Treatment Alternatives

Redwood Sanitary Sewer Service District
Josephine County, Oregon

Parametrix, Inc.

6. TREATMENT ALTERNATIVES

6.1 ALTERNATIVES INVESTIGATED

To evaluate the best method for meeting the District's wastewater treatment needs to the year 2020, twelve alternatives were analyzed. These alternatives were separated into three groups, the first and second of which use the Redwood WWTP for treatment and are considered treatment alternatives. The third group uses the City of Grants Pass WRP for treatment and are considered conveyance alternatives.

- Alternatives 1, 2, and 3 would provide secondary treatment at the existing Redwood WWTP with some ammonia removal. These alternatives would meet the effluent limitations shown on Table 5-4. These alternatives include:

    - ► Construct a new contact-stabilization activated sludge system.

    - ► Construct a new Sequencing Batch Reactor (SBR) treatment system.

    - ► Modify the existing process to a trickling filter/activated sludge treatment system.

    Each of these alternatives would provide additional organic removal as well as partial ammonia removal at the plant but would require ODEQ approval of an increase in permitted mass discharges. The alternatives were investigated because they appear to be the most cost-effective and reasonable ways to expand the plant and they would meet the effluent limitations established by OAR 340-41-375; however, ODEQ would need to grant a special effluent discharge load limit to the Rogue river for any of these alternatives to be implemented.

- Alternatives 4 and 5 would provide tertiary treatment at the existing Redwood WWTP and would not require a special discharge load limit to the Rogue River. These two alternatives would meet the effluent limitations shown in Table 5-5. These alternatives include:

    - ► Construct a new anoxic selector complete mix activated sludge system with effluent filtration.

    - ► Construct a new sequencing batch reactor (SBR) treatment system with effluent filtration.

    Both of these alternatives would also provide additional organic removal as well as significant ammonia removal at the plant. They would <u>not</u> require ODEQ approval of permitted mass discharge increases and they would meet the effluent limitations established by OAR 340-41-026.

- Alternatives 6 through 12 provide pumping and transmission facilities to convey all of the wastewater to the Grants Pass WRP for treatment.

  This group of alternatives evaluates conveying wastewater to the Grants Pass WRP instead of upgrading the Redwood WWTP. The Grants Pass WRP has adequate treatment capacity available. Each of the six conveyance alternatives considers a different sewer force-main route between the existing Redwood WWTP and the Grants Pass WRP. A more detailed description of these conveyance alternatives is presented later in Subsection 6.5.

6.2 ALTERNATIVES 1, 2, AND 3

Preliminary sizing criteria, for each of the three alternatives investigated that meet the effluent limitations established by OAR 340-41-375 (shown in Table 5-4), are presented in Table 6-1. A short description of each of these three alternatives follows.

Table 6-1
Preliminary Sizing Criteria, New Unit Treatment Processes
Treatment Plant Expansion Alternatives Meeting OAR 340-41-375

Unit Process	Size Criteria
Alternative 1 – Contact Stabilization with Anoxic Selectors	
Anoxic Selector Basins	
No. of Trains	2
No. of Cells	3/Train
Total Volume	10,200 ft^3
Contact Basins	
No. of Trains	2
Total Volume	26,400 ft^3
Depth	15 ft
Stabilization Basins	
No. of Trains	2
Total Volume	26,400 ft^3
Depth	15 ft
Secondary Clarifier(1)	
Diameter	60 ft
Depth	13 ft
Surface Area (effective)	2,714 ft^2
Anaerobic Digesters	
Volume (total of 2)	17,000 ft^3
Diameter	25′ dia. – 20′

Table 6-1
Preliminary Sizing Criteria, New Unit Treatment Processes
Treatment Plant Expansion Alternatives Meeting OAR 340-41-375

Unit Process	Size Criteria
Alternative 2 - SBR (Sequencing Batch Reactor)	
Sequencing Batch Reactor	
Number	2
Dimensions	75′ x 65′ x 17′ SWD
Cycles per Day	5 - summer, 6 - winter
Anaerobic Digesters	
Volume (total of 2)	17,000 ft^3
Dimensions	25′ dia. - 20′ SWD
Alternative 3 - TF/AS (Trickling Filter/Activated Sludge)	
Primary Sedimentation Basins	
Volume	21,000 ft^3
Depth	11 ft
Biofilters	
Number	2
Media Depth	15 ft
Diameter	40 ft
Secondary Clarifier[(1)]	
Diameter	60 ft
Surface Area (effective)	2,714 ft^2
Anaerobic Digesters	
Volume (total of 2)	17,000 ft^3
Diameter	25′ dia. - 20′ SWD

(1) In Alternatives 1 and 3, the existing secondary clarifier also remains in service. A polymer addition system would be provided to improve clarifier performance if the effluent suspended solids limits were not being met.

A new contact stabilization activated sludge process would closely resemble the existing conventional activated sludge treatment process at the plant. In this process the activated sludge returned from the secondary clarifiers is aerated in a separate basin (the stabilization tank) before being mixed with the raw sewage. The combined raw sewage/RAS flow is then aerated using standard DO control in the contact tanks. Unaerated selector zones ahead of the contact tanks would be used to control filamentous bacteria by recycling nitrate-rich mixed liquor into the raw sewage. This alternative would have the least impact to operation and maintenance since the staff is accustomed to the processes and control. Waste-activated sludge from the clarifiers would be sent to the existing aerobic digester. Also, anaerobic digestion facilities would be constructed and are described in Section 6.4. A schematic diagram of this treatment process alternative is presented in Figure 6-1.

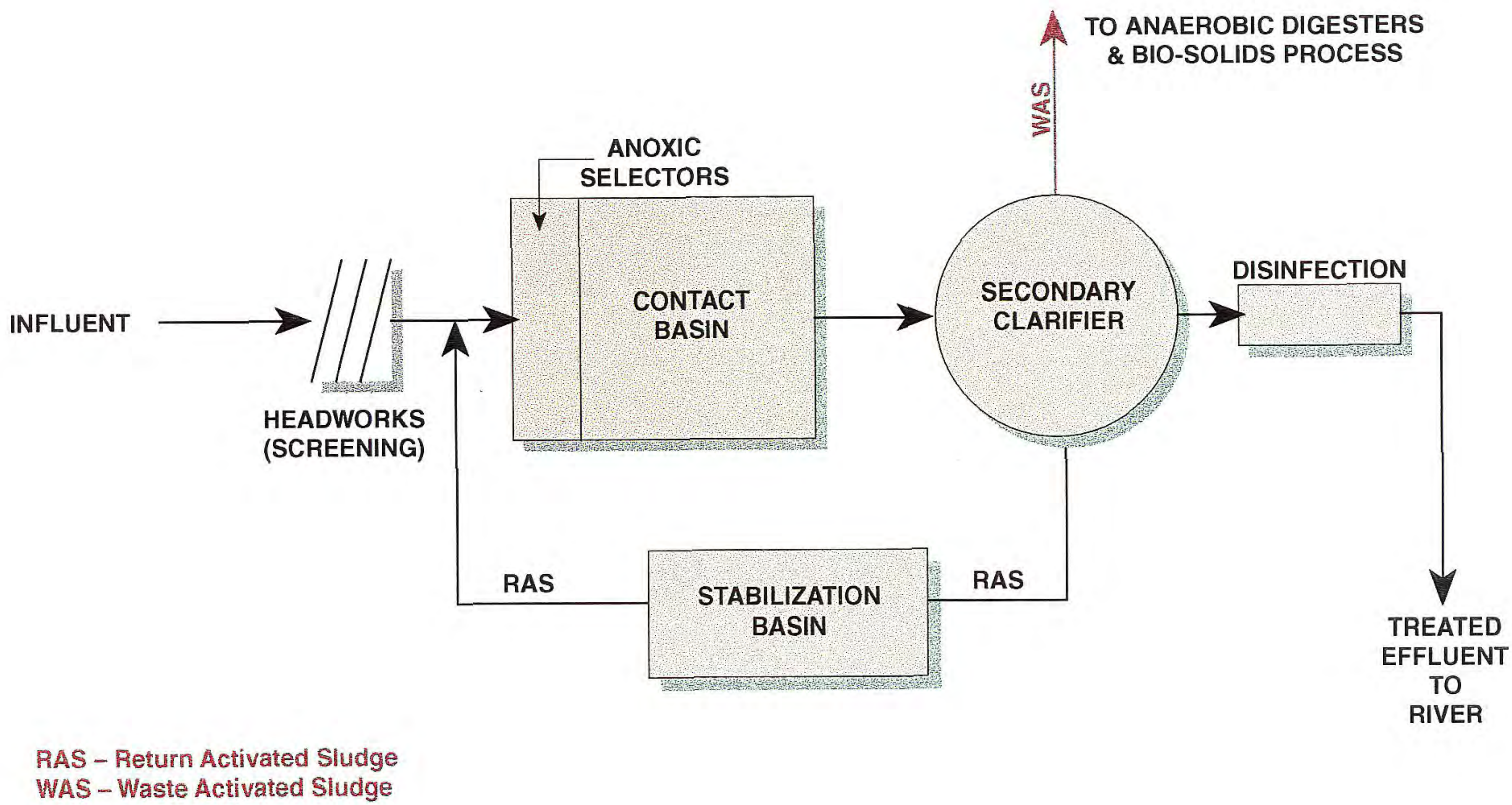


Figure 6-1
Treatment Alternative 1
Construct Stabilization With Anoxic Selectors

NOTE: EXISTING CLARIFIER NOT SHOWN

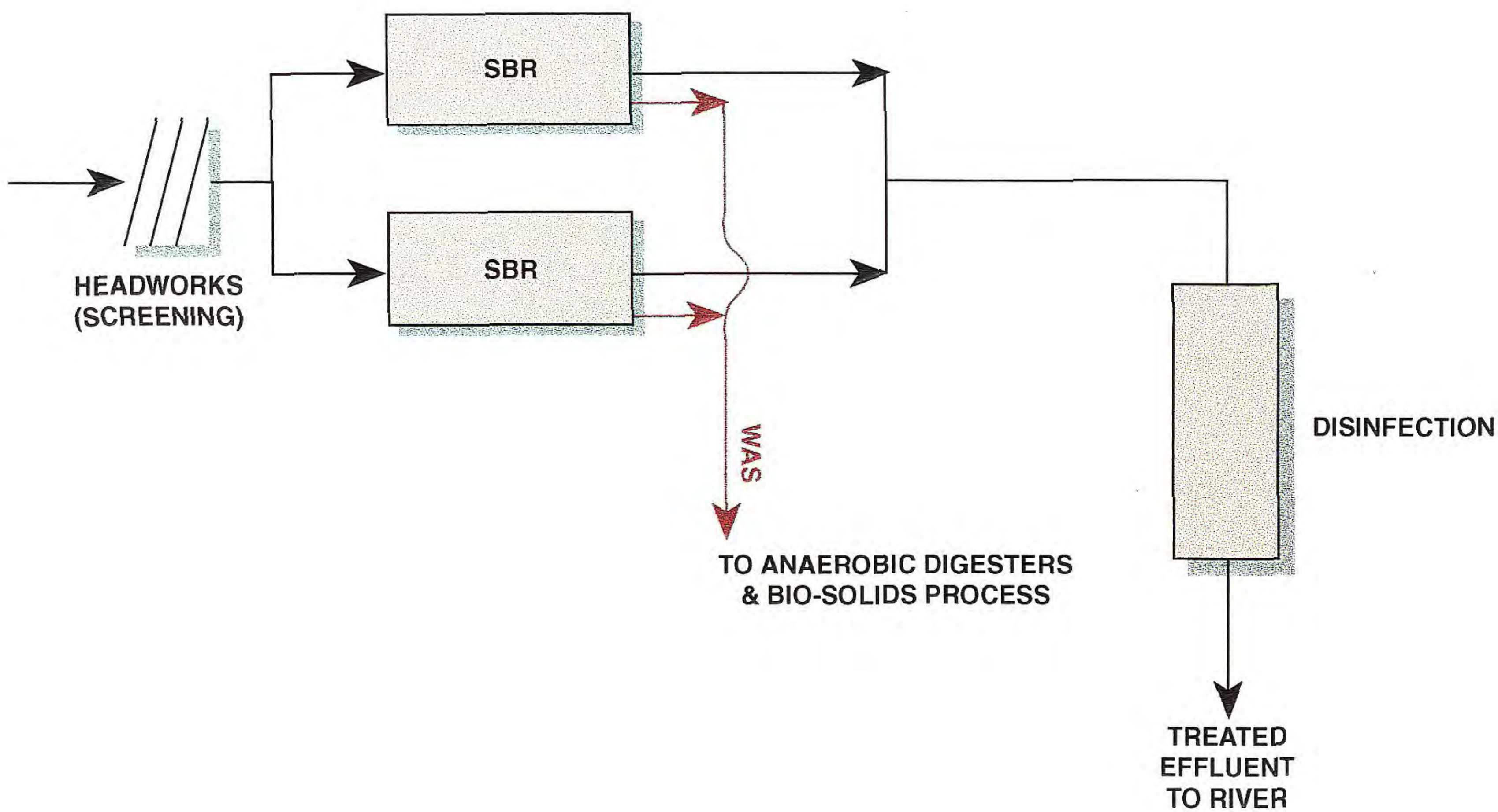
The second alternative considered is a sequencing batch reactor (SBR). Several manufacturers offer these as package units where all of the mechanical equipment required is supplied and installed in concrete tanks and structures built by the Owner. An SBR completes aeration and decanting of the mixed liquor in a single basin in 4- to 6-hour cycles. Two reactors are provided so that while one is filling the other is undergoing aeration and decanting of the clarified secondary effluent. The anoxic selector is created by sequencing aeration and idle cycles in the basin. A schematic diagram of this treatment process is presented in Figure 6-2.

The third alternative considered was the construction of trickling filters upstream of the existing activated sludge process. Trickling filters have been successfully used as an add-on process to provide additional organic and ammonia removal beyond that which can be achieved in the conventional activated-sludge process. Placing trickling filters before the existing aeration basin would require the installation of a primary clarifier between the headworks and the trickling filters. The existing aeration basin would remain in service, and the aerobic digester would be converted to biosolids storage. This alternative would also require the use of filtration for the secondary effluent to assure that a 10/10 effluent could consistently be attained. A schematic diagram of this treatment process is shown in Figure 6-3.

In both Alternatives 2 and 3, anaerobic digestion facilities, which are described in Section 6.4, would be added.

The unit processes associated with each of these alternatives and the use of each existing structure at the plant are summarized below:

Alternative 1	Contact Stabilization Basin with Anoxic Zones - New Secondary Clarifiers - New and Existing Aerobic Digester - Converted to Biosolids Storage Aeration Basin - Abandoned Anaerobic Digesters - New
Alternative 2	SBR - New Aerobic Digester - Converted to Biosolids Storage Aeration Basin - Abandoned Anaerobic Digesters - New
Alternative 3	Primary Clarifier - New Trickling Filters - New Aeration Basin - Existing Secondary Clarifiers - New and Existing Aerobic Digester - Converted to Biosolids Storage Secondary Effluent Filters - New Anaerobic Digesters - New



WAS - WASTE ACTIVATED SLUDGE

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Figure 6-2
Treatment Alternative 2
Sequencing Batch Reactor (SBR)

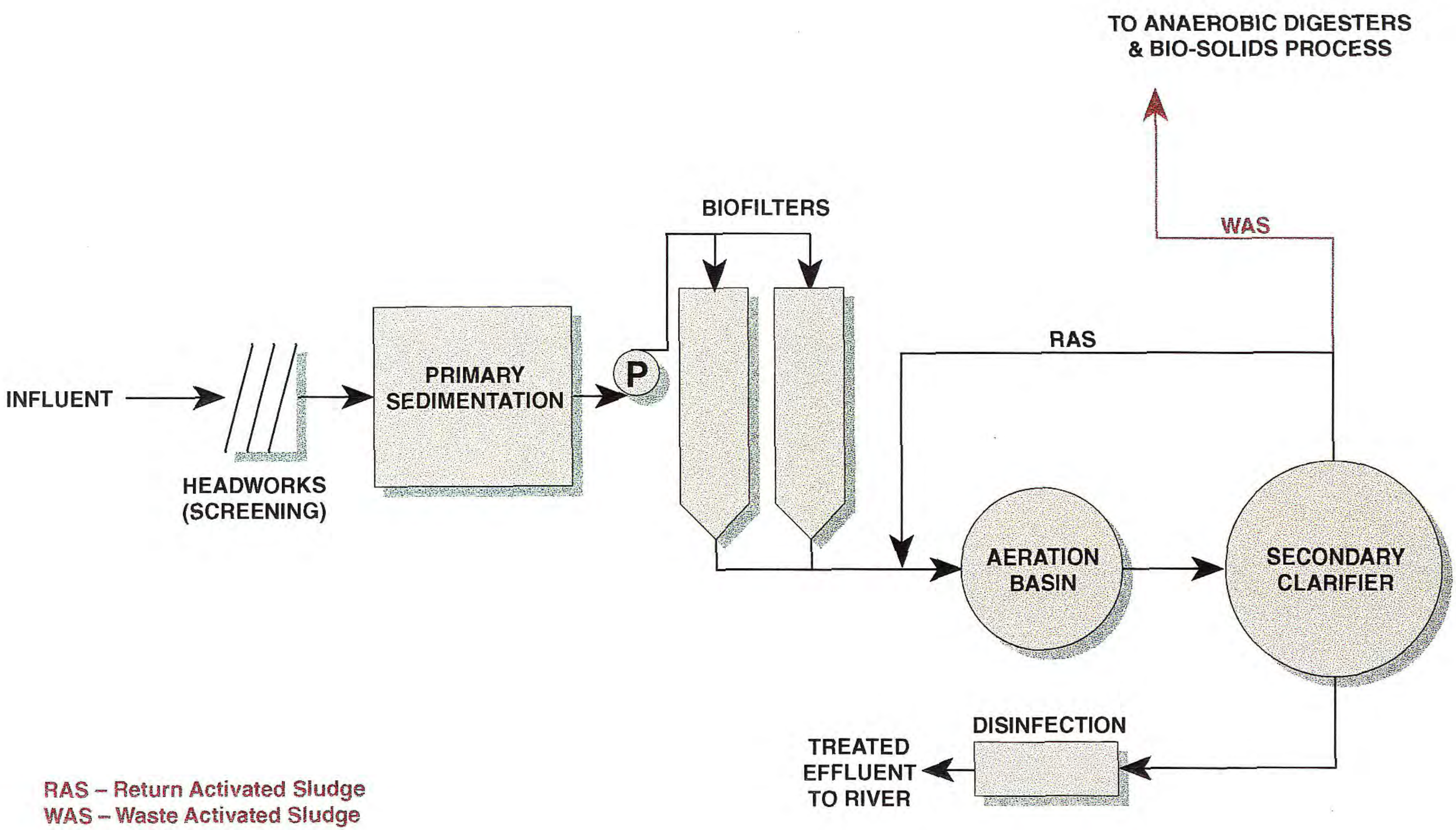

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Figure 6-3
Treatment Alternative 3
Add Biofilter Process

In addition to the three plant expansion alternatives above, several plant improvements are needed, as suggested in Section 5.4. Other plant improvements are also needed to meet future treatment requirements regardless of which of the three expansion alternatives is selected. These improvements include:

- Upgrade the influent pump station to handle future wastewater flows and provide variable-speed pumps. This improvement was identified in Section 5.4.
- Modify the existing headworks to remove the comminutor and install additional screening. This will effectively remove rags and plastics and provide the existing screen as a backup unit.
- Provide adequate disinfection for future wastewater flows.
- Investigate the need for an emergency effluent pump station to provide for effluent discharge to the river during high river elevations.

To reduce the effect of the influent pump operation on downstream treatment processes, it is recommended that variable-speed pumps be installed. Originally, there were mechanical devices to regulate the flow, but this system no longer functions. Installation of variable-speed pumps would allow treatment units at the plant to operate more efficiently.

It is also recommended that a new screen be installed. Presently, the comminutor is used at the headworks, but this merely grinds large solids into a smaller, more manageable size material. Unwanted debris, hair, and plastics are still in the wastewater stream. It would be better for equipment and the composting operation if these materials could be removed. A screen installed in the present headworks would perform this function. The headworks structure would have to be modified, however, to accommodate a new screen. This would include raising the outside walls to provide for adequate hydraulic capacity.

To provide for future disinfection, a new ultraviolet disinfection system would be required.

An emergency effluent pump station may also be a required plant improvement. If required, effluent pumps would be sized to match influent pumping capacity.

Recent Rogue River flood elevation mapping has apparently raised the projected 100-year flood elevations in the river at the plant site from those previously identified. At this new higher projected elevation, wastewater flows can no longer gravity discharge to the river as suggested in the original 1977-78 design. Instead, an effluent pump station would be necessary to ensure plant discharge capabilities during extreme river floods.

During design of any plant improvement, the need for an effluent pump station would be carefully evaluated. An analysis of the need for an effluent pump station would be based on the hydraulics of the expanded process which would show the effects of an extreme flood condition at the plant.

6.3 ALTERNATIVES 4 AND 5

Preliminary sizing criteria for each of the two alternatives investigated which meet the effluent limitations established by OAR 340-41-026 (shown in Table 5-5) are presented in Table 6-2.

Table 6-2
Preliminary Sizing Criteria, New Unit Treatment Processes
Treatment Plant Expansion Alternatives Meeting OAR 340-41-026

Unit Process	Size Criteria
Alternative 4 – Complete Mix/Anoxic Selector with Effluent Filtration	
Anoxic Selector Basins	
No. of Trains	2
No. of Cells	3
Total Volume	10,300 ft^3
Anoxic Basins	
No. of Trains	2
No. of Cells	1
Total Volume	29,800 ft^3
Aeration Basins	
No. of Trains	2
No. of Cells	2
Total Volume	121,000 ft^3
Secondary Clarifier(1)	
Diameter	60 ft
Depth	13 ft
Surface Area (effective)	2,714 ft^2
NOTE: Polymer addition system would be provided to improve clarifier performance if 10 mg/ℓ suspended solids limits were not being met.	
Effluent Filtration System	
Average Daily Loading	4 gpm/ft^2
Maximum Daily Loading	6 gpm/ft^2
Total Surface Area	360 ft^2, minimum

Table 6-2 Preliminary Sizing Criteria, New Unit Treatment Processes Treatment Plant Expansion Alternatives Meeting OAR 340-41-026	
Unit Process	**Size Criteria**
Alternative 5 – SBR with Effluent Filtration	
Sequencing Batch Reactor	
Number	2
Dimensions	75′ x 65′ x 17′ SWD
Cycles per Day	5 – summer, 6 – winter
Anaerobic Digesters	
Volume (total of 2)	17,000 ft^3
Dimensions	25′ dia. - 20′ SWD
Effluent Filtration System	
Average Daily Loading	4 gpm/ft^2
Maximum Daily Loading	6 gpm/ft^2
Total Surface Area	360 ft^2, minimum

(1) In Alternative 4, existing secondary clarifier remains in service.

A new anoxic selector complete mix activated-sludge process would closely resemble the existing conventional activated-sludge treatment process at the plant but would be much larger. In this process, the return activated sludge from the secondary clarifiers would be returned to the anoxic selector basins to be combined with raw sewage. Also, mixed liquor would be recycled to the anoxic selector to provide for substantial ammonia removal. To meet effluent limitations of OAR 340-41-206, effluent filtration would be required. A schematic diagram of this treatment process is presented in Figure 6-4.

The second alternative being considered to meet the effluent limitations of OAR 340-41-026 is an SBR with effluent filtration. This alternative is essentially identical to Alternative 3 presented in Section 6.1.1, except that it also includes effluent filtration. This alternative also requires a flow equalization basin prior to effluent filtration due to flow fluctuations from the SBR process. A schematic diagram of this treatment process is presented in Figure 6-5.

For both Alternatives 4 and 5, anaerobic digestion would be added as described in Section 6.4.

The unit processes associated with each of these alternatives and the use of each existing structure at the plant are summarized below:

Alternative 4

Anoxic Selector/Anoxic/Aeration Basin – New
Secondary Clarifiers – New and Existing
Filtration – New
Aerobic Digester – Converted to Biosolids Storage
Aeration Basin – Abandoned
Anaerobic Digesters – New

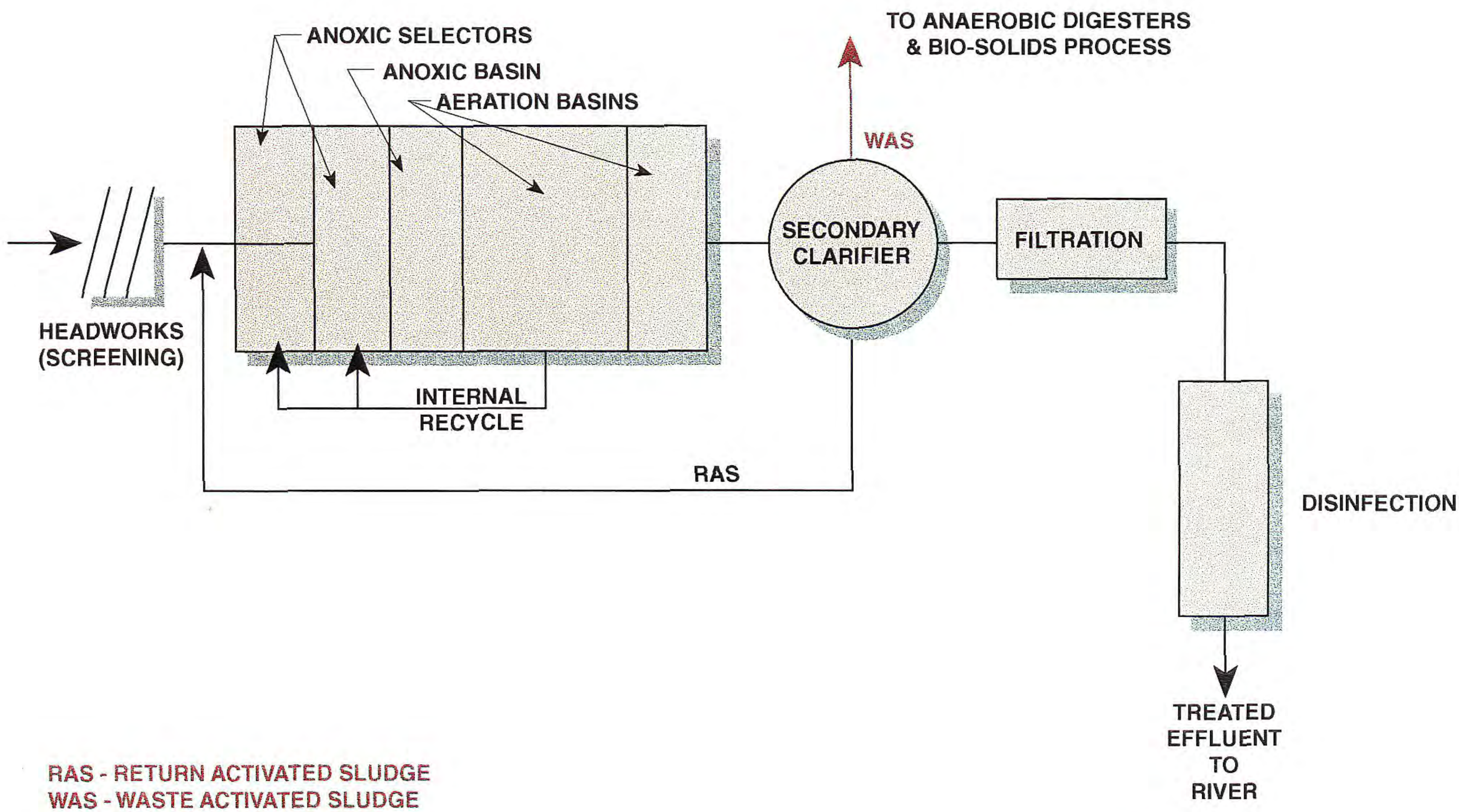

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Figure 6-4
Treatment Alternative 4
Complete Mix/Anoxic Selectors
With Effluent Filtration

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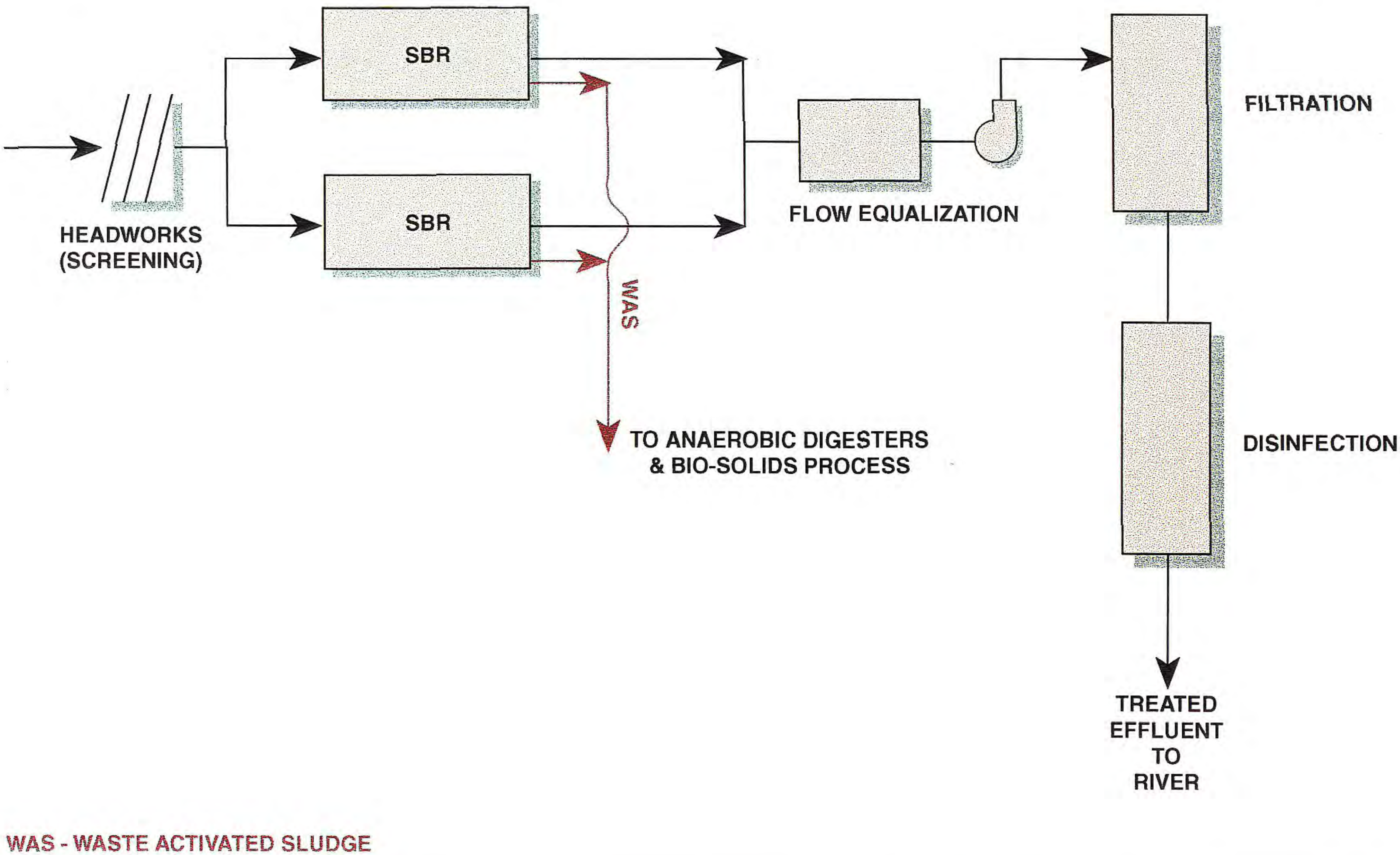


NOTE: EXISTING CLARIFIER NOT SHOWN

Figure 6-5
Treatment Alternative 5
Sequencing Batch Reactor
(SBR) With Effluent Filtration

Alternative 5	SBR - New Flow Equalization - New Filtration - New Aerobic Digester - Convert to Biosolids Storage Aeration Basin - Abandoned Anaerobic Digester - New

Similar to the three plant alternatives discussed in Section 6.1.1, several plant improvements are also needed as part of Alternatives 4 and 5, as suggested in Section 4. All of these improvements are provided in either Alternative 4 or 5.

6.4 NEW BIOSOLIDS TREATMENT PLAN

Regardless which of the Alternatives 1 through 5 are evaluated, new biosolids treatment facilities will be necessary at the Redwood WWTP. This is because the existing biosolids composting operation has been ordered to close in October 1999.

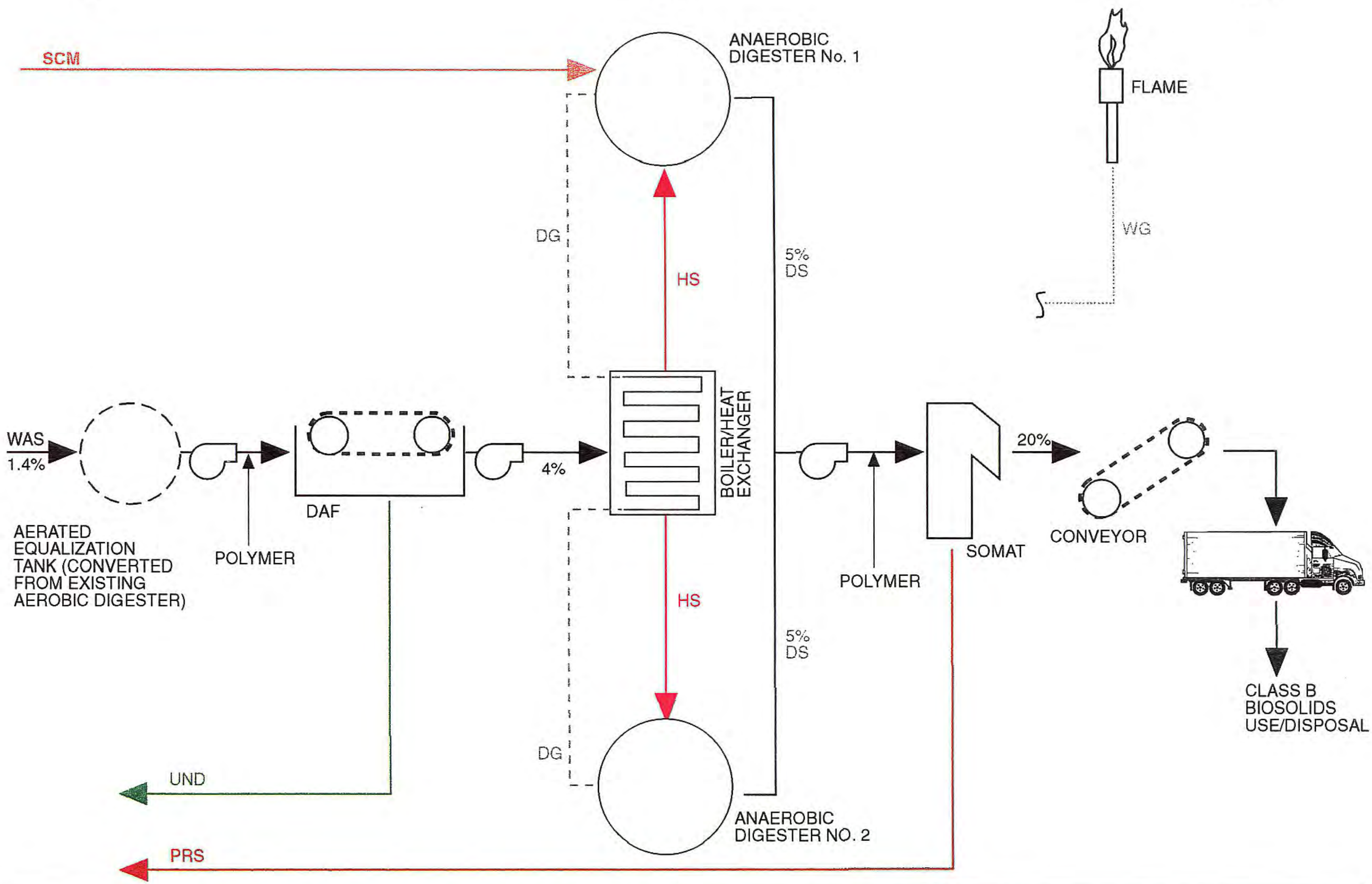
The District's biosolids composting facility, which has been in operation since 1988, aerobically digests sludge and blends it with yard waste, saw dust, lumber waste and livestock bedding to produce a material sold as a soil amendment. The composting operation is designed as a process to further reduce pathogens (PFRP), sometimes referred to as Class A biosolids treatment.

Concerns about odor and dust generation from the composting operation are the main reasons why composting must be closed in 1999. Wastewater treatment alternatives 1 through 5 therefore need to include a new biosolids treatment and disposal process. The existing aerobic digesters do not have adequate future solids loading capacity nor can they meet PFRP standards. The Grants Pass WRP uses anaerobic digesters to treat biosolids before they are land applied. For evaluation purposes, it was assumed that the Redwood WWTP would also require new anaerobic digesters. The biosolids would then be land applied, which is similar to the biosolids handling and disposal plan currently used at the Grants Pass Facility.

6.4.1 Anaerobic Digestion Process Description

Anaerobic digestion is a biological process that uses bacteria, in an oxygen-free environment, to convert volatile solids into carbon dioxide, methane, and ammonia. The best suited anaerobic digester for the Redwood WWTP would be a mesophilic single-stage, high-rate digester. High-rate anaerobic digestion combines active mixing and carefully controlled, elevated temperature to increase sludge stabilization rate. Figure 6-6 shows a process flow diagram for this system.

Temperature variations are more critical to the anaerobic digestion process than the aerobic digestion process, and careful temperature control is required to avoid process upsets. The Redwood WWTP anaerobic digesters would be operated in the mesophilic temperature range of 30 to 38°C. Gas production, a by-product of anaerobic digestion, is optimized in this range.



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SCM - Scum
WAS - Waste Activated Sludge
SUP - Supernatant
CEN - Centrate

PRS - Pressate
UND - Underflow
HS - Heated Sludge

DS - Digested Sludge
DG - Digested Gas
WG - Waste Gas

Figure 6-6
Anaerobic Digestion Flow Schematic

A typical municipal anaerobic digester handling primary and waste-activated sludge should produce approximately 15 to 18 cu-ft gas/lb of volatile suspended solids (VSS) destroyed. The amount of gas produced is a function of temperature, sludge retention time, and volatile solids loading. Methane and carbon dioxide are the two main constituents of digester gas, nitrogen, hydrogen, and hydrogen sulfide are found in trace amounts. Methane concentrations range from 60 to 70 percent by volume. Typical digester gas has a heat content between 500 to 700 BTU/cu-ft and may be used as a fuel supply for heating incoming sludge or for space heating of WWTP buildings. For periods when digester gas production is low, natural gas may be used as a supplemental fuel source.

Two types of covers are available for anaerobic digesters: fixed and floating. Floating covers may either directly float on the sludge, or rest on side skirts and float on the gas (gas holder type). Floating covers are generally more expensive than fixed types, but provide better safety against explosions. The District may wish to consider the benefits of floating covers at a later time; however, a fixed cover is used in this analysis.

Several heating methods have been used with anaerobic digesters, including submerged burners, steam injection, internal heat exchangers, and external heat exchangers. External heat exchangers are the most popular because of their flexibility and ease of maintenance. This type of heat exchanger is recommended for the Redwood WWTP.

Three general mixing methods have been used in anaerobic digesters: mechanical, pumped, and gas recirculation. Mixing the digester contents minimizes thermal stratification, disperses the substrate for better contact with the active biomass, reduces scum and grit buildup, dilutes any inhibitory substances or adverse pH and temperature feed characteristics, increases the effective volume of the reactor, allows reaction gases to separate more easily, and keeps more inorganic material in suspension. A gas recirculation system was chosen for this evaluation. Mechanical mixers and pump impellers are subject to wear resulting from grit and debris abrasion. The Redwood WWTP has no grit removal facilities, so grit is expected to accumulate in the digesters. The digester should be designed with highly sloped floors, several withdrawal ports, and easy access though wall openings near the ground to facilitate cleaning and grit removal.

The first step of this process would be aerated equalization. Equalization prior to thickening would facilitate even feeding of the thickening device. Next, sludge is thickened prior to anaerobic digestion, which reduces sludge heating and tank volume requirements. Pre-thickening the sludge also helps maintain constant feed conditions to the reactor. With dissolved air floatation thickening, some grit can be removed prior to digestion. Following thickening to approximately 4 percent solids, the sludge is transferred into the anaerobic digesters. Digester gas is fed into a boiler. Waste gas in excess of that needed for the boiler and gas mixing systems would be flared or alternately stored during periods when gas production is low. A heat exchanger transfers heat from the boiler to feed sludge. Following anaerobic digestion, the sludge is dewatered in the most cost-effective device, a SOMAT press, and subsequently conveyed to a trailer for hauling.

Chemical feed systems may be necessary if changes in alkalinity, pH, sulfides, or heavy metals cause process upsets. The ability to feed certain chemicals such as sodium bicarbonate, ferrous chloride, ferrous sulfate, lime, and alum should be considered early in the design process. Chemical feed equipment would include standby chemical metering pumps, several points of application, and associated piping.

To facilitate process control, all water, sludge, and gas flows should be metered. Sight access ports should be provided on the digester tank as well as 36-inch-diameter manholes in the roof and on the lower portions of the digester tanks to facilitate cleaning.

The major advantages of anaerobic digestion include the following:

- Excess energy over that required by the process is produced. Methane can be used to heat and mix the reactor. Excess methane gas can be used to space heat.
- The quantity of total solids is reduced over the aerobic digestion process. About 30 to 40 percent of the total incoming solids may be destroyed.
- The product is a stabilized sludge, that may be free from strong or foul odors.

The major disadvantages of anaerobic digestion are as follows:

- The digester is easily upset by unusual or erratic conditions and therefore requires increased operator attention; it is also slow to recover.
- Anaerobic digestion requires more equipment than other processes (i.e., boiler, heat exchanger, waste gas flare), and this greatly increases system complexity.
- Cleaning operations are difficult because the reactors are closed vessels.
- Grit can accumulate in the reactors, and grit removal facilities are not currently part of the Redwood WWTP design.
- A natural gas main would need to be constructed from the Redwood Elementary School to the plant to supplement digester gas when digester gas production is low. This gas main may cost the District as much as $50,000 per mile (Ball, E., October 17, 1996).
- There is a possibility of explosion as a result of inadequate operation and maintenance, leaks, or operator carelessness.
- Gas line condensation or clogging can cause major maintenance problems.

6.4.2 Preliminary Design Criteria

Factors that govern the design of anaerobic digestion systems include feed characteristics, temperature, solids loading, detention time, mixing method, heating requirements, and energy recovery. Design parameters were evaluated, and suitable preliminary design criteria and equipment selected for an anaerobic digestion system at the Redwood WWTP. Preliminary design criteria are listed in Table 6-3.

Table 6-3
Anaerobic Digestion Preliminary Design Criteria

Volatile Suspended Solids Reduction (minimum):	40 - 60%
Total Solids Reduction:	33 - 50%
Detention Time:	18 days
Design Temperature:	35°C
Feed Concentration:	4.0%
Feed Rate (maximum month):	8,540 gpd
Solids Loading (maximum month):	0.13 lbs VSS/cu-ft/day
Anaerobic Digesters:	
Number:	2
Material:	Concrete
Type:	Aboveground
Volume (each):	128,000 gal
Diameter:	25 feet
Height:	20 feet
Cover:	Fixed
Floor Slope:	1:6
Aerated Equalization Tank (existing):	
VSS Reduction:	<9%
Digester Mixing:	
Type:	Gas recirculation
Gas Requirement:	55 - 75 scfm/compressor
Power Consumption:	2½ HP
Foam Cutters:	Included
Digester Heating:	
Boiler type:	Recirculating water
Gas Production:	18,000 cu-ft/day
Methane Content:	66.6%
Minimum Incoming Sludge Temperature:	15°C
Heat Value of Gas:	+ 7.0 million BTU/day
Requirement for Sludge Heating:	- 2.6 million BTU/day
Transfer Losses (tank, floors, walls)	- 2.1 million BTU/day
Net Heat Surplus (deficit):	2.3 million BTU/day

6.4.3 Site Plan

Figure 6-7 shows how the facilities might be placed on the site. Ample space exists for all proposed facilities. The biosolids handling building footprint is based on space requirements for a dissolved air floatation thickener and SOMAT press for dewatering device. An integral digester operations and control building is located between the two digesters. This building would contain the boiler and heat exchanger, process pumps, polymer feed equipment, piping, valves, flow meters, and appurtenances. A biosolids pump station adjacent to the equalization tank pumps sludge to the thickening device. Gas storage and odor control facilities are not included in this evaluation. Facilities are grouped together to minimize site piping.

6.4.4 Capital and Operations and Maintenance Costs

The estimated cost to construct anaerobic digesters is $3,370,000 ($2,590,000 without contingency). A detailed breakdown estimate of probable costs is presented in Appendix G. Included in this estimate are two aboveground concrete digester tanks with fixed covers, vessel access platforms and ladders, integral operations building, thickened sludge transfer pumps, conversion of existing aerobic digester to an aerated sludge equalization tank, equalization transfer pumps, yard piping, dedicated trailer for dewatered sludge storage, interconnecting piping, valves, and appurtenances, reactor design, installation, start-up and training services. Sludge thickening and dewatering facilities are estimated separately. Additional facilities that may be needed upon further review, such as polymer feed equipment and waste gas scrubbing equipment, are not included in this estimate. It is assumed no natural gas will be used in the process.

Operations and maintenance costs shown in Appendix G include pumping of thickened sludge, equalized sludge, and digested sludge; conveying dewatered sludge; and compressing digester gas for mixing requirements. Sludge thickening and dewatering labor requirements, as well as polymer costs, are included. Heating energy for the anaerobic digestion process is supplied primarily by digester gas recovery.

6.4.5 Preliminary Screening of Alternatives 1 Through 5

To reduce the complexity of evaluating twelve different alternatives, a preliminary screening of Alternatives 1 through 5 was conducted based on cost. Capital cost estimates for the each of these five alternatives, which include the cost of new biosolids treatment, are shown in Table 6-4. Detailed cost estimates are included in Appendix G. Operation and maintenance cost estimates for each of these alternatives are summarized in Table 6-5. Also shown in this table is the operation and maintenance cost of the existing Redwood WWTP for 1999.

Based on cost, Alternative 1 - Contact Stabilization and Alternative 4 - Complete Mix/Anoxic Selector/Filter were selected for further comparison to Alternatives 6 through 12.

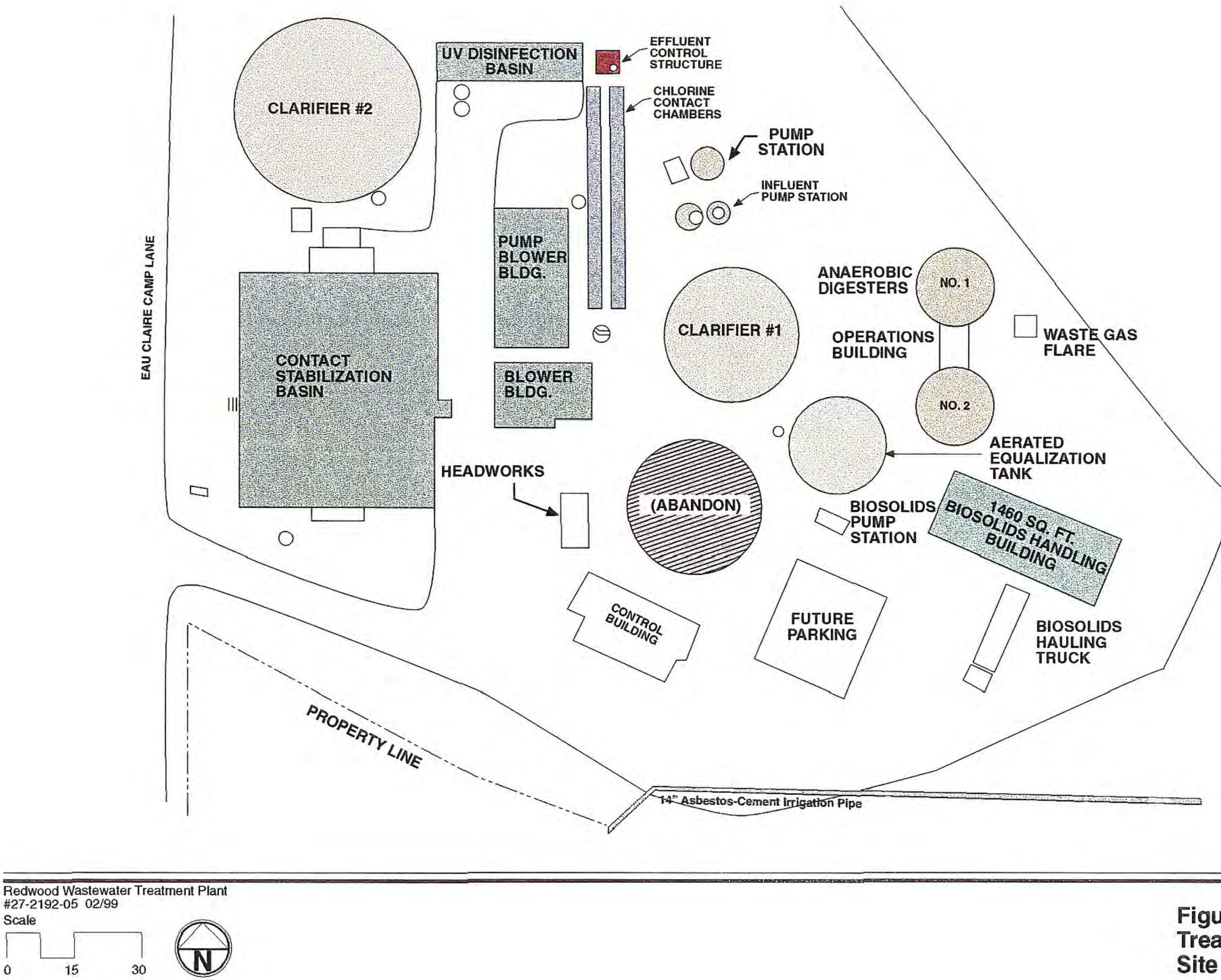

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Figure 6-7
Treatment Option Site Plan

Table 6-4 Treatment Alternatives 1 through 5 Estimate of Probable Costs (costs in $1,000s)					
Wastewater Process	**Alt. 1 Contact Stabilization**	**Alt. 2 SBR**	**Alt. 3 Trickling Filter**	**Alt. 4 Complex Mix Anox Select Filter**	**Alt. 5 SBR Filter**
Biofilters	--	--	$719	--	--
Aeration Basin	$1,239	--	--	$1,742	--
Secondary Clarifier	$513	--	$513	$513	--
SBR Basin	--	$1,717	--	--	$1,585
Blower Building	$129	--	--	$129	$123
Primary Sedimentation	--	--	$586	--	--
Package Filtration	--	--	$409	$409	$409
Effluent EQ	--	$95	--	--	$95
Influent Pump Stn Mods	$113	$148	$115	$113	$148
Headworks Mods	$121	$161	$56	$121	$161
UV Disinfection	$315	$315	$315	$315	$315
Site/Civil	$72	$72	$72	$72	$72
Yard Pipe	$72	$72	$72	$108	$108
Electrical	$433	$433	$503	$559	$475
Subtotal	**$3,008**	**$3,014**	**$3,356**	**$4,082**	**$3,491**
Biosolids Process	$2,590	$2,590	$2,590	$2,590	$2,590
Contingency, 30%	$1,679	$1,681	$1,784	$2,002	$1,824
Subtotal Construction	**$7,278**	**$7,285**	**$7,730**	**$8,673**	**$7,906**
Engineering and Admin, 22%	$1,601	$1,603	$1,701	$1,908	$1,739
Total Project Cost(1)	**$8,880**	**$8,890**	**$9,430**	**$10,580**	**$9,650**

(1) Rounded to three significant figures.

Table 6-5 Treatment Alternatives 1 through 5 Annual O&M Costs						
	Existing Plant	Alt. 1 Contact Stabilization	Alt. 2 SBR	Alt. 3 Biofilter	Alt. 4 Comp Mix Effluent Filter	Alt. 5 SBR with Effluent Filter
Salary and Wages	$55,500	$73,800	$73,800	$73,800	$84,300	$84,300
Employee Benefits	$18,949	$25,250	$25,250	$25,250	$28,850	$28,850
Supply and Material	$24,808	$27,808	$26,400	$29,800	$31,500	$31,000
Services	$55,835	$77,235	$76,800	$80,500	$82,500	$81,500
Interfund and Inter Gov.	$123,254	$136,700	$135,500	$144,000	$146,000	$145,000
Capital Replace/ Improvements	$39,870	$49,370	$49,370	$51,400	$55,400	$55,400
Subtotal	**$318,216**	**$390,163**	**$387,120**	**$404,750**	**$428,550**	**$426,050**
Anaerobic Digestion	$193,760	$193,760	$193,760	$193,760	$193,760	$193,760
Total O&M Cost(1)	**$512,000**	**$584,000**	**$581,000**	**$599,000**	**$622,000**	**$620,000**

(1) Rounded to three significant figures.

6.5 ALTERNATIVES 6 THROUGH 12

An alternative to upgrading the Redwood WWTP (Alternatives 1 through 5) would be to convey all wastewater to the Grants Pass WRP for treatment. This option is evaluated in Alternatives 6 through 12. Each of these alternatives utilize a slightly different route of conveying wastewater between these two points. In each case, a conveyance system consisting of either one or two pump stations and associated sewer force mains would be used to transfer all wastewater flow from the Redwood WWTP to the Grants Pass WRP, where it would be treated.

For any of these alternatives, centralized wastewater treatment for the entire Grants Pass area is provided at one treatment plant rather than at two plants. This reduces the operation and maintenance costs significantly. The following information is presented in this section for each of these alternatives.

- Design criteria
- Description of alternatives
- Capital costs estimates
- Preliminary screening of alternatives

6.5.1 Design Criteria

Based on the existing wastewater flow data presented in Table 4-1 and the wastewater flow projections presented in Table 5-1, Alternatives 6 through 12 design criteria are presented in Table 6-6.

Table 6-6
Treatment Alternatives 6 through 12
Design Flows

Item	1998 Actual	2020 Estimated
Average Flow, mgd		
Summer	0.49	0.88
Winter	0.63	1.22
Annual	0.56	1.05
Max. Day, mgd		
Summer	0.77	1.43
Winter	1.79	3.08
Min. Day, mgd	0.28	0.76

Pump Stations

To ensure that the facility has adequate capacity, a peaking factor was applied to maximum daily flow to obtain a peak hourly design flow of 4.2 mgd. Designing conveyance facilities that would handle such a large range of flow, 0.28 mgd to 4.2 mgd, is not a simple task. The pump station would also be required to have standby pumping capacity. State guidelines require that pump station capacity be met with the largest pump out of service.

Alternatives discussed later in this section include either one pump station or two pump stations. The larger pump station in the two-station alternative is very similar to that required for the single station alternatives. Design of this pump station would be based on the selected pipeline route but can be summarized for all alternatives as follows:

- Three pumps (one stand-by)
- 1,460 gpm, each pump (2.1 mgd each)
- Approximate total pumping head: 180 to 200 feet depending on route selection
- Variable speed drives

It is recommended that variable speed drives be used on the large pump station because of the high head associated with the peak flows. Variable speed drives will result in lower electrical costs and more continuous flow to the Grants Pass WRP.

To provide the high head required to convey the wastewater five to six miles to the Grants Pass WRP, it is necessary for the pump station to either consist of several sets of two pumps in series or operate single pumps at higher speed (1,800 rpm). The cost estimates in this report are based on 1,800 rpm pumps. This is because the cost to operate two pumps at a slower rpm in series would be more expensive than the cost to operate larger single pumps.

High-head pumping stations with long force mains often experience surge conditions. During design, the conveyance system should be analyzed to determine the surge conditions and provide appropriate protection as needed.

If there is only one pump station, it will be located at the same location and depth as the Redwood WWTP influent pump station (RI-0). The structure housing the pumps will be approximately 23 feet deep. The existing WWTP influent pump station dry well is too small and will be replaced with a new dry well large enough for the three pumps. An above-grade structure will house the chemical injection system, motor control center, and emergency generator.

It appears that the existing wet well could be used for two pumps. The two existing 12-inch suction pipes are adequately sized for the new pumps.

Alternatives involving two pumping stations locate a small pump station at the existing Redwood WWTP (RI-0) and a second larger pump station at manhole RI-25. Manhole RI-25 is near the north end of Darneille Lane, and near the west boundary of the designated urban growth area. Pump Station RI-0 would accept flow that is collected from the area west of RI-25 and would pump it to the larger station through a force main.

Construction of the small pump station at RI-0 would involve replacing the pumps and some of the electrical and mechanical equipment in the existing influent pumping station. The new pumps would each be sized for 0.5 mgd (350 gpm) at 40 feet of total pumping head, based on a 6-inch force main going to the larger pump station at RI-25. These pumps would likely need to be upgraded in year 2020.

Sewer Force Main

Because raw wastewater contains grit and other solids, force main flow velocity is a critical design factor. If the wastewater velocity in the force main is too fast, the grit and sand can prematurely erode the inside of the pipe. If the flow velocities are too slow, solids will settle and accumulate in the pipe causing sedimentation and pipe blockage. The design criteria for any force main is as follows:

- Provide minimum pipe scour velocity for the following conditions:
  - Noncontinuous flow: 3 feet per second at start-up and ultimate peak flows
  - Continuous flow: 2.0 feet per second

- Keep pump head below 100 feet if possible

Based on the above criteria, preliminary design is based on the providing twin 12-inch force mains with Class 250 pressure rating.

The advantages to providing the twin force mains would be as follows:

- Allows for adequate scour velocity at start-up flows while minimizing pumping head at ultimate flows.

- Reduces odor and corrosion problems by reducing detention time in the pipeline and providing better scouring action.

- Allows for maximum pump turn down and optimum pump selection.

- Reduces initial peak flows to the Grants Pass WRP, by allowing for variable speed drives or a smaller lead pump.

Operating the conveyance system involves selecting the appropriate pipe (or pipes) to provide capacity and maintain proper scour velocities. Pipe selection will be done by valve manipulation at the pump station, either manually or automatically. In the first five years of operation, only one pipe will be used, except during occasional very high flows. Ultimately, the conveyance system valves will be set for continuous use of both pipes.

Odor and Corrosion Control

Generally, for long sewage force mains experiencing varying flows and detention times, it is necessary to provide odor and corrosion protection. Preliminary design for the conveyance system is based on providing the following methods of minimizing odor and corrosion:

- Two points of chemical injection: One at Pump Station RI-0, and one at a single point along the pipeline route (at Pump Station RI-25 for the two station alternatives).

- Activated carbon canisters at any automatic air release valves

The wastewater constituent responsible for most odor and corrosion problems is hydrogen sulfide (H_2S). Many of the other odor compounds in the wastewater are also reduced by targeting H_2S.

A variety of chemicals have been used to oxidize H_2S. The two most common for wastewater force mains are sodium hypochlorite and hydrogen peroxide. Sodium hypochlorite injection is less costly to operate; however, hydrogen peroxide provides the added benefit of providing residual oxygen to limit the reformation of H_2S. Another product available for odor control is Bioxide™. These three systems should be evaluated during detailed design.

Automatic air release valves will be provided at any high points in the pipeline. They are a potential source of odor, particularly during low summer flows. To minimize these odors, activated carbon canisters will be connected at the exhaust of each air release valve.

6.5.2 Description of Alternatives 6 Through 12

Seven potential pipeline routes were investigated for this study. The two most critical factors in selecting the route are the location and method of crossing the Rogue River and length of roadway to be disturbed.

River Crossing Alternatives

The following options for crossing the river were investigated:

- Open cut the river crossing
- Tunnel (boring) under the river
- Cross the river at the proposed pedestrian bridge near the Grants Pass WRP
- Cross the river at the existing bridge for SR 199

Tunnel crossing or open-cut alternatives would require investigation of geotechnical and bathymetric conditions. There are many potential locations for either of these options, but only two of the more feasible locations were evaluated.

Open Cut Crossing

A cross section of the river crossing near the Redwood WWTP (Figure 6-8) shows that the depth of the water is too shallow for laying the pipe on the river bottom and the pipe would need to be buried. In the figure, cover over the pipe is shown at 6 feet. Because of natural resource complications, the relatively long time needed to obtain a permit, and the potential for public resistance, this option was not further investigated.

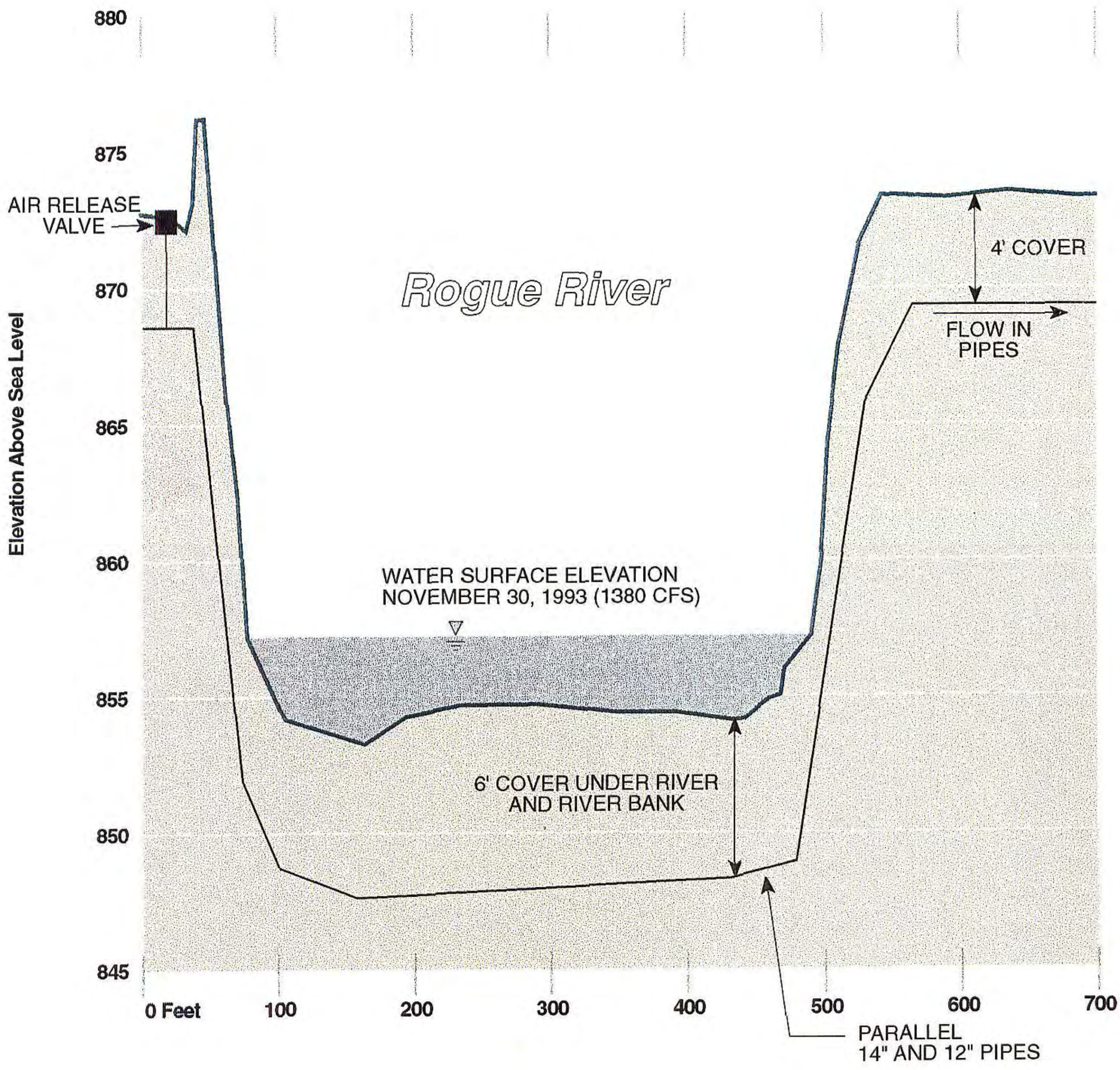

Figure 6-8
Rogue River Crossing
Cross Section

Tunnel (Boring) Under the River

Boring a pipeline under the river would be more feasible (from a permitting standpoint) than open cut crossing. The likely method would be directional drilling; the advantages and disadvantages of this alternative are presented here:

Advantages:

- No disruption to river
- Lower pump head than bridge crossings

Disadvantages:

- Requires geotechnical and bathymetric investigation to choose the best location for the river crossing
- Potentially the most expensive type of crossing
- If large boulders are encountered during the boring, the drill would have to be retracted and reset on a different path.

Use Proposed Pedestrian Bridge Crossing

A ribbon-type pedestrian bridge to be built about 500 feet west of Grants Pass WRP could be adapted to carry the pipeline. The advantages and disadvantages of this alternative are as follows:

Advantages:

- Least expensive type of crossing
- No disruption to river; few or no natural resource permits

Disadvantages:

- Must act quickly to coordinate with the City of Grants Pass to incorporate any necessary modifications to pedestrian bridge

- The bridge design has two high points. The force main at these locations will require air release valves.

- Provide odor control for the air release valves

- Possibility of a break in the force main at the river crossing releasing raw sewage to Rogue River.

Use of SR 199 Bridge

This existing bridge carries motor traffic across the Rogue River west of the Redwood WWTP. The advantages and disadvantages of this alternative are as follows:

Advantages:

- Existing bridge
- No disruption to river
- Air release valves can be more easily located

Disadvantages:

- Longest route (additional 7,000 feet longer than alternative routes)
- High cost due to added length

Because of the high cost of this alternative, it was dropped from further consideration.

Based on the preceding river crossing evaluation, the two most feasible alternatives that were selected for further cost evaluation are 1) attaching force main(s) to the pedestrian bridge and 2) boring force main(s) under the river. An estimate of probable costs for both of these options is included in Appendix H.

Force Main Routes

Once the river crossing alternatives were narrowed down to the two most feasible options, seven alternative force-main routes were evaluated. These seven routes are shown on Figure 6-9 and designated Alternatives 6 through 12. A brief description of each alternative is as follows:

Alternative 6: Dual 12-inch force mains would be bored under the Rogue River just north of Redwood WWTP, then the force mains would follow the right-of-way of Lower River road and Webster Lane to the Grants Pass WRP Plant.

Alternative 7: A 6-inch force main would be placed in an existing sewer interceptor easement between Redwood WWTP and pump station RI-25. From there dual 12-inch mains would be bored under the Rogue River. From the Lathrop boat landing, the force mains would follow the right-of-way of Lower River Road and Webster Lane to the Grants Pass WRP.

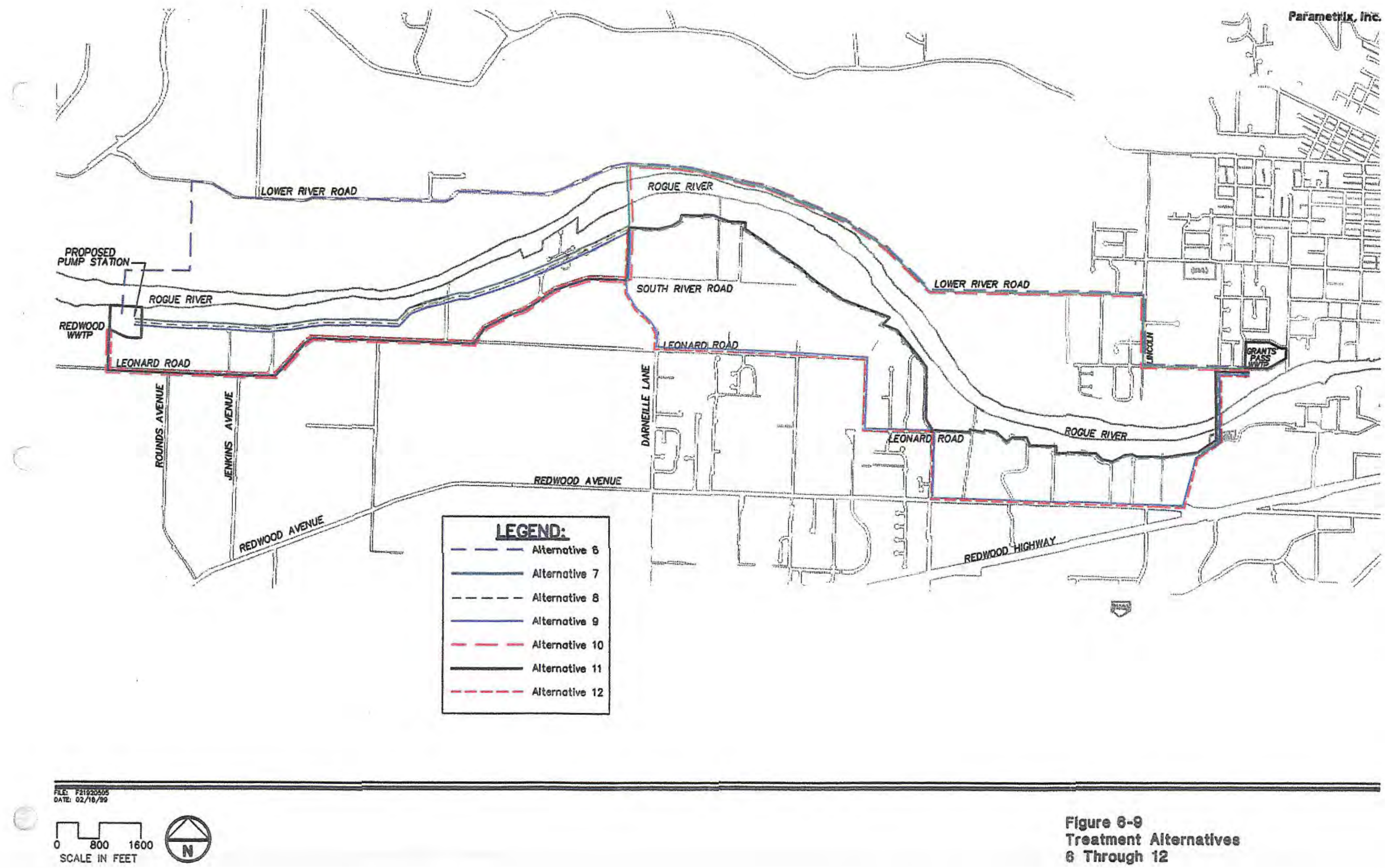

Figure 6-9
Treatment Alternatives
6 Through 12

Alternative 8: The force main would be placed in the existing sewer interceptor easement between Redwood WWTP and the proposed location of the pedestrian bridge near the Grants Pass WRP. A 6-inch main would be installed to pump station RI-25, then dual 12-inch mains from go from there to the Grants Pass WRP. The force mains would be attached to the pedestrian bridge.

Alternative 9: A 6-inch force main would be placed in the existing sewer interceptor easement between Redwood WWTP and pump station RI-25. From there dual 12-inch force mains would follow the right-of-way of Leonard Road and Redwood Avenue to the pedestrian bridge, then to the Grants Pass WRP.

Alternative 10: A 6-inch force main would be placed in the right-of-way of Leonard Road up to Pump Station RI-25. From there dual 12-inch mains would be bored under the Rouge River and follow the right-of-way of Lower River Road and Webster Lane to the Grants Pass WRP.

Alternative 11: A 6-inch force main would be placed in the right-of-way of Leonard Road up to Pump Station RI-25. From there dual 12-inch force mains would be placed in the existing sewer interceptor easement to the pedestrian bridge, and then to the Grants Pass WRP.

Alternative 12: A 6-inch force main would be placed in the right-of-way of Leonard Road up to Pump Station RI-25. From there dual 12-inch force mains would follow the right-of-way of Leonard Road and Redwood Avenue to the pedestrian bridge, then to the Grants Pass WRP.

The existing 20-foot-wide interceptor maintenance easement is wide enough to accept the new force main but not wide enough for the associated construction activity, deliveries, and staging. New temporary construction easements would need to be acquired.

6.5.3 Cost Estimates

A summary of the preliminary cost estimates, force-main length, and easements required of each treatment Alternatives 6 through 12 are presented in Table 6-7.

Table 6-7
Force Main Alternatives
Preliminary Cost Estimates

Key	Treatment Alternative	Pipeline Length	# Ease.	Pipeline	Pump Station	Contingency 30%	Engineering & Admin. 25%	Total[1]
Blue	6	26,500	1	$3,240,000	$1,182,000	$1,326,600	$1,105,500	$6,850,000
Green/ Blue	7	24,000	48	$2,960,000	$1,284,000	$1,273,000	$1,061,000	$6,580,000
Green	8	27,000	77	$2,780,000	$1,284,000	$1,219,200	$1,016,000	$6,300,000
Green/ Red	9	29,300	47	$3,000,000	$1,284,000	$1,285,200	$1,071,000	$6,640,000
Red/ Blue	10	28,600	3	$2,930,000	$1,284,000	$1,264,200	$1,053,500	$6,530,000
Red/ Green	11	31,100	32	$3,080,000	$1,284,000	$1,309,200	$1,091,000	$6,700,000
Red	12	33,400	1	$3,230,000	$1,284,000	$1,354,200	$1,128,500	$6,700,000

(1) Rounded to three significant figures.

Alternative 6 provides a single pump station at the Redwood WWTP. Alternatives 7 through 12 include two pump stations: One large pump station at the north end of Darneille Lane, at manhole RI-25, and a smaller one at the Redwood WWTP (RI-0). One disadvantage of this route is that flow in the existing 24-inch-diameter interceptor west of RI-25 would be significantly reduced, thereby resulting in poor scouring of the solids in this gravity interceptor pipe. The District would need to periodically clean this pipeline, using portable, jet-type sprayers.

Operation and maintenance costs for these alternatives are generally similar. Costs would include maintenance of the existing sewer collection system, electrical pumping costs, odor/chemical costs and equipment maintenance. Treatment costs at the Grants Pass WRP would also be paid by the users. The total probable annual O&M/treatment cost would be approximately $230,800. A breakdown of these costs is included in Appendix H.

6.5.4 Preliminary Screening of Alternatives 6 Through 12

Similar to the preliminary screening that was completed on Alternatives 1 through 5, a preliminary screening of Alternatives 6 through 12 was also conducted based on cost and potential impact to residents adjacent to the conveyance pipeline. Based on cost and impact, Alternatives 7 and 9 were selected for further comparison to Alternatives 1 and 4. At workshops with the District and the City of Grants Pass staff, Alternative 9 was further refined into Alternatives 9A and 9B which are described as follows:

Alternative 9A: The force main would be located along the existing easements to RI-25. Then follow the public right-of-way on Leonard Road to Dowell Road, then back onto the existing easement to West Park, the Pedestrian Bridge, and then to the Grants Pass WRP. From Figure 6-10, this alternative is referred to as the "green-red-green" route.

Alternative 9B: Same as above, but the force main would follow the public right-of-way on South River Road, then to Leonard Road.

6.6 PREFERRED ALTERNATIVE SELECTION

A final economic evaluation of Treatment Alternatives 1, 4, 7, 9A and 9B was made by comparing their present worth costs. The present worth costs include capital costs and operation and maintenance costs. Capital and O&M costs for the alternatives were presented earlier in Tables 6-5, 6-6, and 6-8, and in Appendix G and H. Annual O&M costs were converted to a present worth cost based on a return rate of 6 percent over a 21-year period (1999 to 2020). A summary of present worth costs for these alternatives is presented in Table 6-8.

Table 6-8
Treatment Alternatives 1, 4, 7, 9A, and 9B
Present Worth Cost Estimates (in $1,000s)

	Alternative 1 Contact Stabilization	Alternative 4 Complex Mix Effluent Filter	Alternative 7 Easement/ Lower River Road	Alternative 9A Easement/ Leonard Road	Alternative 9B Easement/ South River Road
Subtotal Construction	$7,280	$8,670	$5,520	$5,600	$5,510
Engineering and Admin.	$1,600	$1,910	$1,060	$1,160	$1,150
Total Project Cost	**$8,880**	**$10,580**	**$6,580**	**$6,760**	**$6,660**
Present Worth O&M Cost(1)	$6,870	$7,320	$2,710	$2,710	$2,710
Total Present Worth	**$15,750**	**$17,900**	**$9,280**	**$9,470**	**$9,370**

(1) Present worth based on 6 percent interest for 22 years.

For each of the conveyance alternatives, the City of Grants Pass omitted charging the District a connection charge or System Development Charge (SDC) for treatment at the City's plant. However, even if the City had charged a fee, it would not change the least cost alternative.

As an example, if the City were to charge District customers the SDC currently collected by the District for new developments ($1,966 per ERU), approximately four million dollars would be added to the capital and present worth cost of each conveyance alternative. For Alternatives 7, 9A, and 9B the present worth cost would be $13.28, $13.47, and $13.37 million, respectively. In comparison, the present worth cost of Treatment Alternatives 1 and 4 are $15.75 and $17.9 million, respectively, which are considerably greater. Still, the least cost would be any of the conveyance alternatives.

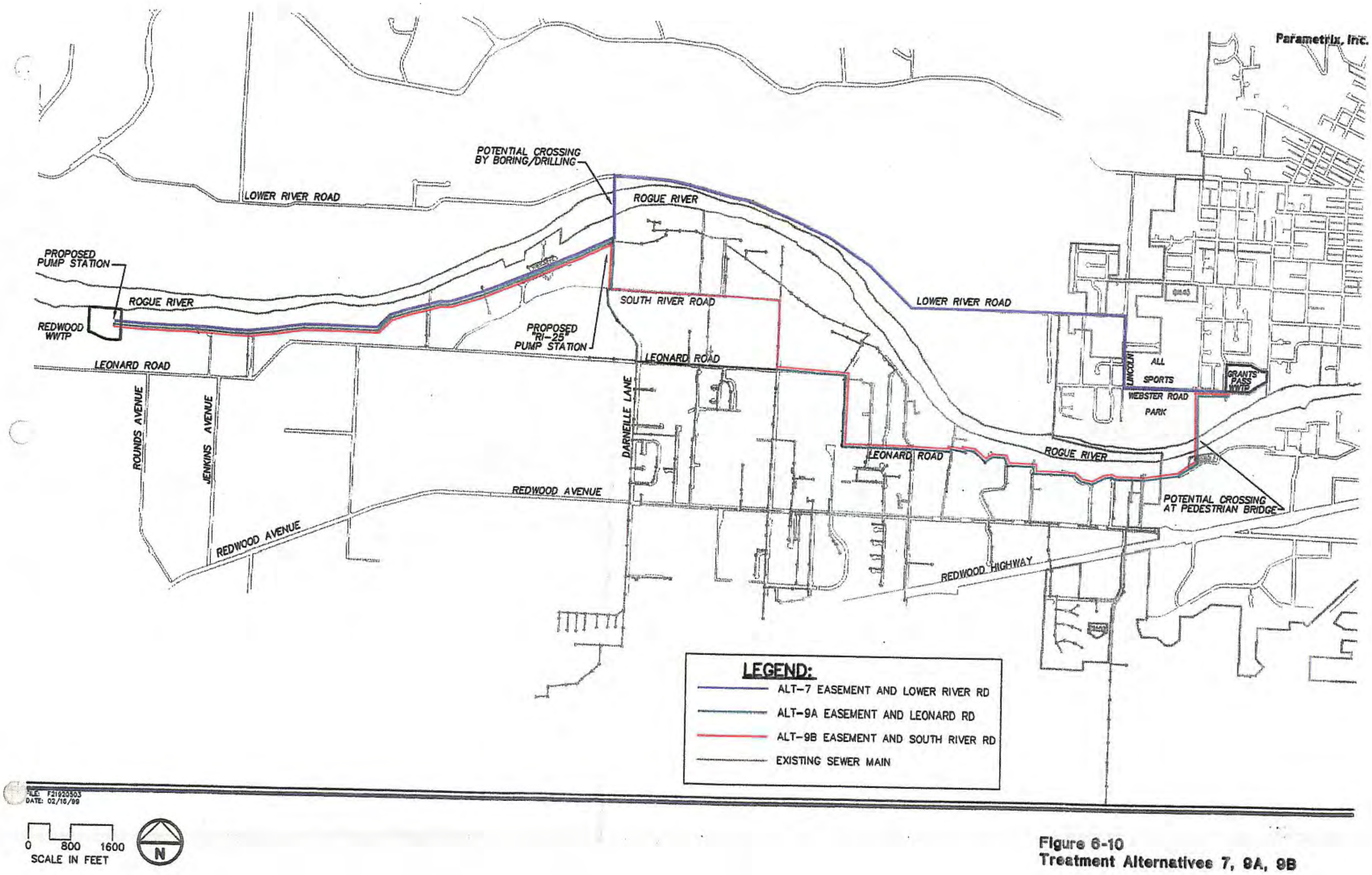

Figure 6-10
Treatment Alternatives 7, 9A, 9B

An important part of the evaluation process was a selection workshop held in Grants Pass on December 3, 1998. To facilitate the selection process, a list of selection criteria was generated and each criterion weighted in terms of importance. The criteria generally fell into four main categories, Cost Issues, Environmental Issues, Community Issues, and Operation Issues. Because cost is a major concern, 42 percent of the weighting was placed on this category.

The selection group was comprised of two representatives from the District, six representatives from the City of Grants Pass, and the City's Attorney. Each representative ranked the alternatives using an uncompleted version of the matrix shown in Table 6-9. The criteria for each alternative were given a rating of 1 to 10 (10 being the higher ranking). After the rankings were done individually then, as a group, all participants completed the matrix shown in Table 6-9. Because of higher costs, the treatment alternatives ranked much lower than the conveyance alternatives. The two top equally ranked alternatives were Alternative 7 - Lower River Road (Blue route) and Alternative 9B - South River Road (Red route).

The results of the selection process were then presented to the Grants Pass City Council, acting as the governing Board for the District, on December 14, 1998. Of the top two alternatives, the Board selected Alternative 9B - South River Road as the preferred treatment alternative.

Table 6-9
Treatment Alternative Selection Process
Evaluation Criteria and Selection Ranking

Criteria	Item Weight	Alt. 1 Contact Stab. without Filtration	Alt. 4 Anoxic Select with Filtration	Alt. 7 Easement/ Lower River Road	Alt. 9A Easement/ Leonard Road	Alt. 9B Easement/ South River Road
Cost Issues - 42%						
Capital Cost	20%	3	1	10	9	10
Present Worth O&M Cost	18%	3	1	10	10	10
Traffic Control	1%	10	10	3	7	8
Probable Utility Conflict	1%	10	10	5	3	4
Length of Pipeline Route	1%	10	10	3	1	1
Geologic Condition Rock	1%	10	10	5	10	10
Environmental Issues - 14%						
Natural Resource Concerns	1%	10	10	8	10	10
River Crossing Risk	5%	10	10	3	5	5
Permitting Issues	2%	10	10	5	8	8
Wetland Concerns	1%	10	10	9	8	8
Community Issues - 24%						
Customer Satisfaction	9%	1	1	5	8	8
Number of Easements Required	9%	10	10	7	4	5
Schedule of Compliance	7%	1	1	6	5	5
Flexibility to Meet Future Demands	1%	5	5	5	5	5
Business Impacts	1%	5	5	5	5	5
Jurisdictional Issues	2%	10	10	9	10	10
Operation Issues - 20%						
Operator Familiarity	1%	8	8	5	5	5
Operation of Existing Plant	1%	1	1	9	9	9
Potential for Odor	10%	5	5	8	5	5
Constructibility	1%	3	3	6	8	8
Potential for Noise	2%	1	1	9	9	9
NPDES Permit Issues	5%	1	3	8	8	8
Weighted Total (high score = Preferred Alternative)	100%	4.49	3.83	7.74	7.43	7.74

Each alternative was given a 1 to 10 rating for each criteria; a "10" being the best rating and "1.0" being the worst.

6.7 ENVIRONMENTAL REVIEW

6.7.1 Introduction

The purpose of this environmental review is to summarize the potential impacts associated with the No Action Alternative and two build alternatives evaluated for improvements to the Redwood Sanitary Sewer District Wastewater facility. This section includes a characterization of the natural and human elements in the study area, economic considerations, and a summary of public participation. Natural and human elements considered in this chapter include land uses and zoning, historic and cultural resources, wetlands, floodplains, agricultural lands, wild and scenic rivers, fish and wildlife, threatened and endangered species, and other unique or sensitive environmental resources.

During the preparation of this Facilities Plan, 12 improvement alternatives were initially evaluated (please refer to sections 6.1 through 6.5 of this chapter). Ten of the 12 alternatives were eliminated from further consideration. The remaining two build alternatives were more extensively evaluated for potential environmental impacts and the findings are summarized in this section. The No Action Alternative and the two build alternatives are defined below.

6.7.1.1 No Action Alternative

The No Action Alternative is defined as continuing operation at the existing Redwood WWTP as in the past using composting to manage biosolids. Because the District is under court order to eliminate the biosolids composting, the No Action Alternative would be in violation of the court order and, therefore, is not a feasible alternative. This alternative was eliminated from further consideration for this environmental evaluation.

6.7.1.2 Preferred Alternative

The Preferred Alternative is shown as Alternative 9B in Figure 6-10. A smaller pump station would be located at the Redwood WWTP and would pump into a 6-inch force main in existing easements between the Redwood WWTP to RI-25. At RI-25, a second larger pump station would pump through dual force mains to the Grants Pass WRP. The force main route follows the public right-of-way on South River Road to Leonard Road to Dowell Road, then back on existing easements to West Park, then back on public right-of-way on the Pedestrian Bridge to the Grants Pass WRP.

This Alternative was selected by the District Board over the Second Preferred Alternative because they felt that the risks associated with crossing the Rogue River with a horizontal boring were greater than risks associated with the restricted access on easements east of Dowell Road and obtaining easements from property owners.

6.7.1.3 Second Preferred Alternative

The Second Preferred Alternative is shown as Alternative 7 in Figure 6-10. A smaller pump station would be located at the Redwood WWTP and would pump into a 6-inch force main in existing easements between the Redwood WWTP to RI-25. At RI-25, a second larger pump station would pump through dual force mains to the Grants Pass WRP. The force main crosses the Rogue River due north of the RI-25 pump station using a horizontal boring. The route then follows public right-of-way on Lower River Road, Lincoln and Webster Roads to the Grants Pass WRP.

6.7.2 Zoning and Land Uses

Between the Redwood WWTP and Darneille Lane, both alternatives use the same route. This route is zoned Rural Residential with 1-acre-minimum lots. The pipeline would be located in an existing 20-foot-wide easement that currently runs through property used for residential yards, fallow fields, small scale farming, and pastures for horses and cows.

After Darneille Lane, the Preferred Alternative continues through areas zoned for Rural Residential, and Low, Moderate and High Density Residential uses until the route ends at the Grants Pass WRP. All of the proposed pipeline in this section would be located in existing public road rights-of-way and easements. This route would cross the Rogue River using a pedestrian bridge that is under construction.

The Second Preferred Alternative turns north at Darneille Lane, crossing the Rogue River and continuing east through areas zoned for Rural Residential, Exclusive Farm Use, and Low to Moderate Density Residential uses until it ends at the Grants Pass WRP. With the exception of where the pipeline crosses the Rogue River, the pipeline would be located entirely within public road rights-of-way. A small easement would need to be acquired from the Rogue River to the Lower River Road right-of-way. Abutting property in this section of the alignment is used for agricultural, residential and recreational uses. This route would require a boring to cross underneath the Rogue River.

The proposed pipeline is a permitted use in all of the zoning districts. The land use compatibility requirements are apart of the Clean Water State Revolving Fund (CWSRF) and have been documented in the State Revolving Fund (SRF) loan files. Although construction of the proposed pipeline may cause temporary impacts, no adverse impacts to land uses as a result of operating the pipeline are anticipated.

6.7.3 Historic and Cultural Resources

A cultural resource inventory of the area of proposed improvements was conducted. Although no evidence of cultural materials or deposits were observed directly, because archaeological sites in the immediate vicinity of both alternatives have been previously recorded with the State Historic Preservation Office (SHPO), it is recommended that an archaeologist review the final project plans showing all anticipated areas of impact. Using the most current plans, archaeological monitoring is recommended for specific locations along the project route.

In addition, there is always the possibility that ground disturbance during construction activities along the alignment might expose buried cultural material or human burials that were not detected during the survey. If such an event should occur, Oregon State law (ORS 97.740, 97.760, 358.905, 390.235, and 358.955), and various federal laws and regulations, which may be applicable to this project, will require that work in the vicinity of such finds be suspended. The SHPO and the appropriate tribes would be notified, and a qualified archaeologist would be called in to evaluate the discovery and recommend subsequent courses of action in consultation with the tribes and SHPO.

6.7.4 Economic Considerations

Various project-funding scenarios were evaluated to determine the best way for the District to finance the projected project cost of $6.7 million for the Preferred Alternative. After reviewing several scenarios, a preferred funding alternative was to fund the project with approximately $5.4 million of State Revolving Fund (CWSRF) loan money and approximately $1.3 million of available cash from the District. The District has an additional $0.7 million cash that will be needed for project reserves. No sewer rates or system development charge increases would be necessary in the District in the next several years; therefore, there will be no adverse economic impact to service area users. The Preferred Alternative is $90,000 less than the Second Preferred Alternative in present worth costs.

6.7.5 Wetlands

The Preferred Alternative will not impact wetland or stream crossings. The proposed project will cross four streams: Sparrow Hawk Creek, Sand Creek, Allen Creek, and Darneille Creek. The boring method of construction will be used to avoid impacts to the systems. The staging area for construction equipment will be set back 25 feet on either side of the stream crossings and will not impact the riparian corridor.

The Preferred Alternative will not impact the Rogue River. The proposed pipeline will be attached to the City of Grants Pass' Pedestrian/Bikeway Bridge, currently under construction. A Nationwide Permit for the Pedestrian/Bikeway Bridge was received from the Army Corps of Engineers on March 22, 1999. The pipeline connection to the Pedestrian/Bikeway Bridge on the north and south sides of the Rogue River were reviewed by a biologist and no wetlands were identified.

The Second Preferred Alternative would cross three stream systems: Sparrow Hawk Creek, Sand Creek, and Darneille Creek. Because the boring method of construction would be used, there will be no wetland impacts. The staging area for the boring will be located 25 feet on either side of the stream crossing and would not impact the riparian corridor of these systems.

The Second Preferred Alternative proposes using the boring method under the Rogue River. No adverse impacts to the River would be expected from this method of construction.

6.7.6 Floodplains

Between the Redwood WWTP and Darneille Lane, both alternatives use the same route and cross flood zones A11, B, and C. Zone A11 is considered an area of special flood hazard (for the 100-year flood). Zone B is considered an area between the limits of the 100-year flood and the 500-year flood; or certain areas subject to 100-year flooding with average depths less than 1-foot or where the contributing drainage area is less than 1 square mile; or areas protected by levees from the base flood. Zone C is considered an area of minimal flooding. The pipeline would be located in an existing 20-foot-wide easement for a gravity sewer. Addition of the proposed pipeline to this existing easement will not alter or affect flooding in this area, nor would the proposed pipeline be affected by flooding.

After Darneille Lane, the Preferred Alternative continues through areas with flood zones C, X, and AE where the route ends at the Grants Pass WRP. Zone X is considered an area of 500-year flood; areas of 100-year flood with average depths of less than 1 feet or with drainage less than 1 square mile; and areas protected by levees from 100-year flood. Zone AE is considered a special flood hazard area inundated by 100-year flood. All of the proposed pipeline in this section would be located in existing public road rights-of-way and easements. This route would cross the Rogue River using a pedestrian bridge, which is under construction. Addition of the proposed pipeline to this existing easement and the public road rights-of-way will not alter or affect flooding in this area, nor would the proposed pipeline be affected by flooding.

The Second Preferred Alternative turns north at Darneille Lane, crossing the Rogue River and continuing east through areas with flood zones B, A11, A4, and AE where it ends at the Grants Pass WRP. Zone A4 is considered an area of special flood hazard by a 100-year flood. With the exception of where the pipeline crosses the Rogue River, the pipeline would be located entirely within public road rights-of-way. A small easement would need to be acquired from the Rogue River to the Lower River Road right-of-way. This route would require boring underneath the Rogue River to cross it. Addition of the proposed pipeline to the existing or proposed easements and public road rights-of-way will not alter or affect flooding in this area nor would the proposed pipeline be affected by flooding.

Although construction of the proposed pipeline may cause temporary impacts, no adverse impacts to land uses as a result of operating the pipeline are anticipated.

6.7.7 Agricultural Lands

Between the Redwood WWTP and Darneille Lane, the pipeline would be located in an existing 20-foot-wide easement that currently runs through property used for residential yards, fallow fields, small scale farming, and pastures for horses and cows. Because the pipeline would be located within an existing easement for a gravity sewer, construction could cause temporary disruption of agricultural activities. However, after construction is complete, the operation of the proposed pipeline in this section of the route would not disrupt any agricultural activities. The Second Preferred Alternative turns north at Darneille Lane, crossing the Rogue River and continuing east within public road rights-of-way. Some abutting property in this section of the alignment is used for agricultural activities. Construction of the proposed pipeline could cause temporary disruption of agricultural activities. However, after construction is complete, the operation of the proposed pipeline in this section of the route would not disrupt any agricultural activities.

6.7.8 Wild and Scenic Rivers

A section of the Rogue River has been designated a wild and scenic river. The wild and scenic river designation begins at the confluence of the Applegate River and extends approximately 84 miles to the Lobster Creek Bridge. Because the project is not located within the wild and scenic area of the Rogue River, neither the Preferred Alternative or the Second Preferred Alternative will have impacts to the area designated as a wild and scenic river.

6.7.9 Fish and Wildlife

Correspondence with the Oregon Natural Heritage Program (ONHP), U.S. Fish and Wildlife Service (FWS), and National Marine Fisheries Service (NMFS) was initiated to identify any federally listed, proposed, or candidate threatened or endangered species that may potentially occur within the project area. Potential impacts to listed species identified in the agency correspondence along with the results from the October 1999 fish and wildlife survey will be addressed in a Biological Assessment (BA). The BA will be conducted after the route alignment is selected and final design is underway. Potential impacts to listed species will be the same for the Preferred Alternative and the Second Preferred Alternative.

6.7.10 Threatened and Endangered Species

Informal consultation with the NMFS, ONHP, and FWS was initiated as part of this process to identify the presence of any federally listed, proposed, or candidate threatened or endangered plant or animal species. A BA in compliance with Section 7 of the Endangered Species Act (ESA) will be prepared to determine potential effects of the project on listed, proposed, and candidate species and their habitats. The BA will be conducted after the route alignment is selected and final design is underway. The impacts to listed species will be the same for the Preferred Alternative and the Second Preferred Alternative. Based on preliminary review by biologists, impacts to listed species are not anticipated.

6.7.11 Other Unique or Sensitive Environmental Resources

No other unique or sensitive environmental resources were identified for either alignment alternative.

6.8 CONSTRUCTION TECHNIQUES, BEST MANAGEMENT PRACTICES, AND MITIGATION OF SELECTED NATURAL RESOURCE CONCERNS

6.8.1 Construction Techniques

The pipelines will be installed at 3- to 6-foot-deep and 3- to 7-foot-wide trench (wider for dual pipeline). The pipes will be in a bed of ¾-inch aggregate. Trenching and pipe installation will be done with a track hoe. Surfaces will be restored to match the existing conditions: pastures will either have topsoil replaced or hydroseeded (owner's preference), undeveloped areas will be hydroseeded, and roads will be gravel/paved. Where the pipeline alignment is near sensitive natural features, the construction plans will call for appropriate Best Management Practices. See the attached figure for pipeline installation and restoration details.

Dewatering

Where groundwater is encountered in excavations, the excavation will be dewatered either with a submersible pump or temporary well points established around the perimeter of the excavation. Water pumped from these will be sent to a two-stage temporary sedimentation pond. Water will flow into the first cell, then through a gravel filter to get into the second cell. From the second cell, clarified water will be discharged into the natural drainage system. This method has been successfully employed on several projects and is effective in removing turbidity.

Creek Crossings

Creeks will be crossed by horizontal borings (see below). The pipeline(s) will be in a steel casing, which will start and end 25 feet back from the creek banks, and the top of the pipe will be a minimum of 10 feet below the creek bottom.

Horizontal Borings

Boring is done using an auger in a steel casing. The casing is driven horizontally, and the auger in the casing rotates to bring earth to the bore pit, where it is removed to the surface. The casing is advanced using a horizontally oriented hydraulic jack. After the casing is installed, the "carrier" pipeline (containing the liquid being piped) is installed in the casing. Bore pits are excavated on either side of the obstacle (creek): a driving pit and a receiving pit. The pits are from 15 to 30 feet deep, depending on the depth of the creek. The pit excavations will be near vertical and steel trench shoring will be used to maintain the sides. The driving pit will contain the hydraulic jack. The receiving pit is typically dug only after the casing boring is completed to expose the casing and install the carrier pipeline. Fencing is provided around the bore pits during non-working hours for safety and erosion control measures are employed around the work site. The area around the boring is used to stage casing pipe and typically contains a track hoe for removing bored material. Dump trucks travel to and from the site.

Construction Staging

Equipment and material will be staged at the Redwood WWTP, the RI-25 Pump Station, the Josephine County Fairgrounds, and the Grants Pass WRP.

6.8.2 Best Management Practices

Erosion Control

Silt fences (reinforced with wire fencing as required) and straw bales are employed at the perimeter of the construction site to isolate it from natural areas. The silt fence must be installed to capture surface runoff. It must be inspected daily by the contractor. The engineer's inspector checks it upon installation and periodically thereafter for satisfactory condition and performance.

Water Disposal

Water removed from dewatering is typically returned to natural drainage. In the event the water does not meet standards, it will be discharged to the adjoining sanitary sewer or storm sewer, which parallel the entire new pipe alignment.

6.8.3 Mitigation of Selected Natural Resource Concerns

Tree Removal and Replacement

Approximately 20 ornamental cedar trees on the south boundary of All Sports Park will be removed and replaced in kind.

Noise

The area for the pipeline alignment is rural residential. As such, there is a significant amount of farming occurring thus, the sound of tractors operating is not unusual. There are numerous residential communities and several new residential developments currently under construction along the pipeline route. Thus, the sound of construction equipment is quite common.

After construction, the pump stations will operate continuously. The noise from the pumps and the emergency generator will be less than 45 decibels at the property line of each pump station.

6.9 PUBLIC PARTICIPATION

The Redwood Sanitary Sewer Service District has involved the public in a variety of ways in the process to evaluate alternatives and select a preferred alternative for the Redwood WWTP upgrade. The preferred alternative was selected on April 28, 1999, at a Sewer District Meeting. Ongoing communication between ratepayers and affected property owners has continued since the preferred alternative was selected. Copies of newsletters, meeting minutes, and public notices related to this effort can be found in the Appendix I. The following listing identifies public participation activities conducted and planned.

Schedule of Public Involvement Activities

- Public Meeting Announcement, November 1998
- District Board Briefing, November 18, 1998
- Public Meeting, November 19, 1998
- District Board Briefing, December 10, 1998
- District Board Briefing/Selection of a Preferred Alternative, December 14, 1998
- District Board Briefing, March 8, 1999
- District Board Adopts Wastewater Facilities Plan Update, April 28, 1999
- Project Press Release, May 21, 1999
- District-Wide Project Update, Public Meeting Announcement, May 1999
- Letter to Affected Property Owners, May 24, 1999
- Affected Property Owner Meeting, June 1, 1999
- Conveyance Route Field Walk, June 2 and 3, 1999
- Pipeline Route Walk-Through/Talk with Property Owners, June 2 and 3, 1999
- Property Owner Update/Meeting Announcement, July 1999
- Affected Property Owner Meeting, July 20, 1999
- Individual Property Owner Meetings, July through October 1999
- District-Wide Project Update, planned for November 1999
- Public Meeting, To Be Determined

Individual Letters to Property Owners

- Ozust - Information regarding pipe, August 2, 1999
- Langevin - Information regarding pipe, August 6, 1999

6.10 WASTEWATER FACILITIES PLAN UPDATE

6.10.1 District Board Briefing - November 18, 1998

The Grants Pass City Council, acting as the governing board for the District (District Board), received a project update and briefing on November 12, 1998. District Board members were given a status report on the evaluation of the 12 alternatives being evaluated (5 treatment options and 7 conveyance options). District Board members were informed of the November 19, 1998, public meeting to solicit public input on the conveyance and treatment alternatives. In addition, the District Board was informed of a staff workshop on December 3, 1998, to evaluate alternatives.

6.10.2 Public Meeting/Forum – November 19, 1998

A public forum and information meeting notice was sent to all ratepayers in the Redwood District in November 1998.

Twenty-eight people attended the District-wide meeting held on November 19, 1998 and the alternative solutions were presented. A questionnaire was distributed among meeting attendees to determine public comments on a preferred alternative. Written comments or testimony were accepted until November 20, 1998. Sixteen questionnaires were returned to the District. Of the alternatives presented, the public preferred the conveyance alternatives to the treatment alternatives. The rationale for supporting the conveyance option was cost.

6.10.3 District Board Briefing – December 10, 1998

District representatives briefed the District Board on December 10, 1998. District representatives presented the results of the November 19 public meeting and the December 3 staff workshop. The results revealed that the public showed a strong preference for the conveyance alternatives. Staff members had also selected the conveyance alternatives. The staff workshop narrowed the conveyance alternatives to two preferred alternatives. The two conveyance alternatives received identical scoring; therefore, a decision by the District Board was requested.

6.10.4 District Board Briefing, Preferred Alternative Selected – December 14, 1998

The District Board selected the preferred alternative at the meeting (open to the public) held on December 14, 1998.

6.10.5 District Board Briefing – March 8, 1999

A project briefing (open to the public) to the District Board was held to keep the Board and public informed of the status of the Wastewater Facilities Plan Update.

6.10.6 District Board Adopts Wastewater Facilities Plan Update – April 28, 1999

On April 28, 1999, the District Board adopted the Wastewater Facilities Plan Update. This reaffirmed the selection of the Preferred Alternative.

6.11 PREFERRED ALTERNATIVE IMPLEMENTATION

6.11.1 Project Press Release and District-wide Project Update

A project press release was sent to the local newspaper, and a District-wide project update was sent to ratepayers in the District. The purpose of the press release/newsletter was to inform the public of the preferred alternative and explain the next steps related to the project.

6.11.2 Letter to Affected Property Owners

A letter to all affected property owners (approximately 70 people) was sent on May 24, 1999. The letter explained the Pipeline Project and informed property owners that they would be directly impacted by the project. They were invited to attend a public open house on June 1, 1999, to learn more about the project, schedule, and impacts. In addition, a right-of-entry form was included in the letter for property owners to complete and return to the District. The right-of-entry form would allow surveying and selected field work on private property.

6.11.3 Affected Property Owner Meeting

The purpose of the first affected property owner meeting was to explain the project history, project purpose, and project plan. Because pipeline construction would occur across easements located on private property, the District thought it was necessary to meet with property owners and discuss the project. In addition, the meeting set the stage for obtaining right-of-entry forms and temporary construction easements. A property owner informational survey was distributed.

6.11.4 Conveyance Route Field Walk

On June 2nd and 3rd, District representatives walked the conveyance route to obtain field data and talk one-on-one with impacted property owners. District representatives discussed the project with approximately 50 percent of the property owners along the route. They also put flags in the projected location of the new pipeline. The purpose of the flags was to show residents where the new pipeline route and the existing sewer easement are located. In addition, the flags included the phone number of a District contact in case property owners had questions about the project.

6.11.5 Property Owner Update/Meeting Announcement and Property Owner Meeting

A second property owner update and meeting announcement was distributed in early July 1999. The property owner meeting was held on July 20, 1999. The purpose of the meeting was to discuss the issue of temporary construction easements. District representatives explained the need for the temporary construction easements and the rate schedule that would be used to compensate property owners for granting the temporary easements. The process for obtaining easements was also discussed.

6.11.6 Individual Property Owner Meetings

From July to October, District representatives spent time meeting with affected property owners individually to discuss the project, answer property owner questions, discuss restoration requirements, and obtain temporary construction easements. Letters were sent and follow-up phone calls were made to individuals who were unable to meet with District representatives.

In addition, letters were sent to two separate property owners addressing questions and concerns (see letters to Ozust and Langevin).

6.12 FUTURE PUBLIC INVOLVEMENT ACTIVITIES

The District plans to send out another District-wide Update in November 1999. A District-wide and affected property owner public meeting will be held prior to construction. In addition, the District will continue to update ratepayers and property owners of the construction schedule when construction begins in April 2000.