June 12, 2025
Updated June 17, 2025
ES-9607.02

Derek and Eileen Cheshire
7615 East Mercer Way
Mercer Island, Washington 98040

Subject: Response to Review Comments
Cheshire Property
7615 East Mercer Way
Mercer Island, Washington

Dear Derek and Eileen:

As requested, Earth Solutions NW, LLC (ESNW) has prepared this response to review comments letter for the subject project. This response letter addresses city of a city of Mercer Island review comments in the referenced review letter. This update includes a review of the latest submittal plans.

Geotechnical Review:

It is the opinion of the reviewer that the submitted geotechnical report (Earth Solutions NW, LLC, November 1, 2024) has not comprehensively assessed or provided design recommendations to effectively mitigate the risks of the geologic hazards at the site. The entire site should be assessed, including the steep slope to the west of the proposed residential structure.

Specific comments to be addressed include:

1. *The statement of risk on page 5 of the report indicates: "The development is so minor as not to pose a threat to the public health, safety and welfare." The reviewer does not agree with this statement of risk when the potential impact of failure of the steep slope to the west and potential post-seismic impacts to the property and structure are considered. Please consider an alternate statement of risk available in MICC 19.07.160.B.3.*

ESNW Response

In our opinion, based on site conditions and slope stability analyses attached to this report, **"The landslide hazard area or seismic 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" (19.07.160.B.3.b).** As noted in the Project Description, the new construction will essentially replace the same footprint area as the existing structure and will be of similar height; therefore, no significant increase in loading is expected from the project. Improved drainage controls will improve the overall stability of this site. Further discussion regarding landslide susceptibility is provided in the *Slope Stability Analysis* section of this response.

2. *Please provide a scaled site plan with elevation contours showing the boring locations.*

ESNW Response

Attached.

3. *Please provide surface and subsurface information for the slope located to the west of the proposed structure.*

ESNW Response

ESNW representatives conducted a site visit on May 13, and June 4, 2025 to assess the slope off the west side of the residence. Due to the terrain and dense groundcover, access with mechanical means such as drill rig or excavator is not practical. The hand-auger borings were excavated at accessible areas of the site using hand tools at the locations illustrated on the attached site plan. The maximum exploration depth was approximately three and one-half feet below the existing ground surface where refusal was encountered. Topsoil with root intrusions was encountered and thickness ranged from 10 to 12 inches. Native soils generally consisted of silty sand with gravel and mottling, resembling weathered glacial drift deposits. The in-situ density of the native soil was characterized as medium dense, and the in-situ moisture content was chiefly observed in a moist to wet condition at the time of exploration. No fill was encountered at the exploration locations. Light groundwater seepage was observed at one location at a depth of approximately three feet.

In terms of surface conditions, the slope is heavily vegetated with forested growth and underbrush. Based on the conditions observed at the hand auger boring locations, the slope is comprised of firm glacial drift deposits, consistent with local geologic mapping.

4. *Please provide a slope stability assessment of the entire site (including the slope west of the residence) under static and seismic loading conditions.*

Please include the computer printout of all the results of the slope stability analyses. Appendix B of the geotechnical report was not included in the submitted report.

ESNW Response

Included as an attachment to this response letter.

5. *A maximum design earthquake acceleration of 0.35g was used in stability analyses as noted on page 6 of the geotechnical report. Please revise all analyses and design recommendations to include a peak ground acceleration associated with a 2% probability of exceedance in 50 years earthquake as required by IBC. Please clearly show what seismic coefficient was used in the stability analyses.*

ESNW Response

The local standard for modeling seismic acceleration in slope stability is to use one-half the peak value. This is consistent with local standards and based on the calculated site-modified peak ground acceleration of 0.7g for a 2 percent probability of exceedance in 50-year return period.

6. *Please show on the slope stability cross-sections the locations and subsurface information (SPT, soil type and groundwater condition) of the borings used to generate the stratigraphy shown on the sections. Please provide discussion on the stratigraphic changes from one section to another and how the groundwater level was determined across the sections.*

ESNW Response

Requested information included in updated SlopeW output attached. We updated the soil layers to include additional saturated sandy layers. This analysis does not account for the gradation between layers and related ‘fabric’ of the soil underlying this site. With respect to groundwater, while the soil logs report groundwater, it is not within a consistent layer or zone on this site, rather, it’s reported within the sandier deposits that vary across the slope. The updated SlopeW analysis applies a groundwater condition under the entire slope. Comparing the updated SlopeW analysis to the version previously submitted, it appears that minimum factor of safety (FOS) values are relatively consistent and suggest that, while there may be isolated areas of instability, such as within the slope to the west, global site stability does not pose an increased threat to the property. We applied a relatively thick layer of silty sand soil to the western slope, as a conservative approach given the limited amount of subsurface data. We expect much of the core of this slope to be comprised of dense/hard silt deposits. The slope stability modeling focused on the soil and groundwater conditions under the proposed building. It is acknowledged that soil, groundwater and terrain vary across this site, including the existing DADU. On this basis, in our opinion, the overall stability of the site is acceptable from a geotechnical standpoint. This analysis further supports the use of a structural fill mat and woven geotextile under new foundations, that will provide a uniform support and help reduce the potential for differential settlement that may cause the building to collapse. As is standard for any site located on a slope, should a maximum credible earthquake event occur and trigger movement, the goal is to prevent structural collapse, while acknowledging that severe damage to the overall site may occur. This is supported by the age of the existing building that was subjected to the Nisqually earthquake in 2001 and shows little to no signs of obvious foundation settlement or displacement. The recommended foundation support approach will provide a significantly more robust and resilient support system for the new building.

7. *Please review the soil strength values assigned under seismic loading conditions and provide supporting information for their use. An increase in cohesion while maintaining the same effective friction angle would result in a higher factor of safety against slope instability under seismic loading which would not be expected. Please revise soil strengths and slope stability analyses.*

ESNW Response

The local standard for modeling seismic soil conditions includes an apparent cohesion value to account for negative pore pressure and other related soil characteristics in a dynamic loading condition. This is consistent with local standards and based on published recommendations for values, including FHWA.

8. *Unless otherwise determined, it should be assumed that the residence may be impacted by a future landslide since a landslide reached the garage in 1997. Please provide mitigation recommendations. Please consider all types of landslide failures.*

ESNW Response

Based on recent information/clarification, it appears the reviewer was referring to the address number along West Mercer Way or some other lot, not the subject site. During review exchanges, there has been some confusion related to which address the event in this comment occurred. In any case, ESNW provides an assessment of potential natural geologic hazards and mitigation recommendations (where applicable) below.

Slope stability modeling attached does not include a slope reduction in horizontal acceleration forces for dynamic loading, which has been identified and discussed in numerous professional publications, including the 2011 FHWA-NHI-11-032 Seismic Design manual (Chapter 6). This publication provides a clear acknowledgement that a 'factored' horizontal acceleration is recommended for slope stability modeling to account for 'spatial incoherence' effects. While this approach is not codified, and not included in this response, even a minor reduction in horizontal acceleration results in minimum FOS values of 1.1 for the western slope.

<u>Deep Seated Rotational Failures</u>

The site is located on an ancient landslide that is mapped within the larger area that encompasses numerous private residences, public roadways and utilities. The landslide feature is based largely on LiDar mapping and the age estimate of failure is not given; however, typical ancient landslide features in this general geographic area are thought to be associated with glacial unloading soon after retreat some 13,000 years ago. Most ancient landslides in the area show little to no signs of recent movement and the conditions that initiated these events are not present.

Mitigation for this type of movement depends largely on the loading of the new structure and the resilience of the envelope to maintain integrity to preserve life safety. It is acknowledged that if a large-scale failure occurs on this site (or any other sloped site in the Puget Sound area), that structural damage is likely and may be extensive. However, preservation of life safety is the target for mitigation. On this basis, providing a stiff uniform support via the recommendations in the referenced report will provide a resilient foundation system that will preserve life-safety in the event a maximum credible earthquake event occurs.

Debris Flows

There is a steeply ascending natural slope off the west side of the residence. The most common mode of failure on this slope is related to shallow debris flow, where the upper zone of weathered soil becomes saturated and loses internal strength. This is a common occurrence on similar sloped terrain in the area. The current slope condition is vegetated with a dense understory and mature trees. This condition suggests the slope is stable in the current condition and configuration. No modification is proposed for this slope; therefore, the stability will not be adversely impacted by the project. The current proposal includes enhanced surface and interflow capture and conveyance of water near this slope. A CIP retaining wall will be constructed along most of the western project limits and the new residence will be set back at least 40 feet from the ascending slope. In this respect, no additional mitigation is warranted to protect the new residence in our opinion.

Lateral Spread

While there is a descending slope off the east side of the residence, it is relatively low height and slope stability modeling does not suggest a particularly high susceptibility to lateral spread even with groundwater in the soil layers. Typically, lateral spread occurs where a slope is in direct contact with open water. In our opinion, this risk is low.

9. *Please assess the potential for liquefaction at the site and estimate post- liquefaction settlement, lateral spreading or flow failures as required by IBC using a peak ground acceleration associated with a 2% probability of exceedance in 50 years earthquake. Please include liquefaction assessment calculations, any post- liquefaction settlement calculations, residual strength determinations and associated stability analyses and/or lateral deformation calculations for review.*

ESNW Response

Included as an attachment. The groundwater conditions on this slope are highly variable and discontinuous, as are the soil gradations. In this respect, while saturated clean sandy soils that are loose may liquefy, the extent of this phenomenon is expected to be discontinuous across the site and may not adversely impact the overall site response as the estimated magnitude suggests. Based on the soil variability on this site, we would expect the effects of liquefaction to be isolated and variable as well. Therefore, overall site or site global effects would likely be discontinuous.

10. *On page 14 of the report, an interceptor drain was recommended by Earth Solutions NW to "improve site conditions related to stability...". Please indicate where the interceptor drain is located along with specific design details such as depth, pipe diameter, construction recommendations, etc.*

ESNW Response

Based on review of the referenced civil/drainage plans, significant new drainage is planned for the proposed project. This includes a cast-in-place (CIP) retaining wall at the toe of the ascending slope to the west of the new residence that will cut into the slope by up to about five feet and include up-sized drainage pipe and drain zone, a yard drain and improved drainage for the residence, and a sub-slab drainage system, all of which are tightlined to a conveyance and ultimately to the existing public drainage in the street. These elements will provide additional capture of surface and interflow water that may impact the new residence and effectively dewater the development envelope from these water sources. Therefore, no interceptor drainage is required in addition to the current drainage provisions. ESNW has coordinated with the civil engineering consultant regarding temporary excavations for the CIP wall along the western slope area. In our opinion, given the low height of the wall, temporary excavations for wall sections four feet and greater can be near vertical for the lower two to three feet then tapered to a shallower slope continuing to the existing slope surface. For wall sections less than four feet, a near vertical temporary excavation can be used. In any case, the geotechnical engineer must be contacted to observe temporary excavations for the wall construction as grading occurs to confirm stable soil conditions are present. The goal will be to limit the grading required to construct the retaining wall to the extent practical, while maintaining a safe condition for work to occur.

11. *The proposed foundation design as discussed on page 7 of the report, involves the use of shallow foundations "bearing on undisturbed competent native soil, recompacted native soil, or new structural fill." The recommendation goes on to indicate "Based on conditions observed during the fieldwork, we recommend new foundations be supported on a structural fill mat consisting of at least two feet of crushed rock structural fill placed on a woven geotextile (Mirafi 500X or approved alternative) that is underlain by a firm subgrade." It is the opinion of the reviewer that the reported site conditions do not warrant the use of shallow foundations for support of the proposed structure. On page 3 of the report, "Native soils observed at the exploration sites chiefly consisted of loose to medium dense colluvial and ancient landslide deposits that were characterized as sand (USCS: SM, SP-SM and SP) and silt (USCS: ML) … The upper soils were described as colluvium due to chaotic texture and the presence of organic debris."*

Reviewing logs for borings B-6 and B7, the thickness of what would be considered unsuitable soils for support of shallow foundations extends at least 25 feet below existing grade. Floating shallow foundations on landslide debris is not considered in conformance with the local geotechnical engineering standard of practice. Due to the "chaotic texture and presence of organic debris" it is unrealistic to accurately estimate foundation settlements over the lifespan of the structure. In addition, the presence of potentially liquefiable soils could result in post-earthquake differential ground surface settlement and/or lateral spreading or debris flow failure. These post-earthquake effects could significantly impact the structural integrity of the proposed structure. The associated life safety issue would require mitigation recommendations before a building permit could be approved.

ESNW Response

Based on review of the soil logs in borings B-1 and B-2, which are the closest explorations within the building footprint, soils are reported to consist of non- to slightly plastic silt (USCS: ML). While conditions reported at locations B-6 and B-7 are texturally different than those in B-1 and B-2, in our opinion, the difference does not pose an elevated risk for long term settlement, particularly since the existing house foundations show no unusual signs of settlement and have been in service since 1970. The new house will occupy a similar footprint and will not impose significant additional loading. Our recommendations and analysis recognize the diminished depth of foundation loading that occurs within a soil column below foundations. A simple calculation suggests the new building will impose approximately 250 psf new loading on the soil beneath the foundations. Within a depth of about 4B (where B = footing width), the additional loading on soil is 10 percent of the foundation load, predicted using the Boussinesq pressure calculations. The structural fill mat will effectively reduce or otherwise attenuate potential differential settlement and provide a uniform support conditions for this lightly loaded structure. It is important to recognize that foundation loads decrease with depth; therefore, while there are looser soils at depth on this site, the actual increase in loading from the new building is very low and diminishes with depth. This analysis further supports the use of a structural fill mat and woven geotextile under new foundations, that will provide a uniform support and help reduce the potential for differential settlement that may cause the building to collapse. As is standard for any site located on a slope, should a maximum credible earthquake event occur and trigger movement, the goal is to prevent structural collapse, while acknowledging that severe damage to the overall site may occur. This is supported by the age of the existing building that was subjected to the Nisqually earthquake in 2001 and shows little to no signs of obvious foundation settlement or displacement. The 'chaotic' nature of soil deposits on this site will tend to attenuate dynamic forces in a larger aerial context compared to continuous zones of different soil types. The recommended foundation support approach will provide a significantly more robust support for the new building. This approach has been approved for use on many residential projects in the Puget Sound in settings that present high liquefaction hazard and is considered an adequate form of mitigation for protecting foundations and reducing differential settlement to preserve life-safety. Our analysis acknowledges that there are zones of soil on this site at depth that may be susceptible to liquefaction and potential instability in the design earthquake event and the approach provides a viable alternative mitigation to approaches such as pile support or other deep foundation systems.

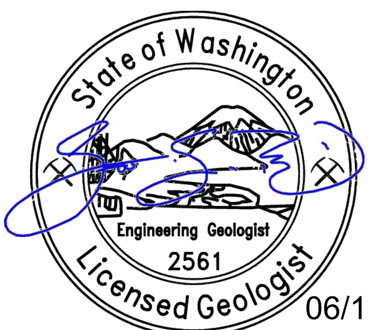
Plan Review

As part of this response preparation, the referenced submittal plans were reviewed and conform to the recommendations provided by ESNW during the design process. During the design process, cast-in-place retaining walls were developed for portions of the east and west sides of the project are to provide more useable space. The retaining walls range in height up to about five and one-half feet (exposed). The wall proposed along the western edge of the project will require excavation into a natural, moderately inclined slope (outside regulated steep slope hazard areas). ESNW provided sloped earth pressures to the structural engineering consultant for design purposes and those values are reflected in the current submittal package.

We trust this response letter meets your current needs. Should you have questions regarding the content herein, or require additional information, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC



06/17/2025

Scott S. Riegel

06/17/2025

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

Kyle R. Campbell, P.E.
Senior Principal Engineer

Attachments: Plate 1 – Vicinity Map
Plate 2 – Subsurface Exploration Plan
Subsurface Exploration Logs
SlopeW Output
Liquefaction Analysis

References:

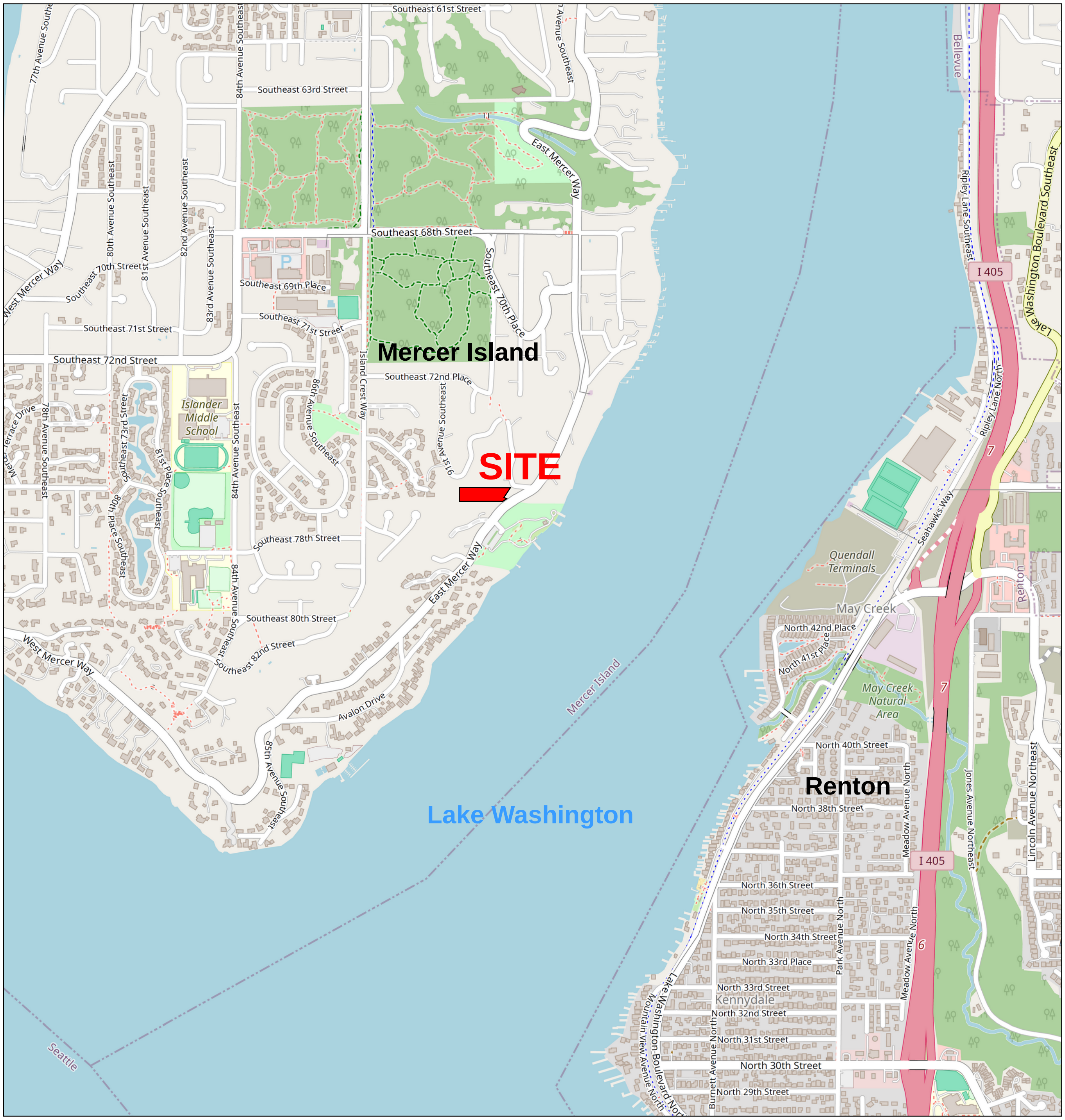
- Architectural Plans Sub1, prepared by Patrick D. Lynch, LLC, dated June 9, 2025

- Drainage Plan, prepared by LPD Engineering, PLLC, dated March 7, 2025

- Geotechnical Engineering Study, prepared by ESNW, ES-9607.01, updated January 23, 2025

- Review Letter, prepared by City of Mercer Island, dated April 30, 2025

- Structural Calculations, prepared by Merrell Design Services, PLLC, revision dated June 10, 2025



NORTH

Reference:
King County, Washington
OpenStreetMap.org

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.

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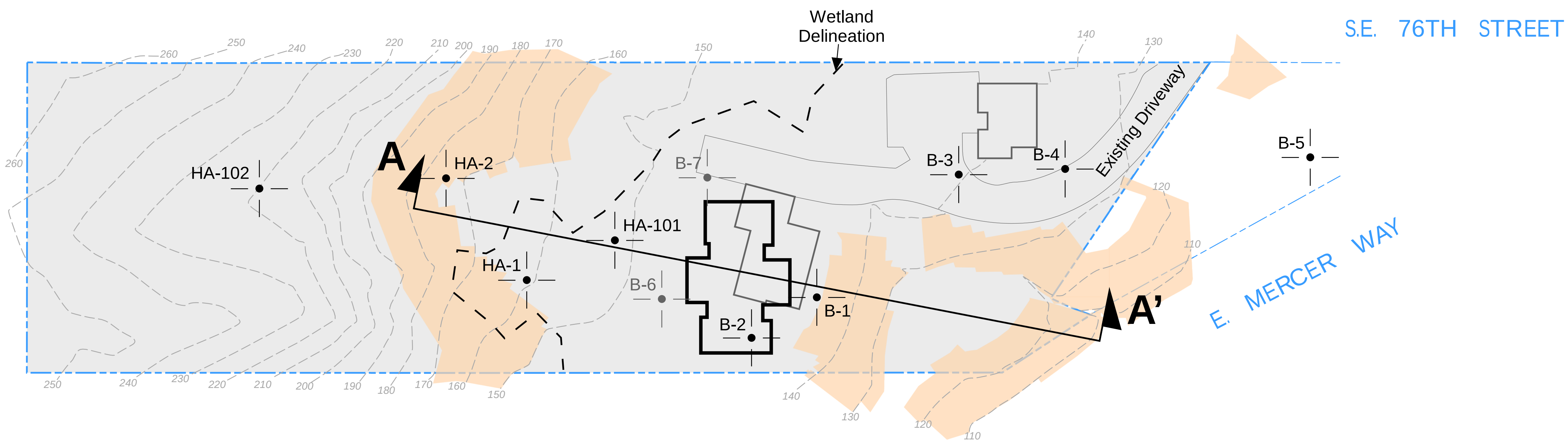
Vicinity Map
Cheshire Property
Mercer Island, Washington

Drawn CAM	Date 06/10/2025	Proj. No. 9607.02
Checked SSR	Date June 2025	Plate 1



LEGEND

HA-101 — Approximate Location of ESNW Hand Auger Boring, Proj. No. ES-9607.02, June 2025

HA-1 — Approximate Location of ESNW Hand Auger Boring, Proj. No. ES-9607.02, May 2025

B-1 — Approximate Location of Geotech Consultants, Inc. Boring, Job 16095, March 2016

B-6 — Approximate Location of Geotech Consultants, Inc. Boring, Job 23177, June 2023

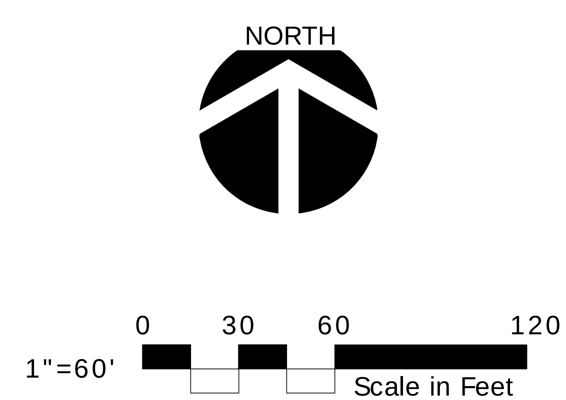
Subject Site

Proposed Building

Existing Building

Cross-Section

Approximate Location of Steep Slope Hazard Area



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.

Subsurface Exploration Plan
Cheshire Property
Mercer Island, Washington

Geotechnical Engineering
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Drawn	CAM
Checked	SSR
Date	06/11/2025
Proj. No.	9607.02
Plate	2

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

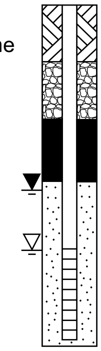
Wet - Water visible but not free draining, likely above optimum MC

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

Symbols

ATD = At time of drilling

Static water level (date)



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.

EXPLORATION LOG KEY

EARTH SOLUTIONS NW
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Geotechnical Engineering
Environmental Services
Earthwork Observation & Testing
CESCL & Stormwater Services

BORING NUMBER HA-101

PROJECT NUMBER ES-9607.02
PROJECT NAME Cheshire Property
DATE STARTED 6/4/25 **COMPLETED** 6/4/25
GROUND ELEVATION
DRILLING CONTRACTOR ESNW Rep
LATITUDE 47.53453 **LONGITUDE** -122.21661
LOGGED BY JMN **CHECKED BY** SSR
GROUND WATER LEVEL:
NOTES
▽ **AT TIME OF DRILLING**
SURFACE CONDITIONS Field grass & underbrush
AFTER DRILLING

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0		TPSL	0.5	Dark brown TOPSOIL with thin roots and gravel
		SM		Brown silty SAND with gravel, medium dense, moist
				-probed 4"
				-becomes dense
2.5				-probed 2"
			3.0	

Hand auger boring terminated at 3.0 feet below existing grade due to refusal on significant gravel content of soil. No groundwater encountered during excavation. No caving observed.

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.

GENERAL BH / TP / WELL - 9607-2.GPJ - GINT US.GDT - 6/10/25

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Geotechnical Engineering
Environmental Services
Earthwork Observation & Testing
CESCL & Stormwater Services

BORING NUMBER HA-102

PROJECT NUMBER ES-9607.02
PROJECT NAME Cheshire Property
DATE STARTED 6/4/25 **COMPLETED** 6/4/25
GROUND ELEVATION
DRILLING CONTRACTOR ESNW Rep
LATITUDE 47.53461 **LONGITUDE** -122.21725
LOGGED BY JMN **CHECKED BY** SSR
GROUND WATER LEVEL:
NOTES
∇ **AT TIME OF DRILLING**
SURFACE CONDITIONS Forest floor
AFTER DRILLING

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG		MATERIAL DESCRIPTION
0.0		TPSL		0.5	Dark brown TOPSOIL with roots to 1.5'
		SP-SM			Tan poorly graded SAND with silt and gravel, loose, damp
2.5				3.0	-becomes gray, medium dense
		SM		3.5	Gray silty SAND, medium dense, moist -mottled texture

Hand auger boring terminated at 3.5 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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
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Geotechnical Engineering
Environmental Services
Earthwork Observation & Testing
CESCL & Stormwater Services

BORING NUMBER HA-1

PROJECT NUMBER ES-9607.02
PROJECT NAME Cheshire Property
DATE STARTED 5/13/25 **COMPLETED** 5/13/25
GROUND ELEVATION
DRILLING CONTRACTOR ESNW Rep
LATITUDE 47.53450 **LONGITUDE** -122.21680
LOGGED BY JMN **CHECKED BY** SSR
GROUND WATER LEVEL:
NOTES
AT TIME OF DRILLING
SURFACE CONDITIONS Forest floor
AFTER DRILLING

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0		TPSL		Dark brown TOPSOIL with roots and gravel
			1.0	
		SM		Gray silty SAND with gravel, medium dense, moist
				-mottled, probed 6"
				-becomes wet, light groundwater seepage
2.5				-increased gravel content, probed 6"
			3.0	-probed 4"

Hand auger boring terminated at 3.0 feet below existing grade due to refusal on gravel. Groundwater seepage encountered at 2.0 feet during excavation. No caving observed.

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.

BORING NUMBER HA-2

EARTH SOLUTIONS NW
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Geotechnical Engineering
Environmental Services
Earthwork Observation & Testing
CESCL & Stormwater Services

PROJECT NUMBER ES-9607.02 **PROJECT NAME** Cheshire Property

DATE STARTED 5/13/25 **COMPLETED** 5/13/25 **GROUND ELEVATION**

DRILLING CONTRACTOR ESNW Rep **LATITUDE** 47.53463 **LONGITUDE** -122.21695

LOGGED BY JMN **CHECKED BY** SSR **GROUND WATER LEVEL:**

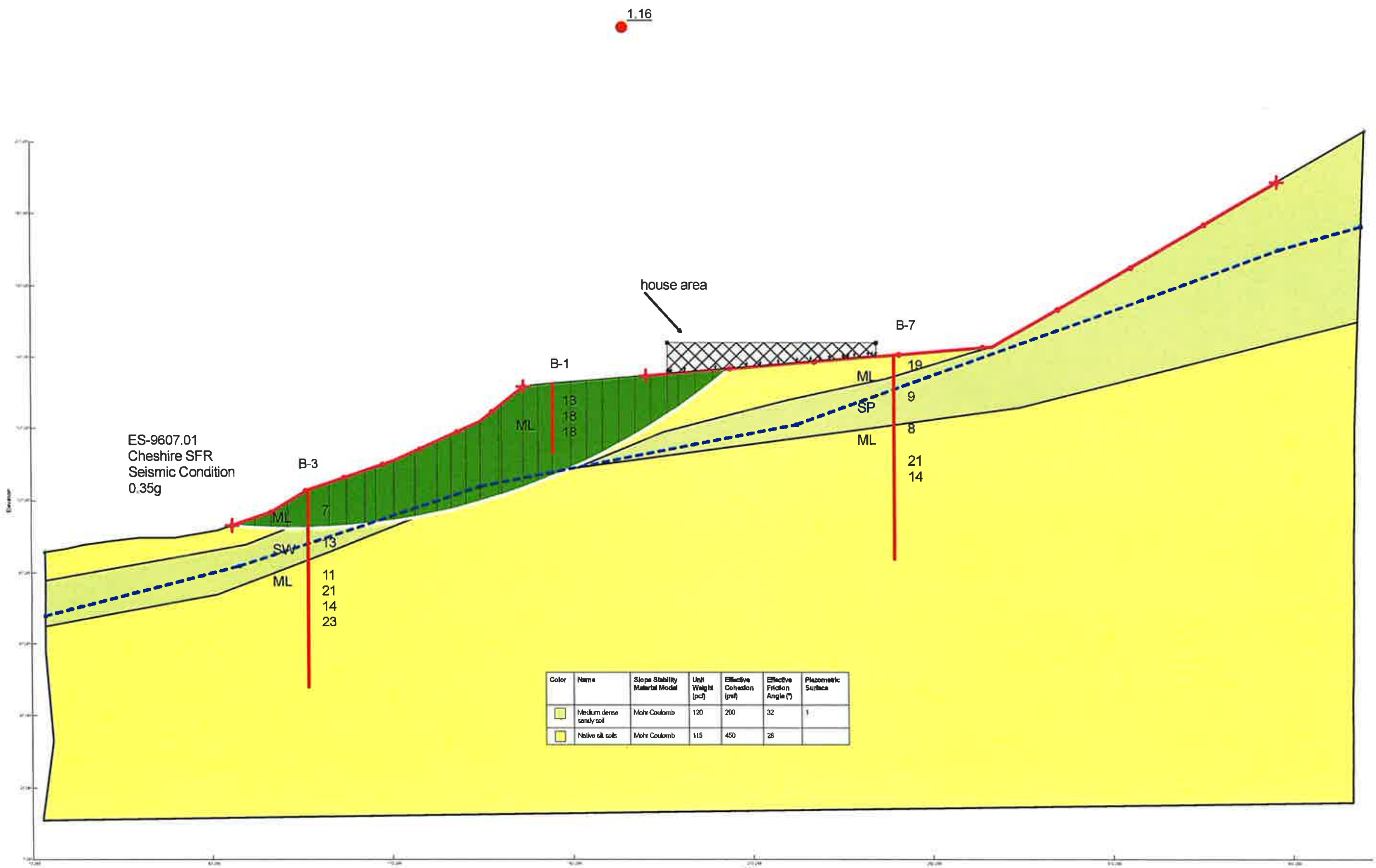
NOTES ▽ **AT TIME OF DRILLING**

SURFACE CONDITIONS Forest floor **AFTER DRILLING**

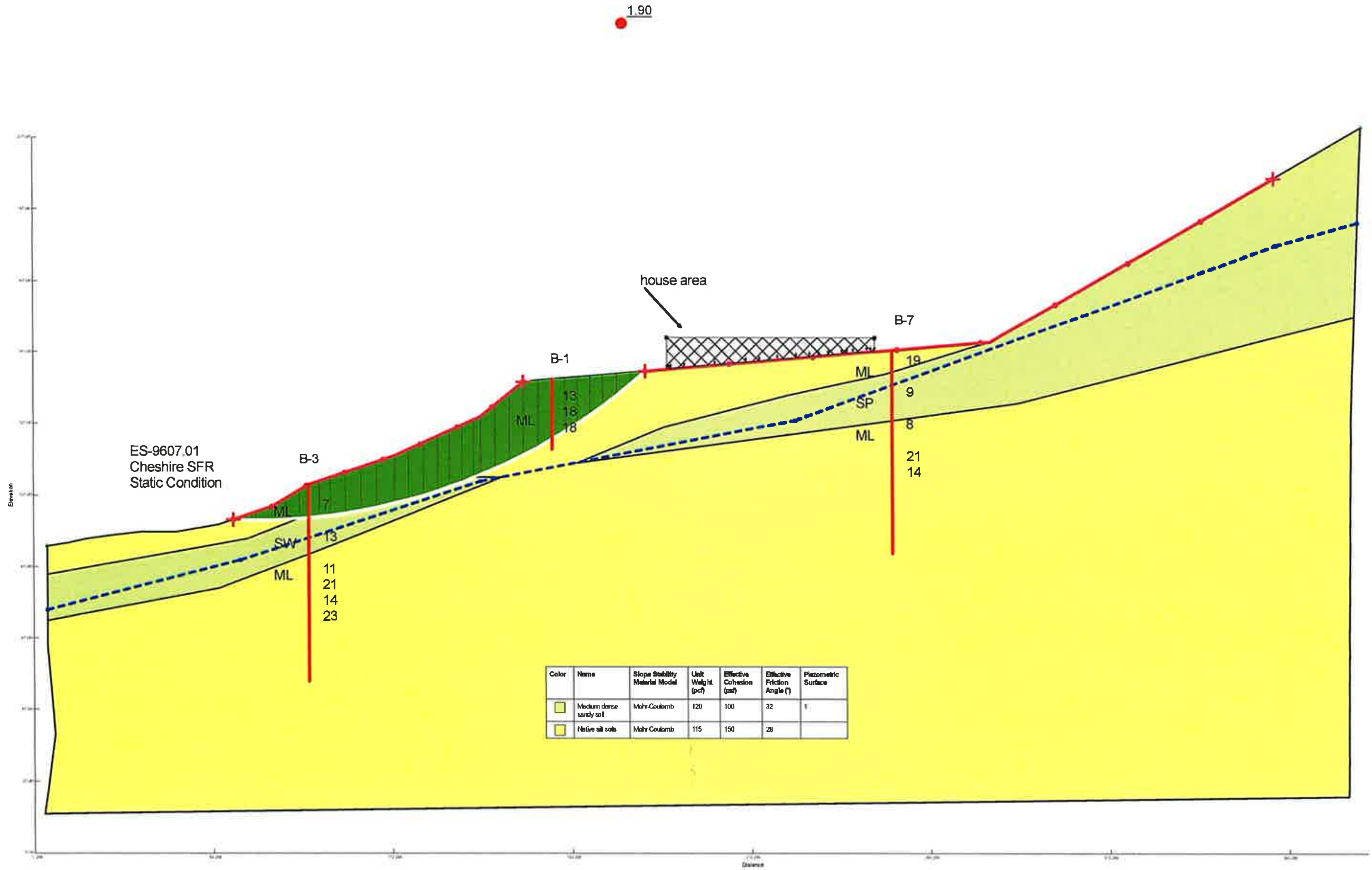
DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0		TPSL	0.9	Dark brown TOPSOIL with roots
2.5		SM	3.5	Brown silty SAND with gravel, medium dense, moist -probed 8" -becomes gray, wet, mottled, probed 6" -increased silt content -probed 6"

Hand auger boring terminated at 3.5 feet below existing grade. No groundwater encountered during excavation. No caving observed.

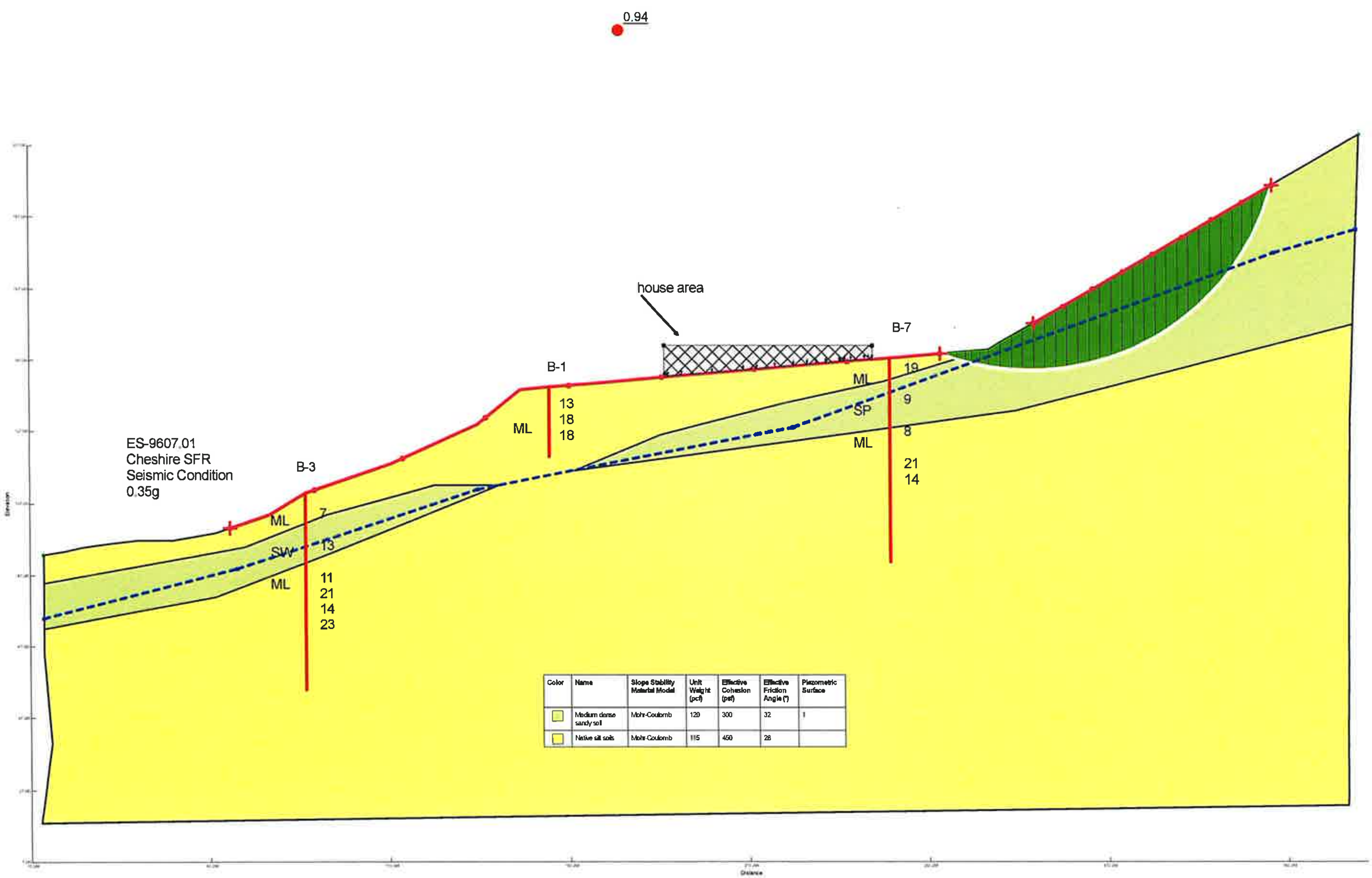
LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.



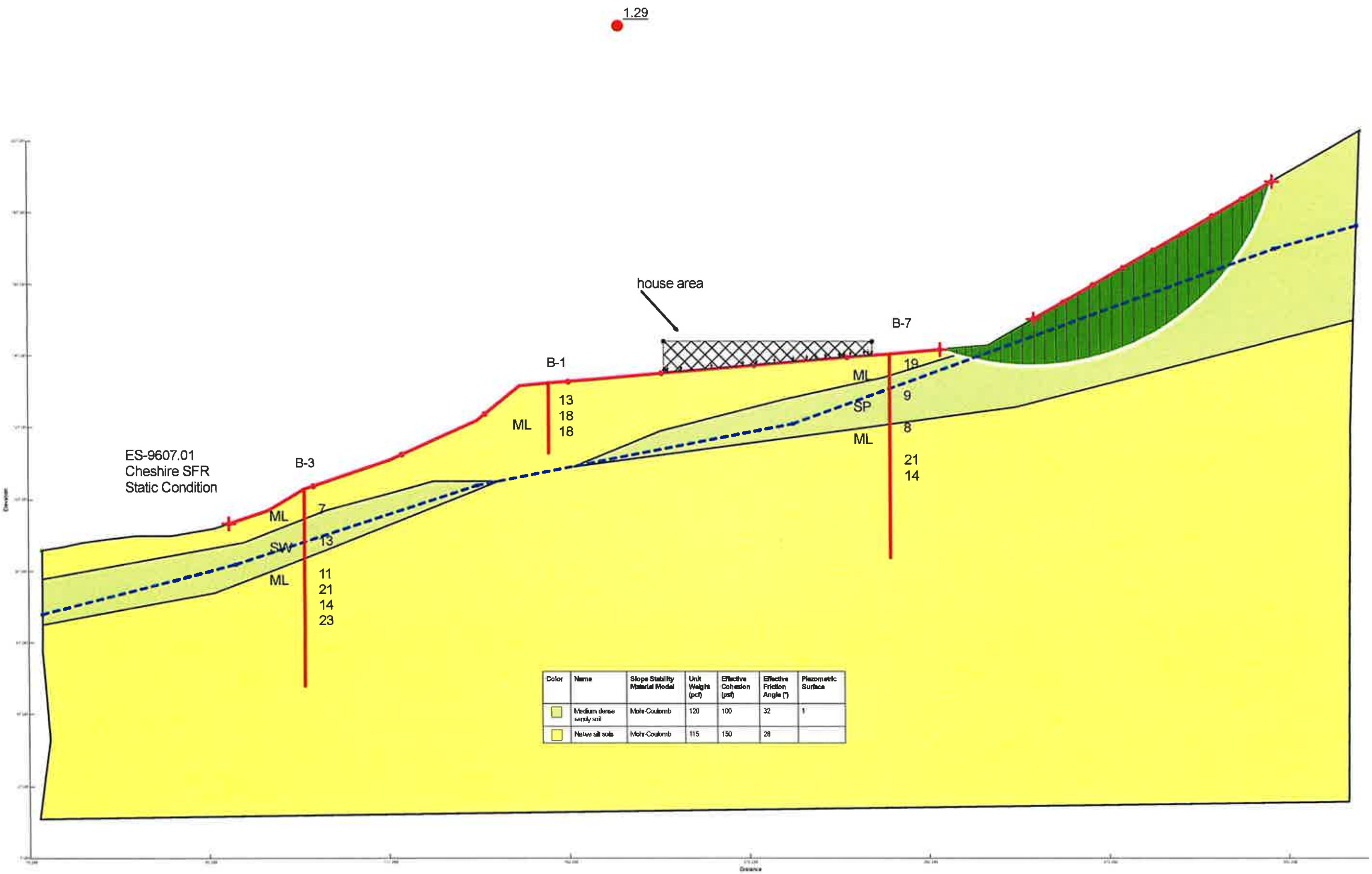
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface
	Medium dense sandy soil	Mohr-Coulomb	120	200	32	1
	Native silt soils	Mohr Coulomb	115	450	28	



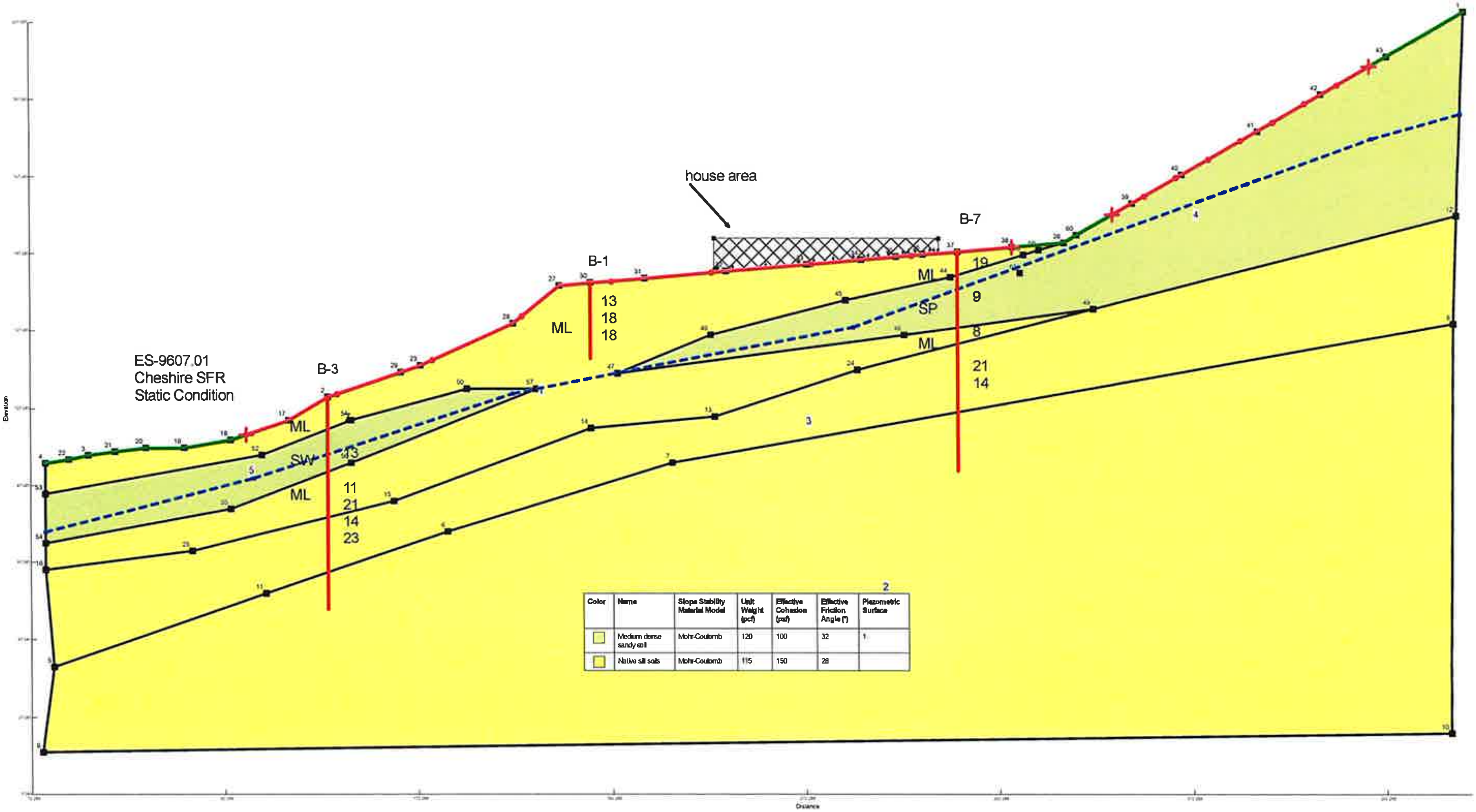
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface
	Medium dense sandy soil	Mohr-Coulomb	120	100	32	1
	Native silt soils	Mohr-Coulomb	115	150	28	



Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface
	Medium dense sandy soil	Mohr-Coulomb	120	300	32	1
	Native silt soils	Mohr-Coulomb	115	450	28	



Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface
	Medium dense sandy soil	Mohr-Coulomb	120	100	32	1
	Native silt soils	Mohr-Coulomb	115	150	28	



Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface
	Medium dense sandy soil	Mohr-Coulomb	120	100	32	1
	Native silt soils	Mohr-Coulomb	115	150	28	

SLOPE/W Analysis

File Information

- File Version: 11.05
- Title: Cheshire SFR ES-9607.01
- Created By: Scott Riegel
- Last Edited By: Scott Riegel
- Revision Number: 65
- Date: 06/11/2025
- Time: 09:36:37 AM
- Tool Version: 23.1.0.520
- File Name: updated static.gsz
- Directory: C:\Users\scott.riegel\Documents\Documents\GeoSlope Runs\ES9607.01\
- Last Solved Date: 06/11/2025
- Last Solved Time: 09:36:43 AM

Project Settings

- Unit System: U.S. Customary Units

Analysis Settings

SLOPE/W Analysis

- Kind: SLOPE/W
- Analysis Type: Morgenstern-Price
- Settings
  - Side Function
    - Intercolumn force function option: Half-Sine
  - PWP Conditions from: Piezometric Surfaces
  - Apply Phreatic Correction: No
  - Use Staged Rapid Drawdown: No
  - Unit Weight of Water: 62.4 pcf
- Slip Surface
  - Direction of movement: Right to Left
  - 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
- Convergence
  - Geometry Settings
    - Minimum Slip Surface Depth: 3 ft
    - Number of Columns: 30
  - Factor of Safety Convergence Settings
    - Maximum Number of Iterations: 100
    - Tolerable difference in F of S: 0.001
  - 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

Native silt soils

- Slope Stability Material Model: Mohr-Coulomb
- Unit Weight: 115 pcf
- Effective Cohesion: 450 psf
- Effective Friction Angle: 28 °
- Phi-B: 0 °

Medium dense sandy soil

- Slope Stability Material Model: Mohr-Coulomb
- Unit Weight: 120 pcf
- Effective Cohesion: 200 psf
- Effective Friction Angle: 32 °
- Phi-B: 0 °

Pore Water Pressure
Piezometric Surface: 1

Slip Surface Entry and Exit

Left Type: Range
Left-Zone Left Coordinate: (66, 100.33333) ft
Left-Zone Right Coordinate: (147, 138.74483) ft
Left-Zone Increment: 8
Right Type: Range
Right-Zone Left Coordinate: (181, 141.67882) ft
Right-Zone Right Coordinate: (356.51405, 195.81504) ft
Right-Zone Increment: 8
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (14, 93) ft
Right Coordinate: (381, 210) ft

Piezometric Surfaces

Piezometric Surface 1

Coordinates

	X	Y
Coordinate 1	14 ft	75 ft
Coordinate 2	68 ft	89 ft
Coordinate 3	135 ft	111 ft
Coordinate 4	223 ft	128 ft
Coordinate 5	357 ft	177 ft
Coordinate 6	380 ft	183.5 ft

Seismic Coefficients

Horz Seismic Coef.: 0.35

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 125 pcf
Direction: Vertical

Coordinates

	X	Y
	187 ft	151 ft
	245 ft	151 ft

Geometry

Name: Default Geometry

Settings

View: 2D
Element Thickness: 1 ft

Points

	X	Y
Point 1	381 ft	210 ft
Point 2	87 ft	110 ft
Point 3	25 ft	95 ft
Point 4	14 ft	93 ft
Point 5	16 ft	40 ft
Point 6	118 ft	75 ft
Point 7	176 ft	93 ft
Point 8	378 ft	129 ft
Point 9	13 ft	18 ft
Point 10	377 ft	23 ft
Point 11	71 ft	59 ft

Point 12	379 ft	157 ft
Point 13	187 ft	105 ft
Point 14	155.05084 ft	101.94916 ft
Point 15	104 ft	83 ft
Point 16	14 ft	65 ft
Point 17	77 ft	104 ft
Point 18	62 ft	99 ft
Point 19	50 ft	97 ft
Point 20	40 ft	97 ft
Point 21	32 ft	96 ft
Point 22	20 ft	94 ft
Point 23	111 ft	118 ft
Point 24	224 ft	117 ft
Point 25	52 ft	70 ft
Point 26	277.42857 ft	150 ft
Point 27	147 ft	138.74483 ft
Point 28	135 ft	128.89655 ft
Point 29	106 ft	116.33333 ft
Point 30	155 ft	139.43518 ft
Point 31	169 ft	140.64329 ft
Point 32	190 ft	142.45546 ft
Point 33	211 ft	144.26763 ft
Point 34	225 ft	145.47574 ft
Point 35	234 ft	146.25238 ft
Point 36	241 ft	146.85644 ft
Point 37	250 ft	147.63308 ft
Point 38	264 ft	148.8412 ft
Point 39	295 ft	160.17931 ft
Point 40	308 ft	167.71034 ft
Point 41	327.4881 ft	179 ft
Point 42	344 ft	188.56552 ft
Point 43	361 ft	198.41379 ft
Point 44	248 ft	141 ft
Point 45	221 ft	135 ft
Point 46	186 ft	126 ft
Point 47	162 ft	116 ft
Point 48	236 ft	126 ft
Point 49	285 ft	132.74194 ft
Point 50	123 ft	112 ft
Point 51	93 ft	104 ft
Point 52	70 ft	95 ft
Point 53	14 ft	85 ft
Point 54	14 ft	72 ft
Point 55	62 ft	81 ft
Point 56	93 ft	93 ft
Point 57	141 ft	112 ft
Point 58	267 ft	146.81068 ft
Point 59	270.88889 ft	148 ft
Point 60	280.73256 ft	151.91404 ft
Point 61	266 ft	142 ft

Regions

	Material	Points	Area
Region 1	Native silt soils	38,37,36,35,34,33,32,31,30,27,28,23,29,2,17,18,19,20,21,3,22,4,53,52,51,50,57,56,55,54,16,25,15,14,13,24,49,48,47,46,45,44,58,59,26	5,571.8 ft²
Region 2	Native silt soils	5,9,10,8,7,6,11	25,714 ft²
Region 3	Native silt soils	16,5,11,6,7,8,12,49,24,13,14,15,25	6,498.3 ft²
Region 4	Medium dense sandy soil	26,59,58,44,45,46,47,48,49,12,1,60	4,844.2 ft²
Region 5	Medium dense sandy soil	50,51,52,53,54,55,56,57	1,295.5 ft²

Slip Results

Slip Surfaces Analysed: 336 of 405 converged

Current Slip Surface

Slip Surface: 7
Factor of Safety: 1.16
Volume: 2,145.1097 ft³
Weight: 248,121.82 lbf
Resisting Moment: 35,089,991 lbf·ft
Activating Moment: 30,213,410 lbf·ft
Resisting Force: 175,846.02 lbf
Activating Force: 151,500.44 lbf
Slip Rank: 1 of 405 slip surfaces
Exit: (204.43598, 143.7012) ft
Entry: (65.999999, 100.33333) ft
Radius: 186.84338 ft
Center: (83.742972, 286.33235) ft

Slip Columns

	X	Y	PWP	Base Normal Stress	Frictional Strength	Cohesive Strength	Suction Strength	Base Material
Column 1	202.02998 ft	141.73301 ft	0 psf	608.30724 psf	323.4427 psf	450 psf	0 psf	Native silt soils
Column 2	197.21799 ft	137.92516 ft	0 psf	947.59951 psf	503.8476 psf	450 psf	0 psf	Native silt soils
Column 3	192.40600 ft	134.36510 ft	0 psf	1,244.4109 psf	661.66503 psf	450 psf	0 psf	Native silt soils
Column 4	188.50000 ft	131.62899 ft	0 psf	1,463.749 psf	778.28914 psf	450 psf	0 psf	Native silt soils
Column 5	184.75000 ft	129.16723 ft	0 psf	830.87074 psf	441.78181 psf	450 psf	0 psf	Native silt soils
Column 6	180.25000 ft	126.36380 ft	0 psf	1,009.3849 psf	536.69949 psf	450 psf	0 psf	Native silt soils
Column 7	175.75000 ft	123.73324 ft	0 psf	1,173.5053 psf	623.96382 psf	450 psf	0 psf	Native silt soils
Column 8	171.25000 ft	121.26726 ft	0 psf	1,328.8195 psf	706.54586 psf	450 psf	0 psf	Native silt soils
Column 9	166.81933 ft	118.99186 ft	0 psf	1,478.2029 psf	785.97441 psf	450 psf	0 psf	Native silt soils
Column 10	162.45800 ft	116.89619 ft	0 psf	1,626.0885 psf	864.60661 psf	450 psf	0 psf	Native silt soils
Column 11	157.63866 ft	114.74674 ft	0 psf	1,794.9786 psf	954.40707 psf	450 psf	0 psf	Native silt soils
Column 12	153.00000 ft	112.81211 ft	0 psf	1,968.5043 psf	1,046.6723 psf	450 psf	0 psf	Native silt soils
Column 13	149.00000 ft	111.26833 ft	0 psf	2,128.4285 psf	1,131.7055 psf	450 psf	0 psf	Native silt soils
Column 14	144.00000 ft	109.50053 ft	0 psf	2,173.5029 psf	1,155.672 psf	450 psf	0 psf	Native silt soils
Column 15	140.58824 ft	108.34674 ft	0 psf	2,131.9379 psf	1,133.5715 psf	450 psf	0 psf	Native silt soils
Column 16	137.58824 ft	107.43621 ft	0 psf	2,095.5387 psf	1,114.2177 psf	450 psf	0 psf	Native silt soils
Column 17	133.00000 ft	106.11056 ft	0 psf	2,096.5271 psf	1,114.7433 psf	450 psf	0 psf	Native silt soils
Column 18	129.00000 ft	105.06459 ft	0 psf	2,159.8821 psf	1,148.4297 psf	450 psf	0 psf	Native silt soils
Column 19	125.00000 ft	104.11243 ft	0 psf	2,214.2491 psf	1,177.3371 psf	450 psf	0 psf	Native silt soils
Column 20	119.93631 ft	103.05459 ft	0 psf	2,255.948 psf	1,199.5088 psf	450 psf	0 psf	Native silt soils
Column 21	113.93631 ft	101.96870 ft	131.96773 psf	2,187.0046 psf	1,284.1296 psf	200 psf	0 psf	Medium dense sandy soil
Column 22	108.50000 ft	101.15358 ft	71.443213 psf	2,187.492 psf	1,322.254 psf	200 psf	0 psf	Medium dense sandy soil
Column 23	104.48098 ft	100.64970 ft	20.537688 psf	2,177.0118 psf	1,347.5146 psf	200 psf	0 psf	Medium dense sandy soil
Column 24	100.47148 ft	100.25615 ft	-37.057795 psf	2,111.3966 psf	1,319.347 psf	200 psf	0 psf	Medium dense sandy soil
Column 25	95.49049 ft	99.87534 ft	-115.35343 psf	1,970.342 psf	1,231.2063 psf	200 psf	0 psf	Medium dense sandy soil
Column 26	90.00000 ft	99.61790 ft	-211.78663 psf	1,748.3636 psf	1,092.4989 psf	200 psf	0 psf	Medium dense sandy soil
Column 27	84.25302 ft	99.50986 ft	-322.79838 psf	1,368.2174 psf	854.95711 psf	200 psf	0 psf	Medium dense sandy soil
Column 28	79.25302 ft	99.55653 ft	0 psf	959.44816 psf	510.14764 psf	450 psf	0 psf	Native silt soils

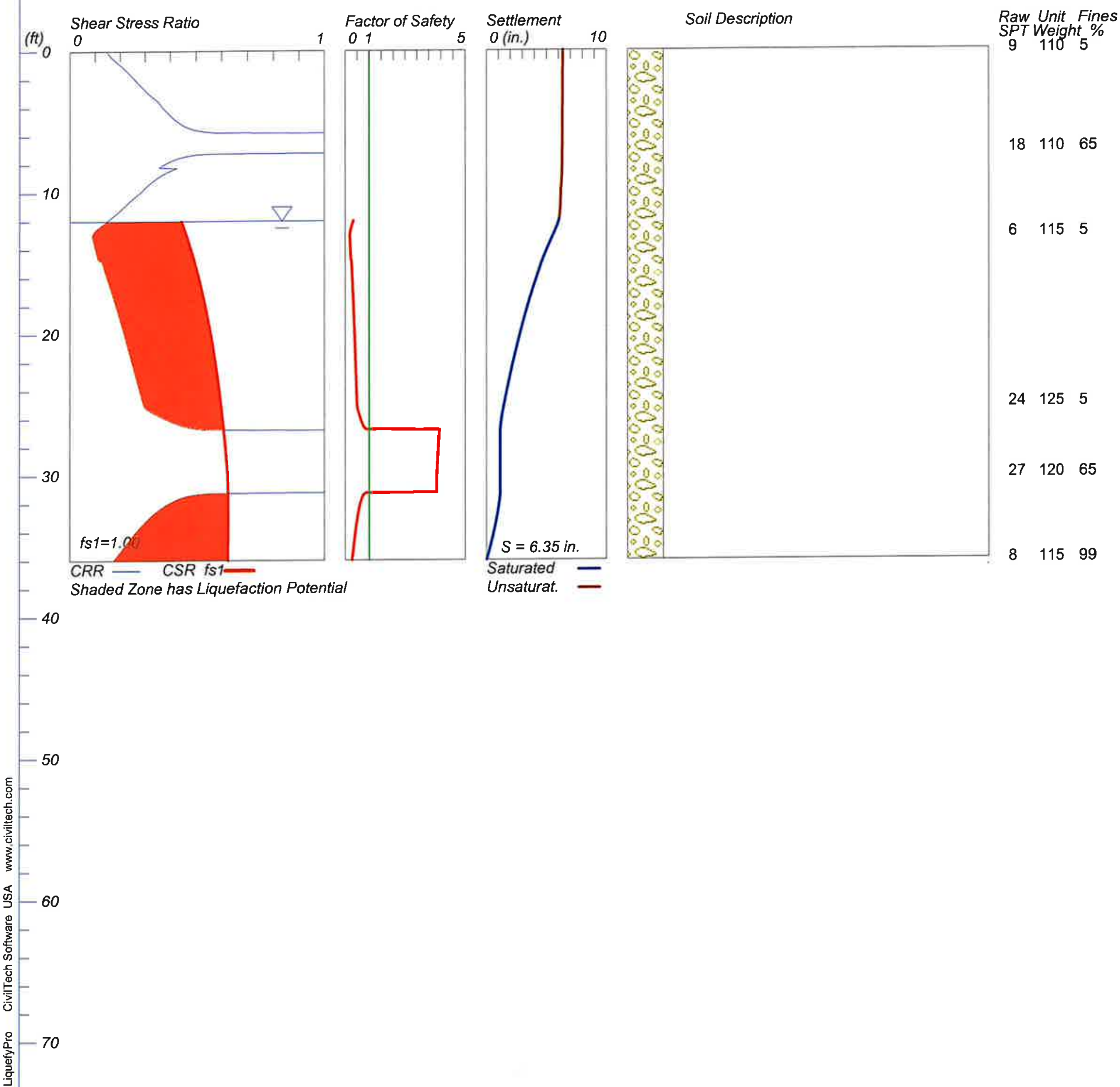
Column 29	74.75000 ft	99.71911 ft	0 psf	605.61133 psf	322.00926 psf	450 psf	0 psf	Native silt soils
Column 30	70.25000 ft	99.99047 ft	0 psf	315.15262 psf	167.56962 psf	450 psf	0 psf	Native silt soils
Column 31	67.00000 ft	100.24336 ft	0 psf	103.74412 psf	55.161727 psf	450 psf	0 psf	Native silt soils

LIQUEFACTION ANALYSIS

7615 E. Mercer Way

Hole No.=B-7 Water Depth=12 ft

Magnitude=7
Acceleration=0.7g



CivilTech Corporation **ES-9607.02** **Plate A-1**