# 3.2 Water Resources (Waterways, Hydrology, Water Quality, Hydrogeology, and Floodplains)

This section provides a description of water resources in the study area and analysis of the potential impacts of the No Build and Build Alternatives. Studies and research conducted as part of the Tier II Final Environmental Impact Statement (FEIS) are listed. Waterways, floodplains, and groundwater in the study area are described, and the potential construction and operational impacts of the alternatives and options on these features are quantified. The Washington State Department of Transportation (WSDOT) and the Federal Highway Administration (FHWA) will adhere to all relevant regulations and obtain required permits, and mitigating measures will be implemented. Mitigation opportunities are introduced and evaluated at the end of this section.

Surface water, groundwater, and floodplains provide public water supply, aquatic habitat, and flood storage and attenuation in the Puyallup valley. Potential effects of the proposed project to water resources in the analysis area include changes in water quality, floodwater storage and displacement, erosion, and habitat quality and availability.

Because of the flat topography and moderately slow soil permeability of the study area, the Tier I EIS process suggested that localized surface drainage would be a major design consideration. The Tier I EIS process projected that soil densification below and adjacent to roadway embankments would have little impact because aquifers at or below 70 feet are the primary source of water in the study area.

Various methods of estimating stormwater quality and quantity can be used to evaluate the impact of the Build Alternative and its options on water resources. Pollutant loads of treated stormwater may provide a measure of impact among different options, as some pollutant loading can be expected regardless of treatment type.

FHWA and WSDOT reorganized and expanded this section in response to comments on the Tier II Draft Environmental Impact Statement (DEIS). Results are presented by basin (e.g., Hylebos, Wapato) rather than by mainline and interchange options. Additional recent water quality data are summarized. More preliminary design information is presented on stream channel design and the Riparian Restoration Proposal, which is compared to conventional stormwater treatments. An expanded discussion of cumulative impacts is included in this section and summarized in Section 3.17.

## *3.2.1 Studies Performed and Coordination Conducted*

This section incorporates information compiled in the *Water Resources Discipline Study* (EnviroVision 2005). Information sources consulted for the DEIS and FEIS are described, as are the methods for analyzing impacts and coordination with agencies and stakeholders.

### DEIS Information Sources

The City of Federal Way Department of Public Works Surface Water Management Division provided information regarding watershed planning and water quality conditions in the Hylebos Creek Watershed. The City of Puyallup Department of Public Works provided information about their public water supply systems.

The Tacoma-Pierce County Health Department supplied information on wellhead protection and groundwater quality. Representatives of the Pierce County Public Works and Utilities Department provided information related to watershed planning, stormwater management, and water quality.

The Puyallup Tribe of Indians, Fish and Wildlife Department, provided ambient water quality data for Wapato Creek and information regarding tribal regulatory jurisdiction over water resources.

The Washington State Department of Ecology (Ecology) Southwest Regional Office Water Quality Program provided information on water quality. The Ecology Environmental Investigations and Laboratory Services Program supplied information on water and sediment quality. The Ecology Standards Program was contacted for information on the classification of surface waters under Chapter 173-201A of the Washington Administrative Code (WAC 173-201A).

The United States Geological Survey (USGS) Water Resources Division in Tacoma provided information regarding the drainage area of the Puyallup River. The United States Environmental Protection Agency (EPA), Region 10 was contacted for information on historical sediment and water quality conditions within the Hylebos Waterway.

Portions of the Riparian Restoration Proposal (RRP) were developed with assistance from Washington Department of Fish and Wildlife (WDFW), Washington Department of Natural Resources (WDNR), United States Fish and Wildlife Service (USFWS), NOAA National Marine Fisheries Service (NOAA Fisheries), EPA, Ecology, the Puyallup Tribe of Indians- Environmental Protection Department, City of Fife - Planning Department, and Friends of the Hylebos Wetlands (FOHW).

### FEIS Additional Information

Geographical Information System (GIS) and land use information for Hylebos and Wapato basins was used for existing land use data as well as review and documentation of future land use as portrayed in existing land use related plans for the various jurisdictions affected by the project.

Additional WSDOT design details were provided for the project including more detail on the RRP, stormwater treatment concepts, stream crossing information, and other project aspects that may affect water quality.

The FOHW provided water quality data from recent monitoring in the project vicinity.

The Puyallup Tribe of Indians was contacted to obtain additional or more recent water quality data. They provided annual average data for a few parameters for two sites in both the Hylebos and Wapato Creeks.

King County was contacted to obtain additional data for the Hylebos and they provided (through their website) a copy of a recent monitoring effort on the East Fork of Hylebos Creek.

A summary report to assess engineering solutions associated with alternatives to mitigate potential impacts of the B&L Woodwaste site on the Hylebos Creek relocation was reviewed to evaluate groundwater contamination concerns (Tetra-Tech 2004).

*SR 167 Extension Preliminary Hydrologic Analysis Riparian Restoration for Wapato Creek at Valley Avenue Interchange* (WSDOT 2004c) was used to evaluate flooding impacts to Wapato Creek.

*Analysis of the SR 167 Extension and Riparian Restoration Proposal in the Hylebos Watershed; Hydrology, Hydraulics, and Geomorphology* (MGS et al. 2004) was used to evaluate floodplain and channel impacts to Hylebos Creek and Surprise Lake Drain.

*SR 167 Net Environmental Benefits Analysis* (CH2M HILL 2005) was also reviewed.

### Methods

A primary consideration of FHWA and WSDOT is the development of a safe public transportation infrastructure that minimizes environmental impacts and does not cause chronic maintenance problems associated with flooding. Floodwaters can cause loss of life and damage to transportation infrastructure, while emergency repairs associated with flooding can result in impacts to aquatic species and substantial operational costs. Thus, it is imperative for a project of this magnitude to have the most accurate flooding information available. In 1990 and 1996, flooding in the study area damaged WSDOT right-of-way (ROW) and extended beyond the boundaries of the 100-year floodplain identified on Flood Insurance Rate Maps produced by the Federal Emergency Management Agency (FEMA). It is also well known by local agencies that the FEMA Flood maps underestimate the extent of floodplains within the study area (King County 1990; Pierce County 1991).

In order to develop the information needed to avoid and mitigate flood hazards, WSDOT conducted a study to identify and map flood prone areas. These areas are more extensive than what is shown on the current FEMA maps (FEMA 1981 and 1987). Flood prone areas were developed from aerial photographs taken during the peaks of 1990 and 1996 flood events. The resulting maps were used to identify threats to public infrastructure and assess the impacts that could result from new construction of SR 167.

Floodplain storage displacement results in lost detention and can result in increased stream flows and bank erosion. Therefore, floodplain storage loss was also estimated for the purpose of developing appropriate mitigation. Hydrologic analysis of the Hylebos Creek watershed was performed for the FEIS using the Hydrological Simulation Program Fortran (HSPF) and the U.S. Army Corps of Engineers' Hydrologic Engineering Centers River Analysis System (HEC-RAS) models to examine effects of the project on stream flows, floodplain elevations, velocities and erosion (MGS et al. 2004). Hydrology of the Wapato Creek project area was analyzed with MGSFlood, which is based on HSPF (WSDOT 2004b).

Stormwater pollutant loads in the DEIS were determined using the FHWA Method for Calculating Pollutant Loads (FHWA 1996). Variables in the FHWA method include drainage area, percent impervious surface (pavement area as a percentage of ROW area), and rainfall characteristics (mean volume and mean interval between events).

As detailed in the FHWA methodology, the event mean concentration reported from 50 percent of urban highway sites was used as an estimate of end of pipe pollutant concentrations for discharges of untreated stormwater. Treated stormwater pollutant concentrations were calculated assuming the pollutant removal efficiencies derived from research on constructed wetlands. Event mean load was calculated using the loading variables provided by FHWA (1996) for each parameter of interest.

For the DEIS, pollutant loading estimates for each interchange area were developed as a means of comparing different interchange configurations. It was clear from that study that there was no notable difference between configurations.

For the FEIS analysis, the pollutant loading estimates were developed by basin (e.g., Hylebos) rather than by interchange option. Estimated annual pollutant loads were calculated for each receiving water using pollutant yield values associated with existing and predicted future land use (Horner 1992). Pollutant loads were calculated for total suspended solids (TSS), total phosphorus (TP), total nitrogen (TN), lead (Pb), zinc (Zn), copper (Cu), and fecal coliform bacteria (FC). These parameters were assessed because they represent common water quality problems and/or they are commonly measured in stormwater runoff from roadways. The *Water Resources Discipline Study* (EnviroVision 2005) provides detail on the methods and results from this analysis. Summary tables are provided in Sections 3.2.5 and 3.2.7.

WSDOT geotechnical staff conducted a groundwater study to determine the potential for aquifer compaction and its impact to public water systems and groundwater flooding. Eleven monitoring wells were drilled to depths of up to 100 feet throughout the project area. Water levels within the wells were monitored for approximately one year by the WSDOT Geotechnical Branch (WSDOT 2001).

Descriptions of streamside vegetation (riparian) conditions and land use drainages were augmented with windshield surveys, physical stream channel measurements, and aerial photo interpretations. Maps were prepared using ArcView™ GIS. A list of public water supply wells was obtained from the Washington State Department of Health (DOH) and their Wellhead Protection Zones were delineated. Wellhead protection zones that overlap the SR 167 corridor were identified. (The SR 167 corridor was defined as the immediate roadway plus an additional 600-foot buffer to allow for GIS errors in scale and data collection.) WSDOT subsequently field verified the location of each public well. Local jurisdictions provided additional information on their water supply wells and respective wellhead protection zones.

## 3.2.2 Affected Environment

### Surface Water Resources

The SR 167 project area lies within Water Resource Inventory Area (WRIA) 10 known as the Puyallup-White Basin. The construction and operation of the proposed SR 167 highway improvements has the potential to impact the following surface waters: Hylebos Creek, Surprise Lake Drain, Fife Ditch, Hylebos Waterway, Wapato Creek, Old Oxbow Lake Ditch, and Puyallup River.

### Surface Water Quality

Table 3.2-1 provides a summary of recently proposed (2003) water quality standards for Aquatic Life Uses and Recreational Use since these are the most stringent and can be applied to all waters found in the project area. Currently the EPA is reviewing Ecology's proposed water quality standards for aquatic life criteria (EPA 2005).

The Puyallup River basin up to river mile 1.0 (approximately ½ mile downstream of the SR 509 bridge) has been designated Anadromous Salmon/Trout Rearing and Migration Only and Primary Contact Recreational Use. The EPA has recommended that river miles 7.3 to 31, outside the project area, be classified as Anadromous Salmon/Trout Spawning, Core Rearing, and Migration as well as the Primary Contact Recreational Use. All other freshwaters in the project area are designated as Salmon/Trout Spawning, Noncore Rearing and Migration and Primary Contact Recreation Use (WAC 173-201A).

Under Section 303(d) of the federal Clean Water Act, bodies of waters that are impaired or threatened, or do not meet State water quality standards need to be identified. Every two years, Ecology creates a list of those waters that do not, or are not expected to, meet water quality standards and includes the list in a statewide water quality assessment report. This report is often referred to as the "List of Impaired and Threatened Waterbodies," or the "303(d) list".

When surface waters are categorized as "polluted" on the 303(d) list, a "clean up plan" (often in the form of a total maximum daily load [TMDL] analysis) is required to identify methods for controlling pollution and monitoring the effectiveness of these controls. The 1998 303(d) List describes segments with excursions above criteria and identifies if a TMDL analysis is necessary. In the 2002/2004 303(d) List (Ecology 2002/2004), stream segments that are designated Category 5 are considered "polluted."

## Table 3.2-1: Comparison of Freshwater Water Quality Standards

| | Class/Category | | Temperature | Dissolved Oxygen | Bacteria [2] | Turbidity | pH |
|---|---|---|---|---|---|---|---|
| Proposed Aquatic Life and Recreational Use Criteria[3] | Char | | Highest 7-DADMax 12°C, with human induced impacts ≤0.3°C | Lowest 1-Day Minimum 9.5 mg/L, with human induced impacts ≤0.2 mg/L | **Extraordinary Primary Contact -** Fecal Coliform organism levels must not exceed a geometric mean value of 50/100mL, with no more than 10% of samples above 100/100 mL<br>**Primary Contact** - Fecal Coliform organism levels must not exceed a geometric mean value of 100/100mL, with no more than 10% of samples above 200/100 mL<br>**Secondary Contact** – Enterococci levels must not exceed a geometric mean of 200/100mL, with no more than 10% of samples above 400/100 mL | 5 NTU over background with background ≤50 NTU; or a 10% increase when NTU is >50 | 6.5 to 8.5, human induced variation <0.2 |
| | Anadromous Salmon & Trout | Spawning, Core Rearing, & Migration | Highest 7-DADMax 16°C, with human induced impacts ≤0.3°C | Lowest 1-Day Minimum 9.5 mg/L, with human induced impacts ≤0.2 mg/L | Same for all Aquatic Life Categories | Same as for Char. | 6.5 to 8.5, human induced variation <0.2 |
| | | Spawning, Noncore Rearing, & Migration | Highest 7-DADMax 17.5°C, with human induced impacts ≤0.3°C | Lowest 1-Day Minimum 8.0 mg/L, with human induced impacts ≤0.2 mg/L | Same for all Aquatic Life Categories | Same as for Char. | 6.5 to 8.5, human induced variation <0.2 |
| | | Rearing & Migration Only | Highest 7-DADMax 17.5°C, with human induced impacts ≤0.3°C | Lowest 1-Day Minimum 6.5 mg/L, with human induced impacts ≤0.2 mg/L | Same for all Aquatic Life Categories | 10 NTU over background with background ≤50 NTU; or a 20% increase when NTU is >50 | 6.5 to 8.5, human induced variation <0.2 |
| | Non-Anadromous Trout | | Highest 7-DADMax 18°C, with human induced impacts ≤0.3°C | Lowest 1-Day Minimum 8.0 mg/L, with human induced impacts ≤0.2 mg/L | Same for all Aquatic Life Categories | Same as for Char. | 6.5 to 8.5, human induced variation <0.2 |
| | Indigenous Warm Water Species | | Highest 7-DADMax 20°C, with human induced impacts ≤0.3°C | Lowest 1-Day Minimum 6.5 mg/L, with human induced impacts ≤0.2 mg/L | Same for all Aquatic Life Categories | Same as for Char. | 6.5 to 8.5, human induced variation <0.2 |

(1) This table is a subset of the Washington State Water Quality Criteria (WAC 173-201A 1992 and 2003). Additional criteria exist for metals, toxics and marine waters.

(2) Bacteria standards are based on recreational use criteria described in the WAC. Primary Contact means activities where there will be direct contact with water including swimming and submergence. Secondary Contact activities are those where there would be limited contact with the water, such as wading or fishing. These standards have been approved for use by the EPA.

(3) Washington State Department of Ecology proposed water quality standards currently in review with the Environmental Protection Agency (Ecology 2002/2004).

The 1998 and 2002/2004 303(d) lists included several segments of waterbodies found within the project area. Table 3.2-2 summarizes these impaired waterbodies, and for 2002/2004 listings, the categories have been listed. Figure 3.2-1 indicates location of 303(d) listed segments in the project area.

**Table 3.2-2: Summary of 303(d) Impaired Waterbodies**

| Waterbody | 1998 List | 2002/2004 List [1] |
|---|---|---|
| **Puyallup River Basin**<br>Puyallup River | As, FC, Pb, Temp, pH | Category 5: Cu, Pb, FC<br>Category 2: Cu, DO, FC, Pb, Hg, Temp, Turbidity |
| **Hylebos Creek Basin**<br>East Fork Hylebos<br>West Fork Hylebos<br>Fife Ditch<br>Hylebos Waterway/ Commencement Bay | FC<br>FC<br>FC, Ammonia-N, DO<br>Benzene, FC, DO,<br>Dioxin,<br>Tetrachloroethylene | Category 5: FC<br>Category 2: DO and pH<br>Category 5: FC and Temp<br>Category 5: FC, Ammonia-N, DO<br>Category 5: DO, FC<br>Category 2: pH, Temp, benzene, Cu, Tetrachloroethylene, Trichloroethylene |
| **Wapato Creek Basin**<br>Wapato Mainstem | DO, Instream Flow,<br>Benzene, FC | Category 5: DO, FC<br>Category 2: Benzene, FC |

[1] Category 5 – Polluted water that require a TMDL, Category 2 – Waters of Concern.
FC = Fecal Coliform, DO = Dissolved Oxygen, As = Arsenic, Pb = Lead, Cu = Copper, Hg = Mercury

Only one pollutant cleanup plan or TMDL has been developed for the project area. In 1993, a TMDL was completed for the Puyallup River for biochemical oxygen demand, ammonia, and residual chlorine (Pelletier 1993). This TMDL was amended in 1994. A TMDL for fecal coliform bacteria was proposed for the next review period. The analysis would include the mainstem Puyallup and White rivers and their associated tributaries listed for FC (McKee, K., Pers. Comm. 2005). A temperature TMDL was proposed at one time but is not currently planned.

In addition to State water quality standards, basin specific thresholds were set by King County to allow comparison between subbasins and to identify problem areas in the Hylebos Watershed (King County 1991). Threshold values were established for two parameters that were not covered (at the time) under State or federal water quality standards. A threshold of 1.25 mg/L (milligrams per liter) was set for nitrate+nitrite (N+N) and a threshold of 50 mg/L was set for TSS (King County 1991). These values were determined based on review of other study results, monitoring experience and professional judgment (King County 1991). Other thresholds (e.g., 0.05 mg/L for TP) for the Hylebos Watershed were set according to existing EPA recommended guidelines and State Board of Health Drinking Water Standards.

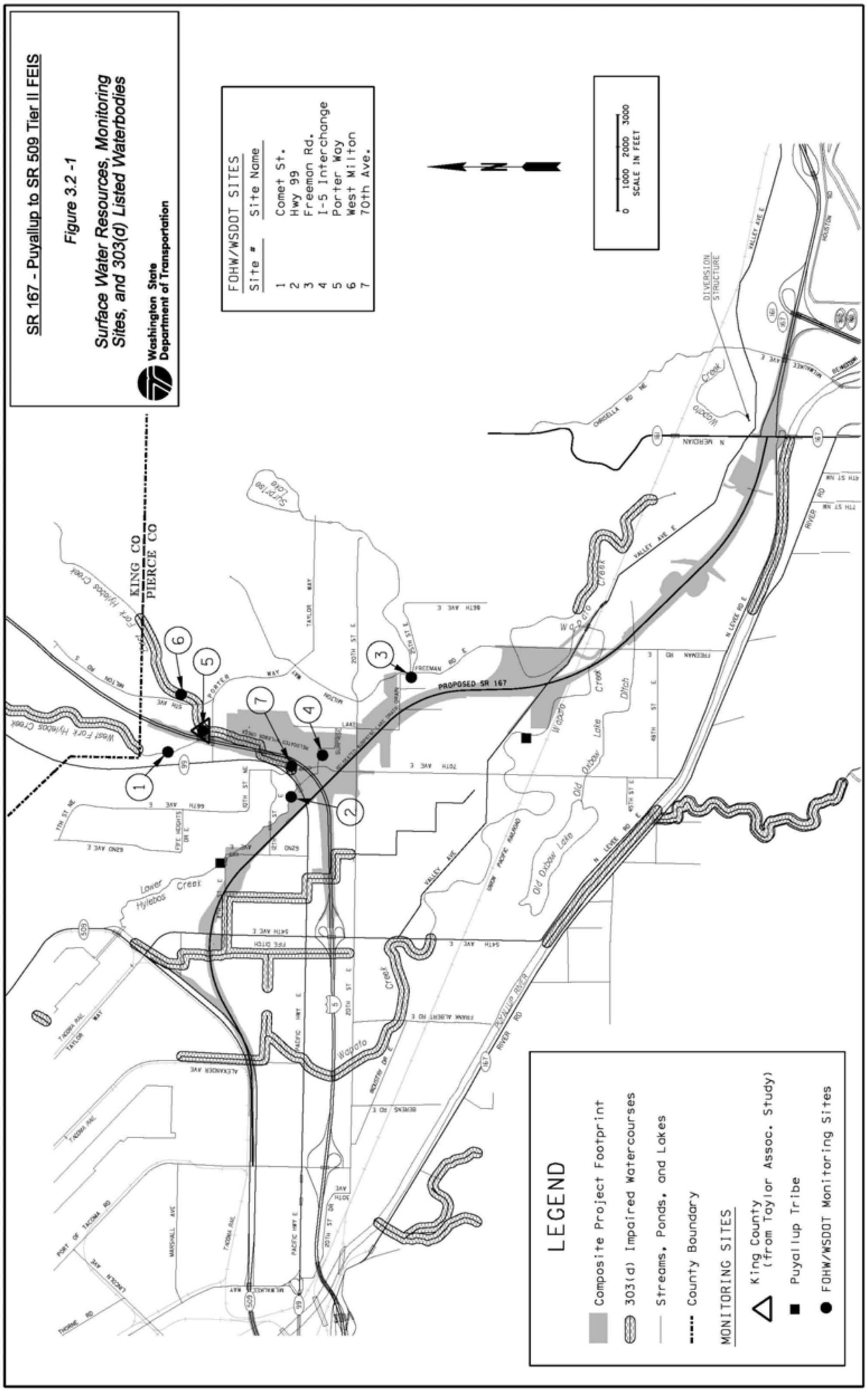
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Figure 3.2-1
Surface Water Resources, Monitoring Sites, and 303(d) Listed Waterbodies
Washington State Department of Transportation
FOHW/WSDOT SITES
Site # Site Name
1 Comet St.
2 Hwy 99
3 Freeman Rd.
4 I-5 Interchange
5 Porter Way
6 West Milton
7 70th Ave.
0 1000 2000 3000
SCALE IN FEET
LEGEND
Composite Project Footprint
303(d) Impaired Watercourses
Streams, Ponds, and Lakes
County Boundary
MONITORING SITES
King County (from Taylor Assoc. Study)
Puyallup Tribe
FOHW/WSDOT Monitoring Sites
KING CO
PIERCE CO
West Fork Hylebos Creek
Lower Hylebos Creek
Wapato Creek
Surprise Lake
Old Oxbow Lake
Puyallup River
DIVERSION STRUCTURE
PROPOSED SR 167

## Floodplains and Flooding

To assess affected area under typical high flood conditions, a number of methods were used to estimate the acres of floodplain potentially impacted by the project. The 100-year floodplain as previously mapped by FEMA provided the first level of analysis. However, review of aerial photos from the 1996 flood indicated that the flooded area was substantially larger. Consequently, the DEIS analysis included estimates of what has been termed the "flood prone area" to allow a more accurate analysis of impacted area. In the Hylebos basin where the majority of the project impacts occur, yet another method for estimating floodplain area was used. This involved hydrologic modeling and was used to estimate the existing 100-year floodplain and the floodplain under future build-out conditions in the drainage area.

*Flooding along I-5 at Hylebos Creek in February 1996.*

## Hylebos Basin

The Hylebos Creek watershed drains over 18 square miles of land from the city of Federal Way to the Hylebos Waterway and Commencement Bay in the city of Tacoma (King County 1990). The watershed consists of three subbasins: the East Fork Hylebos Creek, the West Fork Hylebos Creek, and Lower Hylebos Creek.

Both the East and West Forks of Hylebos Creek originate in Federal Way and flow south along either side of I-5 into Milton where they join and form the mainstem of Hylebos Creek and the beginning of Lower Hylebos Creek subbasin. South of the convergence of the two forks, near I-5 and the 70th Avenue East overpass, the Lower Hylebos Creek flows northwest, through the Tacoma tide flats, before discharging to the Hylebos Waterway.

Surprise Lake Drain is a tributary to the Lower Hylebos Creek. Fife Ditch discharges even lower in the basin in the Hylebos Creek Estuary. The SR 167 project footprint lies at the lower end of the Hylebos watershed and almost entirely within the Lower Hylebos Creek subbasin.

The Hylebos Waterway is one of seven waterways situated within the Commencement Bay tide flats at the western boundary of the project area. The Hylebos Waterway is an estuary that receives fresh surface water from Hylebos Creek, Fife Ditch, Surprise Lake Drain, and direct runoff from the surrounding tide flats. Aquifers within the Puyallup valley and the adjacent uplands also contribute fresh water to the waterway. This section describes the existing surface waters in the Hylebos Basin. After the primary streams and constructed drains or ditches are characterized, hydrology and flooding are discussed and water quality is summarized.

### Hylebos Creek

Urbanization of the Hylebos Creek basins has disrupted the hydrology of these systems. The headwaters of West Fork Hylebos Creek originate as a spidery web of smaller tributaries at Panther Lake (the corner of 348th Street and 1st Avenue South), and near the vicinity of the Sea-Tac Mall at Pacific Highway and South 320th Street. The tributaries converge in the vicinity of the West Hylebos Wetlands and then converge with the North Fork just north of South 373rd and Pacific Highway forming the main trunk of the West Fork of Hylebos Creek. Tributaries north of 348th Street receive runoff from a highly urbanized land use area, consisting primarily of commercial, multifamily residential housing, and associated roads. These areas have a high percentage of impervious surfaces, and often lack adequate stormwater detention or are served by undersized detention ponds. Therefore, runoff is quickly conveyed to the tributaries, which results in short duration, high volume flows. These tributaries then flow into the 93-acre West Hylebos wetland. Despite less intensive land use and the presence of large forested areas south of the West Hylebos wetland, tributaries have been piped and undergone encroachment and bank armoring along several reaches. Additionally, flash discharges from the urbanized sub-catchments to the north are conveyed to these lower segments. Pierce County (1991) estimated that flood peaks on the West Fork Hylebos Creek have increased 80 percent over the pre-developed forested condition.

The headwaters of East Fork Hylebos Creek subbasin originate at Lake Killarney, North Lake, and north of 320th Street. The tributary originating west of I-5 conveys runoff from highly urbanized areas of commercial development. Originally a tributary to the West Fork Hylebos Creek, this drainage was constrained to pipes and channels during the construction of I-5. Currently, it joins other East Fork Hylebos Creek tributaries east of the Wild Waves Water Park and south of SR 161. From the lakes to SR 161, the stream gradients are gentle and the velocity is slow. Stream gradients and velocities increase south of the highway until they reach the valley floor in the city of Milton. These increased stream flows have been attributed to residential development, gravel mining, and other site-specific land uses within the subbasin. Urban runoff originating in the headwaters of the subbasin increases peak flows, leading to erosion of the channel substrate and substantial channel incision along reaches of East Fork Hylebos Creek. Throughout the basin, wetlands have been filled or disconnected from the floodplain thus reducing floodwater storage while impervious surface has reduced detention time, and increased flow rates. King County (1990) estimated that flood peaks on the East Fork Hylebos Creek have increased 60 percent over the pre-developed forested condition.

Lower Hylebos Creek, I-5 vicinity.

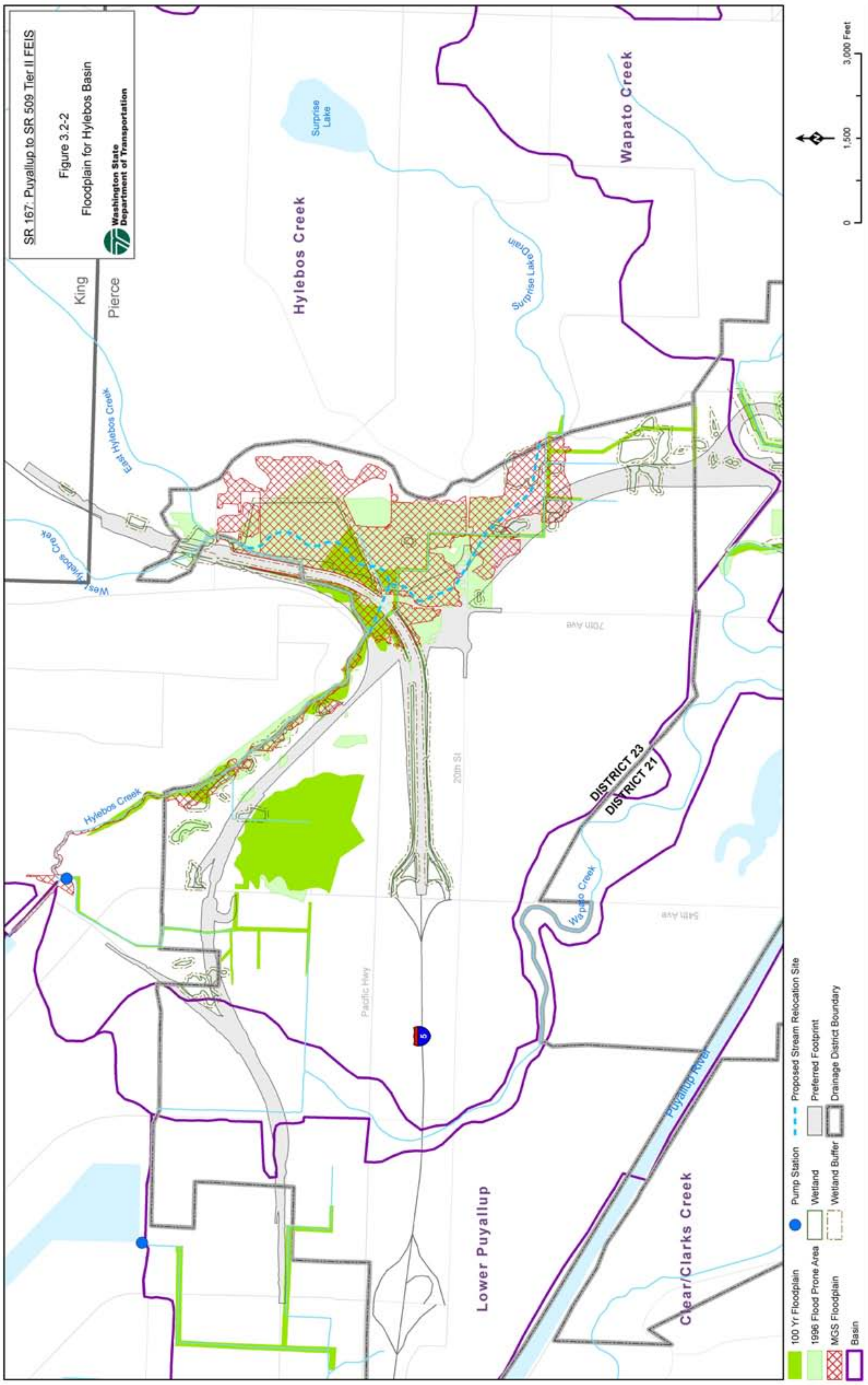
The Lower Hylebos Creek subbasin originates at the confluence of the East and West Forks of Hylebos Creek. It flows through a broad floodplain in the city of Milton, turns northwest and flows beneath a bridge on I-5 into Tacoma, where it slowly makes its way through the tide flats, and discharges to the Hylebos Waterway and Commencement Bay. Surprise Lake Drain is a tributary to Lower Hylebos Creek and enters just upstream of the Highway 99 bridge crossing. Fife Ditch flows into the Hylebos Creek estuary through a tide gate and pump station. Consequently, although it can be considered to be part of the Hylebos watershed, its proximity to the mouth of the stream limits its impact as a typical tributary. Lower Hylebos Creek and Fife Ditch convey runoff from the following land use types: light manufacturing and single family residential in the city of Milton; industrial, commercial, and residential in the city of Fife; and industrial and residential in the city of Tacoma.

In Lower Hylebos Creek the floodplain has been filled, channelized, and encroached upon, resulting in a reduction of floodplain storage. The stream is confined to a narrow channel, constricted between I-5 on the left bank and a vertical wall of concrete blocks on the right bank. There is no riparian vegetation or large woody debris along this reach. Downstream of this reach in the segment between 70th Avenue East and Porter Way, the stream runs through a fairly straight trapezoidal channel that is incised several feet and with nearly vertical banks. There is no streambed gravel and little or no overhanging riparian vegetation. The banks are primarily vegetated with invasive reed canary grass and blackberries.

*Hydrology and Flooding*

During recent large flood events (January 1990 and February 1996) the entire floodplain as defined by the FEMA Flood Insurance Rate Map (FIRM) was inundated along with several areas outside the mapped boundaries (FEMA 1981 and 1987). These two storms were calculated to be approximately a 20-year (1996) and nearly a 100-year (1990) rain event. The designated floodplain and flood prone area (as defined by the 1996 event) are depicted in Figure 3.2-2.

A hydrologic analysis of the lower reaches of Hylebos Creek (from Porter Way to the mouth and including Surprise Lake Drain), was performed using the HSPF and HEC-RAS models to examine effects of the project on stream flows, floodplain elevations, velocities and erosion (MGS et al. 2004). The flood magnitude just upstream of the project area (Porter Way) is considerably higher than immediately downstream due to flood storage in the large wetland and broad floodplain south of Porter Way. The discharge then increases as inflow enters from the Lower Hylebos subbasin and Surprise Lake Drain.



SR 167: Puyallup to SR 509 Tier II FEIS
Figure 3.2-2
Floodplain for Hylebos Basin
Washington State Department of Transportation
King
Pierce
Hylebos Creek
Wapato Creek
Lower Puyallup
Clear/Clarks Creek
Surprise Lake
Surprise Lake Drain
East Hylebos Creek
West Hylebos Creek
Hylebos Creek
Wapato Creek
Puyallup River
DISTRICT 23
DISTRICT 21
70th Ave
20th St
54th Ave
Pacific Hwy
5
0
1,500
3,000 Feet
100 Yr Floodplain
1996 Flood Prone Area
MGS Floodplain
Basin
Pump Station
Wetland
Wetland Buffer
Proposed Stream Relocation Site
Preferred Footprint
Drainage District Boundary

The flood season for Hylebos Creek is from October to March. The greatest floods are caused by rainfall versus melting snow. The stream rises quickly during heavy rainfall because of the relatively steep terrain and development in the upper watershed (MGS et al. 2004). Generally, streams rise to flood stage within a day of peak rainfall and duration is only a few days. In an extreme flood event, large portions of the Lower Hylebos Creek watershed are flooded. In 1991, flood peaks on Lower Hylebos Creek were predicted to more than double in size over pre-developed forested flows once the basin is fully developed (King County 1991). Regional stormwater ponds included in the basin plan should moderate the increase in peak flows when they are constructed.

The lack of capacity to handle high flows, and the very flat low lands adjoining the stream appear to be the major cause of flooding in Lower Hylebos Creek (Pierce County 1991). The trapezoidal channel typically ranges from 12 to 16 feet wide, has 5-foot-high banks, and a low gradient. The water crossings at 12th Street, 67th Avenue, 62nd Avenue, and 8th Street East are only 16 feet wide. These can be expected to constrict flows and collect debris leading to local non-systemic flooding during smaller events and exacerbating flooding during large events. Currently, the channel appears to be actively maintained to remove obstructions and improve stream flow efficiency.

Water surface elevations for floods of the selected recurrence intervals were computed using the HEC-RAS model (MGS et al. 2004). Over 50 cross sections and flood profiles were modeled on the Hylebos beginning just below the confluence of the East and West forks and ending at Hylebos Waterway. Another approximately 25 cross sections were modeled on Surprise Lake Drain. Under existing conditions the flood elevation ranged from 15.75 feet at Porter Way to 8.04 feet near the mouth at 4th Street East. and several bridges were identified as being either overtopped or subject to pressure flow during a 100-year flood event.

Under existing conditions, approximately 246 acres are predicted for inundation during a 100-year flood event. Most of the flooding (approximately 220 acres) occurs upstream of SR 99. The SR 99 bridge represents a substantial restriction to flood flows, as are the Surprise Lake Drain culverts under I-5. For the 100-year flood, levels are expected to be contained by the crown of the I-5 roadbed and would inundate the area between SR 99 and I-5 with spill onto the southbound I-5 traffic lanes. The large wetland area to the east of I-5 and north of the Interurban Trail ROW would also be inundated; the agricultural lands south of the trail and adjacent to Surprise Lake Drain would also be inundated. The 100-year flood elevations would be high enough to allow co-mingling of Hylebos Creek and the Surprise Lake Drain where they would both flow over the Interurban Trail ROW.

Downstream of SR 99 to 8th Street East, the floodplain is limited to an area extending approximately 100 feet south of the channel. Flooded area increased due to the limited capacity of the many bridges that cross the channel in this stream segment. Downstream of 8th Street East, Hylebos is contained within its banks at the 100-year flood. Although the 4th Street Bridge represents an obstruction to flood flows, flood waters backup into the Milgard Nature Area which was designed for periodic inundation.

Since low flows can also be a problem in Hylebos Creek, mean monthly flow statistics were also computed using the HSPF model. The lowest flows were predicted to occur in August. Minimum stream flows for the mouth of the Hylebos were predicted to be 10.7 cfs and for the mouth of Surprise Lake 1.4 cfs. Groundwater discharge that occurs along the mainstem of the creek, upstream of the project area, was identified as the water source responsible for maintaining adequate summer flow in the project area (MGS et al. 2004).

*Water Quality*

The Municipality of Metropolitan Seattle (Metro) monitored base flow conditions between May of 1987 and April of 1988 (Metro 1989, as cited in King County 1990). Monitoring results indicated that FC exceeded state standards on four occasions in the West Hylebos and on one occasion in the East Hylebos.

King County monitored water quality within the three subbasins during storm flow conditions in December of 1989 and October of 1990. The monitoring results showed numerous exceedances of state water quality standards, federal recommendations, and basin specific thresholds (Table 3.2-3). FC and the metals Cu and Zn exceeded State standards in the majority of samples, while the nutrients, TP and N+N and TSS often exceeded federal recommendations and basin thresholds.

**Table 3.2-3: Number of Samples Exceeding Federal Recommendations (F), State Standards (S) and Basin Specific Thresholds (BS) in Hylebos Creek. (Adapted from King County 1990)**

| | Standard or Threshold | East Hylebos(1) | West Hylebos(1) | Lower Hylebos(1) |
|---|---|---|---|---|
| Fecal Coliform | 100/100 mL (S) | 10/13 | 25/26 | 4/4 |
| Total Phosphorus | 0.10 mg/L (F) | 6/13 | 14/26 | 4/4 |
| Nitrate + Nitrite | 1.25 mg/L (BS) | 3/13 | 0/26 | 2/4 |
| Total Suspended Solids | 50 mg/L (BS) | 6/17 | 9/28 | 2/4 |
| Copper (2) | 67.58 ug/L (S) | 12/13 | 19/20 | 3/4 |
| Zinc (2) | 46.53 ug/L (S) | 6/15 | 23/27 | 1/4 |

(1) Number of exceedances/total number of samples.
(2) Exceedances based on concentrations in excess of acute metals criteria.

More recent water quality monitoring was conducted on East Hylebos Creek (Taylor and Assoc. 2002). Water quality and flow information was collected from four sites on six occasions; four of which were storm events. Only one of the stations (located where 5th Avenue crosses the mainstem) was located near the project impact area, just upstream of the confluence of the East and West forks. Figure 3.2-1 depicts the location of the station, as well as other project area monitoring stations described in this section. FC bacteria exceeded State standards in almost all samples. TSS and TP routinely exceeded recommended thresholds at all stations. State water quality standards are not directly comparable due to duration of sample collection period in the study. However, at each station the concentration of pollutants increased substantially between baseflow and storm events; indicating the pollutant source is runoff generated.

The Puyallup Tribe of Indians has an ongoing monitoring program in the project area. This program includes two monitoring stations on the Lower Hylebos Creek. They have been monitoring since 1998. These data indicate there are at least occasional exceedances of dissolved oxygen (DO) and pH standards and that nutrient concentrations (TP and N+N) are high. Both of these stations are located in the Lower Hylebos subbasin (Figure 3.2-1).

The FOHW have been monitoring in the Hylebos basin monthly since November 2003 (Figure 3.2-1). High temperatures occurred at all three stations where it was measured. TSS concentrations also appear to be elevated on occasion. Evaluation of metals criteria exceedance can not be made without coincident measurements of hardness. However, it is possible that both Cu and Pb exceeded acute toxicity criteria at all three stations where it was measured. The *Water Resources Discipline Study* (EnviroVision 2005) provides more details on these data.

The long-term monitoring program is planned as a means of improving understanding of the water quality condition of Hylebos Creek near the project area, and to allow for long term evaluation of possible impacts from the roadway. Monitoring sites are shown in Figure 3.2-1. Monitoring includes measurements of temperature, turbidity, pH, hardness, DO, TSS, nitrates, phosphorus and heavy metals. Temperature is currently measured through a continuous recorder; the remaining parameters are currently measured through quarterly grab samples from the six sites. Storm event sampling will also occur at a subset of the six sites.

Washington State Department of Ecology (1983, 1985a, 1985b) reported elevated arsenic and cadmium levels, originating from two industrial landfills, in the waters and sediments of the Lower Hylebos. The B&L Woodwaste landfill was identified as contributing high levels of arsenic, turbidity, solids, ammonia, phosphorus and possibly tannic acid to the Lower Hylebos via the Surprise Lake Drain. The US Gypsum landfill was found to be discharging arsenic and cadmium directly to the Lower Hylebos and possibly through contaminated groundwater leachate. The B&L Woodwaste and US Gypsum sites have undergone remediation and are subject to ongoing monitoring.

FC bacteria are listed as problems throughout the basin (Category 5: Polluted). Other Category 5 listings include temperature in the West Fork, ammonia-N and DO in Fife Ditch and DO in the Hylebos Waterway. Category 2 (waters of concern) listings included DO and pH in the East Fork, and pH, temperature, Cu, and a few organic pollutants (i.e., benzene, tetrachloroethylene, and trichloroethylene) in Hylebos Waterway. Of these known water quality problems, Cu and Zn are the parameters that can be most directly linked to highway runoff and therefore are a more direct concern for the project. However, seasonal considerations of possible indirect affects on flow and therefore temperature and DO concentrations are also a concern.

**Surprise Lake Drain**

Surprise Lake Drain originates at the spring-fed Surprise Lake north of the Puyallup River valley. Its drainage includes residential areas in the city of Edgewood south to the valley below, and agricultural and residential runoff from the city of Fife. It flows through a series of linear ditches to its confluence with Lower Hylebos Creek. The ditches consist of bare soil trapezoidal channels, about 3 feet wide at the base and about 4 feet deep that zigzag around property lines.

*Surprise Lake Drain, Freeman Road vicinity.*

Surprise Lake Drain crosses under Freeman Road through a 3-foot diameter concrete culvert. About 180 feet downstream of the Freeman Road culvert is a privately owned 24-inch diameter concrete culvert pipe. Once Surprise Lake Drain crosses Freeman Road, the channel becomes an agricultural ditch. The crossing under 20th Street East is through a 5.5-foot span by 3.5-foot rise corrugated metal pipe arch culvert. The crossings under 70th Avenue East and I-5 are through 8.5-foot span by 5.5-foot rise corrugated metal pipe arch culverts. Limited riparian vegetation is present between 70th Avenue East and I-5, but juvenile coho salmon were observed where habitat was available.

*Hydrology and Flooding*

The general hydrology and flooding information described under Hylebos Creek also relates to this tributary. Under existing conditions the flow at the mouth (i.e., confluence with Lower Hylebos) for the 2-year and 100-year return frequency storms is 62 and 104 cfs, respectively (MGS et al. 2004). August low flows for the mouth of this stream were predicted to be 1.1 cfs. During the 100-year flood predicted through modeling and aerial photo interpretation (Figure 3.2-2) the entire area is inundated and the flows would be expected to co-mingle with the Lower Hylebos. As a consequence, the floodplain area described for the Hylebos includes flooded area within Surprise Lake Drain.

As described previously, approximately 25 cross sections were modeled to evaluate flood elevations on Surprise Lake Drain. Under existing conditions the 100-year flood elevation at Freeman Road was predicted at 19.49 feet. The flood elevation near the mouth would be similar to what was calculated for Hylebos at SR 99, which was 13.93 feet (MGS et al. 2004).

*Water Quality*

There are no 303(d) listings specific to Surprise Lake Drain. The only water quality data identified for the Surprise Lake Drain is associated with the recent monitoring by FOHW that was described previously. The data indicated that temperature probably frequently exceeds standards during the summer and that turbidity and TSS are also higher than measured in other parts of the Hylebos system. There may also be occasional exceedances of acute toxicity standards for Cu. Since the WSDOT/FOHW monitoring program includes a site up- and downstream of the area proposed for relocation, over the long term conditions in this stream and the impacts from the project will be better known.

**Fife Ditch**

Fife Ditch drains runoff from 2 square miles, including industrial sections of the Port of Tacoma, and industrial, commercial, residential, and agricultural sections of the city of Fife (Parametrix 1991). The ditch conveys the runoff through a tide gate into the Lower Hylebos Creek near its terminus at the Hylebos Waterway. A pump station located at the tide gate is used to control the discharge. This system is considered to be under capacity since water backs up here during flood events. Riparian coverage is almost non-existent along the ditch.

Two active Drainage Districts (#21 and #23) operate in the area and have authority over ditch maintenance. The drainage districts were originally created by farmers with agricultural lands that required maintenance on drainage. Their primary goal is to maintain channel conveyance capacity. Normal maintenance activities include; cutting back riparian vegetation (primarily reed canary grass) and dredging sloughed material out of the channels. Drainage District #23 is also responsible for operation and maintenance of the tide gates and pumps that control Fife Ditch flow into the mouth of Hylebos Creek.

*Hydrology and Flooding*

This drainage was not included in the detailed hydrologic assessment and modeling efforts done for this project, because only a small amount of land is affected in this basin. The Fife industrial area is flat and poorly drained. Under normal conditions the Fife Ditch drains to Hylebos Creek estuary near the crossing of SR 509 via a tide gate. During periods of high flow, surface water is routed through a pumping station (Figure 3.2-2); consequently, flooding is typically not too extensive. However, during the January 1990 flood, much of the Fife Ditch drainage basin flooded; there were standing pools of water throughout the basin and the collector channels were full. This is designated as the flood prone area in Figure 3.2-2. Surface water flows have been documented varying from 0.3 to 16.0 cfs and are characterized as sluggish. Channel geometry is linear and uniform and sediments consist primarily of silts and clays (USGS 1986).

*Water Quality*

Available data indicate that Fife Ditch does not meet State water quality standards. Studies performed by the USGS between August 1983 and September 1984 indicated that concentrations of DO and FC exceeded state standards. High levels of ammonia-N were also measured (USGS 1986). Ambient monitoring records for this waterway include two instances of arsenic and one instance of Hg at levels near the chronic toxicity criteria, indicating the potential for future problems (Ecology 1995b). Currently, Ecology has included Fife Ditch on the 303(d) list due to low DO, high FC, and high ammonia.

**Hylebos Waterway**

Historically the Hylebos Waterway was part of a large saltwater marsh within Commencement Bay. The marshes were filled in the early 20th century and now support heavy industrial uses. As the receiving waters from multiple drainages, the Hylebos Waterway receives runoff from most types of land use including: agricultural, low to high-density residential, commercial, light and heavy industrial, and roads.

## Wapato and Lower Puyallup Basins

### Wapato Basin

Wapato Creek drains 3.5 square miles of land from north of the city of Puyallup, the city of Fife, and the Port of Tacoma to the Blair Waterway and Commencement Bay in the city of Tacoma. Simmons Creek, a tributary to Wapato Creek, receives runoff from a portion of the city of Edgewood's Urban Growth Area. Wapato Creek receives a substantial amount of runoff directly from adjacent agricultural, residential, commercial and industrial lands in the cities of Puyallup and Fife. Wapato Creek has been greatly altered from its natural condition, and riparian cover along most of the system is thin to nonexistent. Channel sediments consist primarily of clays and sands.

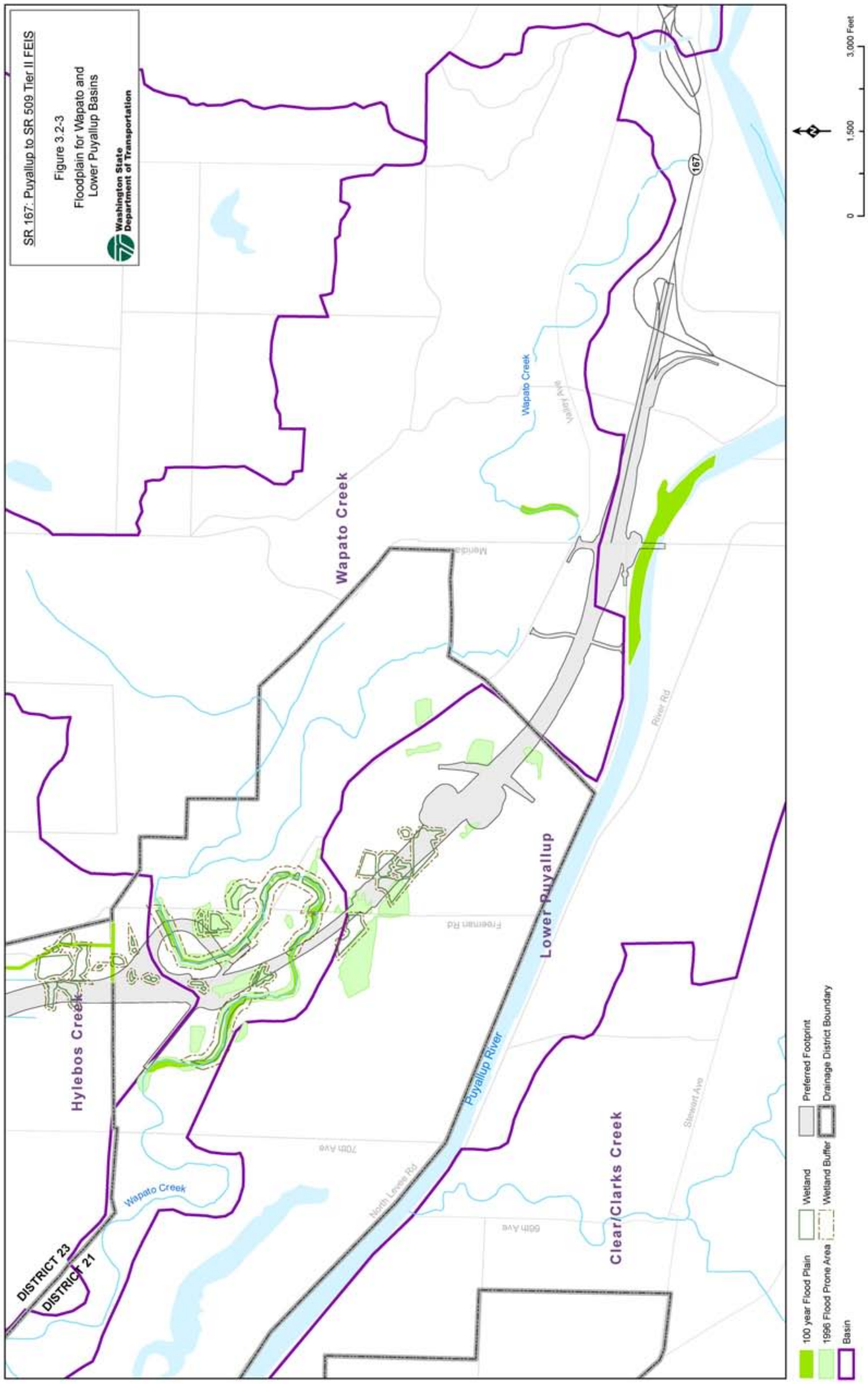
### Wapato Creek

Wapato Creek, in the vicinity of the proposed Valley Avenue Interchange, occupies a low gradient and sinuous channel. The channel is formed in silt dominated soils and as a result has cohesive soil banks and a silty-sand substrate bottom with little or no gravel. The banks are gradually sloping and generally uniform. The flood prone area averages less than 200 square feet (Figure 3.2-3).

A culvert placed in the upper reach near the intersection of Valley Avenue East and SR 161, in or after 1977, diverts up to 120 cfs from Wapato Creek into the Puyallup River (JMM 1991). Approximately 1.5 square miles of Wapato Creeks' upper basin drains to this diversion. A narrow area, north of the Puyallup River levee and south of Wapato Creek basin, also drains to the diversion structure. The area upstream of this diversion is referred to in the FEIS as Upper Wapato Creek.

*Hydrology and Flooding*

Lower Wapato Creek watershed is flat and the channel has limited capacity. The estimated 25-year flood flow for the Wapato Creek watershed is 165 cfs (Pierce County 1991), and much of that flow is intercepted and routed to the Puyallup River through the diversion structure. The remainder flows through Wapato Creek. During the February 1996 flood event, the diversion structure discharged most of the peak flows from Wapato Creek to the Puyallup River before the peak flows from the Puyallup River reached the lower valley. This reduced much of the flood impact in the Wapato Creek watershed. Although the diversion structure minimizes flood impacts, it also contributes to chronic summer low flow problems.


SR 167: Puyallup to SR 509 Tier II FEIS
Figure 3.2-3
Floodplain for Wapato and Lower Puyallup Basins
Washington State Department of Transportation
Wapato Creek
Hylebos Creek
Lower Puyallup
Clear/Clarks Creek
Puyallup River
Wapato Creek
Wapato Creek
DISTRICT 23
DISTRICT 21
Valley Ave
River Rd
Freeman Rd
70th Ave
66th Ave
North Levee Rd
Stewart Ave
167
0
1,500
3,000 Feet
100 year Flood Plain
1996 Flood Prone Area
Basin
Wetland
Wetland Buffer
Preferred Footprint
Drainage District Boundary

Because the diversion structure effectively removed much of the flood risk in the Wapato Creek watershed, the FIRM flood maps show only a narrow width of floodplain along Wapato Creek (FEMA 1981 and 1987). Aerial photos taken during the February 1996 flood indicate that the limit of Wapato Creek's floodwater extends beyond the boundary shown on the FIRM floodplain map. However, the review indicated Wapato Creek remained within its banks over the majority of its length and seldom flooded onto adjacent fields. Isolated areas of flooding were observed in the fields in the same vicinity.

Wapato Creek crosses Freeman Road three times. From upstream to downstream, the first crossing of Freeman Road is through a fairly new 8.8-foot span by 6.4-foot rise corrugated metal pipe-arch culvert. The channel in the vicinity of this culvert varies from 4 to 7 feet wide, with little riparian vegetation. The second Wapato Creek crossing under Freeman Road, near the intersection with Valley Avenue, is through two 4.8-foot diameter concrete culverts in parallel. The channel in the vicinity of this crossing is 10 feet wide, with mud and sediment bottom. About 150 feet upstream of the crossing the channel is 5 feet wide. The channel is 6 to 8 feet wide downstream of the crossing.

Downstream of the second Freeman Road crossing, Wapato Creek flows through a private driveway culvert, a bridge at Valley Avenue, and a pipe under the railroad. The private driveway culvert is a 6-foot diameter corrugated metal pipe that has about 1-foot of cover. The Valley Avenue Bridge has a 46-foot horizontal span, 10-foot vertical clearance, and is the best Wapato Creek crossing structure in terms of floodplains and ecological connectivity. The railroad crossing is a long, 6-foot diameter corrugated metal multi-plate culvert pipe. The channel from the second Freeman Road crossing to the railroad crossing has fairly good riparian cover, although many of the plant species are non-native. The channel width in this area varies from 5 to 8 feet wide with a muddy bottom.

*Wapato Creek, at southern most Freeman Road crossing.*

The third Freeman Road crossing is another set of two 4.8-foot diameter concrete culvert pipes in parallel. From the railroad crossing to the third Freeman Road crossing, and downstream towards Valley Avenue, Wapato Creek has an average channel width of 7 feet. The channel flows through agricultural pastures with no riparian vegetation. The bankfull floodplain channel appears to be about 200 feet wide. In addition to road crossings, there are six undersized culverts in the project area associated with private driveways.

*Water Quality*

Available data indicate that Wapato Creek does not always meet water quality standards. During late 1983 and early 1984, USGS reported DO and FC problems (USGS 1986). In 1998 the Puyallup Tribe of Indians documented several exceedances of state and federal standards and basin specific criteria (Puyallup Tribe 1998). State standards for pH were not met at multiple sites within the basin. Two sites experienced N+N concentrations in excess of federal recommendations and TP concentrations above levels determined by the Puyallup Tribe of Indians to be protective of salmonids.

More recent data by the Tribe indicate that there continue to be times when DO, pH and temperatures do not meet standards, especially at the downstream station (Goldau Road in Fife). The conditions of low oxygen and high temperatures would occur during late summer. Exceedances for pH might occur at any time, depending upon the cause, but it is likely they occurred primarily during winter months as was documented during the Puyallup Tribe's 1998 study. Nutrient levels (TP and N+N) also continued to be high. The *Water Resources Discipline Study* (EnviroVision 2005) provides more details on these data.

Ecology has listed (303(d)) sections of Wapato Creek as "polluted" (Category 5) for FC bacteria and DO and as "concern" (Category 2) for FC bacteria and benzene. Figure 3.2-2 indicates which stream segments are included on the list. Table 3.2-2 lists the impairment for each segment. No TMDLs are currently planned in the Wapato Basin, however it is possible that the bacteria TMDL scheduled for the Puyallup River will be expanded to include the Wapato Basin.

### Old Oxbow Lake Ditch

Old Oxbow Lake Ditch drains mostly agricultural lands that fall between the Wapato Creek divide and the Puyallup River levee system. The ditch drains to Old Oxbow Lake, an old Puyallup River oxbow that is now isolated behind the levee, but connects to the Puyallup River through a floodgate.

#### *Hydrology and Flooding*

The floodplain was not mapped for this drainage and no hydrology data were identified. It is a small drainage basin that is protected from flooding by the levees around the Puyallup and the tide gate. Under widespread regional flooding that would occur if the levees were breached, this entire area would be inundated.

#### *Water Quality*

No water quality data have been identified for this water body and there are no 303(d) listings.

### Puyallup River

The Puyallup River drains approximately 970 square miles (USGS 1986) and is often described as two watersheds: the Upper Puyallup River watershed and the Lower Puyallup River watershed. The headwaters of the Upper Puyallup River are located at the toe of a glacier along the flank of the heavily forested Mt. Rainier. The Lower Puyallup River begins at the river's convergence with its first major tributary, the Carbon River, near the city of Orting. Estuarine conditions exist from the mouth upstream to river mile 2.2. The project is located in the Lower Puyallup watershed.

Below the city of Orting, the Puyallup River primarily drains agricultural land until it joins the White (Stuck) River, near the city of Sumner. The Carbon and

White rivers convey flows from 75 percent of the Lower Puyallup River Watershed drainage area. Smaller creeks that discharge directly or indirectly into the Puyallup River below the city of Orting, but are outside of the project area, include: Horse Haven, Canyon Falls, Fennel, Elhi, Alderton, Clarks, Rody, Deer, Squally, Diru, Swan, and Salishan. From the city of Sumner to the mouth of the Puyallup River at Commencement Bay in the city of Tacoma, the river drains agricultural, industrial, commercial, and residential areas. Mean annual flow at a gauging station located in the city of Puyallup, near the confluence with Clarks Creek, is 3,456 cubic feet per second (cfs) (USGS 1986).

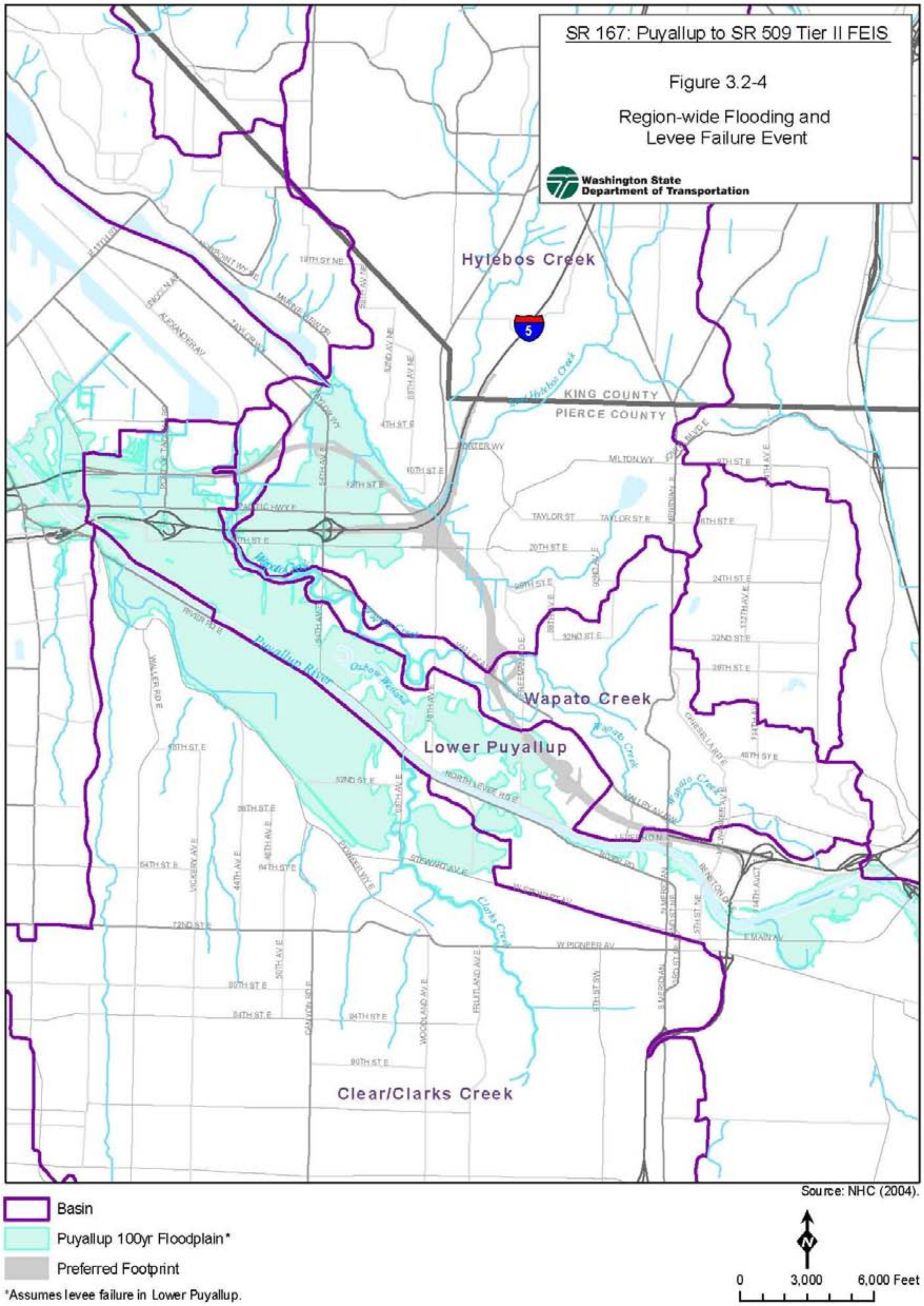
*Hydrology and Flooding*

Historically, major floods have occurred frequently in the Puyallup River. Since Mud Mountain Dam began operating in 1943, the discharges have been regulated and flooding greatly reduced. Although flooding still occurs relatively frequently (five occurrences since 1990) most of the flooding occurs in reaches upstream of the project area. Downstream of the city of Puyallup (within the SR 167 project area), the Puyallup River channel has been dredged, straightened, and stabilized with riprap and concrete. It is also confined between earthen flood control levees which contain most flood flows. Since 1943, regional flooding that affected this lower reach has only occurred once, in 1996, during what was approximately a 60-year storm event in the lower basin (Northwest Hydraulics Consultants 2004). During this event, county officials noted that water levels came close to overtopping the levees in several locations. Aerial photos from this event were used to define the “flood prone areas” (shown in Figures 3.2-2 and 3.2-3).

The past FIRM and aerial photos of flood prone areas indicate that the river is largely held within its banks within the project area. Recent modeling of regional flooding conditions based on sediment buildup in the Puyallup River leading to levee failure (Northwest Hydraulics Consultants, 2004) indicate that the Lower Puyallup River can be expected to merge with Clear/Clarks Creek basin to the south and the Oxbow, Wapato and Hylebos basins to the north under these extreme conditions (Figure 3.2-4). The modifications to the channel have reduced the frequency of flooding but also effectively removed any functional connection between the river and its floodplain.

*Water Quality*

One municipality, one industry, and two fish hatcheries discharge to the Lower Puyallup River and its tributaries under the Ecology’s National Pollutant Discharge Elimination System (NPDES) permit program (Ecology 1993). Nine municipalities, three industries and two fish hatcheries have NPDES permits to discharge to the Upper Puyallup River and its tributaries. Additionally, two tribal fish hatcheries discharge to the Puyallup River; one discharges to the Upper Puyallup River and one to the Lower Puyallup River. The tribal hatcheries do not require NPDES permits.


SR 167: Puyallup to SR 509 Tier II FEIS
Figure 3.2-4
Region-wide Flooding and Levee Failure Event
Washington State Department of Transportation
Hylebos Creek
KING COUNTY
PIERCE COUNTY
Wapato Creek
Lower Puyallup
Puyallup River
Clear/Clarks Creek
Source: NHC (2004).
Basin
Puyallup 100yr Floodplain*
Preferred Footprint
*Assumes levee failure in Lower Puyallup.
0
3,000
6,000 Feet

Analytical results from sampling conducted in 1984 by the USGS indicated that cadmium, Cu, Pb, mercury (Hg), and Zn occurred at levels above chronic and/or acute toxicity criteria (USGS 1986). Based upon these results, the river from river mile 0 to 1.5 was included on the 304(1) short list in January of 1989. The 304(1) short list included those waters which were not expected to meet water quality standards due to discharges of toxic pollutants from point sources. Later that year, the Tacoma Central Wastewater Treatment Plant discharges were re-routed to Commencement Bay and the river was removed from the list.

No excessive metals concentrations were measured in an evaluation done by the city of Puyallup between May of 1994 and August of 1997, suggesting that the problem had been alleviated. However, FC monitoring conducted at the same location between October 1991 and September 1997 indicated that bacteria concentrations exceed state standards.

Through a TMDL study, Ecology set load allocations for 5-day biochemical oxygen demand (19,500 lbs/day); ammonia (3,330 lbs/day as nitrogen); and total residual chlorine (45.9 lbs/day) for the Puyallup River. These load allocations allow for additional discharges by future NPDES permit holders and presently unaccounted for nonpoint pollution sources. Currently, the river is listed under Section 303(d) as polluted (Category 5) for Cu, Pb, FC in some segments. Cu, Pb, Hg, DO, FC, temperature, and turbidity are a concern (Category 2) in other areas. A TMDL study for bacteria has been proposed for the next review period. The analysis would include streams in the Puyallup and White River watersheds.

Maintenance of the Puyallup River's channel previously involved dredging to remove sediment and debris that would build up near the mouth of the river. However, dredging is no longer performed and sediment is beginning to accumulate. Over the long-term design life of the project, the build-up of sediment in the Puyallup River could reduce the flow capacity of the channel.

### Groundwater

Groundwater within the Lower Puyallup valley is found in deep aquifers of undifferentiated glacial and nonglacial sediments and relatively shallow aquifers containing deposits of alluvial sediments. The uplands north of the Lower Puyallup valley are situated above aquifers composed of glacial and nonglacial deposits. Regional, intermediate, and local groundwater flow paths (Freeze and Cherry 1979; Toth 1970) have not been well documented within the project area.

Local groundwater flow is characterized as moving from upland areas into the alluvial aquifers, the Puyallup River, and the Puget Sound (USGS 1986; Earth Tech 1998). The water table within the Lower Puyallup valley is shallow, often at or just below the ground surface during the winter months. Within the neighboring uplands the water table varies with soil composition and is frequently well below the ground surface.

Within the Lower Puyallup River valley the alluvial aquifers reach depths of between 200 and 400 feet below the ground surface. Aquifer compositions range from sands and gravels to fine sands. The aquifers are discontinuously confined by silt and clay deposits. The extent and composition of aquifers within the Lower Puyallup River valley watershed have not been well studied. However, the entire Puyallup valley is designated as a Critical Aquifer Recharge Area (Figure 3.2-5). There is a sole source aquifer on the south side of the Puyallup River within the Central Pierce County Aquifer. WSDOT has confirmed with EPA that this project will not impact the sole source aquifer.

The alluvial aquifers provide water to the majority of public water systems within the Lower Puyallup River valley. The productivity of the shallow alluvial aquifers varies with composition. In general, these aquifers are less porous and water does not flow as quickly as the deeper glacial and nonglacial aquifers. Within the city of Fife, well yields from the alluvial aquifers have been estimated to range between 40 and 2,500 gallons per minute (gpm) (Earth Tech 1998) and well yields beneath the city of Puyallup Recreation Center were documented at 700 gpm. The contact between shallow alluvial and deeper glacial/nonglacial aquifers is indistinguishable in some areas (Earth Tech 1998) and prominently delineated by thick alluvial silts (Hart Crowser 1993) in others.

The Lower Puyallup River valley glacial and nonglacial aquifers are situated below the alluvial sediments extending to depths in excess of 900 feet below the ground surface. The glacial aquifers are composed of outwash sands and gravels and bounded by aquitards composed of tills. The nonglacial aquifers are composed of alluvial sands and gravels interstratified with the glacial aquifers. Well yields within the glacial and nonglacial aquifers are higher than the overlying alluvial aquifers and are likely to be highly productive sources of groundwater for future water system development (Earth Tech 1998; Hart Crowser 1993).

Aquifers situated beneath the uplands are composed of glacial and nonglacial aquifers at elevations ranging from 600 feet above sea level to 1,200 feet below sea level. The glacial aquifers are composed of outwash sands and gravels and bounded by aquitards composed of tills. The nonglacial aquifers are composed of alluvial sands and gravels and are interstratified with the glacial aquifers.

Agricultural farmlands of the Lower Puyallup valley often experience local nonsystemic flooding. The predominant soil of the project area is generally an organic silt loam material that exhibits moderately slow permeability. The surface runoff in the project area infiltrates to a shallow confined aquifer. It is expected that the water in this shallow aquifer moves laterally in a horizontal direction rather than downward in a vertical direction. This lateral movement can be restricted by the construction of roadways and buildings, which has a densifying effect on the underlying soils. When this occurs, localized saturation of the soils is expected to occur during periods of extended rainfall. The result is standing floodwater in the fields. Many of these areas exist near and around Wapato Creek. Another area with frequent occurrences of standing water is north of I-5, between Lower Hylebos Creek and Fife Ditch.

In most instances, the standing floodwater results in isolated ponding with no directional flow. However, aerial photos show areas where the standing water develops into concentrated, overland flows. One such area occurs at Freeman Road, just south of the most southern crossing of Wapato Creek. This overland flow begins near Freeman Road and continues west, past 70th Avenue East, to the old Puyallup River oxbows.