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

Prepared for

King County

December 2014

Prepared by

Parametrix

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

Prepared for

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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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Prepared by Craig Buitrago, P.E.

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Approved by Jenny Bailey

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C Hydrologic and Hydraulic Calculations
D Operation and Maintenance Requirements
E Geotechnical Report, Modret Technichal Memorandum, and Daily Field Report (CD)
F Temporary Erosion and Sediment Control Plan

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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
FCBMP	flow control best management practice
GIS	geographic information system
HDPE	high density polyethylene
2009 KCSWDM	King County Surface Water Design Manual of 2009
KCBW	King County Backwater
Master Plan Trail	East Lake Sammamish Master Plan Trail
MGSFloodV4	MGSFlood Version 4
MODRET	Computer MODel to Design RETention Ponds
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

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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.

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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	0.82
Total		**16.80**	**3.74**	**2.46**

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.

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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:

Date of Approval: _____

PART 7 MONITORING REQUIREMENTS

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Monitoring Required ☐ Yes ☒ No

Start Date: _____

Completion Date: _____

Describe

PART 8 SITE COMMUNITY AND DRAINAGE BASIN

Community Plan: _____

Special District Overlays: _____

Drainage Basin: East Lake Sammamish, Monohon

Stormwater Requirements: 2009 King County Surface Water Design Manual and 2011 City of Sammamish Surface Water Design Manual Addendum

PART 9 ONSITE AND ADJACENT SENSITIVE AREAS

☒	River/Stream	Unnamed Stream #1, Unnamed Stream #2, Stream #0163 SF, Stream #0163 NF, Unnamed Stream #3
☒	Lake	Lake Sammamish
☒	Wetlands	3E, 12A, 13A, 14A, 14C
☐	Closed Depression	
☒	Floodplain	Lake Sammamish
☐	Other	

☒	Steep Slope	
☒	Erosion Hazard	
☒	Landslide Hazard	
☐	Coal Mine Hazard	
☒	Seismic Hazard	
☐	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)

☐ Other _____

☐ Additional Sheets Attached

☐ Sole Source Aquifer

☐ Seeps/Springs

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

PART 11 DRAINAGE DESIGN LIMITATIONS

	REFERENCE	LIMITATION / SITE CONSTRAINT
☒	Core 2 – Offsite Analysis	Private properties downstream
☒	Sensitive/ Critical Areas	Wetland Impact Mitigation
☐	SEPA	
☐	Other	
☐		
☐	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 Q_{100} 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	
Describe:	

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

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 three catch basins and four storm drain pipes and a stormwater detention vault is proposed to control flow discharging to the existing 4-inch conveyance system downstream of the trail adjacent to Station 224+00.	

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: ☒ 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: The existing trail culvert and a segment of the existing conveyance system downstream of TDA 3 will be replaced with a new conveyance system, which will consist of three catch basins and three storm drain pipes. The proposed storm design changes will accommodate the trail widening and wall that will be placed on the left side of the trail. The proposed storm system will re-connect to the existing storm sewer system downstream of TDA 3.	

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: ☒ 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 Q_{100} 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	
Describe: Infiltration trench for target trail impervious surfaces. 3-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 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: ☒ 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 Q_{100} 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): 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: ☐ Yes ☒ No Treatment BMP: N/A Maintenance Agreement: ☐ Yes ☒ 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: ☒ 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 Q_{100} 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): 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: ☐ Yes ☒ No Treatment BMP: N/A Maintenance Agreement: ☐ Yes ☒ No With whom? N/A
Other Drainage Structures	
Describe: Flow Control BMP – Basic Dispersion for target trail impervious surfaces	

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: ☒ 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 Q_{100} 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 Phone206-394-3700 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): 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: ☐ Yes ☒ No Treatment BMP: N/A Maintenance Agreement: ☐ Yes ☒ No With whom? N/A
Other Drainage Structures	
Describe: Infiltration trench for target trail impervious surfaces. 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 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 6/20/2014
Flow Control (incl. facility summary sheet)	Level: ☐ 1 ☐ 2 ☐ 3 or Exemption Number Q_{100} 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): 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: ☐ Yes ☒ No Treatment BMP: N/A Maintenance Agreement: ☐ Yes ☒ No With whom? N/A
Other Drainage Structures	
Describe: Flow Control BMP – Infiltration trench for target trail impervious surfaces. 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: ☒ 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 Q_{100} 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): 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: ☐ Yes ☒ No Treatment BMP: N/A Maintenance Agreement: ☐ Yes ☒ No With whom? N/A
Other Drainage Structures	
Describe: Flow Control BMP – Infiltration trench for target trail impervious surfaces. 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 33rd 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

MINIMUM ESC REQUIREMENTS DURING CONSTRUCTION	MINIMUM ESC REQUIREMENTS AFTER CONSTRUCTION
☒ Clearing Limits	☒ Stabilize Exposed Surfaces
☒ Cover Measures	☒ Remove and Restore Temporary ESC Facilities
☒ Perimeter Protection	☒ Clean and Remove All Silt and Debris, Ensure Operation of Permanent Facilities
☒ Traffic Area Stabilization	☒ Flag Limits of SAO and open space preservation areas
☒ Sediment Retention	☐ Other
☐ Surface Water Collection	
☒ Dewatering Control	
☒ Dust Control	
☐ Flow Control	

PART 14 STORMWATER FACILITY DESCRIPTIONS (NOTE: INCLUDE FACILITY SUMMARY AND SKETCH)

Flow Control	Type/Description	Water Quality	Type/Description
☐ Detention		☐ Biofiltration	
☒ Infiltration	Infiltration Trenches	☐ Wetpool	
☐ Regional Facility		☐ Media Filtration	
☐ Shared Facility		☐ Oil Control	
☒ Flow Control BMPs	Basic Dispersion	☐ Spill Control	
☐ Other		☐ Flow Control BMPs	
		☐ Other	

PART 15 EASEMENTS/TRACTS

- ☐ Drainage Easement
- ☐ Covenant
- ☐ Native Growth Protection Covenant
- ☐ Tract
- ☐ Other

PART 16 STRUCTURAL ANALYSIS

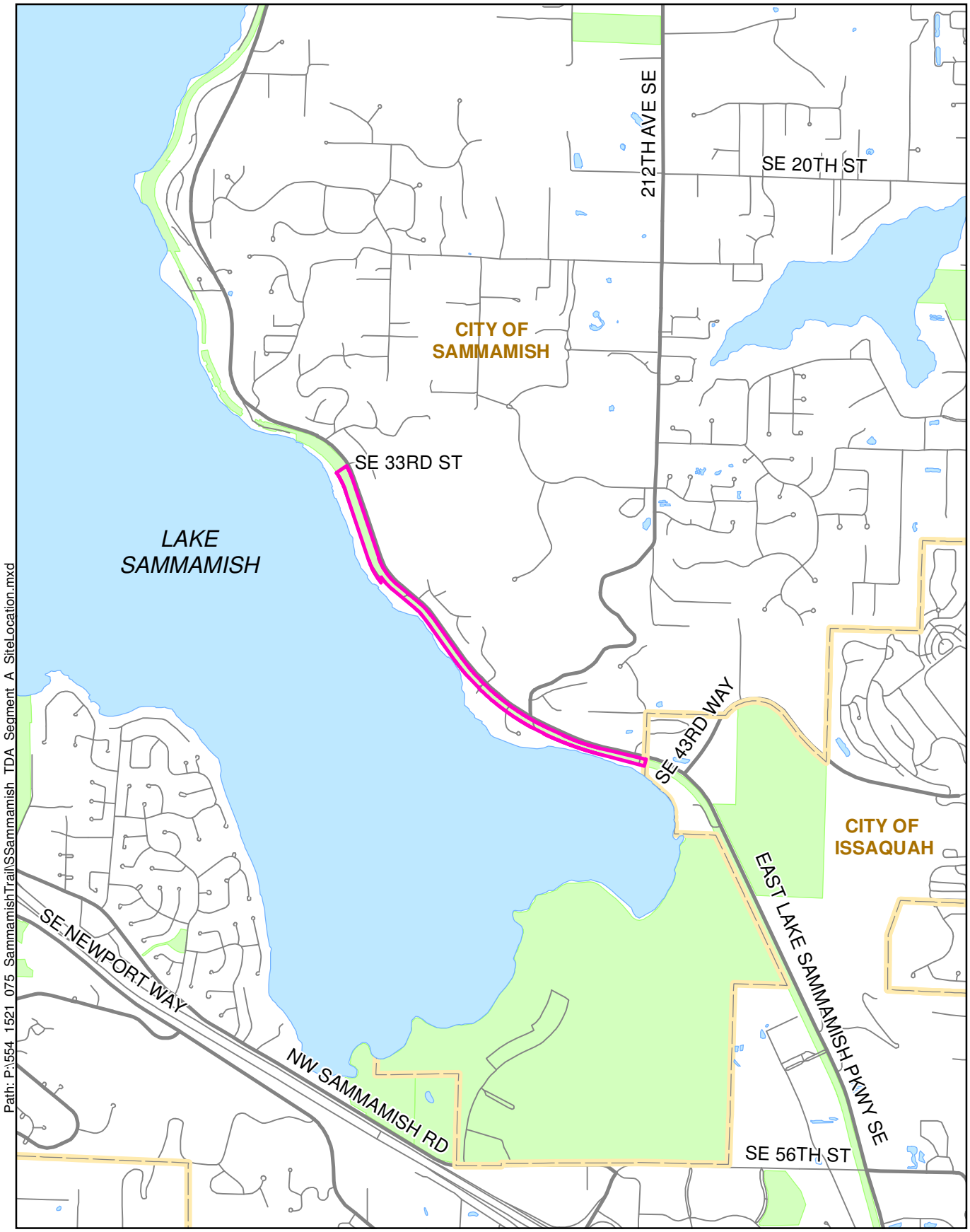
- ☐ Cast in Place Vault
- ☒ Retaining Wall
- ☐ Rockery > 4' High
- ☐ Structural on Steep Slope
- ☒ Other – Precast Vault (by others)

PART 17 EASEMENTS/TRACTS

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.

12/15/2014

Signed/Date



Parametrix

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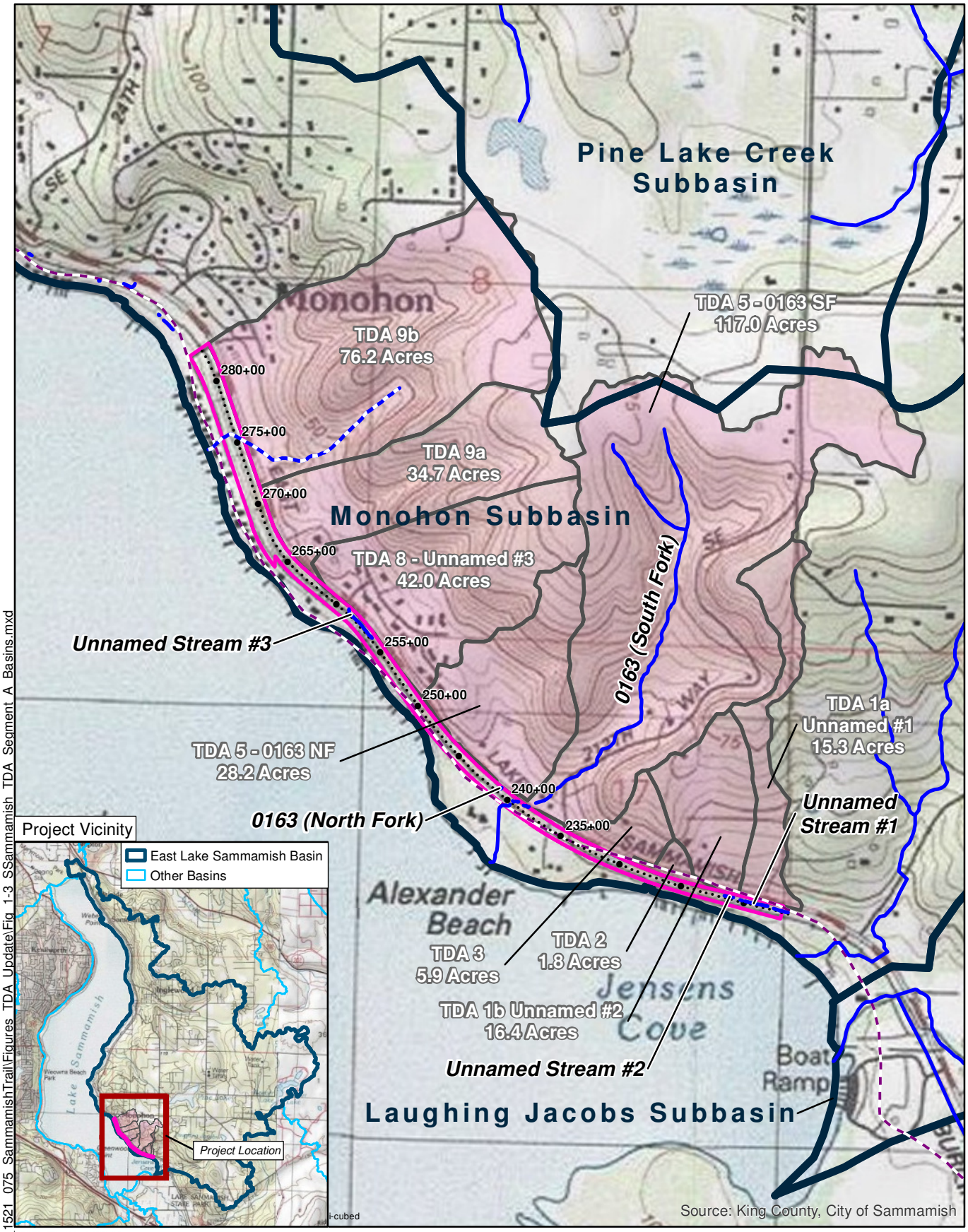
0 1,000 2,000

Feet

Project Location

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



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Parametrix

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0 500 1,000
Feet

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
Catchment Area

480+00 485+00
Proposed Trail Stationing

Note: Project area is within the East Lake Sammamish Basin.

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, and single-ring infiltrometer test (SRIT) was performed at locations where infiltration trenches were thought to be desirable. The infiltration testing procedures are described in the December 1, 2013 draft geotechnical report, and satisfy the general requirements for infiltration facilities as stated in Section 5.4.1 of the KCSWDM. The test results found that infiltration is feasible, and the geotechnical report provides recommendations for the infiltration rates that are to be used to size infiltration facilities in this trail section. Areas where infiltration trenches will be used as flow control best management practices (FCBMPs) and for flow control are discussed in Section 4.4. Design methods and results, including a MODRET (Computer MODel to Design RETention Ponds) analysis performed by the geotechnical engineer are presented in Section 4.4. A technical memorandum (dated December 9, 2014) summarizing the MODRET analysis is provided in Appendix E as a separate document from the December 11, 2013 draft geotechnical report.

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

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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 twelve boring locations throughout this trail segment, including one at each infiltration test pit location, 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 daily field report with a summary of the piezometer measurements is provided in Appendix E as a separate document from the December 11, 2013 draft geotechnical report.

To satisfy the general requirements for infiltration facilities, Section 5.4.1 of the KCSWDM, continuous groundwater monitoring equipment will be installed into 8 piezometers in the vicinity of the proposed infiltration trenches. The data will be collected from December 2014 to April 31, 2014, and again from October 1, 2015 December 2015. The collected groundwater levels will be reported at the time of final permit submittal and again in December 2015 after the equivalent of one wet-season of data has been collected.

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.

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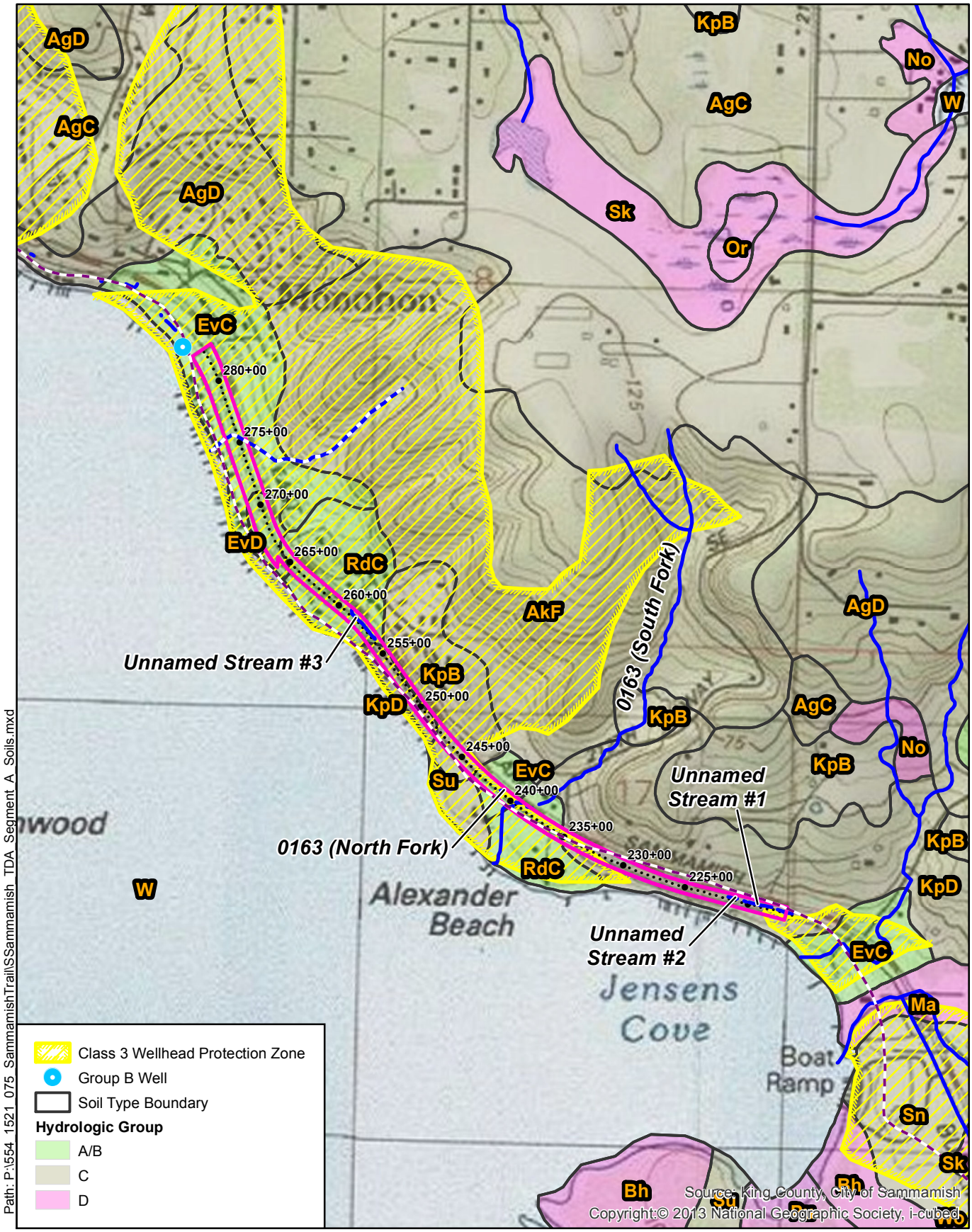

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Parametrix

N

0 500 1,000

Feet

Segment A Project Location

Stream Crossing Field-verified by Parametrix

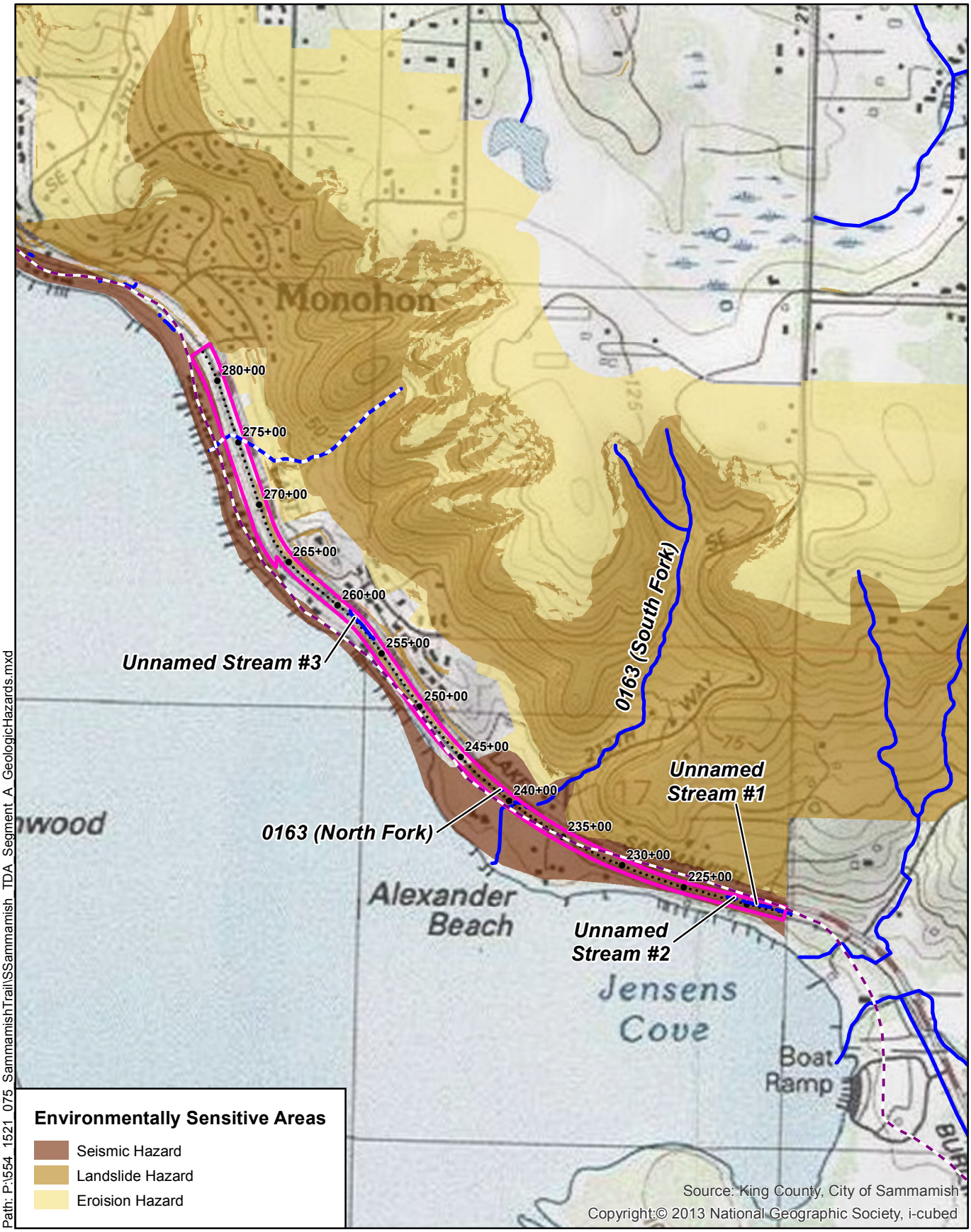
Stream Crossing Not Found within Trail Corridor

100-year Floodplain Boundary

480+00 485+00

Proposed Stationing

Figure 1-4
Soils



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Parametrix

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0 500 1,000
Feet

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

480+00 485+00
Proposed Stationing

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 (Level 1) Flow Control area. However, a Conservation (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.
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.
C3 Flow Control	All TDAs are subject to conservation flow control area requirements (KCSWDM Section 1.2.3.1.D). Summary of flow control approach is provided in this table (below), and a detailed description is provided in Section 4.

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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
	TDAs 1 and 4 through 9 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}). Target surfaces in TDAs 1 and 5 do not use flow control best management practices to meet this exception. Target surfaces in TDA 6 will use basic dispersion for the trail impervious surface area to meet this exception. Target surfaces in TDAs 4, 7, 8, and 9 will use infiltration and will meet the exception. The existing conveyance systems at the discharge locations for TDAs 2 and 3, respectively, directly discharge to Lake Sammamish and satisfy the direct discharge flow control exemption. Although TDA 2 is exempt from flow control, the downstream drainage system is undersized and a flooding nuisance exists in the existing condition. Thus, a flow control facility is proposed. A detailed description is provided in Section 4.
C4 Conveyance	Runoff will sheet flow from the paved trail to the adjacent gravel shoulder and then to existing drainage pathways and ditches. In TDAs 2 and 3, the project proposes to modify the existing trail discharge culvert to accommodate the trail widening. Section 5 provides description of the proposed project conveyance systems and the existing conveyance systems that the project will continue to connect to downstream of the trail area.
C5 Temporary Erosion and Sediment Control (TESC)	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.
C6 Operation and Maintenance (O&M)	Section 10 describes the project O&M plan.
C7 Financial	Not applicable.
C8 Water Quality	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. See section 4.5 for further description.
S1 Other Adopted Requirements	No area-specific requirements apply to this project.
S2 Flood Hazard Area Delineation	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.
S3 Flood Protection Facilities	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.
S4 Source Control	This special requirement is not applicable to this project because it does not meet the commercial development permit threshold.
S5 Oil Control	This special requirement is not applicable to this project because the trail is non-PGIS and does not meet the high-use site threshold.

2.1 FLOW CONTROL BMP REQUIREMENTS

Section 5.2 of the KCSWDM, states that flow control best management practices (FCBMPs) seek to control runoff at or near its sources, and that implementation of the FCBMP requirement is focused primarily on individual site/lot developments as opposed to subdivisions or projects with rights-of-way. Therefore, implementation of FCBMPs are required for individual site/lot project, but are only incentive-based for subdivisions or projects with rights-of-way. This trail project is located within King County right-of-way, therefore, implementation of FCBMPs is incentive based.

KCSWDM Section 5.2.2.2 provides the following requirements for the project to receive credit for use of FCBMPs to be applied where feasible throughout any portion of the project. Table 2-3 summarizes how the project will meet the requirements to receive credit for the use of FCBMPs.

Table 2-3. Summary of Credit Requirement for Flow Control BMP

	Requirement per Section 5.2.2.2 of the 2009 KCSWDM	Proposed FCBMP Implementation Approach
1	BMPs must serve impervious surface located only within the right-of-way.	The FCBMPs, where used, will only serve the trail impervious surface.
2	If the right-of-way is road right-of-way that will be maintained by King County, the BMPs must be approved by King County Department of Transportation through a road variance prior to engineering plan approval.	This requirement is not applicable because the right-of-way is King County Parks right-of-way, and the trail corridor is maintained by King County Parks maintenance staff.
3	If the right-of-way will be privately maintained, provisions must be made for future maintenance of BMPs in accordance with Core Requirement 6, Section 1.2.6 of 2009 KCSWDM.	This requirement is not applicable because the right-of-way is King County Parks right-of-way, and the trail corridor is maintained by King County Parks maintenance staff.
4	If King County will be assuming maintenance of the BMPs, the BMPs must comply with the drainage facility financial guarantee and liability requirements in Core Requirement 7, Section 1.2.7 of 2009 KCSWDM.	King County agrees to pay for construction of the BMPs and King County Parks maintenance staff, which currently maintains the trail right-of-way, will maintain the proposed FCBMPs.

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.

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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. Property access was not granted for survey to collect the invert elevation of the 16-inch culvert or characteristics of the open channel which discharges to the lake.

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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 existing 12-inch trail culvert at 224+00 conveys stormwater southwest where the outlet is buried beneath a rockery. Stormwater flows are dissipated by the rockery, and water exits from the base of the rockery in a flow pattern that appears similar to a groundwater seep. Generally, the flow continues as shallow concentrated flow across East Lake Sammamish Shore Lane SE, and most of the flow is collected in a catch basin that is part of a private stormwater system. The existing, private downstream drainage system consists of a catch basin inlet in East Lake Sammamish Shore Lane SE that does not have a sump, and an existing 4-inch pipe. This system directly discharges collected flows from the trail culvert and runoff from the East Lake Sammamish Shore Lane SE to Lake Sammamish. Due to pavement grading, not all runoff is collected in the catch basin at this location. Surface flow that is not collected in the catch basin continues as sheet flow south toward the trench drains, yard drains, and landscaping in front of the properties at 4259 East Lake Sammamish Shore Lane SE and 4257 East Lake Sammamish Shore Lane SE.

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. From the catch basin, a 12-inch ADS pipe exits to the east, and is part of a private downstream drainage system. It is evident by the slope of East Lake Sammamish Shore Lane SE, that this catch basis does not receive roadway runoff. During the field investigation and survey of the private drainage system, 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.

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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 a drainage complaint they placed with the City of Sammamish in March 2011. Stormwater was 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). This drainage complaint was resolved and is not anticipated to be a reoccurring problem.

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 and appears to dissipate or infiltrate.

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.

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TDA 6 – Station 241+50 to 244+05

No distinct drainage pathways were identified during the field investigations. Runoff drains to adjacent landscaping vegetation and appears to dissipate or infiltrate.

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 and appears to dissipate or infiltrate.

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. Additionally, there is a stormwater

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conveyance system that conveys runoff from a development on the east side of East Lake Sammamish Parkway through the trail right-of-way and directly discharges to Lake Sammamish in a recorded easement. This drainage system does not collect trail runoff, and is depicted in Figure 3-4.

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.

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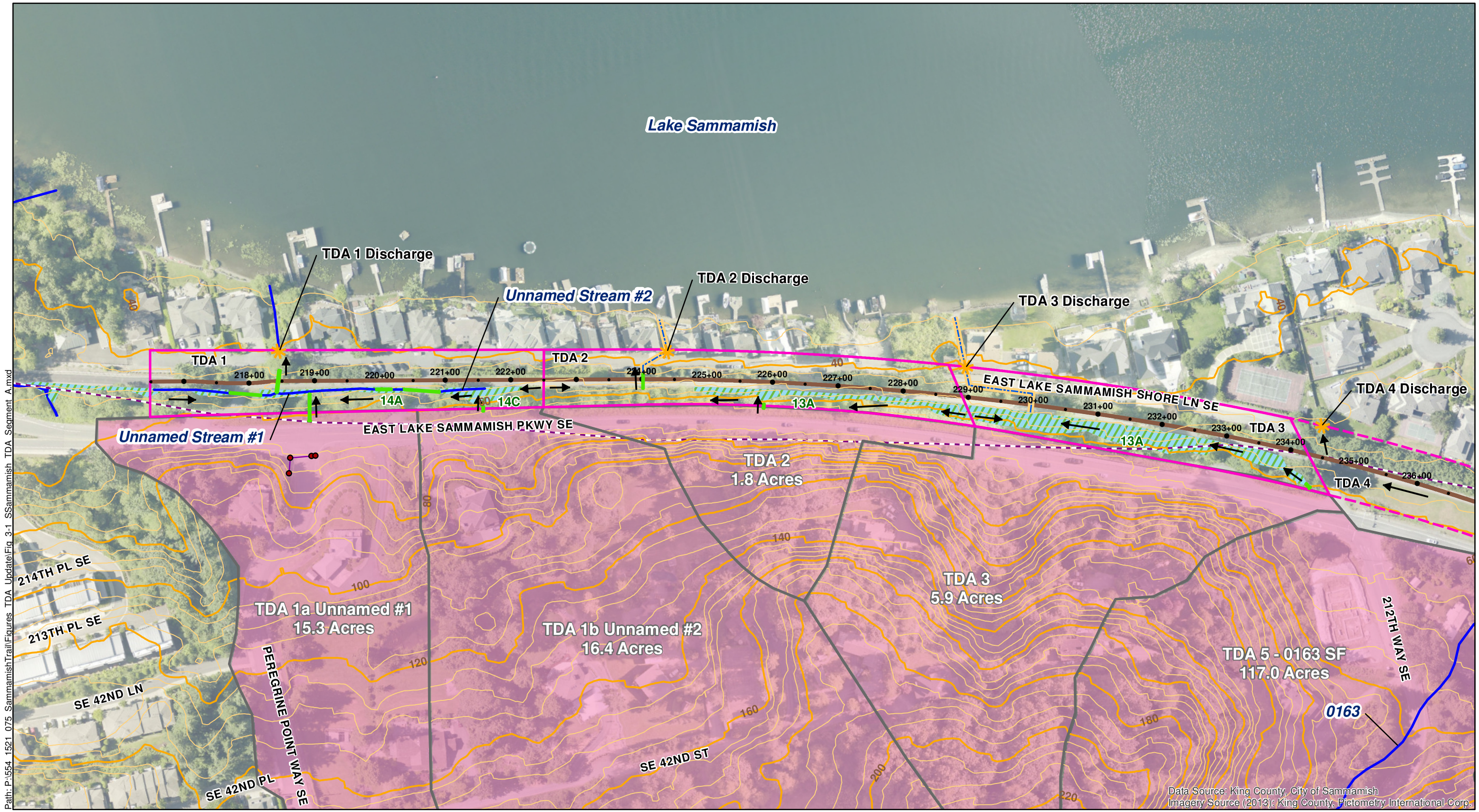


Path: P:\554_1521_075_SammamishTrail\Figures_TDA_Update\Fig_3-1_SSammamish_TDA_Segment_A.mxd

Parametrix

N

0 100
Scale in Feet

480+00 485+00
Proposed Trail Stationing

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
Catchment Area

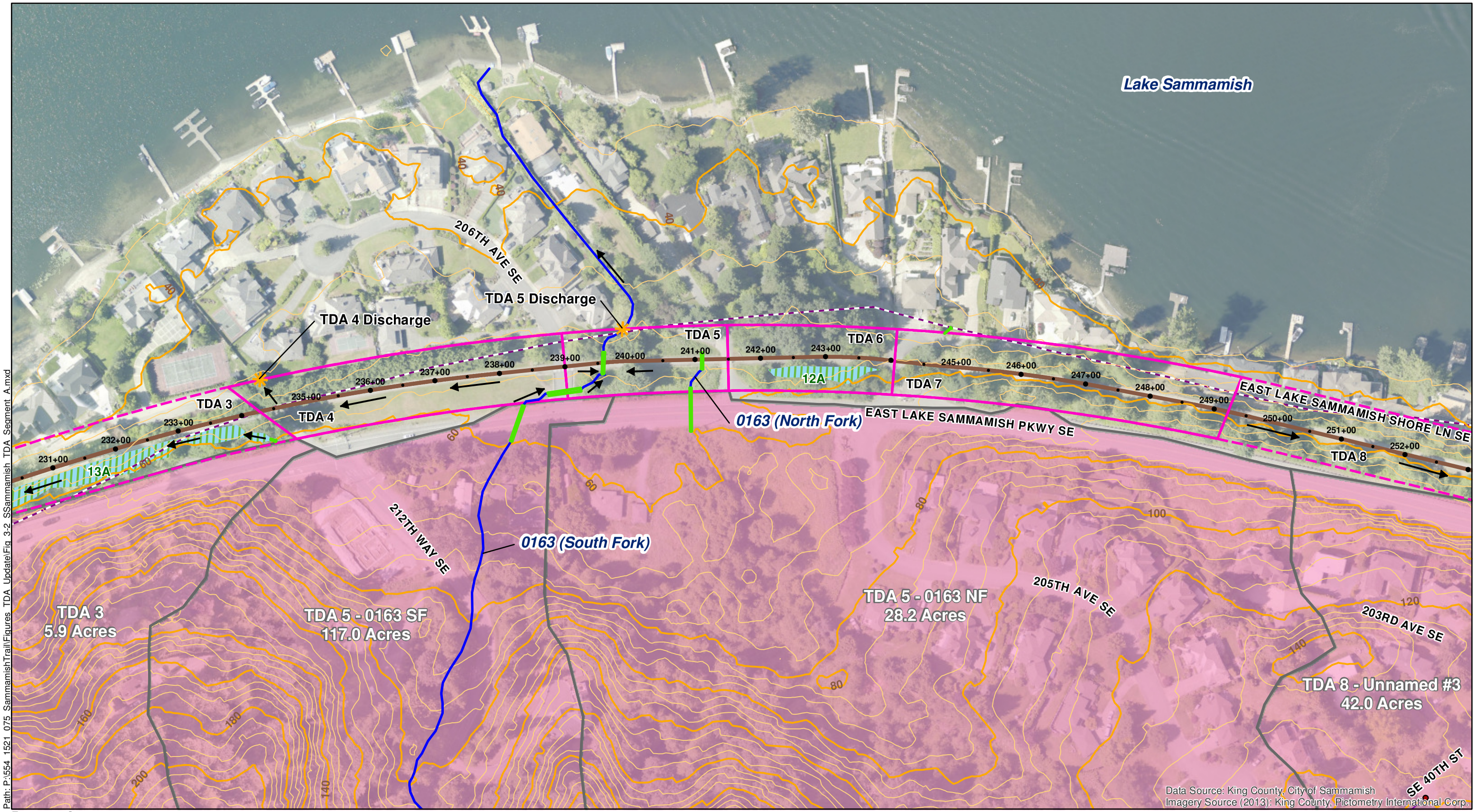
Contour - 20 ft
Contour - 5 ft
Drainage Features
Drainage Lines

100-year Floodplain Boundary
Wetland
Flow Path

Sheet Flow

Figure 3-1

Threshhold Discharge Areas 1 - 3



Path: P:\554_1521_075_SammamishTrail\Figures_TDA_Update\Fig 3-2_SSammamish_TDA_Segment_A.mxd

Parametrix

N

0 100
Scale in Feet

480+00 485+00
Proposed Trail Stationing

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
Catchment Area

Contour - 20 ft
Contour - 5 ft
Drainage Features
Drainage Lines

100-year Floodplain Boundary
Wetland
Flow Path

Sheet Flow

Figure 3-2

Threshhold Discharge Areas 4 - 7

Path: P:\554 1521 075 SammamishTrail\Figures TDA Update\Fig 3-3 SSammamish TDA Segment A.mxd

Lake Sammamish

TDA 8 Discharge

TDA 7

TDA 8

TDA 9

248+00 249+00 250+00 251+00 252+00 253+00 254+00 255+00 256+00 257+00 258+00 259+00 260+00 261+00 262+00 263+00 264+00 265+00 266+00 267+00 268+00 269+00

EAST LAKE SAMMAMISH SHORE LN SE

EAST LAKE SAMMAMISH PKWY SE

Unnamed Stream #3

203RD AVE SE

205TH AVE SE

SE 40TH ST

SE 39TH ST

SE 39TH PL

202ND PL SE

TDA 5 - 0163 NF
28.2 Acres

TDA 8 - Unnamed #3
42.0 Acres

TDA 9a
34.7 Acres

TDA 9b
76.2 Acres

40 60 80 100 120 140 160

Data Source: King County, City of Sammamish
Imagery Source (2013): King County, Pictometry International Corp.

Parametrix

N

0 100
Scale in Feet

480+00 485+00
Proposed Trail Stationing

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
Catchment Area

Contour - 20 ft
Contour - 5 ft
Drainage Features
Drainage Lines

100-year Floodplain Boundary
Wetland
Flow Path

Sheet Flow

Figure 3-3

Threshhold Discharge Area 8

Lake Sammamish

TDA 9 Discharge
(Piped to Lake)

EAST LAKE SAMMAMISH SHORE LN SE

EAST LAKE SAMMAMISH PKWY SE

261+00 262+00 263+00 264+00 265+00 266+00 267+00 268+00 269+00 270+00 271+00 272+00 273+00 274+00 275+00 276+00 277+00 278+00 279+00 280+00 281+00 282+00

TDA 8

TDA 9

TDA 8 - Unnamed #3
42.0 Acres

TDA 9a
34.7 Acres

TDA 9b
76.2 Acres

135.7 Acres

135.7 Acres

SE 39TH ST

202ND PL SE

198TH PL SE

SE 33RD ST

40 60 80 100 120 140 160 180 200 220 240

Data Source: King County, City of Sammamish
Imagery Source (2013): King County, Pictometry International Corp.

Path: P:\554 1521 075 SammamishTrail\Figures TDA Update\Fig 3-4 SSammamish TDA Segment A.mxd

Parametrix

N

0 100
Scale in Feet

480+00 485+00 Proposed Stationing

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
Catchment Area

Contour - 20 ft
Contour - 5 ft
Drainage Features
Drainage Lines

100-year Floodplain Boundary
Wetland
Flow Path

Sheet Flow

Figure 3-4

Threshhold 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. Additionally, on November 28, 2014, there was a complaint of water surcharging the 16-inch East Lake Sammamish Shore Lane SE culvert and flowing across the driveway. Based on documentation of the incident, the culvert was cleaning out, the incident resolved, and no flood damage was done to the adjacent properties. Conveyance analysis and mitigation discussion is presented Section 3.5.

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.

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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 for a three week period of time in March 2011. The problem was thought to be due to drainage system being plugged or the larger 18-inch trail culvert being connected to the smaller 12-inch pipe downstream at the catch basin in the shoulder of East Lake Sammamish Shore Lane SE. The drainage problem was resolved by cleaning out the pipes, and there have been no additional drainage complaints. 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. City staff confirmed that this drainage issue was caused by a plugged culvert at SE 212th Way SE east of the intersection with East lake Sammamish Parkway. City maintenance staff resolved the drainage issue by unplugging the stream culvert, and 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.

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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 does not propose to provide mitigation for the existing driveway drainage problem. If the project were to redirect driveway runoff to the Unnamed Stream channel west of the driveway, this would add offsite runoff to a channel that does not have capacity downstream to convey the 25-year or 100-year storm event flow rates.

Regarding Dr. Vanderhoeven's concerns about flow through the trail culvert near Sta. 218+45, land use and conveyance evauation were performed to determine the severity of the conveyance nuisance. The existing drainage catchment was delineated using GIS and topographic information from King County. Total land use was determined using the existing off-site drainage catchment and measuring the contributing project area in AutoCAD design software. The off-site basin impervious area was calculated using 27.7 percent effective impervious area based on the 42 percent impervious area for City of Sammamish R-4 zoning and 66 percent effective impervious area fraction for medium density single family land use.

The runoff values were computed using the MGSFloodV4 with the 5-minute time step for conveyance. The Manning's Equation was used to evaluate conveyance capacity, with a roughness coefficient of 0.012 for concrete and ductile iron pipes. The 24-inch trail culvert is placed at 3.39 percent slope and has full-flow capacity of 45.12 cfs, which is adequate conveyance capacity to convey the 25- and 100-year storm events (17.05 and 30.64 cfs, respectively). The length and slope for the 16-inch culvert that conveys runoff beneath East Lake Sammamish Shore Lane SE were unknown due to data that could not be collected. Therefore, the downstream gradient was estimated as follows: a constant slope from the pipe invert, 38.02, to the lake, approximate elevation of 32.5, and distance of approximately 130 feet, resulting in an estimated pipe slope of 4.25 percent. The flow cull capacity of the 16-inch culvert is 17.02 cfs. Therefore, the culvert is slightly undersized for conveyance of the 25-year design storm and undersized for the 100- year design storm. The downstream open channel was assumed to have the same 4.25 percent slope, and channel dimensions of two foot bottom width, 2:1 side slopes and one-foot depth. For conveyance capacity calculations a Manning's Roughness Coefficient of 0.040 for a constructed channel with cobble bottom and clean banks was assumed. Conveyance evaluation using Manning's Equation for the channel provides that the channel depth is 0.88 feet during the 25-year storm event and 1.2 feet during the 100-year storm event. Therefore, the water elevation may be expected to overtop the channel bank in the high flow event.

The conveyance analysis demonstrates that the trail culvert is adequately sized to convey runoff from the contributing areas. An analysis based on estimated slope and channel dimension, provide that the conveyance elements downstream and outside of the project area may have enough capacity to contain the 25-year design storm, but not the 100-year design storm. The culvert beneath East Lake Sammamish Shore Lane SE needs to be replaced with a larger pipe to ensure conveyance of the contributing flows for events greater than the 25-year design storm.

. The project is exempt from flow control in this TDA because proposed improvements will have a negligible increase (less than or equal to 0.1 cfs) in the 100-year discharge (see Section 4). Therefore, the project does not propose to make any changes to the trail culvert nor to the downstream culvert at East Lake Sammamish Shore Lane SE.

See Figure 1-3 for offsite drainage catchment areas, and Appendix C for land use and conveyance design calculations.

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

Similar to the scenario at Driveway #1, the project does not propose to provide mitigation for this existing drainage problem. If the project were to redirect driveway runoff to the Unnamed Stream channel west of the driveway, this would add offsite runoff to a channel that does not have capacity downstream to convey the 25-year or 100-year storm event flow rates. Conveyance calculations confirm that the existing 24-inch culvert at 218+45 that conveys the stream beneath the trail has enough capacity for the existing contributing drainage basin, but the downstream culvert is undersized. 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 was resolved in 2011 in response to the complaint.

Drainage calculations confirm that the existing conveyance system has adequate capacity to convey runoff from the contributing drainage basin with the 12-inch diameter storm pipe

Evaluation of the existing trail culvert and the downstream conveyance system beneath East Lake Sammamish Shore Lane SE are provided in Section 5.1. See appendix C for design calculations and offsite drainage areas.

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. The project design proposes infiltration trenches to fully infiltrate trail runoff. in TDA 8. 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.

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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.

As discussed in Section 2.1, the project will apply FCBMPs for target impervious surfaces where feasible to receive the incentive based land use credits. Section 1.2.3.1.B of the 2009 KCSWDM states land use credits may be applied to the target surfaces served by FCBMPs. 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 fully infiltrate the trail impervious surface in TDAs 4, 7, 8 and 9 and basic dispersion for trail impervious surface in TDA 6. 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. For target impervious surfaces where basic dispersion is applied, the impervious areas is modeled as 50 percent impervious and 50 percent pervious grass. Table 4-1 provides the project

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land use summary for pre-developed and developed target areas, including the trail areas that will apply the full infiltration and basic dispersion land use credits. Flow control performance standards and exemptions are presented in Section 4.3.

Table 4-1. Target Project Area Land Use Summary

	Pre-developed			Developed			
TDA	Outwash/Forest (acre)	Till/Forest (acre)	Total Target Area (acre)	Pervious Outwash/Grass (acre)	Pervious Till/Grass (acre)	Impervious (acre)	Total Target Area (acre)
1	0.00	0.33	0.33	0.00	0.12	0.21	0.33
2	0.00	0.48	0.48	0.00	0.24	0.24	0.48
3	0.00	0.38	0.38	0.00	0.18	0.20	0.38
4	0.00	0.32	0.32	0.00	0.15	0.00[a]	0.15
5	0.00	0.17	0.17	0.00	0.08	0.09	0.17
6	0.00	0.21	0.21	0.00	0.16	0.05[b]	0.21
7	0.00	0.36	0.36	0.00	0.17	0.00[a]	0.17
8	0.34	0.40	0.74	0.14	0.15	0.00[a]	0.29
9	1.65	0.00	1.65	0.83	0.00	0.00[a]	0.83

[a] Per Table 1.2.3.C of 2009 KCSWDM, subtract impervious surfaces that are fully infiltrated from modeled land use.
[b] Per Table 1.2.3.C of 2009 KCSWDM, model dispersed impervious surfaces as 50 percent impervious, 50 percent grass.

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.

On the Draft 60-percent design plans, submitted with the Substantial Shoreline Permit Development application, the project proposed to combine the trail drainage areas from two separate trail drainage crossings (TDAs 2 and 3) and create a new drainage discharge to Lake Sammamish via a drainage easement on the McNaughton property (4229 East Lake Sammamish Parkway SE), in effort to separate public stormwater from private drainage and resolve the conveyance capacity issue downstream of the trail culvert at Station 224+00. Attempts to secure a drainage easement were not successful. Therefore, the design team re-considered the conveyance capacity for the contributing drainage areas to both the culvert near trail station 224+00 and the culvert near trail station 229+85.

The proposed design for both trail crossings is to re-construct the trail drainage crossings, and continue to discharge to the existing downstream drainage system. The existing under sized conveyance system downstream of the crossing near trail station 224+00 will be mitigated by sizing a detention vault to control the runoff release rate so that the downstream system will convey the 25-year design storm when flowing full. Further analysis of the 12-inch conveyance system downstream of the trail crossing near station 229+85 confirmed that the existing system has capacity to convey up to the 100-year design storm for the contributing drainage basin.

The proposed conveyance design is described further in Section 5.3.

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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	Exemption/ Reason	100-Year Flow Rates (cfs)		
		Pre-Developed	Developed	Delta
1	Yes/(ΔQ_{100} < or = 0.1)	0.0	0.1	0.1
2	Yes/ Direct Discharge	N/A	N/A	N/A
3	Yes/ Direct Discharge	N/A	N/A	N/A
4	Yes/(ΔQ_{100} < or = 0.1)	0.0	0.0	0.0
5	Yes/(ΔQ_{100} < or = 0.1)	0.0	0.1	0.1
6	Yes/(ΔQ_{100} < or = 0.1)	0.0	0.1	0.1
7	Yes/(ΔQ_{100} < or = 0.1)	0.0	0.0	0.0
8	Yes/(ΔQ_{100} < or = 0.1)	0.0	0.1	0.1
9	Yes/(ΔQ_{100} < or = 0.1)	0.0	0.1	0.1

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Table 4-2 shows that TDAs 2 and 3 are exempt from flow control requirements because they meet the direct discharge requirements, and the remaining TDAs are exempt from flow control requirements based on the applied land use credits and the ΔQ_{100} between the developed site condition and the historical site condition does not exceed 0.1 cfs.

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. Additionally, to mitigate the existing conveyance capacity problem downstream of the TDA 2 discharge point, a stormwater detention vault was sized to meet the Level 2 flow control requirements and reduce the developed 100-year peak flow event to a flow rate that can be conveyed by the downstream drainage system.

The MGSFloodV4 model printouts are included in Appendix C.

4.4 FLOW CONTROL SYSTEM

The project proposes the use of six infiltration trenches as FCBMPs that will fully infiltrate contributing flows from target impervious surface areas in TDAs 4, 7, 8 and 9.

Infiltration Trenches

The infiltration trenches in TDAs 4 and 7 meet the requirements of Limited Infiltration BMPs, and the infiltration trenches in TDAs 8 and 9 meet the requirements of Full Infiltration BMPs. All infiltration trenches are designed to meet the flow control requirement, as detailed below.

The existing drainage pattern was not easily recognized within TDA 4. Therefore, the project will use the underlying 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. The proposed trail widening will reduce the amount of adjacent vegetation that runoff dissipates into. Therefore, the project will use the underlying 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. Therefore, the infiltration trenches in TDAs 8 and 9 (trenches 3, 4, 5, and 6) were designed using 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. Per the December 9, 2014 MODRET Analysis Technical Memorandum, the geotechnical engineer recommended using a long-term design infiltration rate of 0.50 inches per hour for trenches 1 and 2 based on soil conditions observed in Borings B-4 and B-5 as "loamy sand."

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

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ground surface. The daily monitoring report is provided in Appendix E as a separate document from the draft geotechnical report. To satisfy the requirements for infiltration facilities, Section 5.4.1 of the 2009 KCSWDM, the project team will perform continuous groundwater monitoring for the equivalent of one full wet-season. Data monitoring and collection is anticipated to begin in December 2014 and will continue until April 30, 2015. Data collection will resume at the start of the next wet-season on October 1, 2015 and will be completed in December 2015. Once the continuous groundwater monitoring data is complete, the results will be provided to the review agency for record keeping.

The gravel infiltration trenches are located under the 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 2 feet deep with an additional 6 inches of freeboard below the surface of the trail. Typically, the trenches have 2-feet-width, with the exception of trench 1, which is 3-feet-wide.

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. 261+27
- Trench 4 TDA 9—Sta. 261+71 to Sta. 282+54
- Trench 5 TDA 9—Sta. 282+72 (northeast of sidewalk on SE 33rd Street)
- Trench 6 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 above.

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.

Stormwater Detention Vault

As previously discussed, the existing downstream drainage system that conveys off-site basin runoff and trail runoff from TDA 2 to Lake Sammamish is and 4-inch diameter conveyance system. The project will continue to discharge off-site runoff and trail runoff to this drainage system, and a stormwater detention vault is proposed to mitigate the flows and control runoff. The detention vault was sized to meet the Level 2 flow control standard.

Using MGSFloodV4 model and the one-hour time step, the stormwater detention vault was sized using tail water conditions from the backwater analysis to control the outflow. The vault dimensions are 72 feet long by 10 feet wide and 4.32 feet of live storage depth and the flow control riser is an 18-inch diameter pipe, with a 1.5 inch diameter orifice at the bottom, and rectangular notch, 0.25 inches wide by 43.78 inches long, and an open top at the riser crest. Table 4-3 summarizes the existing contributing flow rates compared to the proposed flow rates from the detention vault.

Table 4-3 Existing and Proposed TDA 2 Discharge Flow Rates

Design Storm	Existing Discharge at Station 224+00 Culvert (cfs)	Controlled Discharge from Detention Vault (cfs)
Q_2	0.45	0.14
Q_{25}	1.17	0.33
Q_{100}	2.03	0.49

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Backwater calculations were performed using the proposed storm drain conveyance layout, results found that the generally the existing and proposed storm drain system can convey flow rates up to the 0.50 cfs without overflow. However, the existing catch basin in East Lake Sammamish Shore Lane SE begins to overflow when the flow rate at that junction reaches 0.40 cfs. Therefore, the mitigated 25-year design discharge of 0.33 cfs will be contained in the conveyance system, but the 100-design storm of 0.49 cfs would overflow at that catch basin location.

Further discussion regarding the existing conveyance capacity at Station 224+ 00 is found in Section 5.1. Proposed conveyance, backwater, and vault sizing calculations are located in Appendix C. The stormwater design plans and details are located in Appendix A.

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, 4-2, and 4-3 depict the replaced PGIS at each driveway and summarize the replaced PGIS areas for each TDA.

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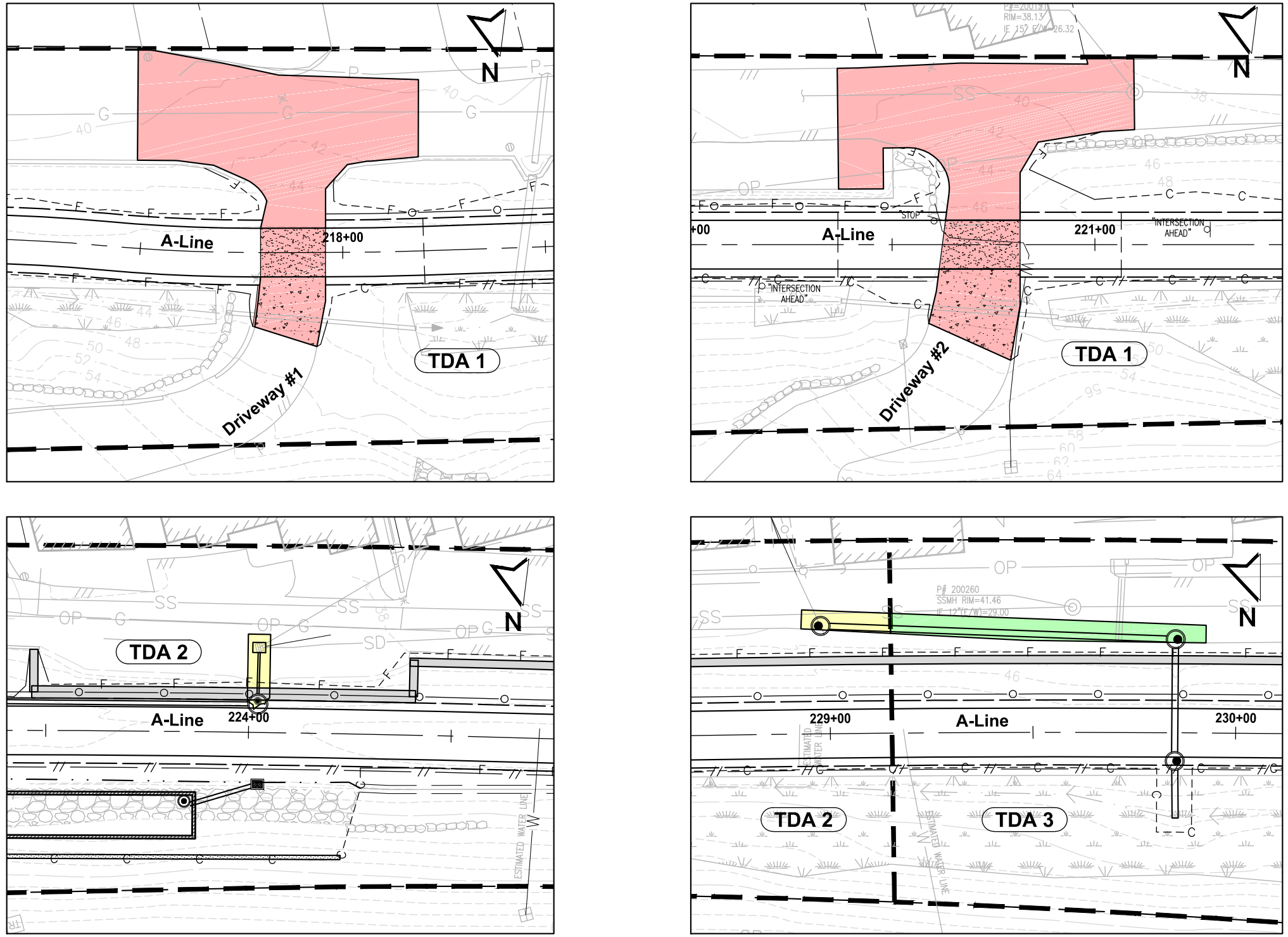


TDA 1 Replaced PGIS = 4,841 sf

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

TDA 2 Replaced PGIS = 200 sf

Storm Drain @ sta 224+00 = 94 sf
Storm Drain @ sta 230+00 = 106 sf

TDA 3 Replaced PGIS = 1,175 sf

Storm Drain @ sta 230+00* = 389 sf
Driveway #3 = 786 sf

* See Figure 4-2

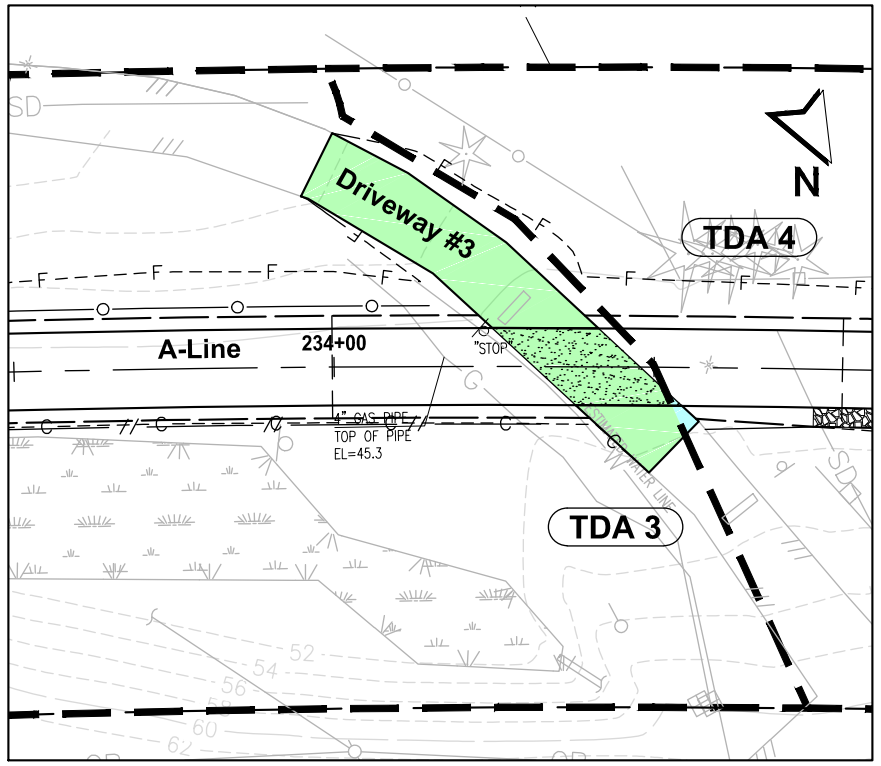
Parametrix DATE: December 16, 2014 FILE: BL1521075P20T03F4-1

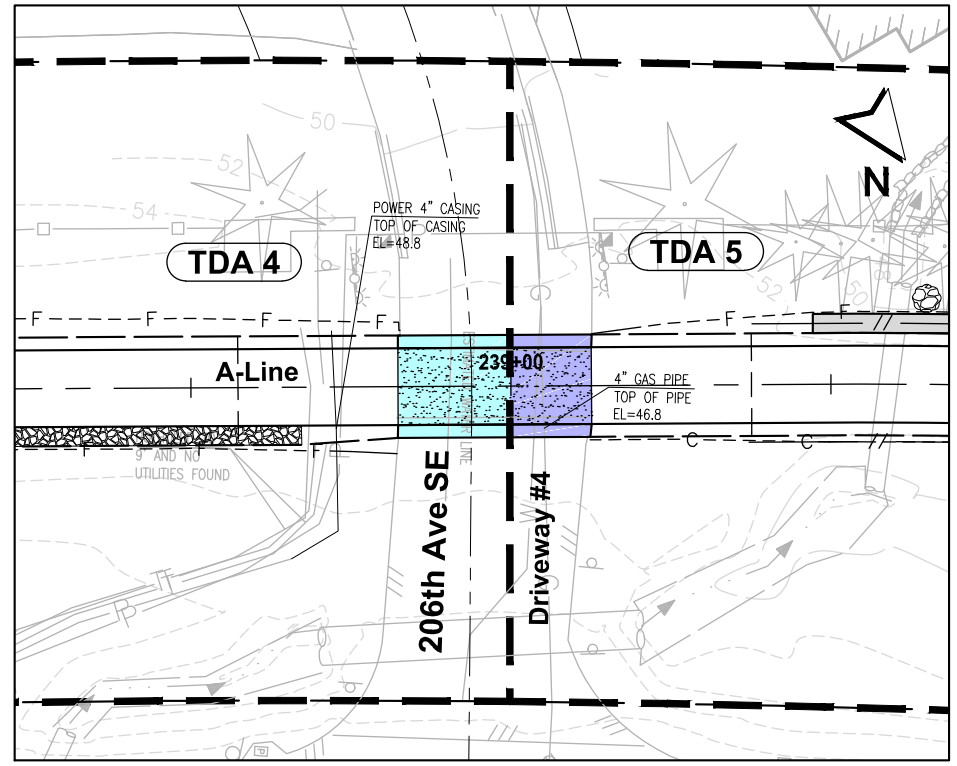
Legend:

- TDA Boundary
- TDA 1 Replaced PGIS
- TDA 2 Replaced PGIS
- TDA 3 Replaced PGIS

0 30
SCALE IN FEET

Figure 4-1
Proposed PGIS Surfaces





TDA 3 Replaced PGIS = 1,175 sf
Storm Drain @ sta 230+00* = 389 sf
Driveway #3 = 786 sf

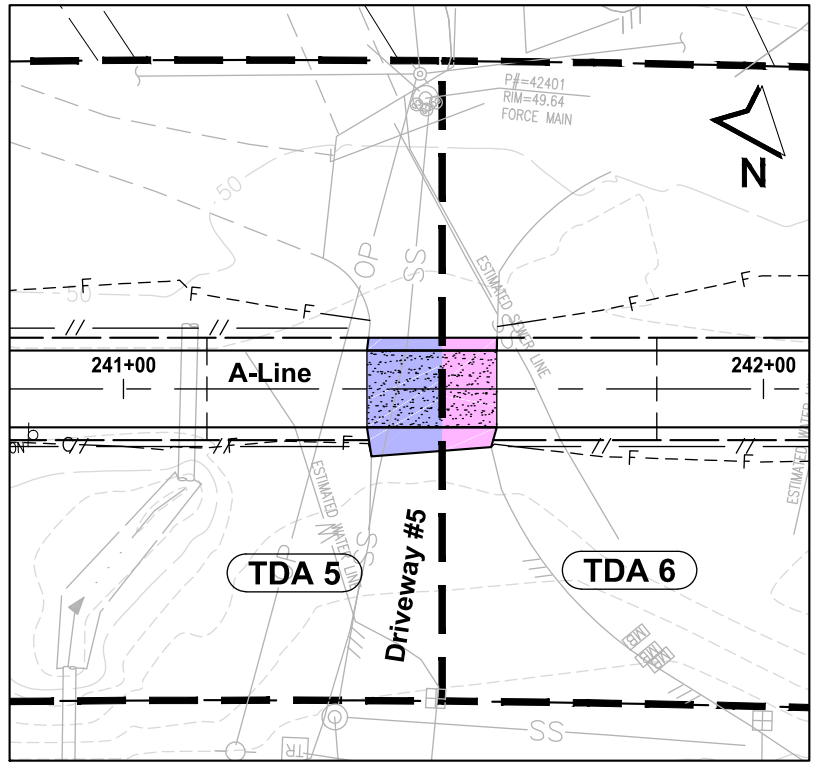
TDA 4 Replaced PGIS = 290 sf
Driveway #3 = 11 sf
Driveway #4 = 279 sf

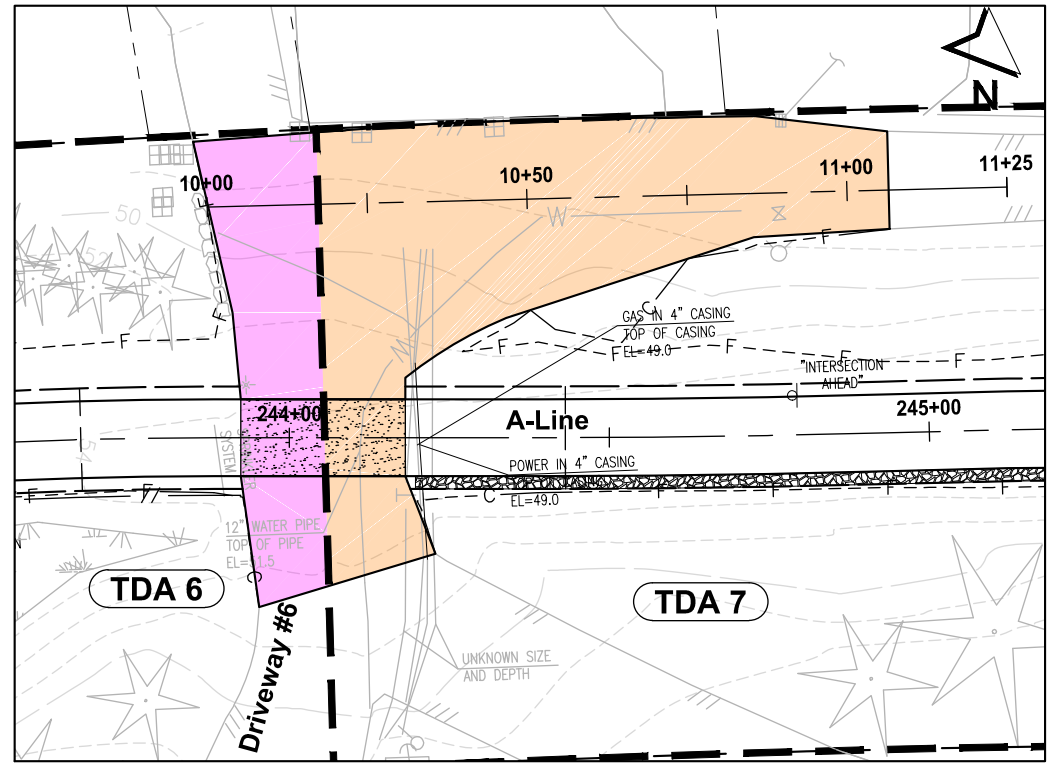
TDA 5 Replaced PGIS = 415 sf
Driveway #4 = 204 sf
Driveway #5 = 211 sf

TDA 6 Replaced PGIS = 1,171 sf
Driveway #5 = 147 sf
Driveway #6 = 1,024 sf

TDA 7 Replaced PGIS = 2,805 sf
Driveway #6 = 2,805 sf

* See Figure 4-1





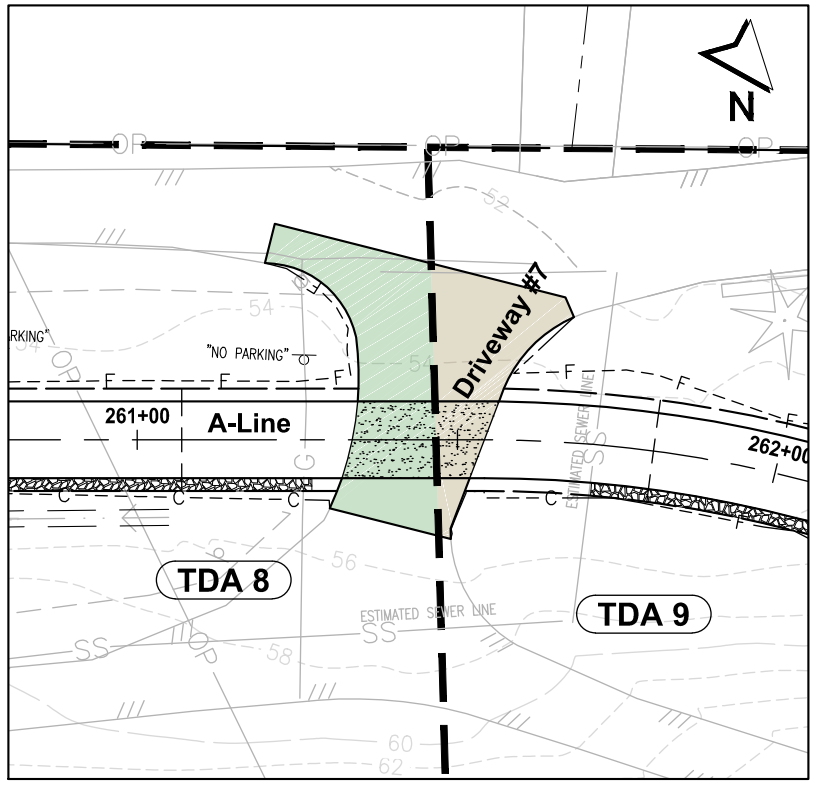
Parametrix DATE: December 16, 2014 FILE: BL1521075P20T03F4-1

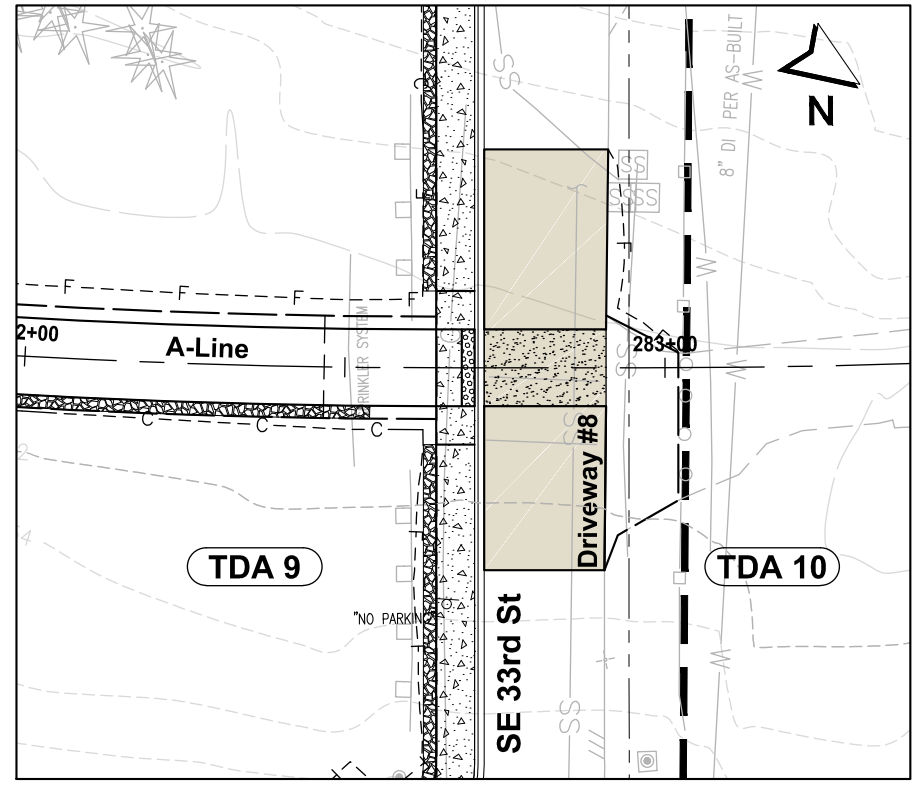
Legend:

- TDA Boundary
- TDA 3 Replaced PGIS
- TDA 4 Replaced PGIS
- TDA 5 Replaced PGIS
- TDA 6 Replaced PGIS
- TDA 7 Replaced PGIS

0 30
SCALE IN FEET

Figure 4-2
Proposed PGIS Surfaces





TDA 8 Replaced PGIS = 647 sf

Driveway #7 = 647 sf

TDA 9 Replaced PGIS = 1,684 sf

Driveway #7 = 431 sf
Driveway #8 = 1,253 sf

Parametrix DATE: December 16, 2014 FILE: BL1521075P20T03F4-1

Legend:

- TDA Boundary
- TDA 8 Replaced PGIS
- TDA 9 Replaced PGIS

0 30
SCALE IN FEET

Figure 4-3
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.

The subsequent sections describe the conveyance evaluation related to culverts, ditches and conveyance pipes. For the purposes of the analysis, conveyance flow rates were calculated for the off-site contributing catchment areas using MGSFloodV4 at the 5-minute time step. Conveyance sizing calculations were completed using the Rational Method via the WSDOT Storm Design spreadsheet calculator. Backwater calculations were completed using the King County Back Water Model (KCBW).

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.

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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	Replace*
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 culvert will not be replaced by another culvert but instead will be replaced with storm drain pipe and catch basins that will connect to the existing downstream conveyance system.

Sta. 218+45

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, and therefore, does not propose to extend or replace it. 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. The conveyance capacity evaluation is described in Section 3.5.

Sta. 224+00

The existing 12-inch trail culvert at 224+00 conveys stormwater southwest where the outlet is buried beneath a rockery. Stormwater flows are dissipated by the rockery, and water exits from the base of the rockery in a flow pattern that appears similar to a groundwater seep. Generally, the flow continues as shallow concentrated flow across East Lake Sammamish Shore Lane SE, and most of the flow is collected in a catch basin that is part of a private stormwater system. The existing, private downstream drainage system consists of a catch basin inlet in East Lake Sammamish Shore Lane SE that does not have a sump, and an existing 4-inch pipe. This system directly discharges collected flows from the trail culvert and runoff from the East Lake Sammamish Shore Lane SE to Lake Sammamish.

Conveyance calculations were performed to evaluate the capacity of the existing 4-inch conveyance pipe downstream of the project. Results from the WSDOT Storm Sewer Design calculator show that the 4-inch pipe only has the capacity to convey 0.44 cfs, which is about 23 percent of the 25-year design storm. The calculations were based on an assumed pipe slope of 5 percent based on estimated elevation of the outfall to Lake Sammamish at elevation 32.5 feet (NAVD 88). A backwater analysis was then performed for this existing storm system and the existing catch basin in East Lake Sammamish Shore Lane SE was found to overflow at 0.50 cfs.

If the project were to extend the 12-inch pipe at Sta. 224+00, a perched outfall condition would be created in Wall #3. To avoid overland flow, and to mitigate the existing conveyance problem with the undersized system downstream, the project proposes to remove the existing culvert and install a new tightline conveyance system that will connect to a stormwater detention vault and ultimately connect to the existing private storm catch basin located in East Lake Sammamish Shore Lane SE. The proposed conveyance system is discussed in Section 5.3.

Conveyance and backwater calculations are found in Appendix C.

Sta. 229+85

The existing 18-inch trail culvert at Sta. 229+85 conveys stormwater southwest to the catch basin at the existing outfall location. The 12-inch pipe from the existing catch basin is part of a private drainage system that conveys water to Lake Sammamish.

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Conveyance calculations were performed to evaluate the capacity of the existing 12-inch conveyance pipe downstream of the project (Appendix C). Results from the WSDOT Storm Sewer Design calculator show that the 12-inch pipe has the capacity to convey at least 5.40 cfs, which is greater than the 25-year design storm (3.67 cfs). 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 proposed conveyance system is described further in Section 5.3. Conveyance and backwater calculations are found in Appendix C.

Sta. 256+35

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 and thus, does not propose to replace it. 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 from the WSDOT Storm Sewer Design calculator and show that the 18-inch culvert is approximately 52 percent full during the 25-year storm event, and 78 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 proposed design will use infiltration trenches to fully infiltrate trail runoff, reducing the amount of area that contributes surface flow to the culvert at Sta. 256+35.

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.

Due to construction activities necessary to install the stormwater vault and retaining wall between the trail and East Lake Sammamish Parkway approximately 160 linear feet of Jurisdictional Ditch #9 will be temporarily excavated and replaced in kind with a ditch that has the following characteristics:

- Front slope: 2H:1V
- Back slope: 2H:1V
- Minimum depth: 1.5 feet
- Low gradient to match existing ditch elevations.

The proposed design is provided in Appendix A, no conveyance calculations were performed since the ditch functions properly as is, and the design proposed to replace it in kind.

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5.3 CONVEYANCE PIPES

Sta. 224+00

The proposed design will replace the 12-inch trail culvert with 127 linear feet of 12-inch storm drain pipe, one Type 1 catch basin with beehive grate, one stormwater detention vault with access manholes and flow control restrictor, 2 Type 2 catch basins, and 14 linear feet of 6-inch drain pipe.

The new Type 1 catch basin with beehive grate will collect off-site runoff and trail runoff and convey drainage to the stormwater detention vault located between the trail and the East Lake Sammamish Parkway. Once the runoff has been detained, the flow control structure will release flows from the detention vault through 110 feet of 12-inch storm drain pipe and two catch basins prior to reducing the conveyance pipe size to a 14 foot long 6-inch drain pipe that will connect to the existing catch basin in East Lake Sammamish Shore Lane SE. The 6-inch pipe will match inverts with the downstream 4-inch conveyance pipe to accommodate low pipe cover.

The proposed design conveyance was sized based on backwater conveyance calculations and controlled runoff rates from the detention vault, as discussed in Section 4.4. The proposed design is provided in Appendix A and the conveyance calculations are provided in Appendix C.

Sta. 229+85

The proposed design will replace the 18-inch trail culvert with 132 linear feet of 18-inch storm drain pipe, one drop catch basin, and two catch basins located in East Lake Sammamish Shore Lane SE.

The new 18-inch culvert will collect flows from the channel in Wetland 13A and connect to a drop catch basin located in the northeast trail shoulder. The drop structure will dissipate energy and allow the storm pipe to convey at 2.67-percent slope rather than at greater than 10 percent slope if the culvert were to be replaced with a new culvert connected to a catch basin in East Lake Sammamish Shore Lane SE. The design will replace with existing catch basin and storm drain pipe located in the northeast shoulder of East Lake Sammamish Shore Lane SE with two new catch basins and approximately 88 linear feet of 18-inch storm pipe. This proposed storm system will connect to the private drainage system adjacent to trail Station 228+93. The existing 12-inch storm system directly discharges to Lake Sammamish downstream of the connection to this new catch basin. The proposed design places the storm system beneath the northeast edge of East Lake Sammamish Shore Lane SE in effort to provide horizontal separation between the storm system and Wall #5.

Results from the WSDOT Storm Sewer Design calculator show that the proposed stormwater conveyance system has adequate capacity to convey the 25-year design storm. Additionally, backwater calculations of the proposed storm system and connection to the existing discharge pipe provide that the system will not overflow at any catch basin when the system is conveying up to 6.0 cfs. The 100-year design storm is 5.9 cfs for contributing off-site runoff and TDA 3 contributing runoff. Therefore, the storm conveyance will not overflow.

The proposed design is provided in Appendix A and the conveyance calculations are provided in Appendix C.

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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.

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7. OTHER PERMITS

Other permits required for this project are:

- Shoreline Permit
- City of Sammamish Grading Permit
- Section 404 Permit by the U.S. Army Corps of Engineers
- National Pollutant Discharge Elimination System (NPDES) General Construction Permit
- Building permit for structural walls and detention vault

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8. TEMPORARY EROSION AND SEDIMENT CONTROL DESIGN

Temporary erosion and sediment control (TESC) plans are provided in Appendix F. The construction Stormwater Pollution Prevention Plan will provided as part of Appendix F with the submittal of the final TIR.

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

This section does not apply to this project.

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10. OPERATION AND MAINTENANCE

10.1 STORMWATER MANAGEMENT

The stormwater system in South Sammamish Segment A consists of ditches, culverts, storm drains, quarry spall 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

DRAFT

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.

Icicle Creek Engineers, Inc. 2014. Technical Memorandum Hydrogeological Services Proposed Stormwater Infiltration East Lake Sammamish Trail South Sammamish Segment A MODRET Analysis, Sammamish, Washington. Prepared by Icicle Creek Engineers, Inc. December 9, 2014.

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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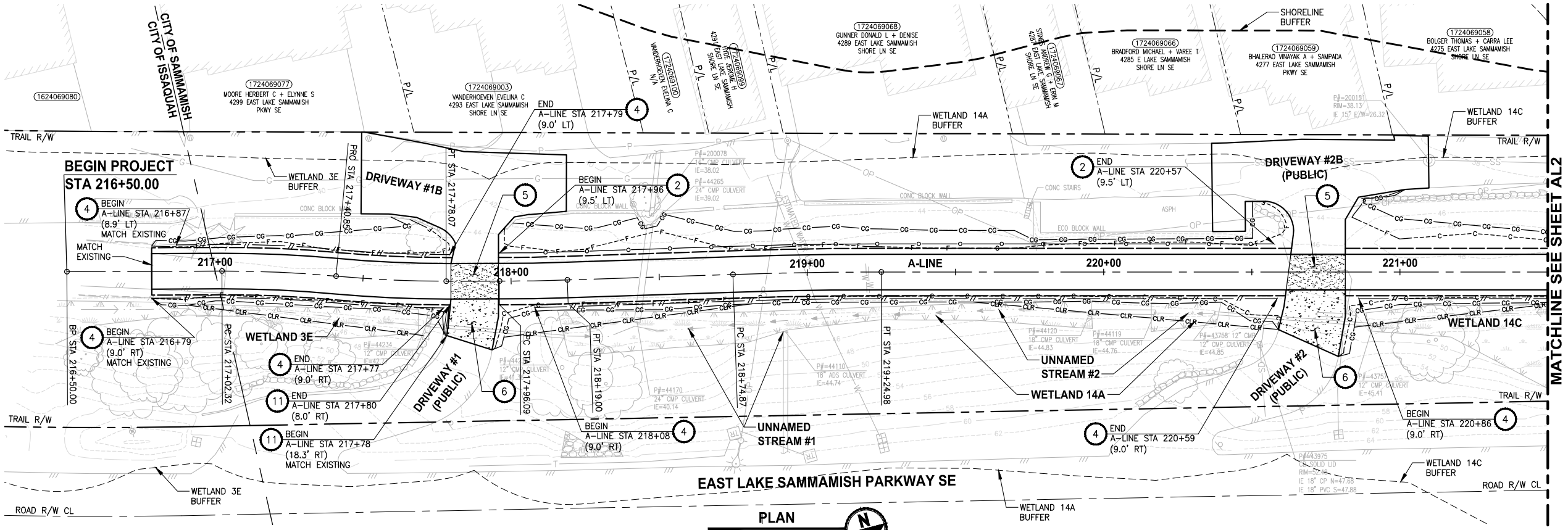
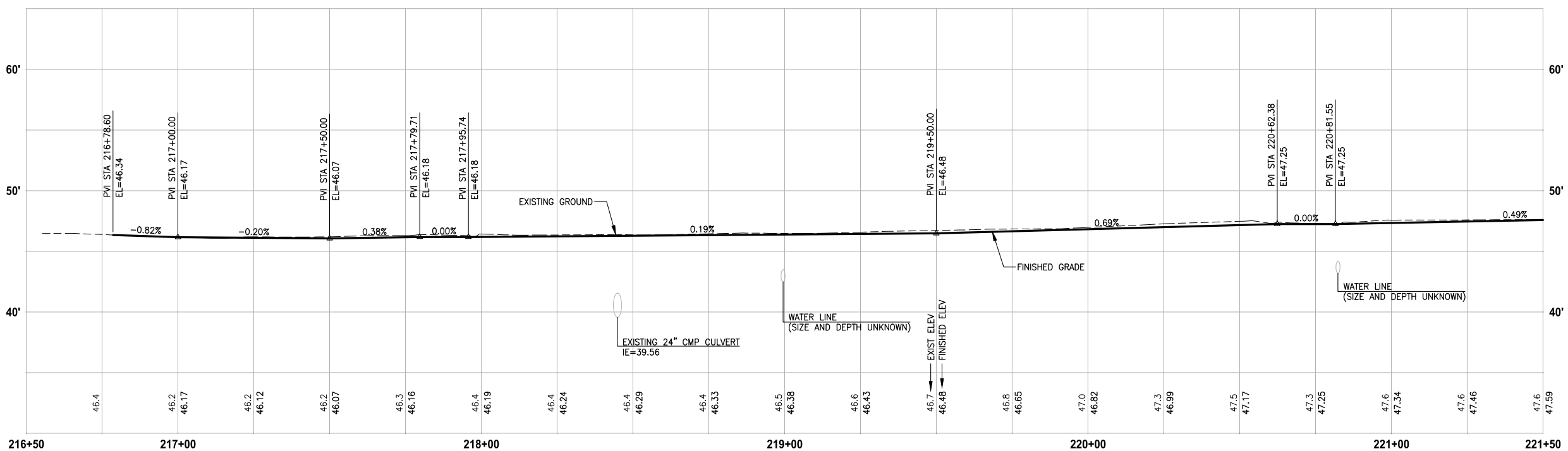
DRAFT

APPENDIX A

Drainage Plans, Profiles, and Detail Sheets

SEC'S 8, 17 TWP. 24 N., RGE. 06 E, W.M.





A-LINE PROFILE

HORIZ: 1"=20'
VERT: 1"=5'

CIVIL CONSTRUCTION NOTES:

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2. SEE SD AND DD SHEETS FOR GENERAL NOTES RELATED TO STORM DRAIN STRUCTURES, PIPES AND DITCH.
3. SEE SHEET G4 FOR SYMBOL AND LINE LEGEND.

CITY OF SAMMAMISH APPROVAL	
City Engineer	Date
Community Development	Date

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REVISIONS	DATE	BY

DESIGNED J. JUN
DRAWN B. PURGANAN
CHECKED Y. HO
APPROVED

ONE INCH AT FULL SCALE. IF NOT, SCALE ACCORDINGLY
FILE NAME BL1521075P20T03AL-01
JOB No. 554-1521-075 P20T03
DATE DECEMBER 2014

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PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

PLAN AND PROFILE

SHEET NO. 26 OF 79
AL1

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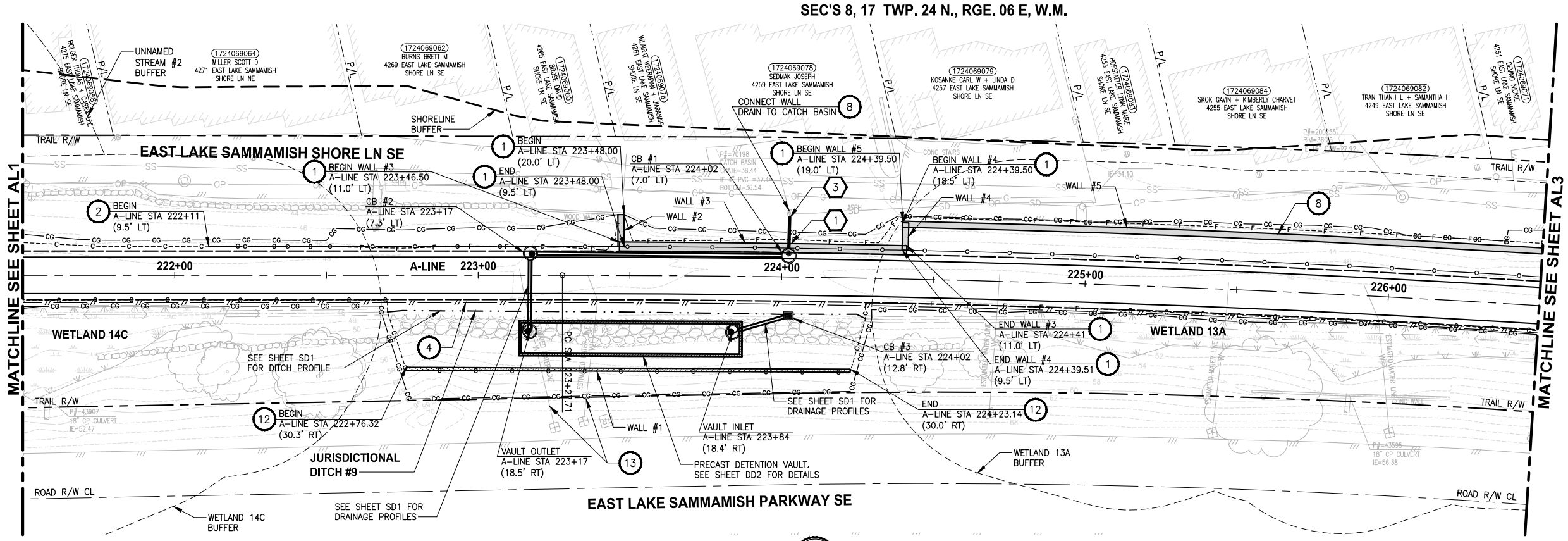

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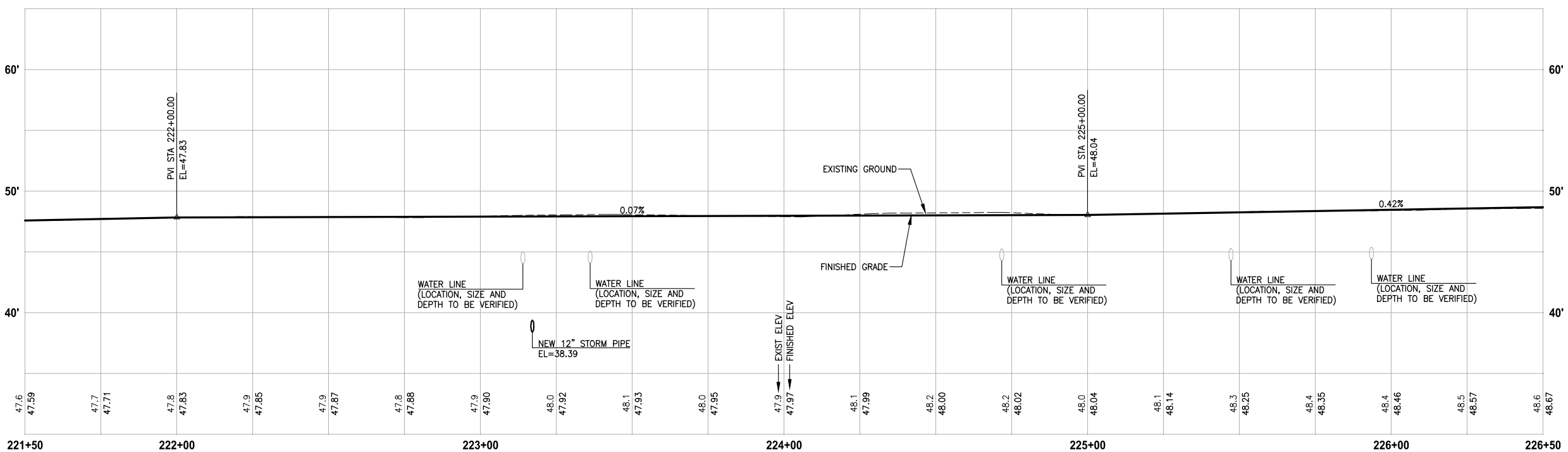

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DRAWN B. PURGANAN
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YAMMIE Y. HO STATE OF WASHINGTON 46859 REGISTERED PROFESSIONAL ENGINEER
CRAIG A. BUITRAGO STATE OF WASHINGTON 49427 REGISTERED PROFESSIONAL ENGINEER

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PLAN AND PROFILE

SHEET NO. 27 OF 79
AL2

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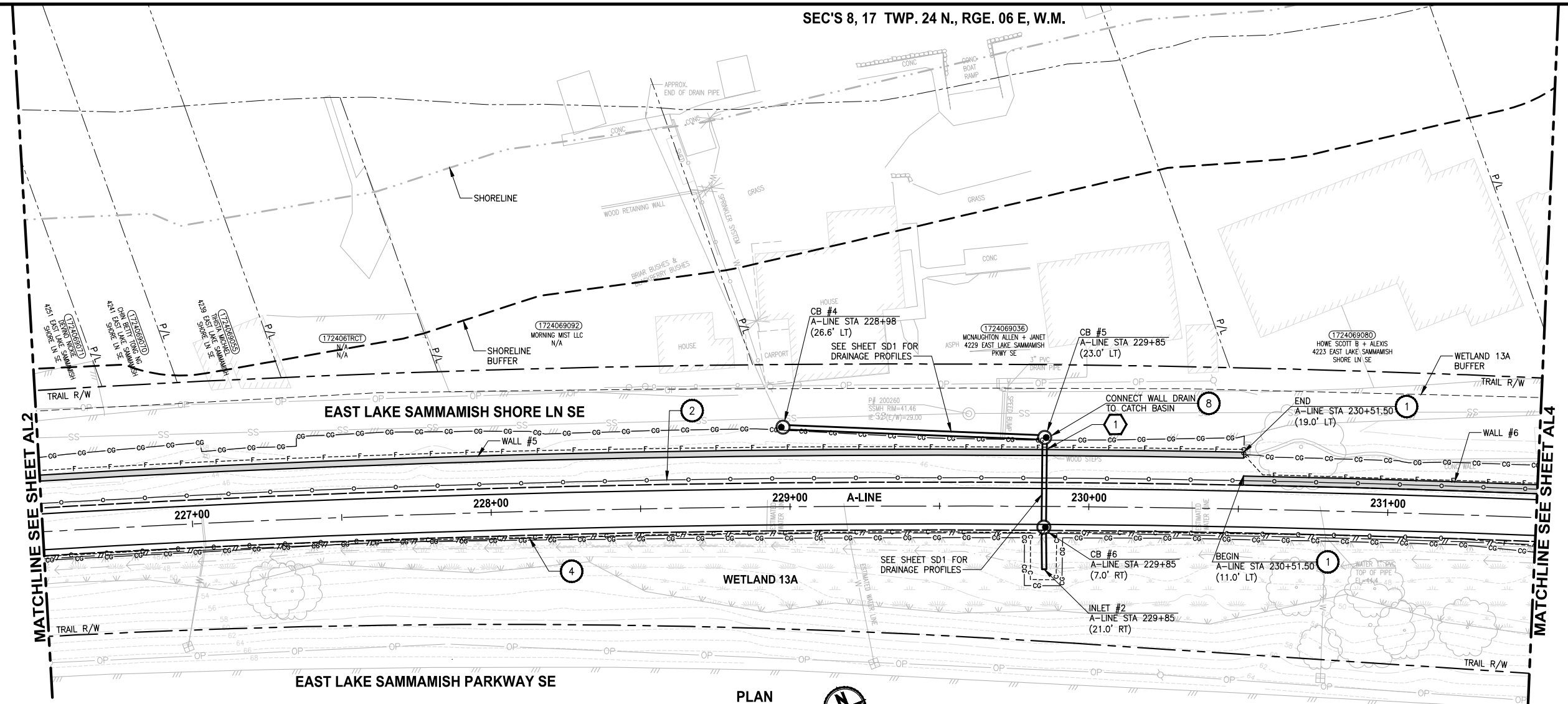

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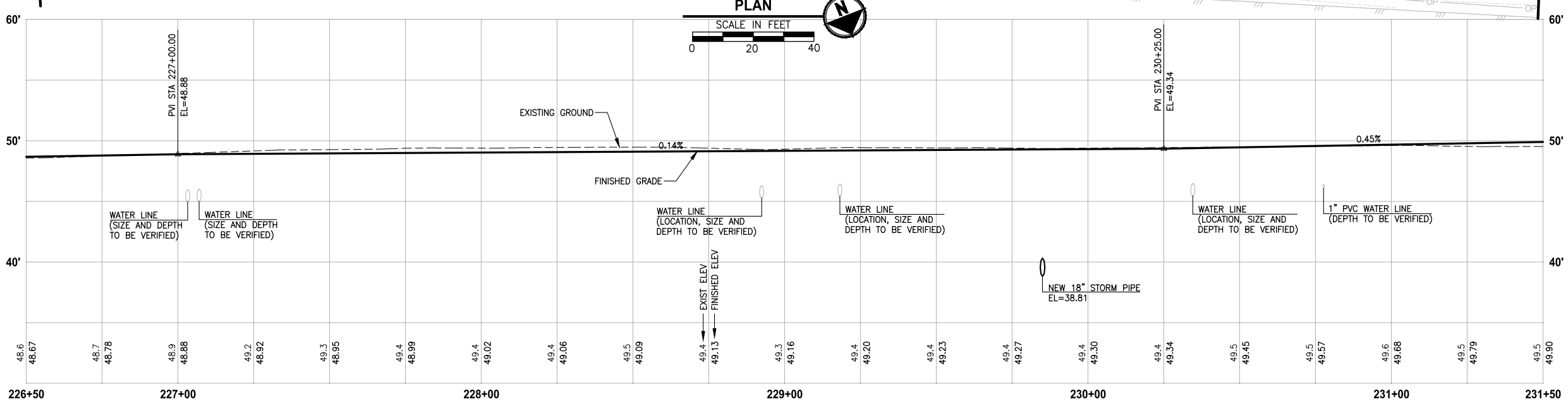

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Community Development	Date

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DRAWN B. PURGANAN
CHECKED Y. HO
APPROVED

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SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

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AL3

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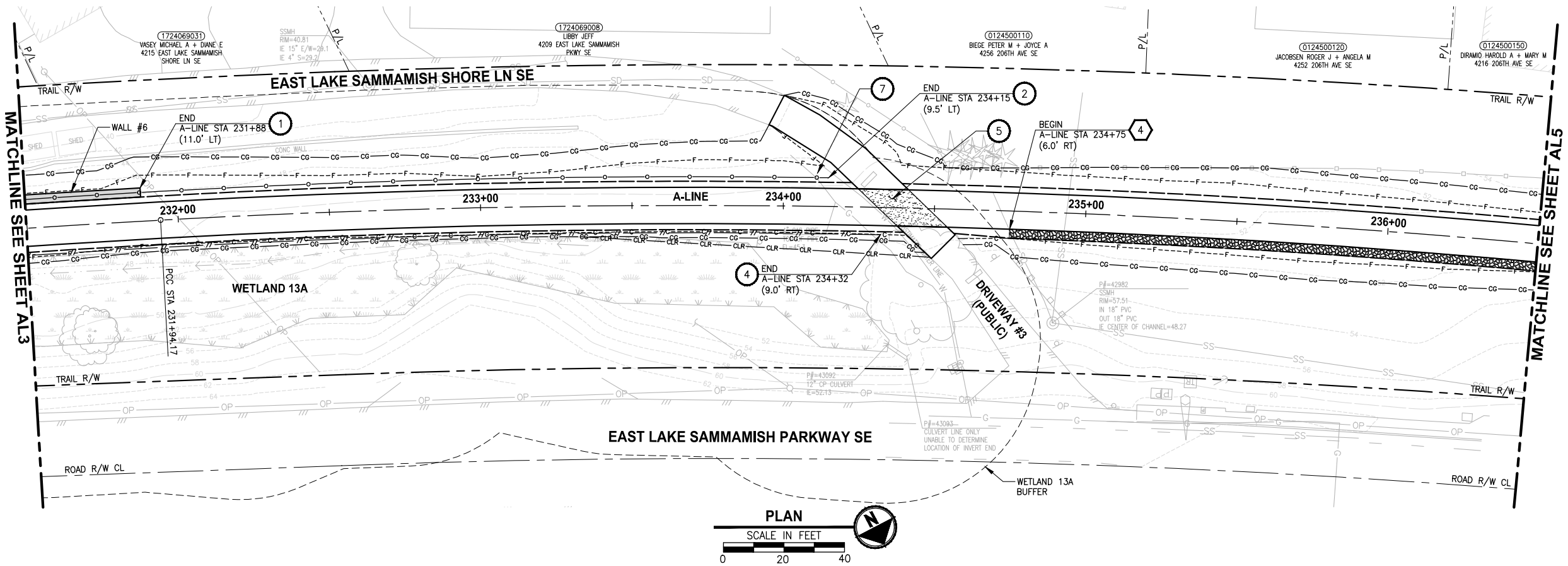

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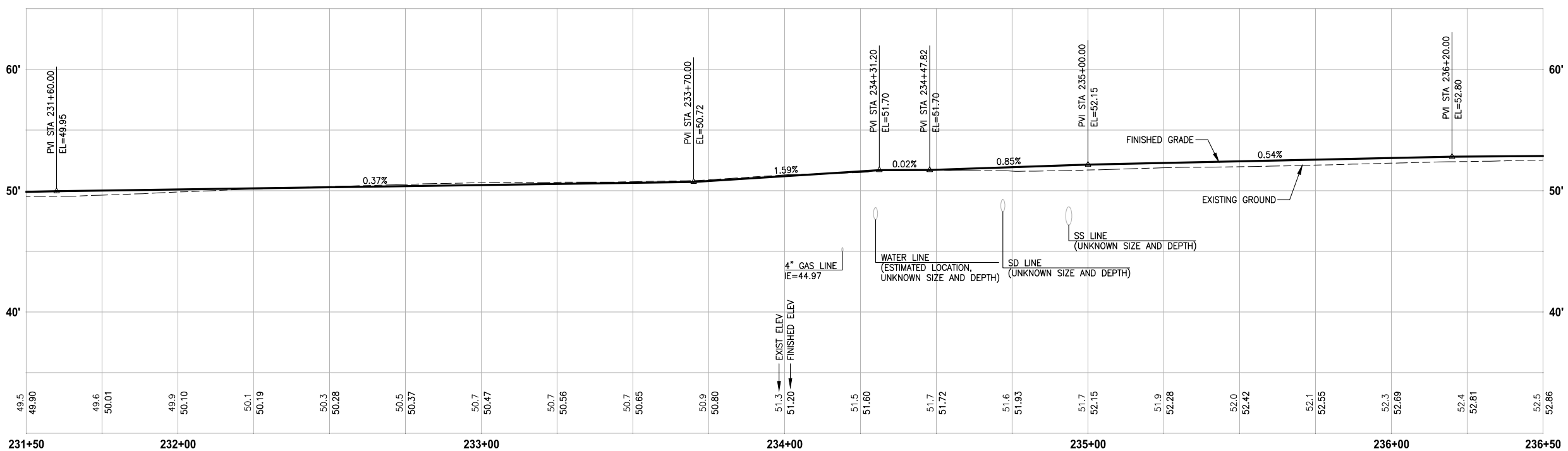

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City Engineer	Date
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SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

PLAN AND PROFILE

SHEET NO. 29 OF 79

AL4

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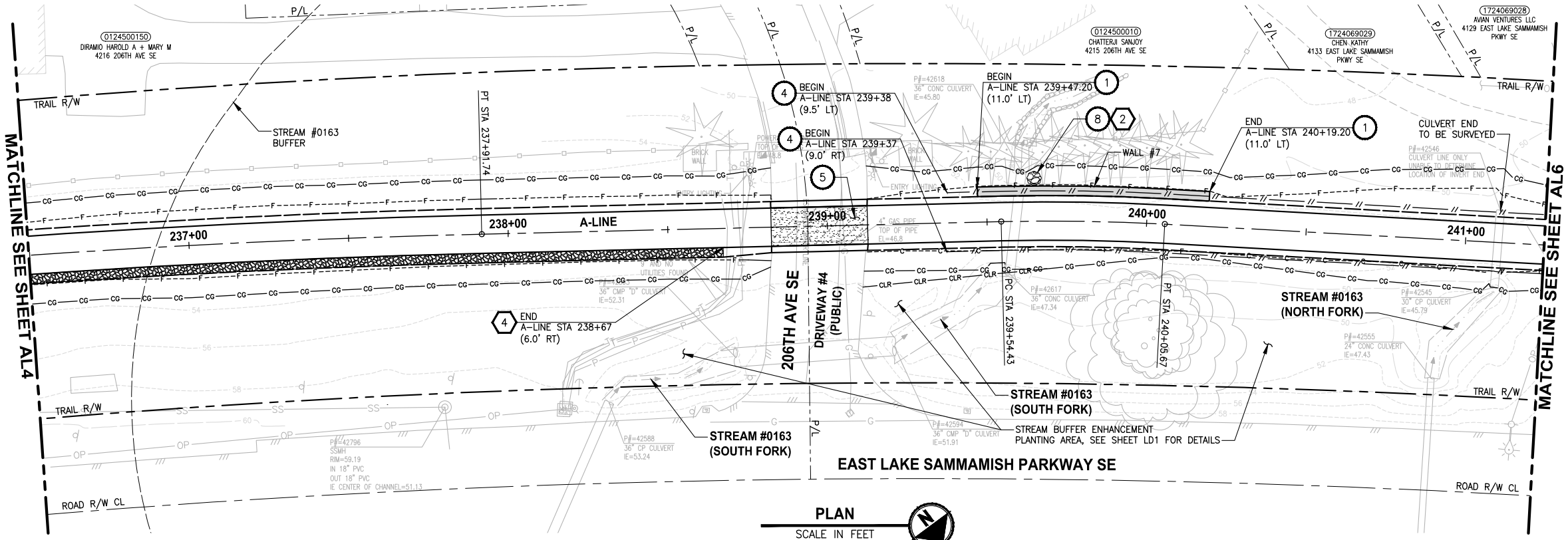

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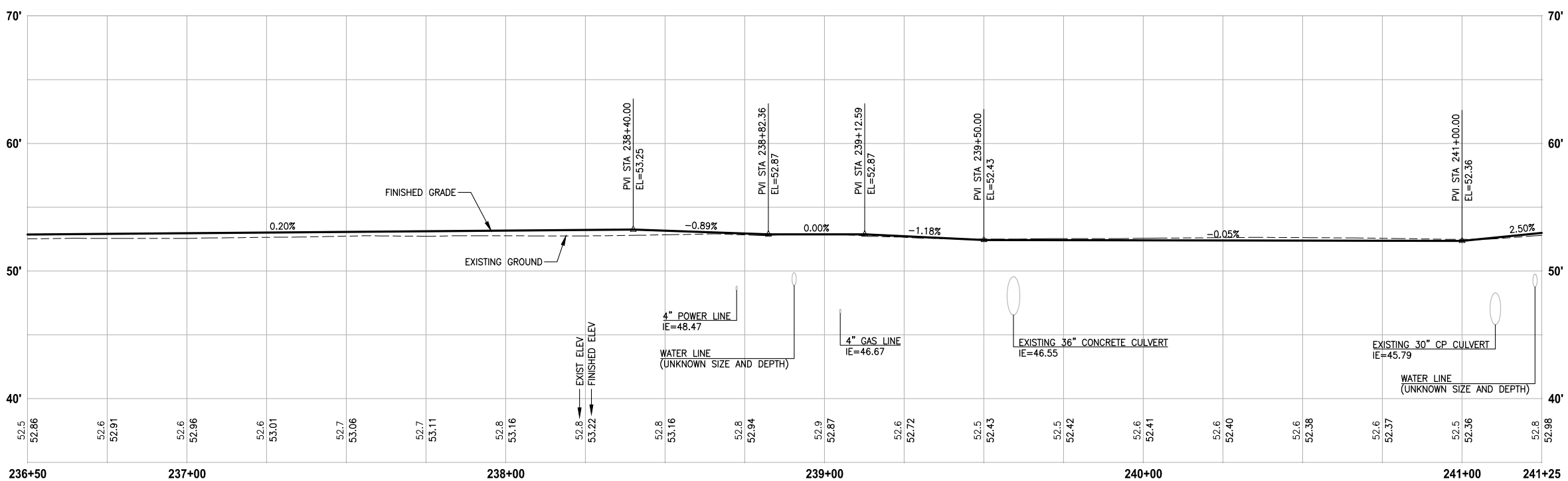

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PROJECT NAME
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MASTER PLAN TRAIL
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SAMMAMISH, WA

PLAN AND PROFILE

SHEET NO. 30 OF 79
AL5

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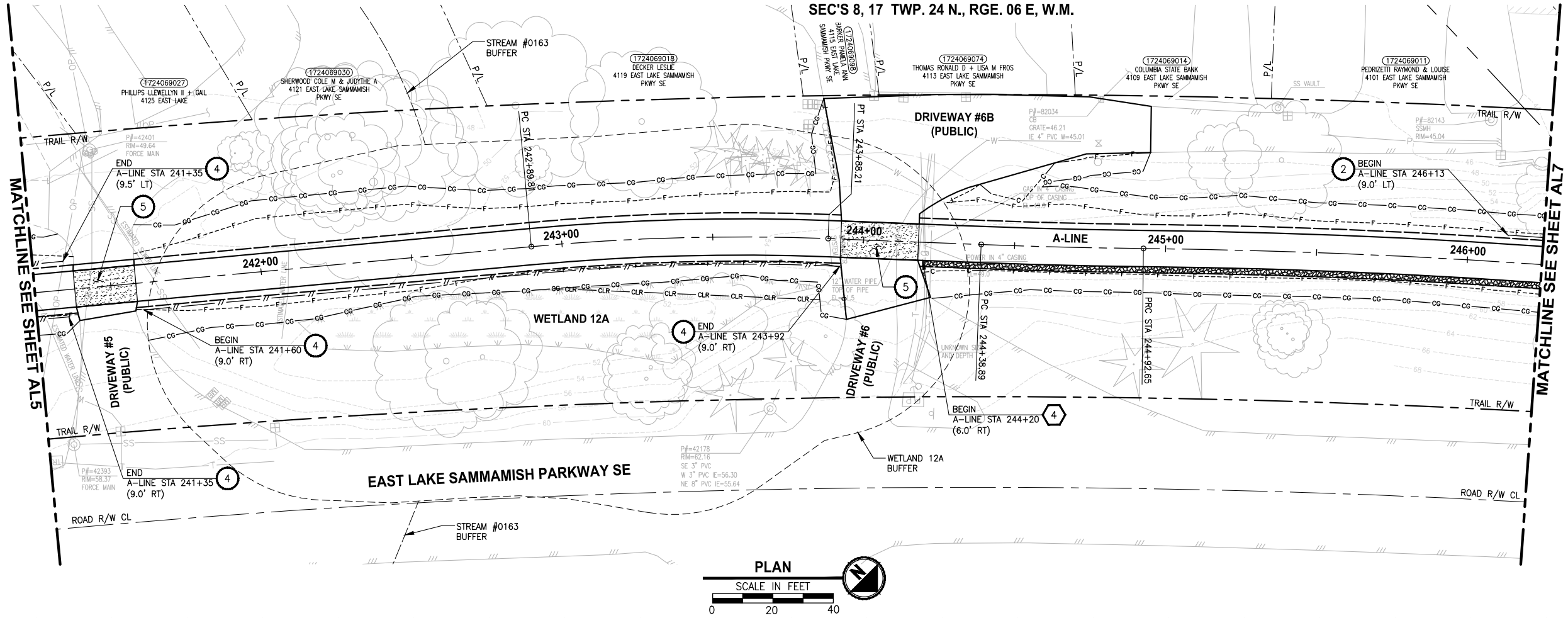

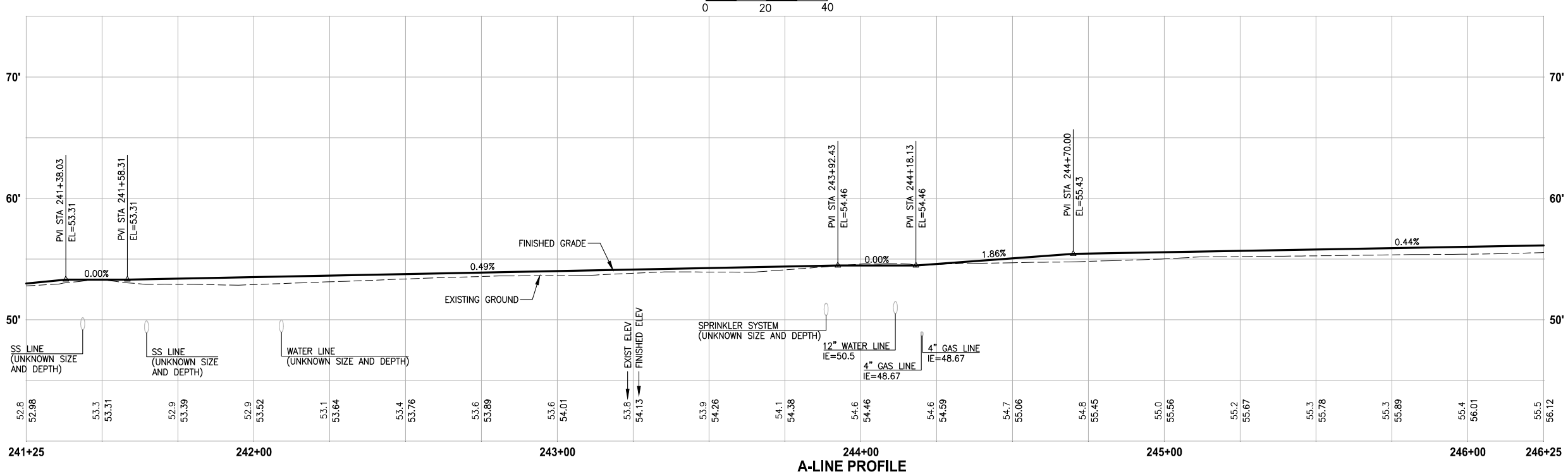

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City Engineer	Date
Community Development	Date

90 % REVIEW SUBMITTAL
NOT FOR CONSTRUCTION

REVISIONS	DATE	BY

DESIGNED J. JUN
DRAWN B. PURGANAN
CHECKED Y. HO
APPROVED

ONE INCH AT FULL SCALE. IF NOT, SCALE ACCORDINGLY
FILE NAME BL1521075P20T03AL-01
JOB No. 554-1521-075 P20T03
DATE DECEMBER 2014

PRELIMINARY
YAMMIE Y. HO
STATE OF WASHINGTON
40820
REGISTERED PROFESSIONAL ENGINEER

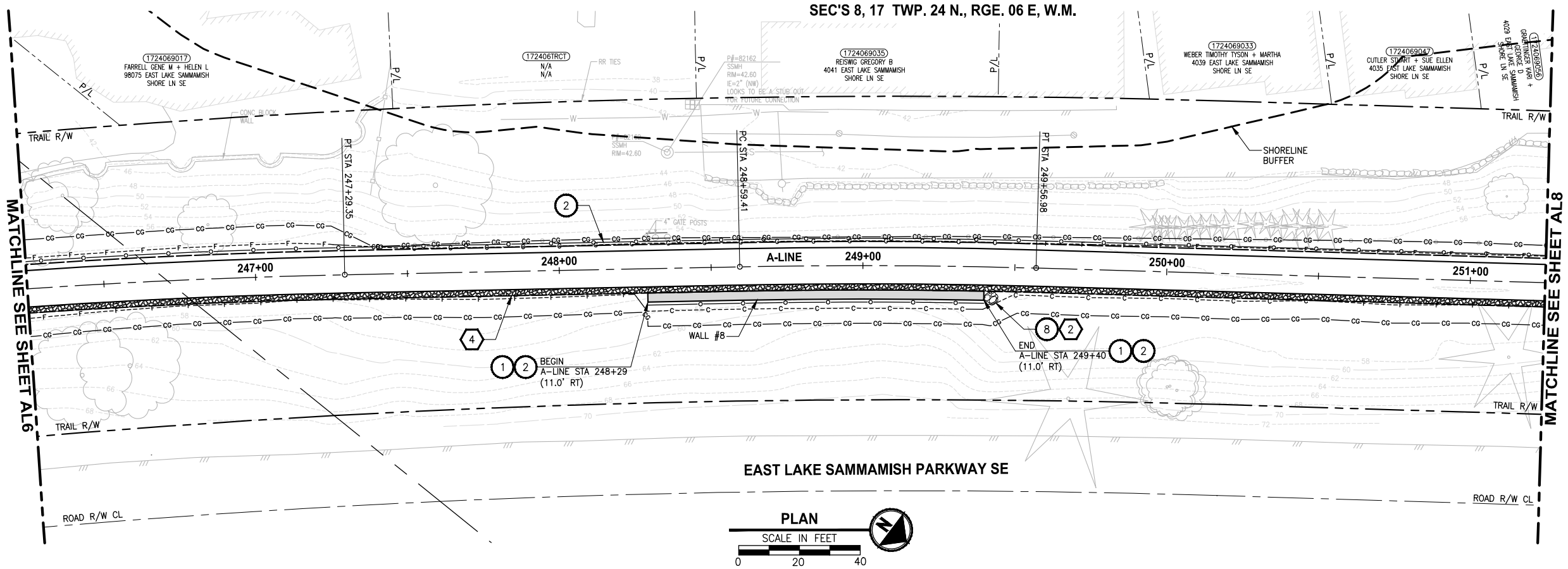
Parametrix
ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES
719 2ND AVENUE, SUITE 200 | SEATTLE, WA 98104
P 206.394.3700
WWW.PARAMETRIX.COM

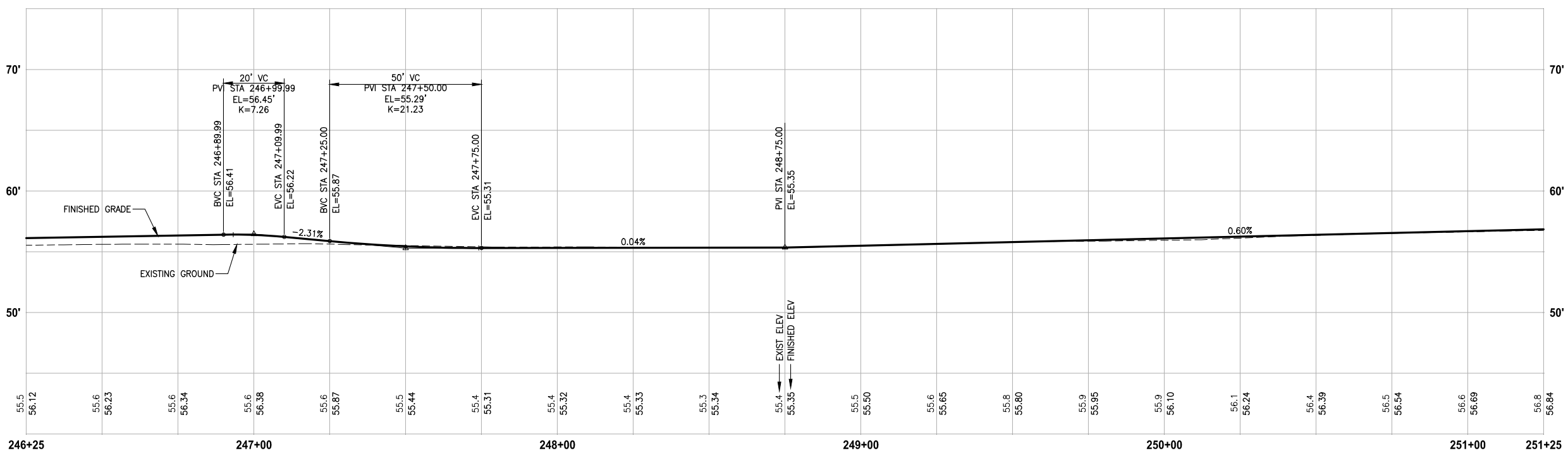
PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

PLAN AND PROFILE

SHEET NO.
31 OF 79
AL6

PATH: U:\PSO\Projects\Clients\1521-KingCo\554-1521-075-ELST\99Svcs\CADD\Phase 20\Task 03\DWG\ PLOTTED BY: purganan DATE: Thursday, December 18, 2014 12:49:33 PM LAYOUT: AL6





A-LINE PROFILE

HORIZ: 1"=20'
VERT: 1"=5'

CIVIL CONSTRUCTION NOTES:

1. INSTALL STRUCTURAL EARTH WALL. SEE WALL DETAILS ON SHEET WD1. SEE WALL PROFILES ON WP SHEETS.
2. INSTALL COATED CHAIN LINK FENCE TYPE 6. FOR GROUND POST INSTALLATION SEE APPENDIX B IN THE SPECIFICATIONS. SEE SHEET WD1 FOR INSTALLATION ON TOP OF WALL.
3. INSTALL CHAIN LINK CANTILEVER GATE, SEE DETAIL ON SHEET MD2.
4. INSTALL SPLIT RAIL FENCE, SEE DETAILS ON SHEET MD3.
5. INSTALL PATTERNED CONCRETE DRIVEWAY, SEE DETAILS ON SHEET MD2 AND DP SHEETS.
6. CEMENT CONCRETE DRIVEWAY. SEE DP SHEETS.
7. INSTALL PVC SLEEVE 4 IN. DIA FOR GAS LINE.
8. WALL DRAIN OUTFALL LOCATION. SEE SHEET WD1.
9. CEMENT CONCRETE TRAFFIC CURB AND GUTTER PER WSDOT STD PLAN F-10.12-03.
10. PARALLEL CURB RAMP PER WSDOT STD PLAN F-40.12-02.
11. INSTALL EXTRUDED CURB TYPE 5 PER WSDOT STD PLAN F-10.42-00.
12. INSTALL SOLDIER PILE WALL. SEE DETAILS ON SHEET S1. SEE WALL PROFILE ON SHEET WP1.
13. ADJUST WATER LINES. ELEVATIONS TO BE DETERMINED AFTER POTHOLING.

STORMWATER CONSTRUCTION NOTES:

1. CONCRETE HEADWALL, SEE DETAIL 1 ON SHEET DD1. SEE WALL PROFILE ON WP SHEETS FOR WALLS #3, #5 AND #7.
2. QUARRY SPALL OUTFALL PROTECTION, SEE DETAIL 2 ON SHEET DD1.
3. CONNECTION TO DRAINAGE STRUCTURE AND CLEANING EXISTING DRAINAGE STRUCTURE.
4. INFILTRATION TRENCH, SEE DETAIL 3 ON SHEET DD1.

GENERAL NOTES:

1. SEE DP SHEETS FOR DRIVEWAY PLAN AND PROFILE.
2. SEE SD AND DD SHEETS FOR GENERAL NOTES RELATED TO STORM DRAIN STRUCTURES, PIPES AND DITCH.
3. SEE SHEET G4 FOR SYMBOL AND LINE LEGEND.

CITY OF SAMMAMISH APPROVAL	
City Engineer	Date
Community Development	Date

90 % REVIEW SUBMITTAL
NOT FOR CONSTRUCTION

REVISIONS	DATE	BY

DESIGNED J. JUN
DRAWN B. PURGANAN
CHECKED Y. HO
APPROVED

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DATE DECEMBER 2014

PRELIMINARY
YAMMIE Y. HO
STATE OF WASHINGTON
40828
REGISTERED PROFESSIONAL ENGINEER

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PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

PLAN AND PROFILE

SHEET NO.
32 OF 79
AL7

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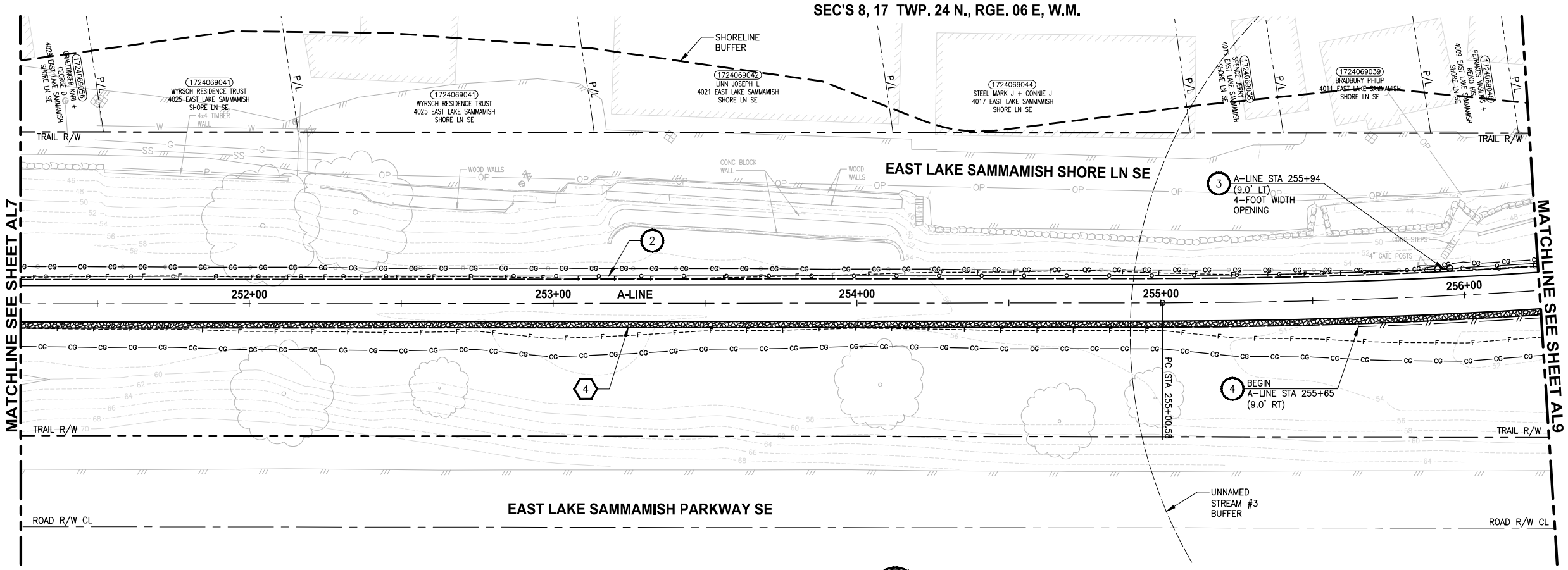

PLAN

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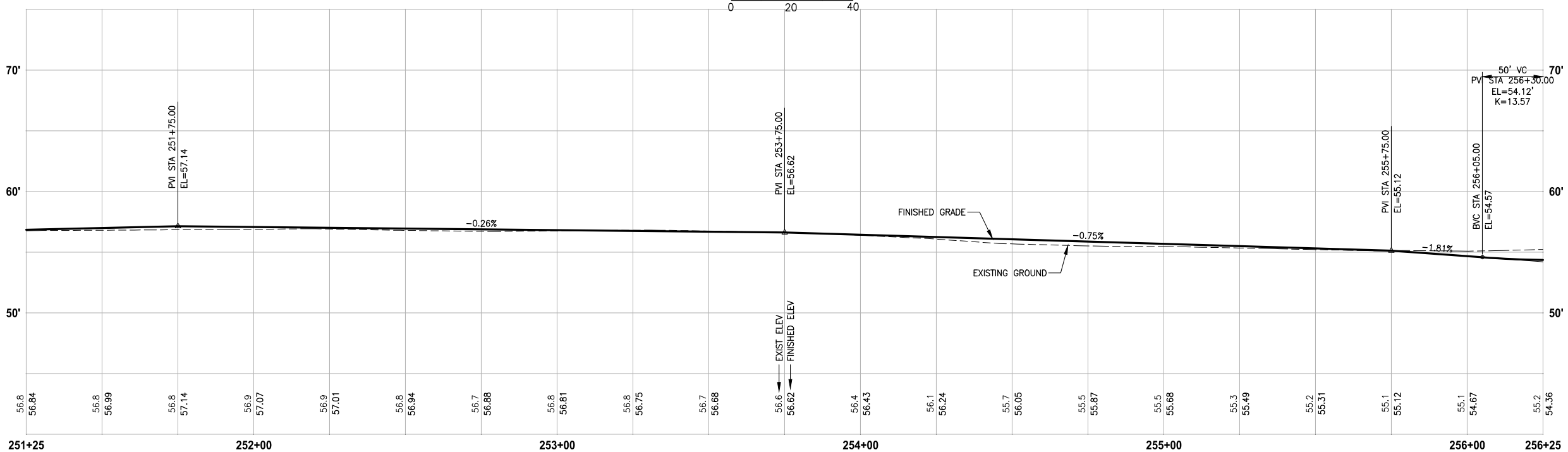

A-LINE PROFILE

HORIZ: 1"=20'
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CIVIL CONSTRUCTION NOTES:

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STORMWATER CONSTRUCTION NOTES:

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4. INFILTRATION TRENCH, SEE DETAIL 3 ON SHEET DD1.

GENERAL NOTES:

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2. SEE SD AND DD SHEETS FOR GENERAL NOTES RELATED TO STORM DRAIN STRUCTURES, PIPES AND DITCH.
3. SEE SHEET G4 FOR SYMBOL AND LINE LEGEND.

CITY OF SAMMAMISH APPROVAL	
City Engineer	Date
Community Development	Date

90 % REVIEW SUBMITTAL
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REVISIONS	DATE	BY

DESIGNED J. JUN
DRAWN B. PURGANAN
CHECKED Y. HO
APPROVED

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DATE DECEMBER 2014

PRELIMINARY
TAMMIE Y. HO STATE OF WASHINGTON 40829 REGISTERED PROFESSIONAL ENGINEER

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PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

PLAN AND PROFILE

SHEET NO. 33 OF 79
AL8

PATH: U:\PSO\Projects\Clients\1521-KingCo\554-1521-075-ELST\995ves\CADD\Phase 20\Task 03\DWG\ PLOTTED BY: purgobut DATE: Thursday, December 18, 2014 12:50:01 PM
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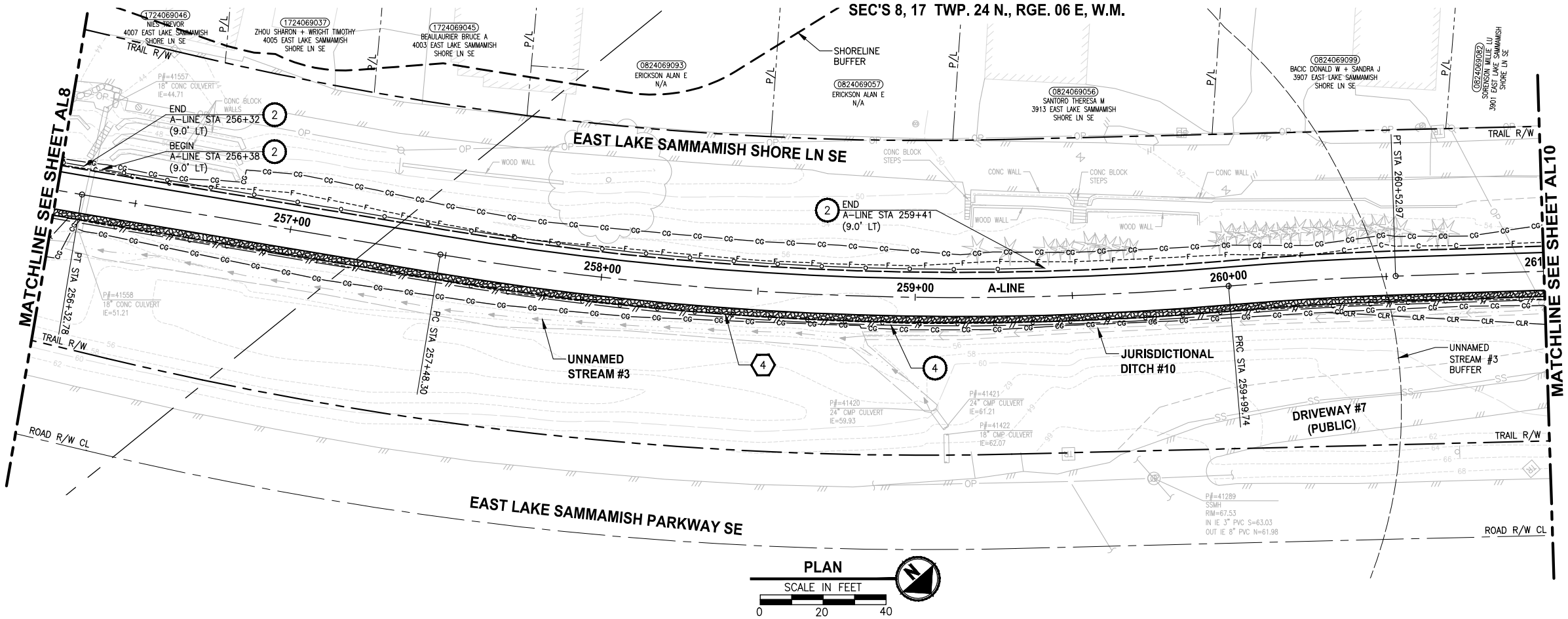

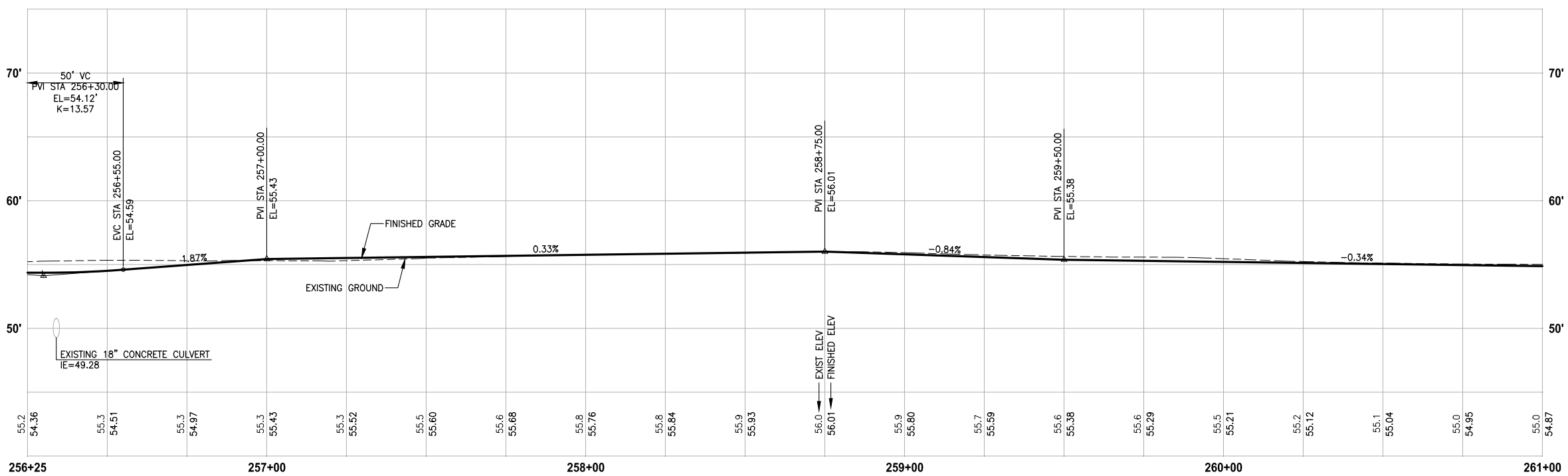

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CITY OF SAMMAMISH APPROVAL	
City Engineer	Date
Community Development	Date

90 % REVIEW SUBMITTAL
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	REVISIONS	DATE	BY

DESIGNED J. JUN
DRAWN B. PURGANAN
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PRELIMINARY
YAMMIE Y. HO STATE OF WASHINGTON 40820 REGISTERED PROFESSIONAL ENGINEER

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WWW.PARAMETRIX.COM

PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

PLAN AND PROFILE

SHEET NO. 34 OF 79
AL9

PATH: U:\PSO\Projects\Clients\1521-KingCo\554-1521-075-ELST\99Svcs\CADD\Phase 20\Task 03\DWG\ PLOTTED BY: purganbut DATE: Thursday, December 18, 2014 12:50:13 PM
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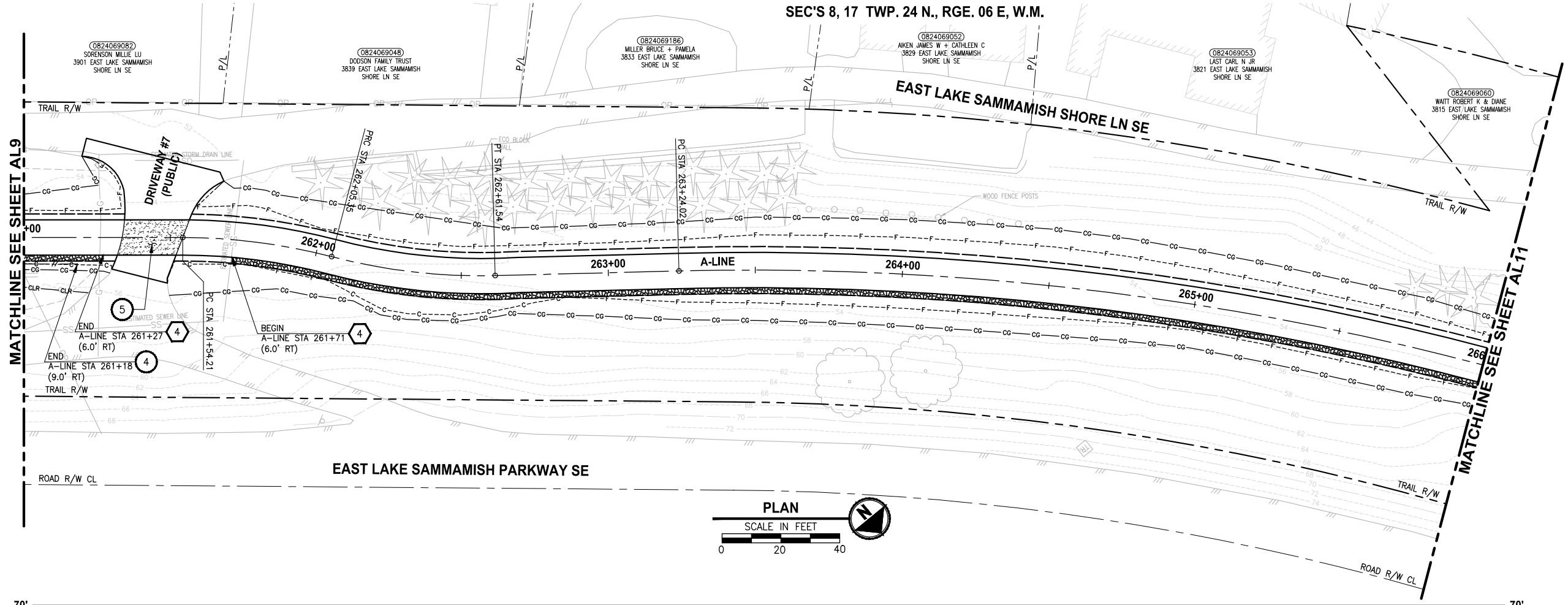

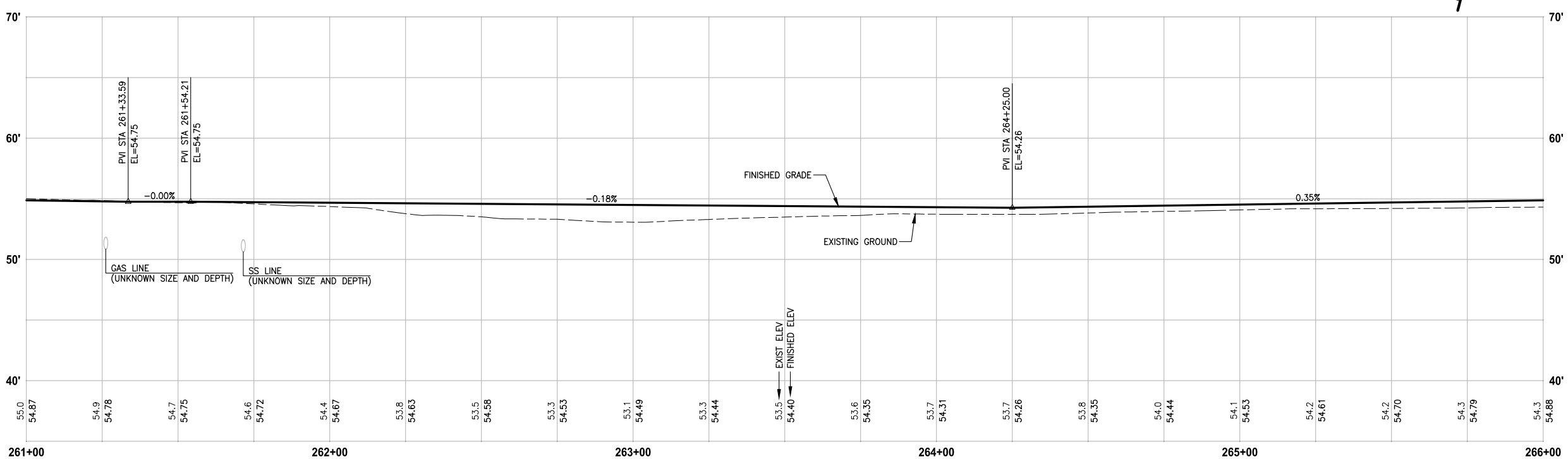

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GENERAL NOTES:

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3. SEE SHEET G4 FOR SYMBOL AND LINE LEGEND.

CITY OF SAMMAMISH APPROVAL	
City Engineer	Date
Community Development	Date

90 % REVIEW SUBMITTAL
NOT FOR CONSTRUCTION

REVISIONS	DATE	BY

DESIGNED J. JUN
DRAWN B. PURGANAN
CHECKED Y. HO
APPROVED

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FILE NAME BL1521075P20T03AL-01
JOB No. 554-1521-075 P20T03
DATE DECEMBER 2014

PRELIMINARY
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REGISTERED PROFESSIONAL ENGINEER

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PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

PLAN AND PROFILE

SHEET NO. 35 OF 79
AL10

PATH: U:\PSO\Projects\Clients\1521-KingCo\554-1521-075-ELST\99Svcs\CADD\Phase 20\Task 03\DWG\
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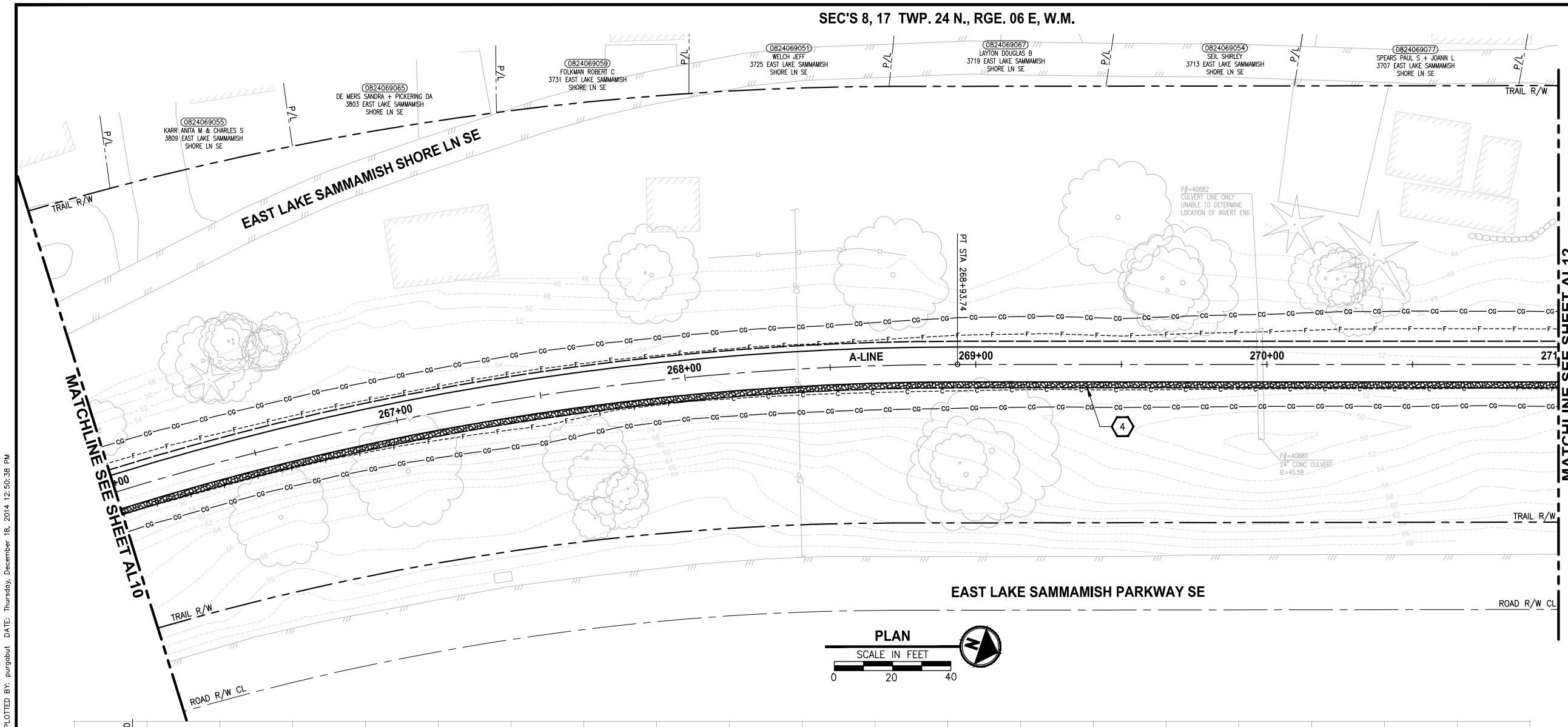

PLAN

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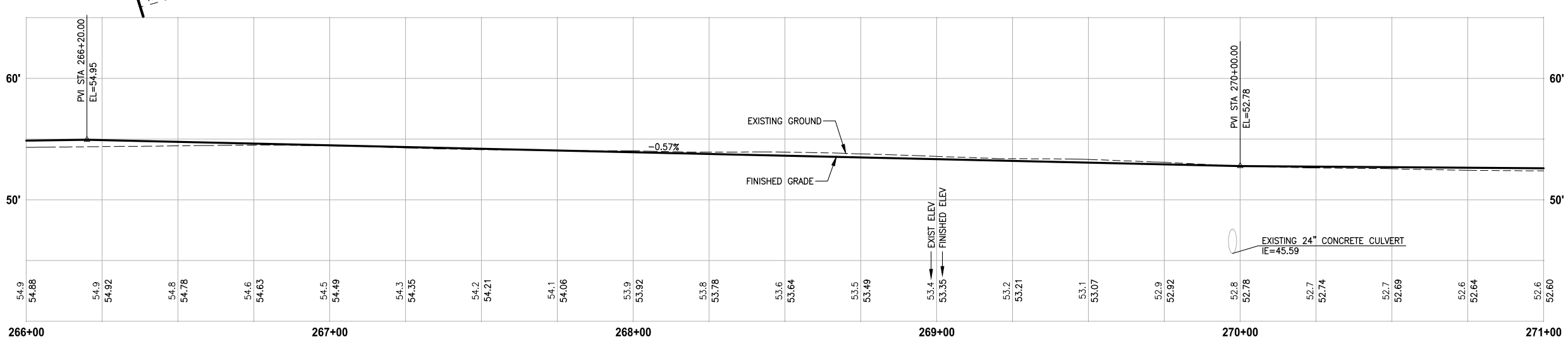

A-LINE PROFILE

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VERT: 1"=5'

CIVIL CONSTRUCTION NOTES:

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CITY OF SAMMAMISH APPROVAL	
City Engineer	Date
Community Development	Date

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DRAWN B. PURGANAN
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YAMMIE Y. HO
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PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

PLAN AND PROFILE

SHEET NO. 36 OF 79
AL11

PATH: U:\PSO\Projects\Clients\1521-KingCo\554-1521-075-ELST\99Svcs\CADD\Phase 20\Task 03\DWG\ PLOTTED BY: purgabut DATE: Thursday, December 18, 2014 12:50:38 PM
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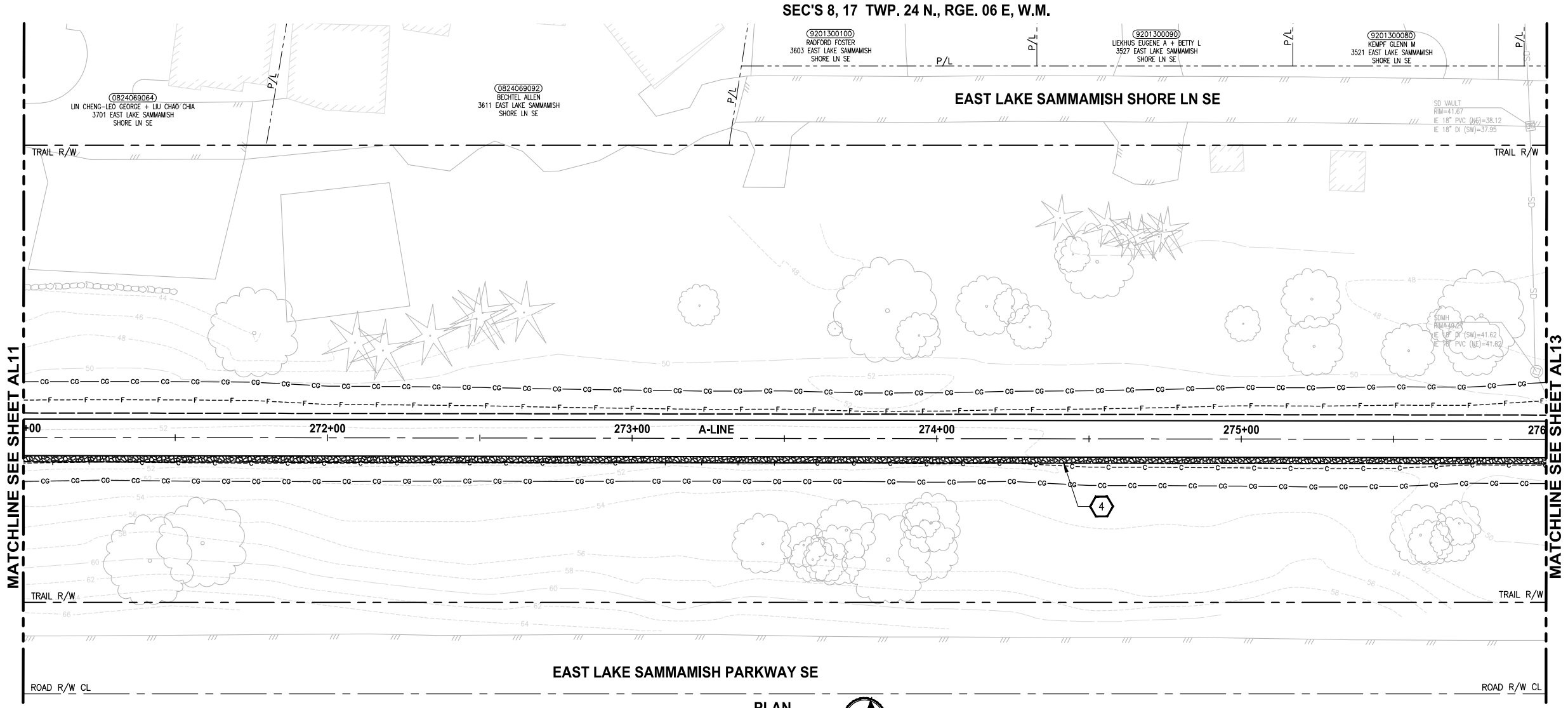

PLAN

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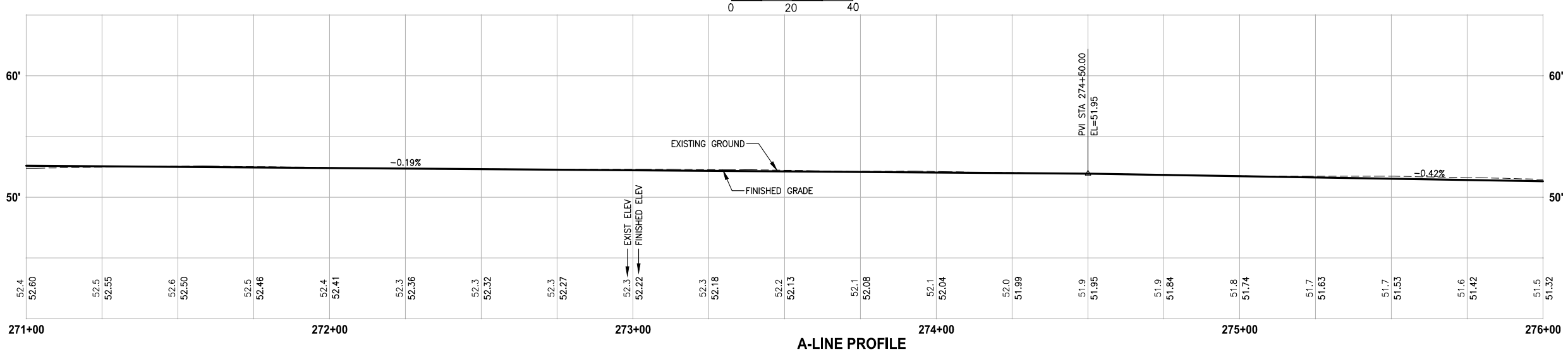
0 20 40



A-LINE PROFILE

HORIZ: 1"=20'
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PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

PLAN AND PROFILE

SHEET NO.
37 OF 79
AL12

PATH: U:\PSO\Projects\Clients\1521-KingCo\554-1521-075-ELST\99Svcs\CADD\Phase 20\Task 03\DWG\
PLOTTED BY: purgabut DATE: Thursday, December 18, 2014 12:50:53 PM
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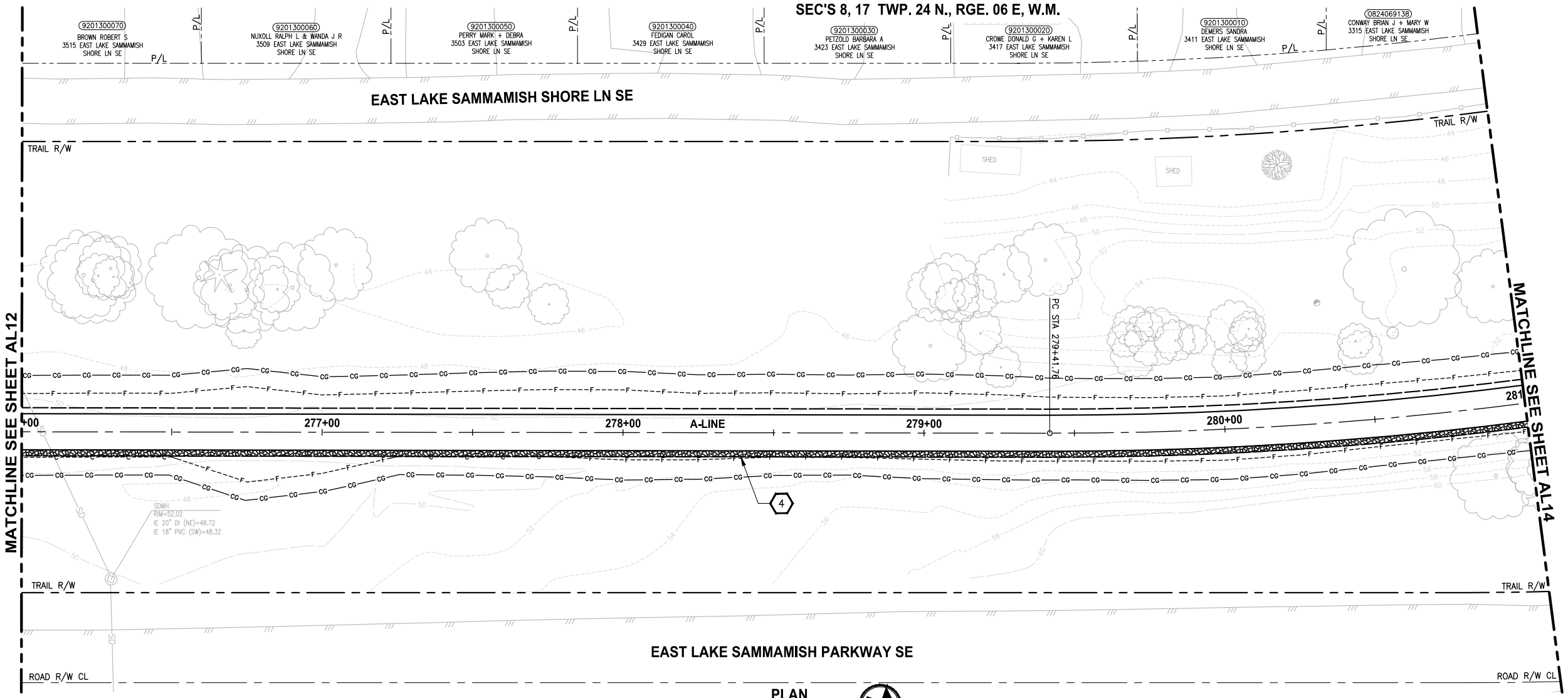
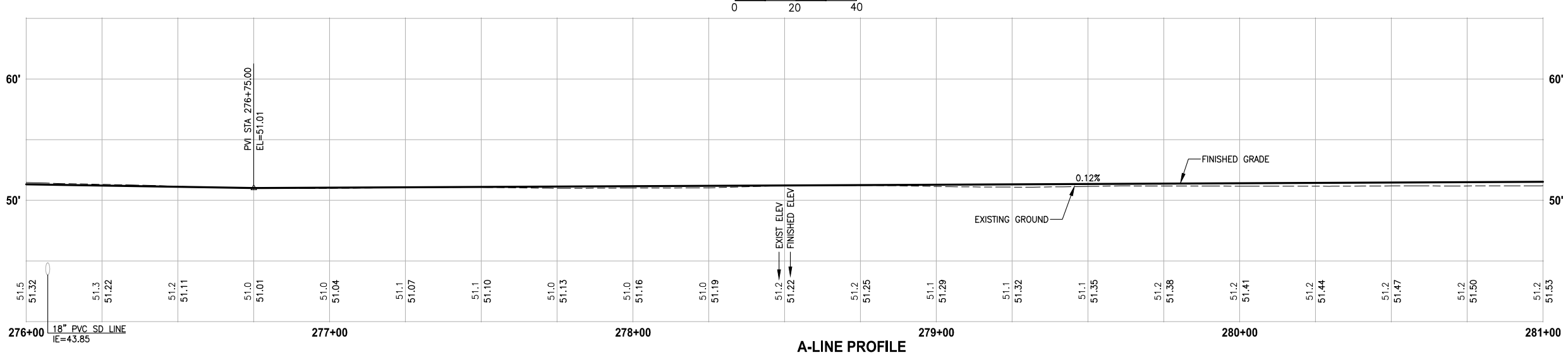


PLAN

SCALE IN FEET

0 20 40



A-LINE PROFILE

HORIZ: 1"=20'
VERT: 1"=5'

CIVIL CONSTRUCTION NOTES:

1. INSTALL STRUCTURAL EARTH WALL. SEE WALL DETAILS ON SHEET WD1. SEE WALL PROFILES ON WP SHEETS.
2. INSTALL COATED CHAIN LINK FENCE TYPE 6. FOR GROUND POST INSTALLATION SEE APPENDIX B IN THE SPECIFICATIONS. SEE SHEET WD1 FOR INSTALLATION ON TOP OF WALL.
3. INSTALL CHAIN LINK CANTILEVER GATE, SEE DETAIL ON SHEET MD2.
4. INSTALL SPLIT RAIL FENCE, SEE DETAILS ON SHEET MD3.
5. INSTALL PATTERNED CONCRETE DRIVEWAY, SEE DETAILS ON SHEET MD2 AND DP SHEETS.
6. CEMENT CONCRETE DRIVEWAY. SEE DP SHEETS.
7. INSTALL PVC SLEEVE 4 IN. DIA FOR GAS LINE.
8. WALL DRAIN OUTFALL LOCATION. SEE SHEET WD1.
9. CEMENT CONCRETE TRAFFIC CURB AND GUTTER PER WSDOT STD PLAN F-10.12-03.
10. PARALLEL CURB RAMP PER WSDOT STD PLAN F-40.12-02.
11. INSTALL EXTRUDED CURB TYPE 5 PER WSDOT STD PLAN F-10.42-00.
12. INSTALL SOLDIER PILE WALL. SEE DETAILS ON SHEET S1. SEE WALL PROFILE ON SHEET WP1.
13. ADJUST WATER LINES. ELEVATIONS TO BE DETERMINED AFTER POTHOLING.

STORMWATER CONSTRUCTION NOTES:

1. CONCRETE HEADWALL, SEE DETAIL 1 ON SHEET DD1. SEE WALL PROFILE ON WP SHEETS FOR WALLS #3, #5 AND #7.
2. QUARRY SPALL OUTFALL PROTECTION, SEE DETAIL 2 ON SHEET DD1.
3. CONNECTION TO DRAINAGE STRUCTURE AND CLEANING EXISTING DRAINAGE STRUCTURE.
4. INFILTRATION TRENCH, SEE DETAIL 3 ON SHEET DD1.

GENERAL NOTES:

1. SEE DP SHEETS FOR DRIVEWAY PLAN AND PROFILE.
2. SEE SD AND DD SHEETS FOR GENERAL NOTES RELATED TO STORM DRAIN STRUCTURES, PIPES AND DITCH.
3. SEE SHEET G4 FOR SYMBOL AND LINE LEGEND.

CITY OF SAMMAMISH APPROVAL	
City Engineer	Date
Community Development	Date

90 % REVIEW SUBMITTAL
NOT FOR CONSTRUCTION

REVISIONS	DATE	BY

DESIGNED J. JUN
DRAWN B. PURGANAN
CHECKED Y. HO
APPROVED

ONE INCH AT FULL SCALE. IF NOT, SCALE ACCORDINGLY
FILE NAME BL1521075P20T03AL-01
JOB No. 554-1521-075 P20T03
DATE DECEMBER 2014

PRELIMINARY
YAMMIE Y. HO
STATE OF WASHINGTON
40829
REGISTERED PROFESSIONAL ENGINEER

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PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

PLAN AND PROFILE

SHEET NO. 38 OF 79
AL13

PATH: U:\PSO\Projects\Clients\1521-KingCo\554-1521-075-ELST\99Svcs\CADD\Phase 20\Task 03\DWG\ PLOTTED BY: purgabut DATE: Thursday, December 18, 2014 12:51:06 PM
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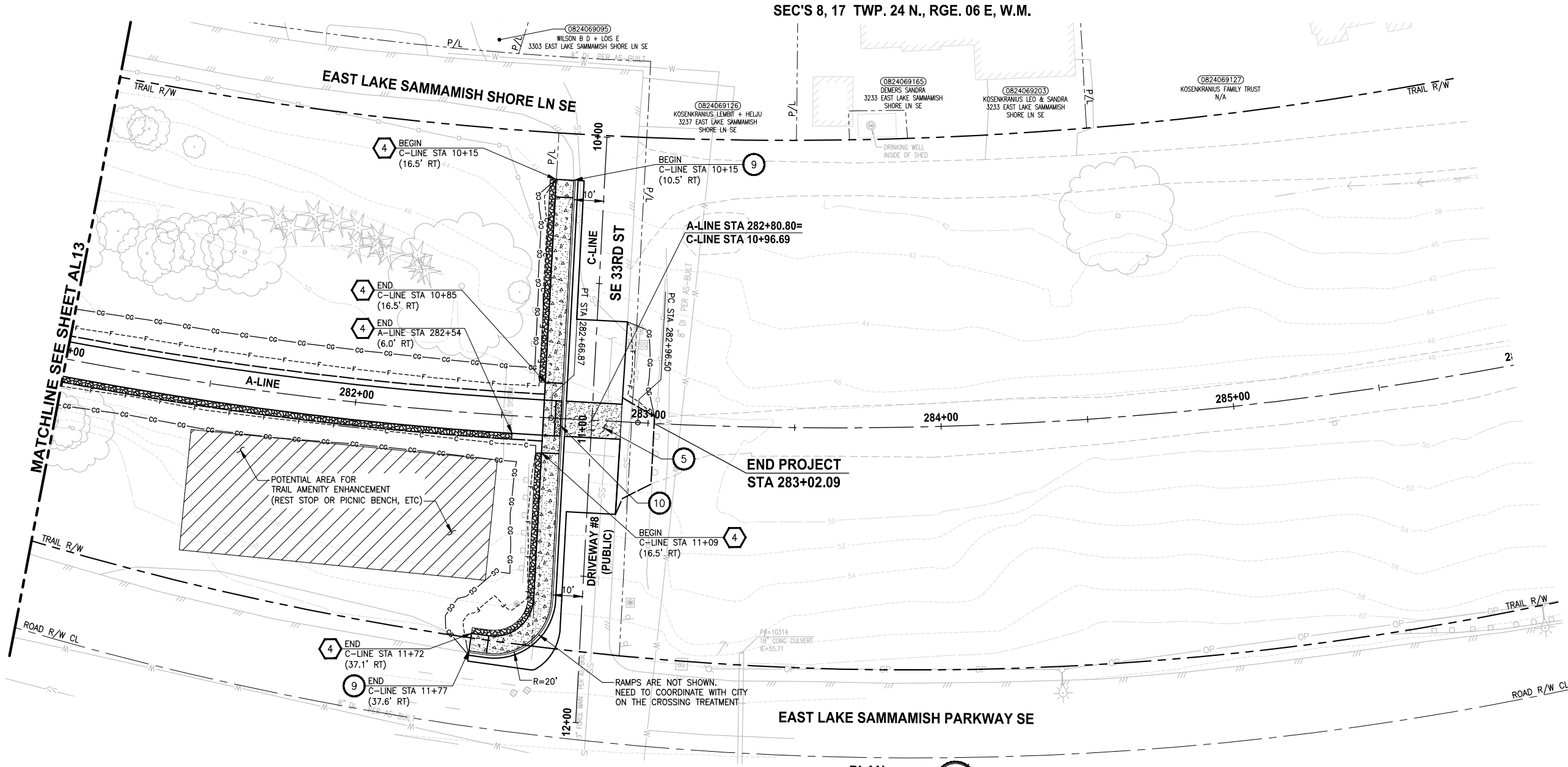
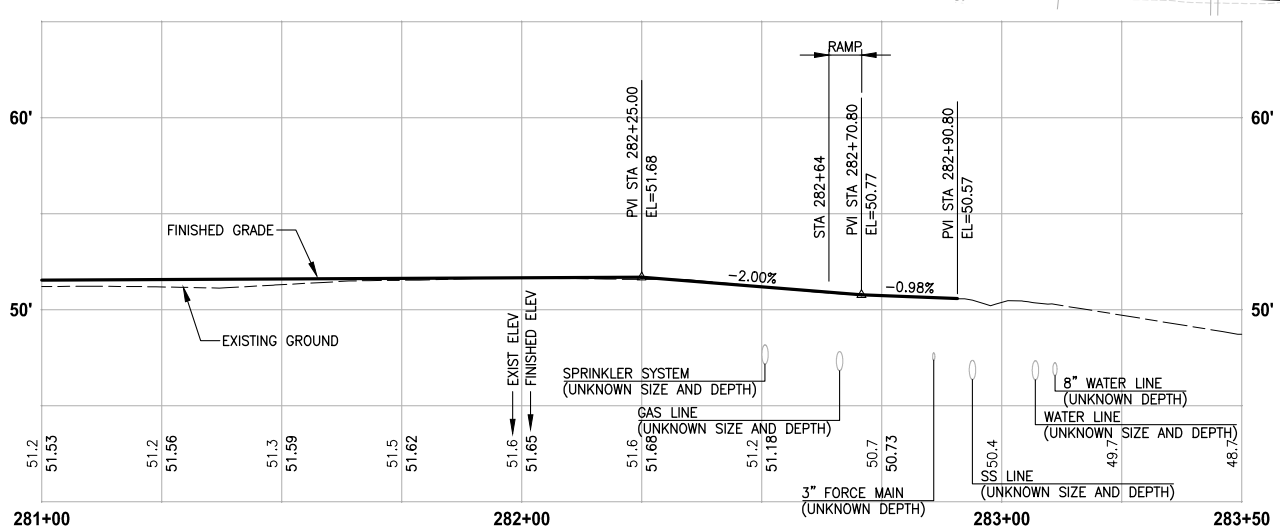


PLAN

SCALE IN FEET
0 20 40



A-LINE PROFILE

HORIZ: 1"=20'
VERT: 1"=5'

CIVIL CONSTRUCTION NOTES:

1. INSTALL STRUCTURAL EARTH WALL. SEE WALL DETAILS ON SHEET WD1. SEE WALL PROFILES ON WP SHEETS.
2. INSTALL COATED CHAIN LINK FENCE TYPE 6. FOR GROUND POST INSTALLATION SEE APPENDIX B IN THE SPECIFICATIONS. SEE SHEET WD1 FOR INSTALLATION ON TOP OF WALL.
3. INSTALL CHAIN LINK CANTILEVER GATE, SEE DETAIL ON SHEET MD2.
4. INSTALL SPLIT RAIL FENCE, SEE DETAILS ON SHEET MD3.
5. INSTALL PATTERNED CONCRETE DRIVEWAY, SEE DETAILS ON SHEET MD2 AND DP SHEETS.
6. CEMENT CONCRETE DRIVEWAY. SEE DP SHEETS.
7. INSTALL PVC SLEEVE 4 IN. DIA FOR GAS LINE.
8. WALL DRAIN OUTFALL LOCATION. SEE SHEET WD1.
9. CEMENT CONCRETE TRAFFIC CURB AND GUTTER PER WSDOT STD PLAN F-10.12-03.
10. PARALLEL CURB RAMP PER WSDOT STD PLAN F-40.12-02.
11. INSTALL EXTRUDED CURB TYPE 5 PER WSDOT STD PLAN F-10.42-00.
12. INSTALL SOLDIER PILE WALL. SEE DETAILS ON SHEET S1. SEE WALL PROFILE ON SHEET WP1.
13. ADJUST WATER LINES. ELEVATIONS TO BE DETERMINED AFTER POTHOLING.

STORMWATER CONSTRUCTION NOTES:

1. CONCRETE HEADWALL, SEE DETAIL 1 ON SHEET DD1. SEE WALL PROFILE ON WP SHEETS FOR WALLS #3, #5 AND #7.
2. QUARRY SPALL OUTFALL PROTECTION, SEE DETAIL 2 ON SHEET DD1.
3. CONNECTION TO DRAINAGE STRUCTURE AND CLEANING EXISTING DRAINAGE STRUCTURE.
4. INFILTRATION TRENCH, SEE DETAIL 3 ON SHEET DD1.

GENERAL NOTES:

1. SEE DP SHEETS FOR DRIVEWAY PLAN AND PROFILE.
2. SEE SD AND DD SHEETS FOR GENERAL NOTES RELATED TO STORM DRAIN STRUCTURES, PIPES AND DITCH.

LEGEND:

SEE SHEET G4 FOR SYMBOL AND LINE LEGEND.

CEMENT CONCRETE SIDEWALK

DETECTABLE WARNING SURFACE PER WSDOT STD PLAN F-45.10-01.

CITY OF SAMMAMISH APPROVAL	
City Engineer	Date
Community Development	Date

90 % REVIEW SUBMITTAL
NOT FOR CONSTRUCTION

REVISIONS	DATE	BY

DESIGNED J. JUN
DRAWN B. PURGANAN
CHECKED Y. HO
APPROVED

ONE INCH AT FULL SCALE. IF NOT, SCALE ACCORDINGLY
FILE NAME BL15210 75P20T03AL-01
JOB No. 554-1521-075 P20T03
DATE DECEMBER 2014

PRELIMINARY
YAMMIE Y. HO STATE OF WASHINGTON 40820 REGISTERED PROFESSIONAL ENGINEER

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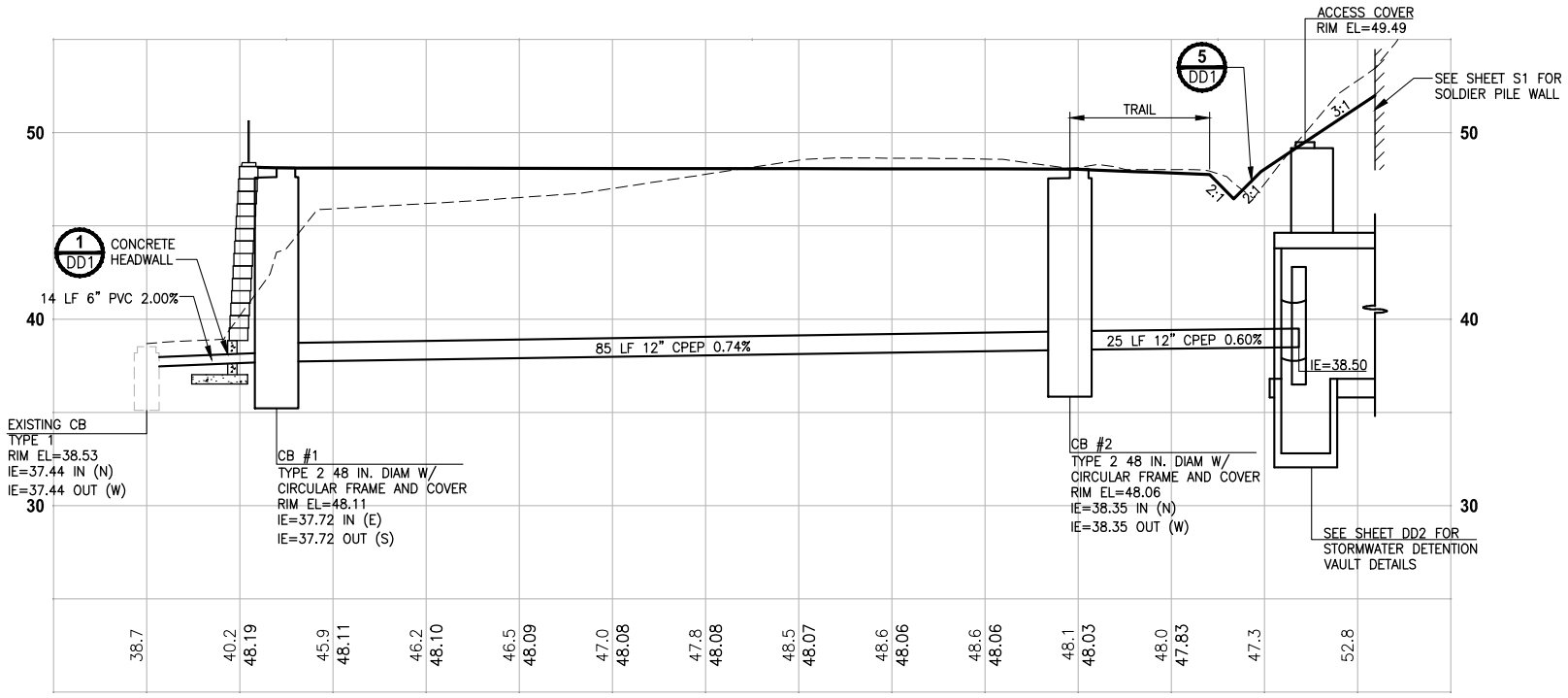
PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

PLAN AND PROFILE

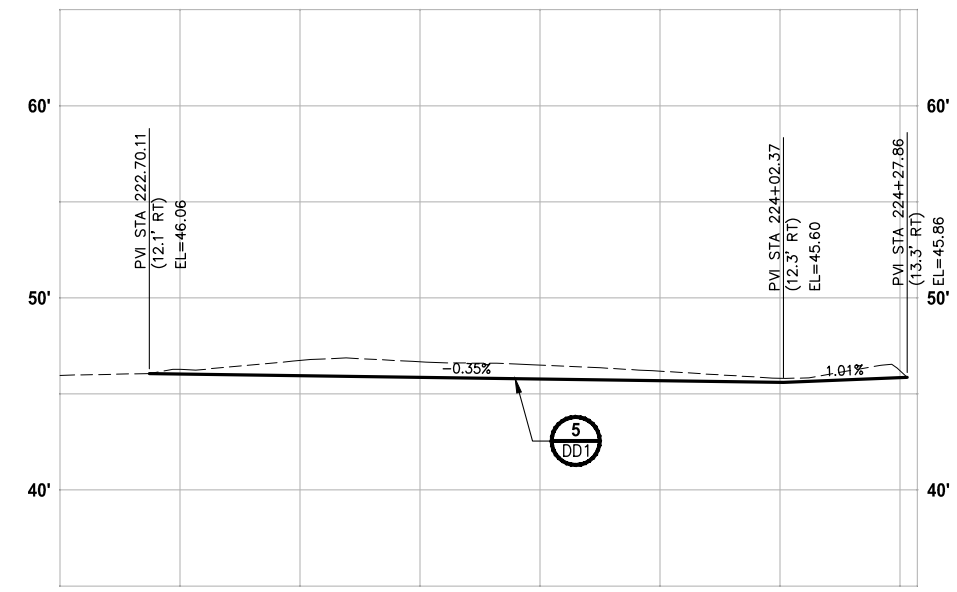
SHEET NO.
39 OF 79
AL14

PATH: U:\PSO\Projects\Clients\1521-KingCo\554-1521-075-ELST\99Svcs\CADD\Phase 20\Task 03\DWG\ PLOTTED BY: purgabut DATE: Thursday, December 18, 2014 12:51:23 PM LAYOUT: AL14



VAULT OUTFALL PROFILE STA 224+00

HORIZ: 1"=10'
VERT: 1"=5'

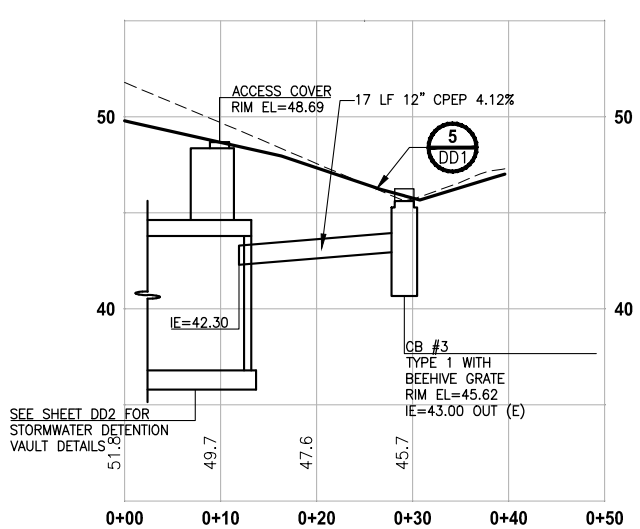


JURISDICTIONAL DITCH #9 PROFILE

HORIZ: 1"=20'
VERT: 1"=10'

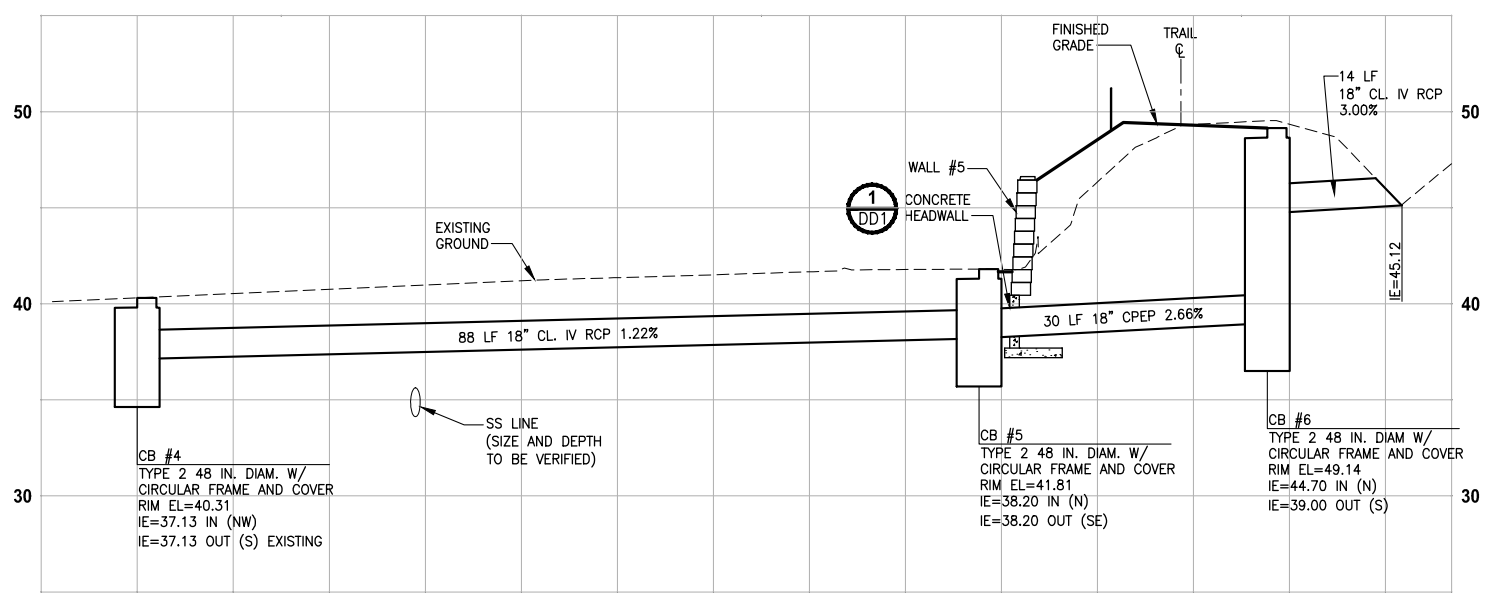
GENERAL NOTES:

1. CULVERTS SHALL HAVE BEVELED END SECTIONS PER 2007 KC ROAD STANDARD DETAIL FIG. 7-001.
2. CATCH BASIN TYPE 2 SHALL BE PER 2007 KC ROAD STANDARD DETAILS FIG. 7-005 AND FIG. 7-006.
3. CL IV RCP = CLASS IV REINFORCED CONCRETE STORM SEWER PIPE.
4. CIRCULAR FRAME (RING) AND COVER SHALL BE PER 2007 KC ROAD STANDARD DETAIL FIG. 7-022.
5. STRUCTURE OFFSETS ARE MEASURED TO CENTER OF SOLID COVER.
6. CPEP = CORRUGATED POLYETHYLENE PIPE, DOUBLE WALLED.
7. PVC = POLY VINYL CHLORIDE PIPE.
8. BEEHIVE GRATE SHALL BE PER DETAIL PROVIDED IN SPECIAL PROVISIONS.



VAULT INLET PROFILE STA 224+00

HORIZ: 1"=10'
VERT: 1"=5'



B-LINE PROFILE

HORIZ: 1"=10'
VERT: 1"=5'

CITY OF SAMMAMISH APPROVAL	
City Engineer	Date
Community Development	Date

90 % REVIEW SUBMITTAL
NOT FOR CONSTRUCTION

REVISIONS	DATE	BY

DESIGNED C. BUITRAGO
DRAWN B. PURGANAN
CHECKED R. CUSHMAN
APPROVED

ONE INCH AT FULL SCALE. IF NOT, SCALE ACCORDINGLY
FILE NAME BL1521075P20T03SD-01
JOB No. 554-1521-075 P20T03
DATE DECEMBER 2014

PRELIMINARY
CRAIG A. BUITRAGO
STATE OF WASHINGTON
49427
REGISTERED PROFESSIONAL ENGINEER

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WWW.PARAMETRIX.COM

PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

STORM DRAINAGE PROFILES AND SECTIONS

PATH: U:\PSO\Projects\Clients\1521-KingCo\554-1521-075-ELST\99Svcs\CADD\Phase 20\Task 03\DWG\ PLOTTED BY: purgabut DATE: Thursday, December 18, 2014 12:52:04 PM
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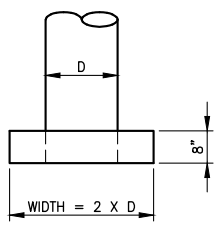
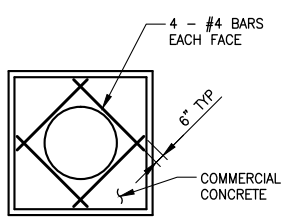


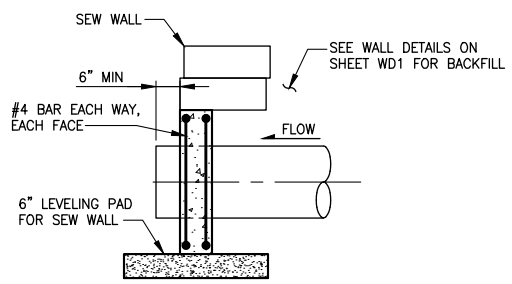
PLAN

NOTES:

1. REINFORCING STEEL SHALL HAVE 1 1/2" MIN. CLEAR COVER TO ALL CONCRETE SURFACES.
2. FOR SEW WALLS SEE SHEET WD1.

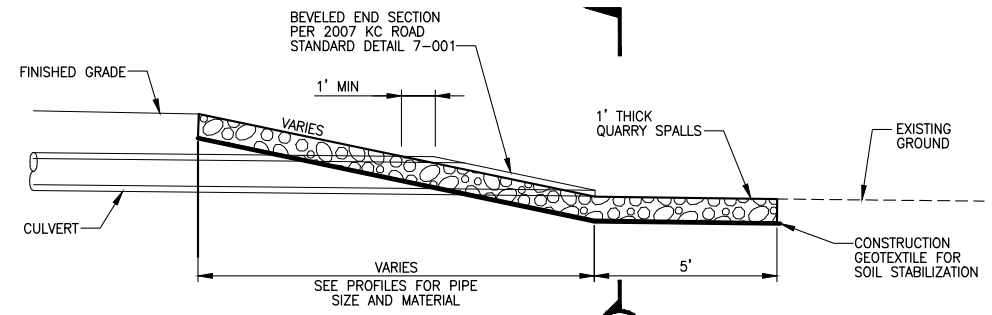


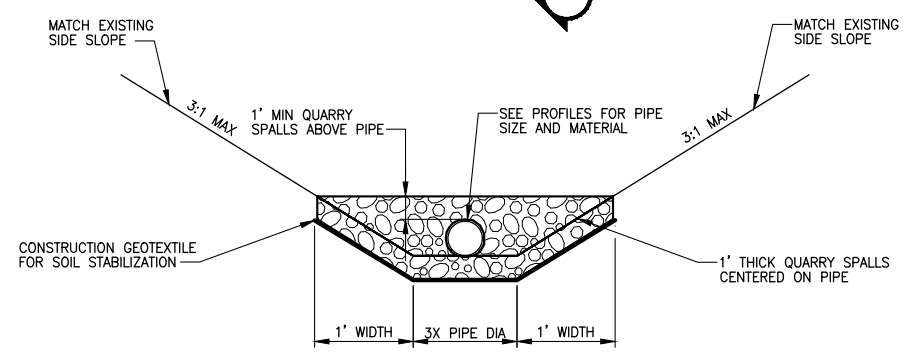
ELEVATION



SECTION A

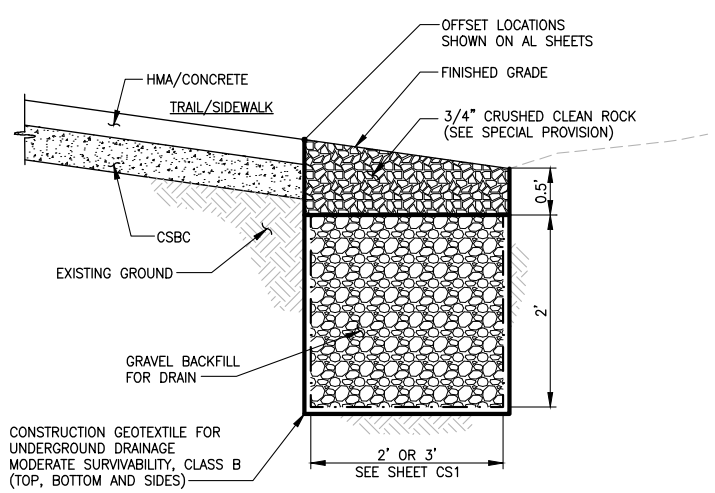
CONCRETE HEADWALL FOR STRUCTURAL EARTH WALL
DETAIL 1
NO SCALE



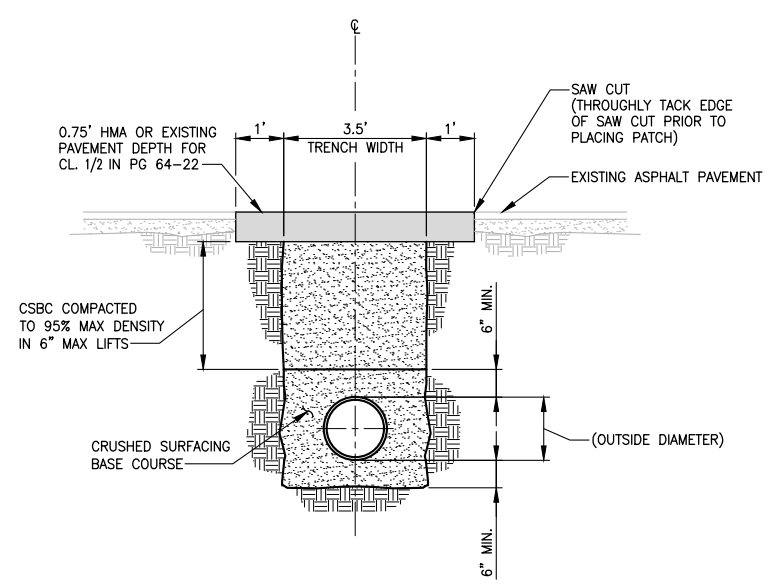


SECTION A

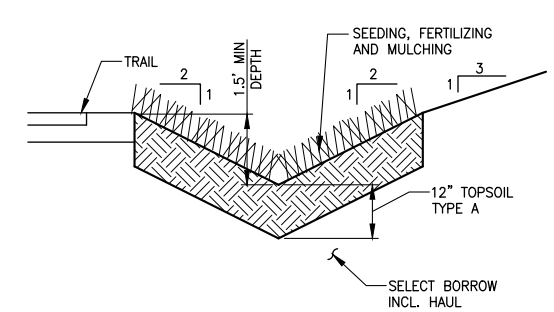
QUARRY SPALL OUTFALL PROTECTION
DETAIL 2
NO SCALE



INFILTRATION TRENCH
DETAIL 3
NO SCALE



(ROADWAY REPAIR)
TRENCH DETAIL 4
NO SCALE



JURISDICTIONAL DITCH #9
DETAIL 5
NO SCALE

GENERAL NOTE:

1. PROTECT INFILTRATION TRENCHES FROM SEDIMENTATION DURING CONSTRUCTION.

CITY OF SAMMAMISH APPROVAL	
City Engineer	Date
Community Development	Date

90 % REVIEW SUBMITTAL
NOT FOR CONSTRUCTION

	REVISIONS	DATE	BY

DESIGNED C. BUITRAGO
DRAWN B. PURGANAN
CHECKED R. CUSHMAN
APPROVED

ONE INCH AT FULL SCALE. IF NOT, SCALE ACCORDINGLY
FILE NAME BL1521075P20T03DD-01
JOB No. 554-1521-075 P20T03
DATE DECEMBER 2014

PRELIMINARY
CRAIG A. BUITRAGO STATE OF WASHINGTON 49427 REGISTERED PROFESSIONAL ENGINEER

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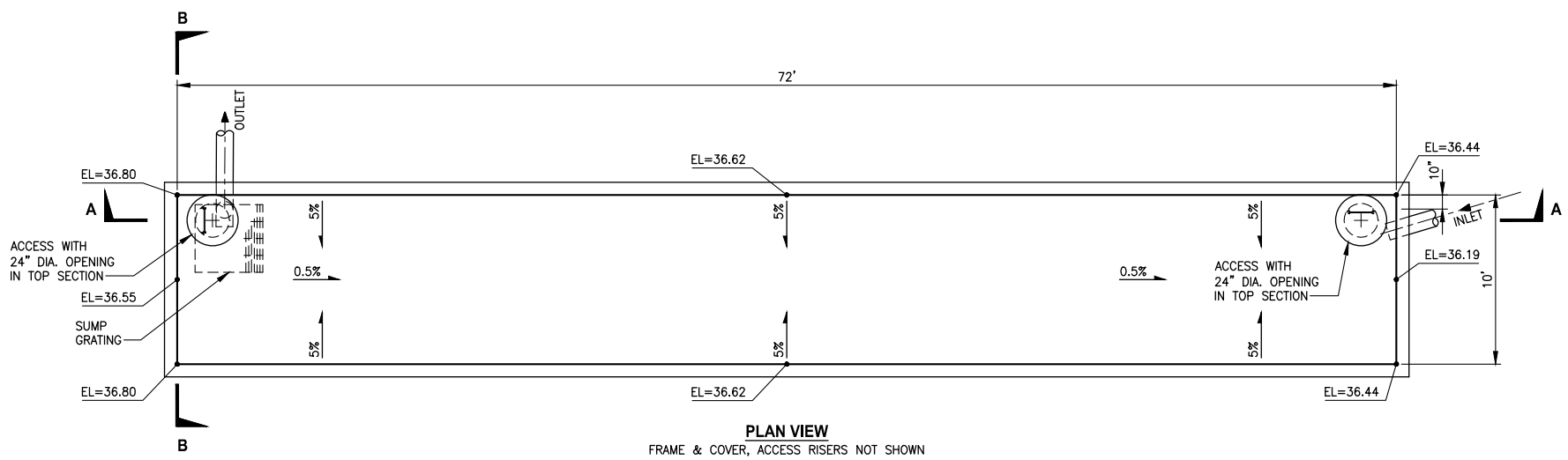
PROJECT NAME
EAST LAKE SAMMAMISH MASTER PLAN TRAIL SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

DRAINAGE DETAILS

SHEET NO. 41 OF 79
DD1

PATH: U:\PSO\Projects\Clients\1521-KingCo\554-1521-075-ELST\99Svcs\CADD\Phase 20\Task 03\DWG\ PLOTTED BY: purgabut DATE: Thursday, December 18, 2014 12:52:14 PM
LAYOUT: DD1



PLAN VIEW
FRAME & COVER, ACCESS RISERS NOT SHOWN

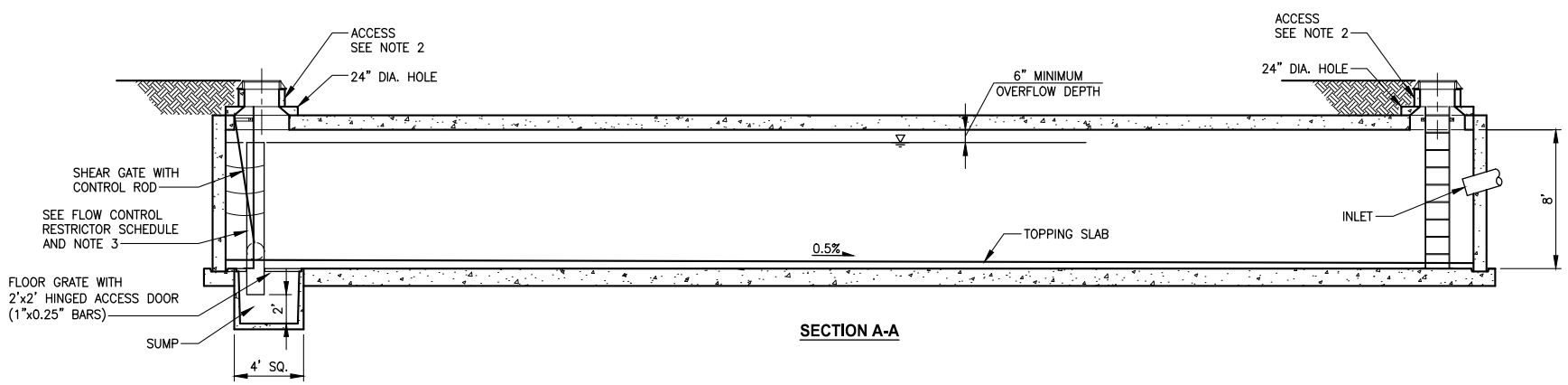
NOTES:

1. ALL METAL PARTS MUST BE CORROSION RESISTANT. STEEL PARTS MUST BE GALVANIZED AND ASPHALT COATED (TREATMENT 1 OR BETTER).
2. ACCESS RISER STRUCTURES SHALL BE PER 2007 KC ROADS STANDARD DETAIL FIG. 7-005. ACCESS COVERS SHALL BE SOLID LOCKING COVERS PER KC ROADS STANDARD DETAIL FIGS. 7-022 AND 7-023.
3. FLOW CONTROL RESTRICTOR, PIPE SUPPORTS AND SHEAR GATE WITH CONTROL ROD FOR CLEANOUT SHALL BE PER KC ROADS STANDARD DETAIL FIGS. 7-025 AND 7-026.

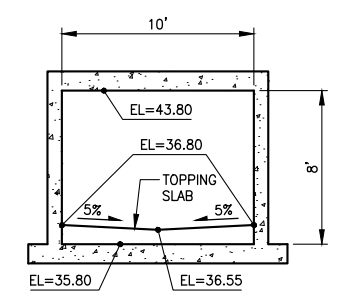
FLOW CONTROL RESTRICTOR SCHEDULE

RISER PIPE		
DIAMETER (IN)	IE (FT)	TOP ELEVATION (FT)
18	38.50'	42.82

ORIFICES		
TYPE	ELEVATION (FT)	DIMENSIONS (IN)
CIRCLE	36.50	1.5 DIA
NOTCH (RECTANGLE)	39.17	0.25L x 43.78H



SECTION A-A



SECTION B-B

PRECAST CONCRETE VAULT
DETAIL 1
NO SCALE

CITY OF SAMMAMISH APPROVAL	
City Engineer	Date
Community Development	Date

90 % REVIEW SUBMITTAL
NOT FOR CONSTRUCTION

REVISIONS	DATE	BY

DESIGNED C. BUITRAGO
DRAWN B. PURGANAN
CHECKED R. CUSHMAN
APPROVED

ONE INCH AT FULL SCALE. IF NOT, SCALE ACCORDINGLY
FILE NAME BL1521075P20T03DD-01
JOB No. 554-1521-075 P20T03
DATE DECEMBER 2014

PRELIMINARY
CRAIG A. BUITRAGO
STATE OF WASHINGTON
49427
REGISTERED PROFESSIONAL ENGINEER

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PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

DRAINAGE DETAILS

SHEET NO.
42 OF 79
DD2

LAYOUT: DD2 PATH: U:\PSO\Projects\Clients\1521-KingCo\554-1521-075-ELST\995ves\CADD\Phase 20\Task 03\DWG\ PLOTTED BY: purgabut DATE: Thursday, December 18, 2014 12:52:19 PM

DRAFT

APPENDIX B

Drainage Problems and Complaints

City of Sammamish Drainage complaints in the project vicinity

ID	Date	Description	Assigned to:	Status	First Name	Last name	Address	Entered	Action	Type	Location	Neighborhood	Date closed	Date entered
2852	8/23/2004	Mr. Reilly had to have the City maintenance crew respond this weekend to a flooding issue at his residence - there is a creek now running down and around his house between his house and his neighbor's. He's not sure exactly how this came to pass, but he knows that something is going to need to be done about this creek, because it is definitely going to be a flooding problem. Requesting someone check it out and see if there isn't some remedy.	elafrance	CLOSED	Mike	Reilly	4215 E LK Sammamish Shore LN SE	crupke	Colleen spoke to Eric L about this, he and Aaron Sundberg and the maintenance crew are already working on this today. Colleen recontacted Mr. Reilly, advised him of this. Completed.	Drainage Problems	E LK Sammamish Shore LN SE		9/1/04	
4602	1/18/2007	Mr. Moore called this morning to report a drainage problem along E. Lake Sammamish Pkwy at Perigrine Point. Water is flowing like a rive off the banks and over the road and part of the bank has broken away and slid down. Could someone please investigate this problem and give him a call.	Elafrance	CLOSED	Carvel	Moore	4299 E Lake Sammamish Shore Lane SE	lhachey	Crews have responded. Case closed	Drainage Problems		Perigrine Point		
5240	11/26/2007	From: Ed Roberts [mailto:eroberts@seanet.com] Sent: Fri 11/16/2007 8:45 AM To: John Cunningham Subject: Lake Sammamish Polution Mr Cunningham, We have a problem at 3839 & 3901 East Lake Sammamish Shore Lane SE. Ever sense the trail went in we have run off from our street during heavy rains, yesterday we had a large plum in the lake. I have called the county several times and they have and they have cleaned their ditches but it has not solved the problem. The City needs to see what can be done to protect the lake from further damage as we enter the wet season. Thanks, Ed Roberts 425 369 1800	Jcunningham	CLOSED	Ed	Roberts	E Lk Sammamish Shore Ln SE	lhachey	From: John Cunningham Sent: Fri 11/23/2007 9:35 AM To: Ed Roberts Subject: RE: Lake Sammamish Polution Good Morning Mr. Roberts. We will take a look at this and see what we can figure out. Thank you for brining this to our attention. John c.	Drainage Problems	3839 & 3901 East Lake Sammamish			
5297	12/20/2007	Flooding at the bottom of 212th at E Lk Samm Pkwy.	csimpson	CLOSED	Anonymous			dlunde		Drainage Problems	212th			
5299	12/24/2007	Mr. Moore left a message Saturday (12/22) in regards to flooding in his and his neighbor's garages from run-off originating off Peregrine Pt. Way SE. I happened to drive by there (as I was working a little Saturday). It was 30 to 60 minutes after it had stopped raining. Water was cascading across the south sidewalk on Peregrine, across the Parkway down to Shore Ln where Mr. Moore lives.	shartwig	CLOSED	Karvel	Moore		thudson		Drainage Problems	E Lk Samm Sh Ln SE - 4200 Block			

ID	Date	Description	Assigned to:	Status	First Name	Last name	Address	Entered	Action	Type	Location	Neighborhood	Date closed	Date entered
7796	3/28/2011	Online Citizen Action Request: Description: Water has been bubbling out of the top of a heavy drain for at least 3 weeks. The water runs down the side of the paved street, then crosses over and is flooding our shared waterfront recreational lot. We didn't report it sooner because it has been so rainy and because we thought it was coming from a nearby construction site. But with the drier weather weather we can now tell that the drain is seriously backed up. The drain is large, round, and topped with a heavy grate. We'd like to see the drain unplugged so our lot can dry out and we can clean up all the debris that washed ashore this winter. Thank you! Location: The drain is located opposite the home at 4229 East Lake Sammamish Shorelane SE. The drain is positioned between the pavement and the railroad tie retaining wall that borders the recreation trail. There's actually a little "cut-out" in the retaining wall to accomodate the drain. You can easily follow the path the water takes after overflowing the drain. Our waterfront lot -- the one being flooded -- is located 3 parcels down from the 4229 property. Sorry to not be more exact, but our shared waterfront lot doesn't really have an address and the parcel number listed in the database is a duplicate of one farther north on the lake.	Elafrance	CLOSED	Celeste and Bob	Boyer	21007 SE 42nd ST	crupke	Forwarded to Michelle, Kyle, Martin and Ho 4/6/11: Celeste called checking the status of this because situation is becoming worse. Colleen referred her to M&O. Michelle indicates that at some point Kyle requested that this be referred to Eric. Colleen has no record of it being referred to Eric. This CAR now being forwarded to Eric and Lisa. This also corresponds with M&O WO #11-295 4/12/11 EL made site visit, determined it is likely a clogged private stysem. Will contact KC and homeowner to advise. LW	Drainage Problems	Oppositie 4229 ELS Shore Lane SE		4/12/11	Mar 28 2011 2:55PM
8545	10/4/2012	Email from Mona 10/3/12: I just received a complaint from the folks that live at 4289 East Lake Sammamish Shore Lane SE calling about the runoff from the gutters and downspouts at 4291 East Lake Sammamish Shore Lane SE. He said this is creating a wetland situation in his back yard and he'd like us to do something about having his neighbors keep their own runoff on their lot and not have it run out onto his lot. Looks like the house at 4291 may have a wetland out back since it's undeveloped, but nothing is showing up in iMap. Perhaps Kathy can expand on this. At any rate, the big house is complaining that the little house is dumping all their stormwater/drainage onto him. Help…thanks!	Elafrance	CLOSED	Citizen		4289 East Lake Sammamish Shore Lane SE	lwerre	Made a site visit and determined neighbor is not doing anything wrong or different, may just be a change in ground water. LW 10/11/12	Drainage Problems	4289 East Lake Sammamish Shore Lane SE		10/11/12	Oct 4 2012 1:31PM
8564	10/23/2012	Broken catch basin	Elafrance	CLOSED	Misty	Weber	4039 E Lk Samm Sh Ln SE	lwerre	Driveway drain is on private road. Homeowner will have to repair. LW 10/23/12	Drainage Problems	4039 E Lk Samm Sh Ln SE		10/23/12	Oct 23 2012 9:18AM

Drainage Related Comments Received During Open House Public Meetings in March 2014

Segment	Comment Type	Contact Information	What are your top priorities and concerns about the trail design?	Please share any other questions or comments that you would like King County to consider during the design process?	Do you have any other special access concerns or issues that King County should be aware of during design and construction?	Are you aware of any private utilities that may conflict with construction activities?
A	Form	Daniel "Dan" O'Donnell 4229 E Lake Sammamish Shore Lane SE Sammamish, WA 98075 425-567-0447 or 206-714-6608 (cell)	Fencing, drainage, stop signs at trails to roads, shrubbery	Fencing to limit access to properties. Better drainage for wetland.	Fencing?	2 house waterlines cross under the trail. Owners can direct for marking.
A	Form	Carv and Elynne Moore 4299 East Lake Sammamish Shore Lane SE Sammamish, WA 98075 (center section 217) cnemoore@aol.com 425-557-8237	Preservation of old, existing trees, preserving beautiful flowering trees and bushes on the berm. We also have landscape lighting and irrigation we want to preserve, privacy is also an issue and concerns about increase in crime.	We would so appreciate working together to make this a win win situation. We have so much beautiful landscaping we would like to keep and maintain.	We want to make sure we have access to our driveway, and parking. We are very concerned about flooding that occurs from Pergtine Point comes down our driveway, crosses he trail, and floods our property.	Yes -- irrigation and landscaping lighting that exist on berm.
A	Form	Allen McNaughton 4229 East Lake Sammamish Shore Lane SE Sammamish, WA 98075 abmcnaug@aol.com 425-392-4287	Love the trail -- a few concerns/wishes. 1. Safety at crossings -- cyclists don't stop even if they have stop signs. 2. Fencing would like along our property - chain link. Hate look of post rail put up Issaquah section. Have had issues with trail users going off trail and going to lake.	Save my Doug fir trees! Several planted on bank over last 10 year. Would really appreciate it if they could be preserved.	Assume you mean to our homes? Road by house is narrow - construction parking could block access. Use of yard as turn around.	Water lines crosses under path current drainage is inadequate during periods of heavy rain.
A	Form	Trevor Nies 4007 East Lake Sammamish Shore Lane SE Sammamish, WA 98075 T-man@live.com 206-799-6013	I would like to have the expansion of the trail to the east of it so I can move the retaining wall east towards trail. This is important to allow access in and out of my garage I'm building. Note, I am looking to rebuild my retaining wall now so also want to make sure it doesn't get torn down during trail expansion.	How will the drainage ditch be improved? Note it flooded my house this winter!		No

Craig Buitrago

From: Jenny Bailey
Sent: Thursday, February 20, 2014 10:16 AM
To: Craig Buitrago
Cc: Phoebe Johannessen
Subject: FW: Reiko at 4009 E Lk Samm Shore Lane - water damage

-----Original Message-----
From: Auld, Gina [mailto:Gina.Auld@kingcounty.gov]
Sent: Thursday, February 20, 2014 10:10 AM
To: Jenny Bailey
Cc: Phoebe Johannessen
Subject: FW: Reiko at 4009 E Lk Samm Shore Lane - water damage

FYI.....

Gina Auld
Capital Project Manager

King County Facilities Management Division | Parks CIP
201 South Jackson Street, Suite 700
Seattle, WA 98104-3854
206.477.4552 | 206.724.1296 (cell) | 206.263.6217 (fax)

Please Note My New Phone Number

-----Original Message-----
From: Nunnenkamp, Robert
Sent: Thursday, February 20, 2014 9:59 AM
To: Auld, Gina
Cc: Clow, Rodger
Subject: RE: Reiko at 4009 E Lk Samm Shore Lane - water damage

This is the first time I've seen this happen. We know we have a sediment problem coming from the other side of the parkway and are proactive about keeping the ditch clear. I believe this was an extraordinary event but it illustrates the current system has limitations.

-----Original Message-----
From: Auld, Gina
Sent: Thursday, February 20, 2014 9:02 AM
To: Nunnenkamp, Robert
Cc: Clow, Rodger
Subject: RE: Reiko at 4009 E Lk Samm Shore Lane - water damage

Thanks Robert. Does this overflow frequently or does this happen on bigger rain events? I see there seems to be quite a bit of silt washed down, does this happen frequently or during bigger rain events? Is the silt coming from the trail?

I will bring this to Phoebe's attention but the more details we can provide her the better.

Thank you.

Gina Auld
Capital Project Manager

King County Facilities Management Division | Parks CIP
201 South Jackson Street, Suite 700
Seattle, WA 98104-3854
206.477.4552 | 206.724.1296 (cell) | 206.263.6217 (fax)

Please Note My New Phone Number

-----Original Message-----
From: Nunnenkamp, Robert
Sent: Thursday, February 20, 2014 8:59 AM
To: Auld, Gina
Cc: Clow, Rodger
Subject: RE: Reiko at 4009 E Lk Samm Shore Lane - water damage

Yes. We had big rains over the weekend and the system overflowed. The system has culverts of varying sizes and residents have modified the system on our property as well.

-----Original Message-----
From: Auld, Gina
Sent: Thursday, February 20, 2014 8:56 AM
To: Nunnenkamp, Robert
Cc: Clow, Rodger
Subject: RE: Reiko at 4009 E Lk Samm Shore Lane - water damage

Hi Robert,

I am assuming you are forwarding the photos that went with the below e-mail to me so we can look at the drainage issue while designing the South Sammamish Segment? Can I get some more information on this?

Thank you.

Gina Auld
Capital Project Manager

King County Facilities Management Division | Parks CIP
201 South Jackson Street, Suite 700
Seattle, WA 98104-3854
206.477.4552 | 206.724.1296 (cell) | 206.263.6217 (fax)

Please Note My New Phone Number

-----Original Message-----
From: Nunnenkamp, Robert
Sent: Thursday, February 20, 2014 8:45 AM
To: Auld, Gina
Subject: FW: Reiko at 4009 E Lk Samm Shore Lane - water damage

This is an area we'll need to take a closer look at as the plans go to 60%. While this was most likely an extraordinary event, we should look at designing the drainage to help minimize the possibility of overflow. This area gets a lot of sediment and the ditch gets cleaned out every year.

-----Original Message-----
From: Clow, Rodger
Sent: Thursday, February 20, 2014 7:00 AM
To: Nunnenkamp, Robert
Subject: FW: Reiko at 4009 E Lk Samm Shore Lane - water damage

Hi Robert,

Here are some of the photos sent to me from the property owner. I took some more photos yesterday and will forward those as soon as I have a chance.

Thanks,
Rodger

-----Original Message-----
From: reikhi@u.washington.edu [mailto:reikhi@u.washington.edu]
Sent: Wednesday, February 19, 2014 9:50 PM
To: Clow, Rodger
Subject: Reiko at 4009 E Lk Samm Shore Lane - water damage

Hi Rodger,
Thank you for your quick response, very much appreciated your call today.
Awaiting your call tomorrow to discuss what you saw at our place this afternoon.
I've attached some pictures I took on Tuesday for your reference as well. The event actually happened last Sunday around midnight (about 2 days before these pictures were taken).

Look forward to speaking with you tomorrow.
Thanks again,
Reiko Hisamatsu

July 21, 2014

King County
KSC-NR-0700
201 S Jackson St, Ste 700
Seattle, WA 98104-3855

Dear Sir or Madam:

I am the homeowner at 4293 East Lake Sammamish Shore Lane SE, and last Monday, July 14, I was present when the County and its consultant, Parametrix, made an on-site introduction of the plans the County has for improving the East Lake Sammamish Trail adjacent to my property. My property is roughly located south of stations 217+75 and 218+75.

During the session I was told that the proper procedure to ask detailed questions was to submit them in writing and set up a follow up appointment with the County and/or Parametrix.

Accordingly here are my questions:

1) I would like to know how much water I should expect in the creek that flows on the west side of my property during the 100 year storm event that I was told was being used as the design criteria. Specifically, since the uphill developments have introduced significant amounts of impermeable surfacing and it appears that the County intends to collect the outfall from several culverts and divert it into the culvert that feeds the creek, I am very worried that the amount of water will exceed the bank capacity of this salmon-bearing creek. This is my most important question and I would like to know the answer to this question quantitatively. During the appointment I would like to see the area that has been determined to be contributory to this runoff.

2) Why do all the trees south of the new trail adjacent to my property have to be removed and replaced with a reinforced earthen berm? This is going to remarkably impact the sight lines from my property and expose the property to sounds that are currently damped by the numerous, large diameter trees that the County plans to remove.

3) With regard to the same piece of land, south of the trail and north of the roadway that serves the homeowners along East Lake Sammamish Shore Lane, SE, there is currently landscape lighting that is powered from my house service. Will it be replaced in some form with the new landscaping plan? The drawings did not depict any lighting.

4) Does the County intend to reimburse me for all the large diameter trees that I have planted and maintained in that same piece of land over the last 18 years?

I have engaged the services of a Professional Engineer to assist me with my questions, and intend to have him present at the appointment. His name is Stephen Laccinole, and he is a currently registered Civil and Structural Engineer in Washington State.

Would you please call me after reviewing this so that I can schedule with the appropriate persons at the appropriate time.

Sincerely,

Dr. Eva C. Vanderhoeven
4293 East Lake Sammamish Shore Lane, SE
Sammamish, WA 98075

Craig Buitrago

From: Jenny Bailey
Sent: Tuesday, October 28, 2014 7:33 AM
To: Paul Fendt; Craig Buitrago
Subject: FW: 140930 ELST S Samm - Vanderhoeven

Just FYI…

From: Laura LaBissoniere [mailto:llabissoniere@prrbiz.com]
Sent: Monday, October 27, 2014 10:13 PM
To: Gina Auld; Jenny Bailey
Subject: Fwd: 140930 ELST S Samm - Vanderhoeven

FYI

LAURA LABISSONIERE MILLER
Associate
206.462.6398<tel:206.462.6398> | C 206.734-9420 |

Begin forwarded message:

Resent-From: <ELST@kingcounty.gov<mailto:ELST@kingcounty.gov>>
From: Steve Laccinole <selaccinole@selpeco.com<mailto:selaccinole@selpeco.com>>
Date: October 27, 2014 at 6:46:29 PM PDT
To: ELST Master Plan <ELST@kingcounty.gov<mailto:ELST@kingcounty.gov>>
Cc: "eva.vanderhoeven@gmail.com<mailto:eva.vanderhoeven@gmail.com>"
<eva.vanderhoeven@gmail.com<mailto:eva.vanderhoeven@gmail.com>>,
"mdavis@sammamish.us<mailto:mdavis@sammamish.us>"
<mdavis@sammamish.us<mailto:mdavis@sammamish.us>>
Subject: RE: 140930 ELST S Samm - Vanderhoeven

Dear Gina,

Thank you for working through the logistics of scheduling the meeting this coming Wednesday. Dr. Vanderhoeven and I will be looking forward to it. I would like to request that the engineer who will stamp both the alignment and the drainage drawings as the Engineer in Responsible Charge also be in attendance at this meeting as there are only two true objectives underlying Dr. Vanderhoeven's concerns, both of them technical in nature. Those are:

1) The present alignment of the trail requires extensive tree removal and re-grading of the southern side of the trail, as well as a retaining wall. Based on a cursory review a realignment of the centerline on both sides of station 118+00 should be achievable with thoughtful engineering that doesn't just take the centerline of the original railroad right of way as the centerline of the trail. This realignment would salvage trees, preserve privacy of Dr. Vanderhoeven's property and may even save the county and/or city expense.

2) The water that is discharging through the creek (a Class S-2 salmon stream as re-designated by Fish and Wildlife agencies) needs to be carefully dealt with as the additional impervious surface and the uphill and

rework of the unnamed streams north of the right of way in this area is a significant concern to the habitat as well as Dr. Vanderhoeven's property.

There is considerable history surrounding this particular lot that the County should also be aware of before taking the drawings from their present 60% completion to a bid ready state. We will describe this to you during the meeting.

Since the meeting date is on the 29th, the last day for filing concerns about the development, this email will constitute the basis for Dr. Vanderhoeven's petitions here. Thanks for providing the opportunity to work with the County and City as opposed to just resisting the development.

S.E. (Steve) Laccinole, PE, SE
Principal Engineer
Selpeco Resources, Inc.
206-255-0885
www.selpeco.com<http://www.selpeco.com>

From: ELST Master Plan [mailto:ELST@kingcounty.gov]
Sent: Tuesday, September 30, 2014 12:36 PM
To: selaccinole@selpeco.com<mailto:selaccinole@selpeco.com>
Cc: eva.vanderhoeven@gmail.com<mailto:eva.vanderhoeven@gmail.com>; mdavis@sammamish.us<mailto:mdavis@sammamish.us>
Subject: 140930 ELST S Samm - Vanderhoeven

Dear Mr. Laccinole,

Thank you for your meeting request and for your ongoing engagement with the East Lake Sammamish Trail project. Members from our project team are available to meet with you in late October or early November. We anticipate that the Tree Preservation Plans will be available to review at that time. Maggie Humphreys with our public outreach team will follow-up by phone to schedule a meeting within that time frame.

Thank you again for your email.

Best,

Gina Auld
Capital Project Manager

King County Department of Natural Resources| Parks CIP
201 South Jackson Street, Suite 700
Seattle, WA 98104-3854
Project Hotline: 1-888-668-4886<tel:1-888-668-4886>

From: Steve Laccinole [selaccinole@selpeco.com<mailto:selaccinole@selpeco.com>]

Sent: Monday, September 29, 2014 10:39 AM
To: 'Fereshteh'
Cc: ELST Master Plan; mdavis@sammamish.us<mailto:mdavis@sammamish.us>; Eva Vanderhoeven
Subject: SHOR14-0022 and SSDP2014-00171: Meeting Request
Dear Sir/Madam

This email is to request a technical meeting with the Engineer in Responsible Charge for this project. The request is being made on behalf of Dr. Eva Vanderhoeven who owns the property located at 4293 East Lake Sammamish Shore Lane, SE
Sammamish WA 98075.

Dr. Vanderhoeven's property is going to experience two severe impacts from the trail expansion project that may be mitigated through proper design and, possibly, waivers and a technical discussion may help to produce a solution that would negate the need for any further protest of any form. Those two impacts are:

1) The amount of storm water runoff that is being channeled via culverts and surface drainage into the stream that is on Dr. Vanderhoeven's property may damage not only her property but also the ability of the stream to harbor its designation as a salmon bearing stream.

2) The number of large trees being removed to establish sight lines for vehicle traffic that will cross the new trail appears to be mitigated by a realignment of the trail to the north while still being able to be located within the trail right of way.

Please advise as to available windows of time for such a meeting. Selpeco will be represented by myself and, if necessary, an additional civil and/or environmental engineer. The objective will be to avoid land use conflict through technical savvy and creativeness. Thank you.

S.E. (Steve) Laccinole, PE, SE
Principal Engineer
Selpeco Resources, Inc.
206-255-0885
www.selpeco.com<http://www.selpeco.com>

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B-twelve Associates, Inc.

1103 W. Meeker St.
Kent, WA 98032-5751

(v)253-859-0515
(f) 253-852-4732
info@b12assoc.com

June 11, 2004

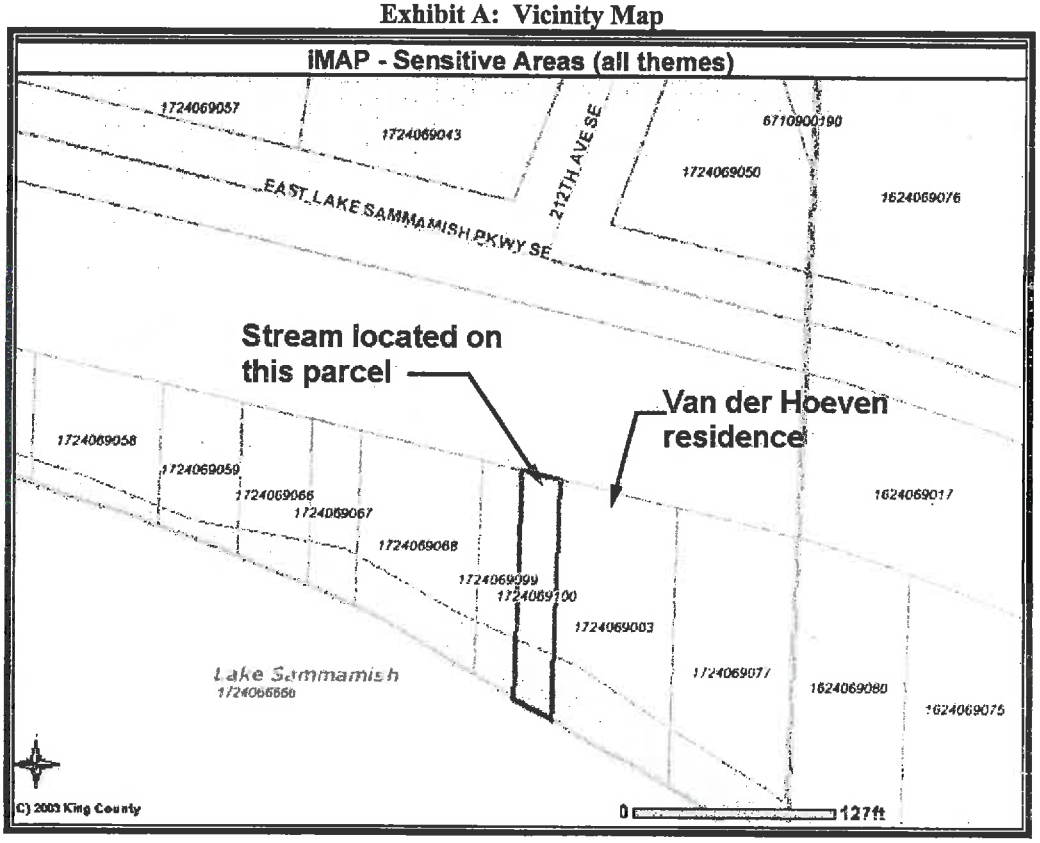
Mrs. Eva Van der Hoeven
4293 E. lake Sammamish Shore Lane SE
Sammamish, WA 98075

Re: Van der Hoeven Property
B-twelve Job #A4-116

Dear Eva,

Per your request, we have completed a study of the sensitive areas on your property located just west of your house at 4293 E. Lake Sammamish Shore Lane SE, in the City of Sammamish, WA. (See Exhibit A.) The narrow lot, Parcel No. 1724069100, contains a stream that flows into Lake Sammamish. This letter describes the current conditions of the stream and buffer, as well our recommendations for additional protection of the sensitive area.

Exhibit A: Vicinity Map



BACKGROUND

The clearing and grading of the stream area occurred in June 1999 without a grading permit, and was therefore considered a violation in King County. The County classified the stream as a Class 2S, and recommended the addition of log weirs and planting of native vegetation on the site. The County required a Restoration Plan, but had not received a plan before the site was annexed into the City of Sammamish in January 2000.

The City of Sammamish sent the property owners a Notice to Comply, dated January 16, 2004. The Notice requests a special study to be completed by a professional biologist, as well as a mitigation plan, if necessary. These items are to be submitted along with the grading permit application.

Ronda Litzau of the City of Sammamish has met with you on the site to observe the conditions of the restoration area. I have corresponded with Ronda and have met with Steve Roberge at the City to discuss this project. It is B-twelve's understanding that the City is generally supportive of the improvements that occurred on the site, but that they are seeking the opinion of a professional biologist.

According to the property owner, before they began restoring the site, it was overgrown with blackberries and contained a large amount of debris. The basement of your home located east of the stream was flooding more frequently due to a higher volume of stormwater coming from upstream. Restoration on the site (prior to receipt of a permit) included the removal of a dilapidated fence, blackberries, and five (5) trucks full of trash. Garbage found on the narrow lot included 16 tires, a refrigerator, car parts, and over 200 bottles. With direction from a UW professor, the stream was graded so that it would contain the water as it flowed to Lake Sammamish. Natural meanders were added to the stream channel, and the banks of the stream were stabilized with rocks and vegetation. The site conditions are described in more detail below.

SITE OBSERVATIONS

Darcey Miller of B-twelve Associates visited the site to inspect current conditions on March 5 and May 16, 2004. The stream area contains a fairly dense mix of native trees, shrubs, and herbaceous species, as well as some non-native flowers. (See Photographs and Sheet W-1: Existing Conditions Map.) A large willow and large Oregon ash are located at the north end of the stream, and provide shade for much of the stream and buffer. In addition, several Oregon ash are also located near the woodshed, and closer to the Lake. A large tree trunk was observed on the north portion of the western streambank. This trunk and the large trees near the stream were located on the site prior to the completion of any restoration work. No wetlands were observed on the site.

The stream area contains a small amount of watercress and reed canary grass, which will eventually block stream flow. The site has been kept free of all other invasive species without the use of any pesticides or machinery.

A small footbridge is located over the stream, approximately three-quarters of the way down the stream from the driveway. A footpath leading from the bridge to the woodshed consists of sandstone blocks with sand between the blocks, and is generally pervious.

We understand that more water is flowing through this feature than even several years ago. We believe that this water consists at least partially of stormwater from impervious surfaces upstream, as more development is occurring. However, blocked culverts appear to also be a cause of more water coming down through the stream on the site. We observed a blocked culvert to the north of the Sammamish Trail, oriented in a north-south direction under E. Lake Sammamish Shore Lane SE. (See Sheet W-1.) In addition, several culverts are also blocked that drain under E. Lake Sammamish Parkway SE and into the ditch to the north of the Trail.

CONCLUSIONS and RECOMMENDATIONS

It is our opinion that the grading and restoration work on the site has greatly improved the overall condition of the sensitive area. The removal of garbage and of non-native invasive species is beneficial to water quality and to wildlife. The planted vegetation is very healthy, and it appears to be helping to stabilize the soil along the streambanks. The mowed lawn begins near the west property line of the lot on which the Van der Hoeven residence is located. We understand that this lawn has existed since construction of the house, and was not considered by King County to be part of the violation.

The buffers were graded to gradual slopes, and are therefore able to support vegetation. The stream meanders appear to be slowing the water as it flows down to the lake. The rocks along the stream banks also appear to be stable, and they help to prevent soil erosion along the banks.

The footbridge on the site is located completely outside of the Ordinary High Water Mark (OHWM). It provides minimal shading of the stream, and plants are growing right up to its edges. The bridge also allows access to the other side of the property, on which the woodshed is located.

In order to attempt to limit the amount of water flowing through the site, we suggest that the City maintain the culvert under E. Lake Sammamish Shore Lane SE.

ENHANCEMENT PLAN

Although the stream and buffers are in very good condition, we recommend that the following restoration actions be completed in order to further improve the functions and values of the sensitive area.

1. Additional native trees, shrubs, and herbaceous species should be installed as shown on the Enhancement Plan. (See Sheet W-2.) Species and locations have been chosen to fill in gaps, to stabilize streambanks, to improve wildlife habitat, and to provide more shading of the stream. We recommend that planting occur during the rainy season (October-March) in order to ensure that the plants get enough water. If plants are installed outside of this time frame, they must be irrigated at least once per day until October.

2. Non-native herbaceous species should be removed from the stream and planted buffer.

3. All invasive species, such as watercress and reed canary grass, should be removed from the stream and planted buffer areas.

4. A gate should be placed across the north end of the footpath in order to provide privacy for the property owners and limit access by the public to the stream area.

5. We recommend that an installation sign-off be completed by the City or a biologist. The sign-off will ensure that the actions described above have been completed. It will also note any differences between the plan and the actual planting locations.

6. Maintenance Program

- Himalayan blackberry, Japanese knotweed, evergreen blackberry, reed canary grass, Scots broom, English ivy, morning glory, watercress, or other invasive species should be controlled by hand and without chemicals within the sensitive areas.

- Replace dead or failed plant material after the annual monitoring report has specified which plants have not survived. Replacement species are to be of the same species, size and location as original plantings. Plantings are to be installed during the dormant period (late October through mid-March).

- Remove tree staking and guy wires from all trees after one year.

7. Monitoring Plan

- One monitoring should be performed approximately one year following the installation sign-off. The property owner may complete the monitoring letter,

which should include a plant survival count, estimate of invasive species coverage, and photographs. If performance standards are not met, additional plants must be planted before the project may be accepted as complete.

- Performance Standards

  a. No more than 10% of the vegetation coverage may consist of non-native or invasive species at the end of the monitoring period.

  b. Evaluation of the success of the mitigation project will be based upon a 90% survival rate for all planted vegetation at the end of the monitoring period.

We believe that with the recommendations described above, the actions completed on the site comply with the Environmentally Sensitive Areas chapter of the Sammamish Municipal Code (Chapter 21A.50). It is our opinion that the stream restoration has improved the condition of the sensitive area, and will continue to improve it as both the existing and new plants grow to maturity.

Please feel free to call or e-mail me (Darcey@b12assoc.com) if you have any questions or require any additional information. Thank you.

Sincerely,

B-twelve Associates, Inc.

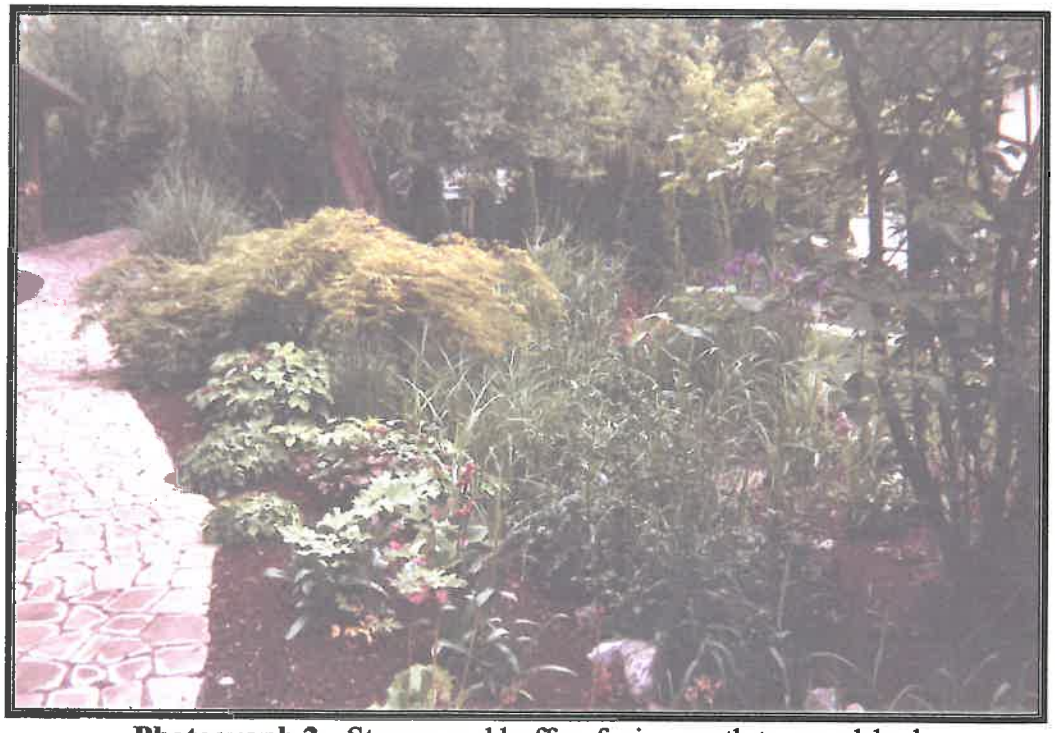
Darcey B. Miller

Darcey B. Miller
Wetland Ecologist

File: dm/A4116-VanderHoeven/A4116-letter.doc

PHOTOGRAPHS

Photograph 1: Culvert at north end of stream



Photograph 2: Stream and buffer, facing north to woodshed

Photograph 3: Stream and buffer, facing west at footbridge

Photograph 4: Stream and buffer, facing south to lake from footbridge

APPENDIX C

Hydrologic and Hydraulic Calculations

DRAFT

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.31
Program License Number: 200510005
Run Date: 12/10/2014 2:24 PM

Input File Name: TDA 1.fld
Project Name: ELST - S Sammamish
Analysis Title: TDA 1 Flow Analysis
Comments: STA 216+80 to STA 226+50

——————————————— PRECIPITATION INPUT ———————————————

Computational Time Step (Minutes): 60

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 216+80 to STA 226+50 ----------

	-------Area(Acres) --------
Till Forest	0.330
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000
Subbasin Total	0.330

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 216+80 to STA 226+50 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	0.120
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.210
Subbasin Total	0.330

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Model Element	Total Predeveloped Recharge During Simulation Recharge Amount (ac-ft)
Subbasin: STA 216+80 to STA 22	57.218
Total:	57.218

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 216+80 to STA 22	14.750
Total:	14.750

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 0.362 ac-ft/year, Post Developed: 0.093 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: STA 216+80 to STA 226+50

Scenario Postdeveloped Compliance Subbasin: STA 216+80 to STA 226+50

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	7.006E-03	2-Year	6.430E-02
5-Year	1.196E-02	5-Year	8.283E-02
10-Year	1.488E-02	10-Year	9.897E-02
25-Year	1.920E-02	25-Year	0.123
50-Year	2.311E-02	50-Year	0.129
100-Year	2.775E-02	100-Year	0.146
200-Year	3.752E-02	200-Year	0.169

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.31
Program License Number: 200510005
Run Date: 12/12/2014 12:17 PM

Input File Name: TDA 2.fld
Project Name: ELST - S Sammamish
Analysis Title: TDA 2 Flow Analysis
Comments: STA 226+50 to STA 229+15

PRECIPITATION INPUT

Computational Time Step (Minutes): 60

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 226+50 to STA 229+15 ----------

	-------Area(Acres) --------
Till Forest	0.240
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000
Subbasin Total	0.240

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 226+50 to STA 229+15 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.240
Subbasin Total	0.240

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 226+50 to STA 22	41.613
Total:	41.613

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 226+50 to STA 22	0.000
Total:	0.000

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 0.263 ac-ft/year, Post Developed: 0.000 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: STA 226+50 to STA 229+15

Scenario Postdeveloped Compliance Subbasin: STA 226+50 to STA 229+15

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	5.096E-03	2-Year	6.681E-02
5-Year	8.697E-03	5-Year	8.581E-02
10-Year	1.082E-02	10-Year	9.572E-02
25-Year	1.396E-02	25-Year	0.112
50-Year	1.681E-02	50-Year	0.124
100-Year	2.018E-02	100-Year	0.140
200-Year	2.729E-02	200-Year	0.148

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.31
Program License Number: 200510005
Run Date: 12/12/2014 12:17 PM

Input File Name: TDA 3.fld
Project Name: ELST - S Sammamish
Analysis Title: TDA 3 Flow Analysis
Comments: STA 229+15 to STA 234+50

PRECIPITATION INPUT

Computational Time Step (Minutes): 60

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 229+15 to STA 234+50 ----------

	-------Area(Acres) --------
Till Forest	0.380
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000
Subbasin Total	0.380

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 229+15 to STA 234+50 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	0.180
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.200
Subbasin Total	0.380

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 229+15 to STA 23	65.887
Total:	65.887

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 229+15 to STA 23	22.126
Total:	22.126

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 0.417 ac-ft/year, Post Developed: 0.140 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: STA 229+15 to STA 234+50

Scenario Postdeveloped Compliance Subbasin: STA 229+15 to STA 234+50

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	8.068E-03	2-Year	6.546E-02
5-Year	1.377E-02	5-Year	8.375E-02
10-Year	1.713E-02	10-Year	0.100
25-Year	2.211E-02	25-Year	0.131
50-Year	2.662E-02	50-Year	0.140
100-Year	3.195E-02	100-Year	0.152
200-Year	4.320E-02	200-Year	0.182

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.31
Program License Number: 200510005
Run Date: 12/12/2014 12:16 PM

Input File Name: TDA 4.fld
Project Name: ELST - S Sammamish
Analysis Title: TDA 4 Flow Analysis
Comments: STA 234+50 to STA 239+00 with Infiltration Trench Land Use Credits Applied

PRECIPITATION INPUT

Computational Time Step (Minutes): 60

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 234+50 to STA 239+00 ----------

	-------Area(Acres) --------
Till Forest	0.320
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000
Subbasin Total	0.320

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 234+50 to STA 239+00 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	0.150
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000
Subbasin Total	0.150

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 234+50 to STA 23	55.484
Total:	55.484

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 234+50 to STA 23	18.438
Total:	18.438

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 0.351 ac-ft/year, Post Developed: 0.117 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: STA 234+50 to STA 239+00

Scenario Postdeveloped Compliance Subbasin: STA 234+50 to STA 239+00

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	6.794E-03	2-Year	9.170E-03
5-Year	1.160E-02	5-Year	1.479E-02
10-Year	1.443E-02	10-Year	2.148E-02
25-Year	1.862E-02	25-Year	3.000E-02
50-Year	2.241E-02	50-Year	3.686E-02
100-Year	2.691E-02	100-Year	4.215E-02
200-Year	3.638E-02	200-Year	5.297E-02

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.31
Program License Number: 200510005
Run Date: 12/12/2014 12:17 PM

Input File Name: TDA 5.fld
Project Name: ELST - S Sammamish
Analysis Title: TDA 5 Flow Analysis
Comments: STA 239+00 to STA 241+50

PRECIPITATION INPUT

Computational Time Step (Minutes): 60

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 239+00 to STA 241+50 ----------

	-------Area(Acres) --------
Till Forest	0.170
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000
Subbasin Total	0.170

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 239+00 to STA 241+50 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	0.080
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.090
Subbasin Total	0.170

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 239+00 to STA 24	29.476
Total:	29.476

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 239+00 to STA 24	9.834
Total:	9.834

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 0.187 ac-ft/year, Post Developed: 0.062 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: STA 239+00 to STA 241+50

Scenario Postdeveloped Compliance Subbasin: STA 239+00 to STA 241+50

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	3.609E-03	2-Year	2.939E-02
5-Year	6.160E-03	5-Year	3.763E-02
10-Year	7.665E-03	10-Year	4.490E-02
25-Year	9.890E-03	25-Year	5.882E-02
50-Year	1.191E-02	50-Year	6.280E-02
100-Year	1.429E-02	100-Year	6.821E-02
200-Year	1.933E-02	200-Year	8.156E-02

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.31
Program License Number: 200510005
Run Date: 12/12/2014 12:18 PM

Input File Name: TDA 6.fld
Project Name: ELST - S Sammamish
Analysis Title: TDA 6 Flow Analysis
Comments: STA 241+50 to STA 244+05 with 50% Impervious, 50% Grass for Basic Dispersion of Trail Impervious surface

PRECIPITATION INPUT

Computational Time Step (Minutes): 60

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 241+50 to STA 244+05 ----------

	-------Area(Acres) --------
Till Forest	0.210
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000

Subbasin Total 0.210

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 241+50 to STA 244+05 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	0.160
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.050
Subbasin Total	0.210

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 241+50 to STA 24	36.411
Total:	36.411

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 241+50 to STA 24	19.667
Total:	19.667

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 0.230 ac-ft/year, Post Developed: 0.124 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: STA 241+50 to STA 244+05

Scenario Postdeveloped Compliance Subbasin: STA 241+50 to STA 244+05

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	4.459E-03	2-Year	2.246E-02
5-Year	7.610E-03	5-Year	3.139E-02
10-Year	9.469E-03	10-Year	4.014E-02
25-Year	1.222E-02	25-Year	5.470E-02
50-Year	1.471E-02	50-Year	6.267E-02
100-Year	1.766E-02	100-Year	6.713E-02
200-Year	2.388E-02	200-Year	8.500E-02

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.31
Program License Number: 200510005
Run Date: 12/12/2014 12:18 PM

Input File Name: TDA 7.fld
Project Name: ELST - S Sammamish
Analysis Title: TDA 7 Flow Analysis
Comments: STA 244+05 to STA 249+25 with Infiltration Trench Land Use Credits Applied

——————————————— PRECIPITATION INPUT ———————————————

Computational Time Step (Minutes): 60

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 244+05 to STA 249+25 ----------

	-------Area(Acres) --------
Till Forest	0.360
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000
Subbasin Total	0.360

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 244+05 to STA 249+25 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	0.170
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000
Subbasin Total	0.170

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 244+05 to STA 24	62.419
Total:	62.419

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 244+05 to STA 24	20.896
Total:	20.896

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 0.395 ac-ft/year, Post Developed: 0.132 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: STA 244+05 to STA 249+25

Scenario Postdeveloped Compliance Subbasin: STA 244+05 to STA 249+25

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	7.643E-03	2-Year	1.039E-02
5-Year	1.305E-02	5-Year	1.676E-02
10-Year	1.623E-02	10-Year	2.434E-02
25-Year	2.094E-02	25-Year	3.400E-02
50-Year	2.522E-02	50-Year	4.177E-02
100-Year	3.027E-02	100-Year	4.777E-02
200-Year	4.093E-02	200-Year	6.003E-02

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.31
Program License Number: 200510005
Run Date: 12/12/2014 12:18 PM

Input File Name: TDA 8.fld
Project Name: ELST - S Sammamish
Analysis Title: TDA 8 Flow Analysis
Comments: STA 249+25 to STA 261+50, Impervious areas to Infiltration Trenches are excluded from this analysis.

PRECIPITATION INPUT

Computational Time Step (Minutes): 60

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 249+25 to STA 261+50 ----------

	-------Area(Acres) --------
Till Forest	0.400
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.340
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000

Subbasin Total 0.740

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 249+25 to STA 261+50 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	0.150
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.140
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000
Subbasin Total	0.290

**********LINK DATA**********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

**********LINK DATA**********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

**********Groundwater Recharge Summary **********
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 249+25 to STA 26	159.754
Total:	159.754

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 249+25 to STA 26	65.082
Total:	65.082

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 1.011 ac-ft/year, Post Developed: 0.412 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: STA 249+25 to STA 261+50

Scenario Postdeveloped Compliance Subbasin: STA 249+25 to STA 261+50

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	8.503E-03	2-Year	9.395E-03
5-Year	1.450E-02	5-Year	1.652E-02
10-Year	1.806E-02	10-Year	2.590E-02
25-Year	2.340E-02	25-Year	3.280E-02
50-Year	2.804E-02	50-Year	4.253E-02
100-Year	3.387E-02	100-Year	6.312E-02
200-Year	4.563E-02	200-Year	7.880E-02

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.31
Program License Number: 200510005
Run Date: 12/12/2014 12:20 PM

Input File Name: TDA 9.fld
Project Name: ELST - S Sammamish
Analysis Title: TDA 9 Flow Analysis
Comments: STA 261+50 to STA 283+02 with Infiltration Trench Land Use Credits Applied

——————————————— PRECIPITATION INPUT ———————————————

Computational Time Step (Minutes): 60

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 261+50 to STA 283+02 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	1.650
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000
Subbasin Total	1.650

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 261+50 to STA 283+02 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.830
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000
Subbasin Total	0.830

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 0

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 261+50 to STA 28	438.701
Total:	438.701

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 261+50 to STA 28	276.530
Total:	276.530

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 2.777 ac-ft/year, Post Developed: 1.750 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 0

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: STA 261+50 to STA 283+02

Scenario Postdeveloped Compliance Subbasin: STA 261+50 to STA 283+02

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	3.238E-04	2-Year	1.954E-03
5-Year	3.305E-04	5-Year	9.235E-03
10-Year	3.322E-04	10-Year	2.210E-02
25-Year	7.696E-04	25-Year	4.567E-02
50-Year	1.527E-03	50-Year	6.412E-02
100-Year	2.362E-03	100-Year	0.136
200-Year	4.249E-03	200-Year	0.157

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.31
Program License Number: 200510005
Run Date: 12/08/2014 3:41 PM

Input File Name: IT1-TDA4.fld
Project Name: ELST - S Sammamish
Analysis Title: Infiltration Trench Sizing
Comments: TDA 4 Infiltration trench 1 from STA 234+75 to STA 238+67

PRECIPITATION INPUT

Computational Time Step (Minutes): 60

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : TDA 4 ----------

	-------Area(Acres) --------
Till Forest	0.170
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000
Subbasin Total	0.170

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : TDA 4 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.170
Subbasin Total	0.170

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 1

Link Name: Infilt Trench 1
Link Type: Infiltration Trench
Downstream Link: None

Trench Type	:	Trench on Embankment Sideslope
Trench Length (ft)	:	392.00
Trench Width (ft)	:	3.00
Trench Depth (ft)	:	2.00
Trench Bottom Elev (ft)	:	100.00
Trench Rockfill Porosity (%)	:	30.00

Constant Infiltration Option Used
Infiltration Rate (in/hr): 0.50

Structure Stage, Storage Discharge Tables

Link: Lnk1 Infilt Trench 1

Elev (ft)	Storage (ac-ft)	Discharge (cfs)	Infilt Discharge (cfs)

100.000	0.000	0.000	0.000
100.010	8.099E-05	5.000E-08	1.370E-02
100.020	1.620E-04	1.000E-07	1.379E-02
100.040	3.240E-04	2.000E-07	1.397E-02
100.080	6.479E-04	4.000E-07	1.434E-02
100.120	9.719E-04	6.000E-07	1.470E-02
100.160	1.296E-03	8.000E-07	1.506E-02
100.200	1.620E-03	1.000E-06	1.543E-02
100.240	1.944E-03	1.200E-06	1.579E-02
100.280	2.268E-03	1.400E-06	1.615E-02
100.320	2.592E-03	1.600E-06	1.651E-02
100.360	2.916E-03	1.800E-06	1.688E-02
100.400	3.240E-03	2.000E-06	1.724E-02
100.440	3.564E-03	2.200E-06	1.760E-02
100.480	3.888E-03	2.400E-06	1.797E-02
100.520	4.212E-03	2.600E-06	1.833E-02
100.560	4.536E-03	2.800E-06	1.869E-02
100.600	4.860E-03	3.000E-06	1.906E-02
100.640	5.183E-03	3.200E-06	1.942E-02
100.680	5.507E-03	3.400E-06	1.978E-02
100.720	5.831E-03	3.600E-06	2.014E-02
100.760	6.155E-03	3.800E-06	2.051E-02
100.800	6.479E-03	4.000E-06	2.087E-02
100.840	6.803E-03	4.200E-06	2.123E-02
100.880	7.127E-03	4.400E-06	2.160E-02
100.920	7.451E-03	4.600E-06	2.196E-02
100.960	7.775E-03	4.800E-06	2.232E-02
101.000	8.099E-03	5.000E-06	2.269E-02
101.040	8.423E-03	5.200E-06	2.305E-02
101.080	8.747E-03	5.400E-06	2.341E-02
101.120	9.071E-03	5.600E-06	2.377E-02
101.160	9.395E-03	5.800E-06	2.414E-02
101.200	9.719E-03	6.000E-06	2.450E-02
101.240	1.004E-02	6.200E-06	2.486E-02
101.280	1.037E-02	6.400E-06	2.523E-02
101.320	1.069E-02	6.600E-06	2.559E-02
101.360	1.101E-02	6.800E-06	2.595E-02
101.400	1.134E-02	7.000E-06	2.631E-02
101.440	1.166E-02	7.200E-06	2.668E-02
101.480	1.199E-02	7.400E-06	2.704E-02
101.520	1.231E-02	7.600E-06	2.740E-02
101.560	1.263E-02	7.800E-06	2.777E-02
101.600	1.296E-02	8.000E-06	2.813E-02
101.640	1.328E-02	8.200E-06	2.849E-02
101.680	1.361E-02	8.400E-06	2.886E-02
101.720	1.393E-02	8.600E-06	2.922E-02
101.760	1.425E-02	8.800E-06	2.958E-02
101.800	1.458E-02	9.000E-06	2.994E-02
101.840	1.490E-02	9.200E-06	3.031E-02
101.880	1.523E-02	9.400E-06	3.067E-02
101.920	1.555E-02	9.600E-06	3.103E-02
101.960	1.587E-02	9.800E-06	3.140E-02
102.000	1.620E-02	1.000E-05	3.176E-02
102.005	1.624E-02	0.277	3.176E-02
102.010	1.628E-02	0.784	3.176E-02

102.015	1.632E-02	1.440	3.176E-02
102.020	1.636E-02	2.217	3.176E-02
102.025	1.640E-02	3.099	3.176E-02
102.030	1.644E-02	4.074	3.176E-02
102.035	1.648E-02	5.134	3.176E-02
102.040	1.652E-02	6.272	3.176E-02
102.045	1.656E-02	7.484	3.176E-02
102.050	1.660E-02	8.765	3.176E-02
102.055	1.664E-02	10.113	3.176E-02
102.060	1.668E-02	11.522	3.176E-02
102.065	1.672E-02	12.992	3.176E-02
102.070	1.677E-02	14.520	3.176E-02
102.075	1.681E-02	16.103	3.176E-02
102.080	1.685E-02	17.740	3.176E-02
102.085	1.689E-02	19.429	3.176E-02
102.090	1.693E-02	21.168	3.176E-02
102.095	1.697E-02	22.956	3.176E-02
102.100	1.701E-02	24.792	3.176E-02

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 1

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: TDA 4	29.476
Total:	29.476

Total Post Developed Recharge During Simulation

Model Element		Recharge Amount (ac-ft)
Subbasin: TDA 4		0.000
Link:	Infilt Trench 1	75.078
Total:		75.078

Total Predevelopment Recharge is Less than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 0.187 ac-ft/year, Post Developed: 0.475 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 1

********** Link: Infilt Trench 1 **********

Infiltration/Filtration Statistics----------
Total Runoff Volume (ac-ft): 75.08
Total Runoff Infiltrated (ac-ft): 75.08, 100.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Percent Treated (Infiltrated+Filtered)/Total Volume: 100.00%

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: TDA 4

Scenario Postdeveloped Compliance Link: Infilt Trench 1
****Point of Compliance Annual Maxima Flow Data ****

Predevelopment Runoff		Postdevelopment Runoff	
Date	Annual Max Q (cfs)	Date	Annual Max Q (cfs)
04/30/1940	4.623E-03	04/30/1940	0.000
01/31/1941	1.769E-03	09/02/1941	0.000
12/15/1941	5.220E-03	12/15/1941	0.000
02/10/1943	1.839E-03	11/13/1942	0.000
01/23/1944	1.393E-03	01/22/1944	0.000
02/07/1945	5.855E-03	02/07/1945	0.000
02/05/1946	3.597E-03	01/24/1946	0.000
02/02/1947	3.624E-03	02/02/1947	0.000
03/21/1948	6.487E-03	10/18/1947	0.000
02/22/1949	3.088E-03	02/16/1949	0.000
03/03/1950	1.436E-02	03/03/1950	0.000
02/09/1951	5.223E-03	02/09/1951	0.000
01/24/1952	1.295E-03	06/29/1952	0.000
01/11/1953	1.973E-03	09/30/1953	0.000
01/22/1954	3.099E-03	02/12/1954	0.000
04/12/1955	1.466E-03	11/05/1954	0.000
03/04/1956	3.329E-03	11/02/1955	0.000
02/25/1957	2.793E-03	11/16/1956	0.000
04/20/1958	3.689E-03	01/16/1958	0.000
01/12/1959	3.732E-03	01/24/1959	0.000
12/15/1959	4.012E-03	01/29/1960	0.000
02/14/1961	3.534E-03	02/14/1961	0.000
03/04/1962	1.756E-03	07/05/1962	0.000
02/03/1963	1.952E-03	11/25/1962	0.000
01/01/1964	3.369E-03	09/17/1964	0.000
02/26/1965	3.891E-03	08/19/1965	0.000
01/05/1966	2.549E-03	06/28/1966	0.000

01/19/1967	6.293E-03	01/19/1967	0.000
02/03/1968	3.227E-03	10/10/1967	0.000
12/03/1968	3.542E-03	12/03/1968	0.000
01/13/1970	2.750E-03	01/14/1970	0.000
12/06/1970	3.118E-03	12/05/1970	0.000
02/28/1972	8.306E-03	02/27/1972	0.000
01/13/1973	2.921E-03	01/13/1973	0.000
02/18/1974	4.317E-03	10/06/1973	0.000
12/26/1974	5.596E-03	12/27/1974	0.000
01/27/1976	3.622E-03	01/27/1976	0.000
05/31/1977	5.212E-04	08/26/1977	0.000
12/15/1977	3.108E-03	09/22/1978	0.000
03/04/1979	3.019E-03	10/23/1978	0.000
12/17/1979	4.946E-03	12/15/1979	0.000
12/26/1980	2.126E-03	11/21/1980	0.000
10/06/1981	6.795E-03	10/06/1981	0.000
01/05/1983	3.540E-03	10/28/1982	0.000
03/14/1984	3.617E-03	02/20/1984	0.000
02/11/1985	2.215E-03	06/07/1985	0.000
01/18/1986	7.300E-03	01/18/1986	0.000
11/24/1986	6.644E-03	11/24/1986	0.000
04/06/1988	3.163E-03	11/11/1987	0.000
04/05/1989	3.516E-03	08/21/1989	0.000
01/09/1990	1.181E-02	01/09/1990	0.000
11/24/1990	1.023E-02	11/24/1990	0.000
01/27/1992	3.146E-03	01/27/1992	0.000
06/09/1993	2.531E-03	06/09/1993	0.000
03/03/1994	1.929E-03	12/01/1993	0.000
02/19/1995	4.127E-03	02/18/1995	0.000
02/08/1996	9.793E-03	02/08/1996	0.000
01/02/1997	6.181E-03	01/02/1997	0.000
02/28/1998	2.159E-03	10/29/1997	0.000
11/25/1998	5.863E-03	11/04/1998	0.000
02/06/2000	3.309E-03	02/06/2000	0.000
05/05/2001	2.486E-03	12/20/2000	0.000
05/03/2002	9.302E-03	05/03/2002	0.000
02/06/2003	7.064E-03	11/23/2002	0.000
01/23/2004	1.663E-03	09/21/2004	0.000
02/05/2005	3.191E-03	02/05/2005	0.000
02/27/2006	3.679E-03	11/27/2005	0.000
12/14/2006	2.856E-03	12/14/2006	0.000
03/21/2008	5.125E-03	03/22/2008	0.000
02/17/2009	7.054E-03	02/17/2009	0.000
01/10/2010	4.764E-03	06/10/2010	0.000
11/17/2010	6.373E-03	11/16/2010	0.000
01/31/2012	4.314E-03	10/22/2011	0.000
01/20/2013	9.304E-03	01/20/2013	0.000
12/06/2013	4.064E-03	11/16/2013	0.000
03/30/2015	2.254E-03	02/28/2015	0.000
01/04/2016	6.782E-03	01/04/2016	0.000
03/07/2017	1.907E-03	06/14/2017	0.000
01/31/2018	3.596E-03	12/25/2017	0.000
02/14/2019	3.461E-03	11/09/2018	0.000
04/14/2020	2.235E-03	12/12/2019	0.000
02/10/2021	5.732E-03	02/10/2021	0.000
03/26/2022	1.614E-03	12/20/2021	0.000

03/30/2023	4.006E-03	11/25/2022	0.000
01/19/2024	3.206E-03	01/19/2024	0.000
12/22/2024	6.859E-03	12/22/2024	0.000
03/09/2026	4.200E-03	03/09/2026	0.000
01/27/2027	3.735E-03	03/15/2027	0.000
02/19/2028	4.579E-03	02/19/2028	0.000
12/04/2028	3.588E-03	10/11/2028	0.000
02/16/2030	4.730E-03	11/04/2029	0.000
12/30/2030	4.499E-03	09/24/2031	0.000
01/20/2032	7.060E-03	01/20/2032	0.000
03/01/2033	1.976E-03	12/23/2032	0.000
01/15/2034	8.298E-03	01/15/2034	0.000
02/19/2035	3.760E-03	02/19/2035	0.000
12/04/2035	3.632E-03	12/04/2035	0.000
03/08/2037	1.274E-04	05/15/2037	0.000
12/14/2037	2.814E-03	11/24/2037	0.000
02/07/2039	1.998E-03	02/07/2039	0.000
01/14/2040	7.792E-03	01/14/2040	0.000
12/25/2040	4.198E-03	12/24/2040	0.000
02/20/2042	4.584E-03	11/11/2041	0.000
03/31/2043	7.267E-03	07/19/2043	0.000
05/01/2044	2.552E-03	09/05/2044	0.000
02/11/2045	2.924E-03	11/02/2044	0.000
02/16/2046	3.716E-03	12/06/2045	0.000
02/01/2047	2.359E-03	11/24/2046	0.000
04/21/2048	2.066E-03	12/02/2047	0.000
03/16/2049	2.245E-03	07/31/2049	0.000
12/04/2049	4.069E-03	12/04/2049	0.000
04/06/2051	3.033E-03	02/02/2051	0.000
04/16/2052	1.982E-03	10/25/2051	0.000
06/04/2053	9.392E-03	06/04/2053	0.000
04/08/2054	1.294E-03	12/08/2053	0.000
02/17/2055	6.185E-03	10/27/2054	0.000
02/07/2056	1.120E-02	11/11/2055	0.000
11/19/2056	1.207E-02	11/19/2056	0.000
01/24/2058	4.619E-03	01/24/2058	0.000
01/17/2059	4.850E-03	11/26/2058	0.000
01/19/2060	1.722E-03	05/15/2060	0.000
01/10/2061	3.899E-03	09/01/2061	0.000
02/03/2062	2.185E-02	02/03/2062	0.000
12/29/2062	3.050E-03	09/16/2063	0.000
12/23/2063	5.709E-03	07/21/2064	0.000
11/30/2064	2.772E-03	11/29/2064	0.000
01/13/2066	1.421E-03	10/14/2065	0.000
01/19/2067	3.753E-03	01/19/2067	0.000
01/18/2068	7.909E-03	01/18/2068	0.000
01/04/2069	2.050E-03	10/05/2068	0.000
04/09/2070	1.723E-03	09/03/2070	0.000
02/14/2071	1.892E-03	09/27/2071	0.000
04/28/2072	2.416E-03	04/28/2072	0.000
12/25/2072	8.677E-03	12/25/2072	0.000
03/16/2074	4.826E-03	12/15/2073	0.000
03/15/2075	1.061E-03	08/27/2075	0.000
03/24/2076	5.488E-03	03/24/2076	0.000
03/02/2077	5.945E-04	08/24/2077	0.000
12/02/2077	1.967E-03	11/25/2077	0.000

02/25/2079	2.653E-03	11/03/2078	0.000
12/17/2079	9.574E-03	12/17/2079	0.000
11/21/2080	4.434E-03	11/06/2080	0.000
02/13/2082	5.249E-03	10/31/2081	0.000
02/19/2083	3.201E-03	03/29/2083	0.000
11/26/2083	4.019E-03	11/26/2083	0.000
12/14/2084	2.702E-03	09/06/2085	0.000
01/18/2086	3.867E-03	09/23/2086	0.000
12/21/2086	3.755E-03	11/19/2086	0.000
01/14/2088	2.514E-03	01/14/2088	0.000
11/05/2088	4.380E-03	11/05/2088	0.000
12/03/2089	1.978E-03	09/16/2090	0.000
12/04/2090	3.602E-03	12/04/2090	0.000
04/28/2092	7.147E-03	06/29/2092	0.000
03/22/2093	1.665E-03	11/18/2092	0.000
03/01/2094	1.452E-03	10/23/2093	0.000
12/27/2094	2.350E-03	07/25/2095	0.000
01/14/2096	2.907E-03	08/02/2096	0.000
01/29/2097	6.894E-03	01/30/2097	0.000

******Point of Compliance Ranked Maxima Flow Data ******

Predevelopment		Postdevelopment	
Tr (yrs)	Q (cfs)	Tr (yrs)	Q (cfs)
1.004	1.274E-04	1.004	0.000
1.010	5.212E-04	1.010	0.000
1.016	5.945E-04	1.016	0.000
1.023	1.061E-03	1.023	0.000
1.030	1.294E-03	1.030	0.000
1.036	1.295E-03	1.036	0.000
1.043	1.393E-03	1.043	0.000
1.050	1.421E-03	1.050	0.000
1.057	1.452E-03	1.057	0.000
1.064	1.466E-03	1.064	0.000
1.072	1.614E-03	1.072	0.000
1.079	1.663E-03	1.079	0.000
1.086	1.665E-03	1.086	0.000
1.094	1.722E-03	1.094	0.000
1.101	1.723E-03	1.101	0.000
1.109	1.756E-03	1.109	0.000
1.117	1.769E-03	1.117	0.000
1.125	1.839E-03	1.125	0.000
1.133	1.892E-03	1.133	0.000
1.141	1.907E-03	1.141	0.000
1.149	1.929E-03	1.149	0.000
1.158	1.952E-03	1.158	0.000
1.166	1.967E-03	1.166	0.000
1.175	1.973E-03	1.175	0.000
1.184	1.976E-03	1.184	0.000
1.193	1.978E-03	1.193	0.000
1.202	1.982E-03	1.202	0.000
1.211	1.998E-03	1.211	0.000
1.220	2.050E-03	1.220	0.000
1.230	2.066E-03	1.230	0.000
1.240	2.126E-03	1.240	0.000

1.249	2.159E-03	1.249	0.000
1.259	2.215E-03	1.259	0.000
1.269	2.235E-03	1.269	0.000
1.280	2.245E-03	1.280	0.000
1.290	2.254E-03	1.290	0.000
1.301	2.350E-03	1.301	0.000
1.312	2.359E-03	1.312	0.000
1.323	2.416E-03	1.323	0.000
1.334	2.486E-03	1.334	0.000
1.345	2.514E-03	1.345	0.000
1.357	2.531E-03	1.357	0.000
1.368	2.549E-03	1.368	0.000
1.380	2.552E-03	1.380	0.000
1.392	2.653E-03	1.392	0.000
1.405	2.702E-03	1.405	0.000
1.417	2.750E-03	1.417	0.000
1.430	2.772E-03	1.430	0.000
1.443	2.793E-03	1.443	0.000
1.457	2.814E-03	1.457	0.000
1.470	2.856E-03	1.470	0.000
1.484	2.907E-03	1.484	0.000
1.498	2.921E-03	1.498	0.000
1.512	2.924E-03	1.512	0.000
1.527	3.019E-03	1.527	0.000
1.542	3.033E-03	1.542	0.000
1.557	3.050E-03	1.557	0.000
1.572	3.088E-03	1.572	0.000
1.588	3.099E-03	1.588	0.000
1.604	3.108E-03	1.604	0.000
1.621	3.118E-03	1.621	0.000
1.638	3.146E-03	1.638	0.000
1.655	3.163E-03	1.655	0.000
1.672	3.191E-03	1.672	0.000
1.690	3.201E-03	1.690	0.000
1.708	3.206E-03	1.708	0.000
1.727	3.227E-03	1.727	0.000
1.746	3.309E-03	1.746	0.000
1.766	3.329E-03	1.766	0.000
1.785	3.369E-03	1.785	0.000
1.806	3.461E-03	1.806	0.000
1.827	3.516E-03	1.827	0.000
1.848	3.534E-03	1.848	0.000
1.870	3.540E-03	1.870	0.000
1.892	3.542E-03	1.892	0.000
1.915	3.588E-03	1.915	0.000
1.939	3.596E-03	1.939	0.000
1.963	3.597E-03	1.963	0.000
1.987	3.602E-03	1.987	0.000
2.013	3.617E-03	2.013	0.000
2.039	3.622E-03	2.039	0.000
2.065	3.624E-03	2.065	0.000
2.093	3.632E-03	2.093	0.000
2.121	3.679E-03	2.121	0.000
2.150	3.689E-03	2.150	0.000
2.179	3.716E-03	2.179	0.000
2.210	3.732E-03	2.210	0.000

2.241	3.735E-03	2.241	0.000
2.273	3.753E-03	2.273	0.000
2.306	3.755E-03	2.306	0.000
2.340	3.760E-03	2.340	0.000
2.376	3.867E-03	2.376	0.000
2.412	3.891E-03	2.412	0.000
2.449	3.899E-03	2.449	0.000
2.488	4.006E-03	2.488	0.000
2.527	4.012E-03	2.527	0.000
2.569	4.019E-03	2.569	0.000
2.611	4.064E-03	2.611	0.000
2.655	4.069E-03	2.655	0.000
2.700	4.127E-03	2.700	0.000
2.747	4.198E-03	2.747	0.000
2.796	4.200E-03	2.796	0.000
2.846	4.314E-03	2.846	0.000
2.898	4.317E-03	2.898	0.000
2.952	4.380E-03	2.952	0.000
3.008	4.434E-03	3.008	0.000
3.067	4.499E-03	3.067	0.000
3.127	4.579E-03	3.127	0.000
3.190	4.584E-03	3.190	0.000
3.256	4.619E-03	3.256	0.000
3.325	4.623E-03	3.325	0.000
3.396	4.730E-03	3.396	0.000
3.471	4.764E-03	3.471	0.000
3.548	4.826E-03	3.548	0.000
3.630	4.850E-03	3.630	0.000
3.715	4.946E-03	3.715	0.000
3.805	5.125E-03	3.805	0.000
3.898	5.220E-03	3.898	0.000
3.997	5.223E-03	3.997	0.000
4.101	5.249E-03	4.101	0.000
4.210	5.488E-03	4.210	0.000
4.325	5.596E-03	4.325	0.000
4.447	5.709E-03	4.447	0.000
4.575	5.732E-03	4.575	0.000
4.712	5.855E-03	4.712	0.000
4.856	5.863E-03	4.856	0.000
5.010	6.181E-03	5.010	0.000
5.174	6.185E-03	5.174	0.000
5.349	6.293E-03	5.349	0.000
5.536	6.373E-03	5.536	0.000
5.737	6.487E-03	5.737	0.000
5.953	6.644E-03	5.953	0.000
6.186	6.782E-03	6.186	0.000
6.438	6.795E-03	6.438	0.000
6.711	6.859E-03	6.711	0.000
7.009	6.894E-03	7.009	0.000
7.334	7.054E-03	7.334	0.000
7.691	7.060E-03	7.691	0.000
8.084	7.064E-03	8.084	0.000
8.519	7.147E-03	8.519	0.000
9.005	7.267E-03	9.005	0.000
9.548	7.300E-03	9.548	0.000
10.162	7.792E-03	10.162	0.000

10.860	7.909E-03	10.860	0.000
11.661	8.298E-03	11.661	0.000
12.589	8.306E-03	12.589	0.000
13.678	8.677E-03	13.678	0.000
14.973	9.302E-03	14.973	0.000
16.540	9.304E-03	16.540	0.000
18.472	9.392E-03	18.472	0.000
20.915	9.574E-03	20.915	0.000
24.104	9.793E-03	24.104	0.000
28.439	1.023E-02	28.439	0.000
34.675	1.120E-02	34.675	0.000
44.416	1.181E-02	44.416	0.000
61.766	1.207E-02	61.766	0.000
101.359	1.436E-02	101.359	0.000
282.357	2.185E-02	282.357	0.000

***** Point of Compliance Flow Frequency Data *****

Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	3.609E-03	2-Year	3.302E-06
5-Year	6.160E-03	5-Year	5.333E-06
10-Year	7.665E-03	10-Year	6.567E-06
25-Year	9.890E-03	25-Year	8.208E-06
50-Year	1.191E-02	50-Year	9.390E-06
100-Year	1.429E-02	100-Year	9.569E-06
200-Year	1.933E-02	200-Year	9.781E-06

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

***** Point of Compliance Flow Duration Data *****

Predevelopment Runoff		Postdevelopment Runoff	
Discharge (cfs)	Exceedance Probability	Discharge (cfs)	Exceedance Probability
0.000E+00	1.0000E+00	0.000E+00	1.0000E+00
1.093E-04	2.0367E-01	0.000E+00	9.3174E-01
2.185E-04	1.4823E-01	0.000E+00	8.6813E-01
3.278E-04	1.1504E-01	0.000E+00	8.0887E-01
4.370E-04	9.1541E-02	0.000E+00	7.5365E-01
5.463E-04	7.4211E-02	0.000E+00	7.0220E-01
6.555E-04	6.1055E-02	0.000E+00	6.5427E-01
7.648E-04	5.0780E-02	0.000E+00	6.0961E-01
8.741E-04	4.2533E-02	0.000E+00	5.6799E-01
9.833E-04	3.5811E-02	0.000E+00	5.2922E-01
1.093E-03	3.0279E-02	0.000E+00	4.9309E-01
1.202E-03	2.5649E-02	0.000E+00	4.5943E-01
1.311E-03	2.1900E-02	0.000E+00	4.2807E-01
1.420E-03	1.8725E-02	0.000E+00	3.9885E-01
1.530E-03	1.6048E-02	0.000E+00	3.7162E-01
1.639E-03	1.3743E-02	0.000E+00	3.4625E-01
1.748E-03	1.1863E-02	0.000E+00	3.2261E-01

1.805E-03	1.1014E-02	0.000E+00	3.0059E-01
1.967E-03	8.9427E-03	0.000E+00	2.8007E-01
2.076E-03	7.7940E-03	0.000E+00	2.6095E-01
2.185E-03	6.8489E-03	0.000E+00	2.4314E-01
2.294E-03	6.0554E-03	0.000E+00	2.2654E-01
2.404E-03	5.3406E-03	0.000E+00	2.1108E-01
2.513E-03	4.7522E-03	0.000E+00	1.9667E-01
2.622E-03	4.2280E-03	0.000E+00	1.8324E-01
2.731E-03	3.7472E-03	0.000E+00	1.7073E-01
2.841E-03	3.3255E-03	0.000E+00	1.5908E-01
2.950E-03	2.9725E-03	0.000E+00	1.4822E-01
3.059E-03	2.6548E-03	0.000E+00	1.3810E-01
3.168E-03	2.3963E-03	0.000E+00	1.2867E-01
3.278E-03	2.1523E-03	0.000E+00	1.1989E-01
3.387E-03	1.9422E-03	0.000E+00	1.1171E-01
3.496E-03	1.7451E-03	0.000E+00	1.0408E-01
3.609E-03	1.5557E-03	0.000E+00	9.6975E-02
3.715E-03	1.4101E-03	0.000E+00	9.0355E-02
3.824E-03	1.2917E-03	0.000E+00	8.4187E-02
3.933E-03	1.1906E-03	0.000E+00	7.8440E-02
4.043E-03	1.0931E-03	0.000E+00	7.3085E-02
4.152E-03	1.0115E-03	0.000E+00	6.8096E-02
4.261E-03	9.3716E-04	0.000E+00	6.3448E-02
4.370E-03	8.6712E-04	0.000E+00	5.9116E-02
4.480E-03	7.8554E-04	0.000E+00	5.5081E-02
4.589E-03	7.2489E-04	0.000E+00	5.1321E-02
4.698E-03	6.7651E-04	0.000E+00	4.7817E-02
4.807E-03	6.2958E-04	0.000E+00	4.4553E-02
4.917E-03	5.8410E-04	0.000E+00	4.1512E-02
5.026E-03	5.5305E-04	0.000E+00	3.8678E-02
5.135E-03	5.1984E-04	0.000E+00	3.6038E-02
5.244E-03	4.8085E-04	0.000E+00	3.3578E-02
5.354E-03	4.5125E-04	0.000E+00	3.1285E-02
5.463E-03	4.1876E-04	0.000E+00	2.9150E-02
5.572E-03	3.8555E-04	0.000E+00	2.7160E-02
5.681E-03	3.5883E-04	0.000E+00	2.5306E-02
5.791E-03	3.3645E-04	0.000E+00	2.3578E-02
5.900E-03	3.1118E-04	0.000E+00	2.1969E-02
6.009E-03	2.9024E-04	0.000E+00	2.0469E-02
6.160E-03	2.6400E-04	0.000E+00	1.9072E-02
6.228E-03	2.5342E-04	0.000E+00	1.7770E-02
6.337E-03	2.3465E-04	0.000E+00	1.6557E-02
6.446E-03	2.1443E-04	0.000E+00	1.5427E-02
6.555E-03	2.0072E-04	0.000E+00	1.4373E-02
6.665E-03	1.9061E-04	0.000E+00	1.3392E-02
6.774E-03	1.7400E-04	0.000E+00	1.2478E-02
6.883E-03	1.5884E-04	0.000E+00	1.1626E-02
6.992E-03	1.4007E-04	0.000E+00	1.0833E-02
7.102E-03	1.2779E-04	0.000E+00	1.0093E-02
7.211E-03	1.1335E-04	0.000E+00	9.4041E-03
7.320E-03	1.0397E-04	0.000E+00	8.7621E-03
7.430E-03	9.3860E-05	0.000E+00	8.1640E-03
7.539E-03	8.5196E-05	0.000E+00	7.6067E-03
7.648E-03	7.6532E-05	0.000E+00	7.0874E-03
7.757E-03	7.0034E-05	0.000E+00	6.6036E-03
7.867E-03	6.3536E-05	0.000E+00	6.1528E-03

7.976E-03	5.7038E-05	0.000E+00	5.7328E-03
8.085E-03	5.1262E-05	0.000E+00	5.3414E-03
8.194E-03	4.5486E-05	0.000E+00	4.9768E-03
8.304E-03	4.0432E-05	0.000E+00	4.6371E-03
8.413E-03	3.6822E-05	0.000E+00	4.3205E-03
8.522E-03	3.1768E-05	0.000E+00	4.0256E-03
8.631E-03	2.5992E-05	0.000E+00	3.7508E-03
8.741E-03	2.2382E-05	0.000E+00	3.4947E-03
8.850E-03	2.0938E-05	0.000E+00	3.2562E-03
8.959E-03	1.8772E-05	0.000E+00	3.0339E-03
9.068E-03	1.8050E-05	0.000E+00	2.8268E-03
9.178E-03	1.5884E-05	0.000E+00	2.6338E-03
9.287E-03	1.4440E-05	0.000E+00	2.4540E-03
9.396E-03	1.1552E-05	0.000E+00	2.2865E-03
9.505E-03	1.0830E-05	0.000E+00	2.1304E-03
9.615E-03	1.0108E-05	0.000E+00	1.9850E-03
9.724E-03	8.6640E-06	0.000E+00	1.8495E-03
9.833E-03	7.9420E-06	0.000E+00	1.7232E-03
9.942E-03	7.9420E-06	0.000E+00	1.6056E-03
1.005E-02	7.9420E-06	0.000E+00	1.4960E-03
1.016E-02	7.9420E-06	0.000E+00	1.3939E-03
1.027E-02	7.2200E-06	0.000E+00	1.2987E-03
1.038E-02	7.2200E-06	0.000E+00	1.2101E-03
1.049E-02	7.2200E-06	0.000E+00	1.1275E-03
1.060E-02	7.2200E-06	0.000E+00	1.0505E-03
1.071E-02	6.4980E-06	0.000E+00	9.7878E-04
1.082E-02	6.4980E-06	0.000E+00	9.1196E-04
1.093E-02	6.4980E-06	0.000E+00	8.4971E-04
1.104E-02	5.7760E-06	0.000E+00	7.9170E-04
1.114E-02	5.7760E-06	0.000E+00	7.3766E-04
1.125E-02	5.0540E-06	0.000E+00	6.8730E-04
1.136E-02	5.0540E-06	0.000E+00	6.4038E-04
1.147E-02	5.0540E-06	0.000E+00	5.9667E-04
1.158E-02	5.0540E-06	0.000E+00	5.5594E-04
1.169E-02	5.0540E-06	0.000E+00	5.1799E-04
1.180E-02	4.3320E-06	0.000E+00	4.8263E-04
1.191E-02	3.6127E-06	0.000E+00	4.4968E-04
1.202E-02	3.6100E-06	0.000E+00	4.1898E-04
1.213E-02	2.8880E-06	0.000E+00	3.9038E-04
1.224E-02	2.8880E-06	0.000E+00	3.6373E-04
1.235E-02	2.8880E-06	0.000E+00	3.3890E-04
1.246E-02	2.8880E-06	0.000E+00	3.1577E-04
1.256E-02	2.8880E-06	0.000E+00	2.9421E-04
1.267E-02	2.8880E-06	0.000E+00	2.7413E-04
1.278E-02	2.8880E-06	0.000E+00	2.5541E-04
1.289E-02	2.8880E-06	0.000E+00	2.3798E-04
1.300E-02	2.1660E-06	0.000E+00	2.2173E-04
1.311E-02	2.1660E-06	0.000E+00	2.0660E-04
1.322E-02	2.1660E-06	0.000E+00	1.9249E-04
1.333E-02	2.1660E-06	0.000E+00	1.7935E-04
1.344E-02	2.1660E-06	0.000E+00	1.6711E-04
1.355E-02	2.1660E-06	0.000E+00	1.5570E-04
1.366E-02	2.1660E-06	0.000E+00	1.4507E-04
1.377E-02	2.1660E-06	0.000E+00	1.3517E-04
1.388E-02	2.1660E-06	0.000E+00	1.2594E-04
1.398E-02	2.1660E-06	0.000E+00	1.1734E-04

1.409E-02	2.1660E-06	0.000E+00	1.0933E-04
1.420E-02	2.1660E-06	0.000E+00	1.0187E-04
1.431E-02	2.1660E-06	0.000E+00	9.4917E-05
1.442E-02	1.4440E-06	0.000E+00	8.8437E-05
1.453E-02	1.4440E-06	0.000E+00	8.2400E-05
1.464E-02	1.4440E-06	0.000E+00	7.6775E-05
1.475E-02	1.4440E-06	0.000E+00	7.1534E-05
1.486E-02	1.4440E-06	0.000E+00	6.6651E-05
1.497E-02	1.4440E-06	0.000E+00	6.2101E-05
1.508E-02	1.4440E-06	0.000E+00	5.7862E-05
1.519E-02	1.4440E-06	0.000E+00	5.3912E-05
1.530E-02	1.4440E-06	0.000E+00	5.0232E-05
1.541E-02	1.4440E-06	0.000E+00	4.6803E-05
1.551E-02	1.4440E-06	0.000E+00	4.3608E-05
1.562E-02	1.4440E-06	0.000E+00	4.0631E-05
1.573E-02	1.4440E-06	0.000E+00	3.7857E-05
1.584E-02	1.4440E-06	0.000E+00	3.5273E-05
1.595E-02	1.4440E-06	0.000E+00	3.2865E-05
1.606E-02	1.4440E-06	0.000E+00	3.0621E-05
1.617E-02	1.4440E-06	0.000E+00	2.8531E-05
1.628E-02	1.4440E-06	0.000E+00	2.6583E-05
1.639E-02	1.4440E-06	0.000E+00	2.4769E-05
1.650E-02	1.4440E-06	0.000E+00	2.3078E-05
1.661E-02	1.4440E-06	0.000E+00	2.1502E-05
1.672E-02	1.4440E-06	0.000E+00	2.0035E-05
1.683E-02	1.4440E-06	0.000E+00	1.8667E-05
1.693E-02	7.2200E-07	0.000E+00	1.7393E-05
1.704E-02	7.2200E-07	0.000E+00	1.6205E-05
1.715E-02	7.2200E-07	0.000E+00	1.5099E-05
1.726E-02	7.2200E-07	0.000E+00	1.4068E-05
1.737E-02	7.2200E-07	0.000E+00	1.3108E-05
1.748E-02	7.2200E-07	0.000E+00	1.2213E-05
1.759E-02	7.2200E-07	0.000E+00	1.1379E-05
1.770E-02	7.2200E-07	0.000E+00	1.0603E-05
1.781E-02	7.2200E-07	0.000E+00	9.8789E-06
1.792E-02	7.2200E-07	0.000E+00	9.2045E-06
1.803E-02	7.2200E-07	0.000E+00	8.5762E-06
1.814E-02	7.2200E-07	0.000E+00	7.9907E-06
1.825E-02	7.2200E-07	0.000E+00	7.4452E-06
1.836E-02	7.2200E-07	0.000E+00	6.9370E-06
1.846E-02	7.2200E-07	0.000E+00	6.4635E-06
1.857E-02	7.2200E-07	0.000E+00	6.0222E-06
1.868E-02	7.2200E-07	0.000E+00	5.6111E-06
1.879E-02	7.2200E-07	0.000E+00	5.2281E-06
1.890E-02	7.2200E-07	0.000E+00	4.8712E-06
1.901E-02	7.2200E-07	0.000E+00	4.5387E-06
1.912E-02	7.2200E-07	0.000E+00	4.2288E-06
1.923E-02	7.2200E-07	0.000E+00	3.9402E-06
1.934E-02	7.2200E-07	0.000E+00	3.6712E-06
1.945E-02	7.2200E-07	0.000E+00	3.4206E-06
1.956E-02	7.2200E-07	0.000E+00	3.1871E-06
1.967E-02	7.2200E-07	0.000E+00	2.9695E-06
1.978E-02	7.2200E-07	0.000E+00	2.7668E-06
1.988E-02	7.2200E-07	0.000E+00	2.5779E-06
1.999E-02	7.2200E-07	0.000E+00	2.4019E-06
2.010E-02	7.2200E-07	0.000E+00	2.2380E-06

2.021E-02	7.2200E-07	0.000E+00	2.0852E-06
2.032E-02	7.2200E-07	0.000E+00	1.9429E-06
2.043E-02	7.2200E-07	0.000E+00	1.8102E-06
2.054E-02	7.2200E-07	0.000E+00	1.6867E-06
2.065E-02	7.2200E-07	0.000E+00	1.5715E-06
2.076E-02	7.2200E-07	0.000E+00	1.4642E-06
2.087E-02	7.2200E-07	0.000E+00	1.3643E-06
2.098E-02	7.2200E-07	0.000E+00	1.2711E-06
2.109E-02	7.2200E-07	0.000E+00	1.1844E-06
2.120E-02	7.2200E-07	0.000E+00	1.1035E-06
2.131E-02	7.2200E-07	0.000E+00	1.0282E-06
2.141E-02	7.2200E-07	0.000E+00	9.5800E-07
2.152E-02	7.2200E-07	0.000E+00	8.9261E-07
2.163E-02	7.2200E-07	0.000E+00	8.3167E-07
2.174E-02	7.2200E-07	0.000E+00	7.7490E-07
2.185E-02	7.2200E-07	2.000E-04	7.2200E-07

****** Flow Duration Performance ******

Excursion at Predeveloped 50%Q2 (Must be Less Than 0%):	0.0%	PASS	
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than 0%):		0.0%	PASS
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	0.0%	PASS	
Percent Excursion from Q2 to Q50 (Must be less than 50%):	0.0%	PASS	

MEETS ALL FLOW DURATION DESIGN CRITERIA: PASS

****** LID Duration Performance ******

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	0.0%	PASS
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	0.0%	PASS

MEETS ALL LID DURATION DESIGN CRITERIA: PASS

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.31
Program License Number: 200510005
Run Date: 12/09/2014 8:25 AM

Input File Name: IT2-TDA7.fld
Project Name: ELST - S Sammamish
Analysis Title: Infiltration Trench Sizing
Comments: Infiltration trench 2 in TDA 7 from STA 244+20 to STA 249+25

PRECIPITATION INPUT

Computational Time Step (Minutes): 60

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 244+05 to STA 249+25 ----------

	-------Area(Acres) --------
Till Forest	0.190
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000
Subbasin Total	0.190

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 244+05 to STA 249+25 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.190
Subbasin Total	0.190

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 2

Link Name: Infilt Trench 2
Link Type: Infiltration Trench
Downstream Link Name: TDA 7 POC

Trench Type	:	Trench on Embankment Sideslope
Trench Length (ft)	:	505.00
Trench Width (ft)	:	2.00
Trench Depth (ft)	:	2.00
Trench Bottom Elev (ft)	:	100.00
Trench Rockfill Porosity (%)	:	30.00

Constant Infiltration Option Used
Infiltration Rate (in/hr): 0.50

Link Name: TDA 7 POC
Link Type: Copy
Downstream Link: None

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 2

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 244+05 to STA 24	32.944
Total:	32.944

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 244+05 to STA 24	0.000
Link: Infilt Trench 2	Not Computed
Link: TDA 7 POC	Not Applicable
Total:	0.000

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 0.209 ac-ft/year, Post Developed: 0.000 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 2

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: STA 244+05 to STA 249+25

Scenario Postdeveloped Compliance Link: TDA 7 POC

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	4.034E-03	2-Year	4.586E-06
5-Year	6.885E-03	5-Year	6.933E-06
10-Year	8.567E-03	10-Year	8.595E-06
25-Year	1.105E-02	25-Year	9.865E-06
50-Year	1.331E-02	50-Year	1.291E-02
100-Year	1.598E-02	100-Year	2.221E-02
200-Year	2.160E-02	200-Year	2.936E-02

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

****** Flow Duration Performance ******

Excursion at Predeveloped 50%Q2 (Must be Less Than 0%):	-100.0%	PASS
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than 0%):	-99.7%	PASS
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	-20.1%	PASS
Percent Excursion from Q2 to Q50 (Must be less than 50%):	0.0%	PASS

MEETS ALL FLOW DURATION DESIGN CRITERIA: PASS

****** LID Duration Performance ******

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	-100.0%	PASS
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	-100.0%	PASS

MEETS ALL LID DURATION DESIGN CRITERIA: PASS

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.31
Program License Number: 200510005
Run Date: 12/09/2014 8:29 AM

Input File Name: IT3-TDA8.fld
Project Name: ELST - S Sammamish
Analysis Title: Infiltration Trench Sizing
Comments: Infiltration trench 3 in TDA 8 from STA 249+25 to STA 261+27

PRECIPITATION INPUT

Computational Time Step (Minutes): 60

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 249+25 to STA 261+50 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.450
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000
Subbasin Total	0.450

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : STA 249+25 to STA 261+50 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.450
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Subbasin Total	0.450

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 2

Link Name: Culvert at Sta 256+35
Link Type: Copy
Downstream Link: None

Link Name: Infilt Trench 3
Link Type: Infiltration Trench
Downstream Link Name: Culvert at Sta 256+35

Trench Type	:	Trench on Embankment Sideslope
Trench Length (ft)	:	1202.00
Trench Width (ft)	:	2.00
Trench Depth (ft)	:	2.00
Trench Bottom Elev (ft)	:	100.00
Trench Rockfill Porosity (%)	:	30.00

Constant Infiltration Option Used
Infiltration Rate (in/hr): 10.00

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 2

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: STA 249+25 to STA 26	119.646
Total:	119.646

Total Post Developed Recharge During Simulation

Model Element		Recharge Amount (ac-ft)
Subbasin: STA 249+25 to STA 26		0.000
Link:	Culvert at Sta 256+3	Not Applicable
Link:	Infilt Trench 3	Not Computed
Total:		0.000

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 0.757 ac-ft/year, Post Developed: 0.000 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 2

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: STA 249+25 to STA 261+50

Scenario Postdeveloped Compliance Link: Culvert at Sta 256+35

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	8.830E-05	2-Year	1.490E-08
5-Year	9.014E-05	5-Year	1.490E-08
10-Year	9.061E-05	10-Year	1.490E-08
25-Year	2.099E-04	25-Year	1.490E-08
50-Year	4.164E-04	50-Year	2.980E-08
100-Year	6.440E-04	100-Year	2.980E-08
200-Year	1.159E-03	200-Year	2.980E-08

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

****** Flow Duration Performance ******

Excursion at Predeveloped 50%Q2 (Must be Less Than 0%):	0.0%	PASS	
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than 0%):		0.0%	PASS
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	0.0%	PASS	
Percent Excursion from Q2 to Q50 (Must be less than 50%):	0.0%	PASS	

MEETS ALL FLOW DURATION DESIGN CRITERIA: PASS

****** LID Duration Performance ******

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	0.0%	PASS
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	0.0%	PASS

MEETS ALL LID DURATION DESIGN CRITERIA: PASS

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.31
Program License Number: 200510005
Run Date: 12/09/2014 9:42 AM

Input File Name: IT456-TDA9.fld
Project Name: ELST - S Sammamish
Analysis Title: Infiltration Trench Sizing
Comments: Infiltration trenches in TDA 9 from STA 261+72 to STA 282+62

PRECIPITATION INPUT

Computational Time Step (Minutes): 60

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : TDA 9 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.820
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000
Subbasin Total	0.820

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 2

---------- Subbasin : TDA 9 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.790
Subbasin Total	0.790

---------- Subbasin : SE 33rd St Sidewalk ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.030
Subbasin Total	0.030

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 3

Link Name: Infilt Trench 5
Link Type: Infiltration Trench
Downstream Link Name: TDA 9 POC

Trench Type : Trench on Embankment Sideslope

Trench Length (ft) : 2082.00
Trench Width (ft) : 2.00
Trench Depth (ft) : 2.00
Trench Bottom Elev (ft) : 100.00
Trench Rockfill Porosity (%) : 30.00

Constant Infiltration Option Used
Infiltration Rate (in/hr): 10.00

Link Name: TDA 9 POC
Link Type: Copy
Downstream Link: None

Link Name: Infilt Trenches 5 and 6
Link Type: Infiltration Trench
Downstream Link Name: TDA 9 POC

Trench Type : Trench on Embankment Sideslope
Trench Length (ft) : 147.00
Trench Width (ft) : 2.00
Trench Depth (ft) : 2.00
Trench Bottom Elev (ft) : 100.00
Trench Rockfill Porosity (%) : 30.00

Constant Infiltration Option Used
Infiltration Rate (in/hr): 10.00

*************************FLOOD FREQUENCY AND DURATION STATISTICS**********************

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 2
Number of Links: 3

************ Subbasin: TDA 9 ************

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.220
5-Year	0.282
10-Year	0.315
25-Year	0.368
50-Year	0.409
100-Year	0.462
200-Year	0.488

********** **Subbasin: SE 33rd St Sidewalk** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	8.352E-03
5-Year	1.073E-02
10-Year	1.196E-02
25-Year	1.399E-02
50-Year	1.555E-02
100-Year	1.754E-02
200-Year	1.855E-02

********** Link: Infilt Trench 5 ********** Link Inflow Frequency Stats
Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.220
5-Year	0.280
10-Year	0.315
25-Year	0.368
50-Year	0.409
100-Year	0.462
200-Year	0.488

********** Link: Infilt Trench 5 ********** Link Outflow 1 Frequency Stats
Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	1.490E-08
5-Year	2.980E-08
10-Year	2.980E-08
25-Year	2.980E-08
50-Year	2.980E-08
100-Year	2.980E-08
200-Year	4.957E-08

********** Link: TDA 9 POC ********** Link Outflow 1 Frequency Stats
Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	2.142E-08
5-Year	3.812E-08

10-Year	3.888E-08
25-Year	4.005E-08
50-Year	4.191E-08
100-Year	4.282E-08
200-Year	6.385E-08

********** Link: Infilt Trenches 5 and 6 ********** Link Inflow Frequency Stats
Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	8.352E-03
5-Year	1.063E-02
10-Year	1.196E-02
25-Year	1.399E-02
50-Year	1.555E-02
100-Year	1.754E-02
200-Year	1.855E-02

********** Link: Infilt Trenches 5 and 6 ********** Link Outflow 1 Frequency Stats
Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	6.519E-09
5-Year	8.321E-09
10-Year	9.073E-09
25-Year	1.024E-08
50-Year	1.211E-08
100-Year	1.301E-08
200-Year	1.427E-08

*************Groundwater Recharge Summary ***************

Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: TDA 9	218.021
Total:	218.021

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: TDA 9	0.000
Subbasin: SE 33rd St Sidewalk	0.000
Link: Infilt Trench 5	348.893
Link: TDA 9 POC	Not Applicable
Link: Infilt Trenches 5 an	13.249

Total: 362.142

Total Predevelopment Recharge is Less than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 1.380 ac-ft/year, Post Developed: 2.292 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 3

********** Link: Infilt Trench 5 **********

Infiltration/Filtration Statistics----------
Total Runoff Volume (ac-ft): 348.89
Total Runoff Infiltrated (ac-ft): 348.89, 100.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Percent Treated (Infiltrated+Filtered)/Total Volume: 100.00%

********** Link: Infilt Trenches 5 and 6 **********

Infiltration/Filtration Statistics----------
Total Runoff Volume (ac-ft): 13.25
Total Runoff Infiltrated (ac-ft): 13.25, 100.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Percent Treated (Infiltrated+Filtered)/Total Volume: 100.00%

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Subbasin: TDA 9

Scenario Postdeveloped Compliance Link: TDA 9 POC

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	1.609E-04	2-Year	2.142E-08
5-Year	1.643E-04	5-Year	3.812E-08
10-Year	1.651E-04	10-Year	3.888E-08
25-Year	3.825E-04	25-Year	4.005E-08
50-Year	7.588E-04	50-Year	4.191E-08
100-Year	1.174E-03	100-Year	4.282E-08
200-Year	2.112E-03	200-Year	6.385E-08

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

****** Flow Duration Performance ******

Excursion at Predeveloped 50%Q2 (Must be Less Than 0%):	0.0%	PASS	
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than 0%):		0.0%	PASS
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	0.0%	PASS	
Percent Excursion from Q2 to Q50 (Must be less than 50%):	0.0%	PASS	

MEETS ALL FLOW DURATION DESIGN CRITERIA: PASS

****** LID Duration Performance ******

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	0.0%	PASS
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	0.0%	PASS

MEETS ALL LID DURATION DESIGN CRITERIA: PASS

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.34
Program License Number: 200510005
Run Date: 12/18/2014 2:27 PM

Input File Name: DrainageBasinFlows.fld
Project Name: ELST - S Sammamish Segment A
Analysis Title: Basin flows for Conveyance Sizing
Comments: Drainage basins for TDA1a, TDA 1b, TDA2, TDA3 and Stream #0163 SF, TDA 8

——————————————— PRECIPITATION INPUT ———————————————

Computational Time Step (Minutes): 5

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 11

---------- Subbasin : U/S Basin to Stream #0163 SF ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	84.590
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	32.410
Subbasin Total	117.000

---------- Subbasin : U/S Basin to TDA 2 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	1.300
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.500
Subbasin Total	1.800

---------- Subbasin : U/S Basin to TDA 3 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	4.270
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	1.630
Subbasin Total	5.900

---------- Subbasin : U/S to TDA 1a - Sta 218+95 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	11.060
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	4.240
Subbasin Total	15.300

---------- Subbasin : TDA 2 - Sta 224+00 ----------

	-------Area(Acres) --------
Till Forest	0.466
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000

Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.244
Subbasin Total	0.710

---------- Subbasin : TDA 3 - Sta 230+00 ----------

	-------Area(Acres) --------
Till Forest	0.536
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.197
Subbasin Total	0.733

---------- Subbasin : TDA 5 to O163 SF ----------

	-------Area(Acres) --------
Till Forest	0.135
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.046
Subbasin Total	0.181

---------- Subbasin : TDA 8 - Sta 256+35 ----------

	-------Area(Acres) --------
Till Forest	1.094
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.450
Subbasin Total	1.544

---------- Subbasin : U/S Basin to Unnamed #3 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	30.370
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	11.630
Subbasin Total	42.000

---------- Subbasin : U/S to TDA 1b - Sta 221+55 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	11.860
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	4.540
Subbasin Total	16.400

---------- Subbasin : TDA 1 - Sta 218+45 ----------

	-------Area(Acres) --------
Till Forest	0.426
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.209
Subbasin Total	0.635

----------SCENARIO: POSTDEVELOPED

Number of Subbasins: 11

---------- Subbasin : U/S Basin to Stream #0163 SF ----------

	-------Area(Acres) --------
Till Forest	0.000

Till Pasture	0.000
Till Grass	84.590
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	32.410
Subbasin Total	117.000

---------- Subbasin : U/S Basin to TDA 2 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	1.300
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.500
Subbasin Total	1.800

---------- Subbasin : U/S Basin to TDA 3 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	4.270
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	1.630
Subbasin Total	5.900

---------- Subbasin : U/S to TDA 1a - Sta 218+95 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	11.060
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000

Impervious	4.240
Subbasin Total	15.300

---------- Subbasin : TDA 2 - Sta 224+00 ----------

	-------Area(Acres) --------
Till Forest	0.466
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.244
Subbasin Total	0.710

---------- Subbasin : TDA 3 - Sta 230+00 ----------

	-------Area(Acres) --------
Till Forest	0.536
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.197
Subbasin Total	0.733

---------- Subbasin : TDA 5 to O163 SF ----------

	-------Area(Acres) --------
Till Forest	0.135
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.046
Subbasin Total	0.181

---------- Subbasin : TDA 8 - Sta 256+35 ----------

	-------Area(Acres) --------
Till Forest	1.094

Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.450
Subbasin Total	1.544

---------- Subbasin : U/S Basin to Unnamed #3 ----------

-------Area(Acres) --------

Till Forest	0.000
Till Pasture	0.000
Till Grass	30.370
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	11.630
Subbasin Total	42.000

---------- Subbasin : U/S to TDA 1b - Sta 221+55 ----------

-------Area(Acres) --------

Till Forest	0.000
Till Pasture	0.000
Till Grass	11.860
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	4.540
Subbasin Total	16.400

---------- Subbasin : TDA 1 - Sta 218+45 ----------

-------Area(Acres) --------

Till Forest	0.426
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000

Impervious 0.209

Subbasin Total 0.635

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 1

Link Name: New Copy Lnk1
Link Type: Copy
Downstream Link: None

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 1

Link Name: New Copy Lnk1
Link Type: Copy
Downstream Link: None

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 11
Number of Links: 1

********** **Subbasin: U/S Basin to Stream #0163 SF** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	23.302
5-Year	35.915
10-Year	46.920
25-Year	62.195
50-Year	93.135
100-Year	111.838
200-Year	113.130

********** **Subbasin: U/S Basin to TDA 2** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)
Tr (yrs) Flood Peak (cfs)

==========

2-Year	0.359
5-Year	0.553
10-Year	0.723
25-Year	0.957
50-Year	1.434
100-Year	1.722
200-Year	1.742

********** **Subbasin: U/S Basin to TDA 3** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	1.174
5-Year	1.810
10-Year	2.364
25-Year	3.135
50-Year	4.694
100-Year	5.636
200-Year	5.701

********** **Subbasin: U/S to TDA 1a - Sta 218+95** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	3.048
5-Year	4.697
10-Year	6.137
25-Year	8.134
50-Year	12.180
100-Year	14.627
200-Year	14.795

********** **Subbasin: TDA 2 - Sta 224+00** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.119
5-Year	0.157
10-Year	0.192
25-Year	0.235
50-Year	0.336
100-Year	0.382
200-Year	0.398

********** **Subbasin: TDA 3 - Sta 230+00** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	9.753E-02
5-Year	0.129
10-Year	0.156
25-Year	0.199
50-Year	0.272
100-Year	0.327
200-Year	0.344

********** **Subbasin: TDA 5 to O163 SF** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	2.307E-02
5-Year	3.017E-02
10-Year	3.640E-02
25-Year	4.706E-02
50-Year	6.347E-02
100-Year	7.634E-02
200-Year	8.210E-02

********** **Subbasin: TDA 8 - Sta 256+35** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.221
5-Year	0.292
10-Year	0.355
25-Year	0.443
50-Year	0.621
100-Year	0.746
200-Year	0.763

********** **Subbasin: U/S Basin to Unnamed #3** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	8.364
5-Year	12.891
10-Year	16.841
25-Year	22.325
50-Year	33.431
100-Year	40.143

200-Year 40.607

********** **Subbasin: U/S to TDA 1b - Sta 221+55 **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	3.266
5-Year	5.033
10-Year	6.575
25-Year	8.717
50-Year	13.053
100-Year	15.674
200-Year	15.855

********** **Subbasin: TDA 1 - Sta 218+45 **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.102
5-Year	0.135
10-Year	0.165
25-Year	0.202
50-Year	0.288
100-Year	0.335
200-Year	0.344

********** Link: New Copy Lnk1 ********** Link Inflow Frequency Stats
Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	39.956
5-Year	61.580
10-Year	80.486
25-Year	106.543
50-Year	159.597
100-Year	191.546
200-Year	193.584

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 11
Number of Links: 1

********** **Subbasin: U/S Basin to Stream #0163 SF **********

Flood Frequency Data(cfs)

(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	23.302
5-Year	35.915
10-Year	46.920
25-Year	62.195
50-Year	93.135
100-Year	111.838
200-Year	113.130

********** **Subbasin: U/S Basin to TDA 2** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.359
5-Year	0.553
10-Year	0.723
25-Year	0.957
50-Year	1.434
100-Year	1.722
200-Year	1.742

********** **Subbasin: U/S Basin to TDA 3** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	1.174
5-Year	1.810
10-Year	2.364
25-Year	3.135
50-Year	4.694
100-Year	5.636
200-Year	5.701

********** **Subbasin: U/S to TDA 1a - Sta 218+95** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	3.048
5-Year	4.697
10-Year	6.137
25-Year	8.134
50-Year	12.180
100-Year	14.627
200-Year	14.795

********** **Subbasin: TDA 2 - Sta 224+00** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.119
5-Year	0.157
10-Year	0.192
25-Year	0.235
50-Year	0.336
100-Year	0.382
200-Year	0.398

********** **Subbasin: TDA 3 - Sta 230+00** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	9.753E-02
5-Year	0.129
10-Year	0.156
25-Year	0.199
50-Year	0.272
100-Year	0.327
200-Year	0.344

********** **Subbasin: TDA 5 to O163 SF** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	2.307E-02
5-Year	3.017E-02
10-Year	3.640E-02
25-Year	4.706E-02
50-Year	6.347E-02
100-Year	7.634E-02
200-Year	8.210E-02

********** **Subbasin: TDA 8 - Sta 256+35** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.221
5-Year	0.292
10-Year	0.355
25-Year	0.443

50-Year	0.621
100-Year	0.746
200-Year	0.763

********** **Subbasin: U/S Basin to Unnamed #3** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	8.364
5-Year	12.891
10-Year	16.841
25-Year	22.325
50-Year	33.431
100-Year	40.143
200-Year	40.607

********** **Subbasin: U/S to TDA 1b - Sta 221+55** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	3.266
5-Year	5.033
10-Year	6.575
25-Year	8.717
50-Year	13.053
100-Year	15.674
200-Year	15.855

********** **Subbasin: TDA 1 - Sta 218+45** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.102
5-Year	0.135
10-Year	0.165
25-Year	0.202
50-Year	0.288
100-Year	0.335
200-Year	0.344

********** Link: New Copy Lnk1 ********** Link Inflow Frequency Stats
Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)

2-Year	39.956
5-Year	61.580
10-Year	80.486
25-Year	106.543
50-Year	159.597
100-Year	191.546
200-Year	193.584

*************Groundwater Recharge Summary ***************

Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: U/S Basin to Stream	10330.600
Subbasin: U/S Basin to TDA 2	158.763
Subbasin: U/S Basin to TDA 3	521.476
Subbasin: U/S to TDA 1a - Sta	1350.709
Subbasin: TDA 2 - Sta 224+00	80.200
Subbasin: TDA 3 - Sta 230+00	92.247
Subbasin: TDA 5 to O163 SF	23.234
Subbasin: TDA 8 - Sta 256+35	188.281
Subbasin: U/S Basin to Unnamed	3708.955
Subbasin: U/S to TDA 1b - Sta	1448.410
Subbasin: TDA 1 - Sta 218+45	73.316
Link: New Copy Lnk1	Not Applicable
Total:	17976.200

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: U/S Basin to Stream	10330.600
Subbasin: U/S Basin to TDA 2	158.763
Subbasin: U/S Basin to TDA 3	521.476
Subbasin: U/S to TDA 1a - Sta	1350.709
Subbasin: TDA 2 - Sta 224+00	80.200
Subbasin: TDA 3 - Sta 230+00	92.247
Subbasin: TDA 5 to O163 SF	23.234
Subbasin: TDA 8 - Sta 256+35	188.281
Subbasin: U/S Basin to Unnamed	3708.955
Subbasin: U/S to TDA 1b - Sta	1448.410
Subbasin: TDA 1 - Sta 218+45	73.316
Link: New Copy Lnk1	Not Applicable
Total:	17976.200

Total Predevelopment Recharge Equals Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 113.773 ac-ft/year, Post Developed: 113.773 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 1

----------SCENARIO: POSTDEVELOPED

Number of Links: 1

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Link: New Copy Lnk1
Scenario Postdeveloped Compliance Link: New Copy Lnk1

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	39.956	2-Year	39.956
5-Year	61.580	5-Year	61.580
10-Year	80.486	10-Year	80.486
25-Year	106.543	25-Year	106.543
50-Year	159.597	50-Year	159.597
100-Year	191.546	100-Year	191.546
200-Year	193.584	200-Year	193.584

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

Drainage Basin areas delineated and calculated ArcGIS10. File Created by: CAB 12/18/2014

Land Use Residential Zoning from City of Sammamish GIS data.

The Zoning map displayed R 1-4 and R-4 throughout the delineated basins.

The below table describes the land use area and how the effective impervious area was calculated.

To be consistent with the Sammamish Basin Plan that Parametrix completed for the City in 2010, R-1=L and R-4=H.

To be conservative, use LU Code H to comply with R-4, since the designation R 1-4 can either be L or H. Therefore, effective impervious are will be 23.1% of the total area.

LU Code	Name	Density	% of Total Impervious	Effective Percentage	% Effective Impervious
RF	Rural Forest	<1 Unit/ac	10	40	4
RG	Rural Grass	<1 Unit/ac	10	40	4
L	Low Density Residen	1-3 Unit/ac	20	50	10
H	Medium Density Resi	3-9 Units/ac	42	66	27.7
MF	Multi-Family	Multi-Family	60	80	48
C	Commercial/Industria	Commercial	90	95	85.5

Drainage Basin	Area (AC)
TDA 1a	15.3
TDA 1b	16.4
TDA 2	1.8
TDA 3	5.9
Stream 0163S	117
Stream 0163N	28.2
TDA 8 Unnamed 3	42

MGSFloodV4 land use input						
Land Type	TDA 1a	TDA 1b	TDA 2	TDA 3	Stream 0163S	TDA 8 Unnamed 3
Till Grass	11.06	11.86	1.30	4.27	84.59	30.37
Impervious	4.24	4.54	0.50	1.63	32.41	11.63
Total Area	15.30	16.40	1.80	5.90	117.00	42.00

MGSFloodV4 5 Min Timestep						
Flow Rate	TDA 1a	TDA 1b	TDA 2	TDA 3	Stream 0163S	TDA 8 Unnamed 3
Q_{2YR}	3.05	3.27	0.36	1.17	23.30	8.36
Q_{10YR}	6.14	6.58	0.72	2.36	46.92	16.84
Q_{25YR}	8.13	8.72	0.96	3.14	62.20	22.33
Q_{100YR}	14.63	15.67	1.72	5.64	111.84	40.14

Offsite Drainage Basin Areas delineated in figure named **Figure 1-3 Drainage Basins, Subbasins and Site Characteristics**

Drainage Basin areas calculations below. Pervious areas delineated and measured in AutoCAD. File Created by: CAB 2/13/2014

MGSFloodV4 5 Min Timestep					
Flow Rate	TDA 1	TDA 2	TDA 3	TDA 5	TDA 8
Q_{2YR}	1.933	0.119	0.098	0.023	0.221
Q_{25YR}	3.949	0.235	0.199	0.047	0.443
Q_{100YR}	6.349	0.382	0.327	0.076	0.746

TDA 1

Impervious area measured by station and trail width calculation below

Begin STA	End STA	length	width	area (SF)	area (ACRE)
217+00	222+50	550	16	8,800	0.202

Pervious area measured in CAD.Area from east edge of KC R/W to east gravel shoulder edge of proposed trail.

File location: U:\Bell\Projects\Clients\1521-King Cnty\554-1521-075-ELST\99Svcs\CADD\Phase 20\Task 03\Engr\Craig

File name: SD-SSammA_cab-working Layer name: AreaMeasure

Area 18,560 SF
0.426 ACRE

MGSFlood Entries	
Cover	Areas (ac)
Till Forest	0.426
Impervious	0.202
Total	0.628

TDA 2

Impervious area measured by station and trail width calculation below

Begin STA	End STA	length	width	area (SF)	area (ACRE)
222+50	229+15	665	16	10,640	0.244

Pervious area measured in CAD.Area from east edge of KC R/W to east gravel shoulder edge of proposed trail.

File location: U:\Bell\Projects\Clients\1521-King Cnty\554-1521-075-ELST\99Svcs\CADD\Phase 20\Task 03\Engr\Craig

File name: SD-SSammA_cab-working Layer name: AreaMeasure

Area 20,308 SF
0.466 ACRE

MGSFlood Entries	
Cover	Areas (ac)
Till Forest	0.466
Impervious	0.244
Total	0.710

TDA 3

Impervious area measured by station and trail width calculation below

Begin STA	End STA	length	width	area (SF)	area (ACRE)
229+15	234+50	535	16	8,560	0.197

Pervious area measured in CAD.Area from east edge of KC R/W to east gravel shoulder edge of proposed trail.

File location: U:\Bell\Projects\Clients\1521-King Cnty\554-1521-075-ELST\99Svcs\CADD\Phase 20\Task 03\Engr\Craig

File name: SD-SSammA_cab-working Layer name: AreaMeasure

Area 23,361 SF
0.536 ACRE

MGSFlood Entries	
Cover	Areas (ac)
Till Forest	0.536
Impervious	0.197
Total	0.733

TDA 5 only area that flows to Stream 0163 South Fork

Impervious area measured by station and trail width calculation below

Begin STA	End STA	length	width	area (SF)	area (ACRE)
239+00	240+25	125	16	2,000	0.046

Pervious area measured in CAD.Area from edge of parkway pavement to east gravel shoulder edge of proposed trail.

File location: U:\Bell\Projects\Clients\1521-King Cnty\554-1521-075-ELST\99Svcs\CADD\Phase 20\Task 03\Engr\Craig

File name: SD-SSammA_cab-working Layer name: AreaMeasure

Area 5,881 SF
0.135 ACRE

MGSFlood Entries	
Cover	Areas (ac)
Till Forest	0.135
Impervious	0.046
Total	0.181

TDA 8

Impervious area measured by station and trail width calculation below

Begin STA	End STA	length	width	area (SF)	area (ACRE)
249+25	261+50	1225	16	19,600	0.450

Pervious area measured in CAD.Area from edge of parkway pavement to east gravel shoulder edge of proposed trail.

File location: U:\Bell\Projects\Clients\1521-King Cnty\554-1521-075-ELST\99Svcs\CADD\Phase 20\Task 03\Engr\Craig

File name: SD-SSammA_cab-working Layer name: AreaMeasure

Area 47,654 SF
1.094 ACRE

MGSFlood Entries	
Cover	Areas (ac)
Till Forest	1.094
Impervious	0.450
Total	1.544

Offsite Basin Flows

MGSFloodV4 5 Min Timestep						
Flow Rate	TDA 1a	TDA 1b	TDA 2	TDA 3	Stream 0163S	TDA 8 Unnamed 3
Q2YR	3.048	3.266	0.359	1.174	23.302	8.364
Q10YR	6.137	6.575	0.723	2.364	46.92	16.841
Q25YR	8.134	8.717	0.957	3.135	62.195	22.325
Q100YR	14.627	15.674	1.722	5.636	111.838	40.143

ROW/TDA Basin Flows

MGSFloodV4 5 Min Timestep					
Flow Rate	TDA 1	TDA 2	TDA 3	TDA 5	TDA 8
Q2YR	0.102	0.119	0.098	0.023	0.221
Q10YR	0.165	0.192	0.156	0.036	0.355
Q25YR	0.202	0.235	0.199	0.047	0.443
Q100YR	0.335	0.382	0.327	0.076	0.746

Total Contributing Flow to a Trail cross-culvert or downstream private drainage system

	TDA 1	TDA 2	TDA 3	TDA 8 Unnamed 3
Culvert Station	218+45	224+00	229+90	256+35
Q2YR	6.416	0.478	1.272	8.585
Q10YR	12.877	0.915	2.520	17.196
Q25YR	17.053	1.192	3.334	22.768
Q100YR	30.636	2.104	5.963	40.889

Use Q25YR as the design storm flow rate when evaluating conveyance and culvert capacity.

Worksheet for STA 218+45 Trail Culvert Exist - Qfull

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.012	
Channel Slope	0.03390	ft/ft
Normal Depth	2.00	ft
Diameter	2.00	ft
Discharge	45.12	ft^3/s

Results

Discharge	45.12	ft^3/s
Normal Depth	2.00	ft
Flow Area	3.14	ft^2
Wetted Perimeter	6.28	ft
Hydraulic Radius	0.50	ft
Top Width	0.00	ft
Critical Depth	1.97	ft
Percent Full	100.0	%
Critical Slope	0.03073	ft/ft
Velocity	14.36	ft/s
Velocity Head	3.21	ft
Specific Energy	5.21	ft
Froude Number	0.00	
Maximum Discharge	48.54	ft^3/s
Discharge Full	45.12	ft^3/s
Slope Full	0.03390	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%

Worksheet for STA 218+45 Trail Culvert Exist - Qfull

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.00	ft
Critical Depth	1.97	ft
Channel Slope	0.03390	ft/ft
Critical Slope	0.03073	ft/ft

Worksheet for STA 218+45 Exist D/S - Qfull

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.012	
Channel Slope	0.04250	ft/ft
Normal Depth	1.33	ft
Diameter	1.33	ft
Discharge	17.02	ft^3/s

Results

Discharge	17.02	ft^3/s
Normal Depth	1.33	ft
Flow Area	1.39	ft^2
Wetted Perimeter	4.18	ft
Hydraulic Radius	0.33	ft
Top Width	0.00	ft
Critical Depth	1.31	ft
Percent Full	100.0	%
Critical Slope	0.03880	ft/ft
Velocity	12.25	ft/s
Velocity Head	2.33	ft
Specific Energy	3.66	ft
Froude Number	0.00	
Maximum Discharge	18.31	ft^3/s
Discharge Full	17.02	ft^3/s
Slope Full	0.04250	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%

Worksheet for STA 218+45 Exist D/S - Qfull

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.33	ft
Critical Depth	1.31	ft
Channel Slope	0.04250	ft/ft
Critical Slope	0.03880	ft/ft

Worksheet for STA 218+45 Exist D/S channel - Q25

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04250	ft/ft
Discharge	17.05	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2.00
0+05	1.00
0+07	0.00
0+09	0.00
0+11	1.00
0+16	2.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2.00)	(0+16, 2.00)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.88	ft
Elevation Range	0.00 to 2.00 ft	
Flow Area	3.29	ft²
Wetted Perimeter	5.92	ft
Hydraulic Radius	0.56	ft
Top Width	5.51	ft
Normal Depth	0.88	ft

Worksheet for STA 218+45 Exist D/S channel - Q25

Results

Critical Depth		0.96	ft
Critical Slope		0.02984	ft/ft
Velocity		5.18	ft/s
Velocity Head		0.42	ft
Specific Energy		1.29	ft
Froude Number		1.18	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.88	ft
Critical Depth	0.96	ft
Channel Slope	0.04250	ft/ft
Critical Slope	0.02984	ft/ft

Worksheet for STA 218+45 Exist D/S channel - Q100

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04250	ft/ft
Discharge	30.64	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2.00
0+05	1.00
0+07	0.00
0+09	0.00
0+11	1.00
0+16	2.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2.00)	(0+16, 2.00)	0.040

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	1.20	ft
Elevation Range	0.00 to 2.00 ft	
Flow Area	5.42	ft²
Wetted Perimeter	8.53	ft
Hydraulic Radius	0.63	ft
Top Width	8.02	ft
Normal Depth	1.20	ft

Worksheet for STA 218+45 Exist D/S channel - Q100

Results

Critical Depth		1.32	ft
Critical Slope		0.02831	ft/ft
Velocity		5.66	ft/s
Velocity Head		0.50	ft
Specific Energy		1.70	ft
Froude Number		1.21	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.20	ft
Critical Depth	1.32	ft
Channel Slope	0.04250	ft/ft
Critical Slope	0.02831	ft/ft

STORM SEWER DESIGN (English Units)

This spreadsheet accomplishes a storm sewer design using the rational method. Enter the data in the non-shaded areas only.
Please use one spreadsheet per stormsewer run.

Project Name: ELST - S Sammamish Segment A

Designed By: C. Buitrago
Project Office: N/A

m = 6.89 **n =** 0.539 **Design Storm Event =** 25-yr MRI **Pavement thickness (ft) =** 0.5 **Pipe Thickness (inches) =** 2

Location														Discharge Drain Design							Drain Profile										Remarks
Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T_c Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	Pipe Capacity Check (Column 13 vs. Column 17)	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)	Upstr. Ground Elev. (ft)	Downstr. Ground Elev. (ft)	Upstr. Pipe Cover (ft)	Downstr. Pipe Cover (ft)	Upstr. Pipe Cover Check (ft)	Downstr. Pipe Cover Check (ft)	
1	2	3	4	5	6	7	8	8a	9	10	11	12	13	14	14a	15	16	17	17a	17b	18	19	20	21	22	23	24	25	26	27	24
ELST	218+45 RT	218+45 LT	Off-site Basin	0.00	0.00	0.00	0.00	5.0	0.0	2.89	0.00	17.05	17.05	24	0.014	0.0339	12.32	38.66	TRY TO REDUCE VELOCITY	ADEQUATE PIPE CAPACITY	33	1.12	40.14	39.02	40.14	39.02	-2.67	-2.67	Not Enough Cover - Need to Revise Pipe Elevations	Not Enough Cover - Need to Revise Pipe Elevations	Existing stream culvert at trail, outfall to open concrete basin
ELS ShoreLn	218+45 LT	218+45 LT	Shore Lane	0.00	0.00	0.00	0.00	5.0	0.0	2.89	0.00		17.05	16	0.014	0.0425	10.52	14.67	TRY TO REDUCE VELOCITY	NEED MORE CAPACITY	30	1.28	38.02	36.75	39.02	37.00	-1.00	-1.75	Not Enough Cover - Need to Revise Pipe Elevations	Not Enough Cover - Need to Revise Pipe Elevations	Existing culvert beneath ELS Shore Ln SE, assume 4.25% slope

See WSDOT Hydraulic Manual 6-5 for explanation of columns. http://www.wsdot.wa.gov/eesc/design/hydraulics/

Notes: Column 12 represents inflow from a storm sewer line, branch, an offsite source that flows into the trunk line being analyzed.
The conservative assumption is that the flow enters the storm sewer run at the upstream end of the run being analyzed.

For pipe cover calculation, Pipe cover = (Ground or Rim Elevation - Pipe invert elevation) - (pavement thickness) - (top of pipe thickness) - (pipe diameter).
The pipe thickness is based on the pipe diameter per WSDOT Manual Concrete for Shallow Pipe Cover Installations Fill Height Table 8-11.2
Please specify the largest pipe thickness of the storm sewer run being analyzed.

The spreadsheet will only calculate one storm sewer line at a time. Please copy the "Blank Template" and use this for calculating new storm sewer lines.
If analyzing complicated stormsewer system with multiple lateral lines to the trunk line, it is recommended that Stormshed be used to
model the conveyance system. Please contact your region Hydraulic Contact.

WARNING: START YOUR STORMSEWER RUN ON ROW 12. DO NOT SKIP ANY ROWS IN BETWEEN. USE ONE SHEET PER STORMSEWER RUN

Please report any problems to the WSDOT HQ Hydraulics Office.

STORM SEWER DESIGN (English Units)

This spreadsheet accomplishes a storm sewer design using the rational method. Enter the data in the non-shaded areas only.
Please use one spreadsheet per stormsewer run.

Project Name: ELST - S Sammamish Segment A

Designed By: C. Buitrago
Project Office: N/A

m = 6.89 **n =** 0.539 **Design Storm Event =** 25-yr MRI **Pavement thickness (ft) =** 0.5 **Pipe Thickness (inches) =** 2

Location														Discharge	Drain Design						Drain Profile										Remarks
Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T_c Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	Pipe Capacity Check (Column 13 vs. Column 17)	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)	Upstr. Ground Elev. (ft)	Downstr. Ground Elev. (ft)	Upstr. Pipe Cover (ft)	Downstr. Pipe Cover (ft)	Upstr. Pipe Cover Check (ft)	Downstr. Pipe Cover Check (ft)	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*8a*	*9*	*10*	*11*	*12*	*13*	*14*	*14a*	*15*	*16*	*17*	*17a*	*17b*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*24*
ELST	224+00 RT	224+00 LT	Off-site Basin	0.00	0.00	0.00	0.00	5.0	0.0	2.89	0.00	1.17	1.17	12	0.014	0.0500	9.42	7.39	VELOCITY OK	ADEQUATE PIPE CAPACITY	34	1.70	38.47	36.77	45.40	38.44	5.26	0.00	More than 2 ft of cover	Not Enough Cover - Need to Revise Pipe Elevations	Theoretical proposed SD connection to existing downstream
ELS ShoreLn	224+00 LT	224+00 LT	Shore Lane	0.01	0.90	0.01	0.01	5.0	5.0	2.89	0.03	0.00	1.20	4	0.013	0.0500	4.88	0.43	VELOCITY OK	NEED MORE CAPACITY	40	2.00	37.44	35.44	38.44	38.00	0.00	1.56	Not Enough Cover - Need to Revise Pipe Elevations	Low Cover - See Notes at Bottom	Existing Private Drainage System in ELS Shore Ln SE
ELS ShoreLn	224+00 LT	224+00 LT	N/A	0.00	0.00	0.00	0.01	5.0	5.1	2.85	0.03	0.00	1.20	4	0.013	0.0525	5.00	0.44	VELOCITY OK	NEED MORE CAPACITY	56	2.94	35.44	32.50	38.00	34.00	1.56	0.50	Low Cover - See Notes at Bottom	Low Cover - See Notes at Bottom	Existing Private Drainage System outfall to Lake Sammamish

See WSDOT Hydraulic Manual 6-5 for explanation of columns. http://www.wsdot.wa.gov/eesc/design/hydraulics/

Notes:

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The pipe thickness is based on the pipe diameter per WSDOT Manual Concrete for Shallow Pipe Cover Installations Fill Height Table 8-11.2
Please specify the largest pipe thickness of the storm sewer run being analyzed.

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STORM SEWER DESIGN (English Units)

This spreadsheet accomplishes a storm sewer design using the rational method. Enter the data in the non-shaded areas only.
Please use one spreadsheet per stormsewer run.

Project Name: ELST - S Sammamish Segment A

Designed By: C. Buitrago
Project Office: N/A

m = 6.89 **n =** 0.539 **Design Storm Event =** 25-yr MRI **Pavement thickness (ft) =** 0.5 **Pipe Thickness (inches) =** 2

Location														Discharge	Drain Design						Drain Profile										Remarks
Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T_c Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	Pipe Capacity Check (Column 13 vs. Column 17)	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)	Upstr. Ground Elev. (ft)	Downstr. Ground Elev. (ft)	Upstr. Pipe Cover (ft)	Downstr. Pipe Cover (ft)	Upstr. Pipe Cover Check (ft)	Downstr. Pipe Cover Check (ft)	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*8a*	*9*	*10*	*11*	*12*	*13*	*14*	*14a*	*15*	*16*	*17*	*17a*	*17b*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*24*
ELST	224+02 RT	224+02 RT	Off-site Basin	0.00	0.00	0.00	0.00	5.0	0.0	2.89	0.00	1.17	1.17	12	0.014	0.0412	8.55	6.71	VELOCITY OK	ADEQUATE PIPE CAPACITY	17	0.70	43.00	42.30	45.62	47.83	0.95	3.86	Low Cover - See Notes at Bottom	More than 2 ft of cover	Inlet to Storm Detention Vault

See WSDOT Hydraulic Manual 6-5 for explanation of columns. http://www.wsdot.wa.gov/eesc/design/hydraulics/

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Please use one spreadsheet per stormsewer run.

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Designed By: C. Buitrago
Project Office: N/A

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Location														Discharge	Drain Design						Drain Profile										Remarks
Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T_c Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	Pipe Capacity Check (Column 13 vs. Column 17)	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)	Upstr. Ground Elev. (ft)	Downstr. Ground Elev. (ft)	Upstr. Pipe Cover (ft)	Downstr. Pipe Cover (ft)	Upstr. Pipe Cover Check (ft)	Downstr. Pipe Cover Check (ft)	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*8a*	*9*	*10*	*11*	*12*	*13*	*14*	*14a*	*15*	*16*	*17*	*17a*	*17b*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*24*
ELST	224+02 RT	224+02 RT	Storm Vault	0.00	0.00	0.00	0.00	5.0	0.0	2.89	0.00	0.30	0.30	12	0.014	0.0060	3.26	2.56	VELOCITY OK	ADEQUATE PIPE CAPACITY	25	0.15	38.50	38.35	45.62	45.83	5.45	5.81	More than 2 ft of cover	More than 2 ft of cover	Outlet from the Storm Detention Vault
ELST	224+02 RT	224+02 RT	Storm Vault	0.00	0.00	0.00	0.00	5.0	0.1	2.89	0.00	0.00	0.30	12	0.014	0.0074	3.63	2.85	VELOCITY OK	ADEQUATE PIPE CAPACITY	85	0.63	38.35	37.72	45.83	45.83	5.81	6.44	More than 2 ft of cover	More than 2 ft of cover	
ELST	224+02 RT	224+02 LT	N/A	0.00	0.00	0.00	0.00	5.0	0.5	2.89	0.00	0.00	0.30	6	0.013	0.0200	4.04	0.79	VELOCITY OK	ADEQUATE PIPE CAPACITY	14	0.28	37.72	37.44	45.83	38.44	6.94	-0.17	More than 2 ft of cover	Not Enough Cover - Need to Revise Pipe Elevations	Connection to existing downstream conveyance
ELS ShoreLn	224+00 LT	224+35 LT	Shore Lane	0.01	0.90	0.01	0.01	5.0	5.0	2.89	0.03	0.00	0.33	4	0.013	0.0500	4.88	0.43	VELOCITY OK	ADEQUATE PIPE CAPACITY	40	2.00	37.44	35.44	38.44	38.00	0.00	1.56	Not Enough Cover - Need to Revise Pipe Elevations	Low Cover - See Notes at Bottom	Existing Private Drainage System in ELS Shore Ln SE
ELS ShoreLn	224+35 LT	224+35 LT	N/A	0.00	0.00	0.00	0.01	5.0	5.1	2.85	0.03	0.00	0.33	4	0.013	0.0525	5.00	0.44	VELOCITY OK	ADEQUATE PIPE CAPACITY	56	2.94	35.44	32.50	38.00	34.00	1.56	0.50	Low Cover - See Notes at Bottom	Low Cover - See Notes at Bottom	

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BACKWATER COMPUTER PROGRAM FOR PIPES
Pipe data from file:ELST224.bwp

Surcharge condition at intermediate junctions
Tailwater Elevation:32.5 feet
Discharge Range:0.1 to 2. Step of 0.1 [cfs]
Overflow Elevation:38.44 feet
Weir:NONE
Upstream Velocity:3. feet/sec

PIPE NO. 1: 56 LF - 4"CP @ 5.25% OUTLET: 32.50 INLET: 35.44
INTYP: 5
JUNC NO. 1: OVERFLOW-EL: 38.00 BEND: 69 DEG DIA/WIDTH: 1.0 Q-
RATIO: 0.00

Q(CFS)	HW(FT)	HW ELEV.	*	N-FAC	DC	DN	TW	DO	DE	HWO	HWI
0.10	0.25	35.69	*	0.012	0.18	0.11	0.00	0.11	0.18	*****	0.25
0.20	0.41	35.85	*	0.012	0.26	0.16	0.00	0.16	0.26	*****	0.41
0.30	0.65	36.09	*	0.012	0.30	0.20	0.00	0.20	0.30	*****	0.65
0.40	0.99	36.43	*	0.012	0.33	0.24	0.00	0.24	0.33	*****	0.99
0.50	1.43	36.87	*	0.012	0.33	0.30	0.00	0.30	0.33	*****	1.43

********** OVERFLOW ENCOUNTERED AT 0.60 CFS DISCHARGE **********
******** OVERFLOW CONDITIONS CALCULATED ASSUMING SURCHARGE CONDITIONS *********

0.60	3.11	38.55	*	0.012	0.33	0.33	0.00	0.33	2.14	3.11	1.96
0.70	5.17	40.61	*	0.012	0.33	0.33	0.00	0.33	3.85	5.17	2.59
0.80	7.55	42.99	*	0.012	0.33	0.33	0.00	0.33	5.83	7.55	3.32
0.90	10.25	45.69	*	0.012	0.33	0.33	0.00	0.33	8.07	10.25	4.15
1.00	13.26	48.70	*	0.012	0.33	0.33	0.00	0.33	10.57	13.26	5.07
1.10	16.59	52.03	*	0.012	0.33	0.33	0.00	0.33	13.34	16.59	6.09
1.20	20.24	55.68	*	0.012	0.33	0.33	0.00	0.33	16.37	20.24	7.21
1.30	24.21	59.65	*	0.012	0.33	0.33	0.00	0.33	19.66	24.21	8.42
1.40	28.50	63.94	*	0.012	0.33	0.33	0.00	0.33	23.22	28.50	9.73

```
   1.50   33.10      68.54  * 0.012  0.33  0.33  0.00  0.33 27.04  33.10
11.14
   1.60   38.02      73.46  * 0.012  0.33  0.33  0.00  0.33 31.12  38.02
12.65
   1.70   43.25      78.69  * 0.012  0.33  0.33  0.00  0.33 35.47  43.25
14.25
   1.80   48.81      84.25  * 0.012  0.33  0.33  0.00  0.33 40.08  48.81
15.95
   1.90   54.68      90.12  * 0.012  0.33  0.33  0.00  0.33 44.96  54.68
17.75
   2.00   60.87      96.31  * 0.012  0.33  0.33  0.00  0.33 50.10  60.87
19.64


PIPE NO. 2:   40 LF -  4"CP   @  5.00%  OUTLET:  35.44  INLET:  37.44
INTYP: 5

 Q(CFS)   HW(FT)   HW ELEV. * N-FAC   DC    DN    TW    DO    DE    HWO
HWI
*************************************************************************
******
   0.10    0.18      37.62  * 0.012  0.18  0.11  0.25  0.25  0.18  *****
0.11
   0.20    0.28      37.72  * 0.012  0.26  0.16  0.41  0.41  0.26  *****
0.28
   0.30    0.55      37.99  * 0.012  0.30  0.20  0.65  0.65  0.30  *****
0.55
   0.40    0.91      38.35  * 0.012  0.33  0.24  0.99  0.99  0.50   0.85
0.91
**************** OVERFLOW ENCOUNTERED AT   0.50 CFS DISCHARGE
*****************
   0.50    2.41      39.85  * 0.012  0.33  0.33  1.43  1.43  1.78   2.41
1.38
   0.60    5.46      42.90  * 0.012  0.33  0.33  3.11  3.11  4.49   5.46
1.96
   0.70    9.14      46.58  * 0.012  0.33  0.33  5.17  5.17  7.78   9.14
2.64
   0.80   13.39      50.83  * 0.012  0.33  0.33  7.55  7.55 11.57  13.39
3.42
   0.90   18.21      55.65  * 0.012  0.33  0.33 10.25 10.25 15.87  18.21
4.31
   1.00   23.59      61.03  * 0.012  0.33  0.33 13.26 13.26 20.67  23.59
5.30
   1.10   29.55      66.99  * 0.012  0.33  0.33 16.59 16.59 25.98  29.55
6.40
   1.20   36.07      73.51  * 0.012  0.33  0.33 20.24 20.24 31.80  36.07
7.60
   1.30   43.15      80.59  * 0.012  0.33  0.33 24.21 24.21 38.12  43.15
8.91
   1.40   50.80      88.24  * 0.012  0.33  0.33 28.50 28.50 44.94  50.80
10.32
   1.50   59.02      96.46  * 0.012  0.33  0.33 33.10 33.10 52.27  59.02
11.83
```

1.60	67.81	105.25	*	0.012	0.33	0.33	38.02	38.02	60.11	67.81	13.45
1.70	77.16	114.60	*	0.012	0.33	0.33	43.25	43.25	68.45	77.16	15.18
1.80	87.08	124.52	*	0.012	0.33	0.33	48.81	48.81	77.30	87.08	17.01
1.90	97.57	135.01	*	0.012	0.33	0.33	54.68	54.68	86.65	97.57	18.94
2.00	108.62	146.06	*	0.012	0.33	0.33	60.87	60.87	96.51	*****	20.98

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.31
Program License Number: 200510005
Run Date: 12/03/2014 6:29 PM

Input File Name: TDA2-VaultFC_BW.fld
Project Name: ELST - S Sammamish Segment A
Analysis Title: Basin flows for Concrete Detention Vault
Comments: Drainage basins for TDA2

PRECIPITATION INPUT

Computational Time Step (Minutes): 60

Extended Precipitation Timeseries Selected
Climatic Region Number: 13

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 2

---------- Subbasin : U/S Basin to TDA 2 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	1.384
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.416
Subbasin Total	1.800

---------- Subbasin : TDA 2 - Sta 224+00 ----------

	-------Area(Acres) --------
Till Forest	0.710
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.000
Subbasin Total	0.710

----------SCENARIO: POSTDEVELOPED

Number of Subbasins: 2

---------- Subbasin : U/S Basin to TDA 2 ----------

	-------Area(Acres) --------
Till Forest	0.000
Till Pasture	0.000
Till Grass	1.384
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.416
Subbasin Total	1.800

---------- Subbasin : TDA 2 - Sta 224+00 ----------

	-------Area(Acres) --------
Till Forest	0.466
Till Pasture	0.000
Till Grass	0.000
Outwash Forest	0.000
Outwash Pasture	0.000
Outwash Grass	0.000
Wetland	0.000
Green Roof	0.000
User	0.000
Impervious	0.244
Subbasin Total	0.710

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 1

Link Name: New Copy Lnk1
Link Type: Copy
Downstream Link: None

********** LINK DATA **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 1

Link Name: Detention Vault
Link Type: Structure
Downstream Link: None

Prismatic Pond Option Used
Pond Floor Elevation (ft) : 38.50
Riser Crest Elevation (ft) : 42.82
Max Pond Elevation (ft) : 43.79
Storage Depth (ft) : 4.32
Pond Bottom Length (ft) : 72.0
Pond Bottom Width (ft) : 10.0
Pond Side Slopes (ft/ft) : L1= 0.00 L2= 0.00 W1= 0.00 W2= 0.00
Bottom Area (sq-ft) : 720.
Area at Riser Crest El (sq-ft) : 720.
(acres) : 0.017
Volume at Riser Crest (cu-ft) : 3,110.
(ac-ft) : 0.071
Area at Max Elevation (sq-ft) : 720.
(acres) : 0.017
Vol at Max Elevation (cu-ft) : 3,881.
(ac-ft) : 0.089

Massmann Infiltration Option Used
Hydraulic Conductivity (in/hr) : 0.00
Depth to Water Table (ft) : 100.00
Bio-Fouling Potential : Low
Maintenance : Average or Better

Riser Geometry
Riser Structure Type : Circular
Riser Diameter (in) : 18.00
Common Length (ft) : 0.020
Riser Crest Elevation : 42.82 ft

Hydraulic Structure Geometry

Number of Devices: 2

--- Device Number 1 ---

Device Type : Circular Orifice with Backwater
Control Elevation (ft) : 36.50
Diameter (in) : 1.50
Orientation : Horizontal

Tailwater Rating Table

Stage (ft)	Discharge (cfs)
38.63	0.100
38.69	0.200
38.73	0.300
38.77	0.400
40.23	0.500
43.37	0.600
47.17	0.700

--- Device Number 2 ---
Device Type : Vertical Rectangular Orifice
Control Elevation (ft) : 39.17
Length (in) : 0.25
Height (in) : 43.78
Orientation : Vertical
Elbow : No

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 2
Number of Links: 1

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 2
Number of Links: 1

********** Link: Detention Vault ********** Link WSEL Stats
WSEL Frequency Data(ft)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	WSEL Peak (ft)
1.05-Year	39.511
1.11-Year	39.656
1.25-Year	39.902
2.00-Year	40.283
3.33-Year	40.716
5-Year	41.011
10-Year	41.399
25-Year	41.686
50-Year	42.463
100-Year	42.696

*************Groundwater Recharge Summary ***************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: U/S Basin to TDA 2	170.122
Subbasin: TDA 2 - Sta 224+00	123.105
Link: New Copy Lnk1	Not Applicable
Total:	293.226

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: U/S Basin to TDA 2	170.122
Subbasin: TDA 2 - Sta 224+00	80.798
Link: Detention Vault	0.000
Total:	250.920

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 1.856 ac-ft/year, Post Developed: 1.588 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 1

----------SCENARIO: POSTDEVELOPED

Number of Links: 1

********** Link: Detention Vault **********

Basic Wet Pond Volume (91% Exceedance): 5166. cu-ft
Computed Large Wet Pond Volume, 1.5*Basic Volume: 7750. cu-ft

Infiltration/Filtration Statistics----------
Total Runoff Volume (ac-ft): 610.08
Total Runoff Infiltrated (ac-ft): 0.00, 0.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Percent Treated (Infiltrated+Filtered)/Total Volume: 0.00%

*************Compliance Point Results ***************

Scenario Predeveloped Compliance Link: New Copy Lnk1
Scenario Postdeveloped Compliance Link: Detention Vault

***** Point of Compliance Flow Frequency Data *****

Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	0.198	2-Year	0.142
5-Year	0.283	5-Year	0.231
10-Year	0.369	10-Year	0.285
25-Year	0.508	25-Year	0.332
50-Year	0.576	50-Year	0.445
100-Year	0.628	100-Year	0.487
200-Year	0.805	200-Year	0.840

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

****** Flow Duration Performance ******

Excursion at Predeveloped 50%Q2 (Must be Less Than 0%):	-6.6%	PASS
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than 0%):	-1.3%	PASS
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	-17.5%	PASS
Percent Excursion from Q2 to Q50 (Must be less than 50%):	0.0%	PASS

MEETS ALL FLOW DURATION DESIGN CRITERIA: PASS

BACKWATER COMPUTER PROGRAM FOR PIPES
Pipe data from file:DetVault224.bwp

Surcharge condition at intermediate junctions
Tailwater Elevation:32.5 feet
Discharge Range:0.05 to 0.5 Step of 0.05 [cfs]
Overflow Elevation:43.8 feet
Weir:NONE
Upstream Velocity:3. feet/sec

PIPE NO. 1: 56 LF - 4"CP @ 5.25% OUTLET: 32.50 INLET: 35.44
INTYP: 5
JUNC NO. 1: OVERFLOW-EL: 38.00 BEND: 69 DEG DIA/WIDTH: 1.0 Q-RATIO: 0.00

Q(CFS)	HW(FT)	HW ELEV.	*	N-FAC	DC	DN	TW	DO	DE	HWO	HWI
0.05	0.16	35.60	*	0.012	0.13	0.08	0.00	0.08	0.13	*****	0.16
0.10	0.25	35.69	*	0.012	0.18	0.11	0.00	0.11	0.18	*****	0.25
0.15	0.33	35.77	*	0.012	0.22	0.13	0.00	0.13	0.22	*****	0.33
0.20	0.41	35.85	*	0.012	0.26	0.16	0.00	0.16	0.26	*****	0.41
0.25	0.52	35.96	*	0.012	0.28	0.18	0.00	0.18	0.28	*****	0.52
0.30	0.65	36.09	*	0.012	0.30	0.20	0.00	0.20	0.30	*****	0.65
0.35	0.81	36.25	*	0.012	0.32	0.22	0.00	0.22	0.32	*****	0.81
0.40	0.99	36.43	*	0.012	0.33	0.24	0.00	0.24	0.33	*****	0.99
0.45	1.20	36.64	*	0.012	0.33	0.27	0.00	0.27	0.33	*****	1.20
0.50	1.43	36.87	*	0.012	0.33	0.30	0.00	0.30	0.33	*****	1.43

PIPE NO. 2: 40 LF - 4"CP @ 5.00% OUTLET: 35.44 INLET: 37.44
INTYP: 5
JUNC NO. 2: OVERFLOW-EL: 38.44 BEND: 56 DEG DIA/WIDTH: 1.8 Q-RATIO: 0.00

Q(CFS)	HW(FT)	HW ELEV.	*	N-FAC	DC	DN	TW	DO	DE	HWO	HWI
0.05	0.16	37.60	*	0.012	0.13	0.08	0.16	0.16	0.13	*****	0.16

```
   0.10    0.25      37.69  * 0.012  0.18  0.11  0.25  0.25  0.18  *****
0.25
   0.15    0.33      37.77  * 0.012  0.22  0.14  0.33  0.33  0.22  *****
0.33
   0.20    0.41      37.85  * 0.012  0.26  0.16  0.41  0.41  0.26  *****
0.41
   0.25    0.53      37.97  * 0.012  0.28  0.18  0.52  0.52  0.28  *****
0.53
   0.30    0.67      38.11  * 0.012  0.30  0.20  0.65  0.65  0.30  *****
0.67
   0.35    0.83      38.27  * 0.012  0.32  0.22  0.81  0.81  0.32  *****
0.83
**************** OVERFLOW ENCOUNTERED AT   0.40 CFS DISCHARGE
*****************
******** OVERFLOW CONDITIONS CALCULATED ASSUMING SURCHARGE CONDITIONS
*********
   0.40    1.02      38.46  * 0.012  0.33  0.24  0.99  0.99  0.50   0.96
1.02
   0.45    1.69      39.13  * 0.012  0.33  0.27  1.20  1.20  1.10   1.69
1.24
   0.50    2.50      39.94  * 0.012  0.33  0.33  1.43  1.43  1.78   2.50
1.48


PIPE NO. 3:   14 LF -  6"CP   @  2.00%  OUTLET:  37.44  INLET:  37.72
INTYP: 5
JUNC NO. 3:  OVERFLOW-EL:  48.11  BEND: 90 DEG    DIA/WIDTH: 4.0  Q-
RATIO: 0.00

 Q(CFS)   HW(FT)   HW ELEV. * N-FAC   DC    DN    TW    DO    DE    HWO
HWI
***********************************************************************
******
   0.05    0.14      37.86  * 0.012  0.11  0.09  0.16  0.16  0.11  *****
0.14
   0.10    0.21      37.93  * 0.012  0.16  0.12  0.25  0.25  0.16  *****
0.21
   0.15    0.27      37.99  * 0.012  0.20  0.15  0.33  0.33  0.20  *****
0.27
   0.20    0.32      38.04  * 0.012  0.23  0.17  0.41  0.41  0.23  *****
0.32
   0.25    0.36      38.08  * 0.012  0.26  0.19  0.53  0.53  0.26  *****
0.36
   0.30    0.49      38.21  * 0.012  0.28  0.21  0.67  0.67  0.42   0.49
0.41
   0.35    0.68      38.40  * 0.012  0.31  0.23  0.83  0.83  0.60   0.68
0.45
   0.40    0.90      38.62  * 0.012  0.33  0.24  1.02  1.02  0.80   0.90
0.50
   0.45    1.61      39.33  * 0.012  0.35  0.26  1.69  1.69  1.48   1.61
0.54
   0.50    2.47      40.19  * 0.012  0.37  0.28  2.50  2.50  2.32   2.47
0.59
```

PIPE NO. 4: 85 LF - 12"CP @ 0.74% OUTLET: 37.72 INLET: 38.35
INTYP: 5
JUNC NO. 4: OVERFLOW-EL: 48.06 BEND: 90 DEG DIA/WIDTH: 4.0 Q-
RATIO: 0.00

Q(CFS)	HW(FT)	HW ELEV.	*	N-FAC	DC	DN	TW	DO	DE	HWO	HWI
0.05	0.12	38.47	*	0.012	0.10	0.09	0.14	0.14	0.10	*****	0.12
0.10	0.17	38.52	*	0.012	0.13	0.12	0.21	0.21	0.13	*****	0.17
0.15	0.21	38.56	*	0.012	0.16	0.15	0.27	0.27	0.16	*****	0.21
0.20	0.24	38.59	*	0.012	0.19	0.17	0.32	0.32	0.19	*****	0.24
0.25	0.28	38.63	*	0.012	0.21	0.19	0.36	0.36	0.21	*****	0.28
0.30	0.30	38.65	*	0.012	0.23	0.21	0.49	0.49	0.23	*****	0.30
0.35	0.33	38.68	*	0.012	0.25	0.22	0.68	0.68	0.25	*****	0.33
0.40	0.40	38.75	*	0.012	0.27	0.24	0.90	0.90	0.32	0.40	0.36
0.45	1.01	39.36	*	0.012	0.28	0.25	1.61	1.61	1.00	1.01	0.38
0.50	1.87	40.22	*	0.012	0.30	0.27	2.47	2.47	1.86	1.87	0.40

PIPE NO. 5: 25 LF - 12"CP @ 0.52% OUTLET: 38.37 INLET: 38.50
INTYP: 5

Q(CFS)	HW(FT)	HW ELEV.	*	N-FAC	DC	DN	TW	DO	DE	HWO	HWI
0.05	0.10	38.60	*	0.012	0.10	0.10	0.10	0.10	0.10	-0.01	-0.02
0.10	0.13	38.63	*	0.012	0.13	0.13	0.15	0.15	0.13	0.05	0.03
0.15	0.16	38.66	*	0.012	0.16	0.16	0.19	0.19	0.16	0.10	0.07
0.20	0.19	38.69	*	0.012	0.19	0.19	0.22	0.22	0.19	0.14	0.11
0.25	0.21	38.71	*	0.012	0.21	0.21	0.26	0.26	0.21	0.17	0.14
0.30	0.23	38.73	*	0.012	0.23	0.23	0.28	0.28	0.23	0.20	0.16
0.35	0.25	38.75	*	0.012	0.25	0.24	0.31	0.31	0.25	*****	0.24

0.40	0.27	38.77	*	0.012	0.27	0.26	0.38	0.38	0.27	*****	0.26
0.45	0.87	39.37	*	0.012	0.28	0.28	0.99	0.99	0.87	0.74	0.24
0.50	1.73	40.23	*	0.012	0.30	0.29	1.85	1.85	1.73	1.60	0.29

STORM SEWER DESIGN (English Units)

This spreadsheet accomplishes a storm sewer design using the rational method. Enter the data in the non-shaded areas only.
Please use one spreadsheet per stormsewer run.

Project Name: ELST - S Sammamish Segment A

Designed By: Enter Here
Project Office: Enter Here

m = 6.89 **n =** 0.539 **Design Storm Event =** 25-yr MRI **Pavement thickness (ft) =** 0.5 **Pipe Thickness (inches) =** 2

Location														Discharge Drain Design							Drain Profile										Remarks
Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T_c Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	Pipe Capacity Check (Column 13 vs. Column 17)	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)	Upstr. Ground Elev. (ft)	Downstr. Ground Elev. (ft)	Upstr. Pipe Cover (ft)	Downstr. Pipe Cover (ft)	Upstr. Pipe Cover Check (ft)	Downstr. Pipe Cover Check (ft)	
1	2	3	4	5	6	7	8	8a	9	10	11	12	13	14	14a	15	16	17	17a	17b	18	19	20	21	22	23	24	25	26	27	24
ELST	230+00 RT	229+90 LT	Off-site Basin	0.00	0.00	0.00	0.00	5.0	0.0	2.89	0.00	3.37	3.37	18	0.013	0.1116	19.85	35.06	TRY TO REDUCE VELOCITY	ADEQUATE PIPE CAPACITY	37	4.13	44.60	40.47	44.60	42.05	-2.17	-0.59	Not Enough Cover - Need to Revise Pipe Elevations	Not Enough Cover - Need to Revise Pipe Elevations	Surveyed info, D/S SD system is undersized
ELS ShoreLn	229+90 LT	228+93 LT	ELS Shore Ln	0.01	0.90	0.01	0.01	5.0	5.0	2.89	0.03		3.39	12	0.013	0.0231	6.89	5.40	VELOCITY OK	ADEQUATE PIPE CAPACITY	85	1.96	40.13	38.17	42.05	41.93	0.25	2.09	Not Enough Cover - Need to Revise Pipe Elevations	More than 2 ft of cover	Surveyed info, D/S SD system is undersized
ELS ShoreLn	228+93 LT	228+93 LT	ELS Shore Ln	0.00	0.00	0.00	0.01	5.0	5.2	2.83	0.03		3.39	12	0.013	0.0777	12.64	9.92	TRY TO REDUCE VELOCITY	ADEQUATE PIPE CAPACITY	118	9.17	38.17	29.00	41.93	31.50	2.09	0.83	More than 2 ft of cover	Low Cover - See Notes at Bottom	Outfall location and IE is guess based on property owner suggestion

See WSDOT Hydraulic Manual 6-5 for explanation of columns. http://www.wsdot.wa.gov/eesc/design/hydraulics/

Notes: Column 12 represents inflow from a storm sewer line, branch, an offsite source that flows into the trunk line being analyzed.
The conservative assumption is that the flow enters the storm sewer run at the upstream end of the run being analyzed.

For pipe cover calculation, Pipe cover = (Ground or Rim Elevation - Pipe invert elevation) - (pavement thickness) - (top of pipe thickness) - (pipe diameter).
The pipe thickness is based on the pipe diameter per WSDOT Manual Concrete for Shallow Pipe Cover Installations Fill Height Table 8-11.2
Please specify the largest pipe thickness of the storm sewer run being analyzed.

The spreadsheet will only calculate one storm sewer line at a time. Please copy the "Blank Template" and use this for calculating new storm sewer lines.
If analyzing complicated stormsewer system with multiple lateral lines to the trunk line, it is recommended that Stormshed be used to
model the conveyance system. Please contact your region Hydraulic Contact.

WARNING: START YOUR STORMSEWER RUN ON ROW 12. DO NOT SKIP ANY ROWS IN BETWEEN. USE ONE SHEET PER STORMSEWER RUN

Please report any problems to the WSDOT HQ Hydraulics Office.

STORM SEWER DESIGN (English Units)

This spreadsheet accomplishes a storm sewer design using the rational method. Enter the data in the non-shaded areas only.
Please use one spreadsheet per stormsewer run.

Project Name: ELST - S Sammamish Segment A

Designed By: C. Buitrago
Project Office: Enter Here

m = 6.89 **n =** 0.539 **Design Storm Event =** 25-yr MRI **Pavement thickness (ft) =** 0.5 **Pipe Thickness (inches) =** 2

Location														Discharge Drain Design							Drain Profile										Remarks
Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T_c Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	Pipe Capacity Check (Column 13 vs. Column 17)	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)	Upstr. Ground Elev. (ft)	Downstr. Ground Elev. (ft)	Upstr. Pipe Cover (ft)	Downstr. Pipe Cover (ft)	Upstr. Pipe Cover Check (ft)	Downstr. Pipe Cover Check (ft)	
1	2	3	4	5	6	7	8	8a	9	10	11	12	13	14	14a	15	16	17	17a	17b	18	19	20	21	22	23	24	25	26	27	24
ELST	229+85 RT	229+85 RT	Off-site Basin	0.00	0.00	0.00	0.00	5.0	0.0	2.89	0.00	3.37	3.37	18	0.013	0.0300	10.29	18.17	TRY TO REDUCE VELOCITY	ADEQUATE PIPE CAPACITY	14	0.42	45.12	44.70	45.12	49.14	-2.17	2.27	Not Enough Cover - Need to Revise Pipe Elevations	More than 2 ft of cover	Culvert inlet to drop Catch Basin
ELS ShoreLn	229+95 RT	229+95 LT	ELS Shore Ln	0.00	0.00	0.00	0.00	5.0	0.0	2.89	0.00	0.00	3.37	18	0.013	0.0267	9.70	17.14	VELOCITY OK	ADEQUATE PIPE CAPACITY	30	0.80	39.00	38.20	49.14	41.81	7.97	1.44	More than 2 ft of cover	Low Cover - See Notes at Bottom	
ELS ShoreLn	228+93 LT	228+93 LT	ELS Shore Ln	0.00	0.00	0.00	0.00	5.0	0.1	2.89	0.00	0.00	3.37	18	0.013	0.0122	6.65	11.57	VELOCITY OK	ADEQUATE PIPE CAPACITY	88	1.07	38.20	37.13	41.81	40.30	1.44	1.00	Low Cover - See Notes at Bottom	Low Cover - See Notes at Bottom	Surveyed info, D/S SD system has reduced size
ELS ShoreLn	228+93 LT	228+93 LT	ELS Shore Ln	0.00	0.00	0.00	0.00	5.0	0.3	2.89	0.00	0.00	3.37	12	0.013	0.0631	11.39	8.94	TRY TO REDUCE VELOCITY	ADEQUATE PIPE CAPACITY	113	7.13	37.13	30.00	40.30	31.50	1.50	-0.17	Low Cover - See Notes at Bottom	Not Enough Cover - Need to Revise Pipe Elevations	Outfall IE is approximate based on survey in vicinity

See WSDOT Hydraulic Manual 6-5 for explanation of columns. http://www.wsdot.wa.gov/eesc/design/hydraulics/

Notes: Column 12 represents inflow from a storm sewer line, branch, an offsite source that flows into the trunk line being analyzed.
The conservative assumption is that the flow enters the storm sewer run at the upstream end of the run being analyzed.

For pipe cover calculation, Pipe cover = (Ground or Rim Elevation - Pipe invert elevation) - (pavement thickness) - (top of pipe thickness) - (pipe diameter).
The pipe thickness is based on the pipe diameter per WSDOT Manual Concrete for Shallow Pipe Cover Installations Fill Height Table 8-11.2
Please specify the largest pipe thickness of the storm sewer run being analyzed.

The spreadsheet will only calculate one storm sewer line at a time. Please copy the "Blank Template" and use this for calculating new storm sewer lines.
If analyzing complicated stormsewer system with multiple lateral lines to the trunk line, it is recommended that Stormshed be used to
model the conveyance system. Please contact your region Hydraulic Contact.

WARNING: START YOUR STORMSEWER RUN ON ROW 12. DO NOT SKIP ANY ROWS IN BETWEEN. USE ONE SHEET PER STORMSEWER RUN

Please report any problems to the WSDOT HQ Hydraulics Office.

BACKWATER COMPUTER PROGRAM FOR PIPES
Pipe data from file:ELST230.bwp

Surcharge condition at intermediate junctions
Tailwater Elevation:30. feet
Discharge Range:3. to 6. Step of 0.5 [cfs]
Overflow Elevation:49.3 feet
Weir:NONE
Upstream Velocity:3. feet/sec

PIPE NO. 1: 113 LF - 12"CP @ 6.31% OUTLET: 30.00 INLET: 37.13
INTYP: 5
JUNC NO. 1: OVERFLOW-EL: 40.30 BEND: 60 DEG DIA/WIDTH: 4.0 Q-RATIO: 0.00

Q(CFS)	HW(FT)	HW ELEV.	*	N-FAC	DC	DN	TW	DO	DE	HWO	HWI
3.00	1.20	38.33	*	0.012	0.75	0.39	0.00	0.39	0.75	*****	1.20
3.50	1.41	38.54	*	0.012	0.80	0.42	0.00	0.42	0.80	*****	1.41
4.00	1.64	38.77	*	0.012	0.85	0.45	0.00	0.45	0.85	*****	1.64
4.50	1.91	39.04	*	0.012	0.89	0.48	0.00	0.48	0.89	*****	1.91
5.00	2.21	39.34	*	0.012	0.92	0.51	0.00	0.51	0.92	*****	2.21
5.50	2.53	39.66	*	0.012	0.94	0.54	0.00	0.54	0.94	*****	2.53
6.00	2.89	40.02	*	0.012	0.96	0.57	0.00	0.57	0.96	*****	2.89

PIPE NO. 2: 88 LF - 18"CP @ 1.22% OUTLET: 37.13 INLET: 38.20
INTYP: 5
JUNC NO. 2: OVERFLOW-EL: 41.81 BEND: 90 DEG DIA/WIDTH: 4.0 Q-RATIO: 0.00

Q(CFS)	HW(FT)	HW ELEV.	*	N-FAC	DC	DN	TW	DO	DE	HWO	HWI
3.00	0.94	39.14	*	0.012	0.66	0.50	1.20	1.20	0.66	*****	0.94
3.50	1.04	39.24	*	0.012	0.72	0.55	1.41	1.41	0.72	*****	1.04
4.00	1.13	39.33	*	0.012	0.77	0.59	1.64	1.64	0.77	*****	1.13
4.50	1.32	39.52	*	0.012	0.82	0.63	1.91	1.91	0.91	1.32	1.23

```
   5.00    1.55      39.75  * 0.012  0.87  0.66  2.21  2.21  1.28   1.55
1.32
   5.50    1.95      40.15  * 0.012  0.91  0.70  2.53  2.53  1.68   1.95
1.42
   6.00    2.40      40.60  * 0.012  0.95  0.74  2.89  2.89  2.07   2.40
1.51


PIPE NO. 3:   30 LF - 18"CP   @  2.67%  OUTLET:  38.20  INLET:  39.00
INTYP: 5
JUNC NO. 3:  OVERFLOW-EL:  49.14  BEND:  0 DEG    DIA/WIDTH: 4.0  Q-
RATIO: 0.00

 Q(CFS)   HW(FT)   HW ELEV. * N-FAC   DC    DN    TW    DO    DE    HWO
HWI
***************************************************************************
******
   3.00    0.87      39.87  * 0.012  0.66  0.41  0.94  0.94  0.66  *****
0.87
   3.50    0.95      39.95  * 0.012  0.72  0.45  1.04  1.04  0.72  *****
0.95
   4.00    1.02      40.02  * 0.012  0.77  0.48  1.13  1.13  0.77  *****
1.02
   4.50    1.09      40.09  * 0.012  0.82  0.51  1.32  1.32  0.82  *****
1.09
   5.00    1.15      40.15  * 0.012  0.87  0.54  1.55  1.55  0.87  *****
1.15
   5.50    1.21      40.21  * 0.012  0.91  0.56  1.95  1.95  0.91  *****
1.21
   6.00    1.77      40.77  * 0.012  0.95  0.59  2.40  2.40  1.68   1.77
1.27


PIPE NO. 4:   14 LF - 18"CP   @  3.00%  OUTLET:  44.70  INLET:  45.12
INTYP: 4

 Q(CFS)   HW(FT)   HW ELEV. * N-FAC   DC    DN    TW    DO    DE    HWO
HWI
***************************************************************************
******
   3.00    0.76      45.88  * 0.012  0.66  0.40  0.00  0.40  0.66  *****
0.76
   3.50    0.85      45.97  * 0.012  0.72  0.43  0.00  0.43  0.72  *****
0.85
   4.00    0.93      46.05  * 0.012  0.77  0.46  0.00  0.46  0.77  *****
0.93
   4.50    1.01      46.13  * 0.012  0.82  0.49  0.00  0.49  0.82  *****
1.01
   5.00    1.09      46.21  * 0.012  0.87  0.52  0.00  0.52  0.87  *****
1.09
   5.50    1.16      46.28  * 0.012  0.91  0.55  0.00  0.55  0.91  *****
1.16
   6.00    1.24      46.36  * 0.012  0.95  0.57  0.00  0.57  0.95  *****
1.24
```

Worksheet for STA 256+35 Exist - Q25

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.15850	ft/ft
Diameter	1.50	ft
Discharge	22.66	ft^3/s

Results

Normal Depth	0.79	ft
Flow Area	0.94	ft^2
Wetted Perimeter	2.43	ft
Hydraulic Radius	0.39	ft
Top Width	1.50	ft
Critical Depth	1.48	ft
Percent Full	52.4	%
Critical Slope	0.04240	ft/ft
Velocity	24.14	ft/s
Velocity Head	9.06	ft
Specific Energy	9.84	ft
Froude Number	5.38	
Maximum Discharge	44.98	ft^3/s
Discharge Full	41.82	ft^3/s
Slope Full	0.04654	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	52.45	%
Downstream Velocity	Infinity	ft/s

Worksheet for STA 256+35 Exist - Q25

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.79	ft
Critical Depth	1.48	ft
Channel Slope	0.15850	ft/ft
Critical Slope	0.04240	ft/ft

Worksheet for STA 256+35 Exist - Q100

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.15850	ft/ft
Diameter	1.50	ft
Discharge	39.88	ft^3/s

Results

Normal Depth	1.17	ft
Flow Area	1.48	ft^2
Wetted Perimeter	3.25	ft
Hydraulic Radius	0.46	ft
Top Width	1.24	ft
Critical Depth	1.50	ft
Percent Full	78.1	%
Critical Slope	0.13983	ft/ft
Velocity	26.94	ft/s
Velocity Head	11.28	ft
Specific Energy	12.45	ft
Froude Number	4.35	
Maximum Discharge	44.98	ft^3/s
Discharge Full	41.82	ft^3/s
Slope Full	0.14415	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	78.09	%
Downstream Velocity	Infinity	ft/s

Worksheet for STA 256+35 Exist - Q100

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.17	ft
Critical Depth	1.50	ft
Channel Slope	0.15850	ft/ft
Critical Slope	0.13983	ft/ft

STORM SEWER DESIGN (English Units)

This spreadsheet accomplishes a storm sewer design using the rational method. Enter the data in the non-shaded areas only.
Please use one spreadsheet per stormsewer run.

Project Name: ELST - S Sammamish Segment A

Designed By: C. Buitrago
Project Office: N/A

m = 6.89 **n =** 0.539 **Design Storm Event =** 25-yr MRI **Pavement thickness (ft) =** 0.5 **Pipe Thickness (inches) =** 2

Location														Discharge	Drain Design						Drain Profile										Remarks
Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T_c Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	Pipe Capacity Check (Column 13 vs. Column 17)	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)	Upstr. Ground Elev. (ft)	Downstr. Ground Elev. (ft)	Upstr. Pipe Cover (ft)	Downstr. Pipe Cover (ft)	Upstr. Pipe Cover Check (ft)	Downstr. Pipe Cover Check (ft)	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*8a*	*9*	*10*	*11*	*12*	*13*	*14*	*14a*	*15*	*16*	*17*	*17a*	*17b*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*24*
ELST	256+35 RT	256+35 LT	Off-site Basin	0.00	0.00	0.00	0.00	5.0	0.0	2.89	0.00	22.66	22.66	18	0.014	0.1585	21.97	38.80	TRY TO REDUCE VELOCITY	ADEQUATE PIPE CAPACITY	41	6.50	51.21	44.71	51.41	44.71	-1.97	-2.17	Not Enough Cover - Need to Revise Pipe Elevations	Not Enough Cover - Need to Revise Pipe Elevations	Existing stream culvert at trail, outfall to open concrete basin
ELS ShoreLn	256+35 LT	256+35 LT	Shore Lane	0.00	0.00	0.00	0.00	5.0	0.0	2.89	0.00	0.00	22.66	12	0.014	0.0500	9.42	7.39	VELOCITY OK	NEED MORE CAPACITY	40	2.00	39.00	37.00	44.18	43.00	3.51	4.33	More than 2 ft of cover	More than 2 ft of cover	Existing culvert beneath ELS Shore Ln SE, assume 5% slope outfall on private property

See WSDOT Hydraulic Manual 6-5 for explanation of columns. http://www.wsdot.wa.gov/eesc/design/hydraulics/

Notes:

Column 12 represents inflow from a storm sewer line, branch, an offsite source that flows into the trunk line being analyzed.
The conservative assumption is that the flow enters the storm sewer run at the upstream end of the run being analyzed.

For pipe cover calculation, Pipe cover = (Ground or Rim Elevation - Pipe invert elevation) - (pavement thickness) - (top of pipe thickness) - (pipe diameter).
The pipe thickness is based on the pipe diameter per WSDOT Manual Concrete for Shallow Pipe Cover Installations Fill Height Table 8-11.2
Please specify the largest pipe thickness of the storm sewer run being analyzed.

The spreadsheet will only calculate one storm sewer line at a time. Please copy the "Blank Template" and use this for calculating new storm sewer lines.
If analyzing complicated stormsewer system with multiple lateral lines to the trunk line, it is recommended that Stormshed be used to model the conveyance system. Please contact your region Hydraulic Contact.

WARNING: START YOUR STORMSEWER RUN ON ROW 12. DO NOT SKIP ANY ROWS IN BETWEEN. USE ONE SHEET PER STORMSEWER RUN

Please report any problems to the WSDOT HQ Hydraulics Office.

APPENDIX D

Operation and Maintenance Requirements

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NO. 5 – CATCH BASINS AND MANHOLES

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Structure	Sediment	Sediment exceeds 60% of the depth from the bottom of the catch basin to the invert of the lowest pipe into or out of the catch basin or is within 6 inches of the invert of the lowest pipe into or out of the catch basin.	Sump of catch basin contains no sediment.
	Trash and debris	Trash or debris of more than ½ cubic foot which is located immediately in front of the catch basin opening or is blocking capacity of the catch basin by more than 10%.	No Trash or debris blocking or potentially blocking entrance to catch basin.
		Trash or debris in the catch basin that exceeds $^1/_3$ the depth from the bottom of basin to invert the lowest pipe into or out of the basin.	No trash or debris in the catch basin.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within catch basin.
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.
	Damage to frame and/or top slab	Corner of frame extends more than ¾ inch past curb face into the street (If applicable).	Frame is even with curb.
		Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in walls or bottom	Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering catch basin through cracks, or maintenance person judges that catch basin is unsound.	Catch basin is sealed and structurally sound.
		Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	No cracks more than $^1/_4$ inch wide at the joint of inlet/outlet pipe.
	Settlement/ misalignment	Catch basin has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the catch basin at the joint of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.

NO. 5 – CATCH BASINS AND MANHOLES

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Metal Grates (Catch Basins)	Unsafe grate opening	Grate with opening wider than $^{7}/_{8}$ inch.	Grate opening meets design standards.
	Trash and debris	Trash and debris that is blocking more than 20% of grate surface.	Grate free of trash and debris. footnote to guidelines for disposal
	Damaged or missing	Grate missing or broken member(s) of the grate. **Any open structure requires urgent maintenance**.	Grate is in place and meets design standards.
Manhole Cover/Lid	Cover/lid not in place	Cover/lid is missing or only partially in place. **Any open structure requires urgent maintenance**.	Cover/lid protects opening to structure.
	Locking mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to Remove	One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.	Cover/lid can be removed and reinstalled by one maintenance person.

NO. 6 – CONVEYANCE PIPES AND DITCHES

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Pipes	Sediment & debris accumulation	Accumulated sediment or debris that exceeds 20% of the diameter of the pipe.	Water flows freely through pipes.
	Vegetation/roots	Vegetation/roots that reduce free movement of water through pipes.	Water flows freely through pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Damage to protective coating or corrosion	Protective coating is damaged; rust or corrosion is weakening the structural integrity of any part of pipe.	Pipe repaired or replaced.
	Damaged	Any dent that decreases the cross section area of pipe by more than 20% or is determined to have weakened structural integrity of the pipe.	Pipe repaired or replaced.
Ditches	Trash and debris	Trash and debris exceeds 1 cubic foot per 1,000 square feet of ditch and slopes.	Trash and debris cleared from ditches.
	Sediment accumulation	Accumulated sediment that exceeds 20% of the design depth.	Ditch cleaned/flushed of all sediment and debris so that it matches design.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Vegetation	Vegetation that reduces free movement of water through ditches.	Water flows freely through ditches.
	Erosion damage to slopes	Any erosion observed on a ditch slope.	Slopes are not eroding.
	Rock lining out of place or missing (If Applicable)	One layer or less of rock exists above native soil area 5 square feet or more, any exposed native soil.	Replace rocks to design standards.

NO. 8 – ENERGY DISSIPATERS

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed.
Site	Trash and debris	Trash and/or debris accumulation.	Dissipater clear of trash and/or debris.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
Rock Pad	Missing or moved Rock	Only one layer of rock exists above native soil in area five square feet or larger or any exposure of native soil.	Rock pad prevents erosion.
Dispersion Trench	Pipe plugged with sediment	Accumulated sediment that exceeds 20% of the design depth.	Pipe cleaned/flushed so that it matches design.
	Not discharging water properly	Visual evidence of water discharging at concentrated points along trench (normal condition is a “sheet flow” of water along trench).	Water discharges from feature by sheet flow.
	Perforations plugged.	Over 1/4 of perforations in pipe are plugged with debris or sediment.	Perforations freely discharge flow.
	Water flows out top of “distributor” catch basin.	Water flows out of distributor catch basin during any storm less than the design storm.	No flow discharges from distributor catch basin.
	Receiving area over-saturated	Water in receiving area is causing or has potential of causing landslide problems.	No danger of landslides.
Gabions	Damaged mesh	Mesh of gabion broken, twisted or deformed so structure is weakened or rock may fall out.	Mesh is intact, no rock missing.
	Corrosion	Gabion mesh shows corrosion through more than ¼ of its gage.	All gabion mesh capable of containing rock and retaining designed form.
	Collapsed or deformed baskets	Gabion basket shape deformed due to any cause.	All gabion baskets intact, structure stands as designed.
	Missing rock	Any rock missing that could cause gabion to loose structural integrity.	No rock missing.
Manhole/Chamber	Worn or damaged post, baffles or side of chamber	Structure dissipating flow deteriorates to ½ or original size or any concentrated worn spot exceeding one square foot which would make structure unsound.	Structure is in no danger of failing.
	Damage to wall, frame, bottom, and/or top slab	Cracks wider than ½-inch or any evidence of soil entering the structure through cracks, or maintenance inspection personnel determines that the structure is not structurally sound.	Manhole/chamber is sealed and structurally sound.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the structure at the joint of the inlet/outlet pipes.	No soil or water enters and no water discharges at the joint of inlet/outlet pipes.

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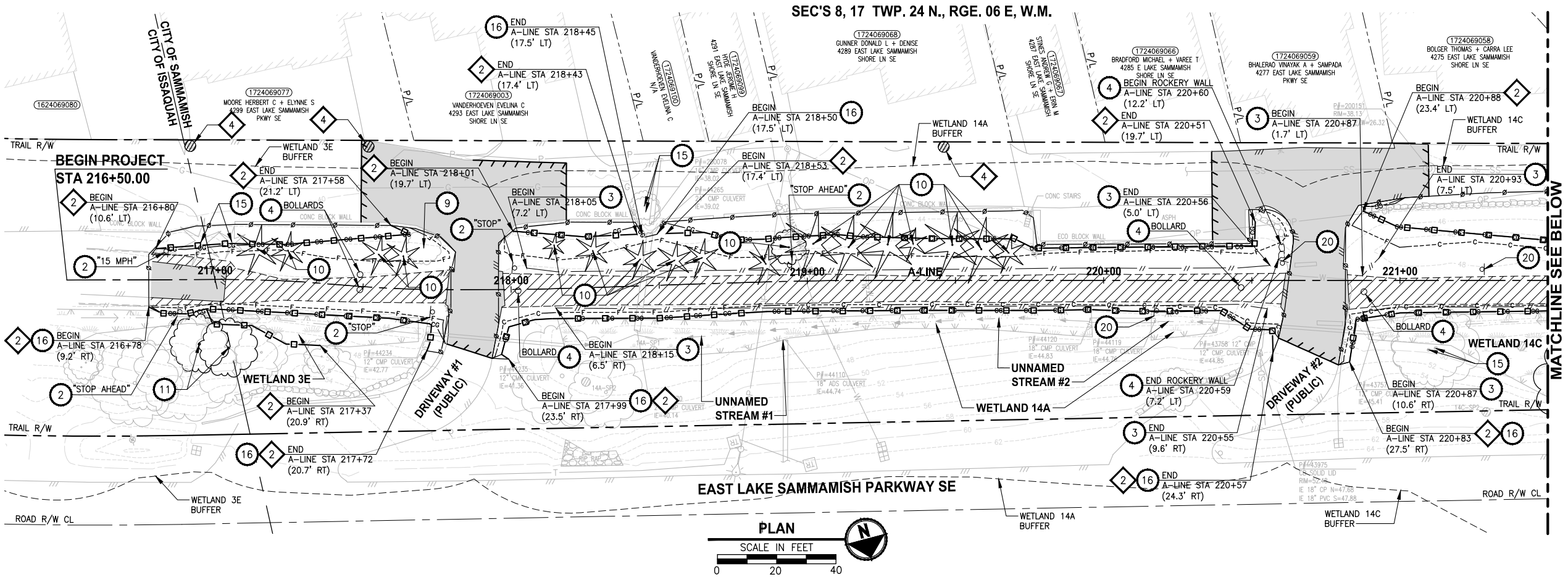
APPENDIX E

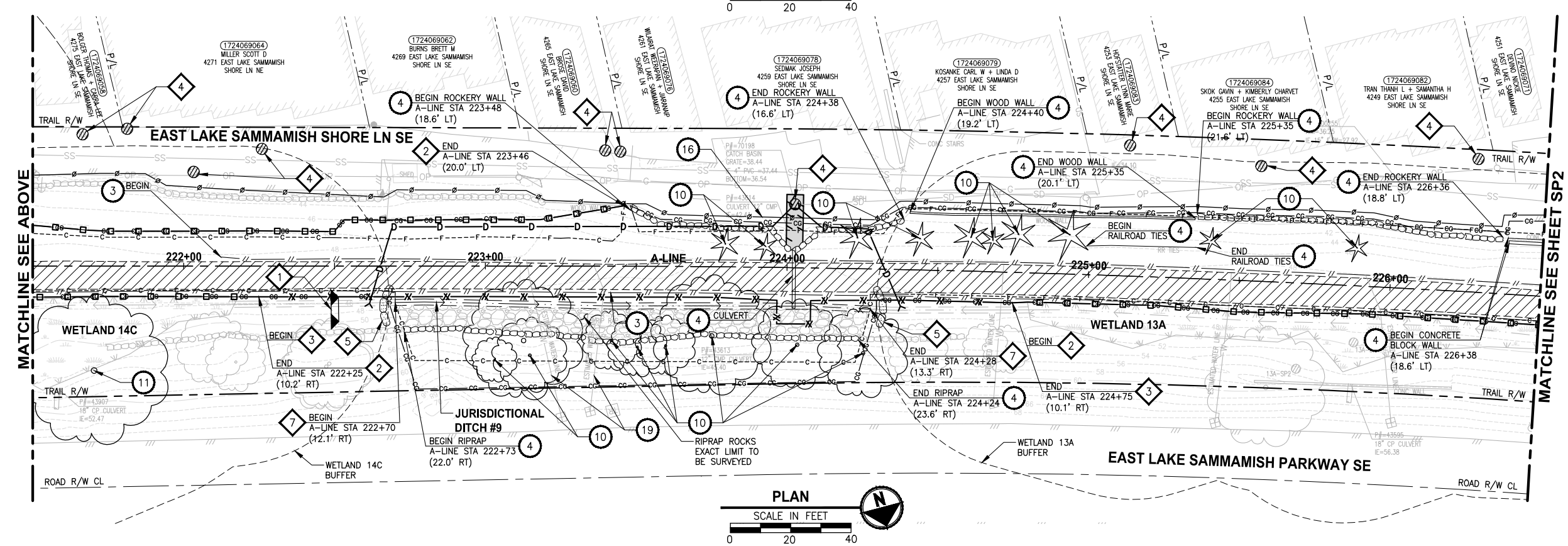
Geotechnical Report, Modret Technichal Memorandum, and Daily Field Report (CD)

APPENDIX F

Temporary Erosion and Sediment Control Plan

DRAFT





SITE PREPARATION NOTES:

1. REMOVE AND SALVAGE CHAIN LINK FENCE.
2. REMOVE AND SALVAGE SIGN.
3. REMOVE AND SALVAGE SPLIT RAIL FENCE.
4. REMOVAL OF STRUCTURE AND OBSTRUCTION.
5. REMOVE AND SALVAGE WOOD GUARDRAILS.
6. REMOVE AND SALVAGE CHAIN LINK GATE.
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8. RELOCATE TRASH CAN. SEE PS SHEETS.
9. PRUNE TREE FOR 10' VERTICAL CLEARANCE PER ARBORISTS' ASSESSMENT. TREE SHALL BE FLAGGED PRIOR TO PRUNING.
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TESC NOTES:

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5. SANDBAG DAM.
6. STABILIZED CONSTRUCTION ENTRANCE, PER WSDOT STANDARD DETAIL I-80.10-01.
7. TEMPORARILY BYPASS & DEWATER JURISDICTIONAL DITCH DURING VAULT CONSTRUCTION.

LEGEND:

- REMOVE EXISTING GRAVEL SURFACE
- REMOVE ASPHALT PAVEMENT
- INLET PROTECTION
- STABILIZED CONSTRUCTION ENTRANCE

GENERAL NOTE:

1. NO STAGING OR STOCKPILING WITHIN CRITICAL AREA BUFFERS, OR WITHIN THE VICINITY OF BALD EAGLE BREEDING AREA FROM STA 216+50 TO STA 226+75.

CITY OF SAMMAMISH APPROVAL	
City Engineer	Date
Community Development	Date

90 % REVIEW SUBMITTAL
NOT FOR CONSTRUCTION

REVISIONS	DATE	BY

DESIGNED J. JUN / C. BUITRAGO
DRAWN B. PURGANAN
CHECKED Y. HO
APPROVED

ONE INCH AT FULL SCALE. IF NOT, SCALE ACCORDINGLY
FILE NAME BL1521075P20T03SP-01
JOB No. 554-1521-075 P20T03
DATE DECEMBER 2014

YAMMIE Y. HO — STATE OF WASHINGTON — 14859 — REGISTERED PROFESSIONAL ENGINEER
CRAIG A. BUITRAGO — STATE OF WASHINGTON — 49427 — REGISTERED PROFESSIONAL ENGINEER

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ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES
719 2ND AVENUE, SUITE 200 | SEATTLE, WA 98104
P 206.394.3700
WWW.PARAMETRIX.COM

PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

SITE PREPARATION AND TESC PLAN

SHEET NO. 17 OF 79
SP1

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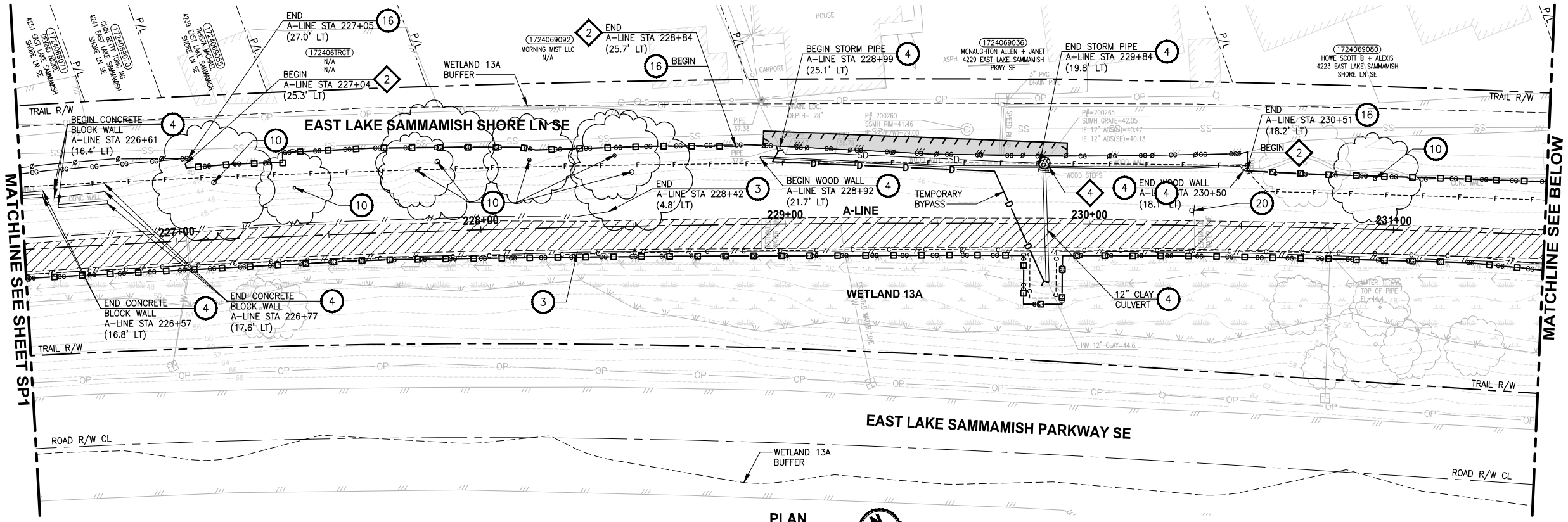

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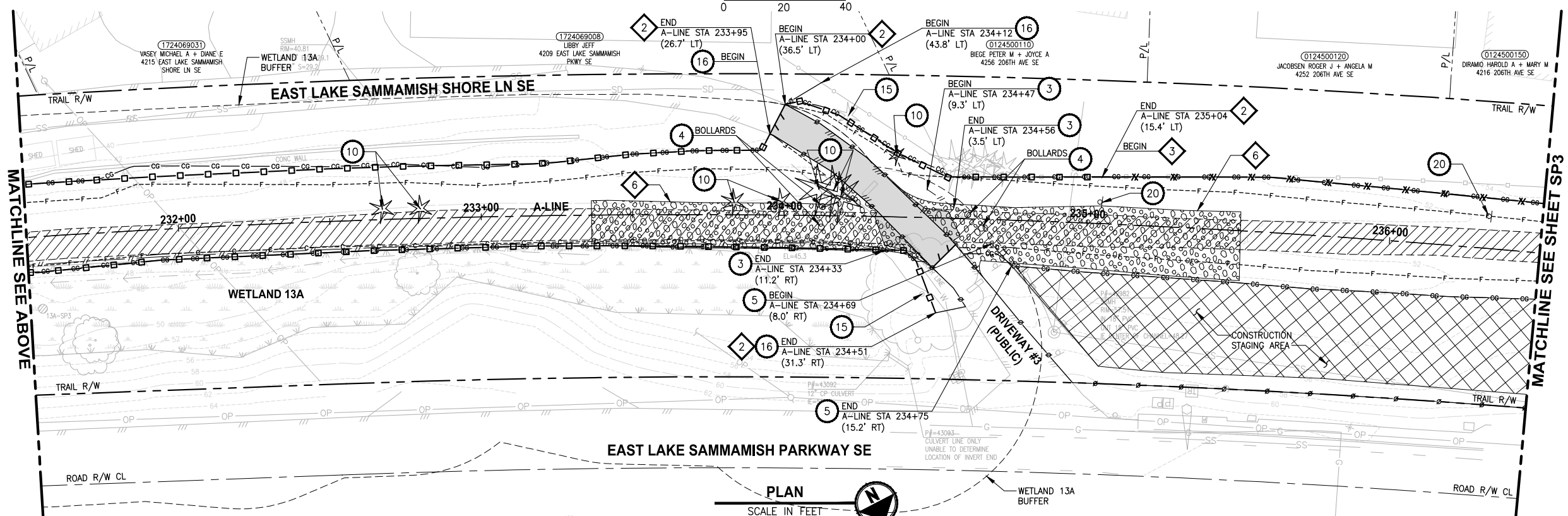

PLAN

SCALE IN FEET 0 20 40

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PROJECT NAME
EAST LAKE SAMMAMISH MASTER PLAN TRAIL SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

SITE PREPARATION AND TESC PLAN

SHEET NO. 18 OF 79
SP2

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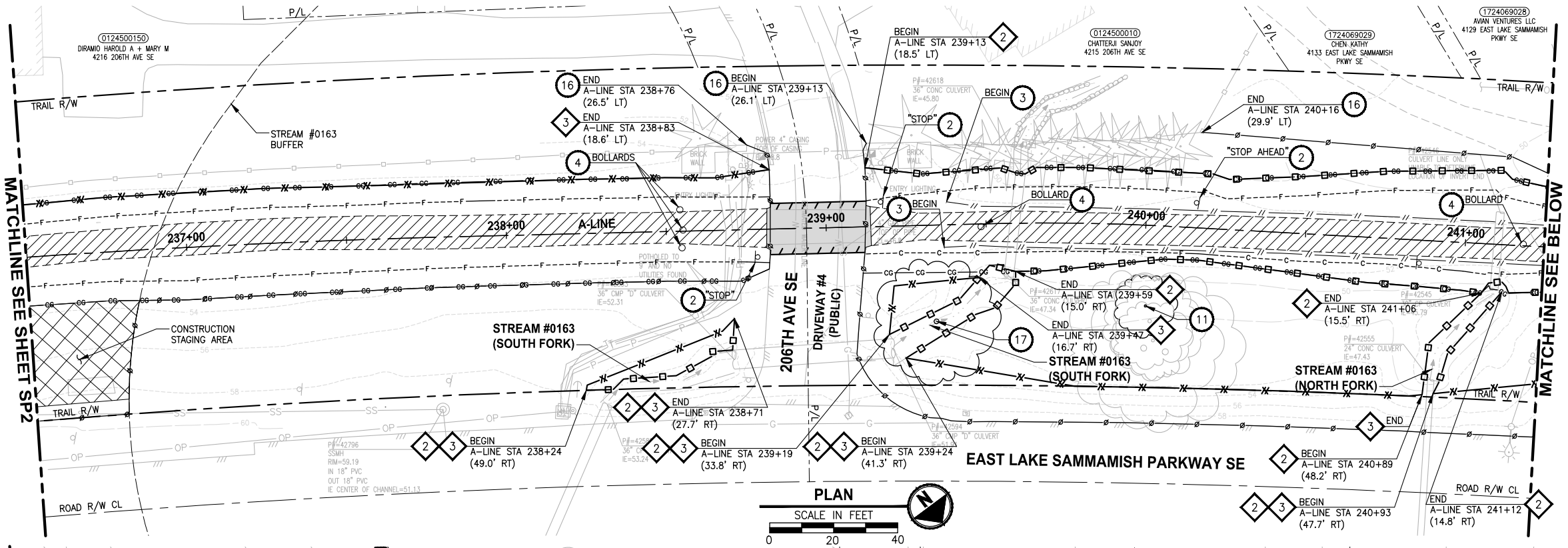

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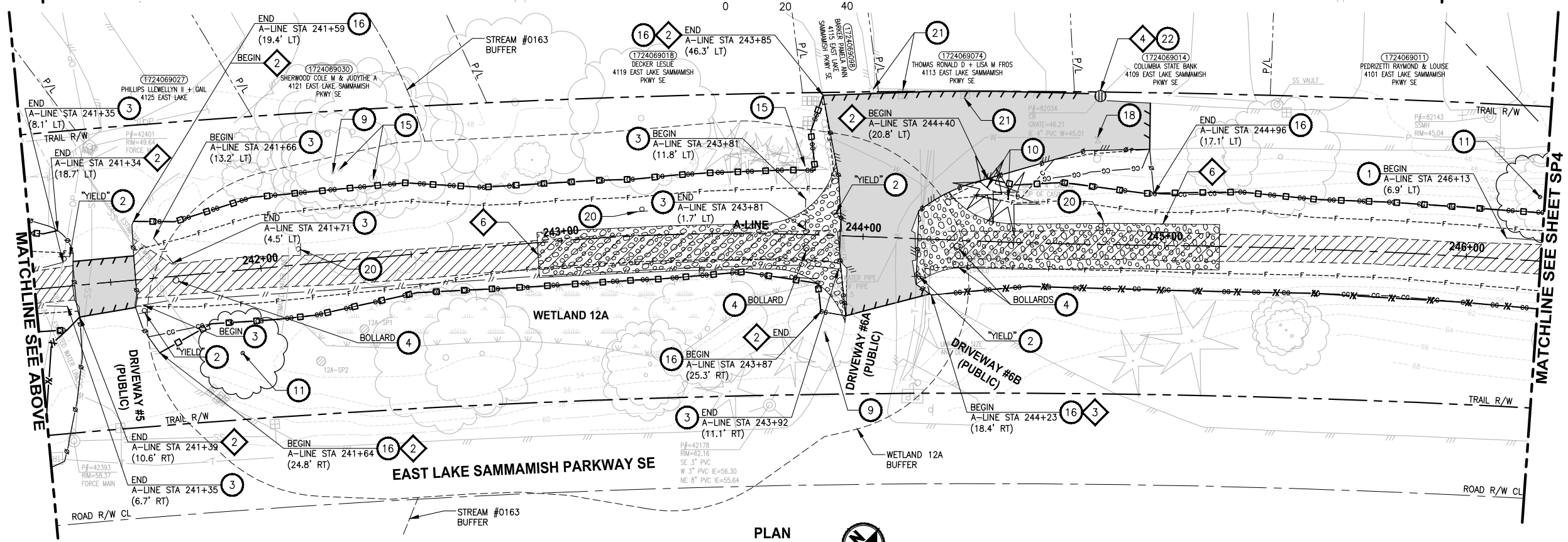

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4. STORM DRAIN INLET PROTECTION, PER WSDOT STANDARD DETAIL I-40.20-00.
5. SANDBAG DAM.
6. STABILIZED CONSTRUCTION ENTRANCE, PER WSDOT STANDARD DETAIL I-80.10-01.
7. TEMPORARILY BYPASS & DEWATER JURISDICTIONAL DITCH DURING VAULT CONSTRUCTION.

LEGEND:

- REMOVE EXISTING GRAVEL SURFACE
- REMOVE ASPHALT PAVEMENT
- INLET PROTECTION
- STABILIZED CONSTRUCTION ENTRANCE

GENERAL NOTE:

1. NO STAGING OR STOCKPILING WITHIN CRITICAL AREA BUFFERS, OR WITHIN THE VICINITY OF BALD EAGLE BREEDING AREA FROM STA 216+50 TO STA 226+75.

CITY OF SAMMAMISH APPROVAL	
City Engineer	Date
Community Development	Date

90 % REVIEW SUBMITTAL
NOT FOR CONSTRUCTION

REVISIONS	DATE	BY

DESIGNED J. JUN / C. BUITRAGO
DRAWN B. PURGANAN
CHECKED Y. HO
APPROVED

ONE INCH AT FULL SCALE. IF NOT, SCALE ACCORDINGLY
FILE NAME BL1521075P20T03SP-01
JOB No. 554-1521-075 P20T03
DATE DECEMBER 2014

TAMMIE Y. HO — STATE OF WASHINGTON — 14829 — REGISTERED PROFESSIONAL ENGINEER
CRAIG A. BUITRAGO — STATE OF WASHINGTON — 49427 — REGISTERED PROFESSIONAL ENGINEER

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PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

SITE PREPARATION AND TESC PLAN

SHEET NO. 19 OF 79
SP3

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PLOTTED BY: buitrara DATE: Friday, December 19, 2014 10:56:59 AM
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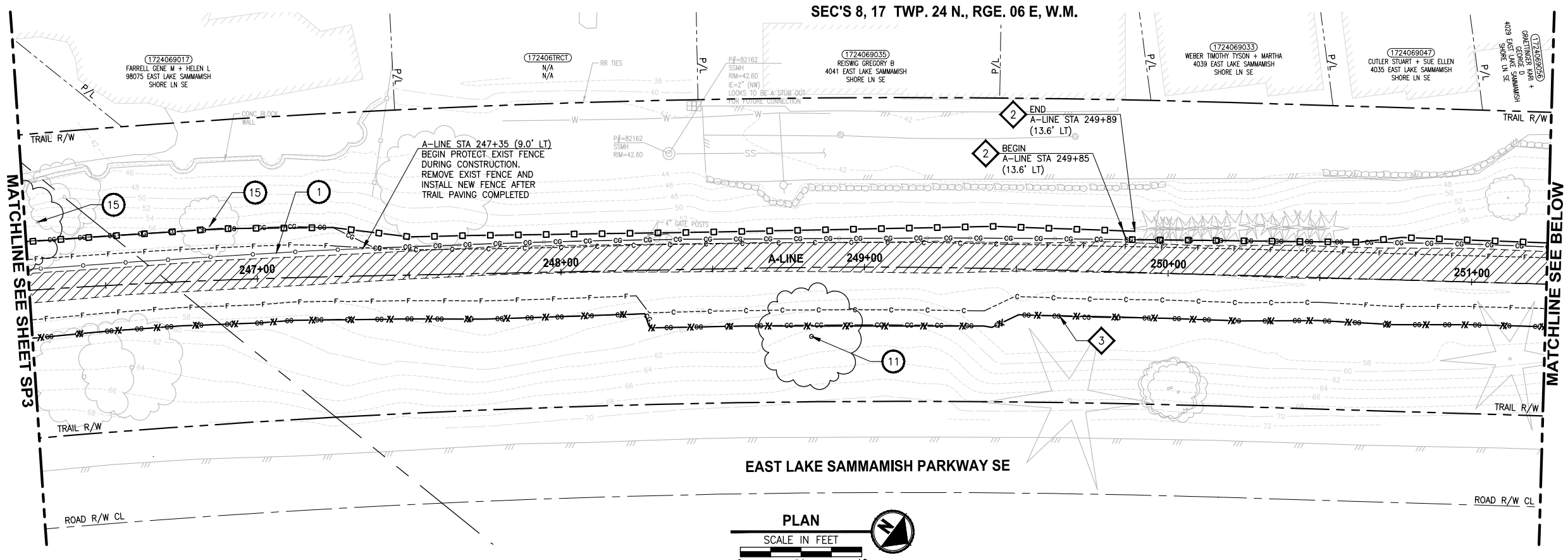

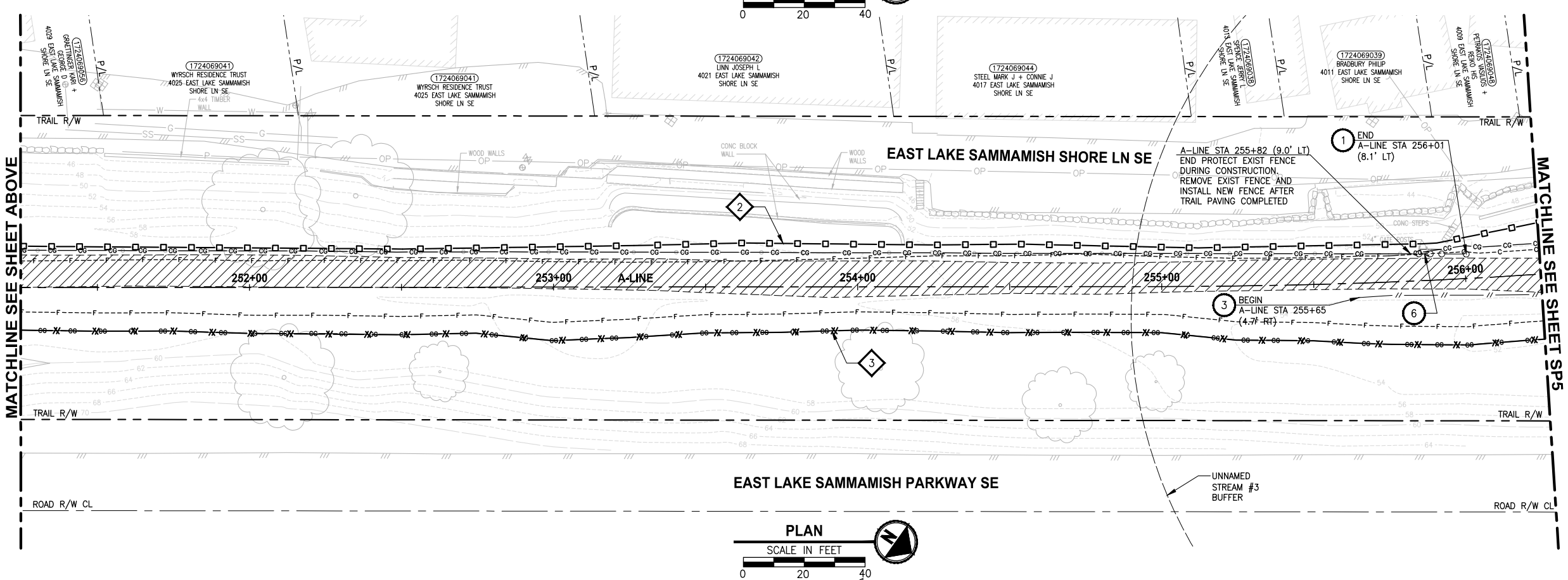

SITE PREPARATION NOTES:

1. REMOVE AND SALVAGE CHAIN LINK FENCE.
2. REMOVE AND SALVAGE SIGN.
3. REMOVE AND SALVAGE SPLIT RAIL FENCE.
4. REMOVAL OF STRUCTURE AND OBSTRUCTION.
5. REMOVE AND SALVAGE WOOD GUARDRAILS.
6. REMOVE AND SALVAGE CHAIN LINK GATE.
7. REMOVE AND SALVAGE TRASH BAG DISPENSER. SEE PS SHEETS.
8. RELOCATE TRASH CAN. SEE PS SHEETS.
9. PRUNE TREE FOR 10' VERTICAL CLEARANCE PER ARBORISTS' ASSESSMENT. TREE SHALL BE FLAGGED PRIOR TO PRUNING.
10. REMOVE TREE WITHIN CLEARING AND GRUBBING LIMITS.
11. REMOVE TREE OUTSIDE OF CLEARING AND GRUBBING LIMITS PER ARBORISTS' ASSESSMENT. TREE SHALL BE FLAGGED PRIOR TO REMOVAL.
12. RETAIN TREE WITHIN CLEARING AND GRUBBING LIMITS PER ARBORISTS' ASSESSMENT.
13. PRUNE TREE ROOT PER ARBORISTS' ASSESSMENT. TREE SHALL BE FLAGGED PRIOR TO PRUNING.
14. REMOVE DEAD STEM.
15. MONITOR TREE, BY ARBORISTS.
16. INSTALL TEMPORARY SAFETY FENCE. SEE SPECIAL PROVISIONS.
17. REMOVE ALL BRANCHES AND LEAVE 18' TALL TRUNK AS HABITAT SNAG.
18. ADJUST WATER VALVE TO FINISHED GRADE.
19. ADJUST WATER LINES.
20. RELOCATE SIGN. SEE PS SHEETS FOR NEW LOCATION.
21. ADJUST WATER METER TO FINISHED GRADE.
22. ADJUST CATCH BASIN TO FINISHED GRADE.

TESC NOTES:

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7. TEMPORARILY BYPASS & DEWATER JURISDICTIONAL DITCH DURING VAULT CONSTRUCTION.

LEGEND:

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- INLET PROTECTION
- STABILIZED CONSTRUCTION ENTRANCE

GENERAL NOTE:

1. NO STAGING OR STOCKPILING WITHIN CRITICAL AREA BUFFERS, OR WITHIN THE VICINITY OF BALD EAGLE BREEDING AREA FROM STA 216+50 TO STA 226+75.

CITY OF SAMMAMISH APPROVAL	
City Engineer	Date
Community Development	Date

90 % REVIEW SUBMITTAL
NOT FOR CONSTRUCTION

REVISIONS	DATE	BY

DESIGNED J. JUN / C. BUITRAGO
DRAWN B. PURGANAN
CHECKED Y. HO
APPROVED

ONE INCH AT FULL SCALE. IF NOT, SCALE ACCORDINGLY
FILE NAME BL1521075P20T03SP-01
JOB No. 554-1521-075 P20T03
DATE DECEMBER 2014

YAMMIE Y. HO — STATE OF WASHINGTON — 46829 — REGISTERED PROFESSIONAL ENGINEER
CRAIG A. BUITRAGO — STATE OF WASHINGTON — 49427 — REGISTERED PROFESSIONAL ENGINEER
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PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

SITE PREPARATION AND TESC PLAN

SHEET NO. 20 OF 79
SP4

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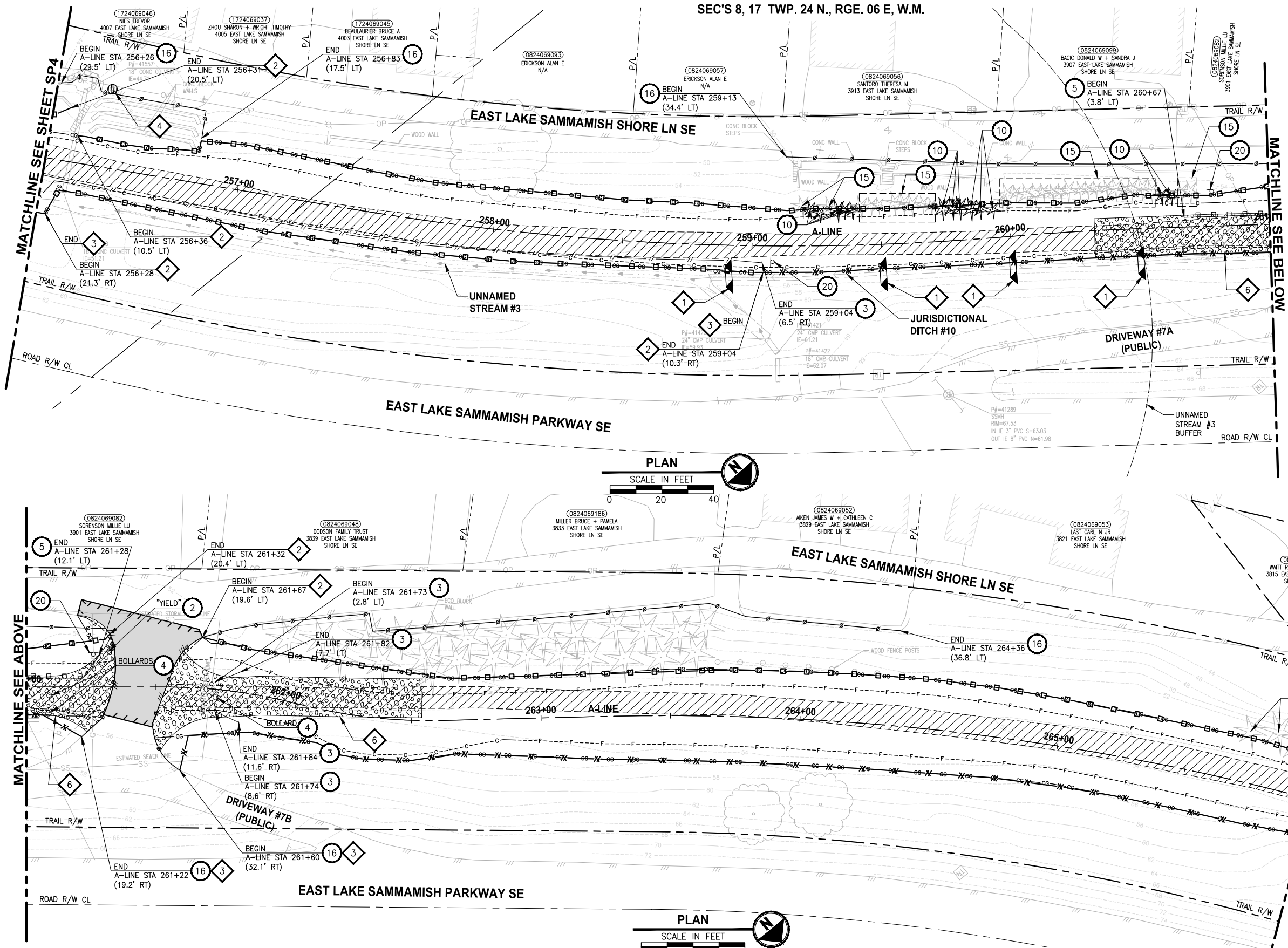

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CITY OF SAMMAMISH APPROVAL	
City Engineer	Date
Community Development	Date

90 % REVIEW SUBMITTAL
NOT FOR CONSTRUCTION

REVISIONS	DATE	BY

DESIGNED J. JUN / C. BUITRAGO
DRAWN B. PURGANAN
CHECKED Y. HO
APPROVED

ONE INCH AT FULL SCALE. IF NOT, SCALE ACCORDINGLY
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JOB No. 554-1521-075 P20T03
DATE DECEMBER 2014

YAMMIE Y. HO — STATE OF WASHINGTON — 14829 — REGISTERED PROFESSIONAL ENGINEER
CRAIG A. BUITRAGO — STATE OF WASHINGTON — 49427 — REGISTERED PROFESSIONAL ENGINEER

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PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

SITE PREPARATION AND TESC PLAN

PATH: C:\PWX\Temp\AcPublish_3108\ PLOTTED BY: buitrara DATE: Friday, December 19, 2014 10:57:29 AM LAYOUT: SP5

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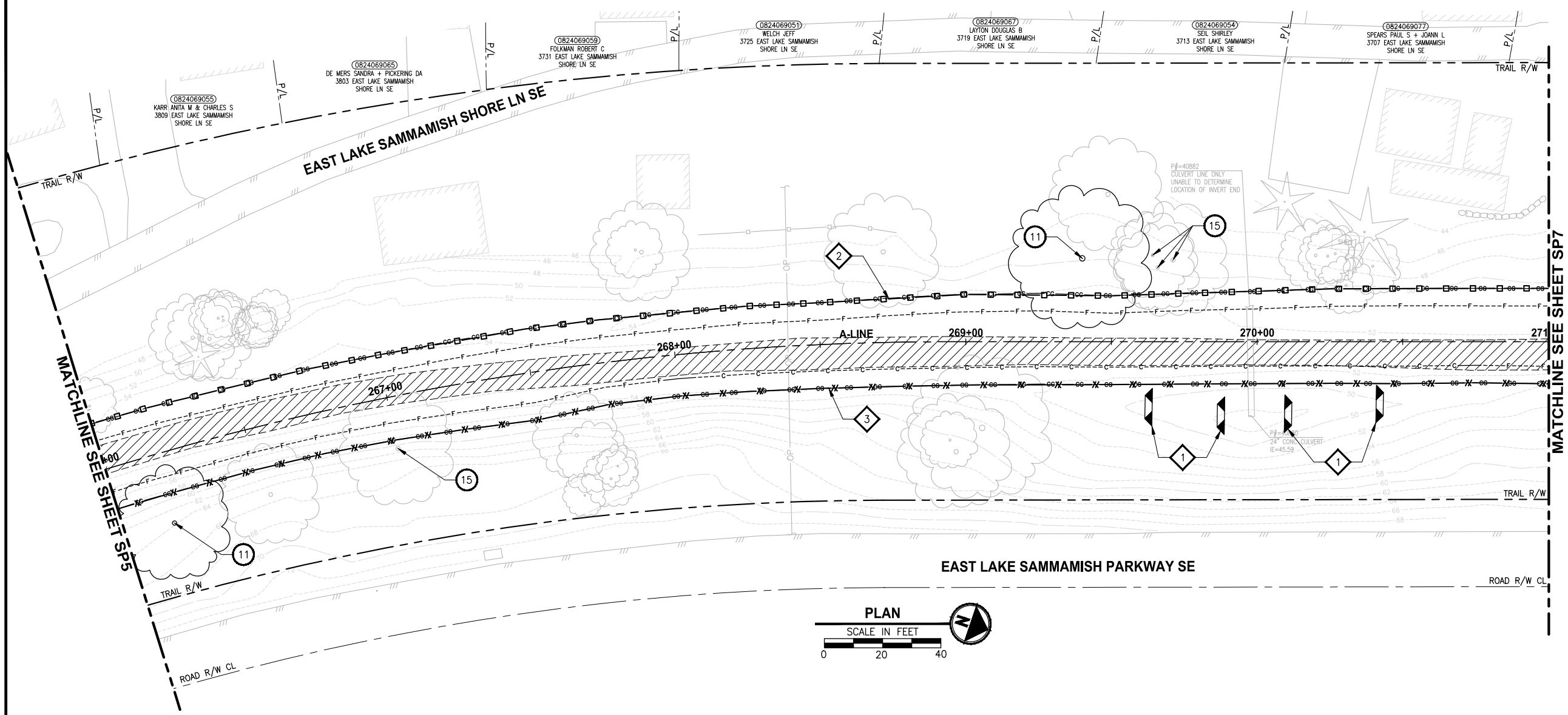

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GENERAL NOTE:

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CITY OF SAMMAMISH APPROVAL	
City Engineer	Date
Community Development	Date

90 % REVIEW SUBMITTAL
NOT FOR CONSTRUCTION

	REVISIONS	DATE	BY

DESIGNED J. JUN / C. BUITRAGO
DRAWN B. PURGANAN
CHECKED Y. HO
APPROVED

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PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

SITE PREPARATION AND TESC PLAN

SHEET NO.
22 OF 79
SP6

PATH: C:\PMX\Temp\AcPublish_3108\ PLOTTED BY: buitrara DATE: Friday, December 19, 2014 10:57:37 AM
LAYOUT: SP6

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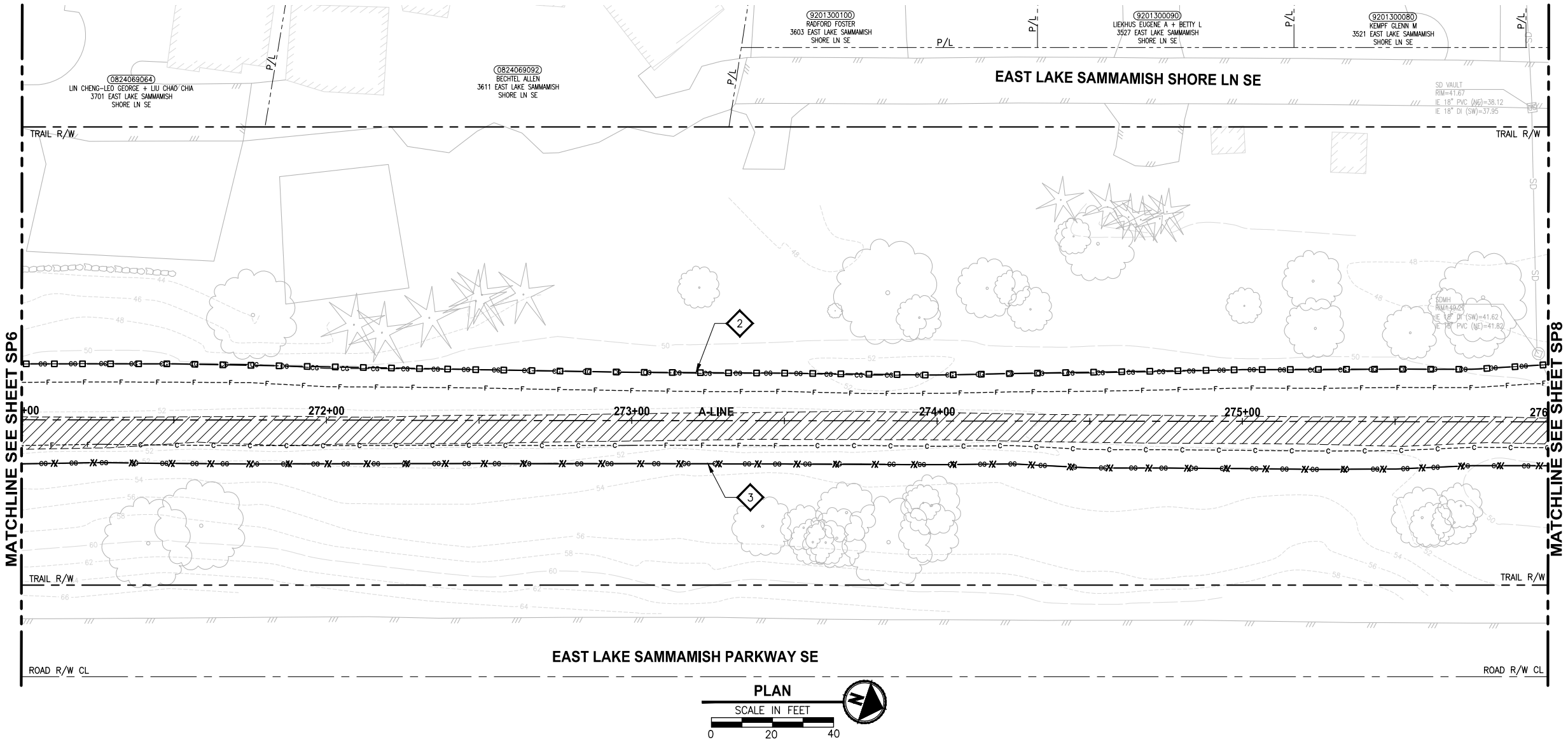

PLAN

SCALE IN FEET

0 20 40

SITE PREPARATION NOTES:

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LEGEND:

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GENERAL NOTE:

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CITY OF SAMMAMISH APPROVAL	
City Engineer	Date
Community Development	Date

90 % REVIEW SUBMITTAL

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REVISIONS	DATE	BY

DESIGNED J. JUN / C. BUITRAGO
DRAWN B. PURGANAN
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PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

SITE PREPARATION AND TESC PLAN

SHEET NO. 23 OF 79

SP7

LAYOUT: SP7 PATH: C:\PWX\Temp\AcPublish_3108\ PLOTTED BY: buitrara DATE: Friday, December 19, 2014 10:57:46 AM

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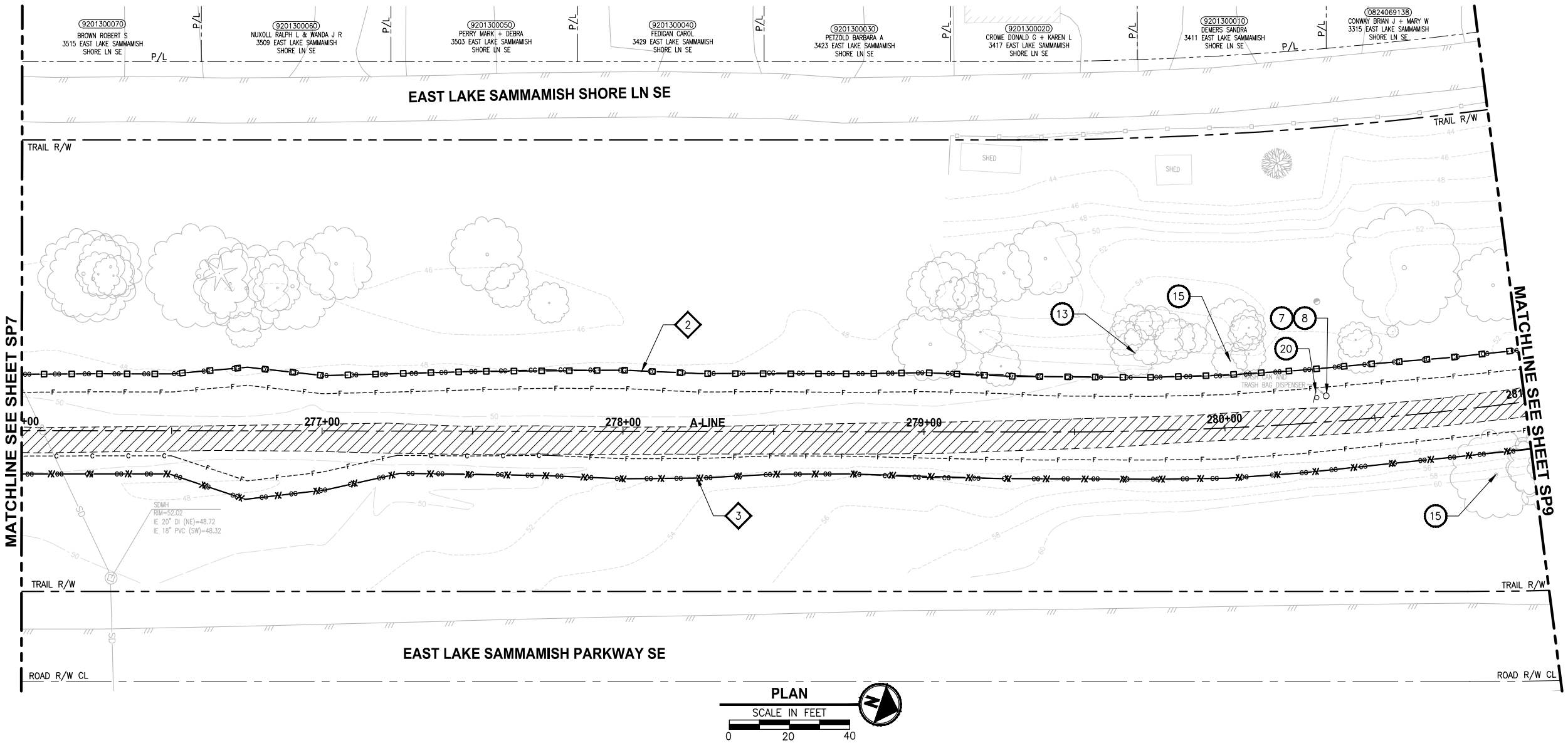

PLAN
SCALE IN FEET
0 20 40

SITE PREPARATION NOTES:

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CITY OF SAMMAMISH APPROVAL	
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PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

SITE PREPARATION AND TESC PLAN

SHEET NO.
24 OF 79
SP8

PATH: C:\PMX\Temp\AcPublish_3108\ PLOTTED BY: buitrcra DATE: Friday, December 19, 2014 10:57:54 AM
LAYOUT: SP8

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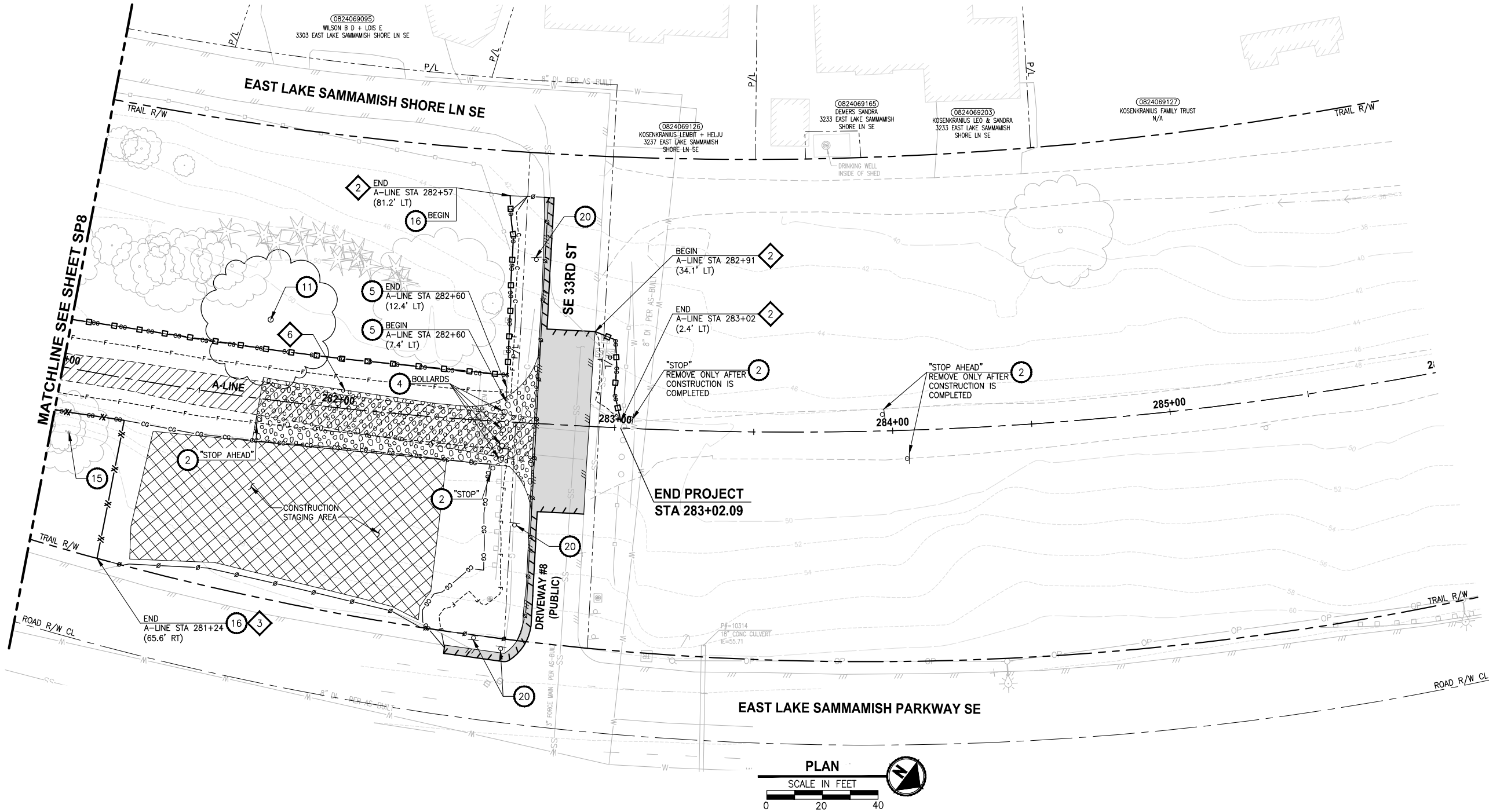

PLAN

SCALE IN FEET

0 20 40

SITE PREPARATION NOTES:

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20. RELOCATE SIGN. SEE PS SHEETS FOR NEW LOCATION.
21. ADJUST WATER METER TO FINISHED GRADE.
22. ADJUST CATCH BASIN TO FINISHED GRADE.

TESC NOTES:

1. CHECK DAMS ON CHANNELS, PER WSDOT STANDARD DETAIL I-50.20-01. USE BIODEGRADABLE CHECK DAMS.
2. HIGH VISIBILITY SILT FENCE (WITH BACKUP SUPPORT) PER WSDOT STANDARD DETAIL I-30.16-00.
3. HIGH VISIBILITY FENCE PER WSDOT STANDARD DETAIL I-10.10-01.
4. STORM DRAIN INLET PROTECTION, PER WSDOT STANDARD DETAIL I-40.20-00.
5. SANDBAG DAM.
6. STABILIZED CONSTRUCTION ENTRANCE, PER WSDOT STANDARD DETAIL I-80.10-01.
7. TEMPORARILY BYPASS & DEWATER JURISDICTIONAL DITCH DURING VAULT CONSTRUCTION.

LEGEND:

- REMOVE EXISTING GRAVEL SURFACE
- REMOVE ASPHALT PAVEMENT
- INLET PROTECTION
- STABILIZED CONSTRUCTION ENTRANCE

GENERAL NOTE:

1. NO STAGING OR STOCKPILING WITHIN CRITICAL AREA BUFFERS, OR WITHIN THE VICINITY OF BALD EAGLE BREEDING AREA FROM STA 216+50 TO STA 226+75.

CITY OF SAMMAMISH APPROVAL	
City Engineer	Date
Community Development	Date

90 % REVIEW SUBMITTAL

NOT FOR CONSTRUCTION

REVISIONS	DATE	BY

DESIGNED J. JUN / C. BUITRAGO
DRAWN B. PURGANAN
CHECKED Y. HO
APPROVED

ONE INCH AT FULL SCALE. IF NOT, SCALE ACCORDINGLY

FILE NAME BL1521075P20T03SP-01
JOB No. 554-1521-075 P20T03
DATE DECEMBER 2014

YAMMIE Y. HO — STATE OF WASHINGTON — 46829 — REGISTERED PROFESSIONAL ENGINEER

CRAIG A. BUITRAGO — STATE OF WASHINGTON — 49427 — REGISTERED PROFESSIONAL ENGINEER

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WWW.PARAMETRIX.COM

PROJECT NAME
EAST LAKE SAMMAMISH
MASTER PLAN TRAIL
SOUTH SAMMAMISH SEGMENT A
SAMMAMISH, WA

SITE PREPARATION AND TESC PLAN

SHEET NO. 25 OF 79

SP9

LAYOUT: SP9 PATH: C:\PWX\Temp\AcPublish_3108\ PLOTTED BY: buitrcra DATE: Friday, December 19, 2014 10:58:02 AM