in violation of the terms of this Agreement, the party making such discovery shall promptly notify the other party of such disclosure. Jordan Cove and the Tribe agree that the unauthorized disclosure of Confidential Information would cause irreparable harm that would be difficult to quantify. Accordingly, Jordan Cove and the Tribe agree the Disclosing Party would be entitled to injunctive relief in the event of a breach of this Agreement with respect to Confidential Information in addition to any other remedies that may be available to the Disclosing Party at law or in equity. The Receiving Party shall not contest the Disclosing Party's right to seek any such relief on the grounds that monetary damages would be available to compensate the Disclosing Party for any such breach.

(h) Nothing in this Agreement shall convey to either Party any rights in or to the Confidential Information, including any rights of ownership or license, whether arising under patent, copyright, trademark, trade secret or any other intellectual property or other proprietary right.

(i) Notwithstanding anything contained herein to the contrary, the commitments and obligations set forth in this Section 3.7 shall continue until the earlier to occur of Jordan Cove notifying the Tribe that (i) Project Activities are complete or (ii) the Project has been cancelled.

3.8 Funding of full time position. Jordan Cove agrees to provide in accordance with the terms of a separate agreement to be entered into between CTCLUSI and Jordan Cove within sixty (60) days of execution of this Agreement funding for a full-time position to assist CTCLUSI's Tribal Historic Preservation Office in carrying out CTCLUSI's obligations under this Agreement and other duties as assigned by CTCLUSI.

3.9 Governing Law. This Agreement shall be governed by and construed in accordance with the laws of the State of Oregon, without reference to conflicts of law rules, and the federal laws of the United States.

3.10 Dispute Resolution.

(a) All standards and procedures contained within Applicable Law pertinent to the provisions of this Agreement shall control.

(b) The Parties desire to prevent disputes regarding compliance with this Agreement whenever possible, and to quickly and effectively resolve disagreements when they arise. All disputes under this Agreement shall be considered Confidential Information and shall be subject to the provisions of Section 3.7, subject to Applicable Law.

(c) To the extent possible, the Parties will use reasonable efforts to negotiate a mutually agreeable resolution to any disagreements by the parties responsible for the day-to-day implementation of the provisions of this Agreement. In the event such parties are not able to resolve any disagreements within a reasonable period of time, the dispute shall be elevated to the principals designated under section 3.3(a) by either party providing written notice to the other party's principal.

(d) Upon receipt of a notice as set out in subparagraph (c) above, the principals agree to meet in person no later than ten (10) days after receipt of the notice, unless the Parties mutually agree to a different time and manner of meeting.

(e) The Principals will attempt, in good faith, to resolve the dispute between the Parties.

(f) If the parties are unable to resolve the disputed issues through joint discussions under this Section, either party may request arbitration by providing a written arbitration demand to the other party. The party on whom the demand is served shall have ten (10) days after receipt of the arbitration demand to advise the other party as to whether it will agree to arbitration.

(g) If the parties do not agree to arbitrate, then each party reserves the right to terminate this Agreement pursuant to Section 3.13, and/or to argue that failure to comply with this Agreement results in a violation of Applicable Law and any permits, certifications or approvals related to the Project.

(h) Arbitration shall be conducted in accordance with the Commercial Arbitration Rules of the American Arbitration Association ("AAA") or other mutually agreed-upon procedures. All arbitration hearings shall be held at Coos Bay, Oregon or such other place mutually agreed to by the Parties. If either Party fails to abide by such arbitration ruling, the Parties agree to enforce the arbitration award in Oregon state courts or any federal court having jurisdiction.

(i) In determining any matter(s) the arbitrators shall apply the terms of the Agreement, without adding to, modifying or changing the terms in any respect, and shall apply the laws of the State of Oregon.

(j) Prior to submitting to arbitration, the Parties may mutually agree to engage in mediation, in which case the Commercial Mediation Procedures of the AAA shall apply or other mutually agreed-upon procedures.

3.11 Limited Waiver of Sovereign Immunity

(a) CTCLUSI hereby grants an irrevocable, limited waiver of sovereign immunity to compel arbitration, once the Tribe has provided written notice to agree to arbitration pursuant to Subsection 3.11(f), and to enforcement of an arbitration award. Furthermore, for the sole and limited purpose of enforcement of any arbitration award, CTCLUSI expressly waives its sovereign immunity from suit by Jordan Cove, JCEP and PCGP and consents to be sued in the Oregon state courts or, if Oregon state courts lack jurisdiction over the suit, then in the United States District Court for the District of Oregon and appeals may be made to the United States Court of Appeals for the Ninth Circuit and the United States Supreme Court.

(b) Relief against the Tribe is specifically limited to the following actions and remedies:
  (1) Injunctive relief as necessary to enforce arbitration awards or orders pursuant to Section 3.10.
  (2) An Action to compel arbitration, once the Tribe has provided written notice to agree to arbitration pursuant to Subsection 3.10(f).

3.12 Term and Termination

(a) This Agreement shall be for a term of ten (10) years from the Effective Date unless extended upon the mutual written agreement of the Parties.

(b) This Agreement may be terminated by either Party by providing thirty (30) days written notice to the other Party. If this Agreement is terminated pursuant to this Section, then each party reserves all rights to argue that termination of this Agreement results in a violation of Applicable Laws and any permits, certifications or approvals related to the Project.

3.13 General Provisions.

(a) If any term or provision of this Agreement is held invalid, illegal or unenforceable by a court of competent jurisdiction for any reason, the Parties agree to modify such provision to the extent required to render it valid, legal, or enforceable, and the remainder of this Agreement shall in no way be affected and shall remain valid and enforceable for all purposes.

(b) All words in this Agreement shall be deemed to include any number or gender as the context or sense of this Agreement requires. The words "will," "shall," and "must" in this Agreement indicate a mandatory obligation subject to the terms hereof and Applicable Law. The use of the words "include," "includes," and "including" followed by one or more examples is intended to be illustrative and shall be deemed to be followed by the words "without limitation." The words "day" and "days" refer to calendar days unless otherwise stated. The words "month" and "months" refer to calendar months unless otherwise stated. The words "hereof", "hereto" and "herein" refer to this Agreement, and are not limited to the article, section, paragraph or clause in which such words are used.

(c) The headings and captions contained herein are for the purposes of convenience and reference only and are not to be construed as a part of this Agreement. All references to any Section in this Agreement are to Sections of this Agreement, unless otherwise noted.

(d) No third party shall be a beneficiary of a Party's rights or benefits under this Agreement, other than as expressly set forth herein.

(e) NOTWITHSTANDING ANYTHING CONTAINED HEREIN TO THE CONTRARY, IN NO EVENT SHALL EITHER PARTY BE LIABLE TO THE OTHER PARTY WITH RESPECT TO ANY CLAIM ARISING OUT OF OR RELATING TO THIS AGREEMENT FOR ANY SPECIAL, CONSEQUENTIAL, INCIDENTAL, OR INDIRECT LOSSES OR DAMAGES FROM ITS PERFORMANCE UNDER THIS AGREEMENT OR ANY FAILURE OF PERFORMANCE HEREUNDER OR RELATED HERETO, WHETHER ARISING OUT OF BREACH OF CONTRACT, TORT, STRICT LIABILITY OT OTHERWISE; provided, however, that the limitations of this clause (e) shall not apply to any rights to defense and indemnification of Jordan Cove, the Tribe or any other Indemnified Parties as provided elsewhere in this Agreement.

(f) Except as the Parties may otherwise agree in writing or as otherwise provided herein, each Party shall bear its respective fees, costs and expenses in connection with this Agreement and the transactions contemplated hereby.

(g) No waiver by any Party, whether express or implied, of any right under any provision of this Agreement shall constitute a waiver of such Party's right at any other time or a waiver of such Party's rights under any other provision of this Agreement unless it is made in writing. No failure by any Party hereto to take any action with respect to any breach of this Agreement or default by another Party shall constitute a waiver of the former Party's right to enforce any provision of this Agreement or to take action with respect to such breach or default or any subsequent breach or default by such latter Party.

(h) **Each Party acknowledges that it and its attorneys have been given an equal opportunity to draft, review, negotiate, and modify the terms and conditions of this Agreement and that any rule of construction to the effect that ambiguities or any other matters are to be resolved against the drafting party, or any similar rule operating against the drafter, shall not be applicable to the construction or interpretation of this Agreement.**

(i) This Agreement shall apply to Jordan Cove's successors and assigns.

(j) Any notice, demand, offer, or other written instrument required or permitted to be given pursuant to this Agreement shall be in writing signed by the Party giving such notice and shall be delivered by (1) hand, (2) same-day or overnight courier, (3) certified mail, return receipt requested, or (4) email to the other Party at the address set forth below:

i. If to the Tribe:

Confederated Tribes of Coos,

Lower Umpqua and Siuslaw Indians
1245 Fulton Avenue
Coos Bay, Oregon 97420
Attention: Tribal Council Chairman
E-mail: MCorvi@ctclusi.org (with CC to SScott@ctclusi.org and scott@wheatlawoffices.com)

ii. If to Jordan Cove:

Jordan Cove Energy Project L.P.
Pacific Connector Gas Pipeline L.P.
c/o Jordan Cove LNG L.L.C.
5615 Kirby Drive, Suite 500
Houston, Texas 77005
Attention: Manager Tribal Affairs
E-mail: (with a CC to neades@pembina.com)

Each Party shall have the right to change the place to which notice shall be sent or delivered by sending a written notice to the other Party in like manner. Notices, demands, offers or other written instruments shall be deemed to be received: (1) if delivered by hand, by same-day or overnight courier service, or certified mail on the date actually received at the address of the intended recipient; or (2) if sent by email, upon actual receipt.

[*Signature pages follow.*]

SIGNATORIES:

7/26/18

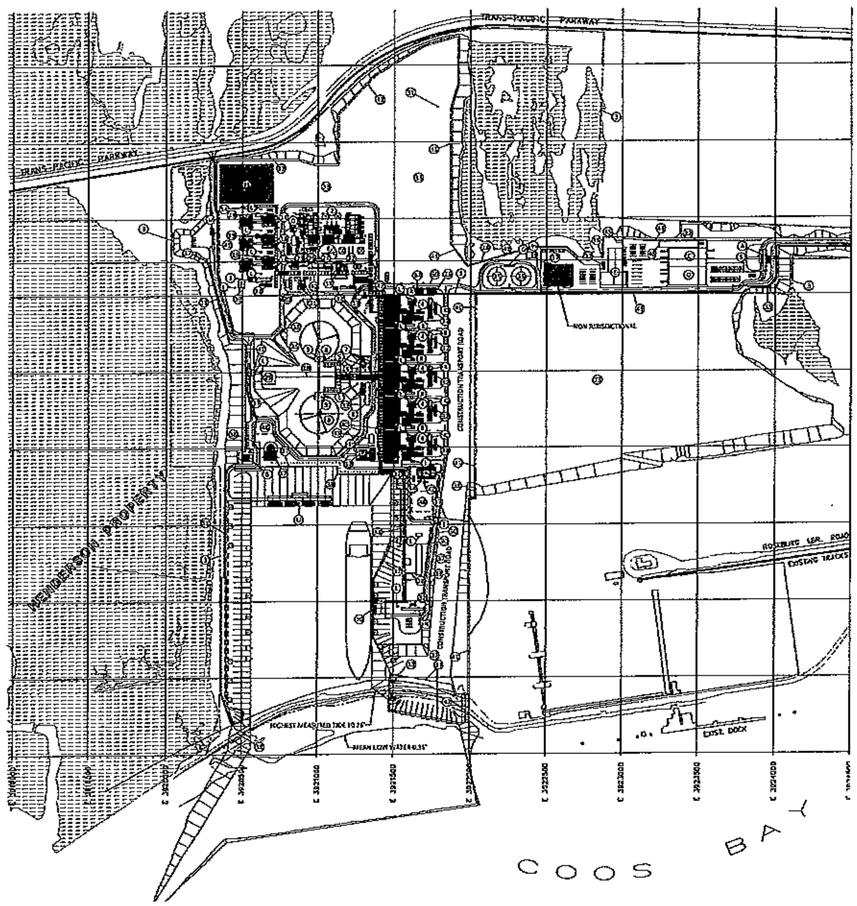
JORDAN COVE ENERGY PROJECT, LP Date
by its General Partner, Jordan Cove Energy Project, L.L.C.
and Pacific Connector Gas Pipeline, LP
by its General Partner, Pacific Connector Gas Pipeline, L.L.C.

SIGNATORIES:

7-20-2018

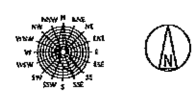
Mark Ingersoll Date
Tribal Council Chairman
Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians

Exhibit A
Project Area



ITEM	FACILITIES LEGEND
1	FEED GAS HEADER
2	GAS CONDITIONING TRAIN
3	PROPERTY BOUNDARY
4	LNG LIQUEFACTION TRAIN #1 THROUGH #5
5	LNG EXPANDER (WITH SHELTER)
6	LNG FLASH DRUM
7	LNG RUNDOWN PUMPS (WITH SHELTER)
8	LNG STORAGE TANK
9	LNG TANK PUMPS
10	LNG LOADING PLATFORM
11	REFRIGERANT MAKE-UP
12	LP/HP BOG COMPRESSORS (WITH SHELTER)
13	COLD FLARE KO DRUM
14	MULTI POINT GROUND FLARE KO DRUM
15	NOT USED
16	MULTI POINT GROUND FLARE
17	ENCLOSED GROUND FLARE - MARINE
18	BOP AUXILIARY POWER STG
19	BOP AUXILIARY POWER STG CONTROL ENCLOSURE
20	AUXILIARY BOILER
21	DEAERATOR / BFW PUMPS
22	NOT USED
23	PLANT / INSTRUMENT AIR PACKAGES
24	NITROGEN GENERATION PACKAGE
25	LIQUID N2 STORAGE / VAPORIZATION
26	AMMONIA STORAGE TANKS AND PUMPS
27	AMINE STORAGE
28	LNG DRAINAGE CHANNEL
29	PROCESS AREA LNG IMPOUND BASIN
30	MARINE AREA LNG IMPOUND BASIN
31	FREE FIELD SEISMOMETER SHELTER
32	TRANSFORMERS
33	CONSTRUCTION LAYDOWN AREA
34	DIESEL STORAGE
35	FIREWATER STORAGE TANKS
36	LNG TANK ACCESS ROAD
37	PLANT SECURITY FENCE
38	RETAINING WALL
39	BACKUP GENERATOR
40	PIPERACK
41	IMPERMEABLE VAPOR BARRIER
42	RO PRODUCT TANK
43	CONST. MARINE OFF-LOADING FACILITIES AREA (CONST. MOF)
44	DEMIN WATER STORAGE TANK
45	WASTEWATER TREATMENT PACKAGE PLANT
46	LAYDOWN AREA
47	DUMP CONDENSER
48	BURIED STORM WATER INFILTRATION CHAMBER
49	BOG VFD ENCLOSURE
50	PERMEABLE VAPOR BARRIER
51	TSUNAMI WALL (ELEVATION VARIES TO SUIT THE DESIGN TSUNAMI)
52	METEOROLOGICAL MAST LOCATED WEST OF THE SITE NEAR INDUSTRIAL WASTEWATER LAGOON

ITEM	FACILITIES LEGEND
A	MAIN GUARD HOUSE / SECURITY BUILDING
B	TUG FACILITY BUILDING
C	PLANT WAREHOUSE
D	MAINTENANCE BUILDING
E	OPERATIONS BUILDING (INCLUDES CONTROL ROOM)
F	WATER TREATMENT BUILDING
G	FACILITY FIREWATER PUMPS WITH BUILDING
H	LUBE OIL, PAINT AND COMPRESSED GAS STORAGE
J	FACILITY [illegible] POWERHOUSE ENCLOSURE
K	POWERHOUSE ENCLOSURE
L	FIREWATER VALVE HOUSE
M	SECONDARY ENTRANCE SECURITY GATE/TERMINAL GUARD BUILDING
N	MARINE POWERHOUSE ENCLOSURE
P	FIRE DEPARTMENT
Q	GC TRAIN 1 POWERHOUSE ENCLOSURE
R	CEMS BUILDING (HRSG PKG)
S	INSPECTION STATION SHELTER
T	MARINE AREA GUARD HOUSE
U	TUG BOAT BERTH

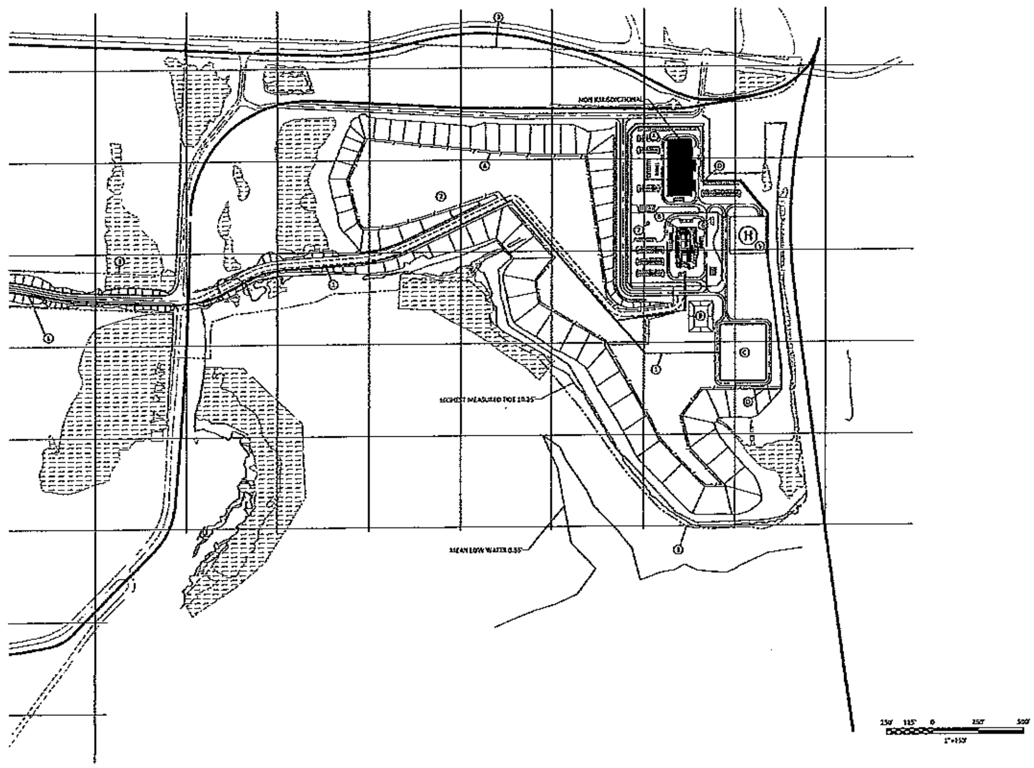


WIND ROSE - ANNUAL
NORTH BEND MUNICIPAL AIRPORT
(PERCENT OF TIME)

NOTES:
1. ELEVATIONS NOTED ARE NAVD88.

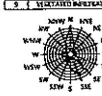
LEGEND:

SECURITY FENCE
DEMARCATION FENCE
PROPERTY BOUNDARY
ASPHALT PAVED ROADS AND PARKING
GRAVEL ROADS AND PARKING
IMPERMEABLE VAPOR BARRIER WITH SECURITY
PERMEABLE VAPOR BARRIER



ITEM	FACILITIES LEGEND
A	SOASC BUILDING
B	ADMINISTRATION BUILDING
C	GAS METERING STATION
D	RETAINING WALL

ITEM	FACILITIES LEGEND
1	ACCESS AND UTILITY CORRIDOR (SEE NOTE 3)
2	TEMPORARY CONSTRUCTION FACILITIES
3	PROPERTY BOUNDARY
4	PG&E SWITCHYARD EASEMENT
5	HELIPAD
6	WASTEWATER TREATMENT PACKAGE PLANT
7	COMMUNICATIONS TOWER
8	PLANT SECURITY FENCE
9	VEGETATED INFILTRATION BASIN



WIND ROSE - ANNUAL
NORTH BEND MUNICIPAL AIRPORT
(PERCENT OF TIME)

NOTES:

1. ELEVATIONS NOTED ARE NAVD88.
2. FOR OVERALL PLOT PLAN, SEE DRAWING [illegible].
3. THE ACCESS AND UTILITY CORRIDOR CONTAINS THE FOLLOWING BURIED LINES. CORRIDOR WILL BE ROUTED ON [illegible] LAND.
   - FEED GAS LINE
   - FIRE WATER SUPPLY TO ADMIN AND SOASC BUILDINGS
   - POWER TO ADMIN BUILDING
   - IT AND SECURITY TO ADMIN AND SOASC BUILDINGS
   - CONTROL CABLING FROM METERING STATION

LEGEND:

	SECURITY FENCE
	DEMARCATION FENCE
	ASPHALT PAVED ROADS AND PARKING
	GRAVEL ROADS AND PARKING

0 3.75 7.5 15
Miles

N

Coos County
Route

REV 1

REVISED DATE:
Date: 8/7/2018

EXHIBIT

Pacific Connector GAS PIPELINE

PACIFIC CONNECTOR GAS PIPELINE, LP

MAP BOOK

COOS COUNTY, OREGON

Exhibit "B"
Unanticipated Discovery Plan

Jordan Cove LNG, LLC

DRAFT

Unanticipated Discovery Plan

Jordan Cove Energy Project

and

Pacific Connector Gas Pipeline Project

July 2018

Unanticipated Discovery Plan

1.0 Introduction

This document provides an Unanticipated Discovery Plan (UDP) that will be followed by Jordan Cove Energy Project, LP (JCEP) and Pacific Connector Gas Project, LP (PCGP) (JCEP and PCGP are collectively referred to as "Jordan Cove"). JCEP is seeking authorization from the Federal Energy Regulatory Commission (FERC) to site, construct and operate a natural gas liquefaction and liquefied natural gas (LNG) export facility on the North Spit of Coos Bay, Oregon (LNG Terminal). PCGP will simultaneously be seeking an authorization from FERC to construct and operate an approximately 229-mile long, 36-inch diameter natural gas transmission pipeline from near Malin, Oregon to the LNG Terminal (the LNG Terminal and Pipeline are collectively referred to as the "Project"). This UDP provides the procedures Jordan Cove, its personnel and consultants will follow in the event that unanticipated discoveries of historic properties, archaeological objects, archaeological sites, or human remains, funerary objects, sacred items and items of cultural patrimony are made during the construction and operation of the Project.

Potential unanticipated discoveries fall into two primary classes. The first class includes archaeological objects, materials or features such as hearths, pit features, or remains of dwellings. The second class consists of human remains, funerary objects, sacred items and items of cultural patrimony. The two classes are governed by different laws and regulations and require different treatment procedures.

Procedures for dealing with unanticipated discovery of human remains are outlined in Section 3.0, and procedures for dealing with the unanticipated discovery of archaeological objects are outlined in Section 4.0.

This UDP is intended to:

- Comply with applicable Federal and State and local laws and regulations – the National Historic Preservation Act of 1966, 16 U.S.C. § 470 and its implementing regulations at 36 CFR Part 800, 36 CFR Part 63; 36 CFR Part 61; the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA), 25 U.S.C. §§ 3001 *et. seq.* and its implementing regulations at 43 CFR Part 10; Archaeological Resources Protection Act of 1979, as amended and its implementing regulations at 36 CFR Part 296; Oregon Revised Statutes (ORS) 97.740-97.760 for Indian Graves and Protected Objects; ORS 358.905-358.961 for the Protection of Archaeological Objects and Sites; ORS 390.235 for Archaeological Permit Requirements; OAR 736-051-0080 through 0090 Administrative Rules for Oregon Archaeological Excavation Permits; the Government to Government Cultural Resource Cluster Group "Treatment of Native American Human Remains Discovered Inadvertently or Through Criminal Investigations on Private and Non-Federal Public Lands in Oregon"; and Federal Energy Regulatory Commission's Guidelines for Reporting on Cultural Resources Investigations for Pipeline Projects (July 2017);
- Describe to regulatory and review agencies the procedure Jordan Cove and its contractors will follow to address the unanticipated discovery of archaeological

objects, historic properties or human remains, funerary objects, sacred items and items of cultural patrimony; and

- Provide direction and guidance to Project personnel as to the proper procedure to be followed should an unanticipated discovery occur.
- Provide contact information for all parties that require notification – State police, LCIS, SHPO and affected Tribes.

2.0 Training and Orientation

Jordan Cove, in consultation with the FERC, will designate a Cultural Resources Coordinator (CRC) who will be responsible for all archaeological materials and historic properties-related activities on the Project. The CRC will be a professional archaeologist (meeting the Secretary of the Interior's Guidelines as defined in 36 CFR 61). For practical purposes, the CRC may designate an Environmental Inspector (EI) or other supervisor to provide notifications required under this UDP but may not delegate any of the CRC's other responsibilities, unless the EI is a professional archaeologist and meets the requirements of 36 C.F.R. Part 61, in which case the EI may act in the CRC's place if the CRC is unavailable. The CRC will provide archaeological/cultural resource orientation for Jordan Cove and advise construction contractors and personnel on the procedures to follow in the event that an unanticipated discovery is made. Training will occur as part of the pre-construction on-site training program for foremen, environmental inspectors (EIs), construction supervisors, and all other supervisory personnel who supervise any construction or inspection activities. Training will involve both general and detailed instructions regarding how to follow the requirements of the UDP, basic archaeological artifact and site identification, and an overview of the state and federal laws pertaining to the protection of archaeological resources. General instructions shall include:

- Ensure that all construction supervisors have contact information for the CRC.
- Stop work immediately if archaeological objects (artifacts, historic or prehistoric features [wells, privies, shell middens, etc.], bones, or any item suspected of being archaeological), funerary objects, sacred items and items of cultural patrimony are identified.
- Contact the construction supervisor immediately. The construction supervisor shall notify the CRC or its designee as soon as possible.
- Restrict access to the discovery.
- Drawings, photographs, or analysis will not be permitted without consultation and approval from the appropriate Indian Tribes.
- The discovery will not be shared with the media or individuals not pertinent to the assessment or protection of the remains.
- Comply with all unanticipated discovery procedures.
- Treat human remains, funerary objects, sacred objects, and objects of cultural patrimony with dignity and respect. Do not touch any human remains.
- A description of the potential penalties for failure to report discoveries or to comply with the procedures outlined in this UDP.
- The penalties that could be incurred by anyone who illegally collects or destroys any archaeological objects, archaeological sites, or historical artifacts, funerary

objects, sacred objects and objects of cultural patrimony and associated materials and/or their context.

3.0 Procedures for the Inadvertent Discovery of Human Remains or Burial Sites

Any human remains, burial sites, or burial related objects that are discovered during construction will at all times be treated with dignity and respect.

Pursuant to ORS 97.745(4), if suspected Native American remains are encountered on private or non-federal public lands, Jordan Cove will notify the state police, SHPO, the Oregon Commission on Indian Services (OCIS), the FERC, and the appropriate Indian Tribe(s) as soon as possible but in all cases, within twenty-four hours of the determination.

In accordance with NAGPRA, if the remains are found on federal lands, in addition to contacting those entities listed in the previous paragraph, the CRC will immediately contact the applicable federal land management agency in accordance with the requirements of 43 C.F.R. § 10.4. The federal land management agency will then be responsible for further contact with any appropriate Indian Tribes.

Indian Tribes that may have ancestral burial sites in the Project area include, but are not limited to, the Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians, the Confederated Tribes of Grand Ronde, the Confederated Tribes of Siletz, the Coquille Indian Tribe, the Cow Creek Band of Umpqua Tribe of Indians, and the Klamath Tribes.

The CRC will, in all cases of a potential discovery, complete a form or provide other written documentation acceptable to FERC and SHPO to document a potential discovery. The CRC and all EIs will comply with the following procedures:

A. If any Jordan Cove personnel or contractors believe he or she has made an unanticipated discovery of human remains (skeletal, teeth or hair), the remains will not be moved or disturbed, and the construction supervisor shall be immediately notified. The construction supervisor shall, in turn, immediately notify the CRC and the appropriate EI.

B. The CRC or its designee will be responsible for taking appropriate steps to protect the discovery. The construction activity that resulted in the exposure of the discovery will be immediately halted, followed, as soon as possible, by the cessation of all other ground-disturbing activity within 300 ft (91 m) of the discovery, unless a greater distance is required by SHPO to protect a discovery. Construction activities may continue elsewhere on the Project site. After all construction activity within 300 ft (91 m) of the discovery has been halted, the following steps will be taken to ensure that no further disturbance occurs to the discovery:

i) secure an area at least 300 ft (91 m) around the discovery using orange safety fencing or a similar material, as necessary;
ii) prevent vehicle traffic through the area immediately surrounding the discovery except as necessary to remove vehicles and equipment already present in the area;
iii) consult with the SHPO to determine whether a 24-hour guard is needed to ensure that the find is secure at all times or consult with the applicable federal land management agency if the lands are federal;

iv) limit access to the area surrounding the discovery to essential personnel, who will be identified by the CRC; and

v) If the remains are suspected to be Native American, no photographs will be allowed unless approval is provided by the appropriate Indian Tribe(s). If the state police determine the discovery to be a crime scene, then any photographs will be taken at the direction of the state police.

C. The CRC or its designee will immediately call the state police, SHPO, the LCIS, the appropriate Indian Tribe(s) and FERC, who will, according to their responsibilities, examine the discovery and determine whether it should be treated as a crime scene or as a human burial/cemetery. The CRC or its qualified designee will also have a physical anthropologist examine the discovery to concur with the coroner on whether the remains are human and whether or not they are contemporary. The physical anthropologist will have been previously agreed upon by the Indian Tribe(s). In the event of a disagreement between the coroner and the physical anthropologist, the opinion of the physical anthropologist shall control. A forensic anthropologist may also be required to determine whether the remains are of Native American ancestry. If the remains are determined to be or suspected to be of Native American ancestry, no photographs will be taken. If the discovery occurs on federal lands, the CRC will also immediately notify the applicable federal land management agency, and the Federal Land Archaeologist, if qualified to do so, will make, in consultation with the appropriate Indian Tribe(s), the determination as to whether the remains are human and of possible Native American ancestry. If the Federal Land Archaeologist is not qualified to determine whether the remains are human, the Federal Land Archaeologist will engage a forensic anthropologist or osteo-archaeologist, who shall consult with the appropriate Indian Tribes to determine whether the remains are of Native American ancestry. All work within 300 ft buffer around the discovery will halt until permission to resume work is provide by FERC, the SHPO or the applicable federal agency for finds on federal lands.

D. If the remains are determined to be non-human by the archaeologist and/or forensic anthropologist, and there are no archaeological objects identified in association with the remains, then the archaeologist or forensic anthropologist will inform the CRC, who will notify the Construction Superintendent that construction can resume. The CRC will complete the Discovery Form and take photographs of any find. The photographs shall be sufficient for a trained archaeologist to determine that the remains are not human by reviewing them. The Discovery Form and photographs shall be submitted to FERC, the SHPO and the appropriate Indian Tribe(s) within 15 days of the discovery.

E. If the remains are determined to be non-human by the archaeologist and/or forensic anthropologist, but associated with an archaeological site, the CRC shall follow the procedures identified in Section 4 below.

F. If the remains are determined to be human and associated with a crime scene by the appropriate county coroner, then the CRC shall immediately inform the Construction Superintendent to follow the coroner's protocol for removal of the remains. The CRC will complete the Discovery Form and take photographs of the find to the extent allowed by State law. The Discovery Form and photographs shall be submitted to FERC and the SHPO within 15 days of the discovery.

G. If the remains are determined to be human, not to be the result of criminal activity and not within an archaeological context, and not of Native American Ancestry, the CRC or its designee will notify the SHPO as soon as possible but in all cases within

24 hours. The SHPO will be kept informed of all discussions regarding the remains until their final status is resolved.

The CRC or its designee will contact the OCIS as well as all appropriate Indian Tribes and notify them of the discovery by phone or e-mail as soon as possible but in all cases within twenty-four hours of the discovery. The appropriate Indian Tribe(s) also will be notified in writing within three days of the discovery, and this notification shall include information on the site of the human remains along with the name of the person or agency in charge of the find.

H. If the remains are determined to be human, within an archaeological context, and of Native American ancestry, the CRC shall follow the steps in Section 4 subparagraphs (5) - (13) for the unanticipated discovery of an archaeological site and the following:

- Notifications to the appropriate agencies and Indian Tribes shall indicate that human remains have been identified.
- No photographs shall be taken of Native American human remains.
- No further assessment shall be conducted until a Tribal representative(s) is present.
- The public and non-essential personnel will be excluded from the site.
- The discovery will not be shared with the media or any individuals who are not required for the assessment and protection of the remains.
- The CRC shall request that the appropriate Indian Tribe(s) inform them of any requests they have regarding the treatment of the remains and such requests shall be honored to the greatest extent possible.
- Field investigations to determine the NRHP-eligibility of archaeological materials shall avoid contact with the human remains.
- The CRC will consult with the SHPO and appropriate Tribe(s) to develop field investigations designed to evaluate the potential for additional human remains to be present without disturbing them.
- The CRC will consult with the Construction Superintendent, the SHPO, and appropriate Tribe(s) to determine if the remains can be avoided by an alternative construction technique. If such a technique is possible, construction shall resume upon approval from SHPO and will be monitored by a professional archaeologist and the appropriate Indian Tribe(s) if they request to do so.
- If disturbance of the remains cannot be avoided and the remains are not part of a crime scene or are part of an historic cemetery, the CRC will consult with the SHPO and appropriate Indian Tribe(s), if applicable, or likely descendants to develop a treatment plan. The treatment plan will outline measure to be implemented, including addressing how the remains should be excavated, repatriated, reinterred and reported. The treatment plan will clearly state that Jordan Cove shall be responsible for all costs associated with implementation of an approved treatment plan. Human remains will not be permanently curated.
- If disturbance of the remains cannot be avoided and the remains are part of an archaeological site that will also be affected by construction, the CRC will consult with the SHPO and appropriate Tribe(s) to develop a treatment plan for the site that includes provisions for temporary curation, reporting, repatriation

and re-internment of the human remains and disposition of any artifacts. The treatment plan will be implemented after approval from the SHPO.

I. The FERC will consult with the appropriate Indian Tribes to determine best practices for handling human remains of Native American ancestry. No work is to take place 300 feet of the area of the delineated discovery until a treatment plan has been approved and implemented.

J. Jordan Cove will offer to compensate the appropriate Indian Tribe(s) for their time and expenses related to any activities associated with the implementation of this UDP. In the event Jordan Cove has entered into a cost recovery agreement with a Tribe addressing such costs, Jordan Cove will abide by the terms of such agreement.

K. Jordan Cove will be responsible for any reburial costs associated with any human remains encountered during construction of the Project that are not associated with a criminal site.

L. If multiple sets of remains are found, which are determined to be of Native American ancestry, Jordan Cove will consult with the appropriate Tribe(s) to determine the appropriate action, including rerouting around any such sites.

4.0 Procedures for the Inadvertent Discovery of Archaeological Objects or Sites

In Oregon, it is illegal to disturb an archaeological site or object on private or non-federal public land without obtaining an archaeological excavation permit (ORS 358.920[1] [a]). When archaeological objects or archaeological sites are identified inadvertently, this law applies once the discovery is determined to be archaeological. Similarly, federal laws prohibit the disturbance of archaeological resources on federal lands in the absence of a valid permit (43 C.F.R. §§ 7.5 and 7.6). The CRC and the EIs will be aware of and follow the procedures set out below:

A. If any Jordan Cove personnel or contractors believe he or she has found archaeological object or an archaeological site, all work within 100 ft (30 m) of the discovery will stop and the Construction Superintendent will be notified immediately. The Construction Superintendent shall notify the EI and the CRC or its designee as soon as possible but no later than within 24 hours of the discovery. The area of work stoppage will be adequate to provide for the security, protection, and integrity of the objects found and therefore may need to be greater than 100 ft depending on the nature of the find. Examples of archaeological objects include but are not limited to:

i) An area of charcoal or charcoal-stained soil;

ii) An arrowhead, stone tool, or stone flakes (chips);

iii) A cluster of animal bones or burned rocks in association with stone tools or flakes (chips);

iv) A cluster of tin cans, bottles, or other historic materials older than 50 years that have not previously been identified as objects that can be removed; or

v) A dense pocket of shells.

B. The CRC or the EI onsite will make an initial determination regarding whether the discovery consists of an archaeological site and/or an archaeological object.

Appropriate Indian Tribes shall be notified of such determination. The CRC or EI shall prepare a report regarding the determination. The report shall be provided to Appropriate Indian Tribes for review and comment. If the CRC or EI initially determines it is not an archaeological site or object and an Indian Tribe disagrees, the SHPO shall make the final determination.

C. If it is determined that the discovery consists of archaeological objects or a site, the Construction Superintendent, CRC, and/or EI will take appropriate steps to protect the discovery site. At a minimum, the construction activity that resulted in the exposure of the discovery will be immediately halted, followed as soon as possible by the cessation of all other ground-disturbing activity within 100 ft (30 m) of the discovery. Vehicles, equipment, and unauthorized personnel will not be permitted to traverse the buffer zone around the site, provided, however, a travel corridor will be allowed along the edge of the buffer zone furthest removed from the discovery, provided that:

a) vehicles will not be allowed to pass closer than 45 ft from the discovery;

b) the edge of the travel corridor nearest the discovery will be secured using orange safety fencing or similar material; and

c) the CRC will consult with the SHPO to determine whether a 24-hour guard is needed to ensure that the find is secure at all times or if the discovery occurs on federal lands, the CRC will consult with the applicable federal land management agency regarding implementation of any security measures.

D. Work in the immediate area will not be re-started until treatment of the discovery has been completed and authorization to proceed has been provided by FERC and/or the SHPO as applicable, and after any required permits have been issued.

E. The buffer zone of 100 ft (30 m) will be established using orange safety fencing or a similar material.

F. The CRC or its qualified designee will arrange for the discovery to be evaluated by a professional archaeologist as soon as possible. The archaeologist must meet the Secretary of the Interior standards as described in 36 CFR Part 61. The appropriate Indian Tribe(s) shall be notified, afforded and opportunity to monitor the examination and provide comments on any written reports provided to Jordan Cove by the archaeologist. The professional archaeologist shall examine the find within 48 hours of notification. The archaeologist will recommend whether the discovery is potentially eligible for listing in the National Register of Historic Places (NRHP) pursuant to 36 CFR §800.4 and 36 CFR Part 63. The CRC will consider the archaeologist's conclusion, make its own recommendation, and then submit documentation, including any documentation or comments provided by an Indian Tribe(s), about the find, the archaeologist's recommendation and its recommendation to FERC, the SHPO and any appropriate Indian Tribe(s) for concurrence within 72 hours of receipt of the professional archaeologist's recommendation. The documentation will be in memorandum form with appropriate photographs included to facilitate FERC and SHPO's review of the conclusions reached.

G. If FERC, in consultation with the SHPO, Jordan Cove, and the appropriate Indian Tribe(s) determines that the discovery is eligible for listing under the NRHP ("NRHP-eligible") as a pre-contact deposit, FERC, Jordan Cove, the SHPO, and the appropriate Indian Tribe(s) will consult to determine if the Project will adversely affect the resource pursuant to 36 CFR 800.5.

H. If FERC, in consultation with the SHPO, Jordan Cove, and the appropriate Indian Tribe(s) determines that the discovery is not NRHP-eligible, then Jordan Cove will prepare a memorandum to this effect and deliver it to the SHPO and the FERC for concurrence. A copy will also be provided to the appropriate Indian Tribe(s). To the extent any Indian Tribe disagrees with the conclusions in such memorandum, the Indian Tribe reserves its rights pursuant to paragraph L below.

I. If FERC, in consultation with the SHPO, Jordan Cove, and the appropriate Indian Tribe(s) determines that the resource is NRHP-eligible and that the Project will have an adverse effect on it, Jordan Cove will first propose whether or not avoidance or minimization of adverse effects is possible via alternative construction techniques.

J. If it is determined that avoidance or minimization of adverse effects via alternative construction techniques to an NRHP-eligible site is not possible, then Jordan Cove will develop a treatment plan in consultation with the appropriate Indian Tribe(s), designed to mitigate the adverse effect pursuant to 36 CFR 800.6. Jordan Cove will consult with the FERC, SHPO, and the appropriate Indian Tribe(s) and follow state and federal regulations for applicable treatment measure(s). Jordan Cove will provide FERC, the SHPO and the appropriate Indian Tribe(s) with a draft treatment plan for review and comment. The SHPO will provide approval of the treatment plan, which will be implemented in accordance with any schedule set out in the plan. Treatment measures may include mapping, photography, subsurface testing and sample collection, complete data recovery, or other activities. Jordan Cove will provide a report on the methods, analysis, and results in compliance with 36 CFR 800.11 and in accordance with the treatment plan. The specific work plan and schedule for these procedures will be included in the treatment plan.

K. If FERC, in consultation with the SHPO, Jordan Cove, and the appropriate Indian Tribe(s) determines that the resource is NRHP-eligible but that the Project will not adversely affect it, then Jordan Cove will prepare a memorandum to this effect and deliver it to the SHPO and the FERC for concurrence and provide a copy to the appropriate Indian Tribe(s).

L. Jordan Cove will ensure that field investigations, research, analysis, reporting, and curation of any materials collected during these investigations are sufficiently funded and implemented and follow all federal and state guidelines and procedures. All treatment efforts shall be conducted under an Oregon permit for archaeological excavation (OAR 736-051-0080 through 0090).

M. If any Indian Tribe does not agree with the findings of the SHPO and Jordan Cove's archaeologist, such Tribe reserves the right to address its concerns with the Advisory Council on Historic Preservation pursuant to 36 C.F.R. Part 800, and otherwise reserves all rights under state and federal law to obtain relief.

N. Upon completion of the treatment plan, Jordan Cove will submit a summary report to the SHPO and appropriate Indian Tribe(s) within thirty (30) days of completion of the treatment plan. If archaeological data recovery is a component of the treatment plan, a full report will be submitted to the SHPO, appropriate Indian Tribes, and the OCIS in accordance with any schedule set out in the treatment plan.

5.0 Parties to Contact

Notice required under this UDP shall be made to those parties set out in the table below. Any party may update its contact information at any time. An effort will be made to update this information on an annual basis during the life of the Project.

Contacts for the Discovery of Archaeological Resources				
Organization	**Name**	**Role**	**Contact Information**	**Mailing Address**
Jordan Cove	To Be Determined	Cultural Resource Coordinator (CRC)	Office: Mobile: Email:	
Historical Research Associates	Bradley Bowden	Archaeological/Historical Consultant	Office: (503) 247-1319 Direct: (971) 386-2042 Mobile: (206) 898-5781 Email: bbowden@hrassoc.com	1825 SE 7th Ave, Portland, OR 97214
Oregon State Historic Preservation Office (SHPO)	Dr. Dennis Griffin	State Archaeologist	Office:(503) 986-0674 Fax: (503) 986-0793 Email: dennis.griffin@state.or.us	Heritage Conservation Division Oregon Parks and Recreation Dept., 725 Summer Street NE, Suite C, Salem, OR 97301-1266
Oregon State Historic Preservation Office (SHPO)	John Pouley	Assistant State Archaeologist	Office: (503) 986-0675 Fax: (503) 986-0793 Email: john.pouley@state.or.us	Heritage Conservation Division Oregon Parks and Recreation Dept., 725 Summer Street NE, Suite C, Salem, OR 97301-1266
Federal Energy Regulatory Commission (FERC)	Paul Friedman	FERC Cultural Resources Contact	Office: (202) 502-6353 Fax: (202) 208-0353 Email: paul.friedman@ferc.gov	888 First Street NE, Washington, D.C. 20426
Federal Energy Regulatory Commission (FERC)		Alternate FERC Contact	Office: Fax: (202) 208-0353 Email:	888 First Street NE, Washington, D.C. 20426
Federal Land Owners				
BLM Coos Bay District	William Kerwin	Archaeologist	Office: (541) 756-0100 Phone: (541)751-4306-3246 Email: wkerwin@blm.gov	1300 Airport Lane North Bend, OR 97459

Contacts for the Discovery of Archaeological Resources				
Organization	**Name**	**Role**	**Contact Information**	**Mailing Address**
BLM—Medford District	Cheryl Foster-Curley	Archaeologist	Office: (541) 618-2200 Phone: (541) 618-2280 Email: cfostercurley@blm.gov	3040 Biddle Road Medford, OR 97504
BLM—Roseburg District	Molly Casperson	Archaeologist	Office: (541) 440-4930 Phone: (541) 440-3284 Email: mcasperson@blm.gov	777 NW Garden Valley Blvd. Roseburg, OR 97471
BLM—Lakeview District: Klamath Falls Resources Area	Laird Naylor II	Archaeologist	Office: (541) 883-6916 Phone: (541) 885-4139 Email: lnaylor@blm.gov	2795 Anderson Avenue, Bldg. #25 Klamath Falls, OR 97603
Umpqua National Forest	Christopher Kelly	Heritage Program Manager/Tribal Liaison	Office: (541) 957-3200 Phone: (541) 957-3350 Email:	2900 NW Stewart Parkway, Roseburg, OR 97471
Rogue River – Siskiyou National Forest	Melissa Schroeder	Heritage Program Manager/Tribal Liaison	Office: (541) 618-2200 Phone: (541) 618-2077 Email:	3040 Biddle Road, Medford, OR 97504
Fremont – Winema National Forest	John Kaiser	Klamath Ranger District Forest Archaeologist	Office: (541) 883-6714 Phone: (541) 947-6260 Email:	2819 Dahlia Street Suite A, Klamath Falls, OR 97601
Fremont – Winema National Forest	Amy Gowen	Tribal Government Relations	Office: (541) 883-6741 Email:	
Bureau of Reclamation Klamath Basin	Adam Nickels	Archaeologist	Office: (541) 883-6935 Fax: (916) 978-5005 Phone (916) 978-5053 Email:	6600 Washburn, Klamath Falls, OR 97603

Contacts for the Discovery of Human Remains				
Organization	**Name**	**Role**	**Contact Information**	**Mailing Address**
Oregon State Police	Sergeant Chris Allori		Office: (503) 731-4717 Mobile: (503) 708-6461 Dispatch: (503) 731-3030	
Coos Bay Area Command State Police	Lieutenant Jeff Lewis		Office: (541) 888-2677 Email: jeffrey.lewis@state.or.us	
Oregon Medical Examiner's Office	Karen Gunson	Oregon State Medical Examiner	Office: (971) 673-8200	

Contacts for the Discovery of Human Remains				
Organization	**Name**	**Role**	**Contact Information**	**Mailing Address**
Oregon Medical Examiner's Office	Eugene Gray	Forensic Administrator	Office: (971) 673-8200 Email: Eugene.Gray@state.or.us	
Oregon Medical Examiner's Office	James Olson, M.D.	Deputy State Medical Examiner-Southern Region	Office: (541) 440-4453	
Tribal Contacts				
Oregon Commission on Indian Services (OCIS)	Karen Quigley	Executive Director	Office: (503) 986-1067 Fax: (503) 986-1071 Email: Karen.Quigley@state.or.us	900 Court Street NE, Rm. 167, Salem OR 97301-1347
Coquille Indian Tribe	Kassandra Rippee	THPO & Archaeologist	Office: (541) 756-0904 ext. 1216 Mobile: (541) 808-5554 Fax: (541) 756-0847 Email: kassandrarippee@coquilletribe.org	3050 Tremont Street, North Bend, OR 97459
Confederated Tribes of Coos, Lower Umpqua & Siuslaw Indians	Stacy Scott	THPO, Cultural Resources Protection Specialist	Office: (541) 888-7513 Mobile: (541) 297-5543 Fax: (541) 888-2853 Email: sscott@ctclusi.org	1245 Fulton Avenue, Coos Bay, OR 97420
Confederated Tribes of Grand Ronde	Briece Edwards	Deputy THPO	Office: (503) 879-2084 Fax: (503) 879-2126 Email: THPO@grandronde.org	9615 Grand Ronde Road, Grand Ronde, OR 97347
Confederated Tribes of Siletz	Robert Kentta	Cultural Resource Program Director	Office: (541) 444-2532 Home: (541) 444-2204 Mobile: (541) 351-0148 Fax: (541) 444-2307 Email: Rkentta@ctsi.nsn.us	PO Box 549, Siletz, OR 97380
Cow Creek Band of Umpqua Tribe of Indians	Jessie Plueard	THPO and Cultural Programs Manager	Office: (541) 677-5575 X5577 Fax: (541) 677-5574 Email: jpluard@cowcreek.com	2371 NE Stephens St. Suite 100, Roseburg OR 97470
The Klamath Tribes	Perry Chocktoot	Director of Culture and Heritage	Office: (541) 783-2219 X159 or (541) 891-5450 Fax: (541) 783-2764 x107 Email: perry.chocktoot@klamathtribes.com	PO Box 436, Chiloquin, OR 97624

EXHIBIT C - COST RECOVERY AGREEMENT

CONFIDENTIAL

Exhibit D

PROJECT ACTIVITY NOTICE

Notice Provided to CTCLUSI

Name: ______________________ Email: ______________________

Position: ______________________ Date: ______________________

Description of Project Activity

Date(s) and Time(s) of Project Activity: ______________________

Type of Project Activity and Equipment: ______________________

____

____

Location of Project Activity: ______________________

____

Equipment needed –

a. Provided by Jordan Cove:

b. Provided by CTCLUSI:

Safety Requirements for Any Monitors:

Monitors shall always require the following equipment and clothing to be worn at all times on site:

- Closed toed shoes, long pants and long sleeves;
- a hard hat;
- a safety vest (brightly colored with reflectors); and
- protective eyewear.

Additional Requirements for this Project Activity and site:

____

____

Response Required from CTCLUSI by: ______________________

Exhibit E
Access Agreement

SITE ACCESS AGREEMENT BETWEEN JORDAN COVE ENERGY PROJECT, L.P. AND THE CONFEDERATED TRIBES OF COOS, LOWER UMPQUA AND SUISLAW INDIANS

This SITE ACCESS AGREEMENT ("Agreement") is entered into on ________ ("Effective Date") by and between Jordan Cove Energy Project, L.P. ("Grantor") and _____________ ("Grantee") (collectively referred to herein as the "Parties") for the purposes of granting a right to access certain lands owned and operated by Grantor.

WHEREAS, Grantor owns real property located in Coos County, Oregon, on which Grantor intends to construct and operate a liquefied natural gas terminal ("Grantor's Property").

WHEREAS, Grantee desires to access Grantor's Property to observe Project Activities to be performed by _________ ("_______") on behalf of Grantor on Grantor's Property;

WHEREAS, this Agreement governs the right of access to Grantor's Property by Grantee.

NOW THEREFORE, in consideration of the foregoing premises and the mutual covenants contained herein and subject to the terms and conditions set forth below, Grantor and Grantee agree as follows:

1. **Grantor's Right to Grant Access.** Grantor has the authority to grant access to Grantor's Property.

2. **Right of Access.** Subject to the terms of this Agreement, Grantor hereby grants access to Grantee for the sole purpose of observing the Surveys.

3. **Conditions of Use of Grantor's Property.**

i. At all times while on Grantor's Property, Grantee shall comply with the instructions and safety requirements of Grantor or its designee.

ii. Grantee agrees to use only established routes for vehicular travel on Grantor's Property, if such routes exist.

iii. Existing gates shall be used and shall remain closed and secured, unless otherwise authorized by Grantor.

iv. The use of alcohol, drugs or the carrying of firearms on Grantor's Property by Grantee is strictly prohibited at all times.

4. **Indemnity**. Grantee shall indemnify, defend and hold harmless, Grantor, its affiliates, successors, assigns, employees, officers, directors, shareholders, contractors and agents ("Grantor Indemnitees") from and against any and all claims, actions, losses, costs, and damages arising out of injury or death to persons, or damage to property caused by the negligence or misconduct of the Tribe and its officials, employees, agents, and subcontractors in the performance of obligations arising under this Agreement, provided: (i) JCEP promptly notifies the Tribe in writing of any such claim; (ii) the Tribe shall have the exclusive right to control the defense; and (iii) the amount does not exceed and is otherwise covered by the Tribe's liability insurance. Grantor shall indemnify, defend and hold harmless, Grantee, its affiliates, successors, assigns, employees, officers, directors, shareholders, contractors and agents ("Grantee Indemnitees") from and against any and all claims, actions, losses, costs, and damages arising out of injury or death to persons, or damage to property caused by the negligence or misconduct of the Grantor and its officials, employees, agents, and subcontractors in the performance of obligations arising under this Agreement, provided the Tribe promptly notifies JCEP in writing of any such claim and JCEP shall have the exclusive right to control the defense. This indemnity provision survives termination of this Agreement.

5. **Termination.** This Agreement shall terminate upon completion of the Monitoring activities for which access has been granted or sooner if terminated in writing by either Party.

6. **Scope**. This Agreement constitutes the entire agreement between Grantor and Grantee regarding site access.

7. **Amendment.** This Agreement may not be changed, amended or modified except by instrument in writing signed by the Parties.

8. **Breach of this Agreement.** Grantee acknowledges and agrees that failure to adhere to any of the provisions of this Agreement by Grantee shall render this Agreement subject to cancellation by Grantor without further notice by Grantor. Failure of Grantor to cancel this Agreement upon discovery or notice of breach of the Agreement does not render the Agreement void nor does it negate Grantor's right to cancel the Agreement in the event of subsequent breaches by Grantee Personnel.

9. **Execution.** This Agreement may be executed in counterparts, and each counterpart shall for all purposes be an original, and all such counterparts shall together constitute one and the same Agreement.

[*Signature page follows.*]

IN WITNESS THEREOF, the parties hereto have caused this Agreement to be duly executed by their duly authorized officers, in accordance with their duly respective laws.

GRANTOR

JORDAN COVE ENERGY PROJECT, LP
by its General Partner, Jordan Cove Energy Project, L.L.C.

________________________________ Date:________________

Signature

____

Name (Print)

____

Title

GRANTEE

[NAME]

________________________________ Date:________________

Signature

____

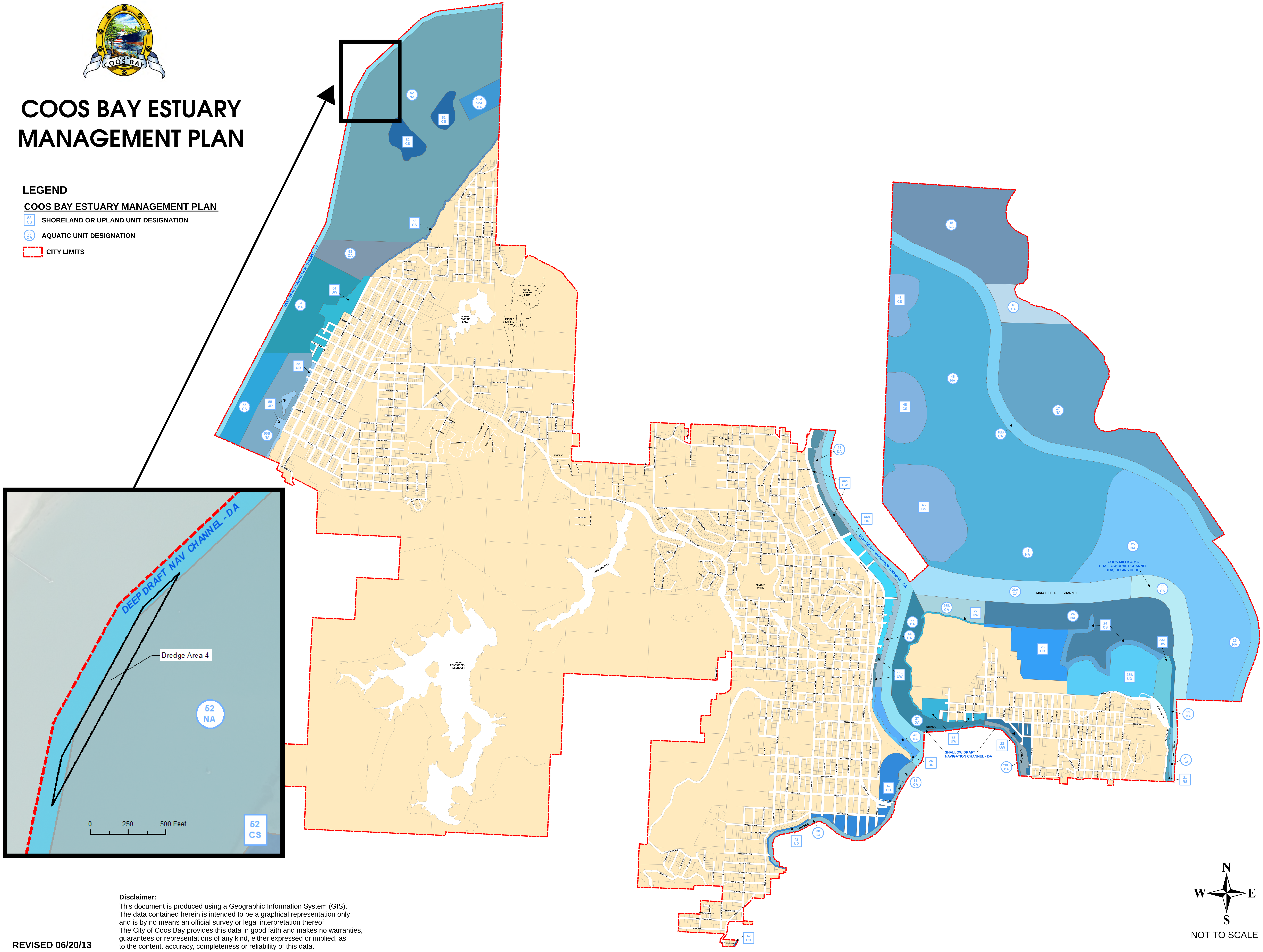
Title

COOS BAY ESTUARY MANAGEMENT PLAN

LEGEND

COOS BAY ESTUARY MANAGEMENT PLAN

- 53 CS — SHORELAND OR UPLAND UNIT DESIGNATION
- 53 CA — AQUATIC UNIT DESIGNATION
- CITY LIMITS



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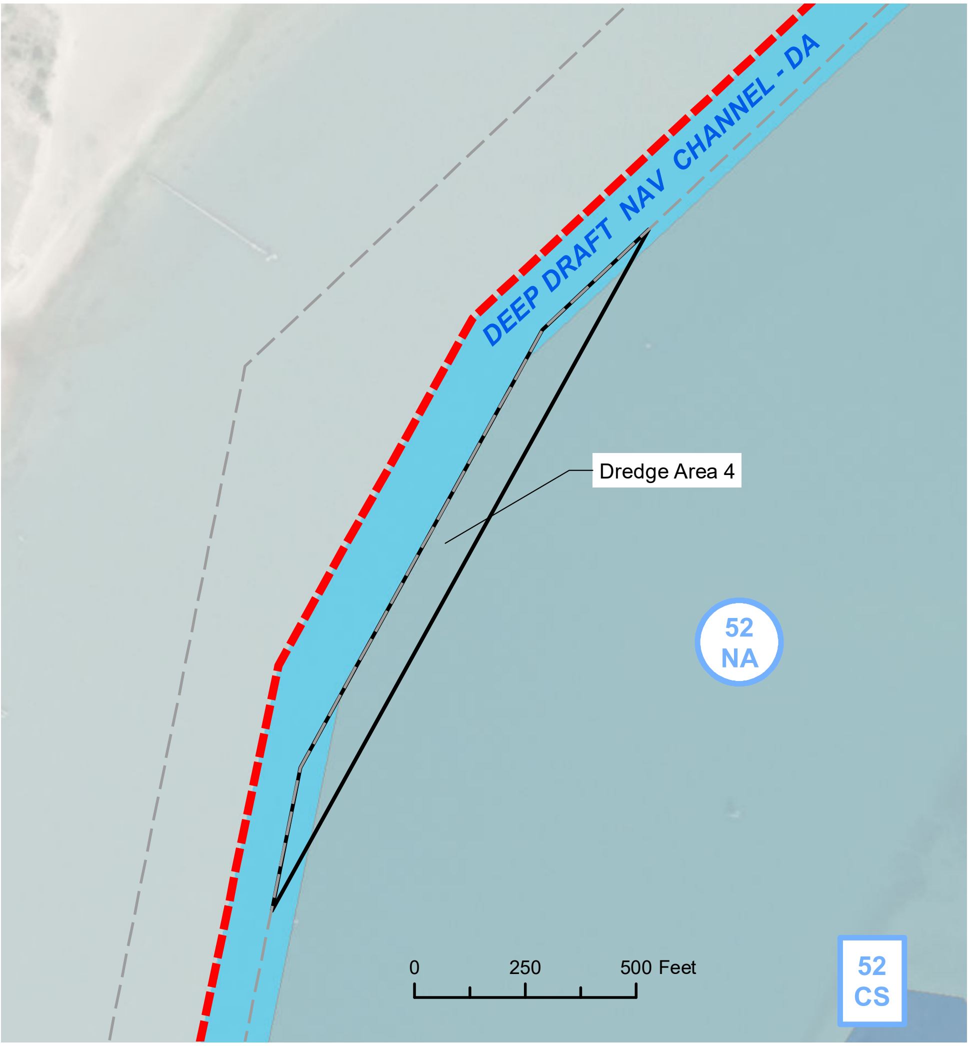
REVISED 06/20/13



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N

CBEMP Aquatic Management Units
Development Aquatic
Natural Aquatic (NA)
Conservation Shorelands (CS)
NRI Dredge Area 4
Federal Navigation Channel
City Limits

Data Source: City of Coos Bay, Feb 2019

Jordan Cove Energy Project

Land Use Permit Application

City of Coos Bay CBEMP Zoning
Navigational Reliability Improvement (NRI)
Dredge Area 4

Jordan Cove LNG℠ 2/13/2019

FIGURE NO. 1

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Legend

CBEMP Aquatic Management Units

- Development Aquatic
- Natural Aquatic
- Conservation Shorelands (CS)
- NRI Dredge Area
- Federal Navigation Channel
- City Limits

Data Source: City of Coos Bay, Feb 2019

Jordan Cove Energy Project

Land Use Permit Application

City of Coos Bay CBEMP Zoning
Navigational Reliability Improvement (NRI)
Dredge Area 4

Jordan Cove LNG℠

2/8/2019

FIGURE NO. 1

\\deainc.com\files\PROJECT\J\JLNG00000001\0600INFO\GS\Maps\Land Use\Perkins Coie - NRI 4 CBEMP\Fig 1 CBEMP Zoning NRIs.mxd

ATTACHMENT B

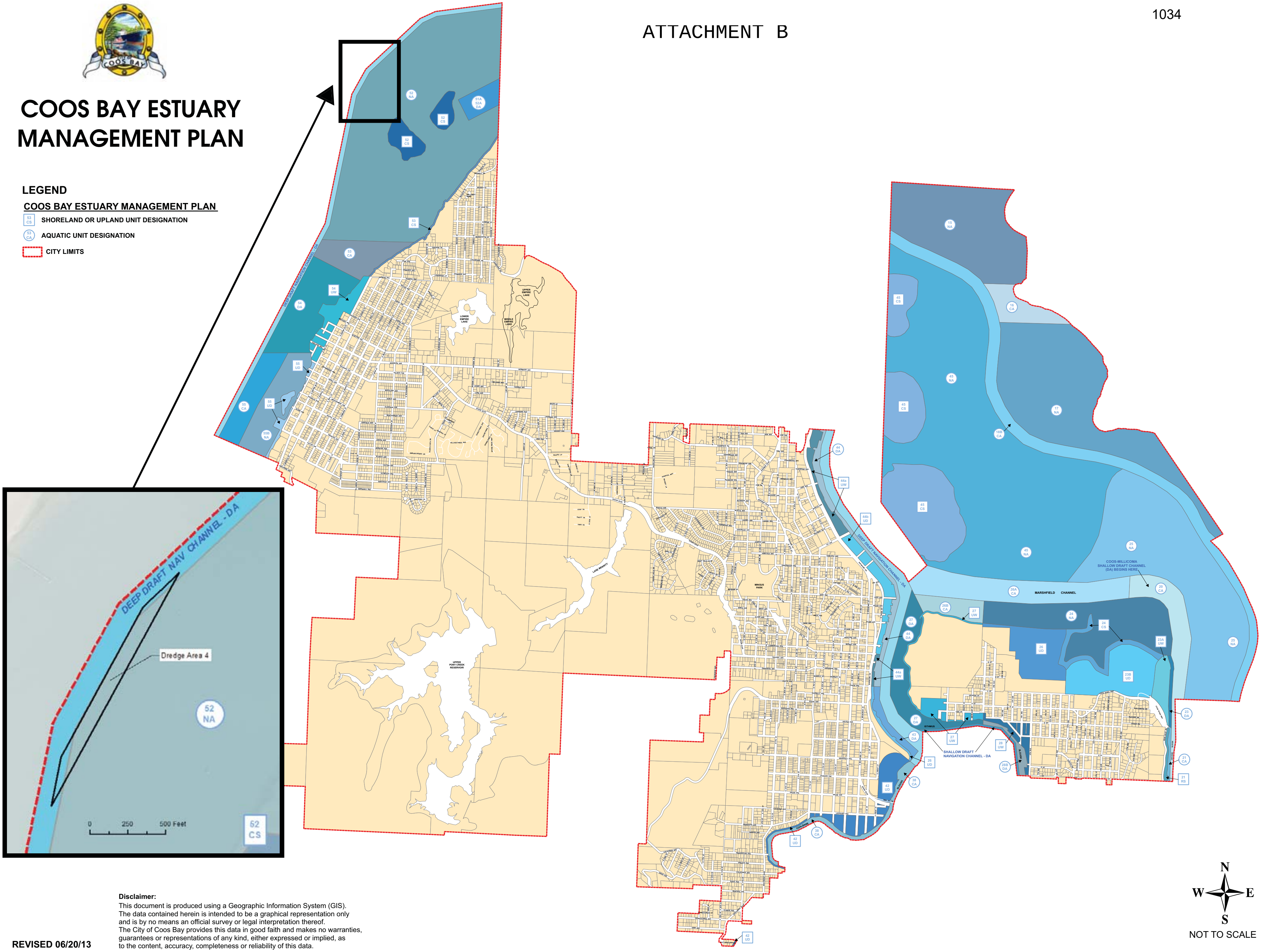
ATTACHMENT B

COOS BAY ESTUARY MANAGEMENT PLAN

LEGEND

COOS BAY ESTUARY MANAGEMENT PLAN

- SHORELAND OR UPLAND UNIT DESIGNATION
- AQUATIC UNIT DESIGNATION
- CITY LIMITS



NOT TO SCALE

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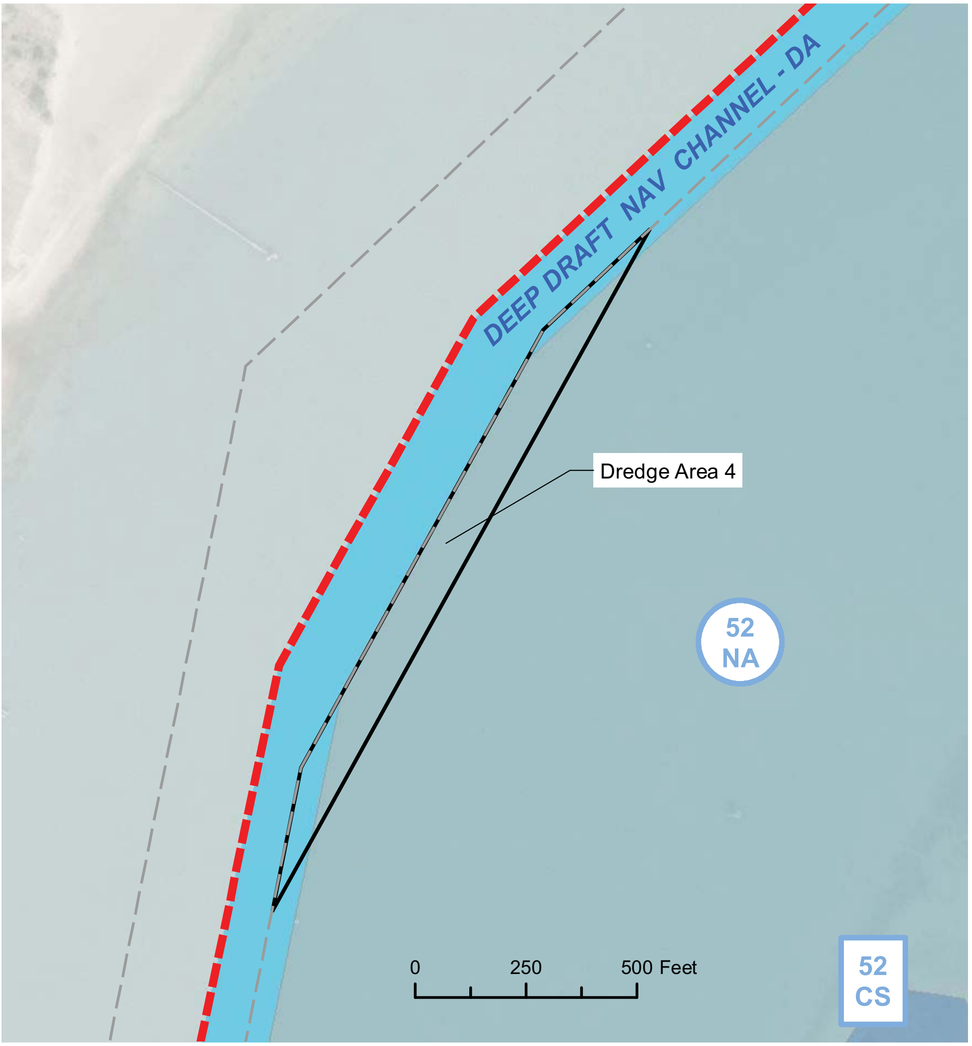
to the content, accuracy, completeness or reliability of this data.

REVISED 06/20/13



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CBEMP Aquatic Management Units
Development Aquatic
Natural Aquatic (NA)
Conservation Shorelands (CS)

NRI Dredge Area 4
Federal Navigation Channel
City Limits

Data Source: City of Coos Bay, Feb 2019

Jordan Cove Energy Project

Land Use Permit Application

City of Coos Bay CBEMP Zoning
Navigational Reliability Improvement (NRI)
Dredge Area 4

Jordan Cove LNG℠

2/13/2019

FIGURE NO. 1

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N

0 0.05 0.1 Miles

Legend

CBEMP Aquatic Management Units
- Development Aquatic
- Natural Aquatic
- Conservation Shorelands (CS)
- NRI Dredge Area
- Federal Navigation Channel
- City Limits

Data Source: City of Coos Bay, Feb 2019

Jordan Cove Energy Project

Land Use Permit Application

City of Coos Bay CBEMP Zoning
Navigational Reliability Improvement (NRI)
Dredge Area 4

Jordan Cove LNG℠ 2/8/2019

FIGURE NO. 1

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