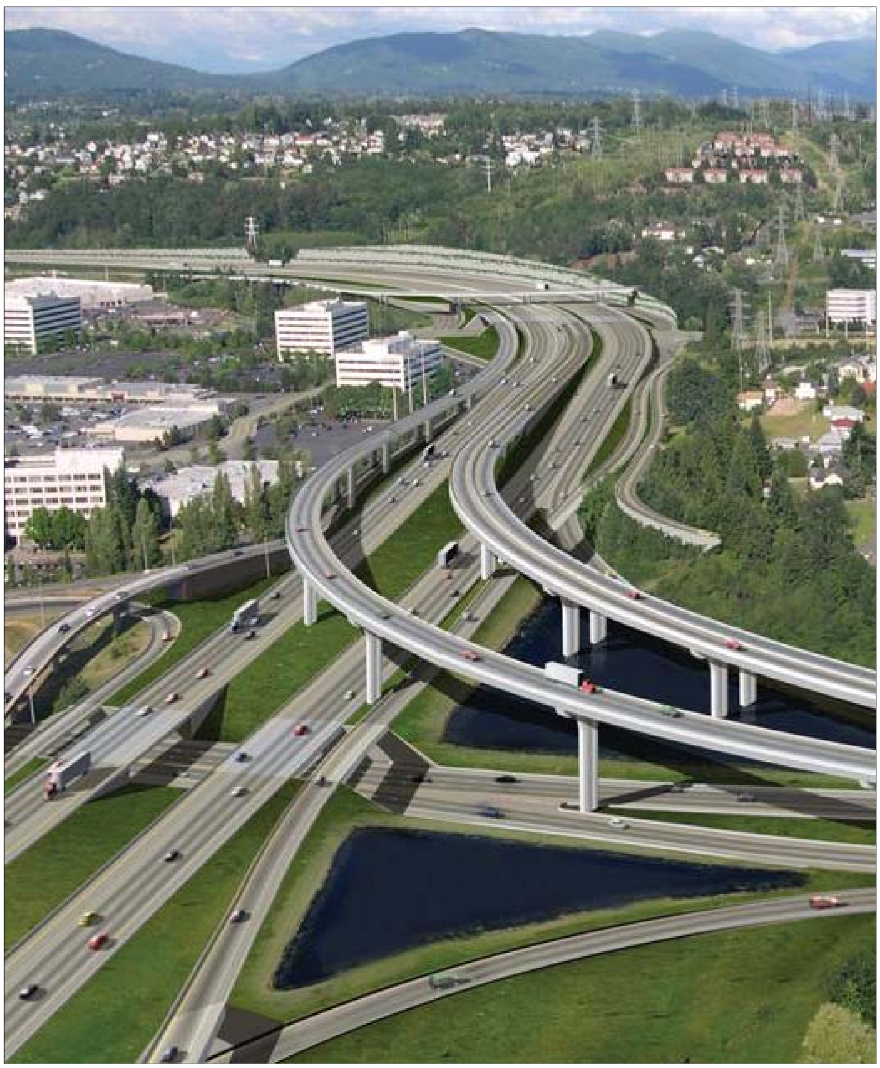
I-405, Tukwila to Renton Improvement Project
(I-5 to SR 169 – Phase 2)

INTERSTATE 405 **Corridor Program**
Congestion Relief & Bus Rapid Transit Projects

WATER RESOURCES DISCIPLINE REPORT

December 2007



Washington State Department of Transportation

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Study Approach

WSDOT is proposing to construct the I-405, Tukwila to Renton Improvement Project (I-5 to SR 169 – Phase 2), referred to as the Tukwila to Renton Project. To evaluate the project's effects on water resources during construction and operation, the I-405 Team used the methods described in WSDOT's Environmental Procedures Manual. The manual provides guidance that WSDOT follows to ensure that its projects comply with local, state, and federal laws and regulations pertaining to water resources. For this project, water resources are considered to consist of surface water flow, surface water quality, floodplains, and groundwater.

Baseline Conditions

The study area includes water resources in the Green River and Cedar River watersheds. Surface waterbodies in the study area include Cottage Creek, Gilliam Creek, an unnamed tributary to Gilliam Creek, the Green River, Springbrook Creek, Panther Creek, Rolling Hills Creek, unnamed tributary to Rolling Hills Creek, Thunder Hills Creek, unnamed tributary to Thunder Hills Creek, and the Cedar River.

In the study area, the Green River is 303(d) listed for fecal coliform bacteria, dissolved oxygen, and temperature. Springbrook Creek is also listed for not complying with standards for dissolved oxygen and fecal coliform bacteria. The Cedar River is listed for fecal coliform bacteria and temperature downstream of the study area.

The floodplains identified in the study area are associated with the Green River, Springbrook Creek, Panther Creek, Rolling Hills Creek, and the Cedar River.

The most important aquifer in the study area exists along the Cedar River, and is known as the Cedar Valley Aquifer. This aquifer is an EPA-designated sole-source aquifer. Another regional aquifer in the study area is the Green-Duwamish Alluvial Aquifer.

Project Effects

The Tukwila to Renton Project is expected to benefit water resources. Peak and base flow rates to streams and rivers will not be altered negatively during project construction. This project will provide flow control and water quality treatment for the impervious areas added by the project and will also retrofit some of the currently existing untreated impervious surface area.

During construction, work crews will clear, grade, and prepare the construction areas for new pavement. Constructing this new pavement will expose bare soil, which is then easily eroded by rainfall and surface water runoff. This soil erosion can create short-term effects to surface water quality. However, because the project will follow standard best management practices (BMPs) for erosion control, these effects are expected to be minimal if they occur.

The project is expected to add temporary and/or permanent fill within the floodplains of the Green River, Springbrook Creek, Panther Creek, Rolling Hills Creek, and Cedar River, decreasing floodplain storage. However, planned mitigation for this fill, both temporary and permanent, will ensure that the floodplain level does not rise.

Potential groundwater effects to aquifers during construction include contamination from spills and reduced well capacity. However, WSDOT will implement several measures (listed below) that will avoid or minimize negative effects to the aquifers.

Measures to Avoid or Minimize Effects

Construction effects to water quality will be minimized by using required sediment and erosion control BMPs. Standard construction BMPs are used to minimize erosion and soil movement so that erosion from construction sites does not contribute solids and pollutants to nearby receiving waters. BMPs are required on all WSDOT roadway construction projects, including the Tukwila to Renton Project, and will be described in more detail in the Temporary Erosion and Sediment Control Plan that WSDOT will write prior to beginning construction.

Potential groundwater effects, including contamination and reduced well capacity, will be avoided during construction by implementing the mitigation measures described in Section 6.

The Green-Duwamish Alluvial Aquifer near the study area is not used for domestic water supply or irrigation purposes and will be protected during construction by WSDOT following standard pollution control practices.

WSDOT, in consultation with the City of Renton, has identified mitigation measures related to protecting the Cedar Valley Aquifer:

- Controlling erosion and spills.
- Specifying the location and maintenance procedures for construction equipment staging areas to prevent pollution of aquifers.
- Adding special protection measures related to construction practices, placement of fill, and roadway and stormwater facility design within Renton's Aquifer Protection Zones 1 and 2 that will comply with State and City of Renton requirements (State of Washington Wellhead Protection Requirements, WAC 246-290-135(4) and the City of Renton Municipal Code, RMC 4-9)
- Identifying the location, type, and installation techniques for highway structures and new embankments relative to production wells. After further geotechnical study, spread footing foundations may be used for the reconstructed bridges over the Cedar River that do not substantially penetrate the Cedar Valley Aquifer.
- Using ponds for highway spill containment to protect the sole-source aquifer.

Operational effects within the study area will be avoided or minimized by:

- Providing detention facilities within the Green River and Springbrook Creek basins. Since the flow/duration relationships are maintained throughout the critical range of storms, from 50 percent of the 2-year through the 50-year recurrent events, with detention design, no negative effects on peaks or flow durations are expected.
- Using stormwater treatment facilities to decrease total suspended solids, total zinc, and total copper pollutant loading.
- Performing additional excavation within the same floodplains and at the same one-foot elevation to offset floodplain fill.

Unavoidable Adverse Effects

Adding fill to the floodplains of the Green and Cedar Rivers and Springbrook, Panther, and Rolling Hills Creeks is an unavoidable negative effect. As mitigation for this fill, additional excavation to provide compensatory floodplain storage will occur within the same floodplains and at the same elevation as the proposed fill for the Tukwila to Renton Project.

ACRONYMS AND ABBREVIATIONS

Term	Meaning
BMP	best management practice
CARA	critical aquifer recharge area.
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers
CWA	Clean Water Act
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
EPM	Environmental Procedures Manual
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
HPA	Hydraulic Project Approval
HRM	Highway Runoff Manual
JARPA	Joint Aquatic Resources Permit Application
MTCA	Model Toxics Control Act
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OHWM	ordinary high water mark
RMC	Renton Municipal Code
SEPA	Washington State Environmental Policy Act
SPCC	Spill Prevention Control and Countermeasures
TDA	threshold discharge area
TESC	Temporary Erosion and Sediment Control
TMDL	total maximum daily load
USFWS	U.S. Fish and Wildlife Service
WAC	Washington Administrative Code
WHPA	wellhead protection area
WRIA	water resource inventory area
WSDOT	Washington State Department of Transportation

GLOSSARY

Term	Meaning
100-year flood	A flood having a 1-percent chance of occurring in any given year.
100-year floodplain	The area of land that would be inundated by a flood having a one-percent chance of occurring in any given year.
500-year floodplain	The area of land that would be inundated by a flood having a 0.2-percent chance of occurring in any given year.
abutment	A retaining wall or structure that supports the end of a bridge.
access	The ability to enter a freeway or roadway via an on-ramp or other entry point.
accessibility	The ability to conveniently travel through an area and reach a destination, e.g., shopping, services, home.
acre-feet	The volume of water, 43,560 cubic feet, that will cover an area of one acre to a depth of one foot.
aquifer	A geological stratum of saturated materials with the capability to yield useable quantities of groundwater on a long-term, sustainable basis.
Aquifer Protection Zone	Areas where special restrictions are imposed on activities that could contaminate groundwater supplies.
aquitard	Soil or rock that is less permeable than adjacent aquifers and restricts groundwater flow.
bank	The slope of land adjoining a body of water, such as a river, lake, wetland or drainage channel. With respect to flowing waters, banks are either right or left as viewed facing in the direction of the flow.
base flood	A flood having a 1-percent chance of occurring in any given year; also called the 100-year flood.
base flow	The volume of flow in a stream or river during dry conditions, as opposed to conditions influenced by storm runoff. Base flows discharge groundwater and water from upstream channels, wetlands, lakes, and ponds.
basin	An area of land that drains to a specific waterbody.
basin planning programs	These are programs containing land use recommendations, regulations, capital projects, and other initiatives to reduce and prevent flooding, erosion, and preserve salmonid habitat in a particular basin.
bedrock	Bedrock is referred to as the rock underlying gravel and/or soil and is sometimes visible on the surface as outcrops.

Term	Meaning
best management practice (BMP)	Innovative and improved environmental protection tools, practices, and methods that have been determined to be the most effective, practical means of avoiding or reducing environmental impacts.
biofiltration swale	Long, broad, shallow grassy channels that are designed so that stormwater flows slowly through the facility. This allows the vegetation and soil matrix to filter and absorb pollutants from the stormwater runoff.
box culvert	A box-shaped concrete structure that drains open channels, swales, or ditches under a roadway or embankment.
buffer (aquatic resource)	A designated area along and adjacent to a stream or wetland that may be regulated to control the negative effects of adjacent development on the aquatic resource.
buffer (land use)	A transitional area that separates land uses that are not naturally compatible. Often the buffer is green space, and is termed a landscape buffer. Other times, a buffer can be a structure or a type of development.
capacity	The maximum sustained traffic flow of a transportation facility under prevailing traffic and roadway conditions in a specified direction.
compensatory floodplain storage	Removal of material from a site in the same floodplain and at the same elevation in order to compensate for the placement of fill within the same regulatory floodplain.
confluence	The convergence of two streams of comparable size into a single channel, or the junction where two rivers, streams, etc. flow together.
congestion	The condition when unstable traffic flows constrain travel speeds to less than the posted limit. Recurring congestion is caused by constant excess traffic volume compared with the highway's capacity. Nonrecurring congestion is caused by unusual or unpredictable events such as traffic accidents.
construction footprint	The physical area affected by project construction activities.
Critical Aquifer Recharge Area	Specially designated areas where aquifers are considered more susceptible to groundwater contamination because the depth to groundwater is shallow; a protective low permeability surface layer is not present; and the aquifers are critical for supply and use.
critical areas	These include aquifer recharge areas, fish and wildlife habitat conservation areas, flood hazard areas, geologic hazard areas, and wetlands. Critical area functions and values are protected by ordinances that require development to avoid or compensate for adverse effects on critical areas.

Term	Meaning
culvert	A pipe or box structure that drains open channels, swales, or ditches under a roadway or embankment.
cumulative effect	The effect on the environment that results from the incremental effect of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such actions. Cumulative effects can result from individually minor but collectively noticeable actions taking place over a period of time.
design storm	A rainfall event of specific size and frequency that is used to calculate the runoff volume and peak discharge rate for a stormwater facility.
detention	The temporary storage of stormwater runoff in a stormwater facility to control the discharge rates.
detention pond	A surface catchment designed to reduce effects on stormwater runoff quality and/or quantity by storing the increased runoff volume that results from development, then slowly releasing it at controlled runoff rates. Detention tanks and vaults are underground structures used to reduce peak stormwater flows.
discharge	Runoff leaving an area via overland flow, built conveyance systems, or infiltration facilities; a rate of fluid flow; or a volume of fluid passing a point per unit of time.
downstream	Referring to the direction of the flow of a stream or river.
drainage ditch	An open channel designed and constructed to convey water. This may include modifications of natural drainages or manmade historic channels incorporated in a system design.
duration	The length of time of an event.
ecology embankment	A stormwater treatment facility constructed in the pervious shoulder area of a highway to provide water quality treatment for highway runoff. It consists of a trench that is dug along side the highway shoulder, lain with perforated pipe, and backfilled with a filtration media. Water from the road flows off the roadway, is filtered by the media, and carried off site by the pipe.
ecosystem	A community of organisms interacting with each other, and the environment in which they live.
effect	Something brought about by a cause or agent; a result. This may include ecological, aesthetic, historic, cultural, economic, social, health, or other effects, whether direct, indirect, or cumulative. Effects may include those resulting from actions that may have both beneficial and detrimental effects.

Term	**Meaning**
Endangered Species Act (ESA)	Federal legislation adopted to prevent the extinction of plants and animals.
environmental impact statement (EIS)	A document prepared under the National Environmental Policy Act and/or the State Environmental Policy Act that identifies and analyzes, in detail, environmental effects of a proposed action. As a tool for decision-making, the EIS describes positive and negative effects and examines reasonable alternatives for an undertaking.
erosion	The wearing away of soil or rock by the action of running water, wind, ice, or geologic agents. For this analysis, erosion relates primarily to stormwater runoff.
falsework	The temporary frame that supports the weight of a bridge or other structures during construction.
Federal Highway Administration (FHWA)	One of several agencies in the U.S. Department of Transportation, the FHWA provides federal financial assistance to the states through the Federal Aid Highway Program, the purpose of which is to construct and improve the National Highway System, urban and rural roads, and bridges.
FEMA floodway	The federally designated channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be conveyed without substantial increases in flood heights. The floodways in the Federal Emergency Management Agency Flood Insurance Study are presented to local agencies as a minimum basis for additional floodway studies.
fill	Any material placed in an area to increase surface elevation.
filter fabric fence	Cloth fencing installed around a construction site to keep soil from migrating off the site.
filter strip	Grassy slopes that filter and diffuse stormwater running off highway shoulders.
flap gate	An opening through which water may flow freely at low water elevations, but which closes automatically and prevents water from flowing in the opposite direction at higher water elevations.
flood	An overflow or inundation that comes from a river, stream, tide, wave action, storm drain, or excess rainfall; any relatively high streamflow overtopping the natural or artificial banks in any reach of a stream.

Term	Meaning
flood insurance rate maps	The insurance and floodplain management map produced by the Federal Emergency Management Agency. These maps identify the areas subject to flooding during a base (100-year) flood event in a community. Flood insurance risk zones, which are used to compute actuarial flood insurance rates, also are shown.
floodplain	Any land area susceptible to being inundated by flood waters from any source. This is typically the flat or nearly flat land on the bottom of a stream valley or tidal area that is covered by water during floods, including the flood fringe and floodway.
floodway	The channel of the river or stream, and those portions of the adjoining floodplains that have been designated as reasonably required to carry and discharge the base flood flow without resulting in a backwater that exceeds flood hazard regulations.
flow rate	The volume of water that moves by a particular point in one second, typically measured in cubic feet per second.
forest duff	Leaves, conifer needles, branches, and other organic debris in various stages of decomposition covering the forest floor on top of the mineral soil; typical of conifer forests in cool climates where the rate of decomposition is slow and accumulation exceeds decay.
glacial till	The mass of rocks and finely ground material carried by a glacier and then deposited when the glacial ice melts. This creates an unstratified material of varying composition.
gradient	A measure of how steep a slope is. A slope with a gradient of ten percent rises (or declines) one foot for every ten feet of horizontal length.
groundwater	That portion of the water below the ground surface that is free flowing within the soil particles. Groundwater typically moves slowly, generally at a downward angle because of gravity, and eventually enters into streams, lakes, and oceans.
groundwater recharge	The process where natural sources (infiltrating rain, snowmelt or surface water) or pumped water enters and replenishes the groundwater supply.
Group A Wells	Groundwater wells that serve 15 or more households.
Group B Wells	Groundwater wells that serve 2 to 14 households.
habitat	The environment or specific surroundings where a plant or animal grows or lives.

Term	Meaning
hazardous materials	Any material that may pose a threat to human health or the environment because of its quantity, concentration, or physical or chemical characteristics.
hydrocarbons	Organic chemicals that contain hydrogen and carbon.
hydrologically connected	Linked to or associated with the water source of another system either through surface water, a stream, groundwater etc.
impervious surface	Pavement, roofs, and other compacted or hardened areas that do not allow the passage of rainfall or runoff into the ground.
indirect effect	An effect that occurs later in time or is removed in distance from the proposed action, but is still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems.
infiltration	The passage of water through the soil surface into the subsoil.
interlocal agreements	An agreement between local agencies such as cities and counties.
land use	The type of activity (i.e., residential, commercial, or industrial) that occurs on property.
levee	A manmade structure, usually an earthen embankment along the edge of a river channel, constructed to contain, control, or divert the flow of water so as to provide protection from temporary flooding.
media	The surrounding environment in which something functions and thrives, typically consisting of air, water, and/or soil.
mitigation	An effort to: (1) avoid the impact altogether by not taking a certain action or parts of an action; (2) minimize the impact by limiting the magnitude of the action and its implementation, by using technology or by taking affirmative steps; (3) rectify the impact by repairing, rehabilitating, or restoring the affected environment; (4) reduce or eliminate the impact over time by preservation and maintenance operations; (5) compensate for the impact by replacing, enhancing or providing substitute resources or environments; and/or (6) monitor the impact and taking appropriate corrective measures.

Term	Meaning
mitigation bank	A mitigation project constructed in advance of planned development to mitigate for unavoidable effects on wetlands and their associated habitat. Banks are generally sized to provide sufficient mitigation for several development projects in one location. As a result, the bank typically provides higher functioning wetlands and more useable habitat than may be possible on an individual project scale.
monitoring well	A ground well used to test or sample on an ongoing basis the quality and quantity of groundwater.
National Environmental Policy Act (NEPA)	Federal legislation adopted in 1969 that established a national environmental policy intentionally focused on federal activities and the desire for a sustainable environment balanced with other essential needs of present and future generations. NEPA also established federal agency responsibility and created the basic framework for integrating environmental considerations into federal decision-making. The fundamentals of the NEPA decision-making process include: an interdisciplinary approach in planning and decision-making for actions that affect the human environment, interagency coordination, consideration of alternatives, examination of potential environmental consequences and mitigation, documentation of the analysis, and making the information available to the public for comment prior to implementation.
National Pollutant Discharge Elimination System (NPDES)	The federal program under Section 402 of the Clean Water Act for issuing, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements for discharges of pollutants from point sources to tidal waters, lakes, wetlands, rivers, streams, or other water courses.
noise wall	A designed wall that provides a noise buffer between a noise source and adjacent residences or other sensitive noise receptors.
nutrients	Essential chemicals needed by plants or animals for growth, such as phosphorus.
ordinary high water mark (OHWM)	The elevation marking the highest water level which is so common and maintained for a sufficient time in all ordinary years that it leaves evidence upon the landscape, such as a clear and natural line impressed on the bank, changes in soil character, destruction of or change in vegetation, or the presence of litter and debris. Generally, it is the point where the natural vegetation changes from predominately aquatic to upland species. Where the ordinary high water mark cannot be found, it is the line of mean annual flood - the highest the water gets in an average year, but not the highest it gets during extreme flooding.

Term	**Meaning**
outfall	The point of discharge for stormwater runoff; also the outlet or mouth of a drain pipe or culvert that discharges stormwater runoff.
outwash	Sediment deposited by flowing water originating from glacial meltwaters. Outwash that is deposited and then subsequently overrun by an advancing ice sheet is known as advance outwash. Outwash that is not overrun is commonly called recessional outwash. Outwash typically consists of sand and gravel sized particles.
peak flow	The maximum instantaneous rate of flow during a storm, usually in reference to a specific design storm event.
permeability	A measure of how quickly a fluid (in this case, water) can move through sediment or other subsurface material.
pier	A vertical column or substructure unit that supports an elevated structure such as a bridge.
point source	A specific source of pollution such as a construction staging area.
pollutant	Any substance introduced into the environment that contaminates or otherwise adversely affects the usefulness of a resource.
production well	A well that produces water for a public drinking water system.
pump station	A mechanical facility that controls flows from one body of water to another.
purveyor	A person or company that provides a service such as electricity, water, sewer, etc.
recharge	Water, whether precipitation, surface water, or groundwater, that enters and adds to an aquifer.
recharge area	Land area important for retaining precipitation as part of the groundwater hydrology of the region.
retaining wall	A structure used to hold earth in place where the natural grade cannot be maintained.
retention/detention pond	A drainage facility designed to reduce stormwater runoff quantity and quality effects either by holding the increased runoff volume that results from development for a considerable amount of time, allowing the suspended particles to settle out, and then slowly releasing it through natural means on site; or by holding the runoff for a short period of time and then releasing it to the stormwater management system for treatment and discharge.

Term	Meaning
right-of-way	Land purchased prior to the construction of transportation improvements along with land for sound walls, retaining walls, stormwater facilities, and other project features. This also includes permanent or temporary easements for construction and maintenance. Vacant land may also be set aside for future highway expansion under certain circumstances.
riparian	Pertaining to anything connected with or immediately adjacent to the banks of a stream, river, or other water body.
riparian area	The land and habitat adjacent to streams, lakes, estuaries, or other waterways, comprising the transition area between the aquatic ecosystem and the nearby upland terrestrial ecosystem. Riparian corridors, or zones, identified by soil characteristics or plant communities, include the wet areas in and near streams, ponds, lakes, springs, and other surface waters.
riprap	A manmade armoring, facing layer, or protective mound of rocks placed to prevent erosion or sloughing of a stream bank or structure due to flow of surface and stormwater runoff.
river mile (RM)	The distance of a point on a river measured in miles from the river's mouth along the low-water channel.
runoff	Rainwater or snowmelt that leaves an area as a surface drainage.
salmonid	Any member of the family Salmonidae, which includes all species of salmon, trout, and char (including bull trout).
sediment	Material that originates from weathering and erosion of rocks, dirt, or unconsolidated deposits and organic material. Sediment is carried and deposited by wind, ice or water. It is often transported by stormwater runoff and may be suspended within the water.
seep	A spot where water trickles out of the ground to form a pool or wet area.
shallow groundwater	Groundwater that is encountered at depths of less than ten feet.

Term	**Meaning**
Shoreline Management Act (SMA)	Washington State legislation adopted in 1971 that requires local jurisdictions to create and implement a Shoreline Master Program (SMP). The purpose of the SMP is to regulate land use and new development within sensitive shoreline areas. Shorelines, according to the SMA, include all areas typically within 200 feet inland from principal bodies of water (rivers and streams with flows of at least 20 cubic feet per second, lakes over 20 acres, and tidal areas) and associated wetlands. The local SMP identifies standards of protection for shoreline areas, and typically contains shoreline policies, shoreline use environments or zones, and specific shoreline regulations. The final SMP is subject to approval by the State Department of Ecology.
slope	The change in elevation over a distance, or an inclined land form.
soil matrix	The portion of a given soil having the dominant color. In most cases, the matrix would be the portion of the soil representing more than 50 percent of the color.
sole-source aquifer	An aquifer that has been designated by the Environmental Protection Agency as the sole or principal source of drinking water for an area. A sole-source aquifer receives special federal protection because few or no reasonable alternatives exist for the area served to acquire drinking water.
span	The section of a superstructure suspended between two supports.
Spill Prevention Control and Countermeasures (SPCC) Plan	A plan for minimizing effects to soil, surface water, and groundwater in the event of a spill of contaminated soil, petroleum products, contaminated water, or other hazardous substances. The SPCC Plan addresses construction procedures, equipment, and materials.
staging area	Locations used during construction to provide room for employee parking, large equipment storage, and material stockpiles.
State Environmental Policy Act (SEPA)	Washington State legislation adopted in 1974, that establishes an environmental review process for all development proposals and major planning studies prior to taking any action. SEPA includes early coordination to identify and mitigate any substantial issues or significant effects that may result from a project or study.
storm drain	A sewer that carries stormwater and surface water, street wash, and other wash waters or drainage, but excludes sewage and industrial wastes; also called a storm sewer.

Term	Meaning
stormwater	The portion of precipitation that does not naturally percolate into the ground or evaporate, but flows overland, in channels, or in pipes into a defined surface water channel or a constructed stormwater facility.
stormwater detention	The process of storing stormwater in manmade facilities such as ponds or vaults and releasing the stormwater at a controlled rate. This helps control the volume and rate at which stormwater enters streams and rivers. Controlling the flow of stormwater helps maintain or improve conditions in the streams and minimizes erosion of stream banks.
study area	The area specifically evaluated for environmental effects.
till	An unsorted and non-stratified deposit of clay to boulder-sized sediment deposited by a glacier. Till deposited at the base of a glacier is usually hard or very dense. Till is often referred to as hardpan.
topography	The physical features of a geographic area taken collectively; especially, the variations in elevation of the earth's surface.
total suspended solids	Soil and other particles that are carried in water. High levels of soil particles can make a water body appear muddy or cloudy and affect fish by clogging gills and reducing their ability to see and forage for food.
tributary	A stream or other body of water that contributes its water to another stream or body of water.
turbidity	A condition caused by suspended sediments or floating material that clouds the water and makes it appear dark and muddy.
underdrain	A drain installed at the base of a fill embankment or cut wall to control seepage and eliminate water pressure against the wall.
vault	Underground facilities that store and treat stormwater. Dry vaults provide stormwater quantity control by detaining runoff and then releasing reduced flows at established rates. Wet vaults are designed to treat stormwater for both quantity and quality by maintaining a permanent pool of water in a settling basin.
Water Resource Inventory Area (WRIA)	An administrative and planning area designated by the Washington State Department of Ecology for addressing water and aquatic resource management issues. Sixty-two WRIAs have been designated, corresponding to the state’s major watershed basins. The terms WRIA and watershed are frequently used interchangeably, although a WRIA may include more than one watershed.

Term	Meaning
watershed	The region of land that drains into a specific body of water, such as a river, lake, sea, or ocean. Rain that falls anywhere within a given body of water's watershed will eventually drain into that body of water.
wellhead protection area	A surface and subsurface land area regulated to avoid contamination of groundwater that feeds a well or well field supplying a public water system. This program, established under the Federal Safe Drinking Water Act, is implemented through the Washington State Department of Health.
wetland	Areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

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SECTION 1 INTRODUCTION

What are the primary features of the Tukwila to Renton Project?

WSDOT is proposing to construct the I-405, Tukwila to Renton Improvement Project (I-5 to SR 169 – Phase 2), referred to as the Tukwila to Renton Project, to relieve congestion. The Tukwila to Renton Project extends approximately four and one half miles along Interstate 405 (I-405), from I-5 to State Route 169 (SR 169), and approximately two miles along SR 167, from I-405 to SW 43rd Street. The project will:

- Add capacity to both I-405 and SR 167.
- Replace bridges over the Green River and Cedar River and add one new bridge over the Green River.
- Improve the SR 181 and SR 169 interchanges.
- Reconstruct the SR 167 interchange consisting of new general-purpose direct-connector ramp from southbound I-405 to southbound SR 167, HOV direct-connector ramps from northbound SR 167 to northbound I-405 and from southbound I-405 to southbound SR 167, and a split-diamond interchange at Lind Avenue and Talbot Road with connecting frontage roads.
- Replace the two local street accesses to Renton Hill.

These improvements represent the second phase of the I-405 Corridor Program for this portion of I-405. The first phase consists of improvements in the Renton Nickel Improvement Project.

What is the purpose of this report?

This report determines effects to water resources from the Tukwila to Renton Project. It also details how WSDOT will avoid or minimize effects to water resources.

What topics are included in water resources?

In this report, water resources include surface water flow, surface water quality, floodplains, and groundwater. For the purposes of this report, surface water flow is defined as the water flow or current in a river or stream. Surface water quality is the condition or amount of pollutants in a river or stream. A floodplain is the area bordering river channels that becomes inundated during flood flows. Groundwater is water located beneath the ground surface in soil pore spaces and in the fractures of geologic formations.

Why are water resources important to consider?

Surface Water Flow and Surface Water Quality

Surface water is an important resource for people, animals, and plants. For this reason, the federal government drafted the Clean Water Act to protect surface waters. This act requires that state water quality standards set limits on pollution in our lakes, rivers, and marine waters to protect water quality for beneficial uses such as drinking water supply, aquatic life habitat, agricultural needs, and recreational purposes.

Within the study area, surface water is an important resource to humans and the environment. Historically, adding impervious surface area has been known to affect water quality and the quantity of runoff. Because the Tukwila to Renton Project will add impervious surface area to the Green River basin, Springbrook Creek basin, and Cedar River basin, this discipline report investigates the effects this new impervious area will have compared to baseline conditions. Existing requirements for stormwater flow control and water quality treatment are considered part of the project description and are not considered mitigation measures.

Floodplains

Floodplains are important because they convey and store floodwater and minimize flood risks during large storm events. These functions reduce flood losses, maintain clean and plentiful water supplies, and generally enhance quality of life in communities. Recognizing the importance and the sensitive nature of these areas is an important first step in planning for this project. By adapting to the natural phenomenon of flooding rather than trying to control floodwaters, we can reduce the loss of life and property, protect critical natural and cultural resources, reduce maintenance and repair costs, and contribute to the sustainable development of our communities. This philosophy is reflected in Executive Order 11988 that requires agencies to avoid adverse effects and incompatible development in floodplains thereby reserving floodplains as natural floodwater storage areas.

Floodplain management is influenced by federal, state, and local regulations or guidance. However, counties and cities bear the primary responsibility for regulating the activities allowed in floodplains. For example, the cities of Tukwila and Renton have developed specific programs to manage floodplains. Both cities have floodplain restrictions in their zoning and building codes as well as in their sensitive area ordinances. These codes prohibit projects that cause any rise in the base flood elevation for the 100-year flood event within the 100-year floodplains as identified on the Flood Insurance Rate Maps (FIRMs). As the study area has several 100-year floodplains, these regulations will apply to the project. The City of Renton has conducted a recent floodplain study for the Springbrook Creek basin that may eventually be approved by FEMA and serve as the basis for final project permitting within that basin.

Groundwater

Groundwater pertains to the water contained in the soil and bedrock below the ground's surface. Groundwater quality and quantity is important to consider because changes to quality and quantity can affect supplies for drinking water, and water available for surface waterbodies such as lakes, streams, and wetlands. When reviewing potential effects to groundwater quality and quantity in the study area, we considered federal, state, and local regulations.

Groundwater is also an important factor to consider for the project design because it is a factor in determining the types of foundations, pavement sections, subsurface drainage, retaining walls, and bridges that are required for the project.

What studies were completed?

The I-405 Team conducted a field investigation on July 13, 2006 to examine surface water resources along the project corridor to verify and update drainage mapping. Aerial photographs, topographic survey data, and drainage maps were used to help the I-405 Team identify flow pathways, outfalls, and existing stormwater facilities.

The I-405 Team determined the existing surface waterbody conditions using data provided by the Washington State Department of Ecology (Ecology), including Watershed Resource Inventory Area (WRIA) maps. WRIAs are the major watershed drainage areas that Ecology uses to track water quality data and to plan and manage water resources.

Other relevant data that the I-405 Team reviewed included Ecology's 2004 303(d) list of impaired waterbodies. Every two years, states are required to prepare a list of waterbody segments that do not meet state water quality standards. The Ecology 2006 303(d) list is expected to be approved in 2008.

The Total Maximum Daily Load (TMDL) list, which is prepared by Ecology, was also reviewed. A TMDL establishes the mechanisms to implement water quality standards for an impaired waterbody. The TMDL establishes the allowable loadings of pollutants to a waterbody so that it achieves state water quality standards.

Additional water resources information was collected during a series of site visits where experts in the fields of fisheries, wetlands, wildlife, road design, drainage design, and permitting reviewed the natural and manmade features located in the study area.

What is the Ecology 303(d) List?

The federal Clean Water Act (CWA), adopted in 1972, requires states to restore their waters to be "fishable and swimmable." The Clean Water Act established a process to identify and clean up polluted waters. Every two years, all states are required to prepare a list of waterbodies that do not meet water quality standards. This list is called the 303(d) list because the process is described in Section 303(d) of the Clean Water Act.

Ecology has prepared a preliminary assessment of water quality in Washington. The assessed waters are listed in categories that describe the status of water quality. For those waters that are in the polluted category, beneficial uses—such as drinking, recreation, aquatic habitat, and industrial use—are impaired by pollution.

At the time research was conducted for the Tukwila to Renton Project, the 2006 list was not yet available.

What is a total maximum daily load (TMDL)?

A TMDL is part of the water clean up plan for each waterbody on the 303(d) list. It is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet State water quality standards. Percentages of the total maximum daily load are allocated to the various pollutant sources.

What are the key messages from this report?

The key points of this report are:

- Runoff from the new pollution generating impervious surfaces or an equivalent area will be treated for water quality. This project will also provide retrofit treatment of some impervious area that is not currently treated. Overall pollutant loading is expected to decrease for total suspended solids, total phosphorus, total zinc, and total copper.
- Runoff increases from the new impervious area will be mitigated using detention facilities in the Green River and Springbrook Creek basins following WSDOT's Highway Runoff Manual (HRM) guidelines. Since the relationship between peak flow and duration is maintained through detention design, no effect on peak flows or flow durations are expected. The Cedar River is exempt from flow control according to the HRM guideline. If the Panther Creek

Watershed Rehabilitation Plan[1] is permitted, about 29 acres of impervious surfaces would be treated and discharged directly into the Panther Creek wetland complex.

- This project will not raise the level of existing 100-year floodplains because any filling within the floodplains will be mitigated for by excavation within the same floodplain, and within the same 1-foot elevation.
- This project is not expected to negatively affect the Delta Aquifer, a subunit of the Cedar Valley Aquifer, because WSDOT will implement several mitigation measures as described in Section 6 of this report.

What measures are proposed to avoid or reduce impacts?

The WSDOT HRM provides guidance on project design to avoid and minimize negative effects on surface water flow, surface water quality, floodplains, and groundwater. According to Ecology, projects meeting the Ecology guidelines or equivalent standards such as the HRM are presumed to meet federal and state water quality requirements. WSDOT will meet the HRM's requirements by implementing an array of treatment BMPs as well as other protection measures. Surface runoff will be treated using ecology embankments, constructed stormwater treatment wetlands, or other enhanced water quality treatment BMPs. WSDOT will also prepare a Temporary Erosion and Sediment Control Plan that will be in place prior to starting construction. This plan will address the specific measures that will be used to manage stormwater during construction. WSDOT will also prepare a Spill Prevention, Control, and Countermeasures Plan prior to construction that will be used to reduce the risk of accidental spills during construction.

What will happen if we adopt the No Build Alternative?

The No Build Alternative assumes that the improvements associated with the Renton Nickel Improvement Project are constructed. Retrofit of stormwater facilities to address existing highway impervious surfaces will not be addressed

[1] *WSDOT 2007*

with No Build Alternative. Only routine activities such as road maintenance, repair, and safety improvements would be expected to take place between 2014 and 2030. This alternative does not include improvements that would increase roadway capacity or reduce congestion beyond baseline conditions. For these reasons, it does not satisfy the project's purpose to reduce congestion on I-405 between I-5 in Tukwila and SR 169 in Renton.

SECTION 2 PROJECT DESCRIPTION

What is the intent of the Tukwila to Renton Project?

WSDOT is proposing to construct the I-405, Tukwila to Renton Improvement Project (I-5 to SR 169 – Phase 2), referred to as the Tukwila to Renton Project, to relieve congestion. Relieving congestion will benefit the public by:

- Lowering the number of accidents thus improving safety.
- Increasing overall speeds through this section of freeway.
- Improving response times for emergency service vehicles using I-405.
- Improving access to and from I-405 and local circulation.

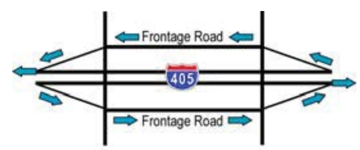
The Tukwila to Renton Project extends approximately four and one half miles along I-405, from I-5 to SR 169, and approximately two miles along SR 167, from I-405 to SW 43rd Street. The project adds capacity to both I-405 and SR 167; improves the SR 181 and SR 169 interchanges; reconstructs the SR 167 interchange consisting of a split-diamond interchange at Lind Avenue and Talbot Road with connecting frontage roads, general-purpose direct-connector ramp from I-405 to SR 167 southbound, and high-occupancy vehicle (HOV) direct-connector ramps from SR 167 northbound to I-405 northbound and from I-405 southbound to SR 167 southbound. These improvements are detailed in the following section.

What are the details of the Tukwila to Renton Project?

The Tukwila to Renton Project improvements are described from west to east (northbound) along the study area on the following pages. These improvements are also illustrated on Exhibits 2-1 through 2-15.

What is a split-diamond interchange?

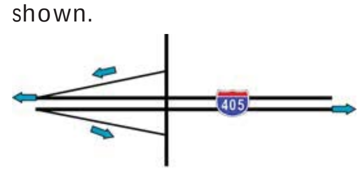
This interchange type consists of two half-diamond interchanges at arterials. These are connected by two, one-way frontage roads. Traffic enters and exits the freeway at the two arterials, creating an elongated diamond configuration as shown.



Split Diamond

What is a half-diamond interchange?

It is an interchange where traffic exits or enters the freeway in one direction. This creates a triangular or half-diamond configuration as shown.



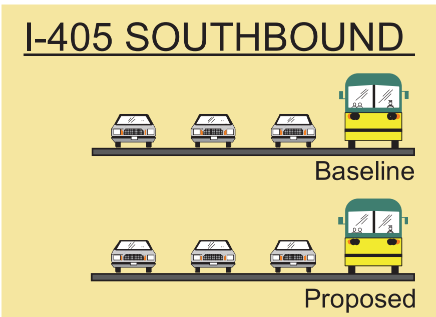
Half Diamond

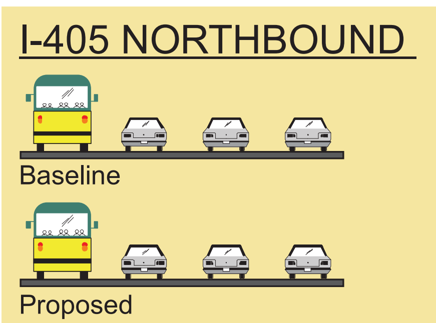
Exhibit 2-1: Project Features, Sheet 1

I-405 from I-5 to East of SR 181

For this portion of the project, WSDOT will:

- Remove the existing northbound I-405 Tukwila Parkway on-ramp. See Exhibits 2-2 and 2-3 for where the project will provide a new on-ramp.
- Realign I-405 mainline slightly to the south beginning just west of the existing northbound I-405 Tukwila Parkway on-ramp to the SR 181 interchange as shown in Exhibits 2-1 and 2-2.





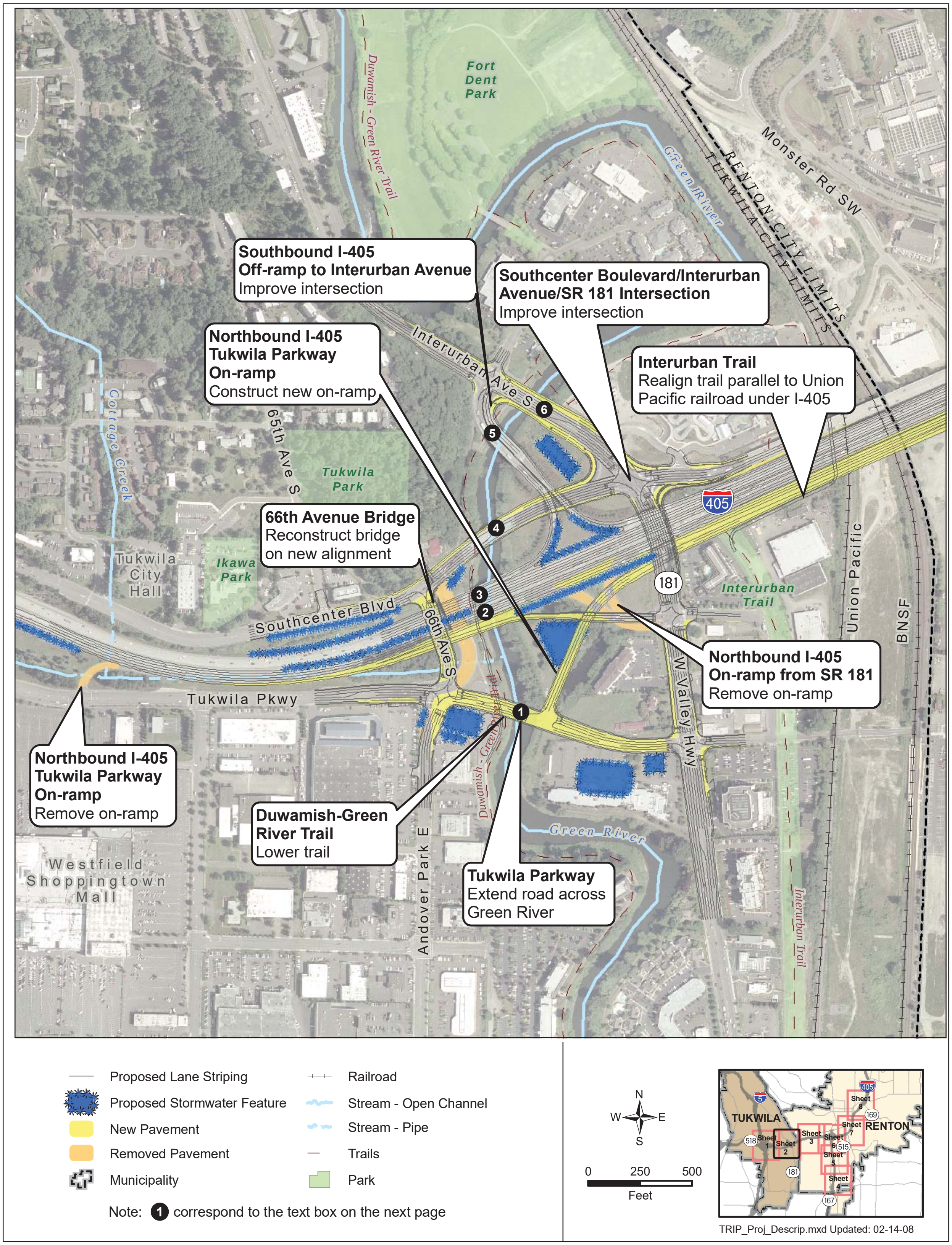
The project will not change capacity along this section

What are baseline conditions for this project?

Baseline conditions describe the site conditions just before construction of the project begins. This can include the build conditions of earlier phased projects that are already approved and funded and expected to be complete before the next project begins. Baseline provides an important point of comparison for understanding the effects of the proposed build alternative.

For the Tukwila to Renton Project, the baseline condition assumes that the Renton Nickel Improvement Project has been completed.

Exhibit 2-2: Project Features, Sheet 2



I-405 at SR 181 Interchange

WSDOT designed the improvements in Exhibits 2-2 and 2-3 to improve freeway and local travel in this area. WSDOT will:

- Improve the SR 181 interchange:
  - o Remove the existing SR 181 on-ramp to northbound I-405.
  - o Extend Tukwila Parkway from the intersection with 66th Avenue east over the Green River to SR 181.
  - o Construct new northbound I-405 on-ramp from Tukwila Parkway just east of the new crossing over the Green River (replaces the two existing on-ramps).
  - o Reconstruct the 66th Avenue S bridge over I-405 on a new alignment to the west and reconstruct the intersections with Southcenter Boulevard and Tukwila Parkway.
  - o Reconstruct the off-ramp from northbound I-405 to SR 181.
  - o Improve local arterials within the interchange area such as Southcenter Boulevard and Interurban Avenue.
- Reconstruct five bridges and build one new bridge over the Green River.
- Lower the Duwamish-Green River Trail.
- Reconstruct the I-405 structures over SR 181.
- Realign the Interurban Trail.

What bridge construction will occur over the Green River?

❶ Tukwila Parkway Bridge (new)

❷ Northbound I-405 Bridge

❸ Southbound I-405 Bridge

❹ Southcenter Boulevard Bridge

❺ Off-Ramp Bridge from southbound I-405.

❻ Interurban Avenue Bridge

See Exhibit 2-2 for the bridge locations.

Exhibit 2-3: SR 181 Interchange Improvements

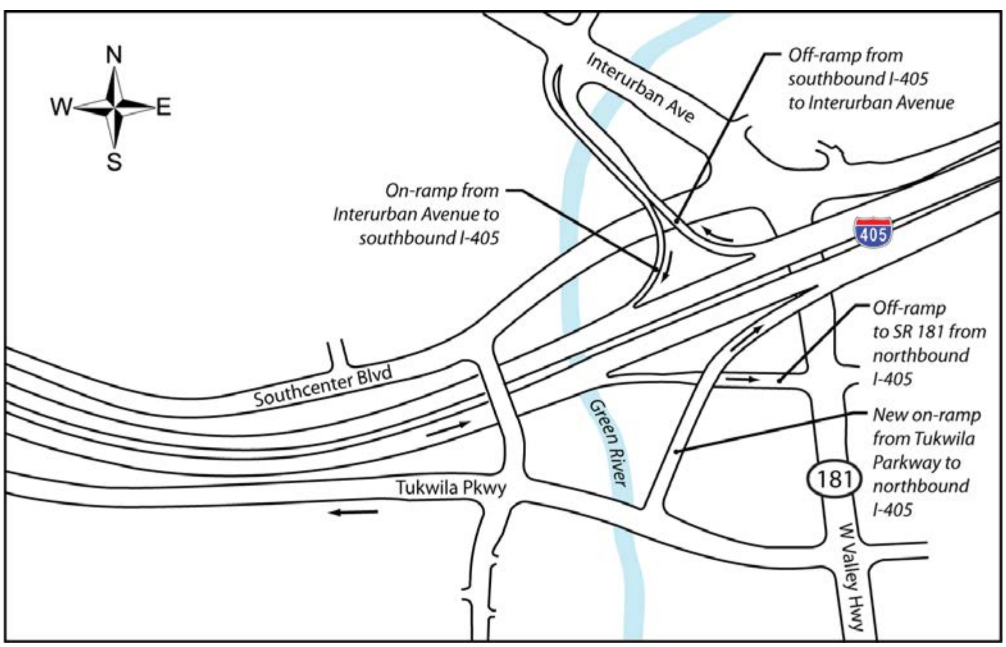
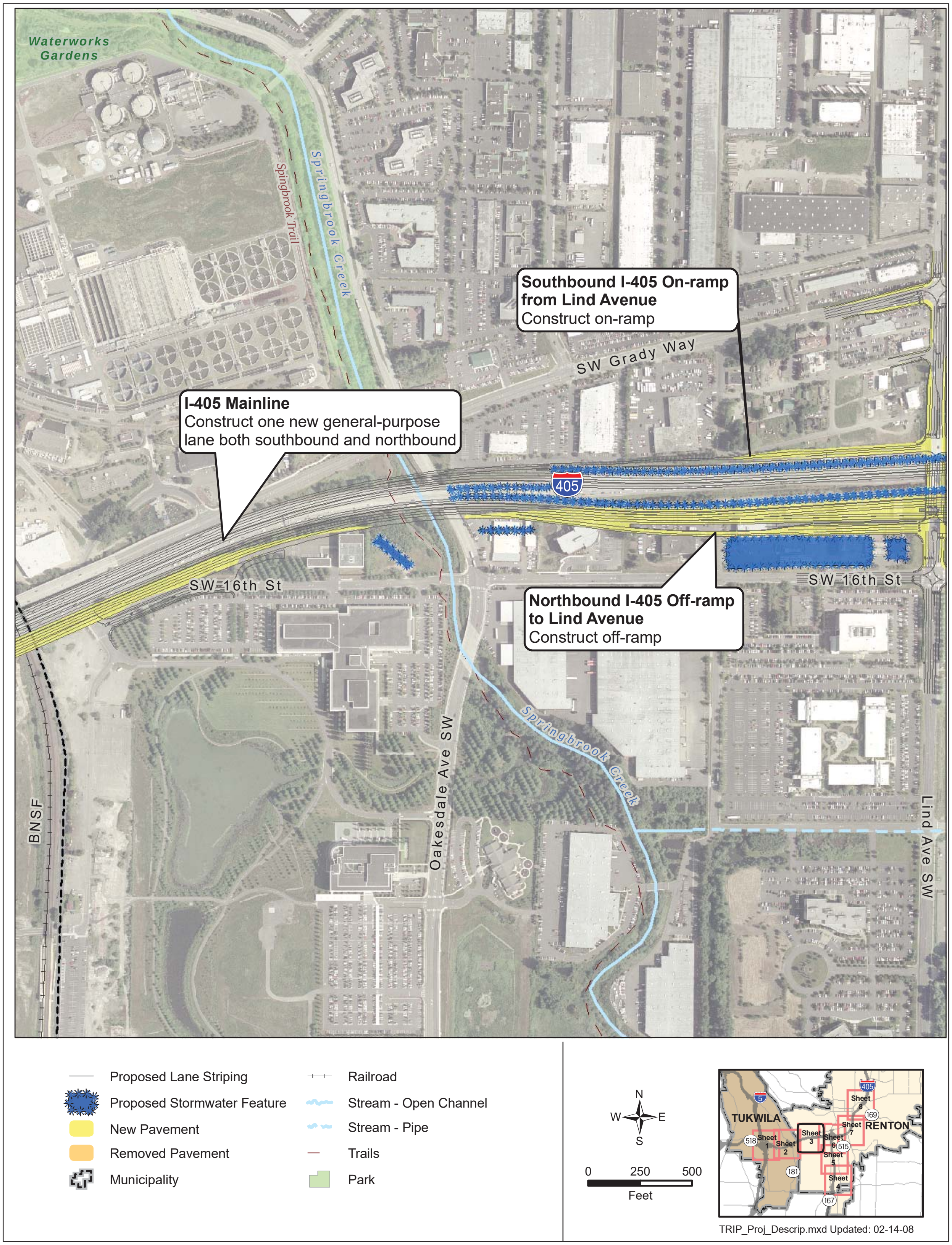


Exhibit 2-4: Project Features, Sheet 3



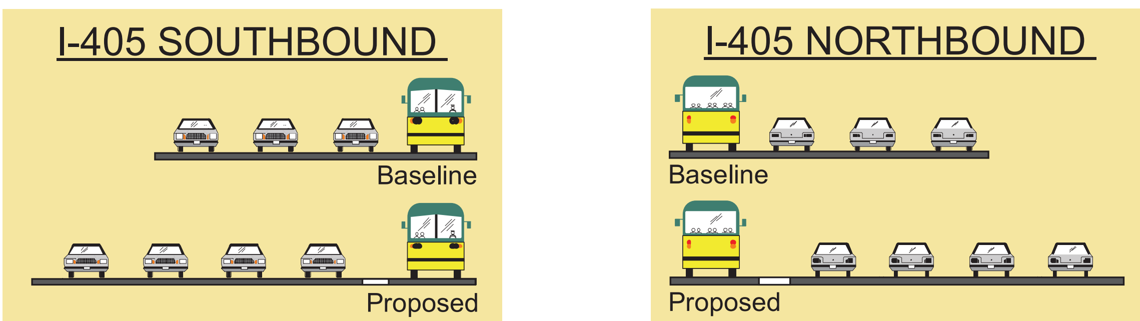
I-405 from East of SR 181 to SR 167 Interchange

From the SR 181 interchange east, WSDOT will realign I-405 to the south. This will:

- Provide a smooth transition onto the new Springbrook Creek/Oakesdale Avenue bridge that was constructed under the Renton Nickel Improvement Project.
- Minimize effects on SW Grady Way and businesses north of I-405.

In addition to realigning I-405, WSDOT will:

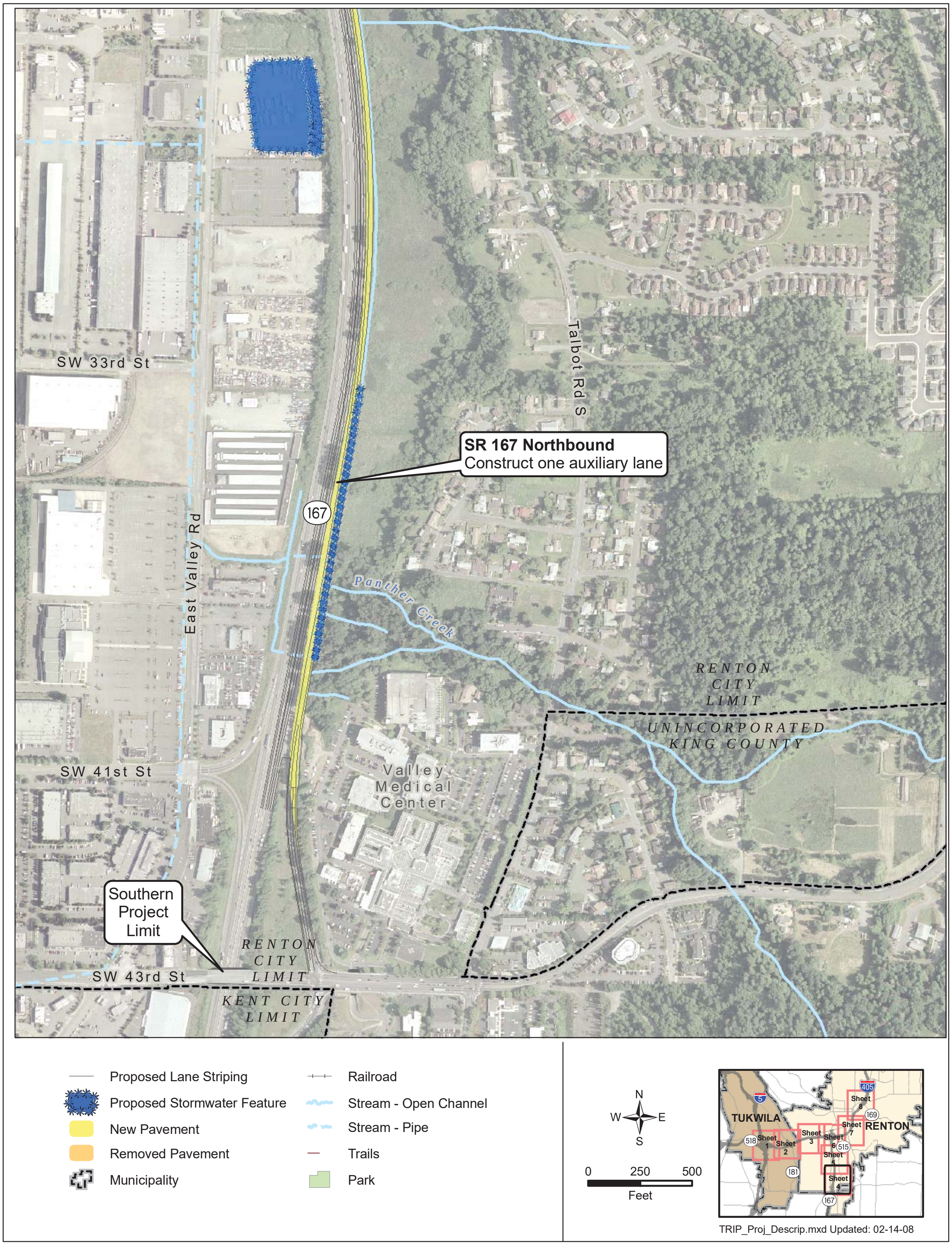
- Construct one additional general-purpose lane in both directions on I-405 from SR 181 through SR 167.
- Stripe lanes to provide a buffer between HOV and general-purpose lanes along I-405.



Project improvements will add capacity to I-405 for both southbound and northbound traffic and will provide a buffer between the HOV lane and the general-purpose lanes

- Stripe the bridges over Springbrook Creek/Oakesdale Avenue to provide five lanes in both directions.
- Reconstruct I-405 structures over the Burlington Northern Santa Fe (BNSF) and Union Pacific railroads.
- Construct a half-diamond interchange at Lind Avenue (see sidebar on page 2-1).

Exhibit 2-5: Project Features, Sheet 4

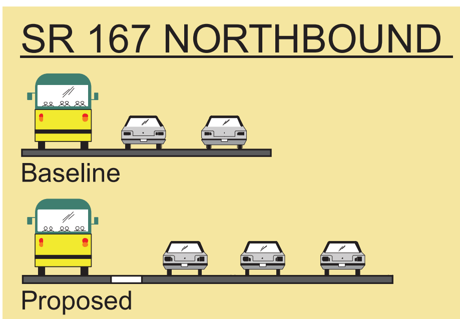


SR 167 from SW 43rd Street On-ramp North to SW 27th Street

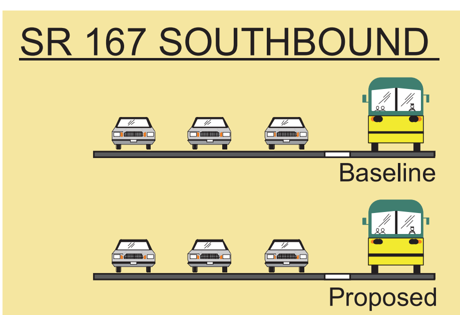
In this area, WSDOT will:

- Construct an auxiliary lane on northbound SR 167 from SW 43rd Street to SW 27th Street.
- Stripe lanes to provide a buffer between HOV and general-purpose lanes along northbound SR 167.

As shown on Exhibit 2-5, the new northbound lane will be added north of the SW 43rd Street on-ramp. This will improve the ability of traffic to merge onto SR 167 and increase capacity along this stretch. To minimize effects on the streams and wetlands along SR 167, WSDOT has used retaining walls instead of fill slopes.



Project improvements will add capacity to northbound SR 167 and will provide a buffer between the HOV lane and the general-purpose lanes



The project will not affect the southbound lanes of SR 167

What is an auxiliary lane?

An auxiliary lane is a lane added between interchanges—from one on-ramp to the next off-ramp. It is dedicated to traffic entering and leaving the freeway and provides motorists with more time and extra room to accelerate or decelerate and merge when getting on and off the freeway.

The signs below show how an auxiliary lane changes how an on-ramp operates.

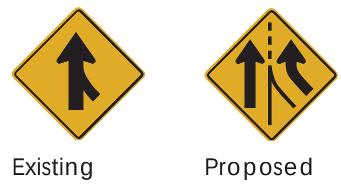
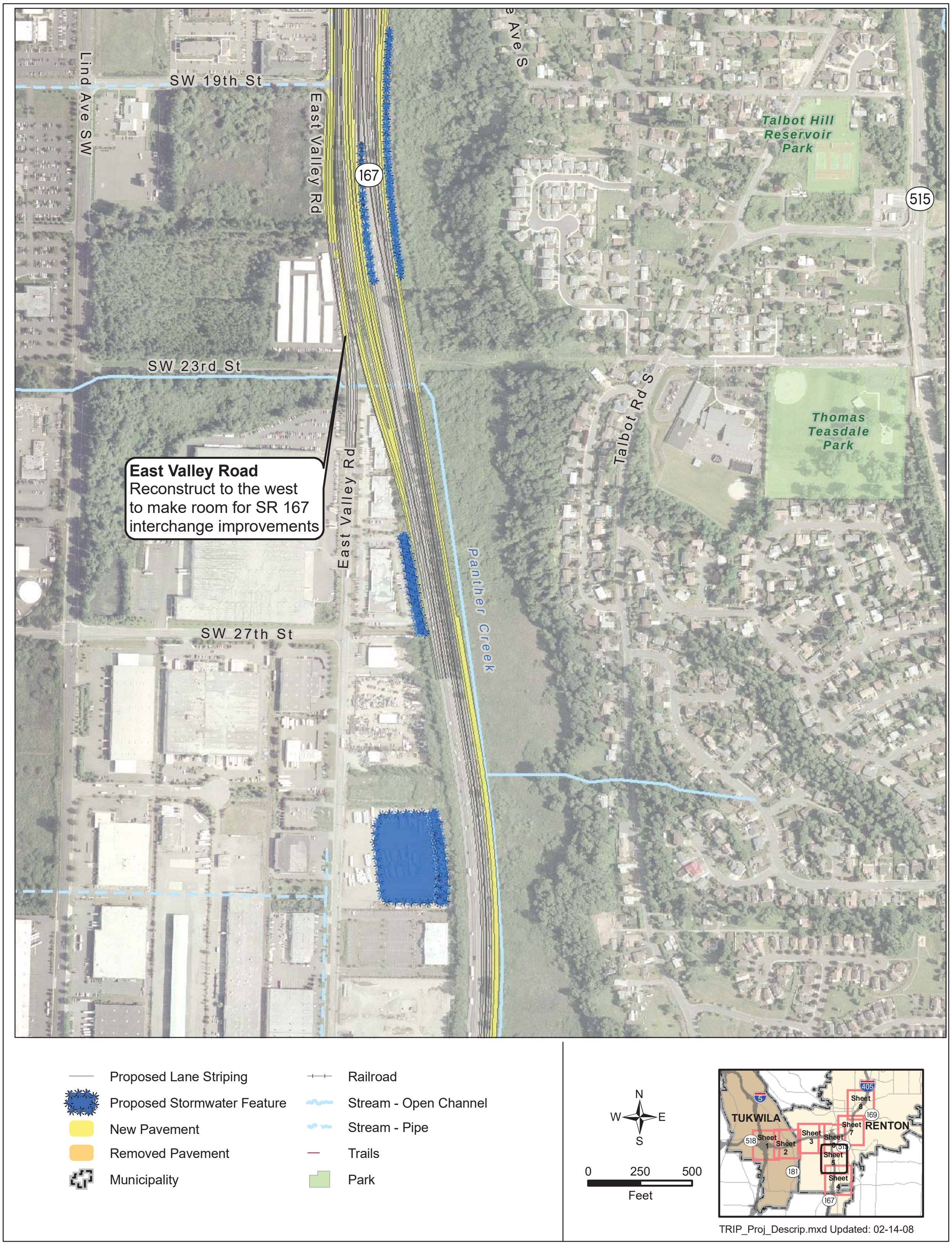


Exhibit 2-6: Project Features, Sheet 5

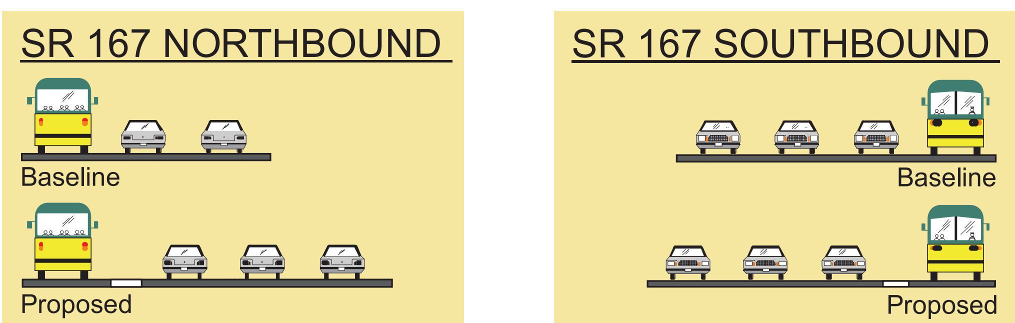


SR 167 from SW 27th Street to I-405

Along this section of SR 167, the project will:

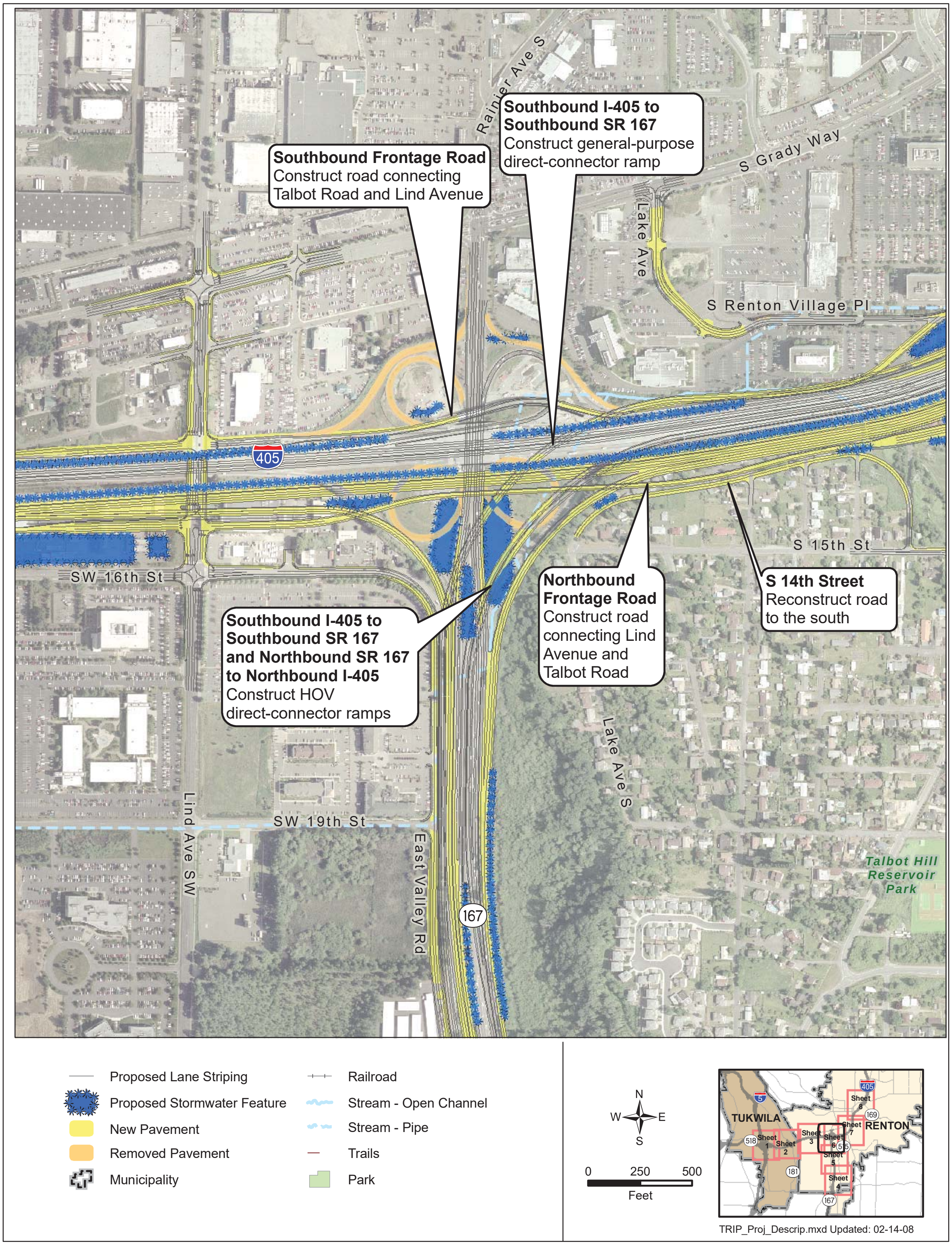
- Reconstruct SR 167 between SW 27th Street and I-405 to accommodate the reconstructed SR 167 interchange as shown on Exhibits 2-7 to 2-9.
- Reconstruct East Valley Road to the west of its current alignment between SW 23rd Street and SW 16th Street to accommodate the reconstructed SR 167 interchange.
- Stripe lanes to provide a buffer between HOV and general-purpose lanes along SR 167.
- Construct an auxiliary lane on northbound SR 167 from SW 27th Street to I-405.

WSDOT has designed the improvements in this area to the west as much as possible to minimize effects on the Panther Creek wetlands while also limiting the effects on businesses west of SR 167. To further minimize the area needed to accommodate the improvements, the new southbound I-405 to southbound SR 167 direct-connector ramp will be built over local street and freeway improvements as shown on Exhibit 2-9. WSDOT also used design features such as retaining walls to minimize the area needed for improvements.



Project improvements will add capacity to northbound SR 167 and will provide a buffer between the HOV lane and the general-purpose lanes in both the northbound and southbound directions of SR 167

Exhibit 2-7: Project Features, Sheet 6



I-405 Interchange with SR 167

Within the I-405/SR 167 interchange, the project will improve freeway to freeway access and local access.

Freeway to Freeway Access

To improve access, WSDOT will:

- Construct a general-purpose direct-connector ramp from southbound I-405 to southbound SR 167, replacing the existing loop ramp.
- Reconstruct exterior ramps from northbound I-405 to southbound SR 167 and from northbound SR 167 to northbound I-405, replacing the existing ramps. This project will also add a general-purpose lane to both ramps.
- Construct HOV direct-connector ramps from southbound I-405 to southbound SR 167 and from northbound SR 167 to northbound I-405.
- Maintain existing loop ramp from northbound SR 167 to southbound I-405.

Exhibit 2-8 focuses on the freeway to freeway interchange improvements and Exhibit 2-9 presents how these improvements will look.

Exhibit 2-8: Freeway to Freeway Ramps in Reconstructed I-405/SR 167 Interchange

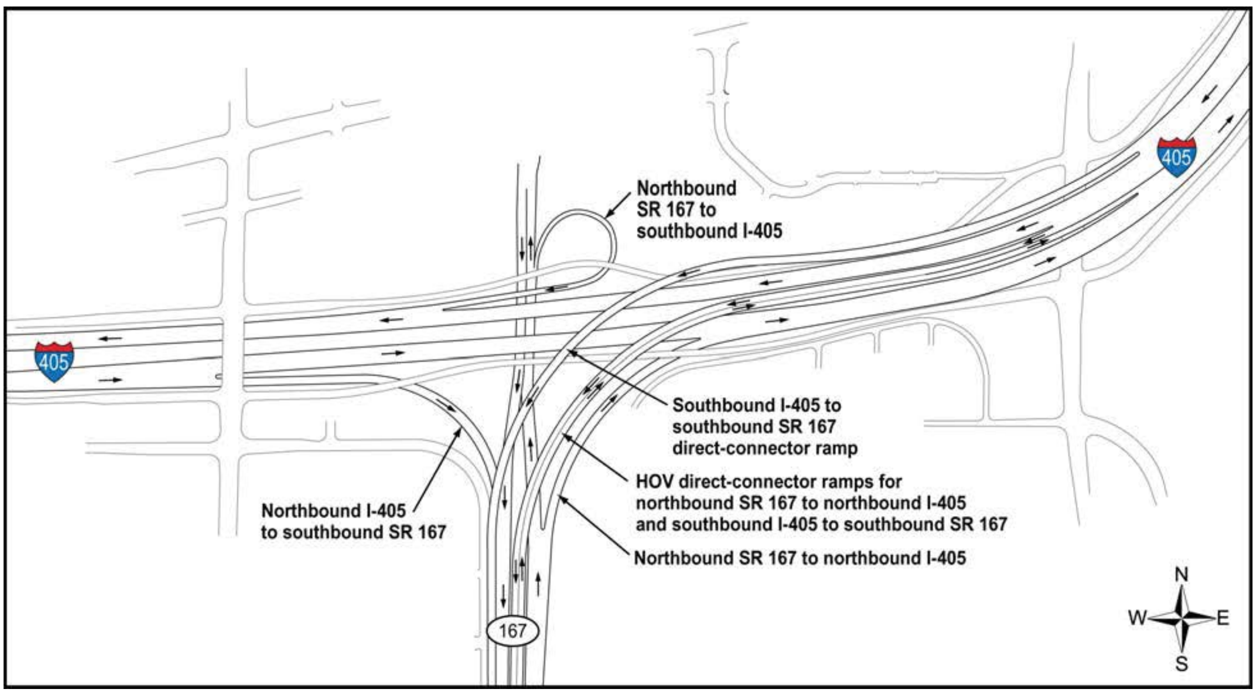


Exhibit 2-9: Rendering of I-405/SR 167 Interchange Improvements

Local Access

WSDOT will improve local access at the SR 167 interchange. The improvements will:

- Construct a split-diamond interchange at Lind Avenue and Talbot Road (SR 515). See Exhibits 2-10 and 2-11.
- Construct southbound and northbound frontage roads connecting Lind Avenue and Talbot Road. The southbound frontage road will reuse the existing I-405 to SR 167 southbound bridge.
- Reconstruct the Lind Avenue bridge over I-405.
- Reconstruct the I-405 structures over Talbot Road.
- Improve local street intersections.
- Provide new connection to Grady Way from S Renton Village Place.

Exhibit 2-10: Split-diamond Interchange at Lind Avenue and Talbot Road

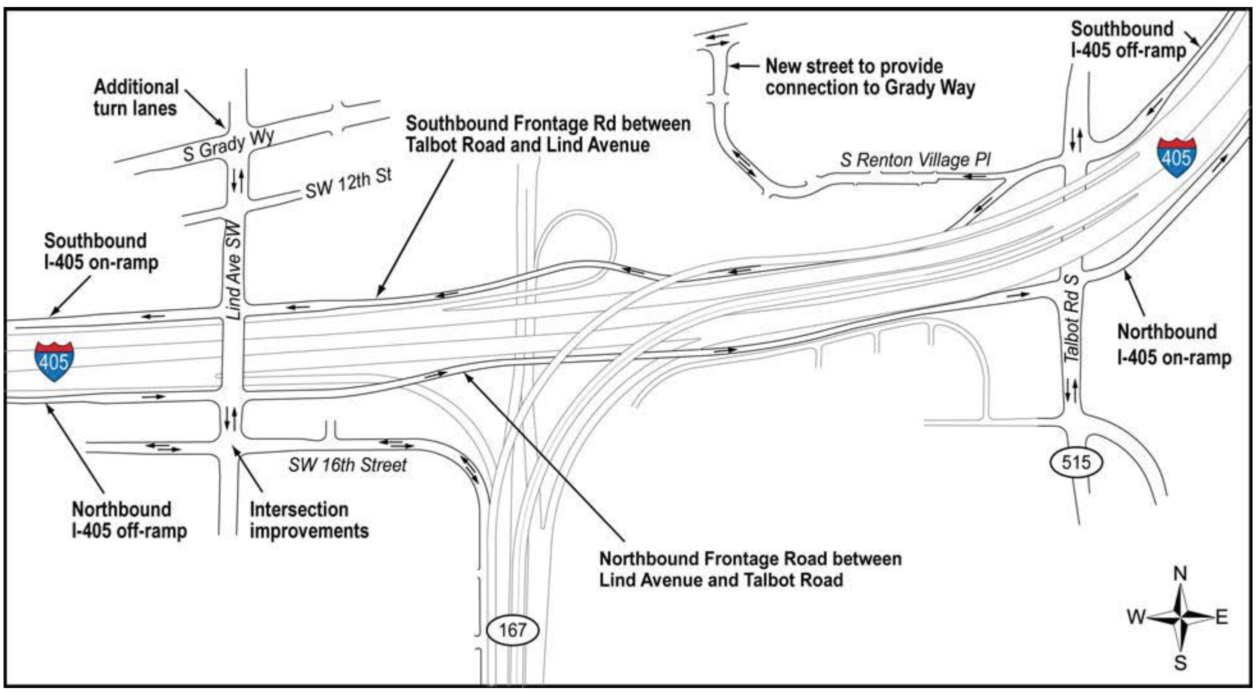
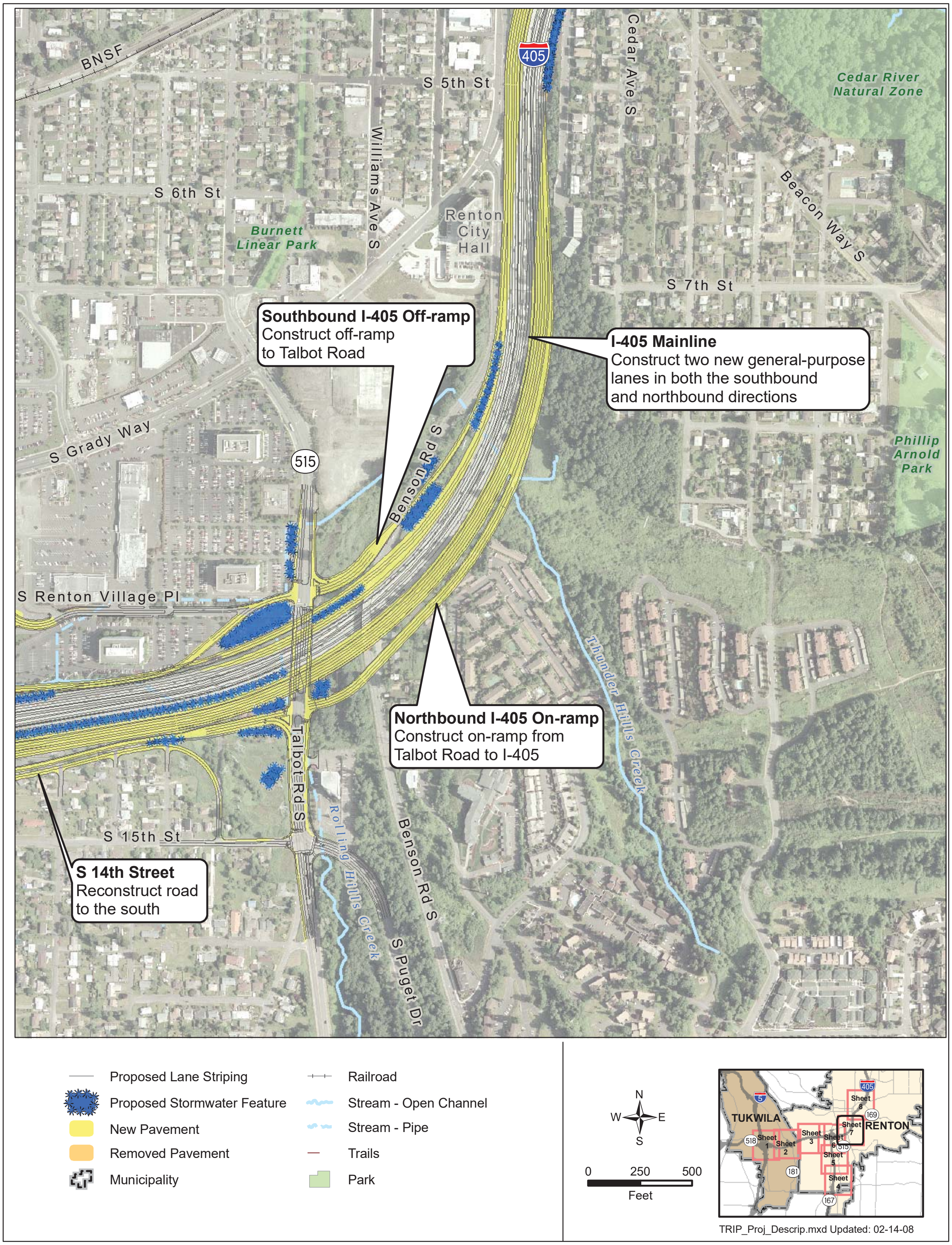


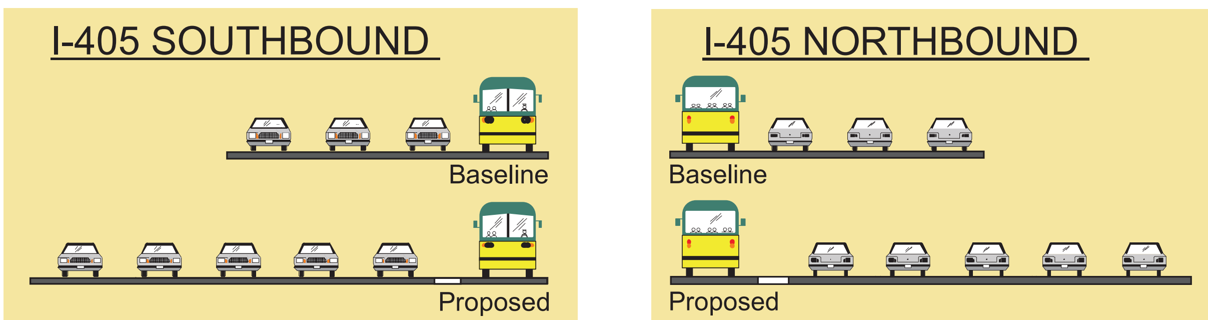
Exhibit 2-11: Project Features, Sheet 7



I-405 from East of SR 167 Interchange to North of S 5th Street

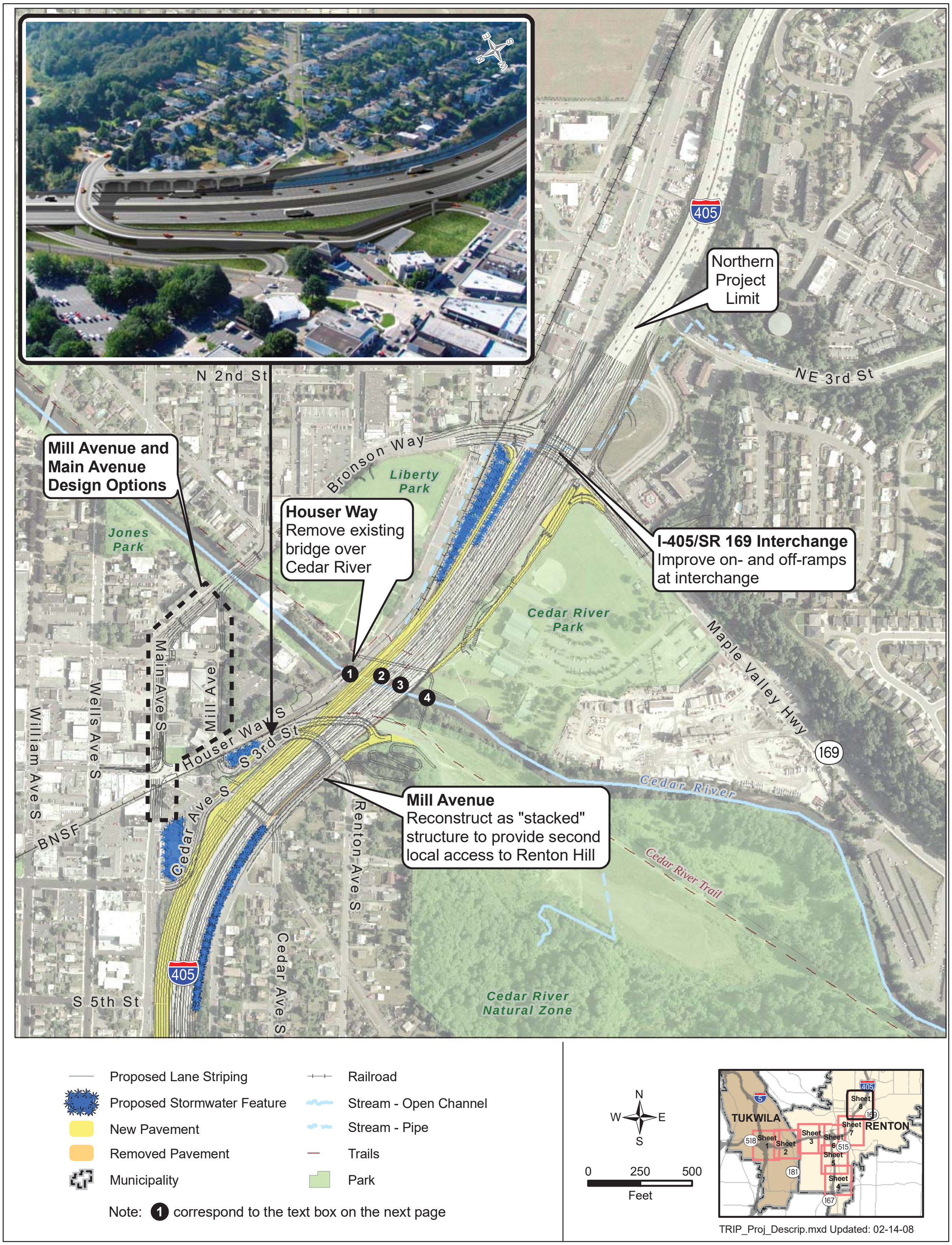
For the section of I-405 that extends from the SR 167 interchange past Renton City Hall as shown on Exhibit 2-11, WSDOT will:

- Construct two additional lanes in both directions on I-405 from SR 167 through SR 169.
- Stripe lanes to provide a buffer between HOV and general-purpose lanes along I-405.
- Construct a new half-diamond interchange at Talbot Road as shown on Exhibit 2-10.
- Reconstruct S 14th Street south of its existing location.



Project improvements will add capacity to I-405 for both southbound and northbound traffic and will provide a buffer between the HOV lane and the general-purpose lanes

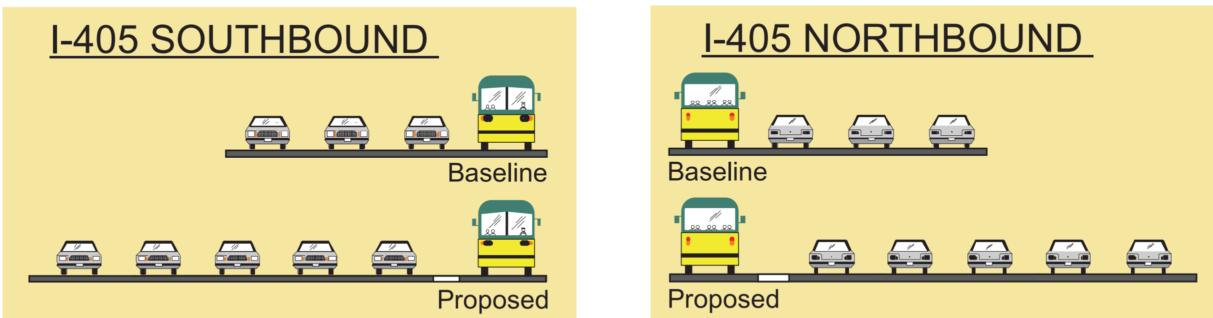
Exhibit 2-12: Project Features, Sheet 8



I-405 from S 5th Street to SR 169

This last portion of the Tukwila to Renton Project crosses the Cedar River to the SR 169 interchange. In this section, WSDOT will:

- Construct two additional lanes in both directions on I-405 from SR 167 through SR 169.
- Stripe lanes to provide a buffer between HOV and general-purpose lanes along I-405.



Project improvements will add capacity to I-405 for both southbound and northbound traffic and will provide a buffer between the HOV lane and the general-purpose lanes

- Cantilever the I-405 structures over Main Avenue.
- Reconstruct three bridges over the Cedar River: southbound I-405, northbound I-405, and a pedestrian bridge.
- Relocate the Burlington Northern Santa Fe railroad bridge.
- Close Houser Way south of the Cedar River north to Bronson Way and remove the bridge over the Cedar River.
- Reroute northbound traffic to Bronson Way, which will be striped to accommodate the new traffic pattern.
- Reconstruct two local street accesses to Renton Hill.

To accommodate the I-405 improvements, the Tukwila to Renton Project also required rerouting traffic from Houser Way and changing access to Renton Hill. These improvements are discussed on the following pages.

What bridge construction will occur over the Cedar River?

❶ Burlington Northern Santa Fe Railroad Bridge

❷ Southbound I-405 Bridge

❸ Northbound I-405 Bridge

❹ Pedestrian Bridge

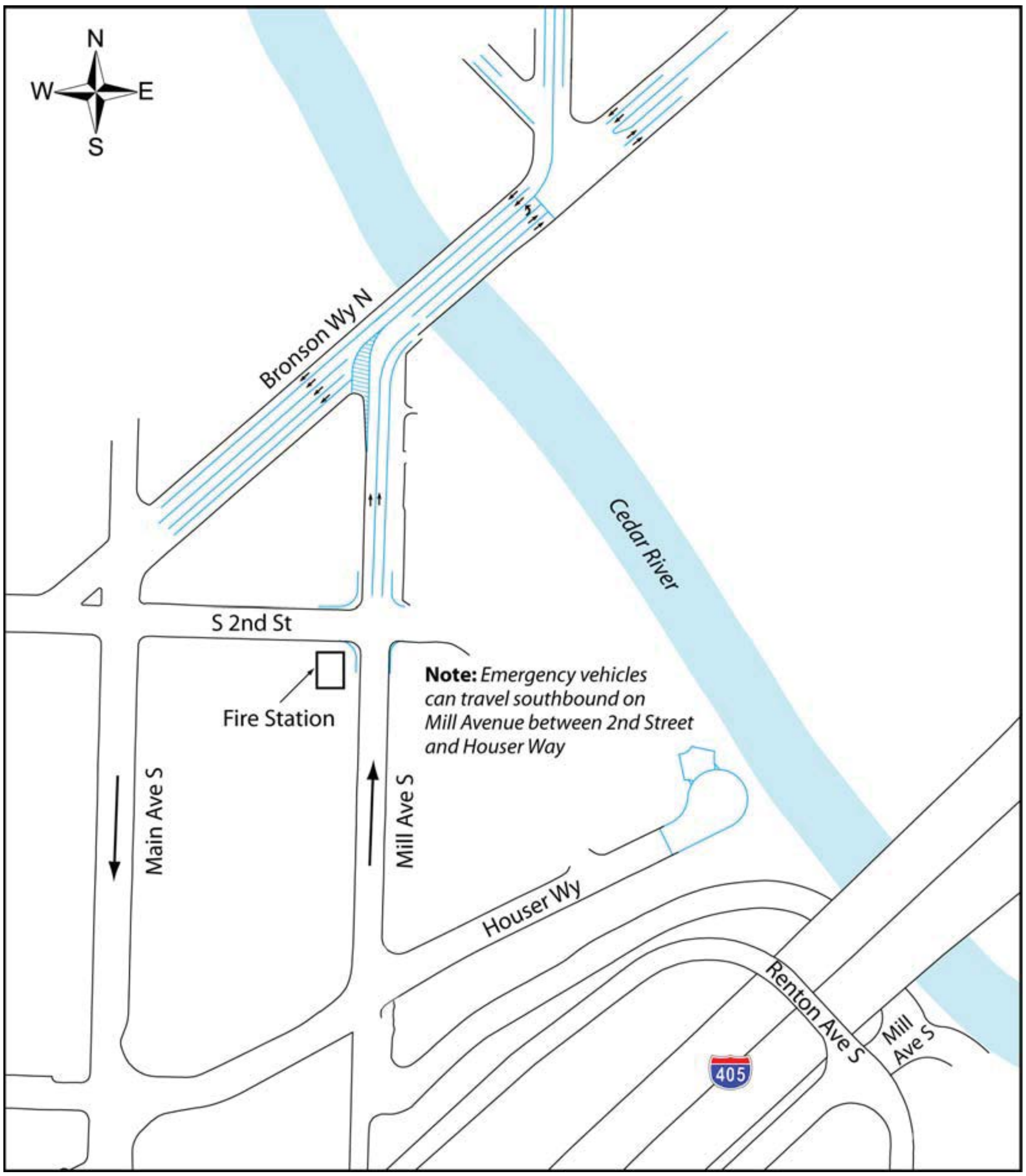
See Exhibit 2-12 for the bridge locations.

Mill Avenue and Main Avenue Design Options

To accommodate widening I-405 over the Cedar River, the Houser Way bridge will be closed. WSDOT worked closely with the City of Renton to develop the most acceptable and feasible solution for redirecting traffic coming from south of Houser Way. For northbound traffic within Renton south of the Cedar River, two design options are being considered:

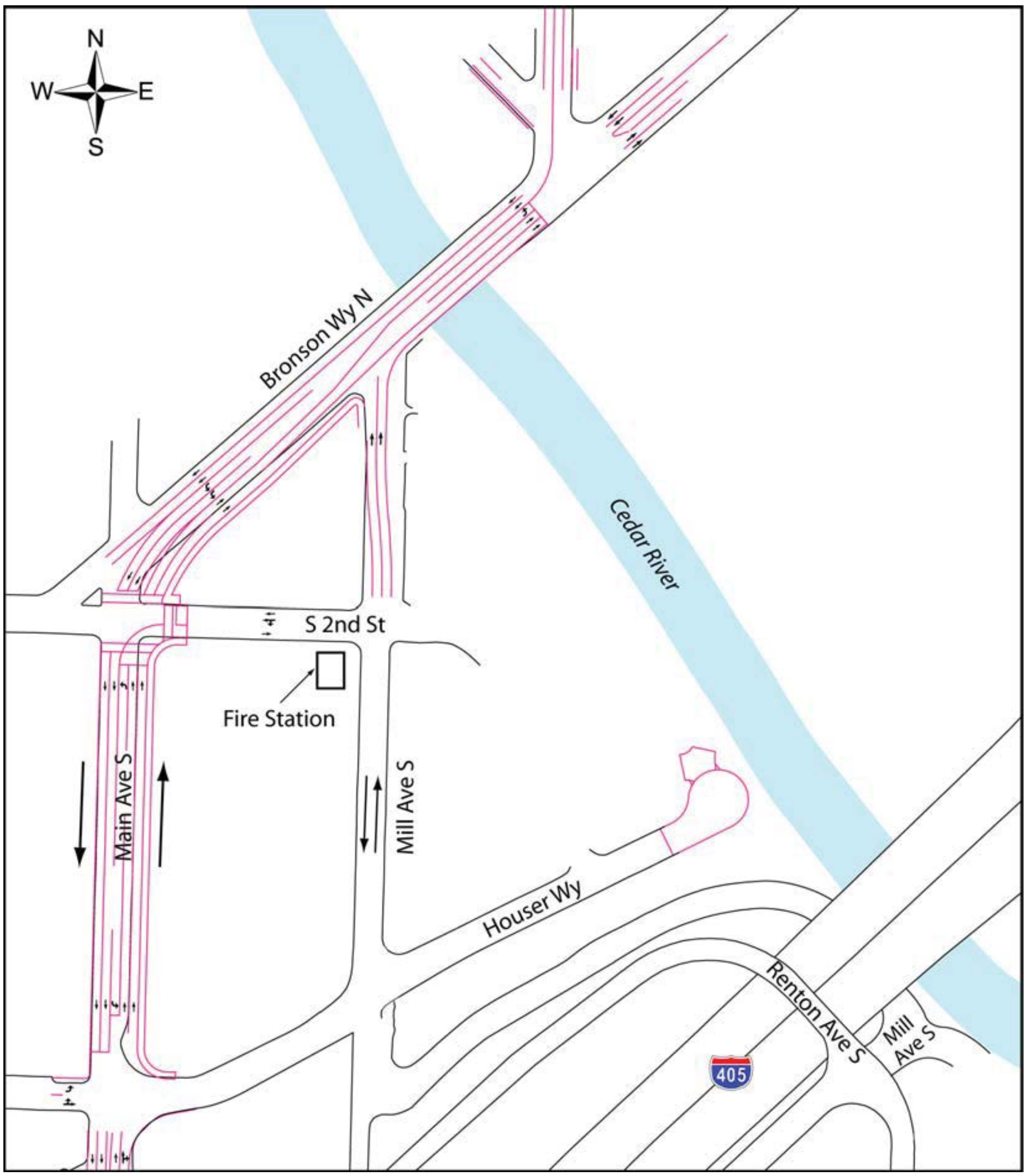
- The first option stripes Mill Avenue as a one-way street to provide two lanes northbound from the intersection of Houser Way and Mill Avenue to Bronson Way (see Exhibit 2-13).

Exhibit 2-13: Mill Avenue Design Option for Local Access to Bronson Way



- The second option leaves Mill Avenue as a two-way street up to the intersection with 2nd Street where it will be striped for one-way traffic northbound and reconfigures Main Avenue, a one-way street southbound, to provide two-way traffic. Main Avenue would be widened and striped for two-way traffic to provide access from the south to Bronson Way (see Exhibit 2-14).

Exhibit 2-14: Main Avenue Design Option for Local Access to Bronson Way

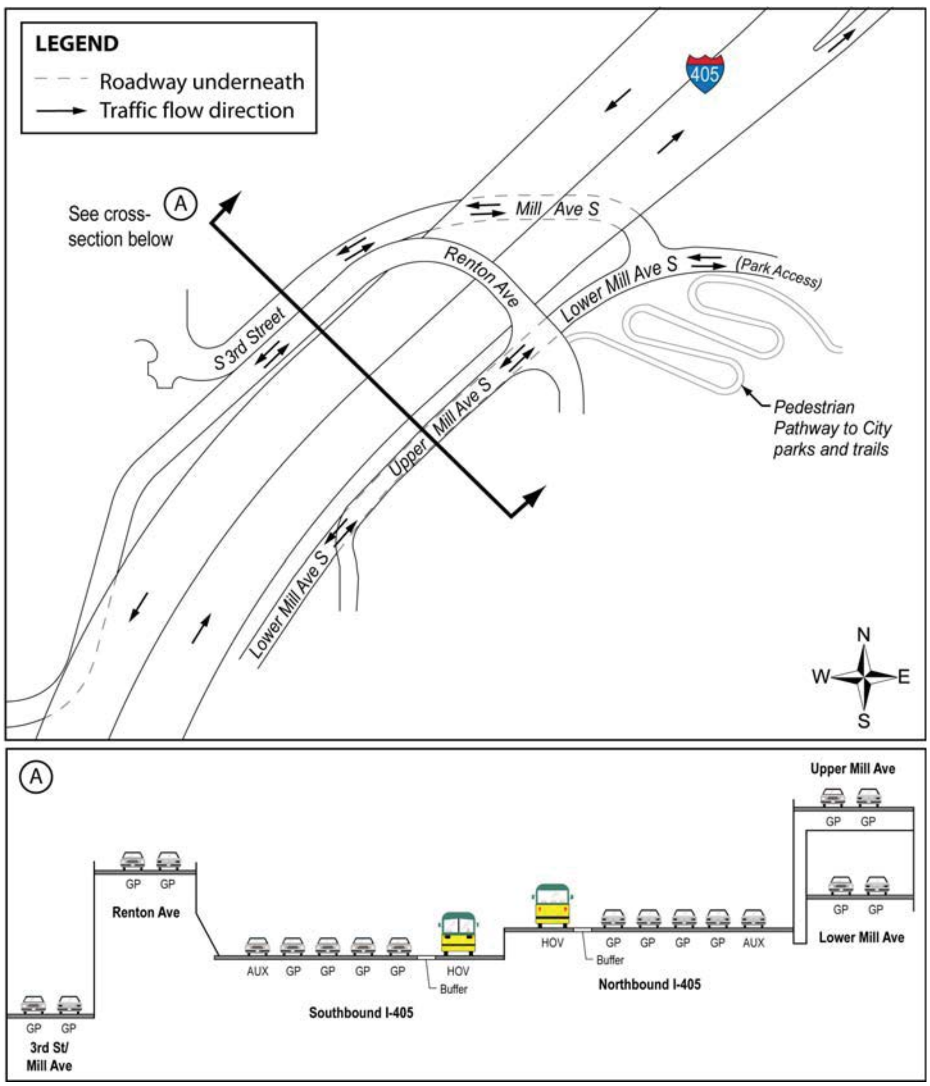


Changes to Renton Hill Access

As shown in the inset on Exhibit 2-12, the Renton Hill Access will be changed to accommodate the widening of I-405. These changes are detailed in Exhibit 2-15 below. WSDOT will:

- Reconstruct the Renton Avenue bridge over I-405 and realign the north end to intersect with Main Avenue rather than Houser Way as it currently does.
- Reconstruct Mill Avenue as a stacked structure that also provides access to Renton Hill as shown in Exhibit 2-15.
- Remove the existing Cedar Avenue bridge.
- Construct a pedestrian pathway connecting residents on Renton Hill to the City's parks and trails.

Exhibit 2-15: New Local Access for Renton Hill



What are the construction methods and schedule for implementation?

Construction Methods

The Tukwila to Renton Project will use different methods to construct the various project elements. The main approaches to construction for this project are described below.

At-grade Construction

At-grade construction, which occurs on the same elevation as the existing lanes, will be staged to minimize traffic delays and detours. One method would shift lanes toward the median. WSDOT then would place a concrete barrier to provide a work zone outside of the roadway. A second method would build the entire new section, then shift traffic to the new portion and reconstruct the existing section. Staging allows construction to occur safely without closing lanes for the duration of construction.

Bridge Construction

Bridge construction will generally occur in multiple stages to minimize traffic delays and detours. The following describes a typical staging approach for bridge construction on I-405 that will be used where practicable. As the first step, traffic is shifted toward the I-405 median, and the existing lanes and shoulders are narrowed slightly. This approach allows widening of the existing structure or construction of the new bridge, depending on the design, to occur on the outside of the roadway. Next, traffic is shifted onto the new bridge area. If the bridge is being replaced rather than simply widened, the old structure is demolished after traffic is shifted to the new bridge.

Road Closures

Some road closures will be necessary to construct various improvements. WSDOT will notify local agencies, public services, utilities, and the general public prior to any temporary road closures and will clearly mark detour routes. As much as possible, closures will be scheduled during times that will have the least impact on the traveling public.

Traffic Control

WSDOT will work with local agencies to develop detours as needed during construction. Prior to starting construction, WSDOT will develop a traffic control plan. The plan's primary objectives will be to provide a safe facility, to streamline the construction schedule, and to minimize reductions to existing traffic capacity. To lessen effects on traffic, the duration of activities will be minimized and reductions in capacity will be limited and will be targeted to a period when they will have the least effect.

Schedule

Because the I-405 Corridor Program master plan configuration is very expensive, WSDOT will implement the improvements in phases as funding becomes available. The Tukwila to Renton Project represents Phase 2 for this section of I-405. This discipline report assumes a baseline condition where the Phase 1 improvements, Renton Nickel Improvement Project, have been completed prior to the start of Phase 2.

Construction of the entire Tukwila to Renton Project is expected to be spread over several years as funding becomes available. For this reason, construction activity will not be constant throughout the entire study area and the duration will vary depending on the improvement being constructed.

The first element of the Tukwila to Renton Project that is proposed for construction is the SR 515 Interchange Project. This portion is funded through the 2005 Transportation Partnership Account (TPA). This Tukwila to Renton project element will construct a half-diamond interchange on I-405 at Talbot Road (SR 515). Construction of this element is scheduled to begin in autumn of 2008. The remaining elements of the Tukwila to Renton Project are unfunded at this time.

To complete the master plan for I-405 from I-5 to SR 169, additional work will need to be accomplished in this area.

Does this project relate to any other improvements on I-405 or connecting highways?

The Tukwila to Renton Project is part of a comprehensive program to address the congestion problems in the I-405 corridor. WSDOT worked with the Federal Highway Administration (FHWA), Federal Transit Administration, Central Puget Sound Regional Transit Authority, King County, and local governments to develop strategies to reduce traffic congestion and improve mobility along the I-405 corridor. The I-405 Corridor Program Environmental Impact Statement (EIS) and Record of Decision (ROD), published in 2002, document these strategies. The selected alternative has become known as the master plan.

WSDOT is constructing the master plan as funding becomes available. For the southern end of I-405 extending from I-5 to SR 169, the Renton Nickel Improvement Project was Phase 1. This phase was largely funded by the statewide transportation-funding plan called the "nickel package," which was approved by the Washington State Legislature in 2003. In 2005, the legislature passed a second funding package, TPA. It also provided funding for the Renton Nickel Improvement Project. Construction of the Renton Nickel Improvement Project began in 2007 and will be completed by 2011.

The other I-405 projects that relate to the Tukwila to Renton Project address the sections north of SR 169 to the end of I-405 at I-5 in Lynnwood. Of these projects, the first stage for the Kirkland area of I-405 is currently under construction. The first stage for Bellevue, SE 112th Street to SE 8th Street, began construction in 2007. As each successive project becomes operational, the public will benefit from the improved traffic movement, safety, and capacity along the I-405 corridor.

Another related project is the HOT Lanes Pilot Project on SR 167. This project will convert the existing HOV lanes to High-Occupancy Toll (HOT) lanes between Auburn and Renton. HOT lanes will better manage the SR 167 corridor traffic demand through tolling. The Tukwila to Renton Project will tie into the HOT lanes project.

In addition, some local agencies are working on projects that will tie into the work on I-405. For example, the City of Renton is proposing to reconstruct Rainier Avenue S, in particular, improving local access and circulation to the interchange with I-405 and SR 167.

As well as the road projects discussed above, WSDOT and the City of Renton are constructing the Springbrook Creek

Wetland and Habitat Mitigation Bank. This project will create a large wetland complex that will provide mitigation credits to multiple projects including the Tukwila to Renton Project.

What is the No Build Alternative?

The No Build Alternative assumes that the improvements associated with the Renton Nickel Improvement Project are constructed as does the baseline condition. Only routine activities such as road maintenance, repair, and safety improvements would be expected to take place between 2014 and 2030. This alternative does not include improvements that would increase roadway capacity or reduce congestion beyond baseline conditions. For these reasons, it does not satisfy the project's purpose to reduce congestion on I-405 between I-5 in Tukwila and SR 169 in Renton.

The No Build Alternative has been evaluated in this discipline report as a comparison for the effects associated with the Build Alternative.

SECTION 3 STUDY APPROACH

What are water resources?

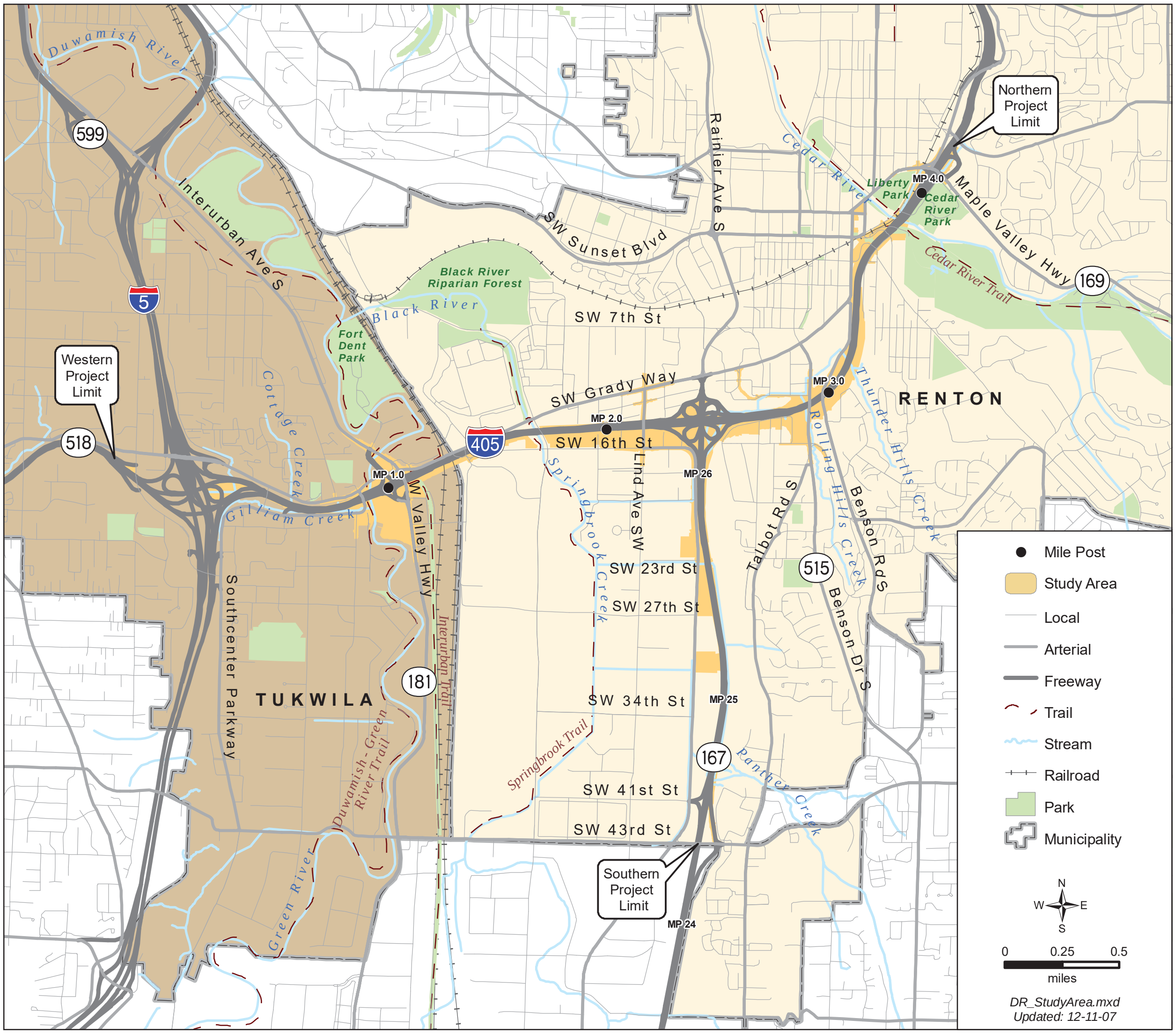
In this report, water resources include surface water flow, surface water quality, floodplains, and groundwater. For the purposes of this report, surface water flow is defined as the water flow or current in a river or stream. Surface water quality is the condition or amount of pollutants in a river or stream. A floodplain is the area bordering river channels that becomes inundated during flood flows. Groundwater is water below the ground surface and is further defined in this report's glossary.

What is the study area and how was it determined?

The I-405 Team used the construction footprint of the Tukwila to Renton Project as the focus of the study area for water resources. Baseline conditions for these water resources are presented in Section 4 of this report. Within the study area, the baseline condition also includes the Phase 1 Built Alternative detailed in the *I-405 Renton Nickel Improvement Project, I-5 to SR 169, Environmental Assessment*.

The study area is the area affected by proposed improvements to I-405 and SR 167 in addition to those areas affected by other necessary project elements, such as stormwater treatment facilities, noise walls, surface street improvements, and staging areas for construction equipment. The study area includes existing and proposed new WSDOT right-of-way. Along streams and rivers, the study area extends 300 feet upstream and 1,320 feet (1/4 mile) downstream so that effects to these waterbodies can be assessed. Streams and rivers in the study area are located in Water Resource Inventory Areas (WRIA) 8 and 9. In total, the study area encompasses approximately 200 acres as shown in Exhibit 3-1.

Exhibit 3-1: Study Area (stream and river 300 feet upstream and 1,320 feet downstream boundary not shown)



What policies or regulations are related to effects on water resources?

Several policies and regulations are related to the Tukwila to Renton Project and its effects on water resources. Authority for implementing these policies and regulations is delegated to different agencies. The following list includes potential policies and regulations related to the Tukwila to Renton Project followed by the agency with authority:

- National Environmental Policy Act (NEPA) – United States Environmental Protection Agency.

- Federal Clean Water Act (CWA) – Washington State Department of Ecology (Ecology) and U.S. Army Corps of Engineers (Corps)
- State Environmental Policy Act – Ecology
- Washington State Shoreline Management Act – Ecology
- King County Critical Areas Ordinance for shorelines and wetlands
- King County Floodplain Ordinance and City of Tukwila and Renton Critical Areas Ordinances. The King County, Tukwila, and Renton floodplain ordinances include a provision that requires compensatory mitigation for flood storage that is lost due to fill in jurisdictional floodplains.

Related to these policies and procedures are several permits. The following list includes potential water resource permits that may be required to construct the Tukwila to Renton Project followed by the agency with authority:

- Joint Aquatic Resources Permit (JARPA)
  - Section 404 of the CWA and Section 10 of the Rivers and Harbors Act – Corps
  - The Bridge Act Permit and Private Aids to Navigation – U.S. Coast Guard
  - 401 Water Quality Certifications – Ecology
  - Hydraulic Project Approval (HPA) – Washington Department of Fish and Wildlife
  - Aquatic Resources Use Authorization Notification – Washington State Department of Natural Resources
- Shoreline Conditional Use permit – Ecology
- Shoreline substantial development and variance permits – Cities of Tukwila and Renton
- National Pollutant Discharge Elimination System (NPDES) – Ecology

How did we collect information on water resources for this report?

The I-405 Team reviewed the I-405 Renton Nickel Improvement Project, I-5 to SR 169 discipline reports related to surface water,[2] water quality,[2] floodplains,[3] and groundwater.[4] We used information from these discipline reports as sources for information about surface water, water quality, floodplains, and groundwater.

Additional water resources information was collected in Autumn 2004 during a series of site visits where experts in the fields of fisheries, wetlands, wildlife, road design, drainage design, and permitting reviewed the natural and manmade features located in the study area.

Authors obtained additional surface water information for the Tukwila to Renton Project from:

- Field surveys
- Aerial photos
- Topographic maps
- Drainage maps
- Data from the City of Tukwila, City of Renton, and King County personnel

We obtained water quality information from:

- Data provided by Ecology including WRIA Maps
- Ecology's 2004 303(d) list of impaired water bodies (according to Ecology, the updated 2006 list will not be approved until 2008, and therefore was not available for this report)
- Ecology's Total Maximum Daily Load (TMDL) list
- Data from the City of Renton, Tukwila, and King County personnel
- Pollutant load estimates, WSDOT Environmental Procedures Manual[5] (EPM) – Method 1

Floodplain information came from FIRMs.

Groundwater information came from several sources including:

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[2] *WSDOT 2005a*

[3] *WSDOT 2005b*

[4] *WSDOT 2005c*

[5] *WSDOT 2004a*

- LiDAR (*Light Detection and Ranging*) data for land elevations and topographic information for this report. LiDAR is an optical remote sensing technology that measures properties of scattered light to find range and/or other information of a distant target.
- Sole Source Aquifers and Group A and B Wellhead Protection Areas from King County and City of Renton databases.
- Databases on wells and water rights from Ecology web sites

How did we evaluate effects on water resources?

The I-405 Team used the methods described in WSDOT's EPM to evaluate the project's effects on surface water, water quality, floodplains, and groundwater during construction and operation. The manual provides guidance that WSDOT follows to ensure that its projects comply with local, state, and federal laws and regulations. We elaborate on the evaluation methods in the following sections.

Surface Water Flow

To determine operational effects, the I-405 Team compared baseline conditions with the proposed project drainage designs to determine the new impervious pavement distribution and the affected streams and rivers. We determined affected streams and rivers by consulting with the authors of the *Ecosystems Discipline Report*, who mapped the streams and rivers for the project.

The WSDOT HRM requires the use of MGSFlood to calculate runoff from impervious pavement. These runoff values are used by the I-405 Team to verify the number and size of ponds needed to protect the receiving waters.

What is MGSFlood?

MGSFlood is a model used in hydrologic analyses. The public domain version was developed for WSDOT by MGS Engineering Consultants. The program is a general, continuous, rainfall-runoff computer model developed specifically for stormwater facility design in the lowlands of Western Washington. The program meets the requirements in the 2001 Washington State Department of Ecology Stormwater Management Manual for Western Washington.

Surface Water Quality

The I-405 Team used Method 1 in WSDOT's EPM to calculate pollutant load estimates that the project will generate during operation. Method 1 is known as the WSDOT Data-FHWA method and is considered to provide conservative results. Method 1 estimates pollutant loads based on highway runoff data collected in western Washington since 2001. These data provide a reasonable estimate of pollutant concentrations flowing from both treated and untreated highway surfaces because they are recent and specific to WSDOT highways.

The I-405 Team reviewed the effectiveness of BMPs to determine potential water quality effects from construction. Specific BMPs for this project will be described in more detail in the Temporary Erosion and Sediment Control Plan that WSDOT will write prior to construction

What are best management practices?

Best management practices, referred to commonly as BMPs, are methods used to minimize or avoid construction effects to water quality such as sediment getting into streams. Examples of BMPs include installing filter fabric fence downstream of all exposed slopes, around existing drainage inlets, and along river, stream, and drainage channels near work areas to prevent sediment-laden stormwater from entering streams.

Floodplains

The I-405 Team compared baseline conditions with the proposed project to determine where construction will require fill or bridge piers to be placed in the floodplain. To determine how much fill will be placed in the floodplain, the I-405 Team used the floodplain elevation maps prepared by the Federal Emergency Management Agency (FEMA).

To evaluate whether the floodplain will be affected by the project, the I-405 Team compared how much material is being placed in the floodplain and how much material is being removed. If, for the same floodplain at the same elevation, more material is being removed than being placed as fill, then the project will not negatively affect floodplain storage capacity.

Groundwater

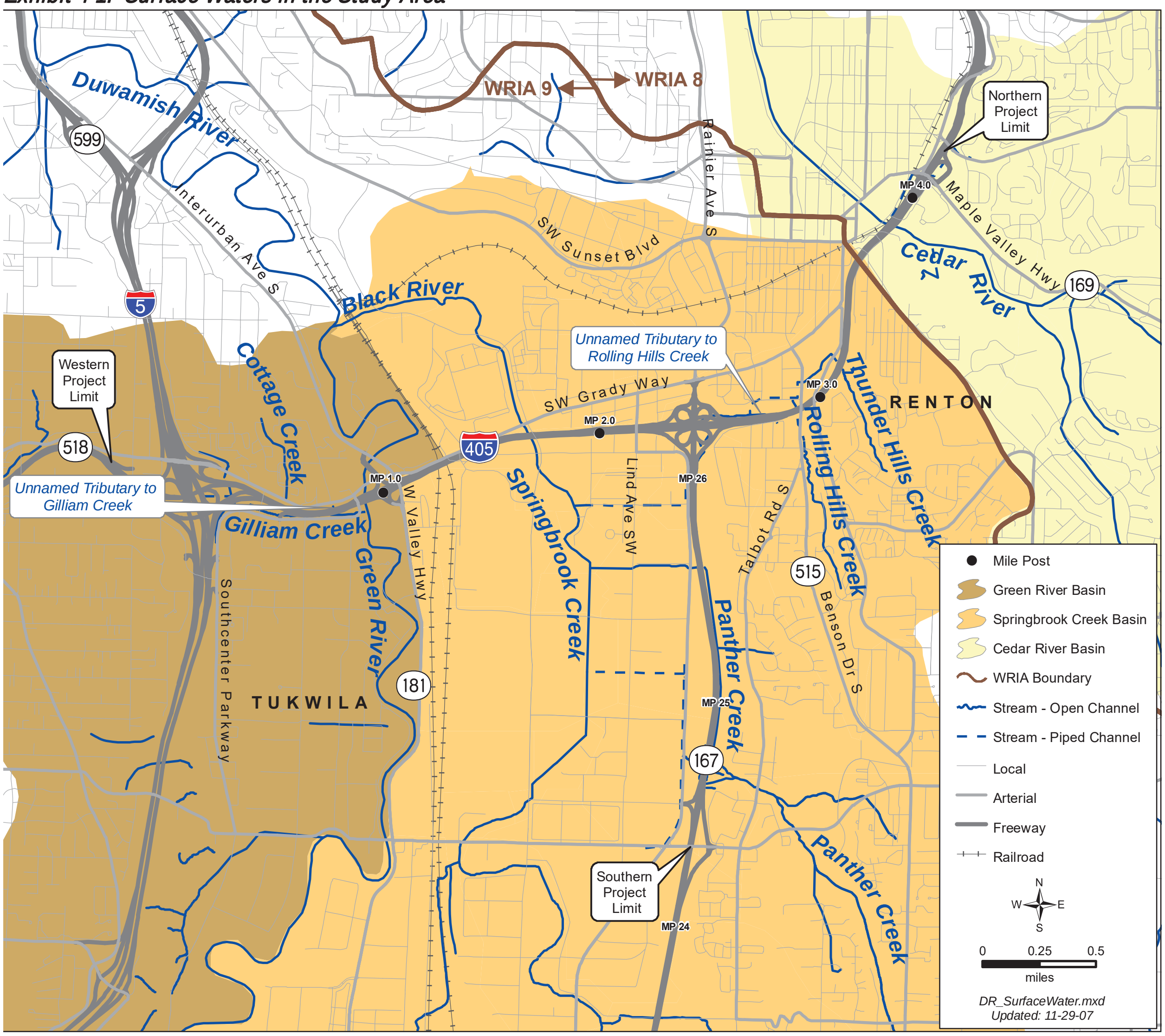
The I-405 Team reviewed the proposed project design and likely construction methods to evaluate the project's potential effects. Evaluations were based primarily on sound engineering principles, WSDOT practices, and professional judgment. Part of WSDOT's practice is to use the Geotechnical Design Manual, which contains many WSDOT design and construction practices that minimize effects to groundwater.

SECTION 4 BASELINE CONDITIONS

What surface waterbodies exist in the study area?

Exhibit 4-1 shows that the study area primarily includes surface waterbodies in the Green River watershed (WRIA 9). The study area also includes surface waterbodies in the Cedar River watershed (WRIA 8). Surface waterbodies in the study area include Cottage Creek, Gilliam Creek, an unnamed tributary to Gilliam Creek, the Green River, Springbrook Creek, Panther Creek, Rolling Hills Creek, unnamed tributary to Rolling Hills Creek, Thunder Hills Creek, unnamed tributary to Thunder Hills Creek, and the Cedar River.

Exhibit 4-1: Surface Waters in the Study Area



In general, the surface waterbodies in the Tukwila to Renton Project study area have been highly altered from their natural states to accommodate residential, commercial, and industrial land uses. This alteration has included bank hardening, such as installing riprap and placing streams in concrete channels and pipes; reducing or removing streamside vegetation; straightening stream channels; and removing in-stream habitat. The installation of levees has also reduced the historic floodplains associated with many of these waterbodies. Dramatic changes have also occurred in the vegetation surrounding these waterbodies. What was once predominantly mature native vegetation has been replaced by a mix of immature native vegetation and non-native invasive plant species.

The following sections describe these surface waters starting at the I-405/I-5 interchange and moving northbound. For details on the ecosystems associated with these waterbodies please see the *Ecosystems Discipline Report*.[6]

Cottage Creek

Cottage Creek is a tributary to Gilliam Creek that originates from the City Hall drainage basin located north of I-405 at approximately milepost 0.4 in the city of Tukwila. The creek has a basin size of approximately 0.1 square miles. It flows south from the hillside and passes under Southcenter Boulevard via a culvert. The creek flows as an open channel for approximately 12 linear feet immediately north of I-405 then flows under I-405 via another culvert and joins with Gilliam Creek at a stormwater outfall.

This flap gate prevents high flows in the Green River from entering Gilliam Creek

Gilliam Creek

Gilliam Creek flows along the south side of I-405 to the Green River in a series of open channels and large culverts. It has a basin size of approximately 1.21 square miles. Gilliam Creek enters the Green River via a 108-inch-diameter flap gate. The flap gate prevents high flows in the Green River from entering the creek. Surface water runoff in its drainage area is conveyed through a network of underground pipes, drainage ditches, and open stream channels.

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[6] *WSDOT 2007*

Unnamed Tributary to Gilliam Creek

An unnamed tributary flows into Gilliam Creek via a culvert immediately west of Gilliam Creek's confluence with the Green River. This tributary has no open channel except for an approximately 50-foot section that daylights into, and flows through, a small riparian wetland immediately north of I-405. The unnamed tributary has a basin size of 0.07 square miles.

Green River

Green River at I-405 milepost 0.8

The Green River drainage basin covers approximately 492 square miles. The Green River crosses I-405 at milepost 0.8. The river has an average flow of 1,696 cubic feet per second (cfs) based on flow records spanning the past 67 years as measured near Auburn.[7] The Howard Hanson Dam, located northeast of Enumclaw at river mile 64.5, regulates the flow of the Green River. This dam maintains the river's flow at a 2-year, 24-hour peak flow rate.

The Green River Valley is the historic floodplain of the Green River. The valley is relatively flat, and it has become highly urbanized with commercial and industrial development. The *Land Use Discipline Report*[8] provides more information on land use in this area.

Springbrook Creek

The Springbrook Creek basin covers approximately 24 square miles. Springbrook Creek is the main tributary to the Green River in the study area, and it crosses under the I-405 bridge at milepost 1.6.

Approximately one mile north of I-405, the Black River Pump Station was built at the confluence of Springbrook Creek and the Black River. Flows from Springbrook Creek into the Green River are controlled by this pump station. The creek has an average annual flow of 10.2 cfs based on flow records spanning the past 12 years as measured upstream of the study area at Orillia.[9]

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7 *WSDOT 2005a*

8 *WSDOT 2007*

9 *USGS 2005*

Panther Creek and Wetlands

The Panther Creek basin encompasses approximately 4.2 square miles. Panther Creek originates from Panther Lake on hills east of SR 167 and flows northwest from the lake to where it encounters SR 167. On the east side of the highway, the creek splits into two channels. The east fork generally flows along the toe of the SR 167 highway fill, through the large Panther Creek wetland complex then crosses SR 167 near SW 23rd Street where it flows west into Springbrook Creek. The Panther Creek wetland complex extends from near SW 41st Street to the I-405/SR 167 interchange. At one time, the Panther Creek wetland complex drained to the west across SR 167 through a series of culverts. Most of these have been plugged and the majority of flow has been redirected to the SW 23rd Street culvert underneath SR 167. A fish ladder was installed at this location immediately upstream, east of SR 167, to promote fish passage. The west fork of the creek flows underneath SR 167 via two culverts north of SW 41st Street. One of these culverts carries the main flow and the other provides for overflow during high flows. From SR 167, Panther Creek flows west to Springbrook Creek.

Rolling Hills Creek

Rolling Hills Creek originates on the hills above Talbot Road on the south side of I-405 and is a tributary of Springbrook Creek. It has a basin size of approximately 0.9 square miles. At S 15th Street, the creek flows from its natural ravine into a piped system that crosses under I-405 at Talbot Road, milepost 2.8. From here, flows move west through a series of pipes under several commercial parking lots to where it daylights on the north side of I-405 into an open channel between I-405 and a parking lot. From this point, the creek flows through culverts to the I-405/SR 167 interchange, and then it daylights again into the north end of the Panther Creek wetlands complex. Rolling Hills Creek flows south along SR 167, and crosses the highway at milepost 26 in a box culvert at SW 19th Street. From here, the creek is piped south along East Valley Road and then west along SW 19th Street to Springbrook Creek.

Unnamed Tributary to Rolling Hills Creek

This channel is likely the historic main channel of Rolling Hills Creek. This water feature has been classified as a wetland for this project, rather than a creek.

Thunder Hills Creek

Thunder Hills Creek also originates on the hills above I-405 just northeast of Rolling Hills Creek and is a tributary of Rolling Hills Creek. It has a basin size of approximately 0.6 square miles. Thunder Hills Creek crosses under I-405 at milepost 3.0 in a 48-inch-diameter culvert. At this point, the creek joins the flow from a historic coalmine. Drainage from these two culverts enters a concrete flume that flows southwest to Talbot Road. From here, the flows are piped and discharged to Rolling Hills Creek.

Unnamed Tributary to Thunder Hills Creek

An unnamed tributary to Thunder Hills Creek is a medium to high gradient creek ranging in width from one to two feet. The creek has year-round flows and the stream flows over an approximately 20-foot-high sandstone outcropping before joining Thunder Hills Creek on the south side of I-405.

Cedar River

The Cedar River crosses I-405 near the north end of the project at milepost 3.7. The Cedar River drains 166 square miles and provides half of the total annual flow into Lake Washington. Direct stormwater discharges into the Cedar River are exempted from flow control provisions according to the HRM.[10]

I-405 and pedestrian bridge crossing of the Cedar River

What is the water quality of these surface waterbodies?

Ecology prepares a 303(d) list that identifies waterbodies that do not meet the state water quality standards and the reasons why. According to the most recently approved 303(d) list (Ecology published in 2004), three waterbodies within the study area do not meet the state water quality standards: Green River, Springbrook Creek, and Cedar River.

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[10] *WSDOT 2006b*

In the study area, the Green River is 303(d) listed for fecal coliform bacteria, dissolved oxygen, and temperature. Springbrook Creek is also listed for not complying with standards for dissolved oxygen and fecal coliform bacteria. The Cedar River is listed for fecal coliform bacteria and temperature downstream of the study area.

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT PROGRAM

The NPDES permit program was established under Section 402 of the CWA, which prohibits the unauthorized discharge of pollutants from a point source (pipe, ditch, well, etc.) to U.S. waters, including municipal, commercial, and industrial wastewater discharges and discharges from large animal feeding operations. Permittees must verify compliance with permit requirements by monitoring their effluent, maintaining records, and filing periodic reports.

Some historic pollutant sources to rivers in the study area have already been eliminated. In 1982, a NPDES permit was issued to move the outfall of King County's South Wastewater Treatment Plant from the Green River to Puget Sound. This project was completed in early 1987. Prior to moving the outfall, the treatment plant was a major source of pollution in the Green River causing increased temperature, low dissolved oxygen, and ammonia toxicity[11]. In 1992, the U.S. Environmental Protection Agency (EPA) approved a TMDL issued by Ecology. The Green River TMDL does not allow the discharge of ammonia-nitrogen into the river.

No other TMDLs have been developed for the waterbodies in the study area at this time. However, as stated in the 2004 303(d) list, Ecology anticipates preparing TMDLs for both the Cedar River and Springbrook Creek in the future.

Currently, King County is undertaking a major study called the Green-Duwamish Watershed Water Quality Assessment. As its goal, the water quality assessment will develop tools to analyze current and future water quality issues, to assist with salmon recovery planning, to guide stormwater management decisions, and to provide guidance for Ecology's TMDL program.

Thunder Hills Creek joins drainage from a historic coal mine at milepost 3.0. Field investigators noted a strong sulfur smell coming from the coal mine drainage and conducted a water quality investigation. Investigators determined that elevated dissolved water concentrations of iron and total aluminum indicate that this reach of Thunder Hills Creek may not provide fully functional habitat for fish and invertebrates.

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[11] *King County 2000*

How does urbanization affect surface water?

Urbanization of natural landscapes radically alters natural drainage processes. In a forested landscape, vegetation and the upper soil layers capture the vast majority of rain and slowly release the rainwater into the ground. The prolific vegetation in forests draws some of the water out of the ground and releases it back into the air. Water that remains in the ground is pulled by gravity downhill toward streams, providing base flow to streams or recharge for groundwater. When the soils and vegetation are replaced by impervious surfaces such as roofs, driveways, sidewalks, parking lots, compacted lawns, and streets, much less water soaks into the ground. These impervious surfaces decrease the amount of water available to recharge the groundwater and contribute to stream base flows. Also, the increased impervious surface generates more stormwater, which runs off much more quickly and can result in streambank erosion, sedimentation, and downstream flooding.

What is urbanization?

Urbanization refers to a process in which an increasing proportion of an entire population lives in cities and the suburbs of cities. In regards to watersheds, urbanization is the process of converting vegetated landscapes to impervious areas.

Stormwater runoff in urban areas also carries pollutants, including: sediment from erosion; oil and grease from roads and parking lots; metals from tires, brakes, and roofs; and pesticides, herbicides, and fertilizers from lawns and landscaping. Some of these pollutants dissolve in stormwater, but most become attached to small particles suspended in the water.

Traffic on I-405 and SR 167 produces several specific types of pollutants in stormwater runoff. These include metals such as copper, zinc, and cadmium; oil and grease; sediment from tire and brake wear; and dirt washed off vehicles during storms.

If untreated, this runoff tends to reduce the habitat value of streams by physically changing the stream bed. The increased sediment in runoff affects water quality by increasing turbidity, which in turn reduces visibility, and by depositing layers of sediment in the streams, referred to as sedimentation. Turbidity can harm fish and aquatic insects. Removing the particles that cause turbidity (i.e., suspended solids) is the primary strategy of many stormwater treatment systems.

What is turbidity?

Turbidity is a cloudiness or haziness of water caused by individual particles of suspended solids. Measurement of turbidity is a key test of water quality.

Another example of water quality effects occurs when stormwater picks up nutrients, such as those from fertilizers or animal waste, as it travels across surfaces. These nutrients can indirectly lower the amount of dissolved oxygen available to aquatic life. These particular pollutants are of lesser concern on roadway projects because traffic-related uses do not generate substantial amounts of these nutrients.

How is stormwater managed in the study area?

The baseline condition has a variety of stormwater facilities such as detention ponds, biofiltration swales, ecology embankments, wet vaults, and stormwater treatment wetlands that convey, detain, and treat stormwater along the project corridor. However, portions of the highway in the baseline condition do not have detention or water quality treatment for runoff because these facilities were not required when I-405 was originally built, and the Renton Nickel Improvement Project only retrofits a small portion of the existing highway pavement.

Over the years, detention standards used to regulate stormwater flows have changed to require more stringent protocols. The newest design protocols for detention ponds require matching the project's stormwater flow and duration characteristics to a selected predevelopment condition. For this project, the duration and magnitude of stormwater discharge into the streams and creeks would be generally equal to or less than that experienced under the baseline condition for the full range of design storm events, from 50 percent of the 2-year storm event through the 50-year recurrent storm event.

What is a 2-year or 50-year storm?

These terms are used to indicate the probability that a storm of a certain magnitude will occur in any particular year. For example, a 2-year storm is a storm that has a 50 percent chance of occurring in any single year, a 10-year storm has a 10 percent chance of occurring in any particular year, and a 50-year storm has a 2 percent chance of occurring in any particular year.

The WSDOT HRM is being used as the design standard for this project and reflects the best available science in stormwater management to ensure that WSDOT projects adequately protect the functions and values of critical environmental areas including wetlands, streams, lakes, and marine waters. The HRM criteria were developed to protect receiving waters from adverse hydrologic changes and water quality degradation. WSDOT maintains this manual to include all known, available, and reasonable methods of prevention and treatment for stormwater runoff discharges consistent with state and federal law. The following descriptions provide explanations of water treatment BMPs commonly used by WSDOT.

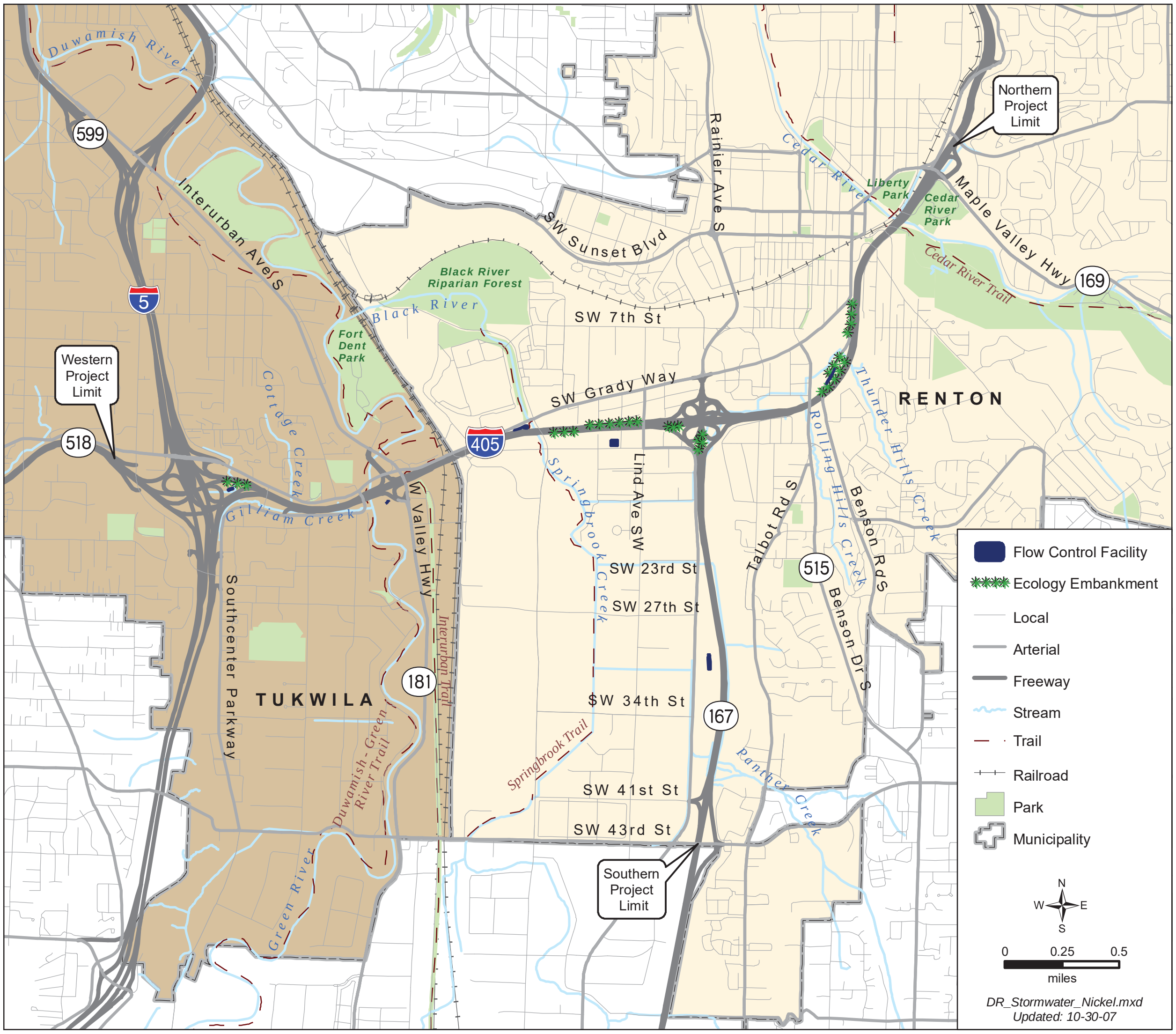
Detention Ponds

Detention ponds provide basic flow control treatment by detaining and slowing down the release of stormwater into the drainage system to assure that flooding and erosion would not increase as a result of the project. The use of wetpools within detention ponds allows some water to be held for extended periods, which provides time for suspended solids to settle out, thus allowing sediments and other pollutants to be removed from stormwater. The detention ponds for this project, however, will not include permanent wetpools because there are concerns about introducing new areas of standing water in the vicinity of the Renton Municipal Airport. Standing water can attract waterfowl and that can be a safety hazard to air traffic. The Federal Aviation Administration (FAA), United States Department of Agriculture (USDA), and Renton airport manager were consulted to coordinate air traffic safety issues associated with the design of facilities within the City of Renton limits along the I-405 corridor. For this project, the function served by wetpools will generally be replaced with ecology embankments within the wildlife hazard management zone.

Under baseline conditions, detention ponds are located in the I-405/I-5 interchange, south of I-405 at the SR 181 interchange, south of I-405 off of SW 16th Street near Oakesdale Avenue SW, west of SR 167 near the intersection of East Valley Road and SW 27th Street, and north of I-405 at Benson Road. Exhibit 4-2 shows the locations of stormwater facilities under baseline conditions within the study area. Small ponds are also located west of SR 167 near SW 23rd Street and south of SW 41st Street.

At the northern end of the project, two ponds are located at mileposts 3.6 and 3.95. These two concrete-lined ponds also serve as spill containment ponds. In the event that hazardous materials are spilled on I-405 and washed into the storm drainage system, these ponds will help to protect the City of Renton's drinking water aquifer.

Exhibit 4-2: Stormwater Facilities under Baseline Conditions in the Study Area



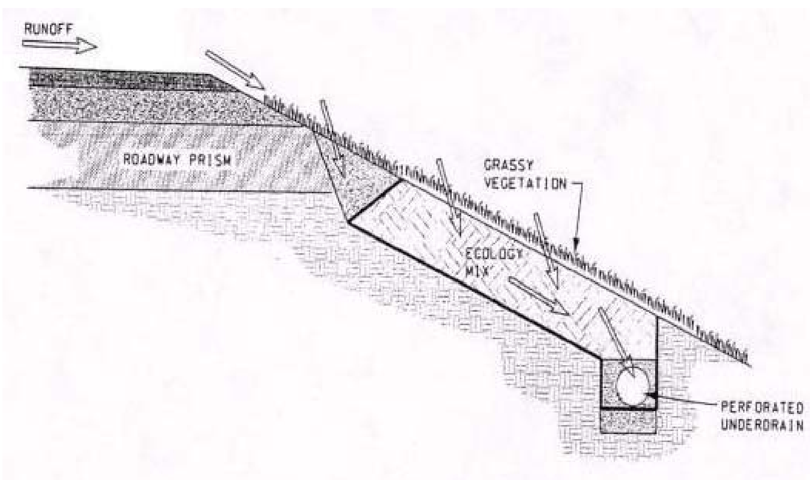
Biofiltration Swales

Biofiltration swales provide basic treatment and consist of broad, shallow grassy channels that are typically 200 feet long and designed so that stormwater filters through them. The vegetation and soil matrix filters and absorbs pollutants from stormwater runoff providing water quality treatment. Treatment efficiency is relatively low; biofiltration swales are designed to remove 80 percent of the total suspended solids, but typically remove around 20 to 40 percent of other pollutants from stormwater. The I-405 Team identified biofiltration swales in the baseline condition south of I-405 at mileposts 1.0 and 1.5 and north of I-405 at milepost 1.0. The loop ramps at the SR 167 interchange on the north side of I-405 also have biofiltration swales.

Ecology Embankments

Ecology embankments provide enhanced treatment and are constructed as a continuous system placed along the highway shoulder that is filled with a granular material designed to remove pollutants. Stormwater flows off the highway and into the ecology embankment where it percolates through the media and pollutants are filtered out. The treated water is then collected by pipes and discharged off site.

Ecology embankments are very efficient at improving water quality and remove around 90 percent of most pollutants.[12] These BMPs are typically used as the first step management system that then conveys stormwater to detention ponds for flow control. Ecology embankments are generally constructed as shown in the drawing below.



In the baseline condition, ecology embankments exist in the study area along the south side of I-405 at the SR 181 interchange, on I-405 west of Springbrook Creek, on the north side of I-405 at Lind Avenue SW, on the east and west side of SR 167, and on the west side of I-405 at Benson Road.

Stormwater Cross Culverts

In the baseline condition, cross culverts convey some stormwater from one side of the highway to the other to prevent ponding along the edge of the roadway. The I-405

[12] *WSDOT 2004*

Team conducted hydrologic and hydraulic analyses of the cross culverts to ensure the proposed modifications will have no effect on the base flood elevations or backwater conditions.

How do environmental regulations affect the stormwater system design for this project?

Water quality regulations mandated by the federal CWA prohibit the discharge of pollutants from non-permitted sources. In Washington, authority for implementing the CWA is delegated to Ecology and the Corps.

The listing of salmonids under the Endangered Species Act (ESA) has triggered new requirements to protect salmon habitat and water quality. WSDOT will need to obtain a variety of permits to construct the project. The best way to apply for several of these permits is by using the JARPA. A JARPA allows an applicant to prepare a single application to apply for multiple water resource related permits issued by various agencies.

What permits does the JARPA cover?

The JARPA application covers several permits including:

- the Hydraulic Project Approval (HPA) from Washington State Department of Fish and Wildlife
- the 401 Water Quality Certification from Ecology
- the Aquatic Resources Use Authorization Notification from the Washington State Department of Natural Resources
- the Section 404 and Section 10 from the Corps
- the Bridge Act Permit and Private Aids to Navigation (PATON – for non-bridge projects) from the U.S. Coast Guard.

The Tukwila to Renton Project may not require all of these permits.

The HPA will contain a list of measures that the project will need to meet for any work within the high water mark of waters of the state. The measures focus on protecting streams from construction-related impacts and pollutants. The HPA will include seasonal limits on construction activities, based on fish use, in which any work within a stream must be completed.

The 401 certification, included in the JARPA, will verify that this project complies with state water quality standards and other aquatic resource protections.

WSDOT uses its HRM to design stormwater facilities for transportation. According to Ecology, projects meeting the Ecology guidelines or equivalent standards such as the HRM are presumed to meet federal and state water quality requirements. To meet water quality standards, the manual requires treating stormwater runoff from new pollution-generating impervious surfaces (e.g., roads) before discharge. Stormwater runoff must also receive flow control (detention) in most situations to protect the receiving water from increases in flooding and streambank erosion.

Also included in the JARPA are the permits to comply with Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. These permits regulate dredging, excavation, filling, and construction of structures within waters of the United States.

FAA regulations require airports to evaluate wildlife hazards. The introduction of facilities that could increase the area of open water within 10,000 feet of the airport are managed by these regulations. For this project, the stormwater plan was reviewed by both the City of Renton and the FAA because of the possibility of introducing facilities that could have open water and encourage wildlife. Where flow control ponds are introduced, the FAA guidelines include measures such as pond grading, planting, liners, netting, and other techniques to discourage wildlife use. Where new pond facilities are proposed within the 10,000 foot wildlife hazard management zone, the FAA, City, and USDA (who oversees wildlife hazard management considerations for the FAA) will be involved as the design continues.

For the Green-Duwamish Alluvial Aquifer, standard WSDOT construction BMPs will be used to protect its water quality. The Washington State Wellhead Protection requirements and the City of Renton Aquifer Protection regulations require spill containment ponds and other mitigation measures to protect the Cedar Valley Aquifer from potential spills on I-405. The portion of the project extending over the Cedar Valley Aquifer will meet these regulations.

What regulated floodplains are associated with the surface waterbodies in the study area?

The FIRM maps for the study area show floodplains associated with the Green River, Springbrook Creek, Panther Creek, Rolling Hills Creek, and the Cedar River. Exhibit 4-3 shows these floodplains.

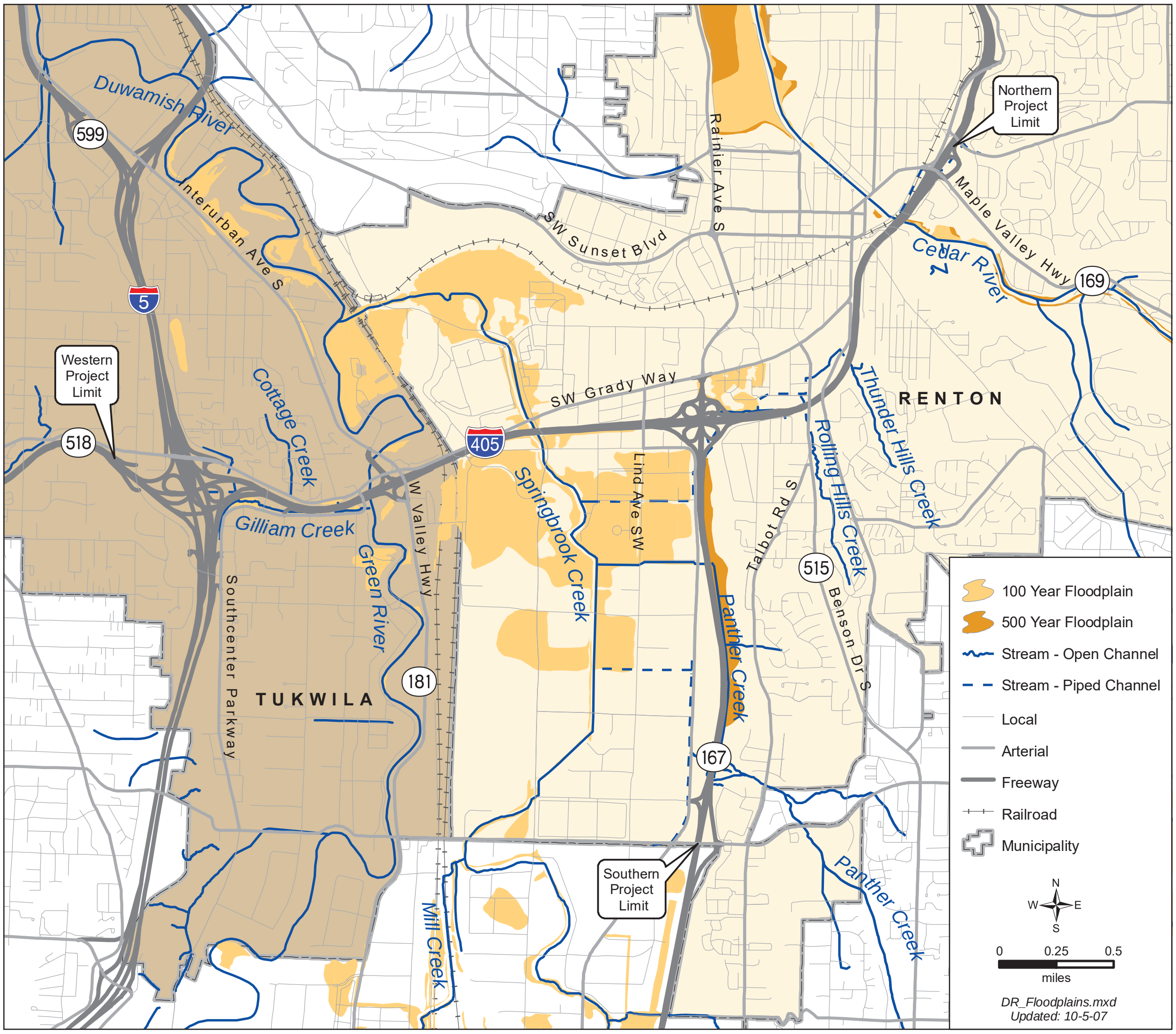
Many efforts have been made over the years to control flooding in the Green River Valley, especially as development has increased. A levee system was constructed on the Green River in the late 1800s. Although the levee reduced the frequency of floods, it also eliminated the natural floodwater storage that floodplains typically provide. In late 1961, the Corps completed the Howard Hanson Dam, near the headwaters of the Green River in King County, to further

What is a Floodplain?

A floodplain is the area bordering river channels that becomes inundated during flood level flows. These portions of river valleys are frequently defined in terms of the likelihood of flooding in a given year. Hence, the "100-year" flood event is the flood having a 1 percent chance of occurring during any given year. This flood is considered the base flood. FIRM maps identify the 100-year floodplain and are used to determine the risk of flooding for a given area.

control flooding. This dam was designed to limit peak flows to about 12,000 cfs, which is about a 25-year storm event.

Exhibit 4-3: FEMA 100-year and 500-year Floodplains in the Study Area



Springbrook Creek drains into the Black River and then to the Green River; however, its flow is controlled by the Black River pump station located north of the project. Operation of the pump station is determined by interlocal agreements and basin planning programs. The pump station can pump as much as 1,700 cfs during high flow events. This pumping rate exceeds the estimated peak flows on Springbrook Creek during a 100-year flood event, which is 1,307 cfs for current land use conditions. However, during flooding, flows on the Green River rise, reducing its capacity to receive additional flows. This decrease in capacity during floods requires that the pumping rates from Springbrook Creek be reduced. The pump station starts reducing pumping rates when the Green River reaches flows of 9,500 cfs. If flows in the Green River exceed 12,000 cfs, then the pump station may stop operating completely until flows in the Green River go down.

Flooding along Springbrook Creek affects its tributaries. This is because with flooding in Springbrook Creek, flows from the tributaries enter and mix into floodwaters and water backs up into the tributaries. When this happens, businesses east of Springbrook Creek near the I-405/SR 167 interchange experience parking lot flooding. In addition, flooding affects Panther Creek, which ponds on both sides of SR 167.

Another tributary to Springbrook Creek is Rolling Hills Creek. This creek has a FEMA-mapped floodplain on the north side of I-405 east of SR 167. In this area, flooding is caused by undersized pipes, not because the area is in a natural floodplain. When flooding occurs, it is limited to a large parking lot.

Historic efforts to control flooding in the Cedar River included building Masonry Dam and a levee system along the river. However, flooding still occurs. When the river flow reaches 4,200 cfs, the Renton Airport experiences flooding and SR 169 may overtop and close. No flooding occurs on I-405.

What groundwater resources exist in the study area?

Most of the groundwater resources in the study area exist within sediment deposits along the Cedar River and Green River valleys. The extent of shallow aquifers closely correlates with the extent of shallow groundwater.

Shallow groundwater aquifers in the study area occur mainly in alluvial sediments. Alluvial sediments in the study area consist primarily of sand, silt, and gravel. Renton Formation bedrock underlies the alluvial sediments and its depth varies considerably throughout the study area. Groundwater, from the Renton Formation bedrock, accumulates in the abandoned Renton Coal Mine tunnel. The groundwater discharges to a wetland and stream below Benson Road.

What is an unconfined aquifer?

An unconfined aquifer is usually a relatively shallow aquifer that can be recharged directly by downward seepage. An unconfined aquifer is called this because the aquifer is not overlain by a thick, low permeability layer, such as a thick deposit of clay.

What is permeability?

Permeability is a measure of a soil or rock's ability to transmit water. Soils such as clean sands and gravel have a high permeability. Excavations below the groundwater table in these types of materials will encounter heavy seepage flows requiring high capacity pumps to dewater. At the other extreme, soils such as clay and silty, very dense tills have a low permeability. Excavations below the groundwater table in these types of materials will encounter little, if any seepage.

What are sole-source aquifers?

Sole Source Aquifers are EPA-designated aquifers where few or no reasonable alternatives exist for acquiring drinking water.

Green-Duwamish Alluvial Aquifer

The Green-Duwamish Alluvial Aquifer is an unconfined aquifer system consisting of interbedded loose to dense silty sand with organics and scattered gravel layers, soft peat, organic silt, soft to stiff silt, and clay.[13] Thickness of these sediments varies but can be over 100 feet.

Groundwater is shallow in this aquifer, often at less than 10 feet below ground surface, but varies considerably with surface topography and season. In many places, the water table is at or near land surface and is hydrologically connected to wetlands. The permeability of this aquifer is variable. Locally, where silt or clay-rich layers have accumulated, the aquifer has a low permeability and may not yield much groundwater. No groundwater supply wells are receiving water from this aquifer within 0.5 miles of the study area.[14]

Groundwater flow in the Green-Duwamish Alluvial Aquifer is complex. The presence of wetlands and drainage ditches locally influences groundwater flow patterns. The primary discharge is to the Green River, but some groundwater may also discharge to the Delta Aquifer subunit of the Cedar Valley Aquifer (see description below) and Lake Washington. Direct infiltration from precipitation recharges this aquifer, but recharge can also occur from higher elevation areas within the Green River drainage, and from overland flow from the bordering valley hills.

Cedar Valley Aquifer and its Subunit, the Delta Aquifer

The most important aquifer in the study area exists along the Cedar River, known as the Cedar Valley Aquifer. Exhibit 4-4 shows the boundaries of the Cedar Valley Aquifer. The Cedar Valley Aquifer is an EPA-designated "Sole-source Aquifer."

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[13] *GeoEngineers 2005.*

[14] *King County 2005.*

This aquifer has been subdivided into several smaller aquifer units. The Delta Aquifer subunit is located along the lower drainage of the Cedar River and is the closest to the Tukwila to Renton Project. The Delta Aquifer subunit is unconfined and composed of alluvial sediments deposited by the lower Cedar River. Other subunits of this system include the Cedar Valley Alluvial Aquifer, the Marblewood Production Aquifer, and other aquifers further up the valley (i.e., the "Deep Aquifer"). These other subunits are located outside the study area and are not discussed in this report.

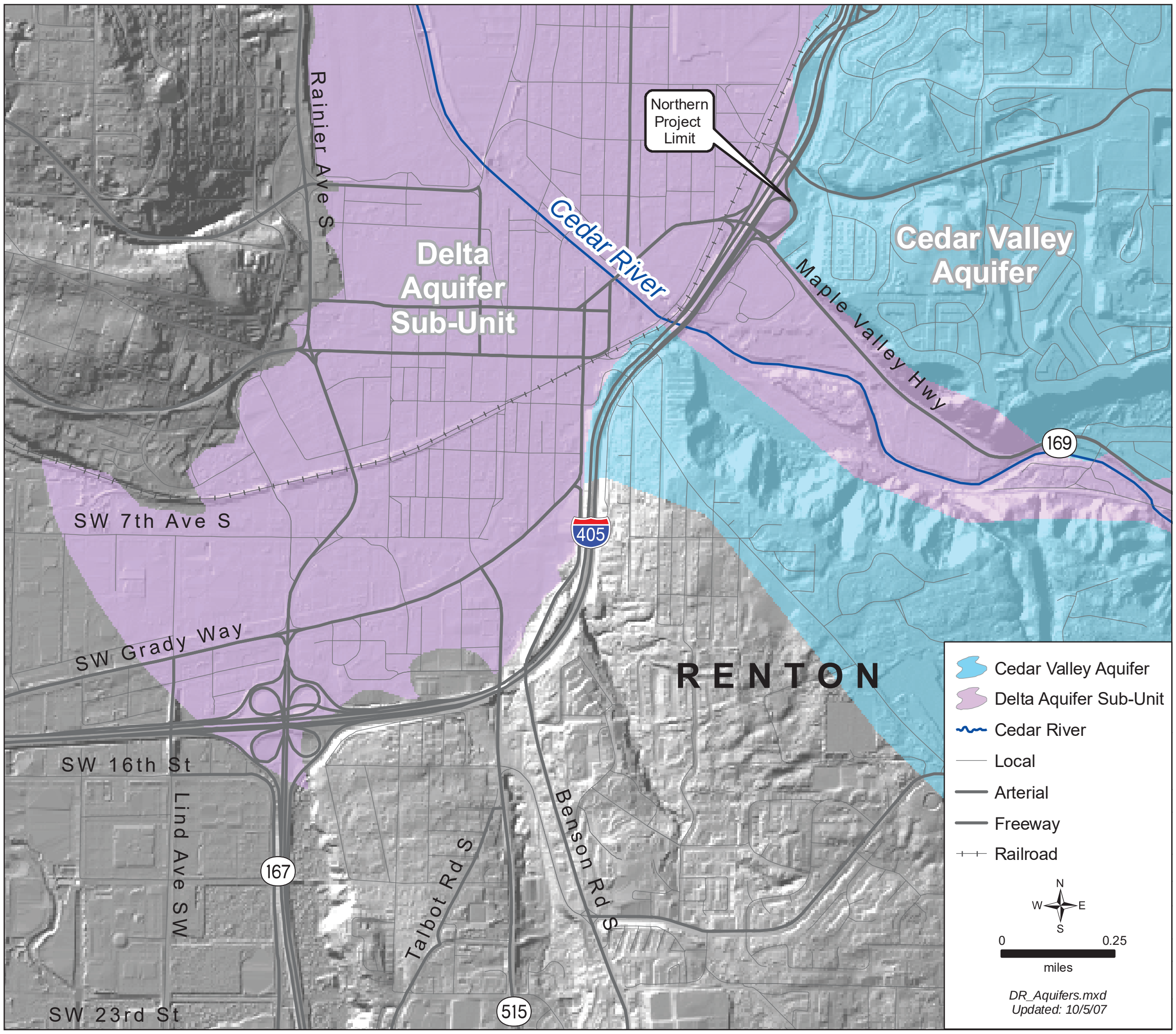
The Delta Aquifer subunit occurs within the Cedar River Valley between bedrock exposures to the south of the Cedar River and glacial uplands along the north side of the valley. Its western boundary is Lake Washington, and the eastern boundary continues southeast up the Cedar River, outside the study area. The depth to the water table varies, but it is generally shallow (less than 25 feet) in the vicinity of the study area. The Delta Aquifer subunit has a saturated thickness of between 65 and 90 feet.[15] The Delta Aquifer subunit is recharged by infiltration from the flow of surface water and groundwater originating in the bordering hills within its drainage basin and groundwater flow from underlying bedrock. The Delta Aquifer subunit discharges to groundwater supply wells, to the Cedar River, and to Lake Washington.

What do you mean by saturated?

Saturated means that all pores or open spaces in a geologic material are completely filled with groundwater at or greater than atmospheric pressure. Saturated thickness is an indication of the amount of water that may be available. The greater the saturated thickness for a geologic material, the greater the potential amount of groundwater that may be available.

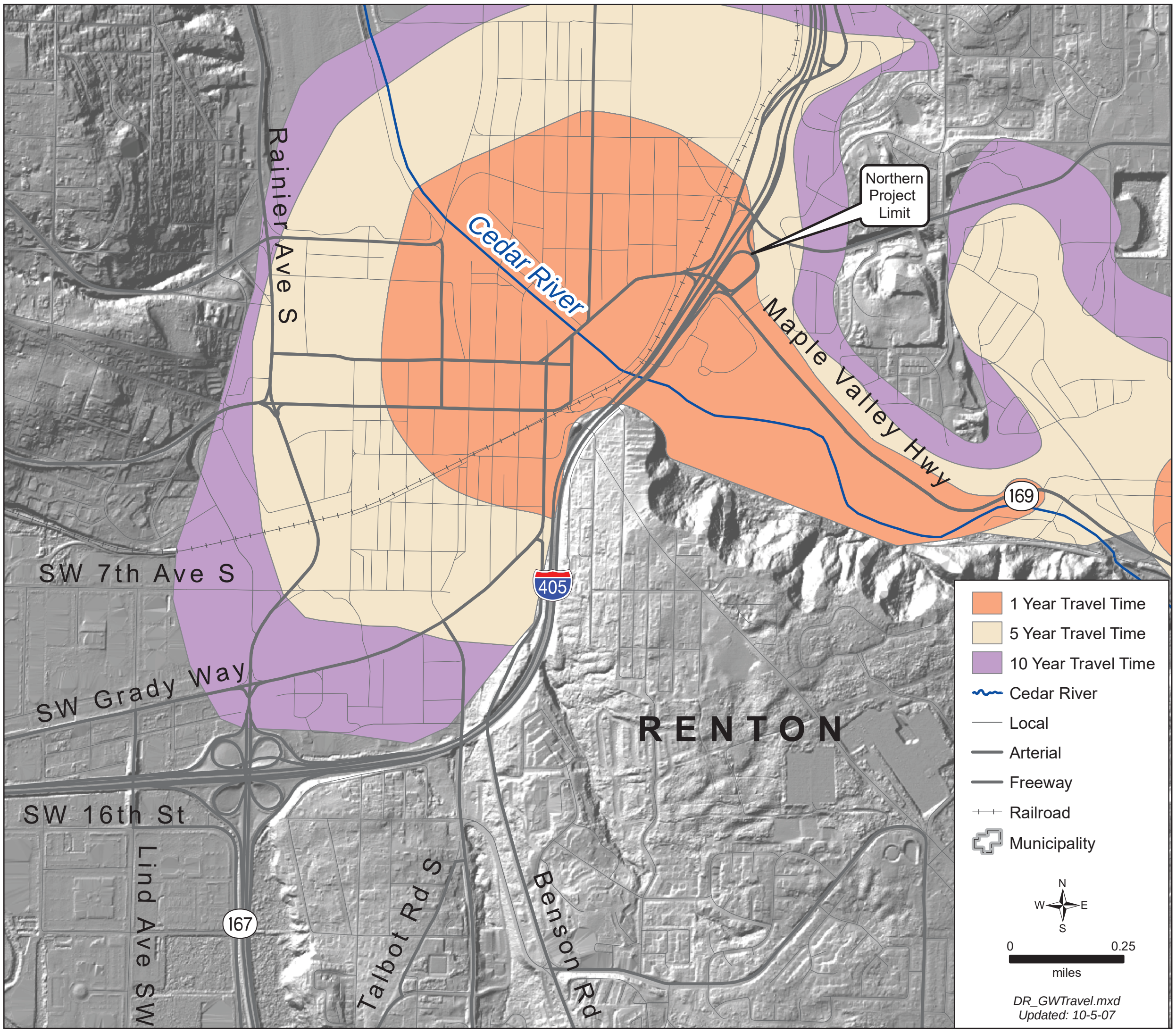
[15] *RH2 and Pacific Groundwater Group 1993.*

Exhibit 4-4: Boundaries of the Cedar Valley Aquifer and its Subunit, the Delta Aquifer, in the Vicinity of the Study Area



Groundwater flow in the Delta Aquifer subunit is predominantly along the valley from east to west. The City of Renton production wells are situated to capture most of the groundwater flowing through the aquifer. Exhibit 4-5 shows modeled groundwater capture zones in the Delta Aquifer subunit for 1-year, 5-year, and 10-year travel times.

Exhibit 4-5: 1-year, 5-year, and 10-year Groundwater Travel Times for the City of Renton's Well Field in the Delta Aquifer Subunit



How is groundwater used in the study area?

Groundwater within the study area has multiple uses, such as groundwater rights and groundwater wells. Specific uses are discussed below.

Groundwater Rights

Groundwater is extracted and used for water supply along the study area. Groundwater certificates and permits for uses that have a point of withdrawal within 0.5 miles of the Tukwila to Renton Project are listed in Appendix A.[16] Appendix A does

[16] *Ecology 2005.*

not list surface water rights, but it does include water certificates and permits for springs, since springs represent groundwater discharges.

Groundwater Wells

What are Group A and B wells?

Group A wells serve 15 or greater households. Group B groundwater supply wells serve between 2 and 14 households.

Many documented water supply wells exist within 0.5 miles of the study area. Existing groundwater wells in the study area include Group A, Group B, and other types of groundwater wells.[17]

The locations of all Group A groundwater supply wells within the study area is illustrated on Exhibit 4-6. The one Group B-designated well in the study area is located outside the 0.5-mile radius of the study area and will not be affected by the proposed project. All Group A wells in the study area are owned and operated by the City of Renton. These six Group A wells are within 0.5 miles of the I-405 corridor and extract groundwater from the Delta Aquifer subunit (Exhibit 4-6). The Delta Aquifer subunit is the primary aquifer that the City of Renton uses for municipal purposes.

Exhibit 4-6: Group A Wells in the Study Area

The Green-Duwamish Alluvial Aquifer within the study area is not used for water supply by water purveyors for Group A or Group B wells systems. There are “other” wells besides A and B wells that consist primarily of decommissioned wells, environmental monitoring wells not used for potable supply, and dewatering wells used on a temporary basis during construction.[18] According to a search of Ecology’s database, none of the “other” wells within the project right-of-way are used for domestic water supply or irrigation purposes.

What is the quality of these groundwaters?

The Delta Aquifer subunit of the designated sole-source, Cedar Valley Aquifer produces good quality water for potable use. The groundwater meets all Washington State Department of Health water quality criteria.

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[17] *King County 2005.*

[18] *Ecology 2005.*

How is groundwater quality protected?

One of the primary purposes of this report is to identify areas that are particularly susceptible to groundwater contamination. These areas are identified because they currently supply or can supply water for drinking and industrial uses, and they are hydrologically connected to bodies of surface water, such as lakes or rivers. Specific areas and their conditions are discussed below.

Critical Aquifer Recharge Areas

Critical Aquifer Recharge Areas (CARA) are one element of the critical areas for which Washington's Growth Management Act (GMA) requires local governments to develop policies or regulations to protect their functions and values. CARA are the geographic areas that have a critical recharging effect on aquifers used for potable water.[19]

The only aquifer used for potable water in the study area is the Cedar Valley Aquifer. Most of the recharge for the Cedar Valley Aquifer occurs in areas upriver from the study area. None of these recharge areas are classified as CARAs.

Green-Duwamish Alluvial Aquifer

The Green-Duwamish Alluvial Aquifer near the study area is not used for domestic water supply or irrigation purposes. Therefore there is no special sole-source designation for this aquifer. This aquifer would fall under the protection of State groundwater regulations that are applicable to all groundwater.

Cedar Valley Aquifer

The City of Renton petitioned the EPA to designate the aquifer along the Cedar River as a sole-source aquifer in March 1988.[20] The petition was submitted because the City's water supply to the public is dependent on this aquifer. The Cedar Valley Aquifer was designated a sole-source aquifer on October 17, 1988 by the EPA, supporting the goals of aquifer protection

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[19] *King County 2004*

[20] *CH2M Hill 1988b*

previously initiated by the City.[21] The EPA states the reasons for designation as follows:

- The Cedar Valley Aquifer supplies at least 80 percent of the drinking water used in the aquifer service area.
- No economically feasible alternative drinking water sources exist.
- Contamination of the aquifer would pose a substantial hazard to public health.

The Cedar Valley Aquifer boundary within the study area is shown in Exhibit 4-4 (source: City of Renton 2003 and EPA 1988). As discussed previously, the Delta Aquifer subunit is most susceptible to potential effects from the Tukwila to Renton Project.

The City has numerous groundwater monitoring wells surrounding its production wells for aquifer testing and water quality monitoring. All production wells are located within the designated sole-source aquifer.

Capture Zones and Travel Times

The City of Renton conducted a study of groundwater travel times being captured by its production wells to formulate wellhead protection areas for its wells. The results are presented in Exhibit 4-5 for 1-year, 5-year, and 10-year groundwater capture zones. Groundwater capture travel times are used for aquifer protection planning.

What are wellhead protection areas?

Wellhead Protection Areas (WHPA) are the areas surrounding a drinking water well that supply groundwater to the well. The boundary of the WHPA is determined by the distance a contaminant travels in a designated time period. For instance, a 5-year WHPA is the distance from a well where a contaminant released into the groundwater would take 5 years to reach the well.

Aquifer Protection Ordinances

The City of Renton established Aquifer Protection Zones for the Sole-Source Cedar Valley Aquifer and its production well fields. Exhibit 4-7 presents the boundaries for Cedar Valley Aquifer Protection Zones 1 and 2. Renton enacted local ordinances specifically to protect its sole-source aquifer and production well fields within the boundaries of Zones 1 and 2. The ordinances are specific to the aquifer protection zones and are in the Renton Municipal Code.[22] The code specifies construction requirements for stormwater facilities and pipelines, sewer pipelines, storage limitations for

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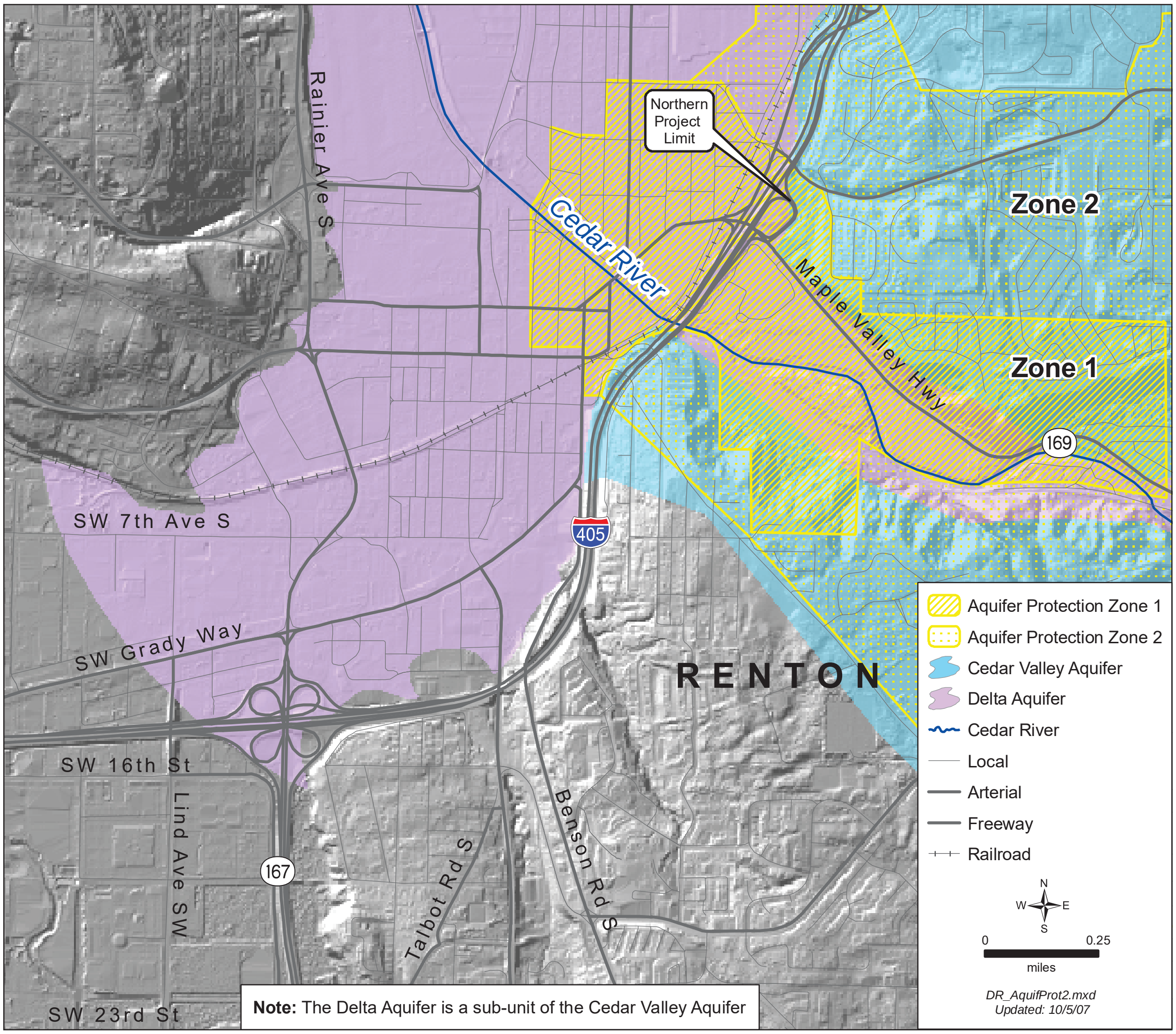
[21] *U.S. Environmental Protection Agency 1988*

[22] *Renton, City of, 2005, Renton Municipal Codes (RMC) http://www.ci.renton.wa.us/.*

hazardous/toxic substances, and other requirements for activities within the aquifer protection zones.

Exhibit 4-7: Cedar Valley Aquifer Groundwater Protection Zones 1 and 2



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SECTION 5 PROJECT EFFECTS

How will project construction affect water resources?

Surface Water Flow

Peak and base flow rates to streams and rivers will not be negatively altered during project construction because detention ponds will be constructed prior to the highway widening. These ponds may be used for temporary erosion and sedimentation control.

Surface Water Quality

WSDOT does not anticipate measurable effects to surface water quality because WSDOT will apply temporary erosion and sediment control measures during construction. Work crews will clear, grade, and prepare the site for new pavement. Construction activities expose bare soil that is easily eroded by rainfall and surface water runoff, which can create short-term effects to surface water quality. These effects include silt-laden, turbid water that may clog the gills of fish and bury aquatic insects. Standard construction BMPs are used to minimize erosion and sediment movement so that erosion from construction sites does not contribute solids and pollutants to nearby receiving waters. BMPs are required on all WSDOT roadway construction projects including the Tukwila to Renton Project and will be described in more detail in the Temporary Erosion and Sediment Control (TESC) Plan that WSDOT will write prior to beginning construction.

The BMPs used to protect water resources for this project will provide either sediment control or erosion control or a combination of both. Sediment control BMPs physically trap runoff until most contaminants settle out or are filtered through the underlying soils. The basic mechanisms for pollutant removal are gravity settling, infiltration of soluble nutrients through soil or filters, or biological and chemical processes. Erosion control BMPs are source control practices such as maintaining vegetated buffers and limiting actual construction to dry periods when possible. Erosion and sediment control BMPs prevent loose soil from reaching local waterbodies and keeps effects at a minimal level.

The existing highway (baseline conditions) has some permanent flow control and runoff treatment BMPs already in place. These BMPs include ponds, biofiltration swales, ecology embankments, filter strips, and a combined stormwater quality wetland and detention facility. During construction of the new roadway and new BMPs, some old BMPs (mostly ecology embankments) will be removed so that they can be replaced. WSDOT will use construction BMPs to maintain water quality during construction periods when permanent BMPs may not be functional.

Construction can also create the potential for unexpected spills of hazardous materials used during the construction process. Construction work typically uses hazardous or toxic materials such as fuel, oil, paint, and other potentially toxic liquids, which may be temporarily stored on site. These materials present the greatest risk near open waterbodies where streams and rivers pass under the highway. Where work will take place over open water, such as at the Green and Cedar Rivers, spills of concrete are a concern because concrete can raise the pH of waterbodies and potentially harm aquatic life. To prevent unexpected spills of hazardous materials to waterbodies, a Spill Prevention, Control, and Countermeasures (SPCC) Plan will be prepared before construction starts. Along with the TESC Plan, the measures provided will prevent substantial effects on water quality during construction.

Floodplains

During construction, temporary piles and falsework could be placed in the Green River, Springbrook Creek, Panther Creek, Rolling Hills Creek, and Cedar River floodplains. These structures provide work platforms and support the new roadway structures and, or, the roadway embankments, as they are built. Depending upon the length of time for construction, the bridge, some of the temporary piles, and falsework may need to remain in place through the winter, which is a concern related to higher steam flows, flood volumes, and the potential for localized scour and erosion.

What is Falsework?

Falsework is the temporary structure erected to support work during the process of construction.

Groundwater

The study area contains wellhead protection areas and a sole-source aquifer. Potential groundwater effects, including contamination and reduced well capacity will be avoided during construction by implementing the mitigation measures described in Section 6.

How will project operation affect water resources?

Surface Water Flow

Concrete and asphalt pavement typically have higher stormwater runoff volumes and peak runoff rates than most other land covers because these surfaces are highly impervious. Surface waters are negatively affected by these changes unless they are classified in the HRM as major water bodies. Stormwater discharges to these major water bodies are exempt from flow controls. Both the Green and Cedar Rivers are classified as major waterbodies in this study area. Direct discharge will occur only to the Cedar River and will occur at existing outfall locations.

Infiltration within the study area would not be an effective method of flow control because the majority of the project is on river-valley bottom that has shallow groundwater. To minimize the negative effects of high stormwater volumes and peak runoff rates, this project will use detention ponds as the preferred flow control BMP. The Tukwila to Renton Project will also use vaults where the right-of way is limited.

WSDOT will construct stormwater facilities based on the HRM to provide treatment and detention. WSDOT is also planning to retrofit approximately 68 acres of existing impervious surfaces. The Renton Nickel Improvement Project retrofitted approximately 2 percent of currently untreated pavement. The Tukwila to Renton Improvement Project will add to this an additional 30 percent retrofit of the existing untreated pavement for a total of 32 percent retrofit since the beginning of the I-405 improvements in this area. Peak flow rates of stormwater discharged to streams and rivers are expected to be reduced from present day conditions because of this retrofit.

The size and distribution of these flow control facilities was determined by looking at the threshold discharge areas (TDAs). This project will add approximately 58 acres of new impervious surface area to the TDAs. The TDAs for the project include 481 acres and are shown in Exhibit 5-1.

How does runoff from a forest area compare with a highway?

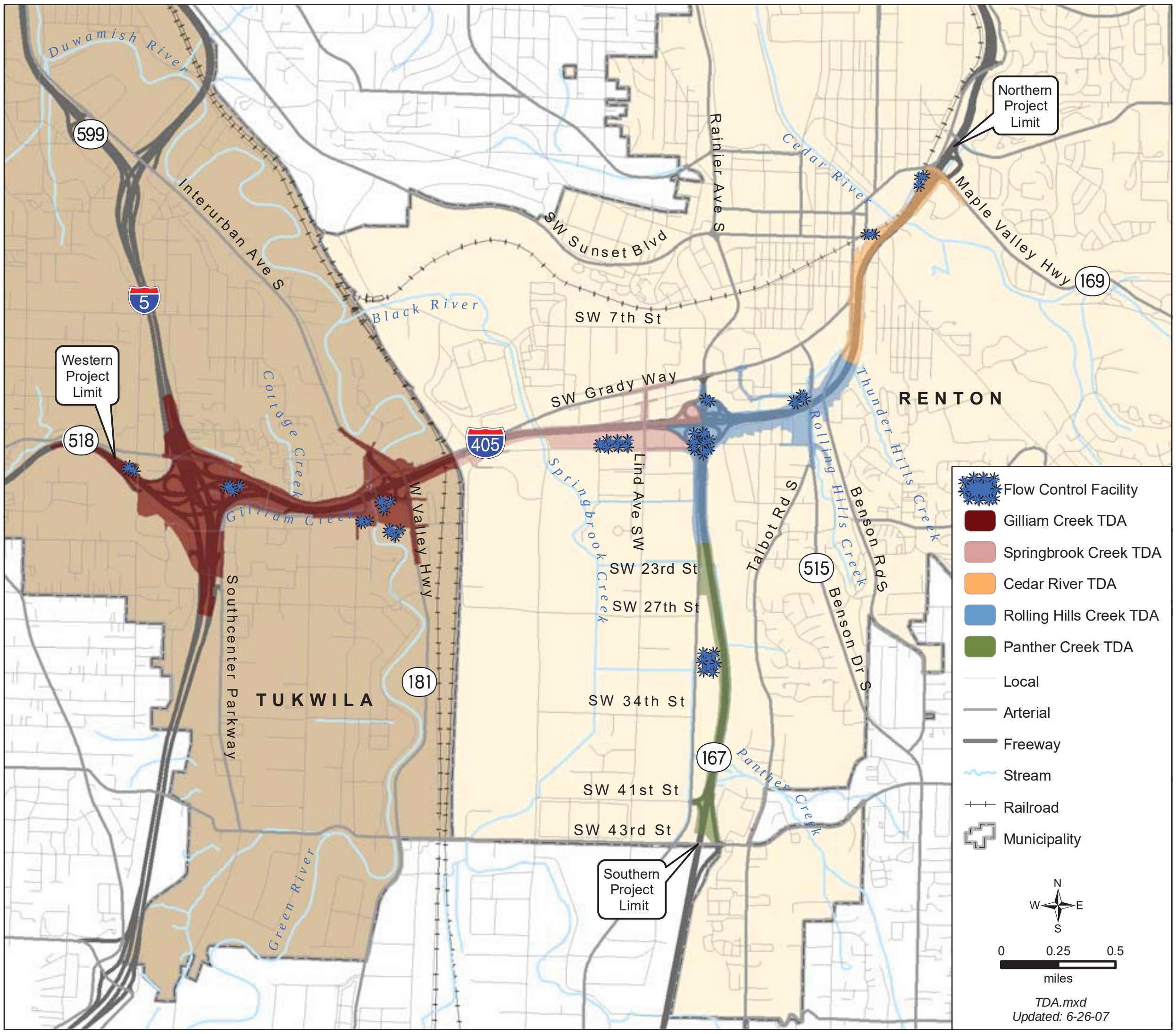
For a forested area in King County, approximately 55 percent of the rain that falls each year eventually appears as water in a stream. The remainder of the rainwater either percolates into the soil or is evaporated back into the atmosphere.

However, for a highly impervious area, approximately 85 to 90 percent of annual rainfall eventually appears as water in a stream, and the remaining water replenishes either the groundwater or the atmosphere. Source: King County Surface Water Design Manual 2005.

What is a Threshold Discharge Area (TDA)?

TDAs are areas of the project that drain to a single natural discharge location or multiple discharge locations that combine within one quarter-mile downstream. The Tukwila to Renton Project has five TDAs: one in the Green River Basin, three in the Springbrook Creek Basin, and one in the Cedar River Basin.

Exhibit 5-1: Threshold Discharge Areas (TDAs) and Proposed Flow Control Facilities



Flow controls in the Springbrook Creek basin will detain enough runoff from new impervious surfaces to match baseline conditions. Two options have been evaluated for the Springbrook Creek basin: 1) conventional flow control and treatment using the HRM procedures; and 2) implementation of the Panther Creek Watershed Rehabilitation Plan, which proposes a direct discharge of treated stormwater into the Panther Creek wetland complex east of SR 167. The second option will be implemented only if permits can be obtained.

Depending on the stormwater option selected for the Springbrook Basin, the conceptual design has avoided using water quality BMPs that have standing water, such as stormwater treatment wetlands. This conceptual design complies with FAA requirements to avoid using stormwater facilities that have permanent areas of open water within 10,000 feet of the Renton Municipal Airport. If the Panther Creek Watershed Rehabilitation Plan is implemented, two ponds in the SR 167 interchange would be omitted and an open vault would be smaller within 10,000 feet of the airport.

The Cedar River is listed as a major waterbody in the HRM and is flow control exempt. For this reason, no flow control facilities are proposed for the Cedar River basin.

Surface Water Quality

Highway runoff contains several pollutants of concern: nutrients such as nitrogen and phosphorous, which generally bond to dirt particles; heavy metals such as copper and zinc; and petroleum hydrocarbons. These contaminants accumulate on the road surface and are eventually washed away by rainfall.

The total area of impervious surfaces in the study area after project completion will be approximately 301 acres. After construction of the Tukwila to Renton Project approximately 154 acres of impervious surfaces will receive enhanced water quality treatment of the runoff, which is more than twice the amount of impervious area added by the project. The enhanced water quality treatment will be provided using ecology embankments, biofiltration swales, and ponds in accordance with the WSDOT HRM. These types of BMPs are described in Section 4, Baseline Conditions.

Exhibit 5-2 shows pollutant removal efficiencies for the two BMP water quality facilities that will be used on this project.

Exhibit 5-2: Pollutant Removal Efficiencies for BMP Water Quality Facilities

	Percent Pollutant Removal				
Facility Type	Suspended Solids	Total Phosphorus	Total Nitrogen	Trace Metals	Notes
Ecology[a] Embankments	88-94	59-89	n/a	84-96 (zinc)	
Stormwater Treatment Wetlands[b]	80-100	60-80	40-60	60-80	Efficiency depends on residence time

n/a – not available
a – source: WSDOT conditional use designation memorandum, 2003.
b – source: WSDOT Environmental Procedures Manual, 2004.

What is meant by pollutant loading?

Pollutant loading is a term used to refer to the amount of a pollutant that enters a waterbody in a specified amount of time. Estimates of pollutant loads are usually given in pounds per year.

Pollutant loading for both the Build and No Build Alternatives are shown in Exhibits 5-3, 5-4, and 5-5 for the Green River, Springbrook Creek, and Cedar River basins, respectively. See Appendix C for the calculations used to generate pollutant loads. The numbers for the Build Alternative assume that the new impervious area will be addressed using BMPs described in this report and designed to specifications in the HRM. For the No Build Alternative, the numbers show pollutant loading assuming that no new impervious area would be added.

Exhibit 5-3: Pollutant Loadings for Build and No Build Alternatives in lbs/year for the Green River Basin

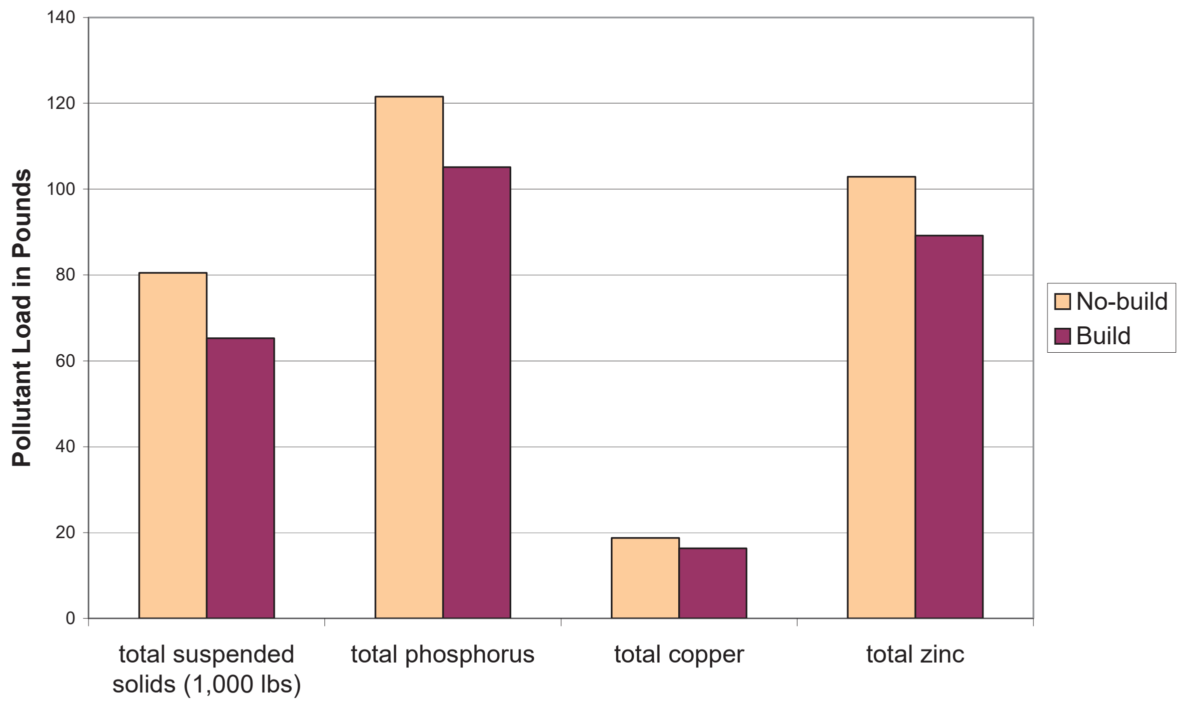


Exhibit 5-4: Pollutant Loadings for Build and No Build Alternatives in lbs/year for Springbrook Creek Basin

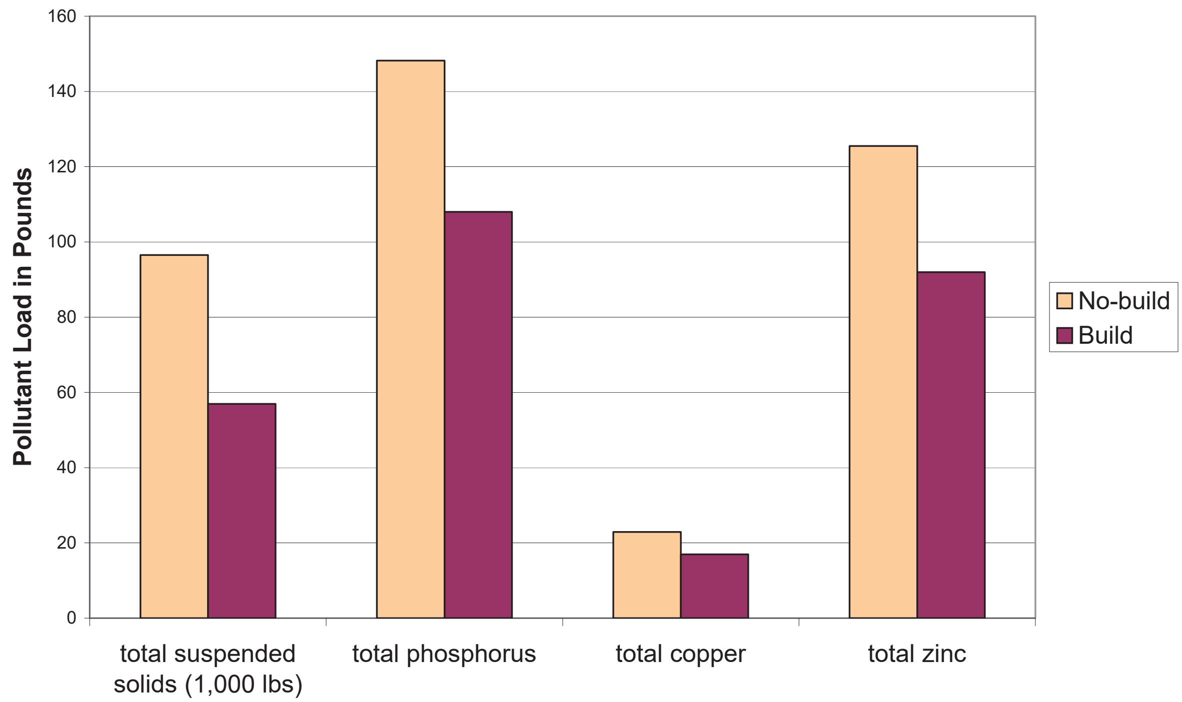
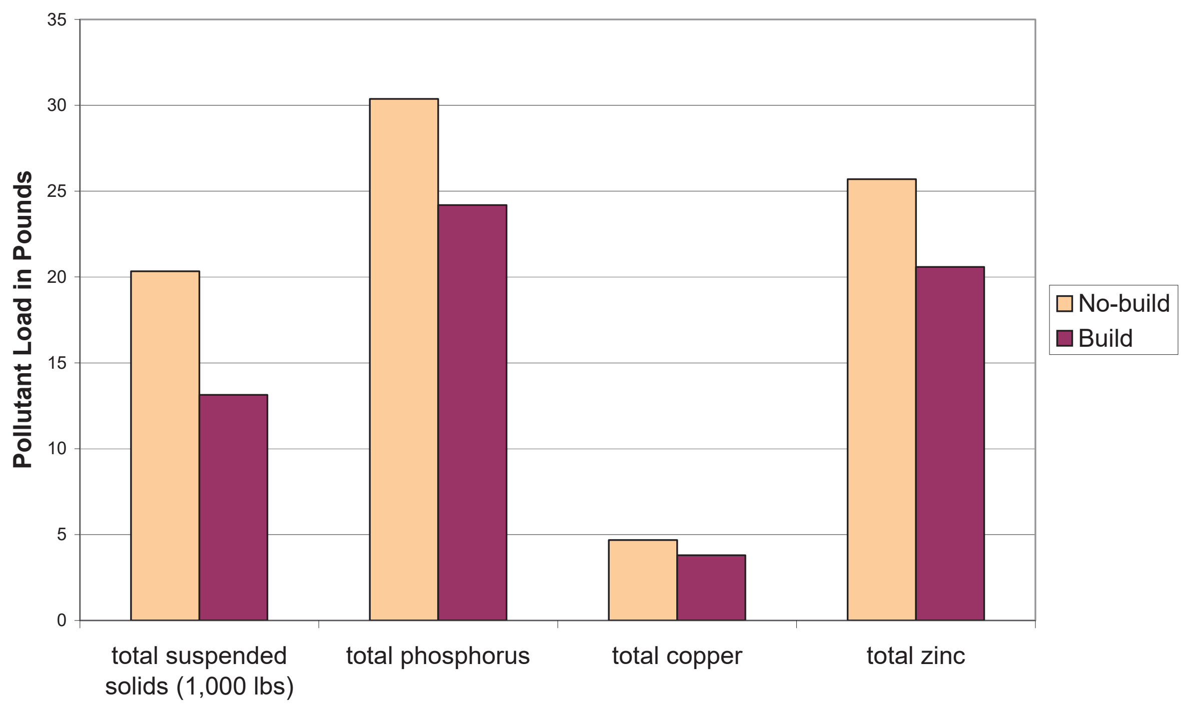


Exhibit 5-5: Pollutant Loadings for Build and No Build Alternatives in lbs/year for the Cedar River Basin



The Build Alternative has lower pollutant loads than the No Build Alternative. This indicates that the project will improve the baseline surface water quality conditions in the study area.

As shown in exhibits 5-3, 5-4, and 5-5, the total pollutant loads to the Green River, the Springbrook Creek, and the Cedar River basins will be lower under the Build Alternative than under the No Build Alternative. This is because stormwater treatment facilities planned for the Build Alternative also cover areas of the highway system that are not currently treated.

This project is not expected to negatively affect the water quality parameters of the three waterbodies included on Ecology's 303(d) List in the study area:

- The Green River is 303(d) listed for dissolved oxygen, fecal coliform bacteria, and temperature.
- Springbrook Creek is 303(d) listed for dissolved oxygen and fecal coliform bacteria.
- The Cedar River is 303(d) listed downstream of the project area, but only for fecal coliform bacteria and temperature.

Temperature and dissolved oxygen in local waterbodies are seasonal concerns and can be influenced by lakes and open-water ponds.[23] Open-water ponds such as detention ponds allow runoff to be exposed to the sun and warm up a few degrees. However, the ponds for this project are small relative to the flow of the rivers to which they will discharge and they will not have wetpools. The ponds from this project will be dry during the summer when river temperatures are highest and dissolved oxygen is lowest.

Fecal coliform bacteria are typically not considered a significant concern in runoff from highways and so it is not expected that this project will affect the existing fecal coliform issue in any of these waterbodies.

Zinc is a constituent on the 303(d) list that is a primary concern for highway runoff. Zinc can be efficiently removed from highway runoff using ecology embankments or other "enhanced" BMPs. Pollutant loading for the Build and No Build Alternatives is shown using the bar graphs in Exhibits 5-3 to 5-5. The bar graphs indicate that the total input

[23] *Derek B. Booth. 2002.*

of zinc to these three impaired waterbodies will be reduced by about 52 pounds per year.

Floodplains

Building new roadway and associated embankments, new piers for bridges, direct-connector ramps, and off-ramps in the Green River, Springbrook Creek, Rolling Hills Creek, Panther Creek, and Cedar River floodplains will add approximately 33,110 cubic yards of fill. A break down of floodplain fill for each basin is shown in Exhibit 5-6. Mitigation for this floodplain fill is discussed in Section 6 of this report.

Exhibit 5-6: Floodplain Fill Volumes for Each Basin

	Volumes (cubic yards)	
Floodplain	Fill	Excavation
Green River	3,300	490
Springbrook Creek	19,300	0
Panther Creek	10,200	0
Rolling Hills Creek	300	330
Cedar River	10	10
Total	33,110	830

Groundwater

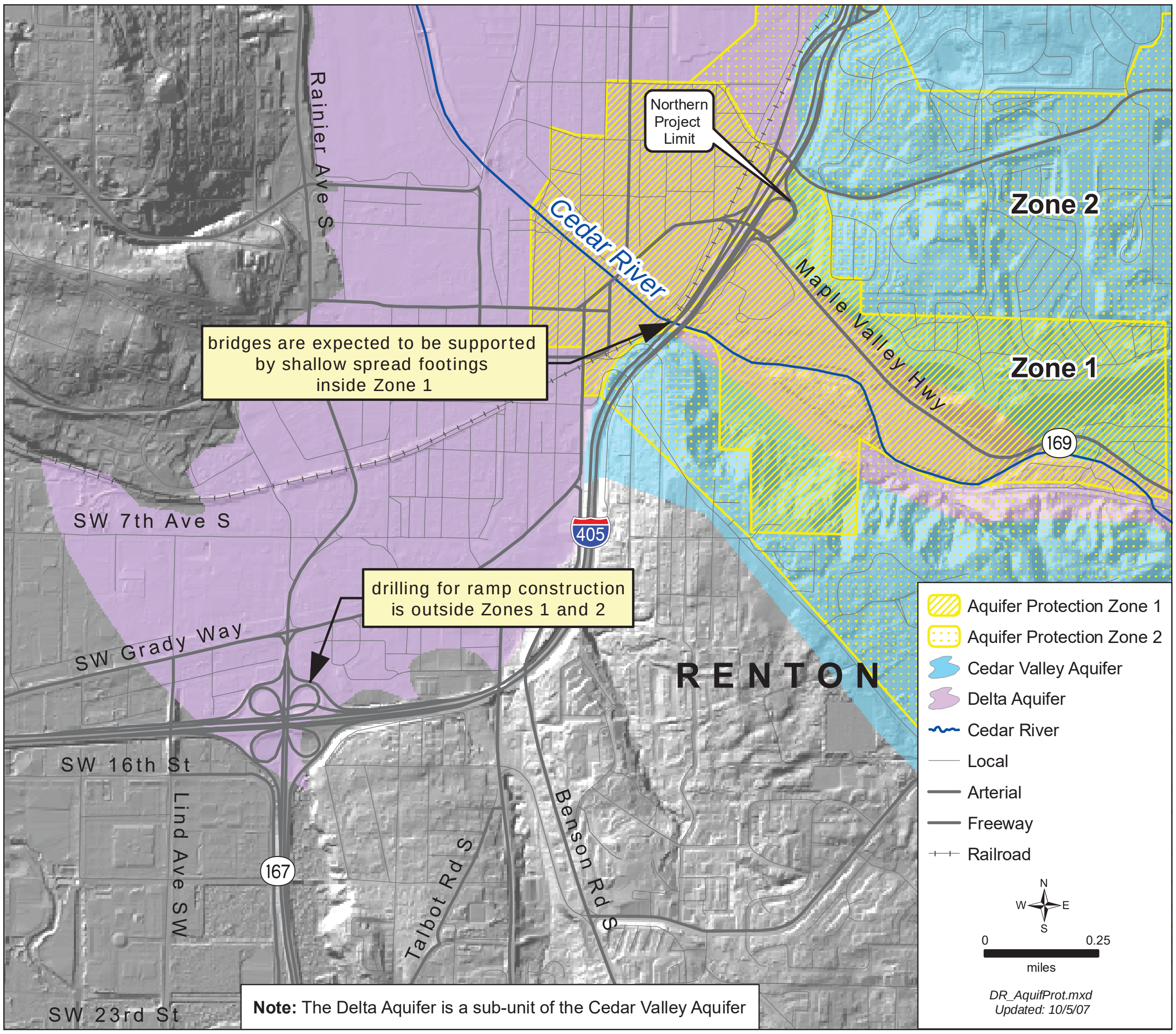
In general, operation of the project is not expected to have any adverse permanent effects related to groundwater. One issue, the increase in impervious surfaces, will not substantially affect the total amount of recharge to the shallow alluvial aquifers in the vicinity of the project, since the majority of recharge to these aquifers is derived from much larger, upgradient drainage areas that are outside the highway corridor. For example, the water yield of the Cedar Valley Aquifer is estimated at 9,000 gallons per minute (gpm).[24] This compares to the potential loss of water recharge of about 70 to 80 gpm for the entire study area due to adding approximately 58 acres of impervious pavement.

Detention ponds in the study area are shallow and will not reach below shallow groundwater levels. Except within the sole-source aquifer protection zones, most ponds will not be lined, so some inadvertent infiltration may occur at those facilities (see Exhibit 5-7). Given the high groundwater,

[24] *City of Renton, 1999*

infiltration is considered to be negligible as a factor for the flow control design, but groundwater recharge will likely occur at each of the pond locations. Direct discharge to the Cedar River will be to existing outfall locations.

Exhibit 5-7: Boundaries of the Cedar Valley Aquifer in the Vicinity of the Study Area and Aquifer Protection Zones 1 and 2.



Potential groundwater contamination effects will be avoided during operation through implementation of the special mitigation measures as defined in Section 6.

Does the project have other effects on water resources that may be delayed or distant from the study area?

Indirect effects are defined in the WSDOT Environmental Procedures Manual as the "effect caused by the proposed action that is later in time or farther removed in distance, but still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems."

Indirect effects typically associated with road projects are changes in land use that happen because accessibility to local areas becomes improved. If urbanization increases because of a road project, this can affect stormwater drainage and local stream flow. The Renton and Tukwila areas are already very highly urbanized and so we do not expect that this project will significantly alter land use in the study area. Therefore, no indirect effects to surface waters, water quality, floodplains, or groundwater are expected because of this project.

Were potential cumulative effects for water resources considered?

Cumulative effects for surface water and water quality are evaluated in a separate Cumulative Effects Analysis Technical Memorandum. That report also discusses cumulative effects for this project in the areas of Air Quality, Aquatic Resources (fisheries and aquatic habitat), and Wetlands. Cumulative effects for other disciplines were determined to be unnecessary for this project.

What effects will occur under the No Build Alternative?

Effects of construction on the study area will not occur under the No Build Alternative. A beneficial aspect of the project is the retrofitting of existing impervious surfaces with proposed stormwater flow control and treatment facilities. As previously mentioned, retrofit will occur on about 32 percent of highway impervious surfaces that existed prior to the construction of the Renton Nickel Improvement Project and Tukwila to Renton Improvement Project. Under the No Build Alternative, these benefits would not be realized.

SECTION 6 MEASURES TO AVOID OR MINIMIZE EFFECTS

What measures will be taken to mitigate effects during construction?

Surface Water Flow

Peak and base flow rates to streams and rivers will not be negatively altered during project construction because detention ponds will be constructed prior to the highway widening. These ponds may be used for temporary erosion and sedimentation control. WSDOT will provide routine maintenance for these facilities throughout construction.

Surface Water Quality

The primary means of avoiding and reducing potential effects from this project are to use standard BMPs during construction. WSDOT makes the following commitments to protect water quality during construction of I-405 projects:

- Where construction must occur within stream channels, such construction will occur "in the dry" whereby stream flow is temporarily diverted around the work site where practicable to prevent turbidity.
- Construction disturbances will be limited to the minimum area needed, the shortest duration, and an appropriate distance away from waterbodies when practical. Seasonal work windows will be identified and implemented.
- BMPs such as erosion-control fencing, landscaping, erosion matting, hydro mulching, soil imprinting, straw bales, detention/sediment trap basins, and vegetated fringes as described in the HRM will be used as appropriate.
- Stormwater chemical treatment following Ecology's guideline may be used as a contingency measure if approved by WSDOT.
- A scour analysis will be conducted on any highway-related structures that are over river or creek crossings or below the OHWM of these water bodies. Appropriate measures such as fish-friendly stream bank protection or bridge modifications will be implemented if the scour analysis identifies needs.

What is the Ordinary High Water Mark?

The line on the shore established by the change in water levels and indicated by physical characteristics such as a clear, natural line impressed on the bank or the presence of litter and debris. The presence and action of water generally leaves an impression on the stream bed and banks that makes a distinct separation between the stream and the adjacent areas and indicates the location of the ordinary high water mark.

- Construction mitigation measures such as use of non-hazardous chemicals and establishment of special hazardous materials storage and handling areas will be implemented to reduce the use, transfer, and storage of hazardous materials in sensitive areas.
- WSDOT will prepare and implement a Temporary Erosion and Sedimentation Control (TESC) Plan. The TESC Plan will consist of operational and structural measures to control the transport of sediment. Operational measures will consist of good housekeeping practices, such as removing mud and dirt from trucks before they leave the site, covering fill stockpiles or disturbed areas, or avoiding unnecessary vegetation clearing. Structural measures consist of the construction of temporary structures to reduce the transport of sediment, such as silt fences or sediment traps. Should any BMP or other operation not function as intended, WSDOT will take additional action to minimize erosion and maintain water quality.

What is a silt fence? Sediment trap?

A silt fence consists of a temporary sediment barrier made of synthetic fabric stretched between posts, with a shallow trench located upslope. The silt fence is "keyed" into the ground to prevent water from running under the fence. A sediment trap consists of a temporary ponding area formed by an earthen embankment or an excavation. Both silt fences and sediment traps are designed to slow the flow of water, allowing sediment to settle out.

- Fuel and chemical storage and fueling operations for construction vehicles and equipment during construction will be located within areas that can provide containment of any spills. A Spill Prevention Control and Countermeasures (SPCC) Plan will be established for construction activities and will also detail the procedures that will be followed in the event of a spill to prevent or minimize effects. The SPCC Plan will specifically address potential fuel spills from vehicles and potential spills of chemicals that are commonly used during construction. Spill response equipment will be located at regular and specified intervals within the construction zones to minimize countermeasure response times.
- WSDOT will identify and develop staging areas for equipment repair and maintenance away from all drainage courses except in areas that are already paved and where no excavation will occur within the staging area. WSDOT will require that washout from concrete trucks will not be dumped into storm drains or onto soil or pavement that carries stormwater runoff. During work on the project site, thinners and solvents will not be used to wash oil, grease, or similar substances from heavy machinery or machine parts in or near sensitive areas. WSDOT will designate a washdown area for equipment and concrete trucks.

- WSDOT will obtain a NPDES (National Pollutant Discharge Elimination System) construction permit. WSDOT will ensure that water meets the standards specified in the NPDES permit prior to discharge from the construction site. If necessary, water quality will be improved, such as by using sediment ponds to allow sediment to settle out prior to discharge.

Floodplains

Plans for compensatory floodplain storage for temporary and permanent fill will be developed after the project is funded but before construction begins. Mitigation will compensate for fill by volume. Excavation for mitigation will be done in the same floodplain as the fill and at the same one-foot elevation. For fill in the Springbrook Creek floodplain, excavation from the construction of the Springbrook Creek Wetland and Habitat Mitigation Bank may be used as compensatory storage. WSDOT will analyze the effectiveness of the proposed fill mitigation to confirm that the 100-year floodplain elevation will have no rise due to the project.

Groundwater

Several construction mitigation measures have been identified by WSDOT, in consultation with the City of Renton and include the following:

- WSDOT will protect groundwater quality during construction by implementing TESC and SPCC Plans to prevent erosion, sedimentation, and spills.
- WSDOT will provide an independent construction environmental coordinator to monitor groundwater quality, storage of hazardous substances, chemical use practices, containment of hazardous materials, and to develop an emergency response and recovery plan for the sole source aquifer.
- WSDOT will develop an environmental protection plan for the City's review prior to construction. This will include additional investigation of the support structures and mitigation for the increase of impervious surfaces, including a monitoring plan.
- WSDOT will identify and locate staging areas away from all drainage courses. Washout from concrete trucks will

not be dumped into storm drains or onto soils 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.

- WSDOT will ensure that fuel and chemical storage is located within secondary containment areas. These areas will be surfaced with an impermeable material and sized to contain the volume of stored fuel and/or chemicals.
- WSDOT will conduct construction within the City of Renton's Aquifer Protection Zones 1 and 2, in compliance with State of Washington Wellhead Protection Requirements outlined in WAC 246-290-135(4) and the City of Renton Municipal Code RMC4-9. The storage of fuel and construction chemicals as well as fueling operations for construction vehicles and equipment will not be allowed within the City of Renton's Aquifer Protection Zone 1. Every effort will be taken to minimize the storage of fuels and chemicals within Renton's Aquifer Protection Zone 2. Emergency countermeasure equipment will be specified in the SPCC Plan and will be dedicated and located at designated locations within Renton's Aquifer Protection Zones 1 and 2 for rapid and effective response to a fuel spill from a vehicle or chemical spill.
- WSDOT will conduct groundwater monitoring during construction to monitor for spills that can affect the sole source aquifer. If necessary, existing City of Renton monitoring wells can be supplemented with additional monitoring wells at key locations and used to monitor water quality in Aquifer Protection Zone 1.
- WSDOT will take added measures for stormwater control and conveyance during construction within Renton's Aquifer Protection Zones 1 and 2, to protect aquifers. Within Aquifer Protection Zones 1 and 2, WSDOT will construct either a lined or piped stormwater conveyance system. Stormwater will go through an existing lined detention pond, or WSDOT will construct a new lined detention pond.
- WSDOT will construct new roadway that is located over the Renton Aquifer Protection Zone 1 with an impervious

liner underneath the pavement for additional protection from spills escaping the stormwater collection system.

- WSDOT will avoid placement of imported contaminated fill during construction. Imported fill must meet the state's Model Toxics Control Act (MTCA) Method A or B soil cleanup standards (WAC 173-340-740) for unrestricted use. A fill evaluation and testing plan will be developed prior to commencing construction activities.
- Any fill over 50 cubic yards in quantity to be placed over Renton's Aquifer Protection Zone 1 will be certified by a professional engineer or geologist that the soils meet MTCA cleanup standards (City of Renton Municipal Code RMC 4-9). A plan will be developed that establishes criteria for evaluating fill sources. Analytical testing protocol for sources that may contain suspect fill materials shall be specified in the plan to ensure MTCA Cleanup Method A or B soil cleanup standards are met. If analytical testing is required, imported fill soils will be analyzed before arriving at the construction site. The fill testing plan will also apply to suspect excavated soils encountered during construction. All sampling will be performed by a professional engineer or geologist.
- WSDOT will avoid drawdown of nearby wells during construction. These effects can be avoided by the use of recharge wells and/or cut-off walls, if necessary.
- WSDOT will implement good construction management, safety precautions, and safety enforcements near the City of Renton's well field to avoid a construction-related traffic accident, which could damage and disrupt these wells.
- WSDOT will locate areas where permanent drainage will be required by site conditions for cut slopes. If local private groundwater users or downgradient wetlands and spring water right holders could become affected by drawdown of the groundwater table from these drain systems, these effects shall be avoided on a site-specific basis by designing the permanent drainage system to recharge or replenish the downgradient water table.
- WSDOT will locate concrete structures away from production wells and use non-hazardous concrete curing chemicals.

- WSDOT will use steel piles when structures are within 50 feet of production wells and locate new embankments at least 50 feet away from production wells.
- WSDOT will minimize ground vibration and settlement within 50 feet of production wells.
- WSDOT acknowledges that existing structures in the production well area use spread footing foundations. After further geotechnical study, spread footing foundations may be used that do not substantially penetrate the Cedar Valley sole source aquifer for the reconstructed bridges over the Cedar River.
- WSDOT will use two ponds for highway spill containment to protect the sole source aquifer.
- WSDOT will further minimize effects by using BMPs from WSDOT's Geotechnical Design Manual and Bridge Design Manual. Contractors and consultants associated with this project will follow these procedures.

What measures will be taken to mitigate effects of operation?

Surface Water Flow

- Stormwater facilities for this project will maintain the peak flow rate of stormwater runoff at present day conditions or better as mandated by the HRM for a range of storms from 50 percent of the 2-year up through the 50-year recurrent storm event. WSDOT will provide routine maintenance for these facilities.
- The area of the project that is within 10,000 feet of the Renton Municipal Airport will require measures to minimize hazards associated with wildlife attraction to stormwater detention ponds. The following are guidelines that will be considered for stormwater management facilities sited near the airport:
    - Design system to minimize the frequency and duration of open water to acceptable levels. Water that is detained by the 2-year design storm should completely drain or fall to a level that is covered by a net or solid cover within 24 hours after the end of the storm event.

- Minimize the size of open water ponds within the FAA 10,000-foot-radius wildlife hazard management zone to minimize aircraft-wildlife interactions.
- Use steep side slopes and deep pond depths to minimize shallow water areas and minimize the total water surface area.
- Slope the pond bottom to allow quick drainage and reduce the potential for standing water.
- Eliminate the potential for wetland vegetation growth on the pond bottom and side slopes by lining the pond with riprap or quarry spalls. Alternatively, plants that provide minimal habitat to wildlife can be used. Dense brush and small trees that will be perceived by waterfowl as hiding places for predators are a good choice. Avoid closely mowed grass, which is preferred by waterfowl.
- Break up possible flight lines by planting trees and setting up poles and or fences, which do not allow most water fowl clear landing or takeoff room on the pond surface.
- Introduce islands within open water areas as needed to support scrub-shrub vegetation cover within wetpools with emergent aquatic planting areas.
- Cover or net all permanent open water surfaces if water fowl use becomes an issue at the site.

Surface Water Quality

BMPs for this project will remove pollutants from runoff generated by the project. With these BMPs, the runoff is expected to meet Washington State water quality standards listed in WAC173-201(A). According to Ecology, projects meeting the Ecology guidelines or equivalent standards such as the HRM, are presumed to meet federal and state water quality requirements. WSDOT will provide routine maintenance for these facilities.

Floodplains

In addition to providing compensatory floodplain storage, stormwater detention will also be provided for drainage from new impervious surfaces. Detaining stormwater will help minimize changes to flow patterns of inlet sources to the floodplain.

Bridge piers placed within the floodplain will be designed to minimize hydraulic disturbance to flow. This may be achieved by designing piers that are all the same size and are placed in lines parallel to the flow path. The shape of the pier, round or elliptical, may also be changed to minimize hydraulic effects.

Groundwater

Several operational mitigation measures have been identified by WSDOT, in consultation with the City of Renton, and include the following:

- WSDOT will operate stormwater facilities to minimize leakage within Aquifer Protection Zone 1.
- WSDOT will use two ponds for highway spill containment to protect the sole source aquifer.
- WSDOT will capture fuel and chemical spills from vehicles using the stormwater collection and detention system. Any new stormwater systems installed for the project will include a shut-off capability for containing a spill or release. WSDOT will establish a plan to contain, clean-up, and minimize potential effects from vehicular accidents.
- A higher level of protection is needed for the City of Renton's Aquifer Protection Zones 1 and 2. To protect the aquifer protection zones, WSDOT will establish a plan in compliance with Washington State Wellhead Protection Requirements outlined in WAC 246-290-135(4) and the City of Renton Municipal Code RMC4-9. The roadway and access ramps over Renton's Aquifer Protection Zone 1 will have curbs and gutters or berms to collect and route major spills to the stormwater collection system. The system will be constructed in accordance with City of Renton requirements for sanitary sewage facilities in Aquifer Protection Zone 1 and will be sized to contain a liquid spill from a double tanker truck.
- WSDOT will routinely inspect the roadway for cracks or openings that would permit leakage and escape of a major spill from the stormwater collection system within Aquifer Protection Zone 1. Patching of observed cracks/openings will be within a short time after discovery. Emergency

counter measures equipment will be dedicated and located at a designated location within Renton's Aquifer Protection Zone 1 for rapid response to a fuel spill from a vehicle or chemical spill occurring during use. Procedures will be specified for emergency containment, control, and cleanup of minor and major spills.

- The Green-Duwamish Alluvial Aquifer near the study area is not used for domestic water supply or irrigation purposes and will be protected during operation by WSDOT maintenance following standard pollution control practices.

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SECTION 7 UNAVOIDABLE ADVERSE EFFECTS

Does the project cause any substantial adverse effects that cannot be avoided?

Surface Water Flow

There are no substantial adverse effects to surface water flows from this project. Stormwater facilities will manage the peak flow rates of stormwater discharge to streams and rivers which will be reduced from present day conditions.

Surface Water Quality

There are no substantial adverse effects to surface water quality from this project. Stormwater facilities will remove pollutants from runoff generated by the project, decreasing the overall pollutant loading.

Floodplains

There are no substantial adverse effects to floodplains due to the proposed mitigation of providing compensatory storage in affected floodplains.

Groundwater

There are no substantial adverse effects to groundwater due to the proposed special mitigation measures to protect the sole-source Cedar Valley Aquifer, specifically, the Delta Aquifer subunit.

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SECTION 8 REFERENCES

GIS data sources

Exhibit 3-1

Washington State Department of Transportation (WSDOT).
2007 Study Area Boundary based upon Limits of Work.

Exhibit 4-1

King County Departments of Natural Resources and Parks Water and Lands Division.
2005 Hydrological Basins.

Washington State Department of Ecology (Ecology).
2000 Water Resource Inventory Areas.

Exhibit 4-2

WSDOT.
2005 I-405 Renton Nickel Improvement Project, I-5 to SR 169. Prepared by I-405 Staff and DMJM Harris. Ecology Embankments.

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Exhibit 4-3

Federal Emergency Management Agency (FEMA).
1996 Floodway, 100-year Floodplain and 500-year Floodplain.

Exhibit 4-4

United States Environmental Protection Agency (EPA).
1995 Sole Source Aquifer.

King County.
2003 LiDAR Digital Elevation Model (DEM). Hillshade.

Exhibit 4-5

King County.
2003 LiDAR Digital Elevation Model (DEM). Hillshade.

WSDOT Environmental Affairs Office.
2005 Wellhead Protection Zones, Group A, Washington State.

Exhibit 4-6

Washington State Department of Health (WSDOH).
2004, 2005 Wellhead Protection Areas, Group A and B Wells.

WSDOT. Urban Corridors – I-405 Team
2007 Proposed Highway Channelization.

Exhibit 4-7

Renton, city of.
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EPA.
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2003 LiDAR Digital Elevation Model (DEM). Hillshade.

Exhibit 5-1

WSDOT.
2007 Stormwater Flow Control Facilities.

2007 Threshold Discharge Areas.

Exhibit 5-7

Renton, city of.
2005 Aquifer Protection Zones.

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1995 Sole Source Aquifer.

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Base Data

All GIS exhibits contain one or more of the following as base layers:

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United States Geological Survey (USGS).
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Herrera Environmental Consultants, Inc. and R.W. Beck
2001 Gilliam Creek Basin Stormwater Management Plan.

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2005 IMAP Web Site. http//www5.metrokc.gov/imap/?mapset=wria, 03/28/05.

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2007 Water Quality Statistical and Pollutant Loadings Analysis, Green-Duwamish Watershed Water Quality Assessment.

2006 Microbial Source Tracking Study, Green-Duwamish Watershed Water Quality Assessment.

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2005 Renton Municipal Codes (RMC) http://www.ci.renton.wa.us/.

2003 Map of current Cedar Valley Sole-Source Aquifer Boundary.

1999 Water System Plan, appendix Q, Wellhead Protection Plan.

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1993 Renton Groundwater Model Design, Development, and Calibration Final Draft Report.

R.W. Beck

2004 East Side Green River Watershed Plan Technical Memorandum Supplement

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2004 Green-Duwamish Water Temperature Report

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1988 Sole Source Aquifer Designation of the Cedar Valley Aquifer, King County, WA. Federal Register. Volume 53, Number 191. October 3, 1988. Washington D.C.

U.S. Geological Survey (USGS)

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Washington State Department of Ecology (Ecology)

2005 Water Rights Application Tracking System (WRATS) Database, January 2005.

2004 Stormwater Management Manual for Western Washington.

Washington State Department of Transportation (WSDOT)

2007 Panther Creek Watershed Rehabilitation Plan. Prepared by David Evans and Associates, Inc. May 2007.

2007 I-405, Tukwila to Renton Improvement Project (I-5 to SR 169, Phase 2), Ecosystems Discipline Report. Prepared by Anchor Environmental, LLC.

2007 I-405, Tukwila to Renton Improvement Project (I-5 to SR 169, Phase 2), Land Use Discipline Report. Prepared by Jones & Stokes.

2007 I-405, Tukwila to Renton Improvement Project (I-5 to SR 169, Phase 2), Cumulative Effects Analysis Technical Memorandum. Prepared by HDR Inc.

2006 Springbrook Creek Wetland and Habitat Mitigation, Mitigation Bank Instrument.

2006a Environmental Procedures Manual, Section 431.

2006b Highway Runoff Manual.

2006c Geotechnical Design Manual

2006d Bridge Design Manual

2005a Surface Water and Water Quality Discipline Report. Prepared by DMJM Harris.

2005b Floodplains Discipline Report. Prepared by DMJM Harris.

2005c Soils, Geology, and Groundwater Discipline Report. Prepared by Golder Associates.

2004 Environmental Procedures Manual, Water Quality Treatment Pollutant Removal Rates.

2003 WSDOT Conditional Use Designation Memorandum. July 24, 2003.

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APPENDIX A GROUNDWATER RIGHTS SUMMARY

Exhibit A-1. Groundwater Rights Summary

Document Number	Document Type	Purpose List	Name	Priority Date	GPM	Acre feet	Old Certificate No.	TRS
G1-082020CL	Claim Short Form	DG	Jack A. McMillen					T23N/R04E-13
G1-084194CL	Claim Short Form	DG	Patricia E. Paolino					T23N/R04E-14
G1-053628CL	Claim Short Form	DG	Eugene W. Ives					T23N/R04E-14
G1-155270CL	Claim Long Form	DG IR	Charles A. Fox					T23N/R04E-23
G1-155271CL	Claim Long Form	DG	Charles A. Fox					T23N/R04E-23
G1-154945CL	Claim Short Form	DG	Donald A. Buckingham					T23N/R04E-23
G1-160407CL	Claim Short Form	IR	Frederick J Ii Pack					T23N/R04E-26
G1-160408CL	Claim Short Form	IR	Frederick J Ii Pack					T23N/R04E-26
G1-24191C	Certificate	MU	Renton City	18-Oct-82	1,300	1,040		T23N/R05E-17
G1-*09985C	Certificate	MU	Renton City	21-Jan-69	500	800	6776	T23N/R05E-17
G1-*09349C	Certificate	MU	Renton City	01-Apr-68	3,000	4,839	6775	T23N/R05E-17
G1-*08040C	Certificate	MU	Renton City	14-Apr-66	1,600	2,560	5835	T23N/R05E-17

Source: Washington State Department of Ecology Water Rights Application Tracking System Database, January 2005
GPM: gallons per minute
TRS: Township-Range-Section
DG: Domestic General
IR: Irrigation
MU: Municipal

Exhibit A-1. Groundwater Rights Summary (continued)

Document Number	Document Type	Purpose List	Name	Priority Date	GPM	Acre feet	Old Certificate No.	TRS
G1-*08041C	Certificate	MU	Renton City	14-Apr-66	1,960	3,136	5836	T23N/R05E-17
G1-*08042C	Certificate	MU	Renton City	14-Apr-66	960	1,536	5838	T23N/R05E-17
G1-*00816S	Certificate	MU	Renton City	01-Jan-44	1,040	1,676	886	T23N/R05E-17
G1-*00817S	Certificate	MU	Renton City	01-Jan-44	1,040	838	887	T23N/R05E-17
G1-134169CL	Claim Short Form	IR	Edward Plute					T23N/R05E-17
G1-155174CL	Claim Short Form	DG IR	James J Elves					T23N/R05E-19
G1-108233CL	Claim Short Form	IR	Mrs J R Butler					T23N/R05E-19

Source: Washington State Department of Ecology Water Rights Application Tracking System Database, January 2005

GPM: gallons per minute

TRS: Township-Range-Section

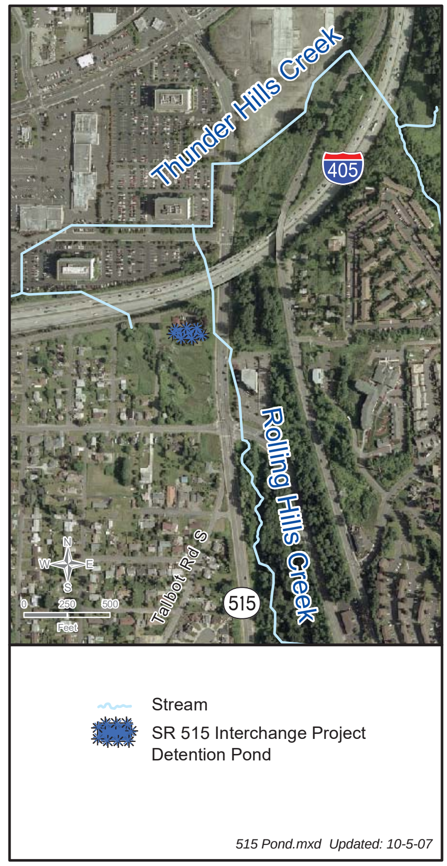
DG: Domestic General

IR: Irrigation

MU: Municipal

APPENDIX B CONSTRUCTION EFFECTS FOR SR 515 INTERCHANGE PROJECT

The SR 515 Interchange Project is the first construction step toward building the Tukwila to Renton Project. This first step may be in operation for some time before other parts of the Tukwila to Renton Project are built. For this reason, the SR 515 Interchange Project needs to build one temporary stormwater detention pond (as shown in sidebar exhibit) that is not shown in the body of this Water Resources Discipline Report. Until the remainder of the Tukwila to Renton Project is built, this pond will provide flow control for stormwater from the SR 515 half-diamond interchange. This stormwater discharge will then be routed to an ecology embankment for enhanced treatment and discharge into Rolling Hills Creek. This pond will be removed when other parts of the project are completed. We do not anticipate that discharge from the temporary detention pond will have any effects on Rolling Hills Creek.



The ecology embankment water quality facilities will remain as part of the overall Tukwila to Renton Project and will not be removed.

To construct this pond, it will be necessary to demolish one home. WSDOT currently plans to acquire this property to build the Tukwila to Renton Project northbound frontage road connecting Talbot Road and Lind Avenue. Therefore, construction of this pond does not add to the right-of-way acquisition or the relocations that are discussed in the Tukwila to Renton Project Environmental Assessment.

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APPENDIX C POLLUTANT LOADING CALCULATIONS

Water Quality Procedures for Water Quality Impact Assessments
Pollutant Loading Estimates
Method 1: WSDOT Data-FHWA Method

Pollutant	Annual pollutant loads from untreated and treated highway surfaces in lbs/acre	
	Mean load (pounds/acre) from untreated surfaces	Mean load (pounds/acre) from treated surfaces based on mean BMP effectiveness
TSS	878	41
Total Phosphorus	1.3	0.3
Total Copper	0.2	0.05
Total Zinc	1.1	0.26

Green River Basin Pollutant Load

	No Build	Build
Roadway Treated	9.79	35.56
Roadway Untreated	91.22	72.66
Total Roadway (acres)	101.01	108.22
Annual Load of total suspended solids (pounds)	80,492.55	65,253.44
Annual load of total phosphorus (pounds)	121.523	105.126
Annual load of total copper (pounds)	18.7335	16.31
Annual load of total zinc (pounds)	102.8874	89.1716

Springbrook Creek Basin Pollutant Load

	No Build	Build
Roadway Treated	22.38	98.82
Roadway Untreated	108.82	60.26
Total Roadway (acres)	131.2	159.08
Annual Load of total suspended solids (pounds)	96,461.54	56,959.9
Annual load of total phosphorus (pounds)	148.18	107.984
Annual load of total copper (pounds)	22.883	16.993
Annual load of total zinc (pounds)	125.5208	91.9792

Cedar River Basin Pollutant Load		
	No Build	**Build**
Roadway Treated	1.04	19.72
Roadway Untreated	23.12	14.05
Total Roadway (acres)	24.16	33.77
Annual Load of total suspended solids (pounds)	20,342	13,144.42
Annual load of total phosphorus (pounds)	30.368	24.181
Annual load of total copper (pounds)	4.676	3.796
Annual load of total zinc (pounds)	25.7024	20.5822