Stormwater Drainage Report
8020 SE 57th Street
Vann Lanz Residence
Mercer Island, Washington
KC Tax Parcel #294890-0082
Permit #: XXXX-XXX

Prepared For:

Vann Lanz
LNL Builds. com
317 4th Street
Kirkland, Washington 98033
206-499-1277
Vann@lnlbuilds.com

March 14, 2024

Prepared By:

Offe Engineers, PLLC
Darrell Offe, P.E.
13932 SE 159th Place
Renton, Washington 98058
425-260-3412
Darrell.Offe@comcast.net

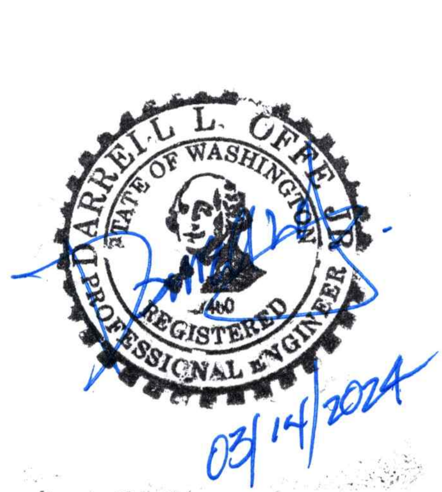


TABLE OF CONTENT

Section 1: Project Narrative:

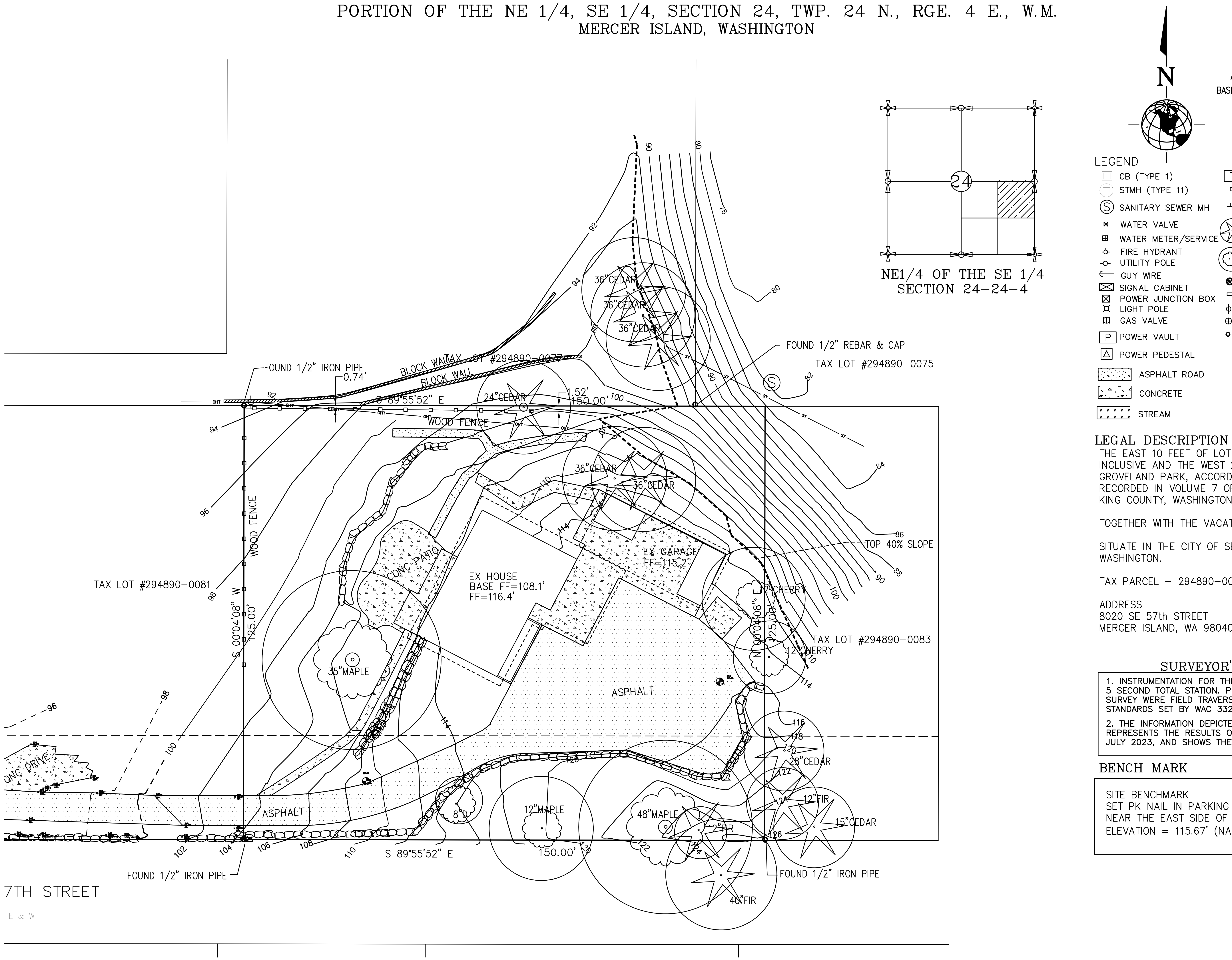
The subject property is located in the Brook Bay area of the City of Mercer Island. The property is located west of West Mercer Way along the north side of an unimproved right-of-way of SE 57th Street. The property is located on the east side of 80th Avenue SE. There is an existing residence on the property together with a paved driveway from 80th Avenue SE and parking area on-site. All these existing features (on-site) will be removed to provide space for the new residence and driveway. There is a null on the property where the existing and proposed residence is located. The area to the north and east of the null slopes towards an existing stream off site to the northeast. There are steep slopes located on and off the northeast side of the property that will be protected and preserved. The subject property slopes from the null in the center of the property towards the northeast and the northwest.

The property was visited in March 2024 to verify runoff patterns and possible storm water discharge options. A downstream analysis from the subject property to Lake Washington was performed during the site visit in March. The results of the downstream analysis can be found within Minimum Requirement #4.

The project will be evaluated for storm water treatment and control using the Amended December 2014 SWMMWW (DOE Manual).

VICINITY MAP

PORTION OF THE NE 1/4, SE 1/4, SECTION 24, TWP. 24 N., RGE. 4 E., W.M.
MERCER ISLAND, WASHINGTON



LEGEND

- CB (TYPE 1)
- STMH (TYPE 11)
- SANITARY SEWER MH
- WATER VALVE
- WATER METER/SERVICE
- FIRE HYDRANT
- UTILITY POLE
- GUY WIRE
- SIGNAL CABINET
- POWER JUNCTION BOX
- LIGHT POLE
- GAS VALVE
- POWER VAULT
- POWER PEDESTAL
- TELEPHONE VAULT
- TELEPHONE CABINET
- SIGN
- CONIFER TREE W/ DRIPLINE
- DECIDUOUS TREE W/DRIPLINE
- MONITORING WELL
- MAIL BOX
- PK NAIL
- MON IN CASE/
- EX REBAR / PIPE AS NOTED
- ASPHALT ROAD
- CONCRETE
- STREAM

LEGAL DESCRIPTION

THE EAST 10 FEET OF LOT 19,AND LOTS 20 THROUGH 22, INCLUSIVE AND THE WEST 20 FEET OF LOT 23, BLOCK 7, GROVELAND PARK, ACCORDING TO THE PLAT THEREOF RECORDED IN VOLUME 7 OF PLATS, PAGE 48, RECORDS OF KING COUNTY, WASHINGTON.

TOGETHER WITH THE VACATED BENNET STREET THEROF

SITUATE IN THE CITY OF SEATTLE, COUNTY OF KING, STATE OF WASHINGTON.

TAX PARCEL – 294890-0082

ADDRESS
8020 SE 57th STREET
MERCER ISLAND, WA 98040

SURVEYOR'S NOTES

1. INSTRUMENTATION FOR THIS SURVEY WAS A FOCUS 35 5 SECOND TOTAL STATION. PROCEDURES USED IN THIS SURVEY WERE FIELD TRAVERSE, MEETING OR EXCEEDING STANDARDS SET BY WAC 332-130-090.
2. THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULTS OF A SURVEY MADE IN JULY 2023, AND SHOWS THE GENERAL CONDITION

BENCH MARK

SITE BENCHMARK
SET PK NAIL IN PARKING LOT OF RESIDANCE
NEAR THE EAST SIDE OF PROPERTY
ELEVATION = 115.67' (NAVD88)

RECORDER'S CERTIFICATE

Filed for record this ____ day of ____________, 20___ at ___M, in Volume ___ of __________ at page ____ at the request of Dan M. Touma.

County Auditor Deputy

SURVEYOR'S CERTIFICATE

This map correctly represents a survey made by me or under my direction in conformance with the requirements of the Survey Recording Act at the request of Vann Lanz in July of 2023.

Daniel M. Touma
Certificate No. 38992

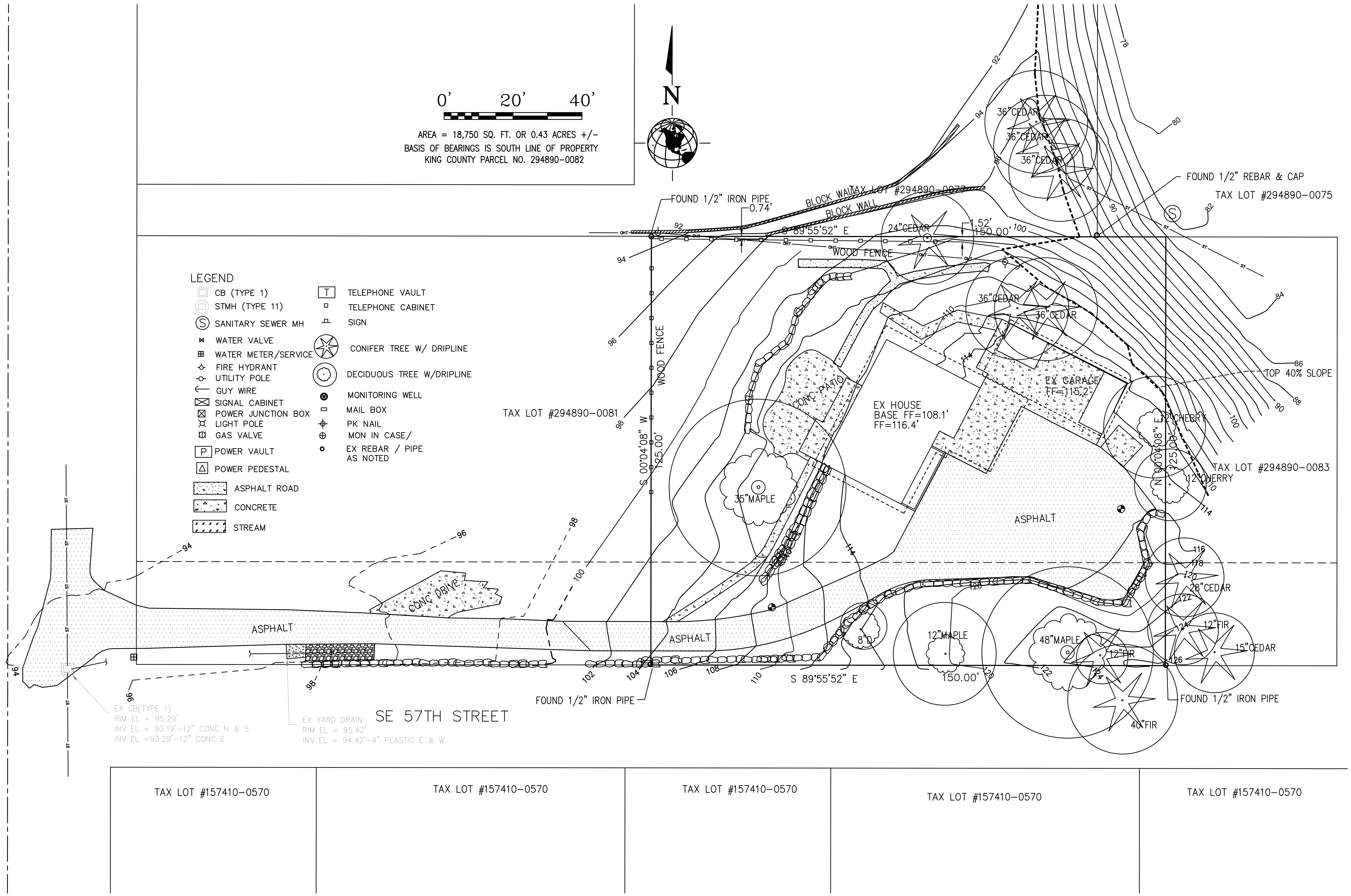
DAN M. TOUMA STATE OF WASHINGTON 38992 REGISTERED PROFESSIONAL LAND SURVEYOR 2/14/24

BOUNDARY SURVEY
FOR
TAX LOT 294890-0082
8020 SE 57th STREET, MERCER ISLAND, WA 98040

DWN BY RF	DATE 2/14/24	JOB NO. 1019-008
CHKD BY DMT	SCALE 1" = 20'	SHEET 1 OF 2

TOUMA ENGINEERS AND LAND SURVEYORS,PLLC
330 SW 43rd STREET SUITE K412
RENTON WA 98057
206-304-3567

PORTION OF THE NE 1/4, SE 1/4, SECTION 24, TWP. 24 N., RGE. 4 E., W.M.
MERCER ISLAND, WASHINGTON



DAN M. TOUMA
STATE OF WASHINGTON
38992
REGISTERED
PROFESSIONAL LAND SURVEYOR
2/14/24

BOUNDARY SURVEY
FOR
TAX LOT 294890-0082
8020 SE 57th STREET, MERCER ISLAND, WA 98040

DWN BY RF	DATE 2/14/24	JOB NO. 1019-008
CHKD BY DMT	SCALE 1" = 20'	SHEET 2 OF 2

TOUMA ENGINEERS AND LAND SURVEYORS,PLLC
330 SW 43rd STREET SUITE K412
RENTON WA 98057
206-304-3567

Section 2: Site Evaluation

Total Lot Area = 18,750 square feet (0.4304 acres)

EXISTING CONDITIONS

Impervious (hard) surfaces:

House roof area = 2,520 sq. feet

Uncovered driveway/parking area ((PGHS)) = 3,356 sq, feet

Uncovered walkways/patio = 1,144 sq. feet

Total Impervious (Hard) Surfaces = 7,020 square feet

Pervious surfaces:

Lawn, trees = *11,730 sq. feet*

DEVELOPED CONDITIONS

Impervious (hard) surfaces:

House roof area w/overhang = 4,968 sq. feet

Uncovered driveway ((PGHS)) = 651 sq. feet

Uncovered exposed slab = 683 sq. feet

Uncovered walkway = 160 sq. feet

Total Impervious (Hard) Surfaces = 6,462 square feet

Pervious Surfaces:

Landscaping, Retained areas = 12,288 sq. feet

Total Pervious Surfaces = 12,288 square feet

((PGHS)) – Pollution generating Hard Surface

Summary of Project Information

Project Site Area	18,750 square feet
Existing Impervious Area	7,020 sq. feet
Existing Impervious Coverage	37.4%
New Impervious Area	2,828 sq. feet
Replaced Impervious Area	3,634 sq. feet
New plus Replaced Impervious	6,462 square feet
Converted pervious: Native to lawn	0 sq. feet
Converted pervious: Native to pasture	0 sq. feet
Total Area of Land Disturbance	12,000 square feet

The subject property has greater than 35% (37.4%) imperious coverage and the total proposed project new plus replaced impervious surfaces will be greater than 5,000 (6,462) square feet; using Figure I-2.4.2 – *"Flow Chart for Determining Minimum Requirements for Redevelopment"* page 38, 2014 Stormwater Management Manual for Western Washington, Minimum Requirements #1 – #9 apply to this project.

8020 SE 57th Street

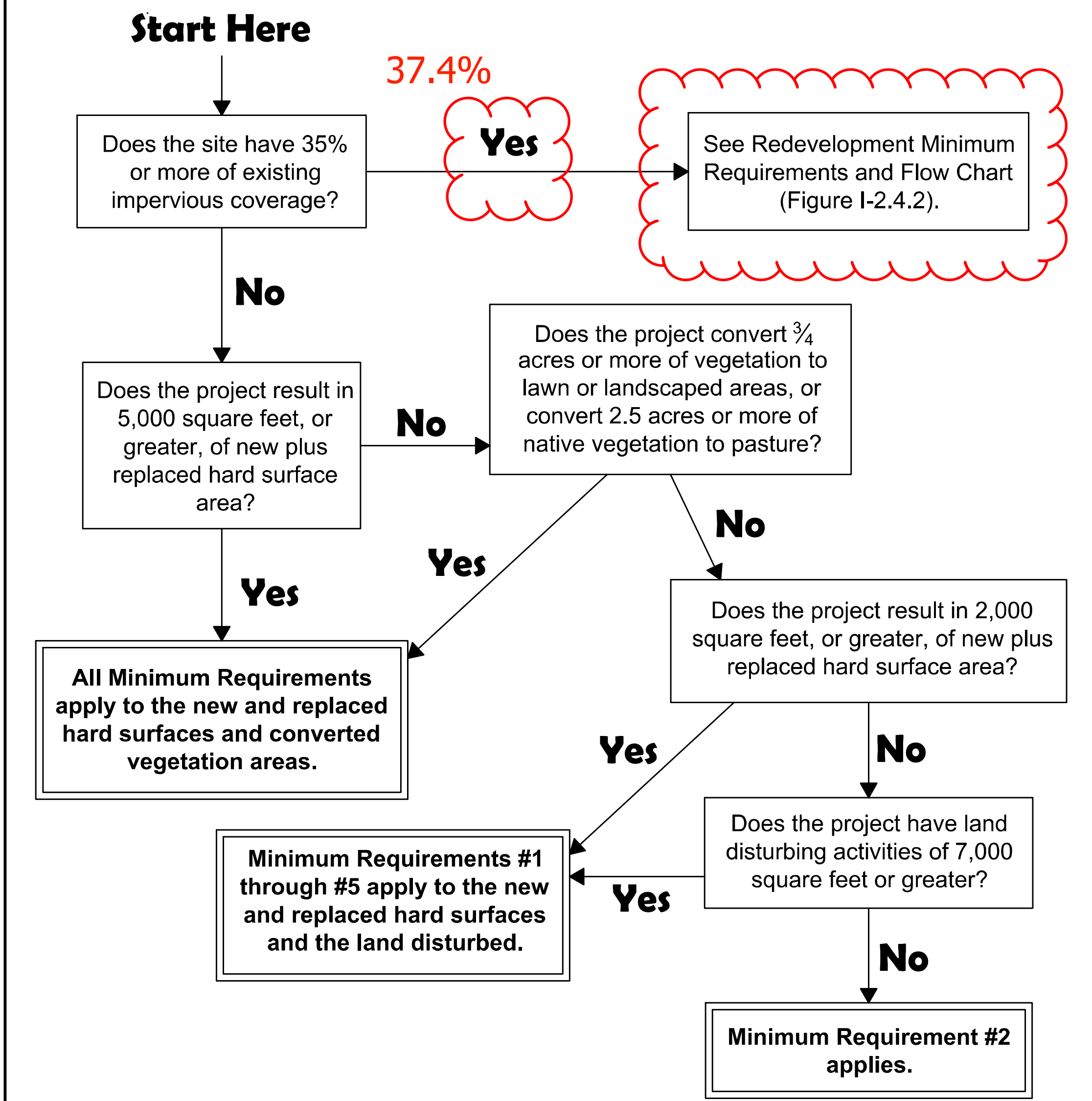
EXISTING CONDTIONS


8020 SE 57th Street
FOUND 1/2" IRON PIPE
BLOCK WALL
TAX LOT #294890-0077
FOUND 1/2" REBAR & CAP
TAX LOT #294890-0075
WOOD FENCE
36"CEDAR
PATIO
EX HOUSE
BASE FF=108.1'
FF=116.4'
GARAGE
TOP 40% SLOPE
TAX LOT #294890-0081
TAX LOT #294890-0083
12"CHERRY
ASPHALT
28"CEDAR
48"MAPLE
12"FIR
15"CEDAR
40"FIR
S 89°55'52" E
150.00'
FOUND 1/2" IRON PIPE
SE 57TH STREET
NEW IMPERVIOUS SURFACES
2,828 SQ. FEET
GRAPHIC SCALE
1 inch = 20 feet

FLOW CHART FIGURE I-2.4.1

8020 SE 57th Street

Figure I-2.4.1 Flow Chart for Determining Requirements for New Development

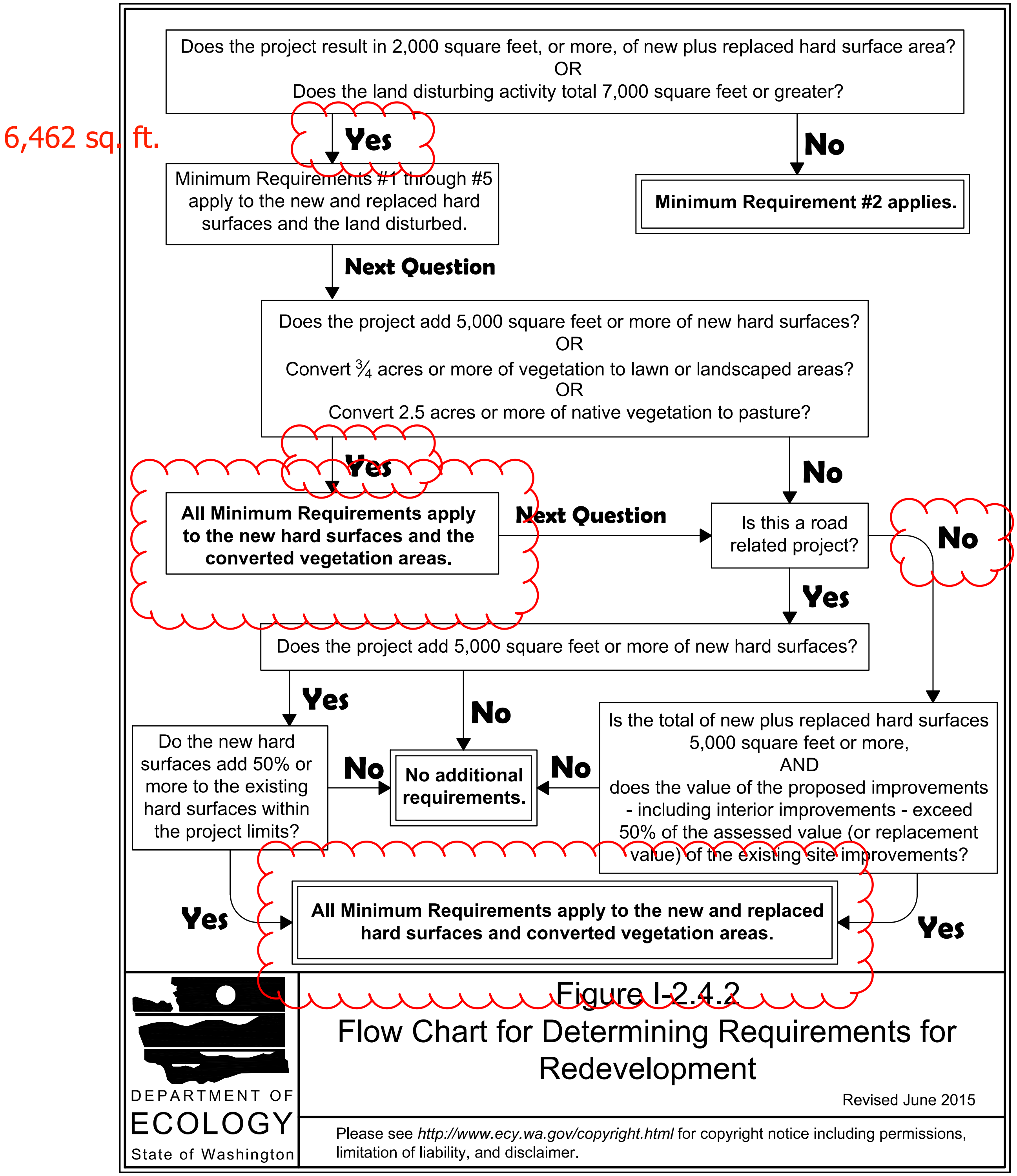


DEPARTMENT OF ECOLOGY
State of Washington

Figure I-2.4.1
Flow Chart for Determining Requirements for New Development

Revised June 2015

Figure I-2.4.2 Flow Chart for Determining Requirements for Redevelopment



Section 3: Minimum Requirements

Based upon the Flow Chart Figure I-2.4.1 and I-2.4.2 (Amended December 2014 SWMMWW, DOE Manual), all Minimum Requirements 1-9 apply to this project.

Section I-2.5.1 Minimum Requirement #1 – Preparation of Stormwater Site Plans

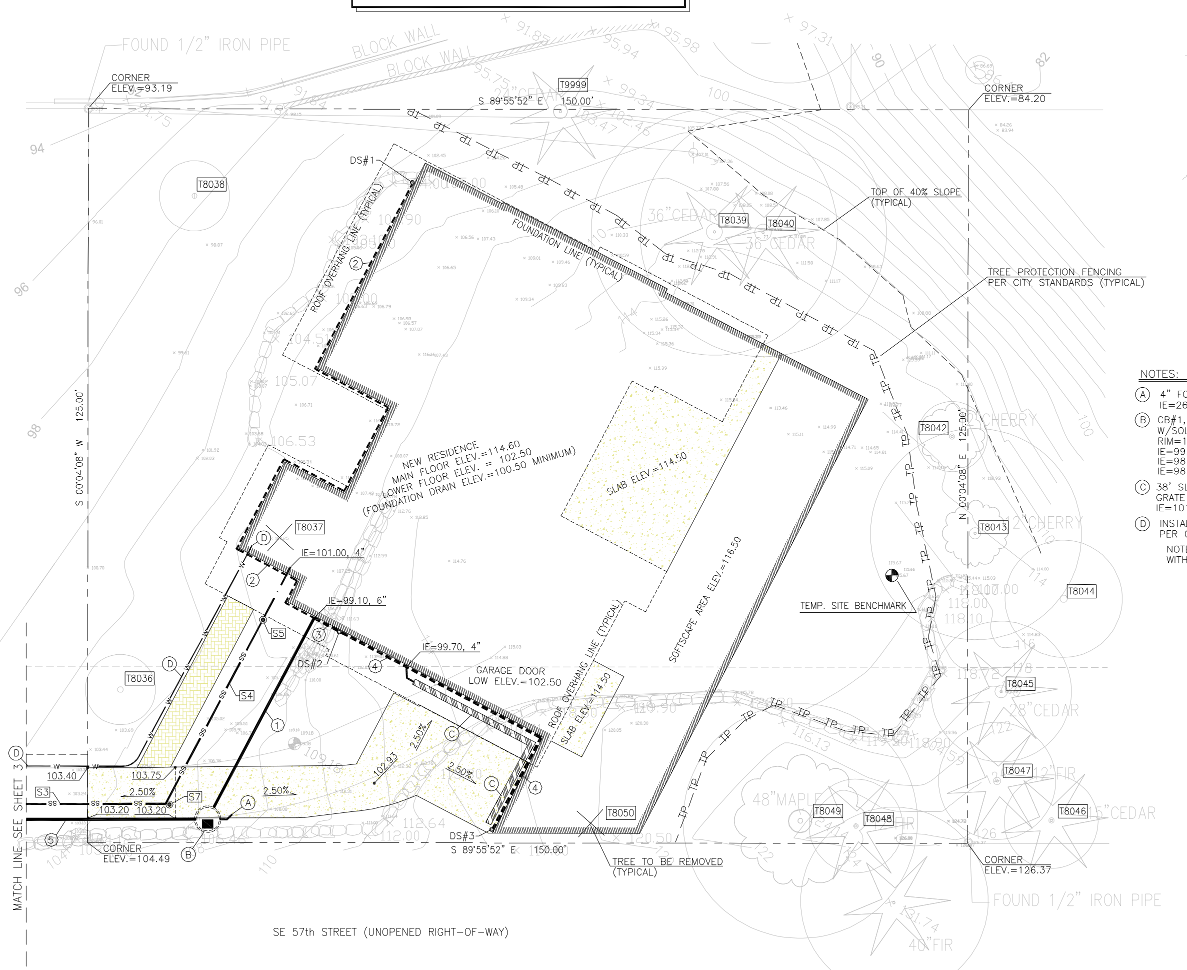
A Stormwater site plan (drainage plan) has been prepared for this project together with construction details for installation of the proposed drainage control system. The Stormwater site plans and drainage narrative shall be submitted and reviewed by the City of Mercer Island as part of the building permit application.

NE 1/4 OF THE SE 1/4 OF SECTION 24, TOWNSHIP 24 NORTH., RANGE 04 EAST, W.M., KING COUNTY, WA.

EXISTING UTILITY LOCATIONS SHOWN HEREON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILIITES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

CALL BEFORE YOU DIG: 811

NOTE: CONNECT 4" FOUNDATION DRAIN AT LOCATION SHOWN ON PLANS – ONLY!



LEGEND

- AIR CONDITION UNIT
- AREA DRAIN
- ASPHALT SURFACE
- BUILDING
- CENTERLINE ROW
- CONCRETE SURFACE
- RETAINING WALL
- ELECTRICAL EASEMENT
- DECK
- FENCE LINE (WOOD)
- GAS LINE
- GAS METER
- HOSE BIB RISER
- HEDGE FOLIAGE LINE
- INLET (TYPE 1)
- INLET (TYPE 1) (SOLID)
- MONUMENT IN CASE (FOUND)
- PAVER SURFACE
- POST
- POWER METER
- POWER (OVERHEAD)
- POWER POLE W/ LIGHT
- REBAR AS NOTED (FOUND)
- REBAR & CAP (SET)
- ROCKERY
- SEWER LINE
- SEWER MANHOLE
- STORM DRAIN LINE
- TREE (AS NOTED)
- WATER LINE
- WATER METER

BENCH MARK

SITE BENCHMARK
SET PK NAIL IN PARKING LOT OF RESIDENCE NEAR THE EAST SIDE OF PROPERTY
ELEVATION = 115.67' (NAVD88)

NOTES:

(A) 4" FOUNDATION DRAIN CONNECTION
IE=264.43, 8"x4" WYE

(B) CB#1, TYPE II–48"ø
W/SOLID LOCKING FRAME & LID
RIM=103.60
IE=99.00, 4"(E)–FOUNDATION DRAIN CONNECTION
IE=98.36, 6"(NE)
IE=98.36, 6"(W)

(C) 38' SLOT DRAIN
GRATE ELEV.=102.45
IE=101.00, 4"(NW)

(D) INSTALL 1-1/2" METER AND 2" SERVICE LINE PER CITY OF MERCER ISLAND STANDARD PLAN W-14.
NOTE: CONTRACTOR TO COORDINATE FINAL LOCATION OF NEW METER WITH CITY OF MERCER ISLAND INSPECTOR AT TIME OF CONSTRUCTION

DOWNSPOUT TABLE

DS#1	GROUND=102.50 DOWNSPOUT LINE=101.50, 4"
DS#2	CONCRETE=102.50 DOWNSPOUT LINE=99.25, 6"
DS#3	CONCRETE=102.50 DOWNSPOUT LINE=101.00, 6"

STORM PIPE TABLE

1	37LF., 6" PVC SDR-35 @ S=2.00%
2	116LF., 4" PVC SDR-35 @ S=2.00%
3	5LF., 6" PVC SDR-35 @ S=3.11%
4	56LF., 6" PVC SDR-35 @ S=3.11%
5	125LF., 6" PVC SDR-35 @ S=4.35%
6	65LF., 8" PVC SDR-35 @ S=2.00%

SIDE SEWER NOTES

S1	41LF., 6" PVC SDR-35 GASKETED SIDE SEWER @ MIN. 2% SLOPE
S2	100LF., 4" PVC SDR-35 GASKETED SIDE SEWER @ MIN. 2% SLOPE
S3	63LF., 4" PVC SDR-35 GASKETED SIDE SEWER @ MIN. 2% SLOPE
S4	45LF., 4" PVC SDR-35 GASKETED SIDE SEWER @ MIN. 2% SLOPE
S5	4" SEWER CLEANOUT PER CITY STD. DETAIL #S-19
S6	6" SEWER CLEANOUT PER CITY STD. DETAIL #S-19 W/ TRAFFIC BEARING FRAME & LID
S7	4" SEWER CLEANOUT PER CITY STD. DETAIL #S-19 W/ TRAFFIC BEARING FRAME & LID

NOTE: THE LAWN AND LANDSCAPE AREAS ARE REQUIRED TO PROVIDE POST-CONSTRUCTION SOIL QUALITY AND DEPTH IN ACCORDANCE WITH BMP T5.13. THE PROJECT CIVIL ENGINEER MUST PROVIDE A LETTER OF CERTIFICATION TO ENSURE THAT THE LAWN AND LANDSCAPE AREAS ARE MEETING THE POST-CONSTRUCTION SOIL QUALITY AND DEPTH REQUIREMENTS SPECIFIED ON THE APPROVED PLAN SET PRIOR TO FINAL INSPECTION OF THE PROJECT.

STORM PIPE PVC SHALL BE SDR-35 PVC AT SLOPE=2.00% MINIMUM (TYPICAL) UNLESS OTHERWISE NOTED

IMPERVIOUS SURFACES:
ROOF AREA (UNDER EAVES) = 4,968 SQ. FT.
UNCOVERED DRIVEWAY AREA = 651 SQ. FT.
UNCOVERED WALKWAY = 160 SQ. FT.
UNCOVERED SLAB AREA = 683 SQ. FT.
TOTAL IMPERVIOUS AREAS = 6,462 SQ. FEET

GRAPHIC SCALE
0 5 10 20
1 inch = 10 feet

PERMIT #: 24XX–XXX

OFFE ENGINEERS

DESCRIPTION | DATE | REV. NO.

03/14/2024

DESIGNED BY: DLO | DRAWN BY: SLS | CHECKED BY: DLO

PROJECT: 8020 SE 57th Street
CLIENT: Vann Lanz Residence
SHEET CONTENT: Stormwater Site Plan

DATE: 03/14/2024
JOB NO.
DWG NO.

SHEET 2 OF 5

NE 1/4 OF THE SE 1/4 OF SECTION 24, TOWNSHIP 24 NORTH., RANGE 04 EAST, W.M., KING COUNTY, WA.

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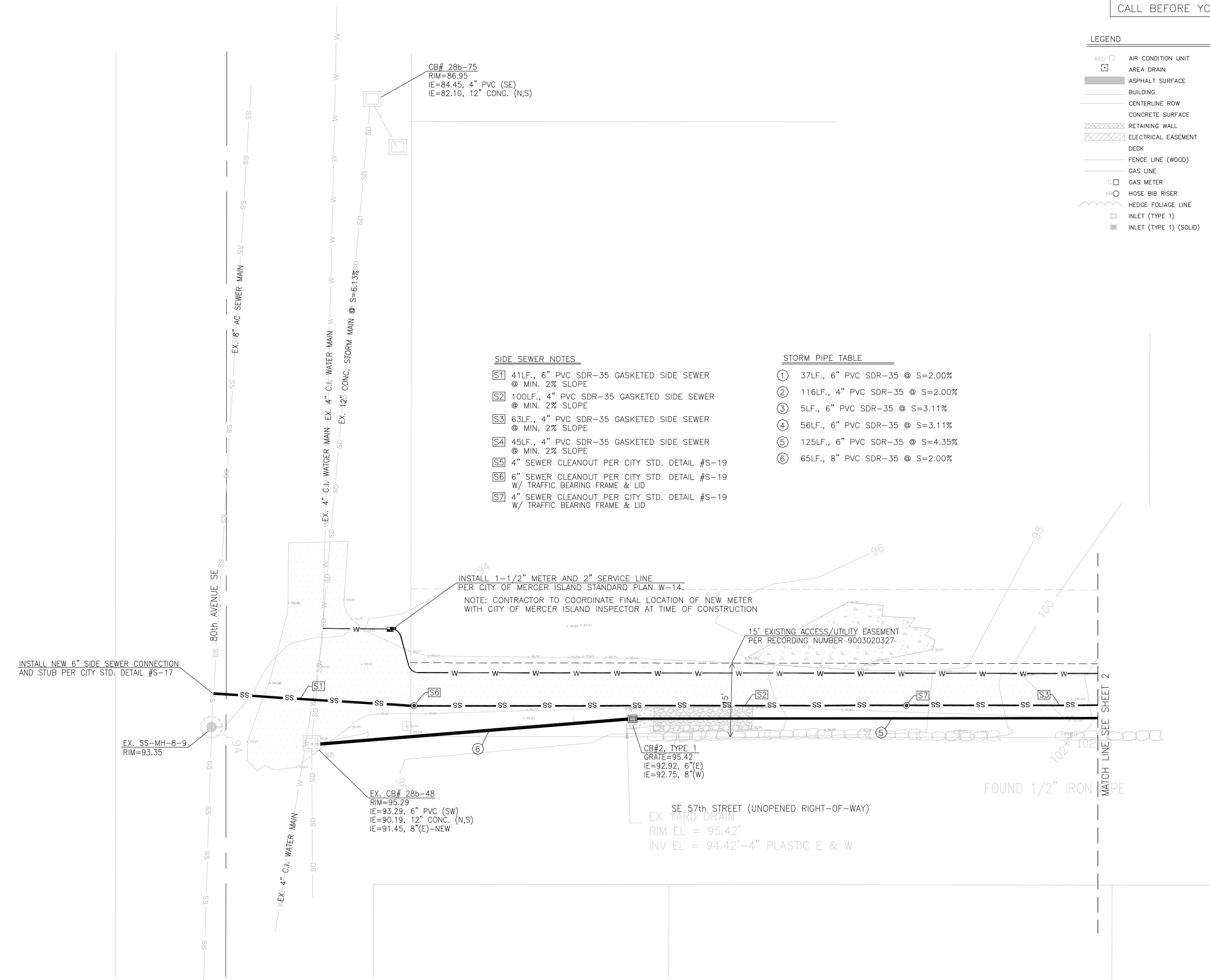
CALL BEFORE YOU DIG: 811

LEGEND

ACU AIR CONDITION UNIT	MONUMENT IN CASE (FOUND)
AREA DRAIN	PAVER SURFACE
ASPHALT SURFACE	PST POST
BUILDING	P POWER METER
CENTERLINE ROW	POWER (OVERHEAD)
CONCRETE SURFACE	POWER POLE W/ LIGHT
RETAINING WALL	REBAR AS NOTED (FOUND)
ELECTRICAL EASEMENT	REBAR & CAP (SET)
DECK	ROCKERY
FENCE LINE (WOOD)	SEWER LINE
GAS LINE	SEWER MANHOLE
G GAS METER	STORM DRAIN LINE
HB HOSE BIB RISER	SIZE TYPE TREE (AS NOTED)
HEDGE FOLIAGE LINE	WATER LINE
INLET (TYPE 1)	WM WATER METER
INLET (TYPE 1) (SOLID)	



SIDE SEWER NOTES

- S1 41LF., 6" PVC SDR-35 GASKETED SIDE SEWER @ MIN. 2% SLOPE
- S2 100LF., 4" PVC SDR-35 GASKETED SIDE SEWER @ MIN. 2% SLOPE
- S3 63LF., 4" PVC SDR-35 GASKETED SIDE SEWER @ MIN. 2% SLOPE
- S4 45LF., 4" PVC SDR-35 GASKETED SIDE SEWER @ MIN. 2% SLOPE
- S5 4" SEWER CLEANOUT PER CITY STD. DETAIL #S-19
- S6 6" SEWER CLEANOUT PER CITY STD. DETAIL #S-19 W/ TRAFFIC BEARING FRAME & LID
- S7 4" SEWER CLEANOUT PER CITY STD. DETAIL #S-19 W/ TRAFFIC BEARING FRAME & LID

STORM PIPE TABLE

- (1) 37LF., 6" PVC SDR-35 @ S=2.00%
- (2) 116LF., 4" PVC SDR-35 @ S=2.00%
- (3) 5LF., 6" PVC SDR-35 @ S=3.11%
- (4) 56LF., 6" PVC SDR-35 @ S=3.11%
- (5) 125LF., 6" PVC SDR-35 @ S=4.35%
- (6) 65LF., 8" PVC SDR-35 @ S=2.00%

PERMIT #: 24XX-XXX

REV. NO.	DATE	DESCRIPTION

03/14/2024

OFFE ENGINEERS

DESIGNED BY	DRAWN BY	CHECKED BY
DLO	SLS	DLO

PROJECT: 8020 SE 57th Street

CLIENT: Vann Lanz Residence

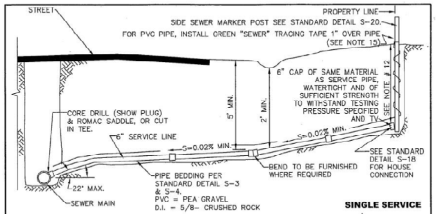
SHEET CONTENT: Stormwater Site Plan

DATE: 03/14/2024

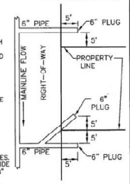
JOB NO.:

DWG NO.:

SHEET 3 OF 5



SINGLE SERVICE



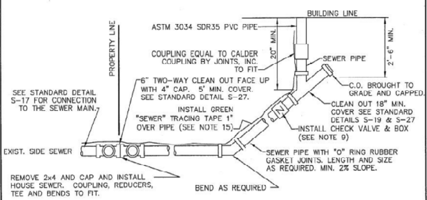
DOUBLE SERVICE

NOTES

1. ELBOWS SHALL NOT BE GREATER THAN 45 DEGREES.
2. CLEAN OUT IS REQUIRED FOR EACH PIPE LENGTH GREATER THAN 100' AND FOR EACH 90° ACCUMULATED ELBOW/100'.
3. RIGHT-OF-WAY RESTORATION SHALL MATCH OR EXCEED THE ORIGINAL CONDITION AND BE IN ACCORDANCE WITH CITY STANDARDS.
4. ALL TRENCH BACKFILL IN PUBLIC RIGHT-OF-WAY OR ROADWAY AREAS SHALL BE CRUSHED SURFACING PER WSDOT 9-09.9(3) OR BANK RUN GRAVEL PER WSDOT 9-03.19, COMPACTED IN 6" LIFTS OR MAY BE CDF WHEN DIRECTED BY THE CITY ENGINEER (SEE DETAIL S-3).
5. LAY PIPE IN STRAIGHT LINE BETWEEN BENDS. MAKE ALL CHANGES IN GRADE OR LINE WITH 1/8 BEND OR WYE. 90° CHANGE WITH 1/8 BEND AND WYE.
6. 6" SEWER PIPE MINIMUM SIZE IN RIGHT-OF-WAY, AND ELSEWHERE AS DIRECTED BY ENGINEER. 2% MIN. GRADE (UNLESS DIRECTED BY ENGINEER), 50% MAXIMUM.
7. ALL A.C. MAINS TO BE TAPPED IN ACCORDANCE WITH WAC 296-62-00775 STATE/FEDERAL GUIDELINES AND CERTIFICATION.
8. CONSTRUCTION IN RIGHT-OF-WAY MUST BE DONE BY A REGISTERED AND LICENSED CONTRACTOR.
9. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH CURRENT CITY SEWER ORDINANCES.
10. WHERE CITY ENGINEER ALLOWS SIDE SEWER CONNECTIONS TO MANHOLE, INVERT OF SIDE SEWER SHALL BE EQUAL TO OR ABOVE MAIN SEWER CROWN, BUT NOT TO EXCEED 18" ABOVE INVERT OF MAIN SEWER.
11. UNLESS OTHERWISE INDICATED ON PLAN, SIDE SEWER SHALL BE MIN. OF 6' DEEP AT PROPERTY LINE, OR 5' LOWER THAN THE LOWEST ELEVATION, WHICH EVER IS LOWER.
12. ALL PIPE MATERIALS NOT TO STANDARDS WILL BE ABANDONED AND REPLACED WITH DUCTILE IRON OR PVC PIPE OF THE SAME SIZE.
13. IF A BUILDING SEWER IS TO SERVE MORE THAN ONE PROPERTY, BY JOINT AGREEMENT OF THE OWNERS, AN APPROVED EASEMENT INSURING THAT ALL PROPERTIES INVOLVED SHALL HAVE PERPETUAL USE OF THE SIDE SEWER, HAVING PROVISIONS FOR OPERATION, MAINTENANCE, RECONSTRUCTION AND FOR ACCESS FOR REPAIR PURPOSES, SHALL BE SIGNED BY THE OWNERS. THIS EASEMENT SHALL BE RECORDED WITH THE COUNTY AUDITOR. A SIX INCH (MINIMUM) DIAMETER PIPE SHALL BE USED FOR THE COMMON LINE AND A SIX INCH CLEANOUT EXTENDING TO WITHIN 12 INCHES OF THE GROUND SURFACE SHALL BE PROVIDED AT THE WYE WHERE THE UPPER GRADE CONNECTIONS ARE MADE. BACKWATER VALVES SHALL BE INSTALLED ON SERVICE LINES UPSTREAM OF THE CONNECTION TO THE SHARED SIDE SEWER.
14. THE CITY ENGINEER MAY REQUIRE BACKWATER VALVES ON SIDE SEWERS WHEN DEEMED NECESSARY. THE EFFECTIVE OPERATION AND MAINTENANCE OF ANY BACKWATER VALVE SHALL BE THE RESPONSIBILITY OF THE OWNER OF THE SIDE SEWER.
15. UTILITY PIPE TRACER TAPE SHALL BE DETECTABLE BELOW GROUND SURFACE, COLOR CODED, WITH UTILITY NAME PRINTED ON TAPE. CONDUCTIVE WARNING TAPE REQUIRED OVER ALL WATER PIPE. TAPE SHALL BE MANUFACTURER'S STANDARD PERMANENT, BRIGHT-COLORED, CONTINUOUS PRINTED PLASTIC TAPE, ALUMINUM BACKED, INTENDED FOR DIRECT-BURIAL SERVICE. TAPE SHALL BE NOT LESS THAN 6" WIDE X 4 MILS THICK.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER
SIDE SEWER CONNECTION AND STUB

6-5-2009	NO SCALE	S-17
REV DATE		APPROVED



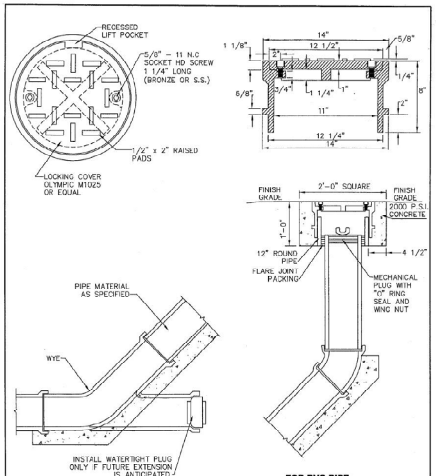
BUILDING CONNECTION

NOTES

1. ELBOWS SHALL NOT BE GREATER THAN 45 DEGREES.
2. CLEAN OUT IS REQUIRED FOR EACH PIPE LENGTH GREATER THAN 100' AND FOR EACH 90° ACCUMULATED ELBOW/100'.
3. ALL HOUSE PLUMBING OUTLETS MUST BE CONNECTED TO THE SEWER. NO DOWN SPOUTS OR STORM DRAINAGE MAY BE CONNECTED TO THE SEWER SYSTEM.
4. 18" MINIMUM COVERAGE OVER PIPE.
5. LAY PIPE IN STRAIGHT LINE BETWEEN BENDS. MAKE ALL CHANGES IN GRADE OR LINE WITH 1/8 BEND OR WYE. 90° CHANGE WITH 1/8 BEND AND WYE.
6. 4" SEWER PIPE MINIMUM SIZE ON PROPERTY. 2% MINIMUM GRADE.
7. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH CURRENT SEWER ORDINANCES.
8. ALL CONSTRUCTION REQUIRES A PLAN SHOWING PROPERTY AND DIMENSIONS AND COMPLETION OF SIDE SEWER APPLICATION AND MAINTENANCE AGREEMENT, AS NEEDED.
9. BACK WATER VALVE (CHECK VALVE) IS REQUIRED:
   A. IF CONNECTED TO A SHARED SIDE SEWER.
   B. IF CONNECTION AT HOUSE IS LOWER THAN BOTH UPSTREAM AND DOWNSTREAM MANHOLE.
   C. SEE S-23 & S-24 FOR LAKE LINE REQUIREMENTS.
10. AS-BUILT DRAWING SHOWING LOCATION OF SIDE SEWER & ALL BENDS, C.O. ETC., IN RELATION TO THE HOUSE IS REQUIRED AFTER INSPECTION & INSTALLATION. SEE STANDARD DETAIL S-38 FOR A TYPICAL "AS BUILT".
11. THE MINIMUM PIPE SIZE FOR SIDE SEWERS SHALL BE:
    6" – WITHIN THE PUBLIC RIGHT-OF-WAY.
    4" – SINGLE FAMILY RESIDENCES.
    6" – 2 TO 6 SINGLE FAMILY RESIDENCES.
    6" – BUILDINGS OTHER THAN SINGLE FAMILY RESIDENCES.
12. UTILITY PIPE TRACER TAPE SHALL BE DETECTABLE BELOW GROUND SURFACE, COLOR CODED, WITH UTILITY NAME PRINTED ON TAPE. CONDUCTIVE WARNING TAPE REQUIRED OVER ALL WATER PIPE. TAPE SHALL BE MANUFACTURER'S STANDARD PERMANENT, BRIGHT-COLORED, CONTINUOUS PRINTED PLASTIC TAPE, ALUMINUM BACKED, INTENDED FOR DIRECT-BURIAL SERVICE. TAPE SHALL BE NOT LESS THAN 6" WIDE X 4 MILS THICK.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER
HOUSE SEWER CONNECTION

6-5-2009	NO SCALE	S-18
REV DATE		APPROVED



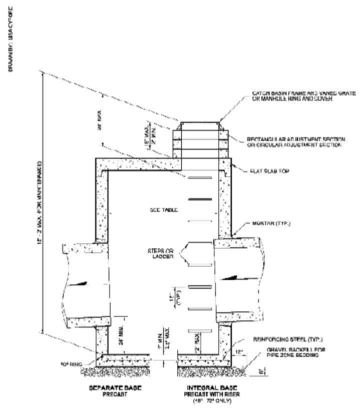
FOR PVC PIPE

NOTES

1. SEE S-27 FOR INSTALLATION DETAILS.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER
CLEAN OUT DETAIL

6-5-2009	NO SCALE	S-19
REV DATE		APPROVED



NOTES

1. No steps are required when height is 4' or less.
2. The bottom of the precast catch basin may be sloped to facilitate cleaning.
3. The rectangular frame and grate may be installed with the flange up or down. The frame may be cast into the adjustment section.
4. Knockouts shall have a wall thickness of 2" minimum to 2.5" maximum. Provide a 1.5" minimum gap between the knockout wall and the outside of the pipe. After the pipe is installed, fill the gap with joint mortar in accordance with **Standard Specification 9-04.3.**

CATCH BASIN DIMENSIONS

CATCH BASIN DIAMETER	MIN. WALL THICKNESS	MIN. BASE THICKNESS	MAXIMUM KNOCKOUT SIZE	MINIMUM DISTANCE BETWEEN KNOCKOUTS
48"	4"	6"	36"	8"
54"	4.5"	8"	42"	8"
60"	5"	8"	48"	8"
72"	6"	8"	60"	12"
84"	8"	12"	72"	12"
96"	8"	12"	84"	12"
120"	10"	12"	96"	12"
144"	12"	12"	108"	12"

PIPE ALLOWANCES

CATCH BASIN DIAMETER	PIPE MATERIAL WITH MAXIMUM INSIDE DIAMETER				
	CONCRETE	ALL METAL	CPSSP ①	SOLID WALL PVC ②	PROFILE WALL PVC ③
48"	24"	30"	24"	30"	30"
54"	30"	36"	30"	36"	36"
60"	36"	42"	36"	42"	42"
72"	42"	54"	42"	48"	48"
84"	54"	60"	54"	48"	48"
96"	60"	72"	60"	48"	48"
120"	60"	84"	60"	48"	48"
144"	78"	96"	60"	48"	48"

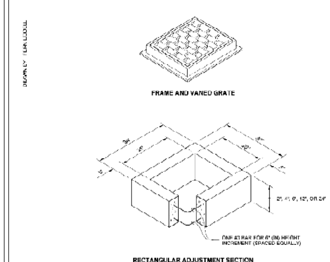
① Corrugated Polyethylene Storm Sewer Pipe **(Standard Specification 9-05.20)**
② **(Standard Specification 9-05.12(1))**
③ **(Standard Specification 9-05.12(2))**

CATCH BASIN TYPE 2

STANDARD PLAN B-10.20-01

SHEET 1 OF 1 SHEET

APPROVED FOR PUBLICATION
Pasco Bakotich III 02-07-12
Washington State Department of Transportation



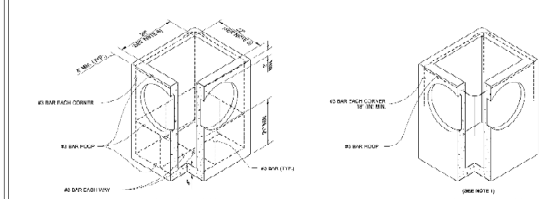
PIPE ALLOWANCES

PIPE MATERIAL	MAXIMUM INSIDE DIAMETER (INCHES)
REINFORCED OR PLAIN CONCRETE	12"
ALL METAL PIPE	15"
CPSSP ★ (STD. SPEC. SECT. 9-05.20)	12"
SOLID WALL PVC (STD. SPEC. SECT. 9-05.12(1))	15"
PROFILE WALL PVC (STD. SPEC. SECT. 9-05.12(2))	15"

★ CORRUGATED POLYETHYLENE STORM SEWER PIPE

NOTES

1. As acceptable alternatives to the rebar shown in the **PRECAST BASE SECTION**, fibers (placed according to the Standard Specifications), or wire mesh having a minimum area of 0.12 square inches per foot shall be used with the minimum required rebar shown in the **ALTERNATIVE PRECAST BASE SECTION**. Wire mesh shall not be placed in the knockouts.
2. The knockout diameter shall not be greater than 20" (in). Knockouts shall have a wall thickness of 2" (in) minimum to 2.5" (in) maximum. Provide a 1.5" (in) minimum gap between the knockout wall and the outside of the pipe. After the pipe is installed, fill the gap with joint mortar in accordance with **Standard Specification Section 9-04.3.**
3. The maximum depth from the finished grade to the lowest pipe invert shall be 5' (ft).
4. The frame and grate may be installed with the flange down, or integrally cast into the adjustment section with flange up.
5. The Precast Base Section may have a rounded floor, and the walls may be sloped at a rate of 1 : 24 or steeper.
6. The opening shall be measured at the top of the **Precast Base Section.**
7. All pickup holes shall be grouted full after the basin has been placed.



Julie Heilman

CATCH BASIN TYPE 1

STANDARD PLAN B-5.20-03

SHEET 1 OF 1 SHEET

APPROVED FOR PUBLICATION
Roark, Steve
STATE DESIGN ENGINEER
Washington State Department of Transportation

PERMIT #: 24XX–XXX

REV. NO.	DATE	DESCRIPTION

03/14/2024

OFFE ENGINEERS

DESIGNED BY	DRAWN BY	CHECKED BY
DLO	SLS	DLO

PROJECT: 8020 SE 57th Street
CLIENT: Vann Lanz Residence
SHEET CONTENT: Stormwater Details

DATE 03/14/2024
JOB NO.
DWG NO.

SHEET 4 OF 5

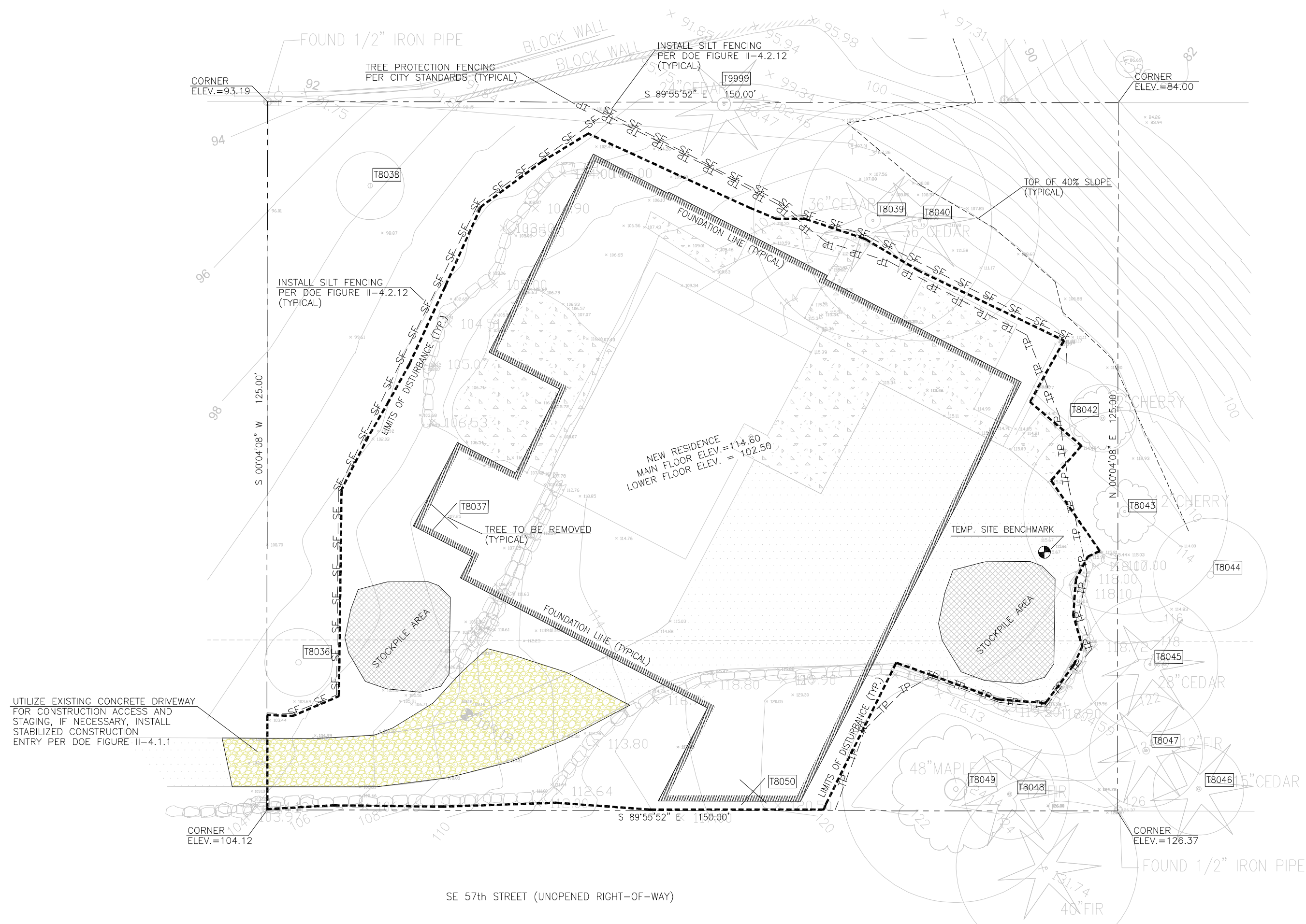
Section I-2.5.2 Minimum Requirement #2 - Construction Storm Water Pollution Prevention Plan (CSWPP)

A Construction Stormwater Pollution Prevention Plan (CSWPP) has been prepared and included within this Report. The CSWPP plan shall include construction installation of erosion control, establish a construction access, preservation of existing vegetation during construction, and protection of existing drainage inlets. This will include but not limited to: the use of the existing asphalt driveway (on the west side) to provide construction access from 80^{th} Avenue SE; installing filter fabric silt fencing along the down gradient property lines (west and north); installation of filter socks within the public catch basins located within 80^{th} Avenue SE; retention of native vegetated areas including tree/vegetation retention within the rear (west, east, and north) potions of the property; and the use straw or chipped materials placed over exposed disturbed soils to prevent runoff from carrying solids.

NE 1/4 OF THE SE 1/4 OF SECTION 24, TOWNSHIP 24 NORTH., RANGE 04 EAST, W.M., KING COUNTY, WA.

EXISTING UTILITY LOCATIONS SHOWN HEREON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILIITES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

CALL BEFORE YOU DIG: 811



LEGEND

AIR CONDITION UNIT		MONUMENT IN CASE (FOUND)	
AREA DRAIN		PAVER SURFACE	
ASPHALT SURFACE		POST	
BUILDING		POWER METER	
CENTERLINE ROW		POWER (OVERHEAD)	
CONCRETE SURFACE		POWER POLE W/ LIGHT	
RETAINING WALL		REBAR AS NOTED (FOUND)	
ELECTRICAL EASEMENT		REBAR & CAP (SET)	
DECK		ROCKERY	
FENCE LINE (WOOD)		SEWER LINE	
GAS LINE		SEWER MANHOLE	
GAS METER		STORM DRAIN LINE	
HOSE BIB RISER		TREE (AS NOTED)	
HEDGE FOLIAGE LINE		WATER LINE	
INLET (TYPE 1)		WATER METER	
INLET (TYPE 1) (SOLID)			

BENCH MARK

SITE BENCHMARK
SET PK NAIL IN PARKING LOT OF RESIDENCE NEAR THE EAST SIDE OF PROPERTY
ELEVATION = 115.67' (NAVD88)

DISTURBANCE ACREAGE: 0.27 ACRES

PROJECT PARCEL NUMBER: 294890-0082
PROJECT ADDRESS: 8020 SE 57th STREET
MERCER ISLAND, WASHINGTON 98040

SECTION/TOWNSHIP/RANGE: 24-24N-04E

TOTAL SITE ACREAGE: 0.4304 ACRES
TOTAL IMPERVIOUS AREA: 6,484 SQUARE FEET

TABLE OF CONTENT

GRAPHIC SCALE
0 5 10 20
1 inch = 10 feet

PERMIT #: 24XX-XXX

DESCRIPTION	DATE	REV. NO.

03/14/2024

OFFE ENGINEERS

DESIGNED BY	DRAWN BY	CHECKED BY
DLO	SLS	DLO

PROJECT: 8020 SE 57th Street

CLIENT: Vann Lanz Residence

SHEET CONTENT: CSWPP Plan

DATE 03/14/2024
JOB NO.
DWG NO.

SHEET 1 OF 5

Section I-2.5.3 Minimum Requirement #3 - Source Control of Pollution

Source control BMP's will be utilized to contain pollution generating runoff. No concrete washout will be allowed on the property during construction. No fuel materials will be placed or stored on site during construction.

Section I-2.5.4 Minimum Requirement #4 - Preservation of Natural Drainage Systems and Outfalls

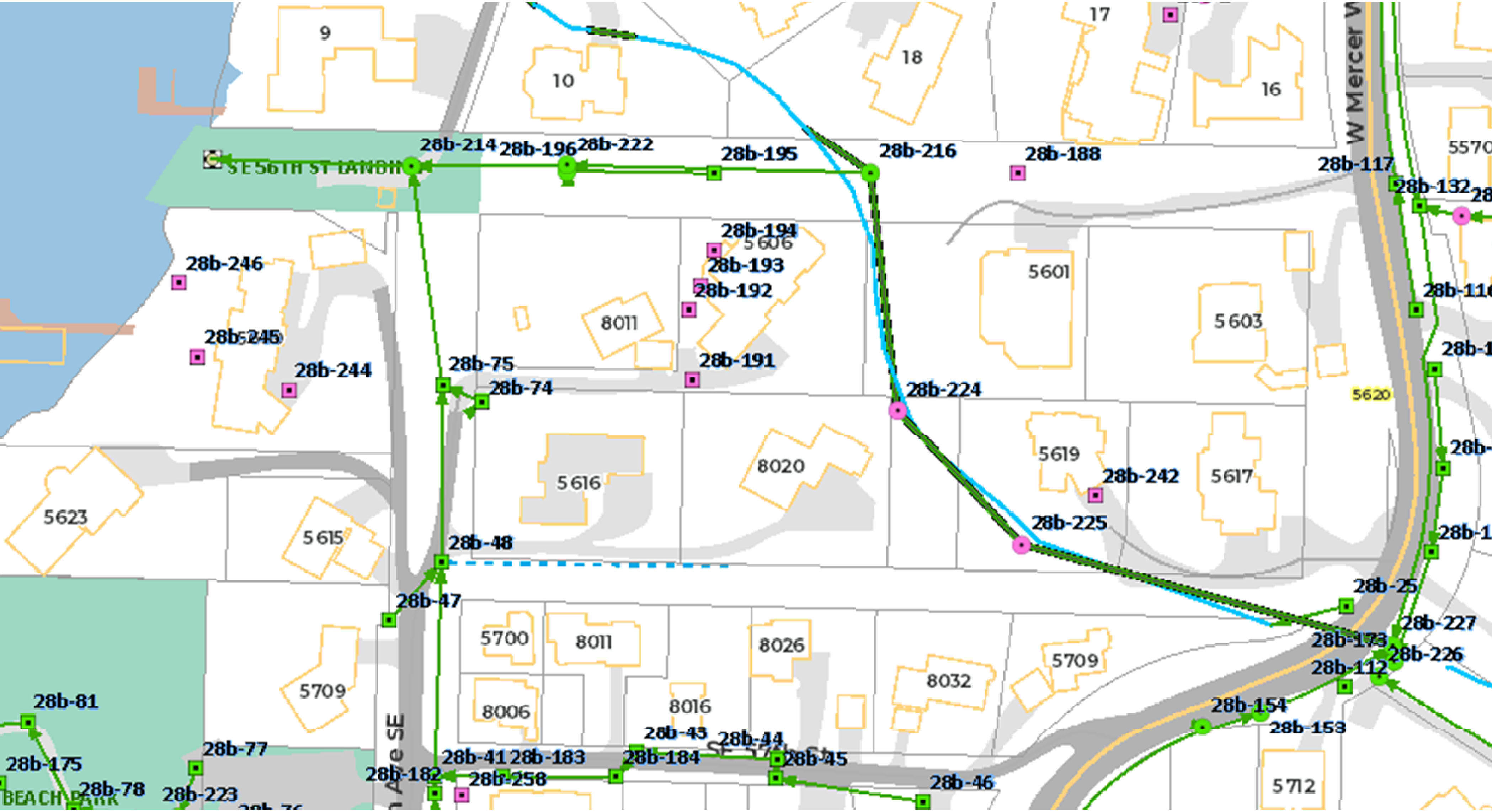
The subject property was visited in March 2024 to evaluate the site drainage patterns and perform a downstream analysis to the shoreline of Lake Washington. The subject property natural drainage outfall is sheet flow in two directions: (1) towards the northeast and down a steep slope to a stream at the bottom of the slope; (2) towards the northwest and west into existing neighboring properties and eventually into 80th Avenue SE. These two natural outfalls come together 420 feet downstream before being conveyed into Lake Washington. The subject property is within a single Threshold Discharge Area (TDA).

A downstream analysis was performed on the 80th Avenue SE outfall area since the new proposed development will connect into this existing system. New impervious surfaces from the new residence and driveway will flow into the existing public drainage system within 80th Avenue SE; no proposed new impervious surface runoff will flow into the stream at the bottom of the steep slope. The downstream drainage system within 80th Avenue SE was walked, reviewed, and pictures taken from the subject property to the shoreline of Lake Washington.

The natural outfall of the subject property will be into CB#28b-48 within 80th Avenue SE. The downstream system consists of catch basins and conveyance pipes to the outfall into Lake Washington. The following is a review and inspection of the conveyance system:

CB#28b-48 – flowing water, sump appeared full of debris
CB#28b-74 – yard drain in the shoulder on the east side of 80th Avenue SE, debris on inlet, small pipe (4") directed towards CB#28b-75 – no water flowing NW
CB#28b-75 – located at the end of 80th Avenue SE, small inlet, debris in sump
CB#28b-214 – solid locking lid, no indications of overflow out of lid
Lake Outfall – flowing water, no scouring or erosion present

The accessible portion of the downstream public storm system downgradient form the subject property natural outfall has no indications of flooding, overtopping, erosion, or scouring. There were no indications of overtopping at of CB#28b-75 into the vegetated slope to the north. There were no indications of overtopping of CB#28b-214, within SE 56th Street Landing, into the gravel area to the west. The downstream system appears to have adequate capacity. The existing catch basins need to have the sumps cleaned out due to debris build-up.



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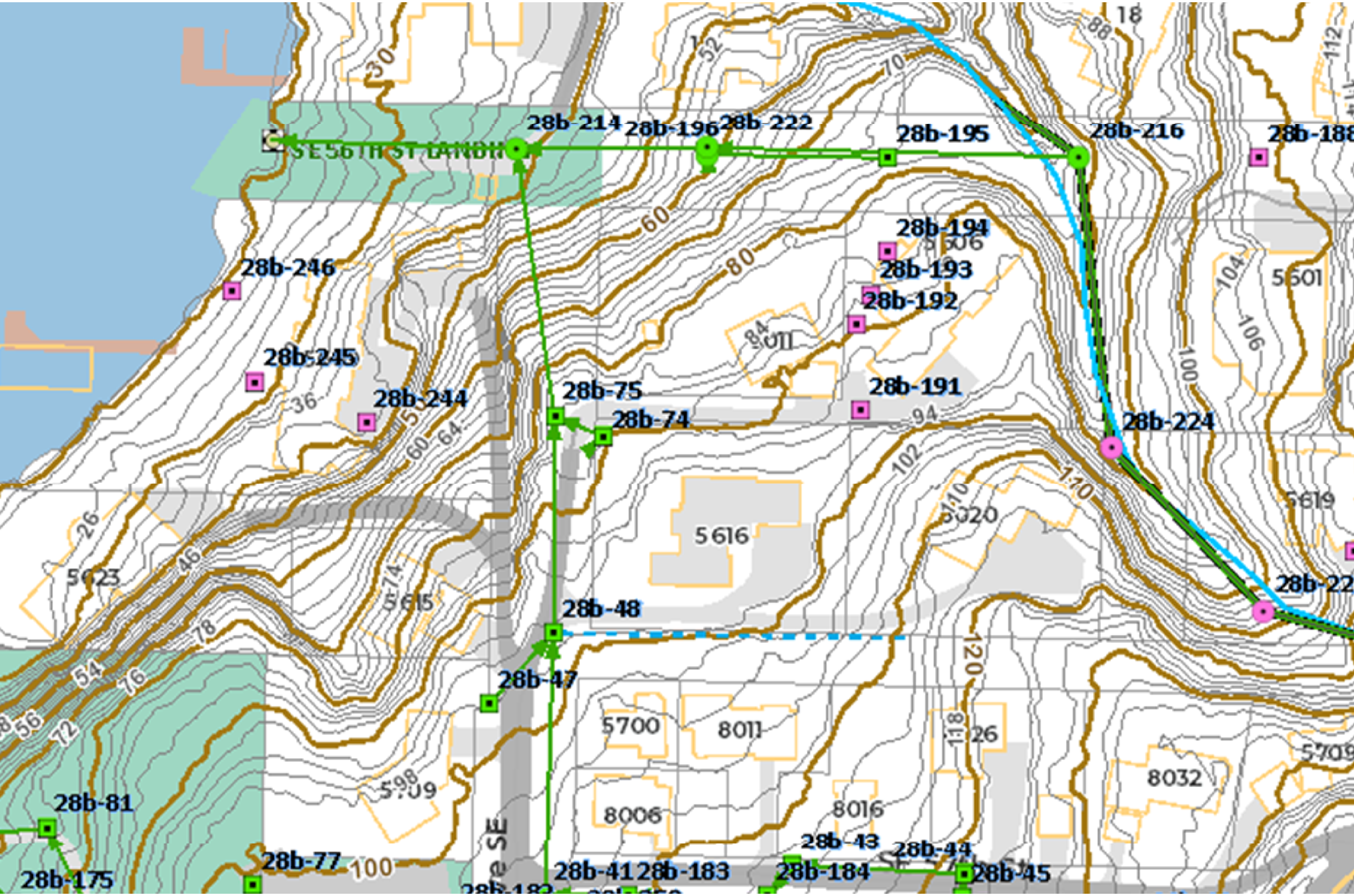
BEACH PARK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8020 SE 57th Street off-site and downstream photos

Photo #1 – Existing CB#28b-48 -within east side of 80th Avenue SE

Photo #2 – Existing CB#28b-48 – viewing east from 80th Avenue SE towards subject property

Photo #3 – Existing area drain on south side of driveway heading towards 8020 SE 57th Street

Photo #4 – Existing CB#28b-48 – viewing north on 80th Avenue SE

Photo #5 – Existing CB#28b-74 – on east side of end of 80th Avenue SE

Photo #6 – Existing CB#28b-75 at end of 80th Avenue SE

Photo #7 – North end of 80th Avenue SE – before dropping down slope

Photo #8 – Existing CB#28b-214 – viewing west towards Lake Washington

Photo #9 – Outfall into Lake Washington – viewing north along shoreline

Section I-2.5.5 Minimum Requirement #5 - On-Site Stormwater Management
The proposed project discharge shall be evaluated using *"List #2, On-Site Stormwater Management BMPs for projects triggering Minimum Requirements #1 - #9"* – DOE Volume 1, Chapter 2, pages 57 and 58.

The subject property is located within an infiltration infeasibility area as shown the attached City of Mercer Island "*Infiltration Infeasibility Map*". Based upon the attached Geotechnical Engineering Study within Appendix A, the Geotechnical Engineer does not recommend infiltration type BMPs.

List #1
Lawn and landscape areas – ***feasible -*** The use of Post-Construction Soil Quality and Depth shall be implemented within areas of the property that are not covered by hard surfaces and were disturbed during condition.

Roofs:

1.a. Full Dispersion (BMP T5.30) – ***infeasible*** due to lack of available 100' of vegetated flow path downgradient from the roof area.

1.b. Full Infiltration (BMP T5.10A)– ***infeasible*** based upon Geotechnical Engineering Report

2. Rain Garden/Bioretention (BMP T7.30) – ***infeasible*** due to lack of available area on the downgradient portion of the property (west side). Proximity to steep slopes, no available on-site areas for bioretention type BMPs.

3. Downspout Dispersion System (BMP T5.10B) – ***infeasible*** due to lack of available 50' flow path downgradient of the downspout leaders.

4. Perforated Pipe Connection (BMP T5-10C) – infeasible due to soils are not suitable for infiltration

Other Hard Surfaces:

1. Full Dispersion (BMP T5.30) – ***infeasible*** due to the lack of available 100' of vegetated flow path length.

2. Permeable Pavement – ***infeasible*** infiltration type BMP not recommended based upon Geotechnical Engineering Report

3. Rain Garden/Bioretention – ***infeasible*** due to lack of available area on the downgradient portion of the property (west side). Proximity to steep slopes, no available on-site areas for bioretention type BMPs .

4. Sheet Flow Dispersion – ***infeasible*** due to lack of available 25 feet of flow path downgradient from driveway.

There are no available BMPs to provide on-site storm water mitigation of the roof area or other hard surfaces. Therefore, connection the public storm system within 80th Avenue SE will be provided.

Section I-2.5.6 Minimum Requirement #6 – Runoff Treatment

Determine if thresholds for runoff treatment have been exceeded:

(a) *Projects that exceed 5,000 square feet of pollution generating hard surfaces (PGHS)* – The proposed project will generate 651 square feet of PGHS – threshold not exceeded

(b) *Projects that create or modify ¾ acre (32,670 square feet) of pollution generating pervious surface (PGPS)* – The proposed project will create or modify 4,800 square feet of PGPS – threshold not exceeded.

The thresholds for runoff treatment have not been exceeded, therefore proposed project does not have to provided runoff treatment.

Section I-2.5.7 Minimum Requirement #7 – Flow Control

Based upon Minimum Requirement #4, the subject property discharges into a flow control exempt receiving body (Lake Washington) through man-made drainage system. Therefore, the proposed project is flow control exempt.

Section I-2.5.8 Minimum Requirement #8 – Wetlands Protection

Proposed project does not discharge into a wetland; therefore, Minimum Requirement #8 does not apply.

Section I-2.5.9 Minimum Requirement #9 – Operation and Maintenance

Attached

Table V-4.5.2(3) Maintenance Standards - Closed Detention Systems (Tanks/Vaults) (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Catch Basins	See "Catch Basins" (No. 5)	See "Catch Basins" (No. 5).	See "Catch Basins" (No. 5).

Table V-4.5.2(4) Maintenance Standards - Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris (Includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
	Structural Damage	Structure is not securely attached to manhole wall. Structure is not in upright position (allow up to 10% from plumb). Connections to outlet pipe	Structure securely attached to wall and outlet pipe. Structure in correct position. Connections to outlet pipe are water tight; structure repaired or replaced and works as

Table V-4.5.2(4) Maintenance Standards - Control Structure/Flow Restrictor (continued)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
		are not watertight and show signs of rust.	designed.
		Any holes - other than designed holes - in the structure.	Structure has no holes other than designed holes.
Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing.	Gate is watertight and works as designed.
		Gate cannot be moved up and down by one maintenance person.	Gate moves up and down easily and is watertight.
		Chain/rod leading to gate is missing or damaged.	Chain is in place and works as designed.
		Gate is rusted over 50% of its surface area.	Gate is repaired or replaced to meet design standards.
Orifice Plate	Damaged or Missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
Manhole	See "Closed Detention Systems" (No. 3).	See "Closed Detention Systems" (No. 3).	See "Closed Detention Systems" (No. 3).
Catch Basin	See "Catch Basins" (No. 5).	See "Catch Basins" (No. 5).	See "Catch Basins" (No. 5).

Table V-4.5.2(5) Maintenance Standards - Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin).	Top slab is free of holes and cracks. Frame is sit-

Table V-4.5.2(5) Maintenance Standards - Catch Basins (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	ting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 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.	Basin replaced or repaired to design standards. Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.
	Contamination and Pollution	See "Detention Ponds" (No. 1).	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed
	Locking Mechanism Not	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into	Mechanism opens with

Table V-4.5.2(5) Maintenance Standards - Catch Basins (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
	Working	frame have less than 1/2 inch of thread.	proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate opening Unsafe	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 inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

Table V-4.5.2(6) Maintenance Standards - Debris Barriers (e.g., Trash Racks)

Maintenance Components	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier cleared to design flow capacity.
Metal	Damaged/ Missing	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than 3/4

Appendix A: Geotechnical Evaluation

Earth Solutions NW LLC

Geotechnical Engineering
Construction Observation/Testing
Environmental Services

PRELIMINARY GEOTECHNICAL ENGINEERING STUDY
PROPOSED SINGLE-FAMILY RESIDENCE
8020 SOUTHEAST 57TH STREET
MERCER ISLAND, WASHINGTON

ES-9304

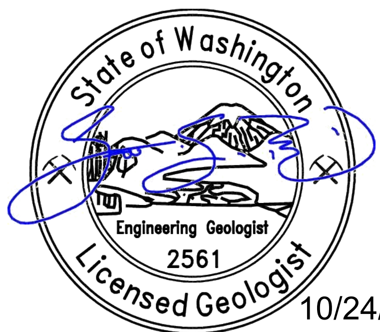
15365 N.E. 90th Street, Suite 100 • Redmond, WA 98052
(425) 449-4704 Fax (425) 449-4711
www.earthsolutionsnw.com

PREPARED FOR

LNL BUILDS, LLC

October 24, 2023

Brian C. Snow, L.G.
Senior Staff Geologist



10/24/2023

Scott S. Riegel

Scott S. Riegel, L.G., L.E.G.
Associate Principal Geologist

PRELIMINARY GEOTECHNICAL ENGINEERING STUDY
PROPOSED SINGLE-FAMILY RESIDENCE
8020 SOUTHEAST 57TH STREET
MERCER ISLAND, WASHINGTON

ES-9304

Earth Solutions NW, LLC
15365 Northeast 90th Street, Suite 100
Redmond, Washington 98052
Phone: 425-449-4704 | Fax: 425-449-4711
www.earthsolutionsnw.com

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will <u>not</u> likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will <u>not</u> be adequate to develop geotechnical design recommendations for the project.

Do <u>not</u> rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do <u>not</u> rely on an executive summary. Do <u>not</u> read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are <u>not</u> final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are <u>Not</u> Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will <u>not</u> of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are <u>not</u> building-envelope or mold specialists.***

GBA GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
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Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

October 24, 2023
ES-9304

LNL Builds, LLC
8015 Southeast 60th Street
Mercer Island, Washington 98040

Attention: Vann Lanz

Dear Vann:

Earth Solutions NW, LLC (ESNW), is pleased to present this preliminary geotechnical report to support the proposed single-family residential development. Based on the results of this study, the proposed construction is preliminarily feasible from a geotechnical standpoint. Our field observations indicate the site is underlain by about 10 to 15 feet of medium dense silty sand deposits, which in turn are underlain by medium dense to very dense silt dominant soils. Groundwater was not encountered during the September 2023 subsurface exploration.

The proposed structure can be supported on conventional spread and continuous foundations bearing on undisturbed competent native soil, recompacted native soil, or new structural fill. Based on our understanding of preliminary design concepts, the proposed residence will include a basement level approximately 10 to 12 feet below existing grades, with bottom-of-footing at about elevation 101 feet. Based on conditions observed during the fieldwork, we recommend that soils exposed at foundation subgrade elevations on native cut surfaces are compacted in situ to a minimum depth of one foot below the design subgrade elevation. An ESNW representative should be contacted to confirm suitability of foundation subgrades at the time of construction and to provide supplementary recommendations, as necessary.

In our opinion, a contingency should be provided in the budget for the export of fine-grained soil cuttings and import of suitable structural fill material, as needed.

Review of the City of Mercer Island GIS portal and the referenced mapping resources indicates that the site is located within an area designated as infeasible for infiltration, and infiltrating LID facilities are not permitted at the subject site. In our opinion, based on the fine-grained native soil textures, sloping surface grades, and the reviewed city mapping resources, on-site infiltration should be considered infeasible from a geotechnical standpoint.

This report provides preliminary geotechnical analyses and recommendations for the proposed construction. We appreciate the opportunity to be of service to you on this project. If you have any questions about this geotechnical engineering study, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

Brian C. Snow, L.G.
Senior Staff Geologist

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Cont'd

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PRELIMINARY GEOTECHNICAL ENGINEERING STUDY
PROPOSED SINGLE-FAMILY RESIDENCE
8020 SOUTHEAST 57TH STREET
MERCER ISLAND, WASHINGTON

ES-9304

INTRODUCTION

General

This preliminary geotechnical engineering study was prepared for the proposed residential construction to be located at 8020 Southeast 57th Street, just east of 80th Avenue Southeast between the intersections with Southeast 56th Street and Southeast 57th, in Mercer Island, Washington.

The purpose of this study was to provide preliminary geotechnical recommendations to support the current development plans, as understood at the time of this study. To complete this study, ESNW performed the following services:

- Subsurface investigation through a series of exploratory borings to characterize the soil and groundwater conditions within accessible areas of the site.
- Laboratory testing of representative soil samples collected at the exploration locations.
- Review of on-site geologically hazardous areas and applicable Mercer Island Code.
- Engineering analyses and recommendations for the proposed construction.
- Preparation of this report.

Project Description

The subject site is located at 8020 Southeast 57th Street, just east of 80th Avenue Southeast between the intersections with Southeast 56th Street and Southeast 57th, in Mercer Island, Washington.

Specific grading and development plans were not available at the time of this report; however, we understand the site will be redeveloped with one new single-family residence and associated improvements. Based on our understanding of preliminary design concepts, the proposed residence will include a basement level approximately 10 to 12 feet below existing grades, with bottom-of-footing at about elevation 101 feet.

At the time of report submission, specific building load values were not available for review; however, we anticipate the proposed residential structure will be two to three stories in height and will consist of relatively lightly loaded wood framing. Based on our experience with similar developments, we estimate perimeter wall loads of about 2 to 3 kips per linear foot and slab-on-grade loading of 150 pounds per square foot (psf) will be incorporated into the final design.

If the above design assumptions either change or are incorrect, ESNW should be contacted to review the recommendations provided in this report. ESNW should review final designs to verify the geotechnical recommendations provided in this report have been incorporated into the plans.

SITE CONDITIONS

Surface

The subject site is located at 8020 Southeast 57th Street, just east of 80th Avenue Southeast between the intersections with Southeast 56th Street and Southeast 57th, in Mercer Island, Washington. The approximate site location is depicted on Plate 1 (Vicinity Map). The site is comprised of a single tax parcel (King County Parcel No. 2948900082) and totals about 0.43 acres of land area. The property is currently occupied by a single-family residence and associated improvements. Undeveloped portions of the site primarily consist of grassy lawn areas and landscaping elements.

Per the City of Mercer Island GIS Portal, surface topography descends at variable gradients to the north, east, and west for a total of about 34 feet of vertical relief within the property boundaries. The GIS portal also indicates portions of the sloped areas are identified as “protected slopes.” The site is generally surrounded by existing residential development. A natural drainage ravine is present off the northeast property corner, and the GIS portal indicates the ravine contains both piped and un-piped watercourses.

Subsurface

An ESNW representative observed, logged, and sampled two soil borings advanced at accessible locations within the property boundaries on September 15, 2023, using a mini-track-mounted drill rig and operators retained by ESNW. The maximum exploration depth was approximately 26.5 feet below the existing ground surface (bgs). Native soils were identified throughout each exploratory boring, both of which were terminated in very dense undisturbed native deposits.

The approximate locations of the borings are depicted on Plate 2 (Boring Location Plan). Please refer to the boring logs provided in Appendix A for a more detailed description of subsurface conditions. Representative soil samples collected at the exploration locations were analyzed in general accordance with Unified Soil Classification System (USCS) and USDA methods and procedures.

Topsoil and Fill

Neither topsoil nor existing fill material were observed within samples collected during the subsurface exploration. However, due to the sampling methods utilized in hollow-stem auger drilling (first sample collected at two-and-one-half feet bgs), there is potential that relatively thin sections of topsoil or fill are present.

Based on the existing site conditions and our experience with similar sites in the project vicinity, roughly 6 to 12 inches of topsoil and/or fill may be assumed. Minor fills should be expected beneath asphalted sections of the property (crushed rock base course) and where existing site improvements have been made.

Native Soil

Native soils observed at the exploration sites chiefly consisted of variable amounts of sand and silt. In general, medium dense silty sand deposits (USCS: SM) were encountered at both exploration sites extending from the surface to depths between about 10 and 15 feet bgs. Underlying the silty sand deposits, medium dense to very dense silt deposits (USCS: ML) were encountered, which extended to the termination depth of each exploratory boring. Relative soil density generally increased with depth. Infrequent interbedding was observed within the upper 10 to 15 feet of existing grades. Fines content ranged from about 6 to 100 percent.

Based on the results of the Atterberg limits analysis, in-situ moisture contents of the native silt soils (USCS: ML) encountered at boring locations B-1 and B-2 were generally between 16 to 35 percent, in some cases exceeding the plastic limit.

Geologic Setting

The referenced geologic map identifies Lawton Clay deposits (Qvlc) at the higher elevations within the southeastern portion of the property, and Pre-Olympia nonglacial deposits (Qpon) at lower elevations in the northwestern portion of the property.

Lawton Clay is characterized as laminated to massive silt with scattered dropstones deposited in lowland proglacial lakes, which locally may include fine-grained sediment associated with Olympia bed deposits (Qob). Pre-Olympia nonglacial deposits are described as sand, gravel, silt, clay, and organic deposits of inferred nonglacial origin, based on the presence of paleosols, tephra layers, or a southern Cascade Range provenance for sedimentary clasts.

The online WSS resource identifies Kitsap silt loam (Map Unit Symbol: KpB) as the primary soil unit underlying the site. Kitsap series soils formed atop glacial lake deposits under a cover of conifer trees and shrubs. Per the referenced soil survey report, runoff over this soil unit is characterized as slow to medium, and the erosion hazard is slight to moderate.

Based on conditions encountered during the fieldwork, we interpret the native soils to be representative of transitional bed and glaciolacustrine deposits and are relatively consistent with the geologic and soil mapping resources reviewed in this section.

Groundwater

Groundwater was not observed during the September 2023 subsurface exploration. However, in our experience, groundwater seepage is typical of the local geologic deposits and should be expected within site excavations, particularly during the wet season. Groundwater flow rates and elevations may fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the winter, spring, and early summer months.

GEOLOGICALLY HAZARDOUS AREAS – MICC 19.07.160

We reviewed Mercer Island City Code (MICC) Chapter 19.07.160 – Geologically Hazardous Areas – to evaluate the presence of geologically hazardous areas at the subject site. Per the MICC, geologically hazardous areas within the City of Mercer Island (City) include areas susceptible to erosion, sliding, earthquake, or other geological events based on a combination of slope (gradient or aspect), soils, geologic material, hydrology, vegetation, or alterations, including landslide hazard areas, erosion hazard areas, and seismic hazard areas.

Review of the City's online GIS portal and critical area maps available in the City's online Map Gallery indicates the site contains landslide and erosion hazard areas. Seismic hazards were not identified. As previously noted, the site also contains both piped and un-piped watercourses. An evaluation of each identified hazard is provided below.

Landslide Hazard Areas

Landslide hazard areas are those areas subject to landslides based on a combination of geologic, topographic, and hydrologic factors. The referenced mapping resources indicate the site is within a landslide hazard area, and that at least three "known landslides" have occurred within about 400 feet of the subject site. However, known slides and mass-wasting deposits are not mapped or otherwise identified within the property boundaries.

Steep slopes include any slope of 40 percent or greater calculated by measuring the vertical rise over any 30-foot horizontal run. Steep slopes do not include artificially created cut slopes or rockeries. Based on our review of Mercer Island GIS Portal topographic data, slope gradients across the site generally exceed 15 percent, with areas exceeding 40 percent for at least 30 feet of horizontal distance along the eastern site margin. Steep slopes are included as a subclassification of landslide hazard areas, and as such, the steep slope descending off the northeast corner of the existing residence is classified as a landslide hazard area.

Per MICC 19.07.160(B)(2), "alteration of landslide hazard areas […] and associated buffers may occur" pending the results of a critical area study. The critical areas study must determine that the project proposal: (a) will not adversely impact other critical areas, (b) will not adversely impact the subject property or adjacent properties, (c) will mitigate impacts to the geologically hazardous area consistent with best available science to the maximum extent reasonably possible such that the site is determined to be save, and (d) includes the landscaping of all disturbed areas outside of building footprints and installation of hardscape prior to final inspection.

MICC section 19.07.160(B)(3) requires a statement of risk from the geotechnical professional in order to allow alteration of landslide hazard areas and associated buffers. In our opinion, based on site conditions observed during the fieldwork and slope stability analyses attached to this report, **"the landslide hazard area will be modified or the development has been designed so that the risk to the site and adjacent property is eliminated or mitigated such that the site is determined to be safe."** Further discussion regarding landslide susceptibility is provided in the *Slope Stability Analysis* section of this report.

Slope Stability Analysis

We evaluated slope stability across the subject site with primary focus on areas likely to be influenced or affected by the proposed modifications. Global slope stability analyses were completed using the 2021 GeoStudio Slope/W modeling program to reflect existing and proposed conditions in both static and seismic scenarios, including foundation loading where applicable. The analyses focused primarily on deep-seated rotational failures and were completed using topographic data available through the online Mercer Island GIS resource. Two cross-sections were prepared (A-A' and B-B') and are depicted on Plate 2 (Boring Location Plan).

The soil stratigraphy was modeled as two distinct soil units based on conditions observed during the subsurface exploration. We utilized relatively conservative strength parameters in our slope models, outlined in the table below. Additional modeling parameters are attached to this letter report (see Appendix C). Groundwater was not included in the modeling as a pervasive groundwater condition was not observed during the September 2023 subsurface exploration.

Soil Unit	Density or Consistency	Unit Weight (pcf)	Cohesion (psf)	Internal Friction Angle (deg)
Silt	Very dense	110	225 (static) 450 (seismic)	20
Silty Sand	Medium dense	125	0 (static) 50 (seismic)	34

Our analyses indicate the proposed site modifications will improve overall slope stability by advancing new foundation loading 10 to 12 feet below existing grades. The proposed site modification and excavation will reduce the overall soil mass and related driving forces for downslope failure, and safety factors for the proposed condition (including new foundation and seismic loading) reflect an improvement over the existing condition. We note that the modeled cohesion value within the silt unit was reduced by half for the static condition; cohesion within the silty sand was reduced to zero under static loading to represent a drained condition, although it is reasonable to assume this soil type remains in a partially undrained condition which reflects a conservative modeling approach. In our opinion, the proposed development and positioning of the new residential structure should be considered preliminarily feasible from a geotechnical standpoint and the analysis indicates no additional mitigation is required to provide an adequate level of safety.

Erosion Hazard Areas

Erosion hazard areas are those areas greater than 15 percent slope and subject to severe risk of erosion due to wind, rain, water, slope, and other natural agents including those soil types and/or areas identified by the U.S. Department of Agriculture's Natural Resources Conservation Service as having a "severe" or "very severe" rill and inter-rill erosion hazard.

The referenced mapping resources indicate the site contains mapped areas of known or suspected erosion hazard areas, with supplemental data indicating mixed infiltration potential (interbedded or mixed fine and coarse-grained deposits) and areas of estimated slope gradients ranging from 15 to 39 percent.

Infiltration potential can influence erosivity by loosening surface material for removal by erosion. Where sandy soils (with relatively high inferred infiltration rates) are exposed at the surface, the City's Erosion Hazard Assessment map delineates areas of potential erosion hazard. Based on our observations of predominantly silty sand soils with relatively high fines content near the surface, infiltration potential at the surface is considered low and not recommended.

In any case, surface grades at the subject site generally exceed 15 percent gradient and, as indicated in the *Geologic Setting* section of this report, the native Kitsap silt loam soils are characterized by the USDA with slight to moderate erosion hazard. The site is therefore not classified as an erosion hazard area per city definition criteria.

Given the moderate erosion potential of the native soils, typical construction stormwater management methods are anticipated to be adequate for mitigating erosion potential during the earthwork and construction phases of the project. At a minimum, silt fencing should be placed along the downslope site margins, and soil stockpiles should be covered with plastic sheeting when not in use. If construction occurs during periods of wet weather, methods to control surface water runoff will be necessary. Construction stormwater should neither be allowed to collect at the top of slope nor flow over steeply sloping areas. Final drainage plans should be designed such that stormwater is collected and diverted away from slopes exceeding 15 percent to an approved discharge location. Erosion control measures should be actively maintained to ensure proper performance.

Watercourses

Based on our review of the Mercer Island GIS Portal, piped and un-piped watercourses are present within the drainage ravine located off the northeastern property corner. During our fieldwork, we performed a visual site reconnaissance to assess the presence of piped and/or un-piped water courses. During our reconnaissance, no piping or exposed surface water flows were observed within the drainage ravine. In our opinion, it is likely that the ravine serves as a seasonal, surface pathway for storm and natural shallow groundwater descending the hillslope.

Per the GIS Portal, a watercourse buffer is applied at about 60 feet from the centerline of the un-piped watercourse, indicating a stream type Np or Ns. However, as the geotechnical professional, watercourse designation, typing, and buffer delineation is outside of our area of expertise, and the watercourse should be evaluated by the appropriate professional.

It is noted that, per MICC 19.07.180(C)(3), any watercourse adjoined by a […] contiguous critical area shall have the buffer required for the stream type involved or the buffer that applies to the […] other critical area, whichever is greater.

Based on the results of our slope stability analysis, the proposed site configuration is acceptable from a global stability and geotechnical standpoint. As noted in the *Landslide Hazard Areas* section above, it is our opinion that alteration of the identified landslide hazard areas and associated buffer area is permissible from a geotechnical standpoint. Therefore, the watercourse buffer will likely prevail per MICC 19.07.180(C)(3).

DISCUSSION AND RECOMMENDATIONS

General

Based on the results of this study, the proposed construction is feasible from a geotechnical standpoint. Our field observations indicate the site is underlain by about 10 to 15 feet of medium dense silty sand deposits, which in turn are underlain by medium dense to very dense silt dominant soils. Groundwater was not encountered during the September 2023 subsurface exploration.

The proposed structure can be supported on conventional spread and continuous foundations bearing on undisturbed competent native soil, recompacted native soil, or new structural fill. Based on our understanding of preliminary design concepts, the proposed residence will include a basement level approximately 10 to 12 feet below existing grades, with bottom-of-footing elevations of about 101 feet. Based on conditions observed during the fieldwork, we recommend that soils exposed at foundation subgrade elevations on native cut surfaces be mechanically compacted in situ to a minimum depth of one foot below the design subgrade elevation prior to placing concrete formwork or rebar. An ESNW representative should be contacted to confirm suitability of foundation subgrades at the time of construction and to provide supplementary recommendations, as necessary.

The near surface soils are considered to be “granular” and are anticipated to be suitable for use as structural fill, provided the soils are near the optimum moisture content. However, fine-grained soils generated from excavations advanced deeper than about 10 to 15 feet bgs should be removed from the site and should not be used as structural fill. In our opinion, a contingency should be provided in the budget for the export of fine-grained soil cuttings and import of suitable structural fill material, as needed.

Review of the City of Mercer Island GIS portal and the referenced mapping resources indicates that the site is located within an area designated as infeasible for infiltration, and infiltrating LID facilities are not permitted at the subject site. In our opinion, based on the fine-grained native soil textures, sloping surface grades, and the reviewed city mapping resources, on-site infiltration should be considered infeasible from a geotechnical standpoint.

This study has been prepared for the exclusive use of LNL Builds, LLC, and its representatives. A warranty is neither expressed nor implied. This study has been prepared in a manner consistent with the level of care and skill ordinarily exercised by other members of the profession currently practicing under similar conditions in this area.

Site Preparation and Earthwork

Site preparation activities should consist of installing temporary erosion control measures and performing site stripping within the designated clearing limits. Subsequent earthwork activities will likely involve grading, subgrade preparation, drainage improvements, and infrastructure and utility installations.

Temporary Erosion Control

The following temporary erosion and sediment control (TESC) BMPs are offered:

- Temporary construction entrances and drive lanes, consisting of at least six inches of quarry spalls, should be considered to both minimize off-site soil tracking and provide stable surfaces at site entrances. Placing geotextile fabric underneath the quarry spalls will provide greater stability, if needed.

- Silt fencing should be placed around appropriate portions of the site perimeter.

- When not in use, soil stockpiles should be covered or otherwise protected to reduce the potential for soil erosion, especially during periods of wet weather.

- Temporary measures for controlling surface water runoff, such as interceptor trenches, sumps, or interceptor swales, should be installed prior to beginning earthwork activities.

- Dry soils disturbed during construction should be wetted to minimize dust and airborne soil erosion.

Additional TESC BMPs, as specified by the project civil engineer and indicated on the plans, should be incorporated into construction activities, as necessary. Temporary erosion control measures must be actively managed and may be modified during construction as site conditions require, as approved by the site erosion control lead to ensure the BMPs are performing as intended.

Given the sloping surface grades and the slight to moderate erosion potential of the native soils, enhanced erosion control measures may be required to provide an adequate level of protection for adjacent properties during construction. The contractor must be prepared to employ additional TESC BMPs during construction depending on soil conditions encountered and actively manage BMPs to ensure proper performance.

Excavations and Slopes

Excavation activities are likely to expose medium dense sandy native soils within the upper 10 to 15 feet of existing grades, transitioning to medium dense to very dense silt dominant soils at depth. Very dense soil conditions are not anticipated within the upper 15 feet of existing grades. Groundwater seepage should be anticipated within site excavations depending on the time of year.

Based on the soil conditions observed at the subsurface exploration locations, the following maximum allowable temporary slope inclinations may be used. The applicable Federal Occupation Safety and Health Administration and Washington Industrial Safety and Health Act soil classifications are also provided.

- Areas exposing groundwater seepage 1.5H:1V (Type C)
- Loose or previously disturbed soil, fill 1.5H:1V (Type C)
- Medium dense native soil 1H:1V (Type B)
- Very dense native soil 0.75H:1V (Type A)

Permanent slopes should be planted with vegetation to both enhance stability and minimize erosion and should maintain a gradient of 2H:1V or flatter. The presence of perched groundwater may cause localized sloughing of temporary slopes; groundwater seepage should be expected within site excavations, particularly if excavations take place during the wet season. An ESNW representative should observe temporary and permanent slopes to confirm the slope inclinations are suitable for the exposed soil conditions and to provide additional excavation and slope recommendations, as necessary. If the recommended temporary slope inclinations cannot be achieved, temporary shoring may be necessary to support excavations.

In-situ and Imported Soil

The in-situ soils observed at the subject site have a high to very high sensitivity to moisture and were generally in a moist to wet condition at the time of exploration. Soils anticipated to be exposed on site will degrade rapidly if exposed to wet weather and construction traffic. Compaction of the soils to the levels necessary for use as structural fill may be difficult or impossible during wet weather conditions. Soils may be encountered during site excavations that are excessively over the optimum moisture content, and will likely require aeration or treatment prior to placement and compaction. Conversely, soils that are substantially below the optimum moisture content will require moisture conditioning through the addition of water prior to use as structural fill. An ESNW representative should determine the suitability of in-situ soils for use as structural fill at the time of construction.

The near surface soils are considered to be “granular” and are anticipated to be suitable for use as structural fill, provided the soils are near the optimum moisture content. However, fine-grained soils generated from excavations advanced deeper than about 10 to 15 feet bgs should be removed from the site and should not be used as structural fill. In our opinion, a contingency should be provided in the budget for the export of fine-grained soil cuttings and import of suitable structural fill material, as needed.

Imported soil intended for use as structural fill should be evaluated by ESNW during construction. The imported soil must be workable to the optimum moisture content, as determined by the Modified Proctor Method (ASTM D1557), at the time of placement and compaction. During wet weather conditions, imported soil intended for use as structural fill should consist of a well-graded, granular soil with a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction).

Subgrade Preparation

Following site stripping and foundation subgrade excavation activities, ESNW should observe the subgrade to confirm soil conditions are as anticipated and to provide supplementary recommendations for subgrade preparation, as necessary.

In general, soils exposed at foundation subgrade elevations on native cut surfaces should be compacted in situ to a minimum depth of one foot below the design subgrade elevation. Uniform compaction of structural fill and the foundation and slab subgrade areas will establish a relatively consistent subgrade condition below the foundation and slab elements. Where competent native soils are exposed at foundation subgrades, additional in-situ compaction is unlikely to be necessary. An ESNW representative should observe native cut surfaces as they are exposed prior to structural loading. Supplementary recommendations for subgrade improvement may be provided at the time of construction and would likely include further mechanical compaction or overexcavation and replacement with suitable structural fill.

Structural Fill

Structural fill is defined as compacted soil placed in foundation, slab-on-grade, roadway, permanent slope, retaining wall, and utility trench backfill areas.

In general, near surface native soils are considered suitable for use as structural fill. However, the native fine-grained soils anticipated to be exposed at depths beginning at 10 to 15 feet bgs are not considered "granular soils," and therefore the fine-grained cuttings generated from site excavations should be removed from the site and should not be used as structural fill. Fill placement should not occur along sloping areas of this site.

Structural fill placed and compacted during site grading activities should meet the following specifications and guidelines:

• Structural fill material	Granular soil
• Moisture Content	At or slightly above optimum*
• Relative compaction (minimum)	95 percent (Modified Proctor)
• Loose lift thickness (maximum)	12 inches

* *Soil shall not be placed dry of optimum and should be evaluated by ESNW during construction.*

With respect to underground utility installations and backfill, local jurisdictions may dictate the soil type(s) and compaction requirements. Unsuitable material or debris must be removed from structural areas if encountered.

Foundations

The proposed structures can be supported on conventional spread and continuous foundations bearing on undisturbed competent native soil, recompacted native soil, or new structural fill. Based on our understanding of preliminary design concepts, the proposed residence will include a basement level approximately 10 to 12 feet below existing grades, with bottom-of-footing elevation of about 101 feet. Based on conditions observed during the fieldwork, we recommend that soils exposed at foundation subgrade elevations on native cut surfaces are compacted in situ to a minimum depth of one foot below the design subgrade elevation.

Provided site earthwork activities are completed in accordance with our recommendations, suitable soil conditions should be exposed at the design foundation subgrade elevations. Where loose or unsuitable soil conditions are encountered at foundation subgrade elevations, compaction of the soils to the specifications of structural fill, or overexcavation and replacement with suitable structural fill will likely be necessary. A representative of ESNW should confirm suitability of foundation subgrades at the time of construction.

Due to the high moisture sensitivity of the site soils, foundation subgrade areas should be protected from wet weather or areas of remediation should be anticipated; a layer of crushed rock can be considered to protect foundation subgrade areas. If structural building pads are disturbed during wet weather, remediation measures such as cement treatment or overexcavation and replacement with rock may be necessary in some areas.

Provided the structures will be supported as described above, the following parameters may be used for design of the new foundations:

- Allowable soil bearing capacity 2,500 psf
- Passive earth pressure 300 pcf
- Coefficient of friction 0.40

A one-third increase in the allowable soil bearing capacity can be assumed for short-term wind and seismic loading conditions. The passive earth pressure and coefficient of friction values include a safety factor of 1.5. With structural loading as expected, total settlement in the range of one inch is anticipated, with differential settlement of about one-half inch. The majority of the settlement should occur during construction as dead loads are applied.

Slab-on-Grade Floors

Slab-on-grade floors should be supported on a firm and unyielding subgrade consisting of competent native soil or at least 12 inches of new structural fill. Unstable or yielding areas of the subgrade should be recompacted, or overexcavated and replaced with suitable structural fill, prior to slab construction.

A capillary break consisting of a minimum of four inches of free-draining crushed rock or gravel should be placed below the slab. The free-draining crushed rock or gravel material should have a fines content of 5 percent or less (defined as the percent passing the No. 200 sieve, based on the minus three-quarter-inch fraction). In areas where slab moisture is undesirable, installation of a vapor barrier below the slab should be considered. If used, the vapor barrier should consist of a material specifically designed to function as a vapor barrier and should be installed in accordance with the manufacturer's specifications.

Seismic Design

The 2018 International Building Code (2018 IBC) recognizes the most recent edition of the Minimum Design Loads for Buildings and Other Structures manual (ASCE 7-16) for seismic design, specifically with respect to earthquake loads. Based on the soil conditions encountered at the boring locations, the parameters and values provided below are recommended for seismic design per the 2018 IBC.

Parameter	**Value**
Site Class	D*
Mapped short period spectral response acceleration, S_S (g)	1.462
Mapped 1-second period spectral response acceleration, S_1 (g)	0.507
Short period site coefficient, F_a	1.0
Long period site coefficient, F_v	1.793†
Adjusted short period spectral response acceleration, S_{MS} (g)	1.462
Adjusted 1-second period spectral response acceleration, S_{M1} (g)	0.909†
Design short period spectral response acceleration, S_{DS} (g)	0.974
Design 1-second period spectral response acceleration, S_{D1} (g)	0.606†

* *Assumes medium dense to dense native soil conditions, encountered to a maximum depth of 26.5 feet bgs during the September 2023 field exploration, remain dense to at least 100 feet bgs.*

† *Values assume F_v may be determined using linear interpolation per Table 11.4-2 in ASCE 7-16.*

As indicated in the table footnote, several of the seismic design values provided above are dependent on the assumption that site-specific ground motion analysis (per Section 11.4.8 of ASCE 7-16) will not be required for the subject project. ESNW recommends the validity of this assumption be confirmed at the earliest available opportunity during the planning and early design stages of the project. Further discussion between the project structural engineer, the project owner, and ESNW may be prudent to determine the possible impacts to the structural design due to increased earthquake load requirements under the 2018 IBC. ESNW can provide additional consulting services to aid with design efforts, including supplementary geotechnical and geophysical investigation, upon request.

Liquefaction is a phenomenon that can occur within a soil profile as a result of an intense ground shaking or loading condition. Most commonly, liquefaction is caused by ground shaking during an earthquake. Soil profiles that are loose, cohesionless, and present below the groundwater table are most susceptible to liquefaction. During the ground shaking, the soil contracts, and porewater pressure increases. The increased porewater pressure occurs quickly and without sufficient time to dissipate, resulting in water flowing upward to the ground surface and a liquefied soil condition. Soil in a liquefied condition possesses very little shear strength in comparison to the drained condition, which can result in a loss of foundation support for structures.

In our opinion, and consistent with the depiction on the referenced liquefaction susceptibility map, site susceptibility to liquefaction may be considered very low. The absence of a uniformly established shallow groundwater table and the relatively dense, fine-grained characteristics of the native soil were the primary bases for this opinion.

Retaining Walls

New retaining walls must be designed to resist earth pressures and applicable surcharge loads. The following parameters may be used for retaining wall design:

- Active earth pressure (unrestrained condition) — 42 pcf
- At-rest earth pressure (restrained condition) — 62 pcf
- Traffic surcharge (passenger vehicles) — 70 psf (rectangular distribution)
- Passive earth pressure — 200 pcf (level surface for at least 10 feet)
- Coefficient of friction — 0.40
- Seismic surcharge — 8H psf*

* *Where H equals the retained height (in feet).*

The passive earth pressure and coefficient of friction values include a safety factor of 1.5. Additional surcharge loading from adjacent foundations, sloped backfill, or other loads should be included in the retaining wall design.

Retaining walls should be backfilled with free-draining material that extends along the height of the wall and a distance of at least 18 inches behind the wall. The upper 12 inches of the wall backfill may consist of a less permeable soil, if desired.

Drainage should be provided behind retaining walls such that hydrostatic pressures do not develop. If drainage is not provided, hydrostatic pressures should be included in the wall design. A perforated drainpipe should be placed along the base of the wall and connected to an approved discharge location. A typical retaining wall drainage detail is provided on Plate 3.

Drainage

Groundwater seepage will likely be encountered within site excavations, particularly during the wet season. Temporary measures to control surface water runoff and groundwater during construction would likely involve passive elements such as interceptor trenches, interceptor swales, and sumps. ESNW should be consulted during preliminary grading to identify areas of seepage and provide recommendations to reduce the potential for seepage-related instability.

Finish grades must be designed to direct surface water away from the new structures and/or slopes for a distance of at least 10 feet or as setbacks allow. Water must not be allowed to pond adjacent to the new structures and/or slopes. In our opinion, drainage should be provided along the building perimeter footings. A typical foundation drain detail is provided on Plate 4.

If buildings will incorporate crawl spaces rather than slab-on-grade, in our opinion, a crawl space drain system will provide adequate drainage in lieu of perimeter footing drains. The crawl space drain must provide positive drainage to an appropriate outlet.

Infiltration Feasibility

Review of the City of Mercer Island GIS portal and the referenced mapping resources indicates that the site is located within an area designated as infeasible for infiltration, and infiltrating LID facilities are not permitted at the subject site. In our opinion, based on the fine-grained native soil textures, sloping surface grades, and the reviewed city mapping resources, on-site infiltration should be considered infeasible from a geotechnical standpoint.

Utility Support and Trench Backfill

The soils observed at the subsurface exploration locations are generally suitable for support of utilities. Use of the native soil as structural backfill in the utility trench excavations will depend on the in-situ moisture content at the time of placement and compaction. If native soil is placed below the optimum moisture content, settlement will likely occur once wet weather impacts the trenches. As such, backfill soils should be properly moisture conditioned, as necessary, to ensure acceptability of the soil moisture content at the time of placement and compaction. Native soil will be difficult or impossible to use as utility trench backfill during extended wet weather conditions. In this respect, aeration or treatment of the soils may be necessary prior to use as structural fill. Utility trench backfill should be placed and compacted to the specifications of structural fill provided in this report or to the applicable requirements of the presiding jurisdiction.

Native soils generated from excavations deeper than about 10 feet bgs are not suitable for use as structural backfill within utility trench excavations. Imported granular fill, or other suitable native soils, should be used for utility backfill applications.

LIMITATIONS

This study has been prepared for the exclusive use of LNL Builds, LLC, and its representatives. No warranty, express or implied, is made. The recommendations and conclusions provided in this study are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. Variations in the soil and groundwater conditions observed at the test locations may exist and may not become evident until construction. ESNW should reevaluate the conclusions provided in this geotechnical engineering study if variations are encountered.

Additional Services

ESNW should have an opportunity to review final project plans with respect to the geotechnical recommendations provided in this report. The geotechnical recommendations provided in this report are considered preliminary, are intended to support initial feasibility consideration, and should be reviewed and/or updated as project plans develop. ESNW should also be retained to provide testing and consultation services during construction.

REFERENCES

The following documents and maps were reviewed in preparation of this study:

- Geologic Map of Mercer Island, Washington, compiled by Kathy G. Troost and Aaron P. Wisher, dated October 2006

- Web Soil Survey (WSS) online resource, maintained by the Natural Resources Conservation Service (NRCS) under the United States Department of Agriculture (USDA)

- Soil Survey of King County Area, Washington, by Snyder, D.E., Gale, P.S., and Pringle, R.F., USDA Soil Conservation Service, issued November 1973

- Mercer Island Landslide Hazard Assessment, by Troost, K.G. and Wisher, A.P., dated April 2009

- Mercer Island Seismic Hazard Assessment, by Troost, K.G. and Wisher, A.P., dated April 2009

- Mercer Island Erosion Hazard Assessment, by Troost, K.G. and Wisher, A.P., dated April 2009

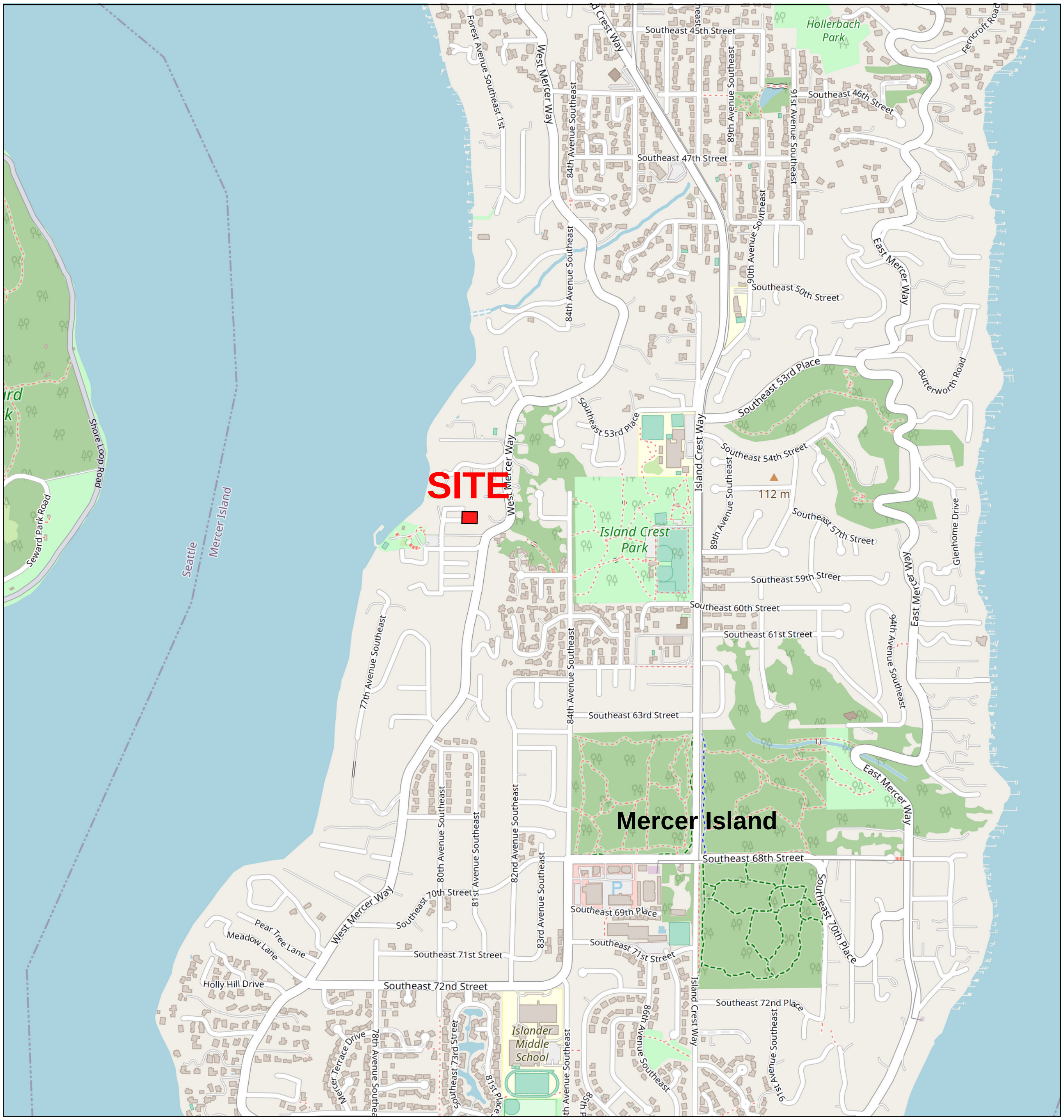
- Low Impact Development Infiltration Feasibility on Mercer Island (Figure 3), prepared by Herrera, undated

- Liquefaction Susceptibility of King County, Washington, Map 11-5, prepared by Tetra Tech, Inc. and endorsed by the King County Flood Control District, dated May 2010

- Mercer Island City Code (MICC)

- Site Plan and Lot Coverage Diagram, prepared by b9 Architects, sheets A1.10 and A1.11, undated

- Boundary Survey, prepared by Touma Engineers and Land Surveyors, PLLC, Job No. 1019-008, dated July 26, 2023



Reference:
King County, Washington
OpenStreetMap.org

NORTH

Earth Solutions NW LLC

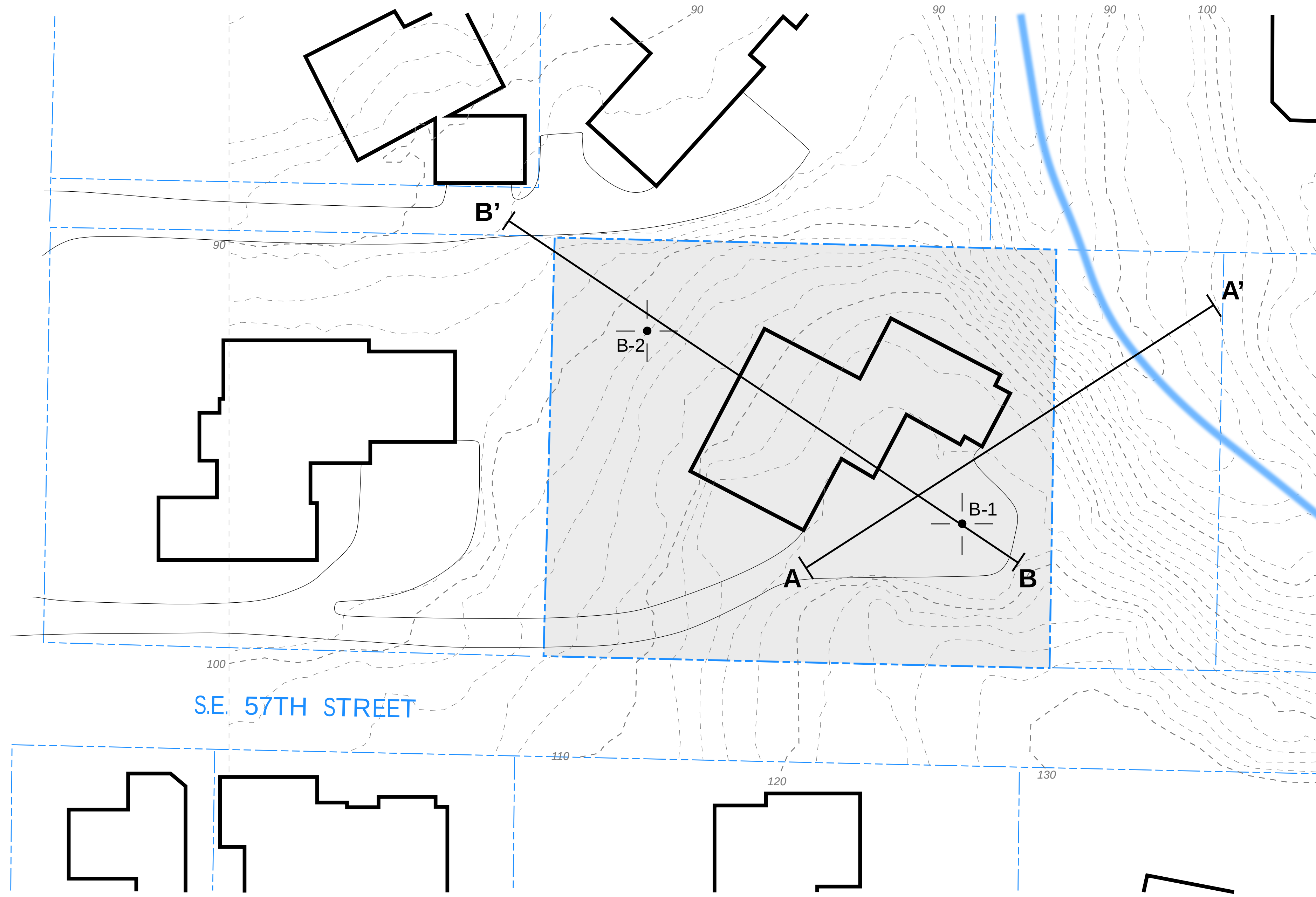
Earth Solutions NWLLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Vicinity Map
8020 S.E. 57th Street
Mercer Island, Washington

Drawn MRS	Date 10/06/2023	Proj. No. 9304
Checked BCS	Date Oct. 2023	Plate 1

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.



LEGEND

B-1 — Approximate Location of ESNW Boring, Proj. No. ES-9304, Sept. 2023

Subject Site

Existing Building

Cross-Section

NORTH

0 20 40 80

1"=40'

Scale in Feet

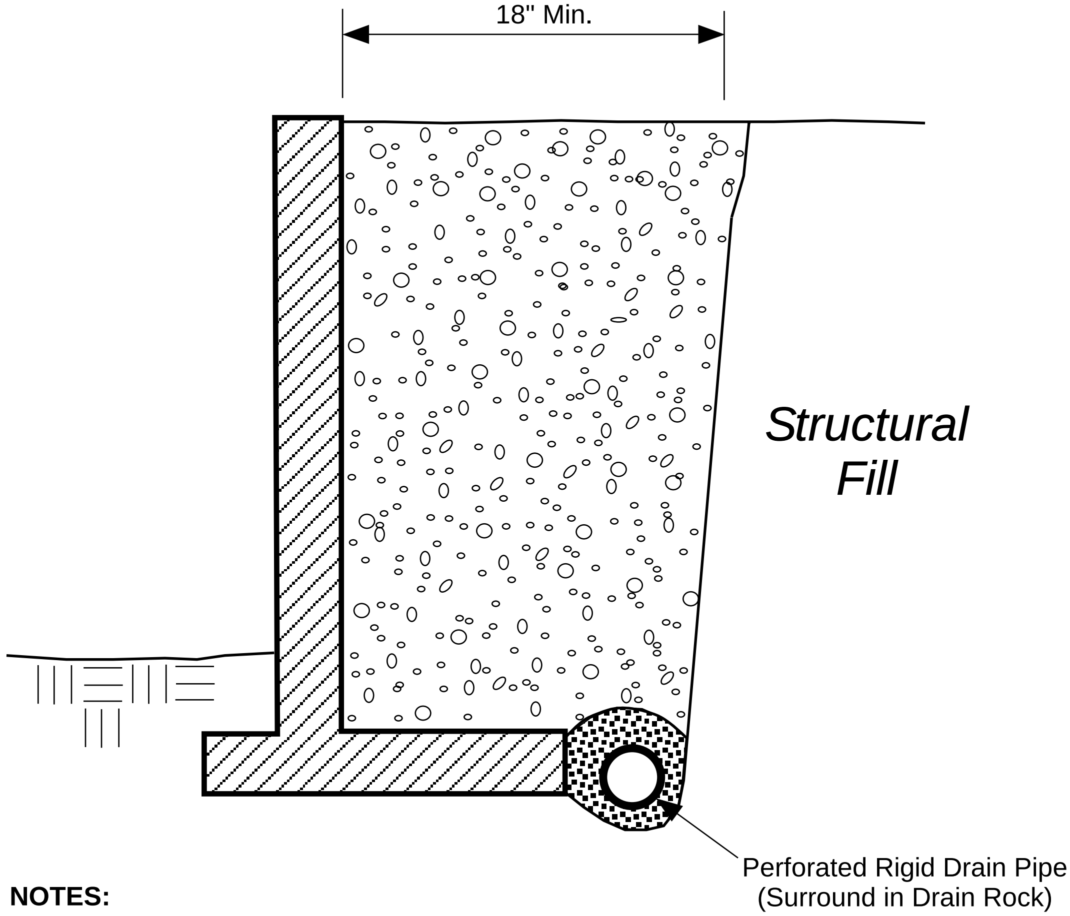
NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Boring Location Plan
8020 S.E. 57th Street
Mercer Island, Washington

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Drawn	MRS
Checked	BCS
Date	10/06/2023
Proj. No.	9304
Plate	2



NOTES:

- Free-draining Backfill should consist of soil having less than 5 percent fines. Percent passing No. 4 sieve should be 25 to 75 percent.
- Sheet Drain may be feasible in lieu of Free-draining Backfill, per ESNW recommendations.
- Drain Pipe should consist of perforated, rigid PVC Pipe surrounded with 1-inch Drain Rock.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

Free-draining Structural Backfill

1-inch Drain Rock

Earth Solutions NW LLC
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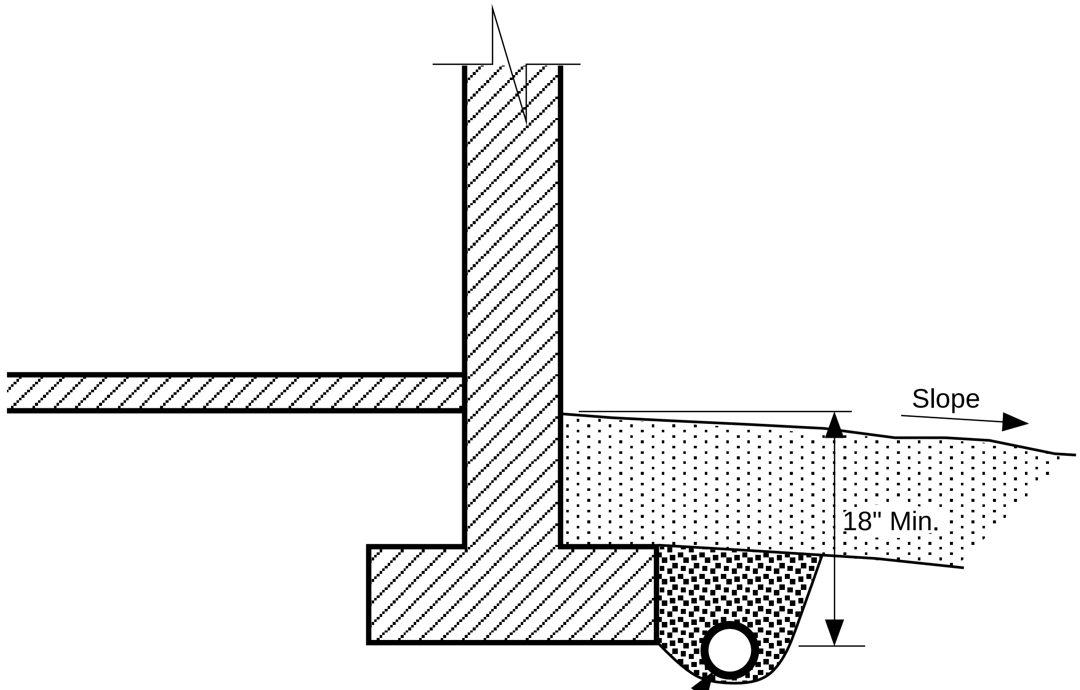
Retaining Wall Drainage Detail
8020 S.E. 57th Street
Mercer Island, Washington

Drawn MRS	Date 10/06/2023	Proj. No. 9304
Checked BCS	Date Oct. 2023	Plate 3



NOTES:

- Do NOT tie roof downspouts to Footing Drain.
- Surface Seal to consist of 12" of less permeable, suitable soil. Slope away from building.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

Surface Seal: native soil or other low-permeability material.

1-inch Drain Rock

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Footing Drain Detail
8020 S.E. 57th Street
Mercer Island, Washington

Drawn MRS	Date 10/06/2023	Proj. No. 9304
Checked BCS	Date Oct. 2023	Plate 4

Appendix A

Subsurface Exploration Logs

ES-9304

Subsurface conditions on site were explored on September 15, 2023, by advancing two test borings at accessible locations within the property boundaries using a machine and operators retained by our firm. The approximate locations of the borings are illustrated on Plate 2 of this study. The subsurface exploration logs are provided in this Appendix. The borings were advanced to a maximum depth of about 26.5 feet bgs.

The final logs represent the interpretations of the field logs and the results of laboratory analyses. The stratification lines on the logs represent the approximate boundaries between soil types. In actuality, the transitions may be more gradual.

Major Divisions			Group Symbol	Description
Coarse-Grained Soils - More Than 50% Retained on No. 200 Sieve	Gravels - More Than 50% of Coarse Fraction Retained on No. 4 Sieve	< 5% Fines	GW	Well-graded gravel with or without sand, little to no fines
			GP	Poorly graded gravel with or without sand, little to no fines
		> 12% Fines	GM	Silty gravel with or without sand
			GC	Clayey gravel with or without sand
	Sands - 50% or More of Coarse Fraction Passes No. 4 Sieve	< 5% Fines	SW	Well-graded sand with or without gravel, little to no fines
			SP	Poorly graded sand with or without gravel, little to no fines
		> 12% Fines	SM	Silty sand with or without gravel
			SC	Clayey sand with or without gravel
Fine-Grained Soils - 50% or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less Than 50		ML	Silt with or without sand or gravel; sandy or gravelly silt
			CL	Clay of low to medium plasticity; lean clay with or without sand or gravel; sandy or gravelly lean clay
			OL	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		MH	Elastic silt with or without sand or gravel; sandy or gravelly elastic silt
			CH	Clay of high plasticity; fat clay with or without sand or gravel; sandy or gravelly fat clay
			OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils
Fill			FILL	Made Ground

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch

Damp - Perceptible moisture, likely below optimum MC

Moist - Damp but no visible water, likely at/near optimum MC

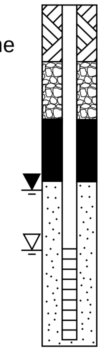
Wet - Water visible but not free draining, likely above optimum MC

Saturated/Water Bearing - Visible free water, typically below groundwater table

Symbols

ATD = At time of drilling

Static water level (date)



Cement grout surface seal

Bentonite chips

Grout seal

Filter pack with blank casing section

Screened casing or Hydrotip with filter pack

End cap

Terms Describing Relative Density and Consistency

Coarse-Grained Soils:

Density	SPT blows/foot
Very Loose	< 4
Loose	4 to 9
Medium Dense	10 to 29
Dense	30 to 49
Very Dense	≥ 50

Fine-Grained Soils:

Consistency	SPT blows/foot
Very Soft	< 2
Soft	2 to 3
Medium Stiff	4 to 7
Stiff	8 to 14
Very Stiff	15 to 29
Hard	≥ 30

Test Symbols & Units

Fines = Fines Content (%)

MC = Moisture Content (%)

DD = Dry Density (pcf)

Str = Shear Strength (tsf)

PID = Photoionization Detector (ppm)

OC = Organic Content (%)

CEC = Cation Exchange Capacity (meq/100 g)

LL = Liquid Limit (%)

PL = Plastic Limit (%)

PI = Plasticity Index (%)

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

Modifier Definitions

Percentage by Weight (Approx.)	Modifier
< 5	Trace (sand, silt, clay, gravel)
5 to 14	Slightly (sandy, silty, clayey, gravelly)
15 to 29	Sandy, silty, clayey, gravelly
≥ 30	Very (sandy, silty, clayey, gravelly)

Classifications of soils in this geotechnical report and as shown on the exploration logs are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates, and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D2487 and D2488 were used as an identification guide for the Unified Soil Classification System.

Earth Solutions NW LLC

Earth Solutions NWLLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

EXPLORATION LOG KEY

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

BORING NUMBER B-1

PROJECT NUMBER ES-9304
PROJECT NAME 8020 S.E. 57th Street
DATE STARTED 9/15/23 **COMPLETED** 9/15/23
GROUND ELEVATION 115 ft
DRILLING CONTRACTOR Geologic Drill Partners
LATITUDE 47.55175 **LONGITUDE** -122.23108
LOGGED BY BCS **CHECKED BY** SSR
GROUND WATER LEVEL:
NOTES
AT TIME OF DRILLING
SURFACE CONDITIONS Asphalt pavement
AFTER DRILLING

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	MATERIAL DESCRIPTION
0					SM	Gray silty SAND, medium dense, moist
						-scattered gravel
	SS	67	12-5-12 (17)	MC = 12.9		
5	SS	89	9-10-14 (24)	MC = 14.6 Fines = 46.2		[USDA Classification: gravelly sandy LOAM] -inch-scale interbeds in sample spoon (SM and SP-SM) -increasing moisture content
						-becomes wet -no interbedding -very fine sand
	SS	100	5-5-6 (11)	MC = 17.3		
10						10.0 — 105.0
	SS	100	6-10-13 (23)	MC = 16.3	ML	Gray sandy SILT, medium dense, moist -light iron oxide staining -scattered fine gravel
						-becomes very dense, slower drilling -slight chatter
15						15.0 — 100.0
	SS	100	15-23-30 (53)	MC = 21.0	ML	Dark gray SILT, very dense, moist to wet
20						

(Continued Next Page)

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DRILLING CONTRACTOR Geologic Drill Partners
LATITUDE 47.55175 **LONGITUDE** -122.23108
LOGGED BY BCS **CHECKED BY** SSR
GROUND WATER LEVEL:
NOTES
AT TIME OF DRILLING
SURFACE CONDITIONS Asphalt pavement
AFTER DRILLING

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
20	SS	100	17-21-28 (49)	MC = 32.7 LL = 37 PL = 30 Fines = 99.7 PI = 7	ML	21.5	Dark gray SILT, very dense, moist to wet *(continued)* 93.5

Boring terminated at 21.5 feet below existing grade due to refusal in very dense silt. No groundwater encountered during drilling. Boring backfilled with bentonite chips.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

BORING NUMBER B-2

PROJECT NUMBER ES-9304 **PROJECT NAME** 8020 S.E. 57th Street
DATE STARTED 9/15/23 **COMPLETED** 9/15/23 **GROUND ELEVATION** 100 ft
DRILLING CONTRACTOR Geologic Drill Partners **LATITUDE** 47.55190 **LONGITUDE** -122.23149
LOGGED BY BCS **CHECKED BY** SSR **GROUND WATER LEVEL:**
NOTES ∇ **AT TIME OF DRILLING**
SURFACE CONDITIONS Lawn grass **AFTER DRILLING**

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					SM		Brown silty SAND, medium dense, damp to moist
	SS	56	9-13-14 (27)	MC = 4.9		4.0	96.0
5					SP-SM		Gray poorly graded SAND with SILT, medium dense, damp [USDA Classification: slightly gravelly SAND]
	SS	89	6-9-11 (20)	MC = 5.3 Fines = 5.9		7.5	92.5
	SS	100	6-10-12 (22)	MC = 29.1 Fines = 34.6	SM		Gray silty SAND, medium dense, wet [USDA Classification: slightly gravelly sandy LOAM] -inch-scale interbeds in sample spoon (SM and SP-SM)
10	SS	100	5-10-12 (22)	MC = 16.7			-no interbeds -scattered gravel, trace iron oxide staining and organic fibers (?) -machine chatter
15						15.0	85.0
	SS	100	12-21-31 (52)	MC = 17.0 Fines = 66.8	ML		Gray sandy SILT, very dense, moist to wet [USDA Classification: slightly gravelly LOAM] -moderate iron oxide staining -scattered fine gravel -slower drilling
20						20.0	80.0

(Continued Next Page)

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BORING NUMBER B-2

PROJECT NUMBER ES-9304
PROJECT NAME 8020 S.E. 57th Street
DATE STARTED 9/15/23 **COMPLETED** 9/15/23
GROUND ELEVATION 100 ft
DRILLING CONTRACTOR Geologic Drill Partners
LATITUDE 47.55190 **LONGITUDE** -122.23149
LOGGED BY BCS **CHECKED BY** SSR
GROUND WATER LEVEL:
NOTES
▽ **AT TIME OF DRILLING**
SURFACE CONDITIONS Lawn grass
AFTER DRILLING

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
20	SS	100	11-12-15 (27)	MC = 31.3	ML		Dark gray SILT, medium dense, wet -scattered fine gravel -becomes very dense
25	SS	100	20-34-38 (72)	MC = 34.8 LL = 28 PL = 28 Fines = 99.9 PI = NP		26.5	73.5

Boring terminated at 26.5 feet below existing grade. No groundwater encountered during drilling. Boring backfilled with bentonite chips.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

Appendix B

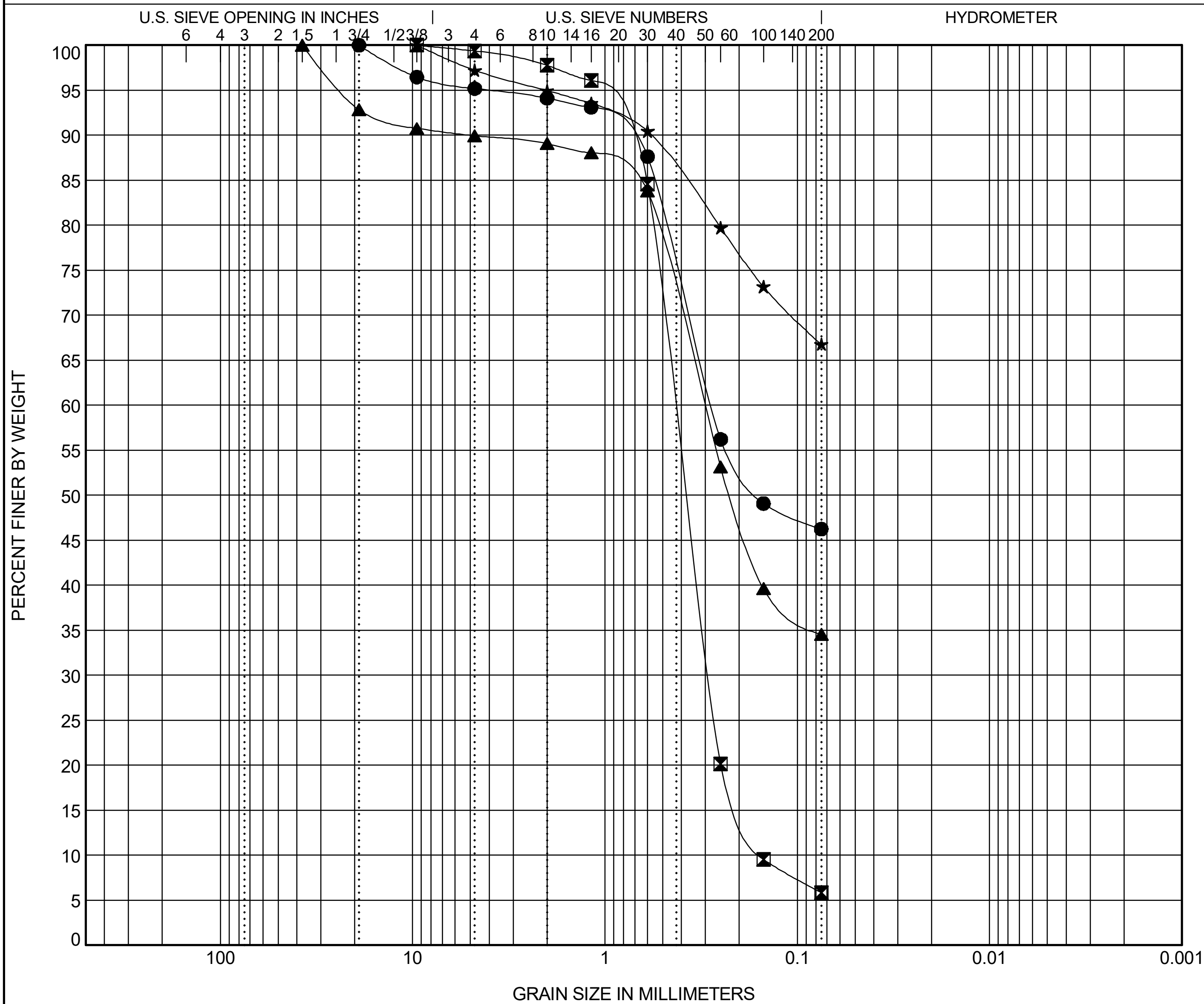
Laboratory Test Results

ES-9304

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-9304 **PROJECT NAME** 8020 S.E. 57th Street



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	Cc	Cu
●	**B-01**	**5.00ft.**	**USDA: Gray Slightly Gravelly Sandy Loam. USCS: SM.**		
⊠	**B-02**	**5.00ft.**	**USDA: Gray Slightly Gravelly Sand. USCS: SP-SM.**	**1.24**	**2.80**
▲	**B-02**	**7.50ft.**	**USDA: Gray Slightly Gravelly Sandy Loam. USCS: SM.**		
★	**B-02**	**15.00ft.**	**USDA: Gray Slightly Gravelly Loam. USCS: Sandy ML.**		

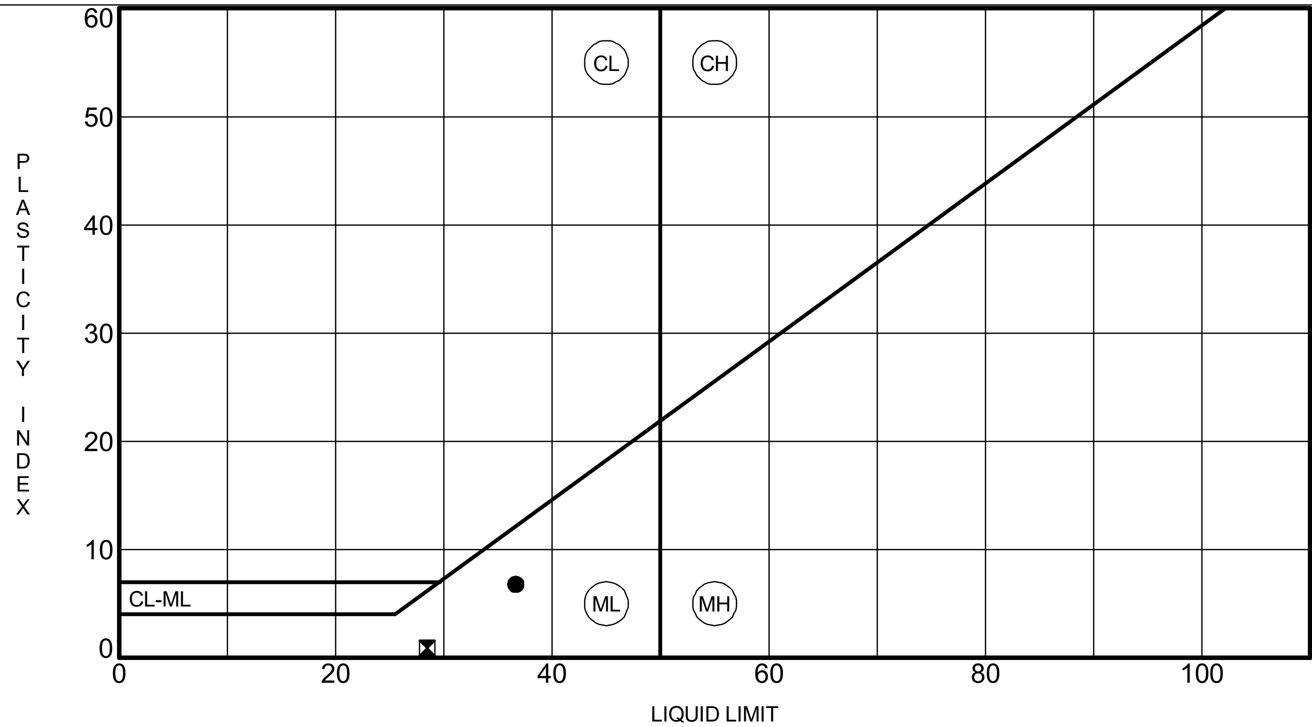
Specimen Identification			D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	**B-01**	**5.0ft.**	**19**	**0.278**						**46.2**	
⊠	**B-02**	**5.0ft.**	**9.5**	**0.43**	**0.286**	**0.153**				**5.9**	
▲	**B-02**	**7.5ft.**	**37.5**	**0.304**						**34.6**	
★	**B-02**	**15.0ft.**	**9.5**							**66.8**	

GRAIN SIZE USDA ES-9304 8020 S.E. 57TH STREET.GPJ GINT US LAB.GDT 10/5/23

Earth Solutions NW LLC
Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

ATTERBERG LIMITS' RESULTS

PROJECT NUMBER ES-9304 **PROJECT NAME** 8020 S.E. 57th Street



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**B-01**	**20.0**	**37**	**30**	**7**	**99.7**	**Dark Gray SILT, ML**
⊠	**B-02**	**25.0**	**28**	**28**	**NP**	**99.9**	**Dark Gray SILT, ML**

Appendix C

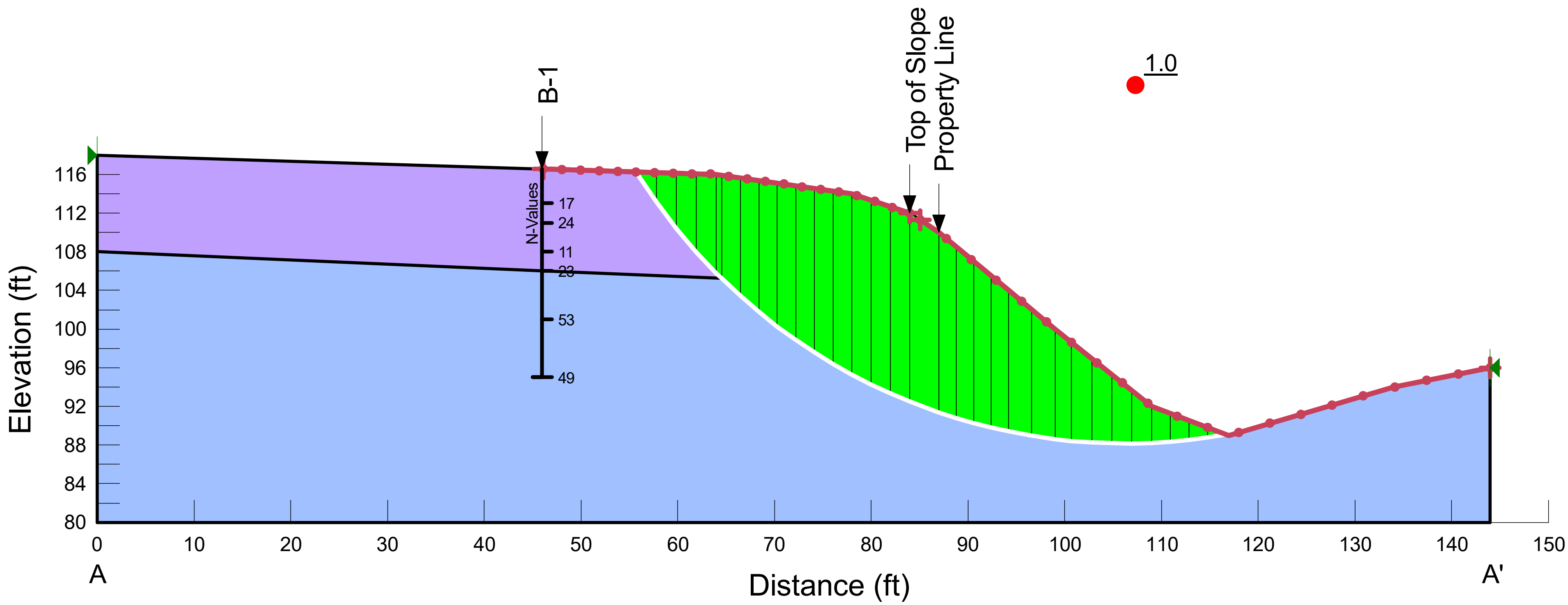
Slope/W Computer Output

ES-9304

Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Silt (Seismic)	110	450	20
	Silty Sand (Seismic)	125	50	34

ES-9304
8020 S.E. 57th Street, Mercer Island
Existing Condition
A-A'

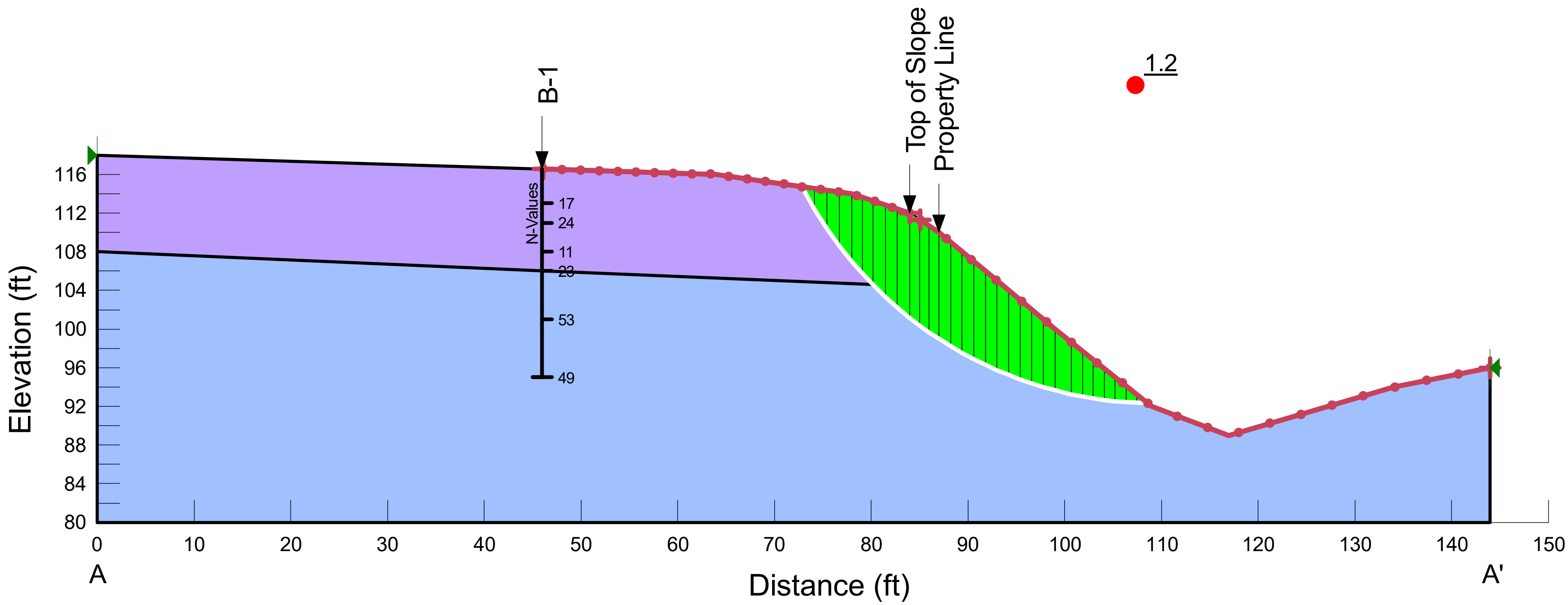
Horizontal Seismic Acceleration = 0.345g



Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
(blue)	Silt (Static)	110	225	20
(purple)	Silty Sand (Static)	125	0	34

ES-9304
8020 S.E. 57th Street, Mercer Island
Existing Condition
A-A'

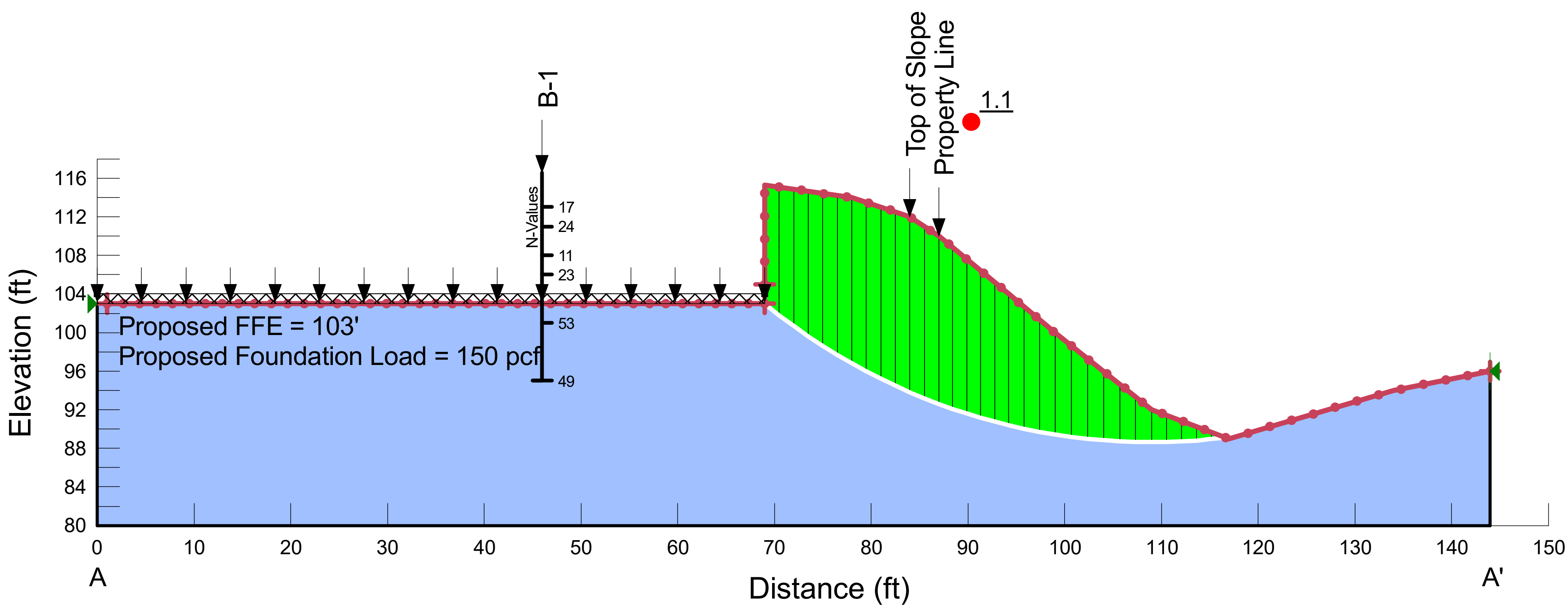
Static Loading



Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Silt (Seismic)	110	450	20
	Silty Sand (Seismic)	125	50	34

ES-9304
8020 S.E. 57th Street, Mercer Island
Proposed Condition
A-A'

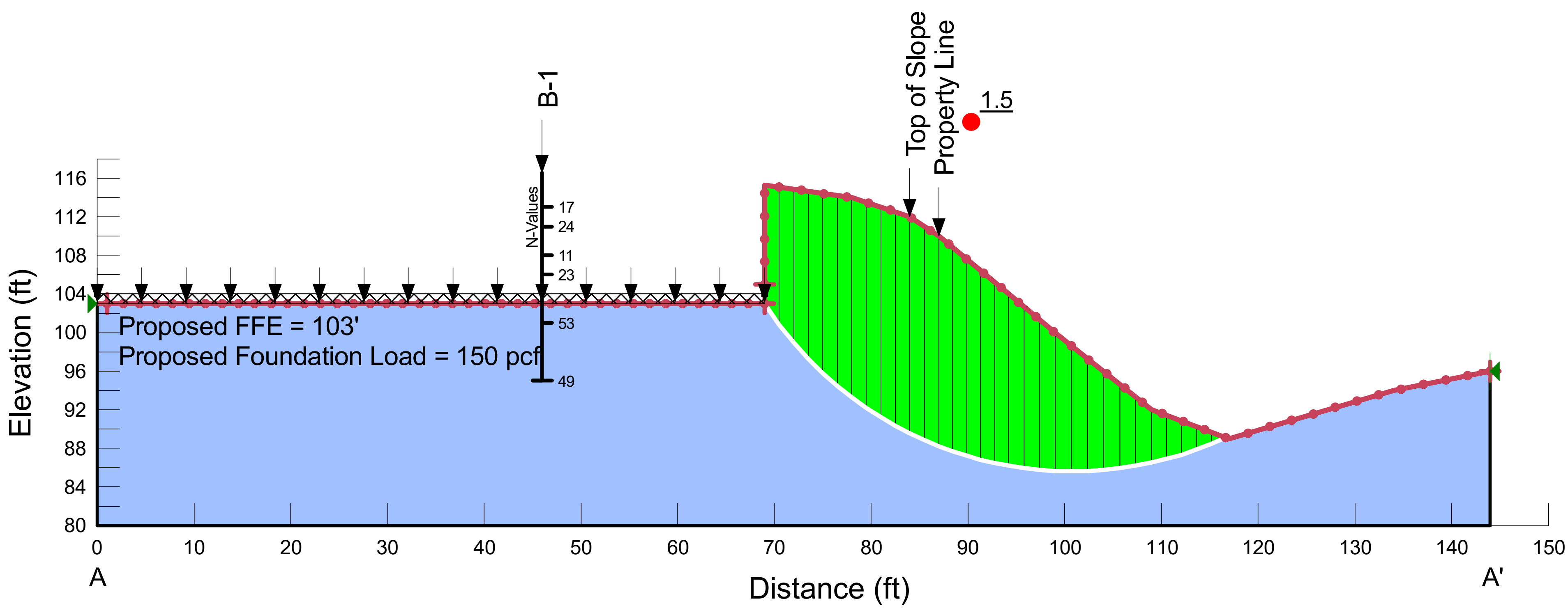
Horizontal Seismic Acceleration = 0.345g



Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Silt (Static)	110	225	20
	Silty Sand (Static)	125	0	34

ES-9304
8020 S.E. 57th Street, Mercer Island
Proposed Condition
A-A'

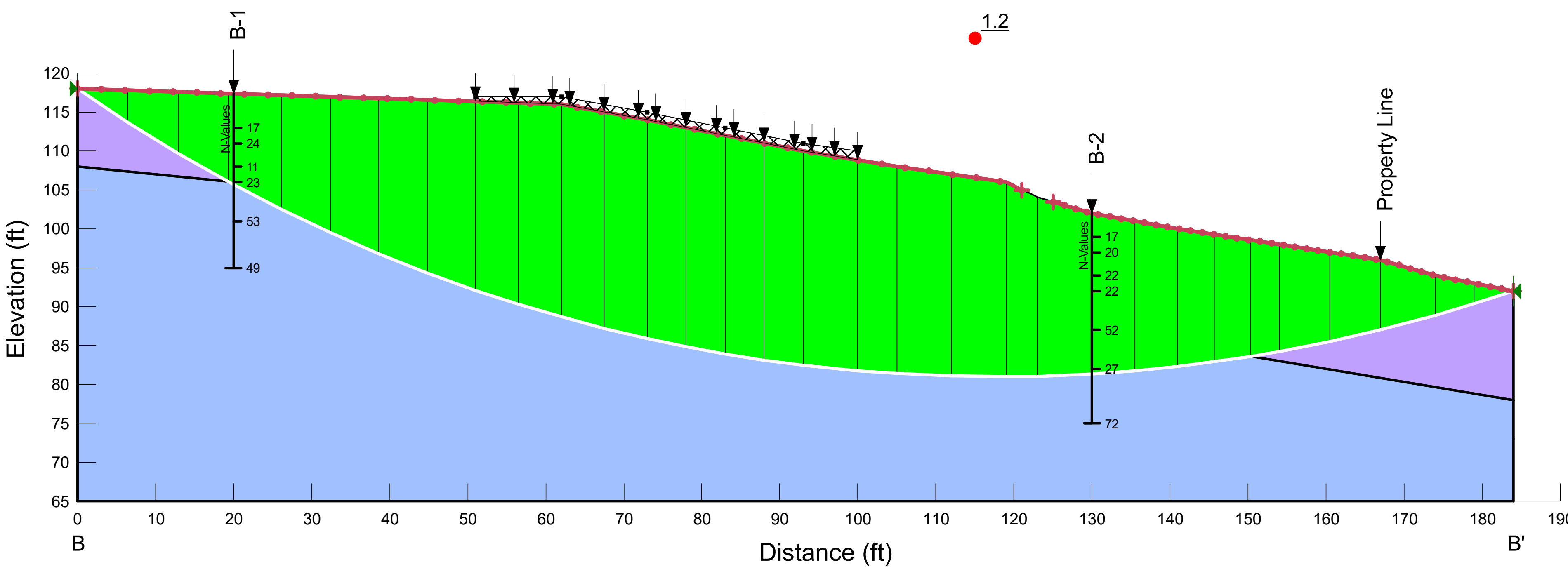
Static Loading



Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
(blue)	Silt (Seismic)	110	450	20
(purple)	Silty Sand (Seismic)	125	50	34

ES-9304
8020 S.E. 57th Street, Mercer Island
Existing Condition
B-B'

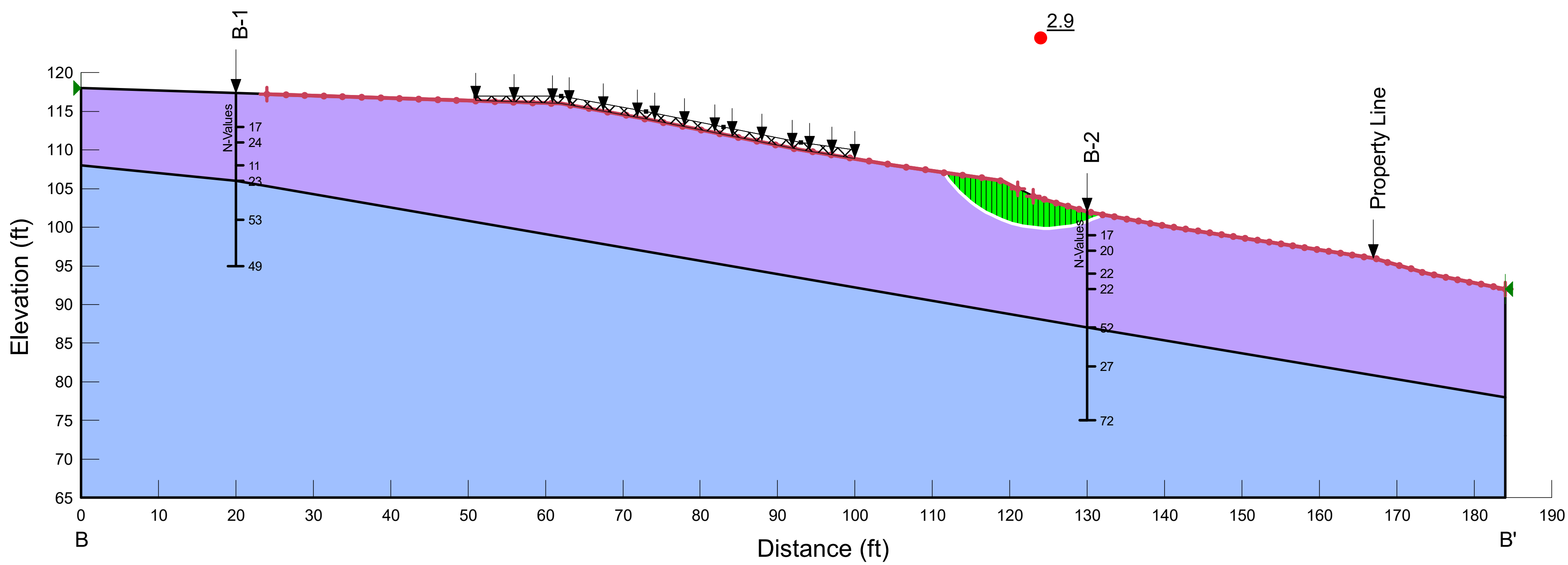
Horizontal Seismic Acceleration = 0.345g



Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
(blue)	Silt (Static)	110	225	20
(purple)	Silty Sand (Static)	125	0	34

ES-9304
8020 S.E. 57th Street, Mercer Island
Existing Condition
B-B'

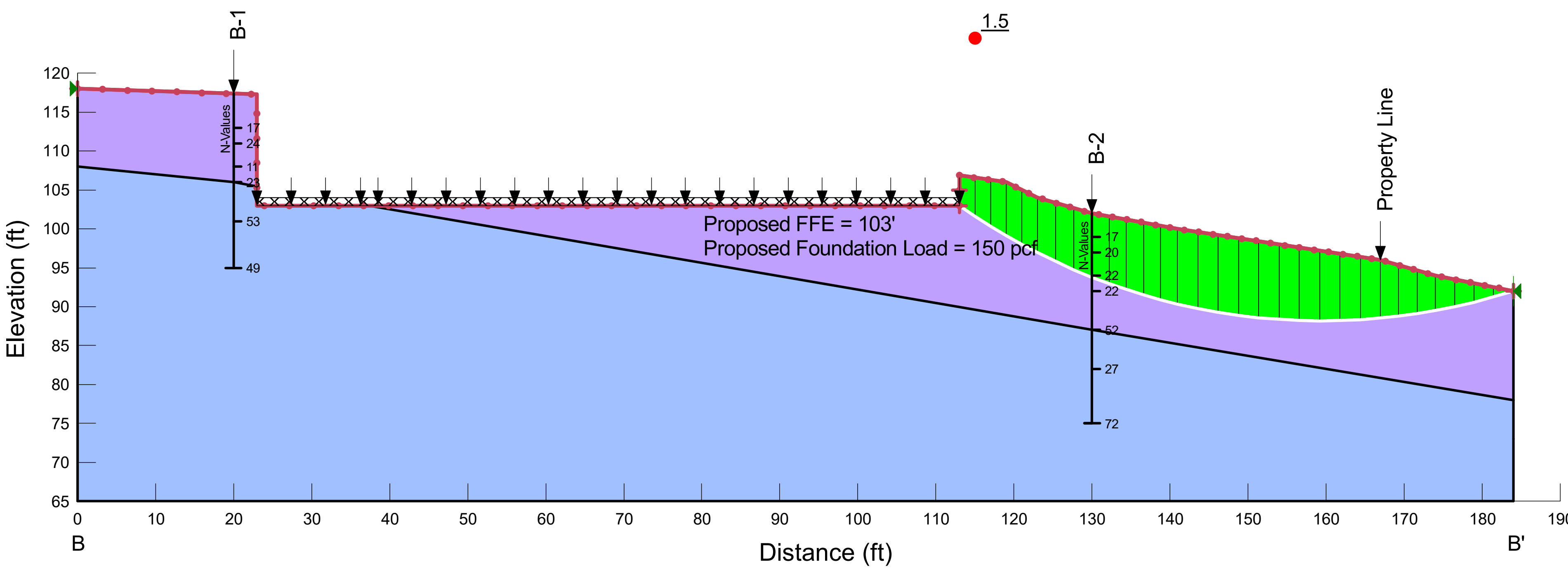
Static Loading



Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Silt (Seismic)	110	450	20
	Silty Sand (Seismic)	125	50	34

ES-9304
8020 S.E. 57th Street, Mercer Island
Proposed Condition
B-B'

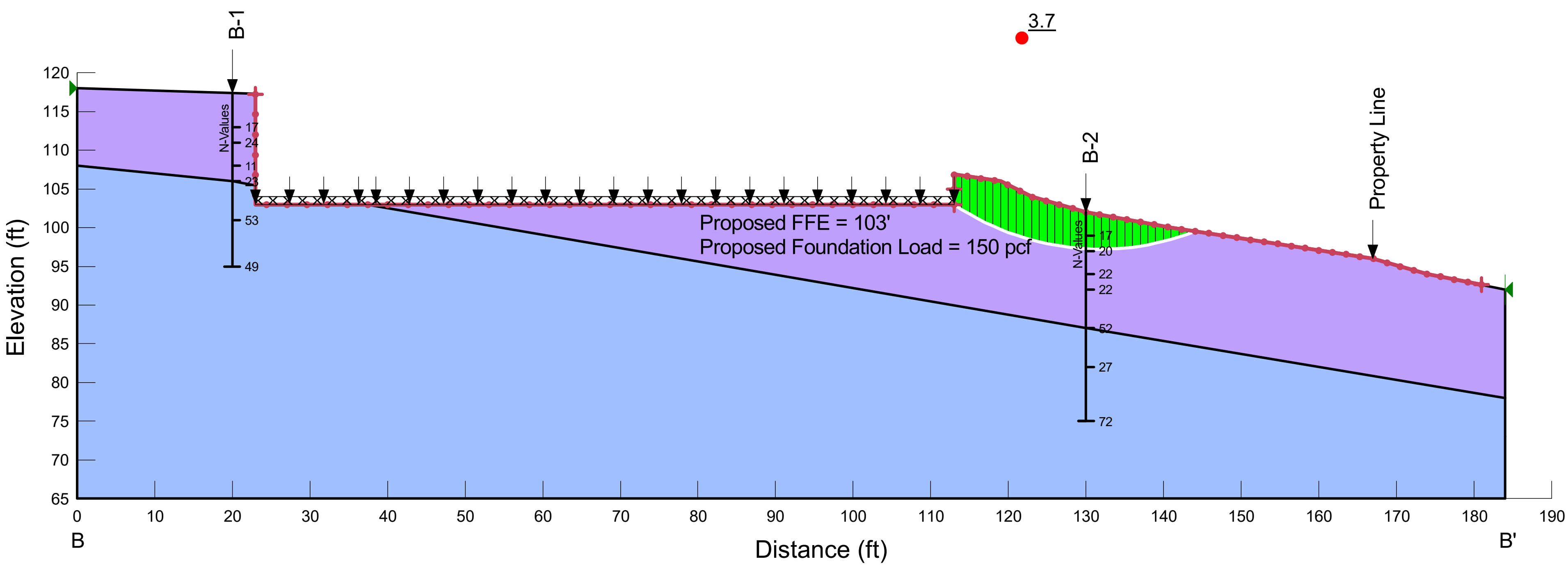
Horizontal Seismic Acceleration = 0.345g



Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
(blue)	Silt (Static)	110	225	20
(purple)	Silty Sand (Static)	125	0	34

ES-9304
8020 S.E. 57th Street, Mercer Island
Proposed Condition
B-B'

Static Loading



A-A' Ex-Seismic

File Information

- File Version: 11.02
- Title: 8020 S.E. 57th Street
- Created By: Brian Snow
- Last Edited By: Brian Snow
- Revision Number: 37
- Date: 10/17/2023
- Time: 11:39:17 AM
- Tool Version: 11.2.0.22838
- File Name: 9304.00 SlopeW.gsz
- Directory: G:\# Brian's ESNW Inbox\# WorkFlow\00 - Project Files\00 - Geotechnical\9304 - (SLOPE) 8020 S.E. 57th Street\
- Last Solved Date: 10/17/2023
- Last Solved Time: 11:39:20 AM

Project Settings

- Unit System: U.S. Customary Units

Analysis Settings

A-A' Ex-Seismic

- Description: ES-9304
- Kind: SLOPE/W
- Analysis Type: Morgenstern-Price
- Settings
  - Side Function
    - Interslice force function option: Half-Sine
  - PWP Conditions from: (none)
  - Unit Weight of Water: 62.430189 pcf
- Slip Surface
  - Direction of movement: Left to Right
  - Use Passive Mode: No
  - Slip Surface Option: Entry and Exit
  - Critical slip surfaces saved: 1
  - Optimize Critical Slip Surface Location: No
  - Tension Crack Option: (none)
- Distribution
  - F of S Calculation Option: Constant
- Advanced
  - Geometry Settings
    - Minimum Slip Surface Depth: 5 ft

Number of Slices: 30
Factor of Safety Convergence Settings
Maximum Number of Iterations: 100
Tolerable difference in F of S: 0.001
Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Silty Sand (Seismic)

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 50 psf
Effective Friction Angle: 34 °
Phi-B: 0 °

Silt (Seismic)

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 110 pcf
Effective Cohesion: 450 psf
Effective Friction Angle: 20 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (46.12597, 116.55856) ft
Left-Zone Right Coordinate: (84, 112) ft
Left-Zone Increment: 20
Right Type: Range
Right-Zone Left Coordinate: (85.04802, 111.30132) ft
Right-Zone Right Coordinate: (144, 96) ft
Right-Zone Increment: 20
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 118) ft
Right Coordinate: (144, 96) ft

Seismic Coefficients

Horz Seismic Coef.: 0.345

Geometry

Name: A-A' Existing

Settings

View: 2D

Element Thickness: 1 ft

Points

	X	Y
Point 1	0 ft	118 ft
Point 2	64 ft	116 ft
Point 3	78 ft	114 ft
Point 4	84 ft	112 ft
Point 5	87 ft	110 ft
Point 6	99 ft	100 ft
Point 7	109 ft	92 ft
Point 8	117 ft	89 ft
Point 9	134 ft	94 ft
Point 10	144 ft	96 ft
Point 11	0 ft	80 ft
Point 12	144 ft	80 ft
Point 13	0 ft	108 ft
Point 14	46 ft	106 ft
Point 15	94.2 ft	104 ft
Point 16	0 ft	103 ft
Point 17	100.72715 ft	98.61828 ft

Regions

	Material	Points	Area
Region 1	Silty Sand (Seismic)	1,2,3,4,5,15,14,13	896.4 ft²
Region 2	Silt (Seismic)	6,15,14,13,16,11,12,10,9,8,7,17	3,142.1 ft²

Slip Results

Slip Surfaces Analysed: 1693 of 2205 converged

Current Slip Surface

Slip Surface: 603

Factor of Safety: 1.0

Volume: 702.51137 ft³

Weight: 81,432.238 lbf
Resisting Moment: 3,165,394.9 lbf·ft
Activating Moment: 3,183,892.5 lbf·ft
Resisting Force: 48,424.359 lbf
Activating Force: 48,725.232 lbf
Slip Rank: 1 of 2,205 slip surfaces
Exit: (116.75004, 89.093737) ft
Entry: (55.708654, 116.2591) ft
Radius: 59.56549 ft
Center: (106.28048, 147.73192) ft

Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	56.745072 ft	114.70465 ft	0 psf	53.837698 psf	36.313986 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 2	58.817909 ft	111.78188 ft	0 psf	219.61507 psf	148.13223 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 3	60.890745 ft	109.19291 ft	0 psf	354.07043 psf	238.82352 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 4	62.963582 ft	106.87347 ft	0 psf	466.45688 psf	314.62914 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 5	64.273584 ft	105.50255 ft	0 psf	529.47085 psf	357.1326 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 6	65.508085 ft	104.32776 ft	0 psf	512.12037 psf	186.39657 psf	450 psf	0 psf	Silt (Seismic)
Slice 7	67.429918 ft	102.59796 ft	0 psf	607.28256 psf	221.03278 psf	450 psf	0 psf	Silt (Seismic)
Slice 8	69.351751 ft	101.0113 ft	0 psf	694.44773 psf	252.7583 psf	450 psf	0 psf	Silt (Seismic)
Slice 9	71.273584 ft	99.553561 ft	0 psf	778.27637 psf	283.26943 psf	450 psf	0 psf	Silt (Seismic)
Slice 10	73.195417 ft	98.213328 ft	0 psf	862.7288 psf	314.0076 psf	450 psf	0 psf	Silt (Seismic)
Slice 11	75.11725 ft	96.98126 ft	0 psf	951.367 psf	346.26927 psf	450 psf	0 psf	Silt (Seismic)
Slice 12	77.039083 ft	95.84963 ft	0 psf	1,047.5043 psf	381.26039 psf	450 psf	0 psf	Silt (Seismic)
Slice 13	79 ft	94.79273 ft	0 psf	1,144.4028 psf	416.52856 psf	450 psf	0 psf	Silt (Seismic)
Slice 14	81 ft	93.80859 ft	0 psf	1,244.897 psf	453.10544 psf	450 psf	0 psf	Silt (Seismic)
Slice 15	83 ft	92.915072 ft	0 psf	1,360.6146 psf	495.22323 psf	450 psf	0 psf	Silt (Seismic)
Slice 16	85.5 ft	91.931762 ft	0 psf	1,491.1109 psf	542.72 psf	450 psf	0 psf	Silt (Seismic)
Slice 17	87.9 ft	91.081142 ft	0 psf	1,598.6256 psf	581.85214 psf	450 psf	0 psf	Silt (Seismic)
Slice 18	89.7 ft	90.528269 ft	0 psf	1,667.124 psf	606.78352 psf	450 psf	0 psf	Silt (Seismic)
Slice	91.5 ft	90.03684	0	1,730.9461	630.01287	450 psf	0 psf	Silt (Seismic)

19		ft	psf	psf	psf			
Slice 20	93.3 ft	89.605293 ft	0 psf	1,783.0948 psf	648.99342 psf	450 psf	0 psf	Silt (Seismic)
Slice 21	95.4 ft	89.181314 ft	0 psf	1,828.1026 psf	665.37494 psf	450 psf	0 psf	Silt (Seismic)
Slice 22	97.8 ft	88.785676 ft	0 psf	1,842.7515 psf	670.70669 psf	450 psf	0 psf	Silt (Seismic)
Slice 23	99.863575 ft	88.519448 ft	0 psf	1,806.6368 psf	657.56201 psf	450 psf	0 psf	Silt (Seismic)
Slice 24	101.76126 ft	88.347165 ft	0 psf	1,723.1959 psf	627.19201 psf	450 psf	0 psf	Silt (Seismic)
Slice 25	103.82947 ft	88.225875 ft	0 psf	1,573.2112 psf	572.60206 psf	450 psf	0 psf	Silt (Seismic)
Slice 26	105.89768 ft	88.176634 ft	0 psf	1,361.9641 psf	495.71441 psf	450 psf	0 psf	Silt (Seismic)
Slice 27	107.96589 ft	88.199263 ft	0 psf	1,096.9891 psf	399.27139 psf	450 psf	0 psf	Silt (Seismic)
Slice 28	109.96875 ft	88.288648 ft	0 psf	849.29961 psf	309.11978 psf	450 psf	0 psf	Silt (Seismic)
Slice 29	111.90626 ft	88.440675 ft	0 psf	637.35054 psf	231.97662 psf	450 psf	0 psf	Silt (Seismic)
Slice 30	113.84377 ft	88.656622 ft	0 psf	415.88804 psf	151.37087 psf	450 psf	0 psf	Silt (Seismic)
Slice 31	115.78128 ft	88.937193 ft	0 psf	194.62325 psf	70.83707 psf	450 psf	0 psf	Silt (Seismic)

A-A' Ex-Static

File Information

File Version: 11.02
Title: 8020 S.E. 57th Street
Created By: Brian Snow
Last Edited By: Brian Snow
Revision Number: 37
Date: 10/17/2023
Time: 11:39:17 AM
Tool Version: 11.2.0.22838
File Name: 9304.00 SlopeW.gsz
Directory: G:\# Brian's ESNW Inbox\# WorkFlow\00 - Project Files\00 - Geotechnical\9304 - (SLOPE) 8020 S.E. 57th Street\
Last Solved Date: 10/17/2023
Last Solved Time: 11:39:20 AM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

A-A' Ex-Static

Description: ES-9304
Kind: SLOPE/W
Analysis Type: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- PWP Conditions from: (none)
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Advanced
- Geometry Settings
  - Minimum Slip Surface Depth: 5 ft

Number of Slices: 30
Factor of Safety Convergence Settings
Maximum Number of Iterations: 100
Tolerable difference in F of S: 0.001
Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Silt (Static)

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 110 pcf
Effective Cohesion: 225 psf
Effective Friction Angle: 20 °
Phi-B: 0 °

Silty Sand (Static)

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (46.12597, 116.55856) ft
Left-Zone Right Coordinate: (84, 112) ft
Left-Zone Increment: 20
Right Type: Range
Right-Zone Left Coordinate: (85.04802, 111.30132) ft
Right-Zone Right Coordinate: (144, 96) ft
Right-Zone Increment: 20
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 118) ft
Right Coordinate: (144, 96) ft

Geometry

Name: A-A' Existing

Settings

View: 2D

Element Thickness: 1 ft

Points

	X	Y
Point 1	0 ft	118 ft
Point 2	64 ft	116 ft
Point 3	78 ft	114 ft
Point 4	84 ft	112 ft
Point 5	87 ft	110 ft
Point 6	99 ft	100 ft
Point 7	109 ft	92 ft
Point 8	117 ft	89 ft
Point 9	134 ft	94 ft
Point 10	144 ft	96 ft
Point 11	0 ft	80 ft
Point 12	144 ft	80 ft
Point 13	0 ft	108 ft
Point 14	46 ft	106 ft
Point 15	94.2 ft	104 ft
Point 16	0 ft	103 ft
Point 17	100.72715 ft	98.61828 ft

Regions

	Material	Points	Area
Region 1	Silty Sand (Static)	1,2,3,4,5,15,14,13	896.4 ft^2
Region 2	Silt (Static)	6,15,14,13,16,11,12,10,9,8,7,17	3,142.1 ft^2

Slip Results

Slip Surfaces Analysed: 1719 of 2205 converged

Current Slip Surface

Slip Surface: 1,518

Factor of Safety: 1.2

Volume: 248.01042 ft^3

Weight: 28,904.557 lbf

Resisting Moment: 731,330.36 lbf·ft

Activating Moment: 599,626.43 lbf·ft

Resisting Force: 15,189.544 lbf

Activating Force: 12,454.65 lbf

Slip Rank: 1 of 2,205 slip surfaces
Exit: (108.59624, 92.323008) ft
Entry: (72.871786, 114.7326) ft
Radius: 41.033741 ft
Center: (109.43997, 133.34807) ft

Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	73.512813 ft	113.56827 ft	0 psf	63.835972 psf	43.057907 psf	0 psf	0 psf	Silty Sand (Static)
Slice 2	74.794866 ft	111.39242 ft	0 psf	185.96768 psf	125.43678 psf	0 psf	0 psf	Silty Sand (Static)
Slice 3	76.07692 ft	109.4847 ft	0 psf	294.86308 psf	198.88766 psf	0 psf	0 psf	Silty Sand (Static)
Slice 4	77.358973 ft	107.78405 ft	0 psf	395.39159 psf	266.69499 psf	0 psf	0 psf	Silty Sand (Static)
Slice 5	78.544465 ft	106.35639 ft	0 psf	477.4761 psf	322.0617 psf	0 psf	0 psf	Silty Sand (Static)
Slice 6	79.633394 ft	105.15751 ft	0 psf	542.92423 psf	366.20702 psf	0 psf	0 psf	Silty Sand (Static)
Slice 7	80.814882 ft	103.96132 ft	0 psf	598.78673 psf	217.94054 psf	225 psf	0 psf	Silt (Static)
Slice 8	82.088929 ft	102.77099 ft	0 psf	672.80866 psf	244.88232 psf	225 psf	0 psf	Silt (Static)
Slice 9	83.362976 ft	101.67668 ft	0 psf	745.60245 psf	271.3771 psf	225 psf	0 psf	Silt (Static)
Slice 10	84.5 ft	100.76941 ft	0 psf	797.03109 psf	290.09559 psf	225 psf	0 psf	Silt (Static)
Slice 11	85.5 ft	100.02741 ft	0 psf	826.33912 psf	300.76284 psf	225 psf	0 psf	Silt (Static)
Slice 12	86.5 ft	99.33099 ft	0 psf	855.30866 psf	311.30689 psf	225 psf	0 psf	Silt (Static)
Slice 13	87.6 ft	98.616514 ft	0 psf	877.51643 psf	319.38986 psf	225 psf	0 psf	Silt (Static)
Slice 14	88.8 ft	97.889964 ft	0 psf	891.82502 psf	324.59776 psf	225 psf	0 psf	Silt (Static)
Slice 15	90 ft	97.217875 ft	0 psf	902.86845 psf	328.61724 psf	225 psf	0 psf	Silt (Static)
Slice 16	91.2 ft	96.597255 ft	0 psf	909.3815 psf	330.9878 psf	225 psf	0 psf	Silt (Static)
Slice 17	92.4 ft	96.02553 ft	0 psf	909.88434 psf	331.17082 psf	225 psf	0 psf	Silt (Static)
Slice 18	93.6 ft	95.500482 ft	0 psf	902.72385 psf	328.56461 psf	225 psf	0 psf	Silt (Static)
Slice 19	94.8 ft	95.02019 ft	0 psf	892.25553 psf	324.75446 psf	225 psf	0 psf	Silt (Static)
Slice 20	96 ft	94.582989 ft	0 psf	877.2899 psf	319.30741 psf	225 psf	0 psf	Silt (Static)
Slice 21	97.2 ft	94.187432 ft	0 psf	850.2564 psf	309.46802 psf	225 psf	0 psf	Silt (Static)
Slice		93.832269	0	809.74704	294.72382			

22	98.4 ft	ft	psf	psf	psf	225 psf	0 psf	Silt (Static)
Slice 23	99.863575 ft	93.457325 ft	0 psf	742.85151 psf	270.37584 psf	225 psf	0 psf	Silt (Static)
Slice 24	101.28923 ft	93.136081 ft	0 psf	660.56973 psf	240.42772 psf	225 psf	0 psf	Silt (Static)
Slice 25	102.41338 ft	92.924448 ft	0 psf	580.84781 psf	211.41131 psf	225 psf	0 psf	Silt (Static)
Slice 26	103.53754 ft	92.745037 ft	0 psf	489.90901 psf	178.3123 psf	225 psf	0 psf	Silt (Static)
Slice 27	104.66169 ft	92.597421 ft	0 psf	389.45137 psf	141.7487 psf	225 psf	0 psf	Silt (Static)
Slice 28	105.78585 ft	92.481255 ft	0 psf	281.63095 psf	102.50528 psf	225 psf	0 psf	Silt (Static)
Slice 29	106.91001 ft	92.396272 ft	0 psf	168.89313 psf	61.472072 psf	225 psf	0 psf	Silt (Static)
Slice 30	108.03416 ft	92.342278 ft	0 psf	53.769483 psf	19.570491 psf	225 psf	0 psf	Silt (Static)

A-A' Pr-Seismic

File Information

- File Version: 11.02
- Title: 8020 S.E. 57th Street
- Created By: Brian Snow
- Last Edited By: Brian Snow
- Revision Number: 37
- Date: 10/17/2023
- Time: 11:39:17 AM
- Tool Version: 11.2.0.22838
- File Name: 9304.00 SlopeW.gsz
- Directory: G:\# Brian's ESNW Inbox\# WorkFlow\00 - Project Files\00 - Geotechnical\9304 - (SLOPE) 8020 S.E. 57th Street\
- Last Solved Date: 10/17/2023
- Last Solved Time: 11:39:22 AM

Project Settings

- Unit System: U.S. Customary Units

Analysis Settings

A-A' Pr-Seismic

- Description: ES-9304
- Kind: SLOPE/W
- Analysis Type: Morgenstern-Price
- Settings
  - Side Function
    - Interslice force function option: Half-Sine
  - PWP Conditions from: (none)
  - Unit Weight of Water: 62.430189 pcf
- Slip Surface
  - Direction of movement: Left to Right
  - Use Passive Mode: No
  - Slip Surface Option: Entry and Exit
  - Critical slip surfaces saved: 1
  - Optimize Critical Slip Surface Location: No
  - Tension Crack Option: (none)
- Distribution
  - F of S Calculation Option: Constant
- Advanced
  - Geometry Settings
    - Minimum Slip Surface Depth: 5 ft

Number of Slices: 30

Factor of Safety Convergence Settings

Maximum Number of Iterations: 100

Tolerable difference in F of S: 0.001

Under-Relaxation Criteria

Initial Rate: 1

Minimum Rate: 0.1

Rate Reduction Factor: 0.65

Reduction Frequency (iterations): 50

Solution Settings

Search Method: Root Finder

Tolerable difference between starting and converged F of S: 3

Maximum iterations to calculate converged lambda: 20

Max Absolute Lambda: 2

Materials

Silty Sand (Seismic)

Slope Stability Material Model: Mohr-Coulomb

Unit Weight: 125 pcf

Effective Cohesion: 50 psf

Effective Friction Angle: 34 °

Phi-B: 0 °

Silt (Seismic)

Slope Stability Material Model: Mohr-Coulomb

Unit Weight: 110 pcf

Effective Cohesion: 450 psf

Effective Friction Angle: 20 °

Phi-B: 0 °

Slip Surface Entry and Exit

Left Type: Range

Left-Zone Left Coordinate: (1, 103) ft

Left-Zone Right Coordinate: (69, 103) ft

Left-Zone Increment: 40

Right Type: Range

Right-Zone Left Coordinate: (69, 105) ft

Right-Zone Right Coordinate: (144, 96) ft

Right-Zone Increment: 40

Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 103) ft

Right Coordinate: (144, 96) ft

Seismic Coefficients

Horz Seismic Coef.: 0.345

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 150 pcf

Direction: Vertical

Coordinates

	X	Y
	0 ft	104 ft
	69 ft	104 ft

Geometry

Name: A-A' Proposed

Settings

View: 2D

Element Thickness: 1 ft

Points

	X	Y
Point 1	0 ft	118 ft
Point 2	64 ft	116 ft
Point 3	78 ft	114 ft
Point 4	84 ft	112 ft
Point 5	87 ft	110 ft
Point 6	99 ft	100 ft
Point 7	109 ft	92 ft
Point 8	117 ft	89 ft
Point 9	134 ft	94 ft
Point 10	144 ft	96 ft
Point 11	0 ft	80 ft
Point 12	144 ft	80 ft
Point 13	94.2 ft	104 ft
Point 14	0 ft	103 ft
Point 15	100.72715 ft	98.61828 ft
Point 16	69 ft	103 ft
Point 17	69 ft	115.28571 ft
Point 18	69 ft	105.04564 ft

Regions

	Material	Points	Area
Region 1	Silt (Seismic)	6,13,18,16,14,11,12,10,9,8,7,15	2,900.1 ft^2
Region 2	Silty Sand (Seismic)	3,4,5,13,18,17	179.21 ft^2

Slip Results

Slip Surfaces Analysed: 4052 of 8405 converged

Current Slip Surface

Slip Surface: 8,342

Factor of Safety: 1.1

Volume: 549.03506 ft^3

Weight: 63,082.016 lbf

Resisting Moment: 2,708,727.8 lbf·ft

Activating Moment: 2,507,509.8 lbf·ft

Resisting Force: 40,393.489 lbf

Activating Force: 37,403.881 lbf

Slip Rank: 1 of 8,405 slip surfaces

Exit: (116.68097, 89.119636) ft

Entry: (69, 103) ft

Radius: 62.723994 ft

Center: (108.94008, 151.36414) ft

Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	69.75 ft	102.39972 ft	0 psf	920.56288 psf	335.05749 psf	450 psf	0 psf	Silt (Seismic)
Slice 2	71.25 ft	101.23553 ft	0 psf	941.42034 psf	342.64898 psf	450 psf	0 psf	Silt (Seismic)
Slice 3	72.75 ft	100.14173 ft	0 psf	958.28337 psf	348.78662 psf	450 psf	0 psf	Silt (Seismic)
Slice 4	74.25 ft	99.113897 ft	0 psf	973.89557 psf	354.469 psf	450 psf	0 psf	Silt (Seismic)
Slice 5	75.75 ft	98.148191 ft	0 psf	990.60151 psf	360.54946 psf	450 psf	0 psf	Silt (Seismic)
Slice 6	77.25 ft	97.241285 ft	0 psf	1,010.5101 psf	367.7956 psf	450 psf	0 psf	Silt (Seismic)
Slice 7	78.75 ft	96.390265 ft	0 psf	1,025.2258 psf	373.15166 psf	450 psf	0 psf	Silt (Seismic)
Slice 8	80.25 ft	95.592571 ft	0 psf	1,037.7306 psf	377.70305 psf	450 psf	0 psf	Silt (Seismic)
Slice 9	81.75 ft	94.845941 ft	0 psf	1,060.447 psf	385.97115 psf	450 psf	0 psf	Silt (Seismic)
Slice 10	83.25 ft	94.148374 ft	0 psf	1,094.567 psf	398.38982 psf	450 psf	0 psf	Silt (Seismic)
Slice 11	84.75 ft	93.498095 ft	0 psf	1,123.7044 psf	408.99496 psf	450 psf	0 psf	Silt (Seismic)
Slice		92.893524	0		418.17742			Silt

12	86.25 ft	ft	psf	1,148.933 psf	psf	450 psf	0 psf	(Seismic)
Slice 13	87.72 ft	92.343612 ft	0 psf	1,178.3688 psf	428.89118 psf	450 psf	0 psf	Silt (Seismic)
Slice 14	89.16 ft	91.845465 ft	0 psf	1,209.9875 psf	440.39944 psf	450 psf	0 psf	Silt (Seismic)
Slice 15	90.6 ft	91.386023 ft	0 psf	1,251.1304 psf	455.37422 psf	450 psf	0 psf	Silt (Seismic)
Slice 16	92.04 ft	90.964403 ft	0 psf	1,299.1235 psf	472.84229 psf	450 psf	0 psf	Silt (Seismic)
Slice 17	93.48 ft	90.579817 ft	0 psf	1,350.4525 psf	491.5245 psf	450 psf	0 psf	Silt (Seismic)
Slice 18	95 ft	90.214318 ft	0 psf	1,409.5549 psf	513.03602 psf	450 psf	0 psf	Silt (Seismic)
Slice 19	96.6 ft	89.871405 ft	0 psf	1,470.6304 psf	535.26568 psf	450 psf	0 psf	Silt (Seismic)
Slice 20	98.2 ft	89.571817 ft	0 psf	1,516.5118 psf	551.96517 psf	450 psf	0 psf	Silt (Seismic)
Slice 21	99.863575 ft	89.306464 ft	0 psf	1,540.7985 psf	560.80481 psf	450 psf	0 psf	Silt (Seismic)
Slice 22	101.55443 ft	89.082056 ft	0 psf	1,532.021 psf	557.61005 psf	450 psf	0 psf	Silt (Seismic)
Slice 23	103.20901 ft	88.90804 ft	0 psf	1,479.8506 psf	538.62156 psf	450 psf	0 psf	Silt (Seismic)
Slice 24	104.86357 ft	88.778242 ft	0 psf	1,379.5541 psf	502.11664 psf	450 psf	0 psf	Silt (Seismic)
Slice 25	106.51815 ft	88.692387 ft	0 psf	1,230.1082 psf	447.72276 psf	450 psf	0 psf	Silt (Seismic)
Slice 26	108.17271 ft	88.650295 ft	0 psf	1,035.1391 psf	376.75982 psf	450 psf	0 psf	Silt (Seismic)
Slice 27	109.7681 ft	88.650313 ft	0 psf	847.76665 psf	308.56183 psf	450 psf	0 psf	Silt (Seismic)
Slice 28	111.30429 ft	88.689429 ft	0 psf	682.70206 psf	248.48323 psf	450 psf	0 psf	Silt (Seismic)
Slice 29	112.84049 ft	88.766262 ft	0 psf	505.11784 psf	183.84786 psf	450 psf	0 psf	Silt (Seismic)
Slice 30	114.37668 ft	88.880953 ft	0 psf	322.72155 psf	117.46104 psf	450 psf	0 psf	Silt (Seismic)
Slice 31	115.91287 ft	89.03371 ft	0 psf	142.13318 psf	51.732246 psf	450 psf	0 psf	Silt (Seismic)

A-A' Pr-Static

File Information

File Version: 11.02
Title: 8020 S.E. 57th Street
Created By: Brian Snow
Last Edited By: Brian Snow
Revision Number: 37
Date: 10/17/2023
Time: 11:39:17 AM
Tool Version: 11.2.0.22838
File Name: 9304.00 SlopeW.gsz
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Last Solved Date: 10/17/2023
Last Solved Time: 11:39:22 AM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

A-A' Pr-Static

Description: ES-9304
Kind: SLOPE/W
Analysis Type: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- PWP Conditions from: (none)
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Advanced
- Geometry Settings
  - Minimum Slip Surface Depth: 5 ft

Number of Slices: 30
Factor of Safety Convergence Settings
Maximum Number of Iterations: 100
Tolerable difference in F of S: 0.001
Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Silt (Static)

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 110 pcf
Effective Cohesion: 225 psf
Effective Friction Angle: 20 °
Phi-B: 0 °

Silty Sand (Static)

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (1, 103) ft
Left-Zone Right Coordinate: (69, 103) ft
Left-Zone Increment: 40
Right Type: Range
Right-Zone Left Coordinate: (69, 105) ft
Right-Zone Right Coordinate: (144, 96) ft
Right-Zone Increment: 40
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 103) ft
Right Coordinate: (144, 96) ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 150 pcf

Direction: Vertical

Coordinates

	X	Y
	0 ft	104 ft
	69 ft	104 ft

Geometry

Name: A-A' Proposed

Settings

View: 2D

Element Thickness: 1 ft

Points

	X	Y
Point 1	0 ft	118 ft
Point 2	64 ft	116 ft
Point 3	78 ft	114 ft
Point 4	84 ft	112 ft
Point 5	87 ft	110 ft
Point 6	99 ft	100 ft
Point 7	109 ft	92 ft
Point 8	117 ft	89 ft
Point 9	134 ft	94 ft
Point 10	144 ft	96 ft
Point 11	0 ft	80 ft
Point 12	144 ft	80 ft
Point 13	94.2 ft	104 ft
Point 14	0 ft	103 ft
Point 15	100.72715 ft	98.61828 ft
Point 16	69 ft	103 ft
Point 17	69 ft	115.28571 ft
Point 18	69 ft	105.04564 ft

Regions

	Material	Points	Area
Region 1	Silt (Static)	6,13,18,16,14,11,12,10,9,8,7,15	2,900.1 ft^2
Region 2	Silty Sand (Static)	3,4,5,13,18,17	179.21 ft^2

Slip Results

Slip Surfaces Analysed: 4108 of 8405 converged

Current Slip Surface

Slip Surface: 8,343

Factor of Safety: 1.5

Volume: 694.70331 ft³

Weight: 79,105.524 lbf

Resisting Moment: 1,554,368.5 lbf·ft

Activating Moment: 1,053,562.3 lbf·ft

Resisting Force: 36,523.55 lbf

Activating Force: 24,767.733 lbf

Slip Rank: 1 of 8,405 slip surfaces

Exit: (116.68097, 89.119636) ft

Entry: (69, 103) ft

Radius: 37.74725 ft

Center: (100.78713, 123.35764) ft

Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	69.75 ft	101.91444 ft	0 psf	994.07694 psf	361.81442 psf	225 psf	0 psf	Silt (Static)
Slice 2	71.25 ft	99.885105 ft	0 psf	1,141.1491 psf	415.34431 psf	225 psf	0 psf	Silt (Static)
Slice 3	72.75 ft	98.108513 ft	0 psf	1,269.2889 psf	461.98337 psf	225 psf	0 psf	Silt (Static)
Slice 4	74.25 ft	96.533716 ft	0 psf	1,385.9509 psf	504.44486 psf	225 psf	0 psf	Silt (Static)
Slice 5	75.75 ft	95.126586 ft	0 psf	1,496.0754 psf	544.52691 psf	225 psf	0 psf	Silt (Static)
Slice 6	77.25 ft	93.862929 ft	0 psf	1,603.1166 psf	583.48672 psf	225 psf	0 psf	Silt (Static)
Slice 7	78.75 ft	92.724872 ft	0 psf	1,695.8293 psf	617.23139 psf	225 psf	0 psf	Silt (Static)
Slice 8	80.25 ft	91.698798 ft	0 psf	1,775.3933 psf	646.19032 psf	225 psf	0 psf	Silt (Static)
Slice 9	81.75 ft	90.77408 ft	0 psf	1,856.4549 psf	675.69432 psf	225 psf	0 psf	Silt (Static)
Slice 10	83.25 ft	89.942272 ft	0 psf	1,939.5226 psf	705.9285 psf	225 psf	0 psf	Silt (Static)
Slice 11	84.75 ft	89.196563 ft	0 psf	1,998.5779 psf	727.42285 psf	225 psf	0 psf	Silt (Static)
Slice 12	86.25 ft	88.531406 ft	0 psf	2,031.4888 psf	739.40146 psf	225 psf	0 psf	Silt (Static)
Slice 13	87.72 ft	87.952608 ft	0 psf	2,049.0893 psf	745.80749 psf	225 psf	0 psf	Silt (Static)
Slice 14	89.16 ft	87.453709 ft	0 psf	2,049.0326 psf	745.78687 psf	225 psf	0 psf	Silt (Static)

Slice 15	90.6 ft	87.018702 ft	0 psf	2,043.1729 psf	743.65412 psf	225 psf	0 psf	Silt (Static)
Slice 16	92.04 ft	86.645311 ft	0 psf	2,029.5383 psf	738.69154 psf	225 psf	0 psf	Silt (Static)
Slice 17	93.48 ft	86.33167 ft	0 psf	2,005.961 psf	730.1101 psf	225 psf	0 psf	Silt (Static)
Slice 18	95 ft	86.06543 ft	0 psf	1,976.9868 psf	719.56434 psf	225 psf	0 psf	Silt (Static)
Slice 19	96.6 ft	85.851972 ft	0 psf	1,938.7244 psf	705.63799 psf	225 psf	0 psf	Silt (Static)
Slice 20	98.2 ft	85.707687 ft	0 psf	1,880.177 psf	684.32846 psf	225 psf	0 psf	Silt (Static)
Slice 21	99.863575 ft	85.631574 ft	0 psf	1,797.9051 psf	654.38395 psf	225 psf	0 psf	Silt (Static)
Slice 22	101.55443 ft	85.627258 ft	0 psf	1,689.909 psf	615.07659 psf	225 psf	0 psf	Silt (Static)
Slice 23	103.20901 ft	85.697283 ft	0 psf	1,555.3179 psf	566.08942 psf	225 psf	0 psf	Silt (Static)
Slice 24	104.86357 ft	85.840374 ft	0 psf	1,392.1236 psf	506.69157 psf	225 psf	0 psf	Silt (Static)
Slice 25	106.51815 ft	86.057371 ft	0 psf	1,201.7556 psf	437.40328 psf	225 psf	0 psf	Silt (Static)
Slice 26	108.17271 ft	86.349578 ft	0 psf	987.26395 psf	359.33469 psf	225 psf	0 psf	Silt (Static)
Slice 27	109.7681 ft	86.702872 ft	0 psf	803.68235 psf	292.51645 psf	225 psf	0 psf	Silt (Static)
Slice 28	111.30429 ft	87.113954 ft	0 psf	656.23004 psf	238.8482 psf	225 psf	0 psf	Silt (Static)
Slice 29	112.84049 ft	87.595722 ft	0 psf	498.00354 psf	181.25846 psf	225 psf	0 psf	Silt (Static)
Slice 30	114.37668 ft	88.151087 ft	0 psf	332.70194 psf	121.0936 psf	225 psf	0 psf	Silt (Static)
Slice 31	115.91287 ft	88.783602 ft	0 psf	163.95503 psf	59.674751 psf	225 psf	0 psf	Silt (Static)

B-B' Ex-Seismic

File Information

File Version: 11.02
Title: 8020 S.E. 57th Street
Created By: Brian Snow
Last Edited By: Brian Snow
Revision Number: 37
Date: 10/17/2023
Time: 11:39:17 AM
Tool Version: 11.2.0.22838
File Name: 9304.00 SlopeW.gsz
Directory: G:\# Brian's ESNW Inbox\# WorkFlow\00 - Project Files\00 - Geotechnical\9304 - (SLOPE) 8020 S.E. 57th Street\
Last Solved Date: 10/17/2023
Last Solved Time: 11:39:20 AM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

B-B' Ex-Seismic

Kind: SLOPE/W
Analysis Type: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- PWP Conditions from: (none)
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Advanced
- Geometry Settings
  - Minimum Slip Surface Depth: 5 ft
  - Number of Slices: 30

Factor of Safety Convergence Settings

Maximum Number of Iterations: 100

Tolerable difference in F of S: 0.001

Under-Relaxation Criteria

Initial Rate: 1

Minimum Rate: 0.1

Rate Reduction Factor: 0.65

Reduction Frequency (iterations): 50

Solution Settings

Search Method: Root Finder

Tolerable difference between starting and converged F of S: 3

Maximum iterations to calculate converged lambda: 20

Max Absolute Lambda: 2

Materials

Silty Sand (Seismic)

Slope Stability Material Model: Mohr-Coulomb

Unit Weight: 125 pcf

Effective Cohesion: 50 psf

Effective Friction Angle: 34 °

Phi-B: 0 °

Silt (Seismic)

Slope Stability Material Model: Mohr-Coulomb

Unit Weight: 110 pcf

Effective Cohesion: 450 psf

Effective Friction Angle: 20 °

Phi-B: 0 °

Slip Surface Entry and Exit

Left Type: Range

Left-Zone Left Coordinate: (0, 118) ft

Left-Zone Right Coordinate: (121, 105) ft

Left-Zone Increment: 40

Right Type: Range

Right-Zone Left Coordinate: (125, 103.42857) ft

Right-Zone Right Coordinate: (184, 92) ft

Right-Zone Increment: 40

Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 118) ft

Right Coordinate: (184, 92) ft

Seismic Coefficients

Horz Seismic Coef.: 0.345

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 150 pcf

Direction: Vertical

Coordinates

	X	Y
	51 ft	117 ft
	62 ft	117 ft
	73 ft	115 ft
	83 ft	113 ft
	93 ft	111 ft
	100 ft	110 ft

Geometry

Name: B-B' Existing

Settings

View: 2D

Element Thickness: 1 ft

Points

	X	Y
Point 1	0 ft	118 ft
Point 2	62 ft	116 ft
Point 3	73 ft	114 ft
Point 4	83 ft	112 ft
Point 5	93 ft	110 ft
Point 6	105 ft	108 ft
Point 7	119 ft	106 ft
Point 8	123 ft	104 ft
Point 9	130 ft	102 ft
Point 10	141 ft	100 ft
Point 11	154 ft	98 ft
Point 12	167 ft	96 ft
Point 13	174 ft	94 ft
Point 14	184 ft	92 ft
Point 15	0 ft	65 ft
Point 16	184 ft	65 ft
Point 17	0 ft	108 ft

Point 18	20 ft	106 ft
Point 19	130 ft	87 ft
Point 20	184 ft	78 ft
Point 21	0 ft	103 ft
Point 22	184 ft	73 ft

Regions

	Material	Points	Area
Region 1	Silty Sand (Seismic)	1,2,3,4,5,6,7,8,9,10,11,12,13,14,20,19,18,17	2,750 ft²
Region 2	Silt (Seismic)	20,19,18,17,21,15,16,22	5,250 ft²

Slip Results

Slip Surfaces Analysed: 5769 of 8405 converged

Current Slip Surface

Slip Surface: 202

Factor of Safety: 1.2

Volume: 3,417.658 ft³

Weight: 412,520.53 lbf

Resisting Moment: 47,775,636 lbf·ft

Activating Moment: 38,687,109 lbf·ft

Resisting Force: 225,389.1 lbf

Activating Force: 182,627.69 lbf

Slip Rank: 1 of 8,405 slip surfaces

Exit: (184, 92) ft

Entry: (0, 118) ft

Radius: 205.58114 ft

Center: (117.65842, 286.58263) ft

Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	3.2120826 ft	115.8469 ft	0 psf	164.8874 psf	111.21795 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 2	9.6362478 ft	111.70964 ft	0 psf	516.41441 psf	348.32592 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 3	16.060413 ft	107.89911 ft	0 psf	834.37509 psf	562.79311 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 4	19.636248 ft	105.87544 ft	0 psf	979.05476 psf	356.34679 psf	450 psf	0 psf	Silt (Seismic)
Slice 5	23.1 ft	104.07202 ft	0 psf	1,128.6408 psf	410.79166 psf	450 psf	0 psf	Silt (Seismic)
Slice 6	29.3 ft	100.99004 ft	0 psf	1,382.1906 psf	503.07624 psf	450 psf	0 psf	Silt (Seismic)
Slice 7	35.5 ft	98.162452 ft	0 psf	1,614.2578 psf	587.54178 psf	450 psf	0 psf	Silt (Seismic)
Slice	41.7 ft	95.577931	0	1,831.0507	666.44793	450 psf	0 psf	Silt (Seismic)

8		ft	psf	psf	psf			
Slice 9	47.9 ft	93.226719 ft	0 psf	2,037.9838 psf	741.76544 psf	450 psf	0 psf	Silt (Seismic)
Slice 10	53.75 ft	91.208761 ft	0 psf	2,327.997 psf	847.32161 psf	450 psf	0 psf	Silt (Seismic)
Slice 11	59.25 ft	89.494233 ft	0 psf	2,532.084 psf	921.60321 psf	450 psf	0 psf	Silt (Seismic)
Slice 12	64.75 ft	87.946766 ft	0 psf	2,685.4387 psf	977.41976 psf	450 psf	0 psf	Silt (Seismic)
Slice 13	70.25 ft	86.56248 ft	0 psf	2,787.3646 psf	1,014.5177 psf	450 psf	0 psf	Silt (Seismic)
Slice 14	75.5 ft	85.386831 ft	0 psf	2,881.2509 psf	1,048.6896 psf	450 psf	0 psf	Silt (Seismic)
Slice 15	80.5 ft	84.403509 ft	0 psf	2,965.5313 psf	1,079.3651 psf	450 psf	0 psf	Silt (Seismic)
Slice 16	85.5 ft	83.548063 ft	0 psf	3,048.3277 psf	1,109.5005 psf	450 psf	0 psf	Silt (Seismic)
Slice 17	90.5 ft	82.818882 ft	0 psf	3,127.7298 psf	1,138.4006 psf	450 psf	0 psf	Silt (Seismic)
Slice 18	96.5 ft	82.123475 ft	0 psf	3,239.8174 psf	1,179.1971 psf	450 psf	0 psf	Silt (Seismic)
Slice 19	102.5 ft	81.576425 ft	0 psf	3,160.0898 psf	1,150.1786 psf	450 psf	0 psf	Silt (Seismic)
Slice 20	108.5 ft	81.235473 ft	0 psf	3,242.8102 psf	1,180.2864 psf	450 psf	0 psf	Silt (Seismic)
Slice 21	115.5 ft	81.04262 ft	0 psf	3,318.4101 psf	1,207.8025 psf	450 psf	0 psf	Silt (Seismic)
Slice 22	121 ft	81.038381 ft	0 psf	3,262.4634 psf	1,187.4396 psf	450 psf	0 psf	Silt (Seismic)
Slice 23	126.5 ft	81.221584 ft	0 psf	3,100.9026 psf	1,128.6362 psf	450 psf	0 psf	Silt (Seismic)
Slice 24	132.75 ft	81.574712 ft	0 psf	2,969.3722 psf	1,080.7631 psf	450 psf	0 psf	Silt (Seismic)
Slice 25	138.25 ft	82.054018 ft	0 psf	2,848.2191 psf	1,036.667 psf	450 psf	0 psf	Silt (Seismic)
Slice 26	143.33055 ft	82.624228 ft	0 psf	2,707.6807 psf	985.51519 psf	450 psf	0 psf	Silt (Seismic)
Slice 27	147.99164 ft	83.26527 ft	0 psf	2,555.3415 psf	930.06823 psf	450 psf	0 psf	Silt (Seismic)
Slice 28	152.1611 ft	83.926045 ft	0 psf	2,542.627 psf	1,715.0235 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 29	157.25 ft	84.877046 ft	0 psf	2,220.7374 psf	1,497.9063 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 30	163.75 ft	86.262761 ft	0 psf	1,770.1293 psf	1,193.9673 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 31	170.5 ft	87.941608 ft	0 psf	1,195.2314 psf	806.19373 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 32	176.5 ft	89.619522 ft	0 psf	646.73638 psf	436.2292 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 33	181.5 ft	91.183191 ft	0 psf	225.9811 psf	152.42618 psf	50 psf	0 psf	Silty Sand (Seismic)

B-B' Ex-Static

File Information

File Version: 11.02
Title: 8020 S.E. 57th Street
Created By: Brian Snow
Last Edited By: Brian Snow
Revision Number: 37
Date: 10/17/2023
Time: 11:39:17 AM
Tool Version: 11.2.0.22838
File Name: 9304.00 SlopeW.gsz
Directory: G:\# Brian's ESNW Inbox\# WorkFlow\00 - Project Files\00 - Geotechnical\9304 - (SLOPE) 8020 S.E. 57th Street\
Last Solved Date: 10/17/2023
Last Solved Time: 11:39:20 AM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

B-B' Ex-Static

Kind: SLOPE/W
Analysis Type: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- PWP Conditions from: (none)
- Unit Weight of Water: 62.430189 pcf

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack Option: (none)

Distribution
- F of S Calculation Option: Constant

Advanced
- Geometry Settings
  - Minimum Slip Surface Depth: 5 ft
  - Number of Slices: 30

Factor of Safety Convergence Settings

Maximum Number of Iterations: 100

Tolerable difference in F of S: 0.001

Under-Relaxation Criteria

Initial Rate: 1

Minimum Rate: 0.1

Rate Reduction Factor: 0.65

Reduction Frequency (iterations): 50

Solution Settings

Search Method: Root Finder

Tolerable difference between starting and converged F of S: 3

Maximum iterations to calculate converged lambda: 20

Max Absolute Lambda: 2

Materials

Silt (Static)

Slope Stability Material Model: Mohr-Coulomb

Unit Weight: 110 pcf

Effective Cohesion: 225 psf

Effective Friction Angle: 20 °

Phi-B: 0 °

Silty Sand (Static)

Slope Stability Material Model: Mohr-Coulomb

Unit Weight: 125 pcf

Effective Cohesion: 0 psf

Effective Friction Angle: 34 °

Phi-B: 0 °

Slip Surface Entry and Exit

Left Type: Range

Left-Zone Left Coordinate: (24, 117.22581) ft

Left-Zone Right Coordinate: (121, 105) ft

Left-Zone Increment: 40

Right Type: Range

Right-Zone Left Coordinate: (123, 104) ft

Right-Zone Right Coordinate: (184, 92) ft

Right-Zone Increment: 40

Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 118) ft

Right Coordinate: (184, 92) ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 150 pcf

Direction: Vertical

Coordinates

	X	Y
	51 ft	117 ft
	62 ft	117 ft
	73 ft	115 ft
	83 ft	113 ft
	93 ft	111 ft
	100 ft	110 ft

Geometry

Name: B-B' Existing

Settings

View: 2D

Element Thickness: 1 ft

Points

	X	Y
Point 1	0 ft	118 ft
Point 2	62 ft	116 ft
Point 3	73 ft	114 ft
Point 4	83 ft	112 ft
Point 5	93 ft	110 ft
Point 6	105 ft	108 ft
Point 7	119 ft	106 ft
Point 8	123 ft	104 ft
Point 9	130 ft	102 ft
Point 10	141 ft	100 ft
Point 11	154 ft	98 ft
Point 12	167 ft	96 ft
Point 13	174 ft	94 ft
Point 14	184 ft	92 ft
Point 15	0 ft	65 ft
Point 16	184 ft	65 ft
Point 17	0 ft	108 ft
Point 18	20 ft	106 ft
Point 19	130 ft	87 ft
Point 20	184 ft	78 ft
Point 21	0 ft	103 ft

Point 22	184 ft	73 ft

Regions

	Material	Points	Area
Region 1	Silty Sand (Static)	1,2,3,4,5,6,7,8,9,10,11,12,13,14,20,19,18,17	2,750 ft²
Region 2	Silt (Static)	20,19,18,17,21,15,16,22	5,250 ft²

Slip Results

Slip Surfaces Analysed: 6613 of 8405 converged

Current Slip Surface

Slip Surface: 7,413

Factor of Safety: 2.9

Volume: 63.803626 ft³

Weight: 7,975.4532 lbf

Resisting Moment: 87,361.888 lbf·ft

Activating Moment: 30,391.025 lbf·ft

Resisting Force: 5,098.846 lbf

Activating Force: 1,773.6943 lbf

Slip Rank: 1 of 8,405 slip surfaces

Exit: (132.02339, 101.63211) ft

Entry: (111.49824, 107.07168) ft

Radius: 15.839474 ft

Center: (124.77207, 115.71427) ft

Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	111.83923 ft	106.58844 ft	0 psf	39.660685 psf	26.75147 psf	0 psf	0 psf	Silty Sand (Static)
Slice 2	112.52121 ft	105.68853 ft	0 psf	113.61725 psf	76.635804 psf	0 psf	0 psf	Silty Sand (Static)
Slice 3	113.20318 ft	104.90685 ft	0 psf	177.14922 psf	119.48866 psf	0 psf	0 psf	Silty Sand (Static)
Slice 4	113.88516 ft	104.2189 ft	0 psf	232.99367 psf	157.15621 psf	0 psf	0 psf	Silty Sand (Static)
Slice 5	114.56714 ft	103.60851 ft	0 psf	283.09261 psf	190.94838 psf	0 psf	0 psf	Silty Sand (Static)
Slice 6	115.24912 ft	103.06436 ft	0 psf	328.86312 psf	221.82098 psf	0 psf	0 psf	Silty Sand (Static)
Slice 7	115.9311 ft	102.57817 ft	0 psf	371.35118 psf	250.47953 psf	0 psf	0 psf	Silty Sand (Static)
Slice 8	116.61308 ft	102.14366 ft	0 psf	411.32297 psf	277.44085 psf	0 psf	0 psf	Silty Sand (Static)
Slice 9	117.29505 ft	101.75599 ft	0 psf	449.32012 psf	303.07025 psf	0 psf	0 psf	Silty Sand (Static)
Slice	117.97703	101.41134	0	485.69291	327.60401	0 psf	0 psf	Silty Sand

10	ft	ft	psf	psf	psf			(Static)
Slice 11	118.65901 ft	101.10664 ft	0 psf	520.61964 psf	351.16238 psf	0 psf	0 psf	Silty Sand (Static)
Slice 12	119.33333 ft	100.84204 ft	0 psf	540.52089 psf	364.58595 psf	0 psf	0 psf	Silty Sand (Static)
Slice 13	120 ft	100.6148 ft	0 psf	544.37583 psf	367.18614 psf	0 psf	0 psf	Silty Sand (Static)
Slice 14	120.66667 ft	100.41998 ft	0 psf	545.19144 psf	367.73627 psf	0 psf	0 psf	Silty Sand (Static)
Slice 15	121.33333 ft	100.25635 ft	0 psf	542.49195 psf	365.91544 psf	0 psf	0 psf	Silty Sand (Static)
Slice 16	122 ft	100.12293 ft	0 psf	535.73017 psf	361.35456 psf	0 psf	0 psf	Silty Sand (Static)
Slice 17	122.66667 ft	100.01895 ft	0 psf	524.3109 psf	353.65217 psf	0 psf	0 psf	Silty Sand (Static)
Slice 18	123.35 ft	99.942678 ft	0 psf	516.64842 psf	348.48376 psf	0 psf	0 psf	Silty Sand (Static)
Slice 19	124.05 ft	99.895144 ft	0 psf	512.39569 psf	345.61526 psf	0 psf	0 psf	Silty Sand (Static)
Slice 20	124.75 ft	99.87868 ft	0 psf	501.77252 psf	338.44984 psf	0 psf	0 psf	Silty Sand (Static)
Slice 21	125.45 ft	99.89319 ft	0 psf	484.13241 psf	326.55143 psf	0 psf	0 psf	Silty Sand (Static)
Slice 22	126.15 ft	99.938758 ft	0 psf	458.96392 psf	309.57507 psf	0 psf	0 psf	Silty Sand (Static)
Slice 23	126.85 ft	100.01566 ft	0 psf	425.94975 psf	287.30673 psf	0 psf	0 psf	Silty Sand (Static)
Slice 24	127.55 ft	100.12435 ft	0 psf	385.01549 psf	259.69623 psf	0 psf	0 psf	Silty Sand (Static)
Slice 25	128.25 ft	100.26551 ft	0 psf	336.3595 psf	226.87735 psf	0 psf	0 psf	Silty Sand (Static)
Slice 26	128.95 ft	100.44004 ft	0 psf	280.4564 psf	189.17023 psf	0 psf	0 psf	Silty Sand (Static)
Slice 27	129.65 ft	100.6491 ft	0 psf	218.02977 psf	147.06293 psf	0 psf	0 psf	Silty Sand (Static)
Slice 28	130.33723 ft	100.88902 ft	0 psf	156.32652 psf	105.44357 psf	0 psf	0 psf	Silty Sand (Static)
Slice 29	131.0117 ft	101.16019 ft	0 psf	96.326344 psf	64.97294 psf	0 psf	0 psf	Silty Sand (Static)
Slice 30	131.68616 ft	101.46844 ft	0 psf	32.556448 psf	21.959602 psf	0 psf	0 psf	Silty Sand (Static)

B-B' Pr-Seismic

File Information

File Version: 11.02
Title: 8020 S.E. 57th Street
Created By: Brian Snow
Last Edited By: Brian Snow
Revision Number: 37
Date: 10/17/2023
Time: 11:39:17 AM
Tool Version: 11.2.0.22838
File Name: 9304.00 SlopeW.gsz
Directory: G:\# Brian's ESNW Inbox\# WorkFlow\00 - Project Files\00 - Geotechnical\9304 - (SLOPE) 8020 S.E. 57th Street\
Last Solved Date: 10/17/2023
Last Solved Time: 11:39:24 AM

Project Settings

Unit System: U.S. Customary Units

Analysis Settings

B-B' Pr-Seismic

- Kind: SLOPE/W
- Analysis Type: Morgenstern-Price
- Settings
  - Side Function
    - Interslice force function option: Half-Sine
  - PWP Conditions from: (none)
  - Unit Weight of Water: 62.430189 pcf
- Slip Surface
  - Direction of movement: Left to Right
  - Use Passive Mode: No
  - Slip Surface Option: Entry and Exit
  - Critical slip surfaces saved: 1
  - Optimize Critical Slip Surface Location: No
  - Tension Crack Option: (none)
- Distribution
  - F of S Calculation Option: Constant
- Advanced
  - Geometry Settings
    - Minimum Slip Surface Depth: 5 ft
    - Number of Slices: 30

Factor of Safety Convergence Settings
- Maximum Number of Iterations: 100
- Tolerable difference in F of S: 0.001

Under-Relaxation Criteria
- Initial Rate: 1
- Minimum Rate: 0.1
- Rate Reduction Factor: 0.65
- Reduction Frequency (iterations): 50

Solution Settings
- Search Method: Root Finder
- Tolerable difference between starting and converged F of S: 3
- Maximum iterations to calculate converged lambda: 20
- Max Absolute Lambda: 2

Materials

Silty Sand (Seismic)

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 50 psf
Effective Friction Angle: 34 °
Phi-B: 0 °

Silt (Seismic)

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 110 pcf
Effective Cohesion: 450 psf
Effective Friction Angle: 20 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (0, 118) ft
Left-Zone Right Coordinate: (113, 103) ft
Left-Zone Increment: 40
Right Type: Range
Right-Zone Left Coordinate: (113, 105) ft
Right-Zone Right Coordinate: (184, 92) ft
Right-Zone Increment: 40
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 118) ft
Right Coordinate: (184, 92) ft

Seismic Coefficients

Horz Seismic Coef.: 0.345

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 150 pcf

Direction: Vertical

Coordinates

	X	Y
	23 ft	104 ft
	113 ft	104 ft

Geometry

Name: B-B' Proposed

Settings

View: 2D

Element Thickness: 1 ft

Points

	X	Y
Point 1	0 ft	118 ft
Point 2	62 ft	116 ft
Point 3	73 ft	114 ft
Point 4	83 ft	112 ft
Point 5	93 ft	110 ft
Point 6	105 ft	108 ft
Point 7	119 ft	106 ft
Point 8	123 ft	104 ft
Point 9	130 ft	102 ft
Point 10	141 ft	100 ft
Point 11	154 ft	98 ft
Point 12	167 ft	96 ft
Point 13	174 ft	94 ft
Point 14	184 ft	92 ft
Point 15	0 ft	65 ft
Point 16	184 ft	65 ft
Point 17	0 ft	108 ft
Point 18	20 ft	106 ft
Point 19	130 ft	87 ft
Point 20	184 ft	78 ft
Point 21	0 ft	103 ft

Point 22	184 ft	73 ft
Point 23	23 ft	103 ft
Point 24	113 ft	103 ft
Point 25	113 ft	106.85714 ft
Point 26	23 ft	117.25806 ft
Point 27	23 ft	105.48182 ft
Point 28	37.36843 ft	103 ft

Regions

	Material	Points	Area
Region 1	Silty Sand (Seismic)	1,26,27,18,17	248.24 ft²
Region 2	Silt (Seismic)	20,19,28,23,27,18,17,21,15,16,22	5,232.2 ft²
Region 3	Silty Sand (Seismic)	7,8,9,10,11,12,13,14,20,19,28,24,25	1,568.6 ft²

Slip Results

Slip Surfaces Analysed: 2958 of 8405 converged

Current Slip Surface

Slip Surface: 8,402
Factor of Safety: 1.5
Volume: 520.57969 ft³
Weight: 65,072.461 lbf
Resisting Moment: 3,721,305.8 lbf·ft
Activating Moment: 2,543,817.5 lbf·ft
Resisting Force: 44,675.939 lbf
Activating Force: 30,534.748 lbf
Slip Rank: 1 of 8,405 slip surfaces
Exit: (184, 92) ft
Entry: (113, 103) ft
Radius: 80.447198 ft
Center: (159.52049, 168.63227) ft

Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	114 ft	102.31361 ft	0 psf	391.3392 psf	263.96162 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 2	116 ft	100.98389 ft	0 psf	478.39785 psf	322.68343 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 3	118 ft	99.737883 ft	0 psf	556.30139 psf	375.23003 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 4	120 ft	98.571129 ft	0 psf	594.08277 psf	400.71389 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 5	122 ft	97.479718 ft	0 psf	593.92043 psf	400.60439 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 6	124.16667 ft	96.381519 ft	0 psf	612.20771 psf	412.93931 psf	50 psf	0 psf	Silty Sand (Seismic)

Slice 7	126.5 ft	95.285415 ft	0 psf	649.21941 psf	437.90402 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 8	128.83333 ft	94.27868 ft	0 psf	682.84274 psf	460.58325 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 9	131.1 ft	93.381728 ft	0 psf	724.174 psf	488.46153 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 10	133.3 ft	92.587001 ft	0 psf	774.34753 psf	522.304 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 11	135.5 ft	91.863536 ft	0 psf	824.35102 psf	556.03178 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 12	137.7 ft	91.209334 ft	0 psf	874.71927 psf	590.0056 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 13	139.9 ft	90.62265 ft	0 psf	925.69177 psf	624.38698 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 14	142.3 ft	90.061064 ft	0 psf	985.39498 psf	664.6573 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 15	144.9 ft	89.535845 ft	0 psf	1,054.0625 psf	710.97415 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 16	147.5 ft	89.099068 ft	0 psf	1,121.388 psf	756.38577 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 17	150.1 ft	88.749282 ft	0 psf	1,184.7014 psf	799.09115 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 18	152.7 ft	88.485344 ft	0 psf	1,240.3399 psf	836.61984 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 19	155.3 ft	88.30641 ft	0 psf	1,283.8146 psf	865.94385 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 20	157.9 ft	88.21191 ft	0 psf	1,310.1546 psf	883.71046 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 21	160.5 ft	88.201546 ft	0 psf	1,314.4258 psf	886.59137 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 22	163.1 ft	88.275286 ft	0 psf	1,292.3649 psf	871.71111 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 23	165.7 ft	88.433363 ft	0 psf	1,241.0291 psf	837.08469 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 24	168.16667 ft	88.659664 ft	0 psf	1,142.3644 psf	770.5345 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 25	170.5 ft	88.946547 ft	0 psf	1,000.2356 psf	674.66742 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 26	172.83333 ft	89.303083 ft	0 psf	836.76656 psf	564.40617 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 27	175.25 ft	89.748121 ft	0 psf	665.02097 psf	448.56231 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 28	177.75 ft	90.288227 ft	0 psf	488.33093 psf	329.38337 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 29	180.25 ft	90.912485 ft	0 psf	301.56356 psf	203.40719 psf	50 psf	0 psf	Silty Sand (Seismic)
Slice 30	182.75 ft	91.622943 ft	0 psf	109.18102 psf	73.643528 psf	50 psf	0 psf	Silty Sand (Seismic)

B-B' Pr-Static

File Information

- File Version: 11.02
- Title: 8020 S.E. 57th Street
- Created By: Brian Snow
- Last Edited By: Brian Snow
- Revision Number: 37
- Date: 10/17/2023
- Time: 11:39:17 AM
- Tool Version: 11.2.0.22838
- File Name: 9304.00 SlopeW.gsz
- Directory: G:\# Brian's ESNW Inbox\# WorkFlow\00 - Project Files\00 - Geotechnical\9304 - (SLOPE) 8020 S.E. 57th Street\
- Last Solved Date: 10/17/2023
- Last Solved Time: 11:39:26 AM

Project Settings

- Unit System: U.S. Customary Units

Analysis Settings

B-B' Pr-Static

- Kind: SLOPE/W
- Analysis Type: Morgenstern-Price
- Settings
  - Side Function
    - Interslice force function option: Half-Sine
  - PWP Conditions from: (none)
  - Unit Weight of Water: 62.430189 pcf
- Slip Surface
  - Direction of movement: Left to Right
  - Use Passive Mode: No
  - Slip Surface Option: Entry and Exit
  - Critical slip surfaces saved: 1
  - Optimize Critical Slip Surface Location: No
  - Tension Crack Option: (none)
- Distribution
  - F of S Calculation Option: Constant
- Advanced
  - Geometry Settings
    - Minimum Slip Surface Depth: 5 ft
    - Number of Slices: 30

Factor of Safety Convergence Settings
Maximum Number of Iterations: 100
Tolerable difference in F of S: 0.001
Under-Relaxation Criteria
Initial Rate: 1
Minimum Rate: 0.1
Rate Reduction Factor: 0.65
Reduction Frequency (iterations): 50
Solution Settings
Search Method: Root Finder
Tolerable difference between starting and converged F of S: 3
Maximum iterations to calculate converged lambda: 20
Max Absolute Lambda: 2

Materials

Silt (Static)

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 110 pcf
Effective Cohesion: 225 psf
Effective Friction Angle: 20 °
Phi-B: 0 °

Silty Sand (Static)

Slope Stability Material Model: Mohr-Coulomb
Unit Weight: 125 pcf
Effective Cohesion: 0 psf
Effective Friction Angle: 34 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (23, 117.22581) ft
Left-Zone Right Coordinate: (113, 103) ft
Left-Zone Increment: 40
Right Type: Range
Right-Zone Left Coordinate: (113, 105) ft
Right-Zone Right Coordinate: (181, 92.6) ft
Right-Zone Increment: 40
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 118) ft
Right Coordinate: (184, 92) ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 150 pcf

Direction: Vertical

Coordinates

	X	Y
	23 ft	104 ft
	113 ft	104 ft

Geometry

Name: B-B' Proposed

Settings

View: 2D

Element Thickness: 1 ft

Points

	X	Y
Point 1	0 ft	118 ft
Point 2	62 ft	116 ft
Point 3	73 ft	114 ft
Point 4	83 ft	112 ft
Point 5	93 ft	110 ft
Point 6	105 ft	108 ft
Point 7	119 ft	106 ft
Point 8	123 ft	104 ft
Point 9	130 ft	102 ft
Point 10	141 ft	100 ft
Point 11	154 ft	98 ft
Point 12	167 ft	96 ft
Point 13	174 ft	94 ft
Point 14	184 ft	92 ft
Point 15	0 ft	65 ft
Point 16	184 ft	65 ft
Point 17	0 ft	108 ft
Point 18	20 ft	106 ft
Point 19	130 ft	87 ft
Point 20	184 ft	78 ft
Point 21	0 ft	103 ft
Point 22	184 ft	73 ft
Point 23	23 ft	103 ft
Point 24	113 ft	103 ft
Point 25	113 ft	106.85714 ft

Point 26	23 ft	117.25806 ft
Point 27	23 ft	105.48182 ft
Point 28	37.36843 ft	103 ft

Regions

	Material	Points	Area
Region 1	Silty Sand (Static)	1,26,27,18,17	248.24 ft²
Region 2	Silt (Static)	20,19,28,23,27,18,17,21,15,16,22	5,232.2 ft²
Region 3	Silty Sand (Static)	7,8,9,10,11,12,13,14,20,19,28,24,25	1,568.6 ft²

Slip Results

Slip Surfaces Analysed: 3245 of 8405 converged

Current Slip Surface

Slip Surface: 8,297
Factor of Safety: 3.7
Volume: 131.82843 ft³
Weight: 16,478.553 lbf
Resisting Moment: 379,605.47 lbf·ft
Activating Moment: 102,182.46 lbf·ft
Resisting Force: 10,760.121 lbf
Activating Force: 2,896.7214 lbf
Slip Rank: 1 of 8,405 slip surfaces
Exit: (144.11101, 99.521383) ft
Entry: (113, 103) ft
Radius: 33.743397 ft
Center: (131.87728, 130.969) ft

Slip Slices

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Slice 1	113.5 ft	102.67524 ft	0 psf	455.7331 psf	307.39586 psf	0 psf	0 psf	Silty Sand (Static)
Slice 2	114.5 ft	102.05003 ft	0 psf	506.02393 psf	341.31745 psf	0 psf	0 psf	Silty Sand (Static)
Slice 3	115.5 ft	101.47198 ft	0 psf	552.05894 psf	372.36846 psf	0 psf	0 psf	Silty Sand (Static)
Slice 4	116.5 ft	100.93834 ft	0 psf	594.45207 psf	400.96299 psf	0 psf	0 psf	Silty Sand (Static)
Slice 5	117.5 ft	100.44679 ft	0 psf	633.70158 psf	427.43711 psf	0 psf	0 psf	Silty Sand (Static)
Slice 6	118.5 ft	99.995327 ft	0 psf	670.19858 psf	452.05465 psf	0 psf	0 psf	Silty Sand (Static)
Slice 7	119.5 ft	99.582207 ft	0 psf	683.9314 psf	461.31756 psf	0 psf	0 psf	Silty Sand (Static)
Slice 8	120.5 ft	99.205938 ft	0 psf	674.66867 psf	455.06977 psf	0 psf	0 psf	Silty Sand (Static)

Slice 9	121.5 ft	98.865221 ft	0 psf	662.56965 psf	446.90887 psf	0 psf	0 psf	Silty Sand (Static)
Slice 10	122.5 ft	98.558934 ft	0 psf	647.48758 psf	436.73589 psf	0 psf	0 psf	Silty Sand (Static)
Slice 11	123.5 ft	98.286108 ft	0 psf	641.85311 psf	432.93539 psf	0 psf	0 psf	Silty Sand (Static)
Slice 12	124.5 ft	98.045909 ft	0 psf	645.81772 psf	435.60955 psf	0 psf	0 psf	Silty Sand (Static)
Slice 13	125.5 ft	97.837629 ft	0 psf	646.63609 psf	436.16155 psf	0 psf	0 psf	Silty Sand (Static)
Slice 14	126.5 ft	97.660667 ft	0 psf	644.03555 psf	434.40747 psf	0 psf	0 psf	Silty Sand (Static)
Slice 15	127.5 ft	97.514525 ft	0 psf	637.70576 psf	430.13797 psf	0 psf	0 psf	Silty Sand (Static)
Slice 16	128.5 ft	97.398802 ft	0 psf	627.31095 psf	423.12658 psf	0 psf	0 psf	Silty Sand (Static)
Slice 17	129.5 ft	97.313183 ft	0 psf	612.50422 psf	413.13932 psf	0 psf	0 psf	Silty Sand (Static)
Slice 18	130.5 ft	97.257438 ft	0 psf	599.57056 psf	404.41545 psf	0 psf	0 psf	Silty Sand (Static)
Slice 19	131.5 ft	97.231419 ft	0 psf	588.39392 psf	396.87671 psf	0 psf	0 psf	Silty Sand (Static)
Slice 20	132.5 ft	97.235057 ft	0 psf	572.10198 psf	385.88766 psf	0 psf	0 psf	Silty Sand (Static)
Slice 21	133.5 ft	97.268363 ft	0 psf	550.42246 psf	371.26463 psf	0 psf	0 psf	Silty Sand (Static)
Slice 22	134.5 ft	97.331423 ft	0 psf	523.14518 psf	352.86588 psf	0 psf	0 psf	Silty Sand (Static)
Slice 23	135.5 ft	97.424407 ft	0 psf	490.13817 psf	330.60237 psf	0 psf	0 psf	Silty Sand (Static)
Slice 24	136.5 ft	97.547563 ft	0 psf	451.36004 psf	304.44619 psf	0 psf	0 psf	Silty Sand (Static)
Slice 25	137.5 ft	97.701228 ft	0 psf	406.86734 psf	274.43549 psf	0 psf	0 psf	Silty Sand (Static)
Slice 26	138.5 ft	97.885827 ft	0 psf	356.81568 psf	240.67521 psf	0 psf	0 psf	Silty Sand (Static)
Slice 27	139.5 ft	98.101881 ft	0 psf	301.45364 psf	203.33304 psf	0 psf	0 psf	Silty Sand (Static)
Slice 28	140.5 ft	98.350017 ft	0 psf	241.1095 psf	162.63041 psf	0 psf	0 psf	Silty Sand (Static)
Slice 29	141.5185 ft	98.636804 ft	0 psf	176.84914 psf	119.28625 psf	0 psf	0 psf	Silty Sand (Static)
Slice 30	142.55551 ft	98.964414 ft	0 psf	108.90875 psf	73.45988 psf	0 psf	0 psf	Silty Sand (Static)
Slice 31	143.59251 ft	99.329397 ft	0 psf	36.877468 psf	24.874167 psf	0 psf	0 psf	Silty Sand (Static)

Appendix B: WWHM Modeling