6-C
MANAGEMENT OF WATER QUALITY DURING CONSTRUCTION AT THE TREATMENT PLANT SITES

FINAL ENVIRONMENTAL IMPACT STATEMENT

Brightwater Regional Wastewater Treatment System

APPENDICES

King County Brightwater TREATMENT SYSTEM

Final

Appendix 6-C
Management of Water Quality During Construction at the Treatment Plant Sites

August 2003

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TABLE OF CONTENTS

TABLES

King County has prepared a Draft Environmental Impact Statement (Draft EIS) and Final Environmental Impact Statement (Final EIS) on the Brightwater Regional Wastewater Treatment System. The Final EIS is intended to provide decision-makers, regulatory agencies, and the public with information regarding the probable significant adverse impacts of the Brightwater proposal and identify alternatives and reasonable mitigation measures.

King County Executive Ron Sims has identified a preferred alternative, which is outlined in the Final EIS. This preferred alternative is for public information only, and is not intended in any way to prejudge the County's final decision, which will be made following the issuance of the Final EIS with accompanying technical appendices, comments on the Draft EIS and responses from King County, and additional supporting information. After issuance of the Final EIS, the King County Executive will select final locations for a treatment plant, marine outfall, and associated conveyances.

The County Executive authorized the preparation of a set of Technical Reports, in support of the Final EIS. These reports represent a substantial volume of additional investigation on the identified Brightwater alternatives, as appropriate, to identify probable significant adverse environmental impacts as required by the State Environmental Policy Act (SEPA). The collection of pertinent information and evaluation of impacts and mitigation measures on the Brightwater proposal is an ongoing process. The Final EIS incorporates this updated information and additional analysis of the probable significant adverse environmental impacts of the Brightwater alternatives, along with identification of reasonable mitigation measures. Additional evaluation will continue as part of meeting federal, state, and local permitting requirements.

Thus, the readers of this Technical Report should take into account the preliminary nature of the data contained herein, as well as the fact that new information relating to Brightwater may become available as the permit process gets underway. It is released at this time as part of King County's commitment to share information with the public as it is being developed.

1 INTRODUCTION

Construction of the Brightwater Regional Wastewater Treatment Plant will result in disturbance of relatively large areas. Disturbed soils will be exposed and subject to erosion due to stormwater and intercepted groundwater. If uncontrolled, this mixture of water and soil could enter downstream water bodies at levels exceeding state water quality standards. Conventional erosion and sediment control Best Management Practices (BMPs) will minimize the amount of erosion. Because typical till soils in the Puget Sound area contain fine sediments that become suspended in runoff water, conventional erosion control measures and runoff treatment may not be sufficient to achieve regulatory requirements for protection of water quality (HoweConsult, 1999; Benedict and Minton, 2000). However, advanced BMPs have been used that provide treatment of construction water to meet regulatory requirements (Oliver, 2003; EES Consulting, 2001; City of Redmond, 2003).

Two general types of construction water—stormwater and groundwater—will occur at the treatment plant sites. Stormwater results from runoff due to precipitation on and upgradient of the project site. Groundwater can be intercepted due to dewatering of excavations at or below the surface at the project site.

Stormwater typically picks up soil particles along its flow path or in excavations. Sediment and turbidity vary in quantity and quality with the precipitation that falls on the site, and with the application of erosion and sediment control measures. This runoff water can contain large quantities of suspended sediment. The reduction and control of construction site runoff is the primary focus of conventional temporary erosion and sediment control measures.

Groundwater discharges are less common at construction sites, occurring typically as pumped dewatering flow from deep excavations. Groundwater discharges can also result from gravity drains. Dewatering operations are intended to maintain a steady-state groundwater level. The flow rate is typically controlled by pumping, and therefore does not vary nearly as much as stormwater runoff water. Also, because the quality of this water is good, including minimal fines content, it can meet water quality standards with little or no treatment.

Direct discharge to surface waters is a regulated activity. Regulations and requirements are summarized below.

1.1 Regulations

Activities in and near surface water are subject to laws and regulations at the federal, state, and local levels. The federal Clean Water Act (CWA) of 1972 and its amendments regulate the point source discharge of pollutants to surface waters. The Washington Department of Ecology (Ecology) has been delegated the authority to implement and enforce CWA Sections 401 and 402. Ecology regulates the point source discharge of stormwater to surface waters from construction sites through National Pollutant Discharge Elimination System (NPDES) Permits.

The General NPDES Permit for Stormwater Discharge Associated with Construction Activities requires application of technology-based stormwater BMPs, including provisions for control of erosion, sediments, and other pollutants. A stormwater pollution prevention plan (SWPPP) is required. Ecology has established guidelines for minimum requirements and the conditions for their applicability in the Stormwater Management Manual for Western Washington (Ecology Manual). Individual NPDES Permits may contain additional terms and conditions.

Local jurisdictions issue permits that are required for development and other land-disturbing activities. Drainage plans must be submitted and approved before the permit can be authorized. Among other things, the drainage plans must specify BMPs that will be implemented to limit erosion and sedimentation during construction. Discharge of stormwater and dewatering water into surface water and stormwater systems is allowable; however, conditions and requirements exist to ensure that water quality standards are met and that increased flow rates do not impact downstream properties or stream and wetland habitat.

1.2 Water Quality Standards

Stormwater discharges associated with construction activities are subject to all applicable state water quality and sediment management standards. Surface water quality standards (State of Washington, 1997) for surface waters of the State of Washington specify the quality requirement for discharges into surface water systems. The state requires that all known, available, and reasonable methods of treatment (AKART) be applied to stormwater discharges associated with construction activities to prevent and control pollution of the waters of the State of Washington.

Pollutants that might be expected in the discharge of water during construction include turbidity, pH, metals, and petroleum products. The majority of surface waters in the state are considered Class AA, which includes the following requirements for freshwater:

- Turbidity shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
- pH shall be within the range of 6.5 to 8.5 (freshwater) with a human-caused variation within a range of less than 0.2 units for Class AA waters and 0.5 for Class A waters.
- Although there is no specific water quality standard for petroleum products, the hazardous waste rules under RCW 90.56 can be interpreted under RCW 90.48 to allow no visible sheen in the stormwater discharge or in the receiving water.
- Dissolved oxygen shall exceed 9.5 milligrams per liter (mg/L).
- Toxic, radioactive, or deleterious material (metals, pesticides, organic compounds) concentrations shall be below those that have the potential either singularly or cumulatively to adversely affect the characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health as determined by Ecology (WAC 173-201A-040 and 173-201A-050).

1.3 Water Quantity

Dewatering flows (typically pumped groundwater or surface water removed from a sump) that are directly or indirectly discharged to waters of the State of Washington would be subject to the state water quality standards listed above. In addition, the dewatering groundwater discharge rate should not exceed 10 percent of the flow rate of the receiving water body at the time of discharge unless a hydrologic study is conducted. This guideline is based on scientific studies reviewed by Ecology staff to protect the chemical, physical, and biological characteristics of streams. If the dewatering discharge is less than or equal to the 10 percent guideline, project-specific information related to anticipated construction dewatering rates and receiving water body flow rates would be included in the Individual NPDES Construction Stormwater Permit. If the dewatering discharge is greater than the 10 percent guideline, a detailed hydrologic impact study would need to be conducted to verify that the additional discharge would not impact the water quality, channel morphology, or aquatic biota of the stream.

1.4 Sanitary Sewer Disposal

A potential disposal alternative for construction water is discharge into a sanitary sewer with permission from the treatment system operator and local sewer agency. These discharges are regulated via the Industrial Waste Program of the local sewer agency, which contains policies and conditions. Approval may include the following, which will vary due to site-specific conditions:

- Demonstrating that a surface water discharge authorization cannot be obtained due to site restrictions and/or regulatory restrictions enforced by state and federal agencies, including but not limited to Ecology, the Washington State Departments of Natural Resources and Fish and Wildlife, and the U.S. Environmental Protection Agency.
- Monitoring wet season discharge limitations.
- Self-monitoring for specified substances.
- Implementing sedimentation-control methods.
- Obtaining a sewer discharge permit from the local sewer agency.

2 STORMWATER AND DEWATERING TREATMENT TECHNOLOGIES

The Ecology Manual provides guidance for the implementation of construction water BMPs that become part of the construction documents for the facility. Source minimization of runoff, erosion, and sedimentation are required. Erosion and sedimentation that cannot be prevented must be treated with site-specific measures designed as part of the detailed project design. Additional measures may be required to comply with regulatory and/or permit requirements.

2.1 Conventional Control Measures

The Ecology Manual provides guidance regarding minimum stormwater requirements and conditions for their applicability. All new development and redevelopment must comply with Minimum Requirement #2–Construction Stormwater Pollution Prevention, which requires implementation of the following 12 elements:

1. Mark clearing limits
2. Establish construction access
3. Control flow rates
4. Install sediment controls
5. Stabilize soils
6. Protect slopes
7. Protect drain inlets
8. Stabilize channels and outlets
9. Control pollutants
10. Control dewatering
11. Maintain BMPs
12. Manage the project

Local jurisdictions issue permits for development and/or land-disturbing activities. Drainage plans must be submitted and approved before the permit can be authorized. The drainage plans must specify BMPs that will be implemented to limit erosion and sedimentation during construction. A wide range of BMPs are available to control erosion during the construction of the project. These include measures to prevent erosion from occurring (source control) and measures to reduce and remove sediment once it is picked up in the stormwater (treatment). Numerous BMPs are available to effectively control erosion and other pollutants during construction. These include:

- Silt fence
- Construction barrier fencing
- Mulching
- Temporary seeding
- Construction vehicle wheel washes
- Stabilized construction entrances
- Erosion netting and plastic covers
- Slope protection
- Inlet protection
- Interceptor dikes and swales
- Flow segregation
- Check dams
- Triangular silt dikes
- Straw barriers
- Straw wattles
- Sediment traps
- Sediment ponds

These and other measures are described in detail in Volume II (Construction Stormwater Pollution Prevention) of the Ecology Manual (Ecology, 2001).

Discharge of stormwater and dewatering water into surface water and stormwater systems is allowable; however, guidance is provided to ensure that water quality standards are met and increased flow rates do not impact downstream properties or stream and wetland habitat.

2.2 Additional Control Measures

Local experience has shown that conventional sediment traps, ponds, and tanks may not always remove suspended sediment from construction runoff to levels low enough to meet turbidity requirements in the receiving waters. These facilities function based on suspended particulates settling from the water column by gravity. Biological uptake of algae and microorganisms also occurs, and pollutants such as metals, hydrocarbons, nutrients, and oxygen-demanding substances can become adsorbed or attached to particulate matter, particularly to clay particles. Removal of these particulates by sedimentation can therefore result in the removal of a large portion of the associated pollutants. The primary design factors affecting particulate removal are the volume of water and settling time. Fine particles such as clay and silt can require detention times of days or even weeks to settle out of suspension, with fine clays effectively never settling out of suspension.

2.2.1 Chemical Flocculation

Common for treatment of drinking water for over a century, chemicals can be mixed with water to enhance settling of fine particulates. Chemical coagulation and flocculation have been used recently in western Washington on a number of large construction sites that discharge to sensitive receiving waters. These systems have achieved reliable reduction of turbidity and associated pollutants of 95 to 99 percent (Benedict and Minton, 2000). These polymer-assisted systems have reduced the very high turbidity levels in wet season runoff to relatively low levels typically occurring in streams during dry weather.

These systems have the following components (EES Consulting, 2001):

- Runoff collection system
- Storage and primary settling basin
- Pumps
- Chemical feed system with injector, emergency shower, eyewash, secondary containment of chemicals, and monitoring equipment
- Treatment cells
- Interconnecting piping

Ecology recommends these systems be designed to provide storage of 1.5 times the runoff volume from the 10-year, 24-hour storm event (Ecology, 2001). For discharges to streams, peak discharge rates shall not exceed 50 percent of the peak rate from the 2-year, 24-hour event, with no peak rate discharge greater than from the 10-year, 24-hour event. At least two treatment cells should be provided. Runoff is routed to one cell at a time. The other cell remains off-line for settling, testing, and discharge. Ecology requires formal written approval of these systems, and that they be included as part of the SWPPP for a project.

The storage and treatment cells are typically provided in excavated open basins or tanks. Operation and maintenance of these systems requires the attention of dedicated and knowledgeable staff for all times that the system is needed. An operational requirement for the effective use of chemical flocculants is the control of pH. In addition to this, pH adjustment of the treated water may also be required prior to discharge. If further treatment is necessary to meet discharge standards, the system can be provided with recirculation piping and valves to allow additional mixing and settlement.

2.2.2 Chitosan

Chitosan is an alternative to a chemical coagulant/flocculant. It is composed of natural carbonaceous material that is typically derived from seashells. It has one potential advantage over chemical coagulants in that there is no requirement for operational pH adjustment (Benedict and Minton, 2000).

2.2.3 Electroflocculation

With electroflocculation (City of Redmond, 2003), stormwater is passed through cells where the water/particles are charged, producing chemical and physical changes that result in enhanced settlement of fine particles. The particles in stormwater are primarily negatively charged and are combined with a positive charge from the cell plates, initiating the coagulation process. The coagulated material is then passed through a tube settler to enhance sedimentation. The process may also 'break' emulsified oils, contaminants, metals, and bacteria. The water can then be directly discharged, with automated on-line monitoring, or sent to a settling pond, where water can be tested before discharge into surface water systems.

Potential advantages of this type of system over the chemical flocculation described above are:

- No operational need for pH adjustment
- In-line process, rather than batching, resulting in smaller facility size
- Lower potential for toxicity

3 ROUTE 9 SITE

3.1 Soils and Slopes

The majority of the Route 9 site slopes moderately to the west and south at an average slope of about 8 percent. The eastern boundary of the site is a moderate to steeper west-facing slope ranging from 10 to 30 percent.

Approximately half of the site has had fill material placed over it. This fill includes crushed gravel and reworked native soil. The majority of the site is underlain by glacial advance outwash and till. These soils have moderate erosion potential and have fine particles, including clay, which are readily suspended in runoff. Chapter 4 of the Final EIS provides detailed soil information.

3.2 Construction Area

The proposed wastewater treatment plant facilities are to be located in the central and southern portion of the 114.3-acre project site, and involve disturbance of all this area at some point in time during construction. Extensive excavation will occur at many of the facilities in the eastern two-thirds of the site, including deep excavation and high retaining walls. Landscaping features and stormwater facilities predominate the western third of the site.

3.3 Dewatering

Several of the project facilities will require deep excavations for construction. With groundwater at 5 feet and less below the existing ground surface, a number of temporary wells will be installed to lower the local groundwater levels during construction. The rate of dewatering flows generated at the project site is estimated to be up to a peak flow of 550 gallons per minute (gpm), or 1.2 cubic feet per second (cfs), for durations as long as 1 month, with more typical flows of 420 gpm, or 0.9 cfs (see Appendix 6-B, Geology and Groundwater).

Based on regional groundwater quality data, the quality of the water is expected to be good, with the exception of dissolved oxygen levels that are substantially lower than state water quality standards. The dissolved oxygen concentration can be raised by using an aerator unit on the discharge side of the pump. Alternatively, the flow could be passed over a series of shallow drops to promote aeration.

The dewatering flows will be collected and conveyed in pipes, separate from the stormwater collection system at the construction site. A portion may be discharged to temporary infiltration ponds where feasible. The remainder will be discharged to stabilized channels downgradient from the stormwater treatment system. Dewatering flows are further discussed in Appendix 6-D, Permanent Stormwater Management at the Treatment Plant Sites.

3.4 Runoff Control Facilities

Conventional temporary erosion and sediment control BMPs will be installed throughout the project site to minimize the potential for erosion and sedimentation. This will likely include the extensive use of all the general categories of items listed earlier in this appendix, including diversion of offsite flows around the disturbed project site areas (see Appendix 6-D). Storage and treatment of construction runoff will be provided at the location of the permanent stormwater ponds and at other temporary excavations. If required due to constrained areas of the project site, portable tanks may also be used to manage construction water.

Sediment pond sizes have been calculated per the Ecology Manual to treat construction runoff from the 10-year, 24-hour storm event. Using the Santa Barbara Urban Hydrograph Method and assuming the entire project site is impervious, disturbed, and destabilized (i.e., construction is not staged), the peak flow rate from the construction area on the site would be 34.8 cfs. A conventional sediment pond water surface area of 1.9 acres would be required to settle this flow. This would most likely be provided in multiple ponds located in the western third of the site. Including design requirements of 2 feet of freeboard, 1.5 feet of sediment storage, and 3.5 feet of runoff storage, the sizes of a single or multiple (equal-sized) sediment ponds have been calculated and are summarized in Table 1.

Given the existing industrial uses at the project site, some contaminated soils may be encountered. If contaminated soils are found, they will be removed or otherwise remediated below state-mandated levels. During construction, stormwater runoff will be monitored for specific contaminants that require remediation. If a contaminant is found at concentrations higher than state surface water discharge criteria, actions will be taken to remove the contaminant source or treat the stormwater to reduce the contaminant to a level meeting discharge requirements.

During the wet season, from October 1 through April 30, most grading and non-essential construction activities would cease. However, in order to maintain the project schedule, a number of the large treatment facilities would require construction throughout the year. These include the solids handling building, headworks, primary clarifier, aeration basins, and membrane bioreactor (MBR) facilities. Advanced treatment using a chemical flocculation system or equivalent may be required to meet turbidity and other water quality standards in the receiving waters (Little Bear Creek). The use of chemical treatment may be necessary during the wet winter months when relatively large volumes of sediment-laden runoff would be produced from these individual construction sites. The construction area for each of these year-round construction sites averages about 2.5 acres. The required stormwater storage volume is 1.5 times the volume from the 10-year, 24-hour event. As above, assuming that each of these construction areas is impervious, disturbed, and destabilized, the runoff volume from the 10-year storm is 0.47 acre-feet. The storage volume for each site is calculated to be 0.7 acre-feet (1.5 times 0.47). Depending on the final construction schedule, one or more of these ponds and associated advanced treatment systems might be in operation during the wet season. This advanced treatment pond(s) would be in addition to the conventional sediment ponds discussed above.

The great majority of the dewatering flows are expected to be pumped groundwater and of good quality. It would, therefore, not require treatment and would bypass the sediment ponds. However, turbid water pumps from sumps or other depressions on the project site would be conveyed to the sediment ponds for treatment.

Table 1. Route 9 Site Sediment Pond Sizing

	Catchment Area Per Pond (ac)	10-Year, 24-Hour Peak Flow Rate (cfs)	Individual Pond Footprint[a]	Individual Pond Storage Volume (ac-ft)
Single Pond	65	34.8	620' x 130'	5.2
Two Ponds	33	17.4	420' x 100'	2.5
Three Ponds	22	11.6	360' x 80'	1.6
Four Ponds	17	8.7	320' x 70'	1.2

[a]The footprint of the sediment ponds is approximate, and assumes 3H:1V side slopes, a 5:1 length-width ratio, 2 feet of freeboard, 1.5 feet of (‘dead’) sediment storage and 3.5 feet of (active) storage depth. Other cut and fill required to bench the ponds into sloping areas is not included in this footprint.

3.5 Runoff Discharge

In addition to control of construction runoff, quantity control of the discharge may be required because the site discharges to a stream. As directed by construction staging, this would be provided as temporary facilities established in the locations where the permanent stormwater facilities would be constructed, generally in the western third of the site. During construction, a portion of the treated stormwater may be infiltrated if suitable locations are found on the site. The rest would be released within swales constructed in the western portion of the project site. Another option would be to disperse a portion of the dewatering flow to vegetated areas adjacent to the construction area, particularly the upland forest areas on the north side of the site.

As stated in Section 3.3, construction dewatering could reach as high as 1.2 cfs, while averaging around 0.9 cfs for most of the construction period. Based on guidelines established by Ecology, dewatering discharges exceeding 10 percent of stream flow could cause impacts to the water quality, channel morphology, and aquatic biota of the stream (see Section 6.2.1.4) and require specific analysis.

The lowest monthly average flow in Little Bear Creek is 7.3 cfs during August (see Appendix 6-E, Route 9 Site Runoff Effects on the Geomorphology of Little Bear Creek). The peak dewatering discharge would add 16 percent to the average August flow, exceeding the 10 percent guideline. A geomorphic analysis of channel stability has been conducted on Little Bear Creek (see Section 6.2.2.A). It was concluded that Little Bear Creek is relatively stable and shows little sign of channel down-cutting or active streambank erosion. The addition of up to 1.2 cfs of dewatering flow would not negatively affect the stability of the stream.

With regard to water quality, Little Bear Creek is on the state's 303(d) list for fecal coliform. The creek occasionally does not meet dissolved oxygen and temperature standards. The dewatering flows from the project site would consist primarily of pumped groundwater. Coliform levels would be low, as would water temperature. The water intended for surface discharge would be piped and released to a stabilized channel near the edge of the project site. One or more techniques, such as pump aeration or short, vertical drops in the pipeline, would be used to assure adequate aeration of the flow. The flow released to Little Bear Creek would therefore meet water quality standards and preserve the water quality in the creek. The mean concentrations of nitrate and phosphorus in Little Bear Creek are 1.28 and 0.053 mg/L, respectively. The mean concentrations in groundwater, regionally, are generally less than 0.6 and 0.1 mg/L. Therefore, the addition of dewatering flows to Little Bear Creek is not expected to substantially change the nutrient concentrations in the creek.

The great majority of the dewatering flow generated at the site would be pumped groundwater. This water would have a very low level of suspended solids and a low level of turbidity (generally less than 5 NTUs). However, it may be necessary to pump accumulated surface water that may collect in low areas around the project site. This water would typically contain high levels of suspended solids, which could seriously degrade water quality. Water pumped from sumps or low-lying areas would need to be handled separately. Advanced treatment may be necessary to assure turbidity is reduced to levels that would not cause water quality impacts in Little Bear Creek.

During construction, onsite monitoring of the erosion control facilities would be actively carried out by King County in accordance with the project SWPPP approved by Ecology and the local agency. This would include daily inspections of erosion control measures during the wet season, and weekly inspections during the dry season and following larger storm events. Discharges of treated stormwater would be monitored for turbidity, pH, and any other parameters identified in the monitoring plan as part of the SWPPP. The stream receiving runoff from the treatment plant site (Little Bear Creek for the Route 9 site or Willow Creek for the Unocal site) would be monitored for turbidity weekly during the dry season, and daily during the wet season, both upstream and downstream of the inflows from the project site during the construction period. If increases in turbidity levels in the creek exceed 5 NTUs due to project discharges, measures would be undertaken to reduce turbidity levels to meet state water quality standards. These measures could include advanced stormwater treatment as necessary to reduce the turbidity of the site discharge(s) to compliant levels.

4 UNOCAL SITE

4.1 Soils and Slopes

The Unocal site consists of the northern third of a local hill, with a level area at the northern foot of the hill, and a number of benches on the hillside. The two largest benches are referred to as the upper yard and the lower yard.

Fill material has been placed over the entire upper and lower yard areas, with depths from 1 to 8 feet in the lower yard and 1 to 3 feet in the upper yard. The lower yard is underlain with alluvium native soil, and the upper yard is underlain with transitional beds and Whidbey formation materials. All these soils have moderate erosion potential and have fine particles, including clay and silt, that are readily suspended in runoff. Chapter 4 provides detailed soil information.

4.2 Construction Area

The proposed wastewater treatment plant facilities would be located over 34.5 acres of the 52.6-acre site. Extensive excavation would occur across most of this area, including deep excavation and high retaining walls that would be constructed at the upper portions of the site.

4.3 Dewatering

Several of the project facilities would require deep excavations for construction. A number of temporary wells would be installed to lower the local groundwater levels for construction. The rate of dewatering flows generated at the project site is estimated to be up to 700 gpm, or 1.6 cfs, for durations as long as a month, with more typical flows of 500 gpm, or 1.1 cfs (see Appendix 6-B, Geology and Groundwater). Much of this groundwater would be pumped from a depth at or below sea level. Pumping this water could lower the local groundwater level, reducing the flow in nearby Willow Creek and affecting the water level in Edmonds Marsh, which borders the project site.

Temporary groundwater cutoff walls would be constructed along the northern boundary of the plant facilities. Groundwater cutoff walls could probably be constructed with tight sheet piling. The cutoff walls would limit drawdown in the adjacent Edmonds Marsh and Willow Creek and reduce the direct influence of Puget Sound on groundwater dewatering wells. However, analysis indicates that there may be 1 foot of groundwater drawdown beneath the Edmonds Marsh, possibly lowering water levels in the marsh. If the Unocal site is selected for the treatment plant construction, further exploratory borings would be completed around the lower yard at depths of up to 100 feet to determine if a suitable low-permeability groundwater cutoff layer is present. If temporary groundwater drawdown occurs in the marsh, this could be mitigated by pumping treated groundwater from the construction site back into the Edmonds Marsh. Further information on groundwater conditions at the Unocal site can be found in Appendix 6-B.

The groundwater beneath the Unocal lower yard currently is contaminated with free- and dissolved-phase petroleum products. Unocal has conducted interim remedial actions to clean up groundwater beneath the lower yard and is scheduled to begin final cleanup activities during the summer or fall of 2005. The expected quality of the shallow groundwater at the time of construction would be determined in the design phase. Unless the site is completely cleaned up prior to plant construction, construction dewatering flows would likely need to be treated for contaminant removal prior to disposal. Suspended solids would be removed during contaminant treatment. However, if treatment for contaminants is not necessary, then mechanical (most likely sedimentation ponds) or chemical (flocculation) treatment would be used to remove sediment.

4.4 Runoff Control Facilities

Conventional temporary erosion and sediment control BMPs will be installed throughout the project site to minimize the potential for erosion and sedimentation. This may include extensive use of all the general categories of items listed earlier in this appendix. Storage and treatment of construction runoff will be provided in the low-lying, level areas of the northern portion of the site. It is expected that the temporary sediment pond(s) can be located in the area proposed for the permanent stormwater basins and potentially in other temporary excavations. If required by constrained areas of the project site, portable tanks may be used to manage construction water from these areas.

Sediment pond sizes have been calculated per the Ecology Manual to treat construction runoff from the 10-year, 24-hour storm event. Using the Santa Barbara Urban Hydrograph Method and assuming the entire project site is impervious, disturbed, and destabilized (i.e., construction is not staged), the peak flow rate from the construction area on the site would be 18.2 cfs. This converts to a sediment pond water surface area of 1 acre. Including design requirements of 2 feet of freeboard, 1.5 feet of sediment storage, and 3.5 feet of active storage, the sizes of a single and two equal-sized sediment ponds have been calculated, and are summarized in Table 2.

As discussed in Section 3.4, year-round construction is anticipated to occur across much of the project site. Additional treatment using chemical flocculation or other advanced treatment methods to remove turbidity may be required during the wet season. The stormwater runoff will be monitored for petroleum hydrocarbons; benzene, toluene, ethylbenzene, and total xylenes (BTEX); and any other contaminants identified in the soil or groundwater at the site. Additional treatment will be provided as necessary to meet discharge requirements.

Table 2. Unocal Site Sediment Pond Sizing

	Catchment Area Per Pond (acre)	10-Year, 24-Hour Peak Flow Rate (cfs)	Individual Pond Footprint[a]	Individual Pond Storage Volume (ac-ft)
Single Pond	48	18.2	430' x 100'	2.6
Two Ponds	24	9.1	330' x 70'	1.2

[a]The footprint of the sediment ponds is approximate, and assumes 3H:1V side slopes, a 5:1 length-width ratio, 2 feet of freeboard, 1.5 feet of ('dead') sediment storage, and 3.5 feet of (active) storage depth. Other cut and fill required to bench the ponds into sloping areas is not included in this footprint.

4.5 Runoff Discharge

Both the treated stormwater runoff and the dewatering flows will be discharged to Puget Sound via the existing Willow Creek pipeline. Therefore, no quantity control of construction runoff is required.

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