Puget Sound GATEWAY Program

509 5 167

SR 167 Completion Project

SR 167/I-5 to SR 161 – New Expressway

Conceptual Hydraulic Report: Stage 2

February 2023

WSDOT

SR 167 Completion Project

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February 2023

Submitted by:
Washington State Department of Transportation
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Through:
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Revision History

Date	Revision
08/15/2022	Draft
02/14/2023	Review Draft

Contents

Appendices

Note: Appendices A-5 through A-10 are not included in this Conceptual Hydraulic Report because they are not applicable at the conceptual design stage.

Tables

Figures

Acronyms

BMPs	Best Management Practices
CABS	Compost Amended Biofiltration Swale
HRM	Highway Runoff Manual
NEPA	National Environmental Policy Act
PGIS	Pollutant Generating Impervious Surface
PSE	Puget Sound Energy
PVC	Polyvinyl chloride
RFP	Request for Proposal
RRP	Riparian Restoration Program
SBUH	Santa Barbara Urban Hydrograph
SLT	Surprise Lake Tributary
SDDS	Stormwater Design Documentation Spreadsheet
TDA	Threshold Discharge Area
UPRR	Union Pacific Railroad
VWP	vibrating wire piezometers
VWIM	virtual weigh-in-motion
WDFW	Washington Department of Fish and Wildlife
WSDOT	Washington State Department of Transportation

1. Project Overview

The **SR 167/I 5 to SR 161 – New Expressway Project** (hereafter referred to as the Stage 2 Project) is the third and final stage of the SR 167 Completion Project's Phase 1 Improvements. The SR 167 Completion Project in Pierce County is part of the Washington State Department of Transportation's (WSDOT) Puget Sound Gateway Program, which also includes the SR 509 Completion Project in King County. Together, the projects will complete two of the Puget Sound region's most critical freight corridors and will improve access to Interstate 5 (I-5), the Ports of Tacoma and Seattle, and Seattle-Tacoma International Airport.

The SR 167 Completion Project Phase 1 improvements will build approximately 6 miles of a new highway to complete the unfinished segment of SR 167 in Pierce County as shown in Figure 1. The Stage 2 Project will be the final stage of the SR 167 Completion Project's Phase 1 Improvements by building a four-lane highway between SR 161 (North Meridian Avenue) and I-5, along with two new interchanges. The project will be completed using the Design-Build delivery process.

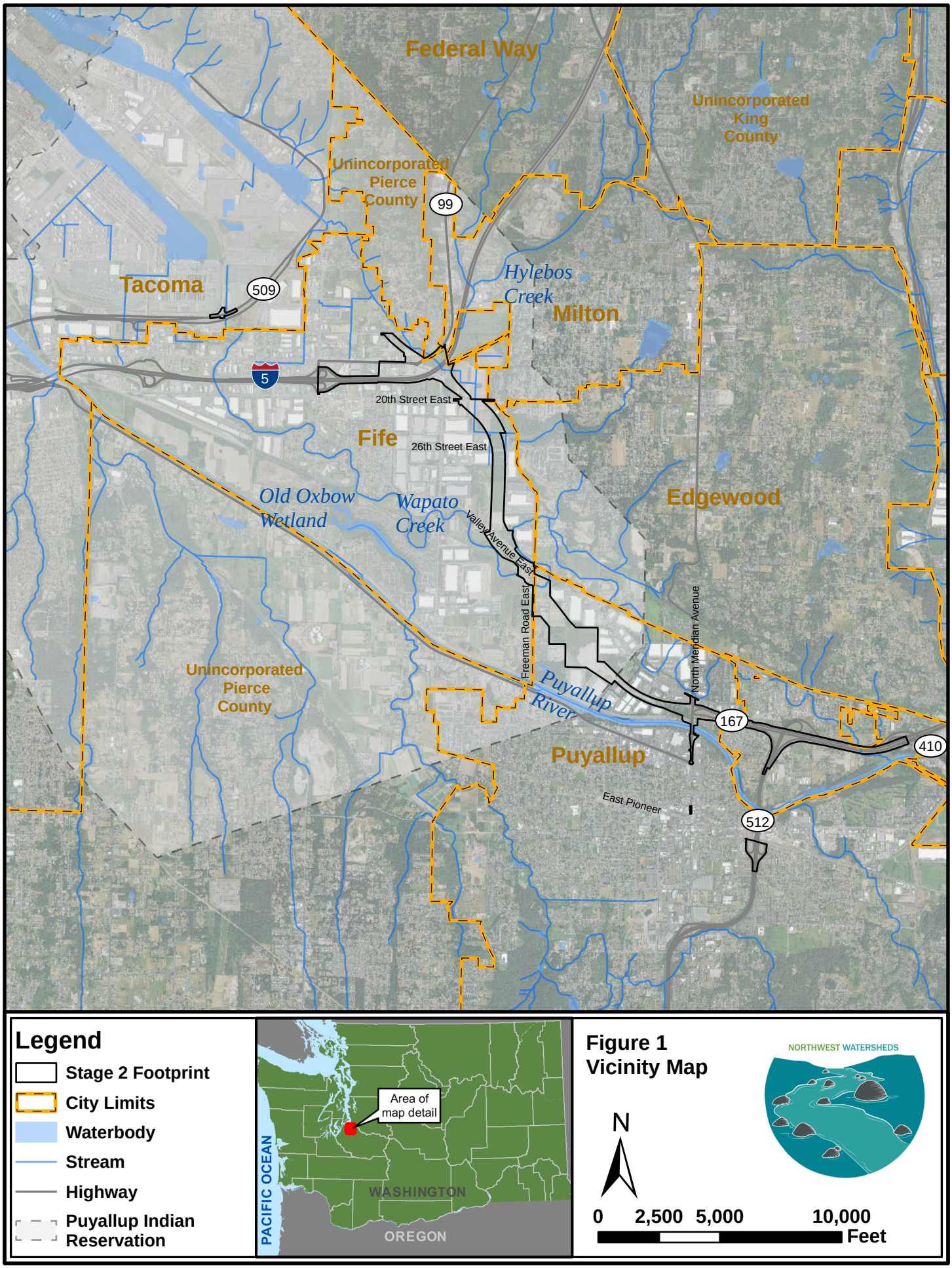
1.1 Site Location

The Stage 2 Project is entirely within Pierce County, Washington, in the cities of Sumner, Puyallup, Fife, Edgewood, and Tacoma, and in unincorporated Pierce County. The Stage 2 Project is also partially located within the Puyallup Tribe of Indians reservation.

The Stage 2 Project area is located in Sections 6, 7, 8, 16, 17, 20, 21, 22, and 23 of Township 20 North, Range 4 East of the Willamette Meridian.

1.2 Vicinity Map

Figure 1 provides a vicinity map.


Federal Way
Unincorporated King County
Unincorporated Pierce County
99
Tacoma
509
Hylebos Creek
Milton
5
20th Street East
Fife
26th Street East
Old Oxbow Wetland
Wapato Creek
Valley Avenue East
Edgewood
Freeman Road East
North Meridian Avenue
Unincorporated Pierce County
Puyallup River
167
410
Puyallup
East Pioneer
512
Legend
Stage 2 Footprint
City Limits
Waterbody
Stream
Highway
Puyallup Indian Reservation
Area of map detail
PACIFIC OCEAN
WASHINGTON
OREGON
Figure 1
Vicinity Map
NORTHWEST WATERSHEDS
N
0
2,500
5,000
10,000
Feet

1.3 Scope of Work

Stormwater runoff from the Stage 2 Project discharges to Wapato Creek, Hylebos Creek and its tributaries (Surprise Lake Tributary and Stream 13), the Puyallup River, unnamed tributaries (Streams 14 and 15) to Old Oxbow Wetland (which drains to the Puyallup River), and Fife Ditch. All of these waterbodies eventually discharge to Commencement Bay in the Puget Sound. Appendix A-1 provides the Stormwater Design Documentation Spreadsheet (SDDS) for the project. Based on this documentation, the project requires enhanced water quality treatment for most threshold discharge areas (TDAs). The project's environmental commitments also include that runoff treatment ensures that dissolved copper and dissolved zinc concentrations are within approved ranges and acceptable concentrations in receiving waters (NMFS 2007). Modeling done in support of the analysis is based on application of enhanced runoff treatment Best Management Practices (BMPs) for all new and replaced pollutant generating impervious surfaces (PGIS). Flow control for portions of the Stage 2 Project that discharge to Wapato Creek and the unnamed tributary to Old Oxbow Wetland is provided by combined stormwater treatment wetland/detention ponds, detention ponds, engineered dispersion, and bioretention areas. Portions of the Stage 2 Project have obtained approval for alternative flow control provided by the Hylebos Riparian Restoration Program (RRP), as discussed in Section 5.2.2 of this report, and as documented in Appendix A-11. The Puyallup River is flow-control exempt within the Stage 2 Project limits. Oil control will be required at some high-traffic intersections and at the Virtual Weigh in Motion Inspection Area (VWIM), as documented in Appendix A-3.

Hydraulic features included in the Stage 2 Project are shown on the project plans provided in Appendix A-4 and the most significant elements are described below:

- Ditch and piped conveyance connections to route stormwater to treatment and flow control facilities and discharge locations.
- Media filter drains to provide enhanced water quality treatment where sections of the roadway do not have curbs and allow sheet flow from the edges of pavement.
- A biofiltration swale and detention pond at the 54th Avenue East ramp managing runoff from the I-5 auxiliary lane widening.
- Bioretention planters along 20th Street East providing treatment of runoff from the city of Fife street.
- A series of biofiltration swales along SR 167 between 20th Street East and Valley Avenue East to provide treatment of concentrated runoff.
- A bioretention area to provide treatment and flow control for runoff from city of Fife streets at the intersection of Valley Avenue East and SR 167.

- Two combined stormwater treatment wetland/detention ponds for detention and treatment of highway runoff from SR 167 near the intersection with Valley Avenue East. Separate facilities are provided for runoff from WSDOT infrastructure and for runoff from local roads that will be maintained by the City of Fife.
- Flow dispersal trenches discharge treated stormwater to Wapato Creek and new wetland mitigation areas in several locations.
- An expanded combined stormwater treatment wetland/detention pond at the intersection of Valley Avenue East and Freeman Road East to manage local runoff from a rerouted Valley Avenue East. The City of Fife will maintain this pond.
- Two combined stormwater treatment wetland/detention ponds for treatment and flow control of highway runoff near the intersection of SR 167 with Freeman Road East, prior to discharge to Wapato Creek.
- A series of bioretention planters along Freeman Road East south of the Union Pacific Railroad (UPRR) tracks, treating local runoff due to realigning and widening the roadway. North of the SR 167 crossing, these bioretention planters will disperse to the landscape draining to Wapato Creek. South of the SR 167 crossing, one planter discharges to a new outfall at Wapato Creek, and other planters discharge to the culvert at unnamed Stream 15 or are dispersed to new wetland mitigation areas.
- A combined wetland and stormwater detention pond on the northeast side of the SR 167 alignment that provides treatment and flow control, prior to discharge to a conveyance ditch and culvert that outfalls to unnamed Stream 14.
- A series of biofiltration swales to treat concentrated runoff from SR 167 between Freeman Road East and North Meridian Avenue where barriers do not allow sheet flow to media filter drains.
- Four detention ponds and one constructed stormwater treatment wetland adjacent to the planned virtual weigh-in-motion (VWIM) inspection facility between Freeman Road East and North Meridian Avenue, prior to discharge to unnamed Stream 15.
- Two new bioretention areas on the west side of North Meridian Avenue to treat runoff from North Meridian Avenue/SR 161.
- Two new constructed stormwater treatment wetlands on the east side of North Meridian Avenue adjacent to the SR 161 ramps to treat project flows before connecting with the existing stormwater conveyance system that discharges to the Puyallup River.
- Proprietary treatment vaults along North Levee Road near the Puyallup River North Meridian Avenue/SR 161 Bridge.

- East of North Meridian Avenue, media filter drains provide treatment for most of the highway runoff, except for at the SR 512 southbound intersection where a new biofiltration swale provides runoff treatment.
- Proprietary water quality treatment devices along North Meridian Avenue south of the Puyallup River. These facilities provide runoff treatment for the widened roadway, and will be maintained by the City of Puyallup.
- Media filter drains at the SR 512/East Pioneer Interchange to provide treatment for widened ramps. Runoff treatment for the westbound SR 512 on-ramp is provided along the west side of mainline SR 512, as compensatory runoff treatment for ramp widening within the same TDA. Steep grades adjacent to the ramp made directly treating the new PGIS infeasible.

The final Hydraulic Report for the Stage 2 Project stormwater improvements will be prepared by the Design-Builder, who shall verify the conceptual design approach and complete the design or develop their own design. The Design-Builder should not consider this to be a completed report. There may be missing components and/or components that have not been seen to completion. The design must meet all mandatory standards and fulfill the project's environmental commitments and the roadway design requirements for the Stage 2 Project.

See Appendix A-1 for a copy of the preliminary SDDS. The spreadsheet documents runoff treatment and flow control needs based on the conceptual design and will need to be updated to reflect the Design-Builder's design. It is also the responsibility of the Design-Builder to complete the "BMPs New or Modified" and "BMPs Removed or Modified" section of the SDDS based on the final design.

The proposed stormwater design for the Stage 2 Project spans multiple TDAs (as defined in the WSDOT *Highway Runoff Manual [M 31-16.05, April 2019]*) based on downstream flow paths.

1.4 Specialty Design

The Stage 2 Project includes mitigation wetlands, flood storage, channel realignment, and riparian and wetland enhancement. Design of these features has been informed by hydraulic modeling, stream and wetland delineation, and habitat assessments that will be summarized in separate reports.

2. Site Conditions

2.1 Existing Conditions

Land use in the Stage 2 Project area and vicinity consists predominantly of commercial, residential, agricultural, and industrial land uses. The portion of SR 167 to be constructed as part of the Stage 2 Project will connect the adjacent highways, I-5 and SR 161, construct a new interchange with Valley Avenue East, and cross several arterial roads.

Existing unpaved portions of the Stage 2 Project area and vicinity are highly modified due to historic land uses. Vegetation consists of a mixture of native and nonnative conifers, deciduous trees, common native shrubs, and mixed grasses as well as agricultural crops. Soils in many locations within the Stage 2 Project area have characteristics and variability that reflect a history of disturbance due to previous road cuts, excavations, and fills associated with I-5, nearby roadways, and other development.

Dense industrial, commercial, and residential developments as well as agricultural land use surround the Stage 2 Project area (WSDOT 2022a). Land development in the Stage 2 Project area is ongoing, and is likely to have continued impacts on vegetation and hydrology.

2.2 Existing Hydraulic Features

The Stage 2 Project area is in the northwestern portion of Water Resource Inventory Area #10, Puyallup-White River Watershed. This watershed drains to Commencement Bay and Puget Sound.

Appendix A-4 contains figures showing the locations of water bodies and wetlands in the Stage 2 Project area (Figures 3A through 3F). Information on existing streams and wetlands summarized in this section is from the Wetland and Stream Assessment Report (WSDOT 2022a).

Biologists identified and surveyed seven streams within the Stage 2 Project limits:

- Surprise Lake Tributary/Creek (Stream 01) is a stream that flows generally to the west from Surprise Lake, crosses the Project alignment, and flows northward under I-5 into Hylebos Creek. Surprise Lake Tributary is being enhanced and realigned as part of WSDOT's SR 167/I-5 to SR 509 – New Expressway (Stage 1b) Project (described below). (Figure 3C)
- North of the Stage 2 Project area, Hylebos Creek (Stream 02) is a stream that flows generally to the south, where it has two main branches (West Hylebos Creek and East Hylebos Creek). The confluence of these branches is in Milton north of Porter Way. After crossing I-5 and Pacific Hwy E, Hylebos

Creek flows to the northwest before discharging in the Hylebos Waterway at Commencement Bay. Hylebos Creek is being enhanced and realigned as part of WSDOT's SR 167/I-5 to SR 509 – New Expressway (Stage 1b) Project. (Figure 3B)

- Wapato Creek (Stream 9) is a stream that flows generally to the west from unincorporated Pierce County and crosses the Stage 2 Project alignment near the Freeman Road East and Valley Avenue East intersection. (Figure 3D)
- Stream 13 is a tributary to Surprise Lake Tributary that is adjacent to the west side of 78th Avenue East. (Figure 3C)
- Stream 14 is a tributary to Stream 15 at the southern terminus of 16thWSDOT Avenue Northwest, south of Valley Avenue East. Stream 14 crosses the Stage 2 Project alignment just south of 16th Avenue Northwest. (Figure 3E)
- Stream 15 is a tributary to Old Oxbow Wetland and thus the Puyallup River that is surrounded by forest and agricultural fields south of Valley Avenue East, east of Freeman Road East, and west of 16th Avenue Northwest, just south of the Stage 2 Project alignment. (Figure 3E)
- The Puyallup River (Stream 17) is a tributary to Commencement Bay. The river lies south of the Project alignment and crosses the Stage 2 Project area only once at North Meridian Avenue. (Figure 3E)

During Stage 1b of this project, Hylebos Creek and Surprise Lake Tributary were realigned, regraded, and enhanced as part of the Hylebos RRP design. See the Conceptual Hydraulic Report and associated memorandums for details of that design.

The Surprise Lake Tributary confluence with Hylebos Creek now occurs east of I-5 and north of the Interurban Trail. Downstream of the project area, Hylebos Creek flows northwest until it crosses under SR 509 and discharges to Commencement Bay.

The Puyallup River watershed is approximately 1,065 square miles, and the Stage 2 Project is in its downstream reach. The river originates from glaciers on the north and west sides of Mount Rainier. Carbon River, White River, Clearwater River, Greenwater River, and Mowich River are the main tributaries to the Puyallup River. The Puyallup River watershed has increased flows between October and March due to rain fall. Within the Stage 2 Project area, the river runs through a mix of industrial, agricultural, natural, and residential land use areas before draining into Commencement Bay. The Stage 2 Project design includes replacing a corrugated metal outfall pipe to the Puyallup River. (The outfall discharges to the north side of the Puyallup River from the east side of North Meridian Avenue/SR 161.) Treated stormwater from the Stage 2 Project will

discharge to the Puyallup River via the replaced outfall and existing outfalls. These outfall pipes will be retrofitted with check valves to prevent fish from entering the stormwater system during high water conditions.

There are several unnamed streams in the Stage 2 Project area, four of which will be impacted by the Stage 2 Project:

- Stream 13 is tributary to Surprise Lake Tributary (Stream 01) on the west side of 78th Avenue East and south of 26th Street East. The stream receives surface runoff from detention ponds at a nearby industrial facility east of the Stage 2 Project area and discharges to Surprise Lake Tributary approximately 600 feet north of 26th Avenue East. The Washington Department of Fish and Wildlife (WDFW) has determined Stream 13 to be fish-bearing only in the portion mapped on Figure 3C – between Surprise Lake Tributary and a culvert (ID 935183) located approximately 1,150 feet south of 26th Street East. Stream 13 will be rerouted north of 26th Street East in a new naturalized channel alignment that will connect it to the new, realigned Surprise Lake Tributary channels constructed during Stage 1b.
- Stream 14 is tributary to Stream 15 south of Valley Avenue East at the southern end of 16th Street Northwest in the Puyallup River watershed. The stream flows west for approximately 630 feet before discharging into Stream 15 near the corner of an agricultural field. In 2021, the stream was flowing between March and May, dried up over the summer, and resumed flowing in October (WSDOT 2022a). This stream is considered non-fish-bearing according to WDFW culvert inventories downstream. The SR 167 Stage 2 embankment will affect Stream 14. A 48-inch diameter culvert will convey Stream 14 flows under the highway embankment.
- Stream 15 is tributary to the Puyallup River, via Old Oxbow Wetland, and flows from a stormwater pond north of North Levee Road East and east of Freeman Road East. The stream enters WSDOT right-of-way north of an industrial complex near the intersection of Industrial Park Way and North Levee Road in Puyallup. It originates at the discharge of a stormwater pond and flows approximately 200 feet through a culvert under an access road before discharging into an open channel that flows northwest through the Stage 2 Project area. After flowing through a series of ditched channels, Stream 15 flows north along WSDOT right-of-way before turning west and flowing towards Freeman Road East. After crossing under Freeman Road, Stream 15 passes through a mitigation wetland and is piped through industrial and residential areas before eventually discharging in Old Oxbow Wetland, a Category 1 wetland jointly managed by the City of Fife and the Puyallup Tribe of Indians. The downstream end of the wetland has a 48-inch culvert which discharges to the Puyallup River. According to the WDFW culvert inventory, the Stream 15 culvert located at the crossing of Freeman Road East (Site ID 935282), meets the physical criteria for potential fish use, but is classified as non-fish-bearing. The current conditions are incapable of supporting salmonids at any time (WDFW 2022). The widening of Freeman

Road East will affect Stream 15, and a new 48-inch-diameter culvert will replace the existing 24-inch-diameter concrete culvert beneath the widened road.

- Stream 24 is a small tributary to Surprise Lake Tributary (Stream 01) that is located west of 76th Avenue East on the south side of 20th Street East in the Hylebos Creek-Frontal Commencement Bay watershed. The stream is an excavated channel that conveys flows for approximately 600 feet along the northern edge of agricultural fields before discharging to Surprise Lake Tributary (Stream 01) via a culvert under an agricultural access road. Stream 24 is seasonally flowing and potentially accessible to fish due to its connection with Surprise Lake Tributary (Stream 01). WDFW documented three-spine stickleback (Gasterosteus aculeatus) and sculpin (unknown species) in this system in January 2022 (WDFW 2022c). The roadway improvements on 20th St. E., including the new culvert, will impact this stream and it will be replaced by work done in the Hylebos RRP during Stage 1b.

In most of the Stage 2 Project area, Wapato Creek is a freshwater stream that flows from its headwaters in unincorporated Pierce County. The creek converges with and approaches the Stage 2 Project area in several places near the intersection of the cities of Edgewood, Puyallup, and Fife. Beginning east of North Meridian Avenue, Upper Wapato Creek has an 84-inch piped diversion structure, constructed in 1977, that diverts all of its flow from upstream of this location to a discharge point in the Puyallup River. West of Freeman Road East and north of Valley Avenue East, Wapato Creek flows southeast along the Stage 2 Project area boundary for approximately 700 feet. The stream exits the project area and continues in a southerly direction under Valley Avenue East and continues west where it re-enters the Stage 2 Project area and flows west for approximately 1,700 feet. The stream flows northwest through the Puyallup Tribe of Indians Freeman Road Mitigation Site and exits the Stage 2 Project area through a culvert under Valley Avenue East. Several mitigation wetlands are planned in the floodplains of Wapato Creek. Stormwater design includes several combined stormwater treatment wetland/detention ponds that will discharge to buffers of mitigation wetlands via flow dispersal trenches. The drainage design team has been coordinating with the wetland mitigation team and WSDOT to identify areas that could benefit from receiving treated stormwater flows.

The lower reach is a tidally influenced portion of Wapato Creek within Tacoma city limits. Wapato Creek enters Tacoma from the south, flowing under 12th Street East through a new bridge. The Port of Tacoma and Puyallup Tribe of Indians completed construction of the Lower Wapato Creek Habitat Project in 2022, which provides a new meandering stream channel and wetlands between this new bridge and the existing bridge under SR 509 near Alexander Ave. E. The stream turns north at this bridge and continues in this direction for approximately 0.5 mile where it connects with Blair Waterway at Commencement

Bay. Bridge #32, which will replace an existing Port of Tacoma railroad bridge over Wapato Creek and is part of the Stage 2 Project, is located in this second reach.

Wetland biologists delineated a combined total of 102 wetlands collectively covering 313.54 acres during all Project stages. This number does not include project impacts which reduced or eliminated some wetlands, and also includes some estimated wetland area in some inaccessible areas. The wetlands are in the cities of Fife, Puyallup, Edgewood, Tacoma, Milton, and unincorporated Pierce County.

Stage 2 affected wetlands include Category II, III, and IV depressional and riverine hydrogeomorphic classes. Wetlands in the Stage 2 Project area typically provide a moderate to high level of hydrologic and water quality functionality and a low level of habitat function for wildlife. Wetland buffers in the Stage 2 Project area are in poor condition and are characterized by high-intensity land uses such as paved roads and sidewalks, commercial agriculture, and encampments. Nonnative and invasive vegetation is prevalent within wetlands and wetland buffers. The Stage 2 Mitigation Plan (WSDOT 2022b) summarized project impacts. Of the delineated wetlands, 24 will be temporarily and/or permanently affected by Stage 2 Project activities. Permanent direct impacts will affect 24.86 acres of wetland and permanent indirect impacts (habitat, shading, or isolation) will affect 3.26 acres. Long-term temporary impacts will affect 4.42 acres of wetlands, and short-term temporary impacts (less than one year) are anticipated for 3.32 acres of wetlands.

See Appendix A-4 (Figures 3A through 3H) for the locations of the waterbodies and wetlands within the Stage 2 Project area.

The proposed stormwater management facilities and the runoff conveyance systems needed to route flows to those facilities are designed to match existing drainage patterns to the extent feasible. The proposed stream channel modifications and new wetland mitigation areas will affect the drainage discharge locations in some locations. The Stage 2 Project work that will physically affect stream channels relates to the following:

- During Stage 1b construction, Surprise Lake Tributary will be rerouted from its current alignment north of 26th Street East, to flow north into the Hylebos RRP. In the Stage 2 Project area, existing stormwater drainage that discharges to the channel west of the SR 167 alignment will be routed to Surprise Lake Tributary. Replacing the existing channel west of SR 167 will be a new culvert south of 20th Street East, which conveys stormwater from existing off-site private detention ponds into the Hylebos RRP.
- Streams 14 and 15 will be modified from their current channelized flow paths and will be integrated with mitigation wetland enhancements in the Freeman Road and Puyallup South wetland mitigation sites. The stormwater

discharges from the adjacent project areas will be rerouted to provide treated runoff to these sites. One exception to this is an offsite area that currently drains to Stream 14 will be rerouted to drain north into Wapato Creek on the east side of the new highway embankment.

- Unavoidable impacts to streams and wetlands will be offset by providing stream and wetland mitigation. See the Stage 2 Project Wetland and Stream Assessment Report (WSDOT 2022a) and the Stage 2 Mitigation Plan (WSDOT 2022b) for additional information on delineated wetlands, impact calculations, and mitigation plans.

Existing drainage and stormwater management within the Stage 2 Project area generally consists of separate systems for each of the major existing impervious features: I-5, 20th Street East, Valley Avenue East, Freeman Road East, North Meridian Avenue/SR 161, and existing SR 167, SR 512, and SR 410. Along the new SR 167 Stage 2 alignment, where the alignment is through areas that are undeveloped or agricultural land, drainage is generally distributed overland or via ditches. Where the alignment is adjacent to commercial development or residential areas, existing drainage is provided via piped stormwater infrastructure, with ponds provided for water quality treatment and flow control. Modifications to the drainage systems to maintain drainage for properties that will remain are shown in Appendix 4 on the drainage plans.

The drainage systems function as follows:

- I-5 – Within the Stage 2 Project area, I-5 drainage either sheet flows to ditches located on both sides of the freeway or collects in a piped drainage system along the median. There is a drainage divide near the location of the future I-5 on-ramp. West of this divide, I-5 runoff flows to the north in ditches draining to the Fife Ditch system. East of the divide, runoff enters Surprise Lake Tributary or ditches that are tributary to Hylebos Creek. Following construction of the Stage 2 Project elements, stormwater from the outside lanes of I-5 southbound will be collected via inlets and conveyed to treatment and detention facilities adjacent to the 54th Avenue East off-ramp. In Stage 1b, the receiving waters for runoff from the eastern portion of I-5 will be reconfigured as part of the Hylebos RRP.
- 20th Street East – Within the Stage 2 Project area, 20th Street East is not fully developed, with drainage flowing to ditches bordering agricultural fields on either side of the road. While relatively flat, the ditches primarily flow toward the east where Surprise Lake Tributary (Stream 01) currently crosses under 20th Street East via a 5.5-foot by 3.7-foot corrugated steel arch culvert. During Stage 1b, which is currently under construction, the existing culvert will be filled and abandoned and replaced by a bridge. At the west edge of the Stage 2 Project, existing curb and gutter convey drainage to a 12-inch storm main flowing to the west at 70th Avenue East, where it eventually drains to Stream 3, which will discharge to Surprise Lake Tributary.

- 26th Street East – Drainage on 26th Street East is contained with curb and gutter draining to the east of the Project area to a detention pond and constructed stormwater treatment wetland located at the intersection of 26th Street East and Freeman Road East. This pond outfalls back into Stream 13 just upstream of the Surprise Lake Tributary confluence. Stream 13 flows north, along the east edge of the Stage 2 Project boundary, crossing 26th Street East via a 24-inch by 35-inch arch culvert.

- Valley Avenue East – Within the Stage 2 Project area, Valley Avenue East is curbed. East of the future SR 167 crossing, drainage is collected in catch basins that tie into a storm drain that discharges to Wapato Creek, near the intersection of Freeman Avenue East. Treatment is provided for the roadway runoff via two existing stormwater treatment vaults. Flow control is provided in underground detention pipes located just west of Freeman Avenue East. From a point just east of the SR 167 crossing, the existing storm drains flow to the west to a constructed stormwater treatment wetland and detention pond which outfalls to Wapato Creek via a pump station, located outside of the Stage 2 Project area.

- Freeman Road East – Within the Stage 2 Project area, Freeman Road East is uncurbed, with roadway runoff sheet flowing to adjacent properties or ditches on either side of the road. The ditches discharge to railroad ditches for the northern portion of Freeman Road East. South of the railroad, the ditches flow to eventually discharge into Wapato Creek or to Stream 15 where the stream crosses under Freeman Road East.

- North Meridian Avenue (SR 161) – Within the Stage 2 Project area, North Meridian Avenue is mostly uncurbed. Stormwater runoff flows to ditches with some inlets discharging directly to the Puyallup River without treatment. Just north of the existing SR 167 intersection, the roadway is curbed, with a biofiltration swale on the west side managing runoff from North Meridian Avenue at the intersection with Valley Avenue East. South of the SR 167 interchange, North Levee Road intersects with North Meridian Avenue and is mostly uncurbed, with runoff collected via ditches and inlets which outfall to the Puyallup River directly. There are two existing WSDOT pipe outfalls on either side of North Meridian Avenue, which discharge to the north bank of the Puyallup River adjacent to the riprap-protected bridge abutments. The east outfall is a 30-inch corrugated metal pipe constructed in 1971. The west outfall is a 24-inch PVC pipe that was constructed in 2015. On the south bank of the Puyallup River, there is an 18-inch concrete pipe outfall on the west side of North Meridian Avenue, constructed prior to 1971. There is also a 12-inch pipe outfall on the east side of North Meridian Avenue constructed in 2015.

- SR 512 Interchange – The existing SR 167 connects with SR 512 east of Milwaukee Avenue East. There are existing ditches along the west and east side of SR 512 which eventually are piped and outfall to the Puyallup River via a 36-inch diameter pipe on the west side of the SR 512 bridge.

- Commercial Developments – There are many large commercial developments along both sides of the Stage 2 Project alignment; however, most have been constructed recently and will not be impacted by the SR 167 construction. Those businesses with drainage infrastructure affected by the Project are listed below.
    - Between 20th Street East and 26th Street East, three developments currently discharge from detention ponds to Surprise Lake Tributary west of the proposed SR 167. Surprise Lake Tributary is being rerouted to remain on the east side of the SR 167 alignment, flowing to the Hylebos RRP. The existing channel will be routed from its current alignment along the toe of the west fill slope to cross under SR 167 in a culvert on the south side of 20th Street East. This rerouting will not impact the detention ponds since it will be graded to drain at a constant slope from the detention pond outfall to the Hylebos RRP area. A check valve will be installed on the downstream end of the culvert to prevent fish from passing upstream into the channel which will now be reserved for stormwater drainage. The current businesses with detention ponds impacted by this change are located at 7495 26th Street East, 2511 70th Avenue East, and 2205 70th Avenue East.
    - South of Valley Ave East, there is an industrial warehouse (LSI Logistic Service Solutions) with a stormwater pond discharging to a ditch which currently crosses the future SR 167 alignment. This ditch will be rerouted to flow north towards a new wetland mitigation area, the East Wapato RRP area.
    - Further south, two industrial warehouses (Serta Simmons Bedding and Mission Foods DC) have a stormwater pond that discharges to Stream 14, which will be conveyed via a new 48-inch culvert under the new shared use path and SR 167 roadway embankment, in order to maintain its existing flow path. This stream joins Stream 15 further west, in a revised stream alignment within the Freeman Road RRP area.
    - South of the new VWIM station there are two industrial warehouses (O'Reilly Auto Parts Distribution and ProLogis) which contribute to a stormwater pond, the outfall of which is the headwaters of Stream 15. The project will realign Stream 15 as part of the Puyallup South RRP, with additional dispersed flows of treated project stormwater draining towards the constructed wetlands around this new stream channel.
    - East of this point, the Puyallup Recreation Center and numerous other warehouses border the proposed SR 167 alignment, with drainage systems either flowing to outfalls on the Puyallup River or to the Wapato Diversion Pipeline, which also discharges in the Puyallup River.

2.2.1 Existing Culverts and Bridges

Table 1 summarizes existing culverts and bridges in the Stage 2 Project area and impacts associated due to the project from West to East. These figures are also shown on Figures in Appendix A-4.

Table 1. Existing Culverts and Bridges

Name	Location	Description	Stream	Project Impact
105 R121419 a	SR 509 WB, MP 2.97	Culvert	Wapato Creek tributary to Blair Waterway	Lower Wapato crossing at Alexander Avenue. Existing culvert to be removed and replaced with two fish-passable bridge structures (environmental approvals will be included in Stage 1b).
935669	SR 167; Future Right-of-Way, MP 0.54	Culvert	Unnamed tributary to Surprise Lake Tributary	The flows through this culvert would be rerouted as part of the Stage 1b realignment of SLT. The culvert would be removed in the Stage 2 Project as part of the 20th Street reconstruction.
935791	SR 167; Future Right-of-Way	Culvert	Unnamed tributary to Surprise Lake Tributary	As documented in Stage 1b reports, Stream 11 will be rerouted as part of Stage 1b and no longer pass through this culvert. This culvert would be removed in the Stage 2 Project as part of the 20th Street reconstruction.
935243	SR 167; Future Right-of-Way,	Culvert	Ardena Road Creek tributary to Surprise Lake Tributary	No project action. Existing culvert to remain.
935156	20th Street E	Culvert	Unnamed stream	Existing culvert to be removed as part of 20th Street reconstruction.
105 R120921 a	Freeman Road E	Culvert	Wapato Creek, tributary to Blair Waterway	No project action. Existing culvert to remain.
105 R120918 a	SR 167; Future Right-of-Way,	Culvert	Wapato Creek tributary to Blair Waterway	Existing culvert to be removed with realignment of Freeman Road and replaced with NEW-17 with Freeman Road crossing.
935151	SR 167; Future Right-of-Way,	Culvert	Unnamed stream	Existing culvert to be removed and water rerouted/daylighted as part of the Stage 2 Project construction.

Table 1. Existing Culverts and Bridges				
Name	**Location**	**Description**	**Stream**	**Project Impact**
105 R121519 a	Levee Road	Culvert	Unnamed tributary of Puyallup River	Currently in coordination with Puyallup Tribe of Indians and WDFW. This is part of the historic Upper Wapato Diversion Pipeline, a portion of which is within WSDOT right-of-way.
935130	SR 167; NR on-ramp	Culvert	Unnamed tributary of Puyallup River	Existing culvert to be removed as part of the Stage 2 Project construction.
935154	SR 167	Culvert	N/A	The Stage 2 Project will replace existing stormwater culvert.
935155	SR 167; NB off-ramp	Culvert	N/A	The Stage 2 Project will replace existing stormwater culvert.
935170	SR 167; EB on-ramp	Culvert	Unnamed stream	No project action; existing culvert to remain.
935168	SR 167	Culvert	Unnamed stream	The Stage 2 Project will replace existing stormwater culvert.
935172	SR 167	Culvert	Unnamed stream	No project action; existing culvert to remain.
935173	SR 167	Culvert	N/A	No project action; existing culvert to remain.
935100	Field crossing, Valley Avenue East	Culvert	Wapato Creek tributary to Blair Waterway	Culvert conveying Wapato Creek to be removed as part of the Stage 2 Project mitigation.
935282	Freeman Road	Culvert	Unnamed tributary to Oxbow Lake	Culvert conveying Stream 15 (tributary to Oxbow Lake/Puyallup River) will be replaced with a new structure for a non-fish-bearing stream.

SLT = Surprise Lake Tributary
Source: WSDOT 2022c.

See Figures 4A through 4H (Appendix A-4) for a depiction of the existing drainage and stormwater management infrastructure within the Stage 2 Project area.

2.3 Threshold Discharge Areas

The WSDOT Highway Runoff Manual (HRM) defines TDAs as delineations of drainage areas that contribute runoff to a single natural or constructed discharge location or multiple discharge locations that combine within a quarter-mile

downstream (based on the shortest flow path) from the WSDOT right-of-way (WSDOT 2019a). TDA delineations applicable to the Stage 2 Project area were completed based on WSDOT drainage infrastructure survey; GIS layers from unincorporated Pierce County, City of Fife, and City of Tacoma; available as-built drawings; LiDAR data; site reconnaissance; and the locations of surface water bodies in the vicinity of the Stage 2 Project.

Figures included in Appendix A-2 and A-4 delineate TDA boundaries and show individual discharge locations and flow paths.

2.3.1 TDA 1

TDA 1 includes approximately 23 acres of I-5 from around 59th Avenue Court East to the western project limits at 54th Avenue East. Runoff in TDA 1 drains to ditches on either side of I-5 before exiting the right-of-way in a ditch north of the I-5/54th Avenue East interchange. The ditch drainage crosses under 54th Avenue East in an enclosed drainage system that flows west to 52nd Avenue East and then flows north to Fife Ditch. For Stage 1b, WSDOT and Pierce County Drainage District 23 (responsible for the operation of Fife Ditch) reached an agreement that stormwater flow control for Stage 1b Project runoff discharges to Fife Ditch is unnecessary because peak storm flows in the system will not increase as a result of WSDOT's project. The Stage 2 Project includes an additional 0.25 acre of new PGIS. This area was not included in the analysis that served as the basis for the agreement with Pierce County Drainage District 23. Therefore, flow control is required for this TDA.

2.3.2 TDA 2

TDA 2 includes approximately 22 acres of I-5 from around 65th Avenue East to 59th Avenue Court East. Runoff in TDA 2 drains to ditches on either side of I-5 before exiting the right-of-way in a ditch east of 54th Avenue East that discharges to Fife Ditch. Flow control is required and will be provided in a new detention pond that also manages flows from TDA 1, located south of the I-5 southbound off-ramp to 54th Avenue East.

2.3.3 TDA 3

TDA 3 includes approximately 14 acres of the project area, including the SR 509 spur alignment from 12th Street East to I-5, which is approximately 1,700 feet long. Paving and embankment construction for TDA 3 will be constructed as part of Stage 1b. The Stage 2 Project includes only new pavement markings in this TDA. Runoff treatment for project improvements in TDA 3 are being designed as part of Stage 1b of the SR 167 Project. Stormwater from TDA 3 flows east into the proposed Hylebos RRP area where HRM flow control requirements will be met.

2.3.4 TDA 4

TDA 4 comprises approximately 58 acres of the project area, including 2,100 feet of I-5 and 1,600 feet of SR 167 to the south of I-5. The southern section of TDA 4, where SR 167 will be constructed, is forested and agricultural land. Along I-5, runoff treatment will be provided as part of Stage 1b of the SR 167 Completion Project and in media filter drains south of northbound I-5 that are included in the Stage 2 Project design. After treatment, runoff will flow north into the Hylebos RRP.

2.3.5 TDA 5

TDA 5 includes 0.5 acre of 20th Street East to the east of 70th Avenue East. Stormwater runoff in TDA 5 is collected in an enclosed piped drainage system that is treated in a new proprietary Filterra vault that was constructed as part of Stage 1a. Treated runoff flows north to a stormwater detention pond, which was expanded as part of Stage 1a of the SR 167 Completion Project. As part of the Stage 1b Project, the detention pond will be removed and the proposed Hylebos RRP will provide flow control function in its place.

2.3.6 TDA 6

TDA 6 includes 30 acres of agricultural land that will be replaced by new highway infrastructure and the adjacent Hylebos RRP. It extends approximately 1,800 feet south of 20th Street East along the new SR 167 alignment. Runoff from TDA 6 flows north through Stream 13 and discharges into the Hylebos RRP area that is being constructed as part of Stage 1b.

2.3.7 TDA 7

TDA 7 is approximately 53 acres in area. It encompasses the SR 167 alignment from a point 700 feet north of 26th Street East to a point north of Valley Avenue East. It includes just under a mile of the new SR 167 alignment. TDA 7 is made up of undeveloped grass and forested areas bordered by industrial properties to the east and west. Runoff flows north through Stream 13 before discharging to Surprise Lake Tributary and the proposed Hylebos RRP, which will be constructed as part of Stage 1b.

2.3.8 TDA 8

TDA 8 is almost 6 acres in area. It encompasses a forested area east of TDA 7 to Wapato Creek. The realignment of Valley Avenue East south of the new roundabout intersection with Freeman Road East will be built in this forested area. This TDA will also include a part of a new SR 167 northbound on-ramp. TDA 8 discharges to Wapato Creek and therefore requires runoff flow control.

This TDA also includes 800 feet of Valley Avenue East, west of Freeman Road East. Runoff collects in detention pipes that discharge to Wapato Creek. The detention pipes will be eliminated as part of the Stage 2 Project, so runoff flow control will be necessary.

2.3.9 TDA 9

TDA 9 comprises 3.5 acres of roadway (Valley Avenue East, east of 36th Street East). Runoff collects in an enclosed conveyance system before discharging to a detention pond that then discharges to Wapato Creek. Since this TDA flows into Wapato Creek, runoff flow control will be necessary.

2.3.10 TDA 11

TDA 11 is approximately 18 acres in area. It encompasses the area south of Valley Avenue East and north of the UPRR tracks, approximately 400 feet south of Valley Avenue East. Under existing conditions, stormwater runoff enters Wapato Creek via sheet flow; therefore, runoff flow control will be necessary.

2.3.11 TDA 13

TDA 13 is approximately 16 acres in area, which spans around a quarter-mile of the SR 167 alignment from south of the UPRR tracks to 50 feet south of the Wapato Creek crossing at Freeman Road East. Runoff will be discharged to Wapato Creek via new outfall locations. Runoff flow control will be necessary.

2.3.12 TDA 14

TDA 14 makes up approximately 110 acres of agricultural and forested land adjacent to intensively developed industrial areas and includes just under 1 mile of the new SR 167 alignment. Runoff from TDA 14 discharges to Stream 15, a tributary to Old Oxbow Wetland (a wetland that discharges to the Puyallup River) and flows through a wetland mitigation site west of Freeman Road East. Flow control will be required. Wetlands protection (HRM Minimum Requirement 7) will also be required for this TDA. Upstream and downstream analyses and water surface elevation assessments will also be required. Review and approval by the City of Fife and the Puyallup Tribe of Indians will be required for runoff discharged to Old Oxbow Wetland and the wetland mitigation site.

2.3.13 TDA 15

TDA 15 encompasses a 24-acre area west of the intersection of the SR 167 alignment with North Meridian Avenue (SR 161). It includes over a half-mile of roadway, adjacent industrial areas, and forested land to the north and south. Runoff from TDA 15 discharges to a piped system with an outfall on the north

bank of the Puyallup River. In this location, the Puyallup River is exempt from stormwater flow control requirements according to Table 3-5 of the HRM.

2.3.14 TDA 16

TDA 16 comprises approximately 35 acres and includes the existing SR 167 alignment from North Meridian Avenue to Milwaukee Avenue East. Runoff from the southbound lanes of SR 167 is collected in catch basins on the northern edge of the road, which outfall to an existing ditch that flows west near the north right-of-way limits before connecting to the existing storm drainage system that leads to an outfall to the Puyallup River. From the northbound lanes, runoff flows to a ditch south of the SR 167 alignment that runs west and outfalls to the Puyallup River east of North Meridian Avenue.

As with TDA 15, stormwater flow control is not needed in this TDA due to direct discharge to the Puyallup River via a piped system with sufficient capacity.

2.3.15 TDA 17

TDA 17 comprises approximately 54 acres and includes the existing SR 167 alignment from Milwaukee Avenue East for approximately 1 mile, near the eastern Stage 2 Project limits. Runoff discharges to existing outfalls into the Puyallup River west and east of SR 512; therefore, stormwater flow control is not required.

2.3.16 TDA 18

TDA 18 comprises approximately 3.6 acres and includes 550 feet of the existing SR 167 alignment. Runoff discharges to an existing outfall into the Puyallup River just west of the SR 167 and SR 410 interchange, north of Houston Road East. Stormwater flow control is not required.

2.3.17 TDA 19

TDA 19 comprises approximately 6.3 acres and includes 850 feet of the existing SR 167 alignment to the eastern project limits. Runoff discharges to an existing outfall into the White River east of the SR 167 and SR 410 interchange. Stormwater flow control is not required.

2.3.18 TDA 20

TDA 20 is made up of approximately 5 acres of SR 509, which extends 500 feet west and 600 feet east of East Alexander Avenue. Runoff discharges into Wapato Creek just north of SR 509. Stormwater flow control is required.

2.3.19 TDA 21

TDA 21 is made up of approximately 15 acres of the SR 512/East Pioneer Interchange, which extends approximately one quarter-mile south of East Pioneer. This TDA discharges to the Puyallup River via a 72-inch storm main and is flow control exempt.

2.3.20 TDA 22

TDA 22 is a 0.3-acre, 230-foot-long section of North Meridian Avenue north of West Stewart Avenue. Runoff discharges north to a catch basin that ultimately ends up in the Puyallup River. TDA 22 is flow control exempt.

2.3.21 TDA 23

TDA 23 is a 0.1-acre, 85-foot-long section of North Meridian Avenue north of West Stewart Avenue. This section of roadway is just south of TDA 22. Runoff discharges south to a catch basin that ultimately ends up in the Puyallup River. Therefore, TDA 23 is flow control exempt.

2.4 Soils

Extensive geotechnical testing has been completed within the Stage 2 Project area, as well as adjacent areas during WSDOT's SR 167/70th Avenue E Vicinity Bridge Replacement (Stage 1a) Project and Stage 1b Project. The reporting for this testing has not been prepared yet, but will be summarized in the Geotechnical Baseline Report, Geotechnical Data Report, and the Historical Data Report included along with the request for proposal (RFP).

According to the Natural Resources Conservation Service soil survey, most of the Stage 2 Project area is underlain by Sultan silt loam, which is characterized as very deep, moderately well drained soil formed in recent floodplain alluvium. Briscot loam and Puyallup fine sandy loam also underlay portions of the project area, primarily the south and east sections. Briscot loam is noted to be poorly drained floodplain alluvium, while Puyallup fine sandy loam is considered well drained. Although the Natural Resources Conservation Service considers some of these soil types to drain moderately well, shallow groundwater is prevalent in the Stage 2 Project area and design of runoff treatment and flow control facilities will need to account for groundwater influences on the performance of those facilities.

Groundwater monitoring data has been collected since 2018 in the project vicinity. Long-term groundwater data at locations of existing piezometers in the Stage 2 Project area is summarized in a memorandum (WSDOT 2022d). Additional data and geotechnical reports are provided as reference information included with the RFP. At the time of this draft report the geotechnical data has

been summarized in a Draft Geotechnical Data Report (WSDOT 2022e), and a Preliminary Geotechnical Evaluation for Conceptual Design reference memo (WSDOT 2023), which were reviewed for this report. Limited geotechnical investigations have been conducted for the BMPs that are identified as part of conceptual design. Overall, 36 new drilled borings were performed for the Stage 2 Project, with the addition of 12 borings performed in 2020 for the Stage 1b Project located within the Stage 2 Project area. Of the new borings, open standpipe piezometers were installed at 11 locations, and vibrating wire piezometers (VWPs) were installed at 10 locations. In addition, 24 new cone penetration test probes were performed with seismic shear wave velocity measurements taken at 12 of the locations. Where feasible, grain size analysis was conducted at boring locations that were close to proposed stormwater facilities in order to estimate infiltration rates. VWPs were installed at boring locations closest to proposed ponds and stormwater treatment wetlands to monitor for seasonally shallow groundwater conditions. The locations of borings with VWPs are shown on Figures 2J through 2P (Appendix A-2).

The Design-Builder is responsible for reviewing all available groundwater data and collecting additional field data as needed to design proposed facilities in accordance with the HRM. The wells which included VWPs have been left in place and not decommissioned, for use by the Design-Builder. For BMPs such as bioretention that require minimum separation from groundwater, the Design-Builder shall ensure that the construction schedule allows adequate time for installation of piezometers and monitoring of groundwater elevations for one year.

2.5 Existing Stormwater Discharge Point Inventory

The proposed Stage 2 Project area currently drains to multiple discharge locations on Fife Ditch, Hylebos Creek, Surprise Lake Tributary, Stream 13, Wapato Creek, Old Oxbow Wetland (via Stream 14 and Stream 15), and the Puyallup River. Table 2 summarizes a preliminary stormwater discharge point inventory. Figures 2A – 2I (Appendix A-2) depict these locations.

The stormwater discharge point inventory locations will be confirmed by the Design-Builder, who shall also complete the Hydraulic Discharge Point Inventory Form spreadsheet.

Table 2. Stormwater Discharge Point Inventory		
ID	**Description**	**Discharge Water Body**
Fife 1	Fife 1 is a ditch outfall located along the north side of the 54th Avenue East off-ramp from southbound I-5. The ditch crosses 54th Avenue East in a 36-inch culvert and ultimately discharges to the Fife Ditch system.	Fife Ditch
Fife 2	Fife 2 is a 48-inch culvert that provides a drainage connection between the wetland channel on the north side of I-5, and the Fife Ditch system near 59th Avenue Court East Drainage flows from the I-5 ditch into a ditch flowing north to Fife Ditch.	Fife Ditch
Hylebos 1	Hylebos 1 is the outfall that discharges to the Hylebos RRP from outfalls that are being constructed as part of Stage 1b.	Hylebos Creek
Hylebos 2	Hylebos 2 is the outfall constructed during Stage 1b to Hylebos Creek where treated runoff from I-5 and SR 99 leaves WSDOT right-of-way.	Hylebos Creek
Hylebos 3	Hylebos 3 is the discharge to Hylebos Creek from 20th Street East. Project runoff discharges to an enclosed storm system that was constructed as part of Stage 1a. Runoff is treated in a proprietary Filterra vault. As part of Stage 1b, this treated runoff will be routed in an enclosed conveyance system then to a ditch and culvert that ultimately discharges to the Hylebos RRP.	Hylebos Creek
Hylebos 4	Hylebos 4 is a ditch outfall discharging runoff from 20th Street East to Hylebos Creek, which will be constructed as part of Stage 1b.	Hylebos Creek
SLT 1	SLT 1 is the new Surprise Lake Tributary backwater channels that are being constructed as part of Stage 1b.	Surprise Lake Tributary
Wapato 1	Wapato 1 is a surface discharge (via dispersion) to Wapato Creek.	Wapato Creek
Wapato 2	Wapato 2 is an outlet pipe from a detention pond that manages existing stormwater runoff along Valley Avenue East. The pond will be eliminated as part of the Stage 2 Project, so a new pond will provide detention for existing and proposed Valley Avenue East stormwater.	Wapato Creek
Wapato 3	Wapato 3 is the outlet–from a series of detention tanks that manage runoff from Valley Avenue East–that discharges to Wapato Creek.	Wapato Creek
Wapato 4	Wapato 4 represents existing dispersed flows from TDA 11 to Wapato Creek.	Wapato Creek

Table 2. Stormwater Discharge Point Inventory		
ID	**Description**	**Discharge Water Body**
Wapato 5	Wapato 5 is an existing outfall from a City of Fife detention pond located at the southwest corner of the intersection of Freeman Road East and Valley Avenue. The outfall discharges to a ditch adjacent to UPRR tracks. The ditch discharges to Wapato Creek.	Wapato Creek
Wapato 6	Wapato 6 represents existing dispersed flows from TDA 13 to Wapato Creek.	Wapato Creek
Wapato 7	Wapato 7 is a 30-inch storm drain outfall at the west side of Wapato Creek near Alexander Avenue East.	Wapato Creek
Wapato 8	Wapato 8 is a 36-inch outfall to Wapato Creek conveying drainage from SR 509.	Wapato Creek
Stream 15	Stream 15 is a tributary stream to Old Oxbow Wetland. Flows from TDA 14 discharge to Stream 15 via existing ditches or other tributary streams within the TDA boundaries.	Old Oxbow Wetland
Diversion 1	Diversion 1 is an open stormwater facility that outfalls to the Upper Wapato Diversion Pipeline, which flows south via enclosed stormwater pipes to a 72-inch concrete outfall on the Puyallup River.	Puyallup River
Puyallup 1	Puyallup 1 is the existing outfall on the north side of N Meridian/SR 161 that discharges stormwater runoff from the enclosed drainage system along the west side of N Meridian. Based on record drawings, it is an 18-inch diameter reinforced concrete storm pipe.	Puyallup River
Puyallup 2	Puyallup 2 is the existing outfall on the north side of N Meridian/SR 161 that discharges stormwater runoff from the enclosed drainage system along the east side of North Meridian. Based on record drawings, it is a 30-inch-diameter reinforced concrete storm pipe.	Puyallup River
Puyallup 3	Puyallup 3 is the existing outfall on the south side of the Puyallup River Bridge crossing of North Meridian/SR 161 that discharges stormwater runoff from the enclosed drainage system along the west side of North Meridian. Based on Puyallup GIS information, it is an 18-inch-diameter concrete pipe.	Puyallup River
Puyallup 4	Puyallup 4 is a ditch flowing south adjacent to the southbound lane of SR 512 south of the SR 167/SR 512 interchange. It is the discharge location for TDA 17.	Puyallup River
Puyallup 5	Puyallup 5 discharges runoff from SR 167 and adjacent ditches and ramps at the SR 410 interchange to an outfall at a culvert under Houston Road East. This runoff eventually reaches the Puyallup River.	Puyallup River

2.6 Existing Utilities

Existing utilities have been identified during WSDOT utility surveys and research by members of the General Engineering Consultant Team. Significant utilities adjacent to the Stage 2 Project's drainage infrastructure include:

- There is an existing Tacoma Power Utility overhead distribution and transmission power line on the north side of 20th Street East between the trail head parking lot and Fife city limits to the east. The distribution lines will be partially relocated underground as part of this project.
- There are existing overhead Puget Sound Energy (PSE) transmission and distribution power and communications lines on the south side of 20th Street East between the trail head parking lot and WSDOT right-of-way limits. The distribution lines will be partially relocated underground as part of this project.
- Aerial Tacoma Power Utility and PSE transmission lines on the north and south side of 20th Street East will be relocated.
- There is an existing City of Fife 12-inch-diameter water main and 2- and 8-inch diameter sewer force mains within Valley Avenue East. These utilities will be relocated to the new alignment of Valley Avenue from 36th Street to Freeman Road.
- There are existing underground PSE power and communications utilities within Valley Avenue East. These will be relocated to the new alignment of Valley Avenue from 36th Street to Freeman Road.
- There are existing PSE power and miscellaneous communications on the east side of Freeman Road from Valley Avenue East to the southern improvement limits of Freeman Road. These utilities may be directionally bored under Wapato Creek.
- There are existing aerial PSE transmission and distribution lines and Comcast communication lines crossing at 167 STA 236+85 that will be relocated.
- There is an existing 12-inch-diameter City of Puyallup watermain crossing of the SR 167 alignment at Station 268+97 that will be relocated. It is yet to be determined if this water main will be relocated or protected in place.
- There are existing aerial PSE power poles and lines along the west side of SR 161 (Meridian Avenue) from River Road East to the Puyallup River bridge that will be relocated.
- Relocation of Tacoma Water 48-inch-diameter main at the existing SR 509 / Wapato Creek culvert.
- Relocation of PSE 8-inch gas main at the existing SR 509 / Wapato Creek culvert.

- Relocation of Tacoma Power Utility aerial transmission and communication lines crossing SR 509 at Wapato Creek.
- There are existing underground power and communications utilities along the east edge of Milwaukee Avenue that may require relocation due to bridge construction.

These utilities are shown on the drainage plans provided in Appendix A-4. The proposed stormwater facilities described in this report are designed to avoid utility conflicts based on the information available during design. Confirmation of the existing utilities within the Stage 2 Project area and potential conflicts is the responsibility of the Design-Builder.

3. Design Standards

The following design guidance and criteria apply to the design of stormwater collection, conveyance, treatment, and flow control systems and facilities for the Stage 2 Project:

- WSDOT HRM (M31-16), April 2019
- WSDOT Hydraulics Manual (M23-03.07), March 2022
- 2022 WSDOT Standard Specifications for Road, Bridge, and Municipal Construction (M41-10)
- WSDOT Standard Plans: Section B – Drainage Structures and Hydraulics
- Washington State Department of Ecology Stormwater Management Manual for Western Washington (Ecology 2019)
- Pierce County Stormwater Management and Site Development Manual, July 2021 (for projects elements within the City of Fife and City of Edgewood) and in unincorporated Pierce County
- City of Fife Storm Water Design and Construction Standards, March 1993
- City of Tacoma Stormwater Management Manual, July 2021
- City of Puyallup Public Works Engineering and Construction Manual, December 2021

3.1 Design Storm Frequency

The Stage 2 Project drainage collection and conveyance systems will be designed using the design storm frequencies recommended in Figure 1-3 of the Hydraulics Manual (WSDOT 2022f); these are summarized in Table 3.

Table 3. Design Storm Frequencies.

Drainage Features	Design Frequency	Hydrology Method
Storm Sewer Trunks and Laterals	25 years	Santa Barbara Unit Hydrograph (SBUH)
Storm Drain Inlets at Vertical Curve Sag	50 years	Rational
Gutters	10 years	Rational
Culverts – Design for HW/D Ratio Check for High flow damage	25 years 100 years	USGS Regression/Rational
Ditches	10 years	SBUH

Runoff treatment and flow control facilities were conceptually designed based on continuous simulation modeling with MGSFlood software, Version 4.46. The Stage 2 Project area is located in the Puget Sound East zone, coinciding with a 40-inch Mean Annual Precipitation time series for MGSFlood modeling.

3.2 Stormwater Management Guidelines

The Stage 2 Project design guidelines are dictated by the 2019 WSDOT HRM. Based on thresholds provided in the HRM, the Stage 2 Project area must adhere to the following minimum requirements stated in the HRM:

- Minimum Requirement 1 – Stormwater Planning
- Minimum Requirement 2 – Construction Stormwater Pollution Prevention
- Minimum Requirement 3 – Source Control of Pollutants
- Minimum Requirement 4 – Maintaining the Natural Drainage System
- Minimum Requirement 5 – Runoff Treatment
- Minimum Requirement 6 – Flow Control
- Minimum Requirement 7 – Wetlands Protection
- Minimum Requirement 8 – Incorporating Watershed/Basin Planning into Stormwater Management
- Minimum Requirement 9 – Operation and Maintenance

The minimum requirements are based on the proposed disturbed surfaces, including new impervious, replaced impervious, and converted native vegetation. The SDDS included in Appendix A-1 summarizes these areas and the applicable minimum requirements. Based on the disturbed surfaces for the proposed Stage 2 Project improvements, the project needs to satisfy Minimum Requirements 1 through 4 for new and replaced impervious surfaces and disturbed land. Minimum Requirement 5 applies to new or replaced PGIS and any converted pollution-generating pervious surfaces. The level of treatment to be provided is enhanced. Minimum Requirement 6 applies to net new impervious surfaces as well as any newly converted pervious surfaces. Minimum Requirements 7, 8, and 9 apply to new impervious surfaces and any converted pervious surfaces. New and replaced impervious surfaces are subject to Minimum Requirements 5 through 9 because new impervious surface areas will comprise more than 50 percent of the existing impervious surface areas (and PGIS) within the project area.

Based on site conditions and the Runoff Treatment and Flow Control selection charts in Figures 5-1, 5-2, and 5-3 of the HRM, runoff treatment in the Stage 2 project area is required for all TDAs. Enhanced treatment will be provided by a combination of Compost-Amended Biofiltration Swales (CABS), media filter drains, bioretention areas, proprietary treatment devices, and constructed stormwater wetlands. Flow control is triggered for all project TDAs, except for those that discharge to the Puyallup River, which is flow control exempt in the Stage 2 Project Area. Flow control for TDAs that discharge to Hylebos Creek or Surprise Lake Tributary is provided by the Hylebos RRP, as discussed in Section

5.2. Flow control for TDAs draining to Fife Ditch, Wapato Creek, or Old Oxbow Wetland is provided by combined stormwater wetland/detention ponds, detention ponds, bioretention areas, or engineered dispersion.

3.3 Stormwater Retrofit Analysis

The Stage 2 Project area is within the Puget Sound Basin and is subject to the WSDOT Puget Sound Basin stormwater retrofit requirement as outlined in the HRM.

The Stormwater Retrofit Cost-Effectiveness and Feasibility Analysis based on the conceptual stormwater design is provided in Appendix A-3.

In accordance with the RFP and WSDOT guidance (WSDOT Undated) and based on the ultimate design for the Stage 2 Project, the Design-Builder is responsible for preparing a Stormwater Retrofit Cost-Effectiveness and Feasibility Analysis that documents the cost of stormwater retrofits associated with the Stage 2 Project.

3.4 Other Requirements

The City of Fife and Puyallup Tribe of Indians both require that all projects contributing to the Old Oxbow Wetland will not affect the surface water elevation of the wetland or negatively affect the upstream conveyance infrastructure.

Discharges to Old Oxbow Wetland will require a water level analysis. (See Section 5.3.)

3.5 Hydraulics Manual Deviations

The Stage 2 Project conceptual design does not include any deviations from the 2022 Hydraulics Manual (M23-03.07).

3.6 Highway Runoff Manual Deviations

The Stage 2 Project conceptual design has requested an HRM deviation from Minimum Requirements #4 (Maintaining the Natural Discharge System); Minimum Requirement #5 (Runoff Treatment); and Minimum #6 (Flow Control), because the concept design includes some areas where drainage patterns would be altered and where runoff treatment or flow control would be provided in a different TDA. HRM Deviations are described in a separate technical memorandum that will be submitted to the Design Approval Team for review. The draft technical memorandum is included as Appendix A-11 of this Conceptual Hydraulic Report.

3.7 Pipe Alternatives

Storm drain pipe materials will be in accordance with the WSDOT Standard Specifications. For pipes that will be maintained by local agencies, pipes shall meet their standards. Galvanized products will not be permitted.

The Project limits are in Western Washington, which is classified as Corrosion Zone II per the WSDOT Hydraulics Manual; therefore, untreated aluminized steel, aluminum alloy, thermoplastic, and concrete pipe are permitted for general use in soils of this classification.

Selection of pipe material alternatives shall be determined by the Design-Builder based on site-specific soil characteristics and proposed burial depths during final design.

3.8 Downstream Analysis

Stormwater from the north and west limits of SR 167 (TDAs 3 through 7) will be managed as part of the Hylebos RRP constructed during Stage 1b of the SR 167 Project. Design of the Hylebos Creek stream channel and bridges and the Surprise Lake Tributary channels was based on extensive hydraulic modeling to evaluate flow conditions under various design storm conditions. An independent downstream analysis for areas contributing to the Hylebos RRP is not needed, because confirmation of basis of design, background modeling, and floodplain and stream channel capacity are evaluated in design documentation prepared in support of the Hylebos RRP design (Herrera 2019a; 2019b).

Other parts of the Stage 2 Project will contribute flows to existing drainage systems or receiving waters, including ditches that discharge to Fife Ditch, enclosed drainage systems that flow down North Meridian Avenue before they outfall to the Puyallup River, ponds and outfalls or engineered dispersion systems that ultimately discharge to Wapato Creek or Stream 15, a tributary to Old Oxbow Wetland.

3.8.1 Scope of Downstream Analysis

Preliminary downstream analyses, based on available data and the conceptual design, were performed where necessary as discussed below. Field verification of the drainage conveyance system was confirmed during a site visit by Northwest Watersheds on July 21, 2022. (Refer to Appendix A-3 for details.) The Design-Builder shall perform an updated inspection of all downstream conveyance systems, analyze downstream effects, and verify capacity based on the final design and conditions of the drainage conveyance systems in accordance with the Hydraulics Manual.

3.8.1.1 Fife Ditch Outfalls

Outfalls FD 1 and FD 2 (Appendix A-3) from TDA 1 discharge to a ditch located along the north side of southbound I-5 that flows along the 54th Avenue East off-ramp from I-5. The ditch crosses 54th Avenue East in a culvert, enters an enclosed drainage system, turns north at 52nd Avenue East, and ultimately discharges to Fife Ditch.

3.8.1.2 Hylebos Creek Outfalls

Outfall HB1 and HB2 (TDA 4) drain to ditches that flow through culverts under the Wapato Way Bridge crossing of I-5 that was constructed during Stage 1a of the SR 167 Project. They will flow through culverts beneath the new SR 167 bridge crossing of I-5 that is being constructed as part of Stage 1b of the SR 167 Project. They drain to the Hylebos RRP that is being constructed as part of Stage 1b.

Outfall OF 1 (TDA 5) collects runoff from 20th Street East and discharges to a drainage ditch running to the east of the catch basin that collects additional discharge from 20th Street East and the adjacent Interurban South Trailhead area. The catch basin directs stormwater west to 70th Avenue East via a culvert then flows north adjacent to 70th Avenue East where it connects into the Hylebos RRP. This outfall location was recently constructed as part of the Interurban South Trailhead development.

3.8.1.3 Surprise Lake Tributary Outfalls

Outfalls SLT 1 (TDA 4), SLT 2, SLT 3, SLT 4, and SLT 5 (TDA 6) discharge to the Surprise Lake Tributary backwater channels within the Hylebos RRP area. Stream and floodplain enhancements in these areas were designed during Stage 1b of the SR 167 Project, which is currently under construction. Analysis for impacts related to project elements in these TDAs were evaluated through hydraulic modeling. Modeling performed during Stage 1b evaluated downstream impacts of project flows and existing flows based on modifications to the existing stream channels and found that the project addressed existing flooding issues and did not cause any downstream impacts (Herrera 2019b).

Outfalls SLT 6, SLT 7, SLT 8, and SLT 9 (TDA 7) discharge to a ditch that flows to the SLT backwater channels that were

included in modeling performed to support the design of the Hylebos RRP that is being constructed as part of Stage 1b.

SLT 10 and 11 (TDA 7) are new outfalls and runoff in this area is currently dispersed and lacks channelization. The existing area was farmland that has now been filled for stockpiling soil material in preparation for the SR 167 Completion Project. This area will eventually drain to Surprise Lake Tributary; however, there are no nearby drainage paths.

3.8.1.4 UPRR Ditch Outfall

Outfall Wapato 2 (TDA 12) is the outfall location for an expanded pond that will manage city of Fife runoff from the realigned Valley Avenue East and the north part of Freeman Road East within the Stage 2 Project limits. The new outfall location will replace the existing outfall to the adjacent UPRR ditch. This ditch gradually flows towards the west, where it eventually discharges to Wapato Creek.

3.8.1.5 Wapato Outfalls

Outfall Wapato 1 (TDA 11) discharges to a flow dispersal trench after runoff treatment and flow control. This discharge will support the hydrology of mitigation wetlands that are being designed as part of the Stage 2 Project, and discharge locations have been identified in collaboration with mitigation wetland designers. (Wapato RRP).

Outfall Wapato 3 (TDA 13) is proposed to provide engineered dispersion of stormwater adjacent to the proposed highway alignment in a vegetated area.

Outfalls Wapato 4 and Wapato 5 (TDA 13) are new outfalls to Wapato Creek. Project flows will discharge through these outfalls after treatment and flow control.

3.8.1.6 Old Oxbow Wetland

Outfalls Oxbow 1, Oxbow 2, Oxbow 3, Oxbow 4, Oxbow 5, Oxbow 6, Oxbow 7, and Oxbow 8 (TDA 14) discharge directly or indirectly to Stream 15, a tributary to Old Oxbow Wetland. Oxbows 1 and 2 discharge directly to Stream 15 at the culvert crossing under Freeman Road East. Oxbow 3, Oxbow 4, and Oxbow 5 are new dispersed outfalls with no existing channels. Once constructed, these outfalls will feed into new wetland

mitigation sites as part of the Freeman Road mitigation site, which includes a realigned Stream 15. Oxbow 6 is a new outfall into Stream 14, which flows under the SR 167 alignment via a new 48-inch culvert before joining the realigned Stream 15. Oxbow 7 is a dispersed outfall flowing into the Freeman Road mitigation site upstream of the Stream 14 and Stream 15 confluence. Oxbow 8 is a new outfall near the head of Stream 15 where an existing stormwater pond discharges north of North Levee Road and west of Industrial Parkway. The area around Stream 15 near this outfall will be restored as part of the Puyallup South mitigation site.

From the existing stormwater pond, Stream 15 flows northwest in a culvert under an access road and empties into an open channel through the Stage 2 Project area. Stream 15 flows in a vegetated channel along the property line before entering an undeveloped forested parcel. When it leaves the forested parcel, Stream 15 meets up with Stream 14 to flow north for a length of approximately 660 feet before turning west where a drainage ditch joins the stream via an 18-inch culvert and flows west under Freeman Road East through a 24-inch concrete culvert. West of Freeman Road East, Stream 15 flows west via surface channels through the Puyallup Tribe of Indians mitigation site before being piped below industrial developments and discharging into Old Oxbow Wetland via a 48-inch outfall constructed in 2006 as part of the Valley Haven development.

3.8.1.7 Meridian Street Outfalls

There are two existing outfalls to the Puyallup River – Puyallup 1 and Puyallup 2 (TDA 16) – that convey stormwater runoff from North Meridian Avenue to the Puyallup River. A 24-inch PVC outfall, constructed in 2015, discharges north of the Puyallup River Bridge on the west side of North Meridian Avenue, and a 30-inch corrugated metal pipe outfall, constructed in 1971, discharges north of the Puyallup River Bridge on the east side of North Meridian Avenue.

Two outfalls to the south side of the Puyallup River convey stormwater runoff from North Meridian Avenue to the Puyallup River. Puyallup 3, an 18-inch concrete pipe outfall, discharges south of the Puyallup River Bridge on the west side of North Meridian Avenue. There is also an 18-inch private outfall from the adjacent Fred Meyer distribution warehouse site, which feeds into the same channel as the 18-inch WSDOT outfall on

the west side of the SR 161/North Meridian Avenue bridge. A 12-inch outfall, constructed in 2015, discharges south of the Puyallup River Bridge on the east side of North Meridian Avenue. No project runoff will discharge via the east outfall so it is not labeled on Figure 2E (Appendix 2).

3.8.1.8 SR 512 Outfalls

Two outfalls to the Puyallup River convey stormwater runoff from North Meridian Avenue to the Puyallup River, called Puyallup 3 and Puyallup 4 (TDA 17) for this design. The east outfall, a 30-inch reinforced concrete pipe, was constructed in 1971. The west outfall, an 18-inch diameter pipe, was existing in 1971. Both outfalls discharge north of the SR 512 Puyallup River Bridge.

3.8.2 Review of Resources

The following resources were reviewed to assess the existing conditions of the drainage conveyance systems in the Stage 2 Project vicinity and capacity for additional project runoff.

- Flood Insurance Rate Maps for city of Fife (530140), city of Tacoma (530148), city of Puyallup (530144), and Unincorporated Pierce County (530138).
- Extensive record drawings were reviewed that covered existing stormwater infrastructure for the Stage 2 Project Area. A list of record drawings reviewed along with available record drawings will be provided with the RFP. A partial list of record drawings reviewed that informed this downstream analysis includes the following:
    - SR 167: SR 161 to SR 512 Interchange Project (WSDOT 1986; Project Number 3183; Job No. 86W055).
    - SR 167 Puyallup River Bridge Replacement Project (WSDOT 2015; F.A. Project No. BR-0167 (047)).
    - SR 167, SR 512, and SR 161, Meridian St. N to N. Sumner Centerline (WSDOT 1971; Contract No. 9075).
    - SR 509, Milwaukee Way to Taylor Way Project (WSDOT 1994, F.A. Project No. ILCS-705-3(002)).
- Drainage Analysis SR 167 Project Area from Meridian Ave to 0.4 miles southwest of 410 Interchange (SISU 2021).
- SR 167 Extension Project Hydraulic Design Notebook (RW Beck 2008).

- Field observations of accessible receiving waters and outfall locations conducted in March 2018 as part of the initial TDA delineations performed as part of Stage 1a design of the SR 167 Completion Project.
- City of Puyallup Public Data Viewer.

3.8.3 Inspection of Drainage Conveyance Systems in the Site Area

Downstream receiving waters and accessible drainage system features were inspected during a site visit by Northwest Watersheds on July 21, 2022. To supplement this inspection, information from Herrera Environmental Consultants staff was utilized based on their March 2018 site visit, following several days of precipitation (WSDOT 2018). The accessible outfall conditions were directly observed.

3.8.4 Analysis of Downstream Effects

Below are the results of the analysis performed via literature review and during Northwest Watersheds' site visit on July 21, 2022. (For additional details and site photos refer to Appendix A-3.)

3.8.4.1 Fife Ditch Outfalls

No field observations were completed during the July 21, 2022, site visit. Known capacity issues downstream of TDA 1 and TDA 2 are in the Fife Ditch system. These issues are managed by Pierce County Drainage District 23, which maintains gravity outfall pipes equipped with flap gates and a pump system that discharges into Hylebos Creek at its outlet to lower Hylebos Creek amid estuarine wetlands, just upstream of the SR 509 bridge. The Stage 2 Project will not increase peak flows to the Fife Ditch system due to proposed flow control facilities.

3.8.4.2 Hylebos Creek Outfalls

Field observations of OF 1 showed no evidence of capacity or erosion issues downstream of TDA 5. No field observations were completed on HB 1 and HB 2 (TDA 4). Downstream analysis performed on the existing drainage system as part of the 2008 Stage 1 hydraulic report noted minor sloughing but no significant erosion problems in Hylebos Creek downstream between 12th Street and I-5 (RW Beck 2008). The current drainage system will be modified by the Hylebos RRP construction in Stage 1b, prior to the Stage 2 Project. The

Hylebos RRP is designed to manage the increased flow from this TDA and will address any capacity issues by providing increased floodplain storage.

3.8.4.3 Surprise Lake Tributary Outfalls

No field observations were completed on SLT 1 (TDA 4), SLT 2, SLT 3, SLT 4, or SLT 5 (TDA 6), because this area was under construction, but the current drainage system will be completely modified by the Hylebos RRP construction in Stage 1b, prior to the Stage 2 Project. The Hylebos RRP is designed to manage increased flow from this TDA and will address any capacity issues by providing increased floodplain storage.

Field observations were performed on SLT 6, SLT 7, SLT 8, SLT 9, SLT 10, and SLT 11 (TDA 7). The current drainage system is a channelized low-gradient stream which does not show signs of capacity or erosion issues. Post-project, the Hylebos RRP construction and the realignment of Surprise Lake Tributary north of 26th Street East will help provide additional flood storage capacity and is designed to be stable with the increased project stormwater flows.

3.8.4.4 UPRR Ditch to Wapato Creek

Field observations of downstream effects showed no evidence of capacity or erosion issues downstream of TDA 12. At the current Wapato 2 outfall location an expanded pond will be constructed as part of the Stage 2 Project that will manage City of Fife runoff from the realigned Valley Avenue East and the north part of Freeman Road East.

3.8.4.5 Wapato Creek Outfalls

Wapato 1 (TDA 11) discharges to an engineered dispersion area that drains to mitigation wetlands that are being designed as part of the Stage 2 Project to manage the treated runoff. There is no current outfall in this location to analyze.

Wapato 3 (TDA 13) will have two outfalls with flow dispersion trenches that allow dispersed flow toward Wapato Creek to mitigate erosion. This area is pastureland, with no existing outfall to analyze.

Field observations of Wapato Creek at the Wapato 4 and Wapato 5 outfall locations showed no sign of downstream capacity or erosion issues. Constructed stormwater wetlands and detention ponds will mitigate future capacity issues.

3.8.4.6 Old Oxbow Wetland

Field observation along with literature review of the drainage system downstream of outfalls Oxbow 1 and Oxbow 2 (TDA 14) indicate capacity issues due to undersized culverts and development within the basin. Outfalls Oxbows 3, Oxbow 4, Oxbow 5, Oxbow 6, Oxbow 7, and Oxbow 8 are new outfalls with no existing channel. Once constructed, these outfalls will connect into Stream 15.

The 24-inch culvert under Freeman Road East will be replaced with a 48-inch culvert during the Freeman Road East widening. Bioretention planters with flow control will be constructed along Freeman Road East, which will discharge dispersed flow to new constructed wetlands. In addition, the restoration and realignment of Streams 14 and 15 will also add considerable flood storage capacity to the system.

Beaver activity at the downstream end of Old Oxbow Wetland has caused the water surface elevation to rise 3 to 4 feet, which leaves little capacity because the bank area has been developed with housing. The City of Fife and Puyallup Tribe of Indians are requiring all projects contributing to this drainage to demonstrate that the surface water elevation of the wetland will not be affected or negatively affected by the conveyance infrastructure. (See Section 5.3 for a discussion of this analysis.)

3.8.4.7 Meridian Avenue Outfalls

Field observation of the North Meridian Avenue outfalls, Puyallup 1 and Puyallup 2 (TDA 16), show no signs of erosion or capacity issues and discharge directly into the north bank of the Puyallup River at a riprap-protected slope beneath the bridge.

The concept design includes replacement of most of the storm drain pipes within the Stage 2 Project limits, because most of the storm system was constructed in 1971. The original outfalls were evaluated to ensure that they have adequate capacity for project and existing storm flows. WSDOT's storm

drainage design spreadsheet was used to evaluate the existing storm system for the 25-year storm event in accordance with Hydraulics Manual criteria. Because the storm system along North Meridian Avenue will be replaced, the pipe slope in upstream sections of pipe was adjusted in some cases, with the existing outfall elevation held. Based on this analysis, the Meridian outfalls have adequate capacity for existing and Stage 2 Project flows. (Calculations are provided in Appendix A-3.)

3.8.4.8 SR 512 Outfalls

SR 512 outfalls, Puyallup 3 and Puyallup 4 (TDA 17), showed no signs of downstream capacity or erosion issues during field observation.

3.9 New Stormwater Discharge Points

Figures 2J through 2P (Appendix A-2) and the conceptual drainage plans (Appendix A-4) show new stormwater discharge locations. The existing conditions at the new outfall locations are also described in the Downstream Analysis in Section 3.8.

The Design-Builder shall enter these and any other new outfalls into the WSDOT Stormwater Discharge Point Inventory. Outfall design will comply with the HRM, Hydraulic Manual, conditions of the various permits, and commitments made in the environmental documents prepared for the Stage 2 Project.

4. Developed Conditions

The Stage 2 Project elements are shown on Figures 2J through 2P (Appendix A-2).

4.1 Drainage Basins

Table 4 summarizes the contributing drainage areas to each flow control and runoff treatment BMP. BMP locations are shown on the Figures in Appendix A-3 and on the Drainage Plans in Appendix A-2. For the 15 percent design, contributing basins were not delineated to smaller degree (e.g., areas contributing to each catch basin). The Design-Builder shall be responsible for detailed design of the drainage collection and conveyance system. (These drainage basins are shown on drainage basin maps included in Appendix A-2.)

Table 4. Drainage Basins

Feature	Contributing Impervious Area (acres)	Contributing Pervious Area (Till Grass; acres)	Description
Swale 167A (CABS)	1.06	0.19	The drainage basin contributing to Swale 167A includes runoff from a 500-foot section of both directions of the SR 167 bridge over 20th Street East. The basin also includes the embankment fill slope to the east, adjacent to the swale.
Swale 167B (CABS)	2.04	0.19	The drainage basin contributing to Swale 167B includes a 1,200-foot stretch of the northbound lanes of SR 167 and a 550-foot stretch of the southbound lanes between 20th Street East and 26th Street East. The basin also includes the embankment fill slope to the east, adjacent to the swale.
Swale 167C (CABS)	0.71	0.20	The drainage basin contributing to Swale 167C includes a 600-foot stretch of the northbound lanes of SR 167 between 20th Street East and 26th Street East. The basin also includes the embankment fill slope to the east, adjacent to the swale.

Table 4. Drainage Basins			
Feature	**Contributing Impervious Area (acres)**	**Contributing Pervious Area (Till Grass; acres)**	**Description**
Swale 167D (CABS)	0.80	0.18	The drainage basin contributing to Swale 167D includes both directions of the SR 167 bridge over 26th Street East and a 260-foot stretch of the southbound lanes north of 20th Street East. The basin also includes the embankment fill slope to the east, adjacent to the swale.
Swale 167E (CABS)	1.30	0.18	The drainage basin contributing to Swale 167E includes an approximately 600-foot stretch of SR 167 as well as the embankment fill slope to the east, adjacent to the swale, just south of 26th Street East.
Swale 167F (CABS)	2.05	0.42	The drainage basin contributing to Swale 167F includes a 550-foot stretch of both directions of SR 167 and a 750-foot stretch of the northbound lanes south of 26th Street East.
Swale 167G (CABS)	2.95	0.08	The drainage basin contributing to Swale 167G includes a 1,600-foot stretch of both directions of SR 167 north of Valley Avenue East. The basin also includes the adjacent fill slope embankment.
Swale 167I (CABS)	0.67	0.11	The drainage basin contributing to Swale 167I includes a 700-foot section of the southbound SR 167 lanes east of 17th Street Northwest, along with the adjacent fill slope embankment.
Swale 167J (CABS)	1.44	0.09	The drainage basin contributing to Swale 167J includes a 1,500-foot section of the southbound SR 167 lanes near Industrial Parkway. The basin also includes the embankment fill slope to the south, adjacent to the swale.
Swale 167K (CABS)	2.46	0.44	The drainage basin contributing to Swale 167K includes a 2,300-foot stretch of the southbound SR 167 lanes. The basin also includes the embankment fill slope to the south, adjacent to the swale.

Table 4. Drainage Basins			
Feature	**Contributing Impervious Area (acres)**	**Contributing Pervious Area (Till Grass; acres)**	**Description**
Swale 167L (CABS)	0.91	0.09	The drainage basin contributing to the Swale 167L includes a 1,000-foot section of the northbound lanes of the SR 167 bridge over North Meridian Avenue, to the west of Meridian, along with the adjacent fill slope embankment.
Swale 167M (CABS)	3.59	0.15	The drainage basin contributing to the Swale 167M includes a 900-foot section of the southbound lanes of the SR 167 bridge over North Meridian Avenue, to the west of Meridian, along with the adjacent fill slope embankment.
Swale 167N (CABS)	1.90	0.00	The drainage basin contributing to the Swale 167N includes a 600-foot section of both lanes of SR 167 east of Milwaukee Avenue East.
Swale 5A (CABS)	2.81	0.05	The drainage basin contributing to Swale 5A includes runoff from a 2,300-foot section of the southbound lanes of I-5, including widened lanes.
Bioretention 20A	0.17	0.00	The drainage basin contributing to Bioretention 20A is a 300-foot section of the westbound lane of 20th Street East. The basin includes the area under the SR 167 overpass and west of the overpass.
Bioretention 20B	0.17	0.00	The drainage basin contributing to Bioretention 20B is a 300-foot section of the eastbound lane of 20th Street East. The basin includes the area under the SR 167 overpass and west of the overpass.
Bioretention 20C	0.13	0.00	The drainage basin contributing to Bioretention 20C is a 200-foot section of the westbound lane of 20th Street East. The basin includes a small section of the area under the SR 167 overpass and east of the overpass.

Table 4. Drainage Basins			
Feature	**Contributing Impervious Area (acres)**	**Contributing Pervious Area (Till Grass; acres)**	**Description**
Bioretention 20D	0.12	0.00	The drainage basin contributing to Bioretention 20D is a 200-foot section of the eastbound lane of 20th Street East. The basin includes a small section of the area under the SR 167 overpass and east of the overpass.
Bioretention 20E	0.12	0.00	The drainage basin contributing to Bioretention 20E is a 250-foot section of the westbound lane of 20th Street East.
Bioretention 20F	0.10	0.00	The drainage basin contributing to Bioretention 20F is a 200-foot section of the eastbound lane of 20th Street East.
Bioretention 20G	0.13	0.00	The drainage basin contributing to Bioretention 20G is an almost 300-foot section of the westbound lane of 20th Street East.
Bioretention 20H	0.12	0.00	The drainage basin contributing to Bioretention 20H is a 200-foot section of the eastbound lane of 20th Street East.
Bioretention VALA	1.44	0.00	The drainage basin contributing to Bioretention VALA consists of a 700-foot section of westbound Valley Avenue East, including the new roundabout east of the SR 167 overpass at Station 160+00.
Bioretention VALB-North	0.94	0.00	The drainage basin contributing to Bioretention VALB-North consists of a 1500-foot section of westbound Valley Avenue East, starting at Freeman Road.
Bioretention VALB-South	0.15	0.00	The drainage basin contributing to Bioretention VALB-South consists of a 200-foot section of eastbound Valley Avenue East.
Bioretention FRMNA	0.33	0.00	The drainage basin contributing to Bioretention FRMNA is a 350-foot section of both lanes of Freeman Road East north of SR 167.

Table 4. Drainage Basins			
Feature	**Contributing Impervious Area (acres)**	**Contributing Pervious Area (Till Grass; acres)**	**Description**
Bioretention FRMNB	0.28	0.00	The drainage basin contributing to Bioretention FRMNB is a 300-foot section of both lanes of Freeman Road East north of SR 167.
Bioretention FRMNC & FRMND	0.23	0.00	The drainage basin contributing to Bioretention FRMNC & FRMND is a 325-foot section of both lanes of Freeman Road East south of SR 167.
Bioretention FRMNE & FRMNG	0.30	0.08	The drainage basin contributing to Bioretention FRMNE & FRMNG is a 900-foot section of the southbound lane of Freeman Road East south of SR 167.
Bioretention FRMNF & FRMNH	0.39	0.00	The drainage basin contributing to Bioretention FRMNF & FRMNG is a 900-foot section of the northbound land and center lane of Freeman Road East south of SR 167.
Bioretention 161A	0.95	0.00	Bioretention 161A treats runoff from a 300-foot section of the southbound lanes of North Meridian and a 300-foot section of the eastbound lanes of Valley Avenue East.
Bioretention 161C	0.66	0.00	The drainage basin contributing to Bioretention 161C includes an almost 300-foot section of the southbound lanes of North Meridian under the SR 167 overpass as well as the top of the northbound SR 167 on ramps.
Stormwater Treatment Wetland 161A	3.48	0.62	Stormwater Treatment Wetland 161A treats runoff from a 300-foot section of the eastbound lanes of Valley Avenue East, a 500-foot section of the northbound lanes of North Meridian, two of the lanes from the northbound SR 167 off-ramp, 850 feet of the northbound lanes of SR 167, and the fill slope between SR 167 and the off-ramp.

Table 4. Drainage Basins			
Feature	**Contributing Impervious Area (acres)**	**Contributing Pervious Area (Till Grass; acres)**	**Description**
Stormwater Treatment Wetland 161B	6.70	0.00	The drainage basin contributing to Stormwater Treatment Wetland 161B includes a 2,500-foot section of the southbound lanes of SR 167, starting at North Meridian, a 1,000-foot section of part of the northbound lanes of SR 167 near Milwaukee Avenue, 150 feet of the northbound lanes of North Meridian, and the on-ramp for SR 167 south from North Meridian.

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4.2 Post Development Drainage Patterns

The Stage 2 Project will result in changes to drainage patterns in TDAs 1, 2, 7, 8, 9, 10, 11, 12, 13, 14, and 15.

Under existing conditions, stormwater in TDAs 1 and 2 drain to a wetland channel north of I-5. This pattern will be maintained under proposed conditions, with a new wall which minimizes disturbance to this wetland. However, portions of TDA 2 will be routed to a different discharge location (the existing TDA 1 discharge location). New impervious area created when widening for the auxiliary lane will be diverted to the west, and treated, detained, and discharged at the existing TDA 1 location. This change will likely require an HRM Deviation and is under review by the Demonstrative Approach Approval Team. The draft technical memorandum is provided in Appendix A-11.

Where Valley Avenue East meets the Stage 2 Project alignment there will be a new interchange with roundabouts and future ramp connections with the SR 167 alignment on a structure over Valley Avenue East. While attempting to maintain existing drainage patterns as much as possible, a number of TDA drainage transfers will be required between TDAs 7 through 13. The WSDOT runoff north of the overpass will drain toward the north to be treated in CABS before outfalling in Stream 13, draining to Surprise Lake Tributary and the Hylebos RRP. Local drainage on Valley Avenue East will be treated in a new stormwater wetland/detention pond and dispersed west of the crossing. East of the crossing, Valley Avenue East drainage will either drain north to a new bioretention area or south to a new stormwater wetland/detention pond at an existing pond location at the intersection of Freeman Road. WSDOT runoff south of the overpass will be collected and treated in a stormwater wetland/detention pond, which discharges dispersed runoff south toward new mitigation wetlands and Wapato Creek. These changes will likely require an HRM Deviation and will be discussed in detail in a technical memorandum that will be submitted to the Demonstrative Approach Team for review and included in Appendix A-11 of subsequent drafts of this report.

The current stormwater pond at the Valley Avenue East and Freeman Road East intersection will be removed and expanded with a new pond discharging to the same location. This will also replace detention pipes and proprietary filter vaults under Valley Avenue East discharging to Wapato Creek. This will alter the current TDAs 8, 9, 10, and 12.

In TDA 13, a new stormwater wetland/detention pond manages Project runoff between the UPRR crossing and the Wapato Creek crossing, outfalling to Wapato Creek. Freeman Road East will have new bioretention planters with dispersed outfalls draining toward Wapato Creek.

South of Wapato Creek, Freeman Road East is also designed with orifice-controlled bioretention planters with outfalls at Wapato Creek, Stream 15, or dispersed to wetland mitigation sites draining to Stream 15. The 24-inch concrete culvert for Stream 15 under Freeman Road East will be replaced with a 48-inch structure that accommodates the widened roadway and pedestrian improvements. The larger structure will be easier to maintain and provide increased conveyance capacity, although peak flows are not expected to increase significantly. It is the Design-Builder's responsibility to verify sizing/capacity of replacement culverts, and verify compliance with all regulations required resulting from potential change in conveyance to downstream water bodies.

South of Wapato Creek, SR 167 runoff will drain to stormwater wetland/detention ponds before discharging to Stream 15 via new outfalls or dispersion trenches. In TDA 15, where runoff infiltrates or flows are dispersed toward the south reaching the Upper Wapato Diversion Pipeline, runoff will be collected and sent either to Stream 15 or to the Puyallup River via outfalls near the North Meridian Avenue bridge. New CABS, media filter drains, and bioretention areas will treat runoff before discharging to the Puyallup River.

East of North Meridian Avenue, existing drainage patterns are maintained with treatment of new impervious surfaces provided via CABS and media filter drains. Existing ditches and piped systems will convey runoff to the Puyallup River.

5. Hydrologic and Hydraulic Design

The goal of this report is to determine estimated stormwater impacts associated with the proposed Stage 2 Project construction and describe conceptual plans for mitigating the impacts. The conceptual design focuses on runoff treatment and flow control facilities and does not address the design of drainage collection and conveyance systems.

The hydrologic and hydraulic design criteria and assumptions used to size and model the runoff treatment and flow control facilities are described in the following sections. (The supporting calculations and model outputs are included in Appendix A-3.)

5.1 Runoff Treatment

Runoff treatment (Minimum Requirement 5) is required for all new and replaced PGIS surfaces in all TDAs.

The Stage 2 Project has committed to providing enhanced treatment (dissolved metals target treatment); therefore, enhanced runoff treatment BMPs have been selected. They include CABS (RT.04), Media Filter Drains (RT.07), Bioretention Areas (RT.08), and Constructed Stormwater Treatment Wetlands (RT.13). Engineered dispersion areas are included in many locations as part of the Stage 2 Project concept drainage design. For the Stage 2 Project, enhanced runoff treatment will be required prior to discharge via engineered dispersion even when flow control and/or project discharge is via engineered dispersion.

Proprietary treatment vaults are proposed along North Levee Road that will be maintained by the City of Puyallup. At a meeting with City of Puyallup staff on April 18, 2022, they requested that proprietary runoff treatment be provided for City-maintained facilities rather than the original design concept of bioretention areas due to maintenance concerns.

Oil control is also necessary at the high-volume traffic intersections, as documented in Section 5.1.5.

The antioxidant 6PPD and its byproduct 6PPD-quinone are recently discovered chemicals associated with tire wear, which have been linked to high rates of pre-spawning mortality in coho salmon in streams draining to Puget Sound. This is an emerging contaminant of concern, which is being studied by Ecology for effective means of removal (Ecology 2022). While there are still many knowledge gaps, initial reviews of literature indicate that BMPs involving dispersion, infiltration, biofiltration, and sorption potentially provide the highest levels of removal. These BMPs include bioretention, media filter drains, and CABS, which are all being proposed for the Stage 2 Project. BMPs with sedimentation and filtration processes may also provide a medium level of removal. Stormwater treatment wetlands are in this category and are proposed on this project.

5.1.1 Bioretention Design

Bioretention areas are proposed at several locations in the Stage 2 Project area. Preliminary site-specific data on groundwater levels has been collected (WSDOT 2022e) and further investigation is planned for September 2022 and March 2023. It is the responsibility of the Design-Builder to install piezometers and monitor groundwater to confirm that design criteria, such as minimum separation from groundwater, in the HRM and Ecology SWMM can be met. Bioretention sizing assumes lined facilities, with underdrains. The conceptual design includes bioretention areas at the following locations in the Stage 2 Project area:

- Eight bioretention areas are proposed for 20th Street East to treat approximately 1.1 acres of PGIS in TDA 5 and TDA 6. The bioretention areas are present on both sides of the roadway. The facilities were modeled as lined facilities with underdrains that would discharge to the existing drainage system on 20th Street East, with eventual discharge to the Hylebos RRP. (The dimensions and individual areas treated by each bioretention area on 20th Street East are shown in Appendix A-3.)
- Three bioretention areas are proposed between Valley Avenue East and the SR 167 overpass to treat runoff from 2.5 acres of PGIS on Valley Avenue East in TDA 7 and TDA 8. These facilities were modeled as lined facilities with underdrains that would discharge to a ditch on the eastside of Wetland 83 (see Appendix A-3).
- Eight bioretention areas are proposed to treat runoff from Freeman Road East. The bioretention areas treat approximately 1.5 acres of PGIS in TDA 12 and TDA 13. Five of the areas are located on the east side of the roadway and three are on the west side. The facilities were modeled as lined facilities with underdrains that would discharge through dispersion to Wetland 95 and directly to Wapato Creek. (The dimensions and individual areas treated by each bioretention area on Freeman Road East are shown in Appendix A-3.)
- Two bioretention areas are proposed at the intersection of North Meridian Avenue and SR 167. The bioretention areas treat 1.6 acres of PGIS from North Meridian Avenue from TDA 15 and TDA 16. The facilities were modeled as lined facilities with underdrains that connect to the existing drainage system, with eventual discharge to the Puyallup River. (The dimensions and individual areas treated by each bioretention area are shown in Appendix A-3.)

Continuous simulation model runs using MGSFlood software were used to determine the bioretention facility sizes based on each contributing area. The modeling analysis included the following assumptions:

- Bioretention facility internal side slopes are 3H:1V (unless noted as concrete planters which had vertical sides).
- Maximum ponding depth is 12 inches.
- Bioretention media depth is 18 inches.
- Assumed native soil infiltration rate is 0.0 inch/hour.
- Design infiltrate rate of 3 inches/hour for the bioretention soil media (infiltration rate of 12 inches/hour with factor of safety of 4 for long-term infiltration rate).

Design results are presented in Appendix A-3.

5.1.2 Compost-Amended Biofiltration Swales Design

The Stage 2 Project includes several CABS. (Swale locations and calculations are included in Appendix A-3.)

5.1.3 Stormwater Treatment Wetland and Combined Stormwater Treatment Wetland/Detention Ponds

Stormwater treatment wetland and combined stormwater treatment wetland/detention pond calculations are included in Appendix A-3.

The Stage 2 Project includes two constructed stormwater wetlands proposed at the following locations in the Stage 2 Project area:

- A constructed stormwater treatment wetland is proposed between the northbound SR 167 off-ramp to North Meridian Avenue and the SR 167 overpass over North Meridian Avenue. This facility will provide runoff treatment for approximately 2.9 acres of PGIS from TDA 16.
- A constructed stormwater treatment wetland is proposed just south of the on-ramp to southbound SR 167 from North Meridian. This facility will provide runoff treatment for approximately 6.7 acres of PGIS from TDA 16.

Constructed stormwater wetlands were designed to include pre-settling cells or stormwater outfall rock dispersion that is accessible for maintenance and shallow wetland cells, with depths ranging from 6 inches to 18 inches. In accordance with the HRM, low-permeability or treatment liners are required for constructed stormwater treatment wetlands. Both the bottom and sides shall be lined. The Design-Builder is responsible for selecting the appropriate liner that meets recommendations and design criteria from the HRM based on review and collection of geotechnical field data.

5.1.4 Proprietary Water Quality Devices

The City of Puyallup has expressed a preference for proprietary stormwater treatment devices to be used to treat runoff from City of Puyallup-owned facilities affected by Stage 2 Project improvements. These devices must be approved for enhanced treatment with a General Use Level Designation by Ecology. It shall be the responsibility of the Design-Builder to select proprietary water quality devices and obtain approval from the City of Puyallup. The concept design includes proprietary water quality devices on Levee Road (north of the SR 161/North Meridian Avenue Bridge over the Puyallup River), and on North Meridian Avenue (south of the bridge). The City of Puyallup will maintain the proprietary devices in these locations. If the Design-Builder proposed proprietary devices in any locations where WSDOT maintenance would be required, they will be responsible for obtaining approval from WSDOT's Hydraulics Superintendent, Olympic Region.

5.1.5 Oil Control

Per Table 3-1 of the HRM, oil control is required at intersections with average daily traffic of ≥15,000 vehicles stopping to cross a roadway with ≥25,000 vehicles or vice versa. A review of the 2045 traffic build volumes indicated one location within the Stage 2 Project area where these conditions apply: the southbound SR 167 off-ramp at North Meridian Avenue will terminate at an intersection that exceeds these limits.

At the SR 167 southbound Meridian Avenue off-ramp, runoff treatment is provided via a constructed stormwater treatment wetland. Oil control will be provided with the addition of an oil containment boom to the wetland pond area, diagonally across the water surface to maximize contact area and time.

5.2 Flow Control

Based on the SDDS (Appendix A-1) and the added new and replaced impervious surfaces, flow control (Minimum Requirement 6) is required for new and replaced impervious surfaces within all TDAs. Flow control is required for all TDAs that discharge to Fife Ditch (TDAs 1 and 2), Wapato Creek (TDAs 8, 9, 10, 11, 12, 13, and 20) and Old Oxbow Wetland (TDA 14). Flow control for TDAs that discharge to Hylebos Creek or Surprise Lake Tributary (TDAs 3, 4, 5, 6, and 7) is provided by the Hylebos RRP under an approved deviation, as discussed in this section and documented in the approval letter that is included in Appendix A-11.

5.2.1 Wapato Creek

TDAs 8 through 13 and TDA 20 discharge to Wapato Creek. Flow control will be provided for project suite runoff in these TDAs through several combined stormwater treatment wetland/detention ponds, with pre-project conditions modeled as historic land cover.

Continuous simulation model runs using MGSFlood software were used to size the facilities. (Modeling results are presented in Appendix A-3.)

TDA 20 also discharges to Wapato Creek; therefore, flow control will be required for applicable impervious surfaces in this TDA. The scope of work in TDA 20 that will be part of the Stage 2 Project is not yet defined, due to design changes proposed by the Design-Builder who is working on Stage 1b of the SR 167 Completion Project. If Stage 2 Project activities trigger flow control, historical conditions may be modeled as pre-project, existing conditions, not historical land cover, based on guidance in the WSDOT HRM Section 3-3.6.4, since the drainage area of the immediate stream and all subsequent downstream basins has had at least 40 percent total impervious area since 1985.

5.2.2 Hylebos Riparian Restoration Program

TDAs 3, 4, 5, 6, and 7 will discharge to Hylebos Creek or Surprise Lake Tributary amid the Hylebos RRP area after Stage 2 Project construction. The concept design also includes TDA transfers of portions of additional TDAs as discussed in the Highway Runoff Manual Deviation technical memorandum that is being prepared separately and will be included in Appendix A-11 of future versions of this report. These areas, including the transferred areas, have been included in modeling and analysis performed as part of the documentation titled Demonstrative Stormwater Flow Control using the Hylebos Riparian Restoration Program (WSDOT 2019b); therefore, flow control for these TDAs will be achieved through the Hylebos RRP. The Design Approval Team, including Washington State Department of Ecology, approved the alternative flow control method in September 2020 (WSDOT and Ecology 2020; Appendix A-11).

5.2.3 Fife Ditch

TDAs 1 and 2 discharge to Fife Ditch. Fife Ditch and its associated infrastructure is managed by Pierce County Drainage District 23 (Drainage District 23).

Within the Fife Ditch basin, WSDOT has removed buildings, parking lots, and other impervious surfaces on several parcels of land acquired for construction of Stage 1b of the SR 167 Completion Project such that the

project resulted in a net reduction in impervious surfaces contributing to Fife Ditch. During Stage 1b, WSDOT provided Drainage District 23 with an assessment of changes in stormwater flows and water quality to Fife Ditch and determined that project flows would not exacerbate conveyance capacity concerns of Fife Ditch. Drainage District 23 approved WSDOT's plan to proceed with project construction without installing flow control facilities for project areas draining to Fife Ditch on the basis that there will not be a net addition of impervious surfaces contributing to Fife Ditch due to the project (WSDOT 2020b).

The Stage 2 Project includes addition of impervious surface area in the Fife Ditch basin that was not evaluated as part of Stage 1b negotiations with Drainage District 23, so a detention pond has been included in the design to ensure that flows to Fife Ditch do not exceed existing flows.

The Stage 2 Project contains a separate, flood storage pond, that is outside of the scope of the drainage design.

From guidance in the WSDOT HRM Section 3-3.6.4, because the drainage area of the immediate stream and all subsequent downstream basins has had at least 40 percent total impervious area since 1985, historic conditions were modeled as pre-project existing conditions, rather than as historic land cover (Ecology 2010).

5.2.4 Puyallup River

TDAs 15, 16, 17, 18, 21, 22, and 23 discharge to the Puyallup River. The Puyallup River is flow control exempt in the Stage 2 Project area, so no flow control is required.

5.2.5 White River

TDA 19 discharges to the White River; however, there is no paving work or proposed change in impervious surfaces in this TDA. The White River is also flow control exempt in the Stage 2 Project area; therefore, no flow control is required.

5.3 Wetlands Protection

Old Oxbow Wetland is a Category I wetland, which requires a wetland hydroperiod analysis per Minimum Requirement 7 in the HRM. This analysis is included in the HRM Deviation technical Memorandum (Appendix A-11).

Modeling to verify that water levels will not change (see Section 3.4) will evaluate the location of the proposed Freeman Road East culvert replacement where

Stream 15 flows to the west toward both the Old Oxbow Wetland and through a Puyallup Tribe of Indians mitigation wetland site. Modeling will account for all stormwater outfalls draining to Old Oxbow Wetland, and will demonstrate compliance with the wetland hydroperiod requirements, and the water surface elevation change requirement as set by the City of Fife and Puyallup Tribe of Indians.

The Design-Builder will be responsible for documenting compliance with the wetland hydroperiod analysis in their hydraulic report.

5.4 Storm Drainage Design

Culvert sizing has been determined in coordination with the stream designers for major culvert crossings. It is the responsibility of the Design-Builder to confirm the sizing of all culverts.

5.4.1 Check Valves

Check valves have been added at several locations based on hydraulic modeling of the Hylebos RRP. Where shown on the drainage plans, check valves are intended to prevent Hylebos Creek water from backing up into the storm system or the other side of the SR 509 Spur or SR 167 embankment and to prevent and exclude fish from entering the stormwater system. Check valves are also required for outfalls to Wapato Creek and the Puyallup River.

6. Permits and Associated Reports

6.1 Environmental Issues, Fish, and Other Endangered Habitat

As noted in Section 2.2, numerous wetlands are located within the Stage 2 Project footprint. Several wetlands will be temporarily or permanently affected by the project. Wetland mitigation will be provided for most of these affected wetland areas within the project footprint by constructing on-site, in-kind mitigation sites within the Hylebos Creek, Wapato Creek, and Puyallup River basins. Additional mitigation will be provided by using remaining area within the Hylebos RRP as documented in the Stage 2 Mitigation Plan (WSDOT 2022b), as well as by using available credits at the Port of Tacoma's Upper Clear Creek Mitigation Bank. (See the Stage 2 Project Wetland and Stream Assessment Report and the Stage 2 Mitigation Plan (WSDOT 2022b) report for additional information on delineated wetlands and mitigation.)

Stage 2 Project construction will have several temporary and permanent effects on aquatic resources. The temporary effects are primarily related to construction-related in-water disturbances, streamflow diversions, in-stream sedimentation, and stream buffer and riparian vegetation removal. Wapato Creek, Surprise Lake Tributary and its tributary Stream 13, and tributary stream channels to Old Oxbow Wetland (Streams 14 and 15) will be affected through construction activities and channel and floodplain modifications included in the design. These streams are in generally poor condition in the Stage 2 Project area due to lack of in-stream habitat structure, lack of native riparian vegetation, extensive growth of invasive vegetation in the stream channel and adjacent riparian areas, and degraded water quality. A goal of the project is to improve upon existing environmental conditions, including improving habitat in streams and their historical floodplains. The Wapato RRP design, a major component of Stage 2, as well as other mitigation sites being constructed in the Hylebos and Puyallup River basins will include new channel alignments and floodplain connections for the streams that will improve existing environmental conditions, including improving habitat in streams and their historical floodplains. The Stage 2 Project proposes to realign and enhance the habitat quality of Wapato Creek and Streams 13, 14, and 15 (tributaries to Surprise Lake Tributary and Old Oxbow Wetland), increase floodplain connectivity for habitat and flood reduction benefits, and plant native riparian vegetation in restored floodplain areas.

Several fish species are known or presumed to be present in the Stage 2 vicinity, including cutthroat trout, Western brook lamprey, steelhead, fall chum, Chinook salmon, and coho salmon. Chinook salmon and steelhead are listed as threatened under the federal Endangered Species Act. Endangered and threatened species and their critical habitat are discussed in the Biological Assessment and the Biological Opinions prepared for the overall SR 167 Completion Project. (See Section 2.8 of the RFP for more information.) Based on

the Endangered Species Act consultation, the Stage 2 Design-Builder shall consult with the National Marine Fisheries Service and U.S. Fish and Wildlife Service if the final design results in changes in potential effects to listed species.

6.2 Permits/Approvals

A preliminary list of permits anticipated to be necessary for Stage 2 is summarized below, along with the approval entities:

- Tribal Development Permit; Puyallup Tribe of Indians
- Clean Water Act; Section 401 Water Quality Certification; Ecology and Puyallup Tribe of Indians
- Clean Water Act; Section 402 NPDES General Permit for Construction Activities; Ecology
- Clean Water Act; Section 404 Individual Permit; U.S. Army Corps of Engineers
- Coastal Zone Management Act of 1972; Coastal Zone Management Consistency Determination; Ecology
- Clean Air Act; Asbestos Demolition/Removal Permit; Puget Sound Clean Air Agency
- Revised Code of Washington (RCW) Chapter 77.55 Washington State Hydraulic Code; Hydraulic Project Approval; Washington State Department of Fish and Wildlife
- RCW Chapter 18.104; Notice of Intent for Installing Geotechnical Borings; Ecology
- RCW Chapter 18.104; Notice of Intent for Installing, Modifying, or Removing Piezometers; Ecology
- RCW Chapter 18.104; Notice of Intent for Installing, Modifying, or Decommissioning Wells; Ecology
- RCW Chapter 70.05.060; Underground Storage Tank (UST) Removal; Tacoma-Pierce County Health Department and Ecology
- Local permits, as applicable, from the Cities of Edgewood, Fife, Milton, Puyallup, and Tacoma and Pierce County, including:
    - Shoreline Substantial Development, City of Puyallup
    - Critical Areas Ordinance Consistency approval
    - Noise Variance
    - Building Permit
    - Clearing and Grading Permit

- Street Use Permit/Haul Route Agreement
- Right-of-Way Use Permit

In addition to, and in relation to, the permits and approvals listed above, WSDOT has made environmental commitments for the entire SR 167 Completion Project that Stage 2 design and construction must honor to the extent these commitments are applicable to Stage 2 work. These stem from the project's National Environmental Policy Act (NEPA) Record of Decision in October 2007, the NEPA Re-evaluation completed in December 2018, and updated project information provided to the U.S. Fish and Wildlife Service and the National Marine Fisheries Service for Endangered Species Act compliance as part of the NEPA Re-evaluation process. WSDOT's Commitment Tracking System database is being updated to reflect the additional commitments made in completing the NEPA Re-evaluation in 2018. The Design-Builder shall refer to the Environmental Commitments List (Appendix C in the RFP) when preparing the final design plans for drainage and stream improvements, and in preparing plans for environmental protection during Stage 2 construction including the Temporary Erosion and Sediment Control Plan and Spill Prevention, Control, and Countermeasures Plan.

6.3 Easements

WSDOT has acquired or will acquire all properties for the Stage 2 Project as shown in the Right of Way Plans (Appendix R of the RFP). WSDOT, or the Design-Builder, has acquired or will acquire Right of Way Use Permits from the Cities of Edgewood, Fife, Milton, Edgewood, and Tacoma; Pierce County; and the Puyallup Tribe of Indians, as required.

It is the responsibility of the Design-Builder to ensure that the right-of-way acquisitions and easements are sufficient for performing the work under the Stage 2 Project.

6.4 Additional Reports or Studies

Other reports and studies conducted and prepared in conjunction with this project include:

- Tier I Environmental Impact Statement (EIS); Federal Highway Administration (FHWA) and WSDOT; 1999
- Tier II EIS; FHWA and WSDOT; 2006
- Biological Opinion; NOAA National Marine Fisheries Service (NMFS); 2007
- Biological Opinion; U.S. Fish and Wildlife Service (USFWS); 2007

- ESA Consultation Documents; FHWA, USFWS, NMFS, and WSDOT; 2018 and 2020
- National Environmental Policy Act (NEPA)/State Environmental Policy Act (SEPA) Environmental Re-evaluation; FHWA and WSDOT; 2018
- Stage 1a NEPA Documentation Associated with Design-Builder's Alternative Design and Construction Methods (WSDOT 2020b)
- Stage 1b NEPA Re-Evaluation (WSDOT 2021)
- Stage 2 Mitigation Plan (WSDOT 2022b)
- Stage 1b Wetland and Stream Assessment Report; Herrera (June 2020)
- Wetland and Stream Assessment Report: SR 167 Project – Stage 2 (WSDOT 2022a)
- Stage 2 Groundwater Monitoring, Data Report No. 4; (WSDOT 2022d)
- SR 167/I-5 to SR 509 – New Expressway, Conceptual Hydraulic Report: Stage 1b; (WSDOT 2021).
- Final Hydraulic Report: SR 167 70th Avenue East Vicinity Bridge Replacement Stage 1A, SR 167 MP 1.70 to MP 1.80. PACE (2020).

7. Inspection and Maintenance Summary

The Design-Builder shall be responsible for annual inspections and maintenance of the existing and new stormwater drainage system, as required by the National Pollutant Discharge Elimination System Construction Stormwater General permit, within the maintenance responsibility limits described in the RFP. The Design-Builder shall coordinate the initial inspection with the WSDOT Engineer to determine the condition of the existing stormwater drainage system. At the Project close out, the Design-Builder shall restore all pieces of the stormwater drainage system (including catch basin, BMPs, and storm drain pipes) to the condition determined during the initial inspection. Maintenance of the stormwater drainage system shall include inspection and maintenance activities described in the RFP.

Procedures for maintaining stormwater facilities and systems are included in the RFP, the HRM, the WSDOT Maintenance Manual, WSDOT Environmental Procedures Manual Chapter 790, the Regional Road Maintenance Endangered Species Act Program Guidelines, and Best Management Practices Field Guide for ESA §4 (d) Habitat Protection.

The Design-Builder is responsible for preparing a stormwater BMP maintenance plan for all new or modified BMPs using the BMP maintenance plan template included in the RFP appendices.

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