City of Coos Bay

COOS COUNTY, OREGON

WASTEWATER COLLECTION SYSTEM MASTER PLAN
Volume A

January 2006

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1.0 Executive Summary

1.1 Introduction

The City of Coos Bay is located in Coos County on the Southern Oregon Coast. Coos Bay is the largest community on the Oregon Coast with a 2004 population of around 15,700 persons. In addition to persons living within the City of Coos Bay, the City accepts raw sewage from both the Charleston and Bunkerhill Sanitary Districts. A total 2004 service population, including the sanitary districts, is in excess of 20,000 persons. The raw sewage from the City and the two districts is conveyed to one of two of the City's wastewater treatment facilities for treatment and disposal.

In 2003, the City authorized the firm of West Yost and Associates to prepare facilities plans for both wastewater treatment plants. In 2004, the City authorized the firm of HBH Consulting Engineers, Inc. to prepare a wastewater collection system master plan.

In addition to providing the technical and engineering information needed to administer and manage the wastewater system, the facilities and master plans have been prepared to provide the backing and basis for the City to establish a system development charge (SDC) program to help offset the financial burden that new development has come to place on the system. This effort is part of a multi-phased approach that is intended to establish SDC's for wastewater, stormwater, transportation, and eventually, the parks systems within the City of Coos Bay.

1.2 Existing System

The City of Coos Bay owns and operates two wastewater treatment facilities, a number of pumping stations, and miles of gravity and force main piping that, together, constitute the City of Coos Bay Wastewater System.

Detailed information is provided on each wastewater treatment facility in the facilities plans prepared by West Yost.

The City owns and operates 26 pumping stations throughout the community. 3 of these stations are stormwater pump stations and are discussed in the City's stormwater master plans (Dyer Partnership-2004, HBH Consulting Engineers, Inc-2006).

Of the remaining 23 wastewater pumping stations, 4 are minor stations serving only park or public restroom facilities or individual buildings. The remaining 19 wastewater pumping stations are located throughout the system and are utilized to convey wastewater to one of the two treatment facilities. Detailed information is provided for each pump station in Section 4.3 of this Master Plan.

Collection system piping in Coos Bay varies by age, condition, size (diameter), and materials. The City's system includes force mains sized from 2-inch and smaller to as large as 24-inches in diameter. Gravity piping includes 4-inch laterals up to 30-inch gravity mains. In total, the City operates and maintains in excess of 90-miles of sewer piping throughout the community.

For the purposes of this study, the collection system was divided into two distinct service areas corresponding to the two wastewater treatment facilities that are the terminuses of each of the service areas. Service area 1 includes Eastside, Englewood, and the majority of the eastern portion of the City.

The entire service area, including the Bunkerhill Sanitary District, terminates at Treatment Plant No. 1 located about a block west of Highway 101. Service area 2 is made up of the western portion of the City and includes the Charleston Sanitary District. Service area 2 terminates at Plant 2 located just off the Cape Arago Highway.

The service areas were further broken down and organized into 34 distinct sanitary sewer basins (not including the sanitary districts located outside the City Limits). The boundaries of each basin are clearly shown on the drawings provided in the separate mapping volume titled “Volume B” of this Master Plan. The mapping in Volume B has also been prepared with special line types and color coding intended to indicate the various piping sizes located throughout the community.

1.3 Identification of Deficiencies and Development of Improvement Alternatives

All of the existing wastewater collection system components were analyzed for deficiencies that exist now and those that are anticipated within the 20-year planning period. Deficiencies were identified related to the age and condition of facilities, operational issues, anticipated development pressures, and capacity related issues.

As part of this planning effort, calculations were developed to estimate the peak wastewater flows existing in each basin as well as those anticipated within the planning period. A study of flows in both summer and winter months and during peak events shows that the City of Coos Bay experiences an increase in flows of between 8 and 12 times the average dry weather condition during storm events. This “peaking factor” is common to communities in Oregon and is a result of inflow and infiltration (I/I) or groundwater and rainwater that enters the system through holes, cracks, cross connections with storm systems or through other means.

As the winter peak flows are much greater than dry weather conditions, the peak flow conditions were used to analyze system capacities.

The following tables indicate the existing and future flows for the City of Coos Bay. The wastewater flow rates and I/I issues are discussed further in Section 5.0 of this Master Plan and within the facilities plans prepared by West Yost (2005).

Table 1.3.1 – Existing Wastewater Flow Rates for Each Service Area

Wastewater Flow Criteria (2003)	**Plant 1 Service Area (MGD)**	**Plant 2 Service Area (MGD)**
Average Dry Weather Flows (ADWF)	1.60	0.85
Average Wet Weather Flows (AWWF)	3.20	1.30
Maximum Month Dry Weather Flow (MMDWF)	2.90	1.20
Maximum Month Wet Weather Flow (MMWWF)	5.50	2.30
Peak Daily Flow (PDF)	10.00	4.50
Peak Wet Weather Flow or Peak Hourly Flow (PWWF)	15.00	7.00

Table 1.3.2 – Projected Wastewater Flow Rates for Each Service Area

Wastewater Flow Criteria (2027)	**Plant 1 Service Area (MGD)**	**Plant 2 Service Area (MGD)**
Average Dry Weather Flows (ADWF)	1.70	1.00
Average Wet Weather Flows (AWWF)	3.40	1.50
Maximum Month Dry Weather Flow (MMDWF)	3.10	1.40
Maximum Month Wet Weather Flow (MMWWF)	5.90	2.70
Peak Daily Flow (PDF)	13.30	5.50
Peak Wet Weather Flow or Peak Hourly Flow (PWWF)	20.00	8.60

With the above system-wide flow rates established. Individual peak flow rates were calculated for each basin. The individual basins were then analyzed for their individual flow rates or for cumulative flow rates if one basin's flows passed through another basin.

In the end, piping sections, pumping stations, and force mains were analyzed for capacity-related deficiencies.

Each pump station was also inspected and reviewed in detail with members from the operations staff (OMI) to discuss maintenance, operational history, or other deficiencies that may not be directly related to capacity. These additional deficiencies were considered when developing alternatives for improvements for the systems.

Section 7 of this Master Plan includes a discussion of alternatives and improvements for each pump station including recommended improvements and associated project costs for each improvement. Section 7 also includes a discussion of the collection piping in each basin and along with projects to improve identified deficiencies in the collection piping systems.

In addition to the alternatives and improvements prepared for the piping and pumping systems, Section 7 includes a discussion on alternatives and recommendations for the reduction of I/I in the system, the reduction of fats, oils, and grease (FOG) that create significant maintenance problems for the City, and recommendations for management and operation of the collection system through the use of modern inventory and management software.

1.4 Recommended Plan

In the final section of the Master Plan, individual projects are grouped into three priority classifications. Each classification group is loosely defined as follows:

Group A: These are the highest priority projects that should be undertaken as soon as adequate funding is available. It should be considered that these projects should be undertaken within the next five years with highest projects on the list to be addressed in the next year or two.

Group B: These projects, while not of the highest priority, should be on the City's capital improvement planning window beyond the 5-year horizon. As Group A projects are completed, Group B projects should be moved to Group A status. System degradation or failures, project coordination, or other occurrence may require the movement of Group B projects to Group A status ahead of schedule. New projects that are developed that are not critical, should be grouped in Group B until funding is available.

Group C: Group C projects are either low priority projects or projects that are dependent on development. If development in an area necessitates a Group C improvement, it should be moved to

Group A status assuming that adequate funding is available to undertake the project. Some projects may remain in Group C indefinitely if the need for the project or the necessitating development never arises.

The following table lists the projects developed for the City's wastewater pumping systems:

Table 1.4.1 – Pump Station Project Prioritization Summary

	Priority Rating	Project Number	Project Name (Description)	Total Project Cost
A	1	PS10B *	Pump Station No. 10 Improvements - New Wet Well	$696,850
A	2	PS4	Pump Station No. 4 Improvements	$930,611
A	3	PS5	Pump Station No. 5 Improvements	$791,480
B	4	PS16A *	Pump Station No. 16 Improvements - New Wet Well	$719,488
B	5	PS9	Pump Station No. 9 Improvements	$467,516
B	6	PS17	Pump Station No. 17 Improvements	$73,062
B	7	PS8A *	Pump Station No. 8 Improvements - New Wet Well	$654,230
B	8	PS10-FM	Pump Station No. 10 Force Main	$653,346
C	9	PS6	Pump Station No. 6 Improvements	$191,880
C	10	PS1	Pump Station No. 1 Improvements	$528,408
C	11	PS2	Pump Station No. 2 Improvements	$401,472
C	12	PS19	Pump Station No. 19 Improvements	$449,423
C	13	PS18	Pump Station No. 18 Improvements	$192,142
C	14	PS12	Pump Station No. 12 Improvements	$986,312
C	15	PS13	Pump Station No. 13 Improvements	$467,516
C	16	PS14	Pump Station No. 14 Improvements	$178,934
			Total	**$8,382,669**

A total of 16 projects have been developed for the City's 19 major wastewater pumping systems totaling in excess of $8.3 million dollars. The high priority pump station projects total around $2.4 million dollars.

Table 1.4.2 below summarizes the projects that were developed for the collection system piping network in the City's 34 wastewater basins.

A total of 24 projects have been developed for the piping network totaling in excess of $7-million dollars. High priority projects for the piping system are in excess of $1.2 million dollars.

Together, (piping and pumping system improvements), the high priority projects total in excess of $3.6-million dollars. All of the projects in the Master Plan account for in excess of 15-million dollars for all of the collection system improvements (in 2005 dollars).

Table 1.4.2 – Collection Piping Project Prioritization Summary

	Priority Rating	Project Number	Project Name (Description)	Total Project Cost
A	1	GG1	Isthmus Slough Crossing	$530,438
	2	HH1	Reconstruct Upstream of Pump Sta. 19	$250,920
	3	O1	Kingwood Canyon Replacement	$39,704
	4	C1	Wasson and Grant Replacement	$175,865
	5	E1	Michigan and Wasson Rehab.	$56,826
	6	F1	Michigan and Morrison Rehab.	$169,799
B	7	W1	Pipe Replacements near Blossom Gulch	$181,548
	8	HH2	Repair Coos River Hwy. Section	$35,572
	9	N1	Pine Ave. Replacement	$33,948
	10	B1	Morrison Interceptor	$469,220
	11	F2	Fillmore Interceptor	$196,485
	12	R1	Misc. Replacements-Basin R	$76,752
	13	L1	Woodland Dr. Upsizing	$696,672
	14	T1	Pipe Replacement west of Plant 1	$92,840
	15	U1	Reroute around Red Lion	$482,154
	16	U2	Pipe Replacement south of Hemlock	$34,612
	17	FF1	FF Interceptor Repairs	$53,357
	18	S1	Date Street Repair	$20,443
	19	N2	N. 8th Street Main Replacement	$182,655
	20	D1	Marple-Jackson to Taylor	$223,437
C	21	AA1	Minnesota Hills Development Extension	$709,698
	22	BB1	California Ave Crest Development	$283,872
	23	V1	Elrod Hills Development Extension	$584,976
	24	I1	Lindy Lane West	$1,144,269
	25	K1	Ocean Boulevard Upsizing	$457,560
			Total	**$7,183,623**

1.5 Plan Implementation

It is presumptuous to develop a strict schedule and order for the implementation of the projects developed in this Master Plan. Funding sources, development pressures, economic environment, and many other variables will steer the implementation of the plan.

The City should maintain the 3-Group approach discussed above and in Section 8.4. By working to complete the high priority projects and maintaining a living, working capital improvement plan (CIP), the City will systematically complete the projects necessary to maintain and effectively operate their wastewater system.

The City should immediately begin on the process of securing funding for the highest priority projects presented above.

1.6 Potential Impacts to Rate Payers

The ultimate impact to rate payers will depend on the projects that the City intends to undertake, the availability of grant funds, the SDC contributions to the projects, and many other variables. Also, the City will be considering significant capital improvements and expenses for their wastewater treatment facilities as developed in their facilities plans (West Yost).

The availability of grant funding is dependent on many variables. Funding agencies usually consider such items as community size, financial hardships, a comparison of user rates, mean household income (MHI) and other variables.

According to the West Yost studies, the City of Coos Bay has an average sewer rate of around $22 per month. In comparison, the League of Oregon Cities has released the results of a recent poll that finds the average sewer rate in Oregon is around $27 (based on poll respondents).

According to the 2000 Census, Coos Bay has an average MHI of around $31,200 which is lower than the state average of around $43,000.

Another indicator of reasonable user rates is the affordability index. Many funding agencies consider an affordable user rate to be no greater than 1.75-percent of the MHI. For Coos Bay residents, this would set a maximum affordable user rate at around $45.50.

Considering these criteria, and the anticipated project costs for the treatment facilities, The City is not guaranteed grant funding for their collection system projects.

A potential funding scenario is presented below that assumes no grant funds will be available:

> **Scenario 1:** It is assumed that the City will undertake all the projects in the Priority A group for a total project cost of $3,642,493. It is also assumed that whatever grants that the City is able to obtain will be utilized on the treatment plant projects. Therefore, the following impact to rate payers is entirely based on a funding source that requires payback (loan, bond, etc.).
>
> Principal: $3,642,493
> Interest : 5-percent
> Term: 20 years
> Annual Payment: $288,466
> EDU's: 10,312
>
> Based on these terms, the average monthly rate increase required to pay back a loan, per EDU, is $2.33. If the I/I reduction and system maintenance program discussed in Section 7.4 is implemented and the $2.83 rate increase is added to the Scenario 1 rate increase, the total rate increase required for both would be just over $5 per month which would raise the average sewer rate in Coos Bay to around the average monthly sewer rate across the State. (It should be reiterated that these rate increases do not include any costs for projects related to the wastewater treatment plant projects.)

The City owns and operates a wastewater collection system. As this system is constantly degrading, development pressures are increasing demands, and regulatory requirements are constantly rising, the City must raise the necessary funds to maintain and operate the system effectively. While a rate increase is not an easy decision for any community, the City must weigh their available resources against what is needed to fund the necessary improvements to maintain and operate their system.

2.0 Introduction, Purpose and Need

2.1 Background

The City of Coos Bay owns and maintains a public wastewater collection and treatment system. The service area is divided into two overall collection regions or service areas and generally encompasses the City Limits, although wastewater flows also are received from areas outside the City Limits including Charleston Sanitary District and Bunker Hill Sanitary District as well as some specific areas that are located within the City Limits of North Bend.

The wastewater system includes two wastewater treatment plants, 23 wastewater pump stations, and miles of gravity and pressure sewer pipe of various sizes and materials. (The City also owns and operates three stormwater pumps stations which are discussed in the City's Stormwater Master Plans, Dyer, 2004, HBH Consulting Engineers, Inc. 2005.)

The original collection system was constructed of clay and concrete pipe in the early 1900's and served what is now the downtown area of Coos Bay. As the City has grown, the collection system has expanded to serve areas of new development. Over the period of time that the City of Coos Bay has operated a wastewater system, growth in the community has occurred at varying rates. Recently, the area in and around Coos Bay has experienced an increased rate of growth due to people moving into the area.

In order to prepare for continued growth and ensure that the City's wastewater collection system is adequately sized and maintained, the City has chosen to undertake this Wastewater Collection System Master Plan.

2.2 Previous Planning Efforts

In 2003 the City of Coos Bay authorized the completion of Wastewater Facilities Plans for both of the existing wastewater treatment plants. The firm of West Yost & Associates was retained to undertake those facilities plans and is expected to complete them by the end of 2005.

In 1984 the firm of H.G.E., Inc. was contracted by the City of Coos Bay to undertake a Wastewater Facilities Plan for Treatment Plant One and the associated collection system. Upon review of the Plan, the Oregon Department of Environmental Quality requested that supplemental planning be performed to address certain deficiencies in the Plan. In 1986 the firm of Brown and Caldwell was retained to perform a Facilities Plan Supplement which refined hydraulic loading projections and preliminary sewer system design.

2.3 Purpose and Need

The overall purpose of this Wastewater Collection System Master Plan is to supplement previous planning efforts and provide the City with the necessary planning information to form the technical, financial, and legal basis required for the establishment of wastewater SDC's. This Master Plan also will serve as a guide for the management of the wastewater system through the upcoming planning period extending through the year 2026.

Specific objectives of this Master Plan include the following:

- Prepare a document that catalogues information about the study area and the existing collection system.
- Evaluate the existing collection system condition and capacity, and identify current deficiencies.
- Estimate current and projected wastewater flows to each treatment plant from each of their respective service areas including areas outside the City Limits.
- Develop potential wastewater collection system improvements to serve existing demands and demands placed on the system by future development within the City Limits.
- Provide cost estimates and prioritization recommendations for the recommended improvements.

The remainder of this study will be dedicated to meeting these planning objectives.

2.4 Authorization

The City of Coos Bay authorized the firm of HBH Consulting Engineers, Inc. to develop a Wastewater Collection System Master Plan via. a contract dated January 25, 2005. Services are in accordance with this professional services contract and the HBH proposal for the project which was presented to the City in November 2004.

2.5 Acknowledgements

This plan is the result of contributions made by a number of individuals and agencies. In particular, the following persons should be acknowledged for the important roles they played in the preparation, review, and development of this plan:

Susanne Baker .... City of Coos Bay
Karen Turner .... City of Coos Bay
Steve Doty .... City of Coos Bay
Mike McDaniel.. OMI
Jon Gasik .... DEQ

In addition to these key personnel, we wish to thank the City of Coos Bay City Council and management staff for providing support and input on the project.

3.0 Study Area Characteristics

3.1 Study Area

The City of Coos Bay is located on the southern Oregon coast and lies approximately 100 miles north of the California border and approximately 200 miles south of the Columbia River. A map showing the location of Coos Bay within the State is presented in Figure 3-1.

The City of Coos Bay is situated on a hilly peninsula which is bounded on the west by the Coos Bay channel which leads to the Pacific Ocean and on the east by the interior portion of the Bay and Isthmus Slough. The downtown portion of the City of Coos Bay lies on the mud flats located on the westerly side of Isthmus Slough. The remainder of the city lies on the rolling hills that form the described peninsula.

Coos Bay is a tourist destination during the summer and fall months and offers beaches, hotels, a casino, the nearby South Slough Estuarine Reserve, and numerous popular outdoor recreational opportunities. US Highway 101 passes through downtown Coos Bay and is the only major highway serving the city.

The study area for this Master Plan lies entirely within the Coos Bay City Limits. While two separate sanitary districts (Charleston and Bunkerhill) are contributors to the total flows within the Coos Bay service areas, the collection systems within these separate agencies will not be part of this study. However, flows from those districts and their impact to the Coos Bay collection system will be analyzed. A map of the study area is presented in Figure 3-2.

3.2 Physical Environment

The following subsection provides information about the physical environment in and around the City of Coos Bay as it relates to wastewater collection system planning. Precipitation and groundwater characteristics are of particular interest as they can have a significant impact on sizing of wastewater collection facilities if not carefully monitored and prevented from entry into the system.

3.2.1 Climate

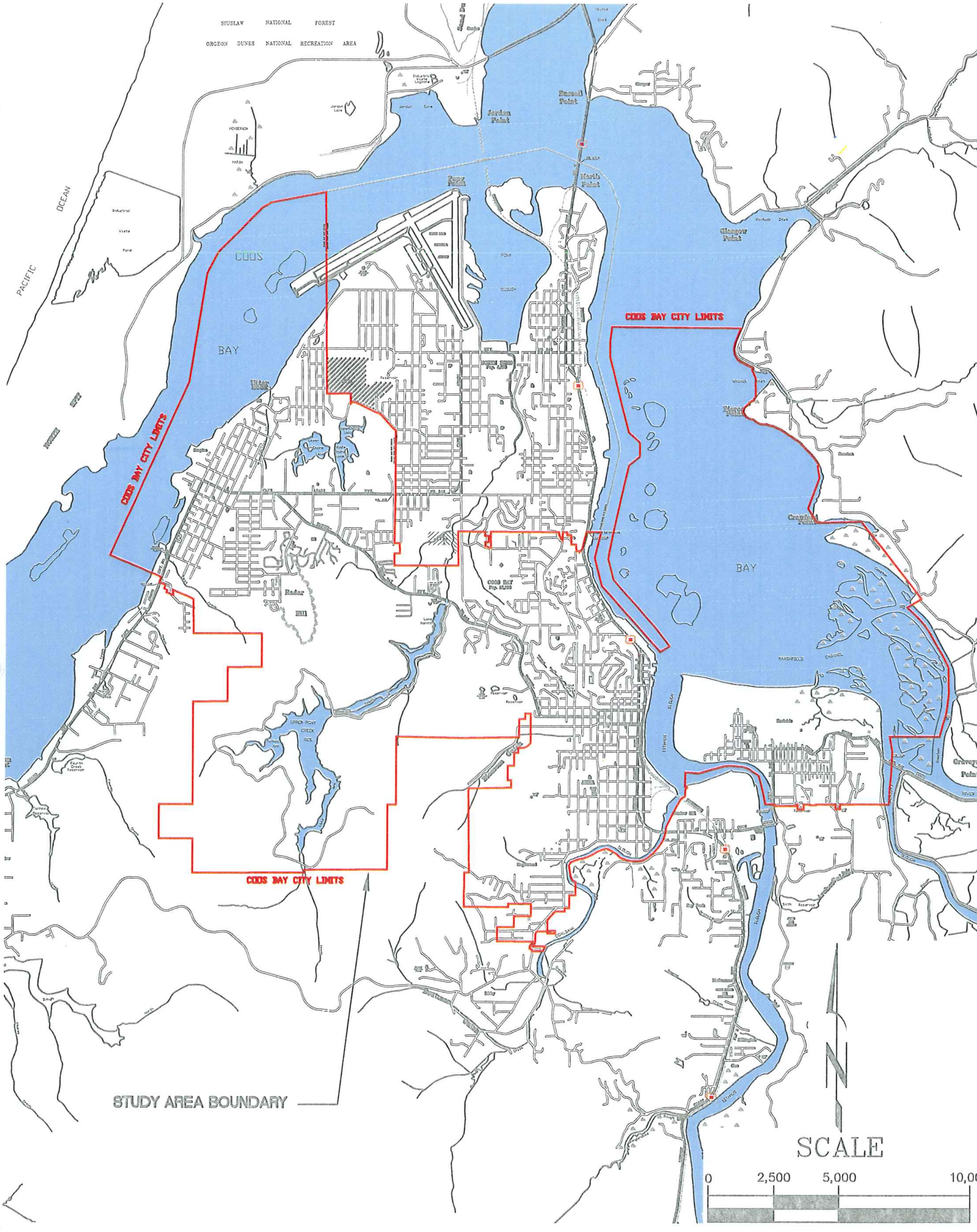
The climate in Coos Bay is moist, marine and temperate. Average temperatures are 46º F in January and 60º F in August. The annual mean temperature is approximately 53º F. Extreme temperatures range from 14º F to 95º F.

Coos Bay experiences prevailing winds from the northwest from May through September. According to the wind rose plots available from the North Bend Airport, winds are generally from the southeast during the winter and early spring months, though some parts of Coos Bay experience a more westerly wind approach. Average wind velocities range from about 9 mph in the winter to about 12 mph in the summer with occasional storms with gusts exceeding 50 mph or more.

The average annual precipitation in Coos Bay is approximately 64 inches. Nearly all the precipitation occurs as rainfall, with the majority (approximately 72%) falling between the months of November and March. Records from the weather station at the North Bend airport indicated that for the period from 1971 to 2000 the average rainfall between November and January was over 30 inches. The wettest month is December with an average of approximately 10.4 inches of rainfall during the above stated period. Records from the stated period also indicate a maximum 24-hour rainfall occurrence of 6.67 inches in the month of November. The driest month is July with an average of about 0.5-inches of rainfall. Figure 3-3 provides a graphical representation of monthly average rainfall amounts for the area based on data from the North Bend airport during the 1971 to 2000 period.

January, 2006

H B H Consulting Engineers	City of Coos Bay *COLLECTION SYSTEM MASTER PLAN*	VICINITY MAP	FIG. 3-1



January, 2006

H B H Consulting Engineers	City of Coos Bay *COLLECTION SYSTEM MASTER PLAN*	STUDY AREA MAP	FIG. 3-2

Figure 3-3 – Monthly Mean Precipitation

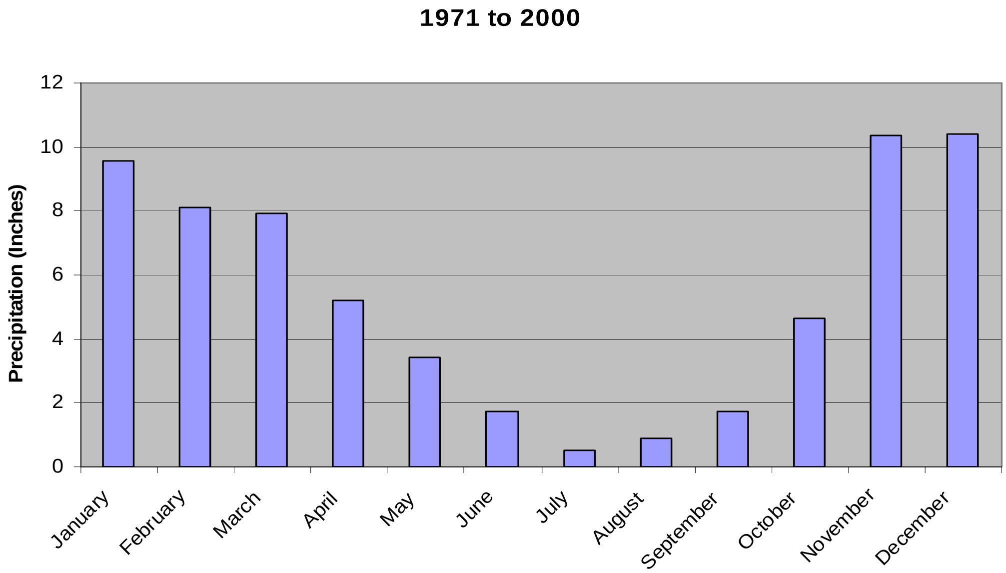
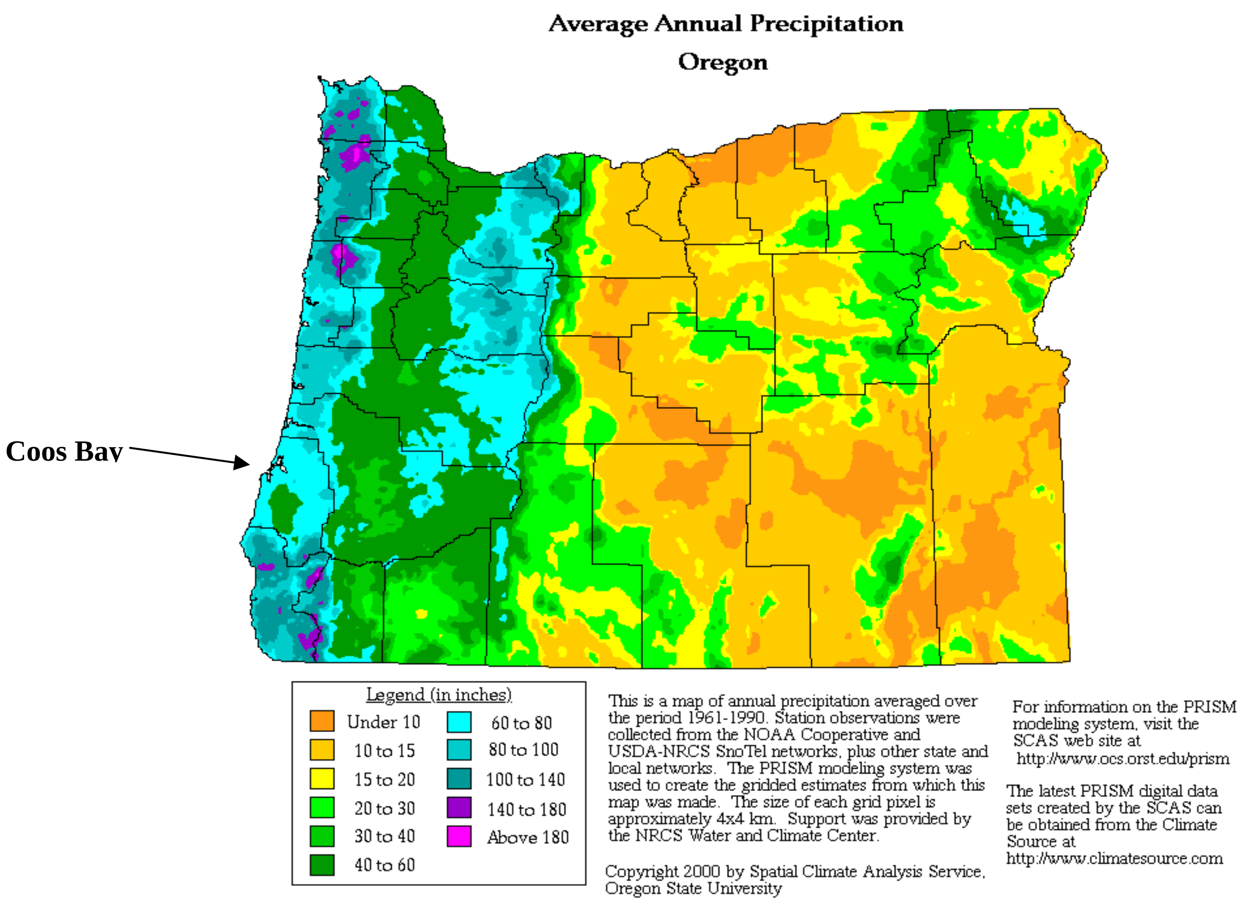


Figure 3-4 below indicates statewide average annual precipitation totals. Coos Bay is located in a zone identified as receiving an average of 60 to 80 inches annually.

Figure 3-4 – Average Annual Precipitation



3.2.2 Soils

Soils within the Coos Bay area are dominated by sandy loams and silt loams. The sandy loam soils that are present on the west facing slopes in the Empire area typically have a cemented layer beneath at depths varying from 1 to 4 feet below the surface. The cemented soils tend to have very slow permeability, but the underlying loams and sands typically have moderately rapid permeability. Silt loam soils that are present on the east facing slopes and in the Eastside area are non-cemented but tend to be clayey below the surface. Permeability of these soils ranges from moderately slow to moderate. Erosion potential of the area soils generally is slight to moderate except where surface slopes are 30% or more. A Soils Map is presented in Figure 3-5.

3.2.3 Geologic Hazards

Coos Bay is subject to a variety of geologic hazards including flooding, landslides, high groundwater, earthquakes and tsunamis. A discussion of each hazard and the areas it affects is presented below.

- **Flooding**

  Flooding in Coos Bay is related to two factors; rainfall and tides. Winter tides frequently include high tide levels that exceed those experienced the rest of the year. According to the National Flood Insurance Program (NFIP) flood maps, the most significant flooding is expected to occur within downtown Coos Bay, Blossom Gulch, the Englewood area, and areas of Eastside when westerly storm winds and high tides coincide with heavy precipitation runoff. Storm drains within these areas include numerous gravity culverts that discharge to the bay, many through tide gates. When tide levels are elevated runoff is unable to exit through the tide gates and water backs up onto streets through catch basins and manholes. Additionally, levees in portions of Englewood are not sufficiently high to prevent flooding during extreme high tides. For additional information on flooding, see the City's Stormwater Master Plans (Dyer-2004, HBH-2005).

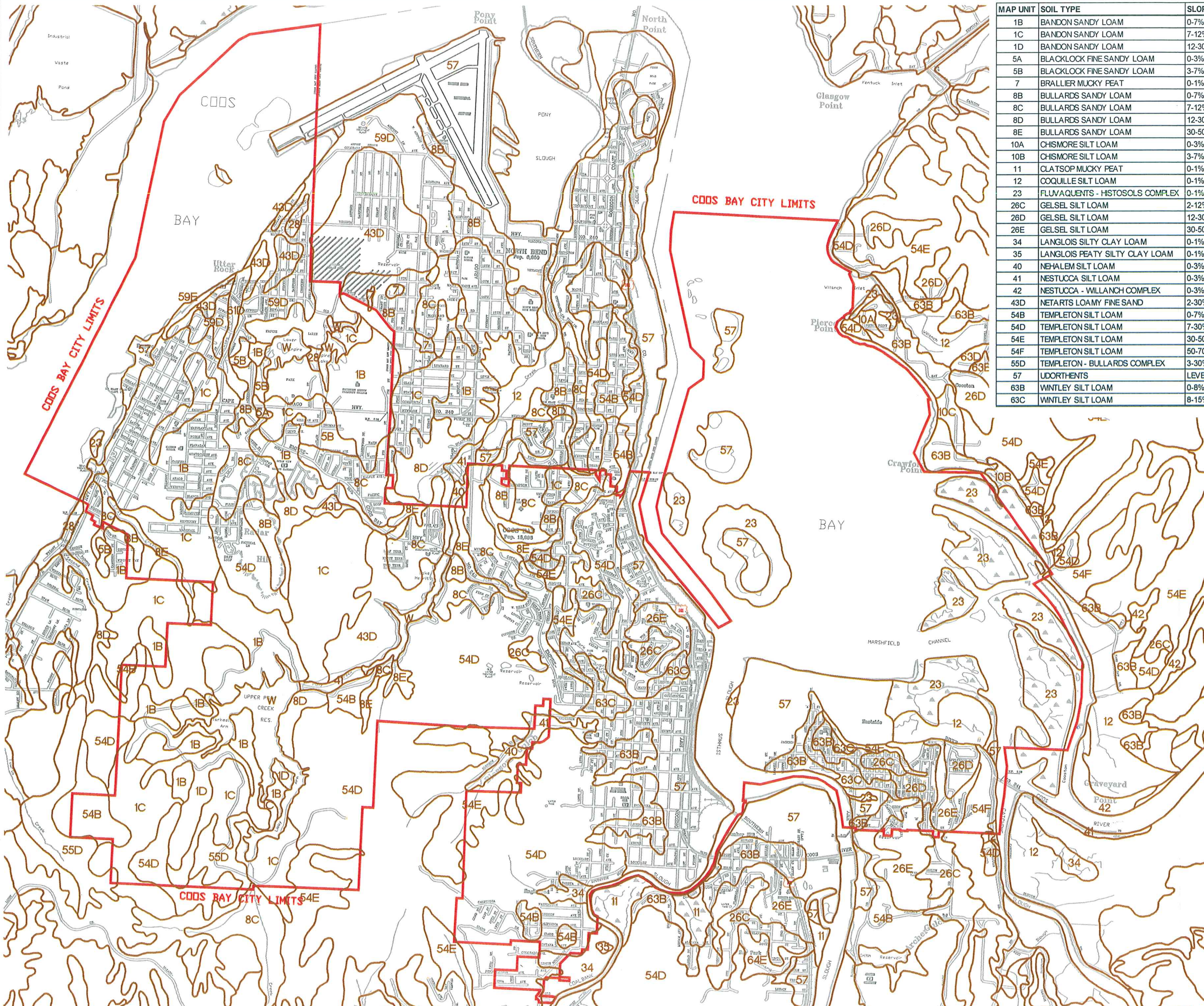
- **Landslides and High Groundwater**

  Landslides within the City of Coos Bay are a potential in locations where homes and/or roadways have been constructed on steep hillsides or cut banks and where high ground moisture makes slope stabilization difficult. One area of recurrent sliding is along the Coos River Highway in Eastside. High ground moisture coupled with clayey soils underlying the roadway have led to recurrent sliding in this area.

- **Earthquakes and Tsunamis**

  A number of faults of Late Quaternary to Holocene age exist within the Coos Bay area. All the faults are relatively short and are estimated to have slip rates of less than 1 mm per year. The most recent events are thought to have occurred on the South Slough syncline that runs north-south from about Beaver Hill to Charleston Harbor, and on the Coquille fault which runs northwest-southeast off shore beginning at the mouth of the Coquille River. The faults located in the immediate Coos Bay area are not considered to present any significant geologic hazard.

  A more significant geologic hazard is the Cascadia Subduction Zone located off the Oregon coast. The Cascadia Subduction Zone consists of a long sloping fault that stretches from mid-Vancouver Island to Northern California. The fault is located approximately 60 miles off the coast at Coos Bay. Very large earthquakes are known to be experienced periodically along this fault. It is estimated that an earthquake of magnitude 9.0 or greater could occur if rupture occurred along the entire fault. Large earthquakes along the Cascadia Subduction Zone are estimated to have a return period of 400 to 600 years with the last major earthquake occurring in January 1700. The Cascadia Subduction Zone presents a significant geologic hazard to the Coos Bay area both due to its potential to produce severe earth tremors and the likelihood to cause a tsunami following a major earthquake. Low lying areas of Coos Bay could experience significant damage from a tsunami. Ground acceleration resulting from a large earthquake could lead to major damage in areas where soft soils and/or high groundwater exist.



MAP UNIT	SOIL TYPE	SLOPE	PERMEABILITY	RUNOFF	WATER CAPACITY	EROSION POTENTIAL
1B	BANDON SANDY LOAM	0-7%	VERY SLOW	SLOW	2" - 6"	SLIGHT
1C	BANDON SANDY LOAM	7-12%	VERY SLOW	MEDIUM	2" - 6"	MODERATE
1D	BANDON SANDY LOAM	12-30%	VERY SLOW	MEDIUM	2" - 6"	MODERATE
5A	BLACKLOCK FINE SANDY LOAM	0-3%	VERY SLOW	VERY SLOW	1.5" - 3.5"	SLIGHT
5B	BLACKLOCK FINE SANDY LOAM	3-7%	VERY SLOW	VERY SLOW	1.5" - 3.5"	SLIGHT
7	BRALLIER MUCKY PEAT	0-1%	MODERATE	PONDED	18" - 24"	SLIGHT
8B	BULLARDS SANDY LOAM	0-7%	MODERATE	SLOW	4.0" - 5.5"	SLIGHT
8C	BULLARDS SANDY LOAM	7-12%	MODERATE	MEDIUM	4.0" - 5.5"	MODERATE
8D	BULLARDS SANDY LOAM	12-30%	MODERATE	MEDIUM	4.0" - 5.5"	MODERATE
8E	BULLARDS SANDY LOAM	30-50%	MODERATE	RAPID	4.0" - 5.5"	SEVERE
10A	CHISMORE SILT LOAM	0-3%	SLOW	SLOW	3.5" - 7.5"	SLIGHT
10B	CHISMORE SILT LOAM	3-7%	SLOW	SLOW	3.5" - 7.5"	SLIGHT
11	CLATSOP MUCKY PEAT	0-1%	SLOW	PONDED	3" - 6"	SLIGHT
12	COQUILLE SILT LOAM	0-1%	SLOW	VERY SLOW	4.0" - 8.5"	SLIGHT
23	FLUVAQUENTS - HISTOSOLS COMPLEX	0-1%	--	--	SATURATED	--
26C	GELSEL SILT LOAM	2-12%	MODERATELY SLOW	MEDIUM	6.5" - 11.5"	MODERATE
26D	GELSEL SILT LOAM	12-30%	MODERATELY SLOW	MEDIUM	6.5" - 11.5"	MODERATE
26E	GELSEL SILT LOAM	30-50%	MODERATELY SLOW	RAPID	6.5" - 11.5"	HIGH
34	LANGLOIS SILTY CLAY LOAM	0-1%	SLOW	SLOW	2.5" - 4.5"	SLIGHT
35	LANGLOIS PEATY SILTY CLAY LOAM	0-1%	SLOW	PONDED	3.5" - 5.0"	SLIGHT
40	NEHALEM SILT LOAM	0-3%	MODERATELY SLOW	SLOW	7.5" - 12.5"	SLIGHT
41	NESTUCCA SILT LOAM	0-3%	MODERATELY SLOW	SLOW	4.0" - 8.5"	SLIGHT
42	NESTUCCA - WILLANCH COMPLEX	0-3%	MODERATELY SLOW	SLOW	4.0" - 8.5"	SLIGHT
43D	NETARTS LOAMY FINE SAND	2-30%	MODERATELY RAPID	SLOW	3" - 6"	SLIGHT
54B	TEMPLETON SILT LOAM	0-7%	MODERATE	SLOW	8.0" - 17.5"	SLIGHT
54D	TEMPLETON SILT LOAM	7-30%	MODERATE	MEDIUM	8.0" - 17.5"	MODERATE
54E	TEMPLETON SILT LOAM	30-50%	MODERATE	RAPID	8.0" - 17.5"	HIGH
54F	TEMPLETON SILT LOAM	50-70%	MODERATE	RAPID	8.0" - 17.5"	HIGH
55D	TEMPLETON - BULLARDS COMPLEX	3-30%	MODERATE	MEDIUM	4.0" - 5.5"	MODERATE
57	UDORTHENTS	LEVEL	--	--	--	--
63B	WINTLEY SILT LOAM	0-8%	MODERATELY SLOW	MEDIUM	8.0" - 9.5"	MODERATE
63C	WINTLEY SILT LOAM	8-15%	MODERATELY SLOW	MEDIUM	8.0" - 9.5"	MODERATE

SCALE

0 1500 3000 6000

(IN FEET)
1 inch = 3000ft.

HBH Consulting Engineers

City of Coos Bay
COLLECTION SYSTEM MASTER PLAN

SOILS MAP

DRAWN BY: DGN
DATE: January, 2006

FIG. 3-5

3.2.4 Water Resources

Water resources around the Coos Bay area include Coos River, Coos Bay and its associated sloughs, Empire Lakes, Pony Creek, Blossom Creek, Mingus Lake, and a number of other small streams. Each resource has significant impacts on the community in both physical and socioeconomic terms.

Numerous storm drains maintained by the City of Coos Bay enter the bay or the sloughs. Effluent from each of Coos Bay's wastewater treatment plants is discharged into the bay. The City holds NPDES permits for discharges from each of the sanitary sewer outfalls.

Residents of Coos Bay obtains domestic water from the Coos Bay-North Bend Water Board. Source water for the municipal supply comes from the upper and lower Pony Creek reservoirs located along the creek. The Water Board has developed additional resources in the dunes north of Coos Bay and continues to explore water resources in the dunes as well as their water rights on Tenmile Creek near Lakeside.

3.2.5 Flora and Fauna

The flora within the study area includes a variety of trees and shrubs suited to the temperate climate and wet winters. The NRCS Soil Survey for Coos County identifies trees and understory vegetation that occur within the various soils in the study area. In areas where sandy loam soils exist, trees generally include Sitka Spruce, Western Hemlock, Red Alder, Western Red Cedar, Shore Pine, and Port Orford Cedar. The understory vegetation in these areas is mainly Salal, Evergreen Huckleberry, Western Bracken Fern, Pacific Wax Myrtle, Pacific Rhododendron, Manzanita, and Slough Sedge. In areas where silty loam soils exist, trees generally include Douglas Fir, Sitka Spruce, Western Hemlock, Western Red Cedar, Shore Pine, Red Alder, and Oregon Myrtle. The understory vegetation in these areas includes Evergreen Huckleberry, Creambush Oceanspray, Salal, Pacific Rhododendron, Cascara, Salmonberry, Rose, Trailing Blackberry, Hairy Bracken Fern, Western Sword Fern, Vine Maple, Thimbleberry, Northern Twinflower, and Pacific Trillium. Trees in low lying areas adjacent to streams include Pacific Willow, Red Alder, Black Cottonwood, and Sitka Spruce. The understory vegetation in these areas is mainly Slough Sedge, Soft Rush, Brown-Headed Rush, and Skunkcabbage. Vegetation along the bay shores is mainly Eelgrass, Seaside Arrow Grass, Pacific Bulrush, Tufted Hair Grass, and Baltic Rush.

Studies of local watersheds funded by the Bureau of Land Management have indicated a number of bird, reptile, amphibian and mammal species that occur or historically occurred in the general area. Because of development within the City of Coos Bay, many species that may have historically occurred within the study area would not be expected presently. Special status bird species known to inhabit the general area include American Perigrine Falcon, Marbled Murrelet, Northern Goshawk, Bald Eagle, Mountain Quail, Northern Spotted Owl, and Pileated Woodpecker. Mammal species which inhabit the general area include Roosevelt Elk, Black Bear, Black-Tailed Deer, bobcat, mountain lion, mink, otter, raccoon, bats, coyote, fox, squirrels, chipmunks and beaver. Special status amphibian species that occur in the general area include Southern Torrent Salamanders, Dunn's Salamanders, Del Norte Salamanders, tailed frogs, Foothill Yellow-legged Frogs, Northern Red-legged frogs, Western Pond Turtles, and Northern Alligator Lizards.

3.2.6 Air Quality and Noise

Air quality in the Coos Bay area is generally very good due to the city's proximity to the Pacific Ocean. Summertime weather patterns include winds from the northwest which provide cool, fresh air from over the ocean. Air pollutants produced within the city are typically blown out before concentrations approach nuisance levels. Undeveloped areas around the city generally are forested or have established ground cover unless recently cleared. Despite summertime prevailing winds, dust is not typically a problem locally. During winter and spring months frequent rains keep dust and pollen levels to a minimum. Occasional brush or slash burning in the area can produce a smoke nuisance when winds direct smoke toward the city.

Major sources of noise within the city include ship horns, the railroad along Front Street and the bay, and traffic along Highway 101 and Ocean Boulevard. Generally noise levels are not significant away from the major traffic corridors. The rolling terrain of the area and the presence of numerous mature trees help diminish noise levels away from the sources.

3.2.7 Environmentally Sensitive Areas

Environmentally sensitive areas within the study area include the bay, the various sloughs, and marshes and tidelands surrounding these water bodies. Much of downtown Coos Bay is built on dredge fills where marshes once existed. Other environmentally sensitive areas include wetland areas adjacent to the various creeks.

3.3 Socio-Economic Environment

3.3.1 Economic Conditions and Trends

Economic conditions within Coos Bay have been varied since the founding of the city. The local economy has long relied on logging and the fishing industry as its economic mainstay. Although logging and wood products do not currently meet production levels that they once did, they remain a vital part of the economy. The fishing industry has also declined significantly over the past few decades.

Other industries that have been integral to the local economy for many years include ranching and farming. Dairy farming, like logging, no longer meets the production levels that it once did in the local area. Dairies that used to occupy much of the land along the Coos River and Catching Slough have been converted to beef farms or have ceased to operate at all.

A significant portion of the local economy now centers around tourism and recreation. Major recreational attractions in the area include the Oregon Dunes, South Slough Estuarine Reserve, the Mill Casino, local beaches, fishing, and other outdoor opportunities.

Lower property values and the discovery of the pristine area by outsiders have recently resulted in a building boom and vibrant real-estate market. While many have moved into the area from California and other areas, it is not clear, at this time, how much of an impact this recent activity has had on the population levels in Coos Bay.

3.3.2 Population

The 2004 Oregon Population Report published by the Population Research Center at Portland State University (PSU) estimated the population of the City of Coos Bay at 15,700 as of July 1, 2004. US Census data stated in the report showed the population of Coos Bay to be 15,372 as of April 1, 2000 and 15,076 as of April 1, 1990. Based on the census data, the average annual population growth rate between

1990 and 2000 was 0.20% per year. Based on population estimates by PSU, the average annual growth rate within the City of Coos Bay between 2000 and 2004 was 0.52% per year. Therefore, according to these estimates the average annual population growth rate over the past four years has more than doubled from the 10-year period between 1990 and 2000.

The average annual growth rate between 1990 and 2004 both in the City of Coos Bay and in Coos County was approximately 0.3% according to data presented in the 2004 Oregon Population Report by PSU. The Coos County Planning Department projects a growth rate of 0.4% for both the City of Coos Bay and Coos County.

The City of Coos Bay Transportation Master Plan utilized a growth rate of 0.7% for its population projections. The City officially recognized this growth rate and adopted it as the new Comprehensive Plan growth rate for Coos Bay.

For the purposes of this Master Plan a growth rate of 0.7% will be used in order to develop population projection estimates for the planning period (through the year 2030) and to be consistent with the City's comprehensive planning projections.

It is worth mentioning that growth and development in Coos Bay has been steadily increasing over the past few years prior to the preparation of this plan. If this growth continues or increases, the population in Coos Bay will quickly outpace the projections in this plan and the City's Comprehensive Plan. Should this growth continue, the City should, within the next 5 to 10 years, readdress population growth in Coos Bay and how it affects infrastructure and land-use planning. This will require the City to adopt a new comprehensive plan growth rate and recalculate the projected populations.

In the draft Facilities Plans for Wastewater Treatment Plants No.1 and No. 2, the firm of West Yost & Associates presented population projections for the City of Coos Bay, Charleston Sanitary District, and Bunker Hill Sanitary District. Because wastewater from Charleston and Bunker Hill Sanitary Districts is conveyed through portions of wastewater collection system maintained by the City of Coos Bay it is considered pertinent to include population projections for these districts herein. The following table summarizes current and future population estimates for the study area based on a 0.7% growth rate and includes data obtained from the referenced Facilities Plans.

Table 3.3.2.a – Population Projections

	2003	**2010**	**2020**	**2030**
City of Coos Bay	15,650	16,433	17,620	18,893
Charleston Sanitary District	3,100	3,255	3,490	3,742
Bunker Hill Sanitary District	1,490	1,565	1,678	1,799

In the West Yost Studies, the existing wastewater equivalent dwelling units (EDU's) were established for the entire service area, including the neighboring wastewater districts. Table 3.3.2.b summarizes the existing EDU's within the City of Coos Bay sewer service area as established by West Yost and adopted by the City.

It should be noted that Coos Bay does receive a small amount of wastewater flows from areas located within the City Limits of North Bend. At the time of this study, these flows were considered to be insignificant compared to the total flows. Also, a limited number of areas within the Coos Bay City Limits flows into North Bend. At this point, for the purposes of overall system planning, we will consider these interconnected areas "a wash". See Section 4.4 for further discussions on system interconnections.

Table 3.3.2.b – Existing EDU User Profile

Description	No. of EDU's
City of Coos Bay	
Residential	4,732
Multiple Use	1,848
Commercial	1,019
Industrial	12
High Strength	812
Public	681
Subtotal	9,104
Charleston and Bunkerhill	1,209
Total EDU's	**10,312**

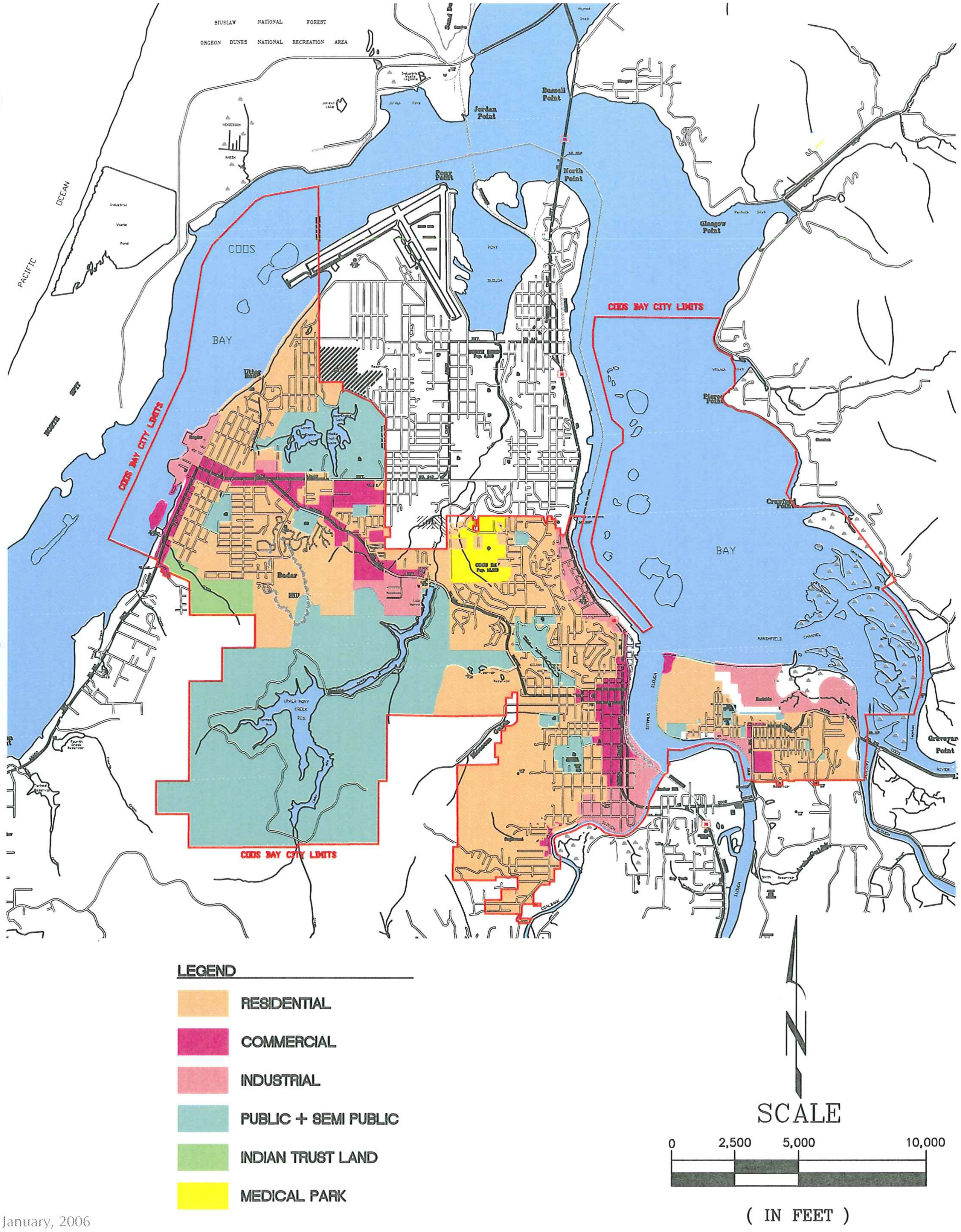
3.4 Land Use

Land use in the City of Coos Bay is typical of urban areas with zones including high and low density residential, commercial, industrial, and public land. Most existing residential neighborhoods are zoned for low density residential. Newer neighborhoods and undeveloped areas within residential zones generally are planned for higher density development. The main commercial zones are located between Highway 101 and Fourth Street in downtown Coos Bay, and along Ocean Boulevard, Cape Arago Highway, and Newmark Avenue in the Empire area. Some commercial zoning also exists along Southwest Boulevard in the Englewood area and along the Coos River Highway in Eastside. Industrial and commercial-industrial zones are generally situated along water front areas around the City. The area surrounding Bay Area Hospital has been designated as a medical park zone. Schools, parks, cemeteries and the watershed areas surrounding the Pony Creek Reservoirs and Empire lakes are zoned public or semi-public. A Land Use Designation Map has been prepared from the City's current zoning map and is presented in Figure 3-6.

As a part of the draft Facilities Plan for Wastewater Treatment Plant No.2, West Yost & Associates determined the acreage of developed land by land use category within the City of Coos Bay as well as Charleston and Bunker Hill Sanitary Districts. They also determined the acreage of vacant developable land as well as that which is not developable within these areas. Table 3-2 lists acreage within the various land use categories from data presented in the referenced Facilities Plan.

Table 3.4.1– Land Use Designations

Land Use Category	Acreage			
	Within City Limits	**Bunker Hill**	**Charleston**	**Total**
Developed				
Residential	800	362	732	**1,894**
Commercial	320	--	14	**334**
Industrial	70	33	--	**103**
Public & Semi-public	540	--	4	**544**
Total Developed	**1,730**	**395**	**750**	**2,885**
Vacant and Open	2,160	--	474	**2,634**
Not Developable	3,010	155	892	**4,057**
Total Area	**6,900**	**550**	**2,116**	**9,576**



January, 2006

HBH Consulting Engineers	City of Coos Bay *COLLECTION SYSTEM MASTER PLAN*	LAND USE DESIGNATION MAP	FIG. 3-6

4.0 Existing Wastewater Facilities

4.1 Wastewater Collection System

The City of Coos Bay wastewater collection system consists of many miles of sanitary sewer mainline piping and force mains along with many more miles of public and private sewer laterals to service individual customers. (See Section 4.2)

In addition to the collection system piping, the City owns and operates 19 major sanitary sewer pump stations and four minor sewer pumping systems. (3 stormwater pump stations in Coos Bay are not discussed in this planning effort.)

As part of this Master Plan, mapping has been prepared for the entire wastewater collection system and has, for convenience of use, been included in a separate document labeled Volume B. Included within Volume B are detailed maps of the overall system and individual basin maps illustrating the existing wastewater collection system in Coos Bay. The second half of Volume B shows the proposed improvements to the collection system as developed in Sections 7 and 8 of this Master Plan.

The wastewater collection system is organized into 34 distinct sanitary basins. A brief description of each sanitary sewer basin is provided below.

4.1.1 Sanitary Sewer Basin A

Basin A is located in the northwestern portion of the City Limits and is bounded on the west by the Bay itself and is primarily characterized by residential zoning and single family dwellings.

Basin A is located within the Service Area for Plant No. 2.

Most of Basin A is near buildout with small pockets of land along the bluff overlooking the Bay still undeveloped and some opportunity for infill development elsewhere in the basin. Due to stability issues, these bluff properties may not be eligible for residential development.

A summary of the data describing Basin A follows:

Basin Summary Table – Basin A	
Located within Plant Service Area	Plant No. 2
Approximate Basin Size	112 ac
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	15,250 ft
Pump station located within basin	Pump Station 16
Force main footage serving basin	330 ft
Basin discharge point:	Manhole B-17
Number of manholes in basin	70
Estimated number of residential dwellings in basin	139
Estimated number of EDU's including non-residential and multi-family residential units located within basin	139

4.1.2 Sanitary Sewer Basin B

Basin B is located in the northwestern portion of the City Limits immediately south of Basin A and is characterized by residential zoning and single family residential dwellings with some duplexes scattered throughout.

While the majority of the basin is developed, there is some undeveloped property in the eastern portion of the basin around Lakeshore Drive in an area that is currently being utilized as a sand pit for a local heavy construction company.

A summary table for Basin B follows:

Basin Summary Table – Basin B	
Located within plant service area	Plant No. 2
Approximate Basin Size	126 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	17,500 ft.
Pump station located within basin	none
Force main footage serving basin	none
Basin discharge point:	Manhole G-1
Number of manholes in basin	64
Estimated number of residential dwellings in basin	356
Estimated number of EDU's including non-residential and multi-residential units located within basin	356

4.1.3 Sanitary Sewer Basin C

Basin C is located around the westernmost portion of the City Limits and is bounded by the Bay itself. Basin C is a small basin with development that is characterized by residential, single family dwellings throughout.

Nearly all of the property within Basin C is developed with only small pockets along the bluff remaining undeveloped.

A summary for Basin C follows:

Basin Summary Table – Basin C	
Located within plant service area	Plant No. 2
Approximate Basin Size	17 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	3,400 ft.
Pump station located within basin	none
Force main footage serving basin	none
Basin discharge point:	Pump Sta. 7
Number of manholes in basin	18
Estimated number of residential dwellings in basin	79
Estimated number of EDU's including non-residential and multi-residential units located within basin	89

4.1.4 Sanitary Sewer Basin D

Basin D is located in the westernmost portions of the City Limits and is bordered by the Bay to the west. Basin D is characterized primarily by residential, single-family dwellings with some duplex and multi-family residential sites.

Basin D includes some commercial development, primarily along Newmark Avenue including the McKay's Market in Empire.

As with the other basins in the vicinity, Basin D has essentially no property available for additional development.

A summary for Basin D follows:

Basin Summary Table – Basin D	
Located within plant service area	Plant No. 2
Approximate Basin Size	114 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	14,700 ft.
Pump station located within basin	none
Force main footage serving basin	none
Basin discharge point:	Manhole E-29
Number of manholes in basin	58
Estimated number of residential dwellings in basin	307
Estimated number of EDU's including non-residential and multi-residential units located within basin	381

4.1.5 Sanitary Sewer Basin E

Basin E is located in the westernmost portion of the City Limits and is bordered by the Bay on the west. Plant No. 2 is located within Basin E.

Basin E is characterized predominantly by single family residential dwellings with some minor commercial development along Newmark and Empire Boulevard. Sunset School is also to be found within Basin. E. Basin E is also home to a few small trailer and RV parks that cater to more transient residents.

The only remaining developable land within Basin E is located in the south end of the basin around Fulton and Webster Avenues. Recently, this area has seen rapid development with new subdivisions under construction during the development of this study.

A summary of Basin E follows:

Basin Summary Table – Basin E	
Located within plant service area	Plant No. 2
Approximate Basin Size	220 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	25,500 ft.
Pump station located within basin	none
Force main footage serving basin	none
Basin discharge point:	Plant No. 2
Number of manholes in basin	93
Estimated number of residential dwellings in basin	340
Estimated number of EDU's including non-residential and multi-residential units located within basin	525

4.1.6 Sanitary Sewer Basin F

Basin F is located to the east of Basin E in the western portion of the system. Basin F is primarily zoned and characterized by residential, single family dwellings, though there are a number of multi-family complexes located within the basin. An assisted care facility was constructed in the 90's in the Basin to provide assisted care living for Alzheimer's patients. Basin F is also home to Madison School.

The majority of Basin F is already developed with the exception of property located in the southern portion of the basin. In recent years, property development in this area has been very active with a number of new subdivisions completed and under construction during the preparation of this plan.

With the completion of the new subdivisions in the southern part of Basin F, there will remain little or no property for additional growth in the Basin with the exception of tribal lands located south and west of the Alzheimer's clinic.

A summary of Basin F follows:

Basin Summary Table – Basin F	
Located within plant service area	Plant No. 2
Approximate Basin Size	202 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	21,300 ft.
Pump station located within basin	none
Force main footage serving basin	none
Basin discharge point:	Manhole E-87
Number of manholes in basin	81
Estimated number of residential dwellings in basin	330
Estimated number of EDU's including non-residential and multi-residential units located within basin	435

4.1.7 Sanitary Sewer Basin G

Basin G is in the middle of the Plant No. 2 Service area and straddles Ocean Boulevard and Newmark Avenue. Basin G is characterized by a combination of residential dwellings with commercial establishments along Newmark and Ocean.

A number of multi-family residential developments are located within Basin G including the Ackerman Apartments and others around Norman and Newmark Avenues.

Basin G is home to two large trailer parks: Shore Pines and Puerto Vista Estates.

Most of Basin G is developed with only pockets of vacant and developable property scattered throughout the basin.

A summary of Basin G follows:

Basin Summary Table – Basin G	
Located within plant service area	Plant No. 2
Approximate Basin Size	271 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	19,000 ft.
Pump station located within basin	Pump Sta. 7
Force main footage serving basin	650 ft.
Basin discharge point:	Pump Sta. 7 then Manhole D-1
Number of manholes in basin	79
Estimated number of residential dwellings in basin	122
Estimated number of EDU's including non-residential and multi-residential units located within basin	519

4.1.8 Sanitary Sewer Basin H

Basin H includes the area on the easternmost side of the Plant 2 service area and includes SWOCC and the area around Wal-Mart. Commercial properties are located along Newmark with some residential properties on the side roads.

Much of the Basin H area is not developable due to the land around Empire Lakes and the associated parks and public areas around the lakes. Some commercial property remains vacant around Newmark and LaClair.

A summary of Basin H follows:

Basin Summary Table – Basin H	
Located within plant service area	Plant No. 2
Approximate Basin Size	271 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	19,000 ft.
Pump station located within basin	Pump Sta. 8
Force main footage serving basin	650 ft.
Basin discharge point:	Manhole G-79
Number of manholes in basin	79
Estimated number of residential dwellings in basin	122
Estimated number of EDU's including non-residential and multi-residential units located within basin	519

4.1.9 Sanitary Sewer Basin I

Basin I is the westernmost basin whose flows terminate at Plant No. 1. Basin I straddles Ocean Boulevard and includes the commercial properties along Ocean Boulevard around the K-Mart site. Some residential properties are located north and south of Ocean Boulevard including an RV park and a trailer park.

There is a relatively large portion of Basin I that is currently undeveloped located south of Ocean Boulevard around what is currently Lindy Lane. This undeveloped parcel has long been a topic of discussion with developers and planners in the area with that discussion continuing during the development of this Master Plan. The undeveloped parcel is approximately 70 acres in size with only small lots of undeveloped property located elsewhere in the basin.

A summary of the basin follows:

Basin Summary Table – Basin I	
Located within plant service area	Plant No. 1
Approximate Basin Size	358 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	10,000 ft.
Pump station located within basin	Pump Sta. 12
Force main footage serving basin	825 ft.
Basin discharge point:	Pump Station 12 then Manhole K-18
Number of manholes in basin	55
Estimated number of residential dwellings in basin	95
Estimated number of EDU's including non-residential and multi-residential units located within basin	239

4.1.10 Sanitary Sewer Basin J

Basin J is a small basin located around the waterfront and public docks in Empire. The basin includes a handful of residential connections, apartment units, and some small industrial and commercial customers. The basin also includes the facilities at the public docks in Empire.

There is little room for additional development or growth within this small basin.

A summary of the basin follows:

Basin Summary Table – Basin J	
Located within plant service area	Plant No. 2
Approximate Basin Size	22 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	1,000 ft.
Pump station located within basin	Pump Sta. 14
Force main footage serving basin	170 ft.
Basin discharge point:	Pump Station 14 then Manhole E-28
Number of manholes in basin	6
Estimated number of residential dwellings in basin	6
Estimated number of EDU’s including non-residential and multi-residential units located within basin	21

4.1.11 Sanitary Sewer Basin K

Basin K straddles Ocean Boulevard and includes the offices and potable water treatment plant for the Coos Bay North Bend Water Board. The basin is relatively small and is primarily used for residential uses with the exception of some commercial properties along Ocean Boulevard.

There is very little property available for additional growth within this basin.

A summary of the basin follows:

Basin Summary Table – Basin K	
Located within plant service area	Plant No. 1
Approximate Basin Size	54 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	3,500 ft.
Pump station located within basin	Pump Sta. 13
Force main footage serving basin	200 ft.
Basin discharge point:	Pump Sta. 13 then Manhole L-1
Number of manholes in basin	16
Estimated number of residential dwellings in basin	32
Estimated number of EDU’s including non-residential and multi-residential units located within basin	107

4.1.12 Sanitary Sewer Basin L

Basin L includes properties along Woodland Drive including many of the medical offices in this area. While much of the area is utilized by the medical community, some residential properties are also located within the basin.

Some properties that are zoned for medical professional use remain undeveloped in the basin leaving little available property for any other growth.

A summary of the basin follows:

Basin Summary Table – Basin L	
Located within plant service area	Plant No. 1
Approximate Basin Size	53 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	3,650 ft.
Pump station located within basin	Pump Sta. 10
Force main footage serving basin	470 ft.
Basin discharge point:	Pump Station 10
Number of manholes in basin	12
Estimated number of residential dwellings in basin	15
Estimated number of EDU's including non-residential and multi-residential units located within basin	90

4.1.13 Sanitary Sewer Basin M

Basin M includes the area straddling Thompson Road between Woodland Drive and Koosbay Boulevard. Basin M can be characterized by a combination of residential dwellings and medical offices including Bay Area Hospital.

Basin M has some available property to allow for modest growth. However, the majority of the available property is zoned for medical use to be used up for expansions of the hospital, medical offices, or other land uses that are related to the medical establishment in the basin.

A summary of the basin follows:

Basin Summary Table – Basin M	
Located within plant service area	Plant No. 1
Approximate Basin Size	119 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	15,600 ft.
Pump station located within basin	none
Force main footage serving basin	3,400 ft.
Basin discharge point:	Pump Station 10 then Manhole N-1
Number of manholes in basin	43
Estimated number of residential dwellings in basin	135
Estimated number of EDU's including non-residential and multi-residential units located within basin	375

4.1.14 Sanitary Sewer Basin N

Basin N is located to the north of Plant 1 and adjacent to the Bay. Basin N includes commercial and industrial properties located along Highway 101 with residential properties located off of the highway.

The basin is built out with only scattered vacant lots to allow for additional infill development.

A summary of the basin follows:

Basin Summary Table – Basin N	
Located within plant service area	Plant No. 1
Approximate Basin Size	106 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	13,200 ft.
Pump station located within basin	None
Force main footage serving basin	50 ft.
Basin discharge point:	Manhole T-6
Number of manholes in basin	62
Estimated number of residential dwellings in basin	75
Estimated number of EDU's including non-residential and multi-residential units located within basin	244

4.1.15 Sanitary Sewer Basin O

Basin O is comprised of a large residential area north of Ocean Boulevard.

Basin contains a significant amount of undeveloped area on the north side of the basin. However, this area is comprised of wetlands and is not likely to be developed in anyway. Little other vacant land is available within the basin.

A summary of the basin follows.

Basin Summary Table – Basin O	
Located within plant service area	Plant No. 1
Approximate Basin Size	112 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	16,000 ft.
Pump station located within basin	Pump Sta.5
Force main footage serving basin	2,000 ft.
Basin discharge point:	Pump Station 5 then Manhole R-20
Number of manholes in basin	76
Estimated number of residential dwellings in basin	247
Estimated number of EDU's including non-residential and multi-residential units located within basin	322

4.1.16 Sanitary Sewer Basin P

Basin P is located centrally within the service area for Plant No. 1 and straddles Koosbay Boulevard. Basin P is characterized by residential development with a small amount of commercial development and some public/educational land uses.

Basin P is near build-out conditions with little or no available land available for development.
A summary of the basin follows:

Basin Summary Table – Basin P	
Located within plant service area	Plant No. 1
Approximate Basin Size	74 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	9,900 ft.
Pump station located within basin	None
Force main footage serving basin	None
Basin discharge point:	Manhole U-25
Number of manholes in basin	50
Estimated number of residential dwellings in basin	126
Estimated number of EDU's including non-residential and multi-residential units located within basin	186

4.1.17 Sanitary Sewer Basin Q

Basin Q is located south of Ocean Boulevard and contains the subdivision known as Westgate.

During the preparation of this Master Plan, a development adjacent to the Westgate subdivision was undertaken to construct a retirement community or assisted living facility. Another development was undertaken to expand the residential area around the Westgate subdivision. With the completion of these projects, there is little land remaining for additional development within the basin.

A summary of the basin follows:

Basin Summary Table – Basin Q	
Located within plant service area	Plant No. 1
Approximate Basin Size	95 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	4,400 ft*
Pump station located within basin	None
Force main footage serving basin	None
Basin discharge point:	Manhole K-3
Number of manholes in basin	24*
Estimated number of residential dwellings in basin	44
Estimated number of EDU's including non-residential and multi-residential units located within basin	119

*Not counting new improvements under construction during planning effort.

4.1.18 Sanitary Sewer Basin R

Basin R includes primary residential land uses between Ocean Boulevard and Mingus Park.

The Basin is essentially near build out with only small parcels of property available for new development through infilling activities.

A summary of the basin follows:

Basin Summary Table – Basin R	
Located within plant service area	Plant No. 1
Approximate Basin Size	146 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	22,100 ft.
Pump station located within basin	None
Force main footage serving basin	None
Basin discharge point:	Manhole V-175
Number of manholes in basin	89
Estimated number of residential dwellings in basin	281
Estimated number of EDU's including non-residential and multi-residential units located within basin	436

4.1.19 Sanitary Sewer Basin S

Basin S is located in the central portion of the Plant No. 1 service area and is comprised primarily of residential land uses with some minor commercial and public uses.

The basin is essentially at build out with only minor opportunities for development through in-fill.

A summary of the basin follows:

Basin Summary Table – Basin S	
Located within plant service area	Plant No. 1
Approximate Basin Size	92 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	13,300 ft.
Pump station located within basin	None
Force main footage serving basin	None
Basin discharge point:	Manhole R-1
Number of manholes in basin	64
Estimated number of residential dwellings in basin	207
Estimated number of EDU's including non-residential and multi-residential units located within basin	282

4.1.20 Sanitary Sewer Basin T

Basin T is a small basin bounded on the east by the bay and containing the Treatment Plant No. 1 site. Land use in Basin T is primarily commercial and industrial land uses.

The basin is at build-out with no vacant properties available for additional development.

A summary of the basin follows:

Basin Summary Table – Basin T	
Located within plant service area	Plant No. 1
Approximate Basin Size	27 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	4,100 ft.
Pump station located within basin	Pump Sta. 3
Force main footage serving basin	100 ft.
Basin discharge point:	Treatment Plant 1
Number of manholes in basin	13
Estimated number of residential dwellings in basin	0
Estimated number of EDU’s including non-residential and multi-residential units located within basin	56

4.1.21 Sanitary Sewer Basin U

Basin U is located adjacent to Highway 101 and includes residential land uses and some commercial properties including Lumberman’s, the Central Dock and The Red Lion Hotel.

Only small parcels of property are available to allow for infill-development within the basin.

A summary of the basin follows:

Basin Summary Table – Basin U	
Located within plant service area	Plant No. 1
Approximate Basin Size	68 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	10,600 ft.
Pump station located within basin	None
Force main footage within basin	2,900 ft.
Basin discharge point:	Manhole T-2
Number of manholes in basin	45
Estimated number of residential dwellings in basin	68
Estimated number of EDU’s including non-residential and multi-residential units located within basin	170

4.1.22 Sanitary Sewer Basin V

Basin V is a large basin located south of Plant No. 1 and comprises much of downtown Coos Bay. Basin V contains nearly all categories of land use available within the system. Much of the basin is utilize for commercial purposes as well as areas of residential and multi-family use.

The basin is at build out with only in-fill or replacement opportunities available for new development.

A summary of the basin follows:

Basin Summary Table – Basin V	
Located within plant service area	Plant No. 1
Approximate Basin Size	231 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	37,500 ft.
Pump station located within basin	Pump Sta. 1
Force main footage within basin	3,700 ft.
Basin discharge point:	Treatment Plant 1
Number of manholes in basin	180
Estimated number of residential dwellings in basin	217
Estimated number of EDU's including non-residential and multi-residential units located within basin	898

4.1.23 Sanitary Sewer Basin W

Basin W is located in the western portion of the Plant No. 1 service area and includes the properties around Blossom Gulch School. With the exception of the school, Basin W is comprised of a combination of single and multifamily residential properties.

Basin W is at build-out within the Urban Growth Boundary (UGB). However, there has been interest and discussion of developing property to the west of the current UGB. This includes the upland areas west of Marshfield High School.

A summary of Basin W follows:

Basin Summary Table – Basin W	
Located within plant service area	Plant No. 1
Approximate Basin Size	58 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	6,600 ft.
Pump station located within basin	PS No. 4
Force main footage serving basin	400 ft.
Basin discharge point:	Pump Sta. 4 then Manhole R-51
Number of manholes in basin	31
Estimated number of residential dwellings in basin	60
Estimated number of EDU's including non-residential and multi-residential units located within basin	383

4.1.24 Sanitary Sewer Basin X

Basin X includes the southern portions of downtown Coos Bay and the residential areas to the west. The basin is divided between nearly all the potential land uses in the City with the majority of the land being used for commercial and residential uses.

A relatively large parcel is partially contained within the western portion of Basin X. The parcel has recently been discussed as being part of a new residential development.

A summary of the basin follows:

Basin Summary Table – Basin X	
Located within plant service area	Plant No. 1
Approximate Basin Size	336 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	33,000 ft.
Pump station located within basin	Pump Sta. 2
Force main footage serving basin	8,200 ft.
Basin discharge point:	Pump Sta. 2 then Manhole V-88
Number of manholes in basin	113
Estimated number of residential dwellings in basin	348
Estimated number of EDU's including non-residential and multi-residential units located within basin	983

4.1.25 Sanitary Sewer Basin Y

Basin Y is located in the southernmost portion of the Plant 1 service area just northwest of the Bunkerhill Sanitary District boundary. Basin Y includes primarily commercial and industrial land uses around Highway 101 and Lockhart Avenue.

While there is little property available for additional development within Basin Y, there has been interest in redevelopment of commercial properties within the basin.

A summary of the basin follows:

Basin Summary Table – Basin Y	
Located within plant service area	Plant No. 1
Approximate Basin Size	48 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	5,300 ft.
Pump station located within basin	Pump Sta. 6
Force main footage serving basin	600 ft.
Basin discharge point:	Pump Station No. 6 Then Pump Sta. 2
Number of manholes in basin	16
Estimated number of residential dwellings in basin	19
Estimated number of EDU's including non-residential and multi-residential units located within basin	101

4.1.26 Sanitary Sewer Basin Z

Basin Z is located in the southern portion of the Plant 1 service area. The basin, which contains primarily residential land uses, also has some commercial and light industrial land use along Lockhart Aveune.

While there is some vacant property within the basin, much of the vacant property in the western portion of the basin would be considered wetland with hilly topography rising to the west.

A summary of the basin follows:

Basin Summary Table – Basin Z	
Located within plant service area	Plant No. 1
Approximate Basin Size	83 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	6,500 ft.
Pump station located within basin	None
Force main footage serving basin	None
Basin discharge point:	Pump Station No. 6
Number of manholes in basin	24
Estimated number of residential dwellings in basin	75
Estimated number of EDU's including non-residential and multi-residential units located within basin	147

4.1.27 Sanitary Sewer Basin AA

Basin AA includes property in the Englewood area as well as undeveloped properties out to the UGB in the southern portion of the Plant 1 service area.

Much of the basin includes undeveloped areas in the hills on the western side of the basin. While there has been discussion of development in this area, the topography and wetland issues will limit growth in the basin.

A summary of the basin follows:

Basin Summary Table – Basin AA	
Located within plant service area	Plant No. 1
Approximate Basin Size	148 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	7,100 ft.
Pump station located within basin	None
Force main footage serving basin	None
Basin discharge point:	Manhole Y-4
Number of manholes in basin	27
Estimated number of residential dwellings in basin	91
Estimated number of EDU's including non-residential and multi-residential units located within basin	111

4.1.28 Sanitary Sewer Basin BB

Basin BB is located in the Englewood area and includes primarily residential land uses in the basin with minor commercial properties along Southwest Boulevard.

Most of the basin is near build-out condition with only infill opportunities available for development. Some properties are available in the western portion of the basin.

A summary of the basin follows:

Basin Summary Table – Basin BB	
Located within plant service area	Plant No. 1
Approximate Basin Size	115 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	14,100 ft.
Pump station located within basin	None
Force main footage serving basin	None
Basin discharge point:	Manhole AA-16
Number of manholes in basin	51
Estimated number of residential dwellings in basin	269
Estimated number of EDU's including non-residential and multi-residential units located within basin	290

4.1.29 Sanitary Sewer Basin CC

Basin CC is located near the southern end of Englewood and contains primarily residential properties along Southwest Boulevard. Some agricultural and farmlands are located along the marshes and lowlands along Coalbank Slough.

With most of the basin at build-out, opportunities for growth are only available through infill development.

A summary of the basin follows:

Basin Summary Table – Basin CC	
Located within plant service area	Plant No. 1
Approximate Basin Size:	53 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	8,800 ft.
Pump station located within basin	Pump Sta. 9
Force main footage serving basin	500 ft.
Basin discharge point:	Pump Sta. 19 then Manhole BB-50
Number of manholes in basin	27
Estimated number of residential dwellings in basin	69
Estimated number of EDU's including non-residential and multi-residential units located within basin	82

4.1.30 Sanitary Sewer Basin DD

Basin DD is the southernmost basin in the system and is comprised of a small residential neighborhood off Old Wireless Lane. Failing septic tanks in the neighborhood necessitated the addition of this neighborhood and this basin to the City's system in 2000.

The basin is at build out with no additional property available for expansion without the annexation of additional lands into the UGB.

A summary of the basin follows:

Basin Summary Table – Basin DD	
Located within plant service area	Plant No. 1
Approximate Basin Size (acres)	<3 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	450 ft.
Pump station located within basin	Pump Sta. 20
Force main footage serving basin	300 ft.
Basin discharge point:	Pump Sta. 20 then Manhole CC-21
Number of manholes in basin	1
Estimated number of residential dwellings in basin	5
Estimated number of EDU's including non-residential and multi-residential units located within basin	10

4.1.31 Sanitary Sewer Basin EE

Basin EE is located on the north side of Isthmus Slough and includes primarily residential properties. The public boat dock is located within the basin with some commercial and light industrial properties located along the water front.

The developed portions of the basin are near build-out with significant property on the western side of the basin (Port property) that is currently undeveloped. This significant area has been the topic of discussion for development for many years thought the Port has made no specific plans for the development of this property at the time of this planning effort.

A summary of the basin follows:

Basin Summary Table – Basin EE	
Located within plant service area	Plant No. 1
Approximate Basin Size	74 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	7,800 ft.
Pump station located within basin	Pump Sta. 18
Force main footage serving basin	1,100 ft.
Basin discharge point:	Pump Sta. 18 then Manhole GG-82
Number of manholes in basin	27
Estimated number of residential dwellings in basin	94
Estimated number of EDU's including non-residential and multi-residential units located within basin	124

4.1.32 Sanitary Sewer Basin FF

Basin FF is located east of Isthmus Slough and includes the properties on the northern end of Eastside that slope down to Coos River to the north. The basin includes the old Eastside treatment site, much of which is still in use by the City as a sludge lagoon and holding facility. Residential properties are located north of D Street with some light commercial along D Street.

There is little available property available for expansion within the basin with the exception of some minor infill.

A summary of the basin follows:

Basin Summary Table – Basin FF	
Located within plant service area	Plant No. 1
Approximate Basin Size	41 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	4,700 ft.
Pump station located within basin	None
Force main footage within basin	1,200 ft.
Basin discharge point:	Pump Sta. 19
Number of manholes in basin	25
Estimated number of residential dwellings in basin	30
Estimated number of EDU's including non-residential and multi-residential units located within basin	91

4.1.33 Sanitary Sewer Basin GG

Basin GG is located east of Isthmus Slough and includes much of the residential areas in Eastside. Millicoma school and other public use properties are located within the basin with commercial properties located along 6th Avenue and D Street

There is little vacant property available for further development within the basin. Some infill development opportunities are available.

A summary of the basin follows:

Basin Summary Table – Basin GG	
Located within plant service area	Plant No. 1
Approximate Basin Size	186 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	21,400 ft.
Pump station located within basin	Pump Sta. 17
Force main footage serving basin	5,500 ft.
Basin discharge point:	Pump Station No. 2
Number of manholes in basin	84
Estimated number of residential dwellings in basin	287
Estimated number of EDU's including non-residential and multi-residential units located within basin	373

4.1.34 Sanitary Sewer Basin HH

Basin HH is the easternmost basin in the system with Catching Slough serving as the eastern border of the basin. Land use within the basin is primarily residential with some minor commercial and the large SOMAR industrial park. A small pump station is located within the basin to service the SOMAR site (Pump Station 21) and a second station to lift flows from the basin on to Basin GG.

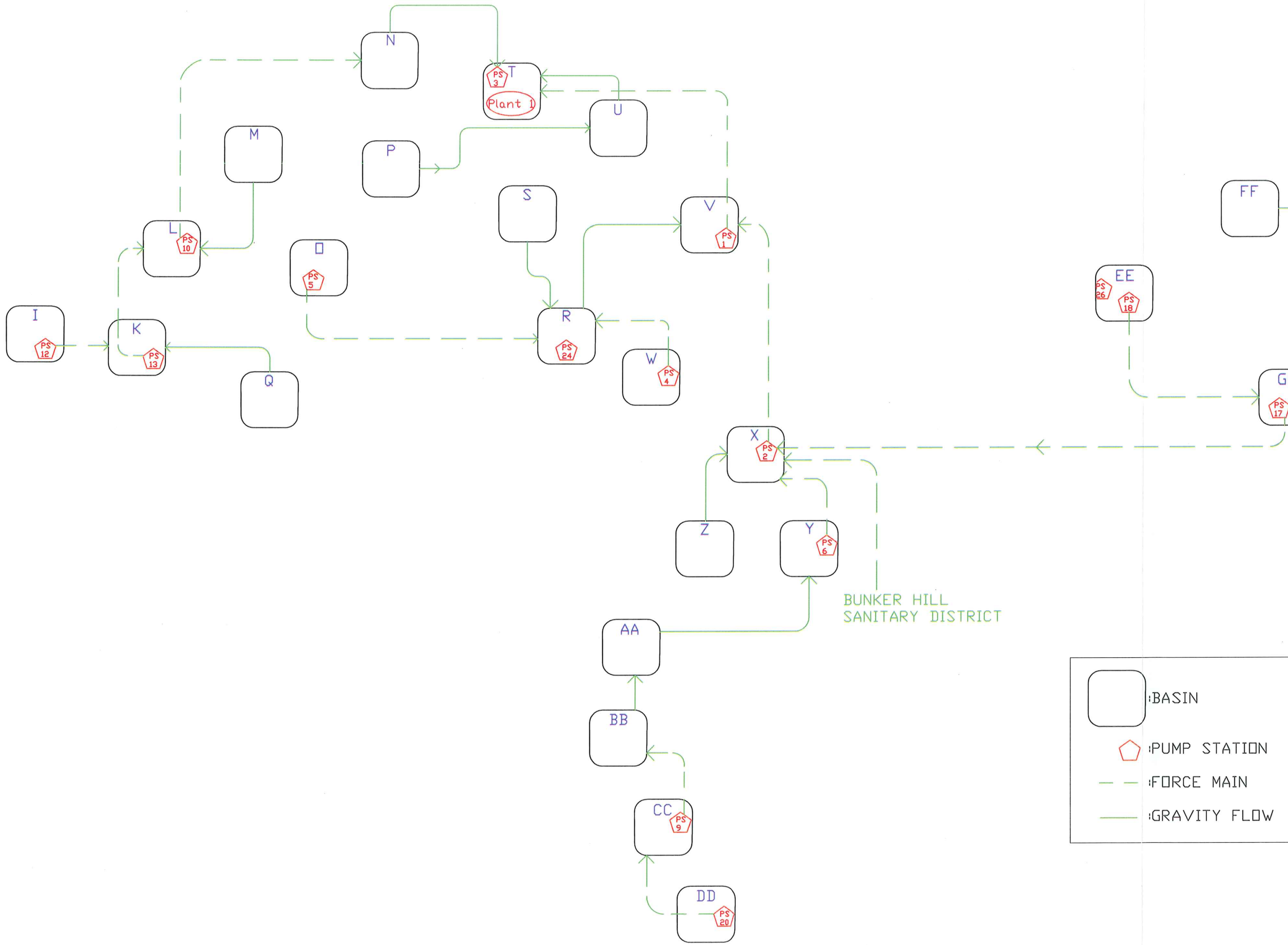
There is some opportunity for additional growth in the basin through infill as well as the potential for some new subdivisions.

A summary of the basin follows:

Basin Summary Table – Basin HH	
Located within plant service area	Plant No. 1
Approximate Basin Size a	135 ac.
Approximate length of gravity sewer collection piping (various sizes) in basin (not including laterals)	13,300 ft.
Pump station located within basin	Pump Sta. 21 Pump Sta. 19
Force main footage serving basin	400 ft.
Basin discharge point:	Pump Sta. 19
Number of manholes in basin	67
Estimated number of residential dwellings in basin	130
Estimated number of EDU's including non-residential and multi-residential units located within basin	168

Figures 4.1.1 and 4.1.2 on the following pages show the relationship between each basin and illustrate how flows move through the system and ultimately to one of the two wastewater treatment facilities.

Appendix A (at the end of the Plan) includes a spreadsheet showing the piping distribution in each basin while Appendix B provides a summary of the manhole inventory throughout the system by basin.



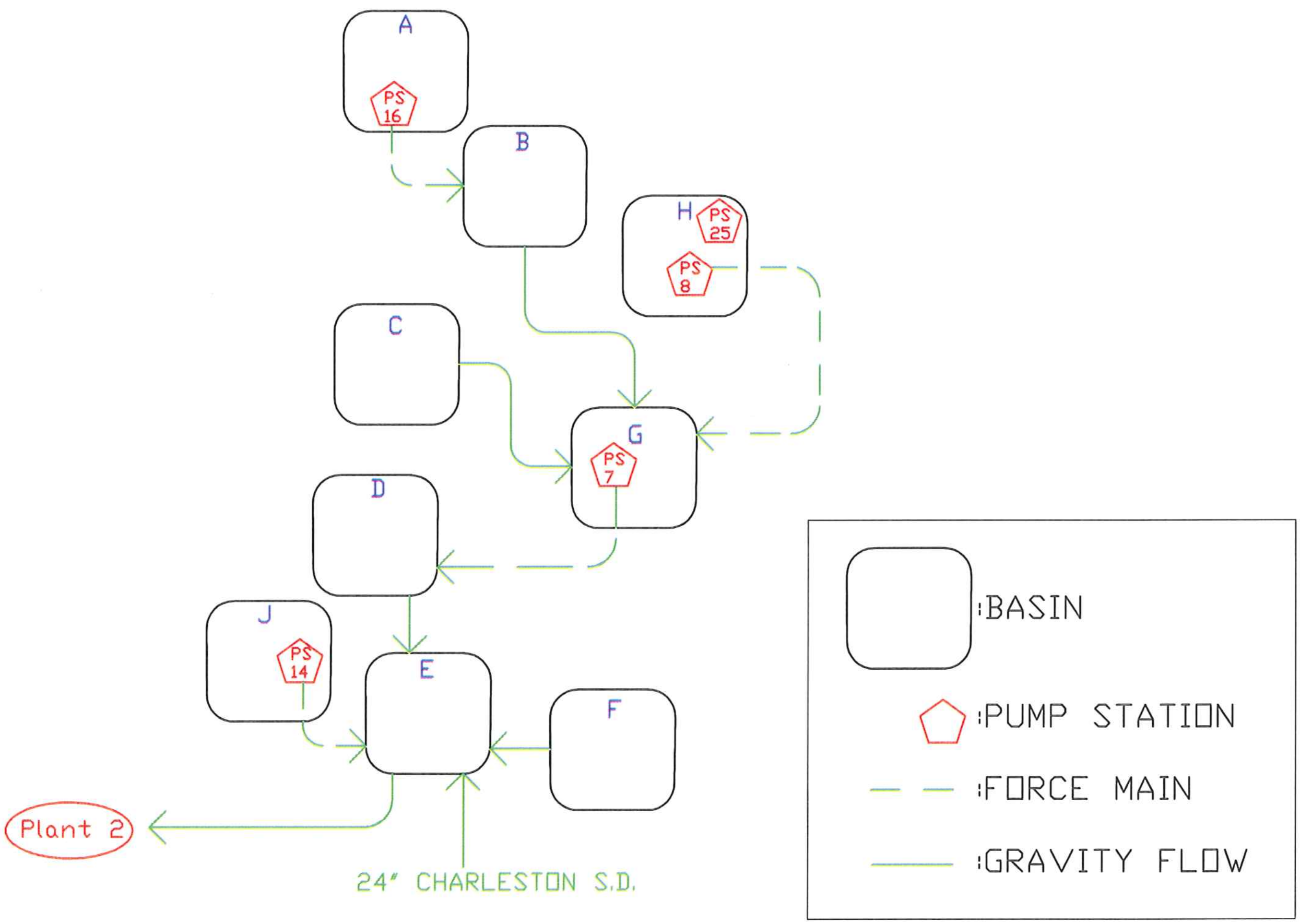
H B H
Consulting Engineers

City of Coos Bay
WASTEWATER COLLECTION SYSTEM MASTER PLAN

PLANT NO. 1 SERVICE AREA
BASIN FLOW CHART

DRAWN BY: SJB
DATE: AUG. 26, 2005

FIG. 4.1.1



HBH Consulting Engineers

City of Coos Bay
WASTEWATER COLLECTION SYSTEM MASTER PLAN

PLANT NO. 2 SERVICE AREA
BASIN FLOW CHART

Aug. 26, 2005

FIG. 4.1.2

4.2 Collection System Piping and Manholes

Wastewater is collected and transmitted from the extents of the service areas to one of the City's two the treatment plants through an elaborate system of piping and pump stations. Manholes are included on the gravity piping to allow maintenance crews to access the piping networks to clean, repair, and otherwise maintain the system.

This section will provide a brief summary of the piping and manholes utilized within the collection system.

4.2.1 Collection System Piping

The City of Coos Bay wastewater collection system includes in excess of 90 miles of sanitary sewer mainline piping. It is likely that nearly as many miles of service laterals are currently in use within the public right-of-ways and on private property.

A summary of the total pipe lengths for each size of pipe is summarized below in Table 4.2.1. The table below includes only public sewer piping sections and does not include sanitary service laterals or other private sewer systems. The totals provided are based upon information extracted from the City's infrastructure maps and utilizing plans from recent developments. Information on the piping in each basin is provided in Section 4.1, on the mapping of the existing system in Volume B, and in Appendix A.

Table 4.2.1 – Collection System Inventory Summary

Pipe Diameter and Type	feet
3" Pressure	670
4" Pressure	1,895
6" pressure	18,620
8" Pressure	2,770
10" Pressure	6,301
12" Pressure	3,699
14" Pressure	5,435
15" Pressure	1,417
18" Pressure	1,456
24" Pressure	3,377
4"	2,095
6"	33,231
8"	313,772
10"	31,630
12"	17,025
14"	6,992
15"	3,831
16"	2,578
18"	2,250
24"	2,163
27"	990
30"	3,777
Total	**465,973**

4.2.2 Wastewater Manholes

Manholes in a gravity collection system should be provided at all changes in direction or grade of the piping. Manholes should be spaced no more than 400 to 500 feet apart so that maintenance crews can “reach” problems between manholes with standard maintenance flushing or repair equipment. The City has developed a standard for manholes to be installed at all installations.

Manholes are typically constructed of precast concrete sections though some companies are marketing HDPE or plastic manholes with a measure of success.

Manholes in Coos Bay vary in diameter, depth, age, and condition. Manholes in poor condition can be a large source of I/I in the system. When identified, the City has a program to repair or rehabilitate leaky manholes in an effort to reduce these easily accessible I/I sources.

The City of Coos Bay has in excess of 1,700 manholes within their collection system. The collection system in the City of Coos Bay is classified as a Class 3 system by DEQ.

Section 4.1 includes descriptions of each basin including how many manholes are included within each. Appendix B provides a basin-by-basin inventory of the manholes in the system.

4.3 Conveyance System Lift Stations

The City owns and operates nineteen major sanitary sewer pump stations within the existing collection system and four minor lift stations. (The 3 storm pump stations are not discussed in this study.) The pump stations serve to lift sanitary sewage from one basin into another or into one of the two wastewater treatment plants.

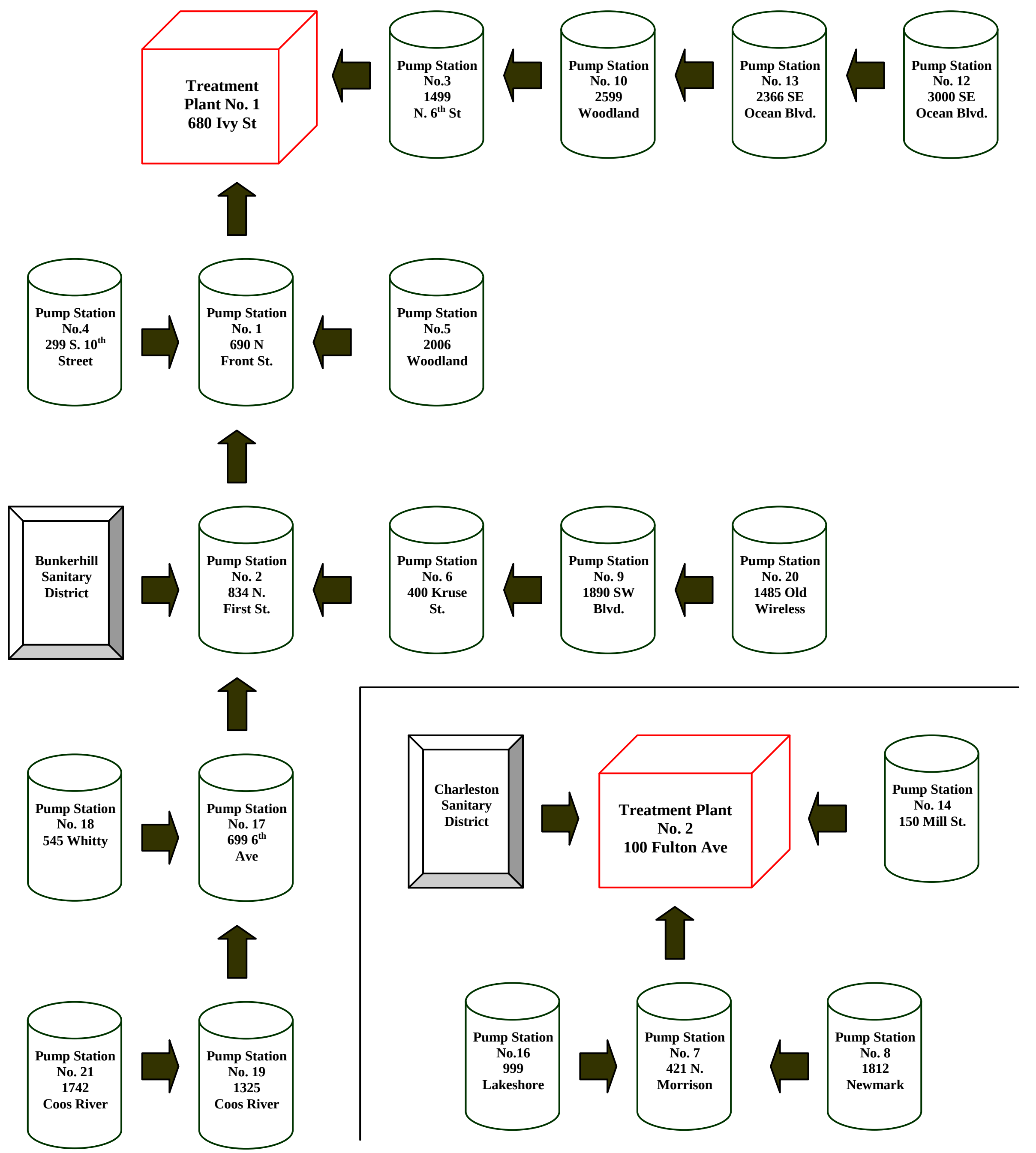
Figure 4.3.1 provides a diagram of the 19 major pump stations that provide service for the basins that feed into Treatment Plants No. 1 and No. 2. The Figure illustrates the relationship of the pump stations to each other as well as their relationship to the Service Districts that feed into the Coos Bay system.

As shown in Figure 4.3.1, the pump stations and collection system operate on two separate and distinct service areas, each with their own treatment plant. In general, the collection system and pump stations in the eastern portion of Coos Bay terminate with Plant No. 1. The collection system and pump stations on the western side of Coos Bay terminate in Plant No. 2.

Also, two nearby sanitary sewer districts utilize Coos Bay for disposal of their sanitary sewer flows. Both the Bunkerhill and Charleston Sanitary Districts both terminate their collection systems into the City’s system at the locations shown on Figure 4.3.1 and on the mapping provided in Volume B.

The four minor pump stations are not shown on this diagram for the purposes of clarity. The relationship of this smaller stations is clearly shown on Figures 4.1.1 and 4.1.2 and on the mapping provided in Volume B. The 3 stormwater pump stations are also not shown on Figure 4.3.1.

FIGURE 4.3.1 – MAJOR WASTEWATER PUMP STATIONS



Pump Stations 11, 15, 23 are storm water pump stations and are not shown in this diagram. Minor sewer stations 22,24,25 & 26 are also not shown.

Field inspections and visits to each pump stations were performed with the assistance of OMI staff. Each pump station was inspected and reviewed for basic operational performance, capacities, maintenance issues, deficiencies, and other qualities. A summary of each pump station is provided below:

Pump Station No. 1

Pump Station No. 1 is the primary and terminating pump station in the Plant No. 1 (eastern) service area in the Coos Bay system. The majority of the service area in the eastern basin passes through and is transmitted to Plant No. 1 by this pump station.

The pump station was originally constructed in 1951 and updated in the late 80's.

Pump Station No. 1 is located on Front Street near the waterfront.

The electrical equipment, controls, and standby power generation equipment are housed within a concrete building. The pumps, piping, valves, and other fittings are located behind the control building inside of a chain link enclosure.

Pump Station No. 1 includes four vertical style pumps that deliver sewer flows to Treatment Plant No. 1. The pumps and motors are located outside and have been the cause of complaints from neighboring residents who feel that the pumps are too loud.

The pumps are all controlled by variable frequency drives (VFD's) to increase or decrease the output of the station depending on the inflow conditions.

A 150 kW backup power generator provides backup power to the station in times of a power outage. The generator is an Onan diesel-powered unit that is started by an automatic transfer switch. Fuel is stored in two fifty-gallon drums that are maintained within the control building.

The pump station includes a motor control center (MCC) with a PLC (programmable logic controller) control system. The control system has the ability to monitor operation of the pump station and send a number of alarms via an autodialer to operations staff.

When all pumps operate at maximum capacity, the station has the ability to overwhelm Treatment Plant No. 1 causing overflows of the plant.

Overflows from the station flow directly to Isthmus slough via gravity piping. With the current pump and equipment configuration, the pump station does not appear to have any capacity related deficiencies.

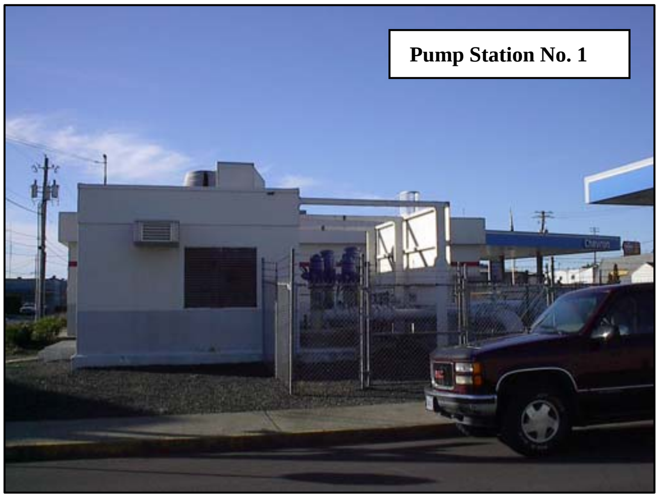
A summary of Pump Station No. 1 and noted deficiencies is provided below:

Summary of Pump Station No. 1
System Components

Year Constructed/Last Upgrade	Originally constructed in 1951 / Last upgrade completed in 1989
Location	Corner of Birch Ave. and North Front Street
Pump Type	Vertical Solids Handling
Manufacturer of Pumps	Fairbanks Morse
Capacity (reported)	Pumps 1 and 2 : 2,110 gpm @ 41 feet TDH
	Pumps 3 and 4: 4,190 gpm @ 41 feet TDH
Pump hp	Pumps 1 and 2: 30 hp
	Pumps 3 and 4: 60 hp
VFD(s)	Pumps 1 and 2: Allen Bradley
	Pumps 3 and 4: Danfoss
Wet Well	Rectangular concrete wetwell below pump area
Overflow Point	Gravity overflow to Isthmus Slough. Outfall number 002; discharge point at river mile 13.85
Auxiliary Power	150 kW (460 V) Onan Generator; diesel powered; fuel consumption measured at 10.5 gal/hr.
Available Property for Expansion	Little or none
Force Main(s)	Old 14" force main to Plant No. 1 – AC New 24" force main to Plant No. 1 - PVC
Phone Circuit	Verizon- 267-8397
Alarms	High wet well, low wet well, seal water fail, VFD fail, power failure, generator run, pump motor high temp, and communications failure.

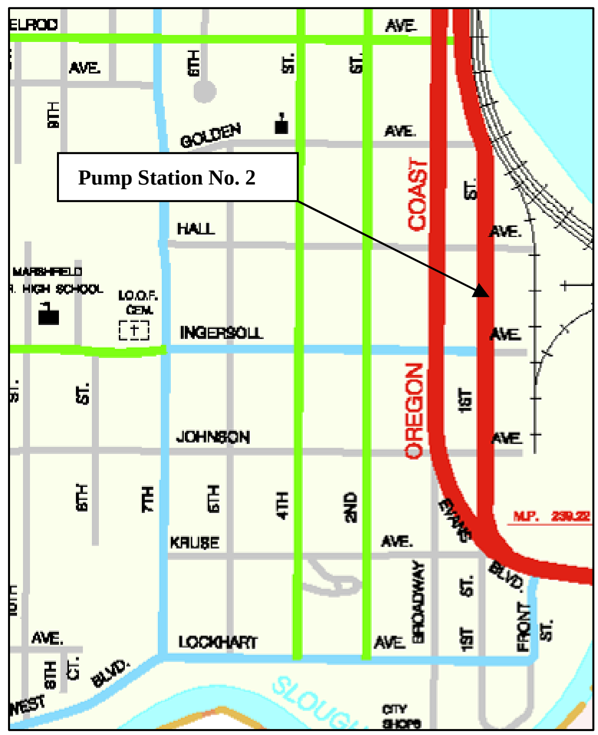
Summary of Pump Station No. 1
Deficiencies

Building	Flat roof has caused problems with leaks in the building and corrosion of metals in the system. Back door is inappropriate style and corroded due to exposure to the elements. Water is regularly blown under the door into the control building.
Noise	Outdoor pumps and valves are noisy and generate complaints from local residents. Ideally pumps should be enclosed to contain the noise and protect the equipment from the elements. This would also increase the security level of the pump station.
Flush system	Pump flush system requires fresh water to flush pump system. This results in high water bills to City since pump is unable to utilize sanitary water for flushing.
Pumps	Pumps do not utilize mechanical seals. Difficult maintenance issue. Obtaining parts for pumps has been difficult.
Generator	Age of generator has made it very difficult to maintain and obtain replacement parts. The generator is in excess of 30 years old and should be replaced with a new generator and automatic transfer switch (ATS).



Pump Station No. 2

Pump station No. 2 is located adjacent to the Farr's Hardware building on Highway 101 near the intersection with Ingersoll.



Pump Station No. 2 is a major station in the system as it transmits flows from the southern part of the City as well as transmitting flows from Eastside and the Bunkerhill Sanitary District.

Station 2 includes an enclosed building that houses three pumps. A separate area of the building is provided to house controls and standby power generation equipment. The control room has a separate entry from the pump room.

The vertical solids handling pumps are controlled through the use of VFD's to adjust throughput of the station depending on influent conditions.

The 90 kW onsite power generation system is diesel fired. A new automatic transfer switch was installed as part of a recent upgrade.

The station is in relatively good condition due to the regular maintenance and upkeep provided by the system operators. Corrosion of some surfaces and components was observed at the station. The floor in the pump station was very wet due to leakage of the flush water systems causing standing water.

Controls for the station are based around a PLC-control system that utilizes an autodialer to alarm operations staff.

The overflow from the pump station is directed to Coalbank Slough at River Mile 14.6.

The existing capacity of the pump station is reported to be adequate for existing flows.

There have been regular complaints of noise and odor nuisance from the businesses located immediately adjacent to the pump station.


Pump Station No. 2


Pump Station No. 2

A summary of the pump station qualities and noted deficiencies is provided in the table below.

Summary of Pump Station No. 2
System Components

Year Constructed/Last Upgrade	Originally constructed in 1951 / Last upgrade completed in 1991
Location	Adjacent to Farr's on Hwy. 101 near Ingersoll intersection
Pump Type	Vertical Solids Handling
Manufacturer of Pumps	Fairbanks Morse
Capacity (reported)	Pumps 1, 2 and 3 : 2,800 gpm @ 26 feet TDH
Pump hp	Pumps 1, 2 and 3: 25 hp
VFD(s)	Pumps 1 and 2: Danfoss
	Pumps 3: Allen Bradley
Wet Well	Rectangular concrete wetwell below pump area
Overflow Point	Gravity overflow to Isthmus Slough. Outfall number 003; discharge point at river mile 14.6
Auxiliary Power	90 kW (480 V) Onan Generator; diesel powered; fuel consumption measured at 8.4 gal/hr.
Available Property for Expansion	Little or none
Force Main(s)	Old 10" AC force main to discharge manhole (has been plugged for many years) New 18" PVC force main to discharge manhole
Phone Circuit	Verizon- 266-8891
Alarms	High wet well, low wet well, seal water fail, VFD fail, power failure, generator run, pump motor high temp, and communications failure.

Summary of Pump Station No. 2
Deficiencies

Building	Flat roof has caused problems with leaks in the building and corrosion of metals in the system.
Flush system	Pump flush system requires fresh water to flush pump system. This results in high water bills to City since pump is unable to utilize sanitary water for flushing.
Pumps	Pumps do not utilize mechanical seals. Difficult maintenance issue. Obtaining parts for pumps has been difficult.
Generator	Age of generator has made it very difficult to maintain and obtain replacement parts. The generator is in excess of 30 years old and should be replaced.
Noise and Odor	Complaints of noise and odor nuisance have been common from nearby businesses.

Pump Station No. 3

Pump Station No. 3 is located at the Treatment Plant No. 1 site. Station 3 delivers flows from the north and middle portion of the service area to Plant No. 1.

The pump station was updated in 2005-2006 to the configuration described in the table on the following page.

The station is configured as a triplex submersible pump station and will pump flows directly into the treatment plant headworks (Plant No. 1).

The pump station will utilize backup power systems and controls available on the Treatment Plant No. 1 site.

A summary of the pump station physical and operational parameters is provided in the table below.

Summary of Pump Station No. 3
System Components

Year Constructed/Last Upgrade	Originally constructed in 1951 and upgraded in 1974. Reconstruction scheduled for 2005-2006.
Location	Treatment Plant No. 1 site
Pump Type	Submersible Triplex Station
Manufacturer of Pumps	ITT Flygt (Model CP-3152.181 MT)
Capacity (reported)	Pumps 1, 2, & 3: 1,100 gpm @ 34.5 feet TDH
Pump hp	Pumps 1, 2 &3: 20 hp
VFD(s)	All
Wet Well	Rectangular trough-type wetwell
Overflow Point	Isthmus Slough River Mile 13.85.
Auxiliary Power	Utilizes Plant 1 backup generator (200 kW Kohler)
Available Property for Expansion	NA
Force Main(s)	12-inch force main to Plant No. 1 headworks
Phone Circuit	Alarms wired directly to Plant 1 autodialer.
Alarms	Through Plant No. 1 system

No deficiencies are noted at this time for the new pump station.

Pump Station No. 4

Pump Station No. 4 is located adjacent to Blossum Gulch School on South 10th Street immediately adjacent to Blossum Gulch Creek.

The pump station is built precariously on the edge of the creek and is crowded by the parking lot for Blossum Gulch School.

The station includes two self-priming suction pumps and on-site standby power generation equipment all located within a small brick enclosure.

The station is deficient for capacity and is known to be in need of a significant upgrade or replacement to meet the capacity needs of the basin which it serves. Backed up flows are known to have flooded nearby buildings and homes.

The pump station building is crowded with equipment, a generator, and electrical components. Flooding of the adjacent creek has inundated the pump station on many occasions.

A summary of the pump station physical and operational parameters and noted deficiencies is provided in the table below.

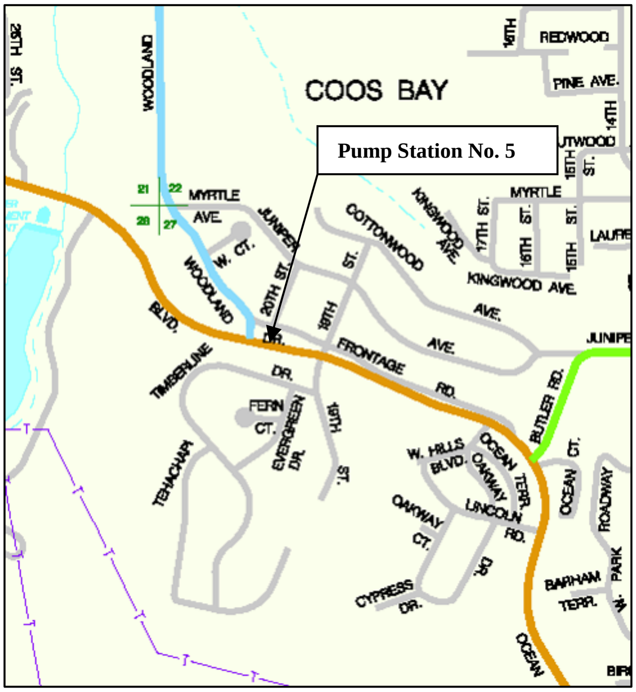
Summary of Pump Station No. 4
System Components

Year Constructed/Last Upgrade	Originally constructed in 1954 and upgraded in 1973.
Location	Adjacent to Blossum Gulch Creek on S. 10th Street
Pump Type	Self-priming suction pumps
Manufacturer of Pumps	Hydromatic (40 MMP)
Capacity (reported)	Pumps 1, 2: 325 gpm @ 40 feet TDH
Pump hp	Pumps 1, 2 : 10 hp
VFD(s)	na
Wet Well	Circular concrete wetwell below pump area
Overflow Point	Gravity overflow to Blossum Gulch Creek and then Isthmus Slough. Outfall number 005, discharge point to Isthmus Slough river mile 14.4.
Auxiliary Power	30 kW (240 V) Onan Generator; diesel powered; fuel consumption measured at 3.1 gal/hr.
Available Property for Expansion	Little or none
Force Main(s)	6" force main to discharge manhole
Phone Circuit	Verizon- 269-7459
Alarms	High wet well, low wet well, power failure, generator run, pump failure.

Summary of Pump Station No. 4
Deficiencies

Building	Flat roof has caused problems with leaks in the building and corrosion of metals in the system. Building and wetwell small for any future expansion.
Controls/Autodialer	Old autodialer system needs to be replaced to standardize to City system. Floats have been a problem due to debris and other issues in the wet well.
Pumps	Pumps are deficient for existing flows. Self priming pumps are problematic.
Generator	Age of generator has made it very difficult to maintain and obtain replacement parts. The generator is in excess of 30 years old and should be replaced along with a new automatic transfer switch (ATS).
Site	Very poor site conditions for expansion or replacement of the station. Immediately adjacent to sensitive creek, in the parking lot of busy school, and little or no room for expansion for upgrade.

Pump Station No. 5



Pump Station No. 5 is located near the intersection of Ocean Boulevard and Woodland Drive.

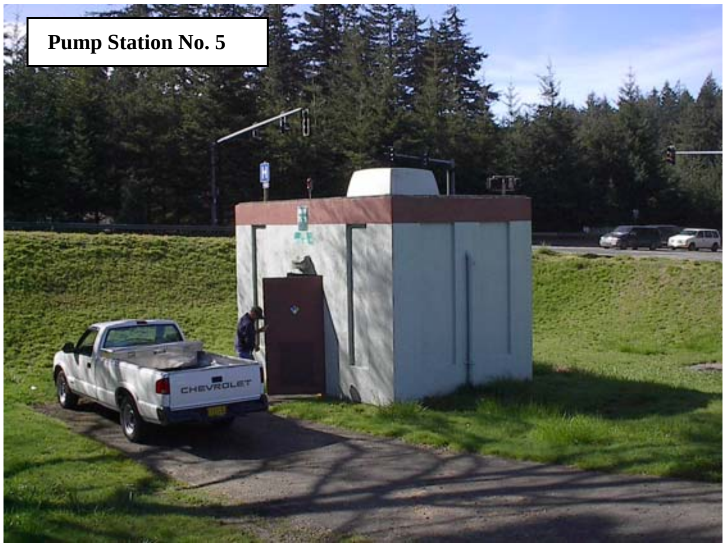
Station 5 was constructed in the 50's and updated in 1975. However, today, the station is in poor condition, aged, and in need of replacement.

The station makes use of two vacuum prime pumps over a wet well. The pumps have become a maintenance problem in recent years.

The pump station has a history of overflowing during peak rainfall events. Overflows enter the storm drainage system and outfall to Pony Creek located to the northwest of the station.

Pump Station No. 5 includes onsite power generation and telemetry to send alarms to operations.

Station 5 is located on what amounts to a "median" strip between Ocean Boulevard and the Woodland Drive frontage road. There is significant room available for expansion or replacement of the station immediately to the east or west of the existing site. Considerations should include the potential for the ultimate widening of Ocean Boulevard in the vicinity of Pump Station No. 5.



A summary of the pump station physical and operational parameters and noted deficiencies is provided in the table below.

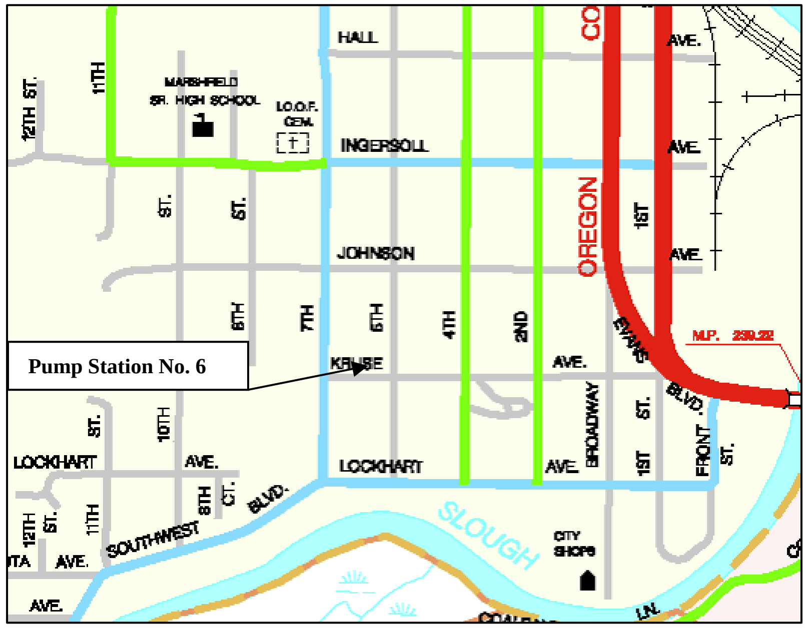
Summary of Pump Station No. 5
System Components

Year Constructed/Last Upgrade	Originally constructed in 1952 / Upgrades in 1974
Location	Near intersection of Woodland Drive and Ocean Boulevard
Pump Type	Vacuum-prime suction pumps
Manufacturer of Pumps	Paco (Pacific) (Model 412-11 MMP)
Capacity (reported)	Pumps 1, 2: 225 gpm @ 118 feet TDH
Pump hp	Pumps 1, 2 : 30 hp
VFD(s)	none
Wet Well	Circular concrete wetwell below pump area
Overflow Point	Gravity overflow to storm drainage system and then Pony Creek. Outfall number 006, discharge point to Pony Creek river mile 8.85
Auxiliary Power	90 kW (480 V) Onan Generator; diesel powered; fuel consumption measured at 8.4 gal/hr.
Available Property for Expansion	Adequate property to the north or south of existing station.
Force Main(s)	6” AC force main to discharge manhole
Phone Circuit	Verizon- 266-9136
Alarms	High wet well, low wet well, power failure, generator run, pump failure.

Summary of Pump Station No. 5
Deficiencies

Building	Flat roof has caused problems with leaks in the building and corrosion of metals in the system. Building and wetwell small for expansion. Facility is aged and near the end of its useful life.
Controls/Autodialer	Old autodialer system needs to be replaced to standardize to City system. Floats have been a problem due to debris and other issues in the wet well.
Pumps	Pumps are deficient for existing flows. Vacuum priming pumps are problematic.
Generator	Age of generator has made it very difficult to maintain and obtain replacement parts. The generator is in excess of 30 years old and should be replaced along with a new ATS.

Pump Station No. 6



Pump Station No. 6

Pump Station No. 6 is located on Kruse Ave. adjacent to the Oregon DMV offices.

The pump station consists of a concrete block pump building housing the pumping equipment. An attached building, with separate entry, houses the controls and backup power generation equipment.

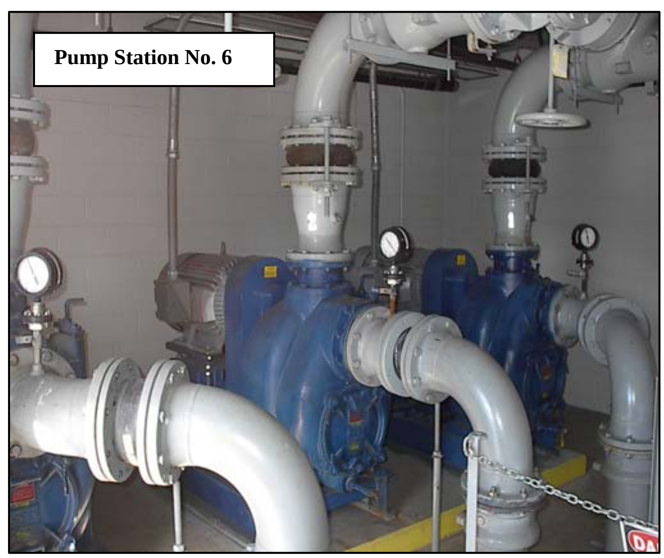
The station has been well maintained and remains in good condition.

In 2003, the controls in the station were upgraded. This included the installation of a new PLC-based control system, autodialer, and related control equipment. Also, a new Hydroranger level control system was added to the station.

Like many of the City's stations, the building employs a flat roof design which has created a maintenance problem. The flat roof has resulted in leaks in the station and regular repair and maintenance requirements.

Generally, Pump Station No. 6 is in good condition.


Pump Station No. 6


Pump Station No. 6

A summary of the pump station physical and operational parameters and noted deficiencies is provided in the table below.

Summary of Pump Station No. 6
System Components

Year Constructed/Last Upgrade	Originally constructed in 1956 / Upgrades in 1991 and 2003 (controls)
Location	Near intersection of 5th and Kruse Ave.
Pump Type	Self priming centrifugal pumps
Manufacturer of Pumps	Gorman Rupp (Model T8A3-B)
Capacity (reported)	Pumps 1, 2 and 3: 400 gpm @ 50 feet TDH
Pump hp	Pumps 1, 2 and 3 : 30 hp
VFD(s)	One of the pumps is controlled by a Danfoss VFD
Wet Well	Rectangular concrete wetwell below pump area
Overflow Point	Gravity overflow to Coalbank Slough. Outfall number 007, discharge point to Coalbank Slough river mile 14.65
Auxiliary Power	90 kW (480 V) Onan Generator; diesel powered; fuel consumption measured at 4.5 gal/hr.
Available Property for Expansion	Adequate property to the north or west of existing station.
Force Main(s)	12”/14” AC force main to Pump Station No. 2
Phone Circuit	Verizon- 267-8440
Alarms	High wet well, low wet well, seal water fail, VFD fail, power failure, generator run, pump motor high temp, communications fail.

Summary of Pump Station No. 6
Deficiencies

Building	Flat roof has caused problems with leaks in the building and corrosion of metals in the system.
Generator	Generator is older but has a good service history and is in good condition. Old ATS used in station. While others need replaced sooner, eventually this standby system should be replaced.

Pump Station No. 7

Pump Station No. 7

Pump Station No. 7 is located near the intersection of Morrison and Harris Ave.

Station 7 underwent a major upgrade and remodel in 2003. Improvements included the installation of new electrical and control components, new standby power equipment, new piping, valves, and meters, and new submersible pumps. Also, a new roof system was added to the structure along with other building improvements.

The new system is a customary duplex submersible station utilizing solids handling submersibles.

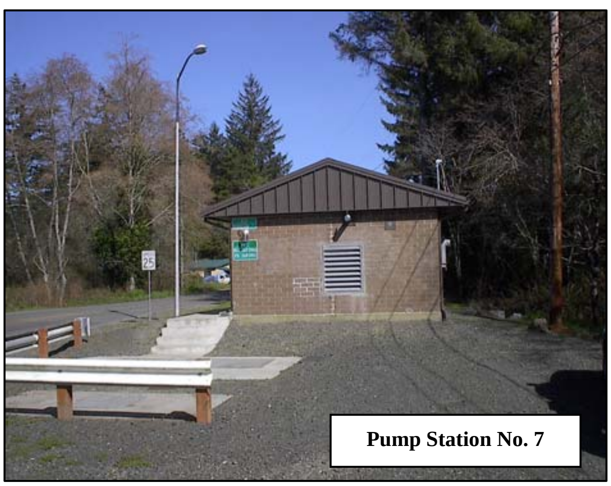
The controls are PLC-based and include standardized telemetry to relay a variety of alarm conditions to operations staff. All electrical equipment was replaced and updated during the remodel.

New on-site standby power generation equipment was installed with the upgrade along with a new automatic transfer switch.

Pump Station No. 7

The station has a gravity overflow to Chicksees Creek and, ultimately, Coos Bay. (Coos Bay River Mile 6.0)

Some problems related to the performance of the new pumps were experienced after startup. With some modification, the pumps are operating near their specified capacities.


Pump Station No. 7

A summary of the pump station physical and operational parameters and noted deficiencies is provided in the table below.

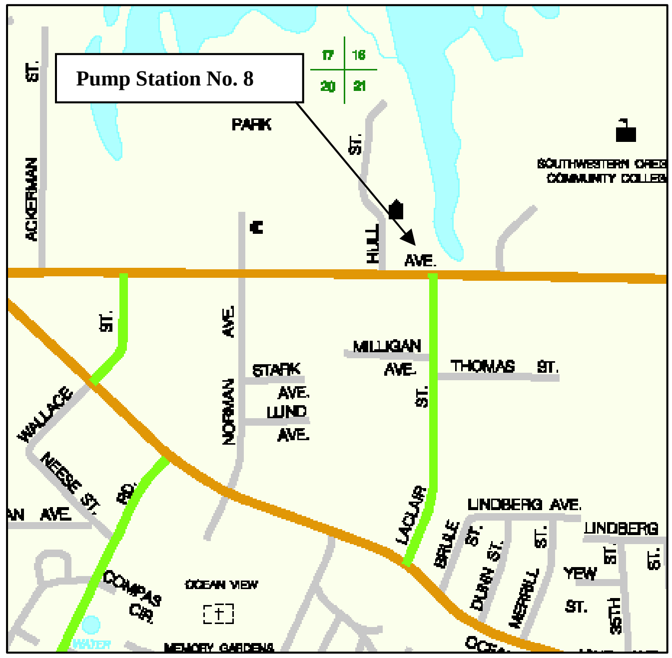
Summary of Pump Station No. 7
System Components

Year Constructed/Last Upgrade	Originally constructed in 50's / Major remodel and upgrade in 2003-2004
Location	Near intersection of Morrison and Harris Ave.
Pump Type	Submersible solids handling
Manufacturer of Pumps	ITT Flygt
Capacity (reported)	Pumps 1, 2 : 649 gpm @ 66 feet TDH
Pump hp	Pumps 1, 2 : 10 hp
VFD(s)	none
Wet Well	Circular concrete wetwell
Overflow Point	Gravity overflow to Chicksees Creek and, ultimately Coos Bay. Outfall number 002, discharge point to Coos Bay river mile 6.0
Auxiliary Power	50 kW (240 V) Kohler Generator; diesel powered; fuel consumption measured at 4.1 gal/hr.
Available Property for Expansion	Ability to expand site limited by Chicksees Creek and Morrison Street
Force Main(s)	6" PVC Force main to discharge manhole
Phone Circuit	Verizon- 888-4726
Alarms	High wet well, low wet well, power failure, generator run, pump fail

Summary of Pump Station No. 7
Deficiencies

No deficiencies are apparent for this station at this time.

Pump Station No. 8



Pump Station No. 8 is located near the intersection of Newmark and LaClair.

Originally, this pump station was constructed with pumps in the dry level below the current control room floor. The station was converted in 1975 to utilize vacuum prime pumps located on the main floor of the station. The station remains in the same configuration today.

Like many of the other pump stations in Coos Bay, Station 8 was constructed with a flat roof which has been a maintenance problem.

Recent improvements to Newmark Ave. resulted in site and access improvements to the pump station site. This included paving the parking and turnaround area and installing a new force main for the station.

The controls in the station are older and the autodialer does not meet the current standard for other autodialers within the system.

The onsite standby power generation equipment is also antiquated and should be upgraded with the next station upgrade.

While the station is reported to operate well, it will require updating within the planning period.

Pump Station No. 8


Pump Station No. 8

A summary of the pump station qualities and noted deficiencies is provided in the table below.

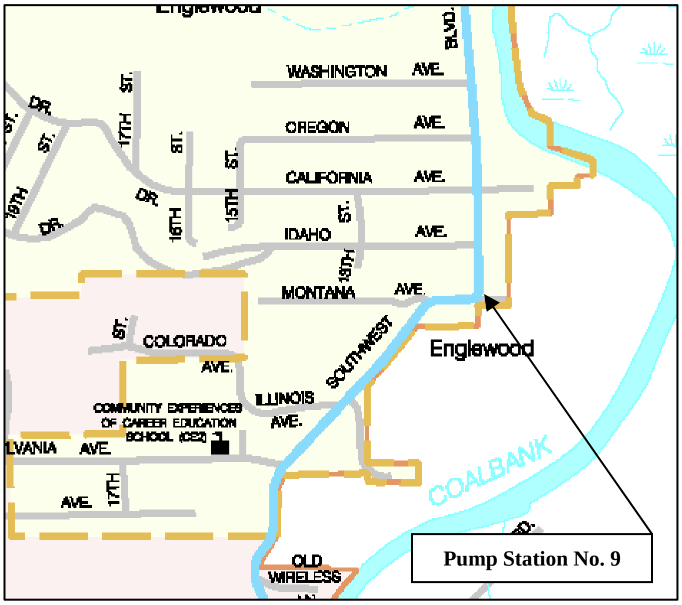
Summary of Pump Station No. 8
System Components

Year Constructed/Last Upgrade	Originally constructed in the 1956 / Upgrades in 1974
Location	Near intersection of Newmark and Laclair
Pump Type	Vacuum-prime suction pumps
Manufacturer of Pumps	Paco (Pacific) (Model 495-11)
Capacity (reported)	Pumps 1, 2: 200 gpm @ 50 feet TDH
Pump hp	Pumps 1, 2 : 15 hp
VFD(s)	none
Wet Well	Rectangular concrete wetwell below pump area; two-level wetwell below main station floor.
Overflow Point	Gravity overflow to storm drainage system and, ultimately, Coos Bay. Outfall number 003, discharge point to Coos Bay river mile 6.0
Auxiliary Power	50 kW (480 V) Onan Generator; diesel powered; fuel consumption measured at 4.5 gal/hr.
Available Property for Expansion	Limited. Depth of station will make expansion a challenge.
Force Main(s)	4" asbestos cement (AC) force main to discharge manhole
Phone Circuit	Verizon- 888-9351
Alarms	High wet well, low wet well, power failure, generator run, pump failure.

Summary of Pump Station No. 8
Deficiencies

Building	Flat roof has caused problems with leaks in the building and corrosion of metals in the system. Depth of wetwell and configuration make it difficult to maintain.
Controls/Autodialer	Old autodialer system needs to be replaced to standardize to City system.
Pumps	Vacuum priming pumps are problematic.
Generator	Age of generator has made it very difficult to maintain and obtain replacement parts. The generator is in excess of 30 years old and should be replaced along with a new ATS.

Pump Station No. 9



Pump Station No. 9 is located on Southwest Boulevard near the intersection of Montana and Southwest Boulevard.

Pump Station No. 9 is a typical wet-pit/dry-pit style station. The station includes two close-coupled centrifugal pumps.

The station has been upgraded to relocate all electrical components in the control building rather than in the dry-pit.

Dry-pit entry is considered a hazardous area and necessitates all OSHA confined space entry requirements.

Due to the location of the station in a flood plain, the control building is built up on a large concrete base. The area around the pump station has been known to flood on a number of occasions.

The on-site standby power generation equipment in the station is in poor condition and is among the first generator systems that should be replaced. Any upgrades planned for this station should include new generation equipment.

Also, like many of the other stations, the flat roof design of the building has been a problem.

A summary of the pump station physical and operational parameters and noted deficiencies is provided in the table below.

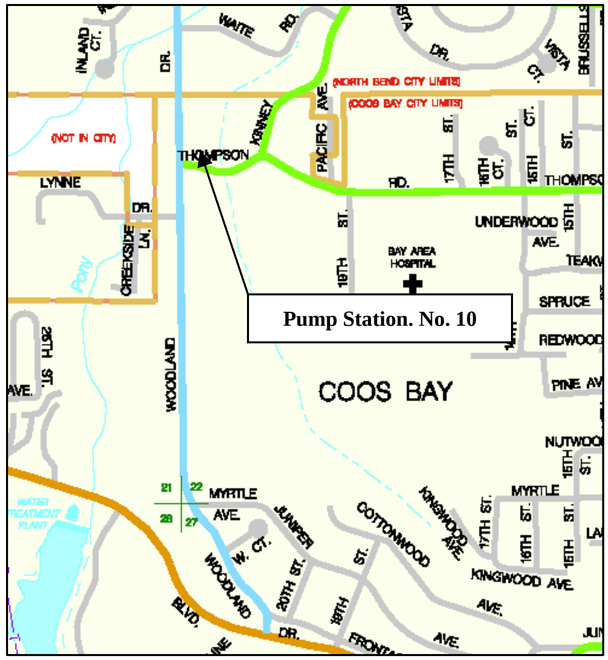
Summary of Pump Station No. 9
System Components

Year Constructed/Last Upgrade	Originally constructed in 1966 with upgrades in 1974.
Location	Near intersection of Montana and Southwest Boulevard
Pump Type	Close coupled centrifugal
Manufacturer of Pumps	Cornell (Model 4HNT)
Capacity (reported)	Pumps 1, 2: 200 gpm @ 43 feet TDH
Pump hp	Pumps 1, 2 : 7.5 hp
VFD(s)	na
Wet Well	Circular concrete wetwell located outside of and adjacent to pump station building (currently configured as a wet-pit.
Overflow Point	Coalbank Slough River Mile 14.65.
Auxiliary Power	30 kW (240 V) Onan Generator; diesel powered; fuel consumption measured at 3.1 gal/hr.
Available Property for Expansion	Potential for expansion on adjacent property.
Force Main(s)	6” AC force main to discharge manhole
Phone Circuit	Verizon- 267-0539
Alarms	High wet well, low wet well, water in dry-pit alarm, power failure, generator run, pump failure.

Summary of Pump Station No. 9
Deficiencies

Building	Flat roof has caused problems with leaks in the building and corrosion of metals in the system.
Controls/Autodialer	Controls are antiquated. Old autodialer system needs to be replaced to standardize to City system.
Pumps	Wet-pit/dry-pit arrangement is difficult to maintain. Confined space entry issues should be eliminated.
Generator	Generator is old and in poor condition. The generator is in excess of 30 years old and should be replaced along with a new ATS.

Pump Station No. 10



Pump Station No. 10 is located near the intersection of Woodland Drive and Thompson Road.

Pump Station 10 is a typical wet-pit/dry-pit configured station. While the electrical components are located within the control building, entry to the dry-pit is still considered hazardous entry and necessitates that all OSHA confined space entry requirements are met.

Pump Station 10 has experienced a number of breakdowns and problems over the years. Of all the City's stations, it is currently in the greatest need of an upgrade. A summary of the recent historical problems is provided below:

- Several times since 1985, high pressures in the force main have broken a pipe section in the drywell. When this happens, the dry-pit floods and overflows. Operations staff report of times when sewage was overflowing the dry-pit hatch and flowing out the front door of the station. When the piping has broken, the City has had to use vac trucks to pump the sewage from the wet-pit and truck it to another pump station for discharge. This practice may have to continue for a number of days until the system can be placed, at least partially, back on-line.
- The roadway used to access the pump station site is located on private property. In 1986 it was discovered that the City does not have an easement to access the station for maintenance and upkeep.
- In 2004, metal and rocks were sucked into the pumps causing serious damage to both pump volutes. When repairing the pumps, it was discovered that new volutes were no longer available. While repairs can be made, the volutes will eventually fail and repairing the components will no longer be an option.
- In 2005, the control system on the on-site power generator failed. Due to the age of the generator equipment, obtaining parts and service for the generator proved difficult. As a result, the generator remained off-line for a significant period of time.
- Due to the conditions associated with the station, pump shafts have a history of breaking. The repair and maintenance of the station requires confined space entry procedures and is considered difficult and dangerous for operations and maintenance staff.
- The flat roof on the station has been a maintenance problem.
- The force main has a history of breaks and should be scheduled for replacement.


Pump Station No. 10

A summary of the pump station physical and operational parameters and noted deficiencies is provided in the table below.

Summary of Pump Station No. 10
System Components

Year Constructed/Last Upgrade	Originally constructed in 1966 / Updated in 1974
Location	Near intersection of Woodland Drive and Thompson Road
Pump Type	Close-coupled centrifugal
Manufacturer of Pumps	Cornell (Model 4HNT)
Capacity (reported)	Pumps 1, 2: 500 gpm @ 180 feet TDH
Pump hp	Pumps 1, 2 : 75 hp
VFD(s)	na
Wet Well	Circular concrete wetwell located outside of and adjacent to pump station building (currently configured as a wet-pit)
Overflow Point	Overflow to storm drain then Pony Creek. Ultimately Coos Bay; discharge point at river mile 8.85. Outfall number 009.
Auxiliary Power	200 kW (480 V) Onan Generator; diesel powered; fuel consumption measured at 16.5 gal/hr.
Available Property for Expansion	Potential for expansion. Site is limited and mostly private property.
Force Main(s)	10” AC force main to discharge manhole
Phone Circuit	Verizon- 267-2589
Alarms	High wet well, low wet well, power failure, generator run, pump failure.

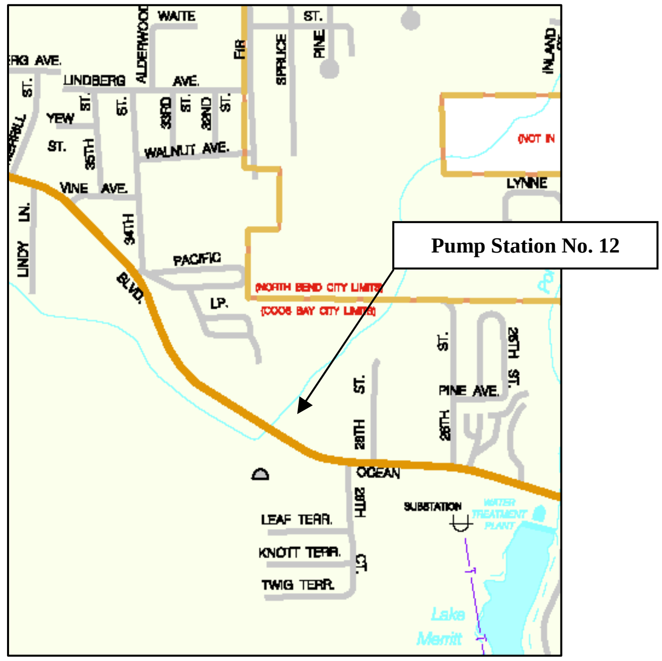
Summary of Pump Station No. 10
Deficiencies

Building	Flat roof has caused problems with leaks in the building and corrosion of metals in the system.
Pumps	Wet-pit/dry-pit arrangement is difficult to maintain. Confined space entry issues should be eliminated. Unable to get replacement parts for pumps.
Generator	Generator is old and in poor condition. The generator is in excess of 30 years old and should be replaced along with a new ATS. Unable to get replacement parts for generator.
Site	No easement to access site. Must cross and park on private property to maintain or visit the site.
Force Main	According to operations staff, the force main has experienced a number of breaks and spills over the years due to the relatively high pressures in the AC main. The main should be upsized and upgraded to a more resilient material.

Pump Station No. 11

Pump Station No. 11 is a stormwater pump station located on the corner of 3rd and Commercial and is discussed within the City’s Stormwater Master Plan (*Dyer Partnership, Engineers and Planners, Inc., 2004*).

Pump Station No. 12



Pump Station No. 12 is located adjacent to Ocean Boulevard near the K-Mart shopping complex.

The station is a relatively new submersible type station constructed immediately adjacent to a creek or drainage way that is a tributary to Pony Creek.

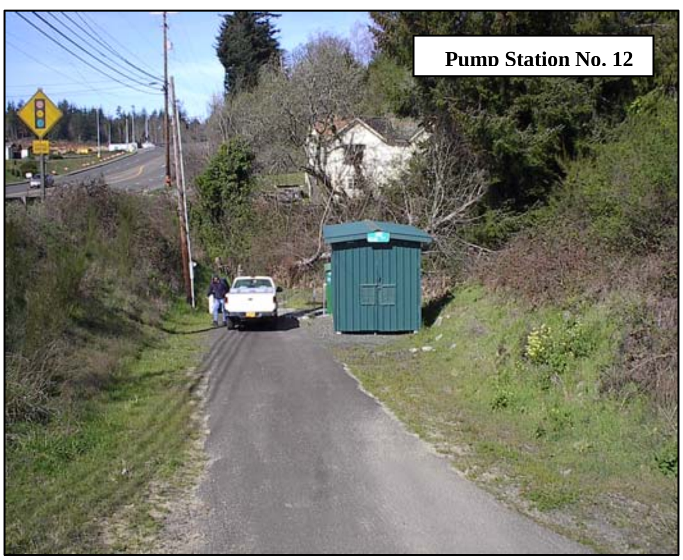
The location of the station has resulted in problems related to flooding of the station when the nearby creek overtops the confines of the waterway.

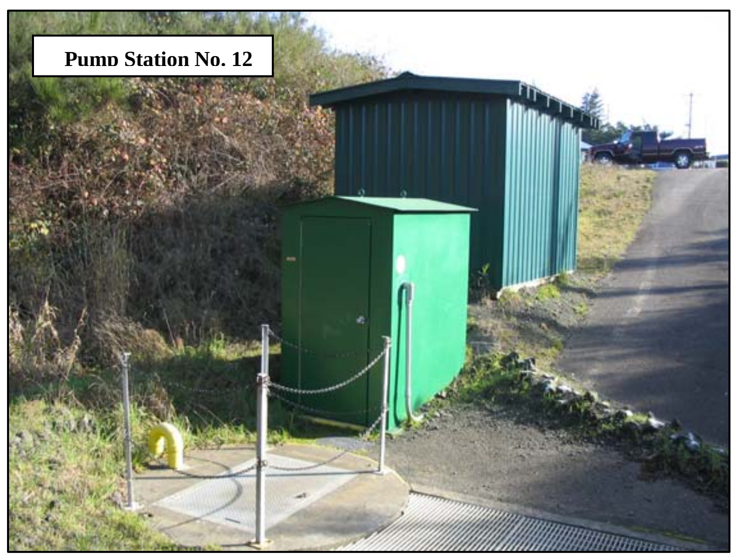
The station includes a small control building to house the electrical components. The building is not capable of adequately protecting the electrical components from flood waters.

A portable standby power generation unit is housed in a small building adjacent, and slightly upland, from the control building. While the generator could be towed to other locations to be utilized for temporary power, it has been housed at the pump station for some time.

The autodialer utilized in the station does not meet the standards for autodialers used at the majority of the stations in the City.

While the pump station is in generally good condition, site improvements to protect the station from flooding are recommended.





A summary of the pump station physical and operational parameters and noted deficiencies is provided in the table below.

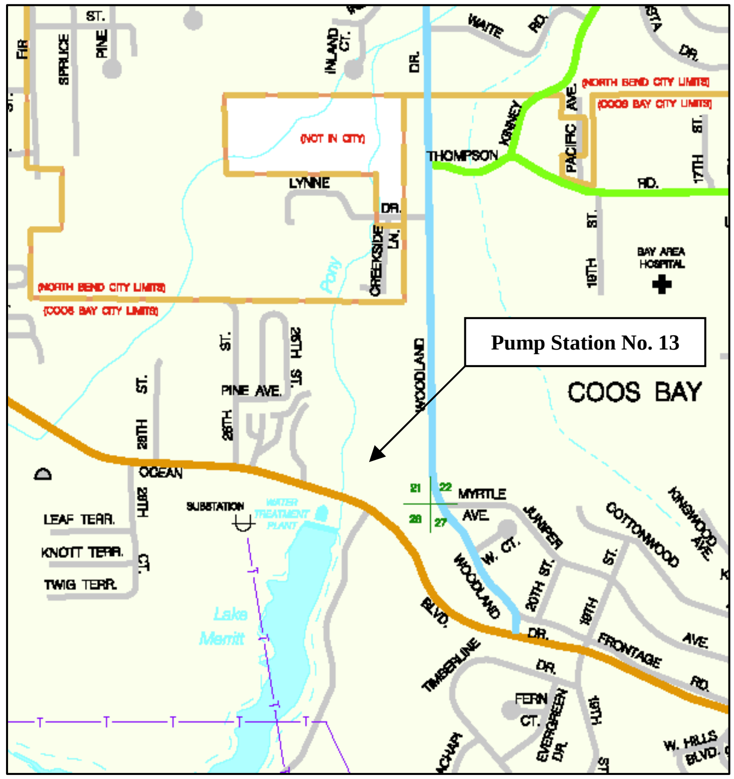
Summary of Pump Station No. 12
System Components

Year Constructed/Last Upgrade	Originally constructed in early 1971 / Major remodel and upgrade in 1992
Location	Adjacent to Ocean Boulevard near the Kmart shopping complex
Pump Type	Submersible solids handling
Manufacturer of Pumps	ABS (Model AFP-15-EX4)
Capacity (reported)	Pumps 1, 2 : 300 gpm @ 65 feet TDH
Pump hp	Pumps 1, 2 : 15 hp
VFD(s)	none
Wet Well	Circular concrete wetwell
Overflow Point	Gravity overflow to nearby creek, a tributary of Pony Creek. Outfall number 010; discharge point to Pony Creek river mile 8.85
Auxiliary Power	30 kW (480 V) Portable Onan generator; diesel powered
Available Property for Expansion	Limited but potential.
Force Main(s)	6” Force main to discharge manhole
Phone Circuit	Verizon- 269-0343
Alarms	High wet well, low wet well, seal fail, power failure, pump fail

Summary of Pump Station No. 12
Deficiencies

Site	Need retaining wall and site improvements to protect station from creek during flood events. Limited potential for expansion at existing site.
Autodialer	Change out autodialer to standardize with other stations.

Pump Station No. 13



Pump Station 13 is located off Ocean Boulevard in a low lying area opposite of the Coos Bay-North Bend Water Board offices and Pony Creek Treatment Plant.

The pump station was recently upgraded and transformed from a vacuum primed packaged station to a submersible-type pump station.

There has been some discussion about elimination of Station 13. This would require the installation of gravity sewer piping to connect the gravity piping that currently empties into the station to the gravity piping to the north and eventually to Woodland Drive. However, it would require crossing a wet, swampy area and some private properties. This option will be discussed in the Alternatives Section later in this Master Plan. In general, the option of elimination of the pump station was not selected during the recent upgrade due to the high cost of installing gravity sewer, obtaining easements through private property, and potential permitting issues to work in the wetland areas.

In the meantime, a new block building was constructed to house the electrical and control equipment for the pump station. A lean-to enclosure was constructed adjacent to the control building to house an on-site power generator. The generator was moved to this station from another site and is relatively old. There is no automatic transfer switch in place so the generator must be operated manually.

Access to the pump station is provided via a utility easement.

A summary of the pump station's physical and operational parameters and noted deficiencies is provided in the table below.

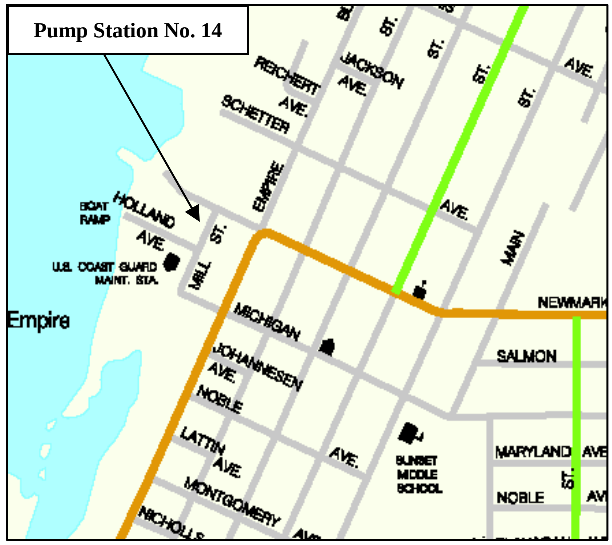
Summary of Pump Station No. 13
System Components

Year Constructed/Last Upgrade	Originally constructed in early 1971 / Major remodel and upgrade in 1992
Location	Adjacent to Ocean Boulevard across from the Pony Creek Treatment Plant (Coos Bay-North Bend Water Board)
Pump Type	Submersible solids handling
Manufacturer of Pumps	ABS (Model AFP-15-EX4)
Capacity (reported)	Pumps 1, 2 : 480 gpm @ 96 feet TDH
Pump hp	Pumps 1, 2 : 25 hp
VFD(s)	none
Wet Well	Circular concrete wetwell
Overflow Point	Gravity overflow to nearby creek, a tributary of Pony Creek. Outfall number 011; discharge point to Pony Creek river mile 8.85
Auxiliary Power	45 kW (480 V) Pavid Manufacturing; diesel powered (33.3 hp)
Available Property for Expansion	Limited but potential.
Force Main(s)	6" Force mains to discharge manhole
Phone Circuit	Verizon- 269-0343
Alarms	High wet well, low wet well, seal fail, power failure, pump fail

Summary of Pump Station No. 13
Deficiencies

Autodialer	Change out autodialer to standardize with other stations.
Generator	No automatic transfer switch. Old generator that should be replaced.

Pump Station No. 14



Pump Station No. 14

Pump Station No. 14 is located near the intersection of Mill Street and Holland Avenue near the Empire Boat docks recreation facility.

Station 14 services a small sewer basin serving properties on the low lying areas adjacent to the Bay in the area around the Empire docks.

Pump Station No. 14 is a small submersible-type pump station with a small enclosure for the electrical and control equipment. All other equipment is located outside but within a chain-link enclosure.

The station does not have a generator to provide on-site and automatic standby power generation nor does it have the a generator connection or manual transfer switch. However, the basin is very small and has the storage capacity to outlast most power outages before overflows become an issue. If power service is out for some time, the City can use vac-trucks to empty the wet well and provide additional storage time until power is restored.

In general, the station is in good condition and provides good pumping service to the basin.

Pump Station No. 14

A summary of the pump station physical and operational parameters and noted deficiencies is provided in the table below.

Summary of Pump Station No. 14
System Components

Year Constructed/Last Upgrade	Originally constructed in 1971 and upgraded in 1992.
Location	On Mill Street in the vicinity of the Empire boat ramp
Pump Type	Submersible solids handling
Manufacturer of Pumps	ABS (Model AF60-8)
Capacity (reported)	Pumps 1, 2 : 350 gpm @ 46 feet TDH
Pump hp	Pumps 1, 2 : 8 hp
VFD(s)	na
Wet Well	Circular concrete wetwell
Overflow Point	Gravity overflow to Coos Bay. Outfall number 004; discharge point to Coos Bay river mile 5.25
Auxiliary Power	None (240 Volt system)
Available Property for Expansion	Limited but potential.
Force Main(s)	6” Force main to discharge manhole
Phone Circuit	Verizon- 888-5660
Alarms	High wet well, low wet well, seal fail, power failure, pump fail

Summary of Pump Station No. 14
Deficiencies

Standby Power	A manual transfer switch and plug should be installed to allow a portable generator to provide power to the station. This would be a preferred solution to trucking sewage during extended outages.
Site	Enclosure for station and controls not completely secure and could be accessed and damaged with little effort.

Pump Station No. 15

Pump Station No. 15 is a stormwater pump station located near Fred Meyer on Johnson Ave and is described in detail in the Coos Bay Storm Drain Master Plan (Dyer Partnership, Engineers and Planners, Inc., 2004).

Pump Station No. 16

Pump Station No. 16 is located on Lakeshore Drive near the intersection of Chicksees Drive.

The pump consists of two self-prime suction pumps housed within a brick building enclosure.

The pumps and other components have presented regular operation and maintenance problems for operations staff.

Onsite standby power generation is provided at the site along with telemetry to send alarms to operations staff.

With the exception of problems with the self-priming pumps, the station is in relatively good condition.

A summary of the pump station physical and operational parameters and noted deficiencies is provided in the table below.

Summary of Pump Station No. 16
System Components

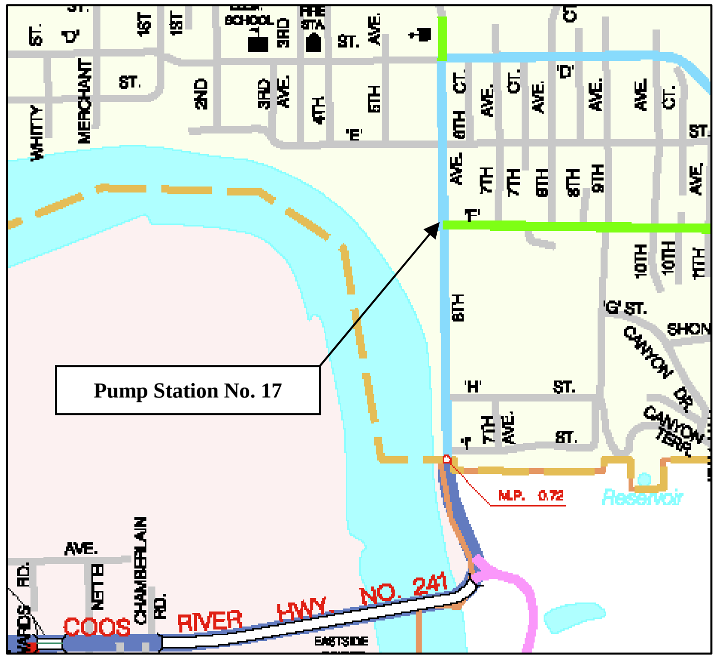
Year Constructed/Last Upgrade	Originally constructed in the 1978
Location	Near intersection of Lakeshore and Chicksees Drives
Pump Type	Self-prime suction pumps
Manufacturer of Pumps	Hydromatic (Model 40MMP)
Capacity (reported)	Pumps 1, 2: 225 gpm @ 41 feet TDH
Pump hp	Pumps 1, 2 : 7.5 hp
VFD(s)	none
Wet Well	Circular concrete wetwell below pump area
Overflow Point	Gravity overflow to Chicksees Creek and, ultimately, Coos Bay. Outfall number 005, discharge point to Coos Bay river mile 6.0
Auxiliary Power	30 kW (240 V) Onan Generator; diesel powered; fuel consumption measured at 3.1 gal/hr.
Available Property for Expansion	Some available property for expansion potential.
Force Main(s)	6” AC force main to discharge manhole
Phone Circuit	Verizon- 888-4208
Alarms	High wet well, low wet well, power failure, generator run, pump failure.

Summary of Pump Station No. 16
Deficiencies

Building	Flat roof has caused problems with leaks in the building and corrosion of metals in the system.
Controls/Autodialer	Old autodialer system needs to be replaced to standardize to City system.
Pumps	Self priming pumps are problematic. Long history of maintenance and operation issues.
Generator	Age of generator has made it very difficult to maintain and obtain replacement parts.

Pump Station No. 17

Pump Station No. 17 is located on 6th Street in Eastside near the intersection of F Street.

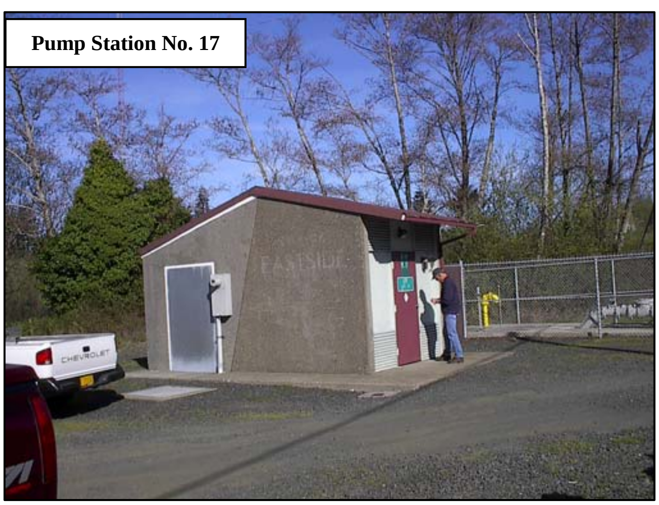


The pump station was updated in 1999 and remains in good condition today.

The station is a submersible type station with VFD controls, telemetry and standby power generation.

Above ground check valves, piping, and fittings are located adjacent to the pump station control building within a chain-link fence enclosure.

The backup power generation system is located outside and under a roofing structure adjacent to the control room. The generator is housed in an acoustical enclosure to reduce noise.



A summary of the pump station physical and operational parameters and noted deficiencies is provided in the table below.

Summary of Pump Station No. 17
System Components

Year Constructed/Last Upgrade	Originally constructed in 1963. The station went through a major remodel and upgrade in 1999.
Location	6th Street near the H Street intersection.
Pump Type	Submersible solids handling
Manufacturer of Pumps	ABS
Capacity (reported)	Pumps 1, 2 : 700 gpm @ 81.5 feet TDH
Pump hp	Pumps 1, 2 : 8 hp
VFD(s)	Danfoss VFD's for both pumps
Wet Well	Circular concrete wetwell
Overflow Point	Gravity overflow to Isthmus Slough. Outfall number 012; discharge point to Isthmus Slough river mile 13.15
Auxiliary Power	80 kW Onan diesel-powered generator (240 V); fuel consumption measured at 6.1 gal/hr (fuel capacity 173 gal)
Available Property for Expansion	Property for expansion is currently available.
Force Main(s)	6" Force main to discharge manhole
Phone Circuit	Verizon- 266-8512 x217
Alarms	High wet well, low wet well, seal fail, VFD fail, power failure, pump fail, generator run

Summary of Pump Station No. 17
Deficiencies

Data acquisition	While there is above-ground valves and fittings, the upgrade did not include a magnetic flow meter to monitor and record flows from the station.

Pump Station No. 18

Pump Station No. 18 is located on the south end of Whitty Street in Eastside.

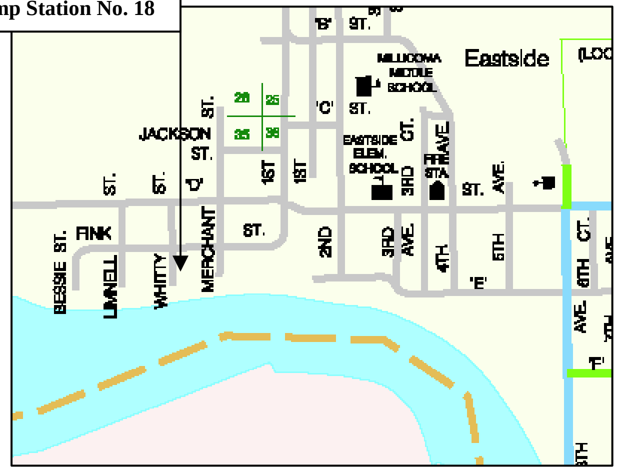
The station consists of a packaged, wetwell-mounted vacuum prime system by Smith and Loveless. The station includes a clamshell-type fiberglass enclosure that covers the electrical equipment and pumps within the same enclosure.

The pump station was upgraded in 2005. The upgrade included the addition of a small building adjacent to the station to house a new on-site standby power generation system and automatic transfer switch. The project also included the installation of a new PLC-based control system and new telemetry.

The new building is a wood-frame structure with concrete siding and a metal roof.

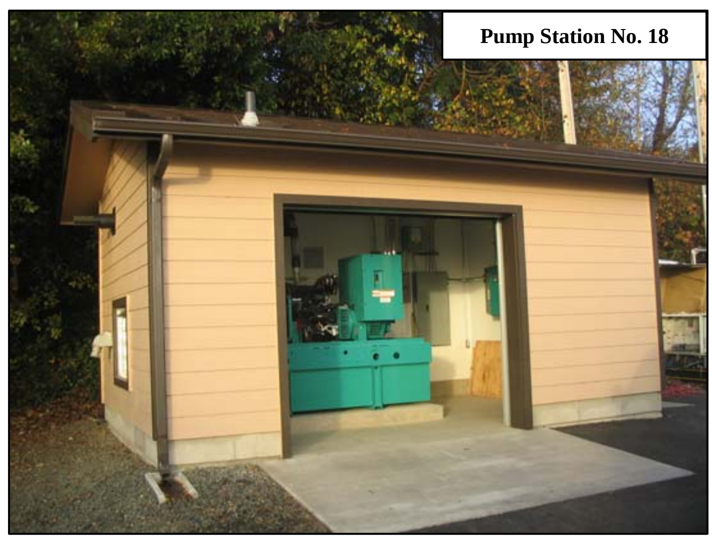
Despite problems that are typical to vacuum prime pumping stations, Pump Station 18 is in good condition.

Pump Station No. 18




Pump Station No. 18


Pump Station No. 18


Pump Station No. 18

A summary of the pump station physical and operational parameters and noted deficiencies is provided in the table below.

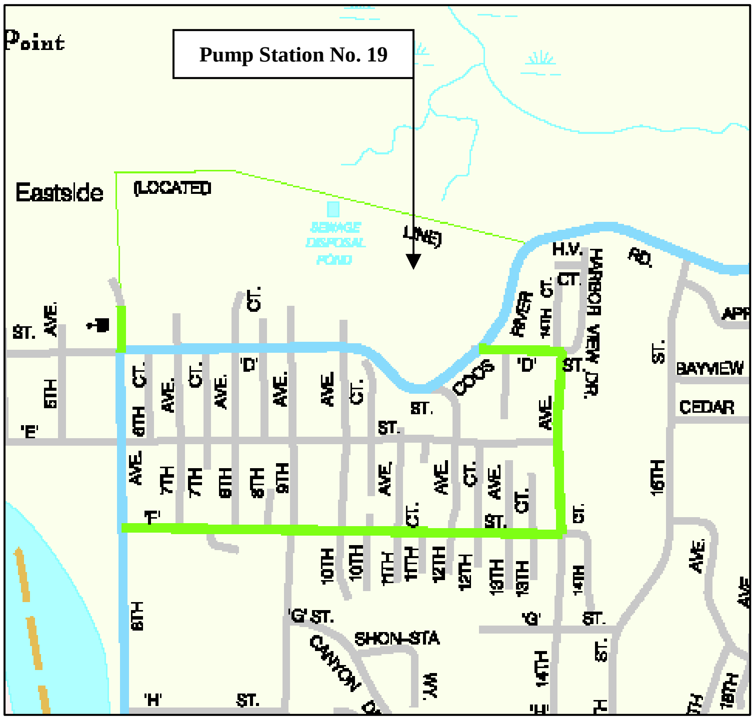
Summary of Pump Station No. 18
System Components

Year Constructed/Last Upgrade	Originally constructed in the 1963/ Upgrades in 2005 (controls and standby power)
Location	On south dead end of Whitty Street in Eastside.
Pump Type	Vacuum-prime suction pumps
Manufacturer of Pumps	Smith and Loveless (Model 4B2B)
Capacity (reported)	Pumps 1, 2: 200 gpm @ 90 feet TDH
Pump hp	Pumps 1, 2 : 15 hp
VFD(s)	na
Wet Well	Circular concrete wetwell
Overflow Point	Gravity overflow to Isthmus Slough. Outfall number 013, discharge point to Isthmus Slough river mile 15.0
Auxiliary Power	35 kW (480 V) Generator; diesel powered
Available Property for Expansion	Some available property for expansion potential within ROW.
Force Main(s)	6” AC force main to discharge manhole
Phone Circuit	Verizon- 265-0517
Alarms	High wet well, low wet well, power failure, generator run, pump failure.

Summary of Pump Station No. 18
Deficiencies

Pumps	Vacuum-priming pumps are problematic.

Pump Station No. 19



Pump Station No. 19 is located adjacent to the old wastewater treatment plant site in Eastside and the existing sludge lagoon.

The pump station was upgraded and remodeled in 2001. The current configuration is that of a submersible pump station.

Controls and electronics are housed in a small wood frame structure.

An older generator was reused to supply on-site standby power generation.

The controls for the station are PLC-based controls. An older telemetry unit was utilized for the station that should be updated at some point in the future to standardize the station.

Problems exist with the gravity piping immediately upstream of the station. The piping was placed too flat and the manhole before the station has conditions that create a hydraulic jump in the flowline. This has created a situation resulting in solids being deposited in the manhole causing overflows of the collection system in the vicinity. Improvements to address this deficiency have been developed in Section 7 of this Plan.

A summary of the pump station physical and operational parameters and noted deficiencies is provided in the table below.

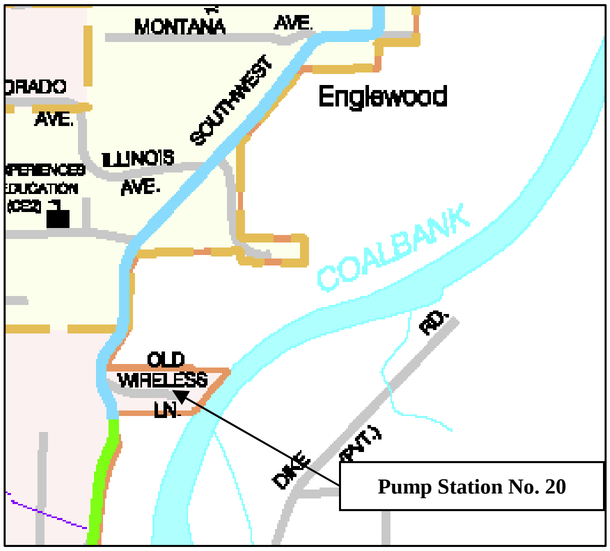
Summary of Pump Station No. 19
System Components

Year Constructed/Last Upgrade	Originally constructed in 1963. The station went through a major remodel and upgrade in 2001.
Location	On the site of the old treatment facility in Eastside.
Pump Type	Submersible solids handling
Manufacturer of Pumps	ABS
Capacity (reported)	Pumps 1, 2 : 400 gpm @ 134 feet TDH
Pump hp	Pumps 1, 2 : 30 hp
VFD(s)	Each pump has individual VFD
Wet Well	Circular concrete wetwell
Overflow Point	Gravity overflow to Coos Bay. Outfall number 014; discharge point to Coos Bay river mile 15
Auxiliary Power	150 kW Onan diesel-powered generator (460 V)
Available Property for Expansion	Limited.
Force Main(s)	6” HDPE/Ductile Iron Force main to discharge manhole
Phone Circuit	Verizon- 267-3527
Alarms	High wet well, low wet well, power failure, pump fail

Summary of Pump Station No. 19
Deficiencies

Autodialer	Autodialer should be upgraded to standardize to system
Generator	Generator is aged and difficult to obtain parts. Transfer switch is ok.
Gravity System	Problems in influent piping should be addressed to eliminate solids problems caused by grade issues.

Pump Station No. 20



Pump Station No. 20 is located on Old Wireless Lane in Englewood just off Southwest Boulevard near the Libby Drive intersection.

Pump Station 20 was constructed to provide sewer service to a small residential development on Old Wireless Road. The development, previously on septic systems, was required to connect to the City's collection system as a result of failing septic tanks and drain fields.

The electronics and controls are located in a stainless steel NEMA 4X cabinet mounted adjacent to the wetwell.

A summary of the pump station physical and operational parameters and noted deficiencies is provided in the table below.

Summary of Pump Station No. 20
System Components

Year Constructed/Last Upgrade	Originally constructed in 2000.
Location	Old Wireless Lane in Englewood
Pump Type	Submersible solids handling
Manufacturer of Pumps	ABS
Capacity (reported)	Pumps 1, 2 : 40 gpm @ 40 feet TDH
Pump hp	Pumps 1, 2 : 1.5 hp
VFD(s)	na
Wet Well	Circular concrete wetwell
Overflow Point	Gravity overflow to Coalbank Slough. Outfall number 016; discharge point to Coalbank Slough River Mile 14.65.
Auxiliary Power	none
Available Property for Expansion	Limited.
Force Main(s)	3" PVC Force main to discharge manhole
Phone Circuit	Verizon- 266-7501
Alarms	High wet well, low wet well, power failure, pump fail

Summary of Pump Station No. 20
Deficiencies

Generator	No ability to connect portable standby power to system

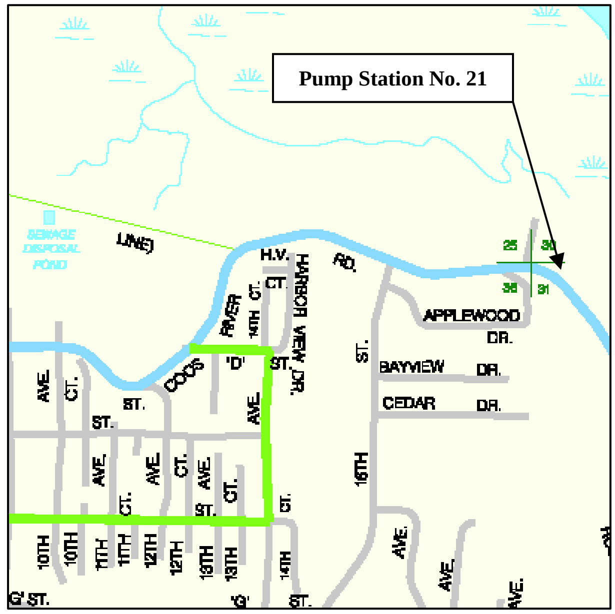
Pump Station No. 21

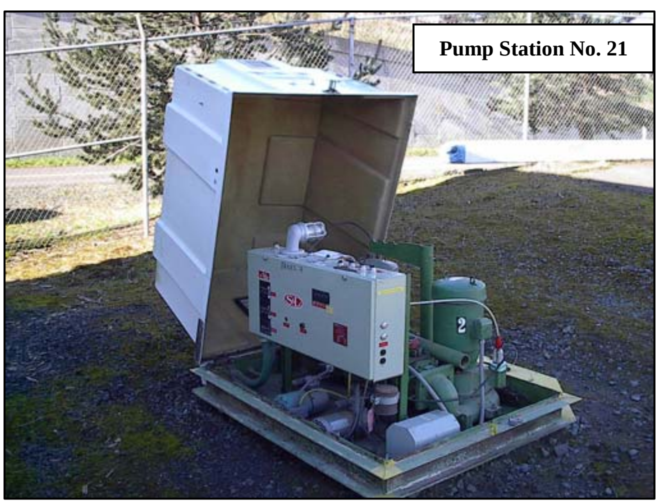
Pump Station No. 21 is located on the Coos River Highway within the SOMAR compound.

Station No. 21 is a small packaged system utilizing a wetwell-mounted vacuum-prime pumping system by Smith and Loveless.

The station's equipment and electronics are housed within a small fiberglass clamshell-type enclosure.

The station services a very small basin, primarily comprised of the SOMAR shipbuilding facility.





A summary of the pump station physical and operational parameters and noted deficiencies is provided in the table below.

Summary of Pump Station No. 21
System Components

Year Constructed/Last Upgrade	Originally constructed in 1985.
Location	Within SOMAR shipbuilding compound in Eastside.
Pump Type	Vacuum-prime suction pumps
Manufacturer of Pumps	Smith and Loveless (Model 4B2B)
Capacity (reported)	Pumps 1, 2: 100 gpm @ 39 feet TDH
Pump hp	Pumps 1, 2 : 5 hp
VFD(s)	na
Wet Well	Circular concrete wetwell
Overflow Point	Gravity overflow to Coos River. Outfall number 016, discharge point to Isthmus Slough river mile 15.5
Auxiliary Power	none
Available Property for Expansion	Some available property for expansion potential within private property of SOMAR compound.
Force Main(s)	4” PVC force main to discharge manhole
Phone Circuit	Verizon- 267-7308
Alarms	High wet well, low wet well, power failure, generator run, pump failure.

Summary of Pump Station No. 21
Deficiencies

Pumps	Vacuum-priming pumps are potentially problematic.
Autodialer	Autodialer should be upgraded to standardize station with the rest of the system.

Other Pump Stations

The City of Coos Bay owns and operates a handful of minor wastewater pump stations at various locations around the community. Generally, these other pump stations constitute a simple grinder or step system type station to serve a community or park bathroom facility.

A brief description of each is provided below:

Pump Station 22: Post Office Pump Station

A small pump system is located in a manhole near the Post Office near Golden Ave. and 4^{th} to lift sanitary waste into the nearby collection system. The station serves the Post Office only.

Pump Station 23: Grant Street Stormwater Pump Station

Station 23 is comprised of a small storm pump station located at South 4th and Grant Street. This station is discussed further in the City's Stormwater Master Plan (HBH Consulting Engineers, Inc., 2005).

Pump Station 24: Scout Cabin Pump Station

The City owns and maintains a historic structure located within Mingus Park that is known at the Scout Cabin. The cabin is available for use by local groups and organizations for meetings, parties, and other uses.

The Scout Cabin restrooms are serviced by a small residential type STEP pressure sewer system that pumps wastewater flows into the collection system within Basin R.

Pump Station 25: John Topits Park (Empire Lakes Park) Restroom Pump Station

The City owns and maintains a restroom at John Topits Park. The location of the restrooms does not allow for gravity flow service for the waste stream.

The restroom is serviced by a simple residential type STEP system that pumps the restroom wastes to the gravity system located to the south of the park and off Newmark Ave.

Pump Station 26: Eastside Boat Ramp Pump Station

The City owns and operates a boat ramp and public recreational area in Eastside. In 1997, the City added a restroom facility to the boat ramp facilities. The facilities at the boat ramp cannot be serviced by gravity flow.

The restroom is serviced by a residential type STEP system, located at Fink and Bessie, that pumps the restroom waste stream to the gravity system on D Street adjacent to the boat ramp area.

4.4 Wastewater Collection System Interconnections

The City of Coos Bay and the City of North Bend wastewater collection systems interlace along the City Limit boundaries of the two communities resulting in interconnections of some customers located within the two systems. In other words, some sewer customers located within the City of Coos Bay City Limits receive sanitary sewer service from the City of North Bend. Other sewer customers living within North Bend receive their sewer service from the City of Coos Bay.

Since most of these interconnections have been in place for some time, both cities have become accustomed to the arrangement and have been able to operate in a cooperative manner.

At the time that this study was prepared, efforts were underway to develop an intergovernmental agreement (IGA) to oversee and administer these existing interconnections as well as new developments that may result in additional connections that would be interconnected. However, at the time this plan was completed, the IGA was not yet available for publication.

For the purposes of documenting the existing interconnections (as of January 2006), Table 4.4.1 is provided summarizing the existing cross connections.

Table 4.4.1 – Sewer Interconnection Summary

Sewer Treated	Address of Interconnection	Sewer Rates Charged
Coos Bay sewer treated in North Bend	1420 Thompson	CB
	1510 Thompson	CB
	2635 N 15th	CB
	2665 N 15th	CB
	2699 N 15th	CB
	2745 N 15th	CB
	2785 N 15th	CB
	2775 N 15th Ct	CB
	2650 N 15th	CB
	2680 N 15th	CB
	2730 N 15th	CB
	2780 N 15th	CB
	2795 N 15th	CB
	2780 N 15th Ct	CB
	1330 Yew	CB
	1460 Yew	CB
	1440 Yew	CB
	1440 Thompson	CB
	885 25th, NB/1290 Lindberg, CB	CB
	1467 25th, NB/1467 Lindberg, CB	CB
	1450 Lindberg	CB
	1430 Thompson	CB
	2110 Newmark	NB
	2140 Newmark	NB
	1020 Yew	CB
	1005 Yew	CB
	2690 Koosbay Blvd	CB
North Bend sewer treated in Coos Bay	3709 Fir	NB
	3733 Fir	NB
	3755 Fir	NB
	3777 Fir	NB
	3793 Fir	NB
	3781 Pacific	NB
	3779 Pacific	NB
	3767 Pacific	NB
	3755 Pacific	NB
	3743 Pacific	NB
	3723 Pacific	NB
	3717 Pacific	NB
	3709 Pacific	NB
	3710 Pacific	NB
	3714 Pacific	NB
	3766 Pacific	NB
	3784 Pacific	NB
Coos Bay sewer treated in Charleston	1040 Jefferson Street, CB	Charleston

4.5 Private Sewer Collection Systems

A private wastewater collection system consists of mainline piping that was constructed in a location or under specific circumstances that results in the system not being owned or maintained by the City. In most cases, these systems are built on private property. In other cases, the sewer systems were built within trailer parks, apartment complexes, or subdivisions that were, for one reason or another, considered to be outside of the public sewer system responsibility.

Private sewers are typically the responsibility of a private owner or a neighborhood cooperative group. Operation and maintenance of these piping sections falls outside of the City's regular O&M responsibilities.

A summary of the known private wastewater systems (mains) that are connected to the City of Coos Bay Wastewater Collection system is provided below:

1. Elton Thompson Subdivision located in Eastside on First Avenue. (see Map 17.)

2. All manufactured home parks and mobile home parks located thoughout the community including:

    a. Puerto Vista Estates (see Map 5)
    b. Shore Pines (see Map 5)
    c. Leaf, Knott, and Twig Terrace off 28th Ave (see Map 7)
    d. Pacific Loop, Marine, and Sandpiper (see Map 7)
    e. Mobile home park at 26th and Ocean Blvd. (see Map 8)
    f. Mobile home parks on Cape Arago Highway/Empire Blvd. (see Map 3)
    g. And others.

3. John Topits Apartments on Ackerman (see Map 5)

4. Blue Water Vista Estates off Lakeshore Drive (see Map 1)

5. The western end of Market Street past Young Life House. (see Map 13)

6. Westgate Subdivision No. 2 (Irv Yeager) (see Map 8)

7. Portions of Pacific Crest Subdivision. (see Map 4)

8. SWOCC campus system. (see Map 6)

9. and others

It is important that the City is aware of all the portions of their system that are considered private systems. As additional private systems are identified, they should be added to this list.

5.0 Wastewater Characteristics

5.1 Existing Wastewater Volumes

The City of Coos Bay authorized the firm of West Yost & Associates (WYA) to prepare facilities plans for both of the Coos Bay wastewater treatment plants. Within each study, WYA studied the treatment plant flow records and established the flow criteria for each service area including average, minimum, maximum, and peak flow conditions.

A summary of the existing (2003) flows for each service area is provided below in Table 5.1.1 as developed by West Yost & Associates.

Table 5.1.1 – Existing Wastewater Flow Rates for Each Service Area

Wastewater Flow Criteria (2003)	Plant 1 Service Area (MGD)	Plant 2 Service Area (MGD)
Average Dry Weather Flows (ADWF)	1.60	0.85
Average Wet Weather Flows (AWWF)	3.20	1.30
Maximum Month Dry Weather Flow (MMDWF)	2.90	1.20
Maximum Month Wet Weather Flow (MMWWF)	5.50	2.30
Peak Daily Flow (PDF)	10.00	4.50
Peak Wet Weather Flow or Peak Hourly Flow (PWWF)	15.00	7.00

Because the job of the collection system is to transmit wastewater flows to the treatment plants, this study is not concerned with the strength of the waste that is to be transmitted, only the volumes. Therefore, the flows outlined above are indicative of the total existing (2003) flow rates experienced in each service area under different flow conditions.

5.2 Projected Wastewater Characteristics

All existing and future infrastructure components must have adequate capacity for future projected flow rates. Along with establishing the existing flow rate criteria presented in Section 5.1 above, West Yost & Associates also developed projected flow rates for the end of the planning period (2027) within each of the Facilities Plans prepared for the two wastewater treatment plants in Coos Bay. A summary of the projected wastewater flow rates developed by WYA is provided below in Table 5.2.1.

Table 5.2.1 – Projected Wastewater Flow Rates for Each Service Area

Wastewater Flow Criteria (2027)	Plant 1 Service Area (MGD)	Plant 2 Service Area (MGD)
Average Dry Weather Flows (ADWF)	1.70	1.00
Average Wet Weather Flows (AWWF)	3.40	1.50
Maximum Month Dry Weather Flow (MMDWF)	3.10	1.40
Maximum Month Wet Weather Flow (MMWWF)	5.90	2.70
Peak Daily Flow (PDF)	13.30	5.50
Peak Wet Weather Flow or Peak Hourly Flow (PWWF)	20.00	8.60

It is clear that under both existing and projected flow rates that winter flows will be the controlling factor when analyzing existing components or designing new facilities. These high flows, brought on by winter weather and high groundwater, eclipse the flows generated from domestic customers.

5.3 Inflow and Infiltration

Nearly all coastal communities in Oregon struggle with the issue of inflow and infiltration (I/I). Inflow and infiltration is defined as follows:

> Infiltration: Flows that enter the collection system through underground paths. Infiltration can be caused by high groundwater levels, rain-induced groundwater, leaky water and storm drain systems, and other sources. Infiltration flows make their way into the collection system through cracks in pipe, open or offset pipe joints, broken piping sections, leaks in manholes, and other below grade openings in the system.
>
> Inflow: Flows that enter the collection system through above ground paths. Inflow is often related to building downspouts being connected to sanitary sewer service laterals, interconnections with storm drain systems that have not been severed, water flowing over manholes and entering in through the openings in the lids, catch basins or area drains being connected to the sewer system, and other surface water sources.

When combined, I/I can result in tremendous increases in flow during the winter and particularly during storm events.

As shown in the flow data presented in Section 5.1 and 5.2, Coos Bay experiences a flow increase between the average summer day and a peak hour storm event of between 8 and 12 times the dry weather flow. This “peaking factor” of between 8 and 12 times the dry flow is a direct result of I/I entering the Coos Bay collection system and is typical of many communities on the Oregon coast.

On a system wide basis, WYA performed an I/I analysis to determine if I/I flows in the system should be considered excessive.

Under EPA guidelines, if the measured per capita flows in the collection system exceed 275 gpcd, I/I is considered excessive and an analysis should be performed to investigate the cost effectiveness of attempted removal of I/I vs. increasing system treatment capacity.

In both Facility Plans, WYA completed a cost effectiveness analysis of rehabilitation costs vs. treatment costs as they relate to dealing with the high levels of seasonal I/I in the collection system.

For the sanitary sewer service areas in Coos Bay, WYA determined that it would cost between $3.5 million dollars to $7 million dollars per MGD of I/I flows to rehabilitate the collection system depending on the aggressiveness of the rehabilitation effort. This can be contrasted with an estimate of around $800,000 per MGD for improvements required to treat the higher flows. Therefore, WYA estimates that it will cost between 4.5 to 9 times as much to rehabilitate the collection system than provide increased treatment capacity.

Based on this analysis, it is likely that an aggressive and comprehensive I/I rehabilitation effort in Coos Bay would not be a cost effective strategy for dealing with the high seasonal flows. As a result of their analyses, the WYA studies include recommendations for improvements that are required at both treatment plants to increase capacity.

While a comprehensive and costly rehabilitation approach may not be appropriate for Coos Bay, the following rehabilitation activities should be considered:

1. Develop an inspection form that is utilized by maintenance personnel to keep records and provide feedback on manhole deficiencies and I/I observed to be entering manholes.

2. Include in the annual budget a line item for I/I rehabilitation activities that allows the City to perform some repairs and rehabilitation each year. (See Section 7.4)
3. Develop an annual program where small portions of the collection system are TV-inspected and deficiencies noted and scheduled for repair when appropriate and cost effective.
4. Perform flow monitoring (mapping) and smoke testing of basins that are suspected of having unreasonably high levels of I/I that may be practically reduced. Correction of inflow sources in particular can have a very cost effective impact on I/I rehabilitation efforts.
5. Perform repairs or replacements of pipe sections when other projects are undertaken in the same area (i.e. water, streets, storm, etc.) and the sewer piping is known to be deficient.

In general, the City can continue to have a positive impact through simple I/I rehabilitation. This is especially true with inflow sources. The City should work to remove all roof downspouts and private area drains that are connected to the collection system. See Section 7.4 of the Plan for additional recommendations on I/I removal efforts and maintenance plans.

5.3.1 System Flow Mapping and Analysis

As part of the scope of work, HBH was to perform isolated flow mapping of areas that were suspected of being large contributors of I/I. The intent of this study was to perform a "sampling" of flow mapping and provide some information on flows in the basins during the midnight hours when little or no domestic flows would be present in the system.

However, the winter of 2004-2005 was very mild with little rain experienced during the months when flow mapping is typically performed (January through March). As a result of this drought year, this work was not undertaken.

HBH will attempt to complete flow mapping and system observations during the 2005-2006 flow mapping season and provide an addendum to the Master Plan outlining the results from that effort.

Because rehabilitation projects are not SDC eligible, the results from flow mapping will not have an impact on the upcoming system development charge (SDC) planning process.

5.4 Design Flows for Individual Basins

In order to perform analyses on existing piping or pump stations, or to determine the capacity needed for future flows, design flows must be established for each basin.

In a perfect world, flow meters would be strategically placed throughout the system and within each pump station to determine the flow ranges in specific basins and sub-basins.

However, metering all the flows within a system is not practical. Also, few of the pump stations in the Coos Bay system have flow meters, so actual flow measurements from the stations are not available.

The following section describes the methods that were used to establish flows in each basin throughout the system.

5.4.1 Flow Determination Methodology

In the absence of actual flow data, systems and methodologies must be utilized to estimate the flows in specific basins within the system. These systems should take advantage of known information to conservatively extrapolate the unknown flow data.

As mentioned previously in this Plan, during peak flow conditions, the vast majority of water in the collection system is I/I flows. In comparison, the flows resulting from domestic or commercial users is relatively insignificant. Therefore, it is reasonable to design the facilities for the existing and anticipated peak flows (resulting from I/I) and not on anticipated development patterns resulting in minor increases in domestic or commercial flow rates.

I/I flows enter the collection system, primarily, through the extensive piping networks and private sewer service laterals in each basin. Older pipe that was constructed with clay, concrete, or asbestos cement materials and placed with short joint lengths have a higher rate of leakage and add more I/I to the system than modern PVC piping materials. The older materials were phased out during the 80's with PVC pipe becoming the predominant pipe material of choice.

Since most of the piping in the Coos Bay collection system has been in service for more than 20 years, it is safe to assume that the majority of pipe in the system is clay or concrete and, therefore, subject to higher rates of leakage and infiltration.

With this in mind, it is a reasonable approach to assume that total peak flows resulting from I/I can be distributed around the system based on the amount of piping present in each basin.

It is also true that larger diameter piping will have a tendency to leak more due to increased surface area and longer joint lengths (circumferences) than do small diameter piping. Therefore, total peak flows must further be distributed based on the relative diameter of piping in any one basin.

The methodology selected for this section utilizes the Inch-Diameter-Mile approach to distributing flows around the system. Under this methodology, the total length of each size of pipe in each basin is tabulated. Then the piping from each basin is added up for each plant service area. Once the total length of pipe in each basin and each service area is known, the length of each size pipe in each basin is converted to an inch-mile as in the following example:

10,000 feet of 8-inch diameter pipe

10,000 x 1/5,280 (ft/mile) = 1.894 miles of 8-inch pipe

8-inch dia. x 1.894 miles of pipe = 15.15 in-miles of pipe

This calculation is completed for each diameter of pipe in each basin. The total inch-miles of pipe in each basin is calculated and added to determine the total inch-miles of pipe in each plant service area.

Because service laterals contribute a significant amount of I/I to the collection system, an effort should be made to include them within the inch-mile calculation. For our purposes, we utilized the aerial maps to count houses, businesses, and other dwellings within each basin. It was assumed that a single lateral services each building and that the laterals are, on average, 4-inches in diameter and approximately 70-feet long from the mainline to the building. Utilizing these assumptions, laterals were included within the calculation of inch-mile piping for each basin.

Because our assumption is that all piping systems, on average, contribute the same amount of I/I to the system, based on their individual diameters, we can distribute the total flows in the system into each basin based on the amount of piping in each basin using the inch-mile calculations prepared for each as shown in the following example:

> Basin A is calculated to have 31.43 in-miles of piping and is located within the Plant No. 2 service area which has 322.19 in-miles of total piping
>
> 31.43 in-mile/322.19 in-mile = 9.76% of the total in-mile piping for the service area
>
> Therefore, we will assume that Basin A contributes 9.76% of the peak flows to Plant No. 2

This calculation was performed for each service area and for each individual basin. Table 5.4.1 presents the existing and projected peak hourly flows for each basin based upon the inch-mile distribution method and the total peak hourly flows for each of the two treatment plants as developed by WYA and discussed in Section 5.2 of this Master Plan.

According to City Staff and records, flows from the Charleston Sanitary District account for approximately 30% of the total flows in the Plant 2 service area. Flows from the Bunkerhill Sanitary District account for approximately 6% of the total flows in the Plant 1 Service area. These flows are not included in the total flows originating from each basin in the following tables.

Appendix A includes a printout of the spreadsheet that was utilized to perform all the calculations and analyses utilized in the flow estimation sections.

Table 5.4.1 – Peak Hourly Flows Per Basin (Flows Originating in Basin) Using Inch-Diameter Mile Method

Basin	Inch-Mile Pipe	% of Total Pipe within the Plant Service Area	2003 Peak Hourly Flows from Basin MGD	2027 Peak Hourly Flows from Basin MGD
A	31.43	9.76	0.48	0.59
B	46.46	14.42	0.71	0.87
C	14.56	4.52	0.17	.21
D	31.25	9.70	0.53	0.65
E	72.68	22.56	1.11	1.36
F	48.55	15.07	0.74	0.91
G	62.16	19.29	0.95	1.16
H	12.43	3.86	0.19	0.23
I	25.08	3.64	0.51	0.68
J	2.67	0.83	0.04	0.05
K	7.63	1.11	0.16	0.21
L	6.81	0.99	0.14	0.19
M	33.46	4.86	0.69	0.91
N	28.17	4.09	0.58	0.77
O	36.92	5.36	0.76	1.01
P	22.20	3.22	0.45	0.61
Q	9.03	1.31	0.16	0.25
R	50.63	7.35	1.04	1.38
S	31.30	4.55	0.64	0.85
T	9.13	1.33	0.19	0.25
U	22.80	3.31	0.47	0.62
V	96.78	14.06	1.98	2.64
W	15.63	2.27	0.32	0.43
X	87.19	12.66	1.79	2.36
Y	12.97	1.88	0.27	0.35
Z	14.32	2.08	0.29	0.39
AA	18.72	2.72	0.38	0.51
BB	37.92	5.51	0.78	1.04
CC	17.88	2.60	0.37	0.49
DD	0.77	0.11	.02	.02
EE	17.49	2.54	.036	0.48
FF	9.78	1.42	.020	0.27
GG	48.77	7.08	1.00	1.33
HH	27.18	3.95	0.56	0.74

5.4.2 Developed Area Methodology

Another method for determining the amount of flow in each basin is to distribute flows around the basins using estimates of total developed area in each basin. Table 5.4.2 below shows the estimated flows originating within each basin based on a developed area approach.

Table 5.4.2 – Peak Hourly Flows Per Basin (Flows Originating in Basin) Using Developed Area Method (MGD)

Basin	Total Basin Area	Estimate of Developed Area Existing	Estimate of Developed Area Future	2003 Peak Hourly Flows from Basin MGD	2027 Peak Hourly Flows from Basin MGD
A	112	78.40	84.00	0.37	0.39
B	126	107.10	113.40	0.50	0.53
C	35	29.75	30.80	0.06	0.07
D	100	90.00	85.00	0.40	0.49
E	220	165.00	209.00	0.77	0.98
F	202	171.70	191.90	0.80	0.90
G	271	220.35	238.48	1.08	1.12
H	314	109.90	125.60	0.51	0.59
I	358	161.10	304.30	1.18	2.43
J	22	14.30	15.40	0.07	0.07
K	54	35.10	45.90	0.26	0.37
L	53	26.50	34.45	0.19	0.28
M	119	101.15	113.05	0.74	0.90
N	106	84.80	90.10	0.62	0.72
O	112	84.00	87.36	0.61	0.70
P	74	55.50	59.20	0.41	0.47
Q	95	57.00	76.00	0.42	0.61
R	146	109.50	116.80	0.80	0.93
S	92	55.20	59.80	0.40	0.48
T	27	22.95	22.95	0.17	0.18
U	68	57.80	59.84	0.42	0.48
V	231	203.28	207.90	1.49	1.66
W	58	31.90	40.60	0.23	0.32
X	336	268.80	302.40	1.97	2.42
Y	48	40.80	45.60	0.30	0.36
Z	83	45.65	74.70	0.33	0.60
AA	148	51.80	103.60	0.38	0.83
BB	115	92.00	103.50	0.67	0.83
CC	53	31.80	37.10	0.23	0.30
DD	3	2.40	2.40	0.02	0.02
EE	74	44.40	59.20	0.33	0.47
FF	41	28.70	32.80	0.21	0.26
GG	186	139.50	158.10	1.02	1.26
HH	135	94.50	114.75	0.69	0.92

Utilizing this method only considers the area of development and does not take into consideration the age and condition of the collection system, the proximity of the collection system to swampy or wet areas, the density of development, or many other parameters that could impact the peak flow conditions in a basin.

5.4.3 Basis for Flows in Individual Basins - Empirical

Clearly, in the absence of actual flow data, estimates of the flow contributions for individual basins must be made. As illustrated in the previous sections, this can be accomplished in a number of ways. For the purposes of this study, the analyses in the previous sections along with empirical evidence and local knowledge of the basins themselves will be used to establish peak flows from each basin.

Table 5.4.3 below presents the flows that have been established for each basin that will be utilized within this study for analyzing systems for capacity and developing preliminary sizing system of system components.

Table 5.4.3 – Peak Hourly Flows per Basin (Flows Originating in Basin) Based on Empirical Information-Basis of Planning (MGD)

Basin	Peak Hourly Flows Based Upon the Inch-Dia. Mile Method		Peak Hourly Flows Based on the Developed Area Method		Peak Hourly Flows Empirical Method Basis of Plan	
	Existing	Future	Existing	Future	Existing	Future
A	0.48	0.59	0.37	0.39	**0.50**	**0.60**
B	0.71	0.87	0.50	0.53	**0.55**	**0.60**
C	0.22	.027	0.14	0.14	**0.10**	**0.15**
D	0.48	0.56	0.42	0.45	**0.53**	**0.57**
E	1.11	1.36	0.77	0.98	**0.95**	**1.25**
F	0.74	0.91	0.80	0.90	**0.80**	**0.95**
G	0.95	1.16	1.08	1.12	**1.00**	**1.20**
H	0.19	0.23	0.51	0.59	**0.40**	**0.60**
I	0.51	0.68	1.18	2.43	**0.75**	**1.80**
J	0.04	0.05	0.07	0.07	**0.07**	**0.10**
K	0.16	0.21	0.26	0.37	**0.25**	**0.35**
L	0.14	0.19	0.19	0.28	**0.20**	**0.30**
M	0.69	0.91	0.74	0.90	**0.75**	**1.00**
N	0.58	0.77	0.62	0.72	**0.60**	**0.72**
O	0.76	1.01	0.61	0.70	**0.62**	**0.72**
P	0.45	0.61	0.41	0.47	**0.40**	**0.50**
Q	0.16	0.25	0.42	0.61	**0.40**	**0.60**
R	1.04	1.38	0.80	0.93	**0.90**	**1.10**
S	0.64	0.85	0.40	0.48	**0.45**	**0.50**
T	0.19	0.25	0.17	0.18	**0.16**	**0.18**
U	0.47	0.62	0.42	0.48	**0.40**	**0.47**
V	1.98	2.64	1.49	1.66	**1.60**	**1.80**
W	0.32	0.43	0.23	0.32	**0.50**	**0.60**
X	1.79	2.36	1.97	2.42	**1.80**	**2.33**
Y	0.27	0.35	0.30	0.36	**0.25**	**0.30**
Z	0.29	0.39	0.33	0.60	**0.35**	**0.58**
AA	0.38	0.51	0.38	0.83	**0.50**	**0.90**
BB	0.78	1.04	0.67	0.83	**0.65**	**0.85**
CC	0.37	0.49	0.23	0.30	**0.25**	**0.30**
DD	.02	.02	0.02	0.02	**0.02**	**0.02**
EE	.036	0.48	0.33	0.47	**0.35**	**0.45**
FF	.020	0.27	0.21	0.26	**0.25**	**0.28**
GG	1.00	1.33	1.02	1.26	**1.00**	**1.25**
HH	0.56	0.74	0.69	0.92	**0.70**	**0.90**
Charleston Sanitary District					**2.10**	**2.58**
Bunkerhill Sanitary District					**0.90**	**1.20**

5.4.4 System Flow Patterns and Combined Flows

In many cases within the Coos Bay collection system, one or more basins discharge their flows into a downstream basin. In these cases, the flows from upstream basins can compound or have a cumulative or cascading effect to the downstream basins resulting in higher flows.

Figures 4.1.1 and 4.1.2 show the relationships between individual basins and the basins that they may affect downstream. Facilities such as main trunk lines and pump stations must be sized for the cumulative effect of flows that may be received from upstream basins.

For example, within the Plant 1 service area (Figure 4.1.1), Basins I and Q discharge their flows into Basin K. Pump Station 13 must be sized to pump cumulative flows from Basins Q, I and K and discharge those flows to Basin L. Basin M also flows into Basin L. Pump Station 10 must be sized to handle the cumulative effect from Basins M, L, K, I, and Q.

These relationships must be considered when analyzing existing facilities for capacity or when sizing new trunk lines and pump stations.

6.0 Basis of Planning

All planning and recommendations must be founded on established and accepted principals and methodologies. This section shall establish the methods and principals that will be utilized to prepare and analyze improvement alternatives as well as make final recommendations for improvements.

6.1 Design Criteria

Design criteria for future conveyance system expansions are based on topography, available and undeveloped land, the existing UGB and the estimated future flows discussed in Section 5.

As is the case with sizing wastewater treatment facilities, inflow and infiltration flows will dominate the sizing of facilities to ensure that the conveyance system has capacity for high winter storm events.

General design considerations incorporated into the development of alternatives and, ultimately, the final recommendations are discussed below.

6.1.1 Design Period

The design period must be long enough to ensure the new facilities will be adequate for future needs, but short enough to ensure that the facilities are effectively utilized within their economic and practical life.

The improvement plan for serving the properties within the UGB will be based on a design period of 25 years for pump stations.

Collection system planning for piping and conduits will be based on ultimate buildout within the current UGB with considerations for existing and anticipated levels of I/I. If the UGB is expanded within the planning period, additional planning and analysis will be required for the areas that may be annexed.

6.1.2 Gravity Sewer Design

Collection systems should be designed considering natural ground slope, subsurface conditions, capacity requirements, minimum slope considerations, minimum flow velocities required to maintain solids suspension, and potential sulfide and odor generation. Whenever possible, gravity collection systems should be utilized for wastewater service rather than systems that require a pump station.

Collection systems should be designed for the ultimate build-out of a sewer basin, taking into account zoning and UGB limitations. This will ensure that the piping is adequate for practically any type and amount of development that may occur within the basin.

The minimum diameter of sewers should be 8-inches. Smaller sewers are difficult to clean or maintain using modern cleaning, TV-inspection, and repair equipment. Pipe diameter sizing should be based on anticipated flows and master planning, not minimum slope considerations.

Manholes should be spaced no more than 500 feet apart for sewers up to 24-inches in diameter. Manholes should also be constructed where sewer alignment, slope, or pipe size changes occur. To facilitate self cleaning, a “drop” or elevation change should occur from the inlet side of the manhole to the outlet and should be required to be incorporated into the manhole base. Flow channels in manholes should include a minimum 0.1-foot drop when the flow is straight through the manhole. If a manhole is constructed with a channel where the flow direction changes by 90-degrees with piping of the same size, the channel should include a base with a drop of 0.2-feet between the inlet and outlet piping runs.

Manholes should have a minimum inside diameter of 48-inches at the bottom and have a standard 23-inch manhole access opening and lid. Manholes located in areas where standing water is common should be constructed with a water tight frame and lid to reduce the inflow into the manhole.

Flat top manholes should be utilized for all manhole installations under 6-feet. Otherwise, standard eccentric cone type manholes should be used. New manholes in Coos Bay should not be provided with integrated ladders in the manhole sections.

Manholes with pipes entering the manhole with inverts two feet or more above the bottom of the manhole should be designed as a drop manhole. An outside drop manhole should be used for all inlets that are 4-inches in diameter or greater.

Minimum pipe slopes are established to ensure that flow velocities are high enough to provide a self-cleaning action for the gravity piping sections.

Slope is also an important design concern for avoiding hydrogen sulfide problems. Sewers with long, flat pipe runs tend to be prone to hydrogen sulfide generation due to long residence times, poor oxygen transfer, and deposition of solids in the pipe section. Current conventional design practice recommends that a minimum velocity of two feet per second (fps) be achieved regardless of pipe size to maintain a self-cleaning action in sanitary sewers. It is desirable to have a velocity of 3 fps or more whenever topography and existing conditions allow. Minimum pipe slope for service laterals should be 2-percent or ¼-inch drop per foot.

Standard methods of determining the slope for self-cleaning velocities are based on pipes flowing at least half-full. Where flows are expected to be less than half-full and adequate grade (topography) exists, a slope should be used that will provide velocities of three fps for full or half full pipes. In general, minimum pipe slopes should be established based on the information in Table 6.1.2..

Table 6.1.2 – Recommended Slopes for Gravity Sewers (ft/ft)
(Based on a Manning's 'n' of 0.013)

Nominal Pipe Diameter (in)	Minimum Slope (2 fps)	Recommended Slope (3 fps)
4	0.02	0.02
6	0.0060	0.0110
8	0.0040	0.0075
10	0.0028	.00056
12	0.0022	0.0044
14	0.0016	0.0035
15	0.0015	0.0033
16	0.0014	0.003
18	0.0012	0.0026
24	0.0008	0.0018
27	0.0007	0.0015
30	0.0006	0.0013
32	0.0005	0.0012
36	0.0005	0.0011

While the information in the table above provides the theoretical slopes to attain 2 fps or 3 fps for various pipe sizes, it is not usually considered practical to construct a gravity pipeline at a slope less than 0.2% (slope=0.002). Therefore, while larger diameter pipes (larger than 12-inch) could be placed at a flatter slope, practical application will result in pipes with higher capacities and flow velocities than if they were placed at the minimum slopes presented above.

6.1.3 Force Mains

Force mains for public pump stations should have a nominal diameter of at least 4-inches so that they are capable of passing larger solids that are pumped by the solids handling pump stations. In general, velocities of at least 3.5 fps are desirable in smaller force mains to help maintain a self-cleaning or scouring action on the inside of the pipes. Larger force mains should convey higher velocities, at least periodically. In no case should the velocity in a force main drop below 2.5 fps.

Very high velocities in a force main result in high friction losses and inefficient operations requiring larger pump motors and higher energy costs. Velocities above 8 fps are usually considered undesirable.

Proper force main design should also address transient or pressure surges due to sudden velocity changes, especially in long force mains.

Minimum flows required to obtain typical force main velocities are provided below for reference. It is important that a designer prepare a system curve for each force main design and consider all issues when recommending sizing for a new force main.

Table 6.1.3.1 – Minimum Force Main Flows (gpm)

Force Main Diameter (in)	Flow for 2.5 fps Velocity	Flow for 3.5 fps Velocity	Flow for 5.0 fps Velocity
3	55	77	110
4	98	137	196
6	220	308	441
8	392	548	783
10	612	857	1,224
12	881	1,234	1,762
14	1,200	1,679	2,399
16	1,567	2,193	3,133
18	1,983	2,776	3,966
24	3,525	4,935	7,050
36	7,932	11,104	15,863

In addition to correct sizing of the force mains based around proper cleansing velocities, the number of high points should be kept to a minimum as these will create a point for air and other gases to be trapped. Trapped gases can reduce a pipes capacity or cause a piping system to become plugged. Typically, a designer should include a means of releasing trapped air at high points through the use of a combination air/vacuum release valve. If it is determined that velocities are high enough to keep entrained air moving, air release systems may not be required.

Detention times in force mains should also be studied to ensure that sanitary fluids do not reside within the piping too long. If so, high levels of hydrogen sulfide and other gases can form in the sewer causing odor issues and other problems. This problem can be reduced by injecting air directly into the force main. The oxygen rich air will prevent the degradation of the sewage and the formation of the undesirable gases. Generally, if detention times in the force main exceed 35 minutes, an air injection system should be included.

6.1.4 Pump Stations

The correct design of pump (lift) stations is an important and critical element of any sanitary sewer collection system. Pump stations should be designed to handle the peak flows experienced by the system without bypassing or overflowing. The pump stations should also be designed so as not to increase the total sulfide generation potential of the collection system.

Contemporary design practices require some wetwell storage of wastewater plus retention in the force main, both of which tend to increase the potential for sulfide generation. In these cases, supplemental aeration must be provided to reduce the production of sulfide.

To minimize sulfide generation, wetwells should be sized to be as small as possible while still allowing for future growth. Consideration should be given to detention times, pump cycle times, and storage volumes when sizing the depth and diameter of the wetwell. Wetwell detention times of 30 minutes or less are recommended to avoid sulfide generation. When detention times in the pump station wetwell exceed 25 to 30 minutes, a system for control of sulfide generation and the accompanying odor and corrosion problems is recommended.

Pumps should be sized so that the station can handle the peak hourly flow rates with the largest pump in the station off line. Stations should be configured around duplex, triplex, or greater and consider all flow ranges when sizing the pumps and combinations of pumps in operation at any one time.

Pump stations should have provisions for redundant power generation equipment. This can be accomplished through a standby generation system housed at the station or through the use of trailer-mounted portable generator and manual transfer switch gear. Power outage frequency and duration must be considered in pump station design to ensure that overflows do not occur due to power outages.

Proper level controls and alarms capable of autodial should be included in each pump station. Redundant high wetwell level sensors or floats should be included as a backup to the regular level sensors.

Designs for pump stations should meet the latest DEQ requirements for pump station design and construction. A summary of the general design criteria for DEQ follows:

Design of the pump station shall include: (per Oregon Standards for Design and Construction of Wastewater Pump Stations, May 2001, Oregon Department of Environmental Quality.)

- A station with firm capacity to pump the peak hourly and peak instantaneous flows associated with the 5-year, 24-hour storm intensity of its tributary area, without overflows from the station or its collection system.
- A design consistent with EPA Class I reliability standards for mechanical and electrical components and alarms.
- A pumping system consisting of multiple pumps, with one spare pump sized for the largest series of same-capacity pumps to provide for system redundancy.
- Pumps with a minimum of five years' service history for a similar duty and size, unless otherwise approved by the Owner. To ensure a valid warranty, pumps shall either be supplied directly by the manufacturer, or by suppliers who are authorized and licensed by the manufacturer to provide manufacturer's warranty services for the pumps to be furnished.
- Inlet, station, and force main piping with all necessary pressure control and measurement features, surge protection systems, air-vacuum/release valves, isolation valves, couplings, odor control systems, and other appurtenances required for a complete and operable system.

- Mechanical systems for heating and ventilating as required by the selected station equipment, local climatic conditions, and applicable codes.
- Plumbing systems for potable water, wash down, and drainage, unless otherwise approved by the Owner.
- Appropriate sound attenuation for noise created by pumping, mechanical, or electrical systems, including a standby generator.
- Electrical systems for lighting, power, communications, security, control, and instrumentation. A motor control center is to be provided for motor starters, accessories, and devices. The motor control center shall provide an isolated, ultra-filtered power, 120 VAC section designed with separate branch circuits for microprocessor-based instrumentation, controls, etc.
- A secondary source of electrical power. Standby generators shall be of sufficient size to start and run the Firm Pumping Capacity of the station, along with all other associated electrical loads necessary to keep the station operational and functioning. At the Owner's discretion, a secondary power feeder from an independent substation may be required as a redundant Oregon Standards for Design and Construction of Wastewater Pump Stations Page 6 power source. With the Owner's approval, the requirement for standby power may be satisfied by providing a trailer-mounted generator and an emergency power connection with manual transfer switch meeting the Owner's specifications.
- A complete system of alarms and alarm telemetry to facilitate operation and maintenance of the station at all hours, including an autodialer or radio telemetry.
- Where required by the Owner, a design to allow remote monitoring of the station through a connection with a Supervisory Control and Data Acquisition (SCADA) system so the Owner can remotely control and monitor station activities. Programmable logic controllers and alarm telemetry must meet the Owner's preferences and standards.
- Structures of adequate size, with interior and exterior clearances to facilitate access for ease of operation and maintenance of all systems. Architectural aspects shall be subject to the Owner's approval.
- Site development including an access road and parking, security, lighting, drainage, signs, and landscaping meeting the Owner's requirements.

6.1.5 Pressure Sewers

Pressure sewer systems include individual pump stations on each parcel of property. Typical pump station equipment includes a grinder pump (GP) or a septic tank effluent pump (STEP). The advantage to a pressure sewer system is that they can generally be installed to provide sewer service independent of ground topology. Also, because the system is pressurized, they will not add any I/I flows to the system. Also, the pumping equipment and tankage generally become the property and responsibility of the sewer customer and not the City.

A STEP system typically includes a small pump and tank. STEP systems typically utilize a 1,000-gallon septic tank with an internal pump that conveys the liquid supernatant to the gravity collection system. Solids remain in the tank and are partially digested through natural processes. Because the effluent experiences some pretreatment and only the supernatant is pumped into the collection system, the strength of the effluent is less than that of GP systems (STEP effluent: BOD_5 100 to 150 mg/L and TSS of 50 to 70 mg/L).

The force main for a single pressure sewer system is much smaller than force mains for large pump stations (1 to 1.5 inch diameter). These small force mains are usually installed in relatively shallow trenches using polyvinyl chloride (PVC) or high density polyethylene (HDPE) piping. Cleanouts and check valves are utilized to prevent backflow from the collection system and provide access for flushing.

GP systems utilize smaller holding tanks and a pumping system that grinds all solids into small enough pieces to be pumped into the collection system. GP systems should be designed so that a pipe velocity of 3 to 5 fps is achieved at least once every day. Because all solids are ground up and pumped as part of the effluent from a GP systems, the strength of the effluent is typically twice that of a STEP system (i.e. BOD and TSS of 350 mg/L).

STEP systems require pump out of system tanks at 3 to 5 year intervals. Owing to their tendency to accumulate grease in the tanks, GP units are often pumped on an annual basis for the purposes of maintenance and cleaning.

As is the case with large pump stations, the City should avoid allowing pressure sewer systems whenever possible. Gravity sewers should be installed whenever practical.

6.2 Basis for Cost Estimate

The construction cost estimates presented in this Plan will include a number of basic components, each of which is discussed in the following sections. The estimates presented are preliminary and are based on the level of detail and planning presented in the Master Plan. As projects proceed and as site specific and new information becomes available, the estimates should be reviewed and updated.

6.2.1 Construction Costs

Construction costs are estimated using a combination of engineering experience with similar past projects, material cost data provided by equipment suppliers, and material and labor cost estimates and indexes published by such sources as the Engineering News Record and others.

Whenever possible, existing as-built drawings were studied to determine the scope of work required for constructing and implementing improvements to existing facilities. When appropriate, preliminary layouts were developed and utilized when preparing construction cost estimates.

Future changes in the cost of labor, equipment and materials will justify comparable changes in the cost estimates provided in this Plan. For this reason, common engineering practice is to tie planning cost estimates to a construction index which is updated regularly in response to changes in the economy and the construction marketplace.

The Engineering News Record (ENR) construction cost index is the most commonly used for engineering planning and estimating purposes. The ENR index is based on a beginning value of 100 established in the year 1913. Average yearly values for the past 16 years are summarized below in Table 6.2.1.

Table 6.2.1 – ENR Index 1990 to 2004

YEAR	INDEX	% CHANGE/YR
1990	4732	2.54
1991	4835	2.18
1992	4985	3.10
1993	5210	4.51
1994	5408	3.80
1995	5471	1.16
1996	5620	2.72
1997	5825	3.65
1998	5920	1.63
1999	6059	2.35
2000	6221	2.67
2001	6343	1.96
2002	6538	3.07
2003	6694	2.39
2004	7308	9.17
2005 (September)	7518	-
2005 (December)	7647	4.64
	Average Annual Change =	3.22

Cost estimates prepared in this plan shall be based on September 2005 index. Future costs should be compared to a baseline ENR Index value of 7,518.

If specific ENR index figures are not available, the historical ENR growth pattern has been around 3% per year.

6.2.2 Contingencies

Contingencies are a prudent inclusion in planning cost estimates to account for unforeseen circumstances that may increase costs. For the purposes of this planning document and the preliminary cost estimates provided, a contingency amount between 15 and 25 percent of the estimated construction cost is used depending on the available information, number of unknowns, and other potential unknown factors that could affect the final project costs. After design work is completed for a project and updated construction cost estimates are completed, contingency values are typically reduced to 10% for estimates used immediately prior to the bidding or construction phase.

While efforts have been made to provide costs for all facets of the proposed projects, it is appropriate that allowances be made for variations in the final design, bidding market conditions, adverse construction conditions, unanticipated specialized investigations and studies, and other complications which cannot be foreseen at this time but may tend to increase the final costs of the proposed projects.

6.2.3 Engineering

The cost of engineering services for major capital improvement projects typically include surveying, foundation explorations, preparation of contract documents and project drawings, development of construction and material specifications, bidding services, construction management, inspection, construction staking, start up services, and the preparation of operation and maintenance manuals.

Depending on the size and type of the project and the required scope of engineering services, engineering costs may range between 18 to 25 percent.

In some cases, additional engineering or technical services may be required such as flow studies, predesign reports, environmental reports or others. These additional services would typically be in addition to the regular engineering services covering surveying, design, bidding, construction management, and construction inspection.

For the purposes of conservative planning, the cost estimates prepared in this Master Plan assume that all projects will require a relatively comprehensive and complete scope of engineering services. Therefore, an engineering cost of 20% is assumed for nearly all projects. In the future, if it is determined that some projects will not warrant this level of service, the cost for engineering on those projects may be reduced. On the other hand, a smaller and less costly project to construct often warrants a higher engineering cost percentage due to the base overhead costs required to complete any project.

6.2.4 Legal and Administrative

Legal and administrative costs include such items as legal counsel review of contracts and contract documents, costs related to obtaining and recording easements and permits, additional city administration expenses occurring during a project, and other miscellaneous legal and administrative costs.

This cost category also includes potential costs for internal budget planning, grant administration, liaison costs, interest on interim loans financing, and other non-construction costs related to the projects.

A cost equal to 3% of the estimated construction cost is used for the estimates in this Plan.

6.2.5 Land Acquisition Costs

Some projects will require the acquisition of land for placement of new piping, pump stations, or other system components when available property is not available on an existing site or within an existing public right-of-way. In some cases, a property owner will require reimbursement for providing an easement across his/her property.

An effort was made in the plan to anticipate and identify which projects would require land or easement acquisition. For these projects, costs have been included for the purchase of additional properties for the improvements.

Property costs can vary depending on location, market volatility, owner’s willingness to sell, and many other factors. In some cases, the City may have to condemn property when an owner is unwilling to sell and no alternative site is available. If needed, the condemnation process also has significant costs associated with it.

When a project is undertaken, the City should review the potential need for land acquisition. If it is determined that additional land is required, the costs for the acquisition of that land should be reviewed and updated based on the land cost climate at the time.

6.2.6 Other Studies and Special Investigations

In some cases, predesign reports, environmental reports, special flow studies, and other investigations may be required prior to beginning actual design activities for a project. These studies may be driven by funding or regulatory agencies or by special needs of a specific project.

An effort has been made to identify projects where these special studies will most likely be required. However, the need for these investigations and studies will be confirmed on a case by case basis throughout the planning period.

7.0 Development and Evaluation of Alternatives

7.1 Pump Station Improvement Alternatives

The City owns and operates 19 major public sanitary sewer pump stations that serve the various collection basins in the two separate sanitary sewer service areas. The City also owns and operates four smaller, residential stations that serve restrooms at City parks or other limited service areas. The pump stations vary in capacity, style, condition, age, and other qualities. As a result, each pump station has its own deficiencies and needs.

The following sections will provide a discussion of the improvement alternatives for each pump station in the system. An effort will be made to discuss the alternatives as well as provide a recommendation for each station. Project summaries, prioritization, and a discussion of potential implementation strategies are provides in Section 8 of this Plan.

When analyzing pump stations for capacity, the City had little or no flow data available to consider as there are little or no flow meters operating in the system with the exception of the meters located at the plants. While the City owns a pair of portable flow meters, they have not developed a plan for collection of flow data within the various basins and for their many pump stations.

While pump run times are regularly collected, they are only recorded on a weekly basis. Furthermore, many of the pump stations operate with VFD's (variable frequency drives) and no effort has been made to record or identify the frequency that the VFD's operate under during a week of recorded run times.

Without more precise data on peak flows, an effort was made to evaluate and size future pump station capacity using a combination of the techniques covered in Section 5.4, empirical evidence, operations staff opinions, and professional experience. In every case, prior to a major station upgrade, the City should work to gather flow data or perform a flow study for a specific pump station to ensure that the proposed improvements are adequately sized. When appropriate, a flow study may be included as part of the predesign effort.

Many funding and regulatory agencies may require an environmental report to be prepared as part of the funding requirements. While the scope or cost of these reports are difficult to predict, an effort was made to include funds in each estimate where it is likely that an environmental report may be required.

The following project alternatives have been developed for each pump station in the system:

7.1.1 Pump Station No. 1

Pump Station No 1 has no apparent capacity deficiencies and only requires operational upgrades.

Specifically, improvements to Pump Station 1 should include:

- Roof improvements to solve leakage issues.
- Enclose the pumps to reduce noise complaints from local residents and businesses.
- Replace the existing backup power generator as parts and maintenance of the old generator have become difficult to obtain. Replace automatic transfer switch and related equipment.

- Building improvements including correcting deficiencies with doors, windows, insulation, and other building elements.

Also, as pumps wear out and require replacement, the City should replace the pumps with new equipment that is superior in operation and provides for improved maintenance, operations costs, and parts availability. Because Pump Station 1 is the most critical and largest station in the entire wastewater system, the City should budget to be able to replace or rebuild at least one of the four large pumps on an annual basis.

A new flow meter is not required for this station as flows are metered at the wastewater plant through a combined meter that measures flows from Pump Sta. 1 and Pump Sta. 3. Pump Sta. 3 also has an individual flow meter. Therefore, flows for Pump Sta. 1 can be determined algebraically by subtracting the flows for Station 3 from the combined flow data.

Estimated improvement costs for Pump Station 1 are as follows:

Table 7.1.1 – Pump Station 1 Improvement Costs
Project No. PS1 (Improvement Map No. 12)

Pump Station No. 1 Improvements					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$38,000.00	$38,000.00
2	Construction Facilities/Temporary Systems	ls	1	$25,000.00	$25,000.00
3	Roof Improvements to existing building	ls	1	$20,000.00	$20,000.00
4	Enclose pump area for sound attenuation	sf	800	$200.00	$160,000.00
5	Onsite Power Generation Equipment	ls	1	$100,000.00	$100,000.00
6	Building Improvements -door, windows, etc.	ls	1	$15,000.00	$15,000.00
		Construction Total			$358,000.00
		Contingency (20%)			$71,600.00
		Subtotal			$429,600.00
		Engineering/Arch. (20%)			$85,920.00
		Administrative costs (3%)			$12,888.00
		Total Project Costs			**$528,408.00**

7.1.2 Pump Station No. 2

Like Pump Station No. 1, pump station No. 2 has no apparent major or capacity-related deficiencies. Issues related to the flat roof, noise complaints, aging electrical and power generation equipment and general operational issues will necessitate improvements to the station during the planning period.

It is also recommended that a flow meter be installed on the force main for the pump station so that flow data can be recorded for future planning efforts.

Specific improvements required for Pump Station 2 include:

- Roof improvements to solve leakage issues.
- Improved insulation and sound attenuation measures to reduce noise complaints from local residents and businesses.
- Replace the existing backup power generator as parts and maintenance of the old generator have become difficult to obtain.

- Building improvements including correcting deficiencies with doors, windows, insulation, and other building elements.
- Flow meter and integration into the control system.

Also, as pumps wear out and require replacement, the City should replace the pumps with new equipment that is superior in operation and provides for improved maintenance, operations costs, and parts availability. Because Pump Station 2 is the second-most critical and second largest station in the entire wastewater system, the City should budget to be able to replace or rebuild at least one of the three large pumps on an annual basis. If a rebuild is not required, the City will have funds available for other maintenance.

Estimated improvement costs for Pump Station 2 are as follows:

Table 7.1.2 – Pump Station 2 Improvement Costs
Project PS2 (Improvement Map No. 14)

Pump Station No. 2 Improvements					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$30,000.00	$30,000.00
2	Construction Facilities/Temporary Systems	ls	1	$17,000.00	$17,000.00
3	Roof Improvements to existing building	ls	1	$25,000.00	$25,000.00
4	Noise Control Improvements	ls	1	$20,000.00	$20,000.00
5	Onsite Power Generation Equipment	ls	1	$65,000.00	$65,000.00
6	Flow meter and integration into control system	ls	1	$100,000.00	$100,000.00
7	Building improvements-doors, windows, etc.	ls	1	$15,000.00	$15,000.00
		Construction Total			$272,000.00
		Contingency (20%)			$54,400.00
		Subtotal			$326,400.00
		Engineering/Arch. (20%)			$65,280.00
		Administrative costs (3%)			$9,792.00
		Total Project Costs			**$401,472.00**

7.1.3 Pump Station No. 3

As Pump Station 3 was constructed in 2005-2006, no deficiencies are noted for this station and no new improvements are recommended.

7.1.4 Pump Station No. 4

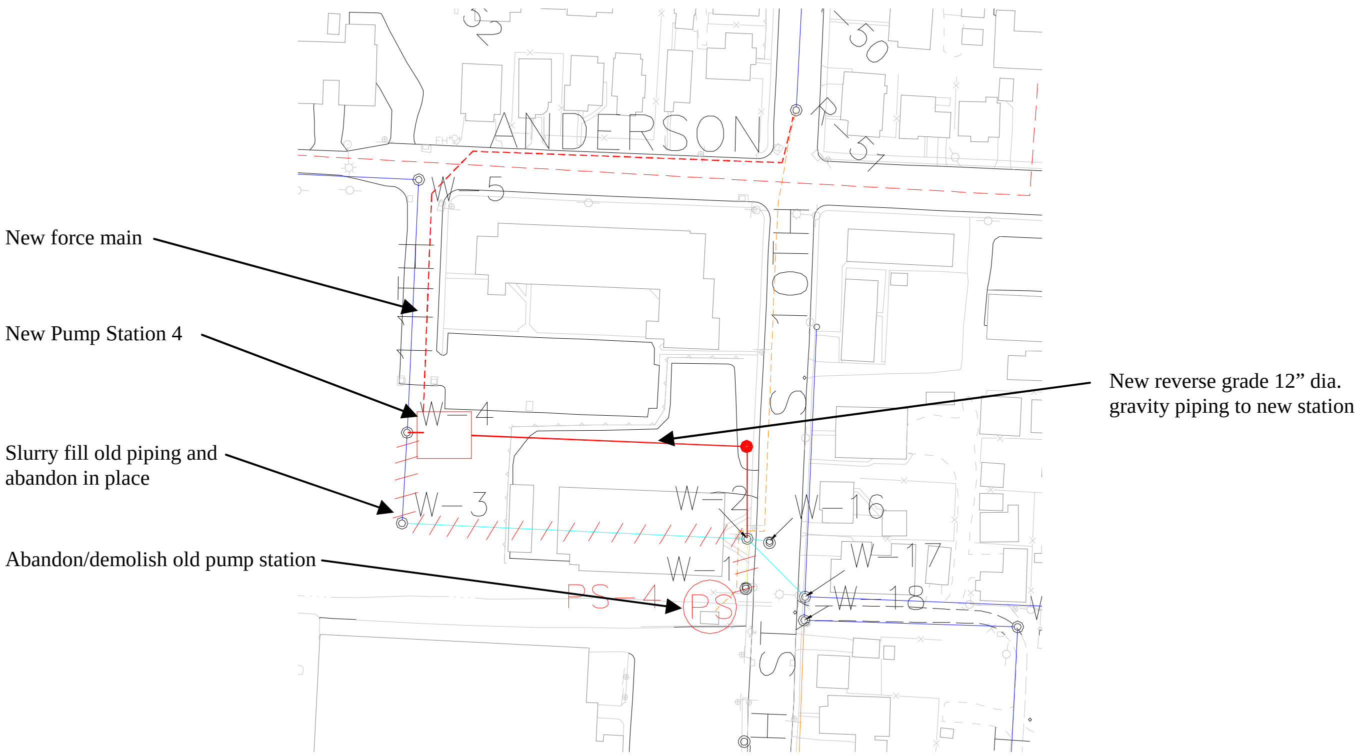
Along with Pump Station 10, Pump Station No. 4 is in the most immediate need of attention and improvement. According to operations staff, the station has inadequate capacity, the pumps are difficult to operate and maintain, the generator is old and difficult to obtain parts for, and the building is in need of repair.

The Pump Station is located immediately adjacent to a salmon-bearing stream on one side and Blossum Gulch School on the other. The pump station was constructed with a 5-foot diameter wetwell which would not provide enough room for the installation of new submersible pumps in the station. There would also be inadequate room for the new vaults that would be required to house valves, fittings, and meters.

While it is possible that larger suction lift pumps could be installed in the cramped pump building, DEQ recommends against the use of suction pumps on new or upgraded pump stations.

The site of the existing pump station does not allow adequate space for the type of expansion that would be required at Pump Station 4. Also, the proximity of the station to the sensitive Blossum Gulch Creek makes expansion of the station difficult.

Recently, the City developed a project to replace a section of piping W-2 to W-3 which currently flows beneath a building. One option for the replacement of the pump station would be to construct the new gravity piping in the opposite flow direction and direct the flow to the vacant property located to the rear of the buildings facing 10th Street. A description of the proposed project is shown in the figure below.



Relocation of the existing pump station would provide the required room for the new pump station as well as eliminating the problems associated with the existing piping under the building between W-3 and W-2 and would move the station away from the creek.

The recommended improvement for Pump Station 4 is to relocate the station as shown in the figure above. The new pump station should include the following components:

- A triplex station with a rated pumping capacity of 500 gpm. To be conservative, as well as allow for the potential for additional or unanticipated growth in the basin, each pump should be sized to handle 500 gpm. The City may wish to build the station capable of housing three pumps but only install two pumps when the station is first put online.
- The new station should include a valve and meter vault, on-site backup power generation equipment, and a small control building.

- Construct a new 8-inch force main to the outlet manhole. A history of breaks and the location of the existing force main in 10th Street warrants the replacement of the main and relocation out of the busy 10th Street right-of-way.
- Construct new gravity piping and manhole to reverse flow to new station.
- Abandonment and demolition of the existing piping between W4 and the existing Pump Station 4.

A preliminary cost estimate for the Pump Station No. 4 improvement project is provided below:

Table 7.1.4 – Pump Station No. 4 Improvements-Preliminary Cost Estimate
Project PS4 (Improvement Map No. 19)

Pump Station No. 4 Improvements					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$63,000.00	$63,000.00
2	Construction Facilities/Temporary Systems	ls	1	$38,000.00	$38,000.00
3	Demolition and slurry fill of old piping	ls	1	$5,000.00	$5,000.00
4	New 12-inch PVC Gravity Piping ,laterals, etc.	lf	375	$120.00	$45,000.00
5	New Manhole	ea	1	$5,000.00	$5,000.00
6	Demolition of old Pump Station	ls	1	$18,000.00	$18,000.00
7	New Triplex Wetwell	ls	1	$55,000.00	$55,000.00
8	New Duplex (plus 1 future-triplex) pumping equipment	ls	1	$45,000.00	$45,000.00
9	New Control Building	sf	300	$250.00	$75,000.00
10	New Controls/VFD's, Telemetry	ls	1	$35,000.00	$35,000.00
11	Electrical Improvements	ls	1	$80,000.00	$80,000.00
12	Valve and Meter Vault	ls	1	$45,000.00	$45,000.00
13	New On-Site Power Generation Equipment	ls	1	$40,000.00	$40,000.00
14	New 8-inch Force Main	lf	550	$65.00	$35,750.00
15	Site work, paving, landscaping, etc.	ls	1	$20,000.00	$20,000.00
		Construction Total			$604,750.00
		Contingency (20%)			$120,950.00
		Subtotal			$725,700.00
		Engineering (20%)			$145,140.00
		Flow Study			$8,000.00
		Predesign Report			$10,000.00
		Environmental Report			$20,000.00
		Administrative costs (3%)			$21,771.00
		Total Project Costs			**$930,611.00**

The above cost estimate does not include costs for land acquisition.

7.1.5 Pump Station No. 5

Pump Station No. 5 is among the stations requiring the most immediate attention due to major deficiencies and capacity-related operational problems.

Because there is available property, improvements for Pump Station 5 should include the construction of a new wetwell and vaults for a new submersible pumping station. The existing station can provide pumping service while the new station is constructed on an adjacent site.

Upgrades to Pump Station No. 5 should include the following components:

- New duplex, submersible pumping station capable of operating at a design rate of 500 gpm at 125' TDH.
- Assuming the material condition of the existing force main is adequate, the existing force main can be reused to convey the flows to the discharge manhole.
- New valve and meter vaults and accessories.
- New controls, electronics, and backup power generation equipment.
- Construction of a new control building to house controls, electronics, backup power generation equipment, and other station accessories.

A preliminary cost estimate for the Pump Station No. 5 improvement project is provided below:

Table 7.1.5 – Pump Station No. 5 Improvements-Preliminary Cost Estimate
Project No. PS5 (Improvement Map No. 10)

Pump Station No. 5 Improvements					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$45,000.00	$45,000.00
2	Construction Facilities/Temporary Systems	ls	1	$35,000.00	$35,000.00
3	Demolition of old station/conversion to manhole	ls	1	$20,000.00	$20,000.00
4	New wet well	ls	1	$40,000.00	$40,000.00
5	New pump control building & generator housing	sf	300	$250.00	$75,000.00
6	New duplex pump equipment	ls	1	$35,000.00	$35,000.00
7	Control Panel, VFD's, Telemetry	ls	1	$30,000.00	$30,000.00
8	On-site power generation equipment	ls	1	$40,000.00	$40,000.00
9	Site work, paving, landscaping	ls	1	$20,000.00	$20,000.00
10	Electrical Improvements	ls	1	$75,000.00	$75,000.00
11	Site Piping Improvements/gravity piping	ls	1	$20,000.00	$20,000.00
12	Valve and meter vault and piping & tie-in	ls	1	$45,000.00	$45,000.00
		Construction Total			$480,000.00
		Contingency (20%)			$96,000.00
		Subtotal			$576,000.00
		Engineering (20%)			$115,200.00
		Flow Study			$8,000.00
		Predesign Report			$10,000.00
		Environmental Report			$20,000.00
		Land Acquisition Costs			$45,000.00
		Administrative costs (3%)			$17,280.00
		Total Project Costs			**$791,480.00**

7.1.6 Pump Station No. 6

Pump Station No. 6 has relatively few operating and maintenance deficiencies associated with the station. Like other stations in Coos Bay, the flat roof and age of the facility will require some investment during the planning period.

Specific improvements recommended for Pump Station No. 6 include:

- Roofing improvements
- Replacement of on-site power generation equipment
- Installation of flow meter and integration of metering into control system.

A preliminary cost estimate for the Pump Station No. 6 improvement project is provided below:

Table 7.1.6 – Pump Station No. 6 Improvements-Preliminary Cost Estimate
Project PS6 (Improvement Map No. 14)

Pump Station No. 6 Improvements					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$15,000.00	$15,000.00
2	Construction Facilities/Temporary Systems	ls	1	$10,000.00	$10,000.00
3	Roof Improvements to existing building	ls	1	$20,000.00	$20,000.00
4	Onsite Power Generation Equipment	ls	1	$45,000.00	$45,000.00
5	Installation of meter, vault, and integration	ls	1	$40,000.00	$40,000.00
		Construction Total			$130,000.00
		Contingency (20%)			$26,000.00
		Subtotal			$156,000.00
		Engineering/Arch. (20%)			$31,200.00
		Administrative costs (3%)			$4,680.00
		Total Project Costs			**$191,880.00**

7.1.7 Pump Station No. 7

No deficiencies were noted and no projects were developed for Pump Station 7.

7.1.8 Pump Station No. 8

Pump Station No. 8 will require significant improvements within the planning period. The existing station utilizes suction lift pumps and a wetwell located within the existing building.

As the City wishes to eliminate all suction lift stations, Station No 8 should be improved to a submersible station by installing submersible pumps in the existing wetwell and station or by constructing a new wetwell adjacent to the existing control building. If pumps and controls are to be placed within the existing building, electrical code requirements for intrinsically safe wiring and explosion-proof components will be required at a greater cost than if the pumps were located in a wetwell that is outside of the building.

Alternatives have been developed for constructing a new wetwell or upgrading the existing station with "indoor" submersibles and accessories to meet the electrical code requirements. Specific details for the improvements recommended for Pump Station No. 8 are as follows:

- New duplex pumping equipment operating at 425 gpm and 50' TDH.
- Roofing, doors, and structural improvements on the existing control building.
- New on-site power generation equipment.
- Accessories and other improvements required for each improvement alternative.
- Installation of a flow meter and integration into the control system.

A preliminary cost estimate for the Pump Station No. 8 improvement project is provided below:

Table 7.1.8a – Pump Station No. 8 Improvements-Preliminary Cost Estimate – Option A
Project No. PS8A (Improvement Map No. 6)

Pump Station No. 8 Improvements - Option A - New Wet well					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$40,000.00	$40,000.00
2	Construction Facilities/Temporary Systems	ls	1	$32,500.00	$32,500.00
3	Demolition of old station/conversion to manhole	ls	1	$20,000.00	$20,000.00
4	New wet well	ls	1	$40,000.00	$40,000.00
5	New duplex pump equipment	ls	1	$25,000.00	$25,000.00
6	Control Panel, VFD's, Telemetry	ls	1	$25,000.00	$25,000.00
7	On-site power generation equipment	ls	1	$40,000.00	$40,000.00
8	Site work, paving, landscaping	ls	1	$20,000.00	$20,000.00
9	Electrical Improvements	ls	1	$80,000.00	$80,000.00
10	Site Piping Improvements/gravity piping	ls	1	$20,000.00	$20,000.00
11	Roofing Improvements and repairs to existing building	ls	1	$35,000.00	$35,000.00
12	Valve and meter vault and piping & tie-in	ls	1	$40,000.00	$40,000.00
		Construction Total			$417,500.00
		Contingency (20%)			$83,500.00
		Subtotal			$501,000.00
		Engineering (20%)			$100,200.00
		Flow Study			$8,000.00
		Predesign Report			$10,000.00
		Environmental Report			$20,000.00
		Administrative costs (3%)			$15,030.00
		Total Project Costs			**$654,230.00**

The following option was developed with the idea that a new wetwell would not be constructed but electrical improvements would be required to meet electrical and explosion proof requirements.

Table 7.1.8b – Pump Station No. 8 Improvements-Preliminary Cost Estimate – Option B Project No. PS8B (Improvement Map No. 6)

Pump Station No. 8 Improvements - Option A - Explosion Proof Electronics					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$40,000.00	$40,000.00
2	Construction Facilities/Temporary Systems	ls	1	$33,000.00	$33,000.00
4	Bypass Pumping	ls	1	$15,000.00	$15,000.00
5	New duplex pump equipment	ls	1	$30,000.00	$30,000.00
6	Control Panel, VFD's, Telemetry-Explosion Proof	ls	1	$30,000.00	$30,000.00
7	On-site power generation equipment	ls	1	$45,000.00	$45,000.00
8	Site work, paving, landscaping	ls	1	$15,000.00	$15,000.00
9	Electrical Improvements - Intrinsically Safe	ls	1	$100,000.00	$100,000.00
10	Roofing Improvements and repairs to existing building	ls	1	$35,000.00	$35,000.00
11	Valve and meter vault and piping & tie-in	ls	1	$40,000.00	$40,000.00
		Construction Total			$383,000.00
		Contingency (20%)			$76,600.00
		Subtotal			$459,600.00
		Engineering (20%)			$91,920.00
		Flow Study			$8,000.00
		Predesign Report			$10,000.00
		Environmental Report			$20,000.00
		Administrative costs (3%)			$13,788.00
		Total Project Costs			**$603,308.00**

7.1.9 Pump Station No. 9

While Pump Station 9 is in relatively good condition, it will require improvement during the planning period. The dry pit/wet pit pumps should be replaced with submersibles in the wetwell and the dry pit filled in. Specific improvements should include the following:

- New submersible pumps in the wet well sized for 250 gpm at 43' TDH.
- New controls, electronics, and telemetry.
- New standby power generation equipment.
- Building improvements including roofing, hardware, and some structural improvements.
- Roadway and access improvements.
- Metering equipment and integration into control system.

A preliminary cost estimate for the Pump Station No. 9 improvement project is provided below:

**Table 7.1.9 – Pump Station No. 9 Improvements-Preliminary Cost Estimate
Project No. PS9 (Improvement Map No. 16)**

Pump Station No. 9 Improvements					
Item No.	Description	Units	Quantity	Unit Cost	Total Cost
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$25,000.00	$25,000.00
2	Construction Facilities/Temporary Systems	ls	1	$16,000.00	$16,000.00
3	Demolition of Old Dry-Pit	ls	1	$15,000.00	$15,000.00
4	New duplex pump equipment	ls	1	$30,000.00	$30,000.00
5	Control Panel, VFD's, Telemetry	ls	1	$30,000.00	$30,000.00
6	On-site power generation equipment	ls	1	$35,000.00	$35,000.00
7	Site work, paving, landscaping	ls	1	$25,000.00	$25,000.00
8	Electrical Improvements	ls	1	$60,000.00	$60,000.00
9	Roofing Improvements and repairs to existing building	ls	1	$15,000.00	$15,000.00
10	Valve and meter vault and piping & tie-in	ls	1	$40,000.00	$40,000.00
		Construction Total			$291,000.00
		Contingency (20%)			$58,200.00
		Subtotal			$349,200.00
		Engineering (20%)			$69,840.00
		Flow Study			$8,000.00
		Predesign Report			$10,000.00
		Environmental Report			$20,000.00
		Administrative costs (3%)			$10,476.00
		Total Project Costs			**$467,516.00**

7.1.10 Pump Station No. 10

Pump Station No. 10 is among the top few pump stations requiring upgrades and improvements. Station 10 has experienced problems with the pumps and obtaining replacement and spare parts. The on-site generation equipment has also been problematic. Force main pressures have also caused pipe breaks in the drywell causing flooding within the station.

The station is sited on a very small parcel with little or no room to expand the footprint of the pump station. In fact, at the time of the preparation of this plan, the City did not yet possess an easement for accessing the property by entering along Woodland Drive. It also appears that an easement may be required to access the site from Thompson Road.

One option (Option A) for upgrading the pumps and solving the spare parts/replacement parts issue is to remove the existing close-coupled pumps and install submersible pumps in the dry pit. Rather than being installed and pumping from the wet well, the submersible pumps are hard-piped into the existing piping and are accessed through the dry pit for maintenance or service. The drawback to installing submersibles in the dry pit is that the equipment will still be located in a confined space area. This will require harnesses, gas-detection, and other confined space entry precautions.

A second option (Option B) is to install submersible pumps in the wet well and fill and abandon the dry pit portion of the existing station. The existing control room can be reused as house controls and electronics for the new submersible pumps. In addition to the pumps, a new valve and meter vault and interconnection to the existing force main would be required. Under this option, the existing dry pit would be filled and abandoned in place. Access to the pumps would be through a vault lid and pump hoist, thus eliminating the confined space entry issues.

Regardless of the option selected, the improvements to Pump Station 10 should include the following:

- A new duplex pump system with submersible type pumps in either the wet pit or dry pit arrangement. Sizing of the pumps is difficult as no flow data information is available. The existing pumps in the station are rated at 500-gpm each. Due to potential growth in the basins served by Pump Station 10, it is recommended that the new pumps be sized to handle 1,000-gpm each.
- New controls, electronics, alarms, etc. to support new equipment.
- Upgrade roof to eliminate leak issues caused by the aging flat roof.
- Install a new generator and automatic transfer switch to provide emergency standby power.
- Acquire necessary property or utility easement to legally access the site for maintenance and operation of the station.

In addition to improvements at the station, the existing 10-inch force main should be scheduled for replacement due to the high pressures in the old AC piping and a history of pipe breaks. A project to upsize the pipe should incorporate PVC or HDPE piping into the new force main to increase the resiliency of the force main.

Estimates for each of the two options as well as the force main project are provided below:

Table 7.1.10.a – Pump Station 10 Improvements – Option A – Dry Pit
Project No. PS10A (Improvement Map No. 8)

Pump Station No. 10 Improvements - Option A - Dry Pit					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$32,000.00	$32,000.00
2	Construction Facilities/Temporary Systems	ls	1	$19,000.00	$19,000.00
3	New On-site Power Generation Equipment & ATS	ls	1	$45,000.00	$45,000.00
4	Roofing Improvements & Building Improvements	ls	1	$25,000.00	$25,000.00
5	New Duplex Pumping Equipment in dry configuration	ls	1	$75,000.00	$75,000.00
6	New meter and vault and integration into controls	ls	1	$40,000.00	$40,000.00
7	Control panel, VFD, Telemetry upgrades	ls	1	$30,000.00	$30,000.00
8	Electrical Updates	ls	1	$75,000.00	$75,000.00
		Construction Total			$341,000.00
		Contingency (20%)			$68,200.00
		Subtotal			$409,200.00
		Engineering (20%)			$81,840.00
		Flow Study			$8,000.00
		Predesign Report			$10,000.00
		Administration (3%)			$12,276.00
		Total Project Costs			**$521,316.00**

Table 7.1.10.b – Pump Station 10 Improvements – Option B – Wet Well Project No. PS10B (Improvement Map No. 8)

Pump Station No. 10 Improvements - Option B - Wet Well					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$40,000.00	$40,000.00
2	Construction Facilities/Temporary Systems	ls	1	$25,000.00	$25,000.00
3	Demolition and slurry fill of dry pit	ls	1	$15,000.00	$15,000.00
4	New duplex pumping equipment	ls	1	$90,000.00	$90,000.00
5	Controls, VFD's, telemetry	ls	1	$30,000.00	$30,000.00
6	Wetwell improvements, vault lid, etc.	ls	1	$25,000.00	$25,000.00
7	Roofing Improvements & Building Improvements	ls	1	$20,000.00	$20,000.00
8	Electrical Improvements	ls	1	$75,000.00	$75,000.00
9	Valve and Meter Vault and tie-in	ls	1	$40,000.00	$40,000.00
10	New On-Site Generation Equipment	ls	1	$45,000.00	$45,000.00
11	Sitework and Landscaping	ls	1	$7,500.00	$7,500.00
		Construction Total			$412,500.00
		Contingency (20%)			$82,500.00
		Subtotal			$495,000.00
		Engineering (20%)			$99,000.00
		Flow Study			$8,000.00
		Predesign Report			$10,000.00
		Environmental Report			$20,000.00
		Land Acquisition Costs			$50,000.00
		Administration (3%)			$14,850.00
		Total Project Costs			**$696,850.00**

The major factors separating the two options are the City's desire to eliminate confined space entry issues, convert all stations to submersible solids-handling type stations, and ultimately, the cost of the improvements.

Table 7.1.10.c– Pump Station 10 Improvements – Force Main Project Project No. PS10C (Improvement Map No. 9)

Pump Station No. 10 Improvements - Project C - Force Main					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$45,000.00	$45,000.00
2	Construction Facilities/Temporary Systems	ls	1	$40,000.00	$40,000.00
3	New 12-inch PVC/HDPE force main	lf	3650	$90.00	$328,500.00
4	Tie ins, manhole connections, fittings, etc.	ls	1	$20,000.00	$20,000.00
		Construction Total			$433,500.00
		Contingency (20%)			$86,700.00
		Subtotal			$520,200.00
		Engineering (20%)			$104,040.00
		Predesign Report			$3,500.00
		Environmental Report			$10,000.00
		Administration (3%)			$15,606.00
		Total Project Costs			**$653,346.00**

Pump Station No. 11: Note: Pump Station 11 is a storm pump station that is discussed in the City's Stormwater Master Plan (Dyer Partnership, 2004).

7.1.11 Pump Station No. 12

Pump Station No. 12 is in relatively good condition and has no serious deficiencies or capacity issues. However, should significant development take place within Basin I which is served by the station, it will require a major upgrade to satisfy the development demand.

Because the existing station is a small submersible station, a significant upgrade of capacity will most likely require a new pump station be constructed on adjacent property. This will allow a larger wetwell to be installed and a triplex equipment package utilized to provide expanded versatility and flexibility to respond to phased development.

Included within the recommendations for a major expansion to Pump Station 12 are the following:

- New triplex pumping station with new control building. The pumps should be sized for 600 gpm each at 65' TDH for a firm pumping capacity of 1,200 gpm.
- New onsite power generation equipment.
- New 10" force main.
- Meter vault and integration into the collection system.

Estimates for the pump station and force main project for Pump Station 12 are provided below:

Table 7.1.11 – Pump Station 12 Improvements
Project No. PS12 (Improvement Map No. 7)

Item No.	Description	Units	Quantity	Unit Cost	Total Cost
Pump Station No. 12 Improvements					
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$60,000.00	$60,000.00
2	Construction Facilities/Temporary Systems	ls	1	$35,000.00	$35,000.00
3	Demolition of old station/conversion to manhole	ls	1	$20,000.00	$20,000.00
4	New wet well	ls	1	$45,000.00	$45,000.00
5	New pump control building & generator housing	sf	300	$250.00	$75,000.00
6	New triplex pump equipment	ls	1	$60,000.00	$60,000.00
7	Control Panel, VFD's, Telemetry	ls	1	$30,000.00	$30,000.00
8	On-site power generation equipment	ls	1	$45,000.00	$45,000.00
9	Site work, paving, landscaping	ls	1	$30,000.00	$30,000.00
10	Electrical Improvements	ls	1	$75,000.00	$75,000.00
11	Site Piping Improvements/gravity piping	ls	1	$25,000.00	$25,000.00
12	Valve and meter vault and piping & tie-in	ls	1	$40,000.00	$40,000.00
13	New 10" Force Main	lf	900	$80.00	$72,000.00
		Construction Total			$612,000.00
		Contingency (20%)			$122,400.00
		Subtotal			$734,400.00
		Engineering (20%)			$146,880.00
		Flow Study			$8,000.00
		Predesign Report			$10,000.00
		Environmental Report			$20,000.00
		Land Acquisition Costs			$45,000.00
		Administrative costs (3%)			$22,032.00
		Total Project Costs			**$986,312.00**

7.1.12 Pump Station No. 13

Pump Station No. 13 had no apparent deficiencies at the time this planning effort was completed. However, should significant development take place in Basin I or expansion of developable property in Basins K and Q, the pump station will likely require an upgrade to increase station capacity.

The large wetwell and many of the existing systems should be reusable with only the pumps and electronics requiring upsizing.

A major upgrade to Pump Station 13 should include the following:

- New duplex pumps and accessories sized for a flow rate of 900 gpm at 100’ TDH with all required accessories.
- New controls and electronics.
- Replacement of the onsite power generation system.
- New 10” force main to discharge
- Flow meter, vault, and integration into controls.

Estimates for the pump station and force main project for Pump Station 13 are provided below:

Table 7.1.12 – Pump Station 13 Improvements
Project No. PS13 (Improvement Map No. 8)

Item No.	Description	Units	Quantity	Unit Cost	Total Cost
Pump Station No. 13 Improvements - Pump Station Improvements					
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$30,000.00	$30,000.00
2	Construction Facilities/Temporary Systems	ls	1	$20,000.00	$20,000.00
3	New On-site Power Generation Equipment & ATS	ls	1	$40,000.00	$40,000.00
4	New VFD's, controls, telemetry	ls	1	$30,000.00	$30,000.00
5	New duplex pumps, accessories & fittings	ls	1	$60,000.00	$60,000.00
6	Electrical Improvements	ls	1	$60,000.00	$60,000.00
7	Misc. Building and Site Improvements	ls	1	$15,000.00	$15,000.00
8	New 10" Force Main	lf	450	$80.00	$36,000.00
		Construction Total			$291,000.00
		Contingency (20%)			$58,200.00
		Subtotal			$349,200.00
		Engineering (20%)			$69,840.00
		Flow Study			$8,000.00
		Predesign Report			$10,000.00
		Environmental Report			$20,000.00
		Administration (3%)			$10,476.00
		Total Project Costs			**$467,516.00**

7.1.13 Pump Station No. 14

Pump Station No. 14 is in relatively good condition and is not likely to face a capacity issue during the planning period unless a major industrial or commercial customer locates within Basin J and requires additional capacity. As this is not foreseen, no project has been developed to add capacity to this station.

Some basic maintenance and improvements are recommended for Pump Station 14 including the following:

- Construction of a permanent control building and housing for electronics and on-site power generation equipment.
- Onsite power generation equipment. (A smaller generator that is being replaced at another station could be rehabilitated and installed at this station.)
- Installation of a flow meter, vault, and integration into the control system.

Estimated costs for improvements to Pump Station 14 are provided below:

Table 7.1.13 – Pump Station 14 Improvements
Project No. PS14 (Improvement Map No. 3)

Pump Station No. 14 Improvements					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$13,500.00	$13,500.00
2	Construction Facilities/Temporary Systems	ls	1	$8,000.00	$8,000.00
3	New control building/enclosure	sf	200	$250.00	$50,000.00
4	Flow meter, vault, and integration into control system	ls	1	$30,000.00	$30,000.00
5	Onsite Power Generation Equipment	ls	1	$25,000.00	$25,000.00
		Construction Total			$126,500.00
		Contingency (15%)			$18,975.00
		Subtotal			$145,475.00
		Engineering/Arch. (20%)			$29,095.00
		Administrative costs (3%)			$4,364.25
		Total Project Costs			**$178,934.25**

Pump Station No. 15: Note: Pump Station 15 is a storm pump station that is discussed in the City's Stormwater Master Plan (Dyer Partnership, 2004).

7.1.14 Pump Station No. 16

As is the case with other wastewater pump stations in the City (i.e. Station No. 8), Pump Station No. 16 is comprised of an existing wetwell located inside of a building that utilizes suction lift pumps. While the station is in acceptable condition, it will require a major upgrade during the planning period. As was the case with Station 8, this can be accomplished by constructing a new wetwell and installing submersible pumps outside of the building, or by installing submersibles within the existing building and paying the additional costs to meet electrical code requirements for intrinsically safe and explosion proof installations.

While there are pros and cons to each option, the final decision may be based on the City's ability to obtain adequate property to construct a new wetwell and valve/meter vault on the site. This decision should be finalized during a predesign effort when specific project requirements can be refined.

Regardless of the alternative selected, improvements to Pump Station No. 16 should include the following:

- Duplex pumping system with each pump sized for 400 gpm at 41' TDH.
- New valve vault, fittings, and accessories as required for a complete installation.
- New controls, electronics, and telemetry.
- Building improvements including roofing, painting, and general maintenance.
- On-site power generation equipment.

Estimates for each of the two options for Pump Station 16 are provided below:

Table 7.1.14.a – Pump Station 16 Improvements – Option A – New Wetwell
Project No. PS 16A (Improvement Map No. 1)

Pump Station No. 16 Improvements - Option A - New Wet Well					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$45,500.00	$45,500.00
2	Construction Facilities/Temporary Systems	ls	1	$27,500.00	$27,500.00
3	Demolition of old wetwell	ls	1	$20,000.00	$20,000.00
4	New wet well	ls	1	$40,000.00	$40,000.00
6	New duplex pump equipment	ls	1	$35,000.00	$35,000.00
7	Control Panel, VFD's, Telemetry	ls	1	$25,000.00	$25,000.00
8	On-site power generation equipment	ls	1	$45,000.00	$45,000.00
9	Site work, paving, landscaping	ls	1	$20,000.00	$20,000.00
10	Electrical Improvements	ls	1	$80,000.00	$80,000.00
11	Site Piping Improvements/gravity piping	ls	1	$35,000.00	$35,000.00
11	Roofing and building improvements	ls	1	$30,000.00	$30,000.00
12	Valve and meter vault and piping & tie-in	ls	1	$35,000.00	$35,000.00
		Construction Total			$438,000.00
		Contingency (20%)			$87,600.00
		Subtotal			$525,600.00
		Engineering (20%)			$105,120.00
		Flow Study			$8,000.00
		Predesign Report			$10,000.00
		Environmental Report			$20,000.00
		Land Acquisition Costs			$35,000.00
		Administrative costs (3%)			$15,768.00
		Total Project Costs			**$719,488.00**

Table 7.1.14.b – Pump Station 16 Improvements – Option B – Explosion Proof Installation Project No. 16B (Improvement Map No. 1)

Pump Station No. 16 Improvements - Option A - Explosion Proof Electronics					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$42,000.00	$42,000.00
2	Construction Facilities/Temporary Systems	ls	1	$25,000.00	$25,000.00
4	Bypass Pumping	ls	1	$15,000.00	$15,000.00
5	New duplex pump equipment	ls	1	$35,000.00	$35,000.00
6	Control Panel, VFD's, Telemetry-Explosion Proof	ls	1	$35,000.00	$35,000.00
7	On-site power generation equipment	ls	1	$45,000.00	$45,000.00
8	Site work, paving, landscaping	ls	1	$20,000.00	$20,000.00
9	Electrical Improvements - Intrinsically Safe	ls	1	$100,000.00	$100,000.00
10	Site Piping Improvements/gravity piping	ls	1	$20,000.00	$20,000.00
11	Roofing and building improvements	ls	1	$30,000.00	$30,000.00
12	Valve and meter vault and piping & tie-in	ls	1	$35,000.00	$35,000.00
		Construction Total			$402,000.00
		Contingency (20%)			$80,400.00
		Subtotal			$482,400.00
		Engineering (20%)			$96,480.00
		Flow Study			$8,000.00
		Predesign Report			$10,000.00
		Environmental Report			$20,000.00
		Land Acquisition Costs			$35,000.00
		Administrative costs (3%)			$14,472.00
		Total Project Costs			**$666,352.00**

7.1.15 Pump Station No. 17

At the time this planning effort was being completed, Pump Station No. 17 had recently been upgraded and was in good condition. Operations staff suggested that an appropriate upgrade to the station would be to add a flow meter and integrate the telemetry to record station flows.

Estimated costs for improvements to Pump Station 17 are provided below:

Table 7.1.15 – Pump Station 17 Improvements Project No. PS17 (Improvement Map No. 18)

Pump Station No. 14 Improvements					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$6,000.00	$6,000.00
2	Construction Facilities/Temporary Systems	ls	1	$3,500.00	$3,500.00
3	Installation of a meter, vault, & integration	ls	1	$35,000.00	$35,000.00
4	Telemetry and control upgrades	ls	1	$5,000.00	$5,000.00
		Construction Total			$49,500.00
		Contingency (20%)			$9,900.00
		Subtotal			$59,400.00
		Engineering (20%)			$11,880.00
		Administrative costs (3%)			$1,782.00
		Total Project Costs			**$73,062.00**

7.1.16 Pump Station No. 18

Pump Station No. 18 is in relatively good condition and, at the time this planning effort was undertaken, was recently upgraded with new controls and new onsite power generation equipment. However, it is likely that the existing pumping equipment will require an upgrade during the planning period.

Any upgrade to the pumping equipment in Pump Station No. 18 should include the following:

- Conversion of the station from a suction lift station to a submersible station using pumps sized for 300 gpm at 90' TDH.
- A valve and meter vault.
- New electronics and control upgrades as required.

Estimated costs for improvements to Pump Station 18 are provided below:

Table 7.1.16 – Pump Station 18 Improvements
Project No. PS18 (Improvement Map No. 17)

Pump Station No. 18 Improvements					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$12,000.00	$12,000.00
2	Construction Facilities/Temporary Systems	ls	1	$10,000.00	$10,000.00
3	New Pumps and Equipment & Fittings	ls	1	$35,000.00	$35,000.00
4	New Valve and Meter Vault	ls	1	$35,000.00	$35,000.00
5	New VFD's and control upgrades as needed	ls	1	$35,000.00	$35,000.00
		Construction Total			$127,000.00
		Contingency (15%)			$19,050.00
		Subtotal			$146,050.00
		Engineering (20%)			$29,210.00
		Flow Study			$5,000.00
		Predesign Report			$7,500.00
		Administration (3%)			$4,381.50
		Total Project Costs			**$192,141.50**

7.1.17 Pump Station No. 19

There were no apparent deficiencies associated with Pump Station 19 at the time this planning was completed. Problems related to the collection system upstream from the station are addressed in Section 7.2.

Should development pressures or capacity issues arise within the planning period, or if the pumping equipment must be replaced, improvements to the station should include the following:

- New duplex pumping equipment with each pump sized to operate at 800 gpm at 100' TDH.
- New controls, electronics, and telemetry as required.
- New onsite power generation equipment.
- Flow meter, vault, and integration into control system.

Estimated costs for improvements to Pump Station 19 are provided below:

Table 7.1.17 – Pump Station 19 Improvements
Project No. PS19 (Improvement Map No. 19)

Pump Station No. 19 Improvements					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$28,000.00	$28,000.00
2	Construction Facilities/Temporary Systems	ls	1	$17,000.00	$17,000.00
3	New On-site Power Generation Equipment & ATS	ls	1	$40,000.00	$40,000.00
4	New pump equipment & fittings	ls	1	$75,000.00	$75,000.00
5	New VFD's and Controls	ls	1	$30,000.00	$30,000.00
6	Flow meter, vault, and integration into controls	ls	1	$35,000.00	$35,000.00
7	Electrical Improvements	ls	1	$65,000.00	$65,000.00
8	Building and Site Improvements	ls	1	$15,000.00	$15,000.00
		Construction Total			$305,000.00
		Contingency (15%)			$45,750.00
		Subtotal			$350,750.00
		Engineering (20%)			$70,150.00
		Flow Study			$8,000.00
		Predesign Report			$10,000.00
		Administration (3%)			$10,522.50
		Total Project Costs			**$449,422.50**

7.1.18 Pump Station No. 20

In Chapter 4, it was mentioned that Station 20 does not have the ability to connect to a portable standby generation system. A project to install a manual transfer switch is not recommended due to the small volume of wastewater entering the station and the City's ability to use a vacuum truck, if needed, to pump down the wet well in the case of a power outage.

No other major deficiencies were identified for Pump Station No. 20.

7.1.19 Pump Station No. 21

In Chapter 4 it was mentioned that suction lift pumps, such as those used in Station 21, can be problematic. However, they function adequately for this small packaged station. Therefore, a recommendation to replace the pumps, just to eliminate the suction lift pumps, is not to be made at this time. Should the pumps require replacement during the planning period, a plan to install submersible pumps should be prepared, however the need for this type of project is not anticipated and is not part of this Master Plan.

No other major deficiencies were identified for Pump Station No. 21.

Pump Stations 22, 24, 25, & 26: No improvements are scheduled for these minor pump stations.

Pump Station No. 23: Note: Pump Station 23 is a storm pump station that is discussed in the City's Stormwater Master Plans (HBH Consulting Engineers, Inc., 2005).

7.2 Wastewater Collection System Piping Projects

Collection system projects have been developed to address existing deficiencies, maintenance, and future development capacity needs. These projects have been developed and organized by basin as shown in Volume B of the Master Plan (Map Volume).

Alternatives, recommendations, and specific project costs are discussed for each basin in the sections below. For illustrations and preliminary layouts of the projects, see the recommended project section in Volume B.

7.2.1 Basin A

Operations personnel report problems in Basin A associated with the "Seagate Interceptor" (manholes A-41 to A-20). This piping section requires regular cleaning due to solids deposition resulting in occasional plugging and capacity reduction. While TV-inspection tapes were not available, a review of the as-builts for this section suggests that the piping was constructed with adequate slope. This piping section should be thoroughly cleaned and televised to allow for an engineering review of the sewer section. It is assumed that TV-inspection services are available to the City through their operations agreement with OMI.

TV

Another piping section that has been a maintenance problem for the City lies between manholes A-35 to A-26. As with the previous section, as-builts suggest that this section was constructed with adequate slope in the pipe to prevent solid deposition. As before, it is recommended that the City thoroughly clean the section and obtain video inspections to allow for an engineering evaluation of the piping section.

7.2.2 Basin B

Flows from Basin A and Basin B combine into a small interceptor section that conveys flows to Pump Station No. 7. This interceptor, which is primarily constructed of 8-inch diameter piping, is undersized for existing flows. This condition will worsen with the moderate amount of in-fill growth anticipated for these basins.

Manhole inspections along piping section suggest that the system occasionally surcharges resulting in a pressurized condition.

Project B1 recommends the replacement of this interceptor section with new 12-inch diameter piping. It is believed that most of the manholes can be reused and rehabilitated. A cost estimate for this project is provided below:

Table 7.2.2 – Collection System Project B1
Improvement Map No. 1

Basin B Collection Project: B1					
Item No.	Description	Units	Quantity	Unit Cost	Total Cost
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$33,000.00	$33,000.00
2	Construction Facilities/Temporary Systems	ls	1	$20,000.00	$20,000.00
3	12" PVC Sewer Piping	lf	1920	$120.00	$230,400.00
4	AC Pavement Repair/Trench Patching	lf	1400	$15.00	$21,000.00
5	Manhole Rehabilitation	ea	9	$1,500.00	$13,500.00
		Construction Total			$317,900.00
		Contingency (20%)			$63,580.00
		Subtotal			$381,480.00
		Engineering (20%)			$76,296.00
		Administrative costs (3%)			$11,444.40
		Total Project Costs			**$469,220.40**

7.2.3 Basin C

Staff reports of regular maintenance problems associated with piping sections located within the vicinity of Grant and Wasson in Basin C. Video inspections of these sections have shown bellies and other problems with the piping sections that result in solids deposition and line plugs.

Project C1 recommends the replacement of these piping sections with new 8-inch diameter PVC piping runs. It is assumed that the manholes are reusable and can be rehabilitated. A summary cost estimate of project C1 is shown below:

Table 7.2.3 – Collection System Project C1
Improvement Map No. 2

Basin C Collection Project: C1					
Item No.	Description	Units	Quantity	Unit Cost	Total Cost
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$12,500.00	$12,500.00
2	Construction Facilities/Temporary Systems	ls	1	$7,500.00	$7,500.00
3	8" PVC Sewer Piping	lf	870	$95.00	$82,650.00
4	AC Pavement Repair/Trench Patching	lf	600	$15.00	$9,000.00
5	Manhole Rehabilitation	ea	5	$1,500.00	$7,500.00
		Construction Total			$119,150.00
		Contingency (20%)			$23,830.00
		Subtotal			$142,980.00
		Engineering (20%)			$28,596.00
		Administrative costs (3%)			$4,289.40
		Total Project Costs			**$175,865.40**

7.2.4 Basin D

Gravity piping located on Marple Avenue between Jackson and Taylor has long been a maintenance problem for the City. Though recent repairs appear to be holding, the section should be added to the CIP for replacement or undertaken if other improvements (street, water, etc) are undertaken within this section.

Project D1 below includes the replacement of some of the 8” piping, the upsizing of some 8-inch with 10-inch and the replacement of some 10-inch sections. A summary cost estimate of project D1 is shown below:

Table 7.2.4 – Collection System Project D1
Improvement Map No. 2

Basin D Collection Project: D1					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$17,000.00	$17,000.00
2	Construction Facilities/Temporary Systems	ls	1	$1,000.00	$1,000.00
3	8" PVC Sewer Piping	lf	434	$70.00	$30,380.00
4	10" PVC Sewer Piping	lf	800	$80.00	$64,000.00
5	AC Pavement Repair/Trench Patching	lf	1200	$25.00	$30,000.00
6	Manhole Rehabilitation	ea	6	$1,500.00	$9,000.00
		Construction Total			$151,380.00
		Contingency (20%)			$30,276.00
		Subtotal			$181,656.00
		Engineering (20%)			$36,331.20
		Administrative costs (3%)			$5,449.68
		Total Project Costs			**$223,436.88**

The only other section in Basin D that may be of some concern is the piping run between manhole D-12 and D-14. The upstream piping in this area is 10-inch and the downstream piping is 14-inch. While the 8-inch section was constructed with a more than adequate slope (.018 ft/ft), it may serve as a bottle-neck for the collection system in this area which conveys flows from Basins A, B, and C through Basin D.

The section should be reviewed during winter storm events to ensure that surcharging or other problems do not occur. This section will be reviewed during flow mapping events in the upcoming winter season.

7.2.5 Basin E

The piping section between manholes E-58 and E-59 has historically been a maintenance problem for the City. The section which runs down the middle of a residential block has been televised in the past and was shown to be in very poor condition. Project E1 recommends that the section be rehabilitated utilizing trenchless technologies (slip lining) to repair existing deficiencies. Prior to undertaking design, the section should be retelevised to allow for a complete engineering review.

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The following cost estimate is provided for Project E1:

Table 7.2.5 – Collection System Project E1
Improvement Map No. 3

Basin E Collection Project: E1					
Item No.	Description	Units	Quantity	Unit Cost	Total Cost
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$4,500.00	$4,500.00
2	Construction Facilities/Temporary Systems	ls	1	$3,000.00	$3,000.00
3	8" PVC Sewer Pipe Lining	lf	450	$40.00	$18,000.00
4	Lateral Replacement	lf	200	$50.00	$10,000.00
4	Manhole Rehabilitation	ea	2	$1,500.00	$3,000.00
		Construction Total			$38,500.00
		Contingency (20%)			$7,700.00
		Subtotal			$46,200.00
		Engineering (20%)			$9,240.00
		Administrative costs (3%)			$1,386.00
		Total Project Costs			**$56,826.00**

Companies that provide trenchless rehabilitation services can provide those services at a lower unit cost when there is more work to undertake. The City will appreciate this economy of scale by grouping a number of projects together within the same overall project.

Creek Crossing. A second project within Basin E is the replacement of the creek crossing between manholes E-2 and E-3. This 24-inch piping section is the terminating piping run prior to Treatment Plant No. 2. This critical section crosses a small creek with most or all of the piping submerged in the creek much of the year. During storm events, this CMP piping section experiences significant forces as the water in the creek flows up against and around the pipe.

Creek Crossing Alternative A. The City is concerned about the integrity of the pipe and the risk associated with this section. The City may choose to replace the CMP piping section with a stronger section of lined ductile iron piping that will create a strong bridge across the creek. New manholes or vaults can be constructed on each side of the creek to serve as structural supports and access points for the crossing.

Creek Crossing Alternative B. Another alternative is to coordinate the replacement of this piping section with the upgrading of the new influent pump station at Plant 2. By deepening the wetwell, this piping run can be lowered below the creek, eliminating the “dam effect” of having the pipe in the creek flow channel. This alternative would include the installation of a drop manhole or drop vault on the highway side of the creek to place the new piping under the creek flow line. The piping would flow by gravity into the wetwell of the new influent pump station. This option should be considered during the predesign phase of the new influent pump station.

Creek Crossing Alternative C. Another alternative is to locate the influent pump station closer on the highway side of the creek and cross the creek only with a force main that can be placed over the creek or directional drilled under the stream. If a new pump station must be constructed, the overall cost of the project, including the creek crossing, could be reduced by locating the station so that the gravity crossing can be eliminated.

Whatever option is selected, the City should consider the Plant 2 creek crossing as a high priority project. Because costs have been included in the Wastewater Facilities Plan for Treatment Plant No. 2 (West Yost, 2005), we are not including costs within this Master Plan. However, careful consideration should be given to this creek crossing when undertaking improvements to Plant 2.

7.2.6 Basin F

A number of "alley" sewer mains in the vicinity of Basin F have been televised and shown to be in poor condition. The City may choose to group these projects into a rehabilitation effort with Project E1. Within project F1, backyard or alley sewer mains should be lined between the following manholes:

- F-23 to F-24
- F-22 to F-25
- G-20 to G-18
- (project E1 is not included in the following estimate but could easily be grouped with this project as funds are available)

The project includes the lining of existing 8-inch piping sections, rehabilitation of manholes, and replacement of existing laterals. Each pipe run should be televised prior to beginning design. A cost estimate for the project is provided below:

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Table 7.2.6.a – Collection System Project F1
Improvement Map No. 4

Basin F Collection Project: F1					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$12,000.00	$12,000.00
2	Construction Facilities/Temporary Systems	ls	1	$7,500.00	$7,500.00
3	8" PVC Sewer Pipe Lining	lf	1126	$40.00	$45,040.00
4	Replacement of laterals	lf	800	$50.00	$40,000.00
5	Manhole Rehabilitation	ea	7	$1,500.00	$10,500.00
		Construction Total			$115,040.00
		Contingency (20%)			$23,008.00
		Subtotal			$138,048.00
		Engineering (20%)			$27,609.60
		Administrative costs (3%)			$4,141.44
		Total Project Costs			**$169,799.04**

A second project is recommended for the replacement of the existing interceptor on Fillmore south of Pacific Avenue. Staff reports maintenance problems and potential capacity issues with the piping section. Recent development in the Prefontaine and Madison areas have increased the potential flows in this interceptor. While many of these lots are currently vacant, build out levels will stress the capacity of the interceptor.

The following cost estimate is provided for Project F2 for the replacement of the interceptor:

Table 7.2.6.b – Collection System Project F2
Improvement Map No. 4

Basin F Collection Project: F2					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$14,000.00	$14,000.00
2	Construction Facilities/Temporary Systems	ls	1	$8,300.00	$8,300.00
3	12" PVC Sewer Piping	lf	786	$120.00	$94,320.00
4	AC Pavement Repair/Trench Patching	lf	700	$15.00	$10,500.00
5	Manhole Rehabilitation	ea	4	$1,500.00	$6,000.00
		Construction Total			$133,120.00
		Contingency (20%)			$26,624.00
		Subtotal			$159,744.00
		Engineering (20%)			$31,948.80
		Administrative costs (3%)			$4,792.32
		Total Project Costs			**$196,485.12**

7.2.7 Basin G

No specific collection piping deficiencies were identified or projects were developed for Basin G.

7.2.8 Basin H

No specific collection piping deficiencies were identified or projects were developed for Basin H.

7.2.9 Basin I

Basin I includes one of the few larger areas in the Coos Bay City Limits that remains undeveloped. Property located behind K-Mart (west and east of Lindy Lane) has the potential to be developed into a relatively large residential area. Should this area be developed, and depending on the final layout, number of new housing units, and other unknown factors, it could have an impact on downstream facilities both inside and outside the basin.

Project I1 has been developed to provide for a potential project to service the area east of Lindy Lane. While the final arrangement of the system may vary depending on the direction and layout of the development, project I1 provides a potential system that could extend service to this area as well as upsize undersize piping in the lower reaches of the basin. Improvements related to Pump Station No. 12, as required for development within Basin I, are discussed in Section 7.1.

A cost estimate for improvements to the collection system in Basin I is provided below:

Table 7.2.9 – Collection System Project I1
Improvement Map No. 7

Basin I Collection Project: I1					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$80,000.00	$80,000.00
2	Construction Facilities/Temporary Systems	ls	1	$50,000.00	$50,000.00
3	8" PVC Sewer Piping	lf	2800	$70.00	$196,000.00
4	10" PVC Sewer Piping	lf	2700	$80.00	$216,000.00
5	12" PVC Sewer Piping	lf	900	$120.00	$108,000.00
6	15" PVC Sewer Piping	lf	250	$150.00	$37,500.00
7	AC Pavement Repair/Trench Patching	lf	150	$25.00	$3,750.00
8	New Manhole	ea	17	$4,500.00	$76,500.00
9	Manhole Rehabilitation	ea	5	$1,500.00	$7,500.00
		Construction Total			$775,250.00
		Contingency (20%)			$155,050.00
		Subtotal			$930,300.00
		Engineering (20%)			$186,060.00
		Administrative costs (3%)			$27,909.00
		Total Project Costs			**$1,144,269.00**

7.2.10 Basin J

No specific collection piping deficiencies were identified or projects developed for Basin J.

7.2.11 Basin K

With increased flows from the development and larger pump station in Basin I, collection piping in Basin K should be upsized. The mainline trunk in Ocean boulevard should be increased from a 8-inch pipe to a 15-inch pipe depending on the amount of development and increased flows from Basin I and/or if unanticipated development takes place in Basin K. Improvements to Pump Station 13 are discussed in Section 7.1.

A cost estimate for improvements to the collection system in Basin K is provided below:

Table 7.2.11 – Collection System Project K1
Improvement Map No. 8

Basin K Collection Project: K1					
Item No.	Description	Units	Quantity	Unit Cost	Total Cost
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$32,000.00	$32,000.00
2	Construction Facilities/Temporary Systems	ls	1	$20,000.00	$20,000.00
3	15" PVC Sewer Piping	lf	1450	$150.00	$217,500.00
4	AC Pavement Repair/Trench Patching	lf	1200	$25.00	$30,000.00
5	Manhole Rehabilitation	ea	7	$1,500.00	$10,500.00
		Construction Total			$310,000.00
		Contingency (20%)			$62,000.00
		Subtotal			$372,000.00
		Engineering (20%)			$74,400.00
		Administrative costs (3%)			$11,160.00
		Total Project Costs			**$457,560.00**

7.2.12 Basin L

As with previous basins, the sewer main on Woodland may require upsizing depending on the timing, volume, and scale of upstream development. At buildout, the collection main on Woodland would require upsizing from an 8-inch pipe to a 15-inch pipe.

A cost estimate for project L1 is provided below:

Table 7.2.12 – Collection System Project L1
Improvement Map No. 8

Basin L Collection Project: L1					
Item No.	Description	Units	Quantity	Unit Cost	Total Cost
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$49,000.00	$49,000.00
2	Construction Facilities/Temporary Systems	ls	1	$30,000.00	$30,000.00
3	15" PVC Sewer Piping	lf	2200	$150.00	$330,000.00
4	AC Pavement Repair/Trench Patching	lf	2100	$25.00	$52,500.00
5	Manhole Rehabilitation	ea	7	$1,500.00	$10,500.00
		Construction Total			$472,000.00
		Contingency (20%)			$94,400.00
		Subtotal			$566,400.00
		Engineering (20%)			$113,280.00
		Administrative costs (3%)			$16,992.00
		Total Project Costs			**$696,672.00**

Improvements related to Pump Station 10 are discussed in Section 7.1.

7.2.13 Basin M

Improvements related to Pump Station No. 10 and force main are discussed in Section 7.1. No other deficiencies within the collection system in Basin M have been identified.

7.2.14 Basin N

A short piping run between N-29 and N-28 has been identified and televised and should be replaced. Project N1 includes the replacement of this short piping run near Pine Avenue and 7th within Basin N. A cost estimate for project N1 follows:

Table 7.2.14.a – Collection System Project N1
Improvement Map No. 9

Basin N Collection Project: N1					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$3,000.00	$3,000.00
2	Construction Facilities/Temporary Systems	ls	1	$2,000.00	$2,000.00
3	8" PVC Sewer Piping	lf	150	$95.00	$14,250.00
4	AC Pavement Repair/Trench Patching	lf	50	$15.00	$750.00
5	Manhole Rehabilitation	ea	2	$1,500.00	$3,000.00
		Construction Total			$23,000.00
		Contingency (20%)			$4,600.00
		Subtotal			$27,600.00
		Engineering (20%)			$5,520.00
		Administrative costs (3%)			$828.00
		Total Project Costs			**$33,948.00**

A second project to be developed in Basin N includes upsizing piping in the trunk line between manholes N-8 and N-19. This piping section should be upsized to 12-inch to accommodate increased flows from the western basins in the Plant No. 1 service area (Basins I, K, L, Q, M, N).

A cost estimate for Project N2 is provided below:

Table 7.2.14.b – Collection System Project N2
Improvement Map No. 9

Basin N Collection Project: N2					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$13,000.00	$13,000.00
2	Construction Facilities/Temporary Systems	ls	1	$8,000.00	$8,000.00
3	12" PVC Sewer Piping	lf	750	$120.00	$90,000.00
4	AC Pavement Repair/Trench Patching	lf	250	$15.00	$3,750.00
5	Manhole Rehabilitation	ea	6	$1,500.00	$9,000.00
		Construction Total			$123,750.00
		Contingency (20%)			$24,750.00
		Subtotal			$148,500.00
		Engineering (20%)			$29,700.00
		Administrative costs (3%)			$4,455.00
		Total Project Costs			**$182,655.00**

Operations staff has also reported maintenance problems associated with the piping run between manholes N-4 and N-5. This section appears to have adequate capacity and slope and should be further cleaned and televised to allow for a more careful and complete engineering review. If deficiencies are discovered, a project can be developed for this section.

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7.2.15 Basin O

The sewer main in Kingwood Canyon has been a regular maintenance problem for operations staff. However, the main appears to be adequately sized and constructed on adequate slope. The cause of the reported solids deposition and plugging problems is not clear, though there are reports of structural damage to the pipe and access issues that have made undertaking repairs difficult.

One piping section has been identified as deficient and needing replacement. The piping section between manholes O-57 and O-58 should be replaced. The rest of the Kingwood Canyon Section (manholes O-71 and O-43) should be thoroughly cleaned and inspected. This will prove difficult due to access issues with the piping in the canyon, but efforts should be made to investigate these deficiencies to determine if there are additional problems that must be corrected.

A cost estimate for the replacement of piping from O-57 to O-58 is provided below. A specific estimate has not been prepared for the televising of Kingwood Canyon. Specialized inspection companies (Gelco, TSR, Kottke, etc) should be contacted and asked to make proposals on the inspection of this difficult to access section if it is determined that the City is unable to undertake the inspection with OMI staff and City equipment.

Table 7.2.15 – Collection System Project O1
Improvement Map No. 10

Basin O Collection Project: O1					
Item No.	Description	Units	Quantity	Unit Cost	Total Cost
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$3,000.00	$3,000.00
2	Construction Facilities/Temporary Systems	ls	1	$2,000.00	$2,000.00
3	8" PVC Sewer Piping	lf	126	$150.00	$18,900.00
4	Manhole Rehabilitation	ea	2	$1,500.00	$3,000.00
		Construction Total			$26,900.00
		Contingency (20%)			$5,380.00
		Subtotal			$32,280.00
		Engineering (20%)			$6,456.00
		Administrative costs (3%)			$968.40
		Total Project Costs			**$39,704.40**

7.2.16 Basin P

A short piping section on Myrtle Ave. (P-34 to P-35) has been identified by operations staff as being a maintenance problem. However, the problem does not appear to be a sizing or capacity issue. Before a specific rehabilitation or replacement project can be recommended, the piping section should be thoroughly cleaned and televised to allow for a thorough engineering evaluation.

7.2.17 Basin Q

No collection system piping deficiencies have been identified nor projects developed for Basin Q.

7.2.18 Basin R

Two small piping sections have been identified for replacement in Basin R. The sections between manholes R-12 and R-74 and R-69 west to a cleanout should both be replaced due to deficiencies causing maintenance problems.

A cost estimate for these piping sections has been developed under Project R1 and is provided below:

Table 7.2.18 – Collection System Project R1
Improvement Map No. 11

Basin R Collection Project: R1					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$5,500.00	$5,500.00
2	Construction Facilities/Temporary Systems	ls	1	$3,500.00	$3,500.00
3	8" PVC Sewer Piping	lf	350	$95.00	$33,250.00
4	AC Pavement Repair/Trench Patching	lf	350	$15.00	$5,250.00
5	Manhole Rehabilitation	ea	3	$1,500.00	$4,500.00
		Construction Total			$52,000.00
		Contingency (20%)			$10,400.00
		Subtotal			$62,400.00
		Engineering (20%)			$12,480.00
		Administrative costs (3%)			$1,872.00
		Total Project Costs			**$76,752.00**

7.2.19 Basin S

The operations staff has identified a 70 foot long section in the midst of the piping run from manhole S-19 to S-20 that requires replacement. Project S1 has been developed for replacement of this short piping section. The section should be televised and reviewed to confirm that the proposed project is adequate or if any additional improvements are warranted.

A cost estimate for these piping sections has been developed under Project S1 and is provided below:

Table 7.2.19 – Collection System Project S1
Improvement Map No. 11

Basin S Collection Project: S1					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$2,000.00	$2,000.00
2	Construction Facilities/Temporary Systems	ls	1	$1,000.00	$1,000.00
3	8" PVC Sewer Piping	lf	70	$95.00	$6,650.00
4	AC Pavement Repair/Trench Patching	lf	80	$15.00	$1,200.00
5	Manhole Rehabilitation	ea	2	$1,500.00	$3,000.00
		Construction Total			$13,850.00
		Contingency (20%)			$2,770.00
		Subtotal			$16,620.00
		Engineering (20%)			$3,324.00
		Administrative costs (3%)			$498.60
		Total Project Costs			**$20,442.60**

7.2.20 Basin T

An 8-inch piping section located on the west side of the Plant No. 1 site has been identified as requiring replacement. Maintenance issues and deficiencies require that the section between manholes T-11 and T-13 be replaced.

A cost estimate for Project T1 is provided below:

Table 7.2.20 – Collection System Project T1
Improvement Map No. 12

Basin T Collection Project: T1					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$7,000.00	$7,000.00
2	Construction Facilities/Temporary Systems	ls	1	$4,500.00	$4,500.00
3	8" PVC Sewer Piping	lf	440	$95.00	$41,800.00
4	AC Pavement Repair/Trench Patching	lf	440	$15.00	$6,600.00
5	Manhole Rehabilitation	ea	2	$1,500.00	$3,000.00
		Construction Total			$62,900.00
		Contingency (20%)			$12,580.00
		Subtotal			$75,480.00
		Engineering (20%)			$15,096.00
		Administrative costs (3%)			$2,264.40
		Total Project Costs			**$92,840.40**

7.2.21 Basin U

In Basin U, the section between manholes U-1 and U-2 runs underneath portions of the Red Lion Hotel on Highway 101. Operations personnel have reported that this section is a regular maintenance problem resulting in solids collection and plugging.

It does not appear that pipe sizing or capacity problems are the issue. Therefore, it is difficult to recommend a specific improvement project to correct an unknown deficiency. This is exacerbated by the fact that the piping runs underneath existing structures. While trenchless rehabilitation may be an option to correct deficiencies in the piping, it will do nothing to correct bellies or other construction-related problems.

The only sure correction to the problem in this piping section is to construct a new sewer main that bypasses the Red Lion site to the west and connects into the piping outside Plant No. 1. The section should be televised as part of a predesign effort to determine the most appropriate corrective action.

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A cost estimate has been prepared for this alternative and is provided below:

Table 7.2.21.a – Collection System Project U1
Improvement Map No. 12

Basin U Collection Project: U1					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$35,000.00	$35,000.00
2	Construction Facilities/Temporary Systems	ls	1	$20,000.00	$20,000.00
3	18" PVC Sewer Piping	lf	1100	$175.00	$192,500.00
7	AC Pavement Repair/Trench Patching	lf	1200	$25.00	$30,000.00
8	New Manhole	ea	6	$6,000.00	$36,000.00
9	Manhole Rehabilitation	ea	2	$1,500.00	$3,000.00
		Construction Total			$316,500.00
		Contingency (20%)			$63,300.00
		Subtotal			$379,800.00
		Engineering (20%)			$75,960.00
		Environmental Report			$15,000.00
		Administrative costs (3%)			$11,394.00
		Total Project Costs			**$482,154.00**

A second project in Basin U is the recommendation to replace a short section of piping between manholes U-20 and U-21. Maintenance problems necessitate replacement of this section. A cost estimate for Project U2 is provided below:

Table 7.2.21.b – Collection System Project U2
Improvement Map No. 12

Basin U Collection Project: U2					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$3,000.00	$3,000.00
2	Construction Facilities/Temporary Systems	ls	1	$1,500.00	$1,500.00
3	8" PVC Sewer Piping	lf	145	$95.00	$13,775.00
4	AC Pavement Repair/Trench Patching	lf	145	$15.00	$2,175.00
5	Manhole Rehabilitation	ea	2	$1,500.00	$3,000.00
		Construction Total			$23,450.00
		Contingency (20%)			$4,690.00
		Subtotal			$28,140.00
		Engineering (20%)			$5,628.00
		Administrative costs (3%)			$844.20
		Total Project Costs			**$34,612.20**

7.2.22 Basin V

A number of piping sections in Basin V have been reported to be maintenance problems on a regular basis. Because these sections appear to be sized appropriately, it is not possible to provide recommendations for improvements while the deficiencies remain unknown. Therefore, it is recommended that the City have the sections thoroughly cleaned and televised to allow for a detailed engineering evaluation of the inside of the piping sections.

The sections in Basin V that are recommended for evaluation are as follows:

TV

1- Manholes V-90 to V-91. Approximately 245 feet of 8-inch piping reported to have solids deposition issues.
2- Manholes V-21 to V-19. 226 lineal feet of 8-inch piping located under structures at the Timber Inn on Highway 101.
3- Manholes V-67 to V-71. Approximately 975 lineal feet of 8-inch pipe on Broadway south of Commercial.
4- Manholes V-171 to V-176. Approximately 900 feet of 8-inch on 6th Street south of Commercial.

Upon completion and review of these inspection tapes, improvement projects may be developed for these areas.

An area located to the west of Basin V in the hills above Marshfield High School remains undeveloped. This area is one of the few areas within the UGB that remains undeveloped in Coos Bay. While the exact timing, phasing, and layout of improvements to service this area is unknown, projects have been included within this Master Plan that could extend service into these properties.

The northern portion of this area could be serviced by the collection system in Basin V via the sewer piping on Elrod. For the purposes of master planning, a theoretical sewer main has been extended into this area and a project planned to serve the northern portion of this undeveloped property. While the final layout of the sewer may vary, this layout represents one alternative to serving the area.

A cost estimate for project V1 is provided below:

Table 7.2.22 – Collection System Project V1
Improvement Map No. 13

Basin V Collection Project: V1					
Item No.	Description	Units	Quantity	Unit Cost	Total Cost
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$40,000.00	$40,000.00
2	Construction Facilities/Temporary Systems	ls	1	$25,000.00	$25,000.00
3	8" PVC Sewer Piping	lf	3500	$70.00	$245,000.00
4	New Manholes	ea	12	$5,500.00	$66,000.00
		Construction Total			$376,000.00
		Contingency (20%)			$75,200.00
		Subtotal			$451,200.00
		Engineering (20%)			$90,240.00
		Environmental Report			$30,000.00
		Administrative costs (3%)			$13,536.00
		Total Project Costs			**$584,976.00**

7.2.23 Basin W

A number of piping sections in Basin W have been identified as requiring replacement due to deficiencies in the sections. Project W1 includes provisions for the replacement of piping sections between manholes W-18 and W-25 as well as a 230-foot section of piping extending to the north out of manhole W-17.

A cost estimate for Project W1 is provided below:

Table 7.2.23 – Collection System Project W1
Improvement Map No. 19

Basin W Collection Project: W1					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$13,000.00	$13,000.00
2	Construction Facilities/Temporary Systems	ls	1	$8,000.00	$8,000.00
3	8" PVC Sewer Piping	lf	230	$95.00	$21,850.00
4	10" PVC Sewer Piping	lf	615	$110.00	$67,650.00
5	AC Pavement Repair/Trench Patching	lf	100	$30.00	$3,000.00
6	Landscaping/Restoration	ls	1	$5,000.00	$5,000.00
7	Manhole Rehabilitation	ea	3	$1,500.00	$4,500.00
		Construction Total			$123,000.00
		Contingency (20%)			$24,600.00
		Subtotal			$147,600.00
		Engineering (20%)			$29,520.00
		Administrative costs (3%)			$4,428.00
		Total Project Costs			**$181,548.00**

Additional improvements required in Basin W related to Pump Station No. 4 are discussed in Section 7.1.

7.2.24 Basin X

As in Basin V, a number of sections have been identified as having maintenance problems with no specific deficiencies identified. Like in Basin V, the following sections are identified for thorough cleaning and televising so that a detailed engineering analysis can be performed:

1- Manholes X-5 to X-9. Approximately 335 feet of 8 and 10-inch piping near Fred Myer and Safeway.
2- Manholes X-19 to X-20. Approximately 515 feet of 8-inch piping on South Broadway south of Hall.
3- Manholes X-99 to X-97. Approximately 230 feet of 8-inch on Ingersoll Ave. west of 11th.

Once these inspections are complete and an engineering review is possible, additional projects may result in these areas.

7.2.24 Basin Y

An 8-inch piping section on South Front Street has been identified as a maintenance problem. As there appears to be no capacity issues with this section, (manholes y-14 to y-15), it is recommended that this section also be cleaned and televised.

7.2.25 Basin Z

No deficiencies have been identified or projects developed for Basin Z.

7.2.26 Basin AA

For the purposes of master planning, a second project has been developed to extend service to the southern half of the property located to the west of the current service boundary. It is understood that development in this area will drive the final layout, access issues, and future right-of-way locations. For the purposes of master planning, potential layouts have been developed in order to provide a starting place and provide an estimated cost for one potential service option.

For this project, it is assumed that this property may be serviced by extending the collection system on Minnesota Ave. further to the west. This path was chosen after a review of topographical data in the area showed that his would allow the service of a greater area with gravity piping avoiding the construction of pump stations. It is possible that traffic patterns will utilize other entry points such as California Street to access this area. However, California cannot provide gravity sewer service to the entire area that may need to be serviced. (see project BB-1)

A cost estimate for Project AA-1 is provided below:

Table 7.2.26 – Collection System Project AA1
Improvement Map No. 15

Basin AA Collection Project: AA1					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$48,000.00	$48,000.00
2	Construction Facilities/Temporary Systems	ls	1	$29,000.00	$29,000.00
3	8" PVC Sewer Piping	lf	4300	$70.00	$301,000.00
4	New Manholes	ea	15	$5,500.00	$82,500.00
		Construction Total			$460,500.00
		Contingency (20%)			$92,100.00
		Subtotal			$552,600.00
		Engineering (20%)			$110,520.00
		Environmental Report			$30,000.00
		Administrative costs (3%)			$16,578.00
		Total Project Costs			**$709,698.00**

Two other piping sections in Basin AA have been identified as maintenance problems and should be cleaned and televised to determine the extent of the problem and to develop appropriate projects to correct any discovered deficiencies. The sections that should be inspected include the following:

1- Manholes AA-18 to AA-17. Approximately 284 feet of 8-inch piping on Dakota Ave.
2- Manholes AA-15 to AA-16. Approximately 750 feet of 8-inch piping on Southwest Boulevard.

TV

7.2.27 Basin BB

A short section of piping on Southwest Boulevard has been identified as having maintenance problems. Again, the section does not appear to have a capacity deficiency. Therefore, it should be thoroughly cleaned and televised to allow for an engineering evaluation of the section. The section is located between manholes BB-2 and BB-8.

TV

Another project developed to extend the service area of Basin BB will provide service further up California Ave. to service the undeveloped area on the ridge to the west of current development. California may well be developed to provide traffic access as well as access for many utilities to this area.

However, due to the existing topographics on the ridge property, serving the entire ridge from California will not be possible without the use of pumping stations.

A project has been developed to extend sewer service to the crest of the ridge above California Avenue and is provided below:

Table 7.2.27 – Collection System Project BB1
Improvement Map No. 15

Basin BB Collection Project: BB1					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$18,000.00	$18,000.00
2	Construction Facilities/Temporary Systems	ls	1	$11,000.00	$11,000.00
3	8" PVC Sewer Piping	lf	1650	$70.00	$115,500.00
4	New Manholes	ea	5	$5,500.00	$27,500.00
		Construction Total			$172,000.00
		Contingency (20%)			$34,400.00
		Subtotal			$206,400.00
		Engineering (20%)			$41,280.00
		Environmental Report			$30,000.00
		Administrative costs (3%)			$6,192.00
		Total Project Costs			**$283,872.00**

7.2.28 Basin CC

No specific collection system piping deficiencies were identified nor projects developed for Basin CC.

7.2.29 Basin DD

No specific collection system piping deficiencies were identified or projects developed for Basin DD.

7.2.30 Basin EE

No specific collection system piping deficiencies were identified or projects developed for Basin EE.

7.2.31 Basin FF

Operations personnel have reported maintenance problems associated with the interceptor in Basin FF. They have specifically reported that two piping sections should be replaced. The two 8-inch diameter sections are located between manholes FF-22 to FF-23 and FF-17 to FF-20.

A cost estimate for the replacement of these two sections is provided below:

Table 7.2.31 – Collection System Project FF1
Improvement Map No. 17

Basin FF Collection Project: FF1					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$4,000.00	$4,000.00
2	Construction Facilities/Temporary Systems	ls	1	$2,500.00	$2,500.00
3	8" PVC Sewer Piping	lf	215	$110.00	$23,650.00
4	Manhole Rehabilitation	ea	4	$1,500.00	$6,000.00
		Construction Total			$36,150.00
		Contingency (20%)			$7,230.00
		Subtotal			$43,380.00
		Engineering (20%)			$8,676.00
		Administrative costs (3%)			$1,301.40
		Total Project Costs			**$53,357.40**

In addition to replacing the two sections in Project FF1, the remainder of the interceptor in Basin FF should be cleaned and televised to determine if there are additional deficiencies that should be corrected.

TV

7.2.32 Basin GG

There were no specific deficiencies identified or projects developed in Basin GG.

However, the Isthmus Slough crossing issue has been grouped with Basin GG as flows pass through Basin GG just before entering the crossing section. The existing 8-inch slough crossing has a history of operational problems and maintenance issues.

While the City should begin considering replacement of the crossing, planning for this type of project must include coordination with the Oregon Department of Transportation as the Isthmus Slough Bridge is currently in the planning stages for a replacement project. The City's plan for replacement of the sewer pipe crossing the slough could be significantly affected by ODOT's choices for the new bridge. For example, the City may save money if they are able to place the new crossing within the structural envelope of the new bridge rather than tunneling a new pipe under the slough.

Also, the City does not want to go through the expense of replacing the crossing only to have it conflict with the alignment or supports of the new bridge.

Clearly, coordination with ODOT is critical for the planning and development of a project to replace the slough crossing.

For the purposes of master planning, a project has been developed to install a new directional-drilled, submarine, slough crossing.

A cost estimate for this project is provided below:

Table 7.2.32 – Collection System Project GG1
Improvement Map No. 18

Item No.	Description	Units	Quantity	Unit Cost	Total Cost
Basin GG Collection Project: GG1					
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$40,000.00	$40,000.00
2	Construction Facilities/Temporary Systems	ls	1	$25,000.00	$25,000.00
3	12" Slough Crossing	lf	700	$400.00	$280,000.00
		Construction Total			$345,000.00
		Contingency (25%)			$86,250.00
		Subtotal			$431,250.00
		Engineering (20%)			$86,250.00
		Administrative costs (3%)			$12,937.50
		Total Project Costs			**$530,437.50**

While this project is developed for a submarine crossing, it is likely that, if scheduling and coordination proves beneficial, a collaboration between the City of Coos Bay and ODOT will result in a crossing that can be constructed integral to or hung beneath the new bridge.

7.2.33 Basin HH

The piping upstream from Pump Station No. 19 is placed at substandard slopes with problems in some of the manholes causing major solids deposition and plugging problems. Recent emergency improvements have made it easier for maintenance crews to clean this section but could do nothing to correct the slope problems.

Project HH1 has been developed to permanently correct the problems associated with the piping upstream from Pump Station 19 between manholes HH-2 to HH-25.

A cost estimate for this project is provided below:

Table 7.2.33.a – Collection System Project HH1
Improvement Map No. 18

Item No.	Description	Units	Quantity	Unit Cost	Total Cost
Basin HH Collection Project: HH1					
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$20,000.00	$20,000.00
2	Construction Facilities/Temporary Systems	ls	1	$12,000.00	$12,000.00
3	8" PVC Sewer Piping	lf	1300	$85.00	$110,500.00
4	New Manholes	ea	5	$5,500.00	$27,500.00
		Construction Total			$170,000.00
		Contingency (20%)			$34,000.00
		Subtotal			$204,000.00
		Engineering (20%)			$40,800.00
		Administrative costs (3%)			$6,120.00
		Total Project Costs			**$250,920.00**

A second project was developed within Basin HH to correct problems with a section of piping on the Coos River Highway that was broken during the construction of the new Catching Slough bridge.

A cost estimate for this project is provided below:

Table 7.2.33.b – Collection System Project HH2
Improvement Map No. 18

Basin HH Collection Project: HH2					
Item No.	**Description**	**Units**	**Quantity**	**Unit Cost**	**Total Cost**
1	Bonds, Insurance, Overhead, Mobilization Costs	ls	1	$2,500.00	$2,500.00
2	Construction Facilities/Temporary Systems	ls	1	$1,500.00	$1,500.00
3	8" PVC Sewer Piping	lf	180	$95.00	$17,100.00
4	Rehabilitate Manholes	ea	2	$1,500.00	$3,000.00
		Construction Total			$24,100.00
		Contingency (20%)			$4,820.00
		Subtotal			$28,920.00
		Engineering (20%)			$5,784.00
		Administrative costs (3%)			$867.60
		Total Project Costs			**$35,571.60**

7.3 *Cleaning and Televising*

As shown in the previous sections, a number of projects were developed to televise (TV) specific sections that have been identified as being maintenance problems. Because no specific information was available as to the nature of the existing deficiency, no specific projects could be developed for these piping sections at this time.

For the piping sections identified, it is recommended that they be thoroughly cleaned and televised to allow for a careful engineering evaluation and development of projects to correct any existing deficiencies.

This work can be completed using City equipment and operations staff (OMI) or by entering into a contract with a cleaning and televising contractor.

Outside of the specific areas identified in Section 7.2, the City should develop a program to regularly and systematically televise the entire system. Through this approach, the entire collection system will be cleaned and deficiencies can be discovered and corrected over a period of time.

All television inspection tapes should be provided to the engineering staff at the City for review. Deficiencies should be noted and catalogued for potential improvement projects. Serious deficiencies should be corrected immediately.

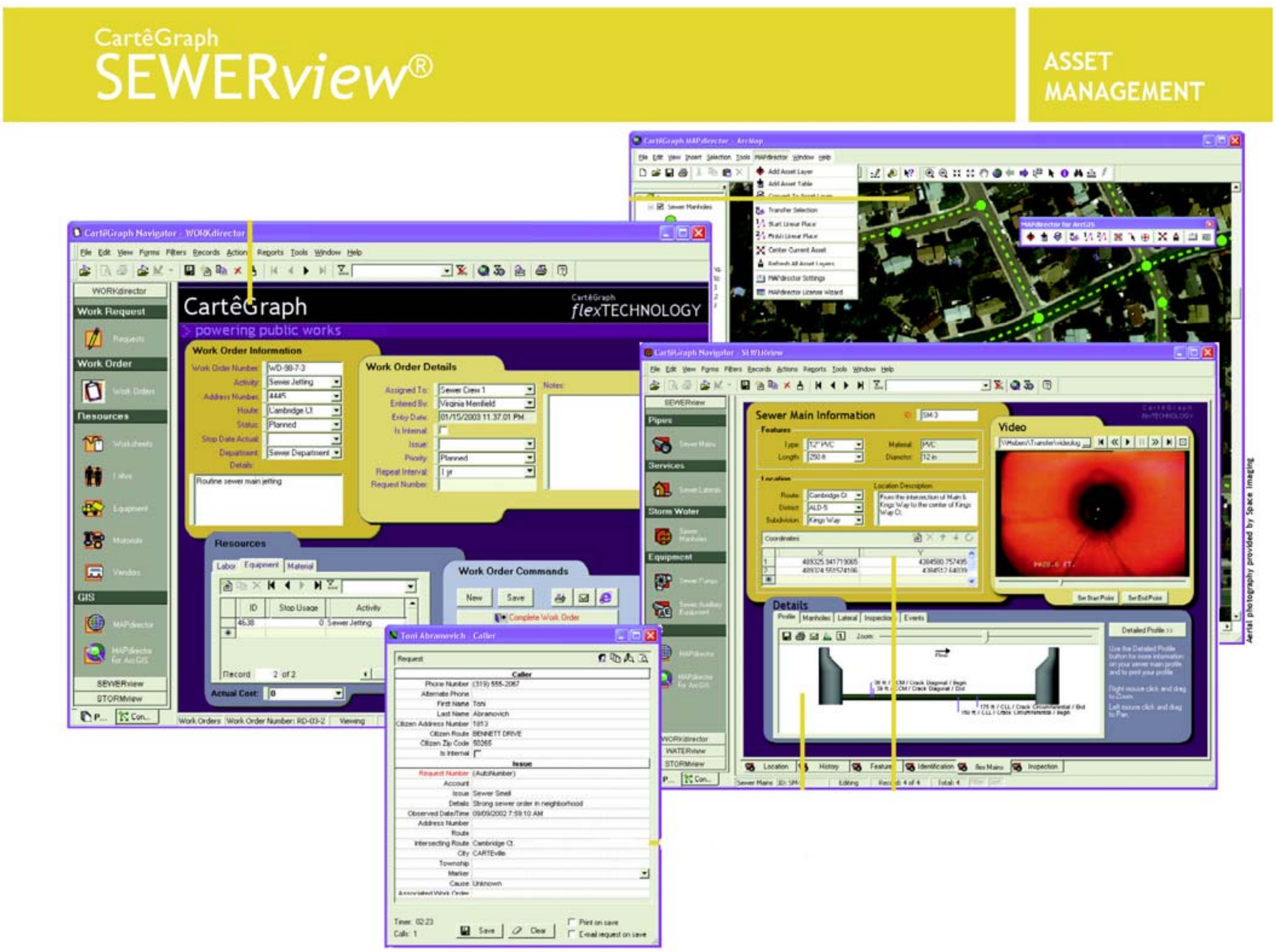
7.4 *Collection System Management and Maintenance*

A program of regular investment in system maintenance will do much to eliminate major system overhauls, replacement projects, and costly system breakdowns. The collection system is in a state of constant degradation. As some piping in the system may be 100 years old, this degradation process may be very far along in older system components.

Development of a collection system maintenance program should include the following components:

1. Detailed inventory, database, and tracking system (software) to monitor system components, schedule maintenance, and track improvement projects.
2. Regular visual inspection of manholes and televising of collection piping. Information about deficiencies and component condition to be entered into software package.
3. Identification of deficiencies and development of projects to correct deficiencies.
4. Regular funding to undertake improvement projects.

Many software programs are available that can assist the City in managing their wastewater collection system. One of the best systems is provided by a company called Cartegraph. Cartegraph provides user-friendly, public infrastructure management software that can be used to organize and manage system maintenance efforts.



Once the City purchases a program such as Cartegraph, they must collect and input data about the system into the program. A software package such as Cartegraph is versatile enough to manage all sectors of City services including sewer, storm, streets, street signs, and other public infrastructure. Information about manholes, piping, and other system components is entered along with ranking of the condition of the components. Once the data is collected, reports can be generated and schedules developed for areas requiring maintenance, cleaning, or repair.

Many Cities have purchased software management programs and utilized summer interns to gather and input data into the program. The City may wish to investigate developing an intern program with SWOCC and working with students enrolled in SWOCC's pre-engineering program.

Development of an infrastructure management program can provide the organizational muscle needed to track and manage the maintenance requirements of a large municipal system. The estimated cost to purchase and setup an infrastructure management program is as follows:

1.	Software for sewer and storm system management	$ 10,000
2.	Setup costs	$ 1,700
3.	First year's maintenance costs	$ 2,000
	Total	**$ 15,200**

When the above quotation was provided by Cartegraph (December 2005), a purchase incentive was provided in the form of a $7,250 rebate if the software was ordered before January 2006. While the City was clearly not in a position to make this decision at that time, it appears that Cartegraph may be able to provide some flexibility on their software costs.

Once the City owns the software, the means and methods used to input data into the software may vary. The City may utilize in-house staff to set up the database using as-builts and other available system data. Other communities have found success using civil engineering interns during the summer months. The interns typically possess the basic knowledge and understanding of sewer systems to be able to complete the necessary tasks to develop the databases. These internships can usually be set up for a very small cost to the City and may be able to be coordinated with Southwestern Oregon Community College on an annual basis.

In addition to developing a management system, the City should provide adequate funding on an annual basis to address and correct deficiencies located through televising and data gathering activities.

For example, if the City raised rates in order to earmark $350,000 per year for wastewater collection maintenance, the rate increase would be around $2.83 per month assuming that all $350,000 must come from a rate increase and that all of the 10,300 existing EDU's would pay an equal share of the increased operational costs.

The amount of money to be earmarked by the City each year for maintenance must be enough to fund investigation (cleaning and televising) activities as well as engineering, bidding, and construction services for a small number of projects.

By developing a collection system management plan, the City can work to eliminate system deficiencies, work to reduce I/I flows, and stay ahead of the natural degradation of system components.

7.5 I/I Reduction Program

The City's Wastewater Facilities Plans (West Yost, 2005) make an analysis of costs of treating flows caused by I/I versus rehabilitating the collection system to reduce the I/I flow component. The Facilities Plans find that removal of I/I flows could cost as much as 7 times the cost of providing treatment capacity for those flows. Furthermore, the study concludes that I/I flows at the plant are not considered excessive and that the City should provide treatment capacity for I/I flows and not invest in projects for the removal of I/I.

While it may be true that projects to rehabilitate collection system piping with the goal of I/I reduction are not always financially feasible, the City should develop a program to systematically remove simple and cost-effective I/I sources as they are discovered.

As part of the maintenance program recommended in Section 7.4, the City should constantly be on the lookout for leaky manholes, broken piping sections, storm drainage (roof drain, catch basin, manhole lid, etc) and other sources of I/I that are cost effective to remove and rehabilitate.

If through their regular cleaning and televising activities the City finds a pipe section that is in poor condition and shows active infiltration, the City may wish to schedule that section for a rehabilitation project. If during the process of collecting data on existing manholes, specific manholes are identified as leaking, a project could be undertaken to seal and rehabilitate a number of manholes.

Furthermore, the City should develop a program where they systematically perform smoke testing and flow mapping of each sanitary collection basin on a rotating basin. Through smoke testing efforts, many inflow sources can be discovered and eliminated. In many cases the inflow sources are on private property and must be corrected at the expense of private property owners.

Flow mapping of individual basins can aid the City by establishing which piping sections and which basins have more flow than is reasonable. These piping sections and basins can then be scheduled for televising to determine if rehabilitation work is appropriate. In addition to flow mapping, the City can install flow meters in specific piping runs to collect data about the flows in individual basins.

In summary, the City should develop an I/I reduction program including:

1. Systematic smoke testing of basins on a rotating basis.
2. Flow mapping of basins on a rotating basis.
3. Identification of deficiencies during televising or manhole inspections.
4. Development of projects to correct deficiencies as part of system maintenance.

The City may use in-house forces to undertake this work or consultants and contractors to complete the necessary tasks. The budget for these activities could be included within the maintenance budget discussed in Section 7.4.

7.6 On-Site Power Generation Improvements

The City owns and operates 19 major wastewater collection pump stations (along with four minor stations) located throughout the system. In order to meet DEQ reliability requirements, the majority of the pump stations include on-site power generation systems. Each on-site system varies in terms of capacity, age, condition, etc.

The typical life of an on-site generation system is around 20 to 30 years. Many of the generators in the Coos Bay system fall within this age range and are nearing the end of their useful lives. At this age, the generators begin to break down with regularity and parts and maintenance are difficult to obtain.

The projects developed for the pump stations in Section 7.1 typically include the installation of a new on-site power generation system with each major pump station upgrade. If generators require replacement prior to the undertaking of an upgrade project, special attention should be given to the potential for that upgrade taking place before the useful life of the new generator expires. For example, if a generator fails, and a pump station is scheduled for upgrading within a matter of years, the new generator should be sized for the loads of the upgraded facility.

Because this Master Plan is based on a 20-year planning period, and that the City has around 20 on-site power generation systems, the City should be replacing around one generator each year.

7.7 Fats, Oils, and Grease Program (FOG)

City operations personnel have reported numerous piping sections that require regular flushing and cleaning due to the build up of fats, oils, and grease (FOG) in the collection system piping. Household and commercial FOG, when dumped into the collection system enters the system as a liquid. When the FOG cools, it often congeals and collects to form clogs and buildups in the piping sections.

It is likely that most of the "problem sections" in Coos Bay are the result of FOG being dumped into the collection system rather than deficiencies with the piping systems themselves. The maintenance costs and problems associated with FOG in Coos Bay result in additional maintenance, collection system problems, and, ultimately, increased operational costs for the City.

The only way to eliminate this problem is for the City to develop a FOG program to eliminate the discharge of FOG into the collection system.

The FOG program should be directed at both residential and commercial sanitary sewer customers. For residential customers, the FOG program should include:

1. City ordinance making discharge of FOG into the wastewater collection system illegal.
2. Public education program to educate the public on what FOG is, what impacts it has on the system, the costs of dealing with FOG, and what residential customers should do to reduce the FOG in their wastewater.

While residential customers can make a major difference in reducing the amount of FOG entering the collection system, commercial FOG contributors account for the majority of FOG related problems with the collection system. Restaurants, grocery stores (with delis, chicken cookers, etc.), and other commercial establishments all contribute a significant amount of FOG to the wastewater collection system. An effective FOG program should include the following points for commercial accounts:

1. City ordinance making the discharge of FOG into the wastewater collection system illegal. The ordinance must describe the requirements of the program, must describe the steps that commercial accounts must go through to be in compliance, and must include civil penalties for establishments that do not comply with the ordinance.
2. Commercial FOG contributors must install grease traps, interceptors, or other facilities to intercept and remove the FOG before it enters the sanitary sewer.
3. Grease traps and grease interceptors must be emptied and cleaned on a regular basis. The owner must report the cleaning to the City.

4. The City must maintain a database of FOG contributors to ensure that they have grease traps and that the traps are being cleaned on a regular basis. Reports should be generated regularly for inspections of traps that are due for cleaning
5. A member of the City staff must be responsible for inspecting and enforcing the FOG requirements including the cleaning and maintaining of grease interceptor equipment.
6. If establishments do not comply with the FOG ordinance, the City must have the legal clout to deny service to the customer until they comply.
7. Emulsifiers, thinners, or other agents intended to break the FOG down cannot be used and discharged to the system.

As FOG programs have been established in many communities, best management practices (BMP's), procedures, and other information is widely available. A sampling of information from other communities is provided in Appendix C of this Master Plan.

8.0 Recommended Plan

8.1 Introduction

This Wastewater Collection System Master Plan has identified a number of system deficiencies in both the collection piping network and in the pumping stations that, together, make up the wastewater collection system for the City of Coos Bay.

To address these deficiencies, improvement projects have been developed that will correct, repair, replace, or upgrade system components that are currently deficient or are projected to be deficient within the planning period.

Cost estimates have been prepared for each project that include potential costs for land acquisition, design, construction, contingency, and other potential project costs. The projects and their associated costs make up the basis for the recommended plan that the City of Coos Bay is to follow throughout the planning period.

Determination of which projects are to be undertaken and the order in which they are undertaken is dependent on a myriad of variables. Development pressures, system failures, priority maintenance issues, and other factors will drive the selection of projects during the planning period.

The purpose of this Section of the Master Plan is to provide the City with a “starting place” for which to begin their wastewater planning. This Section will provide a summary of the developed projects, present a proposed prioritization for the projects, and undertake a discussion on the implementation of the recommended plan.

It is understood that the prioritization and schedule developed in this Plan will be subject to change based on the variables discussed above. The City should develop and maintain a “living and functional” Capital Improvement Plan (CIP) that includes the highest priority projects developed in this Plan.

It is very possible that a project that is not currently considered a high priority can become one due to a catastrophic system failure or, perhaps, due to unanticipated development pressure. In this case, the City must react and move the lower priority project to the “top of the list” so that it can be undertaken sooner.

It is also possible that system components that have not been identified as having a potential deficiency during the planning period will become deficient, necessitating an improvement project. In these cases, the City must develop a project to correct this previously unknown or unexpected deficiency and add the project to the CIP and the project priority list.

8.2 Project Cost Summary

In Section 7, potential improvement projects were developed for each component that required an improvement to correct a serious deficiency. A summary of all of the potential projects is provided in the following sections.

8.2.1 Wastewater Pump Station Improvement Projects

The City owns and operates 23 wastewater pump stations located throughout the system. The majority of the pump stations have been identified as requiring some level of improvement during the planning period. The level of improvement required varies from minor upgrades or upsizing of pumping capacities to major upgrades or complete station replacements.

A summary of the pump station projects is provided below:

Table 8.2.1 – Pump Station Improvement Project Summary

Project Number	Project Name (Description)	Total Project Cost
PS1	Pump Station No. 1 Improvements	$528,408
PS2	Pump Station No. 2 Improvements	$401,472
PS4	Pump Station No. 4 Improvements	$930,611
PS5	Pump Station No. 5 Improvements	$791,480
PS6	Pump Station No. 6 Improvements	$191,880
PS8A *	Pump Station No. 8 Improvements - New Wet Well	$654,230
PS9	Pump Station No. 9 Improvements	$467,516
PS10B *	Pump Station No. 10 Improvements - New Wet Well	$696,850
PS10-FM	Pump Station No. 10 Force Main	$653,346
PS12	Pump Station No. 12 Improvements	$986,312
PS13	Pump Station No. 13 Improvements	$467,516
PS14	Pump Station No. 14 Improvements	$178,934
PS16A *	Pump Station No. 16 Improvements - New Wet Well	$719,488
PS17	Pump Station No. 17 Improvements	$73,062
PS18	Pump Station No. 18 Improvements	$192,142
PS19	Pump Station No. 19 Improvements	$449,423
	Total	**$8,382,669**

* For these projects, more than one alternative was developed. The summary lists the more conservative

8.2.2 Wastewater Collection System Piping Improvement Projects

Projects were developed throughout the City's collection system piping network and in many of the existing basins to correct existing deficiencies, address maintenance issues, and/or to provide for future system capacities.

The projects developed in Section 7 for the collection system piping project are summarized in Table 8.2.2.

Table 8.2.2 – Collection System Piping Improvement Project Summary

Project Number	Project Name (Description)	Total Project Cost
B1	Morrison Interceptor	$469,220
C1	Wasson and Grant Replacement	$175,865
D1	Marple-Jackson to Taylor	$223,437
E1	Michigan and Wasson Rehab.	$56,826
F1	Michigan and Morrison Rehab.	$169,799
F2	Fillmore Interceptor	$196,485
I1	Lindy Lane West	$1,144,269
K1	Ocean Boulevard Upsizing	$457,560
L1	Woodland Dr. Upsizing	$696,672
N1	Pine Ave. Replacement	$33,948
N2	N. 8th Street Main Replacement	$182,655
O1	Kingwood Canyon Replacement	$39,704
R1	Misc. Replacements-Basin R	$76,752
S1	Date Street Repair	$20,443
T1	Pipe Replacement west of Plant 1	$92,840
U1	Reroute around Red Lion	$482,154
U2	Pipe Replacement south of Hemlock	$34,612
V1	Elrod Hills Development Extension	$584,976
W1	Pipe Replacements near Blossom Gulch	$181,548
AA1	Minnesota Hills Development Extension	$709,698
BB1	California Ave Crest Development	$283,872
FF1	FF Interceptor Repairs	$53,357
GG1	Isthmus Slough Crossing	$530,438
HH1	Reconstruct Upstream of Pump Sta. 19	$250,920
HH2	Repair Coos River Hwy. Section	$35,572
	Total	**$7,183,623**

In addition to the projects summarized above, other recommendations were made in Section 7 including the development of a maintenance and inventory database system, a systematic television inspection program to locate and identify I/I contribution areas, and a FOG (fats, oils, and grease) elimination program. While all these additional recommendations have costs associated with them, specific budgets were not developed as part of the CIP (Capital Improvement Plan).

For the purposes of planning, it was recommended that the City budget around $350,000 per year for the pursuit of these additional I/I and maintenance projects. As stated in Section 7.4, an annual maintenance and I/I reduction budget of $350,000 would result in an average rate increase of around $2.83 for each of the existing EDU's in the system.

8.3 Project Prioritization

Pump station projects should be prioritized based on a number of inputs including:

1. Project need (based on condition of existing facility, development pressures, etc)
2. Availability and source of funding

3. The potential for breakdowns or failures and the likely results and damage that could result from those breakdowns.
4. The ability for the City to repair an item or obtain parts for a system.
5. The potential for coordination with other (storm, street, etc) improvements.
6. and others.

An effort was made to establish a priority rating for the recommended improvements to the pump stations as developed in Section 7. Utilizing input from staff, as well as our own analysis of the stations, the following priority summary was developed:

Table 8.3.1 – Pump Station Project Prioritization Summary

	Priority Rating	Project Number	Project Name (Description)	Total Project Cost
A	1	PS10B *	Pump Station No. 10 Improvements - New Wet Well	$696,850
	2	PS4	Pump Station No. 4 Improvements	$930,611
	3	PS5	Pump Station No. 5 Improvements	$791,480
B	4	PS16A *	Pump Station No. 16 Improvements - New Wet Well	$719,488
	5	PS9	Pump Station No. 9 Improvements	$467,516
	6	PS17	Pump Station No. 17 Improvements	$73,062
	7	PS8A *	Pump Station No. 8 Improvements - New Wet Well	$654,230
	8	PS10-FM	Pump Station No. 10 Force Main	$653,346
C	9	PS6	Pump Station No. 6 Improvements	$191,880
	10	PS1	Pump Station No. 1 Improvements	$528,408
	11	PS2	Pump Station No. 2 Improvements	$401,472
	12	PS19	Pump Station No. 19 Improvements	$449,423
	13	PS18	Pump Station No. 18 Improvements	$192,142
	14	PS12	Pump Station No. 12 Improvements	$986,312
	15	PS13	Pump Station No. 13 Improvements	$467,516
	16	PS14	Pump Station No. 14 Improvements	$178,934
			Total	**$8,382,669**

The first 3 or 4 projects on the priority list should be considered critical and should be undertaken as soon as the City is able. Beyond those, the projects should be undertaken and the prioritization updated as the City completes some projects or as issues arise that necessitate a reordering of the pump station projects.

It is more difficult to rate piping projects with a priority status. When considering prioritizing piping projects, the following should be considered:

1. Is there a deficiency that could result in a total failure of the piping section?
2. The length of time the deficiency has caused problems for the City and for residents.
3. Availability and source of funding.
4. Coordination of project with other improvements (water, storm, streets, etc).
5. Amount of I/I that could be eliminated through the project. (cost/benefit)
6. Development pressures requiring the upsizing of pipe to increase capacity.
7. etc.

With these inputs in mind, the following priority summary was prepared for the collection system improvement projects for the piping system:

Table 8.3.2 – Collection Piping Project Prioritization Summary

	Priority Rating	Project Number	Project Name (Description)	Total Project Cost
A	1	GG1	Isthmus Slough Crossing	$530,438
	2	HH1	Reconstruct Upstream of Pump Sta. 19	$250,920
	3	O1	Kingwood Canyon Replacement	$39,704
	4	C1	Wasson and Grant Replacement	$175,865
	5	E1	Michigan and Wasson Rehab.	$56,826
	6	F1	Michigan and Morrison Rehab.	$169,799
B	7	W1	Pipe Replacements near Blossom Gulch	$181,548
	8	HH2	Repair Coos River Hwy. Section	$35,572
	9	N1	Pine Ave. Replacement	$33,948
	10	B1	Morrison Interceptor	$469,220
	11	F2	Fillmore Interceptor	$196,485
	12	R1	Misc. Replacements-Basin R	$76,752
	13	L1	Woodland Dr. Upsizing	$696,672
	14	T1	Pipe Replacement west of Plant 1	$92,840
	15	U1	Reroute around Red Lion	$482,154
	16	U2	Pipe Replacement south of Hemlock	$34,612
	17	FF1	FF Interceptor Repairs	$53,357
	18	S1	Date Street Repair	$20,443
	19	N2	N. 8th Street Main Replacement	$182,655
	20	D1	Marple-Jackson to Taylor	$223,437
C	21	AA1	Minnesota Hills Development Extension	$709,698
	22	BB1	California Ave Crest Development	$283,872
	23	V1	Elrod Hills Development Extension	$584,976
	24	I1	Lindy Lane West	$1,144,269
	25	K1	Ocean Boulevard Upsizing	$457,560
			Total	**$7,183,623**

8.4 Plan Implementation

Implementation of a plan to upgrade pump stations, repair or replace piping sections, and initiate new maintenance and management practices in the City's wastewater system represents a complicated and costly decision for the City of Coos Bay.

It may be considered presumptuous for a master plan to develop a schedule or direct a City to undertake projects in a particular order or on a specific timeline. However, it is appropriate to provide some "broad strokes" with regard to the findings and recommendations in the plan and point the City in the proper general direction.

This section will attempt to discuss a potential schedule, discuss financing, and investigate the potential impact to ratepayers if the City undertakes the high priority projects recommended in the plan.

8.4.1 Schedule

While many have attempted to provide rigid schedules in master planning efforts, they are almost never followed in practice. Obtaining funding, budget processes, seasonal issues, depressions, and other issues change the proposed schedule from almost the first day.

It is, perhaps, more important to identify the highest priority projects and recommend that the City undertake those projects as soon as funding is available.

In Section 8.2, projects were ranked and listed in order of priority. While it may be argued that one project should move up, or another move down, or completely new projects added to the list, this list will provide the City with a starting place when considering what projects to place on their capital improvement list and in what order those projects should be undertaken.

In the tables in Section 8.2, projects are grouped into three separate groups; A, B, and C. These groups are roughly defined as follows:

> **Group A:** These are the highest priority projects that should be undertaken as soon as adequate funding is available. It should be considered that these projects should be undertaken within the next five years with highest projects on the list to be addressed in the next year or two.
>
> **Group B:** These projects, while not of the highest priority, should be on the City's capital improvement planning window beyond the 5-year horizon. As Group A projects are completed, Group B projects should be moved to Group A status. System degradation or failures, project coordination, or other occurrence may require the movement of Group B projects to Group A status ahead of schedule. New projects that are developed that are not critical, should be grouped in Group B until funding is available.
>
> **Group C:** Group C projects are either low priority projects or projects that are dependent on development. If development in an area necessitates a Group C improvement, it should be moved to Group A status assuming that adequate funding is available to undertake the project. Some projects may remain in Group C indefinitely if the need for the project or the necessitating development never arises.

Based on these definitions, the Group A projects are priority projects that should be undertaken as soon as funding is available. And as stated previously, it is recommended that all Group A projects be completed within the next 5 years.

All other projects are dependent upon funding, the completion of Group A projects, or development pressures. The City should maintain a "living" capital improvement list and schedule based on these general guidelines.

8.4.2 Potential Financing Options

The City will soon be considering projects to undertake major improvements to their wastewater treatment plants along with the projects recommended in this plan for the wastewater collection system. The overall cost of these projects will be many millions of dollars.

While there are many grant programs that will be available to the City, it is unlikely that the City will be able to obtain grant funding to significantly offset the overall costs of the projects. For wastewater projects, grant programs are often made available from the Oregon DEQ, United States Department of Agriculture (USDA or RD), Oregon Economic and Community Development Department (OECDD), Oregon Department of Energy (ODOE), and other agencies.

Typically, all funding agencies have requirements that must be met in order for communities to qualify for grant funding. These usually involve community size, median household income (MHI), affordability indices, sewer rate comparisons, and other requirements.

According to the 2000 Census, the MHI in Coos Bay is around $31,200. According to the Census, the average MHI in Oregon is around $43,000. Because the Coos Bay MHI is well below the average MHI for Oregon, the City will receive “points” placing them in favor of receiving grant assistance.

According to the City’s Facilities Plan (West Yost, 2005), the average sewer bill in Coos Bay is around $22 per month. Based on a recent League of Oregon Cities survey, the statewide average sewer bill is around $27 (based on the survey respondents). Being under the State average will count as “points” against the City when determining if they qualify for grant funding. (Some agencies consider an appropriate average sewer bill to be around 1.75-perecent of the MHI. For Coos Bay, this would be around $45.50 per month.)

As stated previously, the City will likely qualify for some financial assistance in the form of grant funding. It is not clear at this point as to how much or if they will be able to receive grants for the wastewater plant projects and separate grants for the collection system projects. These issues will have to be investigated through one-stop meetings and correspondence with the funding agencies.

Non-grant funding includes bonds, loans, system development charges (SDC’s), capital construction funds (sinking funds), local improvement districts, and others.

Loans and bonds will be available to the City with interest rates on the order of 5-percent depending on the status of the federal prime rates, the length of the payback term, the source of revenue used to payback the funds (user rates, general fund taxes, etc.), and other variables.

The City should not obtain loans with payback terms longer than the design life of the improvements that are being constructed. For example, the design life on the pump station improvements in this study are set at around 20-years. Therefore, the loan or bond obtained to pay for those improvements should not exceed a 20-year term.

A specific funding scenario should be worked out and coordinated with both the wastewater treatment and collection system projects together.

8.4.3 Potential Impacts to Rate Payers

The ultimate impact to rate payers will depend on the projects that the City undertakes, the schedule that they follow, the grant funding that is received, and many other variables.

The priority projects developed in this plan are summarized below:

Table 8.4.3. – Project Prioritization Summary

Priority	Description	Total
A	Group A - High Priority Projects	$3,642,493
B	Group B - Lower Priority Projects	$5,347,338
C	Group C - Low Priority and Development Dependent Projects	$6,576,461
	Total	**$15,566,292**

To provide a glimpse into a conservative impact to rate payers, the following scenarios are provided:

Scenario 1: It is assumed that the City will undertake all the projects in the Priority A group for a total project cost of $3,642,493. It is also assumed that whatever grant funding the City is able to obtain will be utilized on the treatment plant projects. Therefore, the following impact to rate payers is entirely based on a funding source that requires payback (loan, bond, etc.).

Principal: $3,642,493
Interest : 5-percent
Term: 20 years
Annual Payment: $288,466
EDU's: 10,312

Based on these terms, the average monthly rate increase required to pay back a loan, per EDU, is $2.33. If the I/I reduction and system maintenance program discussed in Section 7.4 is implemented and the $2.83 rate increase is added to the Scenario 1 rate increase, the total rate increase required for both would be just over $5 per month which would raise the average sewer rate in Coos Bay to around the average monthly sewer rate across the State. (It should be reiterated that these rate increases do not include any costs for projects related to the wastewater treatment plant projects.)

Scenario 2: In this scenario, it is assumed that the City will aggressively pursue the proposed projects by obtaining funding to complete both Priority A and Priority B groups. Under this more aggressive approach, the following impact to ratepayers applies:

Principal: $8,989,831
Interest: 5-percent
Term: 20-years
Annual Payment: $711,947
EDU's: 10,312

Based on these terms, the average monthly rate increase required to pay back a loan, per EDU, is $5.75. Including the $2.83 for the maintenance and I/I program costs, the total rate increase would be around $8.58 per month, per EDU. This would raise the average rate in Coos Bay to around $30 which would still be well below the 1.75% affordability index value of around $45.50 per month.

The final rate increases established by the City must consider all the variables discussed above. Raising rates is a difficult step for any community to make. However, the City is responsible to provide sewer service to the community as well as maintaining the existing system that is already owned by the City. Adequate funding must be raised to meet the demands of a constantly degrading infrastructure, increasing development pressures, inflation, increases in operating costs, and the ever-increasing regulatory requirements. These increases will, inevitably, require the raising of user rates within the City of Coos Bay.

Appendix A

Pipe Inventory and Flow Calculation Worksheet

Coos Bay Collection System
Pipe Inventory (IN FEET)

Basin-->	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH	OTHER	Totals	
3" Pressure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	385	285	0	0	0	0	0	670	
4" Pressure	0	0	0	0	0	0	134	1,381	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	380	0	1,895	
6" pressure	176	157	0	104	170	0	565	0	772	171	146	284	0	0	1,970	0	60	0	0	0	0	0	400	0	0	0	0	96	99	0	1,140	1,175	136	0	11,000	18,620	
8" Pressure	0	0	0	0	0	0	0	0	50	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,670	0	0	2,770	
10" Pressure	0	0	0	0	0	0	0	0	0	0	0	185	3,400	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,664	0	0	6,301	
12" Pressure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,117	582	0	0	0	0	0	0	0	0	0	0	3,699	
14" Pressure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,817	1,400	0	2,218	0	0	0	0	0	0	0	0	0	0	0	5,435	
15" Pressure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,417	0	0	0	0	0	0	0	0	0	0	0	1,417	
18" Pressure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,456	0	0	0	0	0	0	0	0	0	0	0	1,456	
24" Pressure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	335	1,056	1,986	0	0	0	0	0	0	0	0	0	0	0	0	0	3,377	
4"	0	0	0	353	57	0	0	0	0	0	0	0	0	0	117	0	0	0	0	0	0	267	0	0	0	0	0	0	0	458	0	0	0	843	0	2,095	
6"	0	251	420	197	780	2,424	218	750	165	0	146	423	2,296	1,712	2,678	488	121	1,511	2,564	547	1,953	5,511	849	2,069	0	1,759	403	403	562	0	1,139	865	206	17		33,428	
8"	13,143	16,001	3,007	10,748	18,520	20,787	16,531	5,544	9,607	1,063	3,177	2,147	7,004	7,218	12,104	8,643	4,188	13,919	9,518	1,980	7,406	21,819	5,405	19,450	4,711	4,330	4,693	11,825	6,857	0	6,629	2,644	20,726	12,429	0	313,772	
10"	2,163	1,497	0	1,770	1,123	832	2,176	0	0	0	225	392	6,019	2,217	1,003	0	0	1,785	537	0	0	2,943	365	2,538	9	322	166	1,778	1,380	0	0	0	435	0		31,675	
12"	0	0	0	0	2,129	0	0	0	0	0	0	325	344	2,034	59	727	0	3,102	659	0	287	706	0	3,399		168	1,852	0	0	0	0	1,174	61	0		17,025	
14"	0	0	0	1,507	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	495	945	1,394	0	2,058	593	0	0	0	0	0	0	0	0	0	0	6,992	
15"	0	0	0	0	0	0	46	0	0	0	0	0	0	0	0	0	0	297	0	0	0	37	0	3,451	0	0	0	0	0	0	0	0	0	0	0	3,831	
16"	0	0	0	32	2,511	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	0	0	0	0	0	0	0	0	0	0	0	0	2,578	
18"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,515	0	126	0	610	0	0	0	0	0	0	0	0	0	0	0	0	0	2,250	
24"	0	0	0	0	1,796	0	0	0	0	0	0	0	0	0	0	0	0	0	0	367			0	0	0	0	0	0	0	0	0	0	0	0		2,163	
27"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	245	0	745	0	0	0	0	0	0	0	0	0	0	0	0	0	990	
30"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,777	0	0	0	0	0	0	0	0	0	0	0	0	0	3,777	
Total Pipe	15,482	17,906	3,427	14,711	27,086	24,043	19,670	7,675	10,594	1,234	3,744	3,756	19,062	13,233	17,931	9,858	4,368	22,129	13,278	4,095	13,464	41,195	7,054	41,173	5,894	6,579	7,114	14,102	9,283	743	8,907	5,858	26,898	13,670	11,000	466,216 feet	88.30 miles
Manholes	70	64	29	47	93	71	79	19	55	6	16	12	43	62	76	50	24	89	64	13	45	180	31	113	16	24	27	51	27	1	27	25	84	67		1,700	

Flow and Inflow Tables

Inch-Mile Approach

Basin-->	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH		
Estimated number of laterals (assume 4")	140	360	117	201	395	240	615	60	195	20	42	30	152	122	253	130	48	312	216	16	117	357	107	520	80	90	125	305	80	8	116	40	305	145	6059.00	
Estimated average lateral length	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70		
Estimated total lateral length	9800	25200	8190	14070	27650	16800	43050	4200	13650	1400	2940	2100	10640	8540	17710	9100	3360	21840	15120	1120	8190	24990	7490	36400	5600	6300	8750	21350	5600	560	8120	2800	21350	10150	424130.00	80.33 miles
inch-dia*mile for all gravity pipe	31.43	46.46	11.24	34.88	72.68	48.55	62.16	12.43	25.08	2.67	7.63	6.81	33.46	28.17	36.92	22.20	9.03	50.63	31.30	9.13	22.80	96.78	15.63	87.19	12.97	14.32	18.72	37.92	17.88	0.77	17.49	9.78	48.77	27.18	688.57	Plant 1 Service Area Total
Service Area Plant No.	2	2	2	2	2	2	2	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**322.50**	**Plant 2 Service Area Tota**
% of Total inch*mile piping per basin	9.75	14.40	3.48	10.82	22.53	15.06	19.27	3.86	3.64	0.83	1.11	0.99	4.86	4.09	5.36	3.22	1.31	7.35	4.55	1.33	3.31	14.06	2.27	12.66	1.88	2.08	2.72	5.51	2.60	0.11	2.54	1.42	7.08	3.95		
Total flow from basin- PDF 2003 (MGD)	0.31	0.45	0.11	0.34	0.71	0.47	0.61	0.12	0.34	0.03	0.10	0.09	0.46	0.38	0.50	0.30	0.12	0.69	0.43	0.12	0.31	1.32	0.21	1.19	0.18	0.20	0.26	0.52	0.24	0.01	0.24	0.13	0.67	0.37	12.55	
Total flow from basin- PWWF (hour) 2003 (MGD)	0.48	0.71	0.17	0.53	1.10	0.74	0.94	0.19	0.51	0.04	0.16	0.14	0.69	0.58	0.76	0.45	0.18	1.04	0.64	0.19	0.47	1.98	0.32	1.79	0.27	0.29	0.38	0.78	0.37	0.02	0.36	0.20	1.00	0.56	19.00	
Total flow from basin- Average Dry 2003 (MGD)	0.06	0.09	0.02	0.06	0.13	0.09	0.11	0.02	0.05	0.00	0.02	0.01	0.07	0.06	0.08	0.05	0.02	0.11	0.07	0.02	0.05	0.21	0.03	0.19	0.03	0.03	0.04	0.08	0.04	0.00	0.04	0.02	0.11	0.06	2.10	
Total flow from basin- PDF 2027 (MGD)	0.38	0.55	0.13	0.42	0.87	0.58	0.74	0.15	0.46	0.03	0.14	0.12	0.61	0.51	0.67	0.40	0.16	0.92	0.57	0.17	0.41	1.76	0.28	1.58	0.24	0.26	0.34	0.69	0.32	0.01	0.32	0.18	0.89	0.49	16.35	
Total flow from basin- PWWF (hour) 2027 (MGD)	0.59	0.87	0.21	0.65	1.36	0.91	1.16	0.23	0.68	0.05	0.21	0.19	0.91	0.77	1.01	0.61	0.25	1.38	0.85	0.25	0.62	2.64	0.43	2.38	0.35	0.39	0.51	1.04	0.49	0.02	0.48	0.27	1.33	0.74	24.82	
Total flow from basin- Average Dry 2027 (MGD)	0.07	0.10	0.02	0.08	0.16	0.11	0.13	0.03	0.06	0.01	0.02	0.02	0.08	0.07	0.09	0.05	0.02	0.12	0.07	0.02	0.05	0.22	0.04	0.20	0.03	0.03	0.04	0.09	0.04	0.00	0.04	0.02	0.11	0.06	2.30	

Area Dist. Method 1

Basin-->	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH		
Area in Each Basin (acre)	112	126	17	114	220	202	271	314	358	22	54	53	119	106	112	74	95	146	92	27	68	231	58	336	48	83	148	115	53	3	74	41	186	135	4213.00	Total acres
Service Area Plant No.	2	2	2	2	2	2	2	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
% of Total area in Service Area	8.01	9.01	1.22	8.15	15.74	14.45	19.38	22.46	12.72	1.57	1.92	1.88	4.23	3.77	3.98	2.63	3.37	5.19	3.27	0.96	2.42	8.21	2.06	11.94	1.71	2.95	5.26	4.09	1.88	0.11	2.63	1.46	6.61	4.80	2815.00	Plant 1 Service Area Total
Total flow from basin- PDF 2003 (MGD)	0.25	0.28	0.04	0.26	0.50	0.46	0.61	0.71	1.20	0.05	0.06	0.06	0.13	0.12	0.13	0.08	0.11	0.16	0.10	0.03	0.08	0.26	0.06	0.38	0.05	0.09	0.17	0.13	0.06	0.00	0.08	0.05	0.21	0.15	1398.00	Plant 2 Service Area Total
Total flow from basin- PWWF (hour) 2003 (MGD)	0.39	0.44	0.06	0.40	0.77	0.71	0.95	1.10	1.79	0.08	0.27	0.27	0.60	0.53	0.56	0.37	0.48	0.73	0.46	0.14	0.34	1.16	0.29	1.68	0.24	0.42	0.74	0.58	0.27	0.02	0.37	0.21	0.93	0.68		
Total flow from basin- Average Dry 2003 (MGD)	0.05	0.05	0.01	0.05	0.09	0.09	0.12	0.13	0.19	0.01	0.03	0.03	0.06	0.06	0.06	0.04	0.05	0.08	0.05	0.01	0.04	0.12	0.03	0.18	0.03	0.04	0.08	0.06	0.03	0.00	0.04	0.02	0.10	0.07		
Total flow from basin- PDF 2027 (MGD)	0.38	0.55	0.13	0.42	0.87	0.58	0.74	0.15	0.46	0.03	0.14	0.12	0.61	0.51	0.67	0.40	0.16	0.92	0.57	0.17	0.41	1.76	0.28	1.58	0.24	0.26	0.34	0.69	0.32	0.01	0.32	0.18	0.89	0.49		
Total flow from basin- PWWF (hour) 2027 (MGD)	0.48	0.54	0.07	0.49	0.95	0.87	1.17	1.35	2.39	0.09	0.36	0.35	0.79	0.71	0.75	0.49	0.63	0.98	0.61	0.18	0.45	1.54	0.39	2.24	0.32	0.55	0.99	0.77	0.35	0.02	0.49	0.27	1.24	0.90		
Total flow from basin- Average Dry 2027 (MGD)	0.06	0.06	0.01	0.06	0.11	0.10	0.14	0.16	0.20	0.01	0.03	0.03	0.07	0.06	0.06	0.04	0.05	0.08	0.05	0.02	0.04	0.13	0.03	0.19	0.03	0.05	0.08	0.07	0.03	0.00	0.04	0.02	0.11	0.08		

Area Dist. Method 2

Basin-->	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH		
Area in Each Basin (acre)	112	126	17	114	220	202	271	314	358	22	54	53	119	106	112	74	95	146	92	27	68	231	58	336	48	83	148	115	53	3	74	41	186	135	4213.00	Total acres
Service Area Plant No.	2	2	2	2	2	2	2	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
% of Developed Area	70.00%	85.00%	85.00%	90.00%	75.00%	85.00%	85.00%	35.00%	45.00%	65.00%	65.00%	50.00%	85.00%	80.00%	75.00%	75.00%	60.00%	75.00%	60.00%	85.00%	85.00%	88.00%	55.00%	80.00%	85.00%	55.00%	35.00%	80.00%	60.00%	80.00%	60.00%	70.00%	75.00%	70.00%		
% Future Developed Area	75.00%	90.00%	88.00%	95.00%	95.00%	95.00%	88.00%	40.00%	85.00%	70.00%	85.00%	65.00%	95.00%	85.00%	78.00%	80.00%	80.00%	80.00%	65.00%	85.00%	88.00%	90.00%	70.00%	90.00%	95.00%	90.00%	70.00%	90.00%	70.00%	80.00%	80.00%	80.00%	85.00%	85.00%		
Estimated devloped area - Exist	78.40	107.10	14.45	102.60	165.00	171.70	230.35	109.90	161.10	14.30	35.10	26.50	101.15	84.80	84.00	55.50	57.00	109.50	55.20	22.95	57.80	203.28	31.90	268.80	40.80	45.65	51.80	92.00	31.80	2.40	44.40	28.70	139.50	94.50	1926.13	Plant 1 developed
Estimated Developed area - future	84.00	113.40	14.96	108.30	209.00	191.90	238.48	125.60	304.30	15.40	45.90	34.45	113.05	90.10	87.36	59.20	76.00	116.80	59.80	22.95	59.84	207.90	40.60	302.40	45.60	74.70	103.60	103.50	37.10	2.40	59.20	32.80	158.10	114.75	2352.40	Plant 1 Developec
% of Total developed area in Service Area - Existing	7.50%	10.25%	1.38%	9.82%	15.79%	16.43%	22.04%	10.52%	8.36%	1.37%	1.82%	1.38%	5.25%	4.40%	4.36%	2.88%	2.96%	5.68%	2.87%	1.19%	3.00%	10.55%	1.66%	13.96%	2.12%	2.37%	2.69%	4.78%	1.65%	0.12%	2.31%	1.49%	7.24%	4.91%	1045.00	Plant 2 developed
% of Total developed area in Service Area - Future	6.56%	8.86%	1.17%	8.46%	16.33%	15.00%	18.64%	9.81%	12.94%	1.20%	1.95%	1.46%	4.81%	3.83%	3.71%	2.52%	3.23%	4.97%	2.54%	0.98%	2.54%	8.84%	1.73%	12.85%	1.94%	3.18%	4.40%	4.40%	1.58%	0.10%	2.52%	1.39%	6.72%	4.88%	1279.74	Plant 2 Developec
Total flow from basin- PDF 2003 (MGD)	0.24	0.32	0.04	0.31	0.50	0.52	0.69	0.33	0.79	0.04	0.17	0.13	0.49	0.41	0.41	0.27	0.28	0.53	0.27	0.11	0.28	0.99	0.16	1.31	0.20	0.22	0.25	0.45	0.16	0.01	0.22	0.14	0.68	0.46		
Total flow from basin- PWWF (hour) 2003 (MGD)	0.37	0.50	0.07	0.48	0.77	0.81	1.08	0.52	1.18	0.07	0.26	0.19	0.74	0.62	0.61	0.41	0.42	0.80	0.40	0.17	0.42	1.49	0.23	1.97	0.30	0.33	0.38	0.67	0.23	0.02	0.33	0.21	1.02	0.69		
Total flow from basin- Average Dry 2003 (MGD)	0.04	0.06	0.01	0.06	0.09	0.10	0.13	0.06	0.13	0.01	0.03	0.02	0.08	0.07	0.07	0.04	0.04	0.09	0.04	0.02	0.05	0.16	0.02	0.21	0.03	0.04	0.04	0.07	0.02	0.00	0.03	0.02	0.11	0.07		
Total flow from basin- PDF 2027 (MGD)	0.25	0.34	0.05	0.33	0.63	0.58	0.72	0.38	1.62	0.05	0.24	0.18	0.60	0.48	0.46	0.31	0.40	0.62	0.32	0.12	0.32	1.10	0.22	1.61	0.24	0.40	0.55	0.55	0.20	0.01	0.31	0.17	0.84	0.61		
Total flow from basin- PWWF (hour) 2027 (MGD)	0.40	0.53	0.07	0.51	0.98	0.90	1.12	0.59	2.43	0.07	0.37	0.28	0.90	0.72	0.70	0.47	0.61	0.93	0.48	0.18	0.48	1.66	0.32	2.42	0.36	0.60	0.83	0.83	0.30	0.02	0.47	0.26	1.26	0.92		
Total flow from basin- Average Dry 2027 (MGD)	0.05	0.06	0.01	0.06	0.11	0.10	0.13	0.07	0.21	0.01	0.03	0.02	0.08	0.06	0.06	0.04	0.05	0.08	0.04	0.02	0.04	0.14	0.03	0.21	0.03	0.05	0.07	0.07	0.03	0.00	0.04	0.02	0.11	0.08		
Basis For Planning Existing PWWF	0.5	0.55	0.1	0.53	0.95	0.8	1	0.4	0.75	0.07	0.25	0.2	0.75	0.6	0.62	0.4	0.4	0.9	0.45	0.16	0.4	1.6	0.5	1.8	0.25	0.35	0.5	0.65	0.25	0.02	0.35	0.25	1	0.7		
Basis For Planning Future PWWF	0.6	0.6	0.15	0.57	1.25	0.95	1.2	0.6	1.8	0.1	0.35	0.3	1	0.72	0.72	0.5	0.6	1.1	0.5	0.18	0.47	1.8	0.6	2.33	0.3	0.58	0.9	0.85	0.3	0.02	0.45	0.28	1.25	0.9		
Existing gpd/Ac (developed area)	6378	5135	6920	5166	5758	4659	4341	3640	4655	4895	7123	7547	7415	7075	7381	7207	7018	8219	8152	6972	6920	7871	15674	6696	6127	7667	9653	7065	7862	8333	7883	8711	7168	7407		
Future gpd/Ac (developed area)	7143	5291	10027	5263	5981	4950	5032	4777	5915	6494	7625	8708	8846	7991	8242	8446	7895	9418	8361	7843	7854	8658	14778	7705	6579	7764	8687	8213	8086	8333	7601	8537	7906	7843		

Appendix B

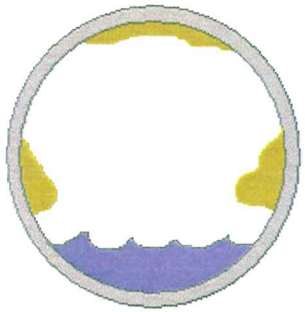
Manhole Inventory

Manholes by Basin				
Basin No.	Total Manholes		double checked	
A	70		70	
B	64		64	
C	18		18	
D	57		57	
E	71		69	
F	71		71	
G	59		79	
H	39		19	
I	52		55	
J	0		6	
K	20		20	
L	12		12	
M	43		43	
N	62		62	
O	76		76	
P	50		50	
Q	24		24	
R	89		89	
S	64		64	
T	13		13	
U	45		45	
V	180		180	
W	28		31	
X	114		113	
Y	14		16	
Z	24		24	
AA	27		27	
BB	51		51	
CC	27		27	
DD	2		1	
EE	27		27	
FF	24		25	
GG	84		84	
HH	27		67	
II	6		0	
TOTAL	1634		1679	

Appendix C

Fats, Oils & Grease (FOG) Sample Information

HOW GREASE CAUSES A BLOCKAGE



The start of a blocked pipe begins when grease collects on the top and sides of the pipe interior.

The build-up increases over time when grease and other debris are washed down the drain.

Excessive accumulation will restrict the flow of wastewater and can result in a sanitary sewer overflow.

HOW A GREASE INTERCEPTOR WORKS

A grease interceptor is a passive control device that is designed to help reduce fats, oils, greases, and solids from entering the sanitary sewer collection and treatment system. Grease interceptors hold the fats, oils, greases, and solids until they can be removed and disposed of by recycling, rendering, or land application.

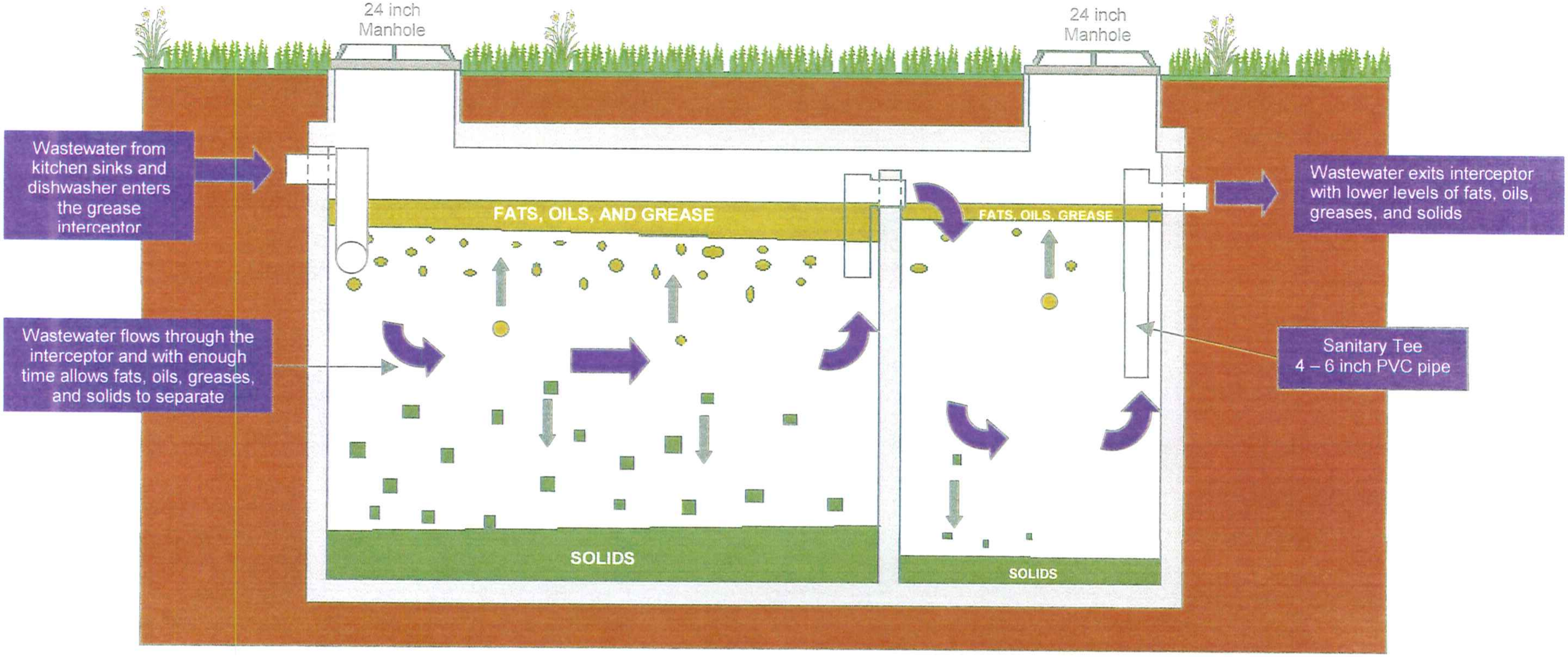
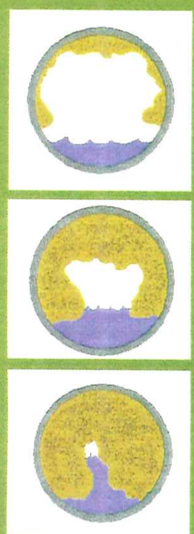


Illustration by:
Donald Smith
Town of Cary

- Grease interceptors allow wastewater flows to slow down
- With sufficient time fats, oils, greases, and solids separate from wastewater
- Fats, oils, and greases are less dense than water and float
- Solids are denser than water and sink
- Grease interceptors are designed in a variety of sizes, shapes, and constructed of various materials

How A Sewer Blockage Affects the Sewer System

Sewer Blockage Formation



The start of a blocked pipe begins when grease and solids collect on the top and sides of the pipe interior.

The build-up increases over time when grease and other debris are washed down the drain.

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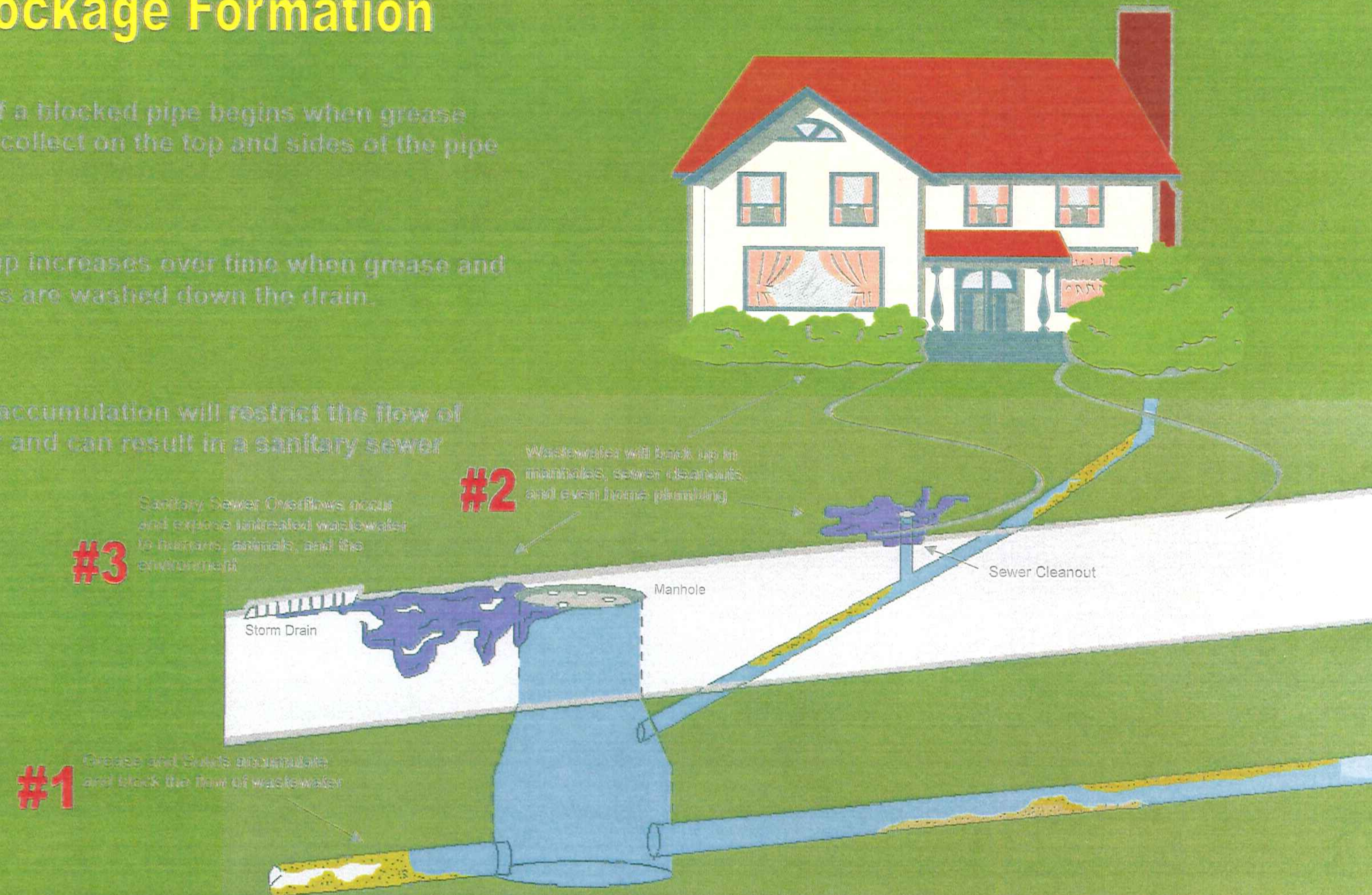
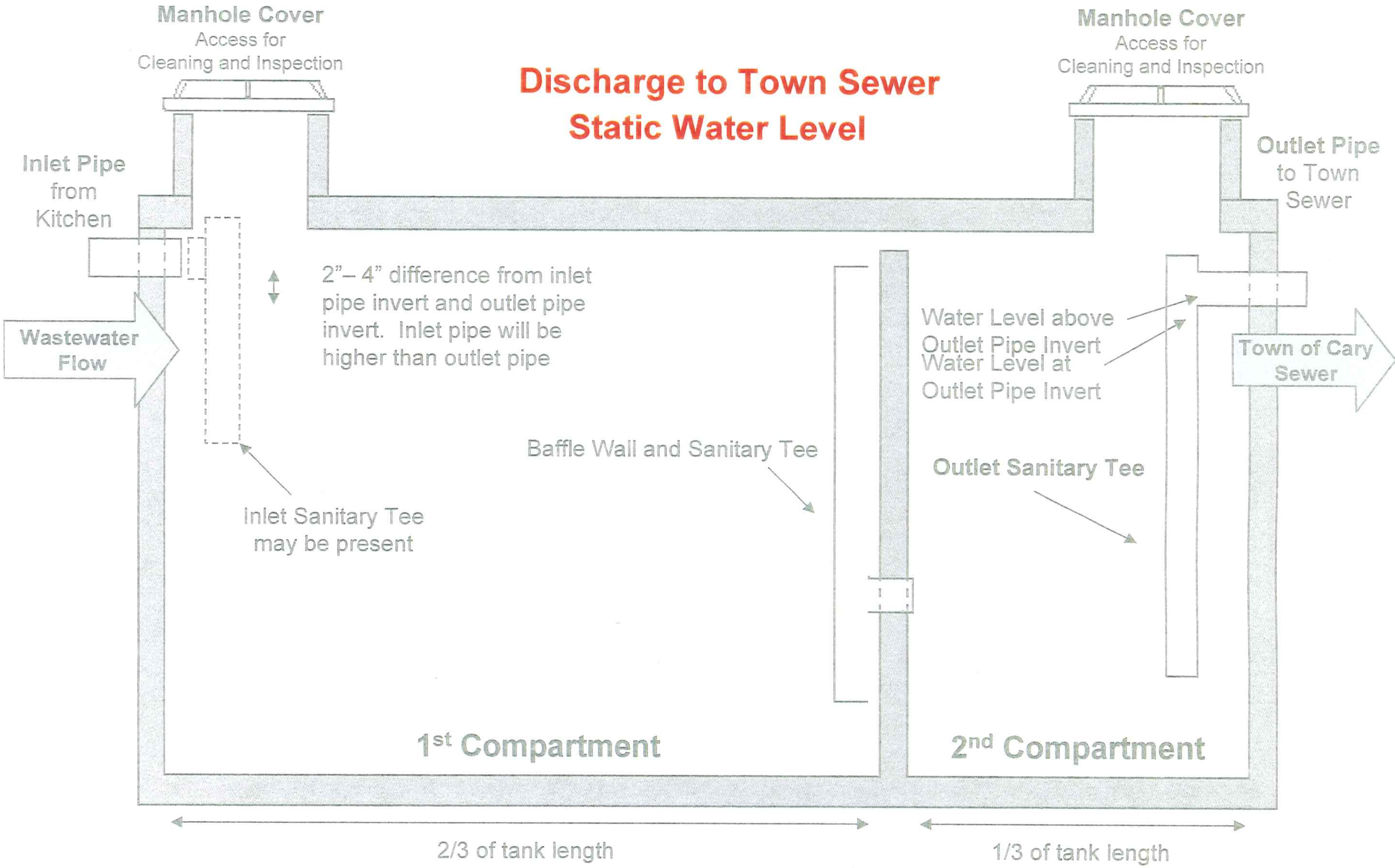
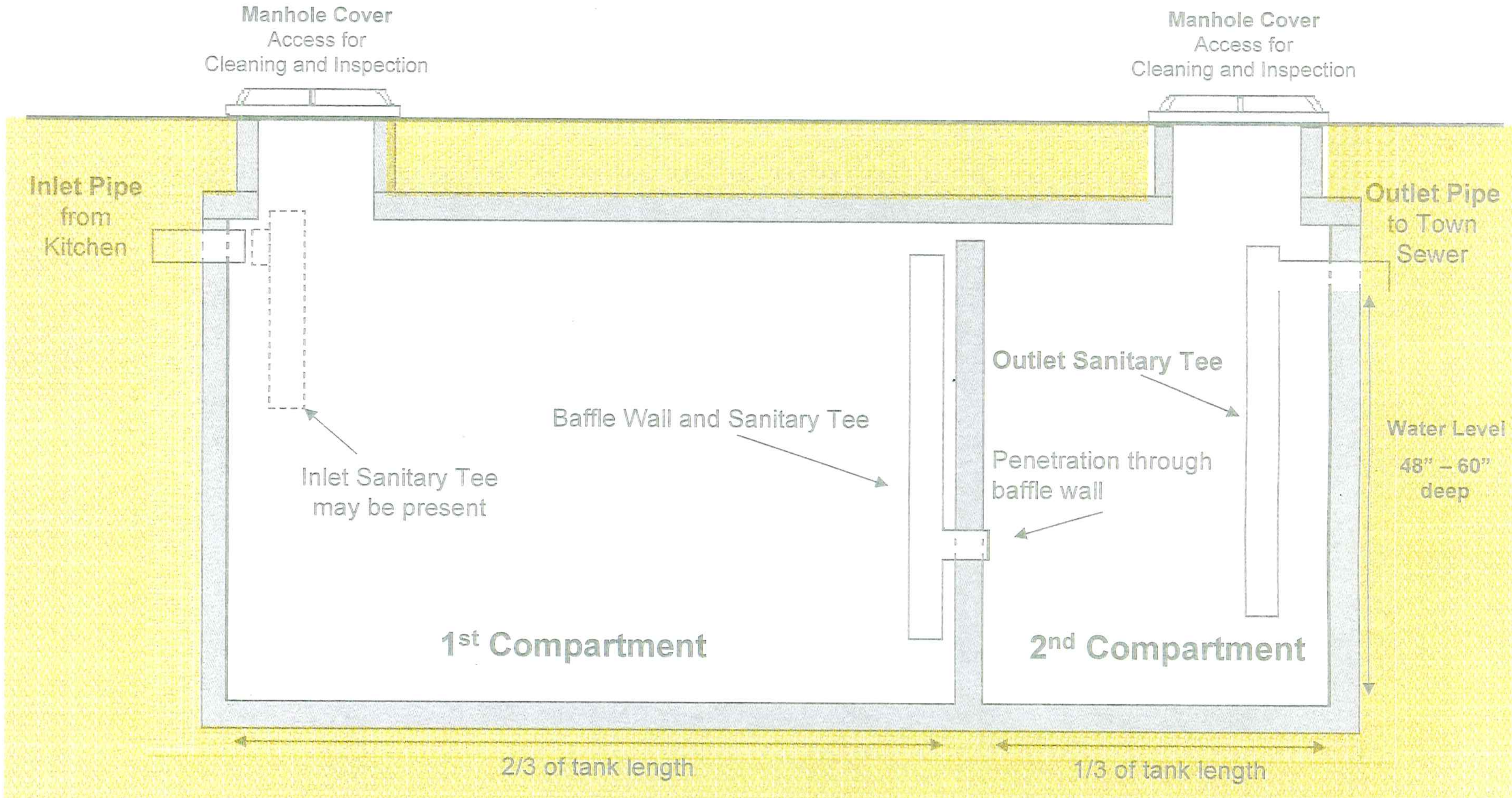


Grease Trap Fluid Levels



Typical Grease Trap/Interceptor Design



TOWN OF CARY

Section 36-183.

FATS, OILS, AND GREASES CONTROL ORDINANCE

Adopted by Town Council: December 10, 1998
Effective Date: January 1, 1999

A. Scope and Purpose

To aid in the prevention of sanitary sewer blockages and obstructions from contribution and accumulation of fats, oils, and greases into such sewer system from industrial or commercial establishments, particularly food preparation and serving facilities.

B. Definitions

Cooking Establishments. Those establishments primarily engaged in activities of preparing, serving, or otherwise making available for consumption foodstuffs and that use one or more of the following preparation activities: cooking by frying (all methods), baking (all methods), grilling, sautéing, rotisserie cooking, broiling (all methods), boiling, blanching, roasting, toasting, or poaching. Also included are infrared heating, searing, barbecuing, and any other food preparation activity that produces a hot, non-drinkable food product in or on a receptacle that requires washing.

Fats, Oils, and Greases. Organic polar compounds derived from animal and/or plant sources that contain multiple carbon chain triglyceride molecules. These substances are detectable and measurable using analytical test procedures established in 40 CFR 136, as may be amended from time to time. All are sometimes referred to herein as "Grease" or "Greases".

Grease Trap or Interceptor. A device for separating and retaining waterborne Greases and Grease complexes prior to the wastewater exiting the trap and entering the sanitary sewer collection and treatment system. These devices also serve to collect settlable solids, generated by and from food preparation activities, prior to the water exiting the trap and entering the sanitary sewer collection and treatment system. Grease Traps and Interceptors are sometimes referred to herein as "Grease Interceptors".

Minimum Design Capability. The design features of a Grease Interceptor and its ability or volume required to effectively intercept and retain Greases from grease-laden wastewaters discharged to the public sanitary sewer.

Non-Cooking Establishments. Those establishments primarily engaged in the preparation of precooked foodstuffs that do not include any form of cooking. These include cold dairy and frozen foodstuffs preparation and serving establishments.

User. Any person, including those located outside the jurisdictional limits of the Town, who contributes, causes or permits the contribution or discharge of wastewater into the POTW, including persons who contribute such wastewater from mobile sources, such as those who discharge hauled wastewater.

C. Grease Interceptor Maintenance, Record Keeping, and Grease Removal

1. Grease Interceptors shall be installed by Users as required by the Director or his designee. Grease Interceptors shall be installed at the User's expense, when such User operates a Cooking Establishment. Grease Interceptors may also be required in non-cooking or cold dairy and frozen foodstuffs establishments and other industrial or commercial establishments when they are deemed necessary by the Director for the proper handling of liquid wastes containing Grease. No User shall allow wastewater discharge concentration from subject Grease Interceptor to exceed 325 milligrams per liter, as identified by method EPA Method 1664 or 275 milligrams per liter, as identified by EPA method 413. All Grease Interceptors shall be of a type, design, and capacity approved by the Director or his designee and shall be readily and easily accessible for User cleaning and Town inspection. All such Grease Interceptors shall be serviced and emptied of accumulated waste content as required in order to maintain Minimum Design Capability or effective volume of the Grease Interceptor, but not less often than every thirty (30) days. Users who are required to pass water through a Grease Interceptor shall:

a. Provide for a minimum hydraulic retention time of twenty-four (24) minutes at actual peak flow or 12 minutes at the calculated theoretical peak flow rate as predicted by the Uniform Plumbing Code fixture criteria, between the influent and effluent baffles with twenty (20) percent of the total volume of the Grease Interceptor being allowed for sludge to settle and accumulate, identified hereafter as a "sludge pocket".

b. Remove any accumulated Grease cap and sludge pocket as required, but at intervals of not longer than thirty (30) days at the Users expense. Grease Interceptors shall be kept free of inorganic solid materials such as grit, rocks, gravel, sand, eating utensils, cigarettes, shells, towels, rags, etc., which could settle into this pocket and thereby reduce the effective volume of the Grease Interceptor.

c. Accept the following conditions: If any skimmed or pumped wastes or other materials removed from Grease Interceptor are treated in any fashion onsite and reintroduced back into the Grease Interceptor as an activity of and after said onsite treatment, the User shall be responsible for the attainment of established Grease numerical limit consistent with and contained in (C)(1) on all discharges of wastewater from said Grease Interceptor into the Town of Cary sanitary sewer collection and treatment system.

d. Operate the Grease Interceptor in a manner so as to maintain said device such that attainment of the grease limit is consistently achieved. "Consistent" shall mean any wastewater sample taken from said Grease Interceptor shall be subject to terms of numerical limit attainment described in (C)(1). If an establishment desires, because of documented space constraints, an alternate to an out--of--building Grease Interceptor, the request for an alternative location shall contain the following information:

1. Location of Town sewer main and easement in relation to available exterior space outside building

2. Existing plumbing at or in a site that uses common plumbing for all services at that site.

e. Understand and agree that: The use of biological additives as a Grease degradation agent is conditionally permissible, upon prior written approval by the Director. Any establishment using this method of Grease abatement shall maintain the trap or interceptor in such a manner that attainment of the Grease wastewater discharge limit, as measured from the trap's outlet, is consistently achieved.

f. Understand and agree that: The use of automatic Grease removal systems is conditionally permissible, upon prior written approval by the Director, the Lead Plumbing Inspector of the Town of Cary, and the Wake County Department of Health. Any establishment using this equipment shall operate the system in such a manner that attainment of the Grease wastewater discharge limit, as measured from the unit's outlet, is consistently achieved.

g. Understand and agree that: The Director reserves the right to make determinations of Grease Interceptor adequacy and need, based on review of all relevant information regarding Grease Interceptor performance, facility site and building plan review and to require repairs to, or modification or replacement of such traps.

2. The User shall maintain a written record of trap maintenance for three (3) years. All such records will be available for inspection by the Town at all times.

3. No non-grease-laden sources are allowed to be connected to sewer lines intended for Grease Interceptor service.

4. Except as provided herein, for a period of one year following adoption of this Ordinance, although installation of Grease Interceptors will be required to be installed, no enforcement actions will be taken under this Ordinance for failure to achieve limits on Grease discharges from Grease Interceptors. If, during this one year period an obstruction of a Town sewer main(s) occurs that causes a sewer overflow to the extent that an impact on the environment is realized and that said overflow or failure of the sanitary sewer collection system to convey sewage can be attributed in part or in whole to an accumulation of Grease in the Town's sewer main(s), the Town of Cary will take appropriate enforcement actions, as stipulated in the Town's Industrial Pretreatment Enforcement Plan and Sewer Use Ordinance, against the generator or contributor of such Grease.

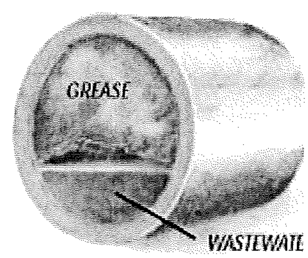
5. Access manholes, with a minimum diameter of 24 inches, shall be provided over each chamber and sanitary tee. The access manholes shall extend at least to finished grade and be designed and maintained to prevent water inflow or infiltration. The manholes shall also have readily removable covers to facilitate inspection, Grease removal, and wastewater sampling activities.

Fats, Oils and Grease

Fats, oils and grease are an unhealthy and expensive problem in our city sewers. Do yoı part to comply with the law and keep our sewers flowing.
This page contains important information for:

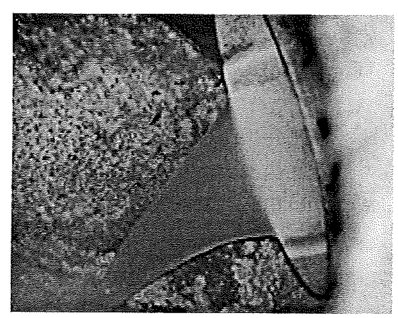
- Restaurant owners
- Bar owners
- Hospitals
- School cafeterias
- Other food preparation establishments

Why are Fats, Oils and Grease a problem in our sewers?



- When Fats, Oils and Grease (FOG) are disposed of improperly they can cause sewer backups. Backups expose the city to costly environmental penalties, and cause health hazards on your property.
- FOG washed down sinks and floor drains builds up over time and eventually creates clogs.
- FOG leads to increased costs for maintaining sewers and wastewater treatment plants and cleaning grease clogs out of private and public property.
- Fats, Oils and Grease are found in food scraps, meat fats, lard, oil, margarine, butter, baking goods, sauces, and dairy products.
- FOG from food preparation establishments is a major source of these wastes in cit sewers.

Why should FOG matter to you?



- Sewer backups and clogs attract insects and vermin and create health hazards.
- Sewer backups can result in property damage and health code violations.
- Clogged sewers can cause sewer overflows, which release untreated sewage into our neighborhoods, rivers and streams.
- FOG is a valuable resource. When recycled rather than dumped down the drain, FOG can be sold to rendering companies for use in soaps, fertilizers, and animal feeds.

Improper FOG disposal is costly at a time when we can least afford it .

- Increased sewer backups and overflows lead to extra maintenance and repairs by the city.
- Increased costs for the city means increased costs for ratepayers.
- Average annual FOG-related preventive maintenance and treatment costs for the City of Indianapolis: $631,000.

What is required?

Chapter 671 of the Indianapolis City Code states:

No person shall discharge or cause to be discharged to any city sewer wastewater or pollutants that cause, threaten to cause or are capable of causing... obstruction to the flow in city sewers. - Sec. 671-4(c)(3)

No person shall discharge or cause to be discharged to any city sewer... solid or viscous substances and/or other pollutants that may cause obstruction to the flow in a sewer ... such as, but not limited to, grease. - Sec. 671-4(d)(6)

Restaurants and other establishments are required to install a grease interceptor (commonly known as grease traps) in the waste line leading from plumbing fixtures or equipment where grease may be introduced to the sewer system. (Sec. 671-4(g)) Grease interceptors must be properly sized, installed and maintained. In reality, many are not maintained on a regular basis.

Click here for MCHD Best Management Practices for FOG.

Click here to read the city code.

Click here to view the city's enforcement policy.

For more information on managing fat, oil and grease discharges, contact the Office of Environmental Services at 327-2234. For more information on the proper installation and sizing of grease interceptors, contact the Department of Metropolitan Development at 327-5544 or 327-5552.

Dispose of fats, oils and grease where they belong.

Don't cause sewer clogs.

You can help protect the environment, improve health, and save money in the process just by taking responsibility for the proper disposal of food waste generated by your business.

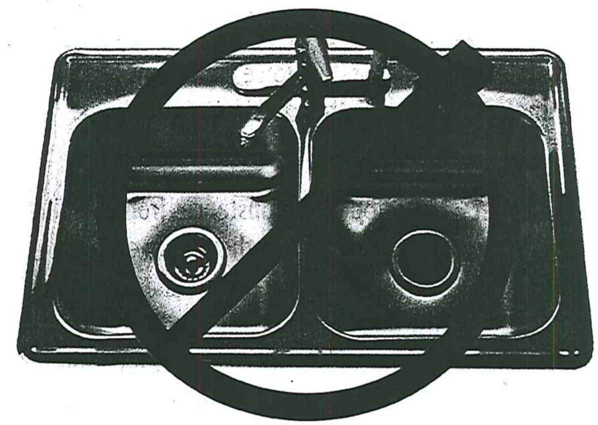
Prevent fats, oils, and grease from getting in the sewer lines. It's more than just a good habit. It's also good business.

Approved by CALIFORNIA Restaurant ASSOCIATION SINCE 1906

IRVINE RANCH WATER DISTRICT

Irvine Ranch Water District
15600 Sand Canyon Avenue, Irvine, CA 92618
(949) 453-5300 www.irwd.com

The drain is not a dump.



The problem with fats, oils and grease

Fats, oils and grease (FOG) come from meat, lard, cooking oil, butter and shortening. You can find them in fryers, pots and pans, food scraps, and spoiled food, and on floors and cooking surfaces. The trouble starts when FOG gets into the sewer through sinks and floor drains.

Sewer lines can become blocked, which can cause untreated wastewater to overflow into your facility and into storm drains leading to the ocean. Sewage spills can spread disease, pollute streets and beaches, require expensive cleanup, and even close your business.

Food service establishments have been found to be major sources of fats, oils and grease that enter the sewer system. The state now requires that your city and local sewer agency enforce limitations on the amount of FOG and other debris that goes in the sewers.

The best way to stop these substances from building up in sewer lines is to prevent them from entering your drains, by using "Kitchen Best Management Practices." The most common Kitchen Best Management Practices are listed here, but be sure to consult with your city or local sewer agency for any additional practices you may be required to follow. Your city or local agency may also conduct inspections to confirm that you are following these practices.

Use Best Practices In The Kitchen

Training – all new employees should be trained in Kitchen Best Management Practices, including the proper methods of fats, oils and grease disposal. Provide frequent refresher training as well.

Signage – display the appropriate signs or posters prominently in the workplace.

Drain screens – install screens on all kitchen drains. Openings should be no more than 3/16 inch. Screens should be removable for frequent cleaning.

Collect & recycle – pour all cooking grease (yellow grease) and liquid oil from pots, pans and fryers into a covered grease container for recycling. Use a permitted waste collection service or authorized recycling center. Keep all written records of their pick ups; inspectors may ask to see them.

Don't overfill – avoid spills by emptying FOG containers before they get full.

Transport carefully – use a covered container to move grease without spilling.

Clean before washing – scrape or dry-wipe excess food and solidified grease from pots, pans, fryers, utensils, screens and mats, then dispose of it in the trash.

Don't dump hot water – cooking or cleaning water over 140° F should NOT be put down a drain that's connected to a grease trap or interceptor.

Clean hoods – dispose of waste from hoods and filters by emptying it into a drain connected to a grease interceptor if you have one, or have the hoods professionally maintained.

Soak up drips & spills – place absorbent materials such as paper towels or absorbent pads under fryers or other areas where grease may drip or spill.

Use "spill kits" – make your own "spill kits" with absorbent materials such as absorbent pads or kitty litter. Keep them well marked and accessible for cleaning spills. Designate a key employee on each shift to monitor cleanup and restock the kits.

Managing

FATS, OIL and GREASE

"It's Easier than YOU Think!"

THE WRONG WAY
La Forma Incorrecta

1

Do not pour cooking residue directly into the drain.

No vierta residuos de cocinar directamente en el desague.

2

Do not dispose of food waste into the garbage disposal.

No ponga desperdicios de comida en el triturador de comida.

3

Do not pour waste oil directly into the drain.

No ponga desperdicio de aceite directamente en el desague.

4

Do not wash floor mats where water will run off directly into the storm drain.

No lave tapetes de piso en un lugar donde el agua corra hacia el desague.

THE RIGHT WAY
La Forma Correcta

1

Wipe pots, pans, and work areas prior to washing.

Limpie con una toallita las ollas, cazuelas, y areas de trabajo antes de lavarlos.

2

Dispose of food waste directly into the trash.

Deseche los desperdicios de comida en el bote de basura.

3

Collect waste oil and store for recycling.

Junte el desperdicio de aceite y guardelo para que sea reciclado.

4

Clean mats inside over a utility sink.

Limpie los tapetes de piso detro de un lavabo o fregador.

CALIFORNIA Restaurant ASSOCIATION SINCE 1906

California Restaurant Association and Irvine Ranch Water District
For more information, (para mas informacion llame a) (949) 453-5300 or visit www.irwd.com

IRVINE RANCH WATER DISTRICT

CleanWater Services Wherever there's water, there's Clean Water.

Commercial Fats, Oils & Grease (FOG) Program

Problems caused by wastes (fats, oils & grease) from restaurants and other grease-producing establishments have served as the basis for ordinances and regulations governing the discharge of grease materials to the sanitary sewer system. This type of waste has forced the requirement of the installation of preliminary treatment facilities, commonly known as grease traps or interceptors.

Determine if you need to install a grease trap or interceptor with the following FAQs. A brochure is available for download in English (PDF, 360KB) and Spanish (PDF, 331KB).

What is a grease trap? How does it work?

A grease trap is a small reservoir built into the wastewater piping a short distance from the grease producing area. Baffles in the reservoir retain the wastewater long enough for the grease to congeal and rise to the surface. The grease can then be removed and disposed of properly as mentioned below.

Do I have a grease trap?

If you are not sure, please contact the Clean Water Services at (503) 681-3600 or the Washington County Public Health Department at (503) 846-8722 for assistance.

Do I need a grease trap?

If you use oil and grease OR you cook greasy food in your establishment and they are washed into the sanitary sewer system, you should have a grease trap or interceptor.

What if I don't install a grease trap?

If you are a restaurant owner and use oil or grease in your food preparation, you will eventually have a maintenance problem with a plugged building sewer line. This blockage can create a sewer backup situation and ultimately a health problem in your restaurant. Someone will have to pay for removing the blockage. If the problem is in your building sewer line, then you will have direct responsibility for paying to remove the blockage or restriction. Contact your local jurisdiction. Their staff will visit your site and assist you in establishing proper grease trap maintenance intervals. If the blockage or restriction is in the public sewer main and it can be proven that you are the cause of the blockage, you are in violation of the Clean Water Act. Enforcement action can be taken and you may also have to pay for the public sewer to be maintained.

What if I don't choose to help?

The rules of the Health Department, Clean Water Services and the Oregon State Plumbing code will assist you in making the correct decision. Oregon State Plumbing Code states that a grease interceptor may be required by the administrative authority. Clean Water Services is the administrative authority in this case, and the District prohibits the discharge of materials that can solidify and create blockage problems in the sewer system or the treatment plants. The Health Department makes periodic inspections to see that no health problems exist due to improperly maintained grease traps. These rules will be enforced if a problem exists.

What is the criteria for grease trap inspections?

All restaurants suspected of causing problems to the collection system or treatment facilities will be inspected. The grease trap shall be inspected using the following criteria: If the trap is in Fair condition, you will be advised that you may need to keep an eye on the maintenance schedule. You may need to increase the cleaning frequency. If a trap is found to be in Poor condition, you will be issued a compliance order to have it cleaned immediately. You will be required to contact the issuing authority within 30 days to have them verify that the grease interceptor has been properly cleaned. It is extremely difficult to formulate exact criteria for sizing grease interceptors because of the many variables that exist. Where one restaurant may burn grease it has collected, another may use a grill and collect its grease for disposal. No two are operated in a like manner. It is important that the method of operation employed be evaluated prior to determining the size of the grease trap. If you have questions, contact your city sewer maintenance, the Washington County Public Health Department at (503) 846-8722 or Clean Water Services at (503) 846-8931.

How can I be sure I am in compliance with the rules?

Contact your local City Public Works Department, Clean Water Services or the County Health Department. They will inspect your facility and provide technical assistance if necessary.

When and how do I clean a grease trap?

The following procedure is recommended:

All grease traps should be cleaned at least twice each week. Some establishments will find it necessary to clean their traps more often than twice per week. If you are having to clean it too often then maybe you should think about installing a larger trap.

- Bail out any water in the trap to facilitate cleaning.
- Dip the accumulated grease out of the trap. Be sure to scrape the sides and the lid.
- Deposit the grease in a watertight container and have a rendering/tallow company pick it up.

DO NOT...

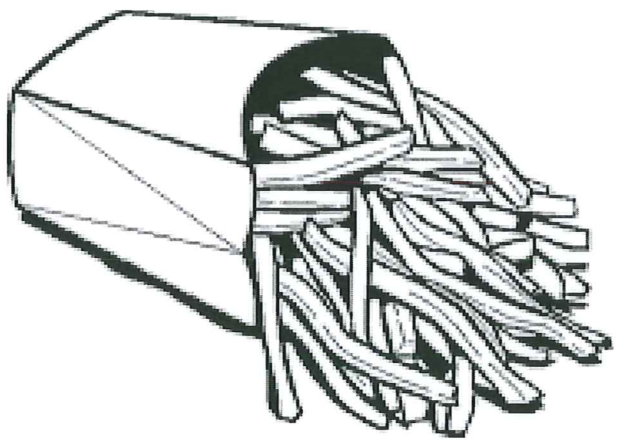
- Flush out the trap with hot water.
- Rely on drain cleaners, enzymes or bacterial agents. They merely soften the grease and transfer the problem down stream.

Remember...

If you have a grease trap, maintain it properly. Work out a specific cleaning schedule right for you and your establishment. All grease traps need to have the separated grease cleaned out periodically and no one likes to do it. It is a dirty job. Running extremely hot water down the sewer drain only moves the problem down stream. It does not go away. Catch the grease at the source to protect public health and the environment!

Preventing Water Pollution

PROPER HANDLING OF FATS, OILS AND GREASE



WATER POLLUTION PREVENTION TIPS FOR THE FOOD SERVICE INDUSTRY

Prepared by
Oregon Department of Environmental Quality

Oregon Association of Clean Water Agencies

and your local sewerage agency

Why Is Water Pollution Prevention Important?

It's in everyone's best interest to reduce the amount of chemicals, hazardous substances and food wastes that flow into the sewer system. It's good for the earth, it's good for our pocketbooks and it's good for our communities.

Oregon's waterways are fragile environmental systems that need our care and protection. Over the last 50 years, local governments and businesses have made tremendous investments in sewage treatment to keep pollution out of lakes, streams and rivers. But just because the facilities are in place doesn't mean we can ignore our responsibilities toward our waterways. It's critical that in homes and businesses we pay attention to the impact of our actions on water quality.

Sanitary Sewers. The fundamental reason we have to be careful about what goes into sanitary sewers is that ***even the best sewage treatment facility has limitations.*** Oregon's sewage treatment systems are designed primarily to handle sanitary or domestic sewage. Bacteria provide "treatment" by breaking down organic matter in the water. We need to remember that:

- Treatment facilities can't treat many chemicals, so the substances may pass untouched into the environment. This may threaten fish, wildlife and vegetation, as well as people using polluted water sources for drinking and recreation.
- Some chemicals can destroy the bacteria in the treatment process – leaving the facility useless. This not only endangers the environment – it means tremendous expense to community ratepayers.

Why Is Water Pollution Prevention Important?

- If the facility receives too much of one type of waste at a time, it will not be able to process the organic matter. Again, this creates environmental hazards, and the community may need to invest in greater treatment capacity.
- Some chemicals in the sewage treatment system put system employees at risk. Exposure to chemicals can cause health problems, and some substances may cause explosions and fires.

How the Food Service Industry can Affect Sanitary Sewer Systems. Every commercial cooking operation produces waste products of fats, oils and grease (FOG). On a small scale, we all know what can happen when heated grease congeals in kitchen pipes – the pipes plug up, blocking passage of liquid and creating unsanitary back-ups into the kitchen.

On a larger scale, the same thing can happen to sewer systems. Most blockages in wastewater collection systems can be traced to FOG. The result can have damaging effects throughout the system, creating sewage spills, man-hole overflows or back-ups into homes and businesses. Too much grease and oil also can create the need for increased maintenance of sanitary lines, increasing costs to all customers.

Restaurant personnel often use chemicals during clean-up that can impact the sewage treatment system – and ultimately lakes, streams or rivers. It's always best to reduce chemical use, and make sure those chemicals you do use are friendly to the environment.

Storm Sewers. In most Oregon communities, storm drains flow directly into waterways without passing through a treatment plant. Anything in the storm drain – from leaves to motor oil – can contribute to water pollution.

How the Food Service Industry Can Affect the Storm Water Collection System

Whenever grease or oil receptacles are stored outside, there is a chance of spills or overflows that will be collected by storm drains. Food product contamination in rivers and streams can interfere with the water's nutrient balance and affect the health of vegetation and wildlife.

Cleaning chemicals washed into storm drains can also impact water quality, as can debris from outdoor eating areas. Leaves, grass and motor oil from parking lots can also be washed into the storm drains and have a negative impact on rivers and streams. Grease and oil escaping through the exhaust system will be collected in rain water and carried into the sewers and waterways.

How Can Pollution Prevention Help Businesses' Bottom Line? Many businesses find that taking steps to prevent pollution – including keeping FOG materials out of the sewer system – saves money.

- Keeping FOG out of your drains will reduce the likelihood of grease-related plumbing problems.
- An establishment causing a FOG spill to the storm sewer may be eligible for fines.
- Fats, oils and grease can often be recycled, reducing garbage costs.
- Some agencies will bill a business for excess sewer line maintenance if the agency can trace the source of the problem to that establishment.
- Ultimately, we all pay if we need to build more treatment system capacity. We all save by keeping materials out of the sewer system.

How to Keep FOG out of the Sewer System

1. **Post "No Grease" signs above sinks and in front of dishwashers.** Frequent reminders can help educate employees about the importance of keeping FOG out of sinks and drains.

2. **Dry wipe pots, pans and dishes.** Get as much oil and grease as possible off the cookware before it hits the water. Send it into the trash for disposal in the solid waste system.

3. **Recycle waste cooking oil and other food wastes.** Call your local sewerage agency for businesses in your area that collect and recycle cooking oil.

4. **Use lower water temperatures.** Water over 140 degrees will dissolve grease, sending it down the drain in wastewater. Inevitably, this grease will congeal – either in your pipes or in the public sewer system.

5. **Use a three-sink dishwashing system.** Design a series of sinks for washing, rinsing and sanitizing with a 50-10 ppm. bleach solution. This system allows you to use water temperatures below 140 degrees, lowering your water heating cost, and better controlling the amount of FOG and food wastes that are washed down the drain.

6. **Install and properly maintain grease traps and interceptors.** State and local laws require restaurants to install and maintain grease traps, interceptors or both, depending on the size and type of the food service. Contact your local health department or your local sewerage agency to find out local requirements and to make sure you are in compliance with all regulations.

   Some rules for maintenance are:

   ✓ **Clean undersink grease traps weekly**. If grease traps are more than 50 percent full after one week, increase how frequently you clean the trap. You also may want to consider ways to reduce the amount of FOG reaching the sink drain.

How to Keep FOG out of the Sewer System

- ✓ **Have interceptors cleaned at least twice a year**. It may be necessary to have interceptors cleaned more often. If more frequent cleanings are needed, consider installing a better trap or an interceptor with larger capacity or using other techniques to keep FOG out of the drains.

- ✓ **Make sure maintenance is done correctly**. At least one employee in each facility should be knowledgeable about cleaning procedures for traps and interceptors. That employee should observe maintenance contractors, haulers and recyclers to make sure all procedures are carried out fully and effectively.

7. **Cover any grease and oil storage containers kept outdoors.** Open containers can collect rainwater and overflow, sending grease and oil into the stormwater system and ultimately polluting local waterways.

8. **Keep grease dumpsters and storage containers an adequate distance from storm drains.** The farther away you keep these units from a catch basin, the more time there will be for someone to clean up a spill or leak before it reaches the sewer system.

9. **Use absorbent pads inside storm drains to catch FOG that may leak into the catch basins.** If grease dumpsters or containers are within 20 feet of the catch basin, or if you detect signs of FOG near the basin, line the basin with an absorbent cloth or pad. Do not use materials like kitty litter to absorb grease or oil. This can be washed into the sewer system. Use absorbent pads or clothes to clean up any spills or leaks.

How to Keep FOG out of the Sewer System

10. **Keep kitchen exhaust filters clean.** Grease and oil escaping through the exhaust system can accumulate on the roof, ultimately getting washed into the storm sewers. Establish a routine schedule and a record-keeping system for cleaning exhaust filters. Make sure that wastewater from washing is routed into the interceptor, where oil and grease can be collected before it reaches the sewer system.

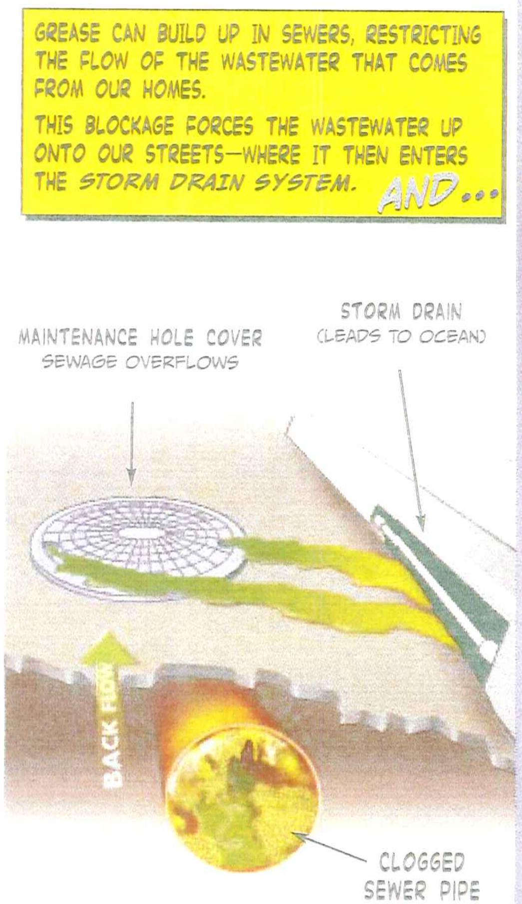
11. **Be cautious about outside cleaning**. Do not conduct outside cleaning activities where wastes can flow into storm drains.

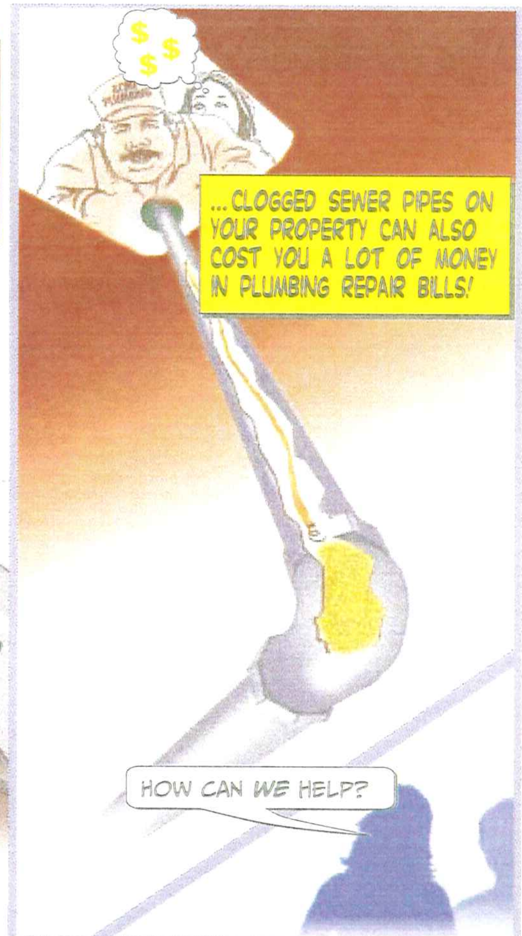
12. **Don't throw wastewater down storm drains.** Train employees and contractors to dispose of wastewater appropriately. Water used for mopping, for carpet cleaning and for washing hood filters should be disposed of through the sanitary sewer system – never in storm drains. To protect the municipal treatment system, limit cleaning chemicals and use the least hazardous products available.

For More Information . . .

See "Fats, Oil and Grease Best Management Practices Manual" - available on the Internet at *www.oracwa.org.*

For more information contact your local sewerage agency at...





REMEMBER...

- USE BASKETS OR STRAINERS IN SINK DRAINS TO CATCH FOOD SCRAPS AND OTHER SOLIDS...
- SCRAPE GREASE AND FOOD SCRAPS FROM PLATES, POTS AND PANS, UTENSILS AND GRILLS...
- FREEZE ANIMAL FATS IN A CAN AND PUT ALL FOOD WASTE AND DISCARDS IN A TRASH CONTAINER—*DON'T* POUR THEM DOWN THE SINK, GARBAGE DISPOSAL OR TOILET...
- GARBAGE DISPOSALS USE LARGE VOLUMES OF WATER AND ELECTRICITY—REDUCING OR ELIMINATING THEIR USE WILL LOWER YOUR SEWER, WATER AND POWER BILLS...
- BE CAUTIOUS OF CHEMICALS OR ADDITIVES THAT CLAIM TO DISSOLVE GREASE—THESE MAY NOT BE EFFECTIVE

KEEP FATS, OIL AND GREASE OUT OF THE SEWERS—AND HELP KEEP OUR ENVIRONMENT CLEAN!

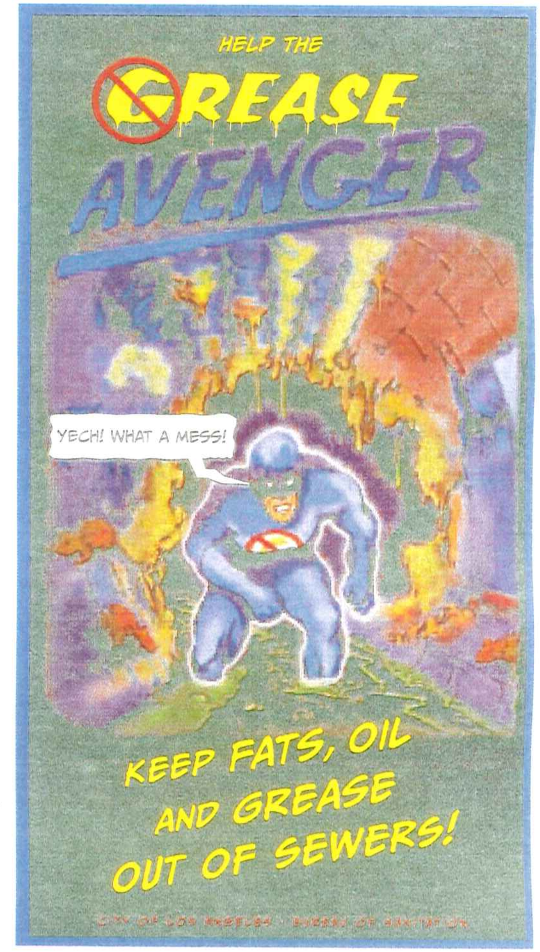
REPORT PROBLEMS WITH THE CITY'S SEWER SYSTEM TO THE WASTEWATER COLLECTION SYSTEMS DIVISION:

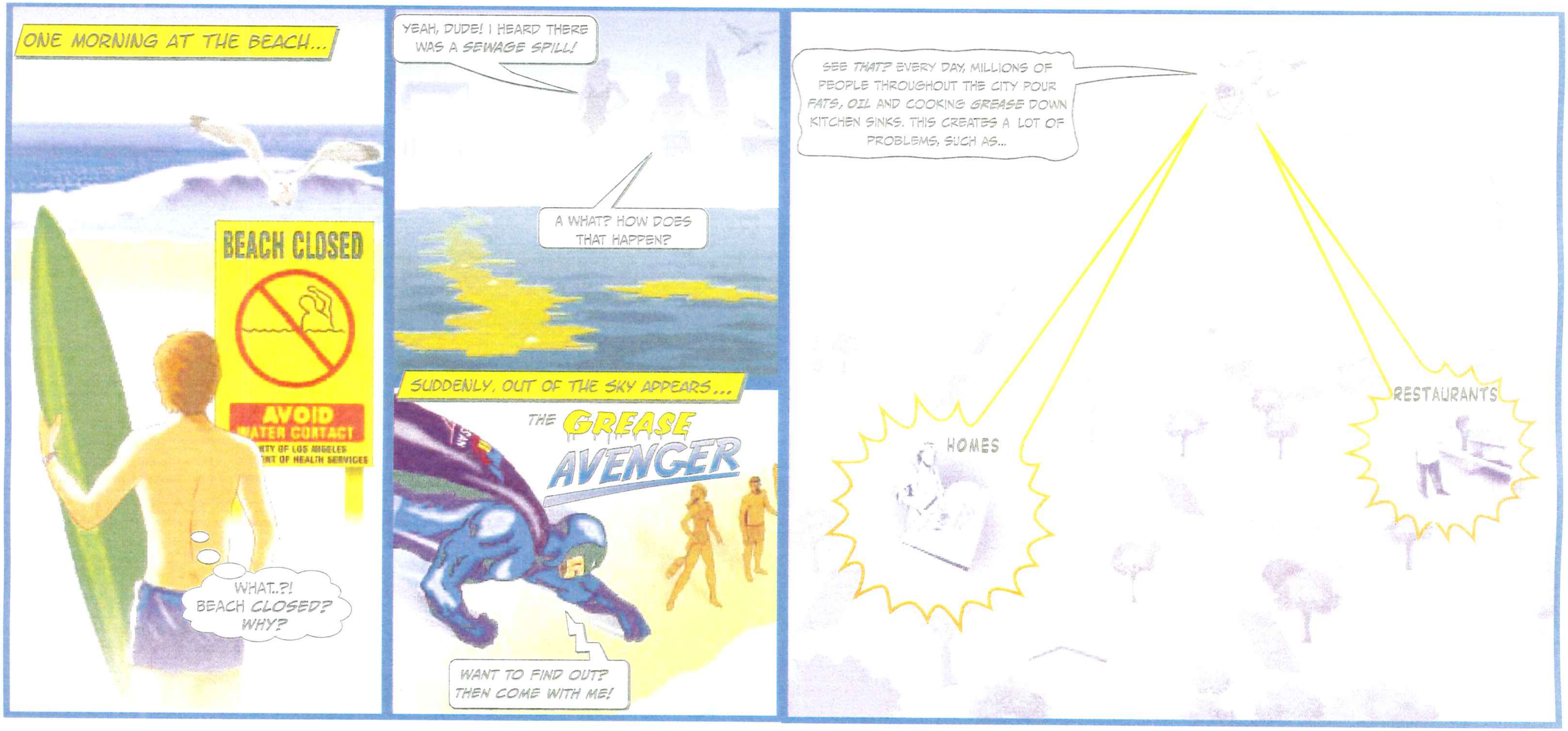
(213) 485-7575

WEB SITE:
WWW.LACITY.ORG/SAN

PRODUCED BY:
CITY OF LOS ANGELES
DEPT. OF PUBLIC WORKS
BUREAU OF SANITATION

ARTWORK:
OSCAR AMARO




ONE MORNING AT THE BEACH...
BEACH CLOSED
AVOID WATER CONTACT
WHAT..?! BEACH CLOSED? WHY?
YEAH, DUDE! I HEARD THERE WAS A SEWAGE SPILL!
A WHAT? HOW DOES THAT HAPPEN?
SUDDENLY, OUT OF THE SKY APPEARS...
THE GREASE AVENGER
WANT TO FIND OUT? THEN COME WITH ME!
SEE THAT? EVERY DAY, MILLIONS OF PEOPLE THROUGHOUT THE CITY POUR FATS, OIL AND COOKING GREASE DOWN KITCHEN SINKS. THIS CREATES A LOT OF PROBLEMS, SUCH AS...
HOMES
RESTAURANTS

Fats, Oils and Grease CLOG THE SEWERS!

Sewage backups and overflows are typically the result of grease buildup which can cause property damage, environmental problems and other health hazards.

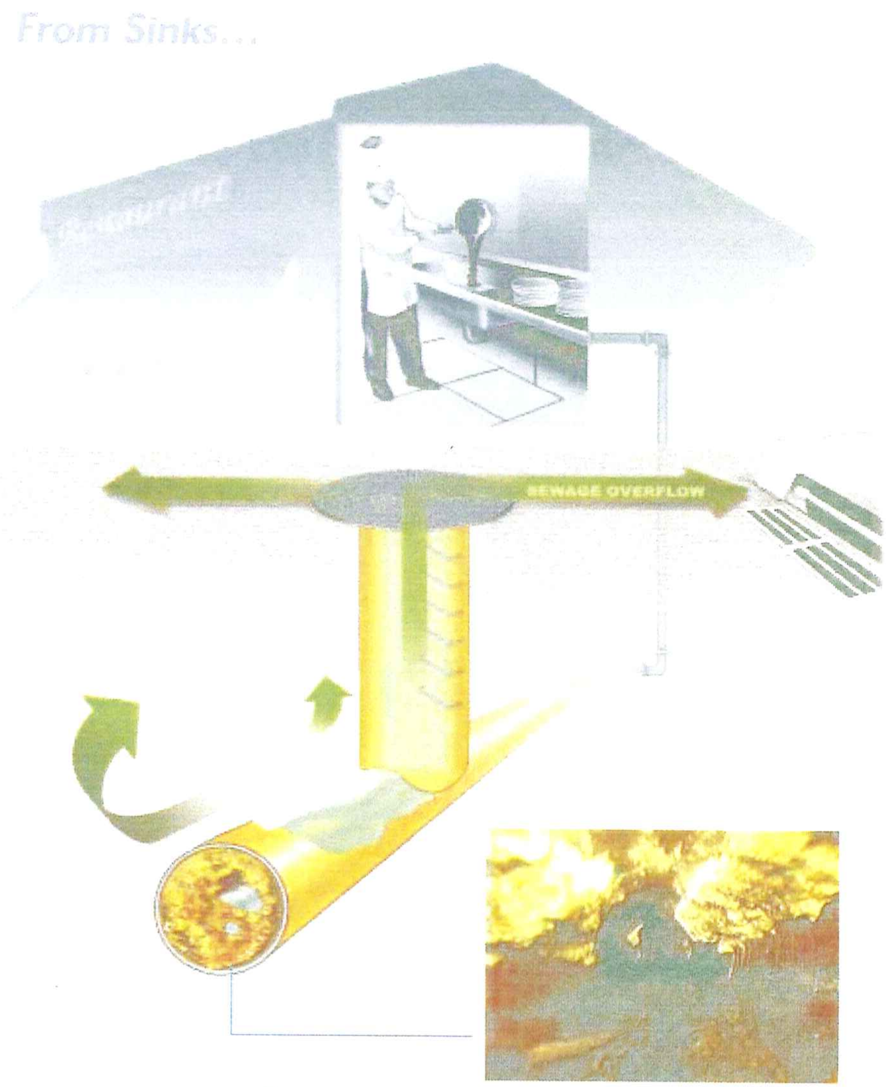
Fats, oils and grease get into the sewers mainly from commercial food preparation establishments that do not have adequate grease control measures in place such as grease interceptors.

Most grease is the byproduct of cooking and is usually found in such things as:

- Food scraps
- Meat fats
- Lard
- Cooking oil
- Butter and margarine
- Baking goods
- Sauces
- Dairy products

All too often, fats, oils and grease are washed into the plumbing system, (usually through kitchen sinks and floor drains found in food preparation areas) and stick to the insides of sewer pipes both on your property and in the streets.

Over time, fats, oils and grease builds up and eventually **blocks the entire pipe** causing sewage backups and overflows.



...to Sewers

Actual photo taken by remote controlled camera showing grease buildup in sewer pipe interior.

COSTS:

To Your Business:

As your sewer pipes back up, sewage and food particles that accumulate can attract insects and other vermin and may create potential health hazards.

Property damage can result from sewage backups leading to expensive cleanup and plumbing repairs that may have to be paid for by you.

Health code violations or closures can greatly impact your business operations.

To the Environment:

Clogged sewers can lead to overflows.

As sewage overflows onto streets, it enters the storm drain system...

...where the sewage is then carried to our local beaches, creating a health risk for swimmers, marine life—and causing beach closures.

To the City:

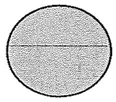
Increased sewer blockages and overflows lead to excessive and costly maintenance and can result in severe fines from the regulatory agencies.

This can increase your sewer fees.

Appendix D

Gravity Piping Capacity Worksheets

MANNING EQUATION FOR PIPE FLOW



➔	Depth of flow?	7.99 *inches*
➔	Pipe diameter?	8 *inches*

phi=	6.142 *radians*	351.90 *degrees*
Wetted Perimeter=	24.567 *inches*	2.047 *feet*
Area=	50.262 *in^2*	0.349 *feet^2*
Hyd. Radius=	2.046 *inches*	0.170 *feet*

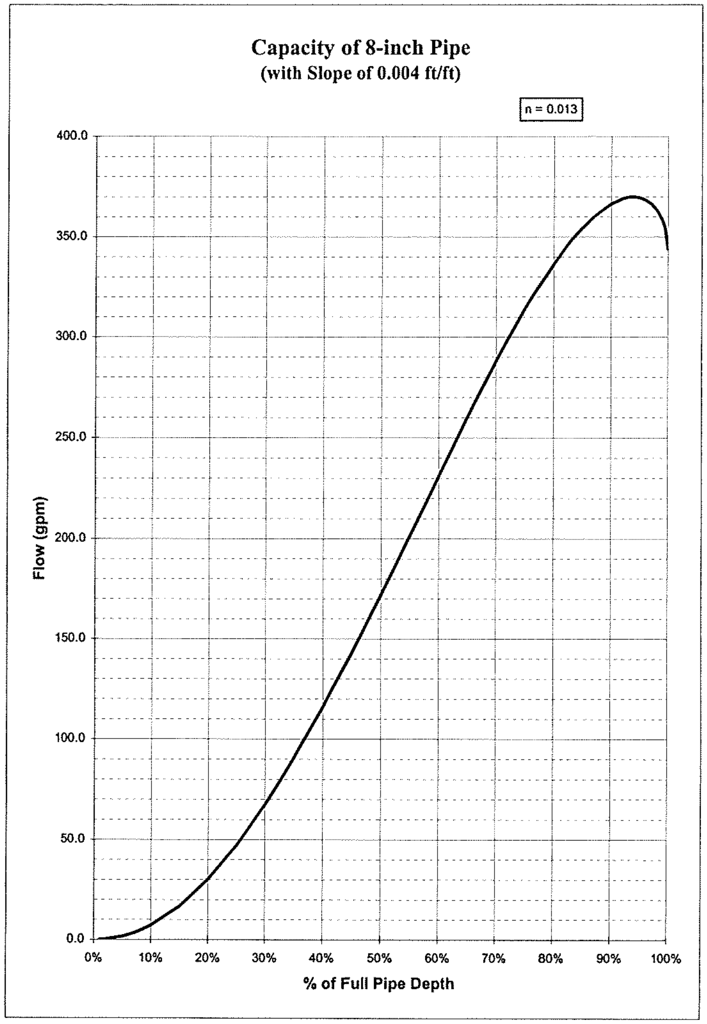
➔	Slope ?	0.004
➔	n ?	0.013

Velocity=	2.229 *fps*	
Flow=	0.778 *cfs*	349.168 *gpm*

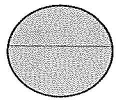
Table Below Assumes Constant Value for "n"

% full	depth (in)	phi (rad)	P (in)	A (in^2)	Rh (in)	Q (cfs)	Q (gpm)	Q (mgd)
1%	0.08	0.401	1.603	0.085	0.053	0.000	0.1	0.0001
2%	0.16	0.568	2.270	0.240	0.106	0.001	0.2	0.0003
5%	0.40	0.902	3.608	0.940	0.260	0.004	1.7	0.0024
7%	0.56	1.071	4.284	1.547	0.361	0.008	3.4	0.0049
8%	0.64	1.147	4.588	1.884	0.411	0.010	4.5	0.0065
10%	0.80	1.287	5.148	2.616	0.508	0.016	7.2	0.0103
15%	1.20	1.591	6.363	4.728	0.743	0.037	16.7	0.0241
20%	1.60	1.855	7.418	7.157	0.965	0.067	30.1	0.0434
25%	2.00	2.094	8.378	9.827	1.173	0.105	47.1	0.0678
30%	2.40	2.319	9.274	12.683	1.368	0.150	67.4	0.0970
35%	2.80	2.532	10.129	15.679	1.548	0.201	90.4	0.1302
40%	3.20	2.739	10.956	18.776	1.714	0.258	115.9	0.1669
45%	3.60	2.941	11.765	21.938	1.865	0.319	143.3	0.2063
50%	4.00	3.142	12.566	25.133	2.000	0.383	172.0	0.2476
55%	4.40	3.342	13.368	28.327	2.119	0.449	201.5	0.2901
60%	4.80	3.544	14.177	31.490	2.221	0.515	231.1	0.3328
65%	5.20	3.751	15.004	34.587	2.305	0.580	260.2	0.3746
70%	5.60	3.965	15.859	37.583	2.370	0.642	288.0	0.4147
75%	6.00	4.189	16.755	40.439	2.413	0.699	313.6	0.4516
80%	6.40	4.429	17.714	43.109	2.434	0.749	336.2	0.4841
83%	6.64	4.583	18.333	44.599	2.433	0.775	347.7	0.5008
85%	6.80	4.692	18.770	45.538	2.426	0.790	354.4	0.5104
87%	6.96	4.808	19.231	46.426	2.414	0.802	360.1	0.5186
90%	7.20	4.996	19.985	47.649	2.384	0.817	366.6	0.5279
92%	7.36	5.136	20.545	48.382	2.355	0.822	369.2	0.5316
93%	7.44	5.212	20.849	48.719	2.337	0.824	369.8	0.5325
94%	**7.52**	**5.293**	**21.173**	**49.034**	**2.316**	**0.824**	**370.0**	**0.5328**
95%	7.60	5.381	21.525	49.326	2.292	0.823	369.6	0.5322
96%	7.68	5.478	21.911	49.591	2.263	0.821	368.5	0.5306
97%	7.76	5.587	22.347	49.826	2.230	0.817	366.6	0.5279
98%	7.84	5.716	22.862	50.026	2.188	0.810	363.5	0.5234
99%	7.92	5.883	23.530	50.180	2.133	0.798	358.4	0.5161
99.5%	7.96	6.000	24.000	50.235	2.093	0.789	354.3	0.5102
100%	8.00	6.283	25.133	50.265	2.000	0.766	344.0	0.4953

Channel Surface	***n***
Smooth Steel Surface	0.012
Corrugated Metal	0.024
Smooth Concrete	0.011
Concrete Culvert (with connection)	0.013
Glazed Brick	0.013
Earth Excavation, clean	0.022
Natural Stream Bed, clean, straight	0.03
Smooth Rock Cuts	0.035
Channels Not Maintained	0.05-0.1
Clean, coated cast iron	0.012-0.013
dirty, tuberculated cast iron	0.015-0.035



MANNING EQUATION FOR PIPE FLOW



→	Depth of flow?	9.99 *inches*
→	Pipe diameter?	10 *inches*

phi=	6.157 *radians*	352.75 *degrees*
Wetted Perimeter=	30.783 *inches*	2.565 *feet*
Area=	78.536 *in^2*	0.545 *feet^2*
Hyd. Radius=	2.551 *inches*	0.213 *feet*

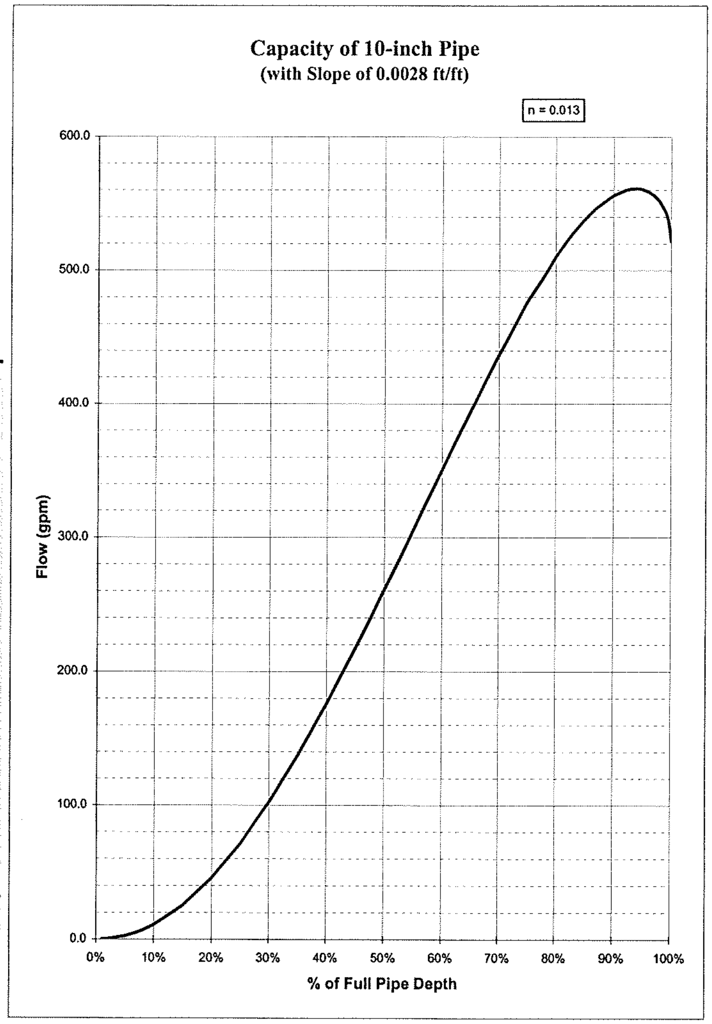
→	Slope ?	0.0028
→	n ?	0.013

Velocity=	2.160 *fps*	
Flow=	1.178 *cfs*	528.837 *gpm*

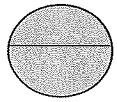
Table Below Assumes Constant Value for "n"

% full	depth (in)	phi (rad)	P (in)	A (in^2)	Rh (in)	Q (cfs)	Q (gpm)	Q (mgd)
1%	0.10	0.401	2.003	0.133	0.066	0.000	0.1	0.0001
2%	0.20	0.568	2.838	0.375	0.132	0.001	0.4	0.0005
5%	0.50	0.902	4.510	1.468	0.326	0.006	2.5	0.0036
7%	0.70	1.071	5.355	2.417	0.451	0.011	5.1	0.0074
8%	0.80	1.147	5.735	2.944	0.513	0.015	6.8	0.0098
10%	1.00	1.287	6.435	4.088	0.635	0.024	10.9	0.0157
15%	1.50	1.591	7.954	7.387	0.929	0.057	25.4	0.0365
20%	2.00	1.855	9.273	11.182	1.206	0.102	45.7	0.0658
25%	2.50	2.094	10.472	15.355	1.466	0.159	71.5	0.1029
30%	3.00	2.319	11.593	19.817	1.709	0.228	102.2	0.1471
35%	3.50	2.532	12.661	24.498	1.935	0.306	137.2	0.1976
40%	4.00	2.739	13.694	29.337	2.142	0.392	175.8	0.2532
45%	4.50	2.941	14.706	34.278	2.331	0.484	217.3	0.3130
50%	5.00	3.142	15.708	39.270	2.500	0.581	260.9	0.3757
55%	5.50	3.342	16.710	44.262	2.649	0.681	305.6	0.4401
60%	6.00	3.544	17.722	49.203	2.776	0.781	350.5	0.5048
65%	6.50	3.751	18.755	54.042	2.881	0.879	394.7	0.5683
70%	7.00	3.965	19.823	58.723	2.962	0.973	436.8	0.6290
75%	7.50	4.189	20.944	63.185	3.017	1.060	475.8	0.6851
80%	8.00	4.429	22.143	67.357	3.042	1.136	510.0	0.7344
83%	8.30	4.583	22.916	69.686	3.041	1.175	527.5	0.7596
85%	8.50	4.692	23.462	71.152	3.033	1.198	537.6	0.7742
87%	8.70	4.808	24.039	72.540	3.018	1.217	546.3	0.7867
90%	9.00	4.996	24.981	74.452	2.980	1.239	556.1	0.8008
92%	9.20	5.136	25.681	75.596	2.944	1.248	560.0	0.8064
93%	9.30	5.212	26.061	76.123	2.921	1.250	561.0	0.8078
94%	**9.40**	**5.293**	**26.467**	**76.616**	**2.895**	**1.250**	**561.2**	**0.8082**
95%	9.50	5.381	26.906	77.072	2.865	1.249	560.6	0.8073
96%	9.60	5.478	27.389	77.486	2.829	1.245	559.0	0.8050
97%	9.70	5.587	27.934	77.853	2.787	1.239	556.1	0.8007
98%	9.80	5.716	28.578	78.165	2.735	1.228	551.3	0.7939
99%	9.90	5.883	29.413	78.407	2.666	1.211	543.7	0.7829
99.5%	9.95	6.000	30.001	78.493	2.616	1.198	537.5	0.7740
100%	10.00	6.283	31.416	78.540	2.500	1.162	521.8	0.7513

Channel Surface	***n***
Smooth Steel Surface	0.012
Corrugated Metal	0.024
Smooth Concrete	0.011
Concrete Culvert (with connection)	0.013
Glazed Brick	0.013
Earth Excavation, clean	0.022
Natural Stream Bed, clean, straight	0.03
Smooth Rock Cuts	0.035
Channels Not Maintained	0.05-0.1
Clean, coated cast iron	0.012-0.013
dirty, tuberculated cast iron	0.015-0.035



MANNING EQUATION FOR PIPE FLOW



➔	Depth of flow?	11.99 *inches*
➔	Pipe diameter?	12 *inches*

phi=	6.168 *radians*	353.38 *degrees*
Wetted Perimeter=	37.006 *inches*	3.084 *feet*
Area=	113.093 *in^2*	0.785 *feet^2*
Hyd. Radius=	3.056 *inches*	0.255 *feet*

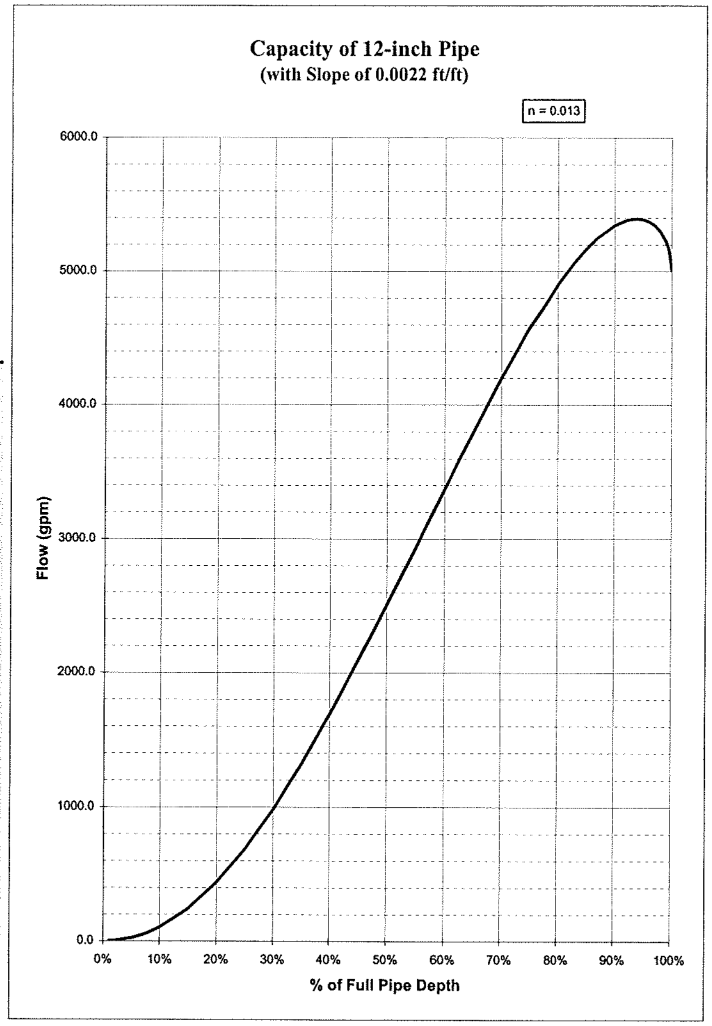
➔	Slope ?	0.0028
➔	n ?	0.0022

Velocity=	14.399 *fps*	
Flow=	11.308 *cfs*	5075.557 *gpm*

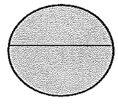
Table Below Assumes Constant Value for "n"

% full	depth (in)	phi (rad)	P (in)	A (in^2)	Rh (in)	Q (cfs)	Q (gpm)	Q (mgd)
1%	0.12	0.401	2.404	0.191	0.080	0.002	0.8	0.0011
2%	0.24	0.568	3.406	0.540	0.159	0.008	3.4	0.0049
5%	0.60	0.902	5.412	2.114	0.391	0.054	24.1	0.0347
7%	0.84	1.071	6.426	3.480	0.542	0.110	49.3	0.0710
8%	0.96	1.147	6.882	4.239	0.616	0.146	65.4	0.0942
10%	1.20	1.287	7.722	5.886	0.762	0.233	104.7	0.1507
15%	1.80	1.591	9.545	10.638	1.115	0.543	243.7	0.3509
20%	2.40	1.855	11.128	16.103	1.447	0.978	439.0	0.6322
25%	3.00	2.094	12.566	22.111	1.760	1.530	686.8	0.9889
30%	3.60	2.319	13.911	28.536	2.051	2.187	981.8	1.4138
35%	4.20	2.532	15.193	35.277	2.322	2.937	1318.3	1.8983
40%	4.80	2.739	16.433	42.245	2.571	3.764	1689.5	2.4329
45%	5.40	2.941	17.648	49.361	2.797	4.653	2088.3	3.0071
50%	6.00	3.142	18.850	56.549	3.000	5.585	2506.8	3.6097
55%	6.60	3.342	20.052	63.737	3.179	6.542	2936.5	4.2285
60%	7.20	3.544	21.266	70.852	3.332	7.505	3368.3	4.8503
65%	7.80	3.751	22.506	77.820	3.458	8.449	3792.3	5.4609
70%	8.40	3.965	23.788	84.561	3.555	9.352	4197.5	6.0444
75%	9.00	4.189	25.133	90.987	3.620	10.186	4571.7	6.5833
80%	9.60	4.429	26.572	96.995	3.650	10.918	4900.5	7.0568
83%	9.96	4.583	27.499	100.348	3.649	11.293	5068.9	7.2991
85%	10.20	4.692	28.154	102.459	3.639	11.510	5166.1	7.4392
87%	10.44	4.808	28.846	104.457	3.621	11.696	5249.4	7.5592
90%	10.80	4.996	29.977	107.211	3.576	11.905	5343.4	7.6945
92%	11.04	5.136	30.817	108.859	3.532	11.989	5380.9	7.7485
93%	11.16	5.212	31.273	109.617	3.505	12.010	5390.5	7.7623
94%	**11.28**	**5.293**	**31.760**	**110.327**	**3.474**	**12.016**	**5392.9**	**7.7658**
95%	11.40	5.381	32.287	110.983	3.437	12.002	5387.1	7.7574
96%	11.52	5.478	32.867	111.580	3.395	11.967	5371.3	7.7347
97%	11.64	5.587	33.521	112.109	3.344	11.905	5343.1	7.6941
98%	11.76	5.716	34.294	112.558	3.282	11.803	5297.7	7.6288
99%	11.88	5.883	35.295	112.906	3.199	11.639	5223.9	7.5224
99.5%	11.94	6.000	36.001	113.030	3.140	11.507	5164.8	7.4373
100%	12.00	6.283	37.699	113.097	3.000	11.170	5013.5	7.2195

Channel Surface	***n***
Smooth Steel Surface	0.012
Corrugated Metal	0.024
Smooth Concrete	0.011
Concrete Culvert (with connection)	0.013
Glazed Brick	0.013
Earth Excavation, clean	0.022
Natural Stream Bed, clean, straight	0.03
Smooth Rock Cuts	0.035
Channels Not Maintained	0.05-0.1
Clean, coated cast iron	0.012-0.013
dirty, tuberculated cast iron	0.015-0.035



MANNING EQUATION FOR PIPE FLOW



➔	Depth of flow?	13.99 *inches*
➔	Pipe diameter?	14 *inches*

phi=	6.176 *radians*	353.87 *degrees*
Wetted Perimeter=	43.234 *inches*	3.603 *feet*
Area=	153.933 *in^2*	1.069 *feet^2*
Hyd. Radius=	3.560 *inches*	0.297 *feet*

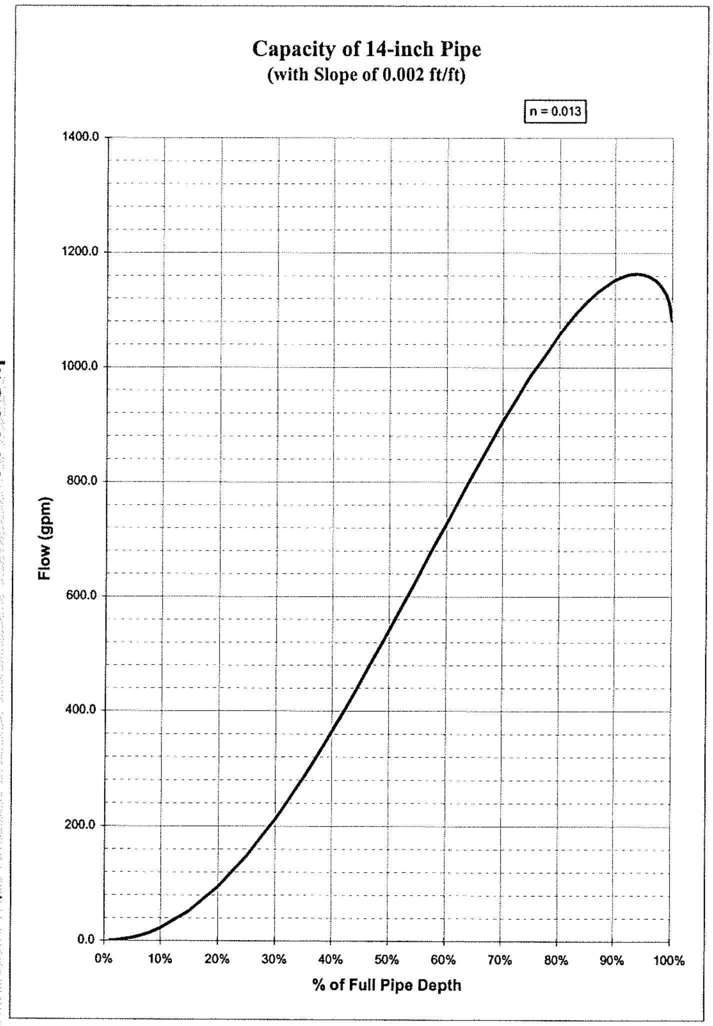
➔	Slope ?	0.002
➔	n ?	0.013

Velocity=	2.280 *fps*		
Flow=	2.438 *cfs*	1094.027 *gpm*	

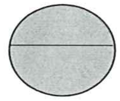
Table Below Assumes Constant Value for "n"

% full	depth (in)	phi (rad)	P (in)	A (in^2)	Rh (in)	Q (cfs)	Q (gpm)	Q (mgd)
1%	0.14	0.401	2.805	0.261	0.093	0.000	0.2	0.0002
2%	0.28	0.568	3.973	0.735	0.185	0.002	0.7	0.0010
5%	0.70	0.902	6.314	2.878	0.456	0.012	5.2	0.0075
7%	0.98	1.071	7.497	4.737	0.632	0.024	10.6	0.0153
8%	1.12	1.147	8.029	5.769	0.719	0.031	14.1	0.0203
10%	1.40	1.287	9.009	8.012	0.889	0.050	22.6	0.0325
15%	2.10	1.591	11.136	14.479	1.300	0.117	52.6	0.0757
20%	2.80	1.855	12.982	21.917	1.688	0.211	94.7	0.1364
25%	3.50	2.094	14.661	30.095	2.053	0.330	148.2	0.2134
30%	4.20	2.319	16.230	38.841	2.393	0.472	211.8	0.3050
35%	4.90	2.532	17.725	48.016	2.709	0.634	284.4	0.4095
40%	5.60	2.739	19.172	57.500	2.999	0.812	364.5	0.5249
45%	6.30	2.941	20.589	67.185	3.263	1.004	450.5	0.6488
50%	7.00	3.142	21.991	76.969	3.500	1.205	540.8	0.7788
55%	7.70	3.342	23.393	86.753	3.708	1.412	633.5	0.9123
60%	8.40	3.544	24.810	96.438	3.887	1.619	726.7	1.0464
65%	9.10	3.751	26.257	105.922	4.034	1.823	818.2	1.1782
70%	9.80	3.965	27.752	115.097	4.147	2.018	905.6	1.3040
75%	10.50	4.189	29.322	123.843	4.224	2.198	986.3	1.4203
80%	11.20	4.429	31.000	132.021	4.259	2.356	1057.3	1.5225
83%	11.62	4.583	32.083	136.585	4.257	2.437	1093.6	1.5748
85%	11.90	4.692	32.847	139.459	4.246	2.483	1114.6	1.6050
87%	12.18	4.808	33.654	142.178	4.225	2.523	1132.5	1.6309
90%	12.60	4.996	34.973	145.926	4.173	2.568	1152.8	1.6600
92%	12.88	5.136	35.953	148.169	4.121	2.586	1160.9	1.6717
93%	13.02	5.212	36.485	149.201	4.089	2.591	1163.0	1.6747
94%	13.16	5.293	37.053	150.167	4.053	2.592	1163.5	1.6754
95%	13.30	5.381	37.668	151.060	4.010	2.589	1162.2	1.6736
96%	13.44	5.478	38.344	151.873	3.961	2.582	1158.8	1.6687
97%	13.58	5.587	39.108	152.592	3.902	2.568	1152.8	1.6600
98%	13.72	5.716	40.009	153.203	3.829	2.547	1143.0	1.6459
99%	13.86	5.883	41.178	153.677	3.732	2.511	1127.0	1.6229
99.5%	13.93	6.000	42.001	153.846	3.663	2.483	1114.3	1.6046
100%	14.00	6.283	43.982	153.938	3.500	2.410	1081.6	1.5576

Channel Surface	*n*
Smooth Steel Surface	0.012
Corrugated Metal	0.024
Smooth Concrete	0.011
Concrete Culvert (with connection)	0.013
Glazed Brick	0.013
Earth Excavation, clean	0.022
Natural Stream Bed, clean, straight	0.03
Smooth Rock Cuts	0.035
Channels Not Maintained	0.05-0.1
Clean, coated cast iron	0.012-0.013
dirty, tuberculated cast iron	0.015-0.035



MANNING EQUATION FOR PIPE FLOW



→	Depth of flow?	14.99 *inches*
→	Pipe diameter?	15 *inches*

phi=	6.180 *radians*	354.08 *degrees*
Wetted Perimeter=	46.349 *inches*	3.862 *feet*
Area=	176.709 *in^2*	1.227 *feet^2*
Hyd. Radius=	3.813 *inches*	0.318 *feet*

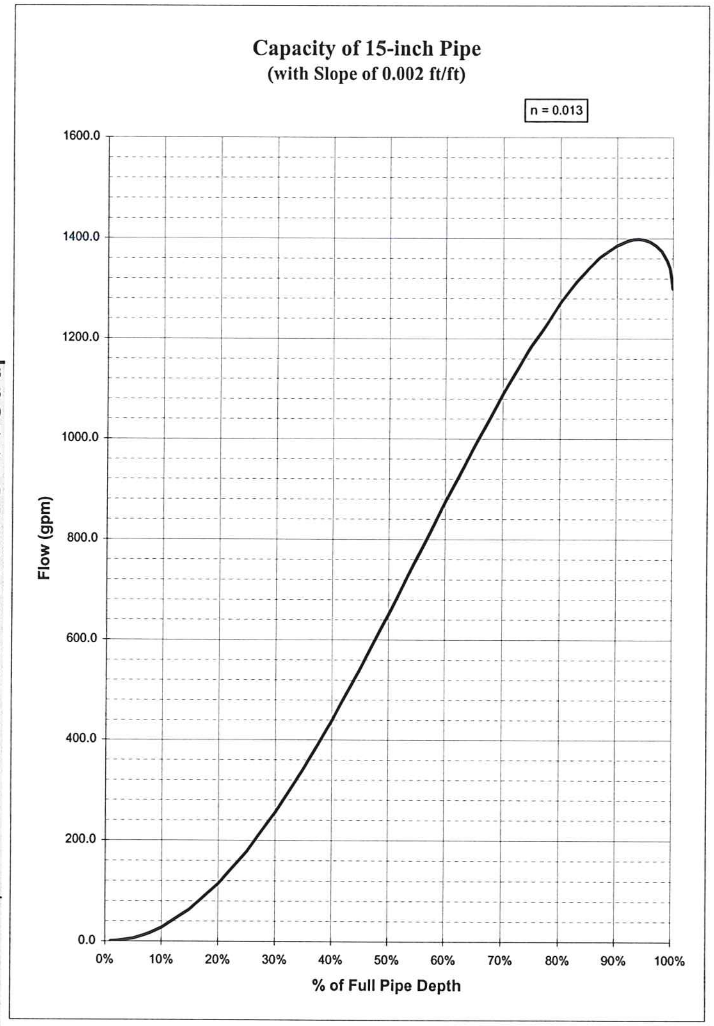
→	Slope ?	0.002
→	n ?	0.013

Velocity=	2.387 *fps*	
Flow=	2.929 *cfs*	1314.505 *gpm*

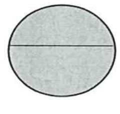
Table Below Assumes Constant Value for "n"

% full	depth (in)	phi (rad)	P (in)	A (in^2)	Rh (in)	Q (cfs)	Q (gpm)	Q (mgd)
1%	0.15	0.401	3.005	0.299	0.100	0.000	0.2	0.0003
2%	0.30	0.568	4.257	0.843	0.198	0.002	0.9	0.0013
5%	0.75	0.902	6.765	3.303	0.488	0.014	6.2	0.0090
7%	1.05	1.071	8.033	5.438	0.677	0.028	12.8	0.0184
8%	1.20	1.147	8.603	6.623	0.770	0.038	17.0	0.0244
10%	1.50	1.287	9.653	9.197	0.953	0.060	27.1	0.0391
15%	2.25	1.591	11.931	16.622	1.393	0.141	63.2	0.0910
20%	3.00	1.855	13.909	25.160	1.809	0.254	113.9	0.1639
25%	3.75	2.094	15.708	34.548	2.199	0.397	178.1	0.2565
30%	4.50	2.319	17.389	44.588	2.564	0.567	254.6	0.3666
35%	5.25	2.532	18.992	55.121	2.902	0.762	341.9	0.4923
40%	6.00	2.739	20.542	66.008	3.213	0.976	438.1	0.6309
45%	6.75	2.941	22.059	77.126	3.496	1.207	541.5	0.7798
50%	7.50	3.142	23.562	88.357	3.750	1.448	650.1	0.9361
55%	8.25	3.342	25.064	99.589	3.973	1.697	761.5	1.0966
60%	9.00	3.544	26.582	110.706	4.165	1.946	873.5	1.2578
65%	9.75	3.751	28.132	121.594	4.322	2.191	983.4	1.4161
70%	10.50	3.965	29.735	132.127	4.444	2.425	1088.5	1.5675
75%	11.25	4.189	31.416	142.167	4.525	2.641	1185.6	1.7072
80%	12.00	4.429	33.214	151.554	4.563	2.831	1270.8	1.8300
83%	12.45	4.583	34.374	156.794	4.561	2.929	1314.5	1.8928
85%	12.75	4.692	35.193	160.093	4.549	2.985	1339.7	1.9292
87%	13.05	4.808	36.058	163.215	4.526	3.033	1361.3	1.9603
90%	13.50	4.996	37.471	167.518	4.471	3.087	1385.7	1.9954
92%	13.80	5.136	38.521	170.092	4.416	3.109	1395.4	2.0094
93%	13.95	5.212	39.091	171.277	4.381	3.114	1397.9	2.0129
94%	**14.10**	**5.293**	**39.700**	**172.386**	**4.342**	**3.116**	**1398.5**	**2.0139**
95%	14.25	5.381	40.358	173.411	4.297	3.113	1397.0	2.0117
96%	14.40	5.478	41.083	174.344	4.244	3.103	1392.9	2.0058
97%	14.55	5.587	41.901	175.170	4.181	3.087	1385.6	1.9953
98%	14.70	5.716	42.867	175.871	4.103	3.061	1373.8	1.9783
99%	14.85	5.883	44.119	176.415	3.999	3.018	1354.7	1.9507
99.5%	14.93	6.000	45.001	176.609	3.925	2.984	1339.4	1.9287
100%	15.00	6.283	47.124	176.715	3.750	2.897	1300.1	1.8722

Channel Surface	***n***
Smooth Steel Surface	0.012
Corrugated Metal	0.024
Smooth Concrete	0.011
Concrete Culvert (with connection)	0.013
Glazed Brick	0.013
Earth Excavation, clean	0.022
Natural Stream Bed, clean, straight	0.03
Smooth Rock Cuts	0.035
Channels Not Maintained	0.05-0.1
Clean, coated cast iron	0.012-0.013
dirty, tuberculated cast iron	0.015-0.035



MANNING EQUATION FOR PIPE FLOW



→	Depth of flow?	17.99 *inches*
→	Pipe diameter?	18 *inches*

phi=	6.189 *radians*	354.60 *degrees*
Wetted Perimeter=	55.700 *inches*	4.642 *feet*
Area=	254.463 *in^2*	1.767 *feet^2*
Hyd. Radius=	4.568 *inches*	0.381 *feet*

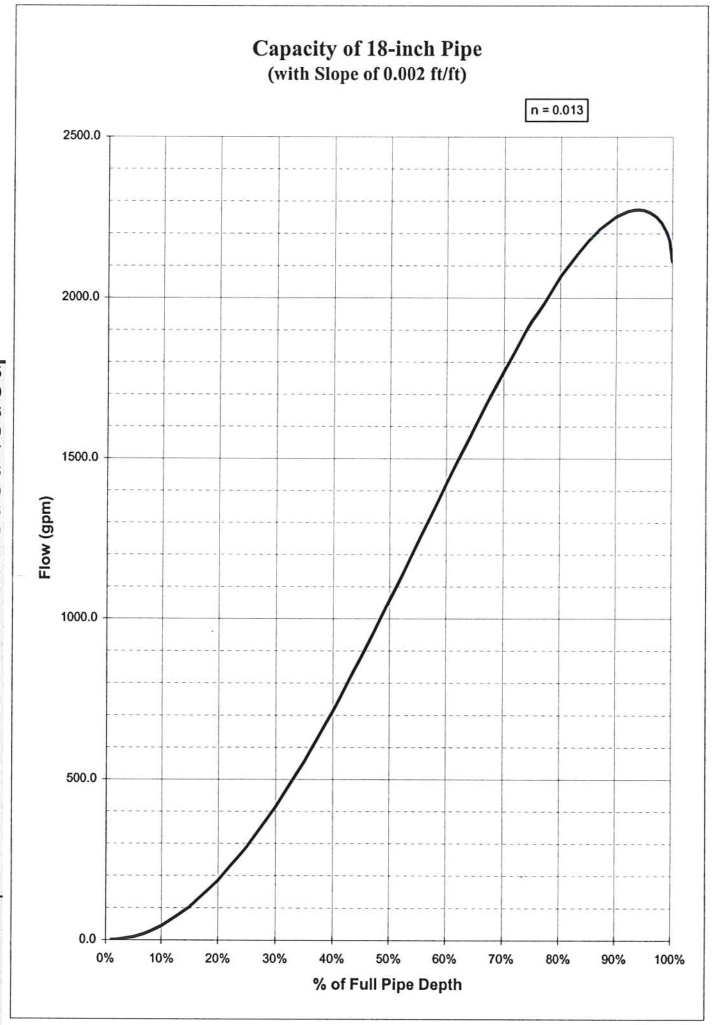
→	Slope ?	0.002
→	n ?	0.013

Velocity=	2.692 *fps*	
Flow=	4.758 *cfs*	2135.482 *gpm*

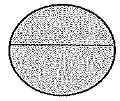
Table Below Assumes Constant Value for "n"

% full	depth (in)	phi (rad)	P (in)	A (in^2)	Rh (in)	Q (cfs)	Q (gpm)	Q (mgd)
1%	0.18	0.401	3.606	0.431	0.119	0.001	0.3	0.0005
2%	0.36	0.568	5.108	1.215	0.238	0.003	1.4	0.0020
5%	0.90	0.902	8.118	4.757	0.586	0.023	10.2	0.0146
7%	1.26	1.071	9.639	7.831	0.812	0.046	20.8	0.0299
8%	1.44	1.147	10.323	9.537	0.924	0.061	27.6	0.0397
10%	1.80	1.287	11.583	13.244	1.143	0.098	44.1	0.0636
15%	2.70	1.591	14.317	23.935	1.672	0.229	102.8	0.1480
20%	3.60	1.855	16.691	36.231	2.171	0.412	185.1	0.2666
25%	4.50	2.094	18.850	49.749	2.639	0.645	289.6	0.4170
30%	5.40	2.319	20.867	64.207	3.077	0.922	414.0	0.5962
35%	6.30	2.532	22.790	79.374	3.483	1.239	555.9	0.8005
40%	7.20	2.739	24.650	95.052	3.856	1.587	712.4	1.0259
45%	8.10	2.941	26.471	111.062	4.196	1.962	880.6	1.2681
50%	9.00	3.142	28.274	127.235	4.500	2.355	1057.1	1.5222
55%	9.90	3.342	30.077	143.407	4.768	2.759	1238.3	1.7831
60%	10.80	3.544	31.899	159.417	4.998	3.165	1420.4	2.0453
65%	11.70	3.751	33.759	175.095	5.187	3.563	1599.2	2.3028
70%	12.60	3.965	35.682	190.262	5.332	3.944	1770.0	2.5489
75%	13.50	4.189	37.699	204.720	5.430	4.295	1927.8	2.7761
80%	14.40	4.429	39.857	218.238	5.475	4.604	2066.5	2.9758
83%	14.94	4.583	41.249	225.783	5.474	4.762	2137.5	3.0780
85%	15.30	4.692	42.231	230.534	5.459	4.854	2178.5	3.1370
87%	15.66	4.808	43.270	235.029	5.432	4.932	2213.6	3.1876
90%	16.20	4.996	44.966	241.225	5.365	5.020	2253.2	3.2447
92%	16.56	5.136	46.225	244.932	5.299	5.055	2269.1	3.2674
93%	16.74	5.212	46.909	246.638	5.258	5.065	2273.1	3.2733
94%	**16.92**	**5.293**	**47.640**	**248.235**	**5.211**	**5.067**	**2274.1**	**3.2748**
95%	17.10	5.381	48.430	249.712	5.156	5.061	2271.7	3.2712
96%	17.28	5.478	49.300	251.055	5.092	5.047	2265.0	3.2617
97%	17.46	5.587	50.282	252.245	5.017	5.020	2253.1	3.2445
98%	17.64	5.716	51.440	253.254	4.923	4.977	2234.0	3.2170
99%	17.82	5.883	52.943	254.038	4.798	4.908	2202.9	3.1721
99.5%	17.91	6.000	54.001	254.316	4.709	4.852	2177.9	3.1362
100%	18.00	6.283	56.549	254.469	4.500	4.710	2114.1	3.0444

Channel Surface	***n***
Smooth Steel Surface	0.012
Corrugated Metal	0.024
Smooth Concrete	0.011
Concrete Culvert (with connection)	0.013
Glazed Brick	0.013
Earth Excavation, clean	0.022
Natural Stream Bed, clean, straight	0.03
Smooth Rock Cuts	0.035
Channels Not Maintained	0.05-0.1
Clean, coated cast iron	0.012-0.013
dirty, tuberculated cast iron	0.015-0.035



MANNING EQUATION FOR PIPE FLOW



➔	Depth of flow?	23.99 *inches*
➔	Pipe diameter?	24 *inches*

phi=	6.202 *radians*	355.32 *degrees*
Wetted Perimeter=	74.418 *inches*	6.202 *feet*
Area=	452.383 *in^2*	3.142 *feet^2*
Hyd. Radius=	6.079 *inches*	0.507 *feet*

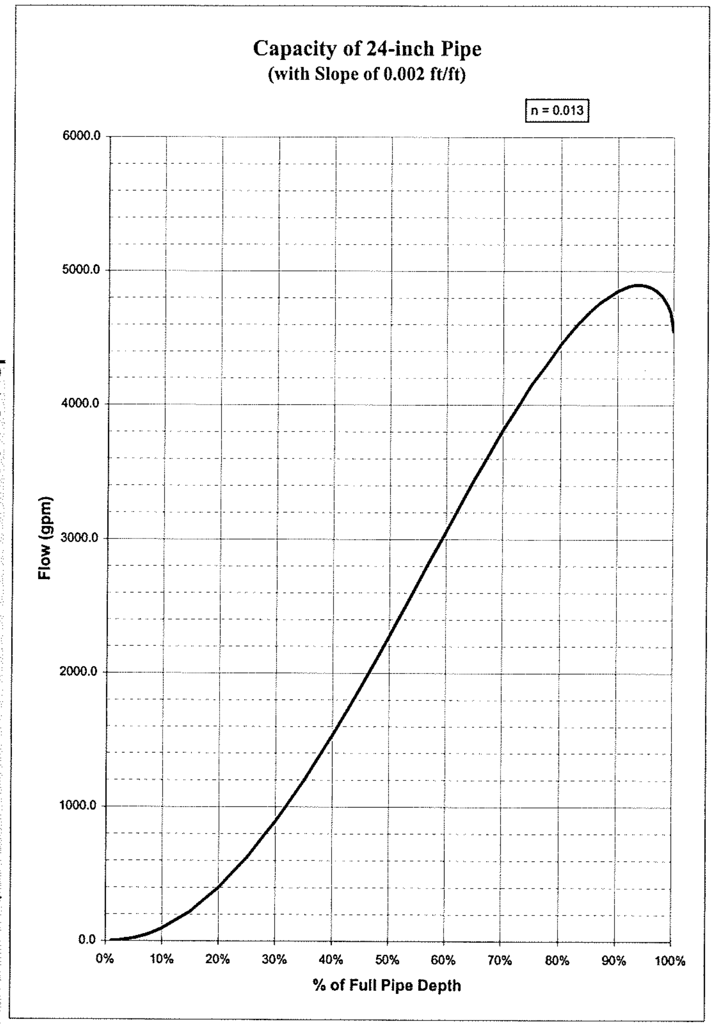
➔	Slope ?	0.002
➔	n ?	0.013

Velocity=	3.257 *fps*	
Flow=	10.233 *cfs*	4592.837 *gpm*

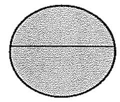
Table Below Assumes Constant Value for "n"

% full	depth (in)	phi (rad)	P (in)	A (in^2)	Rh (in)	Q (cfs)	Q (gpm)	Q (mgd)
1%	0.24	0.401	4.808	0.766	0.159	0.002	0.7	0.0010
2%	0.48	0.568	6.811	2.159	0.317	0.007	3.1	0.0044
5%	1.20	0.902	10.825	8.457	0.781	0.049	21.9	0.0315
7%	1.68	1.071	12.853	13.921	1.083	0.100	44.8	0.0644
8%	1.92	1.147	13.764	16.955	1.232	0.132	59.4	0.0855
10%	2.40	1.287	15.444	23.544	1.524	0.212	95.1	0.1369
15%	3.60	1.591	19.090	42.552	2.229	0.493	221.3	0.3187
20%	4.80	1.855	22.255	64.411	2.894	0.888	398.7	0.5742
25%	6.00	2.094	25.133	88.443	3.519	1.390	623.7	0.8981
30%	7.20	2.319	27.823	114.145	4.103	1.987	891.6	1.2840
35%	8.40	2.532	30.386	141.109	4.644	2.667	1197.2	1.7239
40%	9.60	2.739	32.867	168.981	5.141	3.418	1534.3	2.2094
45%	10.80	2.941	35.295	197.443	5.594	4.225	1896.5	2.7309
50%	12.00	3.142	37.699	226.195	6.000	5.072	2276.5	3.2782
55%	13.20	3.342	40.103	254.947	6.357	5.942	2666.8	3.8402
60%	14.40	3.544	42.532	283.408	6.663	6.815	3058.9	4.4049
65%	15.60	3.751	45.012	311.281	6.916	7.673	3444.0	4.9593
70%	16.80	3.965	47.576	338.244	7.110	8.493	3812.0	5.4893
75%	18.00	4.189	50.265	363.947	7.240	9.250	4151.8	5.9787
80%	19.20	4.429	53.143	387.979	7.301	9.916	4450.5	6.4087
83%	19.92	4.583	54.999	401.393	7.298	10.256	4603.3	6.6288
85%	20.40	4.692	56.309	409.838	7.278	10.453	4691.7	6.7560
87%	20.88	4.808	57.693	417.830	7.242	10.622	4767.3	6.8650
90%	21.60	4.996	59.954	428.845	7.153	10.812	4852.6	6.9878
92%	22.08	5.136	61.634	435.435	7.065	10.888	4886.7	7.0369
93%	22.32	5.212	62.546	438.468	7.010	10.907	4895.4	7.0494
94%	**22.56**	**5.293**	**63.520**	**441.307**	**6.948**	**10.912**	**4897.6**	**7.0526**
95%	22.80	5.381	64.574	443.933	6.875	10.900	4892.3	7.0450
96%	23.04	5.478	65.733	446.320	6.790	10.868	4878.0	7.0244
97%	23.28	5.587	67.042	448.435	6.689	10.811	4852.4	6.9875
98%	23.52	5.716	68.587	450.230	6.564	10.719	4811.2	6.9281
99%	23.76	5.883	70.590	451.624	6.398	10.570	4744.1	6.8315
99.5%	23.88	6.000	72.001	452.118	6.279	10.450	4690.5	6.7543
100%	24.00	6.283	75.398	452.389	6.000	10.144	4553.1	6.5564

Channel Surface	***n***
Smooth Steel Surface	0.012
Corrugated Metal	0.024
Smooth Concrete	0.011
Concrete Culvert (with connection)	0.013
Glazed Brick	0.013
Earth Excavation, clean	0.022
Natural Stream Bed, clean, straight	0.03
Smooth Rock Cuts	0.035
Channels Not Maintained	0.05-0.1
Clean, coated cast iron	0.012-0.013
dirty, tuberculated cast iron	0.015-0.035



MANNING EQUATION FOR PIPE FLOW



➔	Depth of flow?	29.99 *inches*
➔	Pipe diameter?	30 *inches*

phi=	6.210 *radians*	355.82 *degrees*
Wetted Perimeter=	93.152 *inches*	7.763 *feet*
Area=	706.851 *in^2*	4.909 *feet^2*
Hyd. Radius=	7.588 *inches*	0.632 *feet*

➔	Slope ?	0.002
➔	n ?	0.013

Velocity=	3.776 *fps*	
Flow=	18.536 *cfs*	8319.715 *gpm*

Table Below Assumes Constant Value for "n"

% full	depth (in)	phi (rad)	P (in)	A (in^2)	Rh (in)	Q (cfs)	Q (gpm)	Q (mgd)
1%	0.30	0.401	6.010	1.196	0.199	0.003	1.2	0.0018
2%	0.60	0.568	8.514	3.374	0.396	0.012	5.5	0.0080
5%	1.50	0.902	13.531	13.213	0.977	0.088	39.6	0.0571
7%	2.10	1.071	16.066	21.752	1.354	0.181	81.1	0.1168
8%	2.40	1.147	17.205	26.492	1.540	0.240	107.7	0.1550
10%	3.00	1.287	19.305	36.788	1.906	0.384	172.4	0.2482
15%	4.50	1.591	23.862	66.487	2.786	0.894	401.3	0.5778
20%	6.00	1.855	27.819	100.641	3.618	1.611	722.9	1.0410
25%	7.50	2.094	31.416	138.192	4.399	2.519	1130.8	1.6284
30%	9.00	2.319	34.778	178.352	5.128	3.602	1616.6	2.3280
35%	10.50	2.532	37.983	220.482	5.805	4.836	2170.6	3.1257
40%	12.00	2.739	41.083	264.033	6.427	6.198	2781.9	4.0060
45%	13.50	2.941	44.119	308.504	6.993	7.661	3438.6	4.9515
50%	15.00	3.142	47.124	353.429	7.500	9.196	4127.6	5.9438
55%	16.50	3.342	50.129	398.354	7.947	10.773	4835.2	6.9627
60%	18.00	3.544	53.165	442.826	8.329	12.357	5546.2	7.9866
65%	19.50	3.751	56.265	486.376	8.644	13.912	6244.3	8.9919
70%	21.00	3.965	59.469	528.507	8.887	15.399	6911.6	9.9527
75%	22.50	4.189	62.832	568.667	9.051	16.772	7527.8	10.8400
80%	24.00	4.429	66.429	606.217	9.126	17.978	8069.2	11.6197
83%	24.90	4.583	68.748	627.176	9.123	18.596	8346.4	12.0188
85%	25.50	4.692	70.386	640.371	9.098	18.953	8506.6	12.2494
87%	26.10	4.808	72.116	652.859	9.053	19.258	8643.8	12.4470
90%	27.00	4.996	74.943	670.071	8.941	19.603	8798.4	12.6697
92%	27.60	5.136	77.042	680.367	8.831	19.741	8860.2	12.7587
93%	27.90	5.212	78.182	685.107	8.763	19.776	8876.0	12.7814
94%	**28.20**	**5.293**	**79.400**	**689.543**	**8.684**	**19.785**	**8880.0**	**12.7872**
95%	28.50	5.381	80.717	693.645	8.594	19.763	8870.4	12.7734
96%	28.80	5.478	82.166	697.374	8.487	19.706	8844.5	12.7360
97%	29.10	5.587	83.803	700.679	8.361	19.602	8798.0	12.6691
98%	29.40	5.716	85.734	703.485	8.205	19.436	8723.3	12.5615
99%	29.70	5.883	88.238	705.662	7.997	19.165	8601.7	12.3864
99.5%	29.85	6.000	90.002	706.435	7.849	18.948	8504.4	12.2464
100%	30.00	6.283	94.248	706.858	7.500	18.393	8255.3	11.8876

Channel Surface	***n***
Smooth Steel Surface	0.012
Corrugated Metal	0.024
Smooth Concrete	0.011
Concrete Culvert (with connection)	0.013
Glazed Brick	0.013
Earth Excavation, clean	0.022
Natural Stream Bed, clean, straight	0.03
Smooth Rock Cuts	0.035
Channels Not Maintained	0.05-0.1
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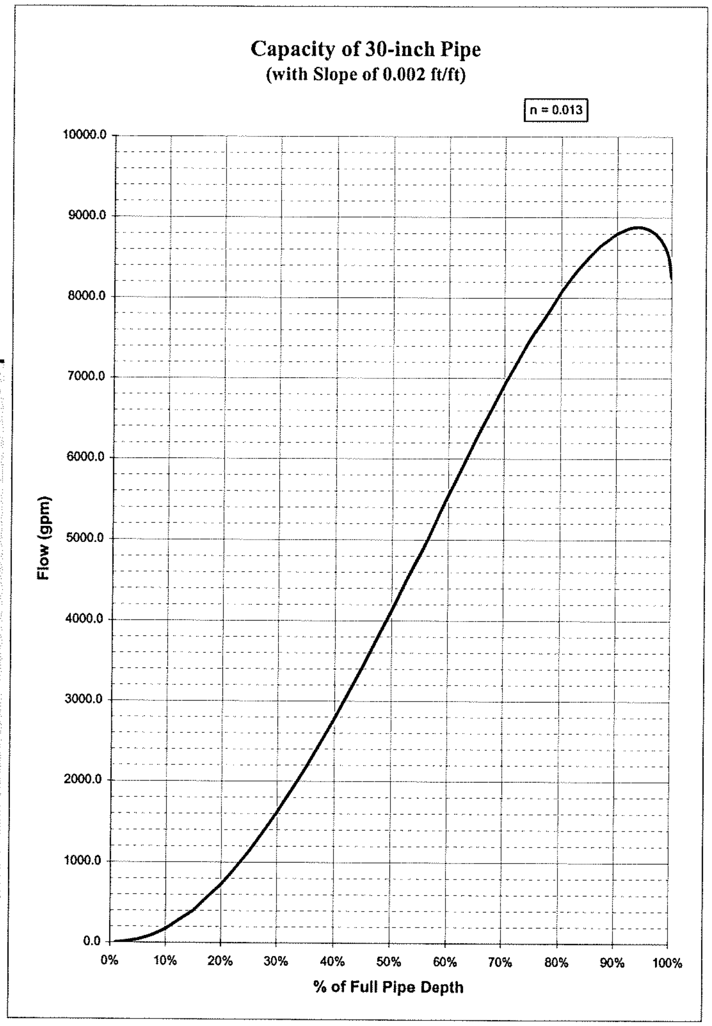


CITY OF COOS BAY
WASTEWATER COLLECTION MASTER PLAN
VOLUME B

SYSTEM MAPPING

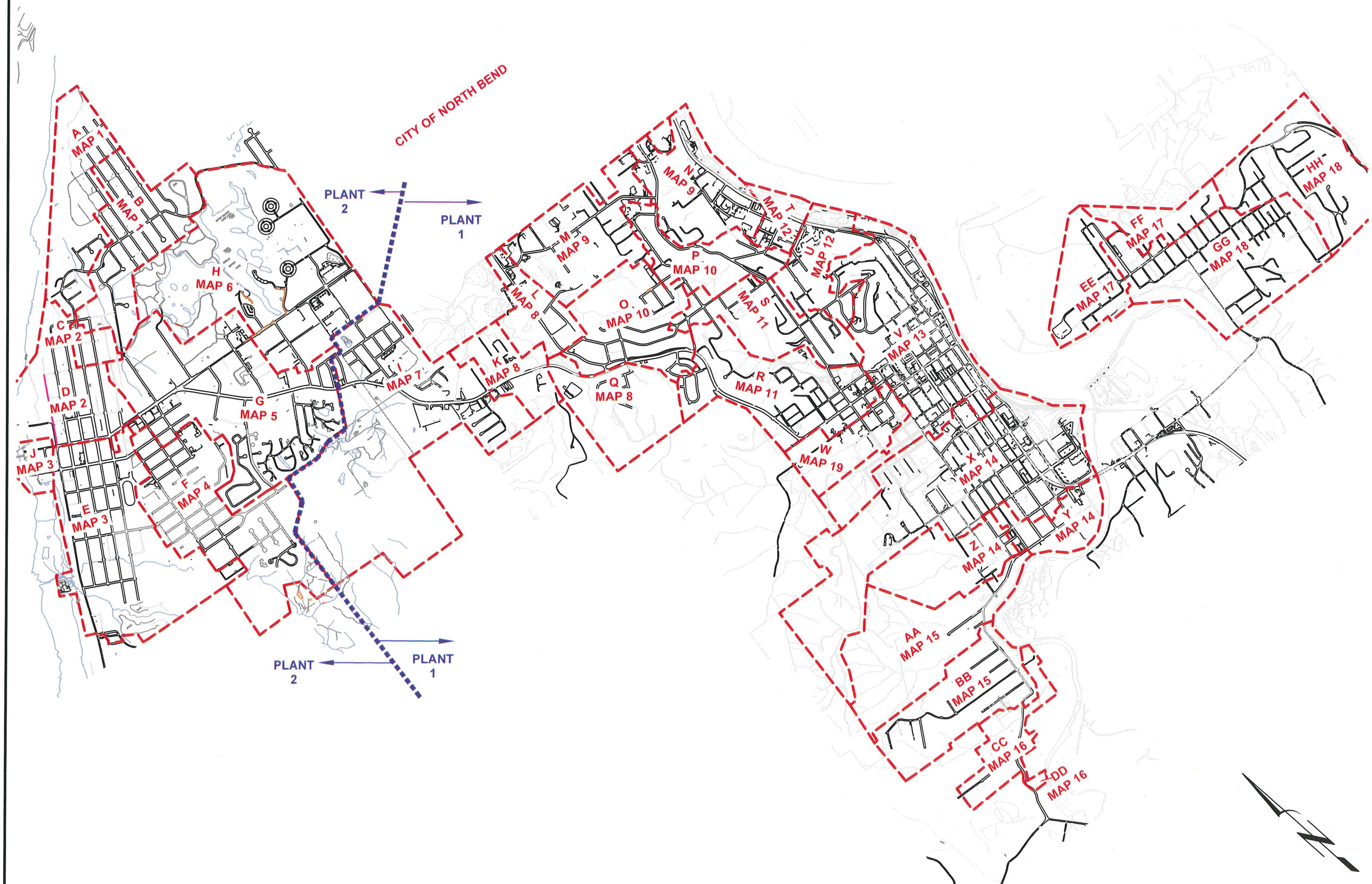
H B H
Consulting
Engineers

CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

COLLECTION SYSTEM MAPPING
COVER SHEET

DRAWN BY: JGP
DATE: JAN 2006

MAP
COV



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CITY OF COOS BAY

WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM

OVERALL MAP

DRAWN BY: JGP

DATE: JAN 2006

MAP

i

LEGEND

PIPE SIZE COLOR CODE

4 INCH	15 INCH
6 INCH	16 INCH
8 IINCH	18 INCH
10 INCH	24 INCH
12 INCH	27 INCH
14 INCH	30 INCH

INDICATES GRAVITY SEWER (SIZE AS INDICATED BY COLOR)

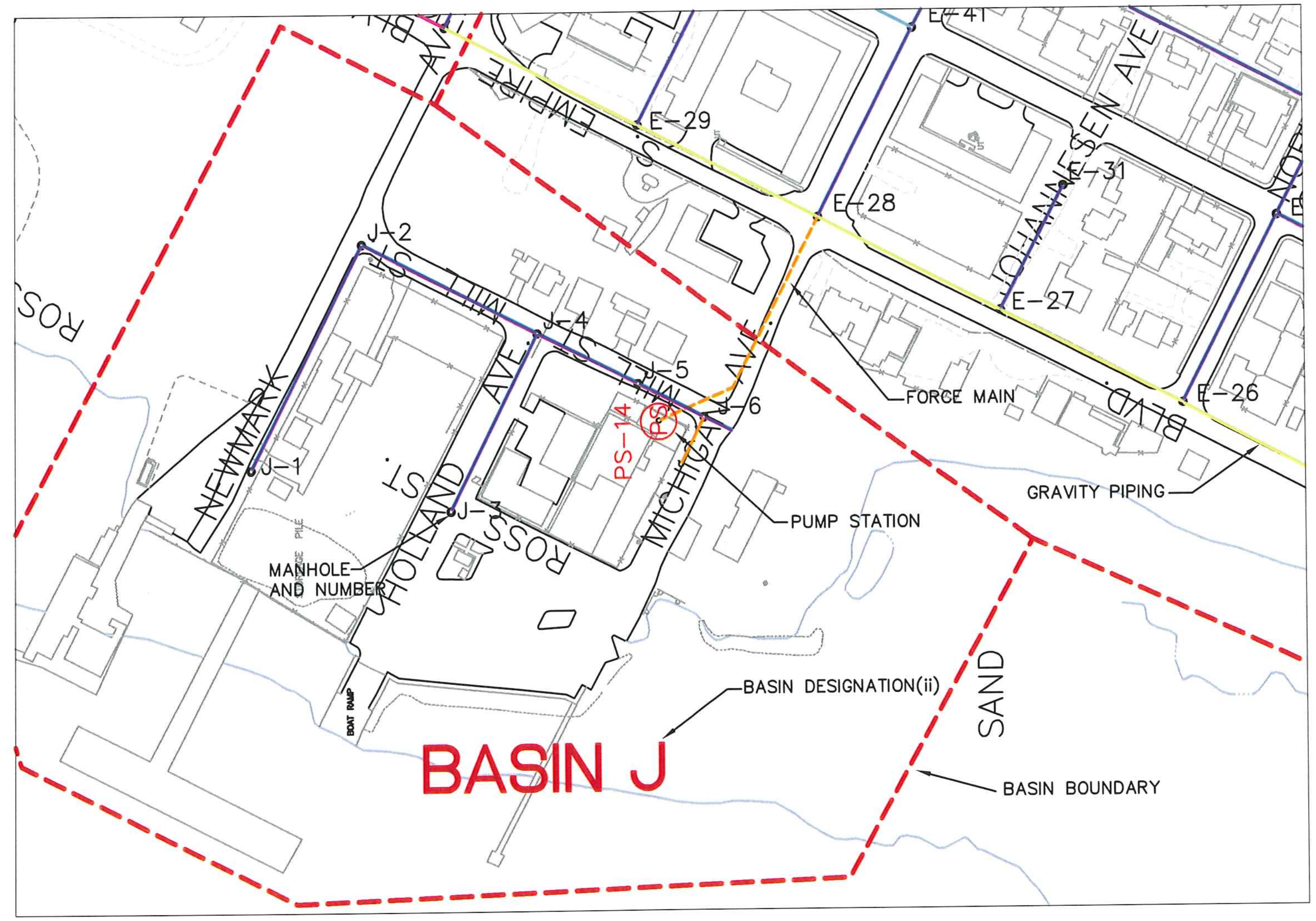
INDICATES PRESSURE SEWER (SIZE AS INDICATED BY COLOR)

PS — PUMP STATION SYMBOL

PS–16 — PUMP STATION NUMBER

A–1 — SANITARY SEWER MANHOLE AND NUMBER

SAMPLE MAP



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CITY OF COOS BAY

WASTEWATER COLLECTION SYSTEM MASTER PLAN

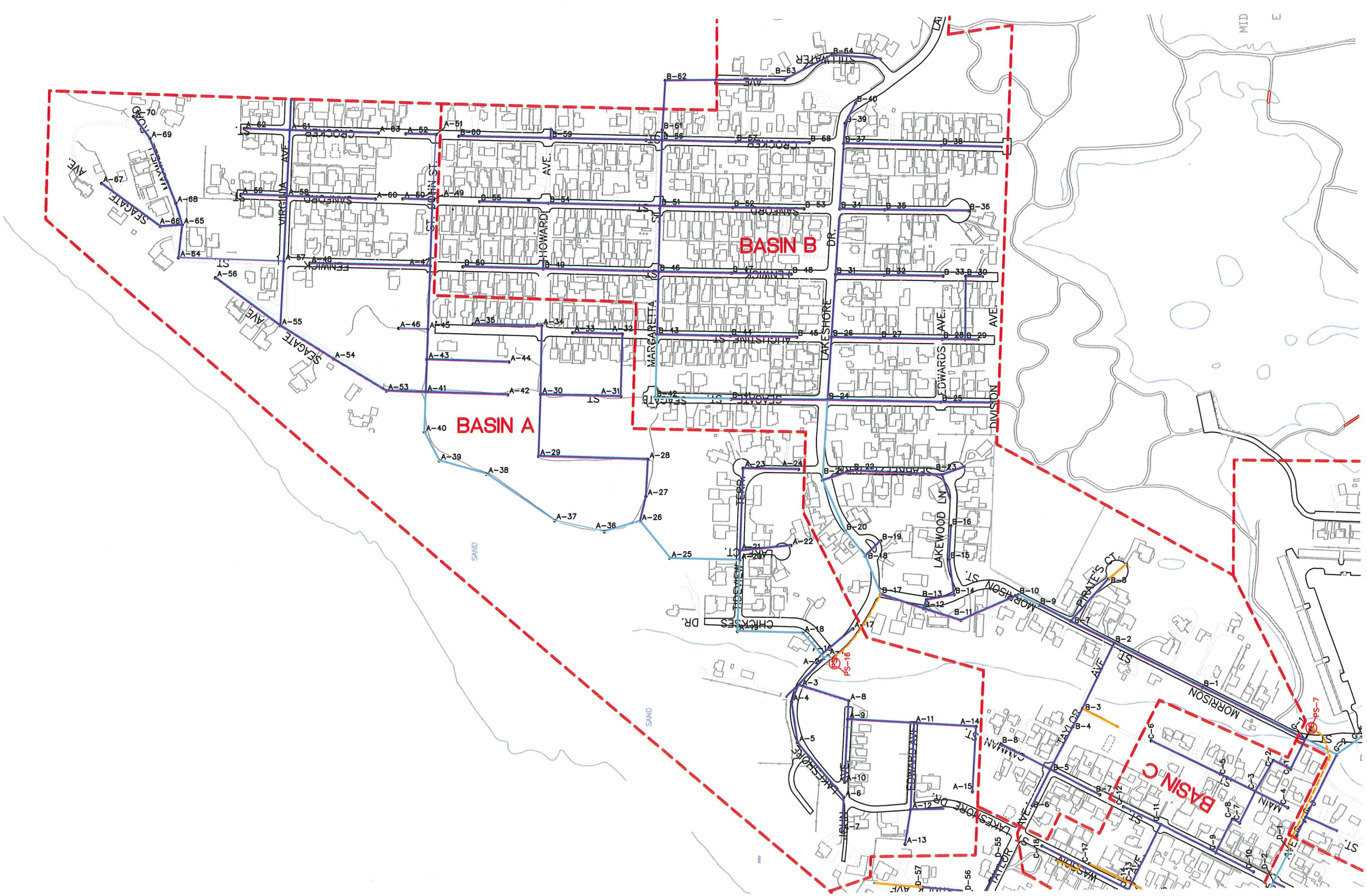
COLLECTION MAPPING LEGEND

EXISTING SYSTEM

DRAWN BY: JGI

DATE: JAN 2006

MAP ii



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

CITY OF COOS BAY

WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS A&B

DRAWN BY: DGN

DATE: JAN 2006

MAP 1

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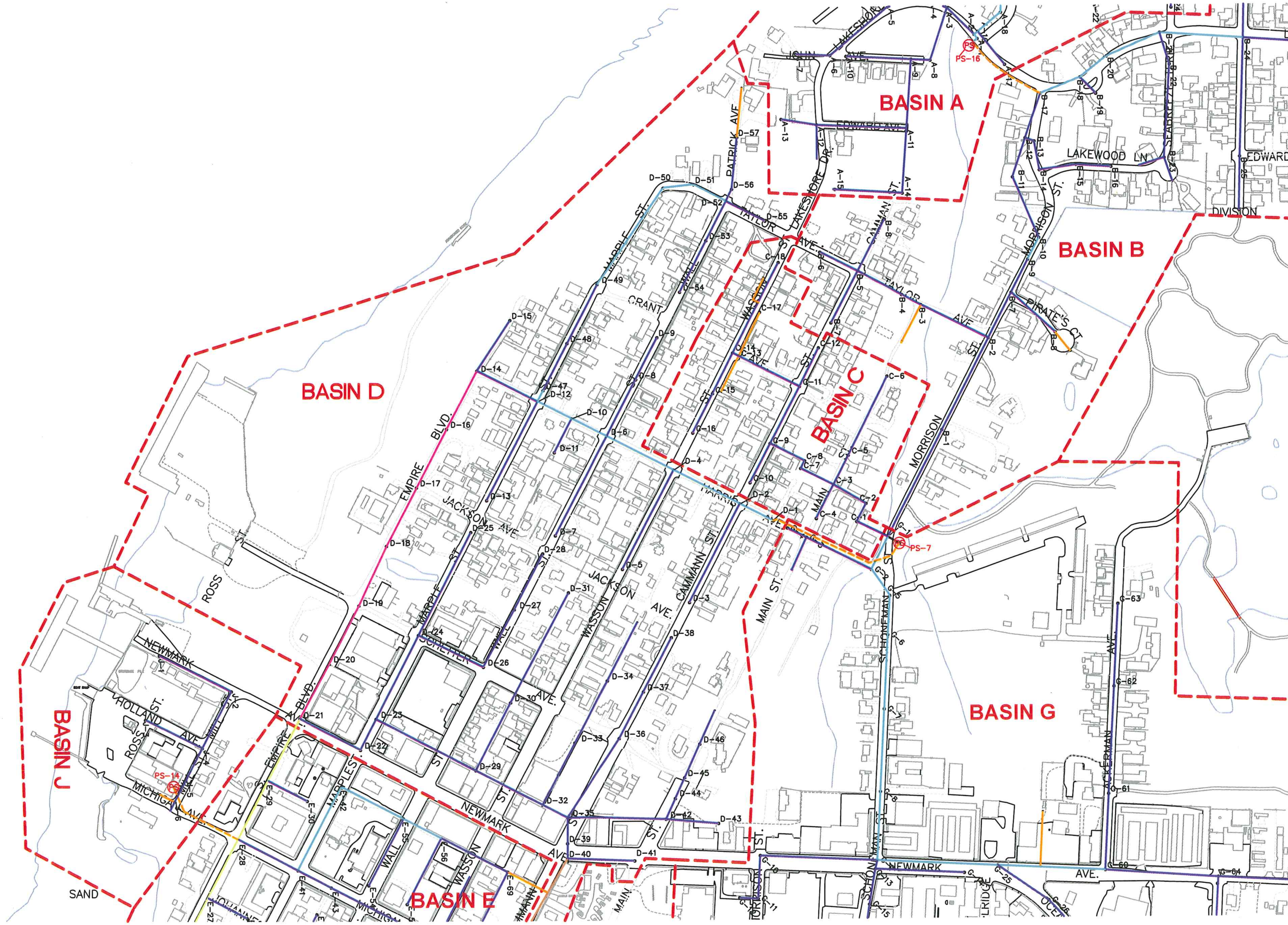
C:\01PALLO\Projects\coos bay\2005-002.01 Coos Bay Collection System Master Plan\dwg\Sanitary.dwg 2/23/2006 9:31:47 AM PST



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

CITY OF COOS BAY

WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS C&D

DRAWN BY: JGP
DATE: JAN 2006

MAP
2

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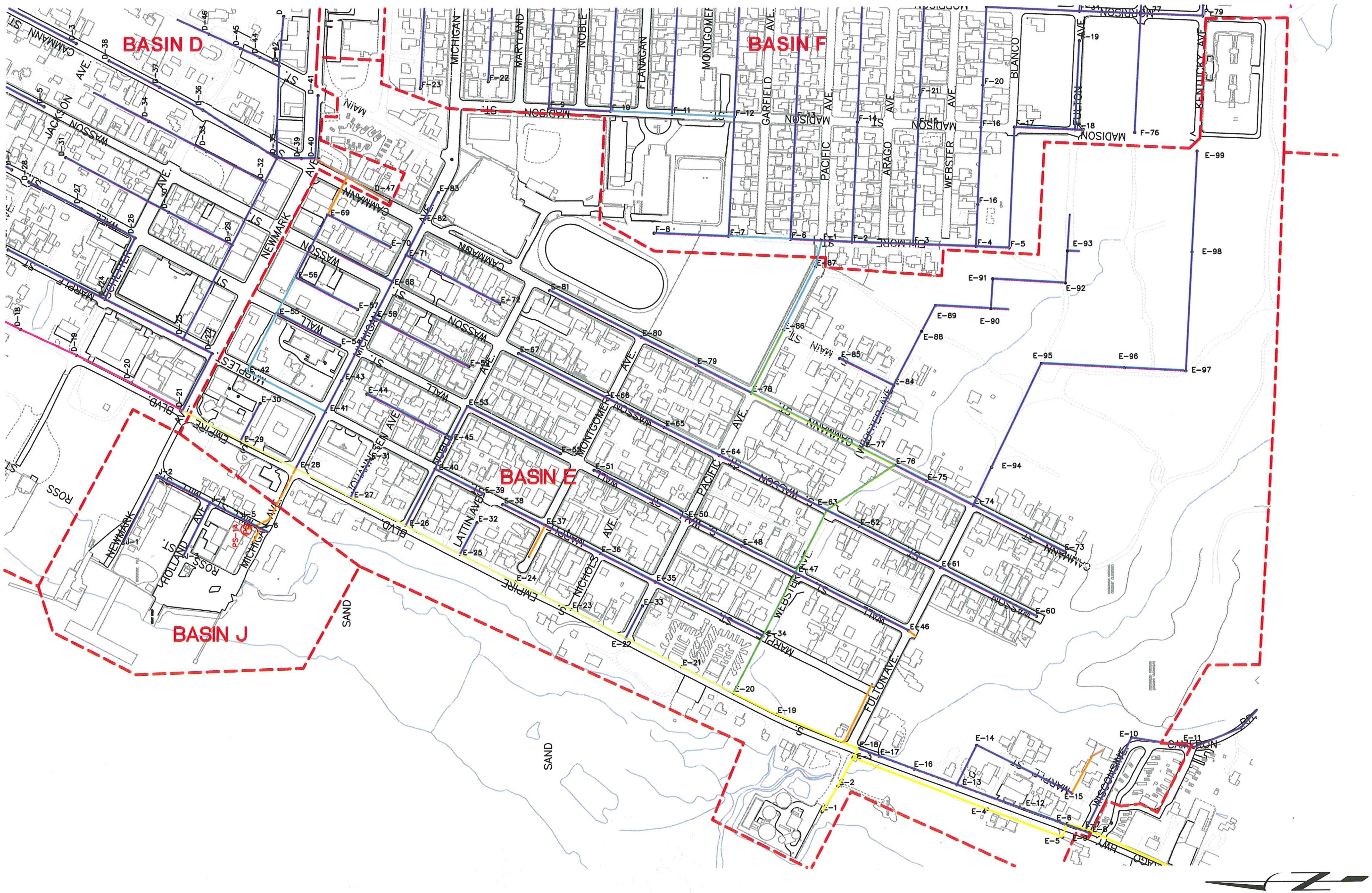


EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

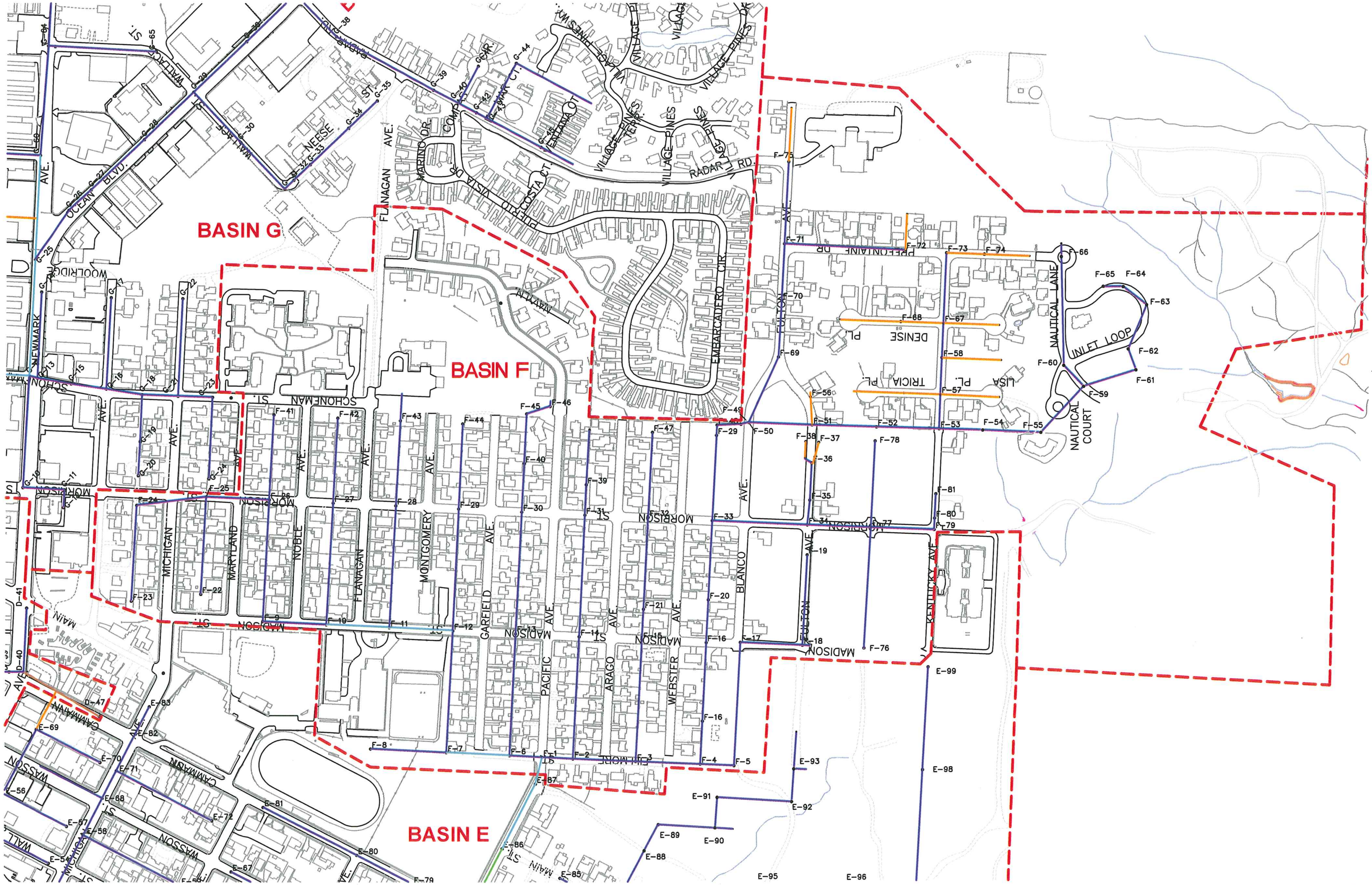
H B H Consulting Engineers

CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASIN E

DRAWN BY: JGP
DATE: JAN 2006

MAP
3



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

CITY OF COOS BAY

WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM

BASIN F

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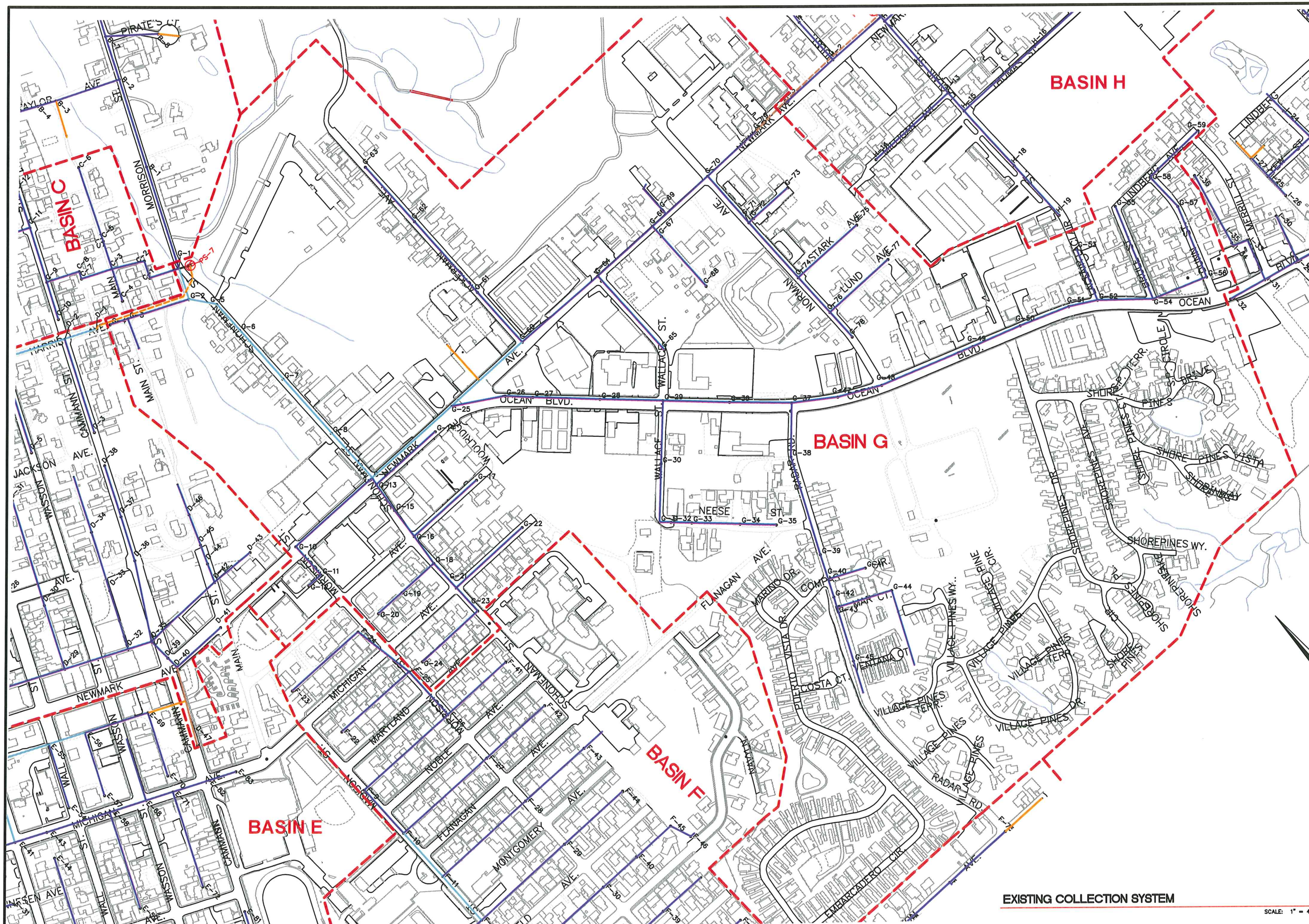
DATE: JAN 2006

MAP 4



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CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASIN G

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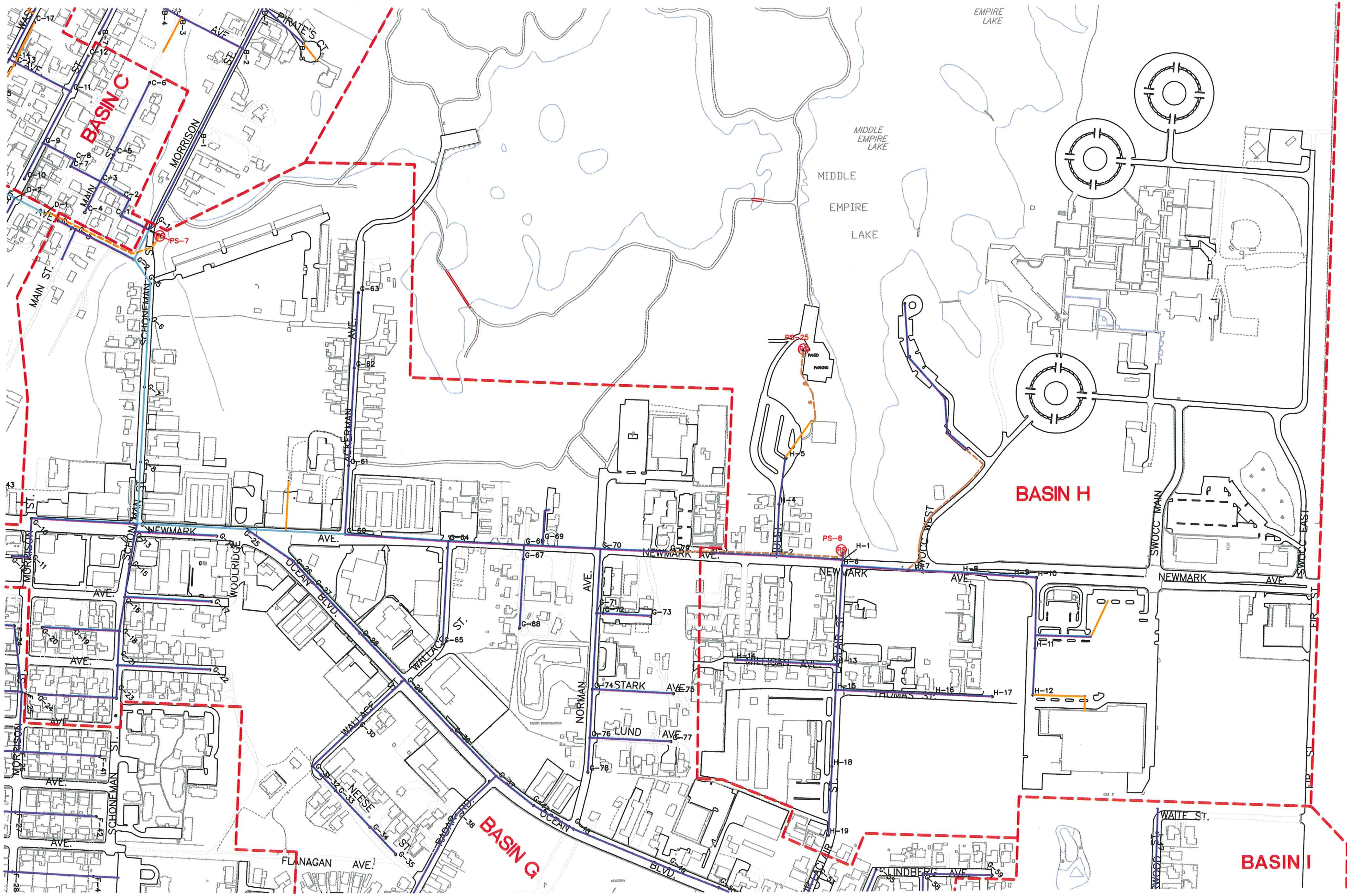
DATE: JAN 2006

MAP
5



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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CITY OF COOS BAY

WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM

BASIN H

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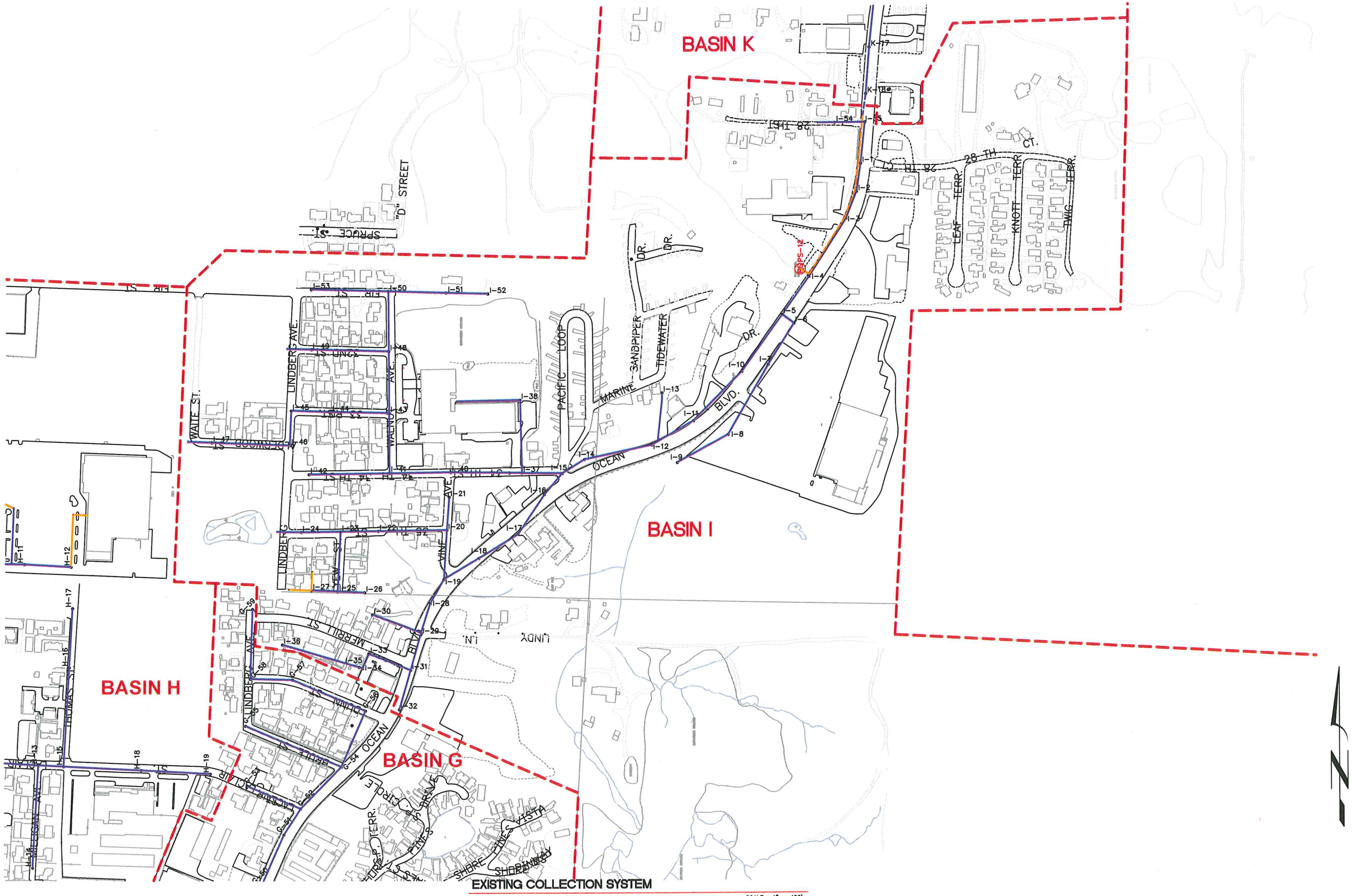
DATE: JAN 2006

MAP 6



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CITY OF COOS BAY

WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM

BASIN I

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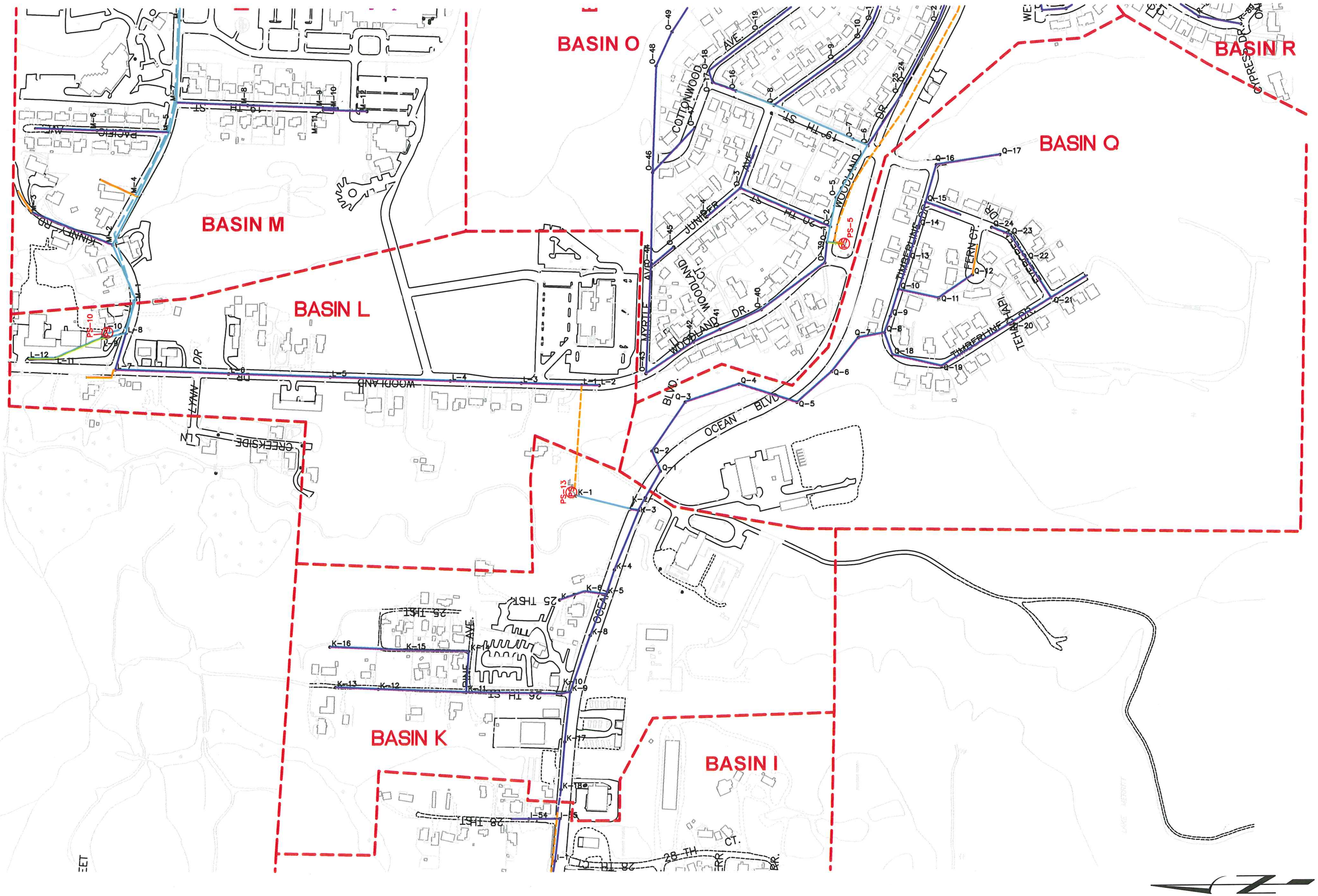
DATE: JAN 2006

MAP 7



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

H B H Consulting Engineers

CITY OF COOS BAY

WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM

BASINS K,L & Q

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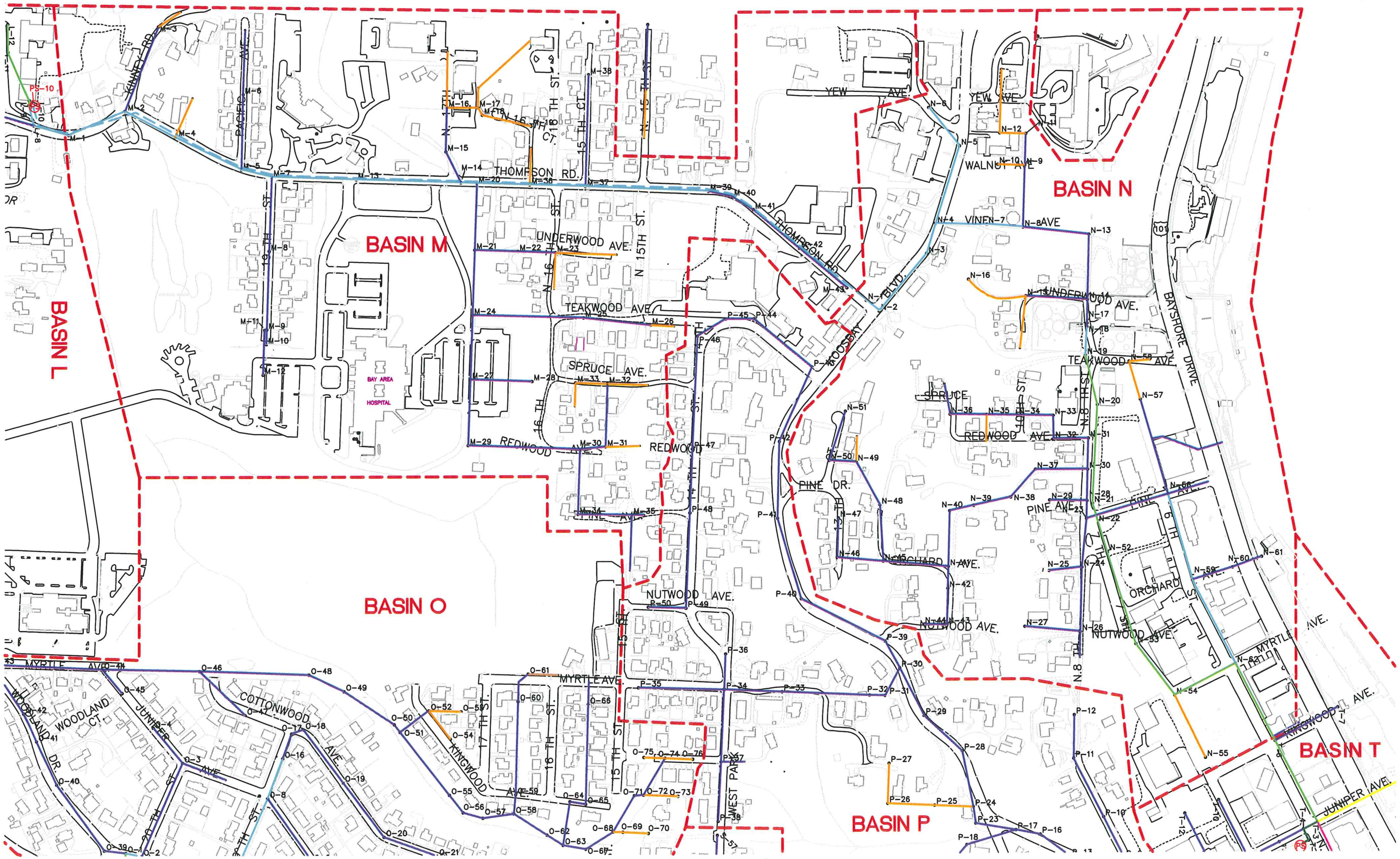
DATE: JAN 2006

MAP 8



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS M&N

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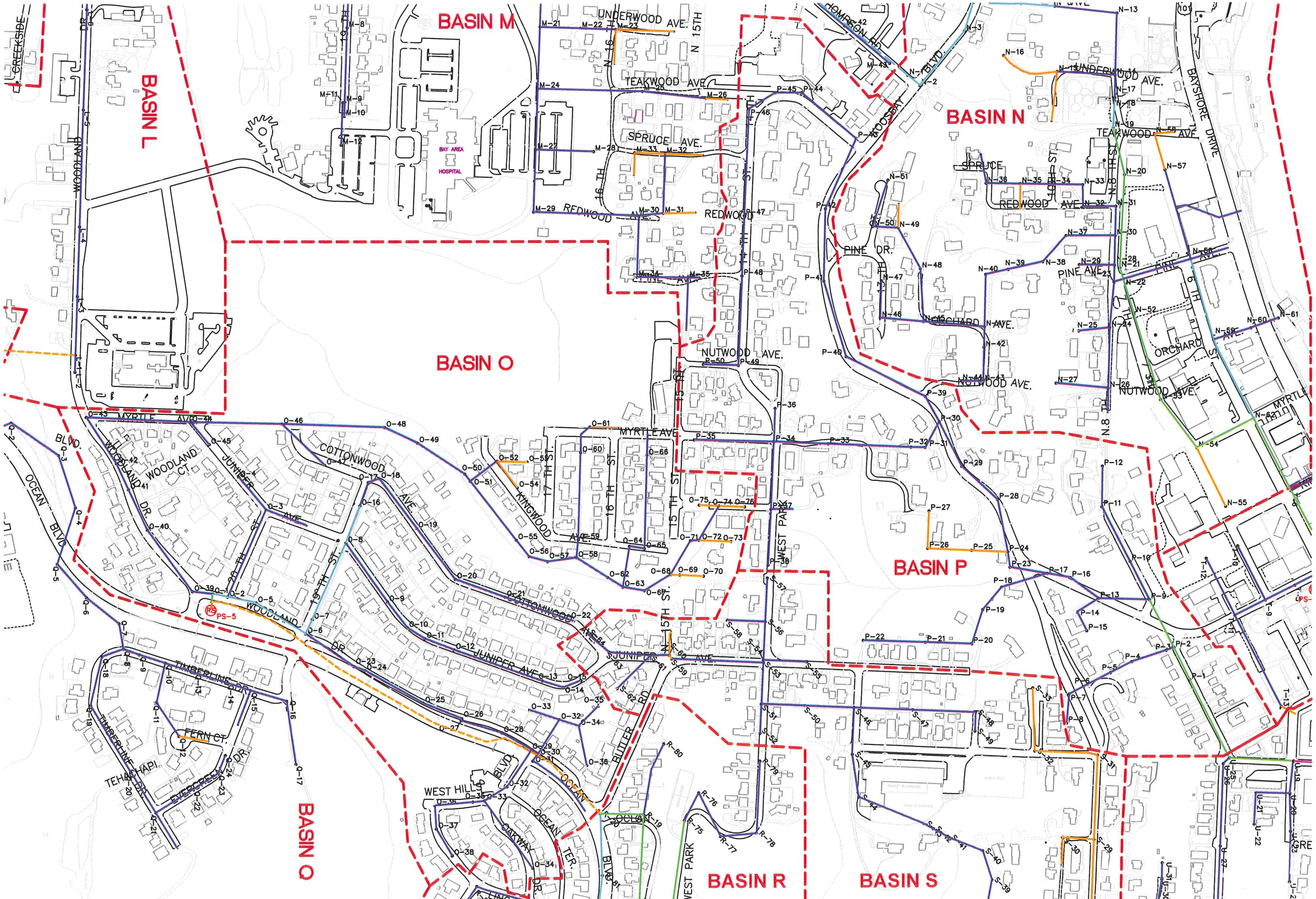
MAP 9



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

H B H Consulting Engineers

CITY OF COOS BAY

WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM

BASINS O&P

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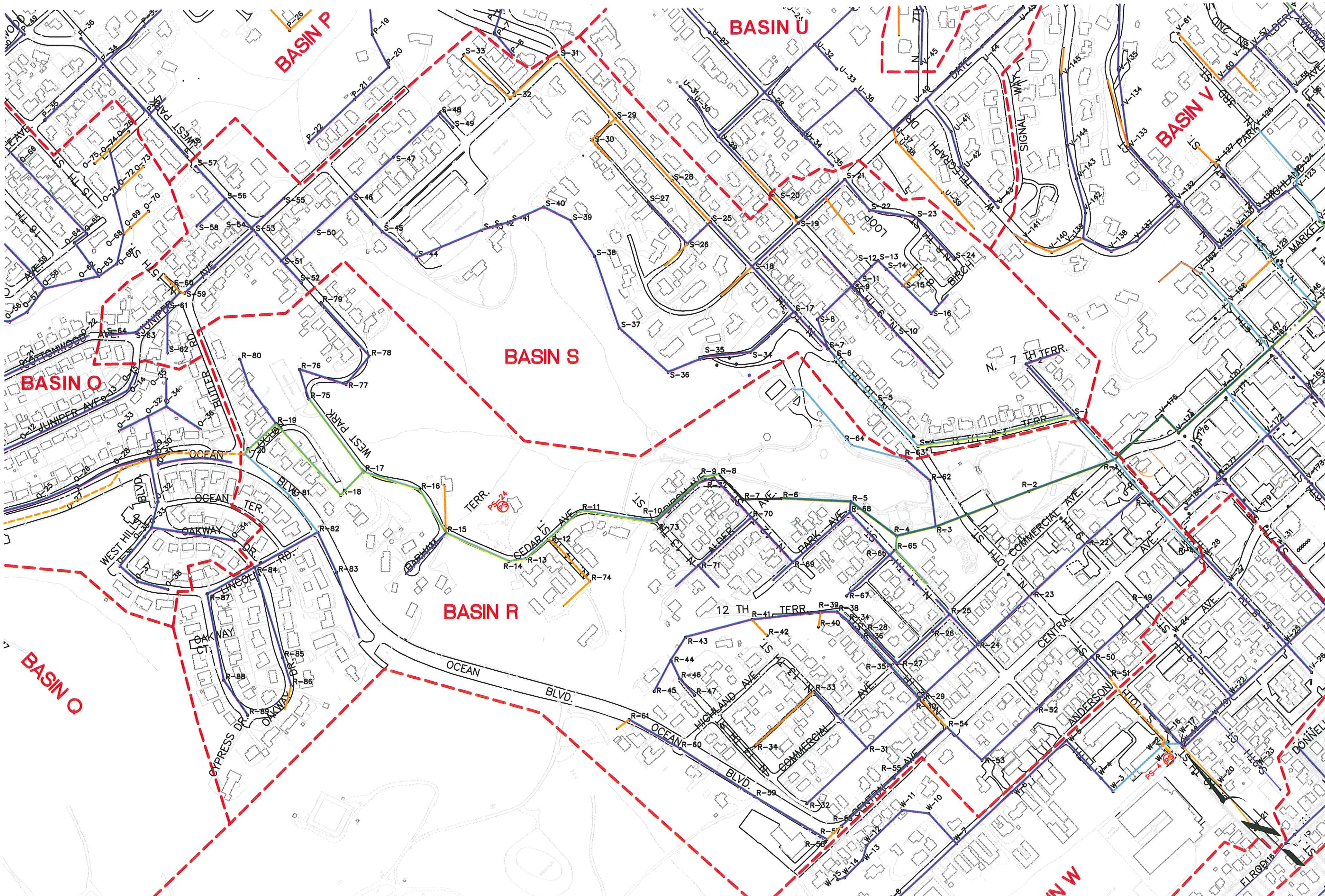
DATE: JAN 2006

MAP 10



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

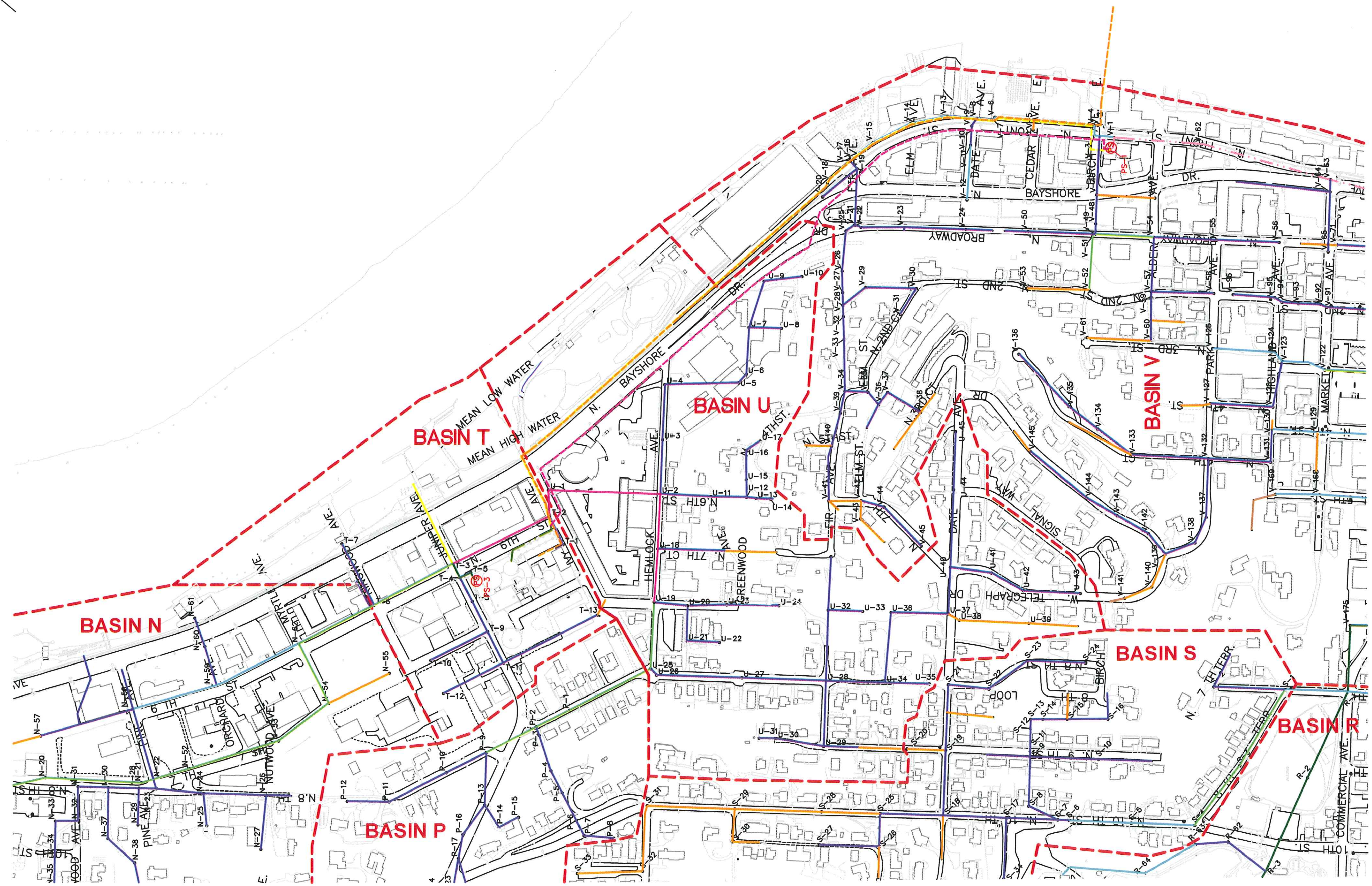
H B H Consulting Engineers

CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS R&S

DRAWN BY: JGP
DATE: JAN 2006

MAP
11



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

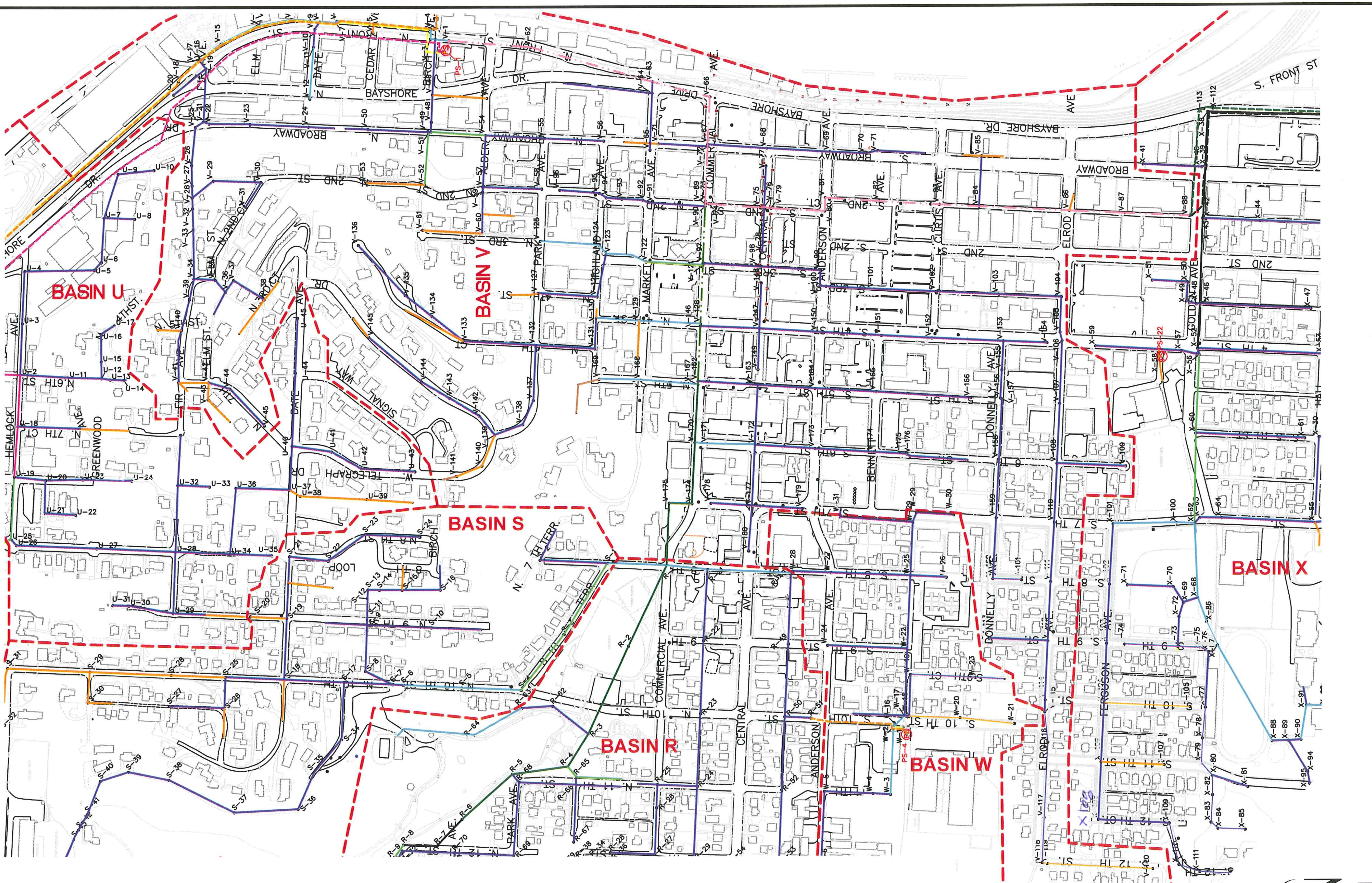
H B H
Consulting Engineers

CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS T&U

DRAWN BY: JGP
DATE: JAN. 2006

MAP
12



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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CITY OF COOS BAY

WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM

BASIN V

DRAWN BY: JGP

DATE: JAN 2006

MAP 13

EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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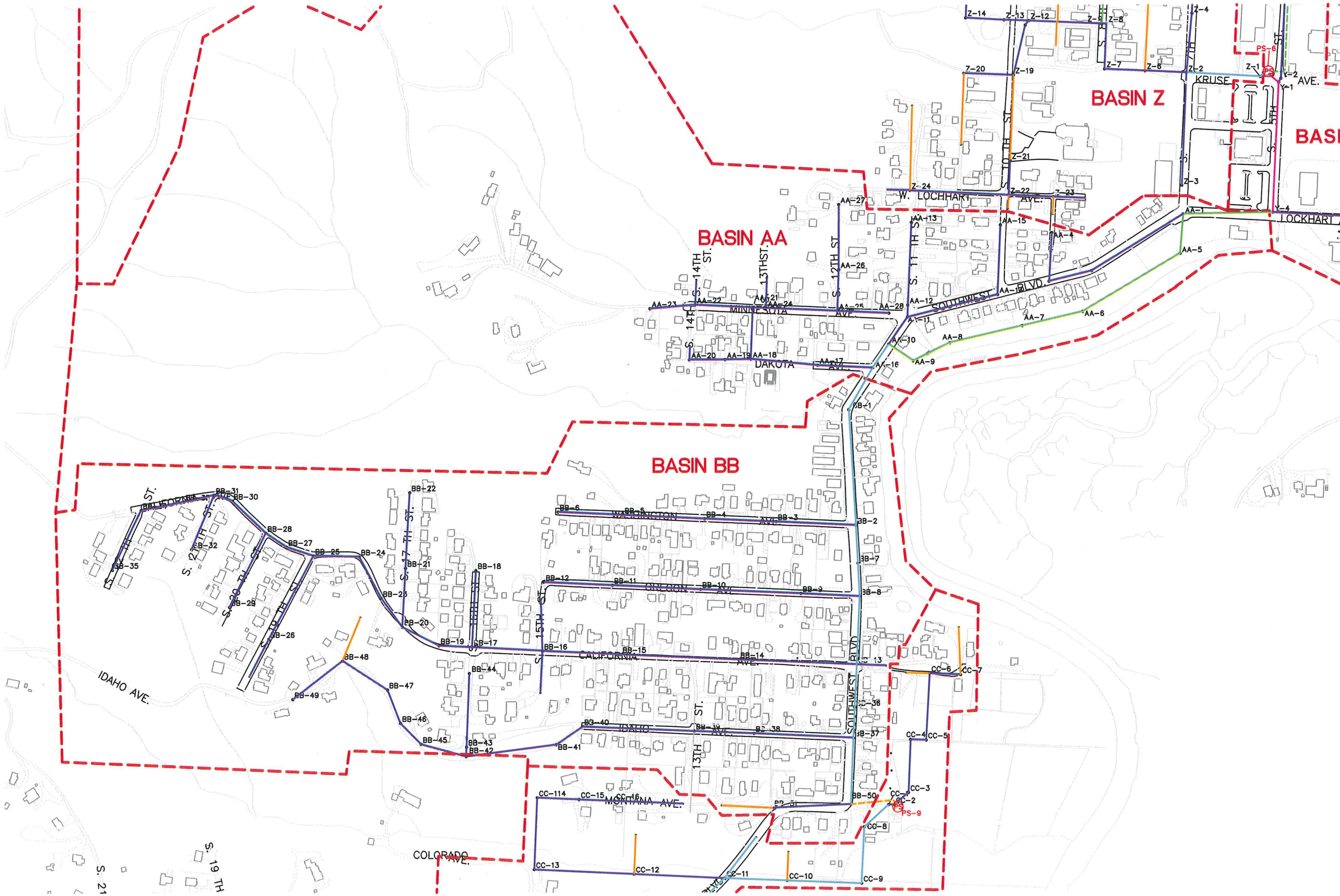
CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS X,Y&Z

DRAWN BY: JGP
DATE: JAN 2006

MAP
14



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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CITY OF COOS BAY

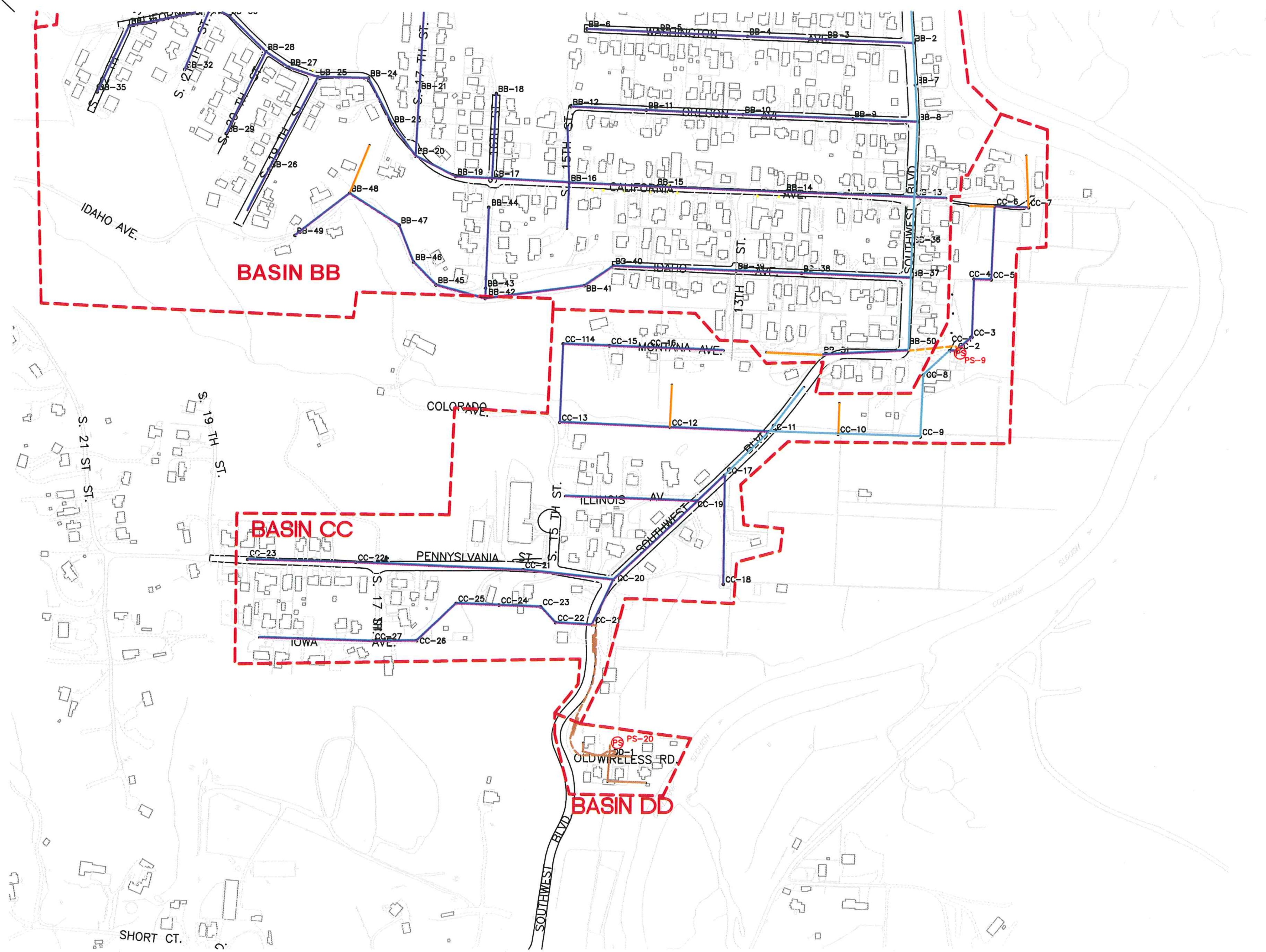
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS AA&BB

DRAWN BY: JGP

DATE: AUG 2005

MAP 15



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

H B H Consulting Engineers

CITY OF COOS BAY

WASTEWATER COLLECTION SYSTEM MASTER PLAN

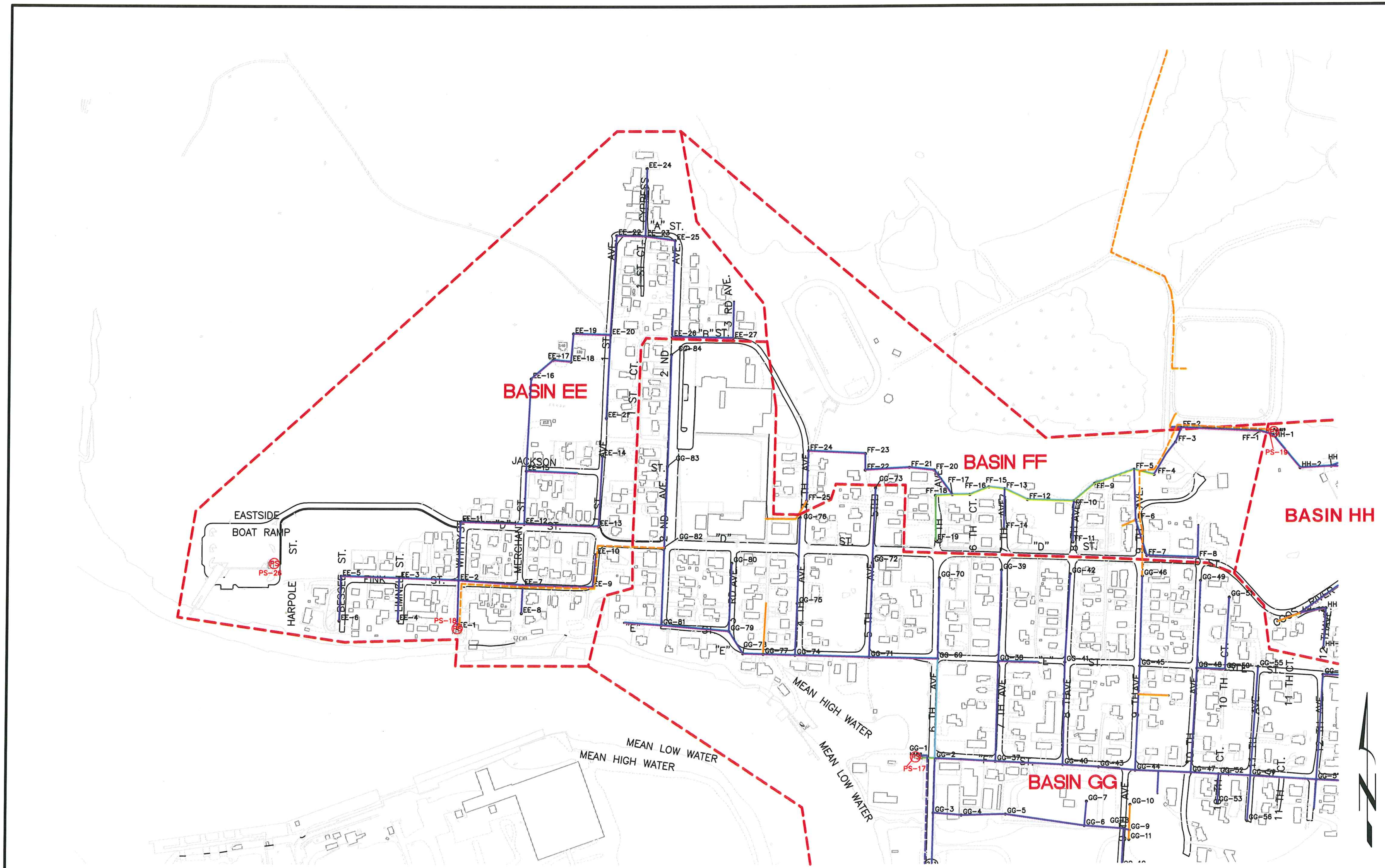
EXISTING COLLECTION SYSTEM

BASINS CC&DD

DRAWN BY: JGP

DATE: JAN 2006

MAP 16



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

H B H Consulting Engineers

CITY OF COOS BAY

WASTEWATER COLLECTION SYSTEM MASTER PLAN

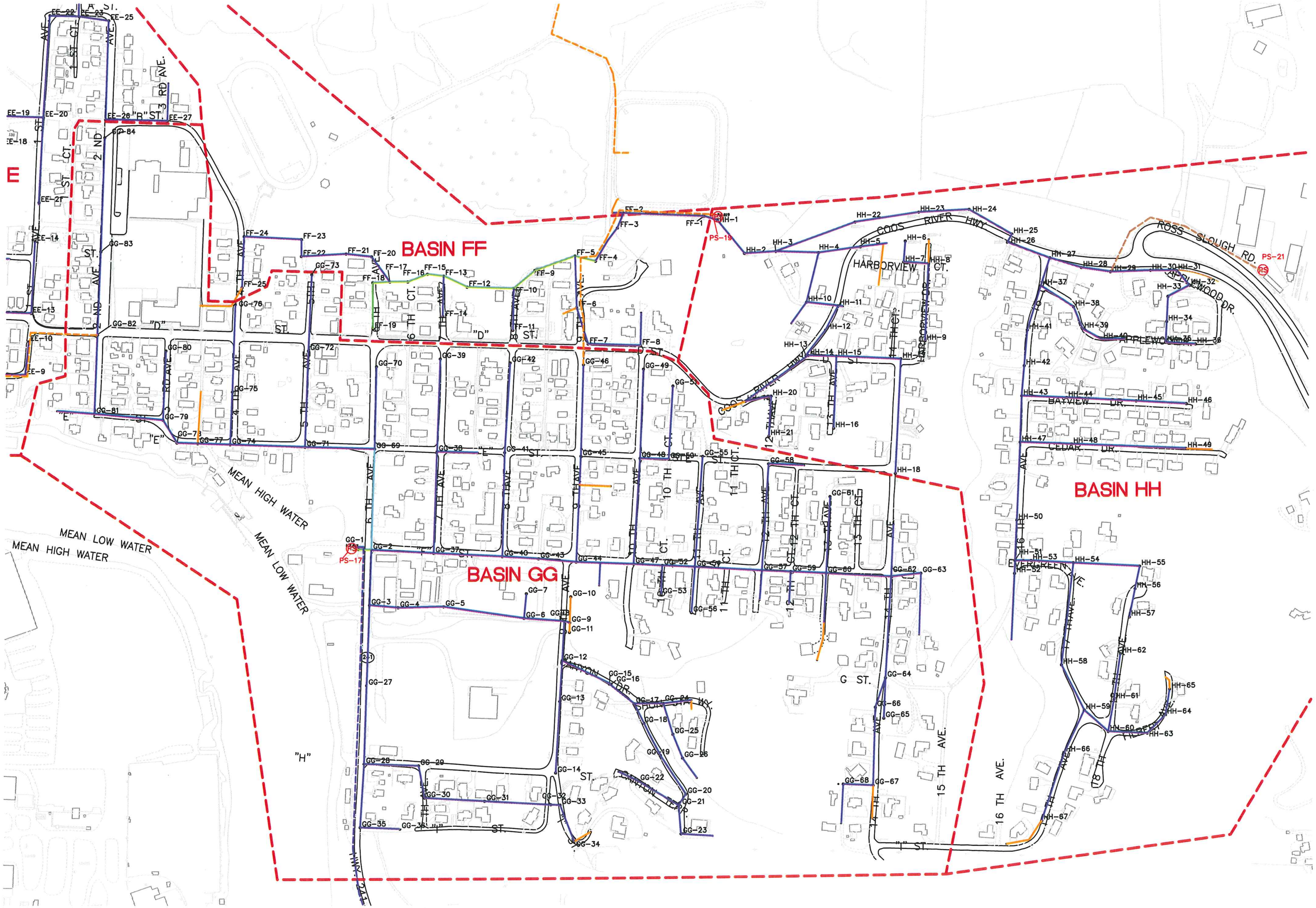
EXISTING COLLECTION SYSTEM

BASINS EE&FF

DRAWN BY: JGP

DATE: JAN 2006

MAP 17



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

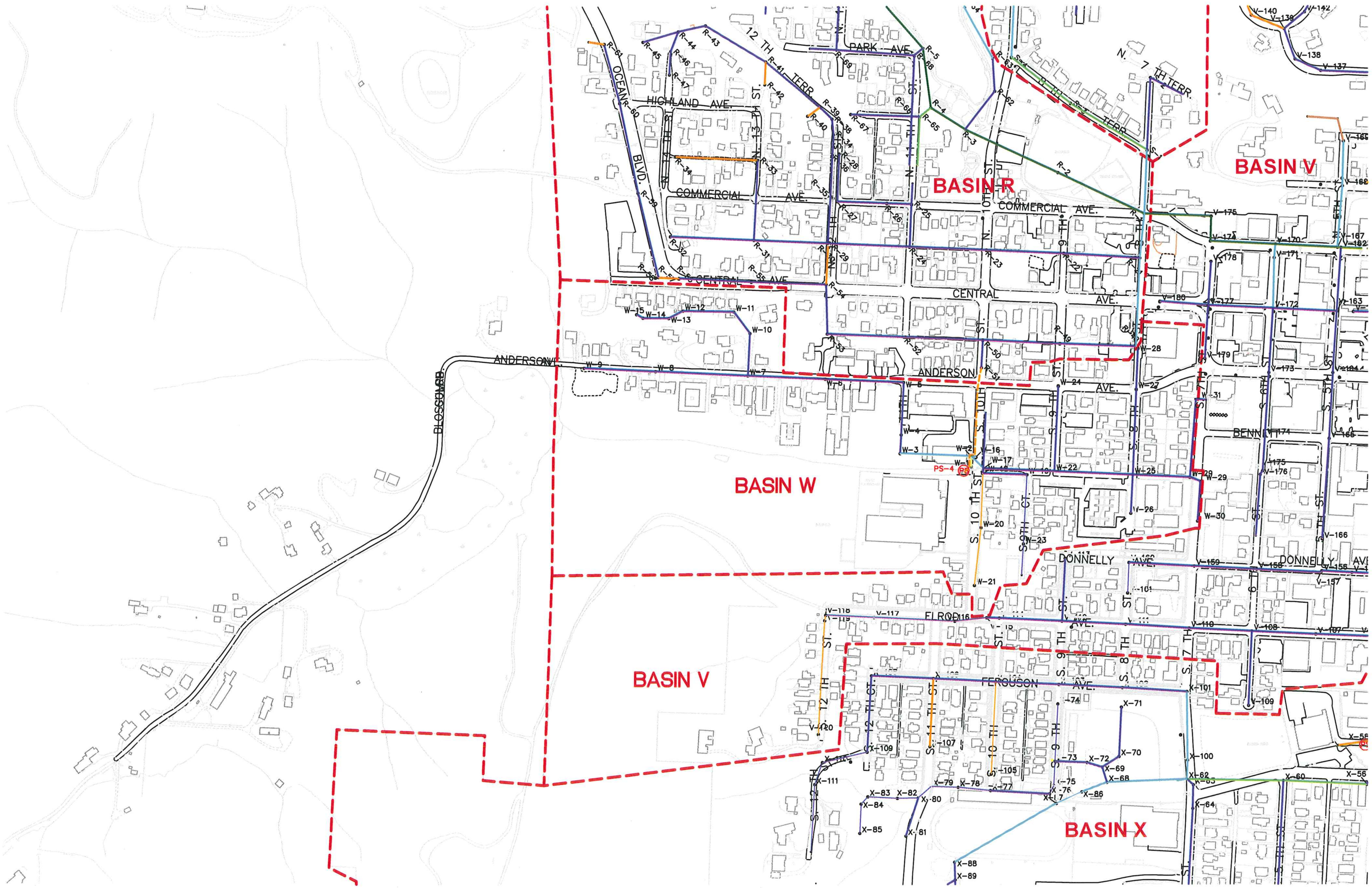
H B H
Consulting Engineers

CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS GG&HH

DRAWN BY: JGP
DATE: JAN 2006

MAP
18



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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CITY OF COOS BAY

WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM

BASIN W

DRAWN BY: JGP

DATE: AUG 2005

MAP 19

CITY OF COOS BAY

WASTEWATER COLLECTION SYSTEM MASTER PLAN

CITY OF COOS BAY

PROPOSED SYSTEM IMPROVEMENTS MAPPING

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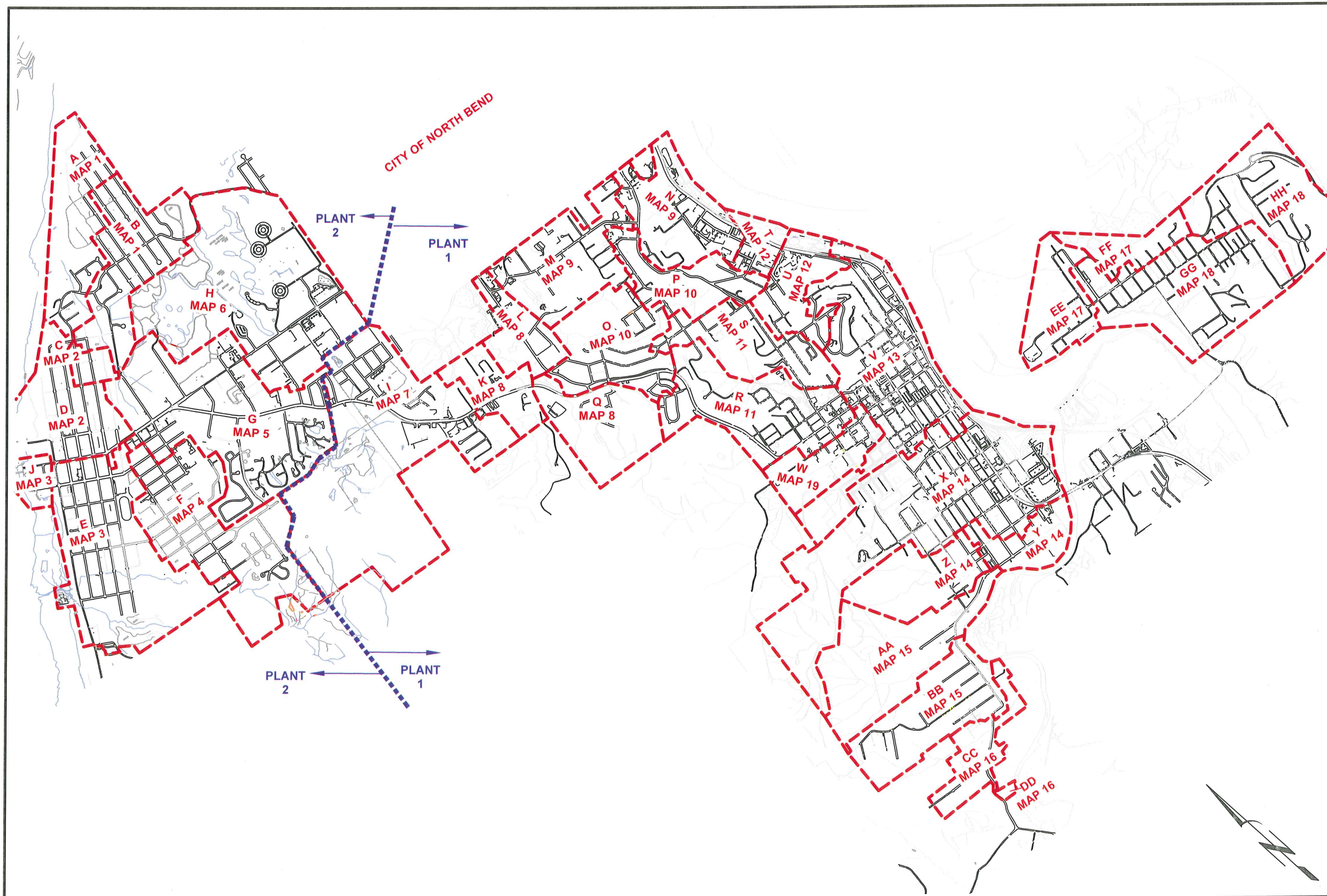
CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

PROPOSED IMRPOVEMENTS COVER SHEET

DRAWN BY: JGP
DATE: JAN 2006

MAP
COV



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CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
W/ IMPS. - OVERALL MAP

DRAWN BY: JGP
DATE: JAN 2006

MAP i

LEGEND

PIPE SIZE COLOR CODE

4 INCH	15 INCH
6 INCH	16 INCH
8 IINCH	18 INCH
10 INCH	24 INCH
12 INCH	27 INCH
14 INCH	30 INCH

PROPOSED IMROVEMENT

PS2 — PROPOSED PROJECT NUMBER

INDICATES GRAVITY SEWER (SIZE AS INDICATED BY COLOR)

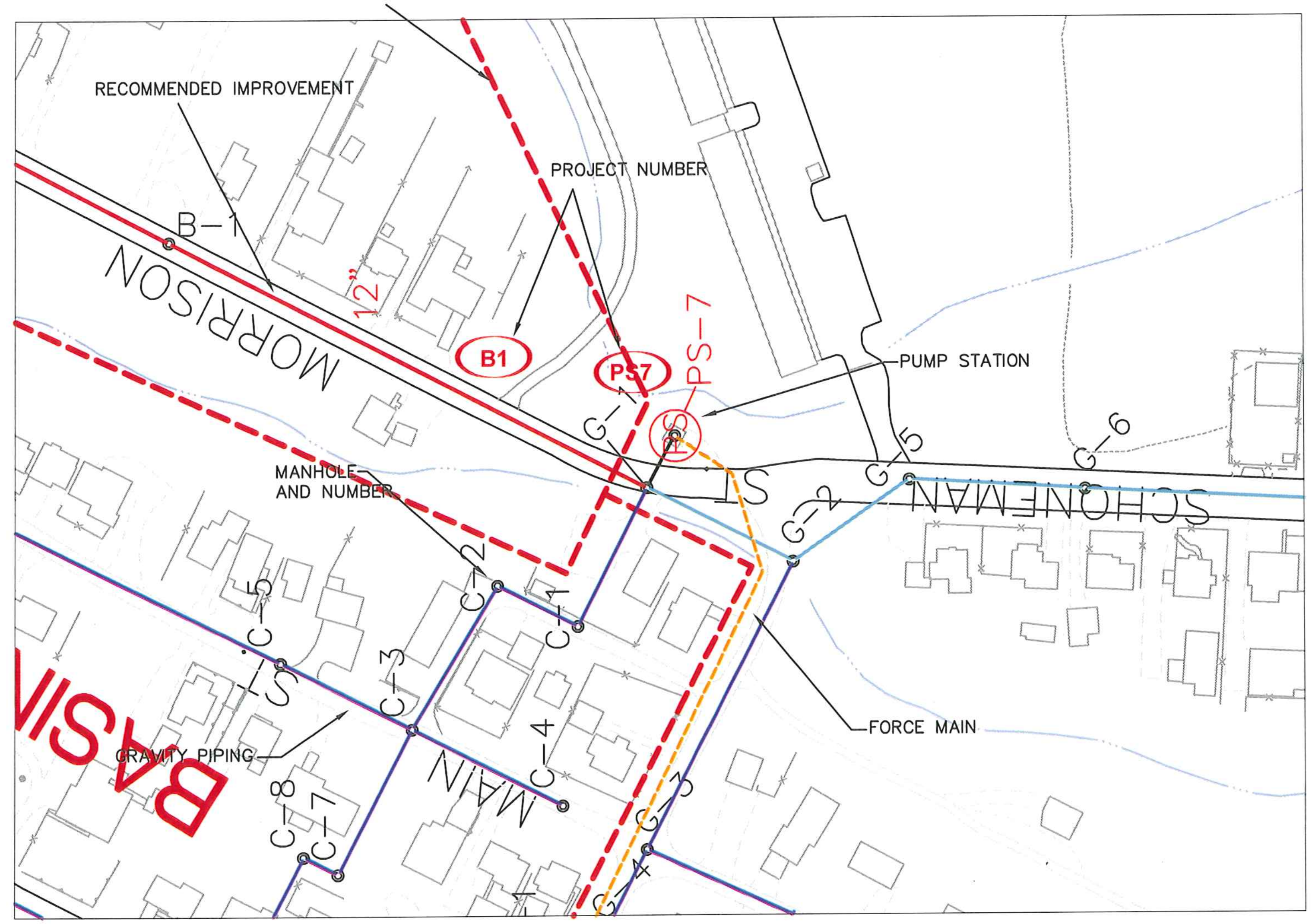
INDICATES PRESSURE SEWER (SIZE AS INDICATED BY COLOR)

PS — PUMP STATION SYMBOL

PS–16 — PUMP STATION NUMBER

A–1 — SANITARY SEWER MANHOLE AND NUMBER

SAMPLE MAP



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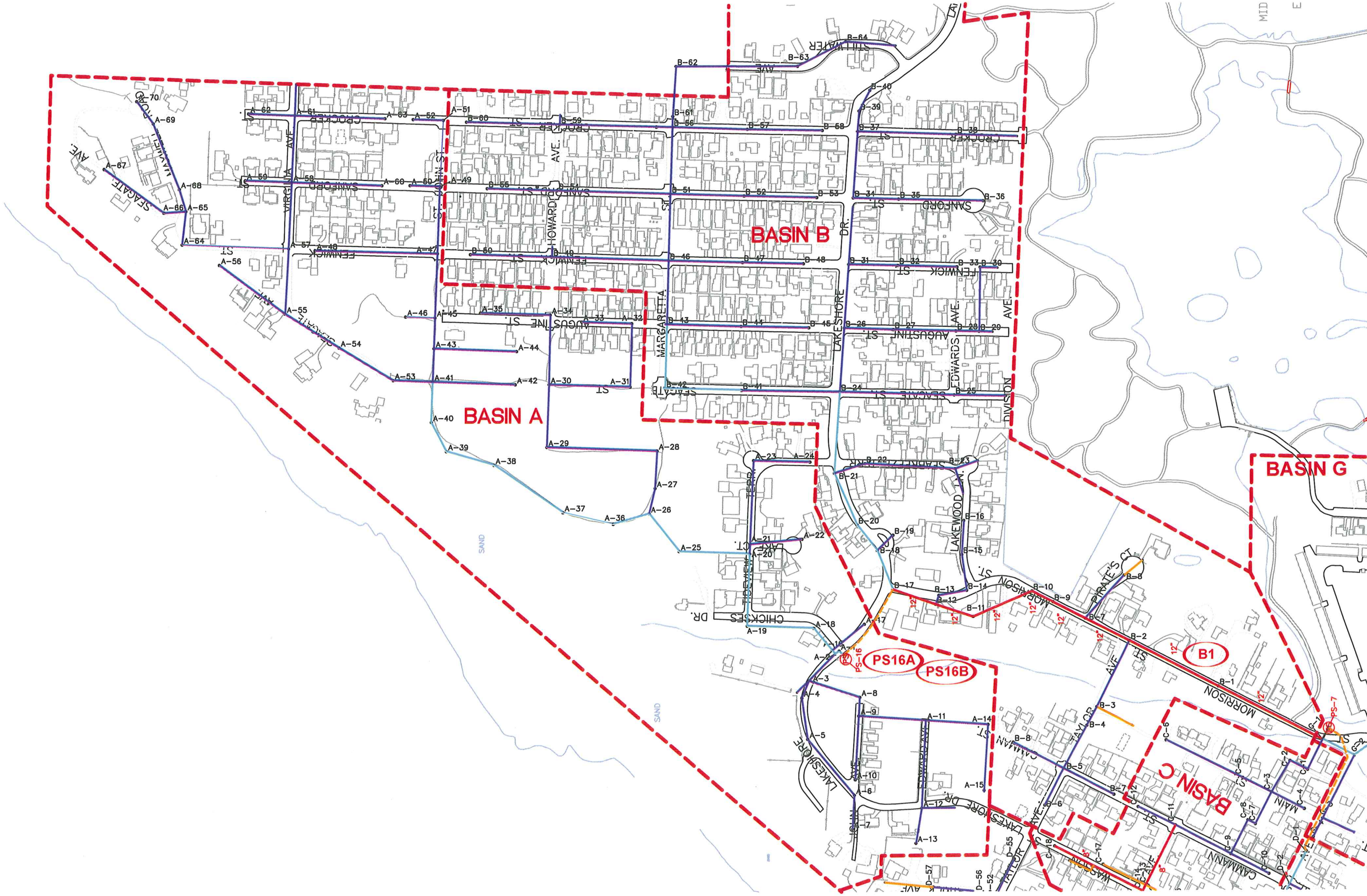
CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

COLLECTION MAPPING LEGEND W/ IMPROVEMENTS

DRAWN BY: JGP
DATE: JAN 2006

MAP ii



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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CITY OF COOS BAY

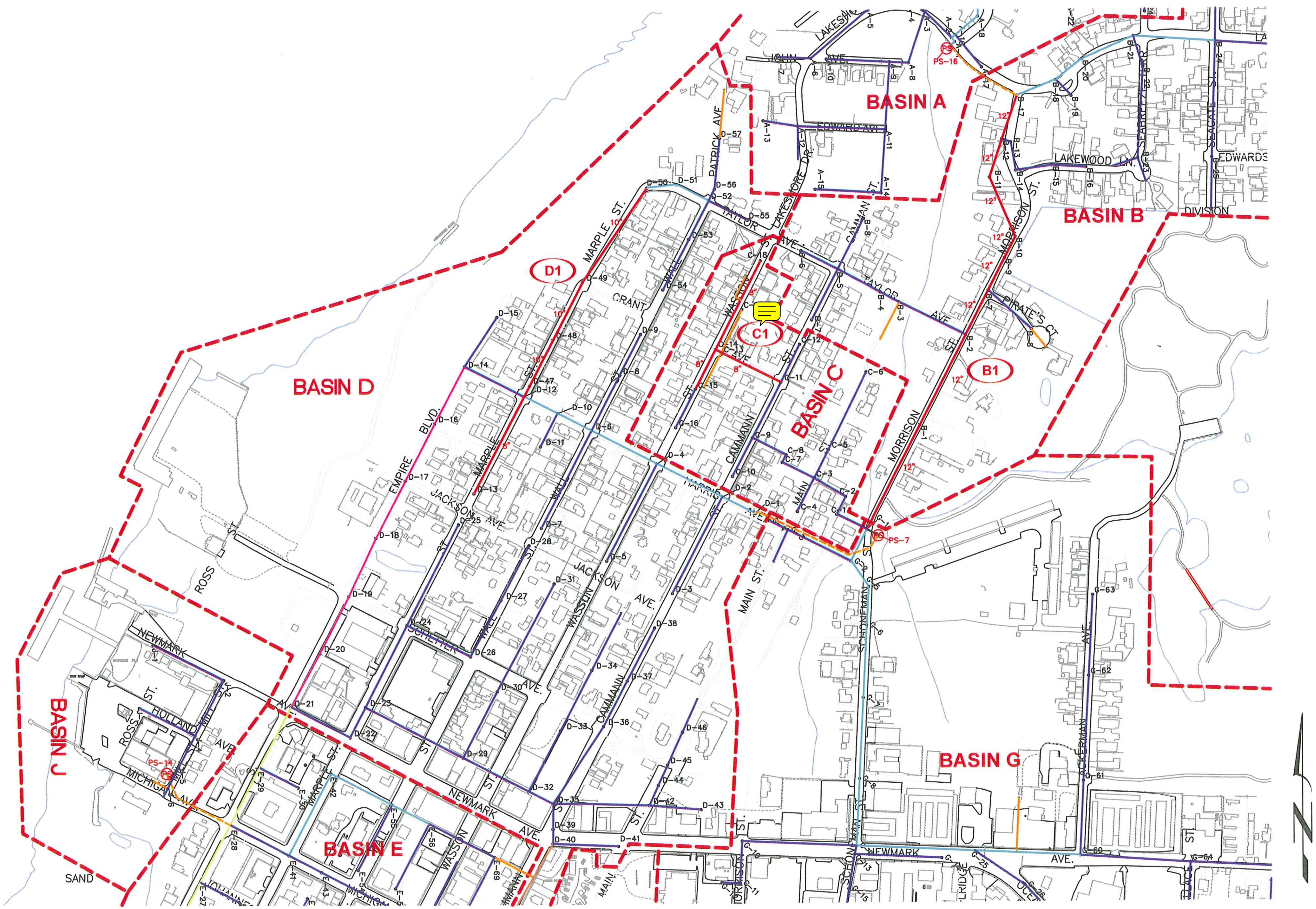
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS A&B - WITH IMPROVEMENTS

DRAWN BY: JGP

DATE: JAN 2006

MAP
1



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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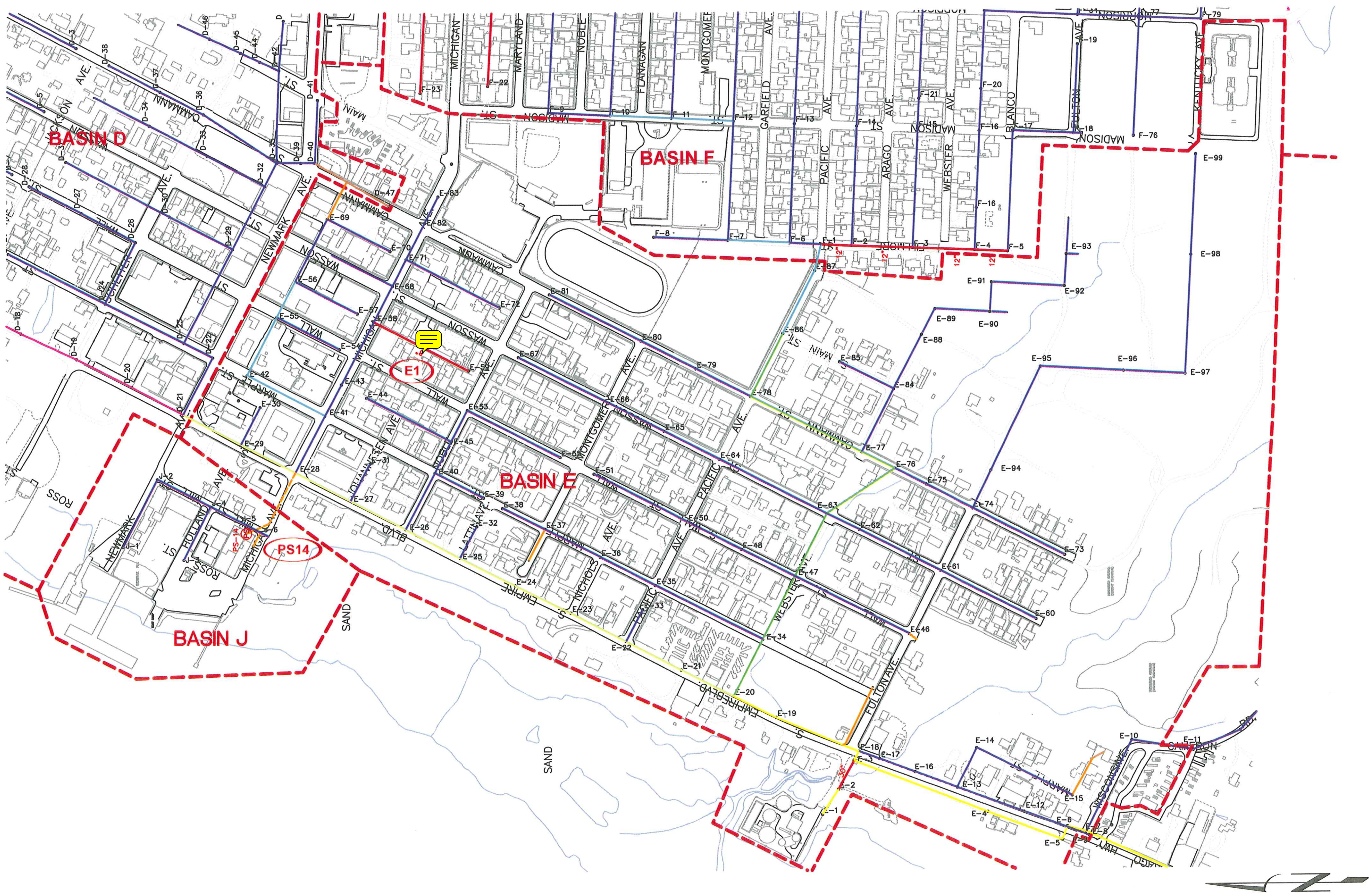
CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS C&D - WITH IMPROVEMENTS

DRAWN BY: JGP
DATE: JAN 2006

MAP 2



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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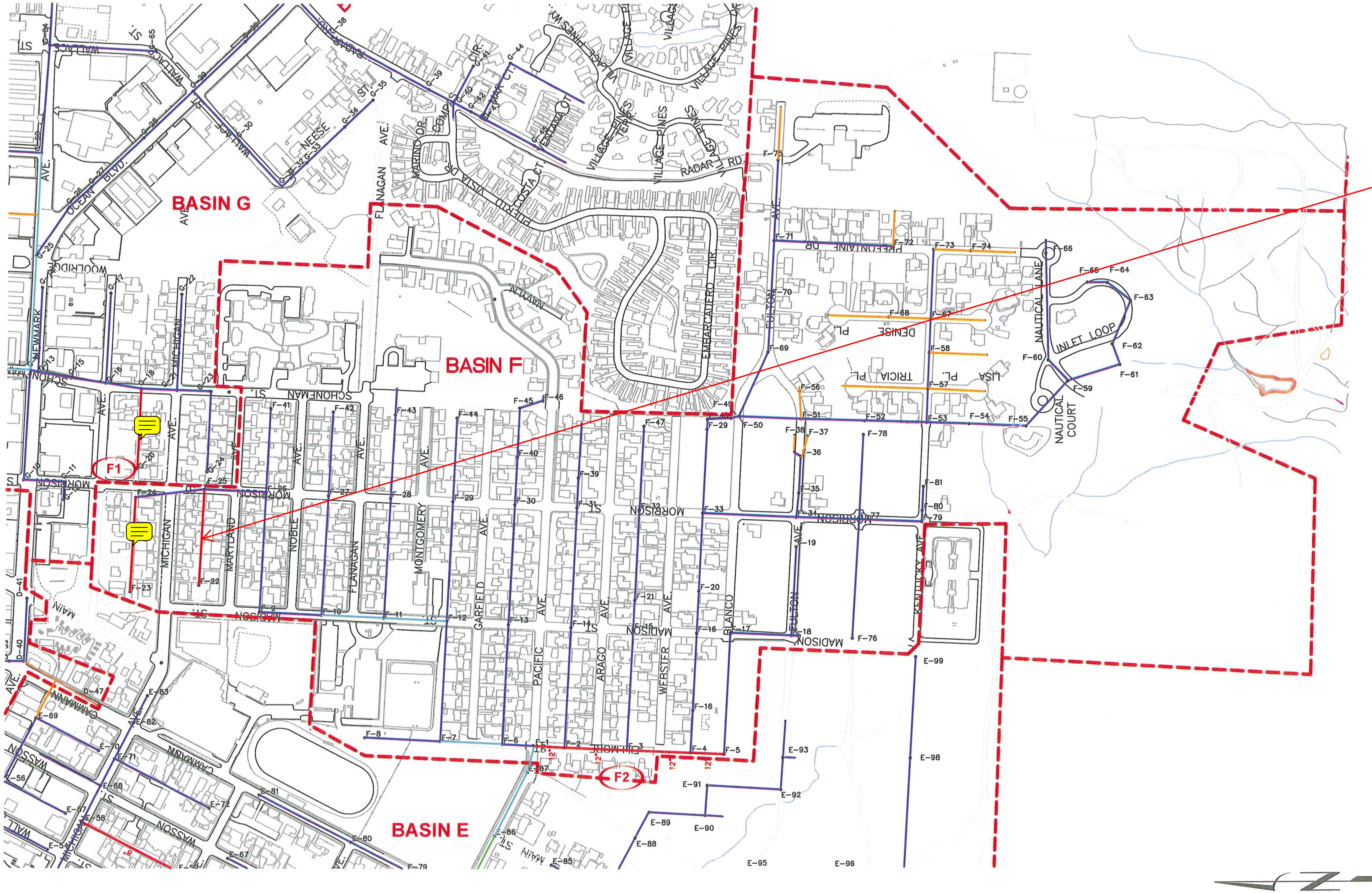
CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASIN E - WITH IMPROVEMENTS

DRAWN BY: JGP
DATE: JAN 2006

MAP 3



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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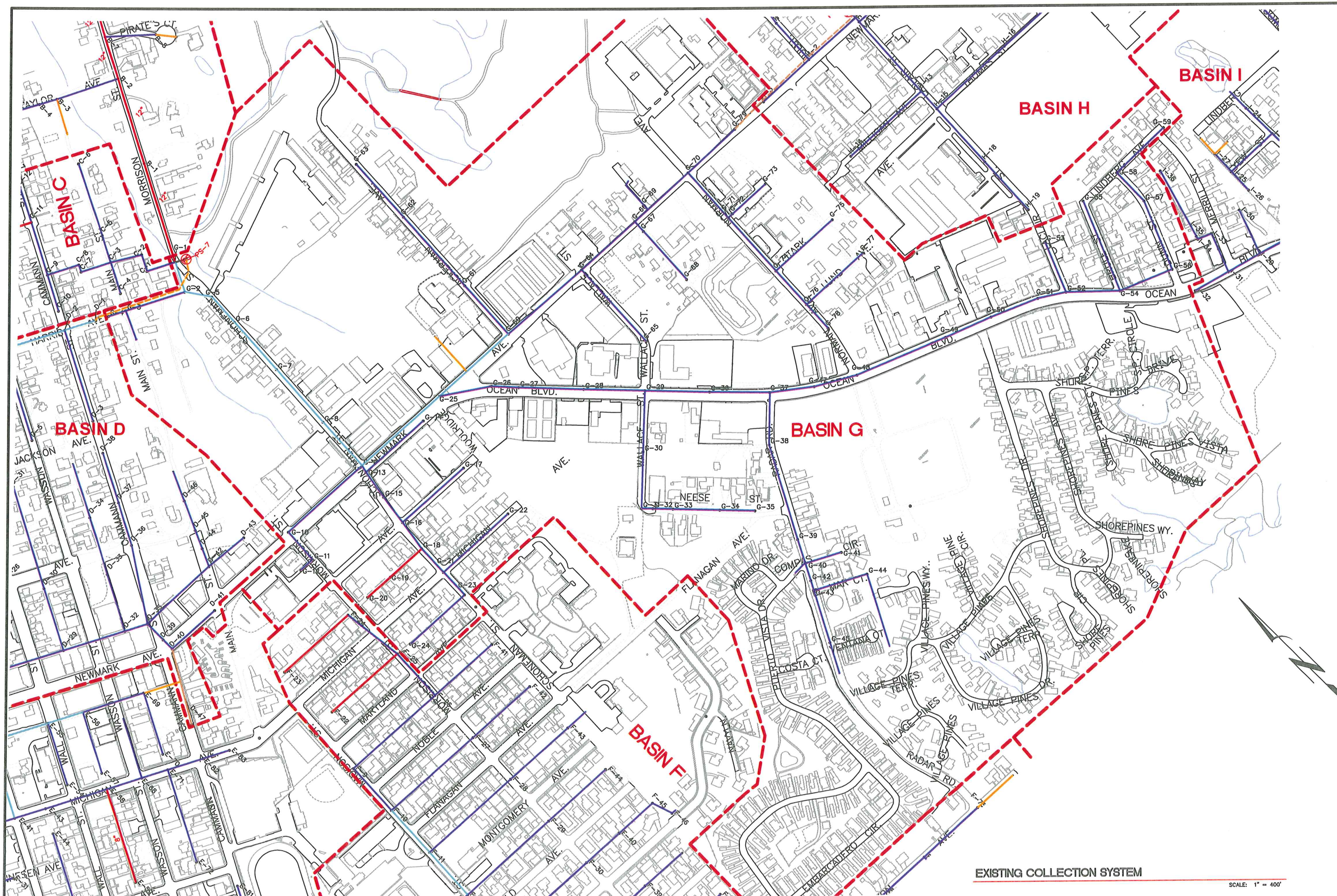
CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASIN F - WITH IMPROVEMENTS

DRAWN BY: JGP
DATE: JAN 2006

MAP
4



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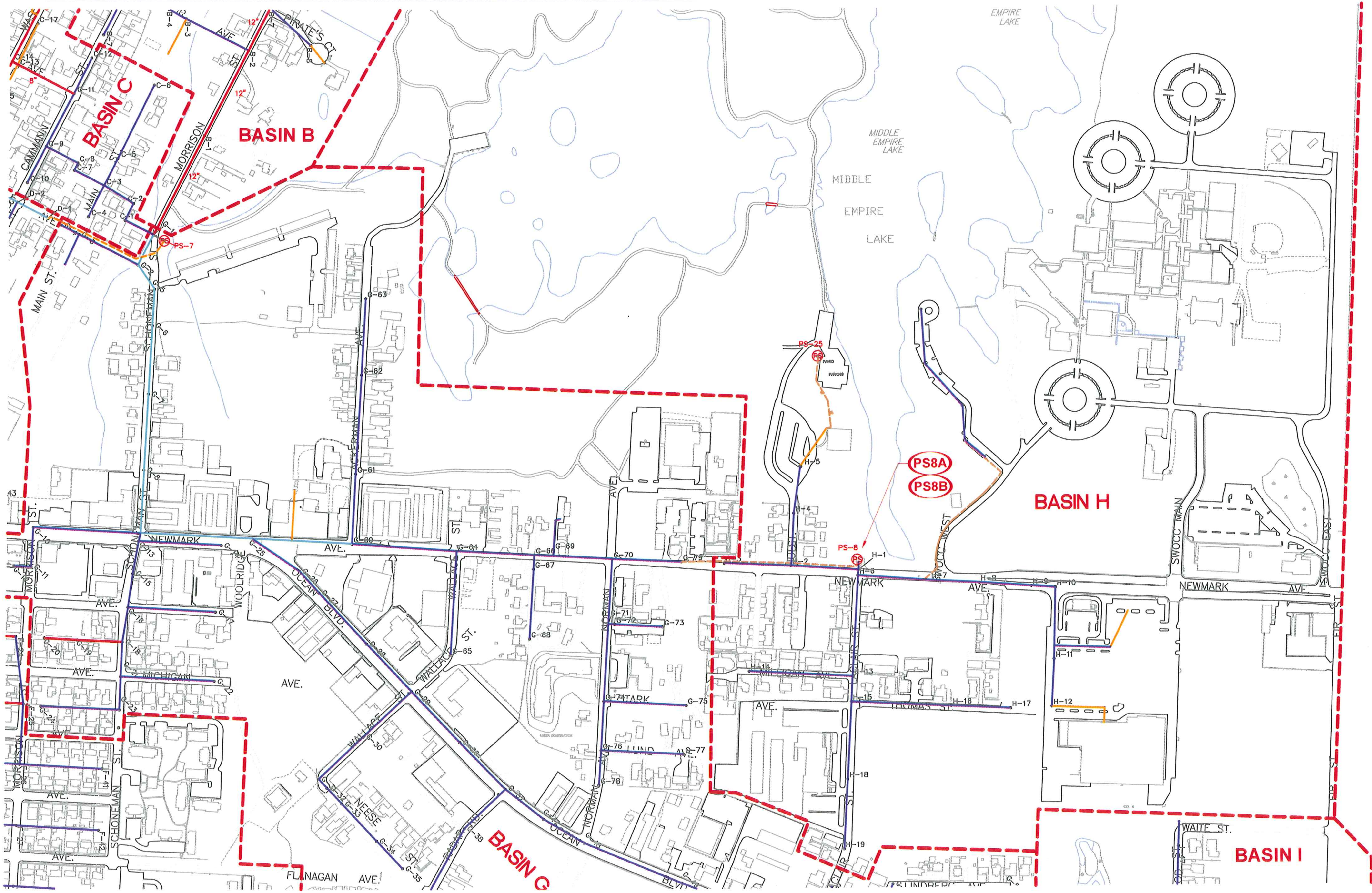
CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASIN G - WITH IMPROVEMENTS

DRAWN BY: JGP
DATE: JAN 2006

MAP
5



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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CITY OF COOS BAY

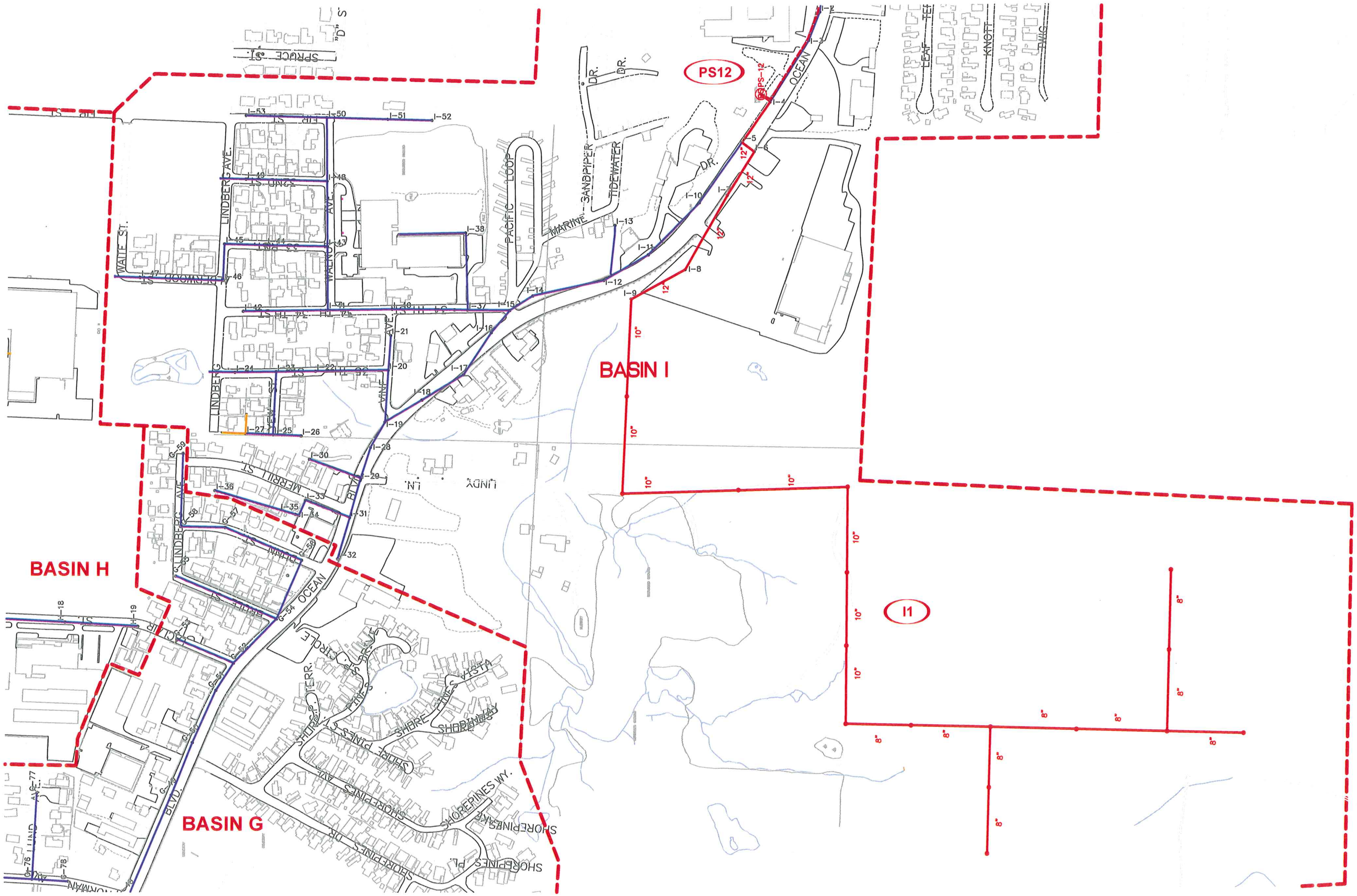
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASIN H - WITH IMPROVEMENTS

DRAWN BY: JCP

DATE: JAN 2006

MAP 6



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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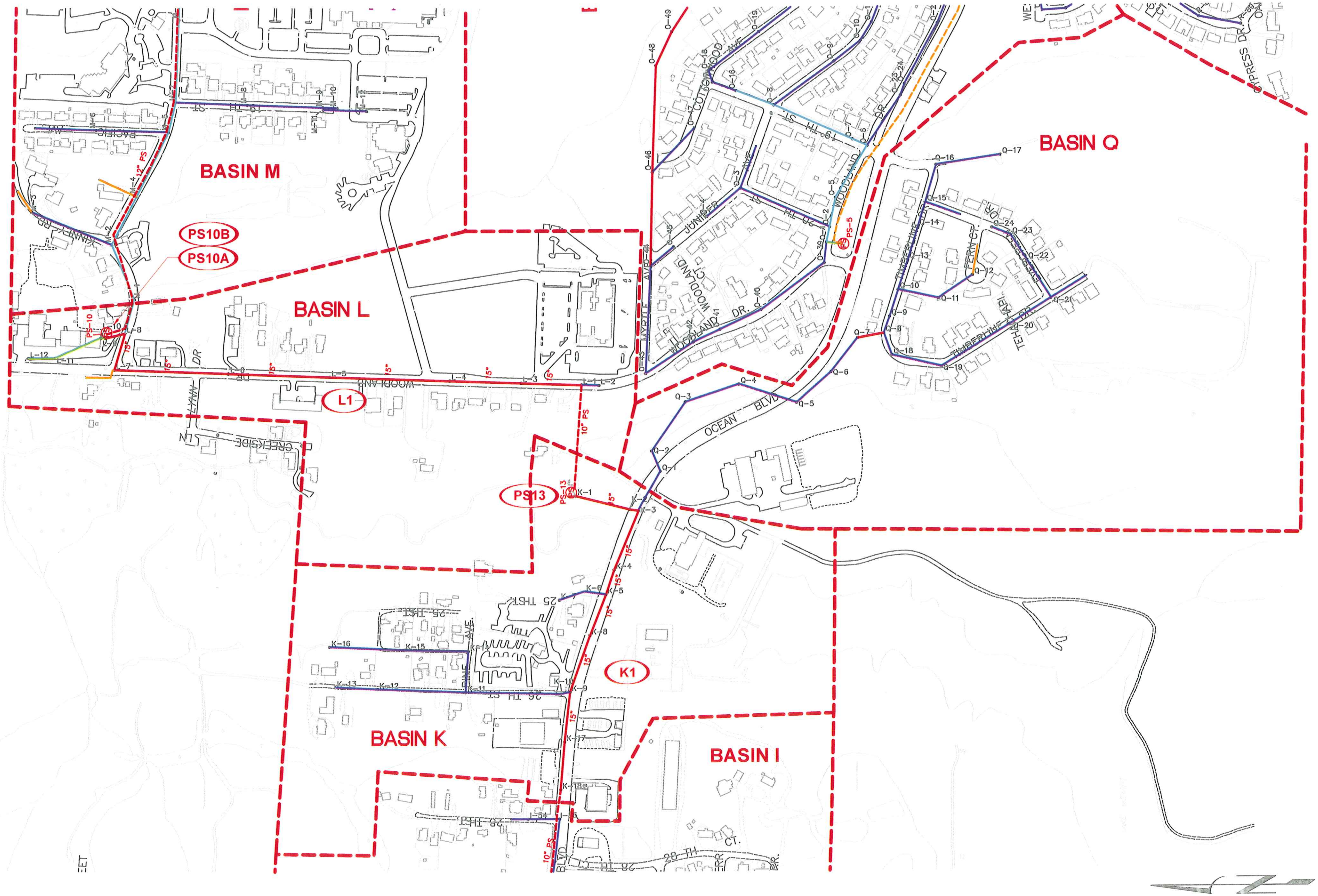
CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASIN I - WITH IMPROVEMENTS

DRAWN BY: JCP
DATE: JAN 2006

MAP 7



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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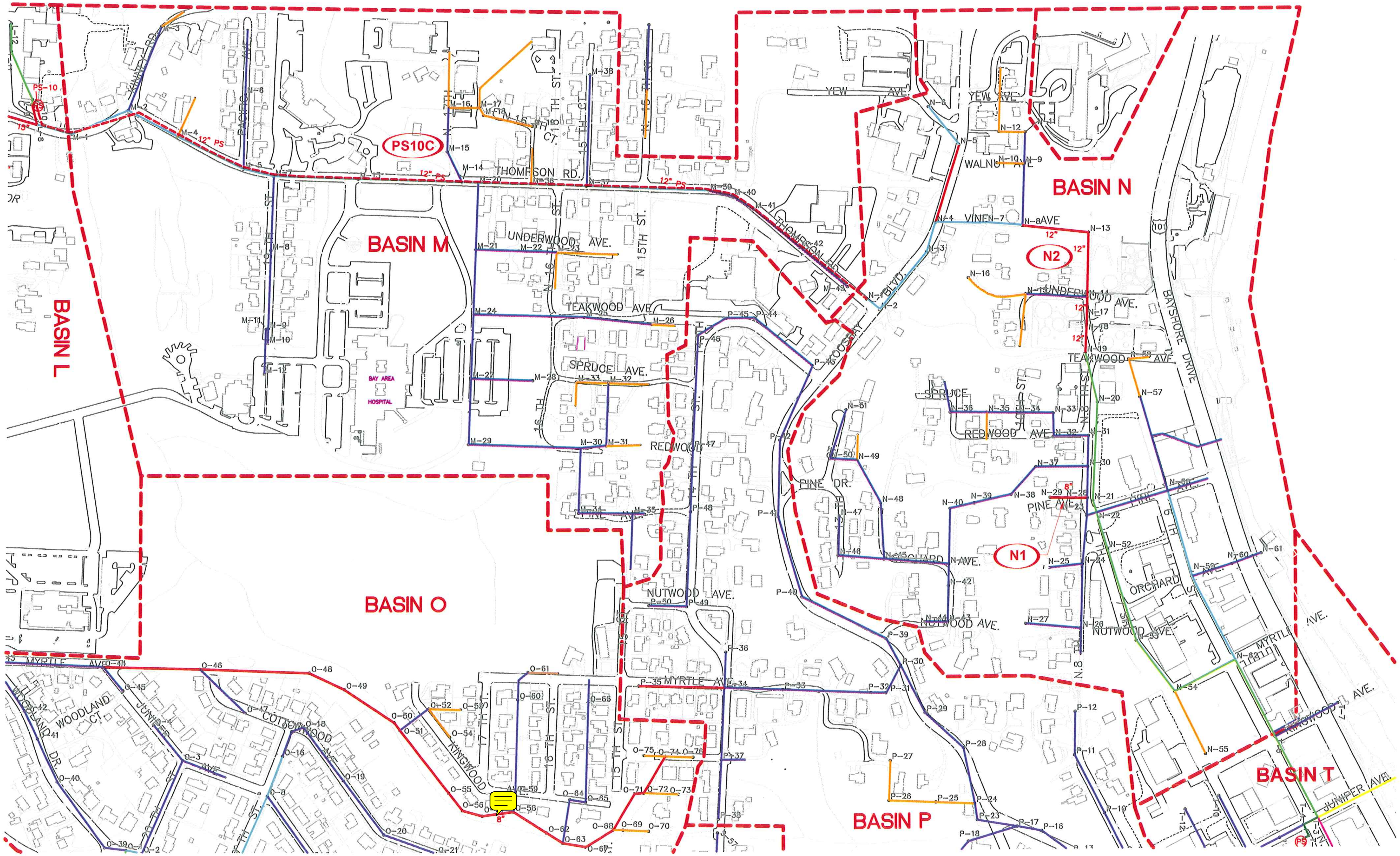
CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS K,L & Q - WITH IMPROVEMENTS

DRAWN BY: JGP
DATE: JAN 2006

MAP
8



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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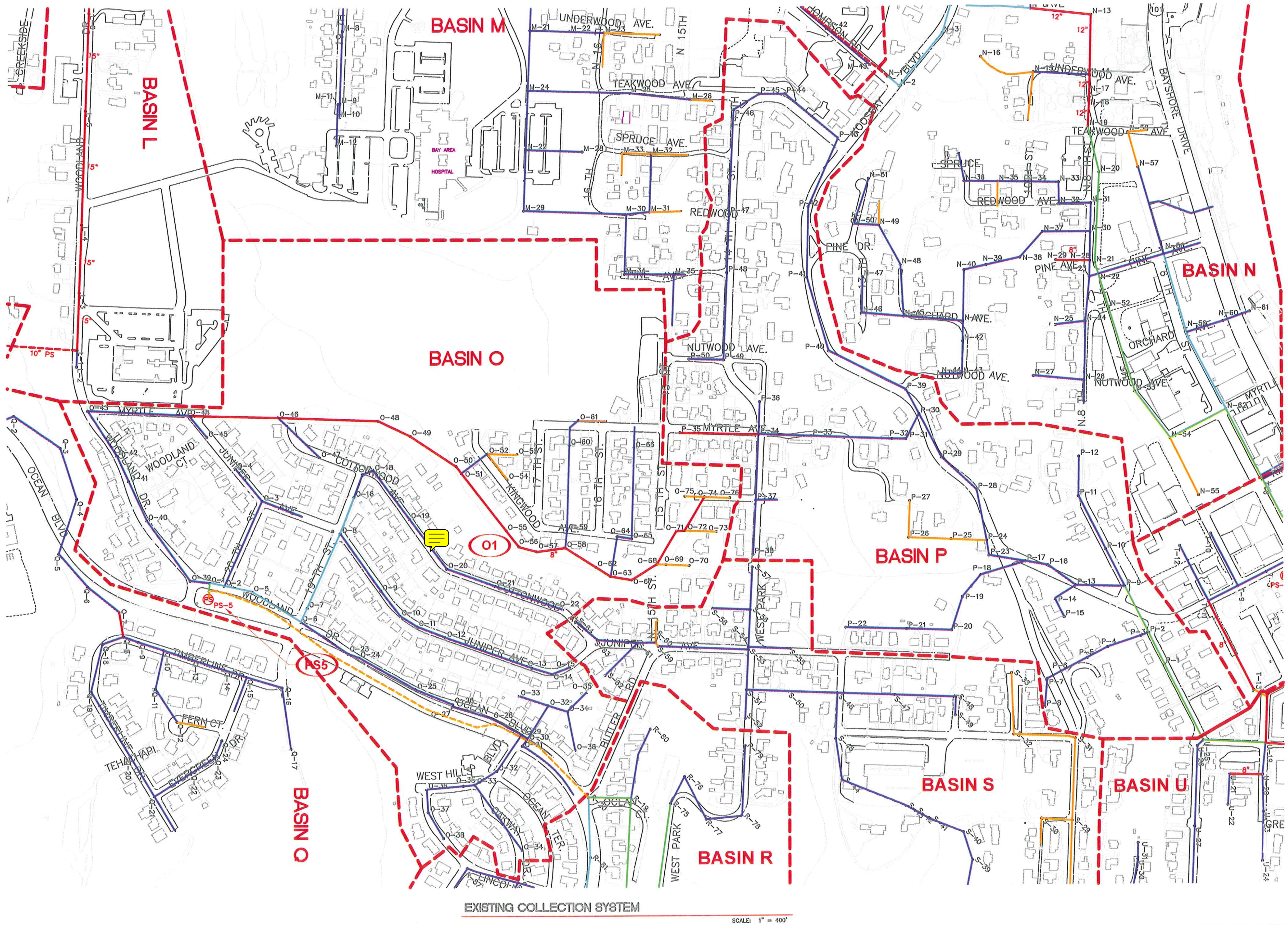
CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS M&N - WITH IMPROVEMENTS

DRAWN BY: JCP
DATE: JAN 2006

MAP 9



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CITY OF COOS BAY

WASTEWATER COLLECTION SYSTEM MASTER PLAN

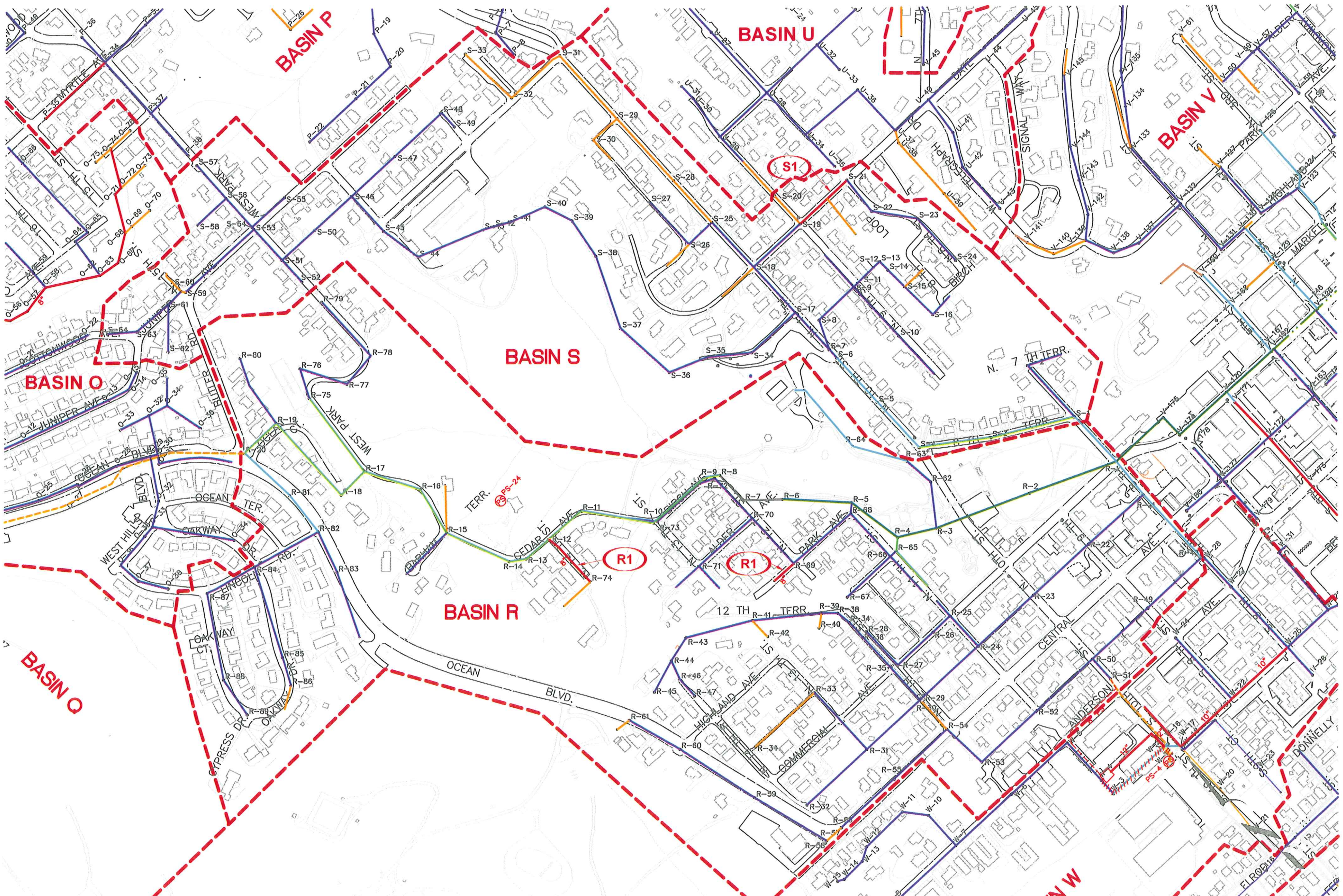
EXISTING COLLECTION SYSTEM

BASINS O&P - WITH IMPROVEMENTS

DRAWN BY: JGP

DATE: JAN 2006

MAP 10



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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CITY OF COOS BAY

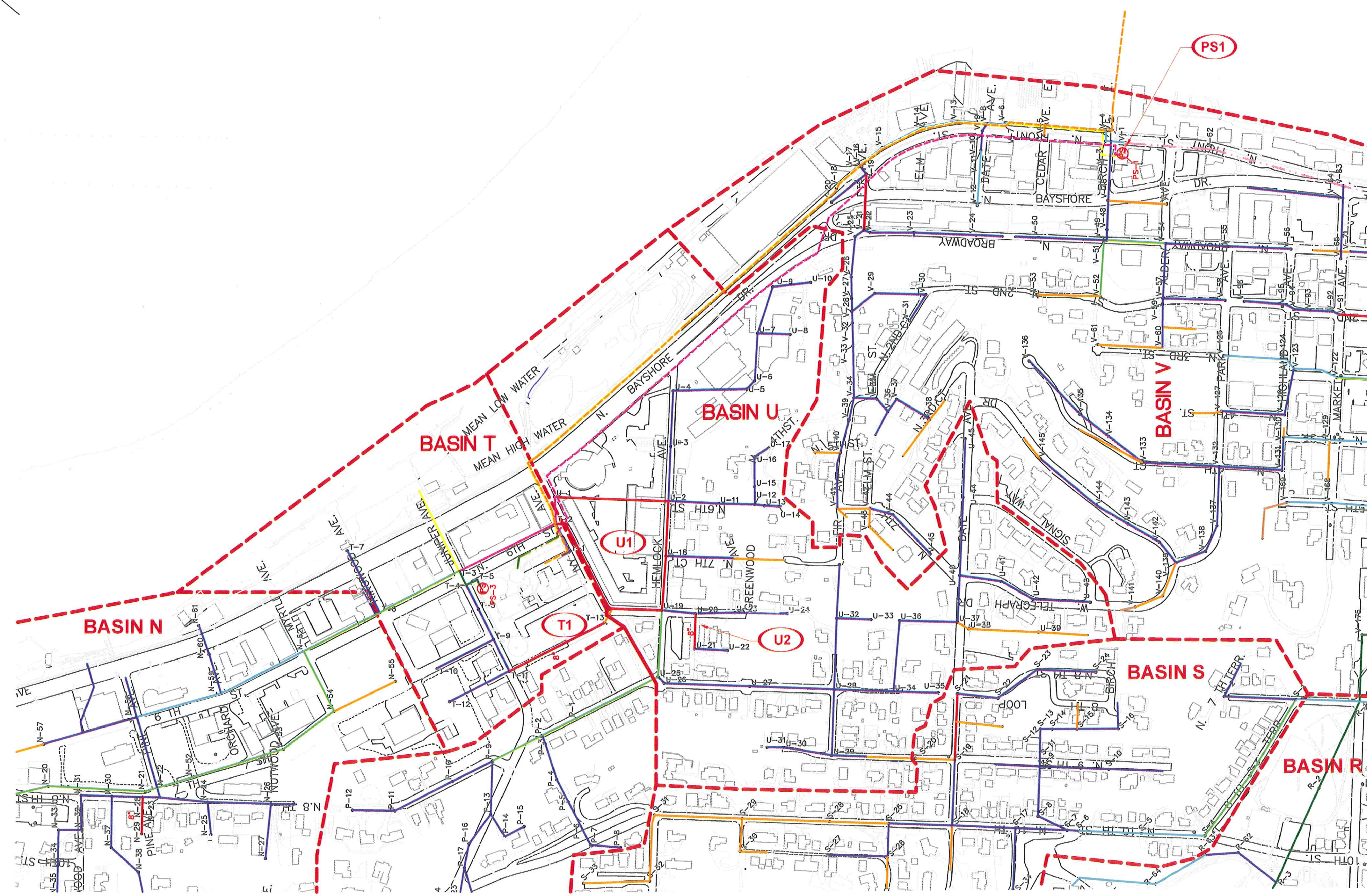
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS R&S - WITH IMPROVEMENTS

DRAWN BY: JGP

DATE: JAN 2006

MAP 11



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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CITY OF COOS BAY

WASTEWATER COLLECTION SYSTEM MASTER PLAN

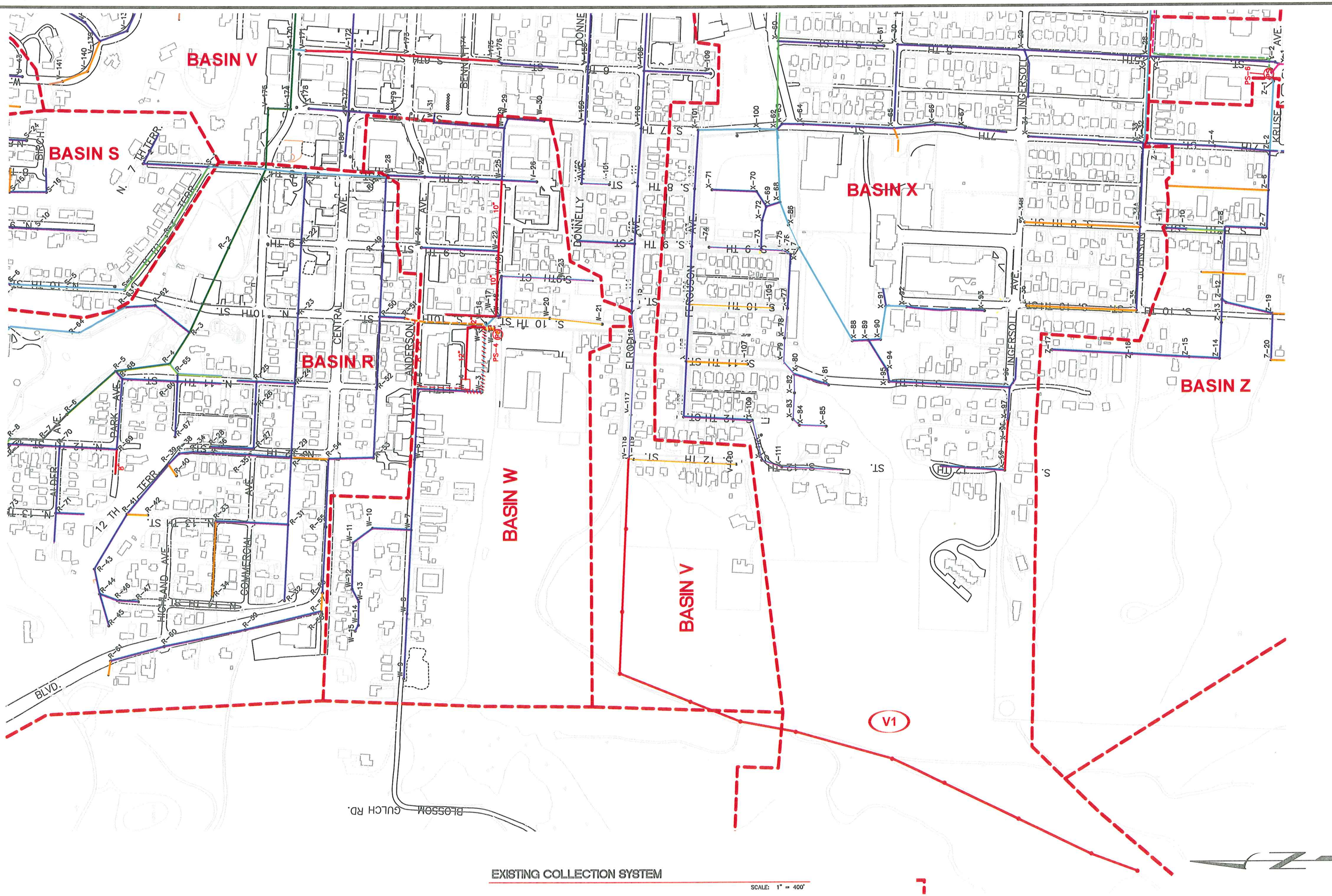
EXISTING COLLECTION SYSTEM

BASINS T&U - WITH IMPROVEMENTS

DRAWN BY: JGP

DATE: JAN 2006

MAP 12



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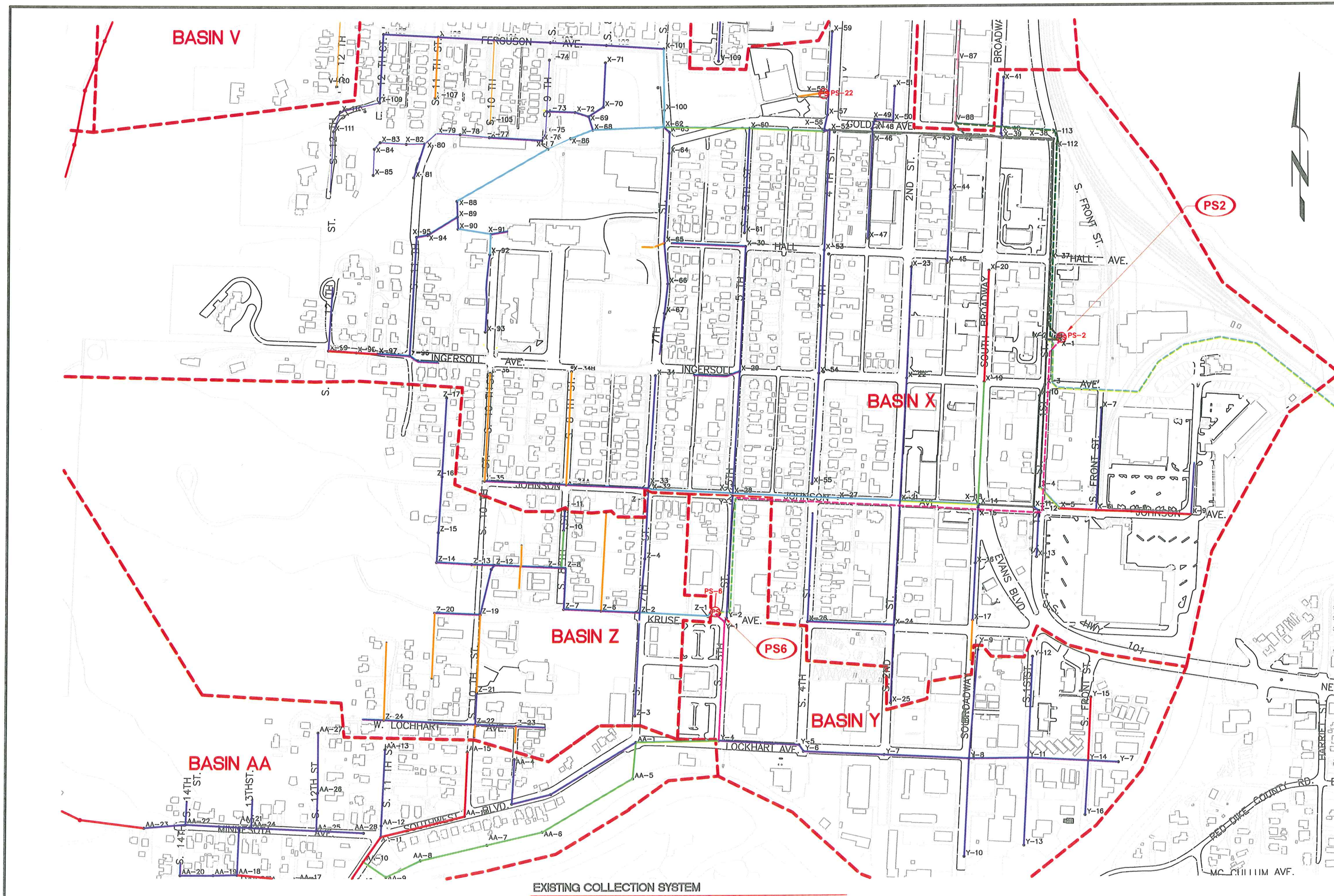
CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASIN V - WITH IMPROVEMENTS

DRAWN BY: JCP
DATE: JAN 2006

MAP
13



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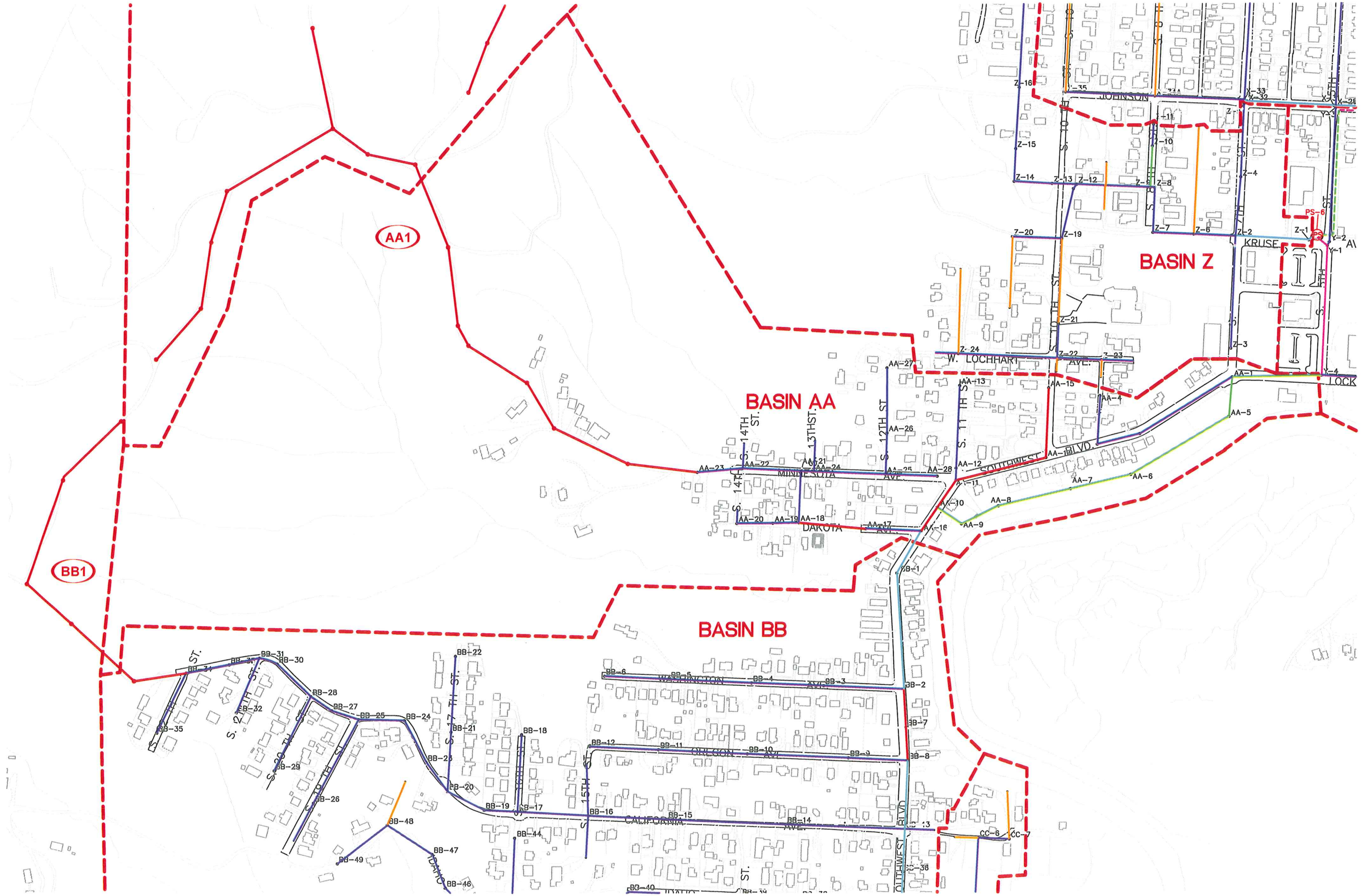
CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS X, Y&Z - W/ IMPROVEMENTS

DRAWN BY: JGP

DATE: JAN 2006

MAP 14



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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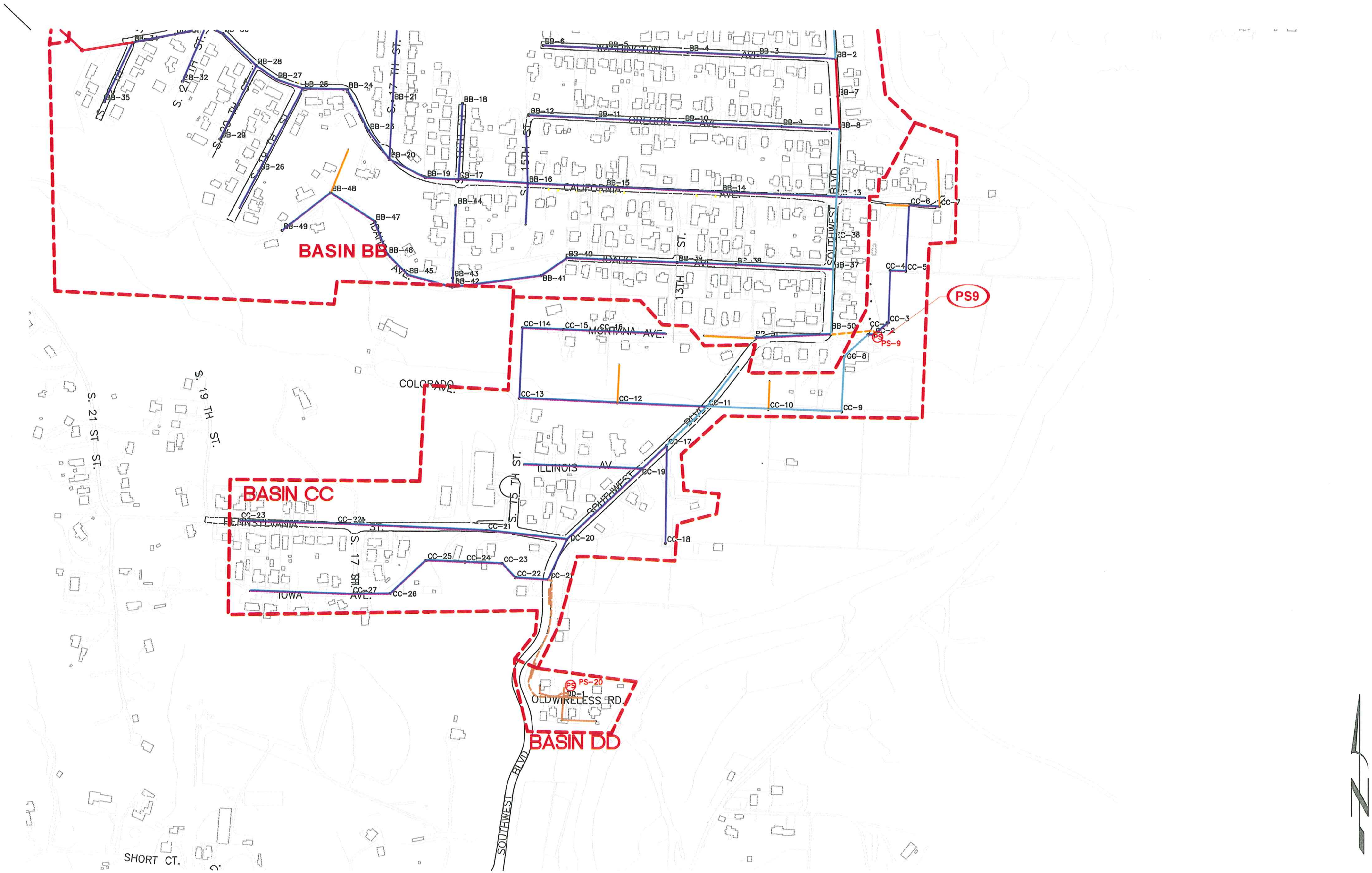
CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS AA&BB - W/ IMPROVEMENTS

DRAWN BY: JGP
DATE: JAN 2006

MAP
15



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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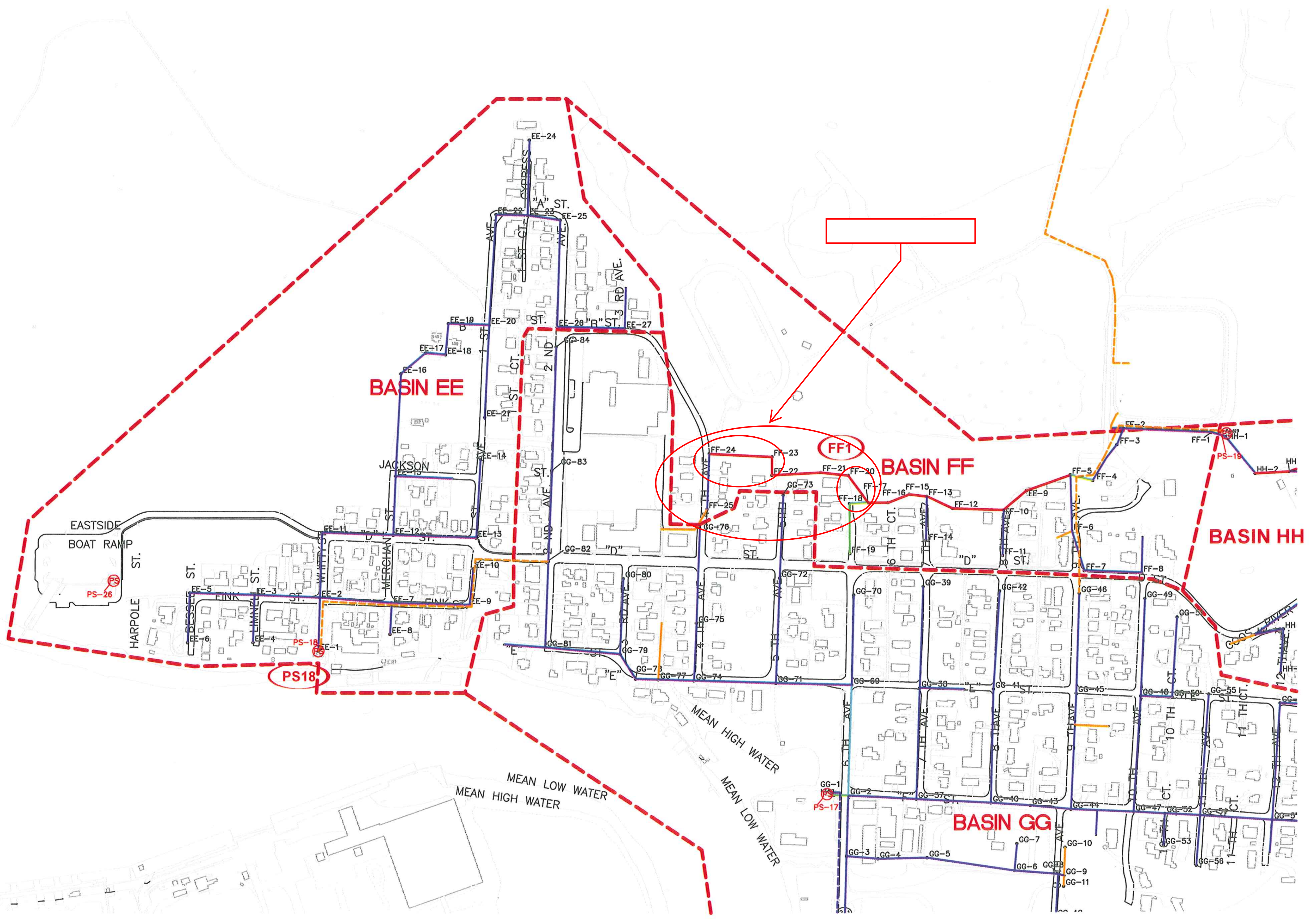
CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS CC&DD - W/IMPROVEMENTS

DRAWN BY: JGP
DATE: JAN 2006

MAP
16



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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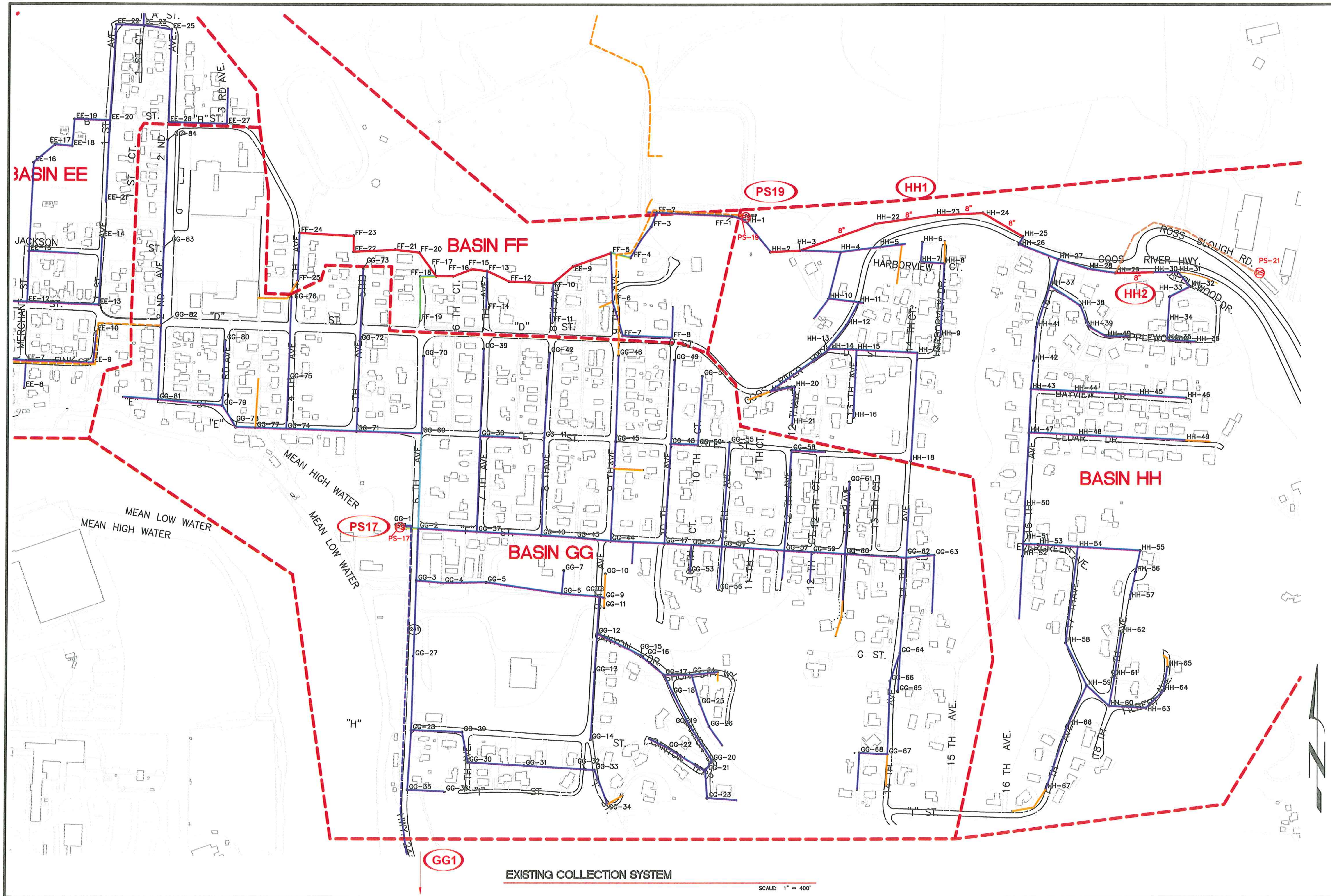
CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS EE&FF - W/IMPROVEMENTS

DRAWN BY: JGP
DATE: JAN 2006

MAP
17



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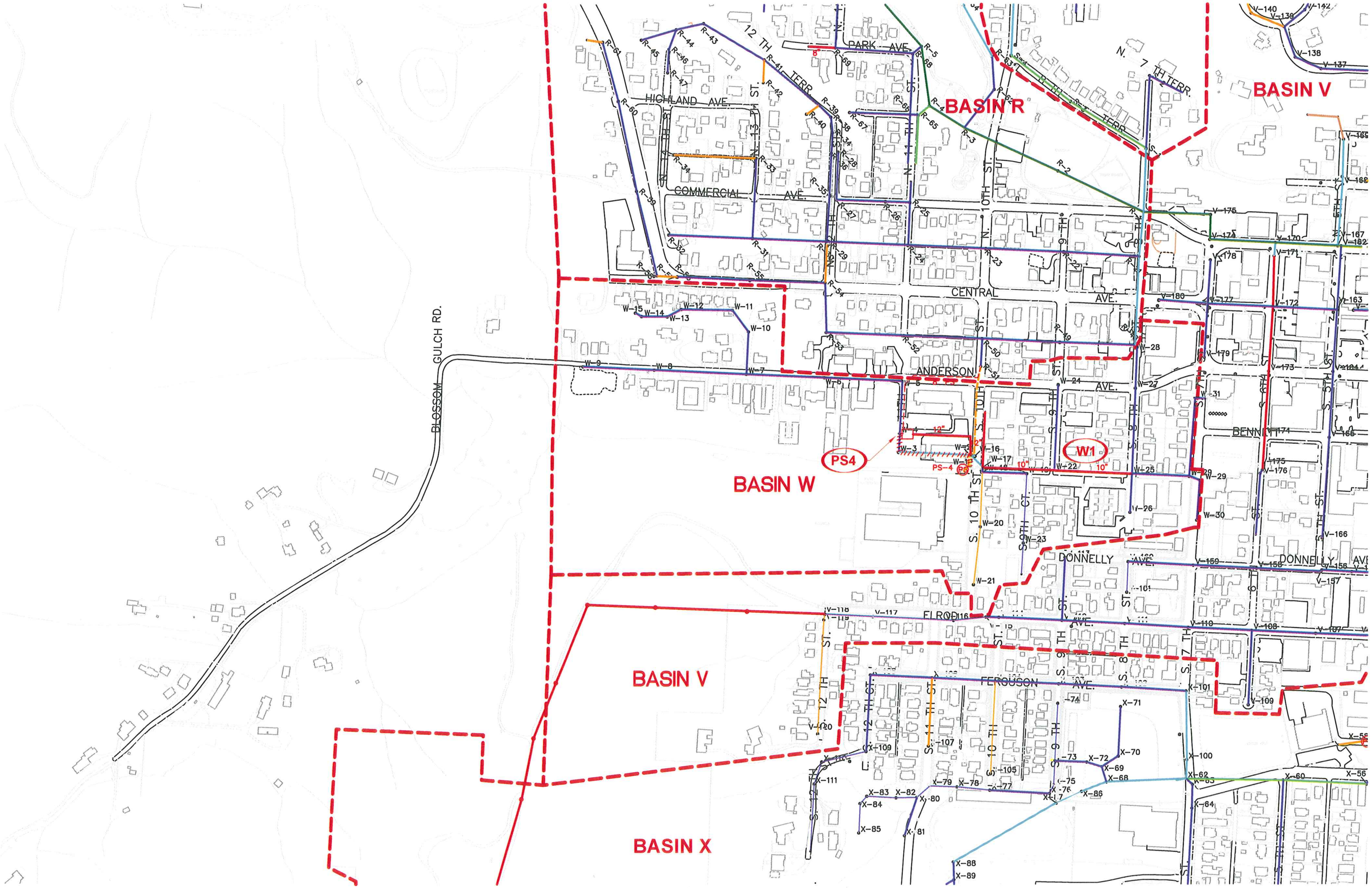
Consulting Engineers

CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASINS GG&HH - W/IMPS.

DRAWN BY: JGP
DATE: JAN 2006

MAP
18



EXISTING COLLECTION SYSTEM

SCALE: 1" = 400'

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CITY OF COOS BAY
WASTEWATER COLLECTION SYSTEM MASTER PLAN

EXISTING COLLECTION SYSTEM
BASIN W - WITH IMPROVEMENTS

DRAWN BY: JGP
DATE: JAN 2006

MAP
19