REPORT

Value Assessment Study at Facilities Plan Amendment Phase

Coos Bay Wastewater Treatment Plant No. 2
City of Coos Bay, Oregon

WBG110211012743BOI

Prepared for

CITY OF COOS BAY

Prepared by

CH2MHILL®

March 2012

Report

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SECTION 1

VA Summary

CH2M HILL conducted a Value Assessment (VA) study of the Coos Bay Wastewater Treatment Plant No. 2 (WWTP No. 2) Upgrade Project, from Monday, October 24, through Wednesday, October 26, 2011. Civil West Engineering of Coos Bay provided project information to the VA team from their work on the Facilities Plan Amendment (FPA). VA team representatives included the City of Coos Bay, Oregon DEQ, Charleston Sanitation District, the Dyer Partnership, and CH2M HILL.

Refer to Appendix A for the VA study agenda, and CH2M HILL's VA Overview and Out-Brief presentations. Refer to Appendix B for Civil West's overview of the current WWTP No. 2 condition and FPA considerations for improvements needed to meet regulatory requirements.

This VA study was conducted during the conceptual planning phase, (the FPA phase for the Coos Bay WWTP No. 2 project). This is the appropriate time to consider alternative process treatment alternatives that will most effectively meet the plant upgrade requirements to address permit and Mutual Agreement and Order (MAO) stipulations by the Oregon DEQ.

This concept-level or planning-level VA study was conducted over a 2.5-day period, with the intent of addressing and rating high level alternatives that have the potential for addressing existing treatment concerns at Coos Bay WWTP No. 2.

The most highly ranked proposals generated during the VA study (VA Options 1 and 2) have the potential, in the VA team's opinion, to improve plant operations and reduce cost as compared to the base FPA alternatives. The City should be aware however, that CH2M HILL has not done a thorough cost estimate evaluation of alternatives as part of this VA study. CH2M HILL has identified several cost concerns with the base FPA proposals, as identified in the VA Overview section of this report. Any of the VA options or FPA alternatives selected for further design should undergo a thorough cost estimating or cost review effort to make reasonable assurance that the project will be able to be delivered within the City's anticipated budget for construction for the WWTP No. 2 upgrades.

The VA team generated numerous ideas for change during the Creative Ideas phase of the VA job plan. The evaluation of these ideas during the Analysis and Development phases was based upon their potential for meeting the following criteria:

- Regulatory Requirements
- Cost (relative cost comparison between alternatives)
- Implementability
- Schedule
- Operations
- Treatment Effectiveness
- Project Delivery

The VA team worked together to evaluate each of the ideas generated during the Creative Ideas phase, ranking each proposal, and categorizing them for further consideration.

During this evaluation process, a variety of implementable cost-savings and design enhancement opportunities were found. The recommendations of this study are presented as alternatives for further evaluation in the forthcoming preliminary design phase, or reminders to the design team of certain functional or risk issues to keep in mind as the design progresses. The VA Team recommends that all high priority proposals be reviewed by the City of Coos Bay and Civil West for consideration as alternatives for evaluation during the FPA phase of the project. All of the alternatives evaluated are described in the *VA Wastewater Process Treatment Proposals* section of this Value Assessment Report.

The top three VA options were then rated in comparison to the base alternatives in the Facilities Plan Amendment. Refer to *Rating of Process Alternatives*, contained in Appendix C. The results of the ratings are shown in **Table 1**

TABLE 1-1
Summary of Rating of Process Alternatives for Top 3 Options and draft Facility Plan Amendment Alternatives
City of Coos Bay Value Assessment Study: Coos Bay WWTP No. 2

Alternative	Score (% of Possible Points)	VA Recommendation
VA Option 1: Secondary Clarifier to Primary Clarifier + Membrane Bioreactor (all at Existing Plant); Headworks at new site. CEPT at high flow only.	82.7%	Consider as a viable alternative in the FPA. Provides the most effective treatment alternative given normal flows (majority of the time), as well as high flows. Precedent for this is established at other plants but this approach needs to be reviewed with EPA and Oregon DEQ for confirmation. This does represent a regulatory risk that is difficult to quantify. An independent cost estimate should be prepared of this alternative to make sure it will be within the owner's budget. Treatment effectiveness will be better in the long run, but there will be some constructability issues. Alternative makes very effective use of existing infrastructure.
VA Option 2: Secondary Clarifier to Primary Clarifier + Integrated Fixed-film Activate Sludge (in existing Aeration Basin) + New Secondary Clarifier (all at Existing Plant): Headworks at new site CEPT at high flow only.	80.2%	Consider as a viable alternative in the FPA. Provides a very effective treatment alternative given normal flows (majority of the time), as well as high flows. This option is the most effective in terms of ammonia removal. An independent cost estimate should be prepared of this alternative to make sure it will be within the owner's budget. Alternative makes very effective use of existing infrastructure.
VA Option 3: CEPT + Ox Ditch/Sequencing Batch Reactor (SBR)/Conventional (New Site); Headworks at new site	80.9%	This option received the third highest rating of any of the alternatives. This is a highly rated option in terms of treatment effectiveness. This option was rated against other alternatives, and it scored well. However, a concern on the part of the VA team as to further advancement of this option is that much of the infrastructure will go on the new site, which may create community concerns, and although more constructible, it does not make nearly as effective re-use of existing plant infrastructure compared to Options 1 and 2.

TABLE 1-1
Summary of Rating of Process Alternatives for Top 3 Options and draft Facility Plan Amendment Alternatives
City of Coos Bay Value Assessment Study: Coos Bay WWTP No. 2

Alternative	Score (% of Possible Points)	VA Recommendation
FPA Alt 1: SBR (New) + New Line to Chlorine Contact Chamber (CCC); Headworks at new site	72.6%	The VA team's concerns with the FPA alternatives from vendor proposals are as follows: • Plant infrastructure is sized for peak wet weather flow, requiring larger facilities to treat up to 8 MGD. This requires significantly larger bioreactors. • Placing much of the facility construction on the new site across the street from WWTP No. 2, could create community concerns, and does not make effective use of existing plant infrastructure which could be retained in VA Options 1 and 2. • There is a concern with the plant's capability to treat typical average flows, which are much lower than the maximum wet weather flows, efficiently. • Vendor proposals appear to size the plant to meet year round nitrification when only seasonal ammonia limits are required to be met for WWTP No. 2, leading to a very conservatively sized system.
FPA Alt 2: Extended Aeration, Conventional with two new clarifiers. All on New Site. UV disinfection.	71.8%	See comments to FPA Alt 1 above.
FPA Alt 3: Oxidation Ditch with one new clarifier on New Site. UV disinfection.	64.4%	See comments to FPA Alt 1 above.
North Spit Alternative. Pipeline under bay. Secondary treatment. Existing outfall.	67.1%	Not a viable option at this time because of schedule risk.

Refer to the VA Overview and VA Observations sections for a discussion of cost and criteria concerns with the vendor proposals from the draft Facility Plan Amendment.

Appendix D contains CH2M HILL's Pro2D™ process simulation data in support of VA Options 1 and 2.

Appendix E contains the EPA permit for the Brightwater WWTP in Woodinville, Washington. This permit addresses the use of Chemically Enhanced Primary Treatment (CEPT) during peak wet weather flows. While CH2M HILL did not locate an explicit letter from EPA approving the CEPT process, we wish to demonstrate that there is precedent for obtaining NPDES permits from EPA concerning the use of CEPT during high wet weather flows. Other examples are discussed in the Observations section of this VA report (refer to Observation 4.2 - Considerations Regarding the Regulatory Climate for Blending Treatment Options.

At the time of publication of this VA report, the City has indicated that they are most comfortable with FPA Alt. 1, SBR, as their preferred alternative. The other alternatives, while ranked higher, did not provide a significant enough cost difference. Further, VA Option 1 does not fully mitigate the regulatory risk.

SECTION 2

VA Overview

2.1 Introduction

Value Analysis or Value Assessment (VA) is similar to Value Engineering (VE), but VA is conducted in the conceptual design phase, and VE is conducted in the early-to-mid design phase. In a VA study, numerous alternative design concepts that would meet the project's functional requirements are compared, and a base design alternative or a short-list of alternatives for further evaluation are determined. In a VE study, a base design alternative has already been selected and the VE process is used to evaluate potential VE cost-saving measures compared to the base design.

VA or VE is a systematic problem-solving technique involving a thorough analysis of project functions using the collective experience and technical expertise of a qualified team to creatively consider design options. Public and private organizations conduct VE workshops, or studies, for their major projects to reduce costs while meeting the intended functions, and to maximize functionality for roughly the same cost.

CH2M HILL conducts two types of studies:

- Concept-level studies (Value Assessment)
- Mid-design studies (Value Engineering)

This VA study of the Coos Bay Wastewater Treatment Plant (WWTP) No. 2 project involved evaluation of wastewater plant treatment process options at a concept-level. The study was conducted at the planning level phase of design, using the draft Facility Plan Amendment dated September 2011, and vendor proposals submitted to Civil West Engineering, as the basis for the VA study.

To illustrate the importance of Value, Cost, and Function, value engineering can be represented by the following value equation: V = F/C.

- "V" stands for value from the owner's perspective. Value is achieved by either reducing cost but still accommodating the basic function, or by enhancing function for the same cost.
- "F" stands for function. Basic functions of the project under study can be described by simple verb-noun definitions such as, "Protect Health," "Treat Waste," "Increase Capacity," and many other functions.
- "C" stands for cost of the function. High-cost functions become the subject of brainstorming, because various alternatives may be able to accomplish the basic function at a reduced cost.

This VA study of the Coos Bay WWTP No. 2 Project was conducted by CH2M HILL for the City of Coos Bay.

The VA orientation meeting was held at the City of Coos Bay Public Works office on Monday morning, October 24, 2011. Two wastewater process engineers and the VA facilitator from CH2M HILL participated. Other VA team members included representatives from the City of Coos Bay, from the Charleston Sanitation District, from the Oregon Department of Environmental Quality (DEQ), and from OMI—plant operators for WWTP No.'s 1 and 2.

Following introductions, CH2M HILL provided an overview of the VA process. City representatives provided an introduction to the project. Engineering representatives from Civil West who are preparing the Facility Plan Amendment discussed the existing plant conditions and requirements for ammonia and bacterial reductions in the wastewater effluent that is discharged to the Bay. A tour of the WWTP No. 2 was held on Monday morning following the project overview. The study continued on Monday afternoon, October 24, and Tuesday, October 25, at the City of Coos Bay Public Works office. On Wednesday, October 26, the VA study continued at the City of Coos Bay Library, where a VA Out-Brief presentation was held from 10:30 a.m. through noon. The VA team presented our recommendations concerning plant treatment processes to City and Civil West representatives.

The proposals and observations from the original VA study are included in this VA Report that is provided for the City's, Civil West's, and other stakeholders' review and input. The stakeholders plan to coordinate to determine

the final disposition of the VA proposals addressed in the rating system, and the VA observations. A selected alternative will then become the basis for design.

For further information about the content and schedule of the VA orientation meeting and study, please refer to the *Agenda for Value Assessment Study at Facilities Plan Amendment Phase* in **Appendix A**.

2.2 VA Participants

The VA team members who participated in the 3-day VA study are identified below.

Team Member	Organization	Home Office	Role
Paul Johnson	CH2M HILL	Boise, ID	Certified Value Specialist and VA Study Leader
Doug Berschauer	CH2M HILL	Phoenix, AZ	Senior Process Engineer
Bill Leaf	CH2M HILL	Boise, ID	Lead Process Engineer and CPES Estimating
Patrick Kavan	CH2M HILL	Coos Bay, OR	Wastewater Operations WWTP 2 Plant Manager
Mike McDaniel	CH2M HILL	Coos Bay, OR	Wastewater Operations WWTP 1 Plant Manager
Jennifer Wirsing	City of Coos Bay	Coos Bay, OR	Engineering Service Coordinator
Jessica Spann	City of Coos Bay	Coos Bay, OR	Engineering Technician
Jim Hossley	City of Coos Bay	Coos Bay, OR	Public Works and Development Director
John Chirrick	Charleston Sanitation District		CSD Representative
Steve Major	The Dyer Partnership		CSD Engineer of Record
Jon Gasik	Oregon DEQ		DEQ Representative

The City Engineer of Record representatives who participated in the VA Orientation Meeting on October 24, and the VA Out-Brief presentation on October 26, are identified below.

Name	Organization	Home Office	Role/Contact
Garrett Pallo	Civil West	Coos Bay, OR	Project Manager
Bill Boger	Civil West	Coos Bay, OR	Engineer

Additional City of Coos Bay representatives who attended the VA Out-Brief presentation on October 26, are identified below.

Name	Organization	Home Office	Role/Contact
Susanne Baker	City of Coos Bay	Coos Bay, OR	Finance Director
Rodger Craddock	City of Coos Bay	Coos Bay, OR	City Manager

2.3 Project Description

The basis for the current project is defined in the draft September 2011 *Wastewater Treatment Plant #2 Facilities Plan Amendment* by Civil West Engineers. The following summary is excerpted from that document:

> The City of Coos Bay is located on the southwestern Oregon coast, approximately 200 miles south of the Columbia River and 100 miles north of the State border with California. The City of Coos Bay owns, operates, and maintains two wastewater treatment facilities.
>
> Coos Bay Wastewater Treatment Plant No. 1 (WWTP No. 1) is located in the eastern portion of the City, near Highway 101 and Coos Bay Boulevard, and treats approximately two-thirds of the flows in the City. Treatment Plant No. 2 (WWTP No. 2) is located on the Cape Arago Highway, near Fulton Avenue, and treats the remaining one-third of the City wastewater and all of the sewage from the Charleston Sanitary District.

Both treatment plants are exhibiting age- and condition-related deficiencies in addition to water quality and capacity issues, and both are in need of upgrades and repairs. WWTP No. 2 is the highest priority for the City, at this time, because of the immediate need for improvements.

Coos Bay Wastewater Treatment Plant No. 2 was originally constructed in 1973 with an influent pump station, headworks, primary clarifier, aeration basins, and two secondary clarifiers. Upgrades constructed in 1990 included new headworks, a second lift station, and a third secondary clarifier.

The plant is currently unable to consistently meet the discharge requirements established in the National Pollution Discharge Elimination System (NPDES) permit, issued August 21, 2003, and amended December 15, 2004. The City of Coos Bay and the Oregon State Department of Environmental Quality (DEQ) have entered into a Mutual Agreement and Order (MAO) which describes the actions the City will perform to upgrade the treatment facility.

Figure 2-1 is a site map showing the City's treatment facilities.

A *Facilities Plan for Wastewater Treatment Plant No. 2* was prepared by West Yost Associates in October 2007. This study reviewed alternate treatment options and provided recommended improvements.

The recommended alternative consisted of a new influent pump station, new headworks, new control building, new 70-foot diameter secondary clarifier, new secondary pump station, new gravity belt thickener, upgrades to the aeration basins, and conversion of an existing clarifier to a chlorine contact chamber. The new headworks, influent pump station, and control building were to be built on an adjacent site owned by the City.

The recommended improvements described in the Facilities Plan are not viable for several reasons: The plan did not address the requirement for ammonia limitations that will be added to the discharge permit. The ability to meet reliability requirements was not clearly addressed, and subsequent investigation of the adjacent site identified wetland impacts that negatively affected the proposed location of new facilities.

Because the recommended option is not feasible, any new alternative constitutes a modification to the approved facilities plan. The DEQ has required the City to prepare an amendment to the Facilities Plan. This amendment will analyze additional options and make a new recommended alternative.

The City contracted with the team assembled by Civil West Engineering Services to complete this Facilities Plan Amendment.

The plant upgrade alternatives proposed herein are intended to provide wastewater treatment in compliance with DEQ requirements for 20 years. For the purposes of this Facilities Plan Amendment report and for planning efforts, it is assumed by Civil West that the proposed upgrades will be built and operational by 2015; therefore, the improvements are designed to meet the projected flow characteristics through the year 2035.

Another objective of the Facilities Plan Amendment is to develop a plan for staging or phasing of construction such that the proposed plant upgrade provides for continued treatment of wastewater throughout the construction period.

Also refer to **Appendix B** for the presentation by Civil West Engineering titled, *The City of Coos Bay, Wastewater Treatment Plant Improvements, 50% Facilities Plan Amendment Review Process*.

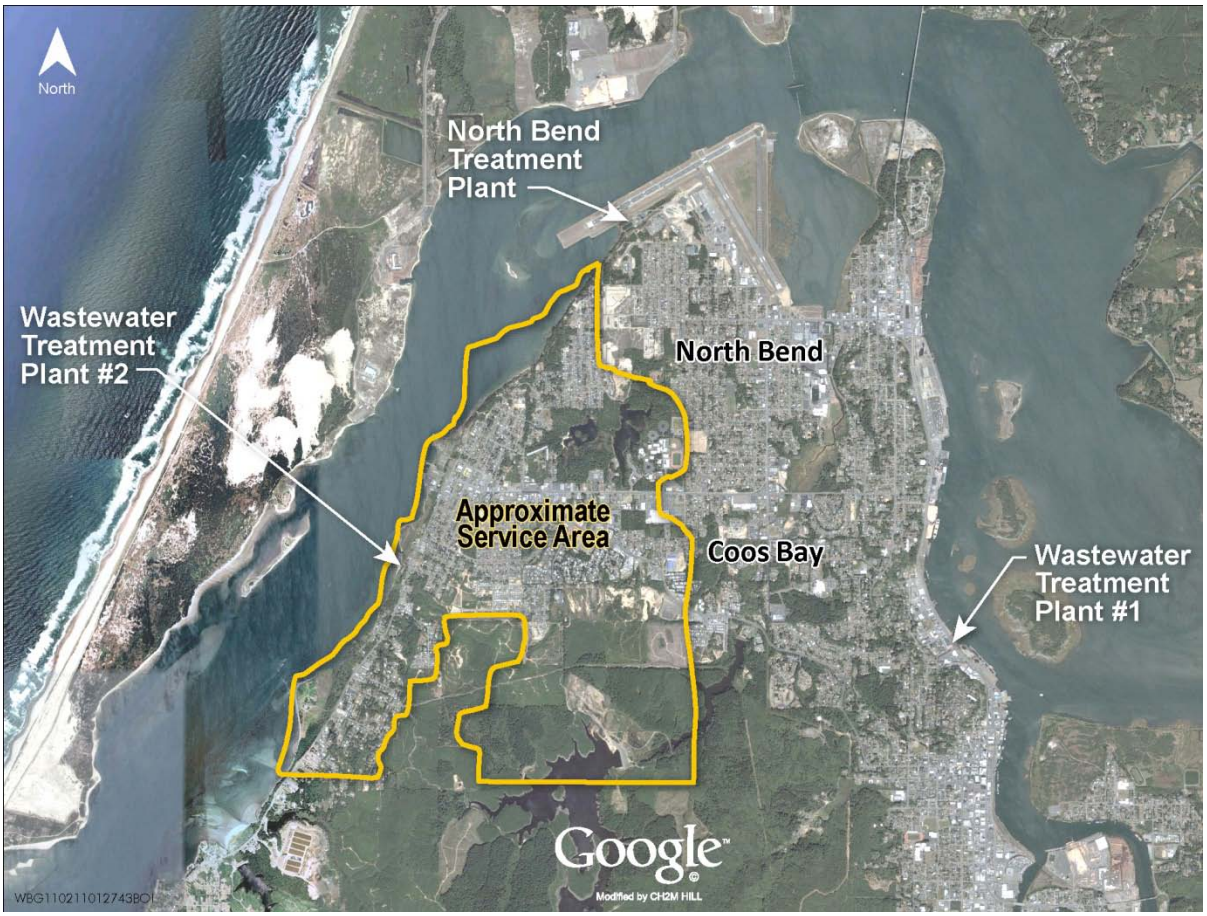


Figure 2-1 – Site Location Map

2.4 General Approach

Because this project has completed facilities planning and no predesign has commenced, this VA study was intended to review work by others, and to validate the recommended approach or suggest alternative recommendations that provide more value or improved performance. The VA study is intended help in the process of making informed decisions on design alternatives as the design process continues. Cost estimates for any of the alternatives will need to be prepared and carefully reviewed prior to implementation of any of the alternatives into the design.

2.5 Study Methodology

During the VA study, the VA team moved through the following phases, as outlined in the *Agenda for Value Assessment Study at Facilities Plan Amendment Phase* contained in **Appendix A**.

2.5.1 Information Phase

At the beginning of the study, the conditions and decisions that have influenced the development of the project must be reviewed and understood. For this reason, following introductions and an overview of the VA process by the VA facilitator, the VA team spent the first several hours listening to the City of Coos Bay and the Civil West Engineering team explain the various elements of the project. Items discussed included overview of the project's mission, functional requirements, and the content of the 2007 Facilities Plan by West Yost Associates, and the 2011 Facilities Plan Amendment by Civil West.

Following a site tour of WWTP No. 2, the VA facilitator led the VA team through a discussion of team focus questions and answers, and identification of treatment process functions of each unit process through the facility. These functions are documented and included in the VA Study Results section later in this report.

This effort allowed the VA team to be briefed on pertinent issues at the WWTP No. 2, and brought the VA team up to speed on the functions of the project and where the significant improvements (and related expenses) are expected for this project.

2.5.2 Creative Phase

This VA study phase involved the creation and listing of ideas. During this phase, the VA team brainstormed alternatives and developed as many ideas as possible to provide the necessary functions within the project at a potentially lower cost to the owner, or to improve the quality of the project within the budget limitations. Judgment of the ideas was restricted at this point. The VA team was charged with developing a large number of ideas and to identify associations between ideas. This phase also included the establishment of process treatment criteria for each unit process through the WWTP No. 2.

2.5.3 Analysis Phase

During this phase of the VA study, the VA team judged the ideas generated during the creative phase. Therefore, each idea was compared with the current design concept in terms of how well it met the design intent. Advantages and disadvantages were discussed and recorded and the ideas were rated pass or fail.

Those that represented potential for cost savings were passed (approved for further study) and given a designation of “P” for “passed.”

Each “passed” proposal was then given a priority rating of high, moderate, or low based on the VA team’s overall feeling about proposal viability.

Each VA idea, as well as the vendor proposals from the Facilities Plan Amendment work by Civil West, was evaluated for overall “treatment effectiveness” and given a shading or rating of green (high treatment effectiveness potential); yellow (moderate to low treatment effectiveness potential; or red (probable fatal flaw in terms of treatment effectiveness).

Some VA ideas were given the designation of Observation. In general, design suggestions with an observation designation were not intended as alternatives to the Facilities Plan Amendment, but as design features that the VA Team recommend be incorporated into the upcoming design work.

This phase of the VA Study also included initial screening and ranking of alternative concepts for the proposed treatment options, area by area, through the plant. The broad criteria categories used for the ranking process included the following:

- Regulatory Risk
- Cost
- Implementability
- Schedule
- Operations
- Treatment Effectiveness
- Project Delivery

From one to eight individual criteria statements were developed within each of the criteria categories. Ratings of High or Moderate were given to each criteria statement within each criterion category. There was no effort to establish the relative importance of these criteria from one to another, because each criterion is considered an important topic for consideration in the evaluation of major treatment alternatives.

2.5.4 Development Phase

An evaluation of alternative ideas for the Coos Bay WWTP No. 2 project included narrative descriptions and graphics generated by the VA team, and a rating of how well each treatment alternative appears to meet each of the criteria statements. This information was tallied in CH2M HILL’s Concept-Level VA Study Rating System. The

ranking of process treatment alternatives from highest to lowest is summarized in Section 2 Study Results, subsection 2.8 – VA Proposals and Observations.

Observation narratives were also prepared by the VA team for numerous discreet observations that are intended to serve as reminders to the City and design team as the project moves into the design phase.

2.5.5 Presentation Phase

The compilation of ideas, observations, and cost analysis is presented in this VA Report. The City of Coos Bay, the Civil West Facility Plan Amendment team, and other stakeholders are requested to review this report. This group is requested to make a determination of the acceptance, rejection, or modification of the recommended process treatment alternatives for further evaluation, with the top alternative ultimately being incorporated into preliminary engineering design.

2.5.6 Implementation Phase

The final phase of the VA study is implementation. Because of the abbreviated nature of this VA Study, this implementation phase will be incorporated into the upcoming predesign and design work. Through the course of the predesign and design work, the City and the Facility Plan Amendment Team (Civil West) and other stakeholders (Charleston Sanitary District and Oregon DEQ) will determine if the process alternatives and observations will be incorporated into the design, modified in some manner, or rejected.

2.6 Study Results

2.6.1 Introduction

The recommendations are the major feature of a VA study because they represent the benefits, or results, that can be realized by the City. Results can be measured quantitatively in terms of accepted cost savings, and qualitatively in terms of accepted functional enhancements and mitigation of risk.

2.6.2 Team Focus Questions and Answers

The VA team addressed the following questions.

2.6.2.1 What is the problem we are about to discuss?

1) WWTP No. 2 is not currently meeting permit requirements, specifically ammonia limits, BOD, and TSS at times. (Bacteria counts have been managed.) Mutual Agreement and Order (MAO) with DEQ says City is out of compliance with BOD, Ammonia and TSS. Interim limits apply. MAO is an enforcement action that settles the past violations and establishes interim limits. City has agreed to the upgrade at WWTP No. 2 (and also WWTP No. 1). Two separate permits and two separate agreements for the respective plants. Alkalinity is too low to nitrify, which causes problems with meeting permit levels.
2) There have been too many Sanitary Sewer Overflows (SSOs) in the collection system. A hydraulic bottleneck near the plant causes offsite overflows in upstream manholes.
3) Ongoing cost of chemicals. Includes high nitrite lock in the chlorine contact basin. Increases chlorine usage.
4) City has advised rate payers of a 6.5% annual increase in sewer rates. Population is aware. This will support a project of $16 million to $20 million for WWTP No. 2. (Adding collection system improvements, pumping stations, and WWTP No. 1 upgrades totals $70 million over 20 years). Rate payers are now paying in the $40 to $50 range per household.
5) Infiltration & Inflow (I&I) results in highly variable flows to the plant. There is excessive I&I at WWTP No. 2 (up to 20 times the Average Daily Flow (ADF). EPA says a Cost Effectiveness Analysis needs to be done. DEQ's policy is that eliminating all inflow including inflow at manholes is cost effective, and all structural deficiencies must be taken care of. The City plans that the whole system will be cleaned and videoed every 5 years.
6) Existing plant equipment is aging and is in need of replacement.

7) The area is anticipated to steadily grow in population and general business.
8) Influent contains a lot of garbage that bottlenecks in the system.
9) The plant site is very space constrained.

2.6.2.2 Why do we consider this a problem?

1) Ammonia is toxic to fish. BOD and TSS may also be harmful to fish.
2) SSOs are a problem because when they occur, shellfish havesting is temporarily closed, which results in loss of industry revenue.
3) Cost of chemicals are rising. Prices increased about 15% for chlorine and 18% for bisulfate. Difficulty in transporting to the plant, followed by storage and handling of chemicals. The City spends approximately $60,000 to $70,000 for both plants annually ($30k for WWTP No. 2) for chemicals.
4) Ability of local citizens to pay the increased rates is limited. City population has a large cohort of older residents with limited incomes.
5) I&I results in greater influent flows, which will require increased plant capacity and capital expenditure.. Highly varying influent flow due to I&I may decrease treatment effectiveness. Funding agencies expect I&I reduction projects to reduce plant expansion costs.
6) Difficult to monitor day to day process. Aging equipment and infrastructure result in increasing cost of repairs, more system downtime due to mechanical failures, and an increased potential to be out of permit compliance, resulting in fines and negative publicity.
7) Future population increases are anticipated.
8) The plant pumps and equipment are plugged by solids in raw sewage, which is difficult and expensive to clear.
9) Ability to adapt future changes to regulations is difficult with the limited space at the existing plant site.

2.6.2.3 Why do we believe a solution is necessary?

1) The City is expected to be an environmental steward and protect the marine environment. Minimization or elimination of SSOs will reduce economic impacts to the fishing and shellfish industry in Coos Bay. Sewer overflows have closed Coos Bay to commercial shellfishing. The City needs to avoid the financial penalties for not meeting the MAO interim discharge criteria and for not meeting the MAO implementation schedule.
2) SSOs increase the risk of exposure to pathogens for swimmers or boaters, as well as a negative financial impact to the shellfish industry.
3) Chlorine is harmful to the environment and is regulated by the NPDES permit. Reducing chemical usage will reduce chemical costs and reduce the environmental impact of trucking the chemicals from Long View, Washington (an approximately 6-hour drive).
4) The rate increases may not be sustainable over the long term.
5) To minimize impact on plant size for treatment, improve treatment and efficiency, and develop a cost effective solution for funding agency.
6) Ultimately, the cost of repairs on aging equipment exceed the cost for upgraded facilities and replacement equipment.
7) Plant treatment processes need to accommodate increasing flow and loads due to the increasing population.
8) Better screening to remove solids in raw sewage will increase the reliability of equipment and processes and reduce maintenance costs. This will more effectively remove debris, improve plant processes, and prevent interruptions.
9) Existing space constraints limit plant expansion required for future treatment requirements.

2.6.2.4 What are the top cost drivers on this project?

- New Influent pumping station.
- New headworks.
- Treatment improvements (ammonia removal).
- Main interceptor between highway and the plant is restricted, has broken in the past, and needs to be upgraded.
- Replacing aging tankage and equipment.
- Cost of property (approximately $600,000) followed by zoning and permitting costs.
- Anticipated budget for this project at WWTP No. 2 is between $18 and $24 million (year 2014 dollars).

2.6.3 What are the top risk areas on this project?

1) Acceptance of the improvements by neighbors who are concerned about view.
2) Obtaining the Conditional Use Permit.
3) Small corner with residence will have to be rezoned.
4) Keeping the plant operational during construction, on this very tight site.
5) Flooding and/or tsunami affecting the plant.
6) The new FEMA maps should show that the plant meets the 500-year storm elevation.
7) Existing plant site has confirmed wetlands on the undeveloped portion of the site, south of existing plant operations. New property has wetlands and delineation is underway.
8) At NW end of the new site, there is a riparian area that needs to be preserved. The available area for improvements is reduced.
9) Sizing for ammonia removal considering space constraints on the site.
10) Current process operations are not stable with respect to effluent quality (BOD, TSS, ph, ammonia).
11) Schedule is important for meeting compliance limits.

2.6.4 Expected Outcomes from the VA Study

1) Recommendation to the City and the engineers on a short-list of treatment alternatives, or ideally a specific alternative for meeting the treatment requirements.
2) Alternative(s) should be cost effective with respect to current budget.
3) Future operations and maintenance costs should be optimized.
4) Plant improvements should accommodate future population growth. Land is set aside for future expansions at Plant No. 2 (decades out).

2.7 Functions

During the Information Phase, the VA team identified functions for the overall project as well as each of the major project components. This exercise is helpful in bringing the VA team to a more complete level of understanding of the project goals, drivers, and purpose.

Functions are described in simple verb–noun definitions (along with occasional adjectives and descriptive statements), and are intended to help clarify the scope of the VA analysis. Functions of a project can be categorized as Higher Order (H) functions, Basic (B) functions, Secondary (S) functions, and All the Time (A) functions.

- **Higher Order (H)** functions describe the overall purpose of the project, but are not within the specific scope of the VA study. For example, several Higher Order functions of the Coos Bay WWTP No. 2 Upgrade project are: "Protect Environment," "Protect Public Health," "Protect Aquatic Life," and "Protect Shellfish Harvesting." These functions represent the high-ideals of the project to which all wastewater treatment facility upgrades and modifications are intended to support.

- **Basic (B)** functions describe the most important elements of the project. Several Basic functions of the Coos Bay WWTP No. 2 Upgrade project include: "Treat Wastewater," "Manage Peak Wet Weather Flows," "Comply with Permit," and "Comply with MAO." There are additional Basic functions within the unit processes themselves.

- **Secondary (S)** functions describe meaningful, yet secondary elements of the project that need to be accommodated to deliver the project, but do not themselves represent a primary purpose for implementing the project. Several Secondary functions of the project include: "Convey Waste to Plant," "Protect Downstream Processes" and "Power Facility." Again, these are important elements to address, but they are not the reasons why the project is being done. In many projects, the costs devoted to accomplishing secondary functions are often higher than they really need to be; therefore, secondary functions receive much scrutiny in a VA study along with basic functions.

  It can be argued that the secondary function "Protect Downstream Processes" should be a basic function versus a secondary function of the Headworks system. Similar arguments can be made regarding the functions of each of the plant components. However, because of the high level of abstraction of the contemplated project, most of the functions of the plant processes themselves are viewed to be secondary in nature to the overall basic functions of the project as identified herein.

- **All the Time (A)** functions describe meaningful objectives that a project should strive to meet. For the Coos Bay WWTP No. 2 Upgrade Project, two All the Time functions include: "Stay within Budget" and "Promote Community Acceptance."

High-cost areas of the project where opportunities for VA savings or functional enhancement exist can be found primarily in Basic and Secondary functions. That is why the VA team spends time identifying project functions. Alternatives are evaluated that can meet the intended function without compromise to quality or the function itself. For example, if a lot of money is being spent on the secondary function "Power Facility" then it is incumbent on the VA team to explore other technically feasible and lower cost alternatives to "Power Facility."

2.7.1 Functions for Current Project

The VA team determined that the primary goals of the current project should be considered the Higher Order Functions for this project. The Coos Bay WWTP No. 2 is required to properly reduce ammonia, BOD and TSS, and manage peak wet weather flows. These requirements are therefore considered the Basic Functions of the contemplated project.

The functions generated by the VA team are identified below, along with the designation, in parentheses, of the type of function they represent.

The following list of functions represents the VA team's discussion of the purpose of each of the areas or processes within the plant. This is a precursor to the Creative Phase session, in which alternative ways of meeting the project functions are brainstormed.

2.7.2 Higher Order Functions

- (H) Protect Environment
- (H) Protect Public Health
- (H) Protect Aquatic Life
- (H) Protect Shellfish Harvesting

- (H) Accommodate Growth

2.7.3 All the Time Functions

- (A) Economical Project
- (A) Stay within Budget
- (A) Avoid Financial Penalties
- (A) Reduce Sanitary Sewer Overflows (SSO's)

2.7.4 Overall Plant

- (B) Determine Optimal Treatment Process
- (B) Treat Wastewater
- (B) Manage Peak Wet Weather Flows
- (B) Comply with Permit (ammonia, BOD, TSS, bacteria limits)
- (B) Comply with Mutual Agreement and Order (MAO)

2.7.5 Contemplated Project

- (B) Improve Reliability
- (B) Improve Efficiency
- (B) Replace worn Equipment

2.7.6 Collection System

- (S) Collect Waste
- (S) Convey Waste to Plant

2.7.7 Headworks

- (S) Remove Garbage/Grit
- (S) Remove Inorganics
- (S) Increase Hydraulic Grade Line
- (S) Protect Downstream Processes

2.7.8 Primary Treatment

- (S) Remove Settleable Solids
- (S) Slow Flow
- (S) Reduce Organic Loading to downstream units
- (S) Remove Scum and Grease
- (S) Thicken Solids (optional)
- (S) Thicken WAS (optional)

2.7.9 Secondary Treatment (Aeration Basins and Secondary Clarifiers)

- (S) Biological Treatment
- (S) Add Air
- (S) Remove Ammonia
- (S) Remove Soluble BOD
- (S) Keep Bugs Suspended
- (S) Separate Bugs and Water
- (S) Remove Sludge (to Maintain Sludge Age)
- (S) Meet Regulations (technology-based effluent limits – TBELs)

2.7.10 Digesters

- (S) Reduce Volatile Solids
- (S) Anaerobic Digestion (or alternative)
- (S) Meet Pathogen Reduction and Vector Attraction Requirements
- (S) Concentrate Solids

- (S) Produce Methane Gas
- (S) Reduce Sludge Volume

2.7.11 Solids Handling

- (S) Produce Biosolids
- (S) Land Apply Biosolids
- (S) Transfer to Field
- (S) Fertilize Trees and Pastureland
- (S) Dispose of Solids

2.7.12 Odor Control

- (S) Control Odor
- (A) Promote Community Acceptance
- (A) Reduce Complaints

2.7.13 Disinfection

- (S) Disinfect Effluent
- (H) Protect Human Health
- (H) Protect Shellfish
- (H) Protect Environment

2.7.14 Power

- (S) Power Facility
- (S) Maintain Treatment during Power Outages

2.7.15 Outfall

- (S) Discharge Effluent
- (S) Promote Dilution

2.7.16 Project Delivery

- (A) Remain within Budget
- (B) Maintain Plant Operations during Construction
- (B) Optimize Treatment Process Selection
- (B) Design Project
- (B) Permit Project
- (A) Maintain Community Relations

2.7.17

2.7.18 FAST Diagram

The VA team arranged the functions into a FAST diagram, shown in **Figure 2-2**. FAST stands for “Function Analysis System Technique.” The following FAST diagram links the basic and high-order functions into “How-Why” relationships for the Coos Bay WWTP No. 2 upgrade project. Development of a FAST diagram helps a VA team better understand the nature of the problem under study, because a full understanding the problem leads to development of more meaningful solutions.

FUNCTION ANALYSIS SYSTEM TECHNIQUE (FAST) DIAGRAM
COOS BAY WWTP #2 UPGRADE PROJECT

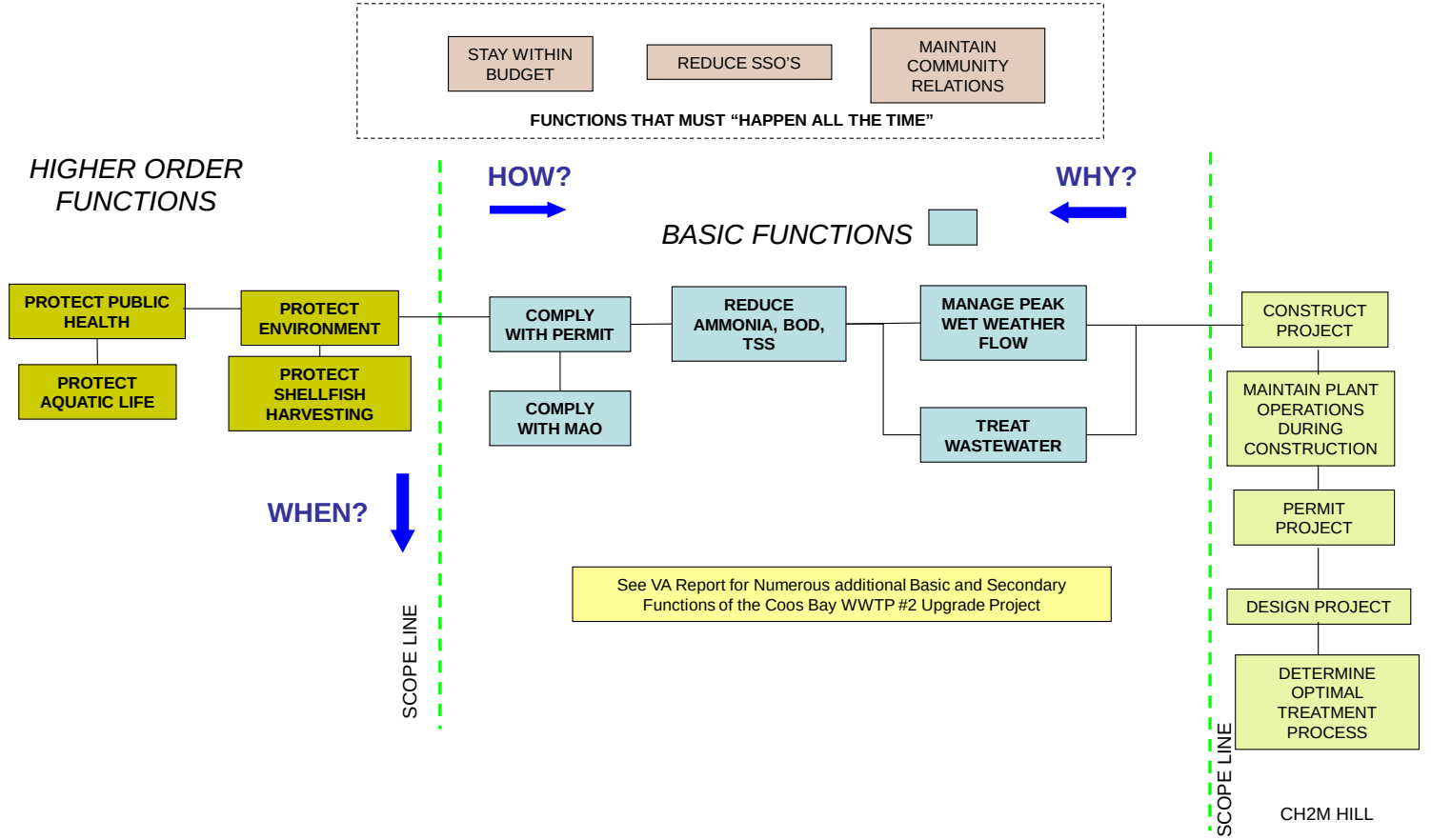


Figure 2-2 – FAST Diagram for Coos Bay WWTP No. 2 Upgrade Project

2.8 VA Proposals and Observations

The VA team generated numerous ideas for change during the Creative Phase of the VA job plan. The evaluation of these ideas during the Analysis and Development Phases was based upon the potential for process improvements, perceived acceptability by the design team and City, cost savings potential, ease of future operations, constructability, and other criteria identified above. The VA team worked together to evaluate each of the ideas coming out of the Creative Phase, ranking each proposal, and categorizing them for further consideration.

During this evaluation process, a variety of implementable cost-savings and design enhancement opportunities were found. The recommendations of this study are presented as alternates for further evaluation in the forthcoming preliminary design phase, or reminders to the design team of certain functional or risk issues to keep in mind as the design progresses. The VA Team recommends that all high priority proposals be reviewed with City staff for consideration as alternatives for evaluation during the Predesign phase of the project. All of the proposals studied are described in Section 3 *VA Wastewater Treatment Process Proposals*.

The top three VA options were rated in comparison to the base alternatives in the Facilities Plan Amendment. Refer to **Appendix C** - Rating of Process Alternatives, contained in. The results of the ratings are as follows.

TABLE 2-1
Summary of Rating of Process Alternatives for Top 3 Options and Facility Plan Amendment Alternatives
City of Coos Bay Value Assessment Study: Coos Bay WWTP No. 2

Alternative	Score (% of Possible Points)	VA Recommendation
VA Option 1: Secondary Clarifier to Primary Clarifier + Membrane Bioreactor (all at Existing Plant); Headworks at new site. CEPT at high flow only.	82.7%	Consider as a viable alternative in the FPA. Provides the most effective treatment alternative given normal flows (majority of the time), as well as high flows. Precedent for this is established at other plants but this approach needs to be reviewed with EPA and Oregon DEQ for confirmation. This does represent a regulatory risk that is difficult to quantify. An independent cost estimate should be prepared of this alternative to make sure it will be within the owner's budget. Treatment effectiveness will be better in the long run, but there will be some constructability issues. Alternative makes very effective use of existing infrastructure.
VA Option 2: Secondary Clarifier to Primary Clarifier + Integrated Fixed-film Activate Sludge (in existing Aeration Basin) + New Secondary Clarifier (all at Existing Plant): Headworks at new site CEPT at high flow only.	80.2%	Consider as a viable alternative in the FPA. Provides a very effective treatment alternative given normal flows (majority of the time), as well as high flows. This option is the most effective in terms of ammonia removal. An independent cost estimate should be prepared of this alternative to make sure it will be within the owner's budget. Alternative makes very effective use of existing infrastructure.

TABLE 2-1
Summary of Rating of Process Alternatives for Top 3 Options and Facility Plan Amendment Alternatives
City of Coos Bay Value Assessment Study: Coos Bay WWTP No. 2

Alternative	Score (% of Possible Points)	VA Recommendation
VA Option 3: CEPT + Ox Ditch/Sequencing Batch Reactor (SBR)/Conventional (New Site); Headworks at new site	80.9%	This option received the third highest rating of any of the alternatives. This is a highly rated option in terms of treatment effectiveness. This option was rated against other alternatives, and it scored well. However, a concern on the part of the VA team as to further advancement of this option is that much of the infrastructure will go on the new site, which may create community concerns, and although more constructible, it does not make nearly as effective re-use of existing plant infrastructure compared to Options 1 and 2.
FPA Alt 1: SBR (New) + New Line to Chlorine Contact Chamber (CCC); Headworks at new site	72.6%	The VA team's concerns with the FPA alternatives from vendor proposals are as follows: • Plant infrastructure is sized for peak wet weather flow, requiring larger facilities to treat up to 8 MGD. This requires significantly larger bioreactors. • Placing much of the facility construction on the new site across the street from WWTP No. 2, could create community concerns, and does not make effective use of existing plant infrastructure which could be retained in VA Options 1 and 2. • There is a concern with the plant's capability to treat typical average flows, which are much lower than the maximum wet weather flows, efficiently. • Vendor proposals appear to size the plant to meet year round nitrification when only seasonal ammonia limits are required to be met for WWTP No. 2, leading to a very conservatively sized system.
FPA Alt 2: Extended Aeration, Conventional with two new clarifiers. All on New Site. UV disinfection.	71.8%	See comments to FPA Alt 1 above.
FPA Alt 3: Oxidation Ditch with one new clarifier on New Site. UV disinfection.	64.4%	See comments to FPA Alt 1 above.
North Spit Alternative. Pipeline under bay. Secondary treatment. Existing outfall.	67.1%	Not a viable option at this time because of schedule risk.

2.9 Cost Considerations

2.9.1 Relative Cost Differences between Process Treatment Alternatives

The VA team was advised by the City that the anticipated budget for the WWTP No. 2 upgrades project is on the order of $18 million to $24 million.

Given the planning level status of the cost estimates, and the abbreviated schedule of the VA study, the VA team did not produce detailed cost estimates for each of the individual proposals, nor the base design alternative. Neither detailed capital cost estimates, nor life cycle cost analyses were included in the scope of this VA study. The VA team encourages the City of Coos Bay and the Facility Plan Amendment consultant to carefully prepare a cost estimate for any of the conceptual alternatives, and carefully review vendor alternatives that have been submitted in the Facility Plan Amendment.

To obtain a comparison of capital costs between the three top-rated alternatives identified by the VA study and the base alternatives identified in the Facility Plan Amendment, high-level, capital cost estimates were prepared using CH2M HILL's Conceptual Parametric Estimating System (CPES). The relative differences in capital cost between alternatives are presented in **Table 2-2**, Costs for alternative Options 1, 2, and 3 range from 75 to 96 percent of the anticipated cost of two base alternatives (Oxidation Ditch and Sequenced Batch Reactor) recommended in the Facility Plan Amendment:.

TABLE 2-2
Estimated Relative Capital Costs of VA Options and Facility Plan Amendment Alternatives
City of Coos Bay Value Assessment Study: Coos Bay WWTP No. 2

Option 1 – Membrane Bioreactor	96%
Option 2 – Integrated Fixed Film Activated Sludge	75%
Option 3 – Primary Clarifier/Conventional Activated Sludge	80%
Base (Oxidation Ditch) [2]	100%
Base (Sequencing Batch Reactor) [3]	100%

1) The values presented are conceptual and are intended for relative cost comparisons only. These values are not intended to be used for planning or budgetary purposes.
2) Cost for base oxidation ditch alternative developed using CH2M HILL's CPES program. Sizing determined from equipment vendor proposal.
3) Cost for base SBR alternative determined from Design Consultant Estimates, which have not been reviewed in detail. This base alternative is used for comparing costs with the other proposed alternatives on a relative cost basis only.

2.9.2 Preliminary Comments Concerning Vendor Criteria and Cost Proposals

The vendor proposals and draft Facility Plan Amendment cost estimate information were received during the VA study. CH2M HILL undertook a quick review of this information, and generated the following comments.

1) There are design criteria variations between vendors.
    a) Flow Rate (MMDWF or Peak Wet Weather Flow) inconsistencies.
    b) Temperature of wastewater inconsistencies between vendor proposals.
2) Additional unit processes are required for redundancy. For example two secondary clarifiers are required, but only one clarifier is shown in several of the vendor proposals.
3) Cost estimate markups appear low.
    a) The aggregate markup for mobilization, overhead, bonds is shown at 10% in the draft Facility Plan Amendment estimates. CH2M HILL typically sees 5% for mobilization, 10% for overhead, and 5% for bonds. This adjustment would cause the Facility Plan Amendment estimate to increase.
    b) Contingency is 20% in the Facility Plan Amendment estimate. CH2M HILL typically applies a 30% contingency at this conceptual level of project planning. This adjustment would cause the Facility Plan Amendment estimate to increase.
    c) Contractor's profit does not appear to be included in the Facility Plan Amendment estimate. CH2M HILL typically shows 10% for contractor profit in a conceptual estimate.
    d) Escalation does not appear to be included in the estimate. For a project like this, CH2M HILL typically would apply an escalation rate of 9.4% to the mid-point of an assumed 24-month construction schedule, with construction beginning in Jan. 2013. This adjustment would cause the Facility Plan Amendment estimate to increase.

2.10 Process Simulation by CH2M HILL for VA Options 1 and 2

CH2M HILL used its Pro2D™ whole-plant process simulator to help develop the conceptual treatment alternative designs presented within the VA study. The process simulation was not calibrated to the actual wastewater characteristics at the Coos Bay WWTP No. 2, but used a representative wastewater common to the western part of the Pacific Northwest. At the conceptual level, and for comparison between alternatives, typical wastewater characteristics are adequate.

Appendix D contains results of the Pro2D™ modeling for Option 1 (MBR) and Option 2 (IFAS). For each alternative two printouts are presented:

1. Mass Balance for the maximum month dry weather condition
2. Performance of the associated bioreactor (noted as “PBNR”).

NPDES Permit Example

Appendix E contains the EPA permit for the Brightwater WWTP in Woodinville, Washington. This permit addresses the use of Chemically Enhanced Primary Treatment (CEPT) during peak wet weather flows. While CH2M HILL did not locate an explicit letter from EPA approving the CEPT process, we wish to demonstrate that is the Brightwater WWTP example provides a precedent for obtaining NPDES permits from EPA concerning the use of CEPT during high wet weather flows. Other examples, including WWTPs in Oregon, are discussed in Section 4 VA Observations. (Refer to Section 4.2 - Considerations Regarding the Regulatory Climate for Blending Treatment Options.)

SECTION 3

VA Wastewater Treatment Process Proposals

Fourteen possible wastewater process alternatives were identified by the VA team during the Creative Phase of the study, as listed below. In the Analysis Phase the VA team discussed the merits of each idea to determine which ideas should be rated against the alternatives considered by Civil West in the draft Facility Plan Amendment.

Three of the VA ideas were found to have merit for rating alongside the base design alternative from Civil West, and became Options 1, 2, and 3 during the Development Phase of the VA study. These are listed below in the "Highest Priority Options" section.

The status of each of the ideas is outlined below, along with descriptions of the ideas.

The base design alternatives from Civil West, along with other vendor proposals are not included in the 14 VA ideas listed below. General comments regarding the vendor proposals can be found in the VA Observations section of this report.

3.1 Existing WWTP No.2

Figure 3-1 is a site plan showing the existing facilities at the Coos Bay WWTP No. 2.

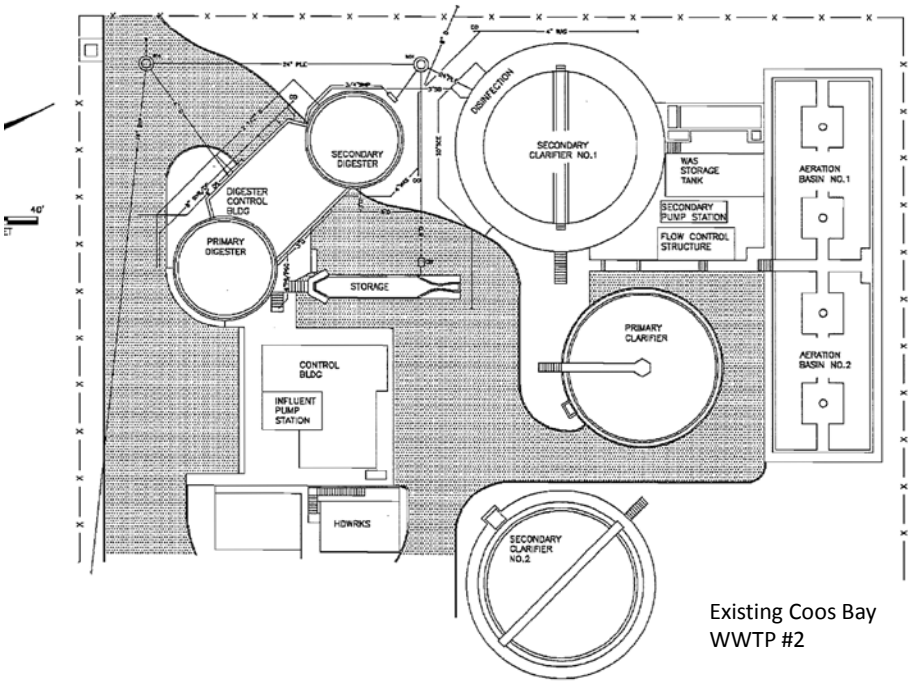


Figure 3-1 – Existing WWTP No. 2 Plant Layout

3.2 Highest Rated Options

3.2.1 Option 1: New Headworks + Secondary Clarifier to Primary Clarifiers + Membrane Bioreactor (Existing Plant)

This alternative would use existing infrastructure to accommodate future flows and loads. **Figure 3-2** shows a proposed plant layout for Option 1, and **Figures 3-3 and 3-4** are schematic process flow diagrams for non-peak

and peak flows, respectively. The secondary clarifiers would be modified to primary clarifiers. This has the added benefit of eliminating the intermediate pump station at the site. The existing aeration basins would be modified to include an anoxic zone and aerobic zone. A separate tank for housing the membranes of a membrane bioreactor (MBR) would be constructed, in part to help with project constructability. The operating water level within the existing aeration basin would be raised to use more volume of the tank (approximately 4 foot increase). There is sufficient volume to accommodate the process (confirmed by CH2M HILL's Pro2D™ model). The MBR would be sized for the maximum month dry weather flow.

The primary clarifiers would be allowed to run as chemically enhanced primary treatment (CEPT) during peak wet weather flows that are beyond the peak capacity of the MBR. This means, that a coagulant such as alum would be added upstream of the primary clarifiers. The coagulant forms polymeric compounds that agglomerate and trap suspended solids within the wastewater, causing more solids to settle in the clarifiers. The portion of flow that cannot be handled by the MBR would be blended with MBR permeate, disinfected, and discharged. The blended effluent would meet all permit requirements prior to discharge.

New headworks would be constructed at the new parcel. The headworks would consist of the following:

- Coarse screens
- Influent pumping
- Fine screens (2 mm)
- Grit removal

The screened/de-gritted influent would flow by gravity to the new primary clarifiers at the existing treatment plant site.

Odor control would be included at the new parcel to contain odors from influent sewer, screenings, and grit.

The digesters could be used for solids storage and thickening. Solids would be hauled to plant No. 1 for digestion.

The existing primary clarifier can be modified to provide additional chlorine contact required.

A new administration building would be built either on the existing site (potentially between the existing digesters that would be used for solids storage) or at the new parcel.

3.2.1.1 Initial Screening Comments from VA Team for VA Option 1

Green Rating (high score by VA team in the initial screening of alternatives)

- Plant stays on existing site.
- Better effluent quality.
- Uses existing infrastructure to maximum extent.
- Community selling point: minimizes shutting down shell fish industry and impacts to marine environment.
- Greater flexibility for meeting future regulatory requirements.
- Sets up well for next phase involving tertiary treatment.
- Reduction of chemicals.

3.2.1.2 Overall Score from Concept Rating System

VA Option 1 received a raw score of 561 out of 666 possible points, for a score of 84.2%. The weighted score was 82.7%. This option received the highest rating of any of the alternatives. However, EPA's and Oregon DEQ's consent with CEPT will need to be secured. Also constructability issues will need to be evaluated. This is the highest rated option in terms of treatment effectiveness.

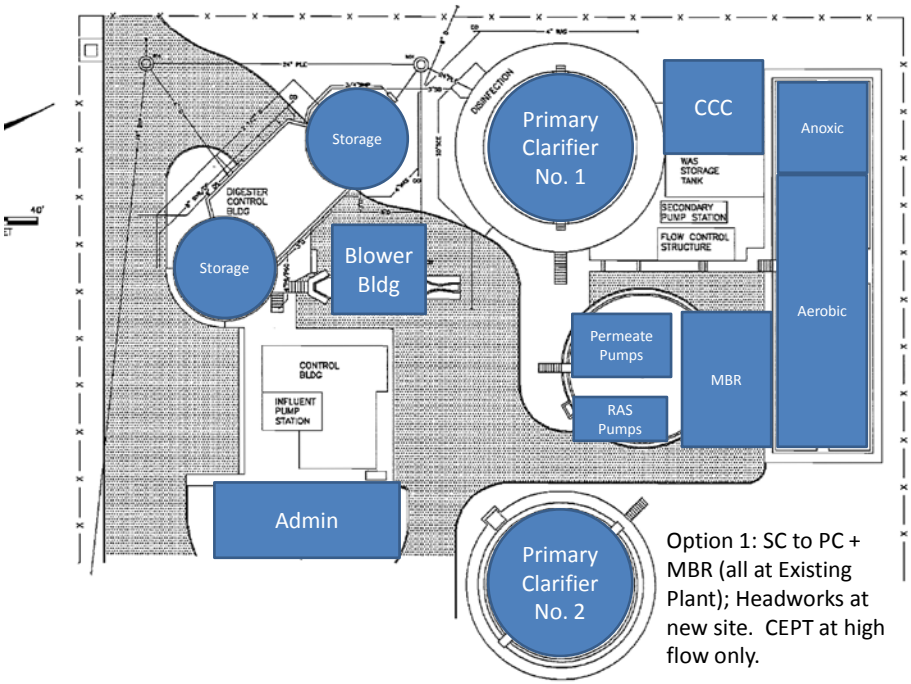


Figure 3-2– Proposed Plant Layout per Option 1

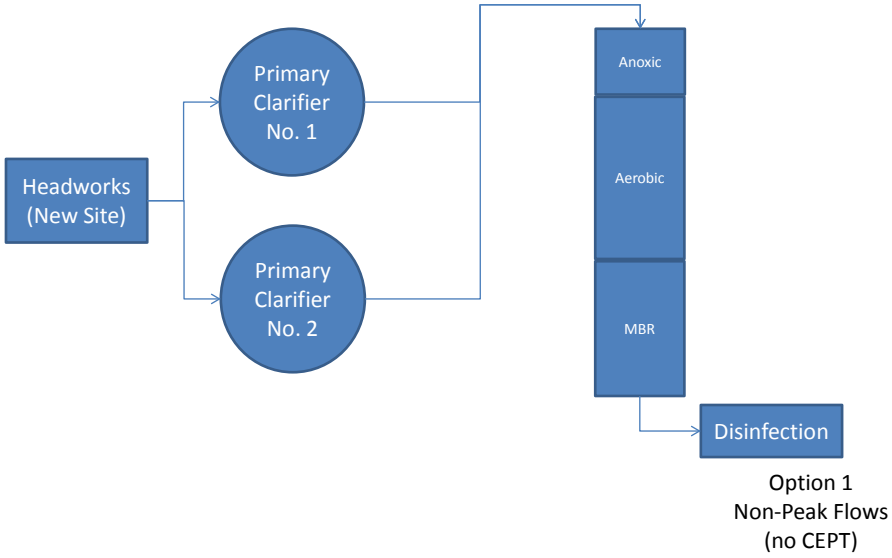


Figure 3-3 – Process Diagram, Option 1 for Non-Peak Flows (no CEPT)

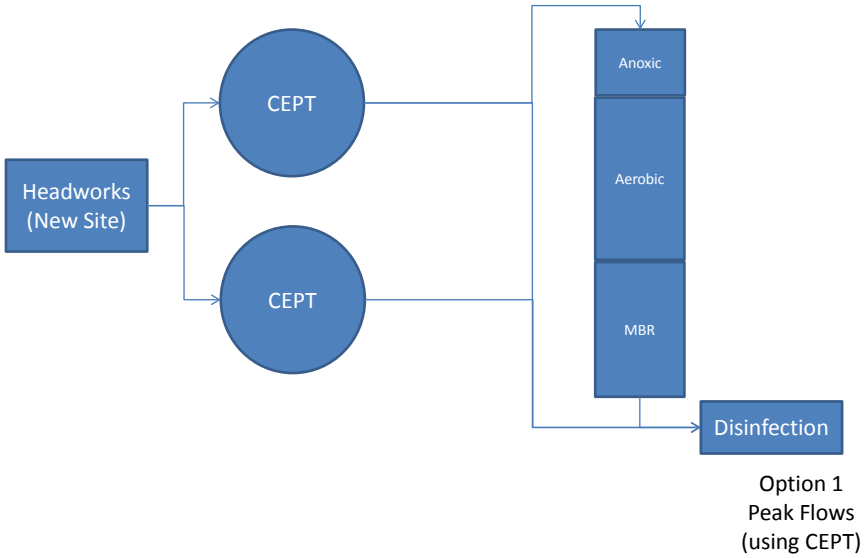


Figure 3-4 – Process Diagram, Option 1 for Peak Flows (using CEPT)

3.2.2 Option 2: New Headworks + Secondary Clarifiers to Primary Clarifiers + Integrated Fixed-film Activated Sludge (Existing basins)

This Option 2 is similar to Option No. 1 because the existing secondary clarifiers would be modified to be primary clarifiers and existing infrastructure would be used as much as possible. Unlike Option 1, the primary clarifier CEPT plus blending option is not used for peak flows. Rather, peak wet weather flow is treated through a portion of the secondary treatment process. The existing aeration basins would be modified with anoxic and aerobic environments, and the water surface level would be raised to increase the working volume. The integrated fixed-film activated sludge (IFAS) process would be incorporated into the aeration basins. A preliminary evaluation using CH2M HILL's Pro2D process simulation indicates that incorporating plastic biofilm carriers into a portion of the aeration basin will provide additional capacity and treatment to meet the City's requirements. The IFAS system would be designed to handle the maximum month wet weather flows, but the peak wet weather flows would be introduced into the aeration basin downstream of the IFAS zone. The wet weather flow would receive a level of secondary treatment within the aeration basin and then pass through the secondary clarifiers prior to disinfection. Two new secondary clarifiers would be built where the headworks and admin building currently reside, and the existing primary clarifier would be converted into a secondary clarifier. This would provide ample capacity for the peak wet weather conditions. **Figure 3-5** shows a proposed plant layout for Option 2, and **Figure 3-6** is schematic process flow diagram for peak flow conditions.

New headworks would be constructed at the new parcel across the street from the existing plant. The headworks would consist of the following:

- Coarse screens
- Influent pumping
- Fine screens (2 mm)
- Grit removal

The screened/de-gritted influent would flow by gravity to the primary clarifiers at the existing treatment plant site.

Odor control would be included at the new parcel to contain odors from influent sewer, screenings, and grit.

The digesters could be used for solids storage and thickening. Solids would be hauled to plant No. 1 for digestion.

A new administration building would be built either on the existing site (potentially between the existing digesters that would be used for solids storage) or at the new parcel.

Additional chlorine contact capacity can be provided between the new secondary clarifiers and the existing contact chamber.

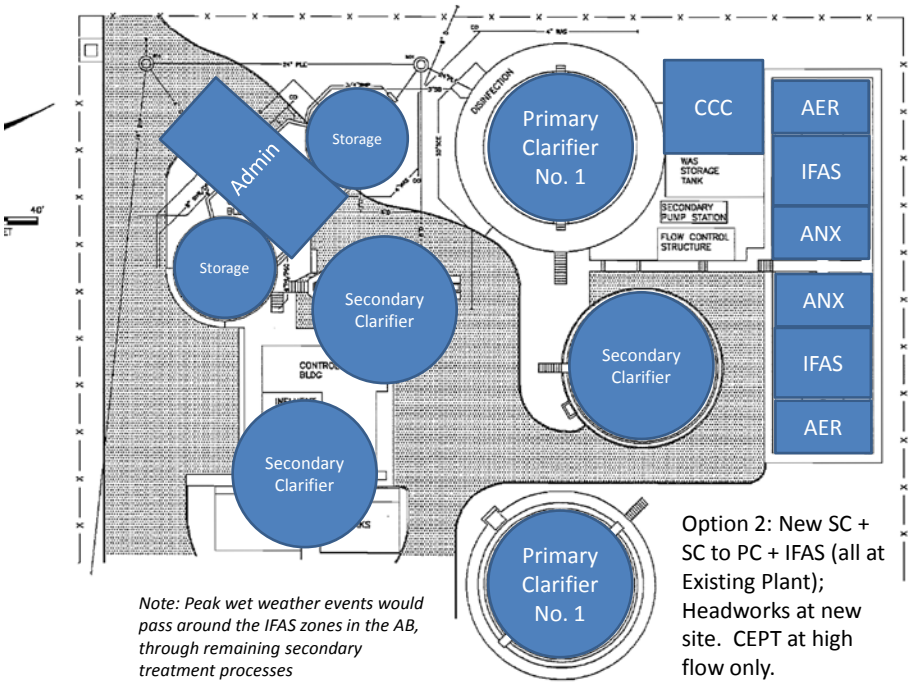
3.2.2.1 Initial Screening Comments from VA Team for VA Option 2

Green Rating (high score by VA team in the initial screening of alternatives)

- Plant stays on existing site.
- Best opportunity to meet ammonia limit.
- Robust nitrification opportunities.
- Chemicals don't interfere with IFAS.
- Beneficial phasing for future capacity.
- Small footprint.
- Add more media to increase process capacity.
- Disadvantage is needed bypass at peak periods.
- Chemically enhanced primary treatment (CEPT) for high flows during wet weather.
- Effluent quality is not as high as Option 1 MBR.
- Blended water quality still meets secondary treatment requirements, but potentially not as well as the MBR option.

3.2.2.2 Overall Score from Concept Rating System

VA Option 2 received a raw score of 543 out of 666 possible points, for a score of 81.5%. The weighted score was 80.2%. This option received the second highest rating of any of the alternatives. This is a highly rated option in terms of treatment effectiveness.



Note: Peak wet weather events would pass around the IFAS zones in the AB, through remaining secondary treatment processes

Option 2: New SC + SC to PC + IFAS (all at Existing Plant); Headworks at new site. CEPT at high flow only.

Figure 3-5 – Proposed Plant Layout per Option 2

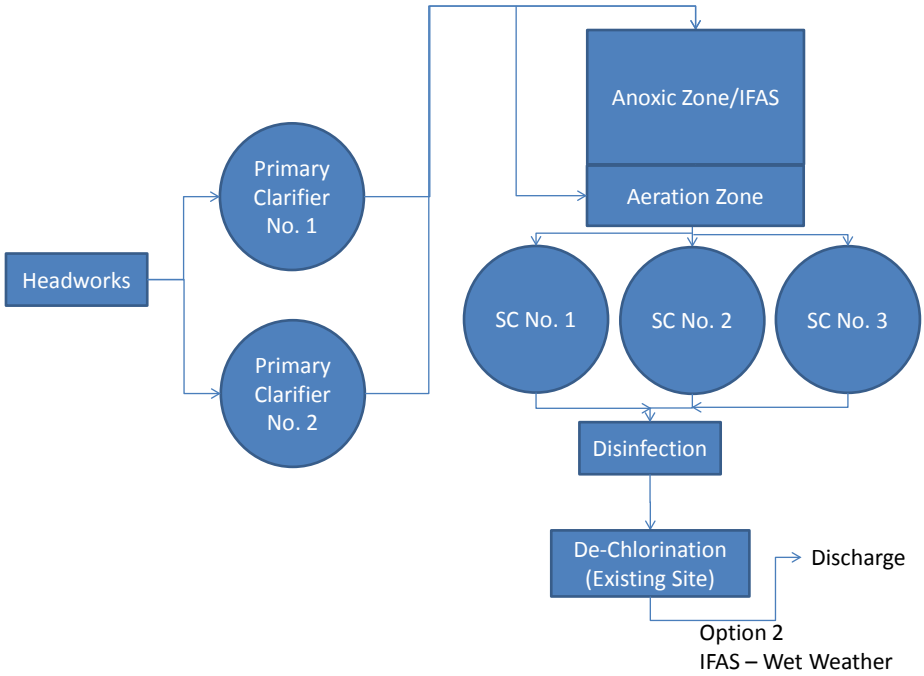


Figure 3-6 - Process Diagram, Option 2 IFAS (during wet weather)

3.2.3 Option 3: New Primary Clarifier + Oxidation Ditch/Sequencing Batch Reactor (New Site)

This concept would construct all the facilities at the new parcel with the addition of a primary clarifier. Normally primary clarifiers are not constructed with an Oxidation Ditch or an SBR, but in this case it would assist in minimizing the footprint of those facilities through reduction of BOD and TSS loading and limit sizing to maximum month dry weather flow. Primary clarification would reduce the size of the secondary clarifiers needed for the Ox Ditch option.

The primary clarifiers would be allowed to run as chemically enhanced primary treatment during peak wet weather flows that are beyond the peak capacity of the Ox Ditch or SBR systems. The portion of flow that cannot be handled by the Ox Ditch or SBR would be blended with secondary effluent, disinfected, then discharged. **Figures 3-7 and 3-8** are process flow schematics for non-peak and peak flow conditions, respectively. The Ox Ditch or SBR unit processes are labeled “Conventional Activated Sludge,” in the figures.

New headworks would be constructed at the new parcel. The headworks would consist of the following:

- Coarse screens
- Influent pumping
- Fine screens (2 mm)
- Grit removal

The screened/de-gritted influent would flow by gravity to the new primary clarifiers at the new parcel.

Odor control would be included at the new parcel to contain odors from influent sewer, screenings, and grit.

The digesters at WWTP No. 2 could be used for solids storage and thickening, but a new waste activated sludge (WAS) line would be required between sites. Solids would be hauled to plant No. 1 for digestion. A new solids storage facility could be phased in at the new site and utilize the odor control system.

The new effluent line could be used for chlorine contact. De-chlorination would be maintained at the existing site.

3.2.3.1 Initial Screening Comments from VA Team for VA Option 3

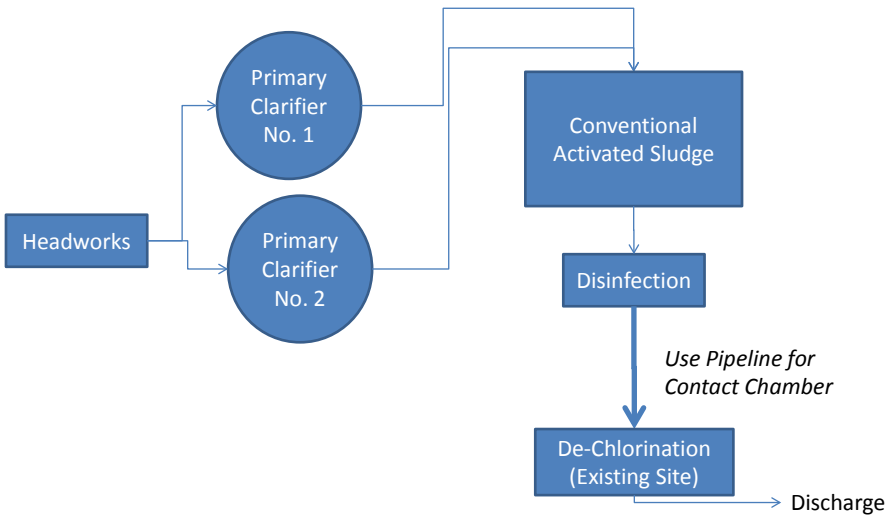
Green Rating (high score by VA team in the initial screening of alternatives)

- This option adds a primary clarifier or options addressed in the facilities plan.
- SBR has been shown in prior VA studies to be more cost effective compared to other options because of decreased number of structures and quantity of concrete.
- Keeps biological process away from storms.
- Ease of constructability because all on new site then cut over.
- Biosolids is offsite.
- Ease of expandability.
- Limited use of existing structures.
- Possible community concern with aesthetics, and blocking of the view.
- Much more construction going on new site.

3.2.3.2 Overall Score from Concept Rating System

VA Option 3 received a raw score of 537 out of 666 possible points, for a score of 80.6%. The weighted score was 80.9%. This option received the third highest rating of any of the alternatives. This is a highly rated option in terms of treatment effectiveness.

This option was rated against other alternatives, and scored well. However, a concern on the part of the VA team as to further advancement of this option is that much of the infrastructure will go on the new site, which may create community concerns, and although more constructable, the option does not make nearly as effective re-use of existing plant infrastructure compared to Options 1 and 2.



Option 3 (Non-Peak): CEPT + Ox Ditch/SBR/Conventional (New Site); Headworks at new site

Figure 3-7 – Process Diagram for Option 3 (Non-Peak Flows)

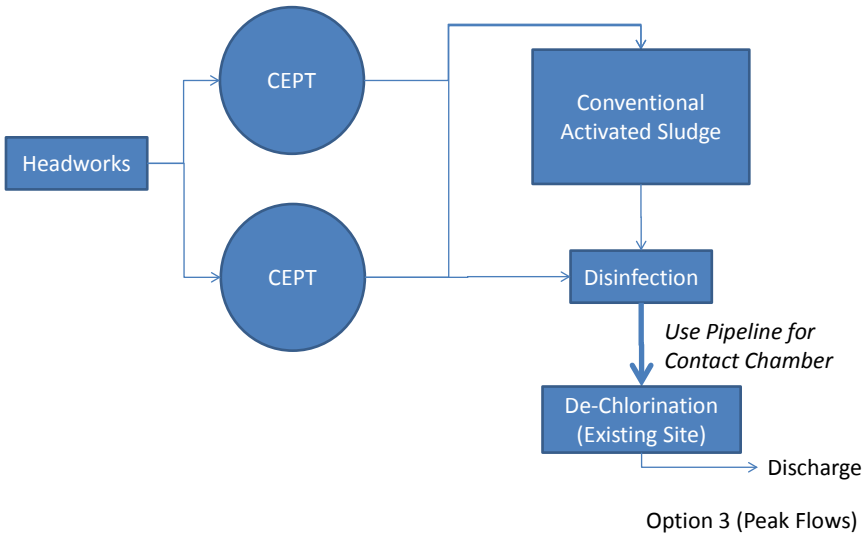


Figure 3-8 – Process Diagram for Option 3 (Peak Flows)

3.3 Moderate to Lowest Rated Options

3.3.1 Idea 4: New Headworks + Secondary Clarifier to Primary Clarifier + Conventional (Existing)

This idea is similar to Option 1 because the existing secondary clarifiers would be modified to be primary clarifiers, and existing infrastructure would be used as much as possible. The existing aeration basins would be modified with fine bubble aeration and the water level raised to increase the working volume. A new aeration/anoxic tank would be built adjacent to the aeration tank in the vicinity of the existing primary clarifier. Two new secondary clarifiers would be built where the headworks and admin building currently reside.

The primary clarifiers would be allowed to run as chemically enhanced primary treatment during peak wet weather flows that are beyond the peak capacity of the conventional activated sludge system. The portion of flow that cannot be handled by the biological system would be blended with secondary effluent, disinfected, and discharged.

New headworks would be constructed at the new parcel. The headworks would consist of the following:

- Coarse screens
- Influent pumping
- Fine screens (2 mm)
- Grit removal

The screened/de-gritted influent would flow by gravity to the new primary clarifiers at the existing treatment plant site.

Odor control would be included at the new parcel to contain odors from influent sewer, screenings, and grit.

The digesters could be used for solids storage and thickening. Solids would be hauled to plant No. 1 for digestion.

A new admin building would be built either on the existing site (potentially between the existing digesters that would be used for solids storage) or at the new parcel.

Additional chlorine contact capacity can be provided between the new secondary clarifiers and the existing contact chamber.

3.3.1.1 Initial Screening Comments from VA Team for VA Idea 4

Yellow Rating (moderate score by VA team in the initial screening of alternatives)

- Places all infrastructure on the existing site, except headworks.
- Build new secondary clarifiers where admin building and headworks are now. See site plan.
- Could create constructability concern and cost increase compared to other options.
- Challenge of taking a basin offline to do this work.
- Limits future expansion potential on the existing site compared to IFAS or MBR options.

This option was not advanced for detailed rating against the criteria, because the top 3 options appear to have more merit.

3.3.2 Idea 5: New Primary Clarifier + New Biological Treatment Unit (New Site) + Upgraded Secondary Clarifier (Existing Site)

This idea constructs the primary clarifiers and conventional activated sludge process at the new parcel. It would use upgraded secondary clarifiers at the existing site.

The primary clarifiers would be allowed to run as chemically enhanced primary treatment during peak wet weather flows that are beyond the peak capacity of the conventional activated sludge system. The portion of flow that cannot be handled by the biological system would be blended with secondary effluent, disinfected, and discharged.

New headworks would be constructed at the new parcel. The headworks would consist of the following:

- Coarse screens
- Influent pumping
- Fine screens (2 mm)
- Grit removal

The screened/de-gritted influent would flow by gravity to the new primary clarifiers on the new parcel.

Odor control would be included at the new parcel to contain odors from influent sewer, screenings, and grit.

The digesters could be used for solids storage and thickening. Solids would be hauled to plant No. 1 for digestion.

This idea would require multiple pipes between the new parcel and the existing site including the following:

- Activated sludge line to secondary clarifiers
- RAS from the secondary clarifiers to the activated sludge basin
- Primary sludge from the primary clarifiers to the sludge storage (existing digesters)
- Plant effluent from the chlorine contact chamber to the headworks for wash water

The existing primary clarifier can be modified to provide additional chlorine contact required.

3.3.2.1 Initial Screening Comments from VA Team for VA Idea 5

Red Rating (low score by VA team in the initial screening of alternatives)

- Key disadvantage is RAS has to come to new site.
- Extensive piping must extend back and forth between sites.
- A lot of back and forth piping under the creek.
- Keeps biological process away from potential storms and tsunamis.

This option was not advanced for detailed rating against the criteria, because the top 3 options appear to have more merit.

3.3.3 Idea 6: New Primary Clarifiers + MBR (New Site)

This idea constructs the primary clarifiers and MBR process at the new parcel.

The primary clarifiers would be allowed to run as chemically enhanced primary treatment during peak wet weather flows that are beyond the peak capacity of the MBR. The portion of flow that cannot be handled by the MBR would be blended with MBR permeate, disinfected, then discharged.

New headworks would be constructed at the new parcel. The headworks would consist of the following:

- Coarse screens
- Influent pumping
- Fine screens (2 mm)
- Grit removal

The screened/de-gritted influent would flow by gravity to the new primary clarifiers on the new parcel.

Odor control would be included at the new parcel to contain odors from influent sewer, screenings, and grit.

The digesters could be used for solids storage and thickening. Solids would be hauled to plant No. 1 for digestion. This would require a separate WAS line to the existing plant. A new solids storage facility could be phased in at the new site and utilize the odor control system.

The new effluent line could be used for chlorine contact. De-chlorination would be maintained at the existing site.

3.3.3.1 Initial Screening Comments from VA Team for VA Idea 6

Yellow Rating (moderate score by VA team in the initial screening of alternatives)

- Concern about cost effectiveness compared to Option 1, but more cost effective than current proposal of MBR with large equalization basin.
- Keeps biological process away from potential storms and tsunamis.
- Better effluent quality.
- Community selling point because minimizes shutting down shell fish industry and impacts to marine environment.
- Greater flexibility for meeting future regulatory requirements.
- Sets up well for next phase involving tertiary treatment.
- Reduction of chemicals.
- Re-use opportunities.

This option was not advanced for detailed rating against the criteria, because the top 3 options appear to have more merit.

3.3.4 Idea 7: New Primary and Secondary Clarifiers + IFAS (New Site)

This idea is similar to idea No. 6 because the IFAS system and associated secondary clarifiers would be constructed at the new parcel. It would use upgraded secondary clarifiers at the existing site. A similar concept to that proposed in Option 2 could be used to address the peak wet weather conditions.

New headworks would be constructed at the new parcel. The headworks would consist of the following:

- Coarse screens
- Influent pumping

- Fine screens (2 mm)
- Grit removal

The screened/de-gritted influent would flow by gravity to the new primary clarifiers at the new parcel.

Odor control would be included at the new parcel to contain odors from influent sewer, screenings, and grit.

The digesters could be used for solids storage and thickening. Solids would be hauled to plant No. 1 for digestion. This would require a separate WAS line to the existing plant. A new solids storage facility could be phased in at the new site and utilize the odor control system.

The new effluent line could be used for chlorine contact. De-chlorination would be maintained at the existing site.

3.3.4.1 Initial Screening Comments from VA Team for VA Idea 7

Yellow Rating (moderate score by VA team in the initial screening of alternatives)

- Same benefits as Options 2 and 6.
- Ease of constructability. Improvement over vendor proposal which just used Actiflo™ for peak flows.
- Reduced system size given use of primary clarifiers.

This option was not advanced for detailed rating against the criteria, because the top 3 options appear to have more merit.

3.3.5 Idea 8: Trickling Filter/Solids Contact (New Site)

This concept would construct primary clarifiers, trickling filter/solids contact, and secondary clarifiers at the new parcel. The secondary process would be sized for the maximum month dry weather flow.

The primary clarifiers would be allowed to run as chemically enhanced primary treatment during peak wet weather flows that are beyond the peak capacity of the secondary process. The portion of flow that cannot be handled by the secondary process would be blended with secondary effluent, disinfected, and discharged.

New headworks would be constructed at the new parcel. The headworks would consist of the following:

- Coarse screens
- Influent pumping
- Fine screens (2 mm)
- Grit removal

The screened/de-gritted influent would flow by gravity to the new primary clarifiers at the new parcel.

Odor control would be included at the new parcel to contain odors from influent sewer, screenings, and grit.

The digesters could be used for solids storage and thickening. Solids would be hauled to plant No. 1 for digestion. This would require a separate WAS line to the existing plant. A new solids storage facility could be phased in at the new site and utilize the odor control system.

The new effluent line could be used for chlorine contact. De-chlorination would be maintained at the existing site.

3.3.5.1 Initial Screening Comments from VA Team for VA Idea 8

Red Rating (low score by VA team in the initial screening of alternatives)

- Compared to other alternatives, would be a challenge meeting ammonia limits on a consistent basis.
- Provides a robust secondary treatment system.
- Limited potential for future expansion.
- Community concern on new site with a 25 foot tall tower.
- Creates odor potential on new site.

This option was not advanced for detailed rating against the criteria, because the top 3 options appear to have more merit.

3.3.6 Idea 9: Secondary Clarifiers to Primary Clarifiers + New Secondary Clarifiers + Digesters to Trickling Filter (Existing) + Solids Storage (New Site)

This idea is very similar to Idea 8 but maximizes the use of existing facilities. The existing secondary clarifiers would be modified to new primary clarifiers. The existing aeration basins would provide solids contact. The existing digesters would be converted to trickling filters.

New headworks would be constructed at the new parcel. The headworks would consist of the following:

- Coarse screens
- Influent pumping
- Fine screens (2 mm)
- Grit removal

The screened/de-gritted influent would flow by gravity to the converted primary clarifiers at the existing site.

Odor control would be included at the new parcel to contain odors from influent sewer, screenings, and grit.

Solids storage would be moved to the new parcel.

The existing primary clarifier would be modified to provide additional chlorine contact.

3.3.6.1 Initial Screening Comments from VA Team for VA Idea 9

Red Rating (low score by VA team in the initial screening of alternatives)

- Uses existing infrastructure.
- Challenges with constructability; critical sequencing.
- Could have an enclosed process on the new site.

This option was not advanced for detailed rating against the criteria, because the top 3 options appear to have more merit.

3.3.7 Idea 10: New Secondary (New Site) + Secondary Clarifier to Peak Wet Weather Treatment (Existing)

This concept would construct a new treatment facility (with appropriate ammonia removal) at the new parcel. The new facility would be sized for maximum month dry weather flow. One of the existing secondary clarifiers at the existing site would be retrofitted to provide peak wet weather flow treatment on an as needed basis. This could be done use CEPT or Actiflo™-type treatment.

New headworks would be constructed at the new parcel. The headworks would consist of the following:

- Coarse screens
- Influent pumping
- Fine screens (2 mm)
- Grit removal

The screened/de-gritted influent would flow by gravity to the new primary clarifiers at the new parcel.

Odor control would be included at the new parcel to contain odors from influent sewer, screenings, and grit.

The digesters could be used for solids storage and thickening. Solids would be hauled to plant No. 1 for digestion. This would require a separate WAS line to the existing plant. A new solids storage facility could be phased in at the new site and utilize the odor control system.

Chlorination and dechlorination would be maintained at the existing site.

3.3.7.1 Initial Screening Comments from VA Team for VA Idea 10

Yellow Rating (moderate score by VA team in the initial screening of alternatives)

- Uses existing infrastructure.
- Minimizes size of biological treatment.
- Less visibly intrusive.
- Less odor potential than option 1 above.
- Less intrusive compared to option 1 above.
- Disadvantage: Would have a facility that is infrequently used and would have to be cleaned out after each use.

This option was not advanced for detailed rating against the criteria, because the top 3 options appear to have more merit.

3.3.8 Idea 11: Ox Ditch (New) + Upgrade Secondary Clarifier (Existing) + Primary Clarifier to Chlorine Contact Chamber

The oxidation ditch would be sized to handle the peak hour flow. The existing secondary clarifier would be upgraded to accommodate activated sludge from the oxidation ditch.

New headworks would be constructed at the new parcel. The headworks would consist of the following:

- Coarse screens
- Influent pumping
- Fine screens (2 mm)
- Grit removal

The screened/de-gritted influent would flow by gravity to the new oxidation ditch at the new parcel.

Odor control would be included at the new parcel to contain odors from influent sewer, screenings, and grit.

The digesters could be used for solids storage and thickening. Solids would be hauled to plant No. 1 for digestion.

The existing primary clarifier would be modified to provide additional chlorine contact.

3.3.8.1 Initial Screening Comments from VA Team for VA Idea 11

Red Rating (low score by VA team in the initial screening of alternatives)

- Use primary clarifiers at old site. Runs piping back and forth between sites.

This option was not advanced for detailed rating against the criteria, because the top 3 options appear to have more merit.

3.3.9 Idea 12: Ox Ditch (New) + New Secondary Clarifier + New Pipeline as Chlorine Contact

A new oxidation ditch would be sized to handle the peak hour flow and sited at the new parcel. New secondary clarifiers would be built at the new parcel to accommodate activated sludge from the oxidation ditch.

New headworks would be constructed at the new parcel. The headworks would consist of the following:

- Coarse screens
- Influent pumping
- Fine screens (2 mm)
- Grit removal

The screened/de-gritted influent would flow by gravity to the new oxidation ditch at the new parcel.

Odor control would be included at the new parcel to contain odors from influent sewer, screenings, and grit.

The digesters could be used for solids storage and thickening. Solids would be hauled to plant No. 1 for digestion. This would require a separate WAS line to the existing plant. A new solids storage facility could be phased in at the new site and utilize the odor control system.

New chlorination facilities would be built at the new parcel. The effluent line from the chlorination facility to the existing facility would be used for chlorine contact. De-chlorination would be maintained at the existing site.

3.3.9.1 Initial Screening Comments from VA Team for VA Idea 12

Yellow Rating (moderate score by VA team in the initial screening of alternatives)

- Use effluent line as part of contact for chlorination.

This option was not advanced for detailed rating against the criteria, because the top 3 options appear to have more merit.

3.3.10 Idea 13: New Sequencing Batch Reactor + New Pipeline as Chlorine Contact

A new SBR would be constructed at the new parcel. It would be designed to handle the peak hour flow.

New headworks would be constructed at the new parcel. The headworks would consist of the following:

- Coarse screens
- Influent pumping
- Fine screens (2 mm)
- Grit removal

The screened/de-gritted influent would flow by gravity to the new SBR at the new parcel.

Odor control would be included at the new parcel to contain odors from influent sewer, screenings, and grit.

The digesters could be used for solids storage and thickening. Solids would be hauled to plant No. 1 for digestion. This would require a separate WAS line to the existing plant. A new solids storage facility could be phased in at the new site and utilize the odor control system.

New chlorination facilities would be built at the new parcel. The effluent line from the chlorination facility to the existing facility would be used for chlorine contact. De-chlorination would be maintained at the existing site.

3.3.10.1 Initial Screening Comments from VA Team for VA Idea 13

Yellow Rating (moderate score by VA team in the initial screening of alternatives)

- Use effluent line as part of contact for chlorination.
- Closest to baseline alternative from Facility Plan Amendment.

This option was not advanced for detailed rating against the criteria, because the top 3 options appear to have more merit.

3.3.11 Idea 14: New WWTP at North Spit

3.3.11.1 Initial Screening Comments from VA Team for VA Idea 14

This idea would require a pipeline to be directionally drilled under the bay to the North Spit. Wastewater would be pumped from the existing WWTP No.2 to the plant site at the North Spit. A new plant would be built on property owned by the Port and currently operated as a small wastewater treatment facility. The Port has a discharge permit to the ocean for the plant's outfall. The idea sounds attractive on a conceptual level, because it would shift the treatment of wastewater to a less populated area.

Red Rating (low score by VA team in the initial screening of alternatives)

- Permitting concern, at least 2.5 to 3 years to go through the USACE 404 Permit.

- There is no apparent permitting advantage to discharging to the ocean versus the bay.
- Consider primary and/or secondary treatment.
- Pipeline would be directional drilled under the bay.
- Use existing outfall from the Port.
- Port may have access to other grants.
- Environmental and geotechnical risk.
- Schedule risk.
- Consider for a future phase.

Even though this idea received a negative rating during the VA team's initial screening, it was advanced for detailed rating against the criteria for purposes of assisting the City with further discussions with the Port concerning this idea.

SECTION 4

VA Observations

4.1 Team 1 - Wastewater Process Observations

4.1.1 Consider Lack of Bioreactor Inventory for Peak Flow Treatment

Treat peak wet-weather flows but don't size plant for the highest experienced flow, either for the three base VA Options or for any new alternative. The bioreactor inventory (biomass) cannot be increased in that short a period to provide treatment for these peak wet-weather conditions.

4.1.2 Consider a Peak Wet-Weather Treatment plus MBR Option at Existing Site

Maximize footprint of existing site and maximize use of existing plant's infrastructure. This plan is detailed in VA Option 1. Turn the existing secondary clarifiers into primary clarifiers. Primaries are a simple straightforward way of reducing load, and capturing energy. Utilize one for chemically enhanced primary treatment (CEPT), which would be used only during peak wet-weather events. Another benefit with the MBR is that the membrane is a pathogen barrier, reducing the associated disinfection (chlorine) requirement. No particles leave the membrane tank, so effectiveness of disinfection increases significantly. This blended treatment approach meets the criteria for secondary treatment surrounding Option 1. Operators can turn on or off the chemically enhanced treatment as needed.

Basic discussion points for Option 1:

- Uses existing basins.
- Use denitrification in existing basins.
- Would have to do this in phases, to keep existing plant on line.
- Would have to do aerobic in sections.
- Clarifiers as primaries have ample capacity even at 8 mgd.
- Rework headworks.
- Noted that one of the secondary clarifiers is not being used now.
- Review primaries with MBR with ability to chemically enhance during high flows.

4.1.3 Consider an IFAS Option Retrofitted into the Existing Site

Consider an IFAS option on the existing site, which can provide for efficient ammonia removal because the nitrification process can be accomplished by the fixed-film organisms. This allows for the nitrification process to be disconnected from the suspended-growth environment. As a result, the solids residence time (SRT) within the reactor is significantly reduced while still meeting the required treatment performance. An approach to address the peak wet-weather flows must be incorporated to minimize the hydraulic impacts to the IFAS system. Additional process capacity is possible with IFAS systems, as the same level of treatment can be accomplished with a reduced suspended-growth SRT. The ammonia limit of 20 mg-N/L is seasonal, from May to October. The system can be designed to optimize the ammonia removal for this seasonal condition (use appropriate wastewater temperature, etc.). IFAS treatment systems have traditionally been used on tight sites, where minimal expansion space is available for a conventional activated sludge (CAS) system. A number of plants that meet wet weather conditions incorporate an IFAS system, so designs are available to address this concern. A benefit with IFAS is that from a capacity standpoint the City can add media over time as the city population grows, increasing the associated process capacity in the system.

4.1.4 Consider the Longevity of Membrane Bioreactors

For the MBR Option, life of membrane is about 10 years. For Integrated Fixed-film Activated Sludge (IFAS) (also known as Moving Bed Biofilm Reactor (MBBR)), in Europe, they've been in operation for decades with no

replacement of plastic biofilm carriers required. For an MBR there is still a need to have the nitrification solids residence time required for a suspended-growth environment, as this is still temperature dependent.

4.1.5 Additional Process Treatment Considerations

- Moderate regulatory risk is added with multiple split treatment options, which means blending primaries with secondaries. Consider expanding secondary capacity without chemical addition.
- Need to address alkalinity. With denitrification there can be a drop of the pH. Equipment vendors have made some incorrect assumptions.
- Consider step feed activated sludge, but this appears to have site constraints at the existing WWTP No. 2 site. It is a good way to achieve nitrification at some plants.
- Alternative to an existing option: basin SBR option. Eliminates EQ basin on the back side.
- Tertiary nitrification alternatives. Consider Tertiary MBR. Leave rest of plant as is. There are some examples on the east coast. Tertiary MBR alternative, or tertiary MBBR alternative. Would only need to use this during the summer to meet the ammonia requirements. This alternative was not evaluated further in the VA study, but it may be worth considering as a cost-effective treatment alternative.
- Oxidation ditch has one secondary clarifier. New site would have headworks and an oxidation ditch. Rehab existing secondary clarifiers versus building a new clarifier. Design comment: two secondary clarifiers are recommended to provide a level of redundancy in the facility. This approach works well at the plant in Ashland, OR.
- Note this plant is sized for only 1.49 mgd, which is a concern for handling peak wet weather flows in its current form.

4.1.6 Review Design Criteria that this WWTP Must Meet

Firmly establish the specific design criteria that this plant needs to be designed to meet.

Review sizing of main stream for the dual treatment option and what loads to accommodate. Note that seasonal effluent criteria for ammonia (May 1 to Oct. 31, with the design condition being in May) – the use of a wastewater temperature more reflective of this condition is recommended for consideration (the 10° C used in the study appears to be lower than any measured temperature at the WWTP throughout the year). Protection of shellfish with respect to the disinfection required at the WWTP may be a primary design criterion. This should be included along with the requirement for meeting ammonia limitations. Verify wastewater temperatures used in the design evaluation.

4.1.7 Review Wastewater Temperature for the Seasonal Ammonia Limit

A review of wastewater temperatures indicates that 10° C is lower than any recorded value. A temperature that aligns with the seasonal effluent ammonia limit may be more appropriate. The VA team noted that the low temperature in May for the past few years appears to be approximately 13° C. A higher wastewater temperature will allow for a reduction in bioreactor size to provide the appropriate level of nitrification, and an associated safety factor on the minimum SRT required for nitrification.

4.2 Team 2 – Regulatory Observations

4.2.1 Considerations Regarding the Regulatory Climate for Blending Treatment Options

Current EPA regulations require all wastewater to have secondary treatment (or equivalent) at all times. However, EPA also recognizes that this is not practical in all cases. In December 2005, EPA proposed a wet weather (AKA “blending”) policy which provides guidance to agencies (e.g. DEQ) for determining when to allow peak wet weather flow diversions around secondary treatment. This policy was not adopted, but postponed for further

consideration. EPA has recently stated that finalizing the wet weather policy is one of their top priorities for the NPDES program. In general, EPA views blending as an interim measure while work is being done to the collection system to reduce infiltration and inflow (I/I). Ultimately, EPA expects that peak wet weather flow diversions will be eliminated through a combination of enhancing storage and treatment capacity, I/I reductions. EPA promoted measures to provide the highest possible treatment to the greatest possible peak wet weather flow using a combination of the following approaches:

- Ensuring full utilization of available secondary treatment capacity;
- Reducing infiltration and inflow (I/I);
- Maximizing the use of the collection system for storage;
- Providing off-line storage;
- Providing sufficient secondary treatment capacity.

EPA expects that the secondary treatment process will be fully used and that only flows in excess of this capacity will be diverted. EPA also expects that all diverted flows would receive at least primary treatment and the blended flow must meet secondary treatment requirements.

Oregon DEQ has approved treatment systems in Salem, Eugene-Springfield, and Lebanon that provide for peak flow diversions, provided that there is a high likelihood that the blended flow will meet secondary effluent quality. In some cases, these systems do not meet the requirements of EPA's proposed wet weather policy. DEQ does not expect to change approval criteria until the EPA policy is finalized. Therefore, while the City may consider peak wet weather diversion options that do not meet EPA's policy, there is a risk that additional measures may be needed in the future. Additionally, there is a risk that EPA may not finalize the proposed policy and instead require secondary treatment of all flows.

Therefore, the VA team recommends that Civil West consider any peak wet weather diversion alternatives within the structure of regulatory risk. Alternatives should be rated and considered on that basis.

CATEGORY 1: No Risk

No Risk Alternatives for Peak Wet Weather Flow treatment include:

- Storage (both in-line and Off-line): Storage options would reduce peak wet weather flows and have no regulatory risk.
- Provide hydraulic capacity in the secondary treatment units for peak flow. EPA does not expect full biological treatment during peak flow events. Instead, EPA only expects that treatment units are hydraulically capable of handing the flow. Therefore, options such as increasing the freeboard of secondary units would meet secondary treatment requirements during peak wet weather flows.
- EPA has procedures to approve treatment systems as "equivalent to secondary". These systems meet EPA's definition of secondary treatment and represent no regulatory risk. The City of Salem's Ballasted Sedimentation system has been approved as equivalent to secondary. Each system must be approved separately and meet the conditions of 40 CFR 133.105. (See attached)

CATEGORY 2: Eligible for Equivalent to Secondary treatment:

This category includes options that may meet EPA's definition of equivalent to secondary, but have not received formal approval. The VA team identified only two of these options:

- Stormblox: This is a high rate membrane system that would be put into service only during peak wet weather flow diversions. The expected effluent quality is less than 1 mg/L TSS. With an activated carbon filter, it would easily meet secondary effluent quality.
- Ballasted Sedimentation with magnetic media: This is new technology that reduces the foot print of a ballasted sedimentation system. While similar to the Actiflo™ system, it has not received EPA approval as equivalent to secondary.

CATEGORY 3: Options that Meet EPA's Proposed Peak Wet Weather Policy

As mentioned above, options that meet the requirements of EPA's proposed peak wet weather policy have regulatory risk, but lower risk than options that do not meet the policy. These options include the following:

- Chemically Enhanced Primary Treatment (CEPT): King County uses CEPT at their Brightwater treatment plant when flows exceed the MBR capacity. Prior to receiving the final NPDES permit, Washington Department of Ecology received comments on the draft permit. In response, King County prepared a Utility Assessment which demonstrated the net environmental benefit of the CEPT and MBR system. This net environmental benefit proved that the combination of the CEPT and MBR had effluent quality superior to a conventional secondary plant. EPA did not object to issuance of the permit with the revisions made. This would also apply to the Coos Bay Plant No. 2 CEPT proposal. A similar Utility Assessment may be needed.
- Primary Clarification (non-chemically enhanced). While this could meet the Peak Wet Weather Policy, it may not be allowed because of the requirement for "a minimum of primary treatment and any feasible supplemental treatment". Since chemical addition is feasible, CEPT may be considered a required feasible supplemental treatment.
- Salsnes Filter: This is a belt filter that is used extensively in Sweden as a primary treatment. The VA team is unsure of any installations in the US. However, pilot studies indicate that this system will meet primary treatment. The City of Klamath Falls will be doing a pilot study in November. This would be a somewhat higher regulatory risk because EPA has not provided comment on a Salsnes filtration system. Additionally, while some pilot studies show that Salsnes filters meet the definition of equivalent to primary, this would have to be proven on a case-by-case basis.

CATEGORY 4: Options that do not meet EPA's Proposed Peak Wet Weather Policy

Category 4 solutions have the highest regulatory risk. Peak wet weather diversion approaches that DEQ has approved, but would not meet EPA's proposed policy include:

- Install a fine screen at the headworks and divert from the headworks to the disinfection system during peak flows. The Cities of Lebanon and Toledo do this. To allow this, DEQ required the Cities to submit an engineering document showing that the effluent quality will be met (BOD/TSS = 30/30).
- Alternates would include a microscreen after the headworks to make it more acceptable, however, would not meet EPA's policy as proposed.
- Coos Bay WWTP No. 1 diverts from the headwork to the disinfection system during peak flows, but with a coarse screen. This system will need to be upgraded to a minimum of a fine screen in the future.

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 TITLE 40--PROTECTION OF ENVIRONMENT

  CHAPTER I--ENVIRONMENTAL PROTECTION AGENCY (CONTINUED)

PART 133_SECONDARY TREATMENT REGULATION--Table of Contents

Sec. 133.105 Treatment equivalent to secondary treatment.

  This section describes the minimum level of effluent quality
attainable by facilities eligible for treatment equivalent to secondary
treatment (Sec. 133.101(g)) in terms of the parameters--
BOD5, SS and pH. All requirements for the specified
parameters in paragraphs (a), (b) and (c) of this section shall be
achieved except as provided for in Sec. 133.103, or paragraphs (d), (e)
or (f) of this section.
  (a) BOD5. (1) The 30-day average shall not exceed 45 mg/l.
  (2) The 7-day average shall not exceed 65 mg/l.
  (3) The 30-day average percent removal shall not be less than 65
percent.
  (b) SS. Except where SS values have been adjusted in accordance with
Sec. 133.103(c):
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(1) The 30-day average shall not exceed 45 mg/l.
(2) The 7-day average shall not exceed 65 mg/l.
(3) The 30-day average percent removal shall not be less than 65 percent.
(c) pH. The requirements of Sec. 133.102(c) shall be met.
(d) Alternative State requirements. Except as limited by paragraph (f) of this section, and after notice and opportunity for public comment, the Regional Administrator, or, if appropriate, State Director subject to EPA approval, is authorized to adjust the minimum levels of effluent quality set forth in paragraphs (a)(1), (a)(2), (b)(1) and (b)(2) of this section for trickling filter facilities and in paragraphs (a)(1) and (a)(2) of this section for waste stabilization pond facilities, to conform to the BOD5 and SS effluent concentrations consistently achievable through proper operation and maintenance (Sec. 133.101(f)) by the median (50th percentile) facility in a representative sample of facilities within a State or appropriate contiguous geographical area that meet the definition of facilities eligible for treatment equivalent to secondary treatment (Sec.133.101(g)).
(e) CBOD5 limitations:
(1) Where data are available to establish CBOD5 limitations for a treatment works subject to this section, the NPDES permitting authority may substitute the parameter CBOD5 for the parameter BOD5 In Sec. Sec. 133.105(a)(1), 133.105(a)(2)and 133.105(a)(3), on a case-by-case basis provided that the levels of CBOD5 effluent quality are not less stringent than the following:
(i) The 30-day average shall not exceed 40 mg/l.
(ii) The 7-days average shall not exceed 60 mg/l.
(iii) The 30-day average percent removal shall not be less than 65 percent.
(2) Where data are available, the parameter CBOD5 may be used for effluent quality limitations established under paragraph (d) of this section. Where concurrent BOD effluent data are available, they must be submitted with the CBOD data as a part of the approval process outlined in paragraph (d) of this section.
(f) Permit adjustments. Any permit adjustment made pursuant to this part may not be any less stringent than the limitations required pursuant to Sec. 133.105(a)-(e). Furthermore, permitting authorities shall require more stringent limitations when adjusting permits if:
(1) For existing facilities the permitting authority determines that the 30-day average and 7-day average BOD5 and SS effluent values that could be achievable through proper operation and maintenance of the treatment works, based on an analysis of the past performance of the treatment works, would enable the treatment works to achieve more
stringent limitations, or
(2) For new facilities, the permitting authority determines that the 30-day average and 7-day average BOD5 and SS effluent values that could be achievable through proper operation and maintenance of the treatment works, considering the design capability of the treatment process and geographical and climatic conditions, would enable the treatment works to achieve more stringent limitations.

[49 FR 37006, Sept. 20, 1984; 49 FR 40405, Oct. 16, 1984

4.2.2 Consider Treatment Effectiveness

With the large differences between maximum month flow and the peak hour conditions, a peaking factor in excess of 4, the treatment effectiveness can be compromised. Discuss optimal solution. Winter peak flows occur when ammonia is of much less concern.

Biological treatment systems operate best at their design conditions. A plant that is designed for 1 mgd will operate poorly during 8 mgd flows. Conversely, a plant that is designed for 8 mgd will operate poorly during 1 mgd flows. Therefore, the VA team recommends for Coos Bay WWTP No. 2 that the system be designed to treat the flows that are received most of the time, and make provisions to manage the infrequent peak high flows as discussed above.

4.2.3 Consider Wet Weather Treatment Alternatives within the Structure of Regulatory Risk

Consider wet weather treatment alternatives within the structure of regulatory risk. Start with the ideas that have no regulatory risk. Consider pure ballasted sedimentation (Actiflo™). This is a compact treatment system. Salem uses it. Represents low regulatory risk. Any treatment unit equivalent to primary, such as Salsnes Filter or Stormblocks, are in the low risk category. Klamath Falls is currently planning for a pilot study in the first 2 weeks in November, utilizing a Salsnes Filter.

4.3 Team 3 – Project Delivery and Operations Observations

4.3.1 Address Condition of Catwalks and Plant's General Infrastructure if Major Components will be Re-used

The catwalks and clarifier bridges are showing signs of heavy corrosion and deterioration. They will need to be addressed if any of the clarifiers are reused or modified to serve another purpose. The handrails around the primary and secondary clarifiers are becoming unsafe due to corrosion.

The primary sweeps and support columns need to be replaced because of deterioration. They were put in service in the 1970s.

In general, for any major plant components that will be re-used, such as clarifiers, the design team should be reminded to thoroughly address the ancillary components of the plant that need to be refurbished or replaced.

4.3.2 Address Influent Line Replacement

The condition of the influent line is poor and needs to be replaced with a larger pipe. Because it is assumed the pump station is going to be placed on the new property on Fulton and Empire Blvd., all flow into the plant will have to be through a pressure line. Consider the possibility of extending this line further under the Arago Highway and First Creek to prevent the line from being exposed to the force of First Creek during periods of heavier creek flow. The VA team noted that the existing influent line had broken in the past and required repair.

4.3.3 Comment Regarding Grit Removal Requirements

The VA team noted that existing primaries are functioning as a grit removal mechanism. If the primary clarifier is going to be demolished, then a better grit removal system will have to be put in place with a way to handle a larger volume of grit.

4.3.4 Address Condition of Aging Digester

There are cracks in the top of the digester's concrete lid that allows methane gas to be released into the environment. There is also a concern for the safety of the operators and maintenance staff while on top of the digester. Daily access is needed for level measurement and maintenance to the equipment on top of the digester, such as mixer motor, flame arrestor, and access to allow cleaning of the digester.

The windows frames of the digester building have deteriorated to the point that they need to be replaced before the windows fall out.

The design team is requested to address how the storage of biosolids would be accomplished at WWTP No. 2 until transport to Plant 1.

Please confirm if the data from Plant 1 digester operation, including operations and maintenance costs, and capacity, have been examined to prove that treating the solids from Plant No. 2 at Plant No. 1 is a viable solution to solids reduction.

4.3.5 Comments Regarding Disinfection and Consideration of Ultraviolet (UV) instead of Chemical Treatment

Review regulations and any anticipated adjustments for UV versus chemical disinfection. UV is a power consumer, which is a greenhouse gas concern.

Review effluent temperature requirements. Both UV and pasteurization can heat up the effluent.

Consider UV for average dry weather flow, then subsequent chemical disinfection for peak flow. If considered, would have to have a chlorine limit on the permit.

Consider wind, rain, lightning and the need for a building to house the UV process. There are salt air concerns leading to a corrosive condition of the equipment. Plant staff will need a safe environment to work on UV bulbs, such as a covered structure or within an enclosed building.

4.3.6 Consider the Need for Battery Backup

Consider the need for battery backup for the UV disinfection system. Plant staff report that there are frequent power bumps at this plant. While there is standby power, there is a momentary loss of power and the unit has to restart.

4.3.7 Address Current Difficulty in Sampling

Current sampling is difficult because tides back up into the outfall and manhole where the sodium bisulfite sample must be taken. During high tides sampling is not viable. The dozox analyzer has to be operated in manual mode and thus does not optimize the amount of chemical needed and used. Plant staff currently over-feed sodium bisulfite to assure they have removed all chlorine before leaving the plant to remain in compliance with regulatory requirements.

4.3.8 Consider Locating the Headworks Upstream of the Pump Station

The existing pumps rag up because there is no rag and debris removal before the current screening. Influent pumps always have to run at a higher speed due to rags and grit sinking into the pump at lower speeds. This decreases the time between pump cycles because it can't follow the incoming flow. The design team is requested to address this concern in the new design. Consider a grinder, or a coarse screen. Consider a channel monster or muffin monster, and ability to clean out.

4.4 Team 4 - General Observations

4.4.1 Comments Regarding the North Spit Alternative.

An existing unused under-the-bay effluent conveyance line leaves Coos Bay (10" inch HDPE pipe) in the vicinity of the Hollering Place (Virginia Ave and Cape Arago HWY). The existing line is too small to convey all flows from WWTP No. 2 service area to the North Spit. A new under the bay effluent conveyance line of perhaps 36 inches would need to be directional drilled to the North Spit to convey the flows to the North Spit. From "landfall" location on the North Spit, the effluent line would have to be extended several thousand feet to either the ocean outfall or treatment location. Pump station(s) of unknown size would need to be constructed to "push" effluent under the Bay and from "landfall" location to outfall/treatment location. Construction cost estimate for conveyance system is expected to be $6 million to $10 million. Ongoing transmission costs, while not calculated, are expected to be quite high.

One idea is to convey secondary treated low flows to the North Spit ocean outfall and high flows to the city's existing bay outfall. Effort to provide conveyance to the North Spit for lower flows (approx 2.07 mgd) would require smaller diameter conveyance line. Cost may not be significantly less than for 36 inches.

For the North Spit option to be cost effective, the North Spit likely would have to provide secondary treatment rather than just an ocean outfall. What entity would operate wastewater facilities on the North Spit is unknown at this time. The time taken to determine and or create the entity could be several years, thus compromising the

City's MAO schedule. Permitting the under the bay conveyance system along with the secondary treatment process through the U.S. Army Corps of Engineers, Oregon Department of State Lands and other permitting agencies is expected to take 2-½ to 3 years.

Additionally, the North Spit option will rely on the existing lagoon for secondary treatment. Based on information received from DEQ, there is a potential that this type of treatment may not meet future permit effluent requirements.

In conclusion while this option has merit, and may be an option to be explored more extensively at the next scheduled plant upgrade (approximately 20 years), at this time due to regulatory scheduling timeframes, transmission costs, and limited treatment capabilities of the lagoon this is not a viable alternative.

4.4.2 Consider the Need for Collection System Upgrades

A preliminary schedule has been created that outlines the City of Coos Bay wastewater system capital improvements over the next 20 years. The schedule is based on information gathered through the development of Facilities Plans for the wastewater treatment plants and the collection system. These plans identify those portions of the system that are in need of upgrade, repair, and replacement. The improvements include both plant upgrades, pump stations, and numerous collection projects. Total 20-year costs are expected to be $80 million. Of that total, approximately $40 million are for repair to the collection system including pump stations.

An Inflow and Infiltration (I/I) program has also been established to monitor the effectiveness of the projects constructed per the collection system 20 year facility plan. The City has performed smoke testing and flow monitoring, and submitted an I/I report to DEQ. These actions have established a baseline for the city. We expect efforts to complete the projects identified in the I/I report will reduce peak flows, and that these effects will be identified by future planned monitoring.

Appendix A

Agenda for Value Assessment Study at Facilities Plan Amendment Phase

VA Study Overview Presentation by CH2M HILL, October 24, 2011

VA Study Out-Brief Presentation by CH2M HILL, October 26, 2011

Agenda for Value Assessment Study at Facilities Plan Amendment Phase

Wastewater Treatment Plant #2
Coos Bay, OR

Study Dates: Monday, October 24 through Wednesday morning, October 26, 2011

Location, Schedule

Day 1: Monday, Oct. 24, 8:00 a.m. through 1:00 p.m.

- **Orientation Meeting - City of Coos Bay Public Works,** 500 Central Ave., Coos Bay, OR, 97420
- **Tour of WWTP #2.** Cape Arago Highway, near Fulton Ave.

Day 1: Monday, Oct. 24, 2:00 p.m. to 5:00 p.m.

- **Workshop - City of Coos Bay Public Works,** 500 Central Ave., Coos Bay, OR, 97420

Day 2: Tuesday, Oct. 25, 7:45 a.m. to 5:00 p.m.

- **Workshop - City of Coos Bay Public Works,** 500 Central Ave., Coos Bay, OR, 97420

Day 3: Wednesday, Oct. 26, 7:45 a.m. to 12:00 p.m.

- **Workshop - City of Coos Bay Library – Myrtlewood Room,** 525 Anderson Ave., Coos Bay, OR, 97420

VA Team Members

Team Member	Organization	Home Office	Role
Paul Johnson	CH2M HILL	Boise, ID	Certified Value Specialist and VA Study Leader
Doug Berschauer	CH2M HILL	Phoenix, AZ	Senior Process Engineer
Bill Leaf	CH2M HILL	Boise, ID	Lead Process Engineer and CPES Estimating
Patrick Kavan	CH2M HILL	Coos Bay, OR	Wastewater Operations WWTP 2 Plant Manager
Mike McDaniel	CH2M HILL	Coos Bay, OR	Wastewater Operations WWTP 1 Plant Manager
Jennifer Wirsing	City of Coos Bay	Coos Bay, OR	Engineering Coordinator
Jessica Spann	City of Coos Bay	Coos Bay, OR	Engineering Technician
Jim Hossley (tentative)	City of Coos Bay	Coos Bay, OR	Public Works Director
John Chirrick	Charleston Sanitation District		CSD Representative
Steve Major	The Dyer		CSD Engineer of Record

Team Member	Organization	Home Office	Role
	Partnership		
Jon Gasik	Oregon DEQ		DEQ Representative

City Engineer of Record Contacts

Name	Organization	Role/Contact
Garrett Pallo	Civil West	541-252-1220
Bill Boger	Civil West	

Detailed Agenda

Monday, October 24

Phase 1 – Information

Location: Coos Bay Public Works, and Coos Bay WWTP #2

8:00 a.m. to 8:20 a.m. **INTRODUCTIONS and OVERVIEW OF STUDY AGENDA AND VA PROCESS** - VA Team Leader

8:20 a.m. to 9:00 a.m. **CITY OF COOS BAY OVERVIEW OF THE COOS BAY WWTP #2 REQUIREMENTS**

- Project history and regulatory drivers
- Overview of existing facilities, operations, deficiencies
- Objectives of the VA Study:
  - ❖ Optimal value solutions for the project to meet wastewater capacity and treatment requirements.
  - ❖ Explore the Draft Water Reclamation Facilities Plan (by Civil West) and determine if improvements can be made to the process, flexibility and components of the wastewater treatment systems.
  - ❖ Focus on the construction access/logistics and approach to the project.
  - ❖ Other priorities in the VA study
- Design objectives
- Permitting agency requirements
- Project funding/constraints
- Scheduling requirements/commitments
- Community concerns
- Other sensitive issues
- General Comments

9:00 a.m. to 10:30 a.m. **DESIGN TEAM PRESENTATION (by Civil West)** *(Including Q/A for each topic)*

- Project background including history, and existing plant characteristics, and plant improvement requirements
- Process treatment alternatives discussed in the WRF Plan:
  - Raw Sewage Pumping
  - Screening and Grit Removal
  - Secondary Treatment
  - Disinfection
- Process treatment alternatives

- Aerial Photographs
- Record Drawings
- Treatability study approach and results from draft Facilities Plan
- Construction logistics and other considerations (for example, community, rights-of-way, utilities, other environmental factors)
- Cost estimates
- Design and implementation schedule

10:30 a.m. to 1:00 p.m. **PLANT TOUR (by Civil West, and OMI)**

Lunch Break, 1:00 to 2:00 p.m.

Phase 1 – Information (continued)
Location: City of Coos Bay Public Works

2:00 p.m. to 3:00 p.m. **QUESTIONS, ANSWERS, REVIEW OF RECORD DRAWINGS AND WRF PLAN**

3:00 p.m. to 3:45 p.m. **TEAM FOCUS QUESTIONS AND ANSWERS**

- What is the problem we are about to discuss?
- Why do we consider this a problem?
- Why do we believe a solution is necessary?
- What are the top cost drivers on this project?
- What are the top risk areas on this project?
- What are the expected outcomes from the VE study?

3:45 p.m. to 5:00 p.m. **FUNCTIONAL ANALYSIS**

- Identify significant project functions with opportunities for cost reduction or functional enhancement
- Prepare FAST Diagram (this activity may continue as an evening session, to link the functions identified above into How-Why relationships)

Tuesday, October 25

Phase 2 – Creative, and Criteria Development (for mechanical process alternatives)
Location: City of Coos Bay Public Works

7:45 a.m. to 10:00 a.m. **ESTABLISHMENT OF WASTEWATER PROCESS TREATMENT EVALUATION CRITERIA**

- Major project components: Raw Sewage Pumping, Screening and Grit Removal, Secondary Treatment, and Disinfection
- Brainstorm criteria
- Prioritize criteria

10:00 a.m. to 1:00 p.m. **BRAINSTORMING**

Working lunch from 12:00 to 12:30 p.m.

- Generate alternative plant treatment concepts
- Generate observations of existing design and treatment process
- Focus on high cost functions of project
- Review area by area
- Review discipline by discipline

Tuesday, October 25

Phase 3 – Analysis, and Ranking of Concepts (for major mechanical process alternatives)
Location: City of Coos Bay Public Works

1:00 p.m. to 2:00 p.m. **REVIEW & CREATE ALTERNATIVE TREATMENT CONCEPTS**

- Review plant treatment concepts developed to date

- Define any alternative concepts

2:00 p.m. to 3:00 p.m. **SCREENING OF ALTERNATIVE CONCEPTS**

- Key advantages and disadvantages of each concept
- Are there any fatal flaws that preclude a concept?
- Are there other concepts that should be considered?
- Pass, Fail of Alternatives
- Selection of the most promising concepts for further ranking and development

Phase 4 – Development, and Refinement of Concepts (for major mechanical process alternatives)

3:00 p.m. to 4:00 p.m. **RANKING OF ALTERNATIVE CONCEPTS**

- Rating of alternative concepts
- CPES estimating for relative cost differences
- Determine top concepts to recommend for further refinement

4:00 p.m. to 5:00 p.m. **PASS/FAIL OF ALTERNATIVE CONCEPTS**

- Discussion of advantages and disadvantages
- Pass/fail analysis
- Selection and refinement of promising treatment plant concepts
- Identify relative CPES cost differences between concepts
- Identify preferred treatment plant concepts
- List any areas for further refinement

Wednesday, October 26

Phase 4 – Development (Continued)

Location: City of Coos Bay Library – Myrtlewood Room

7:45 a.m. to 9:00 a.m. **ALTERNATIVE CONCEPT DEVELOPMENT - Continued**

- Summary write-ups
- CPES Estimates for relative cost differences
- Supporting sketches

9:00 a.m. to 10:30 a.m. **COMPLETE WRITE-UPS, AND CROSS CHECK PROPOSALS.**

PREPARE EXECUTIVE SUMMARY PRESENTATION

Phase 5 – Presentation

10:30 a.m. to 12:30 p.m. **EXECUTIVE SUMMARY PRESENTATION (OR CONFERENCE CALL) WITH CITY, DEQ, AND DESIGN TEAM**

- Summary of VA study methodology
- Preferred treatment alternatives from concept rating system
- Observations (notes to design team and City/DEQ)
- Follow-up activities
- Comments from City, DEQ, OMI
- Comments from Civil West design team

Phase 6 – Implementation

Post-Study The Implementation Phase will be subsequent to the VA Study. The City of Coos Bay, DEQ, and Civil West design team will review the proposals during the predesign phase and will advise the VA Team of acceptance, rejection, or modification of the VA proposals for incorporation into the facilities plan or conceptual design as appropriate.

Value Engineering (Value Assessment) Overview

in preparation for Value Assessment Study Wastewater Treatment Plant No. 2 Coos Bay, OR

October 24, 2011

Presented at VA Orientation Meeting, Coos Bay, OR

Paul Johnson, CVS
Doug Berschauer, P.E.
Bill Leaf, P.E.

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1

OVERVIEW

- VE History
- Why Use VE
- When to Use VE
- Concept Level vs. Mid-Design VE
- Project/Program Examples
  - Courtice Water Pollution Control Plant
  - NDOT, Boulder City Bypass
  - DOE Hanford Site
  - Seattle Federal Courthouse
- VE Methodology
  - What, How, When, and Why
- VE Focus on Coos Bay WWTP #2 at Conceptual Design

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2

Value Engineering History

- 1945 GE assigns L. D. Miles to reduce costs
- 1947-52 L. D. Miles developed and proved function techniques
- 1955 Navy adds VE Incentive Clause in contracts
- 1959 Society of American Value Engineers founded
- 1964 Corps of Engineers applies VE to construction
- 1969 NASA starts formal VE studies
- 1970 DOT uses VE Incentive Clause
- 1988 OMB issues Circular A-131
- 1991 DOE Order 4010.1
  - Replaced by DOE Order 430.1A (1998) and O 413.3 (2000)
- 1996 Public Law 104-106 (all Federal Agencies)
- 2004 DOE Policy 413.2
- SAVE – The Value Society; www.value-eng.org

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3

Value Engineering Balances Cost, Reliability, and Performance Issues

Value Engineering is a proven management technique that uses a systematic approach to identify the best functional balance between the cost, reliability and performance of a product or project to meet the owner's objectives.

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4

Why Use Value Engineering?

- Focus on essential functions not systems or procedures
- Embraces creativity and out of the box thinking
- Uses life-cycle cost analysis for decision making
- Provides an organized framework for alternative development
- Consistently achieves the desired results (from 5:1 to 50:1 ROI)

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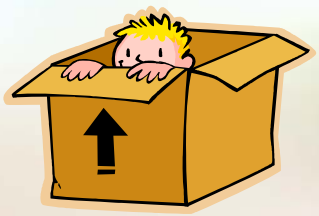
5

VE/VA is a Structured Team Approach Focused On Function(s) And Thinking Outside The Box



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6

VE Has More Than 50 Years Of World Wide Success

- Why Use VM/VE?
  - Get more for less: Judicious application of VM saves DOE **$$$** on each project
  - Enhance Function
  - Improves quality and worker safety
  - Increases productivity by streamlining processes
  - Builds team and synergy to implement change
  - Complies with Federal and State requirements
  - Exceeds customer expectations

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7

The Best Time to Use Value Engineering

- Early on in any project (i.e., pre-conceptual or earlier
- Validated cost savings are best achieved between 80% of conceptual and 20% of definitive design
- VE can also be applied during construction, and during process, operation, and maintenance cycles (typically at two year intervals)

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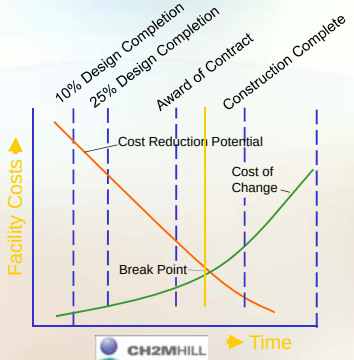
8

Opportunities for Savings in Facility Life Cycle



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9

Concept-Level VE Compared to Mid-Design VE Studies

Concept-Level VE (Value Analysis, or Value Assessment)

- Abbreviated or full study, pre-design
- Many concepts considered
- VE Team includes key project stakeholders
- Goal is to select preferred concept
- Design continues with fewer challenges
- Mid-design VE follows

Mid-Design VE

- 40-hour study at approx. 40% design
- Eng & Owner have selected a design
- VE focus is normally on cost savings
- Functional enhancement proposals possible without major change to project geometry

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10

Dilemma of Conducting Mid-Design VE Only

- **Large program with alternatives early on**
- **V = F/C**
- **VE may suggest different geometry for functional enhancement**
- **Too late or politically impossible to accept proposal for functional enhancement if significant change in design is required**

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11

Concept-Level VE Study Results

Courtice Water Pollution Control Plant (Toronto)

- **Budget validation of project during concept phase ($130 million vs. $100 million)**
- **Functional review of all major plant components**
- **Cost saving opportunities evaluated for major system alternatives**

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Concept-Level VE Study Results

Boulder City Bypass, US-93 Realignment Phase 1, NDOT

- **$170 Million highway realignment and interchange**
- **Multi-disciplinary NDOT/CH2M HILL Value Analysis team**
- **5 concepts brought to VA study**
- **2 concepts developed during VA study**
- **Concept 6 from VA study refined and recommended**
- **$35 million accepted cost saving; 21% of estimated cost; ROI 1400-to-1; with functional enhancements!**

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How Does VE Work?

- Reduce complicated projects into basic components by analyzing its functions
- Identifying the functions of components and systems leads to identifying better ways to accomplish project goals

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How VM Handles Cost

- There is always a better way to do anything.
- The secret is to understand functions…
- And then determine the best value!

Best value does <u>not</u> mean "cost cutting."

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Value Engineering Employs Six Steps

- **Information**
- **Creative**
- **Analysis**
- **Development**
- **Presentation**
- **Implementation**

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Pre-Study Phase

- Solidify customer needs and success criteria
  - ➢ Interview PM and key team members
- Define the problem(s) to be solved
- Gather information on project design, cost, schedule, status, and lessons learned to-date
- Define specific VE study scope, objectives and deliverables
- Identify the appropriate team member skills to match the objectives and deliverables
- Solidify workshop schedule and logistics
- Conduct team briefing prior to the workshop

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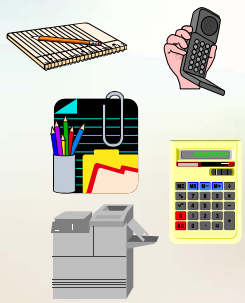
The VE Job Plan: A Structured Six-Phase Approach

- Information Phase
- Function Analysis Phase
- Creative Phase
- Evaluation Phase
- Development Phase
- Presentation Phase



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The Information Phase Is Important!

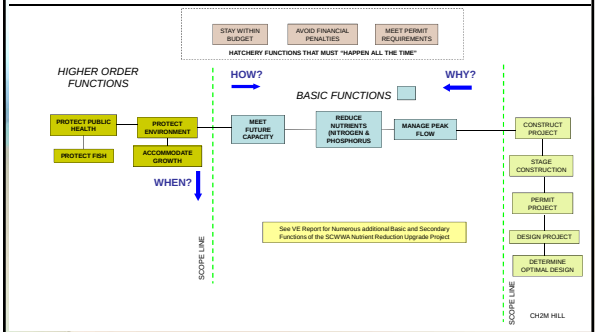
If I were given an hour to solve a problem on which my life depended, I would spend:

40 minutes studying it
15 minutes reviewing it
5 minutes solving it

Albert Einstein

Answers the Questions:
- **How does it work today?**
- **Who does what?**
- **What does that cost?**
- **What's the problem to be solved?**

FUNCTION ANALYSIS SYSTEM TECHNIQUE (FAST) DIAGRAM
SCWWA NUTRIENT REDUCTION UPGRADE PROJECT



Function Analysis Phase

- Function is defined as a two word statement:

"Active Verb/Measurable Noun"

- Identify and classify functions
- Develop function, worth, and cost models
  - Function Analysis System Technique Diagramming
    - Applies intuitive logic to test functions
    - Identifies dependence between functions
    - Creates common language for team

PARETO PRINCIPLE

Developed by Vilfredo Pareto and Dr. Joe Juran
The "80-20" Rule
Separates Vital Few From Trivial Many

Examples

80% of the costs are incurred by
20% of the functions

80% of the time is spent on
20% of the functions

Function Analysis System Technique

FAST Diagramming

- **Developed in 1964 by Charles W. Bytheway**
- **Applies intuitive logic to test functions**
- **Displays functions in a diagram or model form**
- **Identifies dependence between functions**
- **Creates common language for team**
- **Tests validity of functions**
- **No "correct" FAST model -- team consensus**

CREATIVE PHASE

- Select functions to brainstorm
- Follow brainstorming rules
  - Defer judgment
  - Generate many ideas -- Quantity not Quality
  - Freewheeling
  - Listen/improve on other's ideas (hitchhike)
  - Don't criticize/evaluate (yours or others)
  - Encourage participation
  - Record all ideas
- Brainstorm functions
- Identify other ways to perform the function

EVALUATION PHASE

Evaluation is accomplished in 2-3 rounds:

- Eliminate possible, but improbable
- Group similar ideas
- Identify lowest cost ideas
- Develop/Use Criteria
  - Paired comparison
- Rank and rate ideas
  - Weighted criteria
- Select best ideas for development

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DEVELOPMENT PHASE

- Initiate and facilitate changes
- Anticipate roadblocks
- Conduct cost benefit analysis
- Develop implementation plan
- Prepare final proposals
- Promote recommendations

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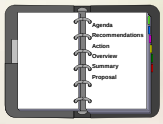
PRESENTATION PHASE

- Present results and obtain approval to proceed
  - Brief overview of VE process
  - Present recommended proposals to management
  - Solicit input/enhancements and approval to proceed



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Post-Study Phase

- Issue Formal Report
  - News you can use
- Implement Changes and Monitor Status
  - Complete change documentation, as appropriate
  - Procure resources, as appropriate
  - Track until completion
- Feedback: Incorporate Lessons Learned

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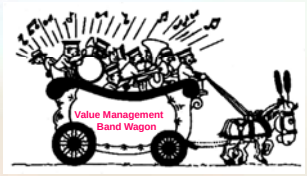
What Makes VM/VE Unique?



Interdisciplinary Team
+
Job Plan
+
Function/Fast
+
Documentation
+
Facilitation

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VE Focus on City of Coos Bay WWTP NO. 2, at Conceptual Design

- **Objectives of the VA Study:**
  - **Optimal value solutions for the project to meet wastewater treatment requirements.**
  - **Explore the Facilities Plan Amendment and see if alternatives or improvements can be made to the process, flexibility and components of the wastewater treatment plant for Ammonia reduction and other improvements.**
  - **Process treatment logistics and other considerations**
  - **VA Recommendations in a Defendable Document**

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Executive Summary Presentation

Value Analysis (VA) Study
City of Coos Bay, WWTP#2
Coos Bay, OR

October 26, 2011

CH2M HILL
Paul Johnson, CVS – VA Team Facilitator

Facility Plan Amendment Team

Garrett Pallo, P.E. – Civil West
Bill Boger, P.E. – Civil West
Matt Wadlington, P.E. – Civil West

OVERVIEW

- VA Focus on Coos Bay WWTP#2 Plant Upgrades
- VA Team, FPA Team, Stakeholder Agencies, Owner
- Why VE/VA is Used
- Methodology
- Study Recommendations
  - Major Process Alternatives
    - Concept Rating System
    - Conceptual Cost Comparisons
  - Observations
- Follow-up Tasks
  - Preliminary Value Analysis Report
  - Proposal Dispositions
  - Final VA Report for Documentation
- Questions/Comments

Why Use Value Engineering (Value Analysis)?

- Focus on essential functions not systems or procedures
- Embraces creativity and out of the box thinking in a multi-disciplinary, communicative setting
- Uses initial and life-cycle cost analysis for decision making
- Provides an organized framework for alternative development
- Consistently achieves the desired results (from 5:1 to 50:1 ROI)

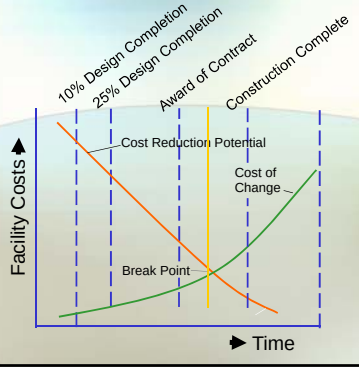
Value Analysis Team

Bill Leaf, P.E. – Lead Process Engineer and CPES Estimating
Doug Berschauer, P.E. – Senior Process Engineer
Paul Johnson, CVS – Value Engineering Team Leader
Patrick Kavan – Wastewater Project Manager
Mike McDaniel – Wastewater Assistant Project Manager
Jennifer Wirsing – City of Coos Bay, Engineering Coordinator
Jessica Spann – City of Coos Bay, Engineering Technician
Jim Hossley – City of Coos Bay, Public Works Director
John Chirrick – Charleston Sanitation District
Steve Major – Dyer Partnership, CSD Representative
Jon Gasik – Oregon DEQ

The Optimal Time to Use Value Engineering (Value Planning)

- Early on in a project design phase (or by the conclusion of the Preliminary Engineering Phase)
- Cost savings are best achieved between predesign and early engineering design (not later than 20% of definitive design)

Opportunities for Savings in Facility Life Cycle



Criteria Categories: Rating

Regulatory Risk	10%
Cost	20%
Implementability	15%
Schedule	5%
Operations	15%
Treatment Effectiveness	25%
Project Delivery	10%
Total	100%

The Value Equation, V = F/C

Traditional VE:

- Respect Function (Numerator)
- Decrease Cost (Denominator)
- Thus, Value Increases

Concept Level VE for Coos Bay WWTP#2:

- **Stay within a Reasonable Budget Range for Cost ($16 million to $20 million)**
- **Significantly Improve Function (Ammonia Reduction, Bacteria Reduction, for Regulatory Compliance)**
- **Thus, Value Increases**

Team Focus Q/A

- **Problem Statements**
- **Cost Components**
- **Project Risks**
- **Expected Outcomes**

What is Different about this Coos Bay WWTP#2 VA Study?

Focus is on Function:

Maximize Potential Ammonia Reduction
Bacteria Reduction
Accommodate Peak Wet Weather Flows
Meet Regulatory Requirements
Stay within Budget

Creative Phase: Utilized a Criteria Generation Process

Relevant Criteria for Treatment Effectiveness, Implementability, Reducing Regulatory Risk, Cost

Evaluation Phase: Rated Criteria as to Importance

High, Medium, Low Priority

See spreadsheet for alternative ratings

Prioritization from VA Study

Highest Priority Alternative

- **Option 1: SC to CEPT + MBR (all at Existing Plant); Headworks at new site (Score: 84.9% of total possible points)**

Middle Priority Alternatives

- **Option 3: CEPT + Ox Ditch/SBR/Conventional (New Site); Headworks at new site (Score: 80.9%)**
- **Option 2: New CEPT + SC to PC + IFAS (all at Existing Plant); Headworks at new site (Score: 80.2%)**
- **FPA Alt#1: Base Alternative: SBR (New) + New Line to CC; Headworks at new site (Score: 72.6%)**
- **FPA Alt#2: Extended Aeration, Conventional with two new clarifiers. All on New Site. UV disinfection (Score: 71.8%)**

Dismissed Alternatives

- **FPA Alt #3: Oxidation Ditch with one new clarifier on New Site. UV disinfection. (Score: 64.4%)**
- **North Spit Alternative. Pipeline under Bay. Secondary treatment. Existing outfall (67.1%, but Fatal Flaw with Schedule Criterion)**

Cost Comparison from VA Study

Highest Priority Alternative

- **Option 1: SC to CEPT + MBR (all at Existing Plant); Headworks at new site (95% of base alternative)**

Middle Priority Alternatives

- **Option 3: CEPT + Ox Ditch/SBR/Conventional (New Site); Headworks at new site (85% of base alternative for SBR)**
- **Option 2: New SC + SC to CEPT + IFAS (all at Existing Plant); Headworks at new site (85% of base alternative)**
- **FPA Alt#1: Base Alternative: SBR (New) + New Line to CC; Headworks at new site (FPA Team Estimate of $16.5 million)**
- **FPA Alt#2: Extended Aeration, Conventional with two new clarifiers. All on New Site. UV disinfection (FPA Team Estimate of $18.9 million)**

Dismissed Alternatives

- **FPA Alt #3: Oxidation Ditch with one new clarifier on New Site. UV disinfection. (FPA Team Estimate of $17.4 million but corrections needed to Oxidation ditch size, and another clarifier needed)**
- **North Spit Alternative. Pipeline under Bay. Secondary treatment. Existing outfall (No Estimate; but Fatal Flaw with Schedule Criterion)**

VA Implementation Phase (Follow-up Tasks)

- Distribute Preliminary VA Report
- Owner and FPA Team Review
- Determination of VA Proposal Dispositions by City in consultation with FPA Team and Stakeholder Agencies as appropriate
- Final VA Report to Document Study Results

Conclusion

- Q/A
- Thanks for the opportunity to work with you on the Value Analysis study for this very important project!

Appendix B

The City of Coos Bay, Wastewater Treatment Plant Improvements, 50% Facilities Plan Amendment Review Process, by Civil West Engineering, October 24, 2011

Civil West Engineering Services, Inc.

THE CITY OF COOS BAY

Wastewater Treatment Plant No. 2 Improvements

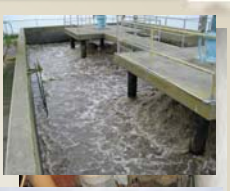
50% Facilities Plan Amendment Review Process

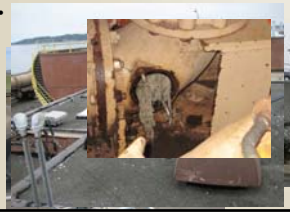
October 24, 2011

WWTP2 Improvement Planning

WWTP2 History

- 1973 Original Construction
- 1990 Upgrades
  - Upgrades to Influent Pump Station
  - New Headworks
  - Additional Secondary Clarifier
-





WWTP2 Improvement Planning

Purpose for this Presentation

- Bring the Review Team "up to speed" on Facilities Plan Amendment
- Illustrate the numerous alternatives under consideration for meeting the City's wastewater needs for WWTP2
- Discuss where the planning effort goes from here
- Answer questions

WWTP2 Improvement Planning

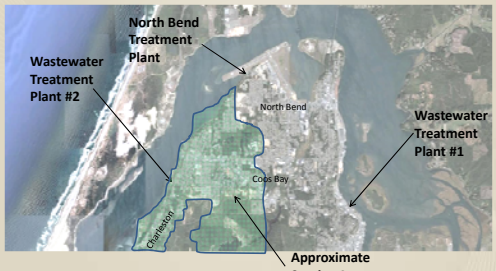
Facilities Plan by West Yost

- Approved October 2007
- Existing Facility Capacity Issues
- Recommendations:
  - New Influent Pump Station (Alternate Site No. 1)
  - New Control Building (Alternate Site No. 1)
  - New Headworks (Alternate Site No. 1)
  - New Secondary Clarifier
  - Re-size Existing Aeration Basins
  - Retrofit Existing Secondary Clarifier No. 1 to be New Chlorine Contact Basin

WWTP2 Improvement Planning

WWTP2 Location

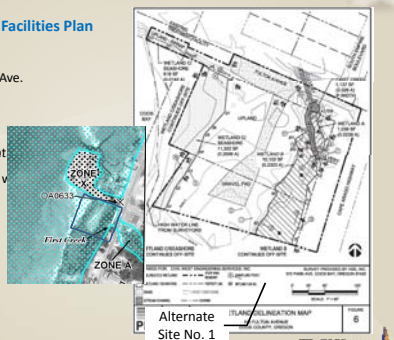
- Service Area = 34.5% Coos Bay + Charleston SD



WWTP2 Improvement Planning

Concerns With 2007 Facilities Plan

- Alternate Site No. 1
  - South of Fulton Ave.
  - Wetlands Issues
  - Floodplain
- Constructability (Aerat
- Phasing Construction v Service/Operation



WWTP2 Improvement Planning

Concerns With 2007 Facilities Plan

- 5-year+ old data (Population, Flows, etc.)
  - Updated Numbers:
    - Population: 9,802 (2010) to 11,352 (2035)
    - Flows:

	2010	2035
MMDWF:	1.29 mgd	1.49 mgd
MMWWF:	1.79 mgd	2.07 mgd
PDAF:	5.39 mgd	6.24 mgd
PIF:	7.00 mgd	8.11 mgd

WWTP2 Improvement Planning

Alternatives Evaluated

- North Spit Treatment
  - Ocean Outfall
  - Relocates Treatment Facility Away from Residents
  - On-site Preliminary Treatment
  - Large Pump Station
  - Transmission Forcemain
  - On-Site Peak Wet Weather Treatment, Disinfection & Discharge
  - Excessive Cost
  - Unknown Legal, Environmental and Administrative Elements

WWTP2 Improvement Planning

Review of Need for Facilities Plan Amendment

- Problems with previous Facilities Planning Effort
- DEQ required that the City "take two steps back" and identify a new planning concept that can be refined through the planning process
- Time has passed s wanted an updated look at planning criteria,
- Economic conditi stimates and financial issues to help the ned upgrades
- Evaluate Addition

WWTP2 Improvement Planning

Alternatives Evaluated Cont'd

- Combined Plant Option (Pump To and Expand Plant 1)
  - Pump All Sewage from WWTP2 to WWTP1
  - Upgrades to WWTP1
  - Large Pump Station at WWTP2
  - Long, Large Diameter Forcemain
  - Excessive Transmission Cost
- Large Equalization Basin (at WWTP2 Alternate Site No. 2)
  - Visual/Odor Impact
  - Safety
  - Existing Facilities Age at 20 & 40-year (Life Expectancy)

WWTP2 Improvement Planning

Summary of 50% FPA Status:

- The goal of the 50% milestone was to provide a report on the evaluation of a wide range of alternatives and identify a small group of "finalists"
- We identified a wide range of technologies capable of providing wastewater service to Coos Bay
- We requested detailed proposals from manufacturers and suppliers of wastewater equipment, literally from around the world
- We performed preliminary evaluations and cost estimates of more than 16 wastewater treatment alternatives for WWTP2

WWTP2 Improvement Planning

Alternatives Evaluated Cont'd

- Alternate Site No. 2
  - NE Corner Empire Blvd & Fulton Ave.
  - Vacant
  - Due Diligence
    - Wetlands Mitig
    - Environmental

WWTP2 Improvement Planning

Alternatives Evaluated Cont'd

- Activated Sludge (Conventional)
- Oxidation Ditch
  - Orbal
  - Vertical Loop Reactor (VLR)
- Sequencing Batch Reactor (SBR) (2-Bay, 3-Bay)
  - Intermittent Cycle Extended Aeration (ICEAS)
- Packaged Activated Sludge
- Membrane Bio-Reactor (MBR)
- Dual-Treatment (Blended-Flow)
- Packaged Fine-Bubble Aerated Lagoon
- Moving Bed Biofilm Reactor (MBBR)
- Integrated Fixed Film Activated Sludge (IFAS)
- Extended Aeration Lagoon
- Wetlands

WWTP2 Improvement Planning

The Next Phases in the Planning Process

- Next, we will evaluate the impacts of varying operation and maintenance (O&M) costs for each of the Top 3 Alternative to see if O&M changes the ranking of the alternatives using a Present Worth Analysis.
- We will also consider other "cost and non-cost" issues (operational flexibility, expandability, etc.) and use them to identify the "best" alternative, all things considered.
- We will utilize input from this City-organized "peer review" as well as input on the 50% plan submittal and prepare a 95% plan submittal for review by DEQ and the City of Coos Bay.

WWTP2 Improvement Planning

Summary of Alternatives

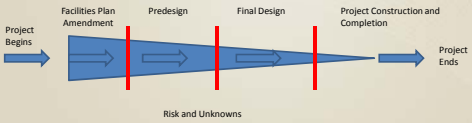
- A capital cost matrix developed for viable alternatives.
- The alternatives were ranked in order from the lowest to the highest capital costs
- Alternatives were eliminated that had fatal flaws (highest costs, space limitations, not capable of meeting effluent requirements, etc)
- The top 3 finalists were identified to move forward in the process. They include:

1. Sequencing Batch Reactors
2. Extended Aeration (conventiona
3. Oxidation Ditch

WWTP2 Improvement Planning

The Next Phases in the Planning Process

- The Facilities Plan Amendment will be finalized and approved by the City and DEQ clearing the way for the predesign phase to begin.
- The remaining process for WWTP2 looks like this:
- Questions?



WWTP2 Improvement Planning

Preliminary Project Cost Range Summary

- Detailed cost estimates have been prepared as part of the evaluation of the most viable alternatives. A summary of the ranges of the top 6 technologies follows: (Total budget estimates include all contingency, engineering, administrative, and construction cost estimates)

Projected Total Budget Estimates	
Technology Alternative	**Total Estimated Budget Ranges for Alternatives**
SBR (incl. ICEAS)	$16.5-$17.5 million
Extended Aeration (Conventional)	$17.0-$18.0 million
Oxidation Ditch	$17.5-$18.5 million
Package Activated Sludge	$19.0-$20.0 million
MBBR (IFAS)	$19.0-$20.0 million
MBR	$21.0-$22.0 million

Appendix C

Tables 1, 2, 3: Rating of Wastewater Process Alternatives,
by CH2M HILL and the VA Team

Concept-Level Value Assessment Study

Coos Bay WWTP#2 Upgrades

Table 1

Rating System Priority Legend

PRIORITY LEGEND FOR CRITERIA	PRIORITY VALUE		RATING LEGEND FOR ALTERNATIVES	RATING VALUE
H = High (Essential)	9		Fully Meets the Criteria	3
M = Moderate (but not Essential)	6		Good Alternative	2
L = Low Importance	3		Acceptable Alternative	1
NR = Not Rated	0		Fails to Meet	0

Concept-Level Value Assessment Study

Coos Bay WWTP#2 Upgrades

Table 2

Process Alternatives

CATEGORY	CRITERIA	PRIORITY	Option 1: SC to PC + MBR (all at Existing Plant); Headworks at new site. CEPT at high flow only.	Option 2: SC to PC + IFAS (in existing AB) + New SC (all at Existing Plant): Headworks at new site CEPT at high flow only.	Option 3: CEPT + Ox Ditch/SBR/Conventional (New Site); Headworks at new site	Base Alternative: SBR (New) + New Line to CC; Headworks at new site	North Spit Alternative. Pipeline under Bay. Secondary treatment. Existing outfall.	Max Score
Regulatory Risk	Proposal should respect the requirements of the MAO in order to comply with environmental requirements, treatment effectiveness, and avoid stipulated penalties.	H	2	3	3	3	3	3
Regulatory Risk	Treatment process would meet regulatory approval from EPA, or at least not run a risk of not fully meeting regulatory approval for blending.	H	2	2	2	3	3	3
Regulatory Risk	Treatment process would meet anticipated future regulatory requirements (metals, organics, human health criteria) TN<10, P<1.	H	3	2	2	2	1	3
Regulatory Risk								
Regulatory Risk								
Regulatory Risk								
Subtotal			**63**	**63**	**63**	**72**	**63**	**81**
Percent			**77.8%**	**77.8%**	**77.8%**	**88.9%**	**77.8%**	**100.0%**
Cost	Alternative represents appropriate initial cost investment within the City's contemplated budget for WWTP#2 of $16 million to $20 million, or at the lower end of this range.	H	2	3	3	2	1	3
Cost	Alternative represents appropriate long-term investment from a future Operations and Maintenance Perspective.	H	1	1	2	1	3	3

Coos Bay WWTP#2 Upgrades

Table 2

Process Alternatives

CATEGORY	CRITERIA	PRIORITY	Option 1: SC to PC + MBR (all at Existing Plant); Headworks at new site. CEPT at high flow only.	Option 2: SC to PC + IFAS (in existing AB) + New SC (all at Existing Plant): Headworks at new site CEPT at high flow only.	Option 3: CEPT + Ox Ditch/SBR/Conventional (New Site); Headworks at new site	Base Alternative: SBR (New) + New Line to CC; Headworks at new site	North Spit Alternative. Pipeline under Bay. Secondary treatment. Existing outfall.	Max Score
Cost	Alternative meets City's desired goals pertaining to energy conservation and sustainable practices where appropriate for plant improvements.	M	2	2	2	1	2	3
Cost								
Cost								
Cost								
Subtotal			**39**	**48**	**57**	**33**	**48**	**72**
Percent			**54.2%**	**66.7%**	**79.2%**	**45.8%**	**66.7%**	**100.0%**
Implementability	Proposal should be compatible with physical limitations of the site, and/or adjacent property that is being purchased.	H	3	3	3	3	3	3
Implementability	Proposal is acceptable to City of Coos Bay.	H	3	3	3	3	3	3
Implementability	Proposal has probability of being acceptable to the community of Coos Bay.	H	3	3	1	1	3	3
Implementability	Proposal minimizes aesthetic impact on new site.	M	3	3	1	1	3	3
Implementability	Proposal minimizes aesthetic impact on existing site, when looking across the plant toward the Bay.	L	3	3	3	3	3	3
Implementability	Proposal represents least risk of increasing odor concerns near residences and businesses.	H	2	2	1	2	3	3
Implementability	Proposal maintains beach access to the public following construction.	M	3	3	3	3	3	3

Coos Bay WWTP#2 Upgrades

Table 2

Process Alternatives

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Implementability	Alternative is appropriate for proper integration of plant components, and pumping station equipment, and biosolids stream (electronics and controls).	H	2	2	3	3	3	3
Subtotal			**162**	**162**	**132**	**141**	**180**	**180**
Percent			**90.0%**	**90.0%**	**73.3%**	**78.3%**	**100.0%**	**100.0%**
Schedule	Alternative can be implemented within appropriate timeframe to meet MAO and NPDES, and to correct the failing condition of the plant within the next 3 to 5 years.	H	3	3	3	3	0	3
Schedule								
Subtotal			**27**	**27**	**27**	**27**	**0**	**27**
Percent			**100.0%**	**100.0%**	**100.0%**	**100.0%**	**0.0%**	**100.0%**
Operations	Proposal should lend itself to reasonable O&M requirements for ease and consistency, as anticipated in the future expansion given increasing regulatory and other requirements.	H	3	3	2	2	1	3
Operations	Alternative is flexible to meet potential future treatment requirements and capacity increases, and expandability on the limited site.	H	3	2	2	2	1	3

Coos Bay WWTP#2 Upgrades

Table 2

Process Alternatives

CATEGORY	CRITERIA	PRIORITY	Option 1: SC to PC + MBR (all at Existing Plant); Headworks at new site. CEPT at high flow only.	Option 2: SC to PC + IFAS (in existing AB) + New SC (all at Existing Plant): Headworks at new site CEPT at high flow only.	Option 3: CEPT + Ox Ditch/SBR/Conventional (New Site); Headworks at new site	Base Alternative: SBR (New) + New Line to CC; Headworks at new site	North Spit Alternative. Pipeline under Bay. Secondary treatment. Existing outfall.	Max Score
Operations	Plant upgrade should meet city's SCADA system masterplan, for overall compatibility of PLC equipment within the pumping stations and wastewater plants. Minimizes the need for multiple specialized contractors to maintain the SCADA system.	M	3	3	3	3	3	3
Operations	Alternative responds to a current significant collection system issue for reducing known SSO sites.	H	3	3	3	3	3	3
Subtotal			**99**	**90**	**81**	**81**	**63**	**99**
Percent			**100.0%**	**90.9%**	**81.8%**	**81.8%**	**63.6%**	**100.0%**
Treatment Effectiveness	Proposal needs to be a proven technology, and at least meet the treatment standards of the design criteria and regulatory requirements including NPDES permit requirements.	H	3	2	2	3	3	3
Treatment Effectiveness	Plant's capability to treat varying flows from average wet weather flow and maximum dry weather flow, increasing to high wet weather flow, is optimized. Focus on the plant flows during the majority of the time, and not the small percentage of time during peak conditions.	H	3	3	3	1	2	3
Treatment Effectiveness	Capability of plant to handle the high wet weather flows is optimized.	H	3	3	3	2	1	3

Coos Bay WWTP#2 Upgrades

Table 2

Process Alternatives

CATEGORY	CRITERIA	PRIORITY	Option 1: SC to PC + MBR (all at Existing Plant); Headworks at new site. CEPT at high flow only.	Option 2: SC to PC + IFAS (in existing AB) + New SC (all at Existing Plant): Headworks at new site CEPT at high flow only.	Option 3: CEPT + Ox Ditch/SBR/Conventional (New Site); Headworks at new site	Base Alternative: SBR (New) + New Line to CC; Headworks at new site	North Spit Alternative. Pipeline under Bay. Secondary treatment. Existing outfall.	Max Score
Treatment Effectiveness	Proposal utilizes existing plant infrastructure to the extent possible, thus minimizing throw-away cost.	M	3	3	1	1	1	3
Treatment Effectiveness	Alternative responds to a current significant plant issue for headworks (screenings) and influent pumping station capacity and reliability; replacement of worn equipment; standby generator's capability; ammonia, TSS, BOD, bacteria reduction requirements.	H	3	2	2	2	1	3
Treatment Effectiveness								
Treatment Effectiveness								
Subtotal			**126**	**108**	**96**	**78**	**69**	**126**
Percent			**100.0%**	**85.7%**	**76.2%**	**61.9%**	**54.8%**	**100.0%**
Project Delivery	Proposal represents a constructable alternative from the perspective of contractors familiar with wastewater systems work on the Oregon Coast, and keeping the plant operational during construction.	H	1	1	3	3	2	3
Project Delivery	Proposal represents minimal disruption of plant operations during construction.	H	1	1	3	3	3	3

Concept-Level Value Assessment Study

Coos Bay WWTP#2 Upgrades

Table 2

Process Alternatives

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Project Delivery	Project delivery is consistent with City's facility and capital plans, and consideration of future plans.	H	3	3	3	3	2	3
Subtotal			**45**	**45**	**81**	**81**	**63**	**81**
Percent			**55.6%**	**55.6%**	**100.0%**	**100.0%**	**77.8%**	**100.0%**
	TOTAL		**561**	**543**	**537**	**513**	**486**	**666**
			84.2%	**81.5%**	**80.6%**	**77.0%**	**73.0%**	**100.0%**
	(Total points equals the sum of the Priority Value multiplied by the Rating Value. See Table 1.)							
		Overall Weighting						
	Recap							
	Regulatory Risk	**10%**	7.8%	7.8%	7.8%	8.9%	7.8%	
	Cost	**20%**	10.8%	13.3%	15.8%	9.2%	13.3%	
	Implementability	**15%**	13.5%	13.5%	11.0%	11.8%	15.0%	
	Schedule	**5%**	5.0%	5.0%	5.0%	5.0%	0.0%	
	Operations	**15%**	15.0%	13.6%	12.3%	12.3%	9.5%	
	Treatment Effectiveness	**25%**	25.0%	21.4%	19.0%	15.5%	13.7%	
	Project Delivery	**10%**	5.6%	5.6%	10.0%	10.0%	7.8%	
	Final Score	**100%**	82.7%	80.2%	80.9%	72.6%	67.1%	
	Recommendation:		Confirm EPA consent with CEPT					

Concept-Level Value Assessment Study

Coos Bay WWTP#2 Upgrade

Table 2

Process Alternatives

CATEGORY	CRITERIA	PRIORITY	Option 1: SC to PC + MBR (all at Existing Plant); Headworks at new site. CEPT at high flow only.	FPA Alt 2: Extended Aeration, Conventional with two new clarifiers. All on New Site. UV disinfection.	FPA Alt 3: Oxidation Ditch with one new clarifier on New Site. UV disinfection.	FPA Alt 1: Base Alternative: SBR (New); Headworks at new site. UV disinfection.		Max Score
Regulatory Risk	Proposal should respect the requirements of the MAO in order to comply with environmental requirements, treatment effectiveness, and avoid stipulated penalties.	H	2	3	3	3		3
Regulatory Risk	Treatment process would meet regulatory approval from EPA, or at least not run a risk of not fully meeting regulatory approval for blending.	H	2	3	3	3		3
Regulatory Risk	Treatment process would meet anticipated future regulatory requirements (metals, organics, human health criteria) TN<10, P<1.	H	3	2	1	2		3
Regulatory Risk								
Regulatory Risk								
Regulatory Risk								
Subtotal			**63**	**72**	**63**	**72**	**0**	**81**
Percent			**77.8%**	**88.9%**	**77.8%**	**88.9%**	**0.0%**	**100.0%**
Cost	Alternative represents appropriate initial cost investment within the City's contemplated budget for WWTP#2 of $16 million to $20 million, or at the lower end of this range.	H	2	2	2	2		3
Cost	Alternative represents appropriate long-term investment from a future Operations and Maintenance Perspective.	H	1	1	1	1		3

Coos Bay WWTP#2 Upgrade

Table 2

Process Alternatives

CATEGORY	CRITERIA	PRIORITY	Option 1: SC to PC + MBR (all at Existing Plant); Headworks at new site. CEPT at high flow only.	FPA Alt 2: Extended Aeration, Conventional with two new clarifiers. All on New Site. UV disinfection.	FPA Alt 3: Oxidation Ditch with one new clarifier on New Site. UV disinfection.	FPA Alt 1: Base Alternative: SBR (New); Headworks at new site. UV disinfection.		Max Score
Cost	Alternative meets City's desired goals pertaining to energy conservation and sustainable practices where appropriate for plant improvements.	M	2	1	1	1		3
Cost								
Cost								
Cost								
Subtotal			**39**	**33**	**33**	**33**	**0**	**72**
Percent			**54.2%**	**45.8%**	**45.8%**	**45.8%**	**0.0%**	**100.0%**
Implementability	Proposal should be compatible with physical limitations of the site, and/or adjacent property that is being purchased.	H	3	2	1	3		3
Implementability	Proposal is acceptable to City of Coos Bay.	H	3	3	3	3		3
Implementability	Proposal has probability of being acceptable to the community of Coos Bay.	H	3	1	1	1		3
Implementability	Proposal minimizes aesthetic impact on new site.	M	3	1	1	1		3
Implementability	Proposal minimizes aesthetic impact on existing site, when looking across the plant toward the Bay.	L	3	3	3	3		3
Implementability	Proposal represents least risk of increasing odor concerns near residences and businesses.	H	2	2	2	2		3
Implementability	Proposal maintains beach access to the public following construction.	M	3	3	3	3		3

Coos Bay WWTP#2 Upgrade

Table 2

Process Alternatives

CATEGORY	CRITERIA	PRIORITY	Option 1: SC to PC + MBR (all at Existing Plant); Headworks at new site. CEPT at high flow only.	FPA Alt 2: Extended Aeration, Conventional with two new clarifiers. All on New Site. UV disinfection.	FPA Alt 3: Oxidation Ditch with one new clarifier on New Site. UV disinfection.	FPA Alt 1: Base Alternative: SBR (New); Headworks at new site. UV disinfection.		Max Score
Implementability	Alternative is appropriate for proper integration of plant components, and pumping station equipment, and biosolids stream (electronics and controls).	H	2	3	3	3		3
Subtotal			**162**	**132**	**123**	**141**	**0**	**180**
Percent			**90.0%**	**73.3%**	**68.3%**	**78.3%**	**0.0%**	**100.0%**
Schedule	Alternative can be implemented within appropriate timeframe to meet MAO and NPDES, and to correct the failing condition of the plant within the next 3 to 5 years.	H	3	3	2	3		3
Schedule								
Subtotal			**27**	**27**	**18**	**27**	**0**	**27**
Percent			**100.0%**	**100.0%**	**66.7%**	**100.0%**	**0.0%**	**100.0%**
Operations	Proposal should lend itself to reasonable O&M requirements for ease and consistency, as anticipated in the future expansion given increasing regulatory and other requirements.	H	3	2	1	2		3
Operations	Alternative is flexible to meet potential future treatment requirements and capacity increases, and expandability on the limited site.	H	3	2	1	2		3

Coos Bay WWTP#2 Upgrade

Table 2

Process Alternatives

CATEGORY	CRITERIA	PRIORITY	Option 1: SC to PC + MBR (all at Existing Plant); Headworks at new site. CEPT at high flow only.	FPA Alt 2: Extended Aeration, Conventional with two new clarifiers. All on New Site. UV disinfection.	FPA Alt 3: Oxidation Ditch with one new clarifier on New Site. UV disinfection.	FPA Alt 1: Base Alternative: SBR (New); Headworks at new site. UV disinfection.		Max Score
Operations	Plant upgrade should meet city's SCADA system masterplan, for overall compatibility of PLC equipment within the pumping stations and wastewater plants. Minimizes the need for multiple specialized contractors to maintain the SCADA system.	M	3	3	3	3		3
Operations	Alternative responds to a current significant collection system issue for reducing known SSO sites.	H	3	3	3	3		3
Subtotal			**99**	**81**	**63**	**81**	**0**	**99**
Percent			**100.0%**	**81.8%**	**63.6%**	**81.8%**	**0.0%**	**100.0%**
Treatment Effectiveness	Proposal needs to be a proven technology, and at least meet the treatment standards of the design criteria and regulatory requirements including NPDES permit requirements.	H	3	3	3	3		3
Treatment Effectiveness	Plant's capability to treat varying flows from average wet weather flow and maximum dry weather flow, increasing to high wet weather flow, is optimized. Focus on the plant flows during the majority of the time, and not the small percentage of time during peak conditions.	H	3	1	1	1		3
Treatment Effectiveness	Capability of plant to handle the high wet weather flows is optimized.	H	3	2	2	2		3

Coos Bay WWTP#2 Upgrade

Table 2

Process Alternatives

CATEGORY	CRITERIA	PRIORITY	Option 1: SC to PC + MBR (all at Existing Plant); Headworks at new site. CEPT at high flow only.	FPA Alt 2: Extended Aeration, Conventional with two new clarifiers. All on New Site. UV disinfection.	FPA Alt 3: Oxidation Ditch with one new clarifier on New Site. UV disinfection.	FPA Alt 1: Base Alternative: SBR (New); Headworks at new site. UV disinfection.		Max Score
Treatment Effectiveness	Proposal utilizes existing plant infrastructure to the extent possible, thus minimizing throw-away cost.	M	3	1	1	1		3
Treatment Effectiveness	Alternative responds to a current significant plant issue for headworks (screenings) and influent pumping station capacity and reliability; replacement of worn equipment; standby generator's capability; ammonia, TSS, BOD, bacteria reduction requirements.	H	3	2	2	2		3
Treatment Effectiveness								
Treatment Effectiveness								
Subtotal			**126**	**78**	**78**	**78**	**0**	**126**
Percent			**100.0%**	**61.9%**	**61.9%**	**61.9%**	**0.0%**	**100.0%**
Project Delivery	Proposal represents a constructable alternative from the perspective of contractors familiar with wastewater systems work on the Oregon Coast, and keeping the plant operational during construction.	H	1	3	3	3		3
Project Delivery	Proposal represents minimal disruption of plant operations during construction.	H	1	3	3	3		3
Project Delivery	Project delivery is consistent with City's facility and capital plans, and consideration of future plans.	H	3	3	2	3		3

Concept-Level Value Assessment Study

Coos Bay WWTP#2 Upgrade

Table 2

Process Alternatives

CATEGORY	CRITERIA	PRIORITY	Option 1: SC to PC + MBR (all at Existing Plant); Headworks at new site. CEPT at high flow only.	FPA Alt 2: Extended Aeration, Conventional with two new clarifiers. All on New Site. UV disinfection.	FPA Alt 3: Oxidation Ditch with one new clarifier on New Site. UV disinfection.	FPA Alt 1: Base Alternative: SBR (New); Headworks at new site. UV disinfection.		Max Score
Subtotal			**45**	**81**	**72**	**81**	**0**	**81**
Percent			**55.6%**	**100.0%**	**88.9%**	**100.0%**	**0.0%**	**100.0%**
	TOTAL		**561**	**504**	**450**	**513**	**0**	**666**
			84.2%	**75.7%**	**67.6%**	**77.0%**	**0.0%**	**100.0%**
	(Total points equals the sum of the Priority Value multiplied by the Rating Value. See Table 1.)							
		Overall Weighting						
	Recap							
	Regulatory Risk	**10%**	7.8%	8.9%	7.8%	8.9%	0.0%	
	Cost	**20%**	10.8%	9.2%	9.2%	9.2%	0.0%	
	Implementability	**15%**	13.5%	11.0%	10.3%	11.8%	0.0%	
	Schedule	**5%**	5.0%	5.0%	3.3%	5.0%	0.0%	
	Operations	**15%**	15.0%	12.3%	9.5%	12.3%	0.0%	
	Treatment Effectiveness	**25%**	25.0%	15.5%	15.5%	15.5%	0.0%	
	Project Delivery	**10%**	5.6%	10.0%	8.9%	10.0%	0.0%	
	Final Score	**100%**	82.7%	71.8%	64.4%	72.6%	0.0%	
	Recommendation:		Confirm EPA consent with CEPT		Check influent flow and loads, and wastewater temperature. VE team is seeing inconsistency with proposals received from vendors.			

Appendix D

Pro2D™ Process Simulation Data by CH2M HILL

CH2M HILL used its Pro2D™ whole-plant process simulator to help develop the conceptual treatment alternative designs presented within the VA study. The process simulation was not calibrated to the actual wastewater characteristics at the Coos Bay WWTP No. 2, but utilized a representative wastewater common to the western part of the Pacific Northwest.

The following printouts are from two of the treatment options discussed in the VA study: Option 1 (MBR) and Option 2 (IFAS).

For each alternative two printouts are presented: 1) the Mass Balance is presented for the maximum month dry weather condition and 2) the performance of the associated bioreactor is presented (noted as “PBNR”).

Mass Balance for MMDWF Flow Conditions - Option 1 (MBR)

Constituent	Raw Wastewater (RW)	Main Recycled Stream (Recycle)	Main Combined Recycle Effluent (RecyE)	Main Primary Influent (PI)	Main Primary Effluent (PE)	Main Bioreactor Influent (BI)	Main MBR Influent (SI)	Main MBR Effluent (SE)	Plant Effluent (PLE)	Main Primary Sludge (PSD)	Meso Anaerobic Digester Influent (AnDI)	Meso Anaerobic Digester Effluent (AnDE)	Biosolids to Disposal	Main WAS
Flow (gallons/day)	1,490,000	42,123	1,532,122	1,532,122	1,514,911	1,514,911	1,472,589	1,472,789	1,472,789	17,211	17,211	17,211	17,211	42,123
Carbonaceous BOD_5 (lbs/day)	3,281	640	3,921	3,921	2,262	2,262	22,367	11	11	1,654	1,654	462	462	640
COD (lbs/day)	7,343	2,531	9,874	9,874	5,431	5,431	88,485	237	237	4,443	4,443	2,408	2,408	2,531
TSS (lbs/day)	4,590	2,592	7,182	7,182	2,873	2,873	90,607	12	12	4,309	4,309	2,798	2,798	2,592
VSS (lbs/day)	3,443	1,845	5,288	5,288	2,139	2,139	64,509	9	9	3,149	3,149	1,810	1,810	1,845
TKN (lbs/day)	439	130	569	569	437	437	4,550	14	14	132	132	132	132	130
NH_3-N (lbs-N/day)	313	0	313	313	310	310	1	1	1	4	4	71	71	0
NO_3-N (lbs-N/day)	0	3	3	3	3	3	111	111	111	0	0	0	0	3
TP (lbs-P/day)	75	57	131	131	74	74	1,979	18	18	57	57	57	57	57
Alkalinity (lbs/day as $CaCO_3$)	6,217	140	6,357	6,357	6,286	6,286	4,906	4,907	4,907	71	71	262	262	140
H_2S (lbs/day)	75	0	75	75	74	74	0	0	0	1	1	7	7	0
Temperature (°C)	15	15	15	15	15	15	15	15	15	15	15	35	35	15
BOD_5 (mg/L)	264	1,820	307	307	179	179	1,820	1	1	11,515	11,515	3,218	3,218	1,820
COD (mg/L)	591	7,200	772	772	430	430	7,200	19	19	30,930	30,930	16,761	16,761	7,200
TSS (mg/L)	369	7,373	562	562	227	227	7,373	1	1	30,000	30,000	19,481	19,481	7,373
VSS (mg/L)	277	5,249	414	414	169	169	5,249	1	1	21,925	21,925	12,602	12,602	5,249
TKN (mg-N/L)	35.27	370	44	44	35	35	370	1	1	920	920	920	920	370
NH_3-N (mg-N/L)	25.19	0	24	24	24	24	0	0	0.06	24	24	494	494	0
NO_3-N (mg-N/L)	0.00	9	0	0	0	0	9	9	9	0	0	0	0	9
TP (mg-P/L)	6.00	161	10	10	6	6	161	1	1	398	398	398	398	161
Alkalinity (mg/L as $CaCO_3$)	500	399	497	497	497	497	399	399	399	497	497	1,822	1,822	399
H_2S (mg/L)	6.00	0	6	6	6	6	0	0	0	6	6	50	50	0

Summary Information					
Total MLSS Inventory	20,832	lbs	Total COD Removed	5,194	lbs/day
Total MLVSS Inventory	14,842	lbs	Food Applied to MLSS Inventory Ratio	0.20	COD/MLSS
MIxed Liquor VSS	71%		Aeration Information	**Excluding Membrane Basin**	
Total Required WAS Rate	2,604	lbs MLSS/day	Total AOR	2,613	lbs O2/day
or	1,855	lbs MLVSS/day	Total SOR	8,899	lbs O2/day
Observed Mass Yield	1.15	lbs MLSS/lb BOD	Total Required Air Rate	1,438	scfm

	Option 1 (MBR)				SRT (d) =	0.26	0.40	0.40	0.82	0.82	0.81	0.81	0.81	2.85
	Standard Model Component Concentrations		Feed	RAS		#1	#2	#3	#4	#5	#6	#7	#8	#9
	Enter Reactor Number to use this Column of Data for the Original Guess					1	2	3	4	5	6	7	8	9
1	S_{O2}	Dissolved Oxygen	mg O_2/L	0.00	0.00	4.05	0.09	0.00	2.00	2.00	2.00	2.00	2.00	6.00
2	S_F	Soluble Fermentable Substrates	mg COD/L	75.52	1.17	1.44	8.93	2.92	0.97	0.71	0.66	0.64	0.66	1.17
3	S_A	Soluble Fermentation Products	mg COD/L	23.03	0.01	0.01	2.45	0.94	0.15	0.04	0.02	0.01	0.01	0.01
4	S_I	Soluble Inerts	mg COD/L	17.11	17.11	17.11	17.11	17.11	17.11	17.11	17.11	17.11	17.11	17.11
5	S_{NH4}	Soluble Ammonia N	mg N/L	24.50	0.06	0.04	5.74	5.61	4.28	3.08	1.99	1.09	0.48	0.06
6	S_{N2}	Dissolved Nitrogen Gas	mg N/L	0	14	14	12	14	14	14	14	14	14	14
7	S_{NO3}	Soluble Nitrate/Nitrite N	mg N/L	0.25	9.00	9.03	5.49	4.10	5.17	6.21	7.17	7.97	8.49	9.00
8	S_{PO4}	Soluble Inorganic Phosphorus	mg P/L	2.81	1.41	1.42	1.93	2.01	1.80	1.60	1.46	1.38	1.34	1.41
9	S_{ALK}	Alkalinity	moles/m^3	9.94	7.98	7.98	8.59	8.71	8.55	8.40	8.25	8.13	8.05	7.98
10	X_I	Inert Particulates	mg COD/L	38	1,362	1,362	1,031	1,031	1,031	1,031	1,031	1,031	1,031	1,362
11	X_S	Slowly Biodegradable Substrate	mg COD/L	200	132	130	146	146	139	132	126	120	115	132
12	X_H	Heterotrophic Organisms	mg COD/L	34	3,000	2,999	2,266	2,269	2,272	2,273	2,273	2,273	2,273	3,000
13	X_{PAO}	Phosphate Accumulating Organisms	mg COD/L	1	119	119	90	90	90	90	90	90	90	119
14	X_{PP}	Polyphosphate	mg P/L	0.38	33.81	33.81	25.13	24.98	25.14	25.32	25.46	25.54	25.59	33.81
15	X_{PHA}	PAO Storage Products	mg COD/L	0.00	0.06	0.05	0.89	1.32	1.07	0.73	0.45	0.26	0.15	0.06
16	X_{AUT}	Autotrophic Organisms	mg COD/L	2	166	166	125	125	125	125	125	125	125	166
17	X_{TSS}	Total Suspended Solids (MLSS)	mg/L	287	7,373	7,371	5,605	5,607	5,605	5,602	5,599	5,596	5,593	7,373
18	X_{MeOH}	Metal Hydroxides	mg/L	0	0	0	0	0	0	0	0	0	0	0
19	X_{MeP}	Metal Phosphates	mg/L	0	0	0	0	0	0	0	0	0	0	0
20	S_M	Methanol	mg COD/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	X_{M1}	Group 1 Methanol Degraders	mg COD/L	0	3	3	2	2	2	2	2	2	2	3
22	X_{M2}	Group 2 Methanol Degraders	mg COD/L	0	3	3	2	2	2	2	2	2	2	3
23	$X_{n,ag}$	Aerobic/Anoxic Decay Products	mg COD/L	39	2,398	2,398	1,809	1,809	1,810	1,811	1,811	1,812	1,813	2,398
		MLVSS	mg COD/L		7,182	7,180	5,471	5,474	5,471	5,466	5,461	5,457	5,452	7,182
		Oxygen Uptake Rate	mg O_2/(L-hr)			33	33	2	63	56	53	48	40	37
		Nitrate Uptake Rate	mg NO_3-N/(L-day)			9	383	376	20	17	17	16	15	7
		Ammonia Uptake Rate	mg NH_4-N/(L-day)			7	111	36	177	160	145	121	81	21
					Alkalinity Limited?									
	Reactor Information													
		Active Reactor Volume	gallons		404,000	11,222	22,444	22,444	45,447	45,447	45,447	45,447	45,447	120,654
		Reactor Sidewater Depth	feet		14	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**	**14**
		AOR, Biological	lbs O2/day			74	149	8	571	514	481	434	364	891
		AOR, H2S	lbs O2/day		148	0	0	0	148	0	0	0	0	0
		AOR, Liquid	lbs O2/day			0	0	0	101	0	0	0	0	202
		Total AOR	lbs O2/day			0	0	0	819	514	481	434	364	1,093
		Aeration Alpha Value				**0.61**	**0.61**	**0.81**	**0.47**	**0.50**	**0.51**	**0.54**	**0.58**	**0.59**
		Fouling Factor				**0.80**	**0.80**	**0.80**	**0.80**	**0.80**	**0.80**	**0.80**	**0.80**	**0.80**
		Alpha F				0.49	0.49	0.65	0.38	0.40	0.41	0.43	0.46	0.47
		SOR/AOR Ratio				4.16	2.16	1.61	3.67	3.48	3.36	3.21	2.99	7.96
		SOR	lbs O2/day			0	0	0	3,008	1,787	1,618	1,396	1,091	8,705
		SOTE				**25%**	**25%**	**25%**	**25%**	**25%**	**25%**	**25%**	**25%**	**25%**
		Required Air Rate	SCFM			0	0	0	486	289	261	225	176	1,407
		Required Mixing Air @ 0.12 scfm/ft2	SCFM			0	0	0	52	52	52	52	52	138
		Max Air per Tank at Design Condition	SCFM			163	327	327	661	661	661	661	661	1,756
		Is Required Diffuser Density Too High?												
		Nitric Oxide (NO) in Off-Gas	lbs NO/day		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitrous Oxide (N2O) in Off-Gas	lbs N2O/day		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		MLVSS	mg/L		5,249	5,248	3,996	3,999	3,997	3,993	3,990	3,987	3,984	5,249

Mass Balance for MMDWF Flow Conditions - Option 2 (IFAS)

Constituent	Raw Wastewater (RW)	Main Recycle Influent (RecyI)	Main Recycled Stream (Recycle)	Main Combined Recycle Effluent (RecyE)	Main Primary Influent (PI)	Main Primary Effluent (PE)	Main Bioreactor Influent (BI)	Main Secondary Clarifier Influent (SI)	Main Secondary Clarifier Effluent (SE)	Plant Effluent (PLE)	Main Primary Sludge (PSD)	Meso Anaerobic Digester Influent (AnDI)	Meso Anaerobic Digester Effluent (AnDE)	Biosolids to Disposal	Main WAS
Flow (gallons/day)	1,490,000	1,490,000	33,386	1,523,386	1,523,386	1,505,462	1,505,462	2,258,194	1,472,077	1,472,077	17,923	17,923	17,923	17,923	33,386
Carbonaceous BOD_5 (lbs/day)	3,281	3,281	926	4,207	4,207	2,373	2,373	21,852	53	53	1,823	1,823	532	532	926
COD (lbs/day)	7,343	7,343	2,882	10,226	10,226	5,566	5,566	68,224	357	357	4,660	4,660	2,459	2,459	2,882
TSS (lbs/day)	4,590	4,590	2,888	7,479	7,479	2,992	2,992	68,135	123	123	4,487	4,487	2,792	2,792	2,888
VSS (lbs/day)	3,443	3,443	2,088	5,531	5,531	2,233	2,233	49,254	89	89	3,298	3,298	1,821	1,821	2,088
TKN (lbs/day)	439	439	151	589	589	445	445	3,574	21	21	145	145	145	145	151
NH_3-N (lbs-N/day)	313	313	0	313	313	310	310	2	1	1	4	4	77	77	0
NO_3-N (lbs-N/day)	0	0	2	2	2	2	2	109	71	71	0	0	0	0	2
TP (lbs-P/day)	75	75	79	154	154	83	83	1,872	4	4	71	71	71	71	79
Alkalinity (lbs/day as $CaCO_3$)	6,217	6,217	115	6,332	6,332	6,258	6,258	7,781	5,072	5,072	74	74	312	312	115
H_2S (lbs/day)	75	75	0	75	75	74	74	0	0	0	1	1	7	7	0
Temperature (°C)	16	16	16	16	16	16	16	16	16	16	16	16	35	35	16
BOD_5 (mg/L)	264	264	3,323	331	331	189	189	1,160	4	4	12,187	12,187	3,559	3,559	3,323
COD (mg/L)	591	591	10,345	804	804	443	443	3,620	29	29	31,152	31,152	16,441	16,441	10,345
TSS (mg/L)	369	369	10,367	588	588	238	238	3,615	10	10	30,000	30,000	18,665	18,665	10,367
VSS (mg/L)	277	277	7,494	435	435	178	178	2,614	7	7	22,049	22,049	12,175	12,175	7,494
TKN (mg-N/L)	35.27	35	542	46	46	35	35	190	2	2	969	969	969	969	542
NH_3-N (mg-N/L)	25.19	25	0	25	25	25	25	0	0	0.11	25	25	518	518	0
NO_3-N (mg-N/L)	0.00	0	6	0	0	0	0	6	6	6	0	0	0	0	6
TP (mg-P/L)	6.00	6	285	12	12	7	7	99	0	0	475	475	475	475	285
Alkalinity (mg/L as $CaCO_3$)	500	500	413	498	498	498	498	413	413	413	498	498	2,088	2,088	413
H_2S (mg/L)	6.00	6	0	6	6	6	6	0	0	0	6	6	50	50	0

Summary Information						
Total MLSS Inventory	12,045	lbs	Total COD Removed	5,209	lbs/day
Total MLVSS Inventory	8,721	lbs	Food Applied to MLSS Inventory Ratio	0.37	COD/MLSS
Mlxed Liquor VSS	72%		Aeration Information		
Total Required WAS Rate	3,011	lbs MLSS/day	Total AOR	3,176	lbs O2/day
or	2,180	lbs MLVSS/day	Total SOR	8,428	lbs O2/day
Observed Mass Yield	1.27	lbs MLSS/lb BOD	Total Required Air Rate	1,995	scfm

Option 2 (IFAS)

	Standard Model Component Concentrations		Feed	RAS	#1	#2	#3	#4	#5	#6	#N/A	#N/A
	Enter Reactor Number to use this Column of Data for the Original Guess				1	2	3	4	5	6		
1	S_{O2} Dissolved Oxygen	mg O_2/L	0.00	0.00	0.02	0.00	4.00	2.00	2.00	2.00		
2	S_F Soluble Fermentable Substrates	mg COD/L	75.97	2.00	7.98	2.65	0.98	1.01	1.56	2.00		
3	S_A Soluble Fermentation Products	mg COD/L	23.16	0.01	1.75	1.11	0.05	0.01	0.01	0.01		
4	S_I Soluble Inerts	mg COD/L	17.11	17.11	17.11	17.11	17.11	17.11	17.11	17.11		
5	S_{NH4} Soluble Ammonia N	mg N/L	24.64	0.11	6.80	6.91	2.25	1.00	0.37	0.11		
6	S_{N2} Dissolved Nitrogen Gas	mg N/L	0	16	14	15	16	16	16	16		
7	S_{NO3} Soluble Nitrate/Nitrite N	mg N/L	0.13	5.78	1.50	0.36	4.32	5.26	5.68	5.78		
8	S_{PO4} Soluble Inorganic Phosphorus	mg P/L	2.79	0.02	2.38	3.79	0.44	0.06	0.02	0.02		
9	S_{ALK} Alkalinity	moles/m^3	9.96	8.26	8.97	9.04	8.50	8.36	8.28	8.26		
10	X_I Inert Particulates	mg COD/L	37	1,612	562	562	562	562	562	562		
11	X_S Slowly Biodegradable Substrate	mg COD/L	202	305	160	159	135	124	115	107		
12	X_H Heterotrophic Organisms	mg COD/L	43	4,738	1,641	1,640	1,647	1,650	1,651	1,652		
13	X_{PAO} Phosphate Accumulating Organisms	mg COD/L	10	1,095	378	378	381	382	382	382		
14	X_{PP} Polyphosphate	mg P/L	0.91	101.75	33.34	31.95	35.13	35.47	35.49	35.49		
15	X_{PHA} PAO Storage Products	mg COD/L	0.02	1.79	5.84	9.94	4.11	2.19	1.18	0.62		
16	X_{AUT} Autotrophic Organisms	mg COD/L	2	253	87	87	88	88	88	88		
17	X_{TSS} Total Suspended Solids (MLSS)	mg/L	299	10,367	3,635	3,631	3,631	3,626	3,621	3,615		
18	X_{MeOH} Metal Hydroxides	mg/L	0	0	0	0	0	0	0	0		
19	X_{MeP} Metal Phosphates	mg/L	0	0	0	0	0	0	0	0		
20	S_M Methanol	mg COD/L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
21	X_{M1} Group 1 Methanol Degraders	mg COD/L	0	6	2	2	2	2	2	2		
22	X_{M2} Group 2 Methanol Degraders	mg COD/L	0	6	2	2	2	2	2	2		
23	$X_{p,aa}$ Aerobic/Anoxic Decay Products	mg COD/L	32	2,309	800	800	803	804	804	805		
	MLVSS	mg COD/L		10,325	3,638	3,640	3,624	3,616	3,608	3,601		
	Oxygen Uptake Rate	mg O_2/(L-hr)			6	2	65	44	32	26		
	Nitrate Uptake Rate	mg NO_3-N/(L-day)			351	149	10	16	14	13		
	Ammonia Uptake Rate	mg NH_4-N/(L-day)			41	-14	193	104	53	21		
		Alkalinity Limited?										
	Reactor Information						63660.3					
	Active Reactor Volume	gallons		398,001	40,400	40,400	127,321	63,293	63,293	63,293	0	0
	Reactor Sidewater Depth	feet		14	14	14	14	14	14	14	14	14
	AOR, Biological	lbs O2/day			50	13	1,652	552	410	327	0	0
	AOR, H2S	lbs O2/day		147	0	0	147	0	0	0	0	0
	AOR, Liquid	lbs O2/day			0	0	176	-88	0	0	0	0
	Total AOR	lbs O2/day			0	0	1,975	464	410	327	0	0
	Aeration Alpha Value				0.78	0.81	0.80	0.56	0.62	0.66	0.83	0.83
	Fouling Factor				0.80	0.80	1.00	0.80	0.80	0.80	0.80	0.80
	Alpha F				0.63	0.65	0.80	0.45	0.49	0.52	0.66	0.66
	SOR/AOR Ratio				1.68	1.61	2.53	3.09	2.79	2.63	1.58	1.58
	SOR	lbs O2/day			0	0	4,989	1,433	1,146	860	0	0
	SOTE				25%	25%	14%	25%	25%	25%	25%	25%
	Required Air Rate	SCFM			0	0	1,440	232	185	139	0	0
	Required Mixing Air @ 0.12 scfm/ft2	SCFM			0	0	146	73	73	73	0	0
	Max Air per Tank at Design Condition	SCFM			588	588	1,853	921	921	921	0	0
	Is Required Diffuser Density Too High?											
	Nitric Oxide (NO) in Off-Gas	lbs NO/day		0.0	0.0	0.0	0.0	0.0	0.0	0.0		
	Nitrous Oxide (N2O) in Off-Gas	lbs N2O/day		0.0	0.0	0.0	0.0	0.0	0.0	0.0		
	MLVSS	mg/L		7,494	2,637	2,639	2,628	2,623	2,618	2,614	0	0
	Flow Balance											
	Raw Feed into Reactor	mgd	1.51		1.51							
	Flow from Previous Reactor	mgd				5.27	5.27	5.27	5.27	5.27		
	Recirculation Into Reactor	mgd			3.01							
	From Reactor				(6)	(0)	(0)	(0)	(0)	(0)		
	RAS Into Reactor	mgd		0.75	0.75							
	Other Flows Into Reactor	mgd	0.00									
	Effluent From Reactor	mgd			5.27	5.27	5.27	5.27	5.27	2.26		
	Waste Activated Sludge	mgd		0.0348								

Appendix E

Brightwater Plant Permit from EPA, discussing CEPT for Peak Wet Weather Flows

Johnson, Paul/BOI

From: Berschauer, Doug/PHX
Sent: Tuesday, November 01, 2011 10:03 AM
To: Johnson, Paul/BOI
Cc: gasik.jon@deq.state.or.us; Leaf, William/BOI
Subject: Brightwater Peak Flow Treatment Approval
Attachments: BrightwaterWWTP_Permit[1].pdf

It appears that EPA did not issue the letter but as indicated by the client, the approval is part of the NPDES permit process.

Attached is the permit

The utility assessment – can be found at
http://www.ecy.wa.gov/programs/wq/permits/northwest_permits.html#K

Any questions, please let me know.

From: Burke, Patrick/SEA
Sent: Monday, October 31, 2011 8:21 AM
To: Berschauer, Doug/PHX
Subject: FW: BW Utilities Analysis

Interesting. So approval is implied in the issued permit. I never saw any further comments on the UA report, either.

From: Komorita, John [mailto:John.Komorita@kingcounty.gov]
Sent: Monday, October 31, 2011 8:07 AM
To: Burke, Patrick/SEA
Subject: RE: BW Utilities Analysis

Pat,

Ecology did not provide any specific approval or acceptance letter, nor did EPA that I'm aware of. The UA was considered a part of the NPDES permit application package. I suppose the issuance of the permit could be considered or implied as the UA approval, but we did not receive anything specific to the UA. This was different than for the Facilities Plan where we did received a formal letter from Ecology approving this document.

Thanks

John Komorita, PE
Brightwater Project Office
22505 State Route 9 SE
Woodinville, WA 98072
206-263-9459

From: Patrick.Burke@CH2M.com [mailto:Patrick.Burke@CH2M.com]
Sent: Friday, October 28, 2011 8:42 AM
To: Komorita, John
Subject: BW Utilities Analysis

Did you ever receive a letter from EPA or Ecology approving the Utilities Analysis? If so, we'd like to see a copy. Doug is likely to be involved in another UA on a project and was interested in how approvals have been worded.

Thanks

Patrick L. Burke, P.E.
CH2M HILL
Brightwater Field Office
patrick.burke@ch2m.com

(206) 263 - 9479 (office)
(425) 922 - 1171 (mobile)

Permit No. WA0032247
Issuance Date: June 10, 2011
Effective Date: August 1, 2011
Expiration Date: July 31, 2016

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT No. WA0032247

State of Washington
DEPARTMENT OF ECOLOGY
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

In compliance with the provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
(The Clean Water Act)
Title 33 United States Code, Section 1342 et seq.

King County Department of Natural Resources and Parks,
Wastewater Treatment Division

King Street Center, KSC-NR-700
201 South Jackson Street
Seattle, Washington 98104-3855

is authorized to discharge in accordance with the Special and General Conditions that follow.

Plant Name: Brightwater Wastewater Treatment Plant (WWTP)	Receiving Water: Puget Sound
Plant Location: 22505 SR 9 SE, Woodinville, WA 98072	Discharge Locations: Outfall 1 *Diffuser 1* Latitude: 47.777138360 Longitude: 122.416948716 *Diffuser 2* Latitude: 47.776987265 Longitude: 122.417957020
Plant Type: Activated Sludge with Hollow Fiber Membranes; Chemically Enhanced Primary Treatment for Peak Wet Weather Flows	

Kevin C. Fitzpatrick
Water Quality Section Manager
Northwest Regional Office
Washington State Department of Ecology

TABLE OF CONTENTS

GENERAL CONDITIONS

SUMMARY OF PERMIT REPORT SUBMITTALS

Refer to the Special and General Conditions of this permit for additional submittal requirements.

Permit Section	Submittal	Frequency	First Submittal Date
S1.A.2 and 3	Notification of Implementation of New Permit Limits	As necessary	
S3	Discharge Monitoring Report	Monthly	September 20, 2011
S3.E	Reporting Permit Violations	As necessary	
S3.F	Other Reporting	As necessary	
S4.B	Plans for Maintaining Adequate Capacity	As necessary	
S4.D	Notification of New or Altered Sources	As necessary	
S4.E	Infiltration and Inflow Progress Report	2/permit cycle	October 1, 2013, biennially
S4.F	Wasteload Assessment	Annually	October 1, 2013
S5.G	Operations and Maintenance Manual	1/permit cycle	September 1, 2011
S5.G	Operations and Maintenance Manual Update or Review Confirmation Letter	Annually	November 1, 2012
S6.A.4	Pretreatment Report	1/year	March 31, 2012
S8	Application for Permit Renewal	1/permit cycle	July 31, 2015
S9	Engineering Documents	As necessary	
S10	Spill Control Plan	1/permit cycle	March 30, 2012
S11	Receiving Water Characterization – Quality Assurance Plan	1/permit cycle	July 1, 2012
S11	Receiving Water Characterization Results	1/permit cycle	July 31, 2015
S12.A	Sediment Quality Summary Report	1/permit cycle	June 30, 2012
S12.B	Sediment Baseline Sampling and Analysis Plan	If required, 1/permit cycle	If required, December 31, 2013
S12.C	Sediment Data Report	If required, 1/permit cycle	If required, March 1, 2016
S13	Outfall Evaluation	1/permit cycle	June 30, 2014
S14.A	Acute Toxicity Characterization Data	4/permit cycle To be completed in 1.5 years beginning June 2012	60 days following each sampling event.
S14.D	Acute Toxicity Compliance Monitoring Reports	If required, 1/permit cycle	
S14.E	Acute Toxicity: “Causes and Preventative Measures for Transient Events”	If required, 1/permit cycle	

Permit Section	Submittal	Frequency	First Submittal Date
S14.E	Acute Toxicity TI/TRE Plan	If required, 1/permit cycle	
S14.F	Acute Toxicity Effluent Test Results with Permit Renewal Application	2/permit cycle July 2014 and January 2015	July 31, 2015
S15.A	Chronic Toxicity Characterization Data	4/permit cycle To be completed in 1.5 years beginning June 2012	60 days following each sampling event.
S15.D	Chronic Toxicity Compliance Monitoring Reports	If required, 1/permit cycle	
S15.E	Chronic Toxicity: "Causes and Preventative Measures for Transient Events"	If required, 1/permit cycle	
S15.E	Chronic Toxicity TI/TRE Plan	If required, 1/permit cycle	
S15.F	Chronic Toxicity Effluent Test Results with Permit Renewal Application	2/permit cycle April 2014 and December 2014	July 31, 2015
S16.B	Monthly Authorized Bypass Report	Monthly	September 30, 2011
S16.B	Annual Authorized Bypass Report including NEB Analysis	Annually	March 31, 2012
S16.C	Utility Analysis Update Report	1/permit cycle	July 31, 2015
G1.C	Notice of Change in Authorization	As necessary	
G4	Reporting Planned Changes	As necessary	
G5	Engineering Report for Construction or Modification Activities	As necessary	
G7	Notice of Permit Transfer	As necessary	
G10	Duty to Provide Information	As necessary	
G23	Contract Submittal	As necessary	

SPECIAL CONDITIONS

In this permit, the word "must" denotes an action that is mandatory and is equivalent to the word "shall" used in previous permits.

S1. DISCHARGE LIMITS

A. Effluent Limits

All discharges and activities authorized by this permit must comply with the terms and conditions of this permit. The discharge of any of the following pollutants more frequently than, or at a level in excess of, that identified and authorized by this permit violates the terms and conditions of this permit.

1. Interim Permit Limits (Phase 1 Initial – 30 MGD Nominal MBR Design Capacity)

At the time discharging commences to Puget Sound and until the start of the Phase I Final condition, the Permittee may discharge treated municipal wastewater at the permitted location subject to compliance with the following limits. The Permittee must notify the Department of Ecology (Ecology) by letter sixty (60) days prior to discharging to Puget Sound.

EFFLUENT LIMITS: Outfall No. 1		
Parameter	**Average Monthly [a]**	**Average Weekly [b]**
Biochemical Oxygen Demand (5-day)	30 mg/L 10,233 lbs/day 85% removal of influent BOD	45 mg/L 15,350 lbs/day
Total Suspended Solids	30 mg/L 10,233 lbs/day 85% removal of influent TSS	45 mg/L 15,350 lbs/day
Total Residual Chlorine (technology-based)	0.5 mg/L	0.75 mg/L
Parameter	**Monthly geometric mean**	**7- day geometric mean**
Fecal Coliform Bacteria [c]	200 organisms/100 mL	400 organisms/100 mL
Parameter	**Daily Minimum**	**Daily Maximum**
pH [d]	6.0	9.0

Footnotes: apply to limits table below

[a] Average monthly effluent limit means the highest allowable average of daily discharges over a calendar month. To calculate the discharge value to compare to the limit, you add the value of each daily discharge measured during a calendar month and divide this sum by the total number of daily discharges measured. See footnote c for fecal coliform calculations.

[b] Average weekly discharge limitation means the highest allowable average of "daily discharges" over a calendar week, calculated as the sum of all "daily discharges" measured during a calendar week divided by the number of "daily discharges" measured during that week. See footnote [c] for fecal coliform calculations.

[c] To calculate the average monthly and average weekly values for fecal coliforms, you must use the geometric mean. Ecology gives directions to calculate this value in publication No. 04-10-020, *Information Manual for Treatment Plant Operators* available at: http://www.ecy.wa.gov/pubs/0410020.pdf

[d] Indicates the range of permitted values. The Permittee must report the instantaneous maximum and minimum pH monthly. Do not average pH values.

2. Final Permit Limits (Phase 1 Final – 39 MGD Nominal MBR Design Capacity)

The below permit limits apply for Phase I Final conditions until the permit expires and/or a new permit is reissued. The Permittee may discharge treated municipal wastewater at the permitted location subject to compliance with the following limits. The Permittee must notify Ecology by letter sixty (60) days prior to implementing new permit limits associated with this mode of operation.

EFFLUENT LIMITS: Outfall No. 1		
Parameter	**Average Monthly [a]**	**Average Weekly [b]**
Biochemical Oxygen Demand (5-day)	30 mg/L 12,760 lbs/day 85% removal of influent BOD	45 mg/L 19,140 lbs/day
Total Suspended Solids	30 mg/L 12,760 lbs/day 85% removal of influent TSS	45 mg/L 19,140 lbs/day
Total Residual Chlorine (technology-based)	0.5 mg/L	0.75 mg/L
Parameter	**Monthly geometric mean**	**7-day geometric mean**
Fecal Coliform Bacteria [c]	200 organisms/100 mL	400 organisms/100 mL
Parameter	**Daily Minimum**	**Daily Maximum**
pH [d]	6.0	9.0

B. Mixing Zone Authorization

The following paragraphs define the maximum boundaries of the mixing zones for outfall #1:

Chronic Mixing Zone

WAC 173-201A-400(7)(b)(i) specifies mixing zones must not extend in any horizontal direction from the discharge ports for a distance greater than 200 feet plus the depth of water over the discharge ports as measured during mean lower low water (MLLW). Given a MLLW water depth of 593 feet for the Permittee's outfall, the horizontal distance therefore is 793 feet. The mixing zone is a circle with radius of 793 feet measured from the center of each discharge port. The mixing zone extends from the seabed to the top of the water surface. Chronic aquatic life criteria and human health criteria must be met at the edge of the chronic zone.

Acute Mixing Zone

WAC 173-201A-400(8)(b) specifies that in estuarine waters a zone where acute criteria may be exceeded must not extend beyond 10% of the distance established for the maximum or chronic zone as measured independently from the discharge ports. The acute mixing zone is a circle with radius of 79.3 feet measured from the center of each discharge port. The mixing zone extends from the seabed to the top of the water surface. Acute aquatic life criteria must be met at the edge of the acute zone.

Available Dilution (dilution ratio)	Phase I - Initial	Phase I - Final
Acute Aquatic Life Criteria	115:1	115:1
Chronic Aquatic Life Criteria	247:1	216:1
Human Health Criteria - Carcinogen	313:1	256:1
Human Health Criteria - Non-carcinogen	247:1	216:1

S2. MONITORING REQUIREMENTS

A. Monitoring Schedule

1. *Interim Condition - (Initial 30 MGD MBR with Discharge to South WWTP or West Pt. WWTP)*

   The Permittee must monitor in accordance with the following schedule and must use the laboratory method, detection level (DL), and quantitation level (QL) specified in Appendix A or corresponding Sampling Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) documents. Alternative methods from 40 CFR Part 136 are acceptable if the DL and QL are equivalent to those specified in Appendix A, corresponding SAP/QAPP documents, or sufficient to produce a measurable quantity.

Parameter [a]	Units	Sample Point Location	Minimum Sampling Frequency	Sample Type
(1) Wastewater Influent				
Wastewater Influent means the raw sewage flow. The Permittee must sample the wastewater entering the headworks of the treatment plant excluding any side-stream returns from inside the plant.				
Flow	MGD	Influent Pump Station (IPS) or Headworks	Continuous [d]	Measurement
BOD_5	mg/L	Headworks	5 times per week	24-hr Composite [c]
BOD_5	lbs/day	--	5 times per week	Calculation [e]
TSS	mg/L	Headworks	5 times per week	24-hr Composite [c]
TSS	lbs/day	--	5 times per week	Calculation [e]
(2) Final Wastewater Effluent				
Final Wastewater Effluent means wastewater which is exiting, or has exited, the last treatment process or operation. Typically, this is after or at the exit from the chlorine contact chamber or other disinfection process. The Permittee may take effluent samples for the BOD_5 analysis before or after the disinfection process. If taken after, the Permittee must dechlorinate and reseed the sample.				
Flow	MGD	Effluent at IPS	Continuous [d]	Measurement
BOD_5	mg/L	Membrane Effluent Box or Effluent at IPS [i]	5 times per week	24-hr Composite [c]
BOD_5	lbs/day	--	5 times per week	Calculation [e]
BOD_5	% removal	--	Monthly [f]	Calculation [g]

Parameter [a]	Units	Sample Point Location	Minimum Sampling Frequency	Sample Type
TSS	mg/L	Membrane Effluent Box or Effluent at IPS [i]	5 times per week	24-hr Composite [c]
TSS	lbs/day	--	5 times per week	Calculation [e]
TSS	% removal	--	Monthly [f]	Calculation [g]
Chlorine	mg/L	Effluent at IPS	Continuous [d]	Measurement
Fecal Coliform	Organisms/100 ml	Effluent at IPS	Daily [b]	Grab [h]
pH	Standard Units	Membrane Effluent Box or Effluent at IPS [i]	Continuous [d]	Measurement

[a]	See Appendix A for the required detection (DL) or quantitation (QL) levels. Report single analytical values below detection as "less than (detection level)" where (detection level) is the numeric value specified in attachment A. Report single analytical values between the agency-required detection and quantitation levels with qualifier code of j following the value. To calculate the average value (monthly average): • Use the reported numeric value for all parameters measured between the agency-required detection value and the agency-required quantitation value. • For values reported below detection, use one-half the detection value if the lab detected the parameter in another sample for the reporting period. For values reported below detection, use zero if the lab did not detect the parameter in another sample for the reporting period. If the Permittee is unable to obtain the required DL and QL in its effluent due to matrix effects, the Permittee must submit a matrix specific MDL and a QL to Ecology with appropriate laboratory documentation.
[b]	"Daily" means once each calendar day.
[c]	"24-hour composite" means a series of individual samples collected over a 24-hour period into a single container, and analyzed as one sample.
[d]	"Continuous" means uninterrupted except for brief lengths of time for calibration, for power failure, or for unanticipated equipment repair or maintenance. The Permittee must sample every hour when continuous monitoring is not possible, except for chlorine which must be sampled once every four hours.
[e]	"Calculation" means figured concurrently with the respective sample, using the following formula: Concentration (in mg/L) X Flow (in MGD) X Conversion Factor (8.34) = lbs/day.
[f]	"Monthly" means once every calendar month.
[g]	Calculate the percent (%) removal of BOD and TSS using the following algorithm (concentrations in mg/L): (Average Monthly Influent Concentration - Average Monthly Effluent Concentration)/Average Monthly Influent Concentration.
[h]	"Grab" means an individual sample collected over a fifteen (15)-minute, or less, period.
[i]	For split flow events, the effluent sample location must be only at the IPS.

2. Permit Monitoring (Phase I - Initial 30 MGD MBR and Final 39 MGD MBR Capacities)

The Permittee must monitor in accordance with the following schedule and must use the laboratory method, detection level (DL), and quantitation level (QL) specified in Appendix A or corresponding Sampling Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) documents. Alternative methods from 40 CFR Part 136 are acceptable if the DL and QL are equivalent to those specified in Appendix A, corresponding SAP/QAPP documents, or sufficient to produce a measurable quantity.

Parameter [a]	Units	Sample Point Location	Minimum Sampling Frequency	Sample Type
(1) Wastewater Influent				
Wastewater Influent means the raw sewage flow. Sample the wastewater entering the headworks of the treatment plant excluding any side-stream returns from inside the plant.				
Flow	MGD	Influent Pump Station (IPS) or Headworks	Continuous [d]	Measurement
BOD_5	mg/L	Headworks	Daily [b]	24-hr Composite [c]
BOD_5	lbs/day	--	Daily [b]	Calculation [e]
TSS	mg/L	Headworks	Daily [b]	24-hr Composite [c]
TSS	lbs/day	--	Daily [b]	Calculation [e]
(2) Final Wastewater Effluent				
Final Wastewater Effluent means wastewater which is exiting, or has exited, the last treatment process or operation. Typically, this is after or at the exit from the chlorine contact chamber or other disinfection process. The Permittee may take effluent samples for the BOD5 analysis before or after the disinfection process. If taken after, the Permittee must dechlorinate and reseed the sample.				
Flow	MGD	Point Wells	Continuous [d]	Measurement
BOD_5	mg/L	Membrane Effluent Box or Effluent at IPS [p]	Daily [b]	24-hr Composite [c]
BOD_5	lbs/day	--	Daily [b]	Calculation [e]
BOD_5	% removal	--	Monthly [f]	Calculation [g]
TSS	mg/L	Membrane Effluent Box or Effluent at IPS [p]	Daily [b]	24-hr Composite [c]
TSS	lbs/day	--	Daily [b]	Calculation [e]
TSS	% removal	--	Monthly [f]	Calculation [g]
Chlorine	mg/L	Point Wells	Continuous [d]	Measurement
Fecal Coliform	Organisms /100 ml	Effluent at IPS	Daily [b]	Grab [h]
pH	Standard Units	Membrane Effluent Box or Effluent at IPS [p]	Continuous [d]	Measurement
Temperature [i]	°C	Membrane Effluent Box or Effluent at IPS [p]	Daily [b]	Grab [h] or Continuous [d]
(3) Effluent Nutrient Characterization – Final Wastewater Effluent				
Total ammonia	mg/L N	Effluent at IPS	Monthly [f]	24-hr Composite [c]

Parameter [a]	Units	Sample Point Location	Minimum Sampling Frequency	Sample Type
Total ammonia	lbs/day	Effluent at IPS	Monthly [f]	Calculation [e]
Nitrate - Nitrite Nitrogen	mg/L N	Effluent at IPS	Monthly [f]	24-hr Composite [c]
Total Kjeldahl Nitrogen	mg/L N	Effluent at IPS	Monthly [f]	24-hr Composite [c]
Total Phosphorus	mg/L P	Effluent at IPS	Monthly [f]	24-hr Composite [c]
Ortho-Phosphorus (PO_4)	mg/L P	Effluent at IPS	Monthly [f]	24-hr Composite [c] or Grab [h]
(4) Chemically enhanced Primary Clarification (CEPC) Effluent Characterization – Primary Clarifier Effluent Only				
Volume	Gallons	CEPC Effluent Channel	Per Split Stream Event	Measurement or Calculation [n]
Duration [m]	Hours	CEPC Effluent Channel	Per Split Stream Event	Measurement
Flow Rate [l]	MGD	CEPC Effluent Channel	Continuous [d]	Measurement
Storm Duration [m]	Hours	--	Per Split Stream Event	Measurement
Precipitation	Inches	Rain Gauge	Per Split Stream Event	Measurement or Calculation [n]
BOD_5	mg/L	CEPC Effluent Channel	Per Split Stream Event	Grab [h] or 24-hr Composite [c]
BOD_5	% removal	--	Per Split Stream Event	Calculation [k]
TSS	mg/L	CEPC Effluent Channel	Per Split Stream Event	Grab [h] or 24-hr Composite [c]
TSS	% removal	--	Per Split Stream Event	Calculation [k]
pH	Standard Units	CEPC Effluent Channel	Per Split Stream Event	Measurement
Metals – Appendix A as listed under "Metals, Cyanide, & Total Phenols"	µg/L	CEPC Effluent Channel	Twice per year	24-hr composite [c] or Grab [h]
(5) Whole Effluent Toxicity Testing – Final Wastewater Effluent [j]				
Acute Toxicity Testing	--	Membrane Effluent Box/CEPC Effluent Channel [q]	Min. 6/permit cycle	24-hr Composite [c]
Chronic Toxicity Testing	--	Membrane Effluent Box/CEPC Effluent Channel [q]	Min. 6/permit cycle	24-hr Composite [c]
Additional requirements specified in Permit Conditions S15 and S16.				

Parameter [a]	Units	Sample Point Location	Minimum Sampling Frequency	Sample Type
(6) Pretreatment				
As specified in Permit Condition S6.				
(7) Permit Renewal Application Requirements – Final Wastewater Effluent				
Temperature	Degrees Celsius	As specified above	As required above	As required above
BOD	mg/L	As specified above	As required above	As required above
Fecal Coliform	Organisms /100ml	As specified above	As required above	As required above
Total Ammonia	mg/L N	As specified above	As required above	As required above
Total Residual Chlorine	mg/L	As specified above	As required above	As required above
Dissolved Oxygen	mg/L	Membrane Effluent Box or Effluent at IPS [p]	Twice per year (once in winter and once in summer)	Grab [h]
Total Kjeldahl Nitrogen	mg/L N	As specified above	As required above	As required above
Nitrate plus Nitrite N	mg/L N	As specified above	As required above	As required above
Oil and Grease (HEM)	mg/L	Membrane Effluent Box or Effluent at IPS [p]	Twice per year (once in winter and once in summer)	Grab [h]
Phosphorus (Total)	mg/L P	As specified above	As required above	As required above
Total Dissolved Solids	mg/L	Membrane Effluent Box or Effluent at IPS [p]	Twice per year (once in winter and once in summer)	24-hr Composite [c]
Total Hardness [o]	mg/L	Membrane Effluent Box or Effluent at IPS [p]	Twice per year (once in winter and once in summer)	24-hr Composite [c]
Cyanide [o]	µg/L	Membrane Effluent Box or Effluent at IPS [p]	Twice per year (once in winter and once in summer)	Grab [h]
Total Phenols [o]	µg/L	Membrane Effluent Box or Effluent at IPS [p]	Twice per year (once in winter and once in summer)	Grab [h]
Metals – Appendix A as listed under "Metals, Cyanide, & Total Phenols" [o]	µg/L	Membrane Effluent Box or Effluent at IPS [p]	Twice per year (once in winter and once in summer)	24-hr composite [c] or Grab [h]
Volatile Compounds – Appendix A [o]	µg/L	Membrane Effluent Box or Effluent at IPS [p]	Twice per year (once in winter and once in summer)	Grab [h]
Acid-Compounds – Appendix A [o]	µg/L	Membrane Effluent Box or Effluent at IPS [p]	Twice per year (once in winter and once in summer)	24-hr composite [c]
Base/Neutral Compounds – Appendix A [o]	µg/L	Membrane Effluent Box or Effluent at IPS [p]	Twice per year (once in winter and once in summer)	24-hr composite [c]

Parameter [a]	Units	Sample Point Location	Minimum Sampling Frequency	Sample Type
The Permittee must record and report the wastewater treatment plant flow discharged on the day it collects the sample for priority pollutant testing with the discharge monitoring report.				
(8) Receiving Water Study				
As specified in Permit Condition S11.				
(9) Sediment Study				
As specified in Permit Condition S12.				

[a]	See Appendix A for the required detection (DL) or quantitation (QL) levels. Report single analytical values below detection as "less than (detection level)" where (detection level) is the numeric value specified in attachment A. Report single analytical values between the agency-required detection and quantitation levels with qualifier code of j following the value. To calculate the average value (monthly average): • Use the reported numeric value for all parameters measured between the agency-required detection value and the agency-required quantitation value. • For values reported below detection, use one-half the detection value if the lab detected the parameter in another sample for the reporting period. For values reported below detection, use zero if the lab did not detect the parameter in another sample for the reporting period. If the Permittee is unable to obtain the required DL and QL in its effluent due to matrix effects, the Permittee must submit a matrix specific MDL and a QL to Ecology with appropriate laboratory documentation.
[b]	"Daily" means once each calendar day.
[c]	"24-hour composite" means a series of individual samples collected over a 24-hour period into a single container, and analyzed as one sample.
[d]	"Continuous" means uninterrupted except for brief lengths of time for calibration, for power failure, or for unanticipated equipment repair or maintenance. The Permittee must sample every hour when continuous monitoring is not possible, except for chlorine which must be sampled once every four hours.
[e]	"Calculation" means figured concurrently with the respective sample, using the following formula: Concentration (in mg/L) X Flow (in MGD) X Conversion Factor (8.34) = lbs/day
[f]	"Monthly" means once every calendar month.
[g]	Calculate the Percent (%) removal of BOD and TSS using the following algorithm (concentrations in mg/L): (Average Monthly Influent Concentration - Average Monthly Effluent Concentration)/Average Monthly Influent Concentration.
[h]	"Grab" means an individual sample collected over a fifteen (15)-minute, or less, period.
[i]	Temperature grab sampling must occur when the effluent is at or near its daily maximum temperature, which is usually in the late afternoon. If temperature is measured continuously, the Permittee must determine and report a daily maximum from half-hour measurements in a 24-hour period. To determine the daily average, use the temperature on the half-hour from the chart for the twenty-four (24)-hour period and calculate the average of the values. Continuous monitoring instruments must achieve an accuracy of 0.2 degrees C, and the Permittee must verify accuracy annually.
[j]	Acute and chronic toxicity testing must be performed with a synthetic, blended effluent twice per the permit cycle. If no split stream events occur during the permit cycle, then this footnote is not required.
[k]	Calculate the percent (%) removal of BOD and TSS using the following equation (concentrations in mg/L): (Primary Influent Concentration – Primary Effluent Concentration)/Primary Influent Concentration X 100.

Parameter [a]	Units	Sample Point Location	Minimum Sampling Frequency	Sample Type
[l]	During each split stream event, the influent flow rate to the WWTP at the time of initiating a bypass must be recorded. The average flow rate to the WWTP during the duration of the split stream event must also be calculated.			
[m]	Storm duration is the amount of total time when precipitation occurred that contributed to a split stream event. It is determined on a case-by-case basis.			
[n]	"Measurement/Calculation" means the total split stream volume or amount of precipitation event as estimated by direct measurement or indirectly by calculation. Precipitation must be measured by the nearest possible precipitation-measuring device and actively monitored during the period of interest.			
[o]	At least one sampling event per year, the final effluent must contain chemically enhanced primary effluent from a split stream event and the final blended effluent analyzed for these parameters. If a split stream event doesn't occur during the winter, on an annual basis, then this footnote is not required.			
[p]	For split flow events, the effluent sample location must be only at the IPS.			
[q]	For the WET synthetic effluent samples, the effluent volume must be collected from the membrane effluent box and the CEPC effluent channel separately. For WET sampling that does not include synthetic samples, the effluent volume must be collected from the membrane effluent box only.			

B. Sampling and Analytical Procedures

Samples and measurements taken to meet the requirements of this permit must represent the volume and nature of the monitored parameters. The Permittee must conduct representative sampling of any unusual discharge or discharge condition, including bypasses, upsets, and maintenance-related conditions that may affect effluent quality.

Sampling and analytical methods used to meet the monitoring requirements specified in this permit must conform to the latest revision of the Guidelines Establishing Test Procedures for the Analysis of Pollutants contained in 40 CFR Part 136.

C. Flow Measurement, Field Measurement and Continuous Monitoring Devices

The Permittee must:

1. Select and use appropriate flow measurement, field measurement, and continuous monitoring devices and methods consistent with accepted scientific practices.

2. Install, calibrate, and maintain these devices to ensure the accuracy of the measurements is consistent with the accepted industry standard and the manufacturer's recommendation for that type of device.

3. Use field measurement devices as directed by the manufacturer and do not use reagents beyond their expiration dates.

4. Calibrate these devices at the frequency recommended by the manufacturer.

5. Calibrate flow monitoring devices at a minimum frequency of at least one calibration per year.

6. Maintain calibration records for at least five years.

D. Laboratory Accreditation

The Permittee must ensure that all monitoring data required by Ecology is prepared by a laboratory registered or accredited under the provisions of chapter 173-50 WAC, *Accreditation of Environmental Laboratories.* Flow, temperature, settleable solids, conductivity, pH, and internal process control parameters are exempt from this requirement.

S3. REPORTING AND RECORDING REQUIREMENTS

The Permittee must monitor and report in accordance with the following conditions. Falsification of information submitted to Ecology is a violation of the terms and conditions of this permit.

A. Reporting

The first monitoring period begins on the effective date of the permit. The Permittee must:

1. Submit monitoring results each month.

2. Submit monitoring data via conventional means or by using Ecology's WebDMR program. To find out more information and to sign up for WebDMR go to: http://www.ecy.wa.gov/programs/wq/permits/paris/webdmr.html.

3. Submit the form as required with the words "no discharge" entered in place of the monitoring results, if the facility did not discharge during a given monitoring period.

4. Submit the conventional forms or the WebDMR forms to Ecology no later than the 20th day of the month following the completed monitoring period, unless otherwise specified in this permit.

All laboratory reports providing data for organic and metal parameters must include the following information: sampling date, sample location, date of analysis, parameter name, analytical method/number, method detection limit (MDL), laboratory practical quantitation limit (PQL), reporting units, and concentration detected. Analytical results from samples sent to a contract laboratory must include information on the chain of custody, the analytical method, QA/QC results, and documentation of accreditation for the parameter.

B. Records Retention

The Permittee must retain records of all monitoring information for a minimum of five (5) years. Such information must include all calibration and maintenance records and all original recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit. The Permittee must extend this period of retention during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by Ecology.

C. Recording of Results

For each measurement or sample taken, the Permittee must record the following information:

1. The date, exact place, method, and time of sampling or measurement.

2. The individual who performed the sampling or measurement.

3. The dates the analyses were performed.

4. The individual who performed the analyses.

5. The analytical techniques or methods used.

6. The results of all analyses.

D. Additional Monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by Condition S2 of this permit, then the Permittee must include the results of such monitoring in the calculation and reporting of the data submitted in the Permittee's DMR.

E. Reporting Permit Violations

The Permittee must take the following actions when it violates or is unable to comply with any permit condition:

- Immediately take action to stop, contain, and cleanup unauthorized discharges or otherwise stop the noncompliance and correct the problem.

- If applicable, immediately repeat sampling and analysis. Submit the results of any repeat sampling to Ecology within thirty (30) days of sampling.

1. Immediate Reporting

The Permittee must report any failure of the disinfection system **immediately** to the Department of Ecology's Regional Office 24-hour number listed below:

Northwest Regional Office	425-649-7000

The Permittee must report any failure of the disinfection system, any collection system overflows which may reach surface waters, or any plant bypass discharging to a shellfish area **immediately** to the Department of Ecology and the Department of Health, Shellfish Program at the numbers listed below:

Northwest Regional Office	425-649-7000
Department of Health, Shellfish Program	360-236-3330 (business hours) 360-786-4183 (24 hours)

2. Twenty-four-hour Reporting

The Permittee must report the following occurrences of noncompliance by telephone, to Ecology at the telephone numbers listed above, within 24 hours from the time the Permittee becomes aware of any of the following circumstances:

a. Any noncompliance that may endanger health or the environment, unless previously reported under subpart 1, above.

b. Any unanticipated **bypass** that exceeds any effluent limit in the permit (See Part S4.B, “Bypass Procedures”).

c. Any **upset** that exceeds any effluent limits in the permit (See G.15, “Upset”).

d. Any violation of a maximum daily or instantaneous maximum discharge limit for any of the pollutants in Section S1.A of this permit.

e. Any overflow prior to the treatment works, whether or not such overflow endangers health or the environment or exceeds any effluent limit in the permit.

3. Report within Five Days

The Permittee must also provide a written submission within five days of the time that the Permittee becomes aware of any event required to be reported under subparts 1 or 2, above. The written submission must contain:

a. A description of the noncompliance and its cause.

b. The period of noncompliance, including exact dates and times.

c. The estimated time noncompliance is expected to continue if it has not been corrected.

d. Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

e. If the noncompliance involves an overflow prior to the treatment works, an estimate of the quantity (in gallons) of untreated overflow.

4. Waiver of Written Reports

Ecology may waive the written report required in subpart 3, above, on a case by case basis upon request if a timely oral report has been received.

5. All Other Permit Violation Reporting

The Permittee must report all permit violations, which do not require immediate or within 24 hours reporting, when it submits monitoring reports for S3.A ("Reporting"). The reports must contain the information listed in paragraph E.3, above. Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failure to comply.

6. Report Submittal

The Permittee must submit reports to the address listed in S3.

F. Other Reporting

The Permittee must report a spill of oil or hazardous materials in accordance with the requirements of RCW 90.56.280 and chapter 173-303-145. You can obtain further instructions at the following website:
http://www.ecy.wa.gov/programs/spills/other/reportaspill.htm .

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application, or in any report to Ecology, it must submit such facts or information promptly.

G. Maintaining a Copy of This Permit

The Permittee must keep a copy of this permit at the facility and make it available upon request to Ecology inspectors.

S4. FACILITY LOADING

A. Design Criteria

The influent flows or influent waste loads for the permitted facility must not exceed the following design criteria:

Parameter	Projected Influent Flows and Loadings in 2016 Phase I – Initial[1]	Projected Influent Flows and Loadings in 2040 Phase I – Final[2]
Flow (MGD), Average Annual	25.2	31.3
Flow (MGD), Average Wet Weather (Oct.-Mar.)	29.0	36.0
Flow (MGD), Maximum Month	40.9	51.0
BOD (lbs/day) Maximum Month	66,063	82,066
TSS (lbs/day) Maximum Month	61,400	76,274

B. Plans for Maintaining Adequate Capacity

The Permittee must submit a plan and a schedule for continuing to maintain capacity to Ecology when:

1. The actual flow or waste load reaches 85 percent of any one of the design criteria in S4.A for three consecutive months.

2. The projected increase would reach design capacity within five years.

   The plan and schedule for continuing to maintain capacity must be sufficient to achieve the effluent limits and other conditions of this permit. This plan must identify any of the following actions or any other actions necessary to meet the objective of maintaining capacity.

   a. Analysis of the present design, including the introduction of any process modifications that would establish the ability of the existing facility to achieve the effluent limits and other requirements of this permit at specific levels in excess of the existing design criteria specified in paragraph A, above.

   b. Reduction or elimination of excessive infiltration and inflow of uncontaminated ground and surface water into the sewer system.

   c. Limitation on future sewer extensions or connections or additional waste loads.

[1] The projected influent flows and loadings from 2011 to 2016 correspond to the installed 30 MGD membrane nominal capacity.

[2] The projected influent flows and loadings from 2017 to 2040 correspond to the installed 39 MGD membrane nominal capacity.

d. Modification or expansion of facilities necessary to accommodate increased flow or waste load.

e. Reduction of industrial or commercial flows or waste loads to allow for increasing sanitary flow or waste load.

Engineering documents associated with the plan must meet the requirements of WAC 173-240-060, "Engineering Report," and be approved by Ecology prior to any construction.

If the Permittee intends to apply for state or federal funding for the design or construction of a facility project, the plan may also need to meet the environmental review requirements as described in 40 CFR 35.3040 and 40 CFR 35.3045 and it may also need to demonstrate cost effectiveness as required by WAC 173-95-730. The plan must specify any contracts, ordinances, methods for financing, or other arrangements necessary to achieve this objective.

C. Duty to Mitigate

The Permittee must take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.

D. Notification of New or Altered Sources

1. The Permittee must submit written notice to Ecology whenever any new discharge or a substantial change in volume or character of an existing discharge into the POTW is proposed which:

   a. Would interfere with the operation of, or exceed the design capacity of, any portion of the POTW;

   b. Is not part of an approved general sewer plan or approved plans and specifications; or

   c. Would be subject to pretreatment standards under 40 CFR Part 403 and Section 307(b) of the Clean Water Act.

2. This notice must include an evaluation of the POTW's ability to adequately transport and treat the added flow and/or waste load, the quality and volume of effluent to be discharged to the POTW, and the anticipated impact on the Permittee’s effluent [40 CFR 122.42(b)].

E. Infiltration and Inflow Progress Report

1. The Permittee shall submit a biennial Infiltration and Inflow (I/I) Progress Report.

2. A report shall be prepared which summarizes progress made toward measuring the infiltration and inflow and the progress that has been made toward removing infiltration and inflow from the system.

3. The first report shall be submitted by October 1, 2013, and every two (2) years thereafter.

F. Wasteload Assessment

1. The Permittee must conduct an annual assessment of their influent flow and waste load and submit a report to Ecology by October 1, 2013, and annually thereafter.

2. The report must contain the following:

   i. An indication of compliance or noncompliance with the permit effluent limits.

   ii. A comparison between the existing and design monthly average dry weather and wet weather flows, peak flows, BOD, and total suspended solids loadings; and the percentage change in these parameters since the previous report (exclude from first report).

3. The report must discuss projected populations and growth rates and the estimated date upon which the design capacity is projected to be reached.

4. Ecology may modify the interval for review and reporting if it determines that a different frequency is sufficient.

S5. OPERATION AND MAINTENANCE

The Permittee must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) that are installed to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance also includes keeping a daily operation logbook (paper or electronic), adequate laboratory controls, and appropriate quality assurance procedures. This provision of the permit requires the Permittee to operate backup or auxiliary facilities or similar systems only when the operation is necessary to achieve compliance with the conditions of this permit.

A. Certified Operator

This permitted facility must be operated by an operator certified by the state of Washington for at least a Class IV plant. This operator must be in responsible charge of the day-to-day operation of the wastewater treatment plant. An operator certified for at least a Class III plant must be in charge during all regularly scheduled shifts.

B. O & M Program

The Permittee must:

1. Institute an adequate operation and maintenance program for the entire sewage system.

2. Keep maintenance records on all major electrical and mechanical components of the treatment plant, as well as the sewage system and pumping stations. Such records must clearly specify the frequency and type of maintenance recommended by the manufacturer and must show the frequency and type of maintenance performed.

3. Make maintenance records available for inspection at all times.

C. Short-term Reduction

The Permittee must schedule any facility maintenance, which might require interruption of wastewater treatment and degrade effluent quality, during non-critical water quality periods and carry this maintenance out in a manner approved by Ecology.

If a Permittee contemplates a reduction in the level of treatment that would cause a violation of permit discharge limits on a short-term basis for any reason, and such reduction cannot be avoided, the Permittee must:

1. Give written notification to Ecology, if possible, thirty (30) days prior to such activities.

2. Detail the reasons for, length of time of, and the potential effects of the reduced level of treatment.

This notification does not relieve the Permittee of its obligations under this permit.

D. Electrical Power Failure

The Permittee must ensure that adequate safeguards prevent the discharge of untreated wastes or wastes not treated in accordance with the requirements of this permit during electrical power failure at the treatment plant and/or sewage lift stations. Adequate safeguards include, but are not limited to, alternate power sources, standby generator(s), or retention of inadequately treated wastes.

The Permittee must maintain Reliability Class II (EPA 430/9-74-001) at the wastewater treatment plant. Reliability Class II requires a backup power source sufficient to operate all vital components and critical lighting and ventilation during peak wastewater flow conditions. Vital components used to support the secondary processes (i.e., mechanical aerators or aeration basin air compressors) need not be operable to full levels of treatment, but must be sufficient to maintain the biota.

E. Prevent Connection of Inflow

The Permittee must strictly enforce its sewer ordinances and not allow the connection of inflow (roof drains, foundation drains, etc.) to the sanitary sewer system, where under ownership and control of King County.

F. Bypass Procedures

This permit prohibits a bypass, except under S16, which is the intentional diversion of waste streams from any portion of a treatment facility. Ecology may take enforcement action against a Permittee for a bypass unless one of the following circumstances (1, 2, or 3) applies.

1. Bypass for essential maintenance without the potential to cause violation of permit limits or conditions.

   Bypass is authorized if it is for essential maintenance and does not have the potential to cause violations of limits or other conditions of this permit, or adversely impact public health as determined by Ecology prior to the bypass. The Permittee must submit prior notice, if possible, at least ten (10) days before the date of the bypass.

2. Bypass which is unavoidable, unanticipated, and results in noncompliance of this permit.

   Bypasses are prohibited unless all of the following conditions are met:

   a. Bypass is unavoidable to prevent loss of life, personal injury, or severe property damage. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass.

   b. No feasible alternatives to the bypass exist, such as:

      - The use of auxiliary treatment facilities.
      - Retention of untreated wastes.
      - Stopping production.
      - Maintenance during normal periods of equipment downtime, but not if the Permittee should have installed adequate backup equipment in the exercise of reasonable engineering judgment to prevent a bypass.
      - Transport of untreated wastes to another treatment facility; and

   c. Ecology is properly notified of the bypass as required in Condition S3.E of this permit.

3. If bypass is anticipated and has the potential to result in noncompliance of this permit.

   a. The Permittee must notify Ecology at least thirty (30) days before the planned date of bypass. The notice must contain:

      - A description of the bypass and its cause.
      - An analysis of all known alternatives which would eliminate, reduce, or mitigate the need for bypassing.
      - A cost-effectiveness analysis of alternatives including comparative resource damage assessment.
      - The minimum and maximum duration of bypass under each alternative.
      - A recommendation as to the preferred alternative for conducting the bypass.
      - The projected date of bypass initiation.
      - A statement of compliance with SEPA.
      - A request for modification of water quality standards as provided for in WAC 173-201A-410, if an exceedance of any water quality standard is anticipated.
      - Details of the steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass.

   b. For probable construction bypasses, the Permittee must notify Ecology of the need to bypass as early in the planning process as possible. The Permittee must consider the analysis required above during preparation of the engineering report or facilities plan and plans and specifications and must include these to the extent practical. In cases where the Permittee determines the probable need to bypass early, the Permittee must continue to analyze conditions up to and including the construction period in an effort to minimize or eliminate the bypass.

   c. Ecology will consider the following prior to issuing an administrative order for this type of bypass:

      - If the bypass is necessary to perform construction or maintenance-related activities essential to meet the requirements of this permit.
      - If feasible alternatives to bypass exist, such as the use of auxiliary treatment facilities, retention of untreated wastes, stopping production, maintenance during normal periods of equipment down time, or transport of untreated wastes to another treatment facility.

- If the Permittee planned and scheduled the bypass to minimize adverse effects on the public and the environment.

After consideration of the above and the adverse effects of the proposed bypass and any other relevant factors, Ecology will approve or deny the request. Ecology will give the public an opportunity to comment on bypass incidents of significant duration, to the extent feasible. Ecology will approve a request to bypass by issuing an administrative order under RCW 90.48.120.

G. Operations and Maintenance Manual

The Permittee must:

1. Prepare an Operations and Maintenance (O&M) Manual in accordance with 173-240-080 WAC and submit it to Ecology for approval by September 1, 2011.

2. Review the O&M Manual at least annually and confirm this review by letter to Ecology by November 1st of each year beginning in 2012.

3. Submit to Ecology for review and approval substantial changes or updates to the O&M Manual whenever it incorporates them into the manual.

4. Keep the approved O&M Manual at the permitted facility.

5. Follow the instructions and procedures of this manual.

In addition to the requirements of WAC 173-240-080 (1) through (5), the O&M Manual or other plant-related manuals must include:

1. Emergency procedures for cleanup in the event of wastewater system upset or failure.

2. Wastewater system maintenance procedures that contribute to the generation of process wastewater.

3. Any directions to maintenance staff when cleaning or maintaining other equipment or performing other tasks which are necessary to protect the operation of the wastewater system (for example, defining maximum allowable discharge rate for draining a tank, blocking all floor drains before beginning the overhaul of a stationary engine).

4. The treatment plant process control monitoring schedule.

5. Minimum staffing adequate to operate and maintain the treatment processes and carry out compliance monitoring required by the permit.

S6. PRETREATMENT

A. General Requirements

1. The Permittee must implement the Industrial Pretreatment Program in accordance with King County Code 28.84.060 and 28.82 as amended by King County Ordinance No. 11963 on January 1, 1996, legal authorities, policies, procedures, and financial provisions described in the Permittee's approved pretreatment program submittal entitled "Industrial Pretreatment Program" and dated April 27, 1981; any approved revisions thereto; and the General Pretreatment Regulations (40 CFR Part 403), including any revisions to 40 CFR Part 403. At a minimum, the Permittee must undertake the following pretreatment implementation activities:

    a. Enforce categorical pretreatment standards under Section 307(b) and (c) of the Federal Clean Water Act (hereinafter, the Act), prohibited discharge standards as set forth in 40 CFR 403.5, local limits , or state standards, whichever are most stringent or apply at the time of issuance or modification of a local industrial waste discharge permit. Locally derived limits are defined as pretreatment standards under Section 307(d) of the Act and are not limited to categorical industrial facilities.

    b. Issue industrial waste discharge permits to all significant industrial users [SIUs, as defined in 40 CFR 403.3(t)(i)(ii)] contributing to the treatment system, including those from other jurisdictions. Industrial waste discharge permits must contain, as a minimum, all the requirements of 40 CFR 403.8 (f)(l)(iii). The Permittee must coordinate the permitting process with Ecology regarding any industrial facility which may possess a state waste discharge permit issued by Ecology.

    c. Maintain and update, as necessary, records identifying the nature, character, and volume of pollutants contributed by industrial users to the POTW. The Permittee must maintain records for at least a three-year period.

    d. Perform inspections, surveillance, and monitoring activities on industrial users to determine or confirm compliance with pretreatment standards and requirements. The Permittee must conduct a thorough inspection of SIUs annually, except that Middle Tier Categorical Industrial Users as defined by 40 CFR 403.8(f)(2)(v)(B)&(C) need only be inspected once every two years. The Permittee must conduct regular local monitoring of SIU wastewaters commensurate with the character and volume of the wastewater but not less than once per year, except for Middle-Tier Categorical Industrial Users which may be sampled once every two years. The Permittee must collect and analyze samples in accordance with 40 CFR Part 403.12(b)(5)(ii)-(v) and 40 CFR Part 136.

e. Enforce and obtain remedies for noncompliance by any industrial users with applicable pretreatment standards and requirements. Once violations have been identified, the Permittee must take timely and appropriate enforcement action to address the noncompliance. The Permittee's action must follow its enforcement response procedures and any amendments, thereof.

f. Publish, at least annually, in a newspaper of general circulation that provides meaningful public notice within the Permittee's service area, a list of all nondomestic users which, at any time in the previous 12 months, were in significant noncompliance as defined in 40 CFR 403.8(f)(2)(viii).

g. If the Permittee elects to conduct sampling of an SIU's discharge in lieu of requiring user self-monitoring, it must satisfy all requirements of 40 CFR Part 403.12. This includes monitoring and record keeping requirements of Sections 403.12(g) and (o). For SIUs subject to categorical standards (CIUs), the Permittee may either complete baseline and initial compliance reports for the CIU [when required by 403.12(b) and (d)] or require these of the CIU. The Permittee must ensure SIUs are provided the results of sampling in a timely manner, inform SIUs of their right to sample, their obligations to report any sampling they do, to respond to noncompliance, and to submit other notifications. These include a slug load report [403.12(f)], notice of changed discharge [403.12(j)], and hazardous waste notifications [403.12(p)]. If sampling for the SIU, the Permittee must not sample less than once in every six-month period unless the Permittee's approved program includes procedures for reduction of monitoring for Middle Tier or Non-Significant Categorical Users per 403.12(e)(2) and (3) and those procedures have been followed.

h. Develop and maintain a data management system designed to track the status of the Permittee's industrial user inventory, industrial user discharge characteristics, and compliance status.

i. Maintain adequate staff, funds, and equipment to implement its pretreatment program.

j. Establish, where necessary, contracts or legally-binding agreements with contributing jurisdictions to ensure compliance with applicable pretreatment requirements by commercial or industrial users within these jurisdictions. These contracts or agreements must identify the agency responsible for the various implementation and enforcement activities to be performed in the contributing jurisdiction.

2. Per 40 CFR 403.8(f)(2)(vi), the Permittee must evaluate each Significant Industrial User to determine if a Slug Control Plan is needed to prevent slug discharges which may cause interference, pass-through, or in any other way result in violations of the Permittee’s regulations, local limits, or permit conditions. The Slug Control Plan evaluation shall occur within one year of a user’s designation as a Significant

Industrial User. In accordance with 40 CFR 403.8(f)(1)(iii)(B)(6), the Permittee shall include slug discharge control requirements in an SIU's permit if the Permittee determines that they are necessary.

3. Whenever Ecology determines that any waste source contributes pollutants to the Permittee's treatment works in violation of Subsection (b), (c), or (d) of Section 307 of the Act, and the Permittee has not taken adequate corrective action, Ecology will notify the Permittee of this determination. If the Permittee fails to take appropriate enforcement action within thirty (30) days of this notification, Ecology may take appropriate enforcement action against the source or the Permittee.

4. Pretreatment Report

   The Permittee must provide to Ecology an annual report that briefly describes its program activities during the previous calendar year.

   By March 31st of each year, the Permittee must send the annual report to Ecology at:

   Water Quality Permit Coordinator
   Department of Ecology
   3190 160th Avenue SE
   Bellevue, WA 98008-5452

   The report must include the following information:

   a. An updated listing of nondomestic industrial dischargers.

   b. Results of wastewater sampling at the treatment plant as specified in Subsection B below. The Permittee must calculate removal rates for each pollutant and evaluate the adequacy of the existing local limits in prevention of treatment plant interference, pass-through of pollutants that could affect receiving water quality, and sludge contamination.

   c. Status of program implementation, including:

      i. Any substantial modifications to the pretreatment program as originally approved by Ecology, including staffing and funding levels.

      ii. Any interference, upset, or permit violations experienced at the POTW that are directly attributable to wastes from industrial users.

      iii. Listing of industrial users inspected and/or monitored, and a summary of the results.

      iv. Listing of industrial users scheduled for inspection and/or monitoring for the next year, and expected frequencies.

v. Listing of industrial users notified of promulgated pretreatment standards and/or local standards as required in 40 CFR 403.8(f)(2)(iii). The list must indicate which industrial users are on compliance schedules and the final date of compliance for each.

vi. Listing of industrial users issued industrial waste discharge permits.

vii. Planned changes in the pretreatment program implementation plan. (See Subsection A.6. below.)

d. Status of compliance activities, including:

i. Listing of industrial users that failed to submit baseline monitoring reports or any other reports required under 40 CFR 403.12 and in the Permittee's pretreatment program, dated April 27, 1981.

ii. Listing of industrial users that were at any time during the reporting period not complying with federal, state, or local pretreatment standards or with applicable compliance schedules for achieving those standards, and the duration of such noncompliance.

iii. Summary of enforcement activities and other corrective actions taken or planned against noncomplying industrial users. The Permittee must supply to Ecology a copy of the public notice of facilities that were in significant noncompliance.

5. The Permittee must request and obtain approval from Ecology before making any significant changes to the approved local pretreatment program. The Permittee must follow the procedure in 40 CFR 403.18 (b) and (c).

B. Monitoring Requirements

The Permittee must monitor its influent, effluent, and sludge for the priority pollutants identified in Tables II and III of Appendix D of 40 CFR Part 122 as amended, any compounds identified as a result of Condition S6.B.4, using U.S. EPA-approved procedures for collection, preservation, storage, and analysis. The Permittee must test influent, effluent, and sludge samples for the priority pollutant metals (Table III, 40 CFR 122, Appendix D) on a quarterly basis throughout the term of this permit. The Permittee must test influent, effluent, and sludge samples for the organic priority pollutants (Table II, 40 CFR 122, Appendix D) on an annual basis. Methods identified in Appendix A may be used.

1. The Permittee must sample POTW influent and effluent on a day when industrial discharges are occurring at normal-to-maximum levels. The Permittee must obtain 24-hour composite samples for the analysis of acid and base/neutral extractable compounds and metals. The Permittee must collect samples for the analysis of volatile organic compounds and samples must be collected using grab sampling techniques at equal intervals for a total of four grab samples per day.

The laboratory may run a single analysis for volatile pollutants (using GC/MS procedures approved by 40 CFR 136) for each monitoring day by compositing equal volumes of each grab sample directly in the GC purge and trap apparatus in the laboratory, with no less than 1 ml of each grab included in the composite.

Unless otherwise indicated, all reported test data for metals must represent the total amount of the constituent present in all phases, whether solid, suspended, or dissolved, elemental or combined, including all oxidation states.

The Permittee must handle, prepare, and analyze all wastewater samples taken for GC/MS analysis using procedures approved by 40 CFR 136.

2. The Permittee must collect a sludge sample concurrently with a wastewater sample as a single grab sample of residual sludge. Sampling and analysis must be performed using procedures approved by 40 CFR 136 unless the Permittee requests an alternate method and Ecology has approved.

3. The Permittee must take cyanide, phenols, and oil and grease as grab samples. Oil & grease must be hexane soluble or equivalent, and should be measured in the influent and effluent only.

4. In addition to quantifying pH, oil and grease, and all priority pollutants, the Permittee must make a reasonable attempt to identify all other substances and quantify all pollutants shown to be present by gas chromatograph/mass spectrometer (GC/MS) analysis using procedures approved by 40 CFR 136. The Permittee should attempt to make determinations of pollutants for each fraction, which produces identifiable spectra on total ion plots (reconstructed gas chromatograms). The Permittee should attempt to make determinations from all peaks with responses 5% or greater than the nearest internal standard. The 5% value is based on internal standard concentrations of 30 μg/l, and must be adjusted downward if higher internal standard concentrations are used or adjusted upward if lower internal standard concentrations are used. The Permittee may express results for non-substituted aliphatic compounds as total hydrocarbon content. The Permittee must use a laboratory whose computer data processing programs are capable of comparing sample mass spectra to a computerized library of mass spectra, with visual confirmation by an experienced analyst. For all detected substances which are determined to be pollutants, the Permittee must conduct additional sampling and appropriate testing to determine concentration and variability, and to evaluate trends.

C. Reporting of Monitoring Results

The Permittee must include a summary of monitoring results in the Annual Pretreatment Report.

D. Local Limit Development

As sufficient data becomes available, the Permittee must, in consultation with Ecology, reevaluate their local limits in order to prevent pass-through or interference. If Ecology determines that any pollutant present causes pass-through or interference, or exceeds established sludge standards, the Permittee must establish new local limits or revise existing local limits as required by 40 CFR 403.5. Ecology may also require the Permittee to revise or establish local limits for any pollutant discharged from the POTW that has a reasonable potential to exceed the water quality standards, sediment standards, or established effluent limits, or causes whole effluent toxicity. Ecology makes this determination in the form of an administrative order.

Ecology may modify this permit to incorporate additional requirements relating to the establishment and enforcement of local limits for pollutants of concern. Any permit modification is subject to formal due process procedures under state and federal law and regulation.

S7. RESIDUAL SOLIDS

Residual solids include screenings, grit, scum, sludge (primary sludge and waste-activated sludge), and other solid waste. The Permittee shall store and handle all residual solids in such a manner so as to prevent their entry into state ground or surface waters. The Permittee shall not discharge leachate from residual solids to state surface or ground water.

S8. APPLICATION FOR PERMIT RENEWAL

The Permittee must submit an application for permit renewal by July 31, 2015.

S9. ENGINEERING DOCUMENTS

Ecology has delegated certain engineering review planning and review functions to King County Wastewater Treatment Division under a Memorandum of Agreement (MOA). The submittal of engineering documents is not required for projects in accordance with the MOA.

For projects not subject to the MOA, engineering reports, facility plans, or plans and specifications which are developed during this permit cycle must comply with the following requirements.

1. The Permittee must prepare and submit two copies of an approvable engineering report or facility plan in accordance with chapter 173-240 WAC to Ecology for review and approval.

2. The report must contain any appropriate requirements as described in *Water Reclamation and Reuse Standards* (Washington State Department of Ecology and Department of Health Publication No. 97-23, 1997) or regulations that apply at the time a project is proposed. As required by RCW 90.48.112, the report must address the feasibility of using reclaimed water as defined in RCW 90.46.010.

3. The Permittee must prepare and submit two copies of approvable plans and specifications to Ecology for review and approval in accordance with chapter 173-240 WAC.

4. Prior to the start of construction, the Permittee must submit to Ecology a quality assurance plan as required by chapter 173-240 WAC.

S10. SPILL CONTROL PLAN

The Permittee must:

1. Submit to Ecology a Spill Control Plan for the prevention, containment, and control of spills or unplanned releases of pollutants by March 30, 2012.

2. Review the plan at least annually and update the Spill Control Plan as needed.

3. Send changes to the plan to Ecology.

4. Follow the plan and any supplements throughout the term of the permit.

The Spill Control Plan must include the following:

1. A list of all oil and petroleum products and other materials used and/or stored on-site, which when spilled, or otherwise released into the environment, designate as dangerous waste (DW) or extremely hazardous waste (EHW) by the procedures set forth in WAC 173-303-070. Include other materials used and/or stored on site which may become pollutants or cause pollution upon reaching state's waters.

2. A description of preventive measures and facilities (including an overall facility plot showing drainage patterns) which prevent, contain, or treat spills of these materials.

3. A description of the reporting system the Permittee will use to alert responsible managers and legal authorities in the event of a spill.

4. A description of operator training to implement the plan.

The Permittee may submit plans and manuals required by 40 CFR Part 112, contingency plans required by Chapter 173-303 WAC, or other plans required by other agencies which meet the intent of this section.

S11. RECEIVING WATER CHARACTERIZATION

In the vicinity of the Brightwater WWTP outfall, the Permittee must provide data via ambient monitoring stations or collect receiving water information via field sampling necessary to determine if the effluent has a reasonable potential to cause a violation of the water quality standards. If reasonable potential exists, Ecology will use this information to calculate effluent limits. Field sampling will be required where ambient monitoring station data does not exist.

For field sampling activities, the Permittee must:

1. Submit a Sampling and Quality Assurance Plan for Ecology review and approval by July 1, 2012.

2. Conduct all sampling and analysis in accordance with the guidelines given in *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies*, Ecology Publication 04-03-030. This document is available at http://www.ecy.wa.gov/programs/eap/qa/docs/QAPPtool/Mod3%20Guidelines/GuidelinesforPreparingQAPPS.pdf .

3. Locate the receiving water sampling locations outside the zone of influence of the effluent.

4. Use sampling station accuracy requirements of ± 20 meters.

5. Time the sampling to account for seasonal differences (i.e. winter and summer conditions).

6. Follow the clean sampling techniques (*Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels*, EPA Publication No. 821-R-95-034, April 1995).

7. Collect at least ten receiving water samples and analyze the samples for total suspended solids, dissolved oxygen, alkalinity, temperature, pH, fecal coliform bacteria, and salinity.

8. In addition, analyze the samples for both the total and dissolved fractions for the following metals: zinc, copper, lead, silver, cadmium, nickel, mercury, arsenic, and chromium.

9. Conduct all chemical analysis using the methods and the detection levels identified in Appendix A or as approved in the Sampling and Quality Assurance Plan.

10. Submit the results of the study to Ecology by July 31, 2015.

Any subsequent sampling and analysis must also meet these requirements. The Permittee may conduct a cooperative receiving water study with other NPDES Permittees discharging in the same vicinity.

S12. SEDIMENT MONITORING

A. Sediment Quality Summary Report

The Permittee must submit to Ecology for review and approval a Sediment Quality Summary Report for the Brightwater outfall no later than June 30, 2012. The purpose of this report is to provide baseline information, based on existing information, of the potential for sediment impacts from the Brightwater outfall and provide a basis for

determining any data gaps. This report must provide a summary of all readily available information on the site history, quantity and quality of the nearby discharges, receiving water characteristics, and current and past sediment quality near the outfall. The report must also include any readily available information on the status of nearby sediment cleanup sites and monitoring plans. An annotated outline and list of references for the report will be submitted to Ecology for review and approval by December 31, 2011.

All existing County sediment data near the Brightwater outfall location, which has not already been submitted to Ecology, must be submitted no later than June 30, 2012. Data which has already been SEDQUAL-formatted for entry into Ecology's SEDQUAL database, may be submitted in the SEDQUAL format. Data not previously submitted and not yet formatted and future data must be formatted in the EIM format.

After Ecology reviews the data and report of existing information, sediment monitoring at the Brightwater outfall may be required during this permit cycle to address data gaps and evaluate compliance with the sediment management standards.

B. Sediment Sampling and Analysis Plan

Based on the review of the Sediment Quality Summary Report, Ecology may require the Permittee to sample and analyze sediments in the vicinity of the Brightwater outfall.

If required, the Permittee must submit to Ecology for review and approval a Sediment Sampling and Analysis Plan for sediment monitoring no later than December 31, 2013. The purpose of the plan is to characterize sediment quality in the vicinity of the Permittee's outfall. The Permittee must follow the guidance provided in the *Sediment Source Control Standards User Manual*, Appendix B: Sediment Sampling and Analysis Plan (Ecology, 2008).

C. Sediment Data Report

Following Ecology approval of the Sediment Sampling and Analysis Plan for the Brightwater outfall, the Permittee must collect and analyze sediments in the summer of 2014 or 2015. The Permittee must submit to Ecology a Sediment Data Report containing the results of the sediment sampling and analysis no later than March 1, 2016. The Sediment Data Report must conform to the approved Sampling and Analysis Plan.

S13. OUTFALL EVALUATION

The Permittee must inspect, once during the life of this permit, the submerged portion of the outfall lines and diffusers to document its integrity and continued function. Include digital video verification in the report. By June 30, 2014, the Permittee must submit the inspection report to Ecology. If the outfall evaluation concludes that repairs need to be made to the outfall lines and/or diffusers, the Permittee must submit a report to Ecology by June 30, 2015, describing the proposed plan to address the necessary repairs.

S14. ACUTE TOXICITY

A. Effluent Characterization

The Permittee must:

1. Conduct acute toxicity testing on the effluent four times within a one and a half year period. Testing must begin by June 2012. Two rounds of characterization testing must be conducted during summer months. Two rounds of characterization testing must include a synthetic effluent that contains 39% by volume of chemically enhanced primary clarifier effluent and a 61% by volume of MBR effluent.

2. Submit a written report to Ecology within sixty (60) days after each sample date.

3. Use a dilution series consisting of a minimum of five concentrations and a control.

4. Conduct the following two acute toxicity tests on each sample:

Acute Toxicity Tests	Species	Method
Fathead minnow 96-hour static-renewal test	*Pimephales promelas*	EPA-821-R-02-012
Daphnid 48-hour static test	*Ceriodaphnia dubia*, *Daphnia pulex*, or *Daphnia magna*	EPA-821-R-02-012

The Permittee has an effluent limit for acute toxicity if after one year of effluent characterization:

1. The median survival of any species in 100% effluent is below 80%, OR

2. Any one test of any species exhibits less than 65% survival in 100% effluent.

If the Permittee has an effluent limit for acute toxicity, the Permittee must immediately follow the instructions in Subsections B, C, D, E, and G.

If the Permittee has no effluent limit for acute toxicity, then the Permittee must follow the instructions in Subsections F and G.

B. Effluent Limit for Acute Toxicity

The effluent limit for acute toxicity is:

No acute toxicity detected in a test concentration representing the acute critical effluent concentration (ACEC).

The ACEC means the maximum concentration of effluent during critical conditions at the boundary of the acute mixing zone, defined in Section S1 of this permit. The ACEC equals 0.87 % effluent.

C. Compliance with the Effluent Limit for Acute Toxicity

Compliance with the effluent limit for acute toxicity means the results of the testing specified in Subsection D show no statistically significant difference in survival between the control and the ACEC.

If the test results show a statistically significant difference in survival between the control and the ACEC, the test does **not** comply with the effluent limit for acute toxicity. The Permittee must then immediately conduct the additional testing described in Subsection E. The Permittee will comply with the requirements of this section by meeting the requirements of Subsection E.

The Permittee must determine the statistical significance by conducting a hypothesis test at the 0.05 level of significance (Appendix H, EPA/600/4-89/001). If the difference in survival between the control and the ACEC is less than 10%, the Permittee must conduct the hypothesis test at the 0.01 level of significance.

D. Compliance Testing for Acute Toxicity

The Permittee must:

1. Perform the acute toxicity tests with 100% effluent, the ACEC, and a control, or with a full dilution series.

2. Submit a written report of all test results to Ecology within sixty (60) days after each sample date.

   The Permittee must perform compliance tests twice each year – July and December, using each of the species and protocols listed below on a rotating basis:

Acute Toxicity Tests	Species	Method
Fathead minnow 96-hour static-renewal test	*Pimephales promelas*	EPA-821-R-02-012
Daphnid 48-hour static test	*Ceriodaphnia dubia*, *Daphnia pulex*, or *Daphnia magna*	EPA-821-R-02-012

E. Response to Noncompliance with the Effluent Limit for Acute Toxicity

If a toxicity test conducted under Subsection D determines a statistically significant difference in response between the ACEC and the control, using the statistical test described in Subsection C, the Permittee must begin additional testing within one week from the time of receiving the test results. The Permittee must:

1. Conduct one additional test each week for four consecutive weeks, using the same test and species as the failed compliance test.

2. Test at least five effluent concentrations and a control to determine appropriate point estimates. One of these effluent concentrations must equal the ACEC. The

results of the test at the ACEC will determine compliance with the effluent limit for acute toxicity as described in Subsection C.

3. Return to the original monitoring frequency in Subsection D after completion of the additional compliance monitoring.

Anomalous test results: If a toxicity test conducted under Subsection D indicates noncompliance with the acute toxicity limit and the Permittee believes that the test result is anomalous, the Permittee may notify Ecology that the compliance test result may be anomalous. The Permittee may take one additional sample for toxicity testing and wait for notification from Ecology before completing the additional testing. The Permittee must submit the notification with the report of the compliance test result and identify the reason for considering the compliance test result to be anomalous.

If Ecology determines that the test result was **not** anomalous, the Permittee must complete all of the additional monitoring required in this subsection. Or,

If the one additional sample fails to comply with the effluent limit for acute toxicity, then the Permittee must complete all of the additional monitoring required in this subsection. Or,

If Ecology determines that the test result **was** anomalous, the one additional test result will replace the anomalous test result.

If all of the additional testing complies with the permit limit, the Permittee must submit a report to Ecology on possible causes and preventive measures for the transient toxicity event, which triggered the additional compliance monitoring. This report must include a search of all pertinent and recent facility records, including:

1. Operating records.
2. Monitoring results.
3. Inspection records.
4. Spill reports.
5. Weather records.
6. Production records.
7. Raw material purchases.
8. Pretreatment records, etc.

If the additional testing shows violation of the acute toxicity limit, the Permittee must submit a Toxicity Identification/Reduction Evaluation (TI/RE) plan to Ecology within sixty (60) days after the sample date [WAC 173-205-100(2)].

F. Testing When There Is No Permit Limit for Acute Toxicity

The Permittee must:

1. Conduct acute toxicity testing on final effluent during July 2014 and January 2015 (once in the last summer and once in the last winter prior to submission of the application for permit renewal). If the initial characterization testing (i.e. S14.A) did not include synthetic testing due to the absence of split flow events associated with peak wet weather events, then a synthetic test must be conducted in January 2015. In the possible absence of split flow events in January 2015, acute toxicity testing must still be performed but with membrane effluent only.

2. Submit the results to Ecology with the permit renewal application.

3. Conduct acute toxicity testing on a series of at least five concentrations of effluent, including 100% effluent, and a control.

4. Use each of the following species and protocols for each acute toxicity test:

Acute Toxicity Tests	Species	Method
Fathead minnow 96-hour static-renewal test	*Pimephales promelas*	EPA-821-R-02-012
Daphnid 48-hour static test	*Ceriodaphnia dubia*, *Daphnia pulex*, or *Daphnia magna*	EPA-821-R-02-012

G. Sampling and Reporting Requirements

1. The Permittee must submit all reports for toxicity testing in accordance with the most recent version of Department of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*. Reports must contain bench sheets and reference toxicant results for test methods. If the lab provides the toxicity test data in electronic format for entry into Ecology's database, then the Permittee must send the data to Ecology along with the test report, bench sheets, and reference toxicant results.

2. The Permittee must collect 24-hour composite effluent samples for toxicity testing. The Permittee must cool the samples to 0 - 6 degrees Celsius during collection and send them to the lab immediately upon completion. The lab must begin the toxicity testing as soon as possible but no later than 36 hours after sampling was completed.

3. The laboratory must conduct water quality measurements on all samples and test solutions for toxicity testing, as specified in the most recent version of Department of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*.

4. All toxicity tests must meet quality assurance criteria and test conditions specified in the most recent versions of the EPA methods listed in Subsection C and the Department of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*. If Ecology determines any test results to be invalid or anomalous, the Permittee must repeat the testing with freshly collected effluent.

5. The laboratory must use control water and dilution water meeting the requirements of the EPA methods listed in Subsection A or pristine natural water of sufficient quality for good control performance.

6. The Permittee must collect effluent samples for whole effluent toxicity testing just prior to the chlorination step in the treatment process.

7. The Permittee may choose to conduct a full dilution series test during compliance testing in order to determine dose response. In this case, the series must have a minimum of five effluent concentrations and a control. The series of concentrations must include the acute critical effluent concentration (ACEC). The ACEC equals 0.87% effluent.

8. All whole effluent toxicity tests, effluent screening tests, and rapid screening tests that involve hypothesis testing must comply with the acute statistical power standard of 29% as defined in WAC 173-205-020. If the test does not meet the power standard, the Permittee must repeat the test on a fresh sample with an increased number of replicates to increase the power.

9. Reports of individual characterization or compliance test results must be submitted to Ecology within sixty (60) days after each sample date.

10. The Acute Toxicity Summary Report must be submitted to Ecology by June 30, 2015.

S15. CHRONIC TOXICITY

A. Effluent Characterization

The Permittee must:

1. Conduct chronic toxicity testing on the effluent four times within a one and a half year period. Testing must begin by June 2012. Two rounds of characterization testing must be conducted during summer months. Two rounds of characterization testing must include a synthetic effluent that contains 39% by volume of chemically enhanced primary clarifier effluent and a 61% by volume of MBR effluent.
2. Submit a written report to Ecology within sixty (60) days after each sample date.

3. Conduct chronic toxicity testing during effluent characterization on a series of at least five concentrations of effluent and a control. This series of dilutions must include the acute critical effluent concentration (ACEC). The ACEC equals 0.87% effluent.

   The Permittee must conduct the following two chronic toxicity tests on each sample:

Saltwater Chronic Test	Species	Method
Topsmelt survival and growth	*Atherinops affinis*	EPA/600/R-95/136
Mysid shrimp survival and growth	*Mysidopsis bahia/ Americamysis bahia*	EPA-821-R-02-014

   The Permittee has an effluent limit for chronic toxicity if after one year of effluent characterization, any test shows a significant difference between the control and the ACEC at the 0.05 level of significance using hypothesis testing (Appendix H, EPA/600/4-89/001).

   If the Permittee has an effluent limit for chronic toxicity, the Permittee must immediately follow the instructions in subsections B, C, D, E and G.

   If the Permittee has no effluent limit for chronic toxicity, then the Permittee must follow the instructions in subsections F and G.

B. Effluent Limit for Chronic Toxicity

The effluent limit for chronic toxicity is:

No toxicity detected in a test concentration representing the chronic critical effluent concentration (CCEC).

The CCEC means the maximum concentration of effluent during critical conditions at the boundary of the mixing zone, defined in Section S1 of this permit. The CCEC equals 0.40% effluent.

C. Compliance with the Effluent Limit for Chronic Toxicity

Compliance with the effluent limit for chronic toxicity means the results of the testing specified in Subsection D show no statistically significant difference in response between the control and the CCEC.

If the test results show a statistically significant difference in response between the control and the CCEC, the test does not comply with the effluent limit for chronic toxicity. The Permittee must then immediately conduct the additional testing described in Subsection E. The Permittee will comply with the requirements of this section by meeting the requirements of Subsection E.

The Permittee must determine the statistical significance by conducting a hypothesis test at the 0.05 level of significance (Appendix H, EPA/600/4-89/001). If the difference in response between the control and the CCEC is less than 20%, the Permittee must conduct the hypothesis test at the 0.01 level of significance.

Ecology will re-evaluate the need for the chronic toxicity limit in future permits. Therefore, the Permittee must also conduct this same hypothesis test (Appendix H, EPA/600/4-89/001) to determine whether a statistically significant difference in response exists between the acute critical effluent concentration (ACEC) and the control.

D. Compliance Testing for Chronic Toxicity

The Permittee must:

1. Perform the chronic toxicity tests using the CCEC, the ACEC, and a control, or with a full dilution series.

2. Submit a written report of all test results to Ecology within sixty (60) days after each sample date. This written report must include the results of hypothesis testing conducted as described in Subsection C using both the ACEC and CCEC versus the control.

3. Perform compliance tests twice each year (July and December) using the following species on a rotating basis and the most recent version of the following protocols:

Saltwater Chronic Test	Species	Method
Topsmelt survival and growth	*Atherinops affinis*	EPA/600/R-95/136
Mysid shrimp survival and growth	*Mysidopsis bahia/ Americamysis bahia*	EPA-821-R-02-014

E. Response to Noncompliance with the Effluent Limit for Chronic Toxicity

If a toxicity test conducted under Subsection D determines a statistically significant difference in response between the CCEC and the control using the statistical test described in Subsection C, the Permittee must begin additional testing within one week from the time of receiving the test results. The Permittee must:

1. Conduct additional testing each month for three consecutive months using the same test and species as the failed compliance test.

2. Use a series of at least five effluent concentrations and a control to determine appropriate point estimates. One of these effluent concentrations must equal the CCEC. The results of the test at the CCEC will determine compliance with the effluent limit for chronic toxicity as described in Subsection B.

3. Return to the original monitoring frequency in Subsection C after completion of the additional compliance monitoring.

Anomalous test results: If a toxicity test conducted under subsection D. indicates noncompliance with the acute toxicity limit and the Permittee believes that the test result is anomalous, the Permittee may notify Ecology that the compliance test result may be anomalous. The Permittee may take one additional sample for toxicity testing and wait for notification from Ecology before completing the additional testing. The Permittee must submit the notification with the report of the compliance test result and identify the reason for considering the compliance test result to be anomalous.

If Ecology determines that the test result was **not** anomalous, the Permittee must complete all of the additional monitoring required in this subsection. Or,

If the one additional sample fails to comply with the effluent limit for chronic toxicity, then the Permittee must complete all of the additional monitoring required in this subsection. Or,

If Ecology determines that the test result **was** anomalous, the one additional test result will replace the anomalous test result.

If all of the additional testing complies with the permit limit, the Permittee must submit a report to Ecology on possible causes and preventive measures for the transient toxicity event, which triggered the additional compliance monitoring. This report must include a search of all pertinent and recent facility records, including:

1. Operating records.
2. Monitoring results.
3. Inspection records.
4. Spill reports.
5. Weather records.
6. Production records.
7. Raw material purchases.
8. Pretreatment records, etc.

If the additional testing shows violation of the chronic toxicity limit, the Permittee must submit a Toxicity Identification/Reduction Evaluation (TI/RE) plan to Ecology within 60 days after the sample date [WAC 173-205-100(2)].

F. Testing When There Is No Permit Limit for Chronic Toxicity

The Permittee must:

1. Conduct chronic toxicity testing on final effluent during April 2014 and December 2014. If the initial characterization testing (i.e. S15.A) did not include synthetic testing due to the absence of split flow events associated with peak wet weather events, then a synthetic test must be conducted in January 2015. In the possible

absence of split flow events in January 2015, chronic toxicity testing must still be performed but with membrane effluent only.

2. Submit the results to Ecology with the permit renewal application.

3. Conduct chronic toxicity testing on a series of at least five concentrations of effluent and a control. This series of dilutions must include the acute critical effluent concentration (ACEC). The ACEC equals 0.87% effluent.

4. Compare the ACEC to the control using hypothesis testing at the 0.05 level of significance as described in Appendix H, EPA/600/4-89/001.

5. Perform chronic toxicity tests with all of the following species and the most recent version of the following protocols:

Saltwater Chronic Test	Species	Method
Topsmelt survival and growth	*Atherinops affinis*	EPA/600/R-95/136
Mysid shrimp survival and growth	*Mysidopsis bahia/ Americamysis bahia*	EPA-821-R-02-014

G. Sampling and Reporting Requirements

1. The Permittee must submit all reports for toxicity testing in accordance with the most recent version of Department of Ecology Publication # WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*. Reports must contain bench sheets and reference toxicant results for test methods. If the lab provides the toxicity test data in electronic format for entry into Ecology's database, then the Permittee must send the data to Ecology along with the test report, bench sheets, and reference toxicant results.

2. The Permittee must collect 24-hour composite effluent samples for toxicity testing. The Permittee must cool the samples to 0 - 6 degrees Celsius during collection and send them to the lab immediately upon completion. The lab must begin the toxicity testing as soon as possible but no later than 36 hours after sampling was completed.

3. The laboratory must conduct water quality measurements on all samples and test solutions for toxicity testing, as specified in the most recent version of Department of Ecology Publication # WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*.

4. All toxicity tests must meet quality assurance criteria and test conditions specified in the most recent versions of the EPA methods listed in Subsection C and the Department of Ecology Publication # WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*. If Ecology determines any test results to be invalid or anomalous, the Permittee must repeat the testing with freshly collected effluent.

5. The laboratory must use control water and dilution water meeting the requirements of the EPA methods listed in Subsection C or pristine natural water of sufficient quality for good control performance.

6. The Permittee must collect effluent samples for whole effluent toxicity testing just prior to the chlorination step in the treatment process.

7. The Permittee may choose to conduct a full dilution series test during compliance testing in order to determine dose response. In this case, the series must have a minimum of five effluent concentrations and a control. The series of concentrations must include the CCEC and the ACEC. The CCEC and the ACEC may either substitute for the effluent concentrations that are closest to them in the dilution series or be extra effluent concentrations. The CCEC equals 0.4% effluent. The ACEC equals 0.87% effluent.

8. All whole effluent toxicity tests that involve hypothesis testing must comply with the chronic statistical power standard of 39% as defined in WAC 173-205-020. If the test does not meet the power standard, the Permittee must repeat the test on a fresh sample with an increased number of replicates to increase the power.

9. Reports of individual characterization or compliance test results must be submitted to Ecology within sixty (60) days after each sample date.

10. The Chronic Toxicity Summary Report must be submitted to Ecology by June 30, 2015.

S16. WET WEATHER OPERATIONS

A. Flow Blending Approval

The Permittee has approval to bypass the secondary treatment portion of the Brightwater WWTP when the flow entering the WWTP exceeds the flow value associated with the membrane bioreactor (MBR) design flow capacities as shown in the table below.

MBR Design Peak Flow Capacities

	Phase I - Initial MBR Capacity 30 MGD Nominal	**Phase I – Final MBR Capacity 39 MGD Nominal**
Duration	**Flow, million gallons/day (MGD)**	
Maximum 1-Hour	44	57
Maximum 4-Hour	44	57
Maximum 8-Hour	44	57
Maximum 16-Hour	41	53
Maximum 24-Hour	35	45
Maximum 7 Days	35	45
Maximum 31 Days	30	39

In the event of a bypass under this condition, the Permittee must minimize the discharge of pollutants to the environment. At a minimum, all bypass flows must receive screening, grit removal, chemically enhanced primary clarification, and disinfection. The final discharge must meet the permit effluent limits in S1.

Bypasses, that occur when the flow conditions are of a shorter duration and/or lower flow than the most limiting flow/duration condition shown in the above table, are not approved under this condition. Such bypasses are subject to the bypass provisions as stated in S5.F of the permit.

B. Records and Reporting

The Permittee must maintain records of all bypasses at the treatment plant. These records must document the date, duration, and volume of each bypass event, and the magnitude of the associated precipitation event. The records must also indicate the influent flow rate at the time when bypassing is initiated and the average influent flow rate during the split flow event.

The Permittee must report all bypass occurrences on a monthly and annual basis.

The monthly report must include the above information and must be included in narrative form with the discharge monitoring report.

The annual report must include all of the above information in summary format and include a net environmental benefit (NEB) analysis. The NEB section must include the actual mass of BOD_5 and TSS discharged through the marine outfall on a monthly and annual basis and compare this information to a theoretical mass loading for a conventional non-blending plant with an assumed effluent quality of 15 mg/L BOD_5 and TSS (annual average basis) and 25 mg/L BOD_5 and TSS (maximum month basis). The annual report must also include notification of anticipated bypasses.

C. Utility Analysis Report

The Permittee must submit an updated Utility Analysis Report with the permit renewal application.

D. Net Environmental Benefit (NEB) Performance Standard

A performance standard applies to the Net Environmental Benefit achieved by the Brightwater WWTP. Achievement of the NEB is required in accordance with the standards in the table below which were approved by Ecology as part of the facility plan approval. If the Brightwater WWTP does not meet the required NEB, the Permittee must submit an explanation in the annual report(s) explaining the cause of non-compliance of the NEB and measures that will be taken to ensure achievement of the NEB.

Net Environmental Benefit Required[3]

Net Environmental Benefit, Split-flow Membrane Bioreactor

Parameter	Net Environmental Benefit (percent reduction in BOD/TSS) [a, b]
Phase 1 – Initial (2012-2016)	
BOD_5	
Maximum year [c]	46 percent
Maximum month [c]	8 percent
TSS	
Maximum year [c]	61 percent
Maximum month [c]	45 percent
Phase 1 - Final (2017-2040)	
BOD_5	
Maximum year [c]	52 percent
Maximum month [c]	15 percent
TSS	
Maximum year [c]	65 percent
Maximum month [c]	50 percent

[a] Net environmental benefit is the reduction in a pollutant from the actual discharge compared to the theoretical discharge from a Conventional Activated Sludge (CAS) process.

[b] Assumes CAS = 15 mg/L BOD_5/TSS for yearly conditions and 25 mg/L BOD_5/TSS for maximum-month condition.

[c] 20-year maximum flow based on 63 years of rainfall data.

BOD_5 = 5-day biochemical oxygen demand, **MBR** = membrane bioreactor, **TSS** = total suspended solids.

[3] King County Wastewater Treatment Division, Brightwater Regional Wastewater Treatment System, Facilities Plan, May 2005, p 4-35.

GENERAL CONDITIONS

G1. SIGNATORY REQUIREMENTS

A. All applications, reports, or information submitted to Ecology must be signed and certified.

1. In the case of corporations, by a responsible corporate officer.

   For the purpose of this section, a responsible corporate officer means:

   (i) A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation, or

   (ii) The manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

2. In the case of a partnership, by a general partner.

3. In the case of sole proprietorship, by the proprietor.

4. In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.

Applications for permits for domestic wastewater facilities that are either owned or operated by, or under contract to, a public entity shall be submitted by the public entity.

B. All reports required by this permit and other information requested by Ecology must be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

1. The authorization is made in writing by a person described above and submitted to Ecology.

2. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

C. Changes to authorization. If an authorization under paragraph B.2, above, is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph B.2, above, must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.

D. Certification. Any person signing a document under this section must make the following certification:

"I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

G2. RIGHT OF INSPECTION AND ENTRY

The Permittee must allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law:

A. To enter upon the premises where a discharge is located or where any records must be kept under the terms and conditions of this permit.

B. To have access to and copy, at reasonable times and at reasonable cost, any records required to be kept under the terms and conditions of this permit.

C. To inspect, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required under this permit.

D. To sample or monitor, at reasonable times, any substances or parameters at any location for purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act.

G3. PERMIT ACTIONS

This permit may be modified, revoked and reissued, or terminated either at the request of any interested person (including the Permittee) or upon Ecology's initiative. However, the

permit may only be modified, revoked and reissued, or terminated for the reasons specified in 40 CFR 122.62, 40 CFR 122.64 or WAC 173-220-150 according to the procedures of 40 CFR 124.5.

A. The following are causes for terminating this permit during its term, or for denying a permit renewal application:

1. Violation of any permit term or condition.

2. Obtaining a permit by misrepresentation or failure to disclose all relevant facts.

3. A material change in quantity or type of waste disposal.

4. A determination that the permitted activity endangers human health or the environment, or contributes to water quality standards violations and can only be regulated to acceptable levels by permit modification or termination.

5. A change in any condition that requires either a temporary or permanent reduction, or elimination of any discharge or sludge use or disposal practice controlled by the permit.

6. Nonpayment of fees assessed pursuant to RCW 90.48.465.

7. Failure or refusal of the Permittee to allow entry as required in RCW 90.48.090.

B. The following are causes for modification but not revocation and reissuance except when the Permittee requests or agrees:

1. A material change in the condition of the waters of the state.

2. New information not available at the time of permit issuance that would have justified the application of different permit conditions.

3. Material and substantial alterations or additions to the permitted facility or activities which occurred after this permit issuance.

4. Promulgation of new or amended standards or regulations having a direct bearing upon permit conditions, or requiring permit revision.

5. The Permittee has requested a modification based on other rationale meeting the criteria of 40 CFR Part 122.62.

6. Ecology has determined that good cause exists for modification of a compliance schedule, and the modification will not violate statutory deadlines.

7. Incorporation of an approved local pretreatment program into a municipality’s permit.

C. The following are causes for modification or alternatively revocation and reissuance:

1. When cause exists for termination for reasons listed in A1 through A7 of this section, and Ecology determines that modification or revocation and reissuance is appropriate.

2. When Ecology has received notification of a proposed transfer of the permit. A permit may also be modified to reflect a transfer after the effective date of an automatic transfer (General Condition G8) but will not be revoked and reissued after the effective date of the transfer except upon the request of the new Permittee.

G4. REPORTING PLANNED CHANGES

The Permittee must, as soon as possible, but no later than sixty (60) days prior to the proposed changes, give notice to Ecology of planned physical alterations or additions to the permitted facility, production increases, or process modification which will result in:
1) the permitted facility being determined to be a new source pursuant to 40 CFR 122.29(b);
2) a significant change in the nature or an increase in quantity of pollutants discharged; or
3) a significant change in the Permittee's sludge use or disposal practices. Following such notice, and the submittal of a new application or supplement to the existing application, along with required engineering plans and reports, this permit may be modified, or revoked and reissued pursuant to 40 CFR 122.62(a) to specify and limit any pollutants not previously limited. Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by this permit constitutes a violation.

G5. PLAN REVIEW REQUIRED

Prior to constructing or modifying any wastewater control facilities, an engineering report and detailed plans and specifications must be submitted to Ecology for approval in accordance with chapter 173-240 WAC. Engineering reports, plans, and specifications must be submitted at least one hundred eighty (180) days prior to the planned start of construction unless a shorter time is approved by Ecology. Facilities must be constructed and operated in accordance with the approved plans.

G6. COMPLIANCE WITH OTHER LAWS AND STATUTES

Nothing in this permit must be construed as excusing the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G7. TRANSFER OF THIS PERMIT

In the event of any change in control or ownership of facilities from which the authorized discharge emanate, the Permittee must notify the succeeding owner or controller of the existence of this permit by letter, a copy of which must be forwarded to Ecology.

A. Transfers by Modification

Except as provided in paragraph (B) below, this permit may be transferred by the Permittee to a new owner or operator only if this permit has been modified or revoked and reissued under 40 CFR 122.62(b)(2), or a minor modification made under 40 CFR 122.63(d), to identify the new Permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

B. Automatic Transfers

This permit may be automatically transferred to a new Permittee if:

1. The Permittee notifies Ecology at least thirty (30) days in advance of the proposed transfer date.

2. The notice includes a written agreement between the existing and new Permittees containing a specific date transfer of permit responsibility, coverage, and liability between them.

3. Ecology does not notify the existing Permittee and the proposed new Permittee of its intent to modify or revoke and reissue this permit. A modification under this subparagraph may also be minor modification under 40 CFR 122.63. If this notice is not received, the transfer is effective on the date specified in the written agreement.

G8. REDUCED PRODUCTION FOR COMPLIANCE

The Permittee, in order to maintain compliance with its permit, must control production and/or all discharges upon reduction, loss, failure, or bypass of the treatment facility until the facility is restored or an alternative method of treatment is provided. This requirement applies in the situation where, among other things, the primary source of power of the treatment facility is reduced, lost, or fails.

G9. REMOVED SUBSTANCES

Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters must not be resuspended or reintroduced to the final effluent stream for discharge to state waters.

G10. DUTY TO PROVIDE INFORMATION

The Permittee must submit to Ecology, within a reasonable time, all information which Ecology may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee must also submit to Ecology upon request, copies of records required to be kept by this permit.

G11. OTHER REQUIREMENTS OF 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G12. ADDITIONAL MONITORING

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G13. PAYMENT OF FEES

The Permittee must submit payment of fees associated with this permit as assessed by Ecology.

G14. PENALTIES FOR VIOLATING PERMIT CONDITIONS

Any person who is found guilty of willfully violating the terms and conditions of this permit is deemed guilty of a crime, and upon conviction thereof must be punished by a fine of up to ten thousand dollars ($10,000) and costs of prosecution, or by imprisonment in the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit will incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars ($10,000) for every such violation. Each and every such violation is a separate and distinct offense, and in case of a continuing violation, every day's continuance is deemed to be a separate and distinct violation.

G15. UPSET

Definition – "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limits because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limits if the requirements of the following paragraph are met.

A Permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:
1) an upset occurred and that the Permittee can identify the cause(s) of the upset;
2) the permitted facility was being properly operated at the time of the upset;
3) the Permittee submitted notice of the upset as required in Condition S3.E; and
4) the Permittee complied with any remedial measures required under S4.C of this permit.

In any enforcement action the Permittee seeking to establish the occurrence of an upset has the burden of proof.

G16. PROPERTY RIGHTS

This permit does not convey any property rights of any sort, or any exclusive privilege.

G17. DUTY TO COMPLY

The Permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G18. TOXIC POLLUTANTS

The Permittee must comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G19. PENALTIES FOR TAMPERING

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit must, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two (2) years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such person under this condition, punishment must be a fine of not more than $20,000 per day of violation, or by imprisonment of not more than four (4) years, or by both.

G20. COMPLIANCE SCHEDULES

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit must be submitted no later than fourteen (14) days following each schedule date.

G21. CONTRACT REVIEW

The Permittee must submit to Ecology any proposed contract for the operation of any wastewater treatment facility covered by this permit. The review is to ensure consistency with chapters 90.46 and 90.48 RCW. In the event that Ecology does not comment within a thirty (30)-day period, the Permittee may assume consistency and proceed with the contract.

Appendix A

LIST OF POLLUTANTS WITH ANALYTICAL METHODS, DETECTION LIMITS, AND QUANTITATION LEVELS

The Permittee must use the specified analytical methods, detection limits (DLs), and quantitation levels (QLs) in the following table for permit required monitoring unless:

- Another permit condition specifies other methods.
- The method used produces measurable results in the sample and EPA has listed it as an EPA-approved method in 40 CFR Part 136.

If the Permittee uses an alternative method, not specified in the permit and as allowed above, it must report the test method, DL, and QL on the discharge monitoring report or in the required report.

When the permit requires the Permittee to measure the base neutral compounds in the list of priority pollutants, it must measure all of the base neutral pollutants listed in the table below. The list includes EPA required base neutral priority pollutants and several additional polynuclear aromatic hydrocarbons (PAHs). The Water Quality Program added several PAHs to the list of base neutrals below from Ecology's Persistent Bioaccumulative Toxics (PBT) List. It only added those PBT parameters of interest to Appendix A that did not increase the overall cost of analysis unreasonably.

Ecology added this appendix to the permit in order to reduce the number of analytical "non-detects" in permit-required monitoring and to measure effluent concentrations near or below criteria values where possible at a reasonable cost.

Pollutant & CAS No. ***(if available)***	**Recommended Analytical Protocol**	**Detection (DL)[1]** ***µg/L unless specified***	**Quantitation Level (QL)[2]** ***µg/L unless specified***
CONVENTIONALS			
Biochemical Oxygen Demand	SM5210-B		2 mg/L
Chemical Oxygen Demand	SM5220-D		10 mg/L
Total Organic Carbon	SM5310-B/C/D		1 mg/L
Total Suspended Solids	SM2540-D		5 mg/L
Total Ammonia (as N)	SM4500-NH3- GH		0.3 mg/L
Flow	Calibrated device		
Dissolved oxygen	4500-OC/OG		0.2 mg/L
Temperature (max. 7-day avg.)	Analog recorder or use micro-recording devices known as thermistors		0.2º C
pH	SM4500-H^+ B	N/A	N/A
NONCONVENTIONALS			
Total Alkalinity	SM2320-B		5 mg/L as $CaCO_3$
Chlorine, Total Residual	4500 Cl G		50.0 mgs
Color	SM2120 B/C/E		10 color unit
Fecal Coliform	SM 9221D/E,9222	N/A	N/A
Fluoride (16984-48-8)	SM4500-F E or SM4110B	25	100
Nitrate-Nitrite (as N)	4500-NO3- E/F/H		100
Nitrogen, Total Kjeldahl (as N)	4500-NH3-C/E/FG or SM4500-Norg-B		300
Ortho-Phosphate (PO_4 as P)	4500- PE/PF	100	100

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
Phosphorus, Total (as P)	4500-PE/PF	100	100
Oil and Grease (HEM)	1664A	1,400	5,000
Salinity	SM2520-B		3 PSS
Settleable Solids	SM2540 -F		100
Sulfate (as mg/L SO_4)	SM4110-B		200
Sulfide (as mg/L S)	4500-S^2F/D/E/G		200
Sulfite (as mg/L SO_3)	SM4500-SO3B		2000
Total dissolved solids	SM2540 C		20 mg/L
Total Hardness	2340B		200 as CaCO3
Aluminum, Total (7429-90-5)	200.8	2.0	10
Barium Total (7440-39-3)	200.8	0.5	2.0
BTEX (benzene +toluene + ethylbenzene + m,o,p xylenes)	EPA SW 846 8021/8260 or 624		1
Boron Total (7440-42-8)	200.8	2.0	10.0
Cobalt, Total (7440-48-4)	200.8	0.05	0.25
Iron, Total (7439-89-6)	200.7 or 200.8	12.5	50
Magnesium, Total (7439-95-4)	200.7 or 200.8	10	50
Molybdenum, Total (7439-98-7)	200.8	0.1	0.5
Manganese, Total (7439-96-5)	200.8	0.1	0.5
NWTPH Dx	Ecology NWTPH Dx		100
NWTPH Gx	Ecology NWTPH Gx		140
Tin, Total (7440-31-5)	200.8	0.3	1.5
Titanium, Total (7440-32-6)	200.8	0.5	2.5
METALS, CYANIDE & TOTAL PHENOLS			
Antimony, Total (7440-36-0)	200.8	0.3	1.0
Arsenic, Total (7440-38-2)	200.8	0.1	0.5
Beryllium, Total (7440-41-7)	200.8	0.1	0.5
Cadmium, Total (7440-43-9)	200.8	0.05	0.25
Chromium (hex) dissolved (18540-29-9)	SM3500-Cr EC or SM3500-Cr-B	5	10
Chromium, Total (7440-47-3)	200.8	0.2	1.0
Copper, Total (7440-50-8)	200.8	0.4	2.0
Lead, Total (7439-92-1)	200.8	0.1	0.5
Mercury, Total (7439-97-6)	1631E	0.0002	0.0005
Nickel, Total (7440-02-0)	200.8	0.1	0.5
Selenium, Total (7782-49-2)	200.8	1.0	1.0
Silver, Total (7440-22-4)	200.8	0.04	0.2
Thallium, Total (7440-28-0)	200.8	0.09	0.36
Zinc, Total (7440-66-6)	200.8	0.5	2.5
Cyanide, Total (57-12-5)	335.4 or SM4500-CN-C,E	5	10
Cyanide, Weak Acid Dissociable	SM4500-CN I or SM4500-CN-I,E	5	10
Phenols, Total	EPA 420.1		50
DIOXIN			
2,3,7,8-Tetra-Chlorodibenzo-P-Dioxin (176-40-16)	1613B	1.3 pg/L	5 pg/L
ACID COMPOUNDS			
2-Chlorophenol (95-57-8)	625	1.0	2.0
2,4-Dichlorophenol (120-83-2)	625	0.5	1.0
2,4-Dimethylphenol (105-67-9)	625	0.5	1.0
4,6-dinitro-o-cresol (534-52-1) (2-methyl-4,6,-dinitrophenol)	625/1625B	1.0	2.0

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
2,4 dinitrophenol (51-28-5)	625	1.0	2.0
2-Nitrophenol (88-75-5)	625	0.5	1.0
4-nitrophenol (100-02-7)	625	0.5	1.0
Parachlorometa cresol (59-50-7) (4-chloro-3-methylphenol)	625	1.0	2.0
Pentachlorophenol (87-86-5)	625	0.5	1.0
Phenol (108-95-2)	625	2.0	4.0
2,4,6-Trichlorophenol (88-06-2)	625	2.0	4.0
VOLATILE COMPOUNDS			
Acrolein (107-02-8)	624	5	10
Acrylonitrile (107-13-1)	624	1.0	2.0
Benzene (71-43-2)	624	1.0	2.0
Bromoform (75-25-2)	624	1.0	2.0
Carbon tetrachloride (56-23-5)	624/601 or SM6230B	1.0	2.0
Chlorobenzene (108-90-7)	624	1.0	2.0
Chloroethane (75-00-3)	624/601	1.0	2.0
2-Chloroethylvinyl Ether (110-75-8)	624	5	10
Chloroform (67-66-3)	624 or SM6210B	1.0	2.0
Dibromochloromethane (124-48-1)	624	1.0	2.0
1,2-Dichlorobenzene (95-50-1)	624	1.9	7.6
1,3-Dichlorobenzene (541-73-1)	624	1.9	7.6
1,4-Dichlorobenzene (106-46-7)	624	4.4	17.6
Dichlorobromomethane (75-27-4)	624	1.0	2.0
1,1-Dichloroethane (75-34-3)	624	1.0	2.0
1,2-Dichloroethane (107-06-2)	624	1.0	2.0
1,1-Dichloroethylene (75-35-4)	624	1.0	2.0
1,2-Dichloropropane (78-87-5)	624	1.0	2.0
1,3-dichloropropylene (mixed isomers) (542-75-6)	624	1.0	2.0
Ethylbenzene (100-41-4)	624	1.0	2.0
Methyl bromide (74-83-9) (Bromomethane)	624/601	5.0	10.0
Methyl chloride (74-87-3) (Chloromethane)	624	1.0	2.0
Methylene chloride (75-09-2)	624	5.0	10.0
1,1,2,2-Tetrachloroethane (79-34-5)	624	1.9	2.0
Tetrachloroethylene (127-18-4)	624	1.0	2.0
Toluene (108-88-3)	624	1.0	2.0
1,2-Trans-Dichloroethylene (156-60-5) (Ethylene dichloride)	624	1.0	2.0
1,1,1-Trichloroethane (71-55-6)	624	1.0	2.0
1,1,2-Trichloroethane (79-00-5)	624	1.0	2.0
Trichloroethylene (79-01-6)	624	1.0	2.0
Vinyl chloride (75-01-4)	624/SM6200B	1.0	2.0
BASE/NEUTRAL COMPOUNDS (compounds in bold are Ecology PBTs)			
Acenaphthene (83-32-9)	625	0.2	0.4
Acenaphthylene (208-96-8)	625	0.3	0.6
Anthracene (120-12-7)	625	0.3	0.6
Benzidine (92-87-5)	625	12	24
Benzyl butyl phthalate (85-68-7)	625	0.3	0.6
Benzo(*a*)anthracene (56-55-3)	625	0.3	0.6
Benzo(j)fluoranthene (205-82-3)	625	0.5	1.0
Benzo(r,s,t)pentaphene (189-55-9)	625	0.5	1.0
Benzo(*a*)pyrene (50-32-8)	610/625	0.5	1.0
3,4-benzofluoranthene	610/625	0.8	1.6

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
(Benzo(b)fluoranthene) (205-99-2)			
11,12-benzofluoranthene (Benzo(k)fluoranthene) (207-08-9)	610/625	0.8	1.6
Benzo(*ghi*)Perylene (191-24-2)	610/625	0.5	1.0
Bis(*2-chloroethoxy)*methane (111-91-1)	625	5.3	21.2
Bis(*2-chloroethyl*)ether (111-44-4)	611/625	0.3	1.0
Bis(*2-chloroisopropyl*)ether (39638-32-9)	625	0.3	0.6
Bis(*2-ethylhexyl*)phthalate (117-81-7)	625	0.1	0.5
4-Bromophenyl phenyl ether (101-55-3)	625	0.2	0.4
2-Chloronaphthalene (91-58-7)	625	0.3	0.6
4-Chlorophenyl phenyl ether (7005-72-3)	625	0.3	0.5
Chrysene (218-01-9)	610/625	0.3	0.6
Dibenzo (a,j)acridine (224-42-0)	610M/625M	2.5	10.0
Dibenzo (a,h)acridine (226-36-8)	610M/625M	2.5	10.0
Dibenzo(a-*h*)anthracene (53-70-3) (1,2,5,6-dibenzanthracene)	625	0.8	1.6
Dibenzo(a,e)pyrene (192-65-4)	610M/625M	2.5	10.0
Dibenzo(a,h)pyrene (189-64-0)	625M	2.5	10.0
3,3-Dichlorobenzidine (91-94-1)	605/625	0.5	1.0
Diethyl phthalate (84-66-2)	625	1.9	7.6
Dimethyl phthalate (131-11-3)	625	1.6	6.4
Di-n-butyl phthalate (84-74-2)	625	0.5	1.0
2,4-dinitrotoluene (121-14-2)	609/625	0.2	0.4
2,6-dinitrotoluene (606-20-2)	609/625	0.2	0.4
Di-n-octyl phthalate (117-84-0)	625	0.3	0.6
1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)	1625B or 625	5.0	20
Fluoranthene (206-44-0)	625	0.3	0.6
Fluorene (86-73-7)	625	0.3	0.6
Hexachlorobenzene (118-74-1)	612/625	0.3	0.6
Hexachlorobutadiene (87-68-3)	625	0.5	1.0
Hexachlorocyclopentadiene (77-47-4)	1625B/625	0.5	1.0
Hexachloroethane (67-72-1)	625	0.5	1.0
Indeno(*1,2,3-cd*)Pyrene (193-39-5)	610/625	0.5	1.0
Isophorone (78-59-1)	625	0.5	1.0
3-Methyl cholanthrene (56-49-5)	625	2.0	8.0
Naphthalene (91-20-3)	625	0.3	0.6
Nitrobenzene (98-95-3)	625	0.5	1.0
N-Nitrosodimethylamine (62-75-9)	607/625	2.0	4.0
N-Nitrosodi-n-propylamine (621-64-7)	607/625	0.5	1.0
N-Nitrosodiphenylamine (86-30-6)	625	0.5	1.0
Perylene (198-55-0)	625	1.9	7.6
Phenanthrene (85-01-8)	625	0.3	0.6
Pyrene (129-00-0)	625	0.3	0.6
1,2,4-Trichlorobenzene (120-82-1)	625	0.3	0.6
PESTICIDES/PCBs			
Aldrin (309-00-2)	608	0.025	0.05
alpha-BHC (319-84-6)	608	0.025	0.05
beta-BHC (319-85-7)	608	0.025	0.05
gamma-BHC (58-89-9)	608	0.025	0.05
delta-BHC (319-86-8)	608	0.025	0.05
Chlordane (57-74-9)	608	0.025	0.05
4,4'-DDT (50-29-3)	608	0.025	0.05

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
4,4'-DDE (72-55-9)	608	0.025	0.05[10]
4,4' DDD (72-54-8)	608	0.025	0.05
Dieldrin (60-57-1)	608	0.025	0.05
alpha-Endosulfan (959-98-8)	608	0.025	0.05
beta-Endosulfan (33213-65-9)	608	0.025	0.05
Endosulfan Sulfate (1031-07-8)	608	0.025	0.05
Endrin (72-20-8)	608	0.025	0.05
Endrin Aldehyde (7421-93-4)	608	0.025	0.05
Heptachlor (76-44-8)	608	0.025	0.05
Heptachlor Epoxide (1024-57-3)	608	0.025	0.05
PCB-1242 (53469-21-9)	608	0.25	0.5
PCB-1254 (11097-69-1)	608	0.25	0.5
PCB-1221 (11104-28-2)	608	0.25	0.5
PCB-1232 (11141-16-5)	608	0.25	0.5
PCB-1248 (12672-29-6)	608	0.25	0.5
PCB-1260 (11096-82-5)	608	0.13	0.5
PCB-1016 (12674-11-2)	608	0.13	0.5
Toxaphene (8001-35-2)	608	0.24	0.5

1. Detection level (DL) or detection limit means the minimum concentration of an analyte (substance) that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero as determined by the procedure given in 40 CFR Part 136, Appendix B.

2. Quantitation Level (QL) also known as Minimum Level of Quantitation (ML) – The lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that the lab has used all method-specified sample weights, volumes, and cleanup procedures. The QL is calculated by multiplying the MDL by 3.18 and rounding the result to the number nearest to (1, 2, or 5) x 10^n, where n is an integer. (64 FR 30417).

   ALSO GIVEN AS:
   The smallest detectable concentration of analyte greater than the Detection Limit (DL) where the accuracy (precision & bias) achieves the objectives of the intended purpose (Report of the Federal Advisory Committee on Detection and Quantitation Approaches and Uses in Clean Water Act Programs Submitted to the US Environmental Protection Agency, December 2007).

FINAL – Coos Bay Wastewater Treatment Plant No.2 Upgrade Cost Estimate

PREPARED FOR: City of Coos Bay

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DATE: May 15, 2012

Introduction

This memorandum presents the cost estimate for two top alternatives selected in the Coos Bay Wastewater Treatment Plant (WWTP) No.2 Facility Plan Amendment (FPA) (Civil West, draft, September 2011), as well as two top alternatives proposed in the Value Assessment (VA) report (CH2M HILL, November 2011). These alternatives are:

- FPA alternative 1 – New plant with Sequencing Batch Reactor (SBR)
- FPA Alternative 2 – New plant with Conventional Modified Ludzack-Ettinger (MLE)
- VA Alternative 1 – Membrane Bioreactor (MBR), utilizing existing aeration basins and clarifiers
- VA Alternative 2 – Integrated Fixed Film Activated Sludge (IFAS), utilizing existing aeration basins and clarifiers

Although preliminary capital costs have been estimated for those two FPA alternatives during alternative pre-screening, the purpose of this cost estimating is to provide a fair comparison for all four alternatives at the same costing platform. CH2M HILL's cost estimating tool CPES^{TM} (CH2M HILL Parametric Cost Estimating System) will be used to determine the project cost, annual O&M costs and life cycle cost of each alternative. Summary of CPES^{TM} cost estimate of each alternative is included in attachment to this memorandum.

The memorandum summarizes all the assumptions and basis used for the cost estimating and presents the comparison. The cost estimate was based on the proposing vendors' quote as well as engineers' experience at other construction projects. The 2035 design criteria listed within the Facility Plan Amendment are used within this evaluation. One exception is that the design wastewater temperature is proposed to be 15^{o}C, which appears to be the low temperature for the Coos Bay WWTP No. 2 during the compliance period for Ammonia-N. The assumed design temperature used within the equipment quotes included as part of the FPA varied from 10 ^{o}C to 13 ^{o}C. It has been noted that the plant discharge monitoring reports (DMR) show that the minimum wastewater temperature from Coos Bay WWTP No. 2 is approximately 13^{o}C.

Treatment Alternatives

This section presents a description of the alternatives under consideration and the basis of design for each used to develop the cost estimate.

FPA Alternative 1 – SBR

This alternative assumes the existing treatment plant No. 2 will be abandoned, with the exception of piping connections to the existing outfall. The new plant will be constructed on a new parcel, across from the existing WWTP. The new site is undeveloped, but free from any existing structures.

Assumptions have been made during cost estimating based on the understanding of the FPA and CH2M HILL's experience on the similar projects. The common assumptions for both FPA alternatives include:

- The process and equipment have been sized to meet the Class I reliability requirements by Environmental Protection Agency (EPA).
- A new headworks building containing screens and grit removal systems is provided. The screening and grit disposal dumpsters are outdoor.
- No primary clarifiers are provided at the new plant.
- A Waste Activated Sludge (WAS) storage tank with over 6 day storage capacity at maximum month condition is provided. WAS is stored and then trucked offsite for treatment.
- Ultraviolet (UV) disinfection is employed to replace existing chlorine system. A high UV dose may be required due to strict discharge coliform requirement in the National Pollutant Discharge Elimination System (NPDES) permit.
- A 3,000-sqft new Administration/Operation & Maintenance (O&M) building is constructed.
- A new 200-kW emergency generator is installed onsite.
- No odor control is included as per the FPA, but this should be evaluated in detail as the project progresses. It may be warranted to have odor control on the new parcel for the headworks facility.

The assumptions specific to SBR alternative include:

- SBR sizing and cost are based on Intermittent Cycle Extended Aeration System (ICEAS) from ITT's proposal. Although the wastewater temperature and the peak flows used in ITT's calculation do not exactly align with the design criteria discussed in the technical memorandum "Preliminary Biological Treatment System Alternative Proposals Review" (Esvelt Environmental Engineering, August 2011), the temperature of 13^{o}C (based on DMRs) used by ITT is conservative for the dry weather condition because the seasonal low temperature during the ammonia compliance period appears to be approximately 15^{o}C. Therefore, the process system sizes proposed have sufficient hydraulic capacity to handle the peak hour flow.
- The scope of supply includes:
    - (2) 40' Decanters with Drive Units (1 decanters per basin)
    - (2) 125-HP Aeration PD Blowers (1 duty & 1 standby)
    - (2) Fine Bubble Aeration Systems (1 system per tank)
    - (2) Automated Air Control Valves
    - (2) DO Control with Probes and Logic (one probe per tank)
    - (2) Waste Activated Sludge (WAS) Pumps
    - (1) ABJ Control Package (including PLC, HMI, Motor Starters/VFD's for above listed equipment, Modem, Level Transmitters and Float Switches, and Local Decanter Control Stations)
    - (10) Service Days
    - (1) Freight

Figure 1 below illustrates the process flow diagram of SBR alternative.

FIGURE 1
FPA Alternative 1 – SBR Process Flow Diagram

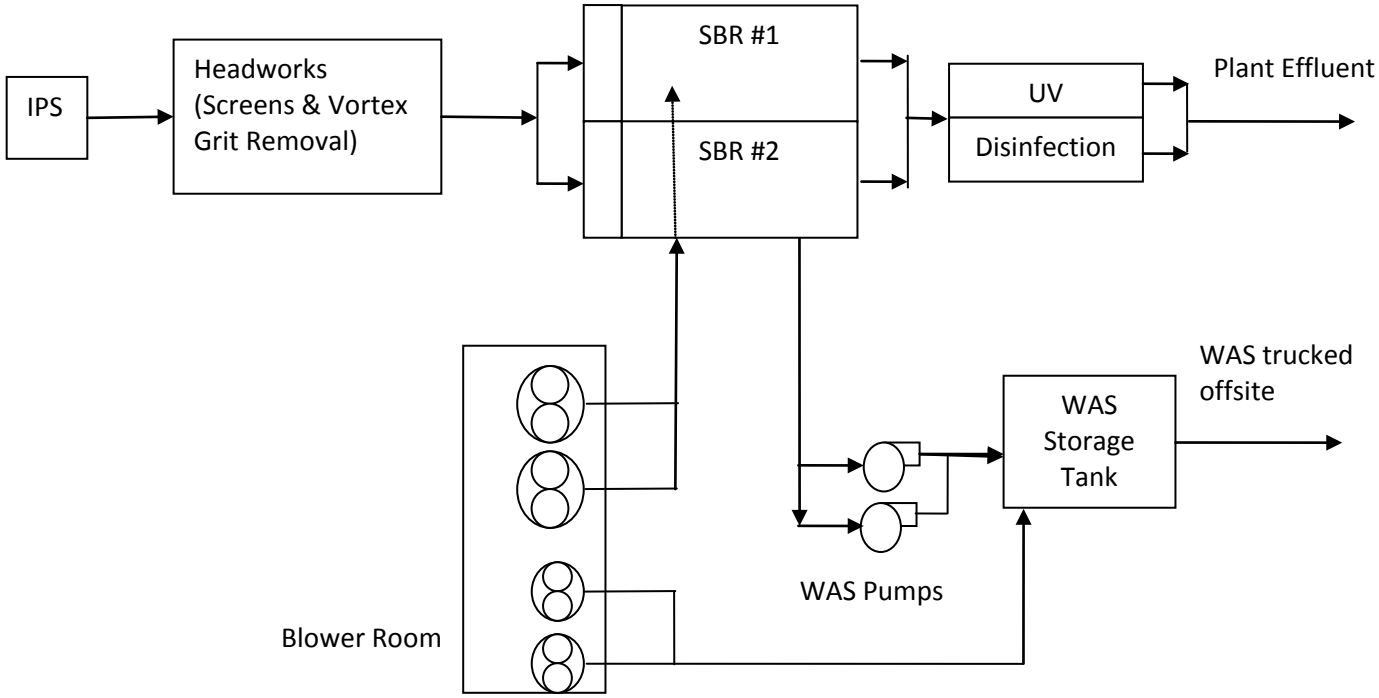


Table 1 below lists preliminary process and major equipment determined for this alternative.

TABLE 1
Process and Major Equipment Design Data Sheet, FPA Alternative 1- SBR

Unit Process	Parameter	Note
Influent Pump Station W/ Magmeter		
Pumps		
Type	Submersible	
Peak flow, mgd	8.11	
No. of Pumps	3 + 1	
Capacity of Pump, gpm, ea	2,000	
TDH, ft	20	Assumed
Motor, hp, ea	30/ with VFD	
Wetwell		
Retention Time, min	20	
Depth, ft	10	assumed
Headworks and Grit Removal		
Screens		

TABLE 1

Process and Major Equipment Design Data Sheet, FPA Alternative 1- SBR

Unit Process	Parameter	Note
Type	Mechanical Bar Screen	
No. of Screens	2 mechanical + 1 manual	
No. of Channels	2 + 1 bypass	
Screen Openings, inch	1/4	
Screen hp, ea	2	
Channel Width, ft	2.2	
Bypass Channel Width, ft	3	
Channel length, ft	9	
Screen Compactor and Washer		
No. of Screen Compactor Washers	2	
Screen Compactor and Washer hp, ea	2	
Grit Removal		
Type	Vortex	
No. of Units	1	
Capacity, mgd, ea	8.1	
Grit Removal Drive hp, ea	1	
Grit Classifier		
No.	1	
hp, ea	1	
Grit Pumps		
No.	1 + 1	
hp, ea	5	
SBR (Per ITT ICEAS)		
No. of Basins	2	
Dimensions of each Basin, ft	123 x 50 x 18 SWD	
Blowers		
No. of Blowers	1 + 1	
Capacity of Blowers, scfm, ea	1170	
Discharge Pressure, psig, ea	8.2	
Horsepower, ea	125	
WAS Pumps		
No. of pumps	1 + 1	
Capacity of Pumps, gpm, ea	131	

TABLE 1

Process and Major Equipment Design Data Sheet, FPA Alternative 1- SBR

Unit Process	Parameter	Note
Horsepower, ea	2.4	
Blower Room (for SBR blowers and WAS Tank Blowers)		
Blower Room Dimensions, ft	38 x 20	
Electrical Room Dimensions, ft	24 x 7	
Overall Dimensions, ft	44 x 24	
WAS Storage Tank		
Volume, MG	0.3	
WAS Production, gpd	46814	Per ITT Calculations
Storage Duration, day	6.4	
Mixing Air required, scfm	802	based on 20 scfm/1000 cf tank
Blowers		
No.	1 + 1	
Capacity, scfm, ea	800	
hp, ea	40	
Coarse Bubble Diffuser (Sanitaire D-24)		
No.	27	
Air flow per Diffuser	30	
UV Disinfection		
System Capacity, mgd	8.11	
UV Dose, mJ/cm2	45	
No. of Channels	2	
No. of Banks/Channel	1	
No. of Modules/Bank	15	
No. of Lamps/Module	8	
Total No. of Lamps	240	
O&M Building		
Footprint, sf	3000	
Unit Cost, $/sf	251.5	
Emergency Generator		
Capacity, kw	200	
Enclosure	Sound Attenuation, Weather Proof	
Operation Time, per year	24	
Other Components Included in CPES™		

TABLE 1

Process and Major Equipment Design Data Sheet, FPA Alternative 1- SBR

Unit Process	Parameter	Note
Gravity System Upgrades		
Estuary Outfall Piping and Connection		

Facility Plan Amendment Alternative 2 – Extended Aeration MLE

Same as the SBR alternative, the extended aeration MLE alternative assumes the existing treatment plant No. 2 will be abandoned, with the exception of connections to the existing outfall. The new plant will be constructed on a new parcel, across from the existing WWTP.

The secondary treatment processes are different between two FPA alternatives. The following assumptions/approaches are specific to MLE alternative:

- Aeration basins are sized based on the dry weather maximum month flow and loads, using CH2M HILL's process simulator Pro2D™. The cost of the aeration basins is determined using CPES™. Although Siemens provided proposal of treatment using MLE with clarifier as responses to Civil West's request for proposal in June 2011, the proposal did not contain sufficient details for the engineers to determine if the system is sized adequately or the clear scope of supply corresponding to the quote submitted. No additional information or clarification was obtained from Siemens during this analysis.
- Secondary clarifiers are sized using CH2M HILL's process simulator Pro2D™. The equipment cost is based on Siemens' quote for two Tow-Bro clarifier mechanisms with the standard coated steel construction ($220,000).

Figure 2 below illustrates the process flow diagram of Extended Aeration MLE alternative.

FIGURE 2
FPA Alternative 2 – Extended Aeration MLE Process Flow Diagram

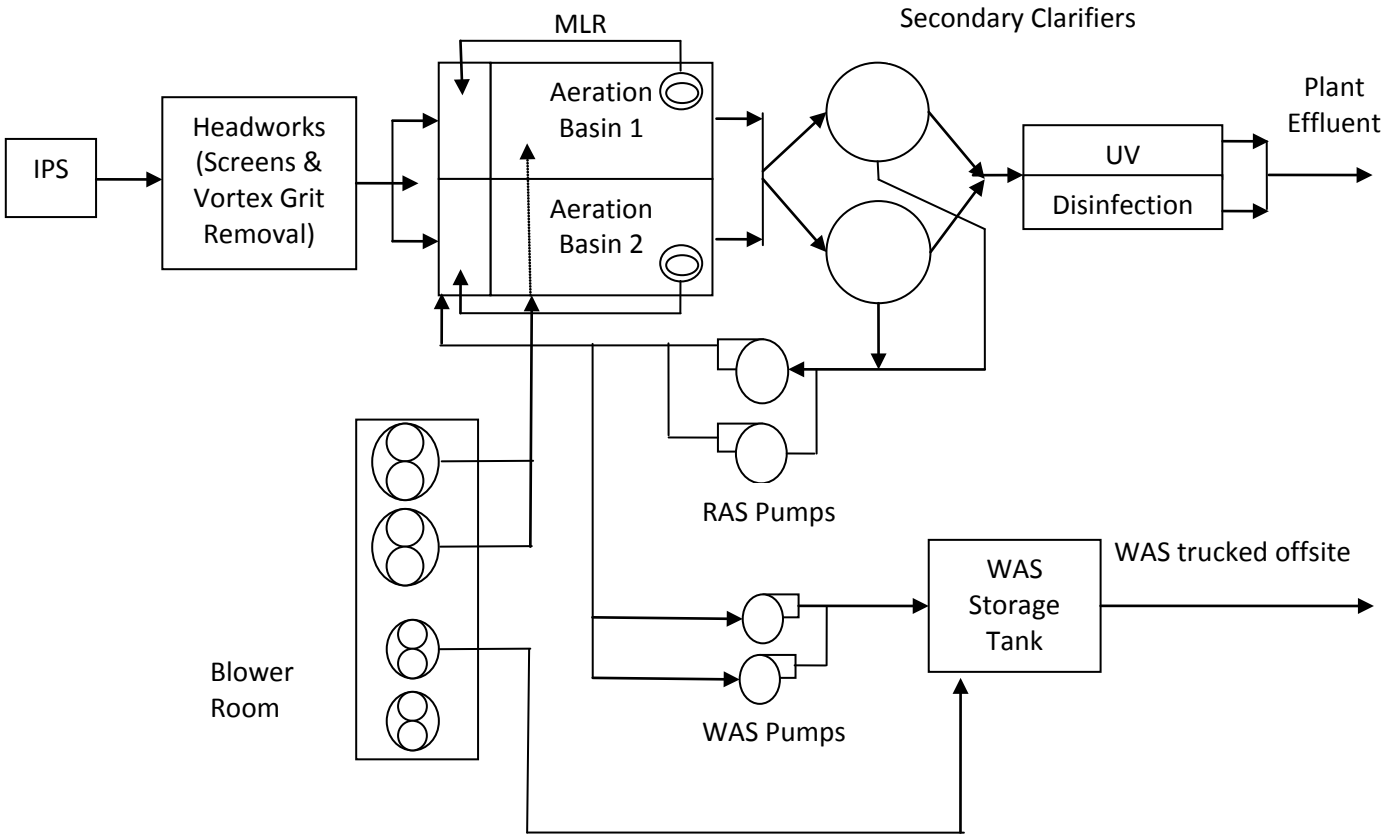


Table 2 below lists preliminary process and major equipment determined for MLE alternative.

TABLE 2
Process and Major Equipment Design Data Sheet, FPA Alternative 2 - MLE

Unit Process	Parameter	Note
Influent Pump Station W/ Magmeter		
Pumps		
Type	Submersible	
Peak flow, mgd	8.11	
No. of Pumps	3 + 1	
Capacity of Pump, gpm, ea	2,000	
TDH, ft	20	Assumed
Motor, hp, ea	30/ with VFD	
Wetwell		
Retention Time, min	20	
Depth, ft	10	assumed
Headworks and Grit Removal		
Screens		

TABLE 2

Process and Major Equipment Design Data Sheet, FPA Alternative 2 - MLE

Unit Process	Parameter	Note
Type	Mechanical Bar Screen	
No. of Screens	2 mechanical + 1 manual	
No. of Channels	2 + 1 bypass	
Screen Openings, inch	1/4	
Screen hp, ea	2	
Channel Width, ft	2.2	
Bypass Channel Width, ft	3	
Channel length, ft	9	
Screen Compactor and Washer		
No. of Screen Compactor and Washers	2	
Screen Compactor and Washer hp, ea	2	
Grit Removal		
Type	Vortex	
No. of Units	1	
Capacity, mgd, ea	8.1	
Grit Removal Drive hp, ea	1	
Grit Classifier		
No.	2	
hp, ea	1	
Grit Pumps		
No.	1 + 1	
hp, ea	5	
Aeration Basins (Per Pro2D)		
No. of Basins	2	
Volume of each Basin, MG	1.05	
Aerobic SRT, day	12.5	
Design MLSS, mg/L	2,800	
Design MLVSS, mg/L	1,800	
MLR Pumps		
No. of Pumps	2	
Capacity, gpm, ea	2,000	
Horsepower, ea	10 hp	
Blowers		

TABLE 2

Process and Major Equipment Design Data Sheet, FPA Alternative 2 - MLE

Unit Process	Parameter	Note
No. of Blowers	1 + 1	
Capacity of Blowers, scfm, ea	3,065	
Discharge Pressure, psig, ea	8.1	
Horsepower, ea	150	
Secondary Clarifiers		
No. of Clarifiers	2	
Diameter, ft, ea	70	
WAS/RAS Pump Station		
WAS Pumps		
No. of pumps	1 + 1	
Capacity of Pumps, gpm, ea	100	
Horsepower, ea	1.5	
RAS Pumps		
No. of pumps	1 + 1	
Capacity of Pumps, gpm, ea	700	
Horsepower, ea	10	
Blower Room (for Aeration Basin Blowers and WAS Tank Blowers)		
Blower Room Dimension, ft	46 x 30	
Electrical Room Dimension, ft	26 x 7	
WAS Storage Tank		
Volume, MG	0.3	
WAS Production, gpd	46,400	Per Pro2D Calculations
Storage Duration, day	6.5	
Mixing Air required, scfm	802	based on 20 scfm/1000 cf tank
Blowers		
No.	1 + 1	
Capacity, scfm, ea	800	
hp, ea	40	
Coarse Bubble Diffuser (Sanitaire D-24)		
No.	27	
Air flow per Diffuser	30	
UV Disinfection		
System Capacity, mgd	8.11	

TABLE 2

Process and Major Equipment Design Data Sheet, FPA Alternative 2 - MLE

Unit Process	Parameter	Note
UV Dose, mJ/cm2	45	
No. of Channels	2	
No. of Banks/Channel	1	
No. of Modules/Bank	15	
No. of Lamps/Module	8	
Total No. of Lamps	240	
O&M Building		
Footprint, sf	3000	
Unit Cost, $/sf	251.5	
Emergency Generator		
Capacity, kw	200	
Enclosure	Sound Attenuation, Weather Proof	
Operation Time, per year	24	
Other Components Included in CPES™		
Gravity System Upgrades		
Estuary Outfall Piping and Connection		

Value Assessment Alternative 1 – MBR

This VA alternative includes converting the existing conventional activated sludge WWTP to a membrane bioreactor plant. Most of the existing structures will remain, but be modified. Some structures will be constructed on the new site across the street. A membrane system quote by GE/Zenon is used as the costing basis.

The following assumptions are made regarding the major processes and equipment in this alternative:

- New influent pump station with four submersible pumps (3 duty and 1 standby) – located on parcel across the street
- New headworks/screening facility on parcel across the street (greenfield site). The facility consists of two mechanical bar screens and one bypass channel with manual clean bar screen, one vortex grit removal, two fine screens required for MBR process and all the ancillary equipment.
- Two existing secondary clarifiers are converted to the primary clarifiers. During peak flows, a coagulant will be added to the primary clarifiers to accomplish chemically enhance primary treatment (CEPT) for higher removal. Partial primary effluent will bypass the biological treatment process and blend with the MBR permeate before discharge.
- New ferric chloride storage and metering system for CEPT during peak wet weather flows. The storage system is sized based on 20 mg/L at 6.24 mgd (peak day flow) for 7-day storage. Multiple totes are required.
- New Flow Splitting structure downstream of CEPT during peak flow.
- New primary sludge pump station.
- Existing aeration basins and electrical room structure, with new diffusers, mixers, and mixed liquor recycle (MLR) pumps. New dissolved oxygen (DO) control, air piping and piping and valves.

- Three new aeration blowers (2 duty and 1 standby) are installed in the membrane building blower room.
- Three new membrane tanks are constructed with the ancillaries, i.e. the new membrane feed pumps, chemical cleaning system and chemical storage & metering pumps. GE/Zenon's scope includes membrane cassettes, membrane blowers, permeate and backpulse pumps, headers and chemical feed system.
- The cost for retrofitting the existing primary clarifier to a new chlorine contact chamber is proposed and included in the cost estimate, but refinements of this alternative could modify this approach.
- As with all other alternatives, a 3,000-sqft new Administration/O&M building is constructed.
- As with all other alternatives, a new emergency generator is installed onsite. For MBR alternative, the generator capacity is 250 kw as opposed to 200 kw assumed for other three alternatives due to the higher power requirement of MBR system.
- As with all other alternatives, no odor control is included. This should be evaluated in detail as the project progresses. It may be warranted to have odor control on the new parcel for the headworks facility.

Figures 3 and 4 show the existing site plan and proposed process changes on the site plan. Figures 5 and 6 illustrate the process flow diagram during normal operation and peak flow.

FIGURE 3
Coos Bay WWTP No.2 Existing Site Plan

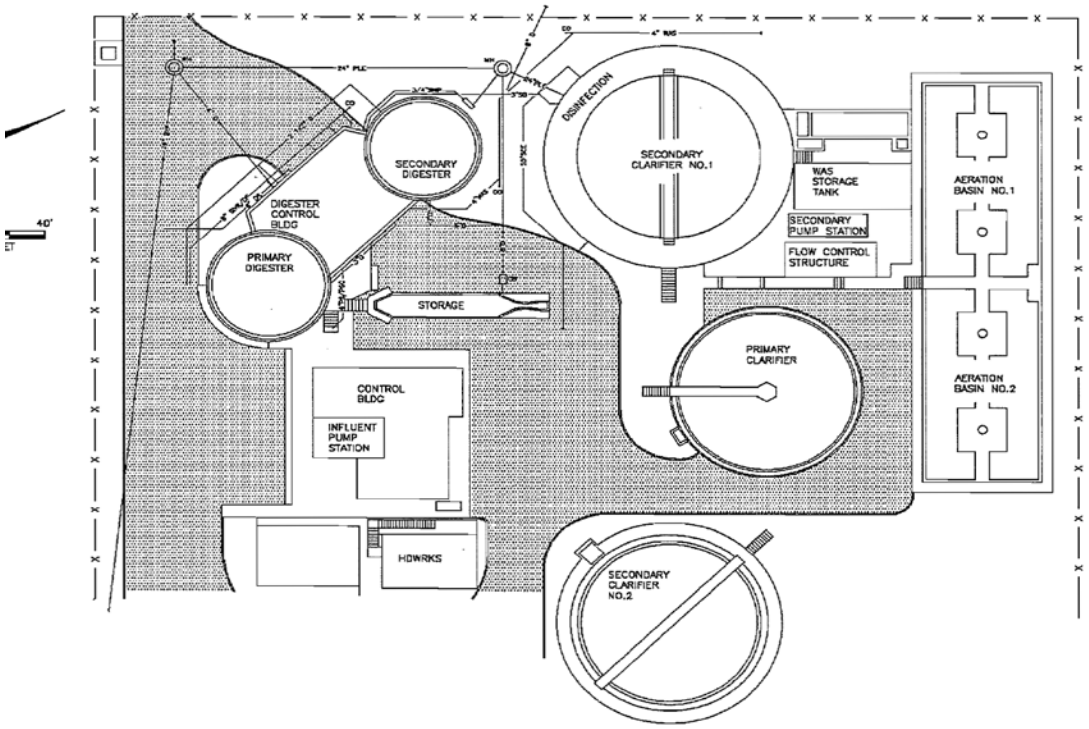


FIGURE 4
Coos Bay WWTP No.2 Site Plan with Proposed Modification, VA Alternative 1 - MBR

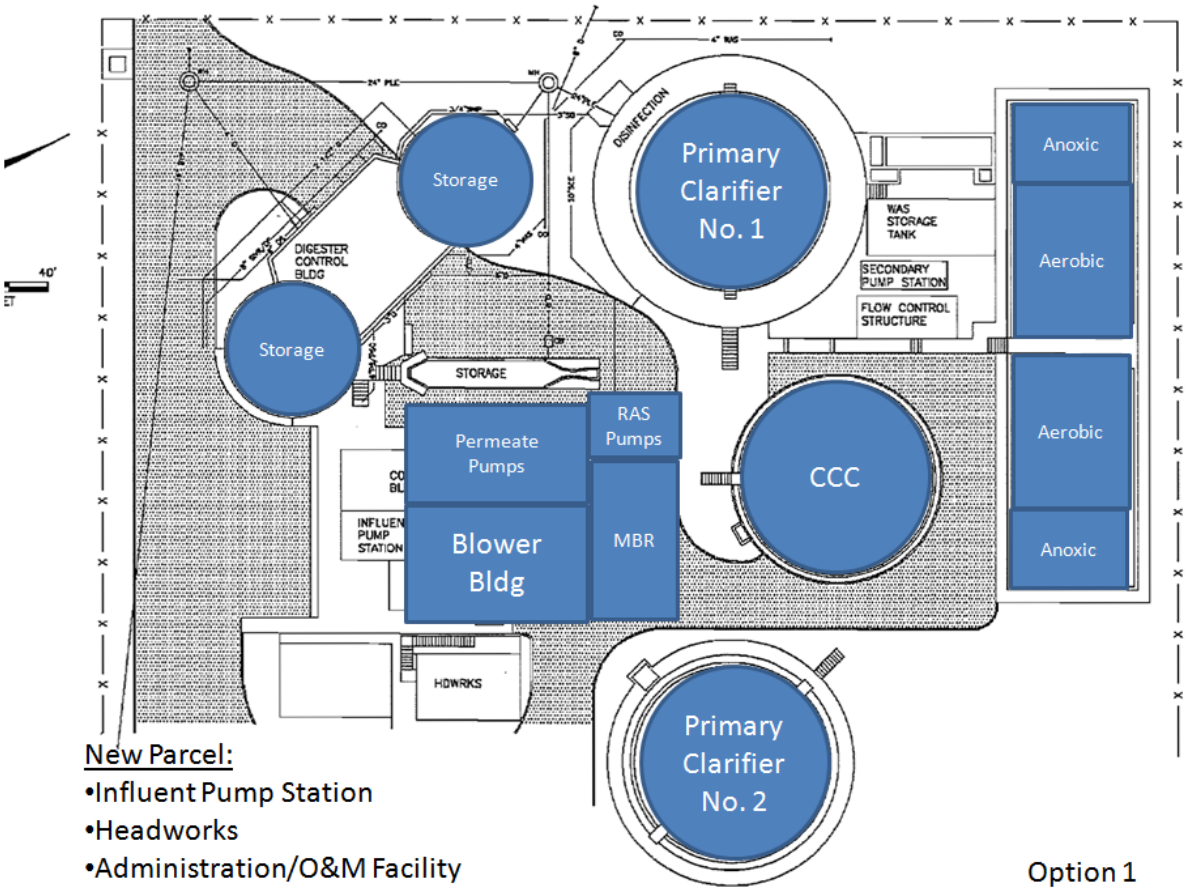


FIGURE 5
VA Alternative 1 – MBR Process Flow Diagram (Normal Operation, Non-peak Flow Condition)

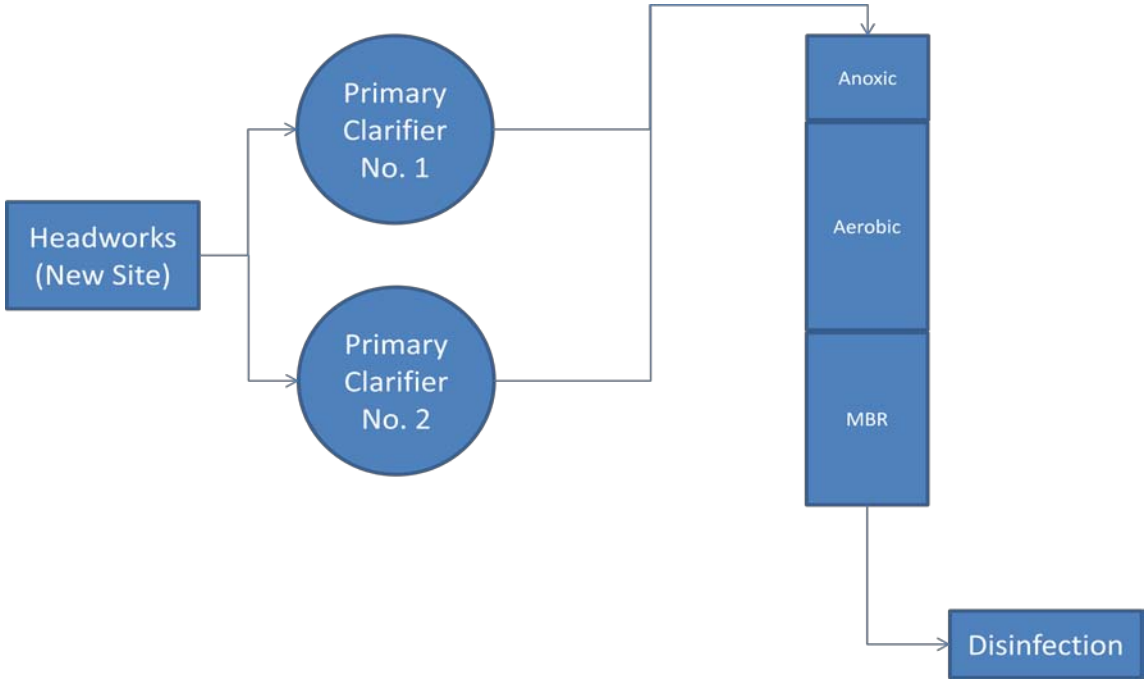
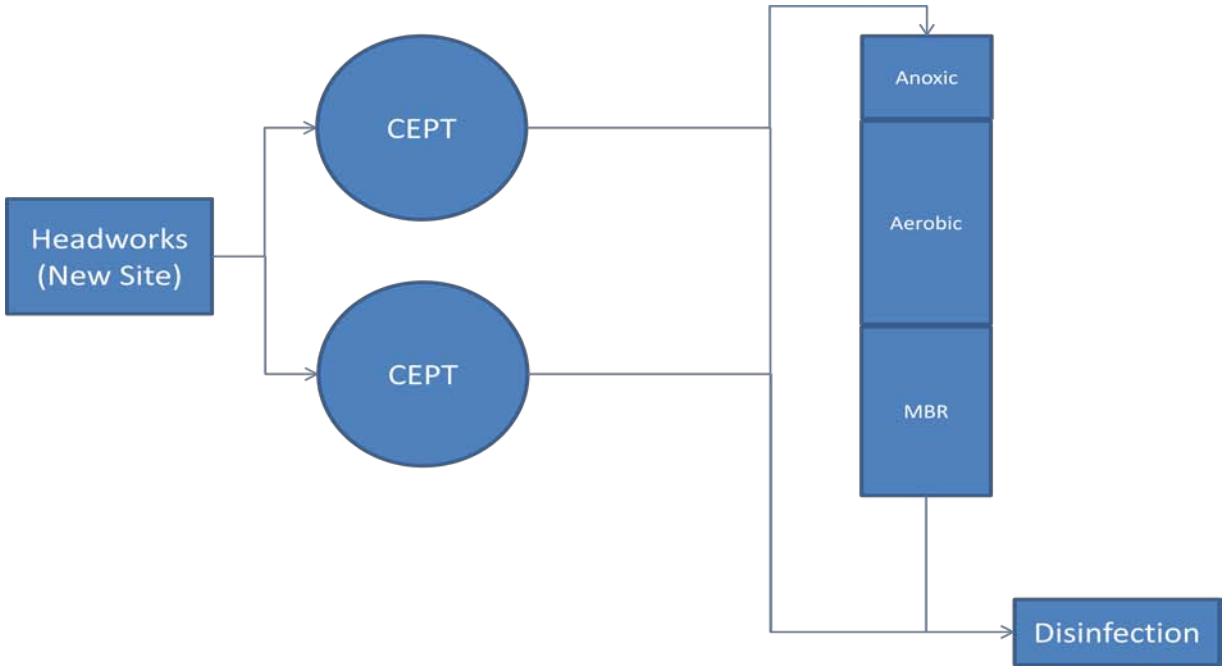


FIGURE 6
VA Alternative 1 – MBR Process Flow Diagram (Blending, Peak Flow Condition)



Construction Approach. The constructability of a treatment alternative utilizing the existing WWTP site is a significant concern as the treatment facility must remain in operation. An alternative is to provide a level of temporary treatment through the use of a package system or similar, but this could prove costly. The concept for the proposed improvement to the existing site is to keep the existing system in operation without the use of temporary treatment. For VA Alternative 1, the constructability approach proposed is:

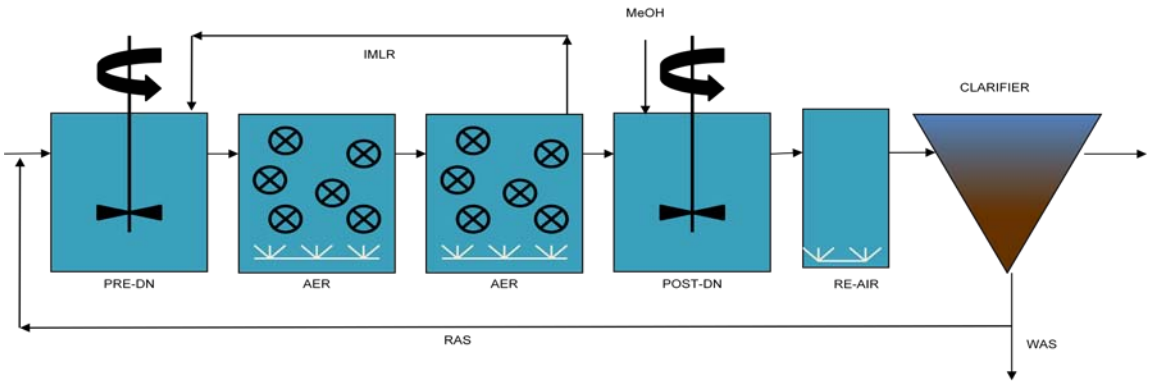
1. Construct the new influent pump station, headworks, and administration/O&M building on the new parcel – once this is complete and brought into service, the existing headworks and administration building could be demolished, providing space for future unit processes.
2. Construct the membrane tanks, RAS pumps, and membrane building (blowers, permeate pumps, chemical systems) – this is to be constructed in the existing location of the Control Building. The remaining unit processes will be in service, operating under typical conditions.
3. Aeration Basin Retrofit. In discussions with WWTP operations, it may be possible to remove one aeration basin from service from April through October. If this timeframe is available, it would be feasible to take one aeration basin offline and complete the required modifications (diffused aeration system, baffle walls, PE and ML piping re-configured). Once the retrofitted aeration basin is available for use, this could be brought back into service (and the other aeration basin taken offline for modifications). At this time the secondary clarifiers could be phased out of operation, while the membrane tanks are brought into service.
4. Secondary Clarifiers converted to Primary Clarifier 1 and 2. With the MBR in service, the existing secondary clarifiers could be converted to the primary clarifiers. Major yard piping improvements would be required at this time, with periodic unit process shutdowns and connections required.
5. Existing Primary Clarifier converted to a Chlorine Contact Chamber. To provide additional chlorine contact chamber volume, the existing primary clarifier volume could be utilized.

This approach for construction is a concept at this phase, but it does appear feasible to continue providing treatment at the existing site while improvements are completed.

Value Assessment Alternative 2 – IFAS

This VA alternative includes the conversion of the existing WWTP to the IFAS treatment process. IFAS processes, depicted in Figure 7, combine suspended growth and biofilm compartments in a single bioreactor. Most IFAS applications are for nitrogen removal where free-moving plastic biofilm carriers are added to one or two aerobic bioreactor cells to enhance system capacity for nitrification. In these systems nitrifiers grow selectively in the biofilm and oxidize ammonium (provided the operational condition results in nitrifiers washing out of the suspended growth compartment) while the suspended biomass largely removes soluble and particulate organic matter and facilitates denitrification in the anoxic zone(s). The short solids retention time (SRT) typical of IFAS processes (e.g., 3 to 5 days) can result in a significant increase in process capacity, while providing the nitrification required.

FIGURE 7
VA Alternative 1 – IFAS Process Flow Diagram (Blending, Peak Flow Condition)



The following assumptions are made regarding the major processes and equipment in this alternative:

- New influent pump station with four submersible pumps (3 duty and 1 standby) – located on parcel across the street
- New headworks/screening facility on parcel across the street (greenfield site). The facility consists of two mechanical bar screens (6-mm maximum screen opening) and one bypass channel with manual clean bar screen, one vortex grit removal system and all the ancillary equipment.
- The two aeration basins are converted to the IFAS system – including anoxic selectors, aerobic zone, and IFAS zone. The IFAS zone contains the free-moving plastic biofilm carriers, where preliminary sizing indicates a 44% fill (by IFAS Zone volume). Other features particular to the IFAS system include the plastic biofilm carrier retention screens and coarse-bubble aeration system. A coarse-bubble system is required to keep the buoyant biofilm carriers completely mixed within the IFAS zone. For this alternative it is assumed that the non-IFAS, aerobic zones will also include coarse-bubble diffusers.
- Two existing secondary clarifiers are converted to the primary clarifiers. This modification is similar to that proposed for VA Alternative 1, but the CEPT modifications are not required.
- Two new 60-foot diameter secondary clarifiers are to be constructed. During the peak wet weather events, a portion of the primary effluent would be routed around the IFAS zone within the bioreactor to a re-aeration reactor at the end of the aeration basin. This wet weather flow will blend with the mixed-liquor for treatment in the new secondary clarifiers. This approach allows for the aeration basins to be cost-effectively sized for the average day maximum month dry and wet weather conditions.
- New primary sludge pump station.
- Three new aeration blowers (2 duty and 1 standby) are installed in a new blower building.
- The cost for retrofitting the existing primary clarifier to a new chlorine contact chamber is proposed and included in the cost estimate, but refinements of this alternative could modify this approach.
- As with all other alternatives, a 3,000-sqft new Administration/O&M building is constructed on the new parcel.

- As with all other alternatives, a new emergency generator is installed onsite. For this IFAS alternative a 200 kw unit is assumed.
- As with all other alternatives, no odor control is included. This should be evaluated in detail as the project progresses. It may be warranted to have odor control on the new parcel for the headworks facility.

Construction Approach. As with VA Alternative 1, the constructability of a treatment alternative utilizing the existing WWTP site is a significant concern as the treatment facility must remain in operation. The concept for the proposed improvement to the existing site is to keep the existing system in operation without the use of temporary treatment. For VA Alternative 2, the constructability approach proposed is:

1. Construct the new influent pump station, headworks, and administration/O&M building on the new parcel – once this is complete and brought into service, the existing headworks and administration building could be demolished, providing space for future unit processes.
2. Construct the Blower Building. With the aeration blowers installed, the conversion of the aeration basins to the IFAS system could start.
3. Aeration Basin Retrofit. As noted above, it may be possible to remove one aeration basin from service from April through October. If this timeframe is available, it would be feasible to take one aeration basin offline and complete the required modifications (coarse-bubble aeration system, baffle walls, PE and ML piping re-configured, IFAS system). It is also proposed that the walls be raised, allowing an increase in the water surface. This, together with the new Secondary Clarifiers, will allow for the secondary pump station to be removed from service. Once the retrofitted aeration basin is available for use, this could be brought back into service (and the other aeration basin taken offline for modifications).
4. Construction of two, new secondary clarifiers – a new Return Activated Sludge (RAS) pump station would be included. The new secondary clarifiers would be installed at an elevation allowing for ML to flow by gravity from the retrofitted aeration basins. Major yard piping improvements would be required at this time, with periodic unit process shutdowns and connections required.
5. Secondary Clarifiers converted to Primary Clarifier 1 and 2. Major yard piping improvements would be required for this phase as well, with periodic unit process shutdowns and connections required.
6. Existing Primary Clarifier converted to a Chlorine Contact Chamber. To provide additional chlorine contact chamber volume, the existing primary clarifier volume could be utilized.

This approach for construction is a concept at this phase, but similar to the previous VA alternative it does appear feasible to continue providing treatment at the existing site while improvements are completed.

The proposed site layout for VA Alternative 2 is presented in Figure 8. As noted, the new influent pump station, headworks facility, and administration/O&M building would be constructed on the new site. Figure 9 presents a process flow diagram for this alternative.

FIGURE 8
Coos Bay WWTP No.2 Site Plan with Proposed Modification, VA Alternative 2 - IFAS

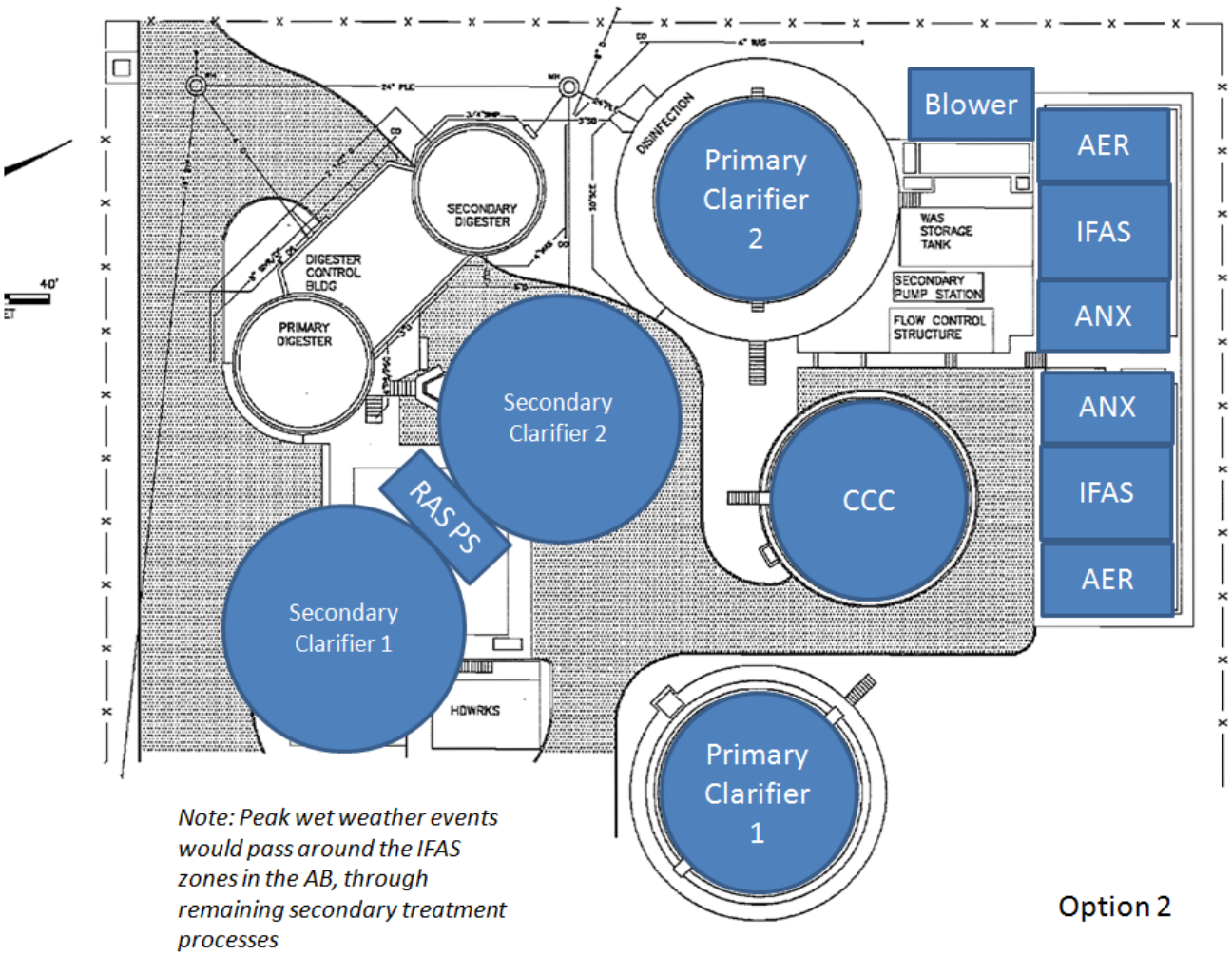
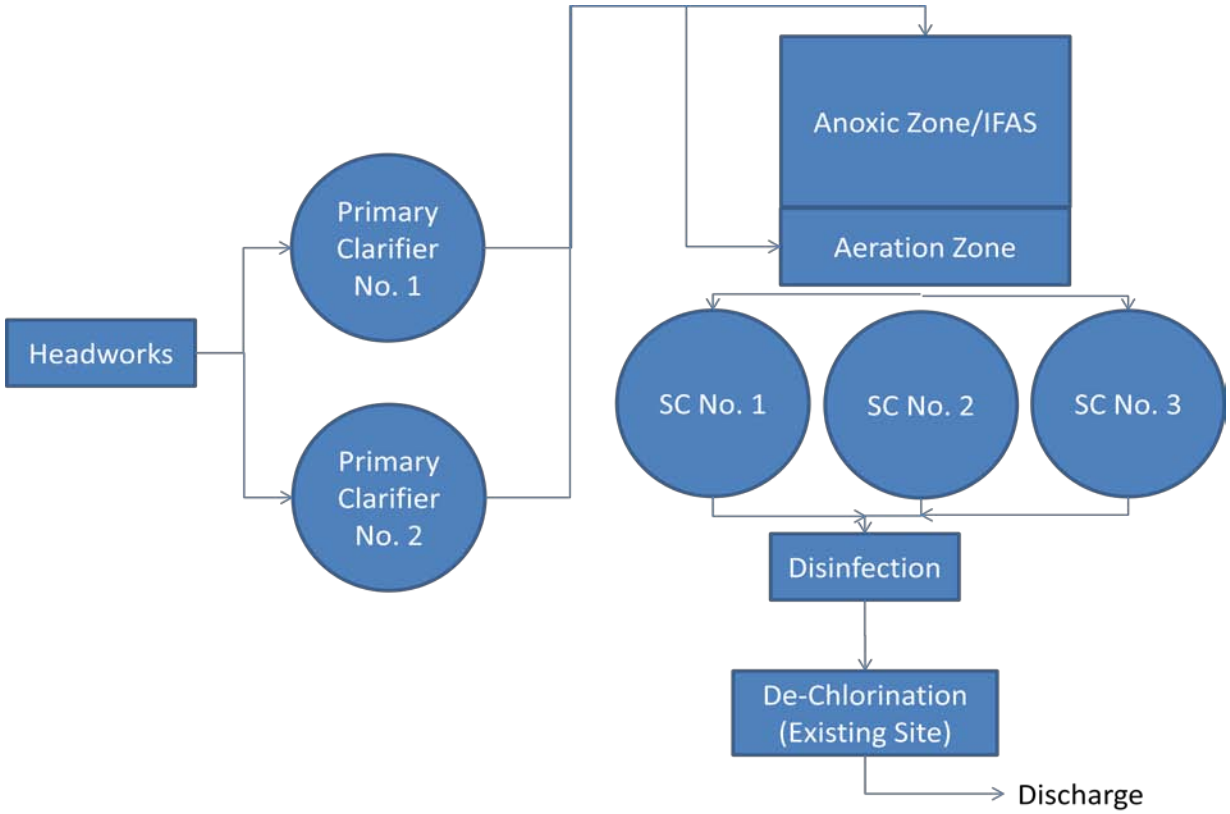


FIGURE 9
VA Alternative 2 – IFAS Process Flow Diagram



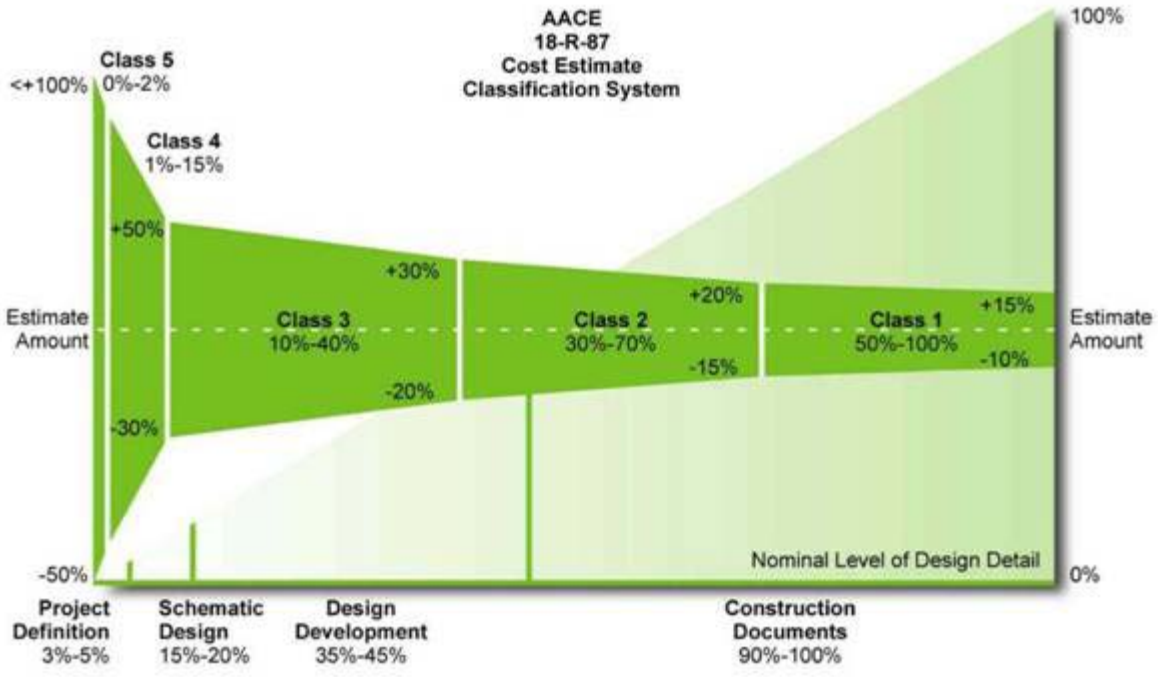
Cost Estimate and Summary

The objective of the life-cycle cost evaluation is to provide a comparison between the alternatives. Given the conceptual level of the alternative evaluation, the cost opinion includes contingencies and markups for each alternative. During future design phases contingencies and allowances to capture additional project costs are refined and reduced as design details become available, allowing for a more detailed cost estimate. These estimates are intended to be used only for comparing initial conceptual alternatives for the purpose of screening them to a reasonable few for further evaluation.

This estimating effort adopts the classification of estimates as defined by the Association for the Advancement of Cost Engineering (AACE). The industry classification system is Recommended Practice-17R-97: “Cost Estimate Classification System” and 18R-97: “Cost Estimating Classification System as Applied in Engineering, Procurement, and Construction for the Process Industries.”

Figure 10 shows the relationship of level of detail to the expected accuracy of the estimate.

FIGURE 10
Construction Cost Estimate Accuracy Ranges



The capital costs within this project definition report are defined as order-of-magnitude-level (Class 4) estimate as defined in the AACE International Recommended Practice No. 18R-97, *Cost Estimate Classification System As Applied in Engineering, Procurement, and Construction for the Process Industries.* An estimate of this type is normally expected to be within +50 percent or –30 percent of the actual construction cost. The final cost of the projects will depend on actual labor and materials costs, actual site conditions, productivity, competitive market conditions, bid dates, seasonal fluctuations, final project scope, final project schedule, and other variables. As a result, the final project costs will vary from the estimates presented in this report.

Capital and operation and maintenance (O&M) cost opinions will be developed to allow comparison of alternatives for a 20-year planning period.

The costs included in this evaluation are:

- **Capital Costs**. Capital costs are associated with building new facilities or expanding and renovating existing facilities. Capital costs shall include construction costs, non-construction costs, and land acquisition costs, and other factors identified as follows:

  The facility construction cost includes the cost for building a new unit process or treatment facility in order to satisfy a specific treatment objective. In addition, other project elements are typically needed to integrate the new unit process or treatment facility into the WWTP. The additional project elements are calculated as a percentage of the facility construction cost. The additional project elements include demolition (2% for FPA alternatives and 5% for VA alternatives), overall site work (5%), plant computer system (5%), yard electrical (3%), and yard piping (5%). The sum of the facility construction cost and the additional project elements is a construction cost subtotal. Higher demolition percentage was used for VA alternatives than the FPA alternatives because VA alternatives require demolition and modification of the existing plant to a much larger extent.

  Contractor markups shall be added to the construction cost subtotal. Contractor markups include overhead (10%); profit (5%); mobilization, bonds, and insurance (5%). Construction contingency (25%) is also added to the construction cost subtotal with markups.

In addition to construction costs, an allowance for non-construction costs shall be provided. The non-construction cost allowance is calculated as percentage of the construction cost subtotal with the contractor markups. For this evaluation an allowance for permitting/admin (5%); engineering (10%), services during construction (5%); commissioning and start-up (5%) are included as non-construction costs. (25% total)

Land Acquisition costs are assumed to be zero for the WWTP as the City owns all existing property required.

For this evaluation all capital costs are based on January 2012 dollars. An escalation factor to adjust the construction cost subtotal to the mid-point of construction in order to properly budget and account for inflation that may occur during planning, design, and construction of the project should be included once the project is better defined. Current economic conditions have resulted in a very competitive bid environment that has the effect of lowering contractor bid prices. CH2M HILL anticipates construction costs to be higher in Coos Bay, Oregon, but expects the current competitive bid environment to offset the higher costs. Therefore, there is no net effect on the overall construction cost estimates presented.

- **Operation and Maintenance Costs**. O&M costs are associated with the daily requirements for maintaining and operating the wastewater treatment facilities. O&M costs include labor, power, chemicals, equipment maintenance, and equipment replacement. An additional increment of O&M costs are estimated for each alternative and presented in 2012 dollars for the first year and then escalated based on the inflation rate for 20 years. A 20-percent contingency is added to obtain the total estimated incremental O&M costs. The incremental O&M costs are increased each year by 3 percent. For this evaluation the O&M costs are based on the following factors:
  - Labor: no additional labor is planned for the four alternatives evaluated
  - Power: $0.082/kilowatt-hour (includes usage, demand, and transmission charges)
  - Ferric chloride used in CEPT is approximately 40 mg/L for four month per year in winter. Ferric Chloride (40 percent solution): $372/dry ton
  - Equipment Maintenance Materials: Figured as a percentage of the initial capital cost (2% finishes, 1% equipment, 0.1% mechanical, and 1% electrical)
- **Life-cycle Cost**. The life-cycle cost analysis converts all expenditures that occur during the project into a single equivalent present value sum at the time of the analysis. Thus, the streams of expenditures associated with each alternative can be compared on the same basis.

  It is assumed that the construction can be financed at an annual discount rate of 5 percent per year, and inflation is about 3 percent per year. The real value of money is the discount rate less the inflation rate, or about 2 percent per year.

  The life-cycle cost is defined as the following, where Pw is the present worth: Life Cycle Cost = P_w (Construction Cost) + P_w (Operation and Maintenance Cost).

Table 3 lists the capital costs of all four alternatives in 2012 dollars.

TABLE 3
Capital Costs of All Alternatives for Coos Bay WWTP No.2

	FPA Alternative 1 SBR	FPA Alternative 2 MLE	VA Alternative 1 MBR	VA Alternative 2 IFAS
Project Cost (exclude contractor markups)	$11,517,000	$15,299,000	$14,428,000	$11,599,000
Construction Cost (include contractor markups)	$17,774,000 [1.]	$23,506,000 [1]	$21,874,000	$17,584,000
Capital Cost (include contractor markups and	$22,219,000	$29,385,000	$27,344,000	$21,983,000

TABLE 3
Capital Costs of All Alternatives for Coos Bay WWTP No.2

	FPA Alternative 1 SBR	FPA Alternative 2 MLE	VA Alternative 1 MBR	VA Alternative 2 IFAS
non-construction cost)				

Note 1: The construction cost for the Facility Plan Alternatives includes the allowance provided in the report for gravity system upgrades and estuary outfall piping and connection.

Table 4 below summarizes the O&M and life cycle cost of all four alternatives for Coos Bay WWTP No.2

TABLE 4
O&M and Life Cycle Costs of All Alternatives for Coos Bay WWTP No.2

	FPA Alternative 1 SBR	FPA Alternative 2 MLE	VA Alternative 1 MBR	VA Alternative 2 IFAS
O&M Cost	$584,000	$623,000	$838,000	$569,000
Life Cycle Cost	$24,701,000	$30,888,000	$32,232,000	$24,571,000

From this evaluation, it appears that the Facility Plan Alternative 1 – SBR (ICEAS) and VA Alternative 2 – IFAS result in equivalent capital and life-cycle costs. At this level of detail, the difference in cost is well within the accuracy of the estimate to be considered equal. The other two options result in higher capital and life-cycle costs. Note, however, that VA Alternative 1 – MBR does provide a significantly higher water quality standard that the other alternatives. These alternatives have not been incorporated into a cost-benefit analysis, where non-monetary criteria (similar to those developed during the VA study) could impact any project selection.

It is noted previously that these estimates are not recommended for financial planning or rate impact analysis due to the conceptual nature of the estimate and associated level of accuracy. However, the use of CPES has been successful in providing cost estimates for facility plan efforts. From this evaluation it does appear that a project to upgrade or replace WWTP No.2 would have a capital cost of approximately $22,000,000.

Cost Considerations

This section presents a number of items that may impact the overall capital cost for the respective alternatives. In general, these are listed as possible approaches to help reduce the overall cost of the project. These are presented for each alternative:

Facility Plan Amendment – Alternative 1 and 2

The cost consideration items are similar for both the SBR and Extended Aeration alternatives. Following are a list of considerations:

- Utilize existing digesters on the WWTP No.2 site for WAS storage. This results in additional WAS piping, but this could be constructed along with the plant effluent piping to help minimize the costs.
- Use chlorine disinfection instead of UV. The peak wet weather flow significantly impacts the costs of the UV system, and it appears significant savings are available with the use of a chlorine-based system. To handle flows with a big peaking factor, even for a short period of time, the UV system needs to be over-sized with sufficient lamps to provide required UV dose at the peak flows; while the chlorine-based system just needs to provide higher chlorine dose at the peak flow to ensure the required CT (concentration x contact time). Based on the cost estimate performed using CPES™, assuming the existing chlorinators could be reused, the construction cost of the new chlorine contact basins to handle 8.1 mgd flow is only 25 percent of the cost of the new UV facility with the same capacity.
- Demolish and/or rehabilitation of existing site. A cost consideration for the demolition or rehabilitation of the existing WWTP No.2 site was not included in this evaluation.

- Odor control should be considered for the headworks facility at the new parcel.

Value Assessment – Alternative 1 and 2

- Rebuild existing clarifier mechanisms instead of complete replacement. For this evaluation, the complete replacement of the clarifier mechanisms is assumed but possible savings may be available through the refurbishment of the systems.
- Construction Phasing Opportunities. With the continued use of the existing site, there appears to be opportunities to phase the construction over time if warranted. As an example, a new Headworks Facility could be constructed on the new parcel in the initial phase – with continued use of the existing WWTP No.2. Improvements to existing WWTP No.2 (or additional construction on the new parcel) could follow.
- For Alternative 2 there may be an opportunity to complete the work on new parcel as noted, followed by the conversion to the IFAS system. However, the continued use of the existing primary clarifier and secondary clarifiers may be a possibility. Allowances for addressing the periodic peak wet weather conditions would be required, but there may be an opportunity to reduce the overall project cost.
- Odor control should be considered for the headworks facility at the new parcel.

Attachment

CPES™ Cost Estimate Summary

FPA Alternative 1 - SBR

CH2M HILL Parametric Cost Estimating System (CPES)

FACILITIES DESIGN & CONSTRUCTION COST MODULE

File Version: 1/25/2012

Click for CPES QA/QC | To Concrete Wall Thickness Help | To Cost Summary Matrix | To Unit Cost Database

Project Name:	Coos Bay VA Cost Estimate
Project Number:	
Project Manager:	Alan Chang
Estimator:	Miaomiao Zhang
Project Description:	FPA Alternative 1 - SBR with ICEAS
Project Location (City):	Default
Project Location (State):	N/A
Project Location (Country):	
Construction Start (Month):	Jan
Construction Start Year):	2012
Construction Duration (months):	1
Mid-Point of Construction:	Feb /2012

Roundup to the nearest: $1,000

This Report is for INTERNAL Distributio

This Report is for EXTERNAL Distributio

Item	Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT	Cost
	Yes	Submersible IPS: New	$1,228,000
	Yes	Screening and Grit: New	$1,883,000
	Yes	Aeration Basin: SBR	$2,990,000
	Yes	Blowers: BldgOnly	$514,000
	Yes	LPHO UV: New	$1,189,000
	Yes	WAS Storage: New	$827,000
	No	GBT: New	$0
	No	RAS WAS PS: WASPump	$0
	Yes	O&M Building: New	$755,000
	No	Demolition: New	$0
	No	Gravity Pipe: New	$0
	Yes	Emergency Generator: New	$211,000
	No	U.D. Facility: New	$0

SUBTOTAL - PROJECT COST				$9,597,000
ADDITIONAL PROJECT COSTS:				
Demolition	2%			$192,000
Overall Sitework	5%			$480,000
Plant Computer System	5%			$480,000
Yard Electrical	3%			$288,000
Yard Piping	5%			$480,000
UD #1 Default Description	0%			$0
UD #2 Default Description	0%			$0
UD #3 Default Description	0%			$0
SUBTOTAL with Additional Project Costs				$11,517,000
TAX:	0.00%		$11,517,000	$0
SUBTOTAL with Tax				$11,517,000
CONTRACTOR MARKUPS:				
Overhead	10%		$11,517,000	$1,152,000

	A	B	C	D	E
54	*Subtotal*				$12,669,000
55	*Profit*		5%	$12,669,000	$634,000
56	*Subtotal*				$13,303,000
57	*Mob/Bonds/Insurance*		5%	$13,303,000	$666,000
58	*Subtotal*				$13,969,000
59	*Contingency*		25%	$13,969,000	$3,493,000
60	*SUBTOTAL with Markups*				$17,462,000
61					
62	*ESCALATION (to Mid-Point of Construction)*		0.0%	$17,462,000	$0
63	*SUBTOTAL with Escalation*				$17,462,000
64					
65	*LOCATION ADJUSTMENT FACTOR*		100	$17,462,000	$17,462,000
66	*SUBTOTAL - with Local Adjustment Factor*				$17,462,000
67					
68	*RED FLAGS:*				
69	*1*	*Rock Excavation*			
70	*2*	*Pile Foundations*			
71	*3*	*Seismic Foundations*			
72	*4*	*Dewatering Conditions*			
73	*5*	*Wetlands Mitigation*			
74	*6*	*Weather Impacts*			
75	*7*	*Depth of Structures*			
76	*8*	*Local Building Code Restrictions*			
77	*9*	*Coatings or Finishes*			
78	*10*	*Building or Architectural Considerations*			
79	*11*	*Client Material Preferences*			
80	*12*	*Client Equipment Preferences*			
81	*13*	*Piping Galleries, Piping Trenches, Piping Racks*			
82	*14*	*Yard Piping Complexity*			
83	*15*	*Existing Site Utilities (New, Retrofit, and Complexity)*			
84	*16*	*I & C Automation (New or Retrofit)*			
85	*17*	*Electrical Feed (New or Retrofit)*			
86	*18*	*Electrical Distribution*			
87	*19*	*Shoring*			
88	*20*	*Contamination*			
89	*21*	*Gravity System Upgrades*			$117,000
90	*22*	*Estuary Outfall Piping and Connection*			$195,000
91	*23*	*User Defined Red Flag 3*			
92	*24*	*User Defined Red Flag 4*			
93	*25*	*User Defined Red Flag 5*			
94	*26*	*User Defined Red Flag 6*			
95	*27*	*User Defined Red Flag 7*			
96	*TOTAL - RED FLAGS*				$312,000
97					
98	*SUBTOTAL - CONSTRUCTION COST with Red Flags*				$17,774,000
99					
100	*MARKET ADJUSTMENT FACTOR*		0%	$17,774,000	$0
101	*SUBTOTAL - CONSTRUCTION COST with Market Adjustment Factor*				$17,774,000
102	*Your CPES Estimate MUST be reviewed by a Process person AND an Estimator:*				
103	*Name of Process Reviewer*			Leaf	Click for Reviewe
104	*Name of Estimator Reviewer*			Lawson	
105	*MAXIMUM CONSTRUCTION COST*				$17,774,000
106					
107	*NON-CONSTRUCTION COSTS:*				
108	*Permitting*		5%	$17,774,000	$889,000
109	*Engineering*		10%	$17,774,000	$1,778,000
110	*Services During Construction*		5%	$17,774,000	$889,000

	A	B	C	D	E
111	***Commissioning & Startup***		**5%**	**$17,774,000**	**$889,000**
112	***Land / ROW***		**0%**	**$17,774,000**	**$0**
113	***Legal / Admin***		**0%**	**$17,774,000**	**$0**
114	***Other Default Description***		**0%**	**$17,774,000**	**$0**
115	***SUBTOTAL - Non-Construction Costs***				**$4,445,000**
116					
117	***TOTAL - CAPITAL COST***				**$22,219,000**
118					
119	***Currency Conversion of TOTAL CAPITAL COST:***				
120		***Currency***	***Unit of Measure***	***Conversion Rate***	***Converted Amount***
121		**None**	**U.S.Dollar**	**1**	**22,219,000**

C H2M HILL P arametric Cost E stimating S ystem (CPES)

FACILITIES LIFE CYCLE COST ANALYSIS

File Version: 1/23/2012

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Import File: C:\Users\mzhang\Documents\Project\CoosBay\CEPS\CPES Facilities Public_CoosBay_SBR_v2.xlsm Brows

Project Name:	Coos Bay VA Cost Estimate
Project Number:	
Project Manager:	Alan Chang
Estimator:	Miaomiao Zhang
Project Description:	FPA Alternative 1 - SBR with ICEAS
Project Location (City):	Default
Project Location (State):	N/A
Project Location (Country):	
Construction Start (Month):	Jan
Construction Start (Year):	2012
Construction Duration (months)	1
Mid-Point of Construction:	Feb /2012

Life Cycle Analysis:
i = 5.00%
n = 20
Annual Inflation %: 3.00%

To Global Life Cycle Data Sheet

To Annual O & M Cost Summary Sheet

This Report is for INTERNAL Distribution

This Report is for EXTERNAL Distribution

Item	Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT	Construction Cost	Annual O&M Cost (Escalated)	Life Cycle Cost (NPV)
	Yes	Submersible IPS: New	$1,862,000	$35,000	$2,297,000
	Yes	Screening and Grit: New	$2,855,000	$131,000	$4,484,000
	Yes	Aeration Basin: SBR	$4,534,000	$84,000	$5,575,000
	Yes	Blowers: BldgOnly	$779,000	$30,000	$1,147,000
	Yes	LPHO UV: New	$1,803,000	$148,000	$3,647,000
	Yes	WAS Storage: New	$1,254,000	$31,000	$1,633,000
	No	GBT: New	$0	$0	$0
	No	RAS WAS PS: WASPump	$0	$0	$0
	Yes	O&M Building: New	$1,144,000	$9,000	$1,246,000
	No	Demolition: New	$0	$0	$0
	No	Gravity Pipe: New	$0	$0	$0
	Yes	Emergency Generator: New	$320,000	$8,000	$416,000
	No	U.D. Facility: New	$0	$0	$0
		Additional Project Costs:			
		Biosolids Disposal	$0	$0	$0
		Standard Items	$2,912,000	$108,000	$4,256,000
		User Defined Items	$0	$0	$0
		Plant O & M Labor		$0	$0
TOTAL - Life Cycle Analysis			$17,463,000	$584,000	$24,701,000
Construction Cost per GPD (based on Maximum Daily Flow Rate)			$2.80 / GPD		
Annual O & M Cost per 1,000 Gallons (based on Average Annual Daily Flow Rate)				$ 1.081 / Thousand Gallons	

FPA Alternative 2 - MLE

CH2M HILL Parametric Cost Estimating System (CPES)

FACILITIES DESIGN & CONSTRUCTION COST MODULE

File Version: 1/25/2012

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Project Name:	Coos Bay VA Cost Estimate
Project Number:	
Project Manager:	Alan Chang
Estimator:	Miaomiao Zhang
Project Description:	FPA Alternative 2 - Extended Aeration MLE
Project Location (City):	Default
Project Location (State):	N/A
Project Location (Country):	
Construction Start (Month):	Jan
Construction Start Year):	2012
Construction Duration (months):	1
Mid-Point of Construction:	Feb /2012

Roundup to the nearest: $1,000

This Report is for INTERNAL Distributio

This Report is for EXTERNAL Distributio

Item	Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT	Cost
	Yes	Submersible IPS: New	$1,228,000
	Yes	Screening and Grit: New	$1,883,000
	Yes	Aeration Basin: Main	$3,161,000
	Yes	Blowers: Main	$1,291,000
	Yes	Round SC: Main	$1,402,000
	Yes	RAS WAS PS: Main	$907,000
	Yes	LPHO UV: New	$1,189,000
	Yes	WAS Storage: New	$827,000
	Yes	O&M Building: New	$755,000
	Yes	Demolition: New	$0
	Yes	Emergency Generator: New	$211,000

SUBTOTAL - PROJECT COST			$12,854,000
ADDITIONAL PROJECT COSTS:			
Demolition	2%		$258,000
Overall Sitework	5%		$643,000
Plant Computer System	2%		$258,000
Yard Electrical	5%		$643,000
Yard Piping	5%		$643,000
UD #1 Default Description	0%		$0
UD #2 Default Description	0%		$0
UD #3 Default Description	0%		$0
SUBTOTAL with Additional Project Costs			$15,299,000
TAX:	0.00%	$15,299,000	$0
SUBTOTAL with Tax			$15,299,000
CONTRACTOR MARKUPS:			
Overhead	10%	$15,299,000	$1,530,000
Subtotal			$16,829,000
Profit	5%	$16,829,000	$842,000

	A	B	C	D	E
54	Subtotal				$17,671,000
55	Mob/Bonds/Insurance		5%	$17,671,000	$884,000
56	Subtotal				$18,555,000
57	Contingency		25%	$18,555,000	$4,639,000
58	SUBTOTAL with Markups				$23,194,000
59					
60	ESCALATION (to Mid-Point of Construction)		0.0%	$23,194,000	$0
61	SUBTOTAL with Escalation				$23,194,000
62					
63	LOCATION ADJUSTMENT FACTOR		100	$23,194,000	$23,194,000
64	SUBTOTAL - with Local Adjustment Factor				$23,194,000
65					
66	RED FLAGS:				
67	1	Rock Excavation			
68	2	Pile Foundations			
69	3	Seismic Foundations			
70	4	Dewatering Conditions			
71	5	Wetlands Mitigation			
72	6	Weather Impacts			
73	7	Depth of Structures			
74	8	Local Building Code Restrictions			
75	9	Coatings or Finishes			
76	10	Building or Architectural Considerations			
77	11	Client Material Preferences			
78	12	Client Equipment Preferences			
79	13	Piping Galleries, Piping Trenches, Piping Racks			
80	14	Yard Piping Complexity			
81	15	Existing Site Utilities (New, Retrofit, and Complexity)			
82	16	I & C Automation (New or Retrofit)			
83	17	Electrical Feed (New or Retrofit)			
84	18	Electrical Distribution			
85	19	Shoring			
86	20	Contamination			
87	21	Gravity System Upgrades			$117,000
88	22	Estuary Outfall Piping and Connection			$195,000
89	23	User Defined Red Flag 3			
90	24	User Defined Red Flag 4			
91	25	User Defined Red Flag 5			
92	26	User Defined Red Flag 6			
93	27	User Defined Red Flag 7			
94	TOTAL - RED FLAGS				$312,000
95					
96	SUBTOTAL - CONSTRUCTION COST with Red Flags				$23,506,000
97					
98	MARKET ADJUSTMENT FACTOR		0%	$23,506,000	$0
99	SUBTOTAL - CONSTRUCTION COST with Market Adjustment Factor				$23,506,000
100	Your CPES Estimate MUST be reviewed by a Process person AND an Estimator:				
101	Name of Process Reviewer			Leaf	Click for Reviewe
102	Name of Estimator Reviewer			Lawson	
103	MAXIMUM CONSTRUCTION COST				$23,506,000
104					
105	NON-CONSTRUCTION COSTS:				
106	Permitting		5%	$23,506,000	$1,176,000
107	Engineering		10%	$23,506,000	$2,351,000
108	Services During Construction		5%	$23,506,000	$1,176,000
109	Commissioning & Startup		5%	$23,506,000	$1,176,000
110	Land / ROW		0%	$23,506,000	$0

	A	B	C	D	E
111	***Legal / Admin***		**0%**	**$23,506,000**	**$0**
112	***Other Default Description***		**0%**	**$23,506,000**	**$0**
113	***SUBTOTAL - Non-Construction Costs***				**$5,879,000**
114					
115	***TOTAL - CAPITAL COST***				**$29,385,000**
116					
117	***Currency Conversion of TOTAL CAPITAL COST:***				
118		***Currency***	***Unit of Measure***	***Conversion Rate***	***Converted Amount***
119		**None**	**U.S.Dollar**	**1**	**29,385,000**

CH2M HILL Parametric Cost Estimating System (CPES)

FACILITIES LIFE CYCLE COST ANALYSIS

File Version: 1/23/2012

Import File: C:\Users\mzhang\Documents\Project\CoosBay\CEPS\CPES Facilities Public_CoosBay_MLE_v2.xlsm Brows

Click for CPES QA/QC

Project Name:	Coos Bay VA Cost Estimate
Project Number:	
Project Manager:	Alan Chang
Estimator:	Miaomiao Zhang
Project Description:	FPA Alternative 2 - Extended Aeration MLE
Project Location (City):	Default
Project Location (State):	N/A
Project Location (Country):	
Construction Start (Month):	Jan
Construction Start (Year):	2012
Construction Duration (months)	1
Mid-Point of Construction:	Feb /2012

Life Cycle Analysis:
i = 5.00%
n = 20
Annual Inflation %: 3.00%

To Global Life Cycle Data Sheet

To Annual O & M Cost Summary Sheet

This Report is for INTERNAL Distribution

This Report is for EXTERNAL Distribution

Item	Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT	Construction Cost	Annual O&M Cost (Escalated)	Life Cycle Cost (NPV)
	Yes	Submersible IPS: New	$1,862,000	$35,000	$2,297,000
	Yes	Screening and Grit: New	$2,854,000	$131,000	$4,483,000
	Yes	Aeration Basin: Main	$4,793,000	$30,000	$5,160,000
	Yes	Blowers: Main	$1,957,000	$46,000	$2,520,000
	Yes	Round SC: Main	$2,125,000	$31,000	$2,505,000
	Yes	RAS WAS PS: Main	$1,375,000	$19,000	$1,603,000
	Yes	LPHO UV: New	$1,803,000	$149,000	$3,654,000
	Yes	WAS Storage: New	$1,254,000	$31,000	$1,634,000
	Yes	O&M Building: New	$1,144,000	$9,000	$1,246,000
	Yes	Demolition: New	$0	$0	$0
	Yes	Emergency Generator: New	$320,000	$8,000	$416,000
		Additional Project Costs:			
		Biosolids Disposal	$0	$0	$0
		Standard Items	$3,707,000	$134,000	$5,370,000
		User Defined Items	$0	$0	$0
		Plant O & M Labor		$0	$0
TOTAL - Life Cycle Analysis			$23,194,000	$623,000	$30,888,000
Construction Cost per GPD (based on Maximum Daily Flow Rate)			$3.72 / GPD		
Annual O & M Cost per 1,000 Gallons (based on Average Annual Daily Flow Rate)				$ 1.153 / Thousand Gallons	

VA Alternative 1 - MBR

CH2M HILL Parametric Cost Estimating System (CPES)

FACILITIES DESIGN & CONSTRUCTION COST MODULE

File Version: 1/25/2012

Click for CPES QA/QC | To Concrete Wall Thickness Help | To Cost Summary Matrix | To Unit Cost Database

Project Name:	Coos Bay VA Cost Estimate
Project Number:	
Project Manager:	Alan Chang
Estimator:	Miaomiao Zhang/Bill Leaf
Project Description:	VA Alternative 1 - MBR with Existing Tanks
Project Location (City):	Default
Project Location (State):	N/A
Project Location (Country):	
Construction Start (Month):	Jan
Construction Start (Year):	2012
Construction Duration (months):	1
Mid-Point of Construction:	Feb /2012

Roundup to the nearest: $1,000

This Report is for INTERNAL Distributio

This Report is for EXTERNAL Distributio

Item	Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT	Cost
	Yes	Submersible IPS: New	$1,238,000
	Yes	Screening and Grit: New	$3,272,000
	Yes	Primary Sludge PS: Main	$131,000
	Yes	Round PC: Main	$382,000
	Yes	Aeration Basin: Main	$667,000
	Yes	Blowers: Main	$821,000
	Yes	MBR: Main	$3,494,000
	Yes	Liquid Chemical: CEPTChem	$302,000
	Yes	Flow Splitting: CEPTBypass	$128,000
	Yes	O&M Building: New	$755,000
	No	Demolition: New	$0
	Yes	Emergency Generator: New	$237,000
	Yes	Oxidant Contactor: New	$301,000

SUBTOTAL - PROJECT COST				$11,728,000
ADDITIONAL PROJECT COSTS:				
Demolition	5%			$587,000
Overall Sitework	5%			$587,000
Plant Computer System	5%			$587,000
Yard Electrical	3%			$352,000
Yard Piping	5%			$587,000
UD #1 Default Description	0%			$0
UD #2 Default Description	0%			$0
UD #3 Default Description	0%			$0
SUBTOTAL with Additional Project Costs				$14,428,000
TAX:	0.00%		$14,428,000	$0
SUBTOTAL with Tax				$14,428,000
CONTRACTOR MARKUPS:				
Overhead	10%		$14,428,000	$1,443,000

	A	B	C	D	E
54	*Subtotal*				$15,871,000
55	*Profit*		5%	$15,871,000	$794,000
56	*Subtotal*				$16,665,000
57	*Mob/Bonds/Insurance*		5%	$16,665,000	$834,000
58	*Subtotal*				$17,499,000
59	*Contingency*		25%	$17,499,000	$4,375,000
60	*SUBTOTAL with Markups*				$21,874,000
61					
62	*ESCALATION (to Mid-Point of Construction)*		0.0%	$21,874,000	$0
63	*SUBTOTAL with Escalation*				$21,874,000
64					
65	*LOCATION ADJUSTMENT FACTOR*		100	$21,874,000	$21,874,000
66	*SUBTOTAL - with Local Adjustment Factor*				$21,874,000
67					
68	*RED FLAGS:*				
69	*1*	*Rock Excavation*			
70	*2*	*Pile Foundations*			
71	*3*	*Seismic Foundations*			
72	*4*	*Dewatering Conditions*			
73	*5*	*Wetlands Mitigation*			
74	*6*	*Weather Impacts*			
75	*7*	*Depth of Structures*			
76	*8*	*Local Building Code Restrictions*			
77	*9*	*Coatings or Finishes*			
78	*10*	*Building or Architectural Considerations*			
79	*11*	*Client Material Preferences*			
80	*12*	*Client Equipment Preferences*			
81	*13*	*Piping Galleries, Piping Trenches, Piping Racks*			
82	*14*	*Yard Piping Complexity*			
83	*15*	*Existing Site Utilities (New, Retrofit, and Complexity)*			
84	*16*	*I & C Automation (New or Retrofit)*			
85	*17*	*Electrical Feed (New or Retrofit)*			
86	*18*	*Electrical Distribution*			
87	*19*	*Shoring*			
88	*20*	*Contamination*			
89	*21*	*User Defined Red Flag 1*			
90	*22*	*User Defined Red Flag 2*			
91	*23*	*User Defined Red Flag 3*			
92	*24*	*User Defined Red Flag 4*			
93	*25*	*User Defined Red Flag 5*			
94	*26*	*User Defined Red Flag 6*			
95	*27*	*User Defined Red Flag 7*			
96	*TOTAL - RED FLAGS*				$0
97					
98	*SUBTOTAL - CONSTRUCTION COST with Red Flags*				$21,874,000
99					
100	*MARKET ADJUSTMENT FACTOR*		0%	$21,874,000	$0
101	*SUBTOTAL - CONSTRUCTION COST with Market Adjustment Factor*				$21,874,000
102	*Your CPES Estimate MUST be reviewed by a Process person AND an Estimator:*				
103	*Name of Process Reviewer*			Leaf	Click for Reviewe
104	*Name of Estimator Reviewer*			Lawson	
105	*MAXIMUM CONSTRUCTION COST*				$21,874,000
106					
107	*NON-CONSTRUCTION COSTS:*				
108	*Permitting*		5%	$21,874,000	$1,094,000
109	*Engineering*		10%	$21,874,000	$2,188,000
110	*Services During Construction*		5%	$21,874,000	$1,094,000

	A	B	C	D	E
111	***Commissioning & Startup***		**5%**	**$21,874,000**	**$1,094,000**
112	***Land / ROW***		**0%**	**$21,874,000**	**$0**
113	***Legal / Admin***		**0%**	**$21,874,000**	**$0**
114	***Other Default Description***		**0%**	**$21,874,000**	**$0**
115	***SUBTOTAL - Non-Construction Costs***				**$5,470,000**
116					
117	***TOTAL - CAPITAL COST***				**$27,344,000**
118					
119	***Currency Conversion of TOTAL CAPITAL COST:***				
120		***Currency***	***Unit of Measure***	***Conversion Rate***	***Converted Amount***
121		**None**	**U.S.Dollar**	**1**	**27,344,000**

C H2M HILL P arametric Cost E stimating S ystem (CPES)

FACILITIES LIFE CYCLE COST ANALYSIS

File Version: 1/23/2012

Import File: C:\Users\mzhang\Documents\Project\CoosBay\CEPS\CPES Facilities Public_CoosBay_MBR.xlsm Brows

Click for CPES QA/QC

Project Name:	Coos Bay VA Cost Estimate
Project Number:	
Project Manager:	Alan Chang
Estimator:	Miaomiao Zhang/Bill Leaf
Project Description:	VA Alternative 1 - MBR with Existing Tanks
Project Location (City):	Default
Project Location (State):	N/A
Project Location (Country):	
Construction Start (Month):	Jan
Construction Start (Year):	2012
Construction Duration (months)	1
Mid-Point of Construction:	Feb /2012

Life Cycle Analysis:
i = 5.00%
n = 20
Annual Inflation %: 3.00%

To Global Life Cycle Data Sheet

To Annual O & M Cost Summary Sheet

This Report is for INTERNAL Distribution

This Report is for EXTERNAL Distribution

Item	Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT	Construction Cost	Annual O&M Cost (Escalated)	Life Cycle Cost (NPV)
	Yes	Submersible IPS: New	$1,876,000	$35,000	$2,311,000
	Yes	Screening and Grit: New	$4,961,000	$221,000	$7,711,000
	Yes	Primary Sludge PS: Main	$198,000	$3,000	$228,000
	Yes	Round PC: Main	$579,000	$25,000	$881,000
	Yes	Aeration Basin: Main	$1,011,000	$21,000	$1,261,000
	Yes	Blowers: Main	$1,244,000	$28,000	$1,587,000
	Yes	MBR: Main	$5,297,000	$280,000	$8,785,000
	Yes	Liquid Chemical: CEPTChem	$457,000	$72,000	$1,346,000
	Yes	Flow Splitting: CEPTBypass	$194,000	$1,000	$199,000
	Yes	O&M Building: New	$1,144,000	$9,000	$1,246,000
	No	Demolition: New	$0	$0	$0
	Yes	Emergency Generator: New	$359,000	$10,000	$474,000
	Yes	Oxidant Contactor: New	$456,000	$1,000	$466,000
		Additional Project Costs:			
		Biosolids Disposal	$0	$0	$0
		Standard Items	$4,094,000	$132,000	$5,737,000
		User Defined Items	$0	$0	$0
		Plant O & M Labor		$0	$0
TOTAL - Life Cycle Analysis			$21,870,000	$838,000	$32,232,000
Construction Cost per GPD (based on Maximum Daily Flow Rate)			$3.50 / GPD		
Annual O & M Cost per 1,000 Gallons (based on Average Annual Daily Flow Rate)				$ 1.551 / Thousand Gallons	

VA Alternative 2 - IFAS

CH2M HILL Parametric Cost Estimating System (CPES)

FACILITIES DESIGN & CONSTRUCTION COST MODULE

File Version: 1/25/2012

Click for CPES QA/QC | To Concrete Wall Thickness Help | To Cost Summary Matrix | To Unit Cost Database

Project Name:	Coos Bay VA Cost Estimate
Project Number:	
Project Manager:	Alan Chang
Estimator:	William Leaf/Miaomiao Zhang
Project Description:	VA Alternative 2 - Integrated Fixed-film Activated Sludge
Project Location (City):	Default
Project Location (State):	N/A
Project Location (Country):	
Construction Start (Month):	Jan
Construction Start (Year):	2012
Construction Duration (months):	1
Mid-Point of Construction:	Feb /2012

Roundup to the nearest: $1,000

This Report is for INTERNAL Distributio

This Report is for EXTERNAL Distributio

Item	Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT	Cost
	Yes	Submersible IPS: New	$1,236,000
	Yes	Screening and Grit: New	$1,883,000
	Yes	Primary Sludge PS: Main	$131,000
	Yes	Round PC: Main	$360,000
	Yes	Aeration Basin: Main	$1,175,000
	Yes	Blowers: Main	$990,000
	Yes	Round SC: Main	$1,254,000
	Yes	RAS WAS PS: Main	$1,102,000
	No	Silo AnDig: Meso	$0
	Yes	Oxidant Contactor: New	$301,000
	Yes	Liquid Chemical: New	$185,000
	Yes	O&M Building: New	$755,000
	No	Demolition: New	$0
	Yes	Emergency Generator: New	$211,000
	No	Yard Piping: New	$0
	No	U.D. Facility: New	$0
SUBTOTAL - PROJECT COST			$9,583,000
ADDITIONAL PROJECT COSTS:			
Demolition		5%	$480,000
Overall Sitework		5%	$480,000
Plant Computer System		3%	$288,000
Yard Electrical		3%	$288,000
Yard Piping		5%	$480,000
UD #1 Default Description		0%	$0
UD #2 Default Description		0%	$0
UD #3 Default Description		0%	$0
SUBTOTAL with Additional Project Costs			$11,599,000
TAX:		0.00%	$11,599,000 $0

	A	B	C	D	E
53	**SUBTOTAL with Tax**				$11,599,000
54					
55	**CONTRACTOR MARKUPS:**				
56	**Overhead**		10%	$11,599,000	$1,160,000
57	**Subtotal**				$12,759,000
58	**Profit**		5%	$12,759,000	$638,000
59	**Subtotal**				$13,397,000
60	**Mob/Bonds/Insurance**		5%	$13,397,000	$670,000
61	**Subtotal**				$14,067,000
62	**Contingency**		25%	$14,067,000	$3,517,000
63	**SUBTOTAL with Markups**				$17,584,000
64					
65	**ESCALATION (to Mid-Point of Construction)**		0.0%	$17,584,000	$0
66	**SUBTOTAL with Escalation**				$17,584,000
67					
68	**LOCATION ADJUSTMENT FACTOR**		100	$17,584,000	$17,584,000
69	**SUBTOTAL - with Local Adjustment Factor**				$17,584,000
70					
71	**RED FLAGS:**				
72	**1**	**Rock Excavation**			
73	**2**	**Pile Foundations**			
74	**3**	**Seismic Foundations**			
75	**4**	**Dewatering Conditions**			
76	**5**	**Wetlands Mitigation**			
77	**6**	**Weather Impacts**			
78	**7**	**Depth of Structures**			
79	**8**	**Local Building Code Restrictions**			
80	**9**	**Coatings or Finishes**			
81	**10**	**Building or Architectural Considerations**			
82	**11**	**Client Material Preferences**			
83	**12**	**Client Equipment Preferences**			
84	**13**	**Piping Galleries, Piping Trenches, Piping Racks**			
85	**14**	**Yard Piping Complexity**			
86	**15**	**Existing Site Utilities (New, Retrofit, and Complexity)**			
87	**16**	**I & C Automation (New or Retrofit)**			
88	**17**	**Electrical Feed (New or Retrofit)**			
89	**18**	**Electrical Distribution**			
90	**19**	**Shoring**			
91	**20**	**Contamination**			
92	**21**	**User Defined Red Flag 1**			
93	**22**	**User Defined Red Flag 2**			
94	**23**	**User Defined Red Flag 3**			
95	**24**	**User Defined Red Flag 4**			
96	**25**	**User Defined Red Flag 5**			
97	**26**	**User Defined Red Flag 6**			
98	**27**	**User Defined Red Flag 7**			
99	**TOTAL - RED FLAGS**				$0
100					
101	**SUBTOTAL - CONSTRUCTION COST with Red Flags**				$17,584,000
102					
103	**MARKET ADJUSTMENT FACTOR**		0%	$17,584,000	$0
104	**SUBTOTAL - CONSTRUCTION COST with Market Adjustment Factor**				$17,584,000
105	**Your CPES Estimate MUST be reviewed by a Process person AND an Estimator:**				
106	**Name of Process Reviewer**			Leaf	Click for Reviewe
107	**Name of Estimator Reviewer**			Lawson	
108	**MAXIMUM CONSTRUCTION COST**				$17,584,000
109					

	A	B	C	D	E
110	***NON-CONSTRUCTION COSTS:***				
111	***Permitting***		**5%**	**$17,584,000**	**$880,000**
112	***Engineering***		**10%**	**$17,584,000**	**$1,759,000**
113	***Services During Construction***		**5%**	**$17,584,000**	**$880,000**
114	***Commissioning & Startup***		**5%**	**$17,584,000**	**$880,000**
115	***Land / ROW***		**0%**	**$17,584,000**	**$0**
116	***Legal / Admin***		**0%**	**$17,584,000**	**$0**
117	***Other Default Description***		**0%**	**$17,584,000**	**$0**
118	***SUBTOTAL - Non-Construction Costs***				**$4,399,000**
119					
120	***TOTAL - CAPITAL COST***				**$21,983,000**
121					
122	***Currency Conversion of TOTAL CAPITAL COST:***				
123		***Currency***	***Unit of Measure***	***Conversion Rate***	***Converted Amount***
124		**None**	**U.S.Dollar**	**1**	**21,983,000**

C H2M HILL P arametric Cost E stimating S ystem (CPES)

FACILITIES LIFE CYCLE COST ANALYSIS

File Version: 1/23/2012

Import File: C:\Users\mzhang\Documents\Project\CoosBay\CEPS\CPES Facilities Public_CB_IFAS_v1.xlsm Brows

Click for CPES QA/QC

Project Name:	Coos Bay VA Cost Estimate
Project Number:	
Project Manager:	Alan Chang
Estimator:	William Leaf/Miaomiao Zhang
Project Description:	VA Alternative 2 - Integrated Fixed-film Activated Sludge
Project Location (City):	Default
Project Location (State):	N/A
Project Location (Country):	
Construction Start (Month):	Jan
Construction Start (Year):	2012
Construction Duration (months)	1
Mid-Point of Construction:	Feb /2012

Life Cycle Analysis:
i = 5.00%
n = 20
Annual Inflation %: 3.00%

To Global Life Cycle Data Sheet

To Annual O & M Cost Summary Sheet

This Report is for INTERNAL Distribution

This Report is for EXTERNAL Distribution

Item	Is This Facility Included in Project? (Yes or No)	SCOPE OF PROJECT	Construction Cost	Annual O&M Cost (Escalated)	Life Cycle Cost (NPV)
	Yes	Submersible IPS: New	$1,862,000	$35,000	$2,297,000
	Yes	Screening and Grit: New	$2,855,000	$131,000	$4,487,000
	Yes	Primary Sludge PS: Main	$199,000	$3,000	$229,000
	Yes	Round PC: Main	$545,000	$25,000	$847,000
	Yes	Aeration Basin: Main	$1,781,000	$56,000	$2,467,000
	Yes	Blowers: Main	$1,501,000	$36,000	$1,938,000
	Yes	Round SC: Main	$1,902,000	$44,000	$2,447,000
	Yes	RAS WAS PS: Main	$1,671,000	$24,000	$1,962,000
	No	Silo AnDig: Meso	$0	$0	$0
	Yes	Oxidant Contactor: New	$456,000	$1,000	$466,000
	Yes	Liquid Chemical: New	$280,000	$105,000	$1,580,000
	Yes	O&M Building: New	$1,144,000	$9,000	$1,246,000
	No	Demolition: New	$0	$0	$0
	Yes	Emergency Generator: New	$320,000	$8,000	$416,000
	No	Yard Piping: New	$0	$0	$0
	No	U.D. Facility: New	$0	$0	$0
		Additional Project Costs:			
		Biosolids Disposal	$0	$0	$0
		Standard Items	$3,052,000	$92,000	$4,189,000
		User Defined Items	$0	$0	$0
		Plant O & M Labor		$0	$0
		TOTAL - Life Cycle Analysis	$17,568,000	$569,000	$24,571,000
		Construction Cost per GPD (based on Maximum Daily Flow Rate)	$2.82 / GPD		
		Annual O & M Cost per 1,000 Gallons (based on Average Annual Daily Flow Rate)		$ 1.053 / Thousand Gallons	