GeoProfessional Innovation.

February 27, 2026
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Mr. Scott Linja, P.E.
Keller Associates, Inc.
733 5th St., Ste. A
Clarkston, WA 99403

RE: **REVISED Geotechnical Engineering Report**
Gun Club Road, Lapwai Road to Stewart Ave
Project No. AO23(881)
Key No. 23881
Nez Perce County, Idaho

Greetings, Scott:

GeoProfessional Innovation Corporation (GPI) prepared this Geotechnical Engineering Report referencing the Idaho Transportation Department (ITD) Materials Manual Section 230 for the Gun Club Road, Lapwai Road to Stewart Avenue project located along the eastern extents of Lewiston in Nez Perce County, Idaho. These improvements are intended to provide enhanced roadway safety for local patrons and commuters traversing this key travel-way. The purpose of our evaluation was to explore the subsurface conditions along the proposed project alignment and provide geotechnical recommendations to assist design and construction. We accomplished the scope of work outlined in our initial proposal dated April 18, 2023 and subsequent Scope Addendum dated March 4, 2025.

This report has been revised from our original submittal, dated July 15, 2025 based on comments we received from ITD. Herein, we summarize our field evaluation, laboratory tests results, and engineering analysis, as well as our geotechnical findings, opinions, and recommendations. Review and implement our geotechnical recommendations in their entirety. Portions or individual sections of our report cannot be relied upon without the supporting text in other pertinent sections.

We appreciate the opportunity to continue our working relationship with Keller on this project. Please do not hesitate to contact us if you have any questions or comments.

Sincerely,
GPI

Noah Hattrup

Noah G. Hattrup, E.I.T.
Staff Engineer

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PROJECT: Gun Club Road, Lapwai Road to Stewart Avenue
COUNTY: Nez Perce County
KEY NO.: 23881

230.00 GEOTECHNICAL ENGINEERING REPORT

230.01 Introduction

This Geotechnical Engineering Report provides design team members and construction personnel with recommendations for use in design and construction of road widening and safety improvements along Gun Club Road between Lapwai Road (Lindsay Creek Road) and Stewart Avenue. The improvements are part of a partnered effort between Nez Perce County (County) and the Local Highway Technical Assistance Council (LHTAC).

Geotechnical recommendations specifically addressing pavement improvements for Gun Club Road are provided in a separate *Roadway Materials Report* referencing the Idaho Transportation Department (ITD) *Materials Manual, Section 240*.

Existing Alignment Conditions

The existing Gun Club Road alignment is a 2-lane road that is paved with asphalt. The paved surface is approximately 26-feet wide, comprising 2, 13-foot-wide travel lanes. The roadway grade slopes downward to the north at approximately 9%. Roadway surface elevation at the south end of the alignment is approximately 1,215 feet above mean sea level (AMSL). At the north end of the alignment, the roadway surface elevation is approximately 910 feet AMSL. The existing Gun Club Road alignment transitions from cut to fill between the western and eastern edge of pavement. The existing road surface elevation varies greatly along the improvement alignment. Road surface elevations range from approximately 1,216 feet at the south end to approximately 910 feet above mean sea level (AMSL) at the north end of the improvement area. The eastern side of the road is situated atop fill embankments along the edge of the drainage east of the road. Existing embankments appear to range in height (vertically) from just a few feet to more than 15 feet along the eastern edge of the existing Gun Club Road alignment. Existing embankment slopes appear to be relatively steep, about 1.5H:1V (horizontal to vertical) in certain locations. Vertical elevation change between the existing Gun Club Road surface and the creek bottom to the east of the roadway ranges from approximately more than 70 feet at the south end of the improvement area to approximately 10-feet near the north end of the improvement area. The western side (i.e. southbound lane) of Gun Club Road is situated primarily over cuts into native soil and bedrock. Existing cut slopes along the western extent of the road alignment are relatively steep along much of the alignment, ranging from 2H:1V to near vertical in some locations.

Power and communication utilities run overhead along the west side of Gun Club Road throughout the alignment. Isolated overhead lines cross over Gun Club Road to serve residences along the east side of the road. Subsurface utilities traverse beneath the roadway surface or the shoulders in certain locations. Some existing roadway approaches connect to the Gun Club Road alignment within the planned improvement area. These existing site features as well as brief descriptions of each are provided in Tables 1, 2 and 3.

Table 1: Existing Approach Summary

Station (STA)	Type	Impact Status	Project Scope / Notes
60+09.60	Approach	Affected	Shoulder paving to ROW; minor regrading. Culvert unaffected.
67+97.30	Approach	Affected	Shoulder paving to ROW; minor regrading. Culvert extension/new aprons.
74+62.83	Approach	Not Affected	Restriping only.
75+39.63	Approach	Not Affected	Restriping only.
78+53.81	Approach	Not Affected	Restriping only.
80+29.18	Approach	Not Affected	Restriping only.
81+45.21	Approach	Not Affected	Restriping only.
81+92.52	Approach	Not Affected	Restriping only.
83+18.55	Approach	Not Affected	Restriping only.
83+41.74	Approach	Not Affected	Restriping only.
84+33.00	Bridge	Not Affected	Restriping only.

Table 2: Existing Culvert Summary

Station (STA)	Current Length	Proposed Length	Construction Context
60+09.60	31.5’	31.5' (No change)	Within ground disturbance range.
67+97.30	37.5’	48.0’	Extension; new aprons on both ends.
70+84.53	41.0’	—	Outside construction vicinity (Restriping only).
74+62.83	25.0’	—	Outside construction vicinity (Restriping only).
75+39.63	28.5’	—	Outside construction vicinity (Restriping only).
78+53.81	55.5’	—	Outside construction vicinity (Restriping only).
80+29.18	23.0’	—	Outside construction vicinity (Restriping only).
81+92.52	38.5’	—	Outside construction vicinity (Restriping only).
83+41.74	27.5’	—	Outside construction vicinity (Restriping only).

Table 3: Existing Utility Summary

Utility Type	Location / Stationing	Position	Risk Assessment
Overhead Power	STA 26+50.55 to 61+10	West side; parallel	No impact; located on private property.
Misc. Utilities	Nez Perce Drive Int.	West side	No impact (Stormwater, Power, Water, Fiber).
Overhead Power	STA 63+83	Crossing	No impact; sufficient vertical clearance.
Overhead Power	STA 83+00 to Lapwai Rd	East side; parallel	No impact; area limited to striping/signage.

Proposed Improvements

Design plans prepared by Keller Associates, Inc. (Keller) show the planned alignment grades are expected to remain relatively consistent with existing grades along the alignment. The project will include primarily shoulder widening along the east side of Gun Club Road, with new asphalt pavement over widened areas. Other improvements will include new striping, upgraded signage, and guardrails.

The project will widen the north-bound paved lane of Gun Club Road to the east by 6-feet. Additional lanes are not planned. Rather, widening will facilitate installation of guardrail along the eastern roadway edge for traffic safety improvements. Grade changes associated with road widening will be accomplished only along the eastern side of the alignment, requiring a combination of sloped fill embankments and mechanically stabilized earth (MSE) walls, comprising geosynthetic-reinforced, wire-faced baskets to facilitate grade changes adjacent to the widened roadway. Keller's design drawings show the planned MSE retaining walls will range from approximately 4-feet to 10-feet in total height, with embedment ranging from 2- to 4-feet below finished grades. MSE retaining walls will be constructed entirely in cuts below existing grade, and will bear on subgrades comprising bedrock or recompacted native soil. 2 distinct MSE retaining wall alignments are planned in different locations along the alignment, designated as "South Wall" and "North Wall" in Keller's plan drawings. MSE retaining wall alignment configurations are summarized in Table 4.

Table 4: MSE Retaining Wall Summary

Wall Designation	Station Range	Wall Description	Maximum Wall Height (feet)
South Wall	1+00.00 – 1+26.40	Geosynthetic-reinforced, wire basket faced MSE	4
South Wall	1+26.40 – 1+70.00	Geosynthetic-reinforced, wire basket faced MSE	8
South Wall	1+70.00 – 2+30.00	Geosynthetic-reinforced, wire basket faced MSE	10
South Wall	2+30.00 – 7+40.00	Geosynthetic-reinforced, wire basket faced MSE	8
South Wall	7+40.00 – 7+80.00	Geosynthetic-reinforced, wire basket faced MSE	10
South Wall	7+80.00 – 9+60.00	Geosynthetic-reinforced, wire basket faced MSE	8
South Wall	9+60.00 – 10+75.00	Geosynthetic-reinforced, wire basket faced MSE	10
South Wall	10+75.00 – 10+87.53	Geosynthetic-reinforced, wire basket faced MSE	8
North Wall	15+00.00 – 15+17.22	Geosynthetic-reinforced, wire basket faced MSE	8
North Wall	15+17.22 – 15+62.00	Geosynthetic-reinforced, wire basket faced MSE	10
North Wall	15+62.00 – 15+89.00	Geosynthetic-reinforced, wire basket faced MSE	10

Outside of planned MSE retaining wall alignments, widening will be facilitated by fill embankments less than 2-feet tall (vertical) with finished slope inclinations up to 2H:1V. These sloped embankments are categorized in Keller's plans in 2 distinct types, designated as Section 1 and Section 2. Sloped embankment configurations and locations are summarized in Table 5.

Table 5: Sloped Embankment Summary

Section Designation	Station Range	Description	Maximum Embankment Height (feet)
Section 1	60+10.95 – 69+25.45	Shoulder widening, 2H:1V finished slope	2
Section 2	37+23.10 – 39+54.25	Shoulder widening with guardrail, 2H:1V finished slope	2

The purpose of this report is to provide geologic conditions and geotechnical recommendations to aid Keller, the County and LHTAC with assessing roadway design and construction as well as to provide geotechnical information for contractor-supplied design of the planned retaining walls.

230.02 Field Exploration and Laboratory Testing

The subsurface conditions presented in this report are based on the results of our exploration and laboratory testing program. Field exploration was accomplished via soil borings accomplished on October 16, 2023, and test pits accomplished on March 7, 2025. The time lapse between these 2 exploration efforts was associated with the County and LHTAC receiving cultural clearance from the Nez Perce Tribe to perform test pit exploration. Both exploration phases were observed and documented by a GPI Geotechnical Engineer. The methods and results of the field and laboratory testing programs are summarized in the following sections.

230.02.01 Borings/Test Pits

GPI observed 8 exploratory borings within the roadway prism. Borings were advanced at various locations of interest outlined by Keller along the alignment. Boring locations were modified somewhat during exploration due to traffic safety and existing utility conflicts. Borings extended 11.5 to 16.5 feet below the existing ground surface. At the conclusion of exploration, GPI recorded the location of each boring with a commercially available global positioning system (GPS) unit with an accuracy of less than 1.0-foot. A boring summary is provided in Table 6.

Table 6: Boring Location Summary

Boring Number	Approximate Latitude[1]	Approximate Longitude[1]	Ground Surface Elevation (feet, AMSL)	Total Exploration Depth (feet)	Uncontrolled Fill Depth (feet)	Bedrock Surface Depth (feet)
B-23073A-1	46.391540°	-116.980988°	1,350.9	6.5	N.E. [2]	N.E. [2]
B-23073A-2	46.392888°	-116.980843°	1,316.8	10.4	N.E.[2]	8.0
B-23073A-3	46.394965°	-116.980743°	1,237.2	9.5	2.5	9.0
B-23073A-4	46.398784°	-116.980767°	1,096.2	9.5	N.E.[2]	7.5
B-23073A-5	46.404782°	-116.980875°	954.8	11.5	5.5	9.0
B-23073A-6	46.407614°	-116.979591°	902.6	9.0	>9.0	N.E. [2]
B-23073A-7	46.409614°	-116.978336°	879.9	12.0	N.E.[2]	N.E.[2]
B-23073A-8	46.411102°	-116.977124°	855.9	11.5	2.0	N.E.[2]

1. World Geodetic System of 1984 (WGS84)
2. Not Encountered (N.E.)

GPI also observed 7 exploratory test pits along the alignment. Test pits were advanced outside the roadway prism, extending into the fill embankment on the eastern edge of the roadway. Test pits were located 5 to 15 feet laterally off of the roadway shoulder to reduce damage to the existing Gun Club Road pavement section and reduce traffic impacts during our work. Test pits extended 8.0 to 14.0 feet below the existing ground surface. At the conclusion of exploration, GPI recorded the location of each boring with a commercially available GPS unit with an accuracy of less than 1.0-foot. A test pit summary is provided in Table 7.

Table 7: Test Pit Location Summary

Test Pit Number	Approximate Latitude[1]	Approximate Longitude[1]	Ground Surface Elevation (feet, AMSL)	Total Exploration Depth (feet)	Uncontrolled Fill Depth (feet)	Bedrock Surface Depth (feet)
TP-23073A-1	46.393515°	-116.980664°	1,293.5	13.0	7.0	12.0
TP-23073A-2	46.394953°	-116.980680°	1,234.2	12.0	4.5	11.0
TP-23073A-3	46.395363°	-116.980615°	1,216.6	12.0	2.5	11.0
TP-23073A-4	46.398776°	-116.980652°	1,092.4	12.0	6.0	9.5
TP-23073A-5	46.399922°	-116.980871°	1,058.8	14.0	5.0	N.E.[2]
TP-23073A-6	46.401122°	-116.980965°	1,024.2	8.5	5.0	7.5
TP-23073A-7	46.402870°	-116.980878°	986.4	8.0	4.0	7.0

1. World Geodetic System of 1984 (WGS84)
2. Not Encountered (N.E.)

Exploratory borings and test pits nearest the planned MSE wall alignments were extended to refusal on dense bedrock. During exploration operations, traffic control including signs and flaggers were used to close the northbound (eastern) roadway lane along Gun Club Road and facilitate exploration. Borings were completed using a trailer mounted G2400 drill rig equipped with 6-inch hollow-stem augers. Test pits were completed using a CASE 580 backhoe equipped with a 2.0-foot-wide bucket. GPI visually classified and described the soil profiles encountered during exploration referencing the *Unified Soil Classification System* (USCS) as delineated in ASTM D 2488. Appendix A provides the individual exploration logs summarizing the conditions encountered along with a USCS explanation, which should be used to interpret soil descriptions and references throughout this report. Borings were backfilled with native soil upon completion and plugged with bentonite. Test pits were loosely backfilled with site soil. Where borings penetrated the existing Gun Club Road pavement section, the surface was patched with cold asphalt.

230.02.02 Field Tests

Standard Penetration Test (SPT) split-spoon soil samples were recovered in borings at approximate 2.5- to 5-foot intervals and N-values were recorded for each sample referencing ASTM D1586. This included standard sized SPT split spoon samplers (1.5-inch inside diameter) and California Modified SPT split spoon samplers (2.5-inch inside diameter. The SPT N-value blow counts are field values and have not been corrected for overburden pressure or for dilation effects on the sample. Exploratory boring logs present the blow counts for each 6-inch segment of the sampler. At select depths and locations, relatively undisturbed soil samples were collected via 2.5-inch inside diameter, 6.0-inch-long steel tubes advanced vertically into the soil. Relatively undisturbed samples were capped in the field and placed in a secondary, water-tight container to be stored upright during transport to the laboratory. GPI staff visually logged and classified the soil conditions referencing ASTM D2488 during exploration.

230.02.03 Geophysical Exploration

No geophysical exploration was performed as part of the evaluation.

230.02.04 Laboratory Tests

Samples obtained during exploration were tested in GPI's laboratory to assess their engineering characteristics. Laboratory test results are provided in Appendix B, *Laboratory Test Results* and on the individual exploratory boring logs in Appendix A. The laboratory tests outlined in Table 8 were accomplished referencing *American Association of State Highway and Transportation Officials* (AASHTO) procedures.

Table 8: Laboratory Testing Program

Tests Performed	Purpose
Grain Size Distribution (AASHTO T 11 and T 27)	To identify the constituent particles in the soil, describing the percent by weight of gravel, sand, and fines, ultimately classifying soil type per ASTM D2487.
Atterberg Limits (AASHTO T 89 and T90)	To determine the soil plastic limit, plasticity index, and liquid limit for soil type classification.
Moisture-Density Relationship Curve (AASHTO T 99)	To establish a maximum dry density and optimum moisture content.
Moisture Content Determination (AASHTO T 255)	To determine the soil's in-place moisture content.
Direct Shear (AASHTO T 236)	To estimate the soil's cohesion and angle of internal friction.
Soil pH (AASHTO T289), Electrical Resistivity (AASHTO T288), & Sulfate Content (AASHTO T290)	To estimate the soil's corrosion potential and impact on buried metal or concrete elements.

230.03 Surface Conditions

A relatively shallow (i.e. less than 2-foot deep) drainage ditch exists on the western edge of the road alignment. Along the eastern side of the road, the ground surface slopes downward relatively steeply, up to about 1.5H:1V, into a large drainage pathway east of Gun Club Road. The roadway shoulders are covered by a mixture of grass, weeds, brush and some trees in isolated locations.

230.04 Subsurface Conditions

Borings were performed within the existing Gun Club Road pavement prism. No vegetation and organic material was encountered at the ground surface in our boring locations. All borings encountered asphalt at the existing roadway surface ranging from 2.2 to 5.0 inches thick underlain by 4.0 to 10.5 inches of silty gravel base course. In borings B-23073A-6 and -7 asphalt pavement was underlain by 2.0 to 3.0 inches of bituminous surface treatment (BST).

All test pit explorations were performed approximately 5 to 15 feet east of the existing Gun Club Road pavement prism. Topsoil was encountered at the ground surface in TP-23073A-4, -6, and -7 comprising silt

that was brown, soft and moist, extending 1.2 to 4.0 feet below the ground surface. Trace vegetation and organics were encountered from 0.2 to 1.0 foot below the ground surface in all test pits.

Beneath asphalt pavement sections and surficial topsoil, we encountered the following primary subsurface units during our exploration:

- **Uncontrolled Fill:** Uncontrolled fill was encountered in most of our explorations, extending 2.5 to more than 9.0 feet below the ground surface. The fill constitutes heterogeneous mixtures of silt, sand, gravel and cobbles with isolated boulders. In some locations, the fill included various debris, such as metal, plastic, glass, wood and other organic material. Fill was described as brown to gray, loose to dense and moist in the locations explored. Due to the varying composition, consistency and debris present within the fill, we consider it to be uncontrolled, and not suitable to support new retaining walls or embankments.

- **Loess**: Beneath asphalt, topsoil and uncontrolled fill, our exploration encountered loess soil comprising silt with varying sand content, that was described as tan to brown, soft to stiff and moist. Loess extended to the termination depth of some explorations, or to the basalt bedrock interface in others at 6.5 to 14.0 feet below the ground surface.

- **Alluvium:** North of the Lone Pine Lane intersection, our explorations encountered alluvial soil beneath surficial asphalt, topsoil and fill. Alluvium comprised silty sand that was brown loose to medium dense and moist. This soil extended to the termination depth of borings B23073A-7 and -8 at 11.5 to 12.0 feet below the ground surface.

- **Basalt Bedrock:** Basalt bedrock was encountered in several borings and test pits between 7.5 to 12.0 feet below the existing ground surface. Bedrock was described as dark grey with orange staining, moderately to highly fractured, moderately to highly weathered and hard. Our drilling exploration equipment (Trailer-mounted G-2400) was able to penetrate basalt bedrock 0.5 to 2.5 feet in boring locations. Test pit excavation equipment (Case 580 backhoe) was able to penetrate bedrock 1.0 to 2.5 feet where encountered.

Consistent, static groundwater was not encountered during exploration and is not expected within the upper 100 feet below ground surface referencing Idaho Department of Water Resources (IDWR) online well reports within 1 mile of the project site. Isolated, perched water tables may be encountered during construction as seeps or springs at any time of the year depending on changes in local and regional precipitation and runoff. Specifically, we expect water may be encountered in site excavations at the boundary between differing subsurface units, such as the boundary between fill and native soil, or soil and bedrock.

Logs illustrating our exploration findings are included in Appendix A. Approximate exploration locations are shown on Plates 1 through 4, *Exploration Maps*

230.05 Conclusions and Recommendations

230.05.01 General

Based on the conditions encountered during exploration and our experience with similar projects, we recommend the planned geosynthetic-reinforced, wire-faced retaining walls be supported on bedrock, native soil or structural fill placed over these materials. The following sections provide our geotechnical recommendations to assist design and construction for the planned retaining walls based on this understanding.

230.05.02 Foundations

Typical concrete spread foundations are not expected for this project. Planned retaining walls and associated reinforced fill must bear on a levelling course of crushed gravel below initial course of reinforcement or wire facing baskets. Subgrade below the levelling course must be basalt bedrock, or native subgrade soil compacted to ITD Class A requirements. If desired for constructability, the contractor may place. The levelling course should be up to 1-foot thick, and comprise *Aggregate for Open Graded Base – Class 1 (Rock Cap)* conforming to Section 703.08 in the latest *ITD Standards* or *Granular Subbase* conforming to Section 703.11 in the latest *ITD Standards*, referencing the latest ITD Standard Specifications.

Design recommendations for the proposed MSE walls are presented in Section 230.05.06 *Embankments and Reinforced Soil Slopes* herein. Referencing AASHTO LRFD Bridge Design Specifications Section 11.10.2.2, we recommend the minimum embedment for the reinforced soil mass at the wall face be at least 2-feet. This embedment depth will also help reduce freeze-thaw impacts to subgrade soil. Also referencing AASHTO LRFD Bridge Design Specifications Section 11.10.2.2, Keller has established a minimum 4-foot-wide zone that extends horizontally in front of each wall.

230.05.03 Lateral Pressures and Backfill

GPI recommends wire-faced retaining walls and associated geosynthetic reinforced zones be backfilled using *RSS Backfill* referencing the Special Provision S501-17A MSE Retaining Wall – Welded Wire Wall prepared by Keller. MSE backfill must be compacted to Class A requirements. Backfill outside the reinforced zone may comprise *Granular Subbase* compacted to Class A requirements. Backfill must be keyed into the existing soil to facilitate uniform performance. Keying recommendation are illustrated in Plate 6, *Wall Backfill Schematic* attached to this report.

Uncontrolled fill, debris and loose soil should be removed from beneath the planned wall foundation and reinforcing elements before placing backfill. Avoid over compaction of the backfill behind the wall facing so that the wall facing and reinforcement are not displaced or damaged. Only light hand operated compaction equipment should be used to compact backfill within 3 feet of wall faces.

As MSE walls will be designed by the Contractor, lateral earth pressures behind MSE walls should be evaluated by the Contractor's engineer based on the geotechnical information presented in Section 230.05.06 *Embankments and Reinforced Soil Slopes* in this report.

230.05.04 Anchors

Anchors are not required for this project.

230.05.05 Drainage

Reinforced wall backfill must comprise referencing the Special Provision S501-17A MSE Retaining Wall – Welded Wire Wall prepared by Keller, compacted to Class A requirements. This open graded granular material will aid in providing drainage throughout the wall backfill and reducing the buildup of hydrostatic pressure.

MSE retaining walls must be constructed with adequate drainage systems to reduce the potential for water ponding within the wall backfill or eroding soil behind, beneath or in front of planned walls. Install wall drains backfill as shown on Plate 6, *Wall Backfill Schematic*. Maintaining uniformly drained conditions is critical to long-term building performance and to help route water away footings to reduce settlement risk. We recommend installing foundation drains at the lowest bearing elevation to achieve gravity draining behind the wall around the structure's perimeter.

Where wire-faced MSE retaining walls are planned, surface drainage features must prevent salt-laden water or de-icing chemicals from either infiltrating into the wall reinforced zones and/or sheet flowing over the wall faces. Such features should include raised curbs and drain inlets to collect and direct surface runoff away from all retaining walls.

230.05.06 Embankments, MSE Walls and Reinforced Soil Slopes

As previously described, 2 separate Contractor-designed MSE walls will be constructed as part of this project. Backfill behind the reinforced zone of each MSE wall should consist of MSE Backfill referencing the Special Provision S501-17A MSE Retaining Wall – Welded Wire Wall prepared by Keller. Material within the reinforced zone of MSE walls should consist of crushed sand and gravel mixtures compacted to Class A requirements. The Contractor's design must establish the specific lengths and spacing of the reinforcing elements and any special requirements for MSE wall materials.

The Contractor's design should account for external surcharge loads applied to the wall, including but not limited to traffic loading on the Gun Club Road surface, and lateral loads associated with vehicle to guardrail impact, where applicable. Table 9 presents recommended material parameters for use by the Contractor in their design. Passive pressure at the toe of the wall should not be used to resist lateral forces.

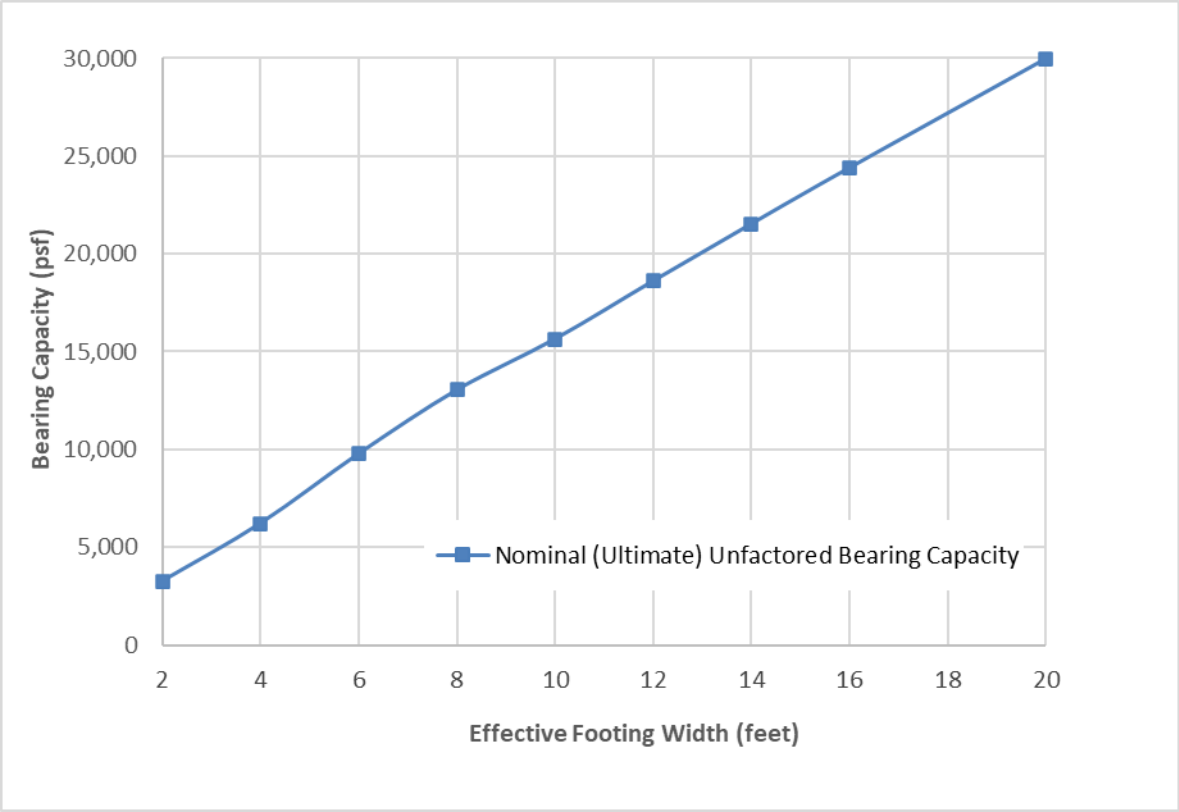
Table 9: MSE Wall Material Properties

Material	Moist Unit Weight (pcf)	Cohesion (psf)	Friction Angle (degrees)	Nominal (Ultimate) Bearing Capaity (psf)
Reinforced MSE Backfill	See Note 1	See Note 1	See Note 1	N.A. [2]
Retained Soil (Granular Subbase)	140	0	34	N.A. [2]
Foundation Soil	115.8[3]	325[3]	36.5[3]	See Figure 1

1. Material Properties must meet requirements in MSE Special Provision S501-17A
2. Not Applicable
3. Foundation soil parameters based on direct shear testing on site soil. See Appendix B for test results.

Figure 1 provide a graph of the calculated nominal (ultimate, unfactored) bearing capacity for MSE wall foundations (as a function of effective footing width) Resistance factors for various wall components must be incorporated into the Contractor's MSE Wall design, referencing AASHTO LRFD Bridge Design Specifications Table 11.5.7-1. Specifically, a resistance factor of 0.65 must be applied to the bearing capacity values in Figure 1 when evaluating bearing resistance for MSE walls for the project.

Figure 1: Nominal (Ultimate) Unfactored Bearing Capacity for MSE Wall Foundations



Settlement below the MSE walls was evaluated by modeling the load applied to the subgrade soil by the soil mass placed for MSE wall construction. Considering the minimum wall embedment recommended herein, and the maximum height of the planned walls, we estimate total vertical settlement at the wall face and reinforced backfill zone will be less than 1-inch. Differential settlement along the wall face is expected to be less than 0.7-inch in a 30-foot span. We expect approximately 50 percent of this settlement will occur during or immediately after MSE construction. Remaining settlement is expected to occur within 6 months after MSE wall construction is complete.

Where poor surface drainage, damaged utility lines, or other causes result in saturation of the wall backfill and underlying native soil subgrade, additional settlement could occur, due to the collapse potential of some of the near surface soils. This settlement is difficult to quantify, but it could be up to several inches depending on the extent of saturation below the embankment. To reduce the potential for soil beneath MSE walls becoming saturated, site grades should slope away from the MSE walls so that water is not allowed to pond adjacent to the wall face or wall foundation.

230.05.06.01 Retaining Wall Global Stability Evaluation

MSE wall design is to be supplied by the selected contractor with respect to internal stability (e.g., bearing capacity, sliding, and overturning resistance) and overall (global) stability. GPI accomplished global stability analysis to evaluate the tallest planned retaining wall configuration provided by Keller. Our analyses relied upon material properties outlined in this report, and the following assumptions regarding wall construction configuration:

- Walls will comprise welded wire facing with geogrid reinforced backfill.
- Reinforced wall backfill comprising *MSE Backfill* compacted to Class A requirements.
- Geogrid reinforcement spaced at regular vertical intervals not more than 2 feet vertically, and extending horizontally at least 70 percent of the wall height behind the wall's facing, per AASHTO Section 11.10.2.
- 250 psf surface traffic surcharge load on pavement surface above walls and reinforced backfill.
- No global failure pathways passing through the MSE wall face or reinforced backfill.
- Final wall design will be provided by the contractor to establish internal and global stability referencing applicable AASHTO and FHWA design criteria.

The wall designer should check these assumptions as part of the design by modeling the specific MSE reinforcement spacing, lengths, and strengths in their stability analysis.

We used the computer software SLOPE/W, developed by GEO-STUDIO, Inc. to estimate global stability safety factors for the planned MSE walls under static conditions. We also performed a pseudo static analysis to evaluate seismic acceleration impacts to wall stability by applying a horizontal acceleration coefficient equal to 50 percent of the anticipated peak horizontal ground acceleration (PGA).

SLOPE/W searches for the potential failure circle with the lowest predicted factor of safety (FOS) by analyzing many different potential failure pathways using various slope stability analysis methods. Our analyses utilized the Morgenstern-Price Method of Slices and evaluated both circular and block specified failure pathways. The approximate wall section we analyzed is located at Station 28+25, on the east side of Gun Club Road as this appears to be the tallest wall sections along the planned alignment. Our preliminary analyses provide predicted FOS against global slope failure at this section corresponding to deep-seated circular slope failures that pass outside the MSE wall face and reinforced backfill zone.

Based on our analysis and the assumptions outlined herein, we predict the planned wall configurations established by Keller will maintain FOS above 1.5 for deep-seated global pathways under static conditions, and FOS above 1.1 under pseudo-static seismic loading conditions, provided the contractor's design adheres to applicable AASHTO and FHWA design criteria. Our stability analysis results are illustrated in Appendix C.

230.05.06.02 Soil Slope Stability

From reviewing plan drawings provided by Keller, we do not anticipate embankment fill slopes greater than 2 vertical feet above existing grades will be constructed as part of this project outside of the planned retaining walls. We recommend slopes and embankments be designed no steeper than 2H:1V. Our opinion is slopes constructed steeper than 2H:1V will be susceptible to seasonal sloughing, erosion, and more significant instability risks during wet periods of the year.

Embankment fill placed over existing surfaces that are steeper than 5H:1V must be keyed into existing site surface as illustrated on Plate 7, *Slope Construction Schematic*. If adequate keying into existing surfaces is not accomplished, differential settlement of the embankments can be expected. All fill for embankment construction must be compacted to Class A requirements.

230.05.07 Erosion Control

Areas disturbed during construction must be revegetated and protected to prevent surface erosion. Implement and maintain erosion control measures until adequate vegetative cover can be established after construction is complete.

We do not anticipate slopes will receive irrigation, however where water is present at the slope surface due to precipitation and storm runoff, sloughing should be expected. If adequate vegetative cover cannot be established immediately after construction is complete, we recommend aggressive erosion control measures be implemented to reduce excessive erosion and violation of local, state, and federal codes. These measures can be, in part, accomplished by following an Idaho Department of Environmental Quality (IDEQ) approved Stormwater Pollution Prevention Plan (SWPPP). We strongly recommend a vegetation and maintenance program be initiated immediately after construction to reduce the potential for erosion and surface sloughing. In addition, a maintenance program allows County staff to visually observe the slope conditions at different times of the year.

County maintenance personnel must be notified that irrigation, snow removal or other water sources must not direct runoff or subsurface water to slopes. Surcharges from stockpiled snow, equipment, materials, or other items must not be allowed to access slope faces.

230.05.08 Seismic Design

We recommend a seismic site class “D” be used in design for this project. The following seismic parameters in Table 10 are recommended for design, referencing Section 630 in the 2020 ITD Materials Manual.

Table 10. Seismic Response Criteria

Period (seconds)	Standard Acceleration Coefficients[1] for Site Class B (g)	Site Factor[2] for Site Class D	Design Spectral Acceleration Parameters for Site Class D (g)
0.0 (Peak)	PGA = 0.09	F_{PGA} = 1.6	A_s = 0.14
0.2 (Short)	S_S = 0.222	F_a = 1.6	$S_{DS} = S_S * F_a$ = 0.36
1.0	S_1 = 0.067	F_v = 2.4	$S_{D1} = S_1 * F_v$ = 0.16

1. Acceleration coefficients based on Figures 630.04.01.1, 630.04.01.2, & 630.04.01.3 in the *ITD Materials Manual*.
2. Site factors based on Tables 630.04.02.1 and 630.04.02.2 in the *ITD Materials Manual*.

Liquefaction is a common concern in low-density sand and non-plastic silt with a potential for saturated conditions. The liquefaction potential rapidly decreases when the soil density increases and the percentage of cohesive fine-grained soil increases and where saturated conditions are not present. The subsurface conditions above bedrock are predominantly silt with varying sand and gravel content. Further, consistent, static groundwater it not anticipated above the bedrock surface. Therefore, in our opinion, the potential risk for liquefaction to impact the planned improvements is low.

Based on Figure 630.05.01.1 in the *ITD Materials Manual*, no active fault exists in Idaho within 100 miles of the project site. Therefore, our opinion is that the risk of impacts due to fault rupture at the project site are low.

230.05.09 Construction

The following sections provide geotechnical recommendations for construction for the planned improvements.

230.05.09.01 Soil Excavation Characteristics

We anticipate site soil above bedrock may be excavated using conventional excavation techniques. Carefully plan and implement temporary excavations to be sloped, shored, or braced in accordance with the *Occupational Safety and Health Act* (OSHA) regulations and local code. The soil conditions atop bedrock we observed are classified as "B" soil according to the OSHA criteria providing they remain dry. Class B soil must not be sloped steeper than 1H:1V. Flatter excavations may be required in areas due to the variable conditions exposed during construction. The contractor is ultimately responsible for excavation stability and site safety. Soil and groundwater conditions can vary and are impacted by contractor means and methods. Isolated, local flattening of slopes or other measures may be required due to surficial sloughing and erosion activity at the site.

Construction vibrations can cause excavations to slough or cave. We do not recommend stockpiling materials adjacent to or within 10 feet of excavations, which may cause a surcharge and contribute to excavation instability. Ultimately, the contractor is solely responsible for site safety and excavation configurations factoring in water infiltration, construction access, adjacent loading, and other factors that contribute to excavation stability.

Plan excavations with water collection points and utilize conventional sumps and pumps to remove nuisance water from runoff, seeps, springs, or precipitation. If site soil excavations are not immediately backfilled, they may degrade when exposed to runoff and require over-excavation and replacement with granular fill. We recommend construction activities and excavation backfilling be performed as rapidly as possible following excavation to reduce the potential for subgrades to degrade under construction traffic. Further, installing wall drainage systems proactively can facilitate drainage during construction and reduce over-excavation.

230.05.09.02 Bedrock Excavation

Exploration encountered basalt bedrock at depths ranging from 7.5 to 12.0 feet below the existing ground surface. Our exploration equipment was able to penetrate the bedrock surface 0.5 to 2.5 feet prior to being refused due to rock density and hardness. Competent basalt bedrock is typically classified as "Stable Rock" referencing OSHA guidelines and can be cut near vertical for temporary applications.

In our opinion, the upper 1 to 2 feet of the bedrock surface is expected to be excavatable using large conventional rock excavation techniques and equipment. Excavating bedrock beyond 1 to 2 feet will be difficult and will require large, and possibly specialized, excavating equipment. We expect excavation equipment will need to be equipped with ripper shanks, rock teeth, and/or hydraulic breakers. We do not anticipate blasting will be allowed for bedrock removal on this project.

The following considerations can be incorporated into the project specifications or used as a general guide to facilitate bedrock excavation requirements. Earthwork and general contractors should consider the following with respect to accomplishing rock excavation.

1. Bedrock excavation shall be performed with late-model excavation equipment; configurations equipped with short-tip-radius rock buckets; rated at not less than 150 hp net flywheel power with a bucket-curling force of no less than 35,000 lbf and stick-crowd force of not less than 23,000 lbf.

2. A minimum 9,500 ft-lb hydraulic breaker is expected to breakout competent bedrock in confined spaces when not fractured or weathered. The contractor shall maintain contingencies for mobilizing such equipment.

3. Other rock excavation methods, including predrilling, chemical agents, and others, may be considered to achieve the required excavation depths. However, potential impacts of each method must be carefully evaluated by the County, design team and any prospective contractor.

4. For reuse as *Granular Subbase*, bedrock excavation must reduce the excavated material to a maximum 0.33-foot particle size.

As part of any bedrock excavation process, it is critical that the overall bedrock removal limits be clearly outlined to contractors such that appropriate methods are utilized to prevent fracturing at or below subgrade elevations and that rock removal extend laterally to the prescribed limits.

230.05.09.03 Uncontrolled Fill Removal

Our exploration encountered uncontrolled fill in various locations, extending to varying depths along the planned alignment. In general, it appears the existing Gun Club Road alignment was created primarily by cutting soil and bedrock from the western side of the alignment and placing it as fill on the eastern side to create a level roadbed. No documentation exists regarding this fill's placement or compaction. The fill placed contained various debris including deleterious material such as wood and organics. Our opinion is this uncontrolled fill is not suitable to support the planned retaining walls. We recommend all uncontrolled fill be removed from beneath all planned walls and reinforced backfill along the planned alignment. Uncontrolled fill removal must expose native soil or bedrock beneath the planned walls, reinforced soil mass and any associated levelling course. Based on our current understanding of the planned wall alignments and configurations, we anticipate much of the uncontrolled fill will be removed as part of excavation to achieve wall subgrade, and keying for backfill placement. However, some additional overexcavation will be required in locations to remove deeper uncontrolled fill deposits.

Given reinforced wall backfill and backfill behind the reinforced soil mass are specified to comprise *Rock Cap* and *Granular Subbase*, respectively, we do not anticipate and do not recommend over-excavated fill soil will be reused as structural fill for this project. Therefore, over-excavated material must be removed from the site by the contractor and disposed of in a location approved by the County and LHTAC.

Though the uncontrolled fill is not suitable to support planned retaining walls, the fill has existed beneath the Gun Club Road alignment for decades without significant settlement or instability evident at the roadway surface. Therefore, our opinion is the fill may remain in-place outside of planned wall alignments and

associated reinforced soil zones. However, where existing fill remains below new embankment fills, we recommend subgrades be compacted to Class A requirements prior to fill placement.

230.06 Appendices

Appendix A includes the exploratory boring logs and a summary of the USCS. Appendix B includes laboratory test results. Index laboratory test results are presented on the individual boring logs. Appendix C includes our slope stability analysis results. Appendix D summarizes ITD's comments on our July 15, 2025 report and GPI's responses.

230.07 Foundation Investigation Plat

The *Foundation Investigation Plat* is included as Plate 5, which illustrates subsurface conditions beneath the planned wall at Station 59+50.

230.08 Current Specifications and Minimum Testing Requirements

This Report is based on the 2023 Idaho Transportation Department Standard Specifications and 2024 Supplemental Specifications, the AASHTO LRFD Bridge Design Specifications, 9th Edition, and the 2020 Idaho Transportation Department Materials Manual.

230.09 Special Provisional Items

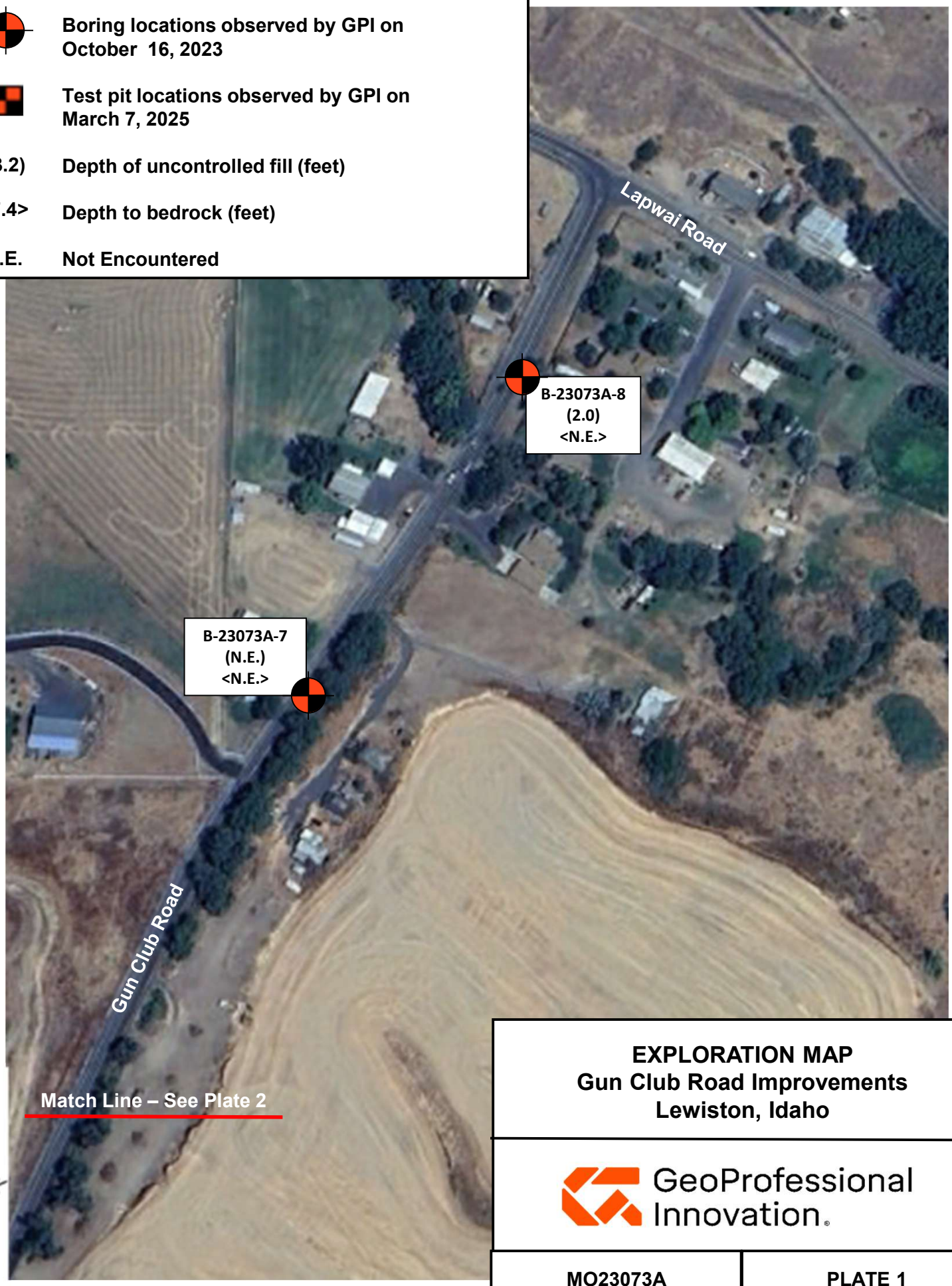
MSE wall design and construction must be accomplished referencing special provision S501-017A prepared by Keller.

230.10 References

- Materials Manual, October 2020 Idaho Transportation Department.
- Standard Specifications for Highway Construction, 2023 Idaho Transportation Department.
- *American Association of State Highway and Transportation Officials (AASHTO) Load Resistance Factor Design (LRFD) Bridge Design Specifications* 2024, 10th Edition.
- Federal Highway Administration (FHWA) Publication No. FHWA-NHI-10-024; *Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes.*
- "Surficial Geologic Map of the Lewiston Orchards North Quadrangle and Part of the Clarkston Quadrangle, Nez Perce Couty Idaho." Othberg, K.L., Breckenridge, R.M., & Weisz, D.W. Idaho Geologic Survey, 2003.

LEGEND

- Boring locations observed by GPI on October 16, 2023
- Test pit locations observed by GPI on March 7, 2025
- (3.2) Depth of uncontrolled fill (feet)
- <7.4> Depth to bedrock (feet)
- N.E. Not Encountered



EXPLORATION MAP
Gun Club Road Improvements
Lewiston, Idaho

GeoProfessional Innovation

MO23073A	PLATE 1

Image Reference: © 2024 Google Maps. No Scale intended.

LEGEND

- Boring locations observed by GPI on October 16, 2023
- Test pit locations observed by GPI on March 7, 2025
- (3.2) Depth of uncontrolled fill (feet)
- <7.4> Depth to bedrock (feet)
- N.E. Not Encountered



N

EXPLORATION MAP
Gun Club Road Improvements
Lewiston, Idaho

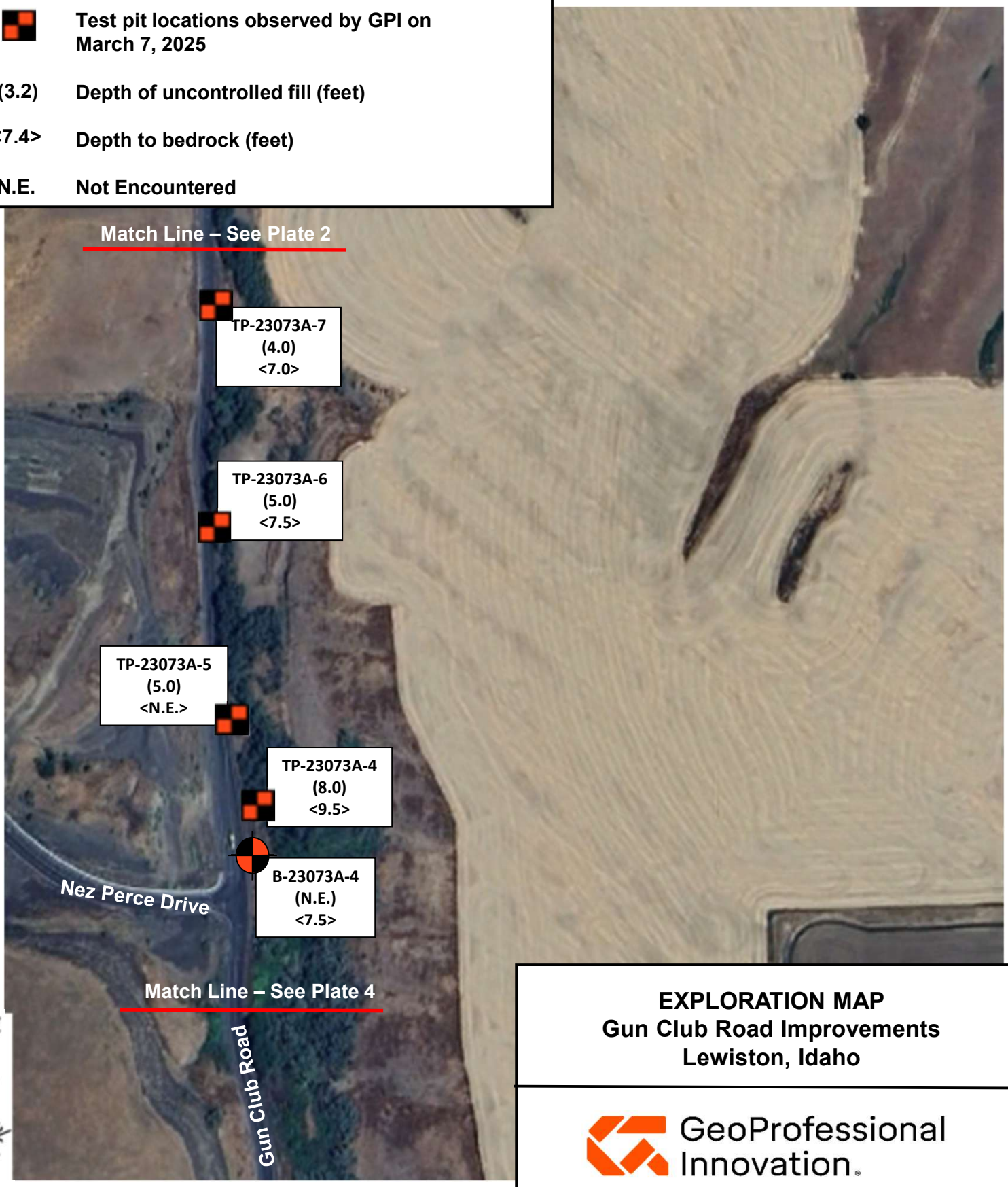
GeoProfessional Innovation

MO23073A	PLATE 2

Image Reference: © 2024 Google Maps. No Scale intended.

LEGEND

- Boring locations observed by GPI on October 16, 2023
- Test pit locations observed by GPI on March 7, 2025
- (3.2) Depth of uncontrolled fill (feet)
- <7.4> Depth to bedrock (feet)
- N.E. Not Encountered



EXPLORATION MAP
Gun Club Road Improvements
Lewiston, Idaho

GeoProfessional Innovation

MO23073A	PLATE 3

Image Reference: © 2024 Google Maps. No Scale intended.

LEGEND

- Boring locations observed by GPI on October 16, 2023
- Test pit locations observed by GPI on March 7, 2025
- (3.2) Depth of uncontrolled fill (feet)
- <7.4> Depth to bedrock (feet)
- N.E. Not Encountered

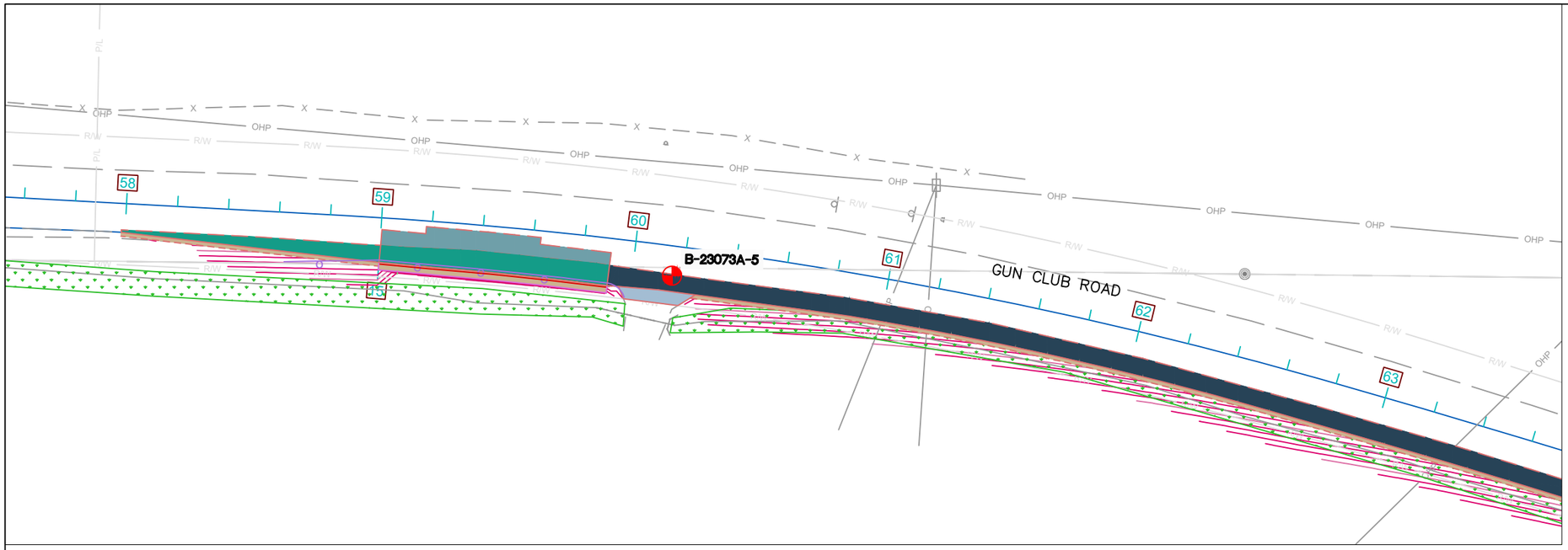


EXPLORATION MAP
Gun Club Road Improvements
Lewiston, Idaho

GeoProfessional Innovation

MO23073A	PLATE 4

Image Reference: © 2024 Google Maps. No Scale intended.

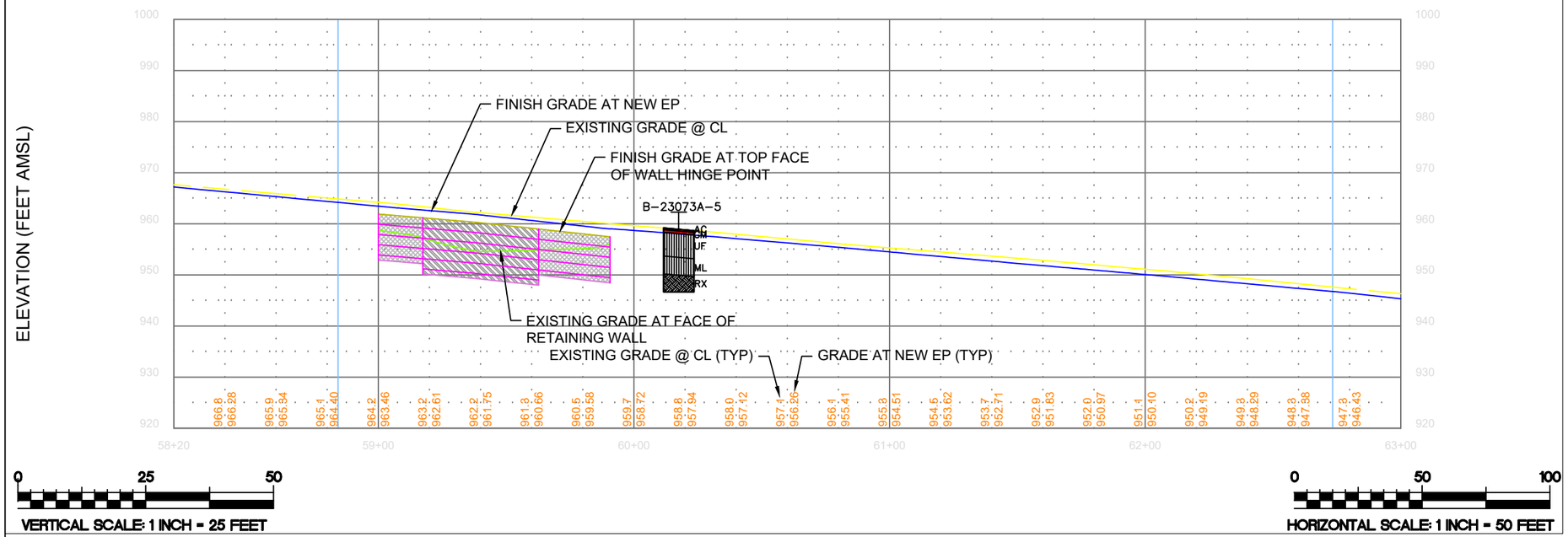


0 50 100

PLAN SCALE: 1 INCH = 50 FEET

PLAN

APPROXIMATE LOCATION OF EXPLORATORY BORING OBSERVED BY GPI ON OCTOBER 16, 2023



0 25 50

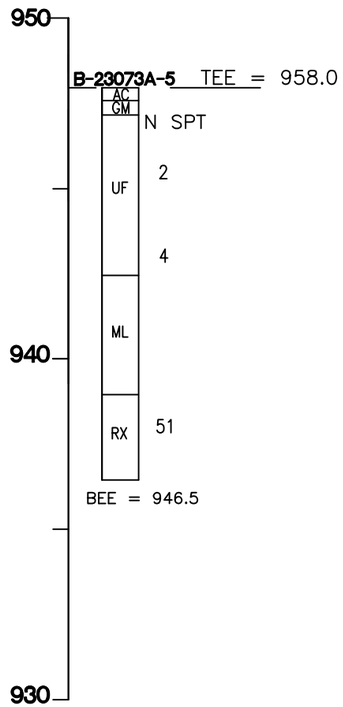
VERTICAL SCALE: 1 INCH = 25 FEET

0 50 100

HORIZONTAL SCALE: 1 INCH = 50 FEET

PROFILE STATION (FEET)

BORING LOG



0 5 10

VERTICAL SCALE: 1 INCH = 5 FEET

LEGEND

TEE– TOP OF EXPLORATION ELEVATION (Approximate)

BEE– BASE OF EXPLORATION ELEVATION (Approximate)

AC	ASPHALT CONCRETE	GM	BASE COURSE – SILTY GRAVEL
UF	UNCONTROLLED FILL – SILT WITH SAND	ML	LOESS – SILT WITH SAND
RX	BEDROCK – BASALT		

REVISIONS			
NO.	DATE	BY	DESCRIPTION
1	5/16/25	NGH	FINAL

DESIGNED: NGH
DESIGN CHECKED: AJA
DETAILED: NGH
DWG. CHECKED: AJA
CORRECTIONS:

SCALES SHOWN ARE FOR 17"X11" PRINTS ONLY

CAD FILE NO. M023073A

DRAWING DATE: MAY 16, 2025

ORIGINAL SIGNED BY:

ORIGINAL DATE SIGNED:

IDAHO TRANSPORTATION DEPARTMENT

GEOPROFESSIONAL INNOVATION CORPORATION

English

PROJECT NO. A023(881)

SOIL PROFILE

GUN CLUB ROAD WALL SECTION – STA 59+50

BRIDGE KEY NO.

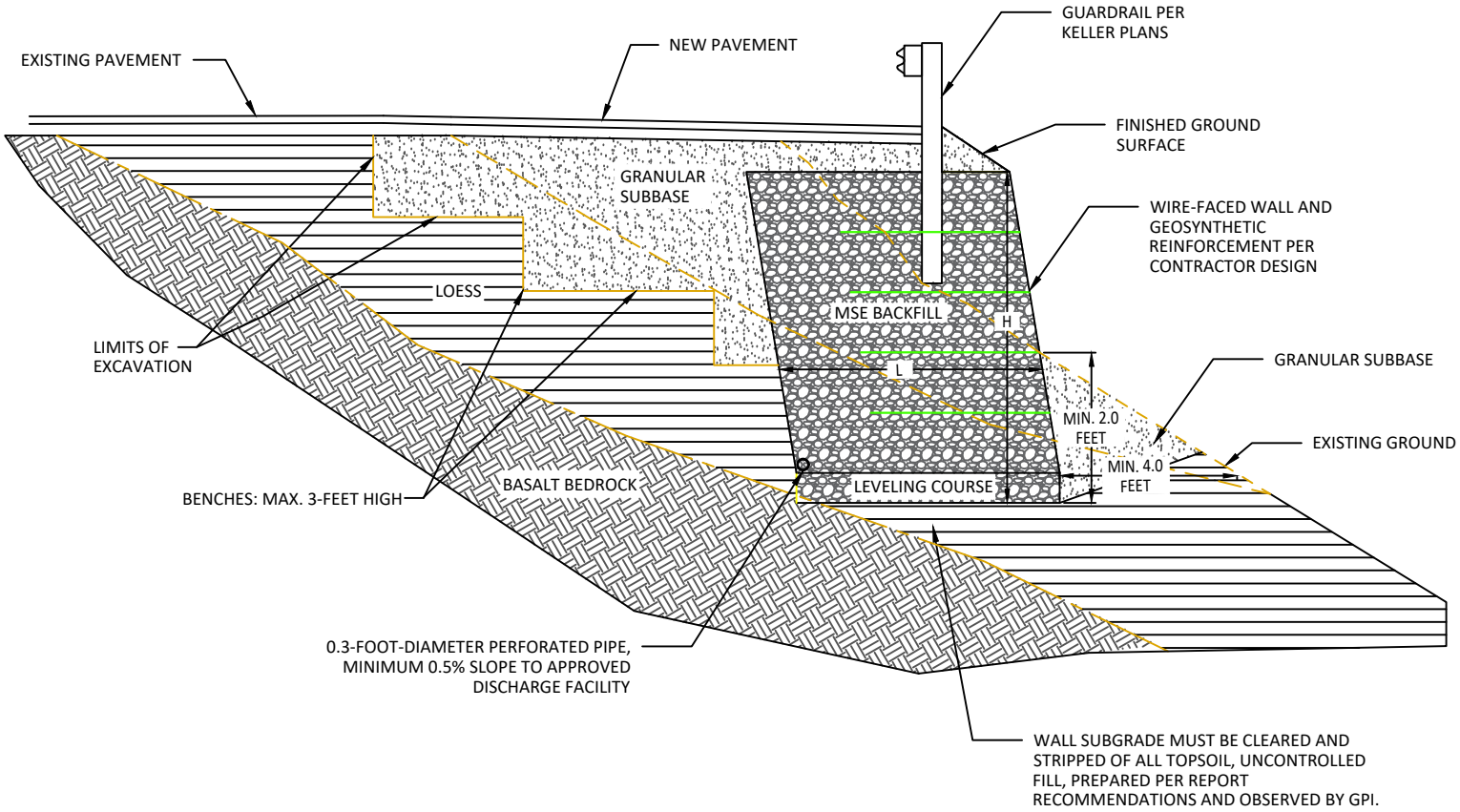
COUNTY: NEZ PERCE

KEY NO.

DRAWING NO.

SHEET: 1 OF 1

Reference: Base files were provided by Keller & Associates Inc.



NOTES:

1. EXCAVATE AND REMOVE UNCONTROLLED FILL BENEATH WALL AND BACKFILL TO EXPOSE NATIVE SOIL OR BEDROCK.
2. PREPARE SUBGRADES PER THE GEOTECHNICAL REPORT REQUIREMENTS.
3. PLACE 0.3-FOOT-DIAMETER, PERFORATED ADS OR PVC PIPE AT LOWEST POSSIBLE ELEVATION, SLOPED AT LEAST 0.5% TOWARDS DAYLIGHT OR APPROVED DISCHARGE FACILITY.
4. ACCOMPLISH KEYING INTO EXISTING SUBGRADES PER THE *EARTHWORK* REPORT SECTION.
5. COMPACT STRUCTURAL FILL PER THE GEOTECHNICAL REPORT REQUIREMENTS.
6. REINFORCED ZONE LENGTH, L , MUST BE AT LEAST 70% OF WALL HEIGHT, H.

INFORMATION ONLY (NOT TO SCALE)

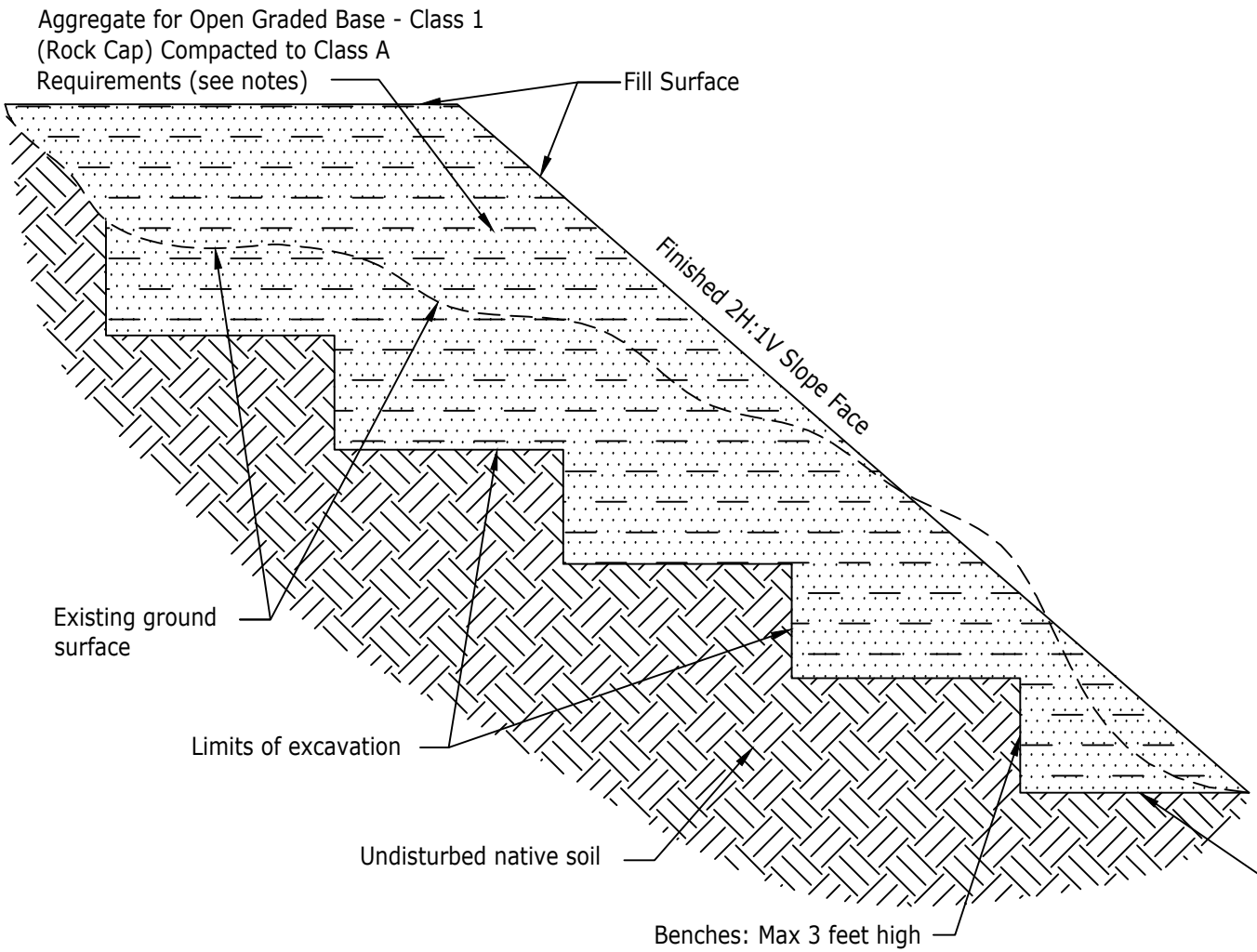
WALL CONSTRUCTION SCHEMATIC
Gun Club Road, Lapwai Road to Stewart Avenue
Nez Perce County
Lewiston, Idaho

GeoProfessional Innovation

NOT TO SCALE

MO23073A	PLATE: 6
DRAWN BY: NGH	CHECKED BY: AJA

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NOTES:

1. Compact subgrade to Class A requirements
2. Rock cap to be placed in 1-foot-thick, loose lifts and compacted to Class A requirements.
3. Rock cap shall consist of approved material conforming to section 703.08 of the last edition of the ITD Standard Specifications for Highway Construction.

INFORMATIONAL ONLY

SLOPE CONSTRUCTION SCHEMATIC
Gun Club Road, Lapwai Road to Stewart Avenue
Nez Perce County
Lewiston, Idaho

NOT TO SCALE

GeoProfessional Innovation

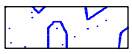
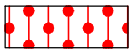
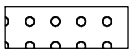
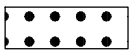
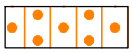
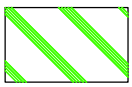
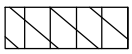
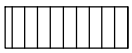
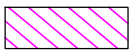
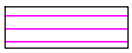
MO23073A	PLATE: 7
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APPENDIX A

Unified Soil Classification System (USCS) and Exploration Logs

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
COARSE GRAINED SOIL	GRAVEL	CLEAN GRAVEL		GW	WELL-GRADED GRAVEL, GRAVEL-SAND MIXTURES.
				GP	POORLY-GRADED GRAVEL, GRAVEL-SAND MIXTURES.
		GRAVEL WITH FINES		GM	SILTY GRAVEL, GRAVEL-SAND-SILT MIXTURES.
				GC	CLAYEY GRAVEL, GRAVEL-SAND-CLAY MIXTURES.
	SAND	CLEAN SAND		SW	WELL-GRADED SAND, GRAVELLY SAND.
				SP	POORLY-GRADED SAND, GRAVELLY SAND.
		SAND WITH FINES		SM	SILTY SAND, SAND-SILT MIXTURES.
				SC	CLAYEY SAND, SAND-CLAY MIXTURES.
FINE GRAINED SOIL	SILT AND CLAY LIQUID LIMIT LESS THAN 50%			ML	INORGANIC SILT, SANDY OR CLAYEY SILT.
				CL	INORGANIC CLAY OF LOW TO MEDIUM PLASTICITY, SANDY OR SILTY CLAY.
				CL-ML	INORGANIC MIXED CLAY AND SILT.
				OL	ORGANIC SILT AND CLAY OF LOW PLASTICITY.
	SILT AND CLAY LIQUID LIMIT GREATER THAN 50%			MH	INORGANIC SILT, MICA- CEOUS SILT, PLASTIC SILT.
				CH	INORGANIC CLAY OF HIGH PLASTICITY, FAT CLAY.
				OH	ORGANIC CLAY OF MEDIUM TO HIGH PLASTICITY.
				PT	PEAT, MUCK AND OTHER HIGHLY ORGANIC SOILS.

BORING LOG SYMBOLS

STANDARD 2 INCH OD SPLIT SPOON SAMPLE



CALIFORNIA MODIFIED 3 INCH OD SPLIT SPOON SAMPLE



ROCK CORE



SHELBY TUBE 3 INCH OD UNDISTURBED SAMPLE



TEST PIT LOG SYMBOLS

GRAB BAG SAMPLE

BG

BULK SAMPLE

BK

RING SAMPLE

RG

GROUNDWATER SYMBOLS

GROUNDWATER AFTER 24 HOURS



GROUNDWATER AT TIME OF EXPLORATION



GROUNDWATER AT THE END OF EXPLORATION

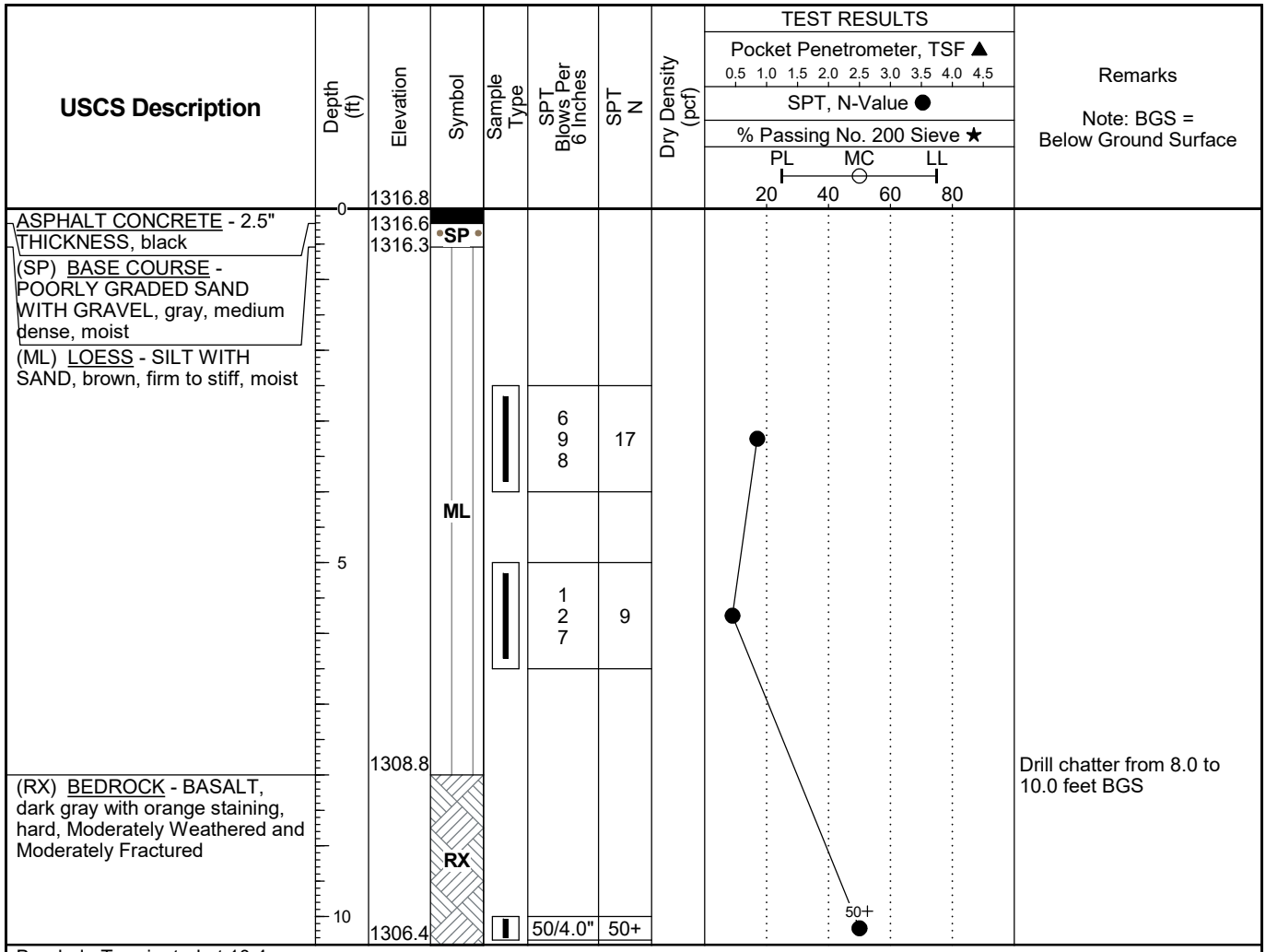


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USCS Description	Depth (ft)	Elevation	Symbol	Sample Type	SPT Blows Per 6 Inches	SPT N	Dry Density (pcf)	TEST RESULTS	Remarks
								Pocket Penetrometer, TSF ▲ 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 SPT, N-Value ● % Passing No. 200 Sieve ★ PL MC LL 20 40 60 80	Note: BGS = Below Ground Surface
	0	1350.9							
ASPHALT CONCRETE - 5.0" THICKNESS, black		1350.5		BK BG					
(SP) BASE COURSE - POORLY GRADED SAND WITH GRAVEL, gray, medium dense, moist		1349.7	SP					★ 3.3	
(ML) LOESS - SILT WITH SAND, brown, firm to stiff, moist				BK					
					1 3 4	7		● ○ 13.2 ★	
			ML						
	5				4 5 5	10			
		1344.4							
Borehole Terminated at 6.5 Feet.									Borehole plugged with bentonite and patched with cold mix asphalt

Client: Keller Associates	**Boring Number:** B-23073A-1	GeoProfessional Innovation.	**EXPLORATORY BORING LOG**
Project: MO23073A	**Date Drilled:** 10-16-2023		
Drill Rig: G2400	**Borehole Diameter:** 8" O.D.		
Depth to Groundwater: N.E.	**Logged By:** AJA		Sheet 1 Of 1

GPI BORING - GPJ GDT - 2/27/26 10:41 - V:\ENGINEERING\GINT FILES\2023\UNSORTED\23073A GUN CLUB ROAD.GPJ



GPI BORING - GPJ GDT - 2/27/26 10:41 - V:\ENGINEERING\GINT FILES\2023\UNSORTED\23073A GUN CLUB ROAD.GPJ

Client: Keller Associates	**Boring Number:** B-23073A-2
Project: MO23073A	**Date Drilled:** 10-16-2023
Drill Rig: G2400	**Borehole Diameter:** 8" O.D.
Depth to Groundwater: N.E.	**Logged By:** AJA

GeoProfessional Innovation.

EXPLORATORY BORING LOG

USCS Description	Depth (ft)	Elevation	Symbol	Sample Type	SPT Blows Per 6 Inches	SPT N	Dry Density (pcf)	TEST RESULTS	Remarks
		1237.2						Pocket Penetrometer, TSF ▲ 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 SPT, N-Value ● % Passing No. 200 Sieve ★ PL MC LL 20 40 60 80	Note: BGS = Below Ground Surface
ASPHALT CONCRETE - 2.2" THICKNESS, black (SP) BASE COURSE - POORLY GRADED SAND WITH GRAVEL, gray, medium dense, moist	0	1237.0 1236.7	SP	BK BG					
(ML) UNCONTROLLED FILL - SILT WITH GRAVEL AND COBBLES, brown, medium dense, moist			ML	BK					
(ML) LOESS - SILT WITH SAND, brown, soft to stiff, moist		1234.7			1 1 1	2		11.9 ○ ●	
	5		ML		2 3 5	8			
		1228.2						50+ ●	Drill chatter from 9.0 to 9.4 feet BGS
(RX) BEDROCK - BASALT, dark gray with orange staining, hard, Moderately Weathered and Moderately Fractured Borehole Terminated at 9.5 Feet.		1227.7	RX		1/1.0"	50+			Borehole terminated due to practical refusal on dense bedrock. Borehole plugged with bentonite and patched with cold mix asphalt

Client: Keller Associates	**Boring Number:** B-23073A-3
Project: MO23073A	**Date Drilled:** 10-16-2023
Drill Rig: G2400	**Borehole Diameter:** 8" O.D.
Depth to Groundwater: N.E.	**Logged By:** AJA

GeoProfessional Innovation.

EXPLORATORY BORING LOG

Sheet 1 Of 1

GPI BORING - GPI.GDT - 2/27/26 10:41 - V:\ENGINEERING\GINT FILES\2023\UNSORTED\23073A GUN CLUB ROAD.GPJ

USCS Description	Depth (ft)	Elevation	Symbol	Sample Type	SPT Blows Per 6 Inches	SPT N	Dry Density (pcf)	TEST RESULTS	Remarks
		1096.2						Pocket Penetrometer, TSF ▲ 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 SPT, N-Value ● % Passing No. 200 Sieve ★ PL MC LL 20 40 60 80	Note: BGS = Below Ground Surface
ASPHALT CONCRETE - 2.7" THICKNESS, black	0	1096.0							
(SP) BASECOURSE - POORLY GRADED SAND WITH GRAVEL, gray, medium dense, moist		1095.1	SP		5 4 4	8			
(ML) LOESS - SILT WITH SAND, brown, firm to stiff, moist	5		ML		2 3 4	7		21.0	
(RX) BEDROCK - BASALT, dark gray with orange staining, hard, Moderately Weathered and Moderately Fractured		1088.7	RX		1/1.0"	50+		50+	Drill chatter from 7.5 to 9.4 feet BGS
Borehole Terminated at 9.5 Feet.		1086.7							Borehole terminated due to practical refusal on dense bedrock. Borehole plugged with bentonite and patched with cold mix asphalt

Client: Keller Associates	**Boring Number:** B-23073A-4
Project: MO23073A	**Date Drilled:** 10-16-2023
Drill Rig: G2400	**Borehole Diameter:** 8" O.D.
Depth to Groundwater: N.E.	**Logged By:** AJA

GeoProfessional Innovation.

EXPLORATORY BORING LOG

Sheet 1 Of 1

GPI BORING - GPI.GDT - 2/27/26 10:42 - V:\ENGINEERING\GINT FILES\2023\UNSORTED\23073A GUN CLUB ROAD.GPJ

USCS Description	Depth (ft)	Elevation	Symbol	Sample Type	SPT Blows Per 6 Inches	SPT N	Dry Density (pcf)	TEST RESULTS	Remarks
								Pocket Penetrometer, TSF ▲ 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 SPT, N-Value ● % Passing No. 200 Sieve ★ PL MC LL 20 40 60 80	Note: BGS = Below Ground Surface
	0	954.8							
ASPHALT CONCRETE - 4.5" THICKNESS, black		954.4							
(SP) BASE COURSE - POORLY GRADED SAND WITH GRAVEL, gray, medium dense, moist		954.0	SP						
(ML) UNCONTROLLED FILL - SILT WITH SAND, brown, soft, moist			ML		4 1 1	2		○ 9.9	Trace crushed gravel in sample.
	5								
(ML) LOESS - SILT WITH SAND, brown, firm, moist		949.3			1 2 2	4			
			ML						
		945.8							Drill chatter from 9.0 to 10.0 feet BGS
(RX) BEDROCK - BASALT, very dense, Highly weathered and Highly Fractured	10		RX		16 26 25	51			Borehole plugged with bentonite and patched with cold mix asphalt
		943.3							
Borehole Terminated at 11.5 Feet.									

Client: Keller Associates	**Boring Number:** B-23073A-5
Project: MO23073A	**Date Drilled:** 10-16-2023
Drill Rig: G2400	**Borehole Diameter:** 8" O.D.
Depth to Groundwater: N.E.	**Logged By:** AJA

GeoProfessional Innovation.

EXPLORATORY BORING LOG

Sheet 1 Of 1

GPI BORING - GPI.GDT - 2/27/26 10:42 - V:\ENGINEERING\GINT FILES\2023\UNSORTED\23073A GUN CLUB ROAD.GPJ

USCS Description	Depth (ft)	Elevation	Symbol	Sample Type	SPT Blows Per 6 Inches	SPT N	Dry Density (pcf)	TEST RESULTS	Remarks
								Pocket Penetrometer, TSF ▲ 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 SPT, N-Value ● % Passing No. 200 Sieve ★ PL MC LL 20 40 60 80	Note: BGS = Below Ground Surface
ASPHALT CONCRETE - 2.8" THICKNESS, black BST - 6.0" THICKNESS, black (GM) UNCONTROLLED FILL - SILTY GRAVEL WITH COBBLES, dark brown, loose to medium dense, moist	0	902.6 902.4 901.9	GM		14 13 12	25			Heavy drill chatter at 2.0 to 7.5 feet BGS
	5				4 3 4	7			
					5 10 13	23		7.3	
Borehole Terminated at 9.0 Feet.		893.6							Borehole plugged with bentonite and patched with cold mix asphalt

Client: Keller Associates	**Boring Number:** B-23073A-6
Project: MO23073A	**Date Drilled:** 10-16-2023
Drill Rig: G2400	**Borehole Diameter:** 8" O.D.
Depth to Groundwater: N.E.	**Logged By:** AJA

GeoProfessional Innovation.

EXPLORATORY BORING LOG

Sheet 1 Of 1

GPI BORING - GPI.GDT - 2/27/26 10:42 - V:\ENGINEERING\GINT FILES\2023\UNSORTED\23073A GUN CLUB ROAD.GPJ

USCS Description	Depth (ft)	Elevation	Symbol	Sample Type	SPT Blows Per 6 Inches	SPT N	Dry Density (pcf)	TEST RESULTS	Remarks
								Pocket Penetrometer, TSF ▲ 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 SPT, N-Value ● % Passing No. 200 Sieve ★ PL MC LL 20 40 60 80	Note: BGS = Below Ground Surface
ASPHALT CONCRETE - 2.7" THICKNESS, black BST - 3.0" THICKNESS, black (SM) ALLUVIUM - SILTY SAND, brown, loose to medium dense, moist	0	879.9 879.7 879.4		BK	2 2 3	5		○ 6.1 ★	
	5		SM		5 6 6	12			
	10				6 11 12	23			
Borehole Terminated at 12.0 Feet.		867.9							Borehole plugged with bentonite and patched with cold mix asphalt

Client: Keller Associates	**Boring Number:** B-23073A-7
Project: MO23073A	**Date Drilled:** 10-16-2023
Drill Rig: G2400	**Borehole Diameter:** 8" O.D.
Depth to Groundwater: N.E.	**Logged By:** AJA

GeoProfessional Innovation.

EXPLORATORY BORING LOG

Sheet 1 Of 1

GPI BORING - GPI.GDT - 2/27/26 10:42 - V:\ENGINEERING\GINT FILES\2023\UNSORTED\23073A GUN CLUB ROAD.GPJ

USCS Description	Depth (ft)	Elevation	Symbol	Sample Type	SPT Blows Per 6 Inches	SPT N	Dry Density (pcf)	TEST RESULTS	Remarks
								Pocket Penetrometer, TSF ▲ 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 SPT, N-Value ● % Passing No. 200 Sieve ★ PL MC LL 20 40 60 80	Note: BGS = Below Ground Surface
		855.9							
ASPHALT CONCRETE - 4.5" THICKNESS, black	0	855.5							
(SP) BASE COURSE - POORLY GRADED SAND WITH GRAVEL, gray, medium dense, moist		855.2	SP						
(SM) FILL - SILTY SAND WITH GRAVEL			SM						
(SM) ALLUVIUM - SILTY SAND, brown, loose, moist		853.9							
	5				1 2 2	4			
			SM						
	10				2 2 3	5			
		844.4							
Borehole Terminated at 11.5 Feet.									Borehole plugged with bentonite and patched with cold mix asphalt

Client: Keller Associates	**Boring Number:** B-23073A-8	GeoProfessional Innovation.	**EXPLORATORY BORING LOG**
Project: MO23073A	**Date Drilled:** 10-16-2023		
Drill Rig: G2400	**Borehole Diameter:** 8" O.D.		
Depth to Groundwater: N.E.	**Logged By:** AJA		Sheet 1 Of 1

GPJ BORING - GPI.GDT - 2/27/26 10:42 - V:\ENGINEERING\GINT FILES\2023\UNSORTED\23073A GUN CLUB ROAD.GPJ

USCS Description	Depth (ft)	Elevation (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
	0.0	1293.5									
(ML) UNCONTROLLED FILL - SILT WITH SAND GRAVEL, AND COBBLES, brown, loose, moist	2.5		ML		BK	24.0					Trace vegetation and organics at the ground surface. Debris including metal, concrete, paper, plastic, and wood encountered from 0 to 7 feet below ground surface.
	5.0	1286.5									
(ML) LOESS - SILT WITH SAND, tan, firm, moist	7.5		ML		BG						
	10.0	1281.5									
(RX) BEDROCK - BASALT, highly to moderately weathered, highly fractured, dark gray with whiteish orange staining, hard	12.5	1280.5	RX								
Test Pit Terminated at 13.0 Feet.											Test pit terminated at 13 feet due to refusal on dense bedrock. Loosely backfilled upon completion.

Client: Keller Associates	**Test Pit Number:** TP-23073A-1	GeoProfessional Innovation.	**EXPLORATORY TEST PIT LOG**
Project: MO23073A	**Date Excavated:** 03-07-2025		
Backhoe: CASE 580	**Bucket Width:** 2.0 feet		Sheet 1 Of 1
Depth to Groundwater: N.E.	**Logged By:** AJA		

GPI TEST PIT - GPI.GDT - 2/27/26 10:09 - V:\ENGINEERING\GINT FILES\2025\250307 MO23073A GUN CLUB ROAD TEST PITS.GPJ

USCS Description	Depth (ft)	Elevation (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
(ML) UNCONTROLLED FILL - SILT WITH SAND GRAVEL, AND COBBLES, brown, loose, moist	0.0	1234.2	ML								Trace vegetation at ground surface. Debris including wood, plastic, and asphalt encountered from 0 to 5 feet below ground surface.
(ML) LOESS - SILT WITH SAND, tan, firm, moist	2.5 5.0	1229.7	ML		RG		100.7	15.1			Direct Shear Phi = 36.5 degrees C = 325 psf
(RX) BEDROCK - BASALT, highly to moderately weathered, highly fractured, dark gray with whiteish orange staining, hard	7.5 10.0	1223.2	RX								
Test Pit Terminated at 12.0 Feet.		1222.2									Test pit terminated at 12 feet below ground surface upon refusal due to bedrock density. Loosely backfilled opun completion.

Client: Keller Associates	**Test Pit Number:** TP-23073A-2	GeoProfessional Innovation.	**EXPLORATORY TEST PIT LOG**
Project: MO23073A	**Date Excavated:** 03-07-2025		
Backhoe: CASE 580	**Bucket Width:** 2.0 feet		Sheet 1 Of 1
Depth to Groundwater: N.E.	**Logged By:** AJA		

GPI TEST PIT - GPI.GDT - 2/27/26 10:09 - V:\ENGINEERING\GINT FILES\2025\250307 MO23073A GUN CLUB ROAD TEST PITS.GPJ

USCS Description	Depth (ft)	Elevation (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
(ML) UNCONTROLLED FILL - SILT WITH SAND GRAVEL AND COBBLES, brown, loose, moist	0.0	1216.6	ML								Trace vegetation and organics at ground surface.
(ML) LOESS - SILT WITH SAND, light tan, loose, moist	2.5	1214.1	ML		BK						
	5.0										
	7.5										
	10.0										
(RX) BEDROCK - BASALT, highly to moderately weathered, highly fractured, whiteish with orange staining		1205.6	ML								
Test Pit Terminated at 12.0 Feet.		1204.6	RX								Test pit terminated at 12 feet below ground surface upon refusal due to bedrock density. Loosely backfilled upon completion.

Client: Keller Associates	**Test Pit Number:** TP-23073A-3	GeoProfessional Innovation.	**EXPLORATORY TEST PIT LOG**
Project: MO23073A	**Date Excavated:** 03-07-2025		
Backhoe: CASE 580	**Bucket Width:** 2.0 feet		
Depth to Groundwater: N.E.	**Logged By:** AJA		Sheet 1 Of 1

GPI TEST PIT - GPI.GDT - 2/27/26 10:09 - V:\ENGINEERING\GINT FILES\2025\250307 MO23073A GUN CLUB ROAD TEST PITS.GPJ

USCS Description	Depth (ft)	Elevation (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
	0.0	1092.4									
(ML) TOPSOIL - SILT, brown, loose, moist		1091.7	ML								Trace vegetation and organics to 8 inches below ground surface.
(ML) UNCONTROLLED FILL - SILT WITH SAND, GRAVEL AND COBBLES, brown, loose, moist	2.5		ML								Debris including metal, plastic, and glass encountered from 1 to 6 feet below ground surface.
	5.0	1086.4									
(GM) UNCONTROLLED FILL - SILTY GRAVEL WITH COBBLES AND BOULDERS, gray, dense, moist	7.5	1084.4	GM								Boulders up to 2 feet in diameter from 6 to 8 feet below ground surface.
(ML) LOESS - SILT WITH SAND, tan, firm, moist		1082.9	ML								
(RX) BASALT, highly to moderately weathered, highly fractured, dark gray whiteish orange staining, hard	10.0	1080.4	RX								
Test Pit Terminated at 12.0 Feet.											Test pit terminated at 12 feet below ground surface upon refusal to due bedrock density. Loosely backfilled upon completion.

Client: Keller Associates	**Test Pit Number:** TP-23073A-4	GeoProfessional Innovation.	**EXPLORATORY TEST PIT LOG**
Project: MO23073A	**Date Excavated:** 03-07-2025		
Backhoe: CASE 580	**Bucket Width:** 2.0 feet		Sheet 1 Of 1
Depth to Groundwater: N.E.	**Logged By:** AJA		

GPI TEST PIT - GPI.GDT - 2/27/26 10:09 - V:\ENGINEERING\GINT FILES\2025\250307 MO23073A GUN CLUB ROAD TEST PITS.GPJ

USCS Description	Depth (ft)	Elevation (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
(ML) UNCONTROLLED FILL - SILT WITH SAND, GRAVEL AND COBBLES, brown, loose, moist	0.0	1058.8	ML								Trace vegetation and organics. Debris including plastic, glass, and metal encountered from 0 to 5 feet below ground surface.
(ML) LOESS - SILT WITH SAND, brown, firm, moist	5.0	1053.8	ML		BG	52.0					
Test Pit Terminated at 14.0 Feet.	14.0	1044.8									Test pit terminated at 14 feet below ground surface, loosely backfilled upon completion.

Client: Keller Associates	**Test Pit Number:** TP-23073A-5
Project: MO23073A	**Date Excavated:** 03-07-2025
Backhoe: CASE 580	**Bucket Width:** 2.0 feet
Depth to Groundwater: N.E.	**Logged By:** AJA

GeoProfessional Innovation

EXPLORATORY TEST PIT LOG

GPI TEST PIT - GPI.GDT - 2/27/26 10:09 - V:\ENGINEERING\GINT FILES\2025\250307 MO23073A GUN CLUB ROAD TEST PITS.GPJ

USCS Description	Depth (ft)	Elevation (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
(ML) TOPSOIL - SILT, brown, loose, moist	0.0	1024.2	ML								Trace vegetation and organics from 0 to 1 foot below ground surface.
(ML) UNCONTROLLED FILL - SILT WITH SAND, GRAVEL AND COBBLES, brown, loose, moist	2.5	1023.2	ML								Debris including metal, plastic, and glass encountered from 0 to 5 feet below ground surface.
(ML) LOESS - SILT WITH SAND, brown, firm, moist	5.0	1019.2	ML								
(RX) BASALT, highly to moderately weathered, highly fractured, dark gray whiteish orange staining, hard	7.5	1016.7	RX								
Test Pit Terminated at 8.5 Feet.		1015.7									Test pit terminated at 8.5 feet below ground surface upon refusal to due bedrock density. Loosely backfilled upon completion.

Client: Keller Associates	**Test Pit Number:** TP-23073A-6	GeoProfessional Innovation.	**EXPLORATORY TEST PIT LOG**
Project: MO23073A	**Date Excavated:** 03-07-2025		
Backhoe: CASE 580	**Bucket Width:** 2.0 feet		
Depth to Groundwater: N.E.	**Logged By:** AJA		Sheet 1 Of 1

GPI TEST PIT - GPI.GDT - 2/27/26 10:09 - V:\ENGINEERING\GINT FILES\2025\250307 MO23073A GUN CLUB ROAD TEST PITS.GPJ

USCS Description	Depth (ft)	Elevation (ft)	U.S.C.S. Class	Symbol	Sample Type	% Passing No. 200 Sieve	Dry Density (pcf)	Moisture Content (%)	Pocket Pen. (tsf)	Atterberg Limits LL PI	Remarks Note: BGS = Below Ground Surface
(ML) UNCONTROLLED FILL - SILT WITH GRAVEL AND COBBLES, brown, loose, moist	0.0	986.4	ML								Trace vegetation and organics at ground surface.
(ML) LOESS - SILT, brown, firm, moist	2.5	982.4	ML								
(RX) BASALT, highly to moderately weathered, highly fractured, dark gray whiteish orange staining, hard	5.0	979.4	RX								
Test Pit Terminated at 8.0 Feet.	7.5	978.4									Test pit terminated at 8 feet below ground surface upon refusal to due bedrock density. Loosely backfilled upon completion.

Client: Keller Associates	**Test Pit Number:** TP-23073A-7	GeoProfessional Innovation.	**EXPLORATORY TEST PIT LOG**
Project: MO23073A	**Date Excavated:** 03-07-2025		
Backhoe: CASE 580	**Bucket Width:** 2.0 feet		Sheet 1 Of 1
Depth to Groundwater: N.E.	**Logged By:** AJA		

GPI TEST PIT - GPI.GDT - 2/27/26 10:09 - V:\ENGINEERING\GINT FILES\2025\250307 MO23073A GUN CLUB ROAD TEST PITS.GPJ

APPENDIX B

Laboratory Test Results

GeoProfessional Innovation.

Project Name: Gun Club Rd, Lapwai Rd to Stewart Ave
Project Number: MO23073A
Client: Keller Associates

Laboratory Test Results Summary

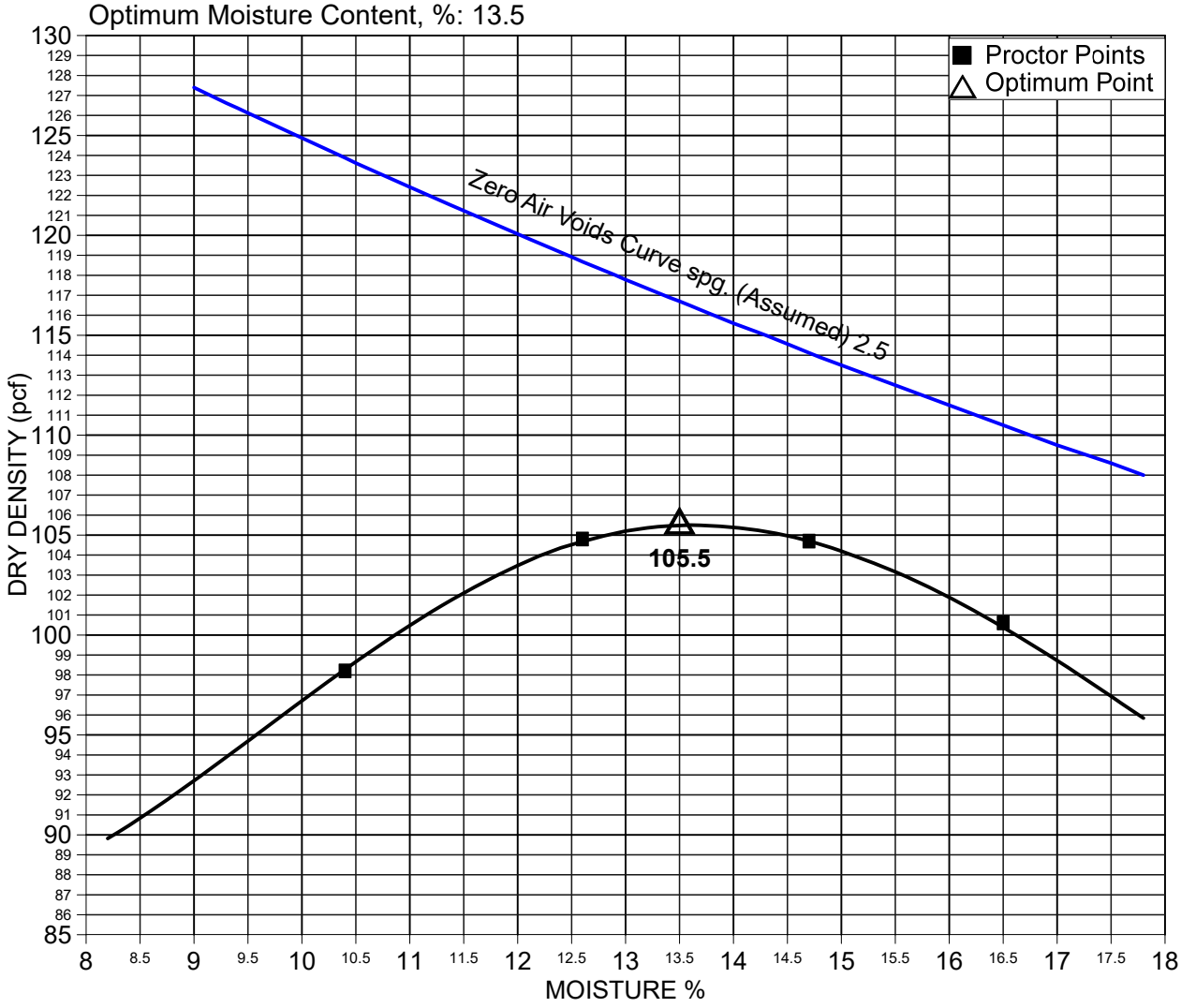
Boring/Test Pit	Depth (feet)	Lab Number	Description (U.S.C.S. Classification)	In situ Moisture, %	In situ Dry Density, pcf	Max Dry Density, pcf	Optimum Moisture, %	C, psf	ϕ, deg	Atterberg Limits		#200 Sieve Passing, %	Organic Matter, %	Cation Exchange Capacity (meq/100g)	pH	Resistivity Ω·cm	Sulfates ppm
										Liquid Limit	Plasticity Index						
B-23073A-1	0.5-1.0	15722	Poorly-Graded Sand with Gravel (SP)	3.3		-	-	-	-	-	-	4.7	-	-	-	-	-
B-23073A-1	1.5-2.5	15723	Sandy Silt (ML)	13.2		103.0	17.0	-	-	23	4	53	-	-	-	-	-
TP-23073A-2	6.5-7.0	19807	Silt with Sand (ML)	15.1	100.7	-	-	325	36.5	-	-	-	-	-	-	-	-
B-23073A-3	2.5-4.0	15724	Silt with Sand (ML)	11.9		-	-	-	-	-	-	-	-	-	-	-	-
B-23073A-4	5.0-6.5	15725	Silt with Sand (ML)	21.0		-	-	-	-	-	-	-	1.55	12.7	8.7	2,700	72.9
B-23073A-5	2.5-4.0	15726	Silt with Sand (ML)	9.9		-	-	-	-	-	-	-	-	-	-	-	-
B-23073A-6	7.5-9.0	15727	Silty Gravel with Cobbles (GM)	7.3		-	-	-	-	-	-	-	-	-	-	-	-
B-23073A-7	1.0-2.5	15729	Silty Sand (SM)	6.1		105.5	13.5	-	-	Non-Plastic		43	-	-	-	-	-
B-23073A-7	10.0-11.5	15728	Silty Sand (SM)	13.3		-	-	-	-	-	-	-	-	-	-	-	-
B-23073A-8	5.0-6.5	19808	Silty Sand (SM)	-	-	-	-	-	-	-	-	-	1.58	15.2	8.7	1,370	70.5
TP-23073A-1	2.0-3.0	19308	Silty Sand with Gravel (SM)	-		-	-	-	-	-	-	24	-	-	8.2	2,860	9.0
TP-23073A-5	5.0-6.0	19307	Silt (ML)	-		-	-	-	-	-	-	52	-	-	8.2	1,690	60.0

Reviewed By: _____

MOISTURE-DENSITY RELATIONSHIP CURVE
AASHTO T 99
Method A

Project Name: Gun Club Rd, Lapwai Rd to Stewart Ave
Project Number: MO23073A
Client: Keller Associates
Lab Number: 15729
Sample Location: B-23073A-7 @ 1.0-3.0 feet BGS
Sample Classification: Silty Sand (SM)
Date Tested: 02/21/26 By: LC
Rammer Type: Manual

Maximum Dry Density, pcf : 105.5
Optimum Moisture Content, %: 13.5



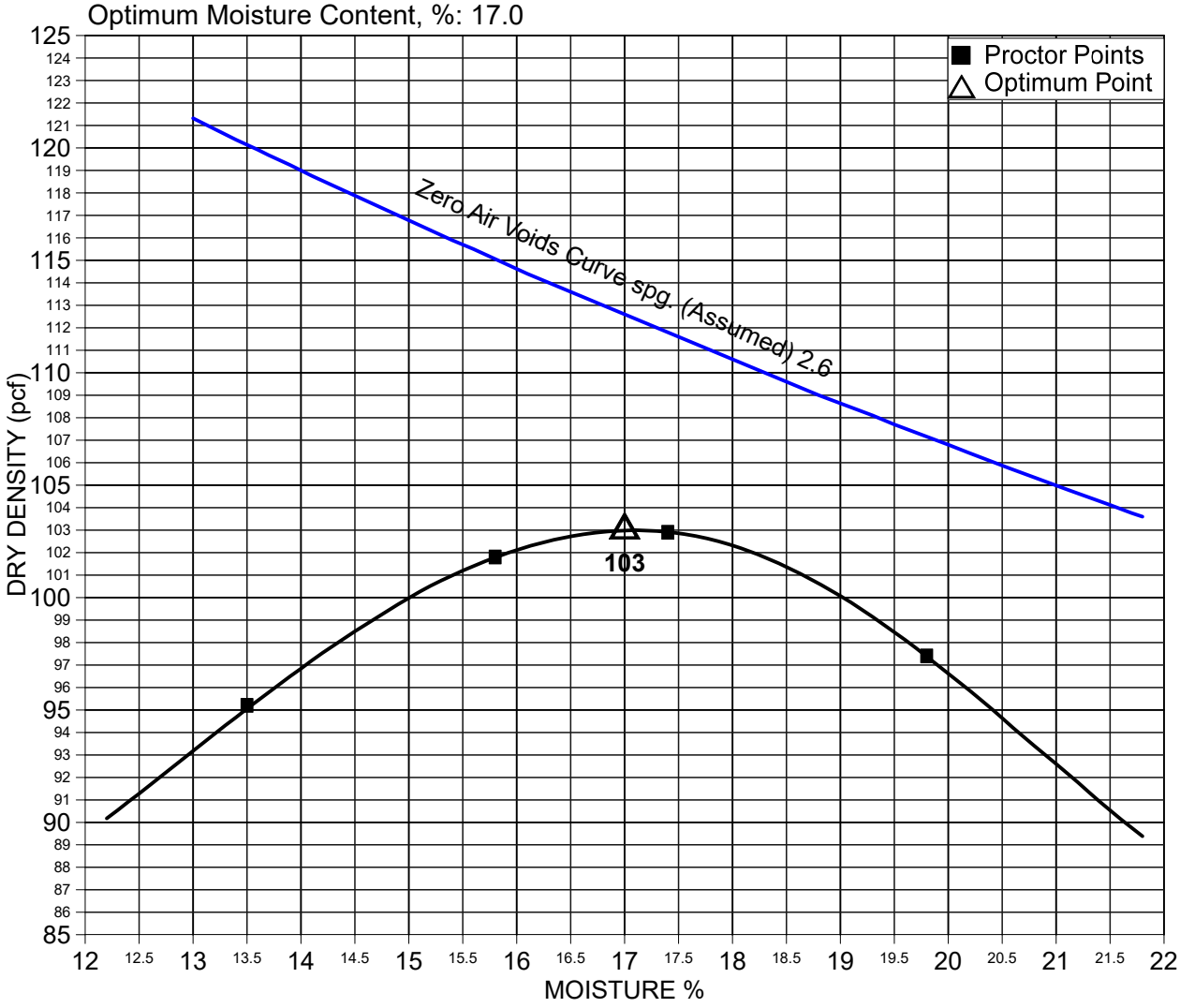
Reviewed By: _____

GeoProfessional Innovation.

MOISTURE-DENSITY RELATIONSHIP CURVE
AASHTO T 99
Method A

Project Name: Gun Club Rd, Lapwai Rd to Stewart Ave
Project Number: MO23073A
Client: Keller Associates
Lab Number: 15723
Sample Location: B-23073A-1 @ 1.5-2.5 feet BGS
Sample Classification: Sandy Silt (ML)
Date Tested: 02/21/2026 By: LC
Rammer Type: Manual

Maximum Dry Density, pcf : 103.0
Optimum Moisture Content, %: 17.0



Reviewed By: Campbell

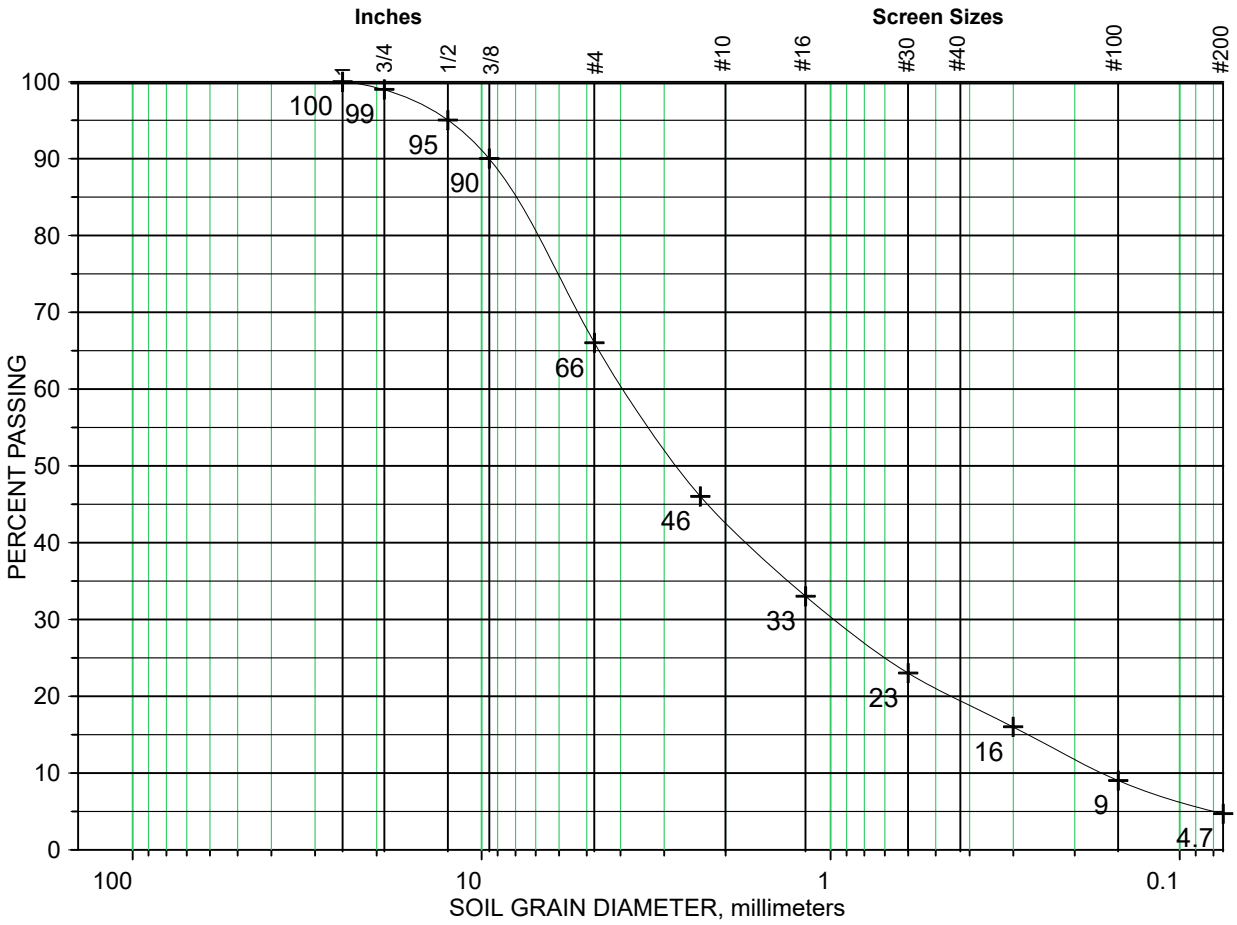
GeoProfessional Innovation.

GRADATION ANALYSIS

AASHTO T27 & T11

Project Name: Gun Club Rd, Lapwai Rd to Stewart Ave
Project Number: MO23073A
Client: Keller Associates
Lab Number: 15722
Sample Location: B-23073A-1 @ 0.5-1.0 feet BGS
Sample Classification: Poorly-Graded Sand with Gravel (SP)
Date Tested: 11/2/2023 By: SS

Cobbles	Gravel		Sand		
	Coarse	Fine	Coarse	Medium	Fine



Reviewed by: Campbell

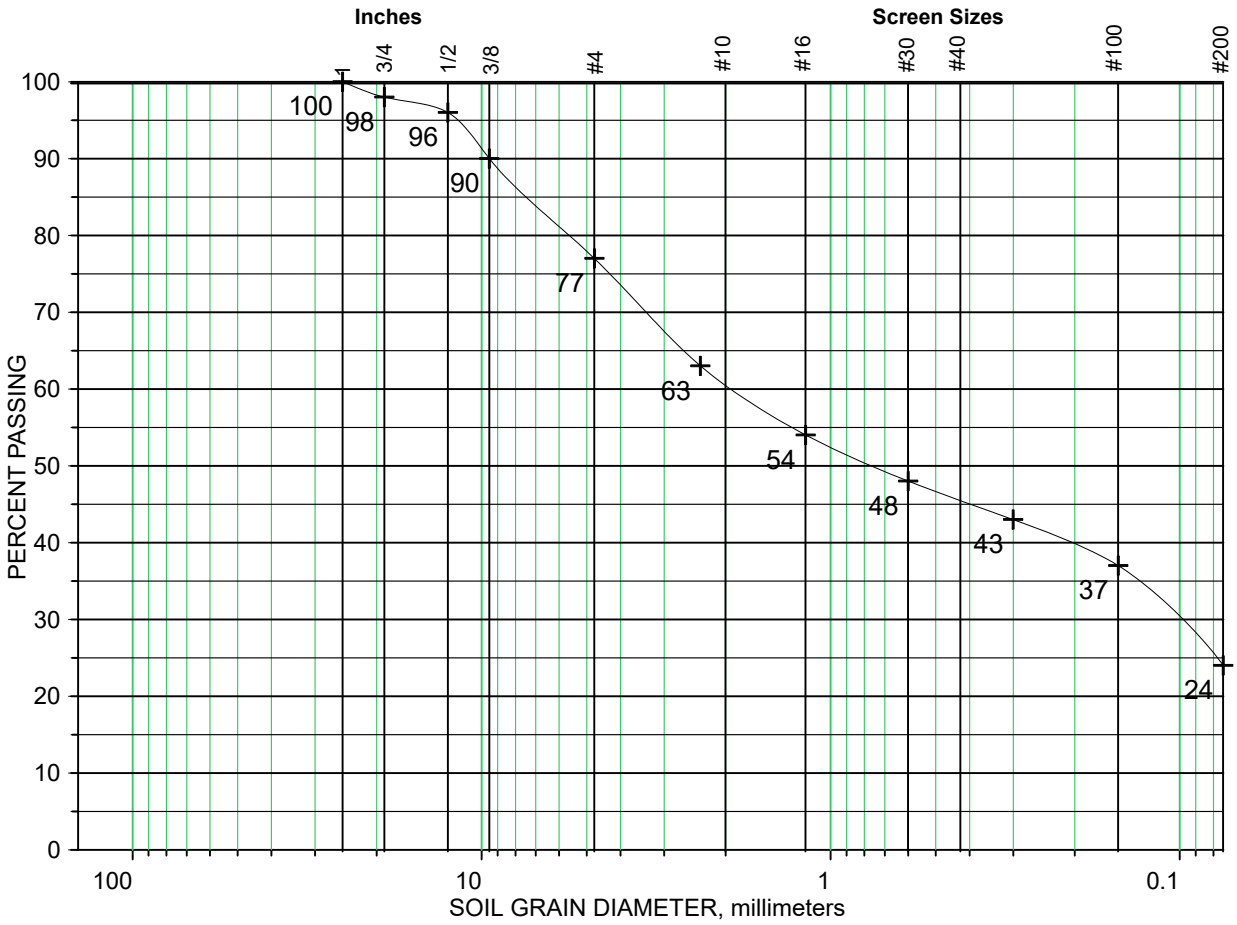
GeoProfessional Innovation.

GRADATION ANALYSIS

AASHTO T27 & T11

Project Name: Gun Club Rd, Lapwai Rd to Stewart Ave
Project Number: MO23073A
Client: Keller Associates
Lab Number: 19308
Sample Location: TP-23073A-1 @ 2.0-3.0 feet BGS
Sample Classification: Silty Sand with Gravel (SM)
Date Tested: 03/12/2025 By: GD

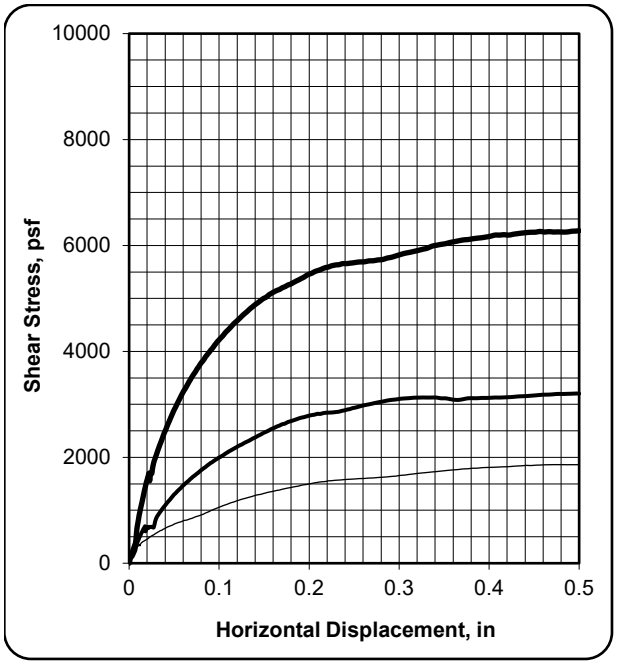
Cobbles	Gravel		Sand		
	Coarse	Fine	Coarse	Medium	Fine

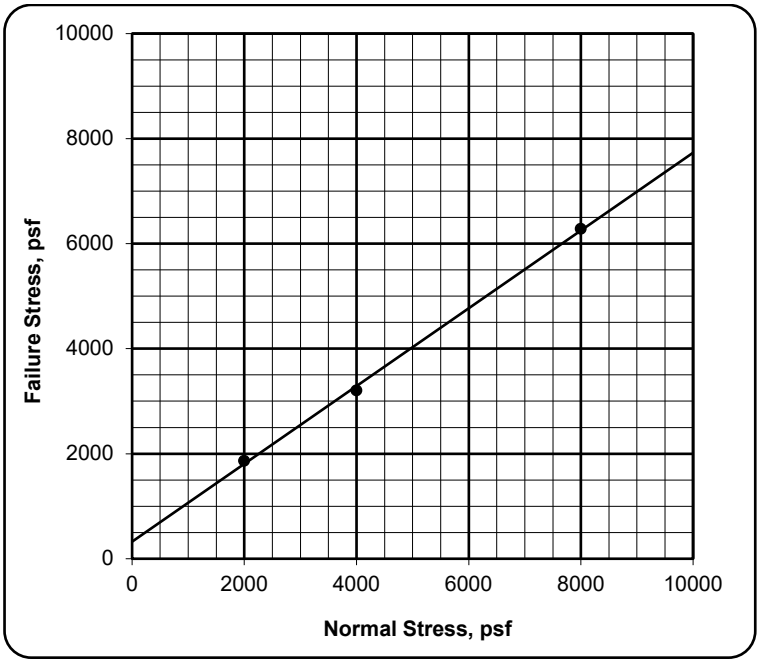


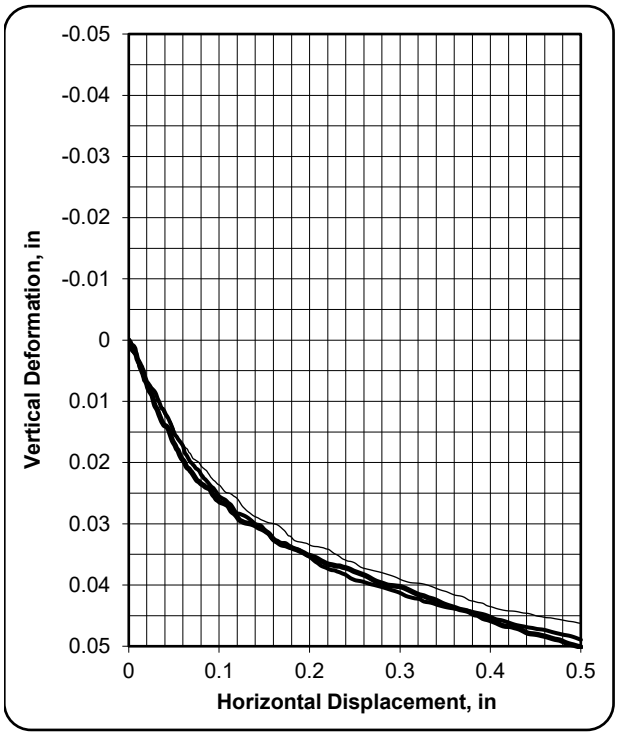
Reviewed by: Campbell

GeoProfessional Innovation.

Direct Shear Test Report - AASHTO T236







	Sample Number	1	2	3
Initial	Water Content, %	15.1	15.1	15.1
	Dry Density, pcf	102.1	100.5	100.7
	Saturation, %	64.4	61.9	62.2
	Void Ratio	0.62	0.65	0.64
	Diameter, in	2.421	2.421	2.421
	Height, in (before consol.)	0.995	0.995	0.995
At Test	Water Content, %	17.8	17.6	16.6
	Dry Density, pcf	104.3	105.8	108.9
	Saturation, %	80.3	83.1	84.9
	Void Ratio	0.59	0.56	0.52
	Diameter, in	2.421	2.421	2.421
	Height, in (prior to shear)	0.974	0.945	0.920
	Normal Stress, psf	2000	4000	8000
	Failure Stress, psf	1863	3204	6278
	Displacement @ Failure, in	0.50	0.50	0.50
	Time to Failure, min	100.0	99.3	100.0
	Ultimate Stress, psf	1863	3203	6278
	Displacement @ Ultimate, in	0.50	0.50	0.50
	Rate of Strain, in/min	0.0050	0.0050	0.0050

Client	GeoProfessional Innovation
Project	Gun Club Road
Project Number	108524-025
Sample Location	TP-23073A-2, Ring; 6.5'-7.0'
Lab Number	25-0268
Date	3/31/2025

Sample Type	In-situ
Description	Silt with Sand (ML)
Sp. Gravity (assumed)	2.650

C, psf	325
ϕ , deg	**36.5**
tan ϕ	0.741

Tested by: PC

Reviewed by: Travis Thomsen

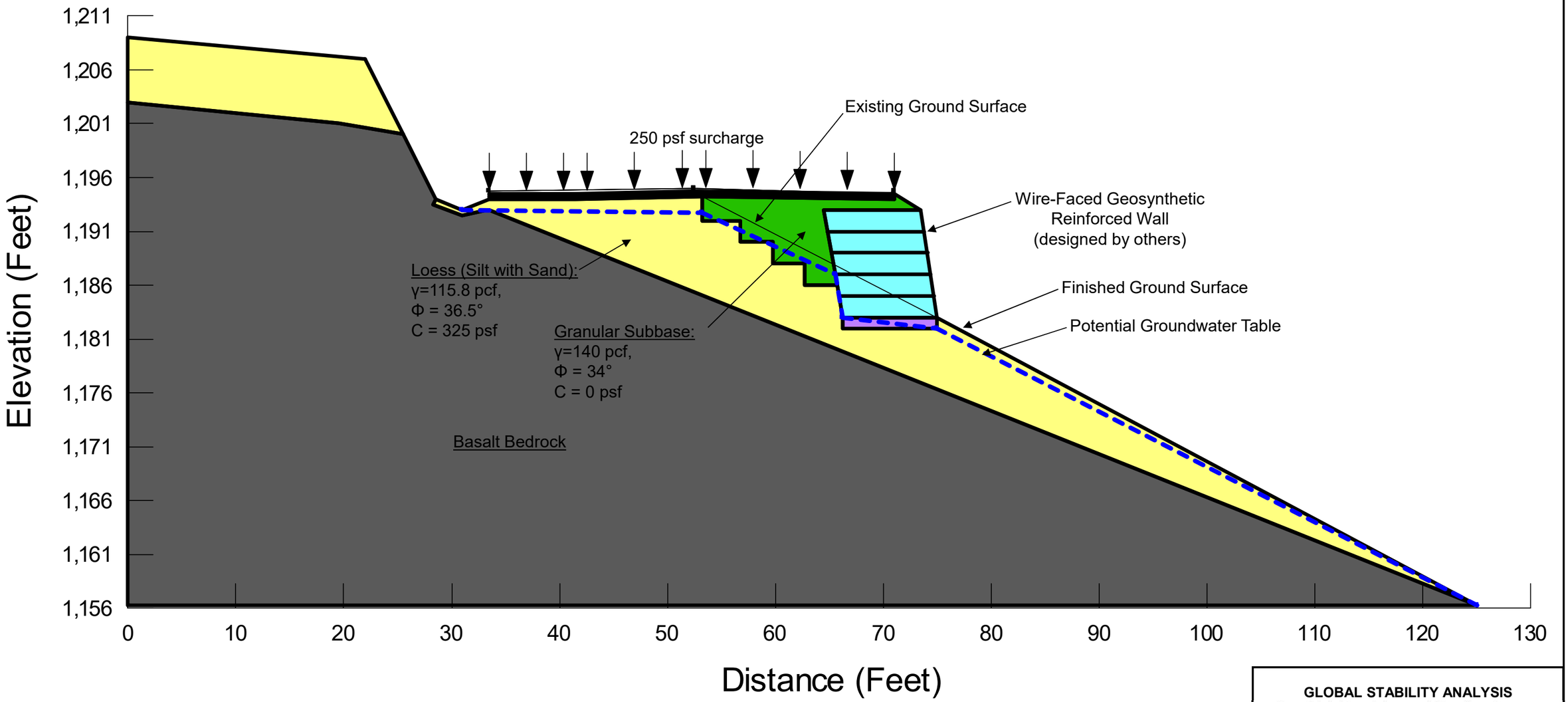
SHANNON & WILSON

APPENDIX C

Stability Analysis Results

Global Stability Analysis - Geometry

Approximate Station 28+25



GLOBAL STABILITY ANALYSIS
Gun Club Road, Lapwai Road to Stewart Avenue
Lewiston, Idaho

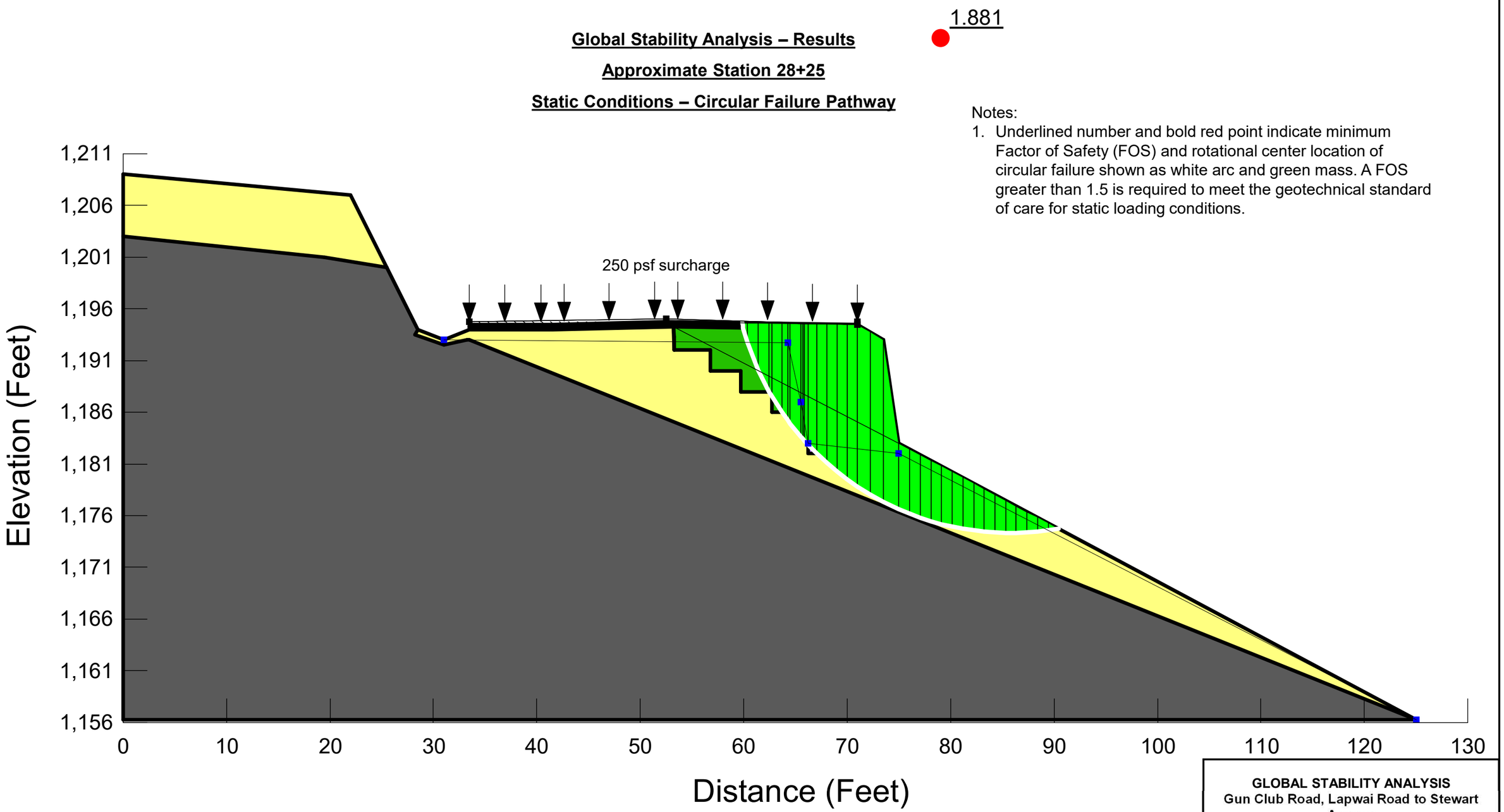
GeoProfessional Innovation®

MO23073A	Figure C.1

Global Stability Analysis – Results

Approximate Station 28+25

Static Conditions – Circular Failure Pathway



Notes:

1. Underlined number and bold red point indicate minimum Factor of Safety (FOS) and rotational center location of circular failure shown as white arc and green mass. A FOS greater than 1.5 is required to meet the geotechnical standard of care for static loading conditions.

GLOBAL STABILITY ANALYSIS
Gun Club Road, Lapwai Road to Stewart Avenue
Lewiston, Idaho

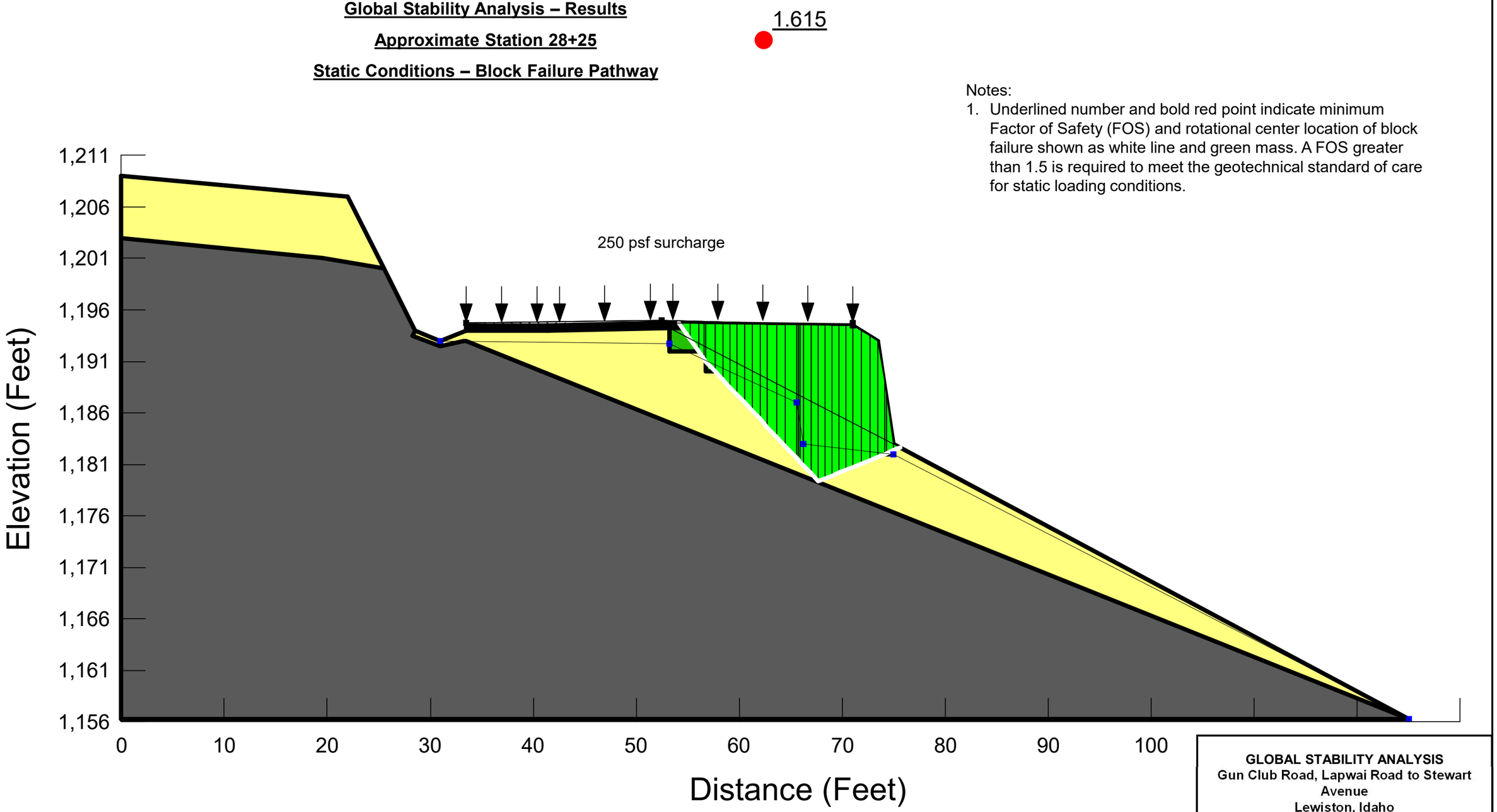
GeoProfessional Innovation®

MO23073A	Figure C.2a

Global Stability Analysis – Results

Approximate Station 28+25

Static Conditions – Block Failure Pathway



Notes:

1. Underlined number and bold red point indicate minimum Factor of Safety (FOS) and rotational center location of block failure shown as white line and green mass. A FOS greater than 1.5 is required to meet the geotechnical standard of care for static loading conditions.

GLOBAL STABILITY ANALYSIS
Gun Club Road, Lapwai Road to Stewart Avenue
Lewiston, Idaho

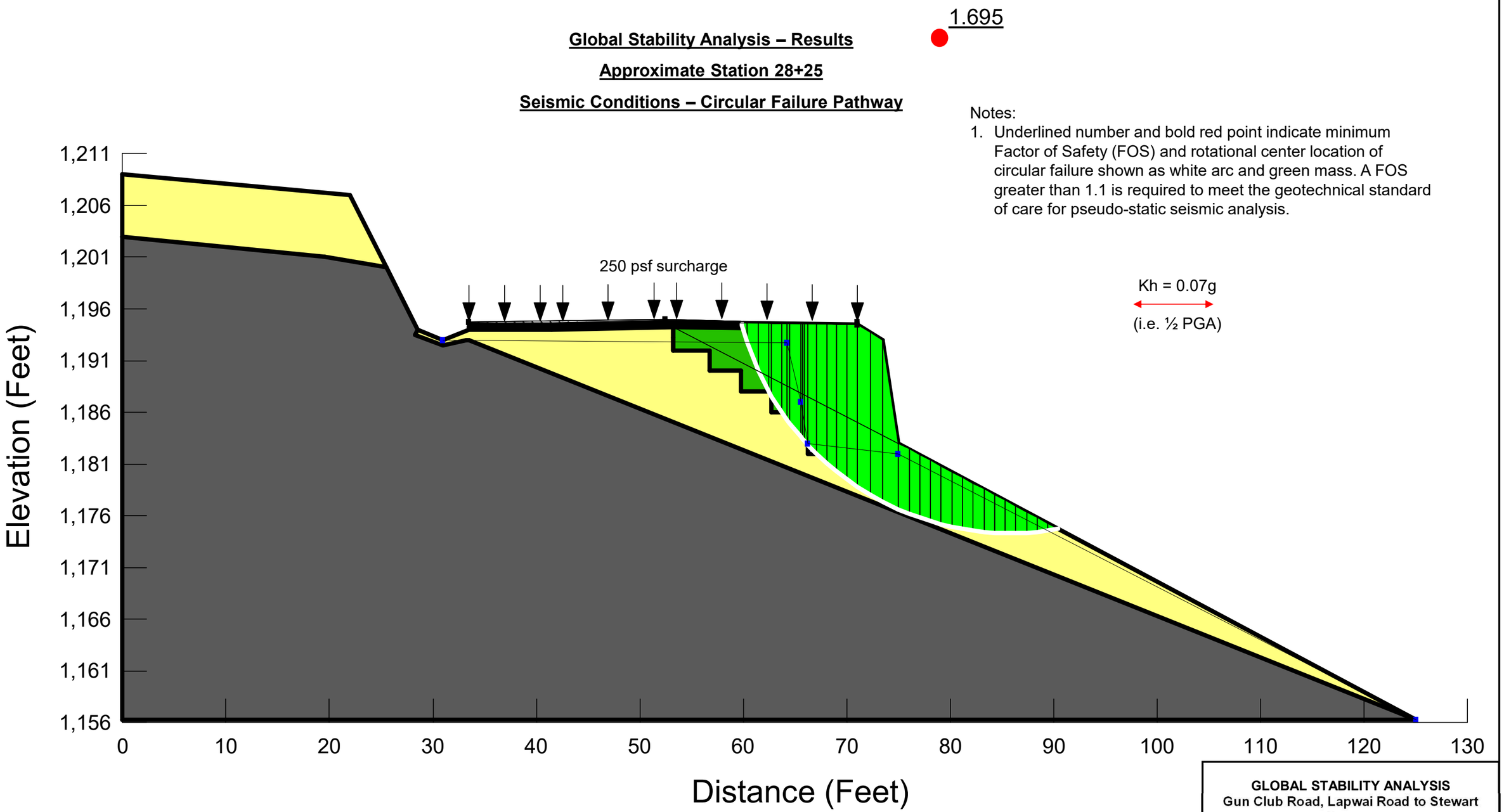
GeoProfessional Innovation®

MO23073A	Figure C.2b

Global Stability Analysis – Results

Approximate Station 28+25

Seismic Conditions – Circular Failure Pathway



Notes:

1. Underlined number and bold red point indicate minimum Factor of Safety (FOS) and rotational center location of circular failure shown as white arc and green mass. A FOS greater than 1.1 is required to meet the geotechnical standard of care for pseudo-static seismic analysis.

GLOBAL STABILITY ANALYSIS
Gun Club Road, Lapwai Road to Stewart Avenue
Lewiston, Idaho

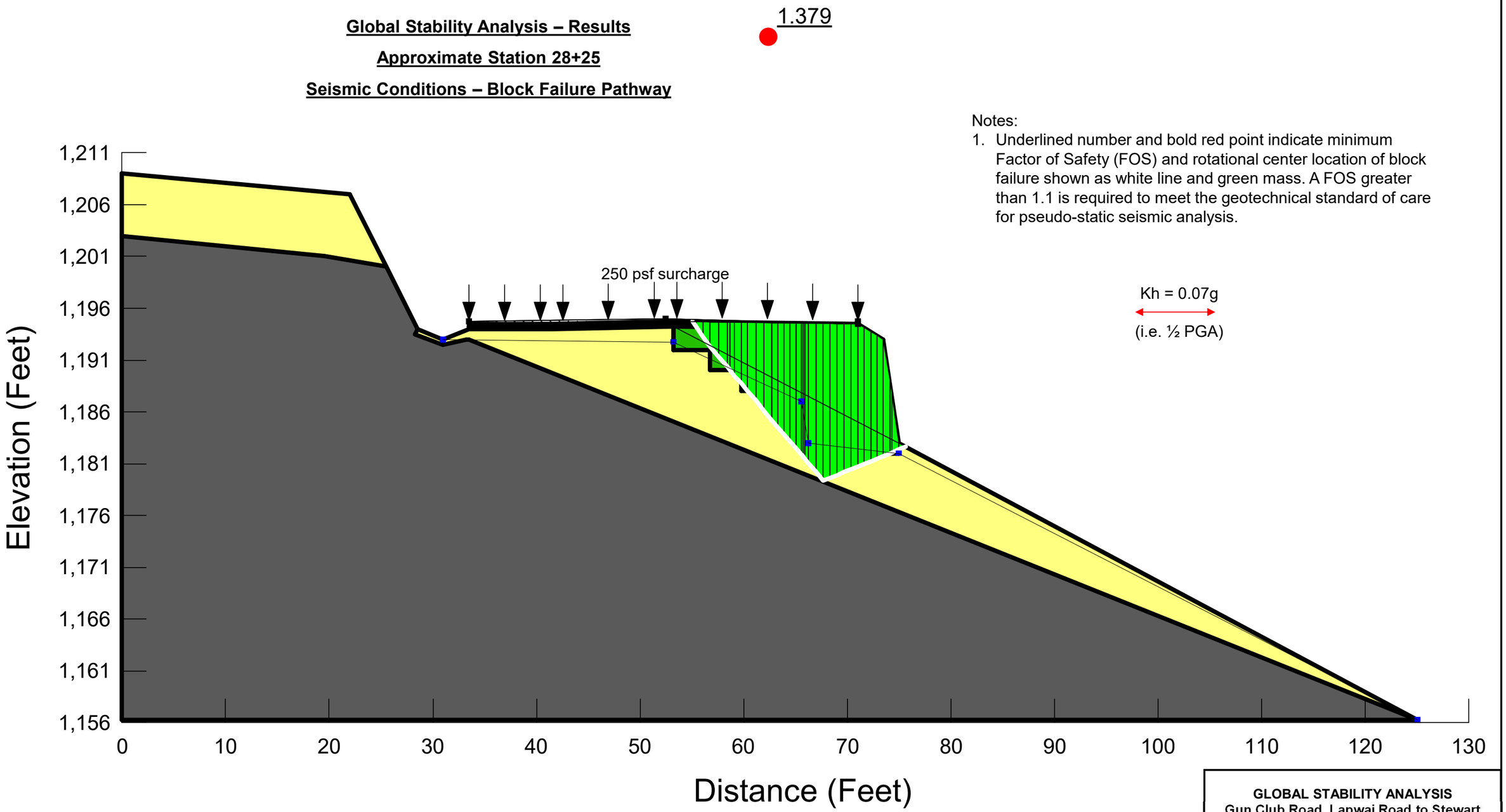
GeoProfessional Innovation

MO23073A	Figure C.3a

Global Stability Analysis – Results

Approximate Station 28+25

Seismic Conditions – Block Failure Pathway



Notes:

1. Underlined number and bold red point indicate minimum Factor of Safety (FOS) and rotational center location of block failure shown as white line and green mass. A FOS greater than 1.1 is required to meet the geotechnical standard of care for pseudo-static seismic analysis.

GLOBAL STABILITY ANALYSIS
Gun Club Road, Lapwai Road to Stewart Avenue
Lewiston, Idaho

GeoProfessional Innovation®

MO23073A	Figure C.3b

APPENDIX D

ITD Comments on July 15, 2025 Report and GPI Responses

Summary of ITD Comments on July 15, 2025 Report & GPI Responses:

Page 1, Comment #1:

"List all standards and specifications referenced in this report (e.g., AASHTO LRFD Bridge Design Specifications, ITD Standard Specifications for Highway Construction). Include edition number and/or adoption year to identify the version of the referenced material used in the report"

- GPI Response: The references and specifications used in our evaluation and report preparation are provided in Section 230.10 of this report.

Page 1, Comment #2:

"road elevation and height above streambed or existing ground, height of existing fills, and ground-slope behind proposed retaining structures."

- GPI Response: The report has been modified to include narrative regarding these details.

Page 1, Comment #3:

"how much embankment widening is planned? how many lanes with width and shoulders existing vs planned."

- GPI Response: The report has been modified to include narrative regarding these details.

Page 1, Comment #4:

"mse"

- GPI Response: The report has been modified to include this descriptor for the planned retaining walls.

Page 1, Comment #5:

"MSE"

- GPI Response: The report has been modified to include this descriptor for the planned retaining walls.

Page 1, Comment #6:

“how long are these walls? if several suggest putting his information in a table with approximate start and end station, example below”

- GPI Response: The report has been modified to include tables summarizing wall length and configuration.

Page 1, Comment #7:

“Existing structures and approaches should also be described, and how will they be affected by this project. there is a bridge at the north end of this project BK 21470. are there previous investigations and/or other project reports? need to be referenced if so.”

- GPI Response: The report has been modified to include a summary of existing infrastructure features along the alignment.

Page 2, Comment #1:

“how were the boring and test pit locations surveyed? and by whom?”

- GPI Response: GPI recorded the location of each boring with a commercially available global positioning system (GPS) unit with an accuracy of less than 1.0-foot.

Page 2, Comment #2:

“elevations to reference ground surface? without ground surface elevation the term "below ground surface" doesn't mean much

- GPI Response: Recorded ground surface elevation at each boring and test pit location were added to the report.

Page 2, Comment #3:

“ground water if encountered?”

- GPI Response: Groundwater was not encountered in our explorations.

Page 2, Comment #4:

“Per ITD Materials Manual retaining wall borings should extend twice the height of the wall, did these borings extend below the bottom of the wall?

- GPI Response: Exploratory borings and test pits nearest the planned MSE wall alignments were extended to refusal on dense bedrock.

Page 2, Comment #5:

"Provide details of how the ring sample was collected (size, method, storage and handling etc.)?

- GPI Response: The following text was added to the report: "…relatively undisturbed soil samples were collected via 2.5-inch inside diameter, 6.0-inch long steel tubes advanced vertically into the soil. Relatively undisturbed samples were capped in the field and placed in a secondary, water-tight container to be stored upright during transport to the laboratory."

Page 3, Comment #1:

"ground water if encountered?"

- GPI Response: Groundwater was not encountered in our explorations.

Page 3, Comment #2:

"in accordance with ASTM D2488"

- GPI Response: This ASTM reference was added to the report text.

Page 3, Comment #3:

"classification standard?"

- GPI Response: The classification standard used was ASTM D 2488. See response to previous comment.

Page 3, Comment #4:

"standard split spoon or modified California sampler? if modified California sampler what was the conversion method to approximate N values?"

- GPI Response: Split spoon sampler size has been clarified in the report text. As stated in our original report, the SPT N-value blow counts reported are field values and have not been corrected for overburden pressure or for dilation effects on the sample.

Page 3, Comment #5:

"in accordance with"

- GPI Response: This comment has been addressed in the revised report text.

Page 4, Comment #1:

“ASTM testing for collapse potential of "loess" described in borings?”

- GPI Response: Consolidation testing to assess collapse potential was not included as part of our approved and authorized scope.

Page 4, Comment #2:

“T-99? which method?”

- GPI Response: Tests were re-run on remaining samples, referencing AASHTO T-99 Method A.

Page 4, Comment #3:

“what are the test standards?”

- GPI Response: AASHTO test standards are referenced in the updated report.

Page 4, Comment #4:

“this belongs in introduction”

- GPI Response: This text was moved into the introduction section of the modified

Page 4, Comment #5:

“what is shallow?”

- GPI Response: The modified report text was clarified to estimate this drainage ditch at less than 2-feet deep.

Page 4, Comment #6:

“overhead low voltage power is visible from Google earth street view with feeders to residences, any other utilities on the surface?”

- GPI Response: The report has been modified to include a brief description of observed utilities along the alignment. Keller’s project narrative includes a more detailed summary of utilities.

Page 4, Comment #7:

“elevation?”

- GPI Response: Our opinion is referencing depth below ground surface is a more useful description for topsoil thickness. This is because the topsoil thickness was

relatively consistent along the alignment (i.e. 0.2 to 1.0-foot) as opposed to the ground surface elevation which varies by hundreds of feet along the alignment.

Page 4, Comment #8:

"Use consistency to describe silt and clay, unless it acts as a non plastic material with no cohesion (need testing to determine that) density is used to describe sand and gravel."

- GPI Response: The report text was modified to reference consistency of fine-grained soil.

Page 4, Comment #9:

"describe slopes of west side of road, most appear to be cut slopes"

- GPI Response: We provide a description of the cut slopes along the west side of Gun Club Road in the "Project Summary" section of the report.

Page 5, Comment #1:

"how was soil determined to be loess? no testing for collapse potential in listed tests or in appendices"

- GPI Response: Some near surface soil at the site was classified as loess based on our visual observations, experience with similar soil conditions in the project vicinity, index laboratory test results, as well as surface geologic mapping in the "Surficial Geologic Map of the Lewiston Orchards North Quadrangle and Part of the Clarkston Quadrangle, Nez Perce Couty Idaho." Othberg, K.L., Breckenridge, R.M., & Weisz, D.W. Idaho Geologic Survey, 2003.

  Consolidation/collapse potential testing was not included in our authorized and approved scope. However, loess does typically exhibit some collapse potential. This is why GPI recommended compaction at the subgrade prior to wall foundation construction.

Page 5, Comment #2:

"need elevations for all these depths or they dont mean much"

- GPI Response: Our opinion is referencing depth below ground surface is a more useful description for uncontrolled fill thickness. This is because the fill thickness varied within a specific range along the alignment (i.e. 2.5 to 9.0-feet) as opposed to the ground surface elevation which varies by hundreds of feet along the alignment.

Page 5, Comment #3:

“RQD?”

- GPI Response: No rock coring was performed to obtain core samples and thus calculate rock quality designation (RQD).

Page 5, Comment #4:

“placed on "loess" without determining collapse potential?”

- GPI Response: Loess soil likely does maintain some collapse potential. This is why GPI recommended the native soil subgrades be compacted to Class A requirements.

Page 6, Comment #1:

“geotechincal engineer of record provides graphs for service, strength, and extreme limit states as a function of effective footing width, not the contractor. contractor will only provide applied load of their wall”

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 6, Comment #2:

“if loess you will need to over excavate, moisture treat, and compact to class a minimum of 2' to break up the soil structure that can collpase”

- GPI Response: Keller’s current design includes over-excavating 1-foot below the wall foundation, compacting the exposed subgrade to Class A requirements, then placing 1-foot of compacted Rack Cap as levelling course for the wall to bear on. This essentially will result in 2 feet of compacted material below the wall foundation. GPI’s opinion is this is an acceptable construction approach to reduce soil collapse potential below the wall.

Page 6, Comment #3:

“ITD”

- GPI Response: This has been included in the modified report.

Page 6, Comment #4:

"Geotechnical engineer of record provides recommended resistance factors."

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 6, Comment #5:

"total settlement?, differential settlement?"

- GPI Response: The MSE wall geotechnical analyses have been updated in the modified report to include estimated settlement.

Page 6, Comment #6:

"resistance factors for shear resistance to sliding?"

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 6, Comment #7:

"Note: rock cap is too granular to test, will be done by a method spec if using rock embankments in 205.03.F.2. who will observe to make sure this happens?"

- GPI Response: GPI is not responsible for selecting or specifying a firm to observe and document construction materials or activities.

Page 6, Comment #8:

"what about over excavating native material defined as loess? absent any testing to determine collapse potential it needs to be over excavated and recompacted to class A standards"

- GPI Response: Keller's current design includes over-excavating 1-foot below the wall foundation, compacting the exposed subgrade to Class A requirements, then placing 1-foot of compacted Rack Cap as levelling course for the wall to bear on. This essentially will result in 2 feet of compacted material below the wall foundation. GPI's opinion is this is an acceptable construction approach to reduce soil collapse potential below the wall.

Page 6, Comment #9:

“guard rail loading?”

- GPI Response: The modified report recommends contractor’s design include guardrail loading.

Page 6, Comment #10:

“is this deeper than frost depth? does this allow for a 4' bench in front of the wall?”

- GPI Response: Local Frost depth for foundations in Lewiston is 2.0 Feet. Keller’s design is developed to establish room for a minimum 4-foot bench in front of the wall.

Page 7, Comment #1:

“these parameters are provided for bridge abutment walls and rigid retaining walls, why providing this?”

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 8, Comment #1:

“the Geotechnical Engineering Report makes recommendations, what does this sentence mean?”

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 8, Comment #2:

“MSE walls are designed governed by Special provision. why repeat this information outside the introduction or when referencing a specific aashto LRFD section?”

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 8, Comment #3:

“recommendations?”

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 8, Comment #4:

“recommend using?”

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 8, Comment #5:

“so GPI is writing themselves in extra construction support work scope in the GER? what is the point of this disclaimer?”

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 8, Comment #6:

“moisture, organic content, percent passing 200 are all defined in the projects special provisions for the contractor”

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 8, Comment #7:

“this will be determined based on testing from the contractors material source for imported material or from lab testing for native material.”

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 8, Comment #8:

“is this derrived from testing?”

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 8, Comment #9:

“recommend a single value or need to provide project stationing where specific values are applicable”

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 8, Comment #10:

"we typically see this table presented like this for contractor designed MSE walls"

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 9, Comment #1:

"not for the contractor to decide, corrosion rates are spelled out in MSE wall special provisions. ALL metal is designed for 0.8 mils annual corrosion for 75 year design life plus the initial galvanization"

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 9, Comment #2:

"reinforced zone? no need to specify unit weight since that is determined contractor source testing submitted to the project during contractors MSE wall design is accepted. also don't need to specify internal friction angle because a minimum of 34 degrees in required in the SP"

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 9, Comment #3:

"MSE?"

- GPI Response: This typographical comment has been addressed in the modified report.

Page 9, Comment #4:

"formatting"

- GPI Response: This formatting comment has been addressed in the modified report.

Page 9, Comment #5:

"why reprint load factors when they need to be in accordance with the most current version of AASHTO LRFD? if this project sits on the shelf for 5 years they will likely be different than what is in this table"

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 10, Comment #1:

“why reprinting these resistance factors? just reference the applicable AASHTO section”

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 10, Comment #2:

“formatting?”

- GPI Response: This formatting comment has been addressed in the modified report.

Page 10, Comment #3:

“Geotecnhincal Engineer of Record needs to provide bearing capacity analysis and present bearing capacity charts as a function of effective footing width for service, strength, and extreme limit states. contractor's MSE wall designer will need to provide a design that does not exceed values presented in this report”

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 10, Comment #3:

“Geotechnical Engineer of Record performs global stability for critical case, if compound stability is needed the contractor;s MSE wall designer will perform that analysis”

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 10, Comment #4:

“this report is not preliminary, when will final be submitted?”

- GPI Response: The modified report is the final submittal.

Page 10, Comment #5:

“not the purpose of this report. need to make recommendations in this report”

- GPI Response: The MSE wall geotechnical design recommendations have been updated in the modified report.

Page 10, Comment #6:

", external, and where applicable compound stability"

- GPI Response: The MSE wall geotechnical analyses have been updated in the modified report.

Page 10, Comment #7:

"doesnt need to, just the most critical sections whose evaluation will envelope the other wall sections"

- GPI Response: The MSE wall geotechnical analyses have been updated in the modified report.

Page 10, Comment #8:

"what methods? modified bishop, simplified janbu, spencer? global stability is presented with factor of safety"

- GPI Response: The MSE wall geotechnical analyses have been updated in the modified report.

Page 10, Comment #8:

"are plans available? this sentence is worded like the author isnt sure what the max height is"

- GPI Response: This language has been updated in the modified report.

Page 11, Comment #1:

"present in factor of safety. need to be stable to 1.5 static and 1.1 seismic"

- GPI Response: The MSE wall geotechnical analyses have been updated in the modified report.

Page 11, Comment #2:

"when will final be ready?"

- GPI Response: The modified report is the final submittal.

Page 11, Comment #3:

"mse"

- GPI Response: This typographical comment has been addressed in the modified report.

Page 11, Comment #4:

"formatting"

- GPI Response: This formatting comment has been addressed in the modified report.

Page 11, Comment #5:

"why D if rock is encountered very shallow?"

- GPI Response: GPI selected Site Class D based on the results of exploration, noting that much of the planned retaining walls will be situated over soil subgrades. Conservatively, we selected Site Class D, which results in higher design ground acceleration for use in our slope stability analysis.

Page 11, Comment #6:

"very long time ago"

- GPI Response: This typographical error has been corrected in the modified report.

Page 12, Comment #1:

"for"

- GPI Response: This comment has been addressed in the modified report.

Page 13, Comment #1:

"elevations"

- GPI Response: Our opinion is referencing depth below ground surface is a more useful description for bedrock. This is because the bedrock depth varied within a specific range along the alignment (i.e. 7.5 to 12.0-feet) as opposed to the ground surface elevation which varies by hundreds of feet along the alignment.

Page 13, Comment #2:

"does this match granular subbase defined in section 703?"

- GPI Response: Referencing ITD Standard Specifications Table 703.11, Granular Subbase must have 100% passing a 4-inch screen, which is equivalent to 0.33 feet.

Page 14, Comment #1:

"how much? where (by stationing)?"

- GPI Response: It is not possible to delineate exactly where or how much additional overexcavation will be required to remove uncontrolled fill beneath all wall alignments.

Page 14, Comment #2:

"special provisions ARE definitely required for the MSE walls and Reinforced Soil Slopes. contact ITD HQ Anthony Beauchamp or Tyler Coy"

- GPI Response: Keller has included a Special Provision document governing MSE Wall design and construction into the project documents.

Plate 6, Comment #1:

"4' bench?"

- GPI Response: Keller's design is developed to establish room for a minimum 4-foot bench in front of the wall.

Plate 6, Comment #2:

"minimum reinforcement lengths?"

- GPI Response:

Page 27 of 52 (Boring log B-23073A-1):

"need a surface elevation for depth to have meaning across the project (Typ)"

- GPI Response: Ground surface elevation has been added to the boring and test pit logs in the modified report.

Page 45 of 52 (Proctor Test B-23073A-1 @ 1.5 – 2.0:

"wrong test, table 3 says T-180 but should be T-99 (typ)"

- GPI Response: The correct test has been added to the modified report.

Page 48 of 52 (Direct Shear Test TP-23073A-2 @ 6.5 – 7.0:

"wrong test, table 3 says AASHTO T236"

- GPI Response: The correct test has been added to the modified report.

Figure C.1 - Sheet 50 of 52 – Comment 1:

"table 3 is as low as 100, global stability needs to be evaluated at the critical section, that may include a shorter wall with weaker soil parameters. is this the critical section?"

- GPI Response: The modified report includes updated analysis results with consistent soil parameters.

Figure C.2 - Sheet 51 of 52 – Comment 1:

"present in factor of safety, need 1.5 static and 1.1 seismic"

- GPI Response: The modified report includes updated analysis results with the requested FOS format.

Figure C.2 - Sheet 51 of 52 – Comment 2:

"Did you also look at non-circular failure mechanisms?"

- GPI Response: The MSE wall geotechnical analyses have been updated in the modified report to evaluate block specified failure pathways.

Figure C.3 - Sheet 52 of 52 – Comment 1:

"present in factor of safety, need 1.5 static and 1.1 seismic"

- GPI Response: The MSE wall geotechnical analyses have been updated in the modified report.

Figure C.3 - Sheet 52 of 52 – Comment 1:

"Should be 0.07 to account for adjusted PGA due to site class D"

- GPI Response: The MSE wall geotechnical analyses have been updated in the modified report.