FSL option. In addition, the FSL is ranked highest in several other categories, and has no ranking lower than second. If sludge hauling distance were greater than 60 miles, dewatering would be more economical than an FSL and could be recommended. However, based on initial investigations, it appears that obtaining suitable land much closer to Florence is realistic. Therefore, the recommended option is an FSL.

Selecting the recommended option does not preclude the city from pursuing an additional option such as composting for producing Class A biosolids. A pilot composting operation could be set up at the FSL site. The operation could be expanded or eliminated depending on the results of the pilot study. The FSL would provide sufficient storage to allow the city to defer the purchase of additional land for sludge application for about 2 years. This would give the city time to evaluate the success of the Class A biosolids program before additional land were purchased for sludge application.

Table 8-8. Summary of Solids Handling Option Rankings

	Alternative ranking			
Criteria	**ATAD**	**Dewatering**	**Composting**	**FSL**
Environmental impact	2	1	1	2
Ease of implementation	3	2	2	1
Reliability	3	1	2	1
Flexibility	3	2	1	1
Aesthetics	3	1	2	2
Economics	3	2	4	1

CHAPTER 9

RECOMMENDED PLAN

Based on the evaluation in Chapter 8, activated sludge was selected as the recommended plan for liquid stream treatment. Anaerobic digestion with facultative sludge lagoon storage of digested sludge was recommended for solids handling. In this chapter, the recommended improvements for the entire wastewater system are summarized and the total costs are presented.

PLANT SCHEMATIC

A schematic diagram of the recommended plan is presented in Figure 9-1. All the major processes include parallel units, which provide redundancy. The flow lines show that digested sludge can be transported directly off-site or it can be thickened prior to removal. It can also be applied directly on land or hauled to the facultative sludge lagoon (FSL) for storage and further stabilization.

SITE PLAN

A proposed site plan for the recommended activated sludge plant is shown in Figure 9-2. An artist's rendition of an oblique aerial view of the site follows in Figure 9-3.

On Figure 9-2, potential future units are shown only to indicate the flexibility in expansion. Whether primary clarifiers, a trickling filter, more aeration basins, or some combination are added will be decided in the future, depending upon factors such as regulatory requirements, economics, and operator preference.

Layout details will be revised and further refined during the design phase, but the locations of the major unit processes are generally fixed. The headworks and aeration basins must be constructed away from the existing unit processes to allow the existing plant to continue to operate during construction. Once those units are completed, the secondary clarifiers can be constructed in the location of the existing aeration pond.

A layout for the FSL site has not yet been developed because it is dependent on the size, shape, and topography of the land. It is important that a suitable site be obtained as soon as possible to allow the design process to start. An artist's rendition of a typical FSL site is shown in Figure 9-4.

DESIGN DATA

The design data for the recommended plan are presented in Table 9-1. The values are those projected for the design year 2020. Proposed future units are not included.

Table 9-1. Design Data For Activated Sludge Plant

Item	Value
Plant flow	
ADWF, million gallons per day (mgd)	1.9
Peak month, mgd	3.6
Peak day, mgd	5.1
PWWF, mgd	6.9
Plant load	
BOD average, ppd	5,300
BOD max month, ppd	7,000
SS average, ppd	3,800
SS max month, ppd	4,800
Influent Pumps	
Type: Self-priming[a]	
Number	3
Capacity each, mgd[b]	1.5
Screen	
Type: Fine-mesh in-channel	
Number	2
Opening size, inches	0.25
Capacity each, mgd	5.3
Emergency bypass bar rack	
Number	1
Opening size, inches	1
Capacity, mgd	6.9
Grit Removal	
Grit chamber: Induced vortex	
Number	2
Diameter, ft	10
Capacity each, mgd	7.0
Grit pump: Recessed impeller	
Grit separation: Cyclone	
Grit dewatering: Auger	
Aeration	
Basins	
Number	2
Width, ft	30
Water depth, ft	15
Length, ft	165

Item	Value
Volume each, 1,000 gallons	555
Operating modes available:	
Plug flow, step feed,	
contact stabilization	
Anaerobic selector	
Process performance[c]	
MLSS, mg/L	2,400
F/M, lb BOD/lb MLVSS/day	0.34
Sludge age, days	4.2
HRT, hours	7.3
Blowers	
Type: Multistage centrifugal[a]	
Number	4
Capacity each, scfm	2,000
Secondary clarifiers	
Type: Flocculator, peripheral weir	
Number	2
Diameter, ft	66
Sidewater depth, ft	17
SOR at peak day, gpd/sq ft	745
SOR at PWWF, gpd/sq ft	1,000
RAS pumping (per clarifier)	
Number of pumps	2
Capacity each, gpm	600
Disinfection	
Type: Closed vessel, medium pressure[a]	
Number of trains	3
Capacity each, mgd	2.3
Lamps per train	8
Outfall	
Length	700
Diameter, inches	24
Diffuser length, ft	200
Number of diffuser ports	50
Sludge thickener (existing)	
Type: Gravity belt	
Number	1
Belt width, m	1
Capacity, lb/hr	800

Item	Value
Thickened sludge tank	
Number	1
Diameter, ft	16
Volume, gallons	22,000
Height, ft	15
Anaerobic digesters	
Type: Mesophilic, fixed submerged cover	
Number	2
Diameter, ft (exist/new)	30/36
Sidewater depth, ft (exist/new)	14/24
Volume, cubic ft (exist/new)	12,070/28,400
SRT at peak month, days	28
Digested sludge holding tank	
Number	1
Diameter, ft	19
Height, ft	15
Volume, gallons	33,000
Odor control biofilter	
Area, sq ft	3,000
Depth, ft	3
Loading rate, cfm/sq ft	2
Air flow rate, cfm	6,000
Facultative sludge lagoon	
Number	1
Area, acres	1.9
Depth, ft	12
Loading, lbVSS/1,000 ft[b]/day	20

Notes: [a] Equipment type selection is preliminary for cost estimating purposes. Selection may change during predesign.

[b] Influent pump station receives flow from new interceptor only. All other flow is pumped to plant from collection system pump stations.

[c] At maximum month conditions.

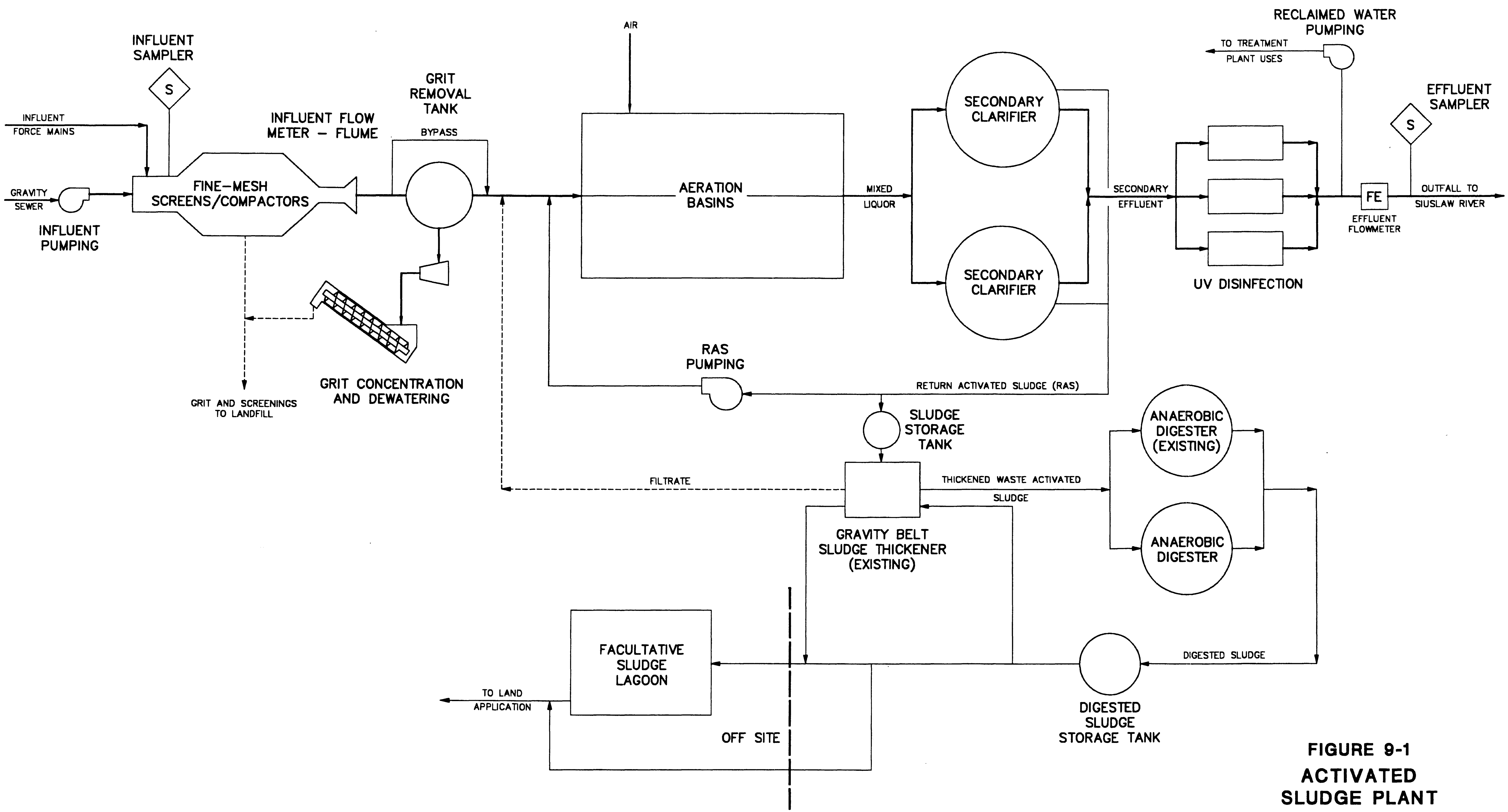

FIGURE 9-1

ACTIVATED SLUDGE PLANT

PLANT SCHEMATIC

NOT TO SCALE

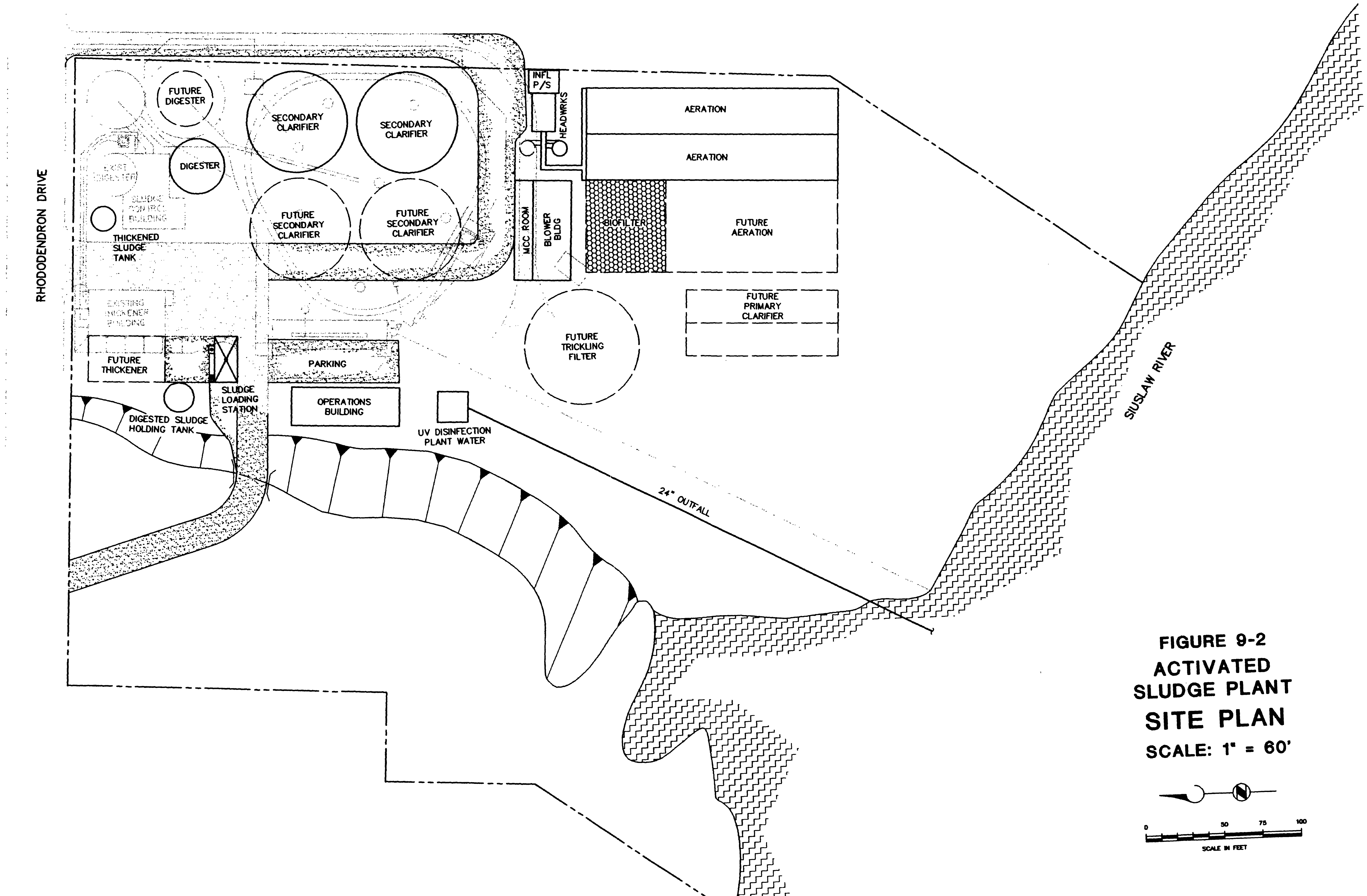

FIGURE 9-2
ACTIVATED SLUDGE PLANT
SITE PLAN
SCALE: 1" = 60'

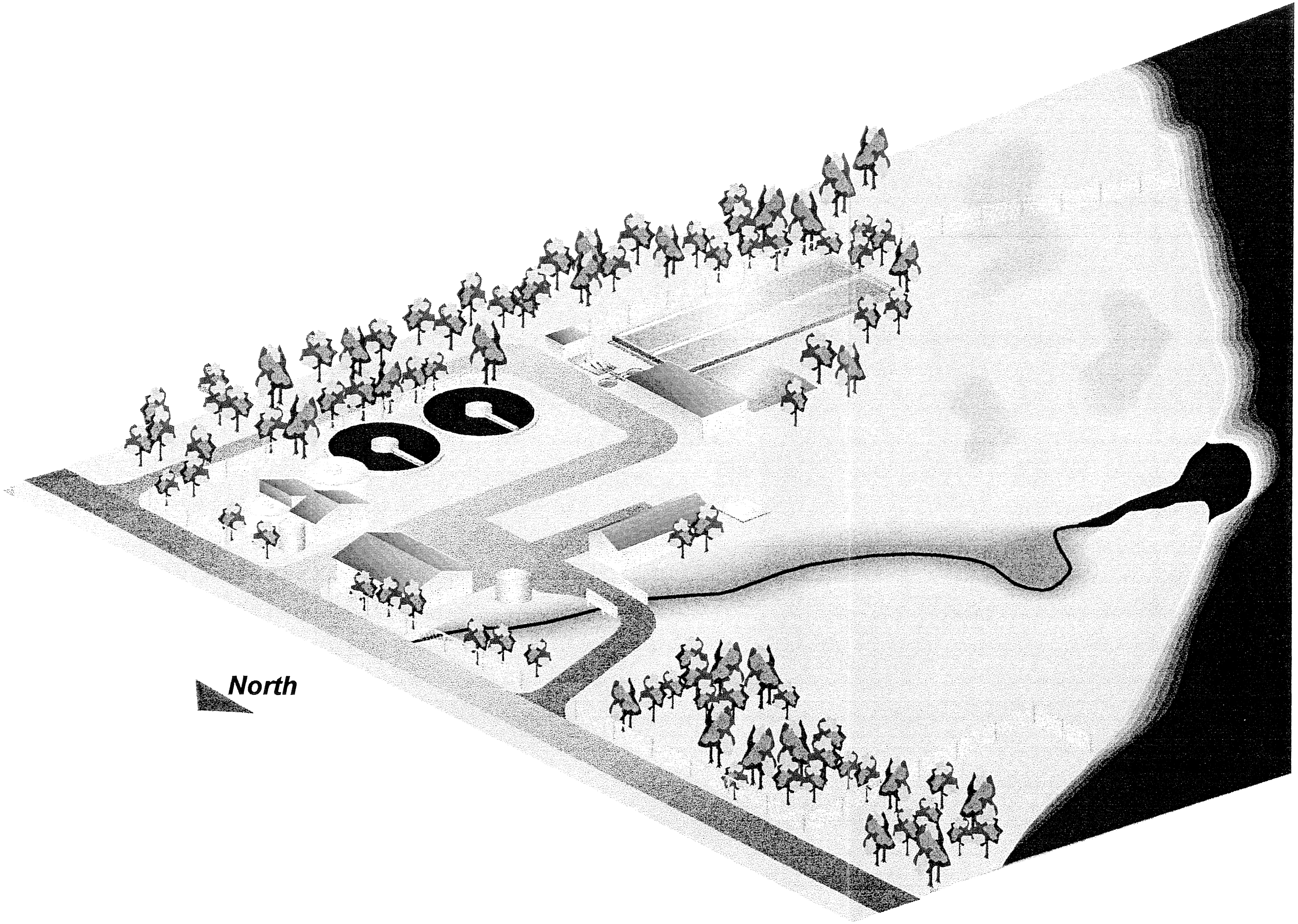

FIGURE 9-3
ARTIST'S RENDITION OF RECOMMENDED PLAN

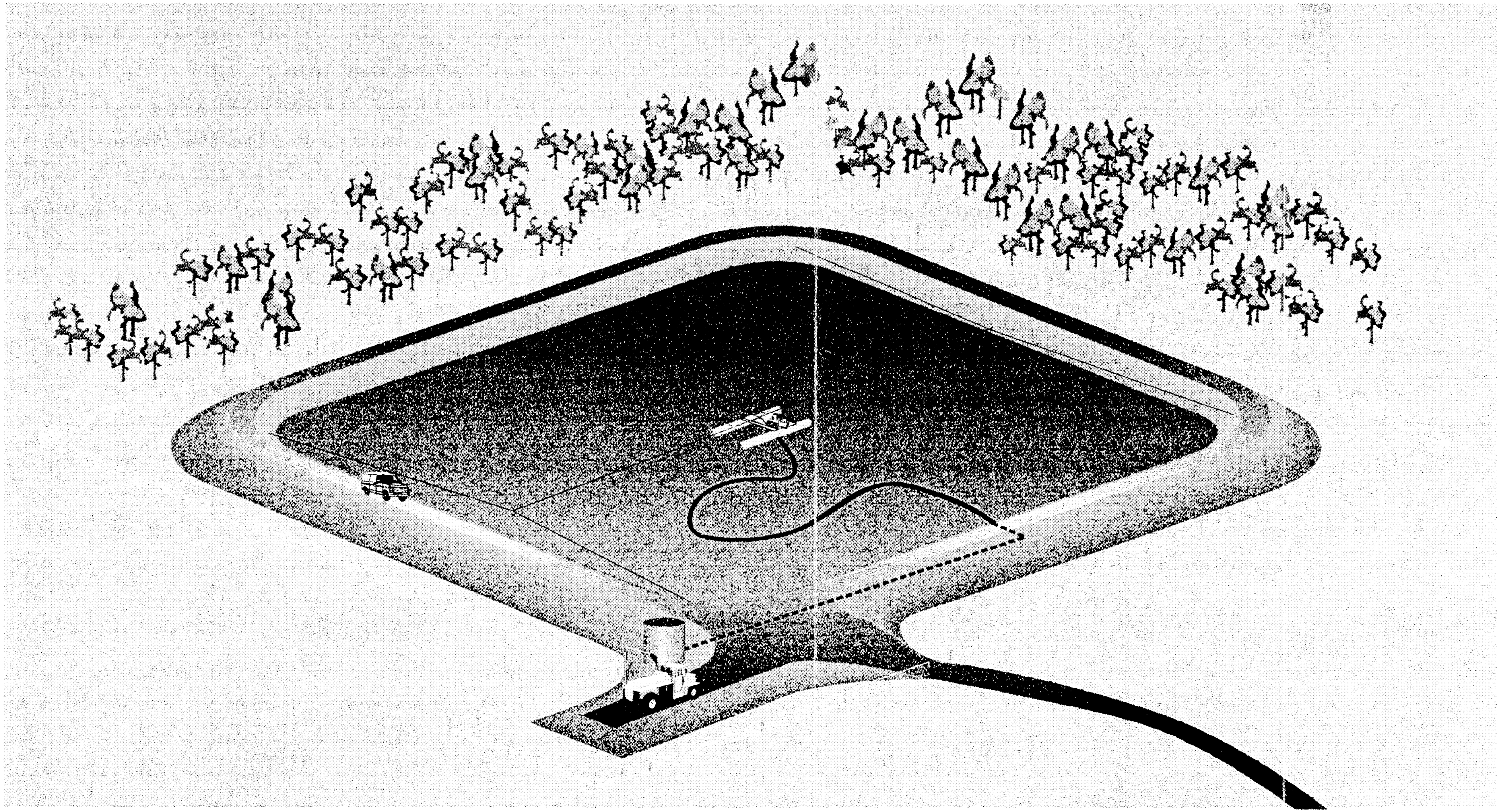

FIGURE 9-4
ARTIST'S RENDITION OF
TYPICAL FSL SITE

CAPITAL COST

Table 9-2 below summarizes the total project costs for the liquid stream treatment and solids handling portions of the project, as well as the collection system improvements. Costs for the collection system improvements, developed in Chapter 3, are also summarized here.

Table 9-2. Estimated Capital Costs for Recommended Plan

Item	Costs, $1,000
Liquid stream treatment	
Contractor indirects	469
Influent pumping	368
Yard development	384
Headworks	773
Odor control	237
Aeration basins	866
Blower building	628
Secondary clarifiers	1,381
Yard piping	341
Electrical/instrumentation	1,680
Disinfection	692
Outfall	558
Operations building	287
Subtotal, treatment plant	8,664
Solids Handling	
Anaerobic digestion	1,483
Tank truck	100
FSL	460
Dredge	50
Access road	100
Supernatant irrigation system	50
Subtotal, solids handling	2,243
Collection system	
Gravity interceptor	1,497
Force mains	493
Pump stations	150
Subtotal, collection system	2,140
Subtotal, total project	13,047
Bond at 1 percent	130
Contingency at 15 percent	1,957
Subtotal	15,135
Engineering, admin. at 20 percent	3,027
Subtotal	18,161
Land	450
Total project cost	18,611

PHASING OPPORTUNITIES

Phasing the construction could allow some costs to be deferred to the future. Because phasing incurs costs associated with multiple design and construction contracts, additional mobilization, and loss of economy of scale, an item should be deferred about 10 years to make phasing worthwhile. An exception would be individual pieces of mechanical equipment such as a blower or pump; these items would be worth deferring even a few years.

Components of this project that may have phasing potential are discussed briefly below.

- Collection system. The upper portions of the new interceptor, including the pump stations and force mains will not be necessary until those areas are developed. At this time, only the lower portion, which provides relief to the Ivy Street pump station, is necessary.
- Influent pumping. It may be possible to provide two pumps now and add the third later.
- Aeration. Four blowers will not be necessary for several years. Two or three would be sufficient at first. Likewise, some of the diffusers can be installed in the future. Although the aeration basins will have excess capacity at first, it is unlikely that phasing the construction of the basins would be worthwhile. Adding on to the basins is a major project with significant mobilization costs and potential disruption to plant operation.
- Disinfection. Although the entire structure would be built initially, some of the actual UV modules could be installed later.

COLLECTION SYSTEM IMPROVEMENTS

The flow modeling of the collection system presented in Chapter 3 shows that large sections of the existing system are inadequate to handle the expected future flows. In addition, new development in the northern part of the Urban Growth Boundary will require a major expansion of the collection system in that area. Adding a major interceptor from the northern end of the system to the treatment plant could alleviate the capacity problems within the system and handle the increased flows from newer developments to the north. The proposed interceptor was evaluated using the computer model.

NEW INTERCEPTOR

The route of the interceptor was selected in conjunction with city staff to take advantage of publicly-owned and undeveloped land. Topography was also considered in order to maintain a reasonable slope while minimizing excavation requirements. Modeling was based on the flows the interceptor would need to carry under two conditions:

- Carrying the flow from the newly developed basins in the north.
- Carrying the flow from the new basins in the north plus flow diverted from the eastern portion of the existing system to relieve the overload there. The diversion is located at Oak and 31st Streets.

The design parameters for the proposed interceptor were developed through an iterative modeling process. The detailed parameters for each section of the interceptor are summarized in Appendix A. The length of the interceptor is approximately 5.5 miles. Topography requires that the upper third of the interceptor (Node 6045 to Node 6040) utilize pump stations and pressure mains. These components can be seen on the map of the collection system model in Appendix A. The middle portion of the interceptor (Node 6040 to Node 6060) would consist of an 18-inch gravity main. The remainder of the interceptor (Node 6060 to Node 6085) would consist of a 24-inch gravity main. The capacity of the proposed interceptor and the calculated flows for the maximum flows under buildout conditions are shown in Figure 9-5. Flows are shown with and without the 31st Street diversion. In either case, the interceptor is more than adequate to handle the flows. The figure shows a dramatic increase in capacity downstream of node 6075. This is a result of the steep slope in this area.

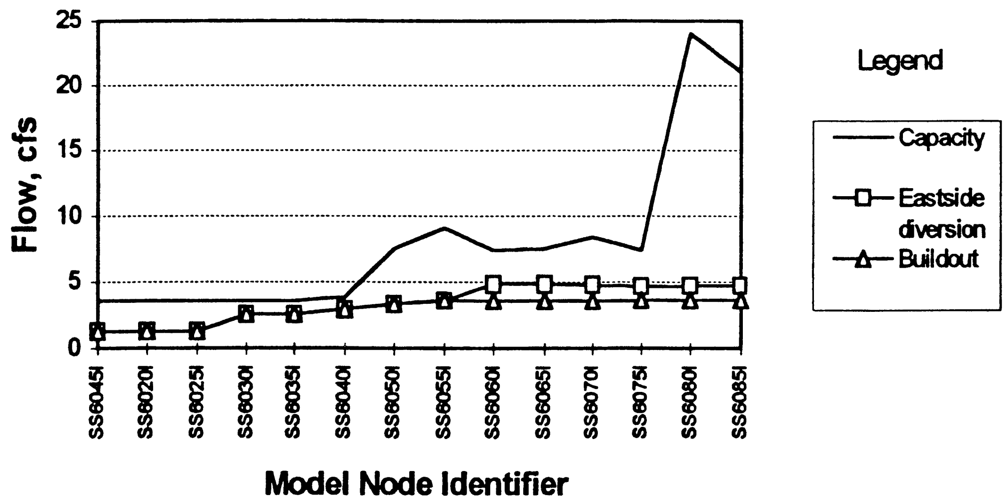

Figure 9-5. Capacity and Flows Through Proposed Interceptor

Although an 18-inch interceptor may be adequate to handle the projected flows, a 24-inch pipeline is recommended in the lower section to ensure that the interceptor does not become overloaded in the future. Because the life span of plastic sewer pipe can be as much as 100 years, the interceptor will continue to be in service far beyond the 20-year planning period. Consequently, it is recommended that the pipe be sized for the maximum flow should growth continue at the current rate over the long term. This will avoid the expensive and disruptive process of sewer replacement in city streets 20 or 30 years from now. The additional cost of providing 24-inch pipe instead of 18-inch pipe is much less than the cost of constructing a new sewer. The cost differential is conservatively estimated at about 35 dollars per foot, for a total of about $400,000.

PUMP STATIONS FOR NEW INTERCEPTOR

As discussed previously, the topography in the area of the upper portion of the interceptor makes construction of a gravity sewer impractical. Consequently, two pump stations are required in this area. These would probably be duplex self-priming stations similar to most of the others in the collection system. The capacity of each station would be about 1.3 cubic feet per second (cfs), or 0.84 mgd.

Because the interceptor would enter the treatment plant as a gravity sewer, a lift station would be required to pump the wastewater up into the headworks. As shown on Figure 9-5, the maximum flow entering the pump station would be about 4.7 cfs, or 3 mgd. The pump station would have three variable-speed pumps. The capacity would be 3 mgd with one pump out of service. It is estimated that the sewer would be about 10 feet deep at the plant, allowing the use of self-priming pumps. If, during detailed design, it is found that substantially greater depth is required, self-priming pumps may not be practical. In this case, submersible or vertical turbine solids handling pumps could be used.

COSTS

There are several components in the proposed interceptor project. These include gravity sewers, pressure mains, and pump stations. Budgetary unit costs for these components are presented in Table 9-3.

Table 9-3. Estimated Unit Costs for Interceptor Components

Item	Unit cost
Duplex package pump station at upper end	$100,000
Pressure main under pavement	$55/LF
18-inch sewer, no pavement	$50/LF
24-inch sewer, no pavement	$85/LF
24-inch sewer under pavement	$100/LF

Based on these unit costs, the entire interceptor project is estimated to cost approximately $3 million, including construction contingency and costs for engineering and contract administration. These costs do not include the influent pump station at the treatment plant; it is included in the estimate for the treatment plant improvements.

SCHEDULE

The improvements described above represent the ultimate facility required under buildout conditions. However, the pump stations and piping in the northern portion of the UGB will not be necessary until development takes place in that area and it is decided to provide wastewater service to the area. As discussed in Chapter 3, the collection system is not currently overloaded, with the exception of the Ivy Street pump station. Additional modeling should be performed based on expected scenarios of near-term development to determine when various portions of the interceptor will be necessary. Because of the overloaded condition of the Ivy Street pump station, a small portion of the interceptor should be constructed as soon as possible to relieve flows to that pump station. Details of this portion of the project are discussed below.

INTERIM PROJECT

Because the Ivy Street pump station is overloaded, resulting in bypassing of wastewater during wintertime high flows, an interim project has been identified to eliminate further bypasses as soon as possible. This project could be completed on a faster schedule than the overall facility improvements, targeting completion before high flows are experienced in the winter of 1998.

The interim improvements would include a temporary pump station and pressure sewer at 8th Street to divert flow from the Ivy Street pump station. A section of the proposed interceptor would be constructed from the pressure sewer discharge on 8th Street to the treatment plant, a distance of about 1200 feet. Additionally, the influent pump station at the treatment plant would be constructed. The only portions of these improvements that would not be retained in the long-term improvements are the 8th Street pump station and pressure sewer. However, the pump station could be relocated to be used elsewhere in the collection system. The cost of these collection system improvements (excluding the influent pump station) is estimated to be about $250,000. As shown in Table 9-2, the cost of the influent pump station is estimated at about $370,000 plus contingency, administration, and engineering costs.

APPENDIX A

COLLECTION SYSTEM MODEL SUMMARY

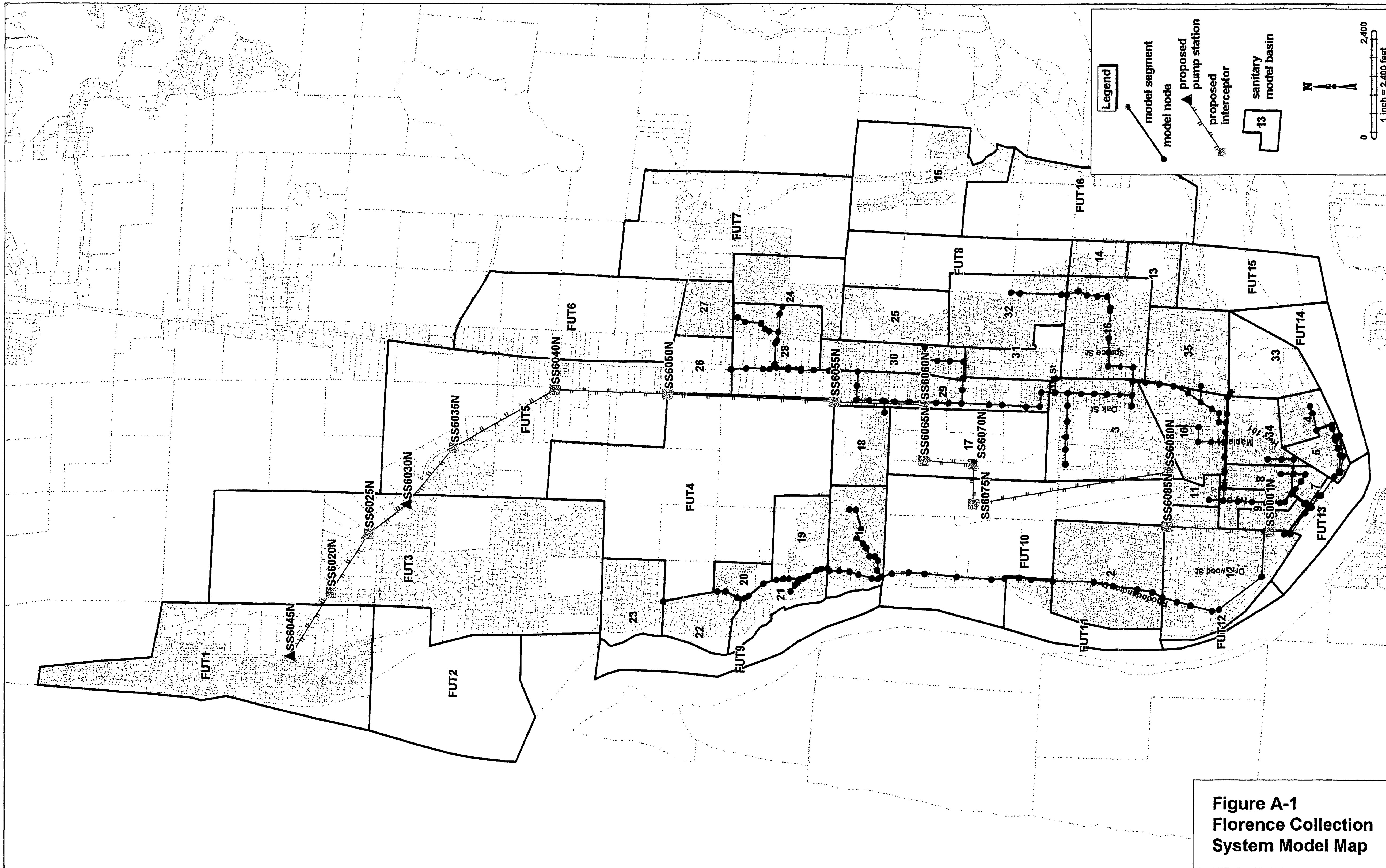

Figure A-1
Florence Collection System Model Map

BEFORE THE ENVIRONMENTAL QUALITY COMMISSION

OF THE STATE OF OREGON

IN THE MATTER OF: CITY OF FLORENCE Permittee,	))))))	MUTUAL AGREEMENT AND ORDER No. WQMW-WR-96-056 LANE COUNTY

WHEREAS:

1. On July 14, 1992, the Department of Environmental Quality (Department or DEQ) issued a National Pollutant Discharge Elimination System (NPDES) Permit Number 100934 (Permit) to the City of Florence (Permittee). The Permit authorizes the Permittee to construct, install, modify or operate wastewater collection, treatment, control and disposal facilities and discharge adequately treated wastewater into the Siuslaw River, waters of the state, in conformance with the requirements, limitations and conditions set forth in the Permit. The Permit expires on July 31, 1997.

2. Condition 1 of Schedule A of the Permit specifies certain wastewater discharge limits for the Permittees facilities. During the time period the Permit has been in effect, the Permittee has not consistently met these discharge limits and probably cannot meet them in the future if the treatment facilities and collection system remain unchanged.

3. On January 2, 1996, the Department issued a Notice of Noncompliance (NON) notifying the Permittee of violations of the Permit. The following violation was cited:

a. Exceeding concentration and mass load limits for Total Suspended Solids (TSS) and the fecal coliform limit. This occurred during a period of heavy rainfall which resulted in sewage bypassing treatment and raw sewage overflows from the Ivy Street pump station. Violations were documented on December 10, 29 and 30, 1995, and from February 6 - 29, 1996.

4. The Permittee's wastewater treatment facility (WWTF) has an average dry weather design flow of 0.75 million gallons per day (MGD). During periods of precipitation, the wastewater collection system receives large amounts of inflow and infiltration (I/I), mostly in the form of infiltration. During these events, flows to the WWTF are typically above 0.9 MGD and have reached

over 1.5 MGD with instantaneous peak flows of 2.5 MGD. These excessive flows result in raw sewage overflows from the Ivy Street pump station, washout of solids from the clarifier, and insufficient detention time of wastewater in the chlorine contact chamber.

5. The WWTF has reached and/or exceeded its hydraulic capacity resulting in the circumstances described in Paragraph 4. The City of Florence is experiencing rapid growth, and any additional connections will increase the hydraulic loading to the WWTF and will likely result in additional violations of the Permit limits and water quality standards in the receiving stream.

6. The Permittee has in the past requested permission to land apply biosolids from the anaerobic digester during periods when runoff from the land application site may occur which is in violation of Permittee's approved sludge management plan required by OAR Chapter 340, Division 50. These requests are made as a result of insufficient storage capacity in the digester. This lack of capacity also causes process control problems with regard to insufficient wasting of solids from the clarifier. The current biosolids handling facilities do not provide enough residence time and are likely inadequate to meet the requirements of 40 CFR 503 and therefore, until an upgrade to the facilities is completed, the requirements may be violated.

7. In accordance with OAR 340-41-445, toxic substances shall not be introduced into waters of the state that exceed in-stream numerical standards or will adversely affect beneficial uses. The Permittee uses chlorine, which is a toxic substance, to disinfect wastewater. The chlorine standard may be exceeded outside the Permittee's mixing zone in the Siuslaw River. Prior to Department approval of any proposed treatment and disposal alternatives, the Permittee will be required to demonstrate that the proposed facilities will meet all discharge standards and will not violate in-stream water quality standards including the chlorine toxicity standard.

8. The Department and the Permittee recognize that until the sewerage facilities are upgraded and the Permittee completes the actions required in this MAO, the Permittee will continue, at times, to violate the effluent limitations of the Permit. The Permittee will also continue to bypass and/or overflow raw or partially treated sewage to the receiving stream.

9. The Permittee is presently capable of treating its effluent so as to meet the following interim effluent limitations unless influent flows are above the design flow of 0.75 MGD in which case sewage may bypass partial treatment and there may be overflows from the Ivy Street pump station:

Outfall Number 001

A. (1) Year Round

Parameter	Average Effluent Concentrations Monthly	Average Effluent Concentrations Weekly	Effluent Loadings Monthly Average lb/day	Effluent Loadings Weekly Average lb/day	Effluent Loadings Daily Maximum lbs
BOD_5	30	45	188	281	376
TSS	30	45	188	281	376

B. During those times when the daily flow exceeds 0.75 MGD, the daily maximum Biochemical Oxygen Demand (BOD) and TSS mass load limitations shall not apply. The WWTF shall be operated as effectively as possible during those times. Also, during those occurrences, the BOD/TSS concentration values obtained for that day will not be used in calculating the monthly average or weekly average effluent concentrations or BOD and TSS percent removal efficiency; and the daily maximum mass load value obtained for that day will not be used for calculating the monthly average or weekly average effluent mass loadings. The fecal coliform colonies per 100 milliliters (ml) results obtained for that day will not be used in calculating the monthly geometric mean or weekly geometric mean.

C. During those times when flows to the Ivy Street pump station exceed 1.0 MGD, overflows of raw sewage will be allowed from the pump station into the Siuslaw River in accordance with the Notification and Response Plan and requirements referred to in Paragraph 11.A(1) and 11.A(2).

10. The Department and Permittee further recognize that the Environmental Quality Commission has the power to impose a civil penalty and to issue an abatement order for violations of conditions of the Permit. Therefore, pursuant to ORS 183.415(5), the Department and Permittee wish to resolve the past and future violations referred to in Paragraphs 2 - 8 by this MAO. This MAO is not

intended to limit, in any way, the Department's right to proceed against Permittee in any forum for any past or future violations not expressly settled herein.

NOW THEREFORE, it is stipulated and agreed that:

11. The Environmental Quality Commission shall issue a final order:

A. Requiring Permittee to comply with the following schedule:

(1) By no later than 30 days after this MAO is signed, the City shall post a sign at the location of the Ivy Street pump station outfall informing the public that raw sewage overflows occasionally occur into the Siuslaw River at that point during the winter. The sign shall remain posted until the City achieves compliance with the Permit.

(2) By no later than 90 days after this MAO is signed, the Permittee shall submit to DEQ for approval a draft Notification and Response Plan describing procedures for notification of the Department and the public for overflows, bypasses and other plant malfunctions. Within 30 days of receiving DEQ comments on the draft, the Permittee shall submit the final Notification and Response Plan for approval. The Permittee shall implement the Plan upon approval. The Plan should include procedures for notifying the public during periods when untreated sewage is discharged. At a minimum, this shall include notifying local radio stations and the nearest newspaper with general circulation of the amount of days that raw sewage was bypassed each month and the gallonage on each day. It shall also contain provisions for posting of the Ivy Street Pump Station, and the overflow location on the Siuslaw River. Sample collection procedures upstream and downstream of the overflow point and sewage treatment plant shall be outlined.

(3) By no later than 3 (three) months after this MAO is signed, Permittee shall retain a consultant to prepare the proposed draft facilities plan report (FPR) for wastewater treatment plant upgrades.

(4) By no later than 9 (nine) months after retaining a consultant, Permittee shall submit a draft facilities plan (FPR) report for upgrading the existing WWTF. The FPR should include an evaluation of sewage collection, treatment and disposal system alternatives for complying with minimum federal secondary treatment standards; all appropriate surface water quality standards,

(as specified in OAR Chapter 340, Division 41, Table 20); DEQ minimum design criteria, (as specified in OAR 340-41-455 (1)(a)); groundwater quality protection regulations, (as specified in OAR 340-40-030); and applicable biosolids regulations listed in 40 CFR 503, and OAR Chapter 340, Division 50. The FPR shall include an evaluation of the mixing zone to demonstrate that all permit limits and water quality standards can be met at the existing outfall location. The evaluation of alternatives shall also include a cost-effective I/I analysis.

(5) By no later than 3 (three) months after the Department provides written comments on the draft FPR, the Permittee shall submit an approvable final FPR.

(6) By no later than 6 (six) months following Department approval of the FPR, Permittee shall submit a preliminary design report.

(7) By no later than 6 (six) months after Department approval of the preliminary design report, the Permittee shall submit for DEQ approval draft Plans and Specifications for upgrading/expanding the WWTF and/or completion of all cost-effective I/I work identified in the approved FPR.

(8) By no later than 3 (three) months after Department provides written comments on the plans and specifications, Permittee shall submit approvable engineering plans and specifications for construction of necessary improvements.

(9) By no later than 6 (six) months after approval of the plans and specifications, Permittee shall award construction contracts for completion of necessary improvements.

(10) By no later than 16 (sixteen) months following award of the construction contract, the Permittee shall complete the necessary upgrades/expansion to the WWTF and any required work on the collection system.

(11) By no later than 3 (three) months after completion of facility upgrades, the Permittee shall attain operational level to comply with all established Permit waste discharge limitations and all water quality standards.

B. Requiring Permittee to meet the interim effluent limitations set forth in Paragraph 9.A above until completion of necessary corrective actions as required by the schedule specified in

Paragraph 11.A. The WWTF shall be operated as effectively as practicable to minimize the discharge of pollutants.

C. Requiring Permittee, upon receipt of a written notice from the Department for any violations of the MAO, to pay the following civil penalties:

(1) $250 for each day of each violation of the compliance schedule referred to in Paragraph 11.A.

(2) $500 for each violation of an interim monthly average waste discharge limitation set forth in Paragraph 11.B.

(3) $100 for each violation of each interim weekly average or daily maximum waste discharge limit set forth in Paragraph 11.B and any other condition of this MAO.

12. If any event occurs that is beyond Permittee's reasonable control and that causes or may cause a delay or deviation in performance of the requirements of this MAO, Permittee shall immediately notify the Department verbally of the cause of delay or deviation and its anticipated duration, the measures that have been or will be taken to prevent or minimize the delay or deviation, and the timetable by which Permittee proposes to carry out such measures. Permittee shall confirm in writing this information within five (5) working days of the onset of the event. It is Permittee's responsibility in the written notification to demonstrate to the Department's satisfaction that the delay or deviation has been or will be caused by circumstances beyond the control and despite due diligence of Permittee. If Permittee so demonstrates, the Department shall extend times of performance of related activities under this MAO as appropriate. Circumstances or events beyond Permittee's control include, but are not limited to acts of nature, unforeseen strikes, work stoppages, fires, explosion, riot, sabotage, or war. Increased cost of performance or consultant's failure to provide timely reports may not be considered circumstances beyond Permittee's control.

13. Regarding the violations set forth in Paragraphs 2 - 8 above, which are expressly settled herein without penalty, Permittee and the Department hereby waive any and all of their rights to any and all notices, hearing, judicial review, and to service of a copy of the final MAO herein. The

Department reserves the right to enforce this MAO through appropriate administrative and judicial proceedings.

14. The terms of this MAO may be amended by the mutual agreement of the Department and Permittee.

15. The Department and Permittee may mutually agree to amend the compliance schedule and conditions of this MAO upon finding that such modification is necessary because of changed circumstances or to protect the public health and environment. The Department may amend the compliance schedule and or conditions of the MAO upon the Permittee's repeated failure or refusal to comply with the terms and conditions of the MAO. The Department shall provide the Permittee a minimum of thirty days written notice prior to issuing an Amended Order modifying any compliance schedules or conditions. If the Permittee contests the Amended Order, the applicable procedures for conduct of contested cases in such matters shall apply.

16. This MAO shall be binding on the parties and their respective successors, agents, and assigns. The undersigned representative of each party certifies that he or she is fully authorized to execute and bind such party to this MAO. No change in ownership or corporate or partnership status relating to the facility shall in any way alter Permittee's obligations under this MAO, unless otherwise approved in writing by DEQ.

17. Unless otherwise directed in writing by the Department, all reports, notices and other communications required under or relating to this MAO should be directed to Julie Berndt, DEQ Western Regional Office, 1102 Lincoln Street, Eugene, Oregon 97401; phone number (503) 686-7838 ext. 234. Permittee contact is Rick Mumpower, PO Box 340, Florence, Oregon 97439; phone number (503) 997-2611.

18. Permittee acknowledges that it has actual notice of the contents and requirements of the MAO and that failure to fulfill any of the requirements hereof would constitute a violation of this MAO and subject Permittee to payment of civil penalties pursuant to Paragraph 11.C. above.

19. Any stipulated civil penalty imposed pursuant to Paragraph 11.C. shall be due upon written demand. Stipulated civil penalties shall be paid by check or money order made payable to the

"Oregon State Treasurer" and sent to: Business Office, Department of Environmental Quality, 811 S.W. Sixth Avenue, Portland, Oregon 97204. Within 21 days of receipt of a "Demand for Payment of Stipulated Civil Penalty" Notice from the Department, Permittee may request a hearing to contest the Demand Notice. At any such hearing, the issue shall be limited to Permittee's compliance or non-compliance with this MAO. The amount of each stipulated civil penalty for each violation and/or day of violation is established in advance by this MAO and shall not be a contestable issue.

20. Providing Permittee has paid in full all stipulated civil penalties pursuant to Paragraph 19 above, this MAO shall terminate 60 days after Permittee demonstrates full compliance with the requirements of the schedule set forth in Paragraph 11.A. above.

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CITY OF FLORENCE

4/2/96
Date

Kenneth D. Hobson

City Manager, City of Florence

DEPARTMENT OF ENVIRONMENTAL QUALITY

4/9/96
Date

Langdon Marsh, Director

FINAL ORDER

IT IS SO ORDERED:

ENVIRONMENTAL QUALITY COMMISSION

4/9/96
Date

Langdon Marsh, Director
Department of Environmental Quality
Pursuant to OAR 340-11-136(1)

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT

Department of Environmental Quality
811 S.W. Sixth Avenue, Portland, OR 97204
Portland, OR 97204
Telephone: (503) 229-5696

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

ISSUED TO:

City of Florence
P.O. Box 340
Florence, OR 97439

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Outfall Number	Outfall Location
Domestic Sewage	001	R.M. 4.1

PLANT TYPE AND LOCATION:

Activated Sludge
Rhododendron Drive
Florence, OR 97439

Treatment System Class: II
Collection System class: II

RECEIVING SYSTEM INFORMATION:

Basin: Mid Coast
Sub-Basin: Siuslaw
Stream: Siuslaw River
Hydro Code: 12C-SIUS 4.1 D
County: Lane

EPA REFERENCE NO: OR-002074-5

Issued in response to Application No. 998778 received January 24, 1989.

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

Lydia R. Taylor (signature)
Lydia R. Taylor, Administrator

JUL 14 1992
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:

Each other direct and indirect discharge to public waters is prohibited.

This permit does not relieve the permittee from responsibility for compliance with any other applicable federal, state, or local law, rule, standard, ordinance, order, judgment, or decree.

SCHEDULE A

1. Waste Discharge Limitations not to be Exceeded After Permit Issuance.

a. Outfall Number 001 (Sewage Treatment Plant Discharge)

(1) May 1 - October 31:

Parameter	Average Effluent Concentrations Monthly	Average Effluent Concentrations Weekly	Mass Load Limits * Monthly Average lb/day	Mass Load Limits * Weekly Average lb/day	Mass Load Limits * Daily Maximum lbs
BOD_5	20 mg/l	30 mg/l	125	188	250
TSS	20 mg/l	30 mg/l	125	188	250
FC per 100 ml	200	400			

(2) November 1 - April 30:

Parameter	Average Effluent Concentrations Monthly	Average Effluent Concentrations Weekly	Mass Load Limits * Monthly Average lb/day	Mass Load Limits * Weekly Average lb/day	Mass Load Limits * Daily Maximum lbs
BOD_5	30 mg/l	45 mg/l	188	281	376
TSS	30 mg/l	45 mg/l	188	281	376
FC per 100 ml	200	400			

(3)

Other Parameters (year-round)	Limitations
pH	Shall be within the range 6.0-9.0.
BOD_5 and TSS Removal Efficiency	Shall not be less than 85 percent monthly average.

* Mass load limits based on the average dry weather design flow to the facility of 0.75 MGD.

(4) Notwithstanding the effluent limitations established by this permit, no wastes shall be discharged and no activities shall be conducted which violate Water Quality Standards as adopted in OAR 340-41-245 except in the defined mixing zone:

That portion of the Siuslaw River within a radius of 100 feet from the point of discharge.

SCHEDULE B

1. Minimum Monitoring and Reporting Requirements.
(unless otherwise approved in writing by the Department)

a. Influent

Item or Parameter	Minimum Frequency	Type of Sample
BOD_5	2/Week	Composite
TSS	2/Week	Composite
pH	3/Week	Grab

b. Outfall Number 001 (Discharge from the sewage treatment plant)

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Measurement
Flow Meter Calibration	Annual	Verification
BOD_5	2/Week	Composite
TSS	2/Week	Composite
pH	3/Week	Grab
Fecal Coliform	Weekly	Grab
Quantity Chlorine Used	Daily	Measurement
Chlorine Residual	Daily	Grab
Average Percent Removed (BOD_5 and TSS)	Monthly	Calculation

c. Sludge Management

Item or Parameter	Minimum Frequency	Type of Sample
Sludge analysis including: Total solids (% dry wt.) Volatile solids (% dry wt.) Sludge nitrogen NH_3-N; NO_3-N; & TKN-N (% dry wt.) Phosphorus-P (% dry wt.) Potassium (% dry wt.) Sludge metals content for Cd, Cu, Ni, Pb, & Zn (mg/kg) pH (standard units)	Annually	Composite sample to be representative of the product to be land applied from the digester withdrawal line. (See note 1/)

Record of % volatile solids reduction accomplished through digestion	Monthly	Calculation (See note 2/)
Record of locations where sludge is applied on land (Site location map to be 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:

1/ Composite samples from the digester withdrawal line shall consist of at least 6 aliquots of equal volume collected over a 24 hour period and combined.

2/ Calculation of the % volatile solids reduction is to be based on comparison of a representative grab sample of total and volatile solids entering the digester (a weighted blend of the primary and secondary clarifier solids) and a representative composite sample of sludge solids exiting the digester withdrawal line (as defined in note 1/ above).

2. Reporting Procedures

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.

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.

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.

SCHEDULE C

Compliance Schedules and Conditions

1. By no later than August 31, 1992, the permittee shall submit a sludge management plan in accordance with Oregon Administrative Rule 340, Division 50, "Disposal of Sewage Treatment Plant Sludge and Sludge Derived Products Including Septage". Upon approval of the plan by the Department, the plan shall be implemented by the permittee.

2. By no later than December 31, 1992, the permittee shall submit to the Department a report which either identifies known sewage bypass locations and a plan for estimating the frequency, duration and quantity of sewage bypassing treatment, or certifies that there are no bypasses. If known sewage bypass locations are identified, the report shall also provide a schedule to eliminate the bypass(es).

3. 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 January 15 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.

4. 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 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.

SCHEDULE D

Special Conditions

1. All sludge shall be managed in accordance with a sludge management plan approved by the Department of Environmental Quality. No substantial changes shall be made in sludge management activities which significantly differ from operations specified under the approved plan without the prior written approval of the Department.

2. 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 2.a. 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 in the proper classification and at grade level I or higher.

   c. 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.

   d. 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 (see address on page one). This requirement is in addition to the reporting requirements contained under Schedule B of this permit.

3. The permittee shall notify the DEQ Salem Office (phone: 378-8240) of any malfunction so that corrective action can be coordinated between the permittee and the Department.

APPENDIX B

DISCHARGE PERMIT AND MUTUAL ORDER AND AGREEMENT

Table A-1. Interceptor Design Parameters

Upstream Node	Upstream Ground Elevation (ft)	Upstream Ground Cover (ft)	Upstream Invert Elevation (ft)	Pipe Length (ft)	Slope (ft/ft)	Pipe Diameter (inches)	Mannings n	Design Capacity (cfs)	Design Velocity (fps)
SS6045N	106.4	5	99.9	1769	0.0012	18	0.013	3.64	2.1
SS6020N	104.3	5	97.8	1640	0.0012	18	0.013	3.64	2.1
SS6025N	102.3	5	95.8	1100	0.0012	18	0.013	3.64	2.1
SS6030N	101.0	5	94.5	1733	0.0012	18	0.013	3.64	2.1
SS6035N	98.9	5	92.4	2745	0.0012	18	0.013	3.64	2.1
SS6040N	95.6	5	89.1	2644	0.0014	18	0.013	3.87	2.2
SS6050N	92.0	5	85.5	3942	0.0051	18	0.013	7.48	4.2
SS6055N	72.0	5	65.5	2110	0.0076	18	0.013	9.14	5.2
SS6060N	56.0	4.5	49.5	1304	0.0011	24	0.013	7.41	2.4
SS6065N	59.6	9.5	48.1	1171	0.0011	24	0.013	7.54	2.4
SS6070N	54.8	6	46.8	937	0.0014	24	0.013	8.42	2.7
SS6075N	56.0	8.5	45.5	4689	0.0011	24	0.013	7.38	2.4
SS6080N	53.0	10.5	40.5	1286	0.0113	24	0.013	24.01	7.6
SS6085N	38.0	10	26.0	2439	0.0086	24	0.013	20.99	6.7

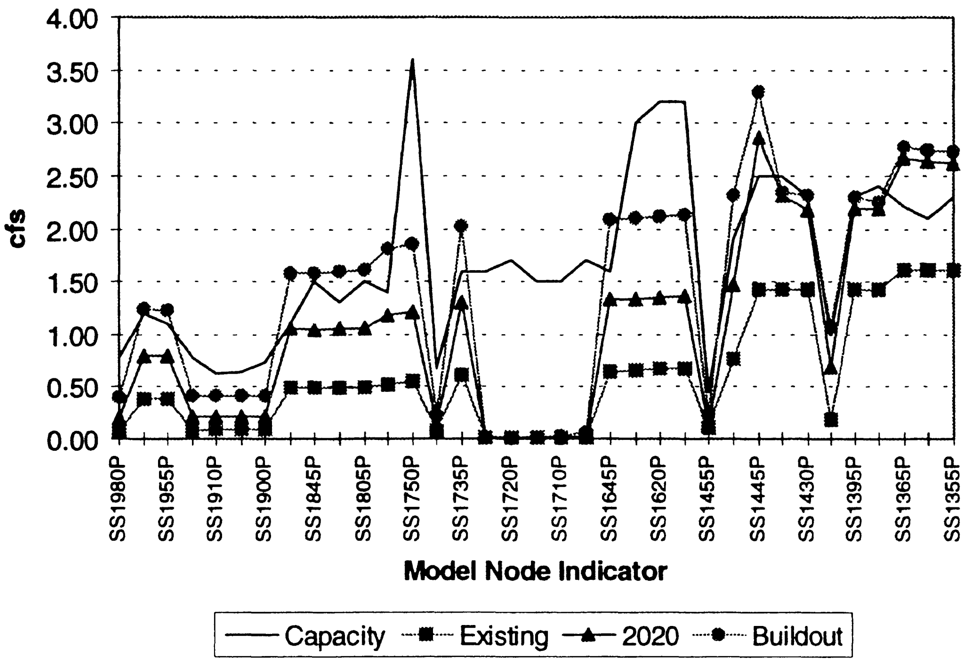


Figure A-4. Collection System Capacity and Wet Weather Flows, Nodes 1980-1355

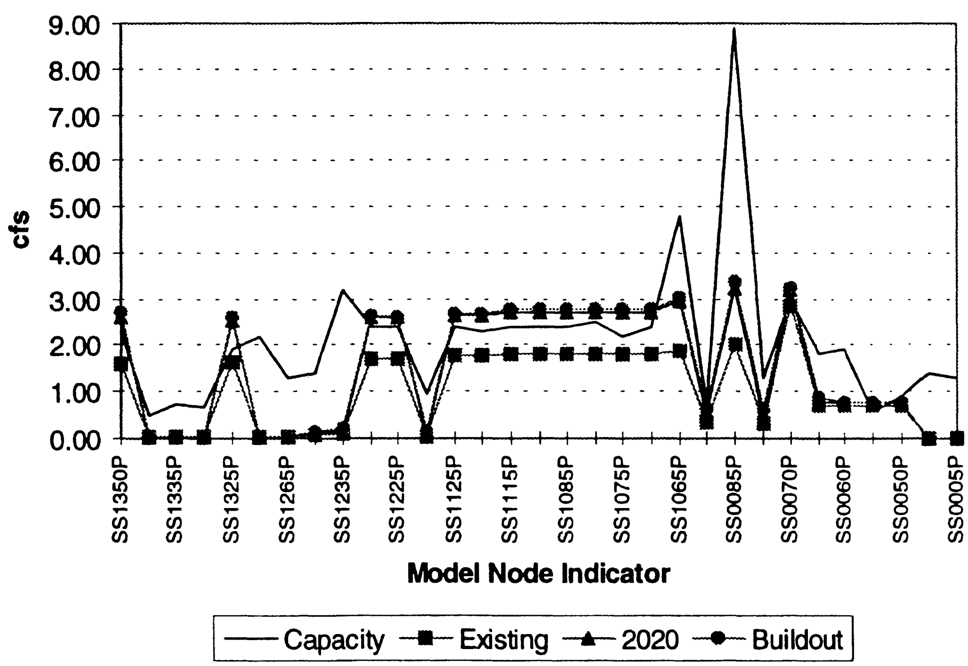


Figure A-5. Collection System Capacity and Wet Weather Flows, Nodes 1350-0005

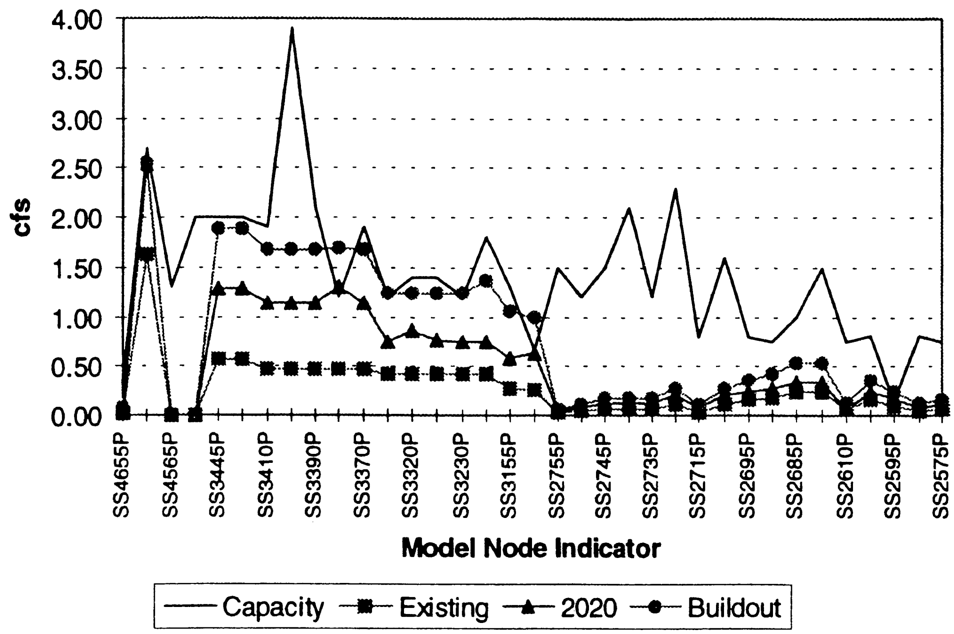


Figure A-2. Collection System Capacity and Wet Weather Flows, Nodes 4655-2575

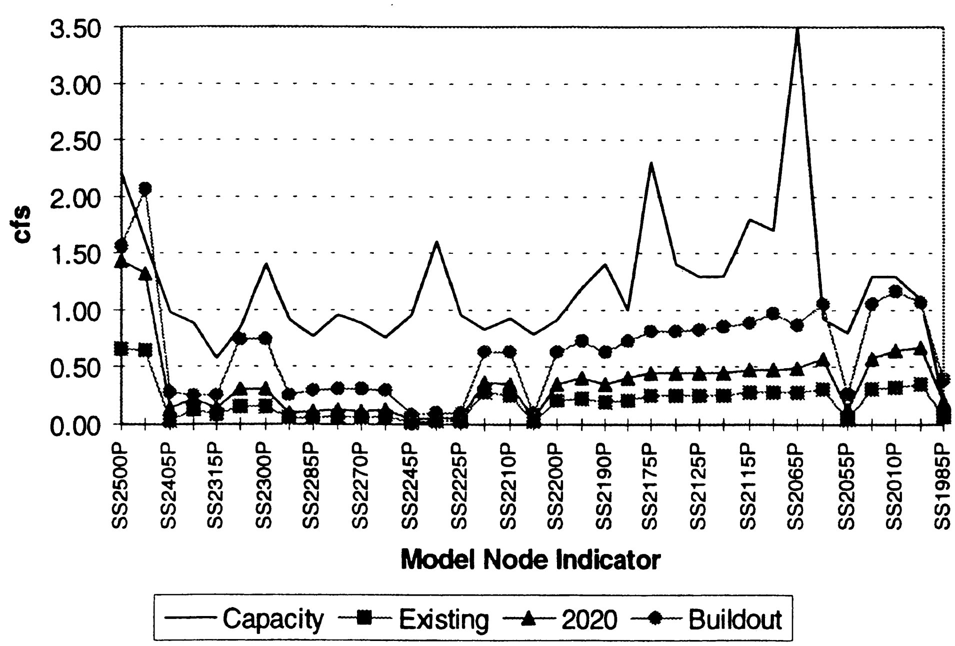


Figure A-3. Collection System Capacity and Wet Weather Flows, Nodes 2500-1985

APPENDIX C

OUTFALL MIXING ZONE STUDY

MEMORANDUM 14-4141.41

March 25, 1997

TO: JOHN HOLROYD, BROWN AND CALDWELL, EUGENE

FROM: MIKE FLANIGAN, BROWN AND CALDWELL, SEATTLE

SUBJECT: FLORENCE, OREGON, WASTEWATER TREATMENT PLANT OUTFALL EVALUATION

SUMMARY

Presented in this memorandum are the results of an outfall evaluation performed for the Florence, Oregon, Wastewater Treatment Plant (WWTP). This outfall evaluation is part of ongoing comprehensive facilities planning effort. Brown and Caldwell has already prepared a series of technical memoranda focused on WWTP equipment and operation, Siuslaw River water quality, and likely regulatory requirements. Data used in this outfall evaluation is drawn primarily from these previous technical memoranda.

We had three objectives for this outfall evaluation. First we sought to gather as much information as possible on the estuarine environment of the lower Siuslaw River. We found that there are only limited data for the upper freshwater reaches of the Siuslaw River, and almost no site-specific data for the lower estuarine portion of the river. Second, we sought to configure an outfall and a terminal diffuser section that would provide good initial mixing without inducing so much hydraulic head loss that effluent pumping would be required. Third, we sought to characterize water quality impacts to a level of detail sufficient for further consideration by the city, the Oregon Department of Environmental Quality (DEQ), and the Brown and Caldwell planning team.

We examined dilution occurring on a rough estuary-wide basis as well as on a more focused basis occurring within a defined regulatory mixing zone. Because of vigorous mixing with relatively large volumes of ocean water, we feel that long-term, estuary-wide accumulation of pollutants within the estuary will not be a problem. We also examined dilution in terms of water quality impacts that might occur within the mixing zone. We think that regulatory limits for ammonia can be met within a mixing zone extending about 210 feet from the diffuser. We estimate that a mixing zone of this size will provide a chronic dilution factor of about 120:1 and an acute dilution factor of about 30:1. In addition, we think that potential effluent limits for chlorine can also be met using conventional chlorination and dechlorination equipment and control schemes.

BACKGROUND

The Florence WWTP is located on the Siuslaw River about 4 miles inland from the mouth of the river on coastal Oregon. The WWTP provides conventional secondary biological treatment. The plant is currently rated for an average dry weather flow (ADWF) capacity of 0.75 million gallons per day (mgd), and has experienced an estimated peak hourly flow rate of about 3 mgd.

Future Discharge Requirements

Future discharge permits for the Florence WWTP will conform to the requirements of Oregon Administrative Rules (OAR) Division 340-41. Specifically, the Florence WWTP must comply with the water quality standards and treatment requirements for discharge to estuarine waters. In addition, special limitations may be applied to the WWTP if the Siuslaw River is found to be water quality limited for certain parameters.

Siuslaw River Water Quality Limitations. As required by Section 303 (d) of the Clean Water Act, the DEQ recently published a list of all streams that do not comply with applicable water quality standards. These waterways are referred to as water quality limited. The Siuslaw River is listed as water quality limited for temperature during the summer months. Discussions with DEQ indicate that this temperature listing will not place limits on future discharges from the WWTP which are more restrictive than those listed in the OAR. However, Florence may be required to participate in the development of a temperature management plan for the Siuslaw River basin.

Discussions with DEQ indicate that the Siuslaw River could be listed as water quality limited for other parameters in the future. The water quality parameters of concern include:

- Dissolved oxygen during the summer. Some past excursions of water quality standards have been noted.
- Habitat modification. More data are needed to determine if stream channelization or alterations to riparian areas is a problem.
- Nutrient and sediment impacts. More data are needed to fully evaluate nutrient and sediment impacts.

It is unclear at this time if the Siuslaw River violates the water quality standards for the above parameters.

Water Quality Parameters. Water quality parameters pertinent to this outfall evaluation are summarized in Table 1. All comments are based on discussions found in OAR 340-41.

Table 1. Summary of Pertinent Water Quality Parameters

Water quality parameter	Comments
Temperature	The Siuslaw River is listed as water quality limited for temperature during the summer. For marine and estuarine waters, no significant increase in temperature above natural background levels is allowed above 0.25 degrees F at the edge of the mixing zone.
Dissolved oxygen	DO concentration in estuaries must be maintained above 6.5 mg/L. DEQ may set more restrictive DO limits in the future if the Siuslaw River is listed as a water quality limited stream.
pH	pH for all fresh and estuarine waters must remain between 6.5 and 8.5.
Bacteria	Bacteria standards are relatively stringent because the WWTP discharges into an estuary containing shellfish-growing areas. The median fecal coliform concentration cannot exceed 14 organisms per 100 mL. In addition, no more than 10 percent of the samples can have more than 43 organisms per 100 mL.
Toxic substances	Toxicity limits for chlorine in marine water are 0.075 mg/L for chronic toxicity and 0.013 mg/L for acute toxicity. Ammonia toxicity is dependent on water temperature, pH, and salinity. Ammonia toxicity can be addressed by converting the ammonia to nitrate in the secondary process through nitrification, by providing adequate mixing of plant effluent and the receiving water, or through a combination of both.

Design WWTP flows expected through year 2020 are presented in Table 2.

Table 2. Expected Future WWTP Flows

Flow condition	Flow, mgd
Average dry weather flow	1.9
Maximum month flow	3.6
Peak day flow	4.3
Peak hour wet weather flow	6.9

Oceanographic Data

Enough stream flow and water quality data are available for the Siuslaw River above the WWTP discharge point to at least roughly assess water quality issues in the upper freshwater reaches of the river (see *Technical Memorandum 4.1, Water Quality Assessment*, prepared by Brown and Caldwell and dated December 18, 1996, for a summary of available stream flow and water quality data). However, the WWTP discharges at the downstream end of the Siuslaw in a region that is strongly estuarine in nature, and for which data are presently scarce.

For instance, tide elevations for Florence can be estimated from the National Oceanic and Atmospheric Administration (NOAA) reference station in Crescent City, California, with enough accuracy for this evaluation. However, corresponding NOAA predictions for tidal current speed are not available. The best estimates of current strength are reported by local fishermen and recreational boaters. Local fishermen claim that maximum current speeds in the vicinity of Florence can approach 4 knots (2 meters per second [m/s]).

Additionally, water quality data which are important to mixing zone studies, such as salinity and temperature, are not well documented. City personnel recently gathered limited salinity and temperature data at and upstream from the WWTP discharge point (see Attachment A). These winter data will not be fully representative of critical summer conditions because a pronounced freshwater layer is present during the winter months. As river flows fall to summer flow rates, the density structure will become less stratified because the estuarine portion of the Siuslaw River will increasingly be filled with fresh ocean water that has been vigorously mixed by strong tidal currents.

Values of ambient temperature and pH will also begin to resemble values for coastal ocean water as summer flow condition begin to establish. We obtained salinity and temperature data for Charleston, Oregon from the University of Oregon Marine Science Laboratory, and have assumed for this analysis that the Charleston data represent the characteristics of ocean water entering the Siuslaw River estuary.

Streamflow data for the Siuslaw River were presented in *Technical Memorandum 4.1.* There is some disagreement between USGS data and that agency's estimate of the 7Q10 summer flow. However, it can be conservatively assumed that the 7Q10 summer flow just upstream from the WWTP is about 75 cubic feet per second (cfs).

HYDRAULIC AND DILUTION ANALYSES

Outfalls must perform well both hydraulically and hydrodynamically. Hydraulic performance can be characterized by total head loss through the outfall and diffuser and by the flow distribution that occurs through the ports along the length of the diffuser. Hydrodynamic performance is defined by the amount of initial dilution that the diffuser can achieve given the limited water column available in the vicinity of the WWTP.

Hydraulic Analysis

One goal of this analysis was to configure an outfall and diffuser which would disrupt existing plant operation as little as possible. The existing WWTP outfall is a shoreline discharge that does not require effluent pumping. We therefore modeled a preliminary outfall and diffuser configuration which offers good initial effluent mixing without requiring effluent pumping.

We set the internal diameter of the outfall and the diffuser section to 24 inches in diameter. The total length of the modeled outfall was about 1,100 feet, of which about 700 feet was placed offshore. This preliminary outfall layout extended from the existing treatment plant to a point just inshore from a navigation beacon located near the edge of the dredged ship channel. We aligned the outfall thus to place the diffuser section as deep as possible without entering the dredged section. Placing the diffuser near to, but inshore from, the navigation beacon will provide additional protection for the diffuser since vessels drawing enough water to damage the diffuser will steer clear of the beacon.

Diffuser hydraulics were examined using DIFF$$.EXE, a proprietary Brown and Caldwell diffuser hydraulic model (see Attachment B). We used a diffuser configuration consisting of 50 identical 2-inch diameter ports placed 4 feet apart. This configuration will impart good initial dilution within the limited water column available for dilution. Further, total head loss through both the diffuser section and outfall pipeline will be about 5.3 feet at 6.9 mgd. Preliminary surveying data supplied by the city indicate that there might be about 10 feet available between mean higher high water (MHHW) and the ground surface elevation at the WWTP. So long as the peak hourly flow rate does not rise appreciably above 6.9 mgd in the future, there should be enough driving head available at the plant to provide gravity flow through the outfall, even at tidal or flood stages higher than MHHW.

Dilution Analysis

Our focus for the dilution analysis was twofold. Our first goal was to roughly characterize the amount of overall dilution that can be achieved within the Siuslaw River estuary over a tidal cycle. The second goal of the dilution analysis was to characterize dilution occurring within a mixing on time scales much shorter than the tidal cycle.

Overall Tidal Dilution. Estimating the volumes of water entering a estuary through freshwater stream flows and through tidal ocean exchange can used to determine if effluent accumulation will be a problem. As note above, little is known about the hydrodynamics of the Siuslaw River estuary. However, a rough calculation can be performed to estimate the volume of ocean water entering the estuary by noting the tidal fluctuations and the extent to which saltwater reaches upstream. As can be seen in Attachment A, salinity begins to drop rapidly about 13,000 feet upstream from the WWTP, or about 6.5 miles upstream from the river jetty. Note that the data in Attachment A were collected during winter conditions. However, the data can be taken as a conservative estimate of saltwater intrusion since during summer conditions saltwater will extend farther upstream.

Additionally, vertical density stratification will be much less in the summer, resulting in higher overall dilution. Winter stratification in the Siuslaw River estuary is caused by a layer of relatively fresh water floating on top of a layer of denser sea water. Stratification tends to reduce dilution because the rising effluent plume becomes trapped beneath the fresh water layer, thereby restricting the extent of vertical mixing that can be achieved. Summertime stratification in deep water can be significant, but this stratification is due more to temperature variations in the water column than salinity differences. The Siuslaw River estuary is shallow, fast-moving, and winding. Turbulence due to friction and bends will mix the estuary well, resulting in only minor stratification.

Additional assumptions must be made to estimate the volume of ocean water entering the estuary. We searched NOAA tide predictions for Florence to determine the smallest predicted tidal elevation change. Using a small tidal elevation change results in a conservative estimate of ocean water entering (and leaving) the estuary. The smallest tidal elevation change we found in our search was 0.9 feet. Applying this elevation change over the lower 6.5 miles of the river and an average estuary width of about 1,100 feet results in a minimum tidal prism of about 38 million cubic feet.

The tidal prism can also be expressed as an average flow rate about 1,700 cfs occurring over a 6-hour tidal cycle. Combining this tidal flow rate with the assumed 7Q10 river flow of 75 cfs results in a dilution of about 930:1 when compared to the ADWF of 1.9 mgd. We assumed for this exercise that none of water leaving the Siuslaw River jetty on ebb tide will return on the subsequent flood tide. We believe this is a reasonable assumption given the jet-like discharge conditions through the jetty and the presence of consistent littoral currents. Given this large tidal-influenced dilution, we have assumed that effluent accumulation in the estuary will not be a significant environmental problem.

Initial Dilution. Typically, the amount of initial dilution that can be reliably achieved is used to address how well an outfall and diffuser perform to protect water quality. Based on the results of a mixing zone analysis, DEQ may grant a mixing zone in which water quality criteria for chronic exposure may be exceeded. The water quality criteria must be met by the time an effluent plume reaches the edge of the mixing zone. DEQ may also grant a zone of initial dilution (ZID) lying within the mixing zone. Acute water quality criteria may be exceeded within the ZID. Mixing zone dimensions are not specifically set forth in the OAR. Instead, DEQ typically requires that the dimensions of a proposed mixing zone be set as small as possible to ensure that water quality criteria are met within the smallest ambient volume reasonable.

The results of computer simulations for chronic and acute conditions are summarized on Figures 1 and 2, respectively. We performed the computer simulations using two EPA-approved effluent dilution models. Acute dilution factors were estimated using PLUMES, while chronic dilution factors were estimated using CORMIX2. We chose PLUMES for estimating acute dilution because this model is far more stable in the highly turbulent environment just outside the diffuser discharge ports. CORMIX2 was used to estimate chronic dilution factors since it is the only EPA-approved dilution model that takes boundary effects such as streambank reflections into account. Because the Siuslaw River estuary is relatively narrow, there is potential for plume interaction with the shore as the plume moves away from the diffuser. Note, however, that CORMIX2 can be as unstable at some distance downstream as it can be close to the point of initial discharge.

Based on direction from DEQ, we conducted both our chronic and acute modeling using an ADWF of 1.9 mgd. We used an iterative approach to determine mixing zone dimensions by first determining initial acute and chronic dilution, and then calculating water quality impacts. We performed a number of computer simulations to determine the dimensions of a proposed mixing zone and a proposed ZID. Chronic dilution factors shown on Figure 1 are for a point about 210 feet from the diffuser, corresponding to a distance 200 feet from the plus the depth of water over the diffuser as measured at mean lower low water (MLLW). Acute dilution factors shown on Figure 2 are predicted values occurring about 21 feet from the diffuser, representing the edge of a ZID extending upstream and downstream 1/10th the length of the overall mixing zone.

For the purposes of this evaluation, we have selected a chronic dilution factor of 120:1 and an acute dilution factor of 30:1. The selected chronic dilution factor corresponds to the estimated dilution achieved when the ambient current is traveling at 1 m/s, or the average of the extreme current speeds of 0 and 2 m/s. Note that we have chosen to pick the chronic dilution factor from a best-fit polynomial line because of the "scatter-gun" instability shown in the CORMIX2 results.

The acute dilution factor was estimated from PLUMES simulations alone (though we have included the dilution factors from of corresponding CORMIX2 simulations to illustrate the relatively high variability of the CORMIX2 predictions close to the diffuser). The selected acute dilution factor corresponds to the estimated dilution achieved when the ambient current is traveling at 0.1 m/s, the ambient current speed we have chosen to represent the 10th percentile current speed for this analysis.

Chronic and acute water quality impacts were assessed as permit limits that DEQ might set for chlorine and ammonia based on available dilution at distances of 21 and 210 feet. Potential permit limits were calculated using a spreadsheet prepared by the Washington State Department of Ecology (Ecology). Ecology developed their spreadsheet on statistical approaches found in the US EPA *Technical Support Document for Water Quality-based Toxics Control* (TSD, 1985). While DEQ may not be familiar with the Ecology spreadsheet, the statistical approaches found in the TSD are the basis of water quality-based toxics control throughout the nation.

Potential permit limits for ammonia are shown on Attachment C. The ammonia permit limits were based on the assumed dilution factors plus conservative estimates of ambient salinity, temperature, and pH. Conservative estimates of background ammonia were also used. The potential permit limits as calculated by the Ecology spreadsheet are about 55 mg/L (as NH_3-N) for a daily maximum limit and about 21 mg/L (as NH_3-N) for a monthly average limit. Both of these effluent limits can be achieved using conventional secondary treatment.

Potential permit limits for chlorine are shown on Attachment D. The chlorine permit limits were based on the assumed dilution factors along with an acute limit for chlorine concentration at the edge of the ZID of 0.013 mg/L and a corresponding chronic limit at the edge of the mixing zone of 0.075 mg/L. To ensure that these criteria are consistently met, DEQ might set a daily maximum limit for chlorine of about 0.39 mg/L. DEQ might set the corresponding monthly average limit at about 0.15 mg/L. These effluent concentrations can be maintained with standard chlorination and dechlorination equipment and control schemes, especially if the city overdoses somewhat with dechlorination agent.

SUMMARY AND RECOMMENDATIONS

Based on our evaluation, we make the following recommendations.

- Construct a new outfall extending about 700 feet offshore from the existing effluent discharge location. Construct a diffuser section consisting of 50 ports, each 2 inches in diameter and spaced 4 feet apart. The diffuser section should be at an average depth of about 10 feet, as measured at MLLW.

- Request that the dimension of the mixing zone be set a no less than 210 feet upstream and downstream form the diffuser. Request that a ZID be granted that extends no less than 21 feet upstream and downstream from the diffuser.

- Collect field data in the estuary during the environmentally-critical months of late summer and early fall. These field data should include current as tide measurements and measurements of water quality parameters such as salinity, temperature, pH. Background concentrations dissolved oxygen concentration and the concentration of toxic substances such as ammonia and metals should also be measured. Close examination of these field data might justify the use of higher acute and chronic dilution factors, which in turn can be used by DEQ to grant higher, more readily achievable permit limits for the plant.

ATTACHMENT A. DENSITY PROFILES FOR FEBRUARY 4, 1997

Distance upstream from WWTP, feet	Time	Depth, feet	Temperature, deg C	Salinity, ppt	Density, σ-t units
@ WWTP	0920	20	10	28	21.53
		1	10	5	3.67
2,700	0930	25	10	26	19.97
		8	10	24	18.42
		1	10	5	3.67
4,800	0940	14	9	23	17.79
8,700	0945	20	9	20	15.45
12,900	0955	20	9	11	8.45
14,400	1000	29	9	2	1.42
@ WWTP	1013	20	9	28	21.69
		8	9	20	15.45
		1	9	6	4.54
@ WWTP	1200	14	10	20	15.32
		1	10	5	3.67

ATTACHMENT B

DIFFUSER HYDRAULIC PERFORMANCE

```
1     florence diff w/ 50 2-in & Qt at 6.9 mgd

         HYDRAULICS FOR A MULTIPORT DIFFUSER
  DENSITY RATIO =       .02212


  DIFFUSER CHARACTERISTICS

   THIS DIFFUSER HAS  1 DISSIMILAR SECTIONS

  PORTS PER      PORT        SECTION       PORT          SECTION
   SECTION    SPACING      DIAMETER    DIAMETER        SLOPE
    50.00000     4.00000    24.00000     2.00000        .01611
```

PORT NUMBER	STATION, FEET	FLOW IN PIPE, MGD	PIPE VEL, FPS	PORT DISCH,MGD	PORT VEL, FPS	DIFFERENTIAL HEAD, FT
1	.0	.14	.07	.14	9.66	1.53
6	20.0	.82	.40	.14	9.68	1.53
11	40.0	1.50	.74	.14	9.70	1.54
16	60.0	2.19	1.08	.14	9.71	1.55
21	80.0	2.87	1.41	.14	9.73	1.57
26	100.0	3.56	1.75	.14	9.75	1.59
31	120.0	4.25	2.09	.14	9.78	1.61
36	140.0	4.94	2.43	.14	9.83	1.65
41	160.0	5.63	2.77	.14	9.89	1.69
46	180.0	6.33	3.12	.14	9.98	1.74
50	196.0	6.90	3.40	.14	10.06	1.79

```
0MINIMUM FROUDE NUMBER =    28.05 AT PORT    1
0TOTAL PORT AREA/OUTFALL AREA =  .347



   SUMMARY OF SYSTEM HYDRAULICS
   WITH TOTAL FLOW OF    10.68 CFS


   COMPONENT            HEAD LOSS,FEET

   DIFFUSER                  1.80
   DENSITY                    .14
   PIPE   FRICTION           3.17
   MINOR LOSSES               .18


   TOTAL                     5.29
```

ATTACHMENT B

DIFFUSER HYDRAULIC PERFORMANCE

```
1     florence diff w/ 50 2-in & Qt at 1.9 mgd

          HYDRAULICS FOR A MULTIPORT DIFFUSER
  DENSITY RATIO =       .02212


  DIFFUSER CHARACTERISTICS

   THIS DIFFUSER HAS  1 DISSIMILAR SECTIONS

  PORTS PER      PORT      SECTION       PORT        SECTION
   SECTION    SPACING     DIAMETER   DIAMETER       SLOPE
   50.00000     4.00000    24.00000     2.00000       .01611
```

PORT NUMBER	STATION, FEET	FLOW IN PIPE, MGD	PIPE VEL, FPS	PORT DISCH,MGD	PORT VEL, FPS	DIFFERENTIAL HEAD, FT
1	.0	.03	.02	.03	2.28	.09
6	20.0	.20	.10	.03	2.37	.09
11	40.0	.37	.18	.03	2.46	.10
16	60.0	.55	.27	.04	2.55	.11
21	80.0	.73	.36	.04	2.63	.11
26	100.0	.92	.45	.04	2.71	.12
31	120.0	1.11	.55	.04	2.79	.13
36	140.0	1.31	.65	.04	2.87	.14
41	160.0	1.52	.75	.04	2.96	.15
46	180.0	1.73	.85	.04	3.04	.16
50	196.0	1.90	.94	.04	3.11	.17

```
0MINIMUM FROUDE NUMBER =     6.62 AT PORT    1
0TOTAL PORT AREA/OUTFALL AREA =  .347


   SUMMARY OF SYSTEM HYDRAULICS
   WITH TOTAL FLOW OF     2.94 CFS


   COMPONENT              HEAD LOSS,FEET

   DIFFUSER                     .17
   DENSITY                      .14
   PIPE   FRICTION              .24
   MINOR LOSSES                 .01


   TOTAL                        .57
```

Figure 1. Predicted Chronic Dilution

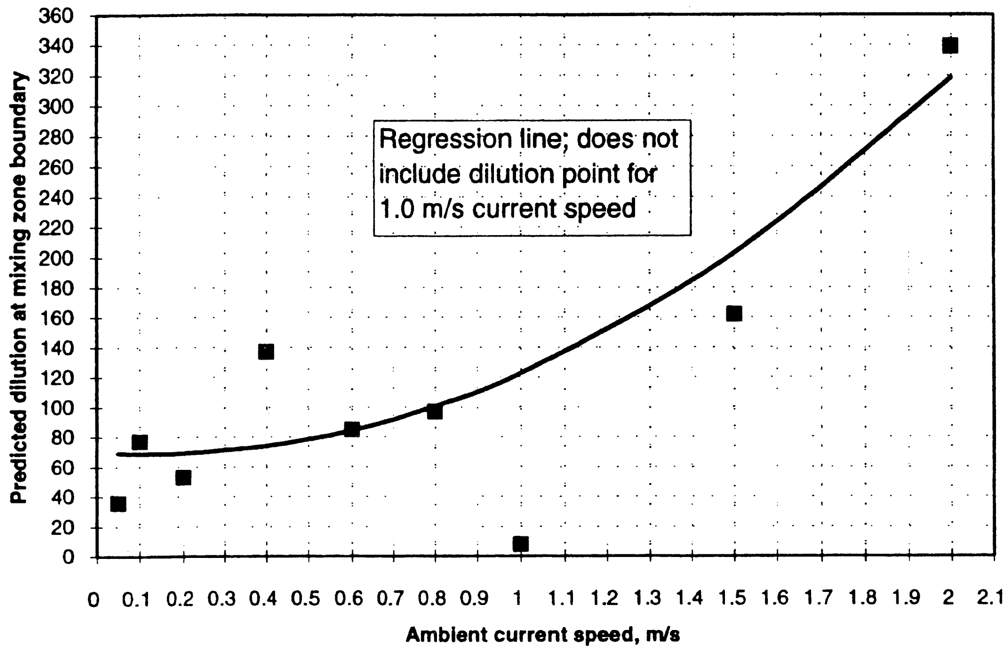
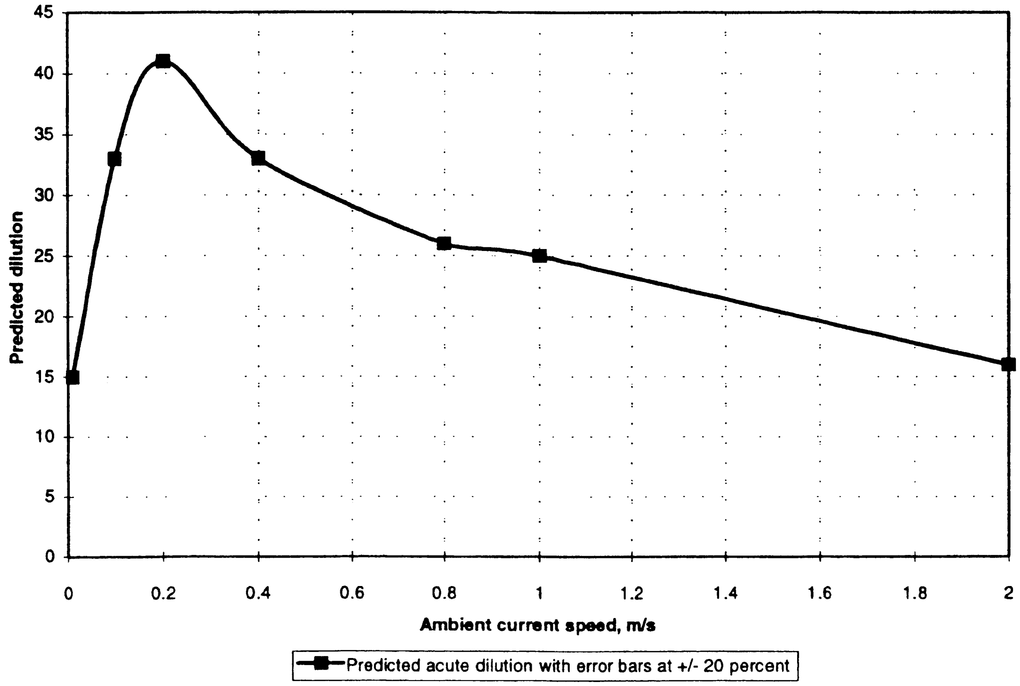


Figure 2. Predicted Acute Dilution



ATTACHMENT C
REPRESENTATIVE PERMIT LIMITS FOR AMMONIA

**Water Quality-Based Permit Limits for acute and chronic criteria.
(based on EPA/505/2-90-001 Box 5-2).**

Based on Lotus File WQBP2.WK1 Revised 19-Oct-93

INPUT	
1. Water Quality Standards (Concentration)	
Acute (one-hour) Criteria:	2.515
Chronic (n-day) Criteria:	0.378
2. Upstream Receiving Water Concentration	
Upstream Concentration for Acute Condition (7Q10):	0.235
Upstream Concentration for Chronic Condition (7Q10):	0.100
3. Dilution Factors (1/{Effluent Volume Fraction})	
Acute Receiving Water Dilution Factor at 7Q10:	20.000
Chronic Receiving Water Dilution Factor at 7Q10:	100.000
4. Coefficient of Variation for Effluent Concentration (use 0.6 if data are not available):	0.600
5. Number of days (n1) for chronic average (usually four or seven; four is recommended):	4
6. Number of samples (n2) required per month for monitoring:	30

OUTPUT	
1. Z Statistics	
LTA Derivation (99%tile):	2.326
Daily Maximum Permit Limit (99%tile):	2.326
Monthly Average Permit Limit (95%tile):	1.645
2. Calculated Waste Load Allocations (WLA's)	
Acute (one-hour) WLA:	45.836
Chronic (n1-day) WLA:	27.880
3. Derivation of LTAs using April 1990 TSD (Box 5-2 Step 2 & 3)	
Sigma^2:	0.3075
Sigma^2-n1:	0.0862
LTA for Acute (1-hour) WLA:	14.717
LTA for Chronic (n1-day) WLA:	14.705
Most Limiting LTA (minimum of acute and chronic):	14.705
4. Derivation of Permit Limits From Limiting LTA (Box 5-2 Step 4)	
Sigma^2-n2:	0.0119
Daily Maximum Permit Limit:	45.798
Monthly Average Permit Limit:	17.494

Source: Permit writer's spreadsheet used by the Washington Department of Ecology.

ATTACHMENT D
REPRESENTATIVE PERMIT LIMITS FOR CHLORINE

**Water Quality-Based Permit Limits for acute and chronic criteria.
(based on EPA/505/2-90-001 Box 5-2).**

Based on Lotus File WQBP2.WK1 Revised 19-Oct-93

INPUT	
1. Water Quality Standards (Concentration)	
Acute (one-hour) Criteria:	0.013
Chronic (n-day) Criteria:	0.075
2. Upstream Receiving Water Concentration	
Upstream Concentration for Acute Condition (7Q10):	0.000
Upstream Concentration for Chronic Condition (7Q10):	0.000
3. Dilution Factors (1/{Effluent Volume Fraction})	
Acute Receiving Water Dilution Factor at 7Q10:	20.000
Chronic Receiving Water Dilution Factor at 7Q10:	100.000
4. Coefficient of Variation for Effluent Concentration (use 0.6 if data are not available):	0.600
5. Number of days (n1) for chronic average (usually four or seven; four is recommended):	4
6. Number of samples (n2) required per month for monitoring:	30

OUTPUT	
1. Z Statistics	
LTA Derivation (99%tile):	2.326
Daily Maximum Permit Limit (99%tile):	2.326
Monthly Average Permit Limit (95%tile):	1.645
2. Calculated Waste Load Allocations (WLA's)	
Acute (one-hour) WLA:	0.260
Chronic (n1-day) WLA:	7.500
3. Derivation of LTAs using April 1990 TSD (Box 5-2 Step 2 & 3)	
Sigma^2:	0.3075
Sigma^2-n1:	0.0862
LTA for Acute (1-hour) WLA:	0.083
LTA for Chronic (n1-day) WLA:	3.956
Most Limiting LTA (minimum of acute and chronic):	0.083
4. Derivation of Permit Limits From Limiting LTA (Box 5-2 Step 4)	
Sigma^2-n2:	0.0119
Daily Maximum Permit Limit:	0.260
Monthly Average Permit Limit:	0.099

Source: Permit writer's spreadsheet used by the Washington Department of Ecology.

APPENDIX D

SLUDGE MANAGEMENT PLAN

CITY OF FLORENCE
SLUDGE MANAGEMENT PLAN

GENERAL INFORMATION:

The City of Florence operates an extended Aeration Activated Sludge Sewage Plant at 794 Rhododendron Drive. The plant was constructed in 1962 as a primary treatment facility. In 1972 the 35' primary clarifier was converted to secondary and aeration was added at that time. An additional 50' diameter clarifier and headworks were built in 1985. Two inclined screens and teacups were installed then, and one more screen and teacup in 1992.

Sewage is pumped to the plant from a main pump station at Ivy Street or a pressure main along Rhododendron Drive. A total of 27 pump stations are used in the collection system. Sewage flows into the plant at an average .68 MGD dry weather flow or .78 MPG wet weather flow. The treatment plant design capacity is .75 MGD. The City is currently under a mutual agreement order allowing bypasses when plan flows exceed .75 MGD.

WASTEWATER PROCESSING:

Approximately 75% of the incoming flow is domestic sewage, the remaining 25% being Commercial. There is no industrial source at this time, nor a sewer ordinance pertaining to industrial waste. Septage is no longer accepted at the plant, although future additional digester's will allow for receiving septage.

Sewage enters the plant at a headworks, consisting of 3 inclined screens and 3 grit separators. Sewage screening and grit are taken to the Lane County Transfer Station. Screened sewage then flows into a 725,000 gallon aerations basin. Optimum MLSS concentration is 3500 mg/L with a minimum of 3000 mg/L and maximum of 4000 mg/L. Seven floating aerators are in use with timers on all circuits to meet different oxygen demands. All aerators are 15 Hp and currently 5 operate 24 hours per day with the remaining two cycling on and off every half-hour. At average summer flows, 25 hours of detention time is achieved and 22 hours at winter flows. Aerated activated sludge is pumped to two secondary clarifiers, a 35' diameter older unit, and a 50' unit installed in 1985. Clarifier volumes are 80,000 and 160,000 gallons. Effluent flows to a 75,000 gallon chlorine chamber. Return sludge flows by gravity back to the aeration basin. Waste sludge is pumped off the bottom of the 50' clarifier to a gravity belt thickener. From there 5-7% solids are pumped to the digester heat exchanger. The high-rate digester has a volume of 90,000 gallons. Feed and mix pumps are progressive cavity. A draft tube mixer further mixes the digester contents.

SLUDGE PROCESSING:

Settled sludge is removed from the secondary clarifier by a Cornell Solids handling pump at a rate of 100 gpm and discharged onto a 1 meter Eimco gravity belt thickener. From there, 5% - 7% solids are pumped to the digester heat exchanger for preheat prior to discharge into the digester at 4 ports spaced equally along the top. Daily thickened feed rates average 2200 gpd for a detention time of about 41 days. Operating temperature is 99 degrees fahrenheit. Feed solids entering the digester are about 82% volatile and digested solids are about 3% and 75% volatile. Average volatile solids reduction for 1996 was 59%. Annual solids production at the present time is .75 MG or 93 dry tons/year. Beneficial use sludge application is on-going at 6 DEQ approved sites. Florence meets EPA 503.32 (Pathogen reduction) for class B sludge with its PSRP anaerobic digester time and temperature. Also 503.33 vector attraction reduction with option #1 (> 38% volatile solids reduction).

TRANSPORTATION AND LAND APPLICATION:

Sludge is removed from the plant via the mix pump (250 gpm) through piping routed across the top of the building to valves located above the truck loading position in the parking area. At the application site, sludge is either pumped through a diesel high pressure pump to an oscillating spray nozzle, or truck spread with a discharge pipe located at the side of the truck. All trucking, pumping and piping equipment is owned by the City of Florence. Truck operators are Tom Cannon, Brad Wilson and Ron Rainwater.

SITE NAME	ACRES	AUTHORIZED VOLUME/YEAR
Airport	19.9	199,000
Beatty	2	20,000
Nordahl	8.2	82,000
Chastain	13.1	131,000
King	90	900,000
Elliott	17	170,000
	150.2	1,502,000

METAL ADDITION
LBS/METAL/ACRE AT AGRONOMIC LOADING RATE

SITE NAME	Z	PB	NI	CU	CA
Airport	1.50	.07	-0-	1.60	.006
Beatty	1.50	.07	-0-	1.60	.006
Nordahl	1.50	.07	-0-	1.60	.006
Chastain	1.50	.07	-0-	1.60	.006
King	1.50	.07	-0-	1.60	.006
Elliott	1.50	.07	-0-	1.60	.006

NITROGEN AND AGRONOMIC LOADING

Organic = 67300 x .1876 x .2 = 2525 lbs/yr

Nitrate = 100 x .1876 = 18.8 " "

Ammonia = 52100 x .1876 x .5 = 4887 " "

7431 lbs/yr

$\frac{100}{7431}$ = 74.3 acres needed

EMERGENCY OPTIONS:

In the event of a spill, either at the treatment plant or along a roadway between the plant and the site, the City has available vacuum tanker trucks that could remove the sludge and return it to the treatment plant. Lime is to be used on all small spills.

In the event of mechanical breakdown of sludge or recirculation pumps, spare parts are available to immediately rebuild pumps or replace parts. If digester cleaning is needed, scheduling it for summer months will allow us to hold solids until it is back in service. A winter shutdown of short term (0-7 days) would necessitate ceasing waste sludge pumping. Medium term solution (7-30 days) would be a combination of drying bed use and lime stabilization. Long term solution would be lime stabilization with the City's tanker and possibly other vacuum tankers.