

# DOCUMENT CONTROL PROCESSING FORM

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To (Company):	WSDOT	To (Individual):	Mary Ann Reddell
From (Company):	Jacobs	From (Individual):	Heather Weeks
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4 **To:** SR 530 Design Build Team  
 5 **From:** Braydan DuRee, PE and Shaun Stauffer, PE  
 6 **Date:** June 6, 2014  
 7 **GEI File:** 0180-322-02  
 8 **Subject:** Subsurface Investigation Plan  
 9 SR 530, Skaglund Hill Vic. to C-Post Road Vic.  
 - Emergency Roadway Reconstruction Project



10 **INTRODUCTION**

11 The purpose of this memorandum is to present our Subsurface Investigation Plan (SIP) to facilitate final design  
 12 and construction of the SR 530, Skaglund Hill Vic. to C-Post Road Vic. - Emergency Roadway Reconstruction  
 13 Project in Snohomish County, Washington. This plan has been prepared in accordance with Section 2.6.8.3 of  
 14 the Technical Requirements for the Request for Proposal dated April 29, 2014. The SIP identifies additional  
 15 subsurface geotechnical explorations and groundwater monitoring wells for final design of the project to  
 16 meet the subsurface exploration requirements provided in the Washington State Department of  
 17 Transportation (WSDOT) Geotechnical Design Manual (GDM). Geotechnical instruments such as groundwater  
 18 monitoring wells, vibrating wire piezometers (VWP), and inclinometers are planned to be installed within borings  
 19 summarized in the SIP. Information pertaining to geotechnical instruments installed within these borings will  
 20 be provided in the Geotechnical Instrumentation Plan (GIP).

21 This SIP describes the additional subsurface information required to provide the necessary geotechnical  
 22 recommendations for the project as currently designed. It is important to note that interpretation of subsurface  
 23 conditions will rely heavily on existing data including the subsurface soil and groundwater information provided  
 24 in the Geotechnical Baseline Report (GBR), the Geotechnical Data Report (GDR), and the geotechnical  
 25 reference material.

26 We plan to complete supplemental explorations consisting of test pits and borings. The proposed additional  
 27 exploration locations are shown on the attached site plan (Figures 1A through 1E). The estimated exploration  
 28 depth, as well as northings and eastings are provided in the attached Table 1. The explorations will be located  
 29 and staked in the field, and some minor adjustments to the locations presented on the attached site plan are  
 30 expected to avoid utilities or other field identified access constraints.

31 The team is required to submit this SIP to WSDOT for review prior to beginning exploration activities; however,  
 32 because of the compressed schedule for the emergency project and the availability of local drillers, we are  
 33 scheduled to start drilling the additional borings June 9, 2014 and request an expedited review by WSDOT. The  
 34 SIP considers geotechnical requirements, maintenance of traffic (MOT), access issues and environmental  
 35 constraints and requirements for the subsurface explorations.

ATKINSON

BSR

JUN 09 2014

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## 1 **GEOTECHNICAL EXPLORATIONS**

2 We have identified four areas requiring additional subsurface investigation for design of the project; (1) cut  
3 slope design within the “knob,” (2) roadway embankment design, (3) fish passage culvert design, and (4)  
4 Steelhead Drive Wall. To augment the geotechnical subsurface investigation provided in the GBR and GDR, we  
5 have identified nine test pits and twelve additional geotechnical borings (GEI-1 through GEI-12) that will be  
6 required based on our current understanding of the preliminary design. Figures 1A and 1E illustrate the  
7 proposed approximate exploration locations and depths.

### 8 **“Knob” Cut-Slope**

9 Boring K-1p-14 was completed within the “knob” as part of the GBR. Supplemental explorations are planned  
10 within the “knob” because of the anticipated non-uniform soil conditions of the old landslide debris and to  
11 provide additional data to evaluate groundwater conditions. Six of the borings (GEI-1 through GEI-6) are located  
12 on the “knob” above the proposed road alignment to facilitate design of the permanent cut slope in the historic  
13 landslide debris. Monitoring wells and VWPs are planned to be installed in these borings. The remaining four  
14 borings (GEI-7 through GEI-10) are located west of the “knob.”

### 15 **Embankments**

16 Nine borings were completed along the SR 530 alignment as part of the GBR. Supplemental explorations are  
17 planned such that the spacing between borings is approximately 500 feet. Three of the borings (GEI-7 through  
18 GEI-9) will be completed at the top of the previously excavated 4H:1V (horizontal to vertical) cut through the  
19 Oso landslide debris to further characterize the landslide debris to facilitate design of the proposed roadway  
20 embankment. Additionally, the borings planned to support the design of the fish passage culverts and  
21 Steelhead Drive Wall will be used to support the proposed roadway embankment design. VWPs and  
22 inclinometer casing will be installed within Borings GEI-7 through GEI-9 for roadway embankment design and  
23 monitoring during construction. Additionally, the landslide debris has been removed along the existing SR 530  
24 alignment with the side slopes inclined at 4H:1V. We plan to observe the conditions of the exposed 4H:1V  
25 slope to further characterize the landslide debris.

26 We have reviewed the available geotechnical information in the GBR, GDR and reference material, and the  
27 information indicates that the subsurface conditions are fairly uniform, with the exception of the landslide  
28 deposits. In our opinion, an exploration spacing of approximately 500 feet together with the reference material  
29 included in the RFP and observing the exposed surfaces of the landslide debris will provide sufficient  
30 information for geotechnical design of the roadway embankment.

### 31 **Fish Passage Culverts**

32 The project includes constructing three arch pipe culverts (Structure Nos. 995404, 991171, and 995405) and  
33 three stiff-leg (3-sided) concrete box culverts (Structure Nos. 991169, 991170, and 990359). The arch pipe  
34 culverts range from approximately 14 feet to 19.8 feet wide and 66 feet to 88 feet long. The stiff-leg culverts  
35 range from approximately 22.5 feet to 30 feet wide and 77 feet to 137 feet long. The location of the culverts  
36 are shown on the site plan (Figures 1A through 1E).

37 The borings included in the GDR were completed approximately within the footprint of two of the six culverts  
38 (Structure Nos. 991169 and 991170). Additionally, borings included in the GDR were completed approximately

1 70 feet, 30 feet, and 90 feet from Structure Nos. 990359, 991171, and 995405, respectively. Borings were  
2 not completed in the vicinity of structure 995404 or the updated location of structure 991170. We understand  
3 that the GDM requires at least two borings for each fish passage structure. We also understand that the culvert  
4 structures will need to be ordered by the middle of June in order to meet the project schedule, and if additional  
5 borings are needed, we may not be able to utilize the information in design and meet the schedule. We have  
6 reviewed the available subsurface information, and the alluvium and glacial outwash soils below the culvert  
7 are expected to be fairly uniform. Given the compressed schedule of the project and that the subsurface  
8 conditions below the proposed fish passage structures appear to be fairly uniform, we propose to complete one  
9 boring below Structure No. 995404 and one boring below Structure 991170, and supplement the borings in  
10 the vicinity of the other structures with test pits. The test pits will confirm similar soil conditions as the nearby  
11 borings and evaluate the suitability of the alluvium or outwash for support of the culvert structures. If  
12 compressible soils are encountered in the test pit, but not encountered in the nearby boring, then we will  
13 estimate settlement potential using conservative parameters derived from index testing, such as moisture  
14 content testing and Atterberg limit relationships, along with correlations to similar site soil samples where  
15 compression testing was completed.

#### 16 **Steelhead Drive Wall**

17 The project includes the design of one wall near the entrance to Steelhead Drive, which will provide future  
18 access to Snohomish County. The wall will be approximately 90 feet long and up to 15 feet tall. No explorations  
19 were completed in the vicinity of the wall as part of the GBR. We plan to complete one boring (GEI-10) for  
20 design of the wall.

21 The borings will be completed using truck- or track-mounted drilling equipment, subcontracted to a local driller.  
22 A total of 655 lineal feet (LF) of geotechnical exploratory drilling is anticipated. Sampling will be completed  
23 using split-spoon or thin-walled steel-tube (Shelby) samplers. Samples are anticipated at 2.5-foot depth  
24 intervals to 20 feet deep and at 5-foot intervals thereafter, but the interval may need to be adjusted based on  
25 observations during drilling. Drilling is anticipated to be accomplished using hollow-stem auger and/or mud  
26 rotary techniques.

27 The test pits will be completed using an excavator provided and operated by KLB. The test pits will be logged  
28 following requirements of the GDM, and samples collected for further examination and laboratory testing.

#### 29 **GEOTECHNICAL EXPLORATION SPECIFICS**

- 30 ■ Prior to commencing explorations the boring locations will be staked in the field and the One-Call utility  
31 locate service will be notified at least 48 hours in advance.
- 32 ■ Borings will be drilled using either mud rotary or hollow-stem-auger drilling methods.
- 33 ■ Two-inch diameter groundwater monitoring wells will be installed within borings GEI-1 through GEI-6 at the  
34 top of the “knob.”
- 35 ■ Inclinator casing will be installed within borings GEI-7 through GEI-9.
- 36 ■ VWPs will be attached to the outside of the groundwater monitoring well casing in borings GEI-1 through  
37 GEI-6 and outside of the inclinometer casing within borings GEI-7 through GEI-9 at variable depths,  
38 depending on observed groundwater conditions during drilling.

- 1 ■ Borings will be sampled using Standard Penetration Test (SPT) sampling methods using a 140-pound  
2 hammer free-falling 30 inches. The hammer energy will be provided for the SPT by the drilling subcontractor  
3 (measured within the last year). Shelby tube samples will be obtained within the soft alluvial and landslide  
4 debris soil.
- 5 ■ Samples will be collected in the borings at 2.5-foot intervals over the upper 20 feet and 5-foot intervals  
6 thereafter, or as adjusted in the field based on observations during drilling. Samples will be collected at  
7 approximately 2-foot intervals within the test pits.
- 8 ■ Geotechnical instruments installed within the borings will consist of groundwater monitoring wells, VWPs,  
9 and inclinometers. Additional information for the proposed instruments is provided in the GIP.
- 10 ■ Borings will be backfilled by the drillers in accordance with Washington State Department of Ecology  
11 requirements. Test pits will be backfilled with the excavated soil.
- 12 ■ Borings that penetrate asphalt or concrete will be patched with a similar material. However, no such  
13 penetrations are anticipated.
- 14 ■ The drill spoils resulting from the borings and bentonite drilling mud (if used) will be stockpiled on-site and  
15 disposed of during roadway construction. If suspected contamination is encountered, the cuttings will be  
16 drummed and disposed at an approved facility.
- 17 ■ Best Management Practices (BMPs) will be implemented during drilling and will include visquine, spill kits,  
18 secondary containment, silt fencing, delineated traffic corridors, limiting clearing and protecting existing  
19 vegetation to the extent possible, and placing straw over disturbed areas at the completion of the  
20 investigation, as appropriate, and identified in permit or environmental compliance requirements.
- 21 ■ We do not anticipate noise restrictions are necessary for this project.
- 22 ■ Each of the explorations will be completed within WSDOT right-of-way.
- 23 ■ All explorations will be monitored and logged by a geotechnical engineer or engineering geologist from  
24 GeoEngineers. Samples will be taken to GeoEngineers' Redmond laboratory for additional classification  
25 and testing to evaluate engineering properties.
- 26 ■ A MOT Plan is not needed for a majority of the explorations as they will not be situated in active trafficable  
27 locations. For borings GEI-10 through GEI-12, one-way piloted traffic will be maintained as the boring will  
28 be located along the north shoulder of SR 530.

## 29 **Decommissioning Instruments**

30 Instruments including piezometers and inclinometers will be decommissioned following Washington State  
31 Department of Ecology requirements during construction, after the instruments are no longer needed.

32 Attachments:

33 Table 1. Borehole Locations and Depths

34 Figures 1A and 1E. Site Plan

35 BPD:SDS:nld

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# Table 1

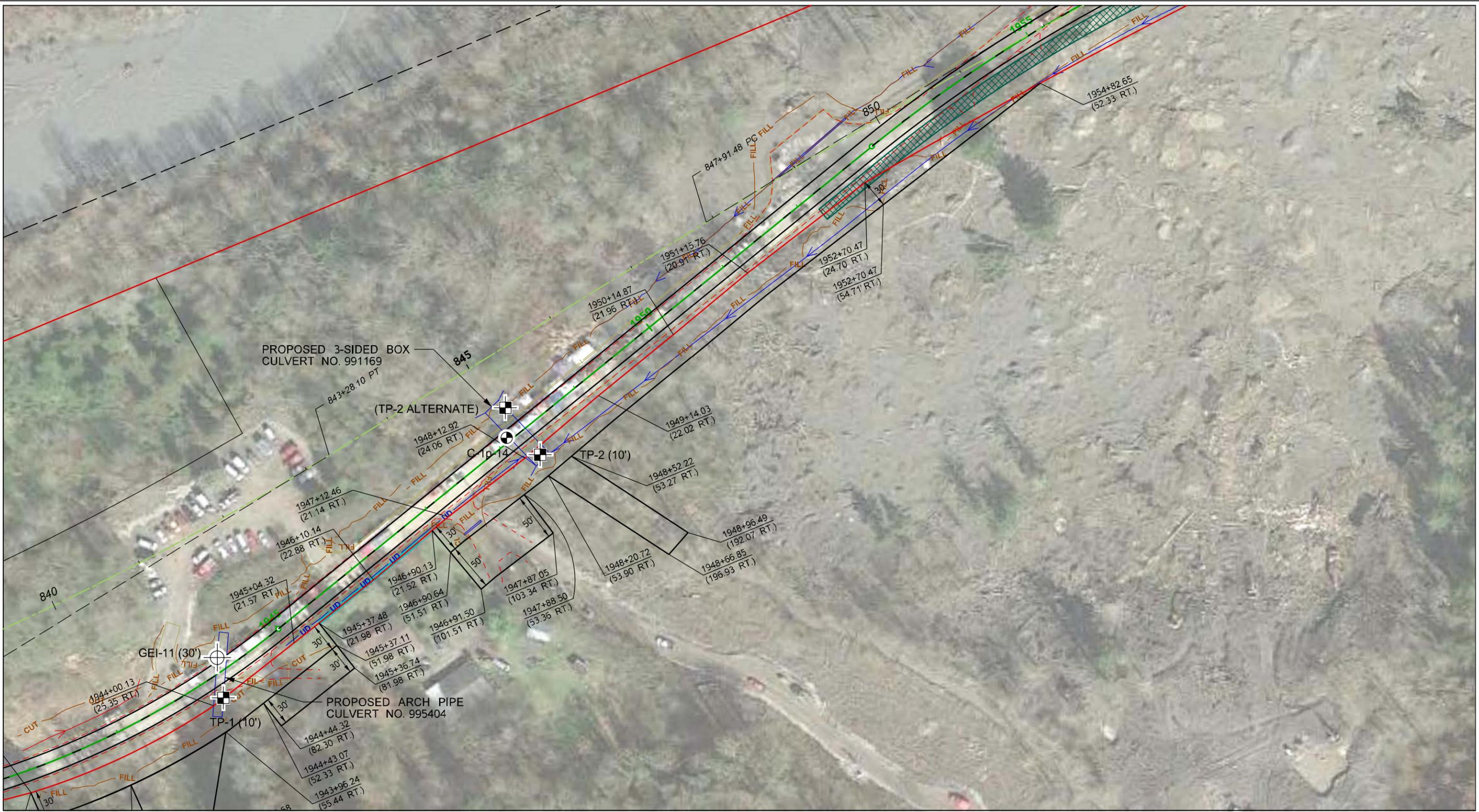
## Borehole Locations and Depths

SR530, Skaglund Hill Vic. To C-Post Road Vic. - Emergency Roadway Reconstruction Project

Snohomish County, Washington

Project Coordinate System (CF = 0.999932573)

Borehole	Northing	Easting	Approximate Ground Surface Elevation (feet)	Depth (feet)	Instrumentation
GEI-1	795552	1724157	370	75	Piezometer
GEI-2	795487	1724163	372	75	Piezometer
GEI-3	795538	1723904	371	75	Piezometer
GEI-4	795480	1723905	368	75	Piezometer
GEI-5	795539	1723611	361	75	Piezometer
GEI-6	795481	1723622	360	75	Piezometer
GEI-7	795417	1723039	292	35	Inclinometer/VWP
GEI-8	795119	1722403	280	35	Inclinometer/VWP
GEI-9	794842	1721788	272	35	Inclinometer/VWP
GEI-10	795377	1722786	275	40	--
GEI-11	794114	1720745	276	30	--
GEI-12	795654	1724488	290	30	--
TP-1	794071	1720752	275	10	--
TP-2	794325	1721083	260	10	--
TP-2 Alternate	794374	1721047	260	10	--
TP-3	795611	1724498	290	10	--
TP-4	795554	1725552	290	10	--
TP-5	795597	1725561	290	10	--
TP-6	795534	1726298	290	10	--
TP-7	795574	1726303	290	10	--
TP-8	795595	1727289	290	10	--
TP-9	795546	1727297	290	10	--



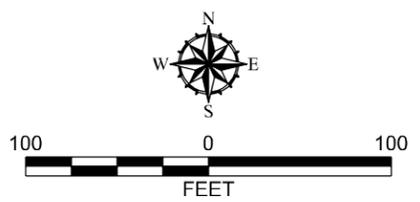
Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

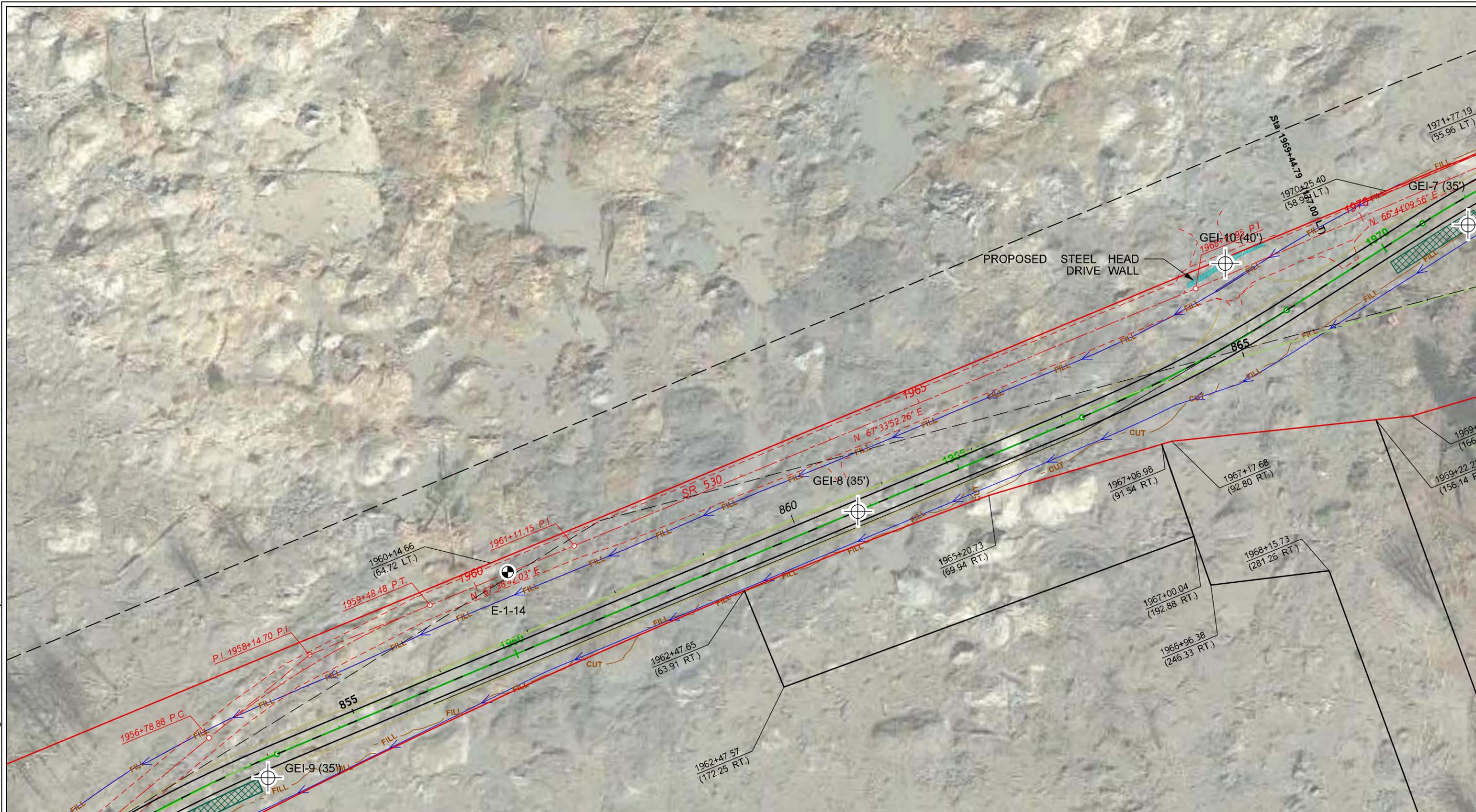
Reference: Base drawing provided by Jacobs.

**LEGEND**

- PREVIOUS WSDOT BORING
- PROPOSED SUPPLEMENTAL BORING (APPROXIMATE DEPTH)
- PROPOSED SUPPLEMENTAL TEST PIT (APPROXIMATE DEPTH)



<b>SITE PLAN</b>	
SR530, Skaglund Hill Vic. To C-Post Road Vic. Emergency Roadway Reconstruction Snohomish County, Washington	
<b>GEOENGINEERS</b>	<b>Figure 1A</b>

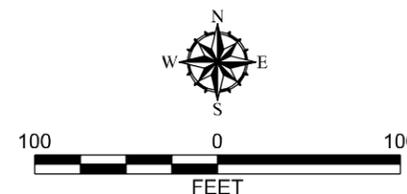


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**LEGEND**

-  PREVIOUS WSDOT BORING
-  PROPOSED SUPPLEMENTAL BORING (APPROXIMATE DEPTH)
-  PROPOSED SUPPLEMENTAL TEST PIT (APPROXIMATE DEPTH)

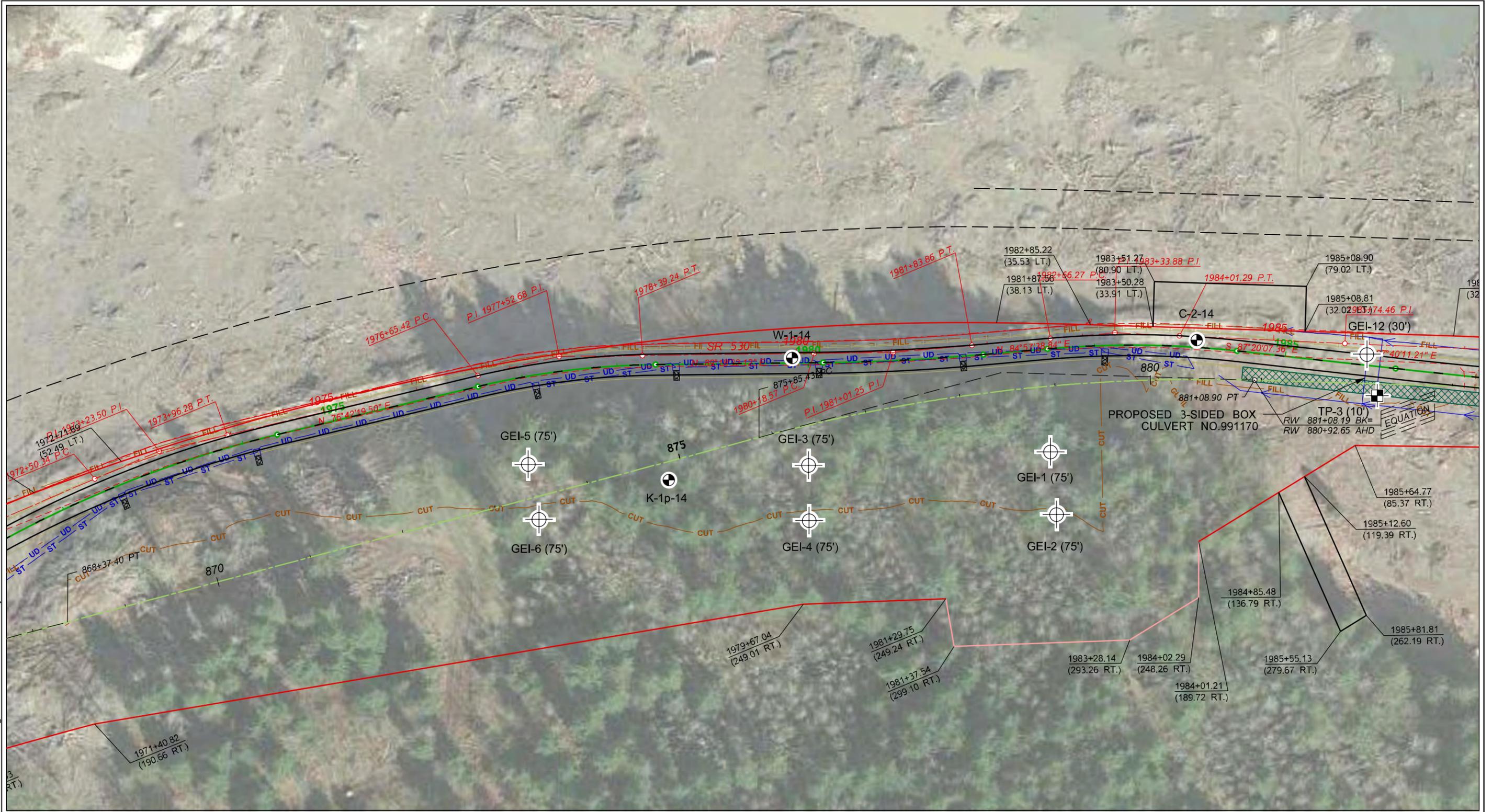


**SITE PLAN**

SR530, Skaglund Hill Vic. To C-Post Road Vic.  
Emergency Roadway Reconstruction  
Snohomish County, Washington



Figure 1B

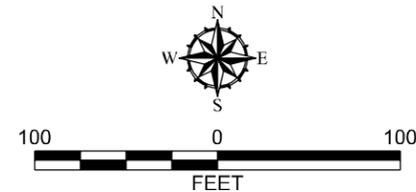


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Reference: Base drawing provided by Jacobs.

**LEGEND**

- PREVIOUS WSDOT BORING**
- PROPOSED SUPPLEMENTAL BORING (APPROXIMATE DEPTH)**
- PROPOSED SUPPLEMENTAL TEST PIT (APPROXIMATE DEPTH)**



**SITE PLAN**

SR530, Skaglund Hill Vic. To C-Post Road Vic.  
Emergency Roadway Reconstruction  
Snohomish County, Washington



**Figure 1C**

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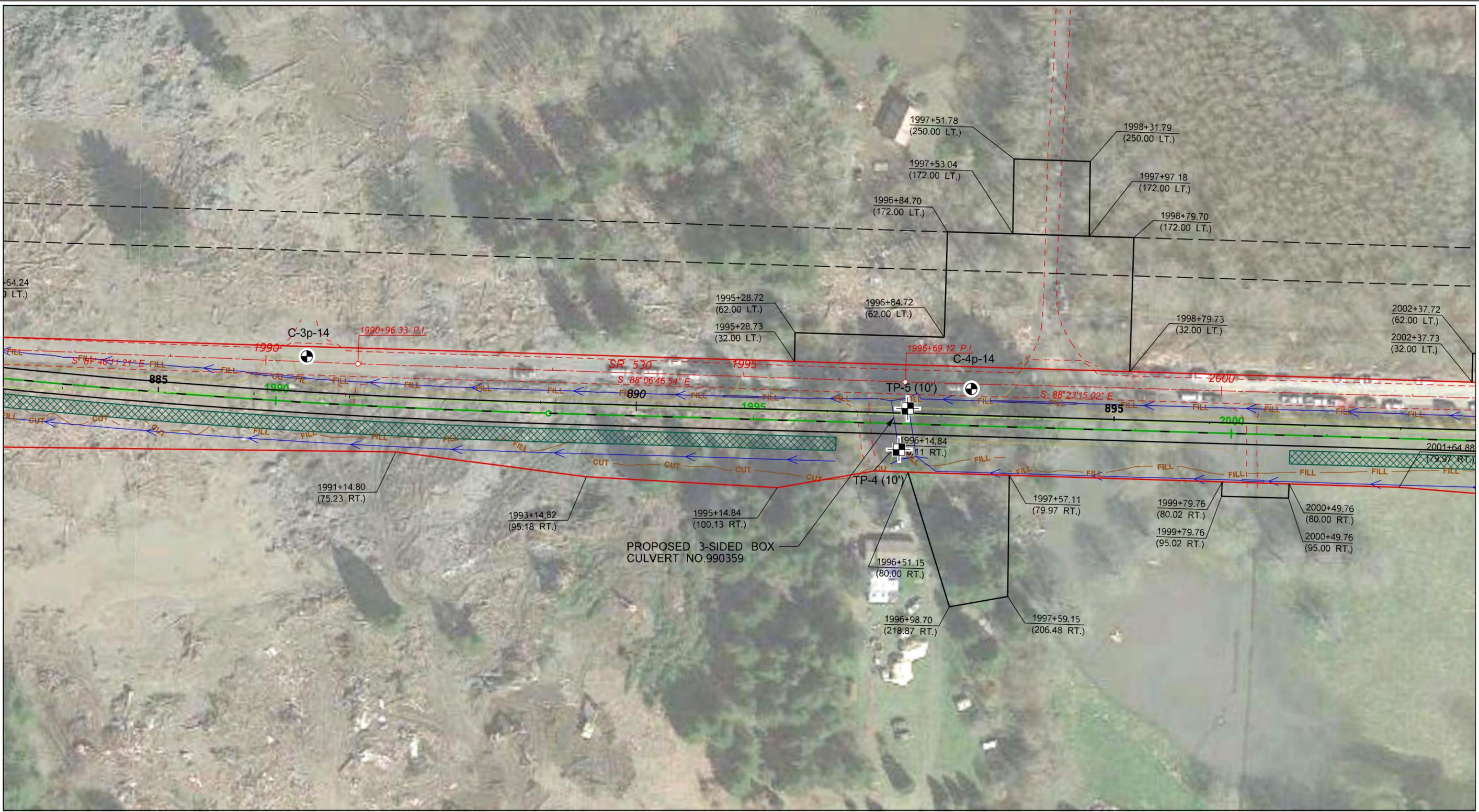
100.0000 ft / in.

17x11 (in.)

Figure 1D

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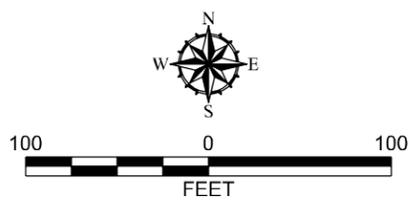
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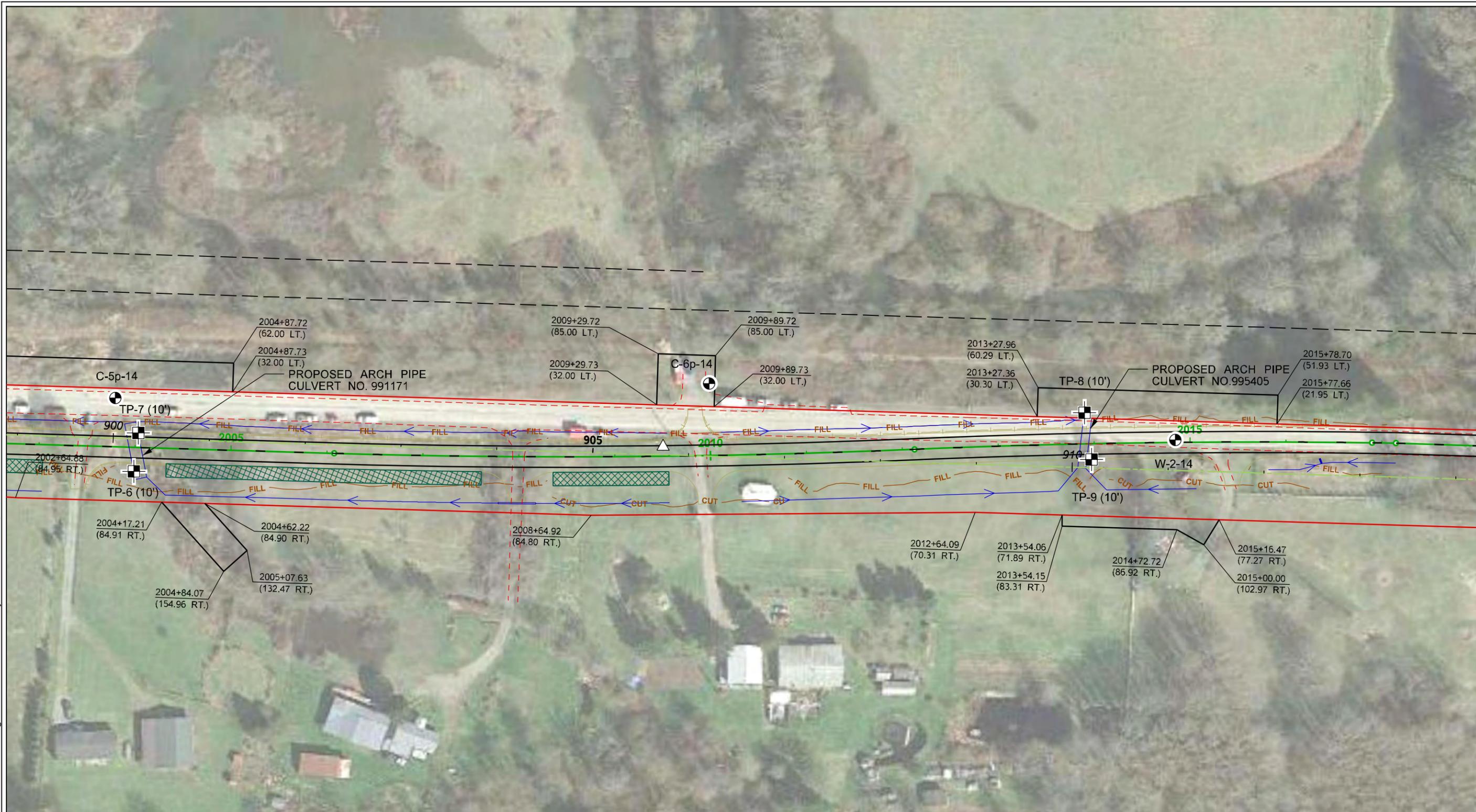
Reference: Base drawing provided by Jacobs.

**LEGEND**

- 
**PREVIOUS WSDOT BORING**
- 
**PROPOSED SUPPLEMENTAL BORING (APPROXIMATE DEPTH)**
- 
**PROPOSED SUPPLEMENTAL TEST PIT (APPROXIMATE DEPTH)**



<b>SITE PLAN</b>	
SR530, Skaglund Hill Vic. To C-Post Road Vic. Emergency Roadway Reconstruction Snohomish County, Washington	
	<b>Figure 1D</b>

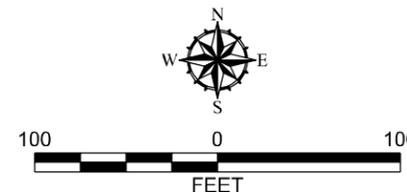


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**LEGEND**

-  **PREVIOUS WSDOT BORING**
-  **PROPOSED SUPPLEMENTAL BORING (APPROXIMATE DEPTH)**
-  **PROPOSED SUPPLEMENTAL TEST PIT (APPROXIMATE DEPTH)**



**SITE PLAN**

SR530, Skaglund Hill Vic. To C-Post Road Vic.  
Emergency Roadway Reconstruction  
Snohomish County, Washington



Figure 1E