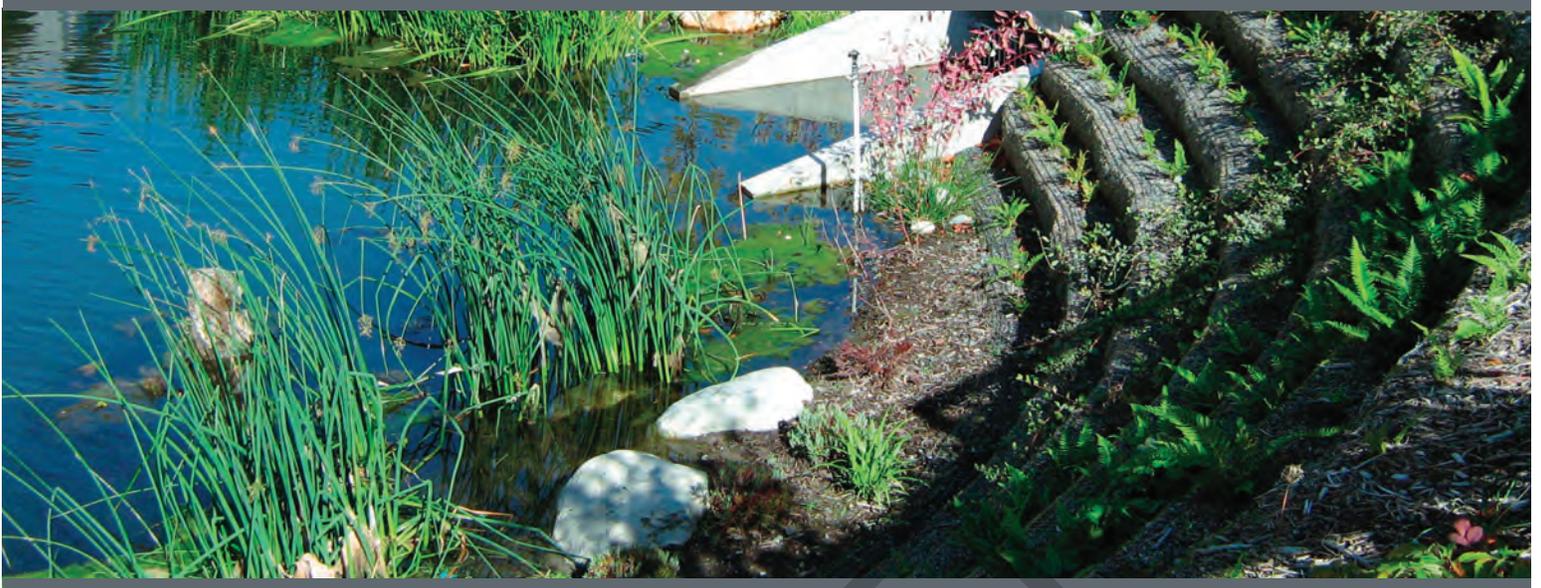




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*Subsurface Exploration, Geologic Hazards,
Preliminary Geotechnical Engineering, and Infiltration Feasibility Report*

ARLINGTON OPERATIONS CENTER REDEVELOPMENT

Arlington, Washington

Prepared For:

CORNERSTONE GENERAL CONTRACTORS, INC.

Project No. 20240001E001

May 30, 2024



Associated Earth Sciences, Inc.

www.aesgeo.com



associated
earth sciences
incorporated

May 30, 2024
Project No. 20240001E001

Cornerstone General Contractors, Inc.
11805 North Creek Parkway South, #115
Bothell, Washington 98011

Attention: Sam Comer

Subject: Subsurface Exploration, Geologic Hazards, Preliminary Geotechnical Engineering,
and Infiltration Feasibility Report
Arlington Operations Center Redevelopment
19620 67th Avenue SE
Arlington, Washington

Dear Sam Comer:

We are pleased to present the enclosed copy of our preliminary geotechnical report. This report presents subsurface exploration and laboratory data and presents preliminary recommendations for the design of the project. We recommend that we be allowed to review project plans as they near completion and verify or update the recommendations in this report as needed to reflect the final design.

We have enjoyed working with you on this study and are confident that the recommendations presented in this report will aid in the successful completion of your project. Please contact me if you have any questions or if we can be of additional help to you.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

DRAFT

Kurt D. Merriman, P.E.
Senior Principal Engineer

KDM/lid – 20240001E001-002

**SUBSURFACE EXPLORATION, GEOLOGIC HAZARDS,
PRELIMINARY GEOTECHNICAL ENGINEERING, AND
INFILTRATION FEASIBILITY REPORT**

**ARLINGTON OPERATIONS CENTER
REDEVELOPMENT**

Arlington, Washington

Prepared for:

Cornerstone General Contractors, Inc.
11805 North Creek Parkway South, #115
Bothell, Washington 98011

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May 30, 2024
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I. PROJECT AND SITE CONDITIONS

1.0 INTRODUCTION

This report presents the results of Associated Earth Sciences, Inc.'s (AESI's) subsurface exploration, geologic hazard, preliminary geotechnical engineering, and stormwater infiltration feasibility study for the proposed site improvements for the Arlington Operations Center Redevelopment in Arlington, Washington. The site location is shown on the "Vicinity Map," Figure 1. The approximate locations of explorations completed for this study are shown on the "Existing Site and Exploration Plan," Figure 2 and "Proposed Site Improvements," Figure 3. Copies of the exploration logs are included in Appendix A, previous exploration logs completed by AESI, and historical exploration logs completed by others are included in Appendix B, and laboratory testing results are included in Appendix C. Groundwater data provided by others is presented in Appendix D. AESI is familiar with the project site through the completion of our previous report, titled "Stormwater Infiltration Facility Arlington Road Maintenance Yard," dated January 12, 2000. For the preparation of this report, we were provided with the following documents:

- "Phase 1 Environmental Site Assessment" prepared by CDM Smith, dated August 31, 2015.
- "Revised Preliminary Geotechnical Report Arlington Operations Center," prepared by Shannon & Wilson, dated May 7, 2020.

This report is considered preliminary, as the project design was still in the conceptual phase and no project plans were available for our review. We recommend that we be allowed to review the recommendations contained in this report and modify them, if necessary, once project plans have been finalized.

1.1 Purpose and Scope

The purpose of this study is to provide subsurface soil and groundwater data to be utilized in the design of the project. Our study included reviewing selected available geologic literature, review of previous studies completed by AESI and others, advancing three exploration borings, and performing a geologic study to assess the type, thickness, distribution, and physical properties of the subsurface sediments and shallow groundwater. Geotechnical engineering studies were completed to determine the type of suitable foundations, allowable foundation soil bearing pressures, anticipated foundation settlements, geologic hazard mitigation considerations, erosion control recommendations, structural fill placement and compaction, drainage considerations, and the feasibility of stormwater infiltration. This report summarizes our current fieldwork and offers preliminary geotechnical recommendations based on our present understanding of the project. We recommend that we be allowed to review the

recommendations presented in this report and revise them, if needed, when a project design has been finalized.

1.2 Authorization

Written authorization to proceed with this study was granted by means of signed scope of work and cost proposals dated January 16, 2024. This report has been prepared for the exclusive use of Cornerstone General Contractors, Inc., and their agents, for specific application to this project. Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering and engineering geology practices in effect in this area at the time our report was prepared. No other warranty, express or implied, is made.

2.0 PROJECT AND SITE DESCRIPTION

The subject site is the Snohomish County's Arlington Operations Center located at 19620 67th Avenue NE in Arlington, Washington (Snohomish County Parcel No. 31051500101500). The site is rectangular in plan view and is approximately 17.5 acres in area. The site is bordered by 63rd Avenue NE to the west, 197th Street NE to the north, 67th Avenue NE to the east, and existing commercial properties to the south.

The Arlington site was formerly a sand and gravel pit that was filled in by the County as part of their mine reclamation process as indicated in the "Phase 1 Environmental Site Assessment, Snohomish County Maintenance Shop" prepared by CDM Smith, dated 2015. As a result, portions of the site are underlain by existing fill soils up to 20 feet thick. These areas are generally located near the central and eastern-central portions of the site, where the former pit was located and the final grades were raised the highest. The Arlington Operations Center generally consists of gravel and paved surfaces used by the County for storage of road cleaning and maintenance equipment, stockpiled materials, and vehicles. Several buildings and covered storage areas are present across the property. This phase of the project is focused on the southeastern corner of the site where the existing single-story administrative and crew building and large, vegetated infiltration pond are located. The infiltration pond has steep slopes with maximum slope heights of about 24 feet at inclinations near 2H:1V (Horizontal:Vertical) on the east side and 3H:1V along the north, west, and south sides of the pond. Site topography slopes from a topographical high of approximately 148 feet along the southern property boundary down to the low point at the infiltration pond bottom with a total vertical relief of approximately 30 feet. Outside of the infiltration pond, site topography is comparatively flatter and generally slopes gently downward towards the north.

The first phase of the Arlington Operations Center site development will consist of a new two-story operations building with an approximate footprint of 15,000 square feet, new

underground stormwater facilities, utilities, paved parking and driveways, and landscaping as shown on Figure 3, “Proposed Site Improvements.” Future project phases may include covered gathering areas, a fabrication shop, equipment storage, waste material storage, a heated vehicle storage building, and various storage sheds. We understand the project will pursue stormwater infiltration with a new infiltration vault proposed near the bottom of the existing large stormwater infiltration pond.

2.1 Previous Studies

Previous studies were completed at the site by AESI in 2000, CDM Smith in 2015, and by Shannon & Wilson in 2020. The AESI study completed in 2000, “Stormwater Infiltration Facility, Arlington Road Maintenance Yard,” included five exploration pits on the northern edge of the site north of the currently proposed site improvements. The 2000 study was focused on the hydrogeologic conditions for a proposed infiltration pond.

CDM Smith completed the “Phase 1 Environmental Site Assessment, Snohomish County Maintenance Shop,” in 2015 at the site. The study includes a site history that details the site’s historical use. The site was previously the location of a railroad from the early 1900’s until it was used as a gravel mine in the 1940’s. The site was then redeveloped in 1973 to support its current operations. Historical information indicates that the mined areas were slowly being restored to reclamation grade by the late 1990’s by the placement of unspecified “excavated materials.” AESI reviewed figures showing elevation data prior to the grading of the pond to determine potential depths of existing fill soils in the vicinity of the proposed site improvements.

The Shannon & Wilson study completed in 2020, “Revised Preliminary Geotechnical Report, Arlington Operations Center,” was focused on the redevelopment of the operations center. Exploration borings were completed across the site with SW-2-19 and SW-3-19 completed in the area of the currently proposed Phase 1 site improvements. One of the explorations, SW-3-19, was completed as a vibrating wire piezometer (VWP) in which groundwater readings were taken from December 2019 through March 2020. The hydrograph created from those groundwater readings is included in Appendix D of this report for reference. The Shannon & Wilson report also provides groundwater data from a VWP (SB-01) which had been previously installed by Snohomish County, and the logs of two borings completed by Terracon in 2016. The additional groundwater data and 2016 borings logs are also included in this report for reference.

The approximate locations of the borings and exploration pits are shown on Figures 2 and 3, and copies of the exploration logs are included in Appendix B. The subsurface conditions encountered in the previous explorations are summarized in Section 3.2 of this report. The previous subsurface exploration information was used to supplement the subsurface information obtained for this current study and aided in our assessment of the depth to groundwater, fill depths, and the characteristics of the native sediments.

3.0 SUBSURFACE EXPLORATION

Our field study, completed in April 2024, included advancing three explorations to define the general soil and shallow groundwater conditions in the vicinity of the proposed Phase 1 improvements. The exploration locations are shown on Figure 2 and Figure 3. The various types of sediments, as well as the depths where characteristics of the sediments changed, are indicated on the exploration logs presented in Appendix A. The depths indicated on the logs where conditions changed may represent gradational variations between sediment types in the field. The locations of our field explorations were determined by approximate measurements from known site features.

The conclusions and recommendations presented in this report are based, in part, on the exploration borings completed for this study. The number, locations, and depths of the explorations were completed within site and budgetary constraints. Because of the nature of exploratory work below ground, extrapolation of subsurface conditions between field explorations is necessary. It should be noted that differing subsurface conditions might sometimes be present due to the random nature of deposition and the alteration of topography by past grading and/or filling. The nature and extent of variations between the field explorations may not become fully evident until construction. If variations are observed at that time, it may be necessary to re-evaluate specific recommendations in this report and make appropriate changes.

3.1 Exploration Borings

The exploration borings were completed by Advance Drill Technology Inc., an independent driller working under subcontract to AESI, by advancing a 6-inch outside-diameter, hollow-stem auger with a track-mounted drill rig. The approximate locations of the borings completed for this study are shown on Figure 2. During the drilling process, samples were generally obtained at 2½- to 5-foot-depth intervals. After drilling, each borehole was backfilled with bentonite grout in combination with bentonite chips, and the surface was patched with on-site material.

Disturbed, but representative samples were obtained by using the Standard Penetration Test (SPT) procedure in accordance with *ASTM International* (ASTM) D-1586. This test and sampling method consists of driving a standard 2-inch, outside-diameter, split-barrel sampler a distance of 18 inches into the soil with a 140-pound hammer free-falling a distance of 30 inches. The number of blows for each 6-inch interval is recorded, and the number of blows required to drive the sampler the final 12 inches is known as the Standard Penetration Resistance (“N”) or blow count. If a total of 50 is recorded within one 6-inch interval, the blow count is recorded as the number of blows for the corresponding number of inches of penetration. The resistance, or N-value, provides a measure of the relative density of granular soils or the relative consistency of cohesive soils; these values are plotted on the attached exploration boring logs.

The borings were continuously observed and logged by a geologist from our firm. The samples obtained from the split-barrel sampler were classified in the field and representative portions placed in watertight containers. The samples were then transported to our laboratory for further visual classification and laboratory testing. The exploration logs presented in Appendix A are based on the N-values, field observations, and drilling action.

3.2 Historical Explorations and Explorations by Others

Summaries of the subsurface conditions encountered in the previously completed explorations at the site are provided below.

AESI 2000

Our previous study included the excavation of five exploration pits in October of 1999, along the northern side of the infiltration pond. These pits were completed to depths between 12 and 13.5 feet below the ground surface. The exploration pits typically encountered fill, overlying Vashon recessional outwash. Fill was observed extending beyond the total depth explored in EP-1 and EP-2 near the northwestern end of the infiltration pond. EP-3, EP-4, and EP-5 encountered recessional outwash underlying the fill at depths of 2, 6, and 8 feet below the ground surface. No groundwater was encountered at the time of the explorations. The sediments observed within the 2000 exploration pits are generally consistent with the borings completed as part of this study. The approximate boring locations are shown on Figures 2 and 3, and copies of the exploration logs from previous studies are included in Appendix B.

Shannon & Wilson 2020

Subsurface explorations for this study included the completion of five exploration borings spread across the parcel, with one of the explorations, SW-3-19, completed as a VWP. These borings typically encountered 7 to 16 feet of fill overlying Vashon recessional outwash (Marysville Sand Member). Vashon advance outwash was reported below the recessional outwash in SW-3-19 and SW-4-19 at depths of 93 feet and 88 feet, respectively. The Shannon & Wilson borings were completed in May 2020, and the depth to groundwater in all five borings, observed at the time of drilling, ranged from 40 feet to 56 feet below the surface. These depths correlate to an elevation range of 72 to 94 feet (NAVD 88). The highest observed groundwater at the time of drilling was observed in the boring completed as the VWP. Groundwater measurements taken from the VWP between December 2019 through March 2020 indicate the estimated groundwater elevation (not surveyed) reportedly fluctuated between depths of 53 feet to 45 feet. Groundwater is discussed in more detail in Section 4.3.

The 2020 Shannon & Wilson report also contained summaries and boring logs for studies completed by Terracon and for the previously mentioned Snohomish County VWP. The Terracon explorations, which were completed along the southeastern margin of the site, encountered

10 to 15 feet of existing fill overlying a 2.5-foot-thick layer of peat with medium dense sand and gravel present below. These borings were completed to a depth of 21.5 feet below the surface. The Snohomish County boring SB-01 northwest of the infiltration pond encountered 3 feet of fill over medium dense to dense sand and interbedded silty sand and was completed to a maximum depth of 145.5 feet. The sediments encountered below the fill are consistent with recessional outwash sediments.

4.0 SUBSURFACE CONDITIONS

Subsurface conditions at the project site were inferred from the field explorations accomplished for this study, previous work by others, visual reconnaissance of the site, and review of applicable geologic literature. As shown on the attached logs in Appendix A, the exploration borings generally encountered existing fill overlying Vashon recessional outwash. Two explorations completed in 2020 by Shannon & Wilson encountered Vashon advance outwash at depth below the recessional outwash. Two explorations completed by Terracon in the southeastern corner of the site encountered a layer of peat below the existing fill and above the recessional outwash. The following section presents more detailed subsurface information organized from shallowest (youngest) to deepest (oldest).

4.1 Stratigraphy

Sod/Topsoil

Sod and organic-rich, dark brown topsoil was encountered in all three of the current exploration borings and extended to approximately 4 to 6 inches below ground surface. The organic topsoil is not suitable for infiltration, foundation support, or for use in structural fill.

Fill

Directly below the sod/topsoil in EB-1, EB-2, and EB-3 we encountered a variety of existing fill material. The fill generally consisted of slightly moist to moist brown to dark brown silty, fine sand, some gravel and scattered to abundant organic debris (rootlets, wood debris, fine black organics). The texture of the existing fill ranged from silty sand to sand some silt with varying amounts of gravel but was typically granular in nature, and also varied in color. During the drilling process, areas of gravel and abundant organics were observed at varying depths. Fill observed by others was typically between 7 and 16 feet thick depending on location with the thickest fills observed to the east of the site. In our recent explorations the existing fill was observed between 5.5 and 19 feet thick. The thicker fill was observed in EB-1 and EB-2 at higher topographic site elevations near the top of the southeast infiltration pond slope. Due to the granular nature of this fill, it may be suitable for reuse in structural fill applications, provided it is free of excessive organic/construction debris and a proper moisture conditioning can be attained.

Peat

A 2.5-foot-thick layer of peat consisting of soft, brown fibrous organic silt was encountered by Terracon in exploration boring B-1 and B-2; see Figures 2 and 3. The peat was encountered 10.5 feet and 15 feet below the existing ground surface in B-1 and B-2, respectively. Peat is typically deposited in areas that were formerly occupied by streams or swamps. Peat is highly compressible and not suitable for structural support. Peat sediments were not encountered in any of the explorations completed by AESI, Shannon & Wilson, or Snohomish County.

Vashon Recessional Outwash- Marysville Sand Member

Sediments encountered directly below the existing fill at a depth of 19 feet in EB-1 and EB-2 and at 5.5 feet in EB-3 generally consisted of medium dense to dense, partially stratified, brownish gray, sand, some gravel with trace to some silt and ranged to gravelly sand with some silt. Occasional layers of very stiff silt, sandy silt, and/or medium dense to dense gravel were observed within the unit with cobbles encountered during drilling. We interpret these sediments to be representative of Vashon recessional outwash (Marysville Sand Member). The Vashon recessional outwash was deposited by meltwater streams flowing off of the retreating glacial ice during the latter portion of the Vashon Stade of the Fraser Glaciation approximately 12,500 to 15,000 years ago. Where encountered in our explorations the recessional outwash extended beyond the depths explored. Laboratory sieve analyses were conducted on three samples of the recessional outwash to assess the suitability of the outwash for infiltration. Copies of the sieve analyses results are included in Appendix C.

Properly prepared recessional outwash is suitable for support of foundation loads. Excavated recessional outwash that is free of organic debris, oversized cobbles and boulders, and other deleterious materials, and which exhibits a moisture content compatible with achieving the specified level of compaction is suitable for reuse as structural fill. Although the majority of the outwash consisted predominantly of granular material (sand and gravel), the outwash has the potential to contain lenses or interbeds of silt. Excavated portions of the outwash that consist predominantly of silt are not recommended for use as structural fill.

Vashon Advance Outwash

Sediments encountered below the Vashon recessional outwash in two borings completed by Shannon & Wilson, SW-3-19 and SW-4-19, consisted of wet, dense, gray silty fine to medium sand with occasional fine gravel layers, lenses of silt, and occasional seams of iron-oxide staining. This material was encountered at depths of 88 feet and 93 feet below ground surface and was interpreted as Vashon advance outwash. Vashon advance outwash was deposited by meltwater streams that emanated from the advancing glacial ice during the Vashon Stade of the Fraser Glaciation, approximately 12,500 to 15,000 years ago. These sediments typically have high

relative density characteristics due to their consolidation by the massive weight of the glacial ice that overrode these sediments subsequent to their deposition.

4.2 Regional Geologic and Soils Mapping

Review of the published geologic map, titled *Geologic Map of the Arlington West 7.5 Minute Quadrangle, Snohomish County, Washington* by J.P. Minard, 1985, indicates that the site is expected to be underlain by Vashon recessional outwash Marysville Sand Member with Vashon advance outwash mapped in the vicinity to the east.

Review of regional soils mapping (*Web Soil Survey*, U.S. Department of Agriculture [USDA], Natural Resources Conservation Service [NRCS]) indicates that the subject site is underlain by Everett very gravelly sandy loam, 0 to 8 percent slopes on the eastern half of the parcel and Lynnwood loamy sand, 0 to 3 percent slopes on the western half of the parcel. The Everett and Lynnwood series soils mapped onsite generally formed from the granular glacial outwash. Our interpretation of the shallow site geology and soils is in general agreement with the regional mapping in that we encountered recessional outwash underlying the existing fill soils.

4.3 Hydrology

Groundwater is present at the site as part of the local water table within the Vashon recessional outwash and as perched groundwater seams within the fill and peat, and above silt/silty interbeds within the Vashon recessional outwash. Information on the Vashon recessional outwash aquifer, perched groundwater, and the existing infiltration pond are described below. Our explorations were conducted in April when groundwater levels are typically elevated. It should be noted that groundwater conditions, including depth and duration and quantity of seepage, should be expected to vary seasonally, and in response to changes in precipitation, soil grain-size distribution, topography, on- and off-site land usage, and other factors. Groundwater measurement data provided by others is included in Appendix D.

Perched Groundwater

Though not encountered in our recent borings, zones of perched groundwater may be present above the groundwater table. Perched groundwater occurs when surface water infiltrates down through relatively permeable shallow soils and becomes trapped or “perched” atop lower-permeable layers such as silty zones within the existing fill, peat, and Vashon recessional outwash sediments. Perched water may travel laterally in flow directions unrelated to the ground surface topography or may be discontinuous and isolated. Wet conditions were noted in the peat sediments encountered in the 2016 Terracon borings.

Vashon Recessional Outwash Aquifer

Groundwater was encountered in EB-2 and EB-3 at the time of drilling within the Vashon recessional outwash deposits and described by others (Shannon & Wilson, 2000). Depth to groundwater and estimated groundwater elevations are summarized in Table 1 below. The depth to groundwater in EB-2 and EB-3 ranged from 33 feet in EB-3 to 54.5 feet in EB-2. These groundwater depths correlate to estimated elevations of 87 feet and 91.5 feet. We interpret this groundwater as the local unconfined groundwater table present within the Vashon recessional outwash sediments.

In addition to the groundwater levels observed in our explorations, the referenced Shannon & Wilson report completed in 2020 indicated that groundwater elevations in the area of the proposed improvements were measured between 91 and 94 feet from the VWP installed in boring SW-3-19. Groundwater measurements were collected between December 2019 and March 2020. These groundwater elevations are similar to the depths observed in our explorations completed for this current study.

This report also summarizes groundwater data reviewed by Shannon & Wilson for a VWP installed by Snohomish County, labeled SB-01. Groundwater data was collected from this VWP over the course of a one-year period during 2016. A plot of the water level measurements is provided in Appendix D. This plot has an irregularity where a rise in groundwater of 11 feet was measured on a single day. No source or explanation for the irregularity was determined in the Shannon & Wilson report. The report does provide water levels measured from SB-01 in January and March of 2020 at depths of 40 feet and 38 feet, respectively. Based on the more recent water level measurements, the report estimates groundwater between elevations 84 feet and 86 feet, from January to March.

Table 1
Estimated Groundwater Depths and Elevations

Exploration Boring No.	EB-1	EB-2	EB-3	SW-1-19	SW-2-19	SW-3-19	SW-4-19	SW-5-19	SB-01
Groundwater Depth (feet)	N/A	54.5	33	52	40	53 to 60	50	46	38 to 40
Approximate Groundwater Elevation* (feet)	N/A	91.5	87	79	80	91 to 94	72	79	84 to 86

*Note: Groundwater elevations for the AESI borings are estimated. The elevations will be defined once the boring locations are surveyed.

It is important to note that the anomalous groundwater data from VWP SB-01 reported by Shannon & Wilson brings an additional level of uncertainty to the data. The uncertainty from the

irregularity in the data is also in addition to some level of uncertainty that comes when reviewing work from others. AESI considered this uncertainty when relying on the information in these reports to formulate our recommendations.

Existing Infiltration Pond Observations

At the time of our exploration the infiltration pond was not holding any water and anecdotally, does not hold water throughout the year. Minor evidence of erosion due to surface flow was observed on slope faces near catch basins and in swales surrounding the infiltration pond.

4.4 Laboratory Testing

AESI performed three grain-size analyses (sieves) on samples of Vashon recessional outwash. The testing was completed generally in accordance with ASTM procedures on samples collected from EB-3 at varying depths. Due to the size of the gravels present at the 7.5-foot-depth sample, it is likely that the sample size obtained from the split-spoon sampler did not meet the ASTM requirement and may not accurately represent the amount of gravel or the maximum size of the gravel present. This sampling method limits gravel size obtained in the sample to less than 2 inches. The grain-size analyses test results are included in Appendix C and summarized below.

Table 2
Summary of Sieve Analysis Test Results

Exploration Boring No.	Sample Depth (feet)	Geologic Unit	USCS Soil Description	Fines Content (%)
EB-3	7.5	Vashon Recessional Outwash	Very gravelly SAND, trace silt	4.8
EB-3	15	Vashon Recessional Outwash	SAND, trace gravel, trace silt	4.5
EB-3	20	Vashon Recessional Outwash	SAND, some gravel, some silt	5.5

USCS = Unified Soil Classification System

We sent out three samples to a subcontracted laboratory for organic content and cation exchange capacity tests. The tests were completed on representative samples of Vashon recessional outwash. The organic content testing was completed in accordance with ASTM procedure D-2974 on samples collected from EB-3 at varying depths. The cation exchange capacity testing was completed in accordance with the Environmental Protection Agency (EPA) EPA-9081 test procedure. The results of these tests are included in Appendix C and summarized below in Table 3 and Table 4.

Table 3
Summary of Organic Burn Test Results

Exploration Boring No.	Sample Depth (feet)	Geologic Unit	Organic Content (%wt)
EB-3	7.5	Vashon Recessional Outwash	1.81
EB-3	15	Vashon Recessional Outwash	0.48
EB-3	20	Vashon Recessional Outwash	0.53

%wt = percent by weight

Table 4
Summary of Cation Exchange Capacity Test Results

Exploration Boring No.	Sample Depth (feet)	Geologic Unit	Cation Exchange Capacity (meq/100g)
EB-3	7.5	Vashon Recessional Outwash	5.1
EB-3	15	Vashon Recessional Outwash	2.7
EB-3	20	Vashon Recessional Outwash	2.7

meq/100g = milliequivalents per 100 grams

II. GEOLOGIC HAZARDS AND MITIGATIONS

The following discussion of potential geologic hazards is based on the geologic conditions as observed and discussed herein.

5.0 LANDSLIDE HAZARDS AND MITIGATIONS

The *City of Arlington Municipal Code* (AMC) classifies landslide hazards in subsection 20.93.600b(2) as the following:

- (A) *Areas characterized by slopes greater than fifteen percent and impermeable soils (typically silt and clay) frequently interbedded with permeable granular soils (predominantly sand and gravel) or impermeable soils overlain with permeable soils or springs or groundwater seepage;*
- (B) *Any area that has exhibited movement during the Holocene epoch (from ten thousand years ago to present) or which is underlain by mass wastage debris of that epoch;*
- (C) *Any area potentially unstable due to rapid stream incision, stream bank erosion or undercutting by wave action;*
- (D) *Any area located on an alluvial fan presently subject to or potentially subject to inundation by debris flows or deposition of stream-transported sediments;*
- (E) *Any area with a slope of thirty-three percent or greater and with a vertical relief of ten or more feet except areas composed of consolidated rock;*
- (F) *Any area with slope defined by the United States Department of Agriculture Soil Conservation Service as having a severe limitation for building site development; and*
- (G) *Any shoreline designated or mapped as class U, UOS, or URS by the Department of Ecology Coastal Zone Atlas.*

Portions of the infiltration pond slope meet criteria E above, for treatment of a landslide hazard. No exceptions were provided in the AMC, for slopes created by past grading activities to be exempt from the landslide hazard classification. As previously mentioned, these slopes were constructed during the mine reclamation process and construction of the infiltration pond. Currently, these slopes are vegetated with grass and other low-lying vegetation. During the completion of our site work, we observed no signs of slope instability of the pond slopes and no signs of groundwater seepage. At its steepest, the pond slopes are generally inclined at a 2H:1V

slope, which is a suitable permanent slope inclination for unsaturated existing fill or Vashon recessional outwash. We understand the project proposes to construct an infiltration vault in the vicinity of the infiltration pond and then backfill the remaining pond area up to adjacent grades. This process will eliminate the slope and any associated hazard. As long as the recommendations in this report are followed, the project will not increase the risk of the hazard on the subject property or neighboring properties.

Slopes less than 8 feet in height were observed in the Light Detection and Ranging (LiDAR)-based contours on Figure 2 near the south property line. These slopes appear to have been created during previous grading activities and are generally retained by ecology blocks and/or existing stockpiles of road repair and maintenance materials. We anticipate that the site improvements associated with this phase of the project will not alter the southern slope.

6.0 SEISMIC HAZARDS AND MITIGATIONS

The following discussion is a general assessment of seismic hazards that is intended to be useful to the project design team in terms of understanding seismic issues, and to the structural engineer for design.

All of Western Washington is at risk of strong seismic events resulting from movement of the tectonic plates associated with the Cascadia Subduction Zone (CSZ), where the offshore Juan de Fuca plate subducts beneath the continental North American plate. The site lies within a zone of strong potential shaking from subduction zone earthquakes associated with the CSZ. The CSZ can produce earthquakes up to magnitude 9.0, and the recurrence interval is estimated to be on the order of 500 years. Geologists infer the most recent subduction zone earthquake occurred in 1700 (Goldfinger et al., 2012¹). Three main types of earthquakes are typically associated with subduction zone environments: crustal, intraplate, and interplate earthquakes. Seismic records in the Puget Sound region document a distinct zone of shallow crustal seismicity (e.g., the Seattle Fault Zone). These shallow fault zones may include surficial expressions of previous seismic events, such as fault scarps, displaced shorelines, and shallow bedrock exposures. The shallow fault zones typically extend from the surface to depths ranging from 16 to 19 miles. A deeper zone of seismicity is associated with the subducting Juan de Fuca plate. Subduction zone seismic events produce intraplate earthquakes at depths ranging from 25 to 45 miles beneath the Puget Lowland including the 1949, 7.2-magnitude event; the 1965, 6.5-magnitude event; and the 2001, 6.8-magnitude event) and interplate earthquakes at shallow depths near the Washington coast including the 1700 earthquake, which had a magnitude of approximately 9.0. The 1949 earthquake appears to have been the largest in this region during recorded history and was

¹ Goldfinger, C., Nelson, C.H., Morey, A.E., Johnson, J.E., Patton, J.R., Karabanov, E., Gutierrez-Pastor, J., Eriksson, A.T., Gracia, E., Dunhill, G., Enkin, R.J., Dallimore, A., and Vallier, T., 2012: *Turbidite Event History—Methods and Implications for Holocene Paleoseismicity of the Cascadia Subduction Zone*: U.S. Geological Survey Professional Paper 1661–F, 170.

centered in the Olympia area. Evaluation of earthquake return rates indicates that an earthquake of the magnitude between 5.5 and 6.0 is likely within a given 20-year period.

Generally, there are four types of potential geologic hazards associated with large seismic events: 1) surficial ground rupture, 2) seismically induced landslides or lateral spreading, 3) liquefaction, and 4) ground motion. The potential for each of these hazards to adversely impact the proposed project is discussed below.

6.1 Surficial Ground Rupture

Generally, the largest earthquakes that have occurred in the Puget Sound area are sub-crustal events with epicenters ranging from 25 to 45 miles in depth. Earthquakes that are generated at such depths usually do not result in fault rupture at the ground surface. Based on current knowledge, the subject property is located several miles from known surface faults. Therefore, based on current information, the risk of damage to planned improvements as a result of surface rupture due to faulting is low, in our opinion.

6.2 Seismically Induced Landslides

Current project plans indicate that an infiltration vault will be constructed in the location of the existing steep-sided stormwater infiltration pond. The vault and pond will be backfilled during construction effectively eliminating the existing on-site slopes. Based on the proposed final site configuration and the lack of steep slopes at the site, it is our opinion that the risk of damage to the subject project by landsliding is low under either static or seismic conditions. No quantitative assessment of seismic slope stability was completed for the current study and none is warranted for the project as currently proposed, in our opinion.

6.3 Liquefaction

Liquefaction is a process through which unconsolidated soil loses strength as a result of vibrations, such as those which occur during a seismic event. During normal conditions, the weight of the soil is supported by both grain-to-grain contacts and by the fluid pressure within the pore spaces of the soil below the water table. Extreme vibratory shaking can disrupt the grain-to-grain contact, increase the pore pressure, and result in a temporary decrease in soil shear strength. The soil is said to be liquefied when nearly all of the weight of the soil is supported by pore pressure alone. Liquefaction can result in deformation of the sediment and settlement of overlying structures. Areas most susceptible to liquefaction include those areas underlain by very soft to stiff, non-cohesive silt and very loose to medium dense, non-silty to silty sands with low relative densities, accompanied by a shallow water table.

We reviewed liquefaction hazards for the new building. The exploration borings generally encountered medium dense native soils below the existing fills at depths between 5.5 and 19 feet

below the ground surface. Groundwater was encountered within the recessional outwash at a depth of 54.5 feet below the ground surface in EB-2 and a depth of 33 feet below the ground surface in EB-5. While saturated Vashon recessional outwash can be prone to liquefaction, groundwater was encountered approximately 54 feet below the surface near the proposed location of the new building. Current local practice assumes that liquefaction that occurs below a depth of about 50 feet will not propagate to the ground surface and result in significant settlement. Therefore, provided the new building is constructed at or above existing grade, the risk of significant liquefaction settlement affecting the new building will be low, in our opinion.

We also reviewed liquefaction hazards for the proposed infiltration vault. The vault base will be situated at a lower elevation, and closer to the water table. Therefore, the risk of liquefaction-induced settlement affecting the proposed infiltration vault may be somewhat greater. Based on the type of structure, the increased risk of liquefaction settlement affecting the vault does not warrant further study of mitigation measures, in our opinion.

No quantitative liquefaction hazard analysis was completed as part of this study and none is warranted based on observed subsurface conditions, in our opinion.

6.4 Ground Motion/Seismic Site Class (2021 International Building Code)

Structural design should follow 2021 *International Building Code* (IBC) standards using seismic Site Class "D" as defined in Table 20.3-1 of American Society of Civil Engineers (ASCE) 7-16 *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*. AESI is available on request to complete an analysis of seismic site class in accordance with ASCE 7-22 if the structural engineer predicts such an analysis would benefit the project.

7.0 EROSION HAZARDS AND MITIGATION

Section 20.93.600 (b) of the AMC defines Erosion Hazard Areas as the following:

- (1) *Erosion hazard areas are as defined by the USDA Soil Conservation Service, United States Geological Survey, or by the Department of Ecology Coastal Zone Atlas. The following classes are high erosion hazard areas.*
 - a. *Class 3, class U (unstable) includes severe erosion hazards and rapid surface runoff areas;*
 - b. *Class 4, class UOS (unstable old slides) includes areas having severe limitations due to slope; and,*
 - c. *Class 5, class URS (unstable recent slides).*

The on-site soils do not meet the requirements of AMC 20.93.600 (b) and is therefore not considered an erosion hazard under the AMC. Furthermore, the property is not within a stream channel migration zone and is not situated along a shoreline.

Although the site is not classified as an Erosion Hazard Area, the fill and natural sediments underlying the site contain quantities of silt and fine sand that are sensitive to disturbance when wet. In order to mitigate erosion hazards and the potential for off-site sediment transport, we recommend the following best management practices (BMPs):

1. Construction activity should be scheduled or phased as much as possible to avoid earthwork activity during the wet season.
2. The winter performance of a site is dependent on a well-conceived plan for control of site erosion and stormwater runoff. The site plan should include ground-cover measures and staging areas. The contractor should be prepared to implement and maintain the required measures to reduce the amount of exposed ground.
3. Temporary erosion and sedimentation control (TESC) elements and perimeter flow control should be established prior to the start of grading.
4. During the wetter months of the year, or when significant storm events are predicted during the summer months, the work area should be stabilized so that if showers occur, it can receive the rainfall without excessive erosion or sediment transport. The required measures for an area to be "buttoned-up" will depend on the time of year and the duration that the area will be left unworked. During the winter months, areas that are to be left unworked for more than 2 days should be mulched or covered with plastic. During the summer months, stabilization will usually consist of seal-rolling the subgrade. Such measures will aid in the contractor's ability to get back into a work area after a storm event. The stabilization process also includes establishing temporary stormwater conveyance channels through work areas to route runoff to the approved treatment/discharge facilities.
5. All disturbed areas should be revegetated as soon as possible. If it is outside of the growing season, the disturbed areas should be covered with mulch. Straw mulch provides a cost-effective cover measure and can be made wind-resistant with the application of a tackifier after it is placed.
6. Surface runoff and discharge should be controlled during and following development. Uncontrolled discharge may promote erosion and sediment transport.

7. Soils that are to be reused around the site should be stored in such a manner as to reduce erosion from the stockpile. Protective measures may include, but are not limited to, covering stockpiles with plastic sheeting or the use of silt fences around pile perimeters.

It is our opinion that with the proper implementation of the TESC plans and by field-adjusting appropriate erosion mitigation (BMPs) throughout construction, the potential adverse impacts from erosion hazards on the project should be mitigated.

DRAFT

III. PRELIMINARY DESIGN RECOMMENDATIONS

8.0 INTRODUCTION

Our exploration indicates that, from a geotechnical engineering standpoint, the proposed Phase 1 site improvements at the subject site are feasible. At the time this report was written, the project was still in the conceptual design phase and final project plans were not available.

Our explorations encountered Vashon recessional outwash beneath a thin layer of topsoil and varying thickness of fill. Fill soils were observed to be the thickest near the edges of the existing stormwater infiltration pond where previous grading and filling occurred during previous site reclamation. Existing fill soils are not suitable for foundation support. Groundwater is present in the recessional outwash sediments, at estimated depths of 52 feet to 59 feet below the surface in the vicinity of the proposed new building. At this depth we do not anticipate that groundwater will be a factor during construction of the proposed improvements. Due to the thickness of the existing fill, we have provided recommendations for a ground improvement system to support the proposed building. Due to the location and anticipated depth of the proposed infiltration vault, we expect the vault can be supported by conventional shallow foundations.

Stormwater infiltration is considered feasible within the recessional outwash sediments. Recessional outwash was encountered near the proposed infiltration vault location at an elevation of approximately 114.5 feet. Where observed as permeable and unsaturated, these sediments are a suitable stormwater infiltration receptor. We have included a discussion on shallow stormwater infiltration later in this report.

9.0 SITE PREPARATION

Prior to site work, erosion and surface water control should be established around the perimeter of the site to satisfy the City of Arlington requirements.

9.1 Clearing and Stripping

Existing pavements, buried utilities, vegetation, topsoil, and any other deleterious materials should be removed where they are located below planned Phase 1 construction areas. Any disturbed soils or depressions, such as those that may be caused by demolition activities, below planned final grades should be compacted with a smooth-drum, vibratory roller to at least 90 percent of the modified Proctor maximum dry density, as determined by the ASTM D-1557 test procedure, and to a firm and unyielding surface, then structural fill should be placed to reach planned grades as discussed under the "Structural Fill" section of this report.

Where excavated existing fill and natural sediments are free of organics and near their optimum moisture content for compaction they can be segregated and considered for reuse as structural fill, if allowed by project specifications. Some of the existing fills and outwash sediments encountered in our explorations contained a moderate silt fraction and are moisture sensitive. These siltier soils may be difficult to reuse as structural fill except during the drier summer months.

9.2 Temporary Cut Slopes

In our opinion, stable construction slopes should be the responsibility of the contractor and should be determined during construction based on the conditions encountered at that time. For estimating purposes, however, we anticipate that temporary, unsupported cut slopes in unsaturated existing fill or unsaturated medium dense recessional outwash can be made at a maximum slope of 1.5H:1V or flatter. As is typical with earthwork operations, some sloughing and raveling may occur, and cut slopes may have to be adjusted in the field. In addition, WISHA/OSHA regulations should be followed at all times. If steeper or deeper cuts are required, then temporary shoring may be necessary.

9.3 Site Disturbance

Most of the near-surface site soils are fills which have a variable grain size and can contain a moderate percentage of fine-grained material, which makes them moisture-sensitive and subject to disturbance when wet. Some of the fill soils may be above their optimum moisture content for compaction when exposed during construction. The contractor must use care during site preparation and excavation operations so that the underlying soils are not softened, particularly during wet weather conditions. If disturbance occurs in areas of conventional footings such as the area for the infiltration vault, the softened soils should be removed and the area brought to grade with clean crushed rock fill. Because of the moisture-sensitive nature of the soils, we anticipate that wet weather construction would significantly increase the earthwork costs over dry weather construction.

9.4 Winter Construction

The near-surface fill soils can contain moderate quantities of silt and fine sand and are considered moisture-sensitive. Soils excavated onsite may require drying during favorable dry weather conditions to allow their reuse in structural fill applications. Care should be taken to seal all earthwork areas during mass grading at the end of each workday by grading all surfaces to drain and sealing them with a smooth-drum roller. Stockpiled soils that will be reused in structural fill applications should be covered whenever rain is possible.

If winter construction is expected, crushed rock fill should be used to provide construction staging areas where exposed soil is present. The stripped subgrade should be observed by

the geotechnical engineer, and should then be covered with a geotextile fabric, such as Mirafi 500X or equivalent. Once the fabric is placed, we recommend using a crushed rock fill layer at least 10 inches thick in areas where construction equipment will be used. Soil-cement treatment is another approach to providing a workable site during the winter. We are available to provide more detailed cement-treatment recommendations on request.

9.5 Frozen Subgrades

If earthwork takes place during freezing conditions, all exposed subgrades should be allowed to thaw, and then be recompacted prior to placing subsequent lifts of structural fill. Alternatively, the frozen material could be stripped from the subgrade to reveal unfrozen soil prior to placing subsequent lifts of fill. The frozen soil should not be reused as structural fill until allowed to thaw and adjusted to the proper moisture content, which may not be possible during winter months.

10.0 STRUCTURAL FILL

We anticipate that structural fill will be required to establish design elevations and fill around the proposed infiltration vault, below pavements and for the backfill of utilities. Structural fill should be placed and compacted according to the recommendations presented in this section and requirements included in project specifications. All references to structural fill in this report refer to subgrade preparation, fill type, placement, and compaction of materials, as discussed in this section. If a percentage of compaction is specified under another section of this report, the value given in that section should be used.

10.1 Compaction

Structural fill is defined as non-organic soil, acceptable to the geotechnical engineer, placed in maximum 8-inch loose lifts, with each lift being compacted to at least 95 percent of the modified Proctor maximum dry density using ASTM D-1557 as the standard. For backfill of buried utilities in the right-of-way, the backfill should be placed and compacted in accordance with applicable codes and standards.

10.2 Reuse of Site Soils

Soils in which the amount of fine-grained material (smaller than No. 200 sieve) is greater than approximately 5 percent (measured on the minus No. 4 sieve size) should be considered moisture-sensitive. Use of moisture-sensitive soil in structural fills should be limited to favorable dry weather conditions.

Those portions of the existing fills that are free of organic debris and other deleterious materials and that have moisture contents suitable for achieving the recommended level of compaction

may be used as structural fill. At the time of our field study, the moisture contents of the existing fill and recessional outwash sediments encountered in our explorations appeared to be near, or slightly over optimum for achieving suitable compaction. If, at the time of construction, the moisture content of the on-site soil is outside the optimum level to achieve suitable compaction, it should be moisture-conditioned prior to its use as structural fill. This could be achieved by either adding water if the soil is too dry, or aerating the soil during periods of warm, dry weather (typically July through September) if the soil is too wet.

10.3 Wet Weather Fill

Use of moisture-sensitive soil in structural fills is not recommended during the winter or spring months or under wet site and weather conditions. In addition, construction equipment traversing the site when the soils are wet can cause considerable disturbance. If import soil is required, a select import material consisting of a clean, free-draining gravel and/or sand should be used. Free-draining fill consists of non-organic soil with the amount of fine-grained material limited to 5 percent by weight when measured on the minus No. 4 sieve fraction and at least 30 percent retained on the No. 4 sieve.

10.4 Compaction Testing

A representative from our firm should observe the subgrades and be present during placement of structural fill to observe the work and perform a representative number of in-place density tests. In this way, the adequacy of the earthwork may be evaluated as filling progresses and any problem areas may be corrected at that time. It is important to understand that taking random compaction tests on a part-time basis will not assure uniformity or acceptable performance of a fill. As such, we are available to aid the owner in developing a suitable monitoring and testing frequency.

11.0 FOUNDATIONS

Based on the conceptual plans for this phase of the project we understand that the new administrative and crew building will be constructed at or near the existing grade near the southeast corner of the site. Our explorations near this location encountered up to 19 feet of existing loose fill soils, not suitable for foundation support. Underlying the loose fill we encountered native sediments generally consisting of medium dense Vashon recessional outwash sediments. Due to the depth to the suitable bearing material we recommend a ground improvement strategy to transfer the building loads to the Vashon recessional sediments present below the existing loose fill. We have provided recommendations for ground improvement through stone columns or aggregate piers below.

As alternative foundation options AESI also assessed deep foundation systems including pipe pile foundations and augercast piles. We determined that both of these options had challenges that rendered them not as favorable as the aggregate pier option provided below. For a pipe pile foundation system, we found that it is unlikely the driven, small-diameter, piles would achieve the required refusal criteria in the Vashon recessional outwash sediments, resulting in pile lengths that could approach 100 feet. Augercast piles were also assessed as a potential option and were considered not as favorable as ground improvement for foundation support. Because of the code requirement for full-depth reinforcement, augercast piles have a maximum practical installation depth of about 50 feet, which is not deep enough to fully penetrate the liquefiable soils and achieve the desired capacities within the deeper, non-liquefiable sediments.

11.1 Stone Columns or Aggregate Piers (Administrative Building)

A ground improvement program consisting of vibratory stone columns or rammed aggregate piers (RAPs) may be used to provide building foundation and slab-on-grade support. The ground improvement system would be designed by the ground improvement contractor to mitigate and limit post-construction differential settlements to structural design requirements. Subsequent to completion of the ground improvement program, the building could be supported using conventional spread footing foundations.

The ground improvement contractor in conjunction with the project structural engineer should provide the final spacing, depths, and diameters of the stone columns/aggregate piers. For project planning purposes, shallow foundations bearing on properly completed stone columns/aggregate piers can typically be designed for an allowable soil bearing pressure ranging from 4,000 to 6,000 pounds per square foot (psf).

Since the geologic conditions are expected to be variable between exploration locations, provisions should be included in the plans and contract documents to allow for adjustments in the extent of the ground improvement area within the building footprint based on the soil conditions encountered at the time of construction. No building loading information was available at the time of this report.

11.2 Conventional Spread Footings (Stormwater Infiltration Vault)

Based on the elevation and limited thickness of fill in the area of the proposed infiltration vault we anticipate that conventional shallow spread footings can be utilized without the use of ground improvement. Conventional spread footings can be founded directly on medium dense to dense Vashon recessional outwash or on structural fill placed over these sediments. For foundations bearing on sediments as described above, we recommend that foundations be designed using an allowable foundation soil bearing pressure of 3,000 psf, including both dead and live loads. An increase of one-third may be used for short-term wind or seismic loading.

11.3 Additional Foundation Recommendations for Building and Vault

Perimeter footings should be buried at least 18 inches into the surrounding soil for frost protection. However, all footings must penetrate to the prescribed bearing stratum, and no footing should be founded in or above organic or loose soils. All footings should have a minimum width of 18 inches.

It should be noted that the area bound by lines extending downward at 1H:1V from any footing must not intersect another footing or intersect a filled area that has not been compacted to at least 95 percent of ASTM D-1557. In addition, a 1.5H:1V line extending down from any footing must not daylight because sloughing or raveling may eventually undermine the footing. Thus, footings should not be placed near the edge of steps or cuts in the bearing soils.

Anticipated settlement of footings founded as described above should be on the order of 1 inch or less. Disturbed soil not removed from footing excavations prior to footing placement could result in increased settlements. All footing areas should be inspected by AESI prior to placing concrete to verify that the design bearing capacity of the soils has been attained and that construction conforms to the recommendations contained in this report. Such inspections may be required by the City of Arlington. Perimeter footing drains for the building should be provided as discussed under the "Drainage Considerations" section of this report. A perimeter foundation drain for the vault can be omitted because any groundwater seepage adjacent to the vault walls is expected to infiltrate into the recessional outwash sediments.

11.4 Passive Resistance and Friction Factors

Lateral loads can be resisted by friction between the foundation and the existing fill, exposed outwash soils or supporting structural fill soils, and by passive earth pressure acting on the buried portions of the foundations. The foundations must be backfilled with structural fill and compacted to at least 95 percent of the maximum dry density to achieve the passive resistance design values recommended below. We recommend the following allowable design parameters which include a factor of safety of 1.5:

- Passive equivalent fluid = 300 pounds per cubic foot (pcf)
- Coefficient of friction = 0.30

12.0 FLOOR SUPPORT

Building slab-on-grade floors may be constructed on a subgrade improved by stone columns or aggregate piers. Areas of the slab subgrade that are disturbed (loosened) during construction should be recompacted to an unyielding condition prior to placing the pea gravel, as described below.

In order to control moisture vapor transfer through the slab, slab-on-grade floors should be constructed atop a capillary break consisting of a minimum thickness of 4 inches of washed pea gravel or washed crushed rock. The pea gravel or clean crushed rock should be overlain by a 10-mil (minimum thickness) plastic vapor retarder.

13.0 CAST-IN-PLACE RETAINING WALLS AND BELOW-GRADE WALLS

All backfill placed behind site walls and foundation walls should be placed in accordance with the recommendations contained in the “Structural Fill” section of this report. Horizontally backfilled walls, which are free to yield laterally at least 0.1 percent of their height, may be designed to resist lateral earth pressure represented by an equivalent fluid pressure equal to 35 pounds per cubic foot (pcf). Fully restrained, horizontally backfilled, rigid walls that cannot yield should be designed for an equivalent fluid pressure of 55 pcf. Walls with sloping backfill up to a maximum gradient of 2H:1V should be designed using an equivalent fluid pressure of 55 pcf for yielding conditions or 75 pcf for fully restrained conditions. It should be noted that the lateral earth pressures presented above are applicable for medium dense native soils or properly compacted structural fill.

If vehicle parking areas are adjacent to walls, we recommend a vertical surcharge equal to 250 psf be added to the wall height in determining the lateral design forces. The lateral pressure resulting from each vertical surcharge can be calculated by multiplying the surcharge load by 0.4 and applying the load as a rectangular distribution along the height of the wall.

As required by the 2021 IBC, retaining wall design should include a seismic surcharge pressure in addition to the equivalent fluid pressures presented above. Considering the site soils and the recommended wall backfill materials, we recommend a seismic surcharge pressure of 10H and 14H psf, where H is the wall height in feet for the “active” and “at-rest” loading conditions, respectively. The seismic surcharge should be modeled as a rectangular distribution with the resultant applied at the midpoint of the walls.

14.0 DRAINAGE CONSIDERATIONS

Traffic across the on-site fill soils when they are damp or wet will result in disturbance of the otherwise firm stratum. Therefore, during site work and construction, the contractor should provide surface drainage and subgrade protection, as necessary.

All perimeter footings, slabs, and retaining walls should be provided with a drain at the footing or subgrade elevation, with the exception of the infiltration vault. Drains should consist of rigid, perforated, PVC pipe surrounded by washed gravel. The level of the perforations in the pipe should be set at the bottom of the footing, and the perforations should be located on the lower

portion of the pipe. The drains should be constructed with sufficient gradient to allow gravity discharge away from the structures. In addition, any retaining or subgrade walls should be lined with a minimum, 12-inch-thick, washed gravel blanket. The drainage aggregate or composite should tie into and freely communicate with the footing drains. Roof and surface runoff should not discharge into the footing drain system, but should be handled by a separate, rigid, tightline drain.

To minimize erosion, stormwater discharge or concentrated runoff should not be allowed to flow down any steep slopes. In planning, exterior grades adjacent to walls should be sloped downward away from the structures at an inclination of at least 3 percent to achieve surface drainage. Runoff water from impervious surfaces should be collected by a storm drain system that discharges into the site stormwater system.

15.0 INFILTRATION FEASIBILITY

Stormwater infiltration feasibility depends upon the presence of a suitable native receptor soil of sufficient thickness, extent, permeability, and vertical separation from the groundwater table. Overall, infiltration appears feasible into the Vashon recessional outwash encountered in our explorations. At the time this report was prepared, project plans were in the conceptual phase and the elevation of the infiltration facility subgrade was not established.

Permeable Vashon advance outwash sediments were encountered in EB-3 near the proposed infiltration vault at an estimated elevation of about 114.5 feet. These sediments generally consisted of fine or fine to medium sand with varying amounts of gravel and trace silt.

We encountered the groundwater table in this boring at about elevation 87 feet at the time of drilling. Groundwater levels in the Vashon recessional outwash fluctuate and current project information as described in Section 4.3 measured groundwater at estimated elevation 94 feet.

Design of the infiltration facility will need to follow the 2019 Washington State Department of Ecology (Ecology) *Stormwater Management Manual for Western Washington* (Ecology Manual). The Ecology Manual requires the infiltration facility to have at least 5 feet of vertical separation from the groundwater table, which can be reduced to 3 feet with a mounding analysis.

For preliminary planning and conceptual sizing purposes only, we recommend use of an estimated long-term design infiltration rate of 5 inches per hour for the proposed infiltration facility.

Additional studies will be required to provide final design infiltration rates for site- and project-specific design described in the Ecology Manual. For a facility sized to receive runoff from more than 10 acres, these studies will include:

- Site-specific explorations (minimum of two) in the footprint of the proposed facility.
- Infiltration testing (minimum of two). The infiltration tests should take place at the bottom elevation of the proposed infiltration system.
- Groundwater level monitoring and groundwater flow direction. The existing water level data may satisfy this requirement.
- Groundwater mounding.
- Review of the infiltration facility design relative to Site Suitability Criteria.

16.0 PAVEMENT RECOMMENDATIONS

The pavement sections included in this report section are for driveway and parking areas onsite and are not applicable to right-of-way improvements. At this time, we are not aware of any planned right-of-way improvements; however, if any new paving of public streets is required, we should be allowed to offer situation-specific recommendations.

Pavement areas should be prepared in accordance with the “Site Preparation” section of this report. If the stripped existing fill soils exposed at pavement subgrade can be compacted to 95 percent of ASTM D-1557 and is firm and unyielding, no additional overexcavation is required. Soft or yielding areas should be overexcavated to provide a suitable subgrade and backfilled with structural fill. The upper 2 feet of pavement subgrade should be recompacted to 95 percent of ASTM D-1557. If required, structural fill may then be placed to achieve desired subbase grades.

Based on the conceptual plans the project will include an expansion of the east parking lot area. We anticipate this parking lot will be subject to light-duty pavements for passenger vehicles and heavy-duty pavements for fire trucks and garbage trucks. In light-duty traffic areas, we recommend a pavement section consisting of 3 inches of hot-mix asphalt (HMA) underlain by 4 inches of crushed surfacing base course (CSBC) as the recommended minimum in areas of planned passenger car lanes and parking. In heavy-duty traffic areas, a minimum pavement section consisting of 4 inches of HMA underlain by 6 inches of CSBC is recommended. The CSBC must be compacted to 95 percent of the maximum density, as determined by ASTM D-1557. All paving materials should meet gradation criteria contained in the current Washington State Department of Transportation (WSDOT) Standard Specifications. If the parking lot expansion will be subjected to continued heavy equipment traffic, we should be allowed to reassess our heavy pavement section recommendations.

Depending on construction staging and desired performance, the crushed base course material may be substituted with asphalt treated base (ATB) beneath the final asphalt surfacing. The substitution of ATB should be as follows: 4 inches of crushed rock can be substituted with 3 inches of ATB, and 6 inches of crushed rock may be substituted with 4 inches of ATB. ATB should be placed over a firm and unyielding subgrade as determined by proof-rolling and a 1½- to 2-inch thickness of crushed rock to act as a working surface. If ATB is used for construction access and staging areas, some rutting and disturbance of the ATB surface should be expected.

The general contractor should remove affected areas and replace them with properly compacted ATB prior to final surfacing.

17.0 PROJECT DESIGN AND CONSTRUCTION MONITORING

We recommend that AESI perform a geotechnical review of the plans prior to final design completion. In this way, our recommendations may be properly interpreted and implemented in the design. We are also available to provide geotechnical engineering and monitoring services during construction. The integrity of the foundation system depends on proper site preparation and construction procedures. In addition, engineering decisions may have to be made in the field in the event that variations in subsurface conditions become apparent. Construction monitoring services are not part of our currently approved scope of work.

We have enjoyed working with you on this study and are confident these recommendations will aid in the successful completion of your project. If you should have any questions or require further assistance, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

DRAFT

Brendan C. Young, L.G.
Senior Staff Geologist

DRAFT

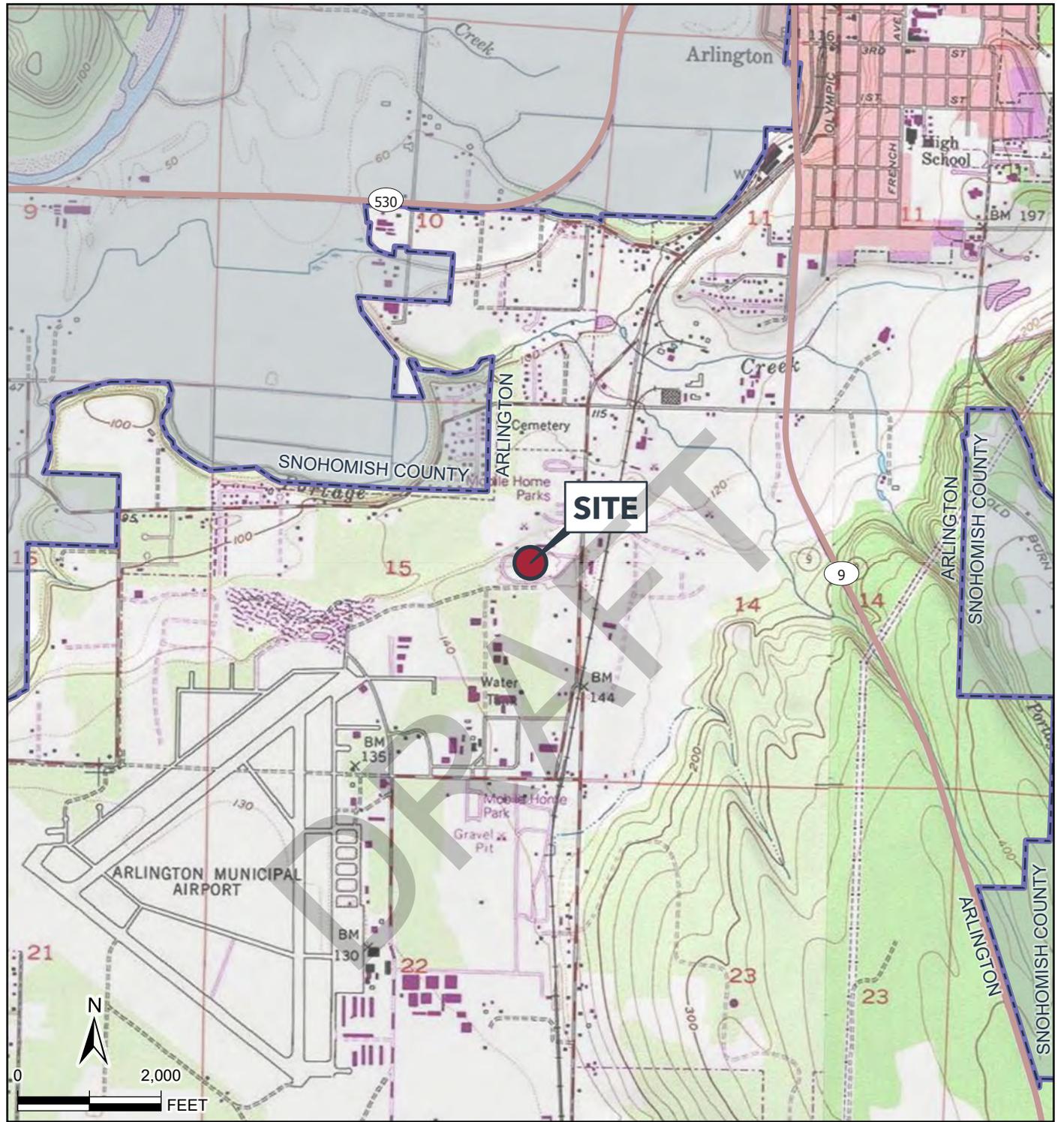
Anthony W. Romanick, P.E.
Senior Engineer

DRAFT

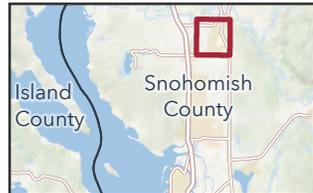
Kurt D. Merriman, P.E.
Senior Principal Engineer

Attachments

- Figure 1: Vicinity Map
- Figure 2: Existing Site and Exploration Plan
- Figure 3: Proposed Site Improvements
- Appendix A: Exploration Logs
- Appendix B: Historical Exploration Logs
- Appendix C: Laboratory Testing
- Appendix D: Hydrographs



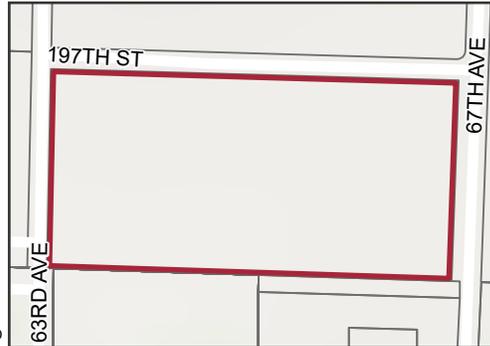
COUNTY LOCALE



ESRI, USGS, NATIONAL GEOGRAPHIC, DELORME, NATURALVUE, I-CUBED, GEBCO; ARCGIS ONLINE BASEMAP, WADOT STATE ROUTES 24K (12/20), SNOHOMISH CO: PARCELS, ROADS (3/24).

NOTE: LOCATION AND DISTANCES SHOWN ARE APPROXIMATE. BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION.

LOCATION



associated
earth sciences
incorporated

VICINITY MAP

ARLINGTON OPERATIONS CENTER REDEVELOPMENT
ARLINGTON, WASHINGTON

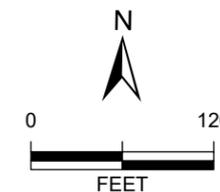
PROJECT NO. 2024001E001	DATE 4/24	FIGURE 1
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LEGEND

- SITE
- EXPLORATION BORING (AESI, 2024)
- EXPLORATION PIT (AESI, 1999)
- EXPLORATION BORING (SNOHOMISH COUNTY, 2015)
- EXPLORATION BORING (TERRACON, 2016)
- EXPLORATION BORING (SHANNON & WILSON, 2019)
- ADMIN/CREW 2-STORY
- VAULT
- ~ CONTOUR 10 FT
- ~ CONTOUR 2 FT
- PARCEL



DATA SOURCES/REFERENCES:
SNOHOMISH COUNTY: TAX PARCELS (3/24), STREETS (3/24).
AERIAL IMAGERY (2022, PICTOMETRY).
WA DNR LIDAR: NORTH_PUGET_2017 ACQUIRED MARCH TO SEPT 2016, 3' CELL SIZE. CONTOURS DERIVED FROM LIDAR.

BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION. LOCATION AND DISTANCES SHOWN ARE APPROXIMATE.



EXISTING SITE AND EXPLORATION PLAN

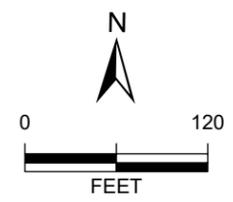
ARLINGTON OPERATIONS CENTER REDEVELOPMENT
ARLINGTON, WASHINGTON

PROJECT NO. 20240001E001	DATE 5/24	FIGURE 2
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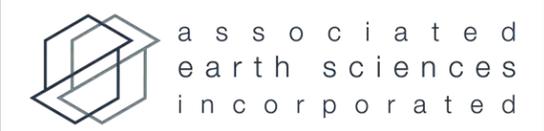


- LEGEND**
- SITE
 - EXPLORATION BORING (AESI, 2024)
 - EXPLORATION PIT (AESI, 1999)
 - EXPLORATION BORING (SNOHOMISH COUNTY, 2015)
 - EXPLORATION BORING (TERRACON, 2016)
 - EXPLORATION BORING (SHANNON & WILSON, 2019)
 - CONTOUR 10 FT
 - CONTOUR 2 FT
 - PARCEL



DATA SOURCES/REFERENCES:
 SNOHOMISH COUNTY: TAX PARCELS (3/24), STREETS (3/24).
 AERIAL IMAGERY (2022, PICTOMETRY).
 WA DNR LIDAR: NORTH_PUGET_2017 ACQUIRED MARCH TO SEPT 2016. 3' CELL SIZE. CONTOURS DERIVED FROM LIDAR.
 PHASE 1 SITE PLAN.

BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION. LOCATION AND DISTANCES SHOWN ARE APPROXIMATE.



PROPOSED SITE IMPROVEMENTS
 ARLINGTON OPERATIONS CENTER REDEVELOPMENT
 ARLINGTON, WASHINGTON

PROJECT NO. 20240001E001	DATE 5/24	FIGURE 3
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<p>195TH ST Key</p> <ul style="list-style-type: none"> ① Fleet Maintenance: 27,400 sf ② Sand: 8,250 sf ③ Salt: 8,250 sf ④ Covered Storage: 10,402 sf ⑤ Wash: 4,798 sf ⑥ Generator: 1,537 sf ⑦ Heated Shops: 5,100 sf 	<ul style="list-style-type: none"> ⑧ Heated Shops: 12,900 sf ⑨ Heated Shop: 3,300 sf ⑩ Bridge Shop: 2,800 sf ⑪ Vault: 15,376 sf ⑫ Admin/Crew (2-story): 15,048 sf ⑬ Small equipment: 11,200 sf ⑭ Helipad 	<ul style="list-style-type: none"> ⑮ Storage: 3,130 sf Unheated building Heated building Covered parking Heated covered parking Landscape planting 	<ul style="list-style-type: none"> Phase I Storm drainage Sanitary sewer Water Power Gas
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Phase I Site Plan

APPENDIX A

Exploration Logs

DRAFT

Coarse-Grained Soils - More than 50% ⁽¹⁾ Retained on No. 200 Sieve	Gravels - More than 50% ⁽¹⁾ of Coarse Fraction Retained on No. 4 Sieve		GW Well-graded gravel and gravel with sand, little to no fines
			GP Poorly-graded gravel and gravel with sand, little to no fines
	Sands - 50% ⁽¹⁾ or More of Coarse Fraction Passes No. 4 Sieve		GM Silty gravel and silty gravel with sand
			GC Clayey gravel and clayey gravel with sand
Fine-Grained Soils - 50% ⁽¹⁾ or More Passes No. 200 Sieve	Sands - 50% ⁽¹⁾ or More of Coarse Fraction Passes No. 4 Sieve		SW Well-graded sand and sand with gravel, little to no fines
			SP Poorly-graded sand and sand with gravel, little to no fines
	Sils and Clays Liquid Limit Less than 50		SM Silty sand and silty sand with gravel
			SC Clayey sand and clayey sand with gravel
Sils and Clays Liquid Limit 50 or More	Sils and Clays Liquid Limit Less than 50		ML Silt, sandy silt, gravelly silt, silt with sand or gravel
			CL Clay of low to medium plasticity; silty, sandy, or gravelly clay, lean clay
	Sils and Clays Liquid Limit 50 or More		MH Elastic silt, clayey silt, silt with micaceous or diatomaceous fine sand or silt
			CH Clay of high plasticity, sandy or gravelly clay, fat clay with sand or gravel
Highly Organic Soils		OH Organic clay or silt of medium to high plasticity	
		PT Peat, muck and other highly organic soils	

Terms Describing Relative Density and Consistency

Coarse-Grained Soils	<u>Density</u>	<u>SPT⁽³⁾ blows/foot</u>	Test Symbols G = Grain Size M = Moisture Content A = Atterberg Limits C = Chemical DD = Dry Density K = Permeability
	Very Loose	0 to 4	
	Loose	4 to 10	
	Medium Dense	10 to 30	
	Dense	30 to 50	
Fine-Grained Soils	Very Dense	>50	
	<u>Consistency</u>	<u>SPT⁽³⁾ blows/foot</u>	
	Very Soft	0 to 2	
	Soft	2 to 4	
	Medium Stiff	4 to 8	
	Stiff	8 to 15	
Very Stiff	15 to 30		
Hard	>30		

Component Definitions

<u>Descriptive Term</u>	<u>Size Range and Sieve Number</u>
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

(4) Estimated Percentage

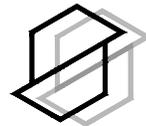
<u>Component</u>	<u>Percentage by Weight</u>	Moisture Content Dry - Absence of moisture, dusty, dry to the touch Slightly Moist - Perceptible moisture Moist - Damp but no visible water Very Moist - Water visible but not free draining Wet - Visible free water, usually from below water table
Trace	<5	
Some	5 to <12	
<i>Modifier</i> (silty, sandy, gravelly)	12 to <30	
Very <i>modifier</i> (silty, sandy, gravelly)	30 to <50	

Symbols

<u>Sampler Type and Description</u>	<u>Groundwater depth</u>	
Blows/6" or portion of 6"	ATD	
Split-Spoon Sampler (SPT)	At time of drilling	
California Sampler	Static water level (date)	
Ring Sampler		
Continuous Sampling		
Grab Sample		
Portion not recovered		

Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.

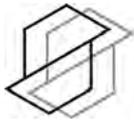
(1) Percentage by dry weight
 (2) Combined USCS symbols used for fines between 5% and 12%
 (3) (SPT) Standard Penetration Test (ASTM D-1586)
 (4) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)



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EXPLORATION LOG KEY

FIGURE: **A1**



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Exploration Boring

EB-1

Arlington Operations Center Redevelopment

Sheet: 1 of 3

Arlington, WA

Start Date: 4/23/24

Logged By: BCY

20240001E001

Ending Date: 4/23/24

Approved By: JHS

Driller/Equipment: Advance Drill Technology / D-50

Total Depth (ft): 51.5

Hammer Weight/Drop: 140#/30"

Ground Surface Elevation (ft): ≈140

Hole Diameter (in): 6

Datum: NAVD 88

Groundwater Depth ATD (ft): N/A

Groundwater Depth Post Drilling (ft) (Date): ()

Depth (ft)	Sample Type	Sample	% Recovery	Graphic Symbol	Description	Water Level	Blows/6"					Other Tests	
							10	20	30	40	50+		
0					Sod / Topsoil - 4 inches Fill								
					Some gravel chatter.								
2.5		1			Slightly moist, dark brown, silty, fine SAND, some gravel; scattered to abundant organics (rootlets and wood debris) (SM).		4	4	4	4			
5		2			As above; scattered organics (rootlets); poor recovery.		2	3	8				
		3			Cal Mod at 5.5: Moist, dark brown mixed with gray, very silty, fine SAND, trace to some gravel; abundant organics (rootlets and wood); scattered construction debris; distorted texture (SM).		5	1	10				
7.5		4			Becomes dark gray; occasional organics (wood and rootlets); poor recovery (SM).		4	5	10				
10		5			Grades to some gravel; scattered organics (rootlets); layer (at 9 feet, 6 inches thick) of heavily oxidized to orange, fine sand, some gravel. Becomes very moist; rare to scattered organics (rootlets).		3	2	5				
12.5		6			Moist, dark gray transitioning to gray in lower 6 inches, silty, fine SAND, some gravel; rare organics (rootlets); less silty with depth; becomes gray, silty, fine to coarse sand, some fine gravel (SM).		3	4	12				
15		7			Moist, gray, silty, SAND, some gravel (angular); scattered organics (rootlets and fine organics); poor recovery (SM). Cal Mod: Gray, brown, silty, fine to coarse SAND; cobbles (broken); pockets at bottom of sample of brown, silty, sand, organic laden (SM).		4	7	31				
17.5							24						

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Exploration Boring

EB-1

Arlington Operations Center Redevelopment

Sheet: 2 of 3

Arlington, WA

Start Date: 4/23/24

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20240001E001

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Hole Diameter (in): 6

Datum: NAVD 88

Groundwater Depth ATD (ft): N/A

Groundwater Depth Post Drilling (ft) (Date): ()

Depth (ft)	Sample Type	Sample	% Recovery	Graphic Symbol	Description	Water Level	Blows/6"	Blows/Foot					Other Tests			
								10	20	30	40	50+				
20		8			<p>Marysville Recessional Outwash</p> <p>Slightly moist, grayish brown with orange oxidation, gravelly, fine to coarse SAND, trace silt; etching around gravel; some brown sand in top of sample; broken gravel in split spoon; blow count overstated (SP).</p>	7	15	24								
22.5																
25		9			<p>Slightly moist, brown and grayish brown, gravelly, medium to coarse SAND; interbed of brown, fine SAND; blow counts overstated; broken gravel in spoon (SP).</p>	14	24	22								
27.5																
30		10			<p>Moist, grayish brown, fine sandy, SILT; interbeds (1/4 inch thick) of fine sand; layers becoming gray, fine to medium sand, trace fine gravel (ML).</p>	4	18	20								
32.5																
35		11			<p>Slightly moist, grayish brown, fine to medium SAND, some gravel; cross beds (<1 inch thick) of orangish brown, fine sand (SP).</p>	12	14	15								
37.5																

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Arlington Operations Center Redevelopment

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Hole Diameter (in): 6

Datum: NAVD 88

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Groundwater Depth Post Drilling (ft) (Date): ()

Depth (ft)	Sample Type	Sample	% Recovery	Graphic Symbol	Description	Water Level	Blows/6"	Blows/Foot					Other Tests	
								10	20	30	40	50+		
40		12			Slightly moist, grayish brown, fine to medium SAND; rare gravel; massive (SP).	12 13 13	26							
45		13			Slightly moist, grayish brown, fine to medium SAND; massive (SP).	7 9 10	19							
50		14			Very moist, grayish brown, medium SAND, some fine sand, trace gravel; layers (6 inches thick) of brownish gray, fine sand at tip of sampler (SP).	10 10 11	21							
52.5					No groundwater observed.									
55														

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EB-2

Arlington Operations Center Redevelopment

Sheet: 1 of 4

Arlington, WA

Start Date: 4/23/24

Logged By: BCY

20240001E001

Ending Date: 4/23/24

Approved By: JHS

Driller/Equipment: Advance Drill Technology / D-50

Total Depth (ft): 61.5

Hammer Weight/Drop: 140#/30"

Ground Surface Elevation (ft): 146

Hole Diameter (in): 6

Datum: NAVD 88

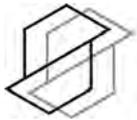
Groundwater Depth ATD (ft): 54.5

Groundwater Depth Post Drilling (ft) (Date): ()

Depth (ft)	Sample Type	Sample	% Recovery	Graphic Symbol	Description	Water Level	Blows/6"					Other Tests	
							10	20	30	40	50+		
0					Sod and Topsoil - 4 inches								
					Fill								
					Gravel chatter.								
2.5		1			Slightly moist, brown mixed with gray to dark gray, silty, fine SAND, some gravel; abundant organics (roots and wood); layers of crushed angular gravel, some light brown silt (SM).		10	5	3				
5		2			Slightly moist, dark gray, silty, SAND, some gravel; occasional fine organics; layer (6 inches thick) of moist, brown and tan, fine to coarse sand, some gravel, trace silt (SM). Driller notes gravel still loose drilling.		3	3	2				
7.5													
10		3			Moist, brown to orange brown, fine to medium SAND, some silt, some gravel; abundant fine black organics (SP-SM).		3	3	3				
12.5													
15		4			Moist, dark brown with some orange brown, fine SAND, some gravel, some silt; abundant fine organics; occasional construction debris (plastic) (SP-SM).		2	2	2				
17.5													

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EB-2

Arlington Operations Center Redevelopment

Sheet: 2 of 4

Arlington, WA

Start Date: 4/23/24

Logged By: BCY

20240001E001

Ending Date: 4/23/24

Approved By: JHS

Driller/Equipment: Advance Drill Technology / D-50

Total Depth (ft): 61.5

Hammer Weight/Drop: 140#/30"

Ground Surface Elevation (ft): 146

Hole Diameter (in): 6

Datum: NAVD 88

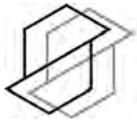
Groundwater Depth ATD (ft): 54.5

Groundwater Depth Post Drilling (ft) (Date): ()

Depth (ft)	Sample Type	Sample	% Recovery	Graphic Symbol	Description	Water Level	Blows/6"	Blows/Foot					Other Tests	
								10	20	30	40	50+		
Marysville Recessional Outwash														
20		5			Slightly moist, grayish brown, gravelly, fine to medium SAND, trace silt; pockets of orange oxidized, silt; broken gravel in sampler; blow counts overstated; cobbles present in cuttings (SP).	40 45 25							70	
22.5														
25		6			Slightly moist, grayish brown, fine to medium SAND; interbeds of fine sand; occasional layer of silty, fine to medium sand; angular crushed rock; blow counts overstated; broken gravel in sampler; layer (2 inches thick) of fine sand at tip of sample (SP).	15 17 19							36	
27.5					Driller notes fine gravel and cobbles while drilling.									
30		7			Slightly moist, grayish brown, gravelly, fine SAND; trace oxidized gravel in horizontal bedding; broken gravel in sampler; blow counts overstated (SP).	22 26 30							56	
32.5					Cuttings predominantly brown, fine sand.									
35		8			Slightly moist, grayish brown, fine to medium SAND, some gravel; transitions to gray, fine sand; occasional mica; broken gravel in sampler; blow counts overstated (SP).	20 16 18							34	
37.5														

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EB-2

Arlington Operations Center Redevelopment

Sheet: 3 of 4

Arlington, WA

Start Date: 4/23/24

Logged By: BCY

20240001E001

Ending Date: 4/23/24

Approved By: JHS

Driller/Equipment: Advance Drill Technology / D-50

Total Depth (ft): 61.5

Hammer Weight/Drop: 140#/30"

Ground Surface Elevation (ft): 146

Hole Diameter (in): 6

Datum: NAVD 88

Groundwater Depth ATD (ft): 54.5

Groundwater Depth Post Drilling (ft) (Date): ()

Depth (ft)	Sample Type	Sample	% Recovery	Graphic Symbol	Description	Water Level	Blows/6"	Blows/Foot					Other Tests	
								10	20	30	40	50+		
40		9			Slightly moist, grayish brown, fine to medium SAND, some gravel, trace silt; occasional laminated silt; broken gravel in sampler; blow counts overstated (SP).	15 23 16					39			
42.5														
45		10			Very moist, grayish brown, fine SAND, some silt; occasional interbed of silty, fine sand (SP-SM). Lower 8 inches: Transitions to gray with brown oxidation staining, fine to medium SAND, trace fine gravel (SP).	17 21 22					43			
47.5					Driller notes material becomes tighter.									
50		11			Very moist, gray to grayish brown, fine to medium SAND; occasional lamination of sandy, silt; rare fine gravel; some observable cross-bedding of fine to medium sand (SP).	13 13 13					26			
52.5														
55		12			Wet, gray, fine to medium SAND; rare fine gravel; massive (SP).	7 10 12					22			

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Arlington Operations Center Redevelopment

Sheet: 4 of 4

Arlington, WA

Start Date: 4/23/24

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Ending Date: 4/23/24

Approved By: JHS

Driller/Equipment: Advance Drill Technology / D-50

Total Depth (ft): 61.5

Hammer Weight/Drop: 140#/30"

Ground Surface Elevation (ft): 146

Hole Diameter (in): 6

Datum: NAVD 88

▼ Groundwater Depth ATD (ft): 54.5

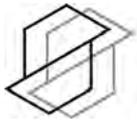
∇ Groundwater Depth Post Drilling (ft) (Date): ()

Depth (ft)	Sample Type	Sample	% Recovery	Graphic Symbol	Description	Water Level	Blows/6"					Other Tests	
							10	20	30	40	50+		
57.5													
60		13			Wet, gray, fine to medium SAND transitioning to brownish gray, fine to medium SAND; interbed of sandy, gravel between (SP).	14 17 20			37				
62.5					Groundwater encountered at 54.5 feet ATD.								
65													
67.5													
70													
72.5													
75													

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EB-3

Arlington Operations Center Redevelopment

Sheet: 1 of 5

Arlington, WA

Start Date: 4/23/24

Logged By: BCY

20240001E001

Ending Date: 4/23/24

Approved By: JHS

Driller/Equipment: Advance Drill Technology / D-50

Total Depth (ft): 76.5

Hammer Weight/Drop: 140#/30"

Ground Surface Elevation (ft): 120

Hole Diameter (in): 6

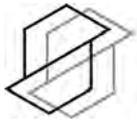
Datum: NAVD 88

Groundwater Depth ATD (ft): 33

Groundwater Depth Post Drilling (ft) (Date): ()

Depth (ft)	Sample Type	Sample	% Recovery	Graphic Symbol	Description	Water Level	Blows/6"	Blows/Foot					Other Tests	
								10	20	30	40	50+		
0					Sod / Topsoil - 6 inches									
					Fill									
2.5		1			Slightly moist, brown, fine SAND, some gravel, some silt; scattered organics (rootlets) (SP-SM).	7	20							
					Lower 6 inches: Slightly moist, gray, fine SAND; interbed (≈2 inches thick) of brown, fine to medium sand (SP).	9								
						11								
5		2			Upper 4 inches: Slightly moist, brown, silty, fine SAND, some gravel; scattered organics (SM).	7	28							
						11								
					Marysville Recessional Outwash	17								
					Lower 4 inches: Transitions to grayish brown, fine SAND, some gravel; broken gravel in spoon; blow counts overstated (SP).									
7.5		3			Slightly moist, grayish brown, very gravelly, SAND, trace silt; occasional interbed of fine to medium sand; broken gravel in sampler (SP).	10	34							
						17								
10		4			Slightly moist, grayish brown with rare oxidation staining to orange around gravel, gravelly, fine to coarse SAND, trace silt; faintly stratified; blow counts overstated; broken gravel in spoon (SP).	5	32							
						16								
						16								
12.5		5			Moist, grayish brown, gravelly, fine to medium SAND, some fine sand (≈2 inches) observed at tip of sampler (SP).	7	23							
						11								
						12								
15		6			Grades to trace gravel, trace silt; occasional interbed of brown, fine to medium sand (SP).	7	20							
						9								
						11								
17.5		7			As above; some gravel; occasional interbed (≈1/2 inch thick) of gray, fine sand, some silt (SP).	10	24							
						10								
						14								

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Exploration Boring

EB-3

Arlington Operations Center Redevelopment

Sheet: 2 of 5

Arlington, WA

Start Date: 4/23/24

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20240001E001

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Total Depth (ft): 76.5

Hammer Weight/Drop: 140#/30"

Ground Surface Elevation (ft): 120

Hole Diameter (in): 6

Datum: NAVD 88

Groundwater Depth ATD (ft): 33

Groundwater Depth Post Drilling (ft) (Date): ()

Depth (ft)	Sample Type	Sample	% Recovery	Graphic Symbol	Description	Water Level	Blows/6"	Blows/Foot					Other Tests	
								10	20	30	40	50+		
20		8			Grades to some silt; massive (SP-SM).		10	21						
22.5		9			Moist, grayish brown, fine to medium SAND, trace fine gravel; massive (SP).		9	24						
25		10			Moist, grayish brown, fine to coarse SAND, some gravel; broken gravel in sampler; blow counts may be overstated (SP).		8	27						
27.5		11			Moist, grayish brown with some oxidation staining, fine to medium SAND; rare fine gravel; massive; sampler overfilled (SP).		7	25						
30		12			Very moist, grayish brown with some oxidation staining, fine to coarse SAND, some gravel; oxidation staining around gravel; moisture appears to increase with depth; trace silt at tip of sampler; massive (SP).		12	29						
32.5		13			Wet, grayish brown, sandy, GRAVEL, trace silt; broken gravel in sampler; blow counts overstated (GP).	10	26					42		
35		14			Wet, grayish brown, fine SAND; stratified; layers of gray, medium to coarse sand, some fine gravel; occasional interbed (≈1/4 inch thick) of brownish gray, fine sand, some silt (SP).	8	26							
37.5														

5/23/2024

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Exploration Boring

EB-3

Arlington Operations Center Redevelopment

Sheet: 3 of 5

Arlington, WA

Start Date: 4/23/24

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20240001E001

Ending Date: 4/23/24

Approved By: JHS

Driller/Equipment: Advance Drill Technology / D-50

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Groundwater Depth ATD (ft): 33

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Depth (ft)	Sample Type	Sample	% Recovery	Graphic Symbol	Description	Water Level	Blows/6"	Blows/Foot					Other Tests	
								10	20	30	40	50+		
40		15			As above, some gravel; broken gravel in sampler; blow counts overstated.	9 13 13	26							
42.5														
45		16			Wet, grayish brown to slightly brownish gray, fine SAND, trace silt; occasional medium sand; finely stratified (SP).	5 10 14	24							
47.5														
50		17			Wet, grayish brown, fine SAND, trace silt; rare gravel; massive (SP).	11 11 16	27							
52.5														
55		18			Wet, grayish brown, fine to medium SAND, some gravel, trace silt; interbeds of fine sand; occasional interbed of orange oxidized, medium sand (SP). Lower 3 inches: Becomes fine sand, some silt (SP SM).	10 14 14	28							

5/23/2024

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Exploration Boring

EB-3

Arlington Operations Center Redevelopment

Sheet: 4 of 5

Arlington, WA

Start Date: 4/23/24

Logged By: BCY

20240001E001

Ending Date: 4/23/24

Approved By: JHS

Driller/Equipment: Advance Drill Technology / D-50

Total Depth (ft): 76.5

Hammer Weight/Drop: 140#/30"

Ground Surface Elevation (ft): 120

Hole Diameter (in): 6

Datum: NAVD 88

Groundwater Depth ATD (ft): 33

Groundwater Depth Post Drilling (ft) (Date): ()

Depth (ft)	Sample Type	Sample	% Recovery	Graphic Symbol	Description	Water Level	Blows/6"	Blows/Foot					Other Tests		
								10	20	30	40	50+			
57.5															
60		19			Wet, gray to brownish gray, fine SAND, some silt, trace fine gravel; occasional lamination of light gray, silt (SP-SM).		6						23		
62.5							11								
65		20			Wet, gray to brownish gray, fine SAND, trace silt; occasional stratification of brown, fine sand, trace silt (SP).		11						31		
67.5							15								
70		21			Wet, grayish brown with occasional orange brown horizontal oxidation staining, fine SAND, some silt; rare gravel; layer (4 inches thick) of fine to medium sand in center of sample; stratified(SP-SM).		11						28		
72.5							12								
75		22			Wet, grayish brown with some orange horizontal oxidation staining, fine		4						31		
							12								

DRAFT

20240001E001 5/23/2024



associated
earth sciences
incorporated

Exploration Boring

EB-3

Arlington Operations Center Redevelopment

Sheet: 5 of 5

Arlington, WA

Start Date: 4/23/24

Logged By: BCY

20240001E001

Ending Date: 4/23/24

Approved By: JHS

Driller/Equipment: Advance Drill Technology / D-50

Total Depth (ft): 76.5

Hammer Weight/Drop: 140#/30"

Ground Surface Elevation (ft): 120

Hole Diameter (in): 6

Datum: NAVD 88

▼ Groundwater Depth ATD (ft): 33

∇ Groundwater Depth Post Drilling (ft) (Date): ()

Depth (ft)	Sample Type	Sample	% Recovery	Graphic Symbol	Description	Water Level	Blows/6"					Other Tests	
							10	20	30	40	50+		
					SAND, trace silt; layers (≈1/2 inch thick) of fine to medium sand (SP).		19						
77.5					Groundwater encountered at 33 feet ATD.								
80													
82.5													
85													
87.5													
90													
92.5													

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5/23/2024

20240001E001

APPENDIX B

Historical Exploration Logs

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LOG OF EXPLORATION PIT NO. EP-1

Depth, ft	DESCRIPTION
	Fill
1	Medium stiff, moist, brown SILT with occasional fine to coarse sand with coarse sand and gravel and organics. (ML)
2	Medium dense to dense, moist, brown to black, SILTY fine to medium SAND with coarse SAND, GRAVEL, and ORGANICS. (SM)
3	
4	
5	
6	
7	
8	
9	Stiff, moist, brown/blue SILT with fine to medium SAND and occasional coarse sand, gravel, and organics. (ML)
10	
11	
12	
13	Dense, moist, brown/black, SILTY fine to medium SAND with coarse SAND and GRAVEL. (ML)
14	Bottom of exploration pit at depth 13.5 feet No ground water encountered; no caving
15	
16	
17	
18	
19	
20	

Arlington Road Maintenance Yard Arlington, Washington

Logged by: GS

Approved by:



Project No. KG99556A

October 1999

LOG OF EXPLORATION PIT NO. EP-2

Depth, ft	DESCRIPTION
	Fill
1	Stiff, moist, brown SILT with fine to coarse SAND and GRAVEL. (ML)
2	Medium dense to dense, moist, brown/black, SILTY fine to medium SAND with coarse SAND and GRAVEL. (SM)
3	
4	Medium dense to dense, moist, gray GRAVEL with occasional fine to coarse sand and trace silt. (GP)
5	
6	
7	Medium dense to dense, moist, brown/black, SILTY fine to medium SAND with coarse SAND and GRAVEL. (SM)
8	
9	
10	
11	Medium dense to dense, moist, gray GRAVEL with occasional fine to coarse sand and trace silt. (GP)
12	
13	Medium dense to dense, moist, brown/black GRAVEL with occasional fine to coarse sand and trace silt. (GP)
14	Medium stiff, moist, brown SILT with fine to medium SAND and GRAVEL. (ML)
15	Bottom of exploration pit at depth 13.5 feet No ground water encountered; severe caving @ 4-7' and 11-13'
16	
17	
18	
19	
20	

Arlington Road Maintenance Yard Arlington, Washington

Logged by: GS
Approved by:



Project No. KG99556A

October 1999

LOG OF EXPLORATION PIT NO. EP-3

Depth, ft	DESCRIPTION
1	Fill Very dense, moist to wet, brown, SILTY fine to medium SAND with coarse SAND and GRAVEL. (SM)
2	Recessional Outwash
3	Medium dense, moist, brown, fine to medium SAND with coarse SAND and GRAVEL and trace silt. (SP)
4	
5	Medium dense, moist, brown, fine to medium SAND with occasional coarse sand and gravel and trace silt. (SP)
6	
7	
8	
9	
10	
11	
12	
13	
14	Bottom of exploration pit at depth 13.5 feet No ground water encountered; moderate caving 10-13.5'
15	
16	
17	
18	
19	
20	

DRAFT

Arlington Road Maintenance Yard Arlington, Washington

Logged by: GS

Approved by:



Project No. KG99556A

October 1999

LOG OF EXPLORATION PIT NO. EP-4

Depth, ft	DESCRIPTION
	Fill
1	Very dense, moist to wet, brown SILTY fine to medium SAND with coarse SAND and GRAVEL. (SM)
2	
3	Medium dense to dense, moist, gray, SILTY fine SAND with occasional medium to coarse sand and gravel. (SM)
4	
5	
6	Recessional Outwash
7	Medium dense, moist, brown, fine GRAVEL with fine to coarse SAND and trace silt. (GP)
8	
9	
10	
11	
12	
13	Bottom of exploration pit at depth 12 feet No ground water encountered; moderate caving 10-12'
14	
15	
16	
17	
18	
19	
20	

DRAFT

Arlington Road Maintenance Yard Arlington, Washington

Logged by: GS
Approved by:



Project No. KG99556A

October 1999

LOG OF EXPLORATION PIT NO. EP-5

Depth, ft	DESCRIPTION
	Fill
1	Medium stiff, moist to wet, brown SILT with fine to coarse SAND and GRAVEL. (ML)
2	
3	Medium dense, moist, to wet, brown, fine to medium SAND with SILT and coarse SAND and GRAVEL. (SP)
4	Medium stiff, moist, brown SILT with occasional fine to medium sand and occasional gravel. (ML)
5	
6	Medium dense to dense, moist, gray, SILTY fine SAND with occasional fine to medium sand and gravel. (SM)
7	
8	Recessional Outwash
9	Medium dense, moist, brown, medium to coarse SAND with GRAVEL and trace silt. (SP)
10	
11	
12	
13	Bottom of exploration pit at depth 12.5 feet No ground water encountered; moderate caving 1-5'
14	
15	
16	
17	
18	
19	
20	

Arlington Road Maintenance Yard Arlington, Washington

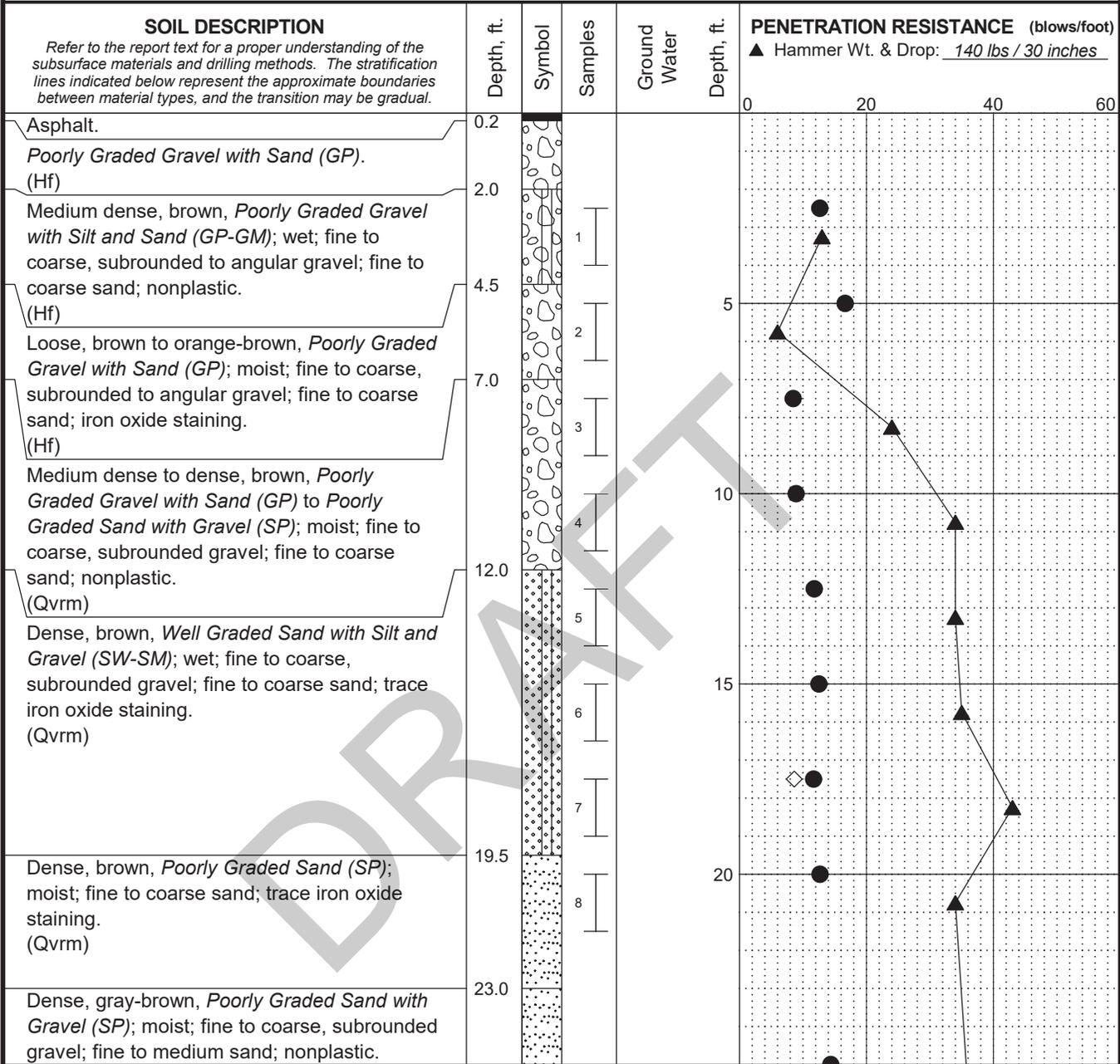
Logged by: GS
Approved by:



Project No. KG99556A

October 1999

Total Depth: 81.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 131 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



CONTINUED NEXT SHEET
LEGEND

- * Sample Not Recovered
- ∇ Ground Water Level ATD
- ◇ % Fines (<0.075mm)
- ⊔ 2.0" O.D. Split Spoon Sample
- % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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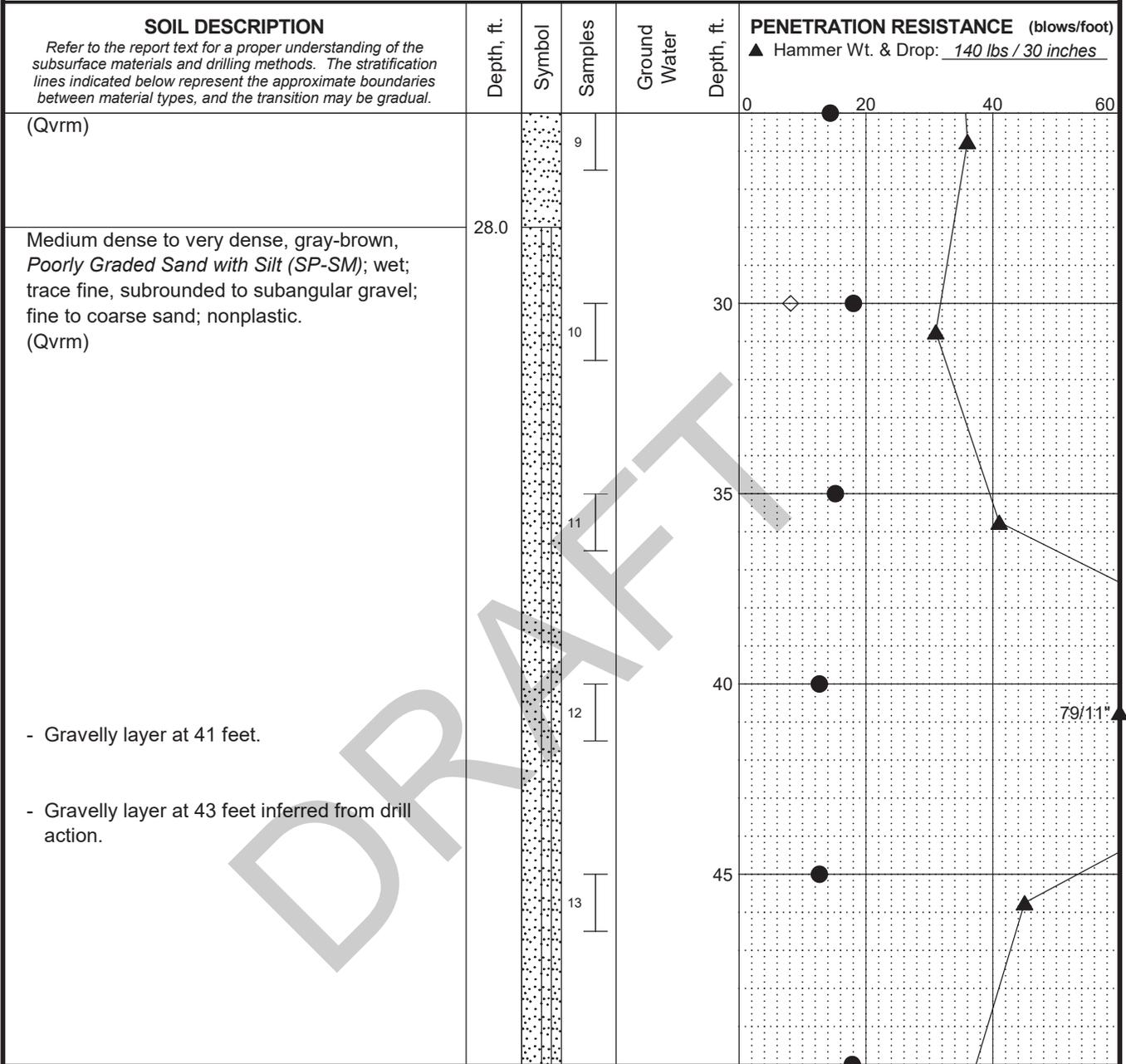
LOG OF BORING SW-1-19

May 2020 104098-001

SHANNON & WILSON, INC. **FIG. A-2**
 Geotechnical and Environmental Consultants Sheet 1 of 4

Log: SAW Rev: EAS Typ: LKN MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20

Total Depth: 81.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 131 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



CONTINUED NEXT SHEET
LEGEND

- * Sample Not Recovered
- ∇ Ground Water Level ATD
- ◇ % Fines (<0.075mm)
- ▬ 2.0" O.D. Split Spoon Sample
- % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
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May 2020

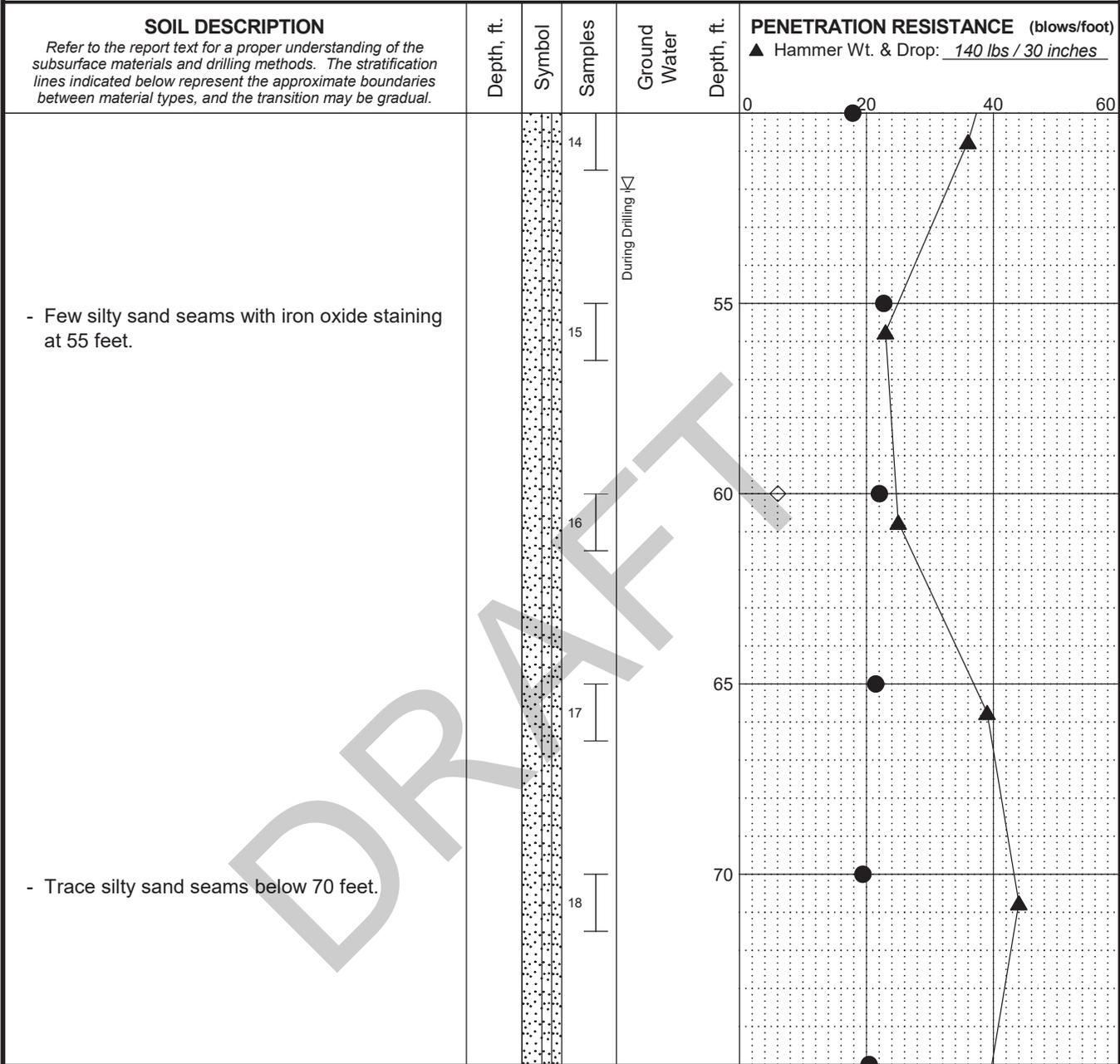
104098-001

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FIG. A-2
 Sheet 2 of 4

Log: SAW Rev: EAS Typ: LKN
 MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20

Total Depth: 81.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 131 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



CONTINUED NEXT SHEET

- LEGEND**
- * Sample Not Recovered
 - ∇ Ground Water Level ATD
 - ◇ % Fines (<0.075mm)
 - % Water Content
 - ⊥ 2.0" O.D. Split Spoon Sample

- NOTES**
1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
 2. Groundwater level, if indicated above, is for the date specified and may vary.
 3. USCS designation is based on visual-manual classification and selected lab testing.

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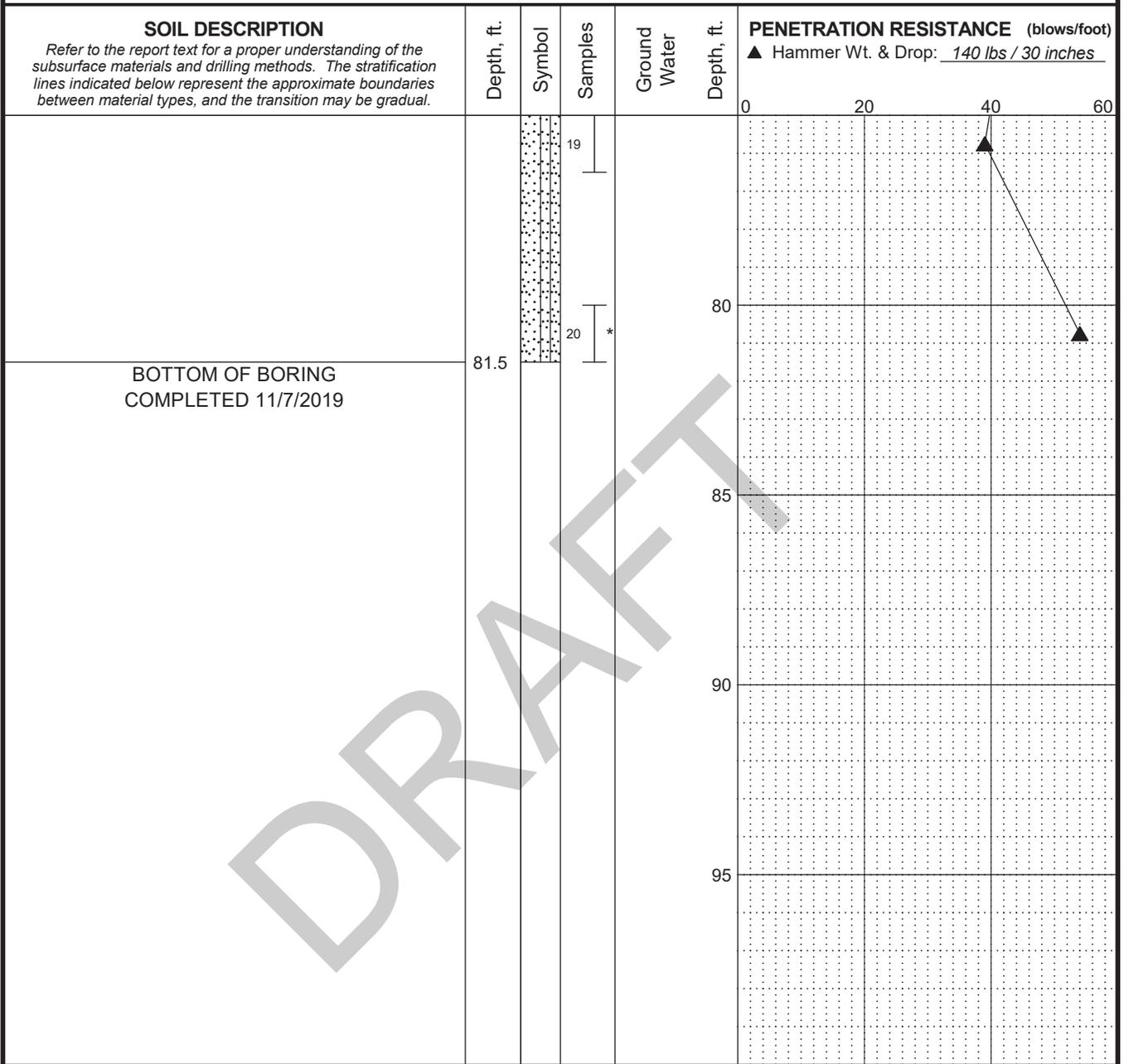
LOG OF BORING SW-1-19

May 2020 104098-001

SHANNON & WILSON, INC. **FIG. A-2**
 Geotechnical and Environmental Consultants Sheet 3 of 4

MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20 Log: SAW Rev: EAS Typ: LKN

Total Depth: 81.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 131 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



LEGEND

* Sample Not Recovered ▽ Ground Water Level ATD ◇ % Fines (<0.075mm)
 I 2.0" O.D. Split Spoon Sample ● % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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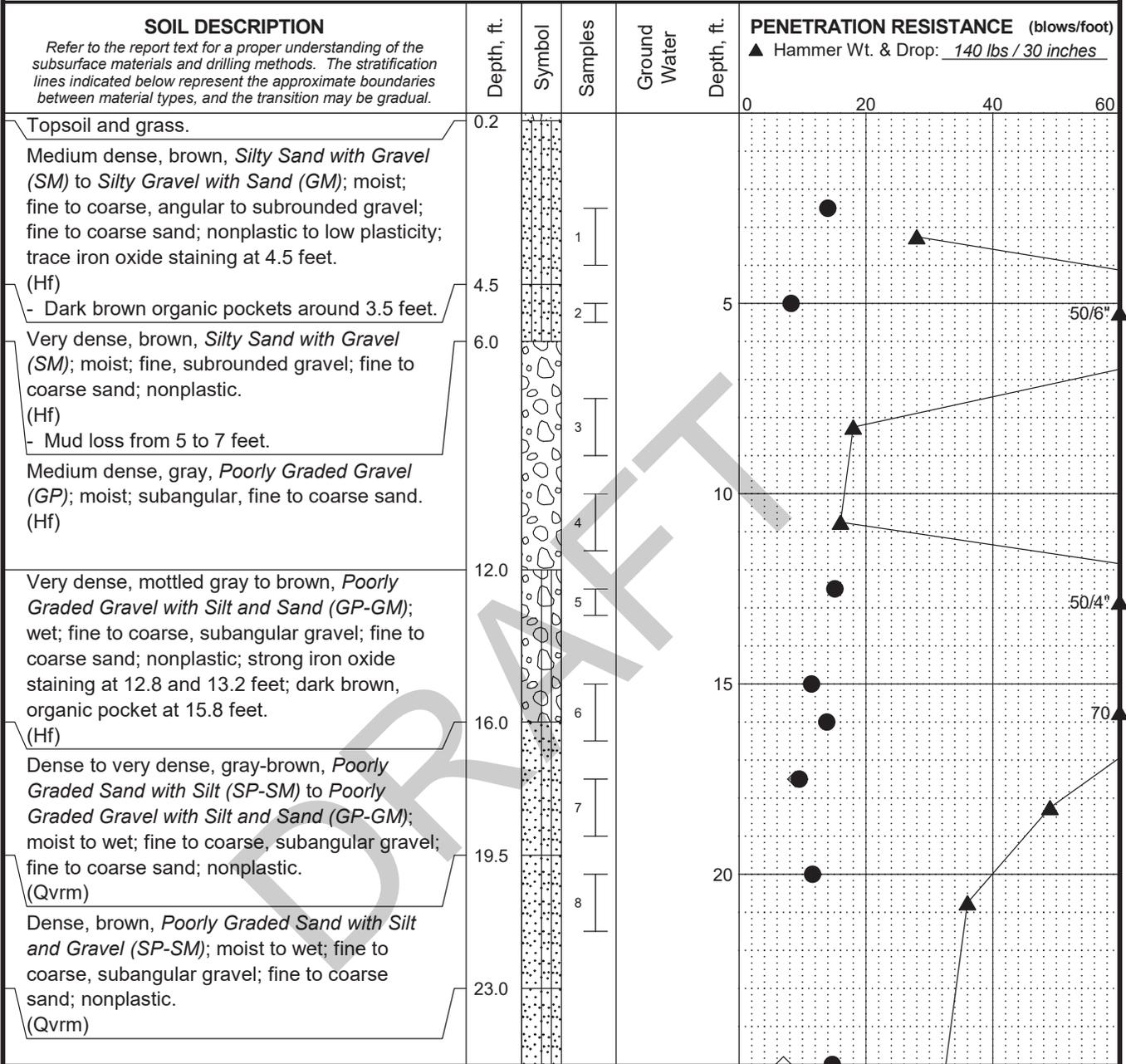
LOG OF BORING SW-1-19

May 2020 104098-001

SHANNON & WILSON, INC. **FIG. A-2**
 Geotechnical and Environmental Consultants Sheet 4 of 4

Log: SAW Rev: EAS Typ: LKN
 MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20

Total Depth: 81.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 120 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



Log: SAW Rev: EAS Typ: LKN MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20

CONTINUED NEXT SHEET
LEGEND

- * Sample Not Recovered
- ∇ Ground Water Level ATD
- ◇ % Fines (<0.075mm)
- ⊔ 2.0" O.D. Split Spoon Sample
- % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

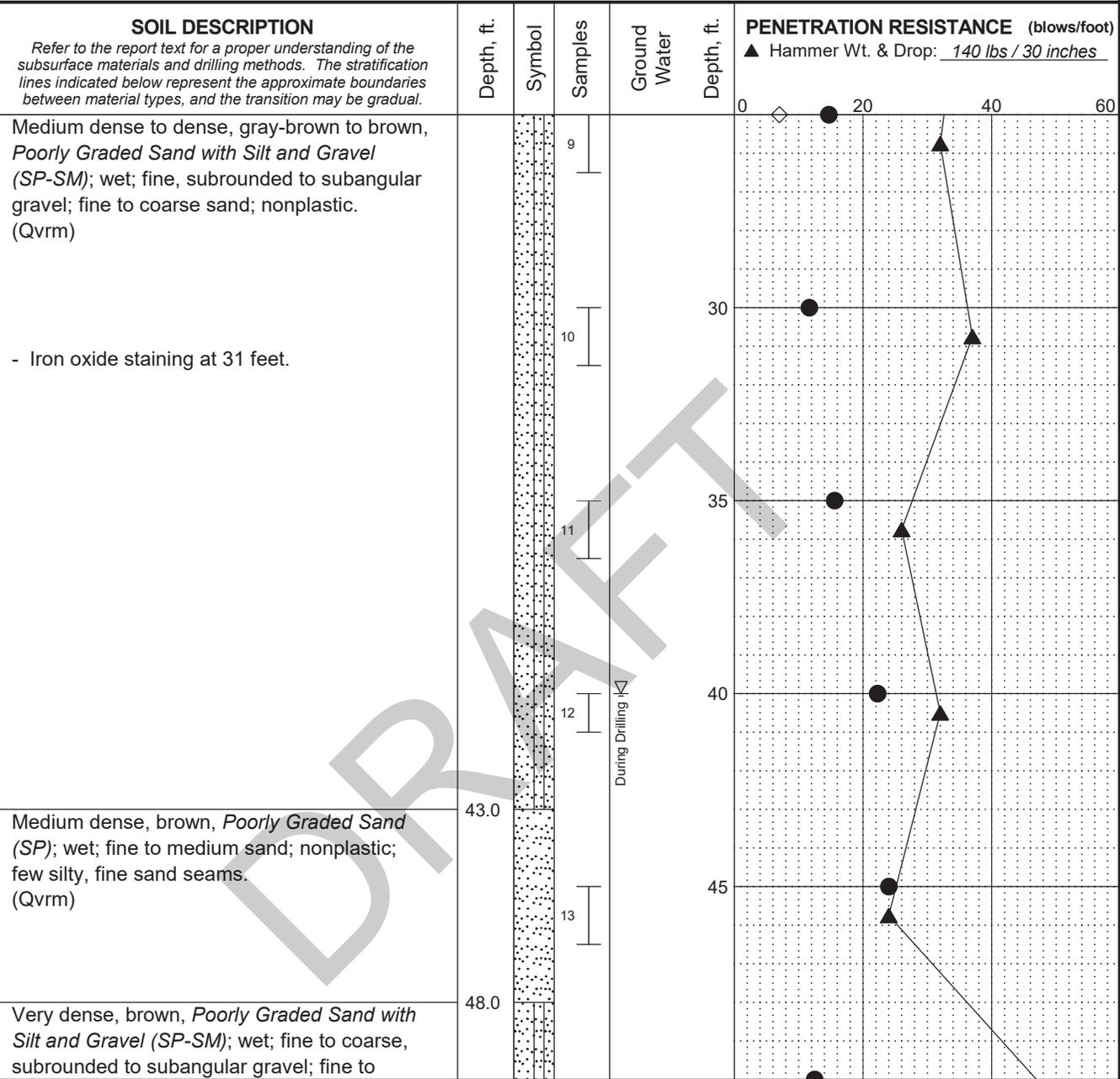
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LOG OF BORING SW-2-19

May 2020
104098-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants
FIG. A-3
Sheet 1 of 4

Total Depth: 81.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 120 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- ∇ Ground Water Level ATD
- ◇ % Fines (<0.075mm)
- ⊔ 2.0" O.D. Split Spoon Sample
- % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING SW-2-19

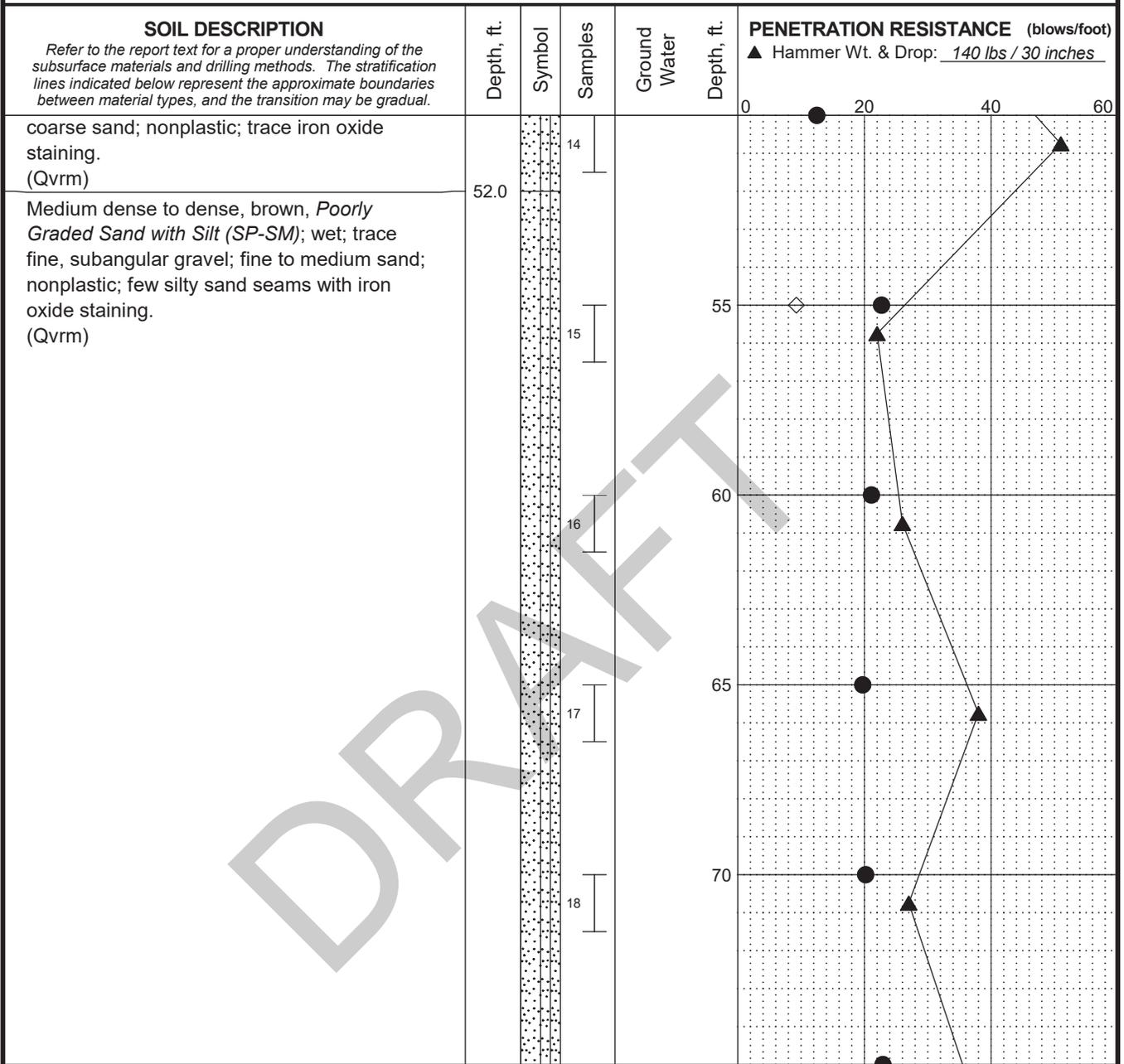
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FIG. A-3
 Sheet 2 of 4

MASTER LOG E 104098.GPJ SHAN_WIL_GDT_5/7/20 Log: SAW Rev: EAS Typ: LKN

Total Depth: 81.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 120 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



CONTINUED NEXT SHEET
LEGEND

- * Sample Not Recovered
- ∇ Ground Water Level ATD
- ◇ % Fines (<0.075mm)
- ⊥ 2.0" O.D. Split Spoon Sample
- % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING SW-2-19

May 2020

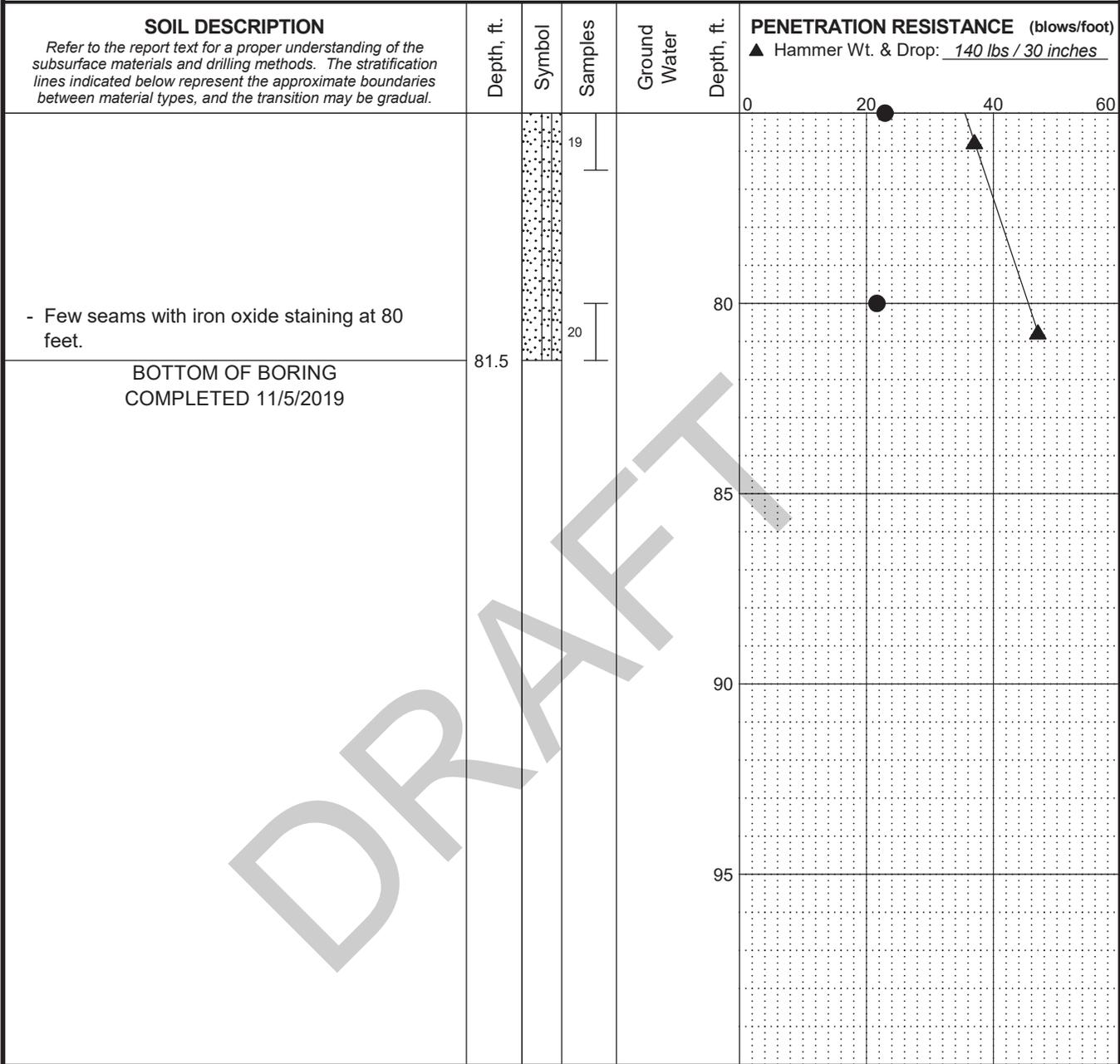
104098-001

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FIG. A-3
 Sheet 3 of 4

MASTER LOG E 104098.GPJ SHAN_WIL_GDT_5/7/20 Log: SAW Rev: EAS Typ: LKN

Total Depth: 81.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 120 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



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LEGEND

* Sample Not Recovered	∇ Ground Water Level ATD	◇ % Fines (<0.075mm)
⊥ 2.0" O.D. Split Spoon Sample		● % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
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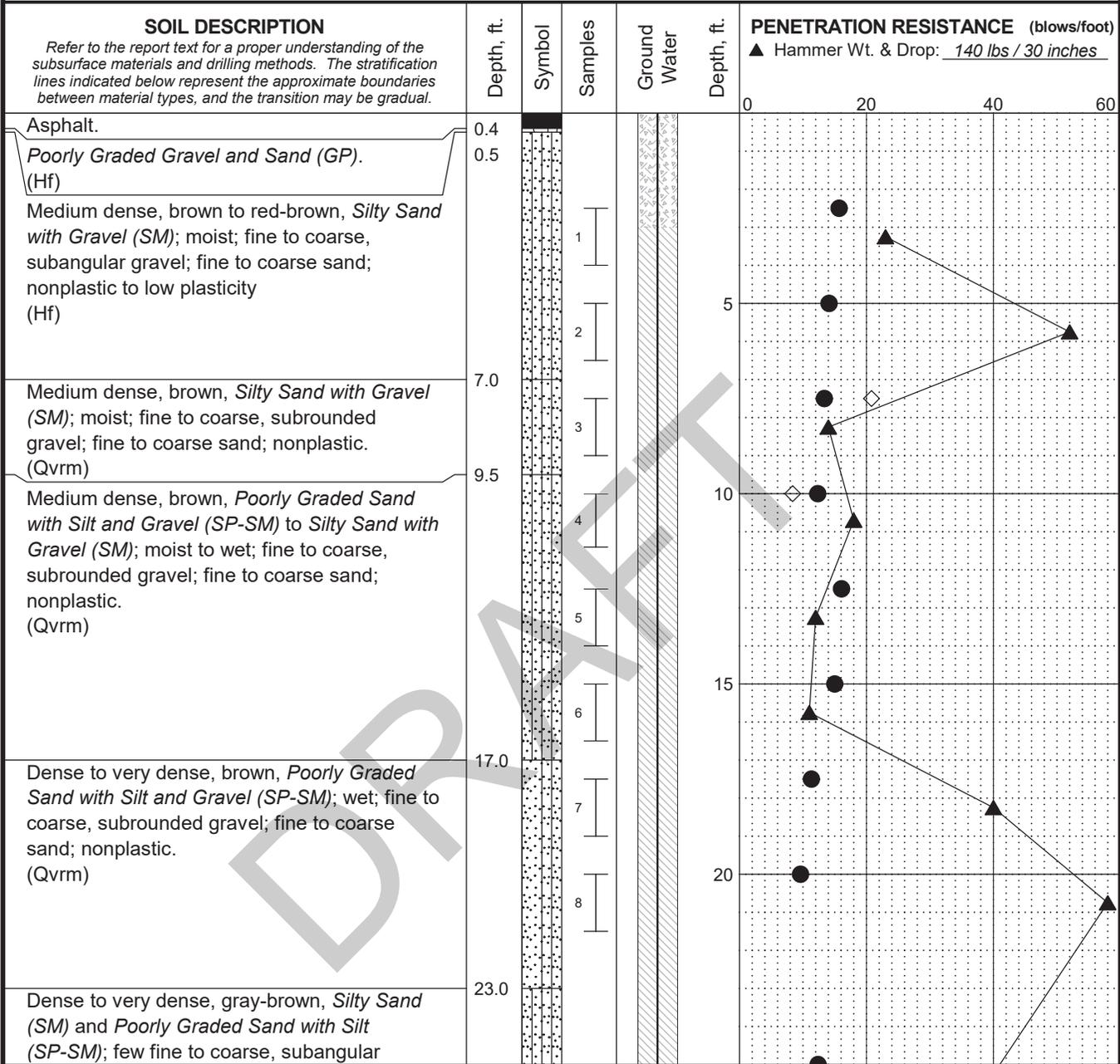
LOG OF BORING SW-2-19

May 2020 104098-001

SHANNON & WILSON, INC. Geotechnical and Environmental Consultants	FIG. A-3 Sheet 4 of 4
---	---------------------------------

Log: SAW Rev: EAS Typ: LKN
MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20

Total Depth: 151.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 147 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- ⊥ 2.0" O.D. Split Spoon Sample
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD
- ◇ % Fines (<0.075mm)
- % Water Content

NOTES

- Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
- Groundwater level, if indicated above, is for the date specified and may vary.
- USCS designation is based on visual-manual classification and selected lab testing.

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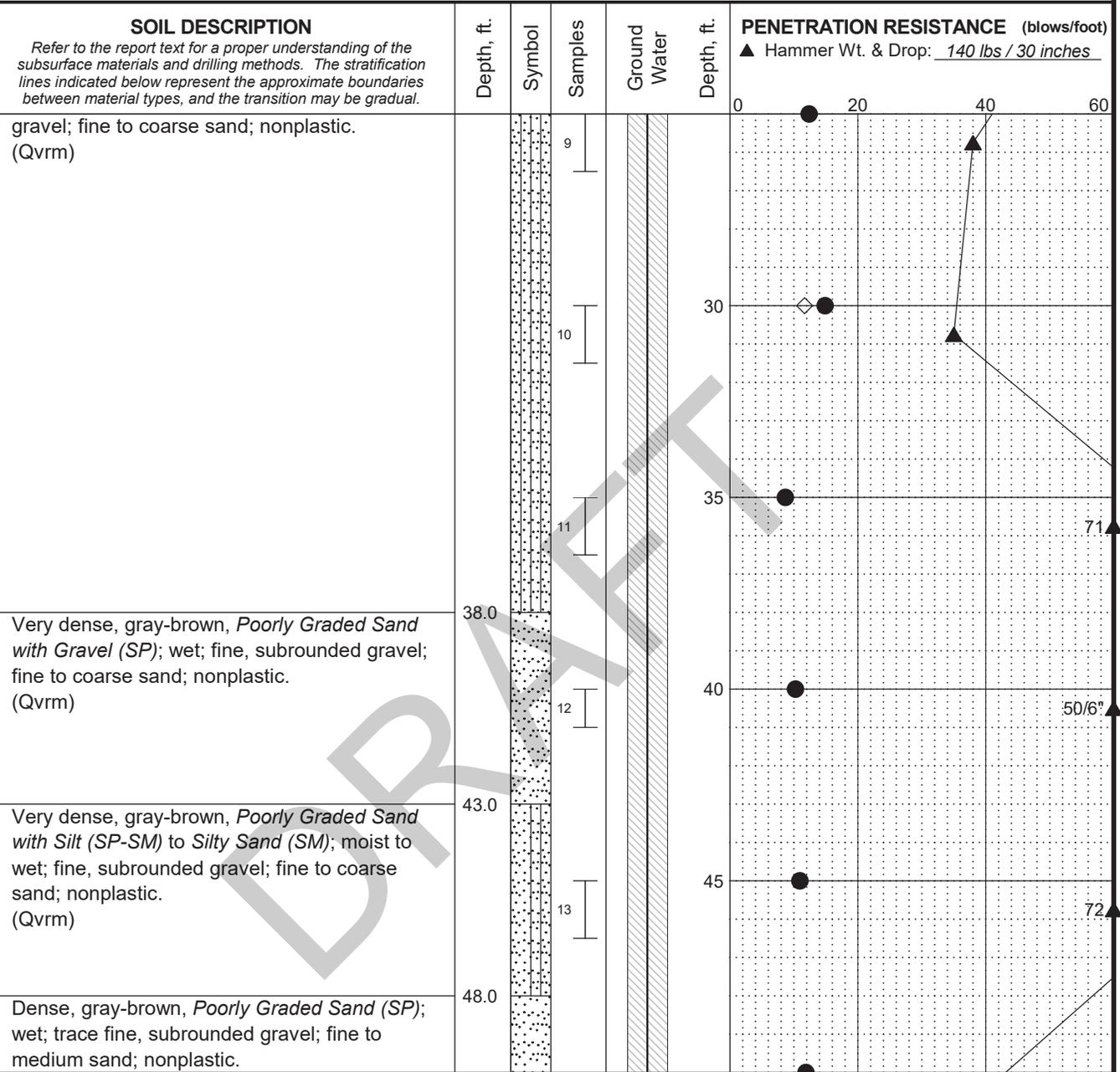
LOG OF BORING SW-3-19

May 2020 104098-001

SHANNON & WILSON, INC. **FIG. A-4**
 Geotechnical and Environmental Consultants Sheet 1 of 7

MASTER LOG E 104098.GPJ SHAN_WIL_GDT_5/7/20 Log: SAW Rev: EAS Typ: LKN

Total Depth: 151.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 147 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



Log: SAW Rev: EAS Typ: LKN MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20

CONTINUED NEXT SHEET

- LEGEND**
- * Sample Not Recovered
 - ⊥ 2.0" O.D. Split Spoon Sample
 - Well Screen and Sand Filter
 - Bentonite-Cement Grout
 - Bentonite Chips/Pellets
 - Bentonite Grout
 - Ground Water Level ATD
 - % Fines (<0.075mm)
 - % Water Content

- NOTES**
1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
 2. Groundwater level, if indicated above, is for the date specified and may vary.
 3. USCS designation is based on visual-manual classification and selected lab testing.

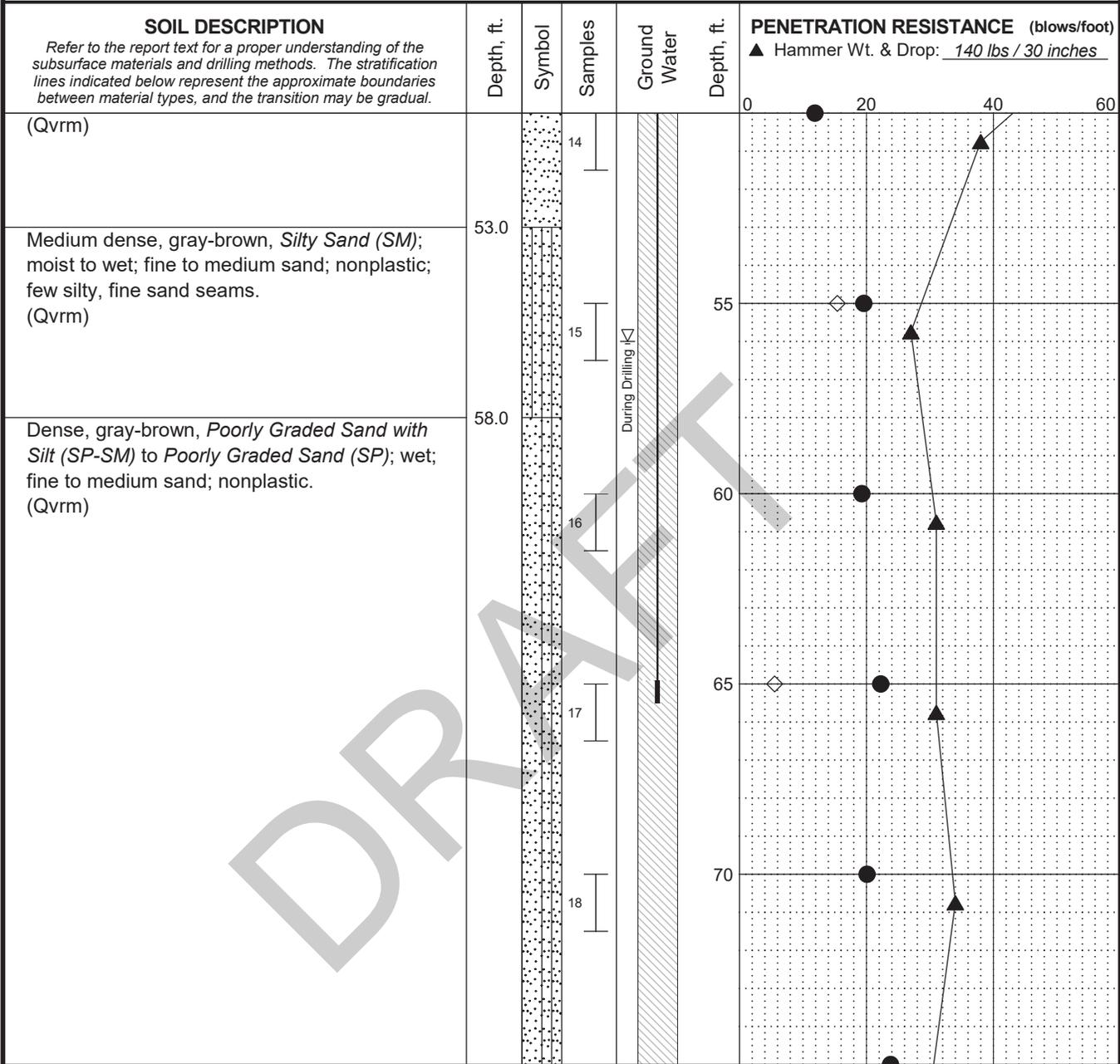
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LOG OF BORING SW-3-19

May 2020 104098-001

SHANNON & WILSON, INC. **FIG. A-4**
 Geotechnical and Environmental Consultants Sheet 2 of 7

Total Depth: 151.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 147 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- ⊥ 2.0" O.D. Split Spoon Sample
-  Well Screen and Sand Filter
-  Bentonite-Cement Grout
-  Bentonite Chips/Pellets
-  Bentonite Grout
-  Ground Water Level ATD
-  % Fines (<0.075mm)
-  % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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LOG OF BORING SW-3-19

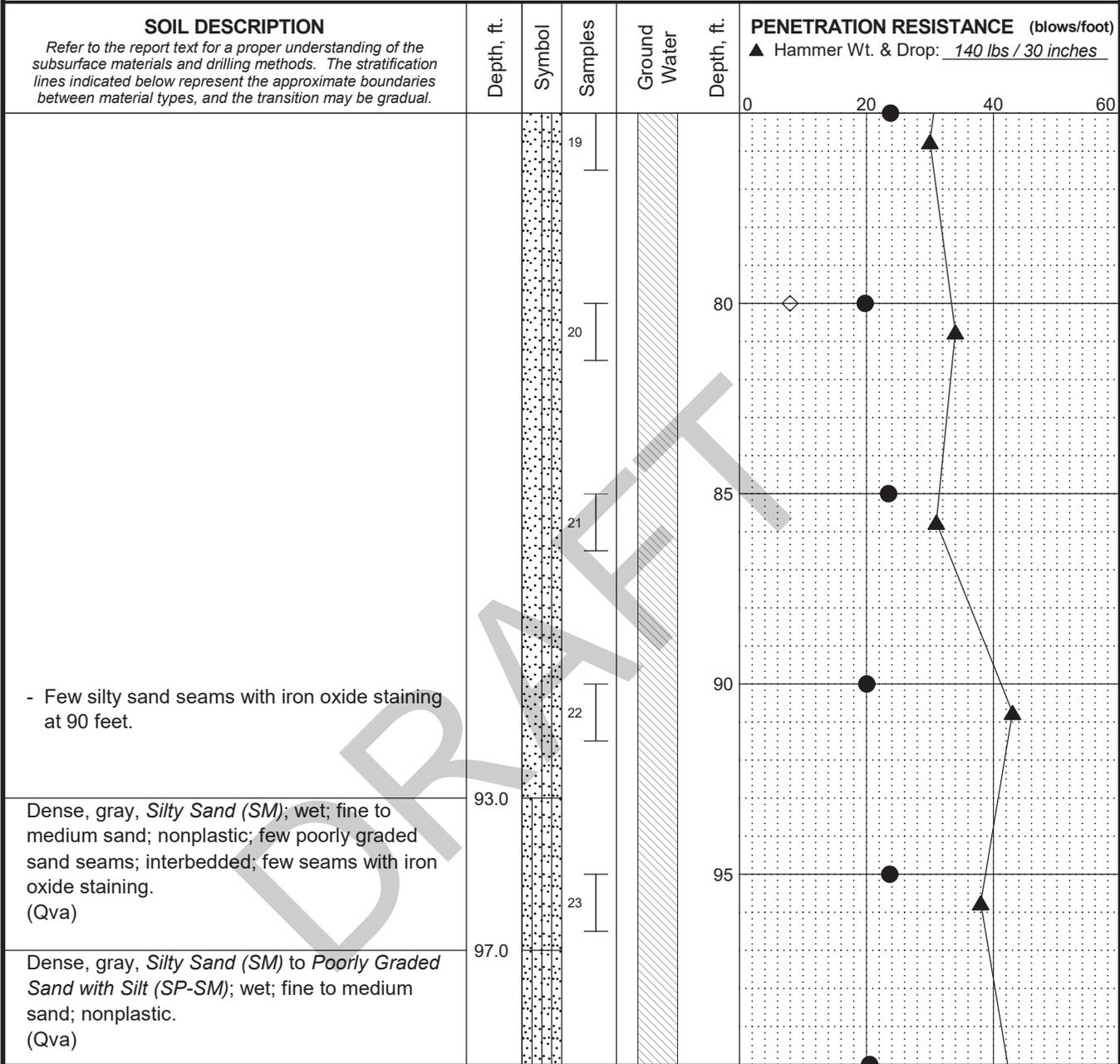
May 2020 104098-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-4
Sheet 3 of 7

MASTER LOG E 104098.GPJ SHAN_WIL_GDT_5/7/20 Log: SAW Rev: EAS Typ: LKN

Total Depth: 151.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 147 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



Log: SAW Rev: EAS Typ: LKN MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20

CONTINUED NEXT SHEET
LEGEND

- * Sample Not Recovered
- ┆ 2.0" O.D. Split Spoon Sample
- [Symbol] Well Screen and Sand Filter
- [Symbol] Bentonite-Cement Grout
- [Symbol] Bentonite Chips/Pellets
- [Symbol] Bentonite Grout
- ∇ Ground Water Level ATD
- [Symbol] % Fines (<0.075mm)
- [Symbol] % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

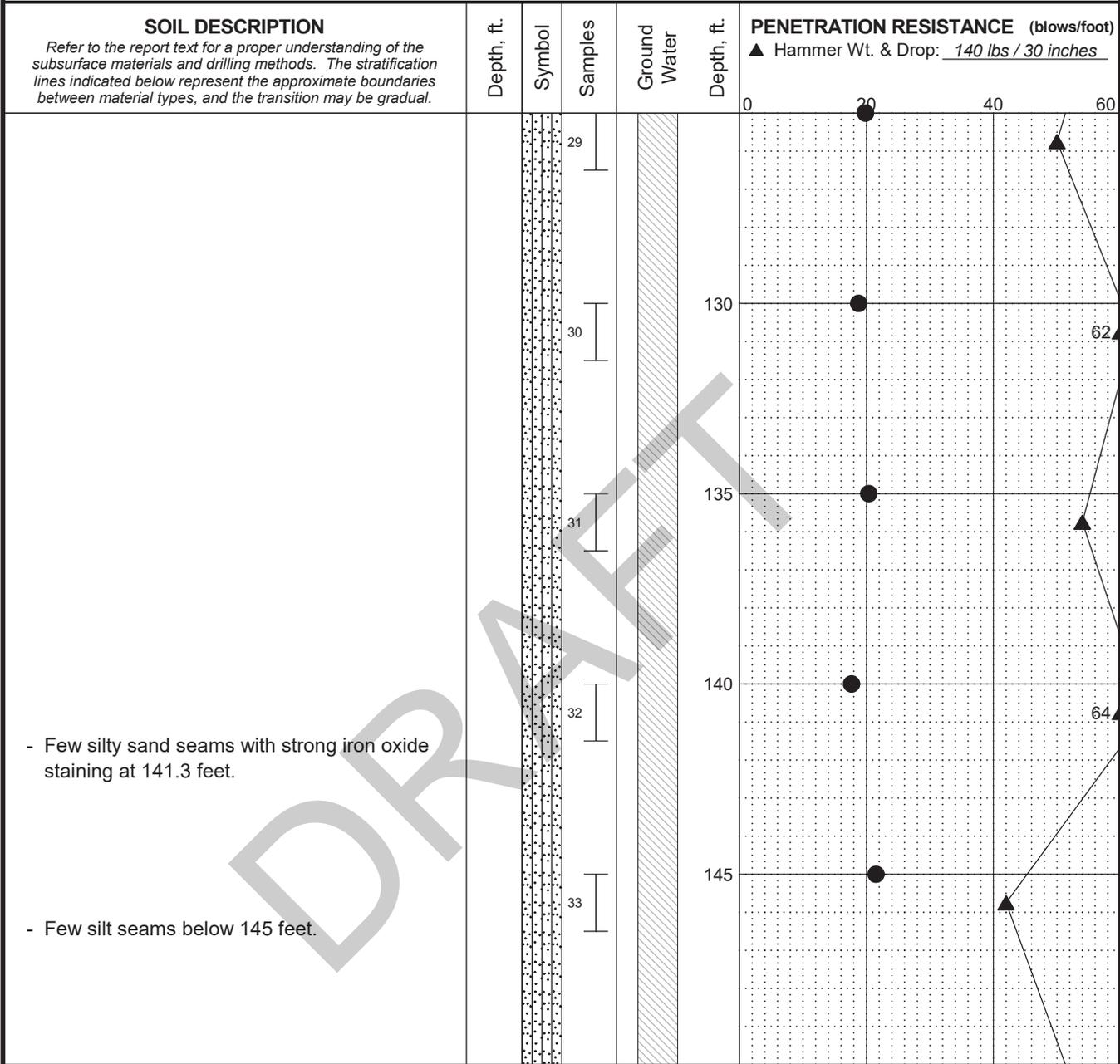
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LOG OF BORING SW-3-19

May 2020
104098-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants
FIG. A-4
Sheet 4 of 7

Total Depth: 151.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 147 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- ┆ 2.0" O.D. Split Spoon Sample
- Well Screen and Sand Filter
- Bentonite-Cement Grout
- Bentonite Chips/Pellets
- Bentonite Grout
- Ground Water Level ATD
- % Fines (<0.075mm)
- % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
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LOG OF BORING SW-3-19

May 2020

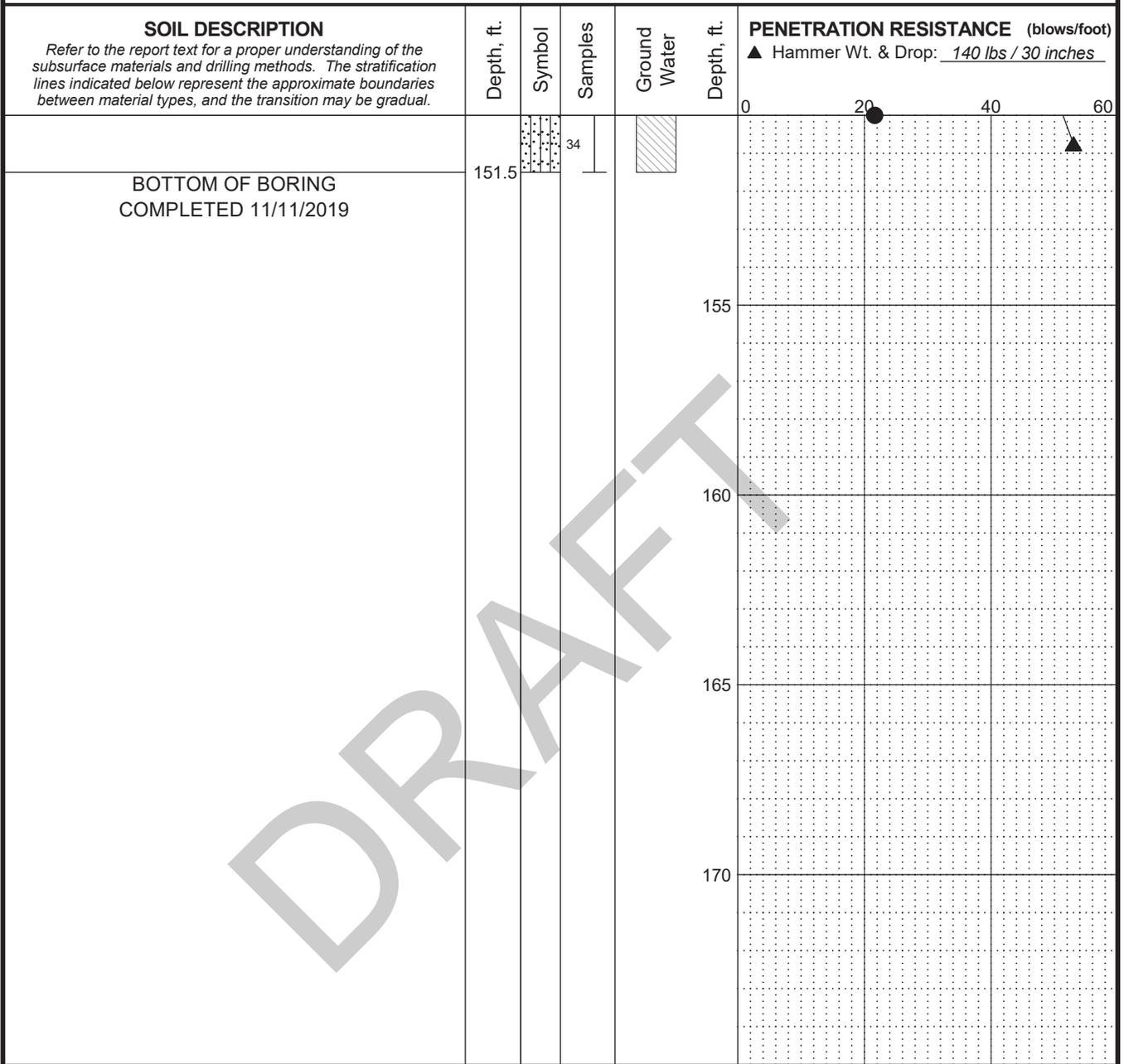
104098-001

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FIG. A-4
 Sheet 6 of 7

MASTER LOG E 104098.GPJ SHAN_WIL_GDT_5/7/20 Log: SAW Rev: EAS Typ: LKN

Total Depth: 151.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 147 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



DRAFT

* Sample Not Recovered
 I 2.0" O.D. Split Spoon Sample

- LEGEND**
- Well Screen and Sand Filter
 - Bentonite-Cement Grout
 - Bentonite Chips/Pellets
 - Bentonite Grout
 - Ground Water Level ATD

- ◇ % Fines (<0.075mm)
- % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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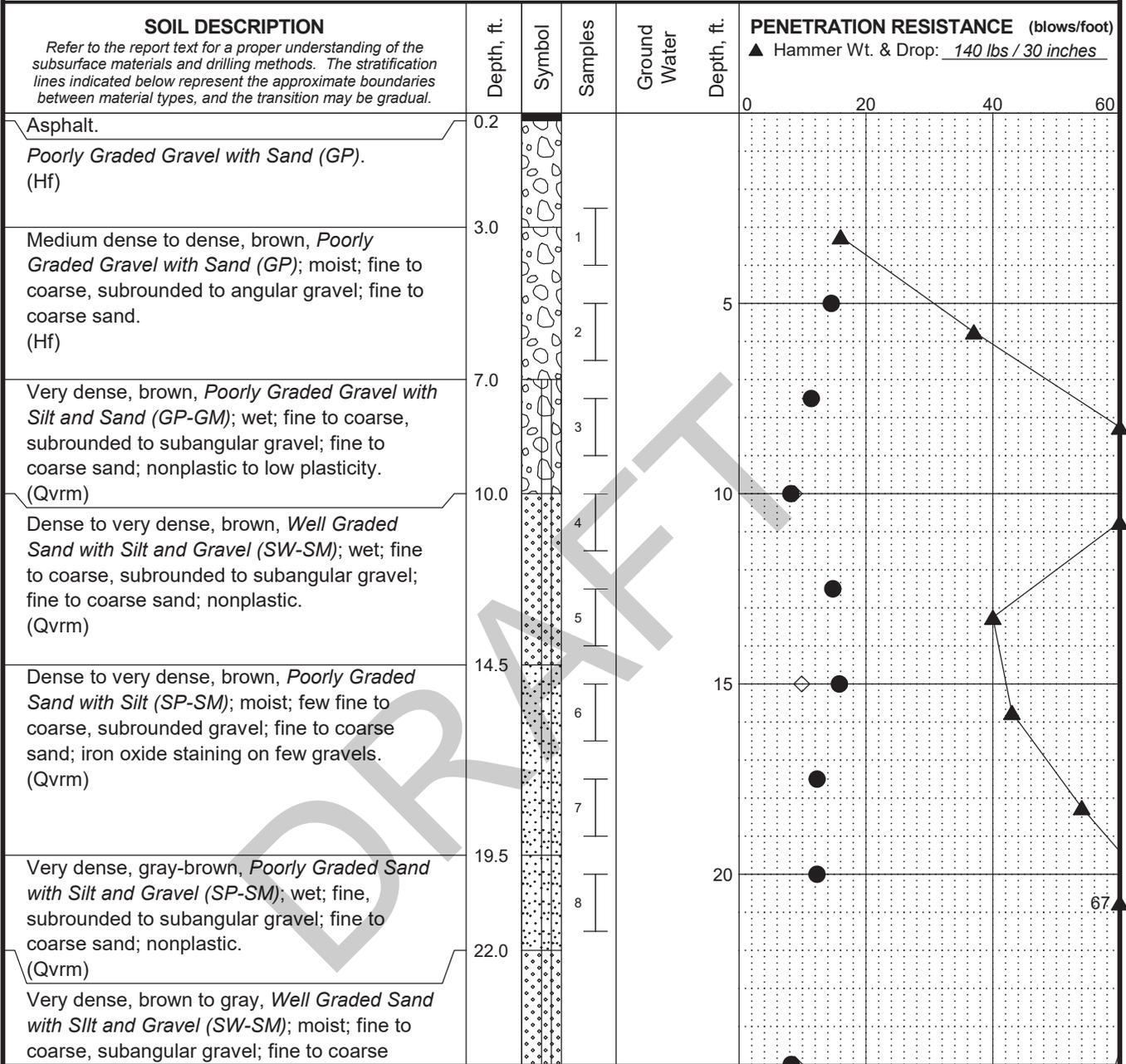
LOG OF BORING SW-3-19

May 2020
104098-001

SHANNON & WILSON, INC.
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FIG. A-4
Sheet 7 of 7

Log: SAW Rev: EAS Typ: LKN MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20

Total Depth: 151.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 122 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



CONTINUED NEXT SHEET
LEGEND

- * Sample Not Recovered
- ∇ Ground Water Level ATD
- ◇ % Fines (<0.075mm)
- ⊔ 2.0" O.D. Split Spoon Sample
- % Water Content

NOTES

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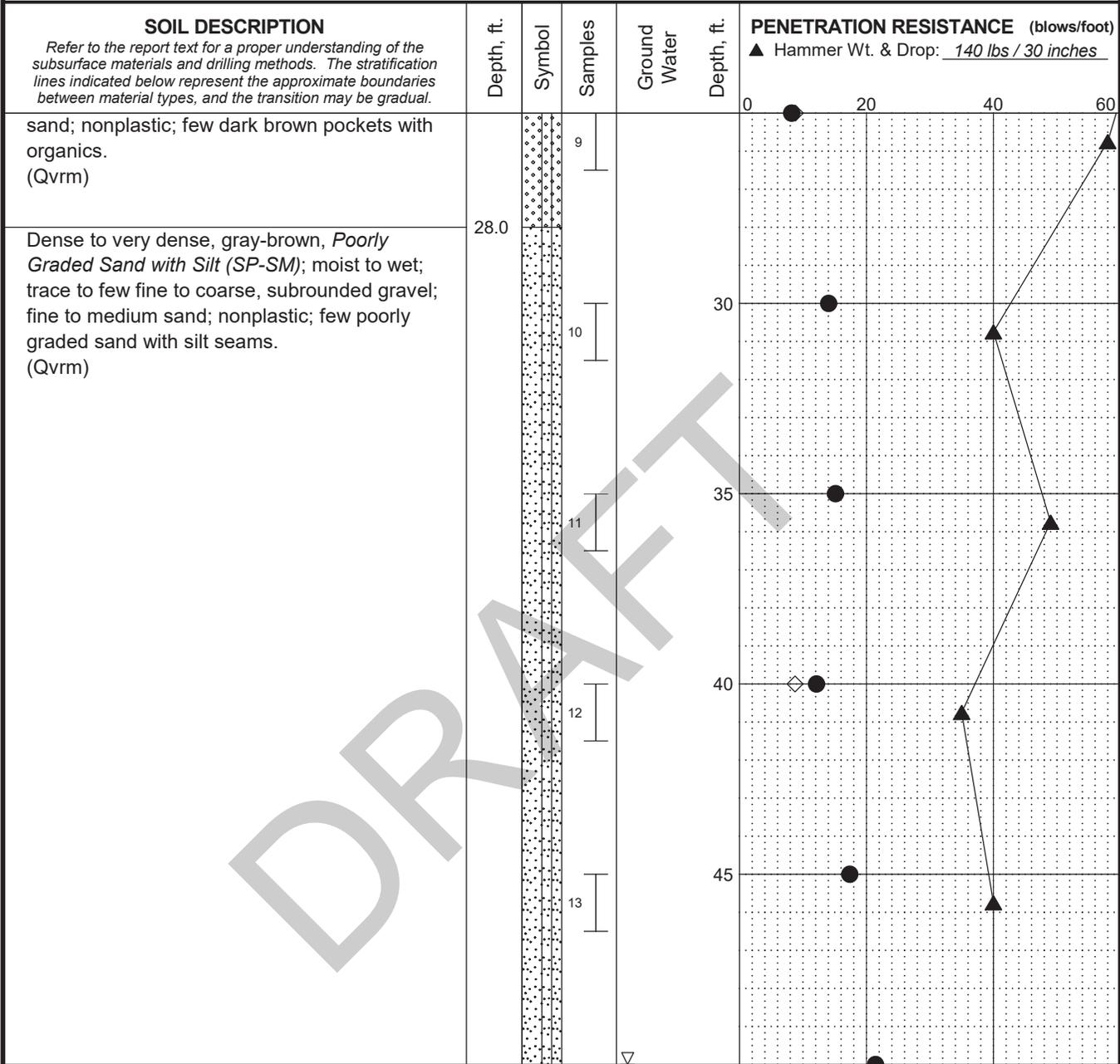
LOG OF BORING SW-4-19

May 2020 104098-001

SHANNON & WILSON, INC. **FIG. A-5**
 Geotechnical and Environmental Consultants Sheet 1 of 7

Log: SAW Rev: EAS Typ: LKN
 MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20

Total Depth: 151.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 122 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



CONTINUED NEXT SHEET
LEGEND

- * Sample Not Recovered
- ∇ Ground Water Level ATD
- ◆ % Fines (<0.075mm)
- I 2.0" O.D. Split Spoon Sample
- % Water Content

NOTES

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2. Groundwater level, if indicated above, is for the date specified and may vary.
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LOG OF BORING SW-4-19

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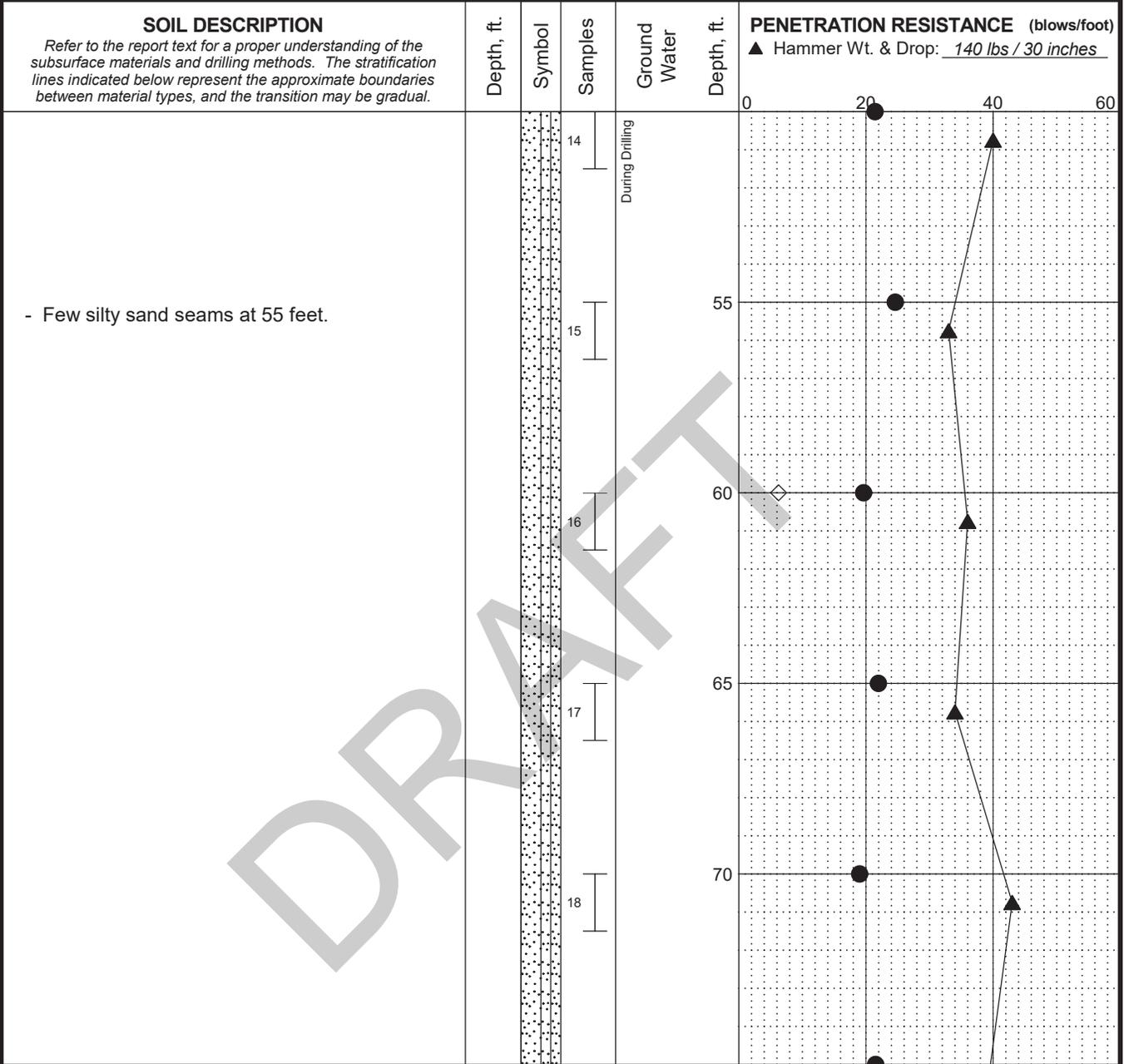
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FIG. A-5
 Sheet 2 of 7

MASTER LOG E 104098.GPJ SHAN_WIL_GDT_5/7/20 Log: SAW Rev: EAS Typ: LKN

Total Depth: 151.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 122 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- ∇ Ground Water Level ATD
- ◇ % Fines (<0.075mm)
- ⊥ 2.0" O.D. Split Spoon Sample
- % Water Content

NOTES

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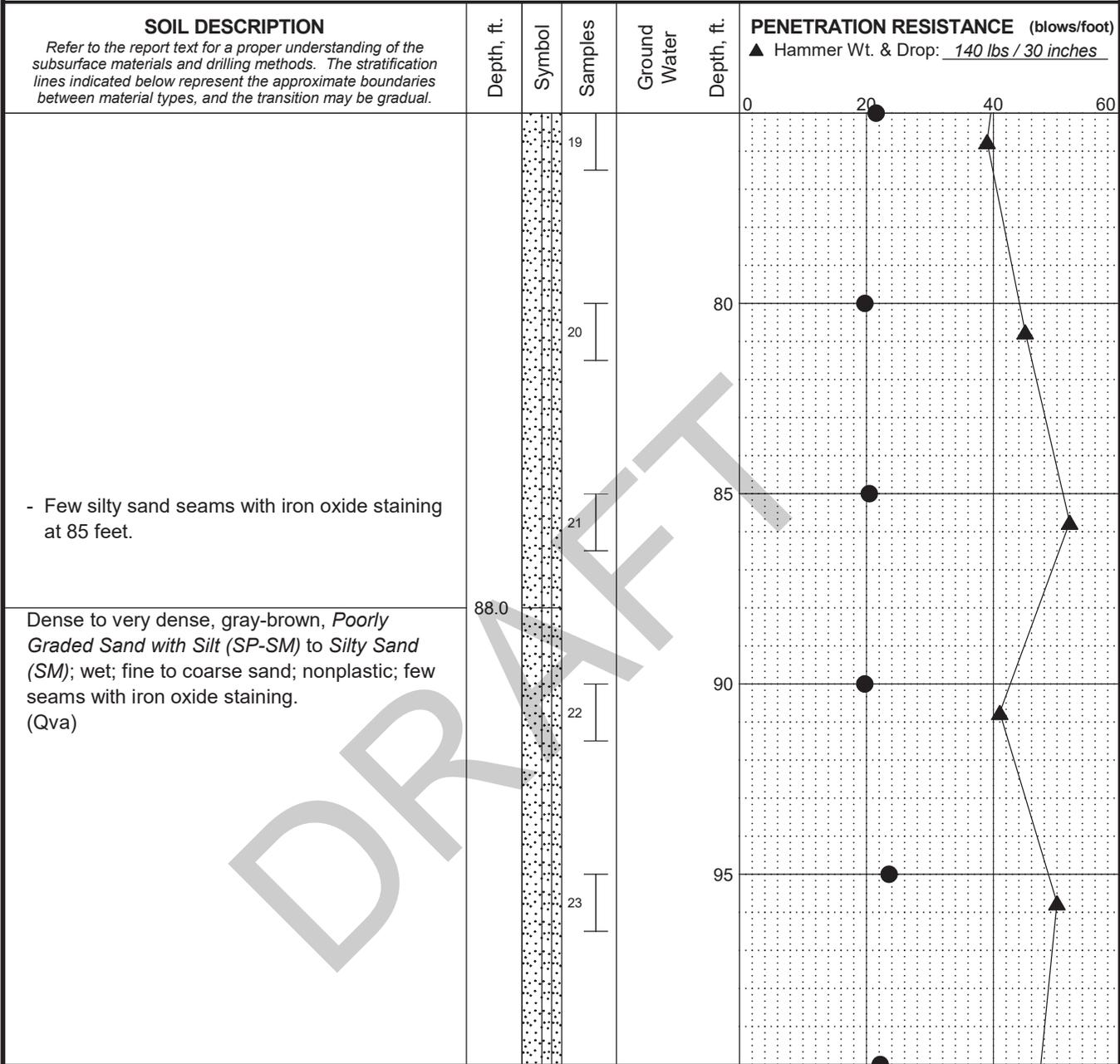
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FIG. A-5
 Sheet 3 of 7

Log: SAW Rev: EAS Typ: LKN
 MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20

Total Depth: 151.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 122 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



CONTINUED NEXT SHEET
LEGEND

- * Sample Not Recovered
- ∇ Ground Water Level ATD
- ⊥ 2.0" O.D. Split Spoon Sample

- ◇ % Fines (<0.075mm)
- % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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May 2020

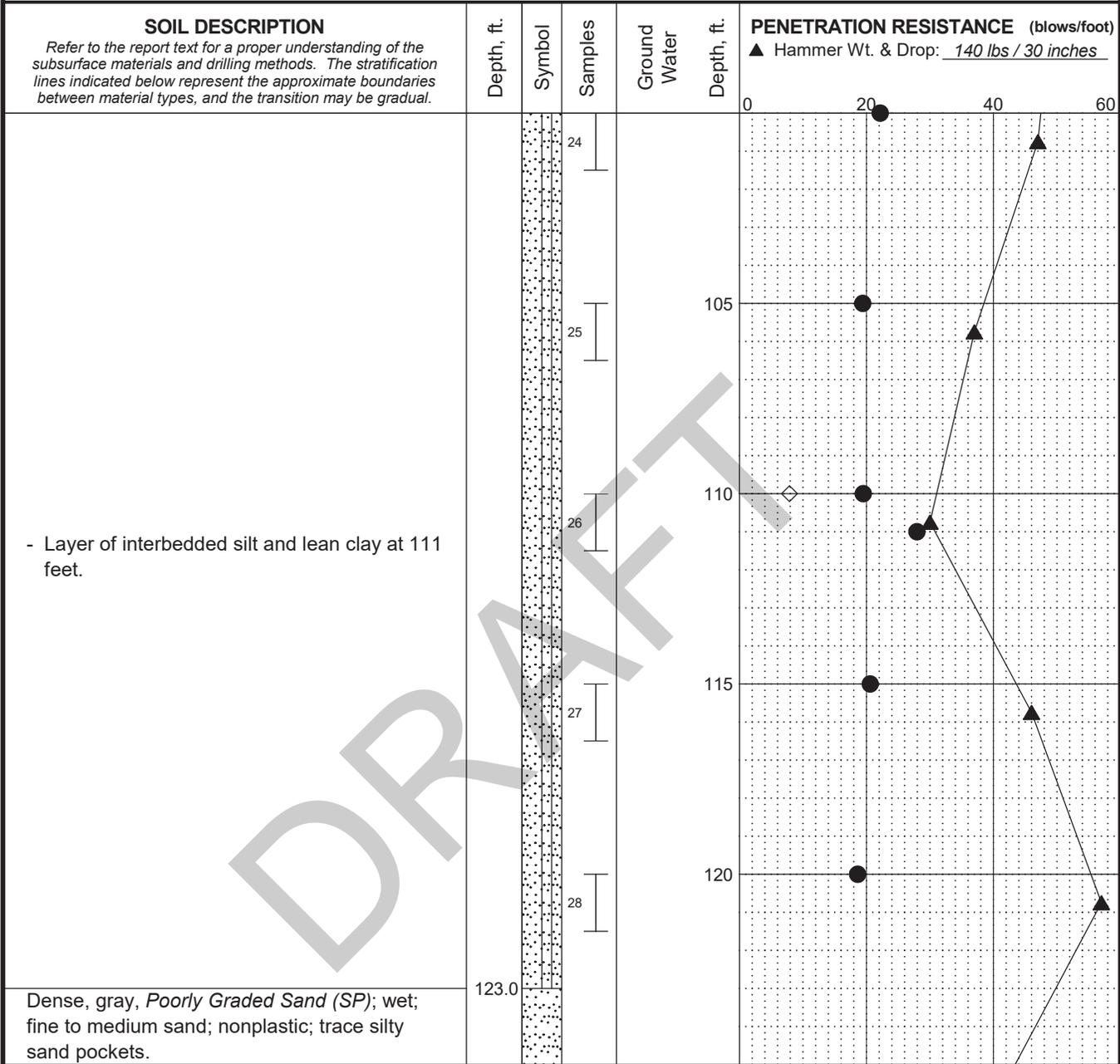
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FIG. A-5
 Sheet 4 of 7

Log: SAW Rev: EAS Typ: LKN MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20

Total Depth: 151.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 122 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



DRAFT

Log: SAW Rev: EAS Typ: LKN
MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20

CONTINUED NEXT SHEET

LEGEND

* Sample Not Recovered	∇ Ground Water Level ATD	◇ % Fines (<0.075mm)
⊥ 2.0" O.D. Split Spoon Sample		● % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

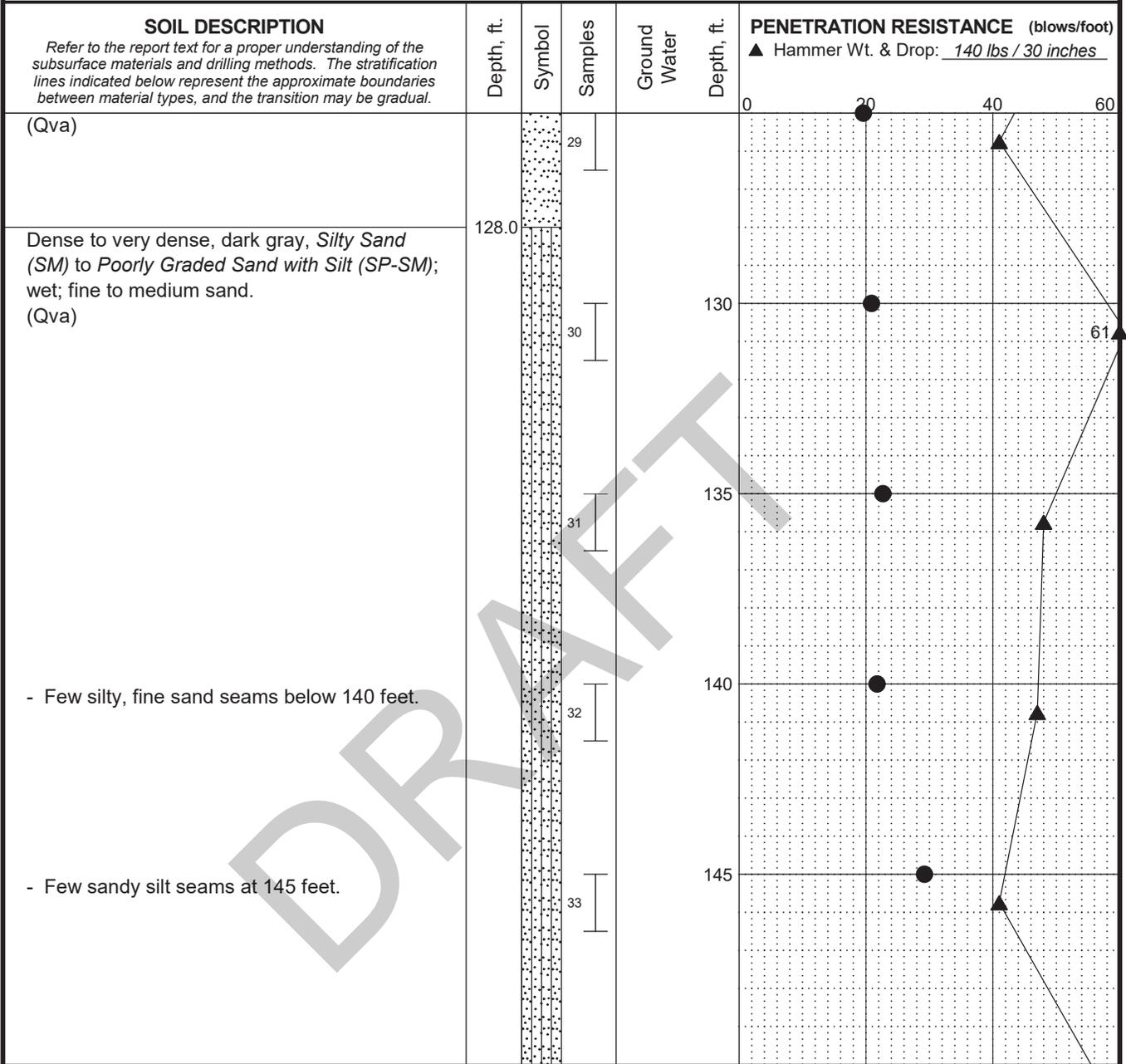
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LOG OF BORING SW-4-19

May 2020
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SHANNON & WILSON, INC. <small>Geotechnical and Environmental Consultants</small>	FIG. A-5 <small>Sheet 5 of 7</small>
--	--

Total Depth: 151.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 122 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



CONTINUED NEXT SHEET
LEGEND

- * Sample Not Recovered
- ∇ Ground Water Level ATD
- ◇ % Fines (<0.075mm)
- ⊥ 2.0" O.D. Split Spoon Sample
- % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

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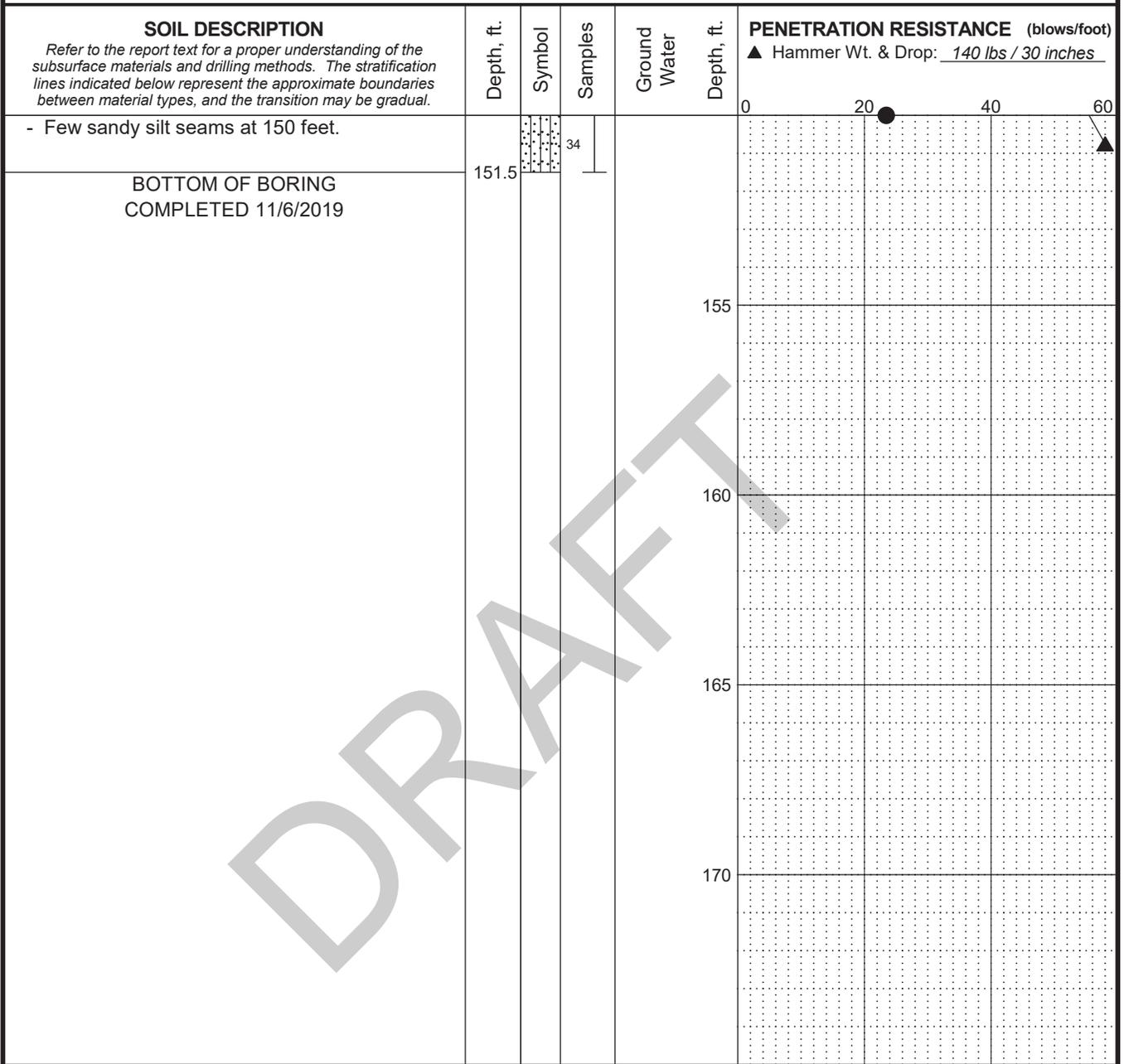
LOG OF BORING SW-4-19

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SHANNON & WILSON, INC. **FIG. A-5**
 Geotechnical and Environmental Consultants Sheet 6 of 7

Log: SAW Rev: EAS Typ: LKN
 MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20

Total Depth: 151.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 122 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



DRAFT

LEGEND

* Sample Not Recovered	∇ Ground Water Level ATD	◇ % Fines (<0.075mm)
⊥ 2.0" O.D. Split Spoon Sample		● % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
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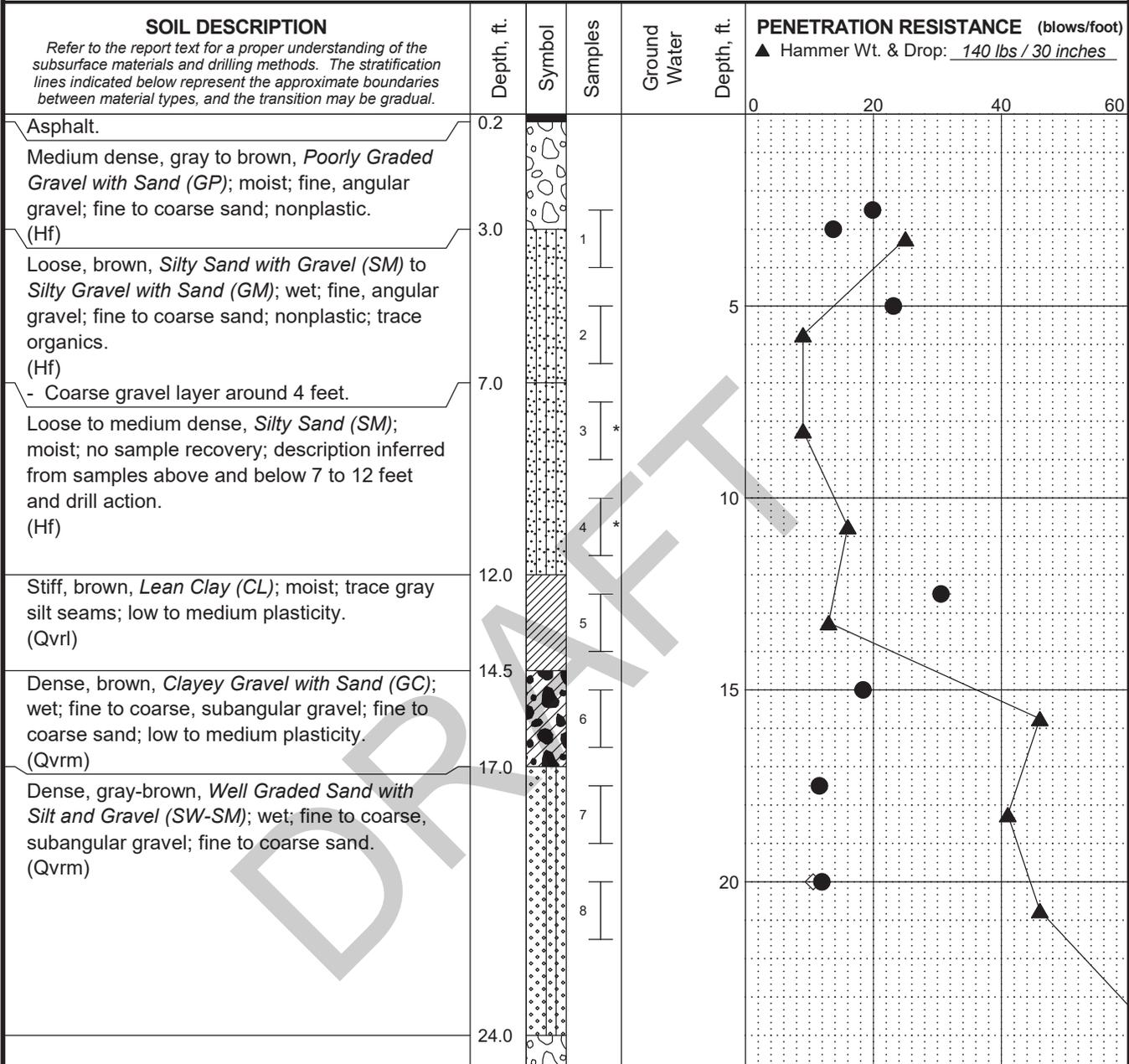
LOG OF BORING SW-4-19

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SHANNON & WILSON, INC. **FIG. A-5**
 Geotechnical and Environmental Consultants Sheet 7 of 7

Log: SAW Rev: EAS Typ: LKN MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20

Total Depth: 81.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 125 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



Log: SAW Rev: EAS Typ: LKN MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20

CONTINUED NEXT SHEET
LEGEND

- * Sample Not Recovered
- ∇ Ground Water Level ATD
- ⊓ 2.0" O.D. Split Spoon Sample
- ◇ % Fines (<0.075mm)
- % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
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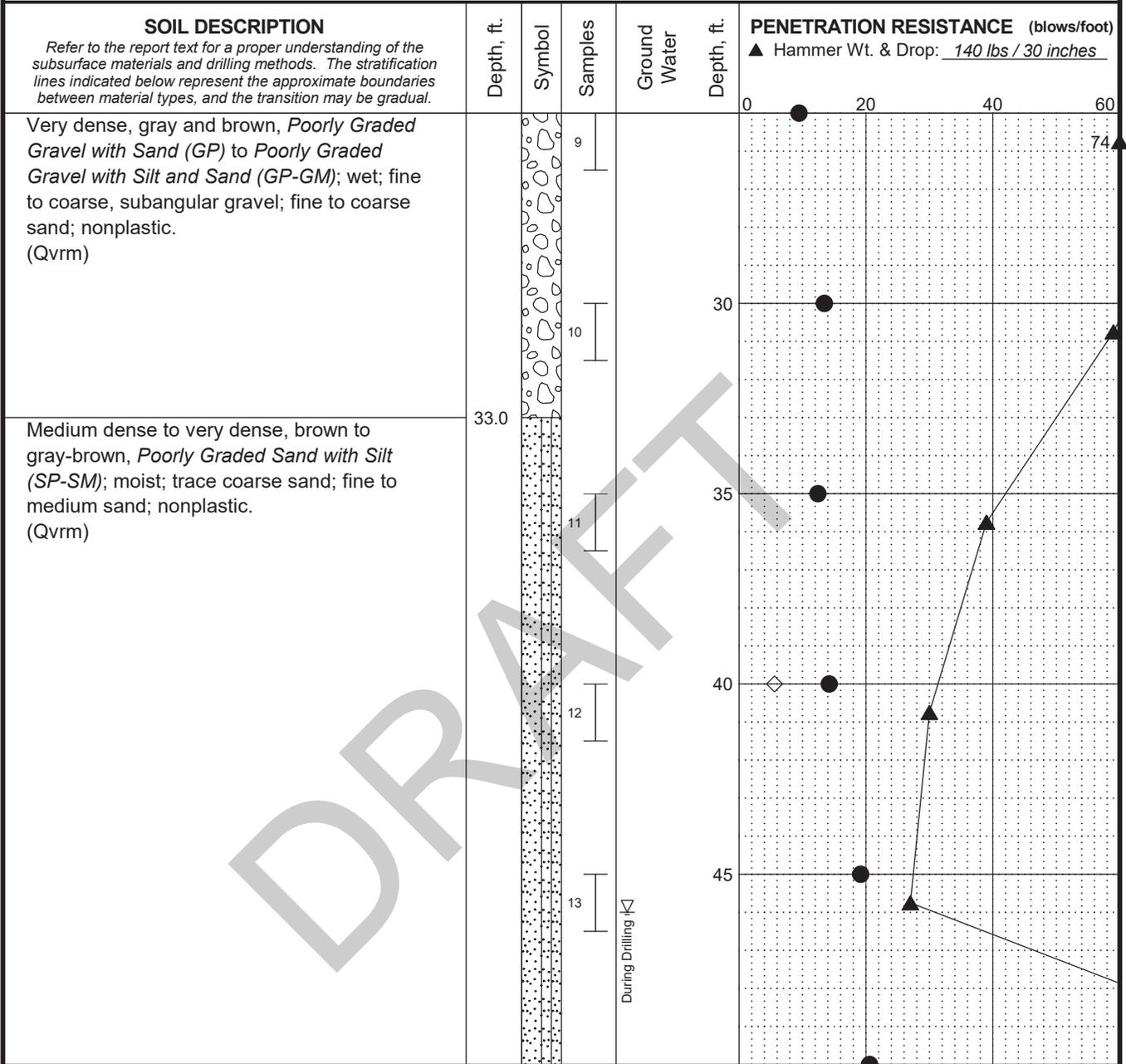
LOG OF BORING SW-5-19

May 2020 104098-001

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FIG. A-6
 Sheet 1 of 4

Total Depth: 81.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 125 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



CONTINUED NEXT SHEET
LEGEND

- * Sample Not Recovered
- ∇ Ground Water Level ATD
- ◇ % Fines (<0.075mm)
- ⊔ 2.0" O.D. Split Spoon Sample
- % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
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LOG OF BORING SW-5-19

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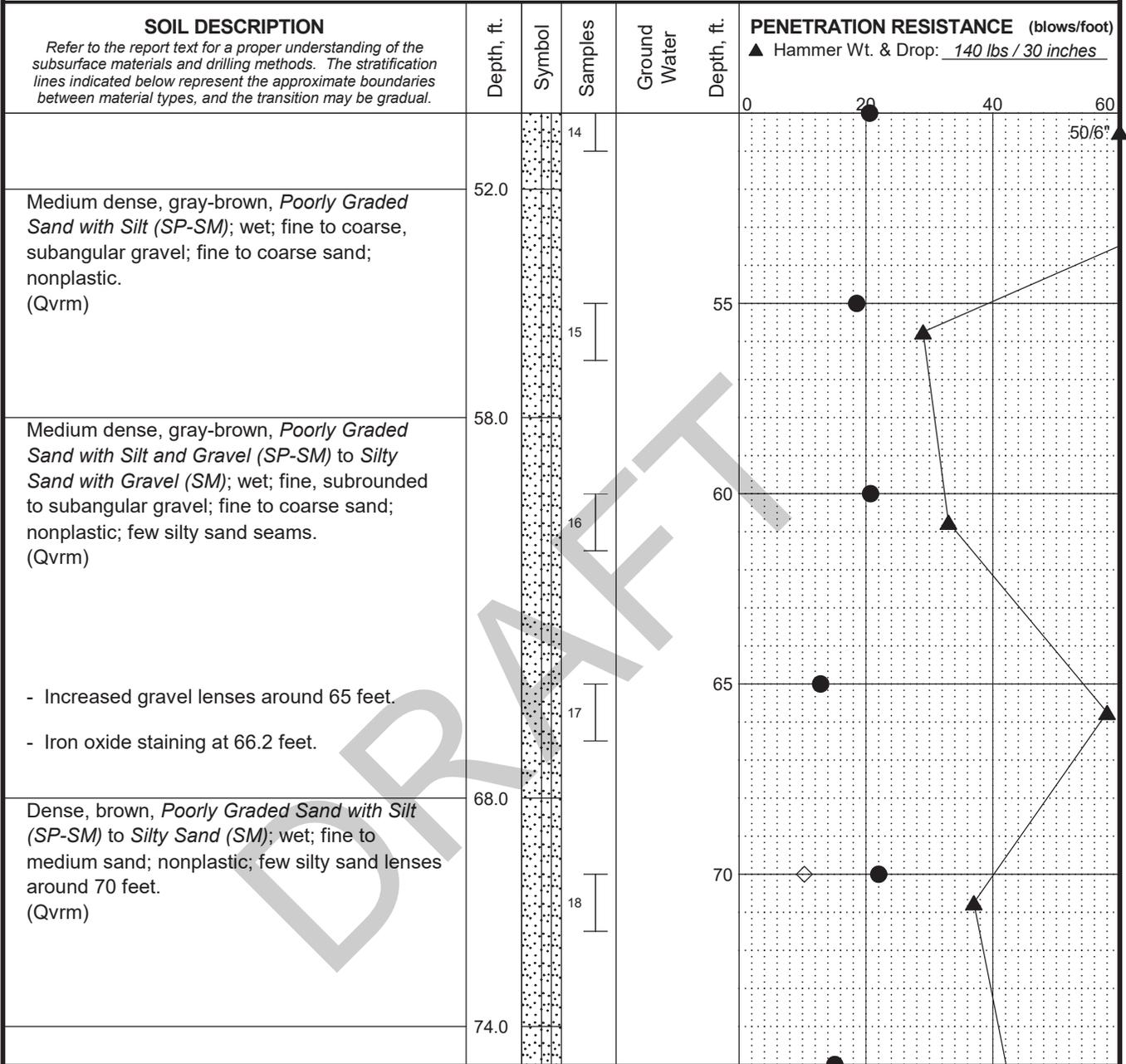
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FIG. A-6
 Sheet 2 of 4

MASTER LOG E 104098.GPJ SHAN_WIL_GDT_5/7/20 Log: SAW Rev: EAS Typ: LKN

Total Depth: 81.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 125 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



Log: SAW Rev: EAS Typ: LKN MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20

CONTINUED NEXT SHEET
LEGEND

- * Sample Not Recovered
- ∇ Ground Water Level ATD
- ◇ % Fines (<0.075mm)
- ⊥ 2.0" O.D. Split Spoon Sample
- % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
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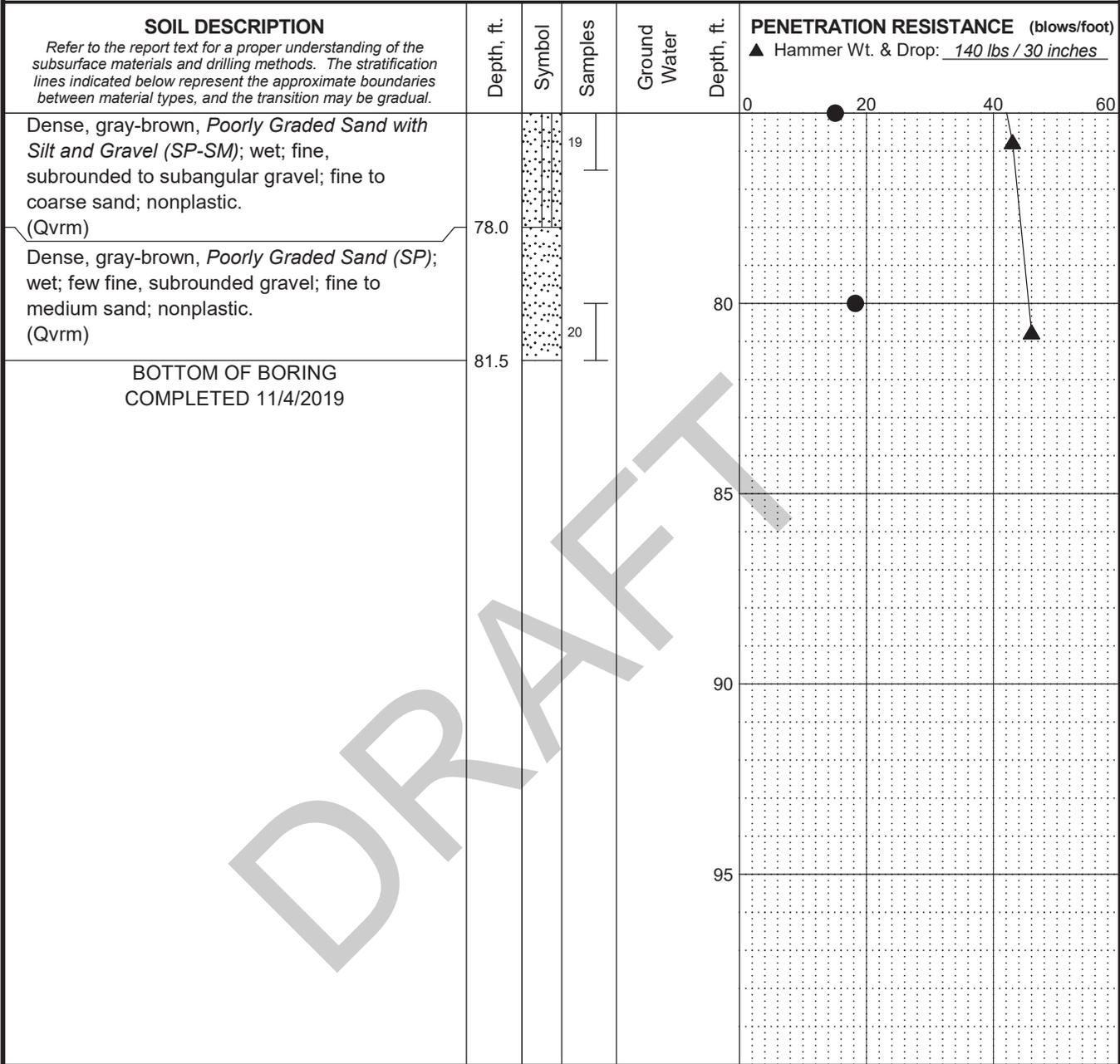
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LOG OF BORING SW-5-19

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SHANNON & WILSON, INC.
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FIG. A-6
Sheet 3 of 4

Total Depth: 81.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 125 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



DRAFT

LEGEND

* Sample Not Recovered	∇ Ground Water Level ATD	◇ % Fines (<0.075mm)
⊥ 2.0" O.D. Split Spoon Sample		● % Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
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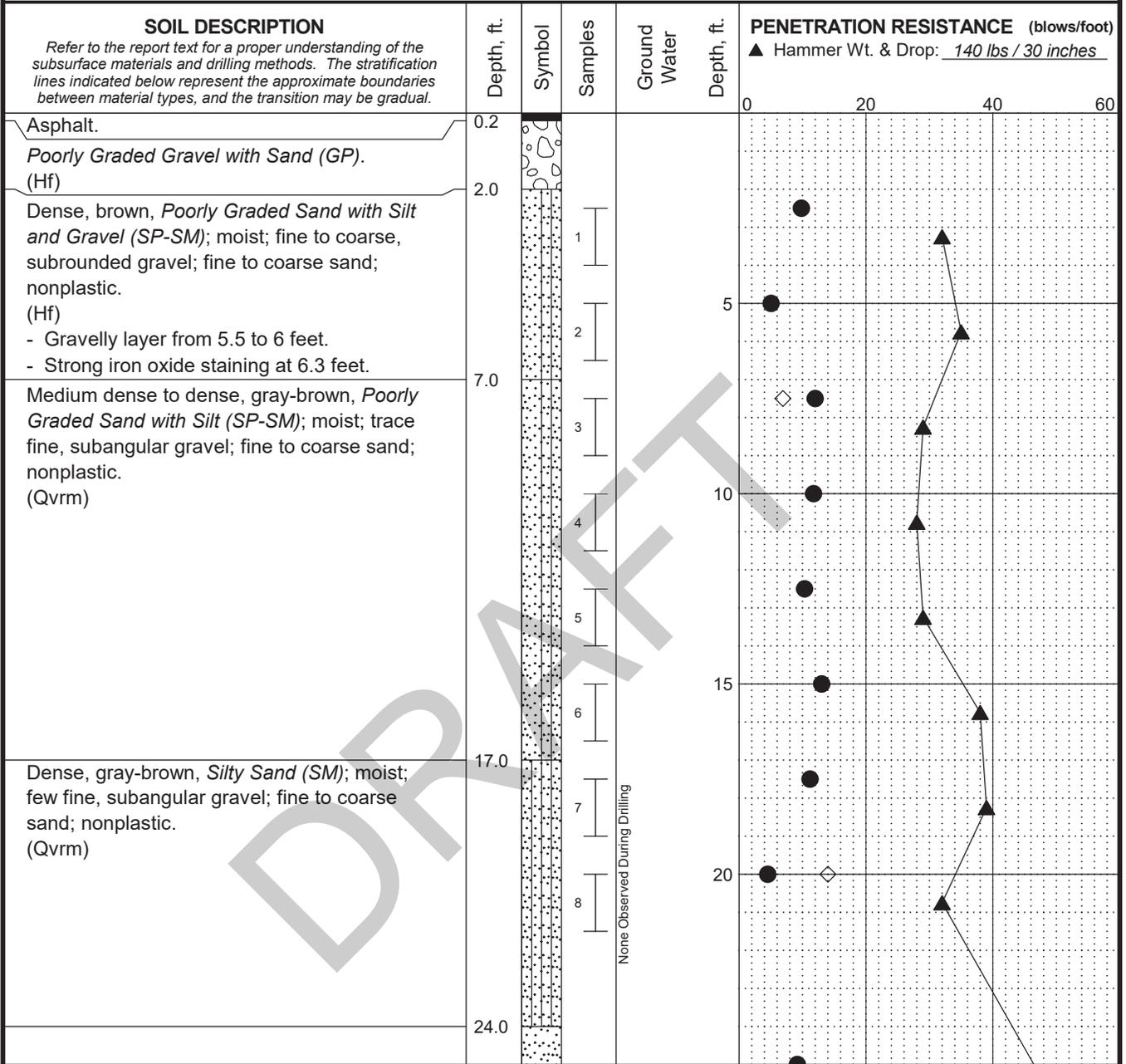
LOG OF BORING SW-5-19

May 2020 104098-001

SHANNON & WILSON, INC. Geotechnical and Environmental Consultants	FIG. A-6 Sheet 4 of 4
---	---------------------------------

Log: SAW Rev: EAS Typ: LKN
MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20

Total Depth: 81.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 125 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



CONTINUED NEXT SHEET

LEGEND

- * Sample Not Recovered
- ⊔ 2.0" O.D. Split Spoon Sample

- ◇ % Fines (<0.075mm)
- % Water Content

NOTES

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LOG OF BORING SW-6-19

May 2020

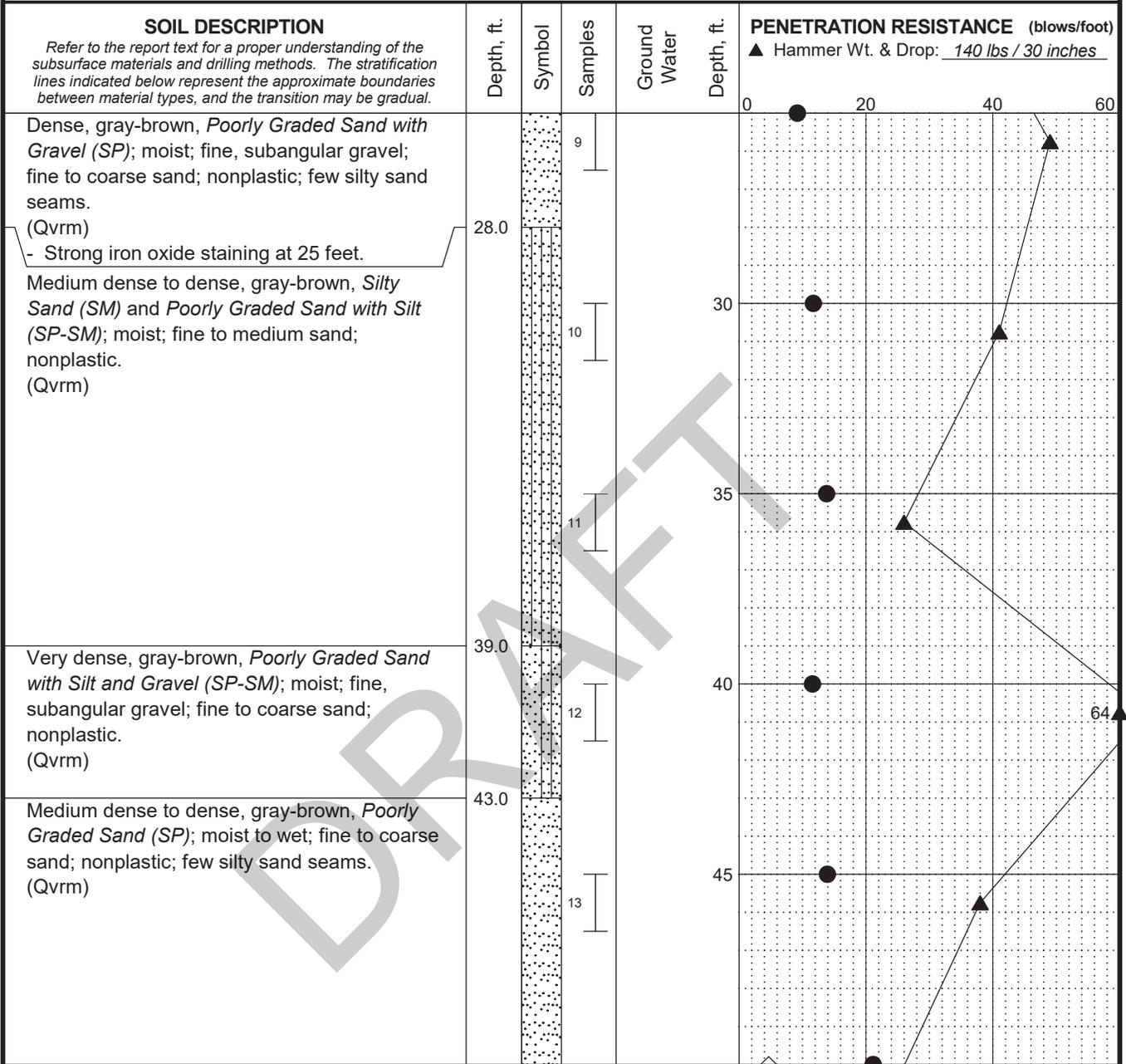
104098-001

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FIG. A-7
 Sheet 1 of 4

Log: SAW Rev: EAS Typ: LKN MASTER LOG E 104098.GPJ SHAN WIL.GDT 5/7/20

Total Depth: <u>81.5 ft.</u>	Northing: _____	Drilling Method: <u>Mud Rotary</u>	Hole Diam.: <u>6 in.</u>
Top Elevation: <u>~ 125 ft.</u>	Easting: _____	Drilling Company: <u>Holocene Drilling</u>	Rod Diam.: <u>2-inch ID</u>
Vert. Datum: _____	Station: _____	Drill Rig Equipment: <u>Diedrich D120 Truck</u>	Hammer Type: <u>Automatic</u>
Horiz. Datum: _____	Offset: _____	Other Comments: _____	



CONTINUED NEXT SHEET
LEGEND

- * Sample Not Recovered
- ┆ 2.0" O.D. Split Spoon Sample

- ◇ % Fines (<0.075mm)
- % Water Content

NOTES

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LOG OF BORING SW-6-19

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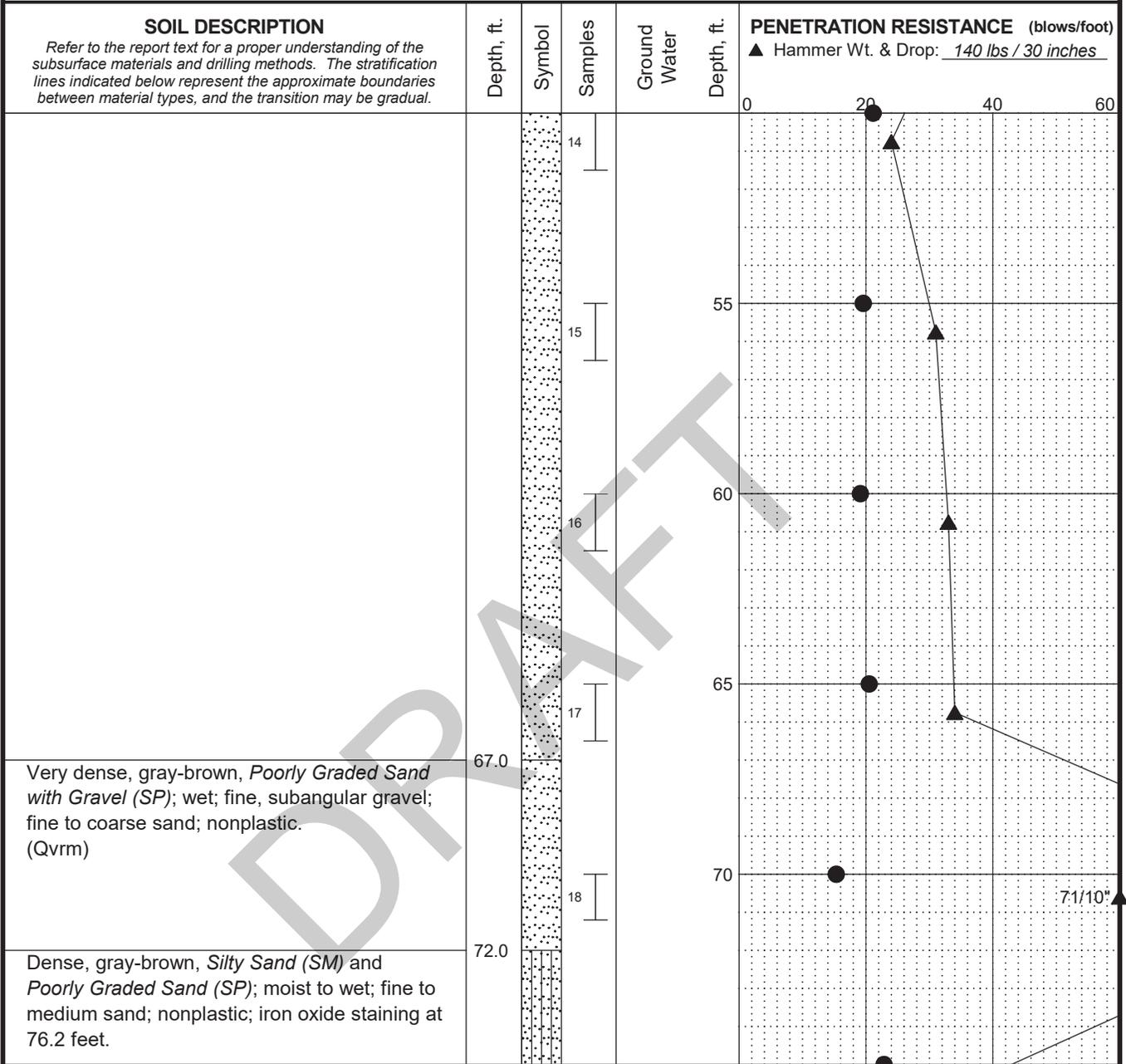
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FIG. A-7
Sheet 2 of 4

MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20 Log: SAW Rev: EAS Typ: LKN

Total Depth: 81.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 125 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



Log: SAW Rev: EAS Typ: LKN
MASTER LOG E 104098.GPJ SHAN WIL.GDT 5/7/20

CONTINUED NEXT SHEET
LEGEND
 * Sample Not Recovered
 I 2.0" O.D. Split Spoon Sample

◇ % Fines (<0.075mm)
 ● % Water Content

NOTES
 1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
 2. Groundwater level, if indicated above, is for the date specified and may vary.
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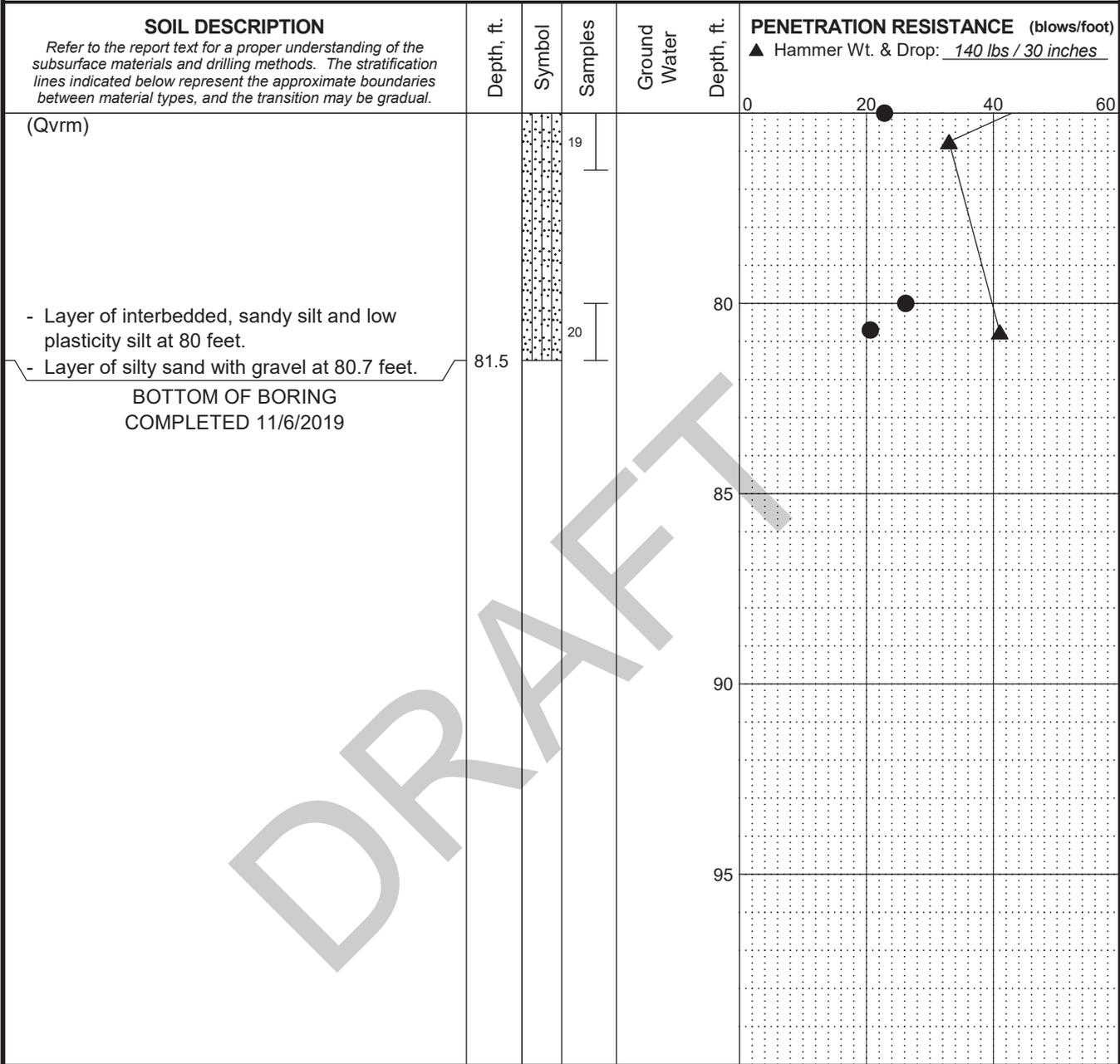
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LOG OF BORING SW-6-19

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SHANNON & WILSON, INC. **FIG. A-7**
 Geotechnical and Environmental Consultants Sheet 3 of 4

Total Depth: 81.5 ft. Northing: _____ Drilling Method: Mud Rotary Hole Diam.: 6 in.
 Top Elevation: ~ 125 ft. Easting: _____ Drilling Company: Holocene Drilling Rod Diam.: 2-inch ID
 Vert. Datum: _____ Station: _____ Drill Rig Equipment: Diedrich D120 Truck Hammer Type: Automatic
 Horiz. Datum: _____ Offset: _____ Other Comments: _____



DRAFT

LEGEND

- * Sample Not Recovered
- ⊥ 2.0" O.D. Split Spoon Sample

- ◇ % Fines (<0.075mm)
- % Water Content

NOTES

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2. Groundwater level, if indicated above, is for the date specified and may vary.
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LOG OF BORING SW-6-19

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FIG. A-7
 Sheet 4 of 4

Log: SAW Rev: EAS Typ: LKN
 MASTER LOG E 104098.GPJ SHAN WIL GDT 5/7/20

PROJECT: Arlington Shop Redevelopment 19620 67th Ave NE Arlington, Wa. 98223 C.R.P.#: ROFAC-52-37 DATE: 12/21/15 STATION: Center Yard Power Pole OFFSET: GEO./ENGR.: Kirk R. Bailey ELEV.:	BORING NO.: SB-01 DRILLER: WSDOT DRILL TYPE: CME 850 (PC2-4) AUGER TYPE: HC Wireline Core FLUID: Super Gel X Bentonite Polymer TOTAL DEPTH: 145.50
--	---

I S A M P L E L V E L	S A M P L E #	B L O W S / F T	S T R A T A	D E P T H	SOIL DESCRIPTION	NOTES
X				19.0	19.0 - 42.0' Sand ; Continued from previous page.	
X	8	14/14/13		40	42.0' ground water table (2/10/2016)	
X	9	13/9/12		45	42.0 - 48.0' Sand ; Gray brown to gray, fine- to medium-grained, little silt, trace coarse-grained sand, trace gravel, medium dense, wet to saturated (<i>sp</i>).	12/18/2015 Continued drilling hole from 45.5' to 100.5 ft bgs. Drill mud down hole measured at 20 ft bgs.
X	10	16/20/24		50	48.0 - 53.0' Sand ; Gray brown, fine- to coarse-grained, some gravel, dense, wet (<i>sp</i>).	
X	11	13/10/14		55	53.0 - 62.0' Sand ; Gray brown, fine- to coarse-grained, trace silt, medium dense, wet (<i>sp</i>).	
X	12	10/8/12		60		
X	13	6/7/10		65	62.0 - 67.0' Silty Sand ; Gray brown to tan, very fine- to fine-grained, thin laminations of silt, local iron staining, loose to medium dense, wet (<i>sm</i>).	
X	14	10/12/13			67.0 - 82.0' Silty Sand ; Gray brown to gray, fine-grained, trace medium-grained sand, local red brown staining, medium dense, wet (<i>sm</i>).	Boring log continued on next page

NOTES: Soil samples were taken in accordance with ASTM D1586-84 standards and specifications. Soil classifications were developed in the field in accordance with ASTM D2488 and following the Unified Soil Classification system format.



PROJECT: Arlington Shop Redevelopment 19620 67th Ave NE Arlington, Wa. 98223	BORING NO.: SB-01
C.R.P.#: ROFAC-52-37 DATE: 12/21/15	DRILLER: WSDOT
STATION: Center Yard Power Pole OFFSET:	DRILL TYPE: CME 850 (PC2-4)
GEO./ENGR.: Kirk R. Bailey ELEV.:	AUGER TYPE: HC Wireline Core
	FLUID: Super Gel X Bentonite Polymer
	TOTAL DEPTH: 145.50

SOIL SAMPLE LEVEL	SAMPLE #	BLOWS / FT	STRATA	DEPTH	SOIL DESCRIPTION	NOTES
				67.0 - 82.0'	Silty Sand ; Continued from previous page.	
	15	13/13/12		75'		
	16	10/10/11		80'		
	17	14/15/22		85'	82.0 - 87.0' Sand ; Gray brown, fine- to coarse-grained, dense, moist to wet (<i>sp</i>).	
	18	10/13/19		90'	87.0 - 145.5' Sand to Silty Sand ; Gray brown, very fine-grained to medium-grained, occasional silt laminations, locally iron stained, medium dense to dense, wet (<i>sm-sp</i>).	
	19	12/12/14		95'	89.0' fine- to very fine-grained sand, trace medium-grained sand, trace to little silt.	
	20	16/16/17		100'		12/21/2015 continued drilling from 100.5 to 145.5 ft bgs. Drill mud down hole measured at 27.9 ft bgs.
	21	13/13/17		104.0'	trace to little medium-grained sand, trace to little silt	Boring log continued on next page

NOTES: Soil samples were taken in accordance with ASTM D1586-84 standards and specifications. Soil classifications were developed in the field in accordance with ASTM D2488 and following the Unified Soil Classification system format.

PROJECT: Arlington Shop Redevelopment 19620 67th Ave NE Arlington, Wa. 98223	BORING NO.: SB-01
C.R.P.#: ROFAC-52-37 DATE: 12/21/15	DRILLER: WSDOT
STATION: Center Yard Power Pole OFFSET:	DRILL TYPE: CME 850 (PC2-4)
GEO./ENGR.: Kirk R. Bailey ELEV.:	AUGER TYPE: HC Wireline Core
	FLUID: Super Gel X Bentonite Polymer
	TOTAL DEPTH: 145.50

I S A M P L E L V E L	S A M P L E #	B L O W S / F T	S T R A T A	D E P T H	SOIL DESCRIPTION	NOTES
					87.0 - 145.5' Sand to Silty Sand ; Continued from previous page.	
	22	15/14/14		110		
	23	24/19/18		115		
	24	12/15/15		120	119.0' trace to little medium-grained sand, trace to little silt	
	25	12/14/19		125		
	26	12/14/16		130		
	27	15/10/18		135	134.0' Silty Sand, very fine-grained	
	28	13/18/22				Boring log continued on next page

NOTES: Soil samples were taken in accordance with ASTM D1586-84 standards and specifications. Soil classifications were developed in the field in accordance with ASTM D2488 and following the Unified Soil Classification system format.



PROJECT:	Arlington Shop Redevelopment 19620 67th Ave NE Arlington, Wa. 98223		BORING NO.:	SB-01	
C.R.P.#:	ROFAC-52-37	DATE:	12/21/15	DRILLER:	WSDOT
STATION:	Center Yard Power Pole	OFFSET:		DRILL TYPE:	CME 850 (PC2-4)
GEO./ENGR.:	Kirk R. Bailey	ELEV.:		AUGER TYPE:	HC Wireline Core
				FLUID:	Super Gel X Bentonite Polymer
				TOTAL DEPTH:	145.50

IN S A M P L E L V E L	S A M P L E #	B L O W S / F T	S T R A T A	D E P T H	SOIL DESCRIPTION	NOTES
					87.0 - 145.5' <u>Sand to Silty Sand</u> ; Continued from previous page.	
	29	17/21/30		145-	Total Depth = 145.5 ft. bgs. Driller: Danny Henderson #2742 VWP Serial #1503092	Boring backfilled to 100 ft. bgs with bentonite pellets. Vibrating wire piezometer installed at 100 ft. bgs. Boring backfilled from 100 ft. bgs to surface with mixture of quickset concrete and bentonite chips. VWP installed with standpipe monument and 4 surrounding bollards.

NOTES: Soil samples were taken in accordance with ASTM D1586-84 standards and specifications. Soil classifications were developed in the field in accordance with ASTM D2488 and following the Unified Soil Classification system format.



BORING LOG NO. B-1

L76:Ä! Ä/Ä!

PROJECT: Sno County Maintenance Triple Wide

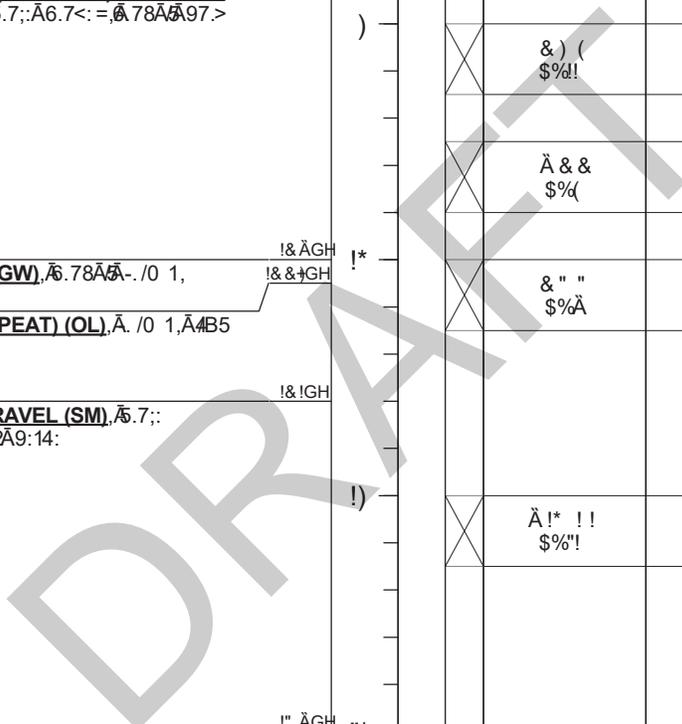
CLIENT: Burton Construction
1000 Industry Drive Tukwila, WA 98188

SITE: 19700 67th Ave NE
Arlington, WA

will@burtonconstruction.net

IJKL	MID/OCI	XZLPM	XZLPMÄY+@	IKPZ JÄOZVZD	CVSZJWKPCSS	SKILOZÄP L Z	YNDYÄPZP	JZ S' OÄS	SPJZ \$I	PMÄPZP	IKPZ J	DC\$P Z\$ PÄE@	XJ:Ä\$ NP	VZNIIPA?QB@	KPPZJVZJI	ON#S	OCL OLN	LZJD Z\$ PÄWZS
	OCDKPNCS \$:ÄZTU35ÄK "																	
	O7589: RÄÄ" Ä!) ÄÄÄ 6358: RÄÄ "HÄ *#(' _																	
	ÄKQ/TZ7 5:ÄSÄB7: ÄZ< RÄÄÄ?Y+@Ä																	
	XZLPM	ZCZWKPNCSÄY+@																
	*+) FILL - GRASS AND TOPSOIL (SM) ,Ä. /O 1,Ä2/345	IA&+GH																
	FILL - POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM) ,Ä. 78ÄÄ-. /O 1,Ä9:14:Ä2 /345						Ä!" !#	\$%&!)										!!
	Ä+*	IA*GH					' &&	\$%Ä										
	FILL - CRUSHED ROCK (5/8" minus) mixed with SILTY SAND (GW-GM) ,Ä. 7:;Ä6.7<: =.Ä 78ÄÄ97.> - /O 1,Ä=//4:Ä0.5)					&) (\$%Ä!										
	5.7:;Ä. 6713;4Ä// 54@																	
	-: ;/2 :4Ä2:9 3A2Ä9:14:																	
	5.7:;Ä43=5																	
	!&+*	IA&GH																
	*+) FILL - SANDY GRAVEL (GW) ,Ä. 78ÄÄ-. /O 1, =//4:Ä0:5	IA&+GH																
	SANDY ORGANIC SILT (PEAT) (OL) ,Ä. /O 1,Ä4B5																	
	C.6713;Ä/ 15:15%Ä#)E																	
	!&+*	IA&GH																
	*+) MIX SILTY SAND and GRAVEL (SM) ,Ä. 7:; /. 6713;4Ä-. /O 1,Ä2:9 3A2Ä9:14:	IA&GH																
	!&+*	IA&GH																
	*+) POORLY GRADED SAND (SP) ,Ä. 78,Ä :9 3A2 9: 14:Ä2/345	IA&GH																
	!&+*	IA&GH																
	!&+*) Boring Terminated at 21.5 Feet	IA&GH																
	S575B3 5B Ä:4 ÄZ: ÄTQ/ TZ7 5:ÄN43ÄÄ5Ä5714358Ä278Ä:Ä6.79A7=+																	

PMNSÄVONS/ÄOCÄNSÄSPÄWÄKÄÄZLJK PZÄY:JC[ÄC:JNINSKÖÄJL: CJ PÄÄÄZCÄS[ÄPÄOCI \$CÄZ OÖÄÄF(Ä) F+ILJÄÄPZJJKDCS(Ä) +IXPÄ ÄIHÄ!Ä!



K9<71:; 2:1 5Ä:5U9 R M/≠0 ÄS:2 ÄKÄ: .	S: :ÄZTU35ÄK&BÄ94:;3Q53 ÄBÄB3:= Q/; :9 A: 4+ S: :ÄKQ:193ÄVÄBÄ94:; 3Q53/ÄBÄÄ=. 75. 8 Q/; :9 A: 4Ä19Ä99353 7=Ä97ÄBÄÄ@	\$/ 5:4R
K- 719/ 12:1 5Ä:5U9 R V/ .316Ä-7;> B99 ÄCÄÄ4Ä3Ä/553ÄÄQ/1Ä;/2Q=53/1+	S: :ÄKQ:193ÄDÄBÄ:TQ=7753/ÄBÄÄ2- /ÄÄ79 7--.:< 353/4+	
WATER LEVEL OBSERVATIONS		
	"I #*)ÄÄ5ÄÄK: ÄI ÄSÄ!" * / / Ä157>:ÄP: ..7:; ÄI ÄK	
	V/ .316Ä57.5:9RÄ H"H" !(X.3=ÄÄÄÄ.7;> L./ a; 53/ 4ÄÄ!()!)F	V/ .316Ä/ 2Q=5: 9RÄ H"H" !(X.3=ÄÄ : / =63; ZTU35R K Ä

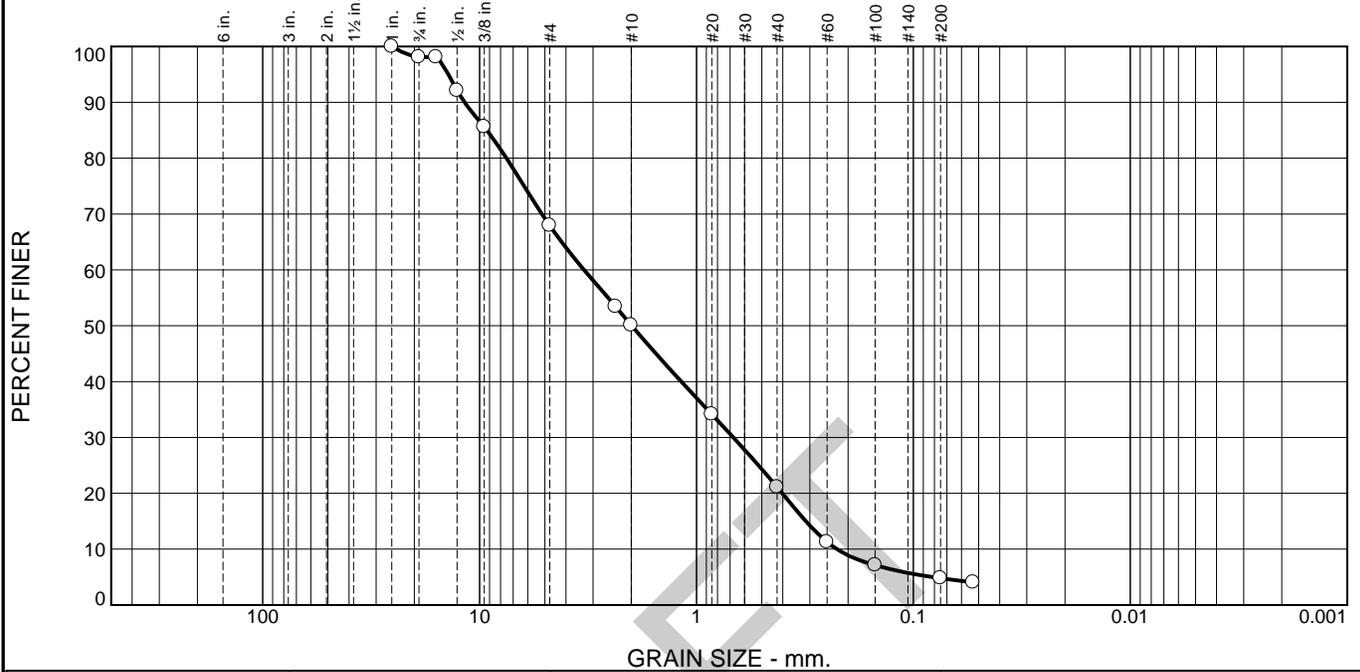
FIG. A-9

APPENDIX C

Laboratory Results

DRAFT

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.9	30.2	17.8	29.0	16.3	4.8	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
3/4"	98.1		
5/8"	98.1		
1/2"	92.1		
3/8"	85.6		
#4	67.9		
#8	53.4		
#10	50.1		
#20	34.1		
#40	21.1		
#60	11.3		
#100	7.1		
#200	4.8		
#270	4.1		

Material Description
very gravelly SAND trace silt

Atterberg Limits (ASTM D 4318)
 PL= NP LL= NV PI=

Classification
 USCS (D 2487)= SP AASHTO (M 145)= A-1-a

Coefficients
 D₉₀= 11.7370 D₈₅= 9.2633 D₆₀= 3.2986
 D₅₀= 1.9897 D₃₀= 0.6767 D₁₅= 0.3131
 D₁₀= 0.2251 C_u= 14.66 C_c= 0.62

Remarks

Date Received: 5-13-2024 Date Tested: 5-15-2024

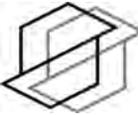
Tested By: FEW

Checked By: BCY/TR

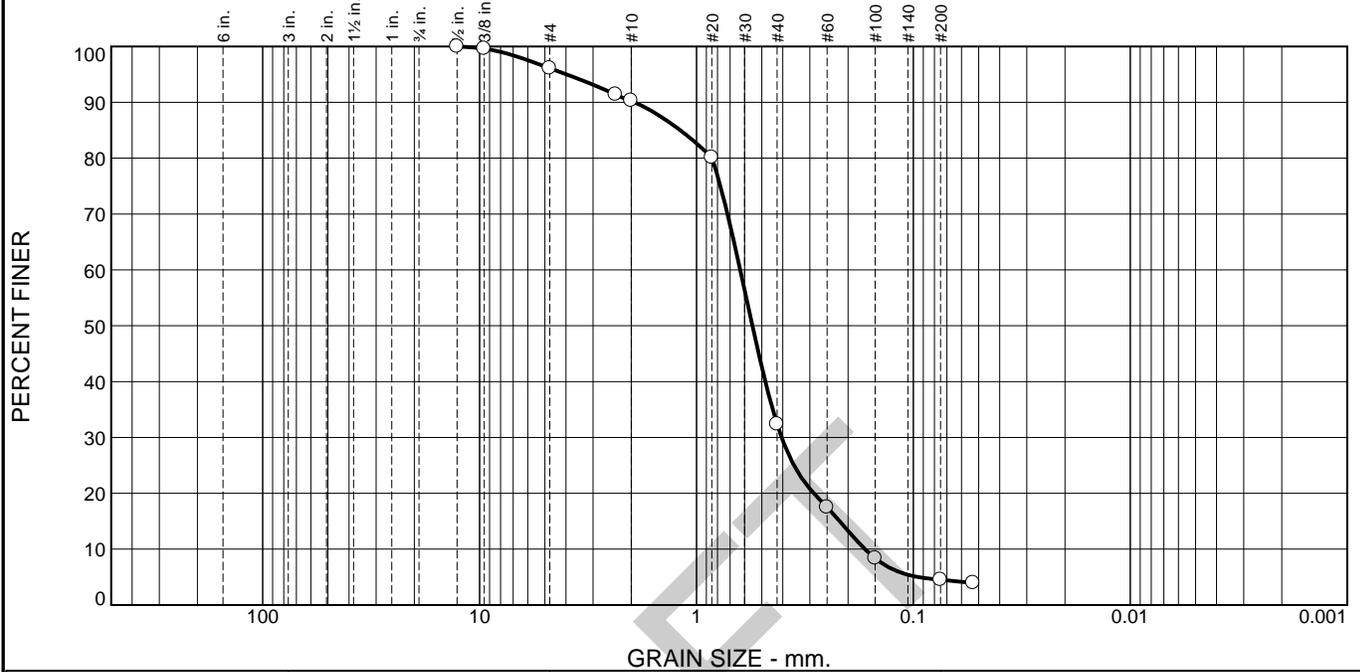
Title: _____

* (no specification provided)

Location: Onsite Date Sampled: 4/24/2024
 Sample Number: EB-3 Depth: 7.5'

	associated earth sciences incorporated	Client: Cornerstone General Contractors, Inc. Project: Arlington Operations Center Redevelopment Project No: 20240001E001
	Figure	

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.9	5.8	57.9	27.9	4.5	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1/2"	100.0		
3/8"	99.6		
#4	96.1		
#8	91.4		
#10	90.3		
#20	80.1		
#40	32.4		
#60	17.5		
#100	8.4		
#200	4.5		
#270	3.9		

Material Description
SAND trace gravel trace silt

Atterberg Limits (ASTM D 4318)
 PL= NP LL= NV PI=

Classification
 USCS (D 2487)= SP AASHTO (M 145)= A-1-b

Coefficients
 D₉₀= 1.9226 D₈₅= 1.1874 D₆₀= 0.6286
 D₅₀= 0.5524 D₃₀= 0.4051 D₁₅= 0.2188
 D₁₀= 0.1672 C_u= 3.76 C_c= 1.56

Remarks

Date Received: 5-13-2024 Date Tested: 5-15-2024

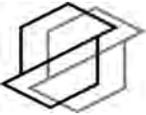
Tested By: FEW

Checked By: BCY/TR

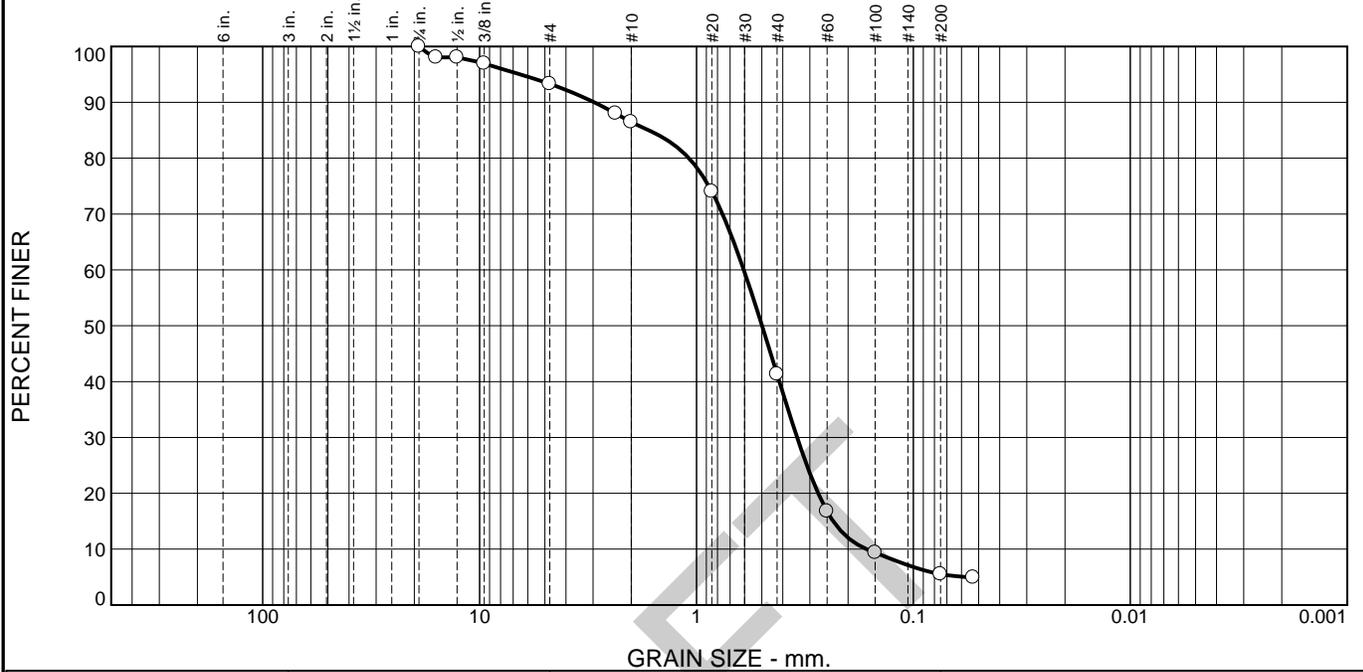
Title: _____

* (no specification provided)

Location: Onsite Date Sampled: 4-24-2024
 Sample Number: EB-3 Depth: 15'

	associated earth sciences incorporated	Client: Cornerstone General Contractors, Inc. Project: Arlington Operations Center Redevelopment
	Project No: 20240001E001 Figure	

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	6.7	6.8	45.2	35.8	5.5	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
5/8"	98.0		
1/2"	98.0		
3/8"	97.0		
#4	93.3		
#8	88.0		
#10	86.5		
#20	74.0		
#40	41.3		
#60	16.8		
#100	9.4		
#200	5.5		
#270	4.9		

Material Description

SAND some gravel some silt

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI=

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)= A-1-b

Coefficients

D₉₀= 2.9624 D₈₅= 1.6638 D₆₀= 0.6054
D₅₀= 0.4987 D₃₀= 0.3435 D₁₅= 0.2343
D₁₀= 0.1641 C_u= 3.69 C_c= 1.19

Remarks

Date Received: 5-13-2024 Date Tested: 5-15-2024

Tested By: FEW

Checked By: BCY/TR

Title: _____

* (no specification provided)

Location: Onsite Sample Number: EB-3 Depth: 20' Date Sampled: 4-24-2024

	Client: Cornerstone General Contractors, Inc.	Figure
	Project: Arlington Operations Center Redevelopment	
Project No: 20240001E001		



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PAP-Accredited



Associated Earth Sciences Inc.
911 5th Ave
Kirkland, WA 98033

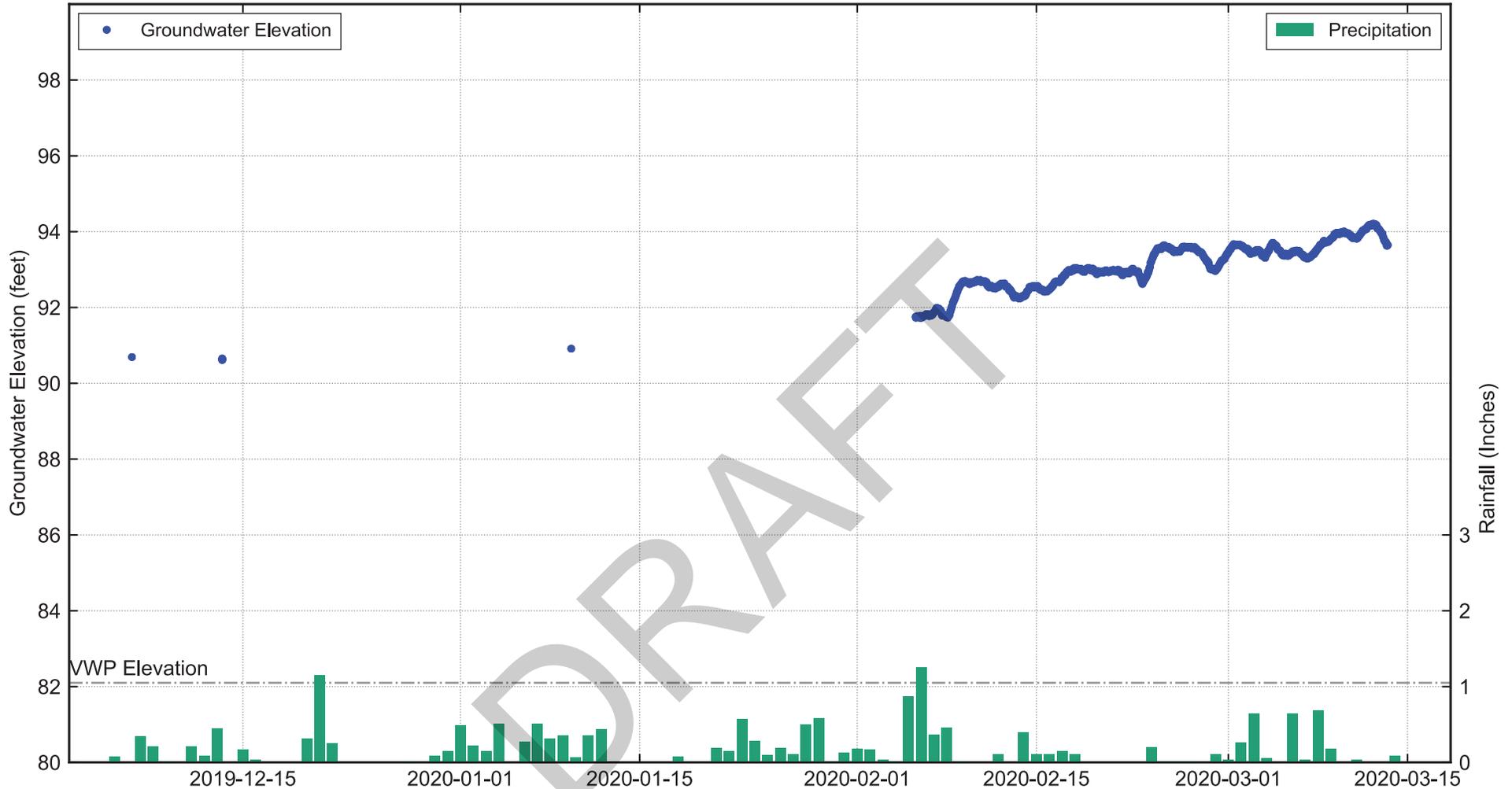
Report: 68315-1-1
Date: May 15, 2024
Project No: 20240001E001
Project Name: Arlington Operations Center
Redevelopment

Sample ID	Organic Matter	Cation Exchange Capacity
EB-3 @ 5.0'	1.81 %	5.1 meq/100g
EB-3 @ 12.5'	0.48 %	2.7 meq/100g
EB-3 @ 22.5'	0.53 %	2.7 meq/100g
Method	ASTM D2974	EPA 9081

APPENDIX D

Hydrographs

DRAFT



Notes:

1. Ground surface elevation at SW-3-19 is approximately 147 feet. The VWP is installed at a depth of 65 feet, corresponding to approximate elevation +82 feet.
2. Rainfall data sourced from NOAA station US1WASN0043 located in North Marysville about 5 miles south of Arlington

Arlington Operations Center
Arlington, Washington

**VIBRATING WIRE PIEZOMETER
GROUNDWATER ELEVATIONS
SW-3-19**

March 2020

104098-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-11

Snohomish County Arlington Shop

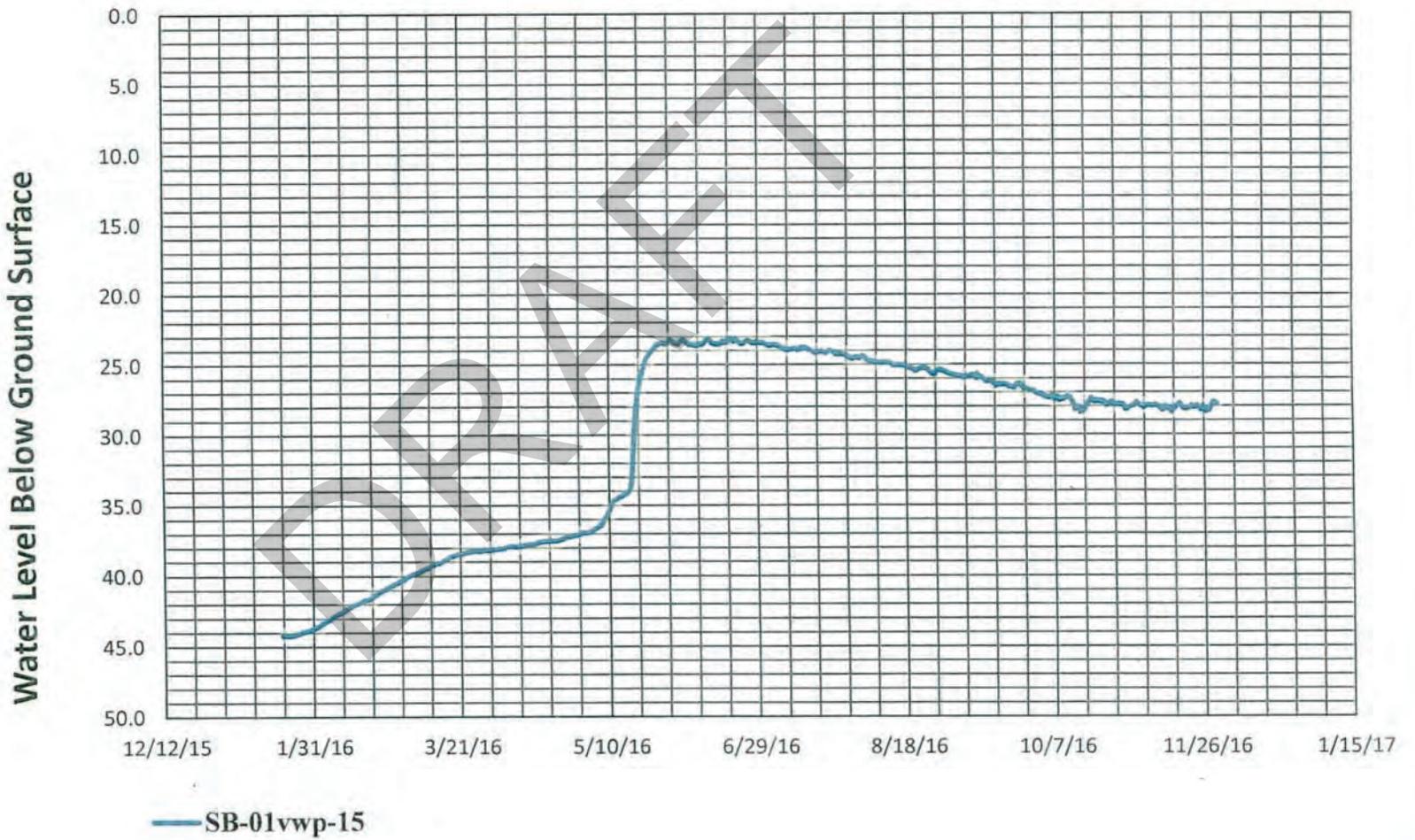


Figure 8