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East Lake Sammamish Master Plan Trail, South Sammamish Segment A Technical Information Report

Prepared for
King County

July 2014

Prepared by
Parametrix



King County

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Prepared for

King County

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CERTIFICATION

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.



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Approved by Jenny Bailey

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- B Drainage Problems and Complaints
- C Hydrologic and Hydraulic Calculations
- D Operation and Maintenance Requirements
- E Geotechnical Report (CD)

ACRONYMS AND ABBREVIATIONS

| | |
|-------------------|---|
| ADS | Advanced Drainage Systems |
| BNSF | Burlington Northern Santa Fe |
| CARA | Critical Aquifer Recharge Area |
| cfs | cubic feet per second |
| CMP | corrugated metal pipe |
| DO | dissolved oxygen |
| Ecology | Washington State Department of Ecology |
| ELSP | East Lake Sammamish Parkway |
| ELST | East Lake Sammamish Trail |
| GIS | geographic information system |
| HDPE | high density polyethylene |
| 2009 KCSWDM | King County Surface Water Design Manual of 2009 |
| Master Plan Trail | East Lake Sammamish Master Plan Trail |
| MGSFloodV4 | MGSFlood Version 4 |
| NPDES | National Pollutant Discharge Elimination System |
| NRCS | Natural Resources Conservation Service |
| OHWM | ordinary high water mark |
| O&M | operation and maintenance |
| PGIS | pollution-generating impervious surfaces |
| PVC | polyvinyl chloride |
| Q ₁₀₀ | 100-year peak flow rate |
| Sta. | station |
| TDA | threshold discharge area |
| TESC | temporary erosion and sediment control |
| TIR | technical information report |
| TMDL | total maximum daily load |
| NAVD 88 | North American Vertical Datum of 1988 |
| WRIA | Water Resource Inventory Area |

1. PROJECT OVERVIEW

1.1 PROJECT DESCRIPTION

The East Lake Sammamish Master Plan Trail (Master Plan Trail) Project begins at Gilman Boulevard in Issaquah and ends 200 feet south of Bear Creek in Redmond. The East Lake Sammamish Trail (ELST) is located on the alignment of the former Burlington Northern Santa Fe (BNSF) railroad that began operations in 1855 and ceased operations along this corridor in 1996. King County acquired the rail-banked corridor in 1998 and completed construction of an interim trail in 2006. The ELST corridor travels along the east shore of Lake Sammamish. Proposed improvements will be constructed in multiple phases, which correspond with the three jurisdictions the trail crosses—Redmond, Sammamish, and Issaquah.

The Redmond Section of the trail was constructed in 2011 and the Issaquah Section was constructed in 2013. The North Sammamish Section is scheduled for construction in 2014. The entire 4.8-mile South Sammamish Section of the ELST will be separated into two construction phases: Segments A and B. Segment A is approximately 1.25 miles long from the city of Issaquah boundary at the south end to SE 33rd Street at the north terminus. Segment B is approximately 3.5 miles long from SE 33rd Street at the south end to Kokomo Drive at the north terminus.

This technical information report (TIR) provides stormwater design documentation for the South Sammamish Segment A phase of the Master Plan Trail project. The TIR Worksheet (Figure 1-1) provides a general overview of the components of this report. Appendices A through E provide geotechnical, drainage, hydrologic, hydraulic, stormwater pollution, and permitting information to supplement the discussions in this report.

The Master Plan Trail – South Sammamish Segment A project will redevelop approximately 1.25 miles of the trail from the Issaquah city limits at the south end to SE 33rd Street at the north end. The project includes widening and paving the existing gravel trail, conducting safety and accessibility improvements, and providing storm drainage improvements. Trail improvements include increasing the width of the existing 8- to 12-foot-wide gravel trail to 12 feet of asphalt with 2-foot-wide gravel shoulders on both sides. This work will disturb approximately 6.6 acres. A site location map is provided as Figure 1-2.

The Master Plan Trail horizontal and vertical alignment has been adjusted, and walls have been designed to minimize impacts on streams, wetlands, and stormwater ditches, as well as to preserve wetland and stream habitat and functions. Table 1-1 provides a land use comparison of the existing and net new impervious area for each threshold discharge area (TDA) within the project site.

1.2 EXISTING SITE CONDITIONS

The ELST is an 8- to 12-foot-wide gravel trail located on a historical railroad prism that generally runs along the east side of Lake Sammamish. Lake Sammamish is located within 0.25 miles downstream of the trail, throughout the South Sammamish Segment A. The Segment A project corridor crosses the Monohon Subbasin of the larger East Lake Sammamish Drainage Basin (Figure 1-3). East Lake Sammamish Parkway (ELSP) parallels the trail to the east for most of the trail length.

Table 1-1. Site Impervious Surface Comparison

| TDA | Receiving Water | Area (acres) | | |
|--------------|--|--------------------|---------------------|--------------------|
| | | Trail Right-of-Way | Existing Impervious | Net New Impervious |
| 1 | Unnamed Stream 1 to Lake Sammamish | 1.18 | 0.49 | 0.21 |
| 2 | Lake Sammamish | 1.29 | 0.44 | 0.24 |
| 3 | Lake Sammamish | 1.21 | 0.33 | 0.20 |
| 4 | Lake Sammamish (sheet flow) | 1.02 | 0.15 | 0.17 |
| 5 | Stream #0163 South Fork and North Fork | 0.57 | 0.12 | 0.09 |
| 6 | Lake Sammamish (sheet flow) | 0.59 | 0.12 | 0.09 |
| 7 | Lake Sammamish (sheet flow) | 1.19 | 0.37 | 0.19 |
| 8 | Unnamed Stream #3 | 2.81 | 0.83 | 0.45 |
| 9 | Lake Sammamish | 6.94 | 0.89 | 0.81 |
| Total | | 16.80 | 3.74 | 2.45 |

Trail runoff sheet flows to adjacent streams, ditches, wetlands, or private property. Existing ditches and wetlands convey runoff to the streams, which flow from northeast to southwest beneath the trail to Lake Sammamish.

Project TDAs are delineated in three ways: areas that runoff directly to the lake via overland flow or manmade conveyance, areas that runoff directly to streams that cross the trail and flow into Lake Sammamish, and areas that runoff to adjacent private property landscaping. Nine TDAs were identified within the project and are summarized by impervious land use and receiving water in Table 1-1.

Tributaries within the Monohon Subbasin in the vicinity of the project are shown on Figure 1-3. Five streams are labeled on Figure 1-3: Stream 0163 South Fork and North Fork, and Unnamed Streams 1, 2, and 3. Four of the streams (Stream 0163 South Fork and North Fork, Unnamed Streams 1 and 3) flow from northeast to southwest through the trail corridor and cross beneath the trail prior to flowing to Lake Sammamish. Unnamed Stream 2 flows into Unnamed Stream 1 along the north edge of the trail prior to the Unnamed Stream 1 crossing beneath the trail near station (Sta.) 218+45. Stream 0163 has two crossings at the trail, but the north and south forks converge within 0.25 miles downstream of the trail, prior to outfall at Lake Sammamish. Therefore, although the project has two culvert crossings for Stream 0163, this area is considered to be one TDA. Further discussion about TDAs is provided in Chapter 3 Offsite Analysis. Lastly, Figure 1-3 depicts one stream in TDA 9 that is listed on the King County stream data layers as an unnamed stream; however, no stream channel was identified during the field investigations, as described in Chapter 3 Offsite Analysis.

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

PART 1 PROJECT OWNER AND PROJECT ENGINEER

Project Owner King County Parks
 Phone 206-263-7281
 Address 201 S. Jackson, 7th Floor
Seattle, WA 98104
 Project Engineer Craig Buitrago, PE
 Company Parametrix
 Phone 206-394-3700

PART 2 PROJECT LOCATION AND DESCRIPTION

Project Name East Lake Sammamish
 Master Plan Trail, South Sammamish Segment A -
 Issaquah/Sammamish City Limit to SE 33rd Street
 DPER Permit # _____
 Location Township 24
 Range 06
 Section 08, 17
 Site Address N/A, King County
right-of-way

PART 3 TYPE OF PERMIT APPLICATION

- Landuse Services
- Subdivision/Short Subd. / UPD
- Building Services
- M/F / Commercial / SFR
- Clearing and Grading
- Right-of-Way Use
- Other _____

PART 4 OTHER REVIEWS AND PERMITS

- DFW HPA
- COE 404
- DOE Dam Safety
- FEMA Floodplain
- COE Wetlands
- Other _____
- Shoreline Mgmt
- Structural
- Rockery/Vault/
- ESA Section 7

PART 5 PLAN AND REPORT INFORMATION

Technical Information Report

Type of Drainage Review: Full/ Targeted
 Large Site
 Date (include revision dates): _____
 Date of Final _____

Site Improvement Plan (Engr. Plans)

Type: Full/ Targeted
 Large Site
 Date (include revision dates): _____
 Date of Final _____

PART 6 ADJUSTMENT APPROVALS

Type: Standard Complex Preapplication Experimental Blanket

Description: (include conditions in TIR Section 2)

The project will apply for a drainage adjustment to Core Requirement 2, which requires the project to maintain natural discharge locations from a project site. The adjustment is necessary to combine the existing direct discharge outfall locations to one new direct discharge outfall location.

Date of Approval: _____

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

PART 7 MONITORING REQUIREMENTS

| | | |
|---------------------|---|--------------------------|
| Monitoring Required | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | Describe |
| Start Date: | _____ | |
| Completion Date: | _____ | |

PART 8 SITE COMMUNITY AND DRAINAGE BASIN

| | |
|----------------------------|---|
| Community Plan: | _____ |
| Special District Overlays: | _____ |
| Drainage Basin: | East Lake Sammamish, Monohon 2009 King County Surface Water Design Manual and 2011 City of Sammamish |
| Stormwater Requirements: | Surface Water Design Manual Addendum |

PART 9 ONSITE AND ADJACENT SENSITIVE AREAS

| | | | | | |
|-------------------------------------|-------------------|---|-------------------------------------|--------------------|-------|
| <input checked="" type="checkbox"/> | River/Stream | Unnamed Stream #1, Unnamed Stream #2, Stream #0163 SF, Stream #0163 NF, Unnamed Stream #3 | <input checked="" type="checkbox"/> | Steep Slope | _____ |
| <input checked="" type="checkbox"/> | Lake | Lake Sammamish | <input checked="" type="checkbox"/> | Erosion Hazard | _____ |
| <input checked="" type="checkbox"/> | Wetlands | 3E, 12A, 13A, 14A, 14C | <input checked="" type="checkbox"/> | Landslide Hazard | _____ |
| <input type="checkbox"/> | Closed Depression | _____ | <input type="checkbox"/> | Coal Mine Hazard | _____ |
| <input checked="" type="checkbox"/> | Floodplain | Lake Sammamish | <input checked="" type="checkbox"/> | Seismic Hazard | _____ |
| <input type="checkbox"/> | Other | _____ | <input type="checkbox"/> | Habitat Protection | _____ |

PART 10 SOILS

| Soil Type | Slopes | Erosion Potential |
|-----------|----------|--------------------|
| EvC | 5 - 15% | moderate |
| EvD | 15 - 30% | severe |
| KpB | <2 - 8% | slight to moderate |
| KpD | 15 - 30% | severe |
| RdC | 5 - 15% | moderate |
| Su | 5 - 15% | moderate |

High Groundwater Table (within 5 feet) Sole Source Aquifer
 Other _____ Seeps/Springs
 Additional Sheets Attached

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

PART 11 DRAINAGE DESIGN LIMITATIONS

| REFERENCE | LIMITATION / SITE CONSTRAINT |
|---|-------------------------------|
| <input checked="" type="checkbox"/> Core 2 – Offsite Analysis | Private properties downstream |
| <input checked="" type="checkbox"/> Sensitive/ Critical Areas | Wetland Impact Mitigation |
| <input type="checkbox"/> SEPA | |
| <input type="checkbox"/> Other | |
| <input type="checkbox"/> | |
| <input type="checkbox"/> Additional Sheets Attached | |

PART 12 TIR SUMMARY SHEET (PROVIDE ONE TIR SUMMARY SHEET PER THRESHOLD DISCHARGE AREA)

Threshold Discharge Area

(name or description): TDA 1: Station 216+50 to 222+50

Core Requirements (all 8 apply)

Discharge at Natural Location Number of Natural Discharge Locations: 1

Offsite Analysis: Level: 1 2 3 Dated: 4/16/2013, 2/24/2014, 5/2/2014, and 6/20/2014

Flow Control (incl. facility summary sheet) Level: 1 2 3 or Exemption Number Q₁₀₀ increase < 0.1 cfs
Small Site BMPs N/A

Conveyance System Spill containment located at: N/A

Erosion and Sediment Control ESC Site Supervisor: Craig Buitrago
Contact Phone: 206-394-3700
After Hours Phone: 206-394-3700

Maintenance and Operation Responsibility: Private Public
If Private, Maintenance Log Required: Yes No

Financial Guarantees and Liability Provided: Yes No

Water Quality (include facility summary sheet) Type: Basic Sens. Lake Enhanced Basic Bog
Or Exemption No. 1, Surface Area Exemption
Landscape Management Plan: Yes No

Special Requirements (as applicable)

Area Specific Drainage Requirements Type: CDA SDO MDP BP Shared Fac. None
Name:

Floodplain/Floodway Delineation Type: Major Minor Exemption None
100- year Base Flood Elevation (or range): 36.57
Datum: NAVD 88

Flood Protection Facilities Describe: N/A

Source Control (comm./ industrial landuse) Describe: N/A
Describe any structural controls: N/A

Oil Control High-use Site: Yes No
Treatment BMP: N/A
Maintenance Agreement: Yes No
With whom? N/A

Other Drainage Structures

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Describe:

Threshold Discharge Area

(name or description): TDA 2: Station 222+50 to 229+15

Core Requirements (all 8 apply)

Discharge at Natural Location Number of Natural Discharge Locations: 1

Offsite Analysis: Level: 1 2 3 Dated: 4/16/2013, 2/24/2014, 5/2/2014, and 6/20/2014

Flow Control (incl. facility summary sheet) Level: 1 2 3 or Exemption Number Direct Discharge
Small Site BMPs N/A

Conveyance System Spill containment located at: N/A

Erosion and Sediment Control ESC Site Supervisor: Craig Buitrago
Contact Phone: 206-394-3700
After Hours Phone: 206-394-3700

Maintenance and Operation Responsibility: Private Public
If Private, Maintenance Log Required: Yes No

Financial Guarantees and Liability Provided: Yes No

Water Quality (include facility summary sheet) Type: Basic Sens. Lake Enhanced Basic Bog
Or Exemption No. 1, Surface Area Exemption
Landscape Management Plan: Yes No

Special Requirements (as applicable)

Area Specific Drainage Requirements Type: CDA SDO MDP BP Shared Fac. None
Name:

Floodplain/Floodway Delineation Type: Major Minor Exemption None
100- year Base Flood Elevation (or range): 36.57
Datum: NAVD 88

Flood Protection Facilities Describe: N/A

Source Control (comm./ industrial landuse) Describe: N/A
Describe any structural controls: N/A

Oil Control High-use Site: Yes No
Treatment BMP: N/A
Maintenance Agreement: Yes No
With whom? N/A

Other Drainage Structures

Describe: A new conveyance system consisting of six catch basins and eight storm drain pipes is proposed to combine runoff from TDA 2 and TDA 3 and the project discharge location will be located at the existing TDA 3 outfall location.

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

| | |
|--|---|
| Threshold Discharge Area (name or description): | TDA 3: Station 229+15 to 234+50 |
| Core Requirements (all 8 apply) | |
| Discharge at Natural Location | Number of Natural Discharge Locations: 1 |
| Offsite Analysis: | Level: <input checked="" type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3 Dated: 4/16/2013, 2/24/2014, 5/2/2014, and 6/20/2014 |
| Flow Control (incl. facility summary sheet) | Level: <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 or Exemption Number <u>Direct Discharge</u> Small Site BMPs N/A |
| Conveyance System | Spill containment located at: N/A |
| Erosion and Sediment Control | ESC Site Supervisor: Craig Buitrago Contact Phone: 206-394-3700 After Hours Phone: 206-394-3700 |
| Maintenance and Operation | Responsibility: <input type="checkbox"/> Private <input checked="" type="checkbox"/> Public If Private, Maintenance Log Required: <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Financial Guarantees and Liability | Provided: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Water Quality (include facility summary sheet) | Type: <input type="checkbox"/> Basic <input type="checkbox"/> Sens. Lake <input type="checkbox"/> Enhanced Basic <input type="checkbox"/> Bog Or Exemption No. 1, Surface Area Exemption Landscape Management Plan: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Special Requirements (as applicable) | |
| Area Specific Drainage Requirements | Type: <input type="checkbox"/> CDA <input type="checkbox"/> SDO <input type="checkbox"/> MDP <input type="checkbox"/> BP <input type="checkbox"/> Shared Fac. <input checked="" type="checkbox"/> None Name: |
| Floodplain/Floodway Delineation | Type: <input type="checkbox"/> Major <input type="checkbox"/> Minor <input checked="" type="checkbox"/> Exemption <input type="checkbox"/> None 100- year Base Flood Elevation (or range): 36.57 Datum: NAVD 88 |
| Flood Protection Facilities | Describe: N/A |
| Source Control (comm./ industrial landuse) | Describe: N/A Describe any structural controls: N/A |
| Oil Control | High-use Site: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Treatment BMP: N/A Maintenance Agreement: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No With whom? N/A |
| Other Drainage Structures | |
| Describe: A new conveyance system consisting of six catch basins and eight storm drain pipes is proposed to combine runoff from TDA 2 and TDA 3 and the project discharge location will be located at the existing TDA 3 outfall location. | |

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

| | |
|---|---|
| Threshold Discharge Area (name or description): | TDA 4: Station 234+50 to 239+00 |
| Core Requirements (all 8 apply) | |
| Discharge at Natural Location | Number of Natural Discharge Locations: 1 |
| Offsite Analysis: | Level: <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 Dated: 4/16/2013, 2/24/2014, 5/2/2014, and 6/20/2014 |
| Flow Control (incl. facility summary sheet) | Level: <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 or Exemption Number <u>Q₁₀₀ increase < 0.1 cfs</u> Small Site BMPs N/A |
| Conveyance System | Spill containment located at: N/A |
| Erosion and Sediment Control | ESC Site Supervisor: Craig Buitrago Contact Phone: 206-394-3700 After Hours Phone: 206-394-3700 |
| Maintenance and Operation | Responsibility: <input type="checkbox"/> Private <input checked="" type="checkbox"/> Public If Private, Maintenance Log Required: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Financial Guarantees and Liability | Provided: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Water Quality (include facility summary sheet) | Type: <input type="checkbox"/> Basic <input type="checkbox"/> Sens. Lake <input type="checkbox"/> Enhanced Basic <input type="checkbox"/> Bog Or Exemption No. 1, Surface Area Exemption Landscape Management Plan: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Special Requirements (as applicable) | |
| Area Specific Drainage Requirements | Type: <input type="checkbox"/> CDA <input type="checkbox"/> SDO <input type="checkbox"/> MDP <input type="checkbox"/> BP <input type="checkbox"/> Shared Fac. <input checked="" type="checkbox"/> None Name: |
| Floodplain/Floodway Delineation | Type: <input type="checkbox"/> Major <input type="checkbox"/> Minor <input checked="" type="checkbox"/> Exemption <input type="checkbox"/> None 100- year Base Flood Elevation (or range): 36.57 Datum: NAVD 88 |
| Flood Protection Facilities | Describe: N/A |
| Source Control (comm./ industrial landuse) | Describe: N/A Describe any structural controls: N/A |
| Oil Control | High-use Site: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Treatment BMP: N/A Maintenance Agreement: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No With whom? N/A |
| Other Drainage Structures | |
| Describe: Optional Infiltration Trench | |

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

| | |
|---|---|
| Threshold Discharge Area (name or description): | TDA 5: Station 239+00 to 241+50 |
| Core Requirements (all 8 apply) | |
| Discharge at Natural Location | Number of Natural Discharge Locations: 1 |
| Offsite Analysis: | Level: <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 Dated: 4/16/2013, 2/24/2014, 5/2/2014, and 6/20/2014 |
| Flow Control (incl. facility summary sheet) | Level: <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 or Exemption Number <u>Q₁₀₀ increase < 0.1 cfs</u> Small Site BMPs N/A |
| Conveyance System | Spill containment located at: N/A |
| Erosion and Sediment Control | ESC Site Supervisor: Craig Buitrago Contact Phone: 206-394-3700 After Hours Phone: 206-394-3700 |
| Maintenance and Operation | Responsibility: <input type="checkbox"/> Private <input checked="" type="checkbox"/> Public If Private, Maintenance Log Required: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Financial Guarantees and Liability | Provided: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Water Quality (include facility summary sheet) | Type: <input type="checkbox"/> Basic <input type="checkbox"/> Sens. Lake <input type="checkbox"/> Enhanced Basic <input type="checkbox"/> Bog Or Exemption No. 1, Surface Area Exemption Landscape Management Plan: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Special Requirements (as applicable) | |
| Area Specific Drainage Requirements | Type: <input type="checkbox"/> CDA <input type="checkbox"/> SDO <input type="checkbox"/> MDP <input type="checkbox"/> BP <input type="checkbox"/> Shared Fac. <input checked="" type="checkbox"/> None Name: |
| Floodplain/Floodway Delineation | Type: <input type="checkbox"/> Major <input type="checkbox"/> Minor <input type="checkbox"/> Exemption <input checked="" type="checkbox"/> None 100- year Base Flood Elevation (or range): Datum: |
| Flood Protection Facilities | Describe: N/A |
| Source Control (comm./ industrial landuse) | Describe: N/A Describe any structural controls: N/A |
| Oil Control | High-use Site: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Treatment BMP: N/A Maintenance Agreement: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No With whom? N/A |
| Other Drainage Structures | |
| Describe: | |

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

| | |
|---|---|
| Threshold Discharge Area (name or description): | TDA 6: 241+50 to 244+05 |
| Core Requirements (all 8 apply) | |
| Discharge at Natural Location | Number of Natural Discharge Locations: 1 |
| Offsite Analysis: | Level: <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 Dated: 4/16/2013, 2/24/2014, 5/2/2014, and 6/20/2014 |
| Flow Control (incl. facility summary sheet) | Level: <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 or Exemption Number <u>Q₁₀₀ increase < 0.1 cfs</u> Small Site BMPs N/A |
| Conveyance System | Spill containment located at: N/A |
| Erosion and Sediment Control | ESC Site Supervisor: Craig Buitrago Contact Phone: 206-394-3700 After Hours Phone: 206-394-3700 |
| Maintenance and Operation | Responsibility: <input type="checkbox"/> Private <input checked="" type="checkbox"/> Public If Private, Maintenance Log Required: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Financial Guarantees and Liability | Provided: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Water Quality (include facility summary sheet) | Type: <input type="checkbox"/> Basic <input type="checkbox"/> Sens. Lake <input type="checkbox"/> Enhanced Basic <input type="checkbox"/> Bog Or Exemption No. 1, Surface Area Exemption Landscape Management Plan: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Special Requirements (as applicable) | |
| Area Specific Drainage Requirements | Type: <input type="checkbox"/> CDA <input type="checkbox"/> SDO <input type="checkbox"/> MDP <input type="checkbox"/> BP <input type="checkbox"/> Shared Fac. <input checked="" type="checkbox"/> None Name: |
| Floodplain/Floodway Delineation | Type: <input type="checkbox"/> Major <input type="checkbox"/> Minor <input type="checkbox"/> Exemption <input checked="" type="checkbox"/> None 100- year Base Flood Elevation (or range): Datum: |
| Flood Protection Facilities | Describe: N/A |
| Source Control (comm./ industrial landuse) | Describe: N/A Describe any structural controls: N/A |
| Oil Control | High-use Site: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Treatment BMP: N/A Maintenance Agreement: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No With whom? N/A |
| Other Drainage Structures | |
| Describe: | |

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

| | |
|---|---|
| Threshold Discharge Area | |
| (name or description): | TDA 7: Station 244+05 to 249+25 |
| Core Requirements (all 8 apply) | |
| Discharge at Natural Location | Number of Natural Discharge Locations: 1 |
| Offsite Analysis: | Level: <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 Dated: 4/16/2013, 2/24/2014, 5/2/2014, and 6/20/2014 |
| Flow Control (incl. facility summary sheet) | Level: <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 or Exemption Number <u>Q₁₀₀ increase < 0.1 cfs</u> Small Site BMPs N/A |
| Conveyance System | Spill containment located at: N/A |
| Erosion and Sediment Control | ESC Site Supervisor: Craig Buitrago Contact Phone 206-394-3700 After Hours Phone: 206-394-3700 |
| Maintenance and Operation | Responsibility: <input type="checkbox"/> Private <input checked="" type="checkbox"/> Public If Private, Maintenance Log Required: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Financial Guarantees and Liability | Provided: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Water Quality (include facility summary sheet) | Type: <input type="checkbox"/> Basic <input type="checkbox"/> Sens. Lake <input type="checkbox"/> Enhanced Basic <input type="checkbox"/> Bog Or Exemption No. 1, Surface Area Exemption Landscape Management Plan: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Special Requirements (as applicable) | |
| Area Specific Drainage Requirements | Type: <input type="checkbox"/> CDA <input type="checkbox"/> SDO <input type="checkbox"/> MDP <input type="checkbox"/> BP <input type="checkbox"/> Shared Fac. <input checked="" type="checkbox"/> None Name: |
| Floodplain/Floodway Delineation | Type: <input type="checkbox"/> Major <input type="checkbox"/> Minor <input type="checkbox"/> Exemption <input checked="" type="checkbox"/> None 100- year Base Flood Elevation (or range): Datum: |
| Flood Protection Facilities | Describe: N/A |
| Source Control (comm./ industrial landuse) | Describe: N/A Describe any structural controls: N/A |
| Oil Control | High-use Site: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Treatment BMP: N/A Maintenance Agreement: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No With whom? N/A |
| Other Drainage Structures | |
| Describe: Optional Infiltration Trench | |

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET**Threshold Discharge Area**

(name or description): TDA 8: Station 249+25 to 261+50

Core Requirements (all 8 apply)

Discharge at Natural Location Number of Natural Discharge Locations: 1

Offsite Analysis: Level: 1 2 3 Dated: 4/16/2013, 2/24/2014, 5/2/2014, and 6/20/2014Flow Control (incl. facility summary sheet) Level: 1 2 3 or Exemption Number
Small Site BMPs N/A

Conveyance System Spill containment located at: N/A

Erosion and Sediment Control ESC Site Supervisor: Craig Buitrago
Contact Phone: 206-394-3700
After Hours Phone: 206-394-3700Maintenance and Operation Responsibility: Private Public
If Private, Maintenance Log Required: Yes NoFinancial Guarantees and Liability Provided: Yes NoWater Quality (include facility summary sheet) Type: Basic Sens. Lake Enhanced Basic Bog
Or Exemption No. 1, Surface Area Exemption
Landscape Management Plan: Yes No**Special Requirements (as applicable)**Area Specific Drainage Requirements Type: CDA SDO MDP BP Shared Fac. None
Name:Floodplain/Floodway Delineation Type: Major Minor Exemption None
100- year Base Flood Elevation (or range):
Datum:

Flood Protection Facilities Describe: N/A

Source Control (comm./ industrial landuse) Describe: N/A
Describe any structural controls: N/AOil Control High-use Site: Yes No
Treatment BMP: N/A
Maintenance Agreement: Yes No
With whom? N/A**Other Drainage Structures**

Describe: 2-ft wide by 2-ft deep infiltration trenches will be installed in the gravel shoulder of the trail. The infiltration trenches will provide full infiltration to satisfy the flow control requirement. Infiltration trench locations and details provided on plans sheets provided in Appendix A and MGSFlood performance calculation provided in Appendix C.

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

| | |
|--|---|
| Threshold Discharge Area | |
| (name or description): | TDA 9: Station 261+50 to 283+02 |
| Core Requirements (all 8 apply) | |
| Discharge at Natural Location | Number of Natural Discharge Locations: 1 |
| Offsite Analysis: | Level: <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 Dated: 4/16/2013, 2/24/2014, 5/2/2014, and 6/20/2014 |
| Flow Control (incl. facility summary sheet) | Level: <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3 or Exemption Number Small Site BMPs N/A |
| Conveyance System | Spill containment located at: N/A |
| Erosion and Sediment Control | ESC Site Supervisor: Craig Buitrago Contact Phone: 206-394-3700 After Hours Phone: 206-394-3700 |
| Maintenance and Operation | Responsibility: <input type="checkbox"/> Private <input checked="" type="checkbox"/> Public If Private, Maintenance Log Required: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Financial Guarantees and Liability | Provided: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| Water Quality (include facility summary sheet) | Type: <input type="checkbox"/> Basic <input type="checkbox"/> Sens. Lake <input type="checkbox"/> Enhanced Basic <input type="checkbox"/> Bog Or Exemption No. 1, Surface Area Exemption Landscape Management Plan: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| Special Requirements (as applicable) | |
| Area Specific Drainage Requirements | Type: <input type="checkbox"/> CDA <input type="checkbox"/> SDO <input type="checkbox"/> MDP <input type="checkbox"/> BP <input type="checkbox"/> Shared Fac. <input checked="" type="checkbox"/> None Name: |
| Floodplain/Floodway Delineation | Type: <input type="checkbox"/> Major <input type="checkbox"/> Minor <input type="checkbox"/> Exemption <input checked="" type="checkbox"/> None 100- year Base Flood Elevation (or range): Datum: |
| Flood Protection Facilities | Describe: N/A |
| Source Control (comm./ industrial landuse) | Describe: N/A Describe any structural controls: N/A |
| Oil Control | High-use Site: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Treatment BMP: N/A Maintenance Agreement: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No With whom? N/A |
| Other Drainage Structures | |
| Describe: 2-ft wide by 2-ft deep infiltration trenches will be installed in the gravel shoulder of the trail and on the back (southeast) side of the proposed sidewalk at SE 33 rd Street. The infiltration trenches will provide full infiltration to satisfy the flow control requirement. Infiltration trench locations and details provided on plans sheets provided in Appendix A and MGSFlood performance calculation provided in Appendix C. | |

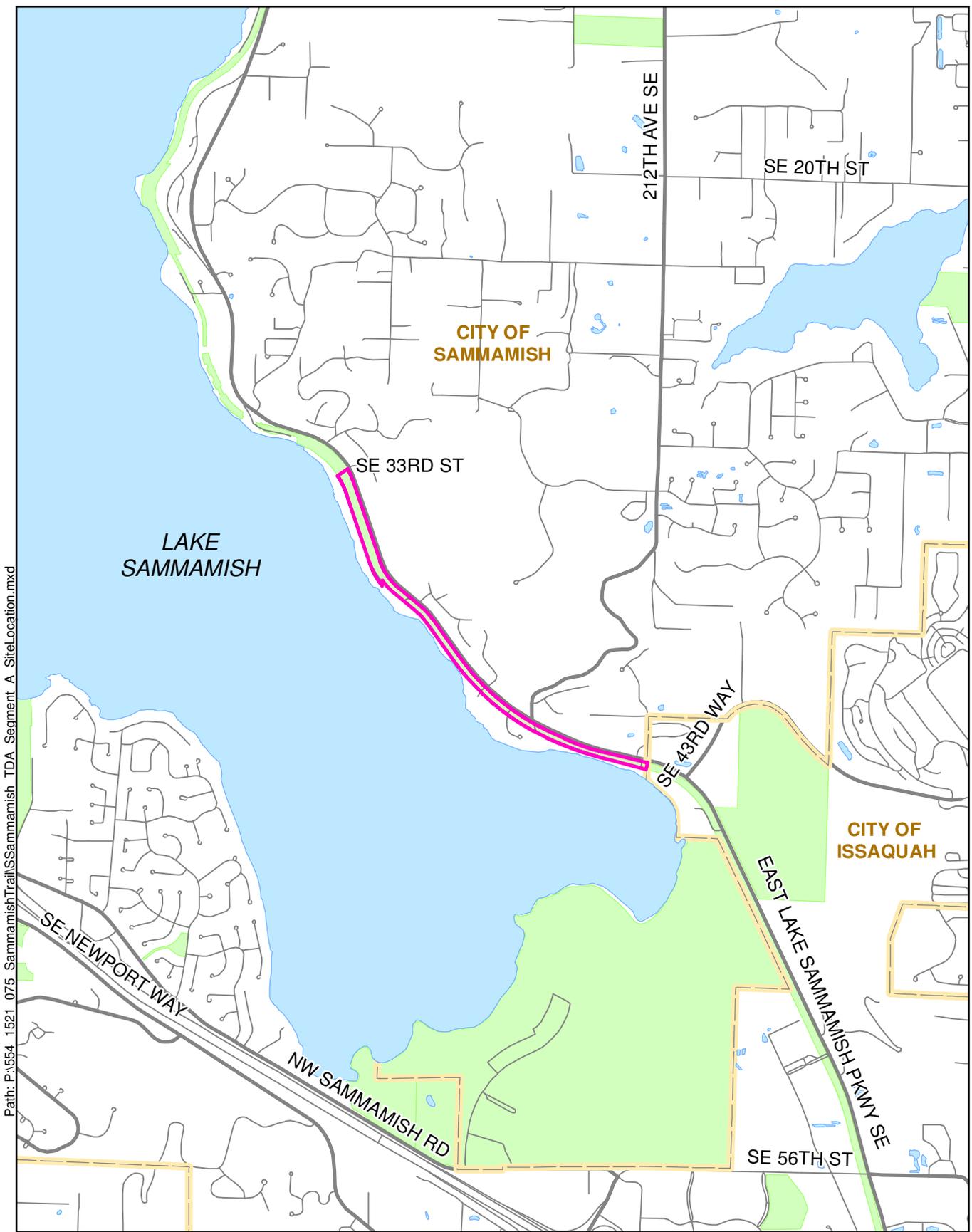
TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

| PART 13 EROSION AND SEDIMENT CONTROL REQUIREMENTS | |
|--|---|
| <p style="text-align: center;">MINIMUM ESC REQUIREMENTS DURING CONSTRUCTION</p> <input checked="" type="checkbox"/> Clearing Limits <input checked="" type="checkbox"/> Cover Measures <input checked="" type="checkbox"/> Perimeter Protection <input checked="" type="checkbox"/> Traffic Area Stabilization <input checked="" type="checkbox"/> Sediment Retention <input type="checkbox"/> Surface Water Collection <input checked="" type="checkbox"/> Dewatering Control <input checked="" type="checkbox"/> Dust Control <input type="checkbox"/> Flow Control | <p style="text-align: center;">MINIMUM ESC REQUIREMENTS AFTER CONSTRUCTION</p> <input checked="" type="checkbox"/> Stabilize Exposed Surfaces <input checked="" type="checkbox"/> Remove and Restore Temporary ESC Facilities <input checked="" type="checkbox"/> Clean and Remove All Silt and Debris, Ensure Operation of Permanent Facilities <input checked="" type="checkbox"/> Flag Limits of SAO and open space preservation areas <input type="checkbox"/> Other |

| PART 14 STORMWATER FACILITY DESCRIPTIONS (NOTE: INCLUDE FACILITY SUMMARY AND SKETCH) | | | |
|--|-----------------------|--|------------------|
| Flow Control | Type/Description | Water Quality | Type/Description |
| <input type="checkbox"/> Detention | _____ | <input type="checkbox"/> Biofiltration | _____ |
| <input checked="" type="checkbox"/> Infiltration | Infiltration Trenches | <input type="checkbox"/> Wetpool | _____ |
| <input type="checkbox"/> Regional Facility | _____ | <input type="checkbox"/> Media Filtration | _____ |
| <input type="checkbox"/> Shared Facility | _____ | <input type="checkbox"/> Oil Control | _____ |
| <input type="checkbox"/> Flow Control BMPs | _____ | <input type="checkbox"/> Spill Control | _____ |
| <input type="checkbox"/> Other | _____ | <input type="checkbox"/> Flow Control BMPs | _____ |
| | | <input type="checkbox"/> Other | _____ |

| PART 15 EASEMENTS/TRACTS | PART 16 STRUCTURAL ANALYSIS |
|--|--|
| <input checked="" type="checkbox"/> Drainage Easement <input type="checkbox"/> Covenant <input type="checkbox"/> Native Growth Protection Covenant <input type="checkbox"/> Tract <input type="checkbox"/> Other | <input type="checkbox"/> Cast in Place Vault <input checked="" type="checkbox"/> Retaining Wall <input type="checkbox"/> Rockery > 4' High <input type="checkbox"/> Structural on Steep Slope <input type="checkbox"/> Other |

| PART 17 EASEMENTS/TRACTS |
|--|
| <p>I, or a civil engineer under my supervision, have visited the site. Actual site conditions as observed were incorporated into this worksheet and the attached Technical information Report. To the best of my knowledge the information provided here is accurate.</p> <div style="text-align: center; margin-top: 20px;">  7/30/2014 </div> <div style="text-align: center; margin-top: 5px;"> Signed/Date </div> |

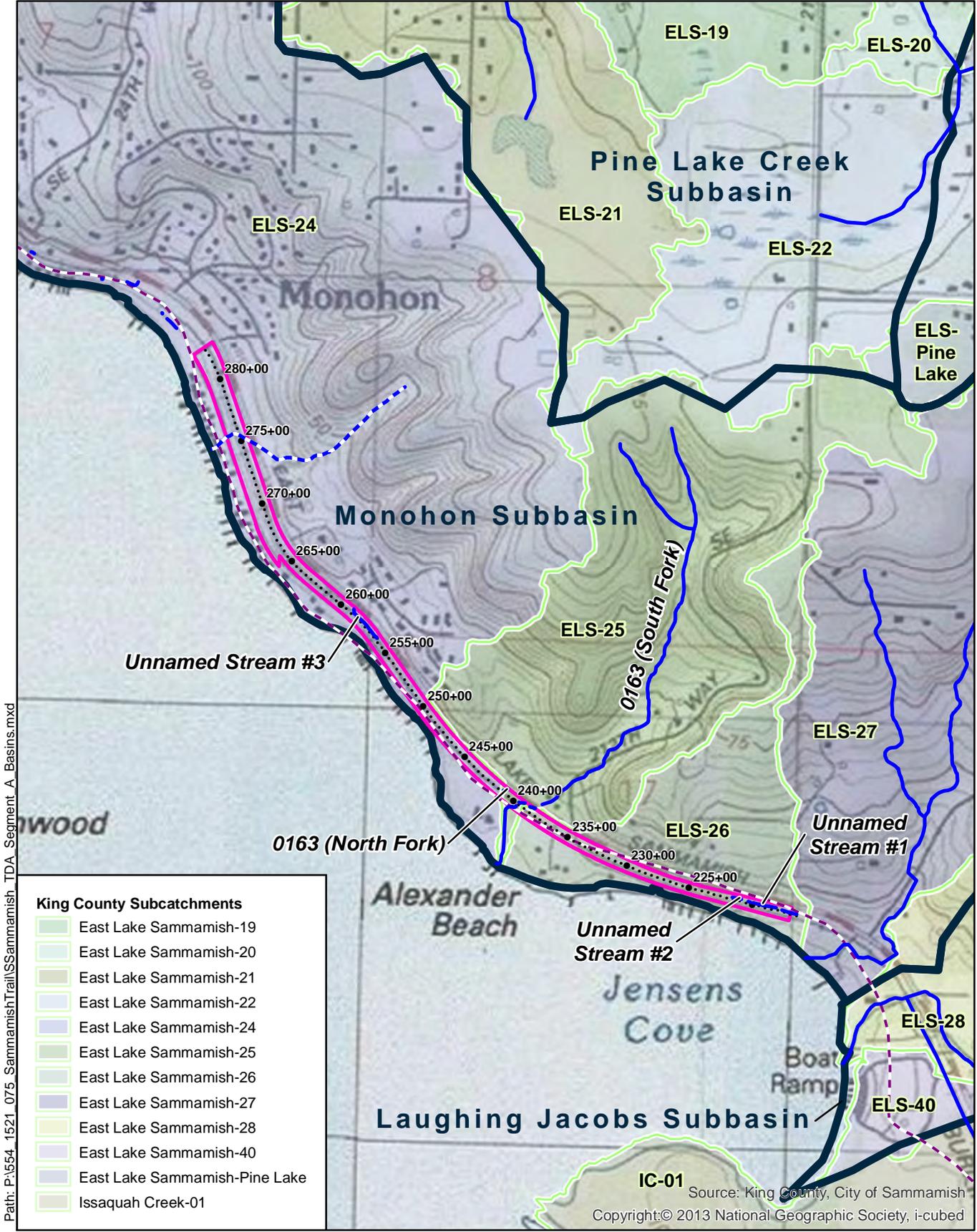


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Parametrix

 Project Location

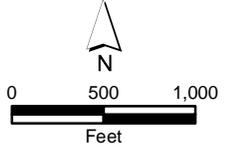
Figure 1-2
Site Location Map
East Lake Sammamish Trail
South Sammamish - Segment A



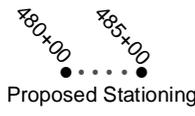
Path: P:\554_1521_075_SammamishTrail\Sammamish_TDA_Segment_A_Basins.mxd

Source: King County, City of Sammamish
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Parametrix



- ▭ South Sammamish Segment A Project Location
- Stream Crossing Field-verified by Parametrix
- - - Stream Crossing Not Found within Trail Corridor
- - - 100-year Floodplain Boundary
- Drainage Subbasin Boundary



**Figure 1-3
 Drainage Basins,
 Subbasins and
 Site Characteristics**

1.3 PROJECT AREA SOILS

Natural Resources Conservation Service (NRCS) soil maps were used to show the existing soils within the project corridor. Figure 1-4 depicts the soils by type and hydrologic group throughout the project corridor. The corridor consists of a mix of all soil types with the primary soil groups consisting of Hydrologic Groups A and B, with lesser areas of Groups C and D.

City of Sammamish Environmentally Sensitive Areas Geologic Hazards map was used to identify the erosion and landslide hazard areas within the project corridor and upland areas. The erosion hazard areas occur when underlying soils types like EvD and KpD are combined with slopes steeper than 15 percent. Landslide hazard areas are typically susceptible to landslide because of a combination of factors including: bedrock, soil, slope gradient, slope aspect, geologic structure, groundwater, or other factors. Figure 1-5 depicts the geologic hazards in the project vicinity, and there are no erosion or landslide areas delineated within the project corridor.

A geotechnical survey was completed by Icicle Creek Engineers, Inc. and their draft report dated December 11, 2013 is provided in Appendix E on a compact disc. Parametrix engineers used the information in the geotechnical report to design walls and infiltration facilities. Soil boring tests were performed throughout the project site at locations where infiltration trenches were desirable. The test results found that infiltration is feasible, and the infiltration rates are high because of the relatively gravelly sandy soils. Areas where infiltration trenches will be used for flow control are discussed in Section 4.4.

The NRCS soil types were categorized into hydrologic soil groups using the guidance provided in Table 3.2.2.B in the 2009 King County Surface Water Design Manual (2009 KCSWDM; King County 2009) (Table 1-2).

Table 1-2. Project Area Soils

| Soil Type | Soil Name | Hydrologic Group |
|-----------|-----------------------------|------------------|
| Ev | Everett gravelly sandy loam | A/B |
| Kp | Kitsap silt loam | C |
| Rd | Ragnar-Indianola | B |
| Su | Sultan silt loam | C |

1.4 GROUNDWATER LEVELS

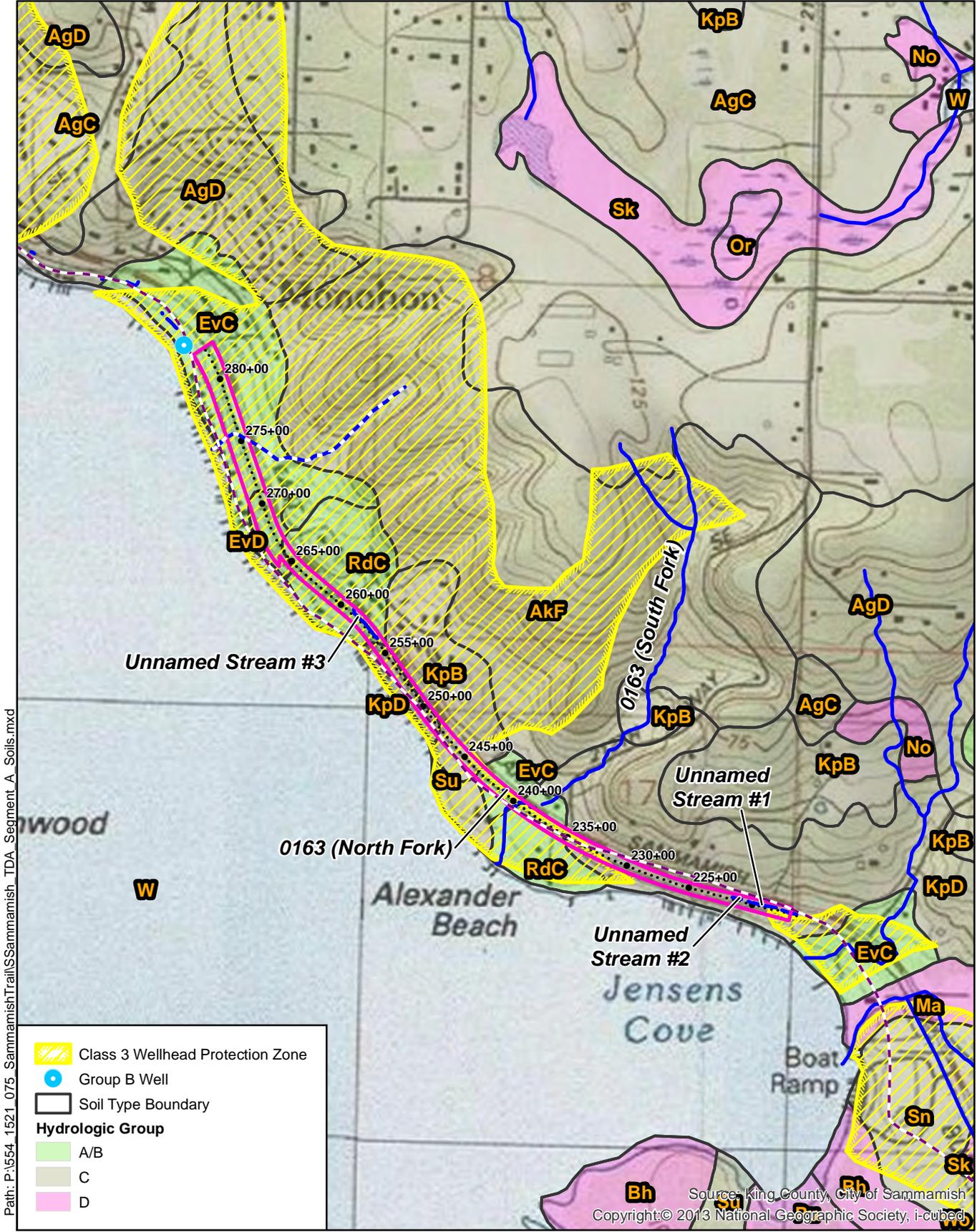
The geotechnical exploration was conducted in September and October 2013. Soil borings extending at least 16.5 feet below ground surface were taken in the areas where the design proposes infiltration trenches (between Sta. 250+00 and 282+70). For most borings groundwater was not found, but when it was encountered it was at a depth of at least 9 feet below ground surface. Additionally, piezometers were installed at all infiltration test pit locations to monitor the groundwater levels in the areas where infiltration facilities are proposed. The Daily Field Report from Icicle Creek Engineers, Inc., dated April 24, 2014, provides water level measurements obtained from piezometers on four monitoring dates: November 13 and December 18, 2013, February 13, 2014 and April 24, 2014. The recorded measurements indicate that even in the wet season the groundwater level in areas where infiltration is proposed is typically greater than 10 feet deep, and no less than 6.80 feet below

grade at the shallowest. The report is provided in Appendix E as a separate document from the draft geotechnical report.

Critical Aquifer Recharge Area

Most of the project area is designated in the City of Sammamish Critical Aquifer Recharge Areas (CARA) map as a Class 3 CARA. Class 3 CARAs are defined as being located outside wellhead protection areas that have high aquifer recharge potential. There is one group B water supply well near the trail intersection at SE 33rd Street. Because there are no target areas within the project requiring water quality treatment, the CARA designation will not affect the project.

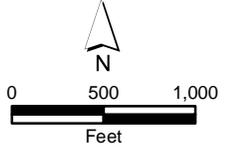
DRAFT



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Source: King County, City of Sammamish
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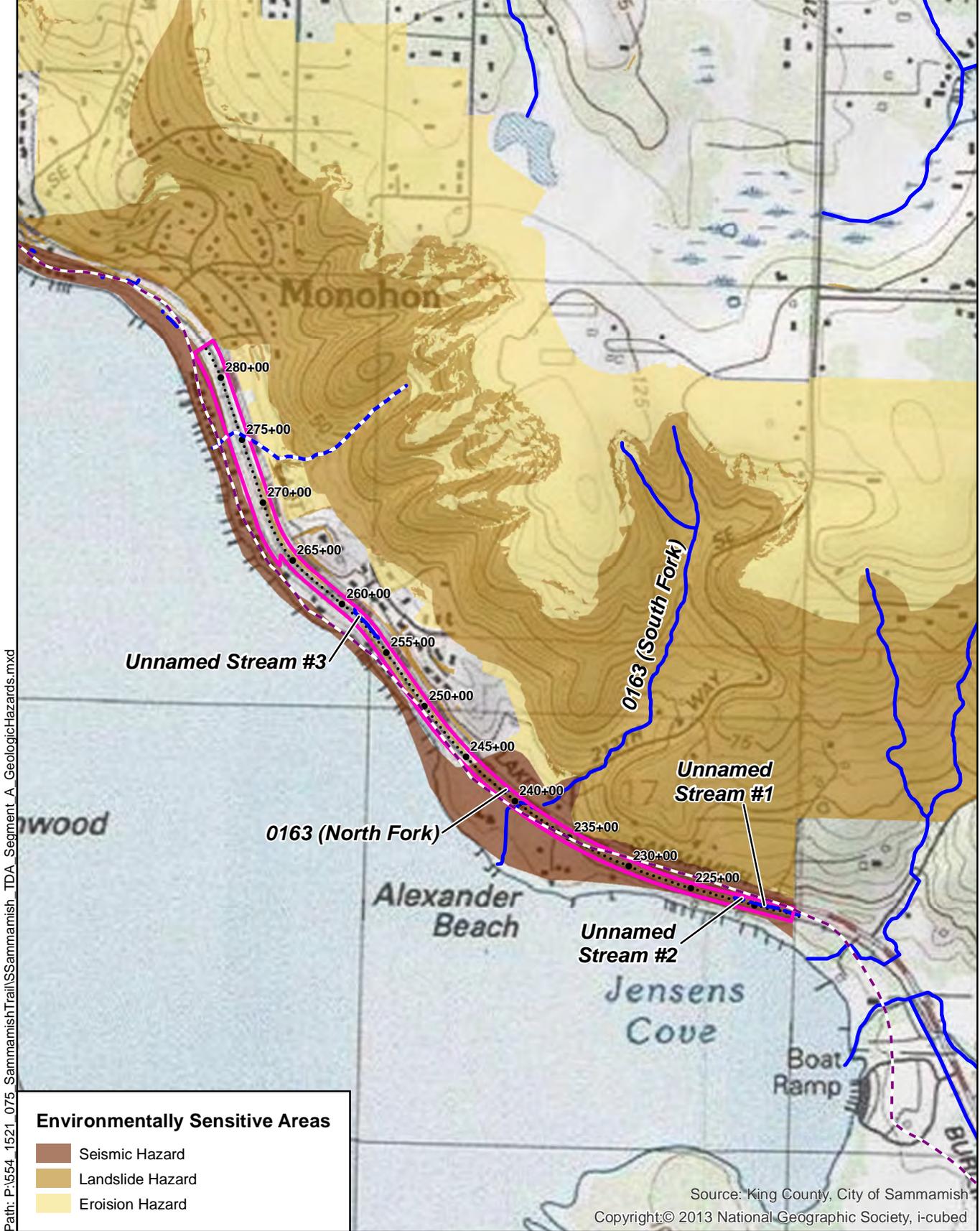
Parametrix



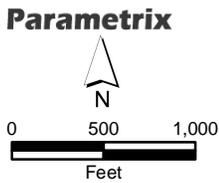
- Segment A Project Location
- Stream Crossing Field-verified by Parametrix
- Stream Crossing Not Found within Trail Corridor
- 100-year Floodplain Boundary



**Figure 1-4
Soils**



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**Figure 1-5
Geologic Hazards**

2. CONDITIONS AND REQUIREMENTS

The City of Sammamish Surface Water Design Manual Addendum directs projects disturbing over an acre to use the 2009 KCSWDM guidelines, in conjunction with the City of Sammamish Addendum published in 2011 (City of Sammamish 2011). The project lies within the East Lake Sammamish Basin, which is designated as a Basic Flow Control area. However, a Level 2 flow control standard applies to this project as indicated in City Ordinance 02011-304, Title 13 Surface Water Management.

Based on the 2009 KCSWDM and the City of Sammamish Addendum, the project requires a full drainage review because it will result in greater than 2,000 square feet of new and replaced impervious surface. Table 2-1 provides a summary of the existing and proposed impervious surfaces within the 100-foot-wide ELST right-of-way. For the impervious surfaces presented in the project area summary (Table 2-1), the existing gravel trail was assumed to be impervious; however, for Chapter 4, flow control calculations were done assuming that the existing trail is forested, in accordance with the 2009 KCSWDM requirements.

Table 2-1. Summary of Project Area Impervious Surfaces

| | Right-of-Way Impervious Surface (acre) | Total Right-of- Way Area (acre) | Percent Impervious Surface |
|----------|---|--|---|
| Existing | 3.7 | 16.8 | 22% |
| Proposed | 6.2 | 16.8 | 37% |

The nine TDAs in the project area are the basis for the analysis of stormwater management requirements described herein. This project meets the eight core requirements and five special requirements outlined in Table 1.1.2.A in the 2009 KCSWDM. The core and special requirements were analyzed for each TDA; this section describes, generally, how this project will meet each requirement (Table 2-2). The details of the analysis, including the basis of the hydrologic and hydraulic design, are discussed in subsequent sections.

Lastly, the project is required to meet the City of Sammamish’s Soil Amendment Requirement for all disturbed pervious areas adjacent to the trail in accordance with Section 1.2 of the City of Sammamish Surface Water Design Manual Addendum. The application of the soil amendment on this project is described in Section 4.4.

Table 2-2. Summary of Core and Special Requirements

| Core and Special Requirements per Table 1.1.1.A of the 2009 KCSWDM | Proposed Stormwater Management Approach |
|---|--|
| C1 Discharge Location | The project will generally preserve existing discharge locations. However, the discharge location for TDA 2 will be combined with TDA 3. Sections 4.2.2 and 5.3 provide description of the new discharge location, and a request for variance to Core Requirement #1 is submitted as part of this TIR. |
| C2 Offsite Analysis | Offsite analysis was conducted during four site visits. Section 3 provides discussion of the offsite analysis; including resource review, downstream analysis, and drainage problems and water quality problems requiring special attention. |

Table 2-2. Summary of Core and Special Requirements (continued)

| Core and Special Requirements per Table 1.1.1.A of the 2009 KCSWDM | Proposed Stormwater Management Approach |
|--|---|
| C3 Flow Control | <p>All TDAs are subject to conservation flow control area requirements. Summary of flow control approach is provided in this table (below), and a detailed description is provided in Section 4.</p> <p>TDAs 1 through 7 meet the exception from the flow control requirement for TDAs generating no more than an increase of 0.1 cubic feet per second (cfs) in the existing site conditions 100-year peak flow (Q_{100}).</p> <p>The existing conveyance systems for TDAs 2 and 3 directly discharge to Lake Sammamish and satisfy the direct discharge flow control exemption.</p> <p>TDAs 8 and 9 will use infiltration to meet flow control requirements.</p> |
| C4 Conveyance | <p>Runoff will sheet flow from the paved trail to the adjacent gravel shoulder and then to existing drainage pathways and ditches. Private conveyance systems downstream of the trail are under sized. The project includes a new conveyance system to convey TDAs 2 and 3 flows to a proposed direct discharge outfall to Lake Sammamish that will be located in a proposed drainage easement.</p> <p>Section 5 provides description of project conveyance.</p> |
| C5 Temporary Erosion and Sediment Control (TESC) | <p>TESC plan and construction documents will be prepared and submitted with the grading permit as part of the design plans and as an appendix to the Final TIR.</p> |
| C6 Operation and Maintenance (O&M) | <p>Section 10 describes the project O&M plan.</p> |
| C7 Financial | <p>Not applicable.</p> |
| C8 Water Quality | <p>Non-motorized trails are considered non-PGIS. Water quality treatment is not required for non-PGIS. Water quality treatment is required if a project TDA has greater than 5,000 square feet of new and replaced PGIS. None of the TDAs trigger the water quality requirement.</p> <p>See section 4.5 for further description.</p> |
| S1 Other Adopted Requirements | <p>No area-specific requirements apply to this project.</p> |
| S2 Flood Hazard Area Delineation | <p>This special requirement is not applicable to this project because the project improvements will not occur below the 100-year floodplain elevation. See section 3.2 for further description.</p> |
| S3 Flood Protection Facilities | <p>This special requirement is not applicable to this project because the project improvements will not occur below the 100-year floodplain elevation. See section 3.2 for further description.</p> |
| S4 Source Control | <p>This special requirement is not applicable to this project because it does not meet the commercial development permit threshold.</p> |
| S5 Oil Control | <p>This special requirement is not applicable to this project because the trail is non-PGIS and does not meet the high-use site threshold.</p> |

3. OFFSITE ANALYSIS

3.1 STUDY AREA DEFINITION AND MAPS

The project lies within the Washington State Department of Ecology (Ecology) Water Resource Inventory Area (WRIA) 8, East Lake Sammamish Basin. The nine TDAs in the project area are defined by three streams (Unnamed Stream 1, Stream 0163, and Unnamed Stream 3) that cross the trail and discharge into Lake Sammamish; three TDAs where runoff discharges directly into Lake Sammamish via manmade conveyance systems; and three TDAs where runoff infiltrates in the landscaping of adjacent private property. Figures 3-1 through 3-4 display the streams, culverts, flow paths, and discharge locations that define the nine TDAs.

3.2 RESOURCE REVIEW

Parametrix reviewed various resources to identify the sensitive areas within the project area. Resources include the King County iMAP: Interactive Mapping Tool, which allows usage of the County's geographic information system (GIS) data, and the City of Sammamish maps that are provided on the City's website, and via GIS data transfer from the City GIS manager. Sensitive areas within the project area include wetlands, streams, landslide hazard areas, and Lake Sammamish, with its associated flood hazards downslope of the project.

As discussed in Section 1.3, review of the City of Sammamish Environmentally Sensitive Areas Geologic Hazards map indicates that the project is surrounded by erosion and landslide hazard areas. However, these areas are not located within the project right-of-way, as depicted in Figure 1-5. Additionally, the Draft Geotechnical Report has identified the project area subsurface conditions.

Review of the City of Sammamish Environmentally Sensitive Areas Map indicates that project right-of-way is within the 100-year floodplain of Lake Sammamish. Using the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) 530330685F, effective May 16, 1995, the 100-year floodplain elevation for Lake Sammamish is 33.00 feet (NGVD 29). The vertical datum for the project is NAVD 88. To convert from NVGD 29 to NAVD 88 the datum shift adds 3.57 feet to get 36.57 feet (NAVD 88). Trail improvements occur at elevations above 45 feet (NAVD 88) and driveway improvements occur at elevations greater than 39 feet (NAVD 88). Therefore, although the 100-year floodplain boundary line is depicted within the project right-of-way, the proposed project improvements will not impact the 100-year floodplain elevation. The 100-year floodplain boundary is depicted on Figures 3-1 through 3-4. Trail elevations are located on the plan sheets located in Appendix A. The City of Sammamish Environmentally Sensitive Areas Map does not include the 100-year floodplain for Unnamed Streams 1 and 2, Stream 0163, or Unnamed Stream 3.

3.2.1 Water Quality Problems Requiring Special Attention

The City of Sammamish Surface Water Design Manual Addendum provides a list of impaired water bodies, based on the Department of Ecology 2008 Water Quality Assessment, approved by the US. Environmental Protection Agency on January 29, 2009. The only water body that applies to this project is Lake Sammamish, which is a Category 5 (requiring a total maximum daily load [TMDL] plan) for dissolved oxygen and fecal coliform, and a Category 2 (water of concern) for total phosphorus. Section 1.2.2.3 Water Quality Problem Impact Mitigation of the 2009 KCSWDM provides treatment options for projects draining to water bodies with bacteria, dissolved oxygen, and phosphorus problems. The remainder of this section discusses how these problems relate to the South Sammamish Segment A project.

Bacteria Problem

None of the TDAs have enough new and replaced pollution-generating impervious surfaces (PGIS) to trigger the requirement of a water quality treatment facility. If a water quality facility is required as stated in Core Requirement #8, then a sand filter, stormwater wetland, or an emerging technology treatment method that removes fecal coliform is needed. Because no water quality facilities are required, the above facilities are not applicable. However, pet stations will be provided along the trail to encourage owners to pick up after their pets.

Dissolved Oxygen Problem

None of the mitigation requirements are applicable for this water quality problem. This project does not include a wet pond or wet vault; therefore, the aeration techniques do not apply.

If the dissolved oxygen (DO) problem is documented to be caused by excessive nutrients, and a water quality facility is required, then a treatment facility option from the Sensitive Lake Protection Menu shall be included in the treatment system. However, this requirement is not applicable because no water quality facilities are required.

Phosphorus Problem

No water quality facilities are required for this project; therefore, the mitigation requirements for the phosphorus problem do not apply. Fertilizers will not be used in Wetland mitigation planting areas, and if fertilizers are necessary for other landscaped areas, care will be taken to use non-phosphorus based fertilizers.

For the purposes of applying Erosion and Sediment Control Standards, the project is assumed to be located within a designated Sensitive Lake Water Quality Treatment Area.

3.3 FIELD INSPECTION

Parametrix performed a Level 1 field inspection of the trail corridor on April 16, 2013 and three follow-up field inspections on February 24, 2014, May 2, 2014, and June 20, 2014. The weather was sunny with brief showers during the initial field inspection. The purpose of the field inspection was to identify any drainage or erosion problems downstream of the ELST corridor, as well as to verify TDA boundaries. The purpose of the follow-up field inspections was to further identify offsite drainage patterns both upstream and downstream of the project site on private properties where temporary right of entry access was granted. A description of each outfall subject to the downstream analysis requirement is provided in a subsequent section. Several of the TDAs will not increase runoff to the outfall and are therefore exempt from the downstream analysis requirement. Descriptions of the upstream flow paths are also included, at least to the point where the project area conveyance systems could backwater. It is unlikely that any of the water courses would backwater across the ELSP due to the steep slopes crossing the project.

TDA 1 – Station 216+79 to 222+50

Unnamed Stream 1 is the receiving water for stormwater runoff from TDA 1. The stream channel collects trail runoff and flows on the north side of the trail to a 24-inch concrete culvert at Sta. 218+45. South of the trail, the stream daylights from the culvert outfall briefly, then flows beneath East Lake Sammamish Shore Lane SE in a 16-inch ductile iron culvert. Finally, the stream flows in an open channel to the lake.

Unnamed Stream 1 receives offsite flow from the ELSP, Peregrine Point Way SE, and the other hillside areas via two drainage outfalls at Sta. 218+90 and 221+55.

Driveway runoff, from both Driveway #1 and Driveway #2, sheet flows northeast to southwest and does not appear to have any collection system. There have been drainage complaints from property owners downslope (south) of Driveway #1 (Sta. 218+00) and Driveway #2 (Sta. 220+75); however, these drainage issues are not influenced by trail runoff. Therefore, they are not required to be mitigated as part of this project.

No signs of erosion were observed during the field investigations.

TDA 2 – Station 222+50 to 229+15

Lake Sammamish is the receiving water body for stormwater runoff from TDA 2. Trail runoff is conveyed in a drainage channel that flows through Wetland 13A on the north side of the trail. Wetland 13A has a highpoint near Sta. 229+00 that divides the drainage flow between TDA 2 and TDA 3. This channel receives offsite flow from the ELSP and other hillside areas via one drainage outfall at Sta. 225+90. Flows are conveyed beneath the trail via a 12-inch corrugated metal pipe (CMP) culvert located at Sta. 224+00. The culvert outfall on the south bank of the trail cannot be seen because the entire slope has been armored with large riprap. Flow from the culvert seeps out of the riprap outfall protection and flows as shallow concentrated flow for approximately ten feet to a rectangular grate inlet located in the northern half of East Lake Sammamish Shore Lane SE. From the catch basin, a 4-inch polyvinyl chloride (PVC) drainage pipe conveys collected runoff in a southwesterly direction. The 4-inch PVC pipe is a private drainage system that conveys stormwater between to two adjacent properties to the southwest, and directly discharges to Lake Sammamish.

No signs of erosion were observed during the field investigations.

TDA 3 – Station 229+15 to 234+50

Lake Sammamish is the receiving water body for stormwater runoff from TDA 3. Trail runoff is conveyed in a drainage channel that flows through Wetland 13A on the north side of the trail. Flows are conveyed beneath the trail via an 18-inch clay culvert located at Sta. 229+85. The culvert enters a catch basin south of the trail on the north edge of the East Lake Sammamish Shore Lane SE roadway. The catch basin receives a 12-inch Advanced Drainage Systems (ADS) pipe from the north, and a 12-inch ADS pipe exits to the east. It is unclear as to where the 18-inch pipe transitions to 12-inches because a junction structure was not located between the trail and the catch basin. It is assumed that the transition is buried. It is evident by the slope of East Lake Sammamish Shore Lane SE, that this catch basin does not receive roadway runoff. The downstream connection to the southeast of the catch basin for the 12-inch conveyance pipe could not be found in the roadway or in the pervious areas located on either side of the roadway.

During the field investigation, both home owners on parcel 1724069036, Mr. O'Donnell (owner of house on east half of parcel) and Mr. McNaughton (owner of the house on the west half of the parcel) explained that the conveyance pipe that exits the catch basin to the southeast follows the short wood wall and then turns south beneath East Lake Sammamish Shore Lane SE, near the eastern property boundary of Mr. O'Donnell's house. There is no junction structure for access to this pipe. However, Mr. O'Donnell did show the direct discharge outfall to Parametrix staff, which follows the eastern property boundary of parcel 1724069036 into Lake Sammamish. The pipe depth and location from the East Lake Sammamish Shore Lane SE catch basin to the Lake Sammamish outfall were surveyed after the fourth field investigation, and the pipe is displayed on the plan sheets provided in Appendix A.

Wetland 13A and the drainage channel receive offsite flow from the ELSP, portions of 212th Way SE, and other hillside areas via two drainage outfalls located at Sta. 229+50 and 234+25.

Stormwater runoff from Driveway #3 sheet flows southeast and is collected within the vegetated shoulder that slopes toward Wetland 13A.

No signs of erosion were observed during the field investigations; however, signs of flood prevention were visible because sand bags were placed around the catch basin on East Lake Sammamish Shore Lane SE. Additionally, both home owners on parcel 1724069036, Mr. O'Donnell and Mr. McNaughton, provided comments about stormwater flowing out of the catch basin inlet during large storm events. They described this problem as a result of the larger 18-inch trail culvert being connected to the smaller 12-inch pipe that conveys flow from the catch basin to the lake outfall. This drainage problem is confirmed in detail by a complaint in the City of Sammamish records that was filed by Mr. McNaughton, who is the property owner at 4229 East Lake Sammamish Parkway SE (parcel 1724069036).

TDA 4 – Station 234+50 to 239+00

No distinct, existing drainage pathways were identified during the field investigations. Runoff drains to adjacent landscaping vegetation.

Driveway #4 is slightly crowned; therefore, the centerline defines the TDA breakpoint. Driveway runoff sheet flows southeast to the gravel shoulder of the driveway. It is assumed that the gravel shoulder is used to dissipate runoff energy prior to the sheet flow continuing into the adjacent vegetation. Downslope of the trail crossing, driveway runoff is collected in the curbs and gutters of the residential neighborhood along 206th Avenue SE.

No signs of erosion were observed during the field investigations.

TDA 5 – Station 239+00 to 241+50

Stream 0163 is the receiving water body for stormwater runoff from TDA 5. Stream 0163 South Fork crosses beneath the trail in a 36-inch concrete culvert at Sta. 239+60, and Stream 0163 North Fork crosses beneath the trail in a 30-inch concrete culvert at Sta. 241+10. Stream 0163 South Fork is an open channel stream that meanders southwest and offsite through four private properties. The downstream end of the Stream 0163 North Fork culvert was not found during the field investigations. Private property access was not granted at the time of the field investigations; therefore, no further information can be provided. However, it is assumed that the streams converge downstream prior to reaching Lake Sammamish.

Driveway #4 is slightly crowned; therefore, the centerline defines the TDA breakpoint. Driveway runoff sheet flows southwest to the gravel shoulder of the driveway. It is anticipated that the gravel shoulder dissipates runoff energy prior to the sheet flow continuing into the adjacent vegetation. Downslope of the trail crossing, driveway runoff is collected in the curbs and gutters of the residential neighborhood along 206th Avenue SE.

Driveway #5 is slightly crowned; therefore, the centerline defines the TDA breakpoint. Driveway runoff sheet flows southeast to the adjacent vegetation. Downslope of the trail crossing, runoff sheet flows across the flat slope of the gravel driveways prior to dispersion in adjacent vegetation.

No signs of erosion were observed during the field investigations.

TDA 6 – Station 241+50 to 244+05

No distinct drainage pathways were identified during the field investigations. Runoff drains to adjacent landscaping vegetation.

Driveway #5 is slightly crowned; therefore, the centerline defines the TDA breakpoint. Driveway runoff sheet flows southwest to the adjacent vegetation. Downslope of the trail

crossing, runoff sheet flows across the flat slope of the gravel driveways prior to dispersion in adjacent vegetation.

Stormwater runoff from Driveway #6 sheet flows northeast to southwest and does not appear to have any collection system. There are no documented complaints regarding uncollected runoff downslope (southwest) of Driveway #6.

No signs of erosion were observed during the field investigations.

TDA 7 – Station 244+05 to 249+25

No distinct drainage pathways were identified during the field investigations. Trail runoff drains to adjacent landscaping vegetation.

No signs of erosion were observed during the field investigations.

TDA 8 – Station 249+25 to 261+50

Unnamed Stream 3 is the receiving water body for stormwater runoff in TDA 8. The stream channel collects trail runoff and flows on the northeast side of the trail to an 18-inch concrete culvert at Sta. 256+35. Southwest of the trail, the stream daylights from the culvert outfall briefly in an open concrete well structure, then flows beneath East Lake Sammamish Shore Lane SE in a 12-inch ductile iron culvert. At the outlet of the 12-inch ductile iron culvert, the stream waterfalls down 6 feet, and finally flows to Lake Sammamish in an open concrete and cobblestone channel.

Unnamed Stream 3 flows onto the site via a culvert beneath ELSP at Sta. 259+00, and receives offsite flow from Driveway #7A via jurisdictional ditch #10.

Driveway #7 has two branches, 7A (northeast) and 7B (northwest), that drain to the adjacent vegetation in TDAs 8 and 9, respectively. Thus, Driveway #7 defines the TDA breakpoint. However, when the two driveway branches merge at the Driveway #7 trail crossing the drainage pattern changes. Driveway runoff from Driveway #7 sheet flows northeast to southwest and does not appear to have any collection system. There are no documented complaints regarding uncollected runoff downslope (southwest) of Driveway #7.

Signs of erosion were observed during the field investigation southwest of the trail on the gravel driveway adjacent to the open concrete well structure that Unnamed Stream 3 flows through.

TDA 9 – Station 261+50 to 282+72

Lake Sammamish is the receiving water body for stormwater runoff from TDA 9. Trail runoff drains to adjacent vegetation on both sides of the trail before a conveyance ditch forms on the northeast side of the trail. The ditch is conveyed beneath the trail via a 24-inch concrete culvert at Sta. 270+00. The downstream end of this culvert was not found within the project site, but it is assumed that it outfalls to the lake.

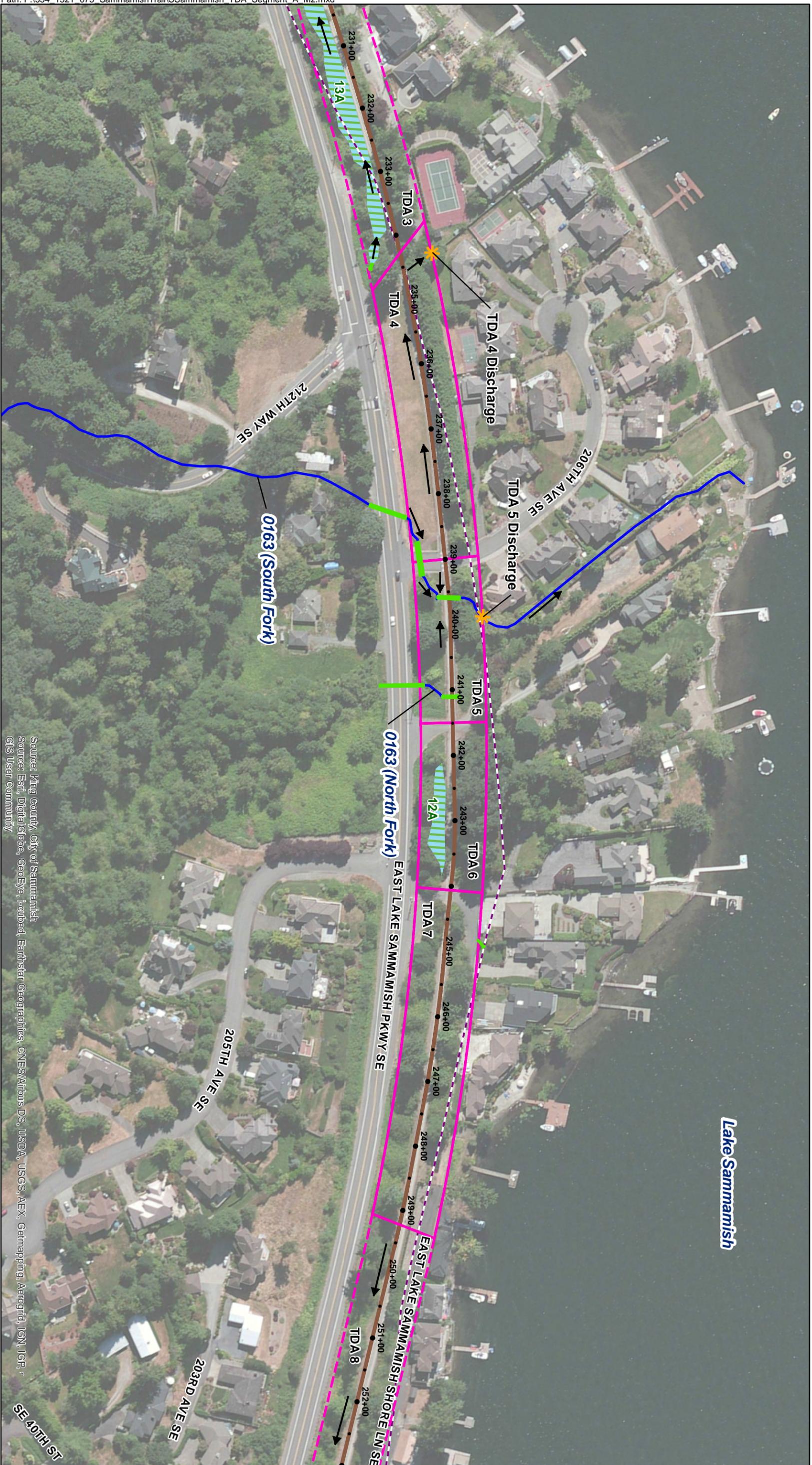
During review of the stream hydrography layer in the King County iMAP, Parametrix identified a stream that should cross through the trail right-of-way between Sta. 275+00 and Sta. 276+00. However, during the field investigation the stream was not found within the project area. Figures 1-3 and 3-4 depict the stream with a blue and white striped line to indicate the stream channel was not found on the project site.

Driveway #8 has a slight super-elevation that directs runoff as sheet flow to the northwest adjacent vegetation. There are no documented complaints regarding uncollected runoff downslope (southwest) of Driveway #8. No signs of erosion were observed during the field investigations.

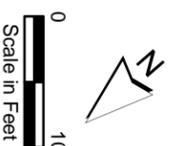


Source: King County, City of Sammamish
 Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, getmapping, Aerogrid, IGN, IGP, swis
 GIS User Community

Figure 3-1
Threshold Discharge
Areas 1 - 3



Parametrix



Proposed Stationing
 485+00
 480+00
 Proposed Trail

Contributing TDA Boundary
 Adjacent TDA Boundary
 TDA Discharge Location

Streams
 (Crossing Field-Verified by Parametrix)
 (Crossing Not Found within Trail Corridor)

Culvert
 Storm Ditch
 Storm Pipe

100-year Floodplain Boundary
 Wetland
 Flow Path
 Sheet
 Flow

Source: King County, City of Sammamish
 Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Geomatics, Aerogrid, IGN, IGP, r
 GIS User Community

Figure 3-2
Threshold Discharge
Areas 4 - 7



Source: King County, City of Sammamish
 Source: Esri, DigitalGlobe, GeoEye, iSat, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo
 GIS User Community

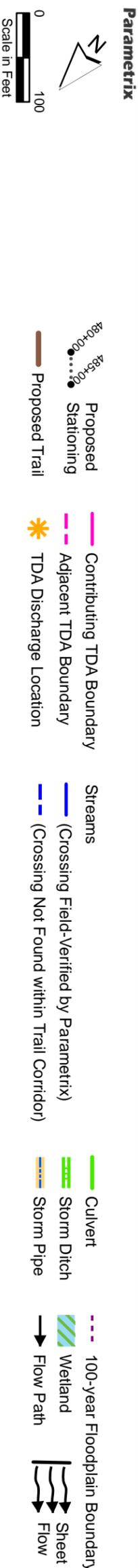


Figure 3-3
Threshold Discharge
Area 8





Source: King County, City of Sammamish
 Source: Esri, DigitalGlobe, GeoEye, iSat, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerotri, GIS User Community

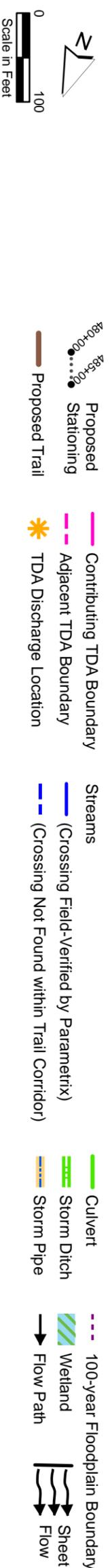


Figure 3-4
Threshold Discharge
Area 9

3.4 DRAINAGE SYSTEMS AND EXISTING DRAINAGE PROBLEMS

Parametrix contacted King County Parks and the City of Sammamish to inquire if there were records of complaints regarding drainage problems along the trail corridor. The City of Sammamish provided a record of drainage complaints, and Parametrix received emails of recorded drainage complaints from Robert Nunnenkamp of the King County Department of Natural Resources and Parks. Additionally, comments received from public meetings in July 2014 further identified drainage nuisances to private properties. These documented drainage complaints are provided in Appendix B, including the offsite analysis data. The local drainage and flooding problems identified along the trail corridor are discussed below according to trail station.

4299 East Lake Sammamish Parkway SE and 4293 East Lake Sammamish Shore Lane SE (south of trail Sta. 217+90, Driveway #1) – Conveyance Nuisance Problem

A property owner (Mr. Moore) on East Lake Sammamish Shore Lane SE (south of the project site) has placed multiple complaints about flooding of the garage and basement of his home and his neighbor's home during heavy rain events. The most recent complaint described the runoff originating from Peregrine Point Way SE. Runoff was described as "...cascading across the south sidewalk on Peregrine, across the Parkway down to Shore Ln where Mr. Moore lives."

The property owner at 4293 East Lake Sammamish Shore SE (Dr. Vanderhoeven) submitted a letter inquiring about the flow capacity of the 24-inch culvert beneath the trail and the downstream 16-inch culvert beneath East Lake Sammamish Shore SE. She is concerned whether or not these existing culverts have enough capacity to convey the flows from 100-year storm event without creating a flooding nuisance on her property.

The project will not be installing additional impervious surface at this driveway crossing. From Mr. Moore's description, the origin of the drainage problem is uncontrolled offsite runoff that flows across ELSP and down the driveway before reaching the private residences. The project design does not direct trail runoff towards the driveway nor will it contribute additional flows to the driveway. Mitigation for this drainage issue is discussed in Section 3.5.

4275 East Lake Sammamish Shore Lane SE (south of trail Sta. 220+75, Driveway #2) – Conveyance Nuisance Problem

A property owner (Mr. Bolger) on East Lake Sammamish Shore Lane SE (south of the project site) has placed multiple complaints about flooding of the garage and basement of his home and his neighbor's home during heavy rain events. The drainage problem is due to uncollected runoff that begins at East Lake Sammamish Parkway, continues down the driveway and bypasses the private catch basins and trench drains in front of the downstream private properties. In particular, the drainage problem can be exacerbated when the driveway culvert at Driveway #2 gets backed up due to debris from the vegetation from Wetland 14C.

The project does not propose to change the existing driveway drainage patterns, and will not be adding additional impervious surface at this driveway crossing. From Mr. Moore's description, the origin of the drainage problem is uncontrolled offsite runoff that flows across ELSP and down the driveway before reaching the private residences. The project design does not direct trail runoff towards the driveway nor will it contribute additional flows to the driveway.

4229 East Lake Sammamish Parkway SE (southwest of trail Sta. 229+85) – Conveyance Nuisance Problem

As discussed in Section 3.3, during the field investigation it was noted that sand bags were placed around the catch basin inlet, and the property owners at parcel 1724069036, described stormwater flowing out of the catch basin inlet during large storm events due to the larger 18-inch trail culvert being connected to the smaller 12-inch pipe downstream of the East Lake Sammamish Shore Lane SE catch basin. This drainage problem is confirmed in detail by the property owner at 4229 East Lake Sammamish Parkway SE. Mitigation for this drainage issue is discussed in Section 3.5.

4215 East Lake Sammamish Shore Lane SE (southwest of trail Sta. 232+00 to 234+00) – Conveyance Nuisance Problem

Two drainage complaints originate from the uncollected runoff from Driveway #3 (212th Way SE). The drainage complaints are documented in the City of Sammamish records (Appendix B). In 2004, Mr. Reilly (4215 East Lake Sammamish Shore Lane SE) provided a flood issue complaint about a “new creek running” down and between his and his neighbor’s house. The runoff was not a creek, but rather shallow concentrated flow from the driveway of 212th Way SE. City of Sammamish maintenance crews resolved this issue. In 2007, an anonymous citizen provided complaints of flooding at the intersection of 212th Way SE and ELSP. It can be assumed that the drainage problem was resolved because there have been no documentation of complaints in this area since 2007.

4007 and 4009 East Lake Sammamish Shore Lane SE (southwest of trail Sta. 256+35) – Conveyance Nuisance Problem

Drainage complaints from property owners at 4007 and 4009 East Lake Sammamish Shore Lane SE have been documented in public meeting comments and email correspondence with King County. Both property owners have submitted complaints that during a recent storm event in February 2014 the conveyance flow surcharged from the open concrete structure and the overflow water eroded the gravel driveway of the property at 4009 East Lake Sammamish Shore Lane SE and flooded both properties. Mitigation for this drainage issue is discussed in Section 3.5.

3839 and 3901 East Lake Sammamish Shore Lane SE (southwest of trail Sta. 261+50) – Conveyance Nuisance Problem

The property owners at 3839 and 3901 East Lake Sammamish Shore Lane SE submitted a drainage complaint in November 2007 regarding a large plume of dirty water visible at the lake outfall. It is assumed that this complaint is in reference to the Unnamed Stream 3 open channel outfall to the lake near Sta. 256+35. The complaint explains that King County cleaned the ditches at the property owner’s request, but that the outfall plume at the lake discharge location did not improve. Mitigation for this drainage issue is discussed in Section 3.5.

3.5 MITIGATION OF EXISTING OR POTENTIAL DRAINAGE PROBLEMS

This section provides proposed mitigation measures to address the drainage problems identified above.

4299 East Lake Sammamish Parkway SE and 4293 East Lake Sammamish Shore Lane SE (south of trail Sta. 217+90, Driveway #1)

The project proposes to provide mitigation for the existing driveway drainage problem by redirecting the driveway runoff to the Unnamed Stream #1 channel west of the driveway. A speed bump will be used to interrupt driveway runoff and serve as a gutter line for driveway

runoff. Conveyance calculations confirm that the existing 24-inch culvert that conveys the stream beneath the trail has enough capacity for the additional runoff from Driveway #1.

Regarding Dr. Vanderhoeven's concerns, the 24-inch trail culvert has adequate conveyance capacity to convey the 25- and 100-year storm events, however, the 16-inch culvert that conveys runoff beneath East Lake Sammamish Shore Lane SE does not have adequate capacity to convey the 25-year design storm nor the 100-year storm event. The project is exempt from flow control in this TDA and does not propose to impact the 24-inch trail culvert. Therefore, the project does not propose to make any changes to the downstream culvert at East Lake Sammamish Shore Lane SE. Evaluation of the existing trail culvert and culvert beneath East Lake Sammamish Shore Lane SE are provided in Section 5.1.

See appendix C for design calculations and offsite drainage areas.

4275 East Lake Sammamish Shore Lane SE (south of trail Sta. 220+75, Driveway #2)

The project proposes to provide mitigation for this existing drainage problem by redirecting the driveway runoff to the Unnamed Stream #2 channel west of the driveway. Conveyance calculations confirm that the existing 24-inch culvert at 218+45 that conveys the stream beneath the trail has enough capacity for the additional runoff from Driveway #2. See appendix C for design calculations and offsite drainage areas.

4229 East Lake Sammamish Parkway SE (southwest of trail Sta. 229+85)

The drainage problem is located at the TDA 3 outfall location, and TDA 3 is exempt from flow control as explained in Section 4.4. However, the evaluation of the downstream drainage systems that TDAs 2 and 3 discharge to indicated that the existing private drainage systems are undersized for conveyance of the 25-year design flow. As a result, the trail drainage design will upgrade the size of the existing 12-inch conveyance pipe downstream of the trail, and relocate the existing outfall to a proposed drainage easement through the property on 4229 East Lake Sammamish Parkway SE. Property negotiations for the proposed drainage easement will begin in August 2014.

4215 East Lake Sammamish Shore Lane SE (southwest of trail Sta. 232+00 to 234+00)

The drainage problem was resolved in 2007 in response to the complaint.

4007 and 4009 East Lake Sammamish Shore Lane SE (southwest of trail Sta. 256+35)

This drainage problem is at the project outfall for TDA 8. TDA 8 requires flow control, and the project proposes the use of infiltration trenches to meet flow control requirements. Infiltrating trail runoff will reduce the amount of flows that contribute to this drainage problem. The flow control analyses for the infiltration trenches is presented in Section 4.4. Evaluation of the existing trail culvert and culvert beneath East Lake Sammamish Shore Lane SE are provided in Section 5.1.

3839 and 3901 East Lake Sammamish Shore Lane SE (southwest of trail Sta. 261+50)

The non-motorized trail is a non-pollution generating impervious surface; therefore, water quality treatment is not required. King County Parks Maintenance manages the sedimentation that occurs in Unnamed Stream 3 on a regular basis. No further mitigation will be provided to treat runoff if the pollutant source is offsite.

4. FLOW CONTROL AND WATER QUALITY FACILITY ANALYSIS AND DESIGN

4.1 EXISTING SITE HYDROLOGY

The ELST is currently a 10-foot-wide gravel path that uses existing ditches and cross culverts that primarily remain from former railroad construction. The railroad ballast serves as a foundation for the trail. The adjacent areas (outside the ballast prism) consist of forest, wetlands, landscaping, and other impervious surfaces such as driveways and parking areas.

Existing (Pre-developed) Land Use

The definition of new impervious surface includes existing gravel surfaces that are upgraded to pavement (King County 2009). Target surfaces do not include existing impervious surfaces that are not disturbed by project activities.

For the purposes of this analysis, it was assumed that target surfaces requiring mitigation within Conservation Flow Control areas include the following:

- Areas within the new 16-foot trail limits (12 feet of asphalt and 2-foot-wide gravel shoulders).
- Existing paved driveways that will be replaced as part of this project.

The project uses the hydrologic model MGSFlood version 4 (MGSFloodV4) to determine flow control requirements. MGSFloodV4 is an approved hydrologic model in accordance with Chapter 3 of the City Amendment. To comply with flow control requirements, pre-developed land uses within target surface areas were assumed to have a historical (forested) land use. Pre-developed land uses outside the target surfaces were not modeled. The native soils underlying the trail corridor are till and outwash soils. Table 4-1 summarizes the pre-developed and developed land use for each TDA.

4.2 DEVELOPED SITE HYDROLOGY

4.2.1 Developed Land Use

The proposed project will upgrade the existing 10-foot-wide gravel trail to a 12-foot-wide paved trail with 2-foot-wide gravel shoulders. Walls are proposed in areas where the trail is bordered by a wetland on one or both sides, and where steep slopes require cut or fill walls. The paved trail and the gravel shoulders are considered new impervious surfaces. The non-target surfaces in the proposed conditions do not change from existing to proposed conditions, and were not included in the model.

Section 1.2.3.2.D of the 2009 KCSWDM provides guidance for applying land use credits when sizing flow control facilities and assessing exceptions from the flow control facility requirement. The project proposes to use infiltration trenches to meet the flow control requirements in TDAs 8 and 9. According to Table 1.2.3.C of the 2009 KCSWDM, when a project applies full infiltration for a contributing drainage area, the impervious area is subtracted from the land use analysis of the TDA.

In addition to the land use credits being applied to fully infiltrated areas in TDA 8, a small section of trail will bypass the infiltration trenches. Section 1.2.3.2.E of the 2009 KCSWDM provides guidance for how to mitigate for target surfaces that bypass the flow control facility. For TDA 8, the infiltration trenches located in the trail shoulder cannot collect trail runoff between infiltration trenches 3 and 4 (Sta. 256+29 to 256+70). The discussion in Section 4.3 explains how the project will satisfy the flow control requirements for TDA 8 using infiltration

for target surfaces, using land use credits for the fully infiltrated areas, and by meeting the flow control mitigation exemption requirements for target areas that bypass the infiltration facilities, as specified in Section 1.2.3.2.E of the 2009 KCSWDM.

Table 4-1 provides the project land use summary for pre-developed and developed conditions, including the trail areas that will be fully infiltrated to meet the flow control requirement. Flow control performance standards and exemptions are presented in Section 4.3.

Table 4-1. Land Use Summary

| TDA | Station | Station | Pre-developed Outwash/Forest (acre) | Pre-developed Till/Forest (acre) | Developed Impervious to Full Infiltration (acre) | Developed Impervious (acre) |
|-----|---------|---------|---|--|---|-----------------------------------|
| 1 | 216+79 | 222+50 | - | 0.22 | - | 0.22 |
| 2 | 222+50 | 229+15 | - | 0.24 | - | 0.24 |
| 3 | 229+15 | 234+50 | - | 0.20 | - | 0.20 |
| 4 | 234+50 | 239+00 | 0.17 | - | - | 0.17 |
| 5 | 239+00 | 241+50 | 0.09 | - | - | 0.09 |
| 6 | 241+50 | 244+05 | - | 0.09 | - | 0.09 |
| 7 | 244+05 | 249+25 | - | 0.19 | - | 0.19 |
| 8 | 249+25 | 261+50 | 0.20 | 0.25 | 0.43 | 0.02 |
| 9 | 261+50 | 283+02 | - | 0.82 | 0.82 | - |

4.2.2 Developed Drainage and Flow Characteristics

Project runoff will sheet flow off the paved trail surface to the adjacent gravel shoulders, with flow directed primarily to the northeast and occasionally southwest depending on existing drainage features and other design considerations. In general, runoff will follow the same flow paths as existing conditions; however, the project proposes to change the direct discharge location to Lake Sammamish for TDA 2.

Currently, conveyance from TDAs 2 and 3 contribute to private, existing conveyance systems that are undersized for the 25-year design storm of each respective contributing basin. The project impacts to both TDA 2 and TDA 3 culverts due to trail widening will require the culverts to be extended or replaced. In both cases, as demonstrated in subsequent sections, the existing downstream conveyance system needs to be upgraded. This project does not propose to make improvements to private drainage systems; however, it does propose an alternative solution.

The project design proposes to convey TDA 2 runoff combined with TDA 3 runoff, and create a new direct discharge outfall location to Lake Sammamish in a proposed 15-foot-wide drainage easement that will cross the property at 4229 East Lake Sammamish Parkway SE and directly discharge to the lake. The proposed design does not change the existing drainage patterns of the trail or the existing conveyance channels on the northeast side of the trail. Also, the proposed design does not change the location of runoff collection from TDAs 2 and 3. Rather, the existing culverts will be removed and replaced with new pipes that will tie into the proposed conveyance system. The proposed conveyance design is described further in Section 5.3.

4.3 PERFORMANCE STANDARDS

A Level 2 flow control standard applies to this project according to City of Sammamish Ordinance 02011-304, Title 13 Surface Water Management. According to Section 1.2.3.1.B of the 2009 KCSWDM, the Level 2 flow control performance standard requires flow control

facilities to match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 50 percent of the 2-year peak flow up to the full 50-year peak flow. Also, the facilities would match developed peak discharge rates to pre-developed peak discharges rates for the 2- and 10-year return periods. For land use, the historical site condition (forest) is assumed as the pre-developed condition.

As stated in Section 1.2, project TDAs were delineated in three ways: areas that runoff into streams that flow beneath the trail and outfall into Lake Sammamish; areas that runoff directly to the lake via overland flow or manmade conveyance; and areas that runoff to adjacent private property landscaping.

Section 1.2.3.1.B of the 2009 KCSWDM also provides exemptions that apply to the Level 2 flow control standard. The flow control facility requirement is waived for any threshold discharge area in which the difference in the 100-year peak runoff flow rate (ΔQ_{100}) between the developed site condition and the historical site condition does not exceed 0.1 cfs. The runoff increase in each TDA was checked to see if it met this exemption. Hydrologic modeling was performed using the MGSFloodV4 hydrologic model and the land use information provided in Table 4-1. Table 4-2 summarizes the pre-developed and developed 100-year peak flow for each TDA.

Table 4-2. Flow Rate Summary

| TDA | 100-Year Flow Rates (cfs) | | | Exemption |
|-----|---------------------------|-----------|-------|-----------|
| | Pre-Developed | Developed | Delta | |
| 1 | 0.0 | 0.1 | 0.1 | Yes |
| 2 | 0.0 | 0.1 | 0.1 | Yes |
| 3 | 0.0 | 0.1 | 0.1 | Yes |
| 4 | 0.0 | 0.1 | 0.1 | Yes |
| 5 | 0.0 | 0.1 | 0.1 | Yes |
| 6 | 0.0 | 0.1 | 0.0 | Yes |
| 7 | 0.0 | 0.1 | 0.1 | Yes |
| 8* | 0.0 | 0.3 | 0.3 | No |
| 9* | 0.0 | 0.5 | 0.5 | No |

*Project area that will fully infiltrate are included in this flow rate analysis.

Table 4-2 shows that TDAs 1 through 7 are exempt from flow control requirements. TDAs 8 and 9 are required to provide flow control, and infiltration trenches will be used to provide flow control in these areas. As noted in the land use discussion in Section 4.2.1, the fully infiltrated project areas can be excluded from the hydrologic modeling effort performed to evaluate the exemption. The hydrologic model analysis was performed to confirm that the proposed infiltration trenches satisfy the Level 2 flow control performance standard and are discussed further in Section 4.4.

The MGSFloodV4 model printouts are included in Appendix C.

4.3.1 TDA 2 and 3 Flow Control Approach

As discussed in Section 4.2.2, the project will combine the outfall for TDAs 2 and 3. The existing conveyance systems for each TDA directly discharges to Lake Sammamish, and therefore meets the flow control exemption in accordance with the 2009 KCSWDM, Section 1.2.3, page 1-37. The proposed design will establish a new direct discharge outfall to Lake

Sammamish and will continue to meet the direct discharge flow control exemption. The outfall will be located in a new drainage easement to be acquired from the property owner at 4229 East Lake Sammamish Parkway SE. Section 5.3 describes how the conveyance system design will meet the requirements of the direct discharge exemption.

4.3.2 TDA 8 Flow Control Approach

Table 4-1 provides that TDA 8 will fully infiltrate 0.43 acres of the 0.45 developed acres in the TDA. Therefore, 0.02 acres of the project site bypasses the flow control facility. Per Section 1.2.3.2.E of the 2009 KCSWDM, some project runoff subject to flow control may bypass required onsite flow control facilities provided that:

- 1) The point of convergence for runoff discharge and runoff bypass are located within one-quarter mile downstream of the facility's project site discharge point,
- 2) The increase in the existing site conditions 100-year-peak discharge from the bypass area must not exceed 0.4 cfs,
- 3) Runoff from the bypassed surface must not create a significant adverse impact to downstream drainage systems, salmonid habitat, or properties as determined by DPER,
- 4) Water quality requirements applicable to the bypassed target surface must be met, and
- 5) Compensatory mitigation by a flow control facility must be provided, however, this mitigation may be waived if the existing site conditions 100-year peak discharge from the area of bypassed target surfaces is increased by no more than 0.1 cfs and flow control BMPs are applied to all impervious surfaces with the area of bypassed target surfaces.

The project meets all five bypass requirements as follows:

- 1) The infiltration trenches fully infiltrate the 100-year storm event, thus removing runoff from the TDA. Runoff from the bypass target surface will continue to sheet flow from the trail across a 2-foot-wide gravel shoulder and down a vegetated embankment prior to entering Unnamed Stream #3 adjacent to the trail.
- 2) The hydrologic model was performed for the two scenarios in this TDA; one calculation evaluates the areas contributing to the infiltration trenches, and one calculation to evaluate the bypass target surface 100-year peak discharge compared to the historic site condition.

The infiltration trenches fully infiltrate 0.43 acres of impervious project area when compared to 0.43 acres of historic site (forested) conditions. Since that area is fully infiltrated, when evaluating the 100-year peak discharge comparison between historic and developed conditions, the 0.43 acres of impervious area contributing to the trenches may be excluded from the developed site condition in the hydrologic model calculations in accordance with Section 1.2.3.2.D of the 2009 KCSWDM. Therefore, the land use used to model the 100-year peak discharge comparison was 0.45 acres of historic site (forested) conditions, compared to a developed site condition of 0.02 acres of impervious area. The 0.02 acres is the bypass target surface. The resulting 100-year-peak discharges are 0.00 cfs and 0.01 cfs for the historic and developed site conditions, respectively. Thus, the resulting 100-year-peak discharge does not exceed 0.4 cfs.

- 3) Runoff from the bypassed surface will not create a significant adverse impact to downstream drainage systems because as stated above, the 100-year-peak discharge for the TDA is 0.01 cfs.

- 4) There are no water quality requirements applicable to the trail. See Section 4.5 for further discussion.
- 5) TDA 8 satisfies the waiver requirements for compensatory mitigation by a flow control facility because the 100-year peak discharge from the area of bypassed target surfaces increases less than 0.1 cfs, as stated above.

4.3.3 TDA 9 Flow Control Approach

Table 4-1 provides that TDA 9 will fully infiltrate all 0.82 acres of the developed site runoff, which satisfies the flow control requirement.

4.4 FLOW CONTROL SYSTEM

The project proposes the use of seven infiltration trenches for this project. Five infiltration trenches are proposed to satisfy the flow control requirements in TDAs 8 and 9, and two infiltration trenches are optional facilities that will establish distinct drainage pathways for TDAs 4 and 7.

Infiltration Trenches

Two infiltration trenches are proposed in TDA 8 and three infiltration trenches are proposed in TDA 9. All five are designed to meet the flow control requirement. The infiltration trenches in TDAs 4 and 7 are not required due to the flow control exemption (see Section 4.3), but are designed to meet the flow control standard for consistency, as detailed below.

The existing drainage pattern was not easily recognized within TDA 4; additionally, there is a history of drainage issues near the 212th Way SE intersection with ELSP and down farther southwest along Driveway #3. Therefore, the project will use the underlying outwash soils and a formal infiltration trench to mitigate project runoff so that it does not exacerbate downstream drainage problems.

The existing drainage pattern was not easily recognized within TDA 7. Although this TDA does not have a history of drainage problems, the proposed trail widening will reduce the amount of adjacent vegetation that runoff dissipates into. Therefore, the project will use the underlying outwash soils and a formal infiltration trench to mitigate project runoff so that it does not create downstream drainage problems.

As discussed in Section 2, soil borings were taken in the areas where the design proposes infiltration trenches, with the exception of infiltration trench 1. The underlying soils from Sta. 250+00 to Sta. 282+72 are gravelly and sandy with thin layers of silt and fine gravel at depths 5 to 10 feet below ground surface. The borings extended at least 16.5 feet below ground surface in all locations. For most borings groundwater was not found, but when it was encountered it was at a depth of at least 9 feet below ground surface. In these areas, the design team used a long-term design infiltration rate of 10 inches per hour, as recommended in the geotechnical report (see Appendix E). The nearest boring to trench 1 was taken at Sta. 233+60, approximately 100 feet southeast of the proposed infiltration trench. However, the groundwater level at the time of boring was 10 feet below ground surface. The underlying soils are gravel with sand for the larger portion of the 16.5-foot boring with a 3-foot layer of sandy silt encountered at 5.5 feet below ground surface. The design team used a long-term design infiltration rate of 10 inches per hour for trench 1 because of the groundwater depth and the underlying soils.

With regard to groundwater elevations, piezometer readings have been collected four times throughout the 2013-2014 wet-season, and the April 24, 2014 data provided that the depth to groundwater is typically greater than 10 feet below ground surface in areas where infiltration trenches are proposed. Only one piezometer (Sta. 260+00) had a groundwater measurement

less than 10 feet below ground surface, and that measurement was measured at 6.8 feet below ground surface. The daily monitoring report is provided in Appendix E as a separate document from the draft geotechnical report.

The gravel infiltration trenches are located under the 2-foot-wide gravel shoulder. A 6-inch thick, clean ¾-inch gravel layer will be used to collect the runoff from the trail and allow it to percolate into the gravel storage area below. The storage depth of the trenches is typically 2 feet deep with an additional 6 inches of freeboard below the surface of the trail.

Infiltration trench locations are listed below and shown on the design plans (Appendix A):

- Trench 1 TDA 4—Sta. 234+77 to Sta. 238+67
- Trench 2 TDA 7—Sta. 244+25 to Sta. 249+25
- Trench 3 TDA 8—Sta. 249+25 to Sta. 256+29
- Trench 4 TDA 8—Sta. 256+70 to Sta. 261+27
- Trench 5 TDA 9—Sta. 261+71 to Sta. 282+54
- Trench 6 TDA 9—Sta. 282+72 (northeast of sidewalk on SE 33rd Street)
- Trench 7 TDA 9—Sta. 282+72 (southeast of sidewalk on SE 33rd Street)

The groundwater is sufficiently deep and the typical trench configuration will meet the required 3 feet of vertical separation above the seasonal high water table. Additional discussion regarding groundwater was provided in Section 1.3.1.

All infiltration trenches are designed to infiltrate 100 percent of contributing trail runoff up to the 100-year storm event. MGSFloodV4 model calculations of the infiltration trenches are provided in Appendix C.

Soil Amendment

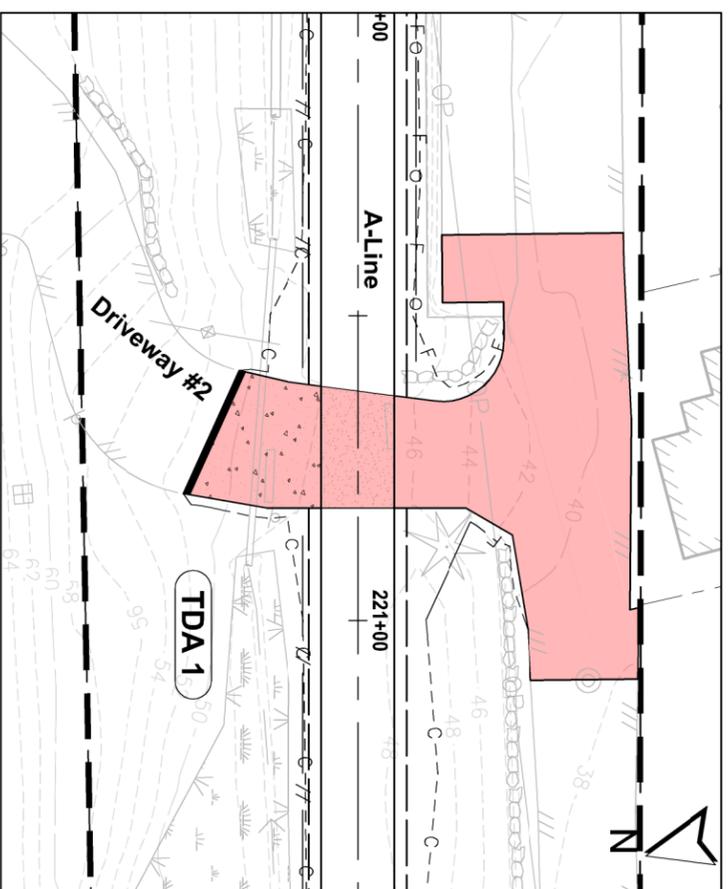
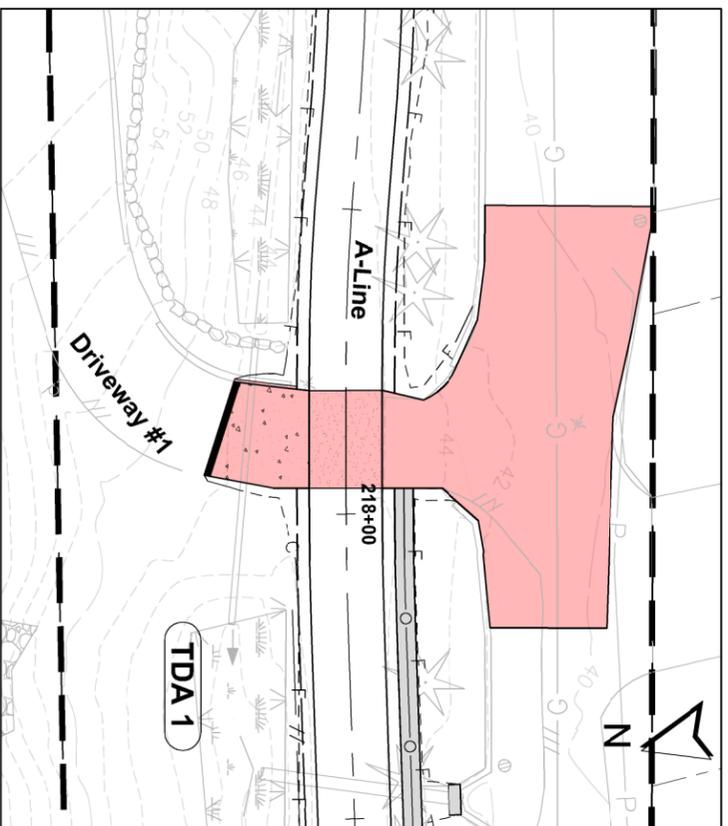
This project will comply with the City of Sammamish’s Soil Amendment Requirement for all disturbed pervious areas adjacent to the trail in accordance with Section 1.2 of the City of Sammamish Solid Waste Design Manual Addendum.

Wetland and stream buffer enhancement mitigation is proposed for this project, but not all locations have been selected. No grading is proposed for these areas. Instead, “mitigation clearing and grubbing” is specified in the plans, and it entails selectively removing plants and roots of unwanted vegetation, while leaving as much topsoil in place as possible. Areas with selective clearing of invasive species, such as knotweed, will receive a 3-inch layer of fine compost prior to planting followed by a 3-inch layer of mulch. These areas will not be tilled due to the risk of spreading invasive species.

Other mitigation planting areas will receive 3 inches of compost tilled into the top 10 inches of soil followed by 1 inch of compost prior to planting and 3 inches of mulch over the entire planting area.

4.5 WATER QUALITY SYSTEM

The new trail surface will be non-PGIS; therefore, water quality treatment facilities are not required. The trail does cross eight private driveways, which are PGIS, and all driveway surfaces will be replaced at the proposed trail grade. Water quality treatment is required for each TDA with new and replaced PGIS areas greater than 5,000 square feet. For this project, new and replaced driveway impervious surfaces total less than 5,000 square feet within each TDA; therefore, runoff treatment is not required. Figures 4-1 and 4-2 provide depict the replaced PGIS at each driveway and summarize the replaced PGIS areas for each TDA.



TDA 1 Replaced PGIS = 4,841 sf

Driveway #1 = 2,330 sf
 Driveway #2 = 2,511 sf

TDA 2 Replaced PGIS = 0

No Driveway

TDA 3 Replaced PGIS = 763 sf

Driveway #3 = 763 sf

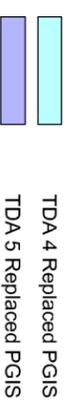
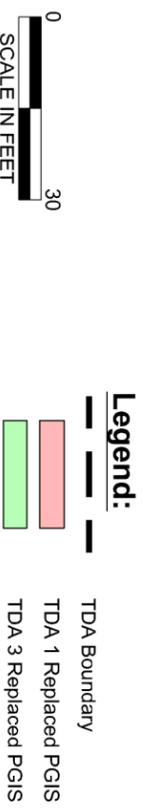
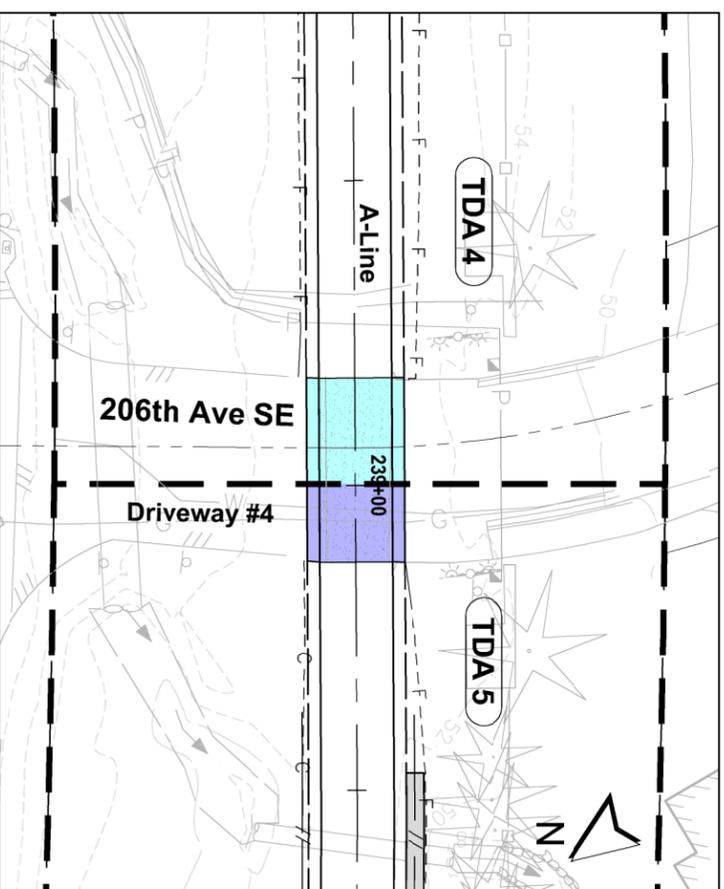
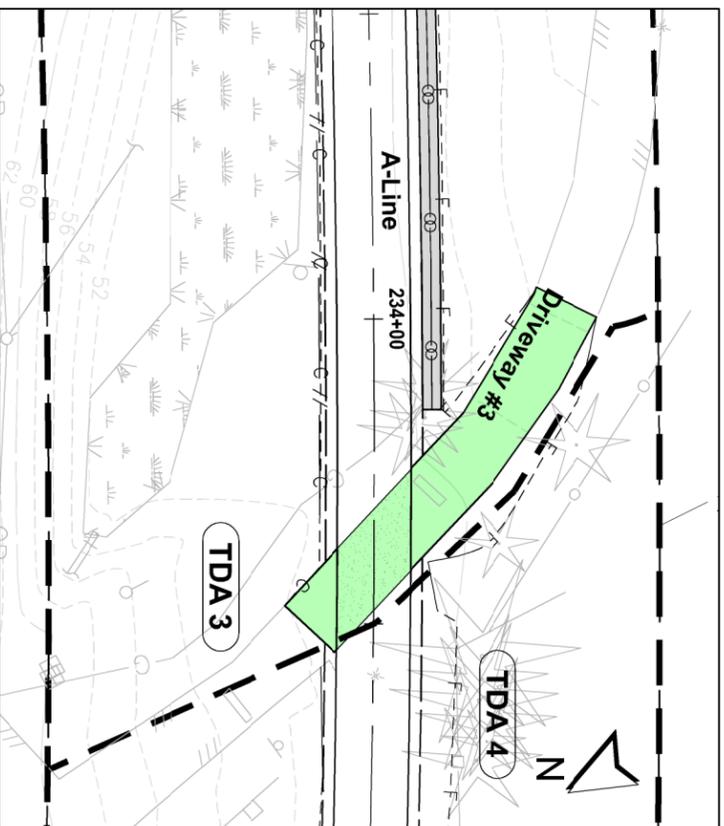
TDA 4 Replaced PGIS = 279 sf

Driveway #4 = 279 sf

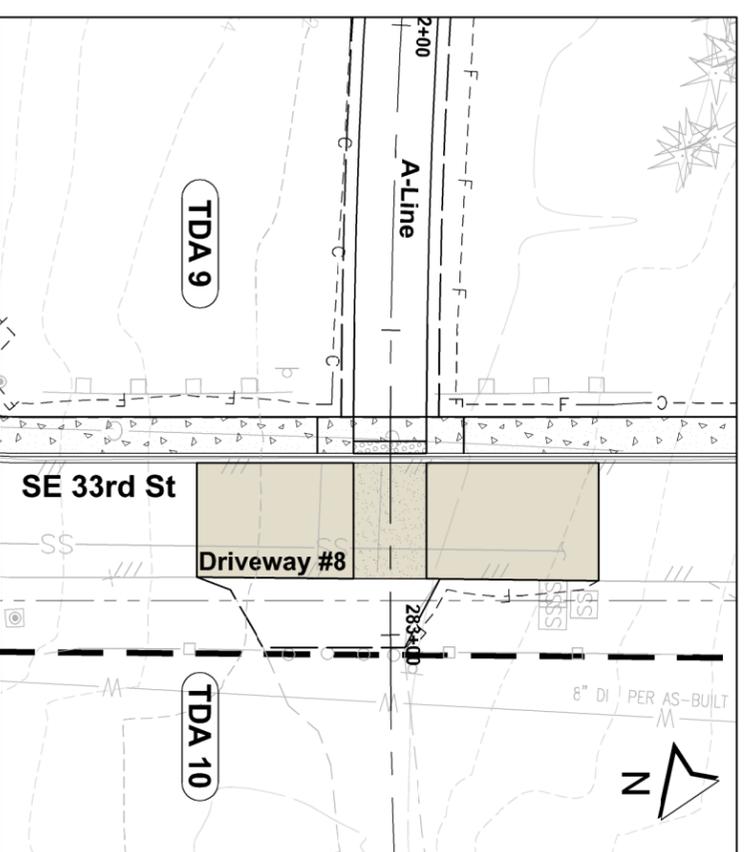
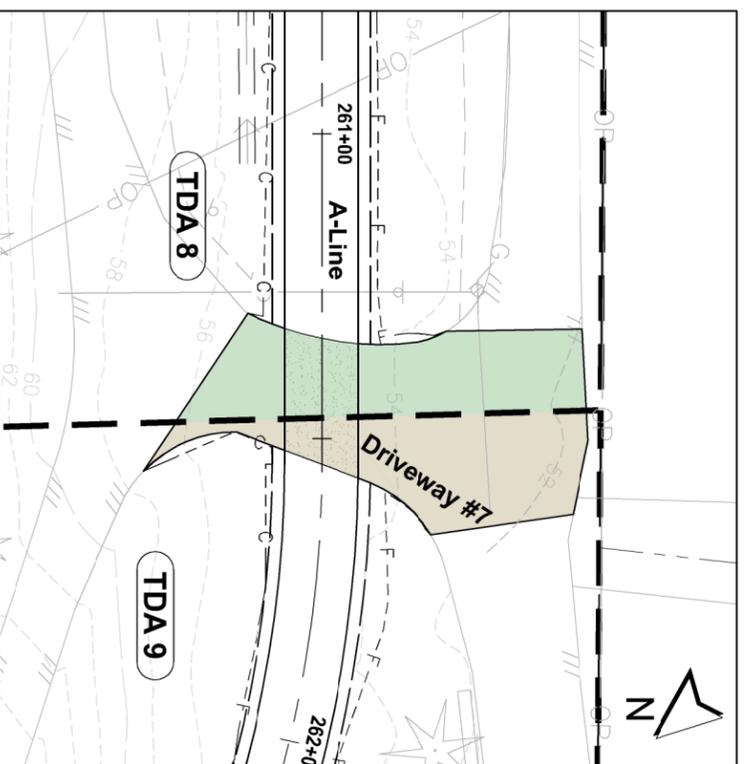
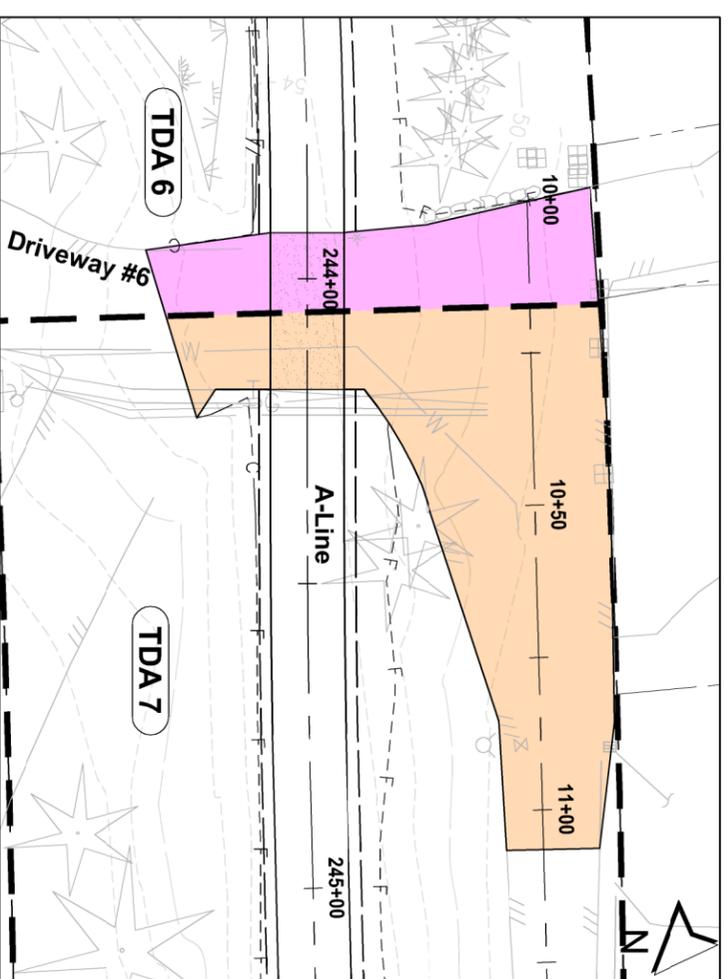
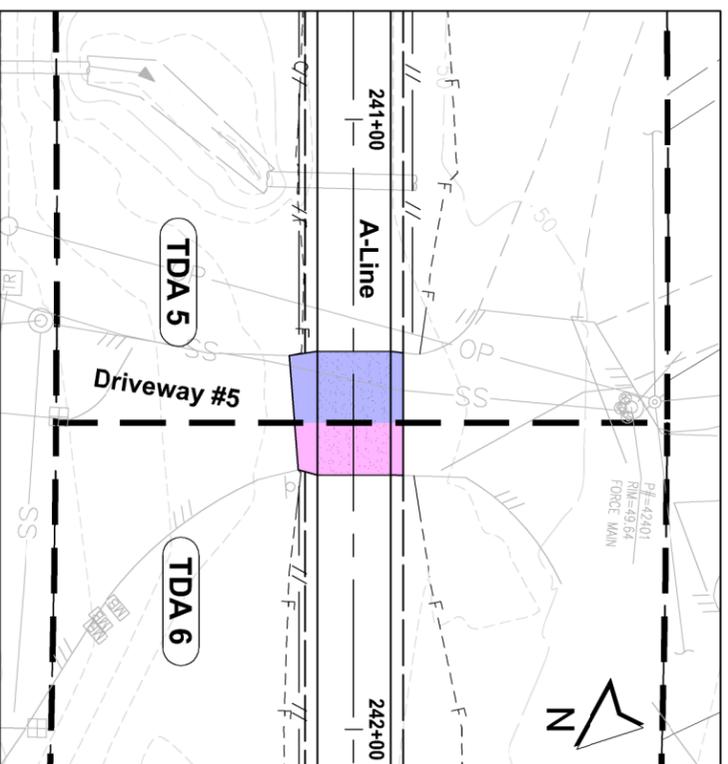
TDA 5 Replaced PGIS = 415 sf

Driveway #4 = 204 sf
 Driveway #5* = 211 sf

* See Figure 4-2



**Figure 4-1
 Proposed PGIS Surfaces**



TDA 5 Replaced PGIS = 415 sf

Driveway #4* = 204 sf
Driveway #5 = 211 sf

TDA 6 Replaced PGIS = 1,171 sf

Driveway #5 = 147 sf
Driveway #6 = 1,024 sf

TDA 7 Replaced PGIS = 2,784 sf

Driveway #6 = 2,784 sf

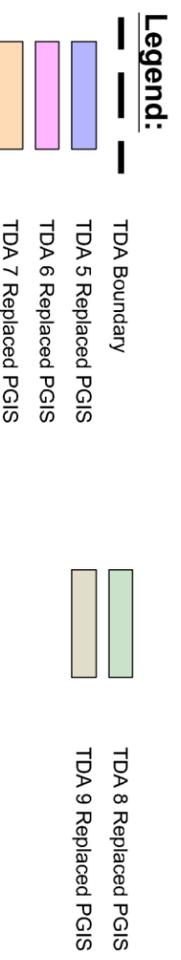
TDA 8 Replaced PGIS = 841 sf

Driveway #7 = 841 sf

TDA 9 Replaced PGIS = 2,020 sf

Driveway #7 = 767 sf
Driveway #8 = 1,253 sf

* See Figure 4-1



**Figure 4-2
Proposed PGIS Surfaces**

5. CONVEYANCE SYSTEM ANALYSIS AND DESIGN

There are three types of conveyance systems within the project area—culverts, ditches, and conveyance pipes—that will be affected by construction of this project. Ditches parallel the trail throughout the corridor, and culverts cross the trail to convey water from ditches and wetlands northeast to southwest. The existing conveyance pipes are private drainage systems located on East Lake Sammamish Shore Lane SE, southwest of the trail. In general, both culverts and ditches are not affected by the project; however, as discussed in Sections 3.3, 3.4, and 3.5, there are existing conveyance problems downstream from the trail, and drainage issues that required further hydraulic analysis. Hydraulic and conveyance capacity analyses were completed for culverts that would be extended or replaced to evaluate the impact trail drainage currently has and will have on the downstream conveyance systems.

Conveyance flow rates were calculated using MGSFloodV4 and conveyance sizing calculations were completed using the Manning’s equation. Hydraulic calculations are provided in Appendix C.

5.1 CULVERTS

Seven existing culverts cross the proposed trail alignment. Each was evaluated for impacts related to the widening of the trail. If a culvert needed to be lengthened to accommodate fill or a wall, an analysis was performed to determine whether to replace or extend the culvert. Based on this analysis, one culvert would need to be extended, and one would be replaced for this project. The remaining five culverts do not require any mitigation (see Table 5-1 below). King County will continue to provide regular maintenance for all culverts along the trail corridor.

The criteria considered in the evaluation included the following:

- Replace the culvert if the following occurs:
 - Culvert is made of clay.
 - Inlet or outlet is cracked or broken.
 - Extending the culvert to the wall face would create a perched culvert outfall.
- Extend the culvert if the following occurs:
 - Material is metal, concrete, or high density polyethylene (HDPE).
 - Physical condition is good (no cracks).

Table 5-1 summarizes the project culverts and how the proposed design will treat each culvert crossing. A hydraulic analysis was completed for culverts located upstream of properties with existing drainage issues. The analysis is discussed further in this section and in Section 5.3 Conveyance Pipes.

Table 5-1. Summary of Existing Culverts and Proposed Design

| Station | Stream | Affected by Trail | Material | Action |
|---------|------------------------|-------------------|----------|----------|
| 218+45 | Unnamed Stream 1 | No | CMP | None |
| 224+00 | No | Yes | CMP | Extend* |
| 229+85 | No | Yes | Clay | Replace* |
| 239+60 | Stream 0163 South Fork | No | Concrete | None |
| 241+10 | Stream 0163 North Fork | No | Concrete | None |
| 256+35 | Unnamed Stream 3 | No | Concrete | None |
| 269+97 | No | No | Concrete | None |

*The action will not apply because the existing downstream conveyance system does not have capacity to convey existing flows.

The existing 24-inch trail culvert at 218+45 conveys stormwater southwest to the open concrete drainage structure at the existing outfall location. The project does not affect this culvert; however, there was a public request to evaluate the conveyance capacity of this culvert and the downstream 16-inch culvert that conveys runoff beneath East Lake Sammamish Shore Lane SE to the open channel on private property. Results provide that the 24-inch culvert has adequate conveyance capacity to convey the 25- and 100-year storm events at 50 percent and 70 percent capacity, respectively. The 16-inch culvert that conveys runoff beneath East Lake Sammamish Shore Lane SE does not have adequate capacity to convey the 25-year design storm nor the 100-year storm event. As stated in Section 3.5, the project is exempt from flow control in this TDA and does not propose to impact the 24-inch trail culvert. Therefore, the project does not propose to make any changes to the downstream culvert at East Lake Sammamish Shore Lane SE.

A 12-inch pipe extension at Sta. 224+00 would convey stormwater southwest to a perched outfall location in Wall #3, and the runoff would flow to the existing outfall location at the catch basin inlet in East Lake Sammamish Shore Lane SE. The existing 4-inch pipe is part of a private drainage system that conveys water to Lake Sammamish. Conveyance calculations were performed to confirm that contributing runoff would not overwhelm the existing 4-inch conveyance pipe downstream of the project (Appendix C). Results show that the 4-inch pipe only has the capacity to convey about 16 percent of the 25-year design storm. The calculations were based on an assumed pipe slope of 1 percent from the topography shown in King County's iMAP.

A replaced 18-inch culvert at Sta. 229+85 would convey stormwater southwest to the catch basin at the existing outfall location at approximately 10 percent slope. The 12-inch pipe from the existing catch basin is part of a private drainage system that conveys water to Lake Sammamish. Conveyance calculations were performed to confirm that contributing runoff would not overwhelm the existing 12-inch conveyance pipe downstream of the project (Appendix C). Results show that the 12-inch pipe has the capacity to convey the 25-year design storm. The calculations were based on surveyed pipe slope of approximately 2.3 percent beneath East Lake Sammamish Shore Lane, and an estimated pipe slope of approximately 7.8 percent based on survey of the land and best estimated location of the discharge pipe at the lake.

The project design will not continue to contribute runoff to the undersized private drainage system. Instead, the project proposes to install a new drainage system that will route existing TDA 2 and TDA 3 drainage to a new direct discharge outfall to Lake Sammamish. The proposed conveyance system is described further in Section 5.3.

The existing 18-inch culvert at Sta. 256+35 conveys stormwater southwest to the open concrete drainage structure at the existing outfall location. The project does not affect this culvert; however, there is a history of drainage problems at the properties downstream of this open concrete outfall structure. Therefore, conveyance calculations were performed to confirm that contributing runoff does not overwhelm the existing trail culvert or the existing 18-inch CMP culvert that conveys flow beneath East Lake Sammamish Shore Lane SE (Appendix C). Results show that the 18-inch culvert is approximately 52 percent full during the 25-year storm event, and 77 percent full during the 100-year storm event. The calculations were based on the surveyed pipe slope of 16.25 percent. It should be noted that the flow velocity in the culvert is approximately 24 feet per second during the 25-year storm event and 27 feet per second during the 100-year storm event.

5.2 DITCHES

In general, grading and walls were used to minimize the amount of fill placed in existing ditches located adjacent to the trail. Therefore, the conveyance function of all ditches along the corridor has been preserved. No new conveyance ditches are proposed.

5.3 CONVEYANCE PIPES

One new conveyance system consisting of six catch basins and eight storm drain pipes is proposed in an effort to separate the trail runoff from the undersized private drainage systems downstream of the trail. All new catch basins located on the trail will have solid, slip-resistant, metal lids. Conveyance pipe calculations are provided in Appendix C.

The project proposes to remove and dispose of the existing 12-inch trail cross culvert in TDA 2 and the 18-inch cross culvert and type 2 catch basin in TDA 3. The new storm drain pipes will be installed at the same location as the existing TDA 2 and TDA 3 culvert inlet locations (Sta. 224+00 and Sta. 229+85, respectively). Beginning in TDA 2, collected flow will be conveyed in a 12-inch tightline system from Sta. 224+00 to Sta. 229+85. Two catch basins will be installed in the northeast shoulder of the trail and two will be installed in the center of the trail, between Sta. 224+00 and Sta. 229+85. Beginning at Sta. 229+85 in TDA 3, the drainage system will increase in size to provide the additional capacity needed to convey the contributing offsite basin flows from TDA 3. The existing drainage structure in East Lake Sammamish Shore Lane SE will be removed and a new structure will be installed at the north roadway edge. An additional catch basin will be installed to the east, along the north edge of East Lake Sammamish Shore Lane SE in order to center the outfall pipe for the most ideal location of a drainage easement on the parcel 1724069036 (property address 4229 East Lake Sammamish Parkway SE). To satisfy the direct discharge requirements, the invert elevation of the outfall pipe to Lake Sammamish will be set at the Lake Sammamish ordinary high water mark (OHWM) elevation of 31.8 feet (North American Vertical Datum [NAVD] 88).

The project would like to preserve the existing outfall location to Lake Sammamish; however, drainage easement requirements specify a minimum width of 15 feet for culverts, and the easement must be located 5 feet from the nearest building setback line. As described in Section 3.3, Mr. O'Donnell indicated that the existing location of the drainage pipe is near the eastern property boundary of his house. A review of the King County iMAP did not find a record of an existing drainage easement on either private parcel, 1724069036 or 1724069092. Mr. O'Donnell's home and the building on parcel 1724069092 are located approximately 11 feet apart at the nearest point, and the building on parcel 1724069092 is located less than 5 feet from the existing storm drain at the nearest point. Thus, the location of the existing outfall pipe cannot be used for the drainage easement because it doesn't meet building set back requirement or the 15-foot-wide minimum width for culverts. Therefore, the project proposes the above stated drainage easement that would be located on parcel 1724069036, between the house of Mr. O'Donnell to the east and Mr. McNaughton to the west. See sheet AL3 in appendix A.

6. SPECIAL REPORTS AND STUDIES

Special reports and studies have been completed for this project including the following:

- Draft Geotechnical Engineering Report (Icicle Creek Engineers, Inc. 2013) (included in Appendix E)

A geotechnical analysis was performed to evaluate the suitability of the site soils for construction of walls, wall foundations, and infiltration trenches along the trail corridor.

- Draft Critical Areas Study (Parametrix 2014)

The critical areas study evaluated the proposed trail impacts on the wetlands, wetland buffers, streams, and stream buffers along the trail corridor in Sammamish. The project will not create permanent impacts to wetlands or streams nor will it create temporary impacts to streams. There will be temporary wetland, wetland buffer and stream buffer impacts, which will be restored on site at the affected locations. Because permanent impacts on wetland buffers and stream buffers could not be completely avoided, King County will offset these impacts through compensatory mitigation. The critical areas report explains the impacts study and describes the selection, sizes location of the proposed mitigation solutions.

7. OTHER PERMITS

Other permits required for this project are:

- Shoreline Permit
- City of Sammamish Grading Permit
- Drainage Easement
- Section 404 Permit by the U.S. Army Corps of Engineers
- Hydraulic Project Approval

The project will require a Hydraulic Project Approval permit for the anticipated in-water work that will be performed when installing the new direct discharge outfall for the combined stormwater conveyance of TDA 2 and TDA 3.

- National Pollutant Discharge Elimination System (NPDES) General Construction Permit
- Building permit for structural walls and culverts

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8. TEMPORARY EROSION AND SEDIMENT CONTROL DESIGN

The construction Stormwater Pollution Prevention Plan will be provided as an appendix with the submittal of the final TIR.

DRAFT

9. BOND QUANTITIES, FACILITY SUMMARIES, AND DECLARATION OF COVENANT

This section does not apply to this project.

DRAFT

10. OPERATION AND MAINTENANCE

10.1 STORMWATER MANAGEMENT

The stormwater system in South Sammamish Segment A consists of ditches, culverts, storm drains, quarry spill outfall protection, catch basins, and infiltration trenches. Excerpts from Appendix A of the 2009 KCSWDM describe the maintenance requirements for the following project components; these excerpts are provided in Appendix D.

- Catch Basins and Manholes
- Conveyance Pipes and Ditches
- Energy Dissipaters

Infiltration Trenches

Infiltration trenches are designed to infiltrate runoff from the trail up to the 100-year storm event. The trenches are designed to drain within 2 days following a storm event. Monitoring wells are not necessary and will not be provided to monitor the depth of water in the trenches. Also, the top 6 to 12 inches of crushed rock will be monitored for sediment buildup. The project design requires that the trenches be wrapped with geotextile fabric, which should keep the drain rock inside the trenches clean, so that only the top crushed rock would need to be replaced.

10.2 VEGETATION MANAGEMENT

For vegetation management of the ELST, King County Department of Natural Resources and Parks uses a Vegetation Management Plan prepared for the East Lake Sammamish Interim Use Trail. Chapter 5 of that plan describes maintenance activities for drainage, including dry and wet ditches, clearing of clogged culverts, and repair of ditches and culverts. The plan also specifies monitoring of ditches and culverts at least twice a year, including once in the fall before the rainy season.

Parametrix will prepare an addendum to the Vegetation Management Plan for South Sammamish Segment A that will include any updates or changes in maintenance requirements. A copy of the Vegetation Management Plan is provided under separate cover.

King County's contact person for maintenance issues is Robert Nunnenkamp. His contact information is:

Email: Robert.Nunnenkamp@kingcounty.gov

Telephone: 206-291-7301

11. REFERENCES

City of Sammamish. 2011. City of Sammamish Surface Water Design Manual Addendum. Sammamish, WA.

Icicle Creek Engineers, Inc. 2013. Draft Report, Geotechnical Engineering Services, South Sammamish Segment, East Lake Sammamish Trail, Sammamish, Washington. Prepared by Icicle Creek Engineers, Inc. December 11, 2013.

King County. 2009. King County Surface Water Design Manual. Prepared by King County Department of Natural Resources and Parks, Seattle, WA.

King County. 2014. East Lake Sammamish Master Plan Trail, South Sammamish Segment A Critical Areas Study. Prepared by Parametrix, Seattle, WA. July 2014.

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