

Geotechnical Engineering Report

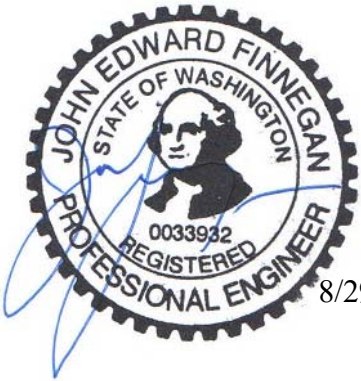
Volkman Housing project
Spokane County, WA

Prepared for:

Michael Kinney, Managing Member
MTK Land Company, Inc.
PO Box 935
Otis Orchard, WA 99027

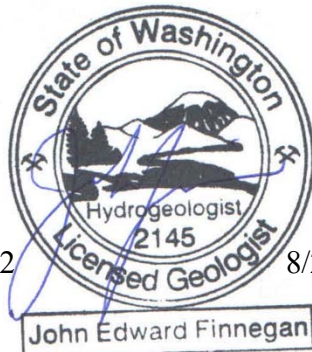
Prepared by:

Budinger & Associates, Inc.
1101 N. Fancher Road
Spokane Valley, WA 99212



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John Finnegan, PE, LHG
Geotechnical Engineer, Principal



8/29/2022

Jack Pappas, GIT
Staff Geologist



Budinger
& Associates

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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 MTK Land Company, Inc., represented by Mike T. Kinney, owner.

Project Considerations

Approximately 124.5 acres are proposed for residential development. Current plans indicate development will consist of 347 single-family lots, located in the northern half of the site. Approximately 38 acres of the development is proposed on slopes greater than 30 percent. This report does not include design or recommendations for house foundations.

Location

The site is located in the W ½ of the SE ¼ of Section 16 and the E ½ of Section 21, Township 26N, Range 42E, Willamette Meridian. Spokane County lists the 10 parcel numbers as 26164.0046, 26164.0018, 26164.0031, 26211.0201, 26211.0211, 26211.0101, 26211.0054, 26211.0057, 26214.0051, and 26214.0058. The physical addresses of 9802 and 9702 N. Nine Mile Road, Highway 291, are assigned to existing houses on the northern two parcels. 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 geologic hazards, 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 S22525, dated June 14, 2022.

The scope of this study does not include foundation evaluation for homes or outbuildings. Additional information including architectural drawings, grading plan, and anticipated foundation loading are required to provide foundation recommendations.

ENCOUNTERED CONDITIONS

Physical Setting

The site is located northwest of Spokane and west of the Five Mile Prairie, a large basalt terrace. Multiple lava flows of the Columbia River Basalt Group blanketed the Spokane region during the Miocene. The Latah fault, an inferred northwest-southeast topographic lineament, is located just west of the site. The fault was mapped using topographic lineaments and stratigraphic offsets in the Miocene Latah Formation and Grande Ronde Basalt flows across the Latah Creek watershed. Flows of the Priest Rapids member of the Wanapum Basalt overlie both units on either side of the fault and do not exhibit appreciable offset, suggesting that most movement on the Latah fault occurred prior to the eruption of the Priest Rapids flows approximately 14.3 million years ago (WSDNR, 2012).

During the last ice age, repeated mega-flood events resulting from rupturing of the ice dams that retained Glacial Lake Missoula, inundated much of the Spokane area, and scoured pre-existing rock and sedimentary formations. The floods deposited coarse-grained sediment in consequentially developed and localized channels.

Several north-south trending alluvial terraces, deposited by the outburst floods, extended down to the west from the top of the Five Mile Prairie to the site. An approximately 250-foot-tall alluvial terrace was located on and directly east of the site and sloped down to the west at 30 to 60 percent. Multiple draws were observed in the terrace and eroded material formed small alluvial fans at the mouth of the draws. The present day Spokane River meanders through a large-scale channel incised into the basalt and outburst flood deposits.

Geologic mapping of the area shows the site is underlain by Quaternary alluvium (*Qal*), Quaternary alluvial fan deposits (*Qaf*), and Pleistocene outburst flood deposits, predominantly sand (*Qfs*) (WSDNR, 2004). The Natural Resources Conservation Service (NRCS) lists the native soils associated with the site as described below in *Table 1*.

Table 1. NRCS Soil Units

Soil Unit Number	Soil Unit Name	Slopes	K Factor, Whole Soil
3120	Marble loamy Sand	0 to 8 percent	0.05
3121	Marble loamy Sand	8 to 15 percent	0.05
3122	Marble loamy Sand	15 to 30 percent	0.05
3123	Marble loamy Sand	30 to 55 percent	0.05
3127	Marblespring fine gravelly loamy coarse sand	0 to 8 percent	0.05
3140	Springdale gravelly ashy coarse sandy loam	0 to 8 percent	0.20
3143	Spens very gravelly loamy coarse sand	30 to 65 percent	0.15
3147	Spens very gravelly loamy coarse sand, cool	15 to 30 percent	0.15
3148	Spens very gravelly loamy coarse sand, cool	30 to 65 percent	0.15
7116	Urban Land-Marblespring, disturbed complex	3 to 8 percent	0.10
7120	Urban land-Marble, disturbed complex	0 to 3 percent	0.10
7121	Urban land-Marble, disturbed complex	3 to 8 percent	0.10
7122	Urban land-Marble, disturbed complex	8 to 15 percent	0.10
7123	Urban land-Marble, disturbed complex	15 to 30 percent	0.10
7170	Urban land-Springdale, disturbed complex	0 to 3 percent	0.20

Surface Conditions

The site primarily consisted of undeveloped land. Total relief across the site was approximately 268 feet. The highest point of elevation was observed in the northeast corner at approximately 1,940 feet (NAVD 88) and the lowest point was approximately 1,672 feet near the southeast corner where a power line alignment leaves the site (discussed subsequently). A 30 to 60 percent slope was located on the eastern and southern halves, sloping down to the west. The slope was moderately populated by coniferous trees and the ground surface was blanketed with forest duff. The lower, western half sloped gently to the northwest and was populated by tall-growing grasses and weeds. Historical aerial imagery indicated that the western half bordering Highway 291 was previously used for agricultural purposes.

Existing houses were observed south of test pit 2211 (TP-2211) and south of TP-2220. The houses were built on level pads constructed by cut and fill methods. In the northeast corner, in the vicinity of TP-2213, fill was observed in an area possibly used as a borrow pit. High-voltage powerlines were observed on an easement from the northwest corner to the southwest corner. On the southern half, a road was cut into the slope beneath the power lines. Near the top of the road, an erratic,

approximately 8-foot diameter boulder was observed. Several indications of buried gas and communication lines were observed perpendicular to Pine Meadows Road between TP-2235 and TP-2236.

Indications of soil instability (scarps, slumps, pistol-butted trees, etc.) were not observed. Several eroded areas were observed along the powerline service road. The eroded areas were downslope of water bars graded into the road.

Subsurface Conditions

Subsurface exploration was performed concurrently with the reconnaissance. 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 symbols:



Existing fill was encountered in TP-2213 and TP-2237 beginning at the ground surface and extending 5.5 feet and 1 foot BGS, respectively. *Existing fill* consisted of sand with silt and gravel. Roots, pine needles, PVC pipes, and power line insulators were observed within the *existing fill*.

silty sand

Log symbols:



Silty sand with varying gravel content was encountered beginning at the ground surface and extending to depths ranging from approximately 1.5 to 7 feet BGS. Roots less than 3-inch diameter were observed, commonly within 1 to 2 feet of the ground surface. The condition varied from very loose to medium-dense but was generally loose from the ground surface to 4 feet BGS. The fines content (percent, by weight, passing the U.S. #200 sieve) ranged from 13 to 23 percent in 3 representative samples evaluated.

Silty sand consisting of silty, clayey sand was encountered in TP-2224 from the ground surface to 1.5 feet BGS. *Silty sand* with gravel was encountered in a dense condition beneath *permeable sand and gravel* in TP-2211 beginning at 10 feet and extending to greater than 12 feet BGS.

Silty sand was not encountered in TP-2210, TP-2212, TP-2213, TP-2215, TP-2216, TP-2229, TP-2235, TP-2236, and TP-2237.

sand with silt

Log symbol:

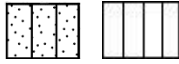


Sand with silt and varying amounts of gravel and cobbles was encountered in the explorations beginning at the ground surface or beneath *silty sand* and extended to depths ranging from 4 to greater than 12 feet BGS. *Sand with silt* was bisected by *ash* in TP-2216 and TP-2221. The

condition ranged from very loose to medium dense. However, very loose to loose conditions were observed within 1 to 5 feet of the ground surface. Fines content was 8.1 percent in 2 representative samples tested. *Sand with silt* was not encountered in TP-2213, TP-2214, and TP-2230

ash

Log symbols:



Naturally deposited volcanic *ash* consisting of non-plastic silt with sand and silty sand was encountered in TP-2211, TP-2212, TP-2216, TP-2221, TP-2223, and TP-2231 beginning beneath *silty sand* or *sand with silt* and extending to depths ranging from 6 to greater than 10.5 feet BGS. The thickness of *ash* ranged from 2 to 3 feet. *Ash* was generally encountered in a medium-dense condition except for TP-2216 and TP-2231 where 4- and 12-inch-thick loose zones were encountered, respectively. Fines content ranged from 36 to 84 percent in 3 representative samples tested.

permeable sand and gravel

Log symbols:



Sand and gravel with varying amounts of cobbles and boulders were encountered beginning beneath *silty sand*, *sand with silt*, *ash*, and *existing fill*, and extending to greater than 11 feet BGS. The condition was generally medium-dense to dense although the presence of large soil particles (large gravel, cobbles, and boulders) tended to interfere with DCP probe advancement which resulted in artificially high blow counts and refusal in some zones. Zones of loose soil were encountered in TP-2213 from 7 to 9.5 feet BGS and TP-2226 from 7 to 8 feet BGS. Fines content ranged from 1.3 to 3.5 percent in 3 representative samples tested.

Permeable sand and gravel was generally not encountered in the steep, west-facing hillside.

Pavement subgrade strength. Kessler® DCP tests were also initiated beginning at the ground surface and advanced to a maximum depth of 36 inches BGS. The DCP tests were used to evaluate pavement subgrade support conditions within the site. A subgrade resilient modulus (M_R) of approximately 7,000 pounds per square inch (psi) appears to be a reasonable value representing the subgrade strength of the encountered soils. Results of the DCP tests are presented in *Figures*.

Surface and Groundwater Hydrology

Surface water was not observed on the site. The nearest surface water was observed in the Spokane River, approximately ½ mile southwest of the site. The surface water elevation in this reach of the river is controlled by the Nine Mile Falls Dam, approximately 2.5 miles to the northwest. Normal pool elevation above Nine Mile Falls Dam is 1,604 feet (USGS, 1973).

Groundwater was not encountered in explorations. A review of local well reports obtained from the Washington State Department of Ecology website indicate the depth to groundwater in the vicinity of the site is approximately 67 feet BGS.

Review of chapter 6.2 in the *Spokane Regional Stormwater Manual* (SRSW) indicates the site is

within the aquifer sensitive area (ASA) and the moderate to high susceptibility range for the critical aquifer recharge area (CARA), shown in *Figure 6-1* and *Figure 6-2*, respectively.

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, geohazard 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 11.20.090L Appendix L);
- 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 indicated components "a", "b", "d", and "e" of the CAO, as described above, were observed on site. Other components of the CAO were not observed. Geohazards are further addressed in the following report sections.

CONCLUSIONS

Geologic Hazards. Geologic hazards identified on the site, as defined by the CAO are slopes greater than 30 percent, soils identified by the NRCS as posing a severe potential for erosion, areas mapped as alluvium, and areas of uncompacted fill. The extent of these hazards were delineated in *Figures 2-2*, to *2-5* utilizing GIS data obtained from the Washington State Department of Natural Resources and Spokane County.

We used the modified version of the Universal Soil Loss Equation (USLE) outlined in Section 11.20.090 L Appendix L in the CAO to determine whether soils pose a severe potential for erosion. “The index is a product of *K* times the average slope of the map unit (*K**ave slope). Slight has an index of less than or equal to 3.0 (less than 5 tons/acre/yr.), moderate has an index of 3.0 to 4.0 (5 to 8 tons/acre/yr.), and severe has an index greater than 4.0 (greater than 8 tons/acre/yr.).” Table 2 lists slopes that pose severe potential for erosion based on the equation outlined above. The potential for erosion, based on the parameters in table 2, is illustrated in Figure 2-5, *Soil Erosion Hazard Map*. Soils identified as posing a severe potential for erosion are located on and north of the northern edge of the site, outside the proposed development.

Table 2. Modified USLE Index Parameters.

K Factor, Whole Soil	Potential for Severe Erosion
0.05	Greater than 80 percent slopes
0.10	Greater than 40 percent slopes
0.15	Greater than 27 percent slopes
0.20	Greater than 20 percent slopes

Quaternary alluvium (*Qal*) was mapped by the WSDNR on parts of the site, as illustrated in Figure 2-2. The encountered soils were coarse-grained, well consolidated, and formed relatively gentle slopes. In the areas mapped as alluvium, we did not observe evidence of erosion or landslide hazards during our surface reconnaissance and subsurface explorations.

Although geologic hazards are present, we conclude these hazards can be mitigated by use of typical construction best management practices, preservation of natural drainages, and following the recommendations outlined in this report.

Earthwork. Existing fill should be removed and replaced with compacted structural fill. Cobbles and boulders will be encountered in explorations. The outburst floods that created the *Qfs* deposit often included large pieces of glacial ice that rafted boulders while being transported by flow. As the ice rafts melted, boulders were dropped within lower-energy environments of deposition that do not typically include such large particles. One such boulder was encountered at the surface on the southern half of the site. Conventional excavation equipment will likely be adequate for removing boulder material should it be encountered.

Stormwater Infiltration. Conditions appear to be suitable for subsurface infiltration of stormwater. 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. *Sand with silt* and *permeable sand and gravel* represent suitable target layers for subsurface infiltration. *Ash* and *silty sand* represent limiting layers due to the higher fines content. We conclude it is feasible to design stormwater infiltration structures while maintaining a minimum 4-foot separation above limiting layers.

The scope of services included exploration to a maximum depth of 12 feet BGS. Thus, stormwater infiltration recommendations will be limited to single-depth drywells. To our knowledge, areas of the site proposed for stormwater swale construction have not yet been defined. Double-depth drywells may be feasible in such areas, however, subsurface exploration at depths deeper than those reached in test pit excavations or full-scale infiltration tests would be necessary to provide recommended outflow rates.

Pavements. A seasonally adjusted, subgrade resilient modulus of 7,000 psi appears suitable for pavement design.

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 D “stiff soil.” 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 3. Seismic Design Parameters

Site Class	Latitude	Longitude	PGA	PGA_M	S_s	S_1	S_{DS}	S_{D1}
D	47.74 N	-117.50 W	0.143g	0.216g	0.331g	0.116g	0.339g	0.180g

*Code Reference: International Building Code (IBC, 2015); Risk Category II

Due to 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 excavate and replace *existing fill*. On sloping ground to receive fill, bench surfaces to near level 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 sand* 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. Setbacks for structures should adhere to R403.1.7.1 of the IRC.

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 *sand with silt* and *permeable sand and gravel* appears to be generally suitable for re-use as structural fill. Soils exhibiting high fines percentages (including the *silty sand* and *existing fill*) are considered moisture sensitive and may be difficult to compact in wet conditions. An earthwork contractor with successful experience using silty soils in wet weather should be employed. *Ash* should not be reused for structural or road fill.

Silty sand, *existing fill*, and *ash* 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 4. Fill Materials

Soil Fill Product	Allowable Use
Non-Structural Fill	• Areas not supporting structures (typically landscaped areas) • Soils should not contain particles larger than 12 inches median diameter and be reasonably free of deleterious items (wood, metal, plastic, trash, etc.)
Existing Site Soils	• Lots fills and paved areas as describe previously in this report • Over excavations • Caution should be used when using soils with high fines content as described in this report
Select Borrow: WSDOT ¹ SS Section 9-03.14(2)	• Lot fills and paved areas to meet subgrade elevations • Over-excavations • Utility trench backfill above bedding course
Gravel Backfill for Walls: WSDOT SS 9-03.12(2)	• Retaining wall backfill
Gravel Backfill for Walls: WSDOT SS 9-03.12(2) Bedding Course: WSDOT SS 9-03.12(3)	• Retaining wall backfill • Backfill for utility and pipe zone bedding

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

¹ Washington State Department of Transportation

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.

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

- Subgrade for lot fills – 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.

Flexible Pavement

Information regarding the estimation of average daily traffic (ADT) was not provided. The ADT was estimated based on 5 trips per day per lot for light passenger vehicles with 3 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 thickness was determined in accordance with 1993 AASHTO *Guide for Design of Pavement Structures*. Input criteria included the following:

- Design Life - 20 years;
- ADT – 1,785;
- Subgrade resilient modulus – 7,000 psi;
- Total design ESALs – 322,800; and,
- Spokane County design standards.

Based upon the above considerations, the recommended flexible pavement section for residential streets is 3 inches asphalt pavement over 4 inches of crushed gravel over 6 inches of crushed gravel base over compacted subgrade.

Table 5: Pavement Compaction and Recommended Materials Summary

Layer	Compaction	Specification
3 inches asphalt pavement	92% TM	Hot-Mix Asphalt, WSDOT Standard Specifications Section 9-03.8(6).
4 inches, crushed gravel	95% MP	Crushed Surfacing Top Course, WSDOT Standard Specifications Section 9-03.9(3)
6 inches, crushed gravel base	95% MP	Crushed Surfacing Base Course, WSDOT Standard Specifications Section 9-03.9(3)
Native subgrade, top 12 inches	95% MP	Native soils or structural fill, moisture conditioned and compacted.

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.

Gradation analysis was used to estimate permeability based on fines percentages from representative soil samples in accordance with the SRSM, *Appendix 4A – Spokane 200 Method*. The results are summarized below.

Table 6. Drywell Design Outflow Rate Analysis

Test Pit ID	Sample Depth (ft)	Fines (%)	Hydraulic Conductivity (in/hr) ¹	Normalized Outflow Rate (cfs/ft) ²	Safety Factor ⁴	Factored Outflow Rate (cfs)	Infiltration Feasibility
						Single Depth H=6	
2212	8-9	8.1	17	0.036	2.3	0.09	Limited
2220	7-8	8.1	17	0.036	2.3	0.09	Limited
2207	10-11	1.3	550	0.69	1.3	3.2	Yes
2225	8-9	1.9	270	0.38	1.3	1.7	Yes
2236	9-10	3.5	86	0.14	1.3	0.65	Yes

1. in/hr - inches per hour (in³/in²/hr)

2. cfs/ft - cubic feet per second per foot

3. cfs – cubic feet per second

4. Safety factors from SRSM Table 4A-1

We recommend using single-depth drywells in conjunction with grass-lined bio-infiltration swales. Size drywells at a maximum design outflow rate of 0.1 cfs where the perforated sections are positioned entirely within *sand with silt*. Where drywells will be constructed in *permeable sand and gravel*, the recommended maximum design outflow rate is 1.0 cfs. Should double-depth drywells be desired, additional explorations to depths of 25 feet or greater, or full-scale drywell

tests on an installed double-depth drywell would be required to provide design outflow rates.

Should higher infiltration rates become desirable, we recommend full-scale permeability testing of newly constructed drywells in accordance with methods defined in the SRSM. Drywells can “silt-up” over time and operation and maintenance guidelines in the stormwater manual should be followed. We recommend setting aside sufficient area for eventual replacement.

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 2 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 Jack Pappas, GIT, and supervised by geotechnical engineer John Finnegan, PE, between July 20 and August 3, 2022. The field activities generally consisted of the following:

- Reconnaissance of the site and surrounding area;
- Logging subsurface conditions in 38 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 CAT 308 track-mounted excavator with a 36-inch-wide toothed bucket. The total depth to which test pits were excavated was controlled by limits of equipment reach and excessive side wall caving.

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 – 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 pound slide hammer and rods with 2-inch graduations. Method 2 involves the use of a Triggs 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 the client and is based on measured offsets from existing site features at the time of exploration. Elevations presented in the *Logs* are correlated from plans provided by Whipple Consulting Engineers, dated September 4, 2020.

Horizontal and vertical locations can be considered accurate to within 5-foot and 2-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.

Chemical Parameters

pH – AASHTO T289. The quantified measurement of soil pH (acidity = pH <7) and minimum resistivity are useful variables in determining the potential corrosivity of the soil. Certain clayey soils contain excess acidity that attacks concrete, iron, and buried utilities.

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.

REFERENCES

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USGS, 2020, Nine Mile Falls, WA, 7.5-minute Quadrangle, 1:24,000

USGS, 2020, Dartford, WA, 7.5-minute Quadrangle, 1:24,000

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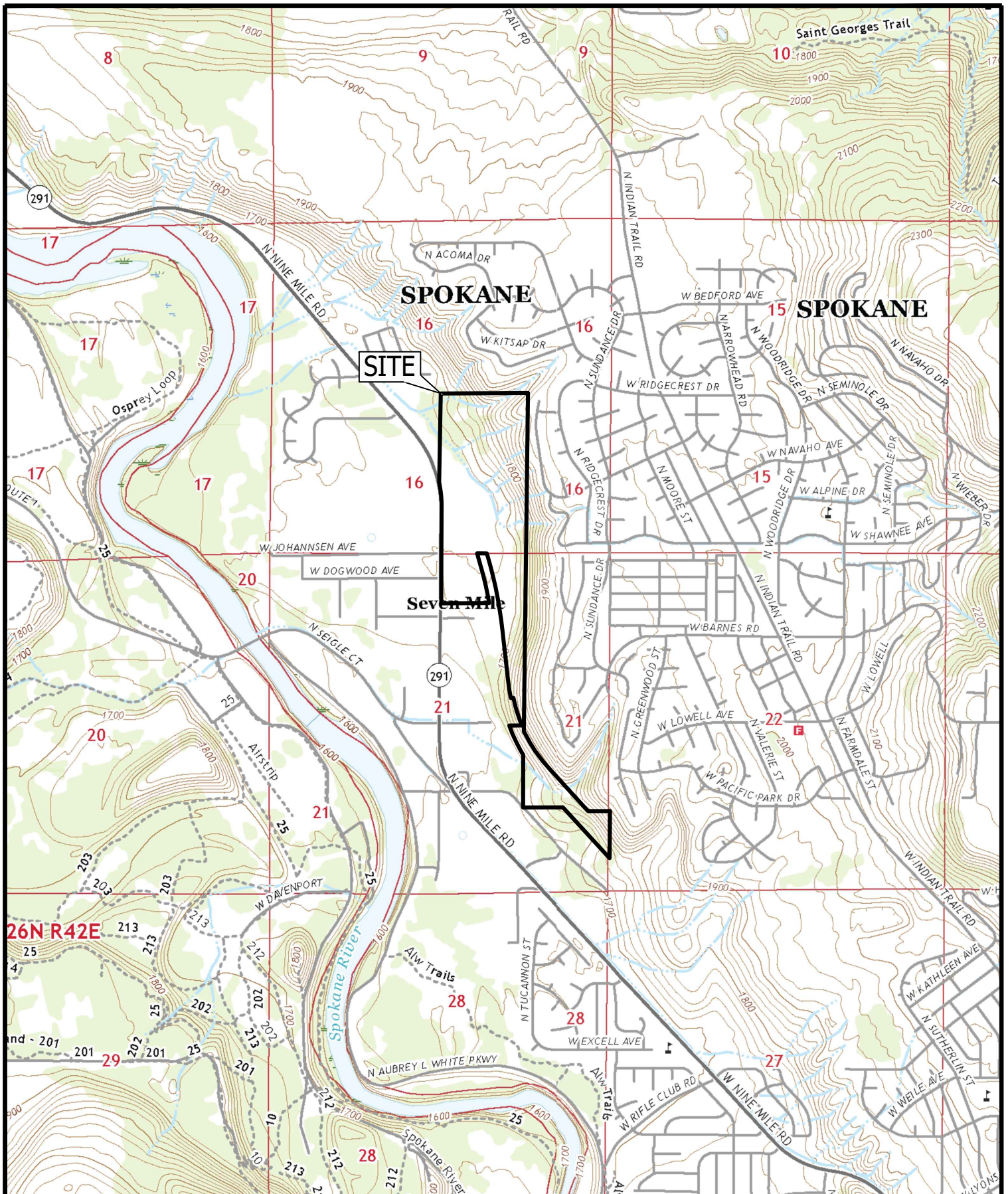
WSDNR, Geologic map of the Dartford 7.5-minute quadrangle, Spokane County, Washington, by R. E. Derkey, W. J. Gerstel, and R. L. Logan. 1998.

WSDNR, Geologic map of the Nine Mile Falls 7.5-minute quadrangle, Spokane and Stevens Counties, Washington, by R. E. Derkey, M. M. Hamilton, and D. F. Stradling. 2003.

WSDNR, Geologic map of the Spokane Northwest 7.5-minute quadrangle, Spokane County, Washington, by R. E. Derkey, M. M. Hamilton, and D. F. Stradling. 2004.

Washington State Department of Transportation, 2022, Geotechnical Design Manual (WSDOT GDM).

Washington State Department of Transportation, 2021, Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT SS).



SCALE: 1"=2000'
0 1000 2000

SECTIONS 16 & 21
T 26 N R 42 E
USGS, 2020



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VICINITY MAP

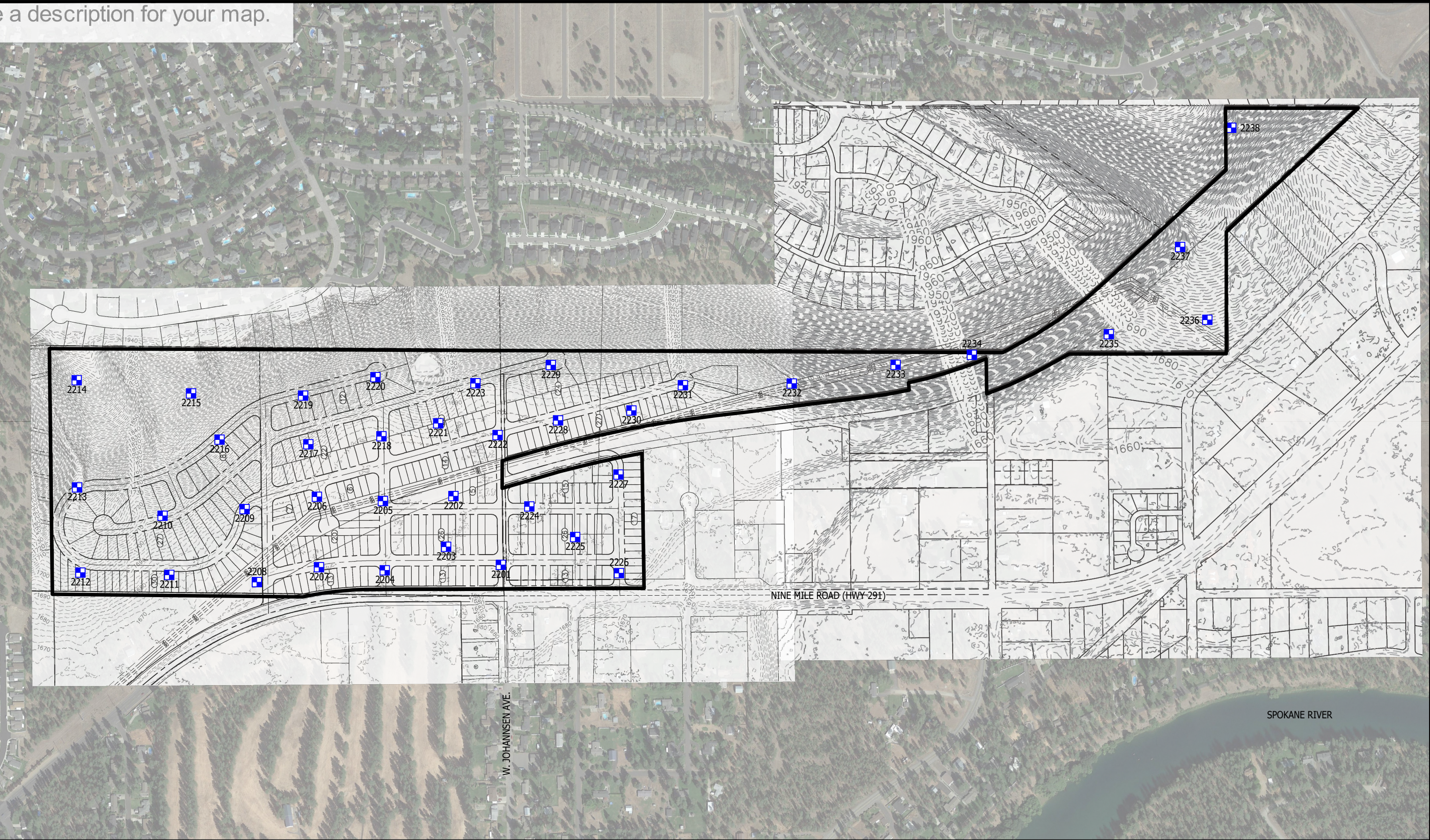
VOLKMAN HOUSING PROJECT
SPOKANE, WASHINGTON

FIGURE 1

PROJECT NUMBER S22525

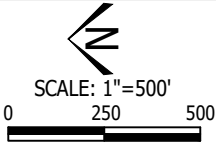
DATE: 8/2022

...a description for your map.



■ TEST PIT LOCATION (2201)

BASE PLAN PROVIDED BY:
WHIPPLE CONSULTING ENGINEERS
(DATED 09/04/2020)

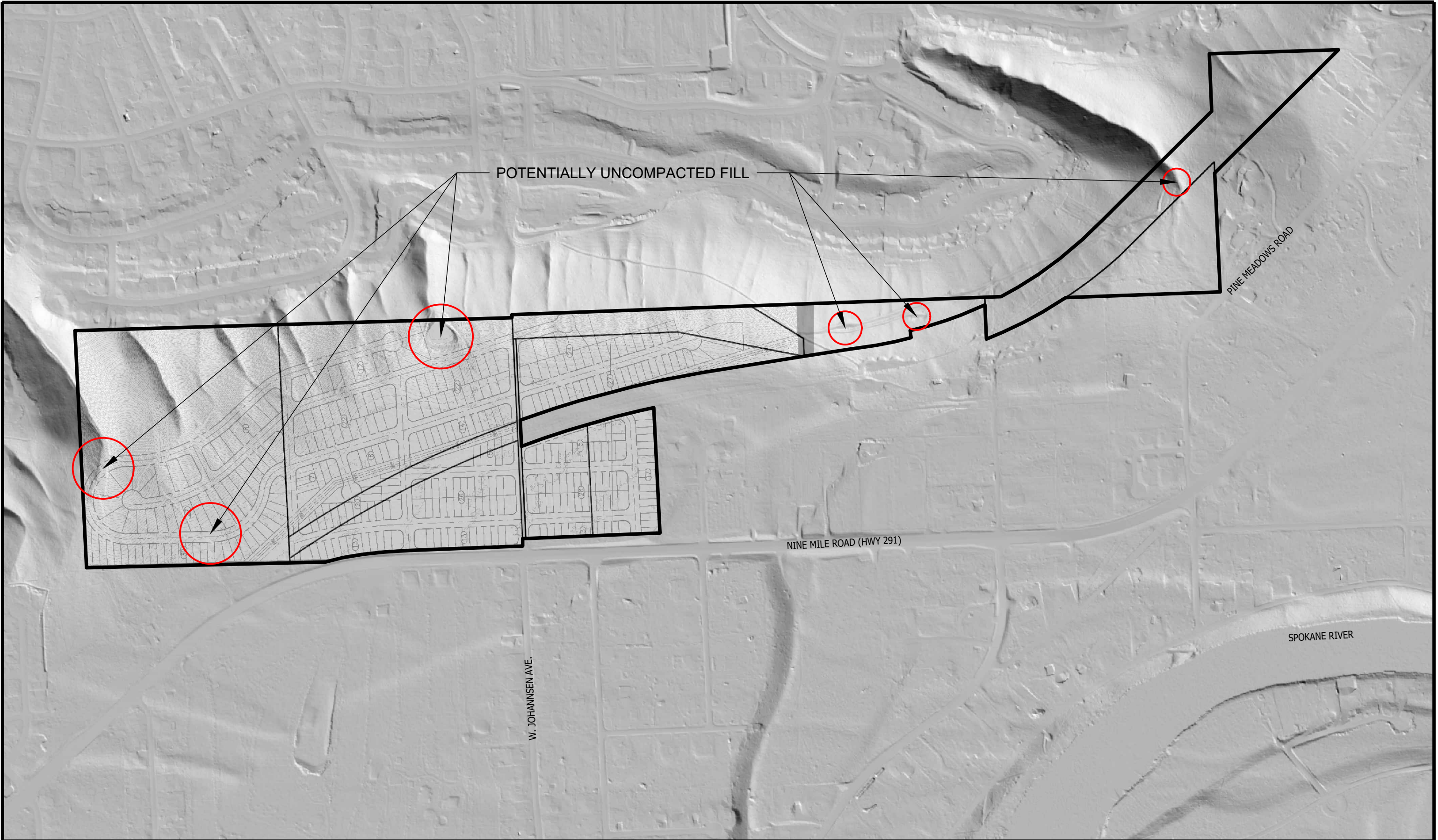


SECTIONS 16 & 21
T 26 N R 42 E
USGS, 2020



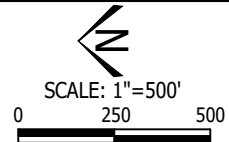
SITE PLAN
VOLKMAN HOUSING DEVELOPMENT NINE MILE FALLS, WASHINGTON

FIGURE 2-1
PROJECT NUMBER S22525
DATE: 8/2022



○ AREAS IDENTIFIED AS POTENTIALLY UNCOMPACTED FILL

BASE PLAN PROVIDED BY:
WHIPPLE CONSULTING ENGINEERS
(DATED 09/04/2020)
LIDAR IMAGERY PROVIDED BY WADNR



SECTIONS 16 & 21
T 26 N R 42 E
USGS, 2020



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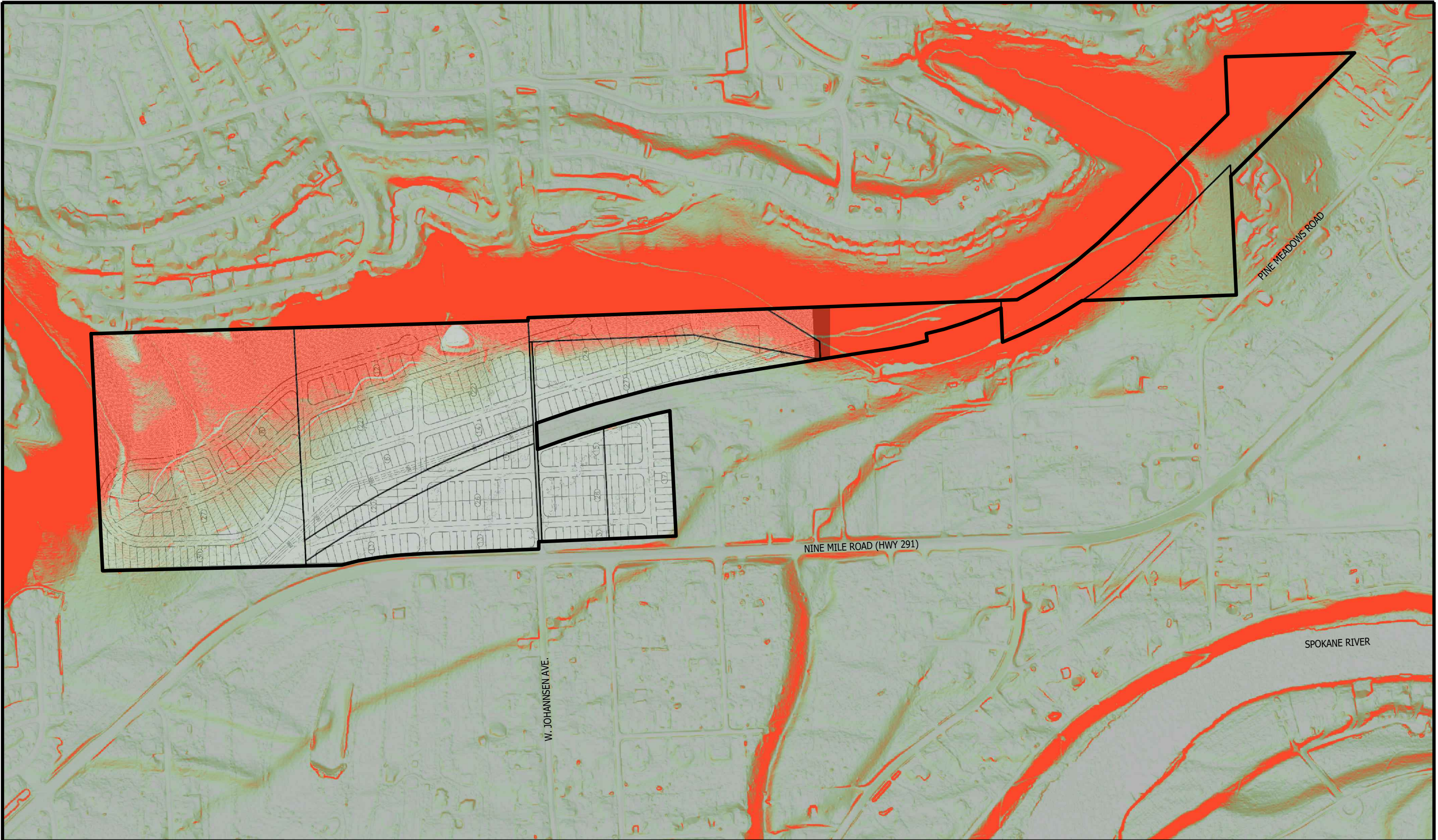
HILLSHADE (LIDAR)

VOLKMAN HOUSING DEVELOPMENT
NINE MILE FALLS, WASHINGTON

FIGURE 2-3

PROJECT NUMBER S22525

DATE: 8/2022



	Slopes Less than 30 percent
	Slopes greater than 30 percent

BASE PLAN PROVIDED BY:
WHIPPLE CONSULTING ENGINEERS
(DATED 09/04/2020)
LIDAR IMAGERY PROVIDED BY WADNR


SCALE: 1"=500'
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SECTIONS 16 & 21
T 26 N R 42 E
USGS, 2020



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& Associates

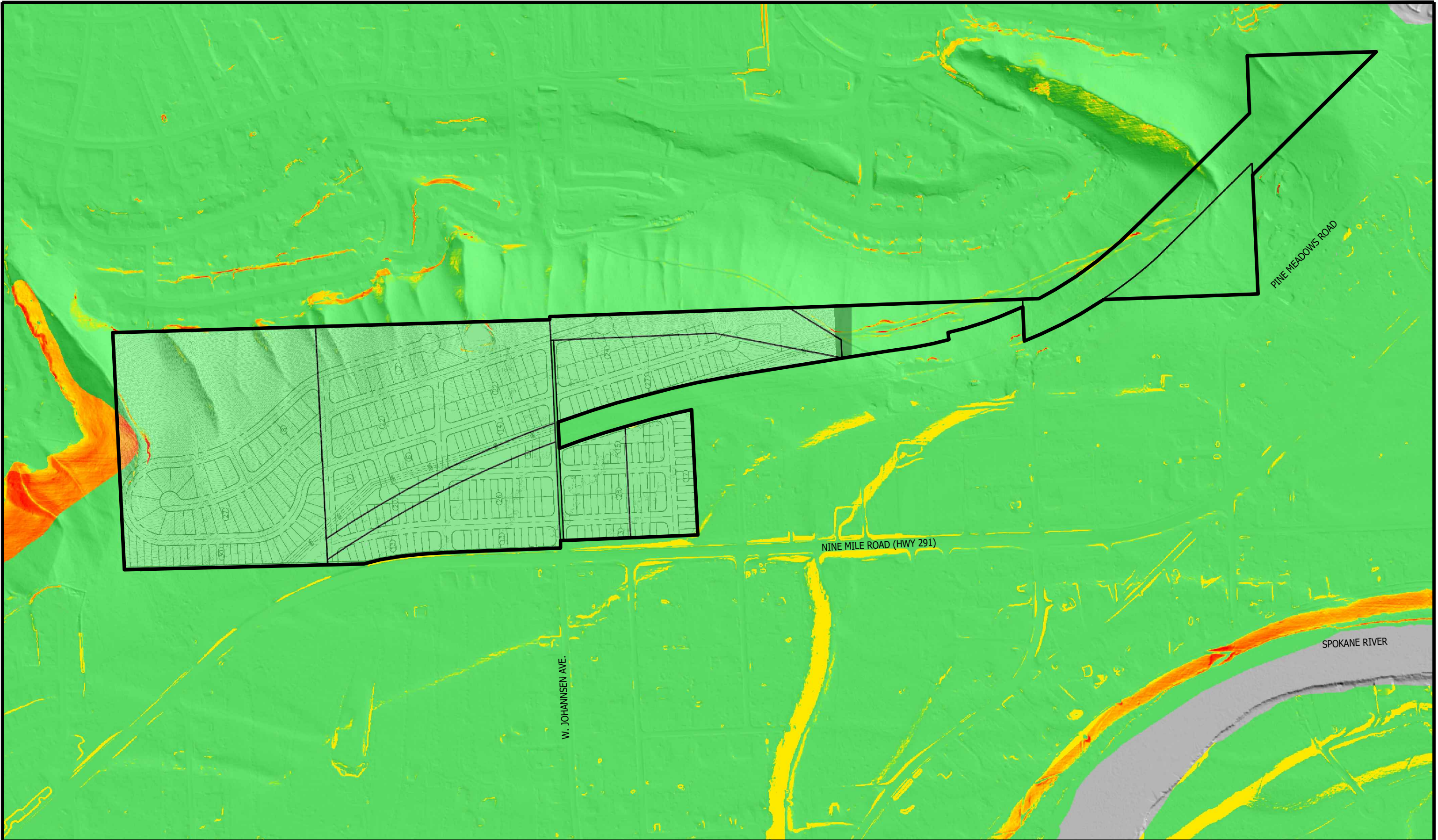
SLOPES GREATER THAN 30%

VOLKMAN HOUSING DEVELOPMENT
NINE MILE FALLS, WASHINGTON

FIGURE 2-4

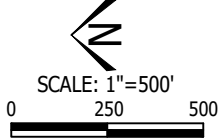
PROJECT NUMBER S22525

DATE: 8/2022



- Slight Erosion Hazard
- Moderate Erosion Hazard
- Severe Erosion Hazard

BASE PLAN PROVIDED BY:
WHIPPLE CONSULTING ENGINEERS
(DATED 09/04/2020)
LIDAR IMAGERY PROVIDED BY WADNR



SECTIONS 16 & 21
T 26 N R 42 E
USGS, 2020

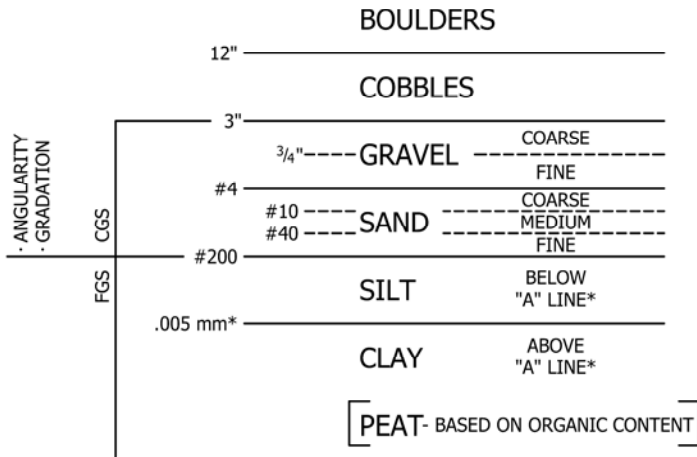


SOIL EROSION HAZARD MAP
VOLKMAN HOUSING DEVELOPMENT
NINE MILE FALLS, WASHINGTON

FIGURE 2-5
PROJECT NUMBER S22525
DATE: 8/2022

GUIDE TO SOIL & ROCK DESCRIPTIONS

SOIL CLASSIFICATION



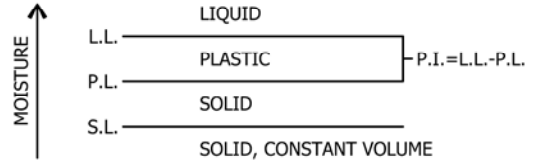
* SEE PLASTICITY CHART

CGS - COARSE GRAINED SOIL - MORE THAN 50% RETAINED ON A #200 SIEVE

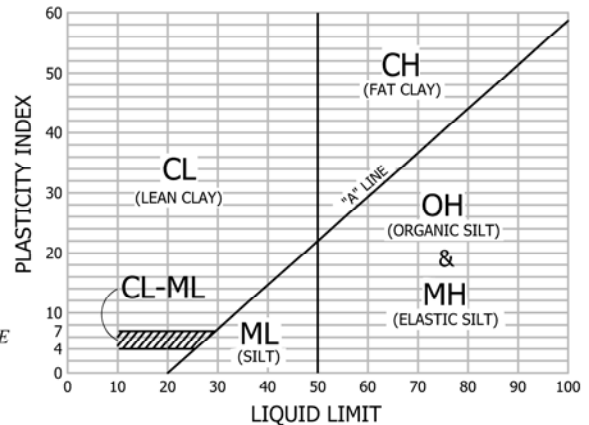
FGS - FINE GRAINED SOIL - 50% MORE PASSES, #200 SIEVE

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	MOISTURE	SOIL CONDITION
SUFFIX "LY" OR "Y"	30% OR MORE FOR COARSE PARTS IN FGS GREATER THAN 12% FOR FINES IN CGS	DRY	CGS:
WITH	15% - 29% FOR COARSE PARTS IN FGS 6% - 14% FOR FINES IN CGS	MOIST	VERY LOOSE
		SATURATED OR WET	LOOSE
			MEDIUM DENSE
			DENSE
			VERY DENSE

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

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
	4" SPLIT SPOON SAMPLER WITH BLOWS PER FOOT
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



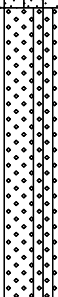
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FIGURE 3

TEST PIT 2201

Date: 7-20-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1680 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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	
		slightly moist, light brown, loose	SILTY SAND with Gravel, coarse to fine, subangular to subrounded, fine roots in upper half foot											
		moist, moderate brown, medium dense	SAND with Silt and Gravel, Cobbles, coarse to fine, subangular to subrounded											
5														
		moist, olive gray, dense	SAND with Gravel, Cobbles, coarse to medium, subangular to subrounded, calcium carbonate deposits on the underside of gravels											
10														
		no free groundwater observed	Excavation terminated due to excessive caving End of Excavation @ 10.5 ft											
15														



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TEST PIT LOGS

FIGURE 4-1

Project: Volkman Housing Development
Location: Spokane, WA
Number: S22525

TEST PIT 2202

Date: 7-20-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1677 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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	
		slightly moist, light brown, loose	SILTY SAND with Gravel, coarse to fine, subangular to subrounded											
		medium dense												
		moist, moderate brown, medium dense	SAND with Silt and Gravel, Cobbles, coarse to fine, subangular to subrounded											
5		moist, olive gray, dense	SAND with Gravel, Cobbles, coarse to medium, subangular to subrounded, calcium carbonate deposits on the underside of gravels											
10		no free groundwater observed	Excavation terminated due to excessive caving and limit of excavator reach End of Excavation @ 10.5 ft											
15														



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TEST PIT LOGS

FIGURE 4-2

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2203

Date: 7-20-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1678 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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	
		slightly moist, light brown, loose	SILTY SAND with Gravel, coarse to fine, subangular to subrounded											
		medium dense												
		moist, moderate brown, medium dense	SAND with Silt and Gravel, Cobbles, coarse to fine, subangular to subrounded											
5														
		moist, olive gray, dense	SAND with Gravel, Cobbles, coarse to medium, subangular to subrounded, calcium carbonate deposits on the underside of gravels											
10														
		no free groundwater observed	Excavation terminated due to excessive caving and limit of excavator reach End of Excavation @ 10 ft											
15														



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TEST PIT LOGS

FIGURE 4-3

Project: Volkman Housing Development
Location: Spokane, WA
Number: S22525

TEST PIT 2204

Date: 7-20-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1676 ft
Logged by: J. Pappas
Size of hole: 4 x 11 ft

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	
		slightly moist, light brown, very loose	SILTY SAND with Gravel, coarse to fine, subangular to subrounded, roots in upper 1 foot											
		medium dense												
		moist, moderate brown, medium dense	SAND with Silt and Gravel, coarse to fine, subangular to subrounded											
5		moist, olive gray, dense	SAND with Gravel, Cobbles, Boulders less than 2 foot in diameter, coarse to medium, subangular to subrounded, calcium carbonate deposits on the underside of gravels											
10														
		no free groundwater observed	Excavation terminated due to excessive caving End of Excavation @ 10 ft											
15														



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TEST PIT LOGS

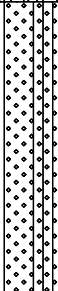
FIGURE 4-4

Project: Volkman Housing Development
Location: Spokane, WA
Number: S22525

TEST PIT 2205

Date: 7-20-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1676 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

					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		slightly moist, light brown, loose	SILTY SAND with Gravel, coarse to fine, subangular to subrounded, roots in upper 1 foot											
		moist, moderate brown, medium dense	SAND with Silt and Gravel, Cobbles, coarse to fine, subangular to subrounded											
5		moist, olive gray, medium dense	SAND with Gravel, Cobbles, coarse to medium, subangular to subrounded											
10		no free groundwater observed	Excavation terminated due to excessive caving and limit of excavator reach End of Excavation @ 10 ft											
15														



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TEST PIT LOGS

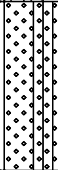
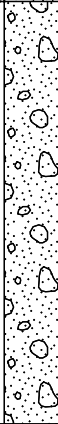
FIGURE 4-5

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2206

Date: 7-20-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1677 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

					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		slightly moist, light brown, very loose	SILTY SAND with Gravel, coarse to fine, subangular to subrounded, roots in upper 6 inches											
		loose												
		moist, moderate brown, loose	SAND with Silt and Gravel, Cobbles, coarse to fine, subangular to subrounded											
5		moist, olive gray, medium dense	SAND with Gravel, Cobbles, coarse to medium, subangular to subrounded											
		dense												
10		no free groundwater observed	Excavation terminated due to excessive caving and limit of excavator reach End of Excavation @ 10 ft											
15														



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TEST PIT LOGS

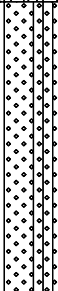
FIGURE 4-6

Project: Volkman Housing Development
Location: Spokane, WA
Number: S22525

TEST PIT 2207

Date: 7-20-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1674 ft
Logged by: J. Pappas
Size of hole: 5 x 10 ft

					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		slightly moist, light brown, loose	SILTY SAND with Gravel, coarse to fine, subangular to subrounded, roots in upper 1 foot											
		moist, moderate brown, medium dense	SAND with Silt and Gravel, Cobbles, coarse to fine, subangular to subrounded											
5		moist, olive gray, medium dense	GRAVEL with Sand, Cobbles, Boulders, fine, subangular to subrounded											
10		no free groundwater observed	Excavation terminated due to excessive caving End of Excavation @ 11 ft											
15														



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TEST PIT LOGS

FIGURE 4-7

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2208

Date: 7-20-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1672 ft
Logged by: J. Pappas
Size of hole: 6 x 10 ft

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	
		slightly moist, light brown, very loose	SILTY SAND with Gravel, coarse to fine, subangular to subrounded, roots in upper 1 foot											
		loose												
		moist, moderate brown, loose	SAND with Silt and Gravel, Cobbles, coarse to fine, subangular to subrounded											
		medium dense												
5		moist, olive gray, medium dense	SAND with Gravel, Cobbles, coarse to medium, subangular to subrounded											
10														
		no free groundwater observed	Excavation terminated due to excessive caving End of Excavation @ 10.5 ft											
15														



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TEST PIT LOGS

FIGURE 4-8

Project: Volkman Housing Development
Location: Spokane, WA
Number: S22525

TEST PIT 2209

Date: 7-20-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1686 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

					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		slightly moist, moderate brown, very loose	SILTY SAND, medium to fine, subangular		○									
		loose												
		medium dense												
5														
		moist, moderate brown, medium dense	SAND with Silt and Gravel, coarse to fine, subangular to subrounded											
10														
		no free groundwater observed	Extent of excavator reach End of Excavation @ 10.5 ft											
15														



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TEST PIT LOGS

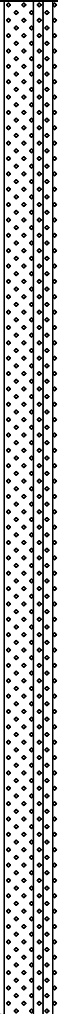
FIGURE 4-9

Project: Volkman Housing Development
Location: Spokane, WA
Number: S22525

TEST PIT 2210

Date: 7-20-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1714 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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, moderate brown, very loose	SAND with Silt and Gravel, coarse to fine, subangular to subrounded, fine roots in the upper 6 inches, roots less than 1.5 feet diameter in the upper 5 feet											
		loose												
		medium dense												
5														
		4-inch loose zone medium dense												
10														
		no free groundwater observed	Excavation terminated due to excessive caving End of Excavation @ 12 ft											
15														



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TEST PIT LOGS

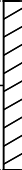
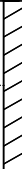
FIGURE 4-10

Project: Volkman Housing Development
Location: Spokane, WA
Number: S22525

TEST PIT 2211

Date: 7-20-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1680 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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, moderate brown, loose	SAND with Silt, trace gravel, coarse to fine, subangular to subrounded, roots in the upper foot											
		medium dense												
5		slightly moist, light gray, medium dense	SILTY SAND, fine, subangular, non-plastic, low dry strength (ASH)											
		moist, olive gray, medium dense	SAND with Gravel, Cobbles, Boulders, coarse to fine, subangular to subrounded											
10														
		moist, moderate brown, dense	SILTY SAND with Gravel, coarse to fine, subangular to rounded											
		no free groundwater observed	Excavation terminated due to excessive caving End of Excavation @ 12 ft											
15														



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TEST PIT LOGS

FIGURE 4-11

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2212			
Date:	7-20-22	Elevation:	1708 ft
Excavator:	Vietzke Excavation	Logged by:	J. Pappas
Equipment:	CAT 308 w/ 36" wide bucket	Size of hole:	4 x 10 ft
Location:			
Surface:	grass and weeds		

Elevation: 1708 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

[illegible]

TEST PIT LOGS		FIGURE 4-12	
Project: Volkman Housing Development			
Location: Spokane, WA			
Number: S22525			

TEST PIT 2213

Date: 7-20-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1764 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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, moderate brown, very loose	SAND with Silt and Gravel, coarse to fine, subangular to subrounded, roots, pine needles, (FILL)											
		loose												
5			1 inch diameter pvc pipe at base of fill											
		moist, olive gray, medium dense	SAND, coarse to medium, subangular to subrounded											
		loose												
10		medium dense												
		no free groundwater observed	Excavation terminated due to excessive caving End of Excavation @ 10 ft											
15														



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TEST PIT LOGS

FIGURE 4-13

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2214			
Date:	7-20-22	Elevation:	1920 ft
Excavator:	Vietzke Excavation	Logged by:	J. Pappas
Equipment:	CAT 308 w/ 36" wide bucket	Size of hole:	4 x 10 ft
Location:			
Surface:	grass and weeds		

Elevation: 1920 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

[illegible]

TEST PIT LOGS	FIGURE 4-14
Project: Volkman Housing Development Location: Spokane, WA Number: S22525	

TEST PIT 2215

Date: 7-20-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds, 25 degree slope

Elevation: 1870 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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, moderate brown, loose	SAND with Silt, coarse to fine, subangular to subrounded, roots less than 1.5 inches in diameter											
5		moist, olive gray, medium dense	SAND, coarse to medium, subangular to subrounded											
10		no free groundwater observed	Extent of excavator reach End of Excavation @ 8 ft											
15														



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TEST PIT LOGS

FIGURE 4-15

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2216

Date: 7-20-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1764 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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, moderate brown, loose	SAND with Silt, coarse to fine, subangular to subrounded, roots in upper 4 feet											
		very loose												
		loose												
		medium dense												
5														
		moist, light gray, medium dense	SILT with Sand, fine, non-plastic, low dry strength (ASH)											
		4-inch loose zone												
		medium dense												
		moist, moderate brown, medium dense	SAND with Silt, coarse to fine, subangular to subrounded											
10														
		no free groundwater observed	Extent of excavator reach End of Excavation @ 11 ft											
15														



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TEST PIT LOGS

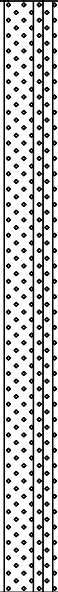
FIGURE 4-16

Project: Volkman Housing Development
Location: Spokane, WA
Number: S22525

TEST PIT 2217

Date: 7-20-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1696 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

					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		slightly moist, light brown, loose	SILTY SAND, coarse to fine, subangular to subrounded											
5		moist, moderate brown, medium dense	SAND with Silt, coarse to fine, subangular to subrounded											
10		no free groundwater observed	Extent of excavator reach End of Excavation @ 11 ft											
15														



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TEST PIT LOGS

FIGURE 4-17

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2218

Date: 7-20-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1679 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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					
		slightly moist, light brown, very loose	SILTY SAND, fine, subangular, ashy															
		loose																
5		medium dense																
		moist, moderate brown, medium dense	SAND with Silt, coarse to fine, subangular to subrounded															
		moist, olive gray, dense	SAND with Gravel, coarse to fine, subangular to subrounded															
10																		
		no free groundwater observed	Extent of excavator reach End of Excavation @ 10 ft															
15																		



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TEST PIT LOGS

FIGURE 4-18

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2219

Date: 7-21-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1760 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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, moderate brown, loose	SILTY SAND with Gravel, coarse to fine, subangular to subrounded, roots in upper foot											
		medium dense												
		moist, moderate brown, medium dense	SAND with Silt and Gravel, coarse to fine, subangular to subrounded, fine roots in upper 2 feet											
5														
10		no free groundwater observed	Extent of excavator reach End of Excavation @ 9 ft											
15														



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TEST PIT LOGS

FIGURE 4-19

Project: Volkman Housing Development
Location: Spokane, WA
Number: S22525

TEST PIT 2220	
Date:	7-21-22
Excavator:	Vietzke Excavation
Equipment:	CAT 308 w/ 36" wide bucket
Location:	
Surface:	grass and weeds
Elevation:	1735 ft
Logged by:	J. Pappas
Size of hole:	4 x 10 ft

Elevation: 1735 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

[illegible]

TEST PIT LOGS	FIGURE 4-20
Project: Volkman Housing Development	
Location: Spokane, WA	
Number: S22525	

TEST PIT 2221

Date: 7-21-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1688 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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, moderate brown, loose	SILTY SAND with Gravel, coarse to fine, subangular to subrounded																
		medium dense																	
		moist, moderate brown, medium dense	SAND with Silt, coarse to fine, subangular to subrounded																
5																			
		moist, light gray, medium dense	SILT with Sand, fine, non-plastic, low dry strength (ASH)																
10																			
		moist, moderate brown, medium dense	SAND with Silt, coarse to fine, subangular to subrounded																
		no free groundwater observed	extent of excavator reach End of Excavation @ 11 ft																
15																			



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TEST PIT LOGS

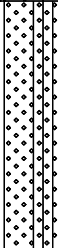
FIGURE 4-21

Project: Volkman Housing Development
Location: Spokane, WA
Number: S22525

TEST PIT 2222

Date: 7-21-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1678 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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	
		slightly moist, light brown, loose	SILTY SAND with Gravel, coarse to fine, subangular to rounded											
		medium dense												
		moist, moderate brown, medium dense	SAND with Silt and Gravel, Cobbles, coarse to fine, subangular to rounded											
5														
		moist, olive gray, medium dense	SAND with Gravel, Cobbles and Boulders, coarse to fine, subangular to subrounded, calcium deposits on the underside of coarse particles											
10														
		no free groundwater observed	test pit terminated due to moderate caving and extent of excavator reach End of Excavation @ 10 ft											
15														



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TEST PIT LOGS

FIGURE 4-22

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2223

Date: 7-21-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1696 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS									
					ATTERBERG LIMITS PL ——— LL WATER CONTENT ○									
0		moist, light brown, loose	SILTY SAND, coarse to fine, subangular to subrounded, roots less than 2 inches in diameter		10	20	30	40	50	60	70	80	90	
		medium dense												
		moist, light gray, medium dense	SILTY SAND with Gravel, medium to fine, subangular to subrounded, roots less than 1 inch in diameter											
5														
		moist, light gray, medium dense	SILT with Sand, fine, non-plastic, low dry strength (ASH)											
		dense												
10		moist, moderate brown, medium dense	SAND with Silt, coarse to fine, subangular to subrounded, interbedded with 1-inch Silt lenses at 3 to 6 inch intervals.											
		no free groundwater observed	extent of excavator reach End of Excavation @ 11 ft											
15														



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TEST PIT LOGS

FIGURE 4-23

Project: Volkman Housing Development
Location: Spokane, WA
Number: S22525

TEST PIT 2224

Date: 7-21-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1680 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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
		slightly moist, light brown, loose	SILTY, CLAYEY SAND, coarse to fine, subangular to subrounded, fine roots		
		moist, moderate brown, medium dense	SAND with Silt and Gravel, coarse to fine, subangular to subrounded		
5		moist, olive gray, dense	SAND with Gravel, Cobbles, Boulders, coarse to fine, subangular to subrounded, calcium deposits on undersides of coarse particles		
10		no free groundwater observed	extent of excavator reach End of Excavation @ 10 ft		
15					



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TEST PIT LOGS

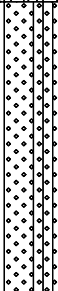
FIGURE 4-24

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2225

Date: 7-21-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1682 ft
Logged by: J. Pappas
Size of hole: 6 x 10 ft

					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, light brown, loose	SILTY SAND with Gravel, coarse to fine, subangular to subrounded											
		moist, moderate brown, medium dense	SAND with Silt, Gravel, and Cobbles, coarse to fine, subangular to subrounded											
5		moist, olive gray, medium dense	SAND with Gravel, coarse to fine, subangular to subrounded											
		dense	Cobbles encountered below 8 feet.											
10		no free groundwater observed	extent of excavator reach End of Excavation @ 11 ft											
15														



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TEST PIT LOGS

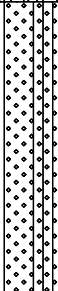
FIGURE 4-25

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2226

Date: 7-21-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1684 ft
Logged by: J. Pappas
Size of hole: 5 x 10 ft

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, light brown, loose	SILTY SAND with Gravel, coarse to fine, subangular to subrounded											
		moist, moderate brown, medium dense	SAND with Silt, Gravel, and Cobbles, coarse to fine, subangular to subrounded											
		loose												
5		moist, olive gray, very loose	SAND with Gravel, coarse to fine, subangular to subrounded											
		loose												
		medium dense												
		dense	Cobbles encountered below 9 feet.											
10		no free groundwater observed	extent of excavator reach End of Excavation @ 10 ft											
15														



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TEST PIT LOGS

FIGURE 4-26

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2227

Date: 7-21-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1681 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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, light brown, loose	SILTY SAND with Gravel, coarse to fine, subangular to subrounded, roots less than 2 inches in diameter											
		medium dense												
		moist, moderate brown, medium dense	SAND with Silt, Gravel, and Cobbles, coarse to fine, subangular to subrounded											
5														
		moist, olive gray, dense	SAND with Gravel, Cobbles and Boulders. coarse to fine, subangular to subrounded, calcium deposits on the underside of coarse particles											
10														
		no free groundwater observed	extent of excavator reach End of Excavation @ 10.5 ft											
15														



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TEST PIT LOGS

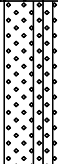
FIGURE 4-27

Project: Volkman Housing Development
Location: Spokane, WA
Number: S22525

TEST PIT 2228

Date: 7-21-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1681 ft
Logged by: J. Pappas
Size of hole: 5 x 10 ft

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, light brown, loose medium dense	SILTY SAND with Gravel, coarse to fine, subangular to subrounded, fine roots											
		moist, moderate brown, dense	SAND with Silt, Gravel, and Cobbles, coarse to fine, subangular to subrounded, fine roots											
5		moist, olive gray, dense	SAND with Gravel, Cobbles, coarse to fine, subangular to subrounded											
10		no free groundwater observed	extent of excavator reach End of Excavation @ 10 ft											
15														



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TEST PIT LOGS

FIGURE 4-28

Project: Volkman Housing Development

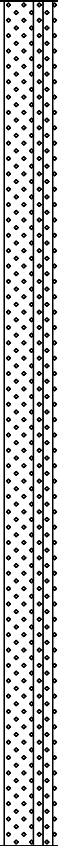
Location: Spokane, WA

Number: S22525

TEST PIT 2229

Date: 7-21-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1728 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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, moderate brown, loose	SAND with Silt and Gravel, coarse to fine, subangular to subrounded, roots up to 4-inches in diameter in the upper 3 feet											
		medium dense												
5														
		dense	Cobbles and boulders encountered below 8 feet.											
10														
		no free groundwater observed	extent of excavator reach End of Excavation @ 10 ft											
15														



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TEST PIT LOGS

FIGURE 4-29

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2230

Date: 7-21-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1685 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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, light brown, loose	SILTY SAND with Gravel, coarse to fine, subangular to subrounded											
		medium dense												
		moist, olive gray, dense	GRAVEL with Sand, Cobbles and Boulders, coarse to fine, subangular to subrounded											
5														
														
10		no free groundwater observed	excavation terminated due to excessive caving End of Excavation @ 9 ft											
15														



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TEST PIT LOGS

FIGURE 4-30

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2231

Date: 7-21-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1700 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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, light brown, loose	SILTY SAND, coarse to fine, subangular to subrounded, roots in upper 2 feet											
		medium dense												
		loose												
5		moist, light gray, loose	SILT with Sand, fine, non-plastic, low dry strength (ASH)											
		medium dense												
		moist, moderate brown, medium dense	SAND with Silt, coarse to fine, subangular to subrounded											
10		no free groundwater observed	extent of excavator reach End of Excavation @ 9.5 ft											
15														



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TEST PIT LOGS

FIGURE 4-31

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2232	
Date: 7-21-22 Excavator: Vietzke Excavation Equipment: CAT 308 w/ 36" wide bucket Location: Surface: grass and weeds	Elevation: 1750 ft Logged by: J. Pappas Size of hole: 4 x 10 ft

Elevation: 1750 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

[illegible]

TEST PIT LOGS	FIGURE 4-32
Project: Volkman Housing Development Location: Spokane, WA Number: S22525	

TEST PIT 2233

Date: 7-21-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1834 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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, moderate brown, loose	SILTY SAND, coarse to fine, subangular to subrounded											
		medium dense												
5														
		moist, moderate brown, medium dense	SAND with Silt, coarse to fine, subangular to subrounded											
10														
		no free groundwater observed	extent of excavator reach End of Excavation @ 10 ft											
15														



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TEST PIT LOGS

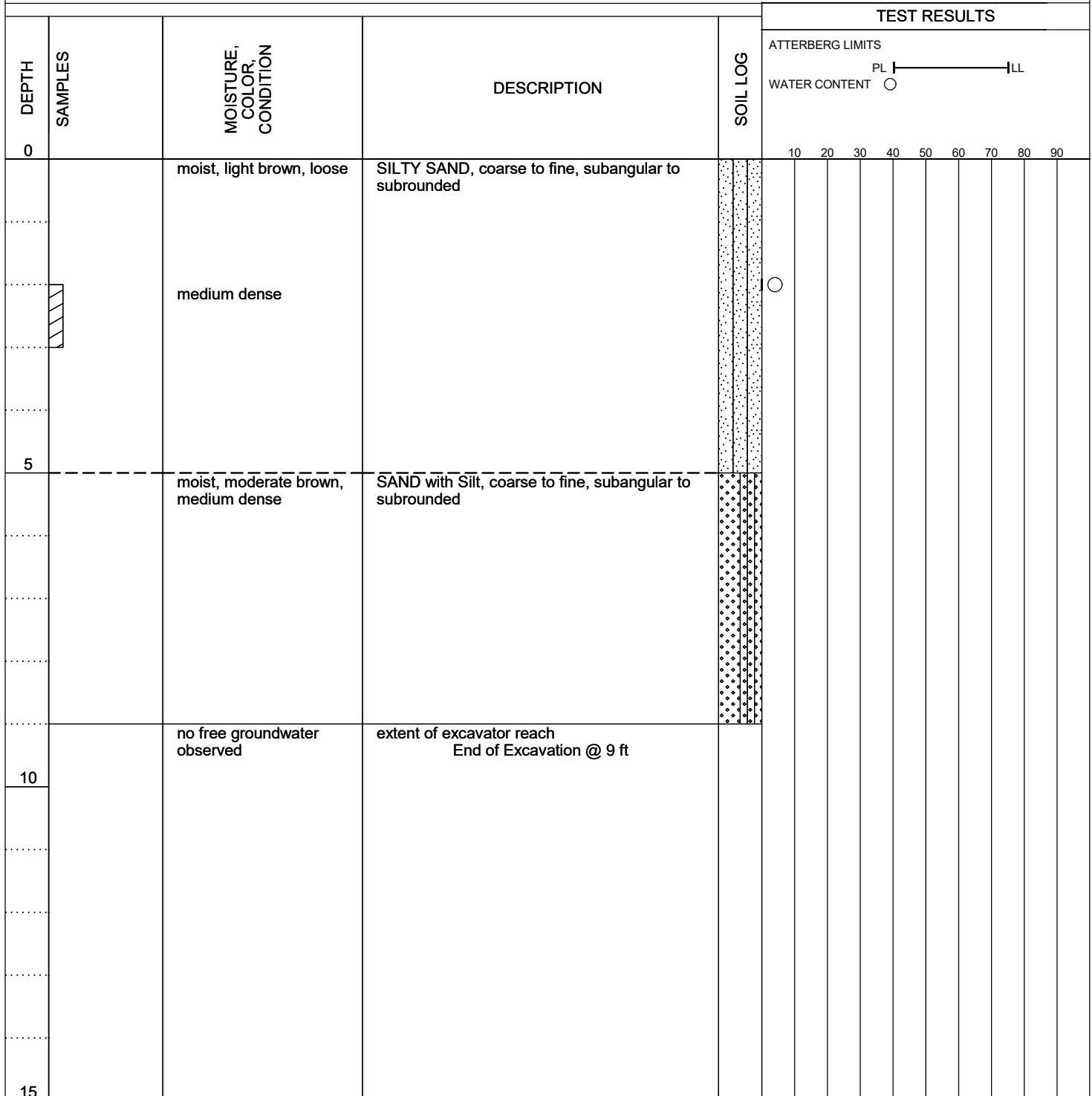
FIGURE 4-33

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2234

Date: 7-21-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1830 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft



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TEST PIT LOGS

FIGURE 4-34

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2235

Date: 7-21-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1692 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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, moderate brown, loose	SAND with Silt, coarse to fine, subangular to subrounded											
		medium dense												
5														
10														
		no free groundwater observed	extent of excavator reach End of Excavation @ 10 ft											
15														



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TEST PIT LOGS

FIGURE 4-35

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2236

Date: 7-21-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1707 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

					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, moderate brown, loose	SAND with Silt, Gravel, coarse to fine, subangular to subrounded, roots up to 3-inches in diameter											
		medium dense												
5		moist, olive gray, medium dense	SAND, coarse to medium, subangular to subrounded											
10		no free groundwater observed	extent of excavator reach End of Excavation @ 10 ft											
15														



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TEST PIT LOGS

FIGURE 4-36

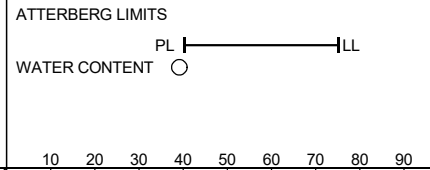
Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2237

Date: 7-21-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds

Elevation: 1750 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

TEST RESULTS



DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG										
0														
		moist, moderate brown, medium dense	SILTY SAND, coarse to fine, subangular to subrounded, roots, power line insulators.											
		moist, moderate brown, medium dense	SAND with Silt, Cobbles, coarse to fine, subangular to subrounded											
		loose												
5		medium dense												
10														
		no free groundwater observed	extent of excavator reach End of Excavation @ 10 ft											
15														



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TEST PIT LOGS

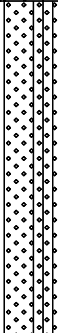
FIGURE 4-37

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

TEST PIT 2238

Date: 7-21-22
Excavator: Vietzke Excavation
Equipment: CAT 308 w/ 36" wide bucket
Location:
Surface: grass and weeds, 30 degree slope

Elevation: 1850 ft
Logged by: J. Pappas
Size of hole: 4 x 10 ft

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, light brown, loose	SILTY SAND, coarse to fine, subangular to subrounded, roots											
		moist, moderate brown, medium dense	SAND with Silt, coarse to fine, subangular to subrounded											
5														
		no free groundwater observed	extent of excavator reach End of Excavation @ 6 ft											
10														
15														



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TEST PIT LOGS

FIGURE 4-38

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

WILDCAT DYNAMIC CONE LOG

Page 1 of 1

PROJECT NUMBER: S22525

DATE STARTED: 08-03-2022

DATE COMPLETED: 08-03-2022

HOLE #: DCP @ TP-2201

CREW: C. Andrews

PROJECT: Volkman Housing Development

ADDRESS: Spokane County, WA

LOCATION: Adjacent to test pit

SURFACE ELEVATION: 1680 feet

WATER ON COMPLETION: N/A

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	12	53.3	.....	15	MEDIUM DENSE	STIFF
-	38	168.7	.....	25+	DENSE	HARD
- 1 ft	49	217.6	.....	25+	VERY DENSE	HARD
-	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						

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Figure 5-1

Page 1 of 1

DATE COMPLETED: 08-03-2022

LOCATION: Adjacent to test pit

CONE AREA: 10 sq. cm

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Figure 5-2

WILDCAT DYNAMIC CONE LOG

Page 1 of 1

PROJECT NUMBER: S22525
DATE STARTED: 08-03-2022
DATE COMPLETED: 08-03-2022

HOLE #: DCP @ TP-2204
CREW: C. Andrews
PROJECT: Volkman Housing Development
ADDRESS: Spokane County, WA
LOCATION: Adjacent to test pit

SURFACE ELEVATION: 1676 feet
WATER ON COMPLETION: N/A
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	10	44.4	••••••••	12	MEDIUM DENSE	STIFF
- 1 ft	17	75.5	••••••••••••	21	MEDIUM DENSE	VERY STIFF
-	13	57.7	••••••••••	16	MEDIUM DENSE	VERY STIFF
-	12	53.3	••••••••••	15	MEDIUM DENSE	STIFF
- 2 ft	12	53.3	••••••••••	15	MEDIUM DENSE	STIFF
-	12	53.3	••••••~	15	MEDIUM DENSE	STIFF
-	12	53.3	••••••~	15	MEDIUM DENSE	STIFF
- 3 ft	13	57.7	••••••~	16	MEDIUM DENSE	VERY STIFF
- 1 m	15	66.6	••••••••••	19	MEDIUM DENSE	VERY STIFF
-	20	77.2	••••••••••••	22	MEDIUM DENSE	VERY STIFF
- 4 ft	33	127.4	••••••••••••••••••••	25+	DENSE	HARD
-	32	123.5	••••••••••~	25+	DENSE	HARD
-	39	150.5	••••••••••~	25+	DENSE	HARD
- 5 ft	50	193.0	••••••~	25+	VERY DENSE	HARD
-						
- 6 ft						
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

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Figure 5-3

Page 1 of 1

SURFACE ELEVATION:	1677 feet
WATER ON COMPLETION:	N/A
HAMMER WEIGHT:	35 lbs.
CONE AREA:	10 sq. cm

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Figure 5-4

WILDCAT DYNAMIC CONE LOG

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PROJECT NUMBER: S22525
DATE STARTED: 08-03-2022
DATE COMPLETED: 08-03-2022

HOLE #: DCP @ TP-2208
CREW: C. Andrews
PROJECT: Volkman Housing Development
ADDRESS: Spokane County, WA
LOCATION: Adjacent to test pit

SURFACE ELEVATION: 1672 feet
WATER ON COMPLETION: N/A
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	2	8.9	••	2	VERY LOOSE	SOFT
-	6	26.6	•••••	7	LOOSE	MEDIUM STIFF
- 1 ft	12	53.3	••••••••••	15	MEDIUM DENSE	STIFF
-	8	35.5	••••••••	10	LOOSE	STIFF
-	8	35.5	••••••••	10	LOOSE	STIFF
- 2 ft	8	35.5	••••••••	10	LOOSE	STIFF
-	8	35.5	••••••••	10	LOOSE	STIFF
-	7	31.1	•••••••	8	LOOSE	MEDIUM STIFF
- 3 ft	10	44.4	••••••••	12	MEDIUM DENSE	STIFF
- 1 m	17	75.5	••••••••••••	21	MEDIUM DENSE	VERY STIFF
-	29	111.9	••••••••••••••••	25+	DENSE	HARD
- 4 ft	26	100.4	••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	18	69.5	••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	20	77.2	••••••••••••	22	MEDIUM DENSE	VERY STIFF
- 5 ft	26	100.4	••••••~	25+	MEDIUM DENSE	VERY STIFF
-	34	131.2	••••••~	25+	DENSE	HARD
-	50	193.0	••••••~	25+	VERY DENSE	HARD
- 6 ft						
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

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Figure 5-5

WILDCAT DYNAMIC CONE LOG

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PROJECT NUMBER: S22525
DATE STARTED: 08-03-2022
DATE COMPLETED: 08-03-2022

HOLE #: DCP @ TP-2210
CREW: C. Andrews
PROJECT: Volkman Housing Development
ADDRESS: Spokane County, WA
LOCATION: Adjacent to test pit

SURFACE ELEVATION: 1714 feet
WATER ON COMPLETION: N/A
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE				N'	TESTED CONSISTENCY	
			0	50	100	150		NON-COHESIVE	COHESIVE
-	3	13.3	...				3	VERY LOOSE	SOFT
-	3	13.3	...				3	VERY LOOSE	SOFT
- 1 ft	4	17.8	....				5	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
-	7	31.1	.....				8	LOOSE	MEDIUM STIFF
-	8	35.5	.....				10	LOOSE	STIFF
- 3 ft	7	31.1	.....				8	LOOSE	MEDIUM STIFF
- 1 m	11	48.8	.....				13	MEDIUM DENSE	STIFF
-	13	50.2	.....				14	MEDIUM DENSE	STIFF
- 4 ft	15	57.9	.....				16	MEDIUM DENSE	VERY STIFF
-	13	50.2	.....				14	MEDIUM DENSE	STIFF
-	13	50.2	.....				14	MEDIUM DENSE	STIFF
- 5 ft	13	50.2	.....				14	MEDIUM DENSE	STIFF
-	14	54.0	.....				15	MEDIUM DENSE	STIFF
-	14	54.0	.....				15	MEDIUM DENSE	STIFF
- 6 ft	13	50.2	.....				14	MEDIUM DENSE	STIFF
-	14	54.0	.....				15	MEDIUM DENSE	STIFF
- 2 m	15	57.9	.....				16	MEDIUM DENSE	VERY STIFF
- 7 ft	14	47.9	.....				13	MEDIUM DENSE	STIFF
-	10	34.2	.....				9	LOOSE	STIFF
-	13	44.5	.....				12	MEDIUM DENSE	STIFF
- 8 ft	17	58.1	.....				16	MEDIUM DENSE	VERY STIFF
-	17	58.1	.....				16	MEDIUM DENSE	VERY STIFF
-	15	51.3	.....				14	MEDIUM DENSE	STIFF
- 9 ft	15	51.3	.....				14	MEDIUM DENSE	STIFF
-	20	68.4	.....				19	MEDIUM DENSE	VERY STIFF
-	16	54.7	.....				15	MEDIUM DENSE	STIFF
- 3 m 10 ft	16	54.7	.....				15	MEDIUM DENSE	STIFF
-	18	55.1	.....				15	MEDIUM DENSE	STIFF
-	18	55.1	.....				15	MEDIUM DENSE	STIFF
-	18	55.1	.....				15	MEDIUM DENSE	STIFF
- 11 ft	22	67.3	.....				19	MEDIUM DENSE	VERY STIFF
-	24	73.4	.....				20	MEDIUM DENSE	VERY STIFF
-	26	79.6	.....				22	MEDIUM DENSE	VERY STIFF
- 12 ft	25	76.5	.....				21	MEDIUM DENSE	VERY STIFF
-	24	73.4	.....				20	MEDIUM DENSE	VERY STIFF
-	28	85.7					24	MEDIUM DENSE	VERY STIFF
- 4 m 13 ft	31	94.9					25+	MEDIUM DENSE	VERY STIFF

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Figure 5-6

WILDCAT DYNAMIC CONE LOG

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PROJECT NUMBER: S22525
 DATE STARTED: 08-03-2022
 DATE COMPLETED: 08-03-2022

HOLE #: DCP @ TP-2212
 CREW: C. Andrews
 PROJECT: Volkman Housing Development
 ADDRESS: Spokane County, WA
 LOCATION: Adjacent to test pit

SURFACE ELEVATION: 1708 feet
 WATER ON COMPLETION: N/A
 HAMMER WEIGHT: 35 lbs.
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	4	17.8	.....	5	LOOSE	MEDIUM STIFF
-	11	48.8	.....	13	MEDIUM DENSE	STIFF
- 1 ft	10	44.4	.....	12	MEDIUM DENSE	STIFF
-	10	44.4	.....	12	MEDIUM DENSE	STIFF
-	9	40.0	.....	11	MEDIUM DENSE	STIFF
- 2 ft	11	48.8	.....	13	MEDIUM DENSE	STIFF
-	13	57.7	.....	16	MEDIUM DENSE	VERY STIFF
-	13	57.7	.....	16	MEDIUM DENSE	VERY STIFF
- 3 ft	16	71.0	.....	20	MEDIUM DENSE	VERY STIFF
- 1 m	17	75.5	.....	21	MEDIUM DENSE	VERY STIFF
-	17	65.6	.....	18	MEDIUM DENSE	VERY STIFF
- 4 ft	12	46.3	.....	13	MEDIUM DENSE	STIFF
-	13	50.2	.....	14	MEDIUM DENSE	STIFF
-	12	46.3	.....	13	MEDIUM DENSE	STIFF
- 5 ft	18	69.5	.....	19	MEDIUM DENSE	VERY STIFF
-	18	69.5	.....	19	MEDIUM DENSE	VERY STIFF
-	20	77.2	.....	22	MEDIUM DENSE	VERY STIFF
- 6 ft	15	57.9	.....	16	MEDIUM DENSE	VERY STIFF
-	16	61.8	.....	17	MEDIUM DENSE	VERY STIFF
- 2 m	16	61.8	.....	17	MEDIUM DENSE	VERY STIFF
- 7 ft	13	44.5	.....	12	MEDIUM DENSE	STIFF
-	15	51.3	.....	14	MEDIUM DENSE	STIFF
-	15	51.3	.....	14	MEDIUM DENSE	STIFF
- 8 ft	15	51.3	.....	14	MEDIUM DENSE	STIFF
-	17	58.1	.....	16	MEDIUM DENSE	VERY STIFF
-	17	58.1	.....	16	MEDIUM DENSE	VERY STIFF
- 9 ft	16	54.7	.....	15	MEDIUM DENSE	STIFF
-	20	68.4	.....	19	MEDIUM DENSE	VERY STIFF
-	22	75.2	.....	21	MEDIUM DENSE	VERY STIFF
- 3 m 10 ft	22	75.2	.....	21	MEDIUM DENSE	VERY STIFF
-	23	70.4	.....	20	MEDIUM DENSE	VERY STIFF
-	25	76.5	.....	21	MEDIUM DENSE	VERY STIFF
-	21	64.3	.....	18	MEDIUM DENSE	VERY STIFF
- 11 ft	30	91.8		25+	MEDIUM DENSE	VERY STIFF
-	39	119.3		25+	DENSE	HARD
-	50	153.0		25+	DENSE	HARD
- 12 ft						
- 4 m 13 ft						

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Figure 5-7

WILDCAT DYNAMIC CONE LOG

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PROJECT NUMBER: S22525
DATE STARTED: 08-03-2022
DATE COMPLETED: 08-03-2022

HOLE #: DCP @ TP-2213
CREW: C. Andrews
PROJECT: Volkman Housing Development
ADDRESS: Spokane County, WA
LOCATION: Adjacent to test pit

SURFACE ELEVATION: 1764 feet
WATER ON COMPLETION: N/A
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	3	13.3	...	3	VERY LOOSE	SOFT
-	14	62.2	.....	17	MEDIUM DENSE	VERY STIFF
- 1 ft	7	31.1	.....	8	LOOSE	MEDIUM STIFF
-	3	13.3	...	3	VERY LOOSE	SOFT
-	2	8.9	..	2	VERY LOOSE	SOFT
- 2 ft	1	4.4	.	1	VERY LOOSE	VERY SOFT
-	1	4.4	.	1	VERY LOOSE	VERY SOFT
-	5	22.2	.....	6	LOOSE	MEDIUM STIFF
- 3 ft	8	35.5	.....	10	LOOSE	STIFF
- 1 m	6	26.6	.....	7	LOOSE	MEDIUM STIFF
-	6	23.2	.....	6	LOOSE	MEDIUM STIFF
- 4 ft	10	38.6	.....	11	MEDIUM DENSE	STIFF
-	9	34.7	.....	9	LOOSE	STIFF
-	6	23.2	.....	6	LOOSE	MEDIUM STIFF
- 5 ft	7	27.0	.....	7	LOOSE	MEDIUM STIFF
-	8	30.9	.....	8	LOOSE	MEDIUM STIFF
-	9	34.7	.....	9	LOOSE	STIFF
- 6 ft	16	61.8	.....	17	MEDIUM DENSE	VERY STIFF
-	14	54.0	.....	15	MEDIUM DENSE	STIFF
- 2 m	10	38.6	.....	11	MEDIUM DENSE	STIFF
- 7 ft	9	30.8	.....	8	LOOSE	MEDIUM STIFF
-	9	30.8	.....	8	LOOSE	MEDIUM STIFF
-	7	23.9	.....	6	LOOSE	MEDIUM STIFF
- 8 ft	8	27.4	.....	7	LOOSE	MEDIUM STIFF
-	8	27.4	.....	7	LOOSE	MEDIUM STIFF
-	7	23.9	.....	6	LOOSE	MEDIUM STIFF
- 9 ft	6	20.5	....	5	LOOSE	MEDIUM STIFF
-	10	34.2	.....	9	LOOSE	STIFF
-	11	37.6	.....	10	LOOSE	STIFF
- 3 m 10 ft	16	54.7	.....	15	MEDIUM DENSE	STIFF
-	13	39.8	.....	11	MEDIUM DENSE	STIFF
-	14	42.8	.....	12	MEDIUM DENSE	STIFF
-	18	55.1	.....	15	MEDIUM DENSE	STIFF
- 11 ft	20	61.2	.....	17	MEDIUM DENSE	VERY STIFF
-	22	67.3	.....	19	MEDIUM DENSE	VERY STIFF
-	21	64.3	.....	18	MEDIUM DENSE	VERY STIFF
- 12 ft	22	67.3	.....	19	MEDIUM DENSE	VERY STIFF
-	21	64.3	.....	18	MEDIUM DENSE	VERY STIFF
-	26	79.6		22	MEDIUM DENSE	VERY STIFF
- 4 m 13 ft	24	73.4		20	MEDIUM DENSE	VERY STIFF

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Figure 5-8

WILDCAT DYNAMIC CONE LOG

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PROJECT NUMBER: S22525
 DATE STARTED: 08-03-2022
 DATE COMPLETED: 08-03-2022

HOLE #: DCP @ TP-2216
 CREW: C. Andrews
 PROJECT: Volkman Housing Development
 ADDRESS: Spokane County, WA
 LOCATION: Adjacent to test pit

SURFACE ELEVATION: 1764 feet
 WATER ON COMPLETION: N/A
 HAMMER WEIGHT: 35 lbs.
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	4	17.8	.....	5	LOOSE	MEDIUM STIFF
-	6	26.6	.....	7	LOOSE	MEDIUM STIFF
-	6	26.6	.....	7	LOOSE	MEDIUM STIFF
-	4	17.8	.....	5	LOOSE	MEDIUM STIFF
-	3	13.3	...	3	VERY LOOSE	SOFT
-	3	13.3	...	3	VERY LOOSE	SOFT
-	4	17.8	.....	5	LOOSE	MEDIUM STIFF
-	4	17.8	.....	5	LOOSE	MEDIUM STIFF
-	7	31.1	.....	8	LOOSE	MEDIUM STIFF
-	6	26.6	.....	7	LOOSE	MEDIUM STIFF
-	9	34.7	.....	9	LOOSE	STIFF
-	11	42.5	.....	12	MEDIUM DENSE	STIFF
-	13	50.2	.....	14	MEDIUM DENSE	STIFF
-	11	42.5	.....	12	MEDIUM DENSE	STIFF
-	12	46.3	.....	13	MEDIUM DENSE	STIFF
-	13	50.2	.....	14	MEDIUM DENSE	STIFF
-	12	46.3	.....	13	MEDIUM DENSE	STIFF
-	14	54.0	.....	15	MEDIUM DENSE	STIFF
-	19	73.3	.....	20	MEDIUM DENSE	VERY STIFF
-	15	57.9	.....	16	MEDIUM DENSE	VERY STIFF
-	10	34.2	.....	9	LOOSE	STIFF
-	14	47.9	.....	13	MEDIUM DENSE	STIFF
-	12	41.0	.....	11	MEDIUM DENSE	STIFF
-	16	54.7	.....	15	MEDIUM DENSE	STIFF
-	18	61.6	.....	17	MEDIUM DENSE	VERY STIFF
-	19	65.0	.....	18	MEDIUM DENSE	VERY STIFF
-	18	61.6	.....	17	MEDIUM DENSE	VERY STIFF
-	24	82.1	.....	23	MEDIUM DENSE	VERY STIFF
-	21	71.8	.....	20	MEDIUM DENSE	VERY STIFF
-	20	68.4	.....	19	MEDIUM DENSE	VERY STIFF
-	21	64.3	.....	18	MEDIUM DENSE	VERY STIFF
-	24	73.4	.....	20	MEDIUM DENSE	VERY STIFF
-	26	79.6	.....	22	MEDIUM DENSE	VERY STIFF
-	28	85.7	.....	24	MEDIUM DENSE	VERY STIFF
-	21	64.3	.....	18	MEDIUM DENSE	VERY STIFF
-	22	67.3	.....	19	MEDIUM DENSE	VERY STIFF
-	31	94.9	.....	25+	MEDIUM DENSE	VERY STIFF
-	33	101.0		25+	MEDIUM DENSE	VERY STIFF
-	36	110.2		25+	DENSE	HARD
-	35	107.1		25+	MEDIUM DENSE	VERY STIFF

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Figure 5-9

Page 1 of 1

SURFACE ELEVATION:	1679 feet
WATER ON COMPLETION:	N/A
HAMMER WEIGHT:	35 lbs.
CONE AREA:	10 sq. cm

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Figure 5-10

WILDCAT DYNAMIC CONE LOG

Page 1 of 1

PROJECT NUMBER: S22525
DATE STARTED: 08-03-2022
DATE COMPLETED: 08-03-2022

HOLE #: DCP @ TP-2220
CREW: C. Andrews
PROJECT: Volkman Housing Development
ADDRESS: Spokane County, WA
LOCATION: Adjacent to test pit

SURFACE ELEVATION: 1735 feet
WATER ON COMPLETION: N/A
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	3	13.3	...	3	VERY LOOSE	SOFT
-	8	35.5	.....	10	LOOSE	STIFF
- 1 ft	11	48.8	.....	13	MEDIUM DENSE	STIFF
-	14	62.2	.....	17	MEDIUM DENSE	VERY STIFF
-	12	53.3	.....	15	MEDIUM DENSE	STIFF
- 2 ft	11	48.8	.....	13	MEDIUM DENSE	STIFF
-	12	53.3	.....	15	MEDIUM DENSE	STIFF
-	19	84.4	.....	24	MEDIUM DENSE	VERY STIFF
- 3 ft	22	97.7	.....	25+	MEDIUM DENSE	VERY STIFF
- 1 m	14	62.2	.....	17	MEDIUM DENSE	VERY STIFF
-	11	42.5	.....	12	MEDIUM DENSE	STIFF
- 4 ft	8	30.9	.....	8	LOOSE	MEDIUM STIFF
-	10	38.6	.....	11	MEDIUM DENSE	STIFF
-	9	34.7	.....	9	LOOSE	STIFF
- 5 ft	10	38.6	.....	11	MEDIUM DENSE	STIFF
-	14	54.0	.....	15	MEDIUM DENSE	STIFF
-	15	57.9	.....	16	MEDIUM DENSE	VERY STIFF
- 6 ft	14	54.0	.....	15	MEDIUM DENSE	STIFF
-	17	65.6	.....	18	MEDIUM DENSE	VERY STIFF
- 2 m	13	50.2	.....	14	MEDIUM DENSE	STIFF
- 7 ft	12	41.0	.....	11	MEDIUM DENSE	STIFF
-	15	51.3	.....	14	MEDIUM DENSE	STIFF
-	18	61.6	.....	17	MEDIUM DENSE	VERY STIFF
- 8 ft	20	68.4	.....	19	MEDIUM DENSE	VERY STIFF
-	21	71.8	.....	20	MEDIUM DENSE	VERY STIFF
-	22	75.2	.....	21	MEDIUM DENSE	VERY STIFF
- 9 ft	25	85.5		24	MEDIUM DENSE	VERY STIFF
-	34	116.3		25+	DENSE	HARD
- 3 m	50	171.0		25+	DENSE	HARD
- 10 ft						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m	13 ft					

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Figure 5-11

WILDCAT DYNAMIC CONE LOG

Page 1 of 1

PROJECT NUMBER: S22525
DATE STARTED: 08-03-2022
DATE COMPLETED: 08-03-2022

HOLE #: DCP @ TP-2223
CREW: C. Andrews
PROJECT: Volkman Housing Development
ADDRESS: Spokane County, WA
LOCATION: Adjacent to test pit

SURFACE ELEVATION: 1696 feet
WATER ON COMPLETION: N/A
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	10	44.4	••••••••	12	MEDIUM DENSE	STIFF
- 1 ft	16	71.0	••••••••••	20	MEDIUM DENSE	VERY STIFF
-	25	111.0	••••••••••••••••	25+	DENSE	HARD
-	20	88.8	••••••••••••	25	MEDIUM DENSE	VERY STIFF
- 2 ft	20	88.8	••••••••••••	25	MEDIUM DENSE	VERY STIFF
-	21	93.2	••••••~	25+	MEDIUM DENSE	VERY STIFF
-	24	106.6	••••••~	25+	MEDIUM DENSE	VERY STIFF
- 3 ft	19	84.4	••••••~	24	MEDIUM DENSE	VERY STIFF
- 1 m	17	75.5	••••••~	21	MEDIUM DENSE	VERY STIFF
-	16	61.8	••••••~	17	MEDIUM DENSE	VERY STIFF
- 4 ft	20	77.2	••••••~	22	MEDIUM DENSE	VERY STIFF
-	16	61.8	••••••~	17	MEDIUM DENSE	VERY STIFF
-	13	50.2	••••••~	14	MEDIUM DENSE	STIFF
- 5 ft	16	61.8	••••••~	17	MEDIUM DENSE	VERY STIFF
-	12	46.3	••••••~	13	MEDIUM DENSE	STIFF
-	16	61.8	••••••~	17	MEDIUM DENSE	VERY STIFF
- 6 ft	16	61.8	••••••~	17	MEDIUM DENSE	VERY STIFF
-	13	50.2	••••••~	14	MEDIUM DENSE	STIFF
- 2 m	13	50.2	••••••~	14	MEDIUM DENSE	STIFF
- 7 ft	28	95.8	••••••~	25+	MEDIUM DENSE	VERY STIFF
-	39	133.4	••••••~	25+	DENSE	HARD
-	50	171.0	••••••~	25+	DENSE	HARD
- 8 ft						
- 9 ft						
- 3 m 10 ft						
- 11 ft						
- 12 ft						
- 4 m 13 ft						

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Figure 5-12

Page 1 of 1

SURFACE ELEVATION:	1680 feet
WATER ON COMPLETION:	N/A
HAMMER WEIGHT:	35 lbs.
CONE AREA:	10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
1 ft	7	31.1	.....	8	LOOSE	MEDIUM STIFF
	18	79.9	.....	22	MEDIUM DENSE	VERY STIFF
	50	222.0	.....	25+	VERY DENSE	HARD
2 ft						
3 ft						
4 ft						
5 ft						
6 ft						
7 ft						
8 ft						
9 ft						
10 ft						
11 ft						
12 ft						
13 ft						

WILDCAT DYNAMIC CONE LOG

Page 1 of 1

PROJECT NUMBER: S22525
DATE STARTED: 08-03-2022
DATE COMPLETED: 08-03-2022

HOLE #: DCP @ TP-2226
CREW: C. Andrews
PROJECT: Volkman Housing Development
ADDRESS: Spokane County, WA
LOCATION: Adjacent to test pit

SURFACE ELEVATION: 1684 feet
WATER ON COMPLETION: N/A
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	4	17.8	.....	5	LOOSE	MEDIUM STIFF
-	14	62.2	.....	17	MEDIUM DENSE	VERY STIFF
- 1 ft	40	177.6	.....	25+	DENSE	HARD
-	27	119.9	.....	25+	DENSE	HARD
-	16	71.0	.....	20	MEDIUM DENSE	VERY STIFF
- 2 ft	16	71.0	.....	20	MEDIUM DENSE	VERY STIFF
-	16	71.0	.....	20	MEDIUM DENSE	VERY STIFF
-	19	84.4	.....	24	MEDIUM DENSE	VERY STIFF
- 3 ft	12	53.3	.....	15	MEDIUM DENSE	STIFF
- 1 m	15	66.6	.....	19	MEDIUM DENSE	VERY STIFF
-	7	27.0	.....	7	LOOSE	MEDIUM STIFF
- 4 ft	4	15.4	....	4	VERY LOOSE	SOFT
-	6	23.2	.....	6	LOOSE	MEDIUM STIFF
-	6	23.2	.....	6	LOOSE	MEDIUM STIFF
- 5 ft	5	19.3	.....	5	LOOSE	MEDIUM STIFF
-	4	15.4	....	4	VERY LOOSE	SOFT
-	3	11.6	...	3	VERY LOOSE	SOFT
- 6 ft	2	7.7	..	2	VERY LOOSE	SOFT
-	2	7.7	..	2	VERY LOOSE	SOFT
- 2 m	2	7.7	..	2	VERY LOOSE	SOFT
- 7 ft	5	17.1	.....	4	VERY LOOSE	SOFT
-	6	20.5	.....	5	LOOSE	MEDIUM STIFF
-	10	34.2	.....	9	LOOSE	STIFF
- 8 ft	34	116.3		25+	DENSE	HARD
-	42	143.6		25+	DENSE	HARD
- 9 ft	50	171.0		25+	DENSE	HARD
-						
- 3 m 10 ft						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

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Figure 5-14

WILDCAT DYNAMIC CONE LOG

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PROJECT NUMBER: S22525
 DATE STARTED: 08-03-2022
 DATE COMPLETED: 08-03-2022

HOLE #: DCP @ TP-2227
 CREW: C. Andrews
 PROJECT: Volkman Housing Development
 ADDRESS: Spokane County, WA
 LOCATION: Adjacent to test pit

SURFACE ELEVATION: 1681 feet
 WATER ON COMPLETION: N/A
 HAMMER WEIGHT: 35 lbs.
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	4	17.8	.....	5	LOOSE	MEDIUM STIFF
-	14	62.2	.....	17	MEDIUM DENSE	VERY STIFF
- 1 ft	33	146.5	.....	25+	DENSE	HARD
-	30	133.2	.....	25+	DENSE	HARD
-	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						

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Figure 5-15

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DATE COMPLETED: 08-03-2022

LOCATION: Adjacent to test pit

CONE AREA: 10 sq. cm

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Figure 5-16

WILDCAT DYNAMIC CONE LOG

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PROJECT NUMBER: S22525
DATE STARTED: 08-03-2022
DATE COMPLETED: 08-03-2022

HOLE #: DCP @ TP-2231
CREW: C. Andrews
PROJECT: Volkman Housing Development
ADDRESS: Spokane County, WA
LOCATION: Adjacent to test pit

SURFACE ELEVATION: 1700 feet
WATER ON COMPLETION: N/A
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	3	13.3	...	3	VERY LOOSE	SOFT
-	5	22.2	.....	6	LOOSE	MEDIUM STIFF
- 1 ft	9	40.0	.....	11	MEDIUM DENSE	STIFF
-	12	53.3	.....	15	MEDIUM DENSE	STIFF
-	17	75.5	.....	21	MEDIUM DENSE	VERY STIFF
- 2 ft	16	71.0	.....	20	MEDIUM DENSE	VERY STIFF
-	16	71.0	.....	20	MEDIUM DENSE	VERY STIFF
-	23	102.1	.....	25+	MEDIUM DENSE	VERY STIFF
- 3 ft	26	115.4	.....	25+	DENSE	HARD
- 1 m	16	71.0	.....	20	MEDIUM DENSE	VERY STIFF
-	10	38.6	.....	11	MEDIUM DENSE	STIFF
- 4 ft	7	27.0	.....	7	LOOSE	MEDIUM STIFF
-	8	30.9	.....	8	LOOSE	MEDIUM STIFF
-	6	23.2	.....	6	LOOSE	MEDIUM STIFF
- 5 ft	5	19.3	.....	5	LOOSE	MEDIUM STIFF
-	16	61.8		17	MEDIUM DENSE	VERY STIFF
-	50	193.0		25+	VERY DENSE	HARD
- 6 ft						
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

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Figure 5-17

WILDCAT DYNAMIC CONE LOG

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PROJECT NUMBER: S22525
 DATE STARTED: 08-03-2022
 DATE COMPLETED: 08-03-2022

HOLE #: DCP @ TP-2233
 CREW: C. Andrews
 PROJECT: Volkman Housing Development
 ADDRESS: Spokane County, WA
 LOCATION: Adjacent to test pit

SURFACE ELEVATION: 1834 feet
 WATER ON COMPLETION: N/A
 HAMMER WEIGHT: 35 lbs.
 CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	3	13.3	...	3	VERY LOOSE	SOFT
-	5	22.2	.....	6	LOOSE	MEDIUM STIFF
- 1 ft	18	79.9	.....	22	MEDIUM DENSE	VERY STIFF
-	22	97.7	.....	25+	MEDIUM DENSE	VERY STIFF
-	25	111.0	.....	25+	DENSE	HARD
- 2 ft	38	168.7	.....	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						

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Figure 5-18

WILDCAT DYNAMIC CONE LOG

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PROJECT NUMBER: S22525
DATE STARTED: 08-03-2022
DATE COMPLETED: 08-03-2022

HOLE #: DCP @ TP-2235
CREW: C. Andrews
PROJECT: Volkman Housing Development
ADDRESS: Spokane County, WA
LOCATION: Adjacent to test pit

SURFACE ELEVATION: 1692 feet
WATER ON COMPLETION: N/A
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	2	8.9	••	2	VERY LOOSE	SOFT
-	6	26.6	•••••	7	LOOSE	MEDIUM STIFF
- 1 ft	6	26.6	•••••	7	LOOSE	MEDIUM STIFF
-	9	40.0	•••••••	11	MEDIUM DENSE	STIFF
-	9	40.0	•••••••	11	MEDIUM DENSE	STIFF
- 2 ft	9	40.0	•••••••	11	MEDIUM DENSE	STIFF
-	12	53.3	••••••••	15	MEDIUM DENSE	STIFF
-	11	48.8	••••••••	13	MEDIUM DENSE	STIFF
- 3 ft	12	53.3	••••••••	15	MEDIUM DENSE	STIFF
- 1 m	12	53.3	••••••••	15	MEDIUM DENSE	STIFF
-	15	57.9	•••••••••	16	MEDIUM DENSE	VERY STIFF
- 4 ft	13	50.2	••••••••	14	MEDIUM DENSE	STIFF
-	14	54.0	••••••••	15	MEDIUM DENSE	STIFF
-	13	50.2	••••••••	14	MEDIUM DENSE	STIFF
- 5 ft	15	57.9	•••••••••	16	MEDIUM DENSE	VERY STIFF
-	12	46.3	••••••••	13	MEDIUM DENSE	STIFF
-	14	54.0	••••••••	15	MEDIUM DENSE	STIFF
- 6 ft	13	50.2	••••••••	14	MEDIUM DENSE	STIFF
-	14	54.0	••••~••••	15	MEDIUM DENSE	STIFF
- 2 m	16	61.8	•••••••••	17	MEDIUM DENSE	VERY STIFF
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

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Figure 5-19

WILDCAT DYNAMIC CONE LOG

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PROJECT NUMBER: S22525
DATE STARTED: 08-03-2022
DATE COMPLETED: 08-03-2022

HOLE #: DCP @ TP-2237
CREW: C. Andrews
PROJECT: Volkman Housing Development
ADDRESS: Spokane County, WA
LOCATION: Adjacent to test pit

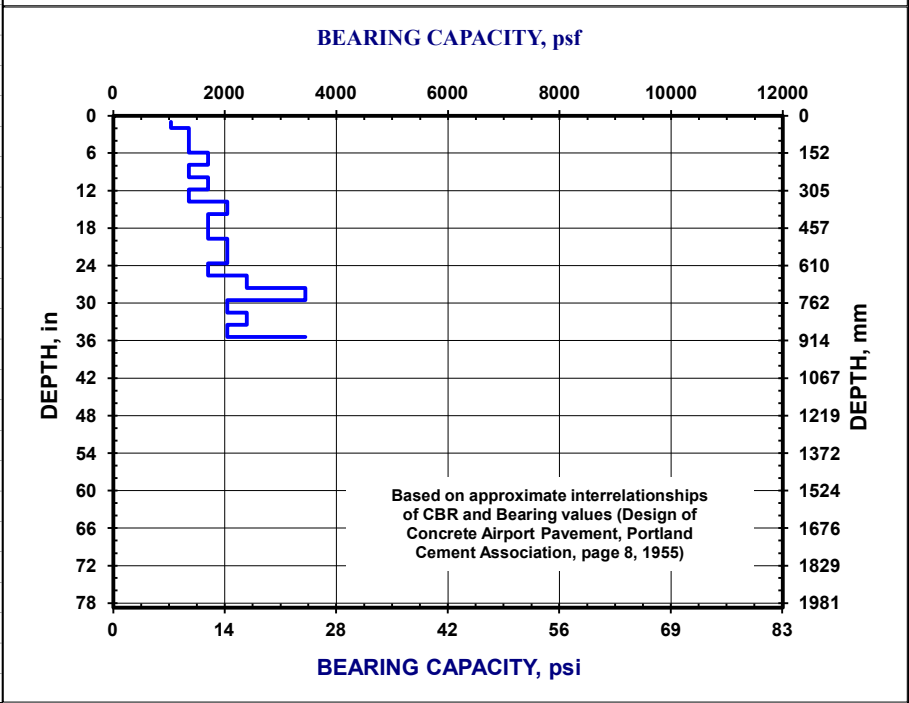
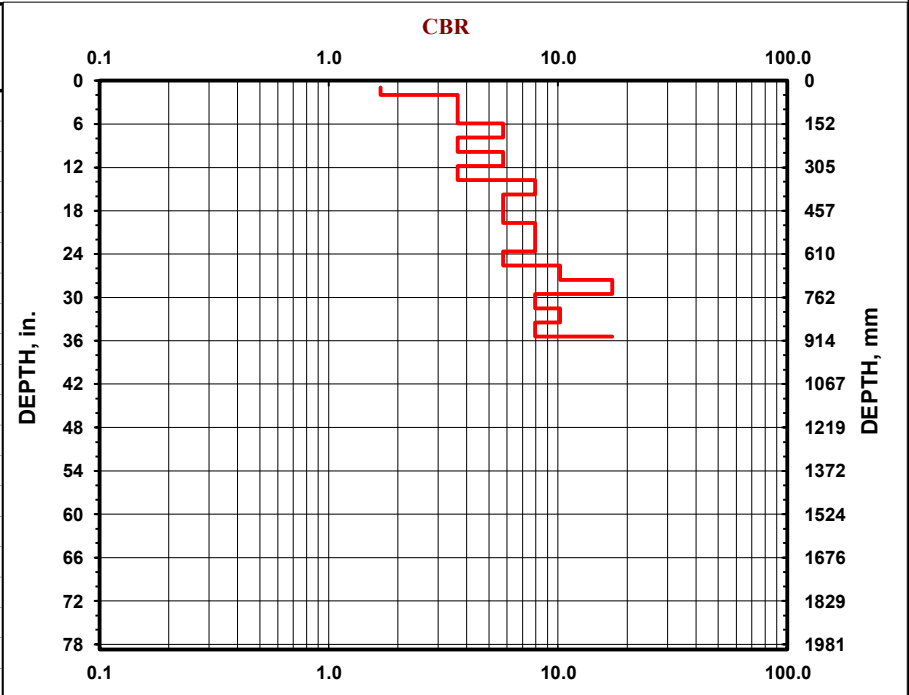
SURFACE ELEVATION: 1750 feet
WATER ON COMPLETION: N/A
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	11	48.8	.....	13	MEDIUM DENSE	STIFF
-	17	75.5	.....	21	MEDIUM DENSE	VERY STIFF
- 1 ft	18	79.9	.....	22	MEDIUM DENSE	VERY STIFF
-	18	79.9	.....	22	MEDIUM DENSE	VERY STIFF
-	13	57.7	.....	16	MEDIUM DENSE	VERY STIFF
- 2 ft	13	57.7	.....	16	MEDIUM DENSE	VERY STIFF
-	11	48.8	.....	13	MEDIUM DENSE	STIFF
-	8	35.5	.....	10	LOOSE	STIFF
- 3 ft	10	44.4	.....	12	MEDIUM DENSE	STIFF
- 1 m	8	35.5	.....	10	LOOSE	STIFF
-	9	34.7	.....	9	LOOSE	STIFF
- 4 ft	8	30.9	.....	8	LOOSE	MEDIUM STIFF
-	7	27.0	.....	7	LOOSE	MEDIUM STIFF
-	8	30.9	.....	8	LOOSE	MEDIUM STIFF
- 5 ft	10	38.6	.....	11	MEDIUM DENSE	STIFF
-	11	42.5	.....	12	MEDIUM DENSE	STIFF
-	12	46.3	.....	13	MEDIUM DENSE	STIFF
- 6 ft	16	61.8	.....	17	MEDIUM DENSE	VERY STIFF
-	11	42.5	.....	12	MEDIUM DENSE	STIFF
- 2 m	11	42.5	.....	12	MEDIUM DENSE	STIFF
- 7 ft	12	41.0	.....	11	MEDIUM DENSE	STIFF
-	11	37.6	.....	10	LOOSE	STIFF
-	14	47.9	.....	13	MEDIUM DENSE	STIFF
- 8 ft	18	61.6	.....	17	MEDIUM DENSE	VERY STIFF
-	13	44.5	.....	12	MEDIUM DENSE	STIFF
-	12	41.0	.....	11	MEDIUM DENSE	STIFF
- 9 ft	16	54.7	.....	15	MEDIUM DENSE	STIFF
-	12	41.0	.....	11	MEDIUM DENSE	STIFF
-	14	47.9	.....	13	MEDIUM DENSE	STIFF
- 3 m 10 ft	17	58.1	.....	16	MEDIUM DENSE	VERY STIFF
-	16	49.0	.....	13	MEDIUM DENSE	STIFF
-	16	49.0	.....	13	MEDIUM DENSE	STIFF
-	16	49.0	.....	13	MEDIUM DENSE	STIFF
- 11 ft	18	55.1	.....	15	MEDIUM DENSE	STIFF
-	20	61.2	.....	17	MEDIUM DENSE	VERY STIFF
-	24	73.4	.....	20	MEDIUM DENSE	VERY STIFF
- 12 ft	20	61.2	.....	17	MEDIUM DENSE	VERY STIFF
-	23	70.4	.....	20	MEDIUM DENSE	VERY STIFF
-	29	88.7		25	MEDIUM DENSE	VERY STIFF
- 4 m 13 ft	34	104.0		25+	MEDIUM DENSE	VERY STIFF

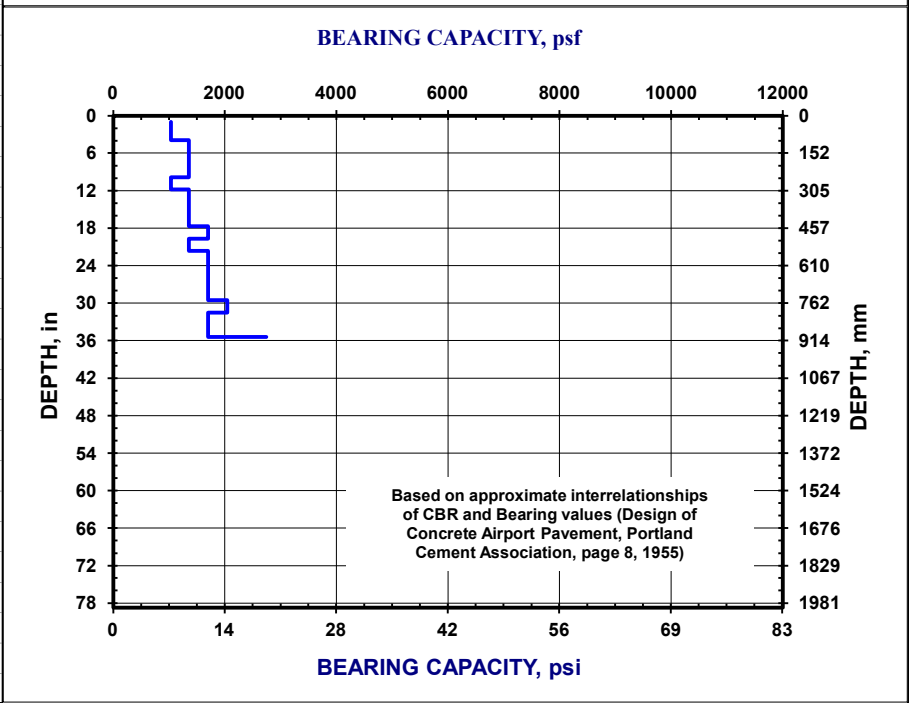
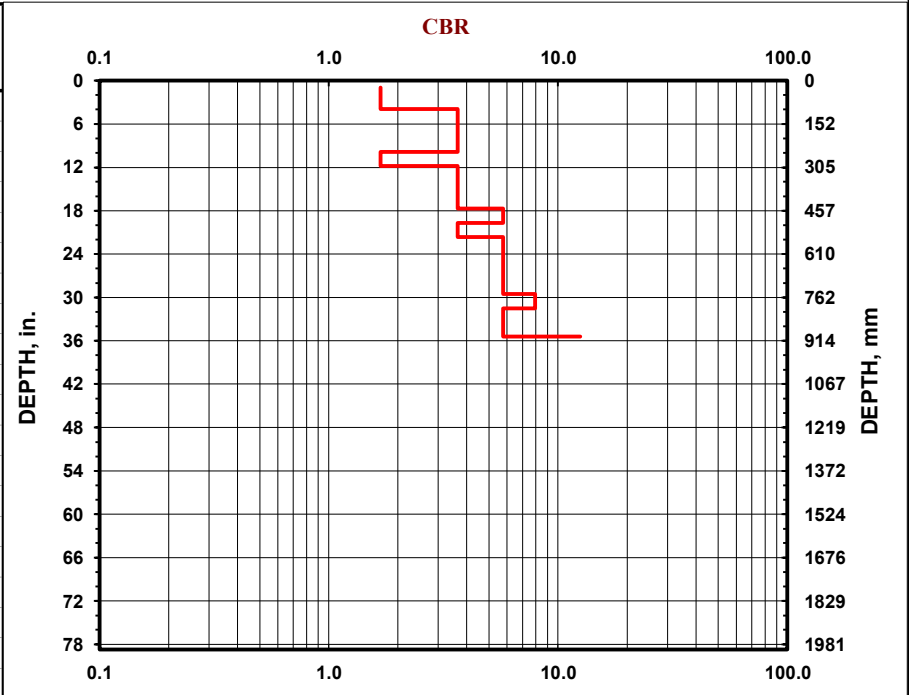
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Figure 5-20

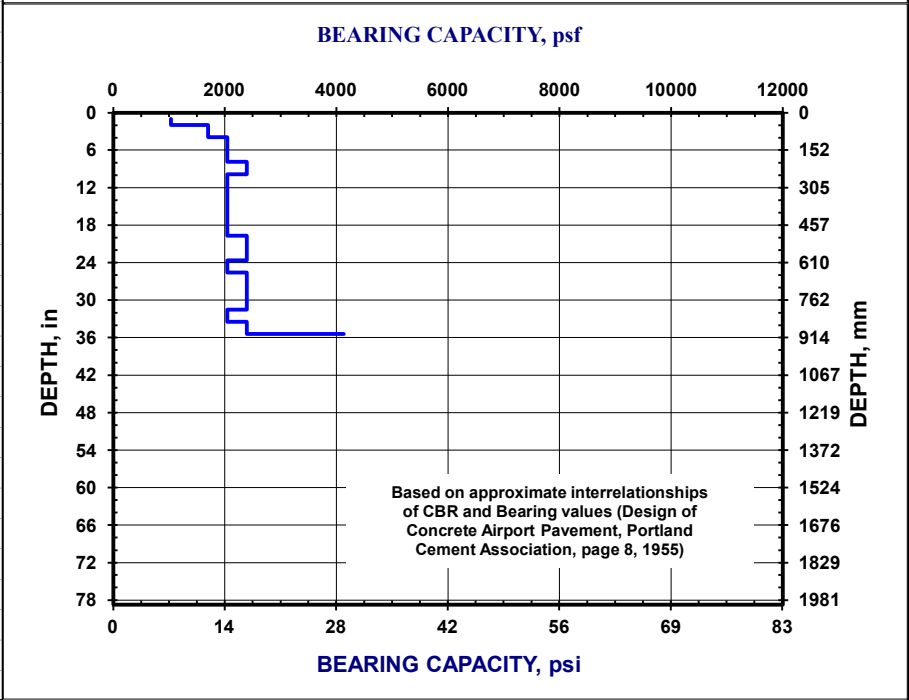
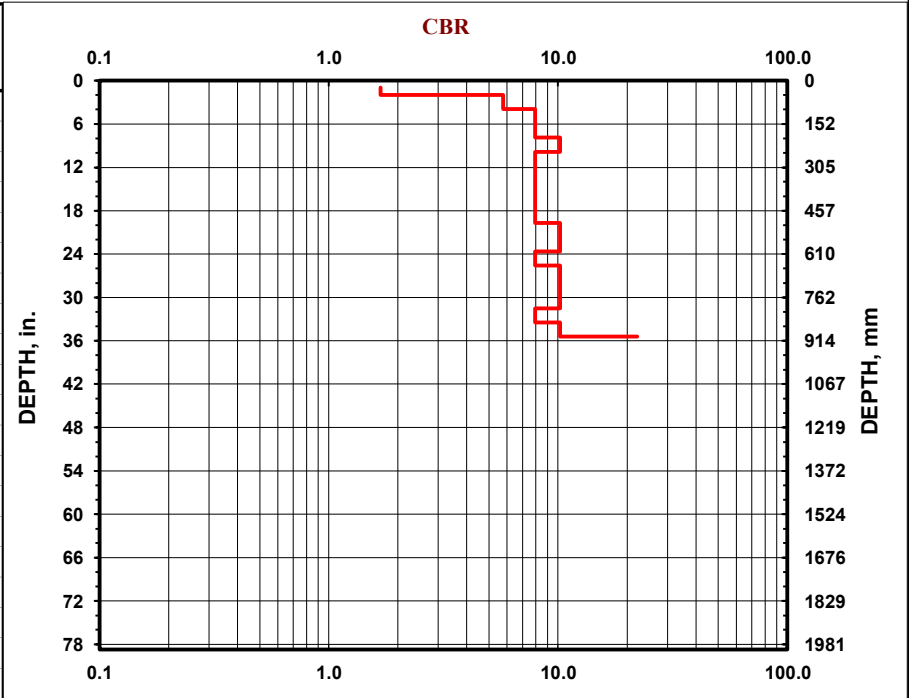
DCP TEST DATA			
Project:	<u>S2525 Volkman Housing</u>	Date:	<u>3-Aug-22</u>
Location:	<u>TP-2206</u>	Soil Type(s):	<u>SM</u>
Hammer ☒ 10.1 lbs. ☐ 17.6 lbs. ☐ Both hammers used		Soil Type ☐ CH ☐ CL ☒ All other soils	

[illegible]

DCP TEST DATA			
Project:	<u>S2525 Volkman Housing</u>	Date:	<u>3-Aug-22</u>
Location:	<u>TP-2210</u>	Soil Type(s):	<u>SM</u>
Hammer ☒ 10.1 lbs. ☐ 17.6 lbs. ☐ Both hammers used		Soil Type ☐ CH ☐ CL ☒ All other soils	

[illegible]

DCP TEST DATA			
Project:	<u>S2525 Volkman Housing</u>	Date:	<u>3-Aug-22</u>
Location:	<u>TP-2212</u>	Soil Type(s):	<u>SM</u>
Hammer ☒ 10.1 lbs. ☐ 17.6 lbs. ☐ Both hammers used		Soil Type ☐ CH ☐ CL ☒ All other soils	

[illegible]

DCP TEST DATA

Project: S22525 Volkman Housing

Location: TP-2220

Date: 3-Aug-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
0.5	25	2
0.5	50	2
0.5	75	2
0.5	100	2
1	125	2
1	150	2
2	175	2
2	200	2
1	225	2
1	250	2
1	275	2
1	300	2
1	325	2
1	350	2
1.5	375	2
1.5	400	2
1	425	2
1	450	2
2	475	2
2	500	2
3.5	525	2
3.5	550	2
4	575	2
4	600	2
3	625	2
3	650	2
5.5	675	2
5.5	700	2
6.5	725	2
6.5	750	2
3.5	775	2
3.5	800	2
3.5	825	2
3.5	850	2
3	875	2
3	900	2

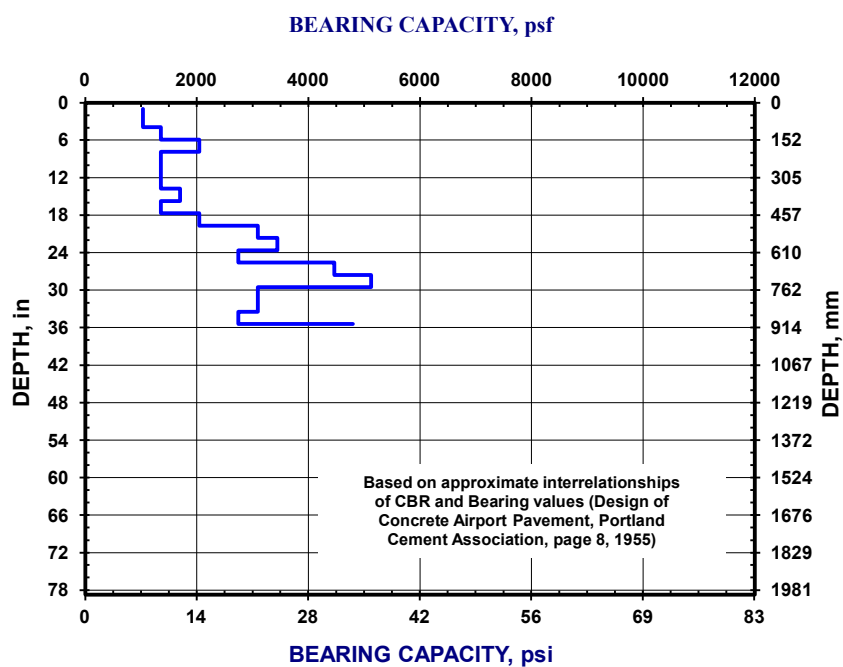
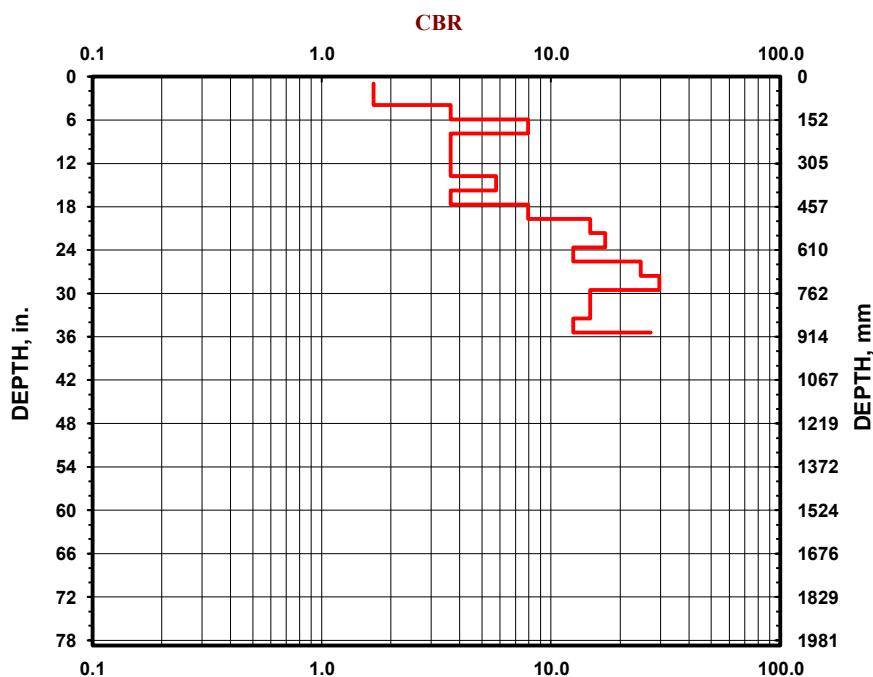


Figure 6-11

DCP TEST DATA

Project: S22525 Volkman Housing

Location: TP-2223

Date: 3-Aug-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
4	125	2
4	150	2
4	175	2
4	200	2
4	225	2
4	250	2
4.5	275	2
4.5	300	2
4	325	2
4	350	2
4.5	375	2
4.5	400	2
2.5	425	2
2.5	450	2
2.5	475	2
2.5	500	2
3	525	2
3	550	2
3.5	575	2
3.5	600	2
3	625	2
3	650	2
3	675	2
3	700	2
2	725	2
2	750	2
1.5	775	2
1.5	800	2
1	825	2
1	850	2
1.5	875	2
1.5	900	2

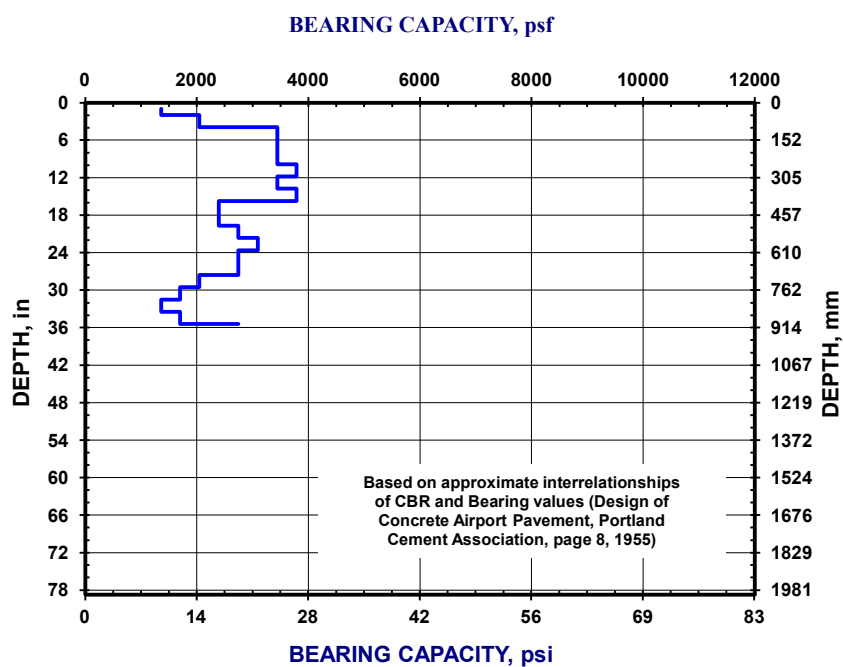
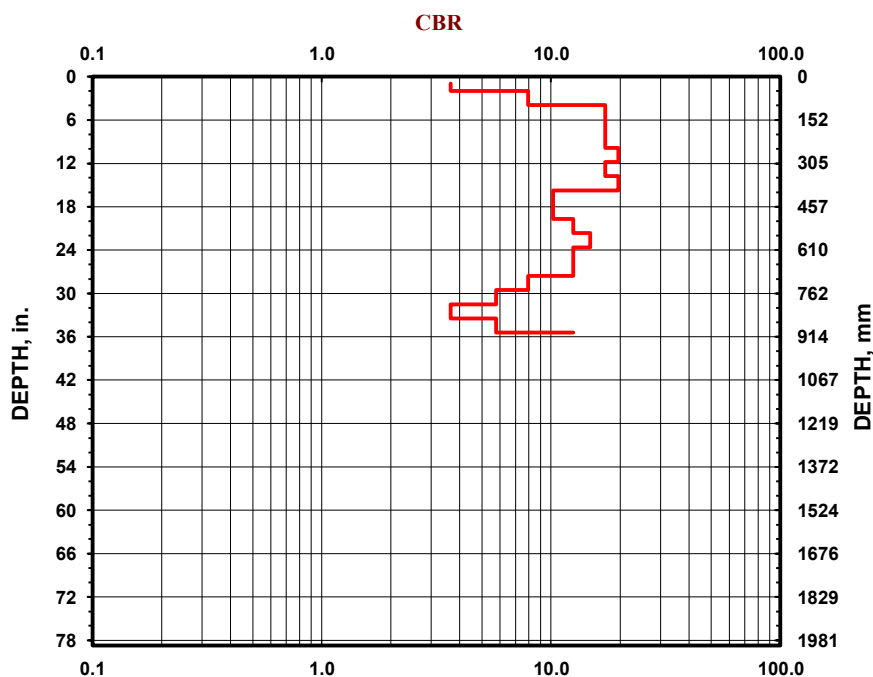
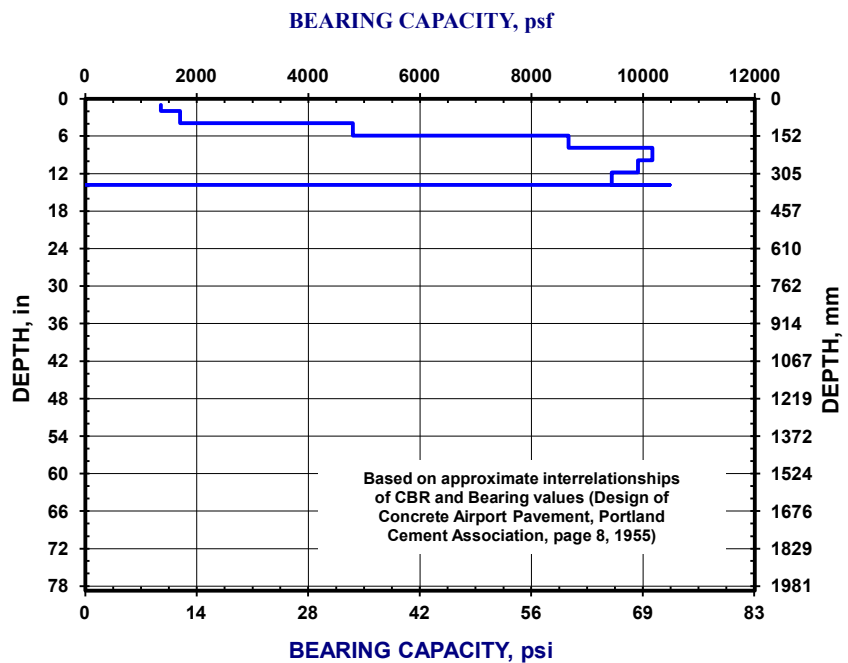
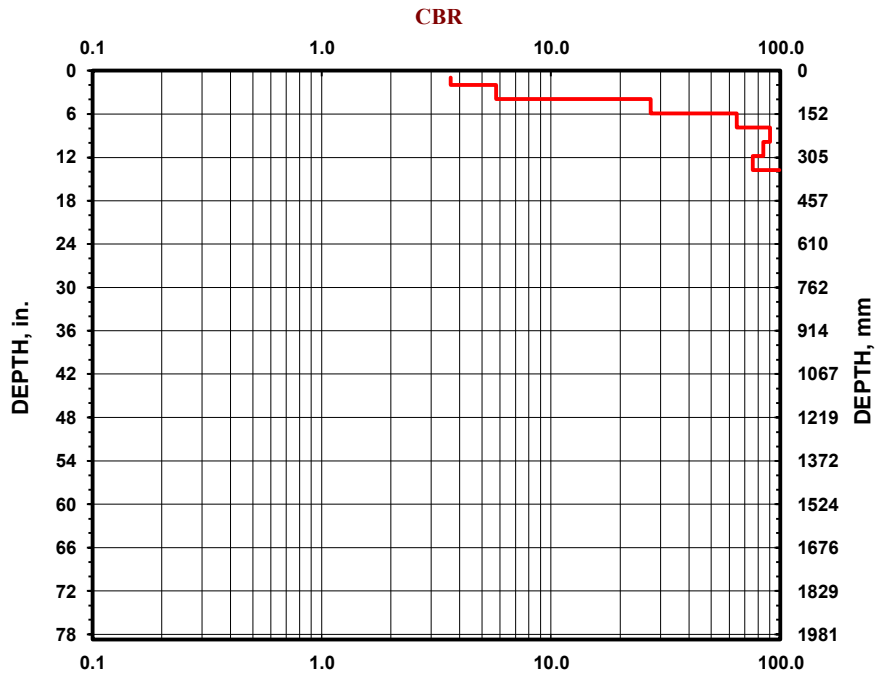


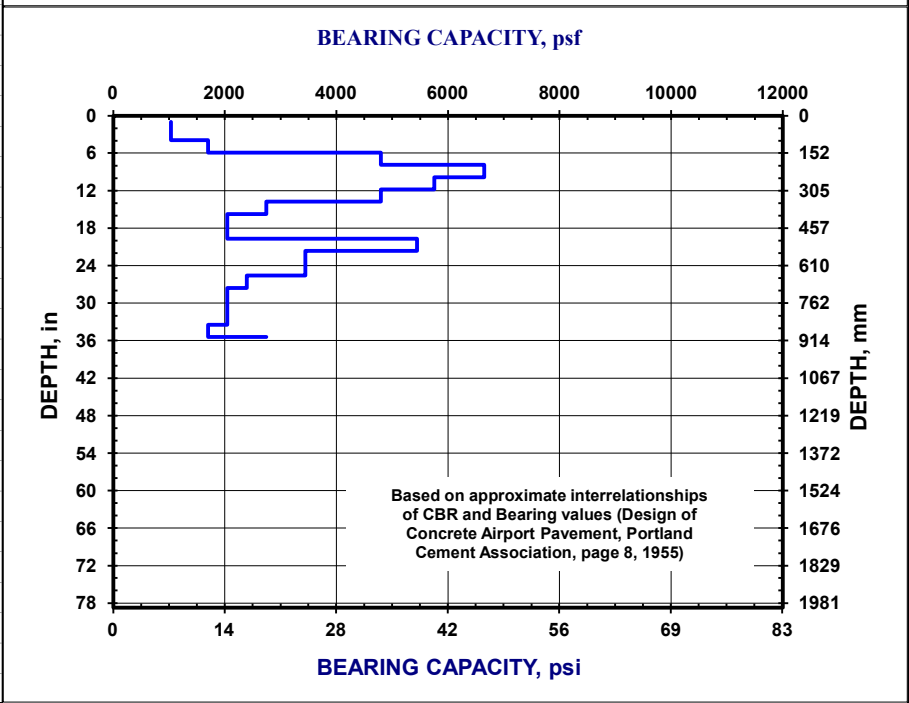
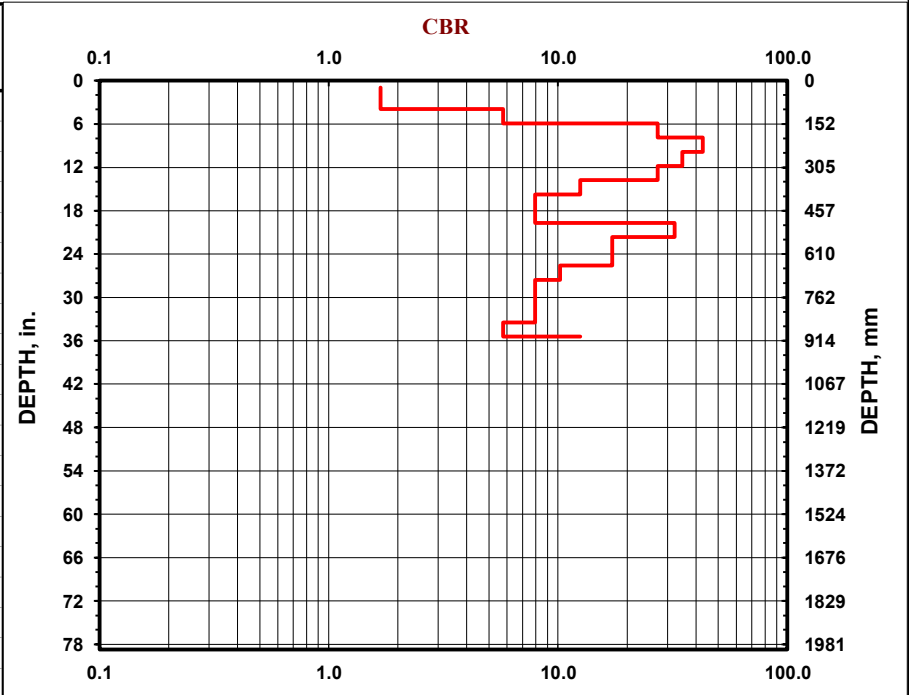
Figure 6-12

DCP TEST DATA			
Project:	<u>S2525 Volkman Housing</u>	Date:	<u>3-Aug-22</u>
Location:	<u>TP-2224</u>	Soil Type(s):	<u>SM</u>
Hammer ☒ 10.1 lbs. ☐ 17.6 lbs. ☐ Both hammers used		Soil Type ☐ CH ☐ CL ☒ All other soils	

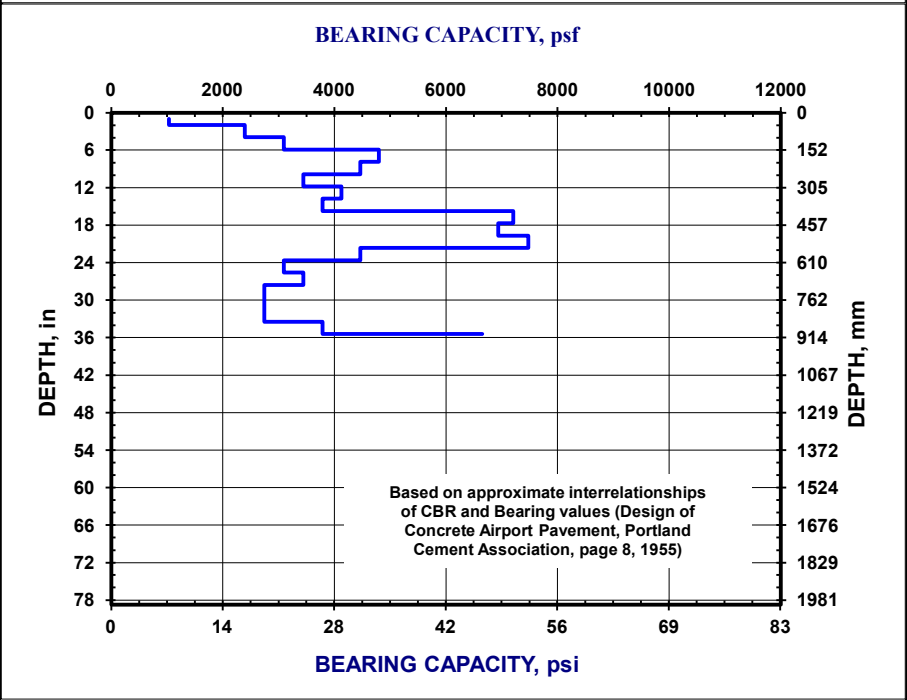
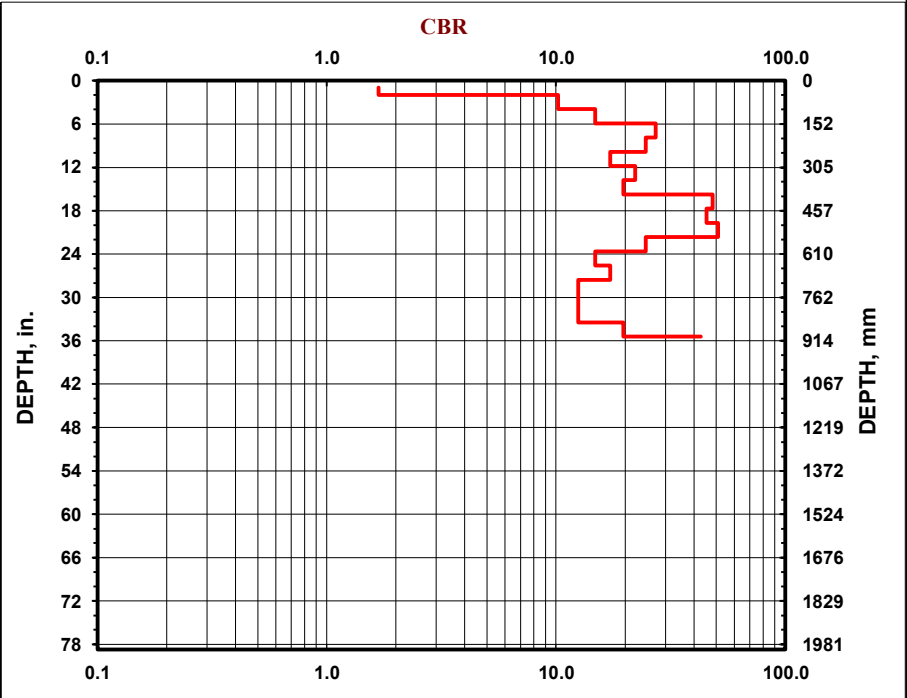
No. of Blows	Accumulative Penetration (mm)	Type of Hammer
1	25	2
1	50	2
1.5	75	2
1.5	100	2
6	125	2
6	150	2
13	175	2
13	200	2
17.5	225	2
17.5	250	2
16.5	275	2
16.5	300	2
15	325	2
15	350	2



DCP TEST DATA			
Project:	<u>S2525 Volkman Housing</u>	Date:	<u>3-Aug-22</u>
Location:	<u>TP-2226</u>	Soil Type(s):	<u>SM</u>
Hammer ☒ 10.1 lbs. ☐ 17.6 lbs. ☐ Both hammers used		Soil Type ☐ CH ☐ CL ☒ All other soils	

[illegible]

DCP TEST DATA			
Project:	<u>S22525 Volkman Housing</u>	Date:	<u>3-Aug-22</u>
Location:	<u>TP-2227</u>	Soil Type(s):	<u>SM</u>
Hammer ☒ 10.1 lbs. ☐ 17.6 lbs. ☐ Both hammers used		Soil Type ☐ CH ☐ CL ☒ All other soils	

[illegible]

DCP TEST DATA

Project: S22525 Volkman Housing

Location: TP-2228

Date: 3-Aug-22

Soil Type(s): SM

Hammer

☒ 10.1 lbs.

☐ 17.6 lbs.

☐ Both hammers used

Soil Type

☐ CH

☐ CL

☒ All other soils

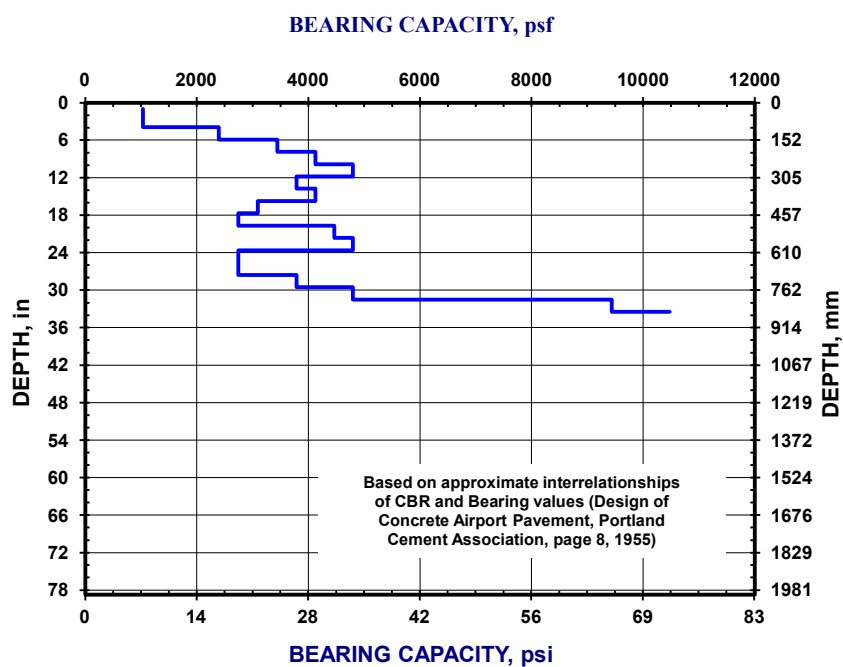
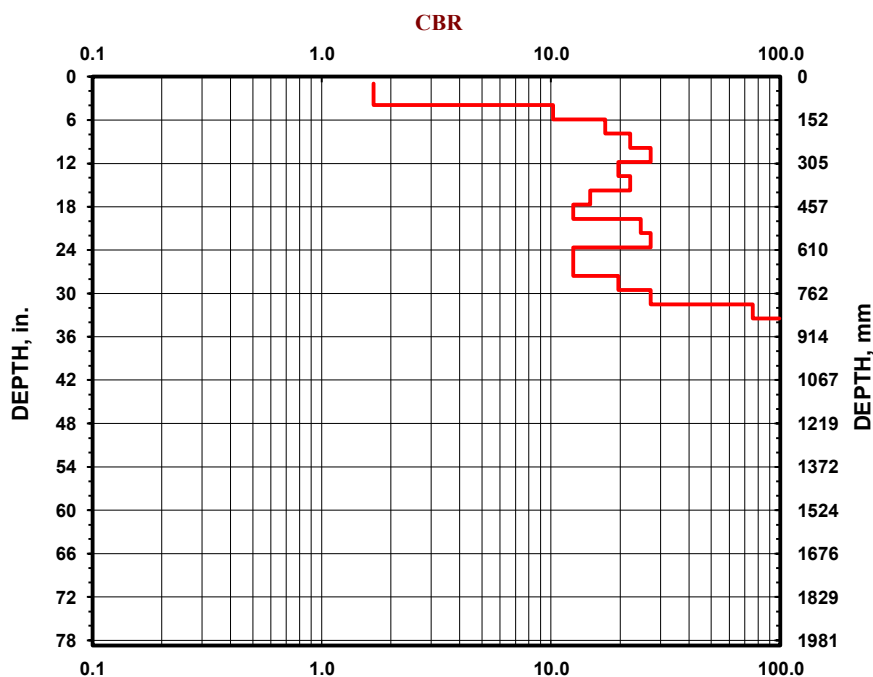
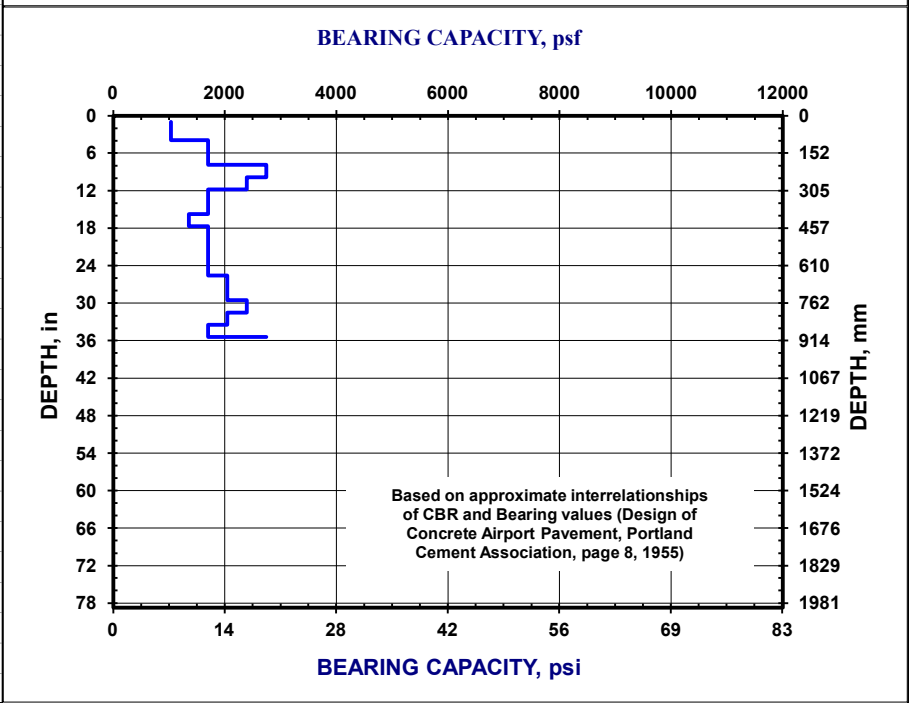
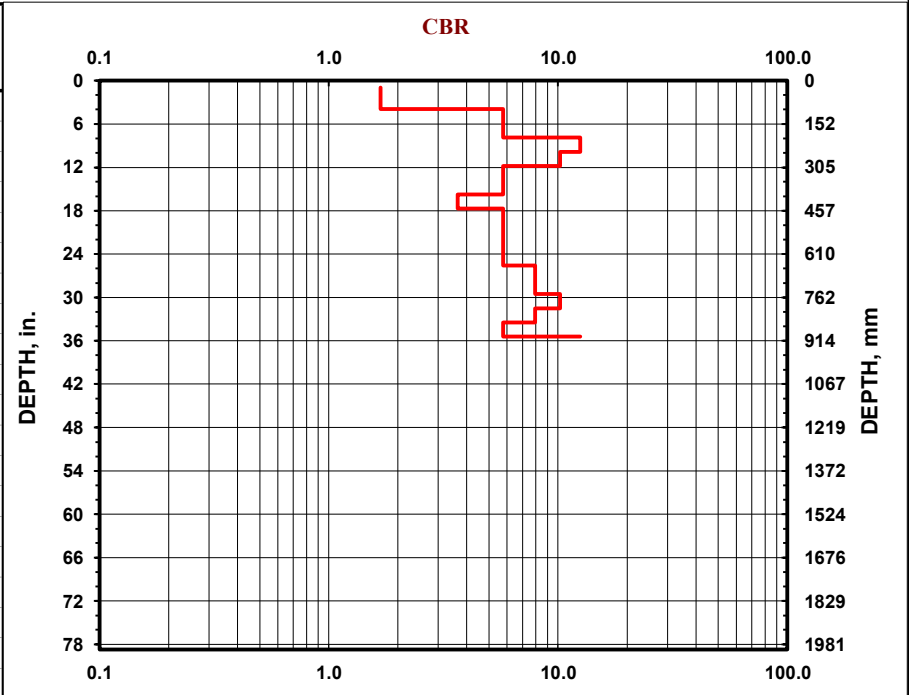
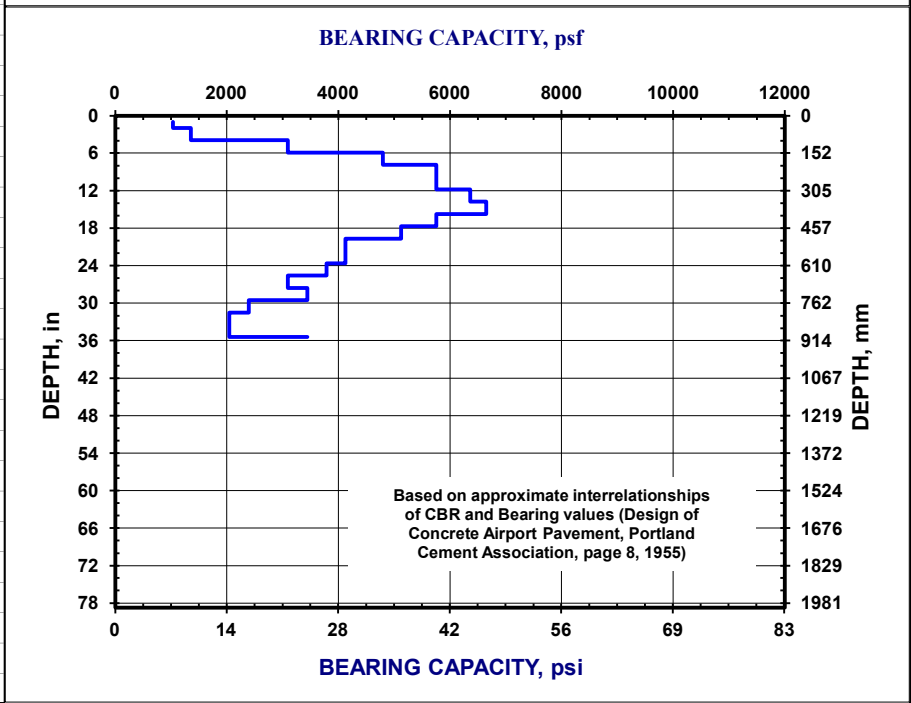
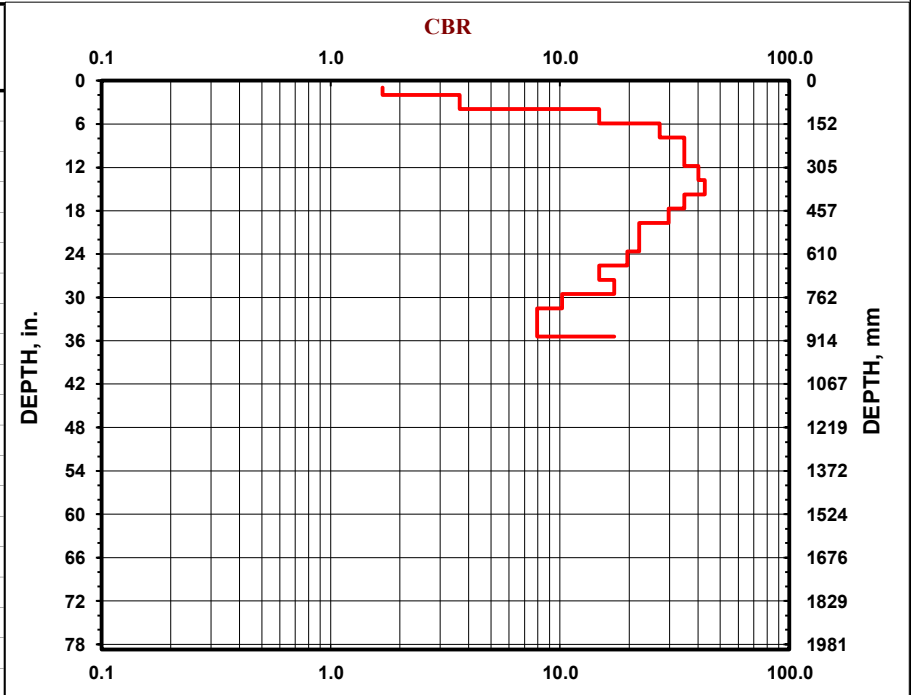
[illegible]

Figure 6-16

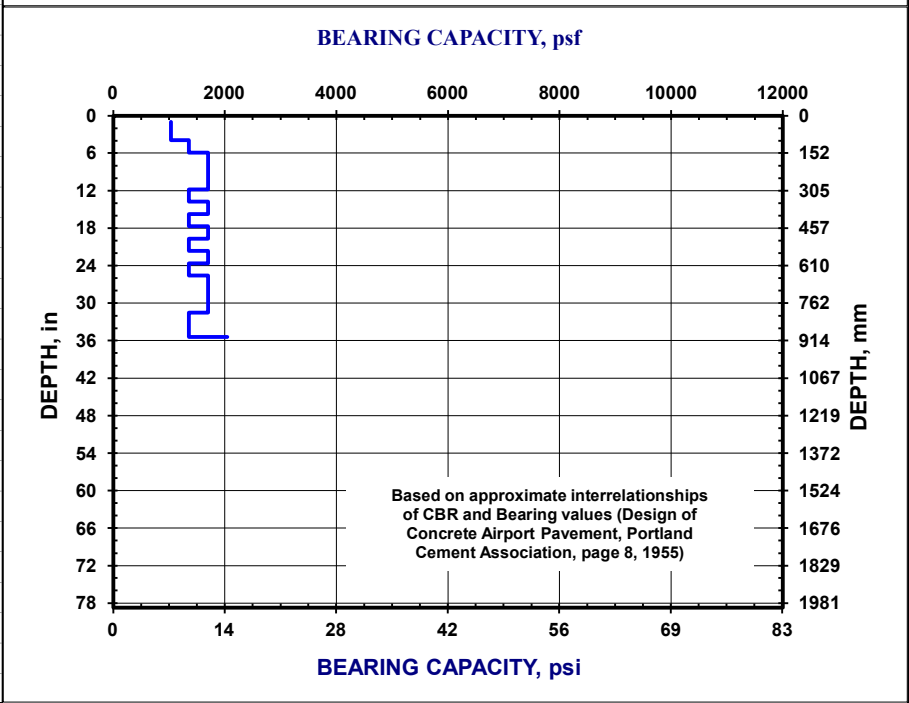
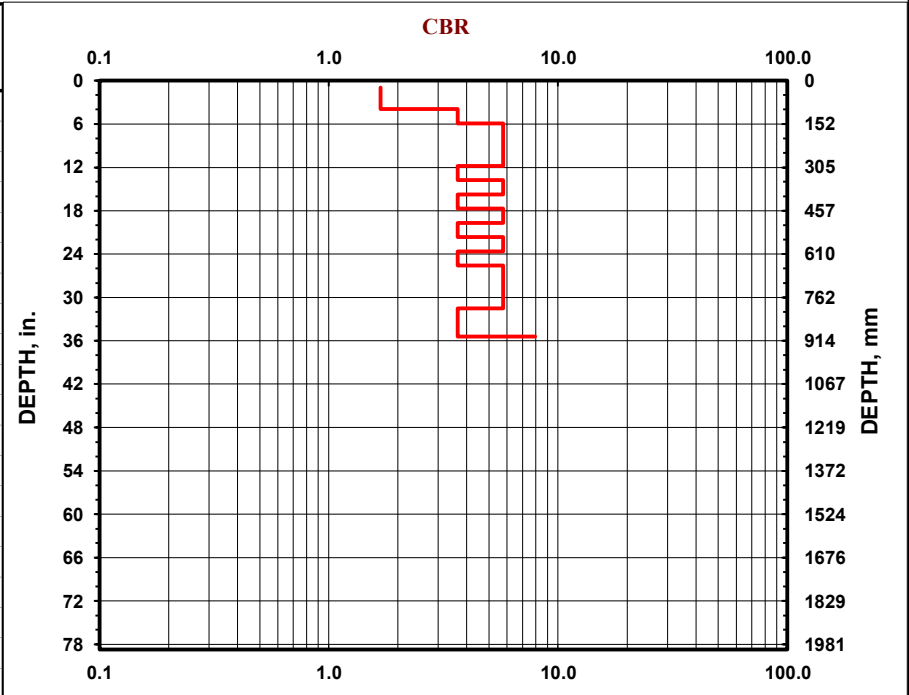
DCP TEST DATA			
Project:	<u>S2525 Volkman Housing</u>	Date:	<u>3-Aug-22</u>
Location:	<u>TP-2231</u>	Soil Type(s):	<u>SM</u>
Hammer ☒ 10.1 lbs. ☐ 17.6 lbs. ☐ Both hammers used		Soil Type ☐ CH ☐ CL ☒ All other soils	

[illegible]

DCP TEST DATA			
Project:	<u>S2525 Volkman Housing</u>	Date:	<u>3-Aug-22</u>
Location:	<u>TP-2233</u>	Soil Type(s):	<u>SM</u>
Hammer ☒ 10.1 lbs. ☐ 17.6 lbs. ☐ Both hammers used		Soil Type ☐ CH ☐ CL ☒ All other soils	

[illegible]

DCP TEST DATA			
Project:	<u>S2525 Volkman Housing</u>	Date:	<u>3-Aug-22</u>
Location:	<u>TP-2235</u>	Soil Type(s):	<u>SM</u>
Hammer ☒ 10.1 lbs. ☐ 17.6 lbs. ☐ Both hammers used		Soil Type ☐ CH ☐ CL ☒ All other soils	

[illegible]

DCP TEST DATA

Project: S22525 Volkman Housing

Location: TP-2237

Date: 3-Aug-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
3.5	75	2
3.5	100	2
3.5	125	2
3.5	150	2
5.5	175	2
5.5	200	2
6.5	225	2
6.5	250	2
5	275	2
5	300	2
4	325	2
4	350	2
3.5	375	2
3.5	400	2
3	425	2
3	450	2
2.5	475	2
2.5	500	2
2.5	525	2
2.5	550	2
2	575	2
2	600	2
2	625	2
2	650	2
1.5	675	2
1.5	700	2
2	725	2
2	750	2
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2	825	2
2	850	2
1.5	875	2
1.5	900	2

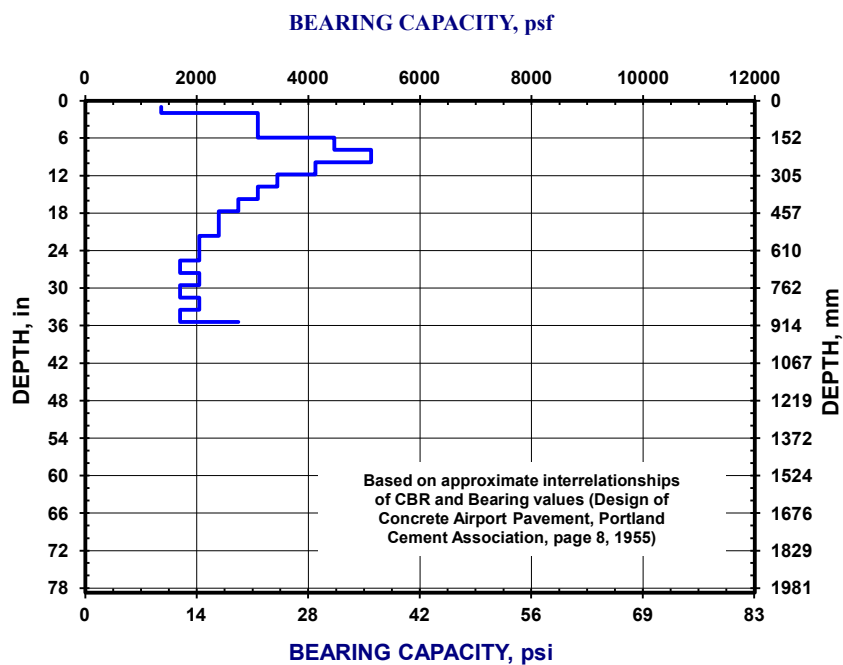
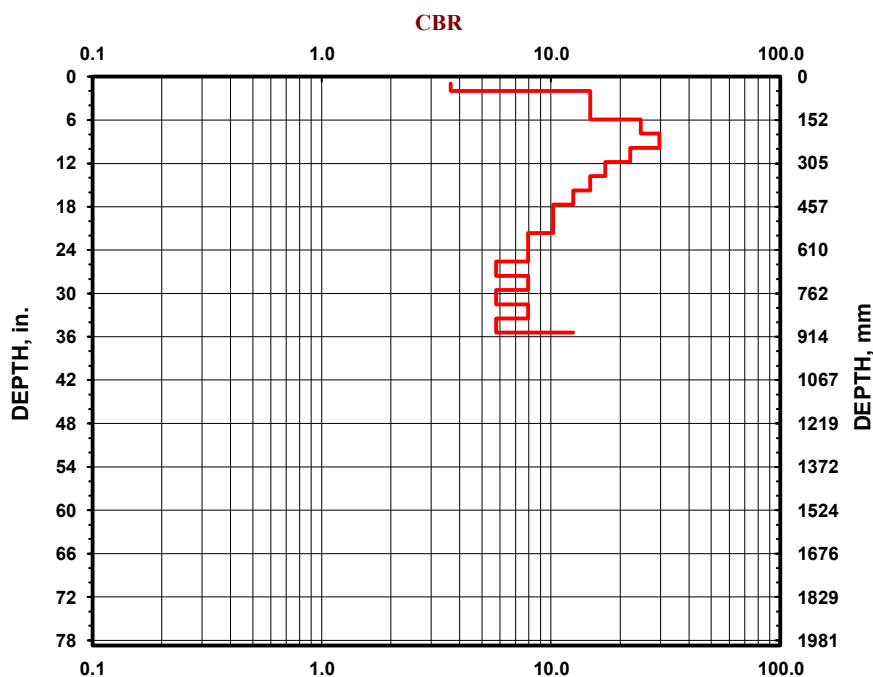
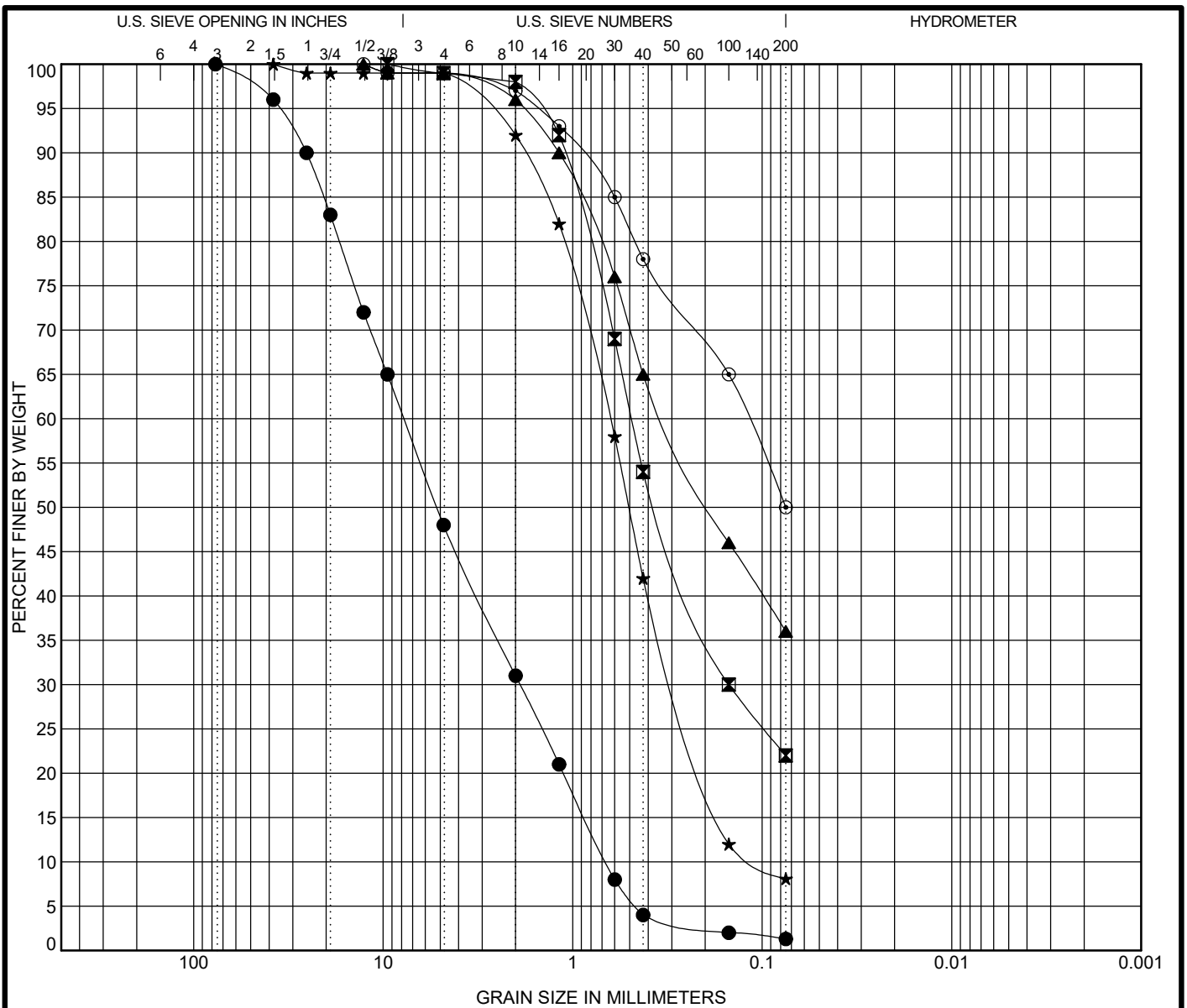


Figure 6-20

SOIL MECHANICS
LABORATORY SUMMARY

LABORATORY NUMBER		Units	Test Methods	22-6077	22-6078	22-6084	22-6081	22-6079	22-6080	22-6082	22-6083	22-6085	22-6086	22-6087
TEST PIT NUMBER				2209	2224	2234	2211	2212	2221	2212	2220	2207	2225	2236
DEPTH	TOP	feet		0	0	2	4	9	8.5	8	7	10	8	9
	BOTTOM	feet		1	1	3	6	10.5	9	9	8	11	9	10
STRATUM				silty sand			ash			sand with silt		permeable sand and gravel		
MOISTURE CONTENT		%	ASTM D2216	5.9	4.8	4.0	13.4	6.6	14.3	4.8	3.5	3.9	3.4	4.0
pH			AASHTO T289	7	7.1	7.2	7.3	7.8	7.9	7.1	7.2	7.9	7.7	8.3
LIQUID LIMIT		%	ASTM D4318		24									
PLASTIC LIMIT		%			20									
PLASTICITY INDEX		%		NP	4	NP	NP	NP	NP	NP	NP			
UNIFIED CLASSIFICATION			ASTM D2487	SM	SC-SM	SM	SM	ML	ML	SW-SM	SW-SM	GP	SP	SP
SIEVE ANALYSIS			ASTM D6913											
	3"											100	100	
	1 1/2"				100					100		96	95	100
S	1"	%			99					99		90	90	98
I	3/4"				98	100				99	100	83	85	98
E	1/2"	P			96	-100	100	100		99	-100	72	77	98
V	3/8"	A		100	95	-100	-100	-100	100	99	99	65	73	98
E	#4	S		-100	88	99	99	99	-100	99	97	48	62	97
	#10	S		98	77	94	96	97	-100	92	81	31	45	94
S	#16	I		92	65	80	90	93	99	82	65	21	29	85
I	#30	N		69	43	46	76	85	99	58	35	8	11	48
Z	#40	G		54	36	31	65	78	98	42	23	4	7	30
E	#100			30	26	16	46	65	96	12	10	2	2	6
	#200			22	23	13	36	50	84	8.1	8.1	1.3	1.9	3.5

NP = Not Plastic



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification			LL	PL	PI	Cc	Cu
●	2207	10.0	POORLY GRADED GRAVEL with SAND(GP)						0.70	11.67
⊠	2209	0.0	SILTY SAND(SM)			NP	NP	NP		
▲	2211	4.0	SILTY SAND(SM)			NP	NP	NP		
★	2212	8.0	WELL-GRADED SAND with SILT(SW-SM)			NP	NP	NP	1.18	6.04
⊙	2212	9.5	SANDY SILT(ML)			NP	NP	NP		
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	2207	10.0	76.8	7.772	1.897	0.666	52.1	46.5	1.3	
⊠	2209	0.0	9.5	0.488	0.15		1.0	77.0	22.0	
▲	2211	4.0	12.7	0.323			1.0	63.0	36.0	
★	2212	8.0	38	0.635	0.28	0.105	1.1	90.8	8.1	
⊙	2212	9.5	12.7	0.119			1.0	49.0	50.0	



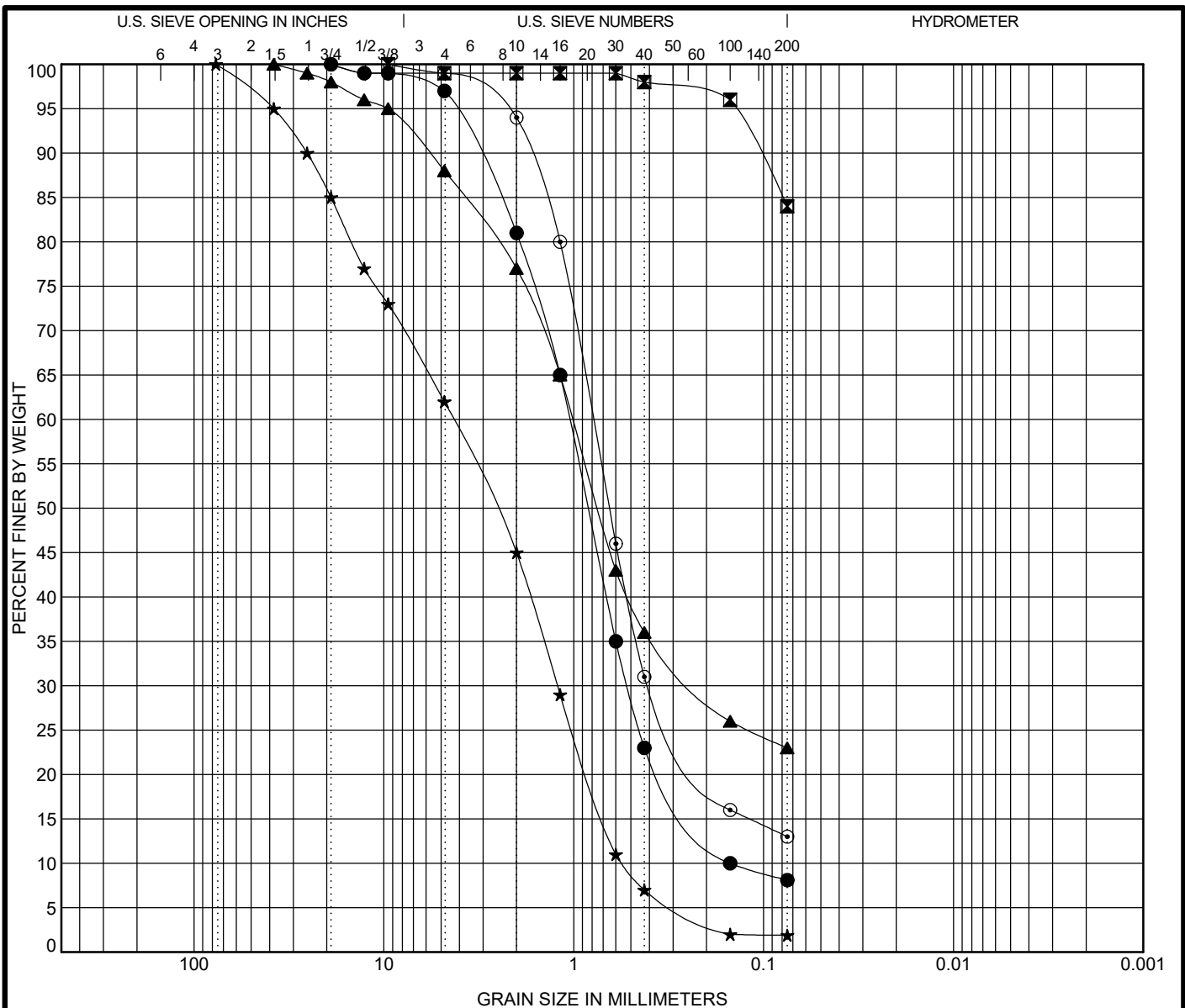
**Budinger
& Associates**
1101 North Fancher Road
Spokane Valley, WA 99212

GRAIN SIZE DISTRIBUTION

Project: Volkman Housing Development
Location: Spokane, WA
Number: S22525

GRAIN SIZE W/ FIGURE # S22525 GINT.GPJ GINT STD US.GDT 8/8/22

Figure 8-1



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification			LL	PL	PI	Cc	Cu
●	2220	7.0	WELL-GRADED SAND with SILT(SW-SM)			NP	NP	NP	1.71	7.03
☒	2221	8.5	SILT with SAND(ML)			NP	NP	NP		
▲	2224	0.0	SILTY, CLAYEY SAND(SC-SM)			24	20	4		
★	2225	8.0	POORLY GRADED SAND with GRAVEL(SP)						0.62	7.87
⊙	2234	2.0	SILTY SAND(SM)			NP	NP	NP		
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	2220	7.0	19	1.054	0.52	0.15	3.2	88.7	8.1	
☒	2221	8.5	9.5				1.0	15.0	84.0	
▲	2224	0.0	38	1.012	0.228		12.1	64.9	23.0	
★	2225	8.0	76.8	4.33	1.22	0.55	38.0	59.9	1.9	
⊙	2234	2.0	19	0.793	0.396		1.1	85.9	13.0	

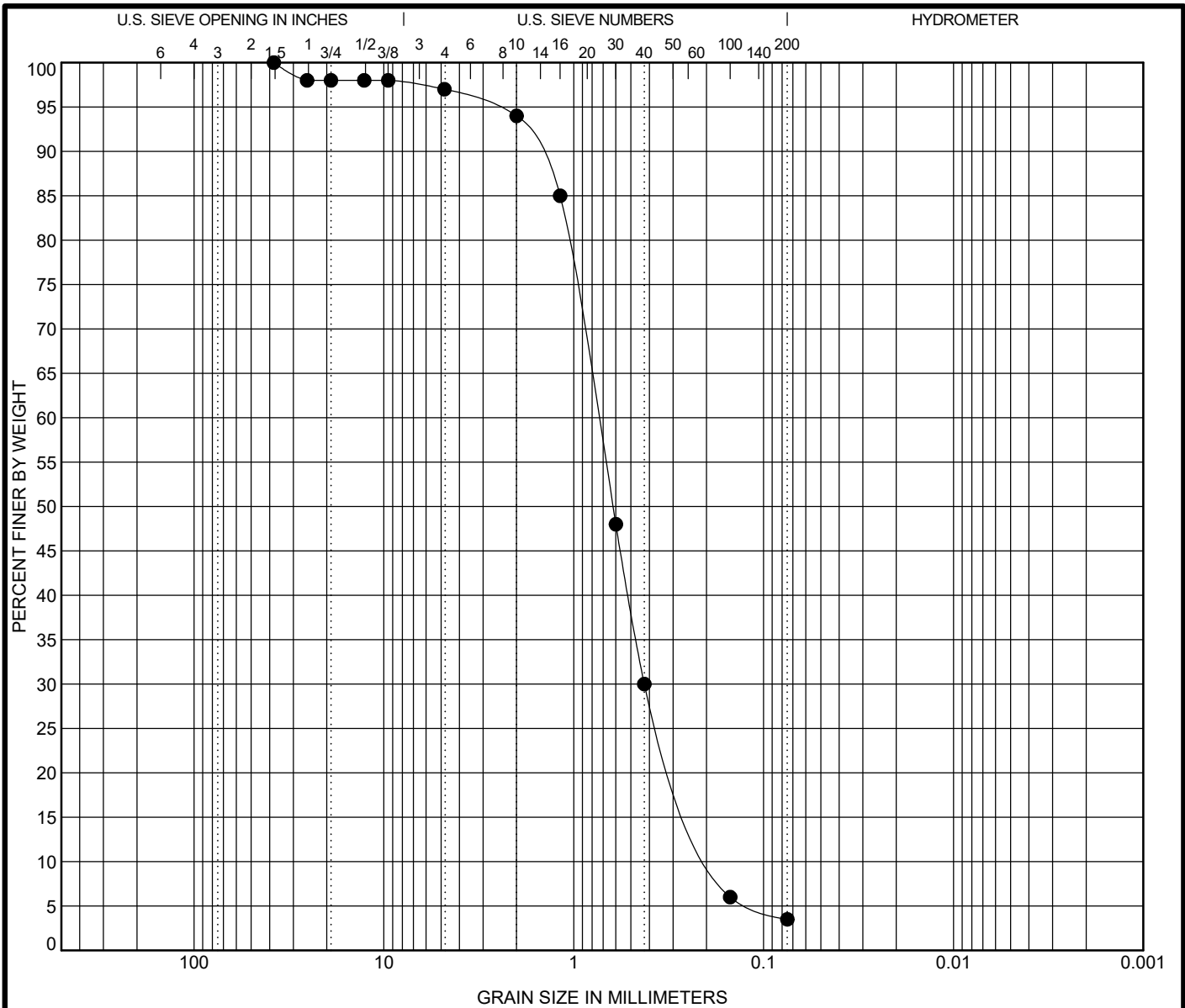


**Budinger
& Associates**
1101 North Fancher Road
Spokane Valley, WA 99212

GRAIN SIZE DISTRIBUTION

Project: Volkman Housing Development
Location: Spokane, WA
Number: S22525

Figure 8-2



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	2236	9.0	POORLY GRADED SAND(SP)				1.35	4.19

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	2236	9.0	38	0.747	0.425	0.178	3.0	93.5	3.5



Budinger & Associates
 1101 North Fancher Road
 Spokane Valley, WA 99212

GRAIN SIZE DISTRIBUTION

Project: Volkman Housing Development
 Location: Spokane, WA
 Number: S22525

GRAIN SIZE W/ FIGURE # S22525 GINT.GPJ GINT STD US.GDT 8/8/22

Figure 8-3

Appendix A: *GBC - Important Information About Your Geotechnical Report*

Important Information about This Geotechnical-Engineering Report

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.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you — should apply this report for any purpose or project except the one originally contemplated.*

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an

assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by:* the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help

others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental 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, many mold-prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical-engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.



8811 Colesville Road/Suite G106, Silver Spring, MD 20910

Telephone: 301/565-2733 Facsimile: 301/589-2017

e-mail: info@geoprofessional.org www.geoprofessional.org

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