CITY OF BANDON
COOS COUNTY, OREGON

Wastewater System Master Plan

JUNE 2002
PROJECT NO. 4501.35

The Dyer Partnership
Engineers & Planners, Inc.

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Coos Bay, Oregon 97420
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Executive Summary

ES.1 Background and Purpose

The City of Bandon has operated a public wastewater collection system since before 1936 and a wastewater treatment plant (WWTP) since 1970. The City's most recent improvement to its system, a major expansion of the wastewater treatment plant (WWTP), was completed in 1993, increasing the peak capacity to 3.2 million gallons per day. The most recent (December 2001) infiltration and inflow (I/I) study identified several areas of deteriorated piping and recommended remediation. Soils in the City and Urban Growth Boundary (UGB) are of limited suitability for on-site septic tank systems, restricting urban growth to areas adjacent the public sewer system. The gravity flow collection system has been expanded to the practical limit, leaving several areas of the City without access to the public system.

This plan addresses additional I/I reduction efforts needed, along with the ability of the existing wastewater system to effectively convey and treat additional wastewater generated by the projected population growth in the 20-year study period. In addition, potential collection system expansions are developed for five areas inside the City or UGB that currently do not have sewer service. An analysis is also included on the ability of the treatment facility to treat increased flows after I/I reductions have been achieved.

ES.2 Population and Flow Projections

Population

The current population of Bandon is estimated at 2,940 within the city limits and 3,120 within the UGB. Census data indicates that there is an average of 2.1 people per household (per EDU). Census data for 2000 lists 1,535 residential housing units; adjusting for units on septic tanks, unoccupied units, transient housing, and commercial use gives a total of 1,734 EDUs.

The City has selected a 1.76% per year growth rate in the study area over the next 20 years for use in this Master Plan. The 20-year projected populations in the city limits and UGB are 4,241 and 4,500 respectively. Projected EDUs are 2,631. Population and EDU growth is discussed in more detail in Section 2 of this Plan.

Flows

Unit wastewater flows are used along with population projections to estimate future wastewater flows. Existing users have higher per capita flows due to the higher infiltration present in the existing system. An allowance of 57 gallons per person per day (gpcd) is used for infiltration in new systems to ensure capacity exists when the constructed improvements are 20 years old and I/I may exist.

Current flows are within the WWTP design capacity. Projected flows based on current conditions exceed the capacity of the facility by the year 2021. A successful I/I rehabilitation program, based on projects identified in the 2001 I/I study, is expected to reduce I/I flows at the project sites by about 30%. Projected flows for the year 2021 with I/I projects complete are within WWTP design capacities.

ES.3 System Condition

A comparison of wastewater flows at the treatment plant to local rain data showed that the system currently has both excessive inflow and infiltration. The December 2001 I/I study identified eight projects to reduce I/I in the system. One project, at Ocean Drive and 4th has been completed. The remaining projects include pipe lining and replacement and manhole rehabilitation at various sites. See Section 3.2 for a further discussion of these projects. Additional potential I/I was discovered in January 2002 during system flow measurement of Basin 6. Television inspection of target areas in Basin 6 is discussed in Section 3.2.

From computer modeling of the collection system, two areas, on Edison Avenue and Oregon Avenue, were found to be at or over the hydraulic capacity of the pipe. Manholes upstream of both locations have been observed to surcharge during heavy rains.

Fillmore Avenue and the South Jetty Pump Stations were found to be in general good condition, pumping at rated capacity, with minor repairs needed at each. North Avenue Pump Station was found to be operating at 25% of rated flow. This station has a number of limitations, including equipment that has exceeded its rated life, discontinued parts for the pumps, and operational and maintenance hazards to City workers. Johnson Creek Pump Station is operating at capacity, but showing wear in the structure and equipment. This station periodically floods, putting it out of service and damaging the equipment. Electrical and ventilation equipment at Johnson Creek Pump Station are not in compliance with NFPA 820, the standard regulating wastewater facilities.

The wastewater treatment plant was found to be in good general condition. A pilot project, sponsored by Bonneville Power Administration, assessing the energy savings of computer controlling the aeration systems, based on dissolved oxygen levels in the aeration basins, is currently underway. A pump control system, utilizing the sensors installed as part of the pilot project, could vary the rate of return activated sludge at the plant, increasing system efficiency. The original 1970 and 1993 flow monitoring equipment is in marginal condition, with effluent flows reading higher than influent flows. Based on the daily plant monitoring records, the system is operating well within design limits and no effluent permit violations were noted. Projected 20-year loads for the plant are within design criteria, providing an I/I remediation program is successfully completed.

ES.4 Recommendations and Costs

The City of Bandon currently does not have public sewers available in all areas of the City limits. City policy is to require developers to extend sewer services as a permit condition prior to construction. Services are only extended to properties within the City limits. Several areas within the City and developed areas in the UGB are served by private septic tanks. While these projects are not recommended for inclusion in the project budget, it is in the interest of the City to have a planned sewer layout to guide future sewer extensions as areas annex into the City. The total estimated cost

for extending public sewers into five areas of the City and UGB is $8,600,000. Descriptions of each area and the proposed improvements are included in Section 6.1.

The recommended projects for improving the City's existing collection system and WWTP are summarized in Table ES.4.1.

- Projects # A, B, & R are low cost projects to remedy deficiencies noted at pump stations that should be addressed before the next wet weather season.
- Projects # C and G-L are pipe and manhole repairs identified in the December 2001 I/I study.
- Projects # D & P are pipe size upgrades recommended to alleviate capacity deficiencies.
- Projects # E & O are pump station replacements, recommended to address major deficiencies.
- Projects # F, M, & N are measures to improve recording, monitoring and control at the wastewater treatment plant.
- Project #Q is to television inspect areas in Basin 6 where large amounts of inflow were noted during a January 2002 site visit.

Project financing was estimated based on the assumption that all measures would be grouped together as a package. Financing is based on obtaining a loan for 100% of the project. SDC funds collected would be used to pay that portion of the loan. To finance these measures and improvements the City will likely need to raise monthly user fees by $3.82 to $5.44 per EDU per month.

Table ES.4.1

Capital Costs of Recommended Projects

#	Priority	Project Description	City O&M	SDC* Eligible	Loan	Project Total
A	1	Filmore Avenue Pump Station Tide Gate	$2,400			$2,400
B	1	North Avenue Pump Station Impellors	$4,000			$4,000
C	2	I/I Project # 2		$49,500	$164,920	$164,920
D	2	Oregon Avenue Line Upsize		$133,420	$133,420	$133,420
E	3	Johnson Creek Pump Station Replacement			$265,000	$265,000
F	4	New Metering Recording System			$25,000	$25,000
G	5	I/I Project # 3		$70,000	$233,635	$233,635
H	6	I/I Project # 4		$14,500	$48,390	$48,390
I	6	I/I Project # 5		$12,000	$39,735	$39,735
J	6	I/I Project # 6		$20,000	$64,775	$64,775
K	6	I/I Project # 7		$20,000	$68,620	$68,620
L	6	I/I Project # 8		$7,350	$24,500	$24,500
M	7	New Influent Meter			$21,000	$21,000
N	7	Automatic RAS Control			$12,000	$12,000
O	8	North Avenue Pump Station Replacement			$126,000	$126,000
P	9	Edison Avenue Line Upsize		$56,500	$56,500	$56,500
Q	10	Basin 6 Television Inspection	$1,500			$1,500
R	Complete	Jetty Pump Station Generator Timer	$500			$500
		Total	$8,400	$383,270	$1,283,495	$1,291,895

* SDC eligible costs are also included in loans

Recommendations for implementation of the recommendations include the following.

- Submit Plan to Council for approval.
- Implement immediate measures and improvements (#A, B, Q, & R).
- Complete environmental assessment
- Request & secure financial assistance from funding agencies to finance the improvements.
- Development and implementation of system development charges.
- Secure authority to issue bonds needed to finance improvements.
- Authorize design and construction of improvements.
- Construct improvements.

The following is a tentative schedule identifying the key activities and approximate implementation date for the improvements.

• Council Approval of Plan	August 2002
• Submit letter to Rural Development and DEQ for financing availability	October 2002
• Start environmental assessment	October 2002
• Completion of low cost improvements	October 2002
• Submit application requesting financing to Rural Development and DEQ	October 2002
• Bond Authorization	April 2003
• Design of Project	April - September 2003
• DEQ Approval of Plans & Specifications	November, 2003
• Advertise for & Receive Construction Bids	January – February 2004
• Construction	March – October 2004
• Performance Evaluation	October – December 2004

Introduction

Section

1

Section 1

Introduction

1.1 Background

The City of Bandon has operated a public wastewater collection system since prior to 1936 and a wastewater treatment plant (WWTP) since 1970. Rapid growth in the 1980's and excessive infiltration and inflow (I/I) in the older parts of the system exceeded the capacity of the WWTP and a new, larger plant was built in 1994. The new plant is sized to meet the population needs, but I/I flows continue to present an operations challenge to properly treating the City's wastewater.

About half of the collection system in Bandon was built prior to 1977. 10% of the piping is terra cotta, laid without mortar. Much of this older piping has shifted or cracked, allowing groundwater to enter the system, increasing the load on the treatment plant. The City's Public Works Department has pursued an aggressive program to replace deteriorated mains and neighborhood service lines, but I/I levels are still excessive. An I/I study completed in December 2001 found 11,000 feet of piping in need of upgrading or repair. Service connections to pre-1970 buildings are a potential source of large amounts of I/I, especially in low-lying Old Town.

Development in Bandon has roughly followed the extension of the sewer lines, as soils in the area are of limited suitability for septic tank drainfields. Areas that are easily served by gravity sewers were generally built out by the 1970's. Lack of access to public sewers has limited development of areas within the urban growth boundary (UGB) and of some areas within the City limits. City policy limits sewer services to within the City limits and requires property owners within the City wishing new sewer service to pay for extending sewer service lines to their property. Sewer extension plans need to allow for areas within the UGB eventually incorporating into the City.

Bandon commissioned Wastewater Facilities Plans in 1978 and in 1991. The 1978 plan addressed concerns with high I/I rates and with failing septic systems in the Beach Loop/Johnson Creek area. This plan led to sewer rehabilitation projects and the construction of the Johnson Creek Pump Station and collection system. The 1991 plan addressed the failing treatment system and proposed the facility plan for construction of a new WWTP.

This Plan will address the ability of the City's existing wastewater system to effectively convey and treat the existing wastewater load as well as expansions necessary to serve additional wastewater generated by projected development. System upgrades to improve the capacity and condition of older pipe sections are covered. Recommendations are included to improve the operational efficiency of the system.

1.2 Objectives

The overall objectives of this Plan include the following:

- Evaluate the existing collection system condition and capacity and identify deficiencies.
- Evaluate the WWTP's hydraulic and treatment capacity.
- Estimate current and projected wastewater flows within the current City Limits.
- Estimate current and projected wastewater flows within the current UGB.
- Develop potential wastewater collection improvements to serve the projected development needs in the City limits and UGB.
- Recommend improvements for the existing collection and treatment system to improve the operating efficiency of the systems.
- Provide cost estimates and phasing recommendations for the recommended improvements.

1.3 Scope of Study

The scope of the Bandon Wastewater System Master Plan is intended to comply with the applicable requirements of State of Oregon's Department of Environmental Quality (DEQ).

Study area characteristics were identified and included both physical and socioeconomic conditions. City population and land use are addressed and projected in the future.

The **existing wastewater facilities** are investigated in detail. Data was collected on the existing wastewater collection and treatment systems from such sources as operating records, conversations with City staff, on-site investigation, maps, as-built records and other pertinent documentation. Existing facilities were evaluated in terms of location, sizing, capacity, condition, limitations, and performance. Consideration was given to the manner in which existing facilities could be utilized in the future. The infiltration and inflow (I/I) contribution to the wastewater flow was evaluated based on past and recent I/I investigations and historic plant operating data.

Wastewater characteristics were identified in terms of loads, flows, and strength during various times of the year. Future characteristics were projected to establish capacity requirements. Flows were addressed for both dry period and wet period conditions, and unit design values were established. Future wastewater characteristics were projected.

The basis for planning was established. Applicable regulatory requirements were identified and addressed, including management plans, current and future treatment criteria, and discharge standards. The present design capacity of the City's conveyance system and treatment plant was estimated to assess the present and future operation of wastewater facilities.
Alternatives were identified for conveyance and treatment. Nonviable options were screened out,

and a limited number of selected alternatives were established and evaluated in detail.

Finally, a **recommended plan** was identified which will enable the City to meet the present and future demands and requirements of their wastewater facilities. This plan includes preliminary design data, capital improvement and operational costs, recommended staging of improvements, a project schedule, and a financing strategy.

1.4 Previous Studies and Information

The following studies, reports and other sources of information have been used in the compilation of this Master Plan:

- City of Bandon 2010 Comprehensive Plan, Draft
  2000, The City of Bandon.
- City of Bandon Infiltration/Inflow Study
  December. 2001, Dyer Partnership, Inc.
- Comprehensive Sewerage Facilities Plan
  July 1978, HGE Engineers and Planners
- Storm Drain Master Plan
  June, 1999, Dyer Partnership, Inc.
- Comprehensive Water System Master Plan
  December 1992, HGE Engineers and Planners
- South Bandon Refinement Plan, Infrastructure Element
  June 1997, Dyer Partnership, Inc.
- Wastewater System Facilities Plan
  February 1991, Brown and Caldwell Consultants
- Bandon Wastewater Treatment Plan Construction Drawings
  January 1992, Brown and Caldwell Consultants

The information in this Plan is for preliminary planning and budgeting purposes. Detailed surveys and elevation information must precede design and some changes from this Plan are anticipated.

1.5 Authorization

The City of Bandon authorized the Dyer Partnership, Engineers & Planners, Inc. to proceed with this Wastewater System Master Plan on March 1, 2001. Services are provided in accordance with a Professional Services Agreement dated March 20, 2000.

1.6 Acknowledgments

This plan is the result of contributions made by a number of individuals and agencies. We wish to acknowledge the efforts of Richard Anderson, Public Works Director, Bill Nielson, Wastewater Treatment Plant Supervisor, Jason Locke, Planning Director, and the staff of the Coos Bay DEQ office.

Section

2

Study Area Characteristics

Section 2

Study Area Characteristics

2.1 Study Area

The City of Bandon is located on the southern Oregon Coast on the south bank of the Coquille River. Bandon is situated on Highway 101 approximately 23 miles south of Coos Bay. The Study Area for this facilities plan encompasses the City of Bandon and surrounding areas within the Urban Growth Boundary (UGB). The Bandon City Limits encompasses approximately 1,980 acres and the current UGB covers approximately 2,900 acres. Situated on a marine terrace, Bandon is bounded on the north by the Coquille River and on the west by the Pacific Ocean. A bluff, on the west and part of the north side, slopes steeply to sandy beach areas. A location map is shown as Figure 2.1.1. Figure 2.1.2 illustrates the Study Area. The area is divided into the following neighborhoods by geographic and historical association as described below.

Downtown/Woodland Heights - Old Town Bandon forms the core of the downtown area, catering to tourists and waterfront activities. This area has most of the restaurants and specialty retail shops in town. Commercial development serving the year-round residents tends to follow the Highway 101 corridor, which curves through this neighborhood on the north and west sides. The Filmore Street Pump Station is located adjacent to Old Town, serving the entire Bandon system, and pumping directly to the WWTP. This area is fully developed, although there are some vacant lots and oversized lots with homes are subject to subdivision. The main concerns for this area are the pre 1936 terra cotta sewer lines and service laterals, which are sources of a high rate of infiltration in the system.

West Bandon - Bounded on the north and west by the bluff, on the south by 13th Street and on the east by Oregon and Allegheny Avenues, West Bandon is one of the oldest residential neighborhoods in the City. While mostly developed, a number of empty lots are currently on the market in this area. The community center, a large public park and schools serving the Bandon Area are located in this neighborhood. Concerns for this area are the pre 1936 terra cotta sewer lines and service laterals, which are sources of a high rate of infiltration in the system. Also of concern is the sizing of the interceptor line serving this neighborhood and areas to the south.

Bandon Heights - Bandon Heights is the area between Ohio Street and Riverside Drive from the north city limits south to Highways 101 and 42S. This area is a mix of residential and commercial, with the city's sole strip mall located on Highway 101. The area is partially developed with a mix of urban and rural lot sizes. Entirely within the city limits, the area is served by sewers except for Riverside Drive and the area north of 6th Street. The North Avenue Pump Station and the Wastewater Treatment Plant (WWTP) are located in this neighborhood. This area is of concern because the existing homes on Riverside Drive have septic systems close to the water table. When drain fields fail, these homes are required to install specialized systems to handle the effluent from their septic tanks.

Beach Loop - This area is bounded on the north by Tupper Creek, on the west by the Pacific Ocean, on the south by Polaris Avenue and the city limits, and on all other sides by the city limits. This area is characterized by bluffs and sandy, vegetation covered dunes along the ocean and sandy hillocks with Gorse, Scotch Broom and scrub pine on the east side of Beach Loop Road and the floodplain of Johnson Creek. The area is a combination of residential and commercial, with most of Bandon's hotels located in this area. Restaurants, a golf course and nursing homes make up the bulk of other commercial development in this area, with additional scattered commercial development along Highway 101. The construction of the Johnson Creek Pump Station and extension of city sewers to the area in 1980 has made this scenic loop some of the most desired retail property in Bandon. This area has experienced about 70% of the total growth in the city over the last 10 years. This area is of concern because the pump station equipment is approaching the end of its rated life, and the rapid growth in the area will require extending the existing sewer mains.

South Jetty - Tucked in between the Pacific Ocean and the bluff, with the Coquille River on the north and Tupper Creek on the south, is the South Jetty area. This area consists of low-lying grounds that have been built up with fill from dredging and construction projects. This area is mainly residential with a public park area providing access to the south jetty and Bandon Beach, and one restaurant. A new assisted living facility has recently opened in this area. The South Jetty Pump Station, built in 1995, serves this area. While some of the homes in this area are on septic systems, DEQ requires connection to the public sewer when existing systems fail. This system is the newest is Bandon, and capacity should exceed the needs of this area through the study period.

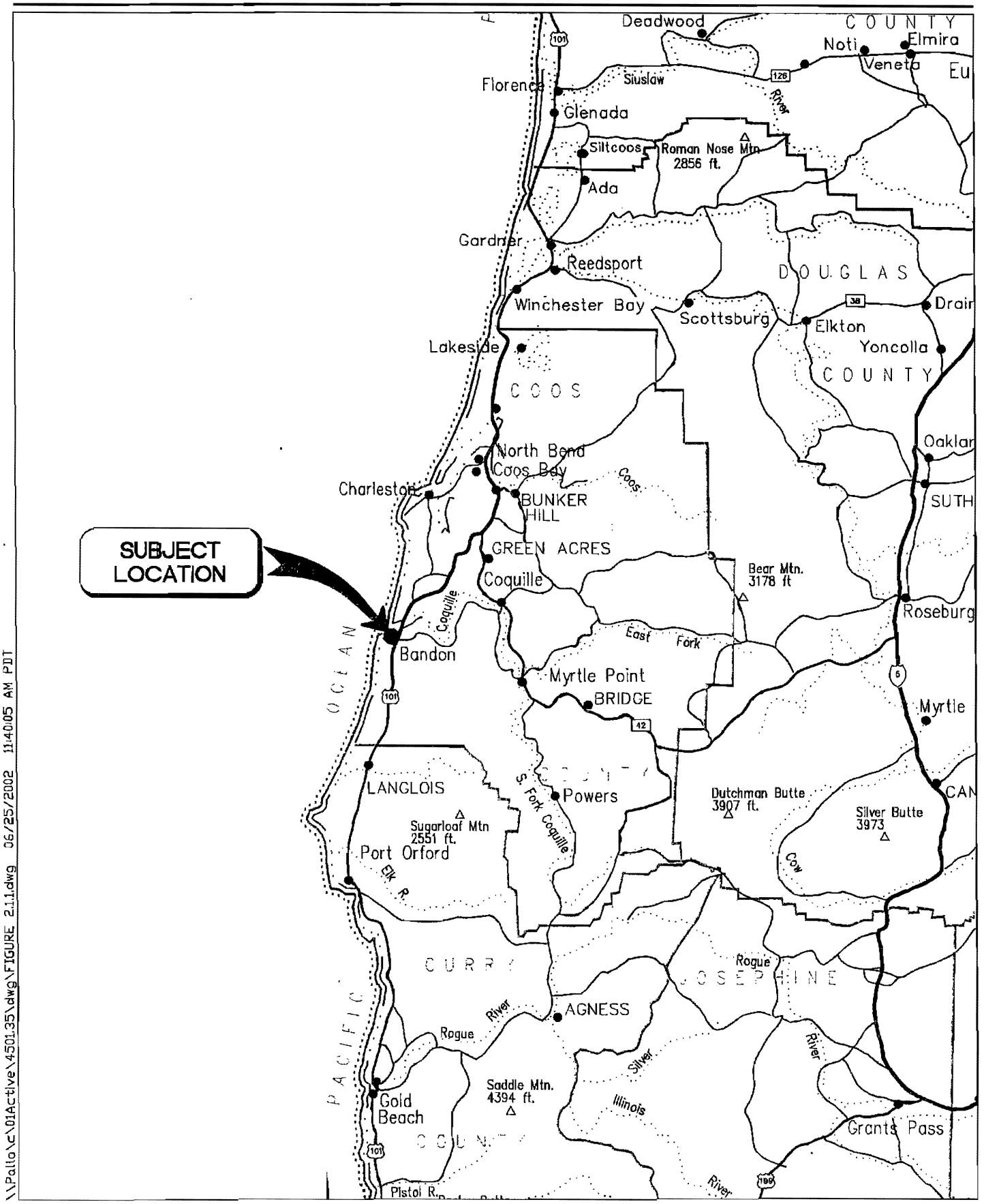
South Bandon - The Old Town area of the City of Bandon is built on the south bank of the Coquille River. As the city grew, residential development spread south along the oceanfront to Johnson Creek and commercial development spread south along Highway 101, leaving an undeveloped swath of land between the highway and the beach. Current residential development is moving east along Johnson Creek toward Highway 101, completing a circle around the undeveloped area. The area between Highway 101 and the developed shoreline is South Bandon, known locally as the Donut-Hole. The Donut-Hole is within the UGB but outside the city limits. This area is surrounded by the city on three and a half sides, which makes it a prime candidate for annexation into the city, and sections of the area are ideally situated for a future public park. It is characterized by sandy hillocks covered with Gorse, Scotch Broom and scrub pine interspersed with wetlands. The soils are not conducive to septic drain fields and city sewers do not extend outside the city limits. A 1997 study examined the development potential and recommended infrastructure to insure sound development progression. This area is of concern because it is under county jurisdiction and currently allowed development may conflict with bringing in city infrastructure in the future.

Sunset City – South of Polaris Street and bounded by the UGB, Sunset City is an area currently undergoing rapid development. Sewers serve the portion of the neighborhood inside the city limits. The area has many ocean view lots and architect-designed homes. Concerns for this area are due to rapid development without city infrastructure in place.

Southeast Bandon – South of Highway 101 and east of Harlem Street, in the city limits, is the area of Southeast Bandon. The two branches of Ferry Creek flow through this area, cutting it into three segments. This area is mainly residential with some commercial development along Highways 101 and 42S. Southern Coos Hospital and Health Center is located in the western segment of this area. Patches of second growth forest and the Ferry Creek waterway characterize the area. City sewer services are available along Highways 101 and 42S and in the southwest corner of this area. Most lot

sizes in this area are too small to support a septic drain field and concerns in this area include extending sewers cost effectively to the remaining properties.

Airport – East of Highway 101 and west of Bandon Airport a zone reserved for the airport and supporting services and for industrial use. The area is sparsely developed at this time. This area is outside of the city limits, and is of concern because it is under county jurisdiction and currently allowed development may conflict with bringing in city infrastructure in the future



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THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON WASTEWATER MASTER PLAN***	**FIGURE NO.**
DATE: JUNE, 2002	***VICINITY MAP***	***2.1.1***
PROJECT NO.: 4501.35		

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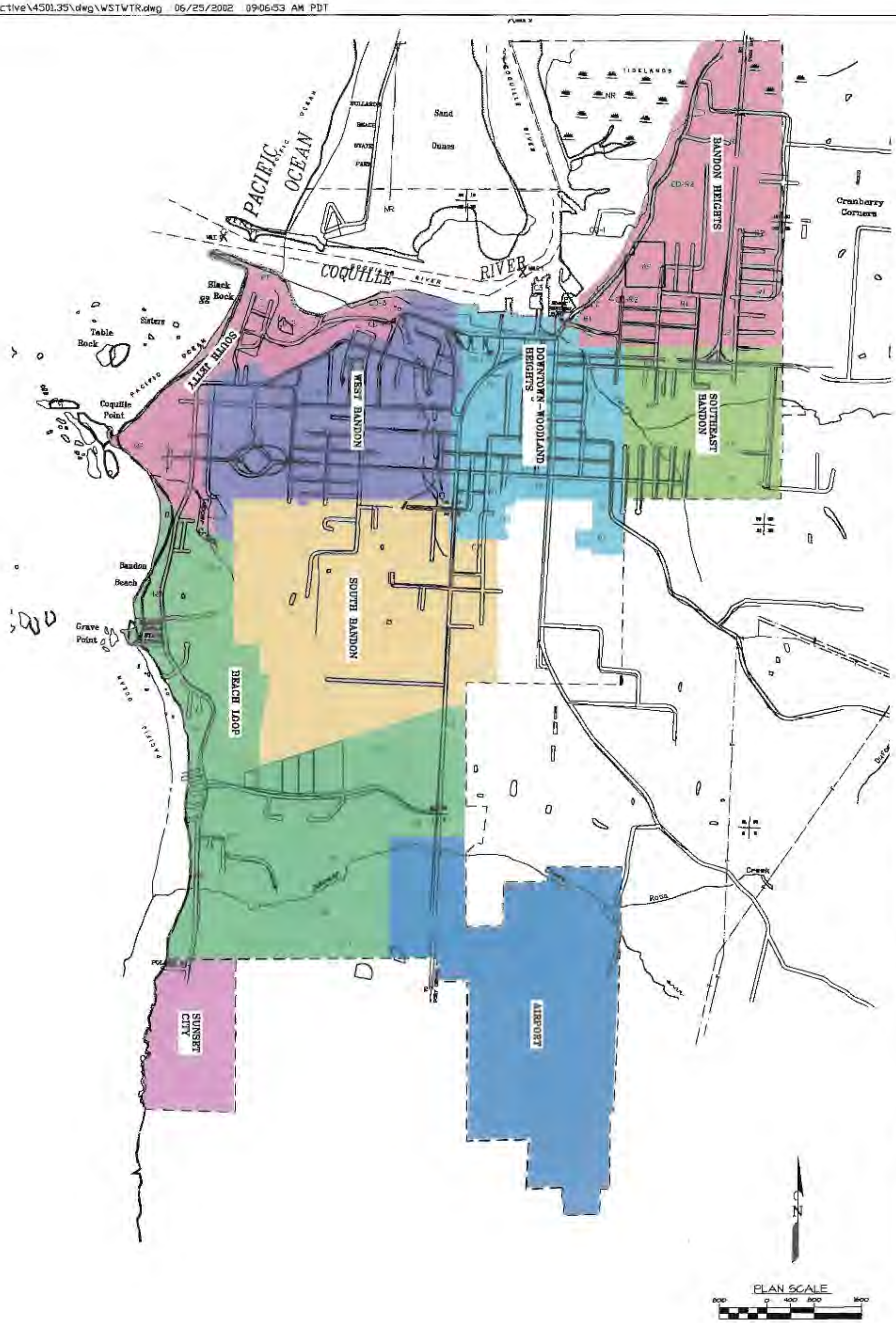

THE DYER PARTNERSHIP ENGINEERS & PLANNERS	CITY OF BANDON - WASTEWATER MASTER PLAN	FIGURE NO.
DATE: JUNE, 2002	STUDY AREA MAP	2.1.2
PROJECT NO.: 4501.35		

2.2 Physical Environment

The following is a discussion of the physical environment in and around the City of Bandon.

Climate

Bandon has a mild marine climate. The monthly average low temperature is 38° F and the average monthly high is 67° F. Annual average rainfall is about 60 inches with July being the driest month and December the wettest. Record annual precipitation was 91 inches in 1996 with 6.25 inches falling on one day. Prevailing winds in the summer are from the northwest with winter storms predominantly from the southwest. Table 2.2.1 summarizes the precipitation and temperature data for Bandon.

Table 2.2.1

Bandon Climate Summary

Month	Precipitation, inches		Temperature °F,
	Mean	Highest Daily	Mean
January	10.07	4.00	45.8
February	7.73	4.99	47.3
March	7.38	3.87	47.6
April	4.37	3.3	49.2
May	3.09	2.56	52.5
June	1.47	1.8	56.0
July	.4	1.14	58.2
August	.79	3.4	58.6
September	1.63	1.91	57.4
October	4.54	3.18	53.7
November	8.62	6.25	49.7
December	9.63	5.61	46.4
Total	59.71		
Average			51.9

1948-2000 data from Western Regional Climate Center

Soils

There are six general classifications of surficial geologic formations found in the local Bandon area. A map showing these formations is included in the Appendix. The formations are described as follows:

- **Quaternary Alluvium (Qal)** - These soils are unconsolidated alluvial floodplain deposits, generally composed of silts, sand, mud and gravels. These soils are found along the south shorelands of the Coquille River and the lower reaches of Ferry Creek.

- **Marsh and Peat (Mpt)** – These soils are organic silt, clay and sand in wetland areas, characterized by abundant vegetation, ponding and high groundwater. These soils are found on the eastern shore of the Coquille River in north Bandon and upstream to Bullards Bridge.

- **Quaternary Marine Terrace Deposits (Qmt)** – These soils are flat-lying marine terrace deposits, typically fine to medium grained friable sandstone of beach origin with thin interbeds of siltstone. Thicknesses range from 10 to 50 feet. Qmt soils are predominant in Bandon, except along the Coquille River.

- **Unstable Dune Sand (Su)** – These soils are unconsolidated fine to medium-grained sands or large dunes not protected from wind erosion by vegetation. Found across the Coquille River from Bandon at Bullards Beach, Su soils cover the area between the river and the Pacific Ocean.

- **Stable Sand (SS)** –These soils consist of fine to medium grained dune sand, protected from wind erosion by vegetation. SS soils are found within the south jetty area of Bandon.

- **Deflation Plain and Beach Sand (Sdpb)** – These soils consist of unconsolidated fine to medium grain sand found along ocean beaches and the dunes area north of Bandon.

Geologic Hazards

There are several areas within Bandon that are susceptible to geologic hazards. These hazards include coastal and river flooding, high groundwater, landslides, earthquakes associated with fault zones, tsunamis, and coastal and river erosion. A discussion of each hazard and expected locations are discussed below. A hazard map is included in the appendix.

- **Coastal and River Flooding** - Major flooding in Bandon usually occurs from November through February. Winter rains increase the flow of the Coquille River and combined with high tides and wind driven seas cause extensive flooding in the Coquille tidal basin. Low lying areas frequently flood annually, with major floods occurring in 1890, 1955, 1964 and 1996. Extreme high water conditions in the Coquille River cause Ferry Creek to back up, flooding the area around the Bandon Cheese Factory and turning Filmore Avenue into an alternate outlet for the creek. The 100-year floodplain for the Coquille River, as shown on FEMA flood insurance maps, roughly follows Jetty Road to 2nd Avenue and continues along Riverside Drive to the Bandon Marsh.

  Ocean flooding is caused by storm driven high seas or earthquake generated tsunamis. The south jetty area, the mouth of Johnson Creek and property west of Seabird Lane have historically been subject to erosion and flooding from winter storms. The Old Town area was flooded by a 1964 tsunami generated by the Good Friday Earthquake in Alaska. The floodplain of the Coquille River, Johnson and Ferry Creeks are shown in Figure 2.2.1.

- **Earthquakes** - Earthquakes are the products of deep-seated faulting and the subsequent release of large amounts of energy. The Coquille Fault comes onshore just north of Bandon. No known earthquakes have originated in Coos County in the last 100-years, but five earthquakes registering above magnitude 5.7 occurred off the Oregon Coast between 1980 and 1990. Research has indicated that an earthquake produced Tsunami reaches the Oregon Coast every 500 to 700 years.

- **High Groundwater.** The areas know as South Bandon and the Beach Loop have perched water tables and contain large areas of wetlands. These areas are not suitable for septic tank systems and may not be easily developed without public sewers.

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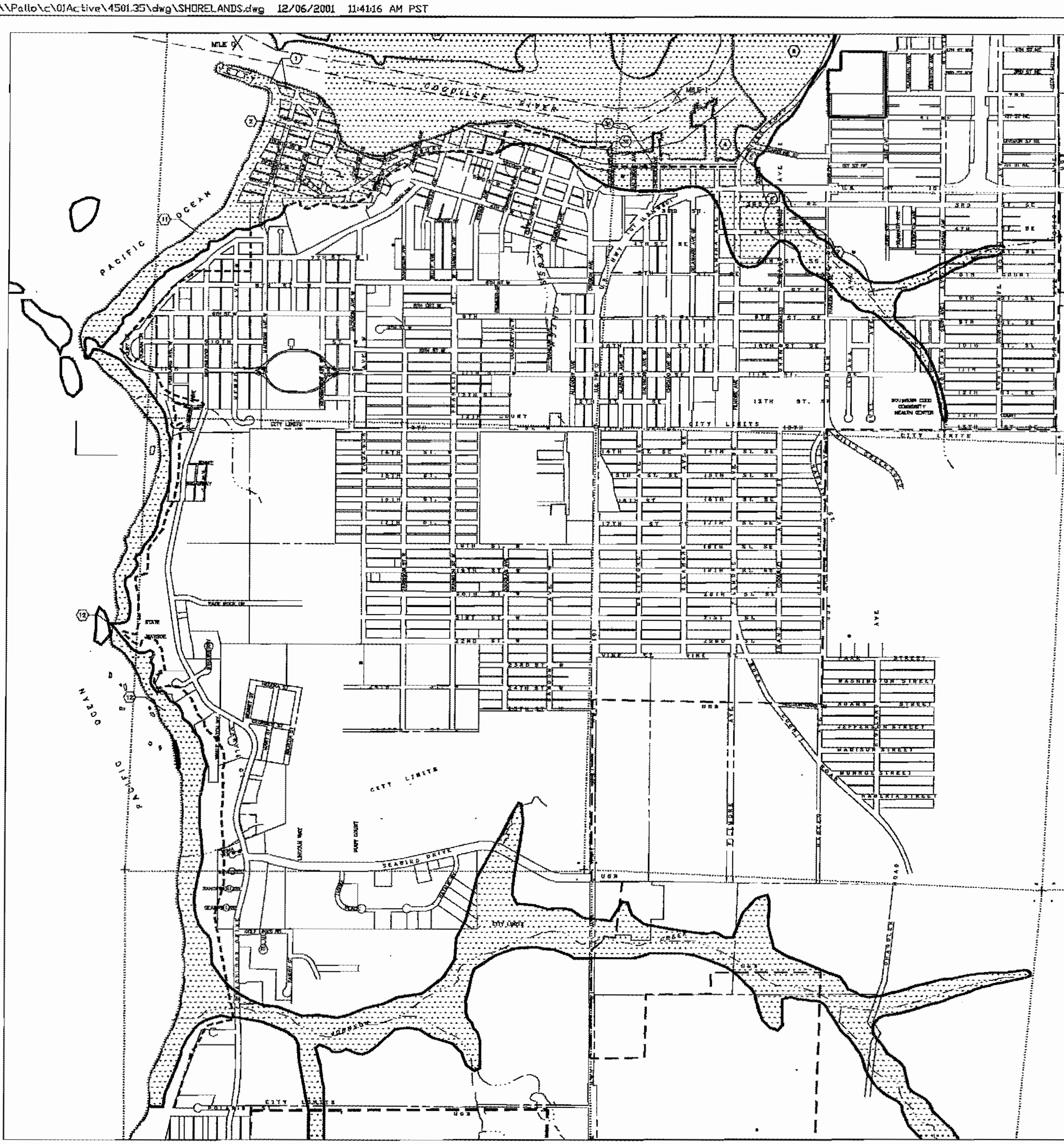


LEGEND

COASTAL SHORELINE MANAGEMENT UNIT

100 YEAR FLOOD PLANE HAZARD AREA

THE DYER PARTNERSHIP ENGINEERS & PLANNERS	CITY OF BANDON - WASTEWATER MASTER PLAN	FIGURE NO.
DATE: April, 2002 PROJECT NO.: 4501.35	FLOOD ZONE & COASTAL SHORELANDS BOUNDARY	2.2.1

- **Coastal Erosion.** Bandon's city limits border thousands of feet of shoreline along the Pacific Ocean. These areas are susceptible to extensive erosion by waves and the elements of weather. The bluff fronting the ocean for most of Bandon's west boundary is composed of heterogeneous, pre-tertiary bedrock, which is slow to erode. Individual areas have experienced noticeable erosion and slides.

Public Health Hazards

Known public health hazards within the Bandon area consist of failing on-site septic systems. The area north of the wastewater treatment plant on Riverside drive has a number of older homes with existing on-site septic systems. This area is below the Coquille River flood zone and has a high ground water table. The area between Harlem Avenue and Highway 101 south of 17th contains older homes on small lots with on-site septic systems and city water. Irrigation use of older wells that are contaminated due to proximity to septic drain fields is a concern. Well drawdowns also move contaminated groundwater deeper into the water table and could spread the contamination.

This Master Plan investigates alternatives for providing City sewer service to these problem areas.

Water Resources

The west boundary of Bandon is the Pacific Ocean and the north boundary is the Coquille River. This location allows year-round salt and fresh water recreation for local residents and seasonal visitors. Crabbing, fishing and boating and beachcombing are popular activities.

The Coquille River drains a 1,032 square mile sub-basin with four main tributaries, the North Fork, East Fork, Middle Fork and South Fork. Average annual flow at the river mouth is 3,020 cubic feet per second (cfs) with median flows ranging from 7,600 cfs in January to 130 cfs in September. There are 21 permitted National Pollution Discharge Elimination Sites (NPDES) on the Coquille River, including Bandon's wastewater treatment plant discharge. Oregon Department of Environmental Quality (DEQ) has found the water quality of the Coquille River upstream of Bandon to be "poor". The discharge from Bandon's outfall does not produce detectable river quality problems, possibly due to mixing action from tidal forces.

Bandon Marsh National Wildlife Refuge established in 1983 contains undisturbed salt marsh and mud flats, partly within the city limits. The marsh is considered a premier site for birding, and also is accessible for hunting, fishing and clamming.

The City's municipal water supply comes from Ferry Creek and it's upper tributary, Geiger Creek. The City has reservoirs on Ferry Creek and Geiger Creek that gravity feed water into the treatment plant.

Flora and Fauna

Vegetation in the Bandon area is typical of coastal regions in Oregon. The sandy soils encourage growths of Beach Grass, Scotch Broom, shrub trees and Gorse. The oily Gorse plant has taken over undeveloped areas invasively and is blamed for fueling the 1936 fire that devastated much of Bandon. Forestlands are predominant to the east and south of Bandon with Douglas Fir, Port Orford Cedar, Sitka Spruce, Western Hemlock and Red Alder trees. Forest shrubs include Scotch Broom,

Salmonberry, Thimbleberry, Blackberry, Mountain Ash, Vine and Bid Leaf Maple, Pacific Rhododendron, Kinnikinnick, Manzanita, and Sword and Bracken Ferns.

The tidal zone along the Pacific Coast and Coquille Estuary are the habitat of Marine Bass, Rock Fish, and Ocean Perch. Other types of marine life include Clams, Mussels, Chitons, Limpets, Dungeness and Rock Crab, Shrimp, Starfish, Sea Anemone, and Urchins. Runs of Chinook and Coho salmon and Steelhead trout enter the Coquille Estuary each year for their seasonal upstream migration.

Bandon Marsh is one of the most important bird wintering areas in Coos County. Several rare species inhabit the intertidal zone, including Peregrine Falcon, Bar-tailed Godwit, and Hudsonian Godwit. Other bird species in the study area include Bald Eagles, Cormorants, Pigeon Guillemots and the Common Murre.

Sea mammals living in the ocean off the coast of Bandon include Harbor Seals, Great Elephant Seals and Northern Sea Lions. Other mammals native to the region include Shrew, Mole, Raccoon, River Otter, Muskrat, Beaver, Skunk, Squirrel, Elk, and Blacktail Deer.

Threatened or Endangered Species

Coho Salmon are currently listed by the federal government as threatened, although angling is allowed in a limited season for hatchery raised Coho. Winter Steelhead and Green Sturgeon are proposed to be added to the federal endangered list. The State of Oregon lists Cut-throat Trout and Pacific Lamprey status as sensitive. Federally listed bird species in Coos County include the Aleutian Canada Goose, Marbled Murrelet, Western Snowy Plover, Northern Spotted Owl and Bald Eagle, all listed as threatened and the Northern Pygmy Owl and Brown Pelican listed as threatened. Protected mammal species include the Northern Sea Lion and Grizzly Bear with a listing of threatened and the Gray Wolf listed as endangered. Few of these actually reside in the UBG, but may be found in the undeveloped areas surrounding Bandon.

Environmentally Sensitive Areas

The Coquille River is considered a Shallow Draft Development estuary under the Oregon Estuary Plan. While this designation allows dredging and development in the vicinity of the Bandon waterfront and the shipping channel, other areas of the estuary may be protected. The Coquille Estuary is divided into three Estuarine Management Units. The management intent of these units is described below. The estuary is further divided into subunits, each uniquely defined by natural boundaries. These boundaries may be geographic or habitat limiting. Each subunit is explicitly defined in terms of permitted uses and activities by means of a permitted matrix.

Development Estuarine Management Units are designated to provide for navigation and other identified needs for public, commercial, and industrial water dependant uses. Such areas include deep-water areas adjacent to or near the shoreline, navigation channels, subtidal areas for in-water disposal of dredged material, and areas of minimal biological significance needed for uses requiring alteration of the estuary not included in Natural or Conservation Estuarine Management Units. The Coquille Channel and Bandon Waterfront are in development management units.
Natural Estuarine Management Units are designated to assure the protection of fish and wildlife habitats, to promote the continued biological production within the estuary, and to provide for scientific research and educational needs. These units are managed to preserve natural resources in

recognition of the dynamic, geological, and evolutionary processes. Areas include all major tracts of salt marsh, tideflats, and seagrass and algae beds. The Bandon Marsh National Wildlife Refuge (NWR) is one such area. The original 304-acre NWR was expanded in 1999 by 577 acres. The City of Bandon has since opened channels in the marsh to restore tidal flows and improve habitat. Other significant wetland areas within the UBG are located in the mostly undeveloped area known as "South Bandon".

Conservation Estuarine Management Units are designed for long term uses of renewable resources that, except for restoration, do not require major alteration of the estuary. These areas are managed to conserve the natural resources and benefits. Areas include those needed for maintenance and enhancement of biological productivity, recreational and aesthetic uses, and aquaculture. They include tracts of habitat smaller or of less biological importance within Natural Units, and recreational or commercial oyster and clam beds not included in Natural Units. The existing wastewater treatment plant is within a conservation unit.

Several areas outside of the Coquille Estuary system have been identified as wetlands. Small Palustrine (marsh) wetlands are scattered throughout the study area, particularly in South Bandon. Bandon is in the process of completing a comprehensive wetlands inventory.

The Oregon Department of Fish and Wildlife (ODFW) maintains a fish hatchery on Ferry Creek. This is located below the water intake for the city and there are currently adequate water flows for both uses.

The City of Bandon has identified lands that limit, control, or are affected by the hydraulic action of coastal waters. These lands are indicated on Federal Flood Insurance Program maps and on the map included in the comprehensive plan as the Coastal Shoreland Inventory map. The boundary of the Coastal Shoreline Management Unit is shown in Figure 2.2.1.

Air Quality and Noise

Air quality within the Bandon area is excellent. Favorable prevailing winds, low population with corresponding low auto emissions, and absence of heavy industrial development result in few air quality problems. Noise is also not a nuisance. Automobile and truck traffic along Highway 101 would likely be the source of any future air quality or noise problems in Bandon.

Energy Production and Consumption

No major energy resources have been identified in the Study Area. There is some potential for individual small-scale wind generation projects, with PacifiCorp maintaining the permit for the dismantled wind farm just north of Bandon. Energy consumption is expected to increase within the Study Area due to population growth during the planning period. The City of Bandon Electric Utility serves the Study Area with electrical power. There is no natural gas service available, although a bond was passed in 1999 to install a pipeline connecting Coos County with Northwest Natural Gas service from Roseburg. Construction of the pipeline is scheduled for June 2002, although the line will not extend to Bandon.

Wild and Scenic River System

There are no Wild and Scenic Rivers within the Study Area.

2.3 Socioeconomic Environment

Population

Since 1990 Bandon has experienced a growth rate higher than most other communities in Oregon. Economic conditions were difficult in the early 1980's due to the decline of the forest products industry, and the population slightly decreased. Bandon's livability characteristics, however, especially for retired persons and those enjoying outdoor recreation, have attracted a long term growing populace to the Oregon Coast regardless of the local economic climate.

Based on Portland State University's (PSU) Center for Population Research census data, the City of Bandon's population increased from 2,224 to 2,940 between 1990 and 2000. This equates to an average annual growth rate of 2.83%. During this same period, the average Coos County growth rate was 0.4%.

Growth in Bandon is expected to continue at a rate higher to that experienced in the county during the last decade. A growth rate of 1.76% per year has been selected for projections used in this Master Plan over the next 20 years (to the year 2021), as suggested by the Revised Coos County Population Report for 1997. Growth occurs through infill of existing land in the City limits or through annexation of property in the UGB. The most recent population projections are shown in Table 2.3.1.

Table 2.3.1

Coos County Population Growth Rates

Item	Year						
	1990	1995	2000	2005*	2010*	2015*	2021*
Coos County Population	60,273	62,100	62,779	64,950	66,338	67,870	69,846
Annual Growth Rate %	N/A	.60	.40	.42	.42	.48	.48
City of Bandon Population	2,224	2,610	2,940	3,208	3,500	3,819	4,241
Growth Rate %	N/A	3.25	2.41	1.76	1.76	1.76	1.76

2.10 1535 248

The 1990 population census for the City of Bandon was 2,224. Housing units totaled 1,195 with 160 units listed as vacant. This results in an occupancy rate of about 2.15 persons per occupied housing unit. The 2000 Census data shows 1,535 housing units with 248 vacant for an occupied rate of 2.1 persons per occupied housing unit, fairly consistent with 1990. About 25 building permits are issued annually. At 2.1 persons per unit this would give a city population of 3,202 in 2005, a number that matches well with projections.

The population in this community has been aging, with the median age in 2000 of 49.3 years. The lower occupancy rate in 2000 is likely due to the increase in retired households. Flow projections will be based on equivalent dwelling units (EDU) with a population equivalent of 2.1 persons per EDU. 120 housing units that are listed as vacant are actually vacation or seasonal use units. For the purposes of sizing the sanitary sewers, these units will be counted as occupied.

The City's records indicated that there are five residential and one commercial sewer connections outside the city limits but within the UBG. Other households outside the city limits in the UGB rely

on septic systems. Approximately 86 households representing 180 people are outside the city limits and inside the urban growth boundary. Table 2.3.2 lists the dwelling units used for this plan. 242 housing units listed are multi-family housing.

Table 2.3.2

Bandon Dwelling Unit Counts

Dwelling Use *	# of Units
Total Housing Units in the City	1,535
Additional Units outside City, Inside UGB	86
Total Units City & UGB	1,621
Vacant Units	248
Vacant Units that are Vacation or Seasonally Used	120
Units Considered Vacant for Master Plan	128

*2000 Census

Sewered Population

Not all residents in the City are currently connected to the sewer system. City records show a total of 1,259 residential water accounts inside the city limits versus 1,126 sewer accounts. (Multi-family housing is not included in this count.) A count of houses in the unsewered area of the city limits showed 130 homes, mostly on Riverside Drive and in Southeast Bandon. This Master Plan proposes improvements that will allow 100% of the population inside the UGB to be sewered. A breakdown of current residential sewage disposal is shown in Table 2.3.3.

Table 2.3.3

Sewered Dwelling Units

Sewer and Septic Use	Dwelling Units	Per Cent of Total
Inside City Limits on Sewers	1,405	86.7 %
Inside City Limits on Septics	130	8.0 %
Inside UGB, Outside City on Sewers	5	.3 %
Inside UGB, Outside City on Septics	81	5.0 %
Total dwelling units in City and UGB	1,621	
Total dwelling units on Sewers	1,410	
Total occupied dwelling units on Sewers	1,282	
Population on Sewer @ 2.1 per EDU	2,692	

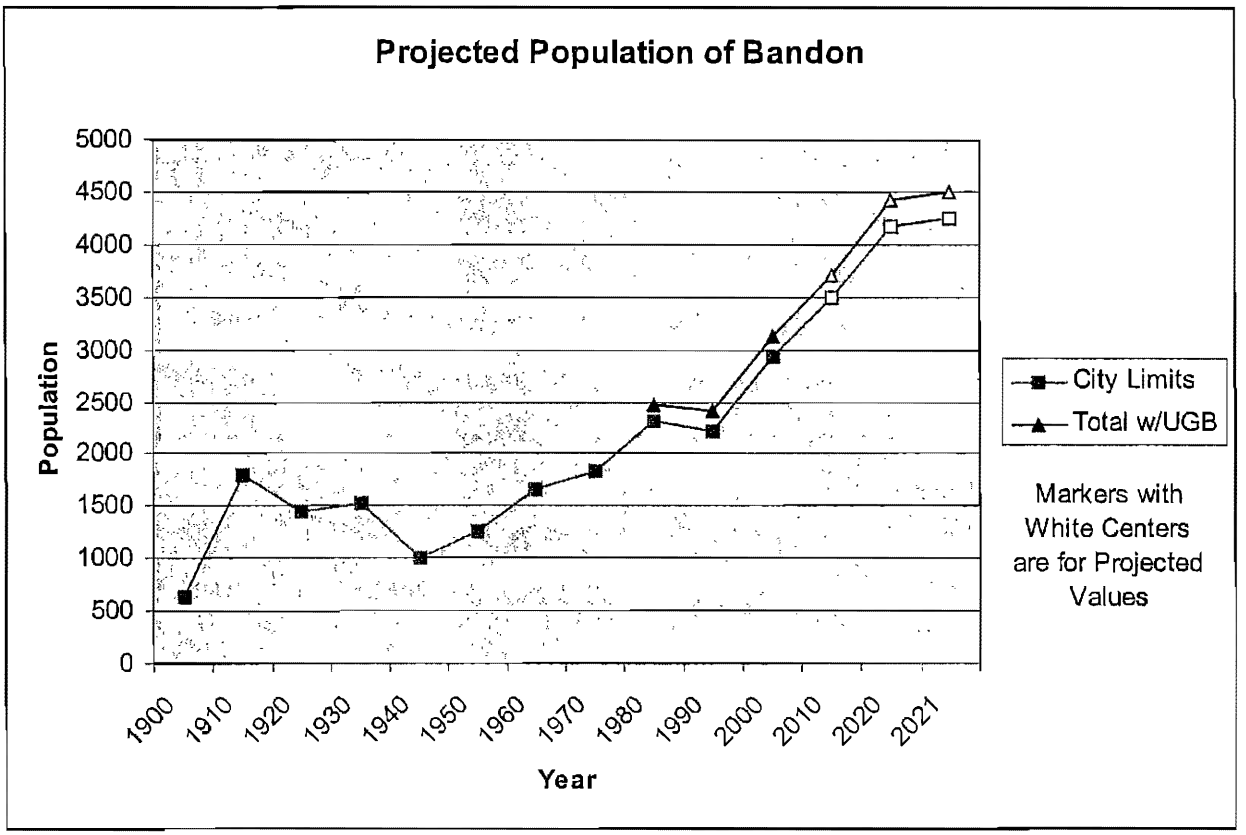
Using a 1.76% average annual growth rate, the projected population inside the City Limits will increase from the current 2,940 persons to a total of 4,241 persons in the year 2021. The current estimated population within the current UGB would increase from 180 up to 260 persons over this 20-year period. These projections assume no annexations into the city and no extensions of city services into the UGB. The total population within the UGB is projected as 4,500 for 2021.

This projected growth trend, along with the historic growth in the City over the last 20 years is shown below in Figure 2.3.1. The projected population numbers shown in Figure 2.3.1 do not

include the potential population that would be added if the UGB were expanded. Currently the City does not offer sewer service outside the city limits (with the exception of five existing connections). A large amount of land in the UGB is difficult to develop without sewers. If sewer service is extended into areas that are currently not served, the population in those areas could rise dramatically.

Figure 2.3.1

Historic and Projected Growth, City Limits and Current UGB



Bandon attracts a considerable tourist population. Sixteen motels with about 385 rooms and two RV parks with 22 spaces serve the transient population. A survey sent to motel owners generated returns from about 50% of the facilities. The occupancy rates for those returning surveys were extrapolated onto the total number of rooms available to generate the following population levels.

Table 2.3.4

Transient Population Levels

Projected Population	Hotels/Motels	RV Parks	Total
Summer Daily	703	14	717
Winter Daily	245	7	252
Annual Daily Average	410	10	420
EDU per Space or Room	.3	.33	-
EDUs	116	7	123

There are 244 businesses and government facilities that account for an additional 452 EDUs of metered water use. Larger users include three schools, three parks, two supermarkets, 24 restaurants, two retirement communities, Southern Coos Hospital, Bandon Cheese Factory, Hardin Optical plant, and Bandon Fisheries and the motels and RV parks discussed above. Table 2.3.4 summarizes the current and projected EDUs for the 20-year planning period. Projected numbers assume that commercial and industrial growth is at roughly the same rate as residential.

Table 2.3.5

Projected Sewered EDUs and Population

Projected EDUs	2000	2021
Residential	1,282	1,979*
Commercial/Industrial	452	652
Total EDUs	1,734	2,631
Equivalent Population	3,641	5,525

Includes growth plus extending sewers to all homes currently within the city limits

Bandon's industrial customers are Bandon Cheese Factory, Hardin Optical and Bandon Fisheries. Bandon Cheese Factory disposes of its industrial waste by trucking off site, leaving only domestic waste and clean up water to discharge into the sewer system. About 425 gallons per day of whey are trucked to an agricultural site where they are applied as fertilizer. Hardin Optical, which makes precision optical equipment, discharges all wastes to the sewer system. Bandon Fisheries discharges processing wastes directly to the Coquille River under an NPDES 900J permit, leaving only domestic waste to discharge into the sewer.

Public Facilities

In addition to the City's sewer system, public facilities within the Study Area and relevant to this facilities plan are the water system, storm drainage system, street system, solid waste disposal, and related federal and state facilities. The City's comprehensive plan addresses public facilities and services. Their goal is to provide adequate public facilities and services consistent with the planned level of development within the UGB.

- **Water System** - Bandon obtains its water supply from Ferry Creek and its upper tributary, Geiger Creek. Two dams impound a five-day supply of water. Water is treated physically and chemically at the treatment plant on Ferry Creek where two reservoirs with a total capacity of three million gallons store treated water. The creek flows are adequate for the needs of the City, even in drought years. Competing water rights needs from the state fish hatchery and cranberry

growers may not be met during drought years as the City has senior water rights. There are approximately 1,690 water services connected to the City water system, of which 1,345 are residential accounts.

- **Street System** - The arterials include state highways, Highway 101 and Highway 42S. Collector streets are Riverside Drive, North Avenue, 11th Street, Elmira Avenue, Filmore Avenue, 1st Street, Franklin Avenue, Ocean Drive, Beach Loop Road and Seabird Avenue. Arterial and collector streets are paved, but most residential streets are not. Many paved collector streets have traffic exceeding their structural capacity. City policy is to require paved streets and drainage as a condition of new development. Storm water drains are in place in several areas, but most drainage is through ditches to natural drainage points.

- **Transportation** – Intercity bus service is available on a regularly scheduled basis. The Bandon State Airport runway is 3,600 feet by 60 feet, suitable for private aircraft. Local charter service is available.

- **Solid Waste Disposal** – Solid waste collection is a franchised operation. Waste is transported to the Coos County Beaver Hill Solid Waste Disposal Site, where it is incinerated. Some waste is transported to a landfill in Corvallis. Curbside recycling is available with solid waste service and a recycling drop off station is located at the Beaver Hill facility.

- **Electric Utility** - The City of Bandon Electric Utility serves the Study Area with electrical power. Power is purchased from Bonneville Power Administration. Electric service extends from just east of the city, south to Denmark.

- **Communication** – Telephone service is provided by Verizon. Cable television service is franchised to a private company. Radio stations broadcast mainly from Coos Bay, with a local translator station for National Public Radio out of Ashland. The Bandon Western World weekly newspaper is distributed on Wednesdays, with the daily World newspaper available from Coos Bay.

Land Use

Land use within Bandon is categorized into five general uses: residential, commercial, industrial, public facilities, and natural resource areas. There are an estimated 1,980 acres within the City Limits, and 2,900 acres within the current UGB. The Bandon zoning map is shown as Figure 2.3.1. The five general land use classifications are briefly discussed below:

- **Residential Areas** - Bandon's residential areas are divided into two categories, Residential and Controlled Development. Most residential areas have existing or easy access to city sewers and water service. The areas are in proximity to schools and commercial centers. Controlled Development areas are primarily residential in nature, but may have commercial components, usually motels and restaurants related to tourism.

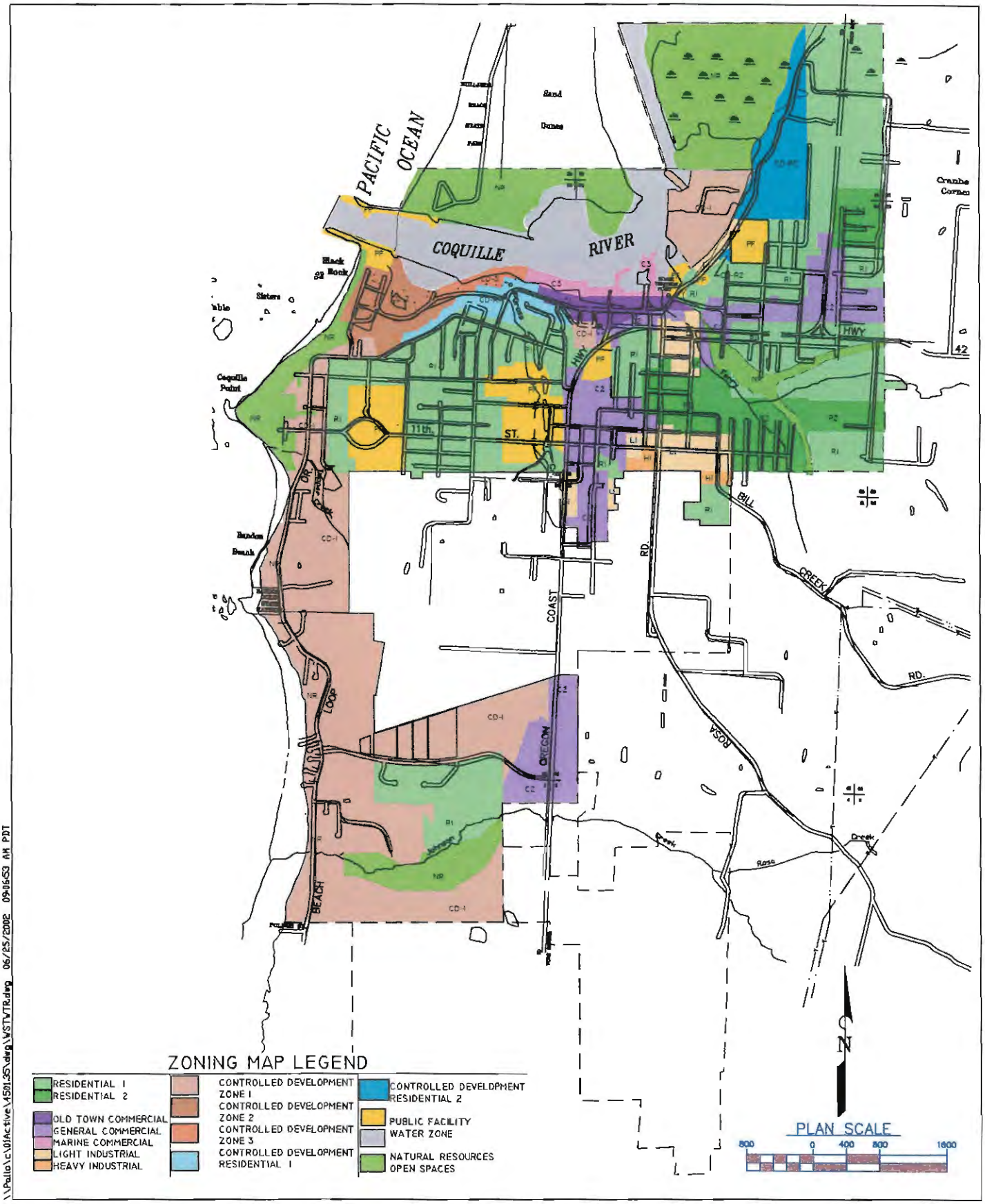
- **Commercial Areas** - Bandon's commercial areas are divided into Old Town, General and Marine Commercial. Old Town is located along the waterfront south of 1st Street and is characterized by gift shops, restaurants and specialty shops that attract substantial tourist trade. The General Commercial area is located along Highway 101 and serves the bulk of the daily local retail and service activity. The Marine Commercial area, located north of 1st Street along

the waterfront, contains most of the Port of Bandon facilities, water-related activities, recreational activities, and tourist services.

- **Industrial Areas** - Industrial areas are divided into Light and Heavy Industrial. Light industrial use is for facilities producing minimal levels of noise, odors and smoke, with minimal traffic generation. The area south of Highway 101, between Grand and Elmira Avenues, currently houses this type of use, including the Bandon Cheese Factory and the City Public Works shops. Heavy Industrial areas are for facilities that could conflict with the quality of life in residential areas and are generally of a more intensive activity. The area south of 11th Street at Rosa Road is zoned for Heavy Industrial uses.

- **Public Facilities** - These are areas that are generally utilized by public agencies such as the City of Bandon and the Bandon School District, and contain structures and uses related to schools, parks, City Offices, and wastewater treatment.

- **Natural Resource Areas** - Natural Resource areas are very limited in the types of development that can occur, and include such areas as the Bandon Marsh, Bullards Beach State Park, Coquille Point, and riparian zones including Ferry Creek and Johnson Creek.



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THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	*CITY OF BANDON WASTEWATER MASTER PLAN*	**FIGURE NO.**
DATE: JUNE, 2002	*BANDON ZONING MAP*	*2.3.1*
PROJECT NO.: 4501.35		

Section

3

Existing Wastewater Facilities

Existing Wastewater Facilities

Section 3

3.1 System History

Bandon built the original wastewater collection system in the early 1900's. The gravity system was constructed of terra cotta pipes and conveyed sanitary sewer and some storm water directly to the Coquille River without treatment. Part of this system is still in use in the Old Town, Woodland Heights and West Bandon neighborhoods, but now discharges to the WWTP. Many of the old mains have been replaced, while retaining the terra cotta service laterals. The original outfall locations were at Carolina Avenue, Bandon Avenue, Baltimore Avenue and Edison Avenue. Records of the early system were destroyed in the 1936 fire that devastated Bandon, and field measurements are the main information available now.

A 1950 engineering report provided the basis on which sewer expansions were laid out for the next 15 years. A recommended sewer along Oregon Avenue and Highway 101, south of 1st Street, was started in 1954. Other sewers were built to meet development needs, roughly following the recommendations in the report. The report addressed the need for future wastewater treatment, as the system still discharged all raw sewage to the river.

As neighborhoods developed and on-site septic systems became impractical, the sewer collection system was extended. Bandon Heights and Southeast Bandon received sewers in 1961 with the installation of about 13,000 feet of concrete pipe. West Bandon had been partly served by the original system and between 1964 and 1973 an additional 2,000 feet of concrete pipe were added to bring service to the rest of the neighborhood. The area between Elmira and Highway 101 was sewered in 1973 with asbestos cement pipe. A 1978 engineering report recommended the installation of a pump station at Johnson Creek and the installation of a sewer system along Beach Loop Road to provide service to homes with failing septic tanks. The 1980 Beach Loop system was expanded in 2000 to include the area surrounding Seabird Lane. The South Jetty Pump Station was built in 1994, connecting that neighborhood to the sanitary sewer system. As septic systems fail in this area, DEQ requires homes to connect to the public system.

A sewer interceptor line was installed from the residential neighborhoods on top of the bluff, along 1st Street through Old Town in 1969 to combine the flow from three of the existing raw sewage outfall pipelines. The sewage discharged into a manhole at 1st and Filmore, future site of the Filmore Street Pump Station, and from there into the river. With the completion of the wastewater treatment plant (WWTP) at Caroline and Riverside Drive, and the Filmore Street Pump station in February 1971, the City was ready to fully treat the public wastewater.

The original activated sludge WWTP was designed based on a population of 4,500 and an average daily flow of 0.45 MGD. The system was designed to handle 610 pounds per day each of BOD and TSS. Clarified effluent was chlorinated and discharged to the river. The system met the needs of Bandon well for the first ten years of operation. Over time additional connections to the system,

including Beach Loop Drive, and leakage into the system due to older deteriorating pipes and manholes appear to have exceeded the treatment capacity of the plant. A lack of sludge disposal sites led to holding too much sludge in the system, causing sludge to washout into the effluent and creating odor problems. High levels of inflow and infiltration in the conveyance system contributed to a loss of quality in the discharge effluent. DEQ required a moratorium on new connections to the system from 1990 until a new plant could be brought on-line.

The current WWTP was built in 1994. An activated sludge plant, this facility incorporated much of the existing system into the new plant. Designed for a future population of 5,070, the basic capacity of this plant should meet the needs of the residential population through 2021. The plant was designed with provisions for expansion, should the population exceed the rated capacity. Treated effluent from this plant is disinfected with ultra-violet (UV) lights and discharged directly to the Coquille River. The sludge is used for agricultural enhancement. Details of the current plant are discussed in Section 3.3.

Infiltration and inflow (I/I) has been a significant problem in Bandon since the first WWTP was built. The original conveyance system was a combined sewer/storm water system built of terra cotta pipes laid with no mortar. Over time pipe sections have shifted and root penetrations have damaged sections. Original manholes built of brick allow excess water into the system. Later sewer additions were of concrete pipe, which tends to be in better condition, but many sections have suffered erosion and deterioration due to hydrogen sulfide. The City has addressed these issues on an ongoing basis, removing most of the storm water catch basins from the system in the 1970's after the original WWTP was built. Sewer lines are regularly upgraded when street projects provide access to the lines, and individual line replacement projects have been completed, including a major upgrade of the service laterals to Old Town in the early 1980s. An I/I study was completed in December 2001, that included smoke testing and flow mapping of major sections of the piping system and video inspection of areas where excessive flow was noted. The results of this study are discussed in Section 3.2.

3.2 Wastewater Conveyance System

Pipe System Description

The Bandon wastewater conveyance system currently consists of approximately 111,100 feet of mainline gravity pipe, 466 manholes, and 8,940 feet of pressure piping. The system also has four lift stations. The conveyance system pipe inventory is presented in Table 3.2.1.

As part of the Facilities Plan, the collection system was separated into sub-basins based upon areas of gravity drainage. Figure 3.2.1 illustrates the existing collection system. The main sewer interceptor for Bandon runs from the Filmore Street Pump Station at Filmore and Riverside Drive, along First Street to Edison Avenue. Basins 1, 2 and 3 tie into the interceptor just before the pump station. A secondary interceptor runs from Bills Creek Road, along 11th and Filmore Streets jogging over to Elmira, where it ties into the main sewer line on 1st. This interceptor conveys waste from Basins 4 and 5, and is sized for future expansion. Basins 6 and 7 tie directly into the main interceptor at Bandon Avenue. Basin 8 is the original old town sewer system and service lines tie directly into the sewer main. Basin 9 is served by the Jetty pump station, which connects to the main interceptor at Edison and Jetty Road. A secondary interceptor runs along Beach Loop Road, starting just north of Face Rock Road and running north, jogging over to Newport at 11th and then following 8th Avenue to Edison and continuing down the hill on Edison, where it meets the main interceptor at Jetty Road. This secondary interceptor picks up waste from Basins 10, 11 and 12. The sewered area south of

Face Rock Road (Basin 13) drains to the Johnson Creek Pump Station, which ties into this interceptor.

Table 3.2.1

Existing Conveyance System Pipe Inventory

Basin	Gravity Sewers (Linear feet of pipe)								
Pipe Diameter	20"	18"	15"	14"	12"		10"		
Pipe Type	C	C	C	C	C	AC	C	TC	PVC
Sub-basin 1									
Sub-basin 2							280		
Sub-basin 3							1,040		
Sub-basin 4						3,580	500		
Sub-basin 5				350		450			
Sub-basin 6									
Sub-basin 7									
Sub-basin 8	60	240	1,610		800			600	
Sub-basin 9									
Sub-basin 10					2,750				
Sub-basin 11					2,680				
Sub-basin 12									
Sub-basin 13					1,800		3,270		1,800
TOTALS	60	240	1,610	350	8,030	4,030	5,090	600	1,800

Basin	Gravity Sewers (Linear feet of pipe)						
Pipe Diameter	8"				6"		MH
Pipe Type	C	AC	TC	PVC	C	PVC	Quantity
Sub-basin 1	6,650						25
Sub-basin 2	7,670	1,490	630				46
Sub-basin 3	4,340	690					19
Sub-basin 4	2,800	4,580		2,300		1,000	64
Sub-basin 5	350	9,140					34
Sub-basin 6	4,720	3,120	1,250				37
Sub-basin 7	1,950	1,650					26
Sub-basin 8			1,250				16
Sub-basin 9				4,890			26
Sub-basin 10	5,330	450	2,850		650		37
Sub-basin 11	4,390	240					39
Sub-basin 12	2,770	2,890	2,325			175	25
Sub-basin 13	5,780			4,590			72
TOTALS	46,750	24,250	8,305	11,780	650	1,175	466

C = Concrete Pipe AC = Asbestos Concrete Pipe PVC = Polyvinyl-chloride pipe
TC = Terra Cotta (some Vitrified Clay pipe included in this category)

Pipe figures taken from Infrastructure drawings. Concrete was assumed where pipe type was not noted on drawing. Service laterals are not included in inventory. Pressure sewers are listed on Table 3.2.4.

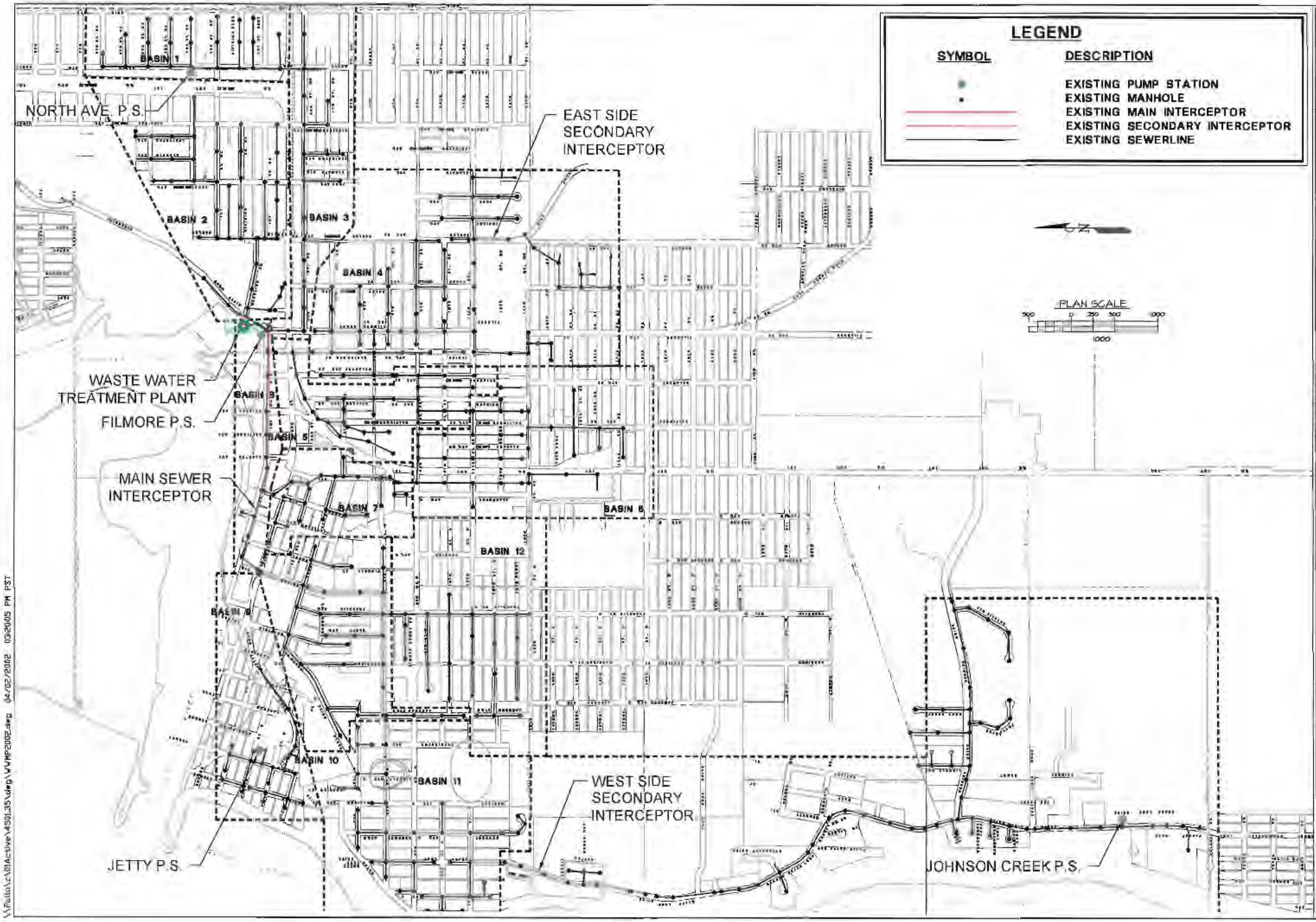

FIGURE NO. 3.21

CITY OF BANDON
WASTEWATER MASTER PLAN
EXISTING WASTEWATER FACILITIES

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
DATE: JUNE, 2002
PROJECT NO.: 4501.35

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Pipe Condition

Recent television inspection of the collection system found many problem areas with structural line failures. Pipe in Basins 2 and 12 is primarily terra cotta, installed prior to 1936. This pipe has shifted causing misaligned pipe segments, allowing infiltration and reducing pipe capacity. Tree roots have intruded into the gaps, causing blockages and dams with the pipeline. Several projects

Bandon has experienced recurring problems with grease accumulations in the collection system. A sewer line was fully plugged by grease in 1998 resulting in a raw sewage spill. Televising in 2000 showed large accumulations of grease throughout the collection system. Problem areas include the sewer trunk line on 1st Street, the Old Town area, and the eight-inch line serving Basins 1 and 3. A severe rat infestation at the WWTP was traced to accumulations of grease in a channel of the headworks in 1999. Lines and pump stations are cleaned at a cost of about $6,400 per year to remove grease and City workers spend an additional 150 hours removing grease from pump stations and the WWTP by hand. Bandon has an active grease ordinance, requiring installation and maintenance of grease traps for restaurants, cafeterias and other food processing facilities, but lacks the manpower to effectively enforce the ordinance.

Two areas were discovered to have flows exceeding capacity. The eight-inch pipe on Edison Avenue, between Jetty Road and 1st Street (Manholes No.8-15 and 8-16) is part of the West Side Interceptor and is undersized for current flows causing Manhole No. 8-16 to surcharge during wet weather. The eight-inch pipe on Oregon Avenue between 4th and 8th Streets currently surcharges during wet weather. Additional loads on this system from development south along Highway 101 would require upsizing this conduit. Recommendations for these pipe sections are presented in Section 6.

Infiltration and Inflow

Infiltration and inflow (I/I) is the leakage of ground or surface water into a sewer system. The Dyer Partnership conducted an I/I Study for the City of Bandon between September 1999 and September 2001. A full analysis of the results was presented under separate cover to the City of Bandon in December 2001. A brief discussion of the study findings is included below.

I/I Study

In September of 1999, smoke testing was conducted. Over 100 potential sources of inflow were identified. Most sources detected by smoke testing were downspouts connected to the sewer, open cleanouts and deteriorated service laterals. The City is has been working with property owners to correct these problem areas.

Flow mapping is done to identify localized areas of I/I. Wet-weather flow mapping was conducted in January 2000 and estimated a total I/I quantity of 600 gpm in the system. Dry-weather flow mapping in March 1999 found 311 gpm of groundwater infiltration in the system. Approximately 11,000 feet of suspect piping was identified during flow mapping as having I/I rates above 10 GPM. The flow mapping data for each basin is summarized in Table 3.2.2.

Table 3.2.2

Infiltration and Inflow Summary for Bandon

Basin #	Wet Weather GPM	Dry Weather GPM	Notes
1	36	2	Inflow due to car wash & pump station
2	30	10	New manholes & pipe lining recommended
3	-	23	Pipe lining recommended
4	30	12	
5	11	5	
6	140	14	Recommended for televising (mapped 1/7/02)
7	80	48	New pipe and lining recommended
8	-	-	Main interceptor, pipe too large to test
9	0	0	
10	113	68	New lines, manholes & lining recommended
11	-	34	Pipe lining recommended
12	0	80	Pipe lining and new manholes recommended
13	-	15	
Total	440	311	

Extensive video investigation of identified problem areas was performed in February and March 2001. About 11,000 feet of pipe was televised and cleaned, with detailed assessments made of system defects and deficiencies. Eight projects, as summarized in Table 3.2.3, were identified to improve I/I rates and address maintenance and capacity concerns.

Table 3.2.3

Recommended I/I Improvements Project Cost Summary

Project Priority	Basin	Description	Total Project Cost
No. 1	10	Line Replacement-Ocean Drive & 4th Street	$ 233,510
No. 2	7	Lining/Line Replacement-Oregon Avenue	$ 164,920
No. 3	12	Lining-9th Street W, 11th Street W & Franklin Avenue	$ 233,635
No. 4	2	Lining-Harlem Avenue	$ 48,390
No. 5	11	Lining-Newport Avenue	$ 39,735
No. 6	10	Lining-Jackson Avenue	$ 64,775
No. 7	3	Lining-3rd Street SE	$ 68,620
No. 8	All	Manhole Grouting, Spot Repairs, Lateral Reconstruction	$ 24,500
-	-	**Overall Total**	**$ 878,085**

Basin 6 was flow mapped again on January 7, 2002. During this period of rain I/I totaling 140 GPM was detected and isolated to two stretches of pipe. The probable sources were in the vicinity of Manhole No. 6-15 and Manhole No. 6-16. Video mapping of the adjacent pipe sections is recommended. See Appendix B for the location of I/I flows in Basin 6.

DEQ I/I Methodology

Oregon Department of Environmental Quality (DEQ) utilizes the previously developed regulations and guidelines of EPA's Construction Grant Program for determination of excessive and non-excessive I/I. For this determination, infiltration and inflow are evaluated separately as discussed below.

Infiltration

- If the flow rate at an existing treatment facility is less than or equal to 120 gpcd during periods of high groundwater (i.e. a 7-14 day average measured during periods of seasonal high groundwater), then the infiltration is considered non-excessive.

- If the flow rate at an existing facility is greater than 120 gpcd during periods of high groundwater, then a study of the sewer system shall be performed to determine the quantity of excessive infiltration and to propose a rehabilitation program to eliminate excessive infiltration.

Inflow

- If the rainfall induced peak inflow rate does not or will not result in chronic operational problems during a storm event, or the highest daily flow recorded during storm events is less than or equal to 275 gpcd, then the inflow is considered non-excessive.

- If the rainfall induced peak inflow rate results or will result in chronic operational problems or the rainfall induced total flow rate exceeds 275 gpcd during storm events, then a study of the sewer system shall be performed. The purpose of this study is to determine the quantity of excessive inflow and propose a rehabilitation program to eliminate the excessive inflow. Facilities planned for specific storage and treatment of inflow shall be subject to a cost-effective analysis.

Bandon System I/I

Infiltration and inflow contributions to the City's sewage flow were evaluated by analyzing historic WWTP influent flow data in relation to the above guidelines. Using the DEQ criteria of flows during high groundwater and low rainfall, the WWTP flows average 175 gpdc. System flows exceeded 120 gpcd 91% of the time during high groundwater, low rain intervals between 1996 and 2001. Bandon flows exceed the EPA level for excessive infiltration.

EPA guidelines suggest that inflow be determined from periods when rainfall levels create ponding and runoff. For this study daily WWTP data was used for any day that rainfall in the previous 48 hour period was 1.5 inches or greater. A 48-hour period was used to account for the effect of surface soil absorption, filling of surface water catchments and the subsequent delayed effect on the treatment plant flows. Use of the 48-hour period runs the risk of including flows caused by rain-induced infiltration, flows caused by temporary rain induced high ground water. A check was made by comparing data for days of one inch or greater rainfall in a 24-hour period.

For 48-hour periods with precipitation exceeding 1.5 inches, Bandon flows averaged 322 gpcd and were higher than the EPA guideline of 275 gpcd 68% of the time. For 24-hour rains exceeding one inch, Bandon flows exceeded EPA's level 54% of the time. Both flows exceed the EPA flow rate guidelines for excessive inflow. See Appendix B for a compilation of the data used for this determination.

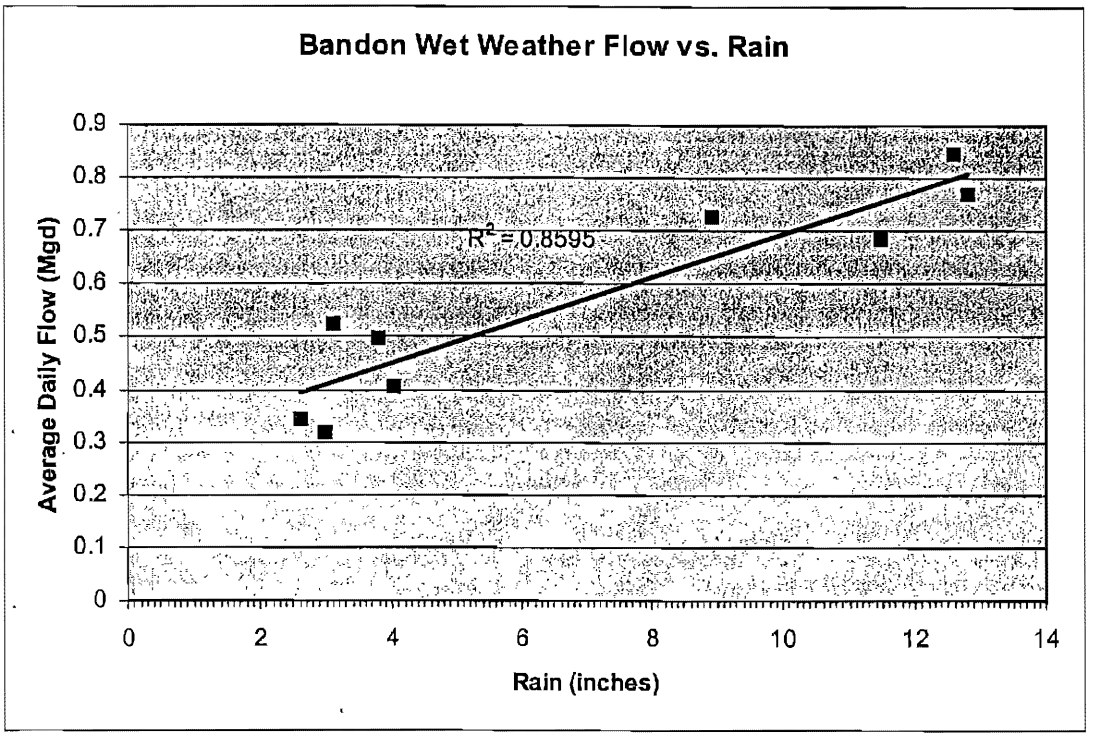
Another way of checking the amount of system I/I is to compare water consumption from the municipal treatment plant to wastewater flows. Water use in Bandon is about equally split between residential use and commercial/industrial use. Accounting for the residential use on septic tanks and city water, about 97% of the metered water accounts are on the sewer system. Accepted numbers for sewer usage are 70% to 80% of metered water use; 80% is used for this study. Correcting the metered winter-time 2000 through 2001 water use for Bandon give an average daily discharge to the sewer system of 0.227 MGD from water system customers. Wet weather WWTP flows for Bandon for the same time period are 0.369 MGD. Approximately 38% of the wet weather flows to the WWTP for this time period came from non-metered sources, most likely I/I.

Some factors need to be considered when comparing current water use to WWTP flows. The data used was the most current available, but it should be recognized that 2000/2001 was a drought period and most likely under represents normal WWTP flows. Comparing current water use with 1999 (a year with average rainfall) WWTP flow data projects 59% of wastewater flows from non-metered sources. The City of Bandon has been engaged in an active program to curtail inflow in response to smoke testing the sewer system in 1999. Almost 100 direct inflow sources were detected and corrected as a result of this program. This would account for an undetermined amount of the reduction in WWTP flows since 1999. A conservative range to use for this facility's I/I would be 40% to 50% of the wet weather flows are due to non-metered sources.

Figure 3.2.2 is a graph of monthly rainfall and the average daily plant flows for the month for wet weather months in 1999 and 2000. The strong correlation between rainfall and plant flows demonstrates the effects of I/I on the system.

Figure 3.2.2

Bandon Wet Weather Flow 1999/2000



Lift Stations

The Bandon wastewater system includes four raw sewage lift stations.

The public works staff monitors each station's performance by visiting the stations every other day. Each station is duplex, with a redundant pump at each station. Design parameters for the pump stations are summarized in Table 3.2.4.

Table 3.2.4

Pump Station Design Data

Pump Station	Filmore Street	North Avenue	Johnson Creek	South Jetty
Date Built	1970	1977	1980	1994
Last Upgrade	1994	-	1995	-
Level Control	Bubbler	Mercury Switch	Float Switch	Mercury Switch
Sulfide Control	None	None	None	Air Injection
Force Main Length (feet)	370	80	6,200	2,470
Force Main Diameter (inches)	12	4	6	6
Generator kW	N/A	N/A	72	35
Pump Size (HP)	50	2	20	5
Rated Flow (Per Pump GPM)	2,222	150	135	310
Head (FT)	64	16	115	37.5

Filmore Street Pump Station - This station, originally built in 1970, receives all incoming flow from the Bandon sewer system and discharges through a 12-inch diameter force main, approximately 370 feet into the headworks of the WWTP. The station was upgraded in 1994, during construction of the WWTP. The original wet-well/dry-well configuration was converted to a wet-well, with the old dry-well used for additional wet storage capacity. The facility is rated as an EPA Class 1 system. The overflow point is a 12-inch line to Ferry Creek. The flapper valve backflow prevention on the overflow is showing signs of leakage and it is recommended that it be replaced with a duckbill valve.

The station now has two Fairbanks Morse 50-Hp variable speed non-clog vertical column turbine pumps, installed in 1994 when the WWTP was upgraded. Capacity of a single pump is 2,222 gpm at 64 feet TDH. One pump was removed and rebuilt in 2001, and the second is scheduled for rebuild in summer 2002. Design flow for this station is 3.2 Mgd. A wood frame building serves to house the controls and electrical equipment. The wet-well level is controlled by a bubbler system. Alarm controls consist of an autodialer and alarm messages recorded at the main control panel of the WWTP. There is no back-up power for this station, although redundant electric feeds from two different local power grids insure against local disruptions.

Bonneville Power Administration, as part of an energy efficiency test project, set the pump controls in 2001 to vary the pump speed to maintain a static wet-well level. With this configuration, the pumps ran too slow to effectively remove solids from the wet-well, resulting in an accumulation of floating grease and rags on top of the wet-well and a build up of sand and gravel on the wet-well floor. The pumps have been returned to a start/stop control strategy.

Figure 3.2.3

Filmore Influent Pump Station

North Street Pump Station - This station is a factory-built, internally wired pumping station manufactured by Hydronix, Inc. Rated capacity is 150 gpm at 16 feet for each of the two horsepower pumps. The lift station is housed within a fiberglass enclosure, mounted over a five-feet diameter by five-feet deep concrete wet well, with two Hydr-o-matic Model 40 MPC self-priming pumps. Serving the north portion of Basin 1, this station discharges into a manhole about 50 feet from the station. The station is equipped with an autodialer and local alarm bell and flashing red alarm lights.

This station is difficult to maintain, as it meets the OSHA definition of a confined space, requiring two operators for entry. The only way in to the wet well is a port in the bottom of the fiberglass enclosure, which is difficult to access for wet well cleaning or inspection. Operators cleaning the wet well use a long handled net to collect floating grease balls and solids and must hand the dripping net over their head to another operator for emptying.

The station was installed in 1977, and the equipment is near the end of its rated life. A pump down flow test on the station showed each pump running at about 35 gpm, well under the design flow. This station serves a small area and no overflows have been recorded, so the combined pump output appears to handle the current flows. The low pump flows could indicate worn out impellors or restrictions in the system downstream of the pump; further investigation is warranted. The remaining expected life of this station is less than the study period and it is recommended that funds be budgeted to replace this pump station in the next ten years.

Figure 3.2.4

North Street Pump Station

Johnson Creek Pump Station - This station was built in 1980 on Beach Loop Road, in the floodplain of Johnson Creek. It serves the Beach Loop and Seabird Drive area south of Face Rock Drive. The system consists of a 6-foot diameter by 15.5 foot deep concrete wet-well with two 20 Hp vertical vacuum prime pumps with float switch level controls. The single pump capacity is 135 GPM at 115 feet of total dynamic head. The 6,200-foot pressure main discharges into a manhole on Beach Loop Drive, just north of Face Rock Drive. The overflow discharges directly into adjacent Johnson Creek. An autodialer and exterior flashing light provide alarm notification. A 72 kW diesel generator with an automatic transfer switch provides auxiliary power.

This station is showing deterioration in both the equipment and structure. At a minimum the structure requires minor siding repair, exterior paint and corrosion sealants for exterior metal fittings and panels. The pumps have exceeded their rated life and parts are difficult to obtain. The auxiliary equipment shows extensive corrosion from flooding. The generator cannot be run during periods of flooding due to safety concerns. The generator has nonfunctioning meters, and is subject to repeated seal leaks. Rodent damage caused generator and control wiring to need replacement recently.

Of greater concern is the fact that the station is located about ten feet below the historic flood level. The pump station has been inundated by surface water during past flood events causing service outages. It is recommended that this station be raised above the floodplain, the generator refurbished, and submersible pumps be installed to replace the existing vacuum prime pumps.

Figure 3.2.5

Johnson Creek Pump Station

South Jetty Pump Station - The station was constructed in 1994 to serve the area below the bluff and south of the jetty. The station is sized to serve the entire neighborhood (Basin 9), although a number of homes have not connected. Homes are allowed to remain on existing septic systems until the leach fields fail, and then are required by DEQ to connect to the public system.

The system has a seven-foot diameter by 12.5-foot deep pre-cast concrete wet-well with duplex submersible constant speed five-HP pumps controlled by a mercury switch. The pumps are each rated at 310 gpm at 37.5-feet of dynamic head. The elevation of the pump station is located just above local flood stage for a hundred year flood event. A 35 HP diesel generator located in the control building provides emergency power via an automatic transfer switch. An autodialer provides alarm notification functions.

The 2,470-foot, 6-inch diameter PVC force main discharges into a manhole at Edison and Jetty Roads, and gravity feeds from there to the Filmore Street Pump Station. The overflow is across a private lawn, 100 feet east of the pump station. This station is in excellent condition.

Figure 3.2.6

South Jetty Pump Station

3.3 Wastewater Treatment Facility

The treatment facility, constructed in 1994, is located east of Old Town, at the intersection of Caroline Avenue and Riverside Drive. The WWTP is a conventional activated sludge plant. The plant includes head works, two aeration tanks, two secondary clarifier tanks, one aerobic digester, a UV disinfection system, a sludge thickening screw press and sludge drying beds. Bandon recently acquired a truck for spreading sludge on agricultural lands. Figures 3.3.1 through 3.3.5 are photos of the main components of the WWTP. Figure 3.3.6 is a plan view of the WWTP. Figure 3.3.7 is a flow chart detailing the processing of the raw sewage.

A copy of the original Brown and Caldwell design data is included in the appendix.

Plant Design

The plant was designed for a population equivalent of 5,068 persons. Actual flows for 2001 are shown in Table 3.3.1. Design flows and loadings are shown below in Table 3.3.2. Rainfall for 2001 was only two-thirds normal, so flows for this year are not typical.

Table 3.3.1

WWTP 2001 Actual Flows and Loading

2001 Flow Data				Influent				Effluent			
Month	Avg. Flow	Max Flow	Rain	BOD	BOD	TSS	TSS	BOD	BOD	TSS	TSS
	Mgd	Mgd	Inches	mg/l	ppd	mg/l	ppd	Mg/l	ppd	mg/l	ppd
Jan-01	0.284	0.342	3.51	247	459	240	459	8	18	10	24
Feb-01	0.280	0.360	3.81	354	650	244	456	6	14	9	19
Mar-01	0.283	0.350	3.01	240	423	259	478	8	17	7	17
Apr-01	0.308	0.385	4.57	289	612	220	456	8	22	7	18
May-01	0.282	0.346	2.04	321	578	258	471	8	18	10	24
Jun-01	0.277	0.367	2.62	373	693	271	491	8	17	11	25
Jul-01	0.300	0.336	0.36	394	804	287	594	8	19	12	30
Aug-01	0.330	0.553	1.14	441	1013	255	569	9	23	12	33
Sep-01	0.303	0.357	0.27	467	918	265	523	9	23	10	26
Oct-01	0.266	0.296	3.21	384	669	207	360	6	13	9	20
Nov-01	0.295	0.545	6.79	296	569	218	426	5	11	12	30
Dec-01	0.379	0.586	11.11	256	712	183	474	8	28	11	34
Max	0.379	0.586	11.11	467	1013	287	594	9	28	12	34
Min	0.266	0.296	0.27	240	423	183	360	5	11	7	17
Avg.	0.299	0.402	3.54	339	675	242	480	8	19	10	25
Annual Total*	109	-	42.44	-	246,358	-	175,203	-	6,798	-	9,144

* Total flow in units of million gallons, total BOD and TSS in units of pounds.

The plant has two aeration basins. Basin 1 holds 157,000 gallons and Basin 2 holds 141,000 gallons. During normal operations, Basin 1 is operated and Basin 2 is held in reserve with just enough liquid to cover the air nozzles. Basin 2 is brought on-line during wet weather high flow days, or when Basin 1 is emptied for cleaning and maintenance. A 1,500-scfm blower with variable frequency drive (VFD) provides air to the basins through a membrane diffuser.

After treatment in the aeration basins, the wastewater flows to the secondary clarifiers for settling. Within the clarifiers the well-fed microorganisms or biomass settle out, while the clarified effluent is drawn from the top. Skimmers remove any non-biodegradable solids that float to the top of the tank. The clarified wastewater flows through an ultraviolet (UV) light disinfection chamber and then is discharged to the Coquille River. Each clarifier has a rotating sludge collector to scrape accumulated sludge from the bottom of the clarifier to the return activated sludge (RAS) pumps for return to the aeration basins or removal to the aerobic digesters.

The plant has two equally sized 45 feet diameter secondary clarifiers. Design overflow for each clarifier is 1000 gallons per square foot for a total capacity of 3.2 MGD.

The UV disinfection system consists of two flow channels, each containing three vertical low-pressure mercury vapor UV disinfection units with 28 lamps per unit. Flow can be directed to each or both channels, and each UV unit can be brought on as needed to meet flow and turbidity conditions. Design exposure time is 12.5 seconds at peak wet weather flow. Minimum exposure time for disinfection is 9.5 seconds.

Sludge from the RAS pumps flows either back into the aeration basins as needed or to the aerobic digesters. Sludge is aerated in the digesters to promote the digestion of biomass. Periodically the aeration is discontinued and the solids are allowed to settle. The liquid layer, or supernatant, is pumped back to the aeration basins for further treatment. The aerobic digesters typically produce sludge at about 2% to 3% solids. The biosolid product is a Class B with a minimum volatile solids reduction of 38%.

The aerobic digester has three basins with a total capacity of about 368,000 gallons. Each basin is a separate digester and may be operated independently or sequentially. The current operation is to operate sequentially. Average design solids retention time is 55 days and average liquid retention time is 20 days. The digested sludge or biosolids may either be pumped directly to a tank truck for spreading on approved agricultural sites for soil enhancement or run through a screw press for further thickening prior to agricultural application. Bandon has recently purchased a spreading tank truck for more efficient biosolids application.

Bandon has two screw presses, one with a 15-gpm capacity and the other with a 35-gpm capacity. The presses are capable of reducing the biosolids to 10% solids with a 2.5% solid feed. The screw presses have not been used in the last eight years, but are currently being rehabilitated for a trial run and possible future use.

The facility has sludge sand drying beds with a surface area of 4,213 square feet. Don Pierce, former City public works director, stated (2002) that the beds were used one time only in the 1970s. The first application of biosolids dewatered well. A second application over the dewatered biosolids was unable to drain due to an impervious seal formed by the first layer. The biosolids turned septic, creating an odor problem. The odiferous product was too thick to drain and not stable enough to remove with a front loader, and was eventually manually removed by City workers.

Operations Changes

A number of operational changes have been instituted at the WWTP in the last three years. A summary of changes is discussed below.

DEQ limits the land application of treated sludge to the dry weather months of June through October. The WWTP was designed to have sludge decanted on a year-round basis. The sludge capacity of the digester is exceeded by June, requiring the sludge to be hauled to alternative sites at a higher expense than land application.

The WWTP has two aeration basins. Past operations utilized both basins full time, although flow levels are low enough most of the year for one basin to have adequate capacity. Operating both basins requires more aeration, which increases energy and maintenance costs. Current operation is to run the larger of the two aeration basins, Basin 1, and maintain a minimum fluid level in Basin 2. When a basin is effectively empty, power consumption is reduced as the blowers for that basin may be reduced to minimum output. Taking Basin 2 out of service allowed it to be thoroughly cleaned and repaired and allows it to be used as a backup digester in the winter when digester space is at a premium. Reliance on the aeration basin as a digester reduces the capacity of the WWTP to handle high flows, and should be seen as a temporary measure.

Similar operation changes have been made in the secondary clarifiers. The second clarifier is now operated only during high flow periods. The reduced operating hours have lowered maintenance and power consumption at the plant, while preserving full treatment and back up abilities.

Bonneville Power Administration (BPA) has implemented an energy efficiency pilot program at the Bandon WWTP. The program includes the installation of a Programmable Logic Center (PLC) and a personal computer to control the speed of the blowers in the aeration basin. Sensors in the aeration basin measure the dissolved oxygen levels in the basin and the blowers are controlled to maintain a set level.

The Filmore Street Pump Station is also part of the pilot program. BPA originally set a control strategy to control the pump speed to maintain a static level in the wet well. Under this control sequence, the pumps ran too slow to effectively remove grit from the wet well, and solids settled out in the wet well and in the channel leading to the headworks auger. The pumps have been reset to allow a fill and pump down run sequence.

3.4 Effluent Disposal

Design anticipated plant effluent quality is 10-20 mg/L dry weather BOD and TSS, and 10-30 mg/L wet weather BOD and TSS. The current annual average BOD is eight mg/L and the TSS is 12 mg/L. The effluent load levels for 2001 are displayed in Table 3.4.1.

Treated effluent from the plant is discharged through a 12-inch outfall line approximately 500 feet to the Coquille River. The discharge point is directly north of the wastewater treatment facility at Filmore and Riverside Drive. The submerged diffuser is ten feet long with ten 4-inch ports. Design outfall capacity is 2.6 mgd at high tide.

The plant has two overflow outfalls, one at the WWTP UV disinfection channel discharging into the river, and one at the influent pump station discharging into Ferry Creek. The only recorded overflow from the WWTP was in November 1996 when 7.5 inches of rain in 24-hours caused flows exceeding

the hydraulic capacity of the plant. The plant was able to process 2.25 MGD on November 19, 1996, 0.15 MGD more than the design maximum daily capacity.

Table 3.4.1

Bandon WWTP 2001 Effluent Daily Averages

Month	BOD Mg/l	BOD PPD	TSS Mg/l	TSS PPD
Jan-01	8	18	10	24
Feb-01	6	14	9	19
Mar-01	8	17	7	17
Apr-01	8	22	7	18
May-01	8	18	10	24
Jun-01	8	17	11	25
Jul-01	8	19	12	30
Aug-01	9	23	12	33
Sep-01	9	23	10	26
Oct-01	6	13	9	20
Nov-01	5	11	12	30
Dec-01	8	28	11	34
Max	9	28	12	34
Min	5	11	7	17
Avg	8	19	10	25

3.5 Sludge Disposal

The sludge generated at Bandon WWTP is a Class B biosolid with a minimum volatile reduction of 38%. The solids content normally runs from 1.5% to 2.5%. Treated biosolids from the plant are decanted into a City owned spray tank truck and spread for beneficial use on 30 acres of agricultural land. Part of the land is used for growing trees and part for growing rye grass hay. About 18 acres of the site is actually in use for application at any one time. Bandon has obtained permits for other beneficial use sites to assure adequate disposal sites for future growth. Current DEQ site restrictions limit spreading biosolids to June through October.

The design solids retention time in the digester is 55 days. The dry weather restriction on spreading has caused sludge to be held up to eight months in the digester, over four times the design period. This causes the digester to be overloaded, with the potential to reduce effluent quality. Careful plant management, the use of one aeration basin for a temporary digester and low rain levels have enabled the plant to maintain high effluent quality, but alternative biosolids disposal and wet weather holding capacity remain high priorities.

Figure 3.3.1

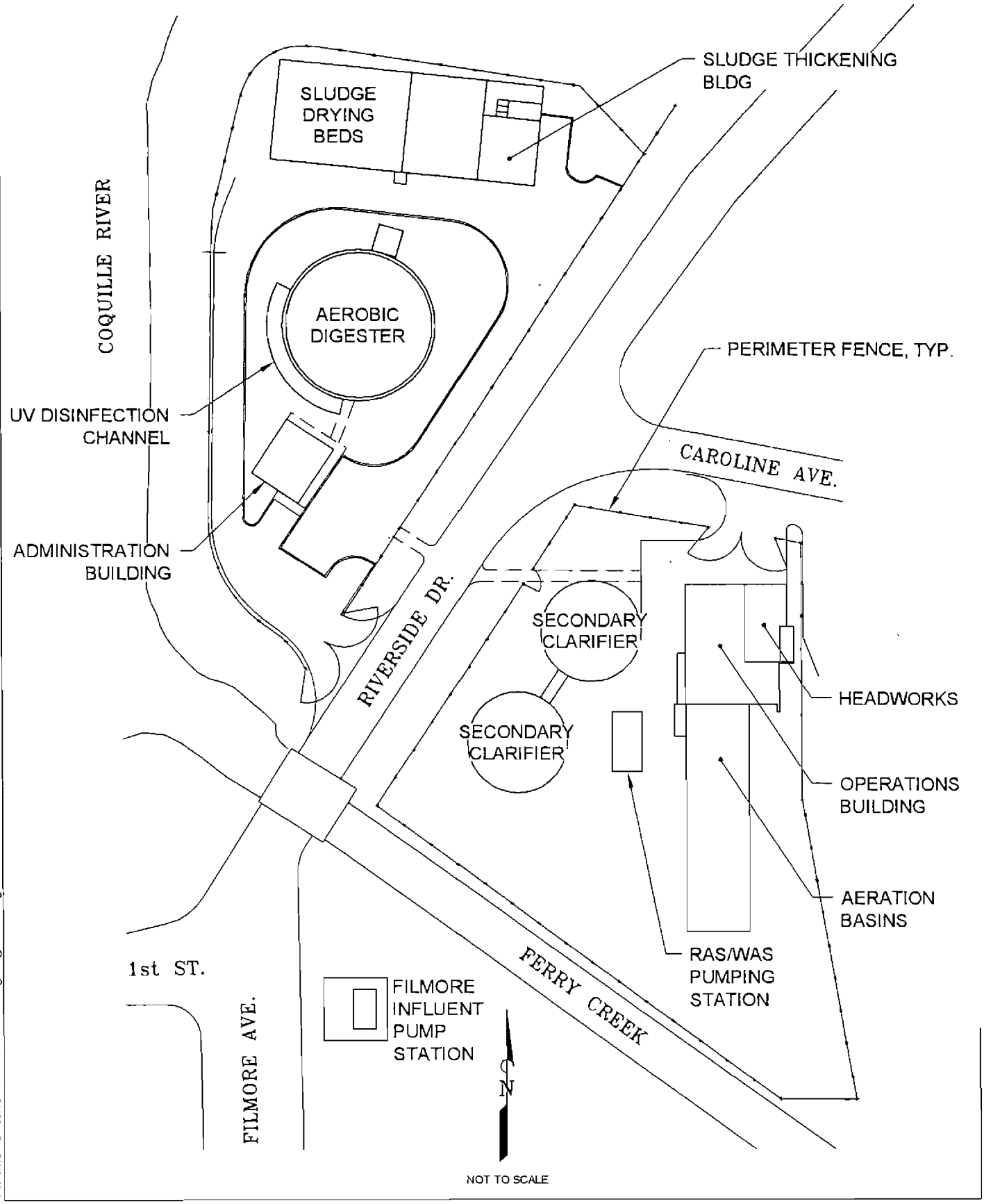
South View of Bandon WWTP

Figure 3.3.2

Headworks of Bandon WWTP

Figure 3.3.5

Bandon WWTP Digester



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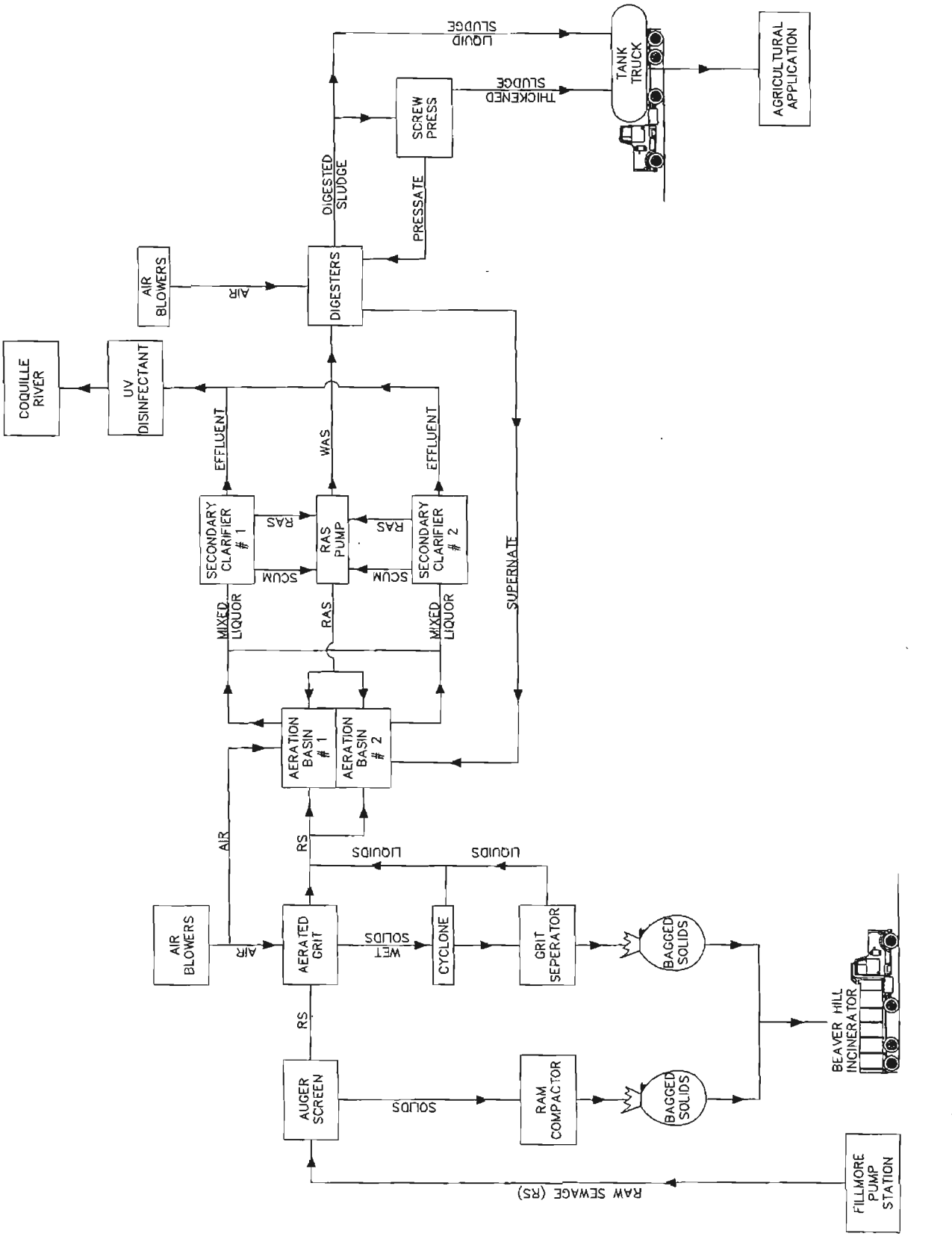
THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON*** ***WASTEWATER MASTER PLAN***	FIGURE NO. ***3.3.6***
DATE: JUNE, 2002	***WASTEWATER TREATMENT PLANT***	
PROJECT NO.: 4501.35		



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THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON WASTEWATER MASTER PLAN***	**FIGURE NO.**
DATE: JUNE, 2002	***WASTEWATER TREATMENT PLANT FLOW DIAGRAM***	***3.3.7***
PROJECT NO.: 4501.35		

Section

4

Wastewater Characteristics

Wastewater Flowrates and Characteristics

Section 4

4.1 Definition Of Terms

As a preface to the review and discussion of wastewater characteristics, the terms used in this study are defined below.

Wastewater - total fluid flow in a sewerage system. Wastewater may include sanitary sewage, industrial wastes, and infiltration and inflow (I/I).

Sanitary Sewage - waterborne wastes principally derived from the sanitary conveniences of residences, business establishments, and institutions.

Industrial Wastes - waterborne wastes produced as the result of manufacturing or processing operations.

Infiltration - water that enters the sewage system from the surrounding soil. Common points of entry include broken pipe and defective joints in pipe and manhole walls. Although generally limited to sewers laid below the normal groundwater level, infiltration also occurs as a result of rain or irrigation water soaking into the ground and entering mains, manholes, and even shallow house sewer laterals with defective joints or other faults.

Base Infiltration - water that enters the sewage system from the surrounding soil during periods of low groundwater levels.

Inflow - water that enters the sewage system from surface runoff. Inflow may enter the sewer system through manhole covers, exposed broken pipes and defective pipe joints, cross connections between storm sewers and sanitary sewers, and illegal connections of roof and area drains.

Excessive Infiltration and Inflow (I/I) - portion of infiltration and/or inflow which can be removed from the sewage system through rehabilitation at less cost than continuing to transport or treat that portion of I/I.

Average Dry Weather Flow (ADWF) - the average flow measured during a dry weather season, usually May 1 to October 31, and during low groundwater levels that occur on a daily basis. During periods of little or no precipitation, wastewater flow is composed primarily of sanitary sewage, commercial and/or industrial wastes. Base infiltration may be present.

Maximum Monthly Dry Weather Flow (MMDWF) - is the monthly average flow which has only twenty-percent probability of being experienced during May to October in any given year. In other words, this flow represents the wettest dry weather season monthly average flow that is anticipated to have a five-year recurrence interval. For western Oregon, May is usually the month that has the highest dry weather flow.

Average Wet Weather Flow (AWWF) – the average flow measured during the wet season, usually November 1st to April 30th. This value may be utilized as a basis for higher winter mass load limits.

Maximum Monthly Wet Weather Flow (MMWWF) - is the monthly average flow which has only twenty-percent probability of being experienced during November to April in any given year. This flow represents the wettest wet season monthly average flow that is anticipated to have a five-year recurrence interval. For western Oregon, January is usually the month that has the highest wet weather flow.

Peak Instantaneous Flow (PIF) - is the highest hourly flow measured during wet weather. The addition of increased I/I during periods of high groundwater levels and rainfall may produce flows several times greater than the ADWF. This value determines the hydraulic capacity of major process units, sewers, channels, and pumps.

Biochemical Oxygen Demand (BOD) - is a measure of wastewater strength in terms of the quantity of oxygen required for biological oxidation of the organic matter contained in wastewater. The BOD loading imposed on a treatment plant influences both the type and degree of treatment, which must be provided to produce the required effluent quality. All references to BOD in this report are with respect to five-day BOD and 20° Celsius.

Total Suspended Solids (TSS) - is a measure of the quantity of suspended material contained in the wastewater. The quantity of TSS removed during treatment influences the sizing of sludge handling and disposal processes, as well as the effectiveness of disinfection with chlorine.

Sludge – the biomass in the digesters of a wastewater treatment plant.

Biosolids – the biomass that has been removed from the digesters of a wastewater treatment plant.

4.2 Wastewater Flowrates

Dry weather and wet weather flows and infiltration and inflow (I/I) are important in the design of wastewater collection, treatment and disposal facilities. The MMDWF usually determines the maximum organic loading of the major treatment process units. The MMWWF determines the size and capacity of the major process units necessary to provide the desired degree of treatment. The PIF determines the hydraulic capacity of pipelines, pumps, channels, and inlet structures and the reserve capacity of units such as clarifiers and disinfection facilities. The flows used for this study are based on flows recorded by the effluent flow meter, which is calibrated annually. This facility does not have an influent flow meter.

WWTP Dry Weather Flow

The average dry weather flow (ADWF) was determined to be 0.34 MGD from analysis of treatment facility flow records for the months of May through October beginning in January 1997 and ending in December 2001. The ADWF can be divided into two components: base sewage flow and base infiltration. The base sewage flow is the portion of the treatment plant flow attributed to sanitary sewage and was estimated based on the City's water consumption records. The average water consumption for Bandon residents is estimated to be 84 gpcd based on usage from November 2000 to May 2001 (time period of minimal irrigation and other non-consumptive uses). The base domestic sewage flow to the treatment plant is estimated to be 0.23 MGD. In determining projected flows, allowance must be made for unavoidable infiltration that is dependent upon such factors as the quality of material and workmanship in the sewers and building connections, the character of maintenance, and elevation of the surrounding groundwater in relation to that of the sewers. The base infiltration is found by comparing the difference of the ADWF and the base sewage flow. The base infiltration is calculated to be approximately 0.11 MGD or 40 gpcd.

The Maximum Monthly Dry Weather Flow (MMDWF) was determined, following DEQ guidelines, by graphing 2000 and 2001 dry weather (June – October) flow for the average daily flow for each month versus the total monthly rainfall. Linear regression was used to fit a line to the data. The May 90% rainfall figure of 5.39 inches per month was obtained from the US Weather Bureau Climatological Summary No. 20. This number was plotted against the regression line to obtain the 10-year high dry weather flow of 0.46 MGD. This number is exceeded on a daily basis about once a year during the dry weather months, possibly due to the high number of tourists vacationing during the summer, which can inflate the population by as much as 700 people based on hotel occupancy rates.

WWTP Wet Weather Flow

The average wet weather flow (AWWF) was determined from analysis of treatment facility flow records for the months of November through April beginning in January 1996 and ending in April 2000. The year 2000 is considered a drought year, with only 50% of the normal rainfall, and so was excluded from calculations. The AWWF for Bandon is calculated to be 0.44 MGD or approximately 162 gpcd.

The maximum month wet weather flow (MMWWF) was determined in a manner similar to that employed for determination of the MMDWF. A five-year January rainfall of 14.74 inches was utilized. For this calculation, flow and rainfall data for the months of January through May (1996 to 1999) was utilized. With linear regression analysis of average monthly flow versus rainfall, a MMWWF of 0.89 MGD or 331 gpcd was calculated.

The peak daily average flow associated with a five-year storm ($PDAF_5$) was calculated from a linear regression of daily flows and associated rainfall from January through April, 1996-2000. The five-year, 24-hour rainfall of 5.5 inches was taken from NOAA Atlas 2, Volume X, Figure 26. (No date available) The PDAF was calculated using rainfall data for rain exceeding one inch per day. The PDAF was calculated using the November 19, 1996 data for the record rainfall of 7.5 inches for a PDAF of 1.74 MGD. If this value was dropped from the data set, the calculated PDAF would be 1.7 MGD. These numbers are so close that the November 1996 data was left in the data set, even though it was well above the other rainfall days. The recorded plant flow on November 19, 1996 was 2.25 MGD, well above the design peak day of 2.1 MGD. This is the only recorded incident of the WWTP overflowing raw sewage into the Coquille River due to flows exceeding capacity.

The average flow, maximum daily flow and PDAF were used to calculate the Peak Instantaneous Flow (PIF) based on the probability of occurrence, using logarithmic probability paper, as outlined by DEQ (1996). Such a projection is based on the principle that an average monthly flow is likely to occur 6/12 of the time or 50%, and a peak monthly flow occurs 1/12 of the time or 8.3%. Likewise, peak weekly flow will take place 1/52 of the time or 1.9%; peak daily flow occurs once in 365 days or 0.27%, a peak hour flow happens once in 8,760 hours or .011%. Plotting these numbers against probability gives a current PIF of 2.6 MGD. The peak I/I flow is calculated to be 2.37 MGD based on peak flow minus base sewage. A summary of flow parameters for the WWTP is included in Table 4.2.1.

Table 4.2.1

Bandon WWTP Existing Flow Rates

Parameter	Design	Current 2001	
Population	5,086	2,692*	
EDUs	2,526	1,734	
MMDWF	-	.46 MGD	171 gpcd
MMWWF	-	.89 MGD	331 gpcd
ADWF	.54 MGD	.34 MGD	125 gpcd
AWWF	.82 MGD	.44 MGD	162 gpcd
Base Sewage	-	.23 MGD	84 gpcd
Base Infiltration	-	.11 MGD	40 gpcd
Peak Month	1.2 MGD	1.13 MGD	420 gpcd
Peak Week	1.5 MGD	1.4 MGD	520 gpcd
Peak Day	2.1 MGD	1.74 MGD	646 gpcd
PIF	3.2 MGD	2.60 MGD	966 gpcd
BOD Avg. Day	1,150 ppd	675 ppd	339 mg/l
BOD Max. Month	1,550 ppd	1,013 ppd	467 mg/l
TSS Avg. Day	1,350 ppd	480 ppd	242 mg/l
TSS Max. Month	2,350 ppd	594 ppd	287 mg/l

* Sewered population only.

4.3 Wastewater Composition

Wastewater is generated by residential, commercial and industrial sources. The wastewater composition and load from these sources cannot be ascertained since they are not separately monitored for flows and composition. Monitoring results of the influent wastewater represent the combined wastewater from these sources. The typical composition of untreated domestic wastewater consists of 110 to 400 mg/l BOD and 100 to 350 mg/l TSS. Both BOD and TSS concentrations in Bandon's influent wastewater are within the typical characteristics of raw sewage.

The values from the last five years of plant records are summarized below in Table 4.3.1.

Table 4.3.1

Bandon Influent Characteristics

Parameter	Wet Weather			Dry Weather		
BOD	Average	Low	High	Average	Low	High
mg/l	185	94	354	266	134	467
ppd	566	406	1063	579	299	1580
ppcd	0.21	0.15	0.39	0.22	0.11	0.59
TSS						
mg/l	168	94	292	214	145	287
ppd	526	426	673	469	360	1177
ppcd	0.20	0.16	0.25	0.17	0.13	0.44
Population	2692			2976*		

ppcd = pound per capita per day
* 710 estimated tourists @ 0.4 equivalent use factor =284 additional summer population

There is relatively little variation in total pounds of BOD and TSS in plant influent throughout the year. TSS is stable at about 500 ppd for an average month. 75% of average monthly TSS readings are between 400 and 550 ppd for 1996 through 2001. BOD is more volatile with an average of about 575 ppd and only 55% of the monthly averages within the 500 ppd to 650 ppd range. Changing the drum screen at the headworks out for the auger screen in 2001 has allowed more organics to pass to the secondary treatment process. BOD pounds per day have increased an average of 18% since the installation of the auger screen. BOD and TSS levels for 2001 are used as the baseline in calculating future levels to reflect this substantial change in operation.

4.4 Unit Design Factors

Unit design values for wastewater flow and loads must be established for future planning and design purposes. These values must have enough flexibility to allow for changes in the characteristics of the service area. The analysis of wastewater volume and composition from current WWTP records provided the foundation for unit design values discussed below.

Wastewater Flows

As previously discussed, various flow parameters were determined which characterize the wastewater flow from the City. Base sewage and infiltration, MMDWF, MMWWF, peak daily, weekly and monthly flows were all calculated based on existing flow records. A summary of the unit design flows, both total and on a per capita basis, was previously presented in Section 4.2.

Only base sewage and infiltration flows can be projected on a per capita basis. The projected population to be served by the City in the years 2021 is summarized in Section 2.3.

Wastewater Composition

Fluctuations in loading rates may have a significant effect on the design and process control of a wastewater treatment plant. Data was reviewed to determine representative peaking factors for BOD and TSS loading. Estimated peaking factors for maximum day, maximum month, along with a summary of unit design values, are presented in Table 4.4.1. Supporting calculations are presented in Appendix C.

Table 4.4.1

Unit Design Values - Wastewater Composition

Parameter	BOD	TSS
Average load, ppcd	0.21	0.18
Peaking Factors		
Maximum Month	1.8	1.4
Maximum Day	2.8	3.2

4.5 Projected Flowrates

Bandon's population is projected to increase by 57% by 2021. This does not mean that the sewer system in terms of area served or lineal feet of pipeline will increase by the same amount. There are several subdivisions within the city limits that have not built out, particularly along Beach Loop Drive and Seabird Lane. There are also several areas within the city limits with homes on septic tanks that may be served by line extensions or alternative individual systems. The City of Bandon has established the policy of providing sewer service only to homes within the city limits. Developers are required to pay for line extensions when building in an area not currently served by the public collection system. These requirements have the effect of encouraging infill along existing service lines, with rapid growth along areas of new line extensions. Annexation requires a formal process and agreement of the City and involved property owners, which means that growth into the UGB tends to be slower than within the City. The size of the collection system will grow at a lower rate than the population. This will not affect the base sewage generated by the population, but it does limit the amount of pipe available for infiltration.

While the collection system does not expand proportionately to the population, base sewage will. Unit values calculated in Section 4.2 for the current population will be used to forecast these flows. Base sewage was calculated as 84 gpcd.

Infiltration

Peak I/I is projected to grow to 2.88 MGD by 2021 based on current flow data. The projects identified in the December 2001 I/I study are estimated to reduce I/I flow for those areas about 30% or 0.13 MGD for an average day. That translates into a reduction in the peak I/I flow rate to 2.51 MGD. With these projects and a vigilant I/I reduction program to maintain the integrity of the existing collection system, the capacity of the existing treatment plant is estimated to be adequate through 2021. Without the I/I remediation work, the WWTP is expected to reach capacity when the population reaches about 3,500 people on the sewer system in the year 2010.

For existing developments, flowrate data can be obtained by direct measurement. For areas of future development, methods for estimating flowrates must be utilized. For planning purposes with the potential new development and existing unsewered conditions within the UGB, estimates of wastewater flowrates must be used. It is expected that I/I quantities in new system expansions will be less than the I/I measured in the existing system.

The method proposed by Metcalf and Eddy calculates infiltration for sewers based on different peak infiltration curves for old and new sewers. The curve represents declining peak infiltration per acre as the service area increases. A chart showing the relationship between service area and peak

infiltration is included in Appendix C. For Bandon, the existing sewered area is about 1,650 acres. A value of 1,185 gallons per acre-day puts Bandon between the curves for old and new sewers. The existing system is a combination of old and new sewer types, so this finding is reasonable.

The service area is not likely to greatly exceed 2,000 acres in the planning period. Using the new sewer curve and 2,000 acres gives a peak infiltration rate of 600 gallons per acre-day. Dividing this by five homes per acre, the current zoning on undeveloped land, and 2.1 persons per home from the population analysis in Section 2, gives 57 gallons per capita per day for new sewer infiltration. This figure is used in calculating the wet weather infiltration rates for future population growth.

Dry weather infiltration was calculated as the existing base infiltration plus 20 gpcd times the projected increase in population. Using the current 40 gpcd for the existing population, averages a projected base infiltration rate of 33 gpcd in 2021.

Flowrate Calculation

The increase in base sewage, base dry weather infiltration and wet weather infiltration were calculated using the projected population increase (4,241-2,692 = 1,549) multiplied by the factors discussed above. These were added onto the existing ADWF, AWWF, MMDWF, and MMWWF to project the flows for 2021.

4.6 Projected Wastewater Composition

It is estimated that the current sewered equivalent population is around 2,692. By the year 2021, the estimated equivalent population inside the city limits is 4,241. This includes extending sewers to the existing 130 homes that are within the existing city limits, infill development within the existing city limits and annexation of a portion of the land within the UGB. The future wastewater loads to the treatment plant were estimated using the unit wastewater strength values from Section 4.3.

The WWTP treats mostly domestic waste, with only one industrial customer discharging into the collection system, Hardin Optical. Bandon Pacific Fishery discharges directly into the Coquille River and Bandon Cheese Factory trucks their process waste to a farm site for beneficial land application. The assumption is made that industrial use will remain at approximately the current proportion of the load. Loads have been calculated on a per capita basis, without breaking industrial use out as a separate factor. Table 4.6.1 details the current and projected BOD and TSS loads.

Table 4.6.1

Projected Wastewater Loads to Plant (lbs/day)

	Current	Projected 2021
BOD		
Avg. Day	675	902
Max. Month	1,013	1,596
Max. Day	1,580	2,489
TSS		
Avg. Day	480	783
Max. Month	594	1,060
Max. Day	1,249	2,488

The design, current, and projected loads for the WWTP are summarized in Table 4.6.2. The projected 2021 load for the system is well under the daily average design load for the existing treatment plant for both BOD and TSS. TSS levels appear to currently be less than was anticipated in the 1992 facilities plan, (0.18 ppcd currently as opposed to 0.25 ppcd in 1992.) and projected levels remain well under design values for the facility. BOD levels appear to have held steady at 0.21 ppcd, but the peaking factor has increased from a daily peaking factor of 2.0 in 1992 to a current value of 2.8. The highest BOD days are in the summer months. Bandon's successful program to increase tourism, longer retention times for wastewater in the collection system due to lower summer flows, and warmer temperatures are all factors that contribute to high summer BOD levels. Projected 2021 BOD loads are slightly above treatment plant design loads for the maximum month.

Table 4.6.2

Summary of Bandon WWTP Loads

Parameter	Design	Current 2001		Projected 2021**		Projected 2021 With I/I work done	
Population	5,086	2,692*		4,241		4,241	
EDUs	2,526	1,734		2,631		2,631	
MMDWF	-	.46 MGD	171 gpcd	0.62 MGD	146 gpcd	0.57 MGD	134 gpcd
MMWWF	-	.89 MGD	331 gpcd	1.11 MGD	262 gpcd	0.94 MGD	222 gpcd
ADWF	.54 MGD	.336 MGD	125 gpcd	0.5 MGD	118 gpcd	0.5 MGD	118 gpcd
AWWF	.82 MGD	.436 MGD	162 gpcd	0.65 MGD	153 gpcd	0.65 MGD	153 gpcd
Base Sewage	-	.227 MGD	84 gpcd	0.36 MGD	85 gpcd	0.36 MGD	85 gpcd
Base Infiltration	-	.109 MGD	40 gpcd	0.14 MGD	33 gpcd	0.14 MGD	33 gpcd
Peak Month	1.2 MGD	1.13 MGD	420 gpcd	1.41 MGD	332 gpcd	1.2 MGD	283 gpcd
Peak Week	1.5 MGD	1.4 MGD	520 gpcd	1.74 MGD	410 gpcd	1.56 MGD	368 gpcd
Peak Day	2.1 MGD	1.74 MGD	646 gpcd	2.17 MGD	512 gpcd	2.03 MGD	479 gpcd
PIF	3.2 MGD	2.60 MGD	966 gpcd	3.24 MGD	764 gpcd	2.87 MGD	677 gpcd
BOD Avg. Day	1,150 ppd	675 ppd	339 mg/l	902 ppd	.21 ppcd	902 ppd	.21 ppcd
BOD Max. Month	1,550 ppd	1,013 ppd	467 mg/l	1596 ppd	.38 ppcd	1596 ppd	.38 ppcd
TSS Avg. Day	1,350 ppd	480 ppd	242 mg/l	783 ppd	.18 ppcd	783 ppd	.18 ppcd
TSS Max. Month	2,350 ppd	594 ppd	287 mg/l	1060 ppd	.25 ppcd	1060 ppd	.25 ppcd

**Projected is based on current flows and does not include an allowance for I/I reduction anticipated in current remediation projects.

Basis of Planning

Section

5

Section 5

Basis of Planning

5.1 Basis for Design

The basis for design includes regulatory requirements and design criteria. These subjects are discussed in detail below.

Present Regulatory Requirements

The City of Bandon owns and operates its wastewater system under the jurisdiction of National Pollutant Discharge Elimination System (NPDES) waste discharge permit, No. 101546. The Oregon Department of Environmental Quality (DEQ) pursuant to ORS 468B.050 issued this permit. A copy of the City's NPDES permit, with an expiration date of December 31, 2001, is included in Appendix A. An application for extension is currently under DEQ review. A summary of regulatory requirements within the NPDES permit is provided below.

The NPDES permit is divided into five separate schedules: Schedule A - waste discharge limitations not to be exceeded, Schedule B - minimum monitoring and reporting requirements, Schedule C - compliance conditions and schedules, Schedule D - special conditions, and Schedule F – General Conditions. The City is required to collect and analyze, and report on the items or parameters pertaining to the WWTP's influent and effluent. A summary table of these monitoring requirements is provided in the City's NPDES permit, which is in Appendix D. The City is also required to provide notification of cause and estimation of flow associated with any sewage bypasses, record all applicable equipment breakdowns, and report method of sludge disposal.

The requirements pertaining to the City's WWTP effluent discharge to the Coquille River are given in Tables 5.1.1. Mass load limits specified in the City's permit are based on an average dry weather design flow (ADWF) of 0.45 MGD.

Table 5.1.1

Waste Discharge Limitations

Parameter	May 1-Oct 31		Nov 1-Apr 30		Year-round
	BOD	TSS	BOD	TSS	Fecal Coliform/pH
Monthly Average (mg/l)	20	20	30	30	-
Weekly Average (mg/l	30	30	45	45	-
Monthly Average (ppd)	75	75	110	110	-
Weekly Average (ppd)	110	110	170	170	-
Daily Maximum (ppd)	150	150	230	230	-
Minimum Removal (%)	85	85	85	85	-
Monthly Log Mean Ave. (# org/100 ml)	-			-	14
PH	-			-	6<pH<9

Fecal Counts for wastes discharged to estuaries must be below 14 outside of the mixing zone as defined in OAR 340-41-325. Bandon has a 200 foot mixing zone.

In addition to the above requirements, the water quality standards, as defined in OAR 340-41-285, shall not be exceeded except in the following defined mixing zone: 200 feet beyond the point of discharge.

Under Schedule C (Compliance Schedules and Conditions) of the permit, the City was required to submit the following.

- Submit a handling and disposal plan for rags, grit, scum and screenings, a public notification plan for untreated discharges, and a sludge management plan.
- Submit a request to retain the existing mass load limits or an engineering evaluation of the wet weather flow to substantiate a need to raise the existing limit.
- Submit an industrial waste survey.

The City has complied with the submission of the plans and reports.

Oregon Administrative Rules regulate the disposal of biosolids from public sewer facilities. Under OAR 340-050-0070, biosolids may not be land applied during flooding or periods where the groundwater is closer to the surface than one-foot. The existing WWTP was designed for biosolids to be decanted throughout the year. Under the current regulations, biosolids may be decanted for agricultural application only from June through October.

Wastewater treatment facilities, including pump stations, are also required to meet the standards set forth in the National Fire Protection Association (NFPA) 820, Fire Protection in Wastewater Treatment and Collection Facilities. This standard is applicable to all new construction and remodels and is the guide used for risk evaluation of existing facilities. NFPA 820 requires that pump houses with direct access to the wet-well have wiring that meets National Electrical Code Class I, Group D, Division 1 or 2 standards as listed in NFPA 70. NFPA also lists acceptable construction materials for pump stations.

OSHA Permit Required Confined Spaces Standard 29-CFR 1910.146 limits individual access to spaces that might trap a person or contain noxious atmospheres. The North Avenue pump station qualifies as a Permit Required Confined Space and requires special equipment and multiple personnel present for entry.

Oregon building codes require structures built in a floodplain to have the finished floor at least one foot above the 100-year floodplain. Johnson Creek Pump Station is built below the floodplain and has experienced severe water damage.

Future Regulatory Requirements

OAR 340-41-026 (2) requires that, unless otherwise approved by the Environmental Quality Commission, growth and development shall be accommodated within the existing permitted loads by the application of increased treatment and control efficiency. Records indicate that the plant operates within the permit mass load limits. While the WWTP normally operates below the average dry weather

flow permit level of 0.45 MGD, high levels of I/I regularly cause plant winter effluent flows to exceed 1.0 MGD.

OAR 340-041-0034 (3) sets forth the following policy guidelines for future sewer planning:

- Each sewer utility is to develop a financing plan for new or modified sewer works.
- The financing plan should assure ability to construct facilities in a timely fashion with locally derived funds.
- Sewer utilities are not to assume grant assistance in addressing planning and construction needs.

The Coquille river is considered water quality limited upstream of Bandon. Tidal action and local marshlands improve the water quality at Bandon to the point that calculating the Total Maximum Daily Load is not required at Bandon.

Design criteria for future conveyance and treatment system expansions are based on topography and the estimated future flows discussed in Section 4. Treatment planning must take into account existing and projected loadings and flows, and regulatory requirements as presented above. General design considerations incorporated in the development and evaluation of alternatives in Section 6 are discussed below.

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 effective use within their economic life. The improvement plan for serving the existing UGB will be based on a design period of twenty years for pump stations. Gravity collection line sizing will be based on ultimate build-out. Treatment facility recommendations will be based on a 20-year planning period.

Collection System

Gravity Sewers

Collection systems must 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.

Collection sewers should be designed for ultimate development of areas. The minimum diameter of sewers should be eight-inches for maintenance purposes. Short, non-extendable six-inch sections up to 250 feet are permissible. Pipe sizing above eight-inches 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 used where sewer alignment, slope, or pipe size changes. To facilitate self-cleaning, a drop should be incorporated in the manhole base. Flow channels in manholes should be designed with a 0.1-foot drop from inlet to outlet. The minimum drop for an outlet at right angles to an inlet of the same diameter should be 0.2 feet. Manholes should have a minimum inside diameter of 48-inches at the bottom and have a 23-inch minimum opening. Flattop manholes should be used when the depth to the invert is six feet or less; otherwise standard eccentric cone type manholes should be used. Pipe inverts over two feet from the bottom of the manhole should have a drop elbow and pipe.

Minimum pipe slopes are established to ensure flow velocities high enough for self-cleaning of the pipe. Slope is the key criterion in designing a wastewater collection system to avoid sulfide problems. Sewers designed with long runs at minimum slope are prone to sulfide generation due to long residence times, poor oxygen transfer, and deposition of solids. 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 sewers. It is desirable to have a velocity of three fps or more whenever practical. Minimum slope for service laterals should be 2% (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 on a regular basis and adequate grade exists, a slope should be used that will provide velocities of three fps for full or half-full pipes. In general, minimum slopes should be established based on this information, which is summarized below in Table 5.1.2.

Table 5.1.2

Slopes for Sewers (based on Manning's n = 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	0.0056
12	0.0022	0.0044
15	0.0015	0.0033
18	0.0012	0.0026

Force Mains

Most force mains should have a nominal diameter of at least four-inches to pass larger solids. In general, velocities of at least 3.5 fps are desirable in small force mains to help maintain self-cleaning action. Larger force mains should convey higher velocities periodically. In no case should the velocity in a force main be less than 2.5 fps. Very high velocities in force mains will result in high friction losses and larger pump motors being required thus design must address maximum velocities. Velocities above eight fps are usually considered excessive. The design should also address transient or pressure surges due to sudden velocity changes, especially in long force mains. Minimum flows required to obtain recommended force main velocities are shown in Table 5.1.3.

Table 5.1.3

Minimum Force Main Flows (gpm)

Force Main Inside Diameter (in)	Flow for Velocity of 2.5 fps	Flow for Velocity of 3.5 fps	Flow for Velocity of 5.0 fps
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

The number of high points in a force main should be kept to a minimum. Air and other gases can become trapped at high points reducing the pipes capacity. A means of releasing air or gases trapped at high points is usually required. Sewage air relief valves are commonly used to release trapped air and gases at high points that are not at the end of the force main. Sewage air relief valves may not be required if the force main is small in diameter or length, or velocities are sufficient to move trapped air and gases.

Pump Stations

Design of pump (lift) stations is a critical element of sanitary sewer collection systems. The pump station installation must be able to handle the peak flows in the system without bypassing and designed so as not to increase the total sulfide generation potential of the collection system. Contemporary design practice requires some wet-well storage of wastewater plus retention in the force main, both of which tend to increase the potential sulfide generation when supplemental aeration is not provided. To minimize sulfide generation, wet-wells should be as small as possible while still allowing for future growth. Wet-well detention times of 30 minutes or less are recommended to avoid sulfide generation[1]. When detention times in the pump station force main exceed 25 to 30 minutes, a system to control hydrogen sulfide generation, and the accompanying odor and corrosion problems, is recommended.

Pump stations should have redundant pump equipment and provisions for emergency generator operation. Power outage frequency and duration must be considered in pump station design to ensure that overflows do not occur due to power loss. In some cases, a portable generator connected to the pump station with a manual transfer switch will suffice. In larger pump stations, a permanent standby generator may be required. Level controls should include a redundant high wet-well level sensor.

Pressure Sewers

Pressure sewers use individual pumps on each property with either a grinder pump (GP) or a septic tank effluent pump (STEP) used. The major difference between the two systems is in the onsite equipment and layout. GP systems have a small pump and basin. STEP systems typically have a 1,000-gallon septic tank with a pump conveying the supernatant into the system. Pressure sewers generally use smaller diameter pipe and are installed shallower than conventional gravity sewers and usually result in lower construction costs in less populated areas. Pressure sewers are considerably independent of slope. Because the mains are pressurized there is no infiltration.

[1] EPA/625/1-85/018 "Odor and Corrosion Control in Sanitary Sewer Systems and Treatment Plants"

Service connections in pressure sewer systems are typically 1.25-inch diameter. Cleanouts are used to provide access for flushing. Automatic air release valves are required at and slightly downstream of summits in the sewer profile. GP systems should be designed so that a pipe velocity of three to five fps is achieved at least once every day. GP effluent is generally about twice the strength of conventional wastewater (e.g., BOD and TSS of 350 mg/L). STEP effluent is pretreated and has a BOD_5 of 100 to 150 mg/L and SS of 50 to 70 mg/L. Both can be assumed to be anaerobic and potentially odorous if subjected to turbulence.

STEP systems require pumpout of interceptor tanks at three to five year intervals. Owing to their tendency to accumulate grease in their tankage, GP units are often pumped as part of the annual preventative maintenance check. Energy costs are borne by the homeowner and range from $1.00 to $2.50 per month depending on the horsepower of the unit. Total O&M costs are estimated at $100 to $200 per year per unit for tank pump out and equipment repair.

Wastewater Treatment Facility

Primary consideration will be the degree of treatment required to meet the discharge requirements and sufficient sizing of the facility to handle future projected peak hydraulic and organic loads.

Flexibility

Conveyance and treatment design should allow for flexibility in operation and maintenance. The treatment plant operator must have the ability to alter plant flows around the major process units without significantly degrading effluent quality. This goal can be achieved by providing redundant units and multiple interconnections between units when appropriate. Conveyance and treatment equipment design should also be such that maintenance, both routine and emergency, can be performed without excessively loading other components. Flexibility is also needed to ensure discharge requirements can be met during changing influent conditions and also allow construction and connection of new process units as needed.

Reliability

Reliability of treatment processes depends on proper application of unit loading factors and conservative selection of equipment to ensure long life and minimum maintenance costs. Each unit process should be selected based on its capabilities to effectively treat the waste characteristics for the specific application. Capabilities of the treatment plant operator and the community should also be considered. Processes that require high degree of manual labor and specialized instrumentation should be avoided in most cases. Electrical equipment should be above the local flood zone and back-up power generation provided. Redundancy is also a key factor in reliability.

The Environmental Protection Agency (EPA) has developed system design criteria for minimum standards of reliability for wastewater treatment works (1974). The minimum standards are defined into three classes of reliability. The following is a description of these three classes (Ibid 1974).

- Reliability Class I – Works that discharge into navigable waters that could be permanently or unacceptably damaged by degraded quality effluent for only a few hours. Examples of this class include discharges near drinking water reservoirs, into shellfish waters, or in close proximity to areas used for water contact sports.

- Reliability Class II – Works that discharge into navigable waters that would not be permanently or unacceptably damaged by short-term effluent quality degradations, but could be damaged by continued (on the order of several days) effluent quality degradation. An example of this class is a discharge into recreational waters.

- Reliability Class III – Works not otherwise classified as Reliability Class I or II.

Bandon's WWTP discharges into shellfish waters, which requires Class I Reliability

The system design criteria for Reliability Class I works includes backup requirements for the main wastewater treatment system components. In general, unit operations in the main wastewater treatment system shall be designed such that, with the largest flow capacity unit out of service, the hydraulic capacity of the remaining units shall be sufficient to handle 75 percent of the design wastewater flow to that unit operation for Class I. In addition, there should be system flexibility to enable the wastewater flow to any unit out of service to be distributed to the remaining units in service. The Bandon WWTP meets these criteria.

Operability

Operation of wastewater systems entails considerable responsibility and cost while providing public health benefits. For these reasons, personnel assigned to operate and maintain a treatment facility must be trained appropriately. The more sophisticated the process or equipment, the greater the level of expertise that is needed. Qualified individuals are usually available in metropolitan areas, as is financial support for their employment. However, small communities often have a problem in finding the personnel and the money with which to pay them. Consequently, the selection of a treatment process or equipment should reflect the regional and local level of training of operations and maintenance.

Durability

Conveyance and treatment systems should consist of materials and equipment that are capable of satisfactory performance over the entire design life/period of the wastewater system components. The selection of durable wastewater system components is a matter of judgment based on a number of factors including type/intensity of use, type/quality of materials used in construction, quality of workmanship during the initial installation, and expected maintenance to be performed during life of the component. For Bandon, direct exposure to salt sea-air needs to be an additional consideration in selecting suitable materials.

Capacity

Individual treatment components must be capable of handling the hydraulic flow through the plant during peak wet weather rainfalls and be sized to treat the mass loads projected for the facility. Jon Gasik of Oregon DEQ (2002) suggests the following guidelines:

- All units should be able to handle the peak hourly flows without overflowing or damaging equipment.
- The headworks should be sized for peak hourly flows.
- Primary clarifiers, when present, should be sized for peak daily flows.
- Aeration basins should be sized using modeling to generate desired treatment. Typically, 10 mg/L at MMDWF (Summer) and 30 mg/L at MMWWF (Winter).

- The secondary clarifiers should be sized for either the peak day with both clarifiers operational or the MMDWF with the largest clarifier off line, whichever results in the greater treatment capacity. Overflow rates for the separate seasons should be used. (e.g. 1200 for winter and 800 for summer)
- The disinfection system should be sized for peak hour flow. The contact chamber should be sized for at least 15 minutes of contact time at the peak hour flow, 20 minutes at peak day, or 60 minutes at ADWF, whichever results in the largest basin.

Sizing of the digester is based on the suspended solids level of the incoming mixed liquor and the exiting biosolids in addition to the holding time in the digester and the amount of plant influent. The assumption is made that sludge is held for 60 days, to meet DEQ pathogen reduction requirements, and that biosolids are removed at 2% solids. The plant is designed for a 55 day holding period, but use of the 60 day period is justified by Bandon's mild winter temperatures.

Miscellaneous

Consideration of site location, daily operational tasks, public perception, health and safety concerns, noise, access to equipment, human factors, and hazardous area all have to be analyzed when assessing the conveyance and treatment alternatives. Plant operations should make efficient use of public resources, while maximizing public safety.

Biosolids Disposal

Biosolids originate as leftover waste materials, domestic septage and sewage sludge, which are generated from sewage treatment. Presently biosolids produced at the WWTP are aerobically digested and land applied on a DEQ approved site. In this section, the most viable biosolids stabilization processes and disposal methods for the WWTP will be identified, evaluated, and recommended.

An important consideration in biosolids management is compliance with applicable regulatory requirements and regulations. The use and disposal of biosolids derived from sewage sludge are regulated under 40 CFR Part 503. Biosolids cannot be applied to land or placed on a surface disposal site unless it has met the two basic types of requirements in Subpart D of the Part 503 regulations: pathogen reduction and vector attraction reduction. These requirements are discussed in detail below.

The pathogen reduction requirements for biosolids are divided into two categories: Class A and Class B. Class A requirements for biosolids are more stringent than for Class B and require pathogens to be reduced to below detectable levels. Biosolids that are sold or given away in a bag or other container for application to land or in bulk applied to a lawn or home garden must meet Class A requirements. In addition, there are no site restrictions for the land application of Class A biosolids. Treatment processes capable of meeting the Class A requirements under specified operating conditions includes composting, heat drying, heat treatment, thermophilic aerobic digestion, beta ray irradiation, gamma ray irradiation, and pasteurization.

Class B requirements are imposed to ensure that pathogens in the biosolids have been reduced to levels that are unlikely to pose a threat to public health and the environment under the specific use conditions. For the application of Class B solids to land, site restrictions are imposed to minimize the potential for human and animal contact with the biosolids until environmental factors have further reduced pathogens. Class B solids cannot be sold or given away in bags or other containers for land application. Processes capable of meeting Class B requirements under specified operating conditions include aerobic digestion, air drying, anaerobic digestion, composting and lime stabilization.

In addition to pathogen reduction requirements, Part 503 regulations specify vector reduction requirements. These requirements are aimed to reducing transport of pathogens via vector transmission. Vectors are any living organisms (e.g. insects, birds, rodents) capable of transmitting a pathogen from one organism to another either mechanically or biologically. Options for vector reduction described in the Part 503 regulations are designed to either reduce the attractiveness of biosolids to vectors or prevent the vectors from coming into contact with the biosolids. One option that is commonly used by small communities for vector attraction regulations is minimum 38 percent reduction in volatile solids content during biosolids treatment (e.g. aerobic and anaerobic digestion).

5.2 Basis For Cost Estimate

The cost estimates presented in this Plan will include four components, each of which is discussed in this section. The estimates presented herein are preliminary and are based on the level and detail of planning presented in this Study. As projects proceed and as site specific information becomes available, the estimates may require updating.

Construction Costs

The estimated construction costs in this Plan are based on actual construction bidding results from similar work, published cost guides, and other construction cost experience. Reference was made to the drawings of the existing facilities to determine construction quantities, elevations of the major components, and treatment of wastewater during construction. Estimates will be based on preliminary layouts of the proposed improvements.

Future changes in the cost of labor, equipment, and materials may justify comparable changes in the cost estimates presented herein. For this reason, common engineering practices usually tie the cost estimates to a particular index, which varies in proportion to long-term changes in the national economy. The Engineering News Record (ENR) construction cost index is most commonly used. This index is based on the value of 100 for the year 1913. Average yearly values for the past twelve years have been summarized in Table 5.2.1.

Estimates in this Plan are based on year 2002 costs. Future yearly ENR indices can be used to calculate the cost of projects for their construction year based on the annual growth in the ENR index. Without using the future ENR Index, costs for construction performed in latter years should be projected on an increase of three percent per year.

Contingencies

A contingency factor equal to 15% of the estimated construction cost has been added. In recognition that the cost estimates presented are based on conceptual design, allowances must be made for variations in final quantities, bidding market conditions, adverse construction conditions, unanticipated specialized investigation and studies, and other difficulties which cannot be foreseen at this time but may tend to increase final costs.

Table 5.2.1

ENR Index - 1990 To 2001

Year	Index	% Change
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	6060	2.36
2000	6222	2.67
2001	6342	1.93
	Average Annual Change =	2.62%

Engineering

The cost of engineering services for major projects typically include special investigations, a predesign report, surveying, foundation exploration, preparation of contract drawings and 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 project, engineering costs may range from 15 to 25% of the contract cost when all of the above services are provided. The lower percentage applies to large projects without complicated mechanical systems. The higher percentage applies to small, complicated projects. The engineering costs for design and construction of this project will average about 20% of the construction cost.

Legal and Administrative

An allowance of 5 % of construction cost has been added for legal and administrative services. This allowance is intended to include internal project planning and budgeting, grant administration, liaison, interest on interim loan financing, legal services, review fees, legal advertising, and other related expenses associated with the project.

Operation and Maintenance Costs

O&M costs are difficult to predict since they depend on many things including the owner's policies, varying costs of labor and materials, specific maintenance required, and repair crew time required. In

addition, future power costs are usually unknown. For the estimates used in this Plan, annual pump station operation and maintenance costs are taken as 5% of the construction cost (excluding power costs). STEP system O&M costs are $145/year per tank plus $500 per mile of piping. Grinder pump system O&M costs are taken as $225/year per tank plus $500 per mile of piping. Power costs are estimated using a cost of 7 cents per kW-hr. Gravity sewers are anticipated to be cleaned/flushed once every five years at a cost of 65 to 85 cents per foot. Additionally, annual O&M funds include an allowance to TV inspect 25% of the sewer length in 20 years at cost of $1.50 per foot.

Annual O&M costs listed for STEP systems include power consumption costs equal to $15 per year per tank. STEP tanks will require pumping about every three to six years. Grinder pump basins should be cleaned every one to three years to remove accumulated grease. Grinder pump power costs are about $30 per year per pump.

5.3 Sewer System Analysis Methodology

For development and implementation of a successful I/I reduction program, it is necessary to identify the following features or conditions of the existing conveyance system.

- Key components within the conveyance system.
- Impact of high groundwater and rainfall on the conveyance system.
- System areas with limited hydraulic capacity and/or frequent blockage problems.
- Sources of extraneous flows.

Several analyses and investigations were performed to identify the above information. Analyses included conducting preliminary field investigations, performing flow mapping and analysis, and smoke testing. The analysis methods are discussed below. The City of Bandon Infiltration/Inflow Study was presented to the City under separate cover in December 2001. Results of that study are summarized in Section 4.

Smoke Testing

Smoke testing was performed to detect inflow and shallow infiltration sources. This technique utilizes a non-toxic "smoke" that is forced into sections of the sewer lines with a blower. The smoke then surfaces at deficient locations, such as open cleanouts, roof drains, catch basins, and broken or leaking pipes. The location and type of deficiency (e.g. open cleanout) are noted and documented.

I/I Flow Mapping & Analysis

Flow mapping studies are performed to determine the quantity and sources of extraneous water that enters a sewer collection system. In order to differentiate the I/I from sanitary flows, flow-mapping studies are typically conducted at night between midnight and five a.m. It is presumed that during these hours most residential users will be sleeping and the domestic flow component will be negligible.

Sewer inspections and measurements of I/I flows are performed during the high groundwater months. Investigations are typically made at selected manholes within a system both during a storm event and during a winter dry period to establish, respectively, the total I/I and to establish the infiltration component alone.

For flow mapping, two crews, three persons each, including one man from City staff, move from manhole to manhole as expeditiously as possible during the middle of the night. The term mapping refers to the sequential order of obtaining instantaneous flow readings between each manhole section.

Flow measurements were conducted by opening mainline manholes, visually assessing flows from the side laterals and the main, inserting a flow measuring device to obtain an instantaneous flow reading before proceeding to the next manhole upstream. Instantaneous flow measurements were made by inserting an Isco® Flow Poke™ into the incoming pipe segments. This flow device utilizes an open channel measuring technique (manometer attached to an open channel V-notch weir insert). During the flow mapping, general observations concerning the condition of the manholes were noted and documented.

Television Inspection

Approximately 11,000 lineal feet of gravity sewer lines were inspected by video camera. The City of North Bend Wastewater Department conducted the inspection and has provided Bandon with two videotapes and detailed reports. Inspection of the sewer lines with a TV camera permits specific identification of clogging and I/I sources and more specific recommendations as to correction of any problems/defects. These recommendations are discussed in the Bandon I/I Study, bound separately.

5.4 Evaluation of Conveyance System and WWTP

The design capacity of the City's conveyance system and wastewater treatment plant was estimated to assess the present and future operation of Bandon's wastewater facilities. This analysis and evaluation was limited to the main components of the City's system. DEQ's minimum design flows for the basis of planning were utilized to assist in this evaluation.

Conveyance System

The conveyance system was computer modeled using the XP-SWMM2000 Stormwater and Wastewater Management Program, 50-node edition. Gravity flows were modeled in hydraulic mode, using the Manning formula for open channel flow. The existing conveyance system was split into two portions, East and West Bandon along the east and west interceptor lines. While the total length of pipe in the system was modeled, manholes and cleanouts were reduced to simplify the model and stay within the capacity of the program. Key manholes were selected for modeling, representing typical areas, areas of converging branch lines, and changes in slope and pipe direction. All flows were modeled as entering the system at the manholes and pump stations.

Current flows were based on existing connections as copied directly from the City of Bandon Public Works Department infrastructure drawings. Future flows were based on 5,400 square foot lots in areas with platted lots and streets and at five housing units per acre, in the currently undeveloped areas of the city limits and UGB without platted streets. The undeveloped areas are not anticipated to reach full build out within the study period, however future flows were modeled at full build out for sizing piping.

Slopes, inverts, sizing and lengths of piping were taken from original construction drawings, the City infrastructure maps or field observations where available. Where no drawings were available, manhole elevations were taken from topographic maps and piping was assumed to follow the slope of

the land surface. Manning's numbers were assumed to be 0.014 for concrete pipe and 0.011 for PVC pipe and pipe lining.

Flows were based on 2.1 occupants per household as developed in Section 3 and flows of 124 gpcd base sewage and 177 gpcd for I/I. I/I for new sewers was calculated at 57 gpcd in Section 4, bringing the total flow to 301 gpcd for existing sewers and 181 gpcd for areas with new sewers. Basin 13 has mainly PVC pipe and was modeled using the I/I rate for new sewers. Base sewage was profiled to follow the hourly use curve recommended by Metcalf and Eddy. (See Appendix C) Daily I/I was profiled to match a five-year 24-hour storm, with the peak of the storm occurring during peak sanitary sewer flows. This presents a worst-case scenario for pipe sizing.

Pump station capacities were checked by performing pump down tests. The fluid levels in the wet-wells were monitored while the pumps were in manual off position and the flow rate was calculated. The pumps were then run for a set time and the wet-well level measured before and after. This provided the information needed to calculate the pump flow rates. Filmore Avenue was not tested due to lack of access to the wet-well and the VFDs on the pumps. Both pumps have been recently rebuilt and should be operating at rated capacity.

WWTP Facilities

The main components of the WWTP examined include the headworks, secondary treatment, ultraviolet (UV) disinfection chamber, and effluent outfall line. The 2021 projected flow rates for the plant do not exceed the construction design as detailed in the Brown and Caldwell construction drawings from 1993 and the 1992 facilities plan.

Headworks

The headworks consist of two main components: screening and grit removal. The design flow for the auger screen is 3.2 MGD. The screenings compactor is designed to handle 12 cubic feet per hour of solids, with current solids generation at 95 cubic feet per month. The headworks appear capable of handling the PIF of 3.2 MGD expected in the year 2021.

Secondary Treatment

Secondary treatment consists of two aeration basins, two clarifiers and three digesters. Digester capacity is discussed under sludge handling. The two aeration basins are divided into seven cells. Basins may be operated in plug flow, step flow or contact stabilization (reaeration) mode. The recommended flow for high rain periods is contact stabilization with the RAS reaerated in cells number one, two and three before being fed raw wastewater. This shifts solids from the clarifiers and helps prevent solids washout. In this mode, the construction design rate for the aeration basins is six hours of contact time for peak month average flows of 1.2 MGD.

The aeration basins have a total liquid capacity of 40,000 cubic feet. At 75 pounds of BOD per 1000 ft^3 per day, the plant has an approximate BOD capacity of 3,000 pounds per day in contact stabilization mode. This capacity exceeds the projected load of 1,596 maximum month load projected for 2021.

The secondary clarifiers have a design PIF overflow rate of 1,000 gallons/day/sf. The 45-foot clarifier diameter gives a total capacity of 3.2 MGD. Each clarifier is designed to handle 2.4 MGD at an overflow rate of 1,500 gpd/sf, which meets the DEQ requirement of each clarifier sized for 75% of

the PIF. The clarifier hydraulic capacity appears to meet the projected flow rates for 2021 based on the original construction data and providing the I/I projects are instituted and maintained.

The average and maximum monthly BOD loading to the WWTP during the study period are 573 ppd and 1,013 ppd, respectively. Construction specifications for the facility list the design plant load as 1,150 ppd average and 1,550 ppd maximum month. Projected load for 2021 is 902 ppd average and 1,596 maximum. The projected maximum month BOD slightly exceeds the plant design. Permit levels require an 85% reduction in BOD and TSS. The allowed mass load limits and effluent concentrations are shown in Table 5.4.1.

Table 5.4.1

Permit Mass Limits For Bandon WWTP

Parameter	Average Effluent Concentrations		Mass Load Limitations		
	Monthly	Weekly	Month Avg. Pounds	Weekly Avg. Pounds	Daily Max. Pounds
BOD Summer	20 mg/l	30 mg/l	75	110	150
TSS Summer	20 mg/l	30 mg/l	75	110	150
BOD Winter	30 mg/l	45 mg/l	110	170	230
TSS Winter	30 mg/l	45 mg/l	110	170	230

Summer = May 1 – October 31 Winter = November 1 – April 30

Based on the permit concentration limits, Bandon is eligible to apply for a mass load limit increase for wet weather flows. If approved, this increase would raise the winter limit to as much as 200 ppd for the monthly average, 300 ppd for the weekly average and 400 ppd for the daily maximum. Documentation for the limit increase is included in Appendix C. DEQ requires an active I/I reduction program for limit increases. Bandon has recently completed an I/I study and addressed the identified inflow sources, a major component of the DEQ requirements. It is recommended that Bandon apply for the mass load increase to meet the growing population demands on the facility.

Current operation of the facility meets the DEQ permit limits.

Conclusions. The headworks and secondary treatment systems appear to have adequate capacity to meet the projected load for the study period.

Ultraviolet Disinfection and Contact Chamber

The existing ultraviolet treatment system consists of two flow channels, each with three UV modules. The original design calls for the modules to be flow controlled, with one channel handling flow up to 1.6 MGD and one module on at all times. Additional modules are brought on line at 0.7 MGD and 1.4 MGD. The system utilizes two-channel operation for flows above 1.6 MGD with one module active in each channel. When effluent flows exceed 1.4 MGD a second module activates in each channel, with a third set of modules activating when the flow exceeds 2.8 MGD.

The system is designed for 12.5 seconds of exposure with both channels operating and 3.2 MGD of flow. Minimum required exposure time is 9.5 seconds with the effluent TSS at 30 mg/l, UV intensity

at 70% of initial lamp intensity and 65% transmittance. The projected PIF of 3.2 MGD is within the design parameters for the UV treatment system.

Current practice is to run both UV channels continuously with all six modules activated. With the current high effluent quality and effective plant management, it is recommended that the UV system be operated with flow-paced control. This will reduce energy consumption at the facility as well as extending average lamp life to over four times the current installed time. Extending lamp life reduces hazardous waste, as UV lamps contain a small but significant amount of mercury. Running only one channel will reduces maintenance time for lamp cleaning and lamp changing by 50%.

Effluent Outfall Line

The existing main effluent outfall line was evaluated to determine its ability to convey the existing and future PIF. The existing main discharge line, Outfall No.1, consists of approximately 500 lineal feet of 12-inch diameter line. The emergency outfall line, Outfall No.2, consists of approximately 170 feet of 12-inch diameter pipe. The capacity of Outfall No.1 was determined for gravity flow, assuming a slope of 3.5%, a high tide of 7.93 feet and a mean water level of zero feet. With gravity flow, the 12-inch gravity line, flowing full with n=0.011, has a capacity of approximately 4.5 MGD at low tide conditions and 2.6 MGD at high tide conditions. Outfall No. 2 capacity is equivalent that of Outlet No.1.

The maximum registered daily effluent flow at the plant was 2.25 MGD on November 19, 1996. The rainfall that day was 7.5-inches, the equivalent for Bandon of a 25-year, 24-hour storm and the Coquille River was at the 100-year flood stage of 12 feet. This is the only recorded instance of Outfall No.2 for the plant being utilized.

Biosolids Treatment, Storage & Disposal

Biosolids treatment at the WWTP was reviewed in terms of actual and required digester capacity to comply with 40 CFR Part 503 regulations on control of pathogens and vector attraction. Control of pathogens for WWTP biosolids was evaluated using Class B Alternative 2: Use of Processes to Significantly Reduce Pathogens, PSRP (EPA 1995). For aerobic digestion, the mean cell residence time and temperature shall be between 40 days at 20°C and 60 days at 15°C. Vector attraction reduction was analyzed using Option 1, which is at least 38 percent reduction in volatile solids during treatment (EPA 1995). With the current WWTP operating parameters and assuming a mean cell residence time of 60 days, the required tank capacity to comply with the pathogen and vector attraction requirements is estimated to be from 175,000 to 185,000 gallons (see Appendix D). Projections for 2021 show a requirement for digester capacity of between 300,000 and 315,000 gallons. The existing three digesters have a combined capacity of 368,000 gallons. The existing digester space is adequate for the projected flows, provided adequate winter biosolids disposal methods and sites are available.

The City currently disposes of its biosolids by land application in the dry weather months. Two farm sites are currently utilized with City personnel spraying the biosolids with the facility tank truck. Additional sites are being negotiated for future use.

Approved sites for beneficial application of biosolids are currently available for use under DEQ permit only between late June and October. This means that sludge is held in the digester for as long as possible in the winter. The existing digester is oversized for the current population and careful management has enabled sludge to be held for over 150 days. Usually the digester reaches capacity

by April, and biosolids are trucked to another facility for disposal. Bandon currently trucks between 50,000 and 100,000 gallons of biosolids each April to the City of North Bend WWTP for disposal at an annual cost of between $7,500 and $14,000. (See Appendix C for cost breakdown.) North Bend will soon need the full capacity of its lagoon, and anticipates closing the facility to outside biosolids disposal in less than five years.

The Dew Valley beneficial use site is an upland beach terrace and portions of the site could be approved for conditional applications as early as April of each year. Use of the site in spring would depend on soil and air temperatures, soil moisture content and a prediction for a period of dry weather.

The WWTP is capable of producing biosolids at 2.2% solids. At this concentration, anticipated biosolids generation in the Year 2021 is approximately 3,000 gallons per day or 540,000 gallons for a six-month period. The existing sludge drying beds hold about 65,000 gallons, but no longer have a roof. This is only 12 % of the storage capacity needed for long term planning, although the beds could be tarped and used for temporary storage. A storage tank with adequate freeboard would require a capacity of 700,000 gallons. There is room for a storage tank or additional digester at the current drying bed location.

Disposal of the WWTP biosolids was evaluated with respect to regulatory requirements pollutant limits (i.e. 40 CFR Part 503, Subpart B) and to agronomic rate for the on-site vegetation (i.e. nitrogen). The Part 503 rule requires that biosolids be land applied at a rate that is equal to or less than the agronomic rate for nitrogen at the application site. Additional Part 503 requirements include the following (EPA 1995).

- Biosolids cannot be land applied unless trace element concentrations in the sludge are below ceiling concentrations specified in Part 503.

- Biosolids must meet either (1) the pollutant concentration limits specified in Table 3 of Part 503 or (2) the Part 503 cumulative pollutant-loading rate (CPLR) limits for bulk biosolids.

The amount of plant available nitrogen (PAN) currently applied to the City's biosolids reuse sites was first calculated and then compared with the nitrogen requirements of the site. The PAN provided at the reuse site from 1999 to 2001 was calculated using procedures outlined in EPA's *Process Design Manual - Land Application of Sewage Sludge and Domestic Septage* (1995). For the PAN calculation, measured nitrogen concentrations (e.g. TKN, nitrate, etc.) and solids concentrations from 1999 to 2001 biosolids analysis were utilized. Application rates for each site was based on the recorded gallons delivered to the site, and assumed to be surface spread evenly. Volatilization of applied ammonia was assumed to be negligible. A summary of the PAN calculations is presented in Appendix C. Based on this analysis, the PAN applied to the Dew Valley site was 33 lb/acre in 2000 and 76 lb/acre in 2001. The PAN applied to the Nelson Ranch site ranged from 50 lb/acre to 132 kg/ha.

The reported nitrogen uptake for biosolids application to a rye grass hay crop is 200 pounds per acre per year (EPA 1995). Paul Kennedy of DEQ suggested using an uptake rate of 100 lbs/acre based on the Oregon State University Extension Service Fertilizer Guide and the soils report for the site, and this is the rate that the WWTP currently uses. At the current biosolids application rate, the applied nitrogen is below the calculated agronomic rate for Dew Valley, but has exceeded the calculated agronomic rate for Nelson Ranch. Test samples were taken in October 2000 at Dew Valley and Nelson Ranch sites to verify soil nitrogen levels. The sample results for both sites came back with no detectable nitrogen found. It appears that the past application rates have not exceeded the actual

uptake rate of the rye grass. Using the current nitrogen and solids concentrations for Bandon's biosolids and the mineralized organic nitrogen available, the Dew Valley site should have limit of 360,000 gallons of biosolids applied and the Nelson site a limit of 290,000 gallons.

To assess future applications, it was assumed that the amount of biosolids generated at the end of the planning period is proportional to the estimated increase of average daily BOD from the Year 2000 to the Year 2021. Assuming that future biosolids will contain nitrogen at the current levels, the estimated gallons of biosolids applied to the site in the year 2021 were calculated as follows.

Gallons Applied (2025)
= (Ave. BOD (2025)/ Ave. BOD, (2000)) * Gallons Applied, (2000)
= (902 lb BOD/day)/(675 lb BOD/day) * 601,900 gallons
= 1.34 * 601,900 gallons/year
= 804,300 gallons/year.

The current sites have an allowed application rate of about 35,000 gallons per acre. At this rate Bandon will require a total of about 23 acres of beneficial application site to meet the WWTP needs in 2021. Bandon currently applies to 17.9 acres and holds a permit to apply to another 4-acre site. An additional 30 acres are available for future use. The sites allocated for beneficial use appear to be sufficient for the study period, under current regulations and limits. These sites are only available seasonally due to groundwater and crop harvest restrictions. An upland site, such as a private forest, would be a good addition to the application site inventory for winter disposal.

The historical trace element concentrations in the WWTP biosolids was compared with the regulatory concentration limits for pollutants given in CFR 40 Part 503, Part B. Based on this comparison, none of the trace elements in the WWTP biosolids were above the ceiling and pollutant concentration limits given in the Part 503 rule. Since the biosolids quality is such that it is in compliance with the pollutant concentration limits, compliance with the cumulative pollutant loading rate (CPLR) limits is also achieved. This fact was confirmed as the calculated CPLRs were all well below the Part 503 limits (see Appendix C). Assuming the trace element concentrations in the WWTP biosolids remain at or below current levels, it appears that compliance with Part 503 regulations for trace elements will not be an issue within the planning period.

Section

6

Development of Alternatives

Development and Evaluation of Alternatives

Section 6

6.1 Conveyance System

The alternatives for the City's conveyance system are affected by such factors as the existing pump and pipeline capacity, projected flowrates, operating and maintenance issues with the existing pumps stations, and potential/observed I/I sources in the collection system.

Collection System Rehabilitation

From the flow mapping study completed in December 2001, about 100 inflow sources were identified. The City has aggressively pursued removing these sources from the sanitary system. A number of deteriorated lines and manholes were discovered and recommended for repair including the following:

1. Line Replacement-Ocean Drive & 4th Street
2. Lining/Line Replacement-Ocean Avenue
3. Lining-9th Street W, 11th Street W & Franklin Avenue
4. Lining-Harlem Avenue
5. Lining-Newport Avenue
6. Lining-Jackson Avenue
7. Lining-3rd Street SE
8. Manhole Grouting, Spot Repairs, Lateral Reconstruction

The estimated cost of the system rehabilitation work is a total of $ 878,085. Costs for each project are presented in Section 3.2. Detailed cost breakdowns and project descriptions are presented under separate cover in the City of Bandon Infiltration/Inflow Study and are not repeated here. Work has started on replacing the line on Ocean Drive and 4th, and the other projects are being scheduled as funds become available. The repair methods for existing pipe systems vary, with the recommended techniques for the Bandon projects briefly discussed below.

Basin 6 was flow mapped again on January 7, 2002. During this period of rain I/I totaling 140 GPM was detected and isolated to two stretches of pipe. The probable sources were in the vicinity of Manhole # 6-15 and Manhole 6-16. Video mapping of the adjacent pipe sections is recommended at an estimated cost of $1,500. See Figure 3.2.2 for the location of I/I flows in Basin 6.

Complete Pipe Replacement

Pipeline replacement by conventional excavation and backfill means is normally required when the existing pipeline is deteriorated so badly that other methods of rehabilitation are not feasible. The obvious advantage of pipe replacement is that the service life gained with modern materials and methods is generally considered to be more than 50 years. Replacement also provides the opportunity to correct

any misalignments, increase the hydraulic capacity of the line, repair service connections, or eliminate storm water entry points such as catch basins. The cost of replacement, though, is generally high, and creates inconveniences to local residents due to temporary street closures and service outages.

Cured in Place Pipe

Cured in place pipe (CIPP) is best described as "manufacturing a new pipe within an existing pipe". A CIPP installation uses a plastic lined felt bag that has been impregnated with resins. The bag is lifted over an existing manhole and inverted (turned inside out) allowing the plastic exterior to be turned inward. The inner space is then filled with water, as the inverted bag is oriented into the existing pipe. The weight of water drives the bag's inversion until the entire section of liner has been turned inside out and the end has been retrieved at the downstream manhole. Once the liner is in place the water is then heated which causes the resins in the bag to cure and harden.

The use of CIPP lining is appropriate for pipelines requiring minor structural repair, sealing holes, leaky joints, leaky misalignments, and for correcting corrosion problems. Because this method of rehabilitation does not require excavations, it may be used under highways, railroads, and buildings. Service lateral connections are typically made with special cutters and sealers from inside the pipe. The entire process typically requires less than 24 hours to complete. In larger sewer lines, this time frame requires the use of bypass pumping equipment to convey flows around the work area. If properly completed, the life of an inversion-lined pipe has been claimed by several lining manufacturers to be 50 years.

Chemical Grouting

Chemical grouting is commonly used to seal leaking joints in structurally sound pipe, laterals, and manholes experiencing infiltration. Chemical grouts used for rehabilitation of sewers include acrylamide, acrylate, or urethane gels. Typical applications consist of two separate chemicals that form a gel or foam when mixed together that expands out through the defect and into the surrounding earth. Typical applications include one tank to mix and dispense the grout and another tank to mix and dispense a catalyst. Depending upon the amount of catalyst utilized, the time required to form the grout can be adjusted to a few seconds or several minutes.

The equipment used for chemical grouting includes a joint or lateral packer and television (TV) camera. The entire assembly is pulled inside the sewer pipe with cables and winches. Chemical feed lines are extended from the supply tanks to the packer unit. Chemical injection is performed internally, using robotic equipment without requiring man entry or excavations unless unique problems develop.

Since manholes are a major component of the collection system, it is often desirable to enhance the grout rehabilitation method by applying an interior coating. This coating increases the effectiveness of a grout repair by providing an interior seal that will last beyond the expected grout life. Successful manhole coatings include cementitious linings, polyethylene linings, epoxy coatings, and cured-in-place fiberglass lining systems.

Chemical grouting does not improve the structural strength of a pipeline, therefore this method of rehabilitation should not be used on pipes that are badly broken or deteriorated. If the groundwater table drops below the level of the pipe, the chemical grout may become dehydrated and its useful life shortened. Also, many chemical grouts do not have shear strength and will tear or fracture if a load is

applied to the surrounding earth. When used appropriately, rehabilitation by chemical grouting should serve a useful life of ten years.

Internal Spot Repairs

There are two highly effective methods for performing internal spot repairs without requiring excavations. The two methods are Link-Pipe and ambient cured soft liners. Link-Pipe is a stainless steel grouting sleeve that is used to accomplish small spot repairs within a sewer line; these sleeves come in a variety of lengths up to three feet long and three-foot diameter. Link-Pipe can be used to restore partially collapsed pipes, replace collapsed pipes, close holes created by material loss in pipe walls, and seal infiltrating cracked pipes and pipe joints. The grouting sleeve is of stainless steel construction and is surrounded by a grout-absorbing gasket. The sleeve is remotely moved into position using a video camera to monitor the position. Once in place, compressed air is used to inflate a positioning plug, which in turn compresses the gasket against the walls of the sewer line. The repair is completed when the flow through plug is fully inflated, the gasket has adhered to the wall, and the Link-Pipe's internal locks have engaged. This method of rehabilitation creates a smooth stainless steel channel that supports damaged pipe and may actually improve the hydraulic properties of the existing line

The second method of performing a spot repair is to install an ambient cure soft-liner. This type of liner is very similar to CIPP except that the liner does not require an inversion system and the resin does not require an external heat source to harden. Spot repair liners are especially applicable when a section of pipe requires a repair over a few feet in length. Another advantage of an ambient cure liner is that it can be used to repair laterals with or without having to excavate at the mainline connection. A special feature of an ambient cure lateral liner was the invention of a "top hat" which can be inserted and used to seal the lateral connection at the main.

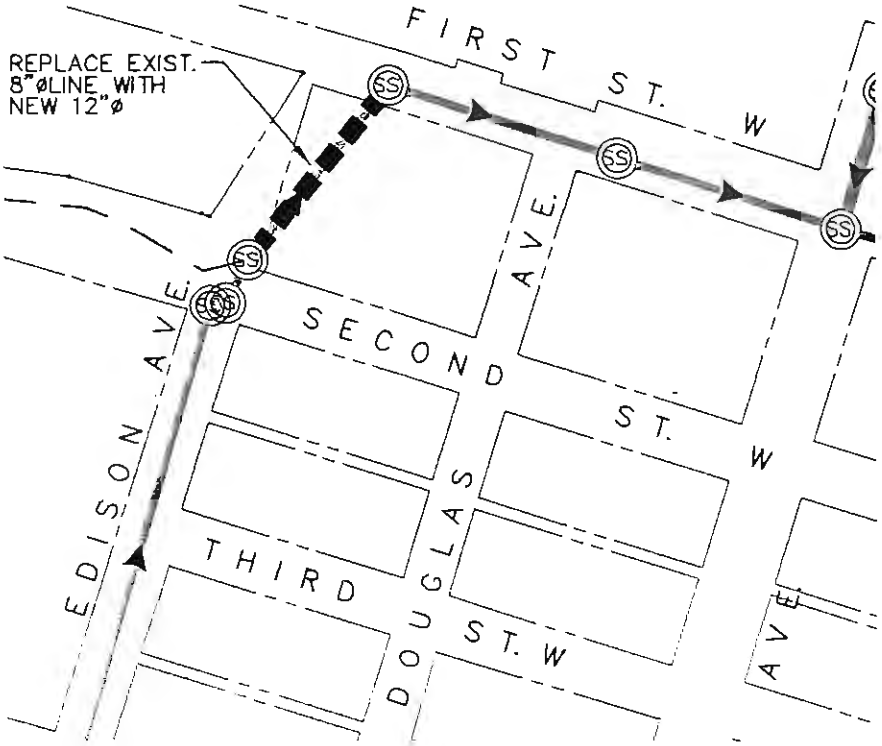
Cost Estimates for Collection System Repairs

The estimated construction costs in this Plan are based on actual construction bidding results from similar work, published cost guides, and other construction cost experience. Reference was made to the available drawings of the existing facilities to determine construction quantities. Where required, estimates were based on preliminary layouts of the proposed improvements. Construction costs are based on the anticipation of construction starting during late spring of the year 2003.

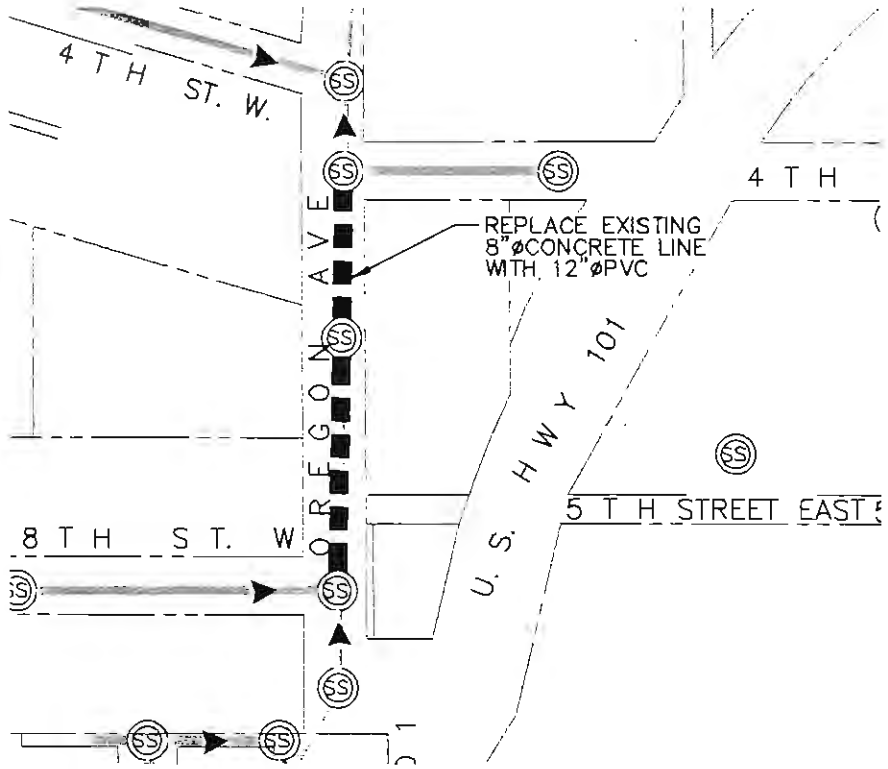
Conveyance System Capacity

The existing conveyance system was modeled using XP-SWMM software to determine areas where the system was at or near current capacity. Two critical areas were discovered; one section of pipe was determined to be at capacity for existing wet weather conditions and another appears to be near capacity. Both pipe sections are capable of carrying current flows but are located in the system where development will create higher loads. Figure 6.1.1 shows the location of each pipe section. Construction cost estimate details are included in Appendix E.

The first section is on Edison Avenue, between Jetty Road and First Street. This section of the west side interceptor is approximately 220 feet of eight-inch concrete pipe laid at a slope of 0.7%. Currently the pipe runs full during high rain periods and the upstream manhole surcharges. New development in the South Jetty, Beach Loop, South Bandon and part of West Bandon neighborhoods would connect to the collection system upstream of this section, increasing flows and potentially causing a sewer overflow.



EDISON AVE. LINE REPLACEMENT



OREGON AVE. LINE REPLACEMENT

LEGEND

- EXISTING SEWER MH
- REPLACED SEWER LINE
- EXSITING SEWER LINE

THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON WASTEWATER MASTER PLAN***	**FIGURE NO. 6.1.1**
DATE: JUNE, 2002 PROJECT NO.: 4501.35	***PROPOSED SEWER LINE CAPACITY IMPROVEMENTS***	

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The recommendation is to replace this line with a section of 12-inch PVC using open trench construction. The estimated cost for replacing this line is $56,500.

The second section of pipe runs along Oregon Avenue, between Fourth Street West and Eighth Street West. This line handles all flows from Basin 6 along Highway 101 south of Old Town. Approximately 520 feet of eight-inch concrete pipe is laid at a slope of just less than 0.4%. Currently the model shows this pipe running 75% full during peak wet weather conditions. The manholes in this section of line were surcharged during the 2001 I/I flow mapping. Line restrictions due to grease accumulations, root intrusions and pipe settlement have reduced the capacity of the line to below the 75% flow shown in the computer model. Lining was recommended for this section of line in the I/I study. The further development in Basin 6 or the addition of a pump station on Highway 101 south of this area would produce flows that exceed the capacity of the repaired line. The recommendation is increase the capacity of this line by replacing it with a section of 12-inch PVC using open trench construction.

The estimated cost to replace the 520 feet of eight-inch pipe is $133,420. The I/I study has a cost of $164,920 for Project #2, which includes lining this section of pipe in addition to lining and replacing adjacent pipe sections on Oregon Avenue. If this line is replaced then the lining portion of I/I Project #2 will not need to be done. If this pipe replacement is combined with the rest of the Oregon Avenue I/I work, a cost savings in engineering and construction set up time is anticipated. The estimated cost for the combined project on Oregon Avenue is $240,750.

Conveyance System Expansion

The City of Bandon currently does not have public sewers available in all areas of the City limits. City policy is to require developers to extend sewer services as a permit condition prior to construction. Services are only extended to properties within the City limits. An exception is made where the property is located on a street that forms the City boundary and sewer lines are already installed. Several areas within the City and most developed areas in the UGB are served by private septic tanks. The soils in Bandon are of limited suitability for septic systems and Del Cline with the Coos Bay DEQ office has expressed concerns about groundwater migration of septic effluent in several areas. Specific areas of concern are Southeast Bandon east of Ferry Creek, South Bandon, Bandon Heights along Riverside Drive and the area along Rosa Road inside the UGB. While several of these areas are outside the City Limits, it is in the interest of the City to have a planned sewer layout to guide future sewer extensions as areas annex into the City. See Figure 6.1.8 (located at the end of this section) for an overall layout of the suggested sewer routing.

Area # 1, Ohio Avenue Sewers

Several developers have expressed interest in building within the City Limits in Southeast Bandon, between Ohio Avenue and Ferry Creek. DEQ has concerns about development without sewers, as the terrain is steep and very close to Ferry Creek. Individual grinder pumps were considered for this area, but are not practical due to the high elevation of the discharge manholes on the south side of Ferry Creek. Conventional gravity sewers were selected for this area with a pump station and pressure main running under Ferry Creek to reach the existing gravity sewer system. This area has about 90 acres in the City Limits, but due to floodplain and terrain concerns, only about 70 acres are buildable. Full build out of 270 homes is not anticipated during the study period. Peak flow at full build out is estimated at 80 gpm. See Figure 6.1.2 for the proposed sewer layout. The estimated cost to install this system is $1.1 million, about $4,000 per future home site or $15,300 per developable acre. The slopes south and east of the City Limits are suitable for gravity flow extensions to this system. With the pump station in place, the cost for

additional homes drops to about $12,000 per acre, but would require annexation into the City under current policies.

Area # 2, Riverside Drive

Riverside Drive follows the Coquille River east of Old Town and connects to Highway 101 north of Bandon. A high water table and proximity to the river make this area unsuitable for septic leach fields and DEQ requires special on-site treatment systems when existing leach fields fail. There are 16 homes in this area that receive City water, but are on septic tanks. Approximately 4,500 feet of Riverside Drive extends beyond the reach of the public sewers within the City Limits. See Figure 6.1.3 for proposed sewer layout.

There is inadequate slope for gravity sewers to this neighborhood and restricted development zoning, due to the adjacent wildlife refuge, will prevent the housing density from reaching the point where a pump station would be economically feasible. Individual grinder pumps and STEP systems are possibilities for this area, but the City does not allow STEP systems to connect to the public system. This leaves individual grinder pumps as the probable alternative. The estimated cost to provide a two-inch force main from the last manhole on the gravity system to the City Limits on Riverside Drive and fully connect with a grinder system the existing 16 homes is $320,050, about $19,400 per existing home. On-site sand or gravel filters generally may be installed for under $12,000, so the grinder pump option is not cost effective.

Full build out for Riverside Drive and the North end of Michigan Avenue (between Cody Avenue and the City Limits) is about 50 EDUs. Assuming 40 homes on the Riverside Drive line and extension of the line up Michigan Avenue brings the construction cost for servicing these homes with grinder pumps to $577,000. This lowers the cost per home to about $14,000, still not cost effective for installation.

Area # 3, Highway 101 South Sewers

This area is west of Highway 101 between Seabird Lane and 22nd Street. This area is currently partially developed, with a mixture of residential and commercial properties. A pump station will be required to serve this area with sanitary sewers. About half of the projected service area is currently within the City Limits, with the other half within the UGB. The majority of the properties along the east side of Highway 101 in this area are outside of the UGB. Construction of a pump station and public sewer system along Highway 101 would create an economic incentive for those property owners east of the highway to annex into the City, increasing the proposed service area. The drainage basin for this system includes about 50 acres in the current City Limits, 60 acres in the UGB, and 35 acres outside the UGB adjacent to Highway 101. Full build out for this area is estimated at about 270 EDUs.

The estimated cost to serve this entire area is $1.4 million, or about $10,000 per acre. To install just the pump station, force main, and piping serving within the City Limits, the estimated cost is $0.8 million or about $15,000 per acre. See Figure 6.1.4 for a proposed sewer and pump station layout for this area.

Area # 4, Allegany Avenue Sewers

This area is currently partially developed, with a mixture of residential and commercial properties. Bounded by Delaware Avenue on the east, Douglas Avenue on the west, 21st Street on the south, and 13th Street on the north, this area is totally outside of, but adjacent to the City Limits and considered part of the South Bandon neighborhood. Due to the flat topography of the land, a pump station will be required

to connect this area with existing gravity sewers. See Figure 6.1.5 for the proposed sewer layout. The estimated cost to install a pump station and sewers to serve this area is $1.2 million, about $14,500 per acre.

Area # 5, South Bandon Sewers

South Bandon is an unincorporated area surrounded on three sides by the City of Bandon. Extensive wetland areas, dense gorse thickets and lack of infrastructure have kept this area from developing. The City commissioned a study in 1997 to investigate providing infrastructure to South Bandon. Figure 6.1.6 is an updated look at the street and sewer layout recommended in the South Bandon Refinement Plan. Parts of the area covered in the 1997 report have been included in Areas # 3 and # 4 above, and will not be included as part of Area #5. Sewers were installed on Seabird Drive in 1999. The remaining area covers about 350 acres and runs from 13th Street south to Seabird Drive and from Douglas Avenue west to the Bandon City Limits. A pump station will be required to serve part of this area and the rest will gravity drain to the existing Johnson Creek Pump Station. The estimated construction cost to serve this area with sewers is about $3.8 million, close to $11,000 per undeveloped acre.

Area # 6, Rosa Road Sewers

This area, totally outside of the City Limits, has been identified by DEQ as an area of concern due to migration of septic tank effluent in ground water. Residents have access to City water services, but wells are still used for landscape irrigation, and are a potential source of contact with the groundwater contamination. The layout in Figure 6.1.7 is presented to show the feasibility of gravity sewers for this area, and as a guideline for future requirements as sewers are extended. Slope requirements dictate the invert elevations of pipelines in this area, and additions at too shallow of a depth could prevent future extension of the gravity flow service area. Full build out is estimated at 370 EDUs. The estimated cost for construction of this system is about $1.1 million. The estimated construction cost comes to about $3,000 per home or $14,000 per undeveloped acre.

Conclusions

Developers are likely to look for the low cost route and line depth to serve their property. Lines may be installed at too shallow a level to allow service beyond this property. The alternatives discussed above were developed after examination of existing topographic maps and sewer design drawings. The recommendation is that these alternatives be used as a guideline when extending sanitary sewer lines to achieve gravity service to the largest possible service territory. The City may wish to include the cost for installing pump stations in areas of rapid growth such as Highway 101 South and Ohio Avenue in the future capital improvements budget.

Pump Station Improvement Alternatives

A number of deficiencies were noted at the pump stations. NFPA 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities, requires pump stations to use explosion proof electrical equipment unless the wet-well is physically separated from the dry-well. Filmore Avenue and the South Jetty Pump Stations are physically separated from the wet-well, but North Avenue and Johnson Creek Pump Stations access the wet-well from inside the pump station. Johnson Creek Pump Station is subject to flooding by surface water, and has sustained service outages and equipment damage in past floods. All of the stations have equipment deficiencies, which are detailed below.

Filmore Avenue Pump Station

Filmore Avenue Pump Station overflow is subject to tidal backflow at tides over 6.9 feet. The existing tide gate leaks and was found stuck open during the study. Salty estuary water interferes with the biological treatment process of the WWTP and imposes a hydraulic load on the equipment. The recommendation is to replace the existing tide gate with a "duck-bill" back flow valve. The estimated cost to remove the old valve and install the new one is $2,450.

One pump was rebuilt last year and the second pump was being rebuilt at the time of this study as part of the regular preventative maintenance program. The estimated cost for each pump rebuild is $5,500.

South Jetty Pump Station

South Jetty Pump Station is the newest pump station and is in good overall condition. A pump test showed that the pump flow is about 185 gpm, lower than the pump rating of 310 gpm. Recommend checking the pumps for plugging from rags. If pumps are clear then the balance on the check valves need to be reset to provide proper flow. Estimated time to check pumps and adjust check valves is 16 man-hours.

The generator timer no longer functions. Estimated cost to replace timer is $500.

North Avenue Pump Station

North Avenue Pump Station is a fiberglass factory-built packaged unit installed below grade over a concrete wet-well. The unit does not meet NFPA 820, is near the end of its service life and is difficult to operate. The pumps are operating at less than 25% of their rated capacity, probably due to worn impellors. The manufacturer has discontinued this pump line, and estimates that parts will be unavailable in about five years. The alternatives examined for this station are:

- No Action, operate the station as-is.
- Refurbish the existing station and continue to operate it
- Build a new pump station

No Action, Operate the Existing Station As-Is – The existing station is operating at about 25% of its rated capacity. With both pumps operating it is capable of handling the MMWWF for this zone, but not the peak daily flow or the peak hourly flow. Operating this station as-is is not a viable option.

Refurbish the Existing Station – Installing new impellors and seals on the existing pumps should restore the station to design capacity. Pump rehabilitation will allow the station to handle the peak daily and hourly flows expected for this basin. The risk of overflow is high enough that this station should not go through another winter below design capacity. Given the lengthy timeline for financing, design, and construction of a major upgrade, this station should be refurbished before next winter, even if a decision is made to replace the station. Refurbishing the station will provide the necessary capacity, but does not address the operational and safety concerns or the failure to meet NFPA 820. The estimated cost for parts to refurbish this station is $3,000. Adding staff labor, shipping, and contingency results in a budget of $4,000.

Build a New Pump Station – The existing pump station has exceeded its rated life. The manufacturer is no longer supporting parts and maintenance for the pumps. In five to ten years, the City will be faced

with the need to replace this station. Installing a new station now would offer the opportunity to improve worker safety and avoid the increased maintenance that will be required to keep this station on-line over the next few years. The options for a new pump station are as follows:

Install an Above Grade Packaged Pump Station – Removing the existing pump station and installing concrete rings to extend the existing wet-well to surface level would enable a surface mount packaged pump station with submersible pumps to be installed on the existing wet-well. A packaged pump station would solve the code and operational problems.

The advantages of a packaged pump station include a lower initial cost as compared to a contractor built station, shorter construction time and less construction disruption to the neighborhood, and single point responsibility for parts and manufacturer's support. Disadvantages include shorter average equipment life, minimal security against vandalism, and lack of storage space for on-site equipment.

Estimated construction cost for an above ground packaged pump station on the existing wet-well is $126,000.

Build a New Above Ground Pump Station with Standby Power – This alternative would involve building a new above-grade structure next to the existing pump station, which could be designed to resemble a small residential garage to blend in with the residential neighborhood. The new building would house the controls, electric service, valves, and generator for the pump station. The old fiberglass dry well would be removed and disposed of. The existing wet-well would be refurbished as necessary, extended to ground level and capped with an access port. The proposed design would include two five-HP submersible pumps.

The advantages of an above ground building include easier access for maintenance, space for a permanent generator, increased worker safety due to separation of the electric components from possible flammable vapors, elimination of confined space concerns for daily maintenance chores, availability of parts, and an aesthetically pleasing station exterior. Disadvantages include the cost, lengthy construction period and associated City related administration time, placement of a larger structure in the street right of way, and possible objections by the property owner abutting the new station. (The station would be near the existing station, within 50 feet of the front of their house, but much larger.)

Estimated construction cost is $215,000 with standby power

Build a New Above Ground Pump Station with Portable Generator Connection – This option is the same as Option #4 and has much the same advantages and disadvantages, except it utilizes a transfer switch and receptacle for portable generator connection instead of a permanent generator. North Avenue has low flows for the size of the wet–well, and of all the City's pump stations, is the best candidate for use of a portable generator. If permanent standby power is not installed, then the City will need to demonstrate the availability of a working portable generator of sufficient capacity to run the station.

The advantages of using a portable generator are a reduction in the initial construction cost and lower maintenance costs. Permanent generators need to be exercised (run for a brief period of time) weekly, which could cause add to the noise level in this residential neighborhood. A portable generator would only run during power outages, reducing the amount of time the neighborhood is exposed to generator noise. The disadvantage is that City workers will need to monitor the wet-well level manually during power outages and deliver and run the portable generator as needed. Estimated construction cost is $170,000.

Conclusions – The recommended alternative for North Avenue Pump Station is to rebuild the pumps now and budget to install a new packaged pump station in the next five years. The portable generator easily serves this station, and low flows make it a minimal risk for overflow, so a permanent generator is not recommended.

Johnson Creek Pump Station

Johnson Creek Pump Station is a wood framed structure sited in the flood plane of Johnson Creek directly over the wet-well. The station has adequate capacity for current and future flows. The floodwaters of Johnson Creek have left a watermark inside the pump station 36 inches above the floor. The station is inoperable and creates an electrical and physical hazard for City workers when the creek floods. The location of the wet-well inside of the structure is not in accordance with NFPA 820, which requires all equipment to be explosion proof when the wet-well is accessible from the structure. NFPA 820 also requires that the pump house structure be of low flame spread construction, a condition not met by the cedar shakes at Johnson Creek. The exterior siding and metal surfaces are deteriorating and need paint and minor repairs. The existing pumps have reached the end of their useful life and parts are difficult to obtain and maintain. The options explored for this station include the following:

- No action, operate the station as-is
- Refurbish the equipment
- Install a floodwall around pump station
- Replace Johnson Creek Pump Station

No Action, Operate the Station As-Is - When Johnson Creek reaches flood stage the station is unable to operate and poses a hazard to workers. The structure is in violation of NFPA 820. Operating the station as-is is not a recommended option.

Refurbish the Existing Equipment – The pumps are currently operating at rated capacity. City operators have been diligent in keeping the pumps operational. The structure needs exterior and interior painting on all surfaces, minor siding repair and sheet metal repair. The generator is corroded due to flood exposure and needs the engine section to be cleaned and the generator section to be refinished. The control panel is corroded and components do not stay tight in their slots.

As this option will not solve any of the deficiencies noted above, it is not a recommended alternative. Restoring finishes on the structure and equipment and replacing the control panel to extend the life of this facility is estimated to cost $14,000.

Install a Floodwall Around Pump Station– Construction of a concrete wall with a floodgate around the pump station would protect it from future floodwaters. City crews could use its existing portable pump if necessary as a sump pump to keep the enclosure dry. National Flood Insurance Program rate maps do not designate the 100-year flood elevation at the station but the historic watermark in the building is 36-inches above the station floor. The finished floor of the pump station is at 19.5 feet (based on the 1978 as-built drawings), with the ground sloping down to Johnson Creek and the adjacent golf course. A floodwall approximately five-feet tall would be needed to provide protection from a 100-year flood. A ten-foot opening with floodgate sections that could be manually dropped into place would provide access to the station.

The advantage of a flood wall would be that the equipment would be protected from damage, the station could continue to operate during a flood, and flood waters would be prevented from draining into the wet-well, adding to the treatment plant load. The disadvantage would be that City workers would need to install the floodgate whenever flood warnings were issued, maintenance access would be restricted, and the aesthetics of the station would be diminished. This option would not address deficiencies associated with NFPA or the age of the pumps. The estimated cost of installing a floodwall around Johnson Creek Pump Station is $50,000.

Replace Johnson Creek Pump Station – This option involves building a new pump station adjacent to the existing pump station, reusing the existing wet-well with modifications. The floor of the new station would be at 23.5 feet of elevation, one foot above the floodplain. The existing generator would be reused, but all pumps, valves and control components would be replaced.

The advantage of this option is that the City would have new equipment with an expected life span of 20 years. Code, flooding, and life safety issues would be addressed in the design of the new station. The disadvantage is the capital construction cost and a lengthy construction period, with the associated traffic, noise, and administration problems. Estimated cost of a new Johnson Creek Pump Station is $265,000.

Conclusions – The recommendation is to replace Johnson Creek Pump Station with a new station; raised above the floodplain. Until a new station is brought on-line, running the exhaust fan system 24 hours in the pump house should help minimize fume accumulations.

Pump Station Recommendation Summary

The recommended pump station projects are summarized in Table 6.1.1.

Table 6.1.1

Pump Station Recommendation Summary

Pump Station	Project Description	Cost Estimate ($)
Filmore Avenue	Install tide gate	2,450
South Jetty	Generator timer	500
North Avenue	Rebuild pumps & replace station	130,000
Johnson Creek	Replace station	265,000
Total		**397,950**

6.2 WWTP Improvements

The Bandon WWTP has the capacity to handle flows and mass loads projected through the study period, providing that the recommended I/I projects are successfully implemented. The facility is well maintained and operated, with only relatively minor deficiencies found.

Headworks

The headworks were upgraded in 2000 and are operating efficiently. One minor operation change is recommended for the headworks. The grease baffles in the channel located prior to the aeration basins should be scheduled for regular cleaning. Removing the grease by ladling or pumping is preferable to allowing it to flow into the treatment portion of the plant.

The major concern for the headworks is accurate measurement of flows. Influent flow for the headworks is not measured directly, but calculated based on effluent flow. Mass loads for the plant are based on effluent and influent flows and inaccurate influent flows could cause these calculations to appear to be erroneously out of compliance. Also the mass load balance for the treatment process is based on influent flows; inaccurate readings could lead to inefficient operation of the plant, and the perception of reduced treatment capacity. The calculated reading at the chart recorder consistently shows the effluent flow to be higher than the influent flow. The staff has had the effluent meter recalibrated, but still records erroneous influent flows. The existing flow recording system was installed in 1970 and has reached the end of its rated life. Parts are difficult to obtain and require installation and calibration by technicians trained to work on older systems.

Options to remedy the problem are as follows:

- No action, operate as-is.
- Recalibrate the existing system.
- Replace the existing system.
- Install new influent meter.

No Action, Operate As-Is

This option is to continue to operate the plant with the effluent reading higher than the influent. DEQ staff has noted the meter discrepancy in their files and has expressed concerns about the accuracy of metering at the plant. Under its NPDES Permit, the City is required to monitor effluent flow by meter and total flow by calculation. An obviously inaccurate flow record would not be in conformance with the City's permit.

Recalibrate the Existing System

The original plant design shows the influent flow level calculated by adding the effluent meter, water reuse meter, and the sludge waste meter reading together. Turning off the reuse water and sludge waste and comparing the influent and effluent readings have shown the effluent still reads higher than the influent. Review of the electrical diagrams and an inspection by a technician lead to the conclusion that components in the metering system are wired incorrectly or summation modules in the system have failed or need calibration. A budget figure of $5,000 is recommended for troubleshooting and repairing these components. The WWTP Operator has the effluent meter calibrated annually. Calibrating the water reuse meter and the sludge waste meter are estimated to cost about $2,000. The water reuse meter and sludge waste meter are recommended for calibration, even if another option is chosen.

Calibrating and repair of the existing system has the advantage of lower initial cost and less disruption to the existing system. The disadvantage is that it might not work, and the plant would still show inaccurate flow readings. Even if the system is operating correctly, actual influent flows vary with the speed and

run times of the Filmore station pumps while effluent flows tend to represent the average of the day's flow due to holding capacity of the treatment process. Another disadvantage is that even if the system is restored to original installation standards, it failed once and likely would fail again. The total estimated cost for calibrating and troubleshooting the metering system is $7,000.

Replace the Existing System

Replacing the existing chart recording system with a new graphical recording system would provide greater confidence in recorded levels and assurance of service support availability. The estimated cost for replacing the chart recorder and modules and connecting them to the existing flow meters is $25,000.

Install New Influent Meter

This option is to install a new mag-meter in the vertical influent line just before the headworks. A remote readout panel would be installed in the motor control center at the operations building and a data wire would feed under Riverside Drive to the administration building through an existing conduit. The data wire would connect to the existing chart recorder, replacing the components that currently calculate the influent flow.

The advantages of a new mag-meter would be a direct influent measurement with a more accurate meter type. Independent meters for influent and effluent act as an accuracy check for each other. The disadvantage is the initial capital cost. Estimated cost for installing a new influent meter is $21,000.

Treatment

The aeration basins and secondary clarifiers have adequate treatment capacity for projected mass loads based on the original construction design drawings. The hydraulic capacity is also considered adequate if the I/I reduction program is completed successfully. WWTP operating staff have identified no deficiencies in the treatment process. The current energy control system installed through Bonneville Power Administration (BPA) creates an opportunity to improve plant performance. BPA installed sensors that measure dissolved oxygen and suspended solids in the aeration basins. Currently, the staff controls the RAS pumps manually, setting them based on a suspended solids level from a grab sample of the aeration basins. Installing a system to control the RAS pumps based on the sensor reading of suspended solids in the aeration basins could effectively increase the treatment capacity of the plant by maintaining a more exact food to mass ratio. The estimated cost to add automatic RAS control to the WWTP is $12,000.

6.3 Disinfection

The disinfection system at the WWTP is an ultraviolet (UV) radiation system with two flow channels and six units of vertical lamps. The system was designed to be flow paced by the effluent meter with one unit and one channel used at low flows and additional units brought on at preset flow values. The current mode of operation is to run both disinfection channels full time with all six units energized. It is the understanding of the current staff that the flow pacing controls have never operated correctly. The plant has no history of problems with excessive fecal counts in the effluent.

Running all six units consumes excessive energy and increases maintenance costs by requiring frequent replacement of lamps and ballasts. Return to flow pacing the UV system is recommended, Frequent fecal tests during the first month should be made to develop confidence in the efficacy of the disinfection process.

Estimated savings in energy, lamp and ballast replacement, and disposal costs is about $10,000 per year. The estimated cost for troubleshooting the flow pacing system, repairing, and calibrating the controls is $5,000.

6.4 Biosolids Management

Biosolids originate as leftover waste materials, domestic septage and sewage sludge, which are generated from sewage treatment. Presently biosolids produced at the WWTP are aerobically digested and land applied on a DEQ approved site. Selection of the most viable biosolids stabilization alternative is depended upon the selected ultimate use and disposal of the biosolids. The following is a discussion of the biosolids stabilization and ultimate use/disposal alternatives.

Biosolids Stabilization

Biosolids stabilization is a treatment process, which converts sludge generated in the liquid stream treatment process to a stable product for ultimate disposal or use. This process reduces pathogens and vector attraction in the sludge and produces a less odorous product. The most common biosolids stabilization processes used in small communities are stabilization lagoons, facultative sludge lagoons, aerobic digestion, anaerobic digestion, and lime stabilization. While not typically utilized in small communities, composting is considered a potential stabilization alternative. The use of stabilization and/or facultative sludge lagoons were not considered viable options for biosolids stabilization since these facilities require relatively large amounts of land, which is at a premium in the vicinity of the WWTP. Available undeveloped parcels are below the 100-year floodplain of the Coquille River, and thus of limited use.

The Bandon WWTP currently uses aerobic digestion for sludge stabilization, followed by land application of the majority of the treated biosolids. When land application sites are not available, biosolids are transferred to the sludge lagoons owned and operated by the City of North Bend. The digester capacity of the Bandon WWTP is projected to be adequate through the study period, based on a 60 day holding time, 2% minimum sludge solids, and projected wastewater flows.

Although the WWTP has adequate digestion space, biosolids disposal is a major operational limitation for the WWTP. DEQ requirements for the currently permitted sites prohibit land application during high groundwater periods. The City owned spreading truck is unable to safely drive on the fields during periods of high soil moisture. The land used for soil enhancement is used for producing hay and is unavailable during the growing season. These conditions restrict the available spreading season to the months of July through October. The retention time for the digester runs up to eight months under this spreading schedule. Consequently, the digesters reach storage capacity by March or April each spring. Currently about 100,000 gallons of biosolids must be removed to prevent negative effects on the treatment process.

The aerobic digesters in Bandon currently meet or exceed the DEQ limits for vector attraction based on a 38% reduction in volatile solids, according the plant DMRs. Operators report that the plant consistently has produced an acceptable Class B biosolid. Based on the projection of adequate future capacity, the recommendation is that Bandon continue to stabilize the sludge with aerobic digestion.

Basic Ultimate Use and Disposal of Biosolids Alternatives

The ultimate use or disposal of biosolids is perhaps the area of greatest uncertainty in sludge handling because of its dependency on solids marketability, land availability, and regulatory requirements. Another

important consideration of an ultimate utilization or disposal option is public acceptance. The reluctance of the public to accept a biosolids disposal or processing facility in their area generally stems from concerns about odors and adverse health impacts. A public education and outreach may be necessary for successful biosolids use or disposal. Potential viable options for use and disposal of biosolids include disposal of biosolids at a landfill, land application of biosolids, and distribution and marketing of biosolids.

Land Application

Land application refers to any beneficial use project that applies biosolids to the land. Such land sites include primary agricultural land, pastures, tree farms, and old mines

Any biosolids to be land applied must be classified as nonhazardous and meet criteria for maximum concentrations of trace metals (e.g. cadmium, copper, lead, nickel and zinc). For application to agricultural lands, all biosolids must undergo treatment by a process which to significantly reduce pathogens. In addition to evaluating a biosolid with respect to its environmental suitability, a land application program will depend on the nutrient content of the biosolids, the land to which it will be applied, and the crops to be grown on the land. For most biosolids produced and land applied, the limiting factor is the nutrient content of the biosolids when it is applied as a fertilizer for a particular crop.

A land application program operating year-round cannot function without adequate permitted acreage available during all but the most inclement periods of weather. The farming practices and crops in a given area determine site availability. As a rule, it is advisable to hold permitted acreage equal to three times the amount actually needed in any given year to accommodate all the biosolids for a particular project. Usually, storage of biosolids will also be necessary at some time during the year. Paul Kennedy of DEQ is currently working with City personnel to obtain permits for winter application sites (2002). Additional acreage on the currently permitted sites could be eligible.

The key advantages of land application are the ability to utilize wastewater biosolids for a beneficial use and the low capital outlay costs. The key disadvantages of land application are securing DEQ approved sites and providing sufficient capacity to store biosolids during the wet season.

Landfill Disposal

Landfill disposal is generally less desirable alternative than land application for beneficial use. If a suitable site is convenient, a sanitary landfill may be used for the disposal of biosolids if landfill and regulatory officials permit this practice. The economics of hauling biosolids usually indicate that the dewatering for volume reduction will result in justifiable savings. While this process is more expensive and does not take advantage of the beneficial uses of biosolids, disposal at a landfill is a viable option when weather conditions or regulatory requirements limit land application.

The City currently has no access to a local landfill site for biosolids. Coffin Butte Landfill (Corvallis), Short Mountain Landfill (Eugene) and Heard Farms (Roseburg) are the three landfills in closest proximity that accept municipal biosolids. DEQ regulations discourage biosolids disposal at a landfill if other viable alternatives exist. In addition to the lack of landfill access, the cost of hauling and disposing of biosolids at a landfill would be substantial.

Hauling to Another Municipal Facility

DEQ requires WWTP facilities to be built with capacity to meet projected growth for 20 years from the date of construction. This means that new facilities tend to have surplus capacity for a few years. Bandon has been able to utilize that surplus in the past by hauling biosolids to the City of North Bend's sludge lagoons. North Bend has indicated that they will run out of surplus capacity in less than five years, and will not commit to accepting biosolids from other communities in the future. The City of Florence also has surplus capacity, but only will take biosolids on an emergency basis.

A multi-community group headed by Charleston Sanitary District recently commissioned a feasibility study for a regional biosolids disposal center. The study found that a regional disposal method is cost effective for Coos County and surrounding communities, but further research is needed to determine methods and costs (John Waddill 2002).

Private Sector Services

Heard Farms - Heard Farms in Roseburg operates a sludge lagoon where municipal and private biosolids may be disposed of for a fee. They also own a tanker truck and will pick up municipal sludge directly from the WWTP. Liquid effluent from the lagoon is held in tanks and used for irrigation of farm crops in the summer. Solids are stabilized in the lagoon and used for soil amendment.

Roto-Rooter - The local Roto-Rooter franchise has been working on a pilot program to dewater biosolids at local wastewater facilities and dispose of the residue in a privately owned landfill in Port Orford. The company delivers a portable press that dewaters the biosolids to approximately 20% solids, with the pressate returned to the headworks of the WWTP.

The advantage of a private service is that the disposal of the biosolids becomes somebody else's headache. Staff time would not be spent dealing with trucking, locating and permitting application sites, or processing biosolids. The disadvantages are the return of the pressate, which requires treatment and reduces the capacity of the WWTP, loss of control over the process and disposal, and the need to administer an outside services contract.

Distribution and Marketing of Biosolids

Compost and heat-dried (Class A) biosolids may be distributed and marketed to end-users such as the agricultural and horticultural industries, landscape contractors, and homeowners. Each municipality must develop its particular distribution and marketing strategy based on surveys of potential users and competing products. Some municipalities have chosen to market the product through a broker or distributor. Such items such as product quality, selling price, storage, responsibility for unsold product, and other risk-sharing decisions should be included in any contracts. Promotional and demonstration programs are usually required to promote public attention and acceptance, and inform potential users of the product's potential use and availability.

The distribution and marketing of processed wastewater biosolids is usually done by rather large municipalities (e.g. Portland, Newberg) that produce considerable amounts of biosolids. These municipalities usually have the resources to successfully develop a product market. Bandon currently produces a Class B biosolid and would need to further process the waste to achieve a Class A. A Class A material could be used directly by the City for fertilizing plantings in parks, at City Hall and at the local

schools. Surplus could be given away to the public or farmers. Methods of producing a Class A biosolid are discussed below.

Composting - Composting is a process in which organic material undergoes biological degradation to a stable end product. Biosolids that have been composted properly is a sanitary, nuisance-free, humus-like material that is an excellent low-grade fertilizer and soil conditioner. With composting, approximately 20 to 30 % of the volatile solids are converted to carbon dioxide, water and heat. Although higher temperatures can be achieved, optimum microbial activity occurs between 45 to 60 °C (113 to 140 °F). To be considered a process that significantly reduce pathogens, the temperature of the composted material must be raised to and remain at 40°C or higher for five days. In addition, the temperature of the composted material must exceed 55°C for at least four hours during the 5-day period.

Biosolids to be composted must have a porous structure and a moisture content of 40 to 60 % to be compostable. Biosolids are mixed with a bulking agent such as wood chips, sawdust, or compost to obtain the required structure, porosity and moisture. To reduce the amount of bulking agent used in composting, the biosolids are typically dewatered to a minimum solids content of 12 %.

There are several methods of composting, including static pile, windrow, mechanical "in vessel" and container composting. Of these methods, container composting appears to be better suited for small communities.

Container composting is similar to the in-vessel process in that composting is conducted in a closed reactor or container under controlled conditions. However, instead of a using continuous process, the container system composts material in batches. For each batch, dewatered biosolids are mixed with an amount of bulking agent and then conveyed into a stainless steel lined container. Air is introduced into the containers using variable speed blowers. A computer program that monitors temperatures within the container determines the amount of air needed for composting. Once composting is completed, container is lifted and the material in the container is emptied onto a concrete slab for cooling and distribution. To control odors, exhaust air is sent through a biofilter consisting of wood chips and compost.

The advantages of composting are the elimination of the need for digestion, relatively low capital cost, reduction of land application if marketed, and production of a useful product. The disadvantages of this process include significant land area, possibility of odor generation, relatively high operation costs, and the need of a market for the compost. Composting is not an option at the current WWTP due to lack of available land and concerns about odors.

Reed Bed Dewatering - Reed bed dewatering is used in Europe and in about 50 sites in the U.S., most in New England. The system consists of marsh plants growing in a sand lined concrete bed with walls about three feet high. A drain system is installed and pea gravel and sand layers are built up over the drains. Marsh plants, usually reeds, are planted in the sand. The reeds are heavily watered with treated effluent to establish them in the sand bed. The established plants are then flooded with digested biosolids with 3 to 4 percent solids, about four inches every 20 days. The penetration of the vegetation root system maintains pathways for drainage and delivers oxygen to the bottom layers of the sand bed to promote aerobic stabilization of the biosolids. The roots also absorb water that is transported to the leaves and evaporated.

Harvesting the above ground vegetation annually maintains the treatment capacity of the beds. Beds that are not harvested have their capacity reduced by the organic load contributed by the decomposing plant material. Harvested material may be composted, burned, or chipped and used for mulch. Beds are

typically run on a ten-year cycle. At the end of the cycle, the beds are allowed to rest for a six-month period and then a front-end loader scoops out the organic layer that has accumulated. The sand layer is left intact. The beds are then flooded with treated effluent to encourage new growth from the existing rootstock. The biosolids removed from the beds are about 90% solids and have aged long enough to remove pathogens. DEQ would require sampling and testing of the removed biosolids prior to classifying them as a Class A.

The existing drying beds in Bandon could be converted into reed dewatering beds by raising the sides of the beds by about two feet. The beds would have a capacity of treating between 200,000 to 300,000 gallons of biosolids annually. This is not enough to handle the full output of the digesters, but could provide storage while waiting for agricultural land spreading in the summer.

There are no municipal reed beds in Oregon. Bandon Dunes has a form of reed bed system that was used to treat the effluent from their system, but was discontinued in the recent treatment system upgrade. Due to the lack of data on local reed beds, this alternative is most attractive as a pilot project, possibly with the cooperation of a graduate student.

Positives for this alternative are that Bandon already has sludge drying beds, making the capital of this alternative very low. A reed bed could showcase the local ecological sentiments and promote environmental awareness. Maintenance is minimal, and the beds only need to be scraped once every ten-years. The negative aspects are that a reed bed could not handle the full output of the digesters and should be considered experimental in Oregon. DEQ would likely require a high level of testing with a resulting high administrative cost. The reeds should be harvested annually with the resultant disposal cost of the cut reeds. There is a chance of odors from the beds, which are in close proximity to the tourist district.

Biosolid Storage

Bandon currently has the digester capacity necessary to meet the projected sludge load during the study period. The agricultural application sites have a calculated life exceeding the expected life of the treatment plant, and capacity to handle the projected nitrogen loading under existing regulations. What Bandon lacks is storage capacity to hold digested biosolids during wet weather and crop growing periods.

Biosolids can be stored within the wastewater treatment process units, biosolids treatment process units, or in separate specially designed tanks. Wastewater treatment units can store biosolids for short-term storage (few hours to 24 hours). For longer detention times, biosolids treatment units, such as aerobic or anaerobic digesters, facultative sludge lagoons, are used for storage. Separate tanks are usually used for obtaining longer detention times than biosolids treatment units. These separate holding tanks often use mixing and/or aeration to prevent septicity, odors, and solids suspension. Mixing may be accomplished using diffused air, and top-entry or submersible mechanical mixers. Other odor control measures include either chemical addition of chlorine, hydrogen peroxide, or iron salts, and maintenance of an aerobic surface layer (e.g. facultative sludge lagoon).

Facultative Sludge Lagoons

Typically in small communities, facultative sludge lagoons have been recommended and implemented for biosolids storage. However, the use of a facultative sludge lagoon in Bandon for biosolids is not considered viable due to lack of appropriate sites.

Drying Beds

Drying beds are contained structures with the floor sloping to a drain system. A layer of gravel is built up over the drains, and a layer of sand applied over the gravel and the surfaces of the beds are flooded with digested biosolids. The liquid content of the biosolids drains through the sand and gravel and is returned to the headworks of the plant. Dewatered biosolids are scraped off after each application, along with the top layer of the sand, using a small front-end loader. The biosolids are then disposed of by land application with a manure spreader or by landfill. The solids content of the finished biosolids may vary from 15% to 70%, with 50% used as an estimate for study purposes.

Bandon has approximately 4,300 square feet of sludge drying beds that were built with the original 1970 treatment plant. The drying beds have not been used within the memory of current staff, but were used once after the original WWTP was built in 1970, with unsatisfactory results. Similar beds are in use in North Bend with no operational problems. Uncovered beds are not practical in areas with over 40 inches of annual rainfall so installation of a roof structure is suggested.

One advantage is that the City already owns drying beds, so no capital outlay or construction is necessary. Another advantage includes a reduced volume of material, with the associated reduction in trucking miles and time. Disadvantages include odor concerns and multiple handling of the material; it must be spread, scraped up, loaded into a truck and then tilled in at the application site.

Tank

Tanks for holding biosolids need to be large enough to get through the period between land application seasons and make provisions for odor prevention. Bandon would need a tank capacity of approximately 600,000 gallons to hold a six-month production of biosolids. Odor control is done by use of aeration or by covering the tank and filtering the exhaust air. A recent study for the City of Lakeside found that a similar tank would cost about $1 million for construction, engineering, and administration of the project (Lakeside 2002).

The advantages of a tank are that there is minimal labor involved in the use of a storage tank and an aerated tank would continue a certain amount of aerobic digestion. The disadvantages of a tank are the high capital construction cost and the large space a tank would occupy. A 600,000-gallon storage tank would have a diameter of 80 feet. With the possibility of a regional disposal center being developed, a large capital investment in storage is not recommended at this time.

Screw Press Thickening

Bandon WWTP has two screw presses, one installed in 1970 with the original WWTP, and one installed in 1993 with the plant upgrade; neither have been operated since 1993. Digested sludge is treated with polymer to allow flocculation and easier dewatering. The screw press produces liquid pressate, which is pumped back to the headworks for further treatment and a dewatered sludge with a solids content of approximately 10% solids. The sludge drying beds may be used as a storage area for the thickened biosolids or the biosolids may be spread over a layer of sand in the beds to further reduce the moisture content. A trial run of the screw presses is scheduled for late summer 2002. At that time, depending on the results of the trial, it will be determined if the sludge beds would require a roof if they are to be used for storing thickened sludge.

The screw press reduces the sludge volume by about 75%, which lowers the storage volume required to hold the biosolids and the number of trips eventually necessary to haul biosolids off site. However, the biosolids will no longer be in a liquid state that can be pumped or sprayed. Removal of the thickened sludge will require a front loader or other mechanical means of loading and spreading, increasing the handling labor.

Selection of Biosolids Disposal Alternative

Sludge at Bandon is currently aerobically digested and land applied to local farms. Anticipated capital and O&M costs were compiled for biosolids hauling, holding, dewatering and land application. The present worth costs for these alternatives are summarized in Table 6.4.1. Additional details are included in Appendix "C".

Table 6.4.1

Present Worth Costs For Biosolids Disposal Alternatives [1]

#	Option	Disposal Site	Solids %	Hauler	Disposal Method	Present Value Cost per Gallon
1	Use reed beds [2]	City Projects	75%	Bandon	Fertilize City Parks	$0.05
2	Apply digester material to local farms	Local Farms	2%	Bandon	Beneficial Land Application	$0.05
3	Use sludge drying bed and apply to local farms [2]	Local Farms	50%	Bandon	Beneficial Land Application	$0.07
4	Thicken, store, then apply to local farms	Local Farms	10%	Bandon	Beneficial Land Application	$0.08
5	Thicken & have Heard Farms pick up at WWTP	Heard Farms	10%	Heard Farms	Sludge Lagoon	$0.09
6	Have Roto-Rooter press at plant and haul solids	Roto-Rooter	2%	Roto-Rooter	Dryer/Compost	$0.11
7	Haul to City of North Bend [3]	North Bend	2%	Bandon	Sludge Lagoon	$0.13
8	Have Heard Farms pick up at WWTP	Heard Farms	2%	Heard Farms	Sludge Lagoon	$0.14
9	Build storage tank and farm apply in summer	Local Farms	2%	Bandon	Beneficial Land Application	$0.15
10	Thicken and haul to City of North Bend [3]	North Bend	10%	Bandon	Sludge Lagoon	$0.15
11	Thicken and haul to Heard Farms	Heard Farms	10%	Bandon	Sludge Lagoon	$0.17
12	Haul to Heard Farms	Heard Farms	2%	Bandon	Sludge Lagoon	$0.24
13	Thicken and haul to Short Mountain Landfill	Short Mountain	10%	Bandon	Landfill	$0.25
14	Thicken and haul to Coffin Butte Landfill	Coffin Butte	10%	Bandon	Landfill	$0.25
15	Haul to Coffin Butte Landfill	Coffin Butte	2%	Bandon	Landfill	$0.43
16	Haul to Short Mountain Landfill	Short Mountain	2%	Bandon	Landfill	$0.45

1) – Present worth costs were based on 6 percent interest over 20 years.
2) – These methods will handle only part of the total plant output.
3) – North Bend will only take sludge on an emergency basis and will discontinue this service in the near future.

Land application, the lowest cost method that would handle the full biosolids production of the WWTP, combined with the four lowest cost storage and dewatering methods were chosen for further discussion. Problems are encountered in land application due weather related restrictions. Therefore, the analysis of biosolids will focus on methods of storage or alternate disposal during wet weather periods. Bandon currently needs wet weather disposal for about 100,000 gallons of biosolids, usually in March or April. By the year 2001, the wet weather surplus is projected at about 600,000 gallons and the plant will need to start removing excess sludge by December.

All detailed alternatives are based on the City continuing to land apply biosolids removed from the digesters without further treatment during dry weather months. Each alternative looks at different methods of disposing of surplus sludge that must be removed from the digesters during wet weather. Biosolids are assumed to increase by equal increments each year to reach the 1.2 million gallon level projected for 2021. Present Value costs are for disposal of all biosolids from the WWTP, assuming that all biosolids produced in dry weather are land applied.

Land Application with Reed Bed Dewatering

The existing drying beds, used for reed bed dewatering, have an estimated capacity of about 200,000 gallons of sludge per year. This is adequate capacity to handle the wet weather surplus for the next ten years, but not through the study period. There is the possibility of obtaining donated plants and labor to set up the reed bed, which would lower the first cost, but the experimental nature of establishing a reed bed in Oregon will drive up the administrative costs in dealing with the regulatory authorities. The estimated costs for setting up and running a reed bed system are listed in Table 6.4.2. The capital costs include $20,000 for setting up a pilot project to test the feasibility of the concept.

Table 6.4.2

Costs for Establishing and Maintaining a Reed Bed

Item	Cost ($)
Capital Costs	$56,750
Annual O&M Costs	$3,600
Ten Year Clean Out Cost	$6,200
Cost to Land Apply Remaining Biosolids	$26,150
Present Worth Cost	$474,000

Land Application with Winter Sites

Bandon currently land applies liquid biosolids directly out of the digesters to farm fields, using a City owned tank truck. This was found to be the most cost effective method of application with a proven history. City staff is currently working with DEQ to obtain permits for sites that would allow year around application of biosolids. The City already owns the tank truck, so no additional capital is needed. However, administrative time will be required for obtaining and maintaining the permits, which are estimated to run over 400 hours per year.

Table 6.4.3

Costs for Wet Weather Land applying Biosolids Directly From the Digester

Item	Cost ($)
Capital Costs	$0
Annual O&M Costs	$30,500
Present Worth Cost	$480,000

Land Application with Winter Storage of Thickened Sludge

Bandon already has two screw presses that were designed to thicken digester biosolids to a minimum of 10% solids. Running the biosolids through the presses should reduce the volume by about 75%. The existing sludge drying beds have a flat storage volume of about 50,000 gallons, the equivalent of 200,000 gallons of biosolids before pressing. This is adequate capacity to handle the wet weather surplus for the next ten years, but not through the study period. The biosolids laid in the drying beds would dewater further through drainage, increasing the total capacity of the beds. The cost of running the screw presses is about $0.03 per gallon.

The solids would be too thick for the City tank truck and would need to be loaded into a lined dump truck for delivery to farm application sites, and spread at the site with a manure spreader. It is assumed that the farmer provides the spreader, and that no additional City labor is required after delivery of the biosolids to the farm. A biosolid with 10% solids content has a consistency similar to Jell-O and the assumption is made that only 8 yards are hauled per load in a ten-yard dump truck, to prevent spills.

With this option, there would be no additional capital costs involved, as the City already owns both the presses and the drying beds. The WWTP would need the use of a dump truck, which could be provided through the City public works department. The costs of running a dump truck were assumed to be similar to the tank truck currently operated by the WWTP personnel at $3.13 per mile. This figure includes maintenance and depreciation, which would need to be reimbursed to the Public Works Department from the sewer budget. Costs for thickening sludge and storing it during the winter before land application are included in Table 6.4.4.

Table 6.4.4

Costs for Thickening, Storing and Land Applying Biosolids

Item	Cost ($)
Capital Costs	$0
Annual O&M Costs	$26,400
Cost to Land Apply Remaining Biosolids	$26,150
Present Worth Cost	$543,000

Land Application with Sludge Bed Dewatering

The existing drying beds may be used as is with no cover. The City of North Bend operates similar uncovered drying beds with good results. However, Bandon has the greatest need for storage during the wettest part of the year, a time when drying beds are least effective. With a cover, the drying beds are

estimated to be capable of dewatering about 350,000 gallons of biosolids annually. This is adequate capacity to handle the wet weather surplus for the next twelve years, but not through the study period. Estimated costs to cover and operate the existing sludge drying beds are included in Table 6.4.5.

Table 6.4.5

Costs for Sludge Bed Dewatering and Land Applying Biosolids

Item	Cost ($)
Capital Costs	$60,000
Annual O&M Costs	$6,630
Cost to Land Apply Remaining Biosolids	$23,000
Present Worth Cost	$592,000

Land Application with Private Hauler Removing Surplus Thickened Sludge

Heard Farms in Roseburg offers a service where they will provide use their company tank trucks to haul biosolids from the WWTP. The quoted rate for digested sludge (2% solids) is currently $0.13 per gallon, but they estimate it would be $.20 per gallon for biosolids thickened to 10%. It would cost the City of Bandon an estimated $0.03 per gallon to run the screw press, which reduces the volume to 25% of the original. Each thickened gallon costs $0.12 to press (4 gallons x $0.03) for a total cost to Bandon of $0.32 per gallon to have thickened biosolids hauled off. Since each gallon started out as four gallons of digested biosolids, this equals a cost of $0.08 for each gallon of original biosolids.

Bandon already has the screw presses, so there would be no new capital costs. Costs for operating the screw presses and having Heard Farms haul the thickened material are included in Table 6.4.6.

Table 6.4.6

Costs for Thickening Biosolids & Contracting with Private Hauler for Disposal

Item	Cost ($)
Capital Costs	$0
Annual O&M Costs [1]	$29,130
Cost to Land Apply Remaining Biosolids	$25,800
Present Worth Cost	$630,000

(1) O&M costs for this measure would be very low the first year and increase each year. Figure given here is the average amount based on total biosolids for the 20-year study period.

Matrix Evaluation

Based on this cost analysis, reed beds would be the choice for treating sludge during wet weather. However other factors, play a role in deciding which system is best suited for the needs of the community. A matrix evaluation was performed on each alternative with respect to present worth value, flexibility, capacity, reliability, operability, ability to construct, environmental factors, and community impact. The following is a discussion of this evaluation.

Present Worth Value

The present worth value of each alternative was calculated based on the estimated construction and O&M costs. A comparison of total present worth costs, based on six percent over 20 years, for the alternatives is summarized in Table 6.4.7. Additional information on the cost estimates for these alternatives is given in Appendix C.

Capital costs for the proposed alternatives range from approximately $0 to $60,000. Bandon already owns equipment to implement wet weather application, thickening and storing, and using a private hauler. Reed bed construction and installing a cover on the sludge drying beds both are estimated at about $60,000 initial cost.

Table 6.4.7

Alternatives for Biosolids Disposal

Number	Alternative	Present Value Cost ($)
1	Reed Bed Dewatering	$474,000
2	Wet Weather Land Application	$480,000
3	Thicken & Store for Summer Land Application	$543,000
4	Sludge Bed Dewatering	$592,000
5	Thicken & Contract with Private Hauler	$630,000

Flexibility

Wet weather land application offers the least flexibility due to site access restraints and permit conditions followed by reed bed dewatering. After a reed bed is set up, it must be fed a minimum amount of fluid to keep the plants healthy. Use of the screw press and sludge drying beds offer a large degree of flexibility, as they can batch process varying amounts of biosolids, depending on the needs of the plant. Using a private hauler offers the highest degree of flexibility, providing advance notice is not required for hauling.

Capacity

The capacity of wet weather application is limited by nitrogen uptake and by metals accumulations for each acre of land. Calculations based on the analysis of the previous three years biosolids production from the WWTP demonstrate that about 17 acres of land would be needed for beneficial application of the wet weather production of biosolids in the study period. At this time, the two private haulers contacted have no restriction on capacity for removal of biosolids.

The screw press had adequate capacity to thicken the projected output for the WWTP. However, the existing sludge drying beds have a storage capacity of only 50,000 gallons. Additional storage sites would be needed, or modifications made to the existing beds to increase storage by the end of the study period. Use of the existing drying beds for a reed bed would have a maximum capacity of about 200,000 gallons per year. Use of the existing sludge drying beds as a drying bed would have a maximum capacity of about 350,000 gallons per year.

Reliability

Use of a private hauler is the only option that is independent of the weather. Wet weather application is fairly reliable, but extremely rainy weather, bad road conditions or equipment failure could disrupt this

alternative. Wet weather could also cause problems with storage of thickened sludge in open beds. While a roof over the drying beds would greatly improve their performance, the drying process is still reliant of low humidity, warm temperature and wind evaporation. Reed beds are considered experimental in Oregon, and cannot be assigned a high reliability until the pilot project has proven successful.

Operability

All alternatives use equipment and processes that are familiar to the plant operators. Thickened biosolids would require use of a dump truck, front loader, and manure spreader, equipment that is currently not used at the WWTP. Some training would be required in operation of the screw press, drying beds or reed bed.

Ability to Construct

None of the alternatives require extensive construction. Installation of a sludge bed roof or reed bed could be accomplished without disruption of the WWTP operations.

Environmental Factors

Reed beds are the only alternative that potentially produces a Class A biosolid. The standard reed used to establish a reed bed is Phragmites, a plant considered invasive to native wetlands. Native local wetland plants are recommended to avoid possible contamination of the Bandon Marsh. The other environmental concern is disposal of the annual reed harvest. If the crop is composted or chipped for mulch, then the environmental impact is minimal. Wet weather land application sites would be carefully screened to avoid runoff due to rain or ground water contamination. Use of the sludge drying beds, screw press or a private hauler would have negligible environmental impacts under normal operation.

Community Impact

Use of wet weather sites would have no community impact greater than the current method. The number of trucks leaving the plant would be the same. The distance to the application sites is shorter than the trip to North Bend, reducing the chance of a spill. Use of reed beds could be used to raise community awareness of sewage treatment concerns and showcase the community's support for the environment. However, there is a possibility of odor problems in the old town area. Use of the screw presses poses no community impact, but storage of the thickened sludge or use of the sludge drying beds might cause an odor problem in Old Town. Thickened sludge would require fewer trips for disposal, reducing the number of trips from the WWTP by 25%. Use of the screw press and pick up by a private hauler would result in about 25% fewer trips than the current system.

Summary

For the matrix evaluation, a rating system was employed to compare the alternatives. This rating system consisted of a three point scale - three being the best and one, the worst. Two or more alternatives may have the same rating for a particular parameter. The ratings for the matrix evaluation are summarized in Table 6.4.8.

Table 6.4.8

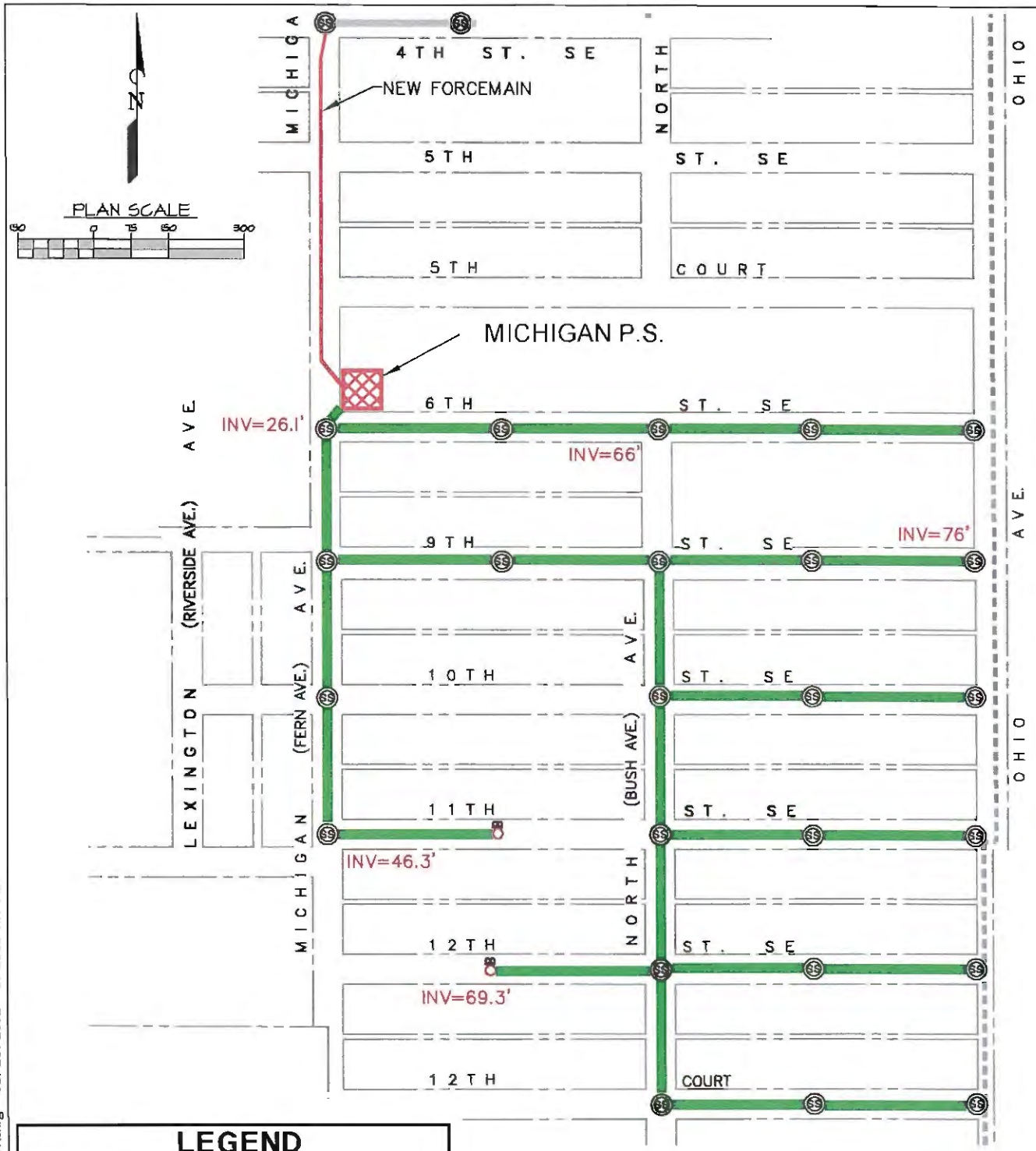
Matrix Evaluation

	Alternative				
Parameter	No. 1	No. 2	No. 3	No. 4	No. 5
Present Worth Cost	3	3	2	2	1
Flexibility	2	2	2	3	3
Capacity	1	3	1	2	3
Reliability	1	2	2	2	3
Operability	2	3	2	2	2
Ability to Construct	2	3	3	2	3
Environmental Factors	3	2	2	2	2
Community Impact	3	3	2	2	3
Total	17	21	16	17	20

Based on the above analysis, Alternatives No. 2 and 5 are considered the highest-ranking alternatives. Alternatives Number 1, 3 and 4 all share the use of the WWTP site for storage, a factor that introduces both the possibility of odor concerns in adjacent neighborhoods and restrictions on capacity. On-site alternatives would require a small-scale test project to see if the process could be conducted without causing odor problems. Capacity issues would not be a concern with any option for at least ten-years, but there is little room for future expansion at the WWTP site.

For the planning period of this Wastewater Master Plan, Alternative No. 2, wet weather land application, is considered the most viable alternative for the City of Bandon's biosolids disposal needs.

Biosolids disposal for the south coast is in a state of flux. A stricter regulatory climate limits disposal options, and the growth in small communities has increased the total volume of biosolids needing disposal sites. Larger communities, that have been able to take biosolids from outside their jurisdiction in the past, are now turning away outside users. Both private haulers and community groups are investigating regional centers for biosolids disposal. These factors could cause major changes in the options available for biosolids disposal in the next five to ten years. The City should plan on reevaluating disposal options within the next five years. It is recommended that the annual operating budget for the WWTP include $5,000 set aside for staff time and outside services for developing biosolids disposal options.



LEGEND

8	SANITARY CLEAN OUT
SS	PROPOSED SANITARY MH
INV=69'	PROPOSED INVERT ELEVATION
	PROPOSED SANITARY SEWER
	PROPOSED PRESSURE MAIN
	PROPOSED PUMP STSTION

NOTE:

1. ALL LINES ARE 8" PIPE UNLESS OTHERWISE NOTED.
2. INVERT ELEVATIONS ARE BASED ON 1929 DATUM.

THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	*CITY OF BANDON WASTEWATER MASTER PLAN*	**FIGURE NO.** 6.1.2
DATE: JUNE, 2002 PROJECT NO.: 4501.35	*OHIO AVE. PROPOSED SEWER LAYOUT*	

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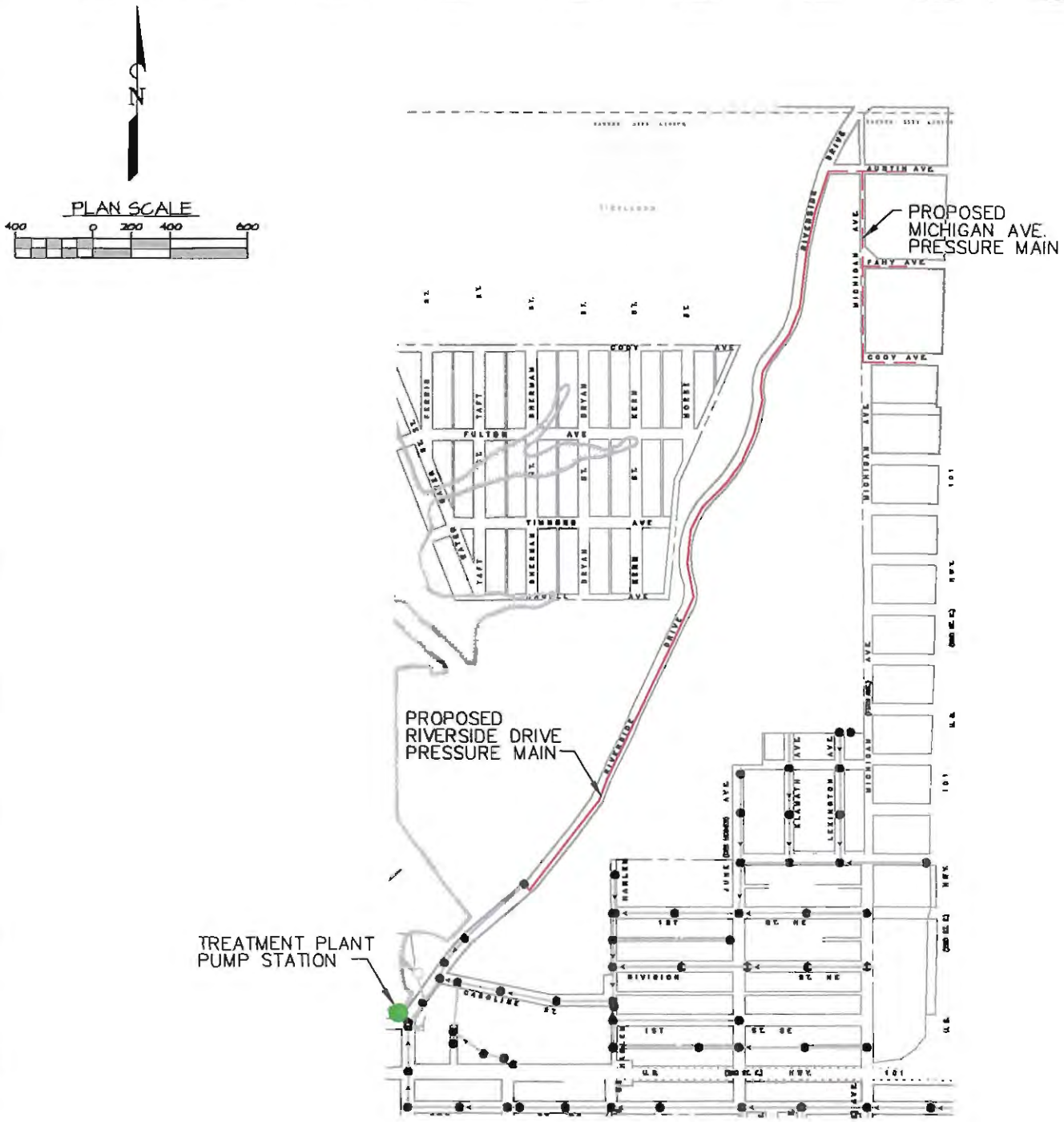

LEGEND

- PROPOSED SANITARY MH
- EXISTING SANITARY SEWER
- PROPOSED SANITARY SEWER
- RIVERSIDE DRIVE PRESSURE MAIN
- MICHIGAN AVE. PRESSURE MAIN

THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	*CITY OF BANDON WASTEWATER MASTER PLAN*	**FIGURE NO.** 6.1.3
DATE: JUNE, 2002	*PROPOSED RIVERSIDE DRIVE PRESSURE MAIN*	
PROJECT NO.: 4501.35		

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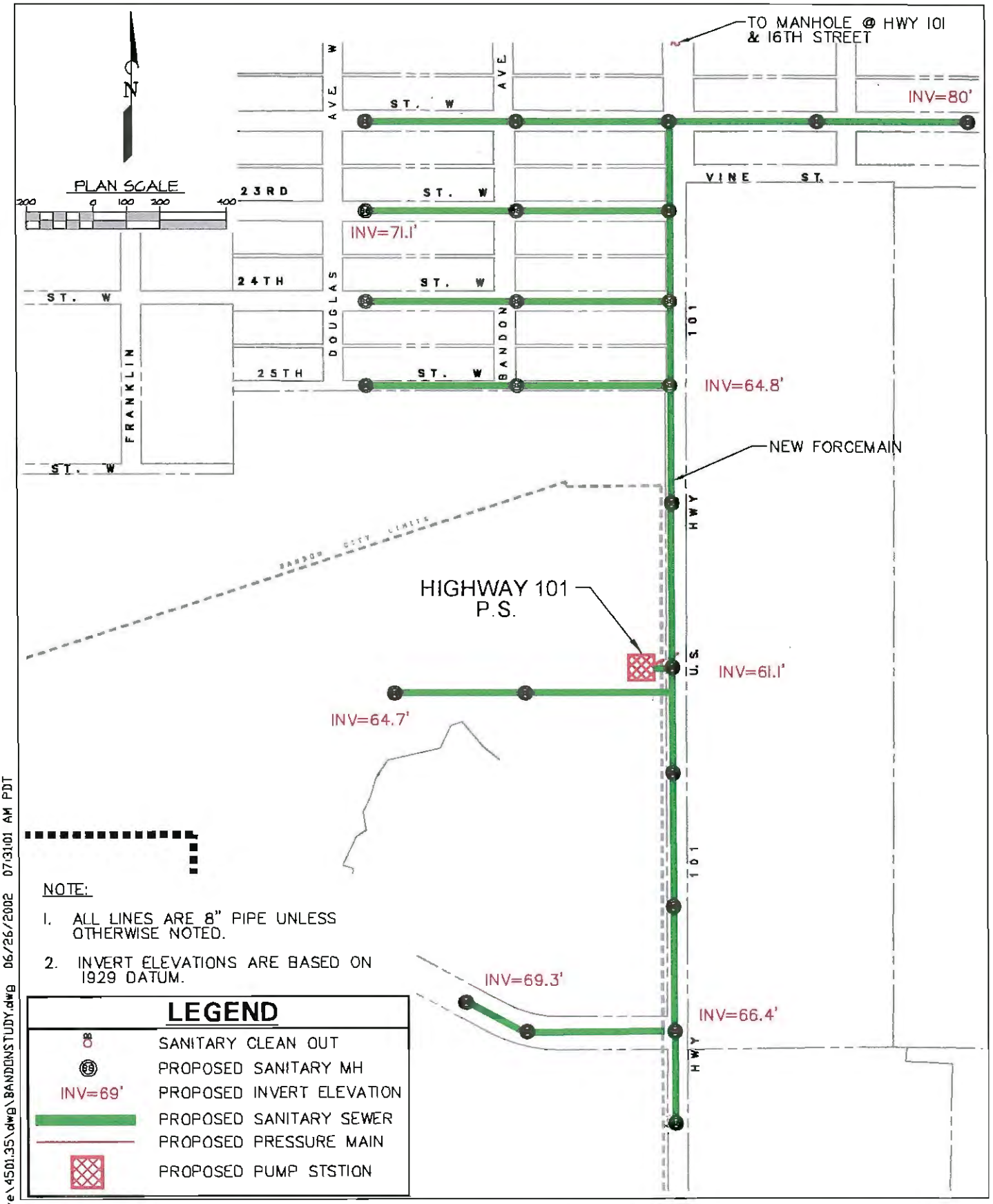

THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	*CITY OF BANDON WASTEWATER MASTER PLAN*	FIGURE NO. 6.1.4
DATE: JUNE, 2002	*PROPOSED HIGHWAY 101 SOUTH PUMP STATION*	
PROJECT NO.: 4501.35		

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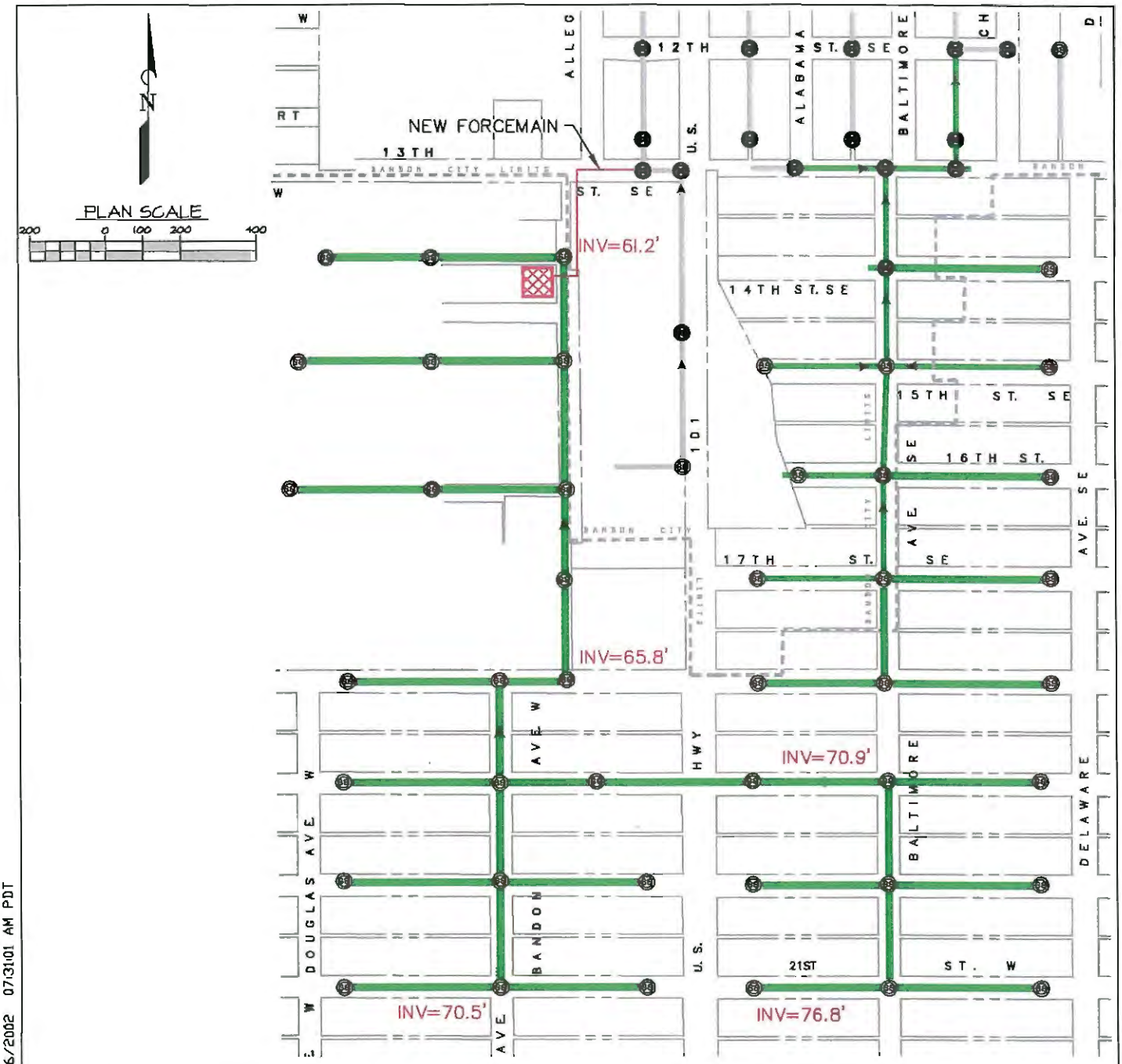

LEGEND

	SANITARY CLEAN OUT
	EXISTING SANITARY SEWER
	PROPOSED SANITARY MH
INV=69'	PROPOSED INVERT ELEVATION
	PROPOSED SANITARY SEWER
	PROPOSED PRESSURE MAIN
	PROPOSED PUMP STSTION

NOTE:

1. ALL LINES ARE 8" PIPE UNLESS OTHERWISE NOTED.
2. INVERT ELEVATIONS ARE BASED ON 1929 DATUM.

THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON WASTEWATER MASTER PLAN***	**FIGURE NO. 6.1.5**
DATE: JUNE, 2002	***PROPOSED ALLEGHENY PUMP STATION & SEWERS***	
PROJECT NO.: 4501.35		

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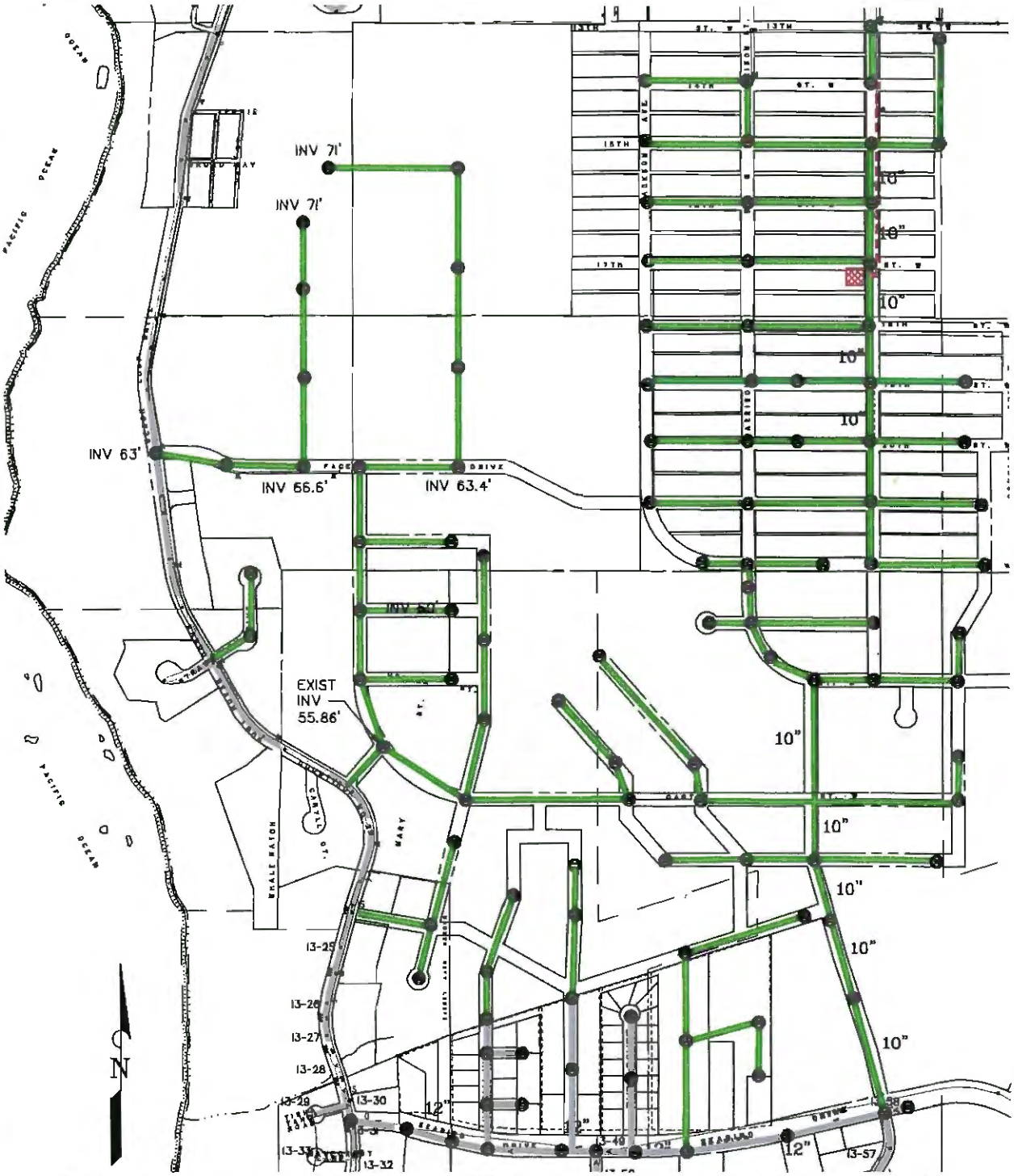

THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	*CITY OF BANDON WASTEWATER MASTER PLAN*	**FIGURE NO.** *6.1.6*
DATE: JUNE, 2002	*SOUTH BANDON PROPOSED SEWERS*	
PROJECT NO.: 4501.35		

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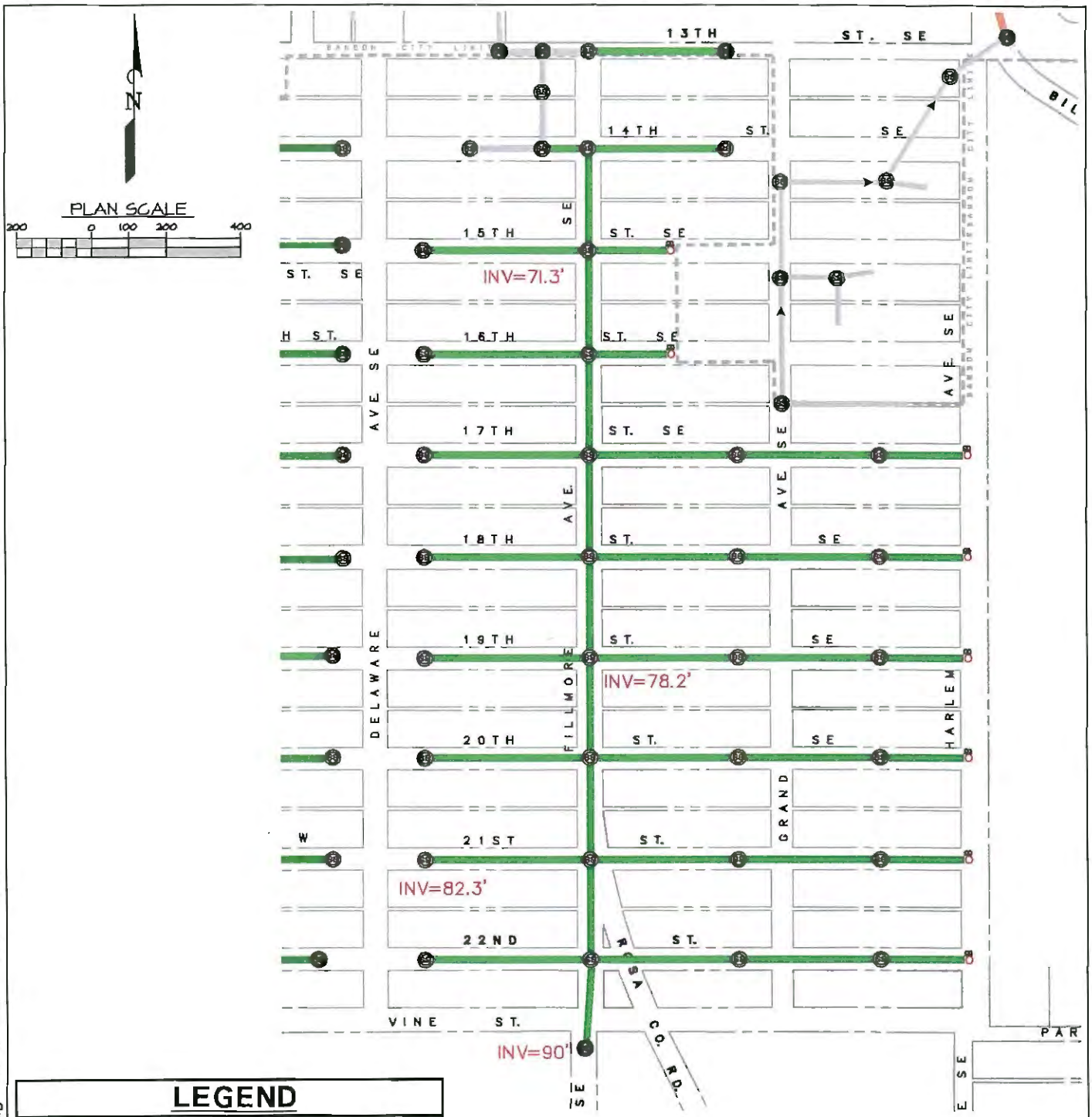

LEGEND

8	SANITARY CLEAN OUT
(S)	PROPOSED SANITARY MH
	EXIST. SANITARY SEWER
	PROPOSED SANITARY SEWER
INV=91'	PROPOSED INVERT ELEVATION

NOTE:

1. ALL LINES ARE 8" PIPE UNLESS OTHERWISE NOTED.
2. INVERT ELEVATIONS ARE BASED ON 1929 DATUM.

THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	*CITY OF BANDON WASTEWATER MASTER PLAN*	**FIGURE NO. 6.1.7**
DATE: JUNE, 2002	*ROSA ROAD PROPOSED SEWER LAYOUT*	
PROJECT NO.: 4501.35		

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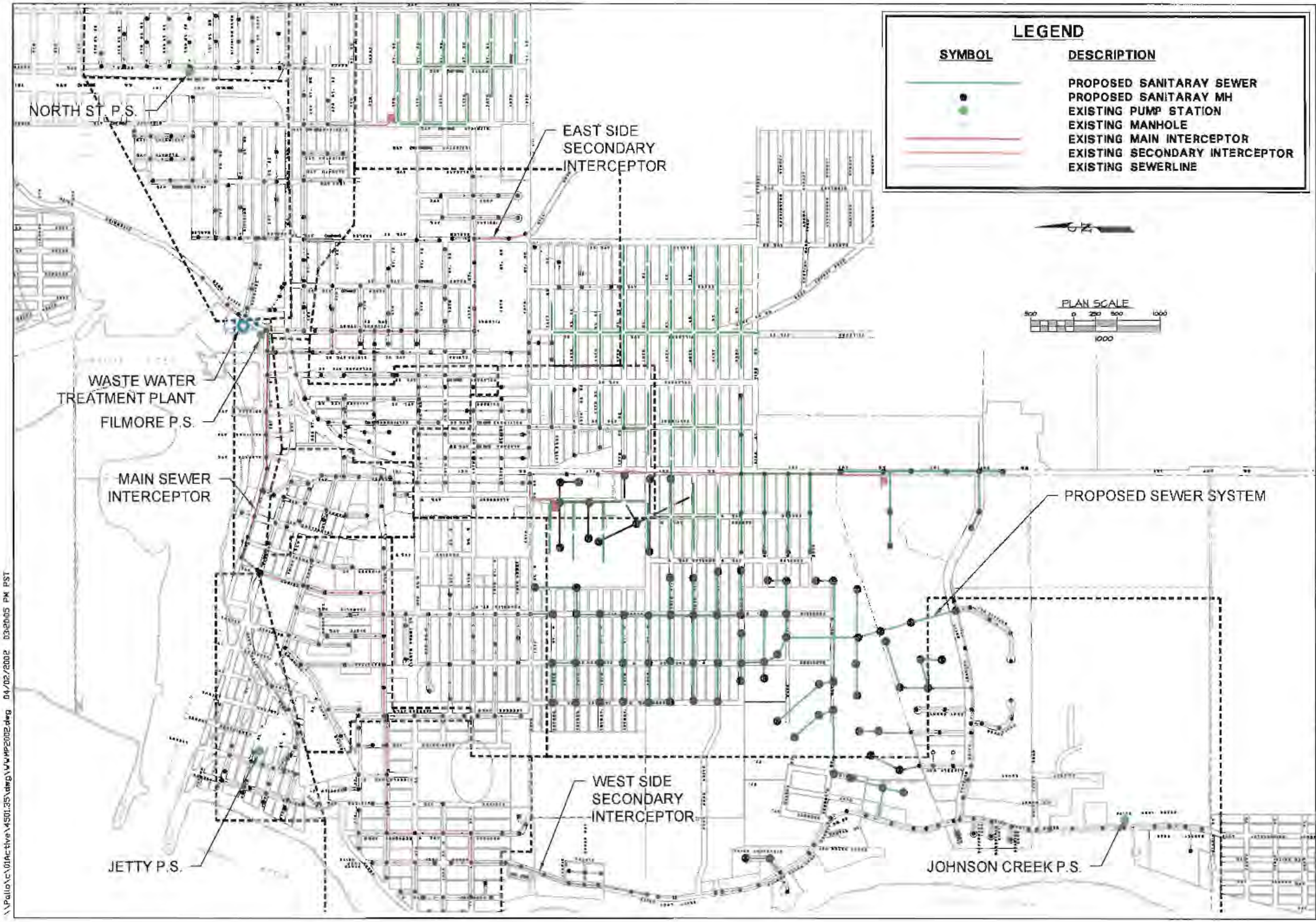

FIGURE NO. 6.18

CITY OF BANDON
WASTEWATER MASTER PLAN
PROPOSED SEWER LAYOUT

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
DATE: JUNE, 2002
PROJECT NO.: 4501.35

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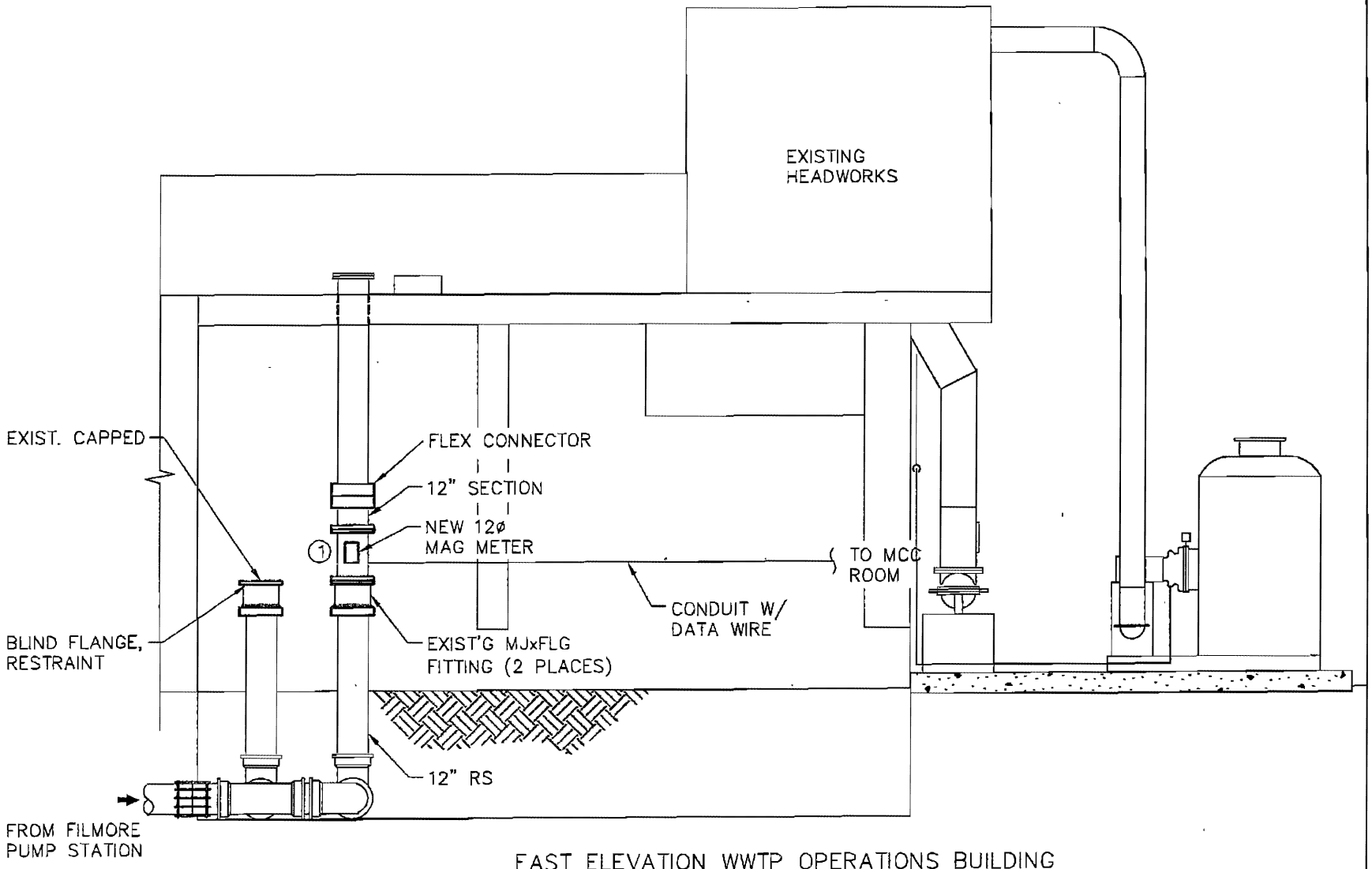


EAST ELEVATION WWTP OPERATIONS BUILDING

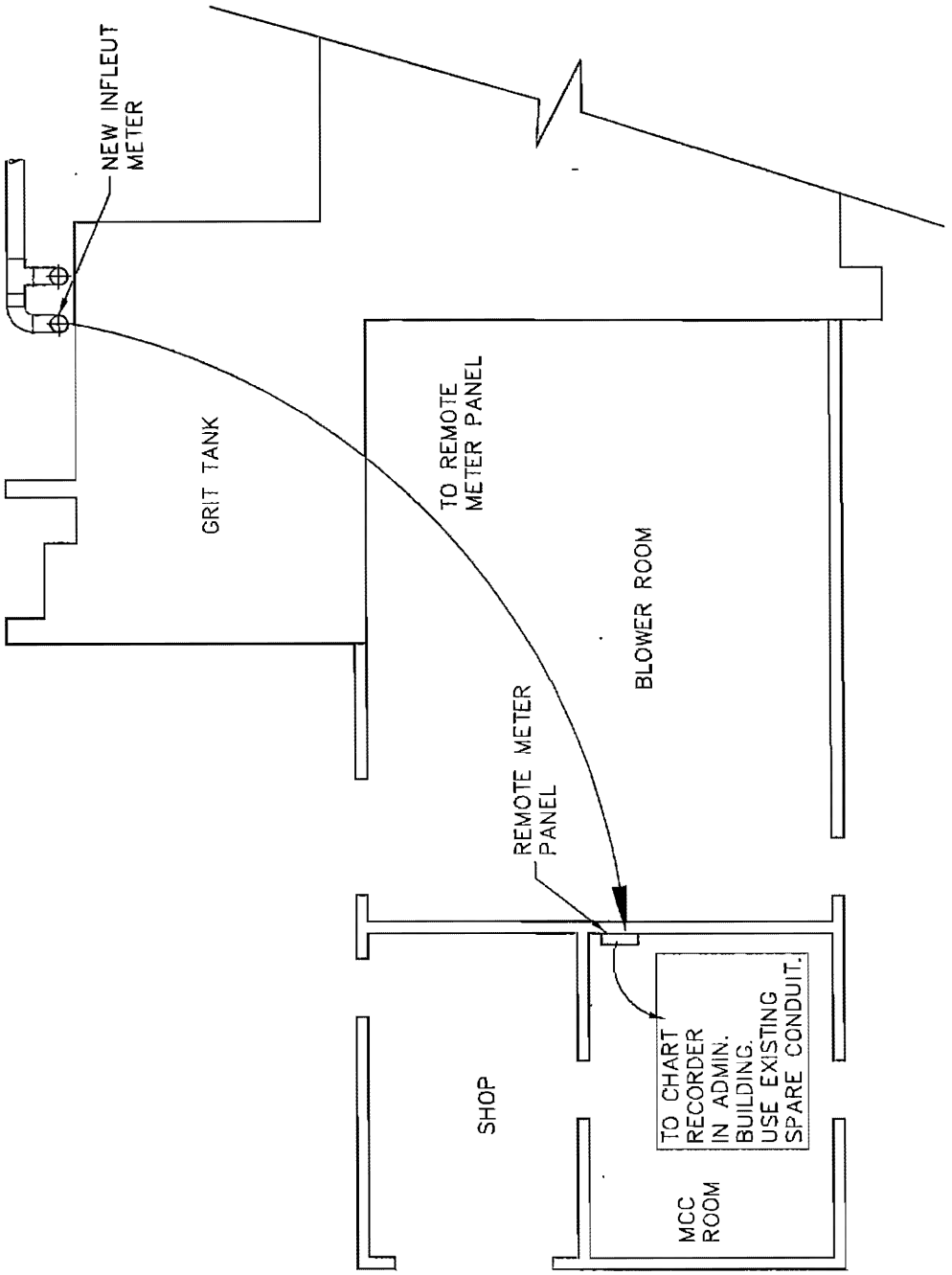
① PROVIDE ADDITIONAL SECTION OF PIPE W/ MJxFLG ON ONE END, SIZED TO REPLACE METER PLUS 12" FOR TEMPORARY DUTY DURING METER SERVICING.

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

DATE: JUNE, 2002
PROJECT NO.: 4501.35

CITY OF BANDON
WASTEWATER MASTER PLAN
PROPOSED INFLUENT METER

FIGURE NO.
6.2.1



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THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON*** ***PLAN VIEW PROPOSED INFLUENT. METER CONNECTIONS***	**FIGURE NO.** **6.2.2**
DATE: JUNE, 2002	***BANDON WWTP***	
PROJECT NO.: 4501.35		

Section

7

Recommended Plan

Section 7

Recommended Plan

7.1 Existing Conveyance System Improvements

Improvements proposed for the collection system are directed to correct sources of I/I and system deficiencies identified in Section 6.1 and the December 2001 I/I Study. Proposed improvements include pipeline lining and replacement, manhole rehabilitation, and pump station repairs and replacements.

I/I work

It is recommended that work continue to identify and correct I/I in the existing system. Eight projects were identified in the 2001 Bandon I/I Study to correct I/I problems with an associated cost estimate of $878,085. The first project, Line Replacement of Ocean Drive & 4th Street Sewers, was completed in July 2002. This leaves $644,575 to be budgeted to complete the projects recommended in the I/I study as listed in Table 7.1.1.

Table 7.1.1

Remaining Recommended I/I Improvements Projects [1]
(From December 2001 I/I Study)

Project Number	I/I Study Number	Basin	Description	Total Project Cost
C	No. 2	7	Lining/Line Replacement-Oregon Avenue	$ 164,920
G	No. 3	12	Lining-9th Street W, 11th Street W & Franklin Avenue	$ 233,635
H	No. 4	2	Lining-Harlem Avenue	$ 48,390
I	No. 5	11	Lining-Newport Avenue	$ 39,735
J	No. 6	10	Lining-Jackson Avenue	$ 64,775
K	No. 7	3	Lining-3rd Street SE	$ 68,620
L	No. 8	All	Manhole Grouting, Spot Repairs, Lateral Reconstruction	$ 24,500
-	-	-	**Overall Total**	**$ 644,575**

(1) Note: Project No. 1 from the I/I study has been completed.

Basin 6 was flow mapped in January 2002 and found to have potential I/I problems. It is recommended that $1,500 be budgeted for television inspection of the areas identified in Figure 3.2.2.

Pipe Capacity

Two sections of existing pipeline were found to be undersized for current flows. The sections recommended for replacement are identified in Figure 6.1.1 and are located on Edison Avenue and on Oregon Avenue.

Estimated cost for replacing the existing eight-inch pipe on Edison Avenue with 12-inch, using open trench construction is $56,500.
Estimated cost for replacing the existing eight-inch pipe on Oregon Avenue with 12-inch, using open trench construction is $133,420.

Pump Stations

Deficiencies were found at all four pump stations, some fairly minor. Recommended improvements are as follows:

Filmore Avenue Pump Station
Install a new tide gate to prevent river water from back flowing into the pump station at high tide. Estimated construction cost is $2,400.

South Jetty Pump Station
Replace the generator timer. Estimated construction cost is $500.

North Avenue Pump Station
Rebuild the pumps this year and budget to install a new above ground packaged pump station in the next five years. Estimated cost to replace the pump impellors and seals using in-house labor is $4,000. The estimated cost to install an above ground pump station is $126,000.

Johnson Creek Pump Station
Build a new pump station located above the floodplain. Reuse the existing generator and wet-well. Locate the wet-well outside of the pump station. Estimated construction cost is $265,000.

7.2 Collection System Expansions

The service areas for expansion have been divided into five separate areas all of which can be served with either conventional gravity systems, pressure sewer systems, or a combination of the two. Riverside Drive was evaluated, but is not recommended for connection to the sanitary sewer system due to the high cost per EDU. DEQ requires special on-site treatment systems in the Riverside Drive area as replacement systems when existing conventional septic drain fields fail. As regulatory requirements and prices for special systems increase, residents in this area may chose to form a local utility district and connect to the public system.

The proposed collection system expansions are presented as guidelines for future expansion, and are not directly recommended for construction. Current City policy is to allow connections only to properties within the City limits and to require developers to pay for line extensions to serve their development. An exception is made where the property is located on a street that forms the City boundary and sewer lines are already installed. The Ohio Avenue and Highway 101 South areas are within the City limits, the other projects are in the UGB. Projects in the Ohio Avenue, Highway 101 South, Allegany Avenue and South Bandon areas will require pump stations and pressure mains to be installed before service may be extended. These projects are detailed in Section 6.1. The estimated construction costs for each area are summarized in Table 7.2.1.

Table 7.2.1

Collection System Expansion Costs Summary (EDUs at Build-out)

Area	Estimated Cost (millions)	EDUs	Cost Per EDU
Ohio Avenue	$1.1	270	$4,000
Highway 101 South	$1.4	270	$5,200
Allegany Avenue	$1.2	340	$3,500
South Bandon	$3.8	900	$4,200
Rosa Road	$1.1	370	$3,000

The costs per EDU can be used as an estimate for the assessments required if each of the five areas forms a local improvement district (LID). If each EDU pays this cost, the collection system can be installed. Costs for any required treatment plant expansion would be in addition to the LID costs. Plant expansion is not necessary to meet the projected load for the year 2021, but will be necessary before full build-out is reached in the UGB.

The improvements and costs discussed in the Plan assume that the selected growth rate occurs relatively evenly throughout the study area. Some improvements may be phased differently than assumed if different growth patterns occur. It is anticipated that a spurt of rapid development would occur directly adjacent any new line extension. With a specific service area selected, a predesign report should be completed with a more accurate determination of LID assessments included.

7.3 Treatment Facility Improvements

The WWTP has adequate capacity to meet the projected load for the anticipated 20-year population growth, based on the original construction design data. One project is recommended to improve treatment efficiency and two measures to correct deficiencies in metering and recording plant flows.

Installation of a RAS monitoring and control system would enable the operators to maintain a more accurate food to mass ratio and optimize the secondary treatment process. Estimated construction cost is $12,000.

Replacing the existing chart recorder and recording modules would improve the accuracy of the WWTP flow records. The existing equipment is out-dated and is not recording flows accurately. The estimated replacement cost, including calibration, training and engineering is $25,000.

Installation of a new influent mag-meter at the headworks of the WWTP would provide accurate information for calculating mass loads, by passes and hydraulic loads, thereby improving the operating efficiency of the plant. Estimated installation cost is $21,000.

7.4 Biosolids Disposal

One of the largest concerns facing the WWTP operating staff is the timely removal and disposal of biosolids from the WWTP digesters. The recommended biosolids measure for dealing with disposal

is to develop wet weather application sites. While this measure involves minimal capital outlay, there will be a considerable investment in staff time to obtain and maintain permits for these sites.

The City should continue to pursue opportunities to increase the flexibility for biosolids disposal. Options involving the existing sludge drying beds received a lower rating in Section 6.4 due to lack of capacity and concerns involving the possibility of odor generation. However, small-scale test projects could be run at minimal cost to assess the viability of these alternatives to handle a portion of the digesters' output. The WWTP staff is currently preparing to run the existing screw presses and will use the sludge drying beds to test the feasibility of storing and drying dewatered biosolids. In addition to this test, it is recommended that one sludge drying bed be used to run a dewatering test on digester biosolids during dry weather. A recommended annual budget for staff time and incidental costs associated with pursuing additional permit sites and on-site biosolids storage options is $3,500.

The City participated in Phase I of the regional biosolids study. Phase II of this study will identify the preferred option for a regional disposal center and is in the process of fund acquisition. As a regional disposal center may provide small municipalities an option for biosolids disposal, it is recommended that the City continue its participation in the project. The Phase II contribution solicited for participation by small municipalities is $1,700.

7.5 Project Cost Summary

Capital costs for the recommended projects are summarized in Table 7.5.1. The estimated project cost total, including construction, engineering, contingency and administration is $1,291,895. Projects are listed in priority order.

Table 7.5.1

Capital Costs of Recommended Projects

#	Project Description	Project
A	Filmore Avenue Pump Station Tide Gate	$2,400
B	North Avenue Pump Station Impellors	$4,000
C	I/I Project # 2	$164,920
D	Oregon Avenue Line Upsize	$133,420
E	Johnson Creek Pump Station Replacement	$265,000
F	New Metering Recording System	$25,000
G	I/I Project # 3	$233,635
H	I/I Project # 4	$48,390
I	I/I Project # 5	$39,735
J	I/I Project # 6	$64,775
K	I/I Project # 7	$68,620
L	I/I Project # 8	$24,500
M	New Influent Meter	$21,000
N	Automatic RAS Control	$12,000
O	North Avenue Pump Station Replacement	$126,000
P	Edison Avenue Line Upsize	$56,500
Q	Basin 6 Television Inspection	$1,500
R	Jetty Pump Station Generator Timer	$500
	Total	$1,291,895

A break down of project capital costs, including expansion projects, to show funding responsibility under current City policy is included in Table 7.5.2.

Table 7.5.2

Associated City, Private and SDC Improvement Costs

#	Priority	Project Description	City Project	SDC Eligible	Private Project	Total Cost
A	1	Filmore Avenue PS Tide Gate	$2,400	$0	$0	$2,400
B	1	North Avenue PS Impellors	$4,000	$0	$0	$4,000
C	2	I/I Project # 2	$115,420	$49,500	$0	$164,920
D	2	Oregon Avenue Line Upsize	$0	$133,420	$0	$133,420
E	3	Johnson Creek PS Replacement	$265,000	$0	$0	$265,000
F	4	New Metering Recording System	$25,000	$0	$0	$25,000
G	5	I/I Project # 3	$163,635	$70,000	$0	$233,635
H	6	I/I Project # 4	$33,890	$14,500	$0	$48,390
I	6	I/I Project # 5	$27,735	$12,000	$0	$39,735
J	6	I/I Project # 6	$44,775	$20,000	$0	$64,775
K	6	I/I Project # 7	$48,620	$20,000	$0	$68,620
L	6	I/I Project # 8	$17,150	$7,350	$0	$24,500
M	7	New Influent Meter	$21,000	$0	$0	$21,000
N	7	North Avenue PS Replacement	$126,000	$0	$0	$126,000
O	8	Automatic RAS Control	$12,000	$0	$0	$12,000
P	9	Edison Avenue Line Upsize	$0	$56,500	$0	$56,500
Q	10	Basin 6 Television Inspection	$1,500	$0	$0	$1,500
R	Done	Jetty PS Generator Timer	$500	$0	$0	$500
		Recommended Project Subtotal	**$908,625**	**$383,270**	**$0**	**$1,291,895**
S	-	Ohio Avenue Sewer Expansion	$0	$420,000	$680,000	$1,100,000
T	-	Highway 101 South Sewer Expansion	$0	$483,200	$916,800	$1,400,000
U	-	Allegany Avenue Sewer Expansion	$0	$0	$1,200,000	$1,200,000
V	-	South Bandon Sewer Expansion	$0	$0	$3,800,000	$3,800,000
W	-	Rosa Road Sewer Expansion	$0	$0	$1,100,000	$1,100,000
		Expansion Project Subtotal	**$0**	**$903,200**	**$7,696,800**	**$8,600,000**
		Total	**$908,625**	**$1,286,470**	**$7,696,800**	**$9,891,895**

7.6 Project Summary

A brief description of each project is included below.

Projects A, B, & R

Pump Station Improvements: Repairs necessary to maintain proper operation of existing pump stations.

- Filmore Pump Station: Replace leaking tide gate.
- Jetty Pump Station: Replace generator timer.
- North Avenue Pump Station: Replace impellors.

Cost is estimated at **$6,900.**

Projects C & G-L

Infiltration and Inflow Rehabilitation: Lining and replacement of sewer lines as identified in the February I/I Study. This work is required for the WWTP to have adequate capacity for the next 20 years. Cost is estimated at **$644,575.**

Projects D & P

Sewer Line Capacity Improvements: Upsize of existing sewer lines that are currently at or over capacity. Includes replacement of approximately 220 feet of pipe on Edison Avenue between Jetty Road and First Street and 520 feet of pipe on Oregon Avenue between Fourth and Eighth Street West. Cost is estimated at **$189,920.**

Projects E & N

Pump Station Replacements: Replacement of pump stations that have operational and safety problems due to their age and construction.

- North Avenue Pump Station: Confined space requirements, failure to meet NFPA 820 and the discontinuation of support by the manufacturer are concerns for this facility. Replace with an above ground packaged station.
- Johnson Creek Pump Station: Failure to meet NFPA 820, damage due to previous flooding, deterioration due to age, maintenance difficulties due to lack of parts and type of equipment, and loss of service during high water conditions are concerns for this facility. Replace with a conventional pump station raised above the floodplain.

Cost is estimated at **$391,000**.

Projects F, M, & O

Wastewater Treatment Plant Controls & Metering: Installation of new monitoring and metering equipment. Includes installation of a new influent meter, replacement of the outdated and/or nonfunctioning recording system, and installation of automatic RAS control. Cost is estimated at **$58,000.**

Project Q

Television Inspection of Basin 6: Inspect existing sewer lines with a video camera to determine the source of excess I/I detected during winter rains. Cost estimated at **$1,500.**

Total recommended project cost is estimated at **$1,291,895.**

Projects S-W are expansion projects and are not recommended at this time.

Financing Options

Section

8

Section 8

Financing

Most communities are unable to finance major infrastructure improvements without some form of governmental funding assistance, such as low interest loans or grants. In this Section, a number of major Federal/State funding programs and local funding mechanisms that are appropriate for the recommended improvements are discussed. A recommended financing strategy for the proposed infrastructure system improvements is also presented along with a discussion of the potential impact to rate payers.

8.1 Grant and Loan Programs

Some level of outside funding assistance in the form of grants or low interest loans may be necessary to make the proposed improvement projects affordable for the City of Bandon and it's citizens. The amount and types of outside funding will dictate the amount of local funding that the City must secure. In evaluating grant and local programs, the major objective is to select a program, or a combination of programs, which are most applicable and available for the intended project.

A brief description of the major Federal and State funding programs that are typically utilized to assist qualifying communities in the financing of infrastructure improvement programs is given below. Each of the government assistance programs has particular prerequisites and requirements. These assistance programs promote such goals as aiding economic development, benefiting areas of low to moderate-income families, and providing for specific community improvement projects. With each program having its specific requirements, not all communities or projects may qualify for each of these programs.

Economic Development Administration (EDA) Public Works Grant Program

The EDA Public Works Grant Program, administered by the U.S. Department of Commerce, is aimed at projects which directly create permanent jobs or remove impediments to job creation in the project area. Thus, to be eligible for this grant, a community must be able to demonstrate the potential to create jobs from the project. Potential job creation is assessed with a survey of businesses to demonstrate the prospective number of jobs that might be created if the proposed project was completed.

Proposed projects must be located within an EDA-designated Economic Development District. Priority consideration is given to projects that improve opportunities for the establishment or expansion of industry and that create or retain private sector jobs in both the near-term and long-term. Communities, which can demonstrate that the existing system is at capacity (i.e. moratorium on new connections), have a greater chance of being awarded this type of grant. EDA grants are usually in the range of the 50 to 80 percent of the project cost; therefore some type of local funding is also required. Grants typically do not exceed 1 million dollars.

Water and Waste Disposal Loans and Grants (Rural Development)

The Rural Development Administration (Rural Development) manages the loans and grants for wastewater programs that used to be overseen by the Farmers Home Administration. While these programs are administered by a new agency, the program requirements are essentially the same. The Rural Utilities Service (RUS) is one of three entities that comprise the USDA's Rural Development mission area. The RUS supports various programs that provide financial and technical assistance for development and operation of safe and affordable water supply systems and sewer and other forms of waste disposal facilities.

Rural Development has the authority to make loans to public bodies and non-profit corporations to construct or improve essential community facilities. Grants are also available to applicants who meet the median household income (MHI) requirements. Eligible applicants must have a population less than 10,000. Priority is given to public entities in areas smaller than 5,500 people to restore a deteriorating water supply, or to improve, enlarge, or modify a water facility and/or inadequate waste facility. Preference is given to requests that involve the merging of small facilities and those serving low-income communities.

In addition, borrowers must meet the following stipulations:

- Be unable to obtain needed funds from other sources at reasonable rates and terms.
- Legal capacity to borrow and repay loans, to pledge security for loans, and to operate and maintain the facilities or services.
- Financially sound and able to manage the facility effectively.
- Financially sound facility based on taxes, assessments, revenues, fees, or other satisfactory sources of income to pay all facility costs including operation and maintenance, and to retire the indebtedness and maintain a reserve.
- Water and waste disposal systems must be consistent with any development plans of State, multi-jurisdictional area, counties, or municipalities in which the proposed project is located. All facilities must comply with Federal, State, and local laws including those concerned with zoning regulations, health and sanitation standards, and the control of water pollution.

Loan and grant funds may be used for the following types of improvements:

- Construct, repair, improve, expand, or otherwise modify waste collection, pumping, treatment, or other disposal facilities. Facilities to be financed may include such items as sewer lines, treatment plants, including stabilization ponds, storm sewer facilities, sanitary landfills, incinerators, and necessary equipment.
- Legal and engineering costs connected with the development of facilities.
- Other costs related to the development of the facility including the acquisition of right-of-way and easements, and the relocation of roads and utilities.
- Finance facilities in conjunction with funds from other agencies or those provided by the applicant.

Interim commercial financing will normally be used during construction and Rural Development funds will be available when the project is completed. If interim financing is not available or if the project cost is less than $50,000, multiple advances of Rural Development funds may be made as construction progresses.

The maximum term on all loans is 40 years. However, no repayment period will exceed any statutory limitation on the organization's borrowing authority, nor the useful life of the improvement of the facility to be financed. Interest rates are set quarterly and are based on current market yields for municipal obligations. Current interest rates may be obtained from any Rural Development office.

The following rates currently apply for the Rural Development program:

Market rate. Those applicants pay the market rate whose median household income (MHI) of the service area is more than the $27,756 (Oregon non-metropolitan MHI). The market rate is currently 5.00%.

Intermediate rate. The intermediate rate is paid by those applicants whose MHI of the service area is less than $27,756 but greater than $22,205. The intermediate rate is currently 4.75%.

Poverty line rate. Those applicants whose MHI of the service area is below $22,205 (80% of the non-metropolitan MHI) pay the lowest rate. Improvements must also be to correct a regulatory violation or health risk issue to qualify for this lowest rate. The current poverty line rate is 4.50%.

Maximum grant amounts, based on MHI, are provided in Table 8.1.1. The grants are calculated on the basis of eligible costs that do not include the costs attributable to reserve capacity or interim financing. In addition, grant funds cannot be used to reduce total user costs below that of comparable communities funded by RUS.

Table 8.1.1
Maximum Rural Development Grant Funds Based On Median Household Income

Median Household Income (MHI)	Maximum Grant [a]	Interest Rate [b]
<$22,205	45%	4.5%
$22,205 - $27,756	45%	4.75%
>$27,756	0%	5.00%

[a] MHI<22,205 may be considered for a grant up to 75% of eligible project cost if the project is needed to alleviate a health or sanitary problem.
[b] Rates apply for quarter ending June 30, 2002.

Eligibility for the Rural Water and Waste Disposal grants and loans are currently based on 1990 Census data. The MHI in the City of Bandon, based on 1990 Census data, is $17,708. At this MHI, the City could be eligible for a maximum grant of up to 75% of the total project cost. The City may also eligible for a Rural Development loan at the intermediate rate of 4.75%.

There are other restrictions and requirements associated with these loans and grants. If the City becomes eligible for grant assistance, the grant will apply only to eligible project costs. Additionally, grant funds are only available after the City has incurred long-term debt resulting in an annual debt service obligation equal to 0.5% of the MHI. In addition, an annual funding allocation limits the Rural Development funds. To receive a Rural Development loan, the City must secure bonding authority, usually in the form of general obligation or revenue bonds.

Rural Utilities Service funds, for use in Oregon, are limited by an annual funding allocation. Because of the success of the Rural Utilities Service Grant and Loans and tightening of the Federal budget, it is becoming increasingly difficult to obtain sole funding from Rural Development for a large project. Rural Development staff believes the maximum amount of grant funding would consist of a 50 percent split between grant and loan funds. Unless Rural Utilities Service receives an increase in funding, the amount of loan and grant funds for any given project is likely to be limited to approximately $3.5 million and $1.0 million, respectively.

Applications for financial assistance are made at area offices of the Rural Development. For additional information on Rural Development loans and grant programs call 1-541-673-0136 or visit the RUS website at http://www.usda.gov/rus/water/. The Oregon Rural Development website is http://www.rurdev.usda.gov/or/.

Technical Assistance and Training Grants (TAT)

Available through the USDA Rural Utilities Service (RUS) as part of the Water and Waste Disposal programs, TAT grants are intended to provide technical assistance and training to associations on a wide range of issues relating to the delivery of water and waste disposal services.

Rural communities with populations of less than 10,000 persons are eligible along with private, nonprofit organizations that have been granted tax-exempt status by the IRS.

TAT funds may be used for the following activities:

- Identify and evaluate solutions to water and/or waste related problems of associations in rural areas.
- Assist entities with preparation of applications for Water and Waste Disposal loans and grants.
- Provide training to association personnel in order to improve the management, operation and maintenance of water and/or waste disposal facilities.
- Pay expenses related to providing the technical assistance and/or training.

Grants may be made for up to 100% of the eligible project costs. Applications are filed with any USDA Rural Development office. For additional information on Rural Development loans and grant programs call 1-541-673-0136 or visit the RUS website at http://www.usda.gov/rus/water/.

Oregon Community Development Block Grant (OCDBG) Program

The Community Development Program section of the Oregon Economic and Community Development Department (OECDD) administers the OCDBG Program. Funds for the program come

from the U.S. Department of Housing and Urban Development. OCDBG funds under the Public Works category are targeted to water and wastewater systems. Oregon has approximately six million dollars targeted for public works projects in 2002.

To receive a grant the applicant must meet the following criteria:

- Be a City or County located in a non-metropolitan area of rural Oregon.
- Have over 51% of population considered low and moderate income in target area based on census data or a local survey.
- Have received less than $750,000 in grants from this program in the previous five years for wastewater projects.
- Have drinking water/waste disposal rates at or above 1.75% of the median annual household income for the target area.
- Have a local match of a minimum of 15% local funding.
- List the project on their top ten Needs and Issues Priority List.
- Use the funds to benefit current residents in a primarily residential area.

Eligible activities include the following categories:

- Public Works Water and Sewer Improvements
- Public Works Infrastructure for New Low/Moderate Income Housing
- Emergency Projects
- Projects which are necessary to bring municipal water and sewer systems into compliance with the requirements of the Safe Drinking Water Act or the Clean Water Act administered by the Oregon Health Division (OHD) or the requirements of water quality statutes, rules or permits administered by the Oregon Department of Environmental Quality (DEQ) or the Environmental Quality Commission (EQC)
- Projects where the municipal system has been issued a notice of non-compliance from the Oregon Health Division or the Department of Environmental Quality or it is determined that there is a high probability that within two years the system will be notified of non-compliance.

Public works project grants are limited to $750,000 for the combined total of all phases. Applications may be submitted year-round for Public Works grants under the OCDBG Program. Based on a local survey, 56.70% of residents in Bandon are Low/Moderate Income, so the City qualifies to apply for grants under this program. The 2000 census data will be released in July 2002 and will supercede previous census and survey data. Income levels for Bandon may no longer meet the eligibility guidelines.

For additional information on the OCDBG programs, call 1-800-233-3306 or visit the OECDD website at http://www.econ.state.or.us/cdbg.htm.

Oregon Special Public Works Fund

The Special Public Works Fund (SPWF) program provides financing to local governments to construct, improve, and repair infrastructure in order to support local economic development and create new jobs locally, especially family wage jobs. In order to be eligible, the following conditions must be satisfied.

- The existing infrastructure must be insufficient to support current or future industrial or eligible commercial development; and

- There must be a high probability that family wage jobs will be created or retained within: 1) the boundary to be served by the proposed infrastructure project or 2) industrial or eligible commercial development of the properties served by the proposed infrastructure project.

The SPWF program is capitalized by the Oregon State Legislature through biennial appropriations from the Oregon Lottery Economic Development Fund, through bond sales for dedicated project funds, through loan repayments and other interest earnings. The Oregon Economic and Community Development Department (OECDD) administers the fund.

Eligible activities include wastewater treatment facilities and all facilities necessary for collecting, pumping, treatment and disposal of sanitary sewage and storm drainage. The following criteria are used to determine project eligibility.

- *Firm Business Commitment.* In addition to creating or retaining of permanent jobs as a result of the project, there must be private and/or public investment in the project equal to at least twice the SPWF funding.

- *Capacity Building.* The applicant is required to document: 1) recent interest benefited by the project, 2) there are ongoing efforts to market the area, and 3) the project will promote future economic development and creation of jobs.

All projects must principally benefit industrial or eligible commercial users.

The Department will structure a financing package that may include loans and/or grants. Final amount of financing and the loan/grant/bond mix is determined by such factors as the financial feasibility of the project, applicant's credit strength, the ability to assess specially benefited property owners, applicant's ability to afford annual loan payments, and future beneficiaries of the project.

Maximum SPWF loan per project is $10 million, if funded from SPWF revenue bond proceeds. Projects financed directly from the SPWF may receive up to $1 million. Interest rates are no less than 6.5 percent and are set quarterly by the Department; loan terms cannot exceed 25 years. The maximum SPWF grant is $500,000 for a construction project and is not to exceed 85 percent of the total project cost. Grants are made only when loans are not feasible.

For additional information on the OCDBG and other OECDD programs, call 1-800-233-3306 or visit the OECDD website at http://www.econ.state.or.us/spwf.htm.

Water/Wastewater Financing Program

The Water/Wastewater Financing Program was designed for communities that must meet Federal and State mandates to provide safe drinking water and adequate treatment and disposal of wastewater. The legislation was intended to assist local governments meet the Safe Drinking Water Act and the Clean Water Act. The Oregon State Legislature capitalizes the funding for this program through a biennial appropriation from the Oregon Lottery Economic Development Fund. The program is administered by OECDD, Community Development Programs Section. Program eligibility is limited to projects necessary to ensure compliance with the applicable State regulatory agency standards or rules.

While loans and grants may be awarded, grant funding must be accompanied by loans from the Community Development Program. Loans are based on a municipality's ability to repay. Grant funding is available only if a loan is not feasible. OECDD will structure a financing package that may include direct loans, bond loans, and/or grants and may include funds from other Community Development programs for which the project is eligible. The mix of loan/grant/bond financing will depend on the financial feasibility of the project and will consider utility rates, per capita income, existing debt, and other factors. Financing limits are as follows:

Table 8.1.2

Project Financing Limitations

Project Financing	Maximum	
	Loan	Grant
With Bond Funds	$10 million	$500,000
With SPWF Funds	$500,00	$500,000
Technical Assistance [a]	$20,000	$10,000

[a] For eligible applicants under 5,000 population.

Interested applicants should contact OECDD prior to submitting an application. Applications are accepted year-round. For additional information on this and other OECDD programs, call 1-800-233-3306 or visit the OECDD website at http://www.econ.state.or.us/wtrww.htm.

Department of Environmental Quality, Clean Water State Revolving Fund (SRF)

The SRF Program is administered by the DEQ and was developed to replace the EPA Construction Grants Program. The SRF is a loan program that provides low interest rate loans, instead of grants, for the planning, design, and construction of water pollution control facilities.

Interest rates on all design and/or construction loans are two-thirds of the current municipal bond rate during the quarter that the loan agreement is signed. Estimated loan rates are currently 3.55 percent. In addition, an initiation fee (1.5 percent of the loan amount) and a servicing fee (0.5 percent of the outstanding balance) are also assessed to cover program administration by DEQ. Loans can be in the form of general obligation bonds or other rated debt obligations, revenue secured loan, or a discretionary loan.

SRF funds are allocated based on a prioritization process. Based on the preliminary applications, projects are assigned points and ranked in priority order based on 1) severity of water quality/health hazard problem; 2) receiving water body sensitivity; and 3) population served by the project.

The Intended Use Plan is one part of Oregon's annual SRF capitalization grant application. This plan includes lists of eligible projects ranked in priority order. Projects allocated funds are placed on the Funded List. Unfunded projects are on the Planning List to receive funds if any of the Funded List projects do not complete the loan process. Projects identified on the Funded List from prior years, which have not been initiated, are placed on a Supplemental List.

For additional information on this and other DEQ programs, call 1-800-452-4011 or visit the DEQ website at http://waterquality.deq.state.or.us.

Oregon Department of Energy, Small Scale Energy Loan Program (SELP)

The SELP program offers loans to projects whose purpose is to promote energy conservation and renewable energy resource development. Eligible applicants include cities, counties, special districts, individuals, and non-profit groups. Loans will cover up to 100% of construction costs, including engineering, fees, and studies. The finished project must at least break even in power costs.

The program offers low-interest loans for projects that:

- conserve natural gas, electricity, oil, or other source of energy
- produce energy from renewable resources such as water, wind, geothermal, solar, biomass, waste materials or waste heat
- use recycled materials to create products.

Interested parties should contact the Oregon Office of Energy for details. For additional information on the Office of Energy programs, call 1-503-378-4040 or visit the Office of Energy website at http://www.energy.state.or.us.

Oregon Department of Energy, Business Energy Tax Credit

The Business Energy Tax Credit was revamped in 2001 to allow public entities to participate. The State of Oregon Department of Energy offers a tax credit of 35% of project costs, taken over a five-year period, for qualifying capital improvements that reduce energy use. Requirements for projects are similar to that of the SELP program. Public entities do not pay taxes and so are not eligible for a direct tax credit, but may sell their credit to private businesses at a discounted rate, usually about 28%. Lighting retrofits, VFDs, efficient motors, and controls are typical projects that qualify for funding.

8.2 Local Funding Sources

The amount and type of local funding obligations for infrastructure improvements will depend, in part, on the amount of grant funding anticipated and the requirements of potential loan funding. Local revenue sources for capital expenditures include *ad valorem* taxes, various types of bonds, wastewater service charges, connection fees, and system development charges. Local revenue sources for operating costs include *ad valorem* taxes and wastewater service charges. The following

sections identify those local funding sources and financing mechanisms that are most common and appropriate for the improvements identified in this study.

General Obligation Bonds

A general obligation (G.O.) bond is backed by the full faith and credit of the issuer. For payment of the principal and interest on the bond, the issuer may levy ad valorem general property taxes. Such taxes are not needed if revenue from assessments, user charges or other sources are sufficient to cover debt service.

Oregon Revised Statutes limit the maximum term to 40 years for cities. Except in the event that Rural Development Administration will purchase the bonds, the realistic term for which general obligation bonds should be issued is 15 to 20 years. Under the present economic climate, the lower interest rates will be associated with the shorter terms.

Financing of wastewater system improvements by general obligation bonds is usually accomplished by the following procedure:

- Determination of the capital costs required for the improvement.
- An election authorizing the sale of general obligation bonds.
- Following voter approval, the bonds are offered for sale.
- The revenue from the bond sale is used to pay the capital costs associated with the projects.

From a fund raising viewpoint, general obligation bonds are preferable to revenue bonds in matters of simplicity and cost of issuance. Since the bonds are secured by the power to tax, these bonds usually command a lower interest rate than other types of bonds. General obligation bonds lend themselves readily to competitive public sale at a reasonable interest rate because of their high degree of security, their tax-exempt status, and their general acceptance.

These bonds can be revenue-supported wherein a portion of the user fee is pledged toward payment of the debt service. Using this method, the need to collect additional property taxes to retire the obligated bonds is eliminated. Such revenue-supported general obligation bonds have most of the advantages of revenue bonds, but also maintain the lower interest rate and ready marketability of general obligation bonds. Because the users of the water system pay their share of the debt load based on their water usage rates, the share of that debt is distributed in a fare and equitable manner.

Advantages of general obligation bonds over other types of bonds include:

- The laws authorizing general obligation bonds are less restrictive than those governing other types of bonds.
- By the levying of taxes, the debt is repaid by all property benefited and not just the system users.
- Taxes paid in the retirement of these bonds are IRS deductible.

- General obligation bonds offer flexibility to retire the bonds by tax levy and/or user charge revenue.

The disadvantage of general obligation bond debt is that it is often added to the debt ratios of the underlying municipality, thereby restricting the flexibility of the municipality to issue debt for other purposes. Furthermore, general obligation bonds are normally associated with the financing of facilities that benefit an entire community and must be approved by a majority vote and often necessitate extensive public information programs. A majority vote often requires waiting for a general election in order to obtain an adequate voter turnout. Waiting for a general election may take years, and too often a project needs to be undertaken in a much shorter amount of time.

Revenue Bonds

Revenue bonds offer some advantages to general obligation bonds and are becoming a more frequently used option. Revenue bonds are payable solely from charges made for the services provided. These bonds cannot be paid from tax levies or special assessments; their only security is the borrower's promise to operate the system in a way that will provide sufficient net revenue to meet the debt service and other obligations of the bond issue.

Many communities prefer revenue bonding, as opposed to general obligation bonding because it insures that no tax will be levied.. In addition, debt obligation will be limited to system users since repayment is derived from user fees. Another advantage of revenue bonds is that they do not count against a municipality's direct debt, but instead are considered "overlapping debt." This feature can be a crucial advantage for a municipality near its debt limit or for the rating agencies, which consider very closely the amount of direct debt when assigning credit ratings. Revenue bonds also may be used in financing projects extending beyond normal municipal boundaries. These bonds may be supported by a pledge of revenues received in any legitimate and ongoing area of operation, within or outside the geographical boundaries of the issuer.

Successful issuance of revenue bonds depends on the bond market evaluation of the revenue pledged. Revenue bonds are most commonly retired with revenue from user fees. Recent legislation has eliminated the requirement that the revenues pledged to bond payment have a direct relationship to the services financed by revenue bonds. Revenue bonds may be paid with all or any portion of revenues derived by a public body or any other legally available monies. In addition, if additional security to finance revenue bonds was needed, a public body may mortgage grant security and interests in facilities, projects, utilities or systems owned or operated by a public body.

Normally, there are no legal limitations on the amount of revenue bonds to be issued, but excessive issue amounts are generally unattractive to bond buyers because they represent high investment risks. In rating revenue bonds, buyers consider the economic justification for the project, reputation of the borrower, methods and effectiveness for billing and collecting, rate structures, provision for rate increases as needed to meet debt service requirements, track record in obtaining rate increases historically, adequacy of reserve funds provided in the bond documents, supporting covenants to protect projected revenues, and the degree to which forecasts of net revenues are considered sound and economical.

Municipalities may elect to issue revenue bonds for revenue producing facilities without a vote of the electorate (ORS 288.805-288.945). In this case, certain notice and posting requirements must be met and a 60-day waiting period is mandatory. A petition signed by 5% of the municipality's registered voters may cause the issue to be referred to an election.

Improvement Bonds

Improvement (Bancroft) bonds can be issued under an Oregon law called the Bancroft Act. These bonds are an intermediate form of financing that is less than full-fledged general obligation or revenue bonds. This type of bond is quite useful, especially for smaller issuers or for limited purposes.

An improvement bond is payable only from the receipts of special benefit assessments, not from general tax revenues. Such bonds are issued only where certain properties are recipients of special benefits not accruing to other properties. For a specific improvement, all property within the improvement area is assessed on an equal basis, regardless of whether it is developed or undeveloped. The assessment is designed to apportion the cost of improvements, approximately in proportion to the afforded direct or indirect benefits, among the benefited property owners. This assessment becomes a direct lien against the property, and owners have the option of either paying the assessment in cash or applying for improvement bonds. If the improvement bond option is taken, the City sells Bancroft improvement bonds to finance the construction, and the assessment is paid over 20 years in 40 semi-annual installments with interest. Cities and special districts are limited to improvement bonds not exceeding 3% of true cash value.

With improvement bond financing, an improvement district is formed, the boundaries are established, and the benefited properties and property owners are determined. The engineer usually determines an approximate assessment, either on a square foot or a front-foot basis. Property owners are then given an opportunity to object to the project assessments. The assessments against the properties are usually not levied until the actual cost of the project is determined. Since this determination is normally not possible until the project is completed, funds are not available from assessments for the purpose of making monthly payments to the contractor. Therefore, some method of interim financing must be arranged, or a preassessment program, based on the estimated total costs, must be adopted. Commonly, warrants are issued to cover debts, with the warrants to be paid when the project is complete.

The primary disadvantage to this source of revenue is that the property to be assessed must have a true cash value at least equal to 50% of the total assessments to be levied. As a result, owners of undeveloped property usually require a substantial cash payment. In addition, the development of an assessment district is very cumbersome and expensive when facilities for an entire community are contemplated. In comparison, general obligation bonds can be issued in lieu of improvement bonds, and are usually more favorable.

Capital Construction (Sinking) Fund

Sinking funds are often established by budgeting for a particular construction purpose. Budgeted amounts from each annual budget are carried in a sinking fund until sufficient revenues are available for the needed project. Such funds can also be developed with revenue derived from system development charges or serial levies.

The disadvantage of a sinking fund is that it is usually too small to undertake any significant projects. Also, setting aside money generated from user fees without a designated and specified need is not generally accepted in a municipal budgeting process.

Connection Fees

Most cities charge connection fees to cover the cost of connecting new development to water and wastewater systems. Based on recent legislation, connection fees can no longer be programmed to cover a portion of capital improvement costs.

System Development Charges

A system development charge (SDC) is essentially a fee collected as each piece of property is developed, and which is used to finance the necessary capital improvements and municipal services required by the development. Such a fee can only be used to recover the capital costs of infrastructure. Operating, maintenance, and replacement costs cannot be financed through system development charges.

Two types of charges are permitted under the Oregon Systems Development Charges Act: improvement fees, and reimbursement fees. SDCs charged before construction are considered improvement fees and are used to finance capital improvements to be constructed. After construction, SDCs are considered reimbursement fees and are collected to recapture the costs associated with capital improvements already constructed or under construction. A reimbursement fee represents a charge for utilizing excess capacity in an existing facility paid for by others. The revenue generated by this fee is typically used to pay back existing loans for improvements.

Under the Oregon SDC Act, methodologies for deriving improvement and reimbursement fees must be documented and available for review by the public. A capital improvement plan must also be prepared which lists the capital improvements that may be funded with improvement fee revenues, and the estimated cost and timing of each improvement. Thus, revenue from the collection of SDCs can only be used to finance specific items listed in a capital improvement plan. In addition, SDCs cannot be assessed on portions of the project paid for with grant funding.

Local Improvement District (LID)

Improvement bonds issued for local improvement districts (LIDs) are used to administer special assessments for financing local improvements in cities, counties, and some special districts. Common improvements financed through a LID include storm and sanitary sewers, street paving, curbs, sidewalls, water mains, recreational facilities, street lighting, and off-street parking. The basic principle of special assessment is that it is a charge imposed upon property owners who receive special benefits from an improvement beyond the general benefits received by all citizens in the community. A public agency should consider three "principles of benefit" when deciding to use special assessment: 1) direct service, 2) obligation to others, and 3) equal sharing/basis. Cities are limited to improvement bonds not exceeding three percent of true cash value.

The Oregon Legislature has provided cities with a procedure for special assessment financing (ORS 223.387-399), which applies when city charter or ordinance provisions do not specify otherwise. To establish a LID, an improvement district is formed, the boundaries are established, and the benefited properties and property owners are determined. An approximate assessment to each property is determined based on the above three principles of benefit and is documented in a written report. Property owners are then given an opportunity to object to the project assessments. The assessments against the properties are usually not levied until the actual cost of the project is determined. Since this determination is normally not possible until the project is completed, funds are not available from

assessments for the purpose of making monthly payments to the contractor. Therefore, some method of interim financing must be arranged based on the estimated total costs.

The primary disadvantage to this source of revenue is that the property to be assessed must have a true cash value at least equal to 50 percent of the total assessments to be levied. As a result, owners of undeveloped property usually require a substantial cash payment. In addition, the development of an assessment district is very cumbersome and expensive.

Ad Valorem Taxes

Ad valorem property taxes are often used as revenue source for utility improvements. Property taxes may be levied on real estate, personal property or both. Historically, *ad valorem* taxes were the traditional means of obtaining revenue to support all local governmental functions.

A marked advantage of these taxes is the simplicity of the system; it requires no monitoring program for developing charges, additional accounting and billing work is minimal, and default on payments is rare. In addition, ad valorem taxation provides a means of financing that reaches all property owners that benefit from a water system, whether a property is developed or not. The construction costs for the project are shared proportionally among all property owners based on the assessed value of each property.

Ad valorem taxation, however, is less likely to result in individual users paying their proportionate share of the costs as compared to their benefits. Public hearings an election with voter approval would be required to implement *ad valorem* taxation.

User Fee

User fees can be used to retire general obligation bonds, and are commonly the sole source of revenue to retire revenue bonds and to finance operation and maintenance. User fees represent monthly charges of all residences, businesses, and other users that are connected to the wastewater system. These fees are established by resolution and may be modified, as needed, to account for increased or decreased operating and maintenance costs. User fees may be based on a metered volume of water consumption and/or on the type of user (e.g. residential, commercial, schools etc.). .

Assessments

Under special circumstances, the beneficiary of a public works improvement may be assessed for the cost of a project. For example, the City may provide some improvements or services that directly benefit a particular development. The City may choose to assess the industrial or commercial developer to provide up-front capital to pay for the administered improvements.

8.3 Financing Strategy

A financing strategy or plan must provide a mechanism to generate capital funds in sufficient amounts to pay for the proposed improvements over the relatively short duration in design and construction, generally two years. The financing strategy must also identify the manner in which annual revenue will be generated to cover the expense for long-term debt repayment and the on-going operation and maintenance of the system.

The objectives of a financial strategy include the following:

- Identify the capital improvement cost for the project and the estimated expense for operation and maintenance.
- Evaluate the potential funding sources and select the most viable program.
- Determine the availability of outside funding sources and identify the local cost share.
- Determine the cost to system users to finance the local share and the annual cost for operation and maintenance.

Project Expenses

A total of $1,291,895 in recommended capital improvement project costs were identified in Section 7.5. (Additional costs for expansion projects are assumed to be born by the developers and are not considered in this section.) The identified projects replace or repair existing equipment and facilities and are not expected to increase the operations and maintenance costs to the City.

Funding Sources

With any of the proposed funding sources within the financial strategy, the City is advised to confirm specific funding amounts with the appropriate funding agencies prior to making local financing arrangements.

Most of the grant programs require that the project address a DEQ issue violation or order before the project is eligible for funding. Rural Development will issue grants for projects without this requirement, but for a reduced amount and the project must pass strict scrutiny. Most agencies are currently relying on 1990 Census data for calculating household income, but the 2000 data is being circulated and will soon be adopted by funding agencies. Bandon median income is expected to rise in comparison with the state average over the last ten years. Any applications for grants or loans should be submitted as soon as possible to take advantage of the 1990 income data for interest rates and program eligibility.

It is recommended that the City undertake efforts to secure funding in the form of grants and loans. Rural Development looks closely at sewer user rates and expects local rates to be at or above that of similar communities before the project becomes eligible for grants. Typical sewer user rates for communities the size of Bandon are in the range of $40 to $45 per month. Sewer revenue per EDU currently runs $19.48 for user fees and $4.86 for the sewer construction bond (paid through property taxes) for a total monthly average cost of $24.34. The actual cost to provide sewer service, based on the operating budget for 2002, is $36.98 per EDU per month, much more in line with other communities.

The City Council voted to raise sewer user rates by 10%, effective in July 2002, and also referred a ballot measure to the voters requesting approval to raise rates 10% per year until user fees match the operations budget. To be considered for grant funds, the City must demonstrate that it is working to reach parity between user fees and operating costs.

Rural Development currently expects a municipality to have a sewer rate of at least $43.00 per month per EDU before it will be considered for grant funding. Without a DEQ violation or order, the City is most likely not eligible for a grant. Projects number 1, 11, 12 and 13 would likely be funded out of operations funds, leaving $1,283,500 to be financed with a loan. Current Rural Development interest rates are 4.75% for a 40-year loan.

The Department of Environmental Quality (DEQ) State Revolving Fund (SRF) Loan program provides low interest loans for planning, design, and construction of all water pollution control facilities. SRF loans are currently at 3.55% for a 20-year loan.

Table 8.3.1

Funding Alternatives

Funding Source	Loan Amount[1]	Effective Interest, %	Loan Duration, yrs	Est. Monthly Rate Increase
Private Funding	$1,283,500	5.00	20	$4.95
Rural Develop.	$1,283,500	4.75	40	$3.47
SRF[2]	$1,302,750	4.05	20	$4.73

[1] – Amount based on current dollars
[2] – Effective interest rate for SRF funding is based on 3.55% annual interest, 0.5% servicing fee. Loan includes 1.5% loan fee.

The recommended funding path is to apply for private loan funding. The overall project construction and administration costs are likely to be lower with private financing than with Rural Development or DEQ funding, which could offset part of the higher private interest rate. The overall cost for operating the system and meeting the debt service, estimated at $41.93, is still below the Rural Development rate minimum.

Local Cost Share

There are several items that should be addressed this year and are small enough to fund from the current operating budget. Television inspection of Basin 6, the tide gate replacement for Filmore Avenue Pump Station, the Jetty Pump Station Timer, and new impellors for North Avenue Pump Station have a combined estimated project cost of $8,400. These projects are recommended for completion before the next wet weather season.

The projects identified in the I/I study will increase capacity of the collection system and effectively increase the capacity of the WWTP by removing flow that would use capacity and prevent future connections. While these projects are also being done to improve pipe conditions, an estimated 30% of the cost is attributable to capacity issues. The line size increase for Edison Avenue and Oregon Avenue will increase capacity to allow for future connections. Projects that increase system capacity are eligible to be considered for SDCs. An estimated $383,270 of the construction costs for these projects could be funded using an SDC.

System User Costs

If the worse case was considered and the City was not successful in obtaining grant funds and all of the projects were completed one at a time, there would have to be an increase in user fees. Based on 1,734 EDUs, for a twenty-year loan, as detailed above, monthly individual user fee increase would be between $3.47 and $4.73 per month.

Once the City has determined what funding may be available, the current rate structure should be reviewed and analyzed to determine the actual impact to ratepayers. The City's collection system is in need of repairs and requires a significant rehabilitation project. Since a project of this nature will likely result in higher sewer rates, all grants, loans, existing debts and reserves, and surpluses should be taken into account when calculating the final impact to rate payers.

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Wastewater Treatment Plant Permits

Appendix

A

Oregon
John A. Kitzhaber, M.D., Governor

Department of Environmental Quality
Western Region
Salem Office
750 Front St NE
Suite 120
Salem, OR 97310
(503) 378-8240
(503) 378-3684 TTY

February 13, 1998

FEB 17 1998

Mr. Matt Winkel
City of Bandon
PO Box 67
Bandon, OR 97411

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Re: NPDES Permit
File No. 5664
Facility: Bandon STP, Riverside Drive & Caroline Street, Bandon
Coos County

Dear Mr. Winkel

We have completed our review of your application for a National Pollutant Discharge Elimination System (NPDES) Permit and the comments received regarding the preliminary draft permit. Your NPDES Permit has been issued and is enclosed.

Please note that two changes were made in the permit following public comment. These are:

1. The bacteria effluent limit and bacteria monitoring were corrected to fecal coliform bacteria, from e.coli bacteria. We had inadvertently included the fresh water bacteria standard.

2. The office to be called in case of malfunction of the treatment plant was changed from the Coos Bay DEQ office, to the state-wide Oregon Accident Response System office. The second office is staffed 24 hours per day and on weekends, and also have "call lists" for other state agencies to be notified including the Department of Agriculture shellfish protection program.

This permit will be considered the final action on permit application number 997367.

You are urged to carefully read the permit and take all possible steps to comply with conditions established to help protect Oregon's environment against pollution.

If you are dissatisfied with the conditions or limitations of this permit, you have 20 days to request a hearing before the Environmental Quality Commission or its authorized representative. Any such request shall be made in writing to the Director and shall clearly state the grounds for the request.

If you have any questions, please contact Ruben Kretzxchmar, Western Region - Coos Bay Office, at (541) 269-2721 extension 23.

Sincerely,

Steve Greenwood
Administrator
Western Region

SG:sms
Enclosure
cc: Ruben Kretzschmar, Western Region - Coos Bay Office, DEQ

Expiration Date: 12/31/01
Permit Number 101546
File Number: 5664
Page 1 of 18 Pages

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM WASTE DISCHARGE PERMIT

Department of Environmental Quality
Western Region - Eugene Office
1102 Lincoln St., Suite 210, Eugene, OR 97401
Telephone: (541) 686-7838

Issued pursuant to ORS 468B.050 and The Federal Clean Water Act

ISSUED TO:

City of Bandon
PO Box 67
Bandon OR 97330

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Outfall Number	Outfall Location
Domestic	001	RM 1.1 Coquille River
Domestic High Flows	002	RM 0.1 Ferry Creek
Emergency Overflow	003	RM 0.5 Ferry Creek

PLANT TYPE AND LOCATION:

Activated Sludge Plant
Interst. of Riverside Dr
and Caroline Street
Bandon OR

RECEIVING SYSTEM INFORMATION:

Basin: South Coast
Sub-basin: Coquille
Stream: Coquille River
Hydro Code: 14B-COQU 1.1 D
Hydro Code: 14B-FERR 0.1 D
County: Coos

Treatment System Class: III
Collection System Class: II

EPA REFERENCE NO: OR-002020-6

Issued in response to Application No. 997367 received 05-27-92.

This permit is issued based on the land use findings in the permit record.

Steve Greenwood, Administrator
Western Region

February 13, 1998
Date

PERMITTED ACTIVITIES

Until this permit expires or is modified or revoked, the permittee is authorized to construct, install, modify, or operate a wastewater collection, treatment, control and disposal system and discharge to public waters adequately treated wastewaters only from the authorized discharge point or points established in Schedule A and only in conformance with all the requirements, limitations, and conditions set forth in the attached schedules as follows:

Unless authorized by another NPDES permit, each other direct and indirect discharge to public waters is prohibited.

SCHEDULE A

1. **Waste Discharge Limitations not to be Exceeded Upon Permit Issuance:**

a. Outfall Numbers 001 and 002 (Wastewater Treatment Plant Discharge)

b.

(1) May 1 - October 31:

Parameter	Average Effluent Concentrations		Mass Load Limitations (See Note 1/)		
	Monthly	Weekly	Monthly Average lb/day	Weekly Average lb/day	Daily Maximum lbs
BOD_5	20 mg/l	30 mg/l	75	110	150
TSS	20 mg/l	30 mg/l	75	110	150

(2) November 1 - April 30:

Parameter	Average Effluent Concentrations		Mass Load Limitations (See Note 2/)		
	Monthly	Weekly	Monthly Average lb/day	Weekly Average lb/day	Daily Maximum lbs
BOD_5	30 mg/l	45 mg/l	110	170	230
TSS	30 mg/l	45 mg/l	110	170	230

(3) Other Parameters (year-round):

Parameter	Limitations
pH	Shall be within the range 6.0 - 9.0.
Fecal Coliform Bacteria	Shall not exceed a 30 day log mean of 14 organisms per 100 ml, with not more than 10 percent of the samples exceeding 43 organisms per 100 ml.
BOD_5 and TSS	Shall not be less than 85% monthly average concentration.

b. Outfall Number 002 (When Discharging)

Outfall Number 002 shall be limited to those conditions when flows through the treatment facility exceed 2.6 MGD combined with a high tidal event where all the effluent is unable to be discharged from outfall 001.

c. Outfall Number 003 (When Discharging)

Unless the cause is the result of an exceptional event beyond the reasonable control of the permittee:

No wastes shall be discharged from Outfall Number 003 and no activities shall be conducted which violate Water Quality Standards as adopted in OAR 340-41-325, unless the cause is an upset as defined in Conditions B4 and B6 of the attached General Conditions.

Events caused by operational error, improperly designed facilities, or lack of preventative maintenance are not beyond the reasonable control of the permittee.

d. Notwithstanding the effluent limitations established by this permit, no wastes shall be discharged and no activities shall be conducted which will violate Water Quality Standards as adopted in OAR 340-41-325, except in the following defined mixing zones:

Outfall 001

The allowable mixing zone for Outfall Number 001 shall not exceed that segment of Coquille River within a radius of 200 feet from the point of discharge.

Outfall 002

The allowable mixing zone for Outfall Number 002 shall not exceed that segment of Ferry Creek within a radius of 50 feet from the point of discharge.

e. Raw sewage discharges are prohibited to waters of the State from May 22 through October 31, except during a storm event greater than the one-in-ten-year, 24-hour duration storm. If an overflow occurs between May 21 and June 1, and if the permittee demonstrates to the Department's satisfaction that no increase in risk to beneficial uses occurred because of the overflow, no violation shall be triggered if the storm associated with the overflow was greater than the one-in-five-year, 24-hour duration storm.

f. No chlorine or chlorine compounds shall be used for effluent disinfection purposes.

Notes:

1/ Mass load limitations for BOD_5 and TSS are based on an original average dry weather design flow to the facility equaling 0.45MGD. Upon expansion to 0.50 MGD design, the permittee was required to retain the existing summer mass load limits.

2/ Mass load limits based upon average dry weather design flow of 0.45 MGD. Schedule C, Condition 5 requires the permittee to select the basis for calculating winter time mass load limits. Upon review and approval of the engineering study to determine the design average wet weather flow, pursuant to OAR 340-41-120(9), and upon request of the permittee, the Department intends to modify this permit and include revised mass load limits.

SCHEDULE B

1. Minimum Monitoring and Reporting Requirements to be Met Upon Permit Issuance:
(unless otherwise approved in writing by the Department)

The permittee shall monitor the parameters as specified below at the locations indicated. The laboratory used by the permittee to analyze samples shall have a quality assurance/quality control (QA/QC) program to verify the accuracy of sample analysis. If QA/QC requirements are not met for any analysis, the results shall be included in the report, but not used in calculations required by this permit. When possible, the permittee shall re-sample in a timely manner for parameters failing the QA/QC requirements, analyze the samples, and report the results.

a. Influent

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Calculation
BOD_5	2/Week	24-Hr Composite
TSS	2/Week	24-Hr Composite
pH	2/Week	Grab

b. Outfall Number 001 (Sewage Treatment Plant Discharge) (See Note 4/)

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Flow meter
Flow Meter Calibration	Annually	Verification
BOD_5	2/Week	24-Hr Composite
TSS	2/Week	24-Hr Composite
Pounds Discharged (BOD and TSS)	2/Week	Calculation
pH	2/Week	Grab
Fecal Coliform Bacteria	1/Week	Grab
Turbidity	1/Week	Grab
Average Percent Removed (BOD/TSS)	Monthly	Calculation
U-V Radiation Percent Intensity	Daily	Reading (See Note 5/)

c. Outfall 003 - When Discharging (See Note 6/)

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily (During each occurrence)	Estimation

d. Sludge Management

Item or Parameter	Minimum Frequency	Type of Sample
Volume biosolids removed	Each occurrence	Measurement
Biosolids analysis including: Total Solids (% dry wt.) Volatile Solids (% dry wt.) Volatile Suspended Solids (% dry wt.) Biosolids Nitrogen: NH_3-N; NO_3-N; & TKN (% dry wt.) Biosolids Metals: As, Cd, Cu, Pb, Hg, Mo, Ni, Se, & Zn (mg/kg) Phosphorus (% dry wt.) Potassium (% dry wt.) pH (standard units)	Annually	Composite samples to be representative of the product to be land applied from the digester and/or sludge drying beds. (See Note 7/)
Record of % volatile solids reduction accomplished through digestion	Monthly	Calculation (See Note 8/)
Quantity and type of lime product used to stabilize sludge [when required to meet federal Process to Significantly Reduce Pathogens (PSRP) regulations]	Each Occurrence	Pounds/gallon of sludge land applied.
Record of locations where sludge is applied on land (Site location map to b maintained at treatment facility for review upon request by DEQ)	Each Occurrence	Date, volume & locations where sludges were applied recorded on site location map.

Notes:

4/ For compliance purposes, effluent samples collected for Outfall Number 001 shall be obtained prior to the point where the effluent flow splits. When sampled above the point where the effluent flow splits, only one set of samples shall be collected. These samples shall be deemed representative of the total effluent discharged through Outfall Number 001 and/or Outfall Number 002.

5/ The intensity of radiation emitted by a bank of U-V lamps will decrease over time. As intensity decreases, its ability to kill organisms will also decrease. To track the reduction in intensity, the U-V disinfection system should include a U-V intensity transmittance meter. This meter will measure the relative intensity of a bank of U-V lamps as compared to a baseline. The baseline should be established after the first 100 hours of burn-in time on the lamps. At 100 hours, the meter should be set at 99.9%. The daily percent U-V transmittance would then be determined by reading the meter each day.

6/ This parameter shall be measured during any discharge or overflow event, but no more frequently than as specified under this Condition, unless otherwise requested by the Department.

7/ Composite samples of the sludge shall consist of representative samples collected from either the digester withdrawal line and/or the sludge drying beds as follows:

Digester withdrawal line: Composite samples from each digester withdrawal line shall consist of at least 4 aliquots of equal volume collected over an 8-hour period and combined. The samples shall be representative of the product being removed from the digester and transferred to a sludge hauling truck. A sufficient number of composite samples shall be obtained to adequately represent the contents of each truck load leaving the facility site.

Inorganic pollutant monitoring must be conducted according to **Test Methods for Evaluating Solid Waste, Physical/Chemical Methods**, Second Edition (1982) with Updates I and II and third Edition (1986) with Revision I

Sludge drying beds: Composite samples from the drying beds shall be taken from reference areas in the bed pursuant to **Test Methods for Evaluating Solid Waste, Volume 2; Field Manual, Physical/Chemical Methods, November 1986, Third Edition, Chapter 9.**

Inorganic pollutant monitoring must be conducted according to Test Methods for Evaluating Solid Waste, Physical. Chemical Methods, Second Edition (1982) with Updates I and II and third Edition (1986) with Revision I.

8/ Calculation of the % volatile solids reduction is to be based on comparison of a representative monthly grab sample of total and volatile solids entering the digester (secondary solids) and a representative composite sample of sludge solids collected during sludge removal (as defined in Note 6/ above).

2. Reporting Procedures

a) Monitoring results shall be reported on approved forms. The reporting period is the calendar month. Reports must be submitted to the Department by the 15th day of the following month.

b) State monitoring reports shall identify the name, certificate classification and grade level of each principal operator designated by the permittee as responsible for supervising the wastewater collection and treatment systems during the reporting period. Monitoring reports shall also identify each system classification as found on page one of this permit.

c) Monitoring reports shall also include a record of the quantity and method of use of all sludge removed from the treatment facility and a record of all applicable equipment breakdowns and bypassing.

3. Report Submittals

a. An annual solids report shall be submitted to the Department by February 19 of each year that describes solids handling activities for the previous year and includes, but is not limited to, the required information outlined in OAR 340-50-035(6)(a)-(e).

b. The permittee shall have in place a program to identify and reduce inflow and infiltration into the sewage collection system. An annual report shall be submitted to the Department by August 1 of each year which details sewer collection maintenance activities that have been done in the previous year and outlines those activities planned for the following year.

SCHEDULE C

Compliance Conditions and Schedules

1. Within 60 days of permit issuance, the permittee shall submit to the Department for review and approval, a report that describes procedures for handling, transporting, and disposal of rags, grit, scum and screenings generated at the treatment facility. Upon written approval by the Department, the permittee shall conform with the approved procedures. Modified procedures may be followed upon prior approval in writing by the Department.

2. By no later than ninety (90) days after issuance of this permit, the permittee shall submit to the Department a biosolids management plan in accordance with OAR 340-50, "Land Application of Domestic Wastewater Treatment Facility Biosolids, Biosolids Derived Products, and Domestic Septage." Upon approval of the plan by the Department, the plan shall be implemented by the permittee.

3. Public Notification Plan

   Within six (6) months of permit issuance, the Respondent shall submit a Public Notification Plan to the Department for approval for notifying the public during periods of discharge of untreated sewage. The Plan shall include procedures to be followed by the Respondent during periods of discharge of untreated sewage, including stream sampling, posting of warning signs and other public notification steps. In addition, the Plan shall include contingency plans for minimizing the flow of raw or partially treated sewage.

4. By no later than twelve (12) months after permit issuance, the permittee shall submit either an engineering evaluation which demonstrates the design average wet weather flow, or a request to retain the existing mass load limits. The design average wet weather flow is defined as the average flow between November 1 and April 30 when the sewage treatment facility is projected to be at design capacity for that portion of the year. Upon acceptance by the Department of the design average wet weather flow determination, the permittee may request a permit modification to include higher winter mass loads based on the design average wet weather flow.

5. Within 180 days of permit modification to include higher winter mass load limits as specified in Condition 4 of this Schedule, the permittee shall submit to the Department for review and approval a proposed program and time schedule for identifying and reducing inflow within 60 days of receiving written Department comments, the permittee shall submit a final approvable program and time schedule. The program shall consist of the following:

   a. Identification of all overflow points and verification that sewer system overflows are not occurring up to a 24-hour, 5-year storm event or equivalent;

   b. Monitoring of all pump station overflow points;

   c. A program for identifying and removing all inflow sources into the permittee's sewer system over which the permittee has legal control; and,

   d. If the permittee does not have the necessary legal authority for all portions of the sewer system or treatment facility, a program and schedule for gaining legal authority to require inflow reduction and a program and schedule for removing inflow sources.

6. The permittee is expected to meet the compliance dates which have been established in this schedule. Either prior to or no later than 14 days following any lapsed compliance date, the permittee shall submit to the Department a notice of compliance or noncompliance with the established schedule. The Director, or his authorized representative, may revise a schedule of compliance if he determines good and valid cause resulting from events over which the permittee has little or no control.

7. Industrial Waste Survey/Pretreatment Program

By no later than six (6) months from permit issuance date, the permittee shall submit an industrial waste survey as described in 40 CFR 403.8(f)(2)(i-iii) suitable to make a determination as to the need and type of pretreatment program to be developed.

Should the Department determine that a pretreatment program is required, the permit shall be reopened and modified in accordance with 40 CFR 403.8(e)(1) to incorporate a compliance schedule to require schedule requiring program development shall be developed in accordance with the provisions of 40 CFR 403.12(k), and shall not exceed twelve (12) months.

SCHEDULE D

Special Conditions

1. The permittee shall comply with Oregon Administrative Rules (OAR), Chapter 340, Division 49, "Regulations Pertaining To Certification of Wastewater System Operator Personnel" and accordingly:

   a. The permittee shall have its wastewater system supervised by one or more operators who are certified in a classification and grade level (equal to or greater) that corresponds with the classification (collection and /or treatment) of the system to be supervised as specified on page one of this permit.

Note: A "supervisor" is defined as the person exercising authority for establishing and executing the specific practice and procedures of operating the system in accordance with the policies of the permittee and requirements of the waste discharge permit. "Supervise" means responsible for the technical operation of a system, which may affect its performance or the quality of the effluent produced. Supervisors are not required to be on-site at all times.

   b. The permittee's wastewater system may not be without supervision(as required by Special Condition 1a. above) for more than thirty (30) days. During this period, and at any time that the supervisor is not available to respond on-site (i.e. vacation, sick leave or off-call), the permittee must make available another person who is certified at no less than one grade lower than the system classification.

   c. If the wastewater system has more than one daily shift, the permittee shall have the shift supervisor, if any, certified at no less than one grade lower than the system classification.

   d. The permittee is responsible for ensuring the wastewater system has a properly certified supervisor available at all times to respond on-site at the request of the permittee and to any other operator.

   e. The permittee shall notify the Department of Environmental Quality in writing within thirty (30) days of replacement or redesignation of certified operators responsible for supervising wastewater system operation. The notice shall be filed with the Water Quality Division, Operator Certification Program, 811 SW Sixth Ave., Portland, OR 97204. This requirement is in addition to the reporting requirements contained under Schedule B of this permit.

   f. Upon written request, the Department may grant the permittee reasonable time, not to exceed 120 days, to obtain the services of a qualified person to supervise the wastewater system. The written request must include justification for the time needed, a schedule for recruiting and hiring, the date the system supervisor availability ceased and the name of the alternate system supervisor(s) as required by 1.b. above.

2. a. All biosolids shall be managed in accordance with the current biosolids management plan approved by the Department and the site authorization letters issued by the Department. The biosolids management plan shall be kept current and remain on file with the permit. No substantial changes shall be made in solids management activities which significantly differ from operations specified under the approved plan without the prior written approval of the Department.

b. This permit may be modified to incorporate any applicable standard for sewage sludge use of disposal promulgated under section 405(d) of the Clean Water Act, if the standard for sewage sludge use or disposal is more stringent than any requirements for sludge use or disposal in the permit, or controls a pollutant or practice not limited in this permit.

3. The permittee shall report any noncompliance or spills which may endanger the health or the environment. This report shall be made immediately (within one hour) from the time the permittee becomes aware of the circumstances. The Department shall be notified through the Oregon Accident Response System at 1-800-452-0311. Submission of a written report shall also be provided to the Department within 5 days of the occurrence. This report should detail all aspects of noncompliance and steps taken to prevent a recurrence.

SCHEDULE F

GENERAL CONDITIONS

SECTION A. STANDARD CONDITIONS

1. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of Oregon Revised Statutes (ORS) 468B.025 and is grounds for enforcement action; for permit termination, suspension, or modification; or for denial of a permit renewal application.

2. Penalties for Water Pollution and Permit Condition Violations

Oregon Law (ORS 468.140) allows the Director to impose civil penalties up to $10,000 per day for violation of a term, condition, or requirement of a permit.

Under ORS 468.943, unlawful water pollution, if committed by a person with criminal negligence, is punishable by a fine of up to $25,000 or by imprisonment for not more than one year, or by both. Each day on which a violation occurs or continues is a separately punishable offense.

Under ORS 468.946, a person who knowingly discharges, places or causes to be placed any waste into the waters of the state or in a location where the waste is likely to escape into the waters of the state, is subject to a Class B felony punishable by a fine not to exceed $200,000 and up to 10 years in prison.

3. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment. In addition, upon request of the Department, the permittee shall correct any adverse impact on the environment or human health resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and have the permit renewed. The application shall be submitted at least 180 days before the expiration date of this permit.

The Director may grant permission to submit an application less than 180 days in advance but no later than the permit expiration date.

5. Permit Actions

This permit may be modified, suspended, revoked and reissued, or terminated for cause including, but not limited to, the following:

a. Violation of any term, condition, or requirement of this permit, a rule, or a statute;

b. Obtaining this permit by misrepresentation or failure to disclose fully all material facts; or

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

The filing of a request by the permittee for a permit modification or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

6. Toxic Pollutants

The permittee shall comply with any applicable effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

7. Property Rights

The issuance of this permit does not convey any property rights of any sort, or any exclusive privilege.

8. Permit References

Except for effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants and standards for sewage sludge use or disposal established under Section 405(d) of the Clean Water Act, all rules and statutes referred to in this permit are those in effect on the date this permit is issued.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls, and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

2. Duty to Halt or Reduce Activity

For industrial or commercial facilities, upon reduction, loss, or failure of the treatment facility, the permittee shall, to the extent necessary to maintain compliance with its permit, control production or all discharges or both until the facility is restored or an alternative method of treatment is provided. This requirement applies, for example, when the primary source of power of the treatment facility fails or is reduced or lost. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

3. Bypass of Treatment Facilities

a. Definitions

(1) "Bypass" means intentional diversion of waste streams from any portion of the treatment facility. The term "bypass" does not include nonuse of singular or multiple units or processes of a treatment works when the nonuse is insignificant to the quality and/or quantity of the effluent produced by the treatment works. The term "bypass" does not apply if the diversion does not cause effluent limitations to be exceeded, provided the diversion is to allow essential maintenance to assure efficient operation.

(2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities or treatment processes which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

b. Prohibition of bypass.

(1) Bypass is prohibited unless:

(a) Bypass was necessary to prevent loss of life, personal injury, or severe property damage;

(b) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance; and

(c) The permittee submitted notices and requests as required under General Condition B.3.c.

(2) The Director may approve an anticipated bypass, after considering its adverse effects and any alternatives to bypassing, when the Director determines that it will meet the three conditions listed above in General Condition B.3.b.(1).

c. Notice and request for bypass.

(1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior written notice, if possible at least ten days before the date of the bypass.

(2) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in General Condition D.5.

4. Upset

a. Definition. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operation error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation.

b. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of General Condition B.4.c are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

c. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

(1) An upset occurred and that the permittee can identify the causes(s) of the upset;

(2) The permitted facility was at the time being properly operated;

(3) The permittee submitted notice of the upset as required in General Condition D.5, hereof (24-hour notice); and

(4) The permittee complied with any remedial measures required under General Condition A.3 hereof.

d. Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

5. Treatment of Single Operational Event

For purposes of this permit, A Single Operational Event which leads to simultaneous violations of more than one pollutant parameter shall be treated as a single violation. A single operational event is an exceptional incident which causes simultaneous, unintentional, unknowing (not the result of a knowing act or omission), temporary noncompliance with more than one Clean Water Act effluent discharge pollutant parameter. A single operational event does not include Clean Water Act violations involving discharge without a NPDES permit or noncompliance to the extent caused by improperly designed or inadequate treatment facilities. Each day of a single operational event is a violation.

6. Overflows from Wastewater Conveyance Systems and Associated Pump Stations

a. Definitions

(1) "Overflow" means the diversion and discharge of waste streams from any portion of the wastewater conveyance system including pump stations, through a designed overflow device or structure, other than discharges to the wastewater treatment facility.

(2) "Severe property damage" means substantial physical damage to property, damage to the conveyance system or pump station which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of an overflow.

(3) "Uncontrolled overflow" means the diversion of waste streams other than through a designed overflow device or structure, for example to overflowing manholes or overflowing into residences, commercial establishments, or industries that may be connected to a conveyance system.

b. Prohibition of overflows. Overflows are prohibited unless:

(1) Overflows were unavoidable to prevent an uncontrolled overflow, loss of life, personal injury, or severe property damage;

(2) There were no feasible alternatives to the overflows, such as the use of auxiliary pumping or conveyance systems, or maximization of conveyance system storage; and

(3) The overflows are the result of an upset as defined in General Condition B.4. and meeting all requirements of this condition.

c. Uncontrolled overflows are prohibited where wastewater is likely to escape or be carried into the waters of the State by any means.

d. Reporting required. Unless otherwise specified in writing by the Department, all overflows and uncontrolled overflows must be reported orally to the Department within 24 hours from the time the permittee becomes aware of the overflow. Reporting procedures are described in more detail in General Condition D.5.

7. Public Notification of Effluent Violation or Overflow

If effluent limitations specified in this permit are exceeded or an overflow occurs, upon request by the Department, the permittee shall take such steps as are necessary to alert the public about the extent and nature of the discharge. Such steps may include, but are not limited to, posting of the river at access points and other places, news releases, and paid announcements on radio and television.

8. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in such a manner as to prevent any pollutant from such materials from entering public waters, causing nuisance conditions, or creating a public health hazard.

SECTION C. MONITORING AND RECORDS

1. Representative Sampling

Sampling and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. All samples shall be taken at the monitoring points specified in this permit and shall be taken, unless otherwise specified, before the effluent joins or is diluted by any other waste stream, body of water, or substance. Monitoring points shall not be changed without notification to and the approval of the Director.

2. Flow Measurements

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated and maintained to insure that the accuracy of the measurements is consistent with the accepted capability of that type of device. Devices selected shall be capable of measuring flows with a maximum deviation of less than $\pm$ 10 percent from true discharge rates throughout the range of expected discharge volumes.

3. Monitoring Procedures

Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit.

4. Penalties of Tampering

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two years, or by both. If a conviction of a person is for a violation committed after a first conviction of such person, punishment is a fine not more than $20,000 per day of violation, or by imprisonment of not more than four years or both.

5. Reporting of Monitoring Results

Monitoring results shall be summarized each month on a Discharge Monitoring Report form approved by the Department. The reports shall be submitted monthly and are to be mailed, delivered or otherwise transmitted by the 15th day of the following month unless specifically approved otherwise in Schedule B of this permit.

6. Additional Monitoring by the Permittee

If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR 136 or as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the Discharge Monitoring Report. Such increased frequency shall also be indicated. For a pollutant parameter that may be sampled more than once per day (e.g., Total Chlorine Residual), only the average daily value shall be recorded unless otherwise specified in this permit.

7. Averaging of Measurements

Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean, except for bacteria which shall be averaged as specified in this permit.

8. Retention of Records

Except for records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five years (or longer as required by 40 CFR part 503), the permittee shall retain records of all monitoring information, including all calibration and maintenance records of all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time.

9. Records Contents

Records of monitoring information shall include:

a. The date, exact place, time and methods of sampling or measurements;

b. The individual(s) who performed the sampling or measurements;

c. The date(s) analyses were performed;

d. The individual(s) who performed the analyses;

e. The analytical techniques or methods used; and

f. The results of such analyses.

10. Inspection and Entry

The permittee shall allow the Director, or an authorized representative upon the presentation of credentials to:

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit, and

d. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by state law, any substances or parameters at any location.

SECTION D. REPORTING REQUIREMENTS

1. Planned Changes

The permittee shall comply with Oregon Administrative Rules (OAR) 340, Division 52, "Review of Plans and Specifications". Except where exempted under OAR 340-52, no construction, installation, or modification involving disposal systems, treatment works, sewerage systems, or common sewers shall be commenced until the plans and specifications are submitted to and approved by the Department. The permittee shall give notice to the Department as soon as possible of any planned physical alternations or additions to the permitted facility.

2. Anticipated Noncompliance

The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

3. Transfers

This permit may be transferred to a new permittee provided the transferee acquires a property interest in the permitted activity and agrees in writing to fully comply with all the terms and conditions of the permit and the rules of the Commission. No permit shall be transferred to a third party without prior written approval from the Director. The permittee shall notify the Department when a transfer of property interest takes place.

4. Compliance Schedule

Reports of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date. Any reports of noncompliance shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirements.

5. Twenty-Four Hour Reporting

The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally (by telephone) within 24 hours, unless otherwise specified in this permit, from the time the permittee becomes aware of the circumstances. During normal business hours, the Department's Regional office shall be called. Outside of normal business hours, the Department shall be contacted at 1-800-452-0311 (Oregon Emergency Response System).

A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. If the permittee is establishing an affirmative defense of upset or bypass to any offense under ORS 468.922 to 468.946, and in which case if the original reporting notice was oral, delivered written notice must be made to the Department or other agency with regulatory jurisdiction within 4 (four) calendar days. The written submission shall contain:

a. A description of the noncompliance and its cause;

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

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

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

e. Public notification steps taken, pursuant to General Condition B.7.

The following shall be included as information which must be reported within 24 hours under this paragraph:

a. Any unanticipated bypass which exceeds any effluent limitation in this permit.

b. Any upset which exceeds any effluent limitation in this permit.

c. Violation of maximum daily discharge limitation for any of the pollutants listed by the Director in this permit.

The Department may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

6. Other Noncompliance

The permittee shall report all instances of noncompliance not reported under General Condition D.4 or D.5, at the time monitoring reports are submitted. The reports shall contain:

a. A description of the noncompliance and its cause;

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

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

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

7. Duty to Provide Information

The permittee shall furnish to the Department, within a reasonable time, any information which the Department may request to determine compliance with this permit. The permittee shall also furnish to the Department, upon request, copies of records required to be kept by this permit.

Other Information: When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Department, it shall promptly submit such facts or information.

8. Signatory Requirements

All applications, reports or information submitted to the Department shall be signed and certified in accordance with 40 CFR 122.22.

9. Falsification of Reports

Under ORS 468.953, any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, is subject to a Class C felony punishable by a fine not to exceed $100,000 per violation and up to 5 years in prison.

10. Changes to Indirect Dischargers - **[Applicable to Publicly Owned Treatment Works (POTW) only]**

The permittee must provide adequate notice to the Department of the following:

a. Any new introduction of pollutants into the POTW from an indirect discharger which would be subject to section 301 or 306 of the Clean Water Act if it were directly discharging those pollutants and;

b. Any substantial change in the volume or character of pollutants being introduced into the POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.

c. For the purposes of this paragraph, adequate notice shall include information on (i) the quality and quantity of effluent introduced into the POTW, and (ii) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

11. Changes to Discharges of Toxic Pollutant - **[Applicable to existing manufacturing, commercial, mining, and silvicultural dischargers only]**

The permittee must notify the Department as soon as they know or have reason to believe of the following:

a. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels:

(1) One hundred micrograms per liter (100 mg/l);

(2) Two hundred micrograms per liter (200 mg/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 mg/l) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (1 mg/l) for antimony;

(3) Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or

(4) The level established by the Department in accordance with 40 CFR 122.44(f).

b. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

(1) Five hundred micrograms per liter (500 mg/l);

(2) One milligram per liter (1 mg/l) for antimony;

(3) Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or

(4) The level established by the Department in accordance with 40 CFR 122.44(f).

SECTION E. DEFINITIONS

1. BOD means five-day biochemical oxygen demand.
2. TSS means total suspended solids.
3. mg/l means milligrams per liter.
4. kg means kilograms.
5. m^3/d means cubic meters per day.
6. MGD means million gallons per day.
7. Composite sample means a sample formed by collecting and mixing discrete samples taken periodically and based on time or flow.
8. FC means fecal coliform bacteria.
9. Technology based permit effluent limitations means technology-based treatment requirements as defined in 40 CFR 125.3, and concentration and mass load effluent limitations that are based on minimum design criteria specified in OAR 340-41.
10. CBOD means five day carbonaceous biochemical oxygen demand.
11. Grab sample means an individual discrete sample collected over a period of time not to exceed 15 minutes.
12. Quarter means January through March, April through June, July through September, or October through December.
13. Month means calendar month.
14. Week means a calendar week of Sunday through Saturday.
15. Total residual chlorine means combined chlorine forms plus free residual chlorine.
16. The term "bacteria" includes but is not limited to fecal coliform bacteria, total coliform bacteria, and E. coli bacteria.
17. POTW means a publicly owned treatment works.

Oregon
John A. Kitzhaber, M.D., Governor

Department of Environmental Quality
Western Region Roseburg Office
725 SE Main
Roseburg, OR 97470
(541) 440-3338
FAX (541) 440-3396

October 11, 2000

Bill Nielson
Bandon Wastewater Treatment Plant
PO Box 67
Bandon OR 97411

Re: File number 5664
Authorization to Land Apply Biosolids
David Leff Property
87432 Cranberry Creek Lane
Bandon OR
Twp. 29S S, R. 15W W. Sec. 24 and 25

Bill:

This letter represents approval of your request to apply aerobic biosolids the above referenced property. Approval is subject to criteria detailed in the Oregon Administrative Rules, Chapter 340, Division 50 and the following conditions:

Responsibility:
It is the responsibility of Bandon Wastewater Treatment Facility (BWTF) to insure the proper handling and application of all biosolids generated. Transportation of the biosolids to the application site shall be done in such a manner as to prevent leaking or spilling the biosolids onto the highways, streets, roads, waterways or other land surfaces not approved for biosolids application.

Site Description:
The site has approximately 30 acres of hay pasture and trees, which can be used for biosolid land application. The site is on the West Side of Highway 101 just south of Bandon, Oregon. The land application of biosolids on this ranch is to help to remediate and stabilize the farm's sandy loam-loamy sand soils. This authorization is good for two years at which time another site visit is required to review the farm practices and crop response to land applied biosolids over the previous two years. This authorization can be renewed in two years as an on going remedial land application practice to help reestablish the soil organic horizon on this farm. This biosolids application site is only that portion of this parcel that is shaded on the enclosed map.

Based upon an evaluation of this property the Department is pleased to grant you authorization to land apply stabilized biosolids subject to the conditions under your National Pollutant Discharge Elimination (NPDES) permit and the following stipulations:

1. This site is approved for summer application (June 1 through Oct. 31) of biosolids. During biosolid land application, care should be taken to avoid wet soil conditions, which may have occurred as a result of precipitation, especially in low and concave areas of sites. Application is authorized when the temporary water table is at least 12 inches below the ground surface.

2. Biosolids shall be applied evenly and in a manner to prevent ponding or runoff.

3. Biosolids shall not be applied closer than 50 feet to any drainage ditch, channel, pond or waterway or within 200 feet of any well or domestic water source.

4. Biosolids application rate shall not exceed approximately 32,000 gallons/acre/years. Changes in biosolids characteristics or crops management may necessitate appropriate adjustments in the application rate to maintain proper agronomic nitrogen loading (75 to 100 lb. Total N/acre depending upon digester-solids analysis).

5. If other sources of nitrogen are used, the biosolids application rate must be reduced so that commercial nitrogen in combination with biosolids nitrogen does not exceed agronomic loading rate of this site (100 lb. Total N/acre-year).

Site Use Limitations:

1. Controlled access to the biosolids site must be maintained for a period of 12 months following biosolids application.

2. Grazing animals should not be allowed on pasture within 30 days following biosolids application and 90 days for lactating animals.

Accidental Spillage:

The permittee shall immediately clean up any spillage of biosolids and notify the DEQ Roseburg office at 440-3338 of any such occurrences. Spillage which cannot be completely cleaned up shall be covered with hydrated lime (calcium Hydroxide) or lime (calcium oxide). A 50-lb. bag of liming material shall remain available during transportation of the biosolids.

Monitoring:

1. BWTF shall maintain daily records of accumulated biosolids application. Daily land application shall be kept on a field grid map or other easily readable system. BWTF is responsible for tracking the land application of biosolids on daily basis (number of dry pounds Nitrogen land applied per acre).

2. A copy of this authorization letter and the biosolids certification statements shall be carried with all biosolids s that are to be land applied. The responsible parties who apply biosolids shall review these documents prior to land applying biosolids to this site.

3. BWTF shall provide the DEQ with monthly summaries of biosolids land application activities along with a current BWTF biosolids analysis in BWTF's annual report due February 19 of each year.

4. A copy of this site authorization letter and a signed biosolid pathogen and vector attraction reduction certification statement shall accompany all biosolids land applied at this site.

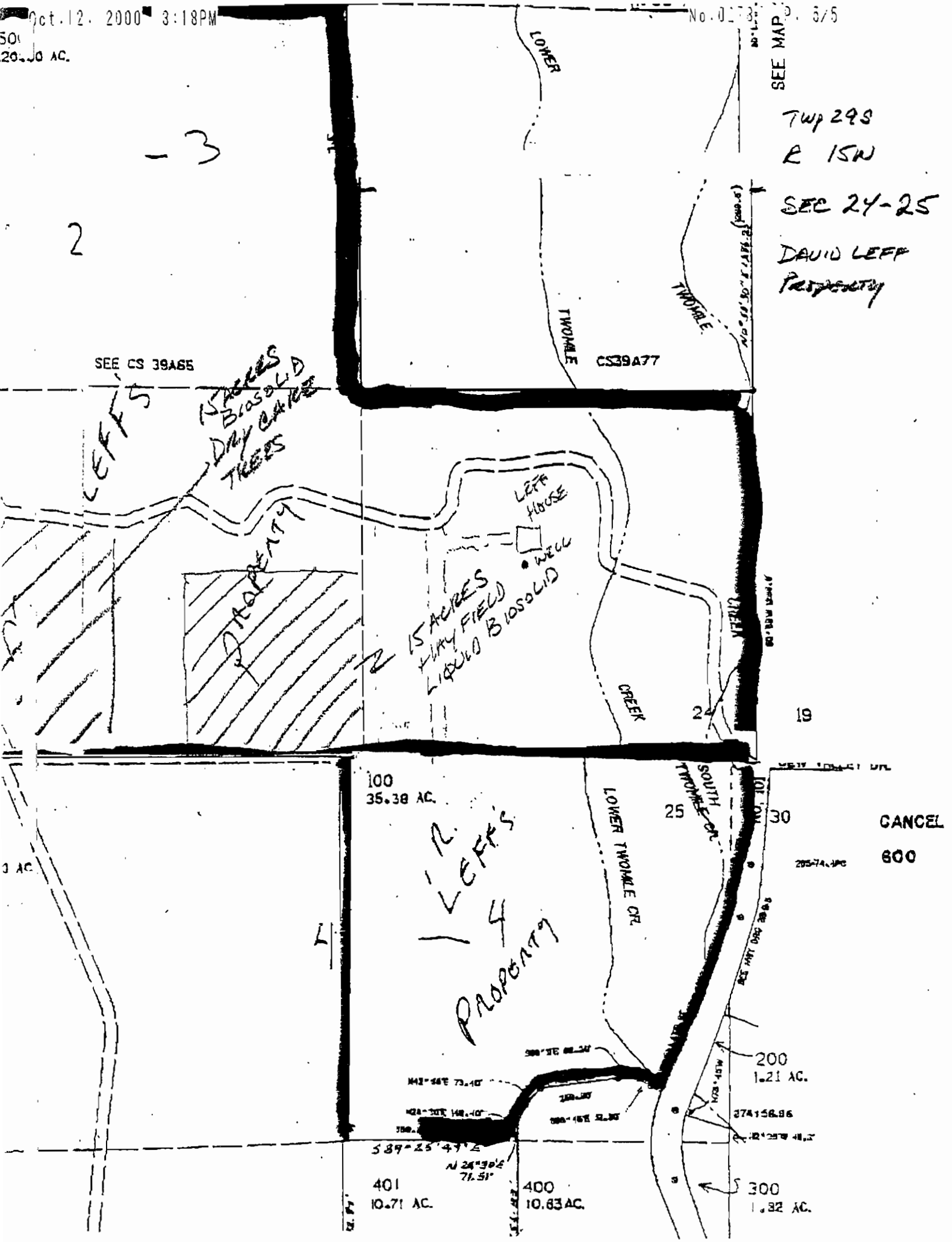
If you have any questions regarding this approval please call me at 440-3338.

Sincerely,

Paul Kennedy

Paul Kennedy, RS
Environmental Specialist

cc: Biosolids Program, DEQ-Portland


SEE MAP
Twp 29S
R 15W
SEC 24-25
DAVID LEFF
PROPERTY
-3
2
LOWER
TWOMILE
TWOMILE
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SEE CS 39A65
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15 ACRES
BIOSOLID
DRY CAKE
TREES
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HOUSE
WELL
ATOP BERM
2
15 ACRES
HAY FIELD
LIQUID BIOSOLID
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24
19
100
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SOUTH
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200
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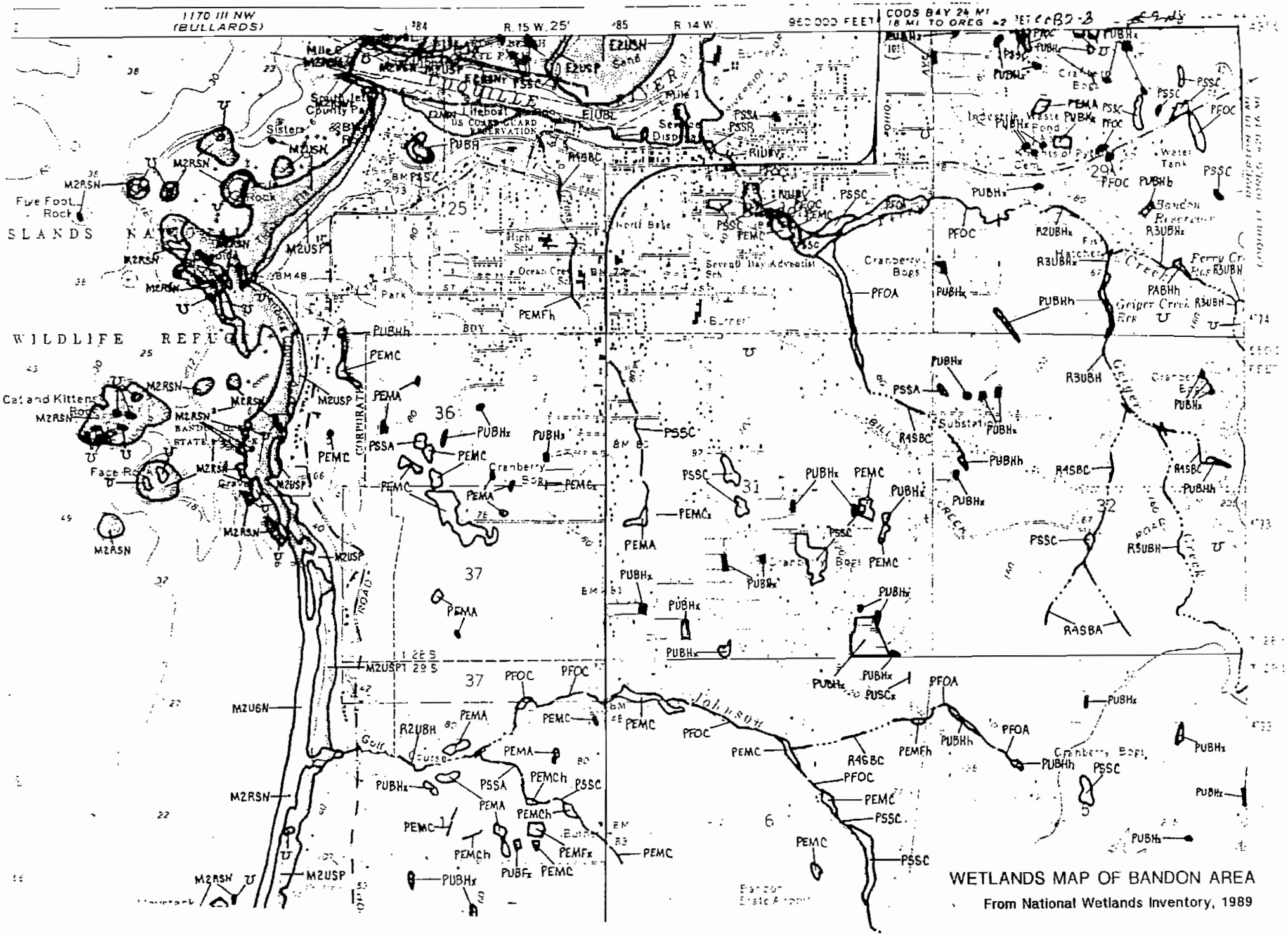
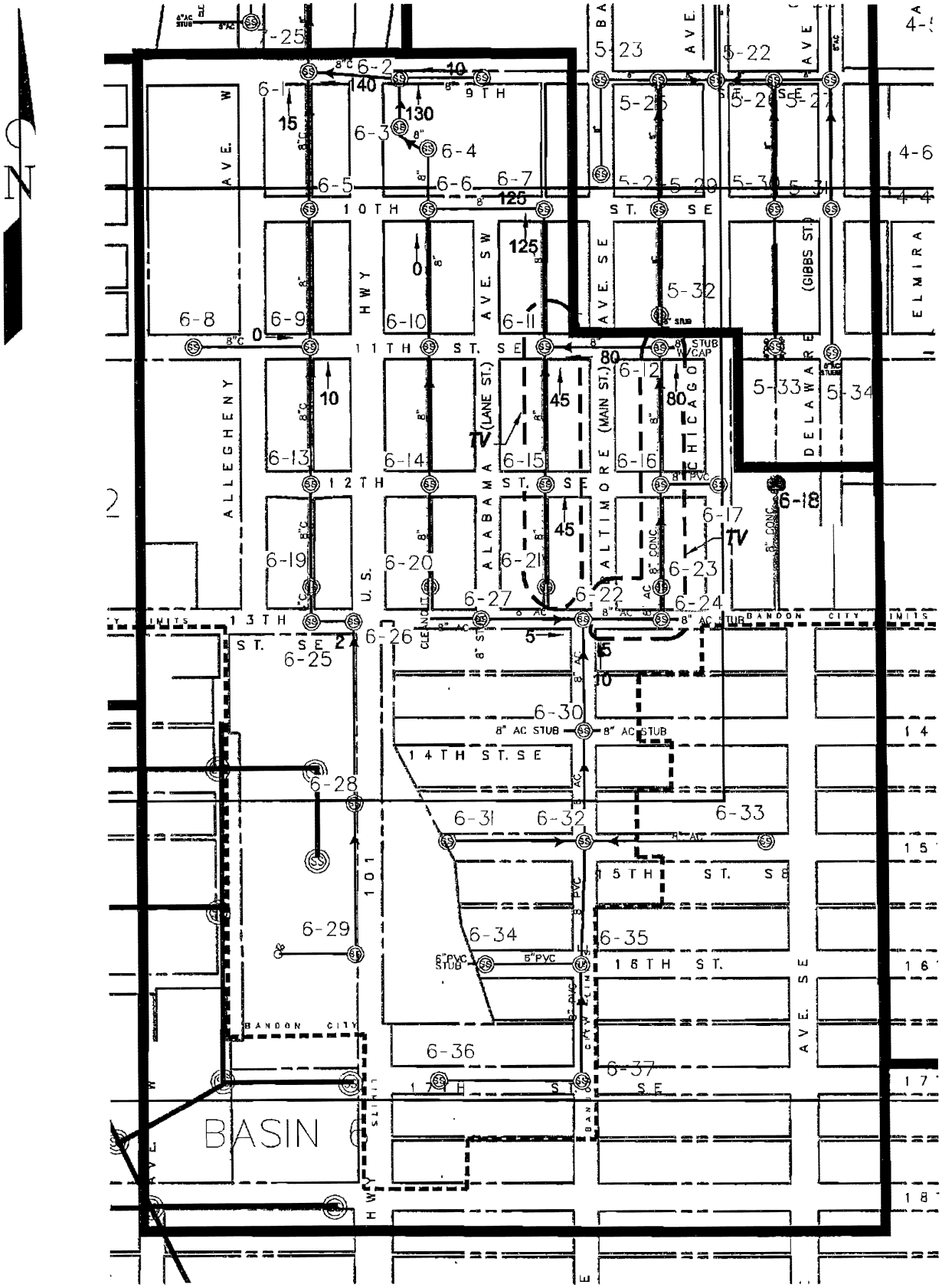
S 89°25'47" E
N 24°39'E
71.51'
401
10.71 AC.
400
10.63 AC.
300
1.82 AC.

Figures and Maps

Appendix

B


WETLANDS MAP OF BANDON AREA
From National Wetlands Inventory, 1989



THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON*** ***BASIN 6***	**FIGURE NO.** ***1***
DATE: JAN., 2002 PROJECT NO.: 4501.35	***I/I ANALYSIS***	

DESIGN DATA

ITEM	VALUE DESIGN	VALUE FUTURE
PLANT FLOW		
AVERAGE DRY WEATHER, MGD	0.6	0.75
PEAK MONTHLY AVERAGE, MGD	1.2	1.8
PEAK DAILY AVERAGE, MGD	2.1	3.2
PEAK WET WEATHER, MGD	3.2	4.8
PLANT LOAD		
BOD AVERAGE, PPD	1,150	1,730
BOD MAXIMUM MONTH, PPD	1,550	2,320
SS AVERAGE, PPD	1,350	2,020
SS MAXIMUM MONTH, PPD	2,350	3,520
FILLMORE AVENUE PUMPING STATION		
TYPE OF PUMPS: NON-CLOG VERTICAL TURBINE, VARIABLE SPEED		
NUMBER OF PUMPS	2	2
CAPACITY, EACH, MGD	0.678-3.2	4.8
HORSEPOWER, EACH	50	
OVERFLOW TO PERRY CREEK, DIAMETER, INCHES	12	12
WET WELL STORAGE BEFORE OVERFLOW AT 1.2 MGD, MINUTES	10	10
HEADWORKS		
ROTATING DRUM SCREEN		
NUMBER	1	1
DIAMETER, INCHES	36	60
LENGTH OF DRUM, INCHES	72	80
SPACING BETWEEN WEDGEWIRES, INCHES	0.1	0.1
CAPACITY, MGD, AT SS CONCENTRATION OF 250 mg/l	3.2	4.8
HAND RAKED BAR SCREEN		
NUMBER	1	1
SPACING BETWEEN BARS, INCHES	1.0	1.0
CAPACITY, MGD	4.8	4.8
SCREENINGS COMPACTOR		
TYPE: PLUNGER OR AUGER		
NUMBER	1	1
WET SCREENINGS CAPACITY, CU FT/HR	12	12
GRIT REMOVAL		
AERATED GRIT TANK		
NUMBER OF BASINS	1	1
LENGTH, FEET	17.33	17.33
WIDTH, FEET	13	13
AVERAGE DEPTH, FEET	5	8
VOLUME, GALLONS	13,400	13,400
DETENTION TIME AT PWWF, MINUTES	6	4
AIRFLOW, SCFM	70	70
GRIT PUMPING		
TYPE: RECESSED IMPELLER		
NUMBER OF PUMPS	1	1
CAPACITY, GPM AT 30 FEET TDH	100	100
HORSEPOWER	7.5	7.5
GRIT SEPARATION		
CYCLONE SEPARATOR		
NUMBER	1	1
CAPACITY, GPM AT 8 PSI	270	270
GRIT WASHER		
TYPE: SCREW CLASSIFIER		
NUMBER	1	1
SCREW DIAMETER, INCHES	12	12
CAPACITY, POUNDS PER HOUR	1,500	1,500

ITEM	VALUE DESIGN	VALUE FUTURE
SECONDARY TREATMENT		
AERATION BASINS		
NUMBER	2	3
WIDTH, FEET	12.67	12.67
WATER DEPTH, FEET	15.8	15.8
BASIN 1		
TYPE: 3-CELL ANOXIC SELECTOR WITH 1 AEROBIC CELL		
LENGTH, FEET	105	105
VOLUME, 1000 GALLONS	157	157
VOLUME ANOXIC CELLS, 1000 GALLONS		
CELL 1	18	18
CELL 2	19	19
CELL 3	42	42
VOLUME, AEROBIC CELL, 1000 GALLONS	78	78
ANOXIC CELL MIXERS		
TYPE: SUBMERSIBLE PROPELLER		
NUMBER	4	8
HORSEPOWER, EACH	3.2	3.2
BASIN 2		
TYPE: 2-CELL AEROBIC		
LENGTH, FEET	84.5	84.5
VOLUME, 1000 GALLONS	141	141
BASIN 3		
TYPE: 2-CELL AEROBIC		
LENGTH, FEET	-	105
VOLUME, 1000 GALLONS	-	157
DIFFUSER TYPE: FINE BUBBLE FLEXIBLE MEMBRANE		
SECONDARY PROCESS PERFORMANCE, MAXIMUM MONTH LOAD		
MLSS IN AERATION BASIN, mg/l	2,000	2,000
RAS SUSPENDED SOLIDS, mg/l	8,000	8,000
F/M, LB BOD/LB MLVSS/DAY	0.37	0.37
SLUDGE AGE, DAYS	6	6
HYDRAULIC DETENTION TIME AT PEAK MONTH AVERAGE FLOW, HOURS	8	8
BLOWERS, AERATION AND DIGESTION		
TYPE: POSITIVE DISPLACEMENT		
NUMBER, STANDBY	2	
NUMBER AND CAPACITY, EACH, SCFM/HORSEPOWER		
AERATION (NEW, VARIABLE SPEED)	1-1,500/75	2-1,500/75
DIGESTION (EXISTING 2-SPEED)	1-880/50 HI SPD 510/30 LO SPD	1-1,300/75 (NEW)
STANDBY (EXISTING)	2-800/40	1-800/40
AIR REQUIRED FOR AERATION, SCFM		
AVERAGE	380	800
MAXIMUM DAY	1,250	1,900
SECONDARY CLARIFIERS		
TYPE: INBOARD WEIR, FLOCCULATOR		
NUMBER	2	3
DIAMETER, FEET	45	45
SIDE WATER DEPTH, FEET	16	16
OVERFLOW RATE AT PWWF, GPD/SQ FT	1,000	1,000
OVERFLOW RATE AT PEAK DAILY FLOW, GPD/SQ FT	880	660
OVERFLOW RATE AT 75% PWWF WITH ONE CLARIFIER OUT OF SERVICE, GPD/SQ FT	1,800	1,100
NUMBER OF SLUDGE LEVEL SIGHT PORTS PER CLARIFIER	3	3

ITEM	VALUE DESIGN	VALUE FUTURE
RETURN SLUDGE PUMPS		
TYPE: NON-CLOG HORIZONTAL CENTRIFUGAL, VARIABLE-SPEED		
NUMBER	3	4
CAPACITY, EACH, GPM	50-270	50-270
HORSEPOWER, EACH	5	5
SLUDGE WASTING CAPACITY, GPM	15-40	15-40
WAS FLOW METER		
TYPE: MAGNETIC		
CAPACITY, GPM	40	40
ULTRAVIOLET DISINFECTION-OPEN CHANNEL VERTICAL TYPE UV DISINFECTION CHANNELS		
NUMBER	2	2
LENGTH, INCHES	224	224
WIDTH, INCHES	18.25	18.25
DEPTH, INCHES	65.5	65.5
CAPACITY, EACH, MGD	1.8	2.4
LAMPS		
NUMBER PER MODULE	28	28
TOTAL NUMBER OF MODULES/CHANNEL	3	4
FLOW CAPACITY, PER MODULE, MGD	0.54	0.60
POWER CONSUMPTION, PER MODULE, KW	2.38	2.38
UV DOSE AT PWWF, 70% OUTPUT, 65% TRANSMISSION, MICROWATT-SEC/SQ CM	38,870	34,850
EXPOSURE AT PWWF, SECONDS	12.5	11.1
AEROBIC DIGESTION		
DIGESTER BASIN (3-CELL SERIES TYPE)		
VOLUME, EACH CELL, GALLONS	2-126,000 1-118,000	2-125,000 1-118,000
FUTURE DIGESTER BASIN, VOLUME, GALLONS		121,600
MAXIMUM MONTH SLUDGE LOADING, GPD AT 0.8% SOLIDS	18,800	27,600
HYDRAULIC DETENTION TIME, DAYS	20	20
SOLIDS RETENTION TIME, DAYS	55	55
PEAK MONTH AIR REQUIREMENT, SCFM	850	1,300
DIGESTED SLUDGE FLOWMETER		
TYPE: MAGNETIC		
CAPACITY, GPM	350	350
LIQUID SLUDGE LOADING SYSTEM		
EXISTING		
FEED PUMP		
TYPE: CENTRIFUGAL		
CAPACITY, GPM	350	350
HORSEPOWER	3	3
AIR LIFT SLUDGE PUMPS		
TYPE: AIR LIFT		
NUMBER	3	3
DIAMETER, INCHES	4	4
CAPACITY AT 3 FEET LIFT AND 82% SUBMERGENCE, EACH, GPM	175	175
AIR REQUIREMENT, EACH, SCFM	30	30
SLUDGE THICKENING		
SCREW PRESS FEED PUMP		
EXISTING		
TYPE: PROGRESSIVE CAVITY, VARIABLE SPEED		
NUMBER	1	1
CAPACITY, GPM	8-57	8-57
HORSEPOWER	5	5
AVERAGE SLUDGE FEED RATE, GPD, AT 2.5% SOLIDS	5,350	8,025

ITEM	VALUE DESIGN	VALUE FUTURE
SCREW PRESS FEED FLOW METERS		
TYPE: MAGNETIC		
NUMBER	2	2
CAPACITY, GPM	15/35	15/35
SCREW PRESSES		
EXISTING		
NUMBER	1	1
CAPACITY, DRY SOLIDS, LB/HR	150	150
CAPACITY, GPM	15	15
PERCENT CAPTURE, MIN	82.5	82.5
NEW		
NUMBER	1	1
CAPACITY, DRY SOLIDS, LB/HR	350	350
CAPACITY, GPM	35	35
PERCENT CAPTURE, MIN	82.5	82.5
POLYMER FEED SYSTEM		
POLYMER DOSE, LBS/TON DRY SOLIDS	8-15	8-15
EXISTING		
NEAT POLYMER FEED PUMP		
TYPE: MECHANICAL DIAPHRAGM, VARIABLE SPEED		
NUMBER	1	1
CAPACITY, GPH	6-104	6-104
HORSEPOWER	0.5	0.5
POLYMER MIXING TANK, VOLUME, GALLONS	500	500
POLYMER SOLUTION MIXER, HORSEPOWER	0.5	0.5
NEW		
NEAT POLYMER DRUM MIXER, HORSEPOWER	0.5	0.5
POLYMER SOLUTION FEED PUMP		
TYPE: PROGRESSIVE CAVITY, VARIABLE SPEED		
NUMBER	1	1
CAPACITY, GPM	1-10	1-10
HORSEPOWER	3	3
SLUDGE STORAGE		
EXISTING		
AIR DRYING BEDS		
NUMBER	2	2
TOTAL AREA, SQ FT	4,213	4,213
PLANT WATER		
PUMPS		
TYPE: VERTICAL TURBINE		
NUMBER	2	2
CAPACITY, EACH, GPM	60	60
HORSEPOWER	5	5
HYDROPNEUMATIC TANK, VOLUME, GALLONS	158	158
SERVICE AIR COMPRESSOR		
TYPE: AIR COOLED RECIPROCATING		
CAPACITY, ACFM AT 100 PSIG	15	15
HORSEPOWER	5	5
EFFLUENT FLOW METER		
TYPE: IN-LINE SONIC		
RANGE, MGD	0.072-4.8	0.072-4.8
AVERAGE MONTHLY PLANT EFFLUENT REQUIREMENTS*		
BOD AND SS, PPD JUNE-OCTOBER	75	75
BOD AND SS, PPD NOVEMBER-MAY	113	113
* MASS LOAD GOVERNS CONCENTRATION AT ALL DESIGN FLOWS		
ANTICIPATED EFFLUENT QUALITY		
BOD AND SS, mg/l JUNE-OCTOBER	10-20	10-20
BOD AND SS, mg/l NOVEMBER-MAY	10-30	10-30

Brown and Caldwell Consultants
Eugene, Oregon

SUBMITTED: Tom R Pierce DATE: 1-20-92
APPROVED: [illegible] PROJECT MANAGER, BROWN AND CALDWELL DATE: 1-20-92
APPROVED: DATE:

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

FILE 6151
DRAWN GTM
DESIGNED WMH,JDB
CHECKED BKP
CHECKED

REGISTERED PROFESSIONAL ENGINEER 10,847 Tom R Pierce OREGON DEC. 15, 1980 THOMAS RICHARD PIERCE

REVISIONS					
ZONE	NO.	DESCRIPTION	BY	DATE	APP.

CITY OF BANDON, OREGON

WASTEWATER TREATMENT PLANT IMPROVEMENTS

DESIGN DATA

SCALE: NONE
DRAWING NUMBER: G5
SHEET NUMBER: 5

Calculations

Appendix

C

TABLE 4.4
EQUIVALENT DWELLING UNITS

Land Use	EDU
Single family dwelling = 1 EDU	
Camp	
Day (no meals)	0.05/person
Resort	0.17/person
Church	0.17/seat
Country Club	0.33/member
Hotel	0.4/room
Industrial (excl. industrial use)	
Without showers	0.05/person/shift
With showers	0.12/person/shift
Institutions	
Hospital	0.83/bed
Rest Home	0.42/bed
Laundries, self-serve	1.67/machine
Mobile home parks	0.83/space
Motels	
With kitchens	0.33/bedroom
Without kitchens	0.27/bedroom
Office building	0.05/worker/shift
Picnic parks	
Toilet only	0.017/user
Showers included	0.033/user
Residential	
Boarding houses	0.5/bedroom
Rooming houses	0.27/person
Condominiums	0.68/unit
Multi-family	0.55/unit
Single family, 3 bedrooms or less	1.0/unit
Each additional bedroom	0.25/bedroom
Restaurant	0.13/seat
Single - service	0.007/customer
With bar/lounge	0.17/seat

Table 4.4, continued

Land Use	EDU
Schools	
Boarding	0.33/person
Day (cafeteria & showers)	0.083/person
Day (cafeteria only)	0.067/person
Day	0.05/person
Service or gas station	1.25/per pump station
Swimming pool	0.033/person
Shopping center	0.53/1000 SF
Tavern	0.07/seat
Theater	0.017/seat
Trailer park	
Without hookup	0.17/space
With hookup	0.33/space

Bandon WWTP Loads 1996-2001

		Average				Daily Max	
Month	Avg flow	BOD	BOD	TSS	TSS	BOD	TSS
	MGD	mg/L	PPD	mg/L	PPD	PPD	PPD
Jan-96	0.491	194	651	148	500	782	889
Feb-96	0.725	94	503	95	487	689	953
Mar-96	0.518	173	626	166	614	924	1050
Apr-96	0.493	189	675	155	533	913	687
May-96	0.499	210	757	145	488	1297	888
Jun-96	0.327	277	635	162	373	712	594
Jul-96	0.293	291	602	226	460	719	933
Aug-96	0.281	297	650	228	504	786	844
Sep-96	0.263	282	590	204	436	711	689
Oct-96	0.257	295	595	189	390	696	598
Nov-96	0.482	265	701	171	500	984	697
Dec-96	0.771	109	644	99	549	1063	1100
Jan-97	0.677	104	508	138	617	692	1579
Feb-97	0.571	142	522	127	479	677	852
Mar-97	0.527	140	578	150	620	740	810
Apr-97	0.291	325	766	216	516		
May-97	0.407	217	523	167	459	1026	951
Jun-97	0.287	271	661	184	435	781	718
Jul-97	0.283	248	578	186	434	772	1064
Aug-97	0.284	286	635	186	404	823	677
Sep-97	0.277	311	636	186	368	835	624
Oct-97	0.298	271	544	202	426	733	710
Nov-97	0.309	233	495	203	455	594	759
Dec-97	0.349	187	481	184	469	642	819
Jan-98	0.586	124	488	123	525	760	1238
Feb-98	0.727	103	540	94	503	719	791
Mar-98	0.541	141	544	151	607	666	914
Apr-98	0.475	169	595	152	534	923	797
May-98	0.393	177	496	175	500	542	746
Jun-98	0.345	205	517	181	457	617	740
Jul-98	0.313	251	577	207	482	728	612
Aug-98	0.309	264	596	203	454	684	599
Sep-98	0.275	257	552	220	481	835	915
Oct-98	0.291	257	539	202	425	666	627
Nov-98	0.407	217	523	167	459	898	1005
Dec-98	0.752	112	541	113	583	837	
Jan-99	0.687	145	593	120	524	689	802
Feb-99	0.848	94	583	97	568	853	932
Mar-99	0.726	113	554	103	495	653	721
Apr-99	0.526	134	446	144	494	615	674
May-99	0.406	134	354	163	428	502	807
Jun-99	0.347	174	375	204	444	548	809
Jul-99	0.378	177	434	185	448	634	938
Aug-99	0.354	184	393	205	457	699	918
Sep-99	0.336	164	332	240	504	472	696
Oct-99	0.326	153	299	230	462	419	674
Nov-99	0.341	183	406	292	625	966	1259
Dec-99	0.378	194	474	213	501	586	874

Bandon WWTP Loads 1996-2001

		Average				Daily Max	
Month	Avg flow	BOD	BOD	TSS	TSS	BOD	TSS
	MGD	mg/L	PPD	mg/L	PPD	PPD	PPD
Jan-00	0.56	172	641	177	631	1061	1245
Feb-00	0.77	129	646	132	673	867	1119
Mar-00	0.498	159	515	181	569	681	1172
Apr-00	0.344	266	565	237	511	743	1004
May-00	0.317	244	471	248	483	628	735
Jun-00	0.342	261	551	224	475	759	900
Jul-00	0.374	255	605	256	618	687	1177
Aug-00	0.354	301	685	231	521	861	1006
Sep-00	0.335	236	484	235	492	641	927
Oct-00	0.333	258	515	277	564	621	815
Nov-00							
Dec-00							
Jan-01	0.284	247	459	240	459	565	815
Feb-01	0.28	354	650	244	456	746	1249
Mar-01	0.283	240	423	259	478	623	931
Apr-01	0.308	289	612	220	456	797	760
May-01	0.282	321	578	258	471	751	875
Jun-01	0.277	373	693	271	491	859	679
Jul-01	0.3	394	804	287	594	1034	773
Aug-01	0.33	441	1013	255	569	1580	1046
Sep-01	0.303	467	918	265	523		777
Oct-01	0.266	384	669	207	360	829	434
Nov-01	0.295	296	569	218	426	730	840
Dec-01	0.379	256	712	183	474	991	1065
Max	0.848	467	1013	292	673	1580	1579
Avg	0.412	227	573	192	497	767	866
Peak factor		2.1	1.8	1.5	1.4	2.1	1.8
PCL		0.08	0.21	0.07	0.18	0.28	0.32

2001 averages	
339	BOD mg/l
675	BOD lbs
242	TSS mg/l
480	TSS lbs

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

MEMORANDUM

To: Bill Nielson, City of Bandon
From: John Waddill
Date: June 18, 2001

Subject: City of Bandon Miscellaneous Services
Wastewater Treatment Plant
Design Average Wet Weather Flow
Project No. 4501.00E

Schedule C, Condition 4 of the city's National Pollutant Discharge Elimination System (NPDES) permit for the wastewater treatment facility allows the city to request an increase in wet weather mass loading based on wet weather flows. The information in this memorandum provides an evaluation of the design average wet weather flow.

The evaluation utilizes the flow analysis by Brown and Caldwell Consulting Engineers in 1991. That information is summarized below:

Design Flow	Flow[1]	Probability of Exceeding [2]
Peak Wet Weather	3.2 Mgd	0.011%
Peak Daily	2.1 Mgd	0.27%
Peak Weekly	1.5 Mgd	1.9%
Peak Monthly	1.2 Mgd	8.3%

These probabilities are illustrated on the attached graph (Exhibit 1). The flow vs. probability line was extrapolated to the 50% probability intersection. This suggests an average annual flow of 0.68 Mgd.

The average dry weather flow used in the 1992 design is 0.54 Mgd[1]. Average annual flow is the mean of the average dry weather flow and the average dry weather flow[2]. That is,

$$\text{Annual Flow}_{AVERAGE} = (\text{Dry Weather Flow}_{AVERAGE} + \text{Wet Weather Flow}_{AVERAGE})/2$$

or

$$\text{Wet Weather Flow}_{AVERAGE} = (2 \times \text{Annual Flow}_{AVERAGE}) - \text{Dry Weather Flow}_{AVERAGE}$$
$$= (2 \times 0.68 \text{ Mgd}) - 0.54 \text{ Mgd}$$
$$= 0.82 \text{ Mgd}$$

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COOS BAY, OREGON 97420
TELEPHONE: (541) 269-0732
FAX: (541) 269-2044

The design data table[3] in the construction drawings for the facility shows the following information about the main process equipment and flow:

Process Equipment	Design Parameter		
Influent Pump Station	Flow	3.2 Mgd	Peak Wet Weather
Rotating Drum Screen[4]	Flow	3.2 Mgd	Peak Wet Weather
Hand Raked Bar Screen	Flow	3.2 Mgd	Peak Wet Weather
Aeration Basin	Hydraulic Retention	6 hours	Peak Wet Weather
Secondary Clarifier	Overflow	1000 sf/gal/day	Peak Wet Weather
	Overflow	660 sf/gal/day	Peak Daily

The overflow rate of the secondary clarifier is the only variable process in the design for the average wet weather flow. Attached Exhibit 2 shows daily influent flow rates, secondary clarifier overflow rates, and the calculated mass load[5].

For clarifiers in general, the preferred average overflow for average flow conditions is about 560 gallons per day per square foot[6]. Using this rate, the calculated average wet weather flow is consistent with the 1992 design scheme.

From this analysis, design average wet weather flow is approximately 0.82 million gallons per day. Using a BOD_5 concentration of 30 mg per liter, the average monthly load is calculated[5] as approximately 200 pounds. Similarly, the not-to-exceed weekly load is approximately 300 pounds and the not-to-exceed daily load is 400 pounds.

Footnotes

(1) Brown and Caldwell, City of Bandon Wastewater Facilities Plan, February 1991
(2) Oregon Department of Environmental Quality, Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western Oregon, 1996
(3) Brown and Caldwell, Bandon Wastewater Treatment Plant Improvement, Volume 3 of 3, Part C: Drawings, January, 1992
(4) This unit was replaced in 1998 with equipment of the same capacity.
(5) OAR 340-41-120(9).
(6) American Society of Civil Engineers, Design of Municipal Wastewater Treatment Plants, Volume I, Chapters 1-12, 1991

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COMPARISION OF MASS LOAD WITH SECONDARY CLARIFIER OVERFLOW RATE

Diameter	45 feet
Area	1590 square feet
Depth	16 feet

Plant Flow Mgd	SCL Overflow (gal/sf/day)	Using Wet Weather Permit Concentration Monthly BOD5 of 30 mg/l: Monthly Average BOD_5 Mass Load (lbs)	Weekly Average BOD_5 Mass Load (lbs)	Daily Average BOD_5 Mass Load (lbs)	Design Flow	Using Dry Weather Permit Concentration Monthly BOD5 of 20 mg/l: Monthly Average BOD_5 Mass Load (lbs)	Weekly Average BOD_5 Mass Load (lbs)	Daily Average BOD_5 Mass Load (lbs)
0.0	0	0	0	0		0	0	0
0.1	31	25	38	50		17	25	33
0.2	63	50	75	100		33	50	67
0.3	94	75	113	150		50	75	100
0.4	126	100	150	200		67	100	133
		110	**170**	**230**	**Mass Load Permit Parameters**	**75**	**110**	**150**
0.45	141	113	169	225	Average Dry Weather Flow	75	113	150
0.5	157	125	188	250				
0.6	189	150	225	300				
0.7	220	175	263	350				
0.8	**252**	**200**	**300**	**400**	**Average Wet Weather Flow**			
0.9	283							
1.0	314							
1.1	346							
1.2	377				Peak Monthly Flow			
1.3	409							
1.4	440							
1.5	472							
1.6	503							
1.7	534							
1.8	566							
1.9	597							
2.0	629							
2.1	660				Peak Daily Average Flow			
2.2	692							
2.3	723							
2.4	755							
2.5	786							
2.6	817							
2.7	849							
2.8	880							
2.9	912							
3.0	943							
3.1	975							
3.2	1006				Peak Wet Weather Flow			

EXHIBIT 2

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

June 19, 2001

Mr. Bill Nielson
City of Bandon
P.O. Box 67
Bandon, OR 97411

Subject: City of Bandon Miscellaneous Services
Wastewater Treatment Plant
Design Average Wet Weather Flow
Project No. 4501.00E

Dear Bill:

As requested by the city, our office evaluated the design average wet weather flow (DAWWF) for the city's wastewater treatment plant. Schedule C, Condition 4 of the city's National Pollutant Discharge Elimination System (NPDES) permit for the facility allows the city to request an increase in wet weather mass loading. The information in the attached memorandum to the city dated June 18, 2001 provides an evaluation of the design average wet weather flow.

The conclusion that was reached in the document is that the DAWWF is approximately 0.82 million gallons per day (Mgd). The current wet weather mass load is based on the average dry weather flow, that is, 0.45 Mgd. The current mass load parameters are about one half of what could be requested. This is shown in the table below:

BOD_5 Mass Load Permit Parameter	Current Permit	Potential Modification
Average Monthly Load	110 lbs	200 lbs
Not-to-exceed Weekly Load	170 lbs	300 lbs
Not-to-exceed Daily Load	230 lbs	400 lbs

The request for modification has attached conditions. The conditions, which are abstracted from OAR 340-41-120(9)(a), are listed below:

(G) Within 180 days after permit renewal or modification, permittees receiving higher mass loads under this rule and having a separate sanitary sewer system shall submit to the Department for review and

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AX: (541) 269-2044

approval a proposed program and time schedule for identifying and reducing inflow. The program shall consist of the following:

(i) Identification of all overflow points and verification that sewer system overflows are not occurring up to a 24-hour, five-year storm event or equivalent;

(ii) Monitoring of all pump station overflow points; and

(iii) A program for identifying and removing all inflow sources into the permittees sewer system over which the permittee has legal control; and

(iv). For those permittees not having the necessary legal authority for all portions of the sewer system discharging into the permittee's sewer system or treatment facility, a program and schedule for gaining legal authority to require inflow reduction and a program and schedule for removing inflow sources.

(H) Within one year after the Department's approval of the program, the permittee shall begin implementation of the program.

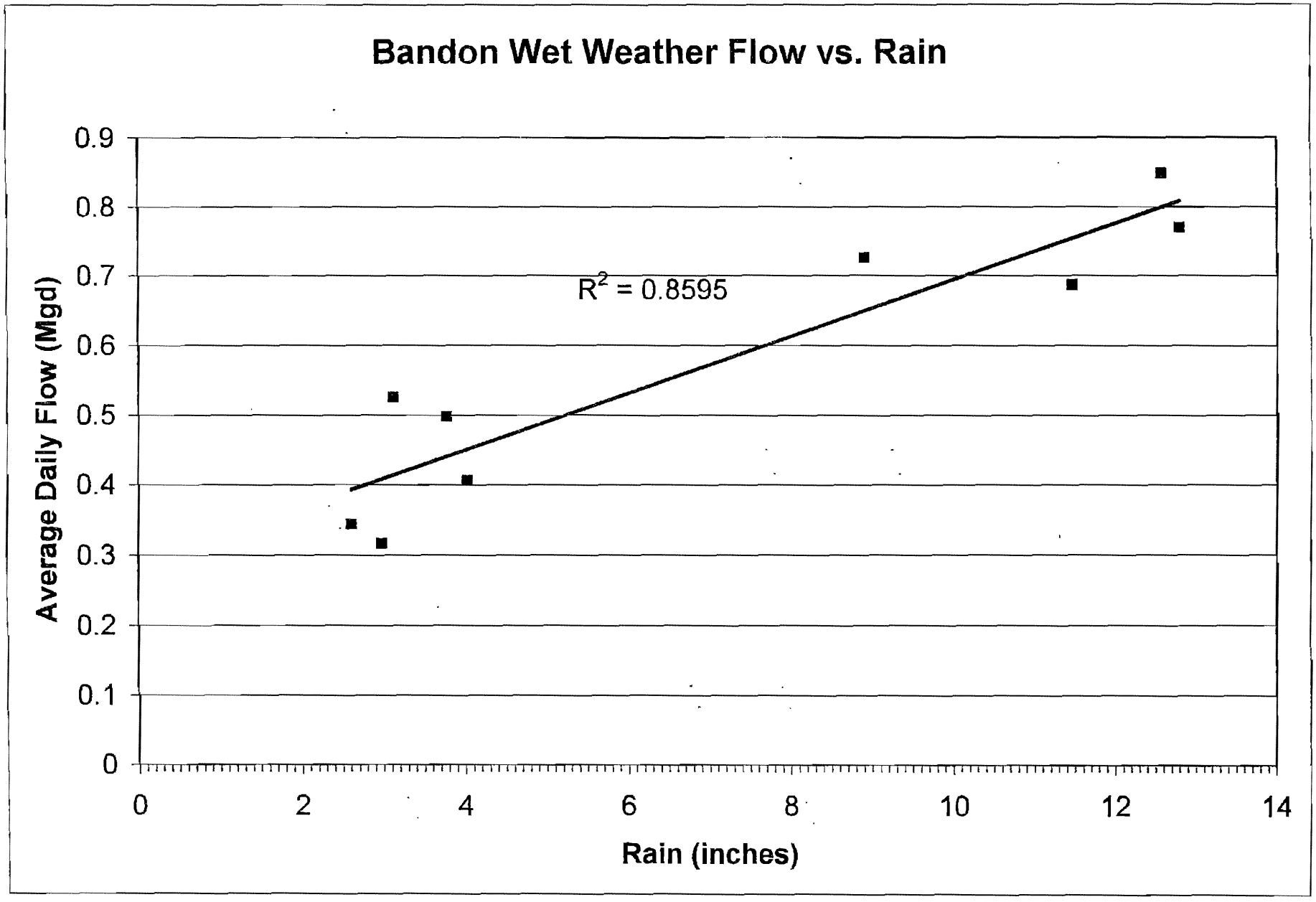
As you can see, the price of increased loading is diligent and monitored pursuit of inflow and infiltration (I/I). While what is demanded in this section of the Oregon Administrative Rules is certainly reasonable and part of a well operated collection system, the specific involvement of the regulator may be carry more labor and care than needed.

Our recommendation in the analysis so far, is that the city should pursue the mass load increase to the next level. That is, request an increase, define the specifics, and evaluate the cost and benefits. While it is obvious that the mass load in the winter should be higher than that in the summer, the regulator may not allow the entire increase that is suggested by the evaluation. The marginal increase must be weighed against the cost of the provisions that are generally described above. In other words, the benefit of increased mass load in the winter is clear. The cost is not clear because the specifics are not yet definite.

Please call if you have any questions.

Respectfully,
THE DYER PARTNERSHIP ENGINEERS AND PLANNERS, INC.

John M. Waddill, P.E., P.L.S.
(signed in two counterparts)

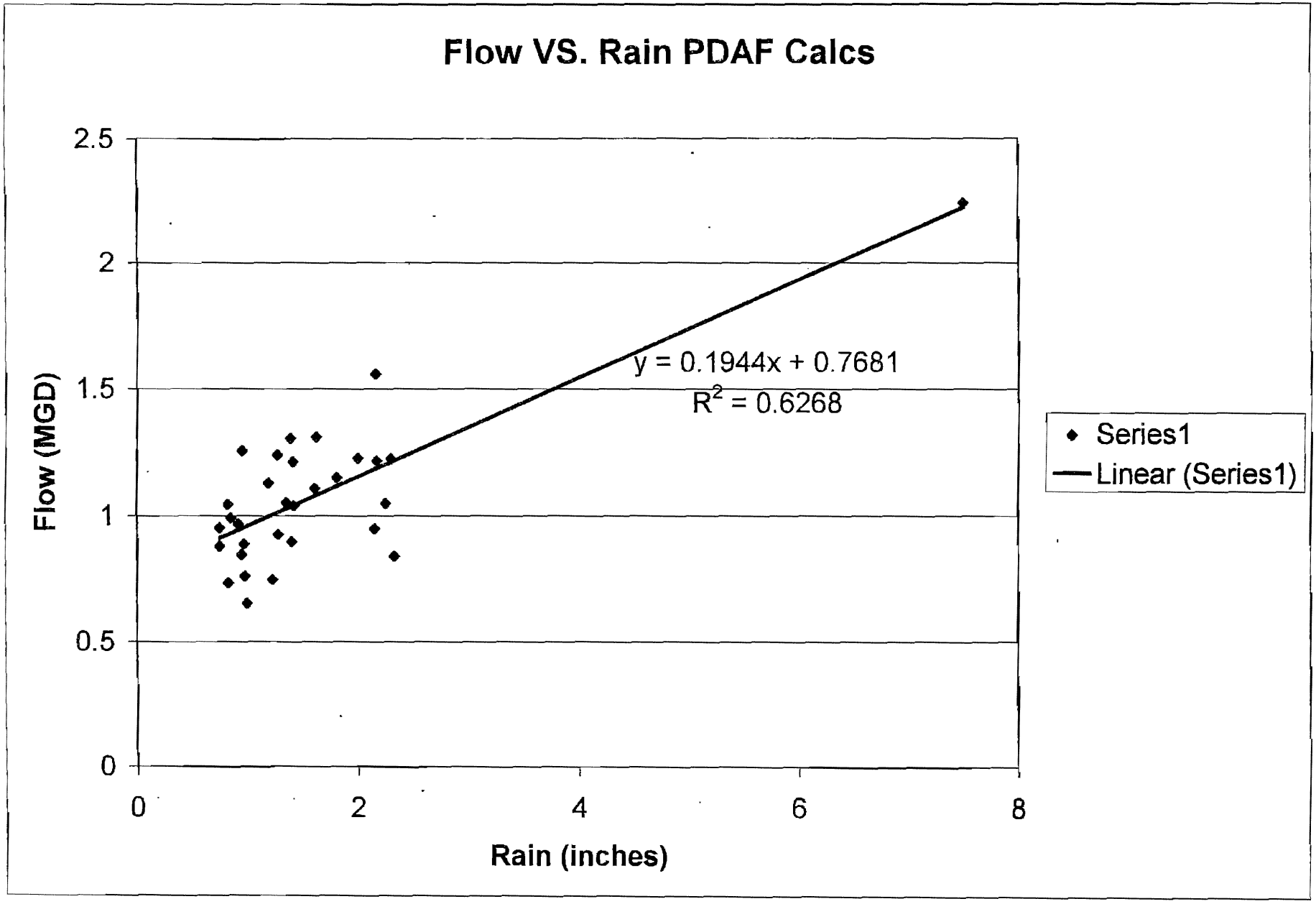

Bandon Wet Weather Flow vs. Rain
Average Daily Flow (Mgd)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
R^2 = 0.8595
0
2
4
6
8
10
12
14
Rain (inches)

INFILTRATION					INFLOW				
Date	Efluent (MGD)	rain (in./day)	Average (MGD)	Per Capita Use (gpcd)	Date	Efluent (MGD)	Rain (in./day)	Rain 48 hr	Per Capita Use (gpcd)
2/10/96	0.981	0			1/9/96	0.547	1.77	2.1	185
2/11/96	0.676	0			1/10/96	0.571	0.09	1.88	193
2/12/96	0.59	0			1/20/96	0.47	1.3	1.89	159
2/13/96	0.586	0			1/21/96	0.763	0.98	2.28	258
2/14/96	0.567	0			1/24/96	0.735	0.83	1.58	248
2/15/96	0.526	0			1/27/96	0.749	1.23	1.56	253
2/16/96	0.526	0.05	0.579	195	1/28/96	0.954	0.75	1.98	322
3/12/96	0.547	0.15			2/9/96	1.218	2.17	2.81	411
3/13/96	0.507	0.1			2/10/96	0.981	0	2.17	331
3/14/96	0.482	0			2/18/96	0.723	1.47	1.71	244
3/15/96	0.487	0.02			2/19/96	1.152	1.81	3.28	389
3/16/96	0.467	0.03			2/20/96	0.993	0.85	2.66	335
3/17/96	0.458	0			2/21/96	1.216	1.41	2.26	411
3/18/96	0.447	0			2/22/96	0.984	0.47	1.88	332
3/19/96	0.419	0			2/29/96	0.908	1.4	1.92	307
3/20/96	0.43	0			3/5/96	0.969	0.92	2.04	327
3/21/96	0.424	0	0.467	158	11/18/96	0.385	2.2	2.98	130
1/4/97	0.791	0.03			11/19/96	2.243	7.5	9.7	758
1/5/97	0.715	0.07			11/20/96	1.514	1.2	8.7	511
1/6/97	0.571	0			11/21/96	0.712	0.3	1.5	240
1/7/97	0.591	0.01			11/22/96	0.95	2.15	2.45	321
1/8/97	0.555	0			11/23/96	0.842	0.02	2.17	284
1/9/97	0.531	0			12/5/96	1.051	2.25	2.32	355
1/10/97	0.506	0.07			12/6/96	0.882	0.75	3	298
1/11/97	0.575	0			12/8/96	1.226	2.3	2.88	414
1/12/97	0.474	0			12/9/96	1.151	0.13	2.43	389
1/13/97	0.441	0			12/11/96	1.131	0.73	1.55	382
1/14/97	0.469	0			12/29/96	0.928	1.23	1.47	313
1/15/97	0.446	0			12/30/96	1.023	0.5	1.73	345
1/16/97	0.405	0.03	0.544	184	12/31/96	1.242	1.27	1.77	419
3/21/97	0.626	0			1/1/97	1.512	1.03	2.3	511
3/22/97	0.577	0			1/26/97	1.557	2.16	3.24	526
3/23/97	0.475	0			1/27/97	0.843	0	2.16	285
3/24/97	0.451	0			1/31/97	1.109	2.81	2.81	375
3/25/97	0.526	0			2/1/97	1.756	0.62	3.43	593
3/26/97	0.478	0.1			3/2/97	0.843	2.33	2.33	285
3/27/97	0.47	0.11	0.515	174	3/3/97	0.613	0.31	2.64	207
12/15/98	0.688	0			11/18/98	0.317	0.66	1.54	107
12/16/98	0.626	0			11/21/98	0.708	3.53	3.96	239
12/17/98	0.595	0			11/22/98	0.865	0.99	4.52	292
12/18/98	0.546	0			11/26/98	0.777	1.74	2.2	262
12/19/98	0.545	0			11/27/98	0.611	0.5	2.24	206
12/20/98	0.538	0			11/30/98	0.883	2.7	3.59	298
12/21/98	0.533	0			12/1/98	1.797	0.75	3.45	607
12/22/98	0.571	0			12/2/98	1.229	2	2.75	415
12/23/98	0.544	0			12/3/98	1.335	0.42	2.42	451
12/24/98	0.53	0	0.572	193	12/28/98	0.835	2.3	2.3	282
1/1/99	0.687	0.05			12/29/98	1.287	0.66	2.96	435

INFILTRATION				
Date	Effluent (MGD)	rain (in./day)	Average (MGD)	Per Capita Use (gpcd)
1/2/99	0.652	0		
1/3/99	0.606	0		
1/4/99	0.561	0		
1/5/99	0.525	0		
1/6/99	0.482	0		
1/7/99	0.481	0.08		
1/8/99	0.459	0		
1/9/99	0.474	0		
1/10/99	0.461	0		
1/11/99	0.452	0	0.531	179
3/15/99	0.747	0.04		
3/16/99	0.686	0.08		
3/17/99	0.646	0		
3/18/99	0.63	0.07		
3/19/99	0.592	0.02		
3/20/99	0.578	0		
3/21/99	0.581	0.02		
3/22/99	0.552	0.06	0.627	212
4/12/99	0.615	0.02		
4/13/99	0.59	0		
4/14/99	0.507	0		
4/15/99	0.426	0		
4/16/99	0.487	0		
4/17/99	0.493	0		
4/18/99	0.479	0		
4/19/99	0.554	0		
4/20/99	0.458	0.05		
4/21/99	0.462	0		
4/22/99	0.439	0.02		
4/23/99	0.433	0		
4/24/99	0.443	0		
4/25/99	0.441	0		
4/26/99	0.438	0.17		
4/27/99	0.43	0.08		
4/28/99	0.409	0.09		
4/29/99	0.379	0		
4/30/99	0.388	0	0.467	158
12/20/99	0.347	0		
12/21/99	0.354	0		
12/22/99	0.335	0		
12/23/99	0.369	0		
12/24/99	0.348	0		
12/25/99	0.325	0		
12/26/99	0.311	0		
12/27/99	0.301	0		
12/28/99	0.331	0		
12/29/99	0.335	0		
12/30/99	0.319	0		

INFLOW				
Date	Effluent (MGD)	Rain (in./day)	Rain 48 hr	Per Capita Use (gpcd)
1/16/99	0.673	0.75	2.05	227
1/18/99	1.041	1.42	1.91	352
1/19/99	0.784	0.43	1.85	265
1/21/99	0.999	0.85	1.8	337
1/30/99	0.936	2.44	2.62	316
1/31/99	1.47	0.39	2.83	496
2/7/99	1.12	0.67	1.52	378
2/9/99	1.307	1.39	1.56	441
2/10/99	0.968	0.3	1.69	327
2/18/99	0.726	1.35	1.71	245
2/19/99	0.991	0.45	1.8	335
2/23/99	0.99	1.6	2	334
2/24/99	1.279	0.45	2.05	432
2/28/99	1.131	1.19	1.52	382
3/4/99	0.99	0.28	1.63	334
3/30/99	0.717	0.53	1.5	242
3/31/99	0.891	0.97	1.5	301
11/26/99	0.464	1.15	1.55	157
12/10/99	0.582	0.75	1.89	197
1/11/00	0.674	1.61	2.33	228
1/12/00	0.564	0.43	2.04	190
1/13/00	0.899	2.9	3.33	304
1/14/00	1	0.77	3.67	338
1/24/00	0.743	1.67	1.7	251
1/25/00	0.954	0.78	2.45	322
2/9/00	0.849	0.48	1.55	287
1/13/00	0.879	0.58	1.56	297
1/14/00	1.109	1.61	2.19	375
1/15/00	1.134	0.7	2.31	383
1/26/00	0.885	1.6	2.3	299
1/27/00	1.312	1.62	3.22	443
1/28/00	1.012	0.04	1.64	342
5/16/00	0.346	0.35	1.54	117
12/14/00	0.515	1.36	1.57	174
12/15/00	0.436	0.18	1.54	147
Average	0.96	1.20	2.40	323
Median				321
EPA Criterion for Inflow				275
Percent > EPA Criteria				69%

INFILTRATION					INFLOW				
Date	Efluent (MGD)	rain (in./day)	Average (MGD)	Per Capita Use (gpcd)	Date	Efluent (MGD)	Rain (in./day)	Rain 48 hr	Per Capita Use (gpcd)
12/31/99	0.326	0	0.333	113					
2/16/00	0.963	0							
2/17/00	0.778	0							
2/18/00	0.704	0							
2/19/00	0.703	0							
2/20/00	0.614	0.03							
2/21/00	0.667	0.31	0.693	234					
3/24/00	0.437	0							
3/25/00	0.427	0							
3/26/00	0.424	0							
3/27/00	0.4	0							
3/28/00	0.395	0.23							
3/29/00	0.402	0							
3/30/00	0.404	0							
3/31/00	0.358	0							
4/1/00	0.393	0							
4/2/00	0.377	0							
4/3/00	0.361	0							
4/4/00	0.353	0							
4/5/00	0.363	0							
4/6/00	0.365	0							
4/7/00	0.35	0							
4/8/00	0.338	0							
4/9/00	0.347	0							
4/10/00	0.34	0							
4/11/00	0.331	0							
4/12/00	0.346	0	0.376	127					
Average			0.518	175					
Median				179					
EPA Criteria for infiltration				120					
Percentage > EPA Criteria				91%					


Flow VS. Rain PDAF Calcs
2.5
2
1.5
1
0.5
0
Flow (MGD)
y = 0.1944x + 0.7681
R2 = 0.6268
Series1
Linear (Series1)
0
2
4
6
8
Rain (inches)

Storm calcs for PDAF		
	MGD	Rain
1/21/1996	0.763	0.98
1/24/1996	0.735	0.83
1/27/1996	0.749	1.23
1/28/1996	0.954	0.75
2/9/1996	1.218	2.17
2/19/1996	1.152	1.81
2/20/1996	0.993	0.85
2/21/1996	1.216	1.41
2/29/1996	0.9	1.4
3/5/1996	0.969	0.92
11/22/1996	0.95	2.15
12/4/1996	0.656	1
12/5/1996	1.051	2.25
12/6/1996	0.882	0.75
12/8/1996	1.226	2.3
12/10/1996	1.046	0.82
12/29/1996	0.928	1.28
12/31/1996	1.242	1.27
1/26/1997	1.557	2.16
3/2/1997	0.843	2.33
12/2/1998	1.229	2
1/18/1999	1.041	1.42
2/9/1999	1.307	1.39
2/25/1999	1.259	0.95
2/28/1999	1.131	1.19
3/3/1999	1.054	1.35
3/9/1999	0.848	0.95
3/31/1999	0.891	0.97
2/14/2000	1.109	1.61
2/27/2000	1.312	1.62
11/19/1996	2.243	7.5
PDAF		1.74

Note: PDAF without 11/96 storm is 1.70

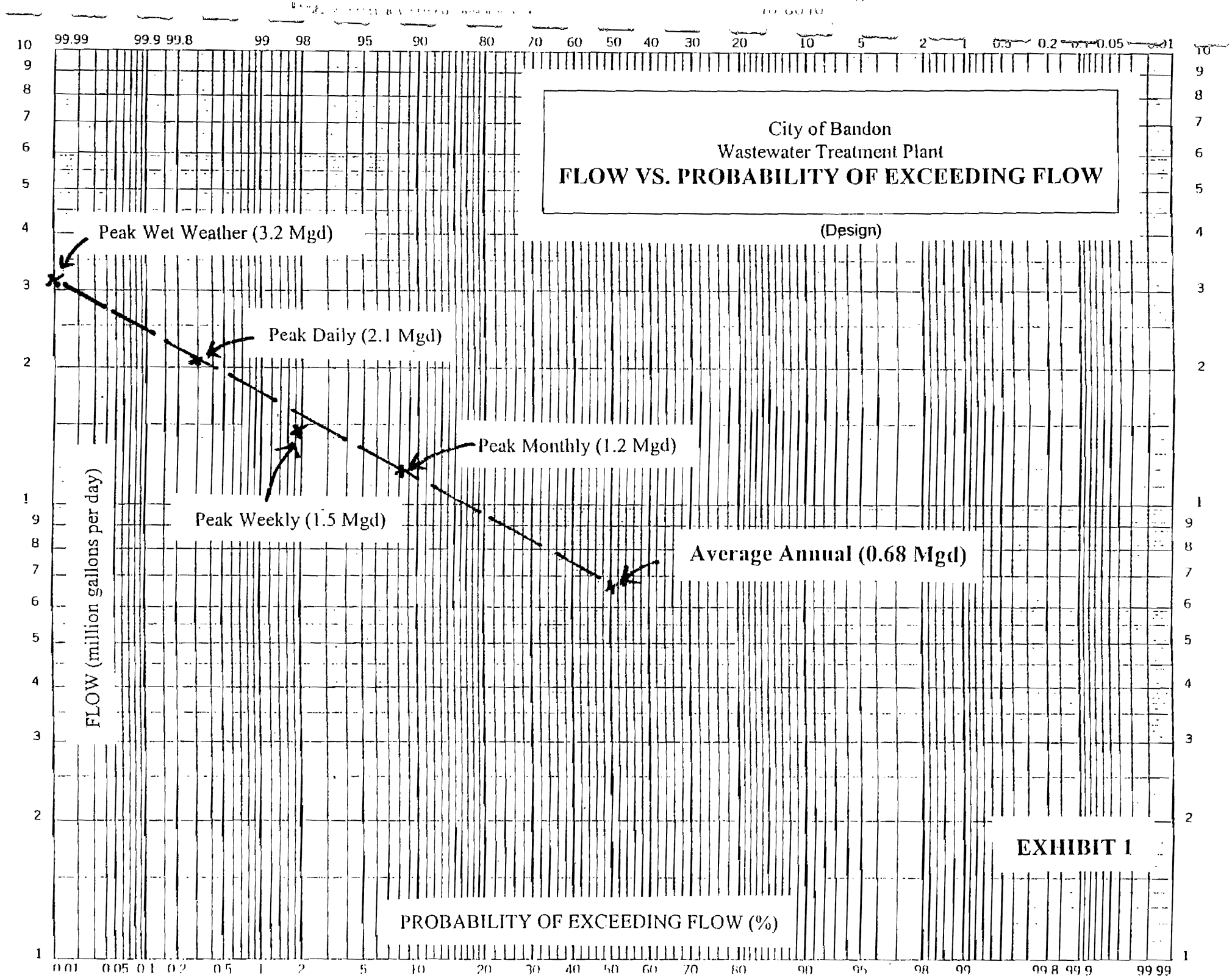
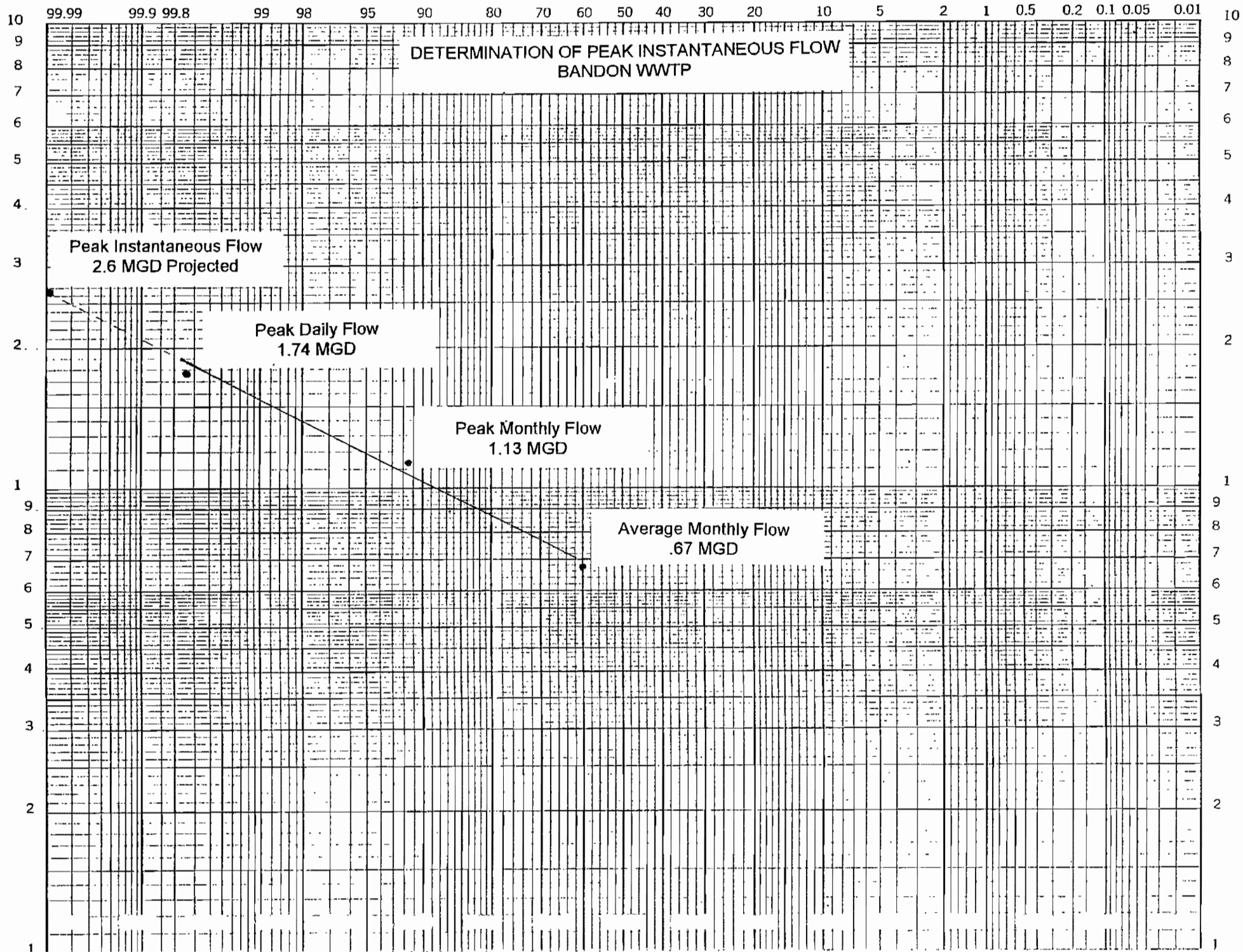

City of Bandon
Wastewater Treatment Plant
FLOW VS. PROBABILITY OF EXCEEDING FLOW
(Design)
Peak Wet Weather (3.2 Mgd)
Peak Daily (2.1 Mgd)
Peak Monthly (1.2 Mgd)
Peak Weekly (1.5 Mgd)
Average Annual (0.68 Mgd)
FLOW (million gallons per day)
PROBABILITY OF EXCEEDING FLOW (%)
99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99

EXHIBIT 1

46 8040



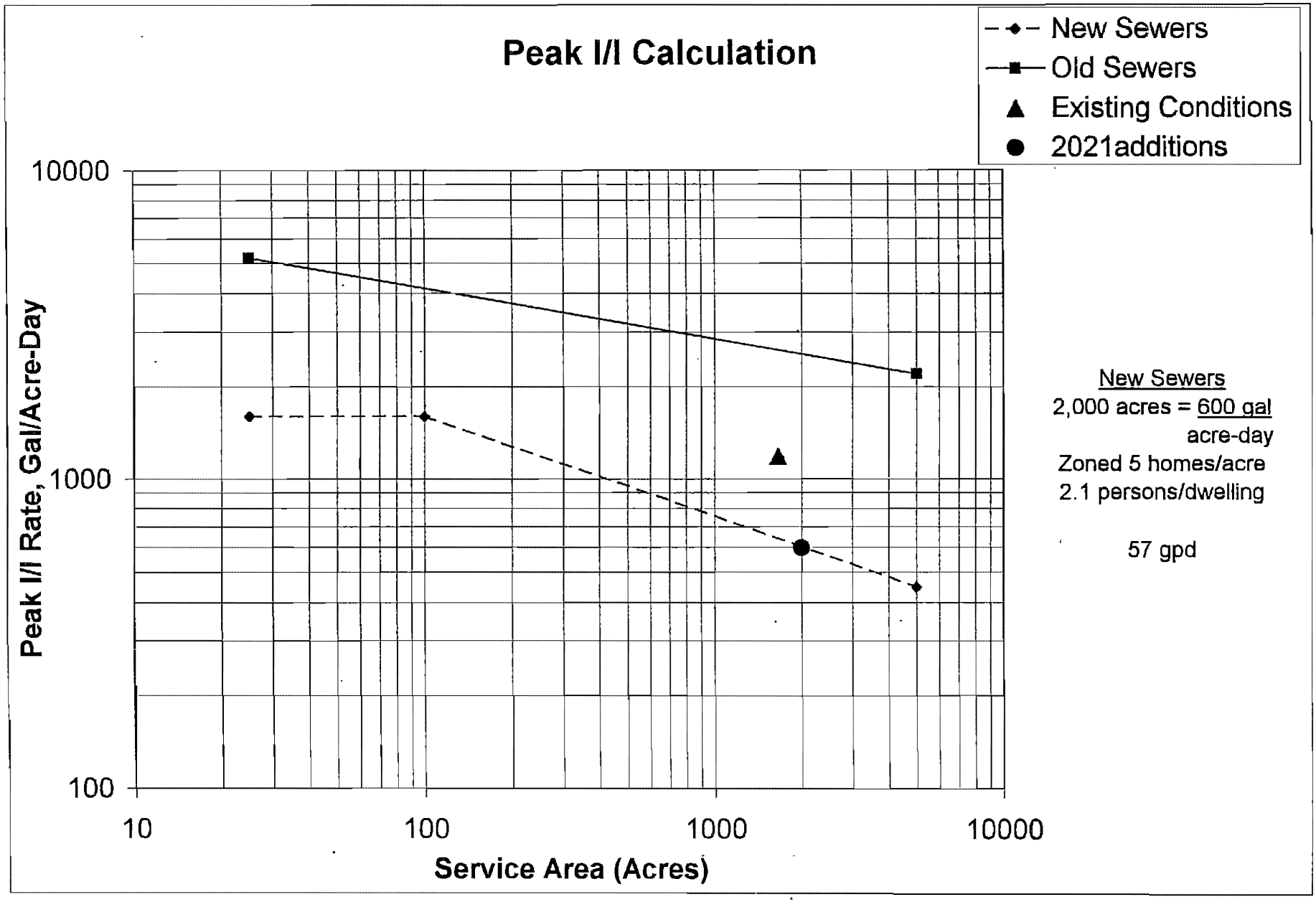
Design Flows for Bandon WWTP			24-Apr-02
Summary of Existing Influent Flows at the Bandon WWTP			
Flow Parameter	gpcd	MGD	Basis
Population - Dry Season	2692		2001 Equivalent Population
Population - Wet Season	2692		2001 Equivalent Population
ADWF	125	0.34	May-Oct 10/97 - 10/00
Base Sewage dry	84	0.23	Based on review of Bandon's Water Consumption Data
Base Sewage wet		0.23	
Base Infiltration		0.11	
AWWF		0.44	Nov-Apr 1/97 - 12/00
MMDWF		0.46	
MMWWF		0.89	
Peak Month		1.13	
Peak Week		1.4	Estimated from probability plot
Peak Day		1.74	Based on 5.0", 5-year, 24-hour storm
PIF		2.6	Estimated from probability plot
MMWW I/I		0.66	MMWWF - Base Sewage
PI I/I		2.37	PIF - Base Sewage
Density people/acre		10.5	5 homes per acre x 2.1 occupancy
Peak I/I gallons/acre/day		600	Metcalf & Eddy new sewer I/I chart (2,000 acres)
Peak I/I gallons/person/day		57	
Flow Projections for the years 2021.		MGD	Basis
Year	2021		
Population - Dry Total	4241		
Population - Wet Total	4241		
Population - Dry Increase	1549		
Population - Wet Increase	1549		
Flow Parameter			
increase in base sewage	A	**0.13**	Base sewage gpcd x population increase
increase in dry weather I/I	B	**0.03**	20 gpcd x population increase
increase in wet weather I/I	C	**0.09**	57 gpcd x population increase
Base Sewage - Dry		0.36	Existing base sewage dry + A
Base Infiltration - Dry		0.14	Existing base infiltration + B
ADWF		0.50	Existing ADFW + A+ B
MMDWF		0.62	Existing MMDFW + A + B
Base Sewage - Wet		0.36	Existing base sewage wet + A
Base Infiltration - Wet		0.20	Existing base infiltration + C
AWWF		0.65	Existing AWWF + A +C
MMWWF		1.11	Existing MMWWF + A + C
Peak Month		1.41	(Exist. Peak Month/Exist MMWWF) * New MMWWF
Peak Week		1.74	(Exist. Peak Week/Exist MMWWF) * New MMWWF
Peak Day		2.17	(Exist. Peak Day/Exist MMWWF) * New MMWWF
PIF		3.24	(Exist. PIF/Exist MMWWF) * New MMWWF
MMWW I/I		0.75	MMWWF - New Base Sewage (wet)
PI I/I		2.88	PIF - New Base Sewage (wet)

Design Loads for Bandon WWTP

6 year data			1996-2001
Existing Peaking Factors			
BOD	ppd	Peak Factor	
Max Day	1580	2.76	Represents 99.5% of all data
Max Week	1312	2.29	August 8-13, 2001
Max. Month	1013	1.77	Maximum month - August 2001
Average Day	573		
Per Capita Load	0.21		
TSS			
Max Day	1579	3.18	Represents 99.5% of all data
Max Week	943	1.90	January 13-17, 2000
Max. Month	673	1.35	Max. Month - February 2000
Average Day	497		
Per Capita Load	0.18		

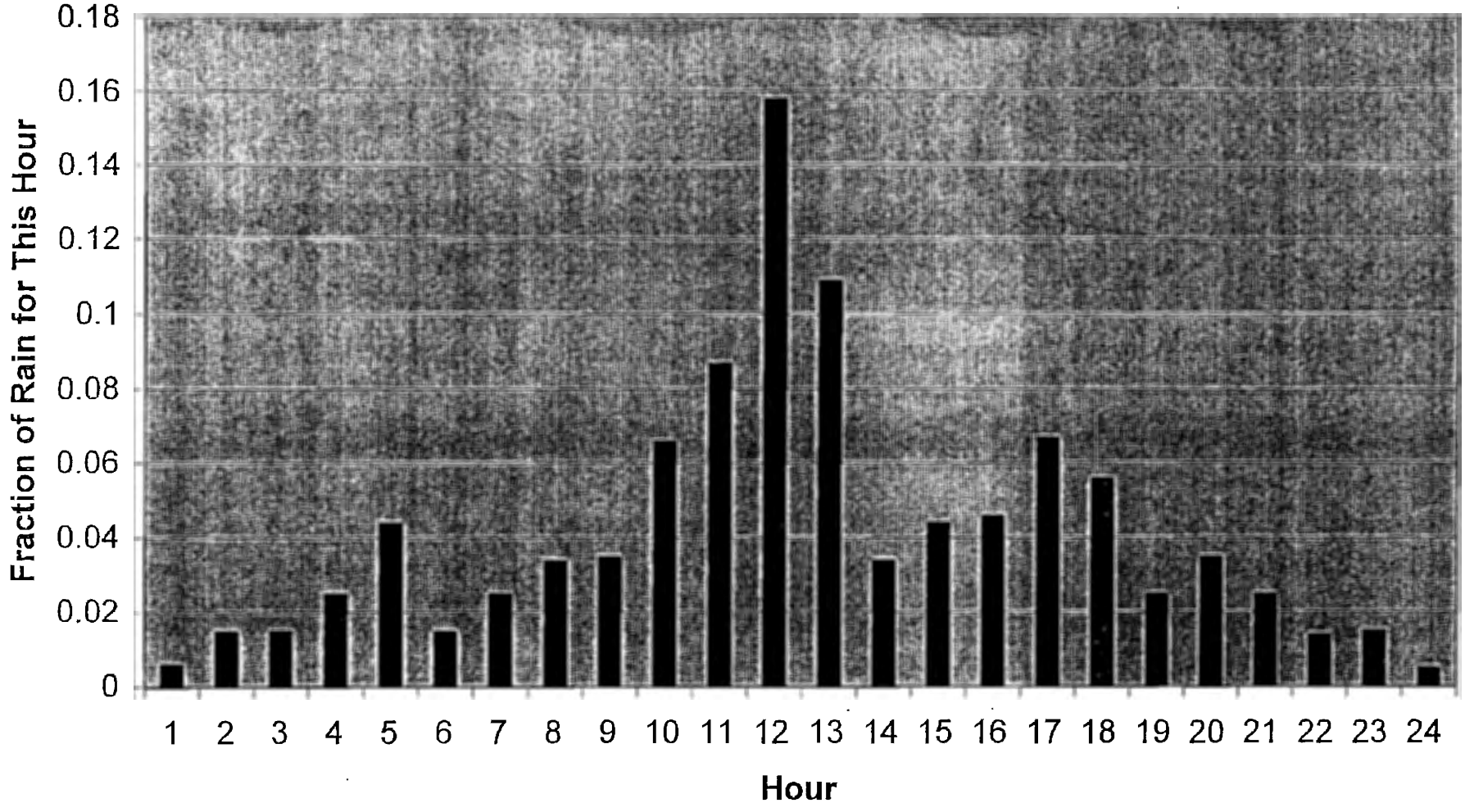
Parameter	2001	2021	Basis
Sewered Population	2692	4241	Sewered population in the city limits
Wastewater Loads, ppd			
BOD, ppd			
Per Capita Load	0.25	0.21	
Average Day	675	902	
Maximum Month	1013	1596	
Maximum Day	1580	2489	
TSS, ppd			
Per Capita Load	0.18	0.18	
Average Day	480	783	
Maximum Month	594	1060	
Maximum Day	1249	2488	

Discarded 9/2001 BOD Maximum as not matching surrounding data
Discarded 12/1998 TSS Maximum as not matching surrounding data

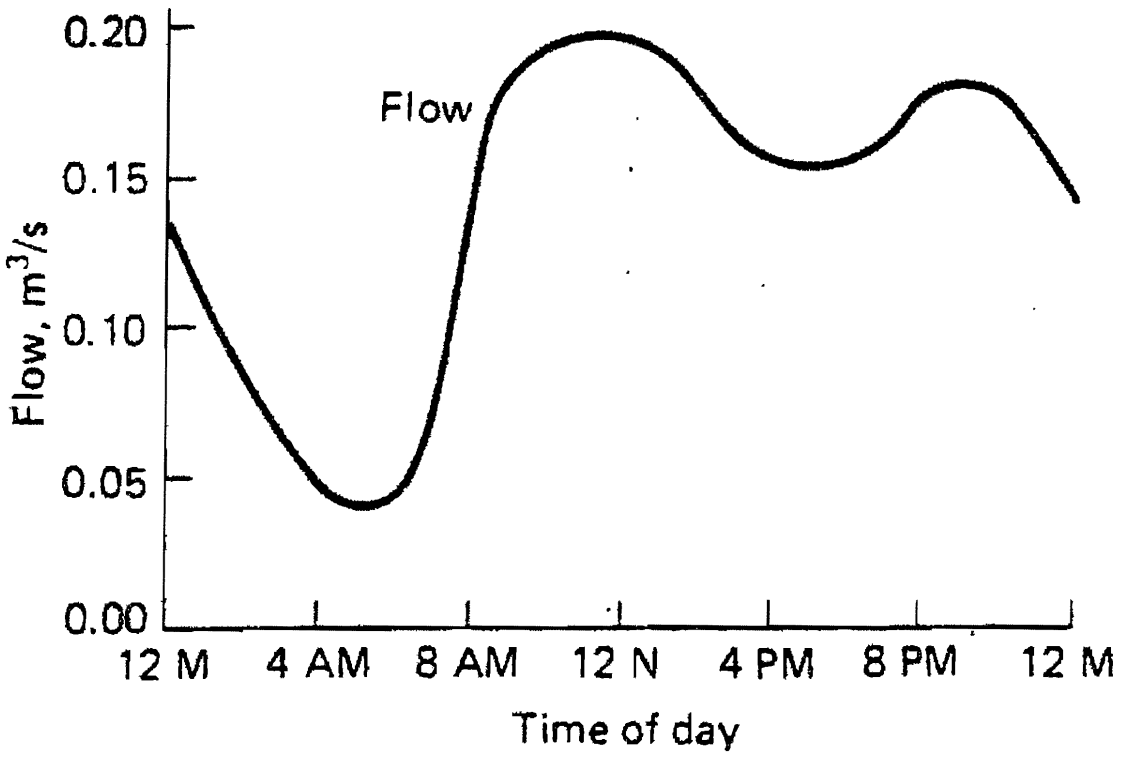

Peak I/I Calculation
New Sewers
Old Sewers
Existing Conditions
2021additions
10000
1000
100
Peak I/I Rate, Gal/Acre-Day
10
100
1000
10000
Service Area (Acres)
New Sewers
2,000 acres = 600 gal
acre-day
Zoned 5 homes/acre
2.1 persons/dwelling
57 gpd

30-yr 24-Hour Storm Profile

(Used for modeling inflow contribution to sewer flows)



Typical Residential Sewer Use Profile



This profile was used to calculate the percent of total sewer flow for each hour of the day. That percentage was multiplied by the base sewer flow per person for Bandon to create the estimated flows for the computer modeling.

Source: Metcalf & Eddy

Bandon WWTP Sludge Disposal 2001				
Date	Gallons	MLSS	Pounds	% Solids
4/4/2001	8800	17560	1289	1.8%
4/5/2001	8700	17750	1288	1.9%
4/6/2001	11600	17060	1650	1.8%
4/11/2001	7400	17630	1088	1.8%
4/19/2001	5100	21920	932	2.3%
4/23/2001	6300	19390	1019	2.0%
4/25/2001	6100	18900	962	2.0%
7/2/2001	10800	22280	2007	2.3%
7/6/2001	7900	20930	1379	2.2%
7/7/2001	13300	21740	2411	2.3%
7/8/2001	20300	22250	3767	2.3%
7/9/2001	11900	20950	2079	2.2%
7/19/2001	15900	19900	2639	2.1%
7/20/2001	16300	19810	2693	2.1%
7/22/2001	20500	18730	3202	2.0%
7/24/2001	12300	18630	1911	1.9%
7/25/2001	24600	18530	3802	1.9%
7/26/2001	23500	18690	3663	1.9%
8/2/2001	23600	17540	3452	1.8%
8/3/2001	11900	17940	1780	1.9%
8/9/2001	11800	16830	1656	1.8%
8/10/2001	23700	16460	3253	1.7%
8/27/2001	7700	13790	886	1.4%
8/28/2001	15700	14350	1879	1.5%
8/29/2001	15800	14290	1883	1.5%
8/30/2001	15600	14070	1831	1.5%
8/31/2001	15600	13580	1767	1.4%
9/5/2001	19700	13020	2139	1.4%
9/6/2001	15800	12600	1660	1.3%
9/8/2001	7800	13100	852	1.4%
9/11/2001	15700	13240	1734	1.4%
9/12/2001	15800	13570	1788	1.4%
9/13/2001	19700	12660	2080	1.3%
9/14/2001	7800	13640	887	1.4%
9/15/2001	11700	13420	1309	1.4%
9/16/2001	15800	12280	1618	1.3%
9/17/2001	7900	12450	820	1.3%
9/18/2001	7900	12100	797	1.3%
9/24/2001	11800	11850	1166	1.2%
9/26/2001	7800	11450	745	1.2%
9/27/2001	15700	11460	1501	1.2%
9/28/2001	19700	11520	1893	1.2%
10/2/2001	19600	10610	1734	1.1%
10/3/2001	19700	10530	1730	1.1%
10/15/2001	15700	10410	1363	1.1%
10/17/2001	7800	9190	598	1.0%
10/26/2001	11800	8870	873	0.9%
Total	647900		83457	1.6%
Daily Average	1775		228.649	

Calculation of Required Digester Space
Bandon Wastewater Master Plan

Parameter	Current Operation		Basis
Year	2001	2021	
AWWF, MGD	0.436	0.65	
ADWF, MGD	0.336	0.5	
Average Flow, MGD	0.386	0.575	
Ave. Month BOD Loading, ppd	675	902	
Max. Month BOD Loading, ppd	1013	1596	Design BOD - max. month
Design Month BOD Loading, ppd	675	1150	
Effluent BOD, mg/l	8	8	
Sludge Yield	0.75	0.75	Assumed yield
Amount of Sludge Produced, ppd	486.9	833.7	
Solids Fraction	0.015	0.015	
Volume of Sludge Produced, gpd	3892	6664	
% Volatile Solids	75	75	Based on current average
Volatile Solids Loading	365.2	625.3	
Residence Time	55	55	
Temperature, oC	15	15	
% Volatile Solids Reduction	45	45	
Fraction of Solids Not Destroyed	0.66	0.66	
Influent SS, mg/l	15000	15000	
Thickened SS, mg/l	19000	19000	
SS in Supernatant	0	0	
Average SS in Digester	13300	13300	70% of thickened solids
Material Retained in Digester	0.52	0.52	
Material Leaving as Supernatant	0.48	0.48	
Required Tank Volume, MG	0.1600	0.2739	
Required Tank Volume, gallons	159956	273876	
Required Tank Volume, ft3	21385	36615	
Mass of Digester Sludge, lb/d	323	552	
Volume of Digester Sludge, gpd	2036	3486	
Separate Calculation of Required Tankage			
Thickened SS, mg/l	19000	19000	
Required Tank Volume, ft3	22595	38687	
Required Tank Volume, gallons	169010	289379	

Calculation of Nitrogen Loading From Application of WWTP Sludge

City of Bandon Wastewater Master Plan

Summary of Analysis of Nitrogen in Dig. #3 Sludge		WWTP Sludge Concentrations, % of dry weight				
Pollutant	2002	10/11/2001	4/24/2001	4/18/2000	4/1/1999	Average
Ammonium Nitrogen	NA	1.3	0.22	0.56	0.25	0.70
Nitrate Nitrogen	NA	0.017	0.156	0.003	0.870	0.297
TKN	NA	5.77	3.58	3.32	1.16	3.42
Net Organic Nitrogen	NA	4.47	3.36	2.76	0.91	2.71
Volatile Solids	NA	71.9	69.6	63.5	70.8	68.7

Dew Valley Site				
Year	2002	2001	2000	1999
Acres	9.5	9.5	9.5	9.5
Ha	3.8	3.8	3.8	3.8
Sludge Gallons	NA	273,200	234,400	0
% solids	1.5%	1.7%	1.5%	2.0%
Dry solids, lb/yr		38,620	28,541	-
Crop	Rye Grass	Rye Grass	Rye Grass	Rye Grass
Agronomic Load Rate lb/acre/yr	100	100	100	100
Agronomic Load Rate kg/ha/yr	112	112	112	112
Application factor (surface)	0.5	0.5	0.5	0.5
Aerobically digested sludge factor	0.3	0.3	0.3	0.3
Total Organic Nitrogen, kg		688	358	0
Ammonium Nitrogen, kg	NA	67	36	0
Nitrate Nitrogen, kg	NA	15.2	0.4	0
Organic Nitrogen Available, kg	NA	206	107	0
Prior available organic Nitrogen, kg	89	38	0	0
Total available nitrogen, kg		326	144	0
Nitrogen available per kg/ha		85	38	0
Average gallons of sludge per year this site can handle				**358,692**

Nelson Site #1				
Year	2002	2001	2000	1999
Acres	8.4	8.4	8.4	8.4
ha	3.4	3.4	3.4	3.4
Sludge Gallons	NA	328,700	252,900	475,000
% solids	1.5%	1.7%	1.5%	2.0%
Dry solids, lb/yr	NA	46,466	30,794	77,645
Crop	Rye Grass	Rye Grass	Rye Grass	Rye Grass
Agronomic Load Rate lb/acre/yr	100	100	100	100
Agronomic Load Rate kg/ha/yr	112	112	112	112
Application factor (surface)	0.5	0.5	0.5	0.5
Aerobically digested sludge factor	0.3	0.3	0.3	0.3
Total Organic Nitrogen, kg		827	386	321
Ammonium Nitrogen, kg	NA	80	39	44
Nitrate Nitrogen, kg	NA	18	0	307
Organic Nitrogen Available, kg	NA	248	116	96
Prior available organic Nitrogen, kg	104	56	34	0
Total available nitrogen, kg		402	189	448
Nitrogen available per kg/ha		118	56	132
Average gallons of sludge per year this site can handle				**290,760**

Calculation of Pollutant Loading From Application of WWTP Sludge
City of Bandon Wastewater Master Plan

Summary of Analysis of Pollutants in Digester #3 Sludge

Pollutant	Part 503.13 Concentration Limits, mg/kg dry Ceiling	Monthly Ave.	WWTP Sludge Concentrations, mg/kg dry 10/11/2001	4/24/2001	4/18/2000	4/1/1999	9/12/1994	Average
Arsenic, As	75	41	ND	ND	0.39	ND	1.15	<3.2
Cadmium, Cd	85	39	2.55	2.5	3.76	0	3.83	2.5
Copper, Cu	4,300	1,500	222	372	401	10.3	465	294.1
Lead, Pb	840	300	58	35.3	35.3	0.3	74	40.6
Mercury, Hg	57	17	10.8	2.42	2.88	0	3.05	3.8
Molybdenum, Mo	75	NA	4.45	4.06	4.07	ND	ND	<10.5
Nickel, Ni	420	420	28.5	22.6	21.7	0	28.3	20.2
Selenium, Se	100	100	8.3	3.07	5.27	0	1.97	3.7
Zinc, Zn	7,500	2,800	1070	1340	0	22.9	1848	856.2

Dew Valley Site							
Year	2001	2000	1999	Cumulative	Avg.		
Acres	9.5	9.5	9.5	9.5	9.5		
ha	3.8	3.8	3.8	3.8	3.8		
Sludge Gallons	273,200	234,400		507,600	253,800		
% solids	1.5%	1.5%	1.5%		0.01460	EPA	
Dry solids, lb/yr	33,266	28,541	-	61,807	20,602	Limit	Site Life
Pollutant \ units	kg/ha/yr	kg/ha/yr	kg/ha/yr	kg/ha/yr	kg/ha/yr	kg/ha	Years
Arsenic, As	0.00004	0.00132	-	0.001355	0.00068	41	60,500
Cadmium, Cd	0.01003	0.01269	-	0.022717	0.01136	39	3,434
Copper, Cu	0.87313	1.35315	-	2.226285	1.11314	1500	1,348
Lead, Pb	0.22812	0.11912	-	0.347233	0.17362	300	1,728
Mercury, Hg	0.04248	0.00972	-	0.052195	0.02610	17	651
Molybdenum, Mo	0.01750	0.01373	-	0.031236	0.01562	NA	NA
Nickel, Ni	0.11209	0.07323	-	0.185317	0.09266	420	4,533
Selenium, Se	0.03264	0.01778	-	0.050427	0.02521	100	3,966
Zinc, Zn	4.20833	0.00023	-	4.208562	2.10428	2800	1,331

Nelson Site #1							
Year	2001	2000	1999	Cumulative	Avg.		
Acres	8.4	8.4	8.4	8.4	8.4		
ha	3.4	3.4	3.4	3.4	3.4		
Sludge Gallons	328700	252,900	475000	1,056,600	352,200		
% solids	1.5%	1.5%	2.0%	-	0.01627	EPA	
Dry solids, lb/yr	40,024	30,794	77,645	148,463	49,488	Limit	Site Life
Pollutant \ units	kg/ha/yr	kg/ha/yr	kg/ha/yr	kg/ha/yr	kg/ha/yr	kg/ha	Years
Arsenic, As	0.00005	0.00161	0.00010	0.001763	0.00059	41	69,760
Cadmium, Cd	0.01365	0.01548	0.00001	0.029134	0.00971	39	4,016
Copper, Cu	1.18807	1.65114	0.10694	2.946143	0.98205	1500	1,527
Lead, Pb	0.31040	0.14535	0.00311	0.458861	0.15295	300	1,961
Mercury, Hg	0.05780	0.01186	0.00208	0.071733	0.02391	17	711
Molybdenum, Mo	0.02381	0.01676	0.00519	0.045764	0.01525	NA	NA
Nickel, Ni	0.15252	0.08935	0.00017	0.242039	0.08068	420	5,206
Selenium, Se	0.04442	0.02170	0.00033	0.066451	0.02215	100	4,515
Zinc, Zn	5.72629	0.00028	0.23775	5.964321	1.98811	2800	1,408

Costs for self hauling & disposing of digested 2% bio-solids

Item	North Bend *	Coffin Butte	Short Mountain	Heard Farms	Farm Spread
Sludge Gallons	647,000	647,000	647,000	647,000	647,000
Round Trip Miles	54	318	280	170	12
Cost Per Mile	3.13	3.13	3.13	3.13	3.13
Disposal Rate	0.07	0.13	0.18	0.07	0
Trip Hours	3	8.3	7.5	5.3	2.2
Annual Admin Hours	40	40	40	40	500
Annual Misc. Costs	0	0	0	0	400
Sludge Testing Costs	500	500	500	500	1000
Total Annual Cost	$ 85,962	$ 279,756	$ 290,907	$ 154,625	$ 30,511
Total Cost/Gallon	$ 0.13	$ 0.43	$ 0.45	$ 0.24	$ 0.05

Assumes 3,900 gallon truck, 1.5 hour load/unload time

Alternative Haulers 2%	Roto-Rooter	Heard Farms
Cost Per Gallon	0.10	0.13
Loading Hours/Trip	1	1
Annual Admin Hours	32.0	32.0
Total Annual Cost	$ 69,310	$ 88,720
Total Cost/Gallon	$ 0.11	$ 0.14

Costs for self hauling & disposing of digested 10% bio-solids

Item	North Bend *	Coffin Butte	Short Mountain	Heard Farms	Farm Spread
Original Sludge Gallons	647,000	647,000	647,000	647,000	647,000
Pessed Sludge Gallons	162,000	162,000	162,000	162,000	162,000
Round Trip Miles	54	318	280	170	12
Cost Per Mile	3.13	3.13	3.13	3.13	3.13
Disposal Rate	$ 0.28	$ 0.13	$ 0.18	$ 0.14	$ -
Trip Hours	4	9.3	8.5	6.3	3.2
Annual Admin Hours	40	40	40	40	500
Annual Misc. Costs**	0	0	0	0	400
Sludge Testing Costs	500	500	500	500	1000
Sludge Pressing Costs	$ 21,538	$ 21,538	$ 21,538	$ 21,538	$ 21,538
Total Annual Cost	$ 94,299	$ 164,232	$ 159,056	$ 113,206	$ 48,677
Total Cost/Orignal Gallon	$ 0.15	$ 0.25	$ 0.25	$ 0.17	$ 0.08

Assumes 10yd truck with 8 yds of bio-solid, 2.5 hour load/unload time

Alternative Haulers 10%	Heard Farms
Cost Per Gallon	0.20
Sludge Pressing Costs	$ 21,538
Additonal Loading Hours/Trip	1
Annual Admin Hours	32.0
Total Annual Cost	$ 55,812
Total Cost/Gallon	$ 0.09

* North Bend will only take bio-solids on an emergency basis and will discontinue emergency service in the next five years.

** Farm road & sign improvments

Bandon Sludge Trucking & Disposal Costs	Annual Cost
Insurance	500
Maintenance	700
Fuel	643
Equipment Depriciation	7800
Total	9643
Cost per mile	3.13

North Bend Vehicle Costs per trip	169
North Bend Fuel costs per trip	11
North Bend non fuel costs per trip	158
Farm Costs per trip	38
Farm Fuel Costs per trip	2.5
Farm Non-fuel costs per trip	35

Bandon Sludge disposal costs

North Bend Disposal	Unit cost	Quantity	Extension
Charge by NB per gallon	0.07	100,000	7000
Trip cost salary (Assume 3 hr roundtrip)	66	26	1692
Trip cost fuel (7 mpg @ $1.46/gallon, 54 miles)	11	26	289
Non Fuel Trip Costs (Insur, maint. deprec.)	158	26	4042
Total			$ 13,023
Cost per gallon			$ 0.13

Farm spreading	Unit cost	Quantity	Extension
Charge for application	0	547,000	$ -
Sludge & soils testing	1000	1	$ 1,000
Permit costs	0	1	$ -
Labor for site inspection, management & paperwork	30	500	$ 15,000
Site maintenance costs	400	1	$ 400
Site maintenance labor	22	40	$ 880
Trip cost Salary	22	140	$ 3,086
Trip Cost Fuel	2.5	140	$ 351
Non Fuel Trip Costs	35	140	$ 4,914
Total			$ 25,630
Cost per gallon			$ 0.05

Non-fuel costs apportioned on a per mile basis	
Gallons of sludge hauled	647000
Trips	166
Total miles	3083
fuel gallons	440
fuel cost	643

Fuel calculated at 7mpg, $1.46/gallon

Costs to operate the Bandon Screw Press	
	HP
Polymer Mixing Motor	0.5
Polymer Feed Pump	2
Screw Press 2	3
Pressate Pump	0.5
Screw Press Feed Pump	5
Total	11

Press GPM	30
Estimated gallons/year	647,000
Hours to Process	359
operator hours	539
Energy kWh	2,946
Energy cost @ $.07/kWh	$ 206
Labor Cost	$ 11,862
Polymer Costs	$ 6,470
Maintenance Costs	$ 3,000
Total Annual Cost	$ 21,538
Cost per Gallon	$ 0.03

Reed Bed Analysis

	1 Year	10 Year
Bed Area (SF)	4,300	
Depth of Flood (FT)	0.33	
Gallons per flood	10,614	
Days between floods	21	
Gallons per year	184,484	1,844,835
Gallons of end product	4,100	40,996
Yards of end Product	20	203

Capital Cost	Material	Hours Labor	Labor Rate	Extension
Pea Gravel at Drains	66	6	22	$ 198
Sand at Drains	398	12	22	$ 662
Plant Material (Reeds)	8600	358	22	$ 16,483
Pilot Study Cost				$ 20,000
Raise bed walls	6300			$ 6,300
Subtotal				$ 43,643
Engineering				6,546.52
Contingency				4,364.35
Administration				2,182.17
Total				$ 56,736

Annual Operations Cost	Material	Hours Labor	Labor Rate	Annual Cost
Flooding Labor		35	22	$ 765
Harvesting Labor		16	22	$ 352
DEQ Testing				$ 1,500
Reed Disposal	280	32	22	$ 984
				$ 3,601

10 Year Operations Cost	Material	Hours Labor	Labor Rate	Annual Cost
Cleaning Labor		48	22	$ 1,056
Equipment Cost	1200			$ 1,200
New Sand	398	16	22	$ 750
DEQ Testing				$ 2,500
Material Handling		32	22	$ 704
Total				$ 6,210

Sludge Drying Bed Analysis	
Bed Area (SF)	4,300
Depth of Flood (FT)	0.75
Gallons per flood	24,123
Days between floods	25
Gallons per year	352,196
Gallons of end product	44,024
Yards of end Product	218

Operations Cost	Material	Hours Labor	Labor Rate	Annual Cost
Pea Gravel at Drains	66	6	22	$ 198
Sand at Drains	53	12	22	$ 317
Flooding Labor		29	22	$ 642
Cleaning Labor		117	22	$ 2,570
Equipment Cost	2900			$ 2,900
Total				$ 6,627

Costs for self hauling & disposing of digested 16% bio-solids from Sludge Drying Beds				
Item	Coffin Butte	Short Mountain	Heard Farms	Farm Spread
Original Sludge Gallons	350,000	350,000	350,000	350,000
Pessed Sludge Gallons	43,750	43,750	43,750	43,750
Round Trip Miles	318	280	170	12
Cost Per Mile	3.13	3.13	3.13	3.13
Disposal Rate	$ 0.13	$ 0.18	$ 0.14	$ -
Trip Hours	9.3	8.5	6.3	3.2
Annual Admin Hours	40	40	40	500
Annual Misc. Costs**	0	0	0	400
Sludge Testing Costs	500	500	500	1000
Sludge Drying Costs	$ -	$ -	$ -	$ -
Total Annual Cost	$ 33,284	$ 32,621	$ 22,364	$ 18,739
Total Cost/Orignal Gallon	$ 0.10	$ 0.09	$ 0.06	$ 0.05

N =	20	
A =	$ 6,627	
I =	0.06	
P/A=	11.47	
AT =	6,627	
P =	76,008	
	4,014,472	Present Value in Gallons of Sludge
	$ 214,931	Present Value including spreading
	$ 60,000	Construction Cost
	$ 274,931	Total Present Value
	$ 0.068	Present value per gallon

Bandon Basic Sewer Rate		
Base monthly rate	$	13.31
Add per H2O unit	$	2.21
Gpcd H2O use		75
People/edu		2.1
Total EDUs		1,734
Annual tax debt service	$	101,090
Direct cost to consumer		
Monthly water use per EDU (gal)		4,791
Average monthly bill	$	19.48
Tax payment for dept per EDU	$	4.86
Sewer revenue per month per EDU	**$**	**24.34**
Total cost to City per EDU		
Operating Budget	$	668,306
Sewer Cost per EDU	$	32.12
Tax based debt service	$	4.86
Total cost of sewer service	**$**	**36.98**

CITY OF BANDON UTILITY RATES

SEWER RATES	$/EDU
SW 01 Residential, inside city	13.31/2.21
SW 02 Commercial/Industrial, inside city	13.31/2.21
SW 03 Residential, outside city	20.98/3.30
SW 04 Commercial/Industrial, outside city	20.98/3.30
SW 05 Residential fixed--No water, inside city	26.59
SW 06 Residential fixed--No water, outside city	36.90
SW 07 Additional unit rate-inside city-attached/detached residence (Duplex, Triplex, etc.), apartment (plus per washer in a common Laundry facility), commercial business, commercial office building, industry	5.46
SW 08 Additional unit rate-inside city-mobile home park (plus per washer In a common laundry facility)	5.46
SW 09 Additional unit rate-inside city-motel, bed & breakfast (plus per washer in a common laundry facility)	2.68
SW 10 Additional unit rate-inside city-RV park (plus per washer in a common laundry facility)	3.44
SW 11 Additional unit rate-inside city-health/elderly care facility	4.44
SW 20 Commercial/special strength customer-inside city (restaurant, Laundromat, other individually negotiated)	8.88/2.66
SW 21 Commercial/special strength customer-inside city Cheese Factory	1,410.00
SW 68 City use only --no charge	
SW 69 City use only--Charge--inside/outside city	13.31/2.21
TX 01 10% CITY TAX	
SUMMER RATE (6/15-10/15)	13.31/1.44

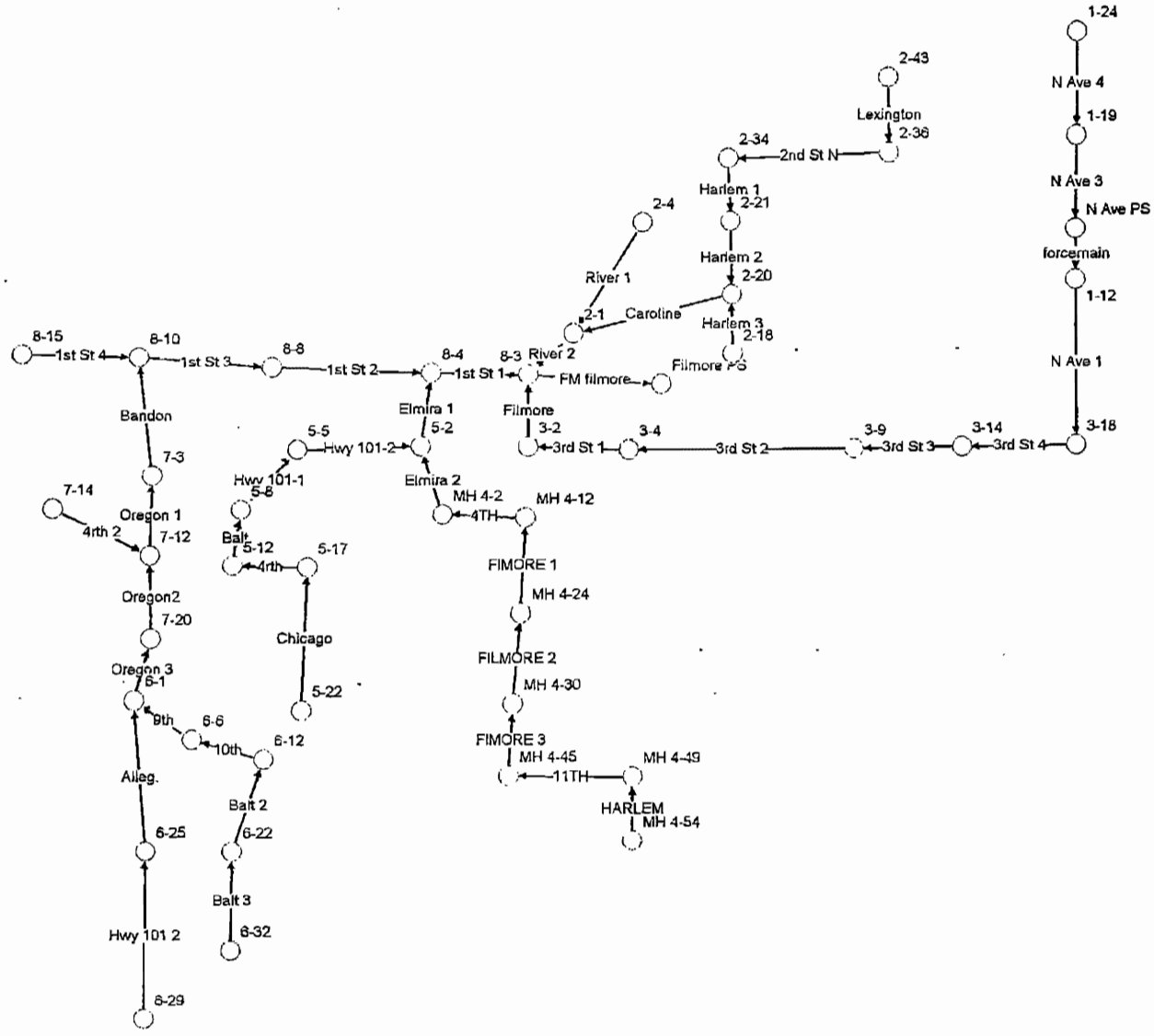
Sewer Rates: SW01, SW02, SW03, SW04 & SW69
Basic Charge includes 1st 2,000 gallons consumpt

Sewer additional Unit Rates - per unit (1st unit is include in basic charge)

Appendix

D

Computer Model Results



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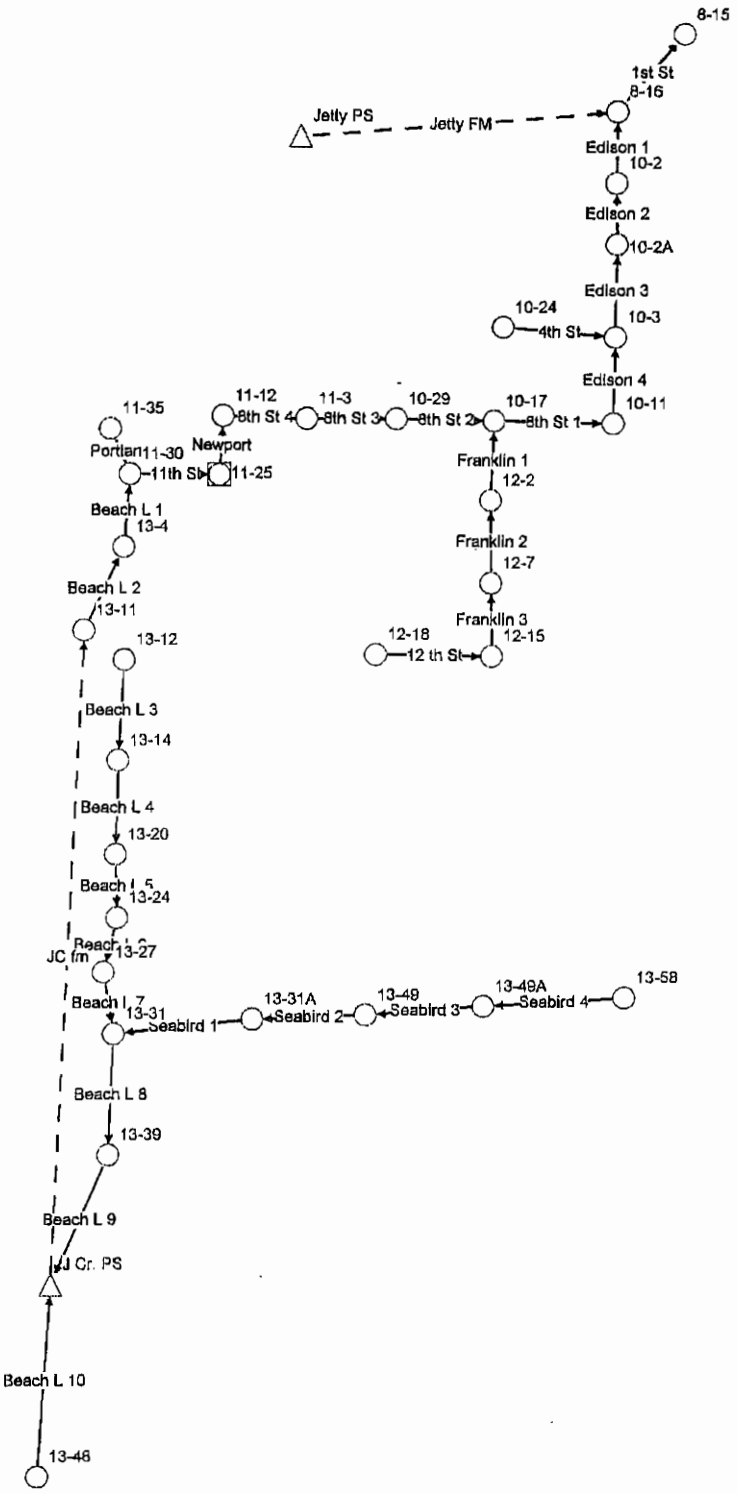
Bandon East 2001	Link Name	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]	HDR:Max Flow/Design Flow (fraction) [Single]	Diameter/Depth (feet, metres) [Single]
Hwy 101 2	Hwy 101 2	880.	.56818	.006527743	.475892937	.857137378	.007615857	.67
Alleg.	Alleg.	1300.	.53846	.028124509	.330416307	.834418860	.033709030	.67
Balt 3	Balt 3	550.	.36364	.109775925	1.42936934	.685709902	.160383369	.67
Balt 2	Balt 2	650.	1.25538	.135509831	1.61349717	1.27407551	.106359374	.67
10th	10th	870.	.28966	.187408141	1.31100040	.611994349	.306226263	.67
9th	9th	600.	.38667	.318466189	1.95244805	.707090716	.450454323	.67
Oregon 3	Oregon 3	350.	.86571	.455345167	2.39331024	1.05802044	.430380277	.67
Oregon2	Oregon2	540.	.38704	.500196240	2.01937947	.707429280	.707066695	.67
4rth 2	4rth 2	400.	1.715	0	0	1.48915131	0	.67
Oregon 1	Oregon 1	350.	.82286	.566314089	2.99133249	1.03149942	.549020267	.67
Bandon	Bandon	600.	7.95	.633669302	2.99977432	3.20619795	.197638858	.67
1st St 4	1st St 4	800.	.89125	.627966999	1.58789982	5.66283328	.110892722	1.25
1st St 3	1st St 3	400.	.1675	1.29356798	2.18109628	2.45494298	.527141803	1.25
1st St 2	1st St 2	1200.	.42667	1.30993933	2.18202315	3.91812567	.334526127	1.25
HARLEM	HARLEM	605.	.49587	.216598934	1.85177715	2.32964764	.092976216	1.
11TH	11TH	1055.	.25592	.435815911	1.79470324	1.67364348	.260399490	1.
FIMORE 3	FIMORE 3	665.	4.84211	.562050651	5.03223062	7.27988323	.077206926	1.
FILMORE 2	FILMORE 2	325.	4.92308	.734850489	4.25262936	7.34049945	.100110846	1.
FIMORE 1	FIMORE 1	650.	.96769	.800641231	2.47483041	3.25443756	.246015750	1.
4TH	4TH	245.	.28571	.948540241	2.33455859	1.76837056	.536400844	1.
Elmira 2	Elmira 2	450.	.62444	1.08563332	3.17869589	2.61429265	.415276126	1.
Chicago	Chicago	860.	.47558	.165566045	1.75907704	.784186202	.211131776	.67
4rth	4rth	270.	7.8037	.220083061	5.15003640	3.17656066	.069283443	.67
Balt.	Balt.	180.	11.28889	.232753464	3.42276589	3.82060700	.060920665	.67
Hwy 101-1	Hwy 101-1	420.	.84524	.237253600	2.40256795	1.04543322	.226943853	.67
Hwy 101-2	Hwy 101-2	400.	1.6575	.237805451	1.64652994	1.46397458	.162438725	.67
Elmira 1	Elmira 1	290.	1.03103	1.34083963	2.62217436	5.07106892	.264410060	1.167
1st St 1	1st St 1	240.	.3	2.81549884	3.17191732	5.34250114	.568782051	1.5
N Ave 4	N Ave 4	520.	.43846	.018193515	.889115139	.752961065	.024276393	.67
N Ave 3	N Ave 3	494.	.4413	.271296397	1.10479123	.755390537	.444868766	.67
forcemain	forcemain							
N Ave 1	N Ave 1	1250.	.4216	.350544367	2.06263033	.738341142	.474965405	.67

Brindon East 2001	Link Name	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]	HDR:Max Flow/Design Flow (fraction) [Single]	Diameter/Depth (feet, metres) [Single]
3rd St 4	3rd St 4	500.	.512	.417888921	2.02825847	.813657718	.513630447	.67
3rd St 3	3rd St 3	620.	.41613	.456708644	2.17521961	.733534891	.622613388	.67
3rd St 2	3rd St 2	1200.	4.44667	.535789548	3.03682456	2.39786128	.223974271	.67
3rd St 1	3rd St 1	500.	.538	.565066881	2.54270850	.834061175	.678296445	.67
Filmore	Filmore	400.	1.5525	4	0	0	0	.833
River 1	River 1	670.	.42239	.010902190	.271709781	.739030878	.014752013	.67
Lexington	Lexington	500.	.568	.013066232	.369547539	.857000225	.015246475	.67
2nd St N	2nd St N	500.	.224	.063164119	.887173703	.538183993	.117365497	.67
Harlem 1	Harlem 1	1000.	.73	.139377122	1.95208138	.971556805	.143457512	.67
Harlem 2	Harlem 2	200.	4.155	.241751705	4.04824031	2.31788712	.104298943	.67
Harlem 3	Harlem 3	100.	.89	.061005932	1.36509082	1.07275802	.056878074	.67
Caroline	Caroline	900.	4.82222	.312990269	4.61909680	2.49706805	.128044303	.67
River 2	River 2	300.	2.24333	.486952003	4.05878436	1.70315303	.444509603	.67
FM filmore	FM filmore							

East future	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]
105					
Hwy 101 2	880.	.56818	.362827384	2.32168799	.857137378
Alleg.	1300.	.53846	.288619827	1.98978916	.834418860
Balt 3	550.	.36364	.109775927	1.42936935	.685709902
Balt 2	650.	1.25538	.135509831	1.61342899	1.27407551
10th	870.	.28966	.187408249	1.33146681	.611994349
9th	600.	.38667	.317998994	1.94346622	.707090716
Oregon 3	350.	.86571	.602162939	2.64179476	1.05802044
Oregon2	540.	.38704	.634009685	2.23328006	.707429280
4rth 2	400.	1.715	0	0	1.48915131
Oregon 1	350.	.82286	.671958861	3.08969594	1.03149942
Bandon	600.	7.95	.739949737	3.35813773	3.20619795
1st St 4	800.	.89125	.645206999	1.58801078	5.66283328
1st St 3	400.	.1675	1.41547185	2.24170556	2.45494298
1st St 2	1200.	.42667	1.42831793	2.28402953	3.91812567
HARLEM	605.	.49587	.216598934	1.85177715	2.32964764
11TH	1055.	.25592	.435820672	1.79361333	1.67364348
FIMORE 3	665.	4.84211	.537630587	4.94831041	7.27988323
FILMORE 2	325.	4.92308	.710434464	4.20709630	7.34049945
FIMORE 1	650.	.96769	.776222976	2.44982792	3.25443756
4TH	245.	.28571	.924121138	2.31824447	1.76837056
Elmira 2	450.	.62444	1.06121328	3.15904045	2.61429265
Chicago	860.	.47558	.165566045	1.75907704	.784186202
4rth	270.	7.8037	.220083061	5.15003640	3.17656066
Balt.	180.	11.28889	.232753464	3.42276568	3.82060700
Hwy 101-1	420.	.84524	.237253600	2.40256795	1.04543322
Hwy 101-2	400.	1.6575	.237805452	1.65986262	1.46397458
Elmira 1	290.	1.03103	1.31641993	2.55124142	5.07106892
1st St 1	240.	.3	2.83835939	3.21031867	5.34250114
N Ave 4	520.	.43846	.017034718	.822740978	.752961065
N Ave 3	494.	.4413	.283228726	1.05294441	.755390537
forcemain					
N Ave 1	1250.	.4216	.347192566	2.06065989	.738341142
3rd St 4	500.	.512	.426075116	1.98110557	.813657718
3rd St 3	620.	.41613	.460804903	2.17866485	.733534891
3rd St 2	1200.	4.44667	.544162448	3.06721661	2.39786128
3rd St 1	500.	.538	.573476257	2.55008443	.834061175
Filmore	400.	1.5525	4	0	0
River 1	670.	.42239	.010902228	.493870320	.739030878
Lexington	500.	.568	.013066232	.369547539	.857000225
2nd St N	500.	.224	.063164119	.887173703	.538183993
Harlem 1	1000.	.73	.139377051	1.95208109	.971556805
Harlem 2	200.	4.155	.241752882	4.04739067	2.31788712
Harlem 3	100.	.89	.061005932	1.36509100	1.07275802
Caroline	900.	4.82222	.316699344	4.37966102	2.49706805
River 2	300.	2.24333	.585154633	3.95388364	1.70315303
FM filmore					

East future	HDR:Max Flow/Design Flow (fraction) [Single]	Diameter/Depth (feet, metres) [Single]
105		
Hwy 101 2	.443472050	.67
Alleg.	.345893220	.67
Balt 3	.160383371	.67
Balt 2	.106359374	.67
10th	.306226436	.67
9th	.449729097	.67
Oregon 3	.569612413	.67
Oregon2	.896216347	.67
4rth 2	0	.67
Oregon 1	.653710430	.67
Bandon	.231264296	.67
1st St 4	.113937134	1.25
1st St 3	.576800716	1.25
1st St 2	.364786989	1.25
HARLEM	.092976216	1.
11TH	.260402335	1.
FIMORE 3	.073852633	1.
FILMORE 2	.096784435	1.
FIMORE 1	.238512867	1.
4TH	.522591894	1.
Elmira 2	.405935517	1.
Chicago	.211131776	.67
4rth	.069283443	.67
Balt.	.060920665	.67
Hwy 101-1	.226943853	.67
Hwy 101-2	.162438726	.67
Elmira 1	.259594510	1.167
1st St 1	.593814678	1.5
N Ave 4	.024074720	.67
N Ave 3	.455532720	.67
forcemain		
N Ave 1	.473411902	.67
3rd St 4	.523838148	.67
3rd St 3	.633120821	.67
3rd St 2	.227246410	.67
3rd St 1	.688187080	.67
Filmore	0	.833
River 1	.014752064	.67
Lexington	.015246475	.67
2nd St N	.117365497	.67
Harlem 1	.143457438	.67
Harlem 2	.104298870	.67
Harlem 3	.056878074	.67
Caroline	.141939145	.67
River 2	.440896988	.67
FM filmore		



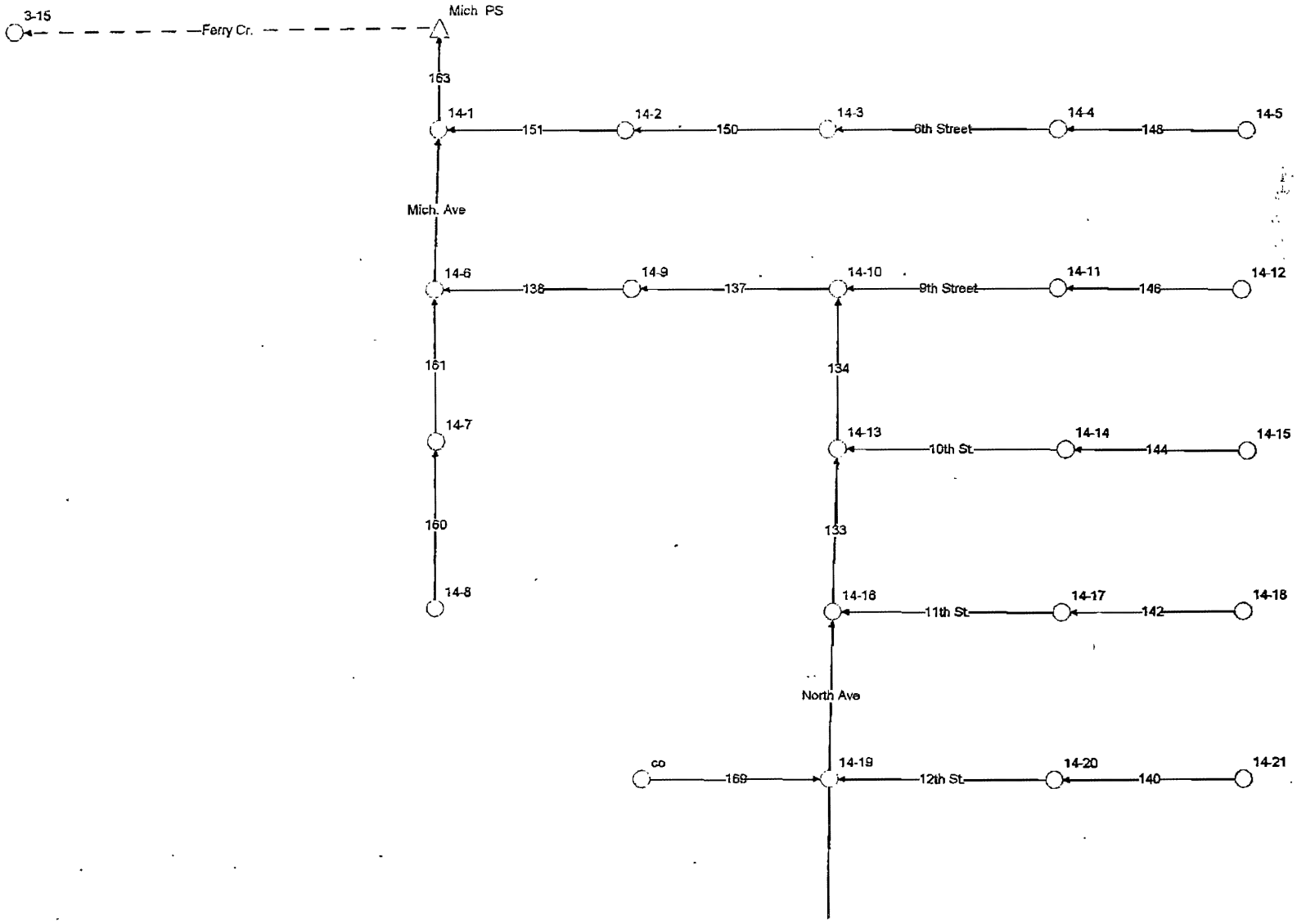
XP-SWMM2000 Version 7.50 Copyright (c) XP Software	**Bandon West** Licenced To: Dyer Partnership [42-750-0181]	04/23/02 Page 1/1

Bandon West Loop	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]	HDR:Max Flow/Design Flow (fraction) [Single]	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	Diameter/Depth (feet, metres) [Single]
12 th St	.034845318	.623533923	.832429778	.041859790	1170.	.5359	.67
Franklin 3	.148105163	1.32601741	.773624568	.191443356	525.	.46286	.67
Franklin 2	.211220671	1.83562927	.750236461	.281538797	510.	.43529	.67
Franklin 1	.250410690	1.35697653	1.40500826	.178227200	300.	1.52667	.67
Portland	.034850486	.489746560	.750514173	.046435480	730.	.43562	.67
Beach L 3	.012532173	.827760576	2.02854508	.006177912	770.	.51818	.83
Beach L 4	.024281741	.858279994	1.49660647	.016224534	1170.	.28205	.83
Beach L 5	.047029869	1.62473368	2.17682139	.021604836	910.	.5967	.83
Beach L 6	.056533092	1.93106913	3.65899217	.015450848	710.	1.68592	.83
Beach L 7	.065982473	1.17564201	2.15130877	.030672347	544.	.57169	.833
Seabird 4	.023205958	.998467296	1.48545034	.015630890	565.	.27257	.833
Seabird 3	.025107570	.966457399	1.55630065	.016133672	800.	.305	.83
Seabird 2	.047904213	1.90683430	2.72152781	.017616436	520.	.93269	.83
Seabird 1	.063384488	1.95108564	4.77817997	.013265404	600.	2.875	.83
Beach L 8	.139324883	2.13546925	2.03661726	.068414249	890.	.51236	.833
Beach L 9	.172726156	3.63097449	3.97056113	.043503587	1008.	1.94742	.833
Beach L 10	.001444217	.871532927	4.76008108	3.03565E-4	895.	2.79888	.833
JC fm							
Beach L 2	.305550430	1.34124344	1.27273549	.242069875	1000.	.148	1.
Beach L 1	.312335825	1.38917459	1.52432392	.205143673	1220.	.2123	1.
11th St	.438130833	1.64535947	1.55257833	.282203802	336.	.22024	1.
Newport	.493517869	1.63264462	1.55833736	.316715286	960.	.22188	1.
8th St 4	.617443917	1.80686482	1.54732424	.399082204	672.	.21875	1.
8th St 3	.702779242	1.89844855	1.60696266	.437333920	640.	.23594	1.
8th St 2	.757925637	1.65307103	1.52631988	.496597044	1245.	.21285	1.
8th St 1	1.06552430	2.18487543	1.47952496	.720216813	250.	.2	1.
Edison 4	1.07900185	3.24601729	2.69547723	.400407994	940.	.66383	1.
4th St	.067538943	1.07901304	1.07796853	.062653909	750.	.89867	.67
Edison 3	1.36597480	7.48988261	4.83069186	.294003707	217.	5.64977	.833
Edison 2	1.73329037	9.93091707	6.40320328	.282294861	273.	9.92674	.833
Edison 1	1.80190266	5.24145619	4.42526127	.437089553	60.	4.83333	.83
Jetty FM							

Bandon West 2/2	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]	HDR:Max Flow/Design Flow (fraction) [Single]	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	Diameter/Depth (feet, metres) [Single]
1st St	1.68783521	6.17057639	.960605909	1.75845790	220.	.71364	.67

West Bandon Future	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]	HDR:Max Flow/Design Flow (fraction) [Single]	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	Diameter/Depth (feet, metres) [Single]
12 th St	.034845298	.623533165	.832429778	.041859744	1170.	.5359	.67
Franklin 3	.148104905	1.32601547	.773624568	.191442867	525.	.46286	.67
Franklin 2	.211221668	1.83563311	.750236461	.281540126	510.	.43529	.67
Franklin 1	.250413485	1.37092200	1.40500826	.178229189	300.	1.52667	.67
Portland	.034850461	.489746560	.750514173	.046435448	730.	.43562	.67
Beach L 3	.012532173	.827760576	2.02854508	.006177912	770.	.51818	.83
Beach L 4	.024281880	.858289364	1.49660647	.016224687	1170.	.28205	.83
Beach L 5	.047029212	1.62472357	2.17682139	.021604884	910.	.5967	.83
Beach L 6	.056533796	1.93107348	3.65899217	.015450774	710.	1.68592	.83
Beach L 7	.065984769	1.17449820	2.15130877	.030672638	544.	.57169	.833
Seabird 4	.023067777	.996814090	1.48545034	.015532041	565.	.27257	.833
Seabird 3	.025059504	.966800277	1.55630065	.016101969	800.	.305	.83
Seabird 2	.047906061	1.90685237	2.72152781	.017602635	520.	.93269	.83
Seabird 1	.063383081	1.95108561	4.77817997	.013265109	600.	2.875	.83
Beach L 8	.138882429	2.13309850	2.03661726	.068199144	890.	.51236	.833
Beach L 9	.174156725	3.62375741	3.97056113	.043896354	1008.	1.94742	.833
Beach L 10	.002197545	.847408322	4.76008108	4.61661E-4	895.	2.79888	.833
JC fm							
Beach L 2	.498145035	1.55164617	1.27273549	.391412973	1000.	.148	1.
Beach L 1	.518254067	1.73980270	1.52432392	.340360500	1220.	.2123	1.
11th St	.646600125	1.86888506	1.55257833	.416490588	336.	.22024	1.
Newport	.693797240	1.84964233	1.55833736	.445216462	960.	.22188	1.
8th St 4	.804207238	1.97347011	1.54732424	.519830468	672.	.21875	1.
8th St 3	.879872746	2.06371449	1.60696266	.547553887	640.	.23594	1.
8th St 2	.916396565	1.78372938	1.52631988	.600396151	1245.	.21285	1.
8th St 1	1.22268065	2.26300852	1.47952496	.826441561	250.	.2	1.
Edison 4	1.23129329	3.35900374	2.69547723	.456807080	940.	.66383	1.
4th St	.067538943	1.07004005	1.07796853	.062653909	750.	.89867	.67
Edison 3	1.41622136	7.67901722	4.83069186	.293206310	217.	5.64977	.833
Edison 2	1.62674790	9.66182385	6.40320328	.275980124	273.	9.92674	.833
Edison 1	1.73293631	5.12790256	4.42526127	.436886082	60.	4.83333	.83
Jetty FM							

WEST BANDON FUTURE	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]	HDR:Max Flow/Design Flow (fraction) [Single]	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	Diameter/Depth (feet, metres) [Single]
1st St	1.70421871	6.31852736	.960605909	1.77410809	220.	.71364	.67



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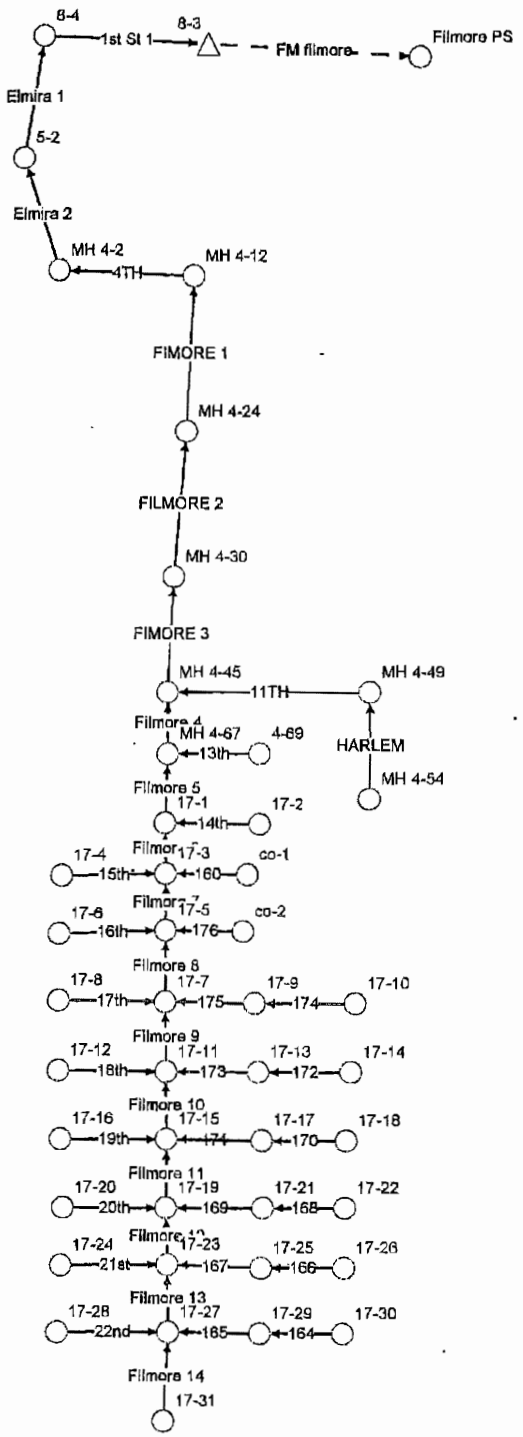
OHIO AVE.	Ground Elevation (feet, metres)	Invert Elevation (feet, metres)	HDR DWF Flow Rate
14-24	100.	96.	0.
14-23	92.	85.	.14
14-22	80.	75.9	.14
14-21	97.	92.3	0.
14-20	92.	85.3	.14
co	73.	69.3	0.
14-19	80.	67.9	.28
14-18	93.	88.	0.
14-17	92.	82.3	.14
14-16	80.	66.76	.14
14-15	75.	70.42	0.
14-14	75.	68.07	.14
14-13	70.	65.62	.14
14-12	80.	76.	0.
14-11	80.	72.4	.14
14-10	65.	61.1	.14
14-9	58.	54.1	.14
14-8	50.	46.3	0.
14-7	50.	45.16	.14
14-6	52.	45.02	.14
14-5	80.	76.3	0.
14-4	80.	71.05	.14
14-3	70.	66.	.14
14-2	50.	46.1	.14
14-1	30.	26.1	.14
Mich. PS	15.	2.	0.
3-15	74.	62.	0.

OHIO SEWERS	Link Name	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]	HDR:Max Flow/Design Flow (fraction) [Single]	Diameter/Depth (feet, metres) [Single]
129	129	300.	3.	0	0	2.50670222	0	.67
12th Ct.	12th Ct.	300.	3.	.009701999	1.69339316	2.50670222	.003870423	.67
131	131	260.	3.	.019403999	2.08208573	2.50670222	.007740847	.67
140	140	300.	2.3	0	0	2.19485602	0	.67
12th St.	12th St.	300.	3.	.009701999	1.69339316	2.50670222	.003870423	.67
169	169	300.	.4	0	0	.915318234	0	.67
North Ave	North Ave	260.	.4	.048509999	1.37358787	.915318234	.052997960	.67
142	142	300.	2.2	0	0	2.14661153	0	.67
11th St.	11th St.	300.	2.1	.009701999	1.48993837	2.09725754	.004626041	.67
133	133	260.	.4	.067913999	1.51809548	.915318234	.074197144	.67
144	144	300.	.75	0	0	1.25335111	0	.67
10th St.	10th St.	300.	.75	.009701999	1.04125333	1.25335111	.007740846	.67
134	134	260.	1.66154	.087317998	2.69696115	1.86550886	.046806530	.67
146	146	300.	1.16667	0	0	1.56320348	0	.67
9th Street	9th Street	300.	3.7	.009701999	1.82792092	2.78383173	.003485124	.67
137	137	300.	2.3	.106721997	3.21057483	2.19485602	.048623689	.67
138	138	300.	2.37	.116423995	3.33169242	2.22643830	.052291588	.67
160	160	260.	.4	0	0	.915318234	0	.67
161	161	260.	.4	.009701987	.844299638	.915318234	.010599579	.67
Mich. Ave	Mich. Ave	260.	7.2	.135827980	5.14592716	3.88336638	.034976864	.67
148	148	300.	1.65	0	0	1.85902012	0	.67
6th Street	6th Street	300.	1.65	.009701999	1.36813300	1.85902012	.005218878	.67
150	150	300.	6.6	.019403999	2.73585701	3.71804024	.005218878	.67
151	151	300.	6.6	.029105999	3.09900397	3.71804024	.007828317	.67
163	163	130.	11.61538	.174635978	6.55913513	4.93240712	.035405832	.67
Ferry Cr.	Ferry Cr.							



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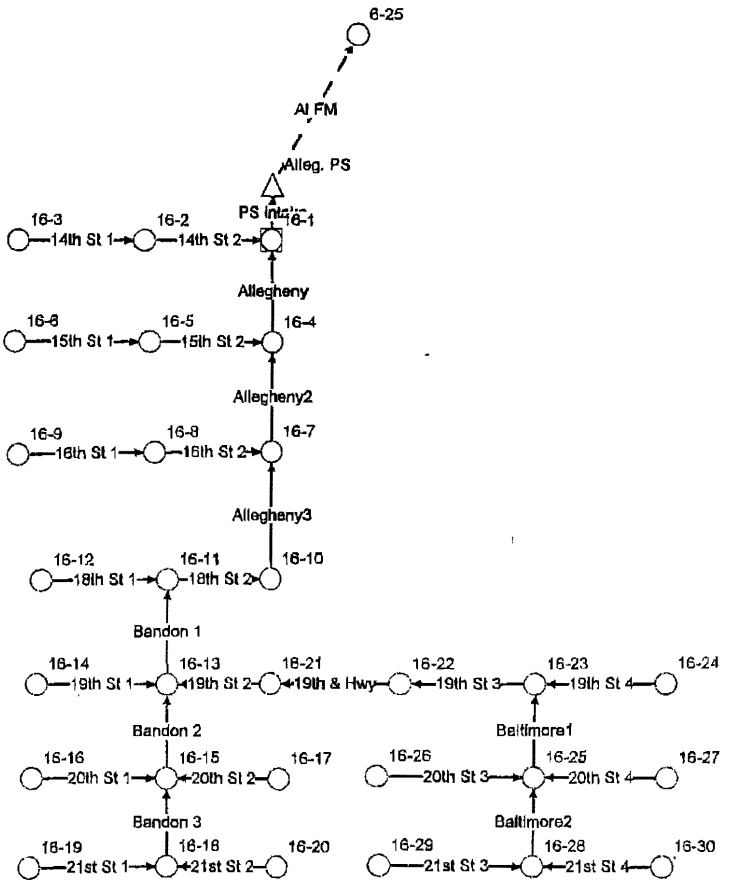
Rosa Road	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]
170	400.	1.4	.010595968	1.32649844	1.71240361
171	400.	1.46	.029861364	1.86256590	1.74871303
Filmore 14	270.	3.	0	0	2.50670222
22nd	400.	.4	0	0	.915318234
164	400.	1.5	.010595968	1.35867225	1.77250613
165	400.	2.	.029861366	2.08418649	2.04671379
Filmore 13	270.	.4	.066465621	1.50818990	.915318234
21st	400.	.4	0	0	.915318234
166	400.	1.5	.010595968	1.35867225	1.77250613
167	400.	2.	.029861366	2.08418649	2.04671379
Filmore 12	270.	.4	.133894505	1.85249477	.915318234
20th	400.	.4	0	0	.915318234
168	400.	2.	.010595969	1.50257065	2.04671379
169	400.	.75	.029861366	1.47624390	1.25335111
Filmore 11	270.	.4	.204213148	2.09010791	.915318234
19th	400.	.4	0	0	.926689083
Filmore 10	270.	.4	.274531477	2.27118999	.915318234
18th	400.	.4	0	0	.915318234
172	400.	1.4	.010595968	1.32649844	1.71240361
173	400.	1.4	.029861364	1.83510253	1.71240361
Filmore 9	270.	.4	.344848334	2.41779755	.915318234
17th	400.	.4	0	0	.915318234
174	400.	1.4	.010595968	1.32649844	1.71240361
175	400.	1.4	.029861364	1.83510253	1.71240361
Filmore 8	270.	.75	.415164936	3.18868998	1.25180280
16th	400.	.4	0	0	.921021207
176	220.	.5	0	0	1.03261823
Filmore 7	270.	.85	.445020927	3.40680035	1.33574683
15th	400.	.47	0	0	.992181323
160	220.	.53	0	0	1.05089608
Filmore 6	270.	.4	.474817224	2.63092841	.915318234
14th	400.	.43	0	0	.949022144
Filmore 5	120.	.5	.494071411	2.46206120	.804066133
13th	400.	.4	0	0	.915318234
Filmore 4	1250.	.928	.512466602	3.05476643	1.09542022
HARLEM	605.	.49587	.216597888	1.85176977	2.32964764
11TH	1055.	.25592	.391964436	1.75026278	1.67364348
FIMORE 3	665.	4.84211	1.02951157	6.24131331	7.27988323
FILMORE 2	325.	4.92308	1.20216531	4.95102725	7.34049945
FIMORE 1	650.	.96769	1.26772269	2.88743377	3.25443756
4TH	245.	.28571	1.41507073	2.55171831	1.76837056
Elmira 2	450.	.62444	1.55168349	3.50815182	2.61429265
Elmira 1	290.	1.03103	1.56879085	3.47593338	5.07106892
1st St 1	240.	.3	1.61143506	2.71555249	5.34250114
FM filmore					

Rosa Road	HDR:Max Flow/Design Flow (fraction) [Single]	Diameter/Depth (feet, metres) [Single]
170	.006187775	.67
171	.017076194	.67
Filmore 14	0	.67
22nd	0	.67
164	.005977958	.67
165	.014589908	.67
Filmore 13	.072614768	.67
21st	0	.67
166	.005977958	.67
167	.014589908	.67
Filmore 12	.146281916	.67
20th	0	.67
168	.005177064	.67
169	.023825220	.67
Filmore 11	.223106172	.67
19th	0	.67
Filmore 10	.299930086	.67
18th	0	.67
172	.006187775	.67
173	.017438274	.67
Filmore 9	.376752392	.67
17th	0	.67
174	.006187775	.67
175	.017438274	.67
Filmore 8	.331653623	.67
16th	0	.67
176	0	.67
Filmore 7	.333162628	.67
15th	0	.67
160	0	.67
Filmore 6	.518745538	.67
14th	0	.67
Filmore 5	.614469380	.67
13th	0	.67
Filmore 4	.467928932	.67
HARLEM	.092975597	1.
11TH	.234216959	1.
FIMORE 3	.141418692	1.
FILMORE 2	.163771595	1.
FIMORE 1	.389540958	1.
4TH	.800216887	1.
Elmira 2	.593538559	1.
Elmira 1	.309379996	1.167
1st St 1	.352810896	1.5
FM filmore		

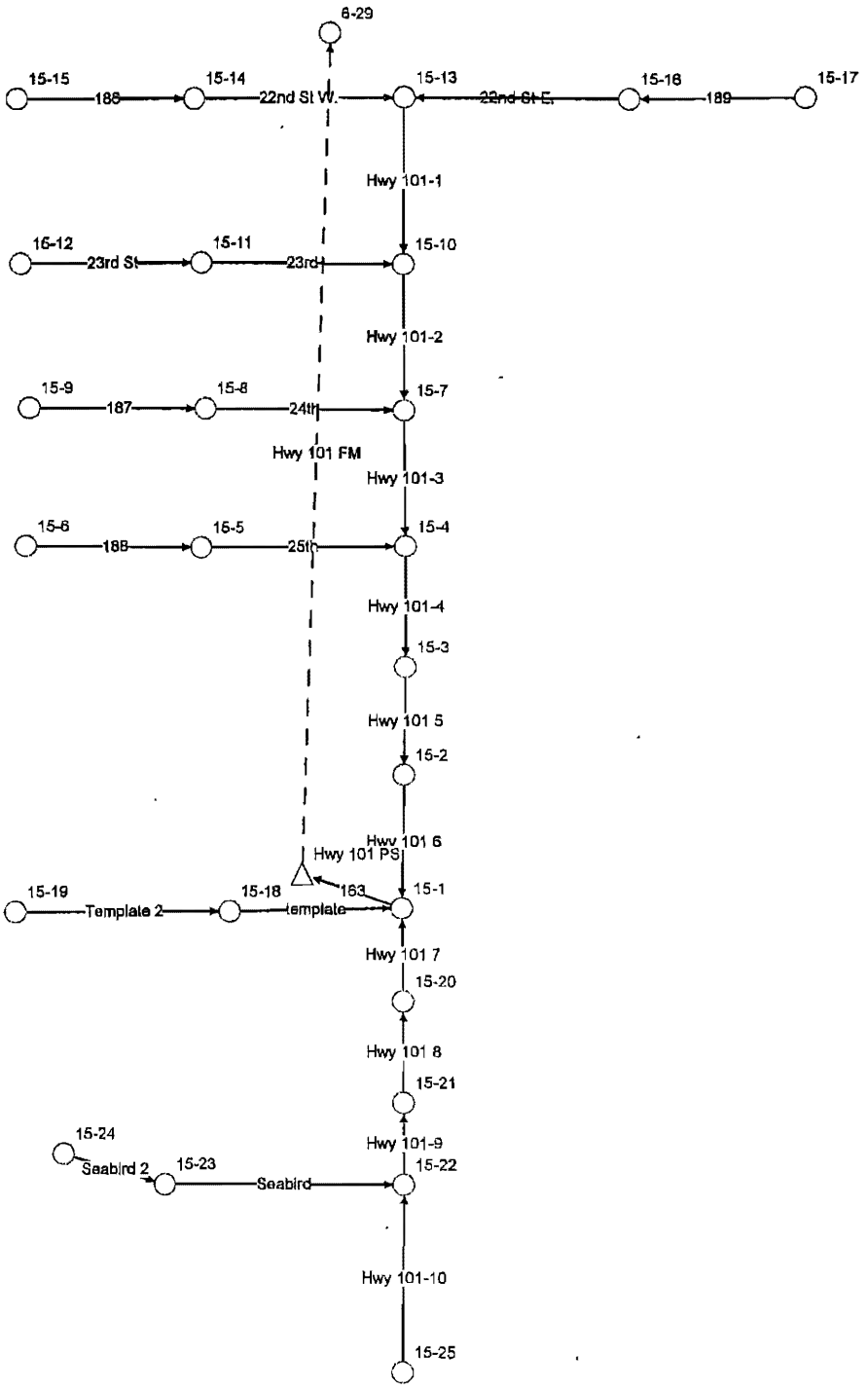
Rosa Road	Ground Elevation (feet, metres)	Invert Elevation (feet, metres)	DWF Sewage Flow Rate
17-18	96.	90.	
17-17	90.	84.2	
17-31	95.	90.	
17-28	87.5	83.5	
17-30	103.	97.8	
17-29	98.	91.6	
17-27	90.	81.7	
17-24	87.5	82.32	
17-26	102.	94.82	
17-25	94.	88.72	
17-23	89.	80.52	
17-20	86.	81.14	
17-22	98.	92.	
17-21	90.	82.54	
17-19	89.	79.34	
17-16	86.	80.	
17-15	89.5	78.16	
17-12	85.	78.78	
17-14	95.	88.8	
17-13	89.	83.1	
17-11	87.5	76.98	
17-8	82.5	77.6	
17-10	92.5	87.5	
17-9	89.	81.8	
17-7	84.	75.8	
17-6	80.	75.5	
co-2	80.	75.	
17-5	79.	73.68	
17-4	77.	73.36	
co-1	77.5	72.64	
17-3	78.	71.28	
17-2	77.5	72.4	
17-1	74.	70.	
4-69	76.	71.	
MH 4-67	74.	69.3	
MH 4-54	78.4	70.	.764
MH 4-49	76.	60.2	.774
MH 4-45	65.	57.5	.445
MH 4-30	34.	25.3	.61
MH 4-24	17.	9.3	.232
MH 4-12	11.	3.01	.522
MH 4-2	13.	2.31	.484
5-2	8.8	-.5	.077
8-4	9.4	-3.49	.079
8-3	10.	-8.43	.087
Filmore PS	40.	35.	1E-4



XP-SWMM2000 Version 7.50 	**South Bandon Allegheny Sewers** Licenced To: Dyer Partnership [42-750-0181]	04/23/02 Page 1/1

Allegheny Sewers	Ground Elevation (feet, metres)	Invert Elevation (feet, metres)	HDR DWF Flow Rate
16-17	78.4	74.2	0.
16-20	81.	77.	0.
16-19	76.	72.3	0.
16-18	79.4	70.5	.45
16-16	76.	72.	0.
16-15	77.	69.22	.45
16-14	75.	71.	0.
16-30	85.	81.	0.
16-29	80.5	76.8	0.
16-28	81.	75.0	.45
16-27	86.	82.	0.
16-26	81.	77.	0.
16-25	79.	73.92	.45
16-24	85.	81.	0.
16-23	79.	72.64	.226
16-22	78.5	70.94	.226
16-21	77.5	69.54	.113
16-13	77.	68.04	.339
16-12	76.	69.86	0.
16-11	78.	66.76	.113
16-10	81.	65.8	.05
16-9	72.	68.27	0.
16-8	76.	65.77	
16-7	77.	63.62	.14
16-6	71.	67.3	0.
16-5	73.	64.7	.226
16-4	75.	62.44	.226
16-3	71.	67.3	0.
16-2	73.5	65.15	.226
16-1	74.	61.26	.226
Alleg. PS	74.	52.	0.
6-25	74.	62.	0.

Allegheny Sewers	Link Name	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]	HDR:Max Flow/Design Flow (fraction) [Single]	Diameter/Depth (feet, metres) [Single]
20th St 2	20th St 2	400.	.75	0	0	1.25335111	0	.67
21st St 2	21st St 2	400.	.75	0	0	1.25335111	0	.67
21st St 1	21st St 1	400.	.4	0	0	.915318234	0	.67
Bandon 3	Bandon 3	270.	.4	.031185146	1.20219219	.915318234	.034070680	.67
20th St 1	20th St 1	400.	.645	0	0	1.16231000	0	.67
Bandon 2	Bandon 2	270.	.4	.062370291	1.47991159	.915318234	.068140650	.67
19th St 1	19th St 1	400.	.69	0	0	1.20217215	0	.67
21st St 4	21st St 4	400.	1.	0	0	1.44724520	0	.67
21st St 3	21st St 3	400.	.4	0	0	.915318234	0	.67
Baltimore2	Baltimore2	270.	.4	.031185192	1.20219282	.915318234	.034070874	.67
20th St 4	20th St 4	400.	1.82	0	0	1.95244052	0	.67
20th St 3	20th St 3	400.	.72	0	0	1.22802827	0	.67
Baltimore1	Baltimore1	270.	.4	.062370497	1.47991318	.915318234	.068141186	.67
19th St 4	19th St 4	400.	1.6	0	0	1.83063646	0	.67
19th St 3	19th St 3	400.	.4	.078032405	1.58096707	.915318234	.085251678	.67
19th & Hwy	19th & Hwy	325.	.4	.093694002	1.66874446	.915318234	.102362226	.67
19th St 2	19th St 2	325.	.4	.101524770	1.70860724	.915318234	.110917461	.67
Bandon 1	Bandon 1	270.	.4	.187387038	2.04001209	.915318234	.204723375	.67
18th St 1	18th St 1	400.	.75	0	0	1.25335111	0	.67
18th St 2	18th St 2	190.	.4	.195214214	2.06629746	.915318234	.213274691	.67
Allegheny3	Allegheny3	520.	.4	.198664571	2.07107629	.915318234	.217044262	.67
16th St 1	16th St 1	400.	.6	0	0	1.12103131	0	.67
16th St 2	16th St 2	325.	.6	0	0	1.12103131	0	.67
Allegheny2	Allegheny2	270.	.4	.211505817	1.91841511	.915318234	.231822862	.67
15th St 1	15th St 1	400.	.6	0	0	1.12103131	0	.67
15th St 2	15th St 2	325.	.6	.015661799	1.01580009	1.12103131	.013970885	.67
Allegheny	Allegheny	270.	.4	.237808768	1.98448391	.915318234	.261561950	.67
14th St 1	14th St 1	325.	.6	0	0	1.12103131	0	.67
14th St 2	14th St 2	325.	.6	.015661845	1.12792716	1.12103131	.013970983	.67
PS Intake	PS Intake	40.	1.	.301074038	2.71433468	4.21058705	.072963706	1.

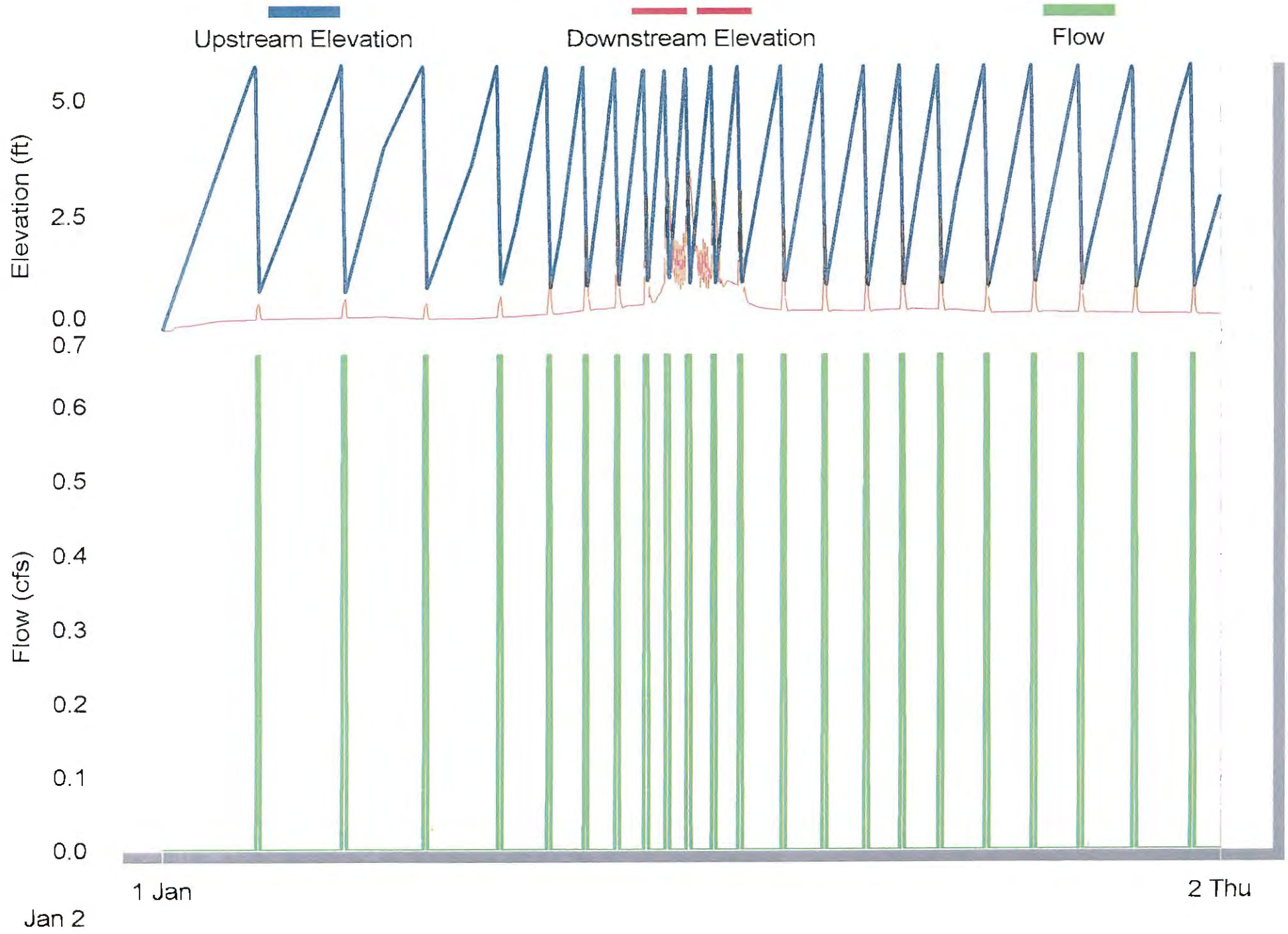

6-29
15-15
188
15-14
22nd St W.
15-13
22nd St E.
15-16
189
15-17
Hwy 101-1
15-12
23rd St
15-11
23rd
15-10
Hwy 101-2
15-9
187
15-8
24th
15-7
Hwy 101 FM
Hwy 101-3
15-6
188
15-5
25th
15-4
Hwy 101-4
15-3
Hwy 101 5
15-2
Hwy 101 6
Hwy 101 PS
15-19
Template 2
15-18
Template
183
15-1
Hwy 101 7
15-20
Hwy 101 8
15-21
15-24
Seabird 2
15-23
Seabird
Hwy 101-9
15-22
Hwy 101-10
15-25

D1 South	Link Name	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]	HDR:Max Flow/Design Flow (fraction) [Single]	Diameter/Depth (feet, metres) [Single]
189	189	400.	.75	0	0	1.25335111	0	.67
22nd St E.	22nd St E.	400.	.75	.015660324	1.21957392	1.25335111	.012494762	.67
186	186	450.	.426	0	0	.945336607	0	.67
22nd St W.	22nd St W.	450.	.425	.015656551	.559466225	.942871579	.016605178	.67
Hwy 101-1	Hwy 101-1	270.	.42593	.062494719	1.51366895	.944515646	.066166051	.67
23rd St	23rd St	450.	.4	0	0	.915318234	0	.67
23rd	23rd	450.	.4	.015661032	.974513642	.915318234	.017109931	.67
Hwy 101-2	Hwy 101-2	270.	.4	.093811901	1.66996046	.915318234	.102491271	.67
187	187	400.	.75	0	0	1.25335111	0	.67
24th	24th	400.	.75	.015661798	1.21961386	1.25335111	.012495938	.67
Hwy 101-3	Hwy 101-3	270.	.4	.125128339	1.81688720	.915318234	.136705078	.67
188	188	400.	.75	0	0	1.25335111	0	.67
25th	25th	400.	.75	.015661798	1.21961386	1.25335111	.012495938	.67
Hwy 101-4	Hwy 101-4	300.	.4	.156442535	1.93695649	.915318234	.170916474	.67
Hwy 101 5	Hwy 101 5	270.	.4	.156431294	1.93740382	.915318234	.170907143	.67
Hwy 101 6	Hwy 101 6	270.	.4	.156416727	1.93735104	.915318234	.170897883	.67
Template 2	Template 2	400.	.4	0	0	.915318234	0	.67
template	template	400.	.4	.009701341	.843602078	.915318234	.010598872	.67
Hwy 101-10	Hwy 101-10	300.	.4	.009701938	.844040469	.915318234	.010599525	.67
Seabird 2	Seabird 2	250.	.4	0	0	.915318234	0	.67
Seabird	Seabird	400.	.4	.009701342	.843602103	.915318234	.010598873	.67
Hwy 101-9	Hwy 101-9	367.	.4	.029104361	1.18542209	.925240673	.031456014	.67
Hwy 101 8	Hwy 101 8	367.	.4	.029102182	1.18539494	.925240673	.031453880	.67
Hwy 101 7	Hwy 101 7	367.	.40872	.029090023	1.00553391	.726974814	.040019961	.67
163	163	40.	1.	.228470017	2.99511113	1.44724520	.157866007	.67
Hwy 101 FM	Hwy 101 FM							

Hwy 101 South	Ground Elevation (feet, metres)	Invert Elevation (feet, metres)	HDR DWF Flow Rate
15-17	84.	80.	0.
15-16	83.3	76.9	.226
15-15	77.4	72.38	0.
15-14	78.3	70.46	.226
15-13	82.7	68.55	.45
15-12	74.8	71.1	0.
15-11	77.	69.2	.226
15-10	80.2	67.2	.226
15-9	79.8	75.8	0.
15-8	77.9	71.	.226
15-7	77.6	66.02	.226
15-6	75.7	71.14	0.
15-5	77.9	68.04	.226
15-4	79.	64.84	.226
15-3	80.	63.54	0.
15-2	80.3	62.36	0.
15-19	70.	64.68	0.
15-18	75.	62.98	.14
15-25	75.	67.7	.14
15-24	73.	69.3	0.
15-23	76.	68.2	.14
15-22	78.	66.4	.14
15-21	82.4	64.8	0.
15-20	82.9	63.2	0.
15-1	80.	61.08	.48
Hwy 101 PS	72.	50.	0.
6-29	74.	62.	0.

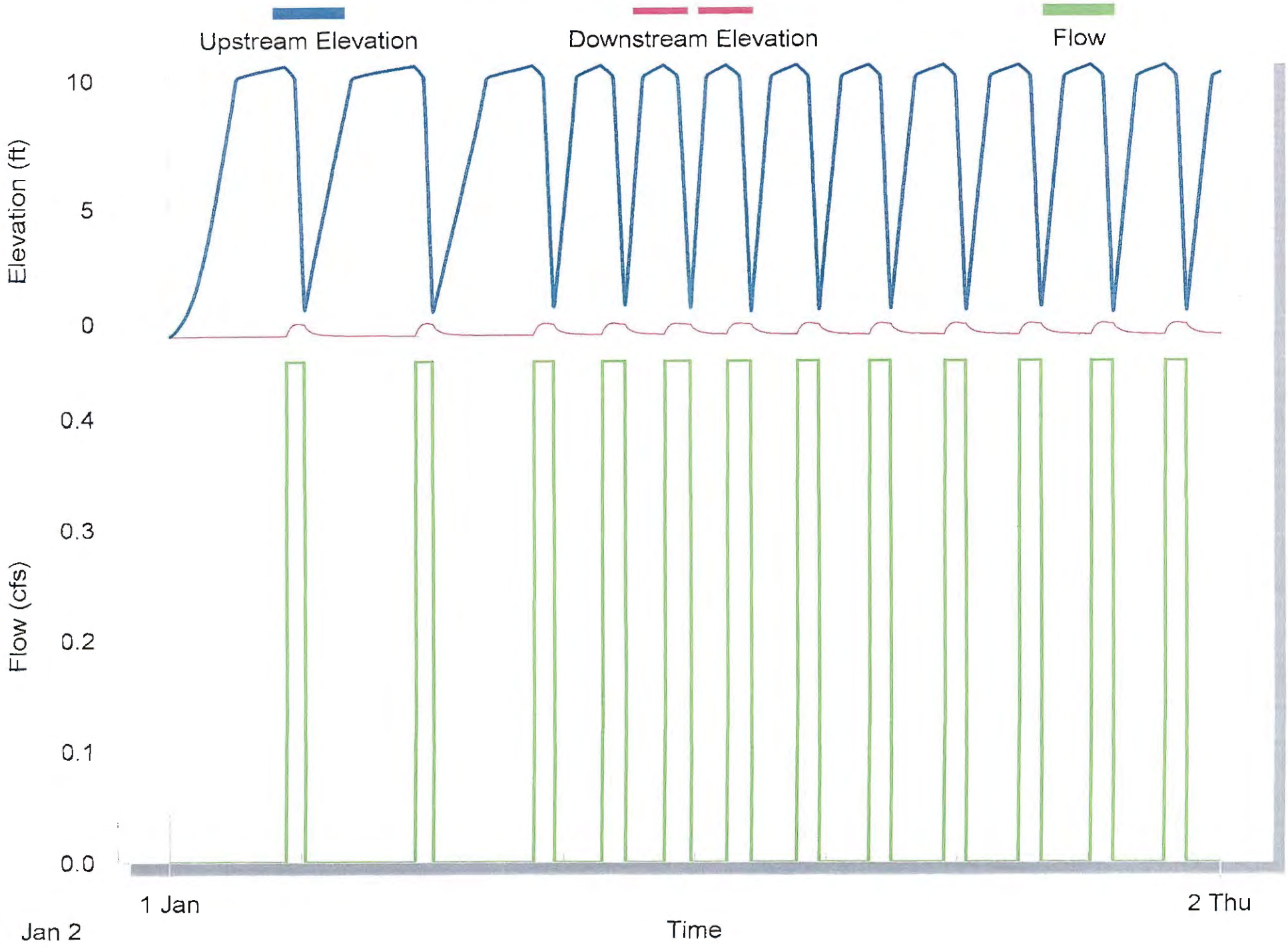
Forcemain from Jetty PS to 8-16 (Wet Weather)

[Max Flow = 0.6700][Max Velocity = 0.00]



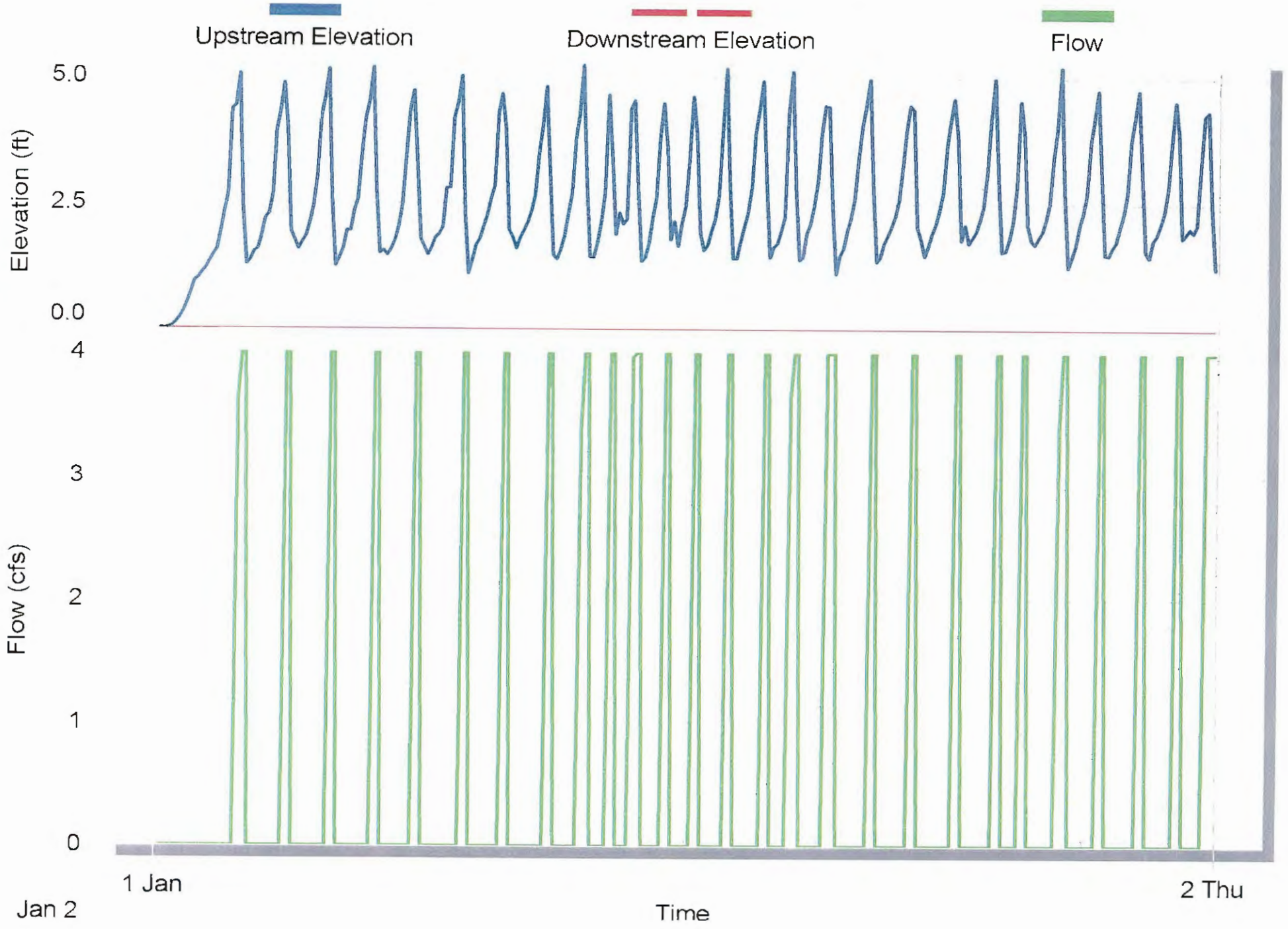
Diversion Johnson from J Cr. PS to 13-11

[Max Flow = 0.4500][Max Velocity = 0.00]



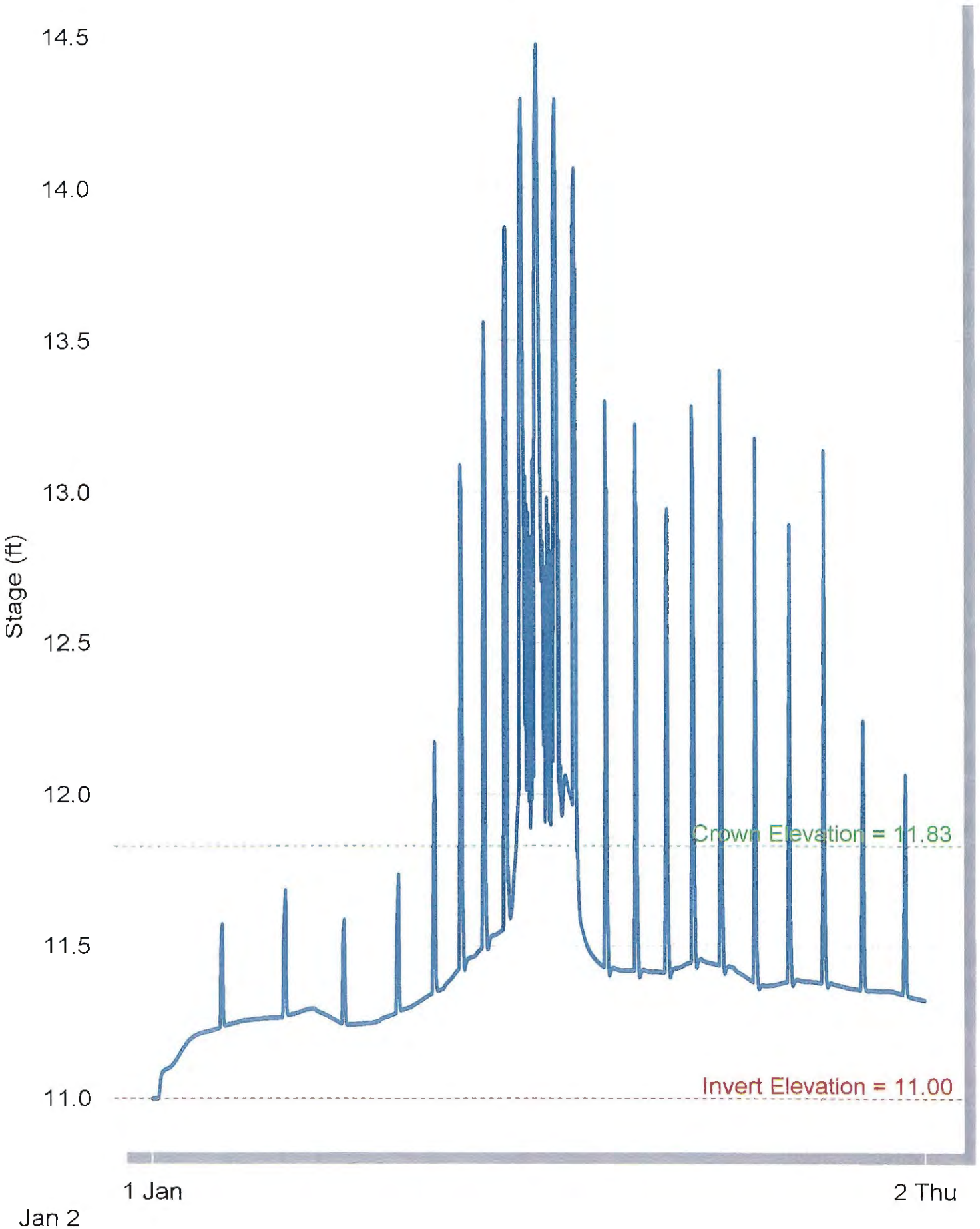
Diversion Filmore from 8-3 to Filmore PS

[Max Flow = 4.0000][Max Velocity = 0.00]



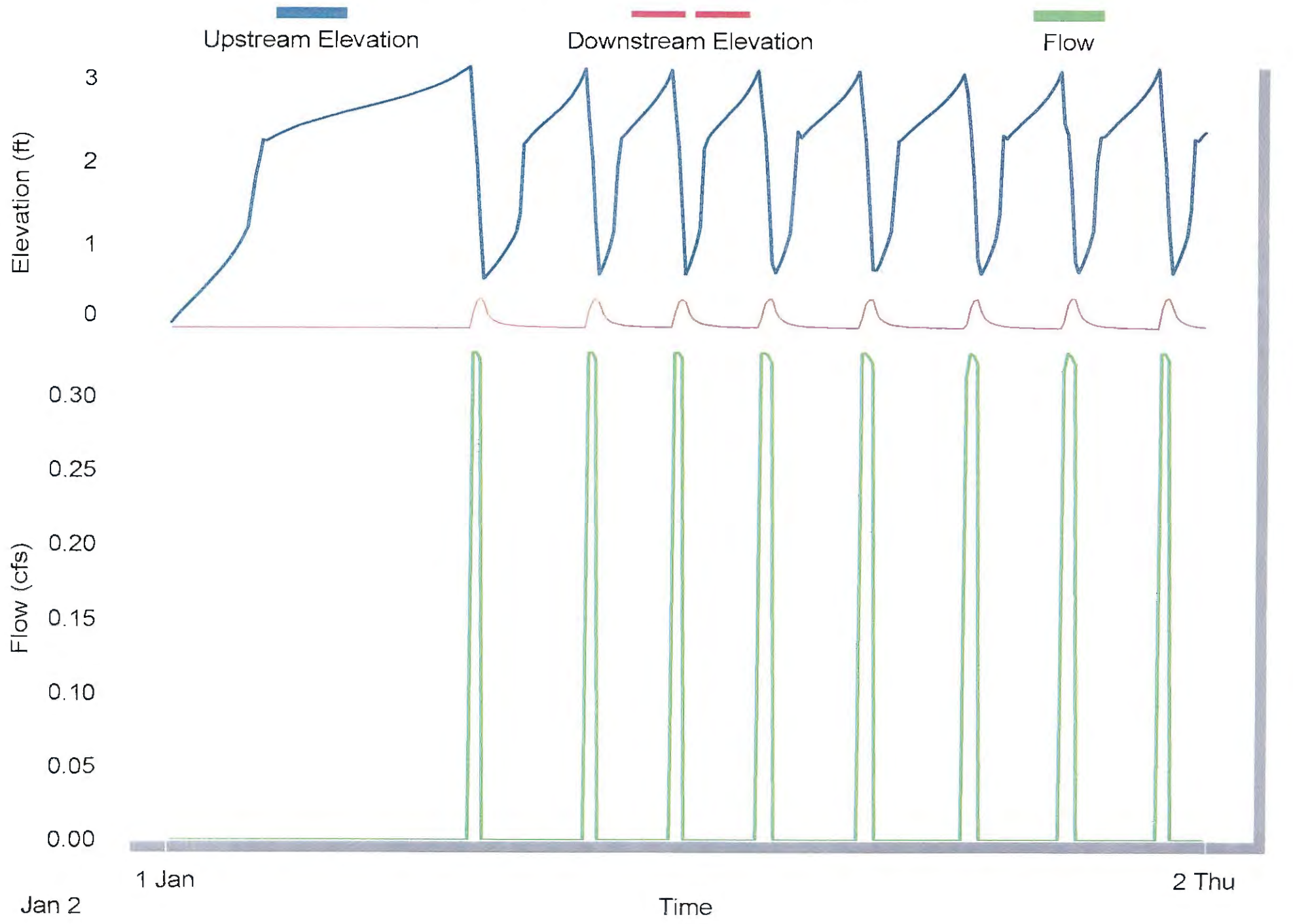
Node - 8-16

Wet Weather surcharge



Diversion North PS from N Ave PS to 1-12

[Max Flow = 0.3300][Max Velocity = 0.00]



Appendix

E

Cost Estimates

City of North Bend WWTP

JOB ESTIMATE

P.O. Box B
1255 Airport Lane
North Bend Or, 97459
(541)756-6078

TO:
Jan
Dyer Partnership
275 Market Street
Coos Bay, Or 97420 269-0732

Tv around 600 feet of sewer lines will be setting up at 2 locations around 300 feet per section
1 hr. to get to Bandon 1 hr to get back
1 hr for total set-up and takadown
1 hr at each location for actual TV time. Will provide video and written report.

1 man @ 27.14/hr for 5 hours	$135.70
1 man @ 21.23/hr for 5 hours	106.15
TV Van @ 40/hr for 5 hours	200.00
Generator	20.00
Video tape (no charge)	-
TOTAL ESTIMATED JOB COST	$461.85

This is an estimate only, not a contract. This estimate is for completing the job described above, based on our evaluation. It does not include unforeseen price increases or additional labor and materials which may be required should problems arise.

PREPARED BY

DATE

Edison Avenue Line Upsize

Construction Cost Estimate

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 5,000	$ 5,000
2	Demolition & Site Preparation	LS	All	$ 3,000	$ 3,000
3	By-Pass Pumping	LS	All	$ 5,000	$ 5,000
4	12" Sewerpipe Replacement	LF	230	$ 120	$ 27,600
5	AC Pavement R & R	LF	75	$ 16	$ 1,200
			Construction Subtotal		**$ 41,800**
			Contingency		$ 6,000
			Engineering		$ 7,500
			Administration		$ 850
			Permit Fees		$ 350
			Project Total		**$ 56,500**

I/I Study Project No. 2 - Basin 7 combined with Line Upsize

Construction Cost Estimate

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 10,500	$ 10,500
2	Demolition & Site Preparation	LS	All	$ 8,000	$ 8,000
3	By-Pass Pumping	LS	All	$ 12,500	$ 12,500
4	8" Sewerpipe Lining	LF	250	$ 35	$ 8,750
5	12" Sewerpipe Replacement	LF	520	$ 120	$ 62,400
6	8" Sewerpipe Replacement	LF	210	$ 70	$ 14,700
7	AC Pavement R & R	LF	730	$ 16	$ 11,680
8	Lateral Connection	EA	16	$ 1,500	$ 24,000
9	Lateral Replacement	LF	480	$ 35	$ 16,800
10	Service Laterals	EA	17	$ 150	$ 2,550
11	Lateral and Line Grout Pack	EA	7	$ 500	$ 3,500
12	Preliminary Televising Work	LF	980	$ 1.50	$ 1,470
			Construction Subtotal		**$ 176,850**
			Contingency		$ 27,000
			Engineering		$ 32,000
			Administration		$ 3,500
			Permit Fees		$ 350
			Project Total		**$ 239,700**

Oregon Avenue Line Upsize Only

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 9,000	$ 9,000
2	Demolition & Site Preparation	LS	All	$ 5,500	$ 5,500
3	By-Pass Pumping	LS	All	$ 7,000	$ 7,000
4	12" Sewerpipe Replacement >12'	LF	520	$ 120	$ 62,400
5	AC Pavement R & R	LF	520	$ 16	$ 8,320
6	Service Laterals	EA	17	$ 150	$ 2,550
			Construction Subtotal		**$ 94,770**
			Contingency		$ 14,800
			Engineering		$ 18,000
			Administration		$ 2,000
			Permit Fees		$ 350
			Project Total		**$ 129,920**

Ohio Ave Proposed Sewers

Construction Cost Estimate

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 70,000	$ 70,000
2	Demolition & Site Preparation	LS	All	$ 42,000	$ 42,000
3	8" Sewerline	LF	8,150	$ 45	$ 366,750
4	Manholes< 8'	EA	21	$ 2,000	$ 42,000
5	Manholes > 8'	EA	3	$ 2,500	$ 7,500
6	Cleanouts	EA	2	$ 500	$ 1,000
7	Pump Station	EA	1	$ 200,000	$ 200,000
8	Land acquisition	Lot	1	$ 20,000	$ 20,000
9	Stream Crossing	LF	200	$ 150	$ 30,000
10	4" Forcemain	LF	750	$ 25.00	$ 18,750
			Construction Subtotal		**$ 798,000**
			Contingency		$ 95,000
			Engineering		$ 160,000
			Administration		$ 16,000
			Permit Fees		$ 1,000
			Project Total		**$ 1,070,000**
			Cost per projected home		$ 3,963
			Cost per acre		$ 15,286

Riverside Drive Grinder Pump Cost Estimate

Riverside Drive, 16 Existing Homes Only

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 20,000	$ 20,000
2	Demolition & Site Preparation	LS	All	$ 9,000	$ 9,000
3	Backfill of old Septic	EA	16	$ 200	$ 3,200
4	Grinder Pump equipment cost	EA	16	$ 2,800	$ 44,800
5	Pump Installation and Electrical	EA	16	$ 1,500	$ 24,000
6	Concrete Anchor	EA	16	$ 300	$ 4,800
7	2" pressure main	LF	4,500	$ 15	$ 67,500
8	Lateral connection (100')	EA	16	$ 300	$ 4,800
9	Manhole Drop Connection	EA	1	$ 1,500.00	$ 1,500
10	Vacuum Release Valve	EA	1	$ 1,500.00	$ 1,500
11	Driveway Crossing	EA	8	$ 300.00	$ 2,400
12	AC cut & Restore	EA	200	$ 16.00	$ 3,200
13	Gravel Resurface	EA	4,300	$ 10.00	$ 43,000
14	Directional Drill 1-1/4" Road Crossing	EA	8	$ 500.00	$ 4,000

Construction Subtotal	**$**	**233,700**
Contingency	$	28,000
Engineering	$	43,000
Administration	$	5,000
Permit Fees	$	350
Project Total	**$**	**310,050**
Cost per Existing Home	$	19,378

Riverside Drive Grinder Pump Cost Estimate

Riverside Drive & Michigan Avenue, 40 Homes

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 37,000	$ 37,000
2	Demolition & Site Preparation	LS	All	$ 15,000	$ 15,000
3	Backfill of old Septic	EA	40	$ 200	$ 8,000
4	Grinder Pump equipment cost	EA	40	$ 2,800	$ 112,000
5	Pump Installation and Electrical	EA	40	$ 1,500	$ 60,000
6	Concrete Anchor	EA	40	$ 300	$ 12,000
7	2" pressure main	LF	6,100	$ 15	$ 91,500
8	Lateral connection (100')	EA	40	$ 300	$ 12,000
9	Manhole Connection	EA	1	$ 1,500.00	$ 1,500
10	Vacuum Release Valve	EA	1	$ 1,500.00	$ 1,500
11	Driveway Crossing	EA	8	$ 300.00	$ 2,400
12	AC cut & Restore	EA	200	$ 16.00	$ 3,200
13	Gravel Resurface	EA	5,900	$ 10.00	$ 59,000
14	Directional Drill 1-1/4" Road Crossing	EA	8	$ 500.00	$ 4,000

Construction Subtotal	**$**	**419,100**
Contingency	$	51,000
Engineering	$	78,000
Administration	$	8,500
Permit Fees	$	350
Project Total	**$**	**556,950**
Cost per Home	$	13,924

Highway 101 South Sewer Construction Cost Estimate

Entire Project

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 85,000	$ 85,000
2	Demolition & Site Preparation	LS	All	$ 35,000	$ 35,000
3	8" sewerpipe Class C	LF	9,120	$ 45	$ 410,400
4	4" Forcemain	LF	3,350	$ 25	$ 83,750
5	Manholes	EA	24	$ 2,000	$ 48,000
6	AC Restoration	LF	2,000	$ 16.00	$ 32,000
7	Gravel Restoration	LF	8,000	$ 10.00	$ 80,000
8	Pump Station	LS	1	$ 200,000	$ 200,000
			Construction Subtotal		**$ 974,150**
			Contingency		$ 117,000
			Engineering		$ 195,000
			Administration		$ 20,000
			Permit Fees		$ 1,000
			Project Total		**$ 1,307,150**
			Cost per acre		$ 9,015

Highway 101 South Sewer Construction Cost Estimate

Portion Serving Within the City Limits

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 50,000	$ 50,000
2	Demolition & Site Preparation	LS	All	$ 20,000	$ 20,000
3	8" sewerpipe Class C	LF	3,070	$ 45	$ 138,150
4	4" Forcemain	LF	3,350	$ 25	$ 83,750
5	Manholes	EA	10	$ 2,000	$ 20,000
6	AC Restoration	LF	2,000	$ 16.00	$ 32,000
7	Gravel Restoration	LF	2,350	$ 10.00	$ 23,500
8	Pump Station	LS	1	$ 200,000	$ 200,000
			Construction Subtotal		**$ 567,400**
			Contingency		$ 70,000
			Engineering		$ 115,000
			Administration		$ 11,500
			Permit Fees		$ 1,000
			Project Total		**$ 764,900**
			Cost per acre		$ 15,298

Allegheny Avenue Updated Construction Cost

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 76,000	$ 76,000
2	Demolition & Site Preparation	LS	All	$ 31,000	$ 31,000
3	8" Sewerpipe	LF	8,125	$ 45	$ 365,625
4	10" Sewerpipe	LF	1,130	$ 90	$ 101,700
5	Manholes	EA	32	$ 2,000	$ 64,000
6	Manholes >8'	EA	6	$ 2,500	$ 15,000
7	Pump Station	EA	1	$ 200,000	$ 200,000
8	4" Forcemain	LF	500	$ 25	$ 12,500

Construction Subtotal	**$ 865,825**
Contingency	$ 105,000
Engineering	$ 175,000
Administration	$ 17,500
Permit Fees	$ 1,000
Project Total	**$ 1,164,325**
	$ 14,199.09

South Bandon Updated Construction Cost

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 278,000	$ 278,000
2	Demolition & Site Preparation	LS	All	$ 166,000	$ 166,000
3	8" Sewerpipe	LF	35,000	$ 45	$ 1,575,000
4	10" Sewerpipe	LF	2,200	$ 90	$ 198,000
5	Manholes	EA	87	$ 2,000	$ 174,000
6	Manholes >8'	EA	10	$ 2,500	$ 25,000
7	Pump Station	EA	1	$ 200,000	$ 200,000
8	Pressure Sewer	EA	1,000	$ 25	$ 25,000

Construction Subtotal	**$**	**2,641,000**
Contingency	$	500,000
Engineering	$	600,000
Administration	$	65,000
Permit Fees	$	350
Project Total	**$**	**3,806,350**
Cost per acre	$	10,875

Rosa Road Proposed Sewers

Construction Cost Estimate

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 70,000	$ 70,000
2	Demolition & Site Preparation	LS	All	$ 28,000	$ 28,000
3	8" Sewerline	LF	12,840	$ 45	$ 577,800
4	Manholes< 8'	EA	23	$ 2,000	$ 46,000
5	Manholes > 8'	EA	10	$ 2,500	$ 25,000
6	Cleanouts	EA	8	$ 500	$ 4,000
7	AC Remove & Replace	LF	2,900	$ 16	$ 46,400
			Construction Subtotal		**$ 797,200**
			Contingency		$ 96,000
			Engineering		$ 145,000
			Administration		$ 16,000
			Permit Fees		$ 1,000
			Project Total		**$ 1,055,200**
			Cost per projected home		$ 2,799
			Cost per acre		$ 14,069

Replace Tide Gate at Fimore PS with Red Valve

Item	Description	Unit	Quantity	Material Cost	Labor Hours	Total Cost
1	Tideflex Valve	Each	1	$ 1,950	$ 4	$ 2,070
2	Remove existing	Each	1	$ 20	$ 12	$ 380
			Construction Total			**$ 2,450**

ESTIMATE SHEET

NAME

ADDRESS

CITY STATE ZIP

MR EXT. PHONE -

FAX

Page of

DATE 4-16-02

QUOTE #

B.O.D.

JOB: C/O Bandon 40MMPC ENGR.:

CONDITIONS OF SERVICE

GPM TDH PSI FT. SUCT PSI FT. DISCH PSI FT. VEL HEAD FT. LIQUID

AVAIL NPSH FT. REQ'D. NPSH FT. VAPOR PRESS PSIA SP. GR TEMP °F. VISC

EFF % BHP MAX. BPH RPM SIZE SOLIDS % SOLIDS

PIT DEPTH PIT DIA VOLTAGE

ITEM NO.	QUAN.	DESCRIPTION	LIST	MULT.	COST	MULT.	NET SELL. PRICE	W
		Parts To Rebuild 1 Pump						
32	1	1088-009-2 7½" Imp.					602.10	
42	1	4025-004-2 7½" Lip plate					711.90	
31	1	891-000-2 Wearplate					156.60	
30	1	150-024-1 Case O Ring					13.50	
24	1	241-007-1 O Ring					4.50	
40	1	3296-001-1 Seal Sleeve					51.30	
41	1	920-001-1 Mech Seal					33.30	
		TOTALS					1573.20	

NOTES: Parts for 1 pump.

SELLING PRICE

SALES TAX ___%

FREIGHT COST

SALES OFFICE COST

SALES OFFICE COMM.

Quoted by

HYDRONIX HYDRONIX

New Johnson Creek Pump Station

Construction Cost Estimate with Generator

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$24,000.00	$ 24,000
2	Demolition & Site Preparation	LS	All	$10,000.00	$ 10,000
3	Temporary controls & Pumping	LS	1	$ 10,000	$ 10,000
4	Remove old PS	EA	1	$ 10,000	$ 10,000
5	Refurbish Wet-Well	EA	1	$ 1,500	$ 1,500
6	Extend & Cap Wet Well	EA	1	$ 5,000	$ 5,000
7	5 HP submersible Pumps	EA	2	$ 9,500	$ 19,000
8	Piping & Valves	LS	1	$ 18,000	$ 18,000
9	Stucture	SF	196	$ 125	$ 24,500
10	Electrical	LS	1	$ 18,000	$ 18,000
11	Controls & Telemetry	LS	1	$ 10,000	$ 10,000
12	Hoist & Rails	EA	2	$ 1,500	$ 3,000
13	Site Landscaping	LS	1	$ 4,000	$ 4,000
14	Concrete & fill	YD	75	$ 400	$ 30,000
15	Generator Rehab & Reinstall	EA	1	$ 10,000	$ 10,000

Construction Subtotal	**$ 197,000**
Contingency	$20,000
Engineering	$36,000
Administration	$9,900
Permit Fees	$ 1,000
Project Total	**$ 263,900**

New Influent Meter

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 2,025	$ 2,025
2	By-Pass Pumping	LS	All	$ 2,000	$ 2,000
3	0-5 MGD Mag Meter	EA	1	$ 6,000	$ 6,000
4	Piping & Connections	LS	1	$ 2,000	$ 2,000
5	Wiring to control panel	LS	1	$ 3,500	$ 3,500

Construction Subtotal	**$ 15,525**
Contingency	$ 2,250
Engineering	$ 3,000
Administration	$ 300
Project Total	**$ 21,075**

Replace Metering & Recording Equipment

(Does not include new flow meters)

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 2,550	$ 2,550
2	By-Pass Pumping	LS	All	$ 2,000	$ 2,000
3	Replacement of the Recorder	EA	1	$ 6,000	$ 6,000
4	Calibration & Set Up	LS	1	$ 4,000	$ 4,000
5	Wiring to control panel	LS	1	$ 5,000	$ 5,000

Construction Subtotal	**$ 19,550**
Contingency	$ 2,000
Engineering	$ 3,000
Administration	$ 300
Project Total	**$ 24,850**

Automatic RAS Pump Controls

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Contractor Overhead	LS	All	$1,200.00	$ 1,200
2	Electrical	LS	1	$ 1,000	$ 1,000
3	BacGen Control Wiring	LS	1	$ 7,000	$ 7,000

Construction Subtotal	**$ 9,200**
Contingency	$900
Engineering	$1,400
Administration	$276
Permit Fees	$ -
Project Total	**$ 11,776**

UV Lamp Operating Cost

Existing	Avg Flow	# Lamps	Watts	Hours	kWh	Lamps Replaced	Ballast Replaced	Lamp Disposal
Jan	0.284	168	8064	730	5,887			
Feb	0.28	168	8064	730	5,887			
Mar	0.283	168	8064	730	5,887			
Apr	0.308	168	8064	730	5,887			
May	0.282	168	8064	730	5,887			
Jun	0.277	168	8064	730	5,887			
Jul	0.3	168	8064	730	5,887			
Aug	0.33	168	8064	730	5,887			
Sep	0.303	168	8064	730	5,887			
Oct	0.266	168	8064	730	5,887			
Nov	0.295	168	8064	730	5,887			
Dec	0.379	168	8064	730	5,887			
Total				8760	70,641	168	16	168
Cost					$4,945	$ 6,720	$ 2,000	$ 504

Total Annual Cost Without Labor $14,169

With Flow Pacing

	Avg Flow	# Lamps	Watts	Hours	kWh	Lamps Replaced	Ballast Replaced	Lamp Disposal
Jan	0.284	56	2688	730	1,962			
Feb	0.28	56	2688	730	1,962			
Mar	0.283	28	1344	730	981			
Apr	0.308	28	1344	730	981			
May	0.282	28	1344	730	981			
Jun	0.277	28	1344	730	981			
Jul	0.3	28	1344	730	981			
Aug	0.33	28	1344	730	981			
Sep	0.303	28	1344	730	981			
Oct	0.266	28	1344	730	981			
Nov	0.295	28	1344	730	981			
Dec	0.379	56	2688	730	1,962			
Total				8760	14,717	35	3	35
Cost					$1,030	$ 1,400	$ 375	$ 105

Total Annual Cost Without Labor $ 2,910

Assume 1 year lamp life & $40 replacement cost
Assume $.07/kWh energy Cost
Assume 5 year ballast life & $125 replacement cost
Assume $3.00 lamp disposal cost

Roof for Sludge Beds

Construction Cost Estimate with Generator

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$5,000	$ 5,000
2	Demolition & Site Preparation	LS	All	$2,000	$ 2,000
3	Pole Building package from BJS'	LS	1	$ 25,000	$ 25,000
4	Presite investigation & core sampling	EA	1	$ 10,000	$ 10,000
			Construction Subtotal		**$ 42,000**
			Contingency		$ 5,000
			Engineering		$ 8,000
			Administration		$ 2,100
			Permit Fees		$ 1,500
			Project Total		**$ 58,600**

Pole style building with metal roof, no walls

Appendix

F

Laboratory Test Results

NEILSON RESEARCH CORPORATION

SLUDGE STUDY

NRC Number 94-9183
Date Received 9/9/94
Time Received 22:20
Date Reported 9/19/94

CLIENT MAILING ADDRESS:

City of Bandon
PO Box 67
Bandon OR 97411

Phone: (503) 347-9122

SAMPLE LOCATION:

City of Bandon
PO Box 67
Bandon OR 97411

SAMPLE COLLECTION DATA

SITE ID : Digester No # 3
MATRIX: Sludge
COMMENTS:

Time Collected: 13:30
Date Collected: 9/9/94
Collector's Name: Ed Hammond

SLUDGE STUDY

ANALYST: TD 9/12-19/94

ANALYSIS PERFORMED	METHOD	UNITS IN DRY WT	TEST RESULTS	METHOD BLANK	LCS % RECOVERY
pH	EPA 150.1	pH Units	< 4	ND	NA
Arsenic, As	EPA 7060	mg/kg	1.15	ND	116
Cadmium, Cd	EPA 7130	mg/kg	3.83	ND	94
Chromium, Cr	EPA 7190	mg/kg	30.2	ND	93
Copper, Cu	EPA 7210	mg/kg	465	ND	104
Lead, Pb	EPA 7420	mg/kg	74.0	ND	95
Mercury, Hg	EPA 7471	mg/kg	3.05	ND	108
Molybdenum, Mo	EPA 7480	mg/kg	ND@10	ND	80
Nickel, Ni	EPA 7520	mg/kg	28.3	ND	105
Selenium, Se	EPA 7740	mg/kg	1.97	ND	95
Zinc, Zn	EPA 7950	mg/kg	1848	ND	103
Ammonia Nitrogen	EPA 250.2	%	1.13	ND	97
Nitrate Nitrogen	EPA 353.3	%	1.13	ND	102
Total Kjeldahl Nitrogen	EPA 351.3	%	4.35	ND	94
Total Phosphorus	EPA 365.3	%	3.72	ND	104
Total Solids	EPA 160.3	% Wet Wt	1.39	NA	NA
Volatile Solids	EPA 160.4	%	58.1	NA	NA
Potassium	EPA 7610	%	0.625	ND	93

ND = None Detected at Level Indicated
MDL = Method Detection Limit

APPROVED _____ APPROVED _____

NEILSON RESEARCH CORPORATION

Analysis Report

Sludge Analysis

NRC Sample ID: 99-3161
Received: 4/2/99
Analyzed: 4/5-15/99
Reported: 4/15/99

CLIENT MAILING ADDRESS
City of Bandon - WWTP
Attn: Bill Nielson
PO Box 67
Bandon, OR 97411

541-347-9122

SAMPLE LOCATION
WWTP
Digester #3

Matrix: Sludge
Analyst W. Batie/J. Thompson

Date Collected: 4/1/99
Sample Point: Digester #3
Collector's Name: Nielson/City of Bandon

Sludge Analysis

Analysis	Method	Test Results As Received	PQL As Received	Units As Received	Test Results Dry Wt.	PQL Dry Wt.	Units Dry Wt.
Arsenic, As	EPA 200.7	ND	0.05	mg/L	ND	0.2	mg/kg
Cadmium, Cd	EPA 200.7	ND	0.001	mg/L	ND	0.05	mg/kg
Chromium, Cr	EPA 200.7	ND	0.001	mg/L	ND	0.05	mg/kg
Copper, Cu	EPA 200.7	0.202	0.001	mg/L	10.3	0.05	mg/kg
Lead, Pb	EPA 200.7	0.006	0.003	mg/L	0.3	0.1	mg/kg
Mercury, Hg	EPA 245.1	ND	0.05	mg/L	ND	0.2	mg/kg
Molybdenum, Mo	EPA 200.7	ND	0.01	mg/L	ND	0.5	mg/kg
Nickel, Ni	EPA 200.7	ND	0.003	mg/L	ND	0.1	mg/kg
Selenium, Se	EPA 200.7	ND	0.003	mg/L	ND	2	mg/kg
Silver, Ag	EPA 200.7	ND	0.001	mg/L	ND	0.05	mg/kg
Zinc, Zn	EPA 200.7	0.449	0.001	mg/L	22.9	0.05	mg/kg
Ammonia Nitrogen	EPA 350.2	49	—	mg/L	0.25%	—	%
Nitrate Nitrogen	SM4500NO_3	170.5	—	mg/L	0.87%	—	%
Total Kjeldahl Nitrogen	EPA 351.3	227	—	mg/L	1.16%	—	%
Total Phosphorus	EPA 365.3	1339	—	mg/L	6.83%	—	%
Potassium	EPA 200.7	2.96	—	mg/L	0.0151%	—	%
Total Solids	EPA 160.3	—	—	% Solids	1.96%	—	% Solids
Volatile Solids	EPA 160.4	—	—	% VS	70.8%	—	% VS
Cyanide	SM4500CN-C/E	ND	0.02	mg/L	ND @ 0.001%	—	%

Release Data Authorization
Analytical Chemist

Reviewed and Approved

ND = None Detected at PQL

Methods = 40CFR- Part 136.3

PQL = Practical Quantitation Limit

NEILSON RESEARCH CORPORATION

Analysis Report

City of Bandon
P.O. Box 67
Bandon, OR 97411
Client Sample ID: **Digester #3**
Sample Location:
Project: **WWTP**

Lab Order: **0004365**
NRC Sample ID **0004365-01A**
Collection Date: **4/18/00 8:45:00 AM**
Received Date: **4/19/00 1:45:38 PM**
Reported Date: **5/9/00 2:52:59 PM**
Matrix: **Aqueous**

ANALYTICAL RESULTS

Analyte	Result	Reporting Limit	Qual	Units	Dilution Factor	Date Analyzed
Ammonia Nitrogen as N by SM 4500-NH3 E						*Analyst: JKT*
Nitrogen, Ammonia (As N)	0.560	0.00685		% Wt-Dry	1	5/2/00
Cyanide, Total by SM 4500CN-CE						*Analyst: JKT*
Cyanide	ND	13.7		mg/Kg-dry	10	5/3/00
Trace Metals by EPA 245.1						*Analyst: WCB*
Mercury	2.38	0.274		mg/Kg-dry	1	4/27/00
Trace Metals by EPA 200.7						*Analyst: WCB*
Arsenic	0.390	0.137		mg/Kg-dry	1	4/26/00
Cadmium	3.76	0.0342		mg/Kg-dry	1	4/26/00
Chromium	26.5	0.0342		mg/Kg-dry	1	4/26/00
Copper	401	0.0342		mg/Kg-dry	1	4/26/00
Lead	35.3	0.0685		mg/Kg-dry	1	4/26/00
Molybdenum	4.07	0.342		mg/Kg-dry	1	4/26/00
Nickel	21.7	0.0685		mg/Kg-dry	1	4/26/00
Potassium	8430	1.37		mg/Kg-dry	1	4/26/00
Selenium	5.27	0.685		mg/Kg-dry	1	4/26/00
Silver	4.24	0.0342		mg/Kg-dry	1	4/26/00
Zinc	ND	0.0685		mg/Kg-dry	1	4/26/00
Nitrate Nitrogen by EPA 300.0						*Analyst: JKT*
Nitrate Nitrogen	ND	0.00342		% Wt-Dry	5	5/2/00
Total Phosphorus as P by SM 4500-P E						*Analyst: JKT*
Phosphorus, Total (As P)	3.40	0.0875		% Wt-dry	25	5/5/00
% Total Solids by EPA 160.3						*Analyst: JKT*
Total Solids	1.46	1		%	1	4/26/00
% Volatile Solids by EPA 160.4						*Analyst: JKT*
Total Volatile Solids	63.5	1		%	1	4/26/00
Total Kjeldahl Nitrogen by SM 4500-NH3 E						*Analyst: JKT*
Nitrogen, Kjeldahl, Total	3.32	0.00685		% Wt-Dry	1	5/2/00

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
B - Analyte detected in the associated Method Blank
* - Value exceeds Maximum Contaminant Level
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range

Analytical Consulting Laboratory
245 S. GRAPE ST. ∆ MEDFORD, OR 97501-3123 ∆ (541) 770-5678 ∆ FAX (541) 770-2901

NEILSON RESEARCH CORPORATION

Analysis Report

City of Bandon
P.O. Box 67 80 Fillmore
Bandon, OR 97411
Client Sample ID: **Digester #3**
Sample Location: #3
Project: **WWTP/Dig #3**

Lab Order: **0104488**
NRC Sample ID **0104488-01A**
Collection Date: **4/24/01 11:00:00 AM**
Received Date: **4/25/01 11:20:27 AM**
Reported Date: **5/7/01 3:35:49 PM**
Matrix: **Sludge**

ANALYTICAL RESULTS

Analyte	Result	PQL	Qual	Units	Dilution Factor	Date Analyzed
Ammonia Nitrogen as N by SM 4500-NH3 E						*Analyst: JKT*
Nitrogen, Ammonia (As N)	**0.216**	0.0966		% Wt-Dry	20	4/30/01
Cyanide, Total by SM 4500CN-CE						*Analyst: JKT*
Cyanide	**ND**	0.966		mg/Kg-dry	1	4/27/01
Trace Metals by EPA 245.1						*Analyst: WCB*
Mercury	**2.42**	0.0145		mg/Kg-dry	1	4/27/01
Trace Metals by EPA 200.7						*Analyst: WCB*
Arsenic	**ND**	0.483		mg/Kg-dry	1	5/2/01
Cadmium	**2.50**	0.0242		mg/Kg-dry	1	5/2/01
Chromium	**29.6**	0.0966		mg/Kg-dry	1	5/2/01
Copper	**372**	0.773		mg/Kg-dry	1	5/2/01
Lead	**35.3**	0.483		mg/Kg-dry	1	5/2/01
Molybdenum	**4.06**	0.145		mg/Kg-dry	1	5/2/01
Nickel	**22.6**	0.773		mg/Kg-dry	1	5/2/01
Potassium	**7660**	15.5		mg/Kg-dry	10	5/4/01
Selenium	**3.07**	1.55		mg/Kg-dry	1	5/2/01
Silver	**38.3**	0.0483		mg/Kg-dry	1	5/2/01
Zinc	**1340**	0.145		mg/Kg-dry	1	5/2/01
Nitrate Nitrogen by SM 4500-NO3-E						*Analyst: JKT*
Nitrate Nitrogen	**0.156**	0.0121		% Wt-Dry	50	4/25/01
Total Phosphorus as P by SM 4500-P E						*Analyst: JKT*
Phosphorus, Total (As P)	**3.20**	0.0875		% Wt-Dry	25	4/30/01
% Total Solids by SM 2540B						*Analyst: JKT*
Total Solids	**2.07**	1		%	1	4/25/01
% Volatile Solids by SM 2540G						*Analyst: JKT*
Total Volatile Solids	**69.6**	1		%	1	4/25/01
Total Kjeldahl Nitrogen by SM 4500-NH3 E						*Analyst: JKT*
Nitrogen, Kjeldahl, Total	**3.58**	0.0966		% Wt-Dry	20	4/30/01

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
B - Analyte detected in the associated Method Blank
* - Value exceeds Maximum Contaminant Level
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range

Environmental Testing Laboratory
245 S. GRAPE ST. ▲ MEDFORD, OR 97501-3123 ▲ (541) 770-5678 ▲ FAX (541) 770-2901

NEILSON RESEARCH CORPORATION

Analysis Report

City of Bandon
P.O. Box 67 80 Fillmore
Bandon, OR 97411
Client Sample ID: **Digester #3**
Sample Location: **Digester #3**
Project: **WWTP/Dig #3**

Lab Order: **0109477**
NRC Sample ID **0109477-01A**
Collection Date: **9/25/01 11:35:00 AM**
Received Date: **9/26/01 11:17:32 AM**
Reported Date: **10/11/01 3:08:36 PM**
Matrix: **Sludge**

ANALYTICAL RESULTS

Analyte	Result	PQL	Qual	Units	Dilution Factor	Date Analyzed
Ammonia Nitrogen as N by SM 4500-NH3 E						*Analyst: JKT*
Nitrogen, Ammonia (As N)	1.30	0.152		% Wt-Dry	20	10/8/01
Cyanide, Total by SM 4500CN-CE						*Analyst: JKT*
Cyanide	ND	15.2		mg/Kg-dry	1	10/3/01
Fecal Coliform Bacteria by SM 9221E						*Analyst: DLC*
Fecal Coliform Bacteria	378789	2		org/gmTS	1	9/28/01
Fecal Coliform Bacteria	526870	2		org/gmVS	1	9/28/01
Trace Metals by EPA 245.1						*Analyst: WCB*
Mercury	10.8	0.0227		mg/Kg-dry	1	10/5/01
Trace Metals by EPA 200.7						*Analyst: WCB*
Arsenic	ND	0.758		mg/Kg-dry	1	10/9/01
Cadmium	2.55	0.0379		mg/Kg-dry	1	10/9/01
Chromium	15.1	0.152		mg/Kg-dry	1	10/9/01
Copper	222	1.21		mg/Kg-dry	1	10/9/01
Lead	58.0	0.758		mg/Kg-dry	1	10/9/01
Molybdenum	4.45	0.227		mg/Kg-dry	1	10/9/01
Nickel	28.5	1.21		mg/Kg-dry	1	10/9/01
Potassium	1.21%	24.2		% Dry Wt.	10	10/9/01
Selenium	8.30	2.42		mg/Kg-dry	1	10/9/01
Silver	26.9	0.0758		mg/Kg-dry	1	10/9/01
Zinc	1070	0.227		mg/Kg-dry	1	10/9/01
Nitrate Nitrogen by SM 4500-NO3-E						*Analyst: JKT*
Nitrate Nitrogen	0.0173	0.00947		% Wt-Dry	25	10/8/01
Total Phosphorus as P by SM 4500-P E						*Analyst: JKT*
Phosphorus, Total (As P)	3.81	0.425		% Wt-Dry	25	10/5/01
% Total Solids by SM 2540B						*Analyst: JKT*
Total Solids	1.32	1		%	1	9/28/01
% Volatile Solids by SM 2540G						*Analyst: JKT*
Total Volatile Solids	71.9	1		%	1	9/28/01
Total Kjeldahl Nitrogen by SM 4500-NH3 E						*Analyst: JKT*

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
B - Analyte detected in the associated Method Blank
* - Value exceeds Maximum Contaminant Level
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range

NEILSON RESEARCH CORPORATION

Analysis Report

City of Bandon
P.O. Box 67 80 Fillmore
Bandon, OR 97411
Client Sample ID: **Digester #3**
Sample Location: **Digester #3**
Project: **WWTP/Dig #3**

Lab Order: **0109477**
NRC Sample ID **0109477-01A**
Collection Date: **9/25/01 11:35:00 AM**
Received Date: **9/26/01 11:17:32 AM**
Reported Date: **10/11/01 3:08:36 PM**
Matrix: **Sludge**

ANALYTICAL RESULTS

Analyte	Result	PQL	Qual	Units	Dilution Factor	Date Analyzed
Nitrogen, Kjeldahl, Total	5.77	0.152		% Wt-Dry	20	10/8/01

Qualifiers:

ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
B - Analyte detected in the associated Method Blank
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E - Value above quantitation range

Environmental Testing Laboratory
245 S. GRAPE ST. • MEDFORD, OR 97501-3123 • (541) 770-5678 • FAX (541) 770-2901

NEILSON RESEARCH CORPORATION

Analysis Report

ity of Bandon
P.O. Box 67
andon, OR 97411

Client Sample ID: **Nelson Ranch #1**
Sample Location: **Nelson Ranch #1**
roject: **Nelson Ranch Site #1**

Lab Order: **0010512**
NRC Sample ID **0010512-01A**
Collection Date: **10/24/00 9:00:00 AM**
Received Date: **10/25/00 9:06:18 AM**
Reported Date: **11/2/00 4:51:34 PM**
Matrix: **Solid**

ANALYTICAL RESULTS

Analyte	Result	PQL	Qual	Units	Dilution Factor	Date Analyzed
litrite Nitrogen by SM 4500-NO2-B						*Analyst: JKT*
Nitrite Nitrogen	ND	0.05		mg/Kg	5	10/26/00
Nitrate Nitrogen by SM 4500-NO3-E						*Analyst: JKT*
Nitrate Nitrogen	ND	1.25		mg/Kg	25	10/27/00

Qualifiers:

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E - Value above quantitation range

NEILSON RESEARCH CORPORATION

Analysis Report

City of Bandon
P.O. Box 67
Bandon, OR 97411
Client Sample ID: Dew Valley
Sample Location: Dew Valley
Project: Dew Valley

Lab Order: 0010416
NRC Sample ID 0010416-01A
Collection Date: 10/14/00 11:00:00 AM
Received Date: 10/19/00 12:20:00 PM
Reported Date: 11/9/00 11:47:04 AM
Matrix: Solid

ANALYTICAL RESULTS

Analyte	Result	PQL	Qual	Units	Dilution Factor	Date Analyzed
Ammonia Nitrogen as N by SM 4500-NH3 E						*Analyst: JKT*
Nitrogen, Ammonia (As N)	ND	500		mg/Kg	1	11/2/00
Trace Metals by EPA 6010B						*Analyst: WCB*
Arsenic	ND	0.497		mg/Kg	1	11/1/00
Cadmium	ND	0.0497		mg/Kg	1	11/1/00
Chromium	21.3	0.497		mg/Kg	1	11/1/00
Copper	3.82	0.497		mg/Kg	1	11/1/00
Lead	4.98	0.497		mg/Kg	1	11/1/00
Molybdenum	ND	0.993		mg/Kg	1	11/1/00
Nickel	5.26	0.497		mg/Kg	1	11/1/00
Selenium	ND	0.993		mg/Kg	1	11/1/00
Silver	ND	0.0993		mg/Kg	1	11/1/00
Zinc	9.80	0.0993		mg/Kg	1	11/1/00
Nitrite Nitrogen by SM 4500-NO2-B						*Analyst: JKT*
Nitrite Nitrogen	ND	0.05		mg/Kg	5	10/19/00
pH in Soil by EPA 9045C						*Analyst: JJS*
pH	5.30	0.1		pH Units	1	10/31/00
Total Phosphorus as P by SM 4500-P E						*Analyst: JKT*
Phosphorus, Total (As P)	ND	1		mg/Kg	1	10/31/00
Total Kjeldahl Nitrogen by SM 4500-NH3 E						*Analyst: JKT*
Nitrogen Kjeldahl Total	ND	500		mg/Kg	1	11/2/00
Total Organic Carbon by EPA415.1						*Analyst: SUB*
Organic Carbon, Total	21400	100		mg/kg	1	11/6/00

Qualifiers:

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