DEVELOPMENT SERVICES DEPARTMENT
ENVIRONMENTAL COORDINATOR
450 110th Ave NE., P.O. BOX 90012
BELLEVUE, WA 98009-9012

OPTIONAL DETERMINATION OF NON-SIGNIFICANCE (DNS) NOTICE MATERIALS

The attached materials are being sent to you pursuant to the requirements for the Optional DNS Process (WAC 197-11-355). A DNS on the attached proposal is likely. This may be the only opportunity to comment on environmental impacts of the proposal. Mitigation measures from standard codes will apply. Project review may require mitigation regardless of whether an EIS is prepared. A copy of the subsequent threshold determination for this proposal may be obtained upon request.

File No.	11-116702-LO
Project Name/Address:	Coal Creek Parkway Culvert Replacement 5200 Coal Creek Parkway SE
Planner:	David Pyle / dpyle@bellevuewa.gov
Phone Number:	425-452-2973
Minimum Comment Period:	**July 28, 2011**

Materials included in this Notice:

- ☒ Blue Bulletin
- ☒ Checklist
- ☒ Vicinity Map
- ☒ Plans
- ☐ Other:

City of Bellevue File Number 11-116702-LO
07/14/2011
City of Bellevue Utilities Department Coal Creek Parkway Culvert Replacement
SEPA Checklist
5200 Coal Creek Parkway SE

SEPA Checklist Reviewed By:
David Pyle, Land Use Planner
425-452-2973 - dpyle@bellevuewa.gov

City of Bellevue Submittal Requirements

ENVIRONMENT

If you need assistance in completing the checklist or have a
please visit or call Development Services (425-452-6800) between 8 a.m. and 4 p.m., Monday through Friday (Wednesday, 10 to 4). Assistance for the hearing impaired: Dial 711 (Telecommunications Relay Service). .

BACKGROUND INFORMATION

Property Owner:

The City of Bellevue, Washington

Proponent:

The City of Bellevue, Washington

Contact Person:

Bruce Jensen, City of Bellevue
(If different from the owner. All questions and correspondence will be directed to the individual listed.)

Address:

450 110th Avenue NE
P.O. Box 90012
Bellevue, WA 98009

Phone:

425-452-7240

Proposal Title: **Coal Creek Culvert Replacement Project**

Proposal Location:

Coal Creek Parkway at Coal Creek Park, roughly ¼ mile south of the intersection of Coal Creek Parkway and Forest Dr. SE.

The project area is located within the right-of-way of Coal Creek Parkway. King County Parcel No. 212405-9001 is the nearest parcel. The right-of-way is owned by the City of Bellevue and is abutting Coal Creek Park, also owned by the City.

The culvert is located under Coal Creek Parkway at Coal Creek River Mile 2.3.

(Street address and nearest cross street or intersection) Provide a legal description if available.

Nearest address: 5200 Coal Creek Parkway SE, Bellevue, WA 98006

Please attach an 8 ½" x 11" vicinity map that accurately locates the proposal site.

See attached Figure 1 for a vicinity map and Figure 3 for a project area map.

Give an accurate, brief description of the proposal's scope and nature:

1.General description:

Replacement of an existing corrugated metal pipe culvert (CMP) with a larger concrete bottomless box style culvert. The proposed culvert will be constructed over the top of and around the existing 9-foot-diameter, 113-foot long, CMP. In conformance with WDFW design criteria, the new culvert will be 39 feet wide and about 108 feet long, with 7 feet of the culvert width devoted to a trail next to the stream channel. This increase in channel width at the crossing will allow Coal Creek to meander under the culvert in a natural manner. The new culvert will be constructed working from the road bed above with soldier pile and steel plate lagging walls and a cast-in-place concrete lid. Fourteen soldier piles will be installed to construct the south side wall, and fifteen will be installed on the north side. Steel plate lagging will then be placed between the soldier piles to form the walls of the culvert. The steel lagging will be sprayed with concrete to seal and protect it in the final stages of construction.

Two wing walls will be installed at both the upstream and downstream ends of the culvert. The wing walls will help prevent bank erosion by armoring the approach and exit of the culvert. The wing walls will be constructed a similar manner as the culvert walls, using soldier piles and concrete.

Two log grade control structures will be placed under the inlet and outlet of the culvert. The grade control structures will manage scour processes by providing hard points in the streambed under the culvert. The grade control structures will be constructed using large (40 to 50 feet long) logs, which will be anchored in place with buried ecology blocks and tethered with steel cable. In addition, the first log weir downstream of the culvert outlet will be replaced. It will be replaced with a stacked log weir to redirect hydraulic shear stress away from the left bank to the center of the channel. Two engineered log jams will also be constructed as part of this project; one downstream and one upstream of the culvert. These log jams will protect the stream banks from erosion. One log jam will be located on the upstream side on right bank and one on the downstream side on the left bank. The log jams will be constructed out of simple logs and logs with rootwads attached. They will be secured in place by partially burying them into the banks, anchored with ecology blocks and partially secured in place with the existing riprap at those locations.

A scour pad will be installed in the pool just east of the inlet of the culvert. The scour pad will be constructed of large (18-inch diameter) alluvial boulders that will be installed up to 5 feet below the culvert inlet. The scour pad will prevent water from scouring out the streambed at the inlet of the culvert.

The project would be constructed in phases, over two construction seasons, commencing in 2012 and would be coordinated with a separate project which would relocate two Olympic Pipe Line gas lines. The gas lines would be relocated by Olympic Pipe Line separate from the culvert project. Another reason for construction phasing is to comply with the Washington Department of Fish and Wildlife (WDFW) fish window, which requires that no in-water work take place during certain times of the year to avoid impacts to fish.

As mentioned above, a trail will be incorporated into the design of the culvert. The trail will cross Coal Creek Parkway SE under the new culvert and connect the trail from the parking lot to the west side of Coal Creek Parkway SE. The trail will be separated from the stream channel by a 5-foot-high concrete wall.

2. Acreage of site:

The project site crosses several parcels and is defined by a construction limits boundary, not a property boundary.

Less than two acres.

3. Number of dwelling units/buildings to be demolished:

Zero.

4. Number of dwelling units/buildings to be constructed:

Zero.

5. Square footage of buildings to be demolished:

Not applicable.

The existing culvert that crosses under Coal Creek Parkway will be demolished after the new culvert has been constructed around it.

6. Square footage of buildings to be constructed:

Not applicable.

7. Quantity of earth movement (in cubic yards):

Approximately 3,800 cubic yards of excavated material and 2,300 cubic yards of fill material.

8. Proposed land use:

The land use would not change as a result of this project.

9. Design features, including building height, number of stories and proposed exterior materials:

The new culvert would be poured in place and constructed of concrete (bottomless box-style). The culvert's "walls" would be about 9 feet tall and would be about 39 feet apart, which allows space for the 6-foot wide trail and 1-foot thick wall, with a concrete "roof." When in place, the entire culvert would measure about 108 feet long. The culvert would be protected by two concrete wing walls and one head wall on both the upstream side and downstream side. Stairs would be constructed at the east end of the culvert for trail access.

Estimated date of completion of the proposal or timing of phasing:

The project would be constructed in two phases. Construction would begin in spring 2012 and end in Fall 2013. The upstream and downstream sides of the project would be constructed separately and be considered distinct and individual phases of the project.

Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

No.

List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

1) **Technical Report addressing the key land use codes prepared by CH2M HILL (2011)**
2) **Stream and Wetland Delineation Report prepared by CH2M HILL (2011)**
3) **Biological Assessment prepared by CH2M HILL (2011)**
4) **Cultural and Historic Resources Report prepared by CH2M HILL (2011)**
5) **Geotechnical Report prepared by CH2M HILL (2011)**
6) **Hydraulics Report prepared by Herrera Environmental Consultants (2011)**

7) **Traffic Technical Memo prepared by CH2M HILL (2011)**
8) **Results of Soil Sampling Technical Memo prepared by CH2M HILL (2011)**
9) **Critical Areas Technical Report prepared by CH2M HILL (2011)**

Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain. List dates applied for and file numbers, if known.

The Olympic Pipeline Company will file for permits to relocate two existing pipelines in the project area. That work will be conducted separately from this project and all permitting for the Olympic Pipeline work will be separate.

The City of Bellevue Parks Department has plans to construct trailhead improvements within the project area. That work will be conducted separately from this project and all permitting for the proposed facility will be separate.

List any government approvals or permits that will be needed for your proposal, if known. If permits have been applied for, list application date and file numbers, if known.

City of Bellevue Critical Areas Land Use Permit and Clearing and Grading Permit

The project would require permits from several agencies and jurisdictions including: U.S. Army Corps of Engineers [USACE] (Section 404 Permit), Washington State Department of Ecology (Section 401 WQ; included in USACE Nationwide Permit [NWP]), Washington Department of Fish and Wildlife [WDFW] (Hydraulic Project Approval [HPA]), and the City of Bellevue (Clearing and Grading and Right of Way Permits).

Please provide one or more of the following exhibits, if applicable to your proposal.
(Please check appropriate box(es) for exhibits submitted with your proposal):

☐ Land Use Reclassification (rezone) Map of existing and proposed zoning
Not applicable.

☐ Preliminary Plat or Planned Unit Development
Preliminary plat map
Not applicable.

☑ Clearing & Grading Permit
Plan of existing and proposed grading
Development plans

☐ Building Permit (or Design Review)
Site plan
Clearing & grading plan
Not applicable.

☐ Shoreline Management Permit
Site plan
Not applicable.

A. ENVIRONMENTAL ELEMENTS

1. Earth

a. General description of the site: ☐ Flat ☑ Rolling ☐ Hilly ☑ Steep slopes ☐ Mountains ☐ Other

b. What is the steepest slope on the site (approximate percent slope)?

The steepest slope onsite is estimated at approximately 40 percent at the Coal Creek Parkway embankments.

c. What general types of soil are found on the site (for example, clay, sand, gravel, peat, and muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.

The U.S. Department of Agriculture mapped soils in the project area as Alderwood and Kitsap soils. Alderwood and Kitsap soils are moderately well drained. Alderwood is gravelly loam (0 to 12 inches) and very gravelly loam (12 to 60 inches). Kitsap is silt loam (0 to 24 inches) and stratified silt to silty clay loam (24 to 60 inches). The project area has been disturbed and much of the area is now covered in fill soil. In general the soils encountered in the project area were silt and sandy loams with fill gravel. See Figure 5 for mapped soils.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

Some areas of the Coal Creek basin are highly erodible as a result of historic mining and land clearing activities. Slope erosion and bank failures are not uncommon due to the occasional failure of old coal mine tailings and the urbanized conditions along portions of the basin. There are steep slopes on and near the project site. The slopes appear to be relatively stable and are mostly vegetated.

e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.

Approximately 2,300 cubic yards of fill material would be needed to construct the new culvert in place, including replacing the roadway. The source of the fill would be a commercial site that is not yet known.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Construction activities related to this project could cause soil erosion. Soil would be removed and added by large construction vehicles in several locations on the project site. The erosion would be short-term, best management practices (BMPs) would be in place, and conditions post-construction would not increase the potential for erosion on this site.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

Impervious surface at the site would increase slightly from the construction of the four wing walls and two head walls and trail at the ends of the culvert.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Conservation and Performance Measures:

General

- **A Temporary Erosion and Sediment Control Plan will be developed and implemented.**
- **A qualified Erosion and Control Inspector will review all sediment control measures twice per week during construction. "Qualified" means the inspector will be a Certified Erosion and Sediment Control Lead.**
- **A Spill Prevention, Control, and Countermeasures Plan that meets Washington Department of Ecology standards will be developed and implemented for the project to ensure that all pollutants and products will be controlled and contained.**
- **Seasonal restrictions applied to work conducted below the ordinary high water mark (OHWM) will be as required by a project-specific HPA issued by the WDFW.**
- **Construction impacts will be confined to the minimum area necessary to complete the project.**
- **Removal of riparian vegetation will be minimized as much as possible.**

Water Quality/Erosion Control

- **All BMPs will be installed according to City of Bellevue standards and will be inspected and maintained throughout the life of the project.**
- **Staging and soil stockpile areas will be limited to those outlined in the clearing and grading permit. Staging areas will be fenced and covered during sustained, heavy rain events.**
- **Spill kits will be kept onsite.**
- **Fuels and other potentially hazardous materials will be kept in a secured area. "Secured" means fenced, and locked during non-work hours.**
- **Secondary containment will be required for all hazardous materials. Spill containment is required for generators, parked equipment, porta-potties, fuels, solvents, etc.**
- **The project will comply with water quality conditions identified by Ecology.**
- **Wash water resulting from wash-down of equipment or work areas will be contained for proper treatment and/or disposal, and will not be directly discharged into state waters.**
- **There will be no discharge of oil, fuels, or chemicals to surface waters, or onto land where there is a potential for re-entry into surface waters.**
- **No cleaning solvents or chemicals used for tools or equipment cleaning will be discharged to ground or surface waters.**
- **The contractor will regularly check fuel hoses, oil drums, oil or fuel transfer valves, fittings, etc. for leaks, and will maintain and store materials properly to prevent spills.**
- **BMPs will be used on all project activities to control and prevent sediments from entering aquatic systems.**

In-water and Over-water Work

- **In-water work will be restricted to periods of low flow.**
- **Materials removed from below the OHWM will be placed in an upland location where they cannot enter water bodies.**
- **Materials, such as riprap and large woody debris, placed within the water, will be free of sediment and other contaminants.**

- **Water pumped from work isolation areas will be treated to remove suspended sediments prior to returning to the water body. Discharge will occur in such a manner as not to cause erosion.**
- **Mechanical equipment will not enter the stream channel until the project area has been dewatered and fish salvage has been completed (or the channel is naturally dry).**
- **Mechanical equipment operating in the project area will be inspected daily for leaks. Any equipment found to be leaking will immediately be repaired or removed from the project site.**

2. AIR

a. What types of emissions to the air would result from the proposal (i.e. dust, automobile odors, and industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

Emissions to air would be temporary and limited to exhaust from internal-combustion-engine-powered construction equipment.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

None known.

c. Proposed measures to reduce or control emissions or other impacts to the air, if any:

None proposed.

3. WATER

a. Surface

(1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

Coal Creek flows through the center of the project site. Coal Creek is a tributary to Lake Washington and is a Type F water body. Several wetlands with some seasonal overland flow (toward Coal Creek) exist on and near the project site. See Figure 6.

(2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If Yes, please describe and attach available plans.

The project would require work over and in Coal Creek and its buffer. The project may also require temporary impacts to a wetland buffer located downstream of the culvert on the left bank to create an area for construction equipment access and staging. Please see the attached plan set (Attachment 1) for details.

(3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

Approximately 3,800 cubic yards of material would be excavated to make room for the new culvert and roadway and approximately 2,300 cubic yards of material would be placed over the new box culvert and roadway. Approximately 795 cubic yards of material; rocks, rip-rap, streambed gravel and logs will be placed in the stream for scour and

erosion control. Approximately 770 cubic yards of material will be removed to make room for these materials.

(4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

The project would conduct all work in the summer during the in-water work window (July 1 through August 31). To prevent an increase in sedimentation, short-term diversions of flow would occur during culvert installation. A temporary collection basin would be constructed in the upstream flow control structure. The water would then be pumped through the project site and discharged back to Coal Creek into the downstream pool below the existing culvert. This would dewater the project site and keep Coal Creek free of additional sediment that could result from culvert installation activities.

(5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

The proposed project lies within the 100-year floodplain of Coal Creek (Figure 4). The 100-year floodplain includes the Coal Creek mainstem and extends out of the channel on both the left and right banks (excluding the right bank on the upstream side) for the entire project area.

(6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

No.

b. Ground

(1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description.

No.

(2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals...; agricultural; etc.) Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

No waste material would be discharged to the ground.

c. Water Runoff (Including storm water)

(1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

No stormwater discharge is associated with this project.

(2) Could waste materials enter ground or surface waters? If so, generally describe.

Waste materials could enter surface or ground waters. Fuel or hydraulic fluid could spill from construction equipment. However, this is unlikely to occur with the use of the BMPs detailed in section 1.h.

d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

A Spill Prevention Control and Countermeasures Plan will be written for this project. Please refer to 1.h. for a complete list of erosion control measures.

4. Plants

a. Check or circle types of vegetation found on the site:

- ☑ deciduous tree: alder, maple, aspen, other
- ☑ evergreen tree: fir, cedar, pine, other
- ☑ shrubs
- ☑ grass
- ☐ pasture
- ☐ crop or grain
- ☑ wet soil plants: cattail, buttercup, bulrush, skunk cabbage, other
- ☑ water plants: water lily, eelgrass, milfoil, other
- ☐ other types of vegetation

Please refer to the abbreviated Critical Areas Report for the complete description of the project site.

b. What kind and amount of vegetation will be removed or altered?

It is expected that up to 10 significant trees (as defined by Bellevue Land Use Code) may be removed during clearing of the site for access by construction equipment. "Significant" is defined as trees with a diameter at breast height of greater than 8 inches. Vegetation to be removed would include grass, shrubs and Alder and Cottonwood trees.

c. List threatened or endangered species known to be on or near the site.

There are no threatened or endangered plant species known to occur on or near the project site.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

Please refer to Attachment 2 to review the proposed restoration and planting plan. Any disturbed areas would be restored to pre-construction conditions (or better) by planting native plant species, where possible, in the areas where vegetation was removed as a result of construction.

5. ANIMALS

a. Check or circle any birds and animals which have been observed on or near the site or are known to be on or near the site:

☑ Birds: hawk, heron, eagle, songbirds, other:

☑ Mammals: deer, bear, elk, beaver, other:

☑ Fish: bass, salmon, trout, herring, shellfish, other:

b. List any threatened or endangered species known to be on or near the site.

Chinook salmon and steelhead trout have been documented in Coal Creek and both are listed by the National Marine Fisheries Service as federally threatened species. Coal Creek has not been designated as Chinook salmon Critical Habitat.

c. Is the site part of a migration route? If so, explain.

The project site lies within the Pacific Flyway for migratory birds. Also, as noted in 5.b. above, anadromous fish species are known to migrate through this reach of Coal Creek.

d. Proposed measures to preserve or enhance wildlife, if any:

The expanded culvert will improve the ability of fish to move upstream and downstream. It may also act as a corridor under the road for terrestrial wildlife species that might otherwise use the road. The culvert will be bottomless and stream flows will rarely occupy the entire area within the culvert, leaving space for wildlife to travel through the culvert. Revegetation of disturbed areas to preconstruction quality will also act as mitigation for project disturbance.

6. Energy and Natural Resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy need? Describe whether it will be used for heating, manufacturing, etc.

The completed project would not have any energy needs.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

The completed project would not affect use of solar energy.

c. What kinds of energy conservation features are included in the plans of the proposal? List other proposed measures to reduce or control energy impacts, if any:

No energy conservation features are associated with this project.

7. Environmental Health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

No risk of fire or explosion are associated with this project. Gasoline and diesel were detected

slightly above cleanup levels at one boring site at 1 ft below ground surface. See the attached technical memorandum *Results of Soil Sampling for the Coal Creek Parkway Culvert Replacement Study* for detailed study results (Attachment 3). The project team would segregate the soil in this area and the contaminated soil would be disposed of at a Subtitle D landfill such as Roosevelt Regional Landfill. The soil will be segregated by using field observations from a PID meter (measures vapor levels), visual staining, or odor. The contamination appears to be very localized to the area of just one boring location. Human health hazards can be minimized by team members examining the soil and wearing nitrile gloves when handling the soil.

(1) Describe special emergency services that might be required.

No special emergency services would be required.

(2) Proposed measures to reduce or control environmental health hazards, if any.

See 7.a. No additional measures are proposed to reduce or control environmental health hazards.

b. Noise

(1) What types of noise exist in the area which may affect your project (for example, traffic, equipment, operation, other)?

No existing noise would affect the project.

(2) What types and levels of noise would be created by or associated with the project on a short-term or long-term basis (for example, traffic, construction, operation, other)? Indicate what hours noise would come from the site.

There would not be a long-term increase in noise resulting from this project. A short-term increase in noise would occur while construction equipment is in use onsite. Noise would generally occur between the hours of 7 a.m. and 5 p.m. on weekdays. The maximum level of noise from a single piece of construction equipment would be 113 A-weighted decibels (dBA) from a pneumatic chipping hammer. Also in use would be jackhammers (102 to 111 dBA), bulldozers, earth tampers, cranes, grade-alls, front-end loaders, and backhoes (all between 84 and 96 dBA).

(3) Proposed measures to reduce or control noise impacts, if any:

Construction activities will conform to the City of Bellevue's Noise Ordinance for both time of day and maximum noise limits.

8. Land and Shoreline Use

a. What is the current use of the site and adjacent properties?

The adjacent land use is city park land and a four-lane road (Coal Creek Parkway).

b. Has the site been used for agriculture? If so, describe.

No.

c. Describe any structures on the site.

There is an existing corrugated metal pipe culvert and a concrete flow-control structure onsite. Coal Creek Parkway bisects the site.

d. Will any structures be demolished? If so, what?

The roadway and culvert would both be demolished and rebuilt as a result of this project.

e. What is the current zoning classification of the site?

The project area is zoned R-1, Single Family Residential.

f. What is the current comprehensive plan designation of the site?

The site is designated P (SF-L) and P (SF-M). P indicates park and the SF-L and SF-M indicate a residential designation allowing up to 3.8 and 1.8 (respectively) dwelling units per acre.

g. If applicable, what is the current shoreline master program designation of the site?

Not applicable.

h. Has any part of the site been classified as an "environmentally sensitive" area? If so, specify.

Coal Creek and the onsite wetlands are considered "environmentally sensitive" by the City of Bellevue.

I. Approximately how many people would reside or work in the completed project?

None.

j. Approximately how many people would the completed project displace?

None.

k. Proposed measures to avoid or reduce displacement impacts, if any:

Not applicable.

i. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The project will be reviewed by the City of Bellevue.

9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

None.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

None.

c. Proposed measures to reduce or control housing impacts, if any:

Not applicable.

10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

Not applicable.

b. What views in the immediate vicinity would be altered or obstructed?

None.

c. Proposed measures to reduce or control aesthetic impacts, if any:

Not applicable.

11. Light and Glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

No lighting is proposed.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

No.

c. What existing off-site sources of light or glare may affect your proposal?

None.

d. Proposed measures to reduce or control light or glare impacts, if any:

Not applicable.

12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?

Hiking, fishing, bird watching within Coal Creek Park and Trail.

b. Would the proposed project displace any existing recreational uses? If so, describe.

Due to safety considerations, construction activities would temporarily disrupt all recreational activities in the immediate vicinity.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

None proposed

13. Historic and Cultural Preservation

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.

None known.

b. Generally describe any landmarks or evidence of historic, archeological, scientific, or cultural importance known to be on or next to the site.

None known.

c. Proposed measures to reduce or control impacts, if any:

A cultural and historic investigation was conducted as part of the permitting process. See Attachment 4 for the Cultural and Historical Technical Report.

14. Transportation

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.

Coal Creek Parkway SE is a four-lane undivided roadway with a posted speed limit of 40 mph. Coal Creek Parkway connects to Interstate 405 to the north and to SR 900 in Renton to the south.

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

Ten bus routes operate within the site. The routes and the site corridors they serve are as follows:

- **King County Metro #114 – 119th Ave. SE, SE 60th St.**
- **King County Metro #167 – Coal Creek Pkwy./I-405, Lake Washington Blvd./I-405**
- **King County Metro #219 – Coal Creek Pkwy., 119th Ave. SE, Forest Dr. SE**
- **King County Metro #240 – Coal Creek Pkwy., 119th Ave. SE, SE 60th St.**
- **King County Metro #247 – Coal Creek Pkwy.**
- **King County Metro #342 – Coal Creek Pkwy./I-405**
- **Sound Transit #560 – Lake Washington Blvd./I-405**
- **King County Metro #821 – Coal Creek Pkwy./I-405, Lake Washington Blvd./I-405, SE 60th St., 119th Ave. SE**
- **King County Metro #824 – Coal Creek Pkwy., Forest Dr. SE**
- **King County Metro #925 – Coal Creek Pkwy., Forest Dr. SE, 119th Ave. SE, SE 60th St., Lake Washington Blvd.**

c. How many parking spaces would the completed project have? How many would the project eliminate?

No parking spaces would be added or eliminated.

d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not Including driveways? If so, generally describe (indicate whether public or private).

No permanent capacity improvements to existing roads are included in the proposal; however, some minor construction-related mitigation roadway improvements may be implemented.

e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

The project would not use or occur in the vicinity of water, rail, or air transportation.

f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.

Prior to the closure, Coal Creek Parkway, between Forest Drive SE and SE 60th Street, is estimated to have 2,197 northbound trips and 725 southbound trips during the AM peak hour. During the PM peak hour, the segment is estimated to have 1,097 northbound trips and 2,264 southbound trips. During the construction, when one lane would be closed in each direction, there would be fewer trips due to traffic diversion. In the AM peak hour, the segment would have 1,650 northbound trips and 615 southbound trips. During the PM peak hour, the segment would have 840 northbound trips and 1,702 southbound trips. After construction is complete, it is expected that traffic volumes would return to pre-construction levels. No additional traffic is anticipated after construction is complete.

g. Proposed measures to reduce or control transportation impacts, if any:

Some minor construction-related mitigation roadway improvements may be temporarily implemented in the study area to reduce impacts due to diversion of traffic.

15. Public Services

a. Would the project result in an increased need for the public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.

No.

b. Proposed measures to reduce or control direct impacts on public services, if any.

Not applicable.

16. Utilities

a. Circle utilities currently available at the site: electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other.

Several utilities pass through and near the site but are not available for use onsite. They include Olympic Pipeline Company (petroleum pipelines), Puget Sound Energy (natural gas and electricity), King County Metro (sanitary sewer), and Qwest (telephone). The Olympic Pipeline Company will relocate its two existing pipelines in the project area.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

No additional utilities are proposed for this project. Utilities that occur on-site would need to be

relocated. The process of confirming the utilities which need to be relocated is on-going. It's known that the following utilities would be impacted and would need to be relocated:

16" petroleum pipelines (BP Pipelines Operator of Olympic Pipeline)
20" petroleum pipelines (BP Pipelines Operator of Olympic Pipeline)
12" natural gas (Puget Sound Energy)
Overhead Local Power (Puget Sound Energy)
Overhead transmission (Puget Sound Energy)

Some impact to the existing fibre optics line is likely to occur and a temporary relocation of this line is anticipated.

The proposed construction sequencing for the utility relocation is as follows:

Construction is planned to begin in early or mid 2012. The project would be constructed in two phases. The west (downstream) half of the culvert would be constructed in the first phase. The City's contractor would then backfill the roadway to the sub-grade and would be de-mobilized to allow for relocation of utilities on the west side of the road. At the completion of these utility relocations, the road surface would be restored and traffic control would switch traffic to the newly constructed southbound lanes. The east (upstream) half of the culvert would then be constructed in a second phase of construction which would occur in Spring/Fall 2013.

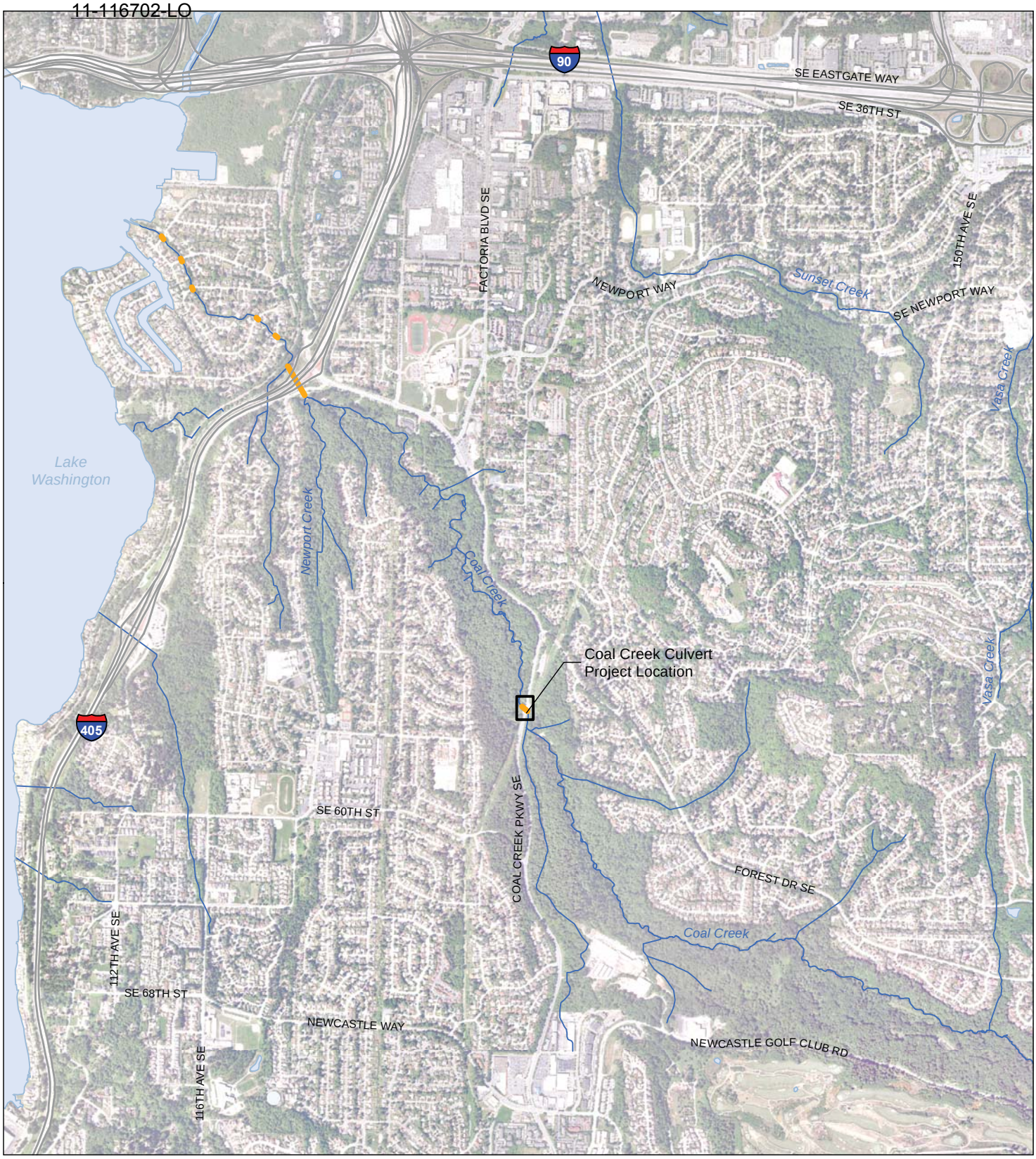
Signature

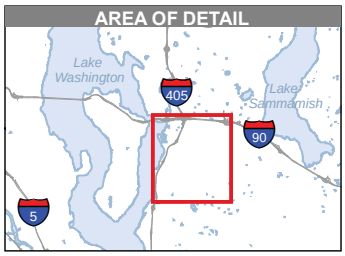
The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature..... .....

Date Submitted.....June 8, 2011.....

FIGURES





Culvert on Coal Creek

Open Stream

Source: City of Bellevue (2006) GIS Data (Streams, Streets); Aerials Express (2009) Aerial. Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

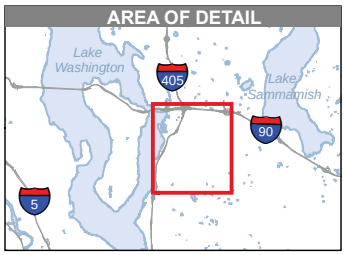
N

0 500 1,000 2,000 Feet

Figure 1. **Project Vicinity**

Coal Creek Culvert Project

Reviewed By: David Pyle 07/12/2011



20 ft Contour

100 ft Contour

Source: City of Bellevue (2006) Streams, Streets; King County (2005) Contours. Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

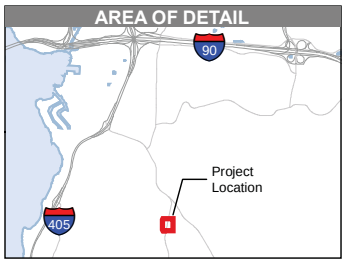
N

0 500 1,000 2,000 Feet

Figure 2. **Topography in Project Vicinity**

Coal Creek Culvert Project

Reviewed By: David Pyle 07/12/2011



Open Stream
Culvert on Coal Creek
Project Area

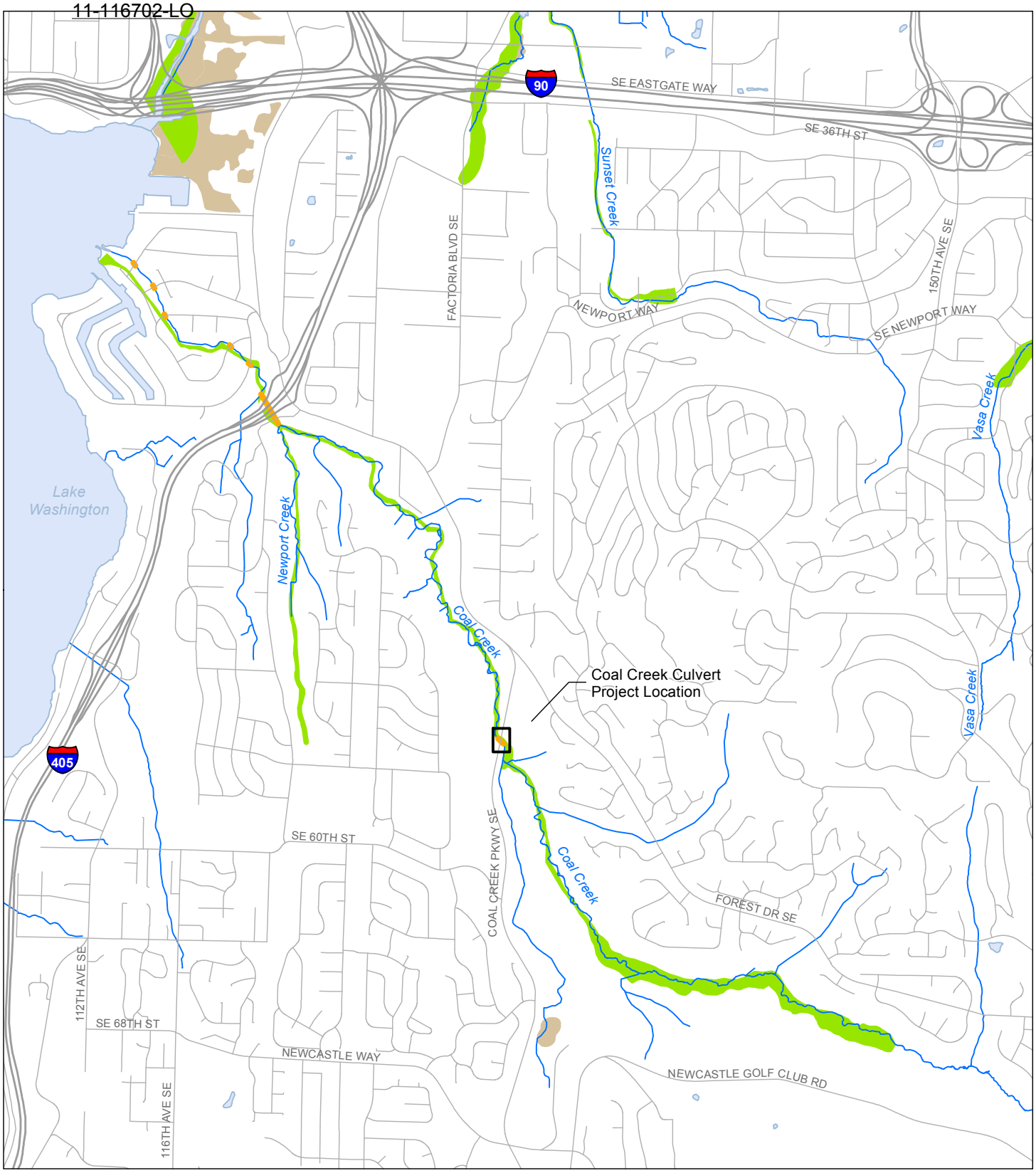
Source: City of Bellevue (2006) Streets; Aerials Express (2009) Aerial. Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

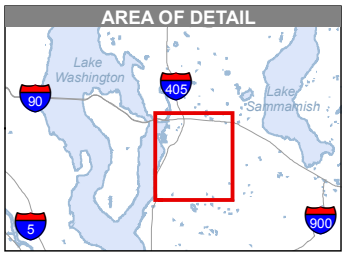
N
0 40 80 Feet

Figure 3. **Project Area**

Coal Creek Culvert Project

Reviewed By: David Pyle 07/12/2011





Culvert on Coal Creek

Floodplain

Wetland Vegetation Class

PFO/SSC (Freshwater Forested)

N

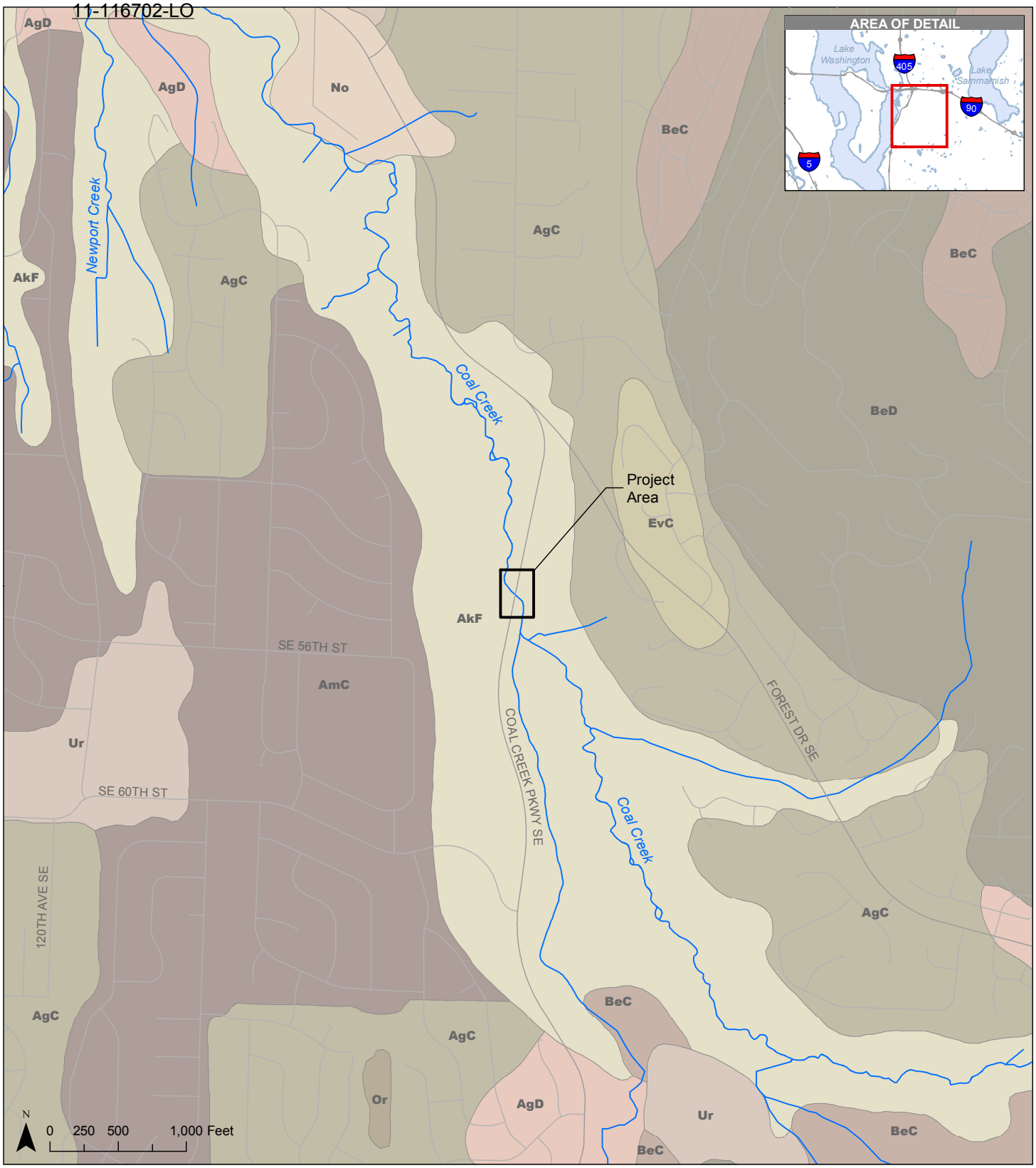
0 500 1,000 2,000 Feet

Source: City of Bellevue (2006) Streams, Streets; King County (2005) Flood Area; USFWS (2010) NWI Wetland. Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

Figure 4. **Wetland and Floodplain Areas in Project Vicinity**

Coal Creek Culvert Project

Reviewed By: David Pyle 07/12/2011



USDA Soil Classification

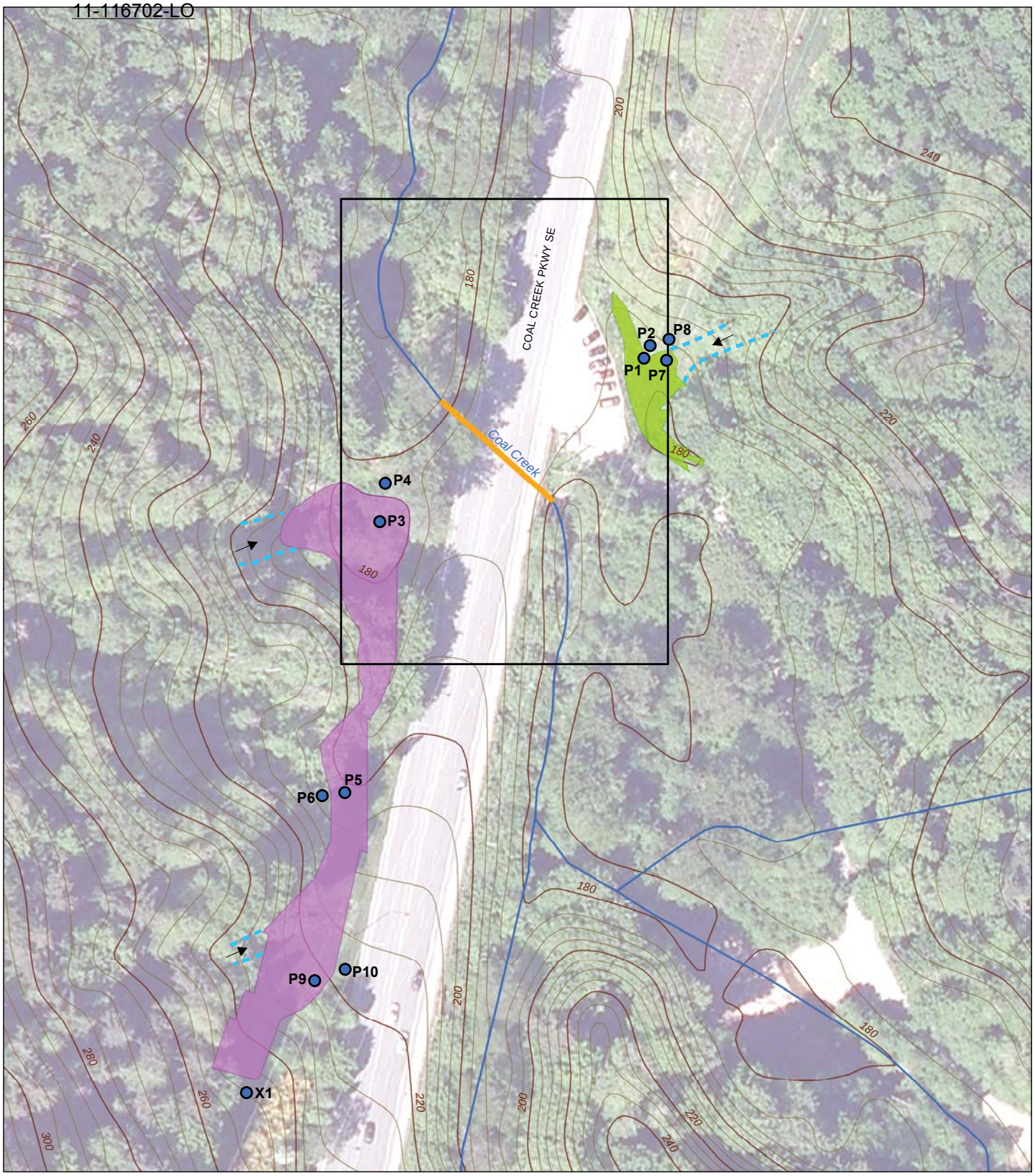
- AgC (Alderwood gravelly sandy loam, 6 to 15 percent slopes)
- AgD (Alderwood gravelly sandy loam, 15 to 30 percent slopes)
- AkF (Alderwood and Kitsap soils, very steep)
- AmC (Arents, Alderwood material, 6 to 15 percent slopes)
- BeC (Beausite gravelly sandy loam, 6 to 15 percent slopes)
- BeD (Beausite gravelly sandy loam, 15 to 30 percent slopes)
- EvC (Everett gravelly sandy loam, 5 to 15 percent slopes)
- No (Norma sandy loam)
- Or (Orcas Peat)
- Ur (Urban land)

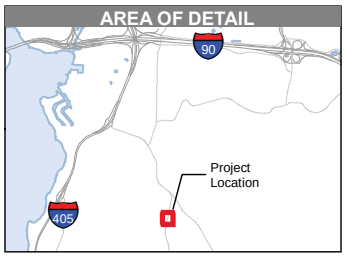
Source: City of Bellevue (2006) Streams, Streets; USDA (2011) Soils. Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

Figure 5. **Soils in Project Vicinity**

Coal Creek Culvert Project

Reviewed By: David Pyle 07/12/2011





Sample Point
5 ft Contour
20 ft Contour
Open Stream
Seep
Culvert on Coal Creek
Project Area
Wetland 1
Wetland 2

N
0 50 100 Feet

Source: CH2M HILL (2011) Wetland Data; City of Bellevue (2006) Streams, Streets; Aerials Express (2009) Aerial. Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

Figure 6. **Wetland Data Collected in 2011**

Coal Creek Culvert Project

Reviewed By: David Pyle 07/12/2011

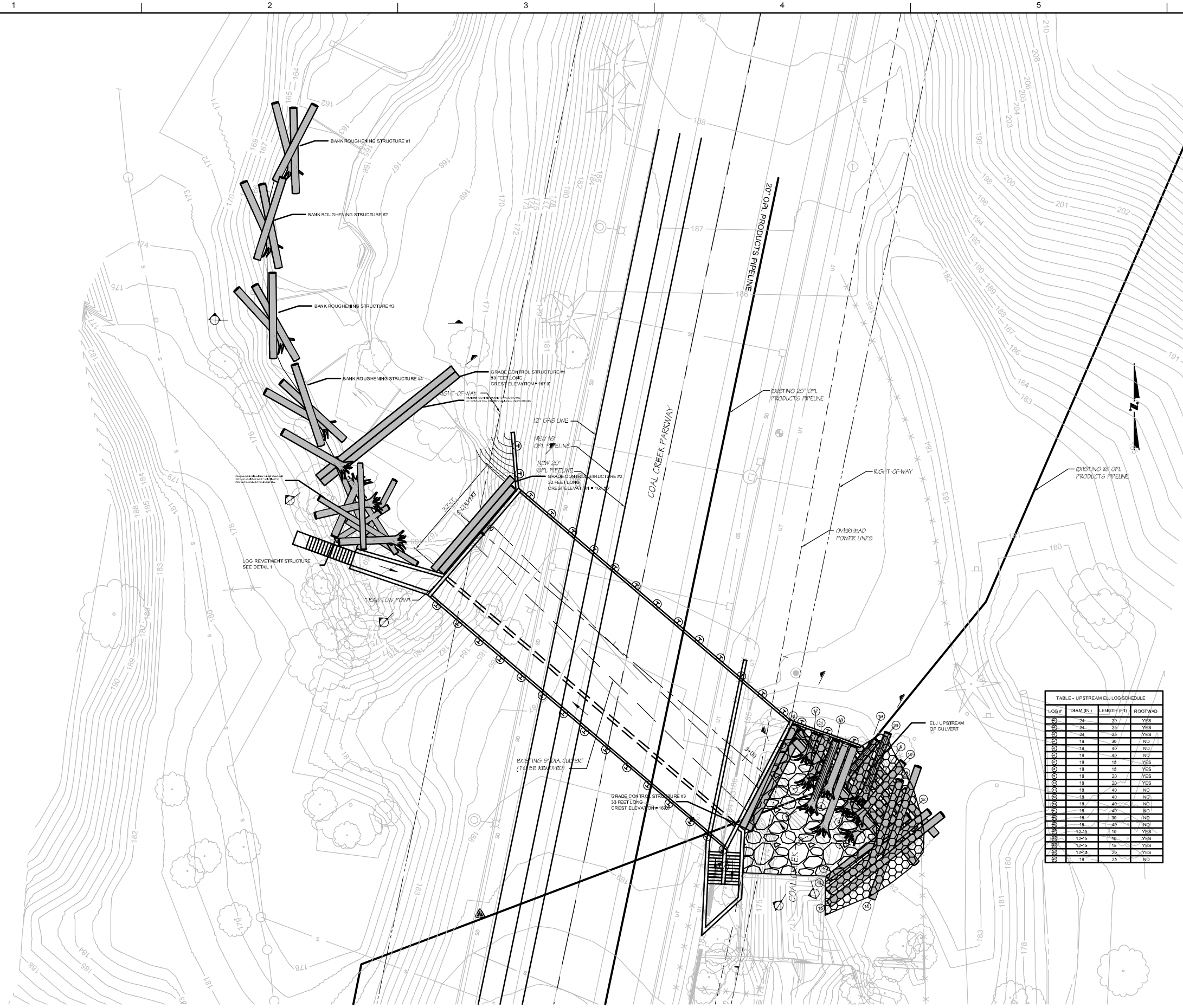


TABLE - UPSTREAM ELJ LOG SCHEDULE			
LOG #	DIAM.(IN.)	LENGTH (FT)	ROOTWAD
1	24	20	YES
2	24	25	YES
3	24	25	YES
4	18	30	NO
5	18	40	NO
6	18	40	NO
7	18	15	YES
8	18	15	YES
9	18	20	YES
10	18	20	YES
11	18	40	NO
12	18	40	NO
13	18	40	NO
14	16	40	NO
15	16	30	NO
16	16	40	NO
17	12-15	10	YES
18	12-15	10	YES
19	12-15	15	YES
20	12-15	20	YES
21	18	25	NO

PLAN LAYOUT

1" = 30'-0"

NO.	DATE	DESCRIPTION	BY	APVD
		PLAN ELEVATION	APVR	N
NO	DATE	DESCRIPTION	APVR	N
NO	DATE	DESCRIPTION	APVR	N
NO	DATE	DESCRIPTION	APVR	N
NO	DATE	DESCRIPTION	APVR	N
NO	DATE	DESCRIPTION	APVR	N
NO.	DATE	REVISION	BY	APVD

DSGN | DR | ENGINEER | DRAWN-BY | CHK | CHECKED-BY | APVD | APPROVED-BY

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COAL CREEK PARKWAY CULVERT REPLACEMENT

PLAN LAYOUT

1" = X'

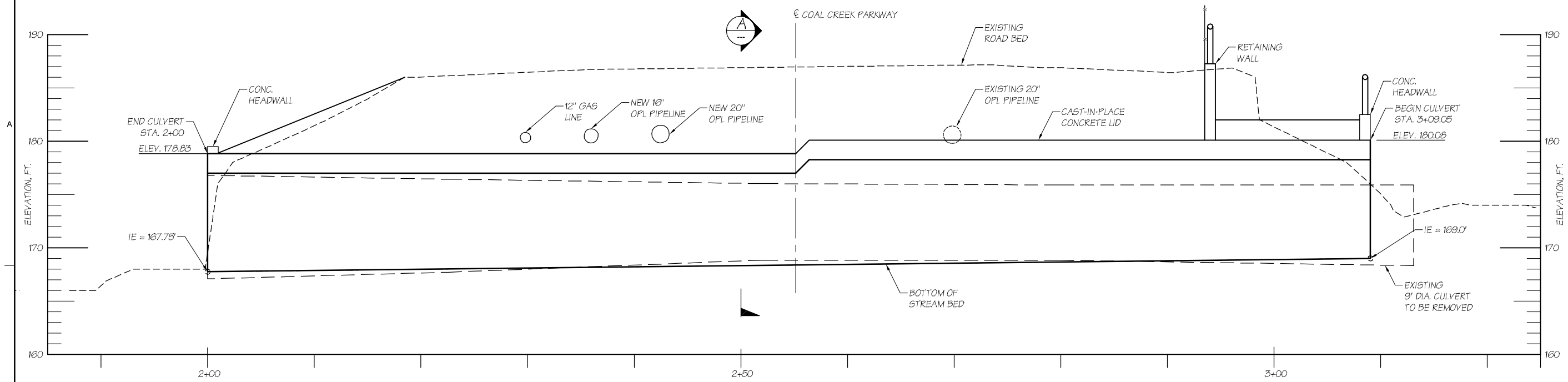
VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	DATE
PROJ	401930
DWG	S-1
SHEET	1

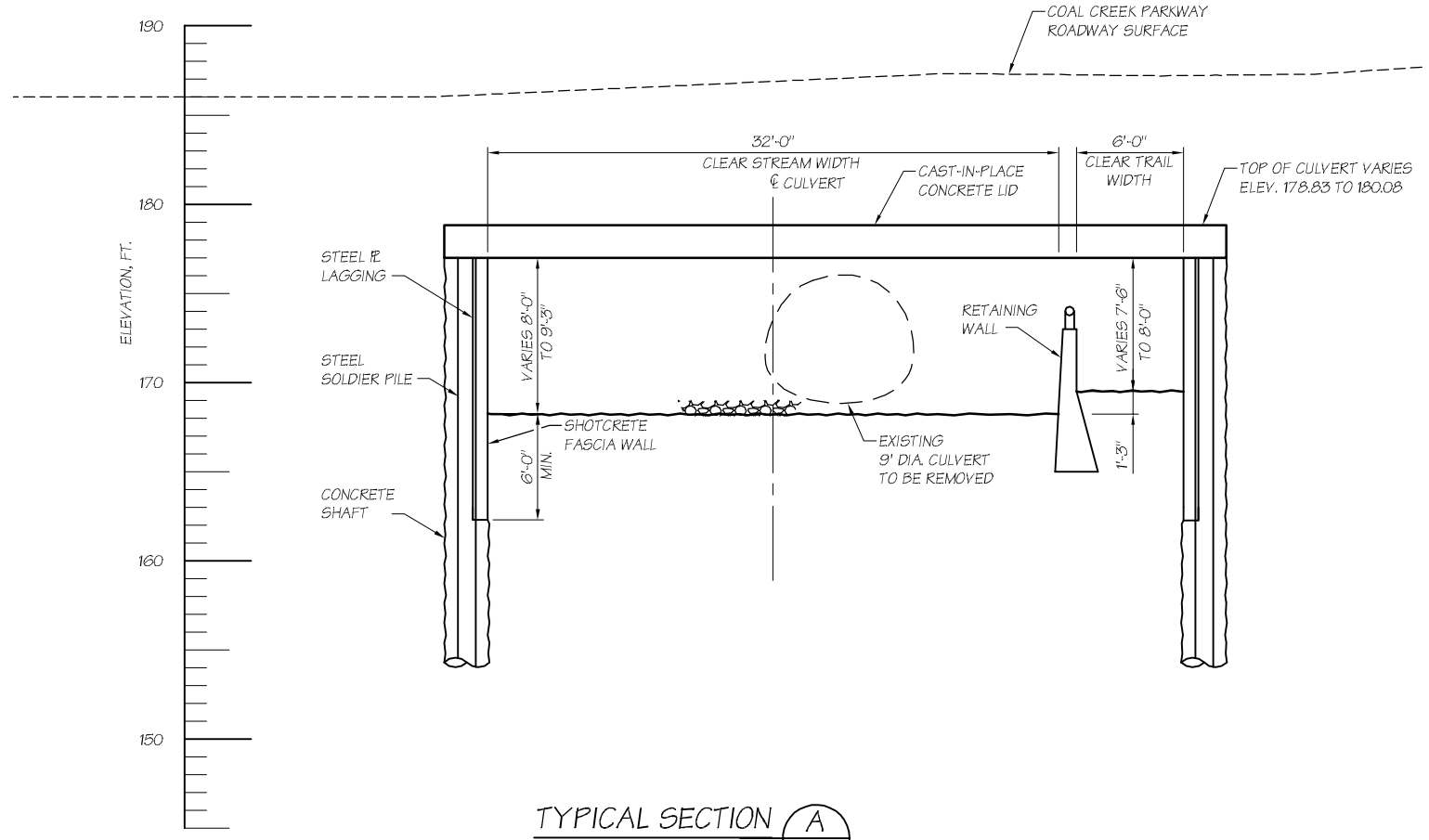
PRELIMINARY

FILE NAME:n:401930_CCP_S01_PLAN_stairs.dwg PLOT DATE: June 03, 2011 - 4:45pm



CULVERT PROFILE

1"=5'-0"
SHOWN ALONG ℄ CULVERT



TYPICAL SECTION A

1" = 5'-0"
SHOWN AT STA. 2+50

NO	DATE	DESCRIPTION	APVR
NO	DATE	DESCRIPTION	APRV
NO	DATE	DESCRIPTION	APVR
NO	DATE	DESCRIPTION	APVR
NO	DATE	DESCRIPTION	APVR
NO.	DATE	REVISION	BY

DSGN	J. REINCHELD	DR	D. HENDERSON	CHK	APVD	APPROVED-BY

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COAL CREEK PARKWAY CULVERT REPLACEMENT

CULVERT PROFILE & TYPICAL SECTION

1" = X'

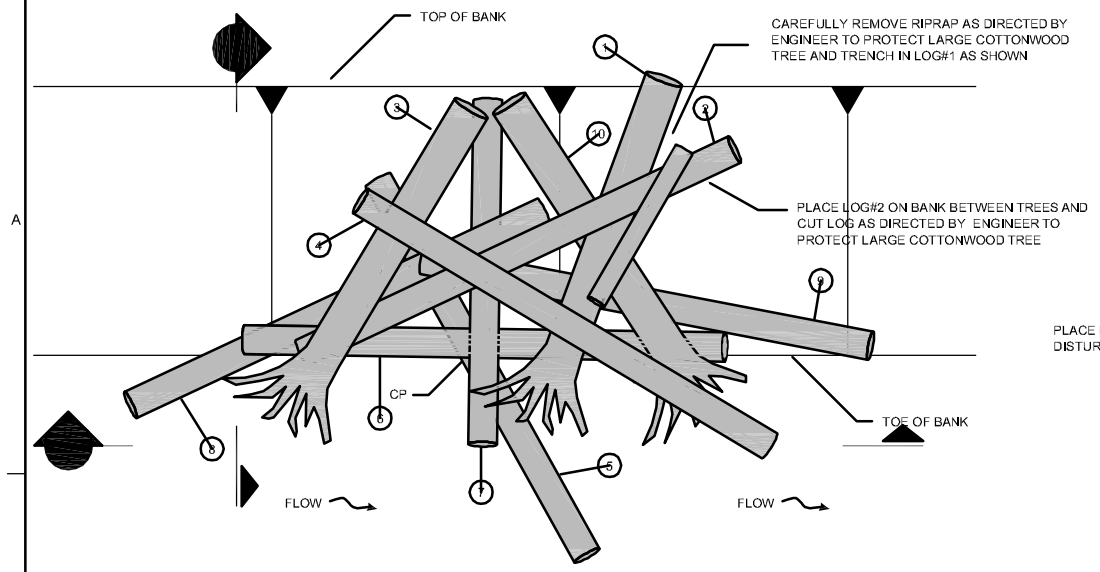
VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

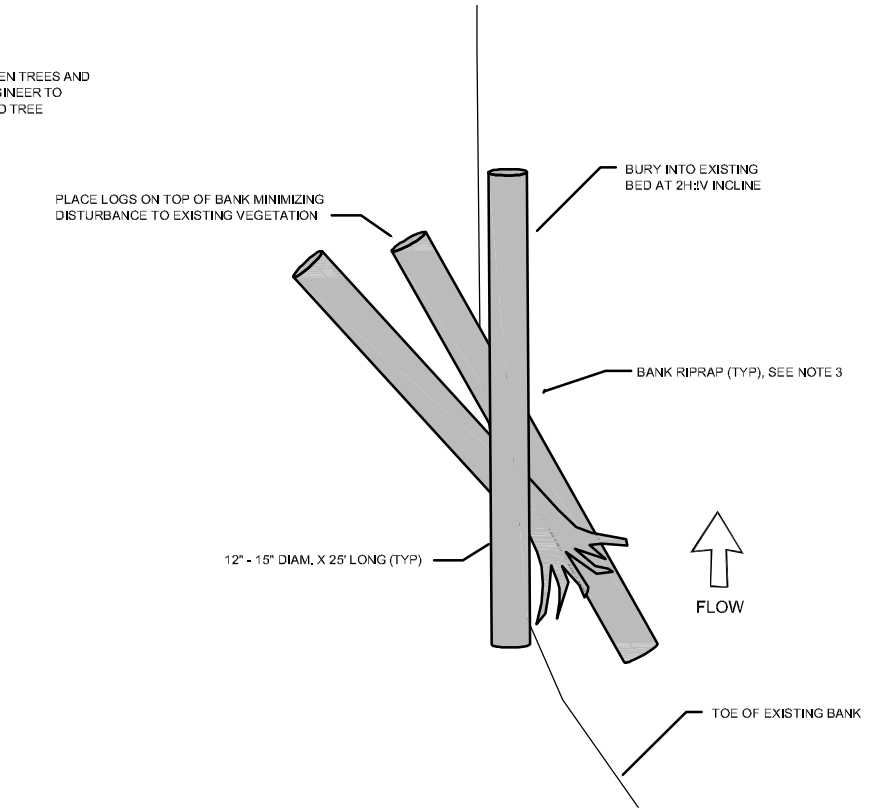
DATE	DATE
PROJ	401930
DWG	S-2
SHEET	2

PRELIMINARY

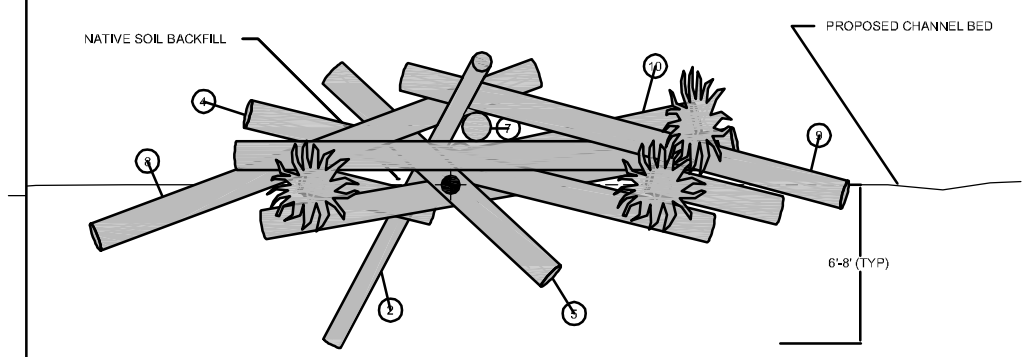
FILE NAME:n401930_CCP_S02_SECTIONS_stairs.dwg PLOT DATE: June 03, 2011 - 4:46pm



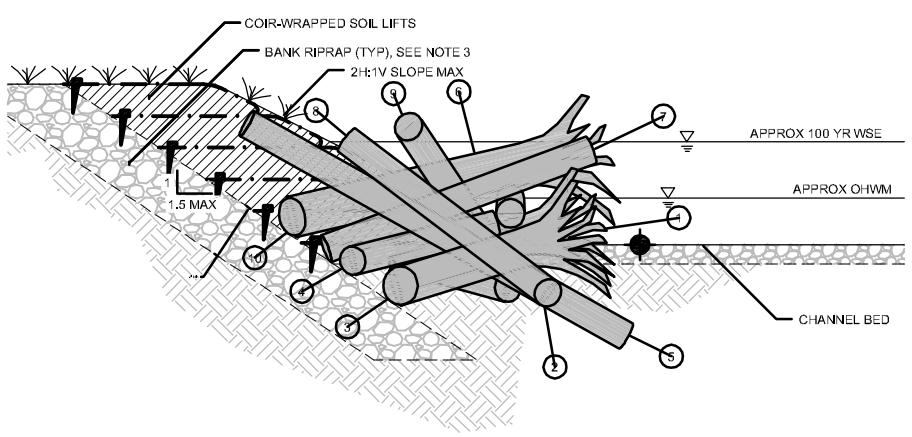
PLAN - REVETMENT LOG STRUCTURE (1 / C-?)
SCALE: 1"=?'



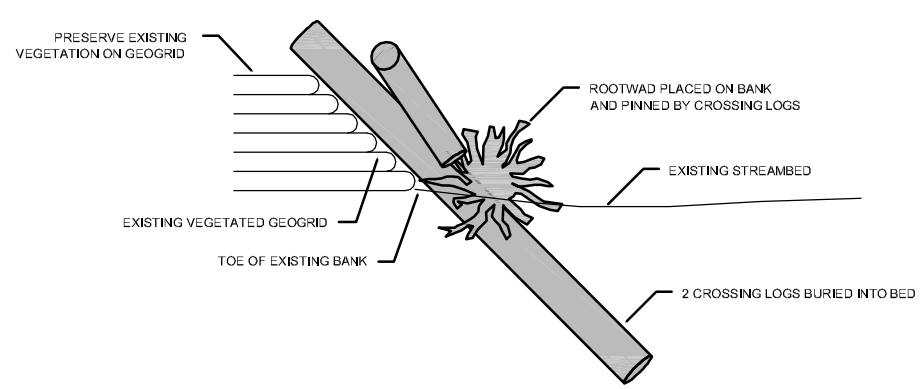
PLAN - BANK ROUGHENING STRUCTURE (2 / C-?)
SCALE: 1"=?'



SECTION - REVETMENT LOG STRUCTURE (B / -)
SCALE: 1"=?'



SECTION - REVETMENT LOG STRUCTURE (A / -)
SCALE: 1"=?'



SECTION - ROUGHENING STRUCTURE (F / -)
SCALE: 1"=?'

LEGEND:

- VEGETATION PER PLANTING PLAN
- WOVEN COIR TEMPORARY EROSION CONTROL FABRIC
- STREAMBED GRAVEL
- BANK RIP RAP
- NATIVE SUBGRADE
- TOPSOIL TYPE B
- SURVEY CONTROL POINT

NOTES:

1. CONTRACTOR SHALL MINIMIZE EXCAVATION INTO EXISTING BANK. MATERIAL EXCAVATED TO PLACE LOGS CAN BE REUSED ON REGRADED BANKS. CONTRACTOR SHALL PUSH LOGS INTO BANK USING EXCAVATOR WHEREVER POSSIBLE TO MINIMIZE EXCAVATION.
2. LOG IDENTIFICATION NUMBERS REPRESENT AN ORDER OF PLACEMENT/INSTALLATION. CORRESPONDING LOG DIMENSIONS SHOWN IN THE LOG SCHEDULE TABLE.
3. BANK RIPRAP SHALL BE PLACED AND BURIED BELOW THE INTERLOCKED LOGS AS DIRECTED BY THE ENGINEER. RIPRAP SHALL NOT BE PLACED IN THE ACTIVE CHANNEL OR ON THE WATER SIDE OF THE LOG REVETMENT
4. PILE LOGS SHALL BE PEELED WITH TIP END SHARPENED. PILE LOGS TO BE PLACED AT SLOPES NO SHALLOWER THAN 2H:1V, AND TO A DEPTH AT LEAST 10 FT TO 12 FT BELOW THE FINISHED CHANNEL BED.

TABLE - REVETMENT LOG STRUCTURE
LOG SCHEDULE :

LOG #	DIAMETER (IN)	LENGTH (FT)	ROOTWAD
1	24	20	YES
2	18	25	NO
3	24	20	YES
4	18	20	NO
5	18	20	NO
6	18	25	NO
7	18	20	NO
8	18	25	NO
9	18	25	NO
10	24	20	YES

TABLE - REVETMENT LOG STRUCTURE

NO	DATE	DESCRIPTION	APVR	N
NO	DATE	DESCRIPTION	APRV	N
NO	DATE	DESCRIPTION	APVR	N
NO	DATE	DESCRIPTION	APVR	N
NO	DATE	DESCRIPTION	APVR	N
NO	DATE	DESCRIPTION	APVR	N
NO.	DATE	REVISION	BY	APVD
DSGN	J. REINCHIELD	DR	D. HENDERSON	CHK

CHECKED-BY APVD
APPROVED-BY

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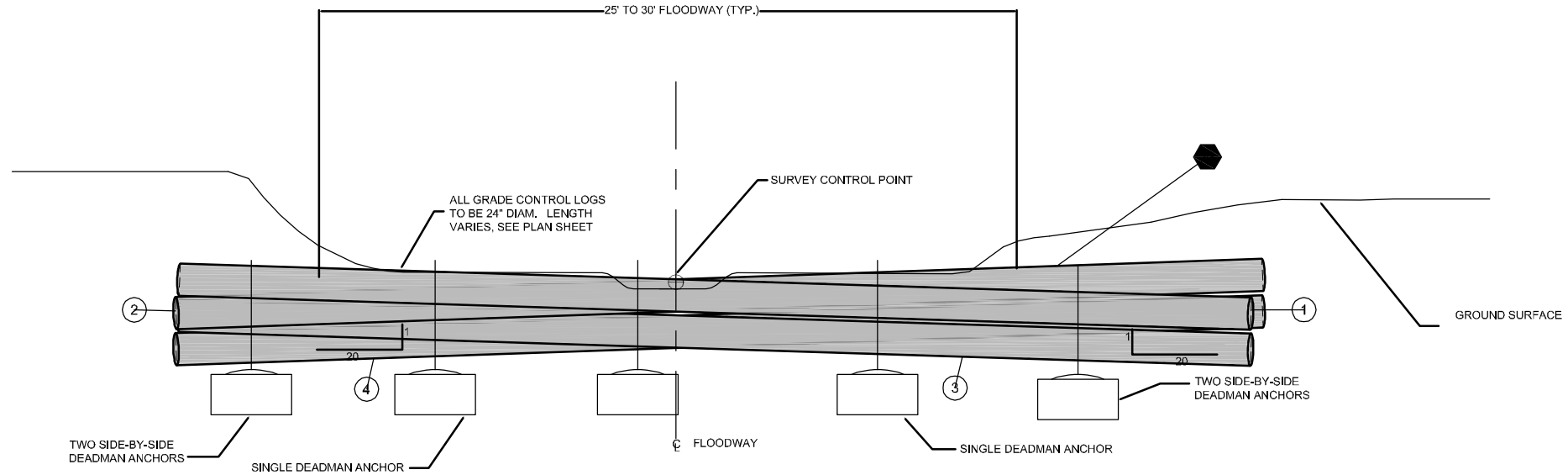
COAL CREEK PARKWAY CULVERT REPLACEMENT

IN STREAM STRUCTURES (1 OF 3)

1" = X'
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

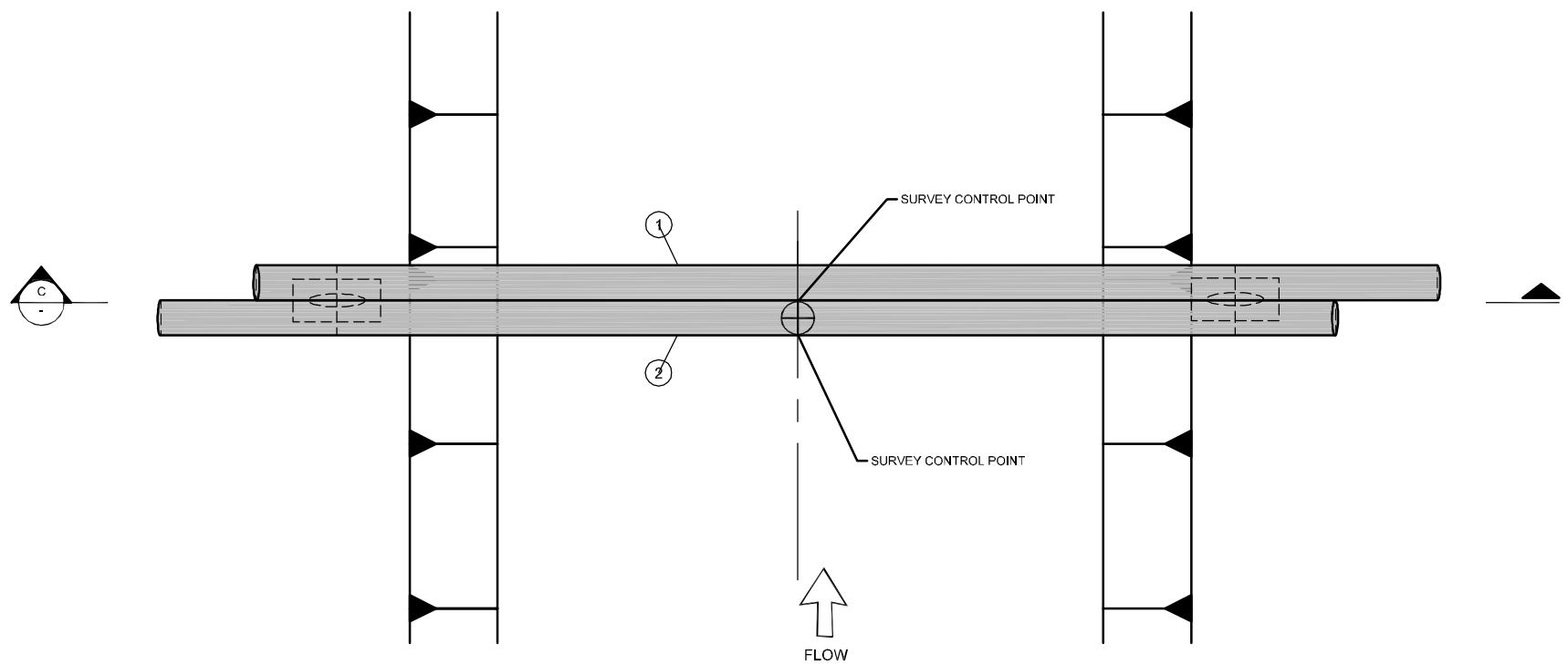
DATE	DATE
PROJ	401930
DWG	S-2
SHEET	2

PRELIMINARY



SECTION - TYPE B GRADE CONTROL STRUCTURE (TYP) C -

SCALE: NTS



PLAN VIEW - GRADE CONTROL STRUCTURES (TYP) 3 ?

SCALE: NTS

HORIZ. SCALE 1"=10'

NO	DATE	DESCRIPTION	APVR	N
NO	DATE	DESCRIPTION	APRV	N
NO	DATE	DESCRIPTION	APVR	N
NO	DATE	DESCRIPTION	APVR	N
NO	DATE	DESCRIPTION	APVR	N
NO	DATE	DESCRIPTION	APVR	N
NO.	DATE	REVISION	BY	APVD
DSGN	J. REINCHELD	DR D. HENDERSON	CHK	CHECKED-BY APVD

APPROVED-BY

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COAL CREEK PARKWAY CULVERT REPLACEMENT

IN-STREAM STRUCTURES
(2 OF 3)

1" = X'

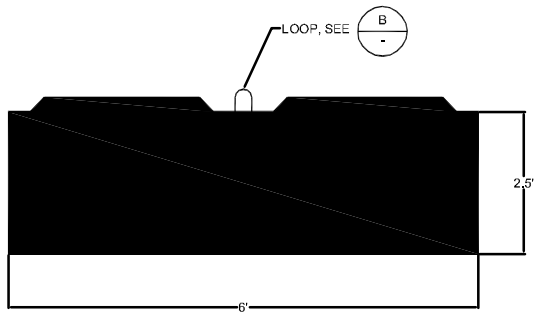
VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

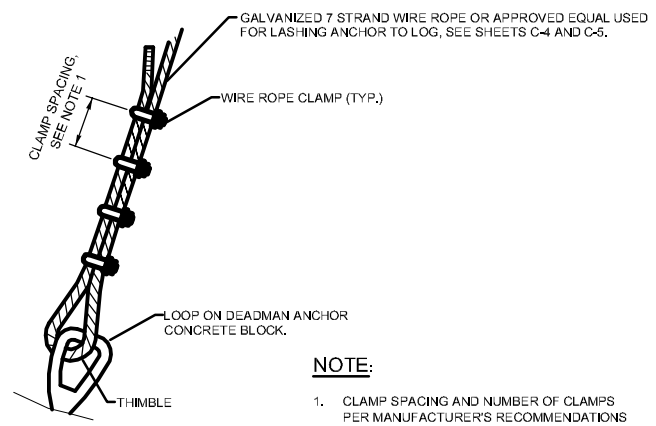
DATE	DATE
PROJ	401930
DWG	S-2
SHEET	2

PRELIMINARY

FILE NAME:n401930_CCP_S02_SECTIONS-rev2(2of3).dwg PLOT DATE: June 03, 2011 - 4:38pm



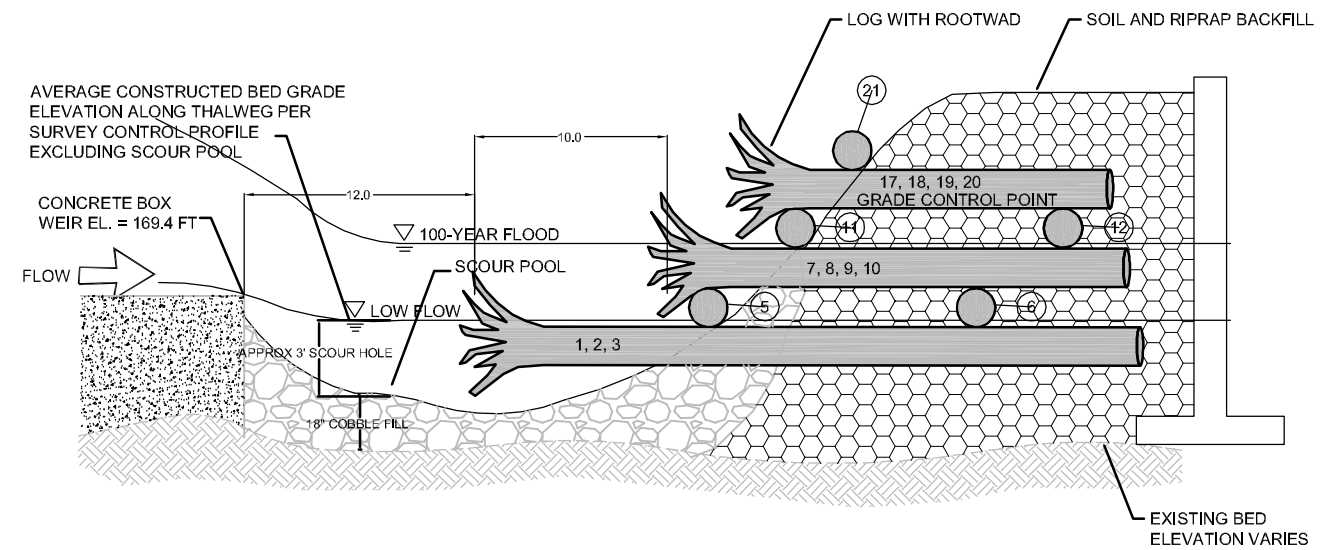
DETAIL - DEADMAN ANCHOR (A -)
SCALE: NTS



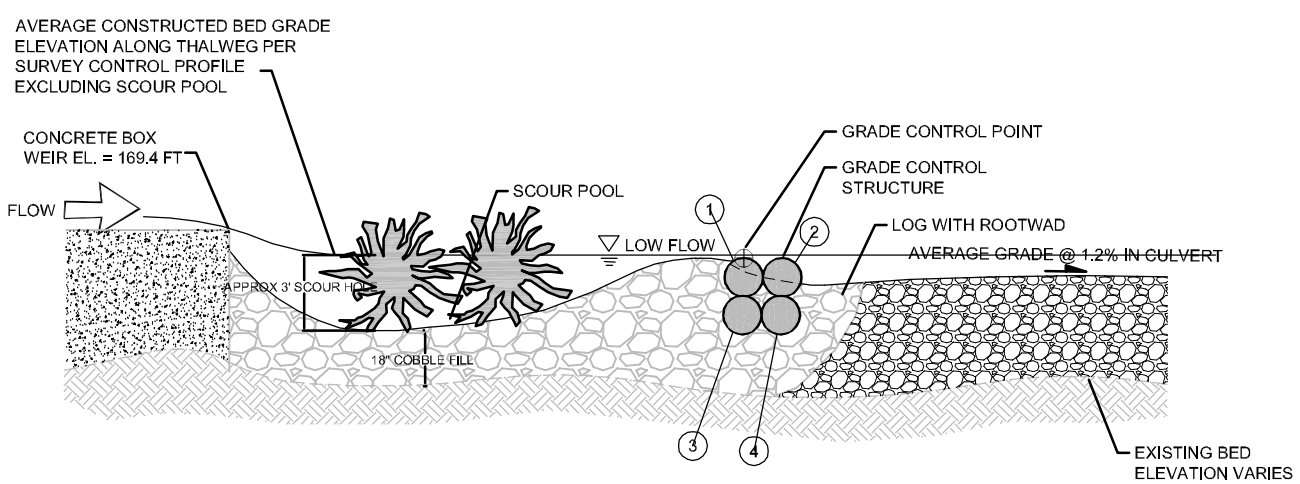
NOTE:

1. CLAMP SPACING AND NUMBER OF CLAMPS PER MANUFACTURER'S RECOMMENDATIONS FOR 7 STRAND WIRE ROPE.

DETAIL - CLAMP FOR DEADMAN ANCHOR WIRE ROPE (B -)
SCALE: NTS



SECTION - ELJ UPSTREAM OF CULVERT (E -)
SCALE: NTS



SECTION - GRADE CONTROL AT CULVERT INLET (D -)
SCALE: NTS

TABLE - UPSTREAM ELJ LOG SCHEDULE

LOG #	DIAM (IN.)	LENGTH (FT)	ROOTWAD
1	24	25	YES
2	24	30	YES
3	24	25	YES
4	18	30	NO
5	18	40	NO
6	18	40	NO
7	18	15	YES
8	18	20	YES
9	18	20	YES
10	18	20	YES
11	18	40	NO
12	18	40	NO
13	18	40	NO
14	18	40	NO
15	18	30	NO
16	18	40	NO
17	12-15	10	YES
18	12-15	12	YES
19	12-15	15	YES
20	12-15	20	YES
21	18	25	NO

NO	DATE	DESCRIPTION	APVR
NO	DATE	DESCRIPTION	APRV
NO	DATE	DESCRIPTION	APVR
NO	DATE	DESCRIPTION	APVR
NO	DATE	DESCRIPTION	APVR
NO	DATE	DESCRIPTION	APVR
NO.	DATE	REVISION	BY APVD
DSGN	DR	CHK	APVD
J. REINCHELD	D. HENDERSON	CHECKED-BY	APPROVED-BY

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COAL CREEK PARKWAY CULVERT REPLACEMENT

IN-STREAM STRUCTURES (3 OF 3)

1" = X'
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	DATE
PROJ	401930
DWG	S-2
SHEET	2

PRELIMINARY

Coal Creek Culvert Replacement Project; Project Narrative

Project Description

The proposed culvert will be constructed over the top of and around the existing 9-foot-diameter corrugated metal pipe (CMP) culvert. In conformance with WDFW design criteria, the new culvert will be 39 feet wide and 108 feet long, with 7 feet of the width devoted to a trail next to the stream channel (Figure 3). This increase in channel width at the crossing will allow Coal Creek to meander under the culvert in a natural manner. The new culvert will be constructed working from the road bed above with soldier pile and steel plate lagging walls and a cast-in-place concrete lid. Fourteen soldier piles will be installed to construct the south side wall, and fifteen will be installed on the north side. Steel plate lagging will then be placed between the soldier piles to form the walls of the culvert. The steel lagging will be sprayed with concrete to seal and protect it in the final stages of construction.

Two wing walls will be installed at both the upstream and downstream ends of the culvert. The wing walls will help prevent bank erosion by armoring the approach and exit of the culvert. The wing walls will be constructed the same manner as the culvert walls, using soldier piles and steel lagging plates.

Two log grade control structures will be placed under the inlet and outlet of the culvert. The grade control structures will manage scour processes by providing hard points in the streambed under the culvert. The grade control structures will be constructed using large (40 to 50 feet long) logs, which will be anchored in place with buried ecology blocks and tethered with steel cable. In addition, the first log weir downstream of the culvert outlet will be replaced. It will be replaced with a stacked log weir to redirect hydraulic shear stress away from the left bank to the center of the channel. Two engineered log jams will also be constructed as part of this project; one downstream and one upstream of the culvert. These log jams will protect the stream banks from erosion. One log jam will be located on the upstream side on right bank and one on the downstream side on the left bank. The log jams will be constructed out of simple logs and logs with rootwads attached. They will be secured in place by partially burying them into the banks, anchored with ecology blocks and partially secured in place with the existing riprap at those locations.

A scour pad will be installed in the pool just upstream of the inlet of the culvert. The scour pad will be constructed of large (18-inch diameter) alluvial boulders that will be installed up to 5 feet below the culvert inlet. The scour pad will prevent water from scouring out the streambed at the inlet of the culvert.

As mentioned above, a trail will be incorporated into the design of the culvert. The trail will cross Coal Creek Parkway SE under the new culvert and connect the trail from the parking lot to the west side of Coal Creek Parkway SE. The trail will be separated from the stream channel by a 5-foot-high concrete wall.

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Site Description and History

The project area is located at the bottom of a ravine, through which Coal Creek flows, in Bellevue, Washington, at an elevation of 180 feet above sea level. The Coal Creek basin has been heavily impacted by nearly 100 years of mining. Both landscape and hydrology have been highly altered. Mining operations began in 1863 and over 11 million tons of coal were removed from the basin. As a result of mining and subsequent development and urbanization, the landscape is highly erodible in many areas within the basin.

The project area is bisected by Coal Creek Parkway and is within a generally forested riparian corridor of Coal Creek Park that extends from I-405 southeast to the headwaters of Coal Creek and beyond. Coal Creek Park is a 550-acre park owned by the City of Bellevue. This park is comprised mainly of third-growth forest and is largely undeveloped. The project area is rolling terrain with mixed deciduous-coniferous upland forest, a stream channel (Coal Creek), and two slope-depressional wetland features. There are some steep slopes onsite that were created during the development of Coal Creek Parkway. The steepest slope onsite is approximately 40 percent and it was created by the construction of Coal Creek Parkway. The other slopes onsite are moderate and appear to be relatively stable.

Coal Creek is a Type F stream that requires a 100-foot buffer at undeveloped sites (City of Bellevue LUC 20.25H.035). The project area is considered undeveloped. Coal Creek is not considered a shoreline of the state.

Impacts Discussion

All aspects of the project have been designed to minimize both temporary and permanent impacts to critical areas.

Because the project is a culvert replacement, the project must be constructed within the designated critical area of Coal Creek. The project must conform to WDFW and other resource agency design criteria for width, length and height which dictate the minimum extent of buffer stream buffer impacts. While there would be temporary impacts to the creek, there would be no permanent impacts and the benefits to the creek would include better fish passage, habitat and water quality, created by the placement of large woody debris and control structures which would minimize scour and bank erosion.

Project design avoids all permanent impacts to wetlands. Temporary impacts to wetland buffers are the minimum necessary to allow construction and will be mitigated consistent with Bellevue Code requirements.

Alternatives Discussion

There is no feasible alternative location for the project because the project must be placed where Coal Creek currently flows. The project is a replacement of an existing, failing culvert. There is no feasible alternative with less impact because the new culvert must conform to current regulations regarding fish passage, habitat, scour and hydraulics.

Several alternative configurations for the new culvert were considered before the proposed preferred alternative was selected, including:

- Replacement with corrugated metal pipe (CMP)
- Replacement with a pre-cast bottomless box culvert

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- Replacement with a bridge

A CMP was not selected because a natural streambed could not be created within a pipe contrary to WDFW requirements. In addition, the required diameter of a CMP was too large to fit within the existing road prism.

A pre-cast bottomless box was not selected because of the higher impacts from foundation excavation, and the unlikelihood that construction could be completed within the fish construction window.

Replacement with a bridge was not selected because of the excessive costs, longer duration of traffic impacts and complications with supporting the Olympic Pipe Line (OPL) high pressure petroleum pipe lines.

Land Use Code Compliance

LUC 20.30P.140

A. *The proposal obtains all other permits required by the Land Use Code*

Discussion

Project approvals would be obtained from the appropriate local, state and federal regulatory agencies, include the following:

- City of Bellevue Clearing and Grading Permit
- City of Bellevue Right of Way Permit
- City of Bellevue Critical Areas Land Use Permit
- Washington State Department of Ecology, State Environmental Protection Act Checklist (SEPA)
- Washington State Department of Ecology, Section 401 Permit
- Washington Department of Fish and Wildlife, Hydraulic Project Approval
- US Army Corps of Engineers, Nationwide Permit

B. *The proposal utilizes to the maximum extent possible the best available construction, design and development techniques which result in the least impact on the critical area and critical area buffer*

Discussion

The project would adhere to all performance standards listed in the City of Bellevue's LUC 20.25H.080, which lists performance standards for any project affecting a Type S or F stream and its critical area buffer. All in-water project work would be conducted in summer during the WDFW mandated in-water work window (August 1 through August 31) and the federally mandated work window (July 1 through August 31). To prevent erosion and sedimentation, Coal Creek would be diverted during in-water culvert construction.

Section 2 of the Critical Areas Report contains a list of the conservation and performance measures proposed for the project.

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LUC 20.25H

C. *The proposal incorporates the performance standards of Part 20.25H LUC to the maximum extent applicable*

Discussion (Streams)

The project would adhere to all performance standards listed in the City of Bellevue's LUC 20.25H.080, which lists performance standards for any project affecting a Type S or F stream and its critical area buffer, as follows:

- The project does not include the use of lights that could affect the stream
- The project will not generate any additional noise from traffic, generators or residential uses. The current use of the area as a park would be maintained. Traffic noise would be unchanged as a result of this project.
- The project will create a small increase in new impervious surface from construction of the wing walls and the trail stairs and pathways. However, there would be no increase in toxic runoff from new these new impervious surfaces.
- No treated water would be produced by this project.
- The outer edge of the stream critical area buffer would be replanted following construction of the new culvert. Access by pets or humans would be via the proposed trail within the new culvert, which would limit access to the stream buffers.
- The use of pesticides, insecticides and fertilizers is not proposed.
- The new culvert would be an in-stream structure that, which is an allowed use under 20.25H.080 (B)
- The new culvert will improve habitat as documented in the Biological Assessment.
- A Critical Areas Report has been completed for this project and is included in the Land Use Application packet.
- The project does not propose relocation of an existing closed stream channel.

Discussion (Wetlands)

The project would comply with each of the performance standards as set forth in 20.25H.100.A through F; and 20.25H.105. Temporary impacts on wetlands buffers within the project area would be mitigated by the enhancement and rehabilitation of the wetland buffers impacted. Code compliance would be met as follows:

- The project does not include the use of lights that could affect nearby wetlands
- The project will not generate any additional noise from traffic, generators or residential uses. The current use of the area as a park would be maintained. Traffic noise would be unchanged as a result of this project.
- The amount of impervious surface will not change from the current condition and there will be no change in the flow of runoff from the existing roadway; there would be no increase in toxic runoff from new impervious surfaces.

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- Treated water will not enter the wetlands or wetland buffers as a result of this project.
- The use of pesticides, insecticides and fertilizers is not proposed.
- Temporary impacts on wetlands buffers within the project area would be mitigated by the enhancement and rehabilitation of the wetland buffers impacted. Any temporary impacts on wetland buffer habitat would be mitigated at a 1:1 ratio. All areas of wetland buffer disturbed during construction will be replanted with native wetland or riparian species. All mitigation would occur onsite. Final details of mitigation for wetlands and wetland buffers would be determined in consultation with the appropriate regulatory agencies.

D. *The proposal will be served by adequate public facilities including streets, fire protection, and utilities*

Discussion

The project could create possible delays in fire protection response times during high peak traffic hours. The City will coordinate with the local fire district to minimize potential impacts where possible.

The City will also coordinate with the local utilities within the project area to minimize and/or avoid utility service interruptions, which could occur during construction as a result of utility relocation work.

Coal Creek Parkway SE will be kept open in both directions during construction though there would be a reduced number of lanes. The City will work to keep the public informed of potential delays, to give commuters as much advance notice as possible, and suggest alternate routes to help minimize traffic impacts.

E. *The proposal includes a mitigation or restoration plan consistent with the requirements of LUC 20.25H.210; except that a proposal to modify or remove vegetation pursuant to an approved Vegetation Management Plan under LUC 20.25H.055.C.3.i shall not require a mitigation or restoration plan*

Discussion

Areas of new permanent disturbance and all areas of temporary disturbance will be mitigated and/or restored pursuant to a mitigation and restoration plan meeting the requirements of LUC 20.25H.210. A copy of the proposed restoration plan is included in the Land Use Application packet.

F. *The proposal complies with other applicable requirements of this code.*

Discussion

The project meets the requirements of LUC 20.30P by applying for a Critical Areas Land Use permit for this project, which will temporarily disturb a critical area and its buffer. The project would be constructed using appropriate methods to minimize impacts to Coal Creek by working from the roadway above the creek, by constructing outside the fish windows as directed by WDFW and NMFS and by rerouting the creek flow around construction to minimize sediment in the creek.

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The project was designed using the WDFW's “Design of Road Culverts for Fish Passage” (WDFW, 2003) as required by the City of Bellevue LUC 20.25H.055.C.3.e.

A Biological Assessment was conducted per LUC 20.25H.230 and 20.25H.165, which addresses habits and species of locale importance within the project. . In addition to the species of local importance list, the USFWS was consulted for information on the known or possible occurrence of plants and animals listed under the federal Endangered Species Act (ESA) that could occur in King County. The WDFW PHS program (WDFW 2007) and the Washington State Department of Natural Resources (WDNR) Washington Natural Heritage Program (WDNR 2007) were also consulted for documented occurrences of priority habitats or species, rare plants, and high quality native ecosystems in the project vicinity. A copy of the BA is included in the Land Use Application packet.

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Draft Report

Critical Areas Technical Report
Coal Creek Culvert Replacement Project
Bellevue, Washington

Prepared for

CITY OF BELLEVUE WASHINGTON

Prepared by

CH2MHILL

June 2011

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1. Introduction

At the request of the City of Bellevue, CH2M HILL collected information to document the presence of critical areas, habitat conditions, and wildlife use in the project vicinity. Also documented here are impacts related to the project, mitigation measures, and monitoring requirements. This investigation also covers any priority habitats and species (PHS) identified by the Washington Department of Fish and Wildlife (WDFW) and those federally-listed species under the jurisdiction of the United States Fish and Wildlife Service (USFWS) or the NOAA National Marine Fisheries Service (NOAA Fisheries Service) that have the potential to occur in the project vicinity.

This project consists of the replacement of an existing corrugated metal pipe culvert. The existing culvert was built in the early 1980s and is heavily corroded. The existing culvert has sustained damage from storm debris that struck the pipe inlet and became lodged in the culvert. The new culvert would allow the passage of major storm flows and debris. The new culvert would also provide fish passage and habitat for aquatic species and would allow terrestrial wildlife to pass through the Coal Creek Natural Area without encountering Coal Creek Parkway. The project also includes a trail segment adjacent to Coal Creek. This project fits under the New or Expanded Bridges and Culverts category of the allowed uses section in the City of Bellevue Land Use Code (LUC) 20.25H.055.B.

The project site is located within the city of Bellevue, Washington (Section 21, Township 24 north, Range 05 east, Willamette Meridian) (Figures 1 and 2; figures are located at the end of this report after References). The culvert to be replaced is located in lower Coal Creek east of Interstate 405 (I-405) and directly underneath Coal Creek Parkway at Coal Creek river mile (RM) 2.3. The project site is nearest the address 5200 Coal Creek Parkway SE, Bellevue, Washington 98006 and is located on King County Parcel No. 212405-9001. This parcel was purchased by the City of Bellevue and is part of Coal Creek Park. The approximate latitude and longitude of the project area is 122° 9′ 59.975″ W, 47° 33′ 14.386″N.

The project area is defined as the immediate vicinity of the proposed action (Figure 3). The project area is approximately 2.2 acres in size and includes the footprint of the culvert and wing walls and trail. The project area also includes the proposed staging areas and any areas that will be rehabilitated to mitigate project impacts.

Project Description

This project would replace an existing 9-foot-diameter corrugated metal pipe culvert lying under Coal Creek Parkway with a larger concrete bottomless box style culvert to convey Coal Creek. The new bottomless culvert would remove a fish barrier and provide superior fish habitat within the reach of Coal Creek flowing through the culvert. The new culvert would measure about 39 feet wide and about 9 feet high and would also accommodate a 7-foot wide trail separated from the creek by a 1-foot thick by 5 foot high wall, which would connect the Coal Creek Park trail from southeast to northwest. The width of the stream channel through the culvert would be 32 feet. The overall length of the new culvert

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(determined by the width of the road above) would be 5-feet shorter than the existing 113-foot culvert and measure approximately 108 feet long. Two wing walls would be added to both the upstream and downstream sides of the culvert. The wing walls would measure from 8 to 28 feet long and 1.5 feet wide and would help reduce stream bank erosion and direct the flow of Coal Creek to the new culvert. On the downstream side of the culvert there is a series of fish passable log weirs. The weir nearest the culvert (approximately 30 feet downstream from the culvert) would be replaced, to redirect flows away from the left bank, as part of this project. Grade control logs would be placed at both ends of the new culvert and logs and root wads would be placed along the left bank of the creek. Rip-rap, woody debris and a scour pad would be placed at the east culvert entrance, to help reduce scour and erosion. Attachment 1, the Coal Creek Project Plan Set, presents the project plans in detail.

The project would be constructed in phases, most likely over two construction seasons commencing in 2012. A 2-year construction cycle is required for two primary reasons. One reason is to conform to requirements to avoid construction in Coal Creek during certain times of the year to protect fisheries resources. The other reason is to allow the safe relocation of two existing Olympic Pipe Line Company petroleum transmission pipes. One of these petroleum pipelines crosses under the culvert to be replaced and the other petroleum pipeline crosses over the top of the existing culvert beneath the pavement of Coal Creek Parkway.

Construction of the project is proposed to commence with removal and replacement of the downstream half of the existing culvert. During this process traffic on Coal Creek Parkway would be restricted to one lane in each direction through the construction zone on the east side of the roadway. Once the downstream half of the culvert has been replaced with a new bottomless concrete box culvert, Olympic Pipe Line Company would mobilize and install and connect two new sections of petroleum pipe over the top of the new culvert section. This work would safely move the petroleum pipelines out of the construction zone for the upstream half of the new culvert.

After Olympic Pipe Line Company completes its new pipeline segments, replacement of the upstream half of the culvert would begin. Traffic would be shifted (still one lane in each direction) to the west side of Coal Creek Parkway. The upstream half of the culvert would be constructed and the roadway above would be replaced and reopened to traffic.

Site Description and History

The project area is located at the bottom of a ravine, through which Coal Creek flows, in Bellevue, Washington, at an elevation of 180 feet above sea level. The Coal Creek basin has been heavily impacted by nearly 100 years of mining. Both landscape and hydrology have been highly altered. Mining operations began in 1863 and over 11 million tons of coal were removed from the basin. As a result of mining and subsequent development and urbanization, the landscape is highly erodible in many areas within the basin.

The project area is bisected by Coal Creek Parkway and is within a generally forested riparian corridor of Coal Creek Park that extends from I-405 southeast to the headwaters of Coal Creek and beyond. Coal Creek Park is a 550-acre park owned by the City of Bellevue.

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This park is comprised mainly of third-growth forest and is largely undeveloped. The project area is rolling terrain with mixed deciduous-coniferous upland forest, a stream channel (Coal Creek), and two slope-depressional wetland features. There are some steep slopes onsite that were created during the development of Coal Creek Parkway. The steepest slope onsite is approximately 40 percent and it was created by the construction of Coal Creek Parkway. The other slopes onsite are moderate and appear to be relatively stable.

Study Methodology

Existing literature and scientific data resources were reviewed to determine the presence of critical areas in the project area and the extent of use by plants and wildlife species. The entire project area (Figure 3) was surveyed during field visits by biologists, while the project vicinity (Figure 1) was evaluated through an office review of the resources listed below. The field visits occurred on January 20, 2011, and February 2, 2011, and focused on the assessment of upland and stream habitats and the delineation of onsite wetlands.

Office Review Resources

Prior to conducting the field investigation, a desktop review of the following information was conducted to identify potential wetlands and other waters (Figure 4). This information was also reviewed to determine if rare habitats or species may occur in the project area or vicinity.

- U.S. Geological Survey (USGS) topographic mapping digital data and online maps at the Terraserver USA web site (USGS, 2008)
- National Wetlands Inventory (NWI) 2010 digital data
- Washington Department of Fish and Wildlife (WDFW) Priority Habitat and Species (PHS) data
- National Resource Conservation Service (NRCS) Hydric Soils of King County 2001
- Washington Department of Natural Resources (WDNR) Washington Natural Heritage Data
- Listed and Proposed Endangered and Threatened Species and Critical Habitat; Candidate Species; and Species of Concern in King County (USFWS, 2007).
- Salmon and Steelhead Habitat Limiting Factors Report for the Cedar–Sammamish Basin (Water Resource Inventory Area 8) (Kerwin, 2001)
- Breeding Birds of Washington State – Location Data and Predicted Distributions (Smith et al., 1997)
- Terrestrial Mammals of Washington State – Location Data and Predicted Distributions (Johnson and Cassidy, 1997)
- Amphibians and Reptiles of Washington State – Location Data and Predicted Distributions (Dvornich et al., 1997)
- Soil Survey digital data (SSURGO)

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- United States Department of Agriculture – Soil Conservation Service: Soil Survey of the King County Area, Washington (1973)
- Pacific Northwest Hydrography Framework (PNWHF) digital watercourse data
- Aerial imagery (Aerial Express, 2009)

Consultation with WDFW occurred prior to project design (Fisher, Larry, pers. comm., October 2009). A WDFW biologist visited the site and suggested dimensions for the proposed new culvert. These dimensions were used in the proposed culvert design (see Attachment 1). Also consulted during the design phase was the WDFW's "Design of Road Culverts for Fish Passage" (WDFW, 2003) as required by the City of Bellevue LUC 20.25H.055.C.3.e.

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2. Streams, Wetlands, and Floodplains

Streams, wetlands and floodplains in the project area are regulated by the Seattle District U.S. Army Corps of Engineers (USACE), the Washington Department of Fish and Wildlife (WDFW), the Washington State Department of Ecology (WSDOE) and the City of Bellevue.

Streams

The project area is located within the Cedar River/Lake Washington Watershed, in the Coal Creek Basin (6th Field Hydrologic Unit Code 17110012) and is in Water Resource Inventory Area 8: Cedar-Sammamish Basin. The project area has a few undefined channels that flow during major storm events, but these channels do not have defined beds and banks and do not function as streams. Coal Creek is the only stream within the project area.

Coal Creek

Coal Creek is 7 miles long from its headwaters on Cougar Mountain, in a generally forested riparian corridor that extends southeast from I-405, to where it drains into Lake Washington in the Newport Shores area. The corridor through which Coal Creek flows is crossed by several roads and has been encroached upon by development of various types, including commercial and residential. Coal Creek is a Type F stream that requires a 100-foot buffer at undeveloped sites (City of Bellevue LUC 20.25H.035). The project area is considered undeveloped. Coal Creek is not considered a shoreline of the state.

As mentioned above, much of the Coal Creek basin is highly erodible as a result of coal mining and development activities within the basin. Development and mining activities stripped away vegetation and added impervious surface to the basin. As a result, Coal Creek is "flashy" and has conveyed large volumes of mining debris and sediment downstream and into Lake Washington. Over the past few decades there have been many projects conducted along Coal Creek aimed at reducing erosion and sedimentation in the basin. The City of Bellevue added approximately 450 pieces of large woody debris (LWD) in the middle reach of Coal Creek during 2006 and approximately 200 pieces of LWD to the upper reach in 2009. An off-channel sediment pond was also constructed atriver mile 1.4. The City made minor repairs to the culvert in the project area in the summer of 2010.

In 1956, coal washings were blamed for nearly eliminating all spawning fishes from Coal Creek (Ajwani, 1956). However, current fisheries resources in Coal Creek include anadromous and resident species, although the basin has few returning adult salmonids (Kerwin, 2001; King County, 2001). Spawning salmonids and other fish species use habitats in Coal Creek below the impassable barrier at river mile 4.0 (Williams et al., 1975). The project area is at Coal Creek river mile 2.3. At river mile 2.7, Coal Creek flows through a ravine with a steep gradient, and at river mile 4.0 there is a 10-foot waterfall and the creek becomes impassable to fish.

In steam habitat in Coal Creek is highly variable but generally degraded resulting from the historical and current land use in the basin. Coal Creek is not ideal fish habitat due to some

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limiting factors. The main limiting factors are increased sedimentation, degraded riparian habitats, altered hydrology, reduced water quality, and loss of in-stream habitat complexity (Kerwin, 2001). Increased sedimentation reduces the quality of spawning habitats and decreases the fry-to-egg ratio of spawning fishes. The Department of Ecology developed a system that evaluates water quality, the Monitoring Water Quality Index (WQI) rating system (; Modified August 2009). The analysis of several parameters gives an overall rating of "high," "moderate," or "low" concern. In recent years, Coal Creek has consistently been rated "moderate concern."

Fish species that are known to occur in Coal Creek include: Cutthroat trout (*Oncorhynchus clarki clarki*), Chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*), sockeye salmon (*O. nerka*), steelhead (*O. mykiss*), sculpin (*Cottus* sp.), and largescale suckers (*Catostomus macrocheilus*). Lamprey (*Lampetra* sp.) have also been documented in Coal Creek.

Habitat conditions along Coal Creek vary, and in general the habitat is degraded due to urbanization of the basin. In the project area the riparian habitat is dominated by the following tree species: red alder (*Alnus rubra*), big-leaf maple (*Acer macrophylum*), and black cottonwood (*Populus balsamifera*) intermixed with a few mature Douglas-fir (*Pseudotsuga menziesii*) and western red cedar (*Thuja plicata*). Dominant understory species include vine maple (*Acer circinatum*), salmonberry (*Rubus specabilis*) and sword fern (*Polystichum munitum*).

Impacts Discussion

Stream-related impacts of the proposed project would be limited to Coal Creek as it is the only stream in the project area.

Permanent Impacts

No permanent or cumulative adverse impacts on Coal Creek are expected for this project. The project would result in several benefits to Coal Creek. The current culvert is 9 feet in diameter and does not adequately handle peak-volume storm flows and during past storm events, has become partially plugged with debris. The proposed bottomless box culvert would have a stream channel 32 feet wide and allow for unimpeded and reduced-velocity flow over this segment of the creek, with an additional 7 feet for the trail and dividing wall, for a total width of 39 feet. Benefits of lowering the velocity of stream flow include a reduction in scour to bed and banks and reduced sedimentation load (lower turbidity). An overall improvement in water quality would result from this project.

Temporary Impacts

As a result of the proposed action, temporary impacts would occur in Coal Creek and its associated 100-foot buffer. Buffer impacts include approximately 12,076 square feet, or approximately 0.3 acres, of temporary impact. The project would also result in temporary stream impacts at the culvert and approximately 75 feet upstream and approximately 200 feet downstream of the culvert. Temporary stream impacts would cover an area of approximately 4,939 square feet or approximately .1 acres. Stream-related impacts include bank disturbance and dewatering activities. Soils would also be disturbed as a result of the replacement of the log weir on the downstream side of the culvert. In stream work would be

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conducted during the dry season and the reduced stream flow diverted to minimize soil disturbance.

Mitigation of Impacts

Any stream or stream buffer impacts related to this project would be temporary and would be mitigated by enhancement and restoration.

The project would adhere to all performance standards listed in the City of Bellevue's LUC 20.25H.080, which lists performance standards for any project affecting a Type S or F stream and its critical area buffer. All project work would be conducted in summer during the WDFW mandated in-water work window (August 1 through August 31) and the federally mandated work window (July 1 through August 31). To prevent an increase in sedimentation, short-term diversions of flow would occur during culvert installation. The concrete box flow control structure upstream of the existing culvert will be sealed to allow water to back up in this structure. The water will then be directed into a pipe and delivered to the downstream side of the culvert. At this point, fish present in the bypass reach will be collected using electrofishing equipment and released downstream. Gravity will be used to carry the water into and through the pipe with pumps on stand-by for back-up. The outlet end of the pipe will be at a location about 20 feet downstream of the last weir located below the work area.

Conservation and Performance Measures

General

- A Temporary Erosion and Sediment Control Plan will be developed and implemented.
- A qualified Erosion and Control Inspector will review all sediment control measures twice per week during construction. "Qualified" means the inspector will be a Certified Erosion and Sediment Control Lead.
- A Spill Prevention, Control, and Countermeasures Plan that meets Washington Department of Ecology standards will be developed and implemented for the project to ensure that all pollutants and products will be controlled and contained.
- Seasonal restrictions applied to work conducted below the ordinary high-water mark (OHWM) will be as required by a project-specific Hydraulic Project Approval (HPA) issued by the WDFW.
- Construction impacts will be confined to the minimum area necessary to complete the project.
- Removal of riparian vegetation will be minimized as much as possible.

Water Quality/Erosion Control

- All best management practices (BMPs) will be installed according to City of Bellevue standards and will be inspected and maintained throughout the life of the project.
- Staging and soil stockpile areas will be limited to those outlined in the clearing and grading permit. Staging areas will be fenced.
- Spill kits will be kept onsite.

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- Fuels and other potentially hazardous materials will be kept in a secured area. "Secured" means fenced, and locked during non-work hours.
- Secondary containment will be required for all hazardous materials. Spill containment is required for generators, parked equipment, porta-potties, fuels, and solvents.
- The project will comply with water quality conditions identified by Ecology.
- Wash water resulting from wash-down of equipment or work areas will be contained for proper treatment and/or disposal, and will not be directly discharged into state waters.
- There will be no discharge of oil, fuels, or chemicals to surface waters, or onto land where there is a potential for re-entry into surface waters.
- No cleaning solvents or chemicals used for tools or equipment cleaning will be discharged to ground or surface waters.
- The contractor will regularly check fuel hoses, oil drums, oil or fuel transfer valves, fittings, etc. for leaks, and will maintain and store materials properly to prevent spills.
- BMPs will be used on all project activities to control and prevent sediments from entering aquatic systems.

In-water and Over-water Work

- In-water work will be restricted to periods of low flow.
- Materials removed from below the OHWM will be placed in an upland location where they cannot enter water bodies.
- Materials, such as riprap and large woody debris, placed within the water, will be free of sediment and other contaminants.
- Water pumped from work isolation areas will be treated to remove suspended sediments prior to returning to the water body. Discharge will occur in such a manner as not to cause erosion.
- Mechanical equipment will not enter the stream channel until the project area has been dewatered and fish salvage has been completed (or the channel is naturally dry).
- Mechanical equipment operating in the project area will be inspected daily for leaks. Any equipment found to be leaking will immediately be repaired or removed from the project site.

Temporary impacts to stream habitat would be mitigated by the enhancement inherent in the culvert replacement. Any temporary impacts to stream buffer habitat will be mitigated at a 1:1 ratio. All areas of vegetation disturbed during construction will be replanted with native species. All mitigation will occur onsite. Final details of mitigation for streams and stream buffers would be determined in consultation with the appropriate agencies and municipalities. These details will be contained in the Mitigation Report that is being developed for this project.

Wetlands

Potential wetlands and waters were field-verified, and classification and ratings of wetlands and waters and determination of buffer widths were completed and documented following

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field verification. Data collection and analysis followed procedures in the *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory, 1987) the *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (U.S. Army Corps of Engineers [USACE], 2006), and the *Washington State Wetlands Identification and Delineation Manual* (Washington State Department of Ecology [Ecology], 1997). The routine onsite wetland determination method was used to observe vegetation, soils, and hydrological conditions at representative locations. Paired sample plots were used to document wetland and upland areas adjacent to wetland boundaries. The *National List of Plant Species that Occur in Wetlands: Northwest (Region 9)* (U.S. Fish and Wildlife Service, 1988) and the 1993 supplement (USACE, 1993) were used to determine hydrophytic status of vegetation.

All onsite wetlands were mapped using a Trimble GeoXT GPS unit. Seeps contributing to wetland hydrology were also mapped. Drainages that were not wetlands or waters were not mapped. These included gullies and swales dominated by upland vegetation that did not have continuous defined channels with evidence of regular flow.

Wetland Existing Conditions

Bellevue, Washington, receives about 35 inches of precipitation annually (www.city-data.com; City of Bellevue 2009). Most precipitation generally occurs in the wet season from October through March. In 2010, precipitation at the downtown rain gage was 38.8 inches, and precipitation at the Coal Creek rain gage, which is the closest rain gage to the project, was 47.6 inches (City of Bellevue, personal communication). This indicates wetter-than-average conditions in the project area.

The National Wetland Inventory database did not indicate any mapped wetlands in the project area (Figure 4) and no hydric soils (USDA, 2011) were mapped in the project area (Figure 5). The U.S. Department of Agriculture mapped soils in the project area are Alderwood and Kitsap soils (USDA, 2011) (Figure 5). It was observed during field surveys that the soils in the project area have been disturbed from various utility installations and roadway construction and that many portions of the site have been covered with a gravelly fill material.

Alderwood Soils

The Alderwood series consists of moderately deep (to a cemented pan), moderately well drained soils that were formed in glacial till. Alderwood soils are gravelly ashy sandy loams and are on glacially modified foothills and valleys and have slopes of 0 to 65 percent. A perched water table can be as high as 18 to 36 inches at periods from January through March.

Kitsap Soils

The Kitsap series consists of very deep, moderately well drained soils formed in lacustrine sediments. Kitsap soils are silty loam and occur on terraces and terrace escarpments and have slopes of 0 to 70 percent.

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Delineated Wetlands

Two wetlands were delineated in the project area. Both wetlands were classified as Category 3 (Attachment 2 Wetland Rating Forms). Category 3 wetlands on undeveloped sites in the City of Bellevue have 60-foot critical area buffers (City of Bellevue LUC 20.25H.035). The wetlands were rated using the Department of Ecology rating system for Western Washington (Hruby, 2004). The City of Bellevue LUC 20.25H.095 was also consulted for rating wetlands in the project area. Table 1 provides a summary of wetlands in the project area.

TABLE 1
Summary of Project Area Wetlands

Wetland ID	Total Area (acres)	Hydrogeomorphic Classification	Cowardin Classification	Ecology Classification[a]	Standard Buffer Width (feet)
1	0.07	Slope/Depressional	Palustrine	III	60
2	0.41	Slope/Depressional	Palustrine	III	60

[a] Washington State Department of Ecology

Wetland 1

Wetland 1 is a palustrine emergent wetland (PEM) that is situated in a depression north of Coal Creek on the east side of Coal Creek Parkway. This wetland is dominated by reed canary grass (*Phalaris arundinacea*). This wetland extends partially up a slope within the right-of-way for a power line. A seep in the slope above the wetland contributes to the hydrology (Figure 6). The water flows from this seep and then sits in the wetland depression. There is a 24-inch culvert along the southern edge of this wetland. The culvert drains this wetland to another wetland (outside the project area) on the other side of a berm that was created as part of the trail system into Coal Creek Park. Wetland 1 is approximately 0.07 acre in size and about 92 percent of the wetland occurs in the project area.

Wetland 2

Wetland 2 is a palustrine emergent wetland situated on a slope and a depression on the south side of Coal Creek west of Coal Creek Parkway (Figure 6). This wetland is dominated by reed canary grass and mowed grasses on the slope portion and watercress (*Nasturtium aquaticum*) and bare ground in the depressional portion of the wetland. At least two seeps exist on the western slope surrounding this wetland and contribute to its hydrology. Wetland 2 is approximately 0.41 acres and only about 29 percent of this wetland occurs within the project area.

Attachment 3 contains the completed data forms for both wetlands. The data forms contain detailed information on the soils, plants, and hydrology for each wetland.

Impacts Discussion

The only wetland impacts that would result from this project would occur in portions of the buffer for Wetland 2. Impacts on Wetland 1, and its buffer, would be entirely avoided.

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Permanent Impacts

There would be no permanent impacts on wetlands or wetland buffers associated with this project.

Temporary Impacts

Temporary impacts would affect the buffer for Wetland 2 as a result of this project. A portion of the buffer would be impacted in order to allow construction equipment to access the site and for the temporary staging of materials. Approximately 4,679 square feet, or approximately .1 acres of temporary wetland buffer impacts would result from this project. Wetland buffer impacts include the removal of vegetation and soil disturbance.

Mitigation of Impacts

The City of Bellevue LUC 20.25H.100 lists performance standards for development on sites with wetlands or wetlands critical area buffers. The project would comply with each of these performance standards. See the Mitigation of Impacts for streams section above for a list of BMPs that would be used to minimize impacts on all habitats in the project area, including wetlands.

Temporary impacts on wetlands buffers within the project area would be mitigated by the enhancement and rehabilitation of the wetland buffers impacted. Any temporary impacts on wetland buffer habitat would be mitigated at a 1:1 ratio. All areas of wetland buffer disturbed during construction will be replanted with native wetland or riparian species. All mitigation would occur onsite. Final details of mitigation for wetlands and wetland buffers would be determined in consultation with the appropriate agencies and municipalities.

Floodplains and Areas of Special Flood Hazard

The project site includes the mainstem of Coal Creek, which is mapped by Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps as being within Zone A where no base flood elevation has been determined. The mainstem channel is also defined as being within the area of special flood hazard that is inundated by the 100-year flood (Figure 4). The 100-year floodplain is confined to the mainstem of Coal Creek, while the adjacent uplands are mapped as the Zone X. Zone X is defined as areas of 500-year flood; areas of 100-year flood with average depths less than one foot or with drainage areas less than one square mile; and areas protected by levees from 100-year flood. The project was designed to meet the performance standards and conditions listed for areas of special flood hazard by the City of Bellevue in LUC 20.25H.180.C.

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3. Habitat and Species

As set forth by City of Bellevue (LUC 20.25H.230 and 20.25H.165) there must be an investigation of habitats for Species of Local Importance for any project that has the potential to impact habitats for these species. In addition to the species of local importance list, the USFWS was consulted for information on the known or possible occurrence of plants and animals listed under the federal Endangered Species Act (ESA) that could occur in King County. The WDFW PHS program (WDFW 2007) and the Washington State Department of Natural Resources (WDNR) Washington Natural Heritage Program (WDNR 2007) were also consulted for documented occurrences of priority habitats or species, rare plants, and high quality native ecosystems in the project vicinity.

Habitat Assessment and Species Occurrence

Habitat types within the project area that provide forage, cover, and breeding opportunities include deciduous forested uplands, Coal Creek and its riparian area, and two palustrine emergent wetlands.

The forested uplands in the project area are populated by an assemblage of deciduous and coniferous third-growth trees. Tree species observed onsite include: red alder, big-leaf maple, Douglas fir, western red cedar, and black cottonwood. Shrub species included: vine maple, salmonberry, red-osier dogwood (*Cornus sericea*), beaked hazelnut (*Corylus cornuta*) and Himalayan blackberry (*Rubus armeniacus*). Also observed in the project area where: sword fern, bracken fern (*Pteridium aquilinum*), lady fern (*Athyrium filix-femina*), field horsetail (*Equisetum arvense*), and stinging nettle (*Urtica dioica*).

In stream and riparian habitats for Coal Creek are described above in Section 2. Fish species occurrence is also covered above in Section 2. Although degraded like most urban streams, Coal Creek provides habitat to many species of wildlife.

As described above in Section 2, the wetlands in the project area are palustrine emergent and are dominated by reed canary grass and in the case of Wetland 2, some mixed grasses and watercress. The wetlands in the project area are heavily impacted by the surrounding land use but may offer forage and cover for common wildlife species.

Mammalian Species

Washington State Gap Analysis (WSGA) data was reviewed to determine what species of mammals, birds, amphibians, and reptiles were likely to occur in the project area. The following mammals are documented to occur in Township 24 North Range 05 East and have potential to occur in the project area: eastern grey squirrel (*Sciurus carolinensis*), Norway rat (*Rattus norvegicus*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), house mouse (*Mus musculus),* shrew-mole (*Neurotrichus gibbsii*),Townsend's mole (*Scapanus townsendii*), little brown myotis (*Myotis lucifugus*). The following species of mammal are not documented in the WSGA and have the potential to occur in the project area: black bear (*Ursus americanus*), Virginia opossum (*Didelphis virginiana*), vagrant shrew (*Sorex vagrans*),

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California myotis (*Myotis californicus*), long-legged myotis (*Myotis volans*), hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris nocitvagans*), big brown bat (*Eptesicus fuscus*), Townsend's big-eared bat (*Plecotus townsendii*), eastern cottontail (*Sylvilagus floridnus*), mountain beaver (*Aplodontia rufa*), Townsend's chipmunk (*Tamias townsendii*), Douglas' squirrel (*Tamiasciurus douglasii*), northern flying squirrel (*Glaucomys sabrinus*), beaver (*Castor canadensis*), forest deer mouse (*Peromyscus keeni*), deer mouse (*Peromyscus maniculatus*), Townsend's vole (*Microtus townsendii*), muskrat (*Ondatra zibethicus*), pacific jumping mouse (*Zapus trinotatus*), porcupine (*Erethizon dorsatum*), nutria (*Myocastor coypus*), black rat (*Rattus rattus*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), ermine (*Mustela erminea*), long-tailed weasel (*Mustela frenata*), mink (*Mustela vison*), striped skunk (*Mephitis mephitis*), spotted skunk (*Spilogale gracilis*), bobcat (*Lynx rufus*), and black-tailed deer (*Odocoileus hemionus*) (NatureServe 2011).

Avian Species

Based on a review of WSGA data, below is a list of avian species that are known to occur in T24N R05E (except the owl species) and may occur in or near the project area (WSGA, Bird Web.Org).

List of Avian Species that May Occur in or Near the Project Area

Cooper's Hawk *Accipiter cooperii*
Red-tailed Hawk *Buteo jamaicensis*
California Quail *Callipepla californica*
Great Blue Heron *Ardea herodias*
Green Heron *Butorides virescens*
Rock Dove *Columba livia*
Western Screech Owl *Otus kennicottii*
Great Horned Owl *Bubo virginianus*
Northern Pygmy Owl *Glacidium gnoma*
Vaux's Swift *Chaetura vauxi*
Rufous Hummingbird *Selasphorus rufus*
Belted Kingfisher *Ceryle alcyon*
Northern Flicker *Colaptes auratus*
Pileated Woodpecker *Dryocopus pileatus*
Red-breasted Sapsucker *Sphyrapicus ruber*
Downy Woodpecker *Picoides pubescens*
Hairy Woodpecker *Picoides villosus*
Olive-sided Flycatcher *Contopus borealis*
Willow Flycatcher *Empidonax traillii*
Pacific-slope Flycatcher *Empidonax difficilis*
Western Wood-Pewee *Contopus sordidulus*
Tree Swallow *Tachycineta bicolor*
Violet-green Swallow *Tachycineta thalassina*
Cliff Swallow *Hirundo pyrrhonota*
Barn Swallow *Hirundo rustica*
Steller's Jay *Cyanocitta stelleri*
American Crow *Corvus brachyrhynchos*

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Black-capped Chickadee *Parus atricapillus*
Bushtit *Psaltriparus minimus*
Red-breasted Nuthatch *Sitta canadensis*
Brown Creeper *Certhia americana*
Winter Wren *Troglodytes troglodytes*
Marsh Wren *Cistothorus palustris*
Golden-crowned Kinglet *Regulus satrapa*
Swainson's Thrush *Catharus ustulatus*
American Robin *Turdus migratorius*
Cedar Waxwing *Bombycilla cedrorum*
European Starling *Sturnus vulgaris*
Hutton's Vireo *Vireo huttoni*
Warbling Vireo *Vireo gilvus*
Orange-crowned Warbler *Vermivora celata*
Yellow Warbler *Dendroica petechia*
Common Yellowthroat *Geothlypis trichas*
Wilson's Warbler *Wilsonia pusilla*
Red-winged Blackbird *Agelaius phoeniceus*
Brewer's Blackbird *Euphagus cyanocephalus*
Brown-headed Cowbird *Molothrus ater*
Bullock's Oriole *Icterus bullockii*
Western Tanager *Piranga ludoviciana*
Black-headed Grosbeak *Pheucticus melanocephalus*
Purple Finch *Carpodacus purpureus*
House Finch *Carpodacus mexicanus*
Red Crossbill *Loxia curvirostra*
Pine Siskin *Carduelis pinus*
American Goldfinch *Carduelis tristis*
Spotted Towhee *Pipilo maculatus*
Song Sparrow *Melospiza melodia*
White-crowned Sparrow *Zonotrichia leucophrys*
Dark-eyed Junco *Junco hyemalis*

Reptile and Amphibian Species

Based on a review of several data sources (NatureServe etc), the following reptiles and amphibians have the potential to occur in or near the project area; Northwestern Salamander *Ambystoma gracile,* Long-toed Salamander *Ambystoma macrodactylum,* Pacific Giant Salamander *Dicamptodon tenebrosus,* Rough-skinned Newt *Taricha granulose,* Western Redback Salamander *Plethodon vehiculum*, Ensatina *Ensatina eschscholtzii,* Pacific Treefrog *Hyla regilla,* Red-legged Frog *Rana aurora*, Northern Alligator Lizard *Elgaria coerulea*, Western Terrestrial Garter Snake *Thamnophis elegans,* Northwestern Garter Snake *Thamnophis ordinoides,* Common Garter Snake *Thamnophis sirtalis.*

The Western Toad *Bufo boreas* Federal species of concern and state candidate, and Rubber Boa *Charina bottae* occur in Washington but are not likely to be present in or near the project area as preferred habitat is lacking. The following introduced species may also occur in or

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near the project area: Bullfrog *Rana catesbeiana,* Painted Turtle *Chrysemys picta*, and Red-eared Slider *Trachemys scripta.*

Species of Local Importance

Table 2 lists the species of local importance as listed in the City of Bellevue in LUC 20.25H.150. Table 2 also provides information on which species may occur in the project area. All habitats associated with species of local importance are considered critical areas.

TABLE 2
City of Bellevue List of Species of Local Importance

Common Name	Scientific Name	Occurrence in Project Area
Bald eagle	*Haliaeetus leucocephalus*	Not present. Closest nest is 2 miles west of the project area.
Peregrine falcon	*Falco peregrinus*	Not present. Closest nest is over 2 miles northwest of the project area.
Common loon	*Gavia immer*	Not present. No suitable habitat.
Pileated woodpecker	*Dryocopus pileatus*	Likely present. Suitable habitat is present.
Vaux's swift	*Chaetura vauxi*	Unlikely to be present. Preferred habitat is mature and old growth forest.
Merlin	*Falco columbarius*	Unlikely to be present. Preferred habitat not available in project area.
Purple martin	*Progne subis*	Unlikely to be present. Closest nest colony is over 2 miles southwest of the project area.
Western grebe	*Aechmophorus occidentalis*	Unlikely to be present. Preferred habitat not available in project area.
Great blue heron	*Ardea herodias*	Possible in general project area. Known to forage in Coal Creek.
Osprey	*Pandion haliaetus*	Not present. Closest nest is over 2 miles southwest of the project area.
Green heron	*Butorides striatus*	Possible in general project area. Known to forage in Coal Creek.
Red-tailed hawk	*Buteo jamaicensis*	Likely occasionally present.
Townsend's Western big-eared bat	*Plecotus townsendii*	Unlikely to be present. May occur upstream in areas with abandoned coal mines and other cavities.
Keen's myotis	*Myotis keenii*	Unlikely to be present. Suitable habitat may be present, but species has not been recorded within miles of the project area.
Long-legged myotis	*Myotis volans*	Possible in general project area. Suitable habitat is present and records of occurrence exist within the County.
Long-eared myotis	*Myotis evotis*	Possible in general project area. Suitable habitat present.
Oregon spotted frog	*Rana pretiosa*	Unlikely to be present due to habitat preferences.

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Western toad	*Bufo boreas*	Unlikely to be present due to habitat preferences.
Western pond turtle	*Clemmys marmorata*	Not present. No suitable habitat.
Chinook salmon	*Oncorhynchus tshawytscha*	Unlikely to be present. Rarely documented in Coal Creek.
Bull trout	*Salvelinus confluentus*	Not present. No suitable habitat.
Coho salmon	*Oncorhynchus kisutch*	Possible in general project area. Suitable habitat present.
River lamprey	*Lampetra ayresi*	Unlikely to be present. Lack of preferred habitat. Records of occurrence exist for this species in Coal Creek.
Sources: NatureServe 2011; WDFW 2010		

Pileated Woodpecker

Pileated woodpeckers occur in mature forests. They also occupy second growth forests that have standing snags and downed logs. These woodpeckers are especially abundant in areas of forest that contain a combination of large conifers (or red alder) and snags. The project site is mainly composed of third growth forest and does not contain many snags or large conifers. It is likely that the pileated woodpecker occurs in the project vicinity, but unlikely that it uses the project area for foraging or nesting. No impacts are anticipated for this species and no mitigation is proposed.

Great Blue Heron

Great blue heron occur along lakes, shorelines, wetlands, streams, estuaries and rivers. They forage along these aquatic habitats and nest in rookeries close to them. There are no heron rookeries mapped within two miles of the project site according to the WDFW PHS database. Great blue heron may occur along Coal Creek and may use the creek to forage. Impacts to great blue heron resulting from this project are unlikely. Any potential impacts would be temporary and would be related to active construction. Mitigation for this species is not proposed.

Green Heron

Green herons occupy the same habitats as great blue herons, and are less common and smaller in size. Green herons especially favor wetlands and ponds and nest in trees near aquatic habitats. The wetlands in the project area are degraded and do not feature the habitat components (open water) preferred by green herons. The project will not degrade habitat associated with green herons. No impacts are anticipated for this species and no mitigation is proposed.

Red Tailed Hawk

Red-tailed hawks hunt in open areas and nest in the canopy of mature trees. The site contains few trees suited to red-tailed hawk nesting preferences. The project area lacks large tracts of open areas for the hawk to hunt. No impacts are anticipated for this species and no mitigation is proposed.

Long-legged Myotis

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Long-legged myotis prefer the edge habitat along montane coniferous forests. Maternity colonies of long-legged myotis have been documented under tree bark and in ground fissures. They have been documented in King County and most of the County is considered a core zone for this species (Johnson and Cassidy 1997). Suitable habitat does exist within Coal Creek parks and the steam corridor along Coal Creek could provide forage. Loose bark and typical roosting habitat was not observed in the project area. Presence of this species in the project area and vicinity cannot be ruled out. Impacts to this species and its preferred habitat are not anticipated for this project. No mitigation for long-legged myotis is proposed.

Long-eared Myotis

Not much is known about the habitat needs of long-eared myotis. It is know that they roost under tree bark, in caves and buildings. Forests are likely their primary habitat and they are more common in east-side Washington forests. Long-eared myotis have been documented in Pierce County and most of King County is considered a core zone for this species (Johnson and Cassidy 1997). No impacts are anticipated for this species and no mitigation is proposed.

Coho Salmon

The potential occurrence of Coho salmon in Coal Creek and the project area is discussed above in Section 2. A full discussion of this species (and potential project related impacts) is found in the Biological Assessment written for this project (Attachment 5).

Chinook Salmon

The potential occurrence of Chinook salmon in Coal Creek and the project area is discussed above in Section 2. A full discussion of this species (and potential project related impacts) is found in the Biological Assessment written for this project (Attachment 5).

State and Federal Special Status Species

Attachment 4, the USFWS list of special status species in King County, updated November 1, 2007, contains seven species listed as threatened or endangered, two candidate species and 22 species of concern. It also lists designated critical habitat for three species. Based on site surveys and a review of the existing data, none of the listed species under the jurisdiction of the USFWS occur within the project area. Coal creek has not been designated as critical habitat for bull trout, nor does it provide suitable habitat for this species. The project area is not within designated critical habitat for any species. Suitable habitat for the species listed with the USFWS does not occur in the project area.

The NMFS has jurisdiction over federally listed anadromous salmonids, marine mammals and turtles, designated salmon critical habitat, and essential fish habitat. Chinook salmon and steelhead trout are listed as threatened species and have been documented in Coal Creek. Coal Creek is considered essential fish habitat for as it is used by Coho salmon. Coal creek has not been designated Chinook salmon critical habitat. Impacts to Chinook salmon and steelhead trout and not anticipated for this project. A full discussion of the NMFS listed species can be found in the Biological Assessment for this project (Attachment 5).

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Rare Plants

As of March 2011 the WDNR Natural Heritage Program lists 27 rare plants that occur in King County (See Attachment 4). These rare plants generally have specific habitat requirements that are not found in the project area. A review of the township, range and section data for the Natural Heritage Program reveals that no occurrence of rare plants is documented for T24 R05E S21.

Priority Habitats and Species

The WDFW PHS database does not list the occurrence of any priority species in the project area or the nearby vicinity.

The WDFW PHS data did not list any priority wildlife heritage points or priority habitat points in the immediate vicinity of the project area. The riparian zone associated with Coal Creek is mapped as an urban natural open space and as such is considered a priority habitat. This is an extensive area extending from I-405 to the headwaters of Coal Creek. Coal Creek is identified by the WDFW as containing priority anadromous and resident fish, including fall Chinook salmon (*Oncorhynchus tshawytscha*), and coho salmon (*O. kisutch*).

Impacts to priority species will not result from project activities. Impacts to priority habitat would be limited to the Coal Creek riparian area and would be temporary.

Impacts Discussion

All impacts to wildlife and habitats resulting from the proposed project would be minimal and temporary in nature. All impacts would be construction related. Impacts include construction related noise, vegetation removal, creek dewatering and wetland filling.

Cumulative Impacts

There are no cumulative impacts associated with this project.

Temporary Impacts

All project related impacts would be temporary. These impacts would occur as a result of construction-related activities. Noise from construction equipment is anticipated to cause some species of wildlife to temporarily flee from or avoid the project area. This would deprive them of the use of this habitat for the duration of the noise.

Vegetation removal near the creek would temporarily disturb wildlife habitat. Wildlife using this vegetation for cover or forage would be impacted by the temporary loss of the vegetation. This would allow the project to avoid impacting birds or their nests and to remain in compliance with the Migratory Bird Treaty Act of 1918.

Coal creek would be temporarily dewatered during culvert installation. The dewatering would occur during the combined WDFW and NMFS in water work window (fish window) from July 1 through August 31. The dewatering would temporarily displace any species inhabiting the creek.

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The buffer for Wetland 2 would be temporarily impacted during construction. Portions of this wetland buffer would be used to allow construction equipment to enter the area and access the stream for culvert installation. All materials and equipment would be removed after construction and the wetland buffer would be restored to pre-construction (or better) conditions.

Mitigation

As set forth in the Bellevue City LUC 20.25H.055.C.3.e: New culverts shall be designed in accordance with the Washington State Department of Fish and Wildlife "Design of Road Culverts for Fish Passage". This project consulted with WDFW in the planning phase of the project to ensure compliance with this City LUC. Under the Innovative Mitigation LUC 20.25H.225 the "Director may encourage, facilitate, and approve innovative mitigation projects that are based on the best available science".

The mitigation for this project would be minimal as the impacts are few and temporary and the project itself results in improvements to fish and wildlife habitat and critical areas. Mitigation would include the adherence to the erosion and sediment control BMPs listed in Section 2 above. Mitigation would also include the revegetation of any areas where vegetation was removed. This project would adhere to the preservation and restoration of habitats in accordance with LUC 20.25H.215.

Result of Project Actions

This project is designed to improve water quality and fish and wildlife habitat. The project would ultimately benefit critical areas and protect these resources as the City of Bellevue's codes are designed to. Project benefits would include improved fish passage, improved LWD conveyance and improved wildlife passage.

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4. Conclusion

The project will adhere to the performance standards outlined in the City of Bellevue LUC 20.25H055.C.1. Minimal and temporary impacts would occur to critical areas as a result of project construction. No impacts to special status species or their habitat would result from this project.

Section 20.25H055.C.2 in the City of Bellevue LUC requires that a determination of technically feasible alternatives be considered. No technically feasible alternative with less impact on the critical areas or their buffers exists for this project.

Since no technically feasible alternative exists the project would comply with the following:

1. Location and design shall result in the least impacts on the critical area or critical area buffer;
2. Disturbance of the critical area and critical area buffer, including disturbance of vegetation and soils, shall be minimized;
3. Disturbance shall not occur in habitat used for salmonid rearing or spawning or by any species of local importance unless no other technically feasible location exists;
4. All work shall be consistent with applicable City of Bellevue codes and standards;
5. The facility or system shall not have a significant adverse impact on overall aquatic area flow peaks, duration or volume or flood storage capacity, or hydroperiod;
6. Associated parking and other support functions, including, for example, mechanical equipment and maintenance sheds, must be located outside critical area or critical area buffer except where no feasible alternative exists; and
7. Areas of new permanent disturbance and all areas of temporary disturbance shall be mitigated and/or restored pursuant to a mitigation and restoration plan meeting the requirements of LUC 20.25H.210.

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5. References

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Figures

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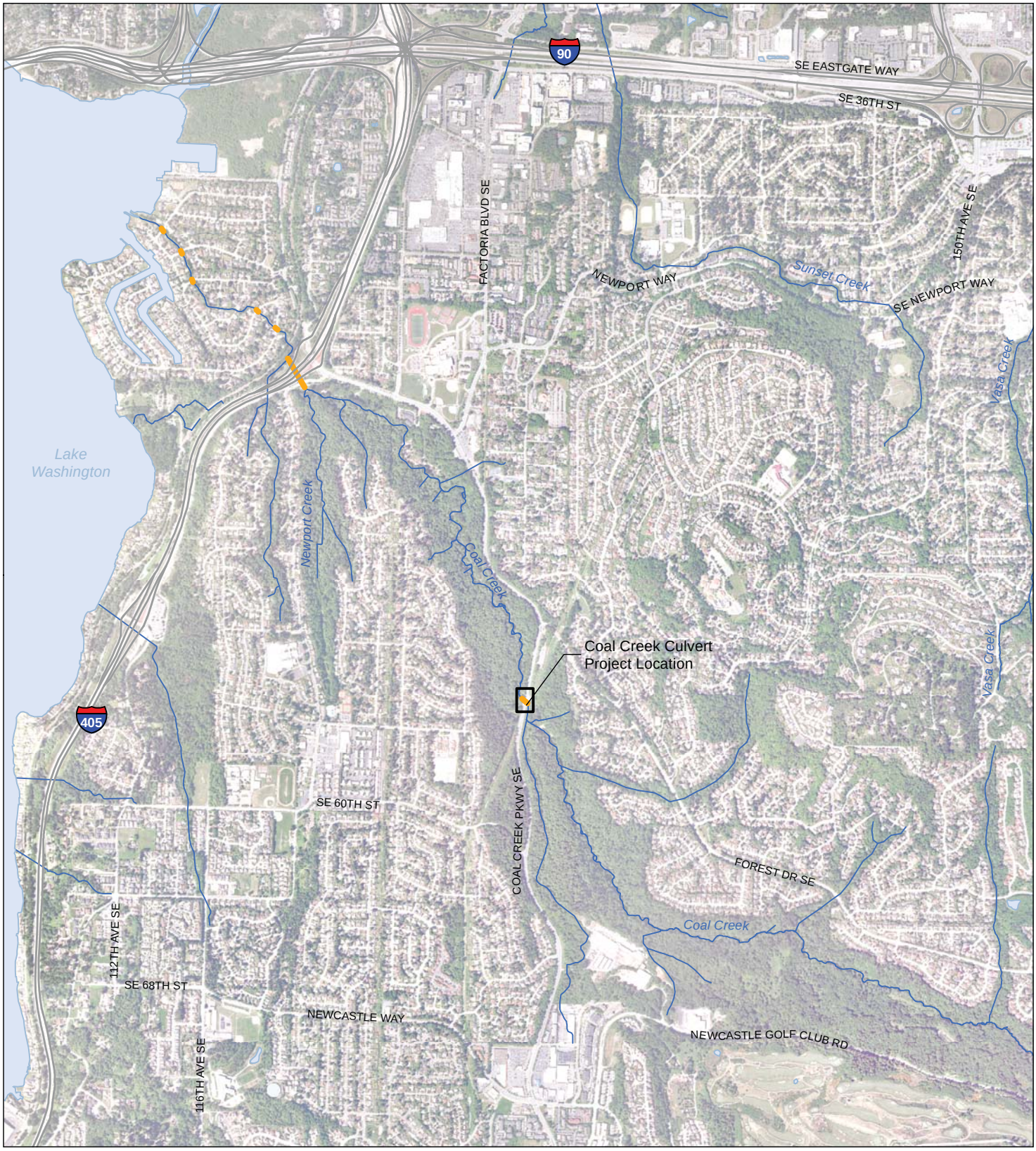
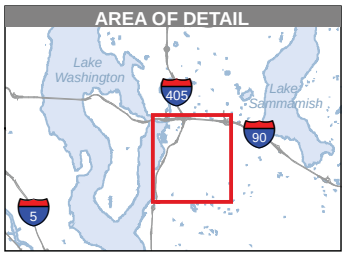




Culvert on Coal Creek

Open Stream

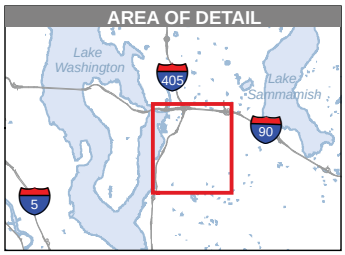
Source: City of Bellevue (2006) GIS Data (Streams, Streets); Aerials Express (2009) Aerial. Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

N

0 500 1,000 2,000 Feet

Figure 1. **Project Vicinity**

Coal Creek Culvert Project



20 ft Contour

100 ft Contour

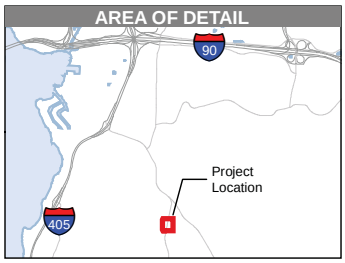
Source: City of Bellevue (2006) Streams, Streets; King County (2005) Contours. Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

N

0 500 1,000 2,000 Feet

Figure 2. **Topography in Project Vicinity**

Coal Creek Culvert Project



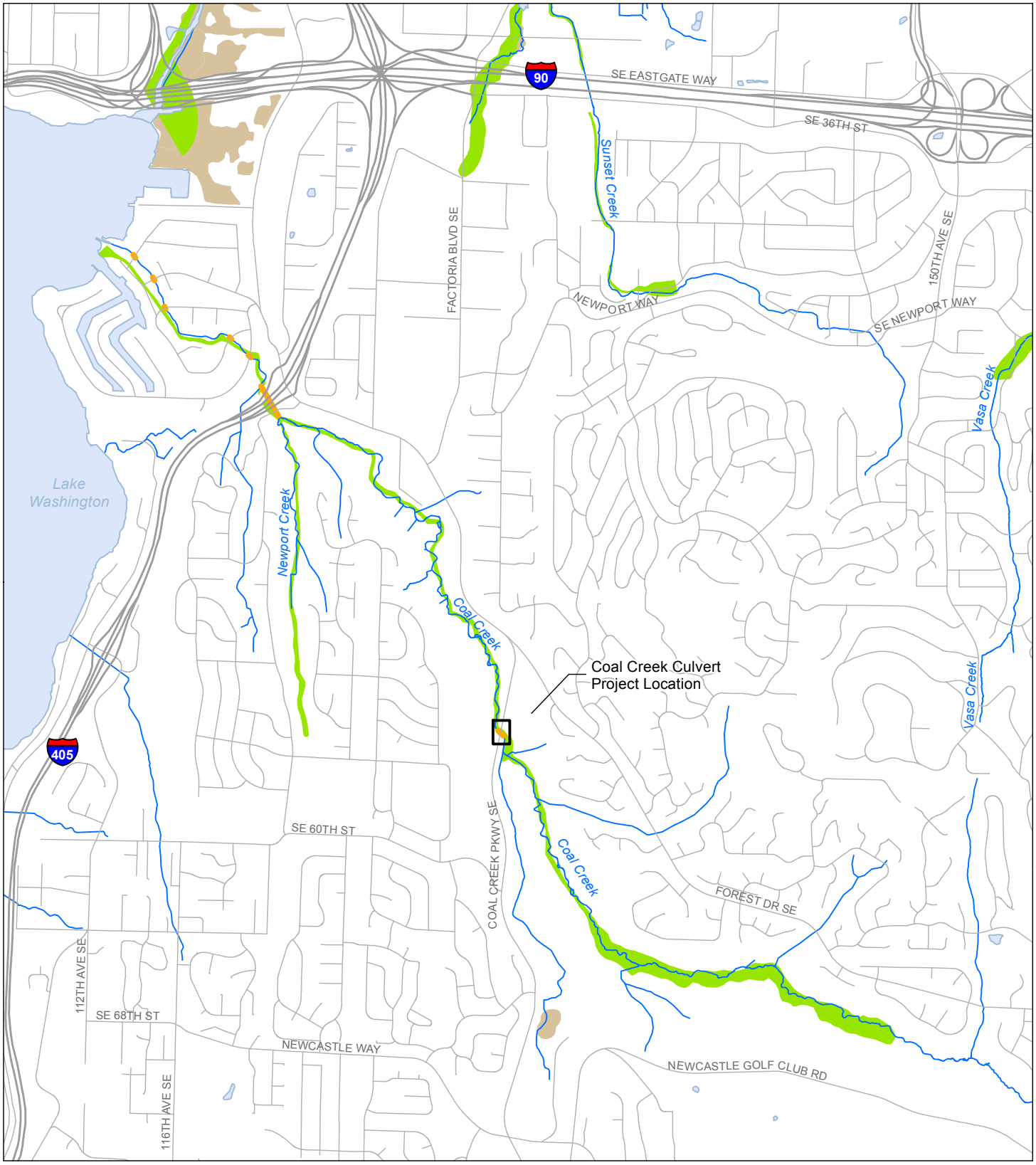
Open Stream
Culvert on Coal Creek
Project Area

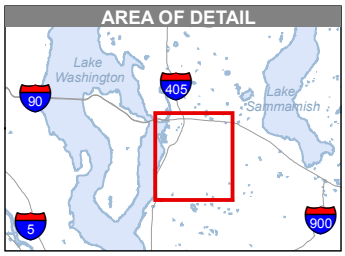
Source: City of Bellevue (2006) Streams, Streets; Aerials Express (2009) Aerial. Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

N
0 40 80 Feet

Figure 3. **Project Area**

Coal Creek Culvert Project





Culvert on Coal Creek

Floodplain

Wetland Vegetation Class

PFO/SSC (Freshwater Forested)

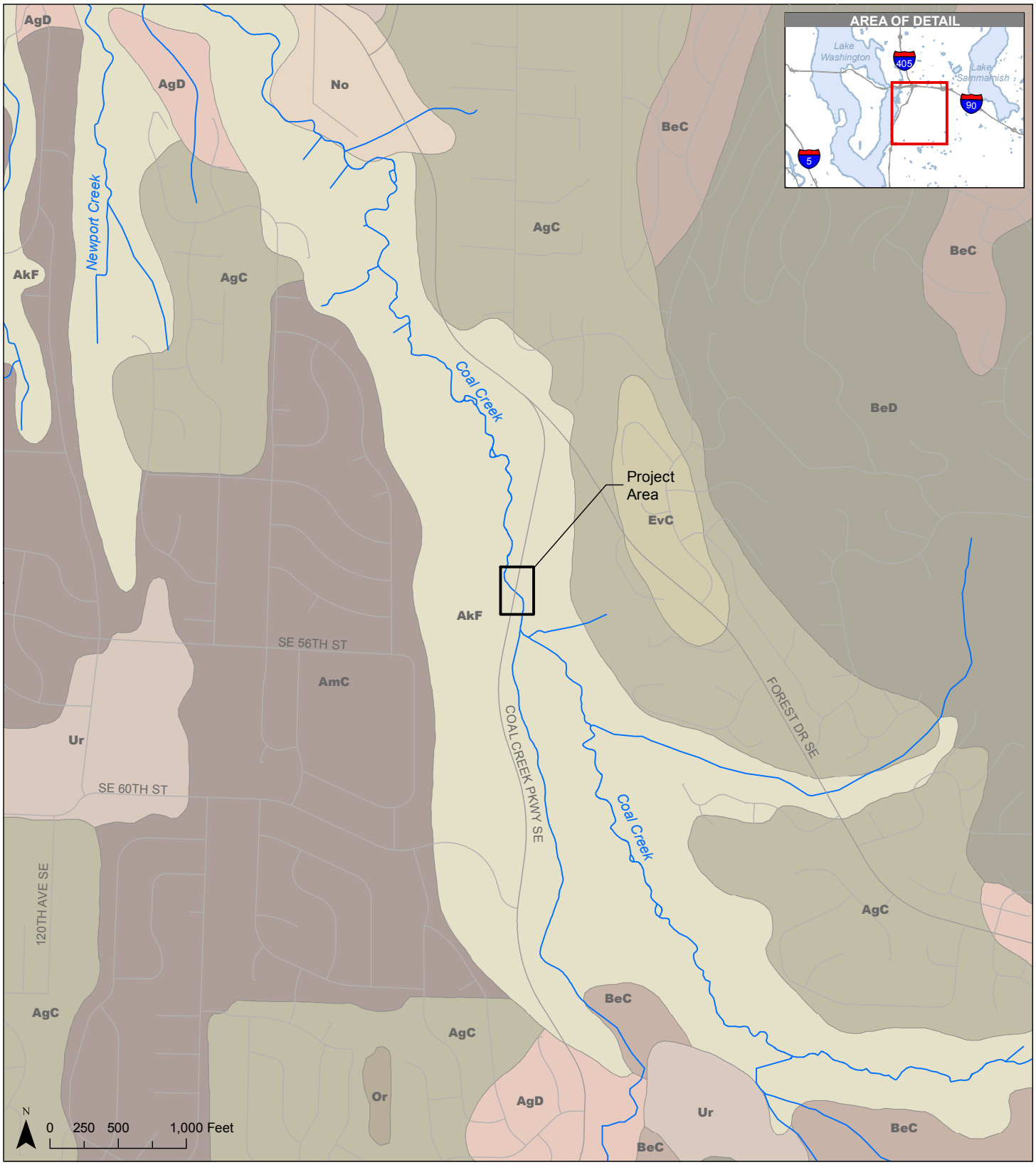
N

0 500 1,000 2,000 Feet

Source: City of Bellevue (2006) Streams, Streets; King County (2005) Flood Area; USFWS (2010) NWI Wetland. Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

Figure 4. **Wetland and Floodplain Areas in Project Vicinity**

Coal Creek Culvert Project



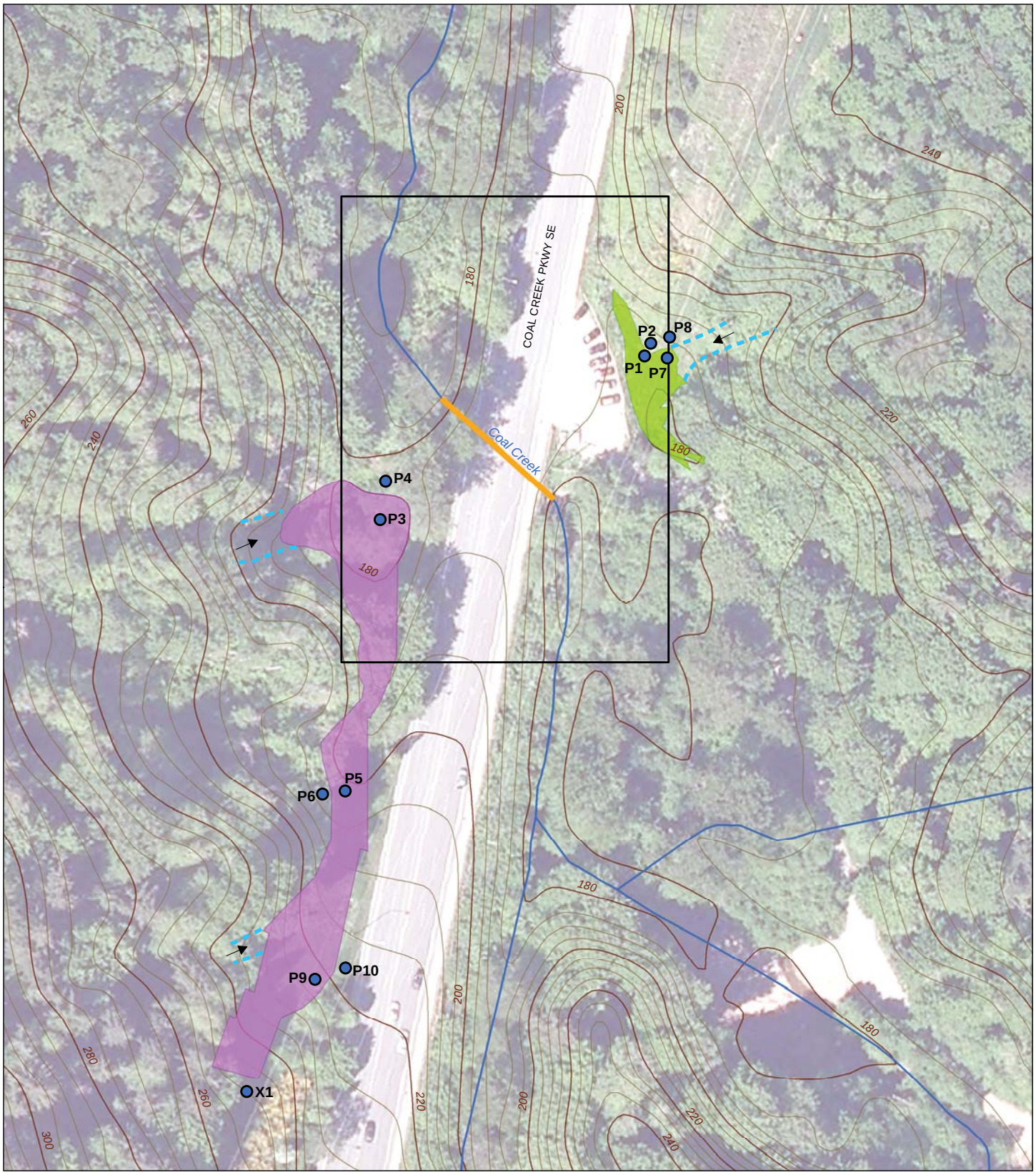
USDA Soil Classification

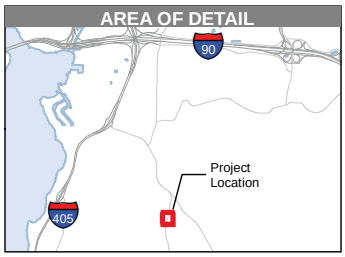
- AgC (Alderwood gravelly sandy loam, 6 to 15 percent slopes)
- AgD (Alderwood gravelly sandy loam, 15 to 30 percent slopes)
- AkF (Alderwood and Kitsap soils, very steep)
- AmC (Arents, Alderwood material, 6 to 15 percent slopes)
- BeC (Beausite gravelly sandy loam, 6 to 15 percent slopes)
- BeD (Beausite gravelly sandy loam, 15 to 30 percent slopes)
- EvC (Everett gravelly sandy loam, 5 to 15 percent slopes)
- No (Norma sandy loam)
- Or (Orcas Peat)
- Ur (Urban land)

Source: City of Bellevue (2006) Streams, Streets; USDA (2011) Soils. Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

Figure 5. **Soils in Project Vicinity**

Coal Creek Culvert Project





Sample Point
5 ft Contour
20 ft Contour
Open Stream
Seep
Culvert on Coal Creek
Project Area
Wetland 1
Wetland 2

N
0 50 100 Feet

Source: CH2M HILL (2011) Wetland Data; City of Bellevue (2006) Streams, Streets; Aerials Express (2009) Aerial. Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

Figure 6. **Wetland Data Collected in 2011**

Coal Creek Culvert Project

Attachment 1
Site Plans

***Site plans included in Land Use Application packet**

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Attachment 2
Wetland Rating Forms

***Wetland rating forms included in Wetland Delineation Report**

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Attachment 3
Data Forms

***Data forms included in Wetland Delineation Report**

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Attachment 4
Threatened and Endangered Species in King County

***Species list included in Biological Assessment**

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Attachment 5
Biological Assessment

***Included in Land Use Application packet**

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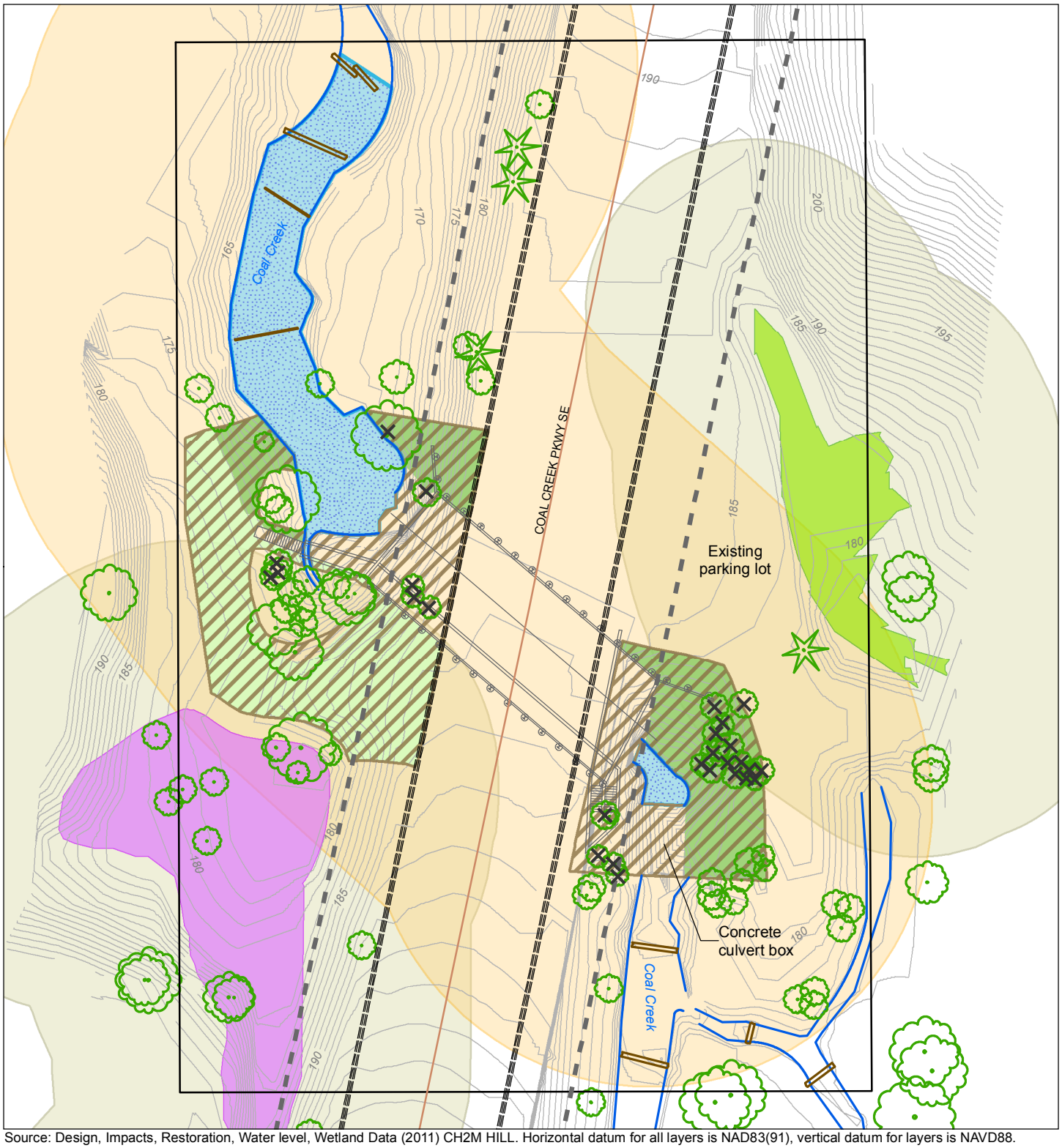
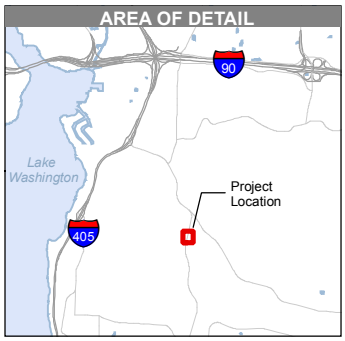


Source: Design, Impacts, Restoration, Water level, Wetland Data (2011) CH2M HILL. Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.



- Existing trees to be removed
- Contour
- Culvert and trail
- Log weir
- Vegetation
- Water level
- Centerline
- Curb
- Right of way
- Project Area
- Wetland 1
- Wetland 2
- 60 ft Wetland buffer
- 100 ft Creek buffer
- Impacted land
- Impacted water

Restoration Areas

- Erosion control non-mow seed mix
- Riparian native woody vegetation
  - *Thuja plicata* (western red cedar)
  - *Salix scouleriana* (Scouler's willow)
  - *Salix sitchensis* (Sitka willow)
  - *Cornus sericea* (Red osier dogwood)
  - *Sambucus racemosa* (Red elderberry)
  - *Rosa nutkana* (Nootka rose)

N

0 25 50 Feet

Figure 3. **Restoration Plan**

Coal Creek Culvert Project

Draft Coal Creek Culvert Replacement Project Wetlands and Other Waters Delineation Report Bellevue, Washington

PREPARED FOR: City of Bellevue, Washington
PREPARED BY: Renée Storey/CH2M HILL
REVIEWED BY: Forrest Parsons/CH2M HILL
COPIES: Doug Playter/CH2M HILL; Gene Peterson/CH2M HILL
DATE: March 2011

Introduction

CH2M HILL conducted a wetland and other waters delineation to identify potentially jurisdictional wetlands and other waters for the proposed Coal Creek Culvert Replacement Project in Bellevue, Washington. The proposed project is located in the City of Bellevue Washington on Coal Creek Parkway at a location about 800 feet south of SE Forest Drive and about 2,500 feet north of SE 60th Street (Figures 1 and 2). Please refer to the JARPA for the complete project description. The delineation was completed in accordance with Section 404 of the Clean Water Act (CWA). The entire project area was surveyed for wetlands (Figure 3).

Report Organization

This report is organized as follows:

A Description of the Site, Landscape Setting, and Previous and Current Land Uses
B Site Alterations
C Precipitation Data and Analysis
D Site-Specific Methods
E Description of Wetlands and Other Waters
F Wetland Mapping Method
G Mitigation
H Results and Conclusions
I Disclaimer

Attachments are as follows:

- Attachment A—Figures
- Attachment B—Wetland Determination Data Forms
- Attachment C—Ground Photographs: Wetlands and Stream
- Attachment D—Washington Wetland Rating Forms
- Attachment E—Literature Citations

A. Description of the Site, Landscape Setting, and Previous and Current Land Uses

The proposed project is located in the Puget Lowland physiographic region. A broad, a low-lying region situated between the Cascade Range to the east and the Olympic Mountains and Willapa Hills to the west. The landscape is generally low lying and near sea level elevations, though small mountains (1400 feet in elevation) with steep terrain occur in this region. Steep ravines drained by numerous creeks dominate some areas of the Puget Lowland.

The regional climate is temperate, with average annual precipitation of approximately 35.96 inches (NRCS 2002). The majority of this precipitation occurs from October through March with April through September seeing relatively little precipitation.

The project area is located in Bellevue Washington at the bottom of a ravine, through which Coal Creek flows, at an elevation of 180 feet above sea level. The Coal Creek basin has been heavily impacted by nearly 100 years of mining. Both landscape and hydrology have been highly altered. Mining operations began in 1863, over 11 million tons of coal was removed from the basin. As a result of mining and subsequent development and urbanization, the landscape is highly erodible in many areas within the basin.

The project area is bisected by Coal Creek Parkway and is within a generally forested riparian corridor of Coal Creek Park that extends from I-405 southeast to the headwaters of Coal Creek and beyond (Figure 1). Coal Creek Park is a 550-acre park owned by the City of Bellevue. This park is comprised mainly of third-growth forest and is largely undeveloped. The project area is rolling terrain with mixed deciduous-coniferous upland forest, a stream channel (Coal Creek), and two slope-depressional wetland features. There are some steep slopes onsite that were created during the development of Coal Creek Parkway. Current land use is City Park, a four lane roadway and a right of way for the Olympic Pipeline Company.

B. Site Alterations

Historically the site was heavily impacted by coal mining. Unstable slopes in the greater Coal Creek basin and mine tailings in the stream channel are current evidence that the impacts from historic mining activities are still occurring. Vegetation communities throughout the site have been altered by road, right of way and culvert, installation activities. Much of the project area contains fill soil that was placed on site during construction of the projects mentioned above.

C. Precipitation Data and Analysis

Annual precipitation in the region averages approximately 35.96 inches of rain annually for the water year (NRCS 2002). Precipitation data were reviewed for the nearest appropriate weather station located in Bellevue, Washington (Downtown Park). This weather station is approximately 220 feet higher in elevation than the project site. Precipitation for the water year beginning October 2009 through June 2010 was 28.22 inches (Table 1).

TABLE 1
Monthly Precipitation Data (NRCS, 2002; KWABELLE17 Weather Station, 2010)

	Actual Precipitation (in inches)	Normal Range* (in inches)	Outside Normal Range (in inches)
October 2009	3.49	1.96 – 3.86	
November 2009	3.07	4.10 – 7.02	-1.03
December 2009	2.25	3.94 – 6.68	-1.69
January 2010	5.17	3.58 – 6.10	
February 2010	2.77	2.73 – 5.02	
March 2010	3.20	2.77 – 4.40	
April 2010	3.06	1.71 – 3.11	
May 2010	2.65	1.16 – 2.13	+1.49
June 2010	2.56	0.96 - 1.79	+1.60
Total	**28.22**	**22.91 – 40.21**	

*"Normal Range" is the range within which precipitation for the given period has a 70 percent chance of occurring.

Table 2 presents the precipitation data for the 2-week period preceding the field investigation on January 20, 2011. Precipitation totaled 2.82 inches. It is worth noting that the month (December) preceding the field investigation received 9.09 inches of rain, which is 2.42 inches above the normal range.

TABLE 2
Daily Precipitation Data (KWABELLE17, Weather Station, 2011)

Date	Precipitation (in inches)
January 7, 2011	0.52
January 8, 2011	0.01
January 9, 2011	0.03
January 10, 2011	0.0
January 11, 2011	0.12
January 12, 2011	0.74
January 13, 2011	0.66
January 14, 2011	0.08
January 15, 2011	0.42
January 16, 2011	0.11
January 17, 2011	0.0
January 18, 2011	0.08
January 19, 2011	0.0
January 20, 2011	0.05
Total:	**2.82**

Based on the above precipitation data, precipitation for the water year prior to the fieldwork was within the normal range. Total January precipitation was 4.86 inches and was within the normal range.

D. Site-Specific Methods

Wetland delineation surveys covered the entire project area (Figure 3).

Literature Review

Prior to conducting the field study, the following information was reviewed:

- U.S. Geological Survey (USGS) 7.5' topographic maps (digital format)
- USGS 100K National Hydrography Dataset (NHD) - digital water course data
- Pacific Northwest Hydrography Framework (PNWHF) 24K Dataset – digital water course data
- National Wetlands Inventory (NWI) digital data
- SSURGO digital soils data
- Hydric Soils List (USDA 2007)
- Aerial imagery (Aerial Express 2009)

No NWI mapped wetlands or mapped hydric soil units were identified within the study area (Figure 4 and 5). Coal Creek was the only water feature found during the literature review process.

Field Study

Fieldwork was conducted on January 20, 2011. Field verification of Coal Creek included observations of geomorphology, hydrology, and biology, and taking site photographs.

Data collection, description, and analysis for wetlands and other jurisdictional waters of the U.S. followed procedures in the *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987), the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains Valley and Coast Region* (USACE 2008). Effective March 14, 2011 the Department of Ecology mandates that state delineations be conducted according to the currently approved federal manual and supplements (*Washington Administrative Code* 173-22-035).

The routine onsite wetland determination method was used to observe vegetation, soils, and hydrological conditions at representative locations. Paired sample plots were used to document wetland and upland areas adjacent to wetland boundaries. The *USFWS National List of Plant Species that Occur in Wetlands: 1993 Supplement List of Plant Species that Occur in Wetlands (Region 9)* (USFWS 1993) was used to determine hydrophytic status of vegetation.

E. Description of Wetlands and Other Waters

Two wetlands were delineated within the project area. One perennial stream (Coal Creek) occurs in the project area. Both wetlands are assumed jurisdictional at the state and federal levels. The final jurisdictional determinations are made by the regulatory agencies.

Field Surveyed Wetlands

Two wetlands totaling 0.47 acres were delineated in and near the survey corridor (Table 1). Of the 0.47 acres, .17 acres occur within the project area boundary (Figure 6).

TABLE 1
Summary of Project Area Wetlands

Wetland ID	Acres in Project Area (acres)	Hydrogeomorphic Classification	Cowardin Classification	Ecology Classification[a]	Standard Buffer Width (feet)
1	0.07	Slope/Depressional	Palustrine	III	60
2	0.41	Slope/Depressional	Palustrine	III	60

[a] Washington State Department of Ecology

Wetland determination data forms are in Attachment B. Ground photographs of wetlands are in Attachment C.

Wetland 1 is a palustrine emergent wetland (PEM) that is situated in a depression north of Coal Creek on the east side of Coal Creek Parkway. This wetland is dominated by reed canary grass (*Phalaris arundinacea*). This wetland extends partially up a slope within the right-of-way for a power line. A seep in the slope above the wetland contributes to the hydrology (Figure 6). The water flows from this seep and then sits in the wetland depression. There is a 24-inch culvert along the southern edge of this wetland. The culvert drains this wetland to another wetland (outside the project area) on the other side of a berm that was created as part of the trail system into Coal Creek Park. Wetland 1 is approximately 0.07 acres in size with approximately 82 percent occurring within the project area.

Wetlands 2 is a palustrine emergent wetland situated on a slope and a depression on the south side of Coal Creek west of Coal Creek Parkway (Figure 6). This wetland is dominated by reed canary grass and mowed grasses on the slope portion and watercress (*Nasturtium aquaticum*) and bare ground in the depressional portion of the wetland. At least two seeps exist on the western slope surrounding this wetland and contribute to its hydrology. Wetland 2 is approximately 0.41 acres in size with approximately 29 percent occurring within the project area.

Other Waters

Field Surveyed Streams

One stream (Coal Creek) was mapped in the field survey corridor (Table 2; Figure 6). Ground photographs of this stream are in Attachment C.

Coal Creek is a perennial, fish-bearing stream that is 7 miles long from its headwaters on Cougar Mountain. Coal Creek flows in a generally forested riparian corridor that extends southeast from I-405, to where it drains into Lake Washington in the Newport Shores area. Coal Creek is a Type F stream that requires a 100-foot buffer at undeveloped sites (City of Bellevue LUC 20.25H.035). Coal Creek is not considered a shoreline of the state.

TABLE 2
Stream Channels at the Coal Creek Culvert Replacement Project

Stream Reach ID	Stream Name	Flow Regime	Width @ Widest Point (feet)	Preliminary Jurisdictional Determination[a], Clean Water Act Section 404	Preliminary Jurisdictional Determination[a], Oregon Removal-Fill Law
Stream 1	Coal Creek	Perennial	40	YES	YES

[a] Jurisdictional determinations, including the applicability of exemptions, are preliminary only. Final determinations are made by the regulatory agencies.

F. Wetland Mapping Method

Wetland sample plot locations and wetland boundaries were mapped using a hand-held Trimble GeoXT Global Positioning System (GPS) unit with sub-meter accuracy capability. Estimated accuracy of mapped wetland boundaries is ± 3 feet.

Coal Creek was mapped by using existing PNW watercourse mapping, following field-verification.

G. Mitigation

Permanent impacts to wetlands and streams would be avoided by this project. This project would improve stream habitat and water quality in Coal Creek. Temporary impacts to wetland buffer and stream buffer would occur as a result of this project. Several significant trees would be removed in the Coal Creek buffer. A small amount of permanent impacts would occur to the Coal Creek buffer resulting from the installation of the trail stairway that would lead into the culvert. Refer to the JARPA for project related impact quantities.

Mitigation for the 0.1 acres of temporary wetland buffer impacts would consist of reestablishing the impacted areas post-construction by replanting those areas with native vegetation appropriate for wetland buffer.

Mitigation for the 0.3 acres of temporary stream buffer impact (including impacts to significant trees) would include reestablishing the impacted areas post-construction by replanting those areas with native vegetation appropriate for stream buffer. The area impacted by the installation of the stairway for the trail would be mitigated for by improving (through the planting of native trees and shrubs) an area of stream buffer downstream of this permanent impact.

The replacement mitigation ratio for this project would be at a 1:1 ratio in all cases.

H. Results and Conclusions

All of the wetlands and other waters identified in this report are potentially subject to federal and/or state jurisdiction. Jurisdictional determinations, including the applicability of exemptions, are made on a case-by-case basis by the regulatory agencies.

The regulatory conclusions in this report are provided as preliminary jurisdictional determinations (PJDs). PJDs, including the applicability of exemptions, are advisory only. Both wetlands and Coal Creek are assumed to be jurisdictional. Final determinations are made by the regulatory agencies.

Waters of the State

"Surface waters of the state" include lakes, rivers, ponds, streams, inland waters, saltwaters, wetlands, and all other surface waters and water courses within the jurisdiction of the state of Washington (Washington Administrative Code 173-201A-020). All of the delineated streams and wetlands at the project site are naturally occurring features of the landscape and are likely waters of the state.

Perennial Streams

Coal Creek is the only stream in the project area. Coal Creek is perennial and is assumed jurisdictional.

Wetlands

Wetlands 1 and 2 contain springs or seeps and are potentially jurisdictional as natural wetlands which are waters of the state by definition.

Waters of the U.S.

USACE asserts jurisdiction over the following waters:

- Traditional navigable waters (TNWs)
- Wetlands adjacent to TNWs
- Non-navigable tributaries of TNWs that are relatively permanent waters (RPWs) where the tributaries typically flow year-round or have continuous flow at least seasonally (i.e., typically 3 months)
- Wetlands that directly abut (i.e., have a continuous surface connection to) such tributaries (U.S. Environmental Protection Agency [EPA] and USACE, 2008)

USACE will decide jurisdiction over the following waters based on a fact-specific analysis to determine whether they have a significant nexus with a TNW:

- Non-navigable tributaries that are not relatively permanent
- Wetlands adjacent to non-navigable tributaries that are not relatively permanent
- Wetlands adjacent to but that do not directly abut a relatively permanent non-navigable tributary (EPA and USACE, 2008a)

A "significant nexus" is determined through analysis of "the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical and biological integrity of downstream TNWs" (EPA and USACE, 2008).

USACE will decide jurisdiction over isolated (i.e., non-adjacent) wetlands and waters based on a fact-specific analysis to determine whether impacts to those wetlands or waters could affect interstate commerce.

Traditional Navigable Waters (TNWs)

There are no traditional navigable waters in the project area. The nearest downstream TNW for Coal Creek is Lake Washington (Figure 1).

Relatively Permanent Waters (RPW) and Abutting Wetlands

Wetlands 1 and 2 are adjacent to Coal Creek which is a perennial stream and therefore an RPW.

Non-RPWs and Adjacent Wetlands

There are no non-RPWs in the project area.

Isolated Waters and Wetlands

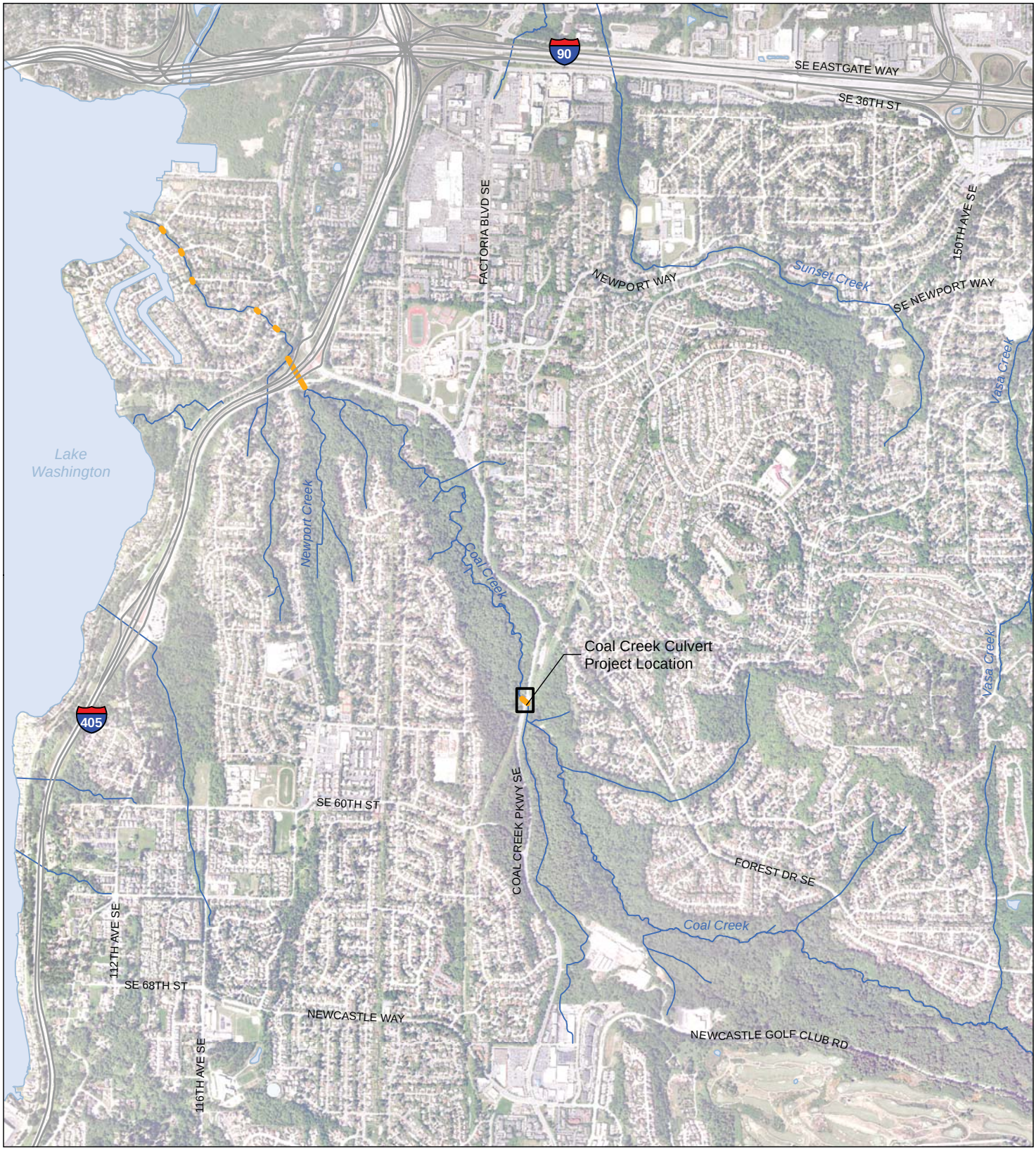
There are no isolated waters or wetlands in the project area.

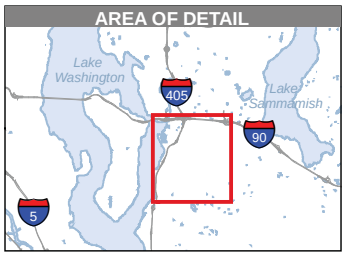
I. Disclaimer

This report documents the investigation, best professional judgment, and conclusions of the investigators. It is correct and complete to the best of our knowledge. It should be considered a Preliminary Jurisdictional Determination and used at your own risk until it has been reviewed and approved in writing by the Washington Department of Ecology and by the U.S. Army Corps of Engineers, Seattle District.

Jurisdictional determinations, including the applicability of exemptions, are made on a case-by-case basis by the Washington Department of Ecology and USACE.

ATTACHMENT A
Figures





Culvert on Coal Creek

Open Stream

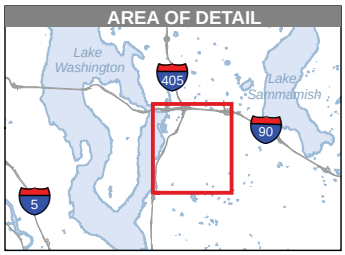
Source: City of Bellevue (2006) GIS Data (Streams, Streets); Aerials Express (2009) Aerial. Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

N

0 500 1,000 2,000 Feet

Figure 1. **Project Vicinity**

Coal Creek Culvert Project



20 ft Contour

100 ft Contour

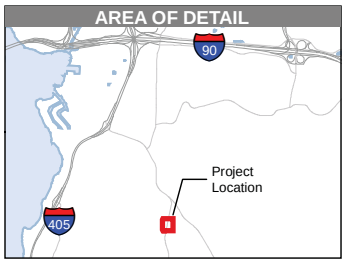
Source: City of Bellevue (2006) Streams, Streets; King County (2005) Contours. Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

N

0 500 1,000 2,000 Feet

Figure 2. **Topography in Project Vicinity**

Coal Creek Culvert Project



Open Stream
Culvert on Coal Creek
Project Area

Source: City of Bellevue (2006) Streams, Streets; Aerials Express (2009) Aerial. Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

N
0 40 80 Feet

Figure 3. **Project Area**

Coal Creek Culvert Project

ATTACHMENT B

Wetland Determination Data Forms

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Coal Creek Culvert Replacement Project City/County: Bellevue/King Sampling Date: 1/20/2011
Applicant/Owner: City of Bellevue State: WA Sampling Point: P1
Investigator(s): Renee Storey, Erin Thatcher Section, Township, Range: 21 24 05E
Landform (hillslope, terrace, etc.): flat Local relief (concave, convex, none): none Slope (%): 1
Subregion (LRR): A. Northwest Forests and Coast Lat: ____ Long: ____ Datum: NAD 83
Soil Map Unit Name: Alderwood and Kitsap soils, very steep NWI classification: None
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☒, or Hydrology ☐ significantly disturbed? Yes ☒ No ☐ Are "Normal Circumstances" present? Yes ☒ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? Yes ☐ No ☒ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐	**Is the Sampled Area within a Wetland?** **Yes ☒** **No ☐**
Hydric Soil Present?	Yes ☒	No ☐	
Wetland Hydrology Present?	Yes ☒	No ☐	

Remarks:
The plot is in a utility ROW and contains fill material.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Alnus rubra	10	Y	FAC
2.			
3.			
4.			
	10	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15')			
1. Rubus discolor	10	Y	FACU
2.			
3.			
4.			
5.			
	10	= Total Cover	

Herb Stratum (Plot size: 5')			
1. Phalaris arundinacea	100	Y	FACW
2. unknown herb	trace	N	unknown
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100	= Total Cover	

Woody Vine Stratum (Plot size: 15')			
1.			
2.			
	0	= Total Cover	

% Bare ground in herb stratum 0

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 66.6 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	100	x 2 =	200
FAC species	10	x 3 =	30
FACU species	10	x 4 =	40
UPL species		x 5 =	
Column Totals:	120 (A)		270 (B)

Prevalence Index = B/A = 2.25

Hydrophytic Vegetation Indicators:
☒ Dominance Test is >50%
☒ Prevalence Index is ≤3.0[1]
☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
☐ Wetland Non-Vascular Plants[1]
☐ Problematic Hydrophytic Vegetation[1] (Explain)
[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes ☒** **No ☐**

Remarks:

SOIL

Sampling Point P1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR2/1	100					Silt Loam	Hit fill gravel/resistence at 12 inches

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Fill rock

Depth (inches): 12

Hydric Soil Present? **Yes** ☒ **No** ☐

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply

- ☒ Surface Water (A1)
- ☒ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (**LRR A**)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☒ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (**LRR A**)
- ☐ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ☒	No ☐	Depth (inches): < 1
Water Table Present?	Yes ☒	No ☐	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes ☒	No ☐	Depth (inches): 0

Wetland Hydrology Present? **Yes** ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The wetland boundary is defined by a change in topography and vegetation. The wetland exists moslty in a depression in the landscape and the vegetation community is dominated by reed canary grass and ranunculus, outside the wetland the landscape slopes up onto the hillside and vegetation changes to Hymalayan blackberry.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Coal Creek Culvert Replacement Project City/County: Bellevue/King Sampling Date: 1/20/2011
Applicant/Owner: City of Bellevue State: WA Sampling Point: P2
Investigator(s): Renee Storey, Erin Thatcher Section, Township, Range: 21 24 05E
Landform (hillslope, terrace, etc.): slope Local relief (concave, convex, none): none Slope (%):5
Subregion (LRR): A. Northwest Forests and Coast Lat: ____ Long: ____ Datum: NAD 83
Soil Map Unit Name: Alderwood and Kitsap soils, very steep NWI classification: None
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☒, or Hydrology ☐ significantly disturbed? Yes ☒ No ☐ Are "Normal Circumstances" present? Yes ☒ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? Yes ☐ No ☒ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐	No ☒	**Is the Sampled Area within a Wetland?** **Yes** ☐ **No** ☒
Hydric Soil Present?	Yes ☐	No ☒	
Wetland Hydrology Present?	Yes ☐	No ☒	

Remarks:
This plot was taken in a utility ROW. Plot was taken in an upland area upslope from P1.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15')			
1. Rubus discolor	95	Y	FACU
2.			
3.			
4.			
5.			
	95	= Total Cover	

Herb Stratum (Plot size: 5')			
1. Polystichum munitum	5	Y	NL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	5	= Total Cover	

Woody Vine Stratum (Plot size: 15')			
1.			
2.			
	0	= Total Cover	

% Bare ground in herb stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ☐ **No** ☒

Remarks:

SOIL

Sampling Point P2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR3/2	100					Silt Loam	fill gravel resistence at 5 inches

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: fill rock

Depth (inches): 5

Hydric Soil Present? **Yes** ☐ **No** ☒

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (**LRR A**)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (**LRR A**)
- ☐ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ☐ No ☐ Depth (inches): _____

Water Table Present? Yes ☐ No ☐ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ☐ No ☐ Depth (inches): _____

Wetland Hydrology Present? **Yes** ☐ **No** ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Coal Creek Culvert Replacement Project City/County: Bellevue/King Sampling Date: 1/20/2011
Applicant/Owner: City of Bellevue State: WA Sampling Point: P3
Investigator(s): Renee Storey, Erin Thatcher Section, Township, Range: 21 24 05E
Landform (hillslope, terrace, etc.): flat Local relief (concave, convex, none): none Slope (%):2
Subregion (LRR): A. Northwest Forests and Coast Lat: Long: Datum: NAD 83
Soil Map Unit Name: Alderwood and Kitsap soils, very steep NWI classification: None
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Yes ☒ No ☐ Are "Normal Circumstances" present? Yes ☒ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? Yes ☐ No ☒ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐	**Is the Sampled Area within a Wetland?** **Yes ☒** **No ☐**
Hydric Soil Present?	Yes ☒	No ☐	
Wetland Hydrology Present?	Yes ☒	No ☐	

Remarks:
The plot is in a utility ROW and contains fill material

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Alnus rubra	10	Y	FAC
2.			
3.			
4.			
	10	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15')			
1. Rubus discolor	10	Y	FACU
2.			
3.			
4.			
5.			
	10	= Total Cover	

Herb Stratum (Plot size: 5')			
1. Ranunculus repens	80	Y	FACW
2. Moss	10	N	unknown
3. Mixed grasses (to short to ID)	10	N	unknown
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100	= Total Cover	

Woody Vine Stratum (Plot size: 15')			
1.			
2.			
	0	= Total Cover	

% Bare ground in herb stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.6 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	80	x 2 =	160
FAC species	10	x 3 =	30
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	90 (A)		190 (B)

Prevalence Index = B/A = 2.1

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is >50%
- ☒ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes ☒** **No ☐**

Remarks:

SOIL

Sampling Point P3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR2/1	100					Sandy Loam	Hit fill gravel/resistence at 7 inches

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Fill rock

Depth (inches): 7

Hydric Soil Present? **Yes** ☒ **No** ☐

Remarks:

Fill gravel mixed in with soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply

- ☐ Surface Water (A1)
- ☒ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (**LRR A**)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☒ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (**LRR A**)
- ☐ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ☐	No ☒	Depth (inches):
Water Table Present?	Yes ☒	No ☐	Depth (inches): 6
Saturation Present? (includes capillary fringe)	Yes ☒	No ☐	Depth (inches): 0

Wetland Hydrology Present? **Yes** ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The wetland boundary is defined by a change in topography and vegetation. The wetland exists moslty in a depression in the landscape and the vegetation community is dominated by reed canary grass and ranunculus, outside the wetland the landscape slopes up onto the hillside and vegetation changes to Hymalayan blackberry.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Coal Creek Culvert Replacement Project City/County: Bellevue/King Sampling Date: 1/20/2011
Applicant/Owner: City of Bellevue State: WA Sampling Point: P4
Investigator(s): Renee Storey, Erin Thatcher Section, Township, Range: 21 24 05E
Landform (hillslope, terrace, etc.): flat Local relief (concave, convex, none): none Slope (%): 2
Subregion (LRR): A. Northwest Forests and Coast Lat: ____ Long: ____ Datum: NAD 83
Soil Map Unit Name: Alderwood and Kitsap soils, very steep NWI classification: None
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☒, or Hydrology ☐ significantly disturbed? Yes ☒ No ☐ Are "Normal Circumstances" present? Yes ☒ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? Yes ☐ No ☒ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐	No ☒	**Is the Sampled Area within a Wetland?** **Yes ☐** **No ☒**
Hydric Soil Present?	Yes ☐	No ☒	
Wetland Hydrology Present?	Yes ☐	No ☒	

Remarks:
The plot is in a utility ROW and contains fill material. Plot taken in an upland area upslope from P3.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15')			
1. Rubus discolor	< 5	Y	FACU
2.			
3.			
4.			
5.			
	5	= Total Cover	

Herb Stratum (Plot size: 5')			
1. Ranunculus repens	85	Y	FACW
2. Moss	10	N	unknown
3. Mixed grasses (to short to ID)	< 5	N	unknown
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100	= Total Cover	

Woody Vine Stratum (Plot size: 15')			
1.			
2.			
	0	= Total Cover	

% Bare ground in herb stratum 0

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)
Total Number of Dominant Species Across All Strata: ____ (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes ☐** **No ☒**

Remarks:

SOIL

Sampling Point P4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR2/1	100					Sandy Loam	Hit fill gravel/resistence at 7 inches

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: Fill rock

Depth (inches): 7

Hydric Soil Present? **Yes** ☐ **No** ☒

Remarks:

Fill gravel mixed in with soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply

- ☐ Surface Water (A1)
- ☒ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (**LRR A**)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☒ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (**LRR A**)
- ☐ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): _____

Water Table Present? Yes ☐ No ☒ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ☐ No ☒ Depth (inches): _____

Wetland Hydrology Present? **Yes** ☐ **No** ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Coal Creek Culvert Replacement Project City/County: Bellevue/King Sampling Date: 1/20/2011
Applicant/Owner: City of Bellevue State: WA Sampling Point: P5
Investigator(s): Renee Storey, Erin Thatcher Section, Township, Range: 21 24 05E
Landform (hillslope, terrace, etc.): flat Local relief (concave, convex, none): none Slope (%):2
Subregion (LRR): A. Northwest Forests and Coast Lat: Long: Datum: NAD 83
Soil Map Unit Name: Alderwood and Kitsap soils, very steep NWI classification: None
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Yes ☐ No ☒ Are "Normal Circumstances" present? Yes ☒ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? Yes ☐ No ☒ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐	**Is the Sampled Area within a Wetland?** **Yes ☒** **No ☐**
Hydric Soil Present?	Yes ☒	No ☐	
Wetland Hydrology Present?	Yes ☒	No ☐	

Remarks:
The plot is in a depression adjacent to a berm that was created to make a nature trail in Coal Creek Park.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer macrophyllum	10	Y	FACU
2. Acer circinatum	5	N	FAC
3. Alnus rubra	10	Y	FAC
4.			
	25	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
	0	= Total Cover	

Herb Stratum (Plot size: 5')			
1. Nasturtium officinale	80	Y	OBL
2. open water	20	NA	NA
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100	= Total Cover	

Woody Vine Stratum (Plot size: 15')			
1.			
2.			
	0	= Total Cover	

% Bare ground in herb stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.6 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	80	x 1 =	80
FACW species		x 2 =	
FAC species	20	x 3 =	60
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	100 (A)		140 (B)

Prevalence Index = B/A = 1.4

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is >50%
- ☒ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes ☒** **No ☐**

Remarks:

SOIL

Sampling Point P5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR2/1	100					Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ☒ **No** ☐

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply

- ☒ Surface Water (A1)
- ☒ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☒ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (**LRR A**)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☒ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (**LRR A**)
- ☐ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ☒ No ☐ Depth (inches): 2

Water Table Present? Yes ☒ No ☐ Depth (inches): 0

Saturation Present? (includes capillary fringe) Yes ☒ No ☐ Depth (inches): 0

Wetland Hydrology Present? **Yes** ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The wetland boundary is defined by an abrupt change in topography and vegetation. The wetland exists in a depression and on a slope. Vegetation in the wetland is watercress in the low area and the slope is mainly reed canary grass and mowed grasses. Outside the wetland are maple and alder trees with some conifers mixed in and sword fern in the understory.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Coal Creek Culvert Replacement Project City/County: Bellevue/King Sampling Date: 1/20/2011
Applicant/Owner: City of Bellevue State: WA Sampling Point: P6
Investigator(s): Renee Storey, Erin Thatcher Section, Township, Range: 21 24 05E
Landform (hillslope, terrace, etc.): terrace/berm Local relief (concave, convex, none): none Slope (%):3
Subregion (LRR): A. Northwest Forests and Coast Lat: ____ Long: ____ Datum: NAD 83
Soil Map Unit Name: Alderwood and Kitsap soils, very steep NWI classification: None
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Yes ☒ No ☐ Are "Normal Circumstances" present? Yes ☒ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? Yes ☐ No ☒ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐	No ☒	**Is the Sampled Area within a Wetland?** **Yes** ☐ **No** ☒
Hydric Soil Present?	Yes ☐	No ☒	
Wetland Hydrology Present?	Yes ☐	No ☒	

Remarks:
This plot was taken in an upland area on a created nature trail berm adjacent to P5.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer macrophyllum	15	Y	FACU
2. Acer rubra	15	Y	FAC
3.			
4.			
	30	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15')			
1. Rubus spectabilis	20	Y	FAC
2.			
3.			
4.			
5.			
	20	= Total Cover	

Herb Stratum (Plot size: 5')			
1. unknown grass mowed	50	Y	unknown
2. unknown herb mowed	5		unknown
3. leaves gravel	45	Y	NA
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100	= Total Cover	

Woody Vine Stratum (Plot size: 15')			
1.			
2.			
	0	= Total Cover	

% Bare ground in herb stratum ____

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)
Total Number of Dominant Species Across All Strata: ____ (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ☐ **No** ☒

Remarks:

SOIL

Sampling Point P6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ☐ **No** ☐

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (**LRR A**)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (**LRR A**)
- ☐ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ☐ No ☐ Depth (inches): _____

Water Table Present? Yes ☐ No ☐ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ☐ No ☐ Depth (inches): _____

Wetland Hydrology Present? **Yes** ☐ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Coal Creek Culvert Replacement Project City/County: Bellevue/King Sampling Date: 1/20/2011
Applicant/Owner: City of Bellevue State: WA Sampling Point: P7
Investigator(s): Renee Storey, Erin Thatcher Section, Township, Range: 21 24 05E
Landform (hillslope, terrace, etc.): flat Local relief (concave, convex, none): none Slope (%): 2
Subregion (LRR): A. Northwest Forests and Coast Lat: ____ Long: ____ Datum: NAD 83
Soil Map Unit Name: Alderwood and Kitsap soils, very steep NWI classification: None
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Yes ☒ No ☐ Are "Normal Circumstances" present? Yes ☒ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? Yes ☐ No ☒ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐	**Is the Sampled Area within a Wetland?** **Yes ☒** **No ☐**
Hydric Soil Present?	Yes ☒	No ☐	
Wetland Hydrology Present?	Yes ☒	No ☐	

Remarks:
The plot is in a utility ROW that contains fill soil.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer macrophyllum	5	N	FACU
2. Acer circinatum	5	N	FAC
3. Alnus rubra	10	Y	FAC
4.			
	20	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
	0	= Total Cover	

Herb Stratum (Plot size: 5')			
1. Nasturtium officinale	95	Y	FACW
2. unknown mowed grass	5	N	unknown
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100	= Total Cover	

Woody Vine Stratum (Plot size: 15')			
1.			
2.			
	0	= Total Cover	

% Bare ground in herb stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	95	x 2 =	190
FAC species	10	x 3 =	30
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	105 (A)		220 (B)

Prevalence Index = B/A = 2.1

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is >50%
- ☒ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes ☒** **No ☐**

Remarks:

SOIL

Sampling Point P7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR4/1	100					Sandy Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ☒ **No** ☐

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply

- ☒ Surface Water (A1)
- ☒ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (**LRR A**)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (**LRR A**)
- ☐ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ☐	No ☒	Depth (inches): _____
Water Table Present?	Yes ☒	No ☐	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes ☒	No ☐	Depth (inches): 0

Wetland Hydrology Present? **Yes** ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The wetland boundary is defined by an abrupt change in topography and vegetation. The wetland exists in a depression and on a slope. Vegetation in the wetland is watercress in the low area and the slope is mainly reed canary grass and mowed grasses. Outside the wetland are maple and alder trees with some conifers mixed in and sword fern in the understory.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Coal Creek Culvert Replacement Project City/County: Bellevue/King Sampling Date: 1/20/2011
Applicant/Owner: City of Bellevue State: WA Sampling Point: P9
Investigator(s): Renee Storey, Erin Thatcher Section, Township, Range: 21 24 05E
Landform (hillslope, terrace, etc.): flat Local relief (concave, convex, none): none Slope (%):2
Subregion (LRR): A. Northwest Forests and Coast Lat: Long: Datum: NAD 83
Soil Map Unit Name: Alderwood and Kitsap soils, very steep NWI classification: None
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Yes ☒ No ☐ Are "Normal Circumstances" present? Yes ☒ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? Yes ☐ No ☒ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☒	No ☐	**Is the Sampled Area within a Wetland?** **Yes ☒** **No ☐**
Hydric Soil Present?	Yes ☒	No ☐	
Wetland Hydrology Present?	Yes ☒	No ☐	

Remarks:
The plot is in a utility ROW that contains fill soil.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
	0	= Total Cover	

Herb Stratum (Plot size: 5')			
1. Phalaris arundinacea	40	Y	FACW
2. Rubus spectabilis	50	Y	FAC
3. moss and leaves	10	N	NA
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100	= Total Cover	

Woody Vine Stratum (Plot size: 15')			
1.			
2.			
	0	= Total Cover	

% Bare ground in herb stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	40	x 2 =	80
FAC species	50	x 3 =	150
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	90 (A)		230 (B)

Prevalence Index = B/A = 2.5

Hydrophytic Vegetation Indicators:

- ☒ Dominance Test is >50%
- ☒ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes ☒** **No ☐**

Remarks:

SOIL

Sampling Point P9

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR2/2	100					sandy loam	
2-4	10YR2/2	85	7YR4/6	15	C	PL	sandy loam	
4-10	2.5YR4/1	85	7YR4/6	15	C	PL	sandy loam	resistence hit at 10" due to hard fill

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☒ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: fill rock

Depth (inches): 10

Hydric Soil Present? **Yes** ☒ **No** ☐

Remarks:

This area is in a utlity ROW and had fill gravel mixed in entire profile.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (**LRR A**)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (**LRR A**)
- ☐ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): _____

Water Table Present? Yes ☐ No ☒ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ☒ No ☐ Depth (inches): 0

Wetland Hydrology Present? **Yes** ☒ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The wetland boundary is defined by an abrupt change in topography and vegetation. The wetland exists in a depression and on a slope. Vegetation in the wetland is watercress in the low area and the slope is mainly reed canary grass and mowed grasses. Outside the wetland are maple and alder trees with some conifers mixed in and sword fern in the understory. The majority of the wetland in a utility ROW.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Coal Creek Culvert Replacement Project City/County: Bellevue/King Sampling Date: 1/20/2011
Applicant/Owner: City of Bellevue State: WA Sampling Point: P10
Investigator(s): Renee Storey, Erin Thatcher Section, Township, Range: 21 24 05E
Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): convex Slope (%):5
Subregion (LRR): A. Northwest Forests and Coast Lat: ____ Long: ____ Datum: NAD 83
Soil Map Unit Name: Alderwood and Kitsap soils, very steep NWI classification: None
Are climatic/hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)
Are Vegetation ☐, Soil ☐, or Hydrology ☐ significantly disturbed? Yes ☒ No ☐ Are "Normal Circumstances" present? Yes ☒ No ☐
Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? Yes ☐ No ☒ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐	No ☒	**Is the Sampled Area within a Wetland?** **Yes** ☐ **No** ☒
Hydric Soil Present?	Yes ☐	No ☒	
Wetland Hydrology Present?	Yes ☐	No ☒	

Remarks:
This plot was taken in upland adjacent to P9. Plot was adjacent to Coal Creek Parkway in mowed grass. Resistence to digging at surface due to fill gravel, grass was moved to estimate soil color.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
	0	= Total Cover	

Herb Stratum (Plot size: 5')			
1. mixed mowed grass (Agrostis?)	100	Y	NA
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100	= Total Cover	

Woody Vine Stratum (Plot size: 15')			
1.			
2.			
	0	= Total Cover	

% Bare ground in herb stratum 0

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)
Total Number of Dominant Species Across All Strata: ____ (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:
- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ☐ **No** ☒

Remarks:

SOIL

Sampling Point P10

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-1	10YR2/2	100						resistence hit at ~1 inch

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: fill rock

Depth (inches): <1

Hydric Soil Present? **Yes** ☐ **No** ☒

Remarks:

resistence to digging hit just below mowed grass.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (**LRR A**)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (**LRR A**)
- ☐ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): _____

Water Table Present? Yes ☐ No ☒ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ☐ No ☒ Depth (inches): _____

Wetland Hydrology Present? **Yes** ☐ **No** ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

ATTACHMENT C

Ground Photographs: Wetlands and Stream

WARNING
PETROLEUM
PIPELINE

ATTACHMENT D

Washington Wetland Rating Forms

Wetland name or number _____

WETLAND RATING FORM – WESTERN WASHINGTON

Version 2 – Updated July 2006 to increase accuracy and reproducibility among users
Updated Oct. 2008 with the new WDFW definitions for priority habitats

Name of wetland (if known): W01 Date of site visit: 1/20/2011

Rated by: Renee Storey Trained by Ecology? Yes ☐ No ☒ Date of training: _____

SEC: 21 TOWNSHP: 24 north RNGE: 5 east Is S/T/R in Appendix D? Yes ☐ No ☒

Map of wetland unit: Figure 7 Estimated size 0.07 acre

SUMMARY OF RATING

Category based on FUNCTIONS provided by wetland: ☐ I ☐ II ☒ III ☐ IV

Category I =	Score > 70	Score for Water Quality Functions	**14**
Category II =	Score 51 - 69	Score for Hydrologic Functions	**10**
Category III =	Score 30 – 50	Score for Habitat Functions	**10**
Category IV =	Score < 30	TOTAL Score for Functions	**34**

Category based on SPECIAL CHARACTERISTCS of Wetland ☐ I ☐ II ☒ **Does not apply**

Final Category (choose the "highest" category from above") **3**

Summary of basic information about the wetland unit.

Wetland Unit has Special Characteristics		Wetland HGM Class used for Rating	
Estuarine	☐	**Depressional**	☒
Natural Heritage Wetland	☐	**Riverine**	☐
Bog	☐	**Lake-fringe**	☐
Mature Forest	☐	**Slope**	☒
Old Growth Forest	☐	**Flats**	☐
Coastal Lagoon	☐	**Freshwater Tidal**	☐
Interdunal	☐		☐
None of the above	☒	Check if unit has multiple HGM classes present	☒

Does the wetland being rated meet any of the criteria below? If you answer YES to any of the questions below you will need to protect the wetland according to the regulations regarding the special characteristics found in the wetland.

Check List for Wetlands that Need Additional Protection (in addition to the protection recommended for its category)	YES	NO
SP1. *Has the wetland unit been documented as a habitat for any Federally listed Threatened or Endangered **animal or plant** species (T/E species)?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state or federal database.	☐	☒
SP2. *Has the wetland unit been documented as habitat for any State listed Threatened or Endangered **animal** species?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state database. Note: Wetlands with State listed plant species are categorized as Category 1 Natural Heritage Wetlands (see p. 19 of data form).	☐	☒
SP3. *Does the wetland unit contain individuals of Priority species listed by the WDFW for the state?*	☐	☒
SP4. *Does the wetland unit have a local significance in addition to its functions?* For example, the wetland has been identified in the Shoreline Master Program, the Critical Areas Ordinance, or in a local management plan as having special significance.	☐	☒

To complete the next part of the data sheet you will need to determine the Hydrogeomorphic Class of the wetland being rated.

The hydrogeomorphic classification groups wetlands in to those that function in similar ways. This simplifies the questions needed to answer how well the wetland functions. The Hydrogeomorphic Class of a wetland can be determined using the key below. See p. 24 for more detailed instructions on classifying wetlands.

Wetland name or number _____

Classification of Vegetated Wetlands for Western Washington

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides (i.e. except during floods)?
   ☒ NO – go to 2 ☐ **YES** – the wetland class is **Tidal Fringe**
   If yes, is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?
   ☐ **YES – Freshwater Tidal Fringe** ☐ **NO – Saltwater Tidal Fringe (Estuarine)**
   *If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is a Saltwater Tidal Fringe it is rated as an **Estuarine** wetland.* Wetlands that were call estuarine in the first and second editions of the rating system are called Salt Water Tidal Fringe in the Hydrogeomorphic Classification. Estuarine wetlands were categorized separately in the earlier editions, and this separation is being kept in this revision. To maintain consistency between editions, the term "Estuarine" wetland is kept. Please note, however, that the characteristics that define Category I and II estuarine wetlands have changed (see p. _____).

2. The entire wetland unit is flat and precipitation is only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.
   ☒ NO – go to 3 ☐ **YES** – The wetland class is **Flats**
   If your wetland can be classified as a "Flats" wetland, use the form for **Depressional** wetlands.

3. Does the entire wetland meet both of the following criteria?
   ☐ The vegetated part of the wetland is on the shores of a body of permanent open water (without any vegetation on the surface) where at least 20 acres (8ha) in size;
   ☐ At least 30% of the open water area is deeper than 6.6 (2 m)?
   ☒ NO – go to 4 ☐ **YES** – The wetland class is **Lake-fringe (Lacustrine Fringe)**

4. Does the entire wetland meet all of the following criteria?
   ☐ The wetland is on a slope *(slope can be very gradual)*.
   ☒ The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks.
   ☐ The water leaves the wetland **without being impounded**?
   NOTE: *Surface water does not pond in these types of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 foot deep).*
   ☒ NO – go to 5 ☐ **YES** – The wetland class is **Slope**

5. Does the entire wetland meet all of the following criteria?
   ☐ The unit is in a valley or stream channel where it gets inundated by overbank flooding from that stream or river.
   ☐ The overbank flooding occurs at least once every two years.
   NOTE: *The riverine unit can contain depressions that are filled with water when the river is not flooding..*
   ☒ NO – go to 6 ☐ **YES** – The wetland class is **Riverine**

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time of the year. This means that any outlet, if present is higher than the interior of the wetland.
   ☒ NO – go to 7 ☐ **YES** – The wetland class is **Depressional**

7. Is the entire wetland located in a very flat area with no obvious depression and no overbank flooding. The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.
   ☒ No – go to 8 ☐ **YES** – The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM classes. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within your wetland. NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the class listed in column 2 is less than 10% of the unit, classify the wetland using the class that represents more than 90% of the total area.

HGM Classes within the wetland unit being rated	*HGM Class to Use in Rating*
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake-fringe	Lake-fringe
Depressional + Riverine along stream within boundary	Depressional
Depressional + Lake-fringe	Depressional
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE under wetlands with special characteristics

If you are unable still to determine which of the above criteria apply to your wetland, or you have more than 2 HGM classes within a wetland boundary, classify the wetland as **Depressional** for the rating.

Wetland name or number _____

D	Depressional and Flat Wetlands	Points
	WATER QUALITY FUNCTIONS – Indicators that wetland functions to improve water quality.	(only 1 score per box)
D 1	**Does the wetland have the <u>potential</u> to improve water quality?**	*(see p.38)*
	D 1.1 Characteristics of surface water flows out of the wetland: • Unit is a depression with no surface water leaving it (no outlet) ..... points = 3 ☐ • Unit has an intermittently flowing, OR highly constricted, permanently flowing outlet ... points = 2 ☒ • Unit has an unconstricted, or slightly constricted, surface outlet (*permanently flowing*) .. points = 1 ☐ • Unit is a "flat" depression (Q.7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch ..... points = 1 ☐ *(If ditch is not permanently flowing treat unit as "intermittently flowing")* **Provide photo or drawing**	**Figure** ☐ **2**
	D 1.2 The soil 2 inches below the surface (or duff layer) is clay or organic (*use NRCS definitions*) **YES** points = 4 **NO** points = 0	0
	D 1.3 Characteristics of persistent vegetation (emergent, shrub, and/or forest Cowardin class): • Wetland has persistent, ungrazed vegetation > = 95% of area ..... points = 5 ☒ • Wetland has persistent, ungrazed vegetation > = 1/2 of area ..... points = 3 ☐ • Wetland has persistent, ungrazed vegetation > = 1/10 of area ..... points = 1 ☐ • Wetland has persistent, ungrazed vegetation < 1/10 of area ..... points = 0 ☐ **Map of Cowardin vegetation classes**	**Figure** ☐ **5**
	D 1.4 Characteristics of seasonal ponding or inundation: *This is the area of the wetland that is ponded for at least 2 months, but dries out sometime during the year. Do not count the area that is permanently ponded. Estimate area as the average condition 5 out of 10 years.* • Area seasonally ponded is > 1/2 total area of wetland ..... points = 4 ☐ • Area seasonally ponded is > 1/4 total area of wetland ..... points = 2 ☐ • Area seasonally ponded is < 1/4 total area of wetland ..... points = 0 ☒ **Map of Hydroperiods**	**Figure** ☐ **0**
	Total for D 1 *Add the points in the boxes above*	**7**
D 2	**Does the wetland have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland? *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* ☐ Grazing in the wetland or within 150 ft ☒ Untreated stormwater discharges to wetland ☐ Tilled fields or orchards within 150 ft. of wetland ☒ A stream or culvert discharges into wetland that drains developed areas, residential areas, farmed fields, roads, or clear-cut logging ☒ Residential, urban areas, golf courses are within 150 ft. of wetland ☐ Wetland is fed by groundwater high in phosphorus or nitrogen ☐ Other _____ ☒ **YES** multiplier is 2 ☐ **NO** multiplier is 1	*(see p. 44)* Multiplier 2
◆	**<u>TOTAL</u> – Water Quality Functions** Multiply the score from D1 by D2; then ***add score to table on p. 1***	**14**
	HYDROLOGIC FUNCTIONS – Indicators that wetland unit functions to reduce flooding and stream degradation.	
D 3	**Does the wetland have the <u>potential</u> to reduce flooding and erosion?**	*(see p.46)*
	D 3.1 Characteristics of surface water flows out of the wetland unit • Unit is a depression with no surface water leaving it (no outlet) ..... points = 4 ☐ • Unit has an intermittently flowing, OR highly constricted permanently flowing outlet .... points = 2 ☒ • Unit is a "flat" depression (Q.7 on key) or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch ..... points = 1 ☐ *(If ditch is not permanently flowing treat unit as "intermittently flowing")* • Unit has an unconstricted, or slightly constricted, surface outlet *(permanently flowing)* ..... points = 0	2
	D 3.2 Depth of storage during wet periods. *Estimate the height of ponding above the bottom of the outlet. For units with no outlet measure from the surface of permanent water or deepest part (if dry).* • Marks of ponding are 3 ft. or more above the surface or bottom of the outlet ..... points = 7 ☐ • The wetland is a "headwater" wetland ..... points = 5 ☐ • Marks of ponding between 2 ft. to < 3 ft. from surface or bottom of outlet ..... points = 5 ☐ • Marks are at least 0.5 ft. to < 2 ft. from surface or bottom of outlet ..... points = 3 ☒ • Wetland is flat (yes to Q.2 or Q.7 on key) but has small depressions on the surface that trap water . points = 1 ☐ • Marks of ponding less than 0.5 ft ..... points = 0 ☐	3
	D 3.3 Contribution of wetland unit to storage in the watershed: *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.* • The area of the basin is less than 10 times the area of unit ..... points = 5 ☐ • The area of the basin is 10 to 100 times the area of the unit ..... points = 3 ☐ • The area of the basin is more than 100 times the area of the unit ..... points = 0 ☒ • Entire unit is in the FLATS class ..... points = 5 ☐	0
	Total for D 3 *Add the points in the boxes above*	5

Wetland name or number _____

D 4	**Does the wetland have the <u>opportunity</u> to reduce flooding and erosion?** Answer YES if the unit is in a location in the watershed where the flood storage, or reduction in water velocity, it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows. Answer NO if the water coming into the wetland is controlled by a structure such as flood gate, tide gate, flap valve, reservoir etc. OR you estimate that more than 90% of the water in the wetland is from groundwater in areas where damaging groundwater flooding does not occur. *Note which of the following indicators of opportunity apply.* ☐ Wetland is in a headwater of a river or stream that has flooding problems. ☐ Wetland drains to a river or stream that has flooding problems ☐ Wetland has no outlet and impounds surface runoff water that might otherwise flow into a river or stream that has flooding problems ☒ Other <u>Wetland may reduce erosion by reducing (delaying) flow to Coal Creek.</u> ☒ **YES** multiplier is 2 ☐ **NO** multiplier is 1	*(see p. 49)* Multiplier 2
◆	**<u>TOTAL</u> – Hydrologic Functions** Multiply the score from D3 by D4; then ***add score to table on p. 1***	**<u>10</u>**

Comments: _____

Wetland name or number _____

R	Riverine and Freshwater Tidal Fringe Wetlands	Points (only 1 score per box)
	WATER QUALITY FUNCTIONS – Indicators that wetland functions to improve water quality.	
R 1	**Does the wetland have the <u>potential</u> to improve water quality?** *(see p.52)*	
	R 1.1 Area of surface depressions within the riverine wetland that can trap sediments during a flooding event: • Depressions cover > 3/4 area of wetland ..... points = 8 ☐ • Depressions cover > 1/2 area of wetland ..... points = 4 ☐ **(If depressions > 1/2 of area of unit draw polygons on aerial photo or map)** • Depressions present but cover < 1/2 area of wetland. ..... points = 2 ☐ • No depressions present ..... points = 0 ☐	**Figure** ☐
	R 1.2 Characteristics of the vegetation in the unit (areas with >90% cover at person height): • Trees or shrubs > 2/3 area of the unit ..... points = 8 ☐ • Trees or shrubs > 1/3 area of the wetland ..... points = 6 ☐ • Ungrazed, herbaceous plants > 2/3 area of unit ..... points = 6 ☐ • Ungrazed herbaceous plants > 1/3 area of unit ..... points = 3 ☐ • Trees, shrubs, and ungrazed herbaceous < 1/3 area of unit ..... points = 0 ☐ **Aerial photo or map showing polygons of different vegetation types**	**Figure** ☐
	Add the points in the boxes above	
R 2	**Does the wetland have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland. *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* ☐ Grazing in the wetland or within 150 ft ☐ Untreated stormwater discharges to wetland ☐ Tilled fields or orchards within 150 ft. of wetland ☐ A stream or culvert discharges into wetland that drains developed areas, residential areas, farmed fields, roads, or clear-cut logging ☐ Residential, urban areas, golf courses are within 150 ft. of wetland ☐ The river or stream linked to the wetland has a contributing basin where human activities have raised levels of sediment, toxic compounds or nutrients in the river water above standards for water quality. ☐ Other _____ **YES** multiplier is 2 **NO** multiplier is 1	*(see p. 53)* Multiplier
◆	**<u>TOTAL</u> – Water Quality Functions** Multiply the score from R1 by R2; then ***add score to table on p. 1***	_____
	HYDROLOGIC FUNCTIONS – Indicators that wetland functions to reduce flooding and stream erosion.	
R 3	**Does the wetland have the <u>potential</u> to reduce flooding and erosion?**	*(see p.54)*
	R 3.1 Characteristics of the overbank storage the wetland provides: *Estimate the average width of the wetland perpendicular to the direction of the flow and the width of the stream or river channel (distance between banks). Calculate the ratio: (average width of unit) / (average width of stream between banks).* • If the ratio is more than 20 ..... points = 9 ☐ • If the ratio is between 10 – 20 ..... points = 6 ☐ • If the ratio is 5- <10 ..... points = 4 ☐ • If the ratio is 1- <5 ..... points = 2 ☐ • If the ratio is < 1 ..... points = 1 ☐ **Aerial photo or map showing average widths**	**Figure** ☐
	R 3.2 Characteristics of vegetation that slow down water velocities during floods: *Treat large woody debris as "forest or shrub". Choose the points appropriate for the best description. (polygons need to have >90% cover at person height NOT Cowardin classes):* • Forest or shrub for > 1/3 area OR herbaceous plants > 2/3 area ..... points = 7 ☐ • Forest or shrub for > 1/10 area OR herbaceous plants > 1/3 area ..... points = 4 ☐ • Vegetation does not meet above criteria ..... points = 0 ☐ **Aerial photo or map showing polygons of different vegetation types**	**Figure** ☐
	Add the points in the boxes above	
R 4	**Does the wetland have the <u>opportunity</u> to reduce flooding and erosion?** Answer YES if the wetland is in a location in the watershed where the flood storage, or reduction in water velocity, it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows. *Note which of the following conditions apply.* ☐ There are human structures and activities downstream (roads, buildings, bridges, farms) that can be damaged by flooding. ☐ There are natural resources downstream (e.g. salmon redds) that can be damaged by flooding ☐ Other _____ *(Answer NO if the major source of water to the wetland is controlled by a reservoir or the wetland is tidal fringe along the sides of a dike)* ☐ **YES** multiplier is 2 ☐ **NO** multiplier is 1	*(see p.57)* Multiplier
◆	**<u>TOTAL</u> – Hydrologic Functions** Multiply the score from R3 by R4; then ***add score to table on p. 1***	_____

Comments: _____

Wetland name or number _____

L	Lake-fringe Wetlands	Points
	WATER QUALITY FUNCTIONS – Indicators that the wetland unit functions to improve water quality.	(only 1 score per box)
L 1	**Does the wetland unit have the <u>potential</u> to improve water quality?** *(see p.59)*	
	L 1.1 Average width of vegetation along the lakeshore (use polygons of Cowardin classes): • Vegetation is more than 33 ft. (10m) wide ..... points = 6 ☐ • Vegetation is more than 16 ft.(5m) wide and < 33 ft ..... points = 3 ☐ • Vegetation is more than 6 ft. (2m) wide and < 16 ft ..... points = 1 ☐ • Vegetation is less than 6 ft. wide..... points = 0 ☐ **Map of Cowardin classes with widths marked**	**Figure** ☐
	L 1.2 Characteristics of the vegetation in the wetland: *Choose the appropriate description that results in the highest points, and do not include any open water in your estimate of coverage. The herbaceous plants can be either the dominant form or as an understory in a shrub or forest community. These are not Cowardin classes. Area of Cover is total cover in the unit, but it can be in patches. NOTE: Herbaceous does not include aquatic bed.* • Cover of herbaceous plants is > 90% of the vegetated area..... points = 6 ☐ • Cover of herbaceous plants is > 2/3 of the vegetated area..... points = 4 ☐ • Cover of herbaceous plants is > 1/3 of the vegetated area..... points = 3 ☐ • Other vegetation that is not aquatic bed or herbaceous covers > 2/3 of the unit ..... points = 3 ☐ • Other vegetation that is not aquatic bed in > 1/3 vegetated area ..... points = 1 ☐ • Aquatic bed cover and open water > 2/3 of the unit..... points = 0 ☐ **Map with polygons of different vegetation types**	**Figure** ☐
	Add the points in the boxes above	
L 2	**Does the wetland have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in the lake water, or polluted surface water flowing through the unit to the lake. *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* ☐ Wetland is along the shores of a lake or reservoir that does not meet water quality standards ☐ Grazing in the wetland or within 150 ft ☐ Polluted water discharges to wetland along upland edge ☐ Tilled fields or orchards within 150 ft. of wetland ☐ Residential or urban areas are within 150 ft. of wetland ☐ Parks with grassy areas that are maintained, ballfields, golf courses (all within 150 ft. of lake shore) ☐ Power boats with gasoline or diesel engines use the lake ☐ Other ☐ **YES** multiplier is 2 ☐ **NO** multiplier is 1	*(see p.61)* Multiplier
◆	**<u>TOTAL</u> – Water Quality Functions** Multiply the score from L1 by L2; then ***add score to table on p. 1***	_____
	HYDROLOGIC FUNCTIONS – Indicators that wetland functions to reduce shoreline erosion.	
L 3	**Does the wetland have the <u>potential</u> to reduce shoreline erosion?**	*(see p.62)*
	L 3 Average width and characteristics of vegetation along the lakeshore *(do not include aquatic bed): (choose the highest scoring description that matches conditions in the wetland)* • 3/4 of distance is shrubs or forest at least 33 ft. (10m) wide ..... points = 6 ☐ • 3/4 of distance is shrubs or forest at least 6 ft. (2m) wide. ..... points = 4 ☐ • 1/4 of distance is shrubs or forest at least 33 ft. (10m) wide. ..... points = 4 ☐ • Vegetation is at least 6 ft. (2m) wide (any type except aquatic bed)..... points = 2 ☐ • Vegetation is less than 6 ft. (2m) wide (any type except aquatic bed) ..... points = 0 ☐ **Aerial photo or map with Cowardin vegetation classes**	**Figure** ☐
	Record the points in the boxes above	
L 4	**Does the wetland have the <u>opportunity</u> to reduce erosion?** Are there features along the shore that will be impacted if the shoreline erodes? *Note which of the following conditions apply.* ☐ There are human structures and activities along the upland edge of the wetland (buildings, fields) that can be damaged by erosion. ☐ There are undisturbed natural resources along the upland edge of the wetland (e.g. mature forests, other wetlands) that can be damaged by shoreline erosion. ☐ Other _____ ☐ **YES** multiplier is 2 ☐ **NO** multiplier is 1	*(see p. 64)* Multiplier
◆	**<u>TOTAL</u> – Hydrologic Functions** Multiply the score from L3 by L4; then ***add score to table on p. 1***	_____

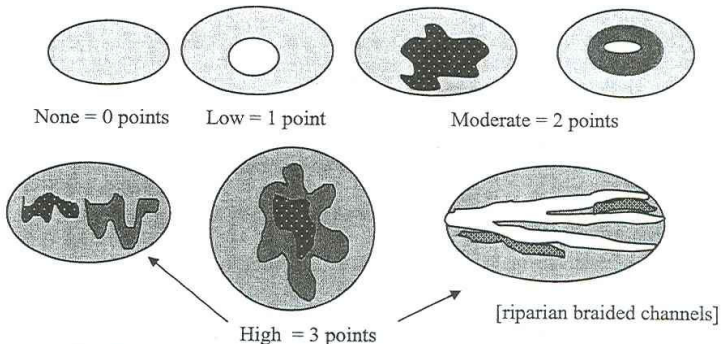
Comments: _____

Wetland name or number _____

S	Slope Wetlands	Points
	WATER QUALITY FUNCTIONS – Indicators that wetland functions to improve water quality.	(only 1 score per box)
S 1	**Does the wetland have the <u>potential</u> to improve water quality?**	*(see p.64)*
	S 1.1 Characteristics of average slope of unit: • Slope is 1% or less *(a 1% slope has a 1 ft. vertical drop in elevation for every 100 ft. horizontal distance)*.... points = 3 ☐ • Slope is 1% - 2% ..... points = 2 ☐ • Slope is 2% - 5%. ..... points = 1 ☐ • Slope is greater than 5% ..... points = 0 ☐	
	S 1.2 The soil 2 inches below the surface (or duff layer) is clay, organic *(Use NRCS definitions).* ☐ **YES** = 3 points ☐ **NO** = 0 points	
	S 1.3 Characteristics of the vegetation in the wetland that trap sediments and pollutants: *Choose the points appropriate for the description that best fits the vegetation in the wetland. Dense vegetation means you have trouble seeing the soil surface (>75% cover), and uncut means not grazed or mowed and plants are higher than 6 inches.* • Dense, uncut, herbaceous vegetation > 90% of the wetland area..... points = 6 ☐ • Dense, uncut, herbaceous vegetation > 1/2 of area ..... points = 3 ☐ • Dense, woody, vegetation > 1/2 of area..... points = 2 ☐ • Dense, uncut, herbaceous vegetation > 1/4 of area ..... points = 1 ☐ • Does not meet any of the criteria above for vegetation ..... points = 0 ☐ **Aerial photo or map with vegetation polygons**	**Figure ☐**
	Total for S 1 *Add the points in the boxes above*	
S 2	**Does the wetland have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland? *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* ☐ Grazing in the wetland or within 150 ft ☐ Untreated stormwater discharges to wetland ☐ Tilled fields, logging, or orchards within 150 ft. of wetland ☐ Residential, urban areas, or golf courses are within 150 ft. upslope of wetland ☐ Other ☐ **YES** multiplier is 2 ☐ **NO** multiplier is 1	*(see p. 67)* Multiplier
◆	**<u>TOTAL</u> – Water Quality Functions** Multiply the score from S1 by S2; then ***add score to table on p. 1***	_____
	HYDROLOGIC FUNCTIONS – Indicators that wetland functions to reduce flooding and stream erosion.	
S 3	**Does the wetland have the <u>potential</u> to reduce flooding and stream erosion?**	*(see p.68)*
	S 3.1 Characteristics of vegetation that reduce the velocity of surface flows during storms: *Choose the points appropriate for the description that best fits conditions in the wetland (stems of plants should be thick enough (usually > 1/8in), or dense enough to remain erect during surface flows).* • Dense, uncut, **rigid** vegetation covers > 90% of the area of the wetland..... points = 6 ☐ • Dense, uncut, **rigid** vegetation> 1/2 area of wetland ..... points = 3 ☐ • Dense, uncut, **rigid** vegetation > 1/4 area..... points = 1 ☐ • More than 1/4 of area is grazed, mowed, tilled, or vegetation is not rigid..... points = 0 ☐	
	S 3.2 Characteristics of slope wetland that holds back small amounts of flood flows. The slope has small surface depressions that can retain water over at least 10% of its area. ☐ **YES** = 2 points ☐ **NO** = 0 points	
	Add the points in the boxes above	
S 4	**Does the wetland have the <u>opportunity</u> to reduce flooding and erosion?** Is the wetland in a landscape position where the reduction in water velocity it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows? *Note which of the following conditions apply.* ☐ Wetland has surface runoff that drains to a river or stream that has flooding problems ☐ Other *(Answer NO if the major source of water is controlled by a reservoir (e.g. wetland is a seep that is on the downstream side of a dam)* ☐ **YES** multiplier is 2 ☐ **NO** multiplier is 1	*(see p. 70)* Multiplier _____
◆	**<u>TOTAL</u> – Hydrologic Functions** Multiply the score from S3 by S4; then ***add score to table on p. 1***	_____

Comments: _____

Wetland name or number _____

These questions apply to wetlands of all HGM classes. HABITAT FUNCTIONS – Indicators that wetland functions to provide important habitat.	Points (only 1 score per box)
H 1 Does the wetland have the potential to provide habitat for many species?	
H 1.1 Vegetation structure *(see P. 72)*: *Check the types of vegetation classes present (as defined by Cowardin) – Size threshold for each class is 1/4 acre or more than 10% of the area if unit is smaller than 2.5 acres.* ☐ Aquatic Bed ☒ Emergent plants ☐ Scrub/shrub (areas where shrubs have > 30% cover) ☐ Forested (areas where trees have > 30% cover) *If the unit has a forested class check if:* ☐ The forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the forested polygon. *Add the number of vegetation types that qualify. If you have:* **Map of Cowardin vegetation classes** 4 structures or more ..... points = 4 ☐ 3 structures ..... points = 2 ☐ 2 structures ..... points = 1 ☐ 1 structure ..... points = 0 ☒	**Figure** ☐ **0**
H 1.2 Hydroperiods *(see p.73)*: *Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or 1/4 acre to count (see text for descriptions of hydroperiods).* ☐ Permanently flooded or inundated — 4 or more types present points = 3 ☐ ☐ Seasonally flooded or inundated — 3 or more types present points = 2 ☐ ☒ Occasionally flooded or inundated — 2 types present points = 1 ☐ ☐ Saturated only — 1 type present points = 0 ☒ ☐ Permanently flowing stream or river in, or adjacent to, the wetland ☐ Seasonally flowing stream in, or adjacent to, the wetland ☐ **Lake-fringe wetland ..... = 2 points** ☐ **Freshwater tidal wetland ..... = 2 points** **Map of hydroperiods**	**Figure** ☐ **0**
H 1.3 Richness of Plant Species *(see p. 75)*: Count the number of plant species in the wetland that cover at least 10 ft^2 *(different patches of the same species can be combined to meet the size threshold)* *You do not have to name the species. Do not include Eurasian Milfoil, reed canarygrass, purple loosestrife, Canadian Thistle.* If you counted: > 19 species ..... points = 2 ☐ 5 – 19 species..... points = 1 ☐ List species below if you want to: < 5 species ..... points = 0 ☒ _____	0
H 1.4 Interspersion of Habitats *(see p. 76)*: Decided from the diagrams below whether interspersion between Cowardin vegetation (described in H1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, medium, low, or none.  Note: If you have 4 or more classes or 3 vegetation classes and open water, the rating is always "high". **Use map of Cowardin classes.**	**Figure** ☐ **1**
H 1.5 Special Habitat Features *(see p. 77)*: *Check the habitat features that are present in the wetland. The number of checks is the number of points you put into the next column.* ☐ Large, downed, woody debris within the wetland (> 4 in. diameter and 6 ft. long) ☐ Standing snags (diameter at the bottom > 4 inches) in the wetland ☐ Undercut banks are present for at least 6.6 ft. (2m) and/or overhanging vegetation extends at least 3.3 ft. (1m) over a stream (or ditch) in, or contiguous with the unit, for at least 33 ft. (10m) ☐ Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet turned grey/brown)* ☐ At least 1/4 acre of thin-stemmed persistent vegetation or woody branches are present in areas that are permanently or seasonally inundated *(structures for egg-laying by amphibians)* ☐ Invasive plants cover less than 25% of the wetland area in each stratum of plants *NOTE: The 20% stated in early printings of the manual on page 78 is an error.*	0
H 1 TOTAL Score – potential for providing habitat *Add the points in the column above*	**1**

Wetland name or number _____

H 2	**Does the wetland have the <u>opportunity</u> to provide habitat for many species?**	(only 1 score per box)
	H 2.1 <u>Buffers</u> *(see P. 80)*: *Choose the description that best represents condition of buffer of wetland unit. The highest scoring criterion that applies to the wetland is to be used in the rating. See text for definition of "undisturbed".* ☐ 100m (330 ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 95% of circumference. No structures are within the undisturbed part of buffer (relatively undisturbed also means no grazing, no landscaping, no daily human use)..... **points = 5** ☐ 100m (330 ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 50% circumference ..... **points = 4** ☐ 50m (170 ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 95% circumference ..... **points = 4** ☐ 100m (330 ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 25% circumference ..... **points = 3** ☐ 50m (170 ft) of relatively undisturbed vegetated areas, rocky areas, or open water for > 50% circumference ..... **points = 3** **If buffer does not meet any of the criteria above:** ☐ No paved areas (except paved trails) or buildings within 25m (80 ft) of wetland > 95% circumference. Light to moderate grazing or lawns are OK ..... **points = 2** ☐ No paved areas of buildings within 50m of wetland for > 50% circumference. Light to moderate grazing or lawns are OK ..... **points = 2** ☐ Heavy grazing in buffer ..... **points = 1** ☐ Vegetated buffers are < 2m wide (6.6 ft) for more than 95% circumference (e.g. tilled fields, paving, basalt bedrock extend to edge of wetland) ..... **points = 0** ☒ Buffer does not meet any of the criteria above ..... **points = 1** **Arial photo showing buffers**	**Figure ☐** **1**
	H 2.2 <u>Corridors and Connections</u> *(see p. 81)* H 2.2.1 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 150 ft. wide, has at least a 30% cover of shrubs, forest or native undisturbed prairie, that connects to estuaries, other wetlands or undisturbed uplands that are at least 250 acres in size? *(Dams in riparian corridors, heavily used gravel roads, paved roads, are considered breaks in the corridor).* ☐ **YES = 4 points** (go to H 2.3) ☒ **NO** = go to H 2.2.2 H. 2.2.2 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 50 ft. wide, has at least 30% cover of shrubs or forest, and connects to estuaries, other wetlands or undisturbed uplands that are at least 25 acres in size? **OR a Lake-fringe** wetland, if it does not have an undisturbed corridor as in the question above? ☒ **YES = 2 points** (go to H 2.3) ☐ **NO** = go to H 2.2.3 H. 2.2.3 Is the wetland: • Within 5 mi (8km) of a brackish or salt water estuary OR • Within 3 miles of a large field or pasture (> 40 acres) OR ☒ **YES** = 1 point • Within 1 mile of a lake greater than 20 acres? ☐ **NO** = 0 points	1

Comments: _____

	H 2.3 Near or adjacent to other priority habitats listed by WDFW (see p. 82): *(see new and complete descriptions of WDFW priority habitats, and the counties in which they can be found, in the PHS report http://wdfw.wa.gov/hab/phslist.htm)* Which of the following priority habitats are within 330 ft. (100m) of the wetland unit? *NOTE: the connections do not have to be relatively undisturbed.* ☐ **Aspen Stands:** Pure or mixed stands of aspen greater than 0.4 ha (1 acre). ☐ **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report p. 152*). ☐ **Herbaceous Balds:** Variable size patches of grass and forbs on shallow soils over bedrock. ☐ **Old-growth/Mature forests:** (Old-growth west of Cascade crest) Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 20 trees/ha (8 trees/acre) > 81 cm (32 in) dbh or > 200 years of age. (Mature forests) Stands with average diameters exceeding 53 cm (21 in) dbh; crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80 - 200 years old west of the Cascade crest. ☐ **Oregon white Oak:** Woodlands Stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158*). ☒ **Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other. ☐ **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161*). ☒ **Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources. ☐ **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report: pp. 167-169 and glossary in Appendix A).* ☐ **Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human. ☐ **Cliffs:** Greater than 7.6 m (25 ft) high and occurring below 5000 ft. ☐ **Talus:** Homogenous areas of rock rubble ranging in average size 0.15 - 2.0 m (0.5 - 6.5 ft), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs. ☒ **Snags and Logs:** Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 51 cm (20 in) in western Washington and are > 2 m (6.5 ft) in height. Priority logs are > 30 cm (12 in) in diameter at the largest end, and > 6 m (20 ft) long. If wetland has **3 or more** priority habitats **= 4 points** If wetland has **2** priority habitats = **3 points** If wetland has **1** priority habitat **= 1 point** No habitats = 0 points Note: All vegetated wetlands are by definition a priority habitat but are not included in this list. Nearby wetlands are addressed in question H 2.4)	4
	H 2.4 Wetland Landscape: *Choose the **one** description of the landscape around the wetland that best fits (see p. 84)* • There are at least 3 other wetlands within 1/2 mile, and the connections between them are relatively undisturbed (light grazing between wetlands OK, as is lake shore with some boating, but connections should NOT be bisected by paved roads, fill, fields, or other development.... points = 5 ☐ • The wetland is Lake-fringe on a lake with little disturbance and there are 3 other lake-fringe wetlands within 1/2 mile ..... points = 5 ☐ • There are at least 3 other wetlands within 1/2 mile, BUT the connections between them are disturbed. ..... points = 3 ☒ • The wetland fringe on a lake **with** disturbance and there are 3 other lake-fringe wetlands within 1/2 mile ..... points = 3 ☐ • There is at least 1 wetland within 1/2 mile ..... points = 2 ☐ • There are no wetlands within 1/2 mile..... points = 0 ☐	3
	H 2 TOTAL Score – opportunity for providing habitat *Add the scores from H2.1, H2.2, H2.3, H2.4*	9
	TOTAL for H 1 from page 8	1
◆	**Total Score for Habitat Functions** Add the points for H 1 and H 2; then ***record the result on p. 1***	**10**

Comments: _____

Wetland name or number _____

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Please determine if the wetland meets the attributes described below and circle the appropriate answers and Category.

	Wetland Type – *Check off any criteria that apply to the wetland. Circle the Category when the appropriate criteria are met.*	
SC1	**Estuarine wetlands?** *(see p.86)* Does the wetland unit meet the following criteria for Estuarine wetlands? ☐ The dominant water regime is tidal, ☐ Vegetated, and ☐ With a salinity greater than 0.5 ppt. ☐ **YES** = Go to SC 1.1 ☒ **NO**	
	SC 1.1 Is the wetland unit within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? ☐ **YES** = Category I ☐ **NO** = go to SC 1.2	**Cat. 1** ☐
	SC 1.2 Is the wetland at least 1 acre in size and meets at least two of the following conditions? ☐ **YES** = Category I ☐ **NO** = Category II ☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. If the non-native *Spartina* spp,. are only species that cover more than 10% of the wetland, then the wetland should be given a dual rating (I/II). The area of Spartina would be rated a Category II while the relatively undisturbed upper marsh with native species would be a Category 1. Do not, however, exclude the area of Spartina in determining the size threshold of 1 acre. ☐ At least 3/4 of the landward edge of the wetland has a 100 ft. buffer of shrub, forest, or un-grazed or un-mowed grassland ☐ The wetland has at least 2 of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands.	**Cat. I** ☐ **Cat. II** ☐ **Dual Rating I/II** ☐
SC2	**Natural Heritage Wetlands** *(see p. 87)* Natural Heritage wetlands have been identified by the Washington Natural Heritage Program/DNR as either high quality undisturbed wetlands or wetlands that support state Threatened, Endangered, or Sensitive plant species. SC 2.1 Is the wetland being rated in a Section/Township/Range that contains a natural heritage wetland? *(This question is used to screen out most sites before you need to contact WNHP/DNR.)* ☐ S/T/R information from Appendix D ☐ or accessed from WNHP/DNR web site ☐ **YES** Contact WNHP/DNR (see p. 79) and go to SC 2.2 ☒ **NO** SC 2.2 Has DNR identified the wetland as a high quality undisturbed wetland or as a site with state threatened or endangered plant species? ☐ **YES** = Category 1 ☒ **NO** not a Heritage Wetland	**Cat I** ☐
SC3	**Bogs** *(see p. 87)* Does the wetland **(or any part of the unit)** meet both the criteria for soils and vegetation in bogs? Use the key below to identify if the wetland is a bog. ***If you answer yes you will still need to rate the wetland based on its function.*** 1. Does the unit have organic soil horizons (i.e. layers of organic soil), either peats or mucks, that compose 16 inches or more of the first 32 inches of soil profile? (See Appendix B for a field key to identify organic soils)? ☐ **YES** = go to question 3 ☒ **NO** = go to question 2 2. Does the wetland have organic soils, either peats or mucks that are less than 16 inches deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on a lake or pond? ☐ **YES** = go to question 3 ☒ **NO** = is not a bog for purpose of rating 3. Does the unit have more than 70% cover of mosses at ground level, AND other plants, if present, consist of the "bog" species listed in Table 3 as a significant component of the vegetation (more than 30% of the total shrub and herbaceous cover consists of species in Table 3)? ☐ **YES** = Is a bog for purpose of rating ☒ **NO** = go to question 4 NOTE: If you are uncertain about the extent of mosses in the understory you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16" deep. If the pH is less than 5.0 and the "bog" plant species in Table 3 are present, the wetland is a bog. 4. Is the unit forested (> 30% cover) with sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Englemann's spruce, or western white pine. WITH any of the species (or combination of species) on the bog species plant list in Table 3 as a significant component of the ground cover *(> 30% coverage of the total shrub/herbaceous cove*r)? ☐ **YES** = Category I ☒ **NO** = Is not a bog for purpose of rating	**Cat. I** ☐

Wetland name or number _____

SC4	**Forested Wetlands** *(see p. 90)* Does the wetland have at least 1 acre of forest that meet one of these criteria for the Department of Fish and Wildlife's forests as priority habitats? *If you answer yes you will still need to rate the wetland based on its function.* ☐ **Old-growth forests**: (west of Cascade Crest) Stands of at least two three species forming a multi-layered canopy with occasional small openings; with at least 8 trees/acre (20 trees/hectare) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 inches (81 cm or more). NOTE: The criterion for dbh is based on measurements for upland forests. Two-hundred year old trees in wetlands will often have a smaller dbh because their growth rates are often slower. The DFW criterion is and "OR" so old-growth forests do not necessarily have to have trees of this diameter. ☐ **Mature forests**: (west of the Cascade Crest) Stands where the largest trees are 80 – 200 years old OR have an average diameters (dbh) exceeding 21 inches (53 cm); crown cover may be less than 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth. ☐ **YES** = Category I ☒ **NO** = not a forested wetland with special characteristics	**Cat. I** ☐
SC5	**Wetlands in Coastal Lagoons** *(see p. 91)* Does the wetland meet all of the following criteria of a wetland in a coastal lagoon? ☐ The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks. ☐ The lagoon in which the wetland is located contains surface water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom.)* ☐ **YES** = Go to SC 5.1 ☒ **NO** not a wetland in a coastal lagoon SC 5.1 Does the wetland meet all of the following three conditions? ☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing) and has less than 20% cover of invasive plant species (see list of invasive species on p. 74). ☐ At least 3/4 of the landward edge of the wetland has a 100 ft. buffer of shrub, forest, or un-grazed or un-mowed grassland. ☐ The wetland is larger than 1/10 acre (4350 square ft.) ☐ **YES** = Category I ☐ **NO** = Category II	**Cat. I** ☐ **Cat. II** ☐
SC6	**Interdunal Wetlands** *(see p. 93)* Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ☐ **YES** = Go to SC 6.1 ☒ **NO** not an interdunal wetland for rating ***If you answer yes you will still need to rate the wetland based on its functions.*** In practical terms that means the following geographic areas: • Long Beach Peninsula -- lands west of SR 103 • Grayland-Westport -- lands west of SR 105 • Ocean Shores-Copalis – lands west of SR 115 and SR 109 SC 6.1 Is the wetland one acre or larger, or is it in a mosaic of wetlands that is one acre or larger? ☐ **YES** = Category II ☐ **NO** = go to SC 6.2 SC 6.2 Is the wetland between 0.1 and 1 acre, or is it in a mosaic of wetlands that is between 0.1 and 1 acre? ☐ **YES** = Category III	**Cat. II** ☐ **Cat. III** ☐
◆	**Category of wetland based on Special Characteristics** *Choose the "highest" rating if wetland falls into several categories, and record on p. 1.* If you answered **NO** for all types enter "Not Applicable" on p. 1	**NA**

Comments: _____

Wetland name or number _____

WETLAND RATING FORM – WESTERN WASHINGTON

Version 2 – Updated July 2006 to increase accuracy and reproducibility among users
Updated Oct. 2008 with the new WDFW definitions for priority habitats

Name of wetland (if known): W01 Date of site visit: 1/20/2011

Rated by: Renee Storey Trained by Ecology? Yes ☐ No ☒ Date of training: _____

SEC: 21 TOWNSHP: 24 north RNGE: 5 east Is S/T/R in Appendix D? Yes ☐ No ☒

Map of wetland unit: Figure 7 Estimated size 0.38 acre

SUMMARY OF RATING

Category based on FUNCTIONS provided by wetland: ☐ I ☐ II ☒ III ☐ IV

Category I =	Score > 70	Score for Water Quality Functions	**14**
Category II =	Score 51 - 69	Score for Hydrologic Functions	**10**
Category III =	Score 30 – 50	Score for Habitat Functions	**13**
Category IV =	Score < 30	TOTAL Score for Functions	**37**

Category based on SPECIAL CHARACTERISTCS of Wetland ☐ I ☐ II ☒ **Does not apply**

Final Category (choose the "highest" category from above") **3**

Summary of basic information about the wetland unit.

Wetland Unit has Special Characteristics		Wetland HGM Class used for Rating	
Estuarine	☐	**Depressional**	☒
Natural Heritage Wetland	☐	**Riverine**	☐
Bog	☐	**Lake-fringe**	☐
Mature Forest	☐	**Slope**	☒
Old Growth Forest	☐	**Flats**	☐
Coastal Lagoon	☐	**Freshwater Tidal**	☐
Interdunal	☐		☐
None of the above	☒	Check if unit has multiple HGM classes present	☒

Does the wetland being rated meet any of the criteria below? If you answer YES to any of the questions below you will need to protect the wetland according to the regulations regarding the special characteristics found in the wetland.

Check List for Wetlands that Need Additional Protection (in addition to the protection recommended for its category)	YES	NO
SP1. *Has the wetland unit been documented as a habitat for any Federally listed Threatened or Endangered **animal or plant** species (T/E species)?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state or federal database.	☐	☒
SP2. *Has the wetland unit been documented as habitat for any State listed Threatened or Endangered **animal** species?* For the purposes of this rating system, "documented" means the wetland is on the appropriate state database. Note: Wetlands with State listed plant species are categorized as Category 1 Natural Heritage Wetlands (see p. 19 of data form).	☐	☒
SP3. *Does the wetland unit contain individuals of Priority species listed by the WDFW for the state?*	☐	☒
SP4. *Does the wetland unit have a local significance in addition to its functions?* For example, the wetland has been identified in the Shoreline Master Program, the Critical Areas Ordinance, or in a local management plan as having special significance.	☐	☒

To complete the next part of the data sheet you will need to determine the Hydrogeomorphic Class of the wetland being rated.

The hydrogeomorphic classification groups wetlands in to those that function in similar ways. This simplifies the questions needed to answer how well the wetland functions. The Hydrogeomorphic Class of a wetland can be determined using the key below. See p. 24 for more detailed instructions on classifying wetlands.

Wetland name or number _____

Classification of Vegetated Wetlands for Western Washington

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides (i.e. except during floods)?
   ☒ NO – go to 2 ☐ **YES** – the wetland class is **Tidal Fringe**
   If yes, is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?
   ☐ **YES – Freshwater Tidal Fringe** ☐ **NO – Saltwater Tidal Fringe (Estuarine)**
   *If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is a Saltwater Tidal Fringe it is rated as an **Estuarine** wetland.* Wetlands that were call estuarine in the first and second editions of the rating system are called Salt Water Tidal Fringe in the Hydrogeomorphic Classification. Estuarine wetlands were categorized separately in the earlier editions, and this separation is being kept in this revision. To maintain consistency between editions, the term "Estuarine" wetland is kept. Please note, however, that the characteristics that define Category I and II estuarine wetlands have changed (see p. _____).

2. The entire wetland unit is flat and precipitation is only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.
   ☒ NO – go to 3 ☐ **YES** – The wetland class is **Flats**
   If your wetland can be classified as a "Flats" wetland, use the form for **Depressional** wetlands.

3. Does the entire wetland meet both of the following criteria?
   ☐ The vegetated part of the wetland is on the shores of a body of permanent open water (without any vegetation on the surface) where at least 20 acres (8ha) in size;
   ☐ At least 30% of the open water area is deeper than 6.6 (2 m)?
   ☒ NO – go to 4 ☐ **YES** – The wetland class is **Lake-fringe (Lacustrine Fringe)**

4. Does the entire wetland meet all of the following criteria?
   ☐ The wetland is on a slope *(slope can be very gradual)*.
   ☒ The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks.
   ☐ The water leaves the wetland **without being impounded**?
   NOTE: *Surface water does not pond in these types of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 foot deep).*
   ☒ NO – go to 5 ☐ **YES** – The wetland class is **Slope**

5. Does the entire wetland meet all of the following criteria?
   ☐ The unit is in a valley or stream channel where it gets inundated by overbank flooding from that stream or river.
   ☐ The overbank flooding occurs at least once every two years.
   NOTE: *The riverine unit can contain depressions that are filled with water when the river is not flooding..*
   ☒ NO – go to 6 ☐ **YES** – The wetland class is **Riverine**

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time of the year. This means that any outlet, if present is higher than the interior of the wetland.
   ☒ NO – go to 7 ☐ **YES** – The wetland class is **Depressional**

7. Is the entire wetland located in a very flat area with no obvious depression and no overbank flooding. The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.
   ☒ No – go to 8 ☐ **YES** – The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM classes. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within your wetland. NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the class listed in column 2 is less than 10% of the unit, classify the wetland using the class that represents more than 90% of the total area.

HGM Classes within the wetland unit being rated	*HGM Class to Use in Rating*
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake-fringe	Lake-fringe
Depressional + Riverine along stream within boundary	Depressional
Depressional + Lake-fringe	Depressional
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE under wetlands with special characteristics

If you are unable still to determine which of the above criteria apply to your wetland, or you have more than 2 HGM classes within a wetland boundary, classify the wetland as **Depressional** for the rating.

Wetland name or number _____

D	Depressional and Flat Wetlands	Points
	WATER QUALITY FUNCTIONS – Indicators that wetland functions to improve water quality.	(only 1 score per box)
D 1	**Does the wetland have the <u>potential</u> to improve water quality?**	*(see p.38)*
	D 1.1 Characteristics of surface water flows out of the wetland: • Unit is a depression with no surface water leaving it (no outlet) ..... points = 3 ☐ • Unit has an intermittently flowing, OR highly constricted, permanently flowing outlet ... points = 2 ☒ • Unit has an unconstricted, or slightly constricted, surface outlet (*permanently flowing*) .. points = 1 ☐ • Unit is a "flat" depression (Q.7 on key), or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch ..... points = 1 ☐ *(If ditch is not permanently flowing treat unit as "intermittently flowing")* **Provide photo or drawing**	**Figure** ☐ **2**
	D 1.2 The soil 2 inches below the surface (or duff layer) is clay or organic (*use NRCS definitions*) **YES** points = 4 **NO** points = 0	0
	D 1.3 Characteristics of persistent vegetation (emergent, shrub, and/or forest Cowardin class): • Wetland has persistent, ungrazed vegetation > = 95% of area ..... points = 5 ☒ • Wetland has persistent, ungrazed vegetation > = 1/2 of area ..... points = 3 ☐ • Wetland has persistent, ungrazed vegetation > = 1/10 of area ..... points = 1 ☐ • Wetland has persistent, ungrazed vegetation < 1/10 of area ..... points = 0 ☐ **Map of Cowardin vegetation classes**	**Figure** ☐ **5**
	D 1.4 Characteristics of seasonal ponding or inundation: *This is the area of the wetland that is ponded for at least 2 months, but dries out sometime during the year. Do not count the area that is permanently ponded. Estimate area as the average condition 5 out of 10 years.* • Area seasonally ponded is > 1/2 total area of wetland ..... points = 4 ☐ • Area seasonally ponded is > 1/4 total area of wetland ..... points = 2 ☐ • Area seasonally ponded is < 1/4 total area of wetland ..... points = 0 ☒ **Map of Hydroperiods**	**Figure** ☐ **0**
	Total for D 1 *Add the points in the boxes above*	**7**
D 2	**Does the wetland have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland? *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* ☐ Grazing in the wetland or within 150 ft ☒ Untreated stormwater discharges to wetland ☐ Tilled fields or orchards within 150 ft. of wetland ☒ A stream or culvert discharges into wetland that drains developed areas, residential areas, farmed fields, roads, or clear-cut logging ☒ Residential, urban areas, golf courses are within 150 ft. of wetland ☐ Wetland is fed by groundwater high in phosphorus or nitrogen ☐ Other _____ ☒ **YES** multiplier is 2 ☐ **NO** multiplier is 1	*(see p. 44)* Multiplier 2
◆	**<u>TOTAL</u> – Water Quality Functions** Multiply the score from D1 by D2; then ***add score to table on p. 1***	**14**
	HYDROLOGIC FUNCTIONS – Indicators that wetland unit functions to reduce flooding and stream degradation.	
D 3	**Does the wetland have the <u>potential</u> to reduce flooding and erosion?**	*(see p.46)*
	D 3.1 Characteristics of surface water flows out of the wetland unit • Unit is a depression with no surface water leaving it (no outlet) ..... points = 4 ☐ • Unit has an intermittently flowing, OR highly constricted permanently flowing outlet .... points = 2 ☒ • Unit is a "flat" depression (Q.7 on key) or in the Flats class, with permanent surface outflow **and no obvious natural outlet** and/or outlet is a man-made ditch ..... points = 1 ☐ *(If ditch is not permanently flowing treat unit as "intermittently flowing")* • Unit has an unconstricted, or slightly constricted, surface outlet *(permanently flowing)* ..... points = 0	2
	D 3.2 Depth of storage during wet periods. *Estimate the height of ponding above the bottom of the outlet. For units with no outlet measure from the surface of permanent water or deepest part (if dry).* • Marks of ponding are 3 ft. or more above the surface or bottom of the outlet ..... points = 7 ☐ • The wetland is a "headwater" wetland ..... points = 5 ☐ • Marks of ponding between 2 ft. to < 3 ft. from surface or bottom of outlet ..... points = 5 ☐ • Marks are at least 0.5 ft. to < 2 ft. from surface or bottom of outlet ..... points = 3 ☒ • Wetland is flat (yes to Q.2 or Q.7 on key) but has small depressions on the surface that trap water . points = 1 ☐ • Marks of ponding less than 0.5 ft ..... points = 0 ☐	3
	D 3.3 Contribution of wetland unit to storage in the watershed: *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.* • The area of the basin is less than 10 times the area of unit ..... points = 5 ☐ • The area of the basin is 10 to 100 times the area of the unit ..... points = 3 ☐ • The area of the basin is more than 100 times the area of the unit ..... points = 0 ☒ • Entire unit is in the FLATS class ..... points = 5 ☐	0
	Total for D 3 *Add the points in the boxes above*	5

Wetland name or number _____

D 4	**Does the wetland have the <u>opportunity</u> to reduce flooding and erosion?** Answer YES if the unit is in a location in the watershed where the flood storage, or reduction in water velocity, it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows. Answer NO if the water coming into the wetland is controlled by a structure such as flood gate, tide gate, flap valve, reservoir etc. OR you estimate that more than 90% of the water in the wetland is from groundwater in areas where damaging groundwater flooding does not occur. *Note which of the following indicators of opportunity apply.* ☐ Wetland is in a headwater of a river or stream that has flooding problems. ☐ Wetland drains to a river or stream that has flooding problems ☐ Wetland has no outlet and impounds surface runoff water that might otherwise flow into a river or stream that has flooding problems ☒ Other <u>Wetland may reduce erosion by reducing (delaying) flow to Coal Creek.</u> ☒ **YES** multiplier is 2 ☐ **NO** multiplier is 1	*(see p. 49)* Multiplier 2
◆	**<u>TOTAL</u> – Hydrologic Functions** Multiply the score from D3 by D4; then ***add score to table on p. 1***	**<u>10</u>**

Comments: _____

Wetland name or number _____

R	Riverine and Freshwater Tidal Fringe Wetlands	Points (only 1 score per box)
	WATER QUALITY FUNCTIONS – Indicators that wetland functions to improve water quality.	
R 1	**Does the wetland have the <u>potential</u> to improve water quality?** *(see p.52)*	
	R 1.1 Area of surface depressions within the riverine wetland that can trap sediments during a flooding event: • Depressions cover > 3/4 area of wetland ..... points = 8 ☐ • Depressions cover > 1/2 area of wetland ..... points = 4 ☐ **(If depressions > 1/2 of area of unit draw polygons on aerial photo or map)** • Depressions present but cover < 1/2 area of wetland. ..... points = 2 ☐ • No depressions present ..... points = 0 ☐	**Figure** ☐
	R 1.2 Characteristics of the vegetation in the unit (areas with >90% cover at person height): • Trees or shrubs > 2/3 area of the unit ..... points = 8 ☐ • Trees or shrubs > 1/3 area of the wetland ..... points = 6 ☐ • Ungrazed, herbaceous plants > 2/3 area of unit ..... points = 6 ☐ • Ungrazed herbaceous plants > 1/3 area of unit ..... points = 3 ☐ • Trees, shrubs, and ungrazed herbaceous < 1/3 area of unit ..... points = 0 ☐ **Aerial photo or map showing polygons of different vegetation types**	**Figure** ☐
	Add the points in the boxes above	
R 2	**Does the wetland have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland. *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* ☐ Grazing in the wetland or within 150 ft ☐ Untreated stormwater discharges to wetland ☐ Tilled fields or orchards within 150 ft. of wetland ☐ A stream or culvert discharges into wetland that drains developed areas, residential areas, farmed fields, roads, or clear-cut logging ☐ Residential, urban areas, golf courses are within 150 ft. of wetland ☐ The river or stream linked to the wetland has a contributing basin where human activities have raised levels of sediment, toxic compounds or nutrients in the river water above standards for water quality. ☐ Other _____ **YES** multiplier is 2 **NO** multiplier is 1	*(see p. 53)* Multiplier
◆	**<u>TOTAL</u> – Water Quality Functions** Multiply the score from R1 by R2; then ***add score to table on p. 1***	_____
	HYDROLOGIC FUNCTIONS – Indicators that wetland functions to reduce flooding and stream erosion.	
R 3	**Does the wetland have the <u>potential</u> to reduce flooding and erosion?**	*(see p.54)*
	R 3.1 Characteristics of the overbank storage the wetland provides: *Estimate the average width of the wetland perpendicular to the direction of the flow and the width of the stream or river channel (distance between banks). Calculate the ratio: (average width of unit) / (average width of stream between banks).* • If the ratio is more than 20 ..... points = 9 ☐ • If the ratio is between 10 – 20 ..... points = 6 ☐ • If the ratio is 5- <10 ..... points = 4 ☐ • If the ratio is 1- <5 ..... points = 2 ☐ • If the ratio is < 1 ..... points = 1 ☐ **Aerial photo or map showing average widths**	**Figure** ☐
	R 3.2 Characteristics of vegetation that slow down water velocities during floods: *Treat large woody debris as "forest or shrub". Choose the points appropriate for the best description. (polygons need to have >90% cover at person height NOT Cowardin classes):* • Forest or shrub for > 1/3 area OR herbaceous plants > 2/3 area ..... points = 7 ☐ • Forest or shrub for > 1/10 area OR herbaceous plants > 1/3 area ..... points = 4 ☐ • Vegetation does not meet above criteria ..... points = 0 ☐ **Aerial photo or map showing polygons of different vegetation types**	**Figure** ☐
	Add the points in the boxes above	
R 4	**Does the wetland have the <u>opportunity</u> to reduce flooding and erosion?** Answer YES if the wetland is in a location in the watershed where the flood storage, or reduction in water velocity, it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows. *Note which of the following conditions apply.* ☐ There are human structures and activities downstream (roads, buildings, bridges, farms) that can be damaged by flooding. ☐ There are natural resources downstream (e.g. salmon redds) that can be damaged by flooding ☐ Other _____ *(Answer NO if the major source of water to the wetland is controlled by a reservoir or the wetland is tidal fringe along the sides of a dike)* ☐ **YES** multiplier is 2 ☐ **NO** multiplier is 1	*(see p.57)* Multiplier
◆	**<u>TOTAL</u> – Hydrologic Functions** Multiply the score from R3 by R4; then ***add score to table on p. 1***	_____

Comments: _____

Wetland name or number _____

L	Lake-fringe Wetlands	Points
	WATER QUALITY FUNCTIONS – Indicators that the wetland unit functions to improve water quality.	(only 1 score per box)
L 1	**Does the wetland unit have the <u>potential</u> to improve water quality?** *(see p.59)*	
	L 1.1 Average width of vegetation along the lakeshore (use polygons of Cowardin classes): • Vegetation is more than 33 ft. (10m) wide ..... points = 6 ☐ • Vegetation is more than 16 ft.(5m) wide and < 33 ft ..... points = 3 ☐ • Vegetation is more than 6 ft. (2m) wide and < 16 ft ..... points = 1 ☐ • Vegetation is less than 6 ft. wide..... points = 0 ☐ **Map of Cowardin classes with widths marked**	**Figure** ☐
	L 1.2 Characteristics of the vegetation in the wetland: *Choose the appropriate description that results in the highest points, and do not include any open water in your estimate of coverage. The herbaceous plants can be either the dominant form or as an understory in a shrub or forest community. These are not Cowardin classes. Area of Cover is total cover in the unit, but it can be in patches. NOTE: Herbaceous does not include aquatic bed.* • Cover of herbaceous plants is > 90% of the vegetated area..... points = 6 ☐ • Cover of herbaceous plants is > 2/3 of the vegetated area..... points = 4 ☐ • Cover of herbaceous plants is > 1/3 of the vegetated area..... points = 3 ☐ • Other vegetation that is not aquatic bed or herbaceous covers > 2/3 of the unit ..... points = 3 ☐ • Other vegetation that is not aquatic bed in > 1/3 vegetated area ..... points = 1 ☐ • Aquatic bed cover and open water > 2/3 of the unit..... points = 0 ☐ **Map with polygons of different vegetation types**	**Figure** ☐
	Add the points in the boxes above	
L 2	**Does the wetland have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in the lake water, or polluted surface water flowing through the unit to the lake. *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* ☐ Wetland is along the shores of a lake or reservoir that does not meet water quality standards ☐ Grazing in the wetland or within 150 ft ☐ Polluted water discharges to wetland along upland edge ☐ Tilled fields or orchards within 150 ft. of wetland ☐ Residential or urban areas are within 150 ft. of wetland ☐ Parks with grassy areas that are maintained, ballfields, golf courses (all within 150 ft. of lake shore) ☐ Power boats with gasoline or diesel engines use the lake ☐ Other ☐ **YES** multiplier is 2 ☐ **NO** multiplier is 1	*(see p.61)* Multiplier
◆	**<u>TOTAL</u> – Water Quality Functions** Multiply the score from L1 by L2; then ***add score to table on p. 1***	_____
	HYDROLOGIC FUNCTIONS – Indicators that wetland functions to reduce shoreline erosion.	
L 3	**Does the wetland have the <u>potential</u> to reduce shoreline erosion?**	*(see p.62)*
	L 3 Average width and characteristics of vegetation along the lakeshore *(do not include aquatic bed): (choose the highest scoring description that matches conditions in the wetland)* • 3/4 of distance is shrubs or forest at least 33 ft. (10m) wide ..... points = 6 ☐ • 3/4 of distance is shrubs or forest at least 6 ft. (2m) wide. ..... points = 4 ☐ • 1/4 of distance is shrubs or forest at least 33 ft. (10m) wide. ..... points = 4 ☐ • Vegetation is at least 6 ft. (2m) wide (any type except aquatic bed)..... points = 2 ☐ • Vegetation is less than 6 ft. (2m) wide (any type except aquatic bed) ..... points = 0 ☐ **Aerial photo or map with Cowardin vegetation classes**	**Figure** ☐
	Record the points in the boxes above	
L 4	**Does the wetland have the <u>opportunity</u> to reduce erosion?** Are there features along the shore that will be impacted if the shoreline erodes? *Note which of the following conditions apply.* ☐ There are human structures and activities along the upland edge of the wetland (buildings, fields) that can be damaged by erosion. ☐ There are undisturbed natural resources along the upland edge of the wetland (e.g. mature forests, other wetlands) that can be damaged by shoreline erosion. ☐ Other _____ ☐ **YES** multiplier is 2 ☐ **NO** multiplier is 1	*(see p. 64)* Multiplier
◆	**<u>TOTAL</u> – Hydrologic Functions** Multiply the score from L3 by L4; then ***add score to table on p. 1***	_____

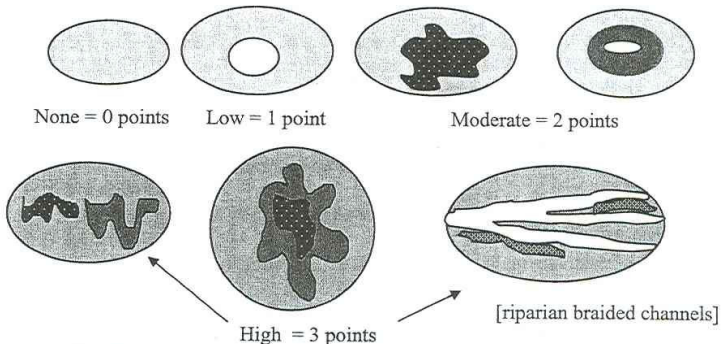
Comments: _____

Wetland name or number _____

S	Slope Wetlands	Points
	WATER QUALITY FUNCTIONS – Indicators that wetland functions to improve water quality.	(only 1 score per box)
S 1	**Does the wetland have the <u>potential</u> to improve water quality?**	*(see p.64)*
	S 1.1 Characteristics of average slope of unit: • Slope is 1% or less *(a 1% slope has a 1 ft. vertical drop in elevation for every 100 ft. horizontal distance)*.... points = 3 ☐ • Slope is 1% - 2% ..... points = 2 ☐ • Slope is 2% - 5%. ..... points = 1 ☐ • Slope is greater than 5% ..... points = 0 ☐	
	S 1.2 The soil 2 inches below the surface (or duff layer) is clay, organic *(Use NRCS definitions).* ☐ **YES** = 3 points ☐ **NO** = 0 points	
	S 1.3 Characteristics of the vegetation in the wetland that trap sediments and pollutants: *Choose the points appropriate for the description that best fits the vegetation in the wetland. Dense vegetation means you have trouble seeing the soil surface (>75% cover), and uncut means not grazed or mowed and plants are higher than 6 inches.* • Dense, uncut, herbaceous vegetation > 90% of the wetland area..... points = 6 ☐ • Dense, uncut, herbaceous vegetation > 1/2 of area ..... points = 3 ☐ • Dense, woody, vegetation > 1/2 of area..... points = 2 ☐ • Dense, uncut, herbaceous vegetation > 1/4 of area ..... points = 1 ☐ • Does not meet any of the criteria above for vegetation ..... points = 0 ☐ **Aerial photo or map with vegetation polygons**	**Figure ☐**
	Total for S 1 *Add the points in the boxes above*	
S 2	**Does the wetland have the <u>opportunity</u> to improve water quality?** Answer YES if you know or believe there are pollutants in groundwater or surface water coming into the wetland that would otherwise reduce water quality in streams, lakes or groundwater downgradient from the wetland? *Note which of the following conditions provide the sources of pollutants. A unit may have pollutants coming from several sources, but any single source would qualify as opportunity.* ☐ Grazing in the wetland or within 150 ft ☐ Untreated stormwater discharges to wetland ☐ Tilled fields, logging, or orchards within 150 ft. of wetland ☐ Residential, urban areas, or golf courses are within 150 ft. upslope of wetland ☐ Other ☐ **YES** multiplier is 2 ☐ **NO** multiplier is 1	*(see p. 67)* Multiplier
◆	**<u>TOTAL</u> – Water Quality Functions** Multiply the score from S1 by S2; then ***add score to table on p. 1***	_____
	HYDROLOGIC FUNCTIONS – Indicators that wetland functions to reduce flooding and stream erosion.	
S 3	**Does the wetland have the <u>potential</u> to reduce flooding and stream erosion?**	*(see p.68)*
	S 3.1 Characteristics of vegetation that reduce the velocity of surface flows during storms: *Choose the points appropriate for the description that best fits conditions in the wetland (stems of plants should be thick enough (usually > 1/8in), or dense enough to remain erect during surface flows).* • Dense, uncut, **rigid** vegetation covers > 90% of the area of the wetland..... points = 6 ☐ • Dense, uncut, **rigid** vegetation> 1/2 area of wetland ..... points = 3 ☐ • Dense, uncut, **rigid** vegetation > 1/4 area..... points = 1 ☐ • More than 1/4 of area is grazed, mowed, tilled, or vegetation is not rigid..... points = 0 ☐	
	S 3.2 Characteristics of slope wetland that holds back small amounts of flood flows. The slope has small surface depressions that can retain water over at least 10% of its area. ☐ **YES** = 2 points ☐ **NO** = 0 points	
	Add the points in the boxes above	
S 4	**Does the wetland have the <u>opportunity</u> to reduce flooding and erosion?** Is the wetland in a landscape position where the reduction in water velocity it provides helps protect downstream property and aquatic resources from flooding or excessive and/or erosive flows? *Note which of the following conditions apply.* ☐ Wetland has surface runoff that drains to a river or stream that has flooding problems ☐ Other *(Answer NO if the major source of water is controlled by a reservoir (e.g. wetland is a seep that is on the downstream side of a dam)* ☐ **YES** multiplier is 2 ☐ **NO** multiplier is 1	*(see p. 70)* Multiplier _____
◆	**<u>TOTAL</u> – Hydrologic Functions** Multiply the score from S3 by S4; then ***add score to table on p. 1***	_____

Comments: _____

Wetland name or number _____

These questions apply to wetlands of all HGM classes. HABITAT FUNCTIONS – Indicators that wetland functions to provide important habitat.	Points (only 1 score per box)
H 1 Does the wetland have the potential to provide habitat for many species?	
H 1.1 Vegetation structure *(see P. 72)*: *Check the types of vegetation classes present (as defined by Cowardin) – Size threshold for each class is 1/4 acre or more than 10% of the area if unit is smaller than 2.5 acres.* ☒ Aquatic Bed ☒ Emergent plants ☐ Scrub/shrub (areas where shrubs have > 30% cover) ☐ Forested (areas where trees have > 30% cover) *If the unit has a forested class check if:* ☐ The forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the forested polygon. *Add the number of vegetation types that qualify. If you have:* **Map of Cowardin vegetation classes** 4 structures or more ..... points = 4 ☐ 3 structures ..... points = 2 ☐ 2 structures ..... points = 1 ☐ 1 structure ..... points = 0 ☒	**Figure ☐** **1**
H 1.2 Hydroperiods *(see p.73)*: *Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or 1/4 acre to count (see text for descriptions of hydroperiods).* ☐ Permanently flooded or inundated — 4 or more types present — points = 3 ☐ ☐ Seasonally flooded or inundated — 3 or more types present — points = 2 ☐ ☒ Occasionally flooded or inundated — 2 types present — points = 1 ☐ ☐ Saturated only — 1 type present — points = 0 ☒ ☐ Permanently flowing stream or river in, or adjacent to, the wetland ☐ Seasonally flowing stream in, or adjacent to, the wetland ☐ **Lake-fringe wetland ..... = 2 points** ☐ **Freshwater tidal wetland ..... = 2 points** **Map of hydroperiods**	**Figure ☐** **0**
H 1.3 Richness of Plant Species *(see p. 75)*: Count the number of plant species in the wetland that cover at least 10 ft^2 *(different patches of the same species can be combined to meet the size threshold)* *You do not have to name the species. Do not include Eurasian Milfoil, reed canarygrass, purple loosestrife, Canadian Thistle.* If you counted: > 19 species ..... points = 2 ☐ 5 – 19 species..... points = 1 ☐ List species below if you want to: < 5 species ..... points = 0 ☒ _____	0
H 1.4 Interspersion of Habitats *(see p. 76)*: Decided from the diagrams below whether interspersion between Cowardin vegetation (described in H1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, medium, low, or none.  Note: If you have 4 or more classes or 3 vegetation classes and open water, the rating is always "high". **Use map of Cowardin classes.**	**Figure ☐** **1**
H 1.5 Special Habitat Features *(see p. 77)*: *Check the habitat features that are present in the wetland. The number of checks is the number of points you put into the next column.* ☒ Large, downed, woody debris within the wetland (> 4 in. diameter and 6 ft. long) ☒ Standing snags (diameter at the bottom > 4 inches) in the wetland ☐ Undercut banks are present for at least 6.6 ft. (2m) and/or overhanging vegetation extends at least 3.3 ft. (1m) over a stream (or ditch) in, or contiguous with the unit, for at least 33 ft. (10m) ☐ Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet turned grey/brown)* ☐ At least 1/4 acre of thin-stemmed persistent vegetation or woody branches are present in areas that are permanently or seasonally inundated *(structures for egg-laying by amphibians)* ☐ Invasive plants cover less than 25% of the wetland area in each stratum of plants *NOTE: The 20% stated in early printings of the manual on page 78 is an error.*	2
H 1 TOTAL Score – potential for providing habitat *Add the points in the column above*	**4**

Wetland name or number _____

H 2	**Does the wetland have the <u>opportunity</u> to provide habitat for many species?**	(only 1 score per box)
	H 2.1 <u>Buffers</u> *(see P. 80)*: *Choose the description that best represents condition of buffer of wetland unit. The highest scoring criterion that applies to the wetland is to be used in the rating. See text for definition of "undisturbed".* ☐ 100m (330 ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 95% of circumference. No structures are within the undisturbed part of buffer (relatively undisturbed also means no grazing, no landscaping, no daily human use)..... **points = 5** ☐ 100m (330 ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 50% circumference ..... **points = 4** ☐ 50m (170 ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 95% circumference ..... **points = 4** ☐ 100m (330 ft) of relatively undisturbed vegetated areas, rocky areas, or open water > 25% circumference ..... **points = 3** ☐ 50m (170 ft) of relatively undisturbed vegetated areas, rocky areas, or open water for > 50% circumference ..... **points = 3** **If buffer does not meet any of the criteria above:** ☐ No paved areas (except paved trails) or buildings within 25m (80 ft) of wetland > 95% circumference. Light to moderate grazing or lawns are OK ..... **points = 2** ☐ No paved areas of buildings within 50m of wetland for > 50% circumference. Light to moderate grazing or lawns are OK ..... **points = 2** ☐ Heavy grazing in buffer ..... **points = 1** ☐ Vegetated buffers are < 2m wide (6.6 ft) for more than 95% circumference (e.g. tilled fields, paving, basalt bedrock extend to edge of wetland) ..... **points = 0** ☒ Buffer does not meet any of the criteria above ..... **points = 1** **Arial photo showing buffers**	**Figure ☐** **1**
	H 2.2 <u>Corridors and Connections</u> *(see p. 81)* H 2.2.1 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 150 ft. wide, has at least a 30% cover of shrubs, forest or native undisturbed prairie, that connects to estuaries, other wetlands or undisturbed uplands that are at least 250 acres in size? *(Dams in riparian corridors, heavily used gravel roads, paved roads, are considered breaks in the corridor).* ☐ **YES = 4 points** (go to H 2.3) ☒ **NO** = go to H 2.2.2 H. 2.2.2 Is the wetland part of a relatively undisturbed and unbroken vegetated corridor (either riparian or upland) that is at least 50 ft. wide, has at least 30% cover of shrubs or forest, and connects to estuaries, other wetlands or undisturbed uplands that are at least 25 acres in size? **OR a Lake-fringe** wetland, if it does not have an undisturbed corridor as in the question above? ☒ **YES = 2 points** (go to H 2.3) ☐ **NO** = go to H 2.2.3 H. 2.2.3 Is the wetland: • Within 5 mi (8km) of a brackish or salt water estuary OR • Within 3 miles of a large field or pasture (> 40 acres) OR ☒ **YES** = 1 point • Within 1 mile of a lake greater than 20 acres? ☐ **NO** = 0 points	1

Comments: _____

	H 2.3 Near or adjacent to other priority habitats listed by WDFW (see p. 82): *(see new and complete descriptions of WDFW priority habitats, and the counties in which they can be found, in the PHS report http://wdfw.wa.gov/hab/phslist.htm)* Which of the following priority habitats are within 330 ft. (100m) of the wetland unit? *NOTE: the connections do not have to be relatively undisturbed.* ☐ **Aspen Stands:** Pure or mixed stands of aspen greater than 0.4 ha (1 acre). ☐ **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report p. 152*). ☐ **Herbaceous Balds:** Variable size patches of grass and forbs on shallow soils over bedrock. ☐ **Old-growth/Mature forests:** (Old-growth west of Cascade crest) Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 20 trees/ha (8 trees/acre) > 81 cm (32 in) dbh or > 200 years of age. (Mature forests) Stands with average diameters exceeding 53 cm (21 in) dbh; crown cover may be less that 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80 - 200 years old west of the Cascade crest. ☐ **Oregon white Oak:** Woodlands Stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158*). ☒ **Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other. ☐ **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161*). ☒ **Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources. ☐ **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report: pp. 167-169 and glossary in Appendix A).* ☐ **Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human. ☐ **Cliffs:** Greater than 7.6 m (25 ft) high and occurring below 5000 ft. ☐ **Talus:** Homogenous areas of rock rubble ranging in average size 0.15 - 2.0 m (0.5 - 6.5 ft), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs. ☒ **Snags and Logs:** Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 51 cm (20 in) in western Washington and are > 2 m (6.5 ft) in height. Priority logs are > 30 cm (12 in) in diameter at the largest end, and > 6 m (20 ft) long. If wetland has **3 or more** priority habitats **= 4 points** If wetland has **2** priority habitats = **3 points** If wetland has **1** priority habitat **= 1 point** No habitats = 0 points Note: All vegetated wetlands are by definition a priority habitat but are not included in this list. Nearby wetlands are addressed in question H 2.4)	4
	H 2.4 Wetland Landscape: *Choose the **one** description of the landscape around the wetland that best fits (see p. 84)* • There are at least 3 other wetlands within 1/2 mile, and the connections between them are relatively undisturbed (light grazing between wetlands OK, as is lake shore with some boating, but connections should NOT be bisected by paved roads, fill, fields, or other development.... points = 5 ☐ • The wetland is Lake-fringe on a lake with little disturbance and there are 3 other lake-fringe wetlands within 1/2 mile ..... points = 5 ☐ • There are at least 3 other wetlands within 1/2 mile, BUT the connections between them are disturbed. ..... points = 3 ☒ • The wetland fringe on a lake **with** disturbance and there are 3 other lake-fringe wetlands within 1/2 mile ..... points = 3 ☐ • There is at least 1 wetland within 1/2 mile ..... points = 2 ☐ • There are no wetlands within 1/2 mile..... points = 0 ☐	3
	H 2 TOTAL Score – opportunity for providing habitat *Add the scores from H2.1, H2.2, H2.3, H2.4*	9
	TOTAL for H 1 from page 8	4
◆	**Total Score for Habitat Functions** Add the points for H 1 and H 2; then ***record the result on p. 1***	**13**

Comments: _____

Wetland name or number _____

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Please determine if the wetland meets the attributes described below and circle the appropriate answers and Category.

	Wetland Type – *Check off any criteria that apply to the wetland. Circle the Category when the appropriate criteria are met.*	
SC1	**Estuarine wetlands?** *(see p.86)* Does the wetland unit meet the following criteria for Estuarine wetlands? ☐ The dominant water regime is tidal, ☐ Vegetated, and ☐ With a salinity greater than 0.5 ppt. ☐ **YES** = Go to SC 1.1 ☒ **NO**	
	SC 1.1 Is the wetland unit within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? ☐ **YES** = Category I ☐ **NO** = go to SC 1.2	**Cat. 1** ☐
	SC 1.2 Is the wetland at least 1 acre in size and meets at least two of the following conditions? ☐ **YES** = Category I ☐ **NO** = Category II ☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. If the non-native *Spartina* spp,. are only species that cover more than 10% of the wetland, then the wetland should be given a dual rating (I/II). The area of Spartina would be rated a Category II while the relatively undisturbed upper marsh with native species would be a Category 1. Do not, however, exclude the area of Spartina in determining the size threshold of 1 acre. ☐ At least 3/4 of the landward edge of the wetland has a 100 ft. buffer of shrub, forest, or un-grazed or un-mowed grassland ☐ The wetland has at least 2 of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands.	**Cat. I** ☐ **Cat. II** ☐ **Dual Rating I/II** ☐
SC2	**Natural Heritage Wetlands** *(see p. 87)* Natural Heritage wetlands have been identified by the Washington Natural Heritage Program/DNR as either high quality undisturbed wetlands or wetlands that support state Threatened, Endangered, or Sensitive plant species. SC 2.1 Is the wetland being rated in a Section/Township/Range that contains a natural heritage wetland? *(This question is used to screen out most sites before you need to contact WNHP/DNR.)* ☐ S/T/R information from Appendix D ☐ or accessed from WNHP/DNR web site ☐ **YES** Contact WNHP/DNR (see p. 79) and go to SC 2.2 ☒ **NO** SC 2.2 Has DNR identified the wetland as a high quality undisturbed wetland or as a site with state threatened or endangered plant species? ☐ **YES** = Category 1 ☒ **NO** not a Heritage Wetland	**Cat I** ☐
SC3	**Bogs** *(see p. 87)* Does the wetland **(or any part of the unit)** meet both the criteria for soils and vegetation in bogs? Use the key below to identify if the wetland is a bog. ***If you answer yes you will still need to rate the wetland based on its function.*** 1. Does the unit have organic soil horizons (i.e. layers of organic soil), either peats or mucks, that compose 16 inches or more of the first 32 inches of soil profile? (See Appendix B for a field key to identify organic soils)? ☐ **YES** = go to question 3 ☒ **NO** = go to question 2 2. Does the wetland have organic soils, either peats or mucks that are less than 16 inches deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on a lake or pond? ☐ **YES** = go to question 3 ☒ **NO** = is not a bog for purpose of rating 3. Does the unit have more than 70% cover of mosses at ground level, AND other plants, if present, consist of the "bog" species listed in Table 3 as a significant component of the vegetation (more than 30% of the total shrub and herbaceous cover consists of species in Table 3)? ☐ **YES** = Is a bog for purpose of rating ☒ **NO** = go to question 4 NOTE: If you are uncertain about the extent of mosses in the understory you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16" deep. If the pH is less than 5.0 and the "bog" plant species in Table 3 are present, the wetland is a bog. 4. Is the unit forested (> 30% cover) with sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Englemann's spruce, or western white pine. WITH any of the species (or combination of species) on the bog species plant list in Table 3 as a significant component of the ground cover *(> 30% coverage of the total shrub/herbaceous cove*r)? ☐ **YES** = Category I ☒ **NO** = Is not a bog for purpose of rating	**Cat. I** ☐

Wetland name or number _____

SC4	**Forested Wetlands** *(see p. 90)* Does the wetland have at least 1 acre of forest that meet one of these criteria for the Department of Fish and Wildlife's forests as priority habitats? *If you answer yes you will still need to rate the wetland based on its function.* ☐ **Old-growth forests**: (west of Cascade Crest) Stands of at least two three species forming a multi-layered canopy with occasional small openings; with at least 8 trees/acre (20 trees/hectare) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 inches (81 cm or more). NOTE: The criterion for dbh is based on measurements for upland forests. Two-hundred year old trees in wetlands will often have a smaller dbh because their growth rates are often slower. The DFW criterion is and "OR" so old-growth forests do not necessarily have to have trees of this diameter. ☐ **Mature forests**: (west of the Cascade Crest) Stands where the largest trees are 80 – 200 years old OR have an average diameters (dbh) exceeding 21 inches (53 cm); crown cover may be less than 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth. ☐ **YES** = Category I ☒ **NO** = not a forested wetland with special characteristics	**Cat. I** ☐
SC5	**Wetlands in Coastal Lagoons** *(see p. 91)* Does the wetland meet all of the following criteria of a wetland in a coastal lagoon? ☐ The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks. ☐ The lagoon in which the wetland is located contains surface water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom.)* ☐ **YES** = Go to SC 5.1 ☒ **NO** not a wetland in a coastal lagoon SC 5.1 Does the wetland meet all of the following three conditions? ☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing) and has less than 20% cover of invasive plant species (see list of invasive species on p. 74). ☐ At least 3/4 of the landward edge of the wetland has a 100 ft. buffer of shrub, forest, or un-grazed or un-mowed grassland. ☐ The wetland is larger than 1/10 acre (4350 square ft.) ☐ **YES** = Category I ☐ **NO** = Category II	**Cat. I** ☐ **Cat. II** ☐
SC6	**Interdunal Wetlands** *(see p. 93)* Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ☐ **YES** = Go to SC 6.1 ☒ **NO** not an interdunal wetland for rating ***If you answer yes you will still need to rate the wetland based on its functions.*** In practical terms that means the following geographic areas: • Long Beach Peninsula -- lands west of SR 103 • Grayland-Westport -- lands west of SR 105 • Ocean Shores-Copalis – lands west of SR 115 and SR 109 SC 6.1 Is the wetland one acre or larger, or is it in a mosaic of wetlands that is one acre or larger? ☐ **YES** = Category II ☐ **NO** = go to SC 6.2 SC 6.2 Is the wetland between 0.1 and 1 acre, or is it in a mosaic of wetlands that is between 0.1 and 1 acre? ☐ **YES** = Category III	**Cat. II** ☐ **Cat. III** ☐
◆	**Category of wetland based on Special Characteristics** *Choose the "highest" rating if wetland falls into several categories, and record on p. 1.* If you answered **NO** for all types enter "Not Applicable" on p. 1	**NA**

Comments: _____

ATTACHMENT E

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Biological Assessment

for the

Coal Creek Parkway Culvert Replacement Project

Bellevue, Washington

Prepared for

City of Bellevue

Prepared by

CH2MHILL

June 2011

TBG052511080338SEA

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Abbreviations and Acronyms

°	degrees
asl	above sea level
BA	Biological Assessment
C	Celsius
CESCL	Certified Erosion and Sediment Control Lead
CFR	*Code of Federal Regulations*
cfs	cubic feet per second
CMP	Corrugated Metal Pipe
DPS	Distinct Population Segment
Ecology	Washington State Department of Ecology
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
F	Fahrenheit
FR	*Federal Register*
HPA	Hydraulic Project Approval
HUC	Hydraulic Unit Code
I-405	Interstate 405
KCWLRD	King County Water and Land Resources Division
LWD	Large Woody Debris
mg/L	milligram(s) per liter
mm	millimeter(s)
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NTU	Nephelometric Turbidity Units

OHWM	ordinary high water mark
PCE	Primary Constituent Elements
RM	River Mile
TESC	Temporary Erosion and Sediment Control
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WDF	Washington Department of Fisheries
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington State Department of Natural Resources
WRIA	Water Resource Inventory Area
WSDOT	Washington State Department of Transportation

1.0 Introduction

The purpose of this biological assessment (BA) is to review the proposed Coal Creek Parkway Culvert Replacement Project in sufficient detail to determine whether the project might affect species protected under the Endangered Species Act (ESA). A BA is needed because there is a potential for impacts to fish and wildlife habitats within the project area that may be caused by the construction and/or operation of the proposed facility. The need for a BA from a regulatory standpoint is because the project requires a federal permit. The U.S. Army Corps of Engineers (USACE) will be required to issue a Section 404 permit. Accordingly, this document is prepared consistent with legal requirements set forth under Section 7 of the ESA (19 U.S. Code 1536 (c)).

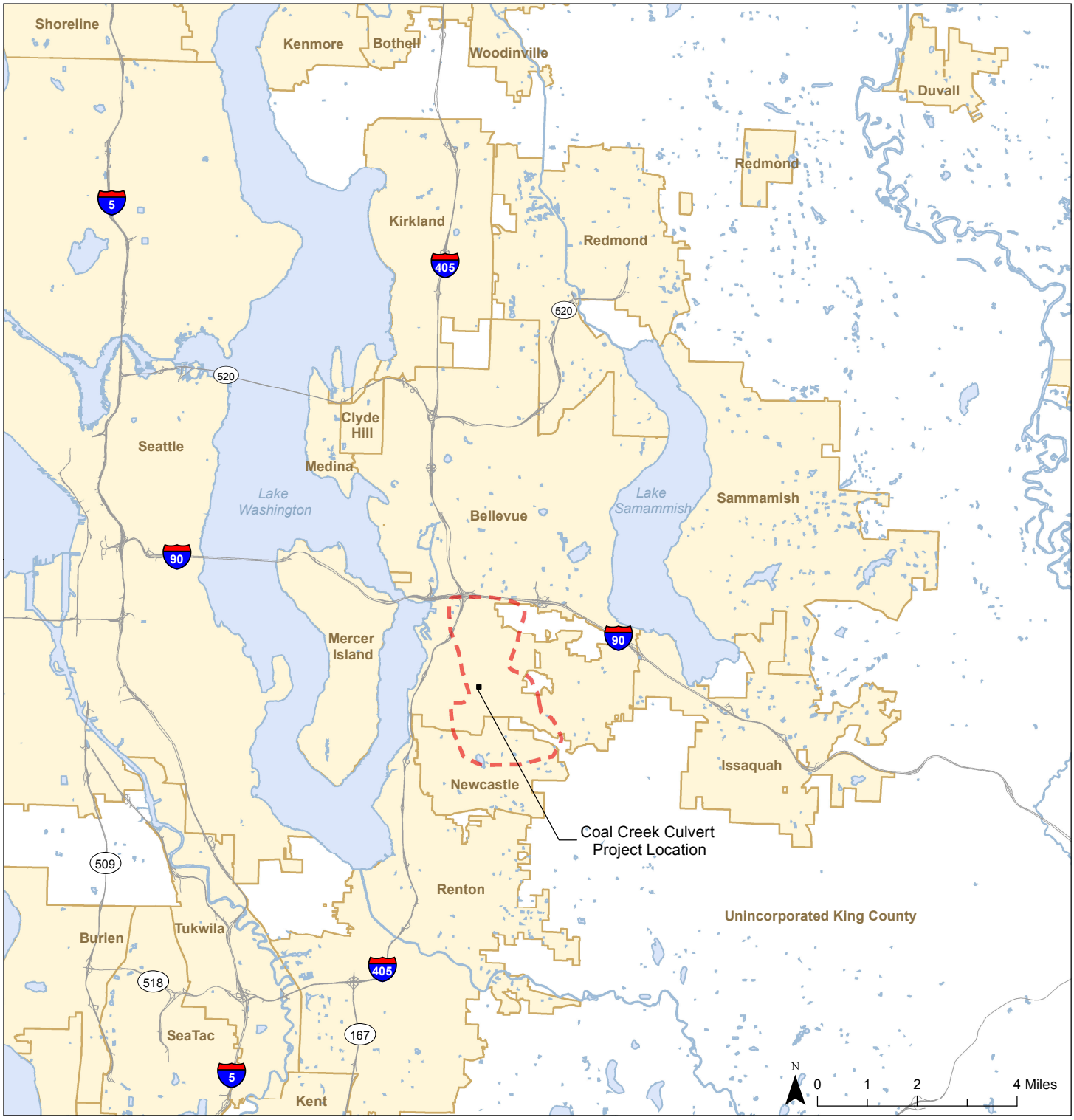
1.1 Project Purpose and Need

The purpose of this project is to replace the existing Coal Creek/Coal Creek Parkway culvert with a new upgraded wider bottomless culvert (Figure 1). Coal Creek is crossed by Coal Creek Parkway once. The existing culvert was built in the 1980s. The culvert is very corroded and about to fail with the potential for a sinkhole to form in this major arterial. The culvert is undersized and is considered to be a partial barrier to salmon passage with passage being obstructed at high and low flows. The proposed culvert design will be based on the Washington Department of Fish and Wildlife (WDFW) Stream Simulation Design as described in the WDFW manual for culvert design for fish passage (WDFW, 2003).

1.2 Project Design Constraints

The design and installation of this culvert was challenging for several reasons. The replacement must be done in the minimum amount of time due to the fact that this is a major arterial with a substantial amount of traffic. There are three major gas pipelines crossing the creek at the road crossing. One is a natural gas pipeline and the other two are gasoline/diesel/jet fuel pipelines. Two are above the existing culvert and one is below the entrance to it. There is also a set of high voltage power lines overhead at the stream crossing.

There are other design constraints. The road crossing is diagonal to the stream channel and cannot be changed. An instream structure just upstream from the culvert cannot be modified; it was constructed to constrict water flow and serves to backwater an inline sedimentation pond. There are log weir structures both upstream and downstream of the project. The sedimentation pond operation results in a condition of alternating periods of sediment scour and aggradation at the culvert.



Action area
City boundary
County boundary

Source: Action Area (2011) CH2M HILL; Cities (2004), Roads (2005), Water (2002) King County; Counties (1998) WA DOE; (Contours. Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

Figure 1. **Project Vicinity**

Coal Creek Culvert Replacement

2.0 Project Description

2.1 Project Location

The project site is located within the City of Bellevue, King County, Washington (Section 16, Township 24 north, Range 05 east) (Figure 1). The proposed culvert replacement is located on lower Coal Creek east of Interstate 405 (I-405), at approximate river mile (RM) 2.3. Coal Creek is tributary to Lake Washington. The project site is in Water Resource Inventory Area (WRIA) 8: Cedar – Sammamish Basin. More specifically, the project site is within the Coal Creek Watershed, 6th Field Hydrologic Unit Code (HUC) 171100120302. The approximate latitude and longitude of the project area is 47°33'14.76''N by 122° 09'59.65''W at an elevation of approximately 180 feet above sea level.

2.2 General Design Features

Figure 2 provides an overview of the proposed new Coal Creek culvert. The proposed culvert will be constructed over the top of and around the existing 9-foot-diameter corrugated metal pipe (CMP) culvert (see photographs – Appendix A). In conformance with WDFW design criteria, the new culvert will be 39 feet wide and 108 feet long, with 7 feet of the width devoted to a trail next to the stream channel (Figure 3). This increase in channel width at the crossing will allow Coal Creek to meander under the culvert in a natural manner. The new culvert will be constructed working from the road bed above with soldier pile and steel plate lagging walls and a cast-in-place concrete lid. Fourteen soldier piles will be installed to construct the south side wall, and fifteen will be installed on the north side. Steel plate lagging will then be placed between the soldier piles to form the walls of the culvert. The steel lagging will be sprayed with concrete to seal and protect it in the final stages of construction.

Two wing walls will be installed at both the upstream and downstream ends of the culvert. The wing walls will help prevent bank erosion by armoring the approach and exit of the culvert. The wing walls will be constructed the same manner as the culvert walls, using soldier piles and steel lagging plates.

Two log grade control structures will be placed under the inlet and outlet of the culvert. The grade control structures will manage scour processes by providing hard points in the streambed under the culvert. The grade control structures will be constructed using large (40 to 50 feet long) logs, which will be anchored in place with buried ecology blocks and tethered with steel cable (Figure B-1, Appendix B). In addition, the first log weir downstream of the culvert outlet will be replaced. It will be replaced with a stacked log weir to redirect hydraulic shear stress away from the left bank to the center of the channel. Two rootwad revetments will also be constructed as part of this project; one downstream and one upstream of the culvert (Figure B-2). These revetment banks will protect the stream banks from erosion. One log revetment will be located on the upstream side on right bank and one on the downstream side on the left bank. Revetments will be constructed out of simple logs and logs with rootwads attached. They will be secured in place by partially burying them

into the banks, anchored with ecology blocks and partially secured in place with the existing riprap at those locations.

A scour pad will be installed in the pool just upstream of the inlet of the culvert. The scour pad will be constructed of large (18-inch diameter) alluvial boulders that will be installed up to 5 feet below the culvert inlet. The scour pad will prevent water from scouring out the streambed at the inlet of the culvert.

As mentioned above, a trail will be incorporated into the design of the culvert. The trail will cross Coal Creek Parkway under the new culvert. The trail will be separated from the stream channel by a 5-foot-high concrete wall.

2.3 Construction Sequencing

Construction will occur in two phases. The first phase will commence in the summer of 2012, and the second phase will commence in the summer of 2013.

2.3.1 Phase 1

In the summer of 2012, traffic controls will be put in place and the two southbound lanes on Coal Creek Parkway will be closed to traffic. The two northbound lanes will remain open to allow one lane of traffic in each direction.

Building of construction staging areas and access roads will begin at that time. The main construction staging areas will be the existing trailhead parking lot on the east side of Coal Creek Parkway and the north side of Coal Creek (Figure B-3). A maintenance access road presently exists on the downstream side of the Coal Creek crossing on the left bank. This access road will allow crews to reach Coal Creek with construction equipment with minimal clearing. Eight trees (8- to 36-inch alder, maple, and cottonwood) will be removed for construction equipment (excavator) access to the channel. The roadway surface on the west side of Coal Creek Parkway will be excavated, and roadway material removed from the project area will be disposed of at an approved offsite location. The holes for the soldier pile installation will be installed using a 30-inch auger. The holes will be drilled down to 40 feet. As the auger removes soil, it will be deposited directly into a truck for containment and removal from the site. Steel H-beams will then be lowered and tamped down into the holes, and a concrete footing will be placed around them for stabilization. The lagging will be installed using a vibratory hammer. The steel lagging will be vibrated into place where they will rest against the inside face of the H-beams for support.

Once the walls of the culvert are in place, the frame and supports will be installed for the culvert lid and then the concrete will be poured in place (Figure B-4). After the culvert lid is installed, a new roadway bed about 6 feet thick will be placed. Up to this point in the project, all work will happen from the road without any in-water work. The existing culvert will remain in place and functioning, untouched up until this point.

Once the fish window is in effect, crews will commence the in-water work. In preparation for wing wall, trail stairway, log weir, and revetment bank installation, Coal Creek will be dewatered in the construction area to allow for in-channel work to be conducted in the dry. The concrete box flow control structure (Figure 2) upstream of the existing culvert will be sealed to allow water to back up in this structure.

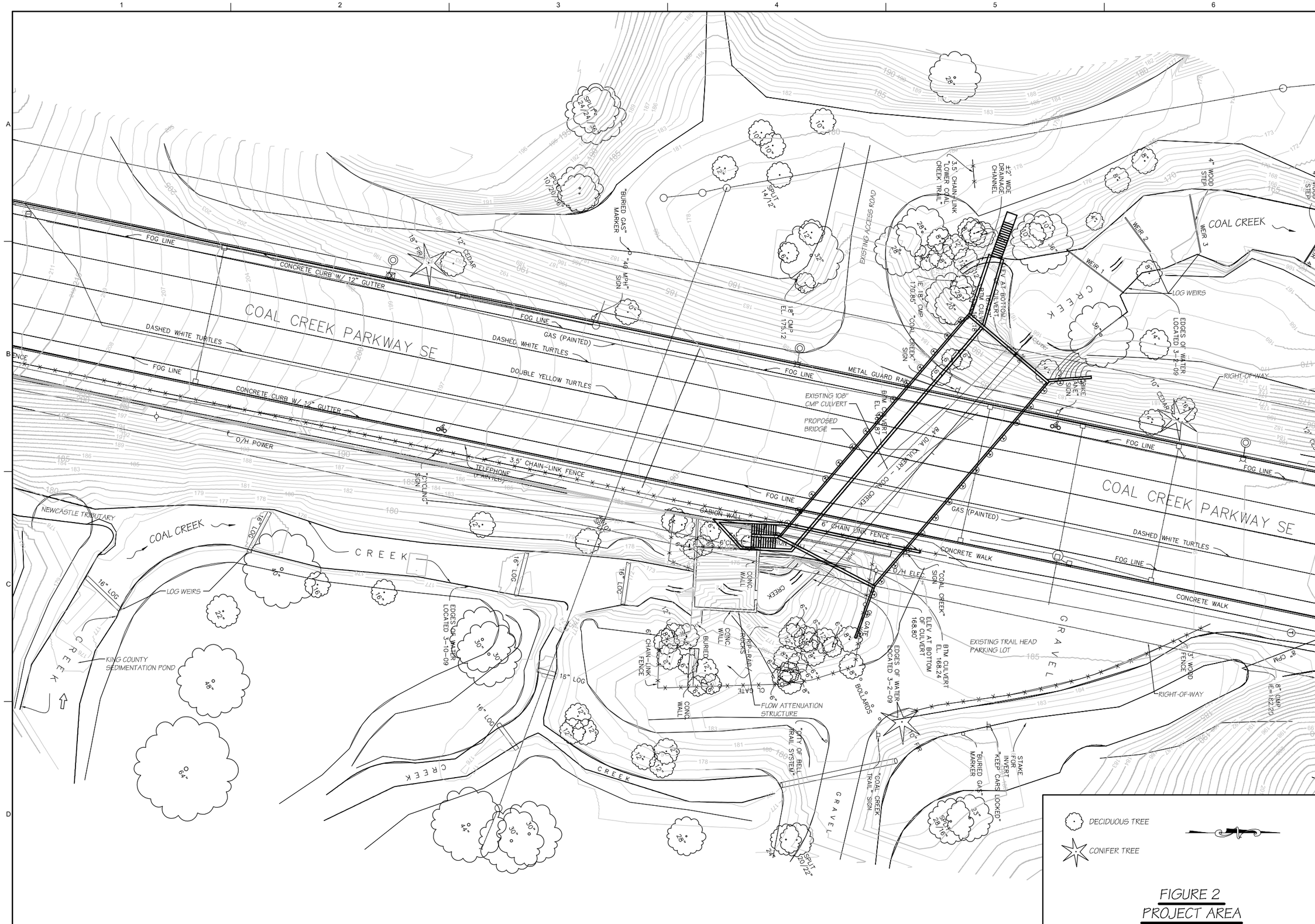


FIGURE 2
PROJECT AREA

NO	DATE	DESCRIPTION	APVR
NO	DATE	DESCRIPTION	APRV
NO	DATE	DESCRIPTION	APVR
NO	DATE	DESCRIPTION	APVR
NO	DATE	DESCRIPTION	APVR
NO	DATE	DESCRIPTION	APVR
NO.	DATE	REVISION	BY
DSGN	DR	ENGINEER	DRAWN-BY
	CHK	CHECKED-BY	APVD
	APVD	APPROVED-BY	

PLAN ELEVATION

N
N
N
N
N
N
N
APVD

CH2MHILL

COAL CREEK PARKWAY CULVERT REPLACEMENT

Figure 2. PROJECT AREA

1" = X'

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	DATE
PROJ	401930
DWG	Figure 2
SHEET	

PRELIMINARY

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FILE NAME:BA_Figure 2.dwg PLOT DATE: May 24, 2011 - 10:16am

PLAN LAYOUT

1" = 15'-0"

	DATE	PLAN ELEVATION	APVR	N
NO	DATE	DESCRIPTION	APRV	N
NO	DATE	DESCRIPTION	APVR	N
NO	DATE	DESCRIPTION	APVR	N
NO	DATE	DESCRIPTION	APVR	N
NO	DATE	DESCRIPTION	APVR	N
NO.	DATE	REVISION	BY	APVD

DSGN ENGINEER | DR DRAWN-BY | CHK CHECKED-BY | APVD APPROVED-BY

CH2MHILL

COAL CREEK PARKWAY CULVERT REPLACEMENT

Figure 3. PLAN LAYOUT

1" = X'

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING: 0 1"

DATE

PROJ 401930 DATE

DWG FIGURE 3

SHEET

FILE NAME:BA_Figure3.dwg PLOT DATE: May 24, 2011 - 9:56am

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The water will then be directed into a pipe and delivered to the downstream side of the culvert. At this point, fish present in the bypass reach will be collected using electrofishing equipment and released downstream (Appendix C). Gravity will be used to carry the water into and through the pipe with pumps on stand-by for back-up. The outlet end of the pipe will be at a location about 20 feet downstream of the last weir located below the work area.

Once the streambed is dewatered, construction of the wing walls on the downstream side will begin. Wing walls will be installed in the same manner and composed of similar materials to the culvert walls. The difference will be that precast concrete lagging will be placed into the H-beams, rather than the steel lagging that was used for the culvert walls. After the wing walls and trail stairway are in place, the new and replacement log weirs (grade control structures) will be installed. Grade control structures 1 and 2 (the two log weirs closest to the outlet of the culvert) will be built with four large logs each. Grade control structure 1 is a replacement for an existing log weir. An excavator will excavate an area to place ecology blocks (dead man anchors). Two logs will be stacked next to two more logs to form a single four-log weir (Figure B-1). The logs will be cabled to the Ecology blocks to ensure that the structure does not move during flood conditions. Grade control structure 2 will be located within 2 feet of the existing culvert outlet and will be at the same elevation as the current culvert outlet invert (167 feet). It is possible that a foot or more of the existing culvert will need to be removed to allow for construction of grade control structure 2. This structure is the same as the first, except that the logs will be shorter.

When the new log weirs are in place, construction of the log revetment bank will begin on the left (south) bank (Figure B-2). The log revetment will extend from the left bank wing wall to the newly installed grade control structure 2 (about 35 feet of stream bank). The revetment bank will be constructed of large logs with and without rootwads attached. These will extend into the streambed and into the bank in a crisscrossing matrix configuration for stability. To imbed the logs, the streambed and streambank will be excavated so that the ends of the logs can be secured into the bed and bank. Four sets of three-log bank roughening structures will be placed downstream of grade control structure 1 (Figure B-2; B-5). The purpose of these structures is to armor the bank around the stream bend below the culvert. These structures are not imbedded into the banks, but one of the logs will extend down into the streambed and will thus need excavation. When the log structures are finished and the streambanks stabilized, the stream flow will be returned to Coal Creek.

As a separate, but related project, the Olympic Pipeline Company will lay two new segments of petroleum product (gasoline/diesel/jet fuel) pipeline on top of the newly installed culvert lid. The pipes will be bedded in previously placed roadway bed material. The Olympic Pipeline Company has two pipelines (mentioned above) crossing over the existing culvert or near the culvert inlet, which it will abandon and replace. The current pipes will be cleared of any products and abandoned in place. The newly installed pipelines will serve to replace the abandoned pipelines. The Olympic Pipeline Company will not be conducting any in-water work. Once Olympic Pipeline completes the installation of the new pipelines, this project will fill over these new pipelines and restore Coal Creek Parkway above the culvert lid. The road paving will finalize the work for 2012 (Phase 1).

2.3.2 Phase 2

Phase 2 of construction will begin in the summer of 2013 and will focus on the upstream half (east side) of the culvert. Traffic controls will be put in place to block traffic on the two northbound lanes of Coal Creek Parkway. Traffic will remain open on the southbound lanes. A short access road will be constructed on the north side of the concrete box flow control structure that is upstream of the culvert (Figure 2). Fifteen red alder and maple trees ranging from 4 to 10 inches in diameter will be cleared to install this access road and work area.

The upstream culvert walls and lid will be installed using the same soldier pile and steel plate process described above for the downstream side.

In-water work for Phase 2 will occur during the fish window in 2013, and the stream flow will again be diverted as described above for Phase 1, except that the water will be gravity fed into a pipe hung from the lid of the culvert cap instead of running down the culvert; and the water will be returned to the channel at the culvert outlet pool. Pumps will be on-site for back-up.

Following the water diversion, a ramp will be built at the culvert inlet and the entire interior of the culvert will be excavated, including the existing culvert. This will be conducted from the inlet to the outlet, probably in 10-foot segments with the soil transported out of the interior and up the bank using a conveyor system. This material will be loaded into trucks in the staging area (the existing trailhead parking lot) and disposed of at an approved site. The culvert material will be recycled as scrap steel. If the excavated materials include former streambed gravels, those materials may be stockpiled for future streambed use (if clean).

When the entire interior under the culvert is excavated, the streambed will be constructed along with the trail and associated stub wall. The streambed, having been overexcavated by 2 feet, will be backfilled with clean streambed materials. This will be composed of new engineered stream gravel mix or a combination of new mix and salvaged streambed material (washed if not clean). The resulting mix will meet the specifications calculated for the site in accordance with the state's manual for culvert design (WDFW, 2004). The streambed mix will be a combination of gravel, cobble, boulders, and fines. This will be placed in a 2-foot-deep layer without contouring a thalweg. The stream simulation design assumes that a thalweg will form as the mix settles and water flow recontour these materials.

After the streambed is placed within the culvert, the log structures and pool at the culvert entrance will be constructed. A 4-log grade control structure will be built at the entrance of the culvert similar to the one at the outlet. The purpose of this structure is to protect the culvert inlet area from erosion and reduce stream energy to reduce scour at the culvert entrance. A log revetment will be built on the right bank adjacent to the culvert entrance (Figure B-6). This revetment bank will differ from the downstream one in that it will be anchored in place by backfilling extensively with soil and riprap boulders around the stems of the logs. The existing riprap will be removed to build the wing wall and make room for the log revetment structure. Unlike the log revetment structure downstream of the culvert, this log revetment will be subjected to the full hydraulic force of the stream as it will be oriented at a right angle to the flow. The design uses large logs and will be anchored securely in recognition of the forces involved at extreme flood flow (Appendix D). The

design will incorporate a scour barrier in the pool at the entrance to the culvert that extends up to the flow attenuation box . This area will be very turbulent with plunging water from the flow attenuation box and the turbulence from water hitting the log revetment. As such, the excavated streambed will be backfilled with 18-inch-diameter alluvial boulders to prevent scour. The top surface of the boulders will be set at 3 feet below the invert of the culvert inlet. Any usable streambed material removed during construction will be used elsewhere onsite. It is anticipated that one of the abandoned Olympic Pipeline Company pipes will be encountered during excavation for the culvert entrance pool. Any abandoned pipe that is encountered will be cut out and removed, and the ends will be capped. Because of the abandonment process employed by Olympic Pipeline Company, there will be no contamination potential from petroleum products. The pipes are expected to be clean at this point. If they aren't clean, appropriate measures will be taken to prevent any of the product from entering the stream.

It is anticipated that the water depth under the new culvert will be as follows:

- The 2-year flood depths are estimated at 1.5 feet deep at the upstream end and 2 feet deep at the downstream end (Appendix D).
- The 100-year flood depths are estimated at 2.7 feet deep at the upstream end and 3 feet deep at the downstream end.
- The 500-year flood depths are estimated at 3.2 feet deep at the upstream end and 3.3 feet deep at the downstream end.

In total, 23 trees ranging from 4 to 36 inches in diameter will be removed for access to construction areas. Other vegetation disturbance will also occur for the access approaches. These will be restored during the first fall season following disturbance (2012 for construction on the downstream end and 2013 for the upstream portion). Alder trees will naturally establish without planting wherever there is exposed soil. Other native trees and shrubs will be planted according to Hydraulic Project Approval (HPA) permit requirements. In addition, conifer plantings will be made outside of the disturbance zone in compensation for temporal riparian function loss. A preliminary revegetation plan is provided in Appendix E.

Project-related construction does not require impact pile riving or blasting. Equipment will include dump trucks, excavators, concrete trucks, a paver, possibly a crane, and various delivery trucks.

2.4 Impact Minimization Measures

Potential impacts to water quality, habitat, or listed species could occur during construction activities. Impacts are primarily limited to temporary increases in turbidity or dewatering activities. Potential water quality impacts can be reduced or avoided by implementation of the conservation and performance measures outlined below.

2.4.1 Conservation and Performance Measures

2.4.1.1 General

- A Temporary Erosion and Sediment Control (TESC) Plan will be developed and implemented.
- A qualified Erosion and Control Inspector will review all sediment control measures twice per week during construction. Qualified means the inspector will be a Certified Erosion and Sediment Control Lead (CESCL).
- Turbidity will be monitored per the City of Bellevue and Washington State Department of Ecology requirements.
- A Spill Prevention Control and Countermeasures plan that meets Ecology standards will be developed and implemented for the project to ensure that all pollutants and products will be controlled and contained.
- Seasonal restrictions applied to work conducted below the ordinary high water mark (OHWM) will be as required by a project-specific HPA issued by WDFW.
- Construction impacts will be confined to the minimum area necessary to complete the project.
- Removal of riparian vegetation will be minimized to the extent possible.
- Implementation of the Revegetation Plan outlined in Appendix E will occur.

2.4.1.2 Water Quality/Erosion Control

- All best management practices (BMPs) will be installed according to City of Bellevue standards and will be inspected and maintained throughout the life of the project.
- Staging and soil stockpile areas will be limited to those outlined in the clearing and grading permit. Staging areas will be fenced.
- Spill kits will be kept onsite.
- Fuels and other potentially hazardous materials will be kept in a secured area. Secured means fenced, and locked during non-work hours.
- Secondary containment will be required for all hazardous materials. Spill containment is required for generators, parked equipment, porta-potty, fuels, solvents, etc.
- The project will comply with water quality conditions identified by Ecology.
- Wash water resulting from washdown of equipment or work areas will be contained for proper treatment and/or disposal, and will not be directly discharged into state waters.
- There will be no discharge of oil, fuels, or chemicals to surface waters, or onto land where there is a potential for reentry into surface waters.
- No cleaning solvents or chemicals used for tools or equipment cleaning will be discharged to ground or surface waters.

- The contractor will regularly check fuel hoses, oil drums, oil or fuel transfer valves, fittings, etc. for leaks, and will maintain and store materials properly to prevent spills.
- BMPs will be used on all project activities to control and prevent sediments from entering aquatic systems.

2.4.1.3 In-water and Over-water Work

- All fish will be removed from the work area prior to any in-water work activities per the Fish Salvage Plan in Appendix C.
- Materials removed from below the OHWM will be placed in an upland location where they cannot enter water bodies.
- Materials placed within the water, such as riprap and large woody debris (LWD), will be free of sediment and other contaminants.
- Water pumped from work isolation areas will be treated to remove suspended sediments prior to returning to the water body. Discharge will occur in such a manner as not to cause erosion.
- Mechanical equipment will not enter the stream channel until the project area has been dewatered and fish salvage has been completed.
- Mechanical equipment operating in the project area will be inspected daily for leaks. Any equipment found to be leaking will be immediately fixed or removed from the project site.

2.5 Ongoing Projects in the Action Area

Coal Creek is undergoing a number of projects related to streambank stability and sediment transport problems. These projects are unrelated to the proposed action, but have an influence on the design and function of the proposed culvert. The primary action is the operation of three sedimentation ponds, one of which is just upstream of the proposed project, and two are located downstream. The ramification of this is that the new culvert must not alter sediment transport in the system.

2.6 Action Area

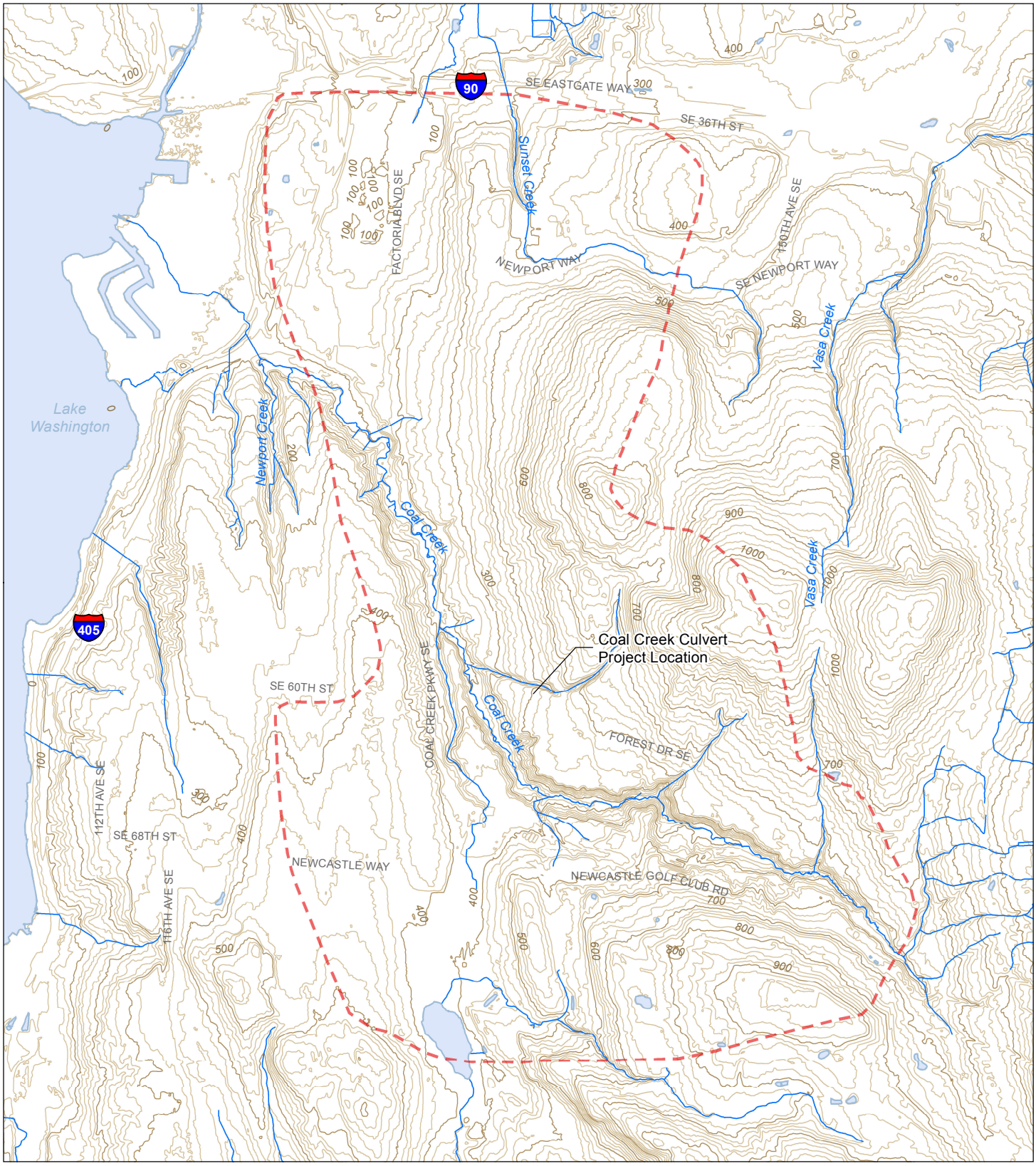
The action area includes all areas that could be affected directly or indirectly by the proposed action and is not limited to the actual work area (project area). The action area represents the geographic extent of the physical, biological, and chemical impacts from the project (Figure 4).

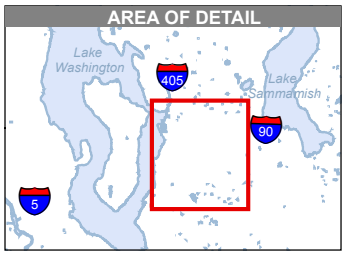
The action area will include potential effects from visual and audible disturbance, terrestrial habitat impacts, and impacts to aquatic environments. The project action area is defined by the spacially farthest reaching element of the project. This will be set by the use of a vibratory hammer used for the placement of the soldier pile panels. A noise level of 101 decibels (A-weighted scale) (dBA) (re: 20 μPa) at a 50-foot distance (WSDOT, 2011) was used to calculate the terrestrial component of the action area. The spherical model was used under vegetated conditions. This method uses a noise attenuation rate of 7.5 dBA per

doubling of distance. Ambient noise levels were assumed to be 45 dBA (WSDOT, 2011. Vibratory hammer noise was calculated to attenuate to an assumed ambient sound level of 45 dBA at 9,600 feet (1.8 miles). This was applied to the surrounding topography such that the ridge tops formed the limit of the action area on the cross-ravine axis of the action area, and the bends in the canyon formed the limits of noise transmission on the other axis (Figure 2).

The aquatic potion of the action area is associated with turbidity and sedimentation during construction. The extent of turbidity and sedimentation effects can vary widely depending on area of disturbance, sediment sources, particle size, and flow fluctuations. All work in or near the water, and water discharged from the project area, are required to meet the state's Water Quality Standards, Washington Administrative Code (WAC 173-201A). A mixing zone for turbidity is authorized within WAC 173.201A-030 during and immediately after necessary in-water or shoreline construction activities that result in the disturbance of in-place sediments. Based on summer flows being less than 10 cubic feet per second (cfs), the allowable mixing zone extends 100 feet downstream. This forms the downstream extent of aquatic action area.

The existing culvert is a partial barrier to upstream migrating adult salmon. The new culvert will be fully passable to migrating salmon, which will have a positive effect on use of spawning areas upstream. The upstream extent of this effect is the waterfall at RM 3.8, thus forming the upstream extent of the aquatic action area.





20 ft Contour

100 ft Contour

Action area

Source: CH2M HILL (2011) Action Area; City of Bellevue (2006) Streams, Streets; King County (2005) Contours. Horizontal datum for all layers is NAD83(91), vertical datum for layers is NAVD88.

N

0 500 1,000 2,000 Feet

Figure 4. **Action Area**

Coal Creek Culvert Replacement

3.0 Status of Species and Critical Habitat

The NMFS ESA web page was consulted for species listed as threatened or endangered under the ESA that are under their jurisdiction. All of the salmonid species occurring on the Pacific Coast were listed. Of these, two are known to be to be present in the action area: Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*) and Puget Sound steelhead (*O. mykiss*) (Appendix F). Of these, only Chinook have designated critical habitat at the present time. While Chinook have designated critical habitat within the Lake Washington watershed, including Lake Washington, Coal Creek is not included.

The U.S. Fish and Wildlife Service (USFWS) website was similarly consulted for species occurrence. Eight listed species were identified on the USFWS countywide listings for King County (Appendix F), including: Coastal-Puget Sound bull trout *(Salvelinus confluentus)*, marbled murrelet *(Brachyramphus marmoratus marmoratus)*, northern spotted owl *(Strix occidentalis caurina)*, gray wolf *(Canis lupus)*, grizzly bear *(Ursus arctos)*, Canada lynx *(Lynx canadensis)*, marsh sandwort *(Arenaria paludicola)*, and golden paintbrush *(Castilleja levisecta)*. Furthermore, critical habitat for the northern spotted owl, marbled murrelet, and bull trout occurs in King County.

Spotted owl and marbled murrelet suitable habitat and critical habitat do not occur in the action area. Therefore, this project will have "no effect" on spotted owl and marbled murrelet or their designated critical habitat. These species and their critical habitat will not be addressed further in the BA. As a result of the project's location within the City of Bellevue and lack of suitable habitat, grizzly bears, gray wolves, and Canada lynx do not occur in the action area. Therefore, the project will have "no effect" on grizzly bears, gray wolves, or Canada lynx, and these species will not be addressed further in the BA.

Marsh sandwort is assumed extirpated from the State of Washington and has not been documented since 1896 when it was collected from "prairies" near Tacoma (USFWS, 1998a). Golden paintbrush typically occurs in prairie/grassland habitat on gravelly, glacial outwash. It is known from nine extant populations in Washington (USFWS, 2000). Prairie habitat does not occur in the action area. Therefore, the project will have "no effect" on marsh sandwort or golden paintbrush, and these species will not be addressed further in the BA. All species addressed in this BA are outlined in Table 1.

TABLE 1
Threatened or Endangered Species Potentially in the Action Area

Species	Scientific Name	Federal Status	Critical Habitat
Puget Sound Chinook Salmon	*Oncorhynchus tshawytscha*	Threatened	Designated
Coastal/Puget Sound Bull Trout	*Salvelinus confluentus*	Threatened	Designated
Puget Sound Steelhead	*Oncorhynchus mykiss*	Threatened	Under Consideration

3.1 Puget Sound Chinook Salmon

3.1.1 Federal Status

Puget Sound Chinook salmon are listed as a threatened species in Washington under the ESA. The NMFS is the lead regulatory agency for this listing under the ESA. The Puget Sound Evolutionarily Significant Unit (ESU of Chinook salmon was listed as threatened on March 24, 1999 (64 *Federal Register* [FR] 14308).

3.1.2 Critical Habitat

The Lake Washington Subbasin (HUC 17110012) has been designated as Chinook salmon critical habitat, which was published in the final rule on September 2, 2005 (70 FR 52629). However, Coal Creek was not included. The closest designated critical habitat is Lake Washington, which is approximately 2.0 miles downstream from the project area. Therefore, designated critical habitat for Chinook salmon occurs near the downstream extent of the action area where Coal Creek enters Lake Washington.

Within areas designated as critical habitat, the Primary Constituent Elements (PCEs) essential for the conservation of these ESUs are those sites and habitat components that support one or more life stages. The PCEs are further described as:

(1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;

(2) Freshwater rearing sites with:

- (i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;
- (ii) Water quality and forage supporting juvenile development; and
- (iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

(3) Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival;

(4) Estuarine areas free of obstruction and excessive predation with:

- (i) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater;
- (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and
- (iii) Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

(5) Nearshore marine areas free of obstruction and excessive predation with:

(i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and

(ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

(6) Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

3.1.3 Habitat Requirements

Migrating adult Chinook salmon seek cover in deep pools, log jams, and undercut banks, until ready to spawn. They require a steady supply of clean, cool, well oxygenated water, and clean gravel for successful spawning. Factors influencing the survival of all juvenile salmonids include the availability of suitable habitat, prey, and refuge from predators and floods. Habitat complexities in the form of pools and riffles, with interspersed downed woody debris of varying size classes, are additionally important for the instream survival of both adult and juvenile salmonids. Chinook salmon from the Lake Washington Subbasin are referred to as ocean type since most spend only a few months in freshwater after emergence.

3.1.4 Occurrence

Small numbers of Chinook salmon have been observed in Coal Creek. Six Chinook salmon were observed spawning near RM 0.6 during October and November of 2004 (Tetra Tech/KCM, 2005). The project reach is at approximate RM 1.4, and no barriers exist between RM 0.6 and the project site. Therefore, Chinook salmon could reach the project area to either spawn or access potentially suitable habitat upstream of the project reach. Data from the City of Bellevue from various electrofishing surveys conducted from 1996 through 2003 in the general project area resulted in the capture of over 2,000 fish, none of which were Chinook salmon.

Based on a review of Chinook salmon juvenile and adult life-history data, this species of salmonid should not be present in the project area during the months of July and August. The federal work window extends from July 1 to August 31. The WDFW in-water work window for Coal Creek extends from August 1 to August 31. Therefore, construction activities will be timed to avoid direct impacts to both juvenile and adult Chinook salmon, because juvenile Chinook salmon will have migrated out of Coal Creek and returning adults will not have arrived yet. However, both juveniles and adults could potentially move through the project area after construction activities.

3.2 Bull Trout

3.2.1 Federal Status

Bull trout are listed as a threatened species in Washington under the ESA. The USFWS is the lead regulatory agency for this listing under the ESA. The final rule listing Coastal-Puget Sound bull trout was published on November 1, 1999 (50 CFR Part 17, Volume 64, No. 210).

3.2.2 Critical Habitat

The Lake Washington Subbasin (HUC 17110012) is within Unit 28: Puget Sound and has been designated as bull trout critical habitat (50 CFR Part 17). However, Coal Creek was not

included. The closest designated critical habitat is Lake Washington, which is approximately 2.0 miles downstream from the project area. Therefore, designated critical habitat for bull trout occurs at the downstream extent of the action area. PCEs of critical habitat are the known physical and biological features that are essential to the conservation of the species. The PCEs for bull trout are:

1. Permanent water of sufficient quantity and quality such that normal reproduction, growth, and survival are not inhibited;
2. Water temperatures that support bull trout use;
3. Complex stream habitat (LWD, side channels, pools, undercut banks);
4. Substrate of sufficient size, amount, and composition, to ensure egg, fry, young of the year, and juvenile survival;
5. Natural hydrograph with peak, high, low, and base flows within historic range;
6. Springs, seeps, groundwater sources, and subsurface water connectivity;
7. Migration corridors with minimum barriers between necessary habitats;
8. Abundant food base.

3.2.3 Habitat Requirements

Bull trout have several different life-history strategies including resident, fluvial, adfluvial, or anadromous. Resident headwater populations tend to be isolated remnants of once more mobile populations and, as such, are more prone to extinction. Fluvial and adfluvial populations are typically associated with larger river and lake systems. Anadromous populations are very mobile, utilize marine waters for part of their adult life, and are more dependent on estuarine habitats for survival.

Bull trout are bottom dwellers that prefer deep pools of cold water rivers, lakes, and reservoirs. Adults typically spawn in fall; juveniles hatch in winter, emerge from the gravel substrate in spring, and remain in these tributary streams for 1 to 3 years before migrating back toward lakes, large rivers, or the ocean. Bull trout require cold water (maximum temperature approximately 13 degrees Celsius (°C) (55 degrees Fahrenheit [°F]) lakes or streams with clean cobble substrate and LWD cover (Rodrick and Milner, 1991). Water temperatures rising above a 7-day average maximum of 8°C (46°F) are reported to limit spawning and rearing success for this species (USFWS, 1998b; WDFW, 1998). Bull trout are particularly sensitive to sedimentation because of their relatively long incubation and development phase (Fraley and Shepard, 1989). The feeding habits of bull trout have been referred to as opportunistic and adaptive. Adults are primarily piscivorous, but will also consume eggs, insects, snails, and leeches. Juvenile bull trout consume primarily macroinvertebrates.

3.2.4 Occurrence

Bull trout have occasionally been documented in Lake Washington and its associated tributaries, but the presence of a self-sustaining population of native char is limited to the Cedar River drainage above the Lower Cedar Falls at RM 34.2, including Chester Morse lake. Within Lake Washington, documentation of bull trout is limited to one captured by an

angler in April 1981, three near the Cedar River Delta during 1984 and 1985, two in Issaquah Creek in 1993, as well as a few additional isolated observations (King County DNR, 2000). Stomach analyses indicated some of these bull trout were feeding on juvenile sockeye and smelt.

Bull trout have not been documented in Coal Creek, nor is suitable habitat present. In the Puget Sound region, the downstream limit of successful spawning always occurs upstream of the winter snowline (WDFW, 1998). The project area is at an approximate elevation of 180 feet above sea level (asl), and the headwaters are at an elevation of approximately 1,160 feet asl, which is below the winter snowline. Elevated stream temperatures and sediment deposition from past coal mining activities further negates the potential use of Coal Creek by bull trout. Stream temperatures reaching 73°F have been reported near the mouth of Coal Creek (Kerwin, 2001).

3.3 Puget Sound Steelhead

3.3.1 Federal Status

Puget Sound steelhead are listed as a threatened species in Washington under the ESA. The NMFS is the lead regulatory agency for this listing under the ESA. The final rule for the Puget Sound steelhead listing was published on May 11, 2007 (50 CFR Part 223, Volume 72, No. 91).

3.3.2 Critical Habitat

The NMFS is currently reviewing critical habitat listing actions for steelhead trout. At this time, critical habitat for Puget Sound steelhead trout is neither designated nor proposed.

3.3.3 Habitat Requirements

Steelhead occur in two forms: the anadromous steelhead and the resident rainbow trout. The life histories of steelhead can vary considerably. Adult steelhead trout are divided into two races, depending on the time of year they enter freshwater: summer-run and winter-run. Winter-run steelhead are native to the Lake Washington Basin, while summer-run are not known to be present. Numerous plants of hatchery stocks have occurred. Wild steelhead in the Lake Washington Basin generally run from mid-December to mid-May and spawn from early March to mid-June (WDFW and WWTT, 1994). After emergence from the gravel, steelhead fry are heavily dependent upon streamside vegetation and submerged cover for protection from predators. Juveniles spend 1 to 4 years in fresh water before migrating to sea. The outmigration generally occurs in the spring (April through June); most spend up to 4 years maturing in the ocean before returning to their natal stream. Some return early and return as jacks, and some survive to spawn multiple times.

3.3.4 Occurrence

Steelhead trout have been documented in the mainstem and in a few tributaries of Coal Creek (Newcastle and 08-0273) (Tetra Tech/KCM 2005). Data from various electrofishing surveys conducted from 1996 through 2003 resulted in the capture of 572 “rainbow” trout, and 33 “trout” less than 80 millimeters (mm) (City of Bellevue unpublished data, 2007). Note that it is impossible to tell the difference between juvenile rainbow trout that are adfluvial (lake rearing) and juvenile steelhead trout that are anadromous (saltwater rearing).

Based on a review of steelhead trout juvenile and adult life-history data, it is assumed that juvenile steelhead trout could be present in the project area during construction activities. This conclusion is based on the extended freshwater rearing exhibited by this species.

3.4 Description of Species

3.4.1 Puget Sound Chinook

Chinook salmon are easily distinguished from other *Oncorhynchus* species by their large size. Adults weighing over 120 pounds have been caught in North American waters. Chinook salmon are very similar to coho salmon in appearance while at sea (blue-green back with silver flanks), except for their large size, small black spots on both lobes of the tail, and black pigment along the base of the teeth. Chinook salmon are anadromous and semelparous. This means that as adults, they migrate from a marine environment into the freshwater streams and rivers of their birth (anadromous) where they spawn and die (semelparous). Adult female Chinook will prepare a spawning bed, called a redd, in a stream area with suitable gravel composition, water depth, and velocity. Redds will vary widely in size and in location within the stream or river. The adult female Chinook may deposit eggs in four to five "nesting pockets" within a single redd. After laying eggs in a redd, adult Chinook will guard the redd from 4 to 25 days before dying. Chinook salmon eggs will hatch, depending upon water temperatures, between 90 to 150 days after deposition. Stream flow, gravel quality, and silt load all significantly influence the survival of developing Chinook salmon eggs. Juvenile Chinook may spend from 3 months to 2 years in fresh water after emergence and before migrating to estuarine areas as smolts, and then into the ocean to feed and mature.

Among Chinook salmon, two distinct races have evolved. One race, described as a "stream-type" Chinook, is found most commonly in headwater streams. Stream-type Chinook salmon have a longer freshwater residency and perform extensive offshore migrations before returning to their natal streams in the spring or summer months. The second race is called the "ocean-type" Chinook, which is commonly found in coastal steams in North America. Ocean-type Chinook typically migrate to sea within the first 3 months after emergence, but they may spend up to a year in freshwater prior to emigration. They also spend their ocean life in coastal waters. Ocean-type Chinook salmon return to their natal streams or rivers as spring, winter, fall, summer, and late-fall runs, but summer and fall runs predominate. The difference between these life-history types is also physical, with both genetic and morphological foundations.

Juvenile stream- and ocean-type Chinook salmon have adapted to different ecological niches. Ocean-type Chinook salmon tend to utilize estuaries and coastal areas more extensively for juvenile rearing. The brackish water areas in estuaries also moderate physiological stress during parr-smolt transition. The development of the ocean-type life history strategy may have been a response to the limited carrying capacity of smaller stream systems and glacially scoured, unproductive, watersheds, or a means of avoiding the impact of seasonal floods in the lower portion of many watersheds.

Stream-type juveniles are much more dependent on freshwater stream ecosystems because of their extended residence in these areas. A stream-type life history may be adapted to those watersheds, or parts of watersheds, that are more consistently productive and less

susceptible to dramatic changes in water flow or which have environmental conditions that would severely limit the success of sub-yearling smolts. At the time of saltwater entry, stream-type (yearling) smolts are much larger, averaging 73 to 134 mm depending on the river system, than their ocean-type (sub-yearling) counterparts and are, therefore, able to move offshore relatively quickly.

Coastwide, Chinook salmon remain at sea for 1 to 6 years (more commonly 2 to 4 years), with the exception of a small proportion of yearling males, called "jacks," which mature in fresh water or return after only 1year in salt water. Ocean- and steam-type Chinook salmon are recovered differentially in coastal and mid-ocean fisheries, indicating divergent migratory routes. Ocean-type Chinook salmon tend to migrate along the coast, while stream-type Chinook salmon are found far from the coast in the central North Pacific. Differences in the ocean distribution of specific stocks may be indicative of resource partitioning and may be important to the success of the species as a whole.

There is a significant genetic influence to the freshwater component of the returning adult migratory process. A number of studies show that Chinook salmon return to their natal streams with a high degree of fidelity. Salmon may have evolved this trait as a method of ensuring an adequate incubation and rearing habitat. It also provides a mechanism for reproductive isolation and local adaptation. Conversely, returning to a stream other than that of one's origin is important in colonizing new areas and responding to unfavorable or perturbed conditions at the natal stream.

Chinook salmon stocks exhibit considerable variability in size and age of maturation, and at least some portion of this variation is genetically determined. The relationship between size and length of migration may also reflect the earlier timing of river entry and the cessation of feeding for Chinook salmon stocks that migrate to the upper reaches of river systems. Body size, which is correlated with age, may be an important factor in migration and redd construction success. Under high density conditions on the spawning ground, natural selection may produce stocks with exceptionally large-sized returning adults.

Early researchers recorded the existence of different temporal "runs" or modes in the migration of Chinook salmon from the ocean to fresh water. Fresh water entry and spawning timing are believed to be related to local temperature and water flow regimes. Seasonal "runs" (that is, spring, summer, fall, or winter) have been identified on the basis of when adult Chinook salmon enter fresh water to begin their spawning migration. However, distinct runs also differ in the degree of maturation at the time of river entry, the thermal regime and flow characteristics of their spawning site, and their actual time of spawning. Egg deposition must occur at a time to ensure that fry emerge during the following spring when the river or estuary productivity is sufficient for juvenile survival and growth.

Pathogen resistance is another locally adapted trait. Chinook salmon from the Columbia River drainage were less susceptible to Ceratomyxa shasta, an endemic pathogen, than stocks from coastal rivers where the disease is not known to occur. Alaskan and Columbia River stocks of Chinook salmon exhibit different levels of susceptibility to the infectious hematopoietic necrosis virus (IHNV).

The preferred temperature range for Chinook salmon has been variously described as 12.2 to 13.9°C (Brett, 1952), 10 to 15.6°C (Burrows, 1963), or 13 to 18°C (Theurer et al., 1985).

Temperatures for optimal egg incubation are 5.0 to 14.4°C (Bell, 1986). The upper lethal temperature limit is 25.1°C (Brett, 1952), but may be lower depending on other water quality factors (Ebel et al., 1971). Variability in temperature tolerance between populations is likely due to selection for local conditions; however, there is little information on the genetic basis of this trait.

Dissolved oxygen concentrations of 5.0 milligrams per liter (mg/L) or greater are needed for successful egg development in redds for water temperatures between 4 to 14˚C (Reiser and Bjornn 1979, as cited in NMFS 1996). Freshwater juveniles avoid water with dissolved oxygen concentrations below 4.5 mg/L at 20°C (Whitmore et al., 1960). Migrating adults will pass through water with dissolved oxygen levels as low as 3.0 to 4.0 mg/L (Fujioka, 1970; Alabaster, 1988, 1989).

3.4.1.1 Status

The Puget Sound ESU of Chinook salmon was listed as threatened on March 24, 1999 (64 FR 14308).

3.4.1.2 Geographic Range and Spatial Distribution

The boundaries of this salmon ESU correspond with the Puget Lowland Ecoregion. This ESU encompasses all runs of Chinook salmon in the Puget Sound region from the North Fork Nooksack River to the Elwha River on the Olympic Peninsula. Chinook salmon in this area all exhibit an ocean-type life history. Although some spring-run Chinook salmon populations in the Puget Sound ESU have a high proportion of yearling smolt emigrants, the proportion varies substantially from year to year and appears to be environmentally mediated rather than genetically determined. Puget Sound stocks all tend to mature at ages 3 and 4 and exhibit similar, coastally-oriented, ocean migration patterns (Meyers et al., 1998).

3.4.1.3 Historical Information

Chinook salmon were abundant in Washington State near the turn of the century, when estimates based on peak cannery pack suggested peak runs of near one million fish in the Oregon Coast, Washington Coast, and Puget Sound ESUs. However, Chinook salmon in this region have been strongly affected by losses and alterations of freshwater habitat. Timber harvesting and associated road building have occurred throughout this region. Agriculture is also widespread in the lower portions of river basins and has resulted in widespread removal of riparian vegetation, rerouting of streams, degradation of streambanks, and summer water withdrawals. Urban development has substantially altered watershed hydrodynamics and affected stream channel structure in many parts of Puget Sound.

The peak recorded harvest landed in Puget Sound occurred in 1908, when 95,210 cases of canned Chinook salmon were packed. This corresponds to a run-size of approximately 690,000 Chinook salmon at a time when both ocean harvest and hatchery production were negligible. (This estimate, as with other historical estimates, needs to be viewed cautiously; Puget Sound cannery pack probably included a portion of fish landed at Puget Sound ports but originating in adjacent areas, and the estimates of exploitation rates used in run-size expansions are not based on precise data.) Recent mean spawning escapements totaling 71,000 correspond to a run entering Puget Sound of approximately 160,000 fish. Based on an

exploitation rate of one-third in intercepting ocean fisheries, the recent average potential run-size would be 240,000 Chinook salmon (USACE, 2000a).

3.4.1.4 Life History

Puget Sound Chinook salmon prefer to spawn and rear in the mainstem of rivers and larger streams (Williams et al., 1975; Healey, 1991). Although the incubation period is determined by water temperatures, fry typically hatch in about 8 weeks (Wydoski and Whitney, 1979; Healey, 1991). After emergence, Puget Sound juvenile Chinook salmon migrate to the marine environment during their first year.

Rearing and development to adulthood occurs primarily in estuarine and coastal waters (Meyers et al., 1998). The amount of time juvenile Chinook spend in estuarine areas depends upon their size at downstream migration and rate of growth. While residing in upper estuaries, juvenile prey mainly on benthic and epibenthic organisms, such as amphipods, mysids, and crustaceans. Juveniles typically move into deeper waters when they reach approximately 65 to 75 mm in fork length. As the juveniles grow and move to deeper waters with higher salinities, their main prey changes to pelagic organisms such as decapod larvae, larval and juvenile fish, drift insects, and euphausids (Simenstad et al., 1982).

3.4.1.5 Hatchery Influence

By 1908 there were state-run and federally-run Chinook hatcheries operating in this ESU. Transfers of Chinook salmon eggs to Puget Sound from other regions, especially the Lower Columbia River, were common practices of early hatcheries (Meyers et al., 1998). By the 1920s, several million Chinook salmon had been released into Puget Sound tributaries (Cobb, 1930). Recently, stock integrity and genetic diversity have become important objectives. New policies have been initiated to reduce the impact of hatchery fish on natural populations (WDF, 1991; WDF et al., 1993). The abundance of Chinook salmon in watersheds throughout this ESU has been closely related to hatchery efforts (Meyers et al., 1998).

WDFW classified 11 out of 29 stocks in this ESU as being sustained, in part, through artificial propagation. Nearly 2 billion fish have been released into Puget Sound tributaries since the 1950s. The vast majority of these have been derived from local returning fall-run adults. Returns to hatcheries have accounted for 57 percent of the total spawning escapement, although the hatchery contribution to spawner escapement is probably much higher than that, due to hatchery-derived strays on the spawning grounds (USACE, 2000a).

3.4.1.6 Population Trends and Risks

The abundance of Chinook salmon in this ESU has declined since historic levels. Widespread stream blockages have reduced available spawning habitat. Widespread release of hatchery fish from limited stocks has increased the risks of loss of genetic diversity and fitness to natural populations. In addition, the large numbers of hatchery releases masks natural population trends and makes it difficult to determine the sustainability of the natural populations. Forestry practices, farming, and urbanization have also blocked or degraded freshwater habitat (Meyers et al., 1998).

3.4.2 Puget Sound Steelhead

The steelhead is the anadromous form of the rainbow trout (O. mykiss), which occurs in two subspecies, *O. mykiss irideus* and *O. mykiss gaidneri*. Whereas stream-resident rainbow trout may complete their life cycle in a limited area of a small stream and attain a length of only 8 inches or so, steelhead may spend half their lives at sea, roaming for thousands of miles in the north Pacific Ocean. Steelhead return to spawn at sizes ranging from about 24 inches and 5 pounds to about 36 to 40 inches or more and 20 pounds or more (Behnke, 2002).

Biologically, steelhead can be divided into two reproductive ecotypes, based on their state of sexual maturity at the time of river entry. These two ecotypes are termed "stream-maturing" and "ocean-maturing." Stream-maturing steelhead enter fresh water in a sexually immature condition and require from several months to a year to mature and spawn. These fish are often referred to as "summer-run" steelhead. Ocean-maturing steelhead enter fresh water with well-developed gonads and spawn shortly after river entry. These fish are commonly referred to as "winter-run" steelhead. In the Columbia River basin, essentially all steelhead that return to streams east of the Cascade Mountains are stream-maturing. Ocean-maturing fish are the predominate ecotype in coastal streams and lower Columbia River tributaries (USACE, 2000b).

All but one of the O. m. gairdneri steelhead populations migrating east of the Cascade Range are characterized as summer-run steelhead (entering the Columbia River from May into the early fall in October); the one exception is a winter-run steelhead spawning in Fifteenmile Creek, which drains the eastern side of the Cascades in Oregon. The genetic traits of Fifteenmile Creek steelhead make it intermediate between the subspecies irideus and gairdneri. Steelhead of the subspecies irideus are mainly winter-run fish, but *irideus* also includes summer runs. Considering the entire range of irideus from California to Alaska, steelhead can be found entering one river or another in every month of the year (Behnke, 2002).

Native steelhead in California generally spawn earlier than those to the north with spawning beginning in December. Washington populations begin spawning in February or March. Native steelhead spawning in Oregon and Idaho is not well documented. In the Clackamas River in Oregon, winter-run steelhead spawning begins in April and continues into June. In the Washougal River, Washington, summer-run steelhead spawn from March into June, whereas summer-run fish in the Kalama River, Washington, spawn from January through April. Among inland steelhead, Columbia River populations from tributaries upstream of the Yakima River spawn later than most downstream populations.

Depending on water temperature, fertilized steelhead eggs may incubate in redds for 1.5 to 4 months before hatching as "alevins." Following yolk sac absorption, young juveniles or "fry" emerge from the gravel and begin active feeding. Juveniles rear in fresh water for 1 to 4 years, then migrate to the ocean as smolts. Downstream migration of wild steelhead smolts in the lower Columbia River begins in April, peaks in mid-May, and is essentially complete by the end of June (USACE, 2000b). Previous studies of the timing and duration of steelhead downstream migration indicate that they typically move quickly through the lower Columbia River estuary with an average daily movement of about 21 kilometers (USACE, 2000b).

Juvenile steelhead generally spend 2 years in freshwater before smolting and migrating to the ocean at lengths of about 6 to 8 inches. After about 15 to 30 months of ocean life, most steelhead return to their natal rivers to spawn. Unlike Pacific salmon, steelhead do not all die soon after spawning, but the rate of survival to repeat spawning is generally low—about 10 percent (Behnke, 2002).

3.4.3 Coastal-Puget Sound Bull Trout

The bull trout is a member of the char family (*Salvelinus*) and is represented by different life history forms, including river-resident populations, lacustrine populations, and sea-run populations. The latter appear to be relatively rare (Behnke, 2002).

The stream-resident form is subdivided into two basic types: one lives its entire life in small headwater streams, often isolated above waterfalls; the other typically spawns in smaller tributary streams but spends most of its time foraging in larger rivers. This second form, often called "fluvial," occurs only in relatively larger river basins that contain a network of headwater spawning tributaries connected to larger riverine habitat, allowing bull trout to undertake movements of more than 100 miles (Behnke, 2002).

The northernmost distribution of bull trout occurs in the headwaters of the Yukon and Mackenzie River basins of Alaska and Canada. In Pacific Coast drainages, they occur in rivers of British Columbia southward to around Puget Sound. Bull trout are not native to Vancouver Island or other islands off the Pacific Coast of and Canada and southern Alaska. Native distribution includes the upper parts of the North and South Saskatchewan River drainages of Alberta, Canada (Behnke, 2002).

To the south, a few bull trout populations persist in cold headwater tributary streams in the Upper Klamath Lake basin of Oregon. The southernmost population of bull trout once occurred in the McCloud River of California. However, those bull trout declined rapidly in the 1940s after construction of Shasta Dam (Behnke, 2002).

The Coastal–Puget Sound Distinct Population Segment (DPS) bull trout was listed as a federal threatened species by USFWS on June November 1, 1999 (Federal Register, 1999). The territory of the Coastal-Puget Sound DPS bull trout encompasses all Pacific Coast drainages within Washington, including Puget Sound. This population segment is discrete because the Pacific Ocean and the crest of the Cascade Mountain Range geographically segregate it from other subpopulations. The Coastal–Puget Sound DPS is significant to the species as a whole because it is thought to contain the only anadromous (technically amphidromous) forms of bull trout in the contiguous United States, thereby occurring in a unique ecological setting.

4.0 Environmental Baseline

4.1 Aquatic and Riparian Zone Condition

Coal Creek is a perennial stream that starts at an elevation of approximately 1,150 feet on the south and west sides of Cougar Mountain. It flows generally northwest for approximately 7.0 miles, draining into lake Washington at Newport Shores in the City of Bellevue. The average annual flow is 13.4 cfs (Appendix D). The low summer flow rate is approximately 1.8 cfs. The bankfull flow rate (2-year) was estimated to be approximately 208 cfs, and the 100-year flow was estimated to be approximately 529 cfs. The gradient is approximately 2.6 percent in the vicinity of the proposed project. The bankfull width was determined to be 24.8 feet just downstream of the proposed project.

The following description of habitat is based on two stream surveys, one performed by David Evans and Associates in 2009 and one performed by the Watershed Company in 1997. Both surveys were conducted in the reach between the I-405 crossing and the proposed project and are considered to be representative of the action area of this project.

In the 2009 survey, the survey reach was 662 feet long. Habitat included 341 linear feet of riffles and 321 linear feet of pools, or approximately a 50:50 ratio. Although pools were abundant, they tended to be relatively shallow with a residual depth ranging from 0.5 to 2.1 feet deep (mean = 1.2 feet). Several of the pools in the lower reach were created by rootwads imbedded in the large (2-man) riprap/boulder bank armoring or fallen boulders. The left bank (facing upstream) was armored for approximately 186 linear feet. The bankfull width (BFW) of riffles ranged from 22 to 40 feet. Approximately 61 pieces of wood were recorded in the survey reach, which included stumps and logs installed for bank protection or mitigation. The predominance of the pieces of wood were relatively small and deciduous, with only three being large enough to have been counted if strictly adhering to the U.S. Forest Service protocol in which small wood is defined as being greater than 12 inches at a length of 25 feet from the large end. Based on the results of two wolman pebble counts, the substrate in the project area was dominated by coarse (D50 = 17.9 mm) to very coarse (D50 = 41.6 mm) gravels. Fines less than 6 mm ranged from 26 to 37 percent. Most of the surface fines were along the stream edges where they settle out during flood events.

Onsite streamside vegetation is generally native and provides shade. The overall dominant riparian tree is red alder (*Alnus rubra*), followed by big-leaf maple (*Acer macrophylum*) intermixed with a few mature Douglas fir (*Pseudotsuga menziesii*) and black cottonwood (*Populus balsamifera*). There are a few small western red cedar (*Thuja plicata*) and bitter cherry (*Prunus emarginata*) trees present. Dominant shrubs include vine maple (*Acer circinatum*), salmonberry (*Rubus specabilis*), and a lesser amount of red-osier dogwood (*Cornus sericea*) and beaked hazelnut (*Corylus cornuta*). Reed canarygrass (*Phalaris arundacea*) and Himalayan blackberry (*Rubus armeniacus*) was common. Other species noted along or near the stream channel during the survey included devil's club (*Oplopanax horridus*), bracken fern (*Pteridium aquilinum*), lady fern (*Athyrium filix-femina*), sword fern (*Polystichum munitum*), creeping buttercup (*Ranunculus repens*), Pacific bleeding heart (*Dicentra formosa*), field

horsetail (*Equisetum arve*nse), giant horsetail (*Equisetum telmateia*), and stinging nettle (*Urtica dioica*).

Habitat conditions in Coal Creek are variable, but typical of most urbanized streams in that habitat conditions have been degraded. According to Kerwin (2001), the primary limiting factors affecting Coal Creek include increased sedimentation, loss of channel complexity, degraded riparian conditions, altered hydrology, and poor water quality.

Increased sedimentation is the result of streambank erosion and the occasional catastrophic failure of old coal mine tailings along the steep slopes above the creek (Kerwin, 2001). The large sediment load degrades spawning habitat by increasing the amount of fines and thereby decreasing the egg-to-fry ratio, increases flooding in depositional areas by reducing channel capacity, and has created a large delta at the mouth at Lake Washington.

The loss of channel complexity is the result of numerous factors, but includes manipulation of the channel between the mouth and I-405, and lack of LWD. The lowermost reach of Coal Creek was adversely impacted by the development of Newport Shores and surrounding area by diverting the channel, excavation of canals, channelization, and bank armoring. LWD is apparently absent in the lower reach, but increased to 1.8 and 1.1 pieces per channel width in the middle and upper reaches (City of Bellevue unpublished data, 2007; Kerwin, 2001). The City of Bellevue added approximately 450 pieces of LWD in the middle reach during 2006.

Degraded riparian conditions are most pronounced along the lower reach downstream of I-405. Although the middle and upper reaches do contain large forested areas, these reaches are dominated by deciduous species that became established after logging and the extensive coal mining activities ceased. Historically, mature coniferous forest would have been the dominant component of the riparian zone and would have contributed LWD to this stream system.

Altered hydrology is due to stormwater runoff from impervious areas as well as past mining activities. Previous studies have reported that base flows in Coal Creek are higher than expected due to augmentation from mine tunnels.

4.2 Fisheries Resources

Fisheries resources in Coal Creek include anadromous and resident species. The WDFW–Priority Habitats and Species (PHS) data obtained for this project reported that fall Chinook salmon , coho salmon (*O. kisutch*), sockeye salmon (*O. nerka*), winter steelhead , and resident cutthroat trout (*O. clarki*) utilize Coal Creek (WDFW, 2011). Based on a review of WDFW salmon spawning survey data, limited numbers of coho salmon have been observed in Coal Creek. This data includes 45 surveys conducted between 1976 and 2002. During this time period, a total of 246 salmon were observed, composed of 243 coho salmon and 3 sockeye salmon. The highest daily count was on January 5, 1978, when 52 coho salmon were observed between RM 2.0 and 3.3. These surveys apparently focused on documenting coho salmon since most occurred from November through January. Small numbers of Chinook salmon have also been observed in Coal Creek. Six Chinook salmon were observed spawning near RM 0.6 during October and November of 2004 (Tetra Tech/KCM, 2005). Steelhead have been documented in both the mainstem and in a few tributaries (Newcastle

and 08-0273). Other non-salmonids observed in Coal Creek include sculpin (*Cottus* sp.), largescale sucker (*Catostomus macrocheilus*), and lamprey (*Lampetra* sp.). Data from the City of Bellevue from various electrofishing surveys conducted from 1996 through 2003 resulted in the capture of 517 cutthroat trout, 572 rainbow trout, 33 trout less than 80 mm, 625 coho salmon, 340 sculpin (species not reported), and 32 lamprey (species not reported). All known fish presence data is summarized in Table 2.

TABLE 2
Coal Creek Fish Use Summary

#	Common Name	Comment
1.	Chinook Salmon	Species of Local Importance per city code (20.25H.150) and federally listed as threatened.
2.	Coho Salmon	Species of Local Importance per city code (20.25H.150).
3.	Sockeye Salmon	Three observed during WDFW salmon spawning surveys.
4.	Steelhead Trout	Federally listed as threatened. Juvenile “trout” were abundant based on data from various electrofishing surveys conducted from 1996 through 2003.
5.	Cutthroat Trout	Abundant based on data from various electrofishing surveys conducted from 1996 through 2003.
6.	Largescale Sucker	Observed at downstream in-line site during site visits.
7.	Sculpin	Probably the most abundant non-salmonid.
8.	Lamprey	Probably western brook lamprey (*Lampetra richardsoni*).

Other native species that could potentially utilize Coal Creek include three-spine stickleback (*Gasterosteus aculeatus*), chum salmon , kokanee (*O. nerka*), peamouth (*Mylocheilus caurinus*), long-fin smelt (*Spirinchus thaleichthys*), and speckled dace (*Rhinichthys osculus*). Lampreys have been documented in Coal Creek, but which species of lamprey was not documented. Western brook lampreys are most common locally, but river lampreys (*L. ayresi*) have also been documented in Lake Washington. Lastly, species information on sculpins in Coal Creek was also not included in electrofishing data obtained from the City of Bellevue for inclusion in this report. Several different species of sculpin have been documented in the Lake Washington Basin.

4.3 Water Quality

Water quality in Coal Creek has been studied by various agencies. Based on a review of King County data from 1990 through 1993 collected at station number 0442 (located downstream of the project area), water quality parameters are highly variable. The maximum stream temperature was 62°F during the month of August (King County, 1994). Monthly minimum/maximum stream temperatures are as follows: January = 34 to 46°F, February = 32 to 50°F, March = 43 to 51°F, April = 43 to 46°F, May = 51 to 54°F, June = 53 to 57°F, July = 57 to 59°F, August = 51 to 62°F, September = 49 to 55°F, October = 50 to 55°F, November = 50 to 52°F, and December = 39 to 43°F. Stream temperatures reaching 73°F have been reported near the mouth of Coal Creek (Kerwin, 2001). Turbidity readings are

relatively high in Coal Creek compared to other streams in the Lake Washington Basin, with the maximum reading being 129.0 nephelometric turbidity units (NTUs). Elevated conductivity readings have also been documented in Coal Creek. Biotic Index Ratings from 1991 and 1992 both resulted in a fair rating (King County, 1994).

King County Water and Land Resources Division (KCWLRD) maintains updated water quality data on their webpage for Site 0442. Temperature ranged from a low of 6.0°C (42.8°F) on February 6, 2008, to a high of 16.5° C (61.7° F) on July 9, 2008. Turbidity ranged from a low of 1.90 NTU on April 9, 2008, to a high of 109 NTU on August 20, 2008.

Coal Creek is designated as "Core Summer Salmonid Habitat" for aquatic life use and "Primary Contact" for recreational use. The lower portion of Coal Creek has been assigned an additional "Supplemental Spawning and Incubation Protection" temperature criteria of 13° C (55.4° F) that is applied from September 15th to May 15th. Based on a review of the KCWLRD web data for 2007/2008, this criteria was met, but temperature measurements above this criteria were reported during early September (15.3 ^{o}C on September 5, 2007). Note that the criterion was not meet during several months in the early 1990s based on King County data (King County, 1994).

The final 2004 Water Quality Assessment – Category 5 Listing for Coal Creek includes one listing for fecal coliform (Ecology, 2005). The 2008 Ecology 303(d) list, which was approved by the U.S. Environmental Protection Agency (EPA) on January 29, 2009, included five listings. Table 3 summarizes water quality data in Coal Creek and includes the parameter tested, category, and station.

TABLE 3
Coal Creek 2008 Water Quality Assessment

Parameter	Category	Station
Ammonia - N	1	Station 442@ RM 0.8 0 excursions out of 39 samples.
Temperature	2	Station 442 @ RM 0.8, criterion exceeded in 2002.
pH	2	Station 442 @ RM 0.8 a few excursions but limited data.
Dissolved Oxygen	5	Station 442 @ RM 0.8 at least 10 percent excursions.
Fecal Coliform	5	Station 442 @ RM 0.8 standards not met 1998 - 2002.

4.4 Habitat Summary

Existing stream and watershed conditions were quantified by using watershed and habitat parameters as defined by the "Matrix of Pathways and Indicators" developed by National Oceanic and Atmospheric Administration (NOAA) Fisheries. The "Matrix of Pathways and Indicators" summarizes important parameters for six major pathways, including:

1. Water Quality
2. Habitat Access
3. Habitat Elements
4. Channel Condition and Dynamics

5. Flow/Hydrology
6. Watershed Conditions

These six major pathways are further broken down into a total of 18 indicators. As an example, the water quality pathway is composed of three indicators: temperature, sediment/turbidity, and chemical contamination/nutrients. The indicator conditions are classified as either "properly functioning," "at risk," or "not properly functioning." Criteria for each condition are defined by a range or goal based on the best scientific data available, but criteria are not absolute, and may be adjusted for unique watersheds (NOAA Fisheries, 1996).

The USFWS utilizes two additional pathways that specifically address bull trout, including subpopulation characteristics and integration of species and habitat conditions (USFWS, 1998b). The subpopulation characteristic pathway is composed of four indictors including subpopulation size, growth and survival, life history diversity and isolation, and persistence and genetic integrity. Table 4 summarizes the baseline conditions based on NOAA Fisheries and USFWS criteria.

TABLE 4
Matrix of Pathways and Indicators Summary

Pathway	Indicators	Baseline Conditions
Water Quality	Temperature	Not Properly Functioning
	Sediment	Not Properly Functioning
	Chemical Contamination & Nutrients	Functioning at Risk
Habitat Access	Physical Barriers	Functioning at Risk
Habitat Elements	Substrate	Functioning at Risk
	LWD	Not Properly Functioning
	Pool Frequency	Not Properly Functioning
	Pool Quality/Depth	Not Properly Functioning
	Off-Channel Habitat	Not Properly Functioning
	Refugia	Not Properly Functioning
Channel Conditions and Dynamics	Width/Depth Ratio	Not Properly Functioning
	Streambank Condition	Functioning at Risk
	Floodplain Connectivity	Functioning at Risk
Flow/Hydrology	Change in Peak/Base Flows	Not Properly Functioning
	Increase in Drainage Network	Functioning at Risk
Watershed Conditions	Road Density and Location	Functioning at Risk
	Disturbance History	Functioning at Risk
	Riparian Reserve/Conservation Areas	Functioning at Risk

TABLE 4
Matrix of Pathways and Indicators Summary

Pathway	Indicators	Baseline Conditions
Subpopulation Characteristics (bull trout)	Subpopulation Size	Not Properly Functioning
	Growth and Survival	Not Properly Functioning
	Life History Diversity and Isolation	Not Properly Functioning
	Persistence and Genetic Integrity	Not Properly Functioning
Species and Habitat	Species Integration/Habitat Conditions	Not Properly Functioning

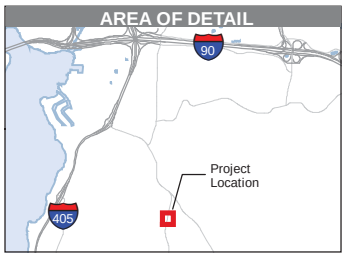
4.5 Wetlands

4.5.1 Wetland 1

Wetland 1 is a palustrine emergent wetland (PEM) that is situated in a depression north of Coal Creek on the east side of Coal Creek Parkway (Figure 5). This wetland is dominated by reed canary grass (*Phalaris arundinacea*). This wetland extends partially up a slope within the right-of-way for a power line. A seep in the slope above the wetland contributes to the hydrology . The water flows from this seep and then sits in the wetland depression. There is a 24-inch culvert along the southern edge of this wetland. The culvert drains this wetland to another wetland (outside the project area) on the other side of a berm that was created as part of the trail system into Coal Creek Park. Wetland 1 is approximately 0.07 acre in size and about 90 percent of the wetland occurs in the project area.

4.5.2 Wetland 2

Wetland 2 is a palustrine emergent wetland situated on a slope and a depression on the south side of Coal Creek west of Coal Creek Parkway . This wetland is dominated by reed canary grass and mowed grasses on the slope portion and watercress (*Nasturtium aquaticum*) and bare ground in the depressional portion of the wetland. At least two seeps exist on the western slope surrounding this wetland and contribute to its hydrology. Wetland 2 is approximately 0.38 acre. Only about 25 percent of this wetland occurs within the project area.



Sample Point
Open Stream
Seep
Culvert on Coal Creek
Wetland 1
Wetland 2

N
0 50 100 Feet

Source: Aerial (2009) Aerials Express; Streams (2006) Bellevue; Streets (2005) King County; Wetland Data (2011) CH2M HILL. Horizontal datum for all layers is NAD83(91), vertical datum for layers is

Figure 5. **Wetlands**

Coal Creek Culvert Replacement

5.0 Effects Analysis

The proposed project will remove a 105-foot-long CMP culvert and replace it with a wider bottomless culvert. It will install two engineered log jams and 4 three-log bank protection structures; and replace or install three log weirs for a total of 49 pieces of LWD. The project will temporarily remove and replace 26 trees and temporarily clear 0.27 acres of riparian habitat. There will be in-water and near-water earth work. There will be no wetland impacts. Approximately 0.14 acres (190 linear feet) of stream channel (including the culvert) will be affected.

5.1 Effects to Salmonid Baseline Habitat Conditions

Based on project location and construction related activities, as well as proposed mitigation measures, project effects to baseline habitat conditions would be variable over time. The implementation of the proposed minimization measures will further reduce potential impacts to listed species and their habitat. The following salmonid effects matrix has been developed to summarize potential project-related direct and indirect effects to baseline conditions (Table 5).

TABLE 5
Salmonid Habitat Effects Matrix

Pathways	Indicators	Effects to Baseline Conditions
Water Quality	Temperature	Maintain. Some vegetation will be cleared for access and replanted, but temperature effects will likely to be unmeasurable.
	Sediment	Maintain/Degrade. There will be a brief pulse of suspended sediment released when the work area is reconnected to flow.
	Chemical Contamination and Nutrients	Maintain. The project does not affect this factor.
Habitat Access	Physical Barriers	Improve. The existing culvert is a partial barrier. The new culvert will not be.
Habitat Elements	Substrate	Improve. The new channel will have natural substrate. The existing culvert has a bare steel bottom.
	LWD	Improve. 49 pieces of LWD will be added to the channel.
	Pool Frequency	Maintain. No change.
	Pool Quality	Maintain. No change.
	Off-Channel Habitat	Maintain. No change.
	Refugia	Maintain. No change.
Channel Conditions and Dynamics	Width/Depth Ratio	Improve. The culvert will be wide enough for the stream to cut an appropriate channel.

TABLE 5
Salmonid Habitat Effects Matrix

Pathways	Indicators	Effects to Baseline Conditions
	Streambank Condition	Improve. The LWD will improve the stability of the associated banks. The alteration of the angle of weir # 1 should take erosion pressure off the left bank just below the weir.
	Floodplain Connectivity	Improve. The new channel will have a floodplain whereas the culvert does not.
Flow/Hydrology	Change in Peak/Base Flows	Maintain. No change.
	Increase in Drainage network	Maintain. No change.
Watershed Conditions	Road Density and Location	Maintain. No change.
	Disturbance History	Maintain. The disturbance will be a one-time event.
	Riparian Reserve	Maintain/Degrade. There will be a temporal loss of riparian function, but riparian restoration will result in an increase in tree number and an increase in conifers.
Bull Trout Subpopulation Characteristics within Subpopulation Watersheds	Subpopulation Size	Maintain. This factor will be unaffected.
	Growth and Survival	Maintain. If there is a change it will be slightly positive as salmonid production may increase slightly with improved fish passage.
	Life History Diversity and Isolation	Maintain. This factor will be unaffected.
	Persistence and Genetic Integrity	Maintain. This factor will be unaffected.
	Species Integration/Habitat Conditions	Maintain. This factor will be unaffected.

Based on the anticipated effects to baseline conditions summarized above, most (15) indicators will be maintained including temperature, chemical contamination and nutrients, pool frequency, pool quality, off-channel habitat, refugia, change in peak/base flows, increase in drainage network, road density and location, disturbance history, as well as all bull trout subpopulation characteristics.

Indicators that are anticipated to improve include physical barriers, substrate, width/depth ratio, streambank stability, and floodplain connectivity. Indicators that could be degraded are limited to sediment . One indicator, riparian reserve, may be initially degraded but shift to maintain after construction.

Because the project proposes to clear existing riparian vegetation and is conducting in-water work, the primary potential impacts to listed salmonids include turbidity and sedimentation impacts, and impacts associated with fish salvage activities. This assumes listed salmonids are present in the action area during construction.

5.2 Turbidity and Sedimentation Impacts

Vegetation clearing will result in exposed soils throughout the project area. Diverting flow around areas where in-water work is proposed (inlet and outlet) during construction could result in an initial flush of suspended material, temporarily increasing turbidity and sedimentation. Additional pulses of sediment could occur following the first major storm event. However, measures to reduce turbidity have been included in the design. A stream flow bypass system will be in place to dewater the work area. BMPs will be in place to minimize exposed soils in the adjacent uplands from entering Coal Creek.

Chinook salmon and steelhead trout spawning will not be impacted by the project because they will be absent during construction. Furthermore, juvenile Chinook salmon will not be in the action area during construction. However, juvenile steelhead trout could be present during construction. Juvenile steelhead trout may be exposed to increased sediment and turbidity for short periods of time. Impacts resulting from this exposure include avoidance of the area, reduced feeding opportunity and efficiency, delayed migration, stress, and gill trauma. However, very few (if any) juvenile steelhead trout are likely to be present in the action area during construction.

5.3 Chinook Salmon Impacts

The following analysis is based on considering life-history stages of Chinook salmon in relationship to their use of Coal Creek.

Upstream migration of adults: Upstream migrants are anticipated to be present in Coal Creek during the months of October and November. Because the proposed culvert replacement will occur in the summer, before the spawning migration starts, the two activities are temporally separated. In addition, the proposed project is located well upstream of where Chinook salmon have been previously documented, but that is not conclusive evidence that they only utilize the lower reach.

Spawning: Construction of the culvert will add riffle habitat to Coal Creek, but this habitat is not likely to be used for spawning. The reason is that spawning habitat is not limiting to them, and there is no particular attraction to salmon spawning from the generally dark conditions that will be present under the new culvert.

Rearing: Rearing includes downstream and upstream movement, short-term rearing in Coal Creek, predation, and availability of refugia and prey items (macroinvertebrates). Upstream and downstream migration of juvenile salmonids will not be impacted by the proposed project. Whereas the existing culvert is probably a barrier to upstream migration of juvenile, the culvert will not be. As previously noted, the primary potential impact to juvenile salmonids is injury or death during dewatering and fish salvage activities. However, it is highly unlikely juvenile Chinook salmon will be present in the action area during construction.

5.4 Steelhead Impacts

The impacts to steelhead, described in Section 5.1.2 for Chinook, would be similar. However, construction has the potential to impact juvenile steelhead trout more due to their extended rearing in fresh water. This is primarily due to dewatering activities that would require the capture and removal of any juveniles in the project area, should they be present during construction activities. A fish removal plan is presented in Appendix C that has been designed to minimize potential impacts to juvenile salmonids during construction. The implementation of BMPs, buffer mitigation, LWD, and additional plans (for example, dewatering plan and turbidity monitoring plan) will further reduce impacts to this species.

5.5 Bull Trout Impacts

No impacts to bull trout are anticipated due to their assumed absence and lack of suitable habitat in the action area.

5.6 Interrelated and Interdependent Actions

The only action that fits into this category is the relocation of the Olympic Pipeline Company's two petrochemical pipelines and Puget Sound Energy's natural gas pipeline. The Olympic pipeline segments crosses the creek, one under the inlet to the existing culvert and the other crossing the culvert in the roadway, will be cut off, cleaned, capped, and abandoned by the Olympic Pipeline Company after Phase 1 construction and prior to Phase 2 construction. No in-water work will be needed. The diversion points are far enough away from the channel so that a risk of spillage during the rerouting actions is low.

5.7 Cumulative Effects

A number of projects are likely to occur in the Coal Creek basin and may affect the action area. The list was narrowed from the project list posted on the City of Bellevue's website (Bellevue, 2011). Most are minor in nature such as:

- Coal Creek Culverts in the Coal Creek Natural Area
- Ongoing residential developments in the watershed

Others are more major such as:

- The annual maintenance dredging at the sedimentation pond just upstream of the proposed project

6.0 Determination of Effect

6.1 Puget Sound Chinook

The proposed project may affect, likely to adversely affect Puget Sound Chinook salmon. The project may affect Chinook salmon based on the following:

- Chinook salmon are present in the action area. Normally, fall Chinook smolts would be expected to leave the system prior to the work window. However residual individuals are possible.

The project is likely to adversely affect Puget Sound Chinook salmon based on the following:

- Juveniles may be captured during dewatering of the work area.
- Temporary sediment related impacts are possible to habitat below the project within the action area from the anticipated brief sediment pulse following the return of flow to the construction area.

6.2 Puget Sound Chinook Critical Habitat

The proposed project may affect, not likely to adversely affect Puget Sound Chinook critical habitat, specifically PCE 1,2 and 3 (spawning sites, freshwater rearing sites, freshwater migration corridors). The project may affect Chinook critical habitat based on the following:

- Some sediment may be released into the action area.
- Access to upstream habitat will be improved

The project is not likely to adversely affect Puget Sound Chinook critical habitat based on the following:

- Sediment related impact risks are low due to BMPs.
- Improved access to Puget Sound Chinook is beneficial.

6.3 Puget Sound Steelhead

The proposed project may affect, likely to adversely affect Puget Sound steelhead. The project may affect Puget Sound steelhead based on the following:

- Puget Sound steelhead are present in the action area.

The project is likely to adversely affect Puget Sound steelhead based on the following:

- Juveniles may be captured during dewatering of the work area.

- Temporary sediment related impacts are possible to habitat below the project within the action area from the anticipated brief sediment pulse following the return of flow to the construction area.

6.4 Coastal-Puget Sound Bull Trout

The proposed project may affect, not likely to adversely affect Coastal-Puget Sound bull trout. The project may affect Coastal-Puget Sound bull trout based on the following:

The proposed action may affect other salmonid species that bull trout forage on.

The project is not likely to adversely affect Coastal-Puget Sound bull trout based on the following:

- Sediment related impact risks are low and bull trout are not likely to use the action area.
- The overall effects of the project are likely to be beneficial to all salmonids from improvements to fish passage at the Coal Creek Parkway crossing, thus increasing the bull trout forage base.

6.5 Coastal-Puget Sound Bull Trout Critical Habitat

The proposed project may affect, not likely to adversely affect Coastal-Puget Sound bull trout critical habitat, specifically PCE 7 (abundant food base). The project may affect Coastal-Puget Sound bull trout based on the following:

- The proposed action may affect other salmonid species that bull trout forage on.

The project is not likely to adversely affect Coastal-Puget Sound bull trout critical habitat based on the following:

- The overall effects of the project are likely to be beneficial to all salmonids from improvements to fish passage at the Coal Creek Parkway crossing, thus increasing the bull trout forage base.

6.6 Effect on Tribal Resources

The proposed action is likely to result in greatly improved fish passage characteristics at the Coal Creek crossing with the new culvert. This could increase salmon production and thus improve tribal fisheries. Lake Washington and associated waterways are in the Usual and Accustomed fishing area for the Muckleshoot Indian Tribe.

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8.0 Essential Fish Habitat Assessment

8.1 Action Agency

U.S. Army Corps of Engineers

8.2 Project Name

Coal Creek Parkway Culvert Replacement Project

8.3 Essential Fish Habitat Background

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), requires federal agencies to consult with NMFS on activities that may adversely affect Essential Fish Habitat (EFH).

The objective of this EFH assessment is to describe potential adverse effects on designated EFH for federally-managed fisheries species within the proposed action area. It also describes conservation measures proposed to avoid, minimize, or otherwise offset potential adverse effects on designated EFH resulting from the proposed action.

8.4 Description of the Project/Proposed Activity

The project is described in the preceding BA. Elements relevant to this analysis are contained in Section 2 and the appendices. In brief, The City of Bellevue is planning to replace the existing culvert crossing of Coal Creek under Coal Creek Parkway in the City of Bellevue, Washington. The existing structure is a 9-foot-round CMP that is a partial barrier to salmon passage. It will be replaced with a 32-foot-wide culvert in accordance with a design in compliance with the WDFW manual for roadway culvert for fish passage (WDFW, 2003). A “simulated stream” option will be incorporated into the design. Design challenges include nearby overhead power lines, two major gasoline pipelines that pass under and over the existing culvert, a restrictive fish work window, and a high-traffic roadway (26,000 vehicles per day). The proposed design incorporates soldier pile abutment walls, a precast concrete lid, and a natural gravel streambed.

8.5 Potentially Affected Species

The species and life stages that may be affected are listed in Table 6. The project is inland so the only relevant species are Pacific salmon. Coal Creek supports Chinook, sockeye, and coho salmon. It does not support pink salmon.

TABLE 6
Species of Fishes and Life-Stages with Designated EFH in the Action Area
(Rocky and Non-Rocky Puget Sound Habitats, and Freshwater)

Common Name	Scientific Name	Eggs	Larvae	Juvenile	Adult	Spawning
Coho salmon	*Oncorhynchus kisutch*	X	X	X	X	X
Chinook salmon	*Oncorhynchus tshawytscha*	X	X	X	X	X
Pink salmon	*Oncorhynchus gorbuscha*					

8.6 Potential Adverse Effects of Proposed Project

8.6.1 Effects on Salmon EFH

The effects of the project on salmon habitat are described in the BA and are beneficial in nature.

8.6.2 Effects on Groundfish EFH

The project will have no effect on groundfish habitat.

8.6.3 Effects on Coastal Pelagics EFH

The project will have no effect on groundfish habitat.

8.7 EFH Conservation Measures

Conservation measures to reduce impacts to salmonid habitats are discussed in the conservation measures section of the BA (Section 5.5).

8.8 Conclusions

Salmon EFH: As stated in the BA, it is our conclusion that the proposed project Will Not Adversely Affect salmon EFH.

Groundfish EFH: The proposed project Will not Adversely Affect groundfish EFH.

Coastal Pelagic EFH: The proposed project Will Not Adversely Affect coastal pelagic species EFH.

APPENDIX A

Action Area Photographs

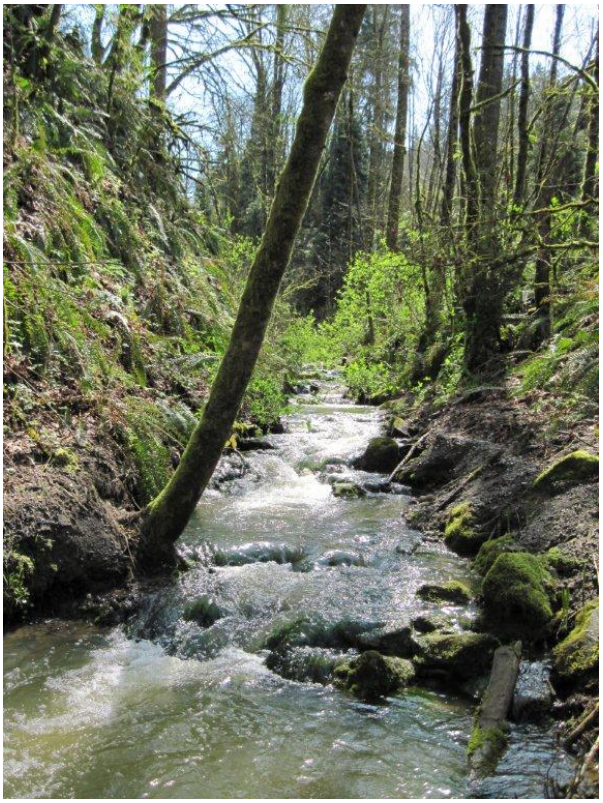
Upstream side of Coal Creek Parkway culvert. The concrete structure on the left is a flow attenuation device built by King County.

Concrete flow attenuation structure.

The reach immediately upstream of the culvert. The Newcastle tributary is visible at the very top of photo. Steps are log weirs.

The Newcastle tributary confluence.

The Coal Creek in-line sediment detention pond (full).



Newcastle tributary.

Upstream of sediment detention facility.

Outlet of culvert. Existing first and second log weirs to upper right. Note gravel bar and eddy pool to the left. Rip rap on left bank. The new rootwad revetment will be placed up against the large tree on left and extend down into the eddy pool.

The second, third, and fourth log weirs downstream of the culvert are visible.

Outlet of culvert showing right bank.

Gravel bar and eddy pool from right bank.

Fourth, fifth, and sixth log weirs downstream.

Outlet of culvert showing slope inside.

Right bank of culvert outlet pool. The rootwad revetment will be placed up against the large tree. Most of this rip rap will be removed and replaced with revetment construction.

Log weir six was flanked (on right of photo/left bank), then cut up and abandoned.

Site of potential seventh log weir downstream of bridge.

APPENDIX B

Project Design Drawing Details

***Included in Land Use Application packet**

APPENDIX C

Fish Salvage Plan

APPENDIX C

Fish Salvage Protocols and Standards

The following document is a revised version of the WSDOT standard protocol for fish removal at project requiring the dewatering and isolation of an in-channel work area.

Work below the Ordinary High-Water Mark (or Mean Higher High-Water Mark) shall, in general, be conducted in isolation from flowing waters. Exceptions to this general rule or performance measure include: 1) implementation of the work area isolation and fish capture and removal protocols described in this document; 2) placement or removal of small quantities of material (e.g., wood or rock), or installation of structural best management practices (e.g., turbidity curtain), under site conditions where potential exposures and effects to fish life are minimized without isolation from flowing waters; 3) work conducted under a declared emergency or under emergency conditions; or, 4) work conducted where flow conditions prevent safe implementation of work area isolation and fish capture and removal protocols.

Implementation of the work area isolation and fish capture and removal protocols shall be planned and directed by a qualified biologist, possessing all necessary knowledge, training, and experience (the directing biologist). All individuals participating in fish capture and removal operations shall have the training, knowledge, skills, and ability to ensure safe handling of fish and to ensure the safety of staff conducting the operations.

The directing biologist shall work with Maintenance, Construction, and/or Environmental staff (as appropriate) to plan the staging and sequence for work area isolation, fish capture and removal, and dewatering. This plan should consider the size and channel characteristics of the area to be isolated, the method(s) of dewatering (e.g., diversion with bypass flume or culvert; diversion with sandbag, sheet pile or similar cofferdam; etc.), and what sequence of activities will provide the best conditions for safe capture and removal of fish. Where the area to be isolated is small, depths are shallow, and conditions are conducive to fish capture, it may be possible to isolate the work area and remove all fish life prior to dewatering or flow diversion. Where the area to be isolated is large, depths are not shallow, where flow volumes or velocities are high, and/or conditions are not conducive to easy fish capture, it may be necessary to commence with dewatering or flow diversion staged in conjunction with fish capture and removal. The directing biologist shall use his/her best professional judgment in deciding what sequence of activities is likely to minimize exposure of fish to conditions causing stress or injury (including standing, exposure to extremes of temperature or reduced dissolved oxygen, risk of injury resulting from electrofishing, etc.).

The directing biologist shall plan work area isolation, fish capture and removal, and dewatering with consideration for the following: habitat connectivity and fish habitat requirements; the duration and extent of planned in-water work; anticipated flow and temperature conditions over the duration of planned in-water work; and, the risk of exposure to turbidity or other unfavorable conditions during construction. If the area to be isolated includes only a portion of the wetted channel width (e.g., large or deep rivers where diversion from the entirety of the wetted channel is difficult or impossible), or if the bypass

flume or culvert will effectively maintain connectivity and fish passage for the duration of construction activities, it may be less important whether fish are herded (and/or captured and released) upstream or downstream of the isolated work area. However, if the area to be isolated includes the entire wetted channel width, and especially if conditions make it unlikely that connectivity (i.e., upstream/ downstream fish passage) can be effectively maintained for the duration of construction activities, then the directing biologist should carefully consider whether to herd fish (and/or capture and release fish) upstream or downstream of the isolated work area.

If conditions upstream of the isolated work area will or may become unfavorable during construction, then fish should not be herded or released to an upstream location; this situation is probably most common where the waterbody in question is small, where seasonal flows are substantially diminished, and conditions of elevated temperature and/or reduced dissolved oxygen are foreseeable. However, the directing biologist shall also consider whether planned in-water work presents a significant risk of downstream turbidity and sedimentation; fish herded or released to a downstream location may be exposed to these conditions.

If large numbers of fish are to be herded (and/or captured and released), and in order to avoid overcrowding or concentrating fish in areas where their habitat needs cannot be met, it may be appropriate to relocate fish both upstream and downstream of the isolated work area. At locations where habitat connectivity or quality is poor, including along reaches upstream and/or downstream of the isolated work area, the directing biologist should carefully consider whether relocated fish can meet their minimum habitat requirements for the duration of planned in-water work. On rare occasions it may be appropriate to relocate fish at a greater distance upstream and/or downstream (e.g., thousands of feet or miles), so as to ensure fish are not concentrated in areas where their habitat needs cannot be met, or where they may be exposed to unfavorable conditions during construction. On those rare occasions where relocation to a greater distance is deemed necessary, the directing biologist shall provide notice to the agencies with jurisdiction in advance of the operations.

Safe implementation is a high priority. The directing biologist shall design and adjust the plan as necessary to ensure the safety of all individuals implementing the plan. Under some conditions it may be appropriate to conduct work without isolation from flowing waters, without placement of block nets, fish capture or removal; for a fuller discussion of this topic see page 1.

Work in or around water outside of daylight hours is not generally permissible. If, under unusual circumstances, the directing biologist identifies work that will or may be necessary outside of daylight hours, he/she shall coordinate and gain approval for this work with appropriate managers.

Work Area Isolation

The directing biologist shall determine appropriate locations for the placement of block nets, based on site characteristics and a consideration of the type and extent of planned in-water work. Sites that exhibit reduced flow volume or velocity, uniformity of depth, and good accessibility are preferred; sites with heavy vegetation, large cobble or boulders, undercut

banks, deep pools, etc. should be avoided due to the difficulty of securing and/or maintaining nets. Sites with a narrow channel cross-section ("constriction") should be avoided if foreseeable flow conditions might overwhelm or dislodge the block nets, posts, or anchors.

Except when planning and intending to herd fish upstream, an upstream block net shall be placed first. With a block net secured to prevent movement of fish into the work area from upstream, a second block net should be used as a seine to herd fish in a downstream direction. Where the area to be isolated includes a culvert(s), deep pools, undercut banks, or other cover attractive to fish (e.g., thick overhanging vegetation, rootwads, logjams, etc.) it may be appropriate to isolate a portion or portions of the work area, rather than attempting to herd fish from the entirety of the work area in a single downstream pass. Fish capture and removal will be most successful if an effort is made to strategically focus and concentrate fish in areas where they can be easily seined and netted. Care shall be taken not to concentrate fish where they are exposed to sources of stress, or to leave them concentrated in such areas for a long duration (e.g., more than 30 minutes).

Depending upon site characteristics, and the planned staging and sequence for work area isolation and dewatering, it may or may not be necessary to place a downstream block net. Typically, however, site characteristics and/or the duration of planned in-water work will necessitate placement of a net(s) to prevent movement of fish into the work area from downstream. If groundwater seepage or site drainage has a tendency to re-wet the area, if the area to be isolated is low-gradient or subject to a backwatering influence, or if the area to be isolated is large and considerable effort will be expended in capturing and removing fish life, a downstream block net should be placed. If foreseeable flow conditions over the duration of planned in-water work might enable fish to re-enter the work area from downstream, a downstream block net should be placed.

In most instances where gradual dewatering or flow diversion is staged in conjunction with fish capture and removal, it is appropriate to delay installation of the downstream block net(s) until after fish have been given sufficient time to move downstream by their own choosing. If flows are reduced gradually over the course of several hours, or the length of an entire workday, some (perhaps many) fish will make volitional movements downstream beyond the area to be isolated. Gradual dewatering can be an effective means by which to reduce the risk of fish stress or injury. Gradual dewatering and the encouragement of volitional movement are particularly important where the area to be isolated is large and may hold many fish. However, where the area to be isolated includes a culvert(s), deep pools, undercut banks, or other cover attractive to fish, some (perhaps many) fish will not choose to move downstream regardless of how gradually flows are reduced. The directing biologist should use his/her best professional judgment in deciding what sequence of activities is likely to minimize fish stress or injury (including stranding).

Where the area to be isolated is small, depths are shallow, and conditions are conducive to fish capture, it may be possible to remove all fish life prior to dewatering, or to implement plans for dewatering staged with fish capture over a relatively short timeframe (e.g., 1 to 2 hours). Where the area to be isolated is large, depths are not shallow, where flow volumes or velocities are high, and/or conditions are not conducive to easy fish capture, dewatering or flow diversion should be staged in conjunction with fish capture and removal over a longer timeframe (e.g., 3 to 6 hours). The large areas and/or most difficult site conditions

may warrant or require that plans for dewatering and fish capture proceed over the length of an entire workday, or multiple workdays. Where this is the case, fish shall be given sufficient time and a means to move downstream by their own choosing so as to reduce the total number of fish exposed to sources of stress and injury (including fish handling).

The directing biologist shall select suitable block nets. Type of material, length, and depth may vary based on site conditions. Typically block nets will be composed of 9.5-millimeter stretched nylon mesh and should be installed at an angle to the direction of flow (i.e., not directly perpendicular to flow) so as to reduce the risk of impinging fish. Anchor bags filled (or half-filled) with clean, washed gravel are preferred over sandbags, especially for nets and anchors that will or may remain in-place for a long duration (i.e., more than two weeks). Any use or movement of native substrates or other materials found on-site should be incidental and shall not appreciably affect channel bed or bank conditions.

Block nets shall remain in-place until work is complete and conditions are suitable for the reintroduction of fish[1]. Block nets require frequent inspection and debris removal. A qualified biologist, or other field staff trained in safe fish handling, shall be assigned the responsibility of inspecting the nets and safely capturing and relocating any impinged fish. The frequency of these inspections shall be determined on a case-by-case basis. However, block nets shall, at a minimum, be inspected for impinged fish (especially juvenile fish) at least three times daily for the first 48 hours after installation (approximate), and for the first 24 hours after significant rainfall (or change in flow volume or velocity). In the event fish are found impinged on the net(s), or if weather or flow conditions change significantly, the directing biologist shall re-consider and adjust the frequency of net inspections so as to minimize the risk of impinging and injuring fish.

Field staff shall be assigned the responsibility of frequently checking and maintaining the nets for accumulated debris, general stability, and proper function. The frequency of these inspections shall be determined on a case-by-case basis, dependent upon the site, seasonal, and weather conditions. Block nets must be secured along both banks and the channel bottom to prevent failure as a result of debris accumulation, high flows, and/or flanking. Some locations may require additional block net support (e.g., galvanized hardware cloth, affixed metal fence posts, etc.).

Fish Capture and Removal

If dewatering and/or flow diversion are deemed necessary, this work (including related fish capture and removal operations) shall comply with any provisions contained in the Hydraulic Project Approval (HPA), or applicable General HPA, issued by the WDFW. If the FWS and/or NMFS have provided relevant Terms and Conditions from a Biological Opinion addressing the work (or action), this work shall also comply with those Terms and Conditions.

[1] If plans for work area isolation and fish capture and removal include the installation of temporary cofferdams, and once the directing biologist has confirmed fish life have been successfully excluded from the entire area enclosed by the cofferdam(s), it may be appropriate to remove block nets and allow fish to re-enter the previously isolated work area; this approach is particularly relevant and appropriate where many weeks or months of construction are planned for completion within temporary cofferdams (i.e., isolated from flowing waters).

If pumps are used to temporarily bypass water or to dewater residual pools or cofferdams, pump intakes shall be screened to prevent aquatic life from entering the intake. Fish screens or guards shall comply with Washington State law (RCW 77.57.010 and 77.57.070), with guidelines prescribed by the NMFS[2], and any more stringent requirements contained in the HPA or General HPA issued by the WDFW. If pumps are to be used on a more permanent basis, as the primary or secondary method for diverting flow around the isolated work area, plans for dewatering shall address contingencies (i.e., extremes of flow or weather). These plans shall include ready access to a larger or additional "back-up" pump with screened intake. If the directing biologist has confirmed that all fish life has been successfully excluded from the area, if there is no risk of entraining fish, and adequate plans are in-place to address contingencies (including a routine schedule for inspection), then pumps may be operated without a screened intake.

Fish Capture and Removal Methods

Methods for safe capture and removal of fish from the isolated work area are described below. These methods are given in order of preference. At most locations, a combination of methods will be necessary. In order to avoid and minimize the risk of injury to fish, attempts to seine and/or net fish shall always precede the use of electrofishing equipment. Visual observation techniques (e.g. snorkeling, surveying with polarized glasses or Plexiglas bottomed buckets, etc.) may be used to assess the effectiveness of these methods, to identify locations where fish are concentrating, or otherwise adjust methods for greater effectiveness.

If the planned fish capture and removal operations have not been addressed through consultation (or programmatic consultation), if seining and netting are impracticable (i.e., electrofishing is deemed the only viable means of fish capture), and fish listed under the ESA will or may be present, the directing biologist shall provide notice to the FWS and/or NMFS (as appropriate). This notice shall be provided in advance of the operations, and shall include an explanation of the unique site conditions or circumstances. Work conducted under a declared emergency (or emergency conditions) shall follow established ESA notification protocols.

Where fish listed under the ESA will or may be present, the directing biologist shall ensure that fish capture and removal operations adhere to the following minimum performance measures or expectations:

1) Only dip nets and seines composed of soft (non-abrasive) nylon material shall be used.

2) The operations shall not resort to the use of electrofishing equipment unless and until other, less injurious methods have been effective in removing most or all of the adult and sub-adult fish (i.e., fish in excess of 300 millimeters); the operations shall conduct a minimum of three complete passes without capture using seines and/or nets.

[2] National Marine Fisheries Service. 1997. Fish screening criteria for anadromous salmonids. NMFS Southwest Region, January 1997, 12p. << http://swr.nmfs.noaa.gov/hcd/fishscrn.pdf >>.

3) The operations shall confirm success of fish capture and removal before completely dewatering or commencing with other work within the isolated work area; the operations shall conduct a minimum of two complete passes without capture using electrofishing equipment.

4) Fish listed under the ESA shall not be held in containers for more than 10 minutes, unless those containers are dark-colored, lidded, and fitted with a portable aerator.

- **Seining** shall be the preferred method for fish capture. Other methods shall be used when seining is not possible, or when/after attempts at seining have proven ineffective. Seines, once pursed, shall remain partially in the water while fish are removed with dip nets. Seines with a "bag" minimize handling stress and are preferred. Seines with a bag are also preferred where obstructions make access to the water (or deployment/ retrieval of the seine) difficult.

  In general, seining will be more effective if fish, especially juvenile fish, are moved (or "flushed") out from under cover. Methods which may increase effectiveness and/or efficiency include conducting seining operations at dawn or dusk (i.e., during low-light conditions), in conjunction with snorkeling, and/or flushing of the cover. In flowing waters, and especially where flow volume or velocity is high or moderately-high, seines that employ a heavy lead line and variable mesh size are preferred. Small mesh sizes are more effective across the full range of fish size (and age class), but also increase resistance and can make deployment/ retrieval more difficult in flowing waters. Seines which use a small mesh size in the bag (or body), and a larger, less resistant mesh size in the wings may under some conditions be most effective and efficient.

- **Baited Minnow Traps** are typically used before and in conjunction with seining. Traps may be left in the isolated work area overnight. Traps shall be inspected at least four times daily to remove captured fish and thereby minimize predation within the trap. Traps should be checked more frequently if temperatures are in excess of 15 degrees C. Predation within the trap may be an unacceptable risk when/ where minnow traps are left in-place over night; large sculpin and other predators that feed on juvenile fish are typically much more active at night. The directing biologist shall consider the need and plan for work outside daylight hours (i.e., inspection and removal) before leaving minnow traps in-place over night.

- **Dip Nets** shall be used in conjunction with seining. This method is particularly effective when employed during gradual dewatering or flow diversion. To be most effective, and to minimize stress and risk of injury to fish (including stranding), the directing biologist shall coordinate fish capture operations with plans for dewatering or flow diversion. Plans for dewatering and/or flow diversion shall proceed at a measured pace (within constraints), to encourage the volitional downstream movement of fish, and reduce the risk of stranding. Plans for dewatering and/or flow diversion shall not proceed unless there are sufficient staff and materials on-site to capture and safely remove fish in a timely manner. Generally this will require a minimum of two persons (three if electrofishing), but the directing biologist may find that some sites (especially large or complicated sites) warrant or require a more intensive effort (i.e., additional staffing).

Once netted, fish shall remain partially in water until transferred to a bucket, cooler, or holding tank. Dip nets which retain a volume of water ("sanctuary nets") are preferred. However, sanctuary nets may be ineffective where flow volume or velocity is high or moderately-high (i.e., increased resistance lessens ability to net and capture fish). In addition, where water depths are very shallow and/or fish are concentrated in very small receding pools or coarse substrate, "aquarium" nets may be a better, more effective choice. Use of dip nets in conjunction with snorkeling, flushing of the cover, or around the hours of dawn or dusk (i.e., during low-light conditions), can be effective for capturing fish sheltered below cover.

- **Connecting Rod Snakes** may be used to flush fish out of stream crossing structures (i.e., culverts). Connecting rod snakes are composed of wood sections approximately three feet in length. Like other cover attractive to fish, culverts (especially long culverts), can present a challenge to fish capture and removal operations. The directing biologist should plan a strategy for focusing and concentrating fish in areas where they can be easily seined and netted, and should take active steps to prevent fish from evading capture. When first implementing plans for work area isolation, fish capture and removal, and dewatering, it may be appropriate to place block nets immediately upstream and/or downstream of culverts so as to minimize the number of fish that might seek cover within the culvert(s). Once most or all of the fish have been removed from other parts of the work area, the block net placed downstream of the culvert(s) should be removed to encourage volitional downstream movement of fish.
- **Electrofishing** shall be performed only when other methods of fish capture and removal have proven impracticable or ineffective at removing all fish. The directing biologist shall ensure that attempts to seine and/or net fish always precede the use of electrofishing equipment. Larger fish (i.e., adult and sub-adult fish with comparatively longer spine lengths) are more susceptible to electrofishing injury than smaller fish. To minimize the risk of injury (and the number of fish potentially injured), the directing biologist shall confirm that other methods have been effective in removing most or all of the adult and sub-adult fish before resorting to the use of electrofishing equipment; see the related performance measure appearing on page 6. As a general rule or performance measure, electrofishing should not be conducted under conditions that offer poor visibility (i.e., visibility of less than 0.5 meter).

The following performance measures shall apply to the use of electrofishing equipment as a means of fish capture and removal:

1. If the planned fish capture and removal operations have not been addressed through consultation (or programmatic consultation), and fish listed under the ESA will or may be present, the directing biologist shall provide notice to the FWS and/or NMFS prior to the initiation of electrofishing attempts. Upon request, the project owner shall permit the FWS, NMFS, and/or their designated representative to observe fish capture and removal operations. Work conducted under a declared emergency (or emergency conditions) shall follow established ESA notification protocols.
2. Electrofishing shall only be conducted when a biologist with at least 100 hours of electrofishing experience is on-site to conduct or direct all related activities. The directing biologist shall be familiar with the principles of electrofishing, including

the effects of voltage, pulse width and pulse rate on fish, and associated risk of injury or mortality. The directing biologist shall have knowledge regarding galvanotaxis, narcosis and tetany, their relationships to injury/mortality rates, and shall have the ability to recognize these responses when exhibited by fish.

3. The directing biologist shall ensure that electrofishing attempts use the minimum voltage, pulse width, and rate settings necessary to achieve the desired response (galvanotaxis). Water conductivity shall be measured in the field prior to each electrofishing attempt to determine appropriate settings. Electrofishing methods and equipment shall comply with guidelines outlined by the NMFS[3].

4. The initial and maximum settings identified below shall serve as guidelines when electrofishing in waters that may support ESA-listed fish. Only DC or pulsed DC current shall be used. [Note: some newer, late-model electrofishing equipment includes a "setup" or initialization function; the directing biologist shall have the discretion to use this function as a means to identify proper initial settings.][4]

Guidelines for Initial and Maximum Settings for Backpack Electrofishing

	Initial Settings	Conductivity (µS/cm)	Maximum Settings
Voltage	100 V	<300	800V
Pulse Width	500 tis	>300	400V
Pulse Rate	15 Hz		60 Hz [In general, exceeding 40 Hz will injure more fish.]

Each attempt shall begin with low settings for pulse width and pulse rate. If fish present in the area being electrofished do not exhibit a response, the settings shall be gradually increased until the appropriate response is achieved (galvanotaxis). The lowest effective settings for pulse width, pulse rate and voltage shall be used to minimize risks to both personnel and fish. Safe implementation is a high priority. The directing biologist shall ensure the safety of all individuals assisting with electrofishing attempts; this includes planning for and providing all necessary safety equipment and materials (e.g., insulated waders and gloves, first aid/cpr kit, a current safety plan with emergency contacts and phone numbers, etc.). Only individuals that are trained and familiar with the use of electrofishing equipment shall provide direct assistance during electrofishing attempts.

5. Electrofishing shall not be conducted where spawning adults or redds with incubating eggs may be exposed to the electrical current. As a general rule or performance measure, waters that support anadromous salmon should not be electrofished from October 15 through May 15, and resident waters from November 1 through May 15. If located within waters that support bull trout, especially waters located within a local bull trout population (i.e., that support

[3] National Marine Fisheries Service. 2000. Guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act. NMFS Northwest Region, June 2000, 5p. « http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf >>.

[4] Adapted from NMFS (June 2000) and WDFW Electrofishing Guidelines for Stream Typing (May 2001).

spawning and rearing), seasonal limitations on the use of electrofishing equipment may be more restrictive; if you have questions, contact the FWS. If any, more restrictive work windows have been identified through consultation, those windows shall apply. The directing biologist shall ensure that electrofishing attempts are made only during appropriate times of year, and not where spawning adults or redds with incubating eggs may be exposed to the electrical current.

6. An individual shall be stationed at the downstream block net(s) during electrofishing attempts to recover stunned fish in the event they are flushed downstream and/or impinged against the block net(s).

7. The operator shall use caution so as to prevent fish from coming into direct contact with the anode. Under most conditions, the zone of potential fish injury extends approximately 0.5 meter from the anode. Netting shall not be attached to the anode, as this practice presents an increased risk of direct contact and injury. Extra care shall be taken near in-water structures or undercut banks, in shallow waters, or where fish densities are high. Under these conditions fish are more likely to come into close or direct contact with the anode and/or voltage gradients may be intensified. Voltage and other settings shall be readjusted to accommodate changing conditions in the field, including channel depth. When electrofishing near undercut banks, overhanging vegetation, large cobble or boulders, or where structures provide cover, fish that avoid capture may be exposed to the electrical current repeatedly. Repeated or prolonged exposures to the electrical current present a higher risk of injury, and therefore galvanotaxis should be used to draw fish out of cover.

8. Electrofishing shall be conducted in a manner that minimizes harm to fish. Once an appropriate fish response (galvanotaxis) is achieved, the isolated work area shall be worked systematically. The number of passes shall be kept to a minimum, but is dependent upon the numbers of fish and site characteristics and shall be at the discretion of the directing biologist. Electrofishing shall not be conducted unless there are sufficient staff and materials on-site, to both minimize the number of passes required and to locate, net, recover, and release fish in a timely manner. Generally this will require a minimum of three persons, but the directing biologist may find that some sites (especially large or complicated sites) warrant or require a more intensive effort (i.e., additional staffing). Care shall be taken to remove fish from the electrical field immediately and to avoid exposing the same fish repeatedly. Fish shall not be held in dip nets while electrofishing is in progress (i.e., while continuing to capture additional fish). [Note: where flow velocity or turbulence is high or moderately-high (e.g., within riffles) it may be difficult to see and net fish; these fish may evade capture (resulting in repeated exposure), or may become impinged on the downstream block net(s); a "frame" net, or small and portable block net approximately 3 feet in width, can be effective under these conditions when held downstream in close proximity to the anode.]

9. The condition of captured fish shall be carefully observed and documented. Dark bands on the body and/or extended recovery times are signs of stress or injury. When such signs are noted, settings for the electrofishing unit may require readjustment. The directing biologist shall also review and consider changes to the

manner in which the electrofishing attempt is proceeding. If adjustments to the electrofishing attempt do not lessen the frequency (or severity) of observed stress, the directing biologist shall have the authority to postpone fish capture and removal operations[5]. Each fish shall be capable of remaining upright and actively swimming prior to release (see Fish Handling, Holding and Release).

10. Electrofishing shall not be conducted when turbidity reduces visibility to less than 0.5 meter, when water conductivity exceeds 350 gS/cm, or when water temperature is above 18°C or below 4°C.

Fish Handling, Holding and Release

- Fish handling shall be kept to the minimum necessary to remove fish from the isolated work area. Fish capture and removal operations shall be planned and conducted so as to minimize the amount and duration of handling. The operations shall maintain captured fish in water to the maximum extent possible during seining/netting, handling, and transfer for release.
- The directing biologist shall document and maintain accurate records of the operations, including: fish species, number, age/size class estimate, condition at release, and release location. Fish shall not be sampled or anesthetized, unless for valid purposes consistent with a Section 10 scientific collection permits.
- Individuals handling fish shall ensure that their hands are free of harmful and/or deleterious products, including but not limited to sunscreen, lotion, and insect repellent.
- The operations shall ensure that water quality conditions are adequate in the buckets, coolers, or holding tanks used to hold and transfer captured fish. The operations shall use aerators to provide for clean, cold, well-oxygenated water, and/or shall stage capture, temporary holding, and release to minimize the risks associated with prolonged holding. The directing biologist shall ensure that conditions in the holding containers are monitored frequently and operations adjusted appropriately to minimize fish stress. If fish listed under the ESA will or may be held for more than a few minutes prior to release, the directing biologist should consider using dark-colored, lidded containers only. Fish listed under the ESA shall not be held in containers for more than 10 minutes, unless those containers are dark-colored, lidded, and fitted with a portable aerator; small coolers meeting this description are preferred over buckets.
- The operations shall provide a healthy environment for captured fish, including low densities in holding containers to avoid effects of overcrowding. Large fish shall be kept separate from smaller fish to avoid predation. The operations shall use water-to-water transfers whenever possible.
- The release site(s) shall be determined by the directing biologist. The directing biologist should consider both site characteristics (e.g., flow, temperature, available refuge and cover, etc.) and the types of fish captured (e.g., out-migrating smolt, kelt, prespawn

[5] If the FWS and/or NMFS have provided an Incidental Take Statement from a Biological Opinion addressing the work (or action), the directing biologist shall ensure limits on take have not been exceeded; if the limits on take are exceeded, or if take is approaching these limits, the directing biologist shall postpone fish capture and removal operations and immediately notify the federal agency (or agencies) with jurisdiction.

migrating adult, etc.) when selecting a release site(s). More than one site may be designated to provide for varying needs, and to separate prey-sized fish from larger fish. The directing biologist shall consider habitat connectivity and fish habitat requirements, seasonal flow and temperature conditions, and the duration and extent of planned in-water work when selecting a fish release site(s). If conditions upstream of the isolated work area will or may become unfavorable during construction, then fish should not be released to an upstream location. However, the directing biologist should also consider whether planned in-water work presents a significant risk of downstream turbidity and sedimentation; fish released to a downstream location may be exposed to these conditions. Site conditions may warrant releasing fish both upstream and downstream, or relocating fish at a greater distance (e.g., thousands of feet or miles), so as to ensure fish are not concentrated in areas where their habitat needs cannot be met. For a fuller discussion of this topic see page 2.

- The directing biologist shall ensure that each fish is capable of remaining upright and has the ability to actively swim upon release.
- Any ESA-listed fish incidentally killed as a result of fish capture and removal operations shall be preserved and delivered to the appropriate authority upon request (see Documentation).
- If the limits on take of ESA-listed species are exceeded (harm or harassment), or if incidental take is approaching and may exceed specified limits, the directing biologist shall postpone fish capture and removal operations and immediately notify the federal agency (or agencies) with jurisdiction. If dewatering or flow diversion is incomplete and still in-progress, the directing biologist shall take remedial actions directed at maintaining sufficient quantity and quality of flow and lessening sources of fish stress and/or injury. If conditions contributing to fish stress and/or injury may worsen before the federal agency with jurisdiction can be contacted, the project team should attempt to move fish to a suitable location near the capture site while keeping fish in water and reducing stress as much as possible.

Reintroduction of Flow and Fish to the Isolated Work Area

If conducting work in isolation from flowing waters has required placement of a block net(s), fish capture and removal, and temporary dewatering, the directing biologist shall ensure that the block net(s) remain in-place until work is complete and conditions are suitable for the reintroduction of fish. Flows shall be gradually reintroduced to the isolated work area, so as to prevent channel bed or bank instability, excessive scour, or turbidity and sedimentation. The directing biologist shall inspect the work area and downstream reach to ensure no fish are stranded or in distress during reintroduction of flows. If conditions causing or contributing to fish stress and/or injury are observed, the directing biologist shall take remedial actions directed at lessening these sources of stress. This may include a more gradual reintroduction of flow, so as to reduce resulting turbidity and sedimentation.

All temporary structures and materials (e.g., block nets, posts, and anchors; bypass flume or culvert; sandbag, sheet pile or similar cofferdam; etc) shall be removed at the completion of work. The directing biologist shall document in qualitative terms the final condition of the

isolated work area (including temporary bypass). The directing biologist shall identify and document any obvious signs of channel bed or bank instability resulting from the work, and shall report these conditions to the appropriate Maintenance, Construction, and/or Environmental staff for remedy. The directing biologist shall document any additional actions taken to correct channel instability, and the final condition of the isolated work area (including temporary bypass).

To avoid and minimize the risk of introducing or spreading nuisance or invasive species, aquatic parasites, or disease, the directing biologist shall ensure that all equipment and materials are cleaned and dried before transporting them for use at another site or waterbody.

Documentation

- All work area isolation, and fish capture and handling shall be documented in a log book with the following information: project location, date, methods, personnel, water temperature, conductivity, visibility, electrofishing equipment settings, and other comments.
- All fish captured or handled shall be documented: species, number of each species, age/ size class estimate, condition at release, and location of release.
- If at any time, fish are observed in distress, a fish kill occurs, or water quality problems develop (including equipment leaks or spills), the project owner shall provide immediate notification to the WDFW consistent with any provisions contained in the HPA (or applicable General HPA). Notification shall consist of a phone call or voice mail message directed to the Area Habitat Biologist identified on the HPA and/or the Washington Military Department Emergency Management Division at (800) 258-5990, as appropriate.
- Any ESA-listed fish incidentally killed as a result of fish capture and removal operations shall be documented with notification provided to the appropriate authority (FWS and/or NMFS) within two working days. Initial notifications may consist of a phone call or voice mail message. Initial notifications shall be directed to the following: (FWS) the nearest FWS Law Enforcement Office, and the Washington Fish and Wildlife Office at (360) 753-9440; (NMFS) the NMFS Office of Law Enforcement at (800) 853-1964, and the Washington State Habitat Office at (360) 753-9530. Any dead specimens shall be kept whole and preserved on-ice or frozen until the project owner receives a response and further directions from the appropriate authority; if the project owner receives no response within 5 working days, the directing biologist shall have the discretion to dispose of specimens. Initial notifications shall be followed by a second notification in writing. All notifications shall provide at a minimum the following: date, time, the project owner point-of-contact (the directing biologist and/or supervisor), project name (and FWS and/or NMFS tracking number if available), precise location of any incidentally killed or injured and unrecovered fish, number of specimens and species, and cause of death or unrecoverable injury. If the limits on incidental take are exceeded (harm or harassment), the written notification shall also include an explanation of the circumstances causing or contributing to observed levels of take.

- The final condition of the isolated work area (including temporary bypass) shall be documented in qualitative terms, including any obvious signs of channel bed or bank instability resulting from the work. The directing biologist shall document any additional actions taken to correct channel instability, and the final condition of the isolated work area (including temporary bypass).

APPENDIX D

Hydraulic and Scour Analysis

***Included in Land Use Application packet**

APPENDIX E

Revegetation Plan

***Included in Land Use Application packet**

Appendix F

NMFS Species List and the USFWS Species List

Endangered Species Act Status of West Coast Salmon & Steelhead

(Updated July 1, 2009)

Species[1]			*Current Endangered Species Act Listing Status*[2]	*ESA Listing Actions Under Review*
Sockeye Salmon (*Oncorhynchus nerka*)	1	Snake River	***Endangered***	
	2	Ozette Lake	***Threatened***	
	3	Baker River	*Not Warranted*	
	4	Okanogan River	*Not Warranted*	
	5	Lake Wenatchee	*Not Warranted*	
	6	Quinalt Lake	*Not Warranted*	
	7	Lake Pleasant	*Not Warranted*	
Chinook Salmon (*O. tshawytscha*)	8	Sacramento River Winter-run	***Endangered***	
	9	Upper Columbia River Spring-run	***Endangered***	
	10	Snake River Spring/Summer-run	***Threatened***	
	11	Snake River Fall-run	***Threatened***	
	12	Puget Sound	***Threatened***	
	13	Lower Columbia River	***Threatened***	
	14	Upper Willamette River	***Threatened***	
	15	Central Valley Spring-run	***Threatened***	
	16	California Coastal	***Threatened***	
	17	Central Valley Fall and Late Fall-run	***Species of Concern***	
	18	Upper Klamath-Trinity Rivers	*Not Warranted*	
	19	Oregon Coast	*Not Warranted*	
	20	Washington Coast	*Not Warranted*	
	21	Middle Columbia River spring-run	*Not Warranted*	
	22	Upper Columbia River summer/fall-run	*Not Warranted*	
	23	Southern Oregon and Northern California Coast	*Not Warranted*	
	24	Deschutes River summer/fall-run	*Not Warranted*	
Coho Salmon (*O. kisutch*)	25	Central California Coast	***Endangered***	
	26	Southern Oregon/Northern California	***Threatened***	
	27	Lower Columbia River	***Threatened***	• Critical habitat
	28	Oregon Coast	***Threatened***	
	29	Southwest Washington	*Undetermined*	
	30	Puget Sound/Strait of Georgia	***Species of Concern***	
	31	Olympic Peninsula	*Not Warranted*	
Chum Salmon (*O. keta*)	32	Hood Canal Summer-run	***Threatened***	
	33	Columbia River	***Threatened***	
	34	Puget Sound/Strait of Georgia	*Not Warranted*	
	35	Pacific Coast	*Not Warranted*	
Steelhead (*O. mykiss*)	36	Southern California	***Endangered***	
	37	Upper Columbia River	***Threatened***	
	38	Central California Coast	***Threatened***	
	39	South Central California Coast	***Threatened***	
	40	Snake River Basin	***Threatened***	
	41	Lower Columbia River	***Threatened***	
	42	California Central Valley	***Threatened***	
	43	Upper Willamette River	***Threatened***	
	44	Middle Columbia River	***Threatened***	
	45	Northern California	***Threatened***	
	46	Oregon Coast	***Species of Concern***	
	47	Southwest Washington	*Not Warranted*	
	48	Olympic Peninsula	*Not Warranted*	
	49	Puget Sound	***Threatened***	• Critical habitat
	50	Klamath Mountains Province	*Not Warranted*	
Pink Salmon (*O. gorbuscha*)	51	Even-year	*Not Warranted*	
	52	Odd-year	*Not Warranted*	

1 The ESA defines a "species" to include any distinct population segment of any species of vertebrate fish or wildlife. For Pacific salmon, NOAA Fisheries Service considers an evolutionarily significant unit, or "ESU," a "species" under the ESA. For Pacific steelhead, NOAA Fisheries Service has delineated distinct population segments (DPSs) for consideration as "species" under the ESA.

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CRITICAL HABITAT; CANDIDATE SPECIES; AND SPECIES OF CONCERN
IN KING COUNTY
AS PREPARED BY
THE U.S. FISH AND WILDLIFE SERVICE
WASHINGTON FISH AND WILDLIFE OFFICE

(Revised December 15, 2010)

LISTED

Bull trout *(Salvelinus confluentus)* – Coastal-Puget Sound DPS
Canada lynx *(Lynx canadensis)*
Gray wolf *(Canis lupus)*
Grizzly bear *(Ursus arctos = U. a. horribilis)*
Marbled murrelet *(Brachyramphus marmoratus)*
Northern spotted owl *(Strix occidentalis caurina)*

Major concerns that should be addressed in your Biological Assessment of project impacts to listed animal species include:

1. Level of use of the project area by listed species.

2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas in all areas influenced by the project.

3. Impacts from project activities and implementation (e.g., increased noise levels, increased human activity and/or access, loss or degradation of habitat) that may result in disturbance to listed species and/or their avoidance of the project area.

Castilleja levisecta (golden paintbrush) [historic]

Major concerns that should be addressed in your Biological Assessment of project impacts to listed plant species include:

1. Distribution of taxon in project vicinity.

2. Disturbance (trampling, uprooting, collecting, etc.) of individual plants and loss of habitat.

1. Changes in hydrology where taxon is found.

DESIGNATED

Critical habitat for bull trout
Critical habitat for the marbled murrelet
Critical habitat for the northern spotted owl

PROPOSED

Revised critical habitat for bull trout

CANDIDATE

Fisher *(Martes pennanti)* – West Coast DPS
North American wolverine *(Gulo gulo luteus)* – contiguous U.S. DPS
Oregon spotted frog *(Rana pretiosa)* [historic]
Yellow-billed cuckoo *(Coccyzus americanus)*

SPECIES OF CONCERN

Bald eagle *(Haliaeetus leucocephalus)*
Beller's ground beetle *(Agonum belleri)*
Cascades frog *(Rana cascadae)*
Hatch's click beetle *(Eanus hatchi)*
Larch Mountain salamander *(Plethodon larselli)*
Long-eared myotis *(Myotis evotis)*
Long-legged myotis *(Myotis volans)*
Northern goshawk *(Accipiter gentilis)*
Northern sea otter *(Enhydra lutris kenyoni)*
Northwestern pond turtle *(Emys (= Clemmys) marmorata marmorata)*
Olive-sided flycatcher *(Contopus cooperi)*
Pacific lamprey *(Lampetra tridentata)*
Pacific Townsend's big-eared bat *(Corynorhinus townsendii townsendii)*
Peregrine falcon *(Falco peregrinus)*
River lamprey *(Lampetra ayresi)*
Tailed frog *(Ascaphus truei)*
Valley silverspot *(Speyeria zerene bremeri)*
Western toad *(Bufo boreas)*
Aster curtus (white-top aster)
Botrychium pedunculosum (stalked moonwort)
Cimicifuga elata (tall bugbane)

City of Bellevue
Coal Creek Culvert Replacement

DRAFT Geotechnical Data Report

Prepared for

City of Bellevue

April 2011

CH2MHILL

1100 112th Avenue NE
Bellevue, WA 98004-4504

City of Bellevue
Coal Creek Culvert Replacment

DRAFT Geotechnical Data Report

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April 2011

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This Report has been prepared by
a registered professional engineer

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SECTION 1

Introduction

This Geotechnical Data Report summarizes the results of a geotechnical investigation conducted by CH2M HILL for the City of Bellevue Coal Creek Parkway Culvert Replacement project (Project). Geotechnical recommendations for the structural design aspects of the culvert (provided in a separate report) are based on the information documented herein.

1.1 Project Description

The Project is located on Coal Creek Parkway in the City of Bellevue, Washington, approximately 1,100 ft south of Forest Drive SE and 2,300 feet north of SE 60th Street. The site location is shown in Figure 1.1-1. The existing 96-inch culvert is deteriorated and will require replacement in the near future. The existing conditions and interests that are likely to drive final solutions for replacement of this culvert include, but not limited to:

- Location of two petroleum pipelines owned and operated by Olympic Pipeline;
- Location of utilities (fiber optic, natural gas, sanitary sewer, etc.);
- Hydraulic characteristics of an existing flow attenuation structure and the existing culvert itself;
- Regulatory entities and their associated requirements for the project; and
- Traffic patterns along the Coal Creek Parkway corridor.

This report focuses on the geotechnical investigation, conducted to identify and characterize the subsurface soil and groundwater conditions needed for geotechnical and structural design of the new culvert. The exploration data are provided in this report; interpretation of subsurface conditions and engineering analyses are documented in a separate report.

1.2 Scope

The geotechnical investigation described in this report generated subsurface data which will be used for characterizing site conditions and conducting engineering analyses for the new culvert. The specific tasks performed by CH2M HILL for subsurface characterization included:

- Reviewing published geologic information for the project area;
- Performing a site reconnaissance and identifying exploration locations;
- Drilling geotechnical borings and conducting Standard Penetration Tests (SPT);
- Installing a piezometer for groundwater level monitoring;
- Conducting laboratory tests on select soil samples for verifying visual classifications;

- Summarizing these efforts in this Geotechnical Data Report.

1.3 Authorization

This report was prepared under the terms of the contract between CH2M HILL and the City of Bellevue. The contract authorizes CH2M HILL to provide geotechnical engineering services associated with the Coal Creek Parkway Culvert Replacement project in accordance with the agreement.

1.4 Limitations

This report has been prepared for the exclusive use of the City of Bellevue for application specific to geotechnical activities associated with the Project. The geotechnical exploration program has been completed in accordance with accepted geotechnical engineering practices. No other warranty, expressed or implied, is made. The explorations described in this report include four soil borings. These exploratory borings are assumed to be representative of the subsurface conditions throughout the project site. If during subsequent exploration or construction, subsurface conditions are found to be different from those described in the following sections of this document, the geotechnical engineers should be notified immediately, so that the geotechnical recommendations provided in the design report can be re-evaluated.

SECTION 2

Regional and Site Geology

This section briefly summarizes the regional and site geology for the project. Information about the regional and site geology was used to identify the source of soils within the project area, and this information helped explain the types, variability, and consistency of soils that were encountered during execution of the exploration program. Topics covered in this section include topography, geologic setting, and the tectonic setting for the project area based on published information.

2.1 Topography

The project area is located in the central portion of the Puget Sound Basin, an elongated, north-south trending depression situated in western Washington between the Olympic Mountain Range to the west and the Cascade Mountain Range to the east. The regional topography was shaped mainly by the most recent glaciations that moved back and forth across the region over 10,000 years ago, creating a series of north-south trending ridges separated by deep troughs. The troughs are now occupied by streams, lakes, and waterways, including Puget Sound, Elliott Bay, Lake Washington, and Lake Sammamish. More recently, erosional processes and landform changes made by human development of the area have modified the regional topography.

Topography within the project area is generally sloping with localized areas of steep slopes. The steep slopes are located near Coal Creek where slope angle can be in excess of 40 percent. Surface elevations range from roughly 165 feet near the stream to about 190 feet on the roadway surface above the culvert. Coal Creek Parkway at the project site is generally flat with slopes not exceeding the roadway crown. The roadway grade increases heading north and south from the site along Coal Creek Parkway.

2.2 Regional Geology

Repeated glaciations within the Puget Sound Basin over the last 1.2 million years have left a thick deposit of unconsolidated soil in the region that includes the project area. Between periods of glaciations, the valleys and low-lying areas filled with river and lake sediments.

The majority of the soils in the project area were deposited during the most recent glacial episode, namely the Vashon Period of the Fraser Glaciation. During the last glaciation, between 15,000 and 13,000 years ago, a 3,000-foot-thick glacier advanced over the Puget Sound area. Deposits associated with this geologic process include the hard or very dense glacial tills, which were deposited at the base of the glacier, and outwash deposits, which were produced by the meltwater streams from the glacier. The very hard and dense consistency of the glacially-overridden deposits is the result of consolidation from the weight of the glacial ice. These deposits typically exhibit very good bearing characteristics and performance during seismic loading.

Erosion and deposition created by the glaciers resulted in alteration of slopes and ground surfaces in the area, resulting in deposits of river and lake sediments that range from a few tens of feet (or less) to hundreds of feet in thickness in some areas. At most locations, these deposits are normally consolidated, meaning that they have not been overridden and compressed by glaciers or subject to significant removal of overburden soils from erosion. These soils are often softer or looser in consistency and, therefore, provide less bearing support. The deposits are often prone to settlement, and when they are saturated and cohesionless, they are subject to liquefaction during seismic events.

2.3 Project-Area Geology

The project-area subsurface conditions are heavily influenced by geomorphic processes associated with Coal Creek. The headwaters of Coal Creek originate in the steep terrain at Cougar Mountain and flows about 7 miles into Lake Washington at Newport Shores. Even though the project area is relatively small, the local geologic conditions resulting from a combination of historic glaciations and more recent stream activity are expected to be complex.

A geologic map of the project area (Booth et al., 2007) is provided in Figure 2.3-1. The map indicates Vashon subglacial till (Qvt) and Vashon advance outwash (Qva) existing near the project site. To the west of the project site, locally-discontinuous Renton Formation (Tpr) bedrock outcrops are encountered.

Where Coal Creek crosses under Coal Creek Parkway, varied soils are encountered. The surface soils are anticipated to be fill from the construction of the Coal Creek Parkway road section. Loose sand and/or organic soil with deep glacially-consolidated soils are anticipated to underly the surficial fill material. The looser/softer soils would have been deposited by the stream; the thickness of these deposits would depend on how the stream eroded the denser till-like soils which are found throughout the area.

2.4 Regional Groundwater

Regional groundwater conditions are controlled by the presence of Puget Sound or Lake Washington, or by infiltration of rainwater. Near Puget Sound and Lake Washington the groundwater is located reasonably close to the elevation of these water bodies. In other areas, the groundwater location is 20 feet or more below the ground surface.

Local topography and subsurface soil conditions have a strong influence on the location of groundwater. In areas where low-permeability silts and clays are present, groundwater is often perched on the top of this layer.

Depths to the top of groundwater typically range from 20 to 30 feet below the ground surface, although in some areas it can be shallower or deeper. The level of groundwater will generally fluctuate a few feet with the season.

2.5 Seismicity

The project is in an area of seismic activity. A number of strong earthquakes have occurred in the recent past, and seismic events are expected in the future. These seismic events will produce ground shaking and, depending on location, could result in permanent ground

offsets along faults or within fault zones. This section identifies the three primary sources of seismic events in the region and provides a description of the two closest faults mapped by the U.S. Geological Survey (USGS).

2.5.1 Sources of Seismicity

Seismic events in western Washington result from three source mechanisms: (1) the very large moment magnitude (M8.5+) (on the Richter scale) Cascadia source off the coast of Washington and Oregon; (2) the intraplate source (M7.5) occurring 20 to 40 miles beneath Puget Sound; and (3) random crustal events (M6.5 to 7) that could occur in the upper 20 miles virtually anywhere in the region. A seismic event from any one of these sources could result in significant ground shaking within the project area.

Of these source mechanisms, the intraplate source mechanism presents the highest risk for the project area. The 1949 Olympia earthquake (M7.1), the 1965 Sea-Tac earthquake (M6.6), and the 2001 Nisqually earthquake (M6.8) are recent events associated with the intraplate fault mechanism. These earthquakes were the cause of ground shaking that exceeded 0.2 g in some locations. The level of ground shaking was sufficient to cause building damage, retaining wall failures, and soil liquefaction.

2.5.2 Faults

The faults documented by the USGS as having probable movement during the Quaternary period within about 40 miles of the project area are shown in Figure 2.5-1. Table 2.5-1 summarizes information about these faults. This information was obtained from the USGS database that documents Quaternary (last 1.6 million years) faults and folds for the United States and includes structures (faults and folds) with noted geologic evidence of movement in the last 10,000 to 15,000 years (late Quaternary or Holocene time period), which are generally considered active for seismic hazard analyses. The Seattle Fault Zone (SFZ) and Southern Whidbey Island Fault Zone (SWIFZ) are the closest active faults to the project area. The following two sections provide more detail about the SFZ and the SWIFZ.

Seattle Fault Zone

The Seattle Fault Zone (SFZ) has been described by Troost et al. (2005) as an approximately 2.5- to 4.5-mile-wide fault zone that extends from the Cascade Range foothills on the east, across the Puget Lowland to Hood Canal, crossing Lake Sammamish, Lake Washington, Puget Sound, Bainbridge Island, and the Kitsap Peninsula. The east-west trending fault zone consists of three or more south-dipping thrust faults, one of which is named the Seattle Fault. The SFZ also includes north-dipping reverse or thrust faults, such as the Toe Jam Hill fault located on Bainbridge Island. The SFZ forms the structural boundary between the Seattle uplift on the south and the Seattle basin on the north.

The City of Bellevue is located near the SFZ. Because strands of the fault zone are typically obscured by water bodies, dense vegetation, and glacial and interglacial deposits, it is possible that strands are present at locations not currently mapped or that new strands may be initiated by the fault zone along the alignment.

The Seattle Fault is considered active (e.g., Gower et al., 1985; Bucknam et al., 1992). Quaternary activity has been well documented for the SFZ. Evidence of late Holocene land-

level changes, tsunamis, and landslides from many sites around the region are effects of a large earthquake that can be correlated to an earthquake event that occurred approximately 1,100 years ago along the SFZ (Bucknam et al., 1992). The SFZ shows both direct and paleoseismic evidence for up to 23 feet of uplift near Restoration Point on Bainbridge Island (Bucknam et al., 1992). The estimated moment magnitude that accompanied this observed displacement is believed to be greater than 7.0 (Pratt et al., 1997).

The potential for seismic events on the SFZ has been incorporated in the seismic hazards maps used to estimate ground motions in the project area. Further modifications can be made to the ground motions for near-fault effects. A seismic event on the SFZ could result in significant permanent ground movement.

Southern Whidbey Island Fault Zone

The mapped portion of the northwesterly/southeasterly trending SWIFZ terminates about 15 miles northeast of the project area. Trenching work confirms that the SWIFZ extends through Woodinville (Sherrod et al., 2005). Although this location is too far to create a hazard from fault displacements, the SWIFZ does affect the potential level of ground motions within the project area.

Like the SFZ, the onshore portion of the SWIFZ is generally concealed beneath a cover of dense vegetation and thick Pleistocene glacial and interglacial deposits. Approximate locations of fault strands are based on available geologic, light detection and ranging (LIDAR), and aero-magnetic data. Information compiled by Johnson et al. (2004) describes the SWIFZ as a 3- to 4-mile-wide, northwest-trending fault zone comprised of several splays.

The SWIFZ is considered an active fault (USGS, 2010) as there are several factors that show evidence for Quaternary movement within the SWIFZ. These factors include evidence of about 8 feet of offset along the fault zone that occurred about 2,900 to 3,400 years ago (Kelsey and Sherrod, 2001). The youngest strata to be cross cut by faults of the SWIFZ are interglacial deposits that are about 80,000 to 125,000 years old (Gower et al., 1985).

2.5.3 Firm-Ground Response Spectra

The AASHTO methodology for estimating seismic ground motions is based on a seismic event with a 7 percent probability of exceedance in 75 years. The return interval for this seismic event is approximately 1,000 years. The AASHTO specifications allow firm-ground response spectra parameters to be determined for locations throughout the United States based on the latitude and longitude of the site. Ground motion parameters from AASHTO (i.e., PGA, S_s, and S_1) are for Site Class B site conditions, where firm ground or soft rock occurs. These site conditions are characterized by shear wave velocities greater than 2,500 fps or refusal-type blowcounts.

As discussed in Section 2.5.2, the project site is located near the Seattle Fault Zone (SFZ). Due to the proximity of the SFZ, corrections made to the firm-ground motion parameters to account for the possibility of near-field seismic ground motion effects are recommended. Past studies of earthquakes have found that higher seismic accelerations result when the site is closer than 10 to 25 miles (depending upon the study). This increase in seismic response is generally termed "near-fault effects." Due to the proximity of the SFZ, near-fault effects

should be taken into account; the California Department of Transportation (Caltrans) method should be used to adjust the site response for near-site effects (Shantz and Merriam, 2009). This method adjusts the code design response spectra as follows:

- No adjustment in spectral accelerations for the 0- to 0.5-second periods;
- A linear increase in spectral accelerations from 0 to 20 percent for 0.5- to 1.0-second periods; and
- A 20 percent increase in the spectral accelerations for periods greater than 1.0 second.

AASHTO mapped parameters are based on the USGS National Seismic Hazard Mapping Project (Site Class B boundary). The PGA, short (0.2-sec) period (S_S), and long (1.0-sec) period (S_1) spectral accelerations for firm ground (Site Class B) include:

AASHTO (2010) Site Class B (without near-fault adjustments):

- PGA = 0.438g;
- S_S = 0.975g; and
- S_1 = 0.324g.

The firm-ground spectrum is associated with a moment magnitude of 7.0. The moment magnitude was defined using the deaggregation feature within the USGS website. A moment magnitude of 7.0 is the mean magnitude for the uniform hazard. Actual magnitudes will be determined by the seismic source and could be smaller or larger than the mean value for specific events.

SECTION 3

Subsurface Exploration Program

A subsurface exploration program was conducted to characterize the subsurface soil and groundwater conditions at the project site. This section summarizes the methods used during the subsurface exploration program. These discussions describe procedures used for: (1) selection of new subsurface exploration locations and (2) subsurface drilling and sampling, including installation of groundwater monitoring wells. The summary also includes a description of laboratory testing methods used to characterize the collected soil samples. Results of the subsurface exploration program are presented primarily in the appendices.

3.1 Selection of New Subsurface Exploration Locations

The initial step in the subsurface exploration program involved identifying existing geotechnical information in the project vicinity. This information was obtained from archives maintained by the Pacific Northwest Center for Geologic Mapping Studies (GeoMapNW) at the University of Washington (Booth et al., 2006. The database of archived information included exploration boring logs and a geotechnical report that had been prepared for the City of Bellevue for improvements to Forest Drive SE. This report is included in Appendix A. The limited available information suggested the need for conducting site-specific explorations.

New exploration locations were selected based on the schematic design of the new culvert. Selection of new exploration locations during the site reconnaissance also considered access, traffic impact, and utility conflicts. Four soil boring locations were identified and drilled, two in the far-east northbound lane and two in the far-west southbound lane. The borings in each lane were spaced about 30 feet apart and at the approximate location of the culvert footings. The location of soil boring BH-1p-10 was located just outside of the fog line; this location was selected so that the reading of groundwater levels from its piezometer would not require a lane closure. Locations of the four explorations are shown in Figure 3.1-1.

3.2 Drilling and Sampling Methods

Representative samples of soil were collected at the project site by conducting a drilling and sampling program. This section describes the types of equipment used for drilling and sample collection, the methods used to classify soils during the drilling and sampling, and procedures used for groundwater monitoring well (piezometer) installations. Results of the boring explorations are presented in Appendix B.

3.2.1 Boring Exploration Methods

Borings for this project were drilled on December 4, 2010 and on January 22, 2011. Geotechnical drilling services for the project were provided by Gregory Drilling, Inc. of Redmond, Washington, under the oversight of CH2M HILL geotechnical staff.

Soil drilling was accomplished using hollow-stem augers with truck-mounted Central Mine Equipment (CME) 85 and 75 drill rigs.

The borings were located in the field based on locations of proposed structures, equipment access, roadway right-of-ways, and utility interference. Before field work was implemented, the following work had to be performed:

- Permits allowing the drilling to take place at the designated locations were obtained by CH2M HILL from the City of Bellevue.
- Utility locates were made before beginning each boring exploration. This work was conducted through the "One-Call" utility notification and locating service.
- Traffic control plans were prepared by Traffic Control Services under subcontract to CH2M HILL. These plans were submitted to the City of Bellevue for review and approval.
- The drilling was coordinated with liasisons from Puget Sound Energy and Olympic Pipeline, who requested to be on-site during geotechnical drilling activities.

Soil borings were advanced to depths of 45 feet below ground surface (bgs). Disturbed soil samples were obtained from the borings using Standard Penetration Test methods. SPTs were conducted at either 2.5- or 5-foot intervals with an automatic-trip hammer and were performed in general accordance with ASTM D1586, *Standard Penetration Test Method for Penetration Test and Split Barrel Sampling of Soils*, except that sample liners were not used. Soil samples collected from the SPTs were visually logged and stored in watertight sample bags for laboratory testing.

At one location, upon encountering a potentially compressible soil, collection of a relatively undisturbed sample was attempted using 3-inch-diameter, thin-walled Shelby tube.

3.2.2 Field Soil Classification

Soil samples were visually classified immediately after sample recovery. Soils were described and classified on the boring logs in general accordance with ASTM D2488, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*. Details such as obstructions, identification of soil stratigraphy, and observation of groundwater seepage were also noted on the boring logs.

The visual field classifications were later revised on the boring logs, as necessary, based on the results of laboratory testing. Appendix B contains the boring logs for the explorations conducted specifically for the project.

3.2.3 Piezometer Installation and Borehole Abandonment

Upon completion of drilling, boreholes were either abandoned by backfilling with high-swelling, granular bentonite chips, or a piezometer was installed and backfilled as described later in this section. All boreholes were capped with a cement mixture and quickset or jetset concrete, dyed to match the color of the surrounding asphalt.

A piezometer was installed in one soil borings for groundwater level monitoring. Installation of the new piezometer was important due to the scarcity of groundwater information at the existing structures.

Piezometer installation consisted of 1-inch-diameter, Schedule 40 polyvinyl chloride (PVC) pipes with 0.01-inch factory slots at approximately 1/8-inch intervals. Sand pack consisted of 10/20 Colorado silica sand. Remaining space above and below the well screen, if applicable, was backfilled with granular bentonite chips. A flush-mount well monuments was installed flush with the ground surface and encased in a quickset concrete mix, which was dyed to match the existing surrounding asphalt. Piezometer construction details are provided on the boring logs in Appendix B. Groundwater level readings in the piezometer, as of the date of this report, are presented later in this section.

3.2.4 Environmental Sampling

While drilling on December 4, 2010, a strong petroleum odor was dected at the location of soil boring BH-3-11 upon coring through the asphalt pavement. The soil boring was immediately abandoned. Upon returning to resume the drilling, the purpose of environmental sampling was to identify the extent of potential contamination at the site and determine the appropriate disposal options for contaminated soil if identified.

Two samples were collected from BH-3-11-1: (1) BH-3-11-1, from 2.5 to 4.0 feet bgs and (2)BH-3-11-2, from 5.0 to 6.5 feet bgs. No evidence of contamination was observed below the second sample, so no additional samples were collected. The soil from sample BH-3-11-1 was olive gray in color, had a Photoionization Detector (PID) reading of 14.4 ppm, and a petroleum odor. The sample was analyzed for gasoline, diesel, volatile organic compounds, and metals. The soil from sample BH-3-11-2 was gray to light tan in color, had a PID reading of 1.6 ppm, and no odor. The sample was collected to confirm the lower limit of contamination. This sample was also analyzed for gasoline, diesel, volatile organic compounds, and metals. Gasoline and diesel were detected in one sample, BH-3-11-1 from 2.5 ft to 4.0 ft, slightly above applicable clean up levels.

Boring BH-4-11 was located approximately 30 ft south from BH-3-11 and did not contain any field observations of contamination. PID readings were below 1.5 ppm and no soil staining or odor was observed. One representative soil sample was collected and analyzed for Toxicity Characteristic Leaching Procedure (TCLP) metals only exclusively to identify appropriate disposal procedures since no other samples were collected.

During construction, the soil in the area of BH-3-11 will need to be segregated by utilizing field observations such as soil staining, odor, and measured vapor levels from a PID meter. The segregated contaminated soil will need to be disposed of at a Subtitle D landfill, such as Roosevelt Regional Landfill. The contamination appears to be localized to the area of boring BH-3-11 from approximately 0 to 4.0 feet bgs.

Environmental laboratory testing results are provided in Appendix C.

3.3 Laboratory Testing

Laboratory index testing was conducted on representative soil samples recovered from the field drilling and sampling program to confirm the field visual classification of soils.

Laboratory testing was performed by HWA Geosciences, Inc. of Bothell, Washington, under subcontract to CH2M HILL. Laboratory testing included:

- ASTM D 2216 – Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass;
- ASTM D 4318 – Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils;
- ASTM D 422 – Standard Test Method for Particle-Size Analysis of Soils (Sieve Analysis);
- ASTM D 422 – Standard Test Method for Particle-Size Analysis of Soils (Hydrometer Test); and
- ASTM D 1140 – Standard Test Methods for Amount of Material in Soils Finer than No. 200 (75-µm) Sieve (P200).

Brief descriptions of the procedures used to perform each of the index tests, as well as complete laboratory test results, are available in Appendix D.

3.4 Groundwater Level Monitoring

Groundwater level readings from the piezometer installed in BH-1p-10 are provided in Table 3.4-1. Groundwater is located approximately 15 feet bgs (Elevation 172 ft).

SECTION 4

Summary

This section summarizes the work completed to evaluate the geotechnical conditions at Coal Creek that will affect the design of the new culvert. The subsurface exploration program to characterize site-specific soil and groundwater conditions involved:

- Review of published geologic information for the project area;
- Collection and review of existing geotechnical data;
- Drilling geotechnical soil borings and conducting Standard Penetration Tests;
- Installing a piezometer for monitoring of groundwater levels; and
- Conducting laboratory tests on selected soil samples for verifying visual classifications.

The exploration data are provided in this report; interpretation of subsurface conditions and engineering analyses are documented in a separate Geotechnical Recommendations Report.

SECTION 5

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SECTION 6

Tables

TABLE 2.5-1
REGIONAL FAULTS

USGS Fault Number	USGS Fault Class	Fault Name	Closest Distance to Project Area (mi)	Fault Type	Mapped Length (mi)	Most Recent Deformation[a]	Slip Rate (in/yr)
570	A	Seattle Fault Zone	0	Thrust	43	< 15 ka	0.001 – 0.04
572	A	Southern Whidbey Island Fault Zone	17	Thrust	400	< 15 ka	0.001 – 0.04
581	A	Tacoma Fault Zone	21	Thrust	14	< 15 ka	0.001 – 0.04
552	B	Hood Canal Fault Zone	27	Unknown	48	< 1.5 Ma	< 0.001
551	B	Unnamed Faults in Strait of Juan de Fuca and Puget Sound	32	Normal	104	< 15 ka	< 0.001
575	A	Saddle Mountain Faults	39	Reverse	3	< 15 ka	0.001 – 0.04
553	B	Straight Creek Fault	40	Dextral	75	< 1.6 Ma	< 0.001

[a] ka = thousand years ago; Ma = million years ago

TABLE 3.4-1
GROUNDWATER LEVEL MEASUREMENT SUMMARY

Boring Number	Ground Surface Elevation (ft)	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)	High Groundwater Reading (ft bgs)	Low Groundwater Reading (ft bgs)
BH-2p-10	188	14	26	14.8	14.8

SECTION 7

Figures

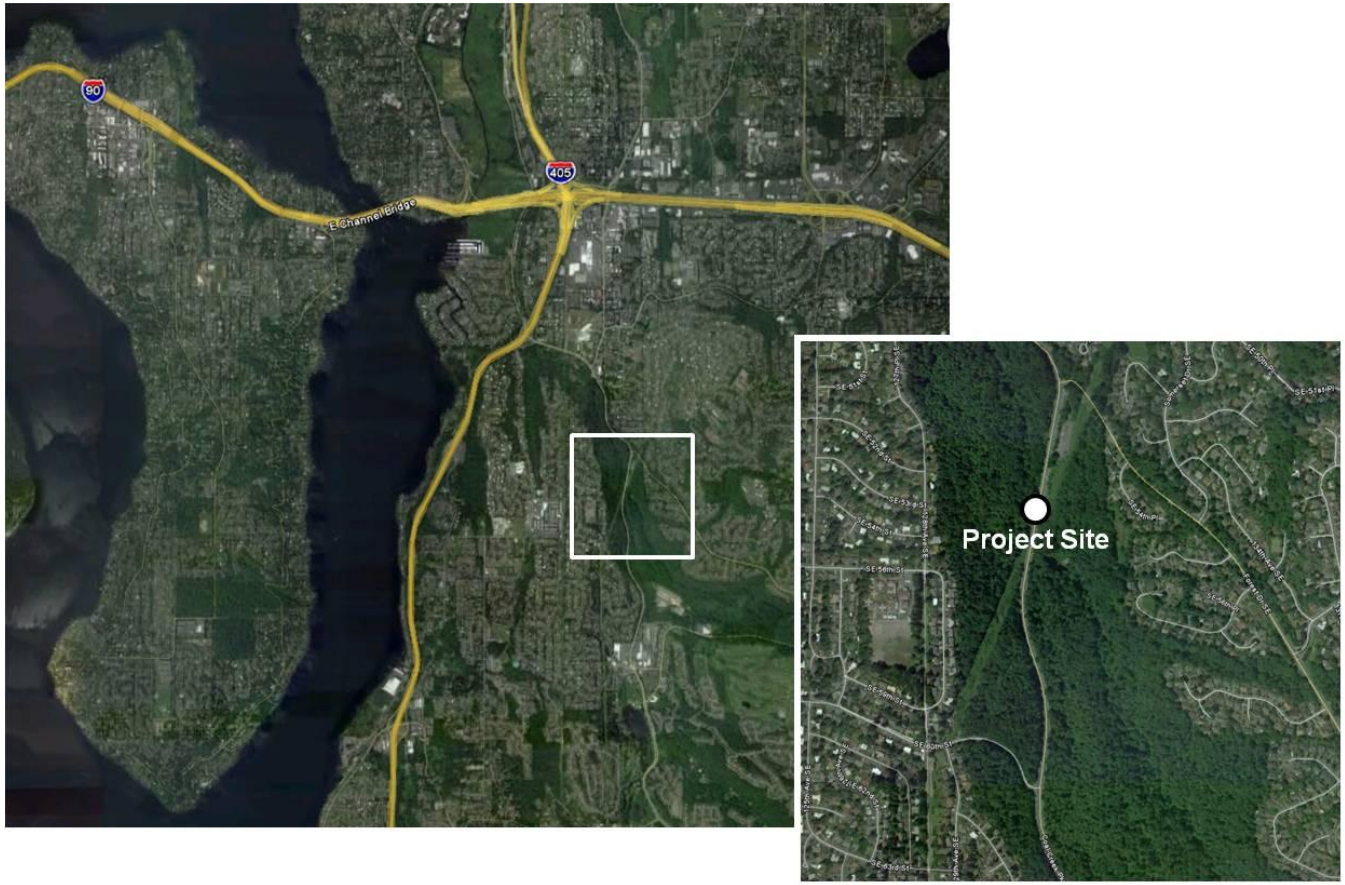

FIGURE 1.2-1
SITE LOCATION

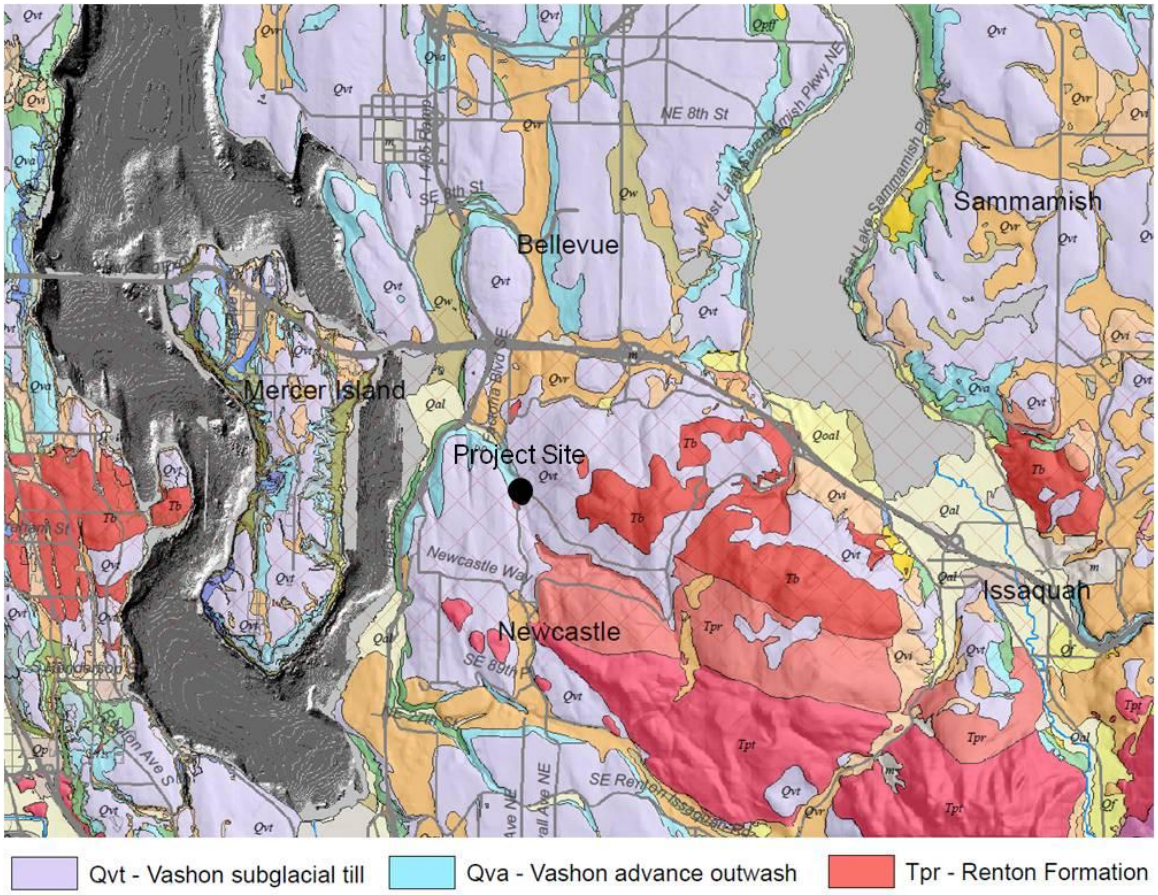

FIGURE 2.3-1
REGIONAL GEOLOGIC MAP

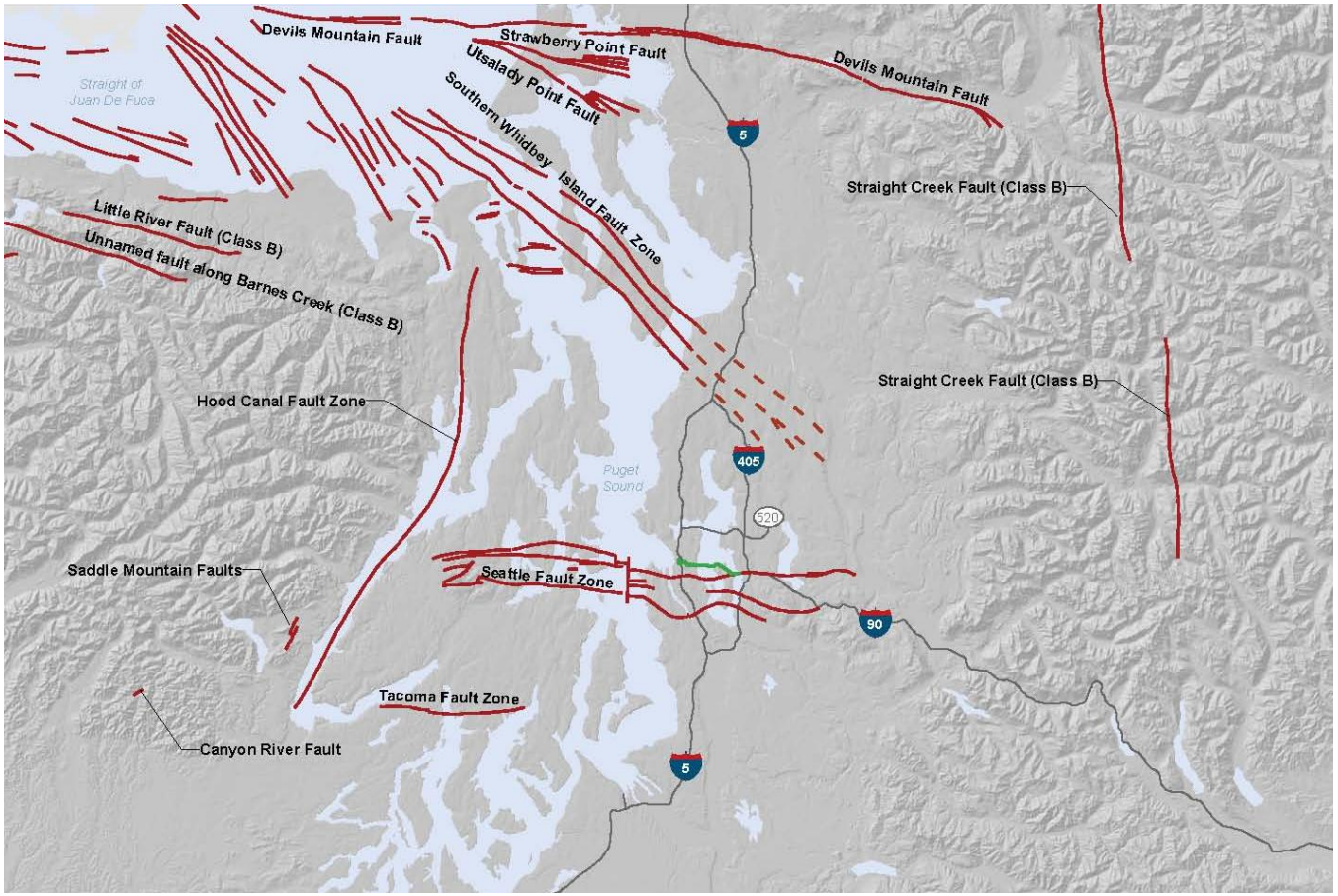

FIGURE 2.5-1
FAULT MAP

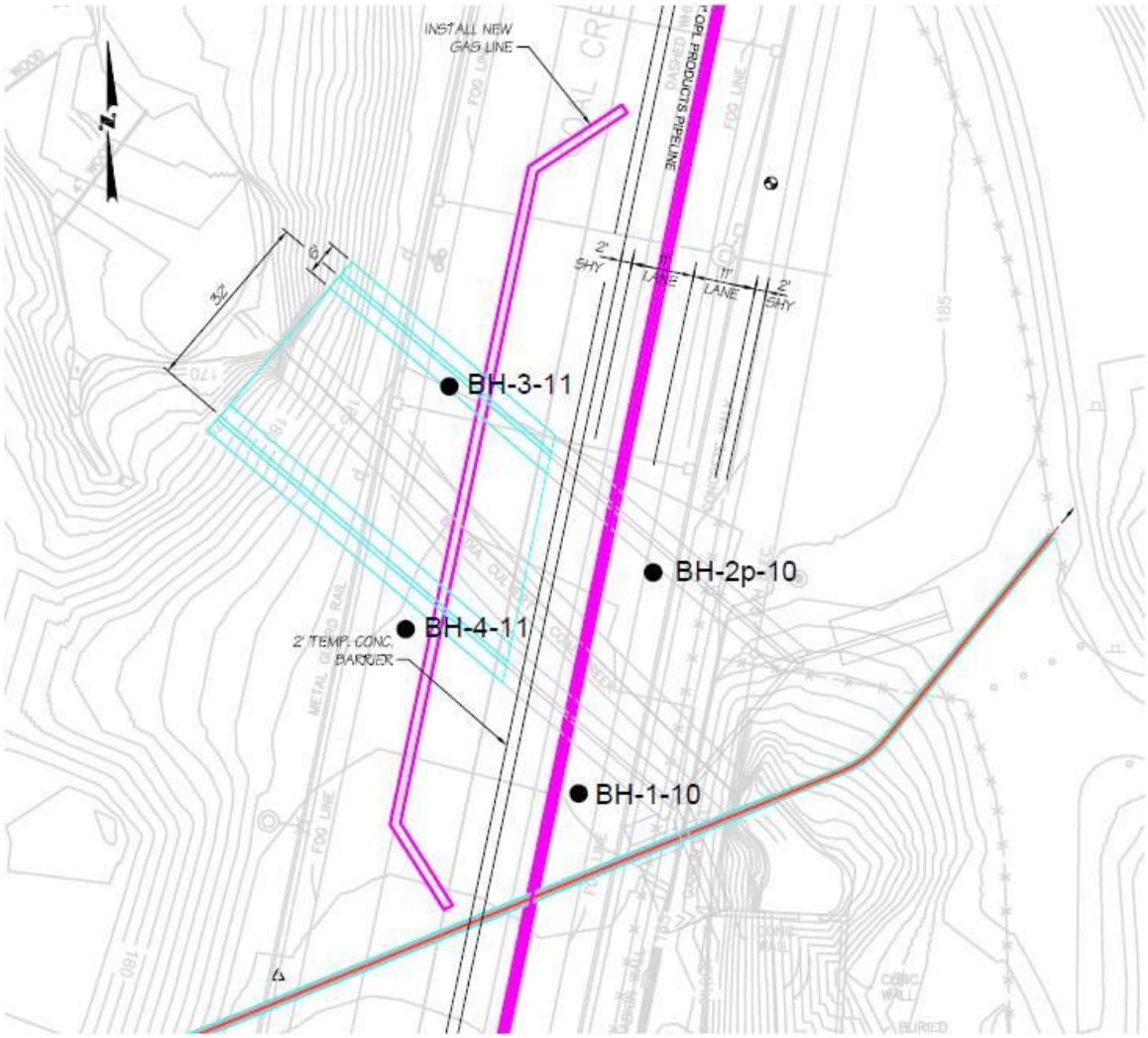

FIGURE 3.1-1
SOIL BORING LOCATIONS

APPENDIX A

Geotechnical Report for Improvements to Forest Drive SE

17945

Report

Geotechnical Engineering Services

Forest Drive Southeast Improvements

Coal Creek Parkway SE to SE 63rd Street

Bellevue, Washington

September 19, 2002

RECEIVED
JUL 27 2004
PERMIT PROCESSING

For

The City of Bellevue

GeoEngineers

September 19, 2002

City of Bellevue
Department of Planning and Community Development
P.O. Box 90012
Bellevue, Washington 98009-9012

Attention: Nancy LeCombe

We are pleased to submit four copies of our report, "Geotechnical Engineering Services, Forest Drive Southeast Improvements, Coal Creek Parkway SE to SE 63rd Street, Bellevue, Washington." Our services were performed in general accordance with our scope of services and fee estimate letter dated May 7, 2001. Our services commenced upon authorization of the subconsultant agreement with W&H Pacific dated August 28, 2001. Preliminary findings and recommendations were presented to the project team during design team meetings. A draft report was issued on January 21, 2002. Comments from the draft report have been incorporated into this final report.

We appreciate the opportunity to work with you on this project. If you have any questions regarding this report, please contact us.

Yours very truly,

GeoEngineers, Inc.

Thomas A. Tobin

Thomas A. Tobin, P.E.
Principal

RTD:TAT:ja
p:\0526067\00\finals\0526067R.doc

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Bothell, WA 98021
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REPORT
GEOTECHNICAL ENGINEERING SERVICES
FOREST DRIVE SOUTHEAST IMPROVEMENTS
COAL CREEK PARKWAY SE TO SE 63RD STREET
BELLEVUE, WASHINGTON
FOR
THE CITY OF BELLEVUE

INTRODUCTION

This report presents the results of our geotechnical engineering services for design of the Forest Drive Southeast (SE) improvements in Bellevue, Washington. The improvements for Forest Drive SE extend over 1.1 miles of roadway from Coal Creek Parkway SE to SE 63rd Street. A vicinity map showing the location of the project is shown in Figure 1.

The project owner is the City of Bellevue (COB). The design team includes W&H Pacific (W&H) of Bothell, Washington as the project civil engineer and Lin and Associates, Inc. of Seattle, Washington as the project structural engineer.

PROJECT UNDERSTANDING

Our understanding of the project is based on the COB project description, meetings with the design team, and site plans for the project shown in Figures 2 through 6. The project will provide safety improvements for vehicles, bicycles, and pedestrians along Forest Drive SE from Coal Creek Parkway SE to SE 63rd Street. Due to existing steep grades, there is a significant accident history near the Coal Creek Parkway intersection. The proposed roadway improvements include the following:

- The only significant change to the alignments occurs between Coal Creek Parkway SE and SE 54th Place. New horizontal and vertical alignments to meet COB design standards for a minor arterial street with a design speed of 35 mph and maximum vertical grade of 8 percent. This will result in cuts up to 25 feet high and minor fills to less than 6 feet high at various locations along the alignment.
- A 46-foot wide roadway from curb to curb including two 12-foot wide travel lanes, two 5-foot wide bicycle lanes, and a 12-foot wide left turn lane or median.
- A six-foot wide concrete sidewalk on the northeast side of the roadway and a six-foot wide concrete sidewalk or multi-purpose path on the southwest side. The path will be constructed of compacted crushed rock or asphalt-concrete (AC).
- New transit bus stops to accommodate the new roadway alignment including new concrete pads for bus shelters.
- A new storm drain system including piping, catch basins, oil/water separators, and detention/water quality vaults or surface ponds/swales, and erosion control features to comply with COB storm water design criteria.
- A new water line and sanitary sewer where necessary to accommodate the new roadway.
- A new 16-inch diameter oil pipeline owned and operated by Olympic Pipeline Company (OPLC) crossing the road near Coal Creek Parkway. This will be designed and constructed by Olympic Pipeline.

- New landscaping for revegetation or replacement of disturbed roadside landscaping.
- New approaches at existing intersections.
- A structural retaining wall will be provided on the northeast side of the roadway from Coal Creek Parkway SE to SE 54th Place. The southwest side of the roadway will have a 2H:1V (horizontal to vertical) slope to meet grade.

We understand that the excavation planned for the northwestern segment of Forest Drive SE near Coal Creek Parkway SE will be done in stages to permit traffic flow in this area. Temporary roads will be constructed at various stages of the excavation and grade-separated traffic lanes may be required. Therefore, temporary retaining structures will be needed to support the temporary roadways.

PURPOSE AND SCOPE

The purpose of our geotechnical engineering services is to evaluate subsurface soil and ground water conditions at the site as a basis for developing recommendations for the geotechnical aspects of the project including earthwork, pavement sections, retaining wall types and design criteria and drainage. Specifically, our scope includes the following tasks:

1. Complete a total of eight borings along Forest Drive SE. Two borings were completed within 1,000 feet of the Coal Creek Parkway intersection to depths of 38 and 69 feet. Piezometers were installed in these borings to observe ground water conditions. The remaining six borings were completed to depths ranging from 9 to 33.5 feet along the remaining 1.1 miles of the alignment at approximately 1,000 feet spacing. The deep borings were completed to characterize the subsurface conditions in the area where retaining walls are planned. The remaining six borings were used to evaluate the pavement thickness and characterize near-surface soil conditions where shallow cuts and fills will be completed. One boring, drilled to a depth of 33.5 feet, was completed to characterize the fill at a ravine crossing.
2. Complete laboratory tests on selected soil samples obtained from the borings. The tests included moisture content, density and gradation tests.
3. Provide recommendations for earthwork including site preparation, structural fill, pavement subgrade preparation, cut and fill slopes and wet weather construction recommendations.
4. Provide design criteria for suitable retaining wall types. The design criteria include earth pressure diagrams for static and seismic loading conditions, drainage requirements, and recommendations for construction.
5. Provide design pavement sections.
6. Provide recommendations for storm water management facilities including detention vaults, detention ponds and/or infiltration facilities as appropriate. (Infiltration testing is not included at this time.)
7. Provide unit costs for the retaining systems.

SITE CONDITIONS

GENERAL

The roadway is divided into four sections in this report. The segments and site plan locations are as follows:

- Coal Creek Parkway SE to SE 54th Place – Figure 2.
- SE 54th Place to Highland Drive – Figures 2 through 4.
- Highland Drive to SE 59th Street – Figure 4.
- SE 59th Street to SE 63rd Street – Figures 4 through 6.

The following sections discuss previous studies and exploration at the site, surface conditions, and subsurface conditions including details on our exploration.

PREVIOUS STUDIES

Improvements to the northwestern segment of Forest Drive SE were originally proposed in 1992 from Coal Creek Parkway SE to 133rd Place SE (about 500 feet east of SE 54th Place). The planned improvements included lowering the roadway grade in this area. Converse Consultants NW (CCNW) completed a geotechnical report for the Forest Drive project dated June 30, 1992.

As part of their geotechnical evaluation, CCNW completed two borings to depths of 33 and 44 feet on September 12 and 13, 1991. The borings, labeled CC-1 and CC-2, are approximately located as shown on Figure 2. Subsurface conditions encountered at these borings are described in the "Subsurface Conditions" section of this report. Copies of the borings are presented in Appendix B.

SURFACE CONDITIONS

General

Forest Drive SE is an arterial roadway servicing a large, mostly residential area of southeast Bellevue. The roadway in the project study area is oriented northwest/southeast. The existing road has one travel lane about 12 feet wide in each direction with variable AC and gravel shoulder widths ranging from 3 to 10 feet. The roadway elevation increases from northwest to southeast from about Elevation +215 feet to +530 feet, with a steep upgrade from Coal Creek Parkway SE. Descriptions of surface conditions from Coal Creek Parkway SE to SE 63rd Street are presented in the following sections.

Coal Creek Parkway SE to SE 54th Place

Forest Drive SE begins a steep ascent from Elevation +215 feet at Coal Creek Parkway SE to Elevation +280 feet at SE 54th Place (Stations 10+00 to 20+00). The travel lanes are 12 feet wide and the AC-paved shoulders vary in width from 5 to 8 feet. The first 250 feet of Forest Drive SE from Coal Creek Parkway SE has 6-inch concrete curbs adjacent the traffic lanes (Stations 10+00 to 12+50). The roadway traverses a moderate to steep northwest facing slope. Cuts up to 15 feet high are present along the northeast side of the road. A combined Puget Sound Energy Transmission Line and Olympic Pipeline Company easement cross the roadway at approximately 250 to 400 feet southeast of the intersection of Coal Creek Parkway SE (Stations 12+50 to 14+00). Two overhead power lines and a 16-inch diameter underground oil pipeline are present within the easement.

Vegetation adjacent to the roadway consists of grasses, brush and scattered trees. The trees were concentrated largely northeast (upslope) of the roadway. Cleared areas covered with grass were observed on the southwest (downslope) of the roadway, particularly between the easement and SE 54th Place (Stations 13+00 to 20+00). Several areas of slow to moderate ground water seepage were observed above and below the roadway within the northwesternmost 600 feet of Forest Drive SE (between Stations 10+00 to 16+00). Earth ditches are adjacent both shoulder areas along most of this segment.

SE 54th Place to Highland Drive

This section of Forest Drive SE is bordered by residential properties and open space areas (Stations 20+00 to 41+00). The travel lanes are about 12 feet wide in each direction at this segment. The shoulder widths are variable between 5 and 13 feet, consisting of AC and/or gravel. A 6-foot wide concrete sidewalk is present on the southwest side of the roadway between SE 54th Place and Somerset Drive (Stations 20+00 and 28+30). A shorter segment of sidewalk is present on the northeast side of the roadway from about 300 feet northwest of Somerset Drive to its intersection (Stations 24+30 to 28+30). The roadway slopes gently to moderately up from approximate Elevation +280 feet at SE 54th Place to Elevation +450 feet at Highland Drive. Somerset Drive SE, SE 55th Place and 135th Place SE intersect Forest Drive SE in this segment.

Cut slopes inclined at approximately 2H:1V ranging from 5 to 15 feet in height are present along the northeast side of the roadway. The slopes are generally vegetated with small brush and trees. The southwest side of the roadway is generally level with slight slopes to the southwest. Much of the southwest side has been landscaped with lawn grass, low brush, and trees. Earth ditches are adjacent both shoulder areas along most of this segment.

Highland Drive to SE 59th Street

Forest Drive crosses a ravine in this segment. The travel lanes are 12 feet wide in each direction and the shoulder width varies from 5 to 15 feet, consisting of AC and/or gravel. The roadway is supported on a fill embankment that is approximately 25 feet high and is inclined from about 1.5H:1V to 2H:1V. The roadway slopes gently up from approximately Elevation +450 feet at Highland Drive to +460 feet at SE 59th Street. Vegetation on the embankment faces consists primarily of blackberry, ferns and scattered small trees. A stream is present at the base of the ravine. The stream flows through a 48-inch diameter culvert at the base of the embankment. Adjacent to the drainage culvert is an 11-foot diameter corrugated pipe that serves as a pedestrian trail tunnel through the embankment.

SE 59th Street to SE 63rd Street

This segment of Forest Drive SE is bordered by residential properties and open space areas. The travel lanes are 12 feet wide in each direction and the shoulder width varies from 5 to 10 feet, consisting of AC and/or gravel. The roadway slopes gently up from approximately Elevation +460 feet at SE 59th Street to Elevation +530 feet at SE 63rd Street. SE 60th Street, 138th, 141st and 142nd Avenue SE intersect Forest Drive SE in this segment.

Cut slopes inclined at approximately 2H:1V ranging from 5 to 15 feet in height are present along the northeast side of the roadway. The slopes are generally vegetated with small brush and trees. The southwest side of the roadway is gently sloping to the southwest. Most of this roadway side has been landscaped with lawn grass, small brush, and occasional trees.

SUBSURFACE CONDITIONS

General

We completed eight borings ranging from 9 feet to 68.5 feet deep and installed three piezometers on October 29, 30, 31, and November 2, 2001. The locations of the borings are shown on Figures 2 through 6. The borings were drilled using a truck-mounted drilling rig subcontracted to GEI. A detailed description of the subsurface exploration program, logs of the borings, and results of the laboratory testing program are presented in Appendix A.

Coal Creek Parkway SE to SE 54th Place

Borings B-6, B-7, and B-8 were completed to depths of 14, 38, and 68.5 feet, respectively in this segment. The locations of these borings are shown on Figure 2. The pavement at this location consists of 4 inches of AC. An Illustrative Subsurface Profile, Figure 7, shows the observed soil stratigraphy overlain with the existing and proposed roadway grades. We have included subsurface data from the two CCNW borings, CC-1 and CC-2, in this segment from their 1992 report. Underlying the pavement the borings encountered between 5 and 15 feet of medium dense to dense sand and gravel with variable amounts of silt. We encountered medium dense to dense silty sand with variable amounts of gravel to the bottom of borings B-6 and B-7. At boring B-8 and the very bottom of boring B-7, the borings encountered a stiff silt that grades to hard silt about 30 feet below the surface at boring B-8. The hard silt appears to have lithified and taken on characteristics of siltstone bedrock. The hard silt was observed to the bottom of boring B-8.

We installed piezometers at borings B-7 and B-8. At boring B-8, a shallow and deep piezometers were installed to depths of 25 and 68 feet. We observed perched ground water in the dense sand and gravel between 3 and 9 feet below the surface as shown on Figure 7. Deeper ground water was observed at boring B-7 at 14.5 feet on October 30, 2001, boring CC-2 at 19 feet on September 27, 1991, and boring B-8 at 33 feet on December 10, 2001. Ground water levels are expected to fluctuate as a result of season, precipitation, and other factors.

SE 54th Place to Highland Drive

Boring B-5 was completed to a depth of 9 feet in this segment at the location shown on Figure 3. The pavement at this location consists of 4 inches of AC. Underlying the pavement the boring encountered medium dense silty sand with gravel to a depth of about 7 feet. Below this depth this silty sand becomes very dense.

No ground water was observed in boring B-5 during drilling. Ground water levels are expected to fluctuate as a result of season, precipitation, and other factors.

Highland Drive to SE 59th Street

Boring B-4 was completed to 33.5 feet in this segment at the location shown on Figure 4. The pavement at this location consists of 6 inches of AC. Underlying the pavement the boring encountered approximately 26 feet of fill overlying very dense native silty sand with gravel. The fill consists of medium dense silty sand below the pavement section.

No ground water was observed in boring B-4 during drilling. Ground water levels are expected to fluctuate as a result of season, precipitation, and other factors.

SE 59th Street to SE 63rd Street

We drilled three borings (B-1 through B-3) along this segment at the locations shown on Figures 4 through 6. The pavement was 8, 6.5, and 6 inches thick in borings B-1, B-2, and B-3, respectively. Below the AC the borings encountered 5 to 9 feet of fill over native medium stiff sandy silt and medium dense to very dense silty sand. The fill consists of loose to dense sand with variable silt and gravel content.

We observed perched ground water in the fill at 5 feet and 2.5 feet at borings B-2 and B-3, respectively during drilling. No ground water was encountered in boring B-1 during drilling. Ground water levels are expected to fluctuate as a result of season, precipitation, and other factors.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

We conclude that the site is suitable for the proposed improvements to Forest Drive SE between Coal Creek Parkway SE and SE 63rd Street. Based on our review of the preliminary plans and discussions with W&H Pacific, we conclude the following:

- The majority of the project alignment will require widening of the roadway with only minor grading.
- The excavation between Coal Creek Parkway SE and SE 54th Place and the ravine between SE 54th Place and Highland Drive will require significant grading and/or improvements to accommodate the proposed roadway.
- Fill consisting of medium dense or dense sand and gravel with variable silt and native medium dense to very dense silty sand (glacial till) soils underlies much of the pavement for the proposed roadway.
- In most places, these soils will provide suitable subgrade for placement of new structural fill, retaining walls, and new pavement sections, provided the subgrade is prepared during dry weather periods and in accordance with our recommendations.
- The on-site soils contain significant fines content and may not be workable during wet weather.

A brief overview of geotechnical design issues for each roadway segment (consisting of earthwork, retaining walls, drainage, and/or pavements) is presented in the next four sections. Detailed recommendations for project construction are given in subsequent sections of this report.

Coal Creek Parkway SE to SE 54th Place

- Earthwork – This segment of Forest Drive SE will be lowered and regraded to reduce the steep grade of the existing roadway. Excavations up to 25 feet deep are anticipated. Recommendations for site preparation, excavations, cut slopes, and wet weather conditions are described in the following section.
- Retaining Walls – Forest Drive SE will remain open during construction of the improved roadway. Therefore, temporary retaining wall systems such as soldier pile walls (with and without tiebacks), ecology block walls, and rockery walls will likely be required to provide temporary traffic lanes as the excavation is performed. We recommend permanent retaining walls taller than about 15 feet be constructed as soldier pile walls with tiebacks. Permanent walls between 6 and 15 feet in height can be designed as cantilever soldier pile walls. Permanent cut slope walls shorter than 6 feet can be designed as rockeries. Permanent fill slope walls should be designed as MSE walls. We observed significant surface and subsurface water in the planned retaining wall area, particularly on the northeast (uphill) side of the roadway. The retaining wall design pressures assume full drainage of the soldier pile walls. Potential impacts to the ground water table are discussed in the "Wall Drainage" section.
- Drainage – We understand that new storm drains and retaining wall drainage will be directed into a detention or infiltration basin. The location of this basin has not been determined, but we understand it will likely be on the southwest side of this road segment. Once the basin is located, we recommend additional field explorations be performed to evaluate the feasibility of infiltration. Retaining wall drainage will likely be conveyed separately from the surface run-off of the roadway.
- Pavements – New pavement is required for this road segment due to the change in vertical alignment.

SE 54th Place to Highland Drive

- Earthwork – This segment of Forest Drive SE has wide shoulders adjacent to the existing roadway. Therefore, only minor earthwork is anticipated for this segment to accommodate new pavement sections, intersection improvements, and sidewalks/pedestrian trails.
- Pavements – New pavement will need to be constructed for the widened sections of the road. New pavement and/or pavement overlays will be required for the existing road.

Highland Drive to SE 59th Street

- Earthwork – This segment of Forest Drive SE is supported on a fill embankment that crosses an existing ravine. The existing roadway width across the embankment is approximately 35 feet. To accommodate the new roadway section, this embankment will require widening to 59 feet. The widening may be achieved by lowering the roadway elevation at this location and/or constructing mechanically stabilized earth (MSE) retaining walls at the top of the embankment. Excavations into the existing embankment may encounter loose fill that will require recompaction and/or stabilization fabric to provide adequate pavement subgrade support. The MSE wall will require placement of structural backfill within the reinforced zone behind the wall.

- Retaining Walls: MSE Wall – An MSE wall constructed at the top of the embankment is feasible to accommodate the new road width.
- Pavements – New pavement will need to be constructed for widened roadway sections. New pavement sections and/or pavement overlays will be needed for the existing road. A new pavement section will be needed if the road elevation is lowered at the ravine crossing.

SE 59th Street to SE 63rd Street

- Earthwork – This segment of Forest Drive SE has wide shoulders adjacent the existing roadway. Therefore, only minor earthwork is anticipated for this segment to accommodate new pavement sections, intersection improvements, and sidewalks/pedestrian trails.
- Pavements – New pavement sections will need to be constructed for widened sections of the road. New pavement sections and/or pavement overlays will be needed for the existing road.

EARTHWORK

General

As discussed, most of the earthwork will be concentrated in the northwestern segment of Forest Drive SE between Coal Creek Parkway SE and SE 54th Place. The road will likely remain open to traffic during construction, so temporary construction staging will be required as the excavation is made. We understand that scenarios for temporary construction staging include separating the traffic lanes, reducing the travel lane widths, and constructing near vertical cut slopes supported by temporary retaining walls. The final excavation to accommodate new roadway grades will be supported by permanent retaining walls discussed in the "Retaining Walls" section.

The ravine crossing between Highland Drive and SE 59th Street may require placement of structural fill behind retaining walls and/or lowering and regrading of the existing road elevation to accommodate the new road width. We also understand that a new stairway is planned along the southwest slope of the embankment. Minor excavation will likely be required for this stairway.

The remainder of the roadway will likely require minor grading along the existing shoulders to accommodate the new road width. Detailed recommendations for earthwork are presented in the following sections.

Site Preparation

General. The existing fill and native soils consist mostly of moisture-sensitive sandy soils with variable silt content on which it will be difficult to operate equipment during wet weather and which cannot be compacted properly when they are more than a few percent above the optimum moisture content. Site preparation and earthwork should be done during extended periods of dry weather when the surficial soils will be less susceptible to disturbance and will provide better support for construction equipment. Stripped subgrades should not be left exposed to inclement weather.

Areas receiving new fill, retaining walls, and/or pavement should be stripped and grubbed of all organic matter and loose topsoil. Based on our experience, the thickness of this stripping will likely be 6 to 12 inches in most areas. Isolated areas of greater stripping should be expected, especially in areas where trees or large shrubs are present. Roots larger than about 1-inch-

diameter should be grubbed to at least 12 inches below finished subgrade. Stripped material should be either removed from the site or stockpiled for later use in landscaping areas, if appropriate.

Overexcavation should be expected in areas where soft or loose fill or native soils are encountered that cannot be compacted to the specified standard.

Subgrade Evaluation – Dry Weather

Following stripping, we recommend that the exposed subgrade soils be thoroughly proofrolled with heavily loaded construction equipment if site preparation is done during extended dry weather conditions. Soft or otherwise unsuitable areas revealed during proofrolling that cannot be compacted to a stable and uniformly firm condition must be either scarified, aerated and recompacted, or overexcavated and replaced with structural fill compacted to the recommended compaction criteria. The depth to which soils must be scarified, recompacted, removed and/or replaced should be evaluated by a geotechnical engineer.

Wet Weather Construction

General. The fill and native soils along the roadway alignment contain sufficient amount of fines (material passing the U.S. No. 200 sieve) to be moisture sensitive. If site preparation is done during wet weather, earthwork and construction operations should be planned to reduce the exposure of subgrade areas to wet weather and construction traffic. During wet weather, forest duff, topsoil and root mass should be stripped with lightweight equipment and construction traffic should be kept off the exposed areas.

Subgrade Evaluation. The exposed subgrade should be evaluated by a geotechnical engineer who will probe the exposed area to identify areas of soft or yielding soils that should be replaced. These soft areas should be overexcavated to the depth recommended by the geotechnical engineer. Upon the recommendation of the geotechnical engineer, the contractor should be prepared to place a nonwoven fabric such as Mirafi 160N or other fabric with similar properties to provide separation between the exposed soils and the structural fill as well as some stabilization.

Recommendations for Wet Weather Earthwork. Other wet weather considerations are as follows:

- The storm drainage system should be installed early in the sequence of earthwork activities to provide a means of removing surface water.
- Structural fill consisting of a thickness of at least 12 inches of free draining sand and/or gravel with less than 5 percent fines by weight of the 3/4-inch minus material will be required to support construction traffic in wet weather.
- The existing fill and native soils in utility trenches will not be suitable for reuse as structural fill in the trenches. A contingency for free draining trench backfill material should be included in the budget if construction takes place in wet weather.

If wet weather construction is expected, we recommend that COB develop a plan to incorporate wet weather considerations into the project plans, specifications, schedule and budget.

Excavations

The roadway improvements will require removal of existing pavements, buried utilities, and possibly other structures or debris, buried along the roadway alignment. Most of this material can either be separated for legal disposal or broken down for use in the fill as approved by the engineer.

The site will be excavated up to 25 feet between SE 54th Place and Coal Creek Parkway SE for the proposed lowering of the road. We expect that most of this excavation will be in medium dense to dense sand and gravel with variable silt content and dense to very dense silty sand. Thus, some ripping with a large bulldozer may be necessary to facilitate excavation. However, in our opinion, the excavation can be completed with conventional excavating equipment. Occasional cobbles (and possibly boulders) could also be encountered in the glacially deposited soils and may require larger excavation equipment.

Temporary and Permanent Cut Slopes

Most of the excavations at this site will require temporary and permanent walls to retain the soil within the road right-of-way. Recommendations for retaining walls are presented in the next section. This section addresses those areas of the site where cut slopes are used to complete excavations.

We understand that an open cut slope may be constructed for the southwest (downslope) side of the excavation and/or for temporary road slopes between Coal Creek Parkway SE and SE 54th Place. Based on the conditions encountered in our explorations, the cuts will likely encounter about 5 to 15 feet of medium dense to dense sand and gravel with variable silt underlain by very dense silty sand. Portions of the upper layer of medium dense to dense sand and gravel with silt will likely be saturated and seepage is expected on the cut slope face. Therefore, we recommend that temporary cut slopes excavated into the upper medium dense to dense sand and gravel be inclined no steeper than 2H:1V and temporary cut slopes into the underlying dense to very dense silty sand be no steeper than 1.5H:1V.

Slope inclinations may have to be modified by the contractor if localized sloughing occurs. In addition, we recommend the following for open cuts at the site:

- No traffic, construction equipment, or building supplies be allowed at the top of cut slopes for a distance of at least 5 feet from the top of the cut.
- Exposed soil along the slope be protected from surface erosion using waterproof tarps or visqueen.
- Construction time be scheduled so that the length of time the temporary cut is left open is minimized.
- Erosion control measures be constructed as appropriate such that runoff from the site onto the slopes is minimized.
- Surface water flow be diverted away from all excavations.

Since the contractor has control of the construction operations, the contractor should be made responsible for the stability of cut slopes, as well as the safety of the excavations. All shoring and temporary slopes should conform to applicable local, state and federal safety regulations.

We recommend a maximum permanent cut slope configuration of 2H:1V. Permanent slopes should be hydroseeded or otherwise protected from erosion. Temporary erosion control measures will be necessary until permanent vegetation is established.

Structural Fill

General. Structural fill must be free of significant debris, organic contaminants and rock fragments larger than 6 inches. The suitability of soil for use as structural fill will depend on its gradation and moisture content. As the amount of fines (portion of 3/4-inch minus soil particles passing a U.S. Standard No. 200 sieve) increases, soil becomes more sensitive to small changes in moisture content and adequate compaction becomes more difficult to achieve. Structural fill placed during wet weather or on wet subgrades should contain no more than 5 percent fines. During dry weather, the fines content may be higher, provided that the fill is at a suitable moisture content, or can be moisture-conditioned and compacted to the specified degree.

We recommend that fill slopes and wall backfill be constructed using material which meets the specifications for select borrow as described in Section 9-03.14(2) of the 2000 Washington State Department of Transportation (WSDOT) Standard Specifications for Road, Bridge and Municipal Construction. Common borrow, as described in Section 9-03.14(3) of the 2000 WSDOT Standard Specifications, may be used for structural fill during periods of dry weather. However, common borrow is typically moisture sensitive and will not be suitable for use as fill during wet weather.

Fill Placement Methods. Structural fill should be placed in horizontal lifts which are 10 inches or less in loose thickness. During wet weather, the initial lift may need to be somewhat thicker in order to reduce the chance of pumping of the fine-grained subgrade soils and to provide adequate support for construction equipment. The moisture content of the fill soil must be adjusted as necessary to achieve the required degree of compaction. Each lift must be compacted to the appropriate specification before placing subsequent layers. Fill placed on existing slopes of 4H:1V (horizontal to vertical) and steeper must be 'keyed' into the existing slope by means of horizontal benches perpendicular to the slope gradient. The width of benches should be a minimum of 3 feet. Within 2 feet of the finished subgrade surface for pavement areas, each lift should be uniformly compacted to at least 95 percent of the maximum dry density (MDD) obtained in general accordance with the ASTM D-1557 test method. Structural fill placed more than 2 feet below finished pavement subgrade elevation should be compacted to at least 90 percent of the MDD per ASTM D-1557.

Suitability of On-Site Soil. The native soils encountered at the site may be suitable for structural fill during dry weather conditions provided they can be moisture conditioned and compacted to the minimum standards.

Import Fill. Import fill should conform to the previous recommendations provided above for structural fill. During summer months, we recommend a fines content up to about 15 percent provided that the moisture content is near optimum. Should fill be needed at the site for grading

during the wet season, we recommend using a select import fill. The select import should consist of a well-graded sand and gravel with less than 5 percent passing the U.S. No. 200 sieve, based on that fraction passing the 3/4 inch sieve. Specific gradation requirements for pavement subbase materials are provided in the "Pavements" section of this report. Specifying a well-graded sand and gravel with at least 40 percent retained on the U.S. No. 4 sieve would further expedite grading and provide a stiffer subgrade, particularly during poor weather.

Permanent Fill Slopes. Permanent fill slopes should be inclined no steeper than 2H:1V in the native soil or in structural fill placed in accordance with our recommendations. Fill should be carefully compacted on the slope face, or the fill embankment can be overbuilt and cut back to a 2H:1V configuration. Permanent slopes must be hydroseeded or otherwise protected from erosion. Temporary erosion control measures may be necessary until permanent vegetation is established.

RETAINING WALLS

General

Permanent walls will be required to retain cut slopes between Coal Creek Parkway SE and SE 54th Place. Permanent fill walls may be required at the ravine crossing between Highland Drive and SE 59th Street. We anticipate that temporary retaining walls will be required between Coal Creek Parkway SE and SE 54th Place to maintain traffic flow during construction.

Based on our understanding of the retaining wall requirements we recommend the following wall types for use:

- Rockeries for cuts 6 feet or less in height and fills 4 feet or less in height
- Cantilever Soldier Pile Walls for temporary or permanent cuts from 6 feet to about 15 feet high
- Tieback Solder Pile Walls for temporary and permanent cuts greater than 15 feet high
- MSE Walls for fills 4 or more feet in height
- Ecology Block Walls for temporary and permanent cuts and fills up to 6 feet high

Cantilever and Tieback Soldier Pile Walls

Lateral Earth Pressures. Design lateral earth pressures are presented for temporary and permanent soldier pile walls in Figure 8 for walls with and without tiebacks. Active pressure values are given for both level and 2H:1V sloping backfill conditions. Active pressure values for backfill slopes shallower than 2H:1V should be linearly interpolated. Permanent soldier pile walls should be designed to resist seismic forces. We recommend a uniform lateral seismic pressure of 15H and 17H psf (where H is the height of the excavation) be used in design of permanent cantilever and tieback soldier pile walls, respectively. In our experience, the static wall factors of safety are reduced to 1.1 or greater when applying seismic pressures.

The pressure diagram does not include earth pressures that may be imposed on the wall from temporary construction equipment such as concrete trucks, cranes or stored supplies. If construction equipment is anticipated within a horizontal distance from the walls equal to or less than about 1/2 the difference in elevation between the top of the wall and the bottom of the

excavation, additional loading to the walls may need to be considered in design. If such loads are anticipated, GeoEngineers should be consulted to develop revised earth pressure diagrams and the structural engineer should be consulted to evaluate the shoring design for the specific loading condition.

The pressure diagrams presented in Figure 8 assume free draining conditions behind the walls. Drainage behind the wall may cause the ground water table in the vicinity of the walls to be lowered which could impact the local ground water regime. This is discussed in more detail in the "Wall Drainage" section.

Soldier Piles. The soldier piles should have a sufficient depth of embedment to resist "kick-out." We recommend a minimum embedment of 10 feet below the planned excavation depth. The vertical capacity of the soldier piles to resist the downward component of anchor loads and other axial loads can be evaluated using an allowable skin-friction value of 1,000 pounds per square foot (psf). Skin friction is applied to the pile perimeter area for the portion of the soldier pile embedded below the lowest level of the excavation. This value includes a factor of safety of about 2. The soldier piles should be backfilled below the base of the excavation with structural concrete and above the base of the excavation with lean mix concrete. Vertical load can also be resisted in end bearing on the soldier pile. We recommend an allowable end-bearing value of 15 ksf for piles supported on dense silty sand. The allowable end-bearing value should be applied to the base area of the drilled hole into which the soldier pile is placed. This value includes a factor of safety of about 2.5. The allowable vertical capacity may be increased by a factor of one-third for short-term loading such as wind or seismic loading.

Soldier Pile Settlement. We estimate that the settlements of soldier piles designed and installed as recommended will be on the order of ½ inch or less. Settlements will occur rapidly as loads are applied.

Lagging and Drainage. We recommend that the lagging be designed for uniform pressures equal to one-half the active lateral pressure presented previously. This pressure reduction is based on a maximum center-to-center pile spacing of 8 feet and results from arching of soil between the soldier piles. If a wider spacing is desired, we should be consulted for revised lagging pressures. For temporary soldier pile walls, drainage can occur between gaps in the lagging provided water coming out of the walls does not interfere with construction or traffic operations and can be suitably discharged.

The space behind the lagging should be backfilled with free draining material as soon as practical. The free draining material will help reduce the risk of voids developing behind the wall and provide additional drainage of potential ground water seepage. The free draining material should be poorly graded with no particle larger than 3/8 inch or smaller than the U.S. Standard No. 40 sieve. Drainage requirements for permanent soldier pile walls are discussed in the "Wall Drainage" section.

Tiebacks. Tieback anchors will likely be required where the wall height exceeds about 12 to 15 feet in height depending on the slope inclination of the backfill. The tiebacks should extend far enough behind the wall to develop anchorage beyond the "no-load" zone and into a stable soil mass. As a minimum, the anchors should extend at least 15 feet beyond the no-load zone. As shown on Figure 8, the "no-load" zone is defined by a line extending horizontally back from the wall at the base of the excavation for a distance equal to H/4 (where H is the height of the wall) and then extending upward and away from the wall at an angle of 60 degrees, measured from the horizontal. The anchors should be inclined downward at 15 to 30 degrees below the horizontal.

We recommend that the tieback anchors be designed and constructed in general accordance with the criteria presented in the following documents.

1. U.S. Department of Transportation, Federal Highway Administration, "Permanent Ground Anchors," Report FHWA-DP-68-1R, 1984.
2. U.S. Department of Transportation, Federal Highway Administration, "Tiebacks," Report FHWA/RD-82/047, 1982.
3. Post Tensioning Institute, "Recommendations for Prestressed Rock and Soil Anchors," 1995.

Anchorage will be developed in the medium dense to dense sand and gravel for upper portions of the wall and dense to very dense silty sand in the lower wall sections. We recommend a preliminary design adhesion between the anchor and soil of 1,500 psf. This value includes a factor of safety of 2. Higher allowable adhesion values may be developed, depending on the anchor installation technique. The contractor should be given the opportunity to use higher adhesion values by conducting performance tests prior to the start of the production shoring operation. This would reduce the required anchor length or allow a smaller anchor diameter.

Corrosion protection will be required for tiebacks that will be used as part of a permanent retaining wall. We recommend that the tieback anchors be designed and constructed in general accordance with the criteria presented in the WSDOT Bridge Special Provision for Permanent Ground Anchors.

We recommend that spacing between tiebacks be at least 3 times the anchor hole diameter to reduce the potential for group interaction.

Anchor Testing. The tieback anchors should be performance- and proof-tested generally as described in the Post Tensioning Institute publication, "Recommendations for Prestressed Rock and Soil Anchors."

We recommend that at least two anchors be installed and performance tested in each different soil type prior to installing production anchors. We recommend that the performance tests be conducted to 200 percent of the design load.

The capacity of each production anchor should be checked by loading to at least 1.3 times the design load and holding the load for a minimum of 5 minutes as described in the above references. The performance and proof testing of the anchors should be monitored, recorded and interpreted by personnel from GeoEngineers.

Construction Considerations

Soldier Piles. We recommend that the soldier piles be installed by drilling a minimum 24-inch diameter hole to install the pile. Boulders are commonly encountered in glacially deposited soils such as the dense to very dense silty sand unit. The contractor should be prepared to address the presence of boulders during construction.

Also note that high-voltage overhead power lines and the underground OPLC pipeline cross Forest Drive SE where soldier pile walls will be constructed as shown on Figure 2. Plans and specifications should clearly show these possible obstructions to wall construction along with locations of other underground or overhead utilities. Adjustments to the wall design may be necessary at this crossing. The contractor has the responsibility for accurately locating the utilities in the field prior to wall construction.

Temporary Casing. Temporary casing may be required at the ground surface and at greater depths if localized caving/sloughing occurs or if ground water is encountered. This will likely occur for tiebacks and soldier piles installed in water bearing zones of medium dense to dense sand and gravel observed in the upper 5 to 15 feet below the surface.

Dewatering and Tremie Placement. If ground water is present at the base of the soldier pile excavations prior to concrete placement, the concrete should be placed using tremie techniques. If ground water is encountered and the excavation is not cased full depth, the water level in the excavation must be maintained at the level of the surrounding ground surface during soldier pile construction. The contractor must also be prepared to control possible blow-ins at the bottom of the excavation.

Obstructions. Although not observed in the borings completed for this project, cobbles and boulders are frequently encountered in glacial soils, particularly the dense to very dense silty sand. Core drilling and/or excavation may be required to remove cobbles and/or boulders. It may be difficult or impossible to remove a portion of an obstruction that is in the path of the excavation. In this situation, some adjustment in the soldier pile location and spacing may be required.

Instrumentation. We recommend a shoring monitoring and instrumentation program be established prior to construction. This should include a series of survey points to monitor horizontal and vertical movements of the shoring, adjacent temporary and/or permanent roads, and any other nearby temporary or permanent facilities. Locations of the monitoring points should be established when the final shoring design is complete. Monitoring points are typically established within a lateral distance of half the height of the shoring, and on all adjacent structures.

Rockeries

General. Rockeries may be used in both cut and fill areas. In cut areas where medium dense or denser native soils are exposed, rockery walls may be up to 6 feet high, with a maximum

backslope of 2H:1V. In fill areas, rockery walls may be up to 6 feet high, with a level backslope.

We recommend that rockeries be founded on medium dense to dense native soils or on structural fill compacted to the recommended standard. In our opinion, when adequate foundation support and suitable materials are present, rockeries will provide a cost-effective earth support system. Specific construction guidelines for rockeries are presented in the following paragraphs.

Construction Guidelines. The primary purpose of a rockery is to protect the slope face from erosion and raveling, while providing limited soil retention. The base of the rockery should be embedded at least one-half the thickness of the lowest course of rocks or 18 inches below the adjacent ground surface, whichever is greater. The rockery should be supported on firm, undisturbed medium dense or denser native soils or on compacted structural fill. The final rockery face should be constructed with a batter of between 1H:5V and 1H:6V.

The rockery rocks should be tabular and rectangular. Rocks should be hard, sound, durable and free of weathered portions, seams, cracks and other defects. Based on the height of the cut and the slope behind the rockery, we recommend that the rockeries be constructed using rock weights from about 750 to 5,000 pounds (3- to 5-man rocks as defined by Associated Rockery Contractors). The rock density should not be less than 160 pounds per cubic foot. The lower 2 to 4 feet of the rockery should be constructed using 4- to 5-man size rocks.

Rock selection and placement should be accomplished to reduce the number and size of voids. In the exposed face of the wall, no openings greater than 6 inches in dimension in any direction should be permitted. Rock courses should be gradational in size from bottom to top with the largest rocks of uniform size being placed for the lowest two courses. The contact between rocks should slope downward to the back side of the rockery. Each course of rocks should be seated tightly and evenly on the course beneath. After seating each course of rock, voids between the rocks should be chinked on the back with quarry spalls to eliminate passage of backfill material. Backfill immediately behind the rockery should consist of quarry spalls. The spalls should consist of well-graded 3/4- to 4-inch crushed rock and should be durable, uncontaminated by soil or other debris, and not readily susceptible to weathering.

The quarry spall fill should be at least 18 inches wide from the rockery and the face of the cut. The spalls should be placed and compacted in lifts to a level approximately 2 inches below the top of each course of rocks as they are placed, until the uppermost course is placed. Backfill material falling onto the bearing surface of one rock course must be removed before setting the next course. Rock placement should be such that each rock above the base course will be supported on two rocks in the next lower row.

A perforated drainpipe should be embedded in the backfill at the base of the rockery. This drain should discharge to the storm drain system or daylight at a location which will not impact the adjacent road or other moisture-sensitive areas.

A qualified contractor experienced in rockery construction should install rockeries. The construction should be monitored by a geotechnical engineer.

MSE Walls

MSE walls utilize reinforcing materials such as polymer grids, metal strips/wire, or geotextiles that are attached to a facing element and embedded in a portion of retained fill behind the wall. These types of walls are typically used to retain fill embankments. They can be used in cut slope areas as well, although they require additional excavation behind the wall face for placement of reinforcing materials. The reinforcing material interacts with controlled granular fill material behind the wall to provide resistance to horizontal loads. Numerous MSE walls systems have been developed to date, most of which are proprietary. Experience with these systems in Washington State and around the United States indicates that they are a cost effective retention system for fill embankments. MSE walls are generally less sensitive to settlement than rigid concrete retaining walls. A rockery facing can be used where the backfill is reinforced.

Wall Drainage

A suitable drainage system should be installed to prevent the buildup of ground water pressures behind all retaining walls. For permanent soldier pile walls, we recommend that vertical wick drains or strips of drainage material be installed on the face of the timber lagging at spacings equal to or less than the soldier pile spacing. For permanent walls with timber or concrete lagging facia panels, the wick or strip drains should be positioned between the lagging and backfill. The minimum width of the vertical drainage material should be 18 inches. A lateral strip of drainage material should be placed along the bottom of the walls to provide additional collection capacity.

The bottom of the drainage material should wrap around a collection pipe that is routed to a suitable discharge. We recommend that strip drains be connected to a perforated drain installed along the base of the wall that is connected to the storm drainage system. We anticipate high volumes of ground water, particularly behind the northeast (uphill) soldier pile wall. Therefore, we recommend that discharge pipes be installed at short intervals (about 50 to 100 feet) to discharge water collected behind the permanent walls.

Surface water should not be allowed to infiltrate into the ground immediately behind the retaining walls. We recommend that surface water be collected above the soldier pile walls by means of a portland cement concrete or asphalt concrete gutter adjacent to the top of the wall, in accordance with WSDOT Standard Plans.

Drainage for other retaining wall systems should be provided by placing a zone of sand and gravel containing less than 5 percent fines at least 18-inch-wide immediately behind the wall. This drainage zone should extend to within 12 inches of the top of the wall. A lower permeable native soil should be placed and compacted in the zone above the drainage material. Weepholes at about 4-foot centers and/or a drainpipe should be installed at the base of the wall to remove water from the drainage zone.

It is possible that retaining wall drainage for the permanent soldier pile wall on the northeast side of Forest Drive SE near Coal Creek Parkway SE may alter the local ground water table. This should be taken into consideration in design of the project. If undesirable impacts will result from altering the ground water levels in this area, the walls can be redesigned to resist hydrostatic pressures from the adjacent ground water. However, this will substantially increase the wall loads requiring larger soldier pile members and/or additional tiebacks. We can provide

redesigned earth pressure diagrams for non-draining retaining walls, if necessary. Also note that a portion of the ground water that is recharging the southwest (downhill) side of the road will be cut off. We can provide additional hydrogeologic services to explore the ground water impacts further, should this be required for the project.

Cost Estimates

We have compiled unit costs for the various retaining wall types that are anticipated for this project. The unit costs were obtained from recent discussions with local contractors, our previous experience on similar projects, and other sources. The following table gives the wall types and unit costs per square foot of wall face.

Wall Type	Installation	Description	Unit Cost per Square Foot of Wall
Soldier Pile Wall without Tiebacks (Cantilever Design)			
	Temporary	Timber Lagging Facia	$35-50
	Permanent	Timber Lagging Facia	$40-55
	Permanent	Cast-in-Place Concrete Facia	$50-70
Soldier Pile Wall with Tiebacks (Tieback Design)			
	Temporary	Timber Lagging Facia	$45-65
	Permanent	Timber Lagging Facia	$50-80
	Permanent	Cast-in-place Concrete Facia	$70-100
MSE Walls	Permanent	Modular Blocks	$25-35
Rockeries	Permanent	Maximum 6 feet high	$10-15

DRAINAGE CONSIDERATIONS

Surface and Subsurface Drainage

We recommend that pavement surfaces be sloped so that surface water runoff flows away from the pavement. The surface water should be discharged into the storm drain system through catch basins. Grading in all areas should be planned to avoid concentration of runoff onto fill, cut slopes, natural slopes steeper than 10 percent or other erosion-sensitive areas. Long-term pavement performance is dependent on a drainage system that will permit rapid drainage of water from the base course and subgrade layers.

Detention and Infiltration Basins

We understand that new storm drains and retaining wall drainage will be directed into a detention or infiltration basin between Coal Creek Parkway SE and the SE 54th Place. The location of this basin has not been determined, but we understand it will likely be on the southwest side of this road segment. From the nearby borings, we anticipate that the soil will have a low permeability. Therefore, infiltration may not be feasible. Once the basin is located, additional field explorations may be required to evaluate the subsurface soil and ground water conditions.

We recommend evaluating the potential benefits of separating surface water runoff and ground water discharge. It may be possible to reduce the size of treatment and/or storage facilities if ground and surface water have separate collection systems.

PAVEMENTS

Existing Pavement Sections

The following table summarizes the thickness of the existing asphalt-concrete (AC) section observed in our borings and as reported in the Converse Consultants report. The existing AC section is apparently underlain by fill with little or no base course observed at our boring locations.

Boring	Street Location	AC Thickness
B-1	Traffic Lane	8 inches
B-2	Traffic Lane	6.5 inches
B-3	Traffic Lane	6 inches
B-4	Traffic Lane	6 inches
B-5	Traffic Lane	4 inches
B-6	Traffic Lane	4 inches
B-7	Gravel Driveway	n/a
CC-2	Shoulder	2 inches
CC-1	Shoulder	2.5 inches
B-8	Shoulder	4 inches

Pavement Design Criteria

The recommendations for pavements presented in this report are based on data provided us by W&H Pacific and by the City of Bellevue (COB). Our pavement design analyses were completed using the design methodology outlined in the 1993 AASHTO Guide for Design of Pavement Structures (AASHTO Guide) and the traffic loading information provided to us as summarized below:

- Total average daily traffic (ADT) of 10,900
- 10 percent trucks
- 20-year design life
- Design truck with a gross vehicular weight of 40,000 pounds

In our pavement design analyses, we assumed the following:

- Percent growth of 4 percent
- 52 percent of ADT in design lane for roadway with 1 lane in each direction
- Reliability of 93 percent
- Initial serviceability of 4.2
- Terminal serviceability of 2.0
- Overall standard deviation of 0.45
- California Bearing Ratio (CBR) for subgrade soils of 20; Resilient Modulus (M_r) of 15,000 pounds per square inch (psi)

Using the information presented above we developed pavement recommendations for 6.2 million 18-kip equivalent single axle loads (ESAL's).

New AC Pavements

New pavement sections will be required for the full width of the roadway between Coal Creek Parkway SE and SE 54th Place where roadway grades will be lowered, and outside of the existing paved drive lanes along the remainder of the roadway improvement project to accommodate the new road width. We developed three alternative pavement sections where new pavements are required. The alternatives include at least 2 inches of asphalt concrete (AC), 4 inches of asphalt-treated base (ATB) and gravel borrow as required, consistent with the COB minimum standards for an arterial street. The three alternative design pavement sections for a 20-year design life are presented in the following table.

Material	Thickness (inches)		
	Alt. 1	Alt. 2	Alt.3
Class A or B AC	2	3	4
ATB	4	4	4
Gravel Borrow	12	9	6

We recommend that the gravel borrow material meet the specifications of Section 9-03.14 of the *2000 WSDOT* Standard Specifications. The gravel borrow must be compacted to at least 95 percent of the MDD per the ASTM D-1557 test procedure.

The ATB material should be mixed, placed and compacted in general accordance with Section 4-06, 9-02 and 9-03.6 of the 2000 WSDOT Specification. We recommend that the asphalt concrete consist of Class A or B AC that is mixed, placed and compacted in general accordance with Sections 5-04, 9-02 and 9-03.8 of the WSDOT Specifications.

Asphalt Concrete Overlays

Most of the existing roadway from SE 54th Place to SE 63rd Street will be at the existing roadway elevation. Therefore, we understand that the travel lanes of the existing road will be overlaid.

At the subsurface exploration locations, the existing pavement within the travel lanes varies in thickness from 8.5 inches to 4 inches. The variation in thickness is likely the result of multiple overlays that have been placed in some areas when residential developments were constructed. The wearing surface is currently in good condition. We did not observe areas of fatigue or load-related cracking, nor did we observe areas of subgrade failure or rutting. However, it is possible that there is some reduction in the stiffness of the underlying asphalt concrete due to cracking and/or aging.

Because of the uncertainties of the stiffness of the underlying asphalt concrete, Falling Weight Deflectometer (FWD) testing was performed from Station 20+00 (SE 54th Place) to the east end of the project (about Station 81+00) on June 21, 2002. The FWD testing was performed by Pavement Engineers as a subconsultant to GeoEngineers. The FWD testing provides more

detailed information about variations in pavement stiffness along the length of the roadway. The Pavement Engineers report is attached as Appendix C.

We have reviewed the FWD test results for Forest Drive. The tests were performed at 200-foot intervals for both the traffic lane and shoulder. The existing pavement section varied significantly along the alignment. Therefore, different overlay thicknesses are recommended at different parts of the alignment. A summary of the overlay thickness applicable to both the traffic lanes and shoulders are as follows:

- Station 20+00 to 44+00: 6.5 inch overlay
- Station 44+00 to 58+00: 4.5 inch overlay
- Station 58+00 to 68+00: 5.5 inch overlay
- Station 68+00 to 81+00: 4.5 inch overlay

LIMITATIONS

We have prepared this report for use by the City of Bellevue and other members of the design team for use in design of this project.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted geotechnical practices in this area at the time the report was prepared. No warranty or other conditions, express or implied, should be understood.

Please refer to the appendix titled Report Limitations and Guidelines for Use for additional information pertaining to use of this report.

We appreciate this opportunity to be of service to the COB and the design team on this project. Please call if you have any questions regarding this report or we can provide additional assistance.

Respectfully submitted,

GeoEngineers, Inc.

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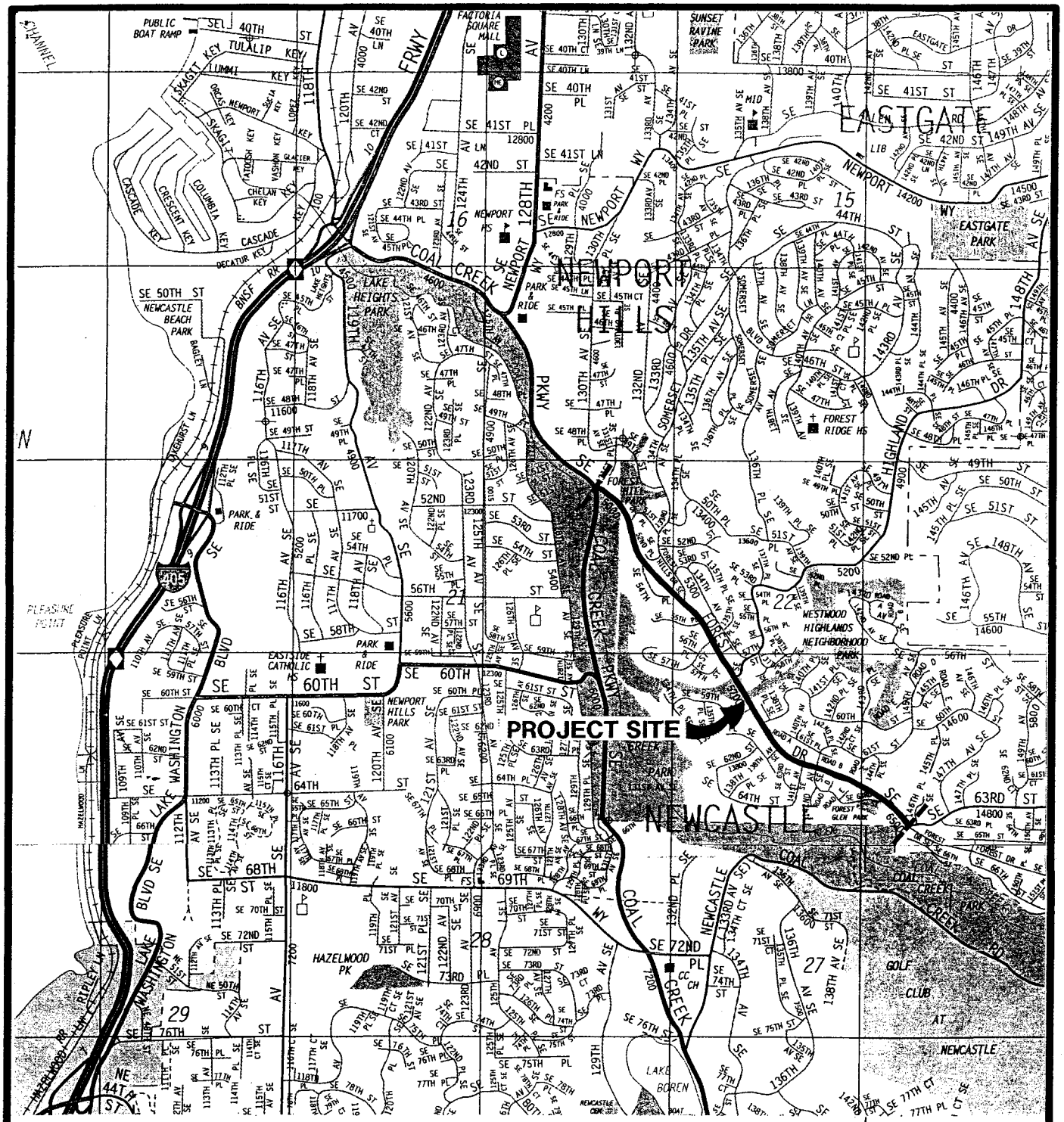

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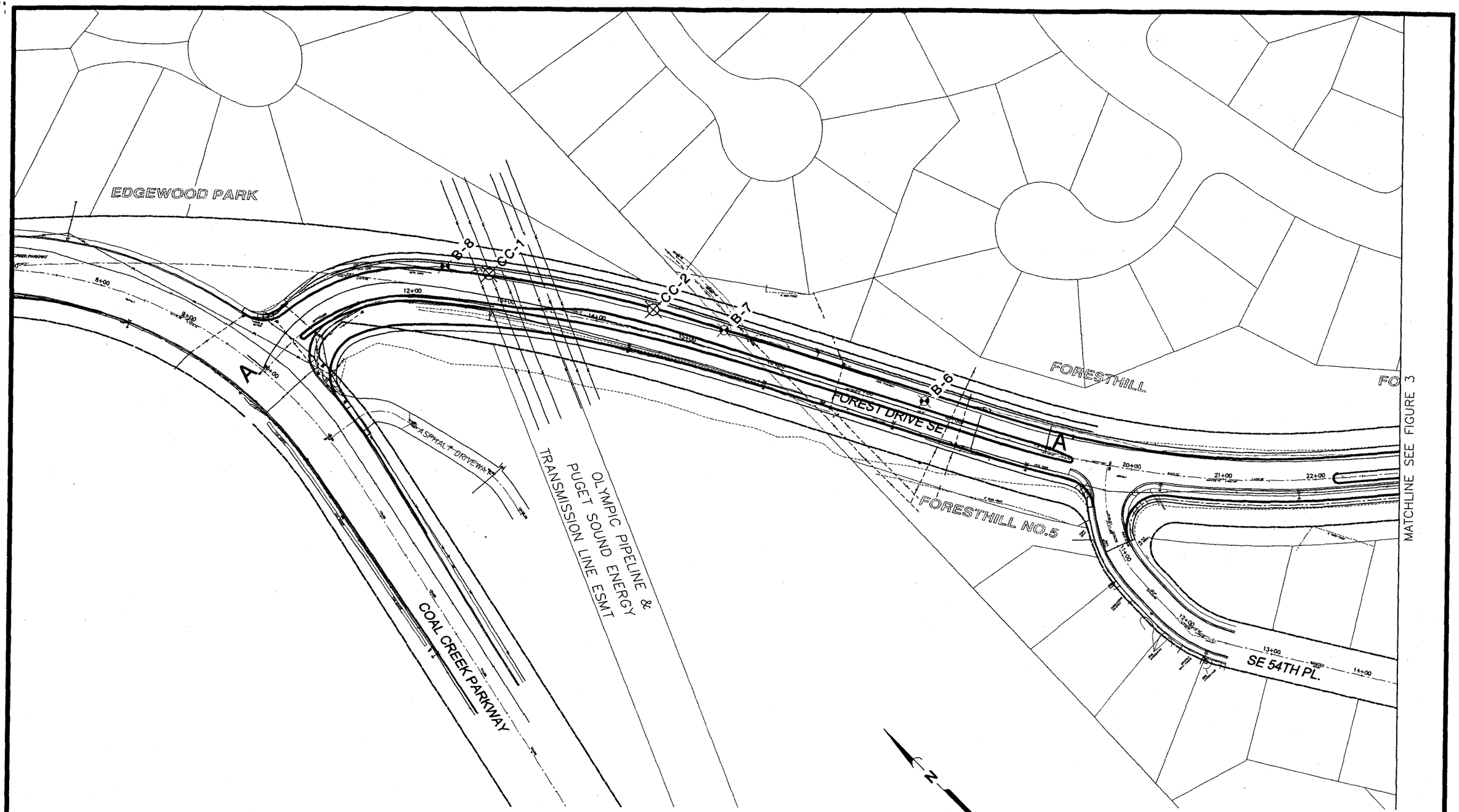
Geo Engineers

VICINITY MAP

FIGURE 1

0526-067-00 RTD:SYF 01/14/02



Notes: 1. The locations of all features shown are approximate.
2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The master hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

Reference: CAD files supplied by City of Bellevue, November 2001 and CAD file "Forest Drive" provided by W&H Pacific, June 2002.

EXPLANATION:

B-1 GEOENGINEERS BORING

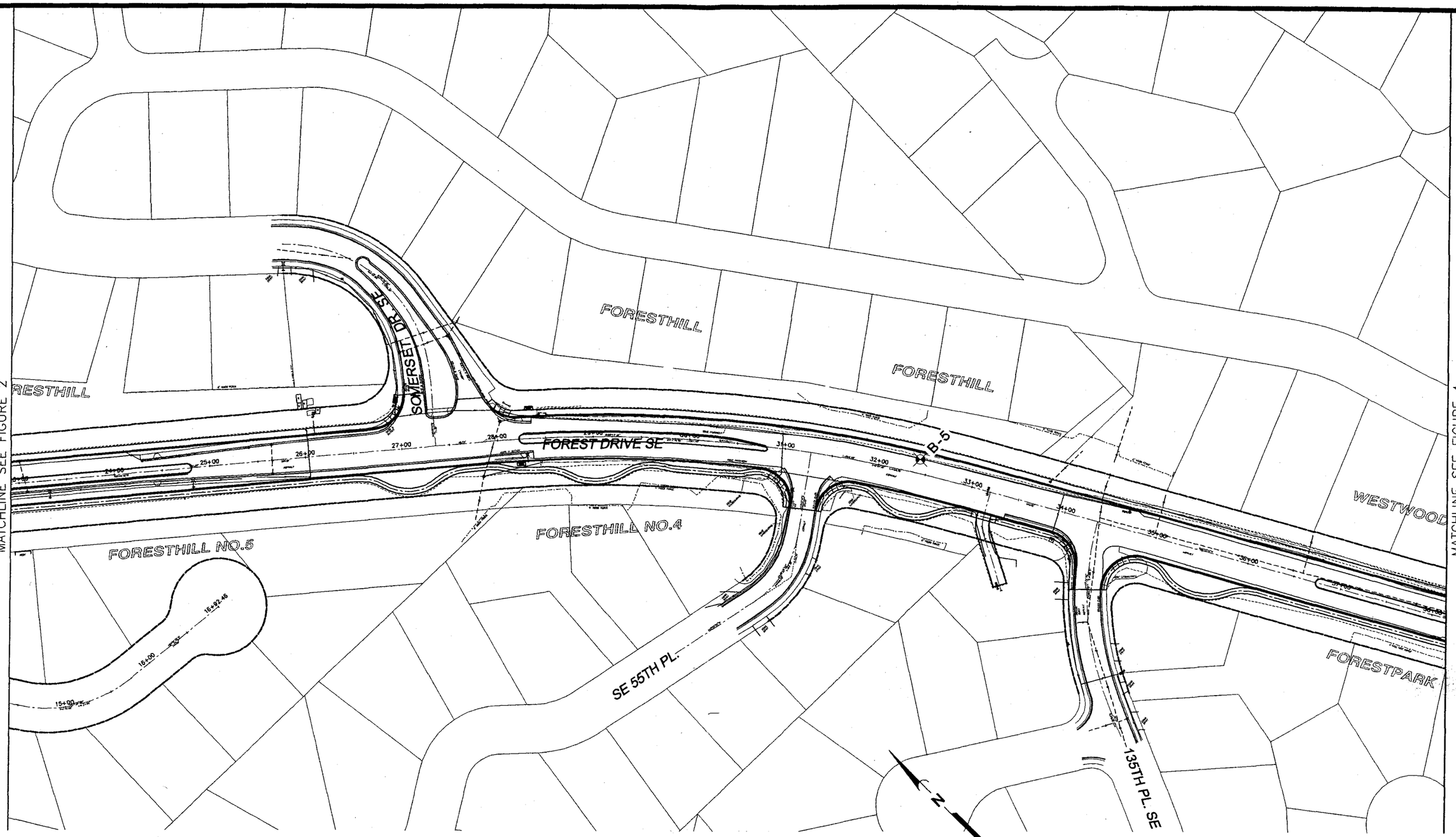
CC-1 CONVERSE CONSULTANTS BORING

GeoEngineers

SITE PLAN

FIGURE 2

REDM\P:\0526067\00\CAD\0526067OOH.DWG MSR:SYF 06/03/02



Notes: 1. The locations of all features shown are approximate.
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Reference: CAD files supplied by City of Bellevue, November 2001 and CAD file "Forest Drive" provided by W&H Pacific, June 2002.

0 100 200
SCALE IN FEET

EXPLANATION:
B-1 GEOENGINEERS BORING

GeoEngineers

SITE PLAN

FIGURE 3

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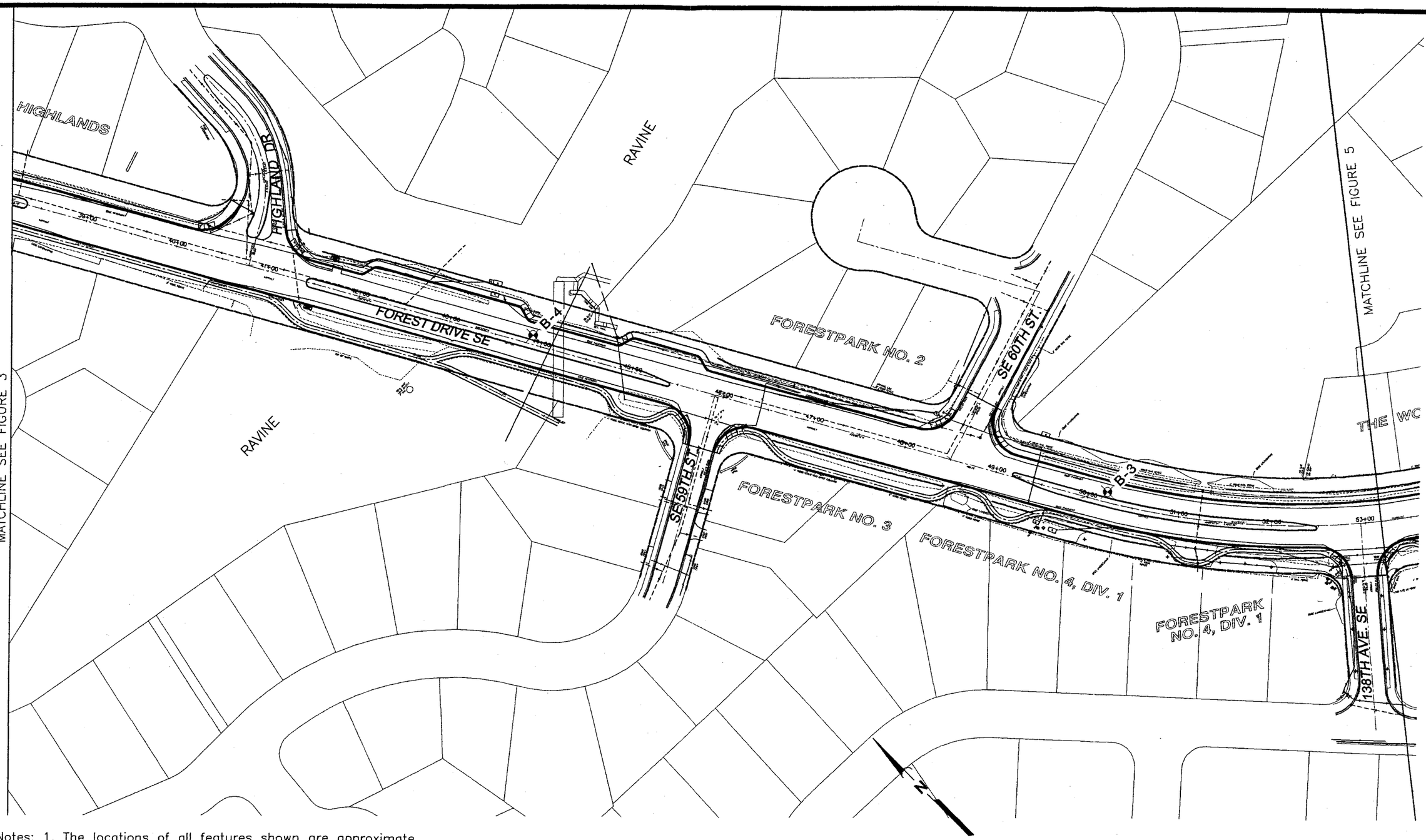


Notes: 1. The locations of all features shown are approximate.
2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The master hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

Reference: CAD files supplied by City of Bellevue, November 2001 and CAD file "Forest Drive" provided by W&H Pacific, June 2002.

0 100 200
SCALE IN FEET

EXPLANATION:

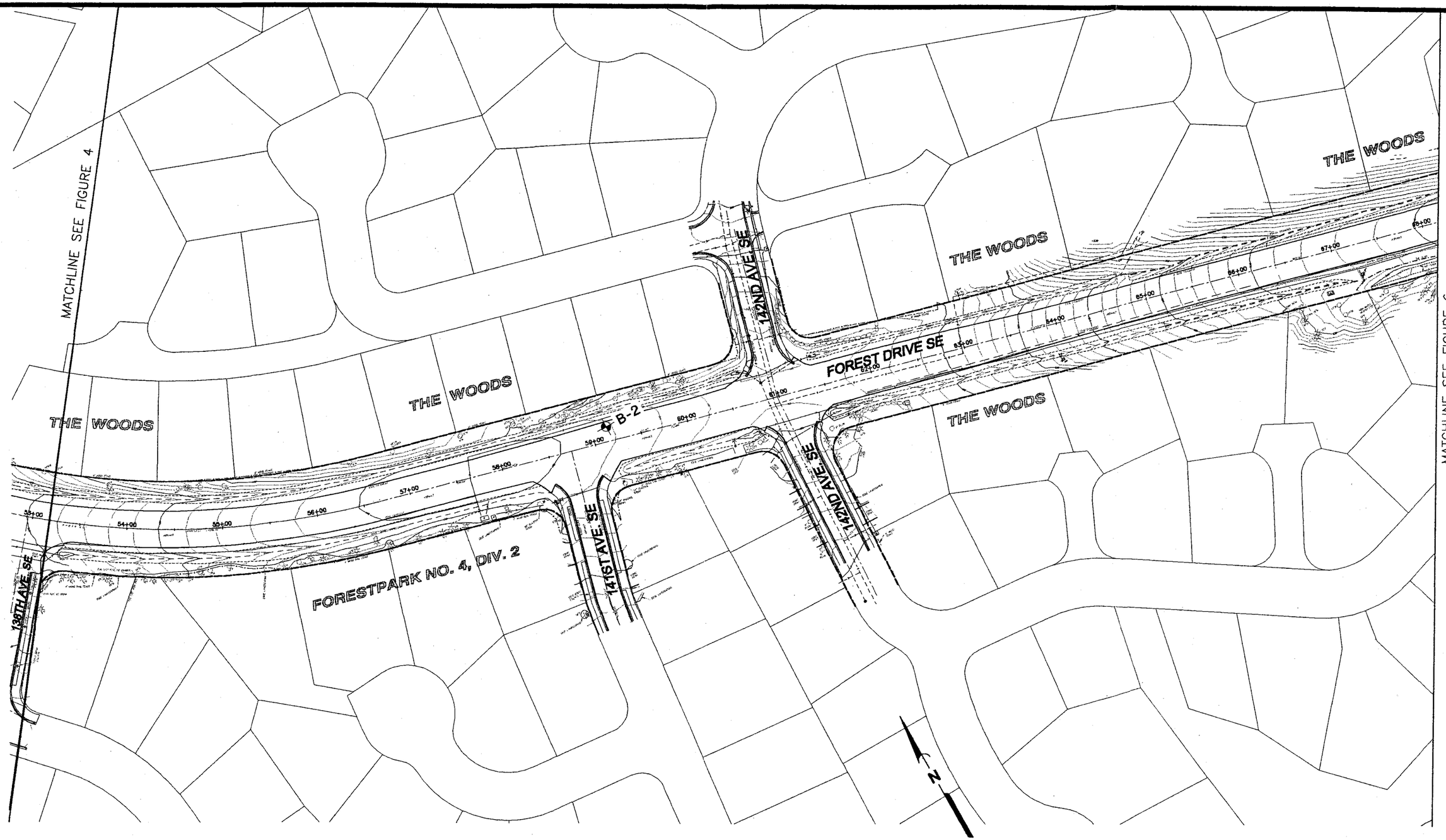
B-1 GEOENGINEERS BORING

Geo Engineers

SITE PLAN

FIGURE 4

REDM\P:\0526067\00\CAD\052606700J.DWG MSR:SYF 06/03/02



Notes: 1. The locations of all features shown are approximate.
2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The master hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

Reference: CAD files supplied by City of Bellevue, November 2001.

0 100 200
SCALE IN FEET

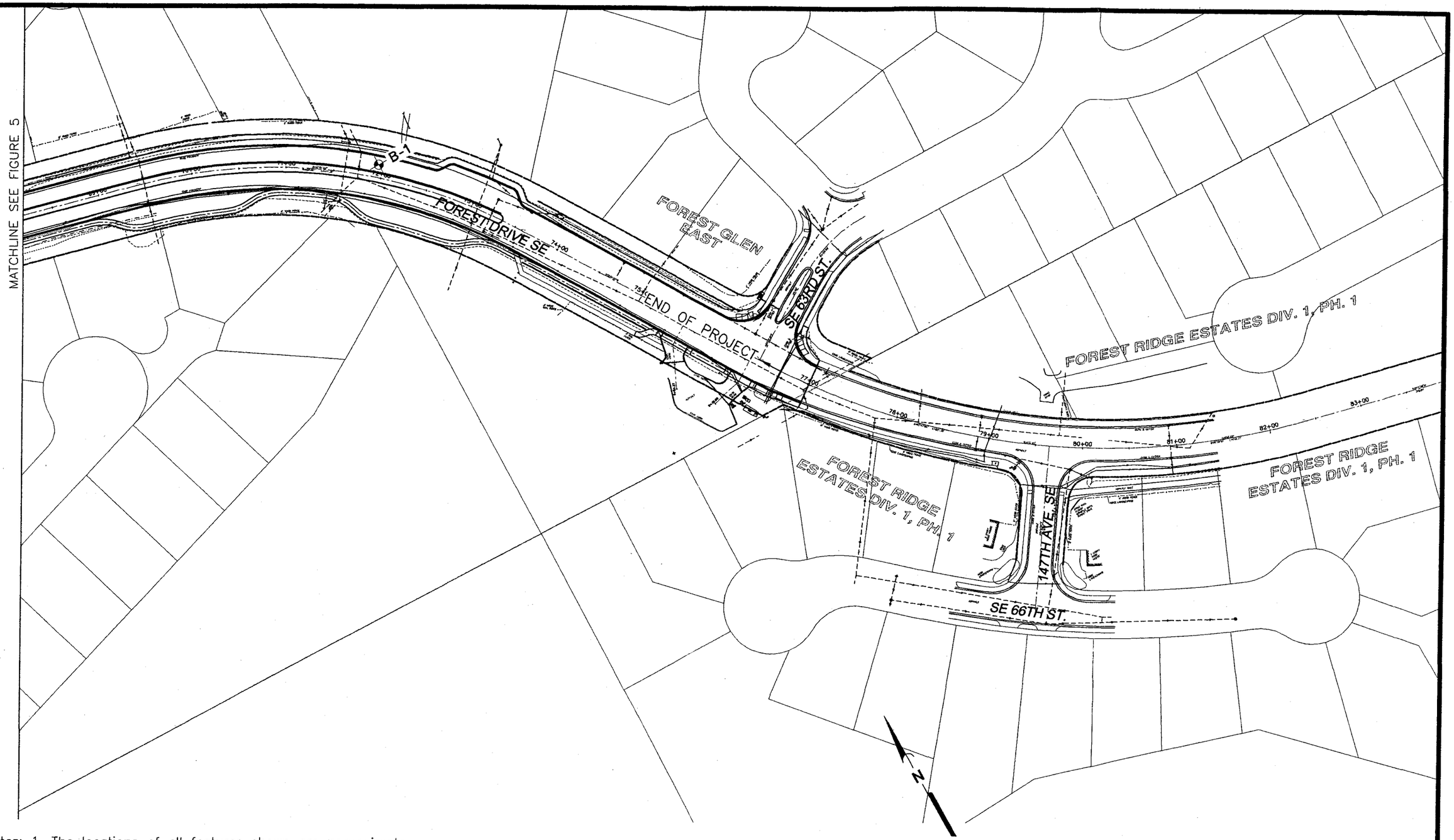
EXPLANATION:
B-1 GEOENGINEERS BORING

GeoEngineers

SITE PLAN

FIGURE 5

REDMOND\P:\0526067\CAD\052606700D.DWG RTD:SYF 01/16/02



Notes: 1. The locations of all features shown are approximate.
2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The master hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

Reference: CAD files supplied by City of Bellevue, November 2001 and CAD file "Forest Drive" provided by W&H Pacific, June 2002.

0 100 200
SCALE IN FEET

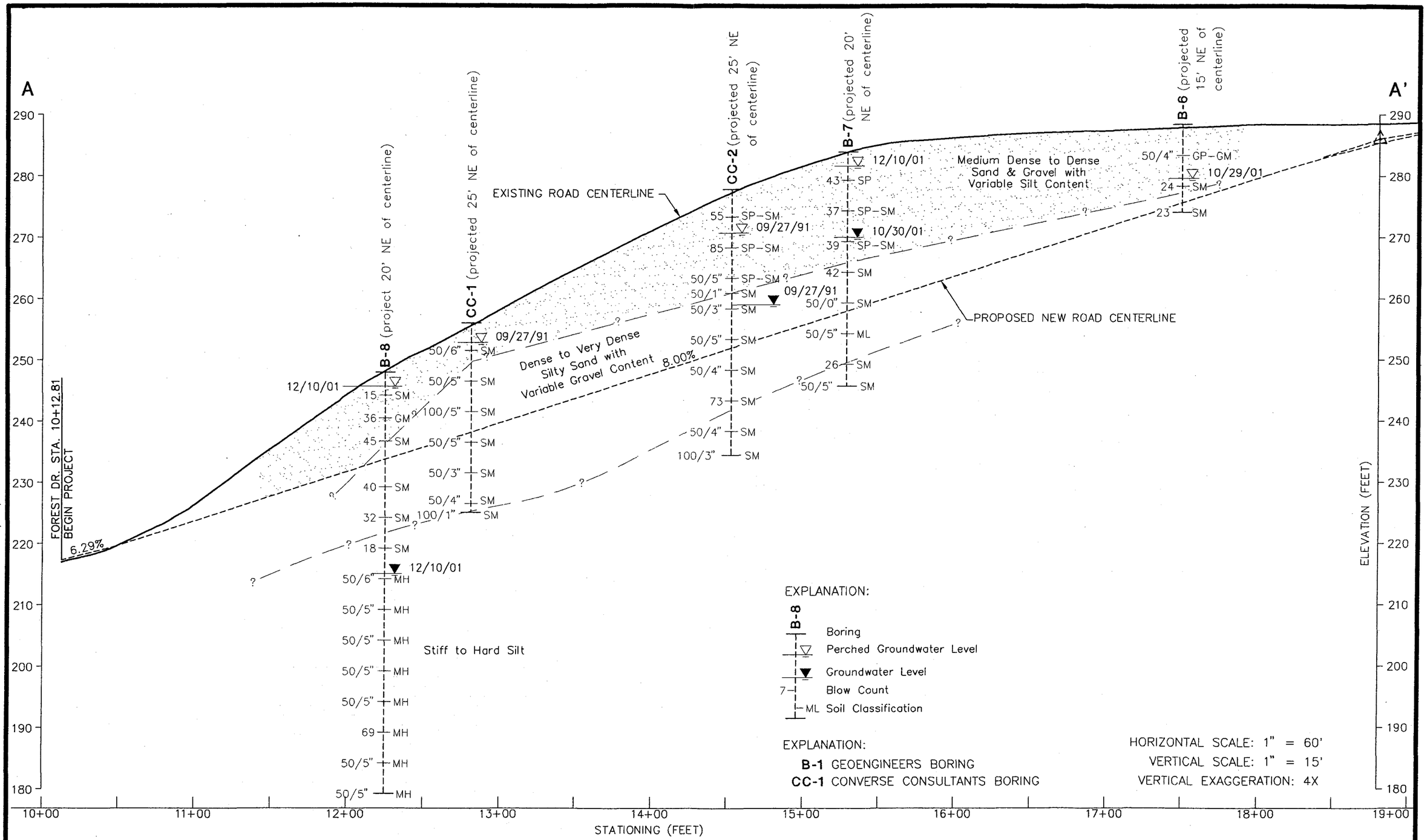
EXPLANATION:
B-1 GEOENGINEERS BORING

GeoEngineers

SITE PLAN

FIGURE 6

REDM\P:\0526067\00\CAD\0526067OOL.DWG MSR:SYF 06/03/02



Notes: 1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. Refer to Figure 2 for location of Section A–A'.
3. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The master hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

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CROSS SECTION A-A'

FIGURE 7

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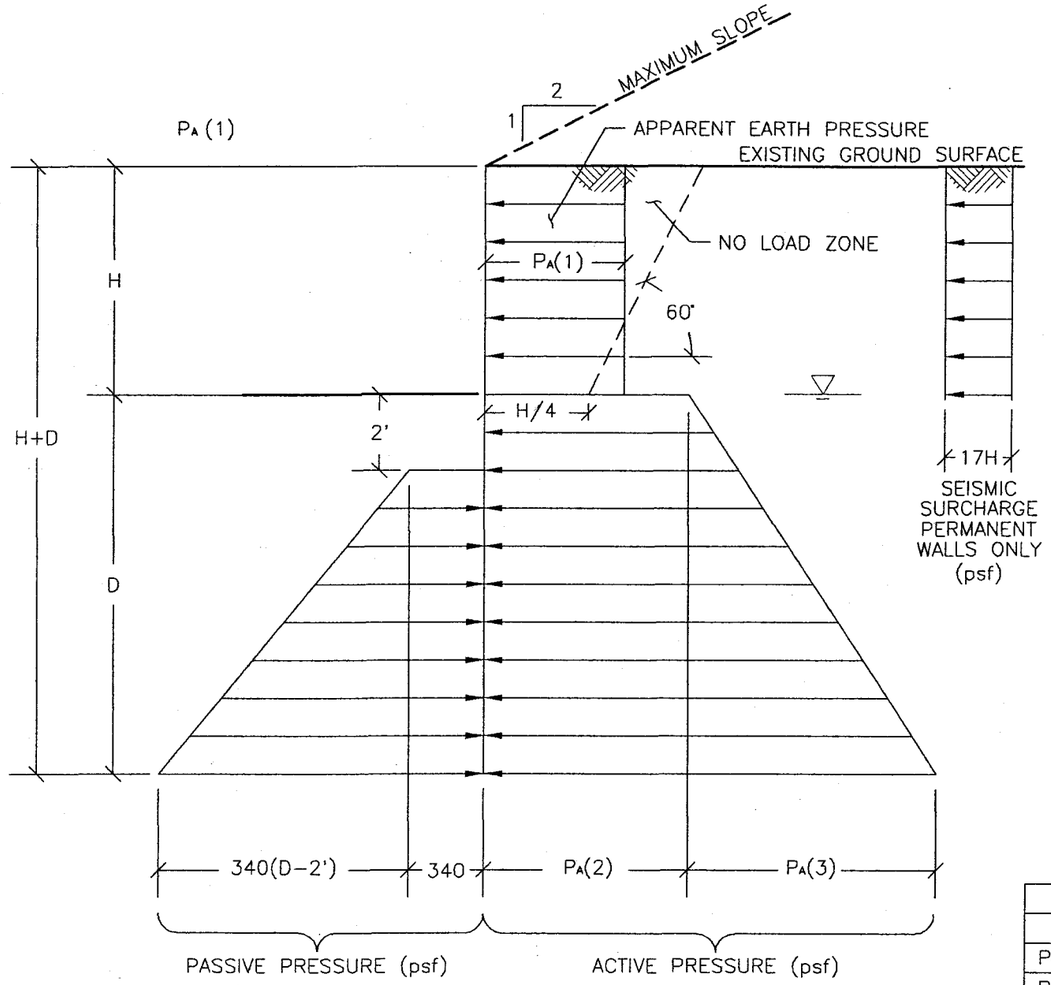
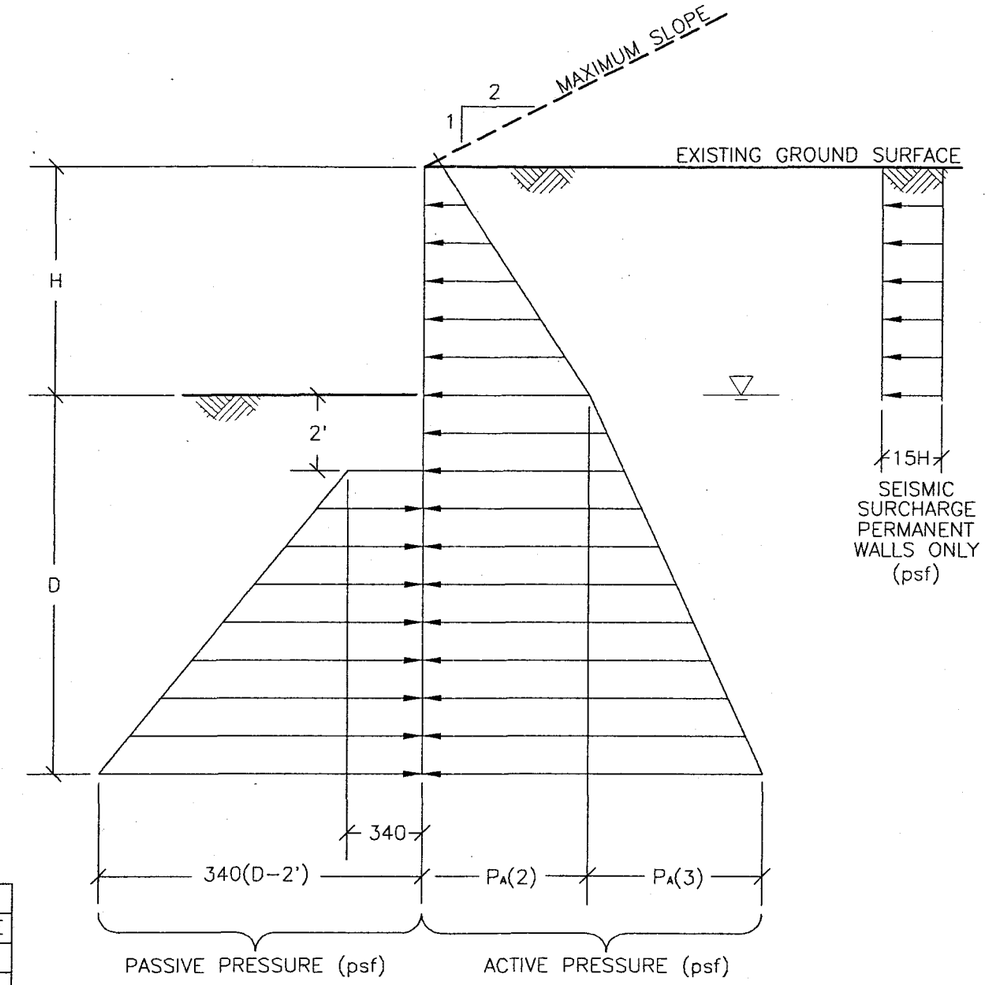


TIEBACK DESIGN
NOT TO SCALE

BACKFILL CONDITION	
LEVEL	2H:1V SLOPE
$P_A(1)=22H$	$P_A(1)=33H$
$P_A(2)=34H$	$P_A(2)=51H$
$P_A(3)=18D$	$P_A(3)=28D$

Note: Linear interpolate values for intermediate slopes



CANTILEVER DESIGN
NOT TO SCALE

Notes:
1. Apparent active earth pressure assumed to act over pile spacing to a depth of H, and over soldier pile diameter below.
2. Passive pressures assumed to act over 3 times the soldier pile diameter or the soldier pile spacing, whichever is less.
3. Passive pressure includes a factor of safety of 1.5.
4. Tieback anchors should be inclined between 15 and 30 degrees below horizontal. Tieback bond zone should be located behind no load zone.
5. Tieback anchors may be designed for an adhesion value of 1,500 pounds per square foot. This value includes a factor of safety of at least 2.0.

Notes:
1. Apparent active earth pressure assumed to act over the pile spacing to a depth of H, and over one soldier pile diameter below.
2. Passive pressures assumed to act over 3 times the soldier pile diameter or the soldier pile spacing, whichever is less.
3. Passive pressure includes a factor of safety of 1.5.

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EARTH PRESSURE DIAGRAM
SOLDIER PILE WALL

FIGURE 8

REDM\P:\0526067\00\CAD\05260670OG.DWG TAT:SYF 08/14/02

APPENDIX A

FIELD EXPLORATION AND LABORATORY TESTING

EXPLORATION PROGRAM

Subsurface soil and ground water conditions were explored by drilling eight borings to depths ranging from 9 to 68.5 feet at the approximate locations shown in Figures 2 through 6. The borings were drilled on October 29, 30 and 31 and November 2, 2001 using hollow-stem auger drilling equipment subcontracted to GeoEngineers. Soil samples were obtained from the borings using a split-barrel sampler driven into the soil with a 300-pound hammer free-falling 30 inches. The number of blows required to drive the sampler the last 12 inches, or other indicated distance, is recorded on the boring log.

Exploration locations were estimated in the field by pacing and taping from existing site features. The explorations were continuously monitored by a geotechnical engineer from our firm who examined and classified the soils encountered, obtained representative soil samples, observed ground water conditions and prepared a detailed log of each exploration. Soils encountered were classified visually in general accordance with ASTM D-2488-90, which is described in Figure A-1. An explanation of the boring log symbols is presented in Figure A-2.

The logs of the borings are presented in Figures A-3 through A-10. The logs are based on our interpretation of the field and laboratory data and indicate the various types of soils encountered. They also indicate the depths at which these soils or their characteristics change, although the change might actually be gradual. If the change occurred between samples in the boring, it was interpreted.

LABORATORY TESTING

The soil samples were brought to our laboratory for further examination. Selected samples were tested to evaluate their moisture content, dry density, and fines content. The results of the moisture content, dry density, and fines content tests performed on samples obtained during drilling are presented on the boring logs.

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE GRAINED SOILS More Than 50% Retained on No. 200 Sieve	GRAVEL More Than 50% of Coarse Fraction Retained on No. 4 Sieve	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND More Than 50% of Coarse Fraction Passes No. 4 Sieve	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE GRAINED SOILS More Than 50% Passes No. 200 Sieve	SILT AND CLAY Liquid Limit Less Than 50	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY Liquid Limit 50 or More	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1. Field classification is based on visual examination of soil in general accordance with ASTM D2488-90.
2. Soil classification using laboratory tests is in general accordance with ASTM D2487-90.
3. Descriptions of soil density or consistency are based on interpretation of blow count data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

Dry - Absence of moisture, dusty, dry to the touch

Moist - Damp, but no visible water

Wet - Visible free water or saturated, usually soil is obtained from below water table

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SOIL CLASSIFICATION SYSTEM

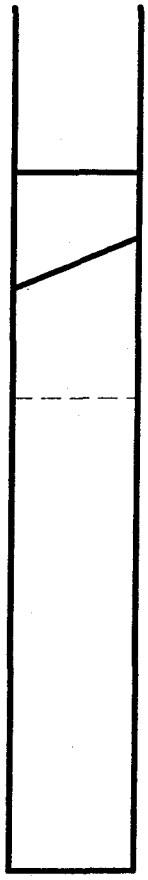
FIGURE A-1

f:\soila-1.doc

LABORATORY TESTS

AL	Atterberg limits
CA	Chemical analysis
CP	Compaction
CS	Consolidation
DS	Direct shear
SA	Sieve analysis
%F	Percent fines
HA	Hydrometer analysis
SK	Permeability
SM	Moisture content
MD	Moisture and density
ST	Swelling test
TX	Triaxial compression
UC	Unconfined compression
OC	Organic Content

SOIL GRAPHICS



SM — Soil Group Symbol (See Note 2)

Distinct Contact Between Soil Strata

Gradual or Approximate Location of Change Between Soil Strata

Approximate Location of Change Within a Soil Strata

Measured groundwater level

Groundwater encountered during drilling

Perched water encountered during drilling

Bottom of Boring

BLOW-COUNT

Blows required to drive sampler 12 inches using a 300-pound hammer falling 30-inches — 15

Blows required to drive sampler 12 inches using a 140-pound hammer falling 30-inches — 15

"P" indicates sampler pushed against with weight of hammer or against weight of drill rig

SAMPLE GRAPHICS

Location of sampling interval with relatively undisturbed recovery

Location of sampling interval with disturbed recovery

Location of sampling interval with no recovery

Location of sample obtained in general accordance with Standard Penetration Test (ASTM D-1586) procedures

Location of SPT sampling attempt with no recovery

Location of Grab Sample

NOTES:

1. The reader must refer to the discussion in the report text, the Key to Log Symbols and the exploration logs for a proper understanding of subsurface conditions.
2. Soil classification system is summarized in Figure A-1.

KEY TO LOG SYMBOLS

GeoEngineers

Project: W&H Pacific
Project Location: Bellevue, Washington
Project Number: 0526-067-00

Figure: A-2
Sheet 1 of 1

0526-067-00 KEY_TO_SYMBOLS P:\0\0526067\00\FINALS\0526067.GPJ GEIV2.GDT 9/19/02

Date(s) Drilled	10/29/01	Logged By	MAM	Checked By	MSR
Drilling Contractor	Holt Drilling	Drilling Method	4" Hollow Stem Auger	Sampling Methods	Dames & Moore
Auger Data	4-inch ID	Hammer Data	300 (lb) hammer/ 30 (in) drop	Drilling Equipment	CME-85
Total Depth (ft)	11.4	Surface Elevation (ft)	+535	Groundwater Level (ft. bgs)	None
Datum/ System	N/A	Easting	Not determined	Northing	Not determined

Elevation feet	Depth feet	SAMPLES Interval	Number	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight,	OTHER TESTS AND NOTES
535	0							AC	8 inches asphalt concrete (AC)			
								SM	Grayish brown silty fine to coarse sand with gravel and organic matter (dense, moist) (fill)			
530	5	■	1	16	6			ML	Blue gray sandy silt with clay and occasional gravel and organic matter (medium stiff, moist)	22	103	
525	10	■	2	16	88/10"			SM	Gray silty fine to medium sand with gravel (very dense, moist) (till)			

Boring completed at 11.4 feet
No groundwater observed during drilling

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-1

Geo Engineers

Project: W&H Pacific
Project Location: Bellevue, Washington
Project Number: 0526-067-00

Figure: A-3
Sheet 1 of 1

0526-067-00 GEI GTBORING 2.1.0 P:\0\0526067\00\FINALS\0526067.GPJ GEIV2.GDT 9/19/02

Date(s) Drilled	10/29/01	Logged By	MAM	Checked By	MSR
Drilling Contractor	Holt Drilling	Drilling Method	4" Hollow Stem Auger	Sampling Methods	Dames & Moore
Auger Data	4-inch ID	Hammer Data	300 (lb) hammer/ 30 (in) drop	Drilling Equipment	CME-85
Total Depth (ft)	12	Surface Elevation (ft)	+484	Groundwater Level (ft. bgs)	5
Datum/ System	N/A	Easting	Not determined	Northing	Not determined

Elevation feet	Depth feet	SAMPLES Interval	Number	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight,	OTHER TESTS AND NOTES
	0							AC	6.5 inches asphalt concrete			
								SP-SM	Brown fine to medium sand with silt and gravel (moist) (fill)			
480												
	5		1	9	8			ML	Light brown sandy silt with lenses of brown fine to medium sand with silt (medium stiff, wet) (weathered till)	12		% fines = 5
475												
	10		2	14	57			SM	Gray silty fine sand (very dense, moist) (till)			

Boring completed at 12 feet
Perched groundwater observed at 5 feet during drilling

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-2

GeoEngineers

Project: W&H Pacific
Project Location: Bellevue, Washington
Project Number: 0526-067-00

Figure: A-4
Sheet 1 of 1

Date(s) Drilled	10/29/01	Logged By	MAM	Checked By	MSR
Drilling Contractor	Holt Drilling	Drilling Method	4" Hollow Stem Auger	Sampling Methods	Dames & Moore
Auger Data	4-inch ID	Hammer Data	300 (lb) hammer/ 30 (in) drop	Drilling Equipment	CME-85
Total Depth (ft)	12	Surface Elevation (ft)	+465	Groundwater Level (ft. bgs)	2.5
Datum/ System	N/A	Easting	Not determined	Northing	Not determined

Elevation feet	Depth feet	SAMPLES Interval	Number	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight,	OTHER TESTS AND NOTES
465	0							AC	6 inches asphalt concrete			
								GP	Brown fine to coarse gravel with sand and trace silt (dense, moist) (fill)			
		☒	1	6	Grab	▼		SM	Dark brown silty sand with organic matter (loose, wet) (fill)	20		
460	5							GP	Gray sandy fine gravel with trace silt and occasional debris (asphalt concrete pieces) (medium dense, wet) (fill)			
		☒	3	3	25							
455	10	■	4	14	22			SM	Brown and gray silty fine to coarse sand with gravel (medium dense, moist) (till)			

Boring completed at 12 feet
Perched groundwater observed at 2.5 feet during drilling

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-3

Geo Engineers

Project: W&H Pacific
Project Location: Bellevue, Washington
Project Number: 0526-067-00

Figure: A-5
Sheet 1 of 1

0526-067-00 GEI_GTBORING_2.1.0 P:\0\0526067\00\FINALS\0526067.GPJ GEIV2.GDT 9/19/02

Date(s) Drilled	10/29/01	Logged By	MAM	Checked By	MSR
Drilling Contractor	Holt Drilling	Drilling Method	4" Hollow Stem Auger	Sampling Methods	Dames & Moore
Auger Data	4-inch ID	Hammer Data	300 (lb) hammer/ 30 (in) drop	Drilling Equipment	CME-85
Total Depth (ft)	33.5	Surface Elevation (ft)	+452	Groundwater Level (ft. bgs)	None
Datum/ System	N/A	Easting	Not determined	Northing	Not determined

Elevation feet	Depth feet	SAMPLES Interval	Number	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight,	OTHER TESTS AND NOTES
	0							AC	6 inches asphalt concrete			
								SM	Brown and gray silty fine to coarse sand with gravel (medium dense, moist) (fill)			
450		■	1	16	27					11	126	
	5	■	2	12	50				Very dense			
445			3	0	50/6"							No recovery
	10								Becomes loose			
440			4	0	7							No recovery
	15											
435		■	5	12	8							
	20								Becomes very loose			
430		■	6	6	3					9		
	25											
425								SM	Light gray and tan silty fine to medium sand with gravel and interbedded fine to medium sand (very dense, moist) (till)			
		■	7	12	50/6"					14	113	
	30											
420		■	8	10	50/4"							

Boring completed at 33.5 feet
No groundwater observed during drilling

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-4

Geo Engineers

Project: W&H Pacific
Project Location: Bellevue, Washington
Project Number: 0526-067-00

Figure: A-6
Sheet 1 of 1

0526-067-00 GEI_GTBORING_2.1.0 P:\0\0526067\00\FINALS\0526067.GPJ GEIV2.GDT 9/19/02

Date(s) Drilled	10/29/01	Logged By	MAM	Checked By	MSR
Drilling Contractor	Holt Drilling	Drilling Method	4" Hollow Stem Auger	Sampling Methods	Dames & Moore
Auger Data	4-inch ID	Hammer Data	300 (lb) hammer/ 30 (in) drop	Drilling Equipment	CME-85
Total Depth (ft)	9	Surface Elevation (ft)	+396	Groundwater Level (ft. bgs)	None
Datum/ System	N/A	Easting	Not determined	Northing	Not determined

Elevation feet	Depth feet	SAMPLES Interval	Number	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight,	OTHER TESTS AND NOTES
	0							AC	4 inches asphalt concrete			
395								SM	Brown and gray silty fine to coarse sand with gravel (medium dense, wet)			
		■	1	12	24					2		
	5											
390												
		☒	2	6	50/6"				Very dense			

Boring completed at 9 feet
No groundwater observed during drilling

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-5

Geo Engineers

Project: W&H Pacific
Project Location: Bellevue, Washington
Project Number: 0526-067-00

Figure: A-7
Sheet 1 of 1

Date(s) Drilled	10/29/01	Logged By	MAM	Checked By	MSR
Drilling Contractor	Holt Drilling	Drilling Method	4" Hollow Stem Auger	Sampling Methods	Dames & Moore
Auger Data	4-inch ID	Hammer Data	300 (lb) hammer/ 30 (in) drop	Drilling Equipment	CME-85
Total Depth (ft)	14	Surface Elevation (ft)	288	Groundwater Level (ft. bgs)	9
Datum/ System	N/A	Easting	Not determined	Northing	Not determined

Elevation feet	Depth feet	SAMPLES Interval	Number	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight,	OTHER TESTS AND NOTES
	0							AC	4 inches asphalt concrete			
								GP-GM	Gray sandy fine to coarse gravel with silt (dense, moist)			
285												
	5	☒	1	5	50/4"					4		
280						▼						
								SM	Brown silty fine sand (medium dense, wet)			
	10			0	24							No recovery
275		■	2	12	23					25		% fines = 30

Boring completed at 14 feet
Groundwater observed at approximately 9 feet during drilling

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-6

Geo Engineers

Project: W&H Pacific
Project Location: Bellevue, Washington
Project Number: 0526-067-00

Figure: A-8
Sheet 1 of 1

Date(s) Drilled	10/30/01	Logged By	MAM	Checked By	MSR
Drilling Contractor	Holt Drilling	Drilling Method	4" Hollow Stem Auger	Sampling Methods	Dames & Moore
Auger Data	4-inch ID	Hammer Data	300 (lb) hammer/ 30 (in) drop	Drilling Equipment	CME-85
Total Depth (ft)	38	Surface Elevation (ft)	284	Groundwater Level (ft. bgs)	3, 14.5
Datum/ System	N/A	Easting	Not determined	Northing	Not determined

Elevation feet	Depth feet	SAMPLES Interval	Number	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight,	OTHER TESTS AND NOTES
	0							SP-SM	Reddish brown and tan gravelly sand with silt (dense, moist)			
			1	14	43					4	123	
280	5							SP-SM	Gray fine to coarse sand with silt and gravel (dense, wet)			
			2	14	37					7		% fines = 9
275	10											
			3	8	39					5		
270	15							SM	Gray silty fine to coarse sand with fine to coarse gravel (dense, wet)			
			4	18	42							
265	20											
				0	50/0"							No recovery
260	25							ML	Gray fine sandy silt with occasional lenses of fine to medium sand (hard, moist)			
			5	5	50/5"							
255	30							SM	Gray silty fine to medium sand with gravel (dense, wet)			
			6	12	26			MH	Dark brown fat silt (very stiff, moist)	32	88	
250	35											

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-7

Geo Engineers

Project: W&H Pacific
Project Location: Bellevue, Washington
Project Number: 0526-067-00

Figure: A-9
Sheet 1 of 2

Elevation feet	Depth feet	SAMPLES Interval	Number	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight,	OTHER TESTS AND NOTES
	35											
			7	5	50/5"			SM	Gray silty fine to medium sand with gravel (very dense, moist)			
245									Boring completed at 38 feet Groundwater observed at 3 and 14.5 feet during drilling Piezometer installed to 20 feet on 10/31/01			

LOG OF BORING B-7 (continued)

Geo Engineers

Project: W&H Pacific
Project Location: Bellevue, Washington
Project Number: 0526-067-00

Figure: A-9
Sheet 2 of 2

Date(s) Drilled	10/30/01	Logged By	MAM	Checked By	MSR
Drilling Contractor	Holt Drilling	Drilling Method	4" Hollow Stem Auger	Sampling Methods	Dames & Moore
Auger Data	4-inch ID	Hammer Data	300 (lb) hammer/ 30 (in) drop	Drilling Equipment	CME-85
Total Depth (ft)	68.5	Surface Elevation (ft)	248	Groundwater Level (ft. bgs)	2.8, 33
Datum/ System	N/A	Easting	Not determined	Northing	Not determined

Elevation feet	Depth feet	SAMPLES Interval Number	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight,	OTHER TESTS AND NOTES
	0						AC	4 inches asphalt concrete			
							SM	Gray silty fine to coarse sand with occasional gravel (medium dense, wet)			
245		1	4	15					12		
	5										
							GM	Brown silty fine to coarse gravel with sand (dense, wet)			
240		2	6	36					11		No recovery - redriven % fines = 23
	10										
							SM	Light gray brown silty fine to coarse sand with gravel (dense, moist)			
235		3	12	45							
	15										
								Grades to gray, wet			
230		4	14	40					12		% fines = 38
	20										
225		5	2	32							
	25										
							MH	Dark brown fat silt (stiff, wet)			
220		6	18	18					28	90	
	30										
215		7	18	50/6"				Grades to hard			
	35										

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-8

Geo Engineers

Project: W&H Pacific
Project Location: Bellevue, Washington
Project Number: 0526-067-00

Figure: A-10
Sheet 1 of 2

Elevation feet	Depth feet	SAMPLES Interval	Number	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight,	OTHER TESTS AND NOTES
	35								Dark brown fat silt (hard, wet)			
210			8	18	50/5"							
	40											
205			9	11	50/5"							
	45											
200			10	16	50/5"							
	50											
195			11	17	50/5"							
	55											
190			12	18	69							
	60											
185			13	17	50/5"					28	92	
	65											
180			14	11	50/5"							

Boring completed at 68.5 feet on 10/30/01
Groundwater observed at 2.8 and 33 feet on 12/10/01
Deep piezometer installed to 68 feet on 10/30/01
A second borehole was completed adjacent to B-8 on 10/31/01 to install a shallow piezometer
Shallow piezometer installed in adjacent bore hole to 25 feet on 11/02/01

LOG OF BORING B-8 (continued)

Geo Engineers

Project: W&H Pacific
Project Location: Bellevue, Washington
Project Number: 0526-067-00

Figure: A-10
Sheet 2 of 2

LOG OF BORING NO. B-1

Date drilled 9/13/91 Driving Weight and Drop 140 lb, 30" drop Elevation (ft) 258

This log is part of the report prepared by Converse Consultants NW for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Depth, ft	Elevation	Samples	Blows/6"	Graphic Symbol	DESCRIPTION	Observation Well	Dry density pcf	Moisture Content, %	Other tests
					2" ASPHALT PAVEMENT				
					TOP/BASE COURSE; 5/8" crushed gravel				
					GLACIAL TILL				
					SILTY SAND WITH GRAVEL; gray, fine to coarse; moist, very dense				
	255	1	45 50/6"					8	
5					9/27/91 ▽				
									G
	250	2	50/5"		SILTY SAND; gray, fine to coarse, little fine to coarse gravel; moist, very dense; low plasticity fines			9	
10									
	245	3	100/5"					12	
15									
	240	4	50/5"					8	
20					grades to very moist				
	235	5	50/3"					11	

Continued Next Page

Project No.

Modifications to Forest Drive

Bellevue, Washington

for Tudor Engineering

91-35152-01

Converse Consultants NW

Geotechnical Engineering and Applied Earth Sciences

Figure No.

A-1

LOG OF BORING NO. B-1

Date drilled 9/13/91 Driving Weight and Drop 140 lb, 30" drop Elevation (ft) 258

This log is part of the report prepared by Converse Consultants NW for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Depth, ft	Elevation	Samples	Blows/6"	Graphic Symbol	DESCRIPTION	Observation Well	Dry density pcf	Moisture Content, %	Other tests
	230	6	28 50/ 4"		SILTY SAND AND GRAVEL; gray, fine to coarse; very moist to wet, very dense			9	
30									
	225	7	100/ 1"					7	
					Bottom of boring at depth 33.0 feet. Piezometer installed in boring, screen section from 27 to 32 feet. G = Grain size analysis				
35									
	220								
40									
	215								
45									
	210								

Project No.

Modifications to Forest Drive

Bellevue, Washington

for Tudor Engineering

91-35152-01

Figure No.

A-1

Converse Consultants NW

Geotechnical Engineering and Applied Earth Sciences

LOG OF BORING NO. B-2

Date drilled 9/12/91 Driving Weight and Drop 140 lb, 30" drop Elevation (ft) 278

This log is part of the report prepared by Converse Consultants NW for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Depth, ft	Elevation	Samples	Blows/6"	Graphic Symbol	DESCRIPTION	Observation Well	Dry density pcf	Moisture Content, %	Other tests
					2" ASPHALT PAVEMENT				
					TOP/BASE COURSE; 5/8" crushed gravel				
					OUTWASH SAND AND GRAVEL				
	275	1	20 28 27		SAND AND GRAVEL; brown, fine to coarse, occasional cobbles, few silt; wet, very dense			9	
5					water level 1				G
	270	2	31 45 40					8	
10									
	265	3	50/5"		SAND AND GRAVEL; brown, fine to coarse, trace to few silt; wet, very dense			10	
15									
		4	37 50/1"		GLACIAL TILL SILTY SAND WITH GRAVEL; gray, fine to coarse; moist, very dense; low plasticity fines			8	
	260	5	50/3"		water level 2			16	
20									
	255	6	50/5"		SILTY SAND; gray, fine to coarse, trace to few fine gravel; moist, very dense; low plasticity fines			13	

Continued Next Page

Project No.

Modifications to Forest Drive

Bellevue, Washington

for Tudor Engineering

91-35152-01

Figure No.

A-2

Converse Consultants NW Geotechnical Engineering and Applied Earth Sciences

LOG OF BORING NO. B-2

Date drilled 9/12/91 Driving Weight and Drop 140 lb, 30" drop Elevation (ft) 278

This log is part of the report prepared by Converse Consultants NW for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Depth, ft	Elevation	Samples	Blows/6"	Graphic Symbol	DESCRIPTION	Observation Well	Dry density pcf	Moisture Content, %	Other tests
	250	7	50/4"					11	G
30									
	245	8	22 39 37		6" layer of fractured silty clay, medium to high plasticity, very hard			30 16	
35									
	240	9	50/4"					13	
40									
	235	10	100/3"					11	
45					Bottom of boring at 44.0 feet. Piezometers installed in boring, screened from 38 to 43 feet and from 9 to 14 feet. G = Grain size analysis Water level 1 taken 9/27/91 in piezometer screened from 9 to 14 feet. Water level 2 taken 9/27/91 in piezometer screened from 38 to 43 feet.				
	230								

Project No.

Modifications to Forest Drive

Bellevue, Washington

for Tudor Engineering

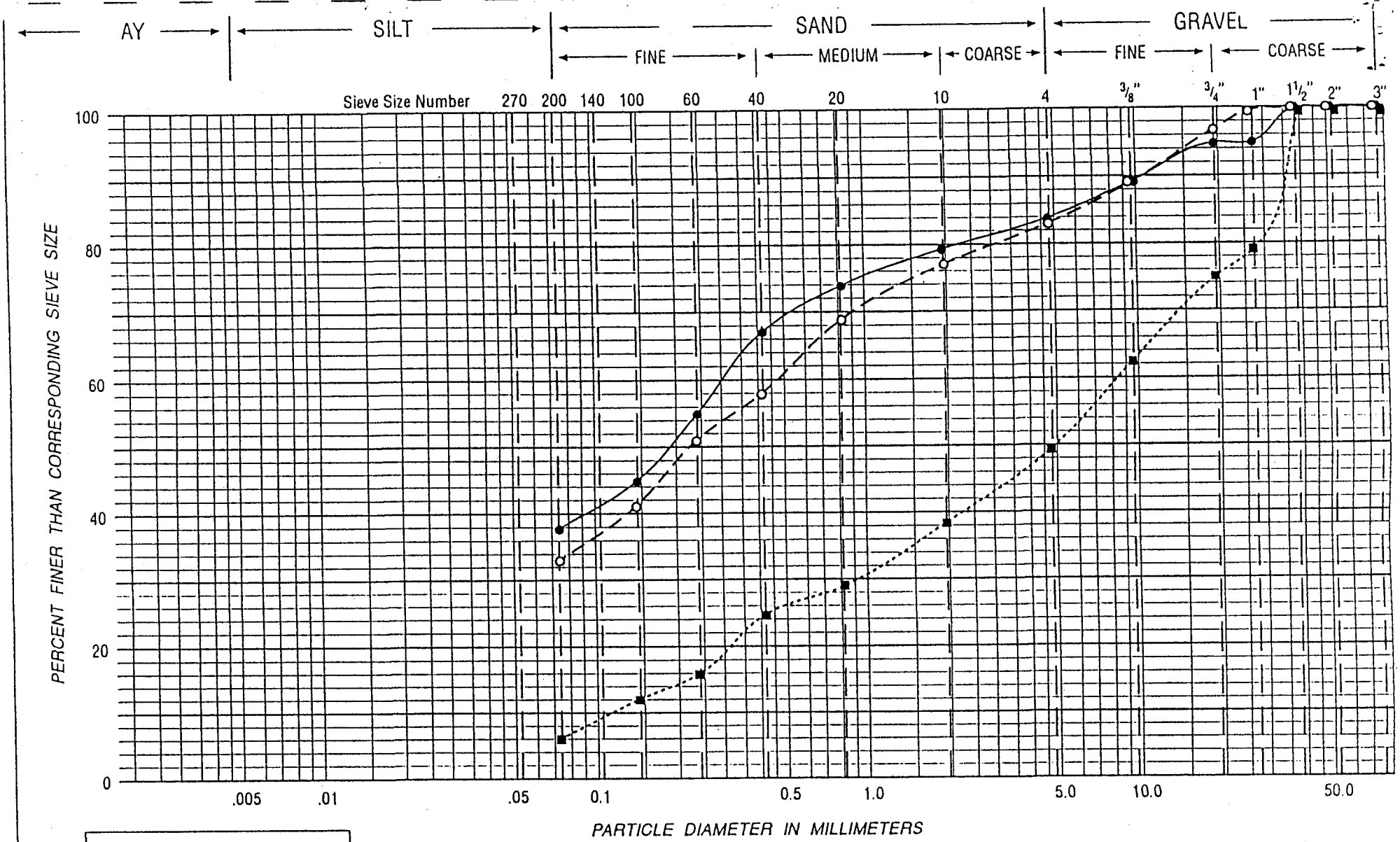
91-35152-01

Figure No.

A-2

Converse Consultants NW

Geotechnical Engineering and Applied Earth Sciences



LEGEND

- B-1 (S-1, S-2, S-3) Depth: 3'-14'
- B-2 (S-1, S-2) Depth: 3'-9'
- B-2 (S-6 through S-8B) Depth: 23'-34'

GRAIN-SIZE DISTRIBUTION CHART

MODIFICATIONS TO FOREST DRIVE
Bellevue, Washington
for Tudor Engineering

Project No. 91-35152-0

Figure No. B-1

Converse Consultants NW Geotechnical Engineering and Applied Earth Sciences

Bellevue, Washington

Forest Drive

(SE 54th Place – SE 63rd Street)

Prepared for

Geo-Engineers, Inc.

June 26, 2002

PAVEMENT ENGINEERS

15226 12th Drive S.E
Mill Creek, WA 98012-3082
(425) 337-5222

layer. The computer program used for this analysis takes this changing *Equivalent Thickness* into consideration when calculating the modulus of the subgrade. With this in mind, the calculated modulus and thickness values should be looked at as a group rather than specific locations.

Figures 2 and 3 present the back-calculated modulus values of the surface, base and subgrade along the road. Figures 4 and 5 present a plot of the *Equivalent Thicknesses*.

Pavement cores were taken by Geo-Engineers, Inc. during their soils investigation and presented in their report. The thicknesses of the asphalt layers are shown in the appropriate figures for comparison to the back-calculated *Equivalent Thicknesses*. We consider the agreement between the back caculated *Equivalent Thicknesses* and cores thicknesses to be very good.

Overlay Design

A design traffic value of 6.2 million 18-kip equivalent single axle loads, ESAL's was used to calculate and overlay thickness for the pavement at each test point. This design traffic value was provided by Geo-Engineers and is discussed in their report. Figures 7 and 8 provide the overlay thicknesses at each test location and the recommended overlay based on an approximate 90 percentile reliability.

The total pavement thickness after the overlay will be approximately 11-12 inches. This was determined by adding the existing pavement thicknesses, Figure 5 and 6, to the recommended overlay thicknesses, Figures 7 and 8. This thickness was compared to that recommended in the WSDOT Pavement Guide, Table 2.1. The WSDOT Pavement Guide is based on the AASHTO Design Guide using input values for local conditions.

For a subgrade modulus of 10,000 to 20,000 psi; design traffic of 6.2 million ESAL's, and 95% Reliability; the recommended new pavement is 105 mm (4.13") ACP, Class A plus 155 mm (6.10") ACB, Class E plus 105 mm (4.13") Crushed Base. The WSDOT method recommends a total asphalt pavement thickness of 10.23" which is very close to that calculated using deflections.

CLOSING

This report was prepared in accordance with generally accepted professional engineering principles and practice. There is no other warranty, either expressed or implied. Should you have any questions regarding the findings or recommendations, please do not hesitate to contact us.

Pavement Engineers, Inc.

DIDRIK A. VOSS
STATE OF WASHINGTON
12759
REGISTERED
PROFESSIONAL ENGINEER

Didrik A. Voss, P.E.
Chief Pavement Engineer

EXPIRES July 28, 2012

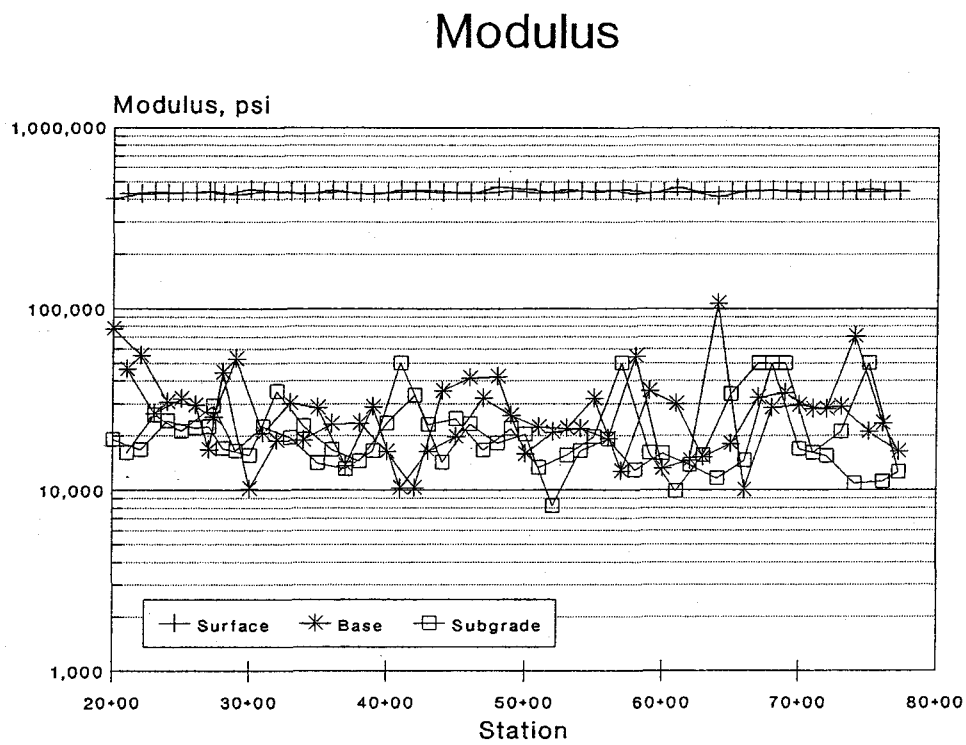


Figure 3. Existing Lanes

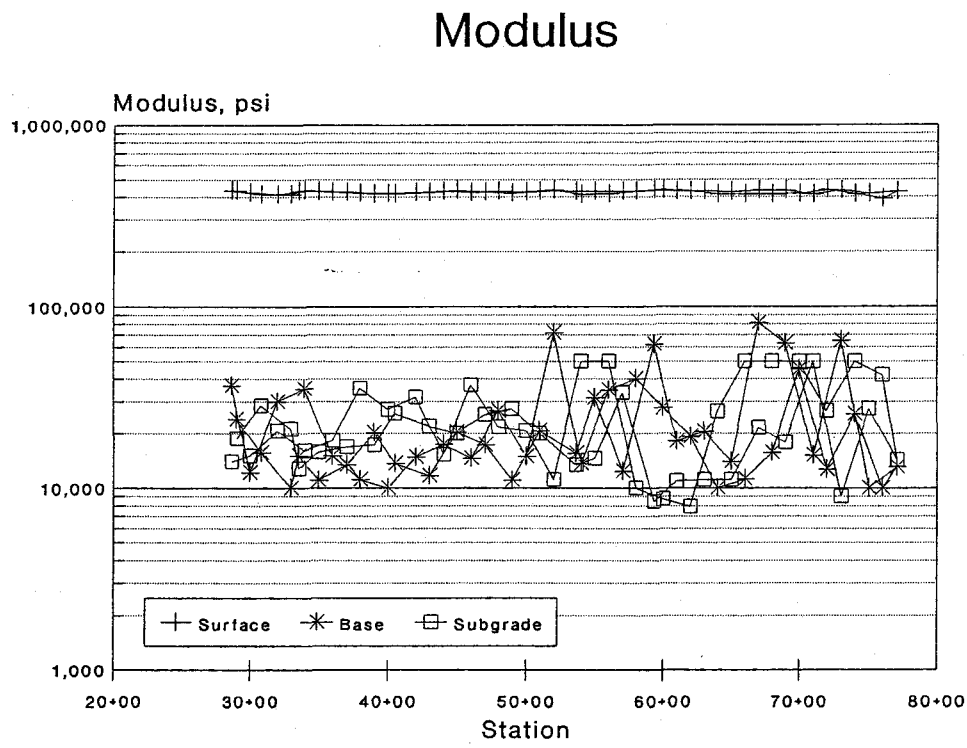


Figure 4. Shoulders

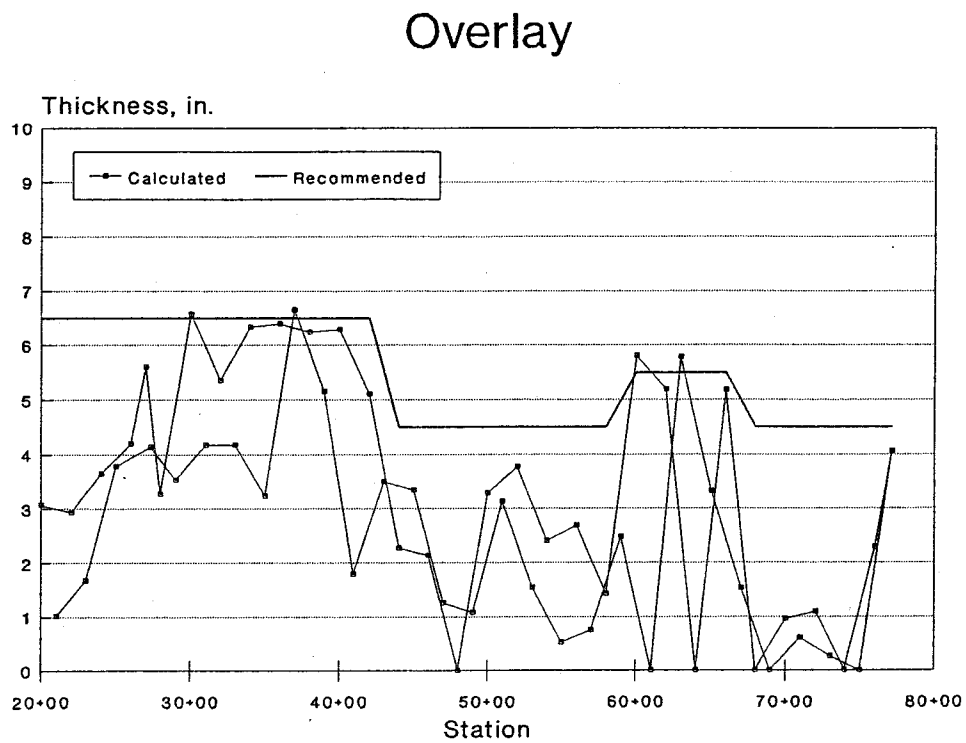


Figure 7. Existing Lanes

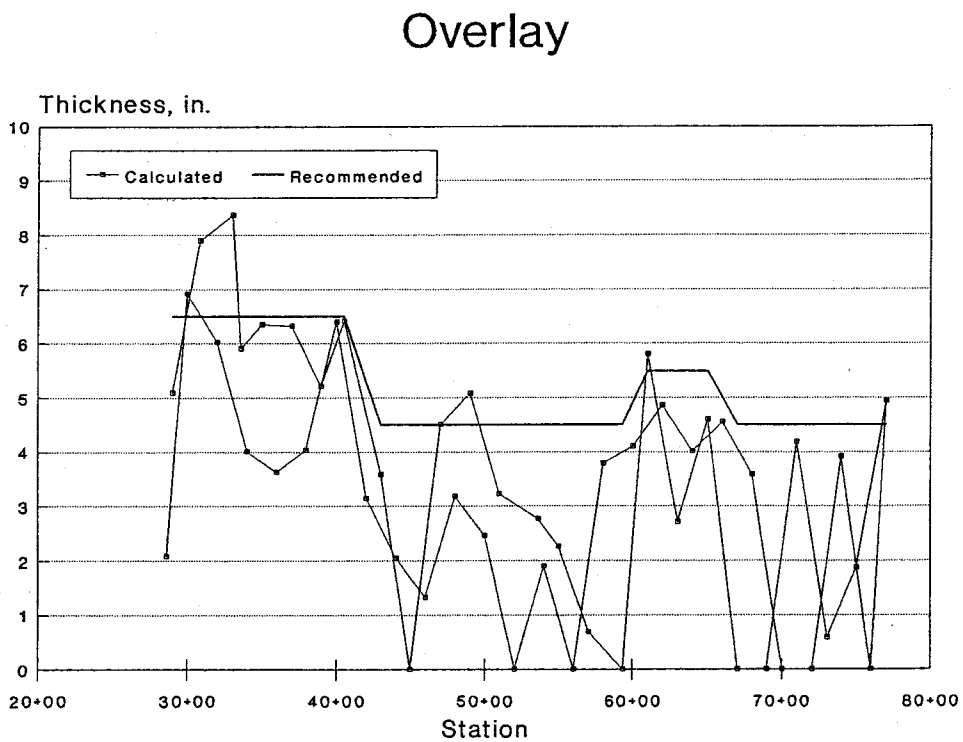


Figure 8. Shoulders

```
IKUAB FWD FILE     : FOREST1
HAgency            : GeoEngineers
HProject Number    :
HRoad Name         : Forest Dr
HTest Section      :
HDirection         :
HStart Point       : SE 54 PL
H  End Point       : SE 63rd St
HLane Number       :
HOperator          : D. A. Voss
H                  :
HSurface Type      : acp
HPoisson Ratio     :
HWeather           : wet
HComment           : temp 70 f

IDate Created      : 21-06-2002
ILoad Mode         : 1          (2 + 2 buffers)
IPlate Radius      : 5.91       (in)
IExtra Field Set   : KUAB STANDARD
IDrop Sequence     : 1123
INo of drops       : 1111
IRecord Drop?      : NYYY
IDrop Height       :     1     2     3     4
IImpact Load       :  5000  9000 12500     0 lbf
ISensor Number     :     0     1     2     3     4     5     6
ISensor Distance   :  0.00 11.81 17.72 23.62 35.43 47.24 82.68 (in)
ISensor Position   : CENTER BEHIND BEHIND BEHIND BEHIND ?????? ??????

IReference Offset :     0 ft
ITestpoint spacing:   200 ft
```

JDistance J ft	Imp Num	Load lbf	D0 mils	D1 mils	D2 mils	D3 mils	D4 mils	Air øF	E Mod Mpa
J--------	---	-----	------	------	------	------	------	-----	------
D 0	2	4988	6.63	3.47	2.25	1.63	0.96	-459	427
D 0	3	9092	11.05	6.07	4.07	2.95	1.81	-459	468
D 0	4	12501	13.92	7.80	5.37	4.00	2.50	-459	511
D 201	2	4916	6.63	3.73	2.59	1.90	1.08	-459	421
D 201	3	8974	11.10	6.63	4.72	3.52	2.04	-459	460
D 201	4	12305	14.28	8.75	6.36	4.81	2.87	-459	490
c Comment at 201 ft :0 is 2000									
D 400	2	4821	6.76	3.67	2.27	1.55	0.77	-459	405
D 400	3	8861	11.23	6.39	4.21	2.85	1.45	-459	449
D 400	4	12280	14.59	8.49	5.73	4.00	2.12	-459	479
D 601	2	4806	7.50	4.05	2.57	1.67	0.78	-459	364
D 601	3	8849	12.47	7.03	4.61	3.06	1.55	-459	404
D 601	4	12268	15.97	9.18	6.16	4.17	2.18	-459	437
D 700	2	4830	9.99	5.20	3.07	1.84	0.85	-459	275
D 700	3	8895	16.85	9.24	5.67	3.49	1.53	-459	300
D 700	4	12173	21.33	11.98	7.56	4.78	2.13	-459	324
D 800	2	4768	6.69	3.79	2.59	1.86	1.00	-459	406
D 800	3	8824	11.41	6.80	4.84	3.55	1.99	-459	440
D 800	4	12195	15.05	9.16	6.59	4.89	2.84	-459	461
D 1001	2	4800	12.33	7.09	4.66	2.97	1.21	-459	221
D 1001	3	8755	22.18	13.12	8.75	5.70	2.31	-459	224
D 1001	4	12145	29.69	17.79	12.07	7.95	3.37	-459	233
D 1200	2	4836	9.00	4.05	2.21	1.24	0.55	-459	306
D 1200	3	8853	15.13	7.37	4.24	2.39	0.95	-459	333
D 1200	4	12282	19.77	9.91	5.84	3.40	1.36	-459	353
D 1399	2	4812	11.80	5.09	2.71	1.67	0.76	-459	232
D 1399	3	8881	19.32	9.12	5.12	3.20	1.43	-459	261
D 1399	4	12239	24.88	12.24	7.17	4.48	2.05	-459	280
D 1600	2	4762	12.10	5.52	2.41	1.78	0.97	-460	224
D 1600	3	8823	19.88	10.02	4.92	3.69	1.92	-460	252
D 1600	4	12229	25.57	13.49	7.04	5.34	2.84	-460	272
D 1802	2	4826	12.15	6.10	3.59	2.26	1.14	-459	226
D 1802	3	8853	19.50	10.48	6.59	4.41	2.28	-459	258
D 1802	4	12315	24.76	13.78	9.02	6.21	3.41	-459	283
D 2001	2	4797	12.05	5.50	3.23	1.90	0.67	-459	226

D	4900	2	4713	3.15	1.91	1.30	0.97	0.35	-459	850
D	4900	3	8861	5.67	3.45	2.44	1.66	0.61	-459	889
D	4900	4	12469	7.79	4.68	3.29	2.32	0.87	-459	910
D	4701	2	4724	3.97	2.20	1.44	0.85	0.31	-459	677
D	4701	3	8764	7.03	4.09	2.57	1.62	0.52	-459	709
D	4701	4	12361	9.84	5.70	3.67	2.27	0.74	-459	715
D	4500	2	4688	5.69	3.31	2.27	1.55	0.66	-459	468
D	4500	3	8777	10.62	6.19	4.25	2.89	1.23	-459	470
D	4500	4	12244	14.79	8.67	6.04	4.12	1.84	-459	471
D	4298	2	4692	9.74	5.59	3.75	2.56	1.15	-459	274
D	4298	3	8759	18.21	10.64	7.27	5.02	2.27	-459	273
D	4298	4	12294	25.24	15.06	10.35	7.23	3.37	-459	277
D	4100	2	4757	4.70	3.64	3.11	2.76	1.78	-459	575
D	4100	3	8873	8.88	6.93	5.86	5.09	3.32	-459	568
D	4100	4	12430	12.42	9.68	8.23	7.02	4.71	-459	569
D	3901	2	4714	5.85	3.70	2.77	2.14	1.15	-459	458
D	3901	3	8870	10.67	6.87	5.22	3.90	2.20	-459	473
D	3901	4	12379	14.92	9.70	7.34	5.55	3.17	-459	472
D	3699	2	4766	4.40	2.93	2.16	1.58	0.66	-459	616
D	3699	3	8904	7.64	5.15	3.83	2.65	1.22	-459	663
D	3699	4	12468	10.47	7.00	5.17	3.67	1.69	-459	677
D	3500	2	4725	4.22	2.81	2.19	1.73	0.97	-459	637
D	3500	3	8794	8.02	5.38	4.21	3.24	1.88	-459	624
D	3500	4	12395	11.39	7.70	6.12	4.75	2.75	-459	619
D	3302	2	4753	5.14	3.85	2.99	2.32	1.30	-459	526
D	3302	3	8817	9.61	7.03	5.54	4.29	2.41	-459	522
D	3302	4	12424	13.46	9.84	7.68	5.97	3.46	-459	525
D	3100	2	4665	6.63	4.49	3.39	2.67	1.45	-459	400
D	3100	3	8849	12.29	8.35	6.38	4.94	2.76	-459	409
D	3100	4	12407	16.76	11.55	8.88	6.84	3.92	-459	421
D	2901	2	4770	4.27	2.95	2.19	1.73	0.88	-459	635
D	2901	3	8885	8.40	5.79	4.35	3.22	1.78	-459	602
D	2901	4	12421	11.78	8.14	6.13	4.68	2.53	-459	600
c	Comment at 2899 ft :se 60 st. end newer acp									
D	2700	2	4690	4.96	3.39	2.53	1.98	1.12	-458	538
D	2700	3	8771	9.13	6.22	4.80	3.66	2.17	-458	546
D	2700	4	12355	12.52	8.61	6.71	5.16	3.07	-458	561
D	2501	2	4684	6.08	3.67	2.53	1.80	0.88	-460	438
D	2501	3	8755	11.13	6.77	4.80	3.33	1.59	-460	447
D	2501	4	12309	15.15	9.31	6.62	4.72	2.31	-460	462
D	2300	2	4650	6.69	4.19	2.97	2.04	0.91	-459	395
D	2300	3	8689	11.71	7.33	5.44	3.81	1.74	-459	422
D	2300	4	12306	15.92	10.04	7.49	5.38	2.51	-459	440
D	2097	2	4696	4.83	3.19	2.27	1.57	0.68	-459	553
D	2097	3	8772	8.88	5.91	4.21	3.08	1.30	-459	562
D	2097	4	12241	12.16	8.05	5.84	4.15	1.81	-459	572
D	1898	2	4661	8.82	4.51	2.85	1.96	1.03	-459	300
D	1898	3	8768	15.56	8.55	5.66	3.85	2.01	-459	321
D	1898	4	12212	20.82	11.86	7.97	5.55	3.04	-459	333
D	1699	2	4660	12.58	6.92	4.52	2.97	1.29	-459	211
D	1699	3	8701	22.18	12.66	8.56	5.70	2.58	-459	223
D	1699	4	12190	29.38	17.16	11.87	8.10	3.84	-459	236
D	1500	2	4725	6.76	4.35	3.17	2.37	1.34	-459	397
D	1500	3	8750	12.12	8.03	5.89	4.37	2.48	-459	411
D	1500	4	12326	16.27	10.93	8.16	6.13	3.56	-459	431
D	1299	2	4719	7.55	4.17	2.67	1.78	0.92	-459	355
D	1299	3	8786	12.72	7.33	4.84	3.37	1.75	-459	393
D	1299	4	12349	16.45	9.78	6.65	4.71	2.56	-459	427
D	1100	2	4763	7.50	4.23	2.77	1.87	0.86	-460	361
D	1100	3	8816	12.85	7.54	5.10	3.45	1.63	-460	390
D	1100	4	12440	16.91	10.06	7.00	4.89	2.45	-460	418
D	901	2	4737	6.56	3.67	2.47	1.81	1.04	-459	411
D	901	3	8851	11.84	6.97	4.80	3.49	2.05	-459	425
D	901	4	12426	16.10	9.62	6.82	5.01	2.98	-459	439
D	733	2	4737	6.89	3.59	2.13	1.30	0.59	-459	391
D	733	3	8800	11.71	6.47	4.03	2.54	1.20	-459	427
D	733	4	12374	15.64	8.85	5.67	3.73	1.78	-459	450
D	501	2	4723	6.81	3.83	2.53	1.72	0.91	-459	394
D	501	3	8802	11.74	6.73	4.55	3.16	1.62	-459	426
D	501	4	12398	15.15	8.87	6.18	4.37	2.35	-459	465

```
IKUAB FWD FILE     : FOREST2
HAgency            : GeoEngineers
HProject Number    :
HRoad Name         : Forest Dr
HTest Section      : shoulder
HDirection         :
HStart Point       : SE 54 PL
H  End Point       : SE 63rd St
HLane Number       :
HOperator          : D. A. Voss
H                  :
HSurface Type      : acp
HPoisson Ratio     :
HWeather           : wet
HComment           : temp 80 f

IDate Created      : 21-06-2002
ILoad Mode         : 1          (2 + 2 buffers)
IPlate Radius      : 5.91       (in)
IExtra Field Set   : KUAB STANDARD
IDrop Sequence     : 1123
INo of drops       : 1111
IRecord Drop?      : NYYY
IDrop Height       :     1     2     3     4
IImpact Load       :  5000  9000 12500     0 lbf
ISensor Number     :     0     1     2     3     4     5     6
ISensor Distance   :  0.00 11.81 17.72 23.62 35.43 47.24 82.68 (in)
ISensor Position   : CENTER BEHIND BEHIND BEHIND BEHIND ?????? ??????

IReference Offset :     0 ft
ITestpoint spacing:   200 ft
```

JDistance J ft	Imp Num	Load lbf	D0 mils	D1 mils	D2 mils	D3 mils	D4 mils	Air øF	E Mod Mpa
J--------	---	-----	------	------	------	------	------	-----	------
D 901	2	4787	9.18	4.69	2.93	1.86	0.89	-459	297
D 901	3	8872	16.67	8.81	5.55	3.61	1.76	-459	303
D 901	4	12412	22.59	12.10	7.84	5.20	2.51	-459	312
D 1082	2	4725	17.31	5.12	1.87	1.05	0.58	-459	155
D 1082	3	8804	29.47	9.38	3.80	1.89	1.06	-459	170
D 1082	4	12336	38.55	12.82	5.41	2.84	1.53	-459	182
D 1301	2	4720	19.24	8.51	4.13	2.17	0.76	-459	139
D 1301	3	8780	34.35	16.01	8.18	4.23	1.39	-459	145
D 1301	4	12213	46.14	22.10	11.55	6.12	1.98	-459	151
D 1357	2	4702	11.24	6.40	4.25	2.88	1.31	-459	238
D 1357	3	8701	20.92	12.34	8.38	5.61	2.62	-459	237
D 1357	4	12188	29.05	17.38	11.99	8.16	3.85	-459	239
c Comment at 1357 ft :along rolled curb									
D 1500	2	4754	13.32	7.12	4.37	2.74	1.13	-459	203
D 1500	3	8748	23.09	12.96	8.39	5.25	2.15	-459	215
D 1500	4	12305	30.74	17.50	11.55	7.49	3.16	-459	228
D 1701	2	4744	12.84	6.58	3.95	2.31	1.00	-459	210
D 1701	3	8834	22.21	11.92	7.50	4.58	1.97	-459	226
D 1701	4	12405	29.48	16.23	10.41	6.53	2.93	-459	239
D 1900	2	4709	9.86	5.38	3.36	2.11	1.01	-460	271
D 1900	3	8869	17.22	9.76	6.20	3.92	1.97	-460	293
D 1900	4	12421	23.07	13.17	8.55	5.58	2.91	-460	306
D 2054	2	4684	13.02	5.76	3.13	1.66	0.61	-459	205
D 2054	3	8768	21.68	10.04	5.72	3.12	1.23	-459	230
D 2054	4	12425	28.26	13.25	7.74	4.42	1.85	-459	250
D 2300	2	4759	8.01	4.98	3.45	2.37	1.00	-459	338
D 2300	3	8847	14.27	9.01	6.33	4.40	1.97	-459	353
D 2300	4	12354	19.21	12.30	8.74	6.15	2.86	-459	366
D 2497	2	4762	4.32	3.04	2.39	1.86	1.04	-459	627
D 2497	3	8863	8.20	5.81	4.55	3.51	1.97	-459	615
D 2497	4	12463	11.73	8.32	6.48	5.08	2.87	-459	604
D 2702	2	4747	8.06	4.40	2.73	1.75	0.74	-459	335
D 2702	3	8782	15.05	8.20	5.18	3.24	1.38	-459	332
D 2702	4	12369	21.13	11.31	7.08	4.48	2.00	-459	333
D 2901	2	4781	9.56	5.18	3.19	1.90	0.77	-459	284

D	4001	4	12411	23.56	16.52	12.87	9.76	5.48	-459	300
D	3800	2	4763	8.01	5.08	3.85	3.01	1.72	-459	338
D	3800	3	8881	15.43	10.04	7.61	5.80	3.34	-459	327
D	3800	4	12414	21.97	14.31	10.99	8.29	4.92	-459	321
D	3601	2	4701	3.89	2.11	1.35	0.85	0.32	-460	687
D	3601	3	8844	7.03	3.77	2.46	1.60	0.59	-460	715
D	3601	4	12494	9.61	5.24	3.53	2.24	0.85	-460	740
D	3400	2	4711	5.52	3.15	2.10	1.33	0.51	-459	486
D	3400	3	8802	10.19	5.93	4.01	2.60	0.96	-459	491
D	3400	4	12421	14.28	8.41	5.69	3.71	1.38	-459	495
D	3201	2	4691	4.91	3.47	2.82	2.29	1.49	-459	544
D	3201	3	8823	9.26	6.65	5.44	4.37	2.86	-459	542
D	3201	4	12414	13.08	9.48	7.69	6.21	4.07	-459	540
D	3000	2	4717	6.08	3.87	2.76	2.06	1.01	-459	441
D	3000	3	8796	12.12	7.89	5.73	4.08	1.97	-459	413
D	3000	4	12496	17.40	11.43	8.38	6.01	3.02	-459	408
D	2801	2	4663	6.33	3.64	2.53	1.69	0.83	-460	419
D	2801	3	8844	12.17	7.05	4.92	3.28	1.61	-460	413
D	2801	4	12388	17.17	9.80	6.82	4.66	2.28	-460	410
D	2600	2	4713	5.34	3.19	2.21	1.48	0.73	-459	502
D	2600	3	8703	9.74	5.87	4.11	2.93	1.30	-459	508
D	2600	4	12386	13.72	8.37	5.93	4.23	1.88	-459	513
D	2401	2	4748	6.51	4.45	3.39	2.56	1.33	-459	415
D	2401	3	8922	12.17	8.44	6.41	4.79	2.52	-459	417
D	2401	4	12559	16.89	11.84	9.04	6.75	3.59	-459	423
D	2202	2	4742	6.81	3.85	2.59	1.67	0.72	-459	396
D	2202	3	8856	12.47	7.26	4.84	3.16	1.31	-459	404
D	2202	4	12503	17.45	10.18	6.85	4.57	1.92	-459	407
D	2001	2	4713	12.41	6.24	3.71	2.23	0.69	-459	216
D	2001	3	8758	22.84	11.45	6.90	4.07	1.26	-459	218
D	2001	4	12383	32.01	15.75	9.45	5.61	1.76	-459	220
D	1795	2	4712	7.93	4.55	2.93	1.78	0.67	-459	338
D	1795	3	8769	14.49	8.35	5.41	3.37	1.26	-459	344
D	1795	4	12383	20.03	11.51	7.49	4.71	1.83	-459	352
D	1598	2	4749	7.50	4.80	3.33	2.29	1.10	-459	360
D	1598	3	8817	14.14	9.03	6.41	4.40	2.10	-459	355
D	1598	4	12468	19.83	12.68	9.01	6.27	3.01	-459	358
D	1399	2	4732	7.50	4.23	2.82	2.00	1.07	-460	359
D	1399	3	8781	13.81	8.09	5.52	3.85	2.08	-460	362
D	1399	4	12436	19.08	11.17	7.75	5.43	2.98	-460	371
D	1200	2	4732	10.35	4.49	2.41	1.45	0.83	-459	260
D	1200	3	8861	18.26	8.12	4.50	2.87	1.57	-459	276
D	1200	4	12501	25.11	10.87	6.07	3.88	2.27	-459	283
D	999	2	4672	13.85	7.05	4.19	2.59	1.10	-459	192
D	999	3	8739	25.32	13.26	8.06	5.02	2.15	-459	196
D	999	4	12341	35.05	18.25	11.15	6.98	3.05	-459	200
D	863	2	4746	6.08	3.97	2.90	2.23	1.21	-459	444
D	863	3	8820	11.48	7.63	5.73	4.32	2.43	-459	437
D	863	4	12531	16.33	10.87	8.20	6.20	3.53	-459	436

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APPENDIX D

REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES, PERSONS AND PROJECTS

This report has been prepared for use by the City of Bellevue (COB). This report may be made available to the project design team for review. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

GeoEngineers structures our services to meet the specific needs of our clients. For example, a geotechnical or geologic study conducted for a civil engineer or architect may not fulfill the needs of a construction contractor or even another civil engineer or architect that are involved in the same project. Because each geotechnical or geologic study is unique, each geotechnical engineering or geologic report is unique, prepared solely for the specific client and project site. No one except the COB and the project design team should rely on this report without first conferring with GeoEngineers. This report should not be applied for any purpose or project except the one originally contemplated.

A GEOTECHNICAL ENGINEERING OR GEOLOGIC REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

This report has been prepared for the proposed roadway improvements to Forest Drive Southeast between Southeast 63rd Street and Coal Creek Parkway SE. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, do not rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

For example, changes that can affect the applicability of this report include those that affect:

- the function of the proposed structure;
- elevation, configuration, location, orientation or weight of the proposed structure;
- composition of the design team; or
- project ownership.

If important changes are made after the date of this report, GeoEngineers should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

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[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org .

SUBSURFACE CONDITIONS CAN CHANGE

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or ground water fluctuations. Always contact GeoEngineers before applying a report to determine if it remains applicable.

MOST GEOTECHNICAL AND GEOLOGIC FINDINGS ARE PROFESSIONAL OPINIONS

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

GEOTECHNICAL ENGINEERING REPORT RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the preliminary construction recommendations included in this report. These recommendations are not final, because they were developed principally from GeoEngineers' professional judgment and opinion. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for this report's recommendations if we do not perform construction observation.

Sufficient monitoring, testing and consultation by GeoEngineers should be provided during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions.

A GEOTECHNICAL ENGINEERING OR GEOLOGIC REPORT COULD BE SUBJECT TO MISINTERPRETATION

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having GeoEngineers confer with appropriate members of the design team after submitting the report. Also retain GeoEngineers to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having GeoEngineers participate in pre-bid and preconstruction conferences, and by providing construction observation.

DO NOT REDRAW THE EXPLORATION LOGS

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognize that separating logs from the report can elevate risk.

GIVE CONTRACTORS A COMPLETE REPORT AND GUIDANCE

Some owners and design professionals believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering or geologic report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might an owner be in a position to give contractors the best information available, while requiring them to at least share the financial responsibilities stemming from unanticipated conditions. Further, a contingency for unanticipated conditions should be included in your project budget and schedule.

CONTRACTORS ARE RESPONSIBLE FOR SITE SAFETY ON THEIR OWN CONSTRUCTION PROJECTS

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and to adjacent properties.

READ THESE PROVISIONS CLOSELY

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering or geology) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

GEOTECHNICAL, GEOLOGIC AND ENVIRONMENTAL REPORTS SHOULD NOT BE INTERCHANGED

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.

APPENDIX B

Soil Boring Logs

PROJECT NUMBER: 411518.AA.05.02	BORING NUMBER: BH-1-10	SHEET 1 OF 2

SOIL BORING LOG

PROJECT: City of Bellevue Coal Creek Pwky Culvert Replacement LOCATION: Eastern NB lane, 56 ft south of driveway, 6 ft west of curb

ELEVATION: TBD DRILLING CONTRACTOR: Gregory Drilling Inc., Redmond, Washington

DRILLING METHOD AND EQUIPMENT: CME 75 truck-mounted rig, 140-lb auto-hammer with 30-inch drop, HSA drilling

WATER LEVELS: — START: 12/4/2010 END: 12/4/2010 LOGGER: M. Thompson

DEPTH BELOW SURFACE (ft)	INTERVAL (ft)	RECOVERY (in)	NUMBER AND TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
					Surface is 7-inch-thick aphalt pavement underlain by about 13 inches dense silty sand.	Start drilling at 07:30.
5	5					
	6½	15"	SS-1	7-9-7 (16)	**SILTY SAND, SM** medium brown with gray, moist, medium dense, fine to coarse sand, non-plastic fines, estimated less than 10% fine gravel.	See laboratory results for SS-1.
10	10					Gravels at 8 ft.
	11½	6"	SS-2	10-13-8 (21)	**SILTY SAND (SM)** similar to above, except dark gray with brown.	
15	15					
	16½	9"	SS-3	2-5-5 (10)	**SILTY SAND, SM** similar to above, except loose, very dark gray to black, trace organics, non-plastic fines.	See laboratory results for SS-3.
	17½					
	19	4"	SS-4	3-5-11 (16)	**ORGANIC SOIL WITH SAND (OL)** black, moist, medium dense, slightly plastic fines, organics.	Sampler wet.
20	20					
	21½	8"	SS-5	2-3-1 (4)	**SILTY SAND, SM** black, very wet, very loose, fine to medium sand, non-plastic fines, shells.	See laboratory results for SS-5.
	22½					
	24	6"	SS-6	14-17-17 (34)	**SILTY GRAVEL WITH SAND (GM)** black, wet, dense, coarse gravel, some fine gravel, estimated 10 to 20% fines, estimated less than 20% fine sand.	Gravels from 22.5 to 25 ft.
25	25					
	26½	15"	SS-7	35-42-50/3" (92/9")	**SILTY SAND WITH GRAVEL, SM** brown, gray and white, moist, very dense, fine to coarse sand, non-plastic fines, fine gravel, till-looking material.	See laboratory results for SS-7.
	27½					
	29	—	SS-8	—	No sample taken.	Driller reports softer at 28.5 ft.
30	30					

PROJECT NUMBER: 411518.AA.05.02	BORING NUMBER: BH-1-10	SHEET 2 OF 2

SOIL BORING LOG

PROJECT: City of Bellevue Coal Creek Pwky Culvert Replacement LOCATION: Eastern NB lane, 56 ft south of driveway, 6 ft west of curb

ELEVATION: TBD DRILLING CONTRACTOR: Gregory Drilling Inc., Redmond, Washington

DRILLING METHOD AND EQUIPMENT: CME 75 truck-mounted rig, 140-lb auto-hammer with 30-inch drop, HSA drilling

WATER LEVELS: — START: 12/4/2010 END: 12/4/2010 LOGGER: M. Thompson

DEPTH BELOW SURFACE (ft)	INTERVAL (ft)	RECOVERY (in)	NUMBER AND TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	31½	16"	SS-9	10-9-11 (20)	**FAT CLAY, CH** medium gray, dry to moist, very stiff, plastic fines, fine to medium sand, trace fine gravel.	See laboratory results for SS-9.
35	35					
	36½	3"	SS-10	50/3"	**SILTY SAND WITH GRAVEL, SM** light gray, moist, very dense, fine to coarse sand, non-plastic fines, fine gravel, till-looking material.	See laboratory results for SS-10.
40	40					
	41½	3"	SS-11	50/3"	**SILTY SAND WITH GRAVEL (SM)** same as above.	
45	45					
	46½	18"	SS-12	12-15-19 (34)	**SILTY SAND, SM** light gray, dry to moist, dense, fine to coarse sand, non-plastic fines, trace fine gravel.	SS-12 at 08:45. See laboratory results for SS-12.
50						
55					Bottom of hole 46.5 ft below ground surface.	Hole Abandonment: Bentonite chips from bottom of hole to 2 ft bgs. Concrete patch at surface, dyed black.
60						

PROJECT NUMBER: 411518.AA.05.02	BORING NUMBER: BH-2p-10	SHEET 1 OF 2

SOIL BORING LOG

PROJECT: City of Bellevue Coal Creek Pwky Culvert Replacement LOCATION: NB shoulder, 26 ft south of driveway, 4 ft west of curb

ELEVATION: TBD DRILLING CONTRACTOR: Gregory Drilling Inc., Redmond, Washington

DRILLING METHOD AND EQUIPMENT: CME 75 truck-mounted rig, 140-lb auto-hammer with 30-inch drop, HSA drilling

WATER LEVELS: — START: 12/4/2010 END: 12/4/2010 LOGGER: M. Thompson

DEPTH BELOW SURFACE (ft)	INTERVAL (ft)	RECOVERY (in)	NUMBER AND TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
					Surface is 6-inch-thick aphalt pavement underlain by fill, the top 9 inches of which may be slightly more dense.	Start drilling at 09:35.
5	5					
	6½	13"	SS-1	6-8-7 (15)	**SILTY SAND, SM** light to medium grayish-brown, some gray, moist, medium dense, fine to coarse sand, non-plastic fines, trace fine gravel.	See laboratory results for SS-1.
10	10					
	11½	8"	SS-2	1-3-2 (5)	**SILTY SAND, SM** very dark brown, moist, loose, fine to medium sand, non-plastic fines, trace organics.	See laboratory results for SS-2.
15	15					
	16½	0"	SS-3	1-1-2 (3)	**NO RECOVERY** soft/loose.	Sampler is wet.
	17½					
	19	16"	SS-4	0-2-2 (4)	**SILT WITH SAND, ML** medium to dark brownish-gray, moist, soft, low-plasticity fines, fine sand, some organics.	See laboratory results for SS-4.
20	20					
	21½	6"	SS-5	8-7-4 (11)	**WELL GRADED GRAVEL WITH SILT, GW-GM** very dark brown, wet, loose to medium dense, medium to coarse sand and fine to coarse gravel, non-plastic fines.	See laboratory results for SS-5.
	22½					
	24	2"	SS-6	7-3-2 (5)	**POOR RECOVERY** similar to above.	
25	25					
	26½	16"	SS-7	1-2-6 (8)	**SILTY SAND, SM** very dark gray, wet, loose/firm, fine to medium sand, non-plastic fines.	See laboratory results for SS-7.
	27½					
	29	7"	SS-8	19-22-14 (36)	**SILTY GRAVEL WITH SAND, GM** dark gray, wet, dense, fine to coarse sand, fine to coarse gravel, non-plastic fines.	See laboratory results for SS-8.
30	30					

PROJECT NUMBER: 411518.AA.05.02	BORING NUMBER: BH-2p-10	SHEET 2 OF 2

SOIL BORING LOG

PROJECT: City of Bellevue Coal Creek Pwky Culvert Replacement LOCATION: NB shoulder, 26 ft south of driveway, 4 ft west of curb

ELEVATION: TBD DRILLING CONTRACTOR: Gregory Drilling Inc., Redmond, Washington

DRILLING METHOD AND EQUIPMENT: CME 75 truck-mounted rig, 140-lb auto-hammer with 30-inch drop, HSA drilling

WATER LEVELS: — START: 12/4/2010 END: 12/4/2010 LOGGER: M. Thompson

DEPTH BELOW SURFACE (ft)	INTERVAL (ft)	RECOVERY (in)	NUMBER AND TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	31½	17"	SS-9	7-12-13 (25)	**SILT WITH SAND, ML** dark gray, moist, medium dense, fine to coarse sand, non-plastic fines, fine gravel, till-looking material.	See laboratory results for SS-9.
35	35					
	36½	18"	SS-10	8-16-17 (33)	**SILT WITH SAND, ML** dark gray, moist, dense, fine to coarse sand, non-plastic fines, fine gravel.	See laboratory results for SS-10.
40	40					
	41½	18"	SS-11	7-11-17 (28)	**SILT WITH SAND (ML)** same as above.	
45	45					
	46½	17"	SS-12	11-15-16 (31)	**SILT WITH SAND (ML)** same as above.	SS-12 at 11:20.
50						
55					Bottom of hole 46.5 ft below ground surface.	Piezometer Installation: Tag No. BBT 723 Flush monument in concrete: 0-2 ft Bentonite chip: 2-14 ft Sand pack: 14-26 ft Slotted screen: 16-26 ft Bentonite chip: 26-46.5 ft
60						

PROJECT NUMBER: 411518.AA.05.02	BORING NUMBER: BH-3-11	SHEET 1 OF 2

SOIL BORING LOG

PROJECT: City of Bellevue Coal Creek Pwky Culvert Replacement LOCATION: Right SB lane, north of existing culvert

ELEVATION: TBD DRILLING CONTRACTOR: Gregory Drilling Inc., Redmond, Washington

DRILLING METHOD AND EQUIPMENT: CME 85 truck-mounted rig, 140-lb auto-hammer with 30-inch drop, HSA drilling

WATER LEVELS: — START: 1/22/2011 END: 1/22/2011 LOGGER: M. Thompson

DEPTH BELOW SURFACE (ft)	INTERVAL (ft)	RECOVERY (in)	NUMBER AND TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
					Surface is asphalt pavement.	Start drilling at 07:45.
	2½					
	4	16"	SS-1	9-20-23-17 (43)	**SILTY SAND (SM)**	
5	5					
	6½	20"	SS-2	6-13-12-8 (25)	**SILTY SAND (SM)** light to medium brown, gray, dry, medium dense, fine to coarse sand, estimated 35 to 45% non-plastic fines.	
	7½					
	9	18"	SS-3	6-8-16-17 (24)	**SILTY SAND (SM)** medium brown, dry to moist, medium dense, fine to coarse sand, estimated 20 to 35% fines, estimated less than 15% fine to coarse gravel.	
10	10					
	11½	6"	SS-4	6-7-5-6 (12)	**SILTY SAND (SM)** similar to above, except darker and looser; wood fragment in tip of sampler.	
	12½					
	14	8"	SS-5	0-1-1-4 (2)	**SILTY SAND (SM)** dark brown, moist to wet, very loose, fine to coarse sand, estimated 30 to 40% fines.	
15	15					
	16½	12"	SS-6	8-8-10-9 (18)	**SILTY SAND (SM)** very dark brown to black, moist to wet, medium dense, fine to coarse sand, estimated 25 to 40% non-plastic fines, estimated 10 to 20% fine to coarse gravel.	
	17½					
	19	12"	SS-7	3-5-3 (8)	**SILTY SAND OR SANDY SILT (SM/ML)** very dark gray, moist to wet, loose, fine to coarse sand, estimated 40 to 55% non-plastic fines, estimated less than 10% fine to coarse gravel.	
20	20					
	21½	5"	SS-8	7-5-17 (22)	**SILTY SAND (SM)** very dark brown to black, wet, medium dense, fine to coarse sand, estimated 15 to 25% non-plastic fines, trace gravel, trace wood.	
	22½					
	24	<1"	SS-9	5-16-15 (31)	**POOR RECOVERY (PR)** 1½" gravel lodged in shoe, recovery similar to above.	
25	25					
	26½	8"	SS-10	19-28-32 (60)	**SILTY SAND (SM)** very dark grayish-black, wet, very dense, fine to coarse sand, estimated 30 to 40% non-plastic fines.	Driller reports heavy gravel at 26 ft.
	27½					
	29	2"	SS-11	8-13-11 (24)	**WOOD** fresh wood, 1½" gravel lodged in shoe.	
30	30					

PROJECT NUMBER: 411518.AA.05.02	BORING NUMBER: BH-3-11	SHEET 2 OF 2

SOIL BORING LOG

PROJECT: City of Bellevue Coal Creek Pwky Culvert Replacement LOCATION: Right SB lane, north of existing culvert

ELEVATION: TBD DRILLING CONTRACTOR: Gregory Drilling Inc., Redmond, Washington

DRILLING METHOD AND EQUIPMENT: CME 85 truck-mounted rig, 140-lb auto-hammer with 30-inch drop, HSA drilling

WATER LEVELS: — START: 1/22/2011 END: 1/22/2011 LOGGER: M. Thompson

DEPTH BELOW SURFACE (ft)	INTERVAL (ft)	RECOVERY (in)	NUMBER AND TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	31½	4"	SS-12	11-19-21 (40)	**SANDY LEAN CLAY OR CLAYEY SAND (CL/SC)** very dark grayish-brown, moist to wet, hard or dense, plastic fines, estimated 30 to 40% fine to medium sand, trace gravel.	
	32½					
	31	4"	SS-13	11-31-33 (64)	**SILTY SAND WITH GRAVEL OR SANDY SILT WITH GRAVEL (SM/ML)** dark gray, wet, very dense, fine to coarse sand, estimated 30 to 40% non-plastic fines, estimated 15 to 25% fine to coarse gravel, till-looking material.	
35	35					
	36½	16"	SS-14	8-13-17 (30)	**SILTY SAND WITH GRAVEL OR SANDY SILT WITH GRAVEL (SM/ML)** similar to above, bottom half had less gravel.	
	37½					
	39	18"	SS-15	4-11-14 (25)	**SANDY SILT (ML)** similar to above, except predominantly non-plastic fines, estimated 30 to 45% fine to coarse sand, estimated less than 10% fine to coarse gravel.	
40	40					
	41½	10"	SS-16	7-10-14 (24)	**SILT WITH SAND AND GRAVEL (ML)** medium to dark gray, moist, very stiff, non-plastic fines, estimated 20 to 30% fine to coarse sand, estimated less than 10% fine to coarse gravel.	
	42½					
	44	18"	SS-17	8-19-28 (47)	**SILT WITH SAND AND GRAVEL (ML)** same as above.	
45	45					
	46½	18"	SS-18	12-22-30 (52)	**SILT (ML)** light gray, dry to moist, hard, low-plasticity fines, estimated less than 10% fine sand.	SS-18 at 09:45.
					Bottom of hole 46.5 ft below ground surface.	Abandoned hole with granular bentonite chips and surficial concrete patch, dyed to match surrounding pavement.
50						
55						
60						

PROJECT NUMBER: 411518.AA.05.02	BORING NUMBER: BH-4-11	SHEET 1 OF 2

SOIL BORING LOG

PROJECT: City of Bellevue Coal Creek Pwky Culvert Replacement LOCATION: Right SB lane, south of existing culvert

ELEVATION: TBD DRILLING CONTRACTOR: Gregory Drilling Inc., Redmond, Washington

DRILLING METHOD AND EQUIPMENT: CME 85 truck-mounted rig, 140-lb auto-hammer with 30-inch drop, HSA drilling

WATER LEVELS: — START: 1/22/2011 END: 1/22/2011 LOGGER: M. Thompson

DEPTH BELOW SURFACE (ft)	INTERVAL (ft)	RECOVERY (in)	NUMBER AND TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
					Surface is asphalt pavement.	Start drilling at 11:25.
	2½					Gravels at 2 ft.
	4	16"	SS-1	16-33-27-25 (60)	**SILTY SAND (SM)** medium brown, dry to moist, very dense, fine to coarse sand, estimated 20 to 35% fines, trace gravel.	
5	5					
	6½	17"	SS-2	6-4-3-3 (7)	**SANDY SILT OR SILTY SAND (ML/SM)** light to medium brown, moist, firm, predominantly non-plastic fines, estimated 40 to 60% fine to coarse sand.	
	7½					
	9	14"	SS-3	7-20-18-10 (38)	**SILTY SAND (SM)** light to medium brown, moist, dense, fine to coarse sand, estimated 20 to 35% fines, trace fine gravel.	
10	10					
	11½	4"	SS-4	5-5-5-6 (10)	**SILTY SAND (SM)** similar to above, except loose, some coarse gravel.	
	12½					
	14	4"	SS-5	4-3-2-1 (5)	**POORLY GRADED SAND WITH SILT OR SILTY SAND (SP-SM/SM)** light to medium brown, moist, loose, fine to coarse sand, estimated 10 to 20% fines, trace coarse gravel.	
15	15					
	16½	14"	SS-6	2-2-4-5 (6)	**SILTY SAND (SM)** very dark gray to black, wet, loose, fine to coarse sand, estimated 25 to 35% non-plastic fines, trace fine gravel, trace shells.	
	17½					
	19	11"	SS-7	2-2-1-2 (3)	**ORGANIC SOIL (OL)** black, moist to wet, very soft, low-plasticity fines, decayed and fresh organics and wood, some sand.	
20	20					
	21½	12"	SS-8	1-2-3-8 (5)	**ORGANIC SOIL (OL)** same as above.	
	22½					
	24	6"	SS-9	4-13-50/6" (63)	**SILTY SAND (SM)** dark gray, wet, very dense, fine to coarse sand, estimated 15 to 25% fines.	
25	25					
	26½	4"	SS-10	5-9-16 (25)	**SILTY SAND WITH GRAVEL (SM)** similar to above, except medium dense, coarse gravel.	Driller reports heavy gravel at 26 ft. Through gravels at 27 ft.
	27½					
	29	9"	SS-11	10-13-14 (27)	**SANDY SILT (ML)** light to medium gray, moist, very stiff, low- to medium-plasticity fines, estimated 20 to 30% fine to medium sand.	Attempted pushing a thin-walled Shelby tube at 27½ ft, recovered less than 5 inches.
30	30					

PROJECT NUMBER: 411518.AA.05.02	BORING NUMBER: BH-4-11	SHEET 2 OF 2

SOIL BORING LOG

PROJECT: City of Bellevue Coal Creek Pwky Culvert Replacement LOCATION: Right SB lane, south of existing culvert

ELEVATION: TBD DRILLING CONTRACTOR: Gregory Drilling Inc., Redmond, Washington

DRILLING METHOD AND EQUIPMENT: CME 85 truck-mounted rig, 140-lb auto-hammer with 30-inch drop, HSA drilling

WATER LEVELS: — START: 1/22/2011 END: 1/22/2011 LOGGER: M. Thompson

DEPTH BELOW SURFACE (ft)	INTERVAL (ft)	RECOVERY (in)	NUMBER AND TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"	SOIL DESCRIPTION: COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	31½	13"	SS-12	7-10-16 (26)	**SILT WITH SAND (ML)** similar to above, except estimated 10 to 20% sand.	
	32½					
	31	9"	SS-13	6-10-15 (25)	**SILT WITH SAND (ML)** same as above.	
35	35					
	36½	12"	SS-14	7-14-14 (28)	**SILT WITH SAND (ML)** same as above, parts with more sand.	
	37½					
	39	16"	SS-15	9-12-14 (26)	**SILT WITH SAND (ML)** same as above.	
40	40					
	41½	16"	SS-16	6-10-17 (27)	**0-6" - A: SILT OR LEAN CLAY (ML/CL)** similar to above. **6-16" - B: SILT WITH SAND (ML)** medium gray, moist, very stiff, non-plastic fines, estimated 25 to 40% fine to medium sand, till-looking material.	
	42½					
	44	14"	SS-17	7-14-16 (30)	**SILTY SAND (SM)** light gray and white, moist, dense, fine to coarse sand, estimated 30 to 40% fines.	
45	45					
	46½	17"	SS-18	13-23-24 (47)	**SILTY SAND (SM)** same as above.	SS-18 at 14:00.
					Bottom of hole 46.5 ft below ground surface.	Abandoned hole with granular bentonite chips and surficial concrete patch, dyed to match surrounding pavement.
50						
55						
60						

APPENDIX C

Environmental Laboratory Testing Results

Analytical Resources, Incorporated
Analytical Chemists and Consultants

February 8, 2011

Marcella Caldwell
CH2M Hill
P.O. Box 91500
Bellevue, WA 98009

RE: Client Project: CCP – 411518.AA.10
ARI Job No: SF98

Dear Marcella:

Please find enclosed the chain of custody (COC) documentation and the final results from the project referenced above. Analytical Resources, Inc. accepted three soil samples in good condition on January 24, 2011.

The samples were analyzed for NWTPH-Dx, NWTPH-Gx, total metals, and VOCs. Quality control analysis results are included for your review.

The VOCs method blank contained acetone. All associated samples that contain analyte have been flagged with a "B" qualifier.

The VOCs CCAL is out of control low for all associated FORM III "Q" flagged analytes. All samples that contain analyte have been flagged with a "Q" qualifier.

There were no other anomalies associated with the samples.

A copy of this report and all corresponding raw data will remain on file electronically with ARI. If you have any questions or require additional information, please contact me at your convenience.

Sincerely,
ANALYTICAL RESOURCES, INC.

Kelly Bottem
Client Services Manager
(206) 695-6211
kellyb@arilabs.com

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: SF98	Turn-around Requested: STND.
ARI Client Company: CH2M HILL	Phone: 425 453 5000
Client Contact: MARCELLA CALDWELL	
Client Project Name: CCP	
Client Project #: 411518.AA.10	Samplers: MC

Page: 1	of 1
Date: 1/22/11	Ice Present? Y
No. of Coolers: 1	Cooler Temps: 0.7

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	No. Containers	NWTPH-G	NWTPH-Dx	TOTAL METALS	TOTAL VOCS	TCLP METALS	HOLD	PENDING RESULTS OF OTHERS		Notes/Comments
BH-3-11-1	1/22/11	0800	S	8	X	X	X	X	X				HOLD ALL ANALYSIS UNTIL P.O. IN PLACE
BH-3-11-2	1/22/11	0815	S	8	X	X	X	X	X				
BH-4-11-1	1/22/11	1230	S	1	—	—	—	—	X				

Comments/Special Instructions	Relinquished by:	Received by:	Relinquished by:	Received by:
* TCLP METALS ON HOLD PENDING ANALYSIS	(Signature) M Caldwell	(Signature)	(Signature)	(Signature)
	Printed Name: MARCELLA CALDWELL	Printed Name: Mikka Mylumba	Printed Name:	Printed Name:
	Company: CH2M HILL	Company: ARI	Company:	Company:
	Date & Time: 1/24/11	Date & Time: 1/24/11 0825	Date & Time:	Date & Time:

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: CH2M HILL

Project Name: CCP

COC No(s): _____ (NA)

Delivered by: Fed-Ex UPS Courier Hand Delivered Other: _____

Assigned ARI Job No: SF98

Tracking No: _____ (NA)

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler?	YES	(NO)
Were custody papers included with the cooler?	(YES)	NO
Were custody papers properly filled out (ink, signed, etc.)	(YES)	NO

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry)..... 0.7 ___ ___ ___ ___ ___

If cooler temperature is out of compliance fill out form 00070F

Temp Gun ID#: 90941619

Cooler Accepted by: MM Date: 1/24/11 Time: 0825

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler?		YES	(NO)
What kind of packing material was used? ... (Bubble Wrap) (Wet Ice) Gel Packs Baggies (Foam Block) Paper Other: _____			
Was sufficient ice used (if appropriate)?	NA	(YES)	NO
Were all bottles sealed in individual plastic bags?		YES	(NO)
Did all bottles arrive in good condition (unbroken)?		(YES)	NO
Were all bottle labels complete and legible?		(YES)	NO
Did the number of containers listed on COC match with the number of containers received?		(YES)	NO
Did all bottle labels and tags agree with custody papers?		(YES)	NO
Were all bottles used correct for the requested analyses?		(YES)	NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)...	(NA)	YES	NO
Were all VOC vials free of air bubbles?	NA	YES	(NO)
Was sufficient amount of sample sent in each bottle?		(YES)	NO
Date VOC Trip Blank was made at ARI	NA	1/3/11	

Was Sample Split by ARI : (NA) YES Date/Time: _____ Equipment: _____ Split by: _____

Samples Logged by: JM Date: 1/24/11 Time: 1536

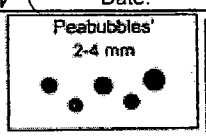
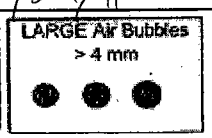
***** Notify Project Manager of discrepancies or concerns *****

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

Trip Blank = pb in 2 of 2

By: JM Date: 1/24/11

Small Air Bubbles ~2mm	Peabubbles' 2-4 mm	LARGE Air Bubbles > 4 mm
		

Small → "sm"	
Peabubbles → "pb"	
Large → "lg"	
Headspace → "hs"	

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: BH-3-11-1**
 SAMPLE

Lab Sample ID: SF98A
LIMS ID: 11-1494
Matrix: Soil
Data Release Authorized:
Reported: 01/28/11

QC Report No: SF98-CH2M Hill
Project: CCP
411518.AA.10
Date Sampled: 01/22/11
Date Received: 01/24/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 01/26/11 18:20

Sample Amount: 4.47 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 9.4%

CAS Number	Analyte	RL	Result	Q
74-87-3	Chloromethane	1.1	< 1.1	U
74-83-9	Bromomethane	1.1	< 1.1	U
75-01-4	Vinyl Chloride	1.1	< 1.1	U
75-00-3	Chloroethane	1.1	< 1.1	U
75-09-2	**Methylene Chloride**	**2.2**	**7.8**	
67-64-1	**Acetone**	**5.6**	**23**	**QB**
75-15-0	Carbon Disulfide	1.1	< 1.1	U
75-35-4	1,1-Dichloroethene	1.1	< 1.1	U
75-34-3	1,1-Dichloroethane	1.1	< 1.1	U
156-60-5	trans-1,2-Dichloroethene	1.1	< 1.1	U
156-59-2	cis-1,2-Dichloroethene	1.1	< 1.1	U
67-66-3	Chloroform	1.1	< 1.1	U
107-06-2	1,2-Dichloroethane	1.1	< 1.1	U
78-93-3	2-Butanone	5.6	< 5.6	U
71-55-6	1,1,1-Trichloroethane	1.1	< 1.1	U
56-23-5	Carbon Tetrachloride	1.1	< 1.1	U
108-05-4	Vinyl Acetate	5.6	< 5.6	U
75-27-4	Bromodichloromethane	1.1	< 1.1	U
78-87-5	1,2-Dichloropropane	1.1	< 1.1	U
10061-01-5	cis-1,3-Dichloropropene	1.1	< 1.1	U
79-01-6	Trichloroethene	1.1	< 1.1	U
124-48-1	Dibromochloromethane	1.1	< 1.1	U
79-00-5	1,1,2-Trichloroethane	1.1	< 1.1	U
71-43-2	Benzene	1.1	< 1.1	U
10061-02-6	trans-1,3-Dichloropropene	1.1	< 1.1	U
110-75-8	2-Chloroethylvinylether	5.6	< 5.6	U
75-25-2	Bromoform	1.1	< 1.1	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.6	< 5.6	U
591-78-6	2-Hexanone	5.6	< 5.6	U
127-18-4	Tetrachloroethene	1.1	< 1.1	U
79-34-5	1,1,2,2-Tetrachloroethane	1.1	< 1.1	U
108-88-3	**Toluene**	**1.1**	**1.6**	
108-90-7	Chlorobenzene	1.1	< 1.1	U
100-41-4	Ethylbenzene	1.1	< 1.1	U
100-42-5	Styrene	1.1	< 1.1	U
75-69-4	Trichlorofluoromethane	1.1	< 1.1	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroe	2.2	< 2.2	U
179601-23-1	**m,p-Xylene**	**1.1**	**1.1**	
95-47-6	o-Xylene	1.1	< 1.1	U
95-50-1	1,2-Dichlorobenzene	1.1	< 1.1	U
541-73-1	1,3-Dichlorobenzene	1.1	< 1.1	U
106-46-7	1,4-Dichlorobenzene	1.1	< 1.1	U
107-02-8	Acrolein	56	< 56	U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: BH-3-11-1**
 SAMPLE

Lab Sample ID: SF98A
LIMS ID: 11-1494
Matrix: Soil
Date Analyzed: 01/26/11 18:20

QC Report No: SF98-CH2M Hill
Project: CCP
411518.AA.10

CAS Number	Analyte	RL	Result	Q
74-88-4	Methyl Iodide	1.1	< 1.1	U
74-96-4	Bromoethane	2.2	< 2.2	U
107-13-1	Acrylonitrile	5.6	< 5.6	U
563-58-6	1,1-Dichloropropene	1.1	< 1.1	U
74-95-3	Dibromomethane	1.1	< 1.1	U
630-20-6	1,1,1,2-Tetrachloroethane	1.1	< 1.1	U
96-12-8	1,2-Dibromo-3-chloropropane	5.6	< 5.6	U
96-18-4	1,2,3-Trichloropropane	2.2	< 2.2	U
110-57-6	trans-1,4-Dichloro-2-butene	5.6	< 5.6	U
108-67-8	1,3,5-Trimethylbenzene	1.1	< 1.1	U
95-63-6	**1,2,4-Trimethylbenzene**	**1.1**	**1.3**	
87-68-3	Hexachlorobutadiene	5.6	< 5.6	U
106-93-4	Ethylene Dibromide	1.1	< 1.1	U
74-97-5	Bromochloromethane	1.1	< 1.1	U
594-20-7	2,2-Dichloropropane	1.1	< 1.1	U
142-28-9	1,3-Dichloropropane	1.1	< 1.1	U
98-82-8	Isopropylbenzene	1.1	< 1.1	U
103-65-1	n-Propylbenzene	1.1	< 1.1	U
108-86-1	Bromobenzene	1.1	< 1.1	U
95-49-8	2-Chlorotoluene	1.1	< 1.1	U
106-43-4	4-Chlorotoluene	1.1	< 1.1	U
98-06-6	tert-Butylbenzene	1.1	< 1.1	U
135-98-8	sec-Butylbenzene	1.1	< 1.1	U
99-87-6	4-Isopropyltoluene	1.1	< 1.1	U
104-51-8	n-Butylbenzene	1.1	< 1.1	U
120-82-1	1,2,4-Trichlorobenzene	5.6	< 5.6	U
91-20-3	Naphthalene	5.6	< 5.6	U
87-61-6	1,2,3-Trichlorobenzene	5.6	< 5.6	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	104%
d8-Toluene	92.4%
Bromofluorobenzene	95.5%
d4-1,2-Dichlorobenzene	99.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: BH-3-11-2**
 SAMPLE

Lab Sample ID: SF98B
LIMS ID: 11-1495
Matrix: Soil
Data Release Authorized:
Reported: 01/28/11

QC Report No: SF98-CH2M Hill
Project: CCP
411518.AA.10
Date Sampled: 01/22/11
Date Received: 01/24/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 01/26/11 18:46

Sample Amount: 4.97 g-dry-wt
Purge Volume: 5.0 mL
Moisture: 12.9%

CAS Number	Analyte	RL	Result	Q
74-87-3	Chloromethane	1.0	< 1.0	U
74-83-9	Bromomethane	1.0	< 1.0	U
75-01-4	Vinyl Chloride	1.0	< 1.0	U
75-00-3	Chloroethane	1.0	< 1.0	U
75-09-2	**Methylene Chloride**	**2.0**	**6.4**	
67-64-1	**Acetone**	**5.0**	**14**	**QB**
75-15-0	**Carbon Disulfide**	**1.0**	**3.8**	
75-35-4	1,1-Dichloroethene	1.0	< 1.0	U
75-34-3	1,1-Dichloroethane	1.0	< 1.0	U
156-60-5	trans-1,2-Dichloroethene	1.0	< 1.0	U
156-59-2	cis-1,2-Dichloroethene	1.0	< 1.0	U
67-66-3	Chloroform	1.0	< 1.0	U
107-06-2	1,2-Dichloroethane	1.0	< 1.0	U
78-93-3	2-Butanone	5.0	< 5.0	U
71-55-6	1,1,1-Trichloroethane	1.0	< 1.0	U
56-23-5	Carbon Tetrachloride	1.0	< 1.0	U
108-05-4	Vinyl Acetate	5.0	< 5.0	U
75-27-4	Bromodichloromethane	1.0	< 1.0	U
78-87-5	1,2-Dichloropropane	1.0	< 1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	< 1.0	U
79-01-6	Trichloroethene	1.0	< 1.0	U
124-48-1	Dibromochloromethane	1.0	< 1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	< 1.0	U
71-43-2	Benzene	1.0	< 1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	< 1.0	U
110-75-8	2-Chloroethylvinylether	5.0	< 5.0	U
75-25-2	Bromoform	1.0	< 1.0	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.0	< 5.0	U
591-78-6	2-Hexanone	5.0	< 5.0	U
127-18-4	Tetrachloroethene	1.0	< 1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	< 1.0	U
108-88-3	**Toluene**	**1.0**	**1.1**	
108-90-7	Chlorobenzene	1.0	< 1.0	U
100-41-4	Ethylbenzene	1.0	< 1.0	U
100-42-5	Styrene	1.0	< 1.0	U
75-69-4	Trichlorofluoromethane	1.0	< 1.0	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroe	2.0	< 2.0	U
179601-23-1	**m,p-Xylene**	**1.0**	**1.2**	
95-47-6	o-Xylene	1.0	< 1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	< 1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	< 1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	< 1.0	U
107-02-8	Acrolein	50	< 50	U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: BH-3-11-2**
 SAMPLE

Lab Sample ID: SF98B
LIMS ID: 11-1495
Matrix: Soil
Date Analyzed: 01/26/11 18:46

QC Report No: SF98-CH2M Hill
Project: CCP
411518.AA.10

CAS Number	Analyte	RL	Result	Q
74-88-4	Methyl Iodide	1.0	< 1.0	U
74-96-4	Bromoethane	2.0	< 2.0	U
107-13-1	Acrylonitrile	5.0	< 5.0	U
563-58-6	1,1-Dichloropropene	1.0	< 1.0	U
74-95-3	Dibromomethane	1.0	< 1.0	U
630-20-6	1,1,1,2-Tetrachloroethane	1.0	< 1.0	U
96-12-8	1,2-Dibromo-3-chloropropane	5.0	< 5.0	U
96-18-4	1,2,3-Trichloropropane	2.0	< 2.0	U
110-57-6	trans-1,4-Dichloro-2-butene	5.0	< 5.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	< 1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	< 1.0	U
87-68-3	Hexachlorobutadiene	5.0	< 5.0	U
106-93-4	Ethylene Dibromide	1.0	< 1.0	U
74-97-5	Bromochloromethane	1.0	< 1.0	U
594-20-7	2,2-Dichloropropane	1.0	< 1.0	U
142-28-9	1,3-Dichloropropane	1.0	< 1.0	U
98-82-8	Isopropylbenzene	1.0	< 1.0	U
103-65-1	n-Propylbenzene	1.0	< 1.0	U
108-86-1	Bromobenzene	1.0	< 1.0	U
95-49-8	2-Chlorotoluene	1.0	< 1.0	U
106-43-4	4-Chlorotoluene	1.0	< 1.0	U
98-06-6	tert-Butylbenzene	1.0	< 1.0	U
135-98-8	sec-Butylbenzene	1.0	< 1.0	U
99-87-6	4-Isopropyltoluene	1.0	< 1.0	U
104-51-8	n-Butylbenzene	1.0	< 1.0	U
120-82-1	1,2,4-Trichlorobenzene	5.0	< 5.0	U
91-20-3	Naphthalene	5.0	< 5.0	U
87-61-6	1,2,3-Trichlorobenzene	5.0	< 5.0	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	102%
d8-Toluene	93.2%
Bromofluorobenzene	93.6%
d4-1,2-Dichlorobenzene	99.1%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C

Sample ID: Trip Blank SAMPLE

Lab Sample ID: SF98D
LIMS ID: 11-1497
Matrix: Water
Data Release Authorized:
Reported: 01/28/11

QC Report No: SF98-CH2M Hill
Project: CCP
411518.AA.10
Date Sampled: 01/22/11
Date Received: 01/24/11

Instrument/Analyst: FINN5/PAB
Date Analyzed: 01/26/11 19:13

Sample Amount: 5.00 mL
Purge Volume: 5.0 mL

CAS Number	Analyte	RL	Result	Q
74-87-3	Chloromethane	1.0	< 1.0	U
74-83-9	Bromomethane	1.0	< 1.0	U
75-01-4	Vinyl Chloride	1.0	< 1.0	U
75-00-3	Chloroethane	1.0	< 1.0	U
75-09-2	Methylene Chloride	2.0	< 2.0	U
67-64-1	Acetone	10	< 10	U
75-15-0	Carbon Disulfide	1.0	< 1.0	U
75-35-4	1,1-Dichloroethene	1.0	< 1.0	U
75-34-3	1,1-Dichloroethane	1.0	< 1.0	U
156-60-5	trans-1,2-Dichloroethene	1.0	< 1.0	U
156-59-2	cis-1,2-Dichloroethene	1.0	< 1.0	U
67-66-3	Chloroform	1.0	< 1.0	U
107-06-2	1,2-Dichloroethane	1.0	< 1.0	U
78-93-3	2-Butanone	5.0	< 5.0	U
71-55-6	1,1,1-Trichloroethane	1.0	< 1.0	U
56-23-5	Carbon Tetrachloride	1.0	< 1.0	U
108-05-4	Vinyl Acetate	5.0	< 5.0	U
75-27-4	Bromodichloromethane	1.0	< 1.0	U
78-87-5	1,2-Dichloropropane	1.0	< 1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	< 1.0	U
79-01-6	Trichloroethene	1.0	< 1.0	U
124-48-1	Dibromochloromethane	1.0	< 1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	< 1.0	U
71-43-2	Benzene	1.0	< 1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	< 1.0	U
110-75-8	2-Chloroethylvinylether	5.0	< 5.0	U
75-25-2	Bromoform	1.0	< 1.0	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.0	< 5.0	U
591-78-6	2-Hexanone	5.0	< 5.0	U
127-18-4	Tetrachloroethene	1.0	< 1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	< 1.0	U
108-88-3	Toluene	1.0	< 1.0	U
108-90-7	Chlorobenzene	1.0	< 1.0	U
100-41-4	Ethylbenzene	1.0	< 1.0	U
100-42-5	Styrene	1.0	< 1.0	U
75-69-4	Trichlorofluoromethane	1.0	< 1.0	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroe	2.0	< 2.0	U
179601-23-1	m,p-Xylene	2.0	< 2.0	U
95-47-6	o-Xylene	1.0	< 1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	< 1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	< 1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	< 1.0	U
107-02-8	Acrolein	10	< 10	U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: Trip Blank**
 SAMPLE

Lab Sample ID: SF98D
LIMS ID: 11-1497
Matrix: Water
Date Analyzed: 01/26/11 19:13

QC Report No: SF98-CH2M Hill
Project: CCP
411518.AA.10

CAS Number	Analyte	RL	Result	Q
74-88-4	Methyl Iodide	1.0	< 1.0	U
74-96-4	Bromoethane	2.0	< 2.0	U
107-13-1	Acrylonitrile	5.0	< 5.0	U
563-58-6	1,1-Dichloropropene	1.0	< 1.0	U
74-95-3	Dibromomethane	1.0	< 1.0	U
630-20-6	1,1,1,2-Tetrachloroethane	1.0	< 1.0	U
96-12-8	1,2-Dibromo-3-chloropropane	5.0	< 5.0	U
96-18-4	1,2,3-Trichloropropane	2.0	< 2.0	U
110-57-6	trans-1,4-Dichloro-2-butene	5.0	< 5.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	< 1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	< 1.0	U
87-68-3	Hexachlorobutadiene	5.0	< 5.0	U
106-93-4	Ethylene Dibromide	1.0	< 1.0	U
74-97-5	Bromochloromethane	1.0	< 1.0	U
594-20-7	2,2-Dichloropropane	1.0	< 1.0	U
142-28-9	1,3-Dichloropropane	5.0	< 5.0	U
98-82-8	Isopropylbenzene	1.0	< 1.0	U
103-65-1	n-Propylbenzene	1.0	< 1.0	U
108-86-1	Bromobenzene	1.0	< 1.0	U
95-49-8	2-Chlorotoluene	1.0	< 1.0	U
106-43-4	4-Chlorotoluene	1.0	< 1.0	U
98-06-6	tert-Butylbenzene	1.0	< 1.0	U
135-98-8	sec-Butylbenzene	1.0	< 1.0	U
99-87-6	4-Isopropyltoluene	1.0	< 1.0	U
104-51-8	n-Butylbenzene	1.0	< 1.0	U
120-82-1	1,2,4-Trichlorobenzene	5.0	< 5.0	U
91-20-3	Naphthalene	5.0	< 5.0	U
87-61-6	1,2,3-Trichlorobenzene	5.0	< 5.0	U

Reported in µg/L (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	102%
d8-Toluene	94.3%
Bromofluorobenzene	93.5%
d4-1,2-Dichlorobenzene	99.4%

2-Chloroethylvinylether is an acid labile compound and may not be recovered from an acid preserved sample.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: MB-012611**
 METHOD BLANK

Lab Sample ID: MB-012611
LIMS ID: 11-1494
Matrix: Soil
Data Release Authorized:
Reported: 01/28/11

QC Report No: SF98-CH2M Hill
Project: CCP
411518.AA.10
Date Sampled: NA
Date Received: NA

Instrument/Analyst: FINN5/PAB
Date Analyzed: 01/26/11 12:51

Sample Amount: 5.00 g-dry-wt
Purge Volume: 5.0 mL
Moisture: NA

CAS Number	Analyte	RL	Result	Q
74-87-3	Chloromethane	1.0	< 1.0	U
74-83-9	Bromomethane	1.0	< 1.0	U
75-01-4	Vinyl Chloride	1.0	< 1.0	U
75-00-3	Chloroethane	1.0	< 1.0	U
75-09-2	Methylene Chloride	2.0	< 2.0	U
67-64-1	**Acetone**	**5.0**	**5.3**	
75-15-0	Carbon Disulfide	1.0	< 1.0	U
75-35-4	1,1-Dichloroethene	1.0	< 1.0	U
75-34-3	1,1-Dichloroethane	1.0	< 1.0	U
156-60-5	trans-1,2-Dichloroethene	1.0	< 1.0	U
156-59-2	cis-1,2-Dichloroethene	1.0	< 1.0	U
67-66-3	Chloroform	1.0	< 1.0	U
107-06-2	1,2-Dichloroethane	1.0	< 1.0	U
78-93-3	2-Butanone	5.0	< 5.0	U
71-55-6	1,1,1-Trichloroethane	1.0	< 1.0	U
56-23-5	Carbon Tetrachloride	1.0	< 1.0	U
108-05-4	Vinyl Acetate	5.0	< 5.0	U
75-27-4	Bromodichloromethane	1.0	< 1.0	U
78-87-5	1,2-Dichloropropane	1.0	< 1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	< 1.0	U
79-01-6	Trichloroethene	1.0	< 1.0	U
124-48-1	Dibromochloromethane	1.0	< 1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	< 1.0	U
71-43-2	Benzene	1.0	< 1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	< 1.0	U
110-75-8	2-Chloroethylvinylether	5.0	< 5.0	U
75-25-2	Bromoform	1.0	< 1.0	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	5.0	< 5.0	U
591-78-6	2-Hexanone	5.0	< 5.0	U
127-18-4	Tetrachloroethene	1.0	< 1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	< 1.0	U
108-88-3	Toluene	1.0	< 1.0	U
108-90-7	Chlorobenzene	1.0	< 1.0	U
100-41-4	Ethylbenzene	1.0	< 1.0	U
100-42-5	Styrene	1.0	< 1.0	U
75-69-4	Trichlorofluoromethane	1.0	< 1.0	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroe	2.0	< 2.0	U
179601-23-1	m,p-Xylene	1.0	< 1.0	U
95-47-6	o-Xylene	1.0	< 1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	< 1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	< 1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	< 1.0	U
107-02-8	Acrolein	50	< 50	U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: MB-012611**
 METHOD BLANK

Lab Sample ID: MB-012611 QC Report No: SF98-CH2M Hill
LIMS ID: 11-1494 Project: CCP
Matrix: Soil 411518.AA.10
Date Analyzed: 01/26/11 12:51

CAS Number	Analyte	RL	Result	Q
74-88-4	Methyl Iodide	1.0	< 1.0	U
74-96-4	Bromoethane	2.0	< 2.0	U
107-13-1	Acrylonitrile	5.0	< 5.0	U
563-58-6	1,1-Dichloropropene	1.0	< 1.0	U
74-95-3	Dibromomethane	1.0	< 1.0	U
630-20-6	1,1,1,2-Tetrachloroethane	1.0	< 1.0	U
96-12-8	1,2-Dibromo-3-chloropropane	5.0	< 5.0	U
96-18-4	1,2,3-Trichloropropane	2.0	< 2.0	U
110-57-6	trans-1,4-Dichloro-2-butene	5.0	< 5.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	< 1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	< 1.0	U
87-68-3	Hexachlorobutadiene	5.0	< 5.0	U
106-93-4	Ethylene Dibromide	1.0	< 1.0	U
74-97-5	Bromochloromethane	1.0	< 1.0	U
594-20-7	2,2-Dichloropropane	1.0	< 1.0	U
142-28-9	1,3-Dichloropropane	1.0	< 1.0	U
98-82-8	Isopropylbenzene	1.0	< 1.0	U
103-65-1	n-Propylbenzene	1.0	< 1.0	U
108-86-1	Bromobenzene	1.0	< 1.0	U
95-49-8	2-Chlorotoluene	1.0	< 1.0	U
106-43-4	4-Chlorotoluene	1.0	< 1.0	U
98-06-6	tert-Butylbenzene	1.0	< 1.0	U
135-98-8	sec-Butylbenzene	1.0	< 1.0	U
99-87-6	4-Isopropyltoluene	1.0	< 1.0	U
104-51-8	n-Butylbenzene	1.0	< 1.0	U
120-82-1	1,2,4-Trichlorobenzene	5.0	< 5.0	U
91-20-3	Naphthalene	5.0	< 5.0	U
87-61-6	1,2,3-Trichlorobenzene	5.0	< 5.0	U

Reported in µg/kg (ppb)

Volatile Surrogate Recovery

d4-1,2-Dichloroethane	97.7%
d8-Toluene	93.5%
Bromofluorobenzene	96.6%
d4-1,2-Dichlorobenzene	99.5%

ANALYTICAL RESOURCES INCORPORATED

VOA SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: SF98-CH2M Hill
Project: CCP
411518.AA.10

ARI ID	Client ID	Level	DCE	TOL	BFB	DCB	TOT OUT
MB-012611	Method Blank	Low	97.7%	93.5%	96.6%	99.5%	0
LCS-012611	Lab Control	Low	82.7%	96.2%	96.8%	96.7%	0
LCSD-012611	Lab Control Dup	Low	90.6%	95.6%	97.4%	100%	0
SF98A	BH-3-11-1	Low	104%	92.4%	95.5%	99.6%	0
SF98B	BH-3-11-2	Low	102%	93.2%	93.6%	99.1%	0

	LCS/MB LIMITS		QC LIMITS	
SW8260C	Low	Med	Low	Med
(DCE) = d4-1,2-Dichloroethane	79-121	76-120	75-152	69-120
(TOL) = d8-Toluene	80-120	80-120	82-115	80-120
(BFB) = Bromofluorobenzene	80-120	80-120	64-120	76-128
(DCB) = d4-1,2-Dichlorobenzene	80-120	80-120	80-120	80-120

Log Number Range: 11-1494 to 11-1495

ANALYTICAL RESOURCES INCORPORATED

VOA SURROGATE RECOVERY SUMMARY

Matrix: Water

QC Report No: SF98-CH2M Hill
Project: CCP
411518.AA.10

ARI ID	Client ID	PV	DCE	TOL	BFB	DCB	TOT OUT
SF98D	Trip Blank	5	102%	94.3%	93.5%	99.4%	0

	LCS/MB LIMITS	QC LIMITS
SW8260C		
(DCE) = d4-1,2-Dichloroethane	80-122	80-125
(TOL) = d8-Toluene	80-120	80-120
(BFB) = Bromofluorobenzene	80-120	80-120
(DCB) = d4-1,2-Dichlorobenzene	80-120	80-120

Prep Method: SW5030B
Log Number Range: 11-1497 to 11-1497

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: LCS-012611**
 LAB CONTROL SAMPLE

Lab Sample ID: LCS-012611
LIMS ID: 11-1494
Matrix: Soil
Data Release Authorized:
Reported: 01/28/11

QC Report No: SF98-CH2M Hill
Project: CCP
411518.AA.10
Date Sampled: NA
Date Received: NA

Instrument/Analyst LCS: FINN5/PAB
LCSD: FINN5/PAB
Date Analyzed LCS: 01/26/11 11:49
LCSD: 01/26/11 12:24

Sample Amount LCS: 5.00 g-dry-wt
LCSD: 5.00 g-dry-wt
Purge Volume LCS: 5.0 mL
LCSD: 5.0 mL
Moisture: NA

Analyte	LCS		Spike Added-LCS	LCS Recovery	LCSD		Spike Added-LCSD	LCSD Recovery	RPD
Chloromethane	37.2	Q	50.0	74.4%	39.7	Q	50.0	79.4%	6.5%
Bromomethane	41.4		50.0	82.8%	44.4		50.0	88.8%	7.0%
Vinyl Chloride	39.8	Q	50.0	79.6%	41.7	Q	50.0	83.4%	4.7%
Chloroethane	43.6		50.0	87.2%	48.2		50.0	96.4%	10.0%
Methylene Chloride	48.4		50.0	96.8%	51.3		50.0	103%	5.8%
Acetone	173	Q	250	69.2%	190	Q	250	76.0%	9.4%
Carbon Disulfide	48.6		50.0	97.2%	50.1		50.0	100%	3.0%
1,1-Dichloroethene	47.9		50.0	95.8%	50.6		50.0	101%	5.5%
1,1-Dichloroethane	48.6		50.0	97.2%	50.7		50.0	101%	4.2%
trans-1,2-Dichloroethene	49.2		50.0	98.4%	52.8		50.0	106%	7.1%
cis-1,2-Dichloroethene	48.6		50.0	97.2%	50.7		50.0	101%	4.2%
Chloroform	47.1		50.0	94.2%	48.4		50.0	96.8%	2.7%
1,2-Dichloroethane	46.0		50.0	92.0%	46.7		50.0	93.4%	1.5%
2-Butanone	218		250	87.2%	239		250	95.6%	9.2%
1,1,1-Trichloroethane	49.9		50.0	99.8%	51.0		50.0	102%	2.2%
Carbon Tetrachloride	49.0		50.0	98.0%	49.4		50.0	98.8%	0.8%
Vinyl Acetate	47.2		50.0	94.4%	50.8		50.0	102%	7.3%
Bromodichloromethane	50.8		50.0	102%	51.9		50.0	104%	2.1%
1,2-Dichloropropane	47.1		50.0	94.2%	46.7		50.0	93.4%	0.9%
cis-1,3-Dichloropropene	53.2		50.0	106%	54.6		50.0	109%	2.6%
Trichloroethene	47.3		50.0	94.6%	48.1		50.0	96.2%	1.7%
Dibromochloromethane	51.1		50.0	102%	51.0		50.0	102%	0.2%
1,1,2-Trichloroethane	47.3		50.0	94.6%	48.8		50.0	97.6%	3.1%
Benzene	50.7		50.0	101%	51.7		50.0	103%	2.0%
trans-1,3-Dichloropropene	54.7		50.0	109%	56.1		50.0	112%	2.5%
2-Chloroethylvinylether	68.1	Q	50.0	136%	65.2	Q	50.0	130%	4.4%
Bromoform	50.6		50.0	101%	52.0		50.0	104%	2.7%
4-Methyl-2-Pentanone (MIBK)	232		250	92.8%	251		250	100%	7.9%
2-Hexanone	235		250	94.0%	241		250	96.4%	2.5%
Tetrachloroethene	52.2		50.0	104%	52.2		50.0	104%	0.0%
1,1,2,2-Tetrachloroethane	45.0		50.0	90.0%	46.8		50.0	93.6%	3.9%
Toluene	49.8		50.0	99.6%	51.1		50.0	102%	2.6%
Chlorobenzene	51.4		50.0	103%	51.1		50.0	102%	0.6%
Ethylbenzene	56.1		50.0	112%	55.3		50.0	111%	1.4%
Styrene	54.8		50.0	110%	54.7		50.0	109%	0.2%
Trichlorofluoromethane	41.2		50.0	82.4%	38.8		50.0	77.6%	6.0%
1,1,2-Trichloro-1,2,2-trifluoroetha	38.9	Q	50.0	77.8%	42.5	Q	50.0	85.0%	8.8%
m,p-Xylene	112		100	112%	113		100	113%	0.9%
o-Xylene	52.3		50.0	105%	52.0		50.0	104%	0.6%
1,2-Dichlorobenzene	50.3		50.0	101%	50.8		50.0	102%	1.0%
1,3-Dichlorobenzene	51.8		50.0	104%	52.9		50.0	106%	2.1%
1,4-Dichlorobenzene	51.4		50.0	103%	53.0		50.0	106%	3.1%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Volatiles by Purge & Trap GC/MS-Method SW8260C **Sample ID: LCS-012611**
 LAB CONTROL SAMPLE

Lab Sample ID: LCS-012611 QC Report No: SF98-CH2M Hill
LIMS ID: 11-1494 Project: CCP
Matrix: Soil 411518.AA.10

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Acrolein	177 Q	250	70.8%	199 Q	250	79.6%	11.7%
Methyl Iodide	48.0	50.0	96.0%	49.5	50.0	99.0%	3.1%
Bromoethane	52.7	50.0	105%	54.8	50.0	110%	3.9%
Acrylonitrile	44.4	50.0	88.8%	47.6	50.0	95.2%	7.0%
1,1-Dichloropropene	50.8	50.0	102%	51.2	50.0	102%	0.8%
Dibromomethane	45.8	50.0	91.6%	47.5	50.0	95.0%	3.6%
1,1,1,2-Tetrachloroethane	50.9	50.0	102%	50.1	50.0	100%	1.6%
1,2-Dibromo-3-chloropropane	42.9	50.0	85.8%	43.3	50.0	86.6%	0.9%
1,2,3-Trichloropropane	51.2	50.0	102%	54.6	50.0	109%	6.4%
trans-1,4-Dichloro-2-butene	44.6	50.0	89.2%	46.7	50.0	93.4%	4.6%
1,3,5-Trimethylbenzene	55.2	50.0	110%	55.5	50.0	111%	0.5%
1,2,4-Trimethylbenzene	54.7	50.0	109%	55.2	50.0	110%	0.9%
Hexachlorobutadiene	49.3	50.0	98.6%	49.9	50.0	99.8%	1.2%
Ethylene Dibromide	47.9	50.0	95.8%	49.8	50.0	99.6%	3.9%
Bromochloromethane	51.3	50.0	103%	52.7	50.0	105%	2.7%
2,2-Dichloropropane	53.7	50.0	107%	55.6	50.0	111%	3.5%
1,3-Dichloropropane	51.1	50.0	102%	52.0	50.0	104%	1.7%
Isopropylbenzene	55.6	50.0	111%	55.7	50.0	111%	0.2%
n-Propylbenzene	51.1	50.0	102%	51.3	50.0	103%	0.4%
Bromobenzene	50.4	50.0	101%	51.6	50.0	103%	2.4%
2-Chlorotoluene	50.1	50.0	100%	51.5	50.0	103%	2.8%
4-Chlorotoluene	54.8	50.0	110%	55.7	50.0	111%	1.6%
tert-Butylbenzene	53.4	50.0	107%	53.8	50.0	108%	0.7%
sec-Butylbenzene	54.2	50.0	108%	54.1	50.0	108%	0.2%
4-Isopropyltoluene	57.7	50.0	115%	58.8	50.0	118%	1.9%
n-Butylbenzene	55.3	50.0	111%	57.2	50.0	114%	3.4%
1,2,4-Trichlorobenzene	48.6	50.0	97.2%	51.5	50.0	103%	5.8%
Naphthalene	46.4	50.0	92.8%	47.9	50.0	95.8%	3.2%
1,2,3-Trichlorobenzene	45.0	50.0	90.0%	46.7	50.0	93.4%	3.7%

Reported in µg/kg (ppb)

RPD calculated using sample concentrations per SW846.

Volatile Surrogate Recovery

	LCS	LCSD
d4-1,2-Dichloroethane	82.7%	90.6%
d8-Toluene	96.2%	95.6%
Bromofluorobenzene	96.8%	97.4%
d4-1,2-Dichlorobenzene	96.7%	100%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG
Matrix: Soil

Data Release Authorized:
Reported: 02/02/11

QC Report No: SF98-CH2M Hill
Project: CCP
Event: 411518.AA.10
Date Sampled: 01/22/11
Date Received: 01/24/11

ARI ID	Client ID	Analysis Date	Basis	Range	Result
MB-012811	Method Blank	01/28/11	Dry	Gasoline	< 5.0 U
11-1494		PID3		HC ID	---
				Trifluorotoluene	102%
				Bromobenzene	99.6%
SF98A	BH-3-11-1	01/28/11	Dry	**Gasoline**	**1200**
11-1494		PID3		HC ID	GRO
				Trifluorotoluene	96.3%
				Bromobenzene	103%
SF98B	BH-3-11-2	01/28/11	Dry	Gasoline	< 7.5 U
11-1495		PID3		HC ID	---
				Trifluorotoluene	96.4%
				Bromobenzene	98.8%

Gasoline values reported in mg/kg (ppm)

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Results corrected for soil moisture content per Section 11.10.5 of EPA Method 8000C.

ANALYTICAL RESOURCES INCORPORATED

TPHG SOIL SURROGATE RECOVERY SUMMARY

ARI Job: SF98
Matrix: Soil

QC Report No: SF98-CH2M Hill
Project: CCP
Event: 411518.AA.10

Client ID	BFB	TFT	BBZ	TOT OUT
MB-012811	NA	102%	99.6%	0
LCS-012811	NA	105%	98.5%	0
LCSD-012811	NA	105%	101%	0
BH-3-11-1	NA	96.3%	103%	0
BH-3-11-2	NA	96.4%	98.8%	0

	LCS/MB LIMITS	QC LIMITS
(BFB) = Bromofluorobenzene	(70-130)	(70-130)
(TFT) = Trifluorotoluene	(80-120)	(66-123)
(BBZ) = Bromobenzene	(80-120)	(62-130)

Log Number Range: 11-1494 to 11-1495

FORM II TPHG

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TPHG by Method NWTPHG

Sample ID: LCS-012811
LAB CONTROL SAMPLE

Lab Sample ID: LCS-012811
LIMS ID: 11-1494
Matrix: Soil
Data Release Authorized:
Reported: 02/02/11

QC Report No: SF98-CH2M Hill
Project: CCP
Event: 411518.AA.10
Date Sampled: NA
Date Received: NA

Date Analyzed LCS: 01/28/11 07:25
LCSD: 01/28/11 07:52
Instrument/Analyst LCS: PID3/MH
LCSD: PID3/MH

Purge Volume: 5.0 mL

Sample Amount LCS: 100 mg-dry-wt
LCSD: 100 mg-dry-wt

Analyte	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Gasoline Range Hydrocarbons	42.7	50.0	85.4%	47.8	50.0	95.6%	11.3%

Reported in mg/kg (ppm)

RPD calculated using sample concentrations per SW846.

TPHG Surrogate Recovery

	LCS	LCSD
Trifluorotoluene	105%	105%
Bromobenzene	98.5%	101%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
TOTAL DIESEL RANGE HYDROCARBONS
NWTPHD by GC/FID-Silica and Acid Cleaned

Matrix: Soil

QC Report No: SF98-CH2M Hill
Project: CCP
411518.AA.10

Data Release Authorized: VTB
Reported: 02/01/11

ARI ID	Sample ID	Extraction Date	Analysis Date	EFV DL	Range	RL	Result
MB-012611	Method Blank	01/26/11	01/27/11	1.00	Diesel	5.0	< 5.0 U
11-1494	HC ID: ---		FID4A	1.0	Motor Oil	10	< 10 U
					o-Terphenyl		101%
SF98A	BH-3-11-1	01/26/11	01/31/11	1.00	**Diesel**	**55**	**2000**
11-1494	HC ID: **DIESEL/MOTOR OIL**		FID4A	10	**Motor Oil**	**110**	**140**
					o-Terphenyl		D
SF98B	BH-3-11-2	01/26/11	01/28/11	1.00	Diesel	5.7	< 5.7 U
11-1495	HC ID: **MOTOR OIL**		FID4A	1.0	**Motor Oil**	**11**	**13**
					o-Terphenyl		101%

Reported in mg/kg (ppm)

EFV-Effective Final Volume in mL.
DL-Dilution of extract prior to analysis.
RL-Reporting limit.

Diesel quantitation on total peaks in the range from C12 to C24.
Motor Oil quantitation on total peaks in the range from C24 to C38.
HC ID: DRO/RRO indicate results of organics or additional hydrocarbons in ranges are not identifiable.

ANALYTICAL RESOURCES INCORPORATED

CLEANED TPHD SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: SF98-CH2M Hill
Project: CCP
411518.AA.10

Client ID	OTER	TOT OUT
MB-012611	101%	0
LCS-012611	91.2%	0
LCSD-012611	97.4%	0
BH-3-11-1	D	0
BH-3-11-2	101%	0

	LCS/MB LIMITS	QC LIMITS
(OTER) = o-Terphenyl	(59-134)	(43-137)

Prep Method: SW3546
Log Number Range: 11-1494 to 11-1495

FORM-II TPHD

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPHD by GC/FID-Silica and Acid Cleaned **Sample ID: LCS-012611**
 LCS/LCSD

Lab Sample ID: LCS-012611
LIMS ID: 11-1494
Matrix: Soil
Data Release Authorized: VJB
Reported: 02/01/11

QC Report No: SF98-CH2M Hill
Project: CCP
411518.AA.10
Date Sampled: 01/22/11
Date Received: 01/24/11

Date Extracted LCS/LCSD: 01/26/11

Date Analyzed LCS: 01/27/11 22:02
LCSD: 01/27/11 22:26
Instrument/Analyst LCS: FID/MS
LCSD: FID/MS

Sample Amount LCS: 10.0 g
LCSD: 10.0 g
Final Extract Volume LCS: 1.0 mL
LCSD: 1.0 mL
Dilution Factor LCS: 1.0
LCSD: 1.0

Range	LCS	Spike Added-LCS	LCS Recovery	LCSD	Spike Added-LCSD	LCSD Recovery	RPD
Diesel	124	150	82.7%	142	150	94.7%	13.5%

TPHD Surrogate Recovery

	LCS	LCSD
o-Terphenyl	91.2%	97.4%

Results reported in mg/kg
RPD calculated using sample concentrations per SW846.

ANALYTICAL RESOURCES INCORPORATED

TOTAL DIESEL RANGE HYDROCARBONS-EXTRACTION REPORT

ARI Job: SF98
Project: CCP
411518.AA.10

Matrix: Soil
Date Received: 01/24/11

ARI ID	Client ID	Client Amt	Final Vol	Basis	Prep Date
11-1494-012611MB1	Method Blank	10.0 g	1.00 mL	-	01/26/11
11-1494-012611LCS1	Lab Control	10.0 g	1.00 mL	-	01/26/11
11-1494-012611LCSD1	Lab Control Dup	10.0 g	1.00 mL	-	01/26/11
11-1494-SF98A	BH-3-11-1	9.11 g	1.00 mL	D	01/26/11
11-1495-SF98B	BH-3-11-2	8.81 g	1.00 mL	D	01/26/11

Basis: D=Dry Weight W=As Received

Diesel Extraction Report

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: BH-3-11-1
SAMPLE

Lab Sample ID: SF98A
LIMS ID: 11-1494
Matrix: Soil
Data Release Authorized:
Reported: 01/31/11

QC Report No: SF98-CH2M Hill
Project: CCP
411518.AA.10
Date Sampled: 01/22/11
Date Received: 01/24/11

Percent Total Solids: 89.6%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	01/25/11	6010B	01/28/11	7440-38-2	Arsenic	5	5	U
3050B	01/25/11	6010B	01/28/11	**7440-39-3**	**Barium**	0.3	**69.9**	
3050B	01/25/11	6010B	01/28/11	7440-43-9	Cadmium	0.2	0.2	U
3050B	01/25/11	6010B	01/28/11	**7440-47-3**	**Chromium**	0.5	**45.4**	
3050B	01/25/11	6010B	01/28/11	**7439-92-1**	**Lead**	2	**3**	
CLP	01/25/11	7471A	01/28/11	7439-97-6	Mercury	0.02	0.02	U
3050B	01/25/11	6010B	01/28/11	7782-49-2	Selenium	5	5	U
3050B	01/25/11	6010B	01/28/11	7440-22-4	Silver	0.3	0.3	U

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: BH-3-11-2
SAMPLE

Lab Sample ID: SF98B
LIMS ID: 11-1495
Matrix: Soil
Data Release Authorized:
Reported: 01/31/11

QC Report No: SF98-CH2M Hill
Project: CCP
411518.AA.10
Date Sampled: 01/22/11
Date Received: 01/24/11

Percent Total Solids: 87.4%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	01/25/11	6010B	01/28/11	7440-38-2	Arsenic	6	6	U
3050B	01/25/11	6010B	01/28/11	**7440-39-3**	**Barium**	0.3	**70.3**	
3050B	01/25/11	6010B	01/28/11	7440-43-9	Cadmium	0.2	0.2	U
3050B	01/25/11	6010B	01/28/11	**7440-47-3**	**Chromium**	0.6	**24.1**	
3050B	01/25/11	6010B	01/28/11	7439-92-1	Lead	2	2	U
CLP	01/25/11	7471A	01/28/11	7439-97-6	Mercury	0.02	0.02	U
3050B	01/25/11	6010B	01/28/11	7782-49-2	Selenium	6	6	U
3050B	01/25/11	6010B	01/28/11	7440-22-4	Silver	0.3	0.3	U

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: METHOD BLANK

Lab Sample ID: SF98MB
LIMS ID: 11-1494
Matrix: Soil
Data Release Authorized:
Reported: 01/31/11

QC Report No: SF98-CH2M Hill
Project: CCP
411518.AA.10
Date Sampled: NA
Date Received: NA

Percent Total Solids: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/kg-dry	Q
3050B	01/25/11	6010B	01/28/11	7440-38-2	Arsenic	5	5	U
3050B	01/25/11	6010B	01/28/11	7440-39-3	Barium	0.3	0.3	U
3050B	01/25/11	6010B	01/28/11	7440-43-9	Cadmium	0.2	0.2	U
3050B	01/25/11	6010B	01/28/11	7440-47-3	Chromium	0.5	0.5	U
3050B	01/25/11	6010B	01/28/11	7439-92-1	Lead	2	2	U
CLP	01/25/11	7471A	01/28/11	7439-97-6	Mercury	0.02	0.02	U
3050B	01/25/11	6010B	01/28/11	7782-49-2	Selenium	5	5	U
3050B	01/25/11	6010B	01/28/11	7440-22-4	Silver	0.3	0.3	U

U-Analyte undetected at given RL
RL-Reporting Limit

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample ID: LAB CONTROL

Lab Sample ID: SF98LCS
LIMS ID: 11-1494
Matrix: Soil
Data Release Authorized:
Reported: 01/31/11

QC Report No: SF98-CH2M Hill
Project: CCP
411518.AA.10
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery	Q
Arsenic	6010B	195	200	97.5%	
Barium	6010B	185	200	92.5%	
Cadmium	6010B	49.6	50.0	99.2%	
Chromium	6010B	48.0	50.0	96.0%	
Lead	6010B	190	200	95.0%	
Mercury	7471A	0.50	0.50	100%	
Selenium	6010B	203	200	102%	
Silver	6010B	49.0	50.0	98.0%	

Reported in mg/kg-dry

N-Control limit not met
NA-Not Applicable, Analyte Not Spiked
Control Limits: 80-120%

APPENDIX D

Geotechnical Laboratory Testing Results

HWA GEOSCIENCES INC.
Geotechnical & Pavement Engineering · Hydrogeology · Geoenvironmental · Planning & Permitting · Inspection & Testing

December 16, 2010
HWA Project No. 2010-109-23

CH2M Hill, Inc.
1100 112th Avenue NE
PO Box 91500
Bellevue, Washington 98004

Attention: Dr. Mark Thompson

Subject: **Materials Laboratory Report**
Bellevue CCP Culvert Replacement
Bellevue, Washington

Dear Dr. Thompson:

As requested, HWA GeoSciences Inc. (HWA) performed laboratory testing for the subject project. Herein we present the results of our laboratory analyses, which are summarized on the attached figures. The laboratory testing program was performed in general accordance with your instructions and appropriate ASTM Standards as outlined below.

SAMPLE INFORMATION: The soil samples were picked up at your facility by HWA personnel on December 8, 2010. These samples were in several sealed plastic bags. The samples were designated by the borehole number, sample number and depth of sampling.

MOISTURE CONTENT OF SOIL: The moisture content of the samples was determined in general accordance with ASTM D 2216. The indicated moisture content of the material, by dry weight of soil, is shown on the Summary of Material Properties tables for each respective boring name.

PERCENT PASSING THE 75 μM SIEVE: Selected samples were tested to determine the percent passing the 75 μm sieve (fines) in general accordance with ASTM D1140. The results are also summarized on the Summary of Material Properties tables for each respective boring name.

PARTICLE SIZE ANALYSIS OF SOILS: Selected samples were tested to determine the particle size distribution of material in general accordance with ASTM D422. The results are summarized by boring name on Figures 1 and 2, Particle Size Analysis of Soils, by boring name, which also provide information regarding the classification of the sample and the moisture content at the time of testing.

21312 30th Drive SE
Suite 110
Bothell, WA 98021.7010

Tel: 425.774.0106
Fax: 425.774.2714
www.hwageo.com

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOILS (ATTERBERG LIMITS): Selected samples were tested using method ASTM D 4318, multi-point method. The results are reported on the attached Figure 3, Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

CLOSURE: Experience has shown that test values on soil and other natural materials vary with each representative sample. As such, HWA has no knowledge as to the extent and quantity of material the tested samples may represent. HWA also makes no warranty as to how representative either the samples tested or the test results obtained are to actual field conditions. It is a well established fact that sampling methods present varying degrees of disturbance that affect sample representativeness.

No copy should be made of this report except in its entirety. We appreciate the opportunity to provide laboratory testing services on this project. Should you have any questions or comments, or if we may be of further service, please call.

Sincerely,

HWA GEOSCIENCES INC.

Harold Benny
Laboratory Manager

George Minassian, Ph.D., P.E.
Geotechnical Engineer

HB:GM:hb

Attachments:

Summary of Material Properties
Liquid Limit, Plastic Limit and Plasticity Index Report
Particle-Size Analysis Reports

SAMPLE IDENTIFICATION	Depth (ft)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			% GRAVEL	% SAND	% FINES	pH	RESISTIVITY (Ω – cm)	ORGANIC CONTENT (%)	ASTM CLASSIFICATION[1]	SAMPLE DESCRIPTION[1]
			LL	PL	PI								
BH-1, SS-1	5.0	14.0				-	-	38.1				SM	Olive brown, silty SAND
BH-1, SS-3	15.0	19.1				-	-	28.6				SM	Dark gray, silty SAND
BH-1, SS-5	20.0	28.3				-	-	12.7				SM	Dark brown, silty SAND with gravel
BH-1, SS-7	25.0	17.9				25.9	58.6	15.5				SM	Dark gray, silty SAND with gravel
BH-1, SS-9	30.0	30.6	67	23	44							CH	Dark gray, fat CLAY
BH-1, SS-10	35.0	20.2				18.3	53.4	28.3				SM	Dark gray, silty SAND
BH-1, SS-12	45.0	29.8				-	-	41.7				SM	Dark gray, silty SAND

1. Soil classification and descriptions based on ASTM D 2487 or D 2488, as appropriate

Note: This table summarizes information presented elsewhere in the report and should be used in conjunction with the report text, other graphs and tables, and the exploration logs.

HWA GEOSCIENCES INC.

SUMMARY OF MATERIAL PROPERTIES

BELLEVUE CCP CULVERT REPLACEMENT
BELLEVUE, WASHINGTON

BORING NAME
BH-1

PROJECT NO.
2010-109

SAMPLE IDENTIFICATION	Depth (ft)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			% GRAVEL	% SAND	% FINES	pH	RESISTIVITY (Ω – cm)	ORGANIC CONTENT (%)	ASTM CLASSIFICATION[1]	SAMPLE DESCRIPTION[1]
			LL	PL	PI								
BH-2p, SS-1	5.0	15.2				-	-	40.8				SM	Olive brown, silty SAND
BH-2p, SS-2	10.0	22.2				-	-	22.8				SM	Very dark brown, silty SAND
BH-2p, SS-4	17.5	44.1				-	-	68.6				ML	Dark brown, sandy SILT
BH-2p, SS-5	20.0	12.7				55.4	37.8	6.8				GW-GM	Olive brown, well graded GRAVEL with silt and sand
BH-2p, SS-7	25.0	29.4				-	-	46.7				SM	Dark gray, silty SAND
BH-2p, SS-8	27.5	12.8				50.4	36.2	13.4				GM	Dark olive brown, silty GRAVEL with sand
BH-2p, SS-9	30.0	24.2				6.7	41.2	52.1				ML	Dark gray, sandy SILT
BH-2p, SS-10	35.0	27.2				2.7	23.2	74.0				ML	Dark olive gray, SILT with sand

1. Soil classification and descriptions based on ASTM D 2487 or D 2488, as appropriate

Note: This table summarizes information presented elsewhere in the report and should be used in conjunction with the report text, other graphs and tables, and the exploration logs.

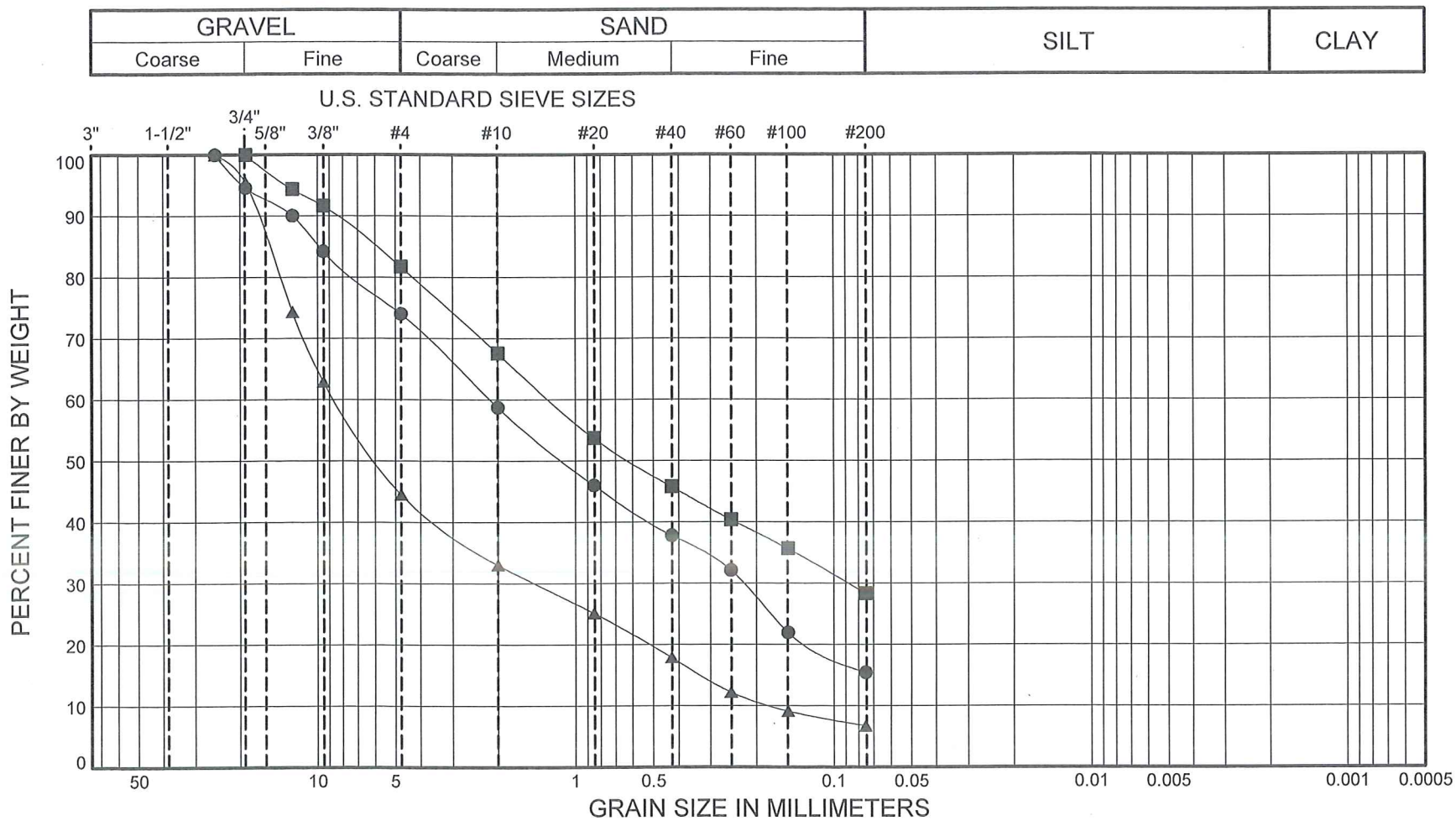
HWA GEOSCIENCES INC.

SUMMARY OF MATERIAL PROPERTIES

BELLEVUE CCP CULVERT REPLACEMENT
BELLEVUE, WASHINGTON

BORING NAME
BH-2p

PROJECT NO.
2010-109



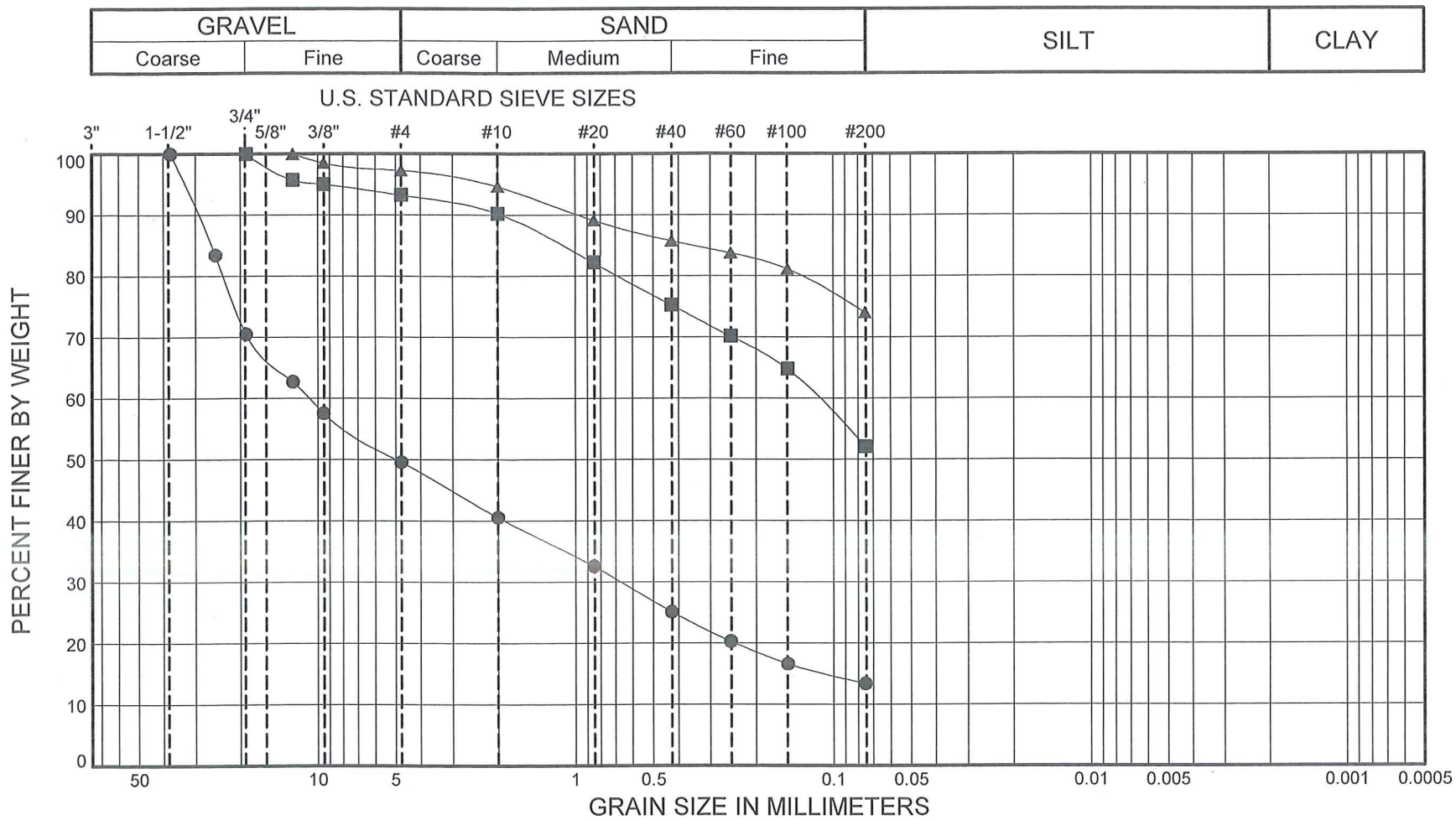
SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	BH-1	SS-7	25.0 - 26.5	(SM) Dark gray, silty SAND with gravel	18				25.9	58.6	15.5
■	BH-1	SS-10	35.0 - 36.5	(SM) Dark gray, silty SAND	20				18.3	53.4	28.3
▲	BH-2P	SS-5	20.0 - 21.5	(GW-GM) Olive brown, Well graded GRAVEL with silt and sand	13				55.4	37.8	6.8

HWA GEOSCIENCES INC.

Bellevue CCP Culvert Replacement
Bellevue, Washington

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D422

PROJECT NO.: 2010-109 FIGURE: 1



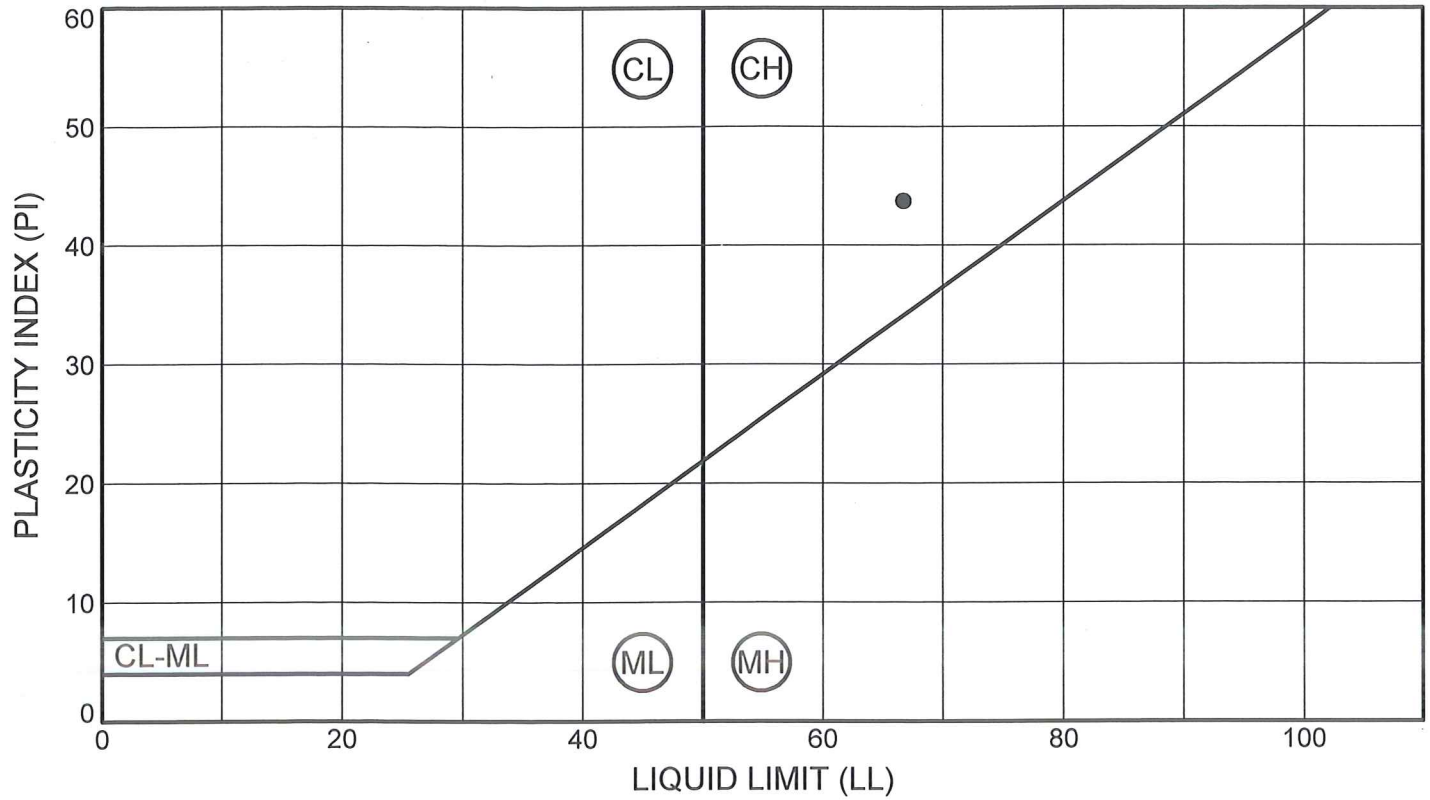
SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	BH-2P	SS-8	27.5 - 29.0	(GM) Dark olive brown, silty GRAVEL with sand	13				50.4	36.2	13.4
■	BH-2P	SS-9	30.0 - 31.5	(ML) Dark gray, sandy SILT	24				6.7	41.2	52.1
▲	BH-2P	SS-10	35.0 - 36.5	(ML) Dark olive gray, SILT with sand	27				2.7	23.2	74.0

HWA GEOSCIENCES INC.

Bellevue CCP Culvert Replacement
Bellevue, Washington

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D422

PROJECT NO.: 2010-109 FIGURE: 2



SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION	% MC	LL	PL	PI	% Fines
●	BH-1	SS-9	30.0 - 31.5	(CH) Dark gray, fat CLAY	31	67	23	44	

HWA GEOSCIENCES INC.

Bellevue CCP Culvert Replacement
Bellevue, Washington

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS
METHOD ASTM D4318

PROJECT NO.: 2010-109 FIGURE: 3