11/30/2022 (*revised 6/30/2026*)

Mineral Lake Resort
Attn: Mike Neghina
2114 Marshall Ave
Tacoma, WA 98421

Subject: **Mineral Lake Resort Bulkhead Study – Geotechnical Investigation**
148 Mineral Hill Rd, Mineral, WA 98355
QG Project No.: QG22-195

Dear Client:

At your request, Quality Geo NW, PLLC (QG) has completed a geotechnical investigation of the above referenced project. The investigation was performed in accordance with our proposal for geotechnical services.

We would be pleased to continue our role as your geotechnical consultant of record during the project planning and construction phases, as local inspection firms have not been found to be as familiar or reliably experienced with geotechnical design. This may include periodic review of special inspection and piling reports, or supplemental recommendations if changes occur during construction. We will happily meet with you at your convenience to discuss these and other additional *Time & Materials* services.

We thank you for the opportunity to be of service on this project and trust this report satisfies your project needs currently. QG wishes you the best while completing the project.

Respectfully Submitted,
Quality Geo NW, PLLC



Ray Gean II
Staff Geologist/Project Manager

GEOTECHNICAL REPORT

MINERAL LAKE RESORT BULKHEAD STUDY
148 MINERAL HILL ROAD
MINERAL, WA

Mineral Lake Resort
Attn: Mike Neghina
2114 Marshall Ave
Tacoma, WA 98421

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11/30/2022
(*revised 6/30/2026*)

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11/30/2022 (*revised 6/30/2026*)

QG Project # QG22-195

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1.0 INTRODUCTION

This report presents the findings and recommendations of Quality Geo's (QG) geotechnical investigation and engineering conducted in support of new developments, facility design, and earthwork construction.

1.1 PROJECT DESCRIPTION

QG understands the project mainly entails the design and construction of a new bulkhead wall (designed by others) within a presently developed parcel. QG has been contracted to perform a geotechnical investigation of the proposed site soils to provide wall and site development recommendations. Exploration locations were chosen by QG as needed to avoid existing utilities.

1.2 SITE INVESTIGATION METHODOLOGY

On 10/27/2022, a QG Staff Geologist visited the site to perform visual reconnaissance of the surface and topographic features of the subject property and its proximal slope. While on site, we conducted site surface explorations for a geologic hazard assessment and site feasibility characterization. Approximate relevant property dimensions and slope topography were documented and mapped at representative intervals as access allowed. Soil conditions were evaluated through local exposures along the slope face. Salient slope features and existing vegetation were documented to assess general site stability as well as observe for signs of local instability of an erosional or subsurface nature currently or in the past.

1.3 FIELD WORK

Site exploration activities were performed on 10/27/2022. Exploration locations were marked in the field by an QG Project Geologist with respect to the provided map and cleared for public conductible utilities. Our exploration location was selected by an QG Project Geologist prior to field work to provide safest access to relevant soil conditions. The geologist directed the advancement of 3 hand auger boreholes (HA). The boreholes were advanced within proximity to the anticipated bulkhead, to a maximum depth of approximately 4.8 feet below present grade (BPG) in general accordance with the specified contract depth and equipment capabilities.

During explorations QG logged each soil horizon we encountered, and field classified them in accordance with the Unified Soil Classification System (USCS). Representative soil samples were collected from each unit, identified according to boring location and depth, and placed in plastic bags to protect against moisture loss for future reference.

QG advanced 2 Wildcat Dynamic Cone Penetrometer (DCP) tests at representative locations within the vicinity of the proposed bulkhead and as slope conditions permitted. The penetrometer

tests were terminated upon reaching the equipment's maximum practical extent. During penetrometer advancement, blow counts were recorded in 10-centimeter increments as a thirty-five-pound weight was dropped 15 inches. Blow counts were then converted to resistance (kg/cm2), standard penetration blow counts (N-values), and corresponding soil consistency, with complete results shown on the attached logs.

Region & vicinity maps are included in Appendix A. Exploration locations are shown in Appendix B. Complete hand auger and DCP logs are provided in Appendix C of this report.

2.0 EXISTING SITE CONDITIONS

2.1 AREA GEOLOGY

QG reviewed available map publications to assess known geologic conditions and hazards present at the site location. The Washington Geologic Information Portal (WGIP), maintained by the Department of Natural Resources Division of Geology and Earth Resources, provides 1:100,000-scale geologic mapping of the region. The maps indicate the affected area within the project site is mapped as Pleistocene alpine glacial drift (Qap(h)). These soils are typically described as, "Till and outwash sand and gravel."

According to the regional-scale interactive map, there are no mapped recent deep seated landslide deposits to exist within the vicinity of the parcel. Available LiDAR imagery of the site did not reveal obvious or prominent active landslide features within the site as well as within the vicinity.

The United States Department of Agriculture portal (USDA), provides a soil mapping of the region. The soils in the vicinity are mapped as Newaukum gravelly silt loam (146), these are formed from basal till as till plains and moraines. The soils are described as gravelly silty loam from 0 to 51 inches and very cobbly silt loam from 51 to 60 inches. Depth to restrictive feature is more than 80 inches. Capacity of most limiting layer to transmit water (ksat) is listed as moderately high to high (0.57 to 1.98 in/hr). Depth to water table is more than 80 inches.

2.2 SURFACE OBSERVATION

The site and slope in question consists of a small waterfront area with a dock and floating structures adjacent to the shoreline of Mineral Lake. There is a gravel parking lot with existing structures above the crest. The slope descends at approximately 24 degrees until it intersects with the lake surface. Soils adjacent to the lake were saturated and were underlying various aquatic vegetation. Soils on the slope face were generally covered by grasses and shrubs.

QG performed reconnaissance within the site to observe for and document indications of surface degradation or large-scale slope instability. Within the proposed construction area, no obvious features were observed that would indicate an active or prior deep-seated slope failure within the proposed home area, such as headscarps or significant downslope accumulations. No obvious evidence of rotational or translational failures or major toppling hazards was observed on the slope in the proximity of the potential building footprint. Some trees on neighboring properties along the slope were noted to be significantly tilted from vertical, indicating localized soil creep conditions. No groundwater was observed to be daylighting from the slope face.

2.3 SOIL LOG

Site soil conditions were generally consistent across the slope. Representative samples were taken from HA-1. Boreholes were taken within proximity of the proposed bulkhead. Soil conditions on site were as follows:

- **0.0' to 1.8' – Topsoil/Silty Sand with Gravel (SP-SM)**

  An overriding 22-inch layer of organic-rich topsoil transitioning into the underlying silty sand with gravel was present across the site.

- **1.8' to 4.8' – Silty Sand with Gravel (SP-SM)**

  Underneath the topsoil, the silty sand and gravel became more distinguished with a higher gravel content. It is dark brown, saturated silty sand with gravel with no organics or mottling present, moderate cobbles, and in a loose to medium dense condition. Groundwater was encountered at 3.5 feet below grade. The particle distribution graded to a finer sand as depth increased.

2.4 SURFACE WATER AND GROUNDWATER CONDITIONS

Natural surface water features were present within the project area at the time of this study. Mineral Lake abuts the property to the east. Groundwater was encountered at 3.5 feet below present grade at the location of HA-1. The groundwater table is likely at similar elevations to the surface of Mineral Lake beneath the property, assuming that soil conditions are consistent with the hand auger explorations.

QG's scope of work did not include determination or monitoring of seasonal groundwater elevation variations, formal documentation of wet season site conditions, or conclusive measurement of groundwater elevations at depths past the extent feasible for explorations at the time of the field explorations.

3.0 GEOTECHNICAL RECOMMENDATIONS

3.1 CRITICAL SLOPE RECOMMENDATIONS

3.1.1 SLOPE CONSIDERATIONS

The findings of QG's site reconnaissance at the subject site appear broadly consistent with available geologic literature and do not indicate any excessively prohibitive conditions exist for the site, assuming appropriate site management efforts are maintained.

In consideration of the available information, and our direct observations, at this time **QG does not consider the site to be within an active landslide hazard area.** With this determination, our study did not involve slope stability modeling, or deep subsurface explorations directly within the site and at this time QG does not recommend any further exploration or analysis be conducted. Based on the information herein, we provide the following development- and site-specific recommendations that will minimize the inherent risks of developing in a sloped area.

Due to the anticipated construction, specific setbacks must be maintained to protect the slopes and structures. Additionally, we recommend final design and construction practices limiting additional surface excavation to the smallest extent possible. Large excavations are generally discouraged.

3.1.2 SETBACK RECOMMENDATIONS

Considering the inclination and conditions of the lower slope specific setback requirements must be followed for successful construction at this location. Lewis County Code delineates minimum slope crest setbacks for slopes inclined greater than 35% (~19°), and areas in the vicinity of mapped landslides. QG reviewed existing topographic data and general site observations made during our visit to infer general slope crest setbacks based on height and inclination of the typical slopes present on the site in proximity to the proposed structure.

Horizontal setbacks were determined based on standard International Building Code (IBC) requirements as accepted by the State of Washington. The IBC details required setback delineations for slopes with an overall inclination less than or equal to 45 degrees. Structures in the vicinity of descending slopes shall maintain a minimum horizontal slope crest setback, the lesser of H/3 or 40 feet. Structures shall also maintain a minimum slope toe setback, the lesser of H/2 or 15 feet from ascending slopes. These setbacks can commonly be achieved through a combination of increasing footing embedment depths, in combination with expanding the building fill pad, and/or partially adjusting the footprint location.

QG recommends that new foundations maintain a minimum horizontal wall setback of 12 feet from the proposed bulkhead wall (designed by others). Additionally, QG recommends a 5-foot wall setback from the base of the proposed wall (designed by others) for the cabins

near Profile A. No setback is required for the cabins near Profiles B and C with the use of daylight basement retaining walls (designed by others). Setbacks are detailed schematically in Appendix C. The proposed new construction location appears suitable. The setback does not prohibit lightweight surface improvements such as septic, uncovered decks, patios, walkways, landscaping, pathways, etc. (if approved by the project engineer). QG does not recommend reducing the setback unless further site-specific foundation design efforts are undertaken to ensure building and slope stability is maintained.

3.2 RETAINING WALLS

The following recommendations pertain to the design and construction of laterally loaded bulkhead retaining wall structures. These recommendations are not applicable to: exceedingly sloping backfills, backfills composed of non-granular soil materials, braced or tied-back walls, or basement retaining wall foundations.

- **Active and At-Rest Pressures:**

  Yielding (cantilever) retaining walls should be designed to withstand an appropriate active lateral earth pressure, whereas non-yielding (restrained) walls should be designed to withstand an appropriate at-rest lateral earth pressure. The at-rest case is applicable where retaining wall movement is confined to less than 0.005 H, where H is the wall height. If greater movement is possible, the active case applies. A wall movement of about 0.02 H will be required to develop the full passive pressure. These pressures act over the entire back of the wall and vary with the backslope inclination. For lateral pressures relative to seismic loading conditions, we recommend applying a uniform blanket seismic surcharge of 10 H psf for a generalized design situation based on our limited subsurface testing at the project site.

  QG understands the structural engineer proposes the installation of new retaining walls on site. For lateral support of these structure, the following soil parameters should be considered regarding any structural fill against these features (ignoring the upper 18 inches, due to freeze/thaw softening, unless covered in concrete or asphalt).

Table 2. Lateral Earth Pressures for Seismic Site Class D-Default

Soil Type	Active Pressure (PSF*H)	At-Rest Pressure (PSF*H)	Seismic Surcharge (PSF*H)	Passive Lateral Equivalent Fluid Weight (PCF)	Grade Beam Coefficient of Friction
Existing Soils	45	60	10	170	0.34
New Structural Fill	35	55	10	200	0.38

- **Excavations:**

  The duration of time that excavations behind walls remain open should be limited to only as necessary to prepare the base pad and placement of the wall features, backfilling with drain rock and approved fill immediately. Temporary worker protections such as trench boxes or temporary shoring may be required for entering excavations deeper than 4 feet, and all OSHA safety regulations should be observed. Extended open cut periods or work proceeding in wet weather may require surface coverings, lesser cut angles, and/or temporary bracing be applied. We suggest a minimum 5-foot horizontal buffer be maintained from the temporary cut to the upslope property lines (to allow for some near-surface disturbance during excavation).

- **Wall Drainage:**

  Due to the detailed elevated water table in the original geotechnical report, and tidal influences, QG recommends the design team account for the potential effects of hydrostatic pressure, and head pressure/uplift on any new bulkhead features. To preclude build-up of hydrostatic pressure, we recommend a minimum width of 1 foot of clean, granular, free-draining material extend from the footing drain at the base of the wall to the ground surface immediately behind the wall. Native soils are not considered suitable as drainage material. Imported wall drain aggregate should conform to WSDOT Standard Specification 9-03.12(4) Gravel Backfill for Drains or 9-03.12(5) Gravel Backfill for Drywells. A filter fabric suitable for use in soil separation and water transmission is recommended to be placed against retained soil cuts behind the wall (if present) to limit migration of fines into the drain corridor. Final parameters shall be determined by the wall designer.

- **Wall Backfill:**

  Native material is not considered suitable for wall backfill due to its elevated fines content. For additional wall backfills as needed, soils should be relatively granular with less than 5 percent fines (material passing the U.S. No. 200 sieve). QG recommends wall backfill import material to conform to WSDOT Standard Specification 9-03.12(2) Gravel Backfill for Walls.

- **Wall Backfill Compaction:**

  It is recommended that the upper two feet of wall backfill be compacted to 95 percent of the modified Proctor maximum dry density per ASTM D1557, and 90 percent below that to avoid added pressure on the wall. Wall backfill supporting landscaping elements and other non-structural components should be compacted to a relatively firm and unyielding condition.

3.3 EXCAVATION, GRADING, FILL RECOMMENDATIONS:

The current project plan was not provided to QG. Based on our understanding, regrading plans propose to refill the area along the driveway with imported fill. Final proposed grade is anticipated to resemble the existing grade.

Existing site soils may be considered for reuse as structural fill on a case by case basis. Imported material may be used as structural fill. Imported structural fill material should conform to the *WSDOT Standard Specifications, Section 9-03.14(1) Gravel Borrow*, or an approved alternative. For lateral and bearing support, structural fill placement below footings shall extend at minimum a distance past each edge of the base of the footing equal to the depth of structural fill placed below the footing [e.g., for a 2.0-foot wide footing, fills placed to approximately 1.5 feet below footing grade will require a minimum backfill width of 5.0 feet (1.5 feet each side plus 2.0-foot width of footing)] Fill shall be placed in maximum 12" thick, horizontal lifts, compacted to a firm and unyielding condition.

Excavations can generally be performed with conventional earthmoving equipment such as bulldozers, scrapers, and excavators. QG recommends removing all organic topsoil, displaced landslide deposits, and weathered overburden, down to the less weathered sedimentary deposits, below where seepage extends, and benching the final bottom of subgrade elevation near flat. We recommend maximum vertical steps of 2.0 feet with horizontal spacing of at least 4.0 feet be constructed unless specified otherwise by the design engineer.

QG recommends that new areas of permanently graded and fill slopes be inclined no greater than 2H:1V, catching natural topography at the top and toe. We recommend that areas expected to receive imported fill be benched, placed, and compacted in accordance with WSDOT Standard Specifications: Embankment Construction & Hillside Terraces, sections 2-03.3(14) through 2-03.3(14)D. Fill slopes may be inclined no greater than 2H:1V. All site slopes should be permanently stabilized from erosion.

3.4 DRAINAGE CONTROLS:

QG recommends proper drainage controls for stormwater runoff during and after site development to protect the site. QG recommends all gathered stormwater water sources (new or existing) be tightlined (piped) away to an existing catch basin, approved dispersion area, stormwater system, established channel, or down the slope to be released beyond the base using appropriate energy-dissipating features at the outfall to minimize point erosion. Drains should be tightlined separately or should be gathered in an appropriately sized catch basin structure and redistributed collectively. If storm drains are incorporated for impervious flatworks (driveways, patios, etc.), collected waters should also be discharged according to these recommendations. All drainage tightlines should be composed of appropriately sturdy material (such as rigid PVC), sized adequately according to

anticipated flow, and anchored sufficiently. QG recommends slope tightlines be inspected by the owner periodically to look for signs of damage or displacement requiring repair.

3.4.1 OUTFALL RECOMMENDATIONS:

QG recommends all stormwater catchments (new or existing) be tightlined (piped) away from the slope and toe to an existing stormwater system or an established channel using appropriate energy-dissipating features at the outfall to minimize point erosion. All drainage tightlines should be composed of appropriately sturdy material (such as rigid PVC), sized adequately according to anticipated flow, and anchored sufficiently. QG recommends slope tightlines be inspected by the owner periodically to look for signs of damage or displacement requiring repair.

QG does not recommend dispersion or infiltration of collected stormwater on or near the base of the slope, as increased runoff or localized stormwater inundation can negatively impact long-term erosional and global slope stability.

4.0 GENERAL CONSTRUCTION RECOMMENDATIONS

4.1 EARTHWORK

4.1.1 GRADING & EXCAVATION

Grading and conceptual plans were not available to QG at the time of this report. This study assumes finished site grade will approximate current grade. Therefore, depths referred to in this report are considered roughly equivalent to final depths. Excavations can generally be performed with conventional earthmoving equipment such as bulldozers, scrapers, and excavators.

4.1.2 SUBGRADE EVALUATION & PREPARATION

After excavations have been completed to the planned subgrade elevations, but before placing fill or structural elements, the exposed subgrade should be evaluated under the part-time observation and guidance of an QG representative.

The special inspection firm should continuously evaluate all backfilling. Any loose backfill should be compacted to a firm and unyielding condition and at least to 95 percent of the modified Proctor maximum dry density per ASTM D1557. Any areas that are identified as being soft or yielding during subgrade evaluation should be overexcavated to a firm and unyielding condition or to the depth determined by the geotechnical engineer. Where overexcavation is performed below a structure, the overexcavation area should extend beyond the outside of the footing a distance equal to the depth of the overexcavation below the footing. The overexcavated areas should be backfilled with properly compacted structural fill.

4.1.3 SITE PREPARATION, EROSION CONTROLL, WET WEATHER

Any silty or organic rich native soils may be moisture-sensitive and become soft and difficult to traverse with construction equipment when wet. During wet weather, the contractor should take measures to protect any exposed soil subgrades, limit construction traffic during earthwork activities, and limit machine use only to areas undergoing active preparation.

Once the geotechnical engineer has approved a subgrade, further measures should be implemented to prevent degradation or disturbance of the subgrade. These measures could include, but are not limited to, placing a layer of crushed rock or lean concrete on the exposed subgrade, or covering the exposed subgrade with a plastic tarp and keeping construction traffic off the subgrade. Once subgrade has been approved, any disturbance because the subgrade was not protected should be repaired by the contractor at no cost to the owner.

During wet weather, earthen berms or other methods should be used to prevent runoff from draining into excavations. All runoff should be collected and disposed of properly. Measures may also be required to reduce the moisture content of on-site soils in the event of wet weather. These measures can include, but are not limited to, air drying and soil amendment, etc.

4.2 STRUCTURAL FILL MATERIALS AND COMPACTION

4.2.1 MATERIALS

All material placed below structures or pavement areas should be considered structural fill. Structural fill material shall be free of deleterious materials, have a maximum particle size of 4 inches, and be compactable to the required compaction level. Excavated site soils are not considered suitable for reuse as structural fill. Imported material can be used as structural fill. Imported structural fill material should conform to the WSDOT manual Section 9-03.14(1) Gravel Borrow, or an approved alternative import material. Controlled-density fill (CDF) or lean mix concrete can be used as an alternative to structural fill materials, except in areas where free-draining materials are required or specified.

Imported materials utilized for trench back fill shall conform to Section 9-03.19, Trench Backfill, of the most recent edition (at the time of construction) of the State of Washington Department of Transportation *Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT Standard Specifications)*. Imported materials utilize as grade fill beneath roads shall conform to WSDOT Section 9-03.10, Gravel Base. Soils with fines content near or greater than 10% fines content may likely be moisture sensitive and become difficult to use during wet weather. Care should be taken by the earthwork contractor during grading to avoid contaminating stockpiled soils that are planned for reuse as structural fill with native organic materials.

Frozen soil is not suitable for use as structural fill. Fill material may not be placed on frozen soil.

The contractor should submit samples of each of the required earthwork materials to the materials testing lab for evaluation and approval prior to delivery to the site. The samples should be submitted **at least 5 days prior to their delivery** and sufficiently in advance of the work to allow the contractor to identify alternative sources if the material proves unsatisfactory.

4.2.2 UTILITY TRENCHES AND EXCAVATIONS

Pipe bedding material should conform to the manufacturer's recommendations and be worked around the pipe to provide uniform support. Cobbles exposed in the bottom of utility excavations should be covered with pipe bedding or removed to avoid inducing concentrated stresses on the pipe.

4.2.3 FILL PLACEMENT AND COMPACTION

For lateral and bearing support, structural fill placement below footings shall extend at minimum a distance past each edge of the base of the footing equal to the depth of structural fill placed below the footing [e.g., for a 2.0-foot wide footing, fills placed to approximately 1.5 feet below footing grade will require a minimum backfill width of 5.0 feet (1.5 feet each side plus 2.0-foot width of footing)].

Prior to placement and compaction, structural fill should be moisture conditioned to within 3 percent of its optimum moisture content. Loose lifts of structural fill shall not exceed 12 inches in thickness. All structural fill shall be compacted to a firm and unyielding condition and to a minimum percent compaction based on its modified Proctor maximum dry density as determined per ASTM D1557. Structural fill placed beneath each of the following shall be compacted to the indicated percent compaction:

- Foundation and Floor Slab Subgrades: 95 Percent
- Pavement Subgrades & wall backfill (upper 2 feet): 95 Percent
- Pavement Subgrades & wall backfill (below 2 feet): 90 Percent
- Utility Trenches (upper 4 feet): 95 Percent
- Utility Trenches (below 4 feet): 90 Percent

A sufficient number of tests should be performed to verify compaction of each lift. The number of tests required will vary depending on the fill material, its moisture condition and the equipment being used. Initially, more frequent tests will be required while the contractor establishes the means and methods required to achieve proper compaction.

Jetting or flooding is not a substitute for mechanical compaction and should not be allowed.

We recommend that fill placed on slopes steeper than 3:1 (H:V) be 'benched' in accordance with hillside terraces entry of section 2-03.3(14) of the WSDOT Standard Specifications.

4.3 TEMPORARY EXCAVATIONS AND SLOPES

All excavations and slopes must comply with applicable local, state, and federal safety regulations. Construction site safety is the sole responsibility of the Contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations. We are providing soil type information solely as a service to our client for planning purposes. Under no circumstances should the information be interpreted to mean that QG is assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not being implied and should not be inferred. The contractor shall be responsible for the safety of personnel working in utility trenches. Given that steep excavations in native soils may be prone to caving, we

recommend all utility trenches, but particularly those greater than 4 feet in depth, be supported in accordance with state and federal safety regulations. Heavy construction equipment, building materials, excavated soil, and vehicular traffic should not be allowed near the top of any excavation.

Temporary excavations and slopes should be protected from the elements by covering with plastic sheeting or some other similar impermeable material. Sheeting sections should overlap by at least 12 inches and be tightly secured with sandbags, tires, staking, or other means to prevent wind from exposing the soils under the sheeting.

5.0 SPECIAL INSPECTION

The recommendations made in this report assume that an adequate program of tests and observations will be made throughout construction to verify compliance with these recommendations. Testing and observations performed during construction should include, but not necessarily be limited to, the following:

- Geotechnical plan review and engineering consultation as needed prior to construction phase,
- Observations and testing during site preparation, earthwork, structural fill, and pavement section placement,
- Consultation on temporary excavation cutslopes and shoring if needed,
- Consultation as necessary during construction.

QG recommends that a local and reputable materials testing & inspection firm be retained for construction phase testing and observation in accordance with the local code requirements. We also strongly recommend that QG be retained as the project Geotechnical Engineering Firm of Record (GER) during the construction of this project to perform periodic supplementary geotechnical observations and review the special inspectors reports during construction.

Our knowledge of the project site and the design recommendations contained herein will be of great benefit in the event that difficulties arise and either modifications or additional geotechnical engineering recommendations are required or desired. We can also, in a timely fashion observe the actual soil conditions encountered during construction, evaluate the applicability of the recommendations presented in this report to the soil conditions encountered, and recommend appropriate changes in design or construction procedures if conditions differ from those described herein.

We would be pleased to meet with you at your convenience to discuss the *Time & Materials* scope and cost for these services.

6.0 LIMITATIONS

Upon acceptance and use of this report, and its interpretations and recommendations, the User shall agree to indemnify and hold harmless QG, including its owners, employees and subcontractors, from any adverse effects resulting from development and occupation of the subject site. Ultimately, it is the owner's choice to develop and live in such an area of possible geohazards (which exist in perpetuity across the earth in one form or another), and therefore the future consequences, both anticipated and unknown, are solely the responsibility of the owner. By using this report for development of the subject property, the owner must accept and understand that it is not possible to fully anticipate all inherent risks of development. The recommendations provided above are intended to reduce (but may not eliminate) such risks.

This report does not represent a construction specification or plan and shall not be used or referenced as such. The information included in this report should be considered supplemental to the requirements contained in the project plans & specifications and should be read in conjunction with the above referenced information. The selected recommendations presented in this report are intended to inform only the specific corresponding subjects. All other requirements of the above-mentioned items remain valid, unless otherwise specified.

Recommendations contained in this report are based on our understanding of the proposed development and construction activities, field observations and explorations, and laboratory test results. It is possible that soil and groundwater conditions could vary and differ between or beyond the points explored. If soil or groundwater conditions are encountered during construction that differ from those described herein, or if the scope of the proposed construction changes from that described in this report, QG should be notified immediately in order to review and provide supplemental recommendations.

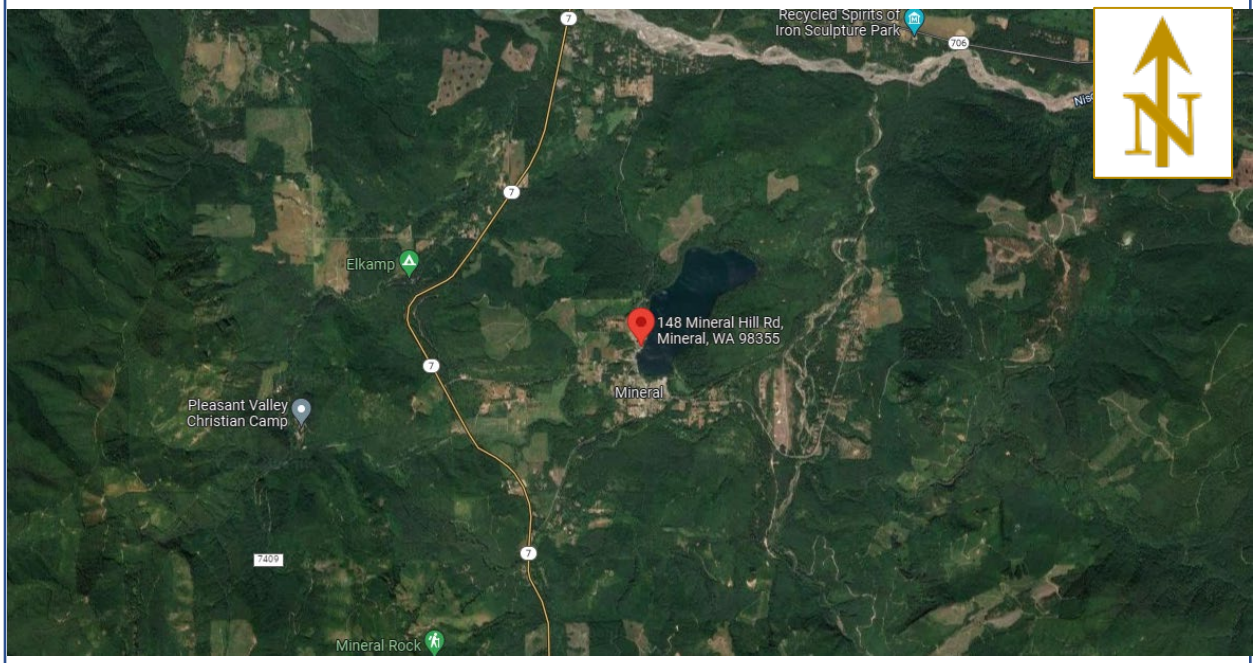
The findings of this study are limited by the level of scope applied. We have prepared this report in substantial accordance with the generally accepted geotechnical engineering practice as it exists in the subject region. No warranty, expressed or implied, is made. The recommendations provided in this report assume that an adequate program of tests and observations will be conducted by a WABO approved special inspection firm during the construction phase in order to evaluate compliance with our recommendations.

This report may be used only by the Client and their design consultants and only for the purposes stated within a reasonable time from its issuance, but in no event later than 18 months from the date of the report. It is the Client's responsibility to ensure that the Designer, Contractor, Subcontractors, etc. are made aware of this report in its entirety. Note that if another firm assumes Geotechnical Engineer of Record responsibilities, they need to review this report and either concur with the findings, conclusions, and recommendations or provide alternate findings, conclusions and recommendation.

Land or facility use, on- and off-site conditions, regulations, or other factors may change over time, and additional work may be required. Based on the intended use of the report, QG may recommend that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the Client or anyone else will release QG from any liability resulting from the use of this report. The Client, the design consultants, and any unauthorized party, agree to defend, indemnify, and hold harmless QG from any claim or liability associated with such unauthorized use or non-compliance. We recommend that QG be given the opportunity to review the final project plans and specifications to evaluate if our recommendations have been properly interpreted. We assume no responsibility for misinterpretation of our recommendations.

Appendix A. REGION & VICINITY MAPS

REGION

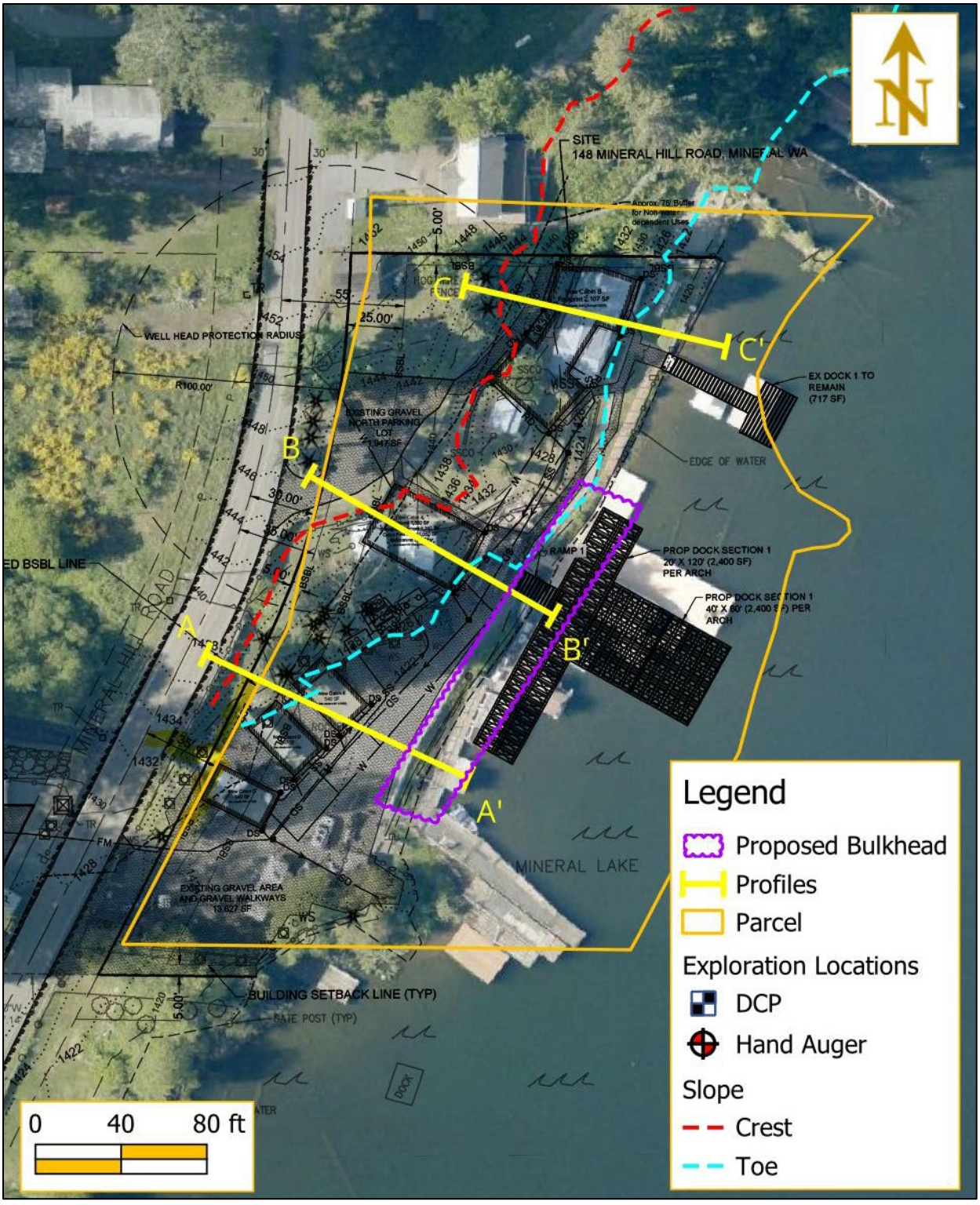


VICINITY



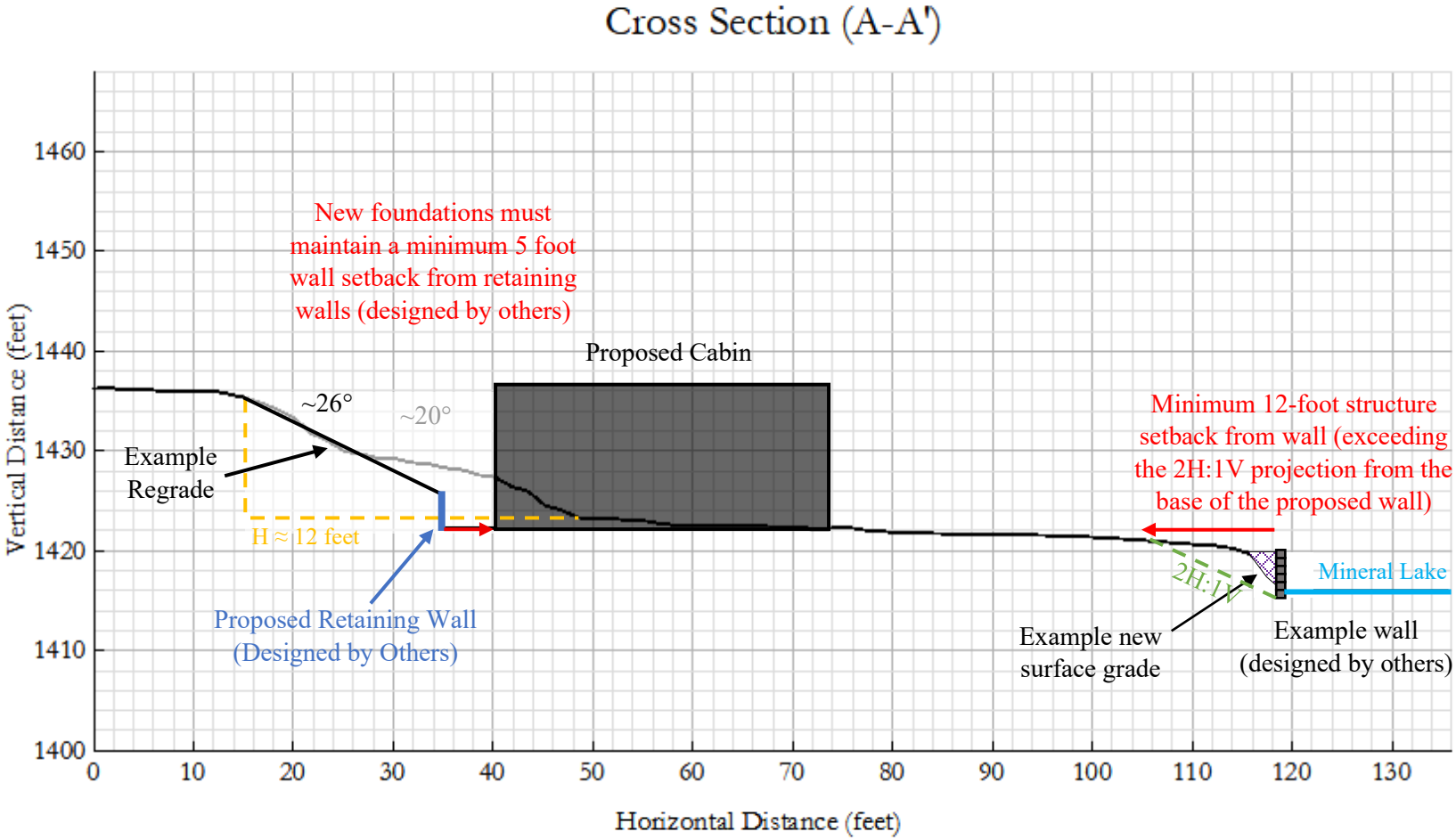
Quality Geo NW, PLLC	**Site Region** Mineral Lake Geo	Source: Google Imagery, 2026 **Scale & Locations are approx.** **Not for Construction**	**Figure 1**

Appendix B. EXPLORATION MAP

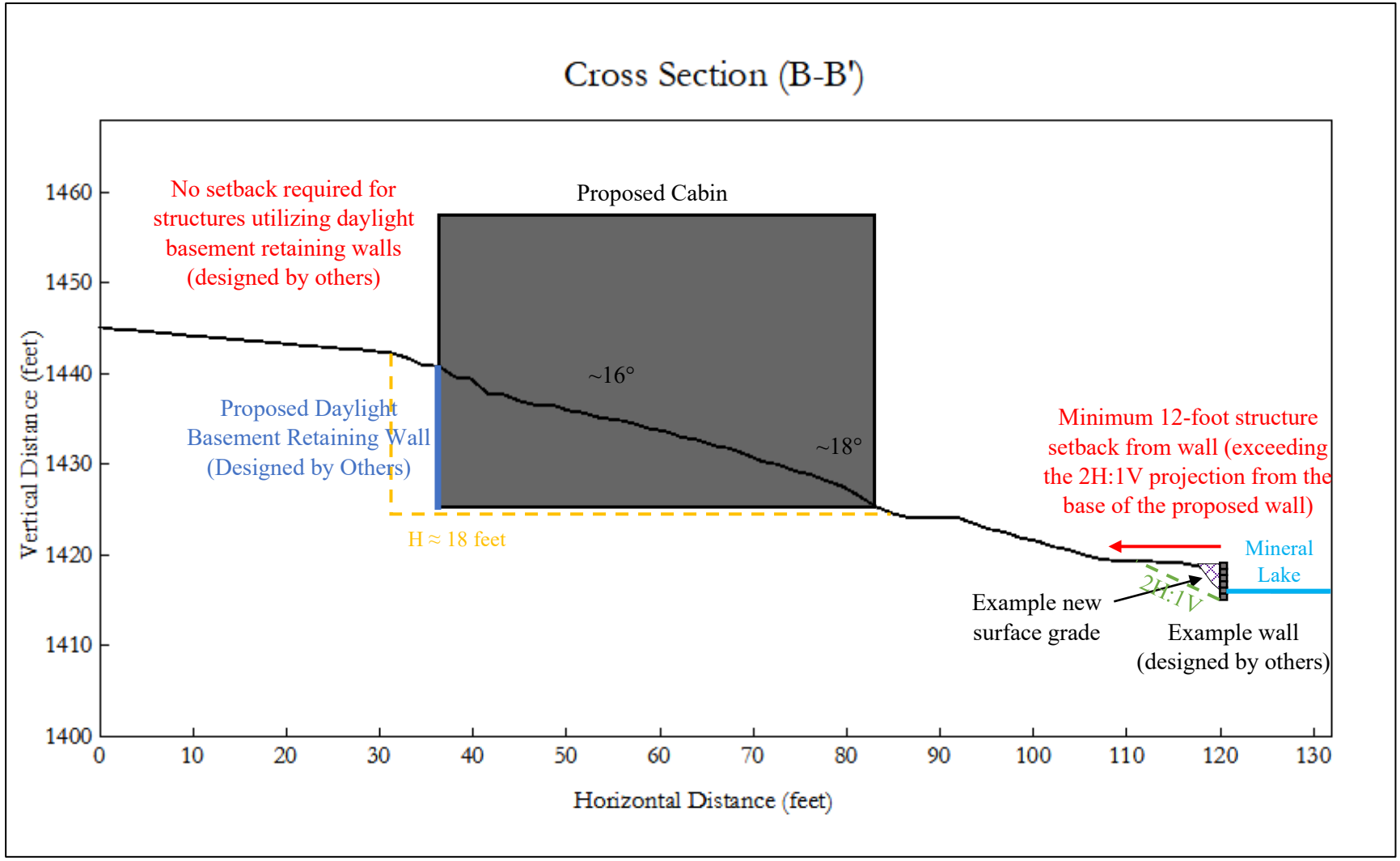


Quality Geo NW, PLLC	**Site Map** Mineral Lake Resort	Source: Google Imagery, 2026 **Scale & Locations are approx.** **Not for Construction**	**Figure 2**

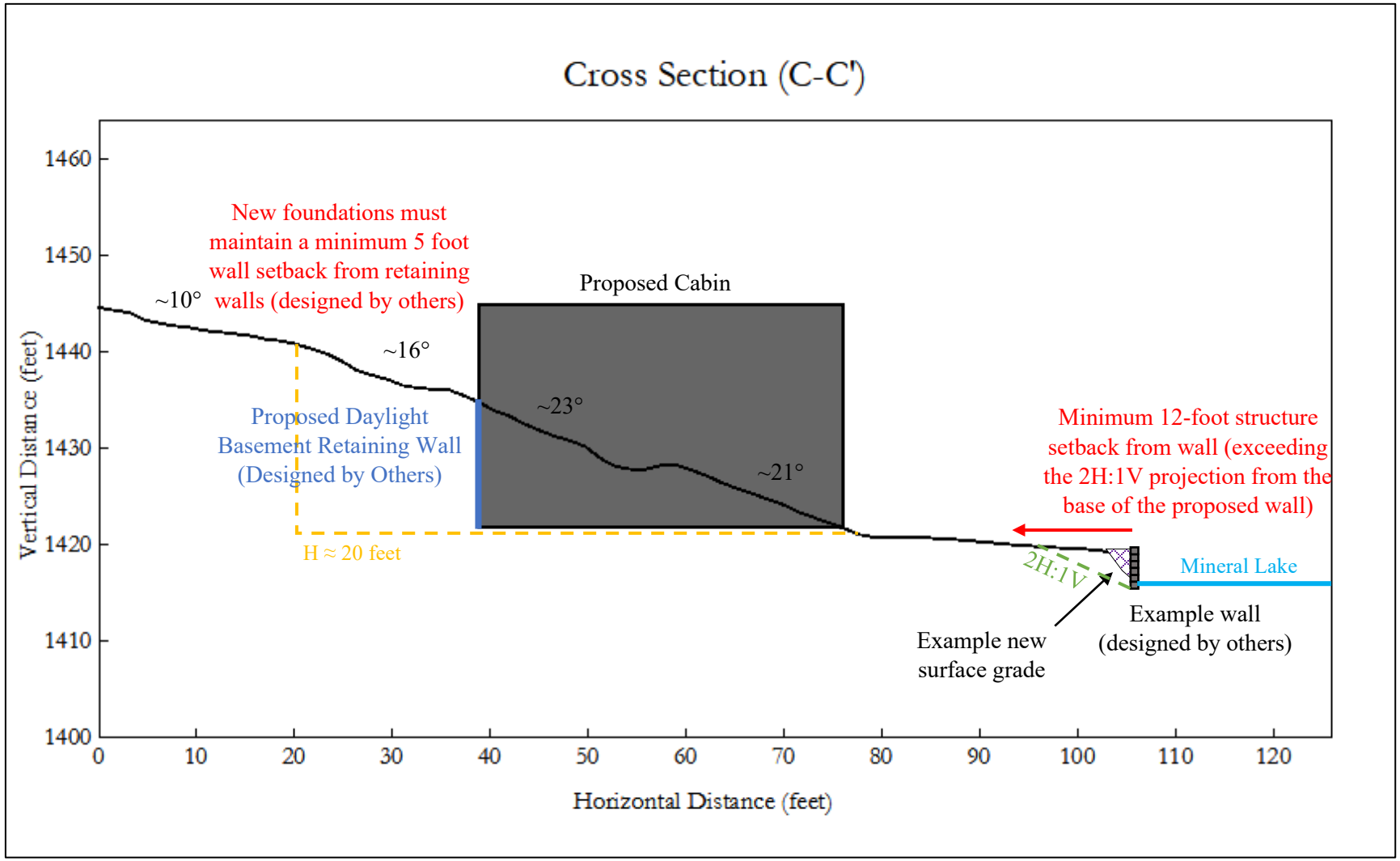
Appendix C. SLOPE PROFILES



Quality Geo NW, PLLC	**Slope Profile A – A'** Mineral Lake Resort Bulkhead Study	Source: Mapped Topo & Hand Measurements **Scale & Locations are approx.** **Not for Construction**	**Figure 3a**



Quality Geo NW, PLLC	**Slope Profile B – B'** Mineral Lake Resort Bulkhead Study	Source: Mapped Topo & Hand Measurements **Scale & Locations are approx.** **Not for Construction**	**Figure 3b**



Quality Geo NW, PLLC	**Slope Profile C – C'** Mineral Lake Resort Bulkhead Study	Source: Mapped Topo & Hand Measurements **Scale & Locations are approx.** **Not for Construction**	**Figure 3c**

Appendix D. EXPLORATION LOGS

Hand Auger Log HA-1

PROJECT NUMBER QG22-195
PROJECT NAME Mineral Lake Resort
PROJECT LOCATION Mineral, WA

FIELD WORK DATE 10/27/2022
DRILLING METHOD Hand Auger

BORING LOCATION TPN 037061000000
SURFACE ELEVATION Existing
LOGGED BY AW

COMMENTS

Depth (ft)	Samples	Is Analysed?	Graphic Log	USCS	Material Description
0				TS	TOPSOIL Brown, very moist, loose, heavy organics, no cobbles, no mottling Gravel= 20% Sand= 50% Fines= 30%
2				SM	SILTY SAND with GRAVEL Dark brown, saturated, medium dense, no organics, no cobbles, no mottling Gravel= 35% Sand= 50% Fines= 15% ▽
5					Termination Depth at 4.8 feet. Terminated at contracted depth. Groundwater encountered at 3.5 feet

Quality Geo NW, PLLC - Ph: 360-878-9705, qualitygeonw.com, 4631 Whitman Lane SE, Ste D, Lacey, WA
produced by ESlog.ESdat.net on 17 Nov 2022

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Hand Auger Log HA-2

PROJECT NUMBER QG22-195
PROJECT NAME Mineral Lake Resort
PROJECT LOCATION Mineral, WA

FIELD WORK DATE 10/27/2022
DRILLING METHOD Hand Auger

BORING LOCATION TPN 037071000000
SURFACE ELEVATION Existing
LOGGED BY AW

COMMENTS

Depth (ft)	Samples	Is Analysed?	Graphic Log	USCS	Material Description
0				TS	TOPSOIL Brown, very moist, loose, heavy organics, no cobbles, no mottling Gravel= 20% Sand= 50% Fines= 30%
0.5					
1					
1.5					
2					
2.5					Termination Depth at 2.5 feet. Terminated due to equipment refusal. No groundwater encountered.

Hand Auger Log HA-3

PROJECT NUMBER QG22-195
PROJECT NAME Mineral Lake Resort
PROJECT LOCATION Mineral, WA

FIELD WORK DATE 10/27/2022
DRILLING METHOD Hand Auger

BORING LOCATION TPN 037061000000
SURFACE ELEVATION Existing
LOGGED BY AW

COMMENTS

Depth (ft)	Samples	Is Analysed?	Graphic Log	USCS	Material Description
0				TS	TOPSOIL Brown, very moist, loose, heavy organics, no cobbles, no mottling Gravel= 20% Sand= 50% Fines= 30%
0.5					
1					
1.5					Termination Depth at 1.5 feet. Terminated due to equipment refusal. No groundwater encountered.

WILDCAT DYNAMIC CONE LOG

Quality Geo NW, PLLC
Geotechnical Consultants
Lacey, WA

PROJECT NUMBER: QG22-195
DATE STARTED: 10-27-2022
DATE COMPLETED: 10-27-2022

HOLE #: DCP-1
CREW: AW
PROJECT: Mineral Lake Resort
ADDRESS: 148 Mineral Hill Rd, Mineral, WA
LOCATION: Center of TPN 037061000000

SURFACE ELEVATION: Existing
WATER ON COMPLETION: No
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	2	8.9	••	2	VERY LOOSE	SOFT
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 1 ft	11	48.8	••••••••••••	13	MEDIUM DENSE	STIFF
-	42	186.5	••	25+	VERY DENSE	HARD
-	17	75.5	••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
- 2 ft	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	2	8.9	••	2	VERY LOOSE	SOFT
- 3 ft	1	4.4	•	1	VERY LOOSE	VERY SOFT
- 1 m	2	8.9	••	2	VERY LOOSE	SOFT
-	2	7.7	••	2	VERY LOOSE	SOFT
- 4 ft	4	15.4	••••	4	VERY LOOSE	SOFT
-	2	7.7	••	2	VERY LOOSE	SOFT
-	2	7.7	••	2	VERY LOOSE	SOFT
- 5 ft	4	15.4	••••	4	VERY LOOSE	SOFT
-	4	15.4	••••	4	VERY LOOSE	SOFT
-	11	42.5	••••••••••••	12	MEDIUM DENSE	STIFF
- 6 ft	10	38.6	••••••••••	11	MEDIUM DENSE	STIFF
-	15	57.9	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 2 m	16	61.8	•••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
- 7 ft	16	54.7	••••••••••••••••	15	MEDIUM DENSE	STIFF
-	15	51.3	••••••••••••••	14	MEDIUM DENSE	STIFF
-	21	71.8	••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
- 8 ft	10	34.2	•••••••••	9	LOOSE	STIFF
-	21	71.8	••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-	11	37.6	•••••••••	10	LOOSE	STIFF
- 9 ft	12	41.0	••••••••••	11	MEDIUM DENSE	STIFF
-	11	37.6	•••••••••	10	LOOSE	STIFF
-	12	41.0	••••••••••	11	MEDIUM DENSE	STIFF
- 3 m 10 ft	22	75.2	••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
-	21	64.3	•••••••••••••••••	18	MEDIUM DENSE	VERY STIFF
-	30	91.8	••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	30	91.8	••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 11 ft	35	107.1	••••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	50	153.0	••	25+	DENSE	HARD
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

Quality Geo NW, PLLC
Geotechnical Consultants
Lacey, WA

PROJECT NUMBER: QG22-195
DATE STARTED: 10-27-2022
DATE COMPLETED: 10-27-2022

HOLE #: DCP-2
CREW: AW
PROJECT: Mineral Lake Resort
ADDRESS: 148 Mineral Hill Rd, Mineral WA
LOCATION: Center of TPN 037071000000

SURFACE ELEVATION: Existing
WATER ON COMPLETION: No
HAMMER WE)s.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	9	40.0	•••••••••••	11	MEDIUM DENSE	STIFF
-	8	35.5	••••••••••	10	LOOSE	STIFF
- 1 ft	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	3	13.3	•••	3	VERY LOOSE	SOFT
- 2 ft	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
-	2	8.9	••	2	VERY LOOSE	SOFT
- 3 ft	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
- 1 m	50	222.0	••	25+	VERY DENSE	HARD
-						
- 4 ft						
-						
-						
- 5 ft						
-						
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						