

Exhibit D-1

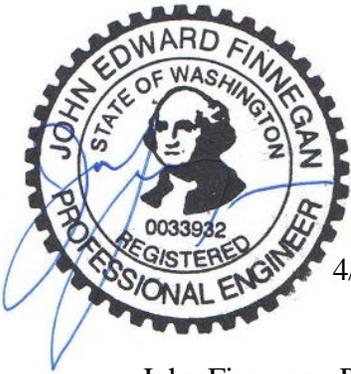
Geotechnical Engineering Report  
Legacy Ridge F  
Spokane County, WA

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***ATTACHED FIGURES***

**Figure 1: Vicinity Map**

**Figure 2: Site Plan**

**Figure 3: Guide to Soil & Rock Descriptions**

**Figures 4-1 to 4-29: Test Boring Logs**

**Figures 5-1 to 5-20: Wildcat Dynamic Cone Penetrometer Logs**

**Figures 6-1 to 6-11: Kessler Dynamic Cone Penetrometer Logs**

**Figures 7-1 to 7-4: Laboratory Summary**

**Figures 8-1 to 8-7: Grain Size Distributions**

**Appendix: GBC - *Important Information about Your Geotechnical-Engineering Report***

## **CONTEXT**

This geotechnical engineering report (GER) presents the results of geotechnical exploration and analysis for the proposed housing development in Spokane County, Washington. These services were contracted with D.R. Horton, represented by Jim Roberge.

### ***Project Considerations***

An approximately 93-acre, 73-lot residential subdivision is planned in the Legacy Ridge area southwest of Liberty Lake. Current plans indicate the development will be accessed from an extension of Valley Vista Drive.

The project will consist of asphalt pavement roadways, underground utilities, stormwater management facilities, and single-family residential lot development. A grading layout plan, showing the lots, streets, and proposed cuts and fills was provided by Whipple Consulting Engineers (WCE) dated December 3, 2021. The grading layout plan indicates cuts and fills of 10 feet or less are proposed.

A retaining wall is proposed south of Legacy Ridge Road in the northeast area of the development. The wall is approximately 300 feet long with a maximum height of 10 feet. Four additional retaining walls are proposed up-slope of the existing water reservoir tank along the east side of the development ranging from 1 to 10 feet.

A new layout was provided by WCE dated March 4, 2022, however does not include site grading. We assume the provided layout will contain similar elements as provided in the plan dated December 3, 2021.

Estimated daily traffic volumes were not provided at the time this report was prepared. We assume average daily traffic (ADT) will be approximately 10 trips per day per lot with 98 percent passenger vehicles and 2 percent heavy traffic (garbage trucks, delivery vehicles).

### ***Site History***

Historic aerial images were reviewed in preparation of this report. The site was previously developed in the 1970s as a downhill ski resort. The ski area was accessed by a single chairlift, which paralleled the east side of the existing high tension power lines that trend northwest/southeast across the middle of the parcel. Remnants of the resort are still visible on portions of the site as sinuous ridges and pole bases. The sinuous ridges appear to be bermed soil. A small pond is illustrated in old topographic maps near test pit 2212 (TP-2212). Satellite images indicate the pond was infilled in 2006.

### ***Location***

The site is located in the NE ¼ of Section 21, Township 25N, Range 45E, Willamette Meridian on Spokane County parcel number 55211.9183. The project area is directly north of the Saltese Uplands Conservation Area. Physical addresses are currently unassigned. The location is illustrated in the *Vicinity Map* and *Site Plan*.

### ***Scope***

This geotechnical study involved interpretation of surficial features and subsurface soil conditions

to provide conclusions and recommendations addressing slope stability, earthwork for lot cuts/fills and utility excavations, pavements, and stormwater infiltration. We endeavored to conduct these services in accordance with generally accepted geotechnical engineering practices as outlined in revised proposal S211189, dated January 19, 2022.

The field and laboratory scope included:

- Reconnaissance of the site and surrounding area;
- Explored subsurface conditions in 29 test pits advanced to a maximum depth of 14 feet;
- Performed dynamic cone penetrometer (DCP) tests;
- Characterized the encountered subsurface conditions; and,
- Completed laboratory testing on representative soil samples.

The scope of this study is limited to providing IRC presumptive bearing pressures based on the encountered soil conditions. Only general (not structure-specific) geotechnical engineering analysis, conclusions and recommendations were prepared. Lot specific allowable bearing capacity will require scheduled site visits during construction. Additional information including architectural drawings, grading plans, and anticipated foundation loading are required to provide site-specific foundation recommendations.

## ***ENCOUNTERED CONDITIONS***

### ***Physical Setting***

The site is in the southern portion of the Priest River metamorphic core complex. Core complexes are typically “domal” and comprised of a core of high-grade metamorphic rocks such as gneiss. These metamorphic rocks formed deep within the crust as a result of significant elevated pressure and temperature causing metamorphism of the preexisting rock. Geologic mapping of the area shows the site is underlain by Hauser Lake Gneiss (*pChl*) consisting of gray, tan, and brown coarse-grained gneiss. (WSDNR, 2004).

The Natural Resource Conservation Service (NRCS) maps the site soils as Units 5071, 5037, 5040,5041, and 5313 for which the erosion hazard ratings are severe.

### ***Surface Conditions***

We completed reconnaissance of the site on February 25, 2022. The site is positioned on the flanks of Carson Hill which slopes down toward the north, northeast, east, and southeast from the topographic high of 2,665 feet. Topographic lows at the north, northeast, east, and southeast are 2,367, 2,425, 2,395, and 2,483 feet, respectively. Slopes range from 15 to 25 percent with some isolated areas greater than 30 percent. Previous development as rough-graded roads, sanitary sewer, and water service were observed. Fill slopes were observed at proposed lots 6 to 8 and 38 to 50, and exceeded the maximum equipment reach of 14 feet at TP-2211 and TP-2212. Vegetation varied throughout the site from dense conifer stands on the northern flank of Carson Hill to tall native grasses and sparse populations of small conifers on the east slope and at lower elevations.

Several sinuous ridges were observed on the north flank of Carson Hill. Cylindrical concrete vaults with shutoff valves and 2-inch steel pipe risers were observed at several locations on the ridges. It is assumed that these were used for snow making operations at the historic ski resort.

### ***Subsurface Conditions***

Subsurface exploration was performed between February 22 and February 25, 2022. Conditions encountered in the explorations are described in the *Logs* in accordance with methods described in *Field Exploration*. The subsurface materials were differentiated based on characteristics relevant to this project.

#### *existing fill*

*Log symbol:*



*Existing fill* consisting primarily of brown silty sand with cobbles and boulders was encountered at the ground surface at TP 2201, 2207, 2210 to 2214, 2217, 2220, 2224, 2226, 2227 and 2229. Depths ranged from 1 to greater than 14 feet BGS at TP-2211 and TP-2212. The condition varied but was generally medium-dense. The fines content (percent, by weight, passing the U.S. #200 sieve) ranged from 8 to 41 percent in 13 representative samples tested.

#### *topsoil*

*Log symbol:*



*Topsoil* consisting of dark brown silty sand with organics (rootlets, pine needles, duff, etc.) was encountered beginning at the ground surface or underlying *existing fill* and ranged from 1 to 3 feet in thickness. Fines content ranged from 7.3 to 44 percent in 5 representative samples tested.

#### *loess*

*Log symbols:*



*Loess* consisting of sandy silty clay and sandy lean clay was encountered in TP-2218 beginning beneath the *topsoil* to approximately 10 feet BGS. The condition ranged from medium-stiff to stiff. Fines content was 54 and 62 percent in two representative samples tested.

#### *medium-dense soil*

*Log symbols:*



*Medium-dense soils* were encountered beneath the *topsoil* or at ground surface and extended to depths ranging from 1.5 to 12.5 feet BGS. The *medium-dense soils* consisted of silty sand with varying sorting and amounts of gravel. Fines content ranged from 7 to 38 percent in 9 representative samples tested.

completely weathered gneiss (CWG)

Log symbols:



CWG consisting of silty sand with varying amounts of gravel was encountered beginning at the ground surface or beneath *topsoil, medium-dense soil, and existing fill* and persisted to depths ranging from 2 to 6.5 feet. CWG was encountered in dense condition and took considerable effort to dig with a CAT 315 excavator.

gneiss

Log symbol:



*Gneiss* was encountered beginning at the ground surface or below the previously mentioned stratum and persisted to depths greater than 10 feet. The *gneiss* was coarse-grained, slightly to moderately weathered and varied from moderately weak (R2) to strong (R4).

**N-value correlation.** Triggs Wildcat® DCP tests were advanced at test pit locations to estimate relative densities of the encountered soils. The tests were initiated beginning at the ground surface and advanced to the point of refusal.

**Pavement subgrade strength.** Kessler® DCP tests were also initiated beginning at the ground surface and advanced to a maximum depth of 30 inches BGS. The DCP tests were used to evaluate pavement subgrade support conditions within the site.

Results of the DCP tests are presented in *Figures*.

***Surface and Groundwater Hydrology***

Surface water was not observed on the site. Surface water was observed approximately 1 mile to the east as Liberty Lake. The surface elevation of Liberty Lake is approximately 300 feet lower than the lowest point of the site.

Groundwater was not encountered in the explorations. Well Reports obtained from the Washington State Department of Ecology indicate water levels vary from 40 to 200 feet BGS in the vicinity of the site.

***Geologic Hazards***

Spokane County's Critical Areas Ordinance (CAO, 2018) requires evaluation of geologically hazardous areas, principally erosion, landslide, and seismic hazards (Section 11.20.030 Table A, and 11.20.070 d.2). The purpose of the ordinance is to discourage development in geologically hazardous areas unless proponents demonstrate that such areas can be developed consistent to acceptable standards for public health and safety.

Based on this ordinance, geo-hazard areas in Spokane County exhibit at least one of the following characteristics:

- a. A slope of 30 percent or greater;
- b. Soils identified by Natural Resource Conservation Service (NRCS) as posing a severe potential for erosion (see Section 11.20.090M Appendix M);
- c. Hydraulic factors such as existing on-site surface and groundwater or changes in hydraulic factors, caused by proposals that create a severe potential for erosion or landslide hazard;
- d. Areas that historically have been prone to land sliding or with one of the following geologic formations: alluvium, landslide deposits, Latah Formation;
- e. Areas of uncompacted fill;
- f. Areas that are unstable as a result of rapid stream or stream bank erosion;
- g. Seismic hazards include the following areas identified on the Liquefaction Susceptibility Map of Spokane County, Washington (source: Washington State Department of Natural Resources, Sept. 2004):
  - i. For public buildings and public assembly buildings and uses those areas classified as having a liquefaction susceptibility of moderate; and
  - ii. For all buildings and public assembly uses those areas classified as having liquefaction susceptibilities of “moderate to high,” “high,” or “peat deposit.”
- h. Seismic hazards include the following areas identified on the Site Class Map of Spokane County, Washington (source: Washington State Department of Natural Resources, Sept. 2004):
  - i. For public buildings and public assembly buildings and uses those areas classified as having a site class of “D;” and
  - ii. For all buildings and public assembly uses those areas classified as having a site class of “D to E,” “E,” or “F.”

A review of readily available information and site observations indicate slopes greater than 30 percent and uncompacted fill were present which qualifies as components “a”, “b”, and “e” in the CAO, as described above. Other components of the CAO were not observed. Slopes greater than 30 percent and areas of existing fill were isolated in occurrence and are further addressed in the following report sections.

## **CONCLUSIONS**

Based on the encountered conditions described above, we conclude the site is feasible for the proposed development provided the recommendations in this report are implemented.

Although geologic hazards as defined by the CAO are present as slopes greater than 30 percent, soils identified as by the NRCS as posing a severe potential for erosion, and uncompacted fill.<sup>1</sup> We conclude these hazards will be mitigated by use of BMPs and following the recommendations outlined in this report.

*Existing fill* was encountered in several explorations to depths of 1 to Records greater than 14 feet BGS. It was primarily encountered in medium-dense condition according to DCP test results, indicating some compactive effort was used during placement. However, these tests do not substitute for records of compaction testing that are required for fill placements. Thus, the *Existing Fill* may still pose a settlement hazard to structures. The majority of the *existing fill* was found to be less than 4 feet in the test pits. The depth was observed to be 6 feet and more than 14 feet in 2 test pits, each.

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<sup>1</sup> If the soils were compacted, no records appear to be available.

Records of compaction testing are not available if they exist. As such, it should be considered undocumented and not meeting the criteria set forth in the recommendations of this report. We should review documentation and revise recommendations associated with existing fill if any testing records become available.

*Topsoil* exhibits high fines percentages and organic content. The *topsoil* poses risks to improvements as differential settlement and high capillarity. Fortunately, it was encountered to shallow depths. Removal of the *topsoil* is recommended. Stockpile the *topsoil* for reuse as non-structural fill and landscaping.

*Loess* was encountered in TP-2218. These soils exhibited high fines content and are considered moisture sensitive and may be difficult to work with in wet conditions.

*Medium-dense soil* primarily consisting of naturally reworked *CWG* was encountered in numerous explorations. The fines percentage varies widely. Soils grading as an SM should be stockpiled for reuse as non-structural fill. Soils grading as an SP-SM, SW-SM, or GP-GC are suitable for reuse as structural fill.

*Completely weathered gneiss* was encountered in the excavations. The *CWG* was encountered in dense condition. This stratum provides suitable bearing for structures but low infiltration rates due to the dense nature. The *CWG* is suitable for reuse as structural fill.

Shallow *gneiss* will be encountered in excavations for utilities and basements. The condition of the encountered *gneiss* varies throughout the site from moderately weathered and moderately weak to slightly weathered and strong. It appears condition improves with depth. Heavy ripping, chipping, and blasting may be needed to establish grades.

Geotechnical site characterization criteria for use of rapid infiltration structures, such as drywells, requires the presence of a suitable target soil with high permeability, wide horizontal extent, and suitable thickness above limiting layers such as fine-grained soils, rock, or groundwater. These conditions were not encountered in the explorations. *Medium-dense* and *glaciofluvial* soils are permeable, but the extent is insufficient. *CWG* and *gneiss* are present at depths of 5 feet BGS or less and constitute limiting layers. The elevated fines content and condition of *medium-dense soil* will result in very low permeability rates.

Drywells and infiltration trenches are not considered feasible due to inadequate separation between the base of infiltration structures and limiting layers. Detention/evaporation ponds with limited subsurface drainage may be a viable alternative for stormwater management. Locations for stormwater disposal were not delineated on the plan sets provided. Should these locations be determined, further exploration may be needed to verify subsurface conditions.

## ***RECOMMENDATIONS***

The recommendations presented throughout this chapter are intended to provide economically feasible criteria at normally accepted risk levels. More conservative design parameters can be used if lower risks are preferred. Specifically, the design should incorporate the following recommendations concerning earthwork, flexible pavement, and stormwater drainage.

### Seismic Considerations

The recommended seismic site class designation is Site Class C “very dense soil and soft rock.” Spectral response acceleration parameters, adjusted for Site Class D\*, were calculated using USGS, Seismic Design Web Services through the Applied Technology Council website (ATC, 2020). The values of predicted earthquake ground motion for short period structural elements (0.2 second spectral response acceleration,  $S_s$ ) and for long period structural elements (1.0 second spectral response acceleration,  $S_1$ ) are provided in the table below. The design parameters ( $S_{DS}$  and  $S_{D1}$ ) are equal to  $\frac{2}{3}$  of the maximum earthquake spectral response accelerations ( $S_{MS}$  and  $S_{M1}$ ).

**Table 1. Seismic design parameters**

Site Class	Latitude	Longitude	PGA	$S_s$	$S_1$	$S_{DS}$	$S_{D1}$
C	47.651 N	117.115 W	0.148g	0.342g	0.115g	0.273g	0.129g

\*Code Reference: ASCE 7-16, Risk Category II

The site modified peak ground acceleration ( $PGA_M$ ) is 0.178g. Due to the relatively dense nature of the encountered soils, the low probability of high ground acceleration, and the absence of shallow groundwater, the liquefaction potential is considered low.

### Earthwork

**Site preparation.** Strip organics and *topsoil* in construction areas only. Existing fill should be accessed on a case by case basis after site excavation and prior to structural fill construction.

On sloping ground which will receive fill, bench surfaces to no steeper than 8 percent before placing and compacting structural fill. Scarify and moisture-condition soils, as necessary. Compact the upper 12 inches to at least 92 percent of the maximum dry unit weight (MDUW). Determine MDUW and optimum moisture contents for fill material in accordance with the modified Proctor method ASTM D-1557. Select an earthwork contractor with successful experience using soils with elevated fines content when working with the silty soil and discuss wet weather contingencies prior to beginning work.

**Temporary slopes.** Due to varying construction methods and conditions, temporary cuts should be the responsibility of the contractor. The overburden soils are consistent with Type C materials per WISHA excavation criteria. WISHA specifies a maximum inclination of 1½ horizontal to 1 vertical (1½ H:1V) in the temporary condition for Type C.

**Permanent slopes.** Maximum permanent cut and fill slope angles of 2H:1V are recommended except where potentially submerged in drainage basins, where the slopes should be no steeper than 3H:1V. Protect completed surfaces as soon as possible with mechanical or bio-technical erosion control.

Vertical cuts in fresh rock greater than 4 feet should be evaluated by a geotechnical engineer on a case by case basis.

**Protection of subgrade.** Following compaction of subgrade, protect surfaces from degradation during inclement weather. Protection measures include erosion control maintenance, preventing tracking soil and rock offsite, and preventing driving on wet subgrade soil. Reduce frost penetration in freezing weather by leaving surfaces of soil un-compacted if left for an extended

duration. Prevent frost penetration in freezing weather by covering soils, such as placing a temporary loose, insulating layer of soil on top.

**Fill material.** The *CWG* and *medium-dense soil* appear to be generally suitable for re-use as structural fill. Soils exhibiting high fines percentages (including the *existing fill*, *topsoil*, silty sand, and *loess*) should not be used for structural fill as they are considered moisture sensitive and may be difficult to compact in wet conditions. However, *existing fill*, *topsoil*, silty sand, and *loess* may be reused as non-structural fill provided that deleterious items (anthropogenic debris, organics, over-sized materials, etc.), if encountered, are removed prior to reuse. General recommendations for imported fill materials and uses are illustrated in the following table:

**Table 2. Fill Materials**

Soil Fill Product	Allowable Use
Non-Structural Fill	<ul style="list-style-type: none"> <li>• Areas not supporting structures (typically landscaped areas)</li> <li>• Soils should not contain particles larger than 12 inches median diameter and be reasonably free of deleterious items (wood, metal, plastic, trash, etc.)</li> </ul>
Select Borrow: WSDOT <sup>2</sup> SS Section 9-03.14(2)	<ul style="list-style-type: none"> <li>• Fills within building footprints and paved areas to meet subgrade elevations</li> <li>• Over-excavations</li> <li>• Utility trench backfill above bedding course</li> </ul>
Class B Gravel Backfill for Foundations: WSDOT SS 9-03.12(1)B	<ul style="list-style-type: none"> <li>• Slab-on-grade aggregate</li> <li>• Structural fill below foundations, where required.</li> </ul>
Gravel Backfill for Walls: WSDOT SS 9-03.12(2)	<ul style="list-style-type: none"> <li>• Foundation and retaining wall backfill</li> </ul>
Bedding Course: WSDOT SS 9-03.12(3)	<ul style="list-style-type: none"> <li>• Backfill for utility and pipe zone bedding</li> </ul>

Contact us to review alternative material selections. Structural fill should extend beyond footings a minimum distance equal to the fill depth.

**Fill Placement.** Place fill in lifts of thickness suited to the compaction equipment but no more than 12 inches. Compact structural fill to at least 92 percent of MDUW for footing subgrades; compact to 92 percent of MDUW also for slabs and pavement subgrades, except within the top 24 inches of final grade where compaction should be increased to 95 percent. Do not place fill in a frozen condition or on un-compacted frozen subgrade.

**Verification and application.** These earthwork recommendations apply to structural fill, backfill against footings, and backfill of utility trenches. Retain a qualified earthwork technician present during fill and backfill operations to observe and test each lift of fill. A representative of the Geotechnical Engineer is best suited to provide such testing.

<sup>2</sup> Washington State Department of Transportation

We recommend completing in-place density testing in accordance with ASTM D-6938 (nuclear density methods) on site soil and compacted structural fill at the following minimum frequencies:

- Subgrade and base course materials for footings and slabs – At least two tests per 2,000 square feet or fraction thereof, per fill lift;
- Subgrade and base course materials for roads – At least one in-place density test per 100 lineal feet per lane, per fill lift;
- Subgrade and base course materials for curbs and sidewalks – At least one in-place density test per 100 lineal feet, per fill lift; and,
- Utility trench backfill – at least one in-place density test per 5 feet of depth per 100 lineal feet of trench.

### ***Foundations***

We recommend founding the proposed structures on conventional spread footings bearing on medium-dense, or denser soils or on compacted structural fill placed on such. Do not construct footings on *existing fill* unless records of adequate compaction testing can be found and reviewed. Do not construct footings on loose, wet, or soft soils. *Existing fill* should be removed and replaced with structural fill as described in *Fill Material* and compacted to 92 percent of the maximum unit weight. Alternatively, extend footings through the *Existing Fill* into medium dense or denser native soil.

Size footings using a preliminary maximum allowable bearing pressure of 3,000 pounds per square foot. Allowable bearing capacity should be confirmed on a case by case basis. Minimum recommended foundation frost embedment depth is 24 inches for heated structures.

With footing construction as recommended, anticipated maximum total and differential settlements are 1-inch and ½ inches, respectively.

### ***Floor Slabs***

Moisture protection for floor slabs with moisture sensitive covering is recommended. A product designed as a durable and impermeable under-slab “moisture barrier” such as Stego® Wrap should be used for moisture protection.

Protection of slabs and floor coverings from moisture can be further improved by installing a course of open-graded gravel (OGG) such as Permeable Ballast (WSDOT 9-03.9(2)) at least 6 inches thick below the slab to break the capillary potential of water in the pore space of soils and aggregates. The combination of a durable, impermeable membrane and OGG provides the best means of slab moisture control, in our opinion. We recommend designing the OGG for slab moisture protection to also serve as a drainage layer.

Backfill adjacent to footings and underlying utility excavations in accordance with the recommendations described in *Earthwork* to provide uniform slab support.

### ***Lateral Earth Pressures and Lateral Resistance***

The recommended equivalent fluid pressures for wall design are 33 pounds per cubic foot per foot of height (pcf) for the active case. For the at-rest case, use 53 pcf and for the passive case, 495 pcf. The recommended earth to concrete friction factor is 0.45, which is based on existing soil types. These values are based on properly compacted backfill and will be substantially reduced when unit

weights are less than those recommended in *Earthwork*. Values anticipate horizontal surfaces above and below retaining walls and drained conditions. Apply appropriate safety factors in design, as values provided are un-factored.

### **Basement Walls**

Due to the limited exploration depths, basements should be incorporated into structure designs to a depth of no more than 12 feet. Deeper basements should be evaluated by a geotechnical engineer on a case-by-case basis. Basements should only be utilized if gravity or pumped drainage systems terminating at a point of positive discharge can be utilized.

Adequate drainage should be provided for basement walls to minimize lateral earth pressures and to prevent buildup of hydrostatic pressures. The wall backfill should contain less than 12 percent fines and be used in conjunction with footing drains and/or other drainage provisions to provide full wall drainage.

In cases where the backfill contains more than 12 percent fines, perimeter foundation drains should be installed at exterior foundation walls. These drains should consist of a 12-inch-wide curtain of clean gravel with less than 3 percent fines. The gravel should extend from the bottom of the wall to within one foot of the ground surface. Alternatively, a geosynthetic drain blanket (Miradrain 5000 or equivalent) can be placed against the wall from the bottom of the wall to within one foot of the ground surface.

Fines percentage for the uppermost 12 inches of fill from ground surface adjacent to the buildings should exceed 12 percent fines. Soils classified as CL, CH, ML, MH, OL, or OH (clays and silts) should not be used as backfill against basement walls unless the wall has been specifically designed to resist loads applied by these soil types. For typically designed walls, these soils should not be placed within a zone delineated by the wall and an imaginary line extending from the bottom of the wall at a 45-degree angle out to the ground surface. Soils classified as PT should not be used.

Footing drains should be placed around the perimeter of the exterior spread footings in general accordance with IRC R405.1. Footing drains should be tied into the foundation wall drains and consist of 4-inch diameter, perforated, plastic pipe, embedded in clean, fabric wrapped free-draining gravel (FDG), consisting of the following gradation:

**Table 3: Foundation Drain Gradation**

<b>U.S. Sieve Opening</b>	<b>Percent Passing</b>
1-1/2 inch	100
#4	0 to 60
#40	< 5

The minimum width of the FDG should be 12 inches and be placed along the outside of the footing and not on top. The FDG should be wrapped in non-woven filter fabric. The fabric should meet the WSDOT specification for filter fabric. The FDG should extend from the base of the footing to within one foot of the ground surface. Accumulated foundation water should be conveyed to an approved drainage system (IRC, R405.1).

Prior to drain installation and back filling, a damp-proofing membrane or coatings should be applied to the outside of basement walls to minimize moisture transfer through the concrete foundation walls (IRC, R406.2). A concrete moisture abatement specialist should be consulted for specific products, installation, or applications.

The ground surface adjacent to the buildings should be graded to drain away from the building in accordance with IRC, R401.3 Drainage.

***Crawlspace Construction***

Adequate drainage must be provided for structures with a framed lower floor and crawlspace. A drain should be installed at the low point of the crawl space to allow accumulated water to flow to a positive discharge point outside of the building. Adequate crawl space ventilation should also be provided. A vapor barrier should be placed over the bare soil if framed floors are used.

***Flexible Pavement***

A resilient modulus of approximately 8,800 pounds per square inch (psi) is suitable for pavement design.

Information regarding the estimation of ADT was not provided at the time this report was prepared. The ADT includes 10 trips per day per lot for light passenger vehicles with 2 percent heavy vehicles added (concrete trucks, construction equipment haulers, garbage trucks, moving and delivery vans, etc.). If traffic information is updated or grading plan developed, we need to be contacted to re-evaluate pavement sections.

Pavement design parameters included the following:

- Design Life is 20 years
- Spokane County design standards;
- Subgrade resilient modulus – 8,900 psi;
- ADT – 730;
- Total design ESALs – 180,000.

Based upon the above considerations, the recommended flexible pavement section for residential streets is 3.5 inches hot mix asphalt (HMA) over 6 inches of crushed surfacing top course (CSTC) over Mirafi 180N non-woven geotextile (filter fabric) over compacted subgrade. Where subgrade soil consists of no more than 15 percent fines, the filter fabric may be omitted.

**Table 4: Pavement Compaction and Recommended Materials Summary**

<b>Layer</b>	<b>Compaction</b>	<b>Specification</b>
3.5 inches Asphalt Surfacing - HMA	92% TM	WSDOT Standard Specifications Section 9-03.8(6).
6 inches Base Coarse - CSTC	95% MP	WSDOT Standard Specifications Section 9-03.9(3)
Native subgrade, top 12 inches	95% MP	Native soils or embankment fill, improved by compaction
TM = Theoretical Maximum Unit Weight MP = Modified Proctor (AASHTO T-180)		

We recommend crack maintenance be performed regularly on paved surfaces to reduce the potential for surface water infiltration into the underlying pavement subgrade.

### ***Stormwater Drainage***

We recommend grading surfaces to allow positive drainage away from structures and pavements. Roof and street runoff should be collected and disposed of such that water is not allowed to accumulate near the structures or pavements.

As previously stated, the use of rapid subsurface infiltration structures doesn't appear to be feasible, based on the available information. Test pit infiltration testing or full-scale drywell testing may offer potential to improve the subsurface characterization and generally results in less conservatism than grain-size correlations, though successful use of drywells cannot be assured.

An alternative method to subsurface infiltration may include the use of evaporative/detention ponds with limited infiltration to the subsurface. In the event this method for stormwater treatment becomes desirable, we recommend following procedures described in the Spokane Regional Stormwater Manual (SRSW), Chapter 5, for designing such facilities.

### ***Additional Services***

Effective geotechnical services involve cooperation with the owner, designer, and constructor as follows:

1. Preliminary study to assist in planning and to economically adapt the project to its geologic environment;
2. Soil exploration and analysis to characterize subsurface conditions and recommend design criteria;
3. Consultation with the designer to adapt the specific design to the site in accordance with the recommendations;
4. Construction observation to verify the conditions encountered and to make recommendations for modifications, as necessary; and,
5. Construction material testing, quality control, and special inspection.

This report satisfies Item 1 of the 5-phase endeavor, as well as item 2 for the items included in the scope of services, as proposed. We are eager to provide assistance with design and construction as appropriate to assist in completing a safe and economical project.

The scope of services does not include foundation design evaluation for homes or outbuildings.

### ***FIELD EXPLORATION***

The fieldwork was conducted by staff geologist Rex Lloyd, and supervised by geotechnical engineer John Finnegan, PE, on February 22 through 25, 2022. The field activities generally consisted of the following:

- Reconnaissance of the site and surrounding area;
- Logging subsurface conditions in 29 test pits;
- Conducting DCP soundings; and,
- Obtaining bulk samples of the encountered soils.

Results are presented in *Figures*.

### ***Test Pits***

Test pits were excavated utilizing a Caterpillar 315 track-mounted excavator with a 42-inch-wide toothed bucket. The total depth to which test pits were excavated was controlled by limits of equipment reach, excessive side wall caving, or digging refusal on *gneiss*.

### ***Soil Samples***

Samples collected during test pit excavations were obtained by collecting representative materials from the bucket of the excavator or directly from within the excavation at 4 feet below grade or less.

### ***DCP Testing***

***DCP Testing – ASTM D6951/ASTM STP 399.*** Soil strength was estimated with a series of DCP tests using two methods. Method 1 involves the use of a Kessler® DCP which consists of a 10.1 or 17.6-pound slide hammer and rods with 2-inch graduations. Both hammer weights were used in this evaluation for Method 1. Method 2 involves the use of a Trigg's Wildcat® DCP system which consists of a 35-pound slide hammer and rods with 4-inch graduations. In both methods the hammer is manually lifted and allowed to fall from a fixed height. Kessler® DCP test results can be correlated to CBR values for estimating relative soil strength for pavement design. Wildcat® DCP results can be correlated to N-values for estimating relative soil density. The results of DCP penetration per 1-inch and 4-inch intervals are presented in *Figures*.

### ***Soil and Rock Classification***

Field descriptions of soils and rock were completed in accordance with the current version of the Washington State Department of Transportation, *Geotechnical Design Manual (GDM)*, M 46-03, except that fines (silt and clay) were described in accordance with ASTM D 2487. *Whereas, the GDM uses the terms 'silty' and 'clayey' to describe a very broad range of fines from 10 to 49 percent; ASTM D 2487 uses those terms for percentages greater than 12 and the term 'with' for fines ranging from 5 to 12 percent, which is typically necessary to describe variations relevant to soil permeability per the SRSM.* A key to the descriptions is provided in *Guide to Soil and Rock Descriptions*.

### ***Location***

**Horizontal & vertical control.** The *Site Plan* was reproduced from a preliminary plan provided by WCE dated March 4, 2022, and is based on measured offsets from locations staked by others prior to the exploration.

Elevations presented in the *Logs* are based elevations marked on the previously placed stakes. Horizontal and vertical locations can be considered accurate to within 5-foot and 1-foot respectively, relative to the information provided.

## ***LABORATORY ANALYSIS***

Laboratory testing was performed on representative samples of the soils encountered to provide data used in our assessment of soil characteristics.

Tests were conducted, where practical, in accordance with nationally recognized standards (ASTM, AASHTO, etc.), which are intended to model in-situ soil conditions and behavior. The results are

presented in *Figures*.

### ***Index Parameters***

**Moisture content – ASTM D2216.** Moisture contents were determined by direct weight proportion (weight of water/weight of dry soil) determined by drying soil samples in an oven until reaching constant weight.

**Gradation – ASTM D6913.** Gradation analysis was performed by the mechanical sieve method. The mechanical sieve method is utilized to determine particle size distribution based upon the dry weight of sample passing through sieves of varying mesh sizes. The results of gradation are provided in *Grain Size Distribution Results*.

**Atterberg Limits – ASTM D4318.** Atterberg limits describe the properties of the fine-grained constituents of soils by relating the water content to the plastic and liquid limits of engineering behavior. As the water content increases, the state of the soil changes from a brittle solid, to a plastic solid, and then to a viscous liquid.

The liquid limit (LL) is the water content above which the soil tends to behave as a viscous liquid. Similarly, the plastic limit (PL) is defined as the water content below which the soil tends to behave as a brittle solid. The plasticity index describes the range of water content over which a soil is plastic and is derived by subtracting the PL from the LL. The soil is classified as “non-plastic” if rolling a 1/8-inch bead is not possible at any water content.

### ***LIMITATIONS***

The conclusions and recommendations presented herein are based upon the results of field explorations and laboratory testing results. They are predicated upon our understanding of the project, its design, and its location as defined in by the client. We endeavored to conduct this study in accordance with generally accepted geotechnical engineering practices in this area.

This GER presents our professional interpretation of exploration data developed, which we believe meets the standards of the geotechnical profession in this area; we make no other warranties, express or implied. Attached is a document titled “*Important Information About Your Geotechnical-Engineering Report*,” which we recommend you review carefully to better understand the context within which these services were completed.

Unless test locations are specified by others or limited by accessibility, the scope of analysis is intended to develop data from a representative portion of the site. However, the areas tested are discreet. Interpolation between these discreet locations is made for illustrative purposes only but should be expected to vary. If a greater level of detail is desired, the client should request an increased scope of exploration.

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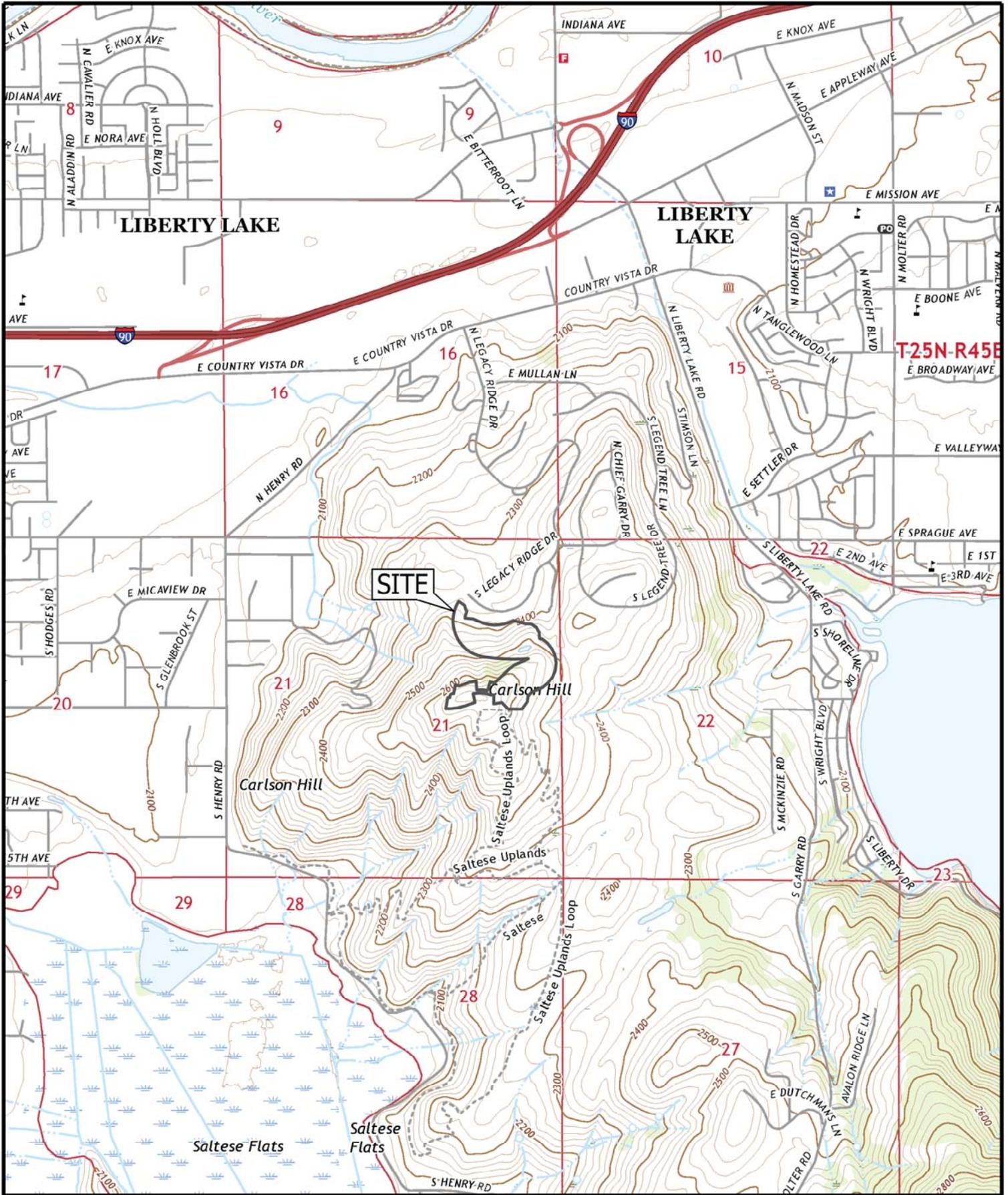
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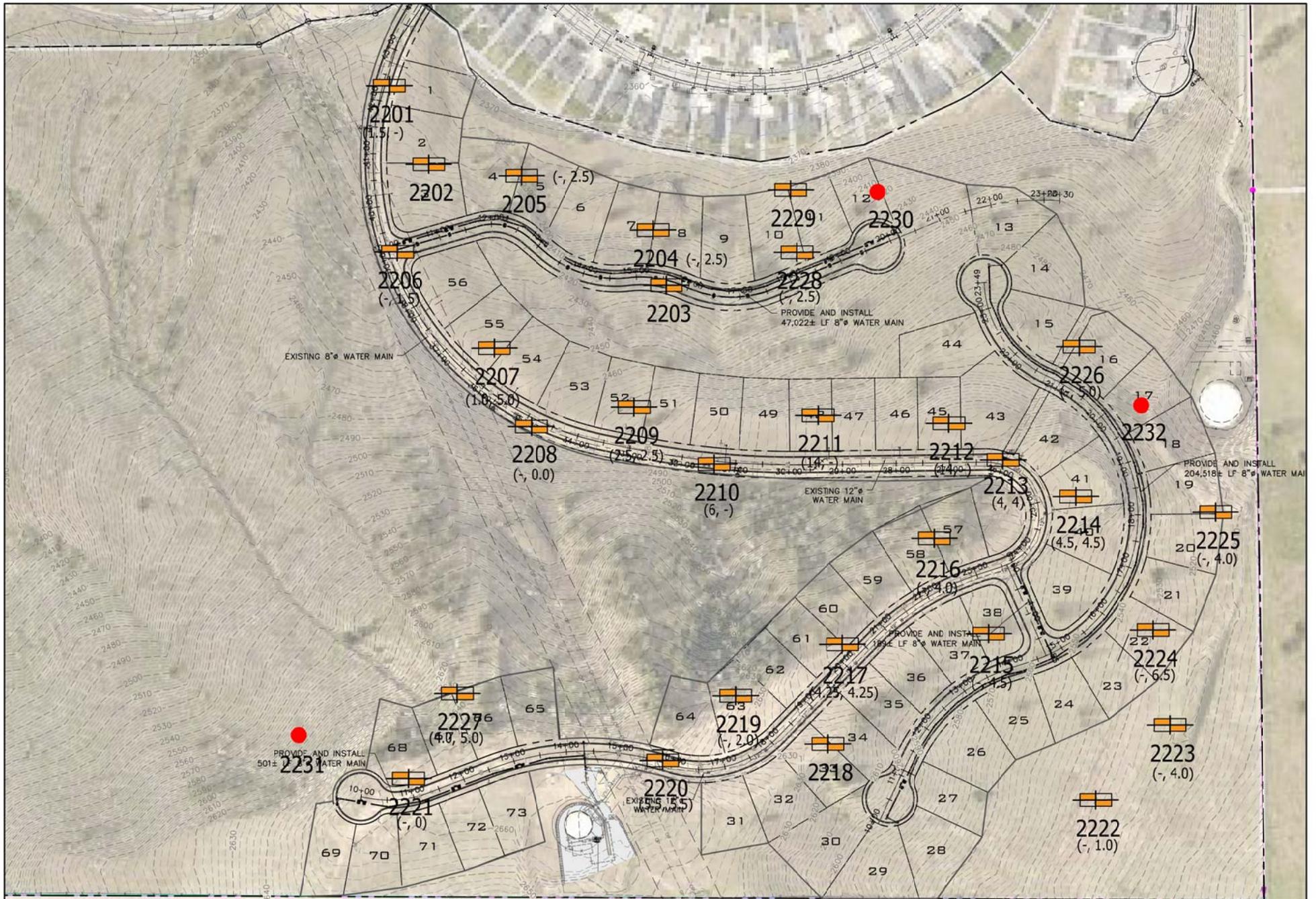


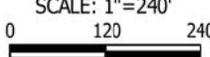
  
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 T 25 N R 45 E  
 USGS 2020


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**VICINITY MAP**  
 LEGACY RIDGE PHASE F  
 LIBERTY LAKE, WASHINGTON

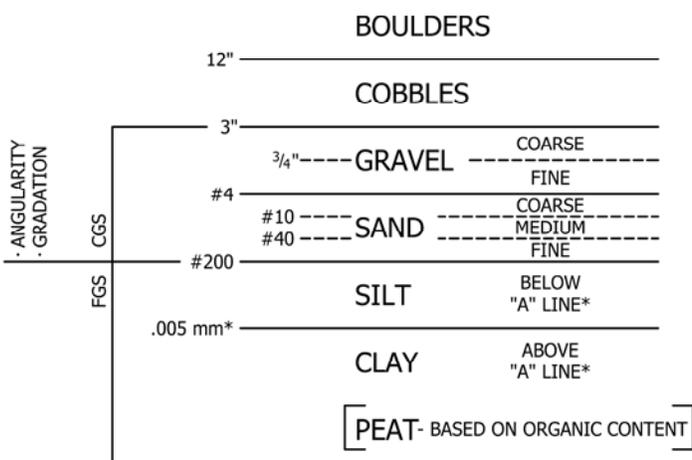
**FIGURE 1**  
 PROJECT NUMBER S211189  
 DATE: 3/2022



<p>  TEST PIT LOCATION   DCP LOCATION          (2.5, 8.5) DEPTH OF FILL, DEPTH TO ROCK (FEET)       </p>	<p>           SCALE: 1"=240'   </p>	<p>         BASE PLAN PROVIDED BY          WCE DATED 3/04/22          AERIAL IMAGERY PROVIDED          BY MAPSPOKANE       </p>  <p><b>Budinger &amp; Associates</b></p>	<p> <b>SITE PLAN</b>          LEGACY RIDGE PHASE F          LIBERTY LAKE, WASHINGTON       </p>	<p> <b>FIGURE 2</b>          PROJECT NUMBER S211189          DATE: 3/2022       </p>
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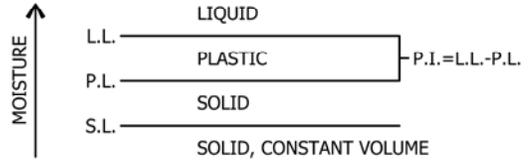
# GUIDE TO SOIL & ROCK DESCRIPTIONS

## SOIL CLASSIFICATION

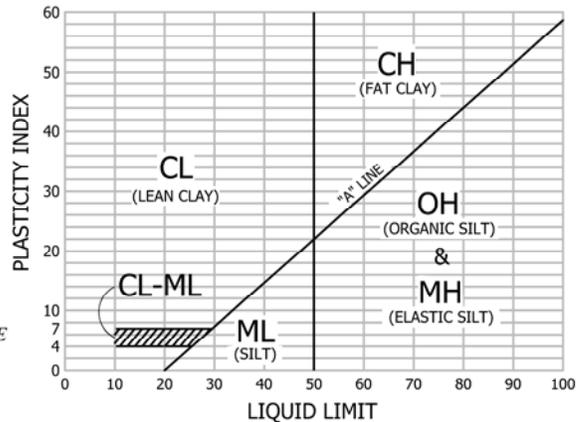


\* SEE PLASTICITY CHART  
 CGS - COARSE GRAINED SOIL - MORE THAN 50% RETAINED ON A #200 SIEVE  
 FGS - FINE GRAINED SOIL - 50% MORE PASSES, #200 SIEVE  
 FINES - PORTION FINER THAN #200 SIEVE

## ATTERBERG LIMITS



## PLASTICITY CHART



NOTE - CHART APPLIES TO FGS AND MINUS #40 SIEVE FRACTION OF CGS

## GUIDE TO SOIL DESCRIPTION MODIFIERS, MOISTURE, AND CONDITION PRESENTED ON LOGS

MODIFIER	ESTIMATED PERCENTAGE OF MATERIAL
SUFFIX "LY" OR "Y".....	30% OR MORE FOR COARSE PARTS IN FGS GREATER THAN 12% FOR FINES IN CGS
WITH .....	15% - 29% FOR COARSE PARTS IN FGS 5% - 12% FOR FINES IN CGS

NOTE - VISUAL ESTIMATES OF MATERIAL PERCENTAGES TYPICALLY VARY 0 TO 10% FROM THOSE DETERMINED BY LABORATORY TESTING.

MOISTURE
DRY
MOIST
SATURATED OR WET

SOIL CONDITION
CGS:
VERY LOOSE
LOOSE
MEDIUM DENSE
DENSE
VERY DENSE

FGS:
VERY SOFT
SOFT
MEDIUM STIFF
STIFF
VERY STIFF
HARD

### SAMPLES

	STANDARD 2" PENETRATION TEST SAMPLER WITH BLOWS PER FOOT
	3" SPLIT SPOON SAMPLER WITH BLOWS PER FOOT
	DRILL CUTTING SAMPLE
	BULK SAMPLE
	THIN-WALLED TUBE SAMPLE
	DIAMOND CORE RUN WITH % RECOVERY & ROCK QUALITY DESIGNATION
	2.5" SPLIT SPOON SAMPLER WITH BLOWS PER FOOT
	CONTINUOUS SOIL SAMPLE
R	REFUSAL OF SAMPLE (50+ BLOWS PER 6")

ROCK WEATHERING
FRESH
SLIGHTLY WEATHERED
MODERATELY WEATHERED
HIGHLY WEATHERED
COMPLETELY WEATHERED
RESIDUAL SOIL

ROCK CONDITION
EXTREMELY WEAK
VERY WEAK
MODERATELY WEAK
MODERATELY STRONG
STRONG
VERY STRONG



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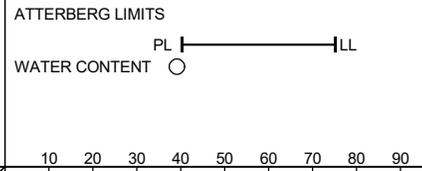
FIGURE 3

## TEST PIT 2201

**Date:** 2-22-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** Centerline of road at lots 1  
**Surface:** bare

**Elevation:** 2384 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 10 x 4 feet

### TEST RESULTS



DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS
0					
		moist, brown, medium dense	SILTY SAND with Gravel, coarse to fine, micaceous (POSSIBLE FILL)	[Cross-hatched pattern]	
		moist, brown, medium dense	SILTY SAND with Gravel, coarse to fine, micaceous (NATIVE)	[Dotted pattern]	○
5	[Diagonal hatching]				
10	[Diagonal hatching]				
		no free groundwater observed	End of Excavation @ 11 ft		
15					
20					



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### TEST PIT LOGS

### FIGURE 4-1

Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

## TEST PIT 2202

**Date:** 2-22-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** lots 2 & 3  
**Surface:** snow

**Elevation:** 2393 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 15 x 4.5 feet

				TEST RESULTS									
DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	ATTERBERG LIMITS								
					WATER CONTENT								
					PL	-----				LL			
					○								
					10	20	30	40	50	60	70	80	90
0		moist, brown, loose	SAND with Silt and occasional Gravel, coarse to fine, angular, micaceous										
		medium dense	1.5-feet: communications wire in 3/4-inch gray conduit		○								
		dense	(moderate effort required to excavate)										
5													
10													
		no free groundwater observed	End of Excavation @ 12 ft										
15													
20													



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### TEST PIT LOGS

### FIGURE 4-2

Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

## TEST PIT 2203

**Date:** 2-22-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** Centerline of road at lot 8  
**Surface:** grass and weeds

**Elevation:** 2421 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 11 x 5 feet

				TEST RESULTS									
DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	ATTERBERG LIMITS								
					WATER CONTENT								
0					10	20	30	40	50	60	70	80	90
	1	moist, dark brown, loose	SILTY SAND with organics as roots (TOPSOIL)	[Soil Log Pattern]									
	2	moist, brown, medium dense	SILTY SAND with occasional gravel, coarse to fine, angular, micaceous	[Soil Log Pattern]				○					
	3	moist, orangish brown, dense	SAND with Silt, coarse to fine, angular, micaceous (COMPLETELY WEATHERED GNEISS) (considerable effort required to excavate)	[Soil Log Pattern]									
5													
		no free groundwater observed	End of Excavation @ 7 ft										
10													
15													
20													



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### TEST PIT LOGS

### FIGURE 4-3

**Project:** Legacy Ridge Phase F  
**Location:** Liberty Lake, WA  
**Number:** S211189

## TEST PIT 2204

**Date:** 2-22-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** lots 7 & 8  
**Surface:** snow

**Elevation:** 2397 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 11 x 4.5 feet

### TEST RESULTS

ATTERBERG LIMITS  
 PL |-----| LL  
 WATER CONTENT ○

10 20 30 40 50 60 70 80 90

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS									
0														
		moist, orangish brown, dense	SILTY SAND, coarse to fine, angular, micaceous (COMPLETELY WEATHERED GNEISS)											
		moist, orangish brown	GNEISS, medium to coarse grained, moderately weathered, moderately weak (R2)											
5														
		no free groundwater observed	Excavator Refusal End of Excavation @ 5 ft											
10														
15														
20														



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### TEST PIT LOGS

### FIGURE 4-4

**Project:** Legacy Ridge Phase F  
**Location:** Liberty Lake, WA  
**Number:** S211189

## TEST PIT 2205

**Date:** 2-23-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** lots 4 & 5  
**Surface:** snow

**Elevation:** 2387 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 13 x 5 feet

					TEST RESULTS															
DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	ATTERBERG LIMITS PL ——— LL WATER CONTENT ○															
					10	20	30	40	50	60	70	80	90							
0		moist, brown, medium dense	SAND with Silt, coarse to fine, angular, micaceous																	
	1	moist, orangish brown	GNEISS, medium to coarse grained, moderately weathered, moderately weak (R2) (considerable effort required to excavate)																	
5		no free groundwater observed	Excavator Refusal End of Excavation @ 5 ft																	
10																				
15																				
20																				



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### TEST PIT LOGS

### FIGURE 4-5

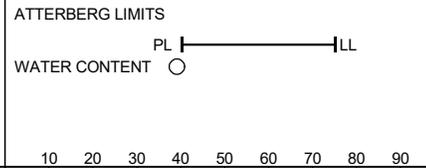
**Project:** Legacy Ridge Phase F  
**Location:** Liberty Lake, WA  
**Number:** S211189

## TEST PIT 2206

**Date:** 2-23-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** intersection at north road  
**Surface:** patchy snow

**Elevation:** 2415 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 14 x 4.5 feet

### TEST RESULTS



DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS															
0		moist, brown, medium dense	SILTY SAND, coarse to fine, angular, micaceous (FILL)																	
5		moist, orangish brown	GNEISS, medium to coarse grained, moderately weathered, moderately weak (R2) (considerable effort required to excavate)  pocket penetrometer (pp) = 4.5 tsf																	
10		no free groundwater observed	End of Excavation @ 6.5 ft																	
15																				
20																				



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### TEST PIT LOGS

### FIGURE 4-6

Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

## TEST PIT 2207

**Date:** 2-23-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** lot 55  
**Surface:** sparse weeds

**Elevation:** 2447 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 10 x 4.5 feet

### TEST RESULTS

ATTERBERG LIMITS  
 PL |-----| LL  
 WATER CONTENT ○

10 20 30 40 50 60 70 80 90

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS
0		moist, brown, loose	SILTY SAND, coarse to fine, angular, micaceous (FILL)		
		moist, brown, medium dense	SAND with Silt, coarse to fine, angular (COMPLETELY WEATHERED GNEISS)		○
5		moist, orangish brown	GNEISS, medium to coarse grained, moderately weathered, moderately weak (R2)		
		no free groundwater observed	Excavator Refusal End of Excavation @ 7 ft		
10					
15					
20					



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### TEST PIT LOGS

### FIGURE 4-7

Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

## TEST PIT 2208

**Date:** 2-23-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** centerline of road at lot 53  
**Surface:** bare

**Elevation:** 2458 ft  
**Logged by:** R. Lloyd  
**Size of hole:** n/a

### TEST RESULTS

ATTERBERG LIMITS  
 PL |-----| LL  
 WATER CONTENT ○

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS
0		moist, orangish brown no free groundwater observed	GNEISS, medium to coarse grained, moderately weathered, moderately weak (R2) Excavator Refusal (possible frost) End of Excavation @ 0.25 ft		10 20 30 40 50 60 70 80 90
5					
10					
15					
20					



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### TEST PIT LOGS

### FIGURE 4-8

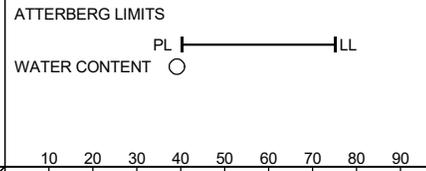
**Project:** Legacy Ridge Phase F  
**Location:** Liberty Lake, WA  
**Number:** S211189

## TEST PIT 2209

**Date:** 2-23-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** lot 52  
**Surface:** sparse weeds

**Elevation:** 2373 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 13 x 4.5 feet

### TEST RESULTS



DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS															
0																				
	[diagonal lines]	moist, dark brown, loose	SILTY SAND, stratified in approximately 1-inch intervals with gray Silty Sand (FILL)	[cross-hatch]																
	[diagonal lines]	moist, orangish brown	GNEISS, medium to coarse grained, moderately weathered, moderately weak (R2)  (considerable effort required to excavate)	[diagonal lines]																
5		no free groundwater observed	Excavator Refusal End of Excavation @ 5 ft																	
10																				
15																				
20																				



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### TEST PIT LOGS

### FIGURE 4-9

Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

## TEST PIT 2210

**Date:** 2-23-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** centerline of road at lot 50  
**Surface:** bare

**Elevation:** 2493 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 6 x 4.3 feet

### TEST RESULTS

ATTERBERG LIMITS  
 PL ———— LL  
 WATER CONTENT ○

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS
0					10 20 30 40 50 60 70 80 90
	[diagonal hatching]	moist, brown, loose	SAND with occasional gravel, coarse to fine, angular (FILL) (frost to 12-inches)	[cross-hatching]	○
	[diagonal hatching]	moist, dark brown, medium dense	SILTY SAND with organics (likely trench backfill)	[stippled]	○
5		no free groundwater observed	(6-feet: water line marking found in excavation, hole abandoned to avoid damage) End of Excavation @ 6 ft		
10					
15					
20					



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### TEST PIT LOGS

### FIGURE 4-10

**Project:** Legacy Ridge Phase F  
**Location:** Liberty Lake, WA  
**Number:** S211189

## TEST PIT 2211

**Date:** 2-23-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** lot 48  
**Surface:** snow

**Elevation:** 2511 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 17 x 4.5 feet

					TEST RESULTS									
DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	ATTERBERG LIMITS									
					WATER CONTENT									
					PL <span style="display: inline-block; width: 100px; border-bottom: 1px solid black; position: relative; top: -5px;"> ----- </span> LL ○									
					10	20	30	40	50	60	70	80	90	
0		moist, brown, loose	SILTY SAND with Gravel, Cobbles, and occasional Boulders, coarse to fine, angular (FILL)											
		medium dense												
		dense												
5														
10														
15		no free groundwater observed	Maximum Reach End of Excavation @ 14 ft											
20														



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### TEST PIT LOGS

**FIGURE 4-11**

**Project:** Legacy Ridge Phase F  
**Location:** Liberty Lake, WA  
**Number:** S211189

## TEST PIT 2212

**Date:** 2-23-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** lots 45  
**Surface:** snow

**Elevation:** 2534 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 18 x 5 feet

### TEST RESULTS

ATTERBERG LIMITS  
 PL |-----| LL  
 WATER CONTENT ○

10 20 30 40 50 60 70 80 90

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS
0					
5	[Hatched Box]	moist, brown, loose  medium dense	SILTY SAND with Gravel, occasional cobbles and boulders, anthropogenic debris as PVC pipe (FILL)	[Cross-hatched Box]	○
10	[Hatched Box]	moist, olive brown, dense	SILTY SAND with Gravel, Cobbles, and occasional boulders (FILL)	[Cross-hatched Box]	○
15		no free groundwater observed	Maximum Reach End of Excavation @ 14 ft		
20					



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### TEST PIT LOGS

### FIGURE 4-12

Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

## TEST PIT 2213

**Date:** 2-23-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** centerline road at lots 42 & 43  
**Surface:** patchy snow

**Elevation:** 2547 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 10 x 4.5 feet

### TEST RESULTS

ATTERBERG LIMITS  
 PL ———— LL  
 WATER CONTENT ○

10 20 30 40 50 60 70 80 90

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS
0	[Hatched Box]	moist, orangish brown, loose	SILTY SAND with Gravel, coarse to fine, angular (FILL)	[Cross-hatched Box]	○
		medium dense			
5	[Hatched Box]	moist, orangish gray	GNEISS, medium to coarse grained, moderately weathered, moderately weak (R2)	[Diagonal-hatched Box]	○
			(becomes strong R4)		
10		no free groundwater observed	Excavator Refusal End of Excavation @ 10 ft		
15					
20					



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### TEST PIT LOGS

### FIGURE 4-13

Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

## TEST PIT 2214

**Date:** 2-24-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** lot 41  
**Surface:** sparse weeds and snow

**Elevation:** 2559 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 16 x 4.5 feet

				TEST RESULTS									
DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	ATTERBERG LIMITS								
					WATER CONTENT ○								
					10	20	30	40	50	60	70	80	90
0	1	moist, brown, loose medium dense	SILTY SAND with Gravel, coarse to fine, angular (FILL)		○								
		dense											
5		moist, orangish brown	4.5-feet: two 6-inch diameter steel pipes at north end of test pit										
		no free groundwater observed	GNEISS, medium to coarse grained, moderately weathered, moderately weak (R2) End of Excavation @ 5 ft										
10													
15													
20													



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### TEST PIT LOGS

### FIGURE 4-14

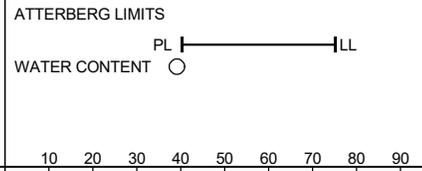
**Project:** Legacy Ridge Phase F  
**Location:** Liberty Lake, WA  
**Number:** S211189

## TEST PIT 2215

**Date:** 2-24-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** Lots 38  
**Surface:** grass and weeds

**Elevation:** 2575 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 16 x 4.5 feet

### TEST RESULTS



DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	
0		moist, dark brown, loose	SILT with Sand and organics as roots (TOPSOIL)		
		moist, brown, medium dense	SILTY SAND with Gravel, coarse to fine, angular		
		moist, orangish brown, dense	SILTY SAND, coarse to fine, angular, micaceous (COMPLETELY WEATHERED GNEISS)		
5		moist, orangish brown	GNEISS, medium to coarse grained, moderately weathered, moderately weak (R2)		
		no free groundwater observed	Excavator Refusal End of Excavation @ 5 ft		
10					
15					
20					



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### TEST PIT LOGS

### FIGURE 4-15

Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

## TEST PIT 2216

**Date:** 2-24-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** lots 57 & 58  
**Surface:** snow

**Elevation:** 2580 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 13 x 4.5 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS									
					ATTERBERG LIMITS PL  -----  LL WATER CONTENT ○									
					10	20	30	40	50	60	70	80	90	
0	1	moist, dark brown, loose	SILTY SAND with organics as roots (TOPSOIL)		○	H								
	2	moist, light brown, loose	SILTY SAND with occasional Gravel, coarse to fine, angular to subrounded pp=0.75 tsf											
	3	moist, orangish brown	GNEISS, medium to coarse grained, moderately weathered, moderately weak (R2)											
5		no free groundwater observed	Excavator Refusal End of Excavation @ 5.5 ft											
10														
15														
20														



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### TEST PIT LOGS

### FIGURE 4-16

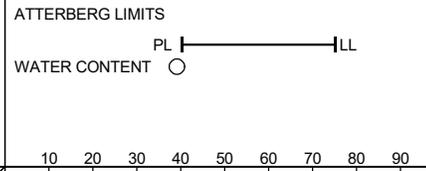
Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

## TEST PIT 2217

**Date:** 2-24-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** lots 60 & 61  
**Surface:** bare

**Elevation:** 2604 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 11 x 5 feet

### TEST RESULTS



DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS
0		moist, brown, loose  medium dense	SILTY GRAVEL with Sand and Cobbles, coarse to fine, angular (FILL)	[Cross-hatched pattern]	○
5		moist, orangish brown no free groundwater observed	GNEISS, medium to coarse grained, moderately weathered, moderately weak (R2) Excavator Refusal End of Excavation @ 3.5 ft	[Cross-hatched pattern]	
10					
15					
20					



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### TEST PIT LOGS

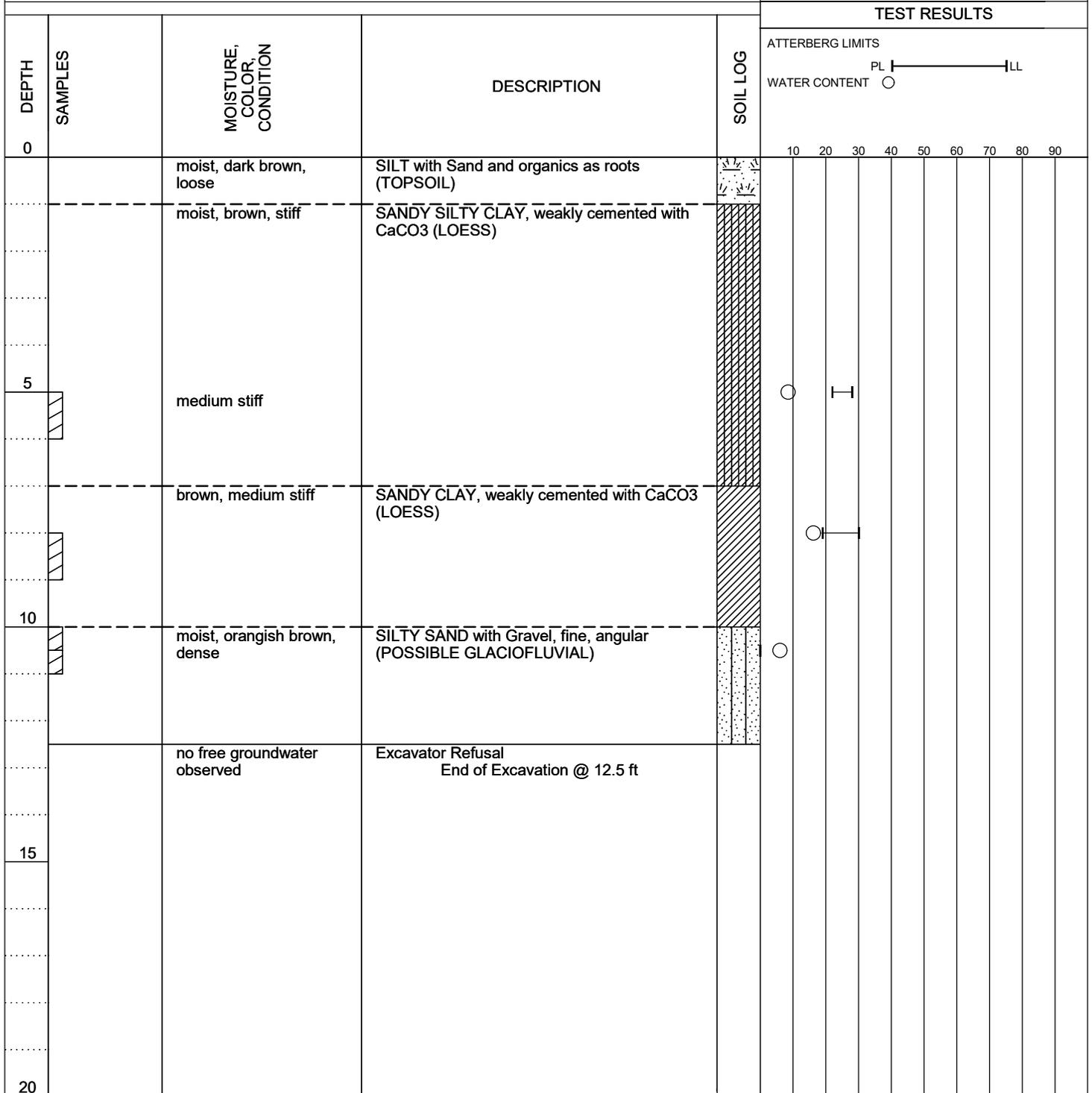
### FIGURE 4-17

**Project:** Legacy Ridge Phase F  
**Location:** Liberty Lake, WA  
**Number:** S211189

## TEST PIT 2218

**Date:** 2-24-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** lots 33 & 34  
**Surface:** sparse weeds and snow

**Elevation:** 2627 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 14 x 4.5 feet



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### TEST PIT LOGS

### FIGURE 4-18

Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

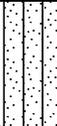
## TEST PIT 2219

**Date:** 2-24-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** lot 63  
**Surface:** bare

**Elevation:** 2637 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 10 x 4.5 feet

### TEST RESULTS

ATTERBERG LIMITS  
 PL ———— LL  
 WATER CONTENT ○

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS
0		moist, orangish gray, dense	SILTY SAND with Gravel, fine, micaceous (COMPLETELY WEATHERED GNEISS)		10 20 30 40 50 60 70 80 90
5		moist, orangish gray	GNEISS, medium to coarse grained, moderately weathered, moderately weak (R2)		
10		no free groundwater observed	Excavator Refusal End of Excavation @ 6.5 ft		
15					
20					



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### TEST PIT LOGS

### FIGURE 4-19

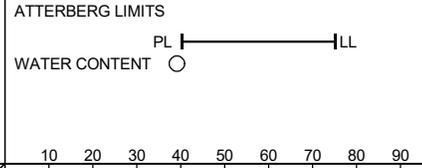
**Project:** Legacy Ridge Phase F  
**Location:** Liberty Lake, WA  
**Number:** S211189

## TEST PIT 2220

**Date:** 2-24-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** centerline road at lot 64  
**Surface:** bare

**Elevation:** 2648 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 8 x 4 feet

### TEST RESULTS



DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS
0					
		moist, orangish brown, dense	GRAVEL with Silt, Sand, Boulders, and Cobbles, coarse to fine, angular (FILL)		○
5					
		no free groundwater observed	End of Excavation @ 6.5 ft		
10					
15					
20					



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### TEST PIT LOGS

### FIGURE 4-20

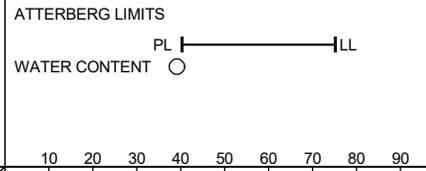
**Project:** Legacy Ridge Phase F  
**Location:** Liberty Lake, WA  
**Number:** S211189

## TEST PIT 2221

**Date:** 2-25-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** north of road at lot 68  
**Surface:** grass and weeds

**Elevation:** 2660 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 12 x 5.5 feet

### TEST RESULTS



DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS															
0		moist, orangish grey	GNEISS, medium to coarse grained, moderately to slightly weathered, moderately weak (R2) to moderately strong (R3)																	
5		no free groundwater observed	Excavator Refusal End of Excavation @ 4 ft																	
10																				
15																				
20																				



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### TEST PIT LOGS

### FIGURE 4-21

Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

## TEST PIT 2222

**Date:** 2-25-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** south east parcel  
**Surface:** sparse grass and weeds

**Elevation:** 2530 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 11 x 4.5 feet

TEST RESULTS														
DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	ATTERBERG LIMITS									
					WATER CONTENT									
0					10	20	30	40	50	60	70	80	90	
	1	moist, dark brown, loose	SILTY SAND with organics as roots (TOPSOIL)											
		dry, orangish gray	GNEISS, medium to coarse grained, fresh to completely weathered, moderately weak (R2) to moderately strong (R3)											
		no free groundwater observed	Excavator Refusal End of Excavation @ 3 ft											
5														
10														
15														
20														



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### TEST PIT LOGS

### FIGURE 4-22

Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

## TEST PIT 2223

**Date:** 2-25-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** south east of lot 23  
**Surface:** sparse weeds and snow

**Elevation:** 2531 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 15 x 5 feet

### TEST RESULTS

ATTERBERG LIMITS  
 PL |-----| LL  
 WATER CONTENT ○

10 20 30 40 50 60 70 80 90

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS
0					
	1	moist, dark brown, loose	SILTY SAND with organics as roots (TOPSOIL)	[diagonal lines]	○
	2	moist, brown, medium dense	SAND with SILT and Gravel, coarse to fine, angular	[dots]	○
	3	orangish brown	GNEISS, medium to coarse grained, completely weathered, moderately weak (R2) (considerable effort required from excavator)	[cross-hatch]	
5					
		no free groundwater observed	Excavator Refusal End of Excavation @ 6 ft		
10					
15					
20					



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### TEST PIT LOGS

### FIGURE 4-23

Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

## TEST PIT 2224

**Date:** 2-25-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** lot 22  
**Surface:** grass and weeds

**Elevation:** 2531 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 13 x 5 feet

					TEST RESULTS															
DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	ATTERBERG LIMITS PL ———— LL WATER CONTENT ○															
					10	20	30	40	50	60	70	80	90							
0	[diagonal lines]	moist, brown, medium dense	SILTY SAND with Gravel, coarse to fine, angular (FILL)	[cross-hatch]	○															
5	[diagonal lines]	moist, orangish brown, medium dense	SAND with SILT and Gravel, coarse, angular, micaceous (COMPLETELY WEATHERED GNEISS)	[dots]	○															
10		no free groundwater observed	Excavator Refusal End of Excavation @ 6.5 ft																	
15																				
20																				



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### TEST PIT LOGS

**FIGURE 4-24**

Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

## TEST PIT 2225

**Date:** 2-25-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** lots 19 & 20  
**Surface:** sparse weeds and snow

**Elevation:** 2516 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 14 x 5 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS									
					ATTERBERG LIMITS PL ——— LL WATER CONTENT ○									
0					10	20	30	40	50	60	70	80	90	
		moist, dark brown, loose	SILTY SAND with organics as roots (TOPSOIL)											
		moist, orangish brown, medium dense	SILTY SAND with Gravel, coarse to fine, angular, micaceous (COMPLETELY WEATHERED GNEISS)											
		orangish gray	GNEISS, medium to coarse grained, moderately weathered, moderately strong (R3)											
5		no free groundwater observed	Excavator Refusal End of Excavation @ 4 ft											
10														
15														
20														



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### TEST PIT LOGS

### FIGURE 4-25

**Project:** Legacy Ridge Phase F  
**Location:** Liberty Lake, WA  
**Number:** S211189

## TEST PIT 2226

**Date:** 2-25-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** lot 16  
**Surface:** sparse weeds and snow

**Elevation:** 2490 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 11 x 4.5 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS									
					ATTERBERG LIMITS PL ———— LL WATER CONTENT ○									
					10	20	30	40	50	60	70	80	90	
0	1	moist, dark brown, medium dense	SILTY SAND, coarse to fine, angular (FILL)		○									
	2	moist, orangish brown, dense	SAND with SILT and Gravel, coarse to fine, angular, micaceous (COMPLETELY WEATHERED GNEISS)		○									
5		no free groundwater observed	Excavator Refusal End of Excavation @ 5 ft											
10														
15														
20														



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### TEST PIT LOGS

### FIGURE 4-26

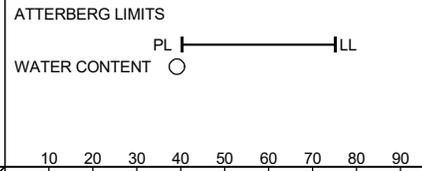
Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

## TEST PIT 2227

**Date:** 2-25-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** northwest corner lot 66  
**Surface:** sparse weeds and snow

**Elevation:** 2634 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 14 x 4.5 feet

### TEST RESULTS



DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS
0					
	[Hatched Box]	moist, brown, loose	SILTY SAND with Gravel and occasional cobbles, organics as fine roots (FILL)	[Cross-hatched Box]	○
5		moist, dark brown, loose	SILTY SAND with organics as roots (TOPSOIL)	[Dotted Box]	
		orangish gray	GNEISS, medium to coarse grained, moderately weathered, moderately weak (R2)	[Diagonal Lines Box]	
10		no free groundwater observed	Excavator Refusal End of Excavation @ 7 ft		
15					
20					



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### TEST PIT LOGS

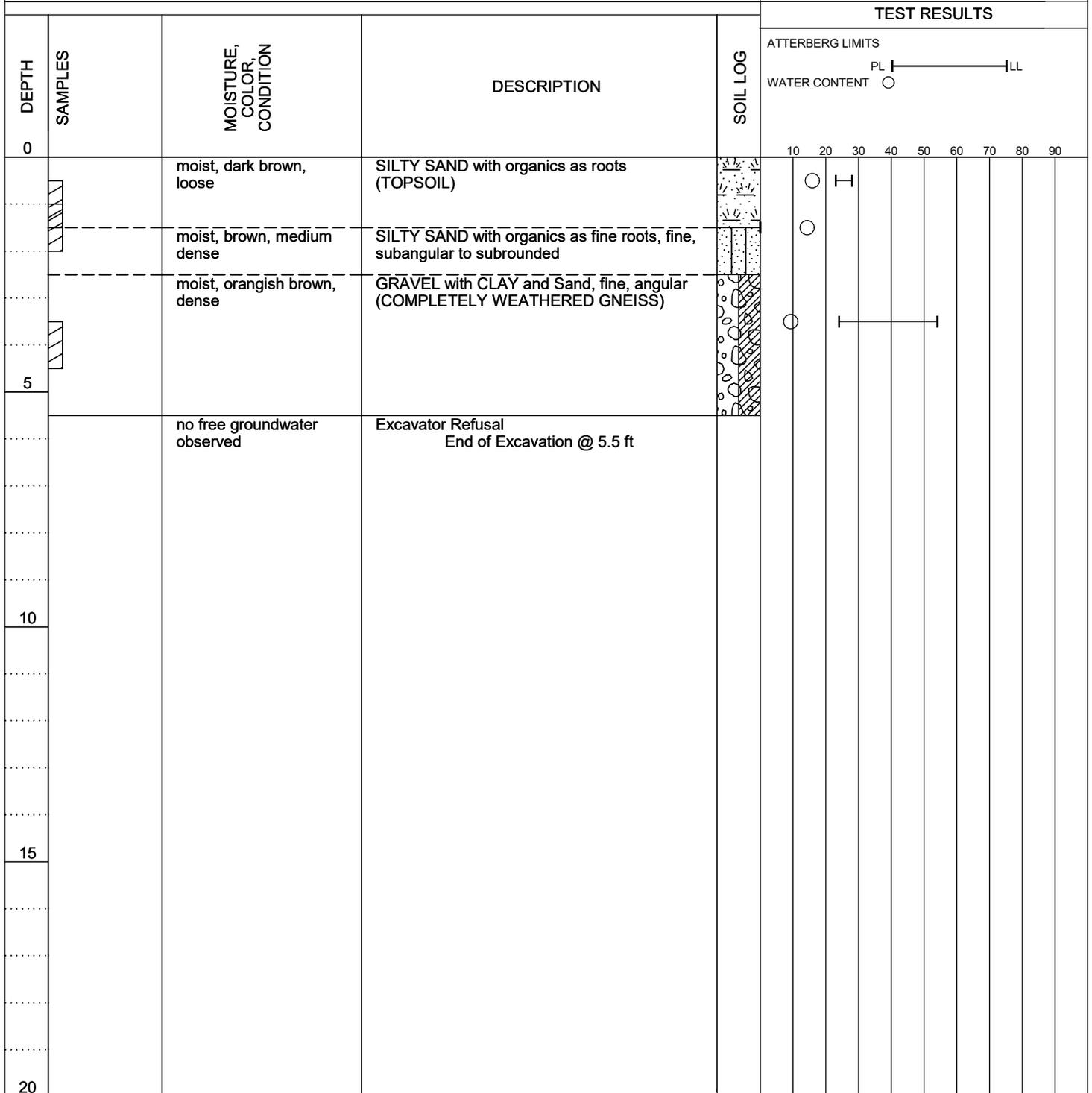
### FIGURE 4-27

Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

## TEST PIT 2228

**Date:** 2-25-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** southeast corner of lot 10  
**Surface:** sparse weeds and snow

**Elevation:** 2416 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 8.5 x 4 feet



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### TEST PIT LOGS

**FIGURE 4-28**

Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

## TEST PIT 2229

**Date:** 2-25-22  
**Excavator:** Budinger & Assoc., Inc.  
**Equipment:** CAT 315 Excavator w/42" bucket  
**Location:** lots 10 & 11 north  
**Surface:** sparse weeds and snow

**Elevation:** 2388 ft  
**Logged by:** R. Lloyd  
**Size of hole:** 13 x 4.5 feet

					TEST RESULTS									
DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	ATTERBERG LIMITS									
					WATER CONTENT ○ PL ————— LL									
					10	20	30	40	50	60	70	80	90	
0		moist, brown, loose	SAND with Gravel, coarse to fine, angular (FILL)											
	1	moist, dark brown, medium dense	GRAVEL with CLAY and SAND, fine, subangular to sub rounded, organics as roots (TOPSOIL)											
	2	moist, brown, medium dense	SILTY SAND, coarse to medium, subangular to subrounded											
5		moist, olive gray, medium dense	Boulders and Cobbles in sand matrix (GLACIOFLUVIAL)											
	3	moist, olive gray, loose	SILTY SAND with Gravel, coarse to fine, angular to subrounded (GLACIOFLUVIAL)											
	4	medium dense												
10		moist, orangish brown, medium dense	SILTY SAND with Gravel, coarse to fine, angular, micaceous (COMPLETELY WEATHERED GNEISS)											
	5	no free groundwater observed	End of Excavation @ 13 ft											
15														
20														



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### TEST PIT LOGS

**FIGURE 4-29**

**Project:** Legacy Ridge Phase F  
**Location:** Liberty Lake, WA  
**Number:** S211189

# WILDCAT DYNAMIC CONE LOG

Budinger and Associates, Inc  
 1101 N Fancher Rd.  
 Spokane Valley, WA, 99212

PROJECT NUMBER: S211189  
 DATE STARTED: 03-08-2022  
 DATE COMPLETED: 03-08-2022

HOLE #: DCP @ TP-2202  
 CREW: Cameron Andrews  
 PROJECT: Legacy Ridge West Phase F  
 ADDRESS: unassigned  
 LOCATION: Liberty Lake, WA

SURFACE ELEVATION: 2393  
 WATER ON COMPLETION: N/A  
 HAMMER WEIGHT: 35 lbs.  
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm <sup>2</sup>	GRAPH OF CONE RESISTANCE				N'	TESTED CONSISTENCY	
			0	50	100	150		NON-COHESIVE	COHESIVE
-	5	22.2	.....				6	LOOSE	MEDIUM STIFF
-	7	31.1	.....				8	LOOSE	MEDIUM STIFF
- 1 ft	10	44.4	.....				12	MEDIUM DENSE	STIFF
-	15	66.6	.....				19	MEDIUM DENSE	VERY STIFF
-	14	62.2	.....				17	MEDIUM DENSE	VERY STIFF
- 2 ft	13	57.7	.....				16	MEDIUM DENSE	VERY STIFF
-	10	44.4	.....				12	MEDIUM DENSE	STIFF
-	11	48.8	.....				13	MEDIUM DENSE	STIFF
- 3 ft	17	75.5	.....				21	MEDIUM DENSE	VERY STIFF
- 1 m	33	146.5	.....				25+	DENSE	HARD
-	39	150.5	.....				25+	DENSE	HARD
- 4 ft	50	193.0	.....				25+	VERY DENSE	HARD
-									
- 5 ft									
-									
- 6 ft									
- 2 m									
- 7 ft									
-									
- 8 ft									
-									
- 9 ft									
-									
- 3 m 10 ft									
-									
- 11 ft									
-									
- 12 ft									
-									
- 4 m 13 ft									

Figure 5-1



# WILDCAT DYNAMIC CONE LOG

Budinger and Associates, Inc.  
 1101 N Fancher Rd  
 Spokane Valley, WA, 99212

PROJECT NUMBER: S211189  
 DATE STARTED: 03-08-2022  
 DATE COMPLETED: 03-08-2022

HOLE #: DCP @ TP-2205  
 CREW: Cameron Andrews  
 PROJECT: Legacy Ridge West Phase F  
 ADDRESS: unassigned  
 LOCATION: Liberty Lake, WA

SURFACE ELEVATION: 2387  
 WATER ON COMPLETION: N/A  
 HAMMER WEIGHT: 35 lbs.  
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm <sup>2</sup>	GRAPH OF CONE RESISTANCE				N'	TESTED CONSISTENCY	
			0	50	100	150		NON-COHESIVE	COHESIVE
-	4	17.8	.....				5	LOOSE	MEDIUM STIFF
-	12	53.3	.....				15	MEDIUM DENSE	STIFF
- 1 ft	19	84.4	.....				24	MEDIUM DENSE	VERY STIFF
-	18	79.9	.....				22	MEDIUM DENSE	VERY STIFF
-	30	133.2	.....				25+	DENSE	HARD
- 2 ft	47	208.7	.....				25+	VERY DENSE	HARD
-	50	222.0	.....				25+	VERY DENSE	HARD
-									
- 3 ft									
- 1 m									
-									
- 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									

Figure 5-3



# WILDCAT DYNAMIC CONE LOG

Budinger and Associates, Inc.  
 1101 N Fancher Rd  
 Spokane Valley, WA, 99212

PROJECT NUMBER: S211189  
 DATE STARTED: 03-08-2022  
 DATE COMPLETED: 03-08-2022

HOLE #: DCP @ TP-2209  
 CREW: Cameron Andrews  
 PROJECT: Legacy Ridge West Phase F  
 ADDRESS: unassigned  
 LOCATION: Liberty Lake, WA

SURFACE ELEVATION: 2373  
 WATER ON COMPLETION: N/A  
 HAMMER WEIGHT: 35 lbs.  
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm <sup>2</sup>	GRAPH OF CONE RESISTANCE				N'	TESTED CONSISTENCY	
			0	50	100	150		NON-COHESIVE	COHESIVE
-	2	8.9	••				2	VERY LOOSE	SOFT
-	7	31.1	••••••••				8	LOOSE	MEDIUM STIFF
- 1 ft	10	44.4	••••••••••				12	MEDIUM DENSE	STIFF
-	14	62.2	••••••••••••				17	MEDIUM DENSE	VERY STIFF
-	18	79.9	••••••••••••••				22	MEDIUM DENSE	VERY STIFF
- 2 ft	15	66.6	••••••••••••				19	MEDIUM DENSE	VERY STIFF
-	15	66.6	••••••~••••••				19	MEDIUM DENSE	VERY STIFF
-	50	222.0	••••••~••••••				25+	VERY DENSE	HARD
- 3 ft									
- 1 m									
-	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								

Figure 5-5

# WILDCAT DYNAMIC CONE LOG

Budinger and Associates, Inc.  
 1101 N Fancher Rd  
 Spokane Valley, WA, 99212

PROJECT NUMBER: S211189  
 DATE STARTED: 03-08-2022  
 DATE COMPLETED: 03-08-2022

HOLE #: DCP @ TP-2211  
 CREW: Cameron Andrews  
 PROJECT: Legacy Ridge West Phase F  
 ADDRESS: unassigned  
 LOCATION: Liberty Lake, WA

SURFACE ELEVATION: 2511  
 WATER ON COMPLETION: N/A  
 HAMMER WEIGHT: 35 lbs.  
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm <sup>2</sup>	GRAPH OF CONE RESISTANCE				N'	TESTED CONSISTENCY	
			0	50	100	150		NON-COHESIVE	COHESIVE
-	2	8.9	••				2	VERY LOOSE	SOFT
-	7	31.1	••••••••				8	LOOSE	MEDIUM STIFF
- 1 ft	7	31.1	••••••••				8	LOOSE	MEDIUM STIFF
-	15	66.6	••••••••••••••				19	MEDIUM DENSE	VERY STIFF
-	22	97.7	••••••••••••••••••				25+	MEDIUM DENSE	VERY STIFF
- 2 ft	23	102.1	••••••~				25+	MEDIUM DENSE	VERY STIFF
-	21	93.2	••••••~				25+	MEDIUM DENSE	VERY STIFF
-	19	84.4	••••••~				24	MEDIUM DENSE	VERY STIFF
- 3 ft	18	79.9	••••••~				22	MEDIUM DENSE	VERY STIFF
- 1 m	20	88.8	••••••~				25	MEDIUM DENSE	VERY STIFF
-	22	84.9	••••••~				24	MEDIUM DENSE	VERY STIFF
- 4 ft	22	84.9	••••~				24	MEDIUM DENSE	VERY STIFF
-	30	115.8	••••••~				25+	DENSE	HARD
-	25	96.5	••••~				25+	MEDIUM DENSE	VERY STIFF
- 5 ft	32	123.5	••••~				25+	DENSE	HARD
-	22	84.9	••••~				24	MEDIUM DENSE	VERY STIFF
-	12	46.3	••••••••				13	MEDIUM DENSE	STIFF
- 6 ft	10	38.6	••••••••				11	MEDIUM DENSE	STIFF
-	8	30.9	••••••••				8	LOOSE	MEDIUM STIFF
- 2 m	42	162.1	••••~				25+	DENSE	HARD
- 7 ft	32	109.4	••••~				25+	DENSE	HARD
-	34	116.3	••••~				25+	DENSE	HARD
-	39	133.4	••••~				25+	DENSE	HARD
- 8 ft	50	171.0	••••~				25+	DENSE	HARD
-									
- 9 ft									
- 3 m	10 ft								
-									
-	11 ft								
-									
-	12 ft								
-									
- 4 m	13 ft								

Figure 5-6

# WILDCAT DYNAMIC CONE LOG

Budinger and Associates, Inc.  
 1101 N Fancher Rd  
 Spokane Valley, WA, 99212

PROJECT NUMBER: S211189  
 DATE STARTED: 03-08-2022  
 DATE COMPLETED: 03-08-2022

HOLE #: DCP @ TP-2212  
 CREW: Cameron Andrews  
 PROJECT: Legacy Ridge West Phase F  
 ADDRESS: unassigned  
 LOCATION: Liberty Lake, WA

SURFACE ELEVATION: 2534  
 WATER ON COMPLETION: N/A  
 HAMMER WEIGHT: 35 lbs.  
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm <sup>2</sup>	GRAPH OF CONE RESISTANCE				N'	TESTED CONSISTENCY	
			0	50	100	150		NON-COHESIVE	COHESIVE
-	4	17.8	.....				5	LOOSE	MEDIUM STIFF
-	4	17.8	.....				5	LOOSE	MEDIUM STIFF
- 1 ft	7	31.1	.....				8	LOOSE	MEDIUM STIFF
-	29	128.8	.....				25+	DENSE	HARD
-	33	146.5	.....				25+	DENSE	HARD
- 2 ft	26	115.4	.....				25+	DENSE	HARD
-	28	124.3	.....				25+	DENSE	HARD
-	32	142.1	.....				25+	DENSE	HARD
- 3 ft	30	133.2	.....				25+	DENSE	HARD
- 1 m	34	151.0	.....				25+	DENSE	HARD
-	20	77.2	.....				22	MEDIUM DENSE	VERY STIFF
- 4 ft	26	100.4	.....				25+	MEDIUM DENSE	VERY STIFF
-	17	65.6	.....				18	MEDIUM DENSE	VERY STIFF
-	28	108.1	.....				25+	MEDIUM DENSE	VERY STIFF
- 5 ft	19	73.3	.....				20	MEDIUM DENSE	VERY STIFF
-	16	61.8	.....				17	MEDIUM DENSE	VERY STIFF
-	26	100.4	.....				25+	MEDIUM DENSE	VERY STIFF
- 6 ft	18	69.5	.....				19	MEDIUM DENSE	VERY STIFF
-	28	108.1	.....				25+	MEDIUM DENSE	VERY STIFF
- 2 m	27	104.2	.....				25+	MEDIUM DENSE	VERY STIFF
- 7 ft	21	71.8	.....				20	MEDIUM DENSE	VERY STIFF
-	19	65.0	.....				18	MEDIUM DENSE	VERY STIFF
-	16	54.7	.....				15	MEDIUM DENSE	STIFF
- 8 ft	15	51.3	.....				14	MEDIUM DENSE	STIFF
-	33	112.9	.....				25+	DENSE	HARD
-	38	130.0	.....				25+	DENSE	HARD
- 9 ft	62	212.0	.....				25+	VERY DENSE	HARD
-	50	171.0	.....				25+	DENSE	HARD
- 3 m	10 ft								
-	11 ft								
-	12 ft								
- 4 m	13 ft								

Figure 5-7

# WILDCAT DYNAMIC CONE LOG

Budinger and Associates, Inc.  
 1101 N Fancher Rd  
 Spokane Valley, WA, 99212

PROJECT NUMBER: S211189  
 DATE STARTED: 03-08-2022  
 DATE COMPLETED: 03-08-2022

HOLE #: DCP @ TP-2214  
 CREW: Cameron Andrews  
 PROJECT: Legacy Ridge West Phase F  
 ADDRESS: unassigned  
 LOCATION: Liberty Lake, WA

SURFACE ELEVATION: 2559  
 WATER ON COMPLETION: N/A  
 HAMMER WEIGHT: 35 lbs.  
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm <sup>2</sup>	GRAPH OF CONE RESISTANCE				N'	TESTED CONSISTENCY	
			0	50	100	150		NON-COHESIVE	COHESIVE
-	5	22.2	.....				6	LOOSE	MEDIUM STIFF
-	10	44.4	.....				12	MEDIUM DENSE	STIFF
- 1 ft	16	71.0	.....				20	MEDIUM DENSE	VERY STIFF
-	21	93.2	.....				25+	MEDIUM DENSE	VERY STIFF
-	25	111.0	.....				25+	DENSE	HARD
- 2 ft	40	177.6	.....				25+	DENSE	HARD
-	50	222.0	.....				25+	VERY DENSE	HARD
-									
- 3 ft									
- 1 m									
-									
- 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									

Figure 5-8

# WILDCAT DYNAMIC CONE LOG

Budinger and Associates, Inc.  
 1101 N Fancher Rd  
 Spokane Valley, WA, 99212

PROJECT NUMBER: S211189  
 DATE STARTED: 03-08-2022  
 DATE COMPLETED: 03-08-2022

HOLE #: DCP @ TP-2215  
 CREW: Cameron Andrews  
 PROJECT: Legacy Ridge West Phase F  
 ADDRESS: unassigned  
 LOCATION: Liberty Lake, WA

SURFACE ELEVATION: 2575  
 WATER ON COMPLETION: N/A  
 HAMMER WEIGHT: 35 lbs.  
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm <sup>2</sup>	GRAPH OF CONE RESISTANCE				N'	TESTED CONSISTENCY	
			0	50	100	150		NON-COHESIVE	COHESIVE
-	4	17.8	•••••				5	LOOSE	MEDIUM STIFF
-	5	22.2	•••••				6	LOOSE	MEDIUM STIFF
- 1 ft	4	17.8	•••••				5	LOOSE	MEDIUM STIFF
-	5	22.2	•••••				6	LOOSE	MEDIUM STIFF
-	5	22.2	•••••				6	LOOSE	MEDIUM STIFF
- 2 ft	12	53.3	••••••••••				15	MEDIUM DENSE	STIFF
-	20	88.8	••••••••••••••				25	MEDIUM DENSE	VERY STIFF
-	27	119.9	••••••••••••••••••				25+	DENSE	HARD
- 3 ft	50	222.0	••••••••••••••••••••				25+	VERY DENSE	HARD
- 1 m									
- 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									

Figure 5-9

# WILDCAT DYNAMIC CONE LOG

Budinger and Associates, Inc.  
 1101 N Fancher Rd  
 Spokane Valley, WA, 99212

PROJECT NUMBER: S211189  
 DATE STARTED: 03-08-2022  
 DATE COMPLETED: 03-08-2022

HOLE #: DCP @ TP-2216  
 CREW: Cameron Andrews  
 PROJECT: Legacy Ridge West Phase F  
 ADDRESS: unassigned  
 LOCATION: Liberty Lake, WA

SURFACE ELEVATION: 2580  
 WATER ON COMPLETION: N/A  
 HAMMER WEIGHT: 35 lbs.  
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm <sup>2</sup>	GRAPH OF CONE RESISTANCE				N'	TESTED CONSISTENCY	
			0	50	100	150		NON-COHESIVE	COHESIVE
-	3	13.3	•••				3	VERY LOOSE	SOFT
-	5	22.2	•••••				6	LOOSE	MEDIUM STIFF
- 1 ft	5	22.2	•••••				6	LOOSE	MEDIUM STIFF
-	5	22.2	•••••				6	LOOSE	MEDIUM STIFF
-	6	26.6	••••••				7	LOOSE	MEDIUM STIFF
- 2 ft	6	26.6	••••••				7	LOOSE	MEDIUM STIFF
-	5	22.2	•••••				6	LOOSE	MEDIUM STIFF
-	6	26.6	••••••				7	LOOSE	MEDIUM STIFF
- 3 ft	6	26.6	••••••				7	LOOSE	MEDIUM STIFF
- 1 m	5	22.2	•••••				6	LOOSE	MEDIUM STIFF
-	8	30.9	•••••••				8	LOOSE	MEDIUM STIFF
- 4 ft	12	46.3	••••••••••				13	MEDIUM DENSE	STIFF
-	11	42.5	••••••••••				12	MEDIUM DENSE	STIFF
-	21	81.1	••••••••••••••••				23	MEDIUM DENSE	VERY STIFF
- 5 ft	29	111.9	••••••••••••••••••••				25+	DENSE	HARD
-	39	150.5	••••••••••••••••••••••••				25+	DENSE	HARD
-	48	185.3	••••••••••~••••••••••~•••••				25+	VERY DENSE	HARD
- 6 ft	50	193.0	••••••~••••••~••••••~•••••				25+	VERY DENSE	HARD
- 2 m									
- 7 ft									
- 8 ft									
- 9 ft									
- 3 m	10 ft								
- 11 ft									
- 12 ft									
- 4 m	13 ft								

Figure 5-10







# WILDCAT DYNAMIC CONE LOG

Budinger and Associates, Inc.  
 1101 N Fancher Rd  
 Spokane Valley, WA, 99212

PROJECT NUMBER: S211189  
 DATE STARTED: 03-08-2022  
 DATE COMPLETED: 03-08-2022

HOLE #: DCP @ TP-2226  
 CREW: Cameron Andrews  
 PROJECT: Legacy Ridge West Phase F  
 ADDRESS: unassigned  
 LOCATION: Liberty Lake, WA

SURFACE ELEVATION: 2490  
 WATER ON COMPLETION: N/A  
 HAMMER WEIGHT: 35 lbs.  
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm <sup>2</sup>	GRAPH OF CONE RESISTANCE				N'	TESTED CONSISTENCY	
			0	50	100	150		NON-COHESIVE	COHESIVE
-	7	31.1	.....				8	LOOSE	MEDIUM STIFF
-	14	62.2	.....				17	MEDIUM DENSE	VERY STIFF
- 1 ft	18	79.9	.....				22	MEDIUM DENSE	VERY STIFF
-	23	102.1	.....				25+	MEDIUM DENSE	VERY STIFF
-	43	190.9	.....				25+	VERY DENSE	HARD
- 2 ft	59	262.0	.....				25+	VERY DENSE	HARD
-	50	222.0	.....				25+	VERY DENSE	HARD
-									
- 3 ft									
- 1 m									
-									
- 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									

Figure 5-14



# WILDCAT DYNAMIC CONE LOG

Budinger and Associates, Inc.  
 1101 N Fancher Rd  
 Spokane Valley, WA, 99212

PROJECT NUMBER: S211189  
 DATE STARTED: 03-08-2022  
 DATE COMPLETED: 03-08-2022

HOLE #: DCP @ TP-2228  
 CREW: Cameron Andrews  
 PROJECT: Legacy Ridge West Phase F  
 ADDRESS: unassigned  
 LOCATION: Liberty Lake, WA

SURFACE ELEVATION: 2416  
 WATER ON COMPLETION: N/A  
 HAMMER WEIGHT: 35 lbs.  
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm <sup>2</sup>	GRAPH OF CONE RESISTANCE				N'	TESTED CONSISTENCY	
			0	50	100	150		NON-COHESIVE	COHESIVE
-	7	31.1	.....				8	LOOSE	MEDIUM STIFF
-	10	44.4	.....				12	MEDIUM DENSE	STIFF
- 1 ft	8	35.5	.....				10	LOOSE	STIFF
-	9	40.0	.....				11	MEDIUM DENSE	STIFF
-	16	71.0	.....				20	MEDIUM DENSE	VERY STIFF
- 2 ft	21	93.2	.....				25+	MEDIUM DENSE	VERY STIFF
-	28	124.3	.....				25+	DENSE	HARD
-	35	155.4	.....				25+	DENSE	HARD
- 3 ft	24	106.6	.....				25+	MEDIUM DENSE	VERY STIFF
- 1 m	23	102.1	.....				25+	MEDIUM DENSE	VERY STIFF
-	50	193.0	.....				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									

Figure 5-16



# WILDCAT DYNAMIC CONE LOG

Budinger and Associates, Inc.  
 1101 N Fancher Rd  
 Spokane Valley, WA, 99212

PROJECT NUMBER: S211189  
 DATE STARTED: 03-08-2022  
 DATE COMPLETED: 03-08-2022

HOLE #: DCP-30  
 CREW: Cameron Andrews  
 PROJECT: Legacy Ridge West Phase F  
 ADDRESS: unassigned  
 LOCATION: Liberty Lake, WA

SURFACE ELEVATION: 2495  
 WATER ON COMPLETION: N/A  
 HAMMER WEIGHT: 35 lbs.  
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm <sup>2</sup>	GRAPH OF CONE RESISTANCE				N'	TESTED CONSISTENCY	
			0	50	100	150		NON-COHESIVE	COHESIVE
-	3	13.3	•••				3	VERY LOOSE	SOFT
-	7	31.1	••••••••				8	LOOSE	MEDIUM STIFF
- 1 ft	8	35.5	••••••••				10	LOOSE	STIFF
-	12	53.3	••••••••••				15	MEDIUM DENSE	STIFF
-	6	26.6	••••••				7	LOOSE	MEDIUM STIFF
- 2 ft	6	26.6	••••••				7	LOOSE	MEDIUM STIFF
-	13	57.7	••••••••••				16	MEDIUM DENSE	VERY STIFF
-	14	62.2	••••••••••				17	MEDIUM DENSE	VERY STIFF
- 3 ft	14	62.2	••••••~				17	MEDIUM DENSE	VERY 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								

Figure 5-18



# WILDCAT DYNAMIC CONE LOG

Budinger and Associates, Inc.  
 1101 N Fancher Rd  
 Spokane Valley, WA, 99212

PROJECT NUMBER: S211189  
 DATE STARTED: 03-08-2022  
 DATE COMPLETED: 03-08-2022

HOLE #: DCP-32  
 CREW: Cameron Andrews  
 PROJECT: Legacy Ridge West Phase F  
 ADDRESS: unassigned  
 LOCATION: Liberty Lake, WA

SURFACE ELEVATION: 2420  
 WATER ON COMPLETION: N/A  
 HAMMER WEIGHT: 35 lbs.  
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm <sup>2</sup>	GRAPH OF CONE RESISTANCE				N'	TESTED CONSISTENCY	
			0	50	100	150		NON-COHESIVE	COHESIVE
-	20	88.8	.....				25	MEDIUM DENSE	VERY STIFF
-	43	190.9	.....				25+	VERY DENSE	HARD
- 1 ft	50	222.0	.....				25+	VERY DENSE	HARD
-									
- 2 ft									
-									
- 3 ft									
- 1 m									
-									
- 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									

Figure 5-20





## DCP TEST DATA

**Project:** S211189 Legacy Ridge Phase F

**Date:** 8-Mar-22

**Location:** TP-2206

**Soil Type(s):** SM

**Hammer**  
 ● 10.1 lbs.  
 ○ 17.6 lbs.  
 ○ Both hammers used

**Soil Type**  
 ○ CH  
 ○ CL  
 ● All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0.5	25	2
0.5	50	2
1	75	2
1	100	2
1.5	125	2
1.5	150	2
1.5	175	2
1.5	200	2
2.5	225	2
2.5	250	2
7	275	2
7	300	2
12.5	325	2
12.5	350	2
22.5	375	2
22.5	400	2
15	425	2
15	450	2

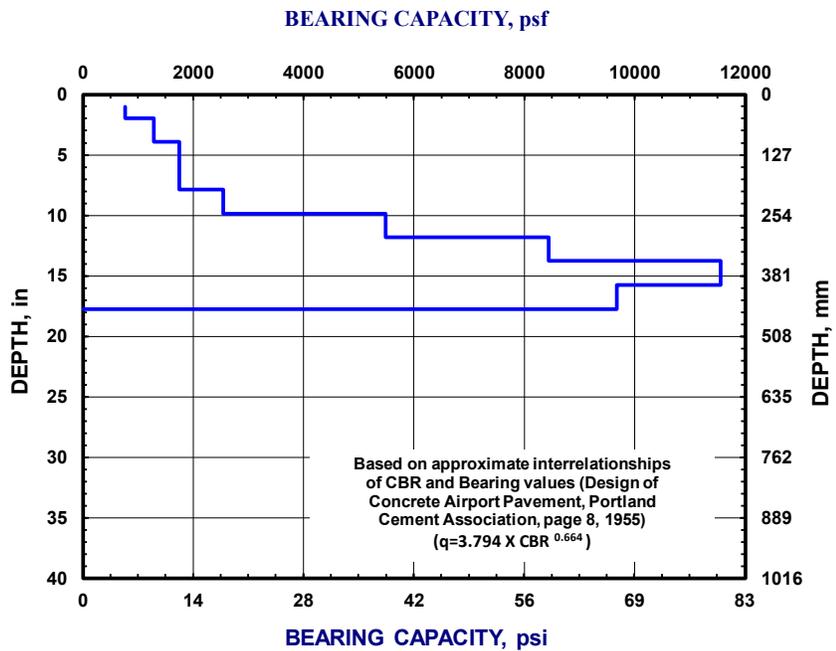
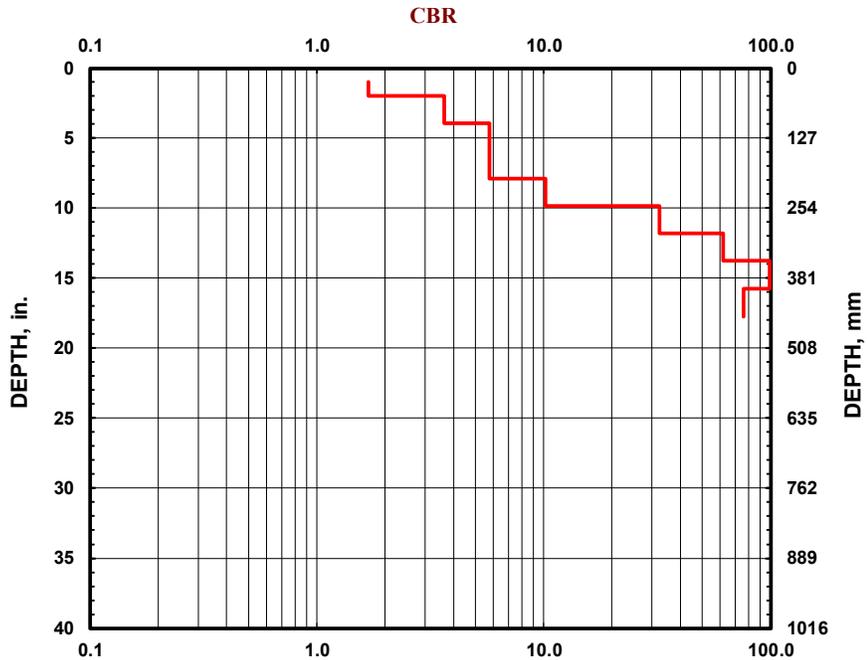


Figure 6-3









## DCP TEST DATA

Project: S211189 Legacy Ridge Phase F  
 Location: TP-2220

Date: 8-Mar-22  
 Soil Type(s): SM

Hammer  
 ● 10.1 lbs.  
 ○ 17.6 lbs.  
 ○ Both hammers used

Soil Type  
 ○ CH  
 ○ CL  
 ● All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
1	25	2
1	50	2
2	75	2
2	100	2
6.5	125	2
6.5	150	2
6	175	2
6	200	2
6	225	2
6	250	2
4	275	2
4	300	2
12	325	2
12	350	2
15	375	2
15	400	2

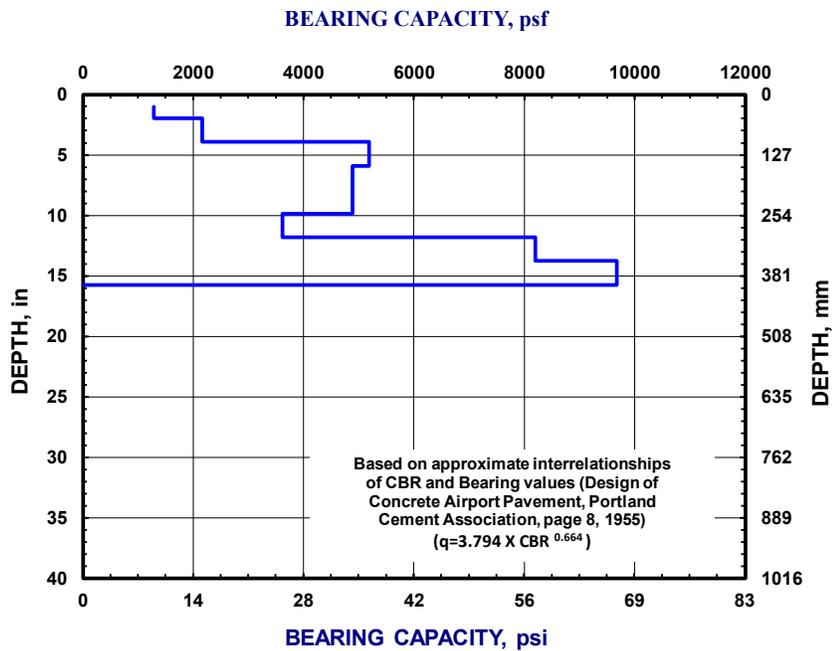
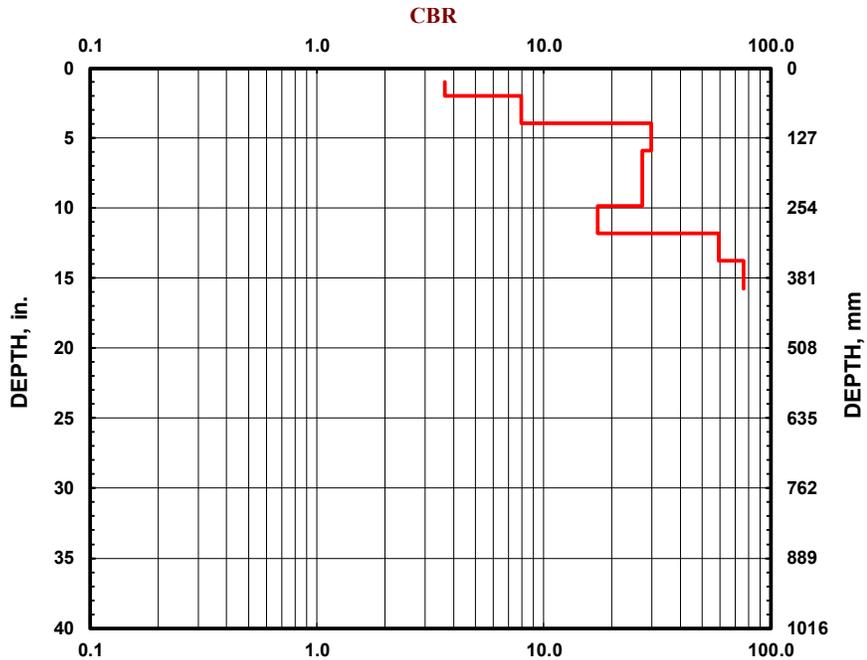


Figure 6-8







**SOIL MECHANICS  
LABORATORY SUMMARY**

LABORATORY NUMBER	Units	Test Methods	22-5695	22-5696	22-5697	22-5699	22-5700	22-5701	22-5702	22-5704
TEST PIT NUMBER			TP-2210	TP-2210	TP-2211	TP-2211	TP-2212	TP-2212	TP-2213	TP-2214
DEPTH	TOP		1.5	4.5	4.5	12.0	2.0	9.0	1.5	1.0
	BOTTOM		2.5	5.5	6.0	13.5	3.0	10.0	3.0	2.5
STRATUM			<i>existing fill</i>							
SAMPLE TYPE			Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
MOISTURE CONTENT	%	ASTM D2216	8.1	14.2	10.8	10.4	12.5	8.7	9.8	6.8
LIQUID LIMIT	%	ASTM D4318								
PLASTIC LIMIT	%									
PLASTICITY INDEX	%		NP	NP	NP	NP	NP	NP	NP	NP
UNIFIED CLASSIFICATION		ASTM D2487	SM	SM	SM <sup>1</sup>	SM	SM	SM	SM	SM
SIEVE ANALYSIS		ASTM D6913								
	6"					100		100	100	100
	3"									
	1 1/2"				100	95	100	94	98	92
S	1"	%			95	90	92	92	96	90
I	3/4"		100		91	86	89	91	95	89
E	1/2"	P	99		85	79	85	88	93	87
V	3/8"	A	99	100	80	75	77	86	91	86
E	#4	S	96	98	74	66	67	82	87	83
	#10	S	84	93	64	57	58	73	78	73
S	#16	I	74	87	58	51	51	65	71	64
I	#30	N	60	77	49	43	42	52	58	48
Z	#40	G	54	72	43	38	37	46	52	40
E	#100		34	55	28	24	25	26	33	24
	#200		22	41	20	17	19	17	23	18

1 = Includes 8 percent Cobbles

**SOIL MECHANICS  
LABORATORY SUMMARY**

LABORATORY NUMBER		Units	Test Methods	22-5706	22-5710	22-5714	22-5716	22-5718	22-5705
TEST PIT NUMBER				TP-2217	TP-2220	TP-2224	TP-2226	TP-2227	TP-2216
DEPTH	TOP	feet		1.0	4.0	0.5	0.5	1.5	1.0
	BOTTOM	feet		3.0	5.0	1.5	1.5	3.5	2.5
STRATUM				<i>existing fill</i>					
SAMPLE TYPE				Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
MOISTURE CONTENT		%	ASTM D2216	8.5	4.6	6.7	10.1	10.0	15.4
LIQUID LIMIT		%	ASTM D4318						28
PLASTIC LIMIT		%							23
PLASTICITY INDEX		%		NP	NP	NP	NP	NP	5
UNIFIED CLASSIFICATION			ASTM D2487	GM	GP-GM	SM	SM	SM	SM
SIEVE ANALYSIS			ASTM D6913						
	6"								
	3"			100	100	100	100	100	
	1 1/2"			98	86	99	97	93	
S	1"	%		71	79	92	96	92	
I	3/4"			67	73	89	95	90	
E	1/2"	P		60	66	83	92	90	
V	3/8"	A		56	61	78	91	85	100
E	#4	S		55	50	68	88	78	98
	#10	S		41	39	53	81	70	92
S	#16	I		38	34	46	71	64	86
I	#30	N		33	27	39	57	55	77
Z	#40	G		30	24	36	50	50	73
E	#100			19	14	24	33	31	55
	#200			12	8.2	16	24	20	44

1 = Includes 8 percent Cobbles

**SOIL MECHANICS  
LABORATORY SUMMARY**

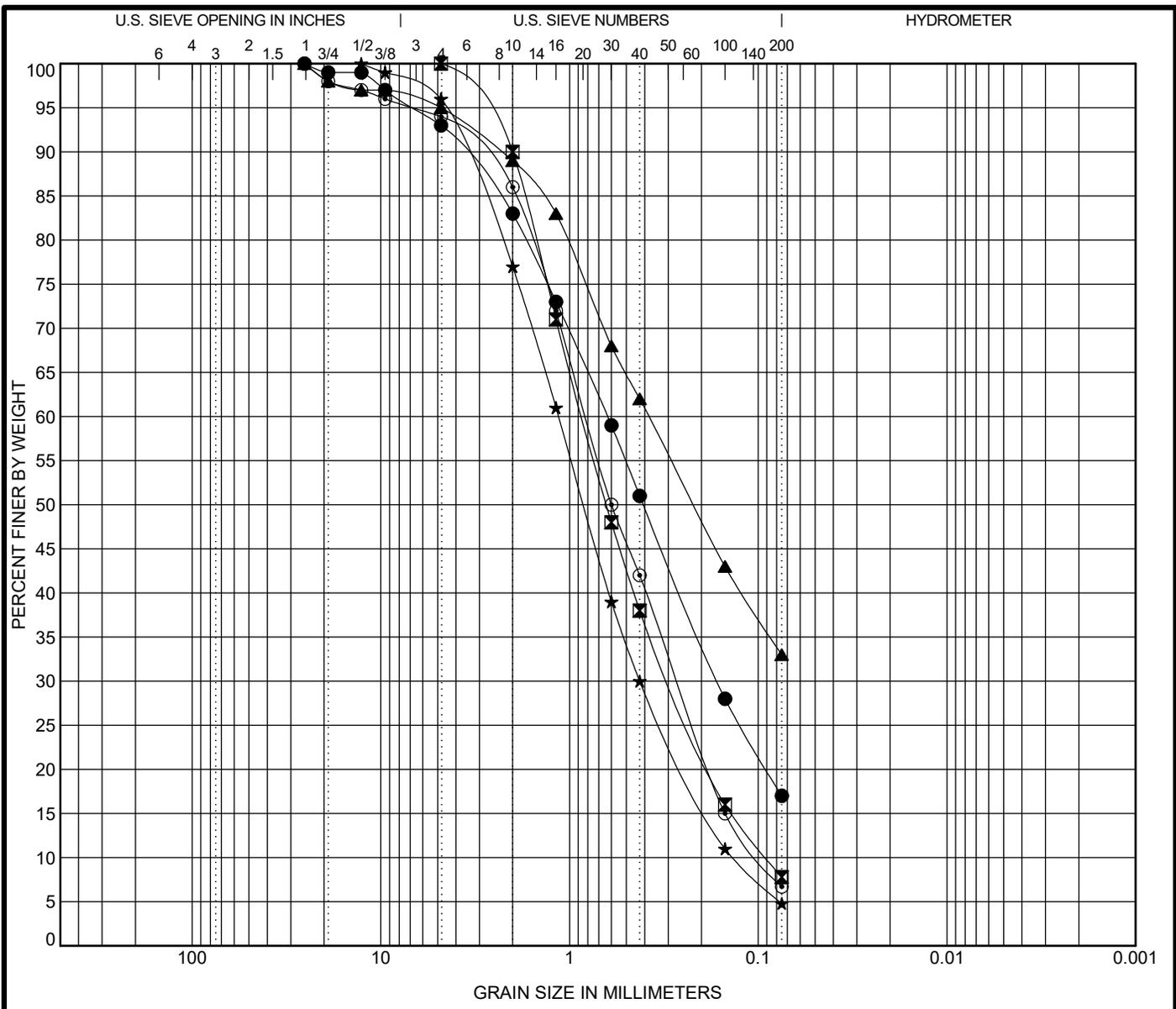
LABORATORY NUMBER	Units		Test Methods							
	TEST PIT NUMBER		22-5719	22-5722	22-5707	22-5708	22-5690	22-5691	22-5692	22-5713
DEPTH	TOP	feet	TP-2228	TP-2229	TP-2218	TP-2218	TP-2201	TP-2202	TP-2203	TP-2223
	BOTTOM	feet	0.5	1.0	5.0	8.0	3.0	2.0	2.5	2.5
STRATUM			topsoil		loess		medium-dense			
SAMPLE TYPE			Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
MOISTURE CONTENT	%	ASTM D2216	15.9	7.1	18.9	16.2	7.6	5.8	12.5	3.9
LIQUID LIMIT	%	ASTM D4318	28	35	28	30				
PLASTIC LIMIT	%		23	19	22	19				
PLASTICITY INDEX	%		5	16	6	11	NP	NP	NP	NP
UNIFIED CLASSIFICATION		ASTM D2487	SM	GP-GC	CL-ML	CL	SM	SW-SM	SM	SW-SM
SIEVE ANALYSIS		ASTM D6913								
	6"									100
	3"									99
	1 1/2"			100						99
S	1"	%		91			100		100	97
I	3/4"			77			99		98	95
E	1/2"	P	100	72			99		97	90
V	3/8"	A	99	59	100	100	97		97	86
E	#4	S	98	42	99	99	93	100	95	72
	#10	S	95	27	95	95	83	90	89	48
S	#16	I	91	22	89	91	73	71	83	36
I	#30	N	86	17	82	86	59	48	68	25
Z	#40	G	83	15	77	83	51	38	62	21
E	#100		65	10	63	72	28	16	43	12
	#200		41	7.3	54	64	17	7.8	33	7.3

1 = Includes 8 percent Cobbles

**SOIL MECHANICS  
LABORATORY SUMMARY**

LABORATORY NUMBER TEST PIT NUMBER DEPTH	Units		Test Methods	22-5709	22-5715	22-5717	22-5720	22-5721	22-5723	22-5724	22-5693	22-5694	22-5703
	TOP	BOTTOM		TP-2218	TP-2224	TP-2226	TP-2228	TP-2228	TP-2229	TP-2229	TP-2229	TP-2205	TP-2207
DEPTH	feet			10.5	3.0	2.5	1.5	3.5	3.0	7.5	2.5	2.0	5.0
DEPTH	feet			11.0	4.0	3.5	2.5	4.5	4.0	9.0	4.0	3.0	6.0
STRATUM				<i>medium-dense soils</i>						<i>weathered gneiss</i>			
SAMPLE TYPE				Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
MOISTURE CONTENT	%	ASTM D2216		6.0	6.5	8.7	14.3	9.3	13.7	9.6	5.0	5.2	4.6
LIQUID LIMIT	%	ASTM D4318						54					
PLASTIC LIMIT	%							24					
PLASTICITY INDEX	%			NP	NP	NP	NP	30	NP	NP	NP	NP	NP
UNIFIED CLASSIFICATION		ASTM D2487		SM	SP-SM	SW-SM	SM	GP-GC	SM	SM	SW	SP-SM	SW-SM
SIEVE ANALYSIS		ASTM D6913											
	6"												
	3"									100			100
	1 1/2"			100	100			100		91			90
S	1"	%		98	97			97		87		100	87
I	3/4"			95	94			89		84		98	85
E	1/2"	P		91	87		100	77		81	100	97	79
V	3/8"	A		89	82	100		67	100	78		96	75
E	#4	S		83	69	99	97	52	99	75	96	94	63
	#10	S		80	58	86	93	35	97	69	77	86	45
S	#16	I		76	51	69	89	28	94	62	61	72	37
I	#30	N		67	42	47	84	22	90	52	39	50	28
Z	#40	G		60	37	38	81	20	87	45	30	42	24
E	#100			32	18	15	63	15	67	27	11	15	13
	#200			17	8.8	7	38	11	42	18	4.8	6.7	7.7

1 = Includes 8 percent Cobbles



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● 2201	SILTY SAND(SM)	NP	NP	NP		
☒ 2202	WELL-GRADED SAND with SILT(SW-SM)	NP	NP	NP	1.10	9.45
▲ 2203	SILTY SAND(SM)	NP	NP	NP		
★ 2205	WELL-GRADED SAND(SW)	NP	NP	NP	1.18	8.53
⊙ 2207	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	0.89	8.26

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 2201	3.0	25.4	0.63	0.164	7.1	75.9	17.0	
☒ 2202	2.0	4.8	0.854	0.291	0.09	92.1	7.8	
▲ 2203	2.5	25.4	0.381		5.1	61.9	33.0	
★ 2205	2.5	12.7	1.144	0.425	0.134	4.2	91.0	4.8
⊙ 2207	2.0	25.4	0.816	0.268	0.099	6.1	87.2	6.7



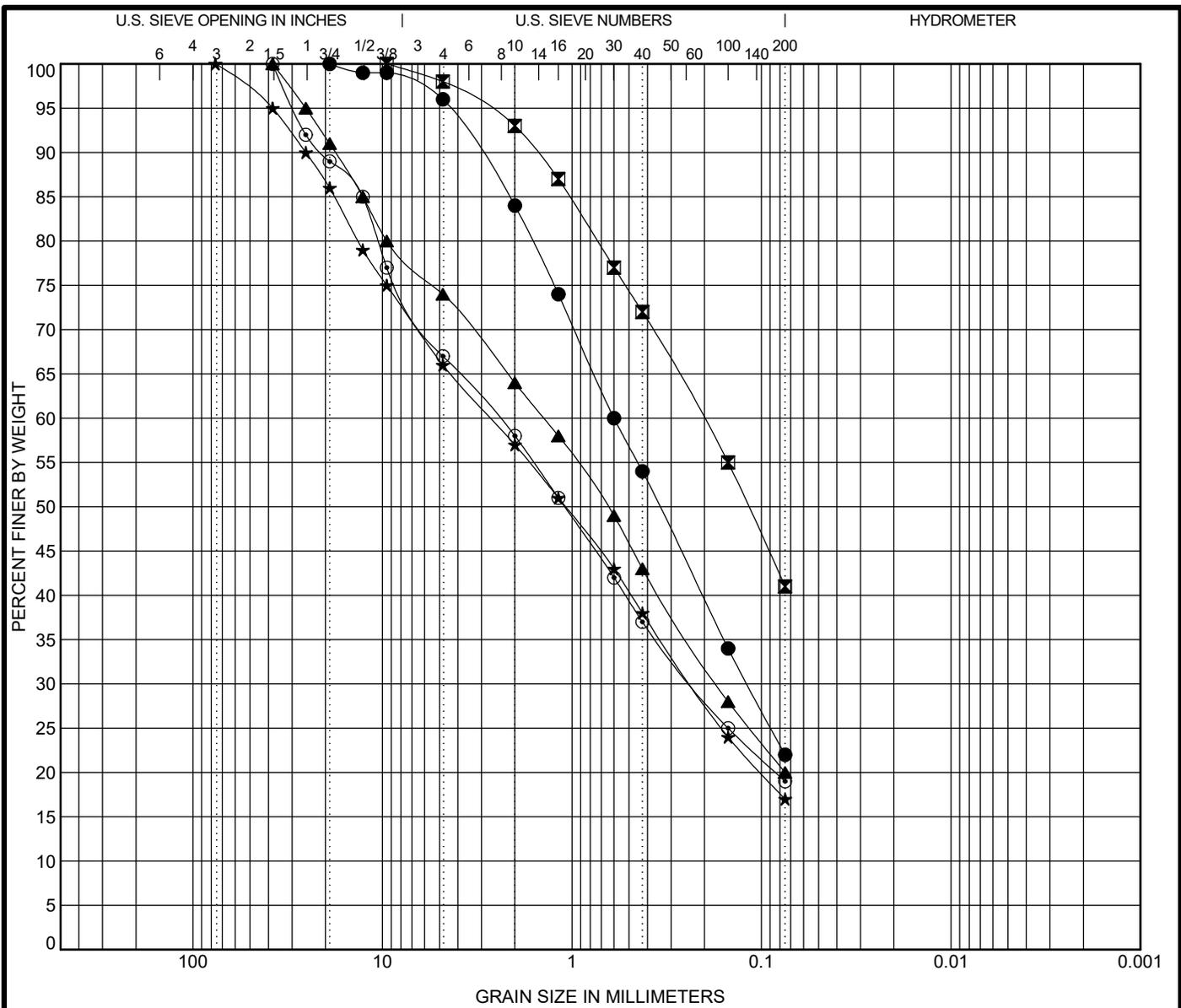
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 Spokane Valley, WA 99212

**GRAIN SIZE DISTRIBUTION RESULTS**

Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

US GRAIN SIZE S211189 LOGS.GPJ GINT STD.US.GDT 3/23/22

Figure 8-1



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● 2210 1.5	SILTY SAND(SM)	NP	NP	NP		
☒ 2210 4.5	SILTY SAND(SM)	NP	NP	NP		
▲ 2211 4.5	SILTY SAND with GRAVEL(SM)	NP	NP	NP		
★ 2211 12.0	SILTY SAND with GRAVEL(SM)	NP	NP	NP		
⊙ 2212 2.0	SILTY SAND with GRAVEL(SM)	NP	NP	NP		

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 2210 1.5	19	0.6	0.119		4.1	73.9	22.0	
☒ 2210 4.5	9.5	0.204			2.1	56.9	41.0	
▲ 2211 4.5	38	1.407	0.172		26.1	53.9	20.0	
★ 2211 12.0	76.2	2.678	0.234		34.0	48.9	17.0	
⊙ 2212 2.0	38	2.43	0.231		33.1	47.9	19.0	



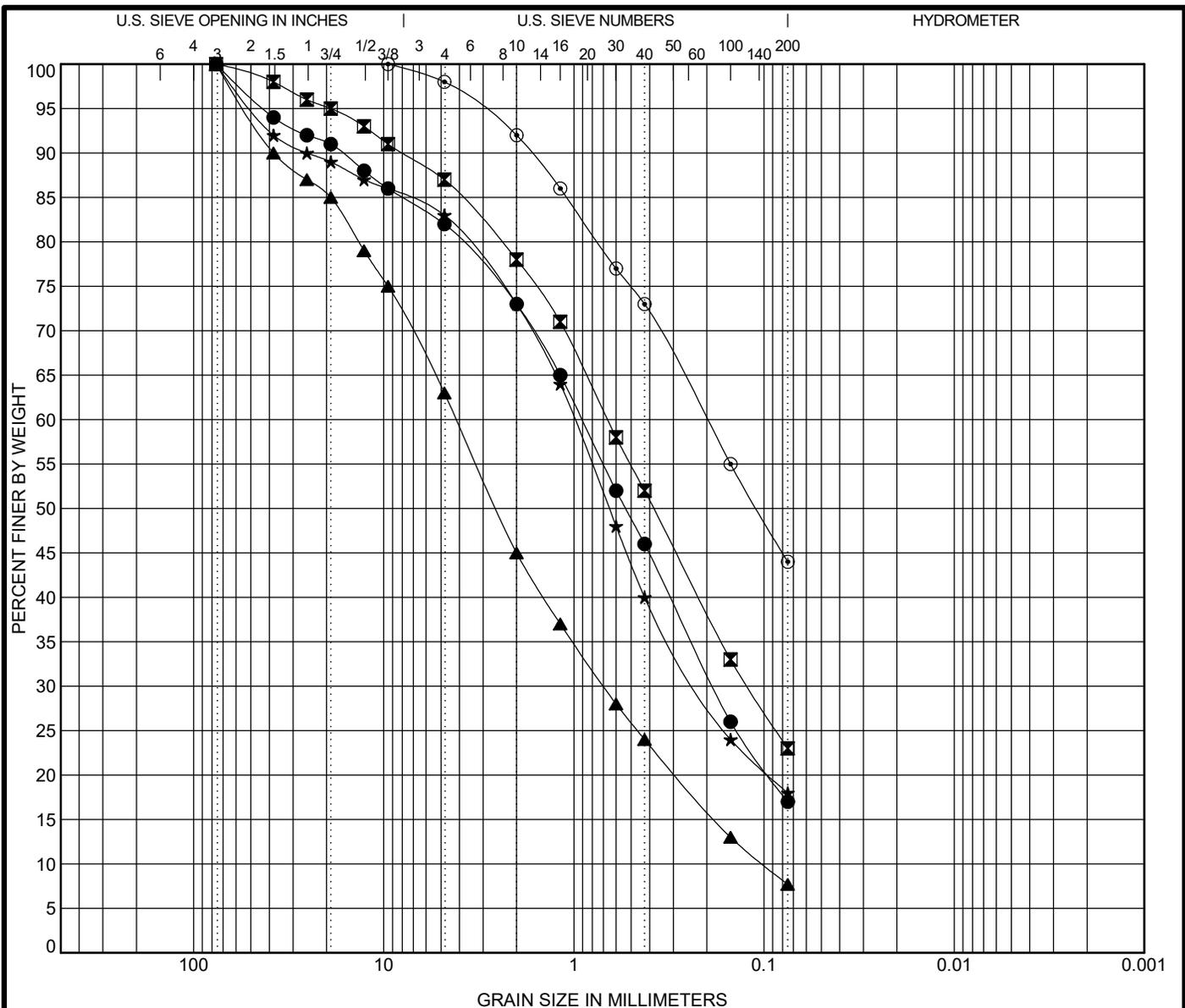
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**GRAIN SIZE DISTRIBUTION RESULTS**

Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

US GRAIN SIZE S211189 LOGS.GPJ GINT STD.US.GDT 3/23/22

Figure 8-2



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● 2212 9.0	SILTY SAND with GRAVEL(SM)	NP	NP	NP		
■ 2213 1.5	SILTY SAND(SM)	NP	NP	NP		
▲ 2213 5.0	WELL-GRADED SAND with SILT and GRAVEL(SW-SM)	NP	NP	NP	1.16	40.94
★ 2214 1.0	SILTY SAND with GRAVEL(SM)	NP	NP	NP		
⊙ 2216 1.0	SILTY SAND(SM)	28	23	5		

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 2212 9.0	76.2	0.91	0.185		18.0	64.9	17.0	
■ 2213 1.5	76.2	0.666	0.122		13.1	63.9	23.0	
▲ 2213 5.0	76.2	4.148	0.697	0.101	37.0	55.1	7.7	
★ 2214 1.0	76.2	0.996	0.222		16.9	64.9	18.0	
⊙ 2216 1.0	9.5	0.2			2.1	53.9	44.0	

US GRAIN SIZE S211189 LOGS.GPJ GINT STD.US.GDT 3/23/22

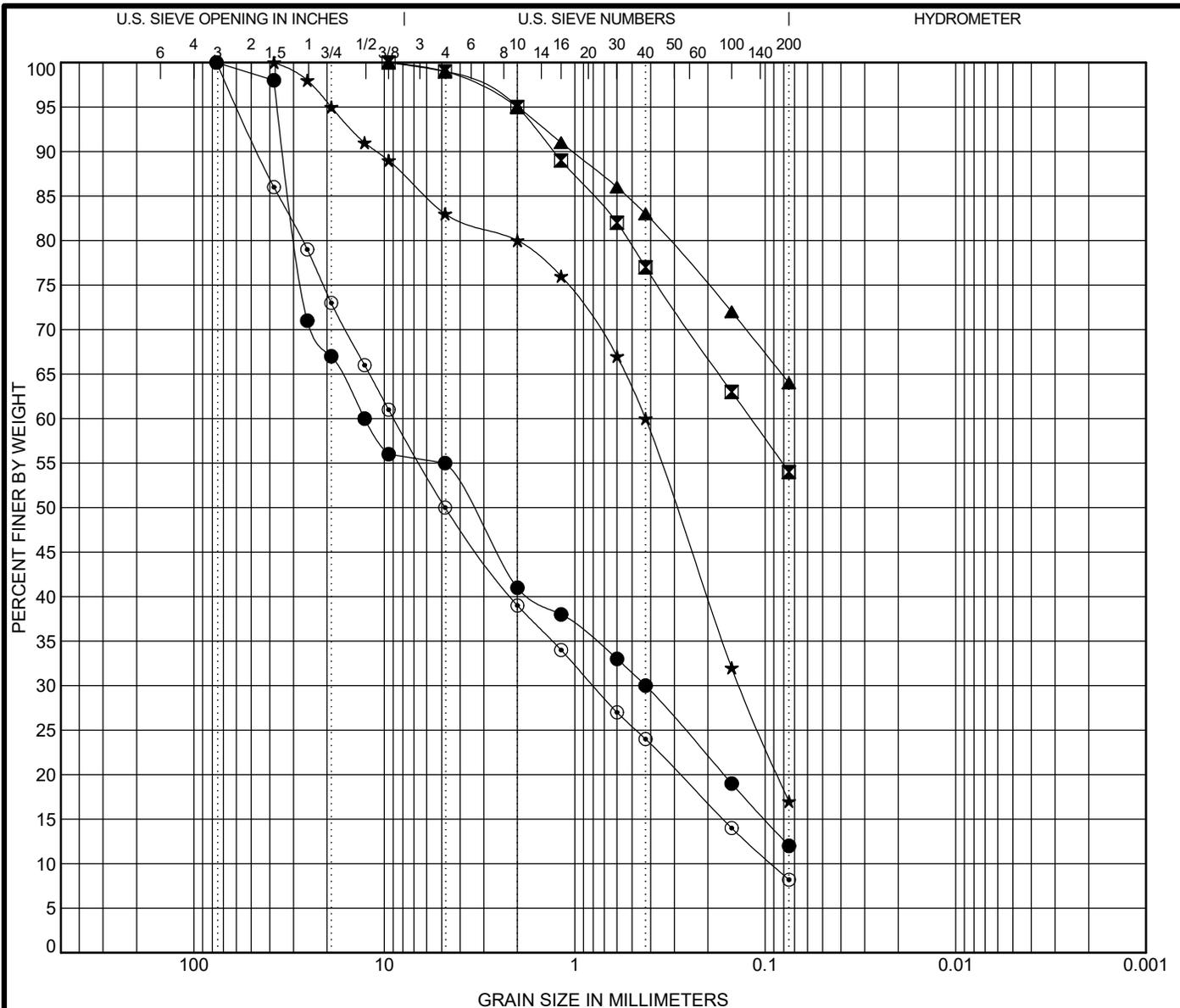


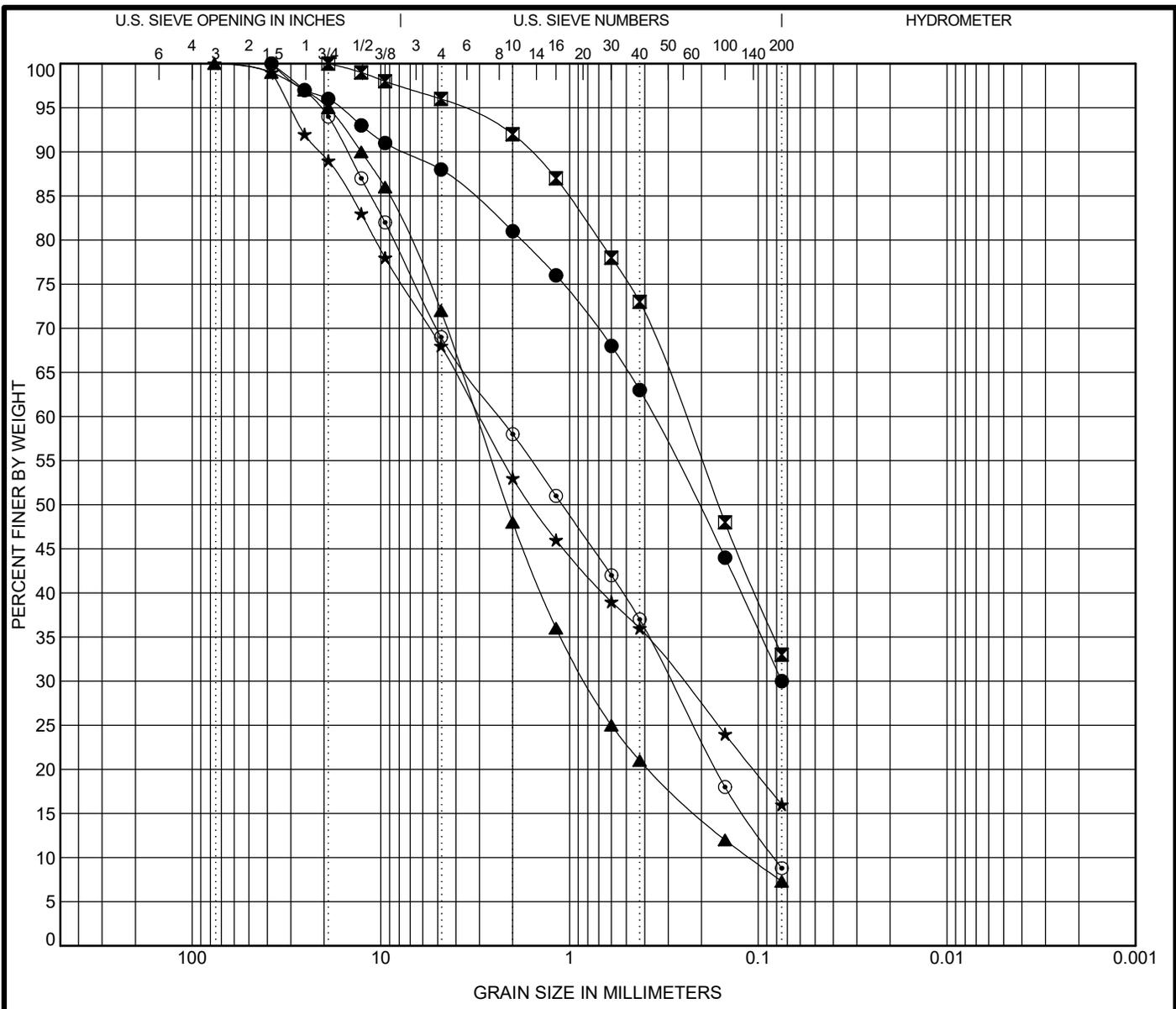
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### GRAIN SIZE DISTRIBUTION RESULTS

Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

Figure 8-3





COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● 2222 0.0	SILTY SAND(SM)	22	19	3		
☒ 2223 0.5	SILTY SAND(SM)	NP	NP	NP		
▲ 2223 2.5	WELL-GRADED SAND with SILT and GRAVEL(SW-SM)	NP	NP	NP	1.92	27.74
★ 2224 0.5	SILTY SAND with GRAVEL(SM)	NP	NP	NP		
⊙ 2224 3.0	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)	NP	NP	NP	0.44	28.56

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 2222 0.0	38	0.361	0.075		12.1	57.9	30.0	
☒ 2223 0.5	19	0.247			4.0	63.0	33.0	
▲ 2223 2.5	76.2	3.098	0.816	0.112	28.3	64.4	7.3	
★ 2224 0.5	76.2	3.009	0.252		32.2	51.8	16.0	
⊙ 2224 3.0	38	2.345	0.29	0.082	31.1	60.1	8.8	



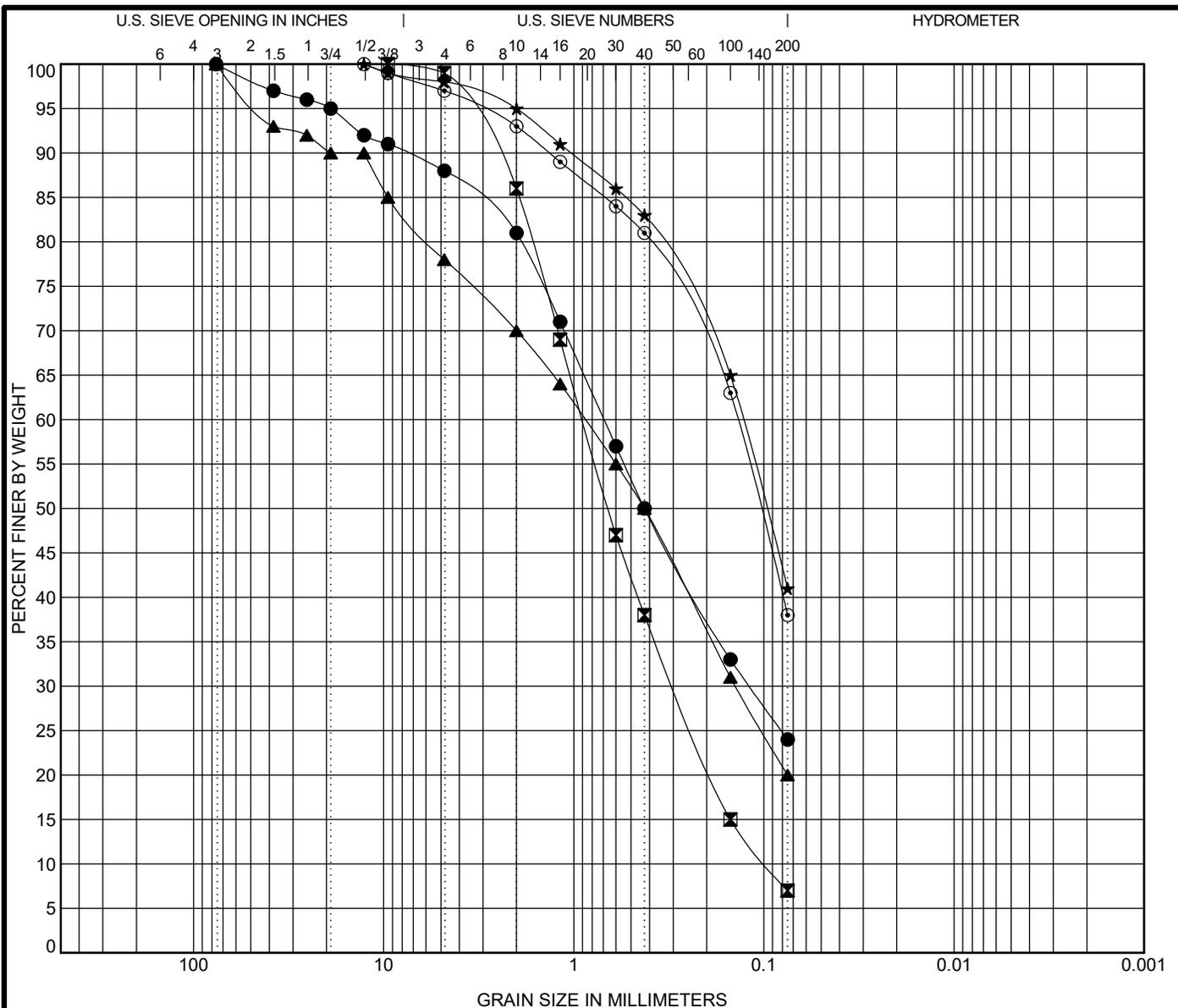
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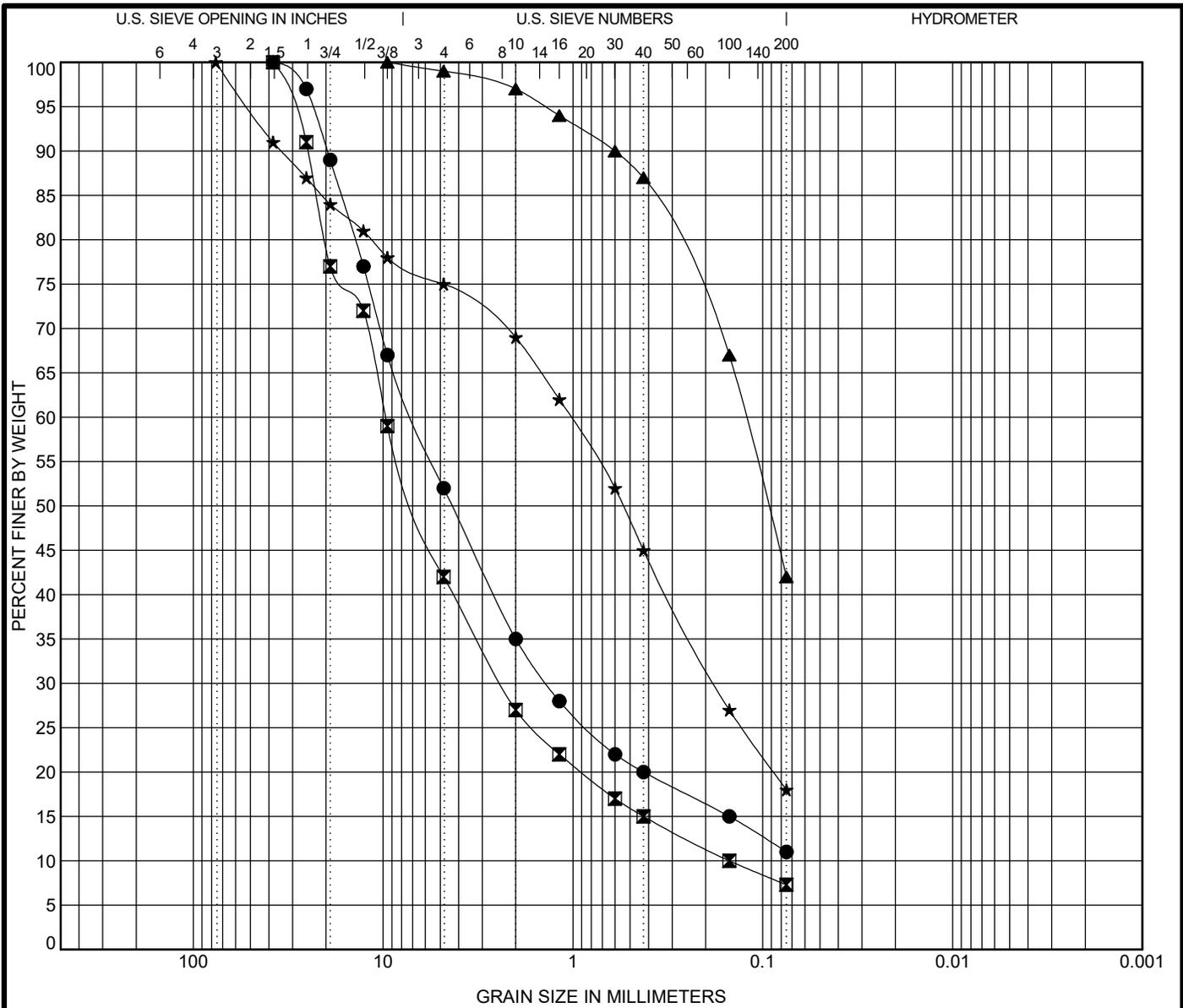
**GRAIN SIZE DISTRIBUTION RESULTS**

Project: Legacy Ridge Phase F  
 Location: Liberty Lake, WA  
 Number: S211189

US GRAIN SIZE S211189 LOGS.GPJ GINT STD.US.GDT 3/23/22

Figure 8-5





COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● 2228 3.5	POORLY GRADED GRAVEL with CLAY and SAND(GP-GC)	54	24	30	4.32	109.54
☒ 2229 1.0	POORLY GRADED GRAVEL with CLAY and SAND(GP-GC)	35	19	16	3.90	64.76
▲ 2229 3.0	SILTY SAND(SM)	NP	NP	NP		
★ 2229 7.5	SILTY SAND with GRAVEL(SM)	NP	NP	NP		

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 2228 3.5	38	6.908	1.372		48.2	40.8	11.0	
☒ 2229 1.0	38	9.715	2.383	0.15	58.2	34.5	7.3	
▲ 2229 3.0	9.5	0.124			1.0	57.0	42.0	
★ 2229 7.5	76.2	1.031	0.178		24.9	56.9	18.0	



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**GRAIN SIZE DISTRIBUTION RESULTS**

Project: Legacy Ridge Phase F  
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US GRAIN SIZE S211189 LOGS.GPJ GINT STD.US.GDT 3/23/22

Figure 8-7

# Important Information about This Geotechnical Engineering Proposal

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

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

## **Participate in Development of the Subsurface Exploration Plan**

Geotechnical engineering begins with the creation of an effective subsurface exploration plan. This proposal starts the process by presenting an initial plan. While that plan may consider the unique physical attributes of the site and the improvements you have in mind, it probably does not consider your unique goals, objectives, and risk management preferences. Subsurface exploration plans that are finalized without considering such factors presuppose that clients' needs are unimportant, or that all clients have the same needs. *Avoid the problems that can stem from such assumptions* by finalizing the plan and other scope elements directly with the geotechnical engineer you feel is best qualified for the project, along with the other project professionals whose plans are affected by the geotechnical engineer's findings and recommendations. If you have been told that this step is unnecessary; that client preferences do not influence the scope of geotechnical engineering service or that someone else can articulate your needs as well as you, you have been told wrong. No one else can discuss your geotechnical options better than an experienced geotechnical engineer, and no one else can provide the input you can. Thus, while you certainly are at liberty to accept a proposed scope "as is," recognize that it could be a unilateral scope developed without direct client/engineer discussion; that authorizing a unilateral scope will force the geotechnical engineer to accept all assumptions it contains; that assumptions create risk. *Manage your risk. Get involved.*

## **Expect the Unexpected**

The nature of geotechnical engineering is such that planning needs to *anticipate the unexpected*. During the design phase of a project, more or deeper borings may be required, additional tests may become necessary, or someone associated with your organization may request a service that was not included in the final scope. During the construction phase, additional services may be needed to respond quickly to unanticipated conditions. In the past, geotechnical engineers commonly did

whatever was required to oblige their clients' representatives and safeguard their clients' interests, taking it on faith that their clients wanted them to do so. But some, evidently, did not, and refused to pay for legitimate extras on the ground that the engineer proceeded without proper authorization, or failed to submit notice in a timely manner, or failed to provide proper documentation. *What are your preferences? Who is permitted to authorize additional geotechnical services on your project? What type of documentation do you require? To whom should it be sent? When? How?* By addressing these and similar issues sooner rather than later, you and your geotechnical engineer will be prepared for the unexpected, to help prevent molehills from growing into mountains.

## **Have Realistic Expectations; Apply Appropriate Preventives**

The recommendations included in a geotechnical engineering report are *not final*, because they are based on opinions that can be verified only during construction. For that reason, most geotechnical engineering proposals offer the construction observation services that permit the geotechnical engineer of record to confirm that subsurface conditions are what they were expected to be, or to modify recommendations when actual conditions were not anticipated. *An offer to provide construction observation is an offer to better manage your risk.* Clients who do not take advantage of such an offer; clients who retain a second firm to observe construction, can create a high-risk "Catch-22" situation for themselves. *The geotechnical engineer of record cannot assume responsibility or liability for a report's recommendations when another firm performs the services needed to evaluate the recommendations' adequacy.* The second firm is also likely to disavow liability for the recommendations, because of the substantial and possibly uninsurable risk of assuming responsibility for services it did not perform. Recognize, too, that no firm other than the geotechnical engineer of record can possibly have as intimate an understanding of your project's geotechnical issues. As such, reliance on a second firm to perform construction observation can elevate risk still more, because its personnel may not

have the wherewithal to recognize subtle, but sometimes critically important unanticipated conditions, or to respond to them in a manner consistent with your goals, objectives, and risk management preferences.

### **Realize That Geoenvironmental Issues Have Not Been Covered**

The equipment, techniques, and personnel used to perform a geoenvironmental study differ significantly from those used to perform a geotechnical study. *Geoenvironmental services are not being offered in this proposal. The report that results will not relate any geoenvironmental findings, conclusions, or recommendations.* Unanticipated environmental problems have led to numerous project failures. If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

### **Obtain Professional Assistance To Deal with Mold**

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the express purpose of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may be addressed as part of the geotechnical engineering study described in this proposal, the geotechnical engineer who would lead this project ***is not*** a mold prevention consultant; ***none of the services being offered have been designed or proposed for the purpose of mold prevention.***

### **Have the Geotechnical Engineer Work with Other Design Professionals and Constructors**

Other design team members' misinterpretation of a geotechnical engineering report has resulted in costly problems. Manage that risk by hav-

ing your geotechnical engineer confer with appropriate members of the design team before finalizing the scope of geotechnical service (as suggested above), and, again, after submitting the report. *Also retain your geotechnical engineer to review pertinent elements of the design team members' plans and specifications.*

Reduce the risk of unanticipated conditions claims that can occur when constructors misinterpret or misunderstand the purposes of a geotechnical engineering report. Use appropriate language in your contract documents. Retain your geotechnical engineer to participate in prebid and preconstruction conferences, and to perform construction observation.

### **Read Responsibility Provisions Closely**

Clients, design professionals, and constructors who do not recognize that geotechnical engineering is far less exact than other engineering disciplines can develop unrealistic expectations. Unrealistic expectations can lead to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their proposals. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks, thus to encourage more effective scopes of service. *Read this proposal's provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

### **Rely on Your ASFE-Member Geotechnical Engineer for Additional Assistance**

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit to everyone involved with a construction project. Confer with an ASFE member geotechnical engineer for more information. Confirm a firm's membership in ASFE by contacting ASFE directly or at its website.



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