# I-405 Bellevue Nickel Improvement Project
# I-90 to Southeast 8th Street

INTERSTATE 405 **Corridor Program**

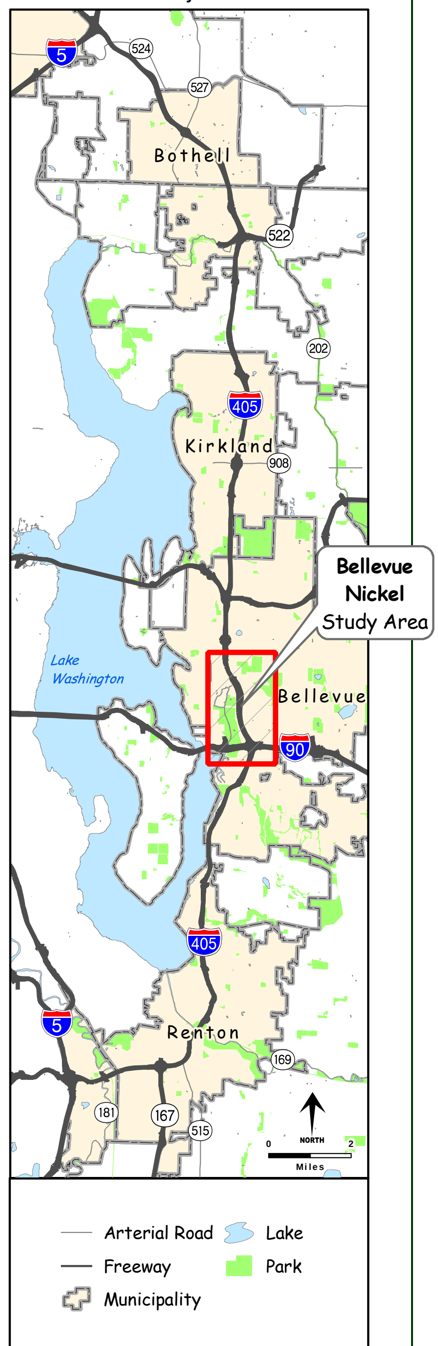
Congestion Relief & Bus Rapid Transit Projects

*SURFACE WATER, FLOODPLAINS & WATER QUALITY*

# DISCIPLINE REPORT

*January 2006*

*I-405 Project Area*




Washington State Department of Transportation

U.S. Department of Transportation Federal Highway Administration

This document should be cited as:

Washington State Department of Transportation. 2005. I-405 Bellevue Nickel Improvement Project. Surface Water, Floodplains, and Water Quality Discipline Report. November. Bellevue, WA. Prepared for the Washington State Department of Transportation, Urban Corridors Office, and the Federal Highway Administration, Olympia, WA.

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# Glossary

| | |
|---|---|
| anadromous fish | These are fish born in freshwater streams, rivers or lakes, spend their adult phase in the ocean, and return to their natal waters to spawn. |
| base flow | Stream flow condition when there has been no recent precipitation. Base flow discharges groundwater and water from upstream channels, wetlands, lakes, and ponds. |
| best management practice (BMP) | BMPs are generally accepted techniques that, when used alone or in combination, prevent or reduce adverse effects of a project. Examples include erosion control measures and construction management to minimize traffic disruption. Please see Appendix A for a complete list of BMPs. |
| chemical oxygen demand (COD) | COD is the quantity of oxygen that would be consumed in oxidation of substances in water through chemical reactions. Where COD is high, surface waters may experience a depletion of dissolved oxygen, which is detrimental to aquatic life. |
| Ecology | Washington State Department of Ecology |
| effective impervious area | Impervious surfaces, such as pavement and buildings, increase stormwater runoff during precipitation events. The effect of this runoff on surface waters (streams, rivers, and lakes) depends on the degree of detention, infiltration, evapotranspiration, and treatment. Effective impervious area is the area of unmitigated (not treated or detained) impervious surface area that would create the runoff characteristics that actually occur in a drainage area. |
| Federal Emergency Management Agency (FEMA) | Among its many responsibilities, this agency maps floodplain areas and determines floodplain elevations to identify flood insurance rates. |
| Flood Insurance Rate Map (FIRM) | FIRMs typically serve as a baseline for determining floodplain effects. FIRMS are published by FEMA. |
| flood hazard area | King County Code (21A.06.470) defines flood hazard area as “any area subject to inundation by the base flood or risk from channel migration including, but not limited to, an aquatic area, wetland, or closed depression.” |
| floodplain | The area that is subject to periodic flooding. The jurisdictional floodplain area for this project is that area that has a greater than 1% chance of flooding in a given year. We refer to this area as the 100-year floodplain. |
| floodway – FEMA | The channel of the stream and that portion of the adjoining floodplain that is necessary to contain and discharge the base flood flow without increasing the base flood elevation more than one foot. FIRM s show this area as floodways. |
| floodway – zero rise | King County Code (21A.06.505) defines the zero-rise floodway as the channel of a stream and that portion of the adjoining floodplain that is necessary to contain and discharge the base flood flow without any measurable (0.01 ft) increase in base flood elevation. |
| hydrologic | Pertaining to the study of water and its interaction with the environment. Hydrologic effects may include changes in stream flow, flooding, or channel capacity, backwatering at culverts, or other characteristics. |

# Glossary

| | |
|---|---|
| impervious surface area | Area that is not permeable to infiltration of precipitation or runoff to groundwater (water will run off this type of surface but not soak in). A high proportion of precipitation that falls onto impervious surfaces drains from the area as stormwater runoff. In contrast, vegetated areas are permeable, and a large proportion of precipitation that falls on vegetated areas is either intercepted by vegetation or infiltrates into the soil. |
| National Pollutant Discharge Elimination System (NPDES) | NPDES construction permits are required for construction projects with stormwater discharges that disturb more than 5 acres. A separate NPDES permit covers municipal stormwater systems including WSDOT facilities in King County and several other jurisdictions. NPDES permits are federal permits administered by the Washington State Department of Ecology. |
| pollutant loading | The quantity of a pollutant that discharges to a given point in a drainage area (e.g., to a stream) over a set period of time (e.g., pounds of phosphorus discharged to Mercer Slough per year). |
| polycyclic aromatic hydrocarbons | A type of compound of carbon and hydrogen that includes multiple rings of carbon atoms. These compounds are often toxic and sometimes cause cancer. PAHs may be found in fossil fuels, creosote, and exhaust from combustion. |
| runoff | Water that flows along the surface as opposed to through the soil. Precipitation falling on impervious surfaces creates stormwater runoff. |
| soluble phosphorus | Phosphorus is an essential nutrient and is often the limiting nutrient for aquatic plant and algal growth. An increase in phosphorus in surface waters may result in plant and algal blooms that degrade water quality. Soluble phosphorus is phosphorus that is not bound to particulate matter where it could be biologically unavailable. |
| stormflow | Stream flow condition following a storm or heavy rainfall (precipitation event). Stormflow from pavement may have a higher pollutant load than base flow due to runoff from contaminated surfaces during the first flush of runoff (typically the first 0.5 inch or the 6-month storm event). However, stormflow may have a lower pollutant concentration than the base flow condition after the first flush, since the additional flow following precipitation dilutes the pollutants. |
| threshold discharge area (TDA) | The entire project area is divided into areas based on drainage. Each area with a discrete stormwater discharge location is defined as a TDA, and stormwater control facilities are located and sized to control drainage in each TDA. |
| total Kjeldahl nitrogen (TKN) | TKN is a measure of total nitrogen in water, determined through the Kjeldahl method. This method is commonly used but we report it as TKN rather than as total nitrogen because it does not account for certain chemical forms of nitrogen. Nitrogen is an important water quality constituent in some systems where it may limit plant growth. Where nitrogen is limiting, an increase in nitrogen may cause excessive plant and algal growth, degrading water quality. |
| wet pond | A constructed stormwater detention or treatment pond designed to include a pool of standing water where physical, chemical, and biological processes remove pollutants from stormwater. |

# Acronyms and Abbreviations

| | |
|---|---|
| BFE | base flood elevation |
| BMPs | best management practices |
| BNSF | Burlington North Santa Fe Railroad |
| COD | chemical oxygen demand |
| DO | dissolved oxygen |
| EA | environmental assessment |
| EIS | environmental impact statement |
| EPM | environmental procedures manual |
| FEIS | final environmental impact statement |
| FEMA | Federal Emergency Management Agency |
| FHWA | Federal Highway Administration |
| FIRM | flood insurance rate map |
| FTA | Federal Transit Administration |
| HOV | high-occupancy vehicle |
| HRM | highway runoff manual |
| HPA | Hydraulic Project Approval |
| I-405 | Interstate 405 |
| I-90 | Interstate 90 |
| KCC | King County Code |
| LWD | large woody debris |
| MP | mile post (MP-0.0 is located at the southern terminus of I-405.) |
| msl | mean sea level |
| NAVD 88 | North American Vertical Datum 1988 |
| NB | northbound |
| NEPA | National Environmental Policy Act |

# Acronyms and Abbreviations

| | |
|---|---|
| NPDES | National Pollutant Discharge and Elimination System |
| PAH | polycyclic aromatic hydrocarbons |
| ROD | record of decision |
| SB | southbound |
| SE | southeast |
| SPCCP | Spill Prevention Control and Countermeasures Plan |
| TDA | threshold discharge area |
| TESC | temporary erosion and sedimentation control plan |
| TKN | total Kjeldahl nitrogen |
| USGS | United States Geological Survey |
| WAC | Washington Administrative Code |
| WRIA | water resource inventory area |
| WSDOT | Washington State Department of Transportation |

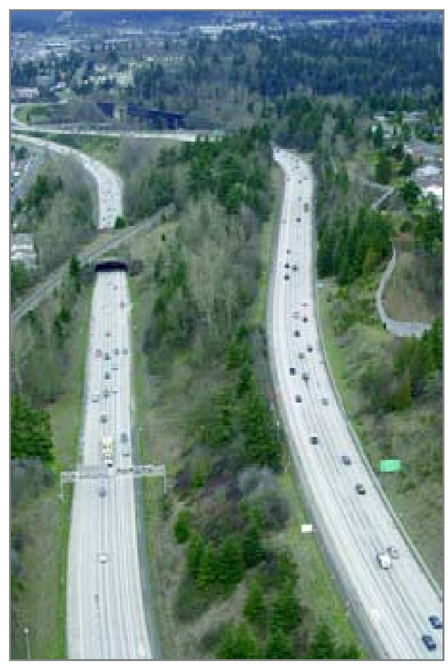
# Introduction

In 1998, the Washington State Department of Transportation (WSDOT) joined with the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), Central Puget Sound Regional Transit Authority (Sound Transit), King County, and local governments in an effort to reduce traffic congestion and improve mobility in the Interstate 405 (I-405) corridor. In fall 2002, the combined efforts of these entities culminated in the *I-405 Corridor Program Final Environmental Impact Statement (EIS)* and *FHWA Record of Decision (ROD)*.

The ROD selected a project alternative that would widen I-405 by as many as two lanes in each direction throughout its 30-mile length. The ultimate configuration of the selected alternative includes buffers separating general-purpose lanes from parallel high-occupancy vehicle (HOV) lanes (potentially used by future high-capacity transit). The design also allows for expanded "managed lane" operations along I-405 that could include use of HOV lanes by other user groups, such as trucks.

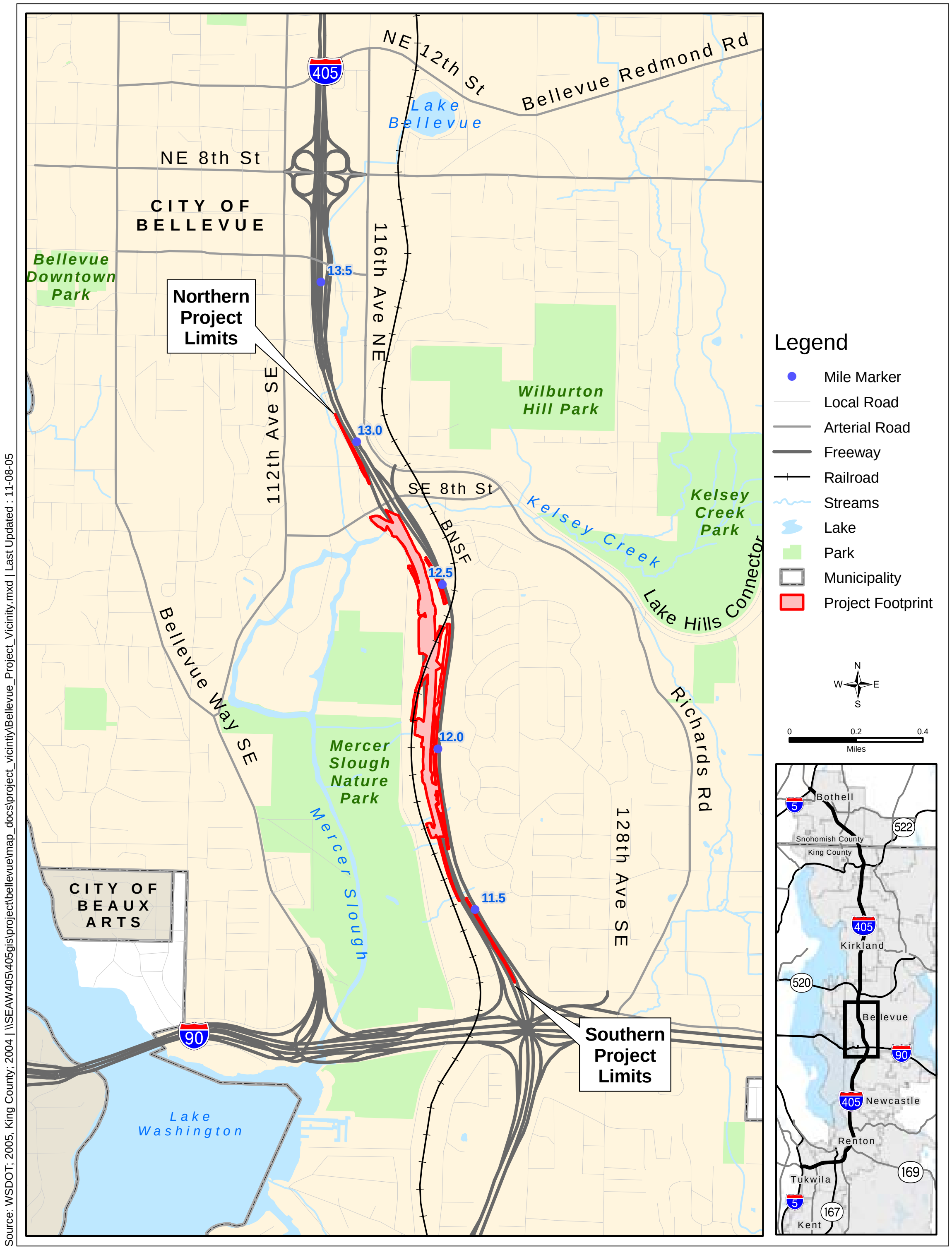
In 2003, the Washington State legislature approved a statewide transportation-funding plan called the "nickel package." The nickel package provided funding for congestion relief projects in three critical traffic hotspots along the I-405 Corridor: Renton, Bellevue, and Kirkland. The Bellevue Nickel Improvement Project is one of several projects now moving forward as part of a phased implementation of the I-405 Corridor Program. Exhibit 1 shows the location of the Bellevue Nickel Improvement Project.

In 2003, the Washington State legislature approved a statewide transportation-funding plan called the "nickel package." The nickel package provided funding for congestion relief projects in three critical traffic hotspots along the I-405 Corridor, including Bellevue.



Traffic moving along I-405

Exhibit 1. Project Vicinity Map



In keeping with the direction established in the Final EIS (FEIS) and ROD, we are preparing a National Environmental Policy Act (NEPA) Environmental Assessment (EA) that focuses on project-level effects of constructing and operating the Bellevue Nickel Improvement Project.

The Environmental Assessment will describe new project changes, information, effects, or mitigation measures, but the assessment will not revisit the alternatives, impacts, and mitigation measures evaluated in the corridor-level EIS or the decisions documented in the *Record of Decision.*

We will base the EA on the analysis in the *I-405 Corridor Program Final EIS*, and will describe any new or additional project changes, information, effects, or mitigation measures not identified and analyzed in the corridor-level Final EIS. The project-level EA for the Bellevue Nickel Improvement Project will not reexamine the corridor-level alternatives, impacts, and mitigation measures presented in the corridor-level Final EIS, or the decisions described in the ROD.

## What alternatives do we analyze in this discipline report?

This discipline report is one of 19 environmental elements WSDOT will study to analyze the effects of the Bellevue Nickel Improvement Project. All of the discipline reports will analyze one build alternative and one "no build" or "no action" alternative. This approach is consistent with FHWA's guidelines for preparing a NEPA EA.

### What is the No Build Alternative?

NEPA requires us to include and evaluate the No Build Alternative in this discipline report. We use this approach to establish an existing and future baseline for comparing the effects associated with the Build Alternative. We assume the No Build Alternative will maintain the status quo: only routine activities such as road maintenance, repair, and safety improvements would occur within the corridor between now and 2030. The No Build Alternative does not include improvements that would increase roadway capacity or reduce congestion on I-405. We describe these improvements further in the Bellevue Nickel Improvement Project Traffic and Transportation Discipline Report.

We assume the No Build Alternative will maintain the status quo: only routine activities such as road maintenance, repair, and safety improvements would occur within the corridor between now and 2030.

### What are the principal features of the Build Alternative?

The Bellevue Nickel Improvement Project will add one new general-purpose lane in each direction along a 2-mile section of I–405 between I-90 and SE 8th Street. We will generally use the inside or "median" side of I-405 for construction. After we re-stripe the highway, the new lanes will occupy the outside of the existing roadway. The project also includes new stormwater management facilities and better drainage structures and systems.

Other project activities include developing an on-site stream mitigation area to compensate for the loss of these resources within the project area. We expect project construction to begin in spring 2007 and the improved roadway to be open to traffic by fall 2009.

### Improvements to Southbound I-405

We will add one lane in the southbound direction of I-405 from approximately SE 8th Street to I-90.

In the southbound (SB) direction, we plan to add one new travel lane from approximately Southeast (SE) 8th Street to I-90 (Exhibits 2, 3, and 4). In addition, the existing outside HOV lane at I-90 will be extended north so that it begins at the on-ramp from SE 8th Street. In order to add these lanes and maintain traffic flow during construction, we will shift approximately 3,000 feet of the SB roadway as much as 200 feet east into the existing median. The relocated SB roadway will connect to the existing SB travel lanes just north of the I-90 interchange, and south of the existing bridge over SE 8th Street.

We will build a new tunnel underneath the Burlington Northern Santa Fe (BNSF) railroad, just east of the existing Wilburton Tunnel, to accommodate the relocated and widened SB roadway. The existing tunnel does not have the capacity to accommodate additional lanes of SB traffic.

The existing SB travel lanes and the Wilburton Tunnel will remain open to traffic during construction of the new tunnel and the relocated/widened SB lanes. We will also build the new tunnel wide enough to accommodate additional lanes. The existing tunnel will remain after we complete the improvements.

Exhibit 2. Proposed Bellevue Nickel Project Improvements (Sheet 1 of 3)

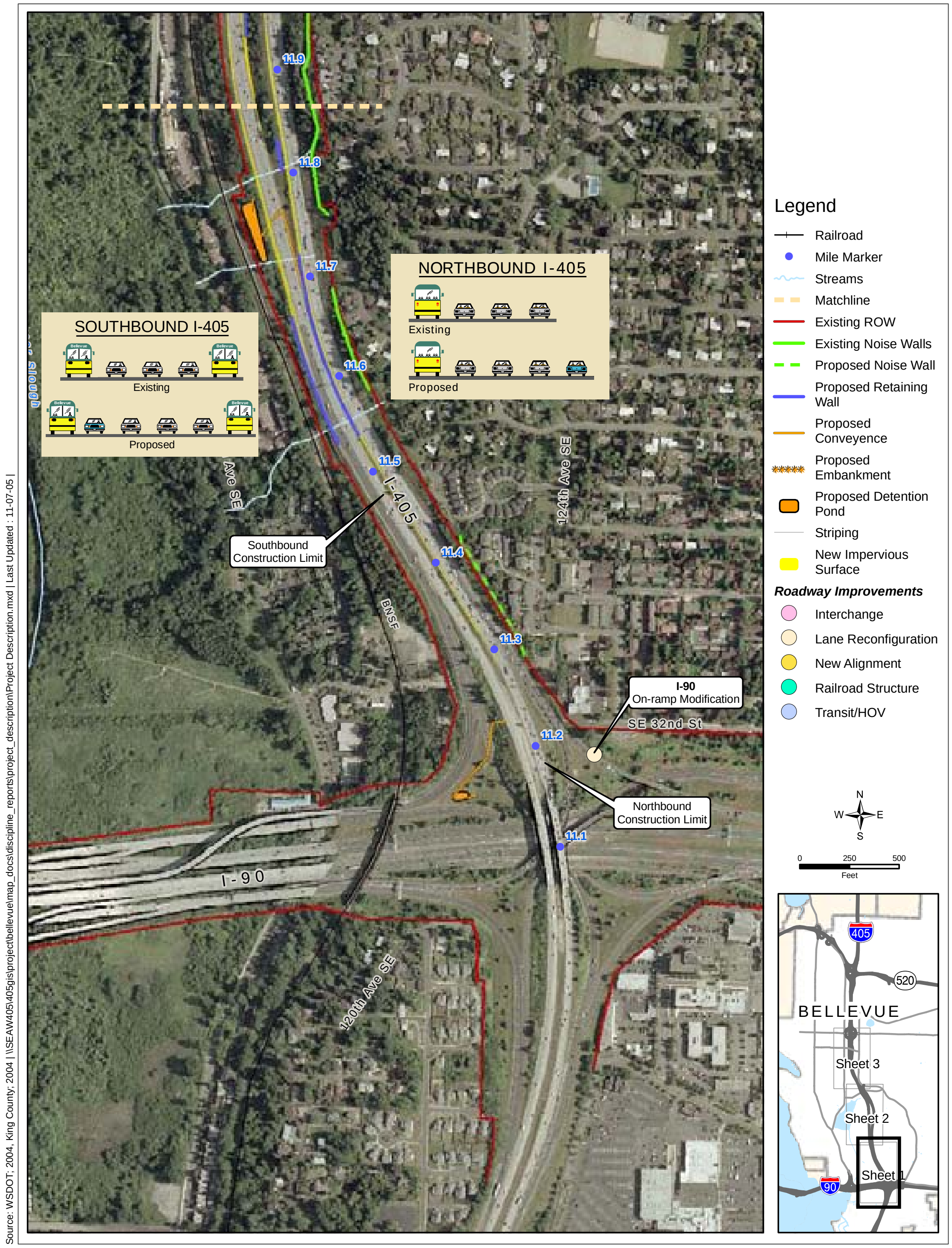


Exhibit 3. Proposed Bellevue Nickel Project Improvements (Sheet 2 of 3)

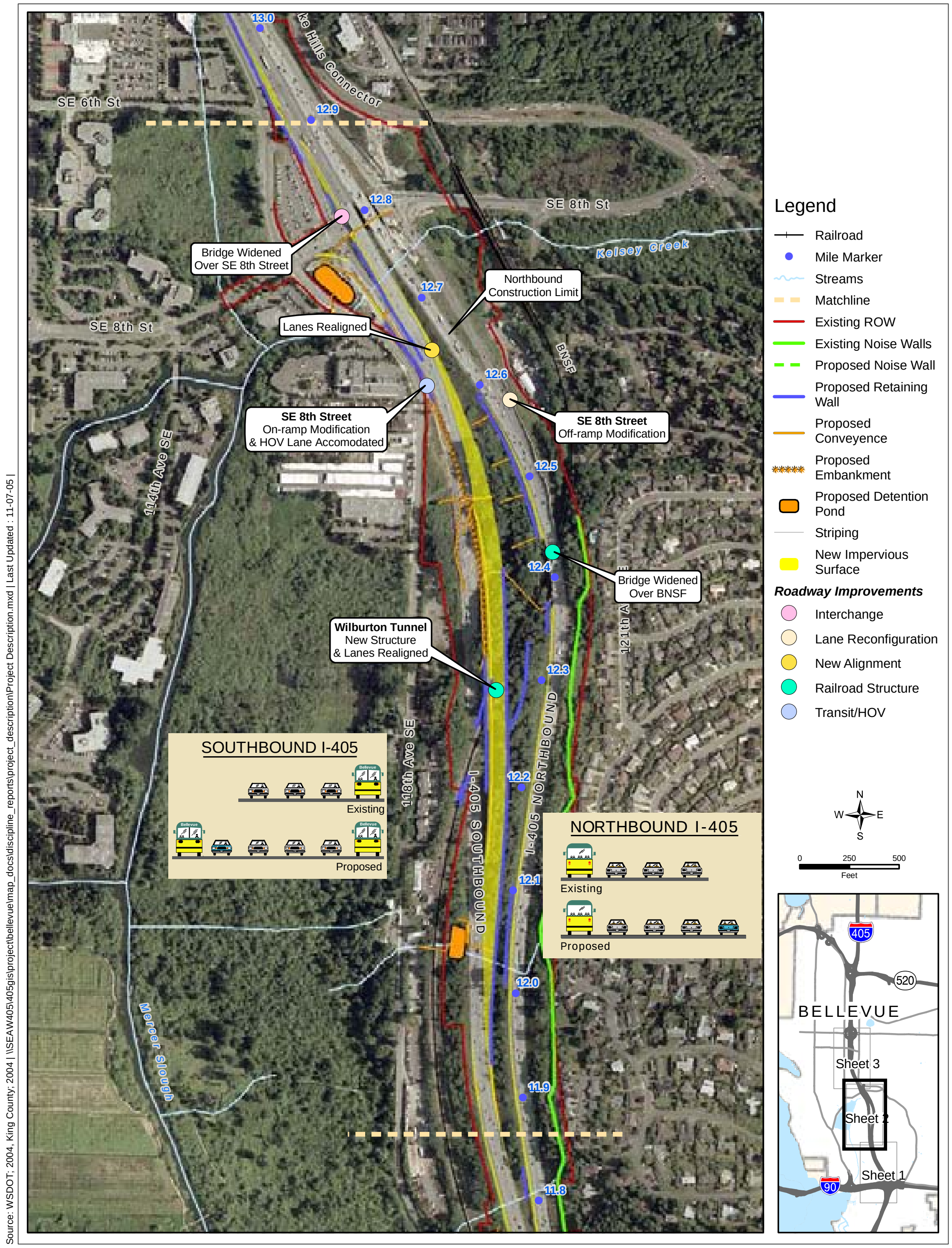
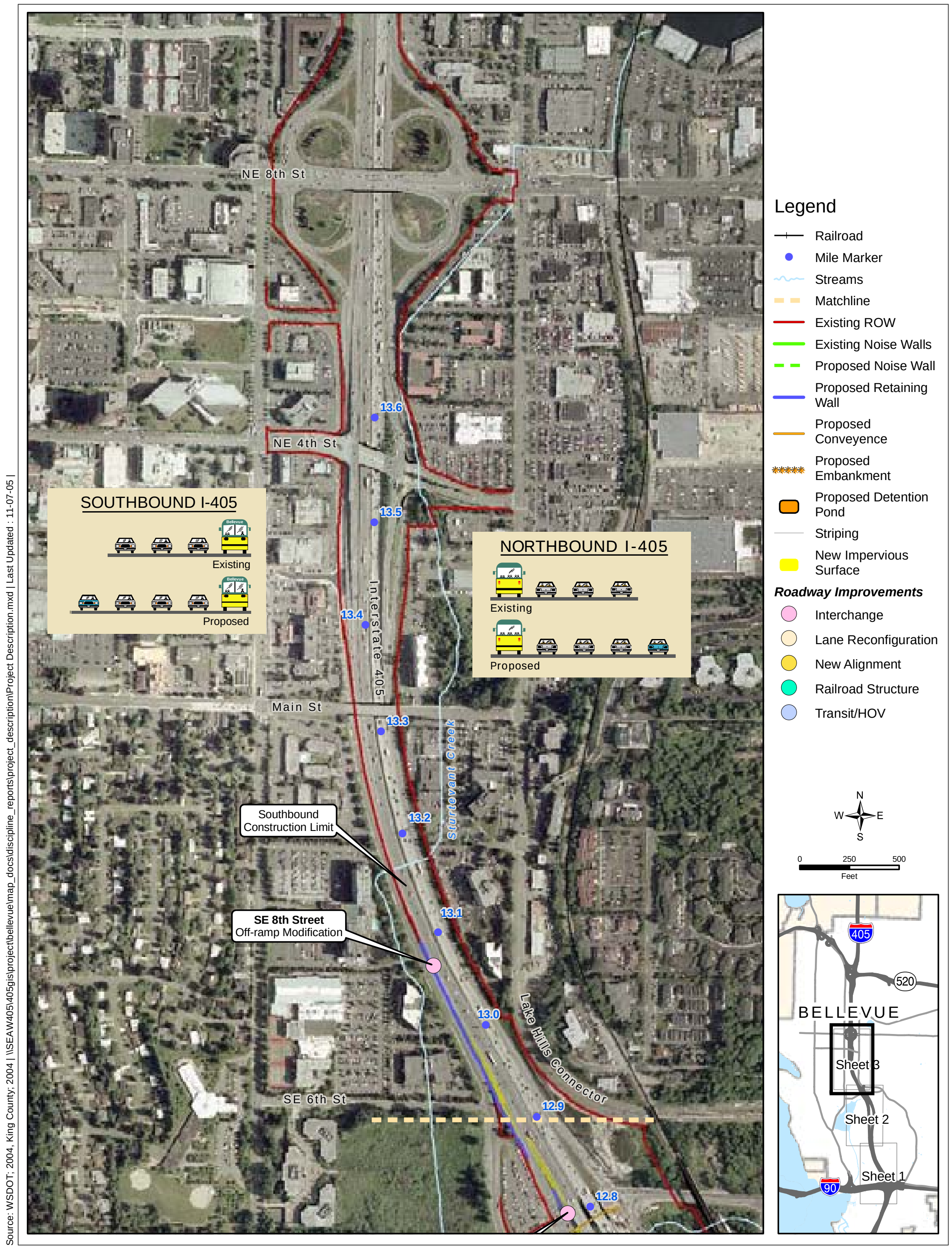


Exhibit 4. Proposed Bellevue Nickel Project Improvements (Sheet 3 of 3)



We will also include the following improvements in the Build Alternative:

- Modify the existing off-ramp at SE 8th Street to make room for an additional southbound lane on I-405. The off-ramp will then become a single-lane, optional off-ramp (i.e., the off-ramp will no longer be an "exit only" off-ramp).
- Build a retaining wall between the SB travel lanes and the off-ramp at SE 8th Street.
- Widen the existing bridge over SE 8th Street to the west to accommodate the new SB lane.
- Modify the existing on-ramp at SE 8th Street to tie into the relocated SB general-purpose travel lanes.
- Reconfigure the on-ramp at SE 8th Street to accommodate the extended outside HOV lane.
- Temporarily shift the existing BNSF railroad track from its current alignment to allow for continuous railroad operation during construction of the new tunnel.
- Construct retaining walls along the eastern edge of the relocated SB travel lanes.

### Improvements to Northbound I-405

We will add one lane in the northbound direction of I-405 from approximately I-90 to SE 8th Street. All widening of the northbound mainline will occur on the inside (median side) of the existing roadway.

In the northbound (NB) direction, we plan to add one new travel lane from approximately I-90 to SE 8th Street (Exhibits 2, 3, and 4). We will add one new lane to the NB ramp from I-90. We will shift the NB lanes to allow all of the proposed widening to occur on the inside, or median side of the existing roadway.

Additional improvements include:

- Re-stripe the westbound/eastbound I-90 on-ramp to NB I-405 resulting in one lane becoming two lanes in the NB direction.
- Widen, shift, and re-stripe NB I-405 travel lanes north of I-90 to allow the westbound I-90 to NB I-405 on-ramp and the eastbound I-90 to NB I-405 on-ramp to enter I-405 without having to merge into a single lane.
- Construct several retaining walls needed for road widening in locations that allow for existing and future widening of I-405.

- Construct a noise barrier approximately 725 feet long and 16 feet high (see Exhibit 2).
- Widen the existing bridge over the BNSF Railroad to the west to accommodate the new NB lane.
- Modify the NB off-ramp to SE 8th Street to make it a single-lane "exit-only" off-ramp.
- Transition the NB travel lanes back into the existing lane configuration before crossing over SE 8th Street.

## Improvements to the Stormwater Management System

Managing stormwater for the I-405 Bellevue Nickel Improvement Project involves the collection and treatment of rainfall runoff from the new project pavement consistent with the guidelines in the WSDOT Highway Runoff Manual.

Currently, we treat less than 5 percent of the existing runoff from paved surfaces in the project area before discharging it. We will improve this condition by treating 17 percent more area than the new paved surface area we create. By treating a greater area, we improve flow control and remove pollutants from a portion of the existing roadway as well as from newly constructed areas.

Reconfiguration and new construction associated with the SB lanes will mean that we need to replace much of the existing drainage system. We will continue to use open roadside ditches along the shoulders of the roadway shoulders where possible. We will use standard WSDOT catch basins and manhole structures to move the roadway runoff to a system of stormwater drain pipes. These features will transport runoff to treatment and flow-control facilities within the existing ROW.

We will construct three new stormwater ponds (detention ponds combined with stormwater treatment wetlands) as part of the project and enlarge the existing pond at SE 8th Street. Two of the new ponds will be located south of the Wilburton Tunnel between the SB lanes and the BNSF railroad ROW. We will construct the third new pond in the northwest quadrant of the I-90/I-405 interchange. The project will discharge treated stormwater following existing flow patterns to Mercer Slough or to the wetlands that surround it.

## Avoidance and Minimization Measures

We will use best management practices (BMPs), standard WSDOT procedures, and design elements to avoid or minimize potential effects to the environment for the Bellevue Nickel

**Best Management Practices (BMPs)**

BMPs are generally accepted techniques that, when used alone or in combination, prevent or reduce adverse effects of a project. Examples include erosion control measures and construction management to minimize traffic disruption. Please see Appendix A for a complete list of BMPs.

**Standard WSDOT Procedures**

Guidelines and procedures established by WSDOT for roadway design and construction in a variety of design, engineering, and environmental manuals.

Improvement Project. We know these measures to avoid or minimize potential effects to the environment collectively as "avoidance measures." We describe these measures in more detail in Appendix A. If the Bellevue Nickel Improvement Project has additional effects not addressed in the avoidance measures, we will address these measures through mitigation.

### Wetland and Stream Mitigation Sites

We will compensate for adverse effects to wetlands and their buffers by creating just over an acre of wetland within the boundaries of Kelsey Creek Park (Exhibit 5). The site is located north of the intersection of Richards Road and the Lake Hills Connector.

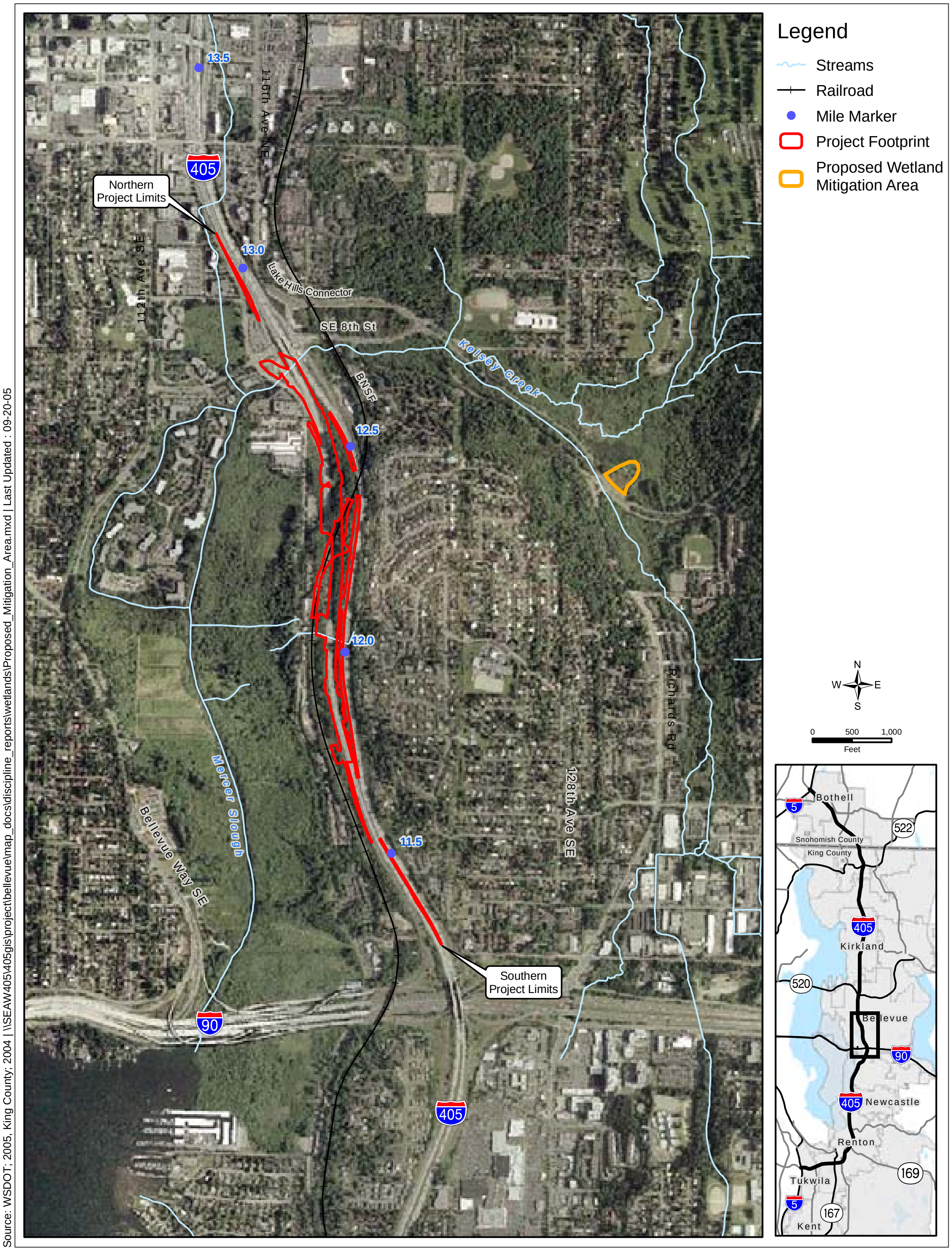
Our general concept will be to create an area that will transition from forested land beside the Lake Hills Connector to wetlands within Kelsey Creek Park. We will reshape the surface area to create favorable conditions for the necessary wetland aquatic characteristics, and we will replant and enhance habitat in the area by constructing habitats and replanting adjacent roadside areas with forest-type vegetation.

Similarly, we will compensate for unavoidable effects to "Median Stream," the unnamed stream within the I-405 median. We have developed a conceptual stream mitigation plan that includes on-site habitat restoration and creation. The conceptual stream mitigation plan includes the following specific elements (See Exhibit 6):

- Connect the new Median Stream culvert under I-90 to the existing channel and wetland located west of SB I-405.
- Create approximately 500 linear feet of stream channel along the western slope of SB I-405.
- Buffer the created stream channel with approximately 16,000 square feet of native streamside vegetation.
- Enhance approximately 300 linear feet of riparian habitat west of SB I-405 by removing selected non-native invasive plant species and replacing with native streamside vegetation.

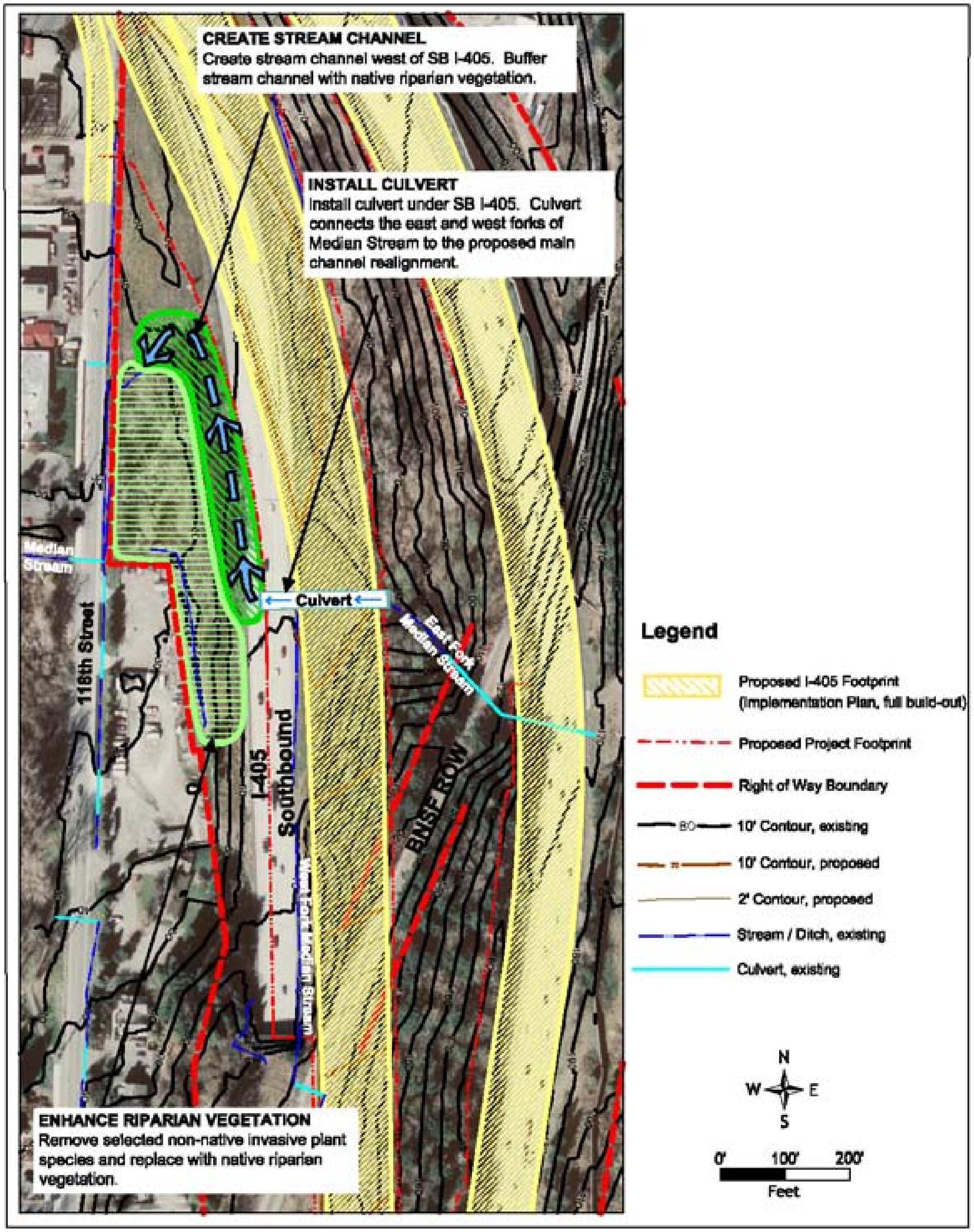
We provide more detailed information about mitigation efforts planned in conjunction with the Bellevue Nickel Improvement in this report and in the Wetlands Discipline Reports.

# Exhibit 5. Proposed Wetland Mitigation Area




Source: WSDOT; 2005, King County; 2004 | \\SEAW405\405gis\project\bellevue\map_docs\discipline_reports\wetlands\Proposed_Mitigation_Area.mxd | Last Updated : 09-20-05

Exhibit 6. Conceptual Stream Mitigation Plan



## Why do we consider surface water, floodplains, and water quality as we plan this project?

Federal, state, and local ordinances apply to this project since it could potentially affect surface water, floodplains, and water quality (see Appendix B). Under NEPA and SEPA, WSDOT is required to identify whether there are any substantial effects to these resources and to inform the public of those effects.

### Surface Water

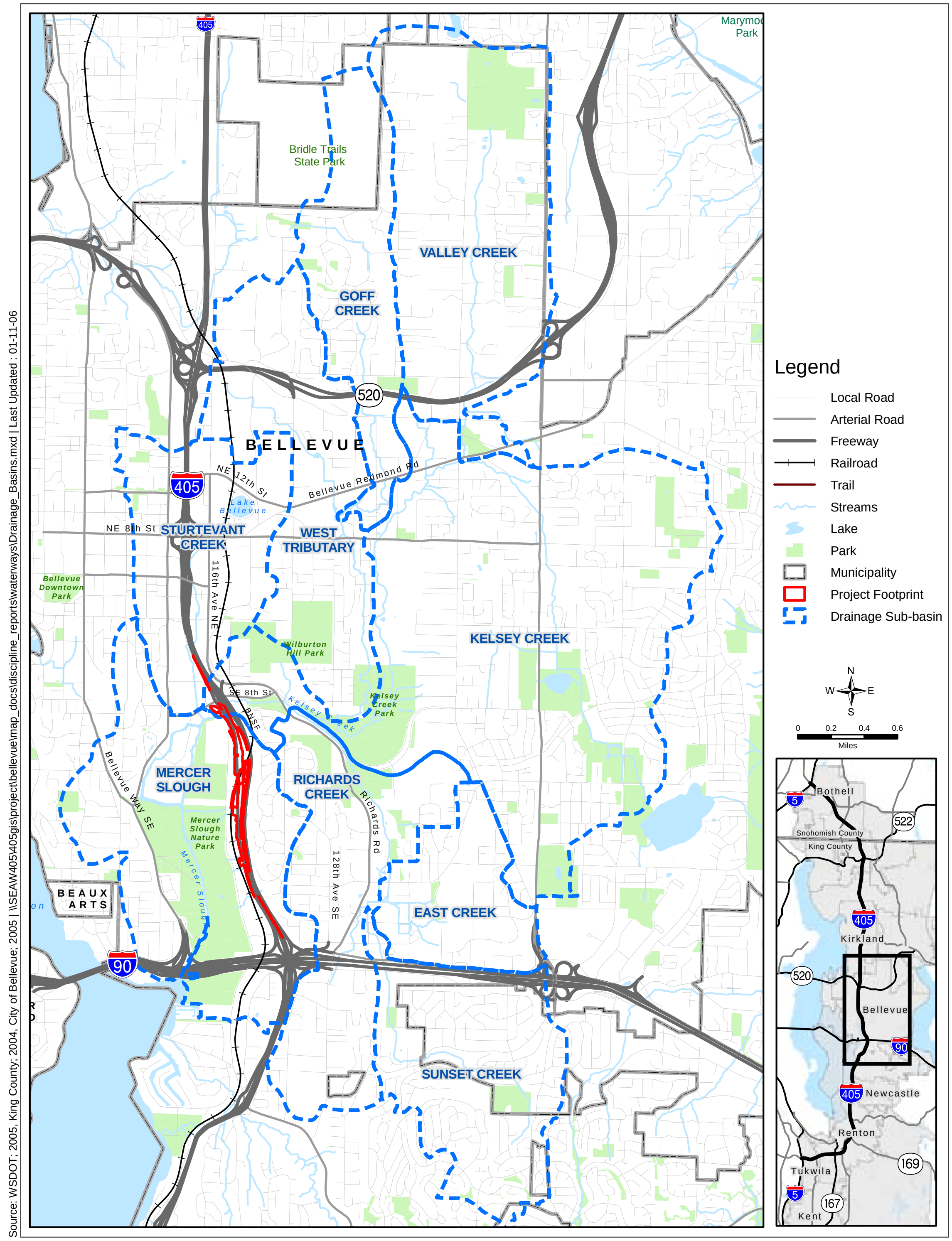
Surface water includes rivers, streams, lakes, and wetlands. Wetlands are defined as waters of the state under Washington Administrative Code, WAC 173-201A. Surface waters are important for supporting aquatic life, as water sources, and for recreational and other uses. We describe wetlands and project effects on wetlands in the separate I-405 Bellevue Nickel Improvement Project Wetlands Discipline Report (WSDOT 2005a).

The study area is located in the Cedar-Sammamish Watershed, or Washington State Water Resource Inventory Area (WRIA) 8. All study area streams ultimately drain to Mercer Slough or its associated wetlands and then to Lake Washington. The entire Mercer Slough sub-basin is composed of 10 sub-basins and covers an area of 10,871 acres (Exhibit 7). Most of the study area is located in two sub-basins, Mercer Slough and Sturtevant Creek. A small portion of the project drains to the Kelsey Creek sub-basin.

### Floodplains

Floodplains are areas prone to periodic inundation and are generally associated with streams, rivers, or lakes. The Federal Emergency Management Agency (FEMA) maps floodplains that have at least a 1 percent probability of flooding in a given year. We define these floodplains as “100-year floodplains” because these areas flood with at least 1 foot of water on average once every 100 years. Flood Insurance Rate Maps (FIRMs) indicate FEMA-delineated floodplains. At the local government scale, King County Code (KCC 21A.24) has designated certain areas as “zero-rise floodways” and requires that new development not cause a measurable rise (0.01 foot or more) in base flood elevation (BFE). Unless a special critical area study has revised the FEMA floodplain, the zero-rise floodway is the FEMA 100-year floodplain area defined by the BFE.

## Exhibit 7. Bellevue Drainage Sub-Basins




Source: City of Bellevue 2002

Floodplains are important features because they can store floodwaters during high flow, offsetting flooding of other areas downstream. When development or natural processes (e.g., landslides, sediment deposition) encroach on floodplains, they reduce the available flood storage. This can result in changes in stream velocity, bank erosion, or location of flooding that can cause damage to habitat or human development elsewhere along the stream. Floodplains may also provide wildlife habitat and migration corridors, and may filter pollutants from overland flow that would otherwise contaminate the associated stream.

## Water Quality

Water quality refers to the physical and chemical properties of water that affect its capability to support beneficial uses. Federal, state, and local agencies regulate surface water quality to maintain a variety of beneficial uses including fish and wildlife habitat, drinking water sources, irrigation water sources, recreation, and aesthetic values. The Washington State Department of Ecology (Ecology) regulates water quality and has established water quality standards for temperature, dissolved oxygen, stream flow, and a wide variety of polluting substances in surface water (WAC 173-201A). Mercer Slough and its tributaries are designated as salmon- and trout-spawning, core-rearing and migration areas, and extraordinary primary contact recreation (swimming and wading) (WAC 173-201A-600).

In this report, we discuss existing conditions and the potential effects of the project on water quality in order to fulfill disclosure requirements, ensure compliance with applicable regulations, and to identify any appropriate mitigation.

## Surface Water, Floodplains, and Water Quality Regulations

City, county, state, and federal levels of government regulate the project and its effects on floodplains and surface water through a large number of regulations (see Appendix B). The following laws, permits, and approvals govern how WSDOT will manage surface water and floodplains:

- Bellevue City Code (9.12 and 20.25)
- WSDOT *Highway Runoff Manual* (HRM) (WSDOT 2004b)
- King County Code Section 21A.24.230-260

- National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater Permit
- NPDES Construction General Permit
- Clean Water Act, Section 401 Water Quality Certification
- Hydraulic Project Approval (HPA)
- State Water Quality Standards
- I-405 Corridor Program Final Environmental Impact Statement FHWA Record of Decision

## What are the key points of this report?

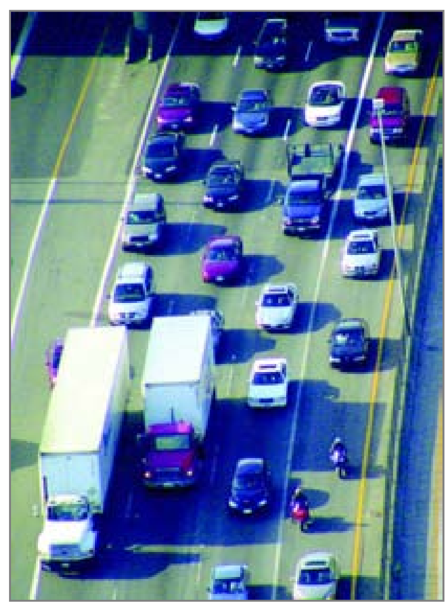
- The project will not encroach into surface water or floodplains except at four stream crossings where WSDOT will replace the existing culverts with similar structures (not specifically designed for fish passage) to maintain channel conditions. These culverts are located at milepost (MP) 11.7 (tributary to Mercer Slough wetlands, 08.MS-11.7), 11.8 (tributary to Mercer Slough wetlands, 08.MS-11.8), 12.03 (Trail Creek), and 12.35 ("Median Stream," the unnamed stream within the I-405 median, 08.MS-12.4, which crosses I-405 between MP 12.3 and 12.5).
- The project will include new impervious surface areas; consequently, there will be additional runoff generated from precipitation falling on pavement. However, WSDOT will collect the runoff from these areas and from a portion of existing impervious surface areas for treatment.
- The project will result in a minor increase in phosphorus, nitrogen, chemical oxygen demand, and metals, and a likely reduction in suspended solids, discharged from the project to local drainages.
- WSDOT will use detention to control flow except where the project discharges to Mercer Slough because discharges to the slough are exempt from flow control requirements (Appendix C).
- In a portion of the study area where runoff drains directly to Mercer Slough, WSDOT will treat for water quality by using an "ecology embankment" to filter pollutants from runoff.


I-405 plays a critical role in the regional movement of people and freight.

# Existing Conditions

## What is the study area for this analysis and how did we determine it?

WSDOT determined the study area as the area in which surface water and floodplains could show effects from highway construction and operation. The study area includes the highway right of way between MP 11.2 (at the bridge over I-90) at the southern end and MP 13.2 at the northern end. Surface water and floodplains located up to 300 feet upstream of the highway right of way (maximum distance anticipated for upstream effects) and 0.25 mile downstream (maximum distance anticipated for effects due to both construction and future stormwater events) are also included in the study area.



Congestion building along the I-405 corridor

## How did we collect information on surface water, floodplains, and water quality?

We collected information on surface water, floodplains, and water quality in the study area from the following sources:

- Federal Emergency Management Agency Flood Insurance Rate Map panel number 53033C0656F). Where floodplains shown on the FEMA map are inconsistent with current topography, we used the FEMA-defined floodplain elevations with current topography to map floodplain locations. Exhibits 8, 9, and 10 show these FEMA floodplains.

Exhibit 8. Surface Waters and Floodplains, MP 11.1 to 11.9

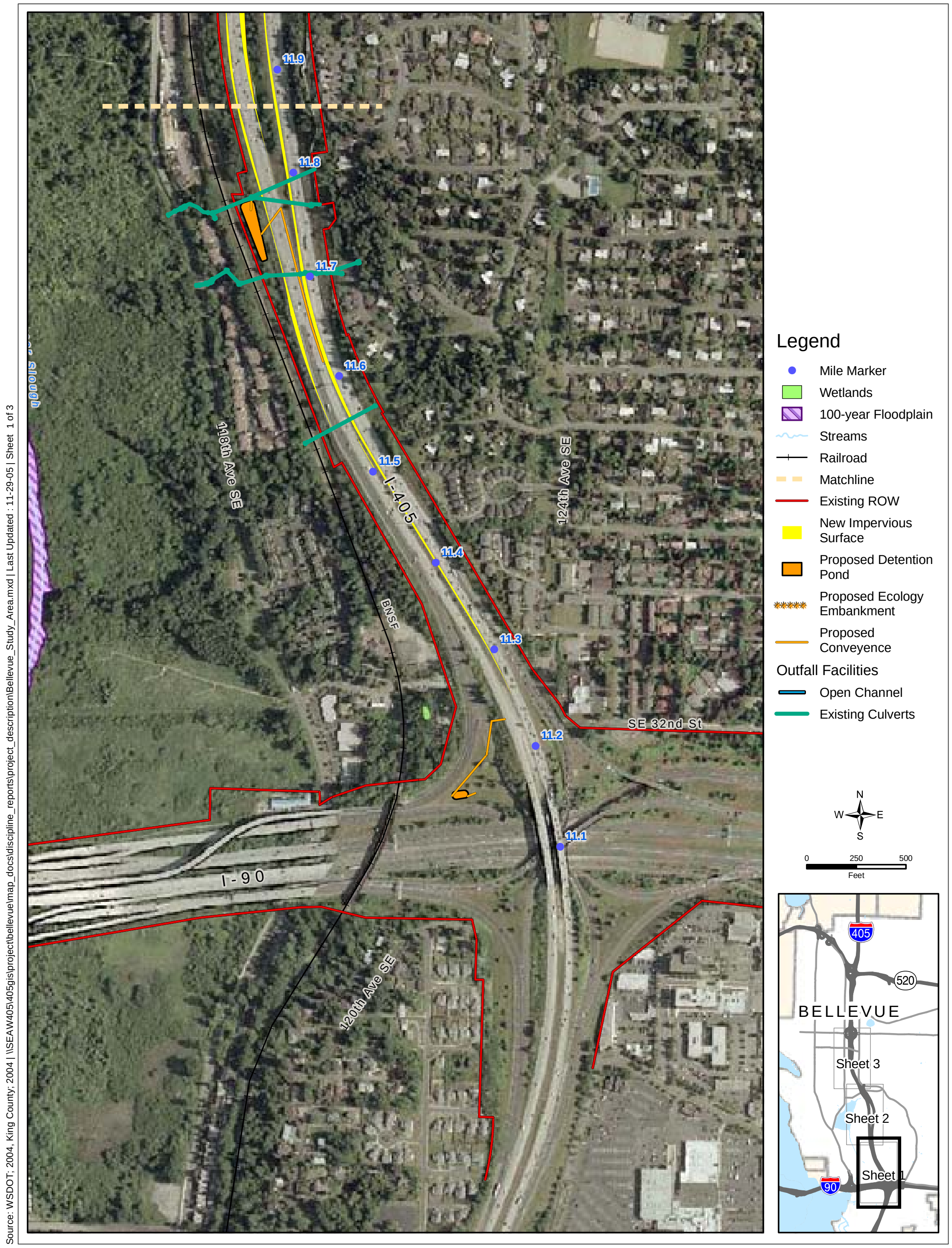


Exhibit 9. Surface Waters and Floodplains, MP 11.8 to 13.0

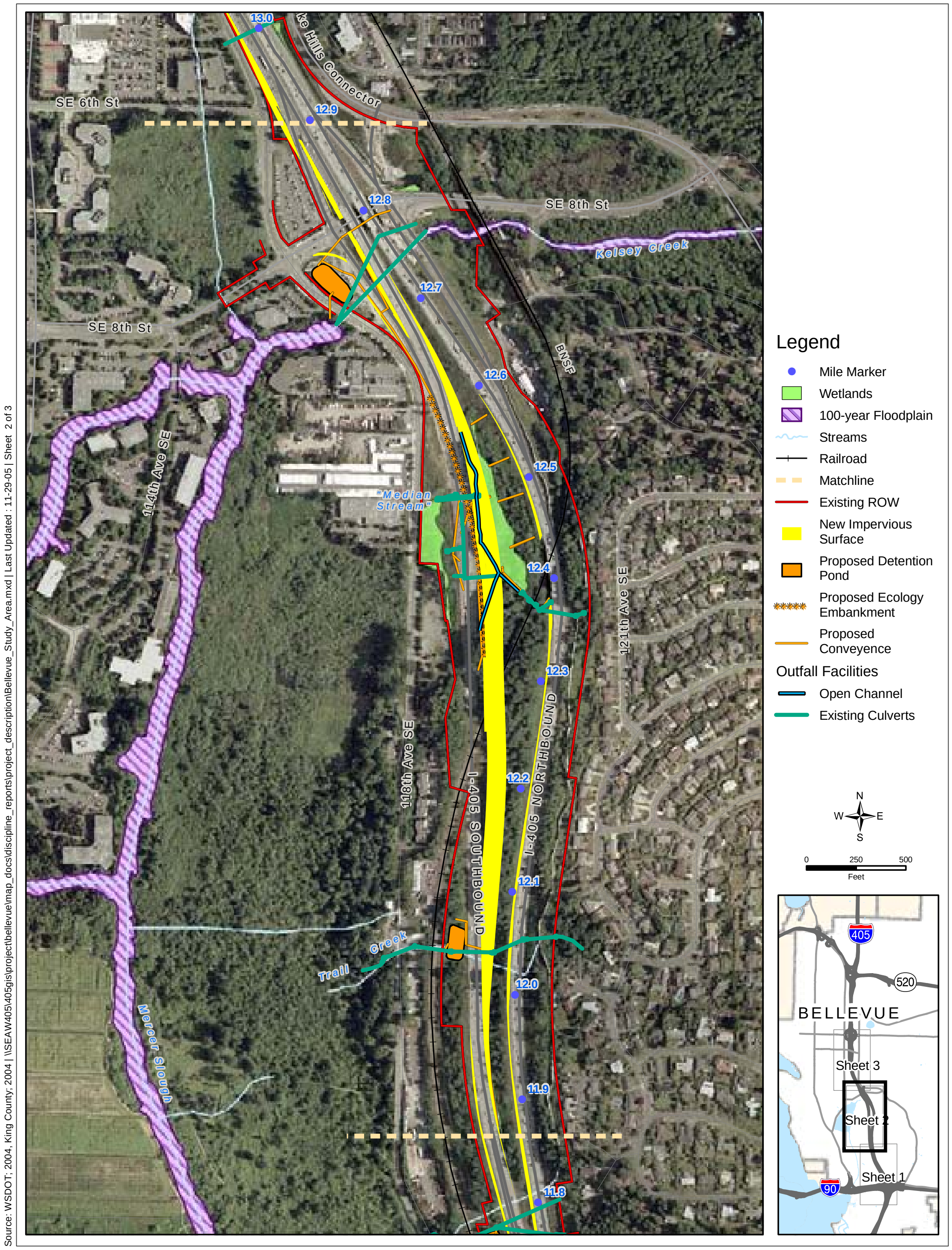
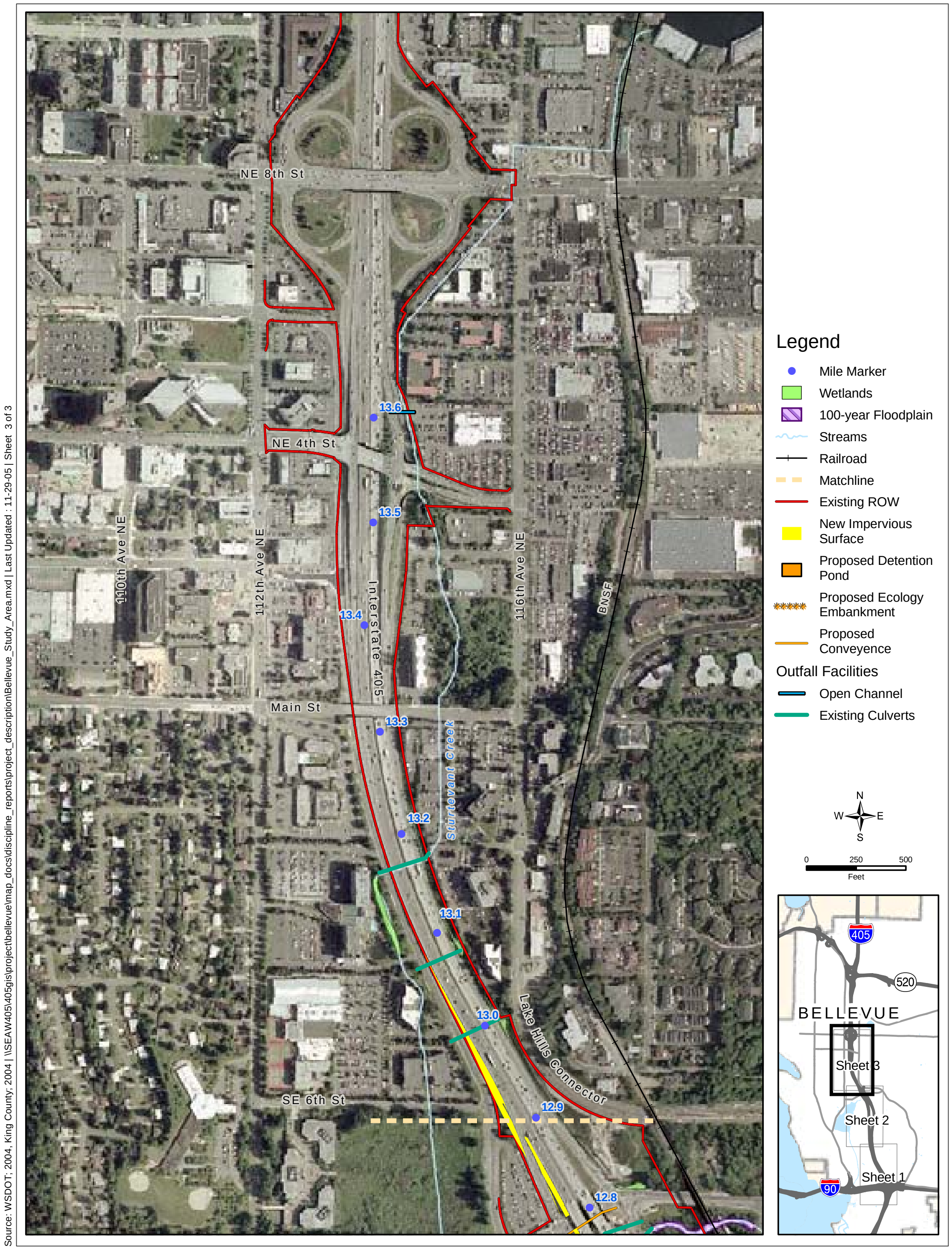


Exhibit 10. Surface Waters and Floodplains, MP 12.8 to 13.6



- The Washington State 303(d) list of impaired water bodies (Ecology 2005b). This is a list of Washington State water bodies that exceed state water quality standards.
- Kelsey Creek water quality data collected by King County (2004).

**What is the Ecology 303(d) list?**

The 303(d) list identifies surface water body segments (lakes, streams, rivers, and ponds) with degraded water quality. Ecology assembles available water quality data and publishes this list, as required under section 303(d) of the federal Clean Water Act (40 CFR 130.7, as revised July 1, 2003).

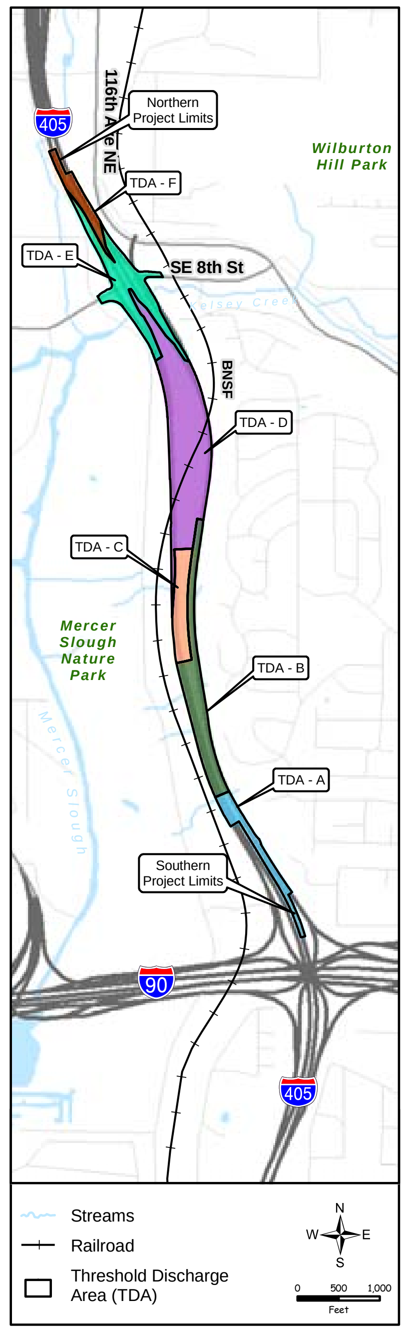
## What are the general topography, soil characteristics, climate, and land cover of the study area?

A number of factors influence how the study area intercepts and influences surface water. Site topography, soils, climate, and land cover all influence the quantity and timing of stormwater runoff, and how it influences surface water, floodplains, and water quality. We describe these site characteristics below.

### Topography

The study area topography is hilly with the overall drainage direction to the west. The topography of the highway in the study area is such that it drains to six individual threshold discharge areas (TDAs) (Exhibit 11). South of Kelsey Creek (MP 11.1 to about 12.6), the study area is on the west slope of a hill between Mercer Slough and the South Fork of Kelsey Creek. Drainage from this area is from the hill east of I-405 to the wetlands associated with Mercer Slough west of I-405. From approximately MP 12.6 to 12.9, drainage is toward Kelsey Creek on the east side of I-405 and to Mercer Slough on the west side of I-405. North of approximately MP 12.9, drainage flows to Sturtevant Creek. The highway elevation ranges from about 82 feet to 179 feet above mean sea level (msl) in the northbound lanes and from about 39 feet to 144 feet above msl in the southbound lanes.

Exhibit 11. Threshold Discharge Areas (TDAs)




### Soil Characteristics

WSDOT has prepared a discipline report that details the geologic conditions of the study area (WSDOT 2005c). Because I-405 is located along a hill slope, bands of steep terrain (greater than 40 percent grade) are present to the east and west sides of portions of the northbound and southbound lanes. The combination of soil type and slope has caused most of the study area (from approximately MP 11.6 to MP 12.6) to be classified as an erosion hazard. Construction in erosion hazard areas has a greater potential for causing turbidity downstream.

The soils in the study area are primarily classified as Alderwood association soils. These soils have rapid permeability at the surface and low permeability below a depth of 20 to 40 inches. This low permeability is typical of glacial origin soils with a dense layer of glacial till. On slopes steeper than 25 percent, Alderwood soils have rapid runoff and a high hazard of erosion. Use of erosion control measures is especially important in steep areas of soils that erode easily.

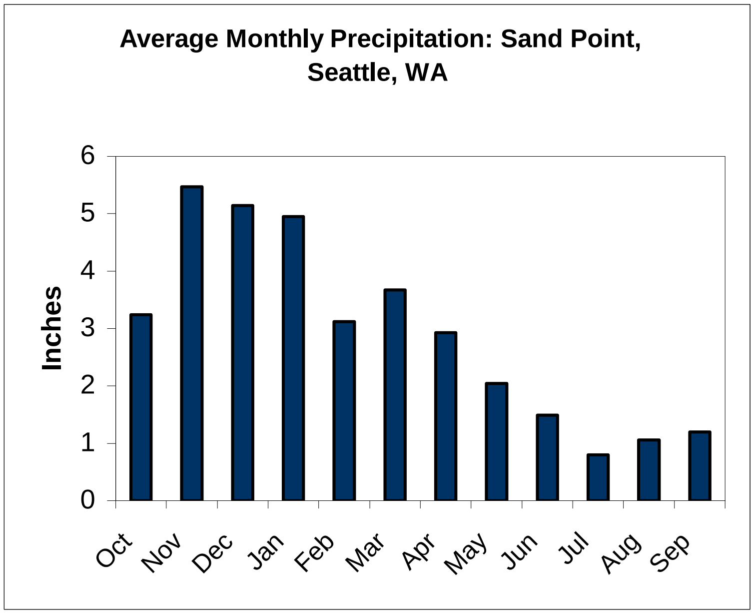
The low permeability of the soils in the study area limits opportunities for using infiltration as a stormwater management technique. Geotechnical borings and soil analysis indicate that only minimal infiltration would be possible at the stormwater detention facilities.

## Climate

The climate and site characteristics of the study area determine the quantity and quality of runoff from the project during construction when soil is disturbed and subject to erosion. Climate also influences how stormwater management systems function during the life of the project. Precipitation in the Bellevue area comes primarily during the winter months with 80 percent of annual precipitation falling between October and May (Exhibit 12).

On average, Bellevue receives 31.4 inches of precipitation per year (Bellevue Chamber of Commerce 2005). WSDOT engineers use climate records and hydrologic models to estimate the volume of runoff from a continuous range of storms from 50 percent of the 2-year storm up to the 50-year storm. In the study area, the 2-year, 24-hour storm event drops 1.9 to 2.1 inches of precipitation in 24 hours, while the 100-year storm event is nearly double, dropping 3.9 to 4.1 inches during a 24-hour period (City of Bellevue 1998).

Exhibit 12. Average Monthly Precipitation near Bellevue, Washington




## Land Use and Cover

Land use and cover influence the hydrologic patterns of runoff from an area and the water quality of that runoff. Urbanization and its associated increased impervious surface area alter water flows in a drainage basin by:

- Decreasing summer minimum flows (base flows)
- Increasing winter maximum flows (peak flows)
- Lowering groundwater levels

Urbanization can also affect the timing of flow changes, leading to more rapid increases and decreases in stream flow rates ("flashiness"), and increased frequency and extent of flooding when it rains. Research on the effects of urbanization on stream ecosystems has shown that impaired stream function is typically evident in watersheds with 10–15 percent effective impervious surface area (Booth et al. 2002; Center for Watershed Protection 2003; May et al. 1998).

**Effective Impervious Area**

Impervious surfaces create stormwater runoff during precipitation events. The effect of this runoff on surface waters depends on the degree of detention and treatment. Effective impervious area is the area of unmitigated impervious surface area that would create the runoff characteristics that actually occur in the drainage area.

Drainage areas with increased impervious surface area often show the following effects on streams:

- Loss of streamside vegetation, which shades the stream, stabilizes stream banks, and filters out stormwater pollutants.
- Increased bank erosion from increased peak flows.

- Reduced structural complexity and stability of stream channels.
- Accumulation of pollutants onto impervious surfaces such as roads, parking areas, and rooftops, and subsequent flushing of these pollutants as stormwater runoff to surface water and groundwater. Stormwater pollutants from urbanized areas may include oil, grease, coolants, and hydraulic fluids from vehicles; nutrients and pesticides from turf management and gardening; viruses and bacteria from failing septic systems; road salts and fine sediment from winter road maintenance; and heavy metals from automobile tire and break wear (EPA 2004).
- Reduced low flow may make a stream susceptible to excessive warming during summer months.

Urban stormwater pollutants may have the following effects:

- Fertilizers may act to cause algal blooms that alter the food web and may deplete dissolved oxygen.
- Increased stream temperature may be detrimental to aquatic life and reduce oxygen solubility in water.
- Increased turbidity may limit plant and algal growth by reducing available light.
- Increased turbidity may be harmful to aquatic animal life.
- Increased concentrations of toxic substances (such as metals, pesticides, oil, and grease) may directly harm aquatic life.
- Increased concentrations of viruses and bacteria may be harmful to people or animals who come into contact with surface water.

Stormwater management systems, especially where infiltration is included, can reduce the effective impervious surface of an area by managing runoff to a natural discharge regime. However, even the most effective systems do not typically remove 100 percent of the pollutants entering the system.

The 10,871-acre Mercer basin includes approximately 43 percent impervious surface area. Roads, parking areas, and rooftops in the basin all contribute to the impervious surface area and the increased stormwater runoff that these surfaces generate. Within the Mercer Creek basin, the sub-basins of three drainage areas intersect the Bellevue Nickel Improvement Project. The southern drainage is the 1,375-acre Mercer Slough sub-basin that is 35 percent impervious. The 2,816 acres that comprise the

Kelsey Creek sub-basin is 42 percent impervious. The northern portion of the project is located in the highly developed Sturtevant Creek basin, which includes 773 acres and is 68 percent impervious (City of Bellevue 2002). The Bellevue Nickel Improvement Project study area is 62.02 acres, including 30.16 acres of impervious surfaces.

## What surface waters occur in the study area?

Three unnamed non-fish-bearing streams cross the project between MP 11.5 and 11.8 (via culverts under I-405) and drain to wetlands associated with Mercer Slough to the west of the project and surface roads (114th Ave SE and 118th Ave SE). They drain to Mercer Slough where they cease to have defined channels and become stream flows that either infiltrate into the soil or spread out into a nearby wetland.

There are four perennial fish-bearing streams within the study area that cross I-405 via culverts:

- Trail Creek (crosses I-405 between milepost [MP] 12.0 and 12.1).
- Median Stream, the unnamed stream in the I-405 median (08.MS-12.4) (crosses I-405 between MP 12.3 and 12.5).
- Kelsey Creek (crosses I-405 between MP 12.7 and 12.8).
- Sturtevant Creek (crosses I-405 between MP 13.1 and 13.2).

Sturtevant Creek is within the study area but outside of the project footprint. Exhibits 8, 9, and 10 show the location of these streams in the study area. Kelsey Creek is the only stream in the study area that has a fish-passable culvert across I-405 that supports anadromous fish upstream of I-405 (WSDOT 2005b). Downstream of I-405, Mercer Slough and Sturtevant Creek support anadromous salmonid fish. As with the unnamed streams, Trail Creek and Median Stream lose channel definition in the wetland complex of Mercer Slough. A separate Fisheries and Aquatic Resources Discipline Report (WSDOT 2005b) details the fish habitat features of these streams.

Fish ladder at outlet of Kelsey Creek/Mercer Slough culverts

Inlet to Kelsey Creek/Mercer Slough culverts

Outlet of Sturtevant Creek culvert under 114th Avenue SE

Kelsey Creek (MP 12.72) and Sturtevant Creek (MP 13.15) are the largest streams in the study area. Kelsey Creek passes under I-405 through two parallel culverts. One is a 132-inch steel pipe and the other is a 10- by 4-foot concrete box culvert. Downstream of these culverts, the stream becomes Mercer Slough. The outlet of the 132-inch culvert is fitted with a fish ladder.

Kelsey Creek is the only stream crossing I-405 in the study area that is fish passable (WSDOT 2005b). The Kelsey Creek culverts extend beyond the entire I-405 construction area. A horizontal partial-flow barrier installed at the opening to the box culvert improves fish passage.

Sturtevant Creek passes under I-405 in two 48-inch culverts located at MP 13.15. The outlets of these culverts are located west of 114th Ave SE that runs parallel and adjacent to the west side of I-405. Sturtevant Creek then flows into Mercer Slough. Sturtevant Creek is outside of the project footprint.

## What is the quality of surface waters in the study area?

Several agencies have examined various aspects of water quality in the larger streams in the study area on a variety of occasions. The results have indicated a number of water quality problems typical of urban streams. Water quality data are available for Kelsey Creek, Mercer Slough, and Sturtevant Creek, and we summarize this information below.

### Kelsey Creek

King County has monitored water quality at the mouth of Kelsey Creek since 1976 (King County 2004). In the 5-year period from 1998 to 2003, King County found relatively low turbidity and improved nutrient conditions compared to conditions prior to 1998. However, the County observed degradation in other water quality conditions in Kelsey Creek over the same period (King County 2004). Between 1979 and 1999, Kelsey Creek increased in pH, conductivity, and temperature. Temperature and pH occasionally exceeded state water quality standards between 1998 and 2003 (King County 2004).

Kelsey Creek is on the Washington State list of water quality impaired surface waters (303(d) list) due to temperature, dissolved oxygen, and fecal coliform bacteria (Ecology 2005b). DDT, dieldrin, fecal coliform, and heptachlor epoxide concentrations recorded in 1979 and 1980 caused Kelsey Creek to be listed (Ecology 1998). DDT, dieldrin, and heptachlor are insecticides that have been used historically in residential and agricultural applications. (Heptachlor epoxide is a compound that forms when heptachlor oxidizes in the environment.) Although the government has banned use of these insecticides, some residues may persist in the environment for many years. Fecal coliform bacteria can come from a variety of sources, including waterfowl, domestic pets, or failed septic or sewer systems.

Nutrient concentrations affect dissolved oxygen (DO) concentration, which is inversely related to temperature. King County observed DO below state standards in 14 percent of base flow samples taken at the mouth of Kelsey Creek between 1998 and 2003. Bacterial counts during this period frequently exceeded state standards in base flow samples and exceeded state standards in 100 percent of stormflow samples. Nutrient (nitrogen and phosphorus) concentrations in Kelsey Creek have improved since 1979 but remain higher than the median concentration for selected King County stream sites (King County 2004).

In 1998, the United States Geological Survey (USGS) reported that stream sediment from the west fork of Kelsey Creek (upstream from the project area) had the highest concentration of polycyclic aromatic hydrocarbons (PAHs) of the 18 Puget Sound streams included in its study (MacCoy and Black 1998). One of these compounds, benzo(a)pyrene was present in concentrations high enough to cause pre-cancerous tumors in fish (under laboratory conditions) (MacCoy and Black 1998). Sources of PAHs may include residues from forest fires, fossil fuel sources such as oil spills, or byproducts of coal tar and asphalt manufacturing (MacCoy and Black 1998). Creosote, long used as a wood preservative for railroad trestles and ties, and other outdoor structural timbers contain PAHs. The source or sources of PAH pollution in Kelsey Creek have not been identified, however.

The high temperatures, low dissolved oxygen, nutrient concentrations, and bacterial pollution in Kelsey Creek are fairly typical of urban streams with altered hydrology and runoff from residential properties and impervious surfaces. Considering the highly developed condition of the drainage basin, it is likely that temperature will continue to exceed water quality standards on occasion in the future.

### Mercer Slough

Mercer Slough is on the state 303(d) list for temperature, dissolved oxygen, and fecal coliform bacteria (Ecology 2005b). Dissolved oxygen depletion is fairly common in streams such as Mercer Slough that are slow-moving and support dense growth of submerged vegetation or algae. Aquatic vegetation uses oxygen for respiration at night and fuels microbial respiration as aging plants and algae decompose. Streams like Mercer Slough are especially sensitive to oxygen depletion during summer months when water temperature is highest (oxygen is less soluble in warmer water), and low stream flow offers little aeration or flushing.

Although highway runoff contributes to the pollutant load of Mercer Slough (as well as study area tributaries), highway runoff is a relatively small fraction of the total pollutant load of Mercer Slough (approximately 2 percent of the load of phosphorus, nitrogen, chemical oxygen demand, and suspended solids). (See Appendix D.)

### Sturtevant Creek

The City of Bellevue took water samples from Sturtevant Creek in the early 1990s and reported relatively high suspended solids, turbidity, oils, greases, petroleum hydrocarbons, and chemical oxygen demand compared to other Bellevue streams (City of Bellevue 2003). These substances may have been high in Sturtevant Creek because a large proportion of this sub-basin is covered by roadway surfaces (49 percent), commercial land use (17 percent), and industrial land use (9 percent). However, scientists have yet to identify the sources of these pollutants. Currently, Sturtevant Creek is not on Ecology's 303(d) list of degraded waterbodies.

## What flood hazard and floodplain areas are located in the project vicinity?

No flood hazard areas are located within the project vicinity. The nearest flood hazard areas to the project are the floodplains associated with Kelsey Creek upstream of the study area (Exhibit 8) and Mercer Slough downstream of the project. However, culverts confine Kelsey Creek where I-405 crosses it. The elevation of I-405 is well above the floodplain elevation of Kelsey Creek; therefore, there is no flood hazard to I-405.

Sturtevant Creek also passes under I-405 in a culvert but does not have an associated jurisdictional floodplain.

Lake Bellevue, at the headwaters of Sturtevant Creek, has flooded in recent years during extreme precipitation events. Immediately upstream of I-405, however, this stream is contained in culverts with no possibility of flooding. Downstream of I-405, Sturtevant Creek passes under 114th Ave SE in a culvert and then into an open channel.

## How do the drainage areas intersected by the project affect floodplains?

The floodplains associated with Mercer Slough are located downstream of the project. The elevation of Lake Washington controls the elevation of these floodplains. The Corps regulates Lake Washington's elevation by adjusting the flow through the Hiram Chittendon Locks and dam in Seattle. The maintenance level of Lake Washington's surface elevation is between 16.7 and 18.7 feet above msl (NAVD 88). This level is lower in winter and highest in spring to minimize winter lakeshore erosion and allow adequate flows for fish passage at the Hiram Chittendon Locks. Because the Mercer Slough channel is unconstricted and flows readily into Lake Washington, the floodplain elevation of Mercer Slough (22 feet) is independent of flow conditions in its tributaries.

Upstream of I-405, the condition of the Kelsey Creek sub-basin determines the peak flow in Kelsey Creek, which in turn determines the location and elevation of floodplains in conjunction with the shape of the Kelsey Creek channel. Because the Kelsey Creek drainage includes approximately 42 percent impervious area, peak flows are considerably higher than they would be in an undeveloped forested condition. As a result, floodplains, particularly in low gradient, unconfined portions of the stream, are more extensive than they would be if the drainage were in a natural forested condition.

Other streams in the study area are too small and confined to have considerable floodplain areas. In the study area upstream of I-405, Sturtevant Creek flows through an underground pipe and therefore has no floodplain.

## How do we currently manage stormwater in the study area?

Currently, precipitation that falls onto I-405 drains to road drains that flow to storm sewers. Currently, we do not detain or treat stormwater from most of the study area. There is a one-cell detention wet pond in the southwest quadrant of the I-405/SE 8th Street interchange that treats 2 acres of impervious surface area from I-405 in the vicinity of SE 8th Street. Otherwise, storm sewers discharge untreated runoff into streams, wetlands, and ditches west of the highway.

Several cross-drains located in the study area (Exhibits 8, 9, 10) carry streams and local runoff to the west of I-405. For a complete description of drainage structures, please refer to the I-405 Bellevue Nickel Improvement Project Preliminary Hydraulic Report (WSDOT 2005d).

Traffic moving through the existing Wilburton Tunnel

# Potential Effects

## What methods did we use to evaluate potential effects to surface water, floodplains, and water quality?

We assessed potential effects of the project on water quantity and quality using methods described in the Environmental Procedures Manual EPM (WSDOT 2004a), Section 431, and in the WSDOT *Highway Runoff Manual* (HRM)(WSDOT 2004b). WSDOT designed the stormwater management features for the project using the HRM. We used the HRM as a reference to determine how efficient these project features are at removing pollutants and controlling flow. The I-405 Bellevue Nickel Improvement Project Preliminary Hydraulic Report describes these features in detail (WSDOT 2005d). We also assumed that construction will follow standard temporary erosion and sedimentation control (TESC) BMPs to meet the minimum requirements of the HRM.

**WSDOT Environmental Procedures Manual (EPM)**

The EPM describes in detail the methods that we used to evaluate water quantity and quality effects. The EPM also includes estimates of pollutant loading from various land uses and removal efficiencies (percentage of pollutants removed through treatment) for stormwater design features used in this project.

Typical wetland vegetation found within the study area

We used Method 2 from the EPM (WSDOT 2004a, Section M31-11, pages 5–11) to estimate runoff and pollutant loading from the project. This method calculates pollutant loading based on the precipitation typical for the project site, the project impervious surface area, and pollutant concentrations that scientists have observed in highway runoff studies. We applied pollutant removal efficiency rates (percent of pollutants removed) that were observed with the proposed stormwater treatment systems and assessed the project for post-treatment effects to water quality. To put the post-construction pollutant-loading estimates in perspective, we compared the post-construction loading estimates to the estimated pollutant loading for the entire Mercer Slough drainage area.

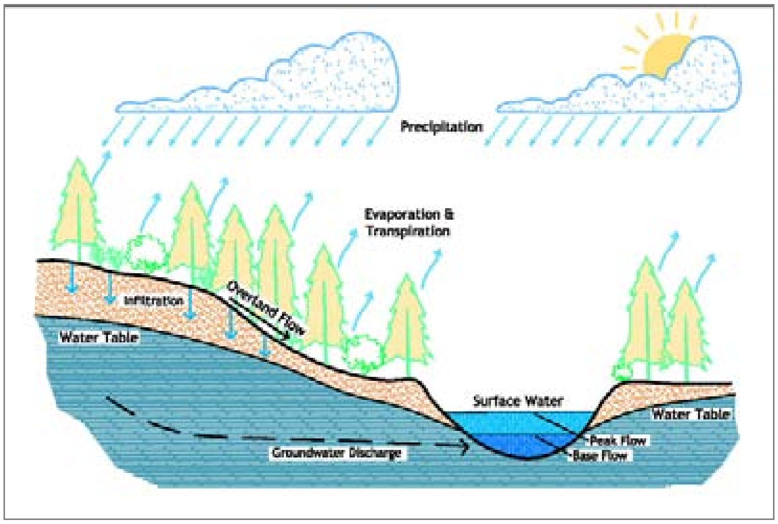
We also evaluated floodplain effects using methods described in the EPM (WSDOT 2004a), Section 432. We compared the project footprint to FEMA-mapped floodplains for potential overlap with floodplain areas and evaluated the potential hydrologic effects of the project on floodplains upstream and downstream.

## How will the project affect surface water and water quality?

The project will cause local increases in pollutant loading to surface water. However, the increased pollutant load will constitute a very small fraction of the pollutant load for Mercer Slough watershed. The project footprint will contribute 1 to 8 percent of the pollutant load in the Mercer Basin. With the Bellevue Nickel Improvement Project, the Mercer Basin pollutant loads will increase by less than 1 percent. Existing and anticipated pollutant loads are shown in Appendix D (Table D-9).

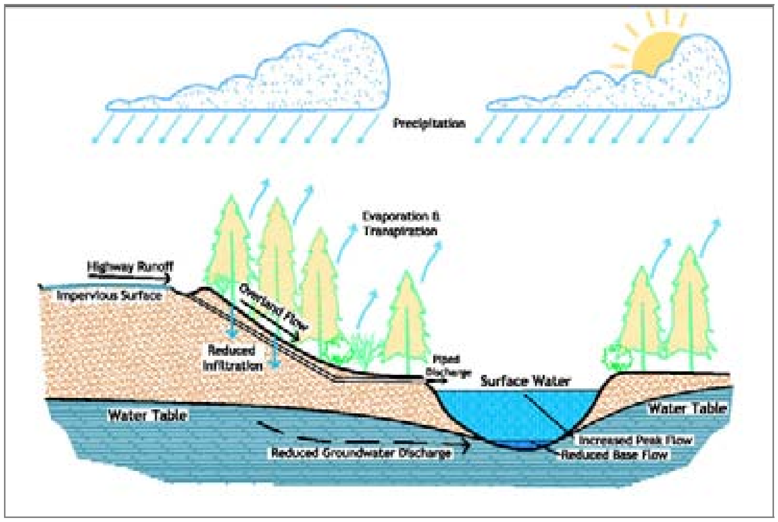
In a natural undeveloped drainage area, precipitation falls onto trees, other vegetation, and soil (Exhibit 13). A portion of this precipitation evaporates off vegetation and soil surfaces, and plant roots take up a portion and then release it to the atmosphere through the leaves (transpiration). The remainder either infiltrates through soil and becomes groundwater, or runs off the soil as surface runoff. Groundwater and surface runoff then enter surface waters and flow downstream.

Exhibit 13. Hydrological Cycle – Natural Undeveloped Condition




Unless mitigated with stormwater detention facilities, highways and other development alter the natural water cycle by replacing vegetation and soil with impervious surfaces (Exhibit 14). When precipitation falls on impervious surfaces, only a small fraction evaporates, none infiltrates, and the remainder runs off rapidly to surface waters. Streams draining areas with impervious surfaces respond more rapidly to precipitation than those in undeveloped areas. Higher peak flows can cause increased erosion due to higher velocity and fill more of the channel (or overtop the banks). Where impervious surface area is increased, less precipitation infiltrates to groundwater, causing lower base flows in streams.

Exhibit 14. Hydrological Cycle Showing Effects of Unmitigated Impervious Highway Surface




For details on the effects of the project on groundwater, please see the separate Geology, Soils, and Groundwater Discipline Report (WSDOT 2005e).

Highways can also affect water quality because vehicles deposit particles of dust, hydrocarbons, and metals on the road surface. These substances are then transported in surface runoff from roads to surface waters during precipitation events.

Highway right of way maintenance can be an additional source of pollutants. In some instances, WSDOT uses herbicides to control invasive vegetation along roadside areas. However, in the Bellevue Nickel Improvement Project study area, use of herbicides will be limited to those areas surrounding the new stormwater detention facilities. WSDOT uses only licensed applicators to treat invasive plants and uses Ecology-approved BMPs to limit the potential for contaminating surface water or groundwater with herbicides.

The Bellevue Nickel Improvement Project will accommodate an increase in traffic volume along I-405. With an increase in traffic, we expect a greater potential for fuel spills or other substance spills that could harm water quality.

WSDOT has designed stormwater detention and treatment facilities specifically to address the potential effects of highway runoff. The Bellevue Nickel Improvement Project will include four two-cell wet ponds to serve as stormwater detention and treatment facilities. The proposed locations of these facilities appear in Exhibits 8, 9 and 10. In TDAs A, B, C, and F, these flow-through facilities will include a wet pond that will detain runoff and allow pollutants to settle out, as well as a shallow constructed wetland that will remove additional pollutants (Exhibit 15).  We regulate stormwater pond discharge to control peak flows and to approximate a natural hydrologic response.

In TDA D, stormwater discharge will flow to Mercer Slough or its associated wetlands.  Because the elevation of Mercer Slough is determined by the elevation of Lake Washington rather than by the volume discharged from Mercer Slough, this area is exempt from flow control requirements.  Therefore, stormwater treatment in TDA D will use an “ecology embankment” to provide superior pollution treatment but less flow control than a two-cell wet pond system.  The ecology embankment does provide some flow control but depends on the permeability of soil where it is installed.  In permeable soils, the ecology embankment will allow onsite infiltration, reducing stormwater discharge as well as filtering pollutants.  Exhibit 16 shows the features included in the ecology embankment.

For details on stormwater management facilities, please see the separate I-405 Bellevue Nickel Improvement Project Preliminary Hydraulic Report (WSDOT 2005d).

Exhibit 15. Example Stormwater Detention and Treatment Facility

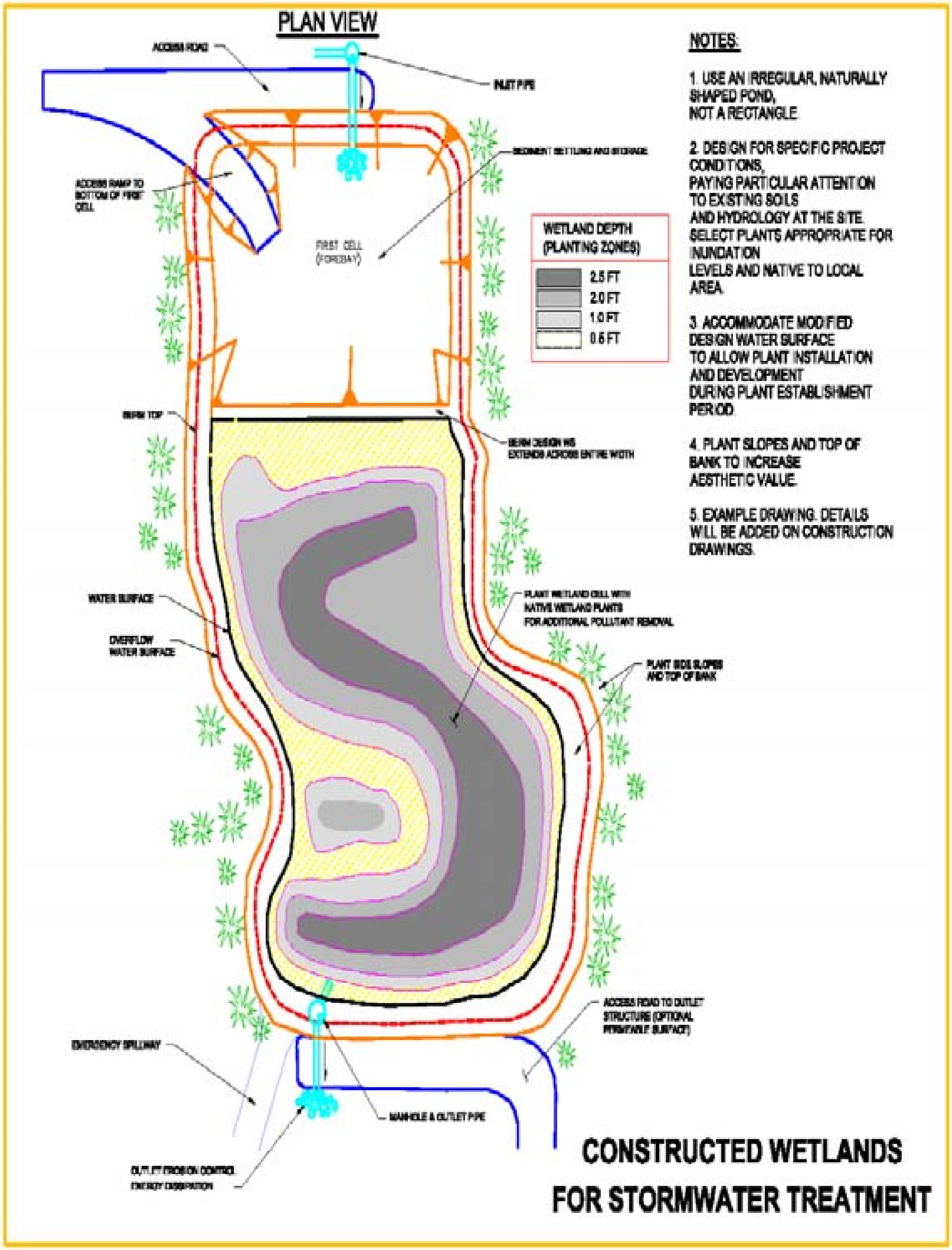
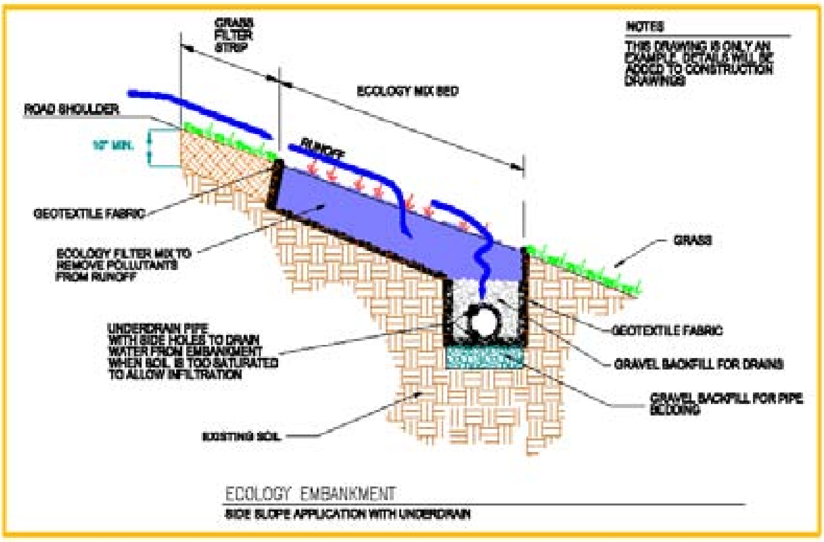


Exhibit 16. Example Stormwater Detention and Ecology Embankment Treatment Facility



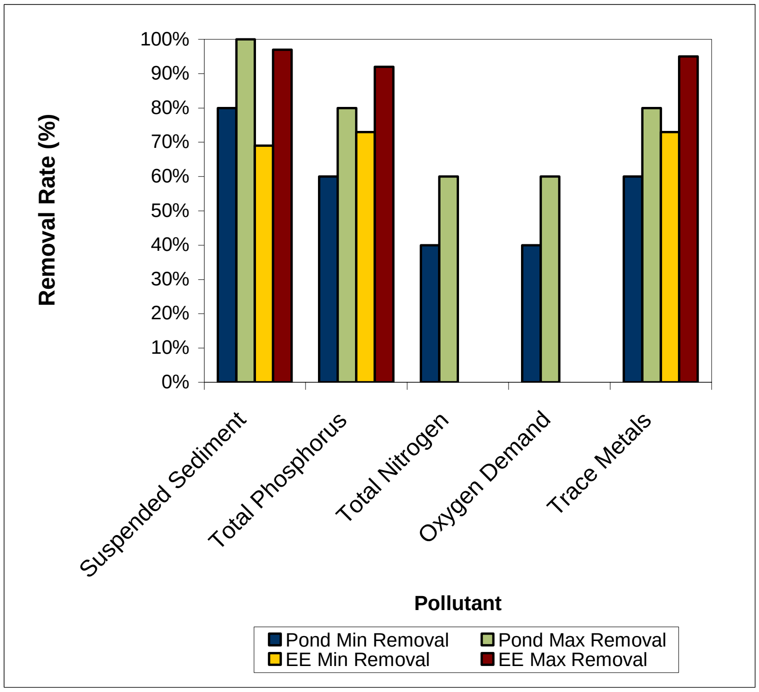

Stormwater detention and treatment systems will treat a portion of the total road drainage that is equal to, or in some areas, slightly greater than the area of new impervious surfaces created in this project. We achieve this by means of a “flow splitter.” When runoff entering the flow splitter exceeds the capacity of the detention system, the excess flow bypasses the facility and discharges untreated as it does under existing conditions. Because roadway pollutants tend to be concentrated in the first flush of runoff, the overflow discharge will, in most cases, be more dilute than the portion of runoff that is treated. We size project detention and treatment systems to treat a portion of the existing impervious surface area along with the new impervious surface area. Overall, the project will detain and treat stormwater from an area 117 percent of the size of the new impervious surface created by the project. The area of existing impervious surface that will be retrofitted for stormwater treatment is located at the northern end of the study area (TDAs D and E).

We used “Simple Method 2” from the EPM (Section M31-11) to determine pollutant loading rates for the highway drainage area under existing conditions and after the project is complete. In this method, we used the annual precipitation and impervious surface area to determine the quantity of runoff. We then used typical pollutant concentrations reported for highway runoff to calculate the pollutant load generated from the study area. The equation for this calculation appears in Appendix D.

As the name implies, the simple method does not attempt to account for every variable that can influence pollutant loading. However, it is a useful tool for determining the relative loading under differing alternatives. In order to capture the worst-case condition in our analysis, we assumed that all precipitation events result in equal pollutant concentrations and that the stormwater management facilities always treat the same proportion of runoff from each TDA. In actuality, the pollutant concentration in heavy precipitation events is often more dilute and a larger proportion of the runoff from each TDA will receive treatment during smaller precipitation events than during larger ones. Therefore, the actual pollutant loading is likely to be something less than what we report here.

Although the proposed stormwater detention and treatment facilities are effective for removing pollutants from stormwater, these facilities are not able to remove 100 percent of pollutants from runoff. The two-cell wet pond design that will be used in TDAs A, B, C, and F typically removes 40 to 100 percent of pollutants, depending on the type of pollutant. The ecology embankment that will be used to treat runoff from TDAs D and E removes a similar percentage of pollutants. Therefore, we estimate that the project will result in a slight increase in pollutant loading to stormwater discharged from the highway. Exhibit 17 shows the removal efficiency for various highway pollutants that we expect with the proposed treatment facilities. Both of the two treatment systems are effective at removing pollutants from stormwater.

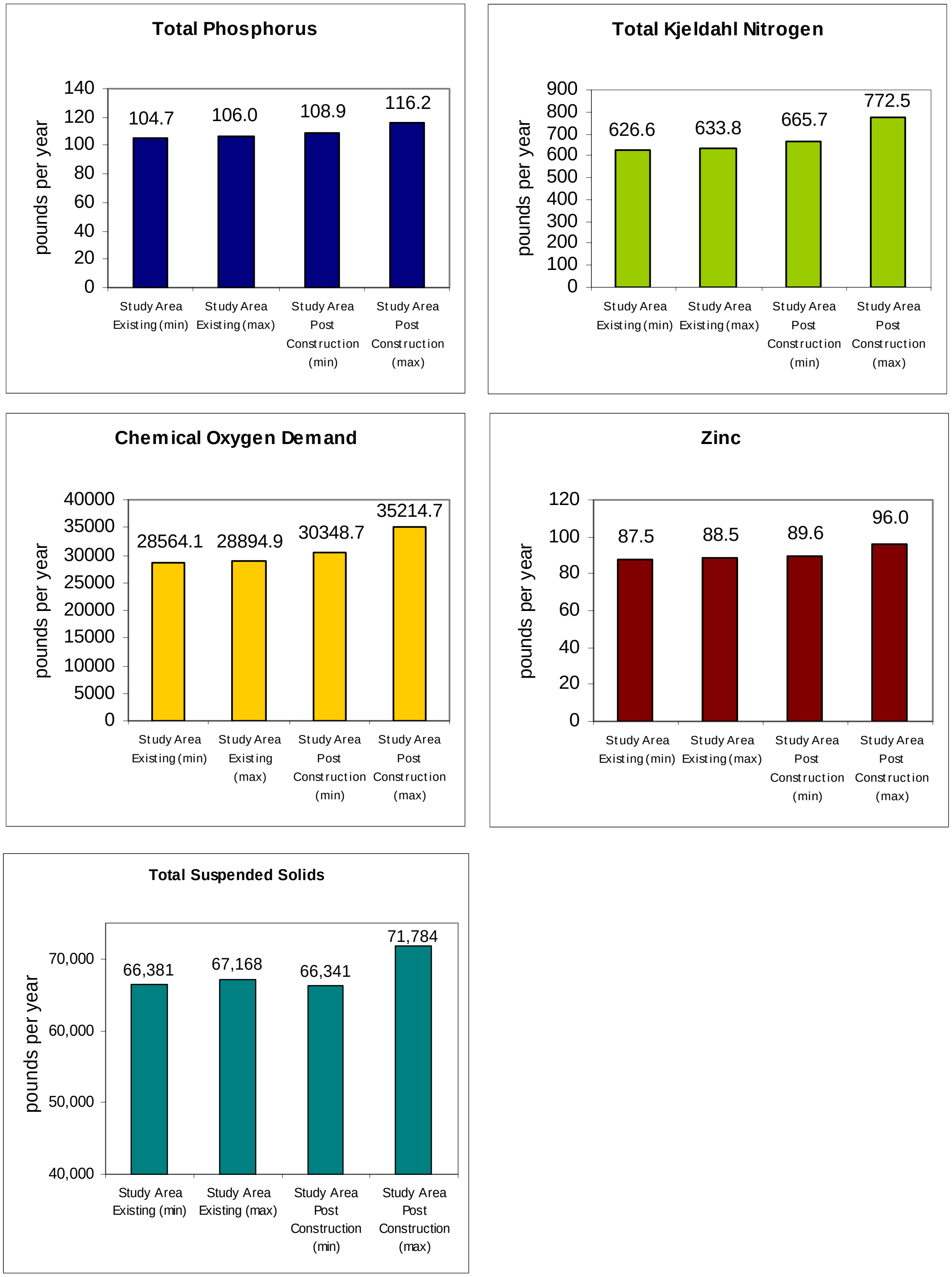
Exhibit 17. Pollutant Removal Efficiency for Two-Cell Wet Pond Detention Facility with Shallow Wetland in Second Cell and for Ecology Embankment (EE) Facilities




Note: Removal rate for total nitrogen and oxygen demand has not been determined for Ecology Embankment Facilities.

Using the Simple Method described above, we found that within the project drainage area (all TDAs combined), phosphorus, nitrogen, chemical oxygen demand (COD), and zinc will all increase slightly and total dissolved solids will likely be essentially the same or slightly less than under existing conditions because the removal efficiency for this pollutant is greater than for the others. Phosphorus loading will increase by 2.9 to 11.4 pounds per year, total Kjeldahl nitrogen (TKN) by 31.9 to 145.9 pounds per year, COD by 1.5 to 6.7 thousand pounds per year, and zinc by 1.1 to 8.4 pounds per year. Other metals in highway runoff, such as copper, will increase at a similar rate as zinc. Because the reported removal efficiency for dissolved solids ranges from 80 to 100 percent, we estimate total dissolved solids will increase by up to 5,403 pounds per year but levels could fall by as much as 827 pounds per year. The estimated ranges of pollutant loading for the combined Bellevue Nickel Improvement Project drainage areas under existing conditions and with the proposed project appear in Exhibit 18. Tables of pollutant loading estimates for the project are included in Appendix D.

Exhibit 18. Pollutant Loading Estimates for the Combined TDA Areas under Existing Conditions



The importance of changes in pollutant loading depends on the existing background pollutant load from other sources. If we compare the pollutant load under existing and post-project conditions for the entire Mercer Slough drainage area (what affects Mercer Slough and Lake Washington), we see that the increases would be slight, no more than 0.73 percent for any water quality constituent. This level of increase will be too slight to result in a measurable difference in the concentration of these constituents in Mercer Slough downstream of the project. The estimated ranges of pollutant loading for the Mercer Slough Basin under existing conditions and with the proposed project appear in Exhibit 19. Tables of pollutant loading estimates are included in Appendix D.

## Will the project affect floodplains?

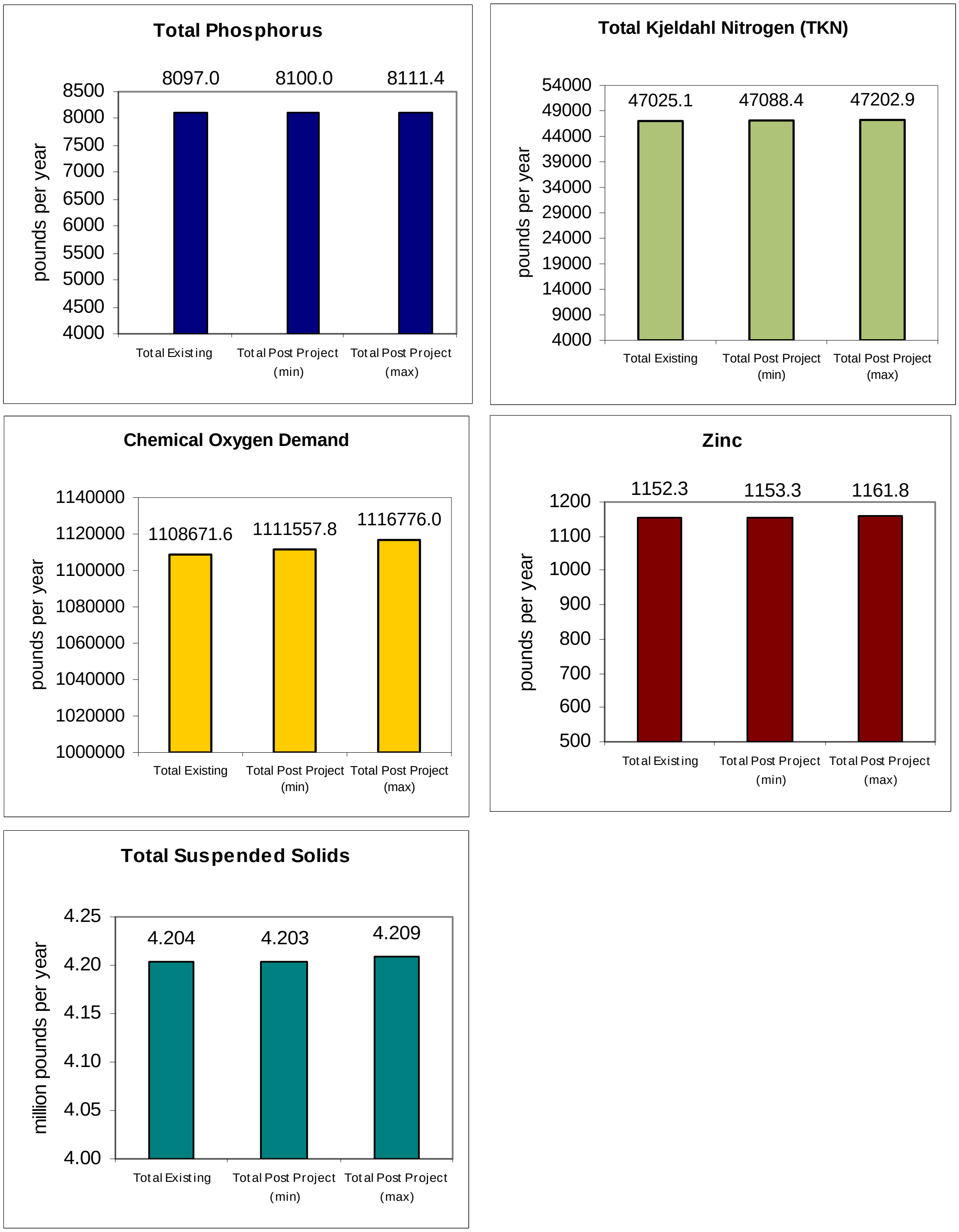
Road projects can affect floodplains by encroaching into floodplain areas, altering peak stream flows that can increase the base flood elevation (BFE), and by increasing floodplain area downstream, or changing backwater effects where construction alters stream-crossing structures.

The Bellevue Nickel Improvement Project will not encroach into any floodplain areas associated with Kelsey Creek, Mercer Slough, or other stream channels.

The project will increase impervious surface areas within the study area. However, where stormwater runoff occurs and could affect stream habitat, WSDOT will install a series of stormwater detention and treatment ponds to attenuate flow. Since the elevation of Lake Washington controls the BFE downstream of the project (i.e. at Mercer Slough floodplains), the increase in peak flow rates of the project will not affect downstream BFE or floodplain area.

The project will require modifying four culverts located at MP 11.7, 11.8, 12.03, and 12.35. Replacing these culverts will not have any adverse effects on floodplains because no floodplains are present and the culverts will be designed so that the resistance to flow will be the same as existing conditions. The BFE upstream and downstream of these culverts will also be the same as with the existing culverts.

Exhibit 19. Pollutant Loading Estimates for Entire Mercer Slough Drainage Area



## How will project construction affect surface water, floodplains, and water quality?

Using standard construction BMPs, the project should not affect surface water, floodplains, or water quality. The Bellevue Nickel Improvement Project will include replacement of four culverts. We expect that replacing the culverts will maintain or improve channel conditions by maintaining or increasing the capacity of these crossings. As with any in-stream construction, this project element will cause a temporary localized increase in stream turbidity either during construction or after we route flow to the new culvert following construction. BMPs, including project timing (to coincide with low-flow conditions), stream diversion during construction, and isolation of the work area during construction, will minimize the extent, duration, and intensity of increased turbidity effects. We discuss potential effects to fish in the separate Fisheries and Aquatic Resources Discipline Report (WSDOT 2005b).

The Bellevue Nickel Improvement Project will require disturbing soil and will have areas of exposed bare soil during construction. As with any construction that disturbs soil, there is a risk of surface erosion. This risk will be greatest in areas with steep slopes and erodible soils. The City of Bellevue has mapped the area of the project from approximately MP 11.2 to 12.6 as a soil erosion hazard area due to the combination of slope and erodible soil. Without erosion-control BMPs, ground clearing, excavation, grading, and soil stockpiling could potentially stimulate soil erosion that could result in increased turbidity downstream. However, the project will be constructed using WSDOT standard erosion control BMPs that will reduce this risk. In addition, stormwater management facilities constructed for this project will be among the first elements completed so that they will be treating stormwater during construction as well as after the project is completed.

The project crosses one water main and one sanitary sewer, both of which are buried north of SE 8th Street at depths well below I-405. Protecting these lines is critical to preventing water quality effects. However, since the project will not include deep excavation at these locations, no protective measures will be required.

Since the Bellevue Nickel Improvement Project will not require any construction, staging, or other activity in floodplain areas, project construction will not affect floodplains.

The wetland mitigation site will be located in an area designated as “Zone X” on the FEMA floodplain map. Zone I may be subject to flooding at a 100- to 500-year return interval but it is not a regulated floodplain so there are no restrictions to building or creating wetlands in these areas. Creating a wetland at the wetland mitigation site will slightly increase flood storage capacity during extreme flood events (greater than the 100-year flood event) but will not cause a measurable change in flood elevations downstream during events less than or equal to the 100-year flood.

## How would the No Build Alternative affect surface water, floodplains, and water quality in the study area?

Under the No Build Alternative, the volume of runoff and pollutant loading would be the same as under existing conditions and there would be no effect on floodplains. Because the No Build alternative would not increase impervious surface area, there would be no change in stormwater runoff volume generated in the study area, or in the way that we manage runoff. Runoff water quality would also be the same as under existing conditions since the pollutant-generating surface area would be unchanged.

## Are there other effects that could be delayed or distant from the project?

Project effects that are delayed or distant from the project are referred to as “indirect effects.” Because the Bellevue Nickel Improvement Project will manage water quality with a combination of BMPs and stormwater treatment facilities to avoid or minimize direct effects on water quality, we anticipate that there will not be any downstream effects outside the study area. The entire Bellevue Nickel Improvement Project drains to Mercer Slough or its tributaries and eventually to Lake Washington. Lakes can be more sensitive to certain types of pollution than streams. However, in the case of Lake Washington and Mercer Slough, the slough is likely to be more sensitive to water quality degradation since it has less aeration from wave action than the lake and less dilution capacity.

The project would not affect floodplains located at a distance from the study area, since the only floodplains downstream are those associated with Mercer Slough and Lake Washington. Because the elevation of Mercer Slough and Lake Washington are controlled entirely by operation of the at the Hiram

Chittendon Locks, floodplains of these water bodies would be unaffected by changes in discharge from the study area.

## Did we consider potential cumulative effects for this discipline?

We evaluate cumulative effects for this discipline in a separate Cumulative Effects Analysis Discipline Report. That report discusses cumulative effects for this project in the areas of Air Quality, Surface Water, Fish and Aquatic Habitat, and Wetlands. We determined that a cumulative effects analysis for other disciplines was unnecessary for this project.

# Measures to Avoid or Minimize Project Effects

## What will we do to avoid or minimize adverse effects of the project on surface waters, floodplains, and water quality?

The project will not encroach upon any floodplain areas. The project will avoid direct physical changes to streams and floodplains by utilizing existing stream crossing structures with the exception of culvert replacements, which will maintain channel capacity, and will have only localized temporary water quality effects associated with construction.

WSDOT has designed stormwater detention and treatment facilities that will minimize adverse effects to stormwater discharge quantity and quality. The stormwater facilities will treat at least 100 percent of the new impervious surface area in each TDA for water quality. As a result, the quality of the stormwater discharged will have a slightly increased amount of pollutants. In addition, stormwater ponds will provide flow control, except where the project discharges directly to Mercer Slough (TDAs D and E).

Typical stream in the study area

## What will we do to minimize construction effects?

Because the project will disturb an area greater than 5 acres of soil, WSDOT must apply for an NPDES construction permit. This permit requires development of the following:

- Temporary Erosion and Sediment Control Plan (TESC)
- Spill Prevention Control and Countermeasures Plan (SPCCP)

The TESC will include BMPs to address the issues of source control, flow control, and treatment. BMPs will be site-specific and will probably include the following (in addition to those listed in Appendix A):

- Installing check dams in drainage ditches to reduce velocity and allow fine sediment to settle.
- Installing inlet protection filters to keep sediment from entering storm drains.
- Installing bypass drains for steep slopes.
- Timing culvert replacements to coincide with seasonal low-flow periods.
- Diverting streams temporarily and isolating culvert replacements from stream flow to minimize discharge of sediment associated with culvert replacement.

## How will we mitigate for unavoidable adverse effects?

Most potential adverse effects to surface water and water quality, and all potential effects to floodplains will be avoided or reduced to an insubstantial effect.

Because stormwater treatment can only remove a percentage of the total pollutant load, any increase in pollutant-generating surfaces (impervious road areas) will result in some residual increase in pollutant load. We mitigate this condition by designing stormwater detention and treatment systems to treat 17 percent more area than the new impervious surface area. By treating a greater area, we ensure pollutant removal from a portion of the existing impervious road area as well as from the new impervious surface areas. The result is that we will maintain flow conditions where required and will likely reduce the quantity of suspended solids discharged.

Additional travel lanes will immediately benefit local residents, commuters, transit riders, and freight haulers.

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# Appendix A

Avoidance and Minimization Measures

# Avoidance and Minimization Measures

The following sections describe the established design and construction practices that WSDOT will include to avoid or minimize effects to the various environmental resources during both the construction and operation phases of the project.

## Project Measures to Avoid or Minimize Effects During Construction

Design elements, such as modifications to boundaries of areas that can be affected, have been incorporated into the project specifications, construction plans, and procedures, to help avoid or minimize most potential construction impacts.  When appropriate, monitoring will be conducted to ensure that these design and construction measures are effective.

### Measures for Geology, Soils, and Groundwater

- WSDOT will prepare and implement a Temporary Erosion and Sedimentation Control (TESC) plan consisting of operational and structural measures to control the transport of sediment.  Operational measures include removing mud and dirt from trucks before they leave the site, covering fill stockpiles or disturbed areas, and avoiding unnecessary vegetation clearing.  Structural measures are temporary features used to reduce the transport of sediment, such as silt fences and sediment traps.
- WSDOT will reduce degradation of moisture-sensitive soils by limiting major earthwork to the drier, late spring through early fall construction season; by maintaining proper surface drainage to avoid ponding of surface water or groundwater; by minimizing ground disturbance through limiting the use of heavy equipment, limiting turns, and/or not tracking directly on the subgrade; and by covering the final subgrade elevation with a working mat of crushed rock and/or geotextile for protection.  Mixing a soil admix such as cement into the subgrade may also add strength and stabilize the ground.
- WSDOT will determine acceptable limits for off-site construction-related ground vibration before construction begins and demonstrate that off-site ground vibrations are within the limits set for the project through the use of vibration-monitoring equipment.
- WSDOT will identify areas subject to shaking from a large earthquake and will mitigate risks using ground modifications or other procedures identified in the WSDOT Geotechnical Design Manual.
- WSDOT will implement construction procedures identified in the geotechnical investigation to maintain or enhance slope stability in areas potentially underlain by landslide-prone soils.
- WSDOT will protect the Kelsey Creek aquifer from contamination by construction-related spills by development and implementation of BMPs and a Spill Prevention Control and

Countermeasures plan (SPCCP). The SPCC will specifically address fuel spills from vehicles and from spills of other chemicals commonly transported over I-405. Spill response equipment will be located at regular and specified intervals within the project area for minimizing countermeasure response times.

- WSDOT will ensure only clean fill is imported and placed for the project and will require documentation for fill brought onto the site from the supplier certifying that the fill does not exceed Washington State soil cleanup standards. If documentation is not available, testing of imported fill soils will be required prior to placement. Suspect soils encountered during project construction will be tested and, where necessary, removed from the site and disposed of in accordance with Washington State regulations.
- WSDOT will identify and develop staging areas for equipment repair and maintenance away from all drainage courses. Washout from concrete trucks will not be dumped into storm drains or onto soil or pavement that carries stormwater runoff. A wash down area for equipment and concrete trucks will be designated and the use of thinners and solvents to wash oil, grease, or similar substances from heavy machinery or machine parts will be prohibited.
- WSDOT will obtain a NPDES (National Pollutant Discharge Elimination System) permit and will conduct a regular program of testing and lab work to ensure that water encountered during construction meets the water quality standards specified in the NPDES permit.
- WSDOT will to meet the NPDES water quality standards prior to the discharge of the encountered water to a surface water body, such as Kelsey Creek. If necessary, water quality will be improved, such as by using sediment ponds to allow sediment to settle out prior to discharge.
- If it is necessary to install seepage drains to control seepage for retaining walls and fill embankments, WSDOT will include special provisions in the design to discharge drain flow back into affected areas, including wetlands.

## Measures for Water Quality

In addition to measures for geology, soils, groundwater, and for hazardous materials that are protective of water quality, the following measures would be implemented for water quality.

- WSDOT will identify and develop staging areas for equipment repair and maintenance away from all drainage courses.
- Washout from concrete trucks will not be dumped into storm drains or onto soil or pavement that carries stormwater runoff.
- Thinners and solvents will not be used to wash oil, grease, or similar substances from heavy machinery or machine parts.
- WSDOT will designate a wash down area for equipment and concrete trucks.

## Measures for Wetlands

- WSDOT will protect, preserve, and enhance wetlands in the project area during the planning, construction, and operation of transportation facilities and projects consistent with USDOT Order 5660.1A, Executive Order 11990, and Governor's Executive Orders EO 89-10 and EO 90-04.
- WSDOT's project-level design and environmental review has included avoidance, minimization, restoration, and compensation of wetlands. WSDOT will implement these measures prior to or concurrent with adverse effects on wetlands, to reduce temporal losses of wetland functions.
- WSDOT will follow guidance contained in the wetlands section of the WSDOT Environmental Procedures Manual (WSDOT 2004a), which outlines the issues and actions to be addressed prior to authorizing work that could affect wetlands.
- WSDOT will use high-visibility fencing to clearly mark wetlands to be avoided in the construction area.

## Measures for Upland Vegetation and Wildlife

- WSDOT will ensure mitigation measures established in the I-405 Corridor EIS will be implemented on the Bellevue Nickel Improvement Project.
- WSDOT will prepare and implement a revegetation plan. In addition, areas with mixed forest will not be removed for temporary use (i.e., construction staging). If an area of mixed forest must be removed for roadway construction, it will be replaced with plantings of native tree and shrub species within the affected area.
- WSDOT will adhere to project conditions identified in the Biological Assessment and agency concurrence letters.
- WSDOT will limit construction activity to a relatively small area immediately adjacent to the existing roadway to minimize vegetation clearing and leave as many trees as possible.

## Measures for Fisheries and Aquatic Resources

- WSDOT will implement construction BMPs (such as silt fencing or sedimentation ponds) to avoid disturbing sensitive areas during the development and use of any staging areas, access roads, and turnouts associated with resurfacing activities.
- WSDOT will not allow in-water work to occur except during seasonal work windows established to protect fish.
- WSDOT will require that all stormwater treatment wetland/detention facilities are sited and constructed at a sufficient distance from named and unnamed streams so no grading or filling in the streams or the streamside zones will be required.

## Measures for Air Quality

- WSDOT will require preparation and implementation of a Fugitive Dust Control Plan in accordance with the Memorandum of Agreement between WSDOT and PSCAA Regarding Control of Fugitive Dust from Construction Projects (October 1999).
- During dry weather, exposed soil will be sprayed with water to reduce emissions of and deposition of particulate matter ($PM_{10}$).
- WSDOT will provide aequate freeboard (space from the top of the material to the top of the truck), cover truckloads, and, in dry weather, wet materials in trucks to reduce emission of and deposition of particulate matter during transport.
- WSDOT use wheel washers to remove particulate matter that would otherwise be carried offsite by vehicles to decrease deposition of particulate matter on area roadways.
- WSDOT will remove particulate matter deposited on public roads to reduce mud on area roadways.
- WSDOT will cover or spray with water any dirt, gravel, and debris piles during periods of high wind when the stockpiles are not in use to control dust and transmissions of particulate matter.
- WSDOT will route and schedule construction trucks to reduce travel delays and unnecessary fuel consumption during peak travel times, and therefore reduce secondary air quality impacts (i.e. emissions of carbon monoxide and nitrogen oxides) that result when vehicles slow down to wait for construction trucks.

## Measures for Noise

- Noise berms and barriers will be erected prior to other construction activities to provide noise shielding.
- The noisiest construction activities, such as pile driving, will be limited to between 7 AM and 10 PM to reduce construction noise levels during sensitive nighttime hours.
- Construction equipment engines will be equipped with adequate mufflers, intake silencers, and engine enclosures.
- Construction equipment will be turned off during prolonged periods of nonuse to eliminate noise.
- All equipment will be maintained appropriately and equipment operators will be trained in good practices to reduce noise levels.
- Stationary equipment will be stored away from receiving properties to decrease noise.
- Temporary noise barriers or curtains will be constructed around stationary equipment that must be located close to residences.
- Resilient bed liners will be required in dump trucks to be loaded on site during nighttime hours.

- WSDOT use Occupational Safety and Health Administration (OSHA)-approved ambient sound-sensing backup alarms that would reduce disturbances during quieter periods.

## Measures for Hazardous Materials

### Known or Suspected Contamination within the Build Alternative Right of Way

- WSDOT will prepare an SPCCP that provides specific guidance for managing contaminated media that may be encountered within the right of way (ROW).
- WSDOT may be responsible for remediation and monitoring of any contaminated properties acquired for this project. WSDOT will further evaluate the identified properties before acquisition or construction occurs. Contamination in soils will be evaluated relative to the Model Toxics Control Act (MTCA).
- If WSDOT encounters an underground storage tank (UST) within the ROW, WSDOT will assume cleanup liability for the appropriate decommissioning and removal of USTs. If this occurs, WSDOT will follow all applicable rules and regulations associated with UST removal activities.
- WSDOT will conduct thorough asbestos-containing material/lead paint building surveys by an Asbestos Hazard Emergency Response Act (AHERA)-certified inspector on all property structures acquired or demolished. WSDOT will properly remove and dispose of all asbestos-containing material/lead-based paint in accordance with applicable rules and regulations.
- Construction waste material such as concrete or other harmful materials will be disposed of at approved sites in accordance with Sections 2-01, 2-02, and 2-03 of the WSDOT Standard Specifications.
- WSDOT may acquire the responsibility for cleanup of any soil or groundwater contamination encountered during construction (that must be removed from the project limits) within WSDOT ROW. Contamination will be evaluated relative to Model Toxics Control Act (MTCA) cleanup levels.
- WSDOT will consider entering into pre-purchaser agreements for purpose of indemnifying itself against acquiring the responsibility for any long-term cleanup and monitoring costs.
- All regulatory conditions imposed at contaminated properties (e.g., Consent Decree) associated with construction will be met. These conditions could include ensuring that the surrounding properties and population are not exposed to the contaminants on the site: i.e., WSDOT will ensure that the site is properly contained during construction so that contaminants do not migrate offsite, thereby protecting the health and safety of all on-site personnel during work at the site.

### Known or Suspected Contamination Outside of the Right of Way

- Contaminated groundwater originating from properties located up-gradient of the ROW could migrate to the project area. WSDOT generally will not incur liability for groundwater contamination that has migrated into the project footprint as long as the agency does not acquire the source of the contamination. However, WSDOT will manage the contaminated media in accordance with all applicable rules and regulations.

### Unknown Contamination

- If unknown contamination is discovered during construction, WSDOT will follow the SPCCP as well as all appropriate regulations.

### Worker and Public Health and Safety and other Regulatory Requirements

The WSDOT will comply with the following regulations and agreements:

- State Dangerous Waste Regulations (Chapter 173-303 WAC);
- Safety Standards for Construction Work (Chapter 296-155 WAC);
- National Emission Standards for Hazardous Air Pollutants (CFR, Title 40, Volume 5, Parts 61 to 71);
- General Occupational Health Standards (Chapter 296-62 WAC); and
- Implementing Agreement between Ecology and WSDOT Concerning Hazardous Waste Management (April 1993).

### Hazardous Materials Spills During Construction

- WSDOT will prepare and implement a SPCCP to minimize or avoid effects on human health, soil, surface water and groundwater.

## Measures for Traffic and Transportation

- WSDOT will coordinate with local agencies and other projects to prepare and implement a Traffic Management Plan (TMP) prior to making any changes to the traffic flow or lane closures. WSDOT willl inform the public, school districts, emergency service providers, and transit agencies of the changes ahead of time through a public information process. Pedestrian and bicycle circulation will be maintained as much as possible during construction.
- Prior to and during construction, WSDOT will implement strategies to manage the demand on transportation infrastructure. These transportation demand management strategies will form an important part of the construction management program and will be aimed at increasing public awareness and participation in HOV travel. The major focus will be on expanding vanpooling and van-share opportunities. Other elements of the transportation demand management plan may include:
    - increased HOV awareness and public information, and
    - work-based support and incentives.

## Measures for Visual Quality

- WSDOT will follow the I-405 Urban Design Criteria. Where the local terrain and placement of light poles allow, the WSDOT will reduce light and glare effects by shielding roadway lighting and using downcast lighting so light sources will not be directly visible from residential areas and local streets.
- WSDOT will restore (revegetate) construction areas in phases rather than waiting for the entire project to be completed.

## Measures for Neighborhoods, Businesses, Public Services and Utilities

- WSDOT will prepare and implement a transportation management plan (TMP). If local streets must be temporarily closed during construction, WSDOT will provide detour routes clearly marked with signs.
- WSDOT will coordinate with school districts before construction.
- WSDOT will implement and coordinate the TMP with all emergency services prior to any construction activity.
- WSDOT will coordinate with utility providers prior to construction to identify conflicts and resolve the conflicts prior to or during construction. Potential utility conflicts within WSDOT ROW will be relocated at the utility's expense prior to contract award.
- WSDOT will prepare a consolidated utility plan consisting of key elements such as existing locations, potential temporary locations and potential new locations for utilities; sequence and coordinated schedules for utility work; and detailed descriptions of any service disruptions. This plan will be reviewed by and discussed with affected utility providers prior to the start of construction.
- WSDOT will field verify the exact locations and depths of underground utilities prior to construction.
- WSDOT will notify neighborhoods of utility interruptions by providing a scheduled of construction activities in those areas.
- WSDOT will coordinate with utility franchise holders and provide them with project schedules to minimize the effects of utility relocations (for example, equipment procurement times, relocation ahead of construction, etc.)
- WSDOT will notify and coordinate with fire departments for water line relocations that may affect water supply for fire suppression, and establish alternative supply lines prior to any breaks in service; and to ensure that fire departments can handle all calls during construction periods and to alleviate the potential for increased response times.
- WSDOT will notify and coordinate with police departments to implement crime prevention principles and to ensure that they have adequate staffing to provide traffic and pedestrian control.

- WSDOT will maintain access to businesses throughout the construction period through careful planning of construction activities and an awareness of the needs to provide adjacent properties with reasonable access during business hours. As part of construction management, WSDOT will prepare access measures. WSDOTT will make provisions for posting appropriate signs to communicate the necessary information to potential customers.
- WSDOT will keep daytime street closures to a minimum to provide access for businesses during regular business hours.

### Measures for Cultural Resources

- WSDOT will prepare an Unanticipated Discovery Plan for the project that WSDOT will follow. This will avoid or minimize unanticipated effects to historic, cultural, and archaeological resources.

## Project Measures to Avoid or Minimize Effects During Project Operation

The following sections describe the measures that WSDOT will implement during project operation.

### Measures for Surface Waters and Water Quality

- WSDOT will follow the Highway Runoff Manual for both the design and implementation of stormwater facilities. WSDOT is not required to manage flow where drainage is directly to Mercer Slough. Where drainage is to a tributary to Mercer Slough, WSDOT will construct a stormwater management system that does provide flow control.

### Measures for Fisheries and Aquatic Resources

- WSDOT will compensate for adverse effects to fish habitat and aquatic resources by providing in-kind mitigation. This in-kind mitigation will take the form of on-site, off-site, or a combination of on- and off-site mitigation.
- Off-site mitigation could include planting native riparian vegetation outside of the study area in areas where restoring native riparian buffers may have a greater benefit to fish and aquatic species. Mitigation could be concentrated along streams with high fish use where important stream processes and functions related to riparian buffers (for example, large woody debris [LWD] recruitment levels, litter fall, and bank stabilization) are impaired.
- On-site/off-site mitigation could include installing in-stream habitat features (for example, boulders or LWD) in the streambed downstream of the project footprint to increase the habitat complexity of the affected waterbody.

- Ongoing maintenance (during and post-construction) of stormwater treatment and detention facilities by WSDOT will not include the application of any chemical weed control agents (e.g., herbicides).

## Measures for Upland Vegetation and Wildlife

- WSDOT will replace areas of mixed forest that will be permanently removed for roadway construction with plantings of native tree and shrub species within the affected area.

# Appendix B

## Summary of Surface Water and Floodplain Regulations

# Summary of Surface Water and Floodplain Regulations

- Bellevue City Code (9.12 and 20.25) governs sensitive areas and the protection of water quality and flood carrying capacity.  In order to comply with Bellevue City Code (and other regulations), WSDOT has, as part of this project, included stormwater design features to prevent pollution of surface water or alteration of flood carrying capacity.

- The WSDOT Highway Runoff Manual (HRM) (WSDOT 2004b) includes the technical requirements for protecting downstream properties from adverse effects, controlling flow, preventing erosion and sedimentation, maintaining drainage features, and controlling water quality.  The manual is in compliance with state and local guidance and requirements for surface water management.

- King County Code Section 21A.24.230-260.  This code section includes regulated floodplains and floodways.  Section 21A.24.240 requires new development to not reduce effective base flood storage volume, and Section 21A.24.250 requires new development to not cause a measurable (0.01 foot) rise in base flood elevation.

- National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater Permit. WSDOT has applied to Ecology for an NPDES Phase II Municipal Stormwater Discharge Permit that will cover discharges from the I-405 project area as well as other roadways that WSDOT manages.  This permit will require WSDOT to construct permanent facilities to treat stormwater runoff for quality and quantity wherever we increase roadways by 5,000 square feet or more.

- NPDES Construction General Permit.  The general construction NPDES permit that Ecology administers will authorize ground-disturbing construction for this project.  This permit regulates activities where at least 5 acres of ground are disturbed for construction.

- Clean Water Act, Section 401 Water Quality Certification.  Projects that include excavation or filling in wetlands, streams, or other surface waters require certification from Ecology that the activities comply with federal and state discharge and aquatic resource protection requirements.  This certificate is designed to ensure that these activities do not degrade aquatic resources.

- Hydraulic Project Approval (HPA).  The Washington State Hydraulic Code Rules (WAC 220-110) specify that an HPA permit is required for "…construction or performance of other work that will use, divert, obstruct, or change the natural flow or bed of any of the salt or fresh waters of the state."  Modifications of stream crossings and new stormwater discharges to streams require an HPA permit.

- State Water Quality Standards.  Washington State water quality standards (WAC 173-201A) describe the beneficial uses for surface waters and set standards for physical and chemical properties of those waters to attain those beneficial uses.  Water quality standards address maximum concentrations of toxic substances.  They also consider turbidity, suspended solids, nutrient concentrations; and appropriate ranges for temperature and acidity.

- Environmental Commitments made under I-405 EIS.  WSDOT has committed to a number of environmental measures related to the protection of aquatic resources.  These include specific measures to prevent water quality degradation, which we discuss in the report's Measures to Avoid or Minimize Project Effects section, and a general commitment to provide water quality detention and treatment from existing impervious surfaces where feasible.

# Appendix C

Washington State Department of Ecology, Letter of Concurrence (June 2005) in Response to Washington State Department of Transportation Petition Letter for Exempted Discharge to Mercer Slough (March 2005)

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
*Northwest Regional Office • 3190 160th Avenue SE • Bellevue, Washington 98008-5452 • (425) 649-7000*

June 15, 2005

RECEIVED
JUN 22 2005
URBAN CORRIDO...

Mr. Alan D. Black, P.E.
I-405 Project Office
600 – 108th Ave NE, Suite 405
Bellevue WA 98004

Dear Mr. Black:

**Re: I-405; I-90 to SE 8th, Bellevue Nickel Project – Detention requirements for Stormwater Design**

I am writing to concur with your request on behalf of the WSDOT to forego requirements for stormwater detention (flow rate control) for new pavement areas that discharge into Mercer Slough for this project. I have conferred with Kim Harper, Ecology's wetland specialist, regarding this request. We agree that detention is not necessary because the discharge is to a wetland area directly associated with Lake Washington, a flow control-exempt water body. The wetland area water level matches the lake water level, so water level in the wetland is regulated by operations at Hiram J. Chittendon Locks. Stormwater detention is not necessary for discharges to Mercer Slough for this project.

Your submittal entitled "Stormwater Design Exempted Discharge (No Detention) to Mercer Slough I-405 Bellevue Nickel & Implementation Projects" (March, 2005) provides appropriate background for Ecology's concurrence. Ecology staff reviewed this design in terms of the project discharging to a wetland and a flow control-exempt water body (per Ecology's Stormwater Management Manual for Western Washington Appendix I-E). Requirements for analysis of the impacts of the new discharge on the hydrological characteristics of the wetland are not relevant in this situation because of existing human manipulation of water levels in the lake. Stormwater detention facilities would be of no benefit due to the water level regulation on Lake Washington at the locks.

Project design should evaluate the potential for the increased flow rates from the project to cause scour at the existing outfalls. Provide appropriate remedy if needed in coordination with the City of Bellevue. Project design should provide all required quality treatment (pollutant removal) measures to the discharge. Please contact me at (425) 649-7215 to answer questions or for further assistance.

Sincerely,

Gerald Shervey

Gerald Shervey, P.E.
Water Quality Engineer
NWRO Water Quality Section

GERALD A. SHERVEY
STATE OF WASHINGTON
28627
REGISTERED PROFESSIONAL ENGINEER
EXPIRES 6-7-06

GS:gs:cu

cc: Christina Martinez -WSDOT MAPT
Rebecca Ponzio – WDOE MAPT
Kim Harper – WDOE MAPT

**INTERSTATE 405 Project Team**
Congestion Relief & Bus Rapid Transit Projects

600 – 108th Avenue NE, Suite 405
Bellevue, WA 98004
Main 425-456-8500
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# Stormwater Design
# Exempted Discharge (No Detention) to Mercer Slough
# I-405 Bellevue Nickel & Implementation Projects

## March 2005

Washington State
Department of Transportation

## Introduction

The purpose of this paper is to provide background information relevant to a petition and design decision to allow direct I-405 drainage discharge without flow control to Mercer Slough for the I-405 Bellevue Section Nickel and Implementation Projects. Petitions to seek exemptions in additional geographic areas (beyond those already permitted) can be submitted to DOE for consideration. Such a petition is required to justify the proposed exemption based upon a hydrologic analysis demonstrating that the potential stormwater runoff from the exempted area will not significantly increase the erosion forces on the stream channel nor have near-field impacts.

The WSDOT Highway Runoff Manual and the Washington State Department of Ecology (DOE) Stormwater Management Manual for Western Washington state the objective of flow control is to prevent increases in the stream channel erosion rates beyond those characteristic of natural or reestablished conditions. The intent is to prevent cumulative future impacts from increased stormwater runoff volumes and flow rates on streams. In suburban and the developing urban fringe portions of western Washington, the intent also includes mitigating impacts of prior development and/or flow modifications.

To protect stream channels from increased erosion, it is necessary to control the durations over which a stream channel experiences geomorphically significant flows such that the energy imparted to the stream channel does not increase significantly. Geomorphically significant flows are those that are capable of moving bank and bedload sediments. This is typically done using flow control best management practices such as infiltration and detention storage.

However, flow control is not required for all discharges to surface waters, because it is not always needed to protect stream morphology. The WSDOT and DOE stormwater manuals include a list of exempted water bodies where direct discharge without flow control is allowable. Lake Washington is included on the list of exempted water bodies. Mercer Slough is an arm of Lake Washington, being a backwater of the lake and having the same surface controls as the main lake area.

Mercer Slough extends to I-405 at the upstream end where the Slough is the outlet for the existing highway drainage. The I-405 Bellevue Nickel and Implementation Projects are adding additional impervious area that will increase both the total volume and peak flow rate of the highway runoff to Mercer Slough. However, the hydraulic conditions of the Slough are controlled by the backwater conditions of Lake Washington, such that the discharge increase to the Slough would have minimal effects on the erosion forces and are geomorphically insignificant.

This paper will review the historical background and provide basic calculations to show why Mercer Slough is appropriate for consideration as an extension of Lake Washington, and should be an exempted water body for purposes of the I-405 project storm drainage design for flow control.

## Background

The City of Bellevue describes Mercer Slough as a designated shoreline of statewide significance under the state's Shoreline Management Act. It is a large-volume water body connected to Lake Washington with very low gradient, slow flows, and a large volume of water with extensive surrounding wetland habitat. This water body remains free of piped sections. Mercer Slough remains free of culverts and has a drainage to open channel ratio of 5, considered a moderate level of watershed alteration (see page 22, Section 5.1.2.1, Bellevue Critical Areas Update, Streams Inventory, March 2003)

Mercer Slough was originally a protected bay of Lake Washington that extended back to where the railroad trestle across Mercer (Kelsey) Creek exists today. The Slough was used for the assembly of log booms and lumber rafts for a local sawmill from the late 1800's to when the lake was lowered (8 to 9 feet) by the construction of the Lake Washington to Puget Sound ship canal in 1916. This lowering of the lake level exposed major portions of the former lake bottom in the upper Slough area, leaving large wetland areas. These wetlands were then drained for agriculture purposes by dredging drainage channels in the 1930s. The Slough and wetland system was further altered by the construction filling for I-90 and I-405 in the 1940s and 1950s. Additional channel dredging for the Bellefields Office Park and Metro Park and Ride developments in the 1970s resulted in the Slough and adjacent wetland configuration that exists today. See the attachments for an aerial photo and portion of USGS Contour map for location and layout of the present day Mercer Slough area.

Mercer Slough today is a system of dredged channels and adjacent wetlands where the main channel extends from Lake Washington about 1.75 miles in a northeasterly direction to intercept with I-405 at approximate milepost 12.71, at the upstream end of the backwater portion of the Slough. The upper end of Mercer Slough is an outlet for Mercer Creek (the lower end of Kelsey Creek drainage basin) which crosses I-405 at this location in a combined structure consisting of a 10' x 4' box and a 141" dia. tunnel liner plate that is joined to a 132" dia. steel structural plate pipe (see attached photos of the upstream and downstream end of the I-405 Mercer Creek culverts and fish ladder).

Sturtevant Creek is another named tributary of the Slough. It flows in a southerly direction generally parallel to I-405 to a confluence with the Slough about 400 feet downstream of the Mercer Creek/I-405 culverts. The main channel of Mercer Slough is 50 to 60 feet wide and varies from 2 to 8 feet deep depending on location and the level of the lake. The Lake Washington water surface is manually controlled at the Hiram J. Chittendon Locks and varies between elevation 16.7' in winter and elevation 18.7' in summer (NAVD 88 Datum)

## Hydraulic Conditions

**Existing Condition Hydrology:** Mercer Creek (including Kelsey Creek, the principle tributary) drains 7,680 acres, of which about 2,150 acres are currently impervious surface. Sturtevant Creek drains an area of 442 acres, of which 313 acres are currently impervious surfaces. Another 1,375 acres drains directly into the Slough itself (from both the east and west sides), which includes 481 acres of impervious area and 367 acres of directly connected wetlands (taken from: WSDOT Hydraulic Report, I-405 / Bellevue Access, SE 8$^{th}$ St. Access Improvements, Bellevue downtown Access Improvements, dated March 2001, by Parson Brinckerhoff PBP Engineering and from the King County Webb Site for WIRA 8).

The USGS maintains a gauge on Mercer (Kelsey) Creek, located immediately upstream of the I-405 culvert crossing. King County has incorporated the USGS readings into their Hydrologic Web Site, where long term records show that for 47 years of record the mean flow in Mercer (Kelsey) Creek is 23 cfs, with a peak recorded discharge of 832 cfs occurring on Jan 18, 1986. Per King County, this 832 cfs is statistically equivalent to an 84.14-year storm, where the100-year storm is projected to be about 843 cfs. The 100-yr peak storm flow for Sturtevant Creek is 288 cfs per recent study summarized in a memorandum to City of Bellevue from R. W. Beck dated October 16, 2004. The additional drainage area surrounding the Slough itself will produce another 190 cfs in peak runoff during the 100-year storm. These flows, simply totaled provide a peak flow estimate of about 1,320 cfs for the 100-yr storm in the main Mercer Slough channel.

From observation (see attached pictures of the footbridge which is located close to the Slough mouth near Lake Washington), the summer Slough levels are at the same level as Lake Washington, which is at the top of the natural bank in the Slough. Any storm flows will immediately spill over the bank spreading out into the adjacent wetlands. The flood storage provided by the adjacent wetlands helps to attenuate the peak storm flows without much of a rise in the Slough water level. Even in winter, when the Lake Washington level is 2 feet lower, this same attenuation will occur for larger storm events due to the comparably minor amount of storage in the channel relative to the amount of runoff volume and available storage within the wetland.

This attenuation by the Slough area was discussed in a US Department of the Interior, Geological Survey (USGS) letter dated November 12, 1969, as included in a WSDOT drainage report for the I-405 Kelsey Creek culvert upgrade approved in September of 1970. The USGS letter included calculations showing an extended flow area through the wetlands adjacent to the main channel with large increase in flow capacity with little rise in elevation.

**Existing Hydraulics:** The development of a detailed hydraulic analysis for the Slough using detailed runoff and flow modeling is beyond the scope of this paper. However, the Slough hydraulic response to a large storm event can be generally estimated. This analysis can then be used for comparison of the proposed project additional discharge, as follows:

- Assumptions: The main channel is a ‘U’ type shape with almost vertical side-slopes in the peat type soil. The channel averages 50’ wide x 5’ deep with a Manning’s ‘n’ value = 0.035.

- As flows through the I-405 culvert increase, the depth of flow is influenced by backwater from the lake and will increase to over-top the normal channel bank and spread out into the wetlands (for example a 2’ depth over the bank will spread an average width of about 560 feet). Assume a Manning’s ‘n’ value = 0.15 for the shallow flow through the brush and grass in the wetland. Assume the peak 100-year flow rate is 832 cfs at the outlet of the I-405 Kelsey Creek culverts, 1,130 cfs downstream of the Sturtevant Creek entrance and 1,320 cfs for the lower section of Mercer Slough.

- Existing survey data shows that the I-405 culvert outlet flow-line is at elevation 17.20 ft., which was designed to match the average lake level (between elevation 16.7 ft. in winter and elevation 18.7 ft. in summer, NAVD 88 Datum). The Slough is generally 3 feet deep at I-405 and more than 8 feet deep where it flows under I-90. The longitudinal slope of the Slough flow-line is estimated at 0.053 percent (5 ft. drop over 9,450 ft. length) but the water surface grade is even flatter due to the backwater effects of Lake Washington.

- Resultant Flow Condition: Using the basic Manning’s Equation for open channel flow with the above channel configuration and ‘n’ values requires an overall hydraulic gradient of about 0.042 percent (0.00042 foot per foot) where the average depth of flow is a little over 2 feet above the normal channel banks flooding out into the adjacent wetlands. For this condition, the flow velocity is 0.3 feet per second through the wetlands and about 3.0 feet per second in the main channel to the Lake.

- Conclusion: Although not a detailed analysis, the resultant flow condition shows that the Slough wetlands effectively act as a large detention buffer for the Sturtevant Creek and Kelsey Creek drainage basins outlet to Lake Washington. The ability for the larger storm events to spread out over the wetlands acts as detention storage with a large flow area where both the main channel and wetland flow velocities are well under erosive conditions. This is true even for extreme events such as the 100-yr storm.

  Observation of the main Mercer Slough channel shows it to be stable, which would support the calculations in that there have been several large storm events occurring in recent history. These events have also occurred since the intense urbanization of the Slough watershed, with large increases in impervious areas since the 1960’s. In summary, the main Mercer Slough channel is a dredged feature which acts as a manmade conveyance channel for the Bellevue urban area drainage systems and appears to be stable for the existing urban, high impervious percentage runoff conditions.

**Comparison of Impacts to Mercer Slough due to the I-405 Corridor Improvements:** The I-405 Corridor in the vicinity of the SE 8th Street interchange currently discharges through storm drains to Mercer Slough. The drainage proposal for the I-405 Bellevue Nickel and Implementation Projects would be to provide water quality treatment for runoff from the new pavement areas prior to direct discharge through these existing outlets to Mercer Slough.

The existing I-405 pavement area that drains into Mercer Slough is about 9.54 acres. The Bellevue Nickel Project will be adding 1.00 acre of impervious area. The Implementation Project will add another 5.02 acres for a total new impervious area of 6.02 acres. The proposed I-405 pavement area that will contribute to the Mercer Slough drainage basin at the completion of the anticipated Implementation Project is 15.6 acres (9.54 + 6.02 = 15.56 acres). This represents about 0.16 percent of the overall Mercer Slough drainage area with the new impervious area adding about 0.06 percent impervious area, or an increase in impervious area of 0.20 percent within the basin.

Without flow control, the additional peak flow produced by this new I-405 corridor impervious area will about 12.5 cfs for the 100-yr storm. This estimate is a 0.95 percent increase to the Mercer Slough peak flow for this storm. This increase in peak flow will have negligible effects on the Mercer Slough flow regime, where the calculated changes to the hydraulic gradient, bank spillover depth to the wetlands and flow velocities would be insignificant.

**Hydraulic Condition - Previous Acceptance:** The City of Bellevue has determined that the surface elevation of Mercer Slough is the same as that of Lake Washington. As such, direct discharge to the Slough satisfies City Code Section 24.06.130E, Section 3.c. where runoff control is provided if the 100-year storm runoff is conveyed directly from the site to Lake Washington (confirmed in a letter from the City of Bellevue to WSDOT regarding the I-405 / Bellevue Access, SE 8th St. Access Project, dated June 5, 2000. Attached is a copy of the letter for reference).

This City of Bellevue confirmation is further supported by an earlier WSDOT Drainage Report for *SR-405 Bellevue: Factoria to Midlakes Wilburton Culverts*, dated September, 1970. This report recommended an additional 10’ diameter culvert be added to the then existing 10’ x 4’ concrete box culvert under I-405. This report set the proposed culvert invert level based on a design tailwater per the criteria at that time. The tailwater assumed that Mercer Slough would be the same elevation as Lake Washington for the normal condition.

## Summary

The following items summarize the above discussion:

- The Mercer Slough water surface is controlled by the levels of Lake Washington. The size of the water body and flat slope of the main channel banks and bottom are such that the hydraulic gradient is virtually flat. Under storm conditions, the Slough main channel simply overtops and spreads out into the adjacent wetlands that are directly connected along the length of the Slough's main channel. The wetlands help to detain and attenuate the peak storm flows such that during even extreme events such as the 100-yr storm, the main channel hydraulic gradients are low and the velocities well below erosive conditions.

- The City of Bellevue has declared that direct discharge to Mercer Slough meets their code for flow control requirements up to and including the 100-yr storm. This is confirmed by previous I-405 hydraulic reports approved by King County and WSDOT where consultant and USGS calculations demonstrated design conditions using Mercer Slough as a backwater channel having the same elevations as Lake Washington.

- The increase in peak flow due to the I-405 Bellevue Nickel and Implementation Projects is negligible as far as hydraulic conditions are concerned. The natural overtopping of flows into the adjacent wetlands effectively prevents increases in the stream channel erosion.

- Direct discharge to Mercer Slough for the I-405 project appears to be the most realistic alternative where other flow control best management practices (BMPs) will be unworkable, or otherwise difficult and expensive to install. Typical infiltration BMPs will be unworkable in this drainage due to low permeable soils and high water tables. Other detention BMPs will be difficult to locate due to the limited availability of right-of-way through the developed Bellevue downtown area. Closed vaults could be installed, but they are expensive to construct and difficult to clean and maintain. Thus, direct discharge to Mercer Slough, where such discharge is insignificant to the Slough geomorphically, is the preferred alternative.

- Since Mercer Slough is a fish-bearing waterway, the I-405 project would be required to provide water quality treatment prior to direct discharge.

## Recommendation

Based on this paper's above discussion, a design decision should be approved to allow direct discharge of the I-405 Bellevue Nickel and Implementation Project drainage to Mercer Slough. This approval would consider Mercer Slough as an exempted water body for drainage flow control requirements.

Concurring Approvals:

Alan Black — Date: 5/24/05

Alex Nguyen — Date: 5/23/05

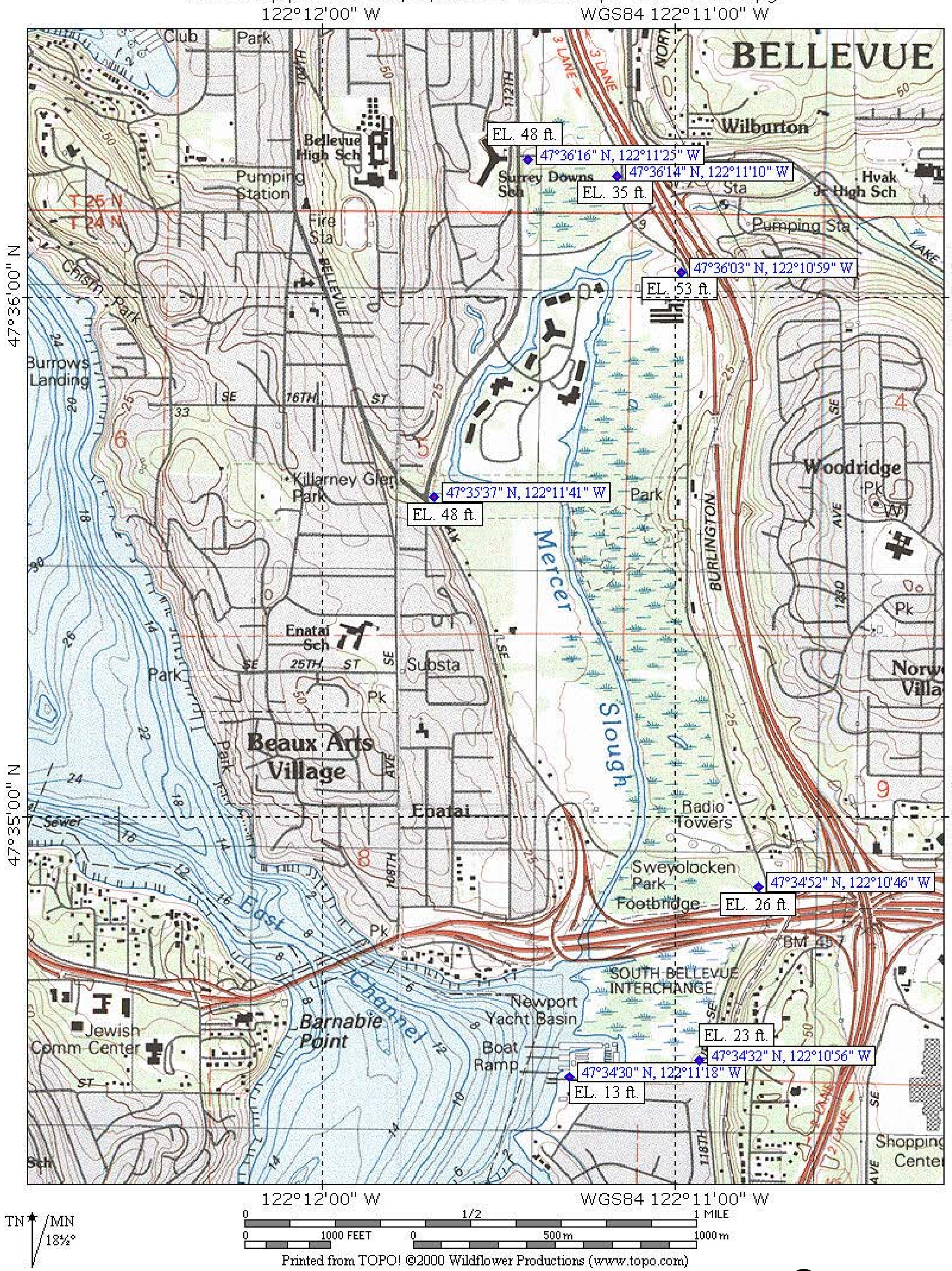
Matt Witecki — Date: 5/16/05

Attachments :

- Arial and Contour Maps
- City of Bellevue Letter dated June 5, 2000
- Photos of Mercer Slough near the Pedestrian Bridge
- Photos of Mercer Slough at each end of the Mercer Creek Culvert under I-405

**Mercer Slough, bordered by I-405 on the east, SE 8th on the north and I-90 on the south**

TOPO! map printed on 02/26/01 from "Seattlen.tpo" and "Untitled.tpg"

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Washington State Department of Transportation

City of Bellevue Post Office Box 90012 • Bellevue, Washington • 98009 9012

June 5, 2000

E. Robert Winter, P.E.
WA State Dept. of Transportation
Northwest Region
P.O. Box 330310
Seattle, WA 98133-9710

Re: I-405 @ SE 8th St.
Storm Runoff Control

Dear Mr. Winter:

The City of Bellevue's runoff control requirements are cited in City Code Section 24.06.130 E. Section 3.c. allows runoff control to be provided by conveying the 100-year storm from the site directly to Lake Washington. When this approach is used, the conveyance system must carry the 100-year, 24-hour design storm from the entire basin that drains to the system considering full development potential of that system.

On a previous project, the City determined that the surface elevation of Mercer Slough is the same as that of Lake Washington. As such, conveyance to the Slough as described above, will satisfy the runoff control requirement for the project.

If you have any questions please call me at 425-452-4855.

Sincerely,

Joy Steiner
Development Review Manager
Engineering Division
Utilities Department

cc: DeWitt Jensen
Parsons Brinkerhoff Quade & Douglas, Inc.
999 Third Avenue, Suite 220
Seattle, WA 98104-4020

Pete Paterson
Parsons Brinkerhoff Quade & Douglas, Inc.
999 Third Avenue, Suite 220
Seattle, WA 98104-4020

JS/jmk/D1-00-0165

**Mercer Slough Main channel near outlet (summer)**

**Mercer Slough Main channel near outlet (winter)**

**Mercer Ck. I-405 Culvert (upstream end)**

**Mercer Ck. I-405 Culvert (downstream end with fish ladder into Mercer Slough)**

**Mercer Ck. I-405 Culvert (downstream end showing fish ladder)**

**Mercer Slough (looking downstream of I-405 culverts)**

# Appendix D

Stormwater Loading Calculations

**Pollutant Loading Variables.**

**L** = Pollutant Loading (Pounds/year) = H x Pj x Rv x C x I x K

**H** = Annual Precipitation (feet/year) = 2.725

**Pj** = Proportion of precipitation generating runoff = 1. Although some storms are too small to generate runoff, we have assumed that Pj = 1 because pollutants are generally not mobilized during storms that do not generate runoff, and because this gives a more conservative estimate on pollutant loading than some smaller value.

**Rv** = Ratio of runoff to precipitation = 0.9. Rv is assumed to be 0.9 since such a large portion of the project area is impervious surface.

**C** = Pollutant concentration (mg/l) = various, see Pollutant Table below. These values are published pollutant concentrations from studies of urban runoff. For this study, we used highway runoff pollutant concentrations to assess runoff from the project area and new suburban runoff pollutant concentrations to assess runoff from other parts of the Mercer Slough drainage area.

I = Impervious surface area (acres)

**K** = A conversion factor to convert units from mg/l (pollutant concentration), and acres (impervious surface area) to units of pounds per drainage area per year (mg/l and acre/drainage to pounds/drainage) = 43560 x 62.42796 / 1000000 = 2.719

**Table D-1: Pollutant concentrations typical of Urban and Rural Highways and New Suburban Areas**

| | C (ppm) | | | | | |
|---|---|---|---|---|---|---|
| **Runoff Type** | **Total P** | **TKN** | **COD** | **Zn** | **TSS** | **Source** |
| Highway Runoff | | 2.72 | 124 | 0.38 | | Shuler 1987 |
| National Urban Runoff Average | 0.46 | | | | | |
| New Suburban Areas | 0.26 | 1.51 | 35.6 | 0.04 | | Shuler 1987 |
| Urban Highway Runoff | | | | | 295 | Driscoll et al 1990 |
| Rural Highway Runoff | | | | | 135 | Driscoll et al 1990 |

### Table D-2: Highway I-405 drainage and impervious surface areas

| Threshold Discharge Area (TDA) | TDA Area (acres) | Existing Impervious Area (Acres) | New Impervious Area (Acres) | Total Impervious Area Being Treated (Acres) | Treated Impervious Area as a Percentage of Post-Project Total Impervious |
|---|---|---|---|---|---|
| A | 4.54 | 4.07 | 0.26 | 0.2633 | 6.00% |
| B | 10.06 | 8.21 | 1.65 | 1.65 | 16.73% |
| C | 5.75 | 1.47 | 1.65 | 1.65 | 52.88% |
| D | 26.27 | 8.61 | 5.81 | 4.33 | 30.03% |
| E | 11.9 | 9.54 | 0.94 | 4.17 | 39.79% |
| F | 3.5 | 3.44 | 0.04 | 0.04 | 1.15% |
| Total | 62.02 | 35.34 | 10.35 | 12.10 | 26.48% |

### Table D-3: Mercer Slough sub-basin drainage and impervious surface areas

| Sub-Basin | Area (acres) | Existing Impervious Area (acres) | Existing % Impervious |
|---|---|---|---|
| Mercer Slough | 1,375 | 481 | 35% |
| Sturtevant Creek | 773 | 526 | 68% |
| Kelsey Creek | 2,816 | 1,183 | 42% |
| Richards Creek | 910 | 410 | 45% |
| East Creek | 459 | 220 | 48% |
| Sunset Creek | 890 | 392 | 44% |
| West Tributary | 1,001 | 440 | 44% |
| Goff Creek | 679 | 204 | 30% |
| Valley Creek | 1,391 | 445 | 32% |
| Sears Creek | 577 | 369 | 64% |
| Total | 10,871 | 4,670 | 43% |

### Table D-4: Pre-treatment pollutant loading estimates (lbs/year) for Bellevue I-405 TDAs – Existing Conditions

| | Existing – Pre-treatment | | | | |
|---|---|---|---|---|---|
| **TDA** | **Total P** | **TKN** | **COD** | **Zinc** | **TSS** |
| A | 12.49 | 73.83 | 3365.8 | 10.31 | 8007.4 |
| B | 25.19 | 148.93 | 6789.5 | 20.81 | 16152.6 |
| C | 4.51 | 26.67 | 1215.7 | 3.73 | 2892.1 |
| D | 26.41 | 156.19 | 7120.3 | 21.82 | 16939.5 |
| E | 29.27 | 173.06 | 7889.4 | 24.18 | 18769.2 |
| F | 10.55 | 62.40 | 2844.8 | 8.72 | 6767.9 |
| Total | 108.42 | 641.08 | 29225.7 | 89.56 | 69528.8 |

### Table D-5: Pre-treatment pollutant loading estimates (lbs/year) for Bellevue I-405 TDAs – with proposed project impervious surfaces

| | Proposed – Pre-treatment | | | | |
|---|---|---|---|---|---|
| **TDA** | **Total P** | **TKN** | **COD** | **Zinc** | **TSS** |
| A | 13.28 | 78.55 | 3,580.8 | 10.97 | 8,518.9 |
| B | 30.25 | 178.86 | 8,154.1 | 24.99 | 19,398.8 |
| C | 9.57 | 56.60 | 2,580.2 | 7.91 | 6,138.4 |
| D | 44.24 | 261.58 | 11,925.1 | 36.54 | 28,370.3 |
| E | 32.15 | 190.11 | 8,666.8 | 26.56 | 20,618.6 |
| F | 10.68 | 63.13 | 2,877.9 | 8.81 | 6,846.6 |
| Total | 140.17 | 828.83 | 37,784.9 | 115.79 | 89,891.6 |

## Table D-6: Pollutant removal rates for existing and proposed detention facilities

| Condition | TDA | Treatment | Range | Pollutant Removal Rates[1] | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Sol. P | TKN | COD | Zinc | TSS |
| Existing | A,B,C,D,F | None | Min | 0 | 0 | 0 | 0 | 0 |
| Existing | A,B,C,D,F | None | Max | 0 | 0 | 0 | 0 | 0 |
| Existing | E | 1-Cell Wet Pond | Min | 0.4 | 0.2 | 0.2 | 0.2 | 0.6 |
| Existing | E | 1-Cell Wet Pond | Max | 0.6 | 0.4 | 0.4 | 0.4 | 0.8 |
| Proposed | A,B,C, ,E,F | 2-Cell Wet Pond | Min | 0.4 | 0.4 | 0.4 | 0.6 | 0.8 |
| Proposed | A,B,C,E,F | 2-Cell Wet Pond | Max | 0.6 | 0.6 | 0.6 | 0.8 | 1.0 |
| Proposed | D | Ecology Embankment | Min | 0.73 | 0 | 0 | 0.73 | 0.69 |
| Proposed | D | Ecology Embankment | Max | 0.92 | 1.0 | 1.0 | 0.95 | 0.97 |

Notes: [1] Removal rates for TKN and COD have not been determined for the Ecology Embankment, therefore the entire range (0-1) is used for calculating maximum and minimum loading.

## Table D-7: Post treatment pollutant loading estimates (lbs/year) for Bellevue I-405 TDAs – Existing Conditions

| TDA | Existing – Post-treatment | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Total P | | TKN | | COD | | Zinc | | TSS | |
| | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max |
| A | 12.49 | 12.49 | 73.83 | 73.83 | 3,365.8 | 3,365.8 | 10.31 | 10.31 | 8,007.4 | 8,007.4 |
| B | 25.19 | 25.19 | 54.97 | 54.97 | 2,505.8 | 2,505.8 | 7.68 | 7.68 | 5,961.3 | 5,961.3 |
| C | 4.51 | 4.51 | 26.67 | 26.67 | 1,215.7 | 1,215.7 | 3.73 | 3.73 | 2,892.1 | 2,892.1 |
| D | 26.41 | 26.41 | 156.19 | 156.19 | 7,120.3 | 7,120.3 | 21.82 | 21.82 | 16,939.5 | 16,939.5 |
| E | 25.59 | 26.81 | 158.55 | 165.80 | 7,227.9 | 7,558.6 | 22.15 | 23.16 | 15,621.3 | 16,408.3 |
| F | 10.55 | 10.55 | 62.40 | 62.40 | 2,844.8 | 2,844.8 | 8.72 | 8.72 | 6,767.9 | 6,767.9 |
| Total | 104.74 | 105.96 | 532.60 | 539.86 | 24,280.28 | 24,611.1 | 76.41 | 75.42 | 56,189.6 | 56,976.6 |

### Table D-8: Post-treatment pollutant loading estimates (lbs/year) for Bellevue I-405 TDAs – with proposed project impervious surface areas

| | Existing – Post-treatment | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sol. P | | TKN | | COD | | Zinc | | TSS | |
| TDA | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max |
| A | 12.65 | 12.81 | 75.72 | 76.66 | 3,451.8 | 3,494.8 | 10.45 | 10.58 | 8,007.4 | 8,109.7 |
| B | 26.20 | 27.21 | 160.90 | 166.89 | 7,335.4 | 7,608.3 | 21.64 | 22.48 | 16,152.6 | 16,801.8 |
| C | 5.52 | 6.53 | 38.64 | 44.63 | 1,761.5 | 2,034.4 | 4.56 | 5.40 | 2,892.1 | 3,541.4 |
| D | 32.02 | 34.54 | 183.04 | 261.58 | 8,344.3 | 1,1925.1 | 26.12 | 28.53 | 20,106.9 | 2,2492.2 |
| E | 21.92 | 24.48 | 144.72 | 159.85 | 6,597.7 | 7,287.4 | 18.11 | 20.22 | 12,414.45 | 1,4055.3 |
| F | 10.58 | 10.60 | 62.69 | 62.84 | 2,858.1 | 2,864.7 | 8.74 | 8.76 | 6,767.94 | 6,783.7 |
| Total | 108.88 | 116.17 | 665.71 | 772.45 | 30,348.7 | 35,214.7 | 89.61 | 95.97 | 66,341.35 | 71,784.0 |

## Table D-9: Pollutant loading summary

| Drainage Area | Range | Sol. P (lbs/yr) | TKN (lbs/yr) | COD (lbs/yr) | Zinc (lbs/yr) | TSS (lbs/yr) |
|---|---|---|---|---|---|---|
| Mercer Slough | | 834.5 | 4846.4 | 114260.7 | 118.8 | 433291.9 |
| Sturtevant Creek | | 911.5 | 5293.5 | 124800.0 | 129.7 | 473258.3 |
| Kelsey Creek | | 2050.8 | 11910.6 | 280807.0 | 291.8 | 1064858.1 |
| Richards Creek | | 710.1 | 4123.9 | 97225.4 | 101.0 | 368692.0 |
| East Creek | | 382.0 | 2218.7 | 52309.4 | 54.4 | 198364.4 |
| Sunset Creek | | 679.0 | 3943.6 | 92975.5 | 96.6 | 352575.8 |
| West Tributary | | 763.7 | 4435.5 | 104571.4 | 108.7 | 396548.7 |
| Goff Creek | | 353.2 | 2051.4 | 48363.4 | 50.3 | 183400.6 |
| Valley Creek | | 771.8 | 4482.6 | 105682.5 | 109.8 | 400762.3 |
| Sears Creek | | 640.3 | 3718.9 | 87676.2 | 91.1 | 332480.0 |
| Total (entire Mercer basin) Existing | | 8097.0 | 47025.1 | 1108671.6 | 1152.3 | 4204232.2 |
| Project Area (sum of TDAs): Existing | Min | 104.7 | 626.6 | 28564.1 | 87.5 | 66380.9 |
| | Max | 106.0 | 633.8 | 28894.9 | 88.5 | 67167.9 |
| Project Area (sum of TDAs): Post-Project | Min | 108.9 | 665.7 | 30348.7 | 89.6 | 66341.4 |
| | Max | 116.2 | 772.5 | 35214.7 | 96.0 | 71784.0 |
| Total (entire Mercer basin): Post-Project | Min | 8100.0 | 47057.0 | 1110125.4 | 1153.3 | 4203405.6 |
| | Max | 8111.4 | 47202.9 | 1116776.0 | 1161.8 | 4208808.8 |
| Loading Change : Post-Project | Min | 2.9 | 31.9 | 1453.8 | 1.1 | -826.5 |
| Loading Change : Post-Project | Max | 11.4 | 145.9 | 6650.6 | 8.4 | 5403.1 |
| | | | | (% change) | | |
| Project Area Change (% of TDA loading): Post-Project | Min | 2.78 | 5.09 | 5.09 | 1.22 | -1.25 |
| | Max | 10.92 | 23.28 | 23.28 | 9.63 | 8.14 |
| Total Change (% of Mercer basin loading): Post-Project | Min | 0.04 | 0.07 | 0.13 | 0.09 | -0.02 |
| | Max | 0.14 | 0.31 | 0.60 | 0.73 | 0.13 |