ATTACHMENT E

SUBMITTED TO:
Municipality of Anchorage
Department of Public Works
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Anchorage, Alaska 99507

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GEOTECHNICAL ENGINEERING REPORT

Battery Bank and Substation

TRACT J, PORT OF ALASKA

January 2025

Shannon & Wilson No: 113134-001

SHANNON & WILSON

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Submitted To: Municipality of Anchorage
Department of Public Works
4700 Elmore Road
Anchorage, Alaska 99507
Attn: Mr. Timothy Huntting, PE

Subject: GEOTECHNICAL ENGINEERING REPORT, BATTERY BANK AND SUBSTATION, TRACT J, PORT OF ALASKA

Shannon & Wilson prepared this report and participated in this project as a consultant to the Municipality of Anchorage Department of Public Works (MOA). Our scope of services was specified in our geotechnical proposal dated March 7, 2024 and executed under our Municipality of Anchorage Professional Services Contract with Shannon & Wilson, Inc. to Provide Professional Engineering Subsurface Soils Exploration Services. This report presents the results of our geotechnical engineering study that was conducted and was prepared under the direct supervision of the undersigned.

We appreciate the opportunity to be of service to you on this project. If you have questions concerning this report, or we may be of further service, please contact us.

Sincerely,

SHANNON & WILSON, INC.
AECC125

Stafford Glashan, P.E.
Senior Engineer III

sjg:KLB

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1 INTRODUCTION

This report presents the results of subsurface explorations, laboratory testing, and geotechnical considerations for developing a battery bank, control building, and substation at the former Defense Fuels Support Point-Anchorage (DFSP-A) located at the Port of Alaska (POA). The site is currently identified as Tract J, Port of Alaska (Tract J).

The purpose of this geotechnical study was to explore subsurface conditions and provide geotechnical engineering guidance needed to support the design-build bid process. To accomplish this, we advanced nine soil borings across four areas proposed for development. Soil samples recovered from the borings were tested in our geotechnical laboratory and engineering studies were performed to support geotechnical engineering. Samples of excess cuttings were also subject to environmental analysis through SGS North America, Inc (SGS). The results of the environmental testing and disposal of excess cuttings is presented under separate cover. Presented in this report are descriptions of the site and project, subsurface explorations and laboratory test procedures, an interpretation of subsurface conditions, and conclusions and recommendations from our engineering studies.

Note that large scale/global stability concerns are not addressed in this study. At the direction of the POA, we focused our study on providing guidance to promote stability around the improvements to reduce the impact of the development on the localized slopes.

2 SITE AND PROJECT DESCRIPTION

The property included in this study is located in a previously developed area of the POA in Anchorage, Alaska. A vicinity map showing the general project area is presented as Figure 1.

Tract J was previously developed as a tank farm in the 1940s and was decommissioned beginning in the mid-1990s. The tank farm included fuel tanks, transmission lines, and fuel handling facilities. Demolition activities removed the majority of the tank farm components; however, some pipelines were decommissioned in place. Demolition included activities to remediate contaminated soil and groundwater, although contamination is still present. The POA maintains an ongoing groundwater monitoring program in the area to monitor contamination, which consists of sampling several wells on a regular schedule. The site is currently overseen by Alaska Department of Environmental Conservation (ADEC) and is listed as cleanup complete with institutional controls, which required coordinating with ADEC for exploration work and will be required for future construction activities.

The portion of the site selected for the substation and battery bank is located on two benches in the southwest portion of the site. These benches were likely formed by prehistoric landslides and modified by construction of the former tank farm. A vicinity map indicating the general project location is presented as Figure 1. A site plan, included as Figure 2, shows prominent site features and the approximate locations of our explorations.

3 SUBSURFACE EXPLORATIONS

Prior to conducting subsurface explorations, Shannon & Wilson solicited Logic Geophysics (LG) to perform ground-penetrating radar (GPR) utility locating surveys at the proposed boring locations. These surveys took place on May 23 & 24, 2024 and consisted of marking nine grids, one at each boring location, ranging in size from 13′ x 20′ to 20′ x 20′. Within these grids, a GPR sensor would detect anomalies, presumed to be abandoned utilities (or some other obstruction), up to a maximum depth that varied by location, typically 6 to 10 feet. The boring locations were subsequently adjusted within the grid to avoid any perceived anomalies, where detected. The general boring locations were selected by Professional & Technical Services, Inc. (PTS) based on the proposed locations of the improvements.

Subsurface explorations consisted of advancing and sampling nine borings, designated Borings B-1 through B-9, to depths between 30 and 52 feet below ground surface (bgs) to evaluate subsurface conditions. The borings were advanced May 28 through May 30, 2024. Boring locations were recorded with a handheld global positioning system (GPS) device during drilling that is considered accurate to within approximately 20 horizontal feet. Elevations shown on the boring logs were estimated from survey information provided by PTS. Approximate boring locations are shown on the site plan included as Figure 2.

Drilling services for this project were provided by Discovery Drilling of Anchorage, Alaska, using a track mounted Geoprobe 7822DT drill rig. A representative from our firm was present during drilling to locate the borings, observe drill action, collect samples, log subsurface conditions, and observe groundwater conditions. We coordinated with the Call Locate Center to clear the boring locations of buried public utilities prior to drilling. We also submitted a Port of Alaska Dig Permit, No. 24-4, which was authorized on May 23, 2024.

The borings were advanced with 4 1/4-inch outer diameter (OD), continuous flight, hollow-stem augers to final depth. As the borings were advanced, samples were generally recovered using standard penetration test (SPT) methods at 2.5-foot intervals to 10 feet bgs, then at 5-foot intervals to the bottom of the borings. In the SPT method, samples are recovered by driving a 2-inch OD split-spoon sampler into the bottom of the advancing hole with blows of a 140-pound hammer free falling 30 inches onto the drill rod. For each sample, the number of blows required to drive the sampler every 6 inches of a total 18-inch penetration into undisturbed soil is recorded. Blow counts are reported on the boring log figures and are displayed adjacent to sample depth. The 'N-Value' is also reported on the logs indicating the sum of the blow count values for the final two 6-inch penetration intervals of each sample. Where the sampler did not penetrate the full 18 inches our log reports the blow count and corresponding penetration in inches. The N-Values give a measure of the relative density (compactness) or consistency (stiffness) of cohesionless or cohesive soils, respectively. In addition to the split spoon samples, a grab sample of the near-surface soils was collected from the auger cuttings in the upper foot of each boring.

Samples of predominantly fine-grained soils were occasionally collected using 3-inch OD by 30-inch long, thin wall (Shelby) tubes to obtain relatively undisturbed samples for laboratory testing. These samples were recovered by attaching the Shelby tube to the end of the drill rods and pushing the rods (and sampler) using hydraulic ram pressure from the rig into the soil at the bottom of the advancing boring. The sampling device was allowed to stay in the hole for approximately 5 to 10 minutes to allow the sample to adhere to the tube at which point it was removed from the bottom of the boring. The exposed soils at the end of the tube samples were tested in the field using a pocket penetrometer and a torvane apparatus (see Section 4.0 for a description of these tests). The ends of the tubes were sealed with plastic caps, labeled, and fixed in an upright position for transporting to our Anchorage laboratory.

The soil samples recovered during drilling were observed and described in the field in general accordance with the classification system described by ASTM International (ASTM) D2488. Selected samples recovered during drilling were tested in our laboratory to refine our soil descriptions in general accordance with the Unified Soil Classification System (USCS) described in Figure A-1. Frost classifications were also estimated for samples based on laboratory testing (sieve analyses, and percent passing the no. 200 sieve [P200]) and are shown on the boring logs. The frost classification system is presented in Figure A-2. Summary logs of the borings are presented in Figures A-3 through A-11.

4 LABORATORY TESTING

Laboratory tests were performed on selected soil samples recovered from the borings to confirm our field classifications and to estimate the index properties of the typical materials encountered at the site. The laboratory testing was formulated with emphasis on determining gradation properties and natural water content. Water content tests were performed on samples collected from the borings. Water content tests were generally conducted according to procedures described in ASTM D2216. The results of the water content measurements are presented graphically on the boring log in Appendix A.

Grain size classification (gradation) testing was performed to estimate the particle size distribution of selected samples from the borings. The gradation testing generally followed the procedures described in ASTM C117/C136 and D422. The test results are presented in Appendix A, Figure A-11 and summarized on the boring log as percent gravel, percent sand, and percent fines. Percent fines on the boring log are equal to the sum of the silt and clay fractions indicated by the percent passing the No. 200 sieve. Note that hydrometer testing indicates particle size only and visual classification under USCS designates the entire fraction of soil finer than the No. 200 sieve as silt. Plasticity characteristics (Atterberg Limits results) are required to differentiate between silt and clay soils under USCS.

Strength testing was performed on select samples of the fine-grained soils from the borings. The procedures used to estimate the strength of the silt and/or clay soils included pocket penetrometer (PP) tests, torvane (TV) tests, and unconfined compression tests.

PP and TV tests were performed on selected SPT samples in the field and on relatively undisturbed Shelby Tube soil specimens in the field and the laboratory. These tests provide an estimate of the unconfined compressive strength and undrained shear strength of the sample, respectively. Tests were performed at horizontal and vertical orientations where possible. PP and TV measurements on Shelby tube samples were taken on the end of the samples in the field and recorded. After extrusion of the soil from the tube in the laboratory, PP and TV measurements were again taken on the Shelby tube samples and these values are provided on the boring logs, Figures A-3 through A-11, and Shelby Tube logs are reported in Figure A-12.

Atterberg limits were evaluated for five samples of fine-grained soil to estimate plasticity characteristics. The tests followed procedures described in ASTM D4318. The results of these tests are presented graphically on the boring logs and in Figure A-14.

5 SUBSURFACE CONDITIONS

The subsurface soil encountered in our explorations at the site are depicted graphically on the boring logs in Appendix A. In general, borings encountered granular fill with varying amounts of fines overlying lean clay. Sands and gravels were encountered in the borings from approximately 7 feet to 23 feet bgs. Boring B-7, advanced to 30 feet bgs did not encounter clay. Based on PP and TV values taken in the field and in the laboratory, the consistency of the fine-grained soils was generally medium stiff to hard, although some soft to medium stiff clays were encountered in Borings B-2, B-3, and B-4.

Based on our laboratory testing, fines contents in the materials interpreted as fill ranged from 5 to 98 percent. Moisture contents ranged from 3 to 38 percent. Based on Atterberg limits results on five samples tested from the clay layer, the material was classified as a lean clay with plasticity indices ranging between 11 and 17. Groundwater was encountered in our borings B-2 through B-9 ranging from 4 to 15 feet bgs during drilling. Groundwater was not encountered in Boring B-1 during drilling. Groundwater levels may fluctuate by several feet seasonally or vary during periods of high precipitation and rapid snow melt.

The soil at Tract J has been significantly disturbed by human activities. First the construction of the DFSP-A and later by demolition and environmental cleanup activities. It is likely that significant changes in the type and density of the soil above the clay can occur over small distances. It is also likely that the disturbed materials were replaced without compaction and areas of loose or organic soil may be encountered during construction.

6 SEISMIC CONDITIONS

Based on our explorations and previous studies in the area, the site class according to the 2018 International Building Code (IBC 2018) will be D for a stiff soil profile based on shear wave velocities estimated to range between 700 and 800 feet per second (ft/s). These estimated shear wave velocities are based on downhole shear wave tests conducted in other studies in the Port of Anchorage area.

For our stability analysis we used the peak ground accelerations (PGA) and controlling earthquake magnitude developed for the POA by Lettis Consultants International. This information is presented in detail in their December 14, 2022 report titled *Site-Specific Seismic Hazard Analyses and Development of Time Histories for the Port of Alaska*. The probabilistic ground motions are summarized below.

Event	Probability of Exceedance	Return Period (years)	PGA	Moment Magnitude
Operating Level Earthquake (OLE)	50% in 50 years	72	0.201	7.1
Contingency Level Earthquake (CLE)	10% in 50 years	475	0.563	7.1
Design Earthquake (DE)	5% in 50 years	975	0.791	7.1
Maximum Considered Earthquake (MCE)	2% in 50 years	2,475	1.187	7.1

Exhibit 6-1: Probabilistic Ground Motions

7 SLOPE STABILITY EVALUATION

The project is situated on a slope that defines Government Hill and is within an area mapped as *Zones 4 and 5 – High to Very High Seismic Ground Failure Susceptibility* by the Municipality of Anchorage (MOA). Two slope aspects at Government Hill experienced slope failures during the 1964 Great Alaska Earthquake. Neither of the areas that failed are within or near the limits of this project, however given the historic instability and similar soil and slope conditions to the areas that failed, a review of the stability of the slopes above the site is prudent. A summary of the landslides that occurred in the Government Hill area follows.

The project locations are situated near the upper portions of the west and north slopes below Government Hill. While this portion of Government Hill did not experience slope failure during the 1964 Great Alaska Earthquake (1964 Quake), signs of slope distress in the form of tension cracks and minor horizontal and vertical displacement were observed on the ground surface immediately after the event. Subsequent stability analyses for the slope since then suggest that the slope is unstable and could experience significant failures during an earthquake. Based on slope analyses for prior developments on Tract J, under what was considered a Maximum Considered Earthquake (MCE) at that time, we believe that large scale failure could result failure of the overall slope. At the time of this prior evaluation, the MCE had a PGA of 0.4 times gravity (0.4g). This analysis indicates a deep-seated instability in the slope with failure surface approximately 100 to 120 feet below the elevation of the planned substation. The prior analysis indicated horizontal and vertical displacement of a deep-seated slide mass on the slope on the order of 6 to 15 feet or greater depending on the duration of shaking and the mechanism of failure. Such displacement will result in movement of the ground surface on the slope face, as well as development of pressure ridges at the toe of the slope.

At your request, this study focuses on the near-surface slopes near the proposed BESS and substation locations. The intent of this study was to evaluate slope performance under the

OLE and CLE and develop guidelines to reduce the impact of the development on the localized slopes.

7.1 Limit Equilibrium Analysis

We evaluated the stability of the slope above the site in accordance with MOA design criteria using the computer program Slope/W version 2021.3 developed by GeoStudio. This is a two-dimensional, limit equilibrium slope stability program that is used to model a slope and estimate the factor of safety against sliding for each potential slip surface. The program allows for heterogeneous soils systems, anisotropic soil strength properties, excess pore water pressure due to shear, static ground water and surface water forces, pseudo-static earthquake loading, and surcharge boundary loading. Our analysis used the assumed soil and slope cross section shown on Figure 3. Soil parameters used in our analysis are shown on Figure 4. These parameters are based on our explorations at the site, laboratory testing, and engineering judgement. Factors of safety were calculated using an optimized failure surface and the Morgenstern-Price methods. Along with static slope conditions, we modeled dynamic (seismic) loading conditions for the wall using a horizontal seismic coefficient equal to one-half of the PGA for the OLE and CLE events. According to MOA code requirements, slopes with a factor of safety of at least 1.5 and 1.1 are considered stable for static and seismic conditions, respectively. The minimum factors of safety based on our analysis are summarized in the table below.

Slope	Static	OLE	CLE
Lower, Over Steepened Portion	1.1	0.9	0.7
Lower Slope	1.5	1.1	0.8
Middle Slope	1.7	1.3	0.9
Upper Slope	1.8	1.4	0.9

Exhibit 7-1: Factor of Safety Summary

Based on our evaluation, only the lower, over steepened part of the lower slope fails to meet the criteria for factor of safety under the OLE. All four slopes evaluated have factors of safety below the criteria for the CLE.

In addition, past studies performed by others have noted strength reductions in the clay on the order of 20 to 30 percent based on cyclic testing and back calculations of previous slope failures. To check the sensitivity of the model to potential strength reductions due to seismic shaking we ran the pseudo-static analysis with clay strengths reduced to 80 percent of the peak strengths assumed in our initial analysis. Using this strength, only the failure surface for the lower slope passes into the weakened clay layer. The calculated factors of safety are the same as the full strength analysis, however a larger slide mass is generated as shown on Figure 4. Past studies also noted that clay strengths could be reduced to a residual strength of about 20 percent of the peak strength where displacements greater than about 6 inches to 1 foot occur.

7.2 Displacement Analysis

According to local amendments to the IBC 2018, displacement analyses are required for slopes that do not meet the minimum required factor of safety. Slope displacements were estimated using methods developed by Bray and Travasarou (2007), which are based on the simplified Newmark sliding block method. The method requires input for the yield acceleration of the slope based on static properties, the shear wave velocity and height or fundamental period of the sliding block, and spectral accelerations for a given ground motion. The yield acceleration is defined as the horizontal seismic acceleration that produces a factor of safety of 1.0 in a pseudo-static analysis.

Slope	OLE Displacement (inches)	CLE Displacement (inches)
Lower, Over steepened Portion	2-8	6-12
Lower Slope	NA	2-6
Lower Slope – weakened clay	NA	12-30
Middle Slope	NA	1-4
Upper Slope	NA	1-4

Exhibit 7-2: Estimated Displacements

These displacements should be expected to take place along the appropriate failure surfaces shown on Figure 4. It is important to note that the analysis methods used to develop the failure envelopes and displacement values presented above are approximations based on generalized models. The influencing factors on the actual performance on the slope during a seismic event are numerous and the results should be considered approximate. The failure surfaces depicted on Figure 3 should not be interpreted as representing precise failure areas and the displacements represent approximate horizontal movement. Horizontal movements can be expected and vertical displacement from pressure ridges could also be experienced. Significantly larger displacements can be expected during seismic events larger than the OLE and CLE events. These movements would be associate with shallow failure surfaces as well as deep-seated global failure surfaces that are associated with the overall slope.

7.3 Surcharge Loading

The BESS will be constructed using Tesla MegaPack 2 XL batteries. Each battery has a rated weight of 84,000 pounds and a footprint of approximately 156 square feet. The batteries will be placed in rows that are generally perpendicular to the slopes. We applied a uniform surcharge load of 540 pounds per square feet (psf) to the ground surface of the lower bench.

This is conservative as the battery will be placed on a structural concrete pad which will spread out the weight on the soil. We then analyzed the slope below the BESS for stability which resulted in factors of safety approximately 0.02 to 0.04 lower than the unloaded slope. When rounded to two significant digits there was no change from the unloaded factors of safety for the lower slope.

8 GEOTECHNICAL DESIGN GUIDANCE

We understand that the BESS and substation will be procured through the design-build process. As such, selected engineering team will be responsible for the final design of the facilities. Below we provide generalized design guidance. This guidance is intended to aid the designers is developing the site in a way that does not negatively impact the performance of the shallow slopes. We assume that the project design will not be required to accommodate deep-seated global instabilities of the overall slope.

8.1 Site Grading

The existing ground surface grade should be maintained below or as close to the existing grade to the greatest extent possible. Importing fill to the site will increase the surcharge load on the slopes and will result in a reduction of site stability. If possible, lowering the site grade will help offset all or some of the new structure loads that will be placed on the site. The building area grades should only be lowered if drainage of surface water is able to be maintained and not allow infiltration of surface water into the ground. We recommend limiting fills to no more than 18 inches above the existing ground. Fill and cut slopes should be as shallow as possible so that concentrated stress areas are not developed. Cut and fill slopes should not be steeper than 4 horizontal to 1 vertical (4:1). New structures should not be placed within 20 feet of natural or fill slopes that are steeper than 4:1.

Due to the extensive prior disturbance of the existing soil, the design-build contractor should be prepared to encounter unsuitable soil and loose zones of soil. These materials should be removed from under foundations and relaced with compacted structural fill. An appropriate separation geotextile should be incorporated where the soil in the bottom of the excavation contains more than 20-percent fines.

8.2 Site Drainage

Preventing infiltration of surface water into the soils at the site is of high importance. The sites should be contoured such that stormwater flowing downhill across the site should be intercepted and collected in stormwater works and discharged into a contained storm sewer off the slope. Resilient pipe materials such as HDPE should be used to improve long term performance of the stormwater system and reduce the risk of pipe rupture and leaking into the slope soils.

8.3 Structure Foundations

Structure loads from the foundations should be spread out as much as possible. We recommend using mat foundations for all improvements on the slope to create a low ground pressure situation and improve foundation performance under a large earthquake and large-scale slope deformations if they occur. The subgrade under the slabs should be prepared with grid-reinforced gravel pad consisting of at least 48 inches of Type II classified fill with two intermediate layers of biaxial geogrid (Mirafi BXG120 or equivalent). The exact depth of the geogrid layers is not critical as long as they are separated by 12 inches of compacted fill material and the top layer is at least 6 inches below the bottom of the slab. If the features will be sensitive to frost-related movements, blueboard insulation should be installed to develop a Frost Protected Shallow Foundation condition. Slab foundations should be designed to span tension cracks up to 4 feet wide or unsupported areas that are 25 percent of their shorter dimension.

8.4 Excavations and Utility Trenches

Excavations will be needed to prepare the site to receive the proposed new structures and for buried pipes and utilities. While the utilities are expected to be relatively shallow in depth, groundwater could be encountered in the excavations. The design-build contractor should evaluate the impact on the slope stability for any excavation deeper than four feet within 25 feet of the toe of a slope. Where possible, utility connections should be designed to resist or accommodate soil movement due to frost action or seismic activity.

We recommend that the contractor be required to submit an excavation plan prior to initiating earthwork at the site. The excavation plan should describe the methods and sequencing for excavation as well as additional information for dewatering and shoring as necessary. The plan should highlight areas that may require dewatering and include details for the type or types of dewatering that will be undertaken (including, but not limited to, pumping rates, discharge locations, water treatment, etc…). The excavation plan should also include the types and locations of shoring to be used and engineered plans for the shoring if required. We recommend that we be retained to review the excavation plan prior to authorizing work to proceed at the site to ensure that the plan contains the necessary information and is appropriate for the conditions at the site. Permits from the Alaska Department of Environmental Conservation (ADEC), Alaska Department of Natural Resources (DNR), and other agencies will be required for construction dewatering due to known soil and groundwater contamination at the site (see Section 9.0). Environmental

9 ENVIRONMENTAL CONSTRAINTS

The project is located on an ADEC-listed contaminated site. Numerous releases of diesel fuel, turbine fuel, unleaded gasoline, slop fuel, and transformer fluid were documented at the former facility between 1960 and 1989. Following cleanup and assessment activities, the DFSP-A site was granted a Cleanup Complete with Institutional Controls (IC's) designation by the ADEC in an April 2003 Record of Decision (ROD). The ROD states that the contaminants of concern in soil, groundwater, and surface water for the site are gasoline range organics (GRO), diesel range organics (DRO), benzene, toluene, ethylbenzene, and xylenes (BTEX). The ROD also provides site specific soil and groundwater cleanup levels for these contaminants.

As such an ADEC-Approved environmental management plan will be needed prior to initializing construction activities at the site. In this plan, procedures for screening, handling, sampling, and potential disposal are identified. The intent of plan is to provide a pre-approved (with the ADEC and other appropriate agencies) flowpath to contractors on how they may be required to handle contaminated soil and water to assist with bidding and reduce costs and delays during construction.

10 CLOSURE AND LIMITATIONS

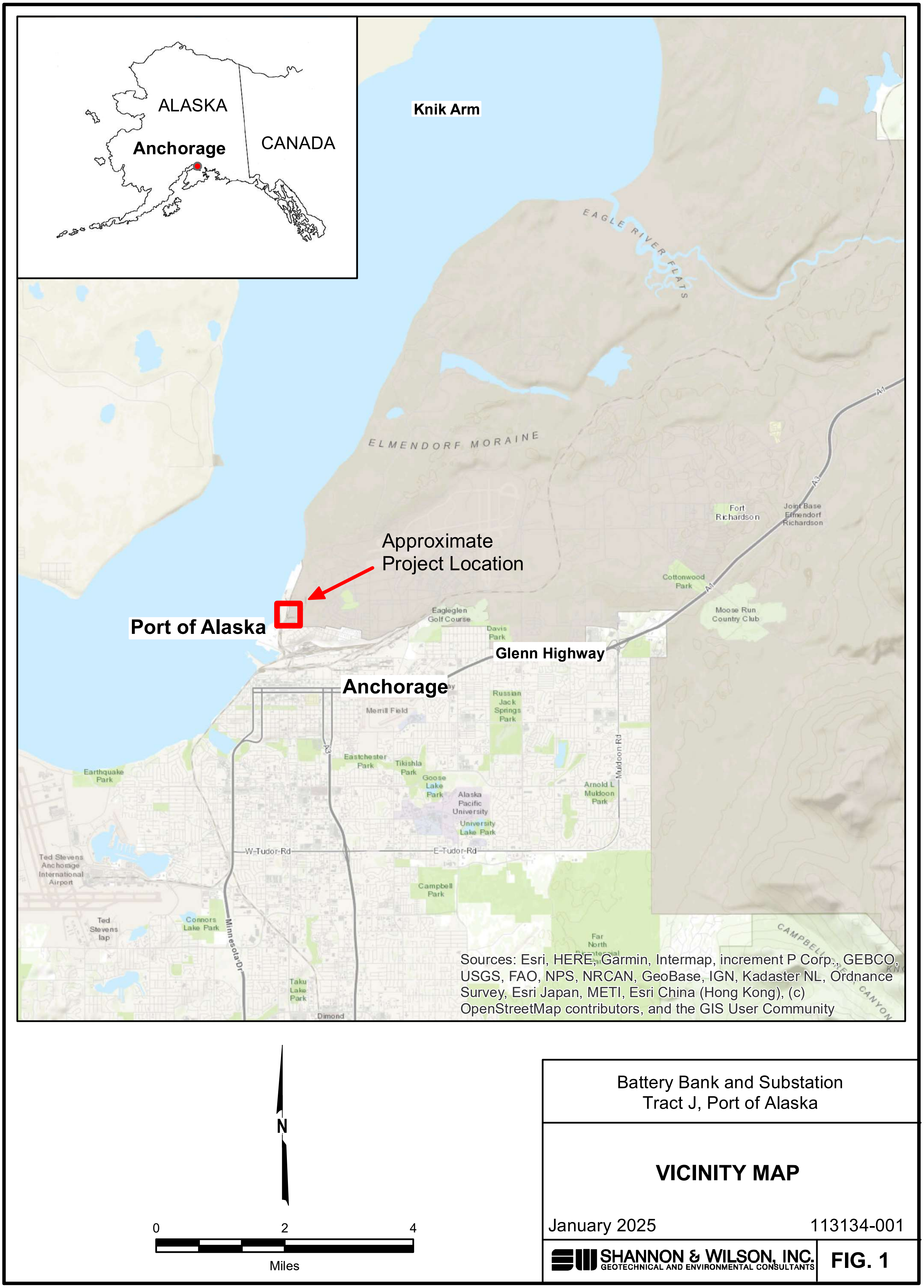
This report was prepared for the exclusive use of our client and their representatives for evaluating the site as it relates to the geotechnical aspects discussed herein. The analyses and conclusions contained in this report are based on site conditions as they presently exist. It is assumed that the exploratory borings are representative of the subsurface conditions throughout the site, i.e., the subsurface conditions everywhere are not significantly different from those disclosed by the explorations.

If, during construction, subsurface conditions different from those encountered in these explorations are observed or appear to be present, Shannon & Wilson, Inc. should be advised at once so that these conditions can be reviewed, and recommendations can be reconsidered where necessary. If there is a substantial lapse of time between the submittal of this report and the start of work at the site, or if conditions have changed due to natural causes or construction operations at or adjacent to the site, it is recommended that this report be reviewed to determine the applicability of the conclusions considering the changed conditions and time lapse.

We recommend that we be retained to review those portions of the plans and specifications pertaining to earthwork and foundations to determine if they are consistent with our guidance. In addition, we should be retained to review design/build contractor's design and submittals, and to observe construction, particularly the site excavations, compaction of structural fill, preparation of foundations, and such other field observations as may be necessary.

Unanticipated soil conditions are commonly encountered and cannot fully be determined by merely taking soil samples or advancing borings. Such unexpected conditions frequently require that additional expenditures be made to attain a properly constructed project. Therefore, some contingency fund is recommended to accommodate such potential extra costs. Shannon & Wilson has prepared the attachment, *Important Information About Your Geotechnical/Environmental Report*, to assist you and others in understanding the use and limitations of the reports.

Copies of documents that may be relied upon by our client are limited to the printed copies (also known as hard copies) that are signed or sealed by Shannon & Wilson with a wet, blue ink signature. Files provided in electronic media format are furnished solely for the convenience of the client. Any conclusion or information obtained or derived from such electronic files shall be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, or you question the authenticity of the report please contact Shannon & Wilson.



Battery Bank and Substation
Tract J, Port of Alaska

VICINITY MAP

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FIG. 1

Imagery and topography provided by PTS. Contour Interval = 1 foot.

0 100 200 400
APPROXIMATE SCALE IN FEET

LEGEND

B-I	Approximate Location of Boring B-1, Advanced by Shannon & Wilson, May 2024
SW-I	Approximate Location of Boring SW-1, Advanced by Shannon & Wilson, November 2017
244	Approximate Location of Boring 244, Advanced by Shannon & Wilson, 1997
83	Approximate Location of Boring 83, Advanced by E & E, 1989
A A'	Subsurface Profile Line A-A'

N

Battery Bank and Substation
Tract J, Port of Alaska

SITE PLAN

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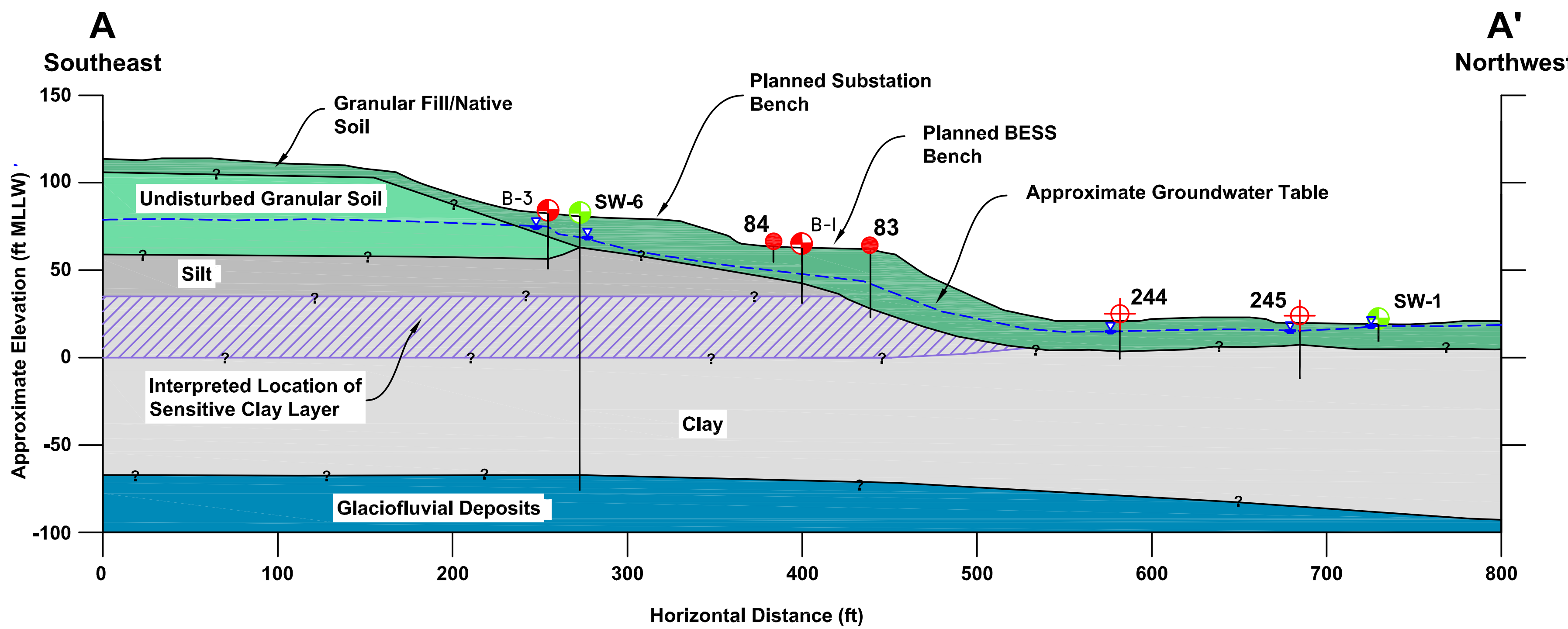
FIG. 2



LEGEND

B-I Approximate Location of Boring B-1, Advanced by Shannon & Wilson, May 2024

SW-I Approximate Location of Boring SW-1, Advanced by Shannon & Wilson, November 2017

244 Approximate Location of Boring 244, Advanced by Shannon & Wilson, 1997

83 Approximate Location of Boring 83, Advanced by E & E, 1989

NOTES

1. Profile taken along the A - A' line as shown on the Site Plan, Figure 2.
2. Stratigraphy interpreted from historical data and observations made during drilling (see Appendix B for graphical logs).
3. Soil contacts on profile between boring locations are interpreted from our understanding of local conditions and should be considered approximate.
4. Borings shown above may not lie exactly on profile line shown on Figure 2. Subsurface conditions in some areas may be projected from borings near the profile line.
5. Ground surface profile based topographic contours provided by PTS.

Battery Bank and Substation
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SUBSURFACE PROFILE A-A'

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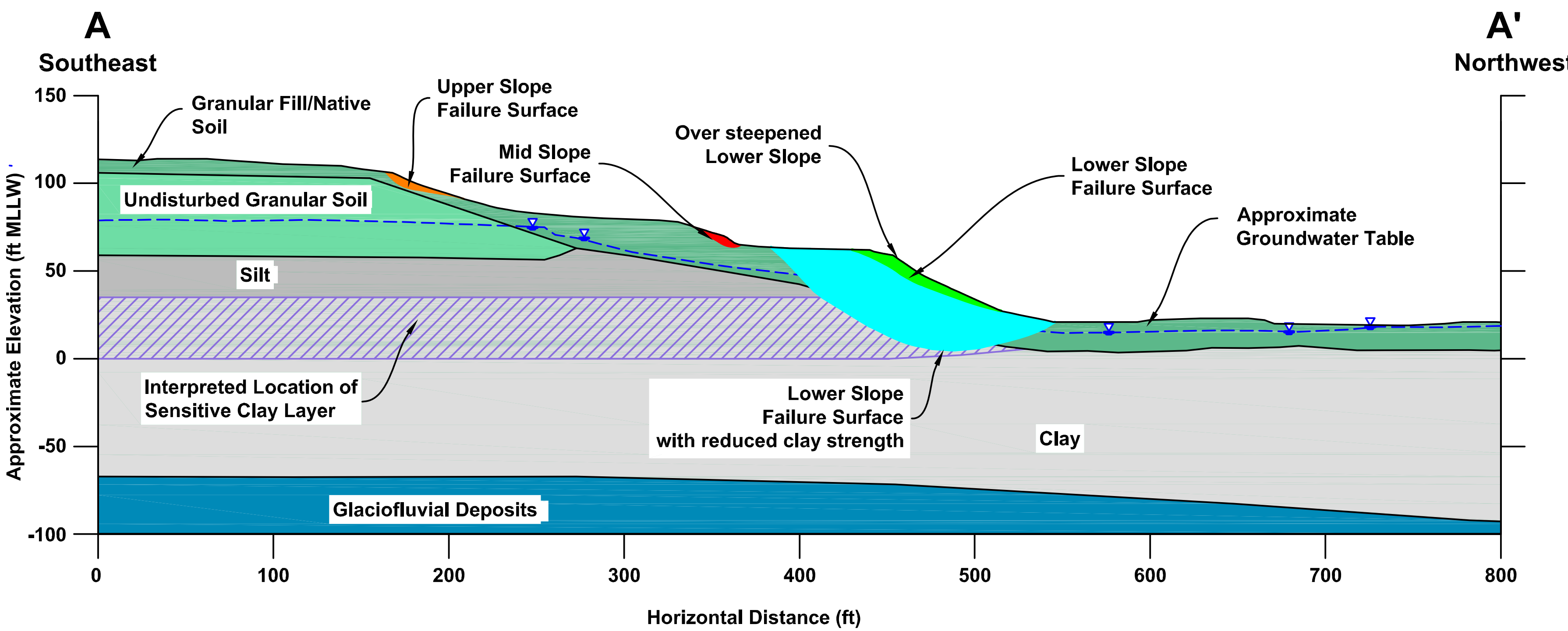
FIG. 3



NOTES

1. Cohesion in the Bootlegger Clay was increased by 11 pounds per square foot per foot of depth.
2. The reduced strength seismic condition was evaluated by applying a reduction factor of 0.2 to cohesive strengths assumed in the sensitive clay layer.
3. Failure surface are approximate and may not reflect actual failure surfaces during a seismic event.
4. See text for factors of safety and displacement estimates.
5. Deeper seated failure surfaces not evaluated; see text.

GENERALIZED SOIL PROPERTIES USED IN SLOPE MODEL

Soil Unit	Unit Weight (pcf)	Soil Friction Angle	Cohesion (psf)
Granular Fill/Native Soil	120	32°	-
Undisturbed Granular Soil	130	36°	-
Silt	110	26°	-
Bootlegger Clay (Top of Layer)	120	-	1,365[1]
Glaciofluvial Deposits	135	-	8,000

pcf - pounds per cubic foot
psf - pounds per square foot

Battery Bank and Substation
Tract J, Port of Alaska

SLOPE STABILITY RESULTS

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FIG. 4

APPENDIX A: BORING LOG AND LABORATORY TEST RESULTS

Appendix A

Boring Log and Laboratory Test Results

Shannon & Wilson, Inc. (S&W), uses a soil identification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following pages. Soil descriptions are based on visual-manual procedures (ASTM D2488) and laboratory testing procedures (ASTM D2487), if performed.

S&W INORGANIC SOIL CONSTITUENT DEFINITIONS

CONSTITUENT[2]	FINE-GRAINED SOILS (50% or more fines)[1]	COARSE-GRAINED SOILS (less than 50% fines)[1]
Major	***Silt, Lean Clay, Elastic Silt,*** or ***Fat Clay***[3]	***Sand*** or ***Gravel***[4]
Modifying (Secondary) Precedes major constituent	30% or more coarse-grained: ***Sandy*** or ***Gravelly***[4]	More than 12% fine-grained: ***Silty*** or ***Clayey***[3]
Minor Follows major constituent	15% to 30% coarse-grained: ***with Sand*** or ***with Gravel***[4]	5% to 12% fine-grained: ***with Silt*** or ***with Clay***[3]
	30% or more total coarse-grained *and* lesser coarse-grained constituent is 15% or more: ***with Sand*** or ***with Gravel***[5]	15% or more of a second coarse-grained constituent: ***with Sand*** or ***with Gravel***[5]

[1]All percentages are by weight of total specimen passing a 3-inch sieve.
[2]The order of terms is: *Modifying Major with Minor*.
[3]Determined based on behavior.
[4]Determined based on which constituent comprises a larger percentage.
[5]Whichever is the lesser constituent.

MOISTURE CONTENT TERMS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

STANDARD PENETRATION TEST (SPT) SPECIFICATIONS

Hammer:	140 pounds with a 30-inch free fall. Rope on 6- to 10-inch-diam. cathead 2-1/4 rope turns, > 100 rpm NOTE: If automatic hammers are used, blow counts shown on boring logs should be adjusted to account for efficiency of hammer.
Sampler:	10 to 30 inches long Shoe I.D. = 1.375 inches Barrel I.D. = 1.5 inches Barrel O.D. = 2 inches
N-Value:	Sum blow counts for second and third 6-inch increments. Refusal: 50 blows for 6 inches or less; 10 blows for 0 inches.

NOTE: Penetration resistances (N-values) shown on boring logs are as recorded in the field and have not been corrected for hammer efficiency, overburden, or other factors.

PARTICLE SIZE DEFINITIONS

DESCRIPTION	SIEVE NUMBER AND/OR APPROXIMATE SIZE
FINES	< #200 (0.075 mm = 0.003 in.)
SAND	
Fine	#200 to #40 (0.075 to 0.4 mm; 0.003 to 0.02 in.)
Medium	#40 to #10 (0.4 to 2 mm; 0.02 to 0.08 in.)
Coarse	#10 to #4 (2 to 4.75 mm; 0.08 to 0.187 in.)
GRAVEL	
Fine	#4 to 3/4 in. (4.75 to 19 mm; 0.187 to 0.75 in.)
Coarse	3/4 to 3 in. (19 to 76 mm)
COBBLES	3 to 12 in. (76 to 305 mm)
BOULDERS	> 12 in. (305 mm)

RELATIVE DENSITY / CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
< 4	Very loose	< 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very dense	15 - 30	Very stiff
		> 30	Hard

WELL AND BACKFILL SYMBOLS

Bentonite Cement Grout	Surface Cement Seal
Bentonite Grout	Asphalt or Cap
Bentonite Chips	Slough
Silica Sand	Inclinometer or Non-perforated Casing
Perforated or Screened Casing	Vibrating Wire Piezometer

PERCENTAGES TERMS[1, 2]

Trace	< 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

[1]Gravel, sand, and fines estimated by mass. Other constituents, such as organics, cobbles, and boulders, estimated by volume.

[2]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

Battery Bank and Substation
Tract J, Port of Alaska

SOIL DESCRIPTION AND LOG KEY

January 2025 113134-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-1
Sheet 1 of 3

2013_BORING_CLASS1 GINT TEMPLATE7.GPJ SWNEW.GDT 1/2/25

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)
(Modified From USACE Tech Memo 3-357, ASTM D2487, and ASTM D2488)

MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL	TYPICAL IDENTIFICATIONS
COARSE-GRAINED SOILS *(more than 50% retained on No. 200 sieve)*	Gravels *(more than 50% of coarse fraction retained on No. 4 sieve)*	Gravel *(less than 5% fines)*	GW	Well-Graded Gravel; Well-Graded Gravel with Sand
			GP	Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Silty or Clayey Gravel *(more than 12% fines)*	GM	Silty Gravel; Silty Gravel with Sand
			GC	Clayey Gravel; Clayey Gravel with Sand
	Sands *(50% or more of coarse fraction passes the No. 4 sieve)*	Sand *(less than 5% fines)*	SW	Well-Graded Sand; Well-Graded Sand with Gravel
			SP	Poorly Graded Sand; Poorly Graded Sand with Gravel
		Silty or Clayey Sand *(more than 12% fines)*	SM	Silty Sand; Silty Sand with Gravel
			SC	Clayey Sand; Clayey Sand with Gravel
FINE-GRAINED SOILS *(50% or more passes the No. 200 sieve)*	Silts and Clays *(liquid limit less than 50)*	Inorganic	ML	Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt
			CL	Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay
		Organic	OL	Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
	Silts and Clays *(liquid limit 50 or more)*	Inorganic	MH	Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt
			CH	Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay
		Organic	OH	Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
HIGHLY-ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT	Peat or other highly organic soils (see ASTM D4427)

NOTE: No. 4 size = 4.75 mm = 0.187 in.; No. 200 size = 0.075 mm = 0.003 in.

NOTES

1. Dual symbols *(symbols separated by a hyphen, i.e., SP-SM, Sand with Silt)* are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart. Graphics shown on the logs for these soil types are a combination of the two graphic symbols (e.g., SP and SM).

2. Borderline symbols *(symbols separated by a slash, i.e., CL/ML, Lean Clay to Silt; SP-SM/SM, Sand with Silt to Silty Sand)* indicate that the soil properties are close to the defining boundary between two groups.

GRADATION TERMS

Poorly Graded	Narrow range of grain sizes present or, within the range of grain sizes present, one or more sizes are missing (Gap Graded). Meets criteria in ASTM D2487, if tested.
Well-Graded	Full range and even distribution of grain sizes present. Meets criteria in ASTM D2487, if tested.

CEMENTATION TERMS[1]

Weak	Crumbles or breaks with handling or slight finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

PLASTICITY[2]

DESCRIPTION	VISUAL-MANUAL CRITERIA	APPROX. PLASITICTY INDEX RANGE
Nonplastic	A 1/8-in. thread cannot be rolled at any water content.	< 4
Low	A thread can barely be rolled and a lump cannot be formed when drier than the plastic limit.	4 to 10
Medium	A thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. A lump crumbles when drier than the plastic limit.	10 to 20
High	It take considerable time rolling and kneading to reach the plastic limit. A thread can be rerolled several times after reaching the plastic limit. A lump can be formed without crumbling when drier than the plastic limit.	> 20

ADDITIONAL TERMS

Mottled	Irregular patches of different colors.
Bioturbated	Soil disturbance or mixing by plants or animals.
Diamict	Nonsorted sediment; sand and gravel in silt and/or clay matrix.
Cuttings	Material brought to surface by drilling.
Slough	Material that caved from sides of borehole.
Sheared	Disturbed texture, mix of strengths.

PARTICLE ANGULARITY AND SHAPE TERMS[1]

Angular	Sharp edges and unpolished planar surfaces.
Subangular	Similar to angular, but with rounded edges.
Subrounded	Nearly planar sides with well-rounded edges.
Rounded	Smoothly curved sides with no edges.
Flat	Width/thickness ratio > 3.
Elongated	Length/width ratio > 3.

[1]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.
[2]Adapted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

ACRONYMS AND ABBREVIATIONS

ATD	At Time of Drilling
Diam.	Diameter
Elev.	Elevation
ft.	Feet
FeO	Iron Oxide
gal.	Gallons
Horiz.	Horizontal
HSA	Hollow Stem Auger
I.D.	Inside Diameter
in.	Inches
lbs.	Pounds
MgO	Magnesium Oxide
mm	Millimeter
MnO	Manganese Oxide
NA	Not Applicable or Not Available
NP	Nonplastic
O.D.	Outside Diameter
OW	Observation Well
pcf	Pounds per Cubic Foot
PID	Photo-Ionization Detector
PMT	Pressuremeter Test
ppm	Parts per Million
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
rpm	Rotations per Minute
SPT	Standard Penetration Test
USCS	Unified Soil Classification System
q_u	Unconfined Compressive Strength
VWP	Vibrating Wire Piezometer
Vert.	Vertical
WOH	Weight of Hammer
WOR	Weight of Rods
Wt.	Weight

STRUCTURE TERMS[1]

Interbedded	Alternating layers of varying material or color with layers at least 1/4-inch thick; singular: bed.
Laminated	Alternating layers of varying material or color with layers less than 1/4-inch thick; singular: lamination.
Fissured	Breaks along definite planes or fractures with little resistance.
Slickensided	Fracture planes appear polished or glossy; sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps that resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
Homogeneous	Same color and appearance throughout.

Battery Bank and Substation
Tract J, Port of Alaska

SOIL DESCRIPTION AND LOG KEY

January 2025 113134-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-1
Sheet 3 of 3

2013_BORING_CLASS3 GINT TEMPLATE7.GPJ SWNEW.GDT 1/2/25

FROST CLASSIFICATION

(after Municipality of Anchorage, 2007)

GROUP		0.02 Mil.	P-200*	USC SYSTEM (based on P-200 results)
NFS	Sandy Soils	0 to 3	0 to 6	SW, SP, SW-SM, SP-SM
	Gravelly Soils	0 to 3	0 to 6	GW, GP, GW-GM, GP-GM
F1	Gravelly Soils	3 to 10	6 to 13	GM, GW-GM, GP-GM
F2	Sandy Soils	3 to 15	6 to 19	SP-SM, SW-SM, SM
	Gravelly Soils	10 to 20	13 to 25	GM
F3	Sands, except very fine silty sands**	Over 15	Over 19	SM, SC
	Gravelly Soils	Over 20	Over 25	GM, GC
	Clays, PI>12			CL, CH
F4	All Silts			ML, MH
	Very fine silty sands**	Over 15	Over 19	SM, SC
	Clays, PI<12			CL, CL-ML
	Varved clays and other fined grained, banded sediments			CL and ML CL, ML, and SM; SL, SH, and ML; CL, CH, ML, and SM

PI = Plasticity Index
P-200 = Percent passing the number 200 sieve
0.02 Mil. = Percent material below 0.02 millimeter grain size

*Approximate P-200 value equivalent for frost classification. Value range based on typical, well-graded soil curves.

** Very fine sand : greater than 50% of sand fraction passing the number 100 sieve

Battery Bank and Substation
Tract J, Port of Alaska

FROST CLASSIFICATION LEGEND

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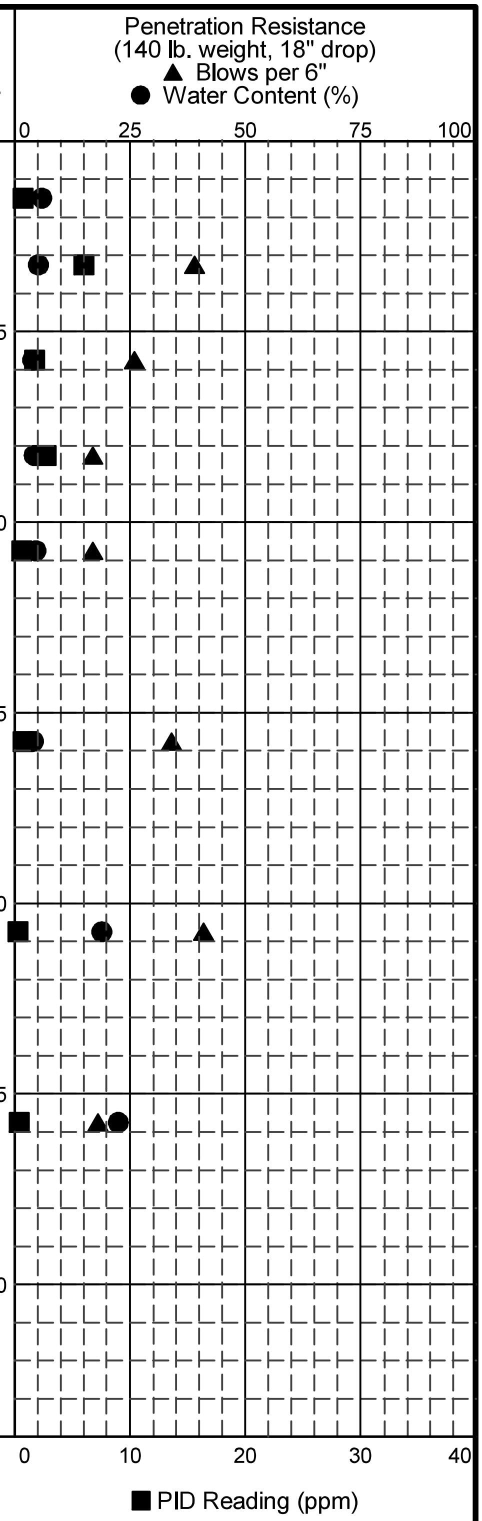
FIG. A-2

MATERIAL DESCRIPTION Lat.: 61.23218 N Long.: 149.88365 W Approx. Elevation: 48 Ft.	Depth, Ft.	Symbol	Samples	Ground Water
Medium dense, dark brown, *Poorly Graded Sand with Gravel (SP)*; moist; trace organics [FILL]			S1	
Dense, dark brown to brown, *Silty Gravel with Sand (GM)*; moist S2: 44% Gravel, 41% Sand, 15% Fines (F2)	2.2		S2	
Medium dense to dense, brown, *Poorly Graded Sand with Gravel (SP)*; moist	4.5		S3, S4, S5, S6	
Very stiff to hard, gray, *Lean Clay (CL)*; moist S9: See Figure A-12 for Shelby Tube log details PP = 3.5 TV = >1V	20.3		S7, S8, S9	Groundwater not encountered during drilling on 5/28/2024
Bottom of Boring Boring Completed 5/28/2024	32.0			



LEGEND

- * Sample Not Recovered
- Grab Sample
- 2" O.D. Split Spoon Sample
- Shelby Tube

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.

Battery Bank and Substation
Tract J, Port of Alaska

LOG OF BORING B-1

January 2025 113134-001

SHANNON & WILSON, INC.
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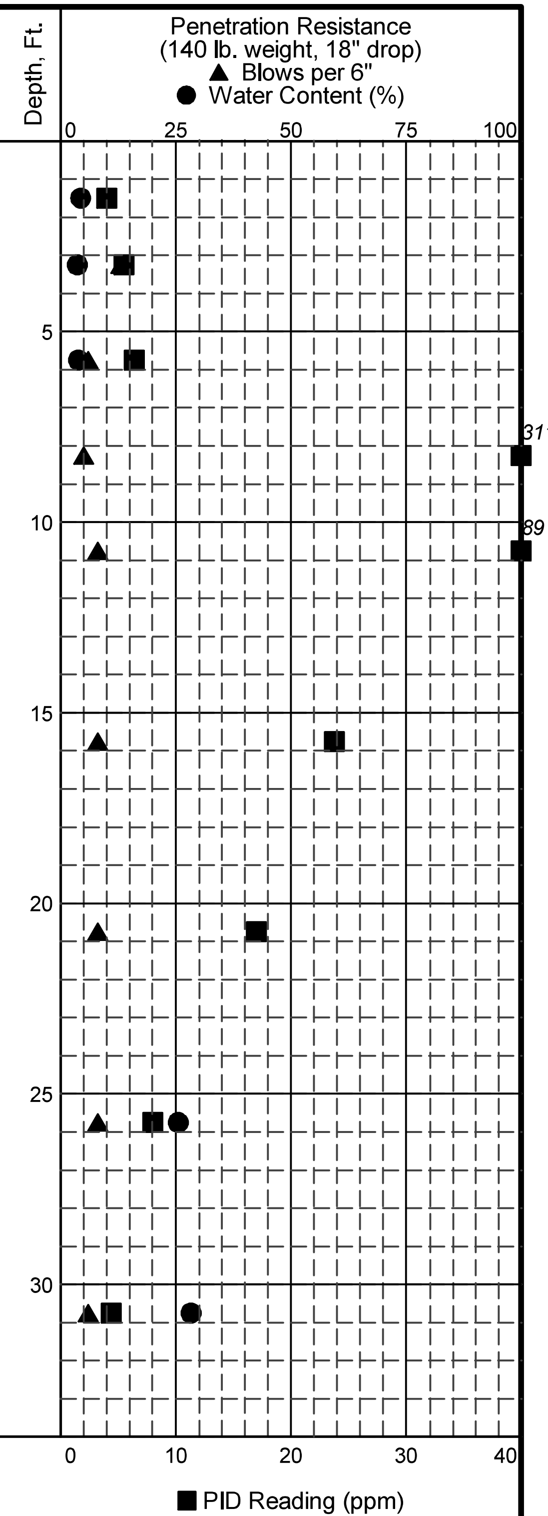
FIG. A-3

GEOTECHNICAL LOG GINT TEMPLATE7.GPJ S&W GEO1.GDT 1/2/25

MATERIAL DESCRIPTION Lat.: 61.23139 N Long.: 149.88369 W Approx. Elevation: 73 Ft.	Depth, Ft.	Samples	Ground Water
Loose to medium dense, dark brown, *Poorly Graded Sand with Silt and Gravel (SP-SM)*; moist; trace organics [FILL] S3: 47% Gravel, 48% Sand, 5% Fines (NFS)		S1, S2, S3	
Loose, gray, *Silty Sand (SM)*; wet	7.0	S4	5/28/2024 ▽
Loose, gray, *Poorly Graded Sand with Silt (SP-SM)*; wet	8.5		
Medium stiff to stiff, gray, *Lean Clay (CL)*; wet	10.5	S5, S6, S7, S8, S6	

CONTINUED NEXT PAGE



LEGEND

- * Sample Not Recovered
- Grab Sample
- 2" O.D. Split Spoon Sample
- Shelby Tube
- ▽ Ground Water Level At Time Of Drilling

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.

Battery Bank and Substation
Tract J, Port of Alaska

LOG OF BORING B-2

January 2025 113134-001

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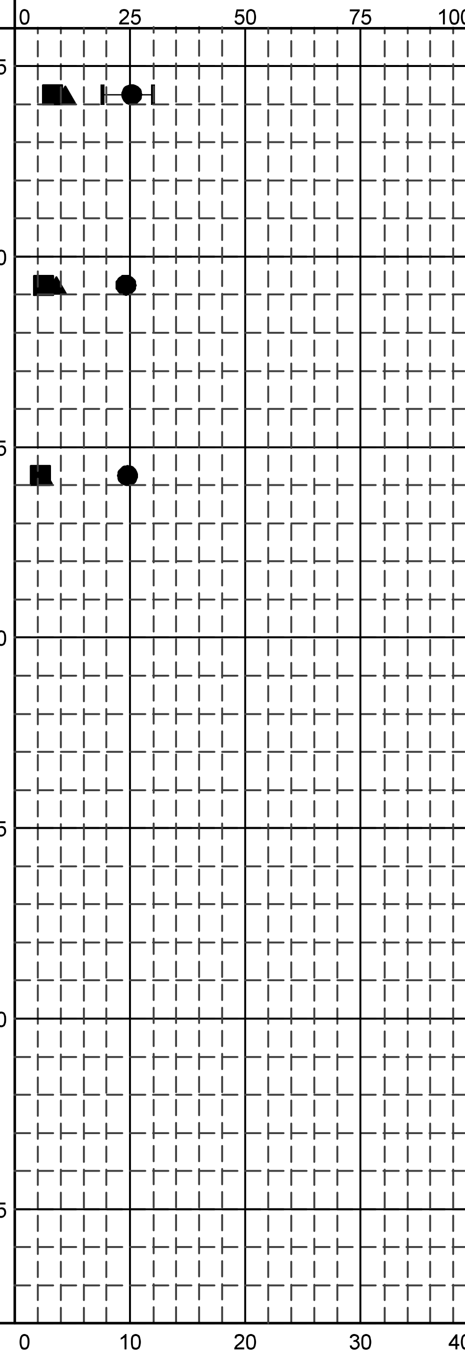
FIG. A-4
Sheet 1 of 2

MATERIAL DESCRIPTION Lat.: 61.23139 N Long.: 149.88369 W Approx. Elevation: 73 Ft.	Depth, Ft.	Symbol	Samples	Ground Water	Depth, Ft.
Medium stiff to stiff, gray, *Lean Clay (CL)*; wet			S11		35
			S9		40
			S6		45
S: See Figure A-12 for Shelby Tube log details	52.0				50
Bottom of Boring Boring Completed 5/28/2024					55 60 65

Penetration Resistance
(140 lb. weight, 18" drop)
▲ Blows per 6"
● Water Content (%)



■ PID Reading (ppm)

LEGEND

* Sample Not Recovered
Grab Sample
2" O.D. Split Spoon Sample
Shelby Tube
Ground Water Level At Time Of Drilling

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.

Battery Bank and Substation
Tract J, Port of Alaska

LOG OF BORING B-2

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FIG. A-4
Sheet 2 of 2

GEOTECHNICAL LOG GINT TEMPLATE7.GPJ S&W GEO1.GDT 1/2/25

MATERIAL DESCRIPTION

Lat.: 61.23187 N Long.: 149.88308 W

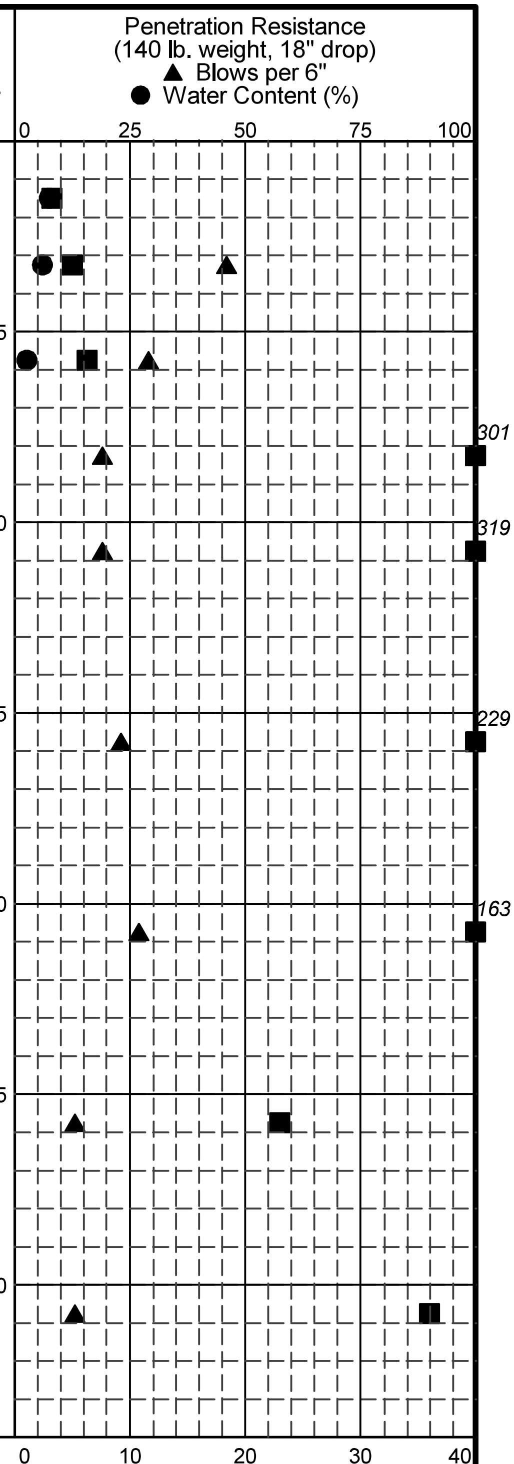
Approx. Elevation: 72 Ft.

Material Description	Depth, Ft. (bottom of layer)	Samples
Medium dense to dense, dark brown to brown, *Poorly Graded Sand with Silt and Gravel (SP-SM)*; moist [FILL]	4.5	S1, S2
Medium dense, brown and gray, *Poorly Graded Gravel with Silt and Sand (GP-GM)*; moist to wet S3: 54% Gravel, 40% Sand, 6% Fines (NFS)	9.5	S3, S4
Medium dense, gray-brown, *Poorly Graded Sand with Silt (SP-SM)*; wet	26.0	S5, S6, S7, S8
Stiff, gray, *Lean Clay (CL)*; wet	31.5	S9

Bottom of Boring

Boring Completed 5/29/2024

Ground Water: 5/29/2024



LEGEND

- * Sample Not Recovered
- Grab Sample
- 2" O.D. Split Spoon Sample
- Shelby Tube
- Ground Water Level At Time Of Drilling

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.

Battery Bank and Substation
Tract J, Port of Alaska

LOG OF BORING B-3

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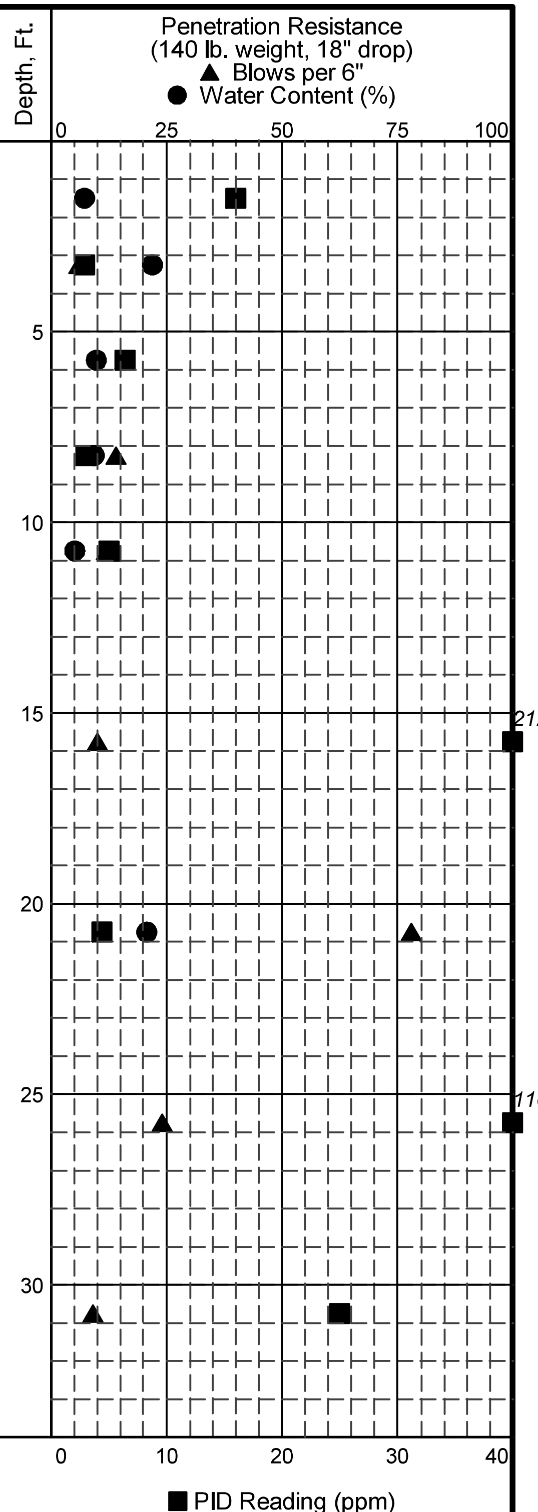
FIG. A-5

GEOTECHNICAL LOG GINT TEMPLATE7.GPJ S&W GEO1.GDT 1/2/25

MATERIAL DESCRIPTION Lat.: 61.23222 N Long.: 149.87789 W Approx. Elevation: 109 Ft.	Depth, Ft.	Symbol	Samples	Ground Water
Loose, brown, *Poorly Graded Sand with Gravel (SP)*; moist [FILL]			S1	
Loose, gray-brown, *Silty Sand (SM)*; moist	2.3		S2	
Medium dense, red-brown to gray, *Poorly Graded Sand with Silt (SP-SM)*; moist to wet S4: 14% Gravel, 78% Sand, 7% Fines (F2) S7: Blow counts may be biased high due to overfull sampler	5.5		S3, S4, S5, S6, S7	5/29/2024
Stiff, gray, *Lean Clay (CL)*; wet S8: Blow counts may be biased high due to overfull sampler	23.0		S8, S9	
Bottom of Boring Boring Completed 5/29/2024	31.5			



LEGEND

- * Sample Not Recovered
- Grab Sample
- 2" O.D. Split Spoon Sample
- Shelby Tube
- Ground Water Level At Time Of Drilling

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.

Battery Bank and Substation
Tract J, Port of Alaska

LOG OF BORING B-4

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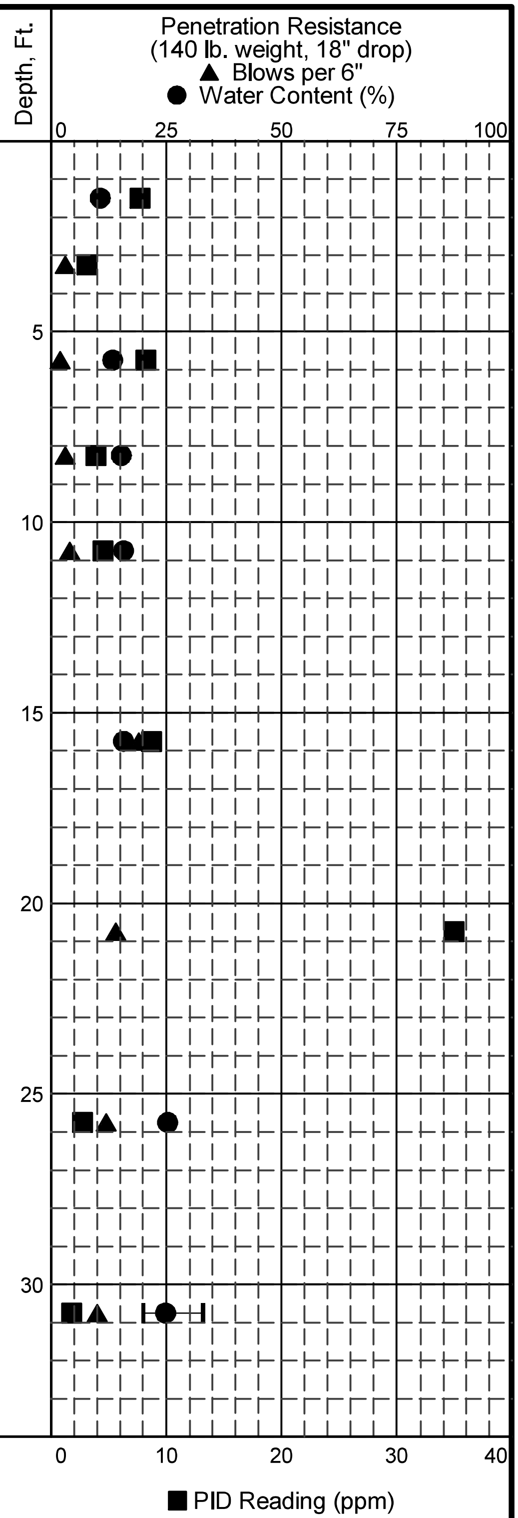
FIG. A-6

MATERIAL DESCRIPTION Lat.: 61.23234 N Long.: 149.8771 W Approx. Elevation: 101 Ft.	Depth, Ft.	Samples	Ground Water
Medium dense, dark brown, *Silty Sand with Gravel (SM)*; moist; trace organics [FILL]		S1	
Loose, brown and gray, *Sandy Silt (ML)*; moist	2.3	S2, S3, S4, S5	
Medium dense, gray-brown, *Poorly Graded Sand with Silt and Gravel (SP-SM)*; wet S6: 34% Gravel, 56% Sand, 10% Fines (F2)	13.0	S6	5/29/2024
Stiff, gray, *Lean Clay (CL)*; wet	19.0	S7, S8, S9	
Bottom of Boring Boring Completed 5/29/2024	31.5		



LEGEND

- * Sample Not Recovered
- Grab Sample
- 2" O.D. Split Spoon Sample
- Shelby Tube
- Ground Water Level At Time Of Drilling

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.

Battery Bank and Substation
Tract J, Port of Alaska

LOG OF BORING B-5

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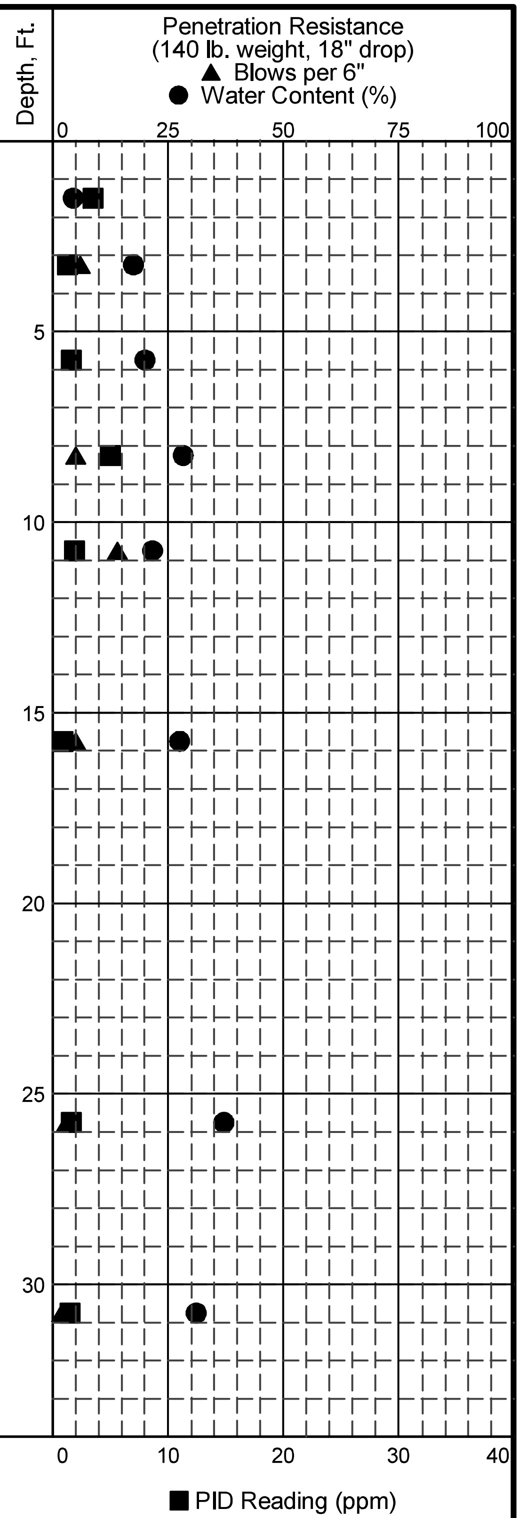
FIG. A-7

GEOTECHNICAL LOG GINT TEMPLATE7.GPJ S&W GEO1.GDT 1/2/25

MATERIAL DESCRIPTION	Depth, Ft.	Symbol	Samples	Ground Water
Lat.: 61.23299 N Long.: 149.87597 W Approx. Elevation: 91 Ft.				
Medium dense, dark brown, *Poorly Graded Sand (SP)*; moist			S1	
Loose, gray, *Silt (ML) lensed with Silty Sand (SM)*; moist	2.3		S2	5/30/2024
Loose, gray-brown, *Poorly Graded Sand with Silt (SP-SM)*; wet	4.5		S3	
Soft to stiff, gray-brown to gray, *Lean Clay (CL)*; wet S4: 98.4% Fines (F4) S7: See Figure A-12 for Shelby Tube log details	7.0		S4 S5 S6 S7 S8 S9	

CONTINUED NEXT PAGE



LEGEND

- * Sample Not Recovered
- Grab Sample
- 2" O.D. Split Spoon Sample
- Shelby Tube
- Ground Water Level At Time Of Drilling

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.

Battery Bank and Substation
Tract J, Port of Alaska

LOG OF BORING B-6

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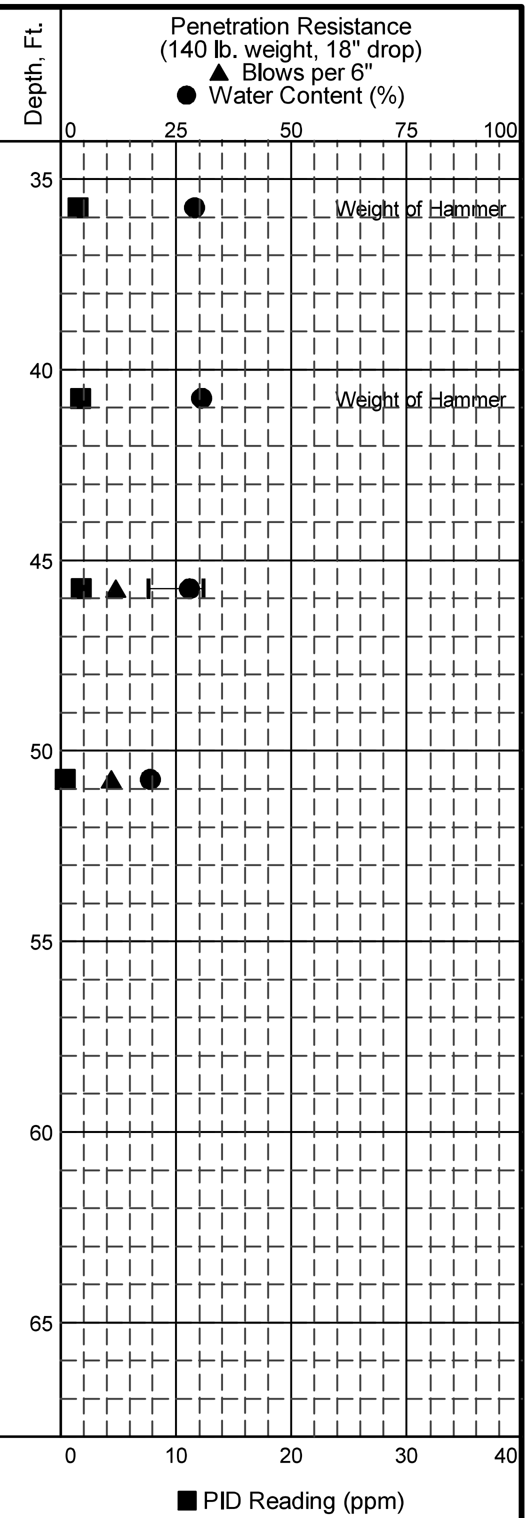
FIG. A-8
Sheet 1 of 2

MATERIAL DESCRIPTION Lat.: 61.23299 N Long.: 149.87597 W Approx. Elevation: 91 Ft.	Depth, Ft.	Symbol	Samples	Ground Water
Soft to stiff, gray-brown to gray, *Lean Clay (CL)*; wet			S10 S11 S12 S13	
Bottom of Boring Boring Completed 5/30/2024	51.5			



LEGEND

- * Sample Not Recovered
- Grab Sample
- 2" O.D. Split Spoon Sample
- Shelby Tube
- Ground Water Level At Time Of Drilling

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.

Battery Bank and Substation
Tract J, Port of Alaska

LOG OF BORING B-6

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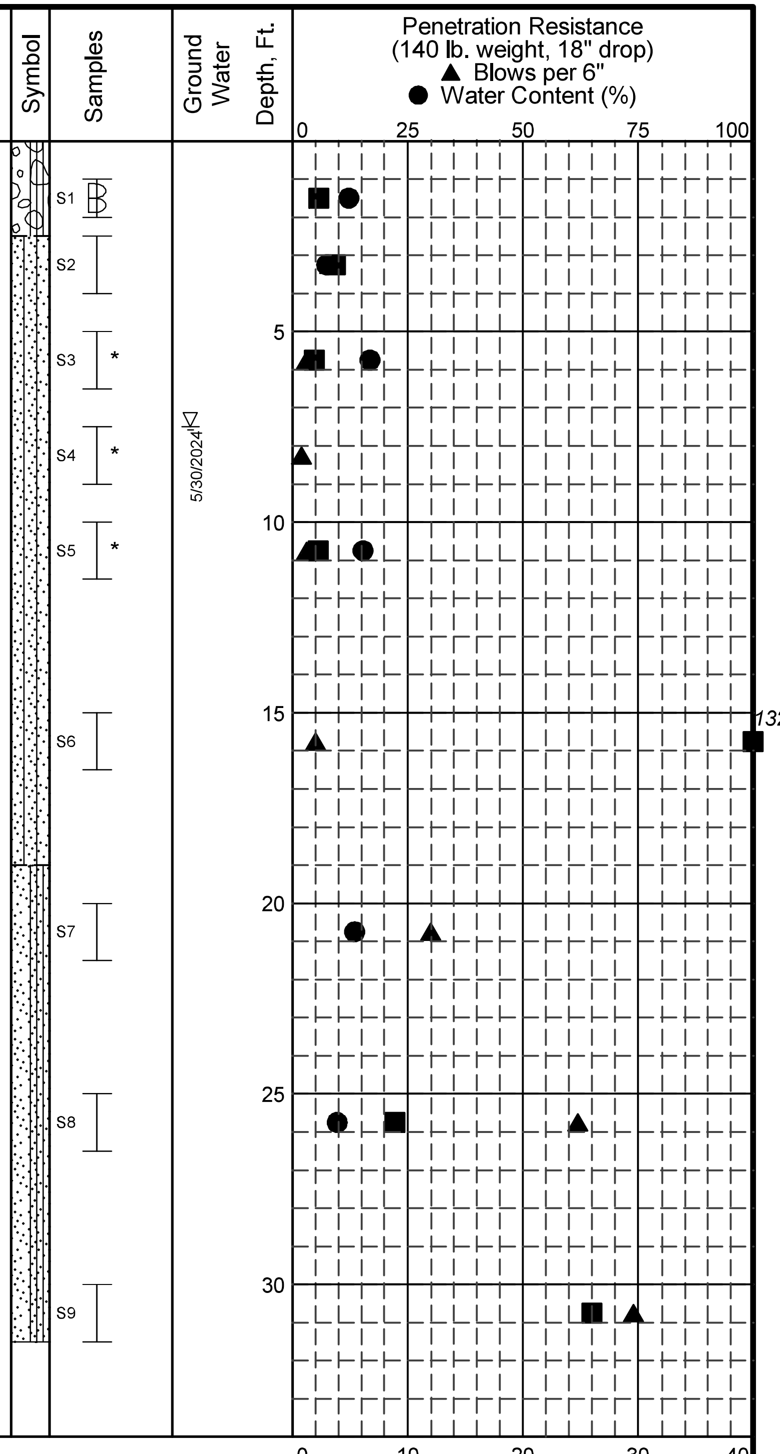
FIG. A-8
Sheet 2 of 2

GEOTECHNICAL LOG GINT TEMPLATE7.GPJ S&W GEO1.GDT 1/2/25

MATERIAL DESCRIPTION Lat.: 61.23309 N Long.: 149.87702 W Approx. Elevation: 86 Ft.	Depth, Ft.
Medium dense, brown, *Poorly Graded Gravel with Silt and Sand (GP-GM)*; moist [FILL]	
Loose, brown, *Silty Sand with Gravel (SM)*; moist to wet	2.5
Dense to very dense, brown, *Poorly Graded Sand with Silt and Gravel (SP-SM)*; wet S7: 33% Gravel, 61% Sand, 6% Fines (NFS)	19.0
Bottom of Boring Boring Completed 5/30/2024	31.5



LEGEND

- * Sample Not Recovered
- Grab Sample
- 2" O.D. Split Spoon Sample
- Shelby Tube
- Ground Water Level At Time Of Drilling

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.

Battery Bank and Substation
Tract J, Port of Alaska

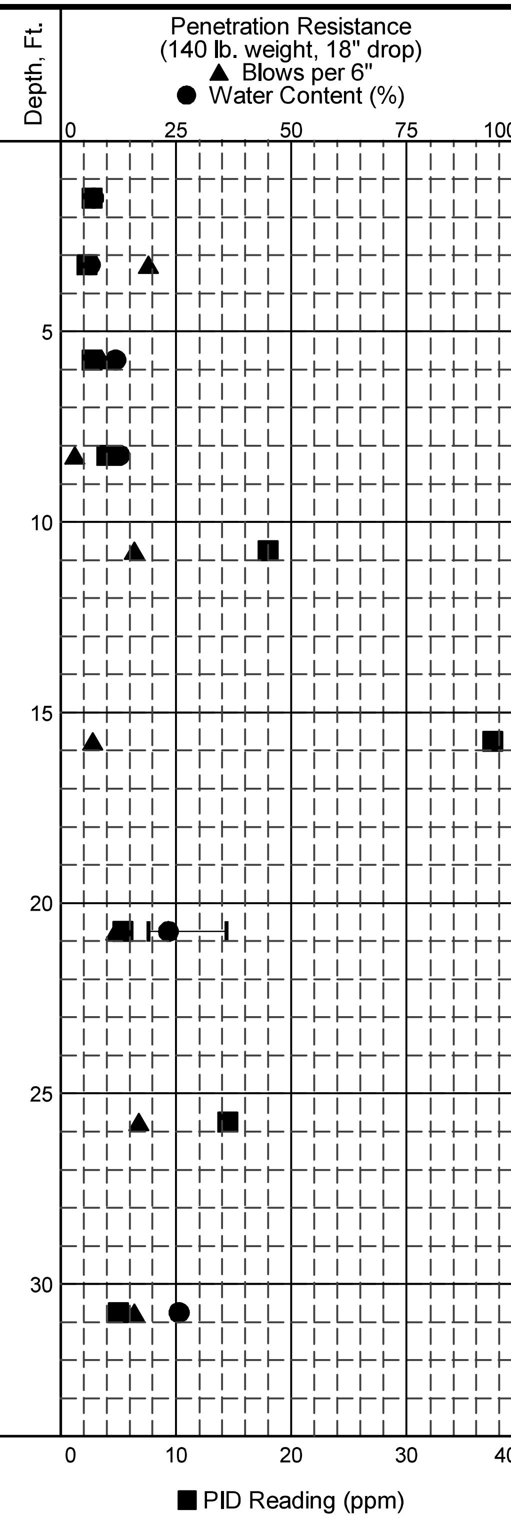
LOG OF BORING B-7

January 2025 113134-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-9

MATERIAL DESCRIPTION Lat.: 61.23296 N Long.: 149.87731 W Approx. Elevation: 77 Ft.	Depth, Ft.	Samples	Ground Water
2-inch grass mat with metal debris	0.1		
Medium dens, brown, *Poorly Graded Sand with Silt and Gravel (SP-SM)*; moist [FILL] S2: 14.9% Fines (F2)		S1 S2	
Loose, brown, *Silty Sand with Gravel (SM) interbedded with Sandy Clay (CL)*; moist	5.0	S3	
Soft, gray, *Sandy Clay (CL)*; moist to wet S4: 33.9% Fines (F3)	7.0	S4	
Medium dense, red-brown and brown, *Poorly Graded Gravel with Silt and Sand (GP-GM); wet*	9.5	S5	5/31/2024
Medium to stiff, gray, *Lean Clay (CL)*; wet	14.5	S6 S7 S8 S9	
Bottom of Boring Boring Completed 5/31/2024	31.5		



LEGEND

- * Sample Not Recovered
- Grab Sample
- 2" O.D. Split Spoon Sample
- Shelby Tube
- Ground Water Level At Time Of Drilling

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.

Battery Bank and Substation
Tract J, Port of Alaska

LOG OF BORING B-8

January 2025 113134-001

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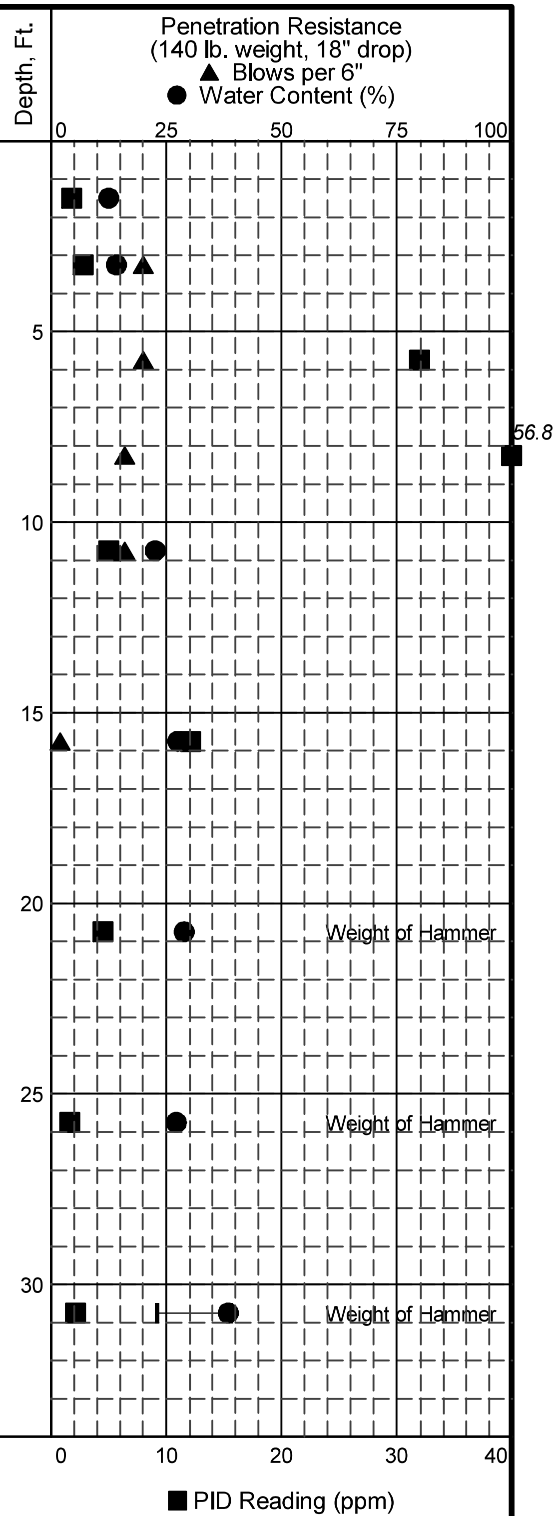
FIG. A-10

MATERIAL DESCRIPTION Lat.: 61.23276 N Long.: 149.87673 W Approx. Elevation: 90 Ft.	Depth, Ft.	Samples	Ground Water
Medium dense, red-brown, *Well-Graded Sand with Silt (SP-SM)*; moist [FILL] S2: 13% Gravel, 79% Sand, 8% Fines (F2)		S1, S2	
Medium dense, red-brown, *Poorly Graded Gravel with Silt and Sand (SP-SM)*; moist	4.5	S3	5/31/2024
Very soft to very stiff, gray, *Lean Clay (CL)*; wet	7.0	S4, S5, S6, S7, S8, S9	
Bottom of Boring Boring Completed 5/31/2024	31.5		



LEGEND

- * Sample Not Recovered
- Grab Sample
- 2" O.D. Split Spoon Sample
- Shelby Tube
- Ground Water Level At Time Of Drilling

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.

Battery Bank and Substation
Tract J, Port of Alaska

LOG OF BORING B-9

January 2025 113134-001

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FIG. A-11

GEOTECHNICAL LOG GINT TEMPLATE7.GPJ S&W GEO1.GDT 1/2/25

Classification of Shelby Tube Sample

Boring: B-1 Sample: S9

Depth: 30 to 32.3 feet below ground surface
Sample Quality: Fair

Depth (ft)	Length	Torvane V	Torvane H	Torvane R	Torvane S	Pocket Pen	M%	Description
30 – 30.5	6"	0.21	0.22	NT	NT	0.25 to 0.3	26.2	Soft, gray, Lean Clay (CL); moist; medium plasticity; increasing plasticity with depth
30.5 – 31	6"	0.24	0.28	NT	NT	0.24 to 0.5	25	
31 – 31.5	6"	0.18	NT	NT	NT	0.24	NT	
31.5 – 32	6"	NT	NT	NT	NT	NT	NT	
32 – 32.3	3"	0.21	0.25	0.23	0.91 to 1.01	0.25	22.7	
32.3								Bottom of Sample

NOTES

1. V, H, and R represent Vertical, Horizontal, and Remolded Torvane measurements, respectively.
2. Clay sensitivity is shown in the column labeled S and is a ratio of Tv to Tr.
3. Torvane and Pocket Pen results are reported in tons per square foot (tsf).
4. Reported Pocket Pen measurements are an average of the values representing each 6-inch section of the sample.
5. Moisture content for each interval is recorded in the column labeled M%.
6. NT = Not Tested

Battery Bank and Substation
Tract J, Port of Alaska

SHELBY TUBE CLASSIFICATION
BORING B-1 S9

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FIG. A-12
Sheet 1 of 3

Classification of Shelby Tube Sample

Boring: B-2 Sample: S13

Depth: 50 to 52 feet below ground surface
Sample Quality: Good

Depth (ft)	Length	Torvane V	Torvane H	Torvane R	Torvane S	Pocket Pen	M%	Description
50 – 50.5	6"	NT	NT	NT	NT	NT	NT	Sluff / Very stiff, gray, Lean Clay, moist; medium to high plasticity
50.5 – 51	6"	1.45	1.5	NT	NT	2.7 to 3.3	20	Very stiff, gray, Lean Clay, moist; medium to high plasticity
51 – 51.5	6"	1.25	1.08	NT	NT	2.25	30.3	
51.5 – 52	6"	1.3	1.18	NT	NT	2.12 to 2.5	22	
52								Bottom of Sample

NOTES

1. V, H, and R represent Vertical, Horizontal, and Remolded Torvane measurements, respectively.
2. Clay sensitivity is shown in the column labeled S and is a ratio of Tv to Tr.
3. Torvane and Pocket Pen results are reported in tons per square foot (tsf).
4. Reported Pocket Pen measurements are an average of the values representing each 6-inch section of the sample.
5. Moisture content for each interval is recorded in the column labeled M%.
6. NT = Not Tested

Battery Bank and Substation
Tract J, Port of Alaska

SHELBY TUBE CLASSIFICATION
BORING B-2 S13

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FIG. A-12
Sheet 2 of 3

Classification of Shelby Tube Sample

Boring: SW-6 Sample: S5

Depth: 20 to 22.4 feet below ground surface
Sample Quality: Good

Depth (ft)	Length	Torvane V	Torvane H	Torvane R	Torvane S	Pocket Pen	M%		Description
20	0"	NT	NT	NT	NT	NT	27		Sand slough
20.9	2"	0.23	0.34	NT	NT	0.3 to 0.34	NT		Stiff, gray, Lean Clay (CL); moist
21	6"	0.71	0.65	NT	NT	0.99 to 1.4	22		
21.5	6"	0.65	0.625	0.38	1.7	NT	NT		
22	4"	0.41	0.46	NT	NT	0.5 to 0.7	25.5		
22.3								Bottom of Sample	

NOTES

1. V, H, and R represent Vertical, Horizontal, and Remolded Torvane measurements, respectively.
2. Clay sensitivity is shown in the column labeled S and is a ratio of Tv to Tr.
3. Torvane and Pocket Pen results are reported in tons per square foot (tsf).
4. Reported Pocket Pen measurements are an average of the values representing each 6-inch section of the sample.
5. Moisture content for each interval is recorded in the column labeled M%.
6. NT = Not Tested

Battery Bank and Substation
Tract J, Port of Alaska

SHELBY TUBE CLASSIFICATION
BORING B-6 S5

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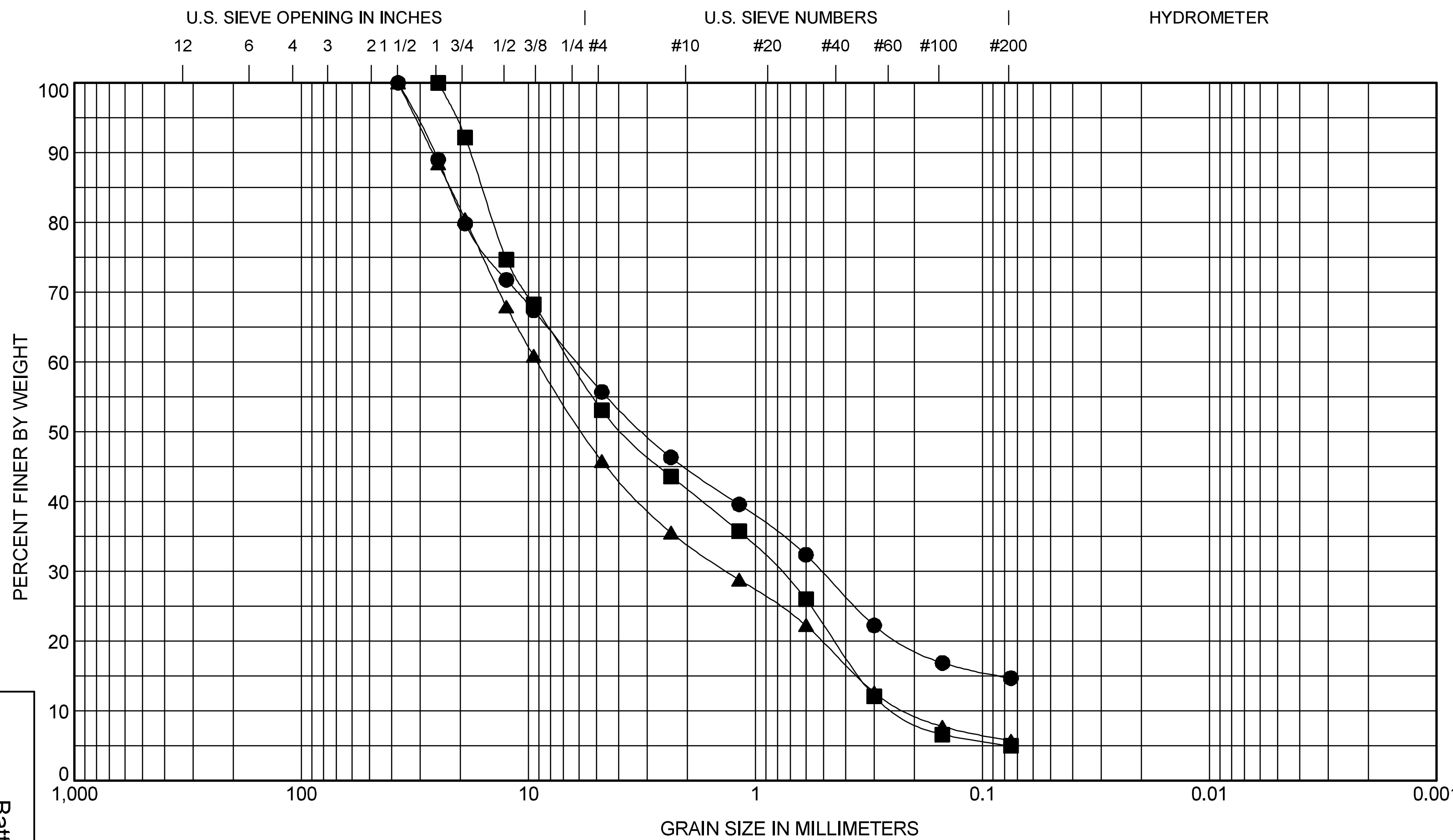
FIG. A-12
Sheet 3 of 3



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample		Depth, Ft	USCS Classification	LL	PL	PI	Cc	Cu
●	B-1 S2	2.5 - 4.0	**Silty Gravel with Sand (GM)**					
■	B-2 S3	5.0 - 6.5	**Poorly Graded Sand with Silt and Gravel (SP-SM)**				**0.4**	**28.3**
▲	B-3 S3	5.0 - 6.5	**Poorly Graded Gravel with Silt and Sand (GP-GM)**				**0.9**	**44.2**

Sample		Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1 S2	2.5 - 4.0	**37.5**	**6.13**	**0.51**		**44**	**41**	**15**	
■	B-2 S3	5.0 - 6.5	**25**	**6.52**	**0.79**	**0.23**	**47**	**48**	**5**	
▲	B-3 S3	5.0 - 6.5	**37.5**	**9.13**	**1.34**	**0.21**	**54**	**40**	**6**	

Battery Bank and Substation
Tract J, Port of Alaska

GRAIN SIZE CLASSIFICATION

January 2025

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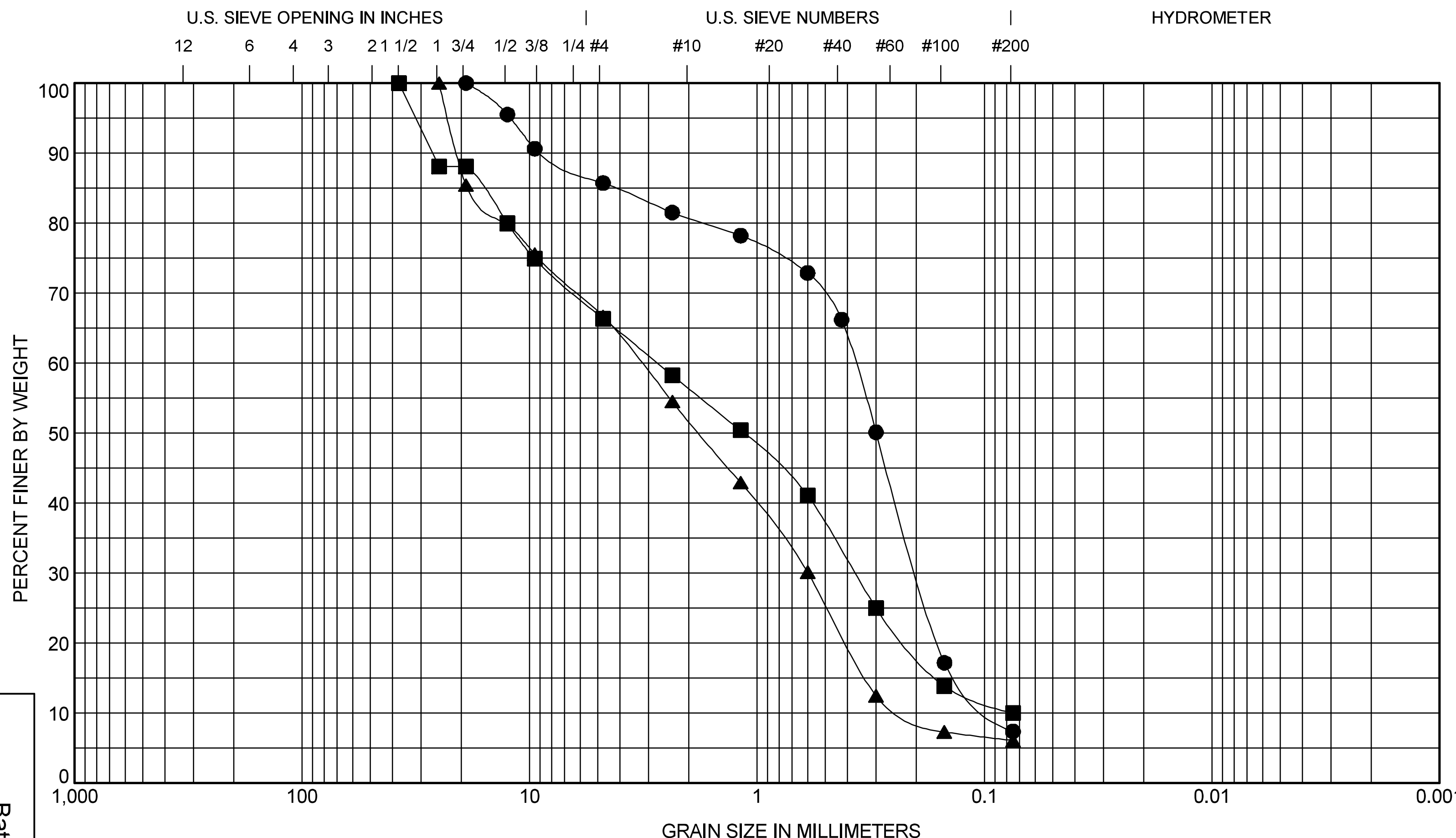
FIG. A-13
Sheet 1 of 3



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth, Ft	USCS Classification	LL	PL	PI	Cc	Cu
●	B-4 S4	7.5 - 9.0	**Poorly Graded Sand with Silt and Gravel (SP-SM)**				1.1	4.1
■	B-5 S6	15.0 - 16.5	**Poorly Graded Sand with Silt and Gravel (SP-SM)**				0.7	36.6
▲	B-7 S7	20.0 - 21.5	**Poorly Graded Sand with Silt and Gravel (SP-SM)**				0.5	15.0

	Sample	Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-4 S4	7.5 - 9.0	19	0.37	0.2	0.09	14	78	7	
■	B-5 S6	15.0 - 16.5	37.5	2.75	0.37	0.08	34	56	10	
▲	B-7 S7	20.0 - 21.5	25	3.24	0.6	0.22	33	61	6	

Battery Bank and Substation
Tract J, Port of Alaska

GRAIN SIZE CLASSIFICATION

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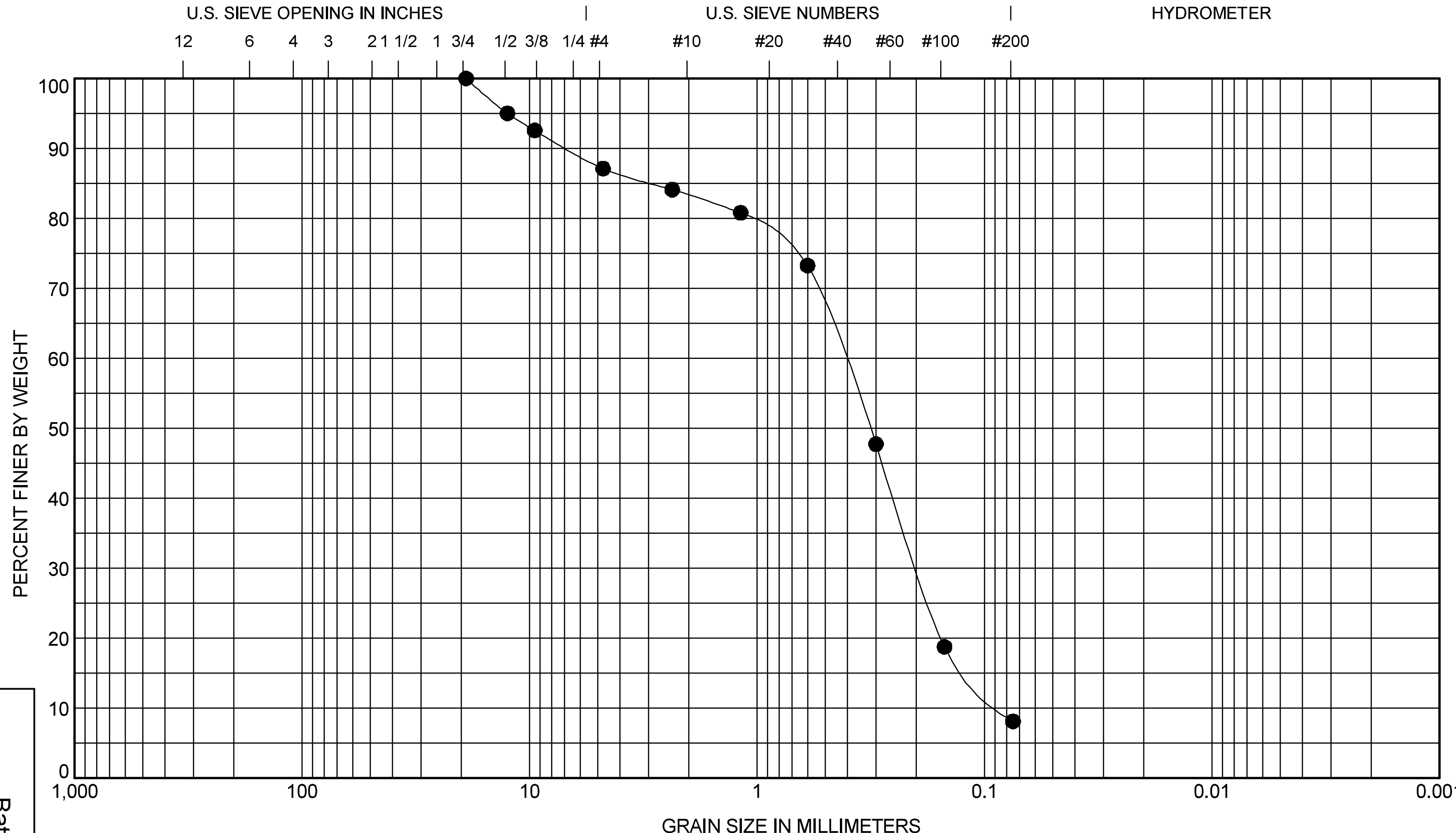
FIG. A-13
Sheet 2 of 3



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample	Depth, Ft	USCS Classification	LL	PL	PI	Cc	Cu
● B-9 S2	2.5 - 4.0	**Poorly Graded Sand with Silt (SP-SM)**				1.1	4.9

Sample	Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-9 S2	2.5 - 4.0	19	0.42	0.2	0.08	13	79	8	

Battery Bank and Substation
Tract J, Port of Alaska

GRAIN SIZE CLASSIFICATION

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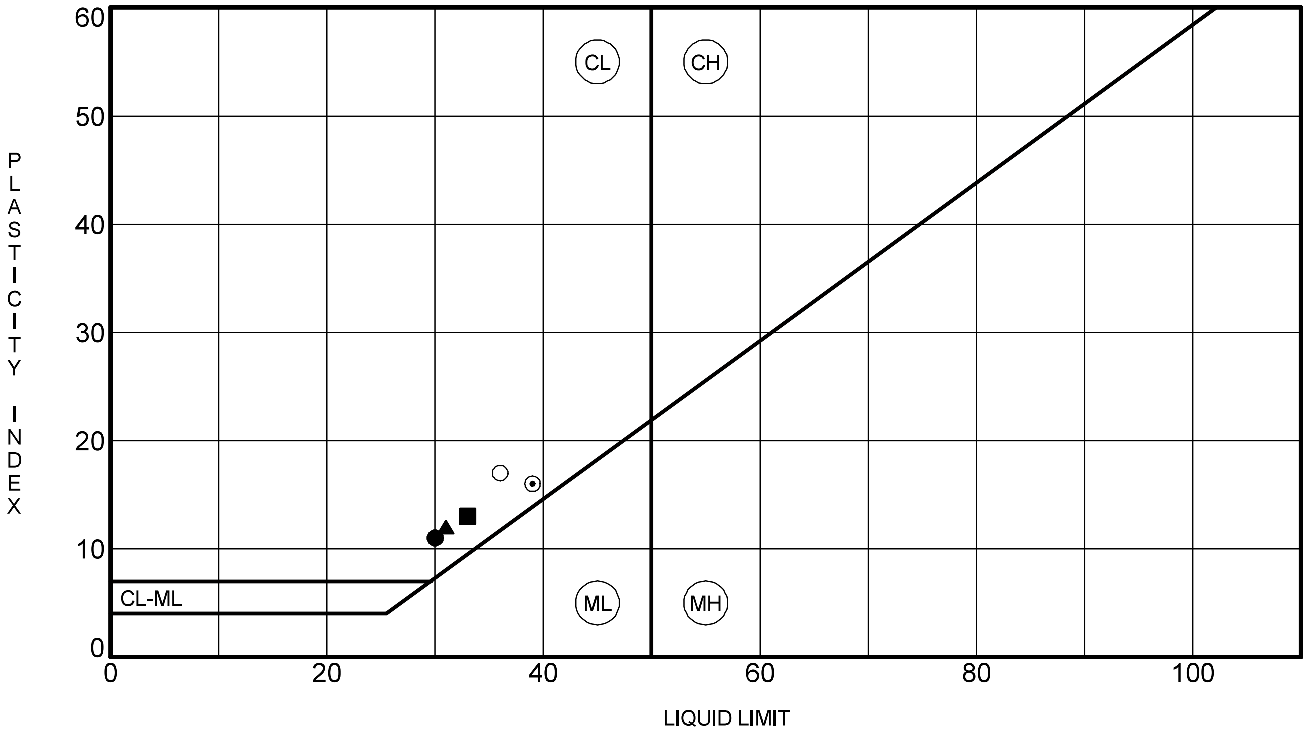
FIG. A-13
Sheet 3 of 3



	Boring	Depth, Ft	LL	PL	PI	Fines	Classification
●	**B-2**	**35.0 - 36.5**	**30**	**19**	**11**		**CL**
■	**B-5**	**30.0 - 31.5**	**33**	**20**	**13**		**CL**
▲	**B-6**	**45.0 - 46.5**	**31**	**19**	**12**		**CL**
○	**B-8**	**20.0 - 21.5**	**36**	**19**	**17**		**CL**
⊙	**B-9**	**30.0 - 31.5**	**39**	**23**	**16**		**CL**

Battery Bank and Substation
Tract J, Port of Alaska

ATTERBERG LIMITS RESULTS

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FIG. A-14

IMPORTANT INFORMATION

Important Information

About Your Geotechnical Report

IMPORTANT INFORMATION

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims

IMPORTANT INFORMATION

being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, M