CHAPTER 2.
ALTERNATIVES TO THE PROJECT ACTION

COLLECTION SYSTEM

The *Port Hadlock UGA Sewer Facility Plan* (Tetra Tech, 2008) evaluated several wastewater collection system technologies: gravity collection, pressurized sewers using grinder pumps or septic tank effluent pumping (STEP), small-diameter gravity sewers, vacuum sewers and grinder pump systems.

Small diameter gravity sewers were rejected for further consideration because they would not provide enough advantage given the local terrain, would require deep pipe excavations, and would not provide significant benefit over conventional gravity sewers principally because septic tanks would be required on private properties. Vacuum sewers were rejected because they are not suitable for the varied terrain found in the sewer service area, they provide limited lift capability, thereby requiring additional local pump stations, they would require vacuum pits at each property, and additional odor control facilities would be required at the vacuum stations.

After further evaluation, STEP systems were rejected because of their inflexibility in phasing, the high level of private easements required, and the high operation and maintenance (O&M) costs. Grinder pump systems were rejected because of high O&M costs, the overall lifetime costs, and the high potential for odor and corrosion.

A conventional gravity system was selected as the recommended collection system alternative, for the following key reasons:

- It has the lowest 20-year life cycle cost of the alternatives evaluated. A gravity collection system can be developed to planned densities at a lower cost than for pressure sewers because on-site costs and space requirements are less.
- It provides the highest degree of flexibility for system expansion. A core area can be implemented as a gravity system, and the County then has the flexibility to implement pressure sewers in outlying areas in the future. If a pressure sewer is implemented in the core area, gravity sewers cannot be installed in the outlying areas, because pressure sewers can discharge into a gravity collection system, but gravity sewers cannot discharge into a pressurized sewer system.
- It requires no maintenance and access easements.
- It has fewer operational and maintenance requirements.

Conventional gravity sewers use a series of sloped pipes between manholes to collect and convey raw wastewater from the sewer connection to the wastewater treatment plant. Wastewater is collected within sewer mains that slope toward the wastewater treatment plant or to a local pump station. A key strategy in the design of a gravity collection system is to use the contours of the existing terrain to maximize efficiency in the construction of pipelines. An efficient design strategy involves sewers excavated as shallow as possible while minimizing the number of pump stations.

Each service connection to the wastewater treatment plant consists of a sloped pipe (service lateral) from the building's drain to a gravity sewer main in the street. Construction of the service lateral is typically the responsibility of the property owner from the property line to the building drain; construction of the service connection from the sewer main to the property line is the responsibility of the sewer agency. This type of collection system does not require any access and maintenance easements since maintenance of the service lateral on private property is the responsibility of the property owner.

Maintenance for a gravity collection system involves pump station checks, routine maintenance of the pump station equipment, and flushing of the gravity collection lines. Operational costs for a typical gravity collection system involve electricity to operate the pump stations.

DISCHARGE/ REUSE METHODS

Seven alternatives were originally considered for discharge or reuse of the treatment plant effluent:

- Marine outfall—Discharge of treatment plant effluent to Port Townsend Bay through a pipeline outfall.
- Irrigation at agronomic rates—Reuse of reclaimed water to irrigate a crop or timberland at rates not to exceed the plants' ability to absorb the water and nutrients.
- Natural wetlands—Discharge of treatment plant effluent into a natural wetland. The wetland would provide additional treatment, nutrient removal and water uptake through transpiration and evaporation.
- Constructed wetlands—Reuse of reclaimed water using either a constructed beneficial use wetland or a constructed treatment wetland. Both provide wildlife habitat and associated public benefits, water uptake through transpiration and evaporation, and additional treatment of the reclaimed water.
- Groundwater recharge by surface percolation; slow-rate infiltration—Reuse of reclaimed water by surface percolation into the groundwater by land application using a slow-rate infiltration gallery. The rate of application is controlled by the treatment plant operator.
- Groundwater recharge by surface percolation; rapid-rate infiltration—Reuse of reclaimed water by surface percolation into the groundwater by land application using a rapid-rate infiltration basin. The rate of application is limited only by the percolation rate of the pond bottom.
- Salinity barrier—Reuse by injecting the reclaimed water into the groundwater to provide an intrusion barrier between a potable water aquifer and a saltwater body such as Puget Sound or Port Townsend Bay.

Three alternatives were rejected early in the evaluation process. A marine outfall was rejected because of the proximity of the outfall to shellfish beds, difficulty in acquiring a permit for a marine outfall when there are viable reuse alternatives, and the stated desire of local residents to consider beneficial reuse options if possible. Natural wetlands were removed from consideration because of extensive regulatory requirements for discharge of treatment plant effluent to a natural wetlands. The salinity barrier alternative was not considered for further evaluation because no local saltwater intrusion issues have been identified for the local aquifer and water wells.

The remaining alternatives were evaluated based on the following criteria: land required, storage required, treatment requirements, opportunities for beneficial reuse, and life-cycle costs. The recommended alternative for treatment plant effluent reuse is rapid-rate infiltration, for the following key reasons:

- Lowest 20-year life cycle cost—This alternative has the lowest 20-year life cycle costs because the amount of land required is less than any of the other land-based reuse or disposal alternatives considered. Additionally, rapid-rate infiltration requires the least amount of piping and associated equipment, further reducing capital cost and operation and maintenance requirements.

- Opportunities for beneficial reuse—This alternative provides good opportunities for beneficial reuse. Stakeholders and the community have expressed interest in beneficial reuse opportunities for treatment plant effluent. A specific reuse strategy mentioned by members of the public was water recharge for Chimacum Creek. The use of rapid-rate infiltration at a site located in the vicinity of Chimacum Creek would provide recharge through local groundwater. Determination of an advantageous site would be part of a hydrogeologic survey of potential reuse sites.

Groundwater recharge by surface percolation using rapid-rate infiltration involves applying reclaimed water to the land at a rate that is not necessarily controlled. The reclaimed water infiltrates into the earth as fast as the soils can accept it. Reclaimed water infiltrates through the soil to the groundwater below.

The key criteria for the design of a rapid-rate infiltration system is the rate at which reclaimed water is applied to the land and the amount of storage required for severe wet weather during winter months when the land is too wet to accept any water. A preliminary geologic investigation of the area indicates that the soils in the Port Hadlock area have a comparatively high acceptance rate, which make rapid-rate infiltration a viable alternative.

TREATMENT METHODS

Wastewater treatment requirements vary significantly depending on the selected effluent discharge or reuse method. Effluent to be used as reclaimed water must meet standards that depend on the type of end-use and the potential for human contact with the reclaimed water. The standards, ranging from Class A (highest quality) to Class D (lowest quality), are achieved through appropriate levels of secondary or advanced treatment and disinfection.

The recommended method of discharge/reuse, rapid-rate infiltration, requires Class A reclaimed water. Treatment options to achieve this standard were assessed through an alternative evaluation and feedback from a stakeholder workshop. Two technologies were evaluated in detail:

- Sequencing batch reactor (SBR)—An SBR is an activated sludge process operated in a batch mode instead of a continuous-flow mode (aeration and secondary clarification occur in the same tank). Two or more parallel basins are required so that influent flows can be treated continuously by this batch process. Control valves, mixers, aerators, and decanters cycle the wastewater through different operational modes within the tanks. Aeration can be in the form of diffused air or jets. The sequential operating modes, which take place in the same basin, are filling, reacting, settling, decanting and sludge wasting. This type of system can remove nutrients such as nitrogen and phosphorus through proper programming of the batch process.
- Membrane bioreactor (MBR)—The MBR process combines the extended aeration activated sludge process with a physical separation process using membranes immersed in the aeration basins rather than separate downstream clarifiers. By providing a positive barrier to virtually all particulate, colloidal and dissolved solids above the 0.1-micron range, the membranes produce an exceptional effluent quality, superior to that of extended aeration activated sludge followed by conventional filters. Chemical coagulation is likely not required for MBRs to meet Class A reclaimed water standards. Because the membranes provide a positive barrier to solids, the activated sludge system can operate at very high mixed-liquor suspended solids concentrations, significantly reducing the size of the aeration basin compared to typical extended aeration activated sludge plants.

The MBR system is recommended based upon the following key reasons:

- It provides a reliable level of Class A effluent.
- It is the most advanced treatment technology available and is best suited to address future potential wastewater treatment requirements such as cosmetics, personal care products and endocrine disruptors (hormones) in wastewater.
- It is best suited to address existing and future regulatory requirements regarding treatment.

Effluent disinfection is also necessary as part of the treatment process, in order to prevent the spread of waterborne diseases. The intent of the Class A reclaimed water standards is to produce reclaimed water that is essentially pathogen-free. Four disinfection methods were evaluated:

- Liquid sodium hypochlorite—Disinfect the treatment plant effluent with 12.5-percent liquid sodium hypochlorite (bleach).
- Ultraviolet (UV) disinfection—Disinfect the treatment plant effluent with ultraviolet light.
- Chlorine gas—Disinfect the treatment plant effluent using chlorine gas.
- On-site generation of sodium hypochlorite—Disinfect the treatment plant effluent using <1.0-percent sodium hypochlorite (bleach) generated on site using salt and hypochlorite generation equipment.

Chlorine gas was rejected early in the evaluation process due to safety and transportation concerns. On-site generation of sodium hypochlorite also was rejected early in the evaluation process because it uses complex, electrically powered mechanical equipment to generate liquid sodium hypochlorite from salt water. The comparatively small amount of liquid sodium hypochlorite needed to disinfect the effluent flow does not justify the cost of equipment, operation, maintenance and electricity when compared to purchasing liquid sodium hypochlorite from a bulk supplier.

The liquid sodium hypochlorite and UV disinfection alternatives were rated on effluent quality, phasing, safety, and lifecycle costs. UV disinfection was removed from evaluation because it does not provide enough additional benefits and features to warrant its higher 20-year life cycle cost.

A liquid sodium hypochlorite system is recommended because it would have a low initial capital investment and low life cycle cost, would not be as potentially hazardous as other chlorine-based methods, and would be easily scalable as the plant grows.

SOLIDS HANDLING AND REMOVAL METHODS

Alternatives were evaluated for two components of the treatment plant solids management process: handling of the solids; and treatment/reuse of the solids. Handling of the solids involves removal of some of the water and storage at the treatment plant site prior to treatment and reuse. Treatment/reuse involves reduction of the solids through digestion, composting, or chemical treatment and reuse through land application or land-filling.

Combinations of solids handling and treatment/reuse alternatives were combined and evaluated. Based on the evaluation, a storage and decanting alternative is recommended for solids handling, and a contracted hauling and reuse alternative is recommended for solids treatment/reuse. These recommendations are based on process simplicity, low initial capital cost, and flexibility to switch other methods in the future.

Storage and decanting involves solids being removed from the wastewater treatment system by removing a calculated volume of mixed liquor or waste activated sludge from the biological treatment process. This waste activated sludge is then stored on site in a storage tank or basin where the heavier solids are allowed to settle to the bottom. The heavier solids, or subnatant, are then separated from the lighter supernatant by decanting.

The decanting process requires only minimal equipment, labor and energy costs and can result in a remarkably improved subnatant with a volume reduction of up to 50 percent. The resulting reduction in hauling and handling costs can be significant. Decanting and storage typically involves a holding tank for decanted solids, minor piping and pumps, and some provisions for odor control. Decanting and storage are accomplished in the same tank.

Contracted hauling and reuse involves hiring a contractor to provide transportation, treatment and reuse of the wastewater solids. The contractor would load waste solids into a tanker truck and haul the material off site for treatment and reuse. Kitsap Bio-Recycle in Belfair, Washington was identified as a contractor that could provide this service.

Each of the two solids-management recommendations has the lowest 20-year life cycle cost based on available cost data. This is a “pay-as-you-go” system. If the economics of these options change in the future, the County will have very little capital investment in solids handling/reuse equipment and can easily explore other options.

SITE LOCATIONS

Several locations were considered for the proposed wastewater treatment plant and effluent reuse area:

- South of Service Area/Adjacent to Sheriff’s Facilities—This location is south of the service area near the intersection of Chimacum Road and Pomwell Road. There are several parcels that would be suitable for development as a wastewater treatment plant.
- H.J. Carroll Park Vicinity—This location is in the area east and north of H.J. Carroll Park. These properties would likely be accessed from Chimacum Road.
- Central Service Area—This location is centrally situated within the service area near the intersection of Mason Street and Cedar Street. This would be at the Port Hadlock Airstrip site or immediately west.
- Airport—This location is adjacent to the Jefferson County International Airport, about 3 miles north of the service area. The site would be acquired from a property owner or from the Port of Port Townsend through a purchase or lease.
- Chimacum High School Vicinity—This location is 1.5 miles south of the service area in the vicinity of Chimacum High School (South of Wades Loop Road and West Valley Road). This would be land purchased from the school district or an adjacent property owner.

Based on an alternative analysis and feedback from the stakeholder workshop, a treatment plant located in the south service area is recommended. A specific parcel has not been identified, but a parcel in the vicinity of the Sheriff’s facility or the adjacent gravel pit/cement plant is recommended. The key reasons for this recommended location are as follows:

- Life Cycle Cost—This alternative has a low 20-year life cycle cost compared to three of the other alternatives. The distance to pump is low, resulting in lower capital and operation and maintenance costs. Siting the facility in the central area may have a lower initial cost, but this area will become prime commercial property as a result of sewers being available. Stakeholders from the Irondale/Port Hadlock area have voiced their opinion that the area will be better served by locating the treatment and reuse facility outside of the central service area in order to maximize its commercial and high-density residential potential.

- Opportunities for Reuse—This alternative has more varied reuse opportunities than the other alternatives. This alternative has three potential opportunities identified whereas the other alternatives have two opportunities.
- Adjacent Land Use—The adjacent land use is primarily public and commercial. A wastewater treatment plant is a compatible use.