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GEOTECHNICAL REPORT

Monroe 30
13611 - 175th Avenue Southeast
Snohomish, Washington

Project No. T-9089

Terra Associates, Inc.

Prepared for:

South Lake Ridge, LLC
c/o Land Pro Group
Lake Stevens, Washington

April 3, 2025

TERRA ASSOCIATES, Inc.
Consultants in Geotechnical Engineering, Geology
and
Environmental Earth Sciences

April 3, 2025
Project No. T-9089

Ms. Abi Toyer
South Lake Ridge, LLC
c/o Land Pro Group
10515 – 20th Street Southeast, Suite 202
Lake Stevens, Washington 98258

Subject: Geotechnical Report
Monroe 30
12611 – 175th Avenue Southeast
Snohomish, Washington

Dear Ms. Toyer:

As requested, we conducted a geotechnical engineering study for the subject project. The attached report presents our findings and recommendations for the geotechnical aspects of project design and construction.

Our field exploration indicates the site is generally underlain by glacial till soils consisting predominantly of medium dense to very dense silty sand with gravel. We did not observe groundwater seepage in any of the test pits.

In our opinion, there are no geotechnical conditions that would preclude development of the site, as currently planned. The residences can be supported on conventional spread footings bearing on competent native soils or on structural fill that is placed on a competent native soil subgrade. Floor slabs and pavements can be similarly supported.

Detailed recommendations addressing these issues and other geotechnical design considerations are presented in the attached report. We trust the information presented is sufficient for your current needs. If you have any questions or require additional information, please call.

Sincerely yours,
TERRA ASSOCIATES, INC.

John Manke, L.E.G.
Project Geologist

Carolyn S. Decker, P.E.
President

4-3-25

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1.0 PROJECT DESCRIPTION

The project consists of developing the site with residential building lots along with associated access, utilities, and landscaping. Based on review of the "Monroe 30 Layout with Townhomes", the site will be developed with 174 townhome units divided into 4-plex, 5-plex, and 6-plex buildings. Site stormwater will be collected and directed to a facility in the southwest portion of the site. Grading plans were not available at the time of this report. Based on existing topography grading is expected to be minimal with cuts and fills from one to five feet.

We expect that the residences would be two- to four- story, wood-frame structures, with their main floors constructed at grade or framed over a crawl space. Foundation loads should be relatively light, in the range of 2 to 4 kips per foot for bearing walls and 25 to 75 kips for isolated columns.

The recommendations contained in the following sections of this report are based on our understanding of the above design features. We should review design drawings as they become available to verify that our recommendations have been properly interpreted and incorporated into project design and to amend or supplement our recommendations, if required.

2.0 SCOPE OF WORK

Our work was completed in accordance with our authorized proposal dated June 25, 2024. Accordingly, on September 12 and 13, 2024, we explored subsurface conditions at the site by observing soil conditions in 23 test pits excavated to depths of about 9 to 12 feet below existing surface grades using a track-mounted excavator. Using the results of our field study and laboratory testing, analyses were undertaken to develop geotechnical recommendations for project design and construction. Specifically, this report addresses the following:

- Soil and groundwater conditions.
- Geologic hazards per the Snohomish County Code.
- Seismic site class per the current International Building Code (IBC).
- Site preparation and grading.
- Excavations.
- Foundations.
- Floor slabs.
- Infiltration feasibility.
- Stormwater facilities.

- Drainage.
- Utilities.
- Pavements.

It should be noted that recommendations outlined in this report regarding drainage are associated with soil strength, design earth pressures, erosion, and stability. Design and performance issues with respect to moisture as it relates to the structure environment are beyond Terra Associates' purview. A building envelope specialist or contactor should be consulted to address these issues, as needed.

3.0 SITE CONDITIONS

3.1 Surface

The project site is an approximately 24.87-acre assemblage of 8 tax parcels located at, north, and east of 12611 – 175th Avenue Southeast in Snohomish, Washington. The site location is shown on Figure 1.

The site is currently developed with four single-family residential buildings, some outbuildings, and associated access and landscaping in the western portion of the site. The northeast corner of the site has been cleared and is used for storage of various objects. The remainder of the site is predominantly undeveloped and covered with a moderate forest and associated understory. Site topography consists of a slope that descends from the east to the west with a gradient of approximately 10 percent and an overall relief of approximately 130 feet.

3.2 Soils

The soil conditions observed in the test pits generally consisted of approximately six inches of topsoil overlying medium dense to very dense silty sand and silty sand with gravel to the termination of the test pits. The upper approximately two to three feet of the formation is generally in a medium dense and moist condition. The soils observed below these depths are generally dense to very dense, weakly to moderately cemented, and moist.

The *Geologic map of the Lake Roesiger 7.5-minute quadrangle, Snohomish County, Washington* by Dragovich, et al. (2015) shows the site mapped as Vashon lodement till (Qgt_v) and Vashon advance outwash deposits (Qva_v). The dense to very dense, weaky to moderately cemented, silty sand with gravel that we observed in the test pits is generally consistent with the mapped Vashon lodgment till.

The preceding discussion is intended to be a general review of the soil conditions encountered. Detailed descriptions of the subsurface conditions are presented on the Test Pit Logs in Appendix A. The approximate locations of the test pits are shown on Figure 2.

3.3 Groundwater

We did not observe groundwater seepage in the test pits. However, we observed mottling of the soils between depths of about one and one-half and three feet, indicating that they have been impacted by perched groundwater at times. The occurrence of shallow perched groundwater is typical for sites underlain by relatively impermeable till and till-like soils. Perched groundwater levels and seepage flow rates will typically fluctuate on a seasonal basis with the highest levels developing during the wet winter months.

3.4 Geologic Hazards

We evaluated current site conditions for the presence of geologic hazards per the Snohomish County Unified Development Code (SCC). Per SCC Chapter 30.91G.020 (Geologic hazard areas), geologically hazardous areas include erosion hazard areas, landslide hazard areas, seismic hazard areas, and mine hazard areas.

3.4.1 Erosion Hazard Areas

SCC Chapter 30.91E.160 (Erosion hazard areas) defines erosion hazard areas as:

(1) "Areas containing soils which are at high risk from water erosion according to the mapped description units of the United States Department of Agriculture Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service, National Soil Classification System;

(2) Channel migration zones; and

(3) The shorelines of water bodies subject to wind and wave erosion."

Conditions meeting the criteria provided in items 2 and 3 above do not exist at the site. The NRCS has mapped the soils in the proposed development areas of the site as *Tokul gravelly medial loam, 0 to 8 percent slopes and Tokul gravelly medial loam, 8 to 15 percent slopes*. Based on our observations, the site soils are more with the *Tokul gravelly medial loam* soils, which are described by the NRCS as derived from till. The *Tokul gravelly medial loam, 0 to 8 percent slopes and 8 to 15 percent slopes* are not mapped as having a severe erosion hazard.

As discussed, we did not observe any indications of significant active erosion at the site. Regardless, the site soils will be susceptible to erosion when exposed during construction. In our opinion, proper installation and maintenance of Best Management Practices (BMPs) for erosion prevention and sedimentation control would adequately mitigate the erosion potential in the proposed development areas. All BMPs for erosion prevention and sedimentation control should conform to Snohomish County requirements.

3.4.2 Landslide Hazard Areas

SCC Chapter 30.91L.040 (Landslide hazard areas) defines landslide hazard areas as "…areas potentially subject to mass earth movement based on a combination of geologic, topographic, and hydrologic factors, with a vertical height of 10 feet or more. These include the following:

(1) Areas of historic landslides as evidenced by landslide deposits, avalanche tracks, and areas susceptible to basal undercutting by streams, rivers or waves;

(2) Areas with slopes steeper than 33 percent which intersect geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock, and which contain springs or ground water seeps;

(3) Areas located in a canyon or an active alluvial fan, susceptible to inundation by debris flows or catastrophic flooding.

For subsections (1), (2), and (3) of this section, the landslide hazard area also includes lands within a distance from the top of the slope equal to the height of the slope or within a distance of the toe of the slope equal to two times the height of the slope."

In our opinion, the site conditions do not meet the above criteria defining landslide hazard areas. Therefore, in our opinion, the site does not contain a landslide hazard area as defined by the SCC.

LiDAR Review

We reviewed LiDAR digital terrain (bare earth) modeling of the site for indications of characteristic landslide topography and potentially unstable landforms using the Washington State Department of Natural Resources Lidar Portal website (https://lidarportal.dnr.wa.gov/). Our review of the LiDAR model identified no surface features indicative of deep-seated landsliding or unstable conditions. This is consistent with our field observations.

DNR Map Review

Review of landslide compilation mapping from the Washington State Department of Natural Resources (DNR) Geologic Information Portal interactive website (https://geologyportal.dnr.wa.gov/#natural_hazards) shows no deep-seated landslides or landslide morphology mapped on the subject site. This is consistent with our field observations.

3.4.3 Seismic Hazard Areas

SCC Chapter 30.91S.121 (Seismic hazard areas) defines seismic hazard areas as "…areas that have been determined by the building official to have known or inferred faults, ground rupture potential, liquefaction potential, or seismically induced slope instability, where such information is provided to Snohomish County through any of the following means: geotechnical studies and reports prepared by licensed professionals pursuant to chapter 19.27 RCW, SCC 30.62B.140 or 30.62B350; geotechnical studies and reports prepared by federal, state or local agencies; and geotechnical studies, reports or environmental impact statements prepared through the requirements of the State Environmental Policy Act (SEPA) chapter 43.21C RCW."

The closest known Class A fault (existence of Quaternary fault of tectonic origin demonstrated by geologic evidence) to the project site is the Southern Whidbey Island Fault Zone (SWIFZ). The SWIFZ is described as a northwest-trending (average strike N51°W), 5- to 7-kilometer-wide fault zone that extends more than 65 kilometers from the Strait of Juan de Fuca southeast to Mukilteo on the eastern side of Possession Sound (USGS Quaternary Faults Web Mapping Application, https://www.usgs.gov/tools/interactive-us-fault-map, accessed September 20, 2024).

Projection of the fault zone striking north 51 degrees west to the southeast passes approximately three miles southwest of the subject site. We did not observe any indications of faulting or surface rupture at the project site and are unaware of any reported documentation of surface rupture due to past movement along the SWIFZ in the project area. Considering this, it is our opinion that the potential for ground rupture at the project site during a severe seismic event is low.

Liquefaction is a phenomenon where there is a reduction or complete loss of soil strength due to an increase in water pressure induced by vibrations. Liquefaction mainly affects geologically recent deposits of fine-grained sand that is below the groundwater table. Soils of this nature derive their strength from intergranular friction. The generated water pressure or pore pressure essentially separates the soil grains and eliminates this intergranular friction; thus, eliminating the soil's strength.

The DNR Geologic Information Portal liquefaction susceptibility mapping shows site conditions having a very low susceptibility to soil liquefaction. Based on the soil and groundwater conditions we observed at the site, it is our opinion that the risk for damage resulting from seismically-induced slope failure and soil liquefaction at the site is negligible. Therefore, in our opinion, the site is not a seismic hazard area as defined by the SCC.

3.4.4 Mine Hazard Areas

SCC Chapter 30.91M.090 (Mine hazard areas) defines mine hazard areas as "…areas underlain by or affected by underground mine workings such as tunnels, air shafts and those areas adjacent to steep slopes produced by open pit mining or quarrying, but excluding any areas where the mine workings have been properly stabilized and closed and made safe consistent with all applicable federal, state and local laws."

The DNR Geologic Information Portal mines and minerals mapping shows no active or historic mines on or adjacent the project site. No evidence of mine works such as sink holes, tunnel entrances or shafts were observed on site. Therefore, it is our opinion that the site is not a coal mine hazard area as defined by the SCC.

3.5 Seismic Site Class

Based on the site soil conditions and our knowledge of the area geology, per the current International Building Code (IBC), site class "C" should be used in structural design.

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 General

Based on our study, there are no geotechnical conditions that would preclude development of the site as currently planned. Residences can be supported on conventional spread footings bearing on competent native soils underlying organic topsoil or on structural fill placed on a competent native soil subgrade. Floor slabs and pavements can be similarly supported.

The site soils contain a sufficient amount of fines (silt- and clay-sized particles) such that they will be difficult to compact as structural fill when too wet or too dry. Accordingly, the ability to use the soils from site excavations as structural fill will depend upon their moisture content and the prevailing weather conditions at the time of construction. If grading activities take place during the winter season, the owner should be prepared to import free-draining granular material for use as structural fill and backfill.

Detailed recommendations regarding these issues and other geotechnical design considerations are provided in the following sections of this report. These recommendations should be incorporated into the final design drawings and construction specifications.

4.2 Site Preparation and Grading

To prepare the site for construction, all vegetation, organic surface soils, and other deleterious materials should be stripped and removed from the site. We expect surface stripping depths of approximately 6 to 12 inches will generally be required to remove the organic surficial soils in the planned development areas. Stripped vegetation debris should be removed from the site. Organic soils will not be suitable for use as structural fill but may be used for limited depths in nonstructural areas or for landscaping purposes. In the developed portions of the site, demolition of existing structures should include removal of existing foundations, slabs, and pavements, and abandonment of drainfields and buried utilities. Abandoned utility pipes that fall outside of new building areas can be left in place provided they are sealed to prevent intrusion of groundwater seepage and soil.

Once clearing and grubbing operations are complete, cut and fill operations to establish desired building pad and roadway elevations can be initiated. A representative of Terra Associates, Inc. should examine all bearing surfaces to verify that conditions encountered are as anticipated and are suitable for placement of structural fill or direct support of building and pavement elements. Our representative may request proofrolling exposed surfaces with a heavy rubber-tired vehicle to determine if any isolated soft and yielding areas are present. If unstable yielding areas are observed, they should be cut to firm bearing soil and filled to grade with structural fill. If the depth of excavation to remove unstable soils is excessive, use of geotextile fabric such as Mirafi 500X or equivalent in conjunction with structural fill can be considered in order to limit the depth of removal. In general, our experience has shown that a minimum of 18 inches of clean, granular structural fill over the geotextile fabric should establish a stable bearing surface.

Our study indicates that the site soils typically contain a significant percentage of fines (silt and clay sized particles) that will make the soils difficult to compact as structural fill when too wet or too dry. Provided these soils are near optimum moisture when excavated, and are placed during dry weather conditions, we anticipate they will be suitable for direct use as structural fill. Soils that are wet of optimum when excavated or become wet prior to use as structural fill will require drying by aeration during dry weather conditions or using soil amendments such as lime or Portland cement to reduce and stabilize the soil's moisture content. If soil amendment products are used, additional Temporary Erosion and Sedimentation Control (TESC) BMPs will need to be implemented to mitigate potential impacts to stormwater runoff associated with possible elevated pH levels.

If grading activities are planned during the wet winter months, or if they extend into fall and winter, the owner should be prepared to import wet weather structural fill. For this purpose, we recommend importing a granular soil that meets the following grading requirements:

U.S. Sieve Size	Percent Passing
6 inches	100
No. 4	75 maximum
No. 200	5 maximum*

*Based on the 3/4-inch fraction.

Prior to use, Terra Associates, Inc. should examine and test all materials planned to be imported to the site for use as structural fill.

Structural fill should be placed in uniform loose layers not exceeding 12 inches and compacted to a minimum of 95 percent of the soil's maximum dry density, as determined by American Society for Testing and Materials (ASTM) Test Designation D-1557 (Modified Proctor). The moisture content of the soil at the time of compaction should be within two percent of its optimum, as determined by this ASTM standard. In nonstructural areas, the degree of compaction may be reduced to 90 percent.

4.3 Excavations

All excavations at the site associated with confined spaces must be completed in accordance with local, state, and federal requirements. Based on the Washington State Safety and Health Administration (WSHA) regulations, the medium dense, weathered soils would typically be classified as Type B soils. The dense to very dense, cemented, glacial till soils would typically be classified as Type A soil.

Accordingly, for temporary excavations of more than 4 feet and less than 20 feet in depth, the side slopes in Type B soils should be laid back at a slope inclination of 1:1 (Horizontal: Vertical) or flatter. Temporary excavations in Type A soils can be laid back at inclinations of 0.75:1 or flatter. For temporary excavation slopes less than 8 feet in height in Type A soils, the lower 3.5 feet can be cut to a vertical condition with a 0.75:1 slope graded above. For temporary excavation slopes greater than 8 feet in height up to a maximum height of 12 feet, the slope above the 3.5-foot high vertical portion should be laid back to an inclination of 1:1 or flatter. No vertical cut with a backslope immediately above is allowed for excavation depths that exceed 12 feet. In this case, a 4-foot high vertical cut with an equivalent horizontal bench to the cut slope toe is required. If there is insufficient room to complete the excavations in the manners discussed above, or if excavations greater than 20 feet deep are planned, you may need to use temporary shoring to support the excavations.

Perched groundwater seepage should be anticipated within excavations extending to the surface of the dense to very dense glacial till, particularly during the wet winter months. In our opinion, the volume of water and rate of seepage flow into the excavation should be relatively minor and would not be expected to impact the stability of the excavations that are sloped as described above. Conventional sump pumping procedures along with a system of collection trenches, if necessary, should be capable of maintaining a relatively dry excavation for construction purposes in these soils.

The above information is provided solely for the benefit of the owner and other design consultants, and should not be construed to imply that Terra Associates, Inc. assumes responsibility for job site safety. It is understood that job site safety is the sole responsibility of the project contractor.

4.4 Foundations

Residential structures may be supported on conventional spread footing foundations bearing on competent native soils or on structural fill placed above these native soils. Foundation subgrades should be prepared as recommended in Section 4.2 of this report.

Perimeter foundations exposed to the weather should bear at a minimum depth of one and one-half feet below final exterior grades for frost protection. Interior foundations can be constructed at any convenient depth. We recommend designing foundations bearing on competent soil for a net allowable bearing capacity of 2,500 pounds per square foot (psf). For short-term loads, such as wind and seismic, a one-third increase in this allowable capacity can be used in design. With the anticipated loads and this bearing stress applied, building settlements should be less than one-half inch total and one-half inch differential.

For designing foundations to resist lateral loads, a base friction coefficient of 0.35 can be used. Passive earth pressure acting on the sides of the footings may also be considered. We recommend calculating this lateral resistance using an equivalent fluid weight of 350 pounds per cubic foot (pcf). We recommend not including the upper 12 inches of soil in this computation because they can be affected by weather or disturbed by future grading activity. This value assumes the foundations will be constructed neat against competent native soil or the excavations are backfilled with structural fill, as described in Section 4.2 of this report. The recommended passive and friction values include a safety factor of 1.5.

4.5 Slab-on-Grade Floors

Slab-on-grade floors may be supported on a subgrade prepared as recommended in Section 4.2 of this report. Immediately below the floor slab, we recommend placing a four-inch thick capillary break layer composed of clean, coarse sand or fine gravel that has less than five percent passing the No. 200 sieve. This material will reduce the potential for upward capillary movement of water through the underlying soil and subsequent wetting of the floor slab.

The capillary break layer will not prevent moisture intrusion through the slab caused by water vapor transmission. Where moisture by vapor transmission is undesirable, such as covered floor areas, a common practice is to place a durable plastic membrane on the capillary break layer and then cover the membrane with a layer of clean sand or fine gravel to protect it from damage during construction, and aid in uniform curing of the concrete slab. It should be noted that if the sand or gravel layer overlying the membrane is saturated prior to pouring the slab, it will be ineffective in assisting uniform curing of the slab and can actually serve as a water supply for moisture seeping through the slab and affecting floor coverings. Therefore, in our opinion, covering the membrane with a layer of sand or gravel should be avoided if floor slab construction occurs during the wet winter months and the layer cannot be effectively drained.

4.6 Lateral Earth Pressures for Below Grade Walls

The magnitude of earth pressures developing on below-grade walls will depend upon the quality and compaction of the wall backfill. We recommend placing and compacting wall backfill as structural fill as described in Section 4.2 of this report. To prevent overstressing the walls during backfilling, heavy construction machinery should not be operated within five feet of the wall. Wall backfill in this zone should be compacted with hand-operated equipment. To prevent hydrostatic pressure development, wall drainage must also be installed. A typical wall drainage detail is shown on Figure 3.

With wall backfill placed and compacted as recommended, and drainage properly installed, we recommend designing unrestrained walls for an active earth pressure equivalent to a fluid weighing 35 pounds per cubic foot (pcf). For restrained walls, an additional uniform load of 100 psf should be added to the 35 pcf. To account for typical traffic surcharge loading, the walls can be designed for an additional imaginary height of two feet (two-foot soil surcharge). For evaluation of wall performance under seismic loading, a uniform pressure equivalent to 8H psf, where H is the height of the below-grade portion of the wall should be applied in addition to the static lateral earth pressure. These values assume a horizontal backfill condition and that no other surcharge loading, sloping embankments, or adjacent buildings will act on the wall. If such conditions exist, then the imposed loading must be included in the wall design. Friction at the base of foundations and passive earth pressure will provide resistance to these lateral loads. Values for these parameters are provided in Section 4.4 of this report.

4.7 Infiltration Feasibility

In our opinion, infiltration of stormwater runoff will not be feasible at the site. The glacially consolidated till soils observed in the test pits are dense to very dense, weakly to moderately cemented, and generally contain a high percentage of soil fines, which all contribute to making the till relatively impermeable. The ability of the site soils to infiltrate is further reduced by the indication of the presence of the seasonally perched groundwater above the till, as observed in our test pits. Even low impact development (LID) would likely fill up, over top, and cause minor local flooding.

4.8 Stormwater Facilities

Site stormwater plans were not available at the time of this report.

Detention Vault

We expect the bottom of the excavations for the detention vaults will expose dense to very dense silty sand with gravel. Vault foundations supported by these very dense native soils may be designed for an allowable bearing capacity of 5,000 psf. For short-term loads, such as seismic, a one-third increase in this allowable capacity can be used.

Vault walls should be designed as below-grade retaining walls. The magnitude of earth pressure development on engineered retaining walls will partly depend on the quality of the wall backfill. We recommend placing and compacting wall backfill as structural fill as described in Section 4.2 of this report. To prevent overstressing the walls during backfilling, heavy construction machinery should not be operated within five feet of the wall. Wall backfill in this zone should be compacted with hand-operated equipment. To prevent hydrostatic pressure development, wall drainage must also be installed. A typical wall drainage detail is shown on Figure 3.

With wall backfill placed and compacted as recommended and drainage properly installed, we recommend designing unrestrained walls for an active earth pressure equivalent to a fluid weighing 35 pounds per cubic foot (pcf). For restrained walls, an additional uniform load of 100 pounds per square foot (psf) should be added to the 35 pcf. To account for typical traffic surcharge loading, the walls can be designed for an additional imaginary height of two feet (two-foot soil surcharge). For evaluation of below-grade walls under seismic loading, an additional uniform lateral pressure equivalent to 8H psf, where H is the height of the below-grade portion of the wall in feet, can be used.

These values assume a horizontal backfill condition and that no other surcharge loading such as traffic, sloping embankments, or adjacent buildings will act on the wall. If such conditions exist, then the imposed loading must be included in the wall design. Friction at the base of foundations and passive earth pressure will provide resistance to these lateral loads. Values for these parameters are given in Section 4.4 of this report.

If it is not possible to discharge collected water at the footing invert elevation, the invert elevation of the wall drainpipe could be set equivalent to the outfall invert. For any portion of the wall that falls below the invert elevation of the wall drain, an earth pressure equivalent to a fluid weighing 85 pcf should be used.

Stormwater Ponds

If fill berms are constructed, the berm locations should be stripped of topsoil, duff, and soils containing organic material prior to the placement of fill. The fill berms should be constructed by placing structural fill in accordance with recommendations outlined in Section 4.2 of this report. Material used to construct pond berms should consist of predominately granular soils with a maximum size of three inches and a minimum of 20 percent fines. Terra Associates, Inc. should examine and test all onsite or imported materials proposed for use as berm fill prior to their use.

Due to the exposure to fluctuating stored water levels and wave action, soils exposed on the interior side slopes of the ponds may be subject to some risk of periodic shallow instability or sloughing. Establishing interior slopes at a 3:1 gradient will significantly reduce or eliminate this potential. Exterior berm slopes and interior slopes above the maximum water surface should be graded to a finished inclination no steeper than 2:1. Finished slope faces should be thoroughly compacted and vegetated to guard against erosion.

We should review the stormwater plans when they are completed and revise our recommendations, if required.

4.9 Drainage

Surface

Final exterior grades should promote free and positive drainage away from the building areas. We recommend providing a positive drainage gradient away from the building perimeter. If a positive gradient cannot be provided, provisions for collection and disposal of surface water adjacent to the structure should be provided.

Surface water from developed areas must not be allowed to flow in an uncontrolled and concentrated manner toward or onto site slopes. Surface water should be directed away from the slopes to a point of collection and controlled discharge. If site grades do not allow for directing surface water away from the slope, then the water should be collected and tightlined to an approved point of controlled discharge.

Subsurface

We recommend installing a continuous drain along the outside lower edge of the perimeter building foundations. The drains can be laid to grade at an invert elevation equivalent to the bottom of footing grade. The drains can consist of four-inch diameter perforated PVC pipe that is enveloped in washed 1/2- to 3/4-inch gravel-sized drainage aggregate. The aggregate should extend six inches above and to the sides of the pipe. The foundation drains and roof downspouts should be tightlined separately to an approved point of controlled discharge. All drains should be provided with cleanouts at easily accessible locations. These cleanouts should be serviced at least once each year.

4.10 Utilities

Utility pipes should be bedded and backfilled in accordance with American Public Works Association (APWA) or local jurisdictional requirements. At minimum, trench backfill should be placed and compacted as structural fill as described in Section 4.2 of this report. As noted, soils excavated onsite should generally be suitable for use as backfill material provided, they are near optimum moisture when excavated, and are placed during dry weather conditions. However, the site soils are fine grained and moisture sensitive; therefore, moisture conditioning may be necessary to facilitate proper compaction. If utility construction takes place during the winter, it may be necessary to import suitable wet weather fill for utility trench backfilling.

4.11 Pavements

Pavements should be constructed on subgrades prepared as recommended in Section 4.2 of this report. Regardless of the degree of relative compaction achieved, the subgrade must be firm and relatively unyielding before paving. Proofrolling the subgrade with heavy construction equipment should be completed to verify this condition.

The pavement design section is dependent upon the supporting capability of the subgrade soils and the traffic conditions to which it will be subjected. For traffic consisting mainly of light passenger vehicles with only occasional heavy traffic, and a stable subgrade prepared as recommended, we recommend the following pavement sections:

- Two inches of hot mix asphalt (HMA) over four inches of crushed rock base (CRB).
- Three and one-half inches full depth HMA over prepared subgrade.

The paving materials used should conform to the Washington State Department of Transportation (WSDOT) specifications for ½-inch class HMA and CRB.

Long-term pavement performance will depend upon surface drainage. A poorly-drained pavement section will be subject to premature failure as a result of surface water infiltrating into the subgrade soils and reducing their supporting capability. For optimum pavement performance, we recommend surface drainage gradients of at least two percent. Some degree of longitudinal and transverse cracking of the pavement surface should be expected over time. Regular maintenance should be planned to seal cracks when they occur.

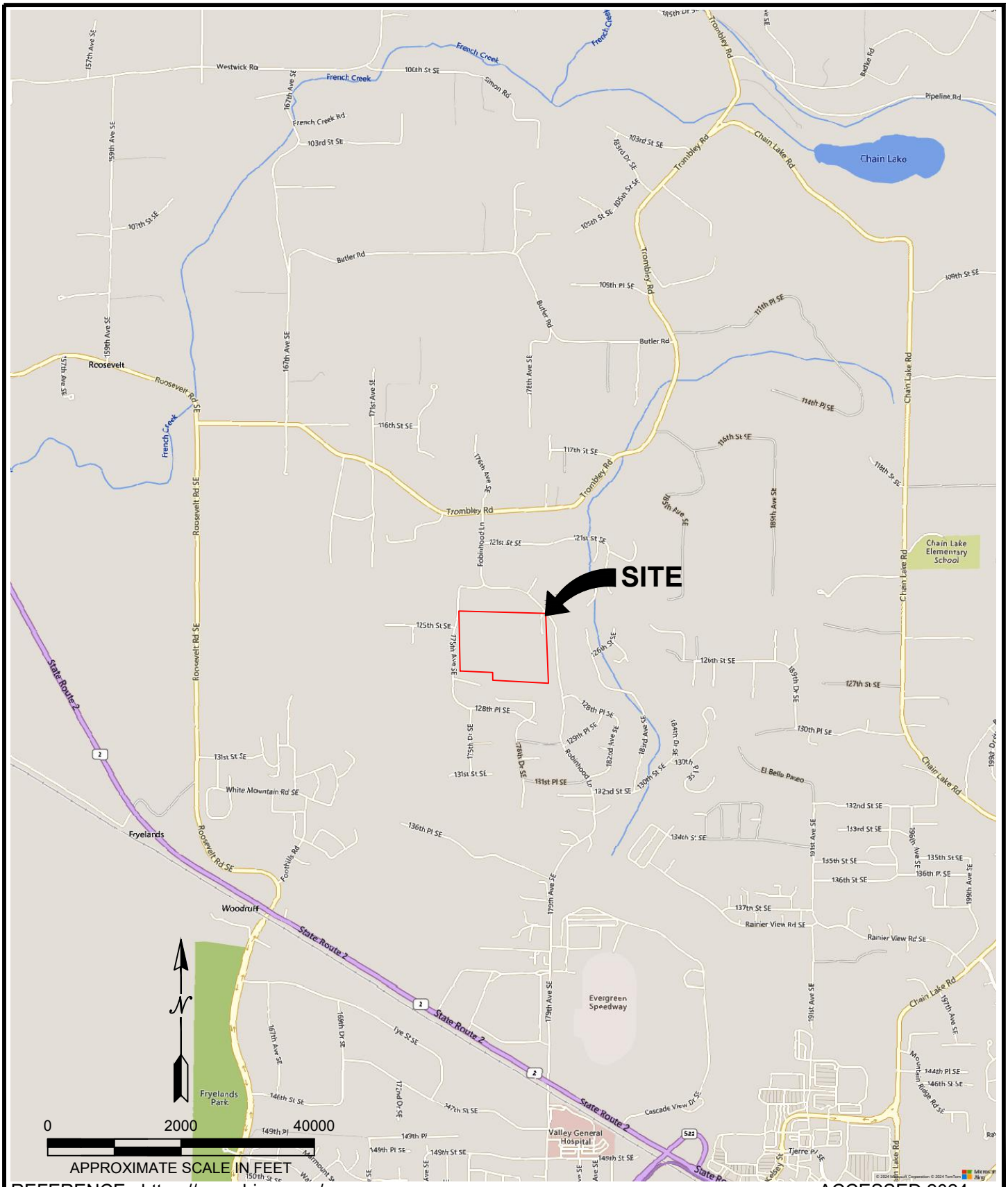
5.0 ADDITIONAL SERVICES

Terra Associates, Inc. should review the final designs and specifications in order to verify that earthwork and foundation recommendations have been properly interpreted and implemented in project design. We should also provide geotechnical services during construction in order to observe compliance with our design concepts, specifications, and recommendations. This will allow for design changes if subsurface conditions differ from those anticipated prior to the start of construction.

6.0 LIMITATIONS

We prepared this report in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made. This report is the copyrighted property of Terra Associates, Inc. and is intended for specific application to the Monroe 30 project in Snohomish County, Washington. This report is for the exclusive use of South Lake Ridge, LLC, Land Pro Group, and their authorized representatives. No other warranty, expressed or implied, is made.

The analyses and recommendations presented in this report are based on data obtained from our on-site test pits. Variations in soil conditions can occur, the nature and extent of which may not become evident until construction. If variations appear evident, Terra Associates, Inc. should be requested to reevaluate the recommendations in this report prior to proceeding with construction.

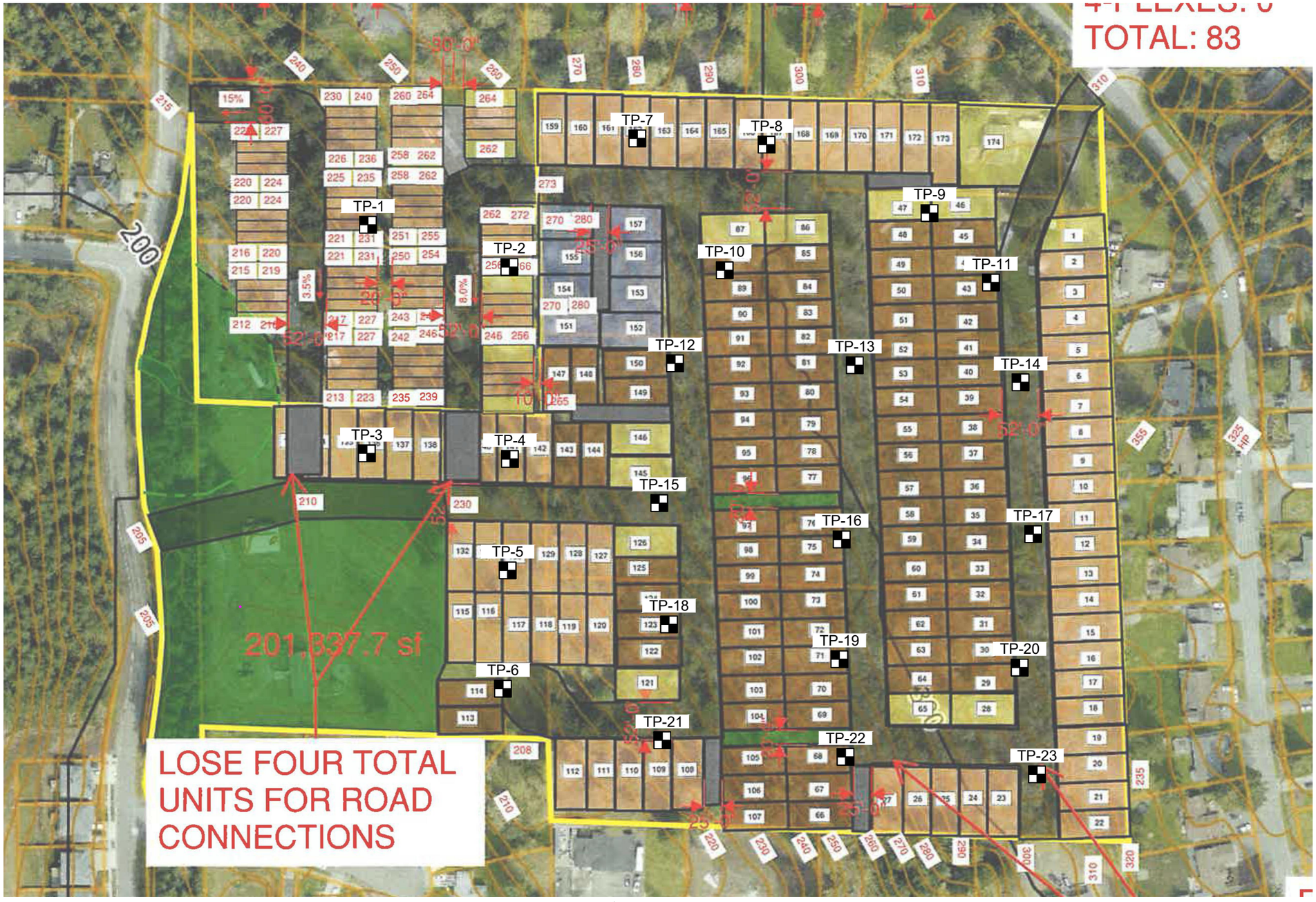


REFERENCE: https://www.bing.com/maps ACCESSED 2024

Terra Associates, Inc.
Consultants in Geotechnical Engineering
Geology and
Environmental Earth Sciences

VICINITY MAP
MONROE 30
SNOHOMISH, WASHINGTON

Proj.No. T-9089	Date: APR 2025	Figure 1



NOTE:

THIS SITE PLAN IS SCHEMATIC. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE. IT IS INTENDED FOR REFERENCE ONLY AND SHOULD NOT BE USED FOR DESIGN OR CONSTRUCTION PURPOSES.

REFERENCE: SITE PLAN PROVIDED BY CLIENT.

LEGEND:

APPROXIMATE TEST PIT LOCATION

0 150 300

APPROXIMATE SCALE IN FEET

N

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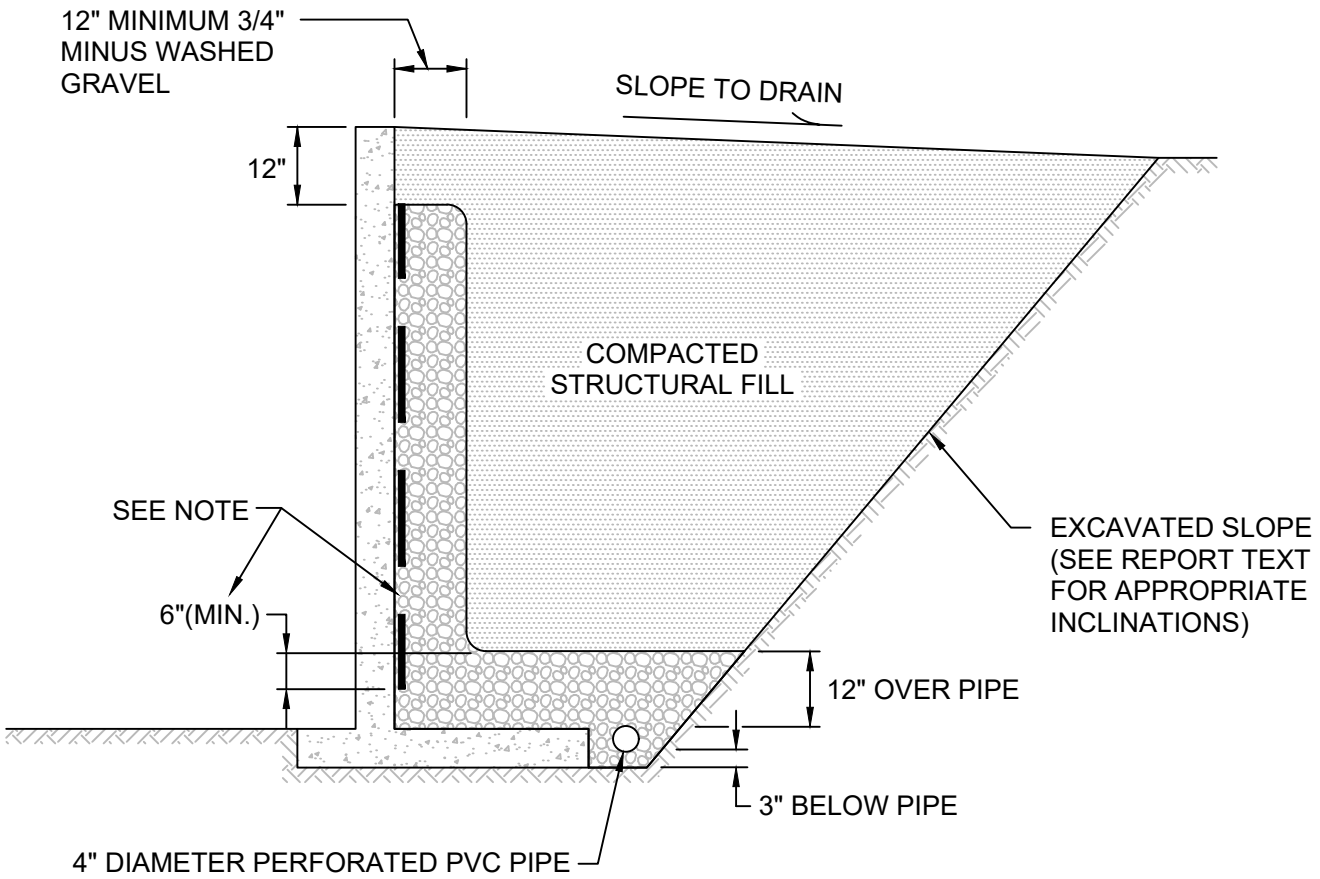
EXPLORATION LOCATION PLAN
MONROE 30
SNOHOMISH, WASHINGTON

Proj.No. T-9089	Date: APR 2025	Figure 2



NOT TO SCALE

NOTE:

MIRADRAIN G100N PREFABRICATED DRAINAGE PANELS OR SIMILAR PRODUCT CAN BE SUBSTITUTED FOR THE 12-INCH WIDE GRAVEL DRAIN BEHIND WALL. DRAINAGE PANELS SHOULD EXTEND A MINIMUM OF SIX INCHES INTO 12-INCH THICK DRAINAGE GRAVEL LAYER OVER PERFORATED DRAIN PIPE.

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TYPICAL WALL DRAINAGE DETAIL
MONROE 30
SNOHOMISH, WASHINGTON

Proj.No. T-9089	Date: APR 2025	Figure 3

APPENDIX A
FIELD EXPLORATION AND LABORATORY TESTING

Monroe 30
12611 – 175th Avenue Southeast
Snohomish, Washington

On September 12 and 13, 2024, we explored subsurface conditions at the site in 23 test pits excavated to maximum depths of approximately 9 to 12 feet below existing surface grades using a track-mounted excavator. The test pit locations were approximately determined in the field with GPS and by sighting relative to existing surface features. The approximate test pit locations are shown on Figure 2. The Test Pit Logs are presented on Figures A-2 through A-24.

An engineering geologist from our office maintained a log of each test pit as it was excavated, classified the soil conditions encountered, and obtained representative soil samples. All soil samples were visually classified in the field in accordance with the Unified Soil Classification System. A copy of this classification is presented as Figure A-1.

Representative soil samples obtained from the test pits were placed in sealed plastic bags and taken to our laboratory for further examination and testing. The moisture content of each sample was measured and is reported on the Test Pit Logs. Grain size analyses were performed on select soil samples. The results are shown on Figures A-25 through A-28.

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS (More than 50% material larger than No. 200 sieve size)	**GRAVELS** More than 50% of coarse fraction is larger than No. 4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
	SANDS More than 50% of coarse fraction is smaller than No. 4 sieve	Clean Sands (less than 5% fines)	SW	Well-graded sands, sands with gravel, little or no fines.
			SP	Poorly-graded sands, sands with gravel, little or no fines.
		Sands with fines	SM	Silty sands, sand-silt mixtures, non-plastic fines.
			SC	Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS (More than 50% material smaller than No. 200 sieve size)	**SILTS AND CLAYS** Liquid Limit is less than 50%		ML	Inorganic silts, rock flour, clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity. (Lean clay)
			OL	Organic silts and organic clays of low plasticity.
	SILTS AND CLAYS Liquid Limit is greater than 50%		MH	Inorganic silts, elastic.
			CH	Inorganic clays of high plasticity. (Fat clay)
			OH	Organic clays of high plasticity.
HIGHLY ORGANIC SOILS			PT	Peat.

DEFINITION OF TERMS AND SYMBOLS

COHESIONLESS

Density	Standard Penetration Resistance in Blows/Foot
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	>50

COHESIVE

Consistancy	Standard Penetration Resistance in Blows/Foot
Very Soft	0-2
Soft	2-4
Medium Stiff	4-8
Stiff	8-16
Very Stiff	16-32
Hard	>32

I	2" OUTSIDE DIAMETER SPILT SPOON SAMPLER
II	2.4" INSIDE DIAMETER RING SAMPLER OR SHELBY TUBE SAMPLER
▼	WATER LEVEL (Date)
Tr	TORVANE READINGS, tsf
Pp	PENETROMETER READING, tsf
DD	DRY DENSITY, pounds per cubic foot
LL	LIQUID LIMIT, percent
PI	PLASTIC INDEX
N	STANDARD PENETRATION, blows per foot

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UNIFIED SOIL CLASSIFICATION SYSTEM
MONROE 30
SNOHOMISH, WASHINGTON

Proj.No. T-9089	Date: APR 2025	Figure A-1

LOG OF TEST PIT NO. TP-1

FIGURE A-2

PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 13, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1	1	(6 Inches of Grass and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly cemented. (SM) (Vashon Till)	Dense to Very Dense	9.6
9	3	Test pit terminated at approximately 9 feet. No groundwater seepage.		
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-2

FIGURE A-3

PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 12, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1	1	(6 Inches of Grass and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)	Dense to Very Dense	
9	3	Test pit terminated at approximately 9 feet. No groundwater seepage.		
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-3

FIGURE A-4

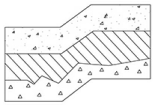
PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 12, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1	1	(6 Inches of Grass and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2				
3	2	Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly cemented. (SM) (Vashon Till)	Dense to Very Dense	6.7
4				
5				
6				
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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LOG OF TEST PIT NO. TP-4

FIGURE A-5

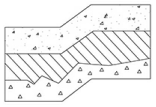
PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 12, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1	1	(6 Inches of Grass and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2				
3	2	Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly cemented. (SM) (Vashon Till)	Dense to Very Dense	
4				
5				
6				
7				
8				
9	3	Test pit terminated at approximately 9 feet. No groundwater seepage.		
10				
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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LOG OF TEST PIT NO. TP-5

FIGURE A-6

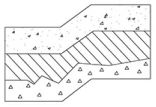
PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 12, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1	1	(6 Inches of Grass and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2				
3	2	Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly cemented. (SM) (Vashon Till)	Dense to Very Dense	
4				
5				
6				
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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LOG OF TEST PIT NO. TP-6

FIGURE A-7

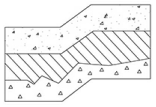
PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 12, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1	1	(6 Inches of Grass and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2				
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly cemented. (SM) (Vashon Till)		
4	2			10.1
5				
6				
7			Dense to Very Dense	
8				
9				
10				
11				
12	3			
13		Test pit terminated at approximately 10 feet. No groundwater seepage.		
14				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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LOG OF TEST PIT NO. TP-7

FIGURE A-8

PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 12, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1	1	(6 Inches of Grass and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2				
3	2	Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)	Dense to Very Dense	
4				
5				
6				
7				
8				
9				
10	3			5.2
11		Test pit terminated at approximately 10 feet. No groundwater seepage.		
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-8

FIGURE A-9

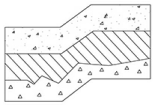
PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 12, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1	1	(6 Inches of Grass and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2				
3	2	Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)	Dense to Very Dense	
4				
5				
6				
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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LOG OF TEST PIT NO. TP-9

FIGURE A-10

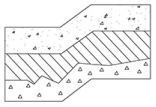
PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 12, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6 Inches of Grass and Topsoil)		
1		Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)		
2				
3	1	Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)		
4				
5	2			
6				
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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LOG OF TEST PIT NO. TP-10

FIGURE A-11

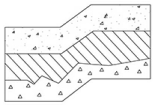
PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 12, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1	1	(6 Inches of Grass and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2				
3	2	Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)	Dense to Very Dense	10.4
4				
5				
6				
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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LOG OF TEST PIT NO. TP-11

FIGURE A-12

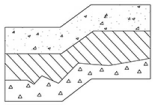
PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 12, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1	1	(6 Inches of Grass and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	30.0
3	2	Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented, approximately 2-foot diameter boulder from 3 to 5 feet. (SM) (Vashon Till)	Dense to Very Dense	
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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LOG OF TEST PIT NO. TP-12

FIGURE A-13

PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 13, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1	1	(6 Inches of Grass and Topsoil) Reddish brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
3	2	Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly cemented. (SM) (Vashon Till)	Dense to Very Dense	
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-13

FIGURE A-14

PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 13, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1	1	(6 Inches of Grass and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
3	2	Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)	Dense to Very Dense	6.9
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-14

FIGURE A-15

PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 12, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1	1	(6 Inches of Grass and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
3	2	Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)	Dense to Very Dense	
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-15

FIGURE A-16

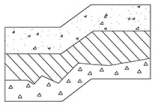
PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 13, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1		(6 Inches of Forest Duff and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1	Gray-brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, weakly cemented. (SM) (Vashon Till)		
3				
4	2		Dense to Very Dense	7.2
5				
6				
7				
8				
9	3			
10		Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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Environmental Earth Sciences

LOG OF TEST PIT NO. TP-16

FIGURE A-17

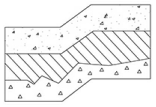
PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 13, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1		(6 Inches of Forest Duff and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1			
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)	Dense to Very Dense	
4	2			
5				
6				
7				
8				
9	3			
		Test pit terminated at approximately 9 feet. No groundwater seepage.		
10				
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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LOG OF TEST PIT NO. TP-17

FIGURE A-18

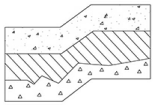
PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 13, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1	1	(6 Inches of Forest Duff and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2				
3	2	Gray-brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)	Dense to Very Dense	8.1
4				
5				
6				
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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LOG OF TEST PIT NO. TP-18

FIGURE A-19

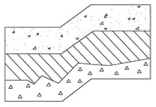
PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 13, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1		(6 Inches of Forest Duff and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1	Gray-brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)	Dense to Very Dense	
3				
4				
5	2			
6				
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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LOG OF TEST PIT NO. TP-19

FIGURE A-20

PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 13, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1	1	(6 Inches of Grass and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
3	2	Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)	Dense to Very Dense	7.3
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-20

FIGURE A-21

PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 13, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1		(6 Inches of Forest Duff and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1			
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)		
4				
5	2			
6			Dense to Very Dense	
7				
8				
9				
10	3			
11		Test pit terminated at approximately 10 feet. No groundwater seepage.		
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-21

FIGURE A-22

PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 13, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1		(6 Inches of Grass and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2	1			8.8
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, weakly cemented. (SM) (Vashon Till)		
4				
5	2			
6			Dense to Very Dense	
7				
8				
9				
10	3			
11		Test pit terminated at approximately 10 feet. No groundwater seepage.		
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.

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LOG OF TEST PIT NO. TP-22

FIGURE A-23

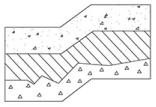
PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 13, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1	1	(6 Inches of Forest Duff and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
3	2	Gray-brown, silty SAND with gravel, fine to coarse sand, fine gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)	Dense to Very Dense	
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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LOG OF TEST PIT NO. TP-23

FIGURE A-24

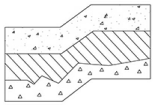
PROJECT NAME: Monroe 30 **PROJ. NO:** T-9089 **LOGGED BY:** JAM

LOCATION: Snohomish County, Washington **SURFACE CONDITIONS:** Grass **APPROX. ELEV:** NA

DATE LOGGED: September 13, 2024 **DEPTH TO GROUNDWATER:** NA **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0				
1	1	(6 Inches of Forest Duff and Topsoil) Light brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, roots. (SM) (Weathered Vashon Till)	Medium Dense	
2				
3		Gray-brown, silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, occasional cobbles, weakly to moderately cemented. (SM) (Vashon Till)	Dense to Very Dense	
4				
5	2			6.7
6				
7				
8				
9				
10	3	Test pit terminated at approximately 10 feet. No groundwater seepage.		
11				
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	9.5	14.3	6.2	12.1	26.7	31.2	
□	0.0	2.5	16.9	8.5	16.4	32.1	23.6	
△	0.0	13.7	21.5	5.8	11.7	21.0	26.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			11.3847	0.5105	0.2609					
□			8.2592	0.5764	0.3109	0.1174				
△			17.9525	2.3295	0.5621	0.1118				

	Material Description	USCS	AASHTO
○	Silty SAND with gravel	SM	
□	Silty SAND with gravel	SM	
△	Silty SAND with gravel	SM	

Project No. T-9089 **Client:** South Lake Ridge, LLC c/o Land Pro Group

Project: Monroe 30

○ **Location:** TP-1 **Depth:** 5'

□ **Location:** TP-3 **Depth:** 4'

△ **Location:** TP-6 **Depth:** 4'

Remarks:

○ Tested October 8, 2024

□ Tested October 8, 2024

△ Tested October 8, 2024

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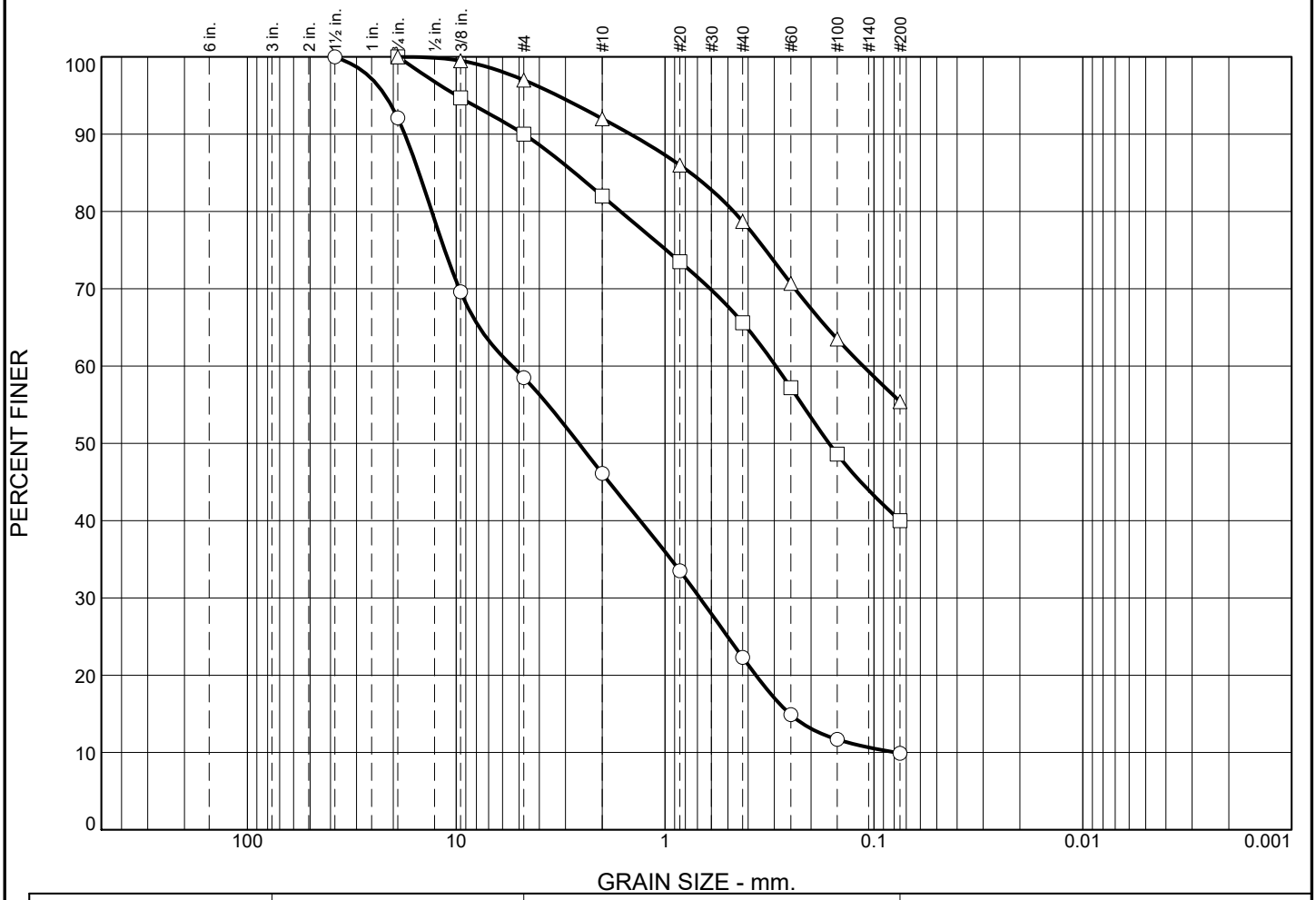
Kirkland, WA

Figure A-25

Tested By: ZA

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	7.9	33.6	12.4	23.8	12.4	9.9	
□	0.0	0.0	10.0	8.0	16.4	25.6	40.0	
△	0.0	0.0	3.0	5.0	13.3	23.3	55.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			15.0791	5.4020	2.5891	0.6816	0.2525	0.0788	1.09	68.59
□			2.7079	0.2949	0.1641					
△			0.7563	0.1127						

	Material Description	USCS	AASHTO
○	Silty SAND with gravel	SM	
□	Silty SAND with gravel	SM	
△	Sandy SILT	ML	

Project No. T-9089 **Client:** South Lake Ridge, LLC c/o Land Pro Group

Project: Monroe 30

○ **Location:** TP-7 **Depth:** 10'

□ **Location:** TP-10 **Depth:** 4'

△ **Location:** TP-11 **Depth:** 2'

Remarks:

○ Tested October 8, 2024

□ Tested October 8, 2024

△ Tested October 8, 2024

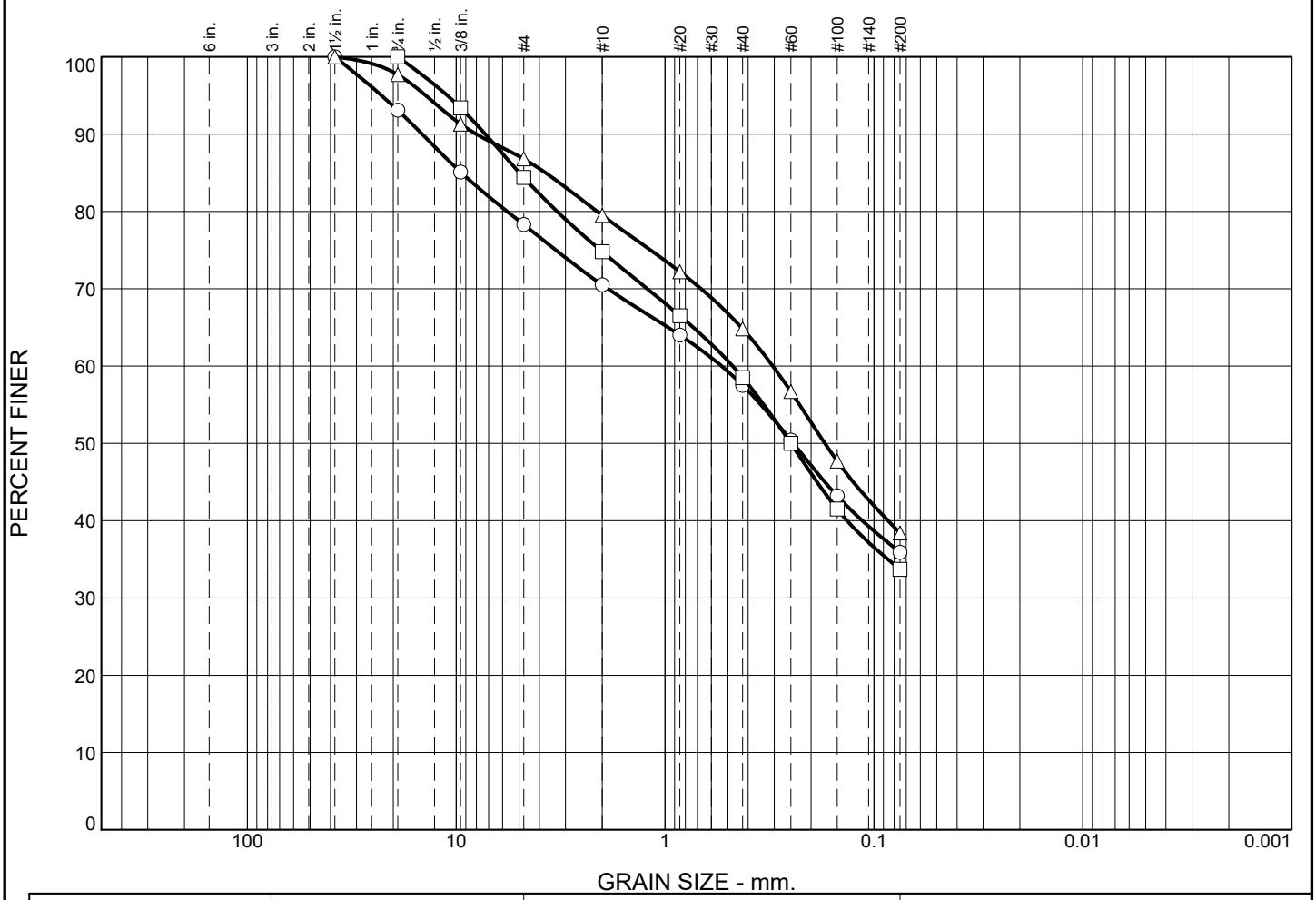
Terra Associates, Inc.

Kirkland, WA

Figure A-26

Tested By: ZA

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	6.9	14.8	7.8	13.0	21.6	35.9	
□	0.0	0.0	15.6	9.6	16.3	24.8	33.7	
△	0.0	2.3	10.9	7.3	14.7	26.4	38.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			9.4378	0.5365	0.2432					
□			4.9764	0.4749	0.2500					
△			3.7349	0.3049	0.1719					

	Material Description	USCS	AASHTO
○	Silty SAND with gravel	SM	
□	Silty SAND with gravel	SM	
△	Silty SAND with gravel	SM	

Project No. T-9089 **Client:** South Lake Ridge, LLC c/o Land Pro Group

Project: Monroe 30

○ **Location:** TP-13 **Depth:** 10'

□ **Location:** TP-15 **Depth:** 4'

△ **Location:** TP-17 **Depth:** 4'

Remarks:

○ Tested October 8, 2024

□ Tested October 8, 2024

△ Tested October 8, 2024

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Kirkland, WA

Figure A-27

Tested By: ZA

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	9.7	13.8	8.6	15.3	21.6	31.0	
□	0.0	0.0	8.9	10.8	18.5	34.2	27.6	
△	0.0	7.7	9.7	7.0	13.8	24.6	37.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			11.5270	0.8590	0.3477					
□			2.8514	0.3818	0.2368	0.0890				
△			6.2271	0.3703	0.1988					

	Material Description	USCS	AASHTO
○	Silty SAND with gravel	SM	
□	Silty SAND with gravel	SM	
△	Silty SAND with gravel	SM	

Project No. T-9089 **Client:** South Lake Ridge, LLC c/o Land Pro Group

Project: Monroe 30

○ **Location:** TP-19 **Depth:** 5'

□ **Location:** TP-21 **Depth:** 2'

△ **Location:** TP-23 **Depth:** 5'

Remarks:

○ Tested October 8, 2024

□ Tested October 8, 2024

△ Tested October 8, 2024

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Kirkland, WA

Figure A-28

Tested By: ZA