FINAL
Subsurface Exploration
and Pavement
Recommendations

RSA Phase IIB Northeast
and Northwest
Development
Juneau, Alaska

June 2016

FINAL
SUBSURFACE EXPLORATION AND
PAVEMENT RECOMMENDATIONS

RSA PHASE IIB NORTHEAST AND NORTHWEST DEVELOPMENT AREAS JUNEAU INTERNATIONAL AIRPORT, JUNEAU, ALASKA

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1.0 INTRODUCTION

The City and Borough of Juneau (CBJ) plans to construct taxiways and aprons in the northeast and northwest development areas at the Juneau International Airport (JNU) (Figure 1). The purpose of this geotechnical engineering report is to present the results of our field exploration, laboratory soil testing program, describe the subsurface conditions, and provide geotechnical engineering recommendations for the pavements.

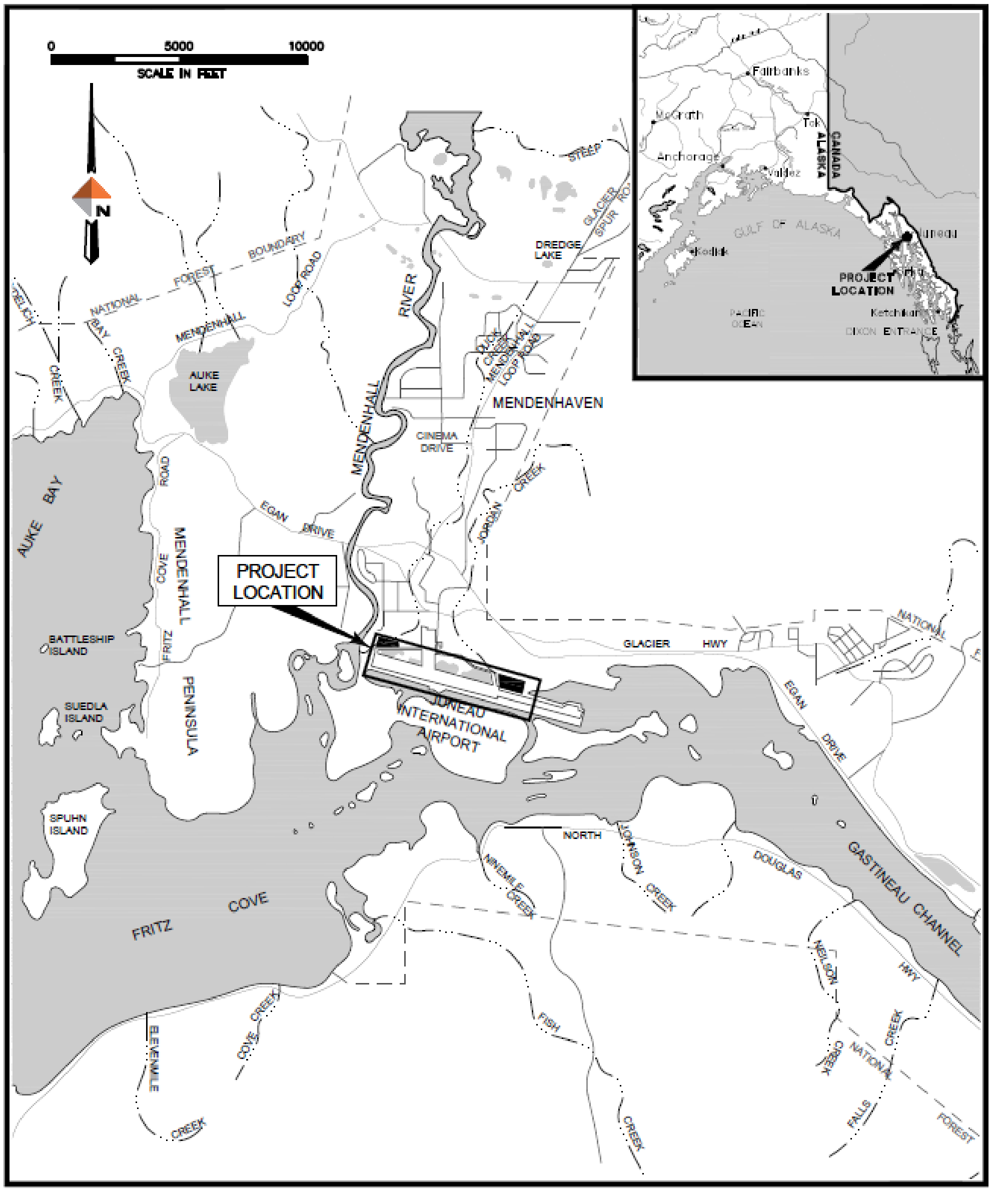


Figure 1: Vicinity Map

1.1 Planned Development

The proposed project has the following project elements:

- The Northeast Development Area (NEDA) will have approximately 1,600 feet of taxilane and an apron approximately 371,000 square feet;
- The Northwest Development Area (NWDA) will have approximately 950 feet of general aviation taxilane and an apron approximately 1,100 feet by 150 feet of pavement.

The current site plans are located in Appendix A on the Test Boring Location Maps, Figures A-1 and A-2. The NEDA is on Figure A-1 and the NWDA is on Figure A-2.

This report is valid only for the planned development as it is currently understood. Any changes to the current development plans, including relocating structures, may impact the recommendations contained herein and should be evaluated by the project geotechnical engineer.

1.2 Scope of Work

DOWL submitted a proposal dated September 3, 2015 for geotechnical engineering services including subsurface exploration consisting of drilling and sampling test borings, dynamic cone penetrometer (DCP), laboratory testing, engineering analysis, report preparation, and geotechnical engineering recommendations.

In brief, the scope of work included:

- Review of the available background information from previous site investigations in the proposed areas;
- Drill four test borings to depths of 20 feet for the Northeast taxiway;
- Drill five test borings to depths of 20 feet for the Northwest taxiway;
- Perform laboratory soils testing for moisture content, particle size distribution, frost classification, sand equivalence, and modified Proctor test;
- Analyze the geotechnical aspects of the planned development with respect to the site soils and groundwater; and
- Prepare a report of findings and geotechnical engineering recommendations.

Our proposal was accepted and Notice-to-Proceed received on April 22, 2016.

2.0 BACKGROUND REVIEW AND HISTORIC GEOTECHNICAL REPORTS

DOWL has previously completed geotechnical investigations for development across the airport property, including the main taxiway west extension, and preliminary evaluation of the NWDA as part of the floatplane pond Airport Improvement Program; the following sections summarize the historic geotechnical engineering reports relevant to this project.

2.1 Final Reconnaissance Geotechnical Report, Floatplane Pond (DOWL 2006)

The report titled *Final Reconnaissance Geotechnical Report, Floatplane Pond, Juneau, Alaska*, dated December 11, 2006 includes discussions and geotechnical data for the floatplane pond dredging, and for the northwest and northeast development areas. Included is research and records for historical geotechnical borings for the taxiway on the western border of the NEDA.

2.2 Juneau Airport Improvements (DOWL 2008)

The report titled *Final Subsurface Exploration and Preliminary Foundation Recommendations, Juneau Airport Improvements, Juneau, Alaska*, dated February 15, 2008 includes the logs of thirty test borings and eleven test pits, laboratory testing results, and preliminary recommendations for foundations, earthwork, and drainage for the following elements:

- Dredging the floatplane pond to generate material necessary for improvements;
- Expansion of the runway safety area (RSA);
- Increasing developed land in the northwest and northeast for future airport expansion; and
- Construction of a snow removal equipment facility in the NEDA.

2.3 2012 Juneau Airport Improvements (DOWL 2012a)

The report titled *Subsurface Exploration and Geotechnical Recommendations, Juneau International Airport Improvements, Juneau, Alaska* dated March 17, 2012 includes 17 test boring logs, laboratory testing results, and recommendations for earthwork and pavements for the following elements:

- Development of the Northwest Taxiway;
- Relocation of Taxiway B at the west end of Runway 8;
- Development of Block O as a general aviation apron;

- Relocation of the Runway 26 threshold and blast pad;
- Relocation of Taxiway G, and;
- Construction of a bridge over Duck Creek to access the fuel tank farm.

2.4 2012 Proposed Northeast SREF Site (DOWL 2012b)

The letter report titled *Discussion of the Potential Settlement Due to Soil Liquefaction* and *Subsurface Exploration and Foundation Recommendations Addendum 1, Juneau International Airport Snow Removal Equipment Facility, Juneau, Alaska* dated March 21, 2012 includes nine test borings, laboratory testing, and foundation recommendations for the formerly proposed SREF at a proposed location in the northeast area of the airport. The addendum revised the original report to seismic Site Class F due to the liquefaction potential.

2.5 2016 Proposed Northwest SREF Site (DOWL 2016)

The report titled *Final Subsurface Exploration and Foundation Recommendations, Snow Removal Equipment Facility (SREF), Juneau International Airport, Juneau, Alaska* dated June 2016 includes nine test borings, laboratory testing, and foundation and pavement recommendations for the proposed SREF location in the northwest area of the airport.

3.0 PHYSICAL SETTING

The northeast and northwest development areas are located at the Juneau International Airport in Juneau, Alaska (Figure 1).

3.1 Area Topography and Existing Development

The NEDA is partially developed. The site is bounded on the west by taxiway D-1, the east by Maplesden Way, Temsco Air, and taxiway E-1, the south by a paved access road, and the north by a frontage road to Yandukin Drive. The site has been graded flat and the surface consists of loose sand with little to no vegetation. The site elevation is approximately the same as the rest of the airport. A stockpile of recycled asphalt pavement (RAP) is located in the northeast portion of the development area. The southern area has buried geothermal loops installed. The northeast area drains east to a number of tidally influenced small channels.

The NWDA currently has a civil air patrol (CAP) building, hangars, taxiway, small aircraft parking and ties downs, helicopter landing pads, and road access to the floatplane pond. The site has a variety of surfaces from gravel and RAP in the parking areas and asphalt in the taxiway and landing pads. The site elevation is approximately the same as the rest of the airport. The area drains locally south towards the historic Duck Creek running through the middle of the project. Duck Creek and surrounding area generally drains west towards the Mendenhall River.

3.2 Historical Development

The 2006 and 2008 DOWL reports describe the northeast area as mostly undeveloped with an FAA installation in the center (DOWL 2006, 2008). In 2010, dredging operations placed fill in the area raising the overall grade to its current elevation.

As recently as 2008, the northwest area was described as mostly undeveloped with Duck Creek running in its original course along the southern site boundary (DOWL 2008). The original site generally sloped south with uneven ground and was vegetated with grass. The northern half of the original site had similar elevations to the airport and was vegetated with alders and large spruce trees along the fence line.

Beginning in 2010, dredging operations began in the float plane pond to provide fill for the airport improvements and development areas. Fill placed in both development areas was quality assurance (QA) monitored by the firm PND Engineering Inc. (PND). Compaction of the fill was maintained at or above 95 percent of the maximum dry density as determined by modified Proctor, AASHTO T180. The final compaction tests were performed in the NEDA on May 2, 2012 and the NWDA on May 31, 2012.

3.3 Regional Geology

The City of Juneau is located on the northeastern side of Gastineau Channel in southeast Alaska. Juneau lies within the Boundary Ranges of southeastern Alaska and northwestern British Columbia, Canada. The Gastineau Fault is present northeast of Juneau and is part of the active tectonic belt of the Pacific Ocean. The bedrock of the Juneau area consists of layered greenstone, greywacke, slate, green schist, and metavolcanic flow breccia that formed during the Mesozoic Era. Unconsolidated material overlies the bedrock and was formed primarily during the Quaternary Period as a result of glacial advances and retreats. The unconsolidated material consists of mass-wasting deposits, glacial deposits, alluvial deposits, marine deposits, glaciomarine deposits, and most recently man-placed fill.

3.4 Climate

Juneau is located in a maritime climate zone. The climatological data presented below for the Juneau International Airport was taken from a range of sources; including the Western Regional Climate Center (WRCC) and American Society of Civil Engineers (ASCE) 32-01.

Mean Annual Precipitation	62 inches
Mean Annual Snowfall	87 inches

Average monthly temperatures and precipitation for Juneau International Airport, Juneau, Alaska for the period between 1985 and 2015 are shown in Table 1 (WRCC 2016).

Table 1: Average Monthly Temperatures and Precipitation

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Temperature (°F)	28.8	30.0	33.2	40.7	48.6	54.5	56.9	55.9	50.1	42.5	33.3	30.4
Precipitation (in)	5.9	4.3	3.8	3.2	3.3	3.6	5.0	5.9	9.0	8.6	6.4	6.2

The construction season in Juneau typically begins in April and ends in October. Snowfall can occur as early as October and prevalent freezing temperatures generally in November and extend to March.

4.0 FIELD EXPLORATION AND LABORATORY TESTING

4.1 Field Exploration

The test boring exploration for the current northwest and northeast projects was conducted on May 2 and May 3, 2016. Nine test borings were drilled, sampled, and logged to a depth of approximately 20 feet; four test borings in the NEDA and five test borings in the NWDA.

The test borings were located in the field by survey and are only as accurate as the method implies. The locations of the test borings are shown on Figures A-1 and A-2, Test Boring Location Maps, located in Appendix A.

The test borings were drilled using a Mobile B-61 truck-mounted drill rig fitted with continuous-flight, hollow-stem auger. The rig is owned and operated by Denali Drilling Inc. of Anchorage, Alaska. The drilling was supervised and the samples logged by a geotechnical engineer with our firm.

Grab samples were obtained from the auger at the surface each test boring. Disturbed samples were obtained at depths of 2.5, 5, 7.5 and 10 feet and then at 5-foot intervals thereafter using a standard split-spoon sampler.

The Standard Penetration Test (SPT) was performed in the test borings by driving a 2-inch outside-diameter, split-spoon sampler a distance of 18 inches ahead of the auger with a 140-pound hammer falling 30 inches in general accordance with ASTM Standard Test Method for Standard Penetration Test and Split-Barrel Sampling of Soils (D1586). The standard penetration resistance (N) value shown on the test boring logs indicates the number of blows required to drive the sampler the last 12 inches. The results are an indication of the relative density or consistency of the subsoil. The N-values shown on the logs are raw data from the field and have not been adjusted for sampling equipment type or overburden pressure. The SPT values are highly influenced by ice content, ground temperature, the presence of gravel, and heaving sand conditions.

Soil samples recovered during drilling were visual-manually classified in general accordance with ASTM D2488 and sealed in plastic bags to preserve the natural water content. The samples were then transported to DOWL's Anchorage laboratory in accordance with ASTM D4220, for further testing.

A slotted PVC standpipe was installed and measured in three test borings. The depth to the groundwater was measured on May 4, 2016 a day or two after drilling to allow the water levels to stabilize.

Four dynamic cone penetrometer (DCP) tests were performed, three tests in the NWDA and one test in the NEDA. DCP consists of a calibrated device using a weight to drive a cone penetrometer. The driving resistance correlates with California Bearing Ratio (CBR) values and bearing capacity. The results of the DCP tests are presented in Appendix B.

No environmental testing or monitoring was conducted as a part of this investigation.

4.2 Laboratory Testing

Laboratory tests were performed on selected samples to measure soil index properties to provide a basis for estimating engineering properties. Soil index testing included moisture contents, particle size distribution analysis, limited mechanical analysis (LMA), and Atterberg Limits performed on selected samples. The natural water content of nearly all the recovered samples was measured. Grain size analyses and limited mechanical analyses were performed on selected samples for classification purposes. A modified Proctor with a sieve was performed on a composite sample. Nine sand equivalent tests were performed, one at each boring location.

Soil samples will be stored until October 2016, after which time they will be discarded unless other arrangements are made.

Moisture Content. The natural moisture content of most recovered samples was determined in accordance with ASTM D2216; except, due to limited sample sizes, some tests may have been performed on samples smaller than the minimum test size required by the standard. The water contents are reported on the graphic test boring logs, Appendix B.

Particle Size Distribution Tests. Eleven particle-size distribution tests were performed on selected soil samples in accordance with ASTM D6913. These tests consisted of mechanical sieving and the results are presented graphically in Appendix C.

Limited Mechanical Analysis. Nine limited mechanical analyses were performed on selected soil samples to supplement visual-manual classification in the field and laboratory. This test is performed in general accordance with ASTM D1140 to determine the amount of material finer than the No. 200 sieve, however, the coarse fraction is passed through the No. 4 sieve. Particles retained on the No. 4 sieve are reported as percent gravel. Particles passing the No. 4 sieve and retained on the No. 200 sieve are reported as percent sand. Particles passing the No. 200 sieve are reported as percent silt or clay. The results of the testing are shown in Table C-1.

Atterberg Limits. One Atterberg Limits test was performed in accordance with ASTM D4318, multipoint method A. The liquid limit, plastic limit, and plasticity index numbers obtained from the test are used to classify the soil fines as silts or clays. In addition, the limits can be used to estimate strength and settlement characteristics of soils. The results of the plasticity index tests are presented on the test boring logs in Appendix B and summarized in Appendix C, Figure C-1.

Modified Proctor. One modified Proctor test was performed in accordance with ASTM D1557, method C. The modified Proctor test develops a moisture-density relationship curve to determine the maximum dry density at optimal moisture content with a specified compactive effort (56,000 ft-lbf/ft^3). The results of the modified Proctor test and an associated sieve are presented graphically in Appendix C.

Sand Equivalent. Nine sand equivalent tests were performed in accordance with ASTM D2419. This test method assigns an empirical value to the relative amount, fineness, and character of claylike material present in the specimen. The test results are presented in Appendix C, Table C-2.

5.0 SITE CONDITIONS

This section reports interpretations and opinions concerning the subsurface soil and groundwater conditions at the site. The site conditions described are valid for the data collected within the scope of work. If additional data becomes available, some or all of the interpretations and opinions expressed herein could change. We should be notified immediately if the conditions found at the site are different from those encountered during this investigation.

The soil descriptions and stratigraphy contained herein and the classifications shown on the test boring logs are the project geotechnical engineer's interpretation of the field logs and the results of the laboratory soil testing. The largest particle size that can be recovered with standard drill hole samplers is often smaller than the maximum particle size in a gravelly soil deposit. Therefore, the soil descriptions and test results for gravelly soils tend to be biased toward the finer particle sizes.

Refer to the Test Boring Log - Descriptive Guide in Appendix B immediately following the test boring logs for a more detailed presentation on sample sizes, sample quality, frost classifications, soil types, and the soil classification procedures.

5.1 NEDA Subsurface Conditions

The subsurface conditions are generally consistent in the upper 20 feet across the site. Controlled surficial fill consisting of sand extends across the site ranging in depth from 2.5 to 7.5 feet. Below the fill, sand was encountered varying from poorly graded sand to poorly graded sand with gravel. An intermittent layer of silty sand was encountered below the fill in two borings at approximately 7 feet. The silty sand layer was observed to be 0.5 feet and 2 feet thick.

Historical borings (DOWL 2006, 2008) indicated a typical profile of a grass surface underlain by sandy silt up to three feet thick, which was typically underlain by poorly graded sand or poorly graded sand with silt and gravel.

Fill. The surficial fill extends from the ground surface to depths of 2.5 to 7.5 feet. The placed fill consists of poorly graded sand (SP). The silt content was tested to be 4.1 to 4.9 percent with a frost classification of non-frost susceptible (NFS). The moisture content of the fill varies from 3 to 12 percent with an average value of 7 percent. The fill's relative density ranges from medium dense to dense with representative, uncorrected N-values ranging from 12 to 37 with an average N-value of 26.

Sand with Silt and Gravel. Below the fill is sand which extends to the termination depth of 21.5 feet below the ground surface. This deposit's classifications include poorly graded sand (SP), poorly graded sand with gravel (SP), poorly graded sand with silt (SP-SM), and silty sand (SM). The silt content varies from as low as 3 percent to as high as 16 percent. The moisture content of the sand ranges from 5 percent to 20 percent with an average of 13 percent. Lower moisture contents are associated with sand above the water table and the higher values are associated with sand below the water table. The sand is medium dense with uncorrected, representative N-values ranging from a low of 12 to a high of 29 with an average N-value of 20.

5.2 NWDA Subsurface Conditions

The subsurface conditions are generally consistent in the upper 20 feet across the site. Controlled surficial fill consisting of sand extends across the site ranging in depth from 4.5 to 8 feet. Below the fill, sand was encountered varying from poorly graded sand to poorly graded sand with gravel.

Fill. The surficial fill extends from the ground surface to depths of 4.5 to 8 feet. The placed fill consists of poorly graded sand (SP), well graded sand with silt (SW-SM), poorly graded sand with silt and gravel (SP-SM), silty sand with gravel (SM), and poorly graded sand with gravel (SP). The silt content was tested to be 5 percent to 19 percent with a frost classification of non-frost susceptible (NFS), S2, and F2. The moisture content of the fill varies from 3 percent to 10 percent with an average value of 7 percent. The fill's relative density ranges from medium dense to dense with representative, uncorrected N-values ranging from 26 to 44 with an average N-value of 36.

Sand with Silt and Gravel. Below the fill is sand which extends to the boring termination depth of 21.8 feet below the ground surface. This deposit's classifications include poorly graded sand (SP), poorly graded sand with gravel (SP), poorly graded sand with silt (SP-SM), and silty sand (SM). The silt content varies from 2 percent to 20 percent. The moisture content of the sand ranges from 2 percent to 37 percent with an average of 14 percent. Lower moisture contents are associated with sand above the water table and the higher values are associated with sand below the water table. The sand is medium dense with uncorrected, representative N-values ranging from a low of 10 to a high of 72 with an average N-value of 24.

5.3 Groundwater

During drilling approximate water levels were observed. After drilling, slotted PVC standpipes were installed in select test borings to measure the groundwater levels. Water levels were measured in the standpipes 1 to 2 days after drilling. The depth to groundwater was measured to be 11.7 feet below the existing grade in the NEDA and 9 to 10.8 feet below existing grade in the NWDA. The groundwater measurements are tabulated in Table 2.

Table 2: Observed and Measured Groundwater Levels of Test Borings

Test Boring	Approximate Groundwater Elevation (ft)	Approximate Surface Elevation (ft)	Depth to Water (ft)	
			While Drilling (May 2 – 3, 2016)	Measured Depth (May 4, 2016)
NE-1	16	26	10	-
NE-2	16	27	11	-
NE-3	16.3	28	12.5	11.7
NE-4	16	27	11	-
NW-1	13.2	24	7.5	10.8
NW-2	16	25	8.5	9.0
NW-3	15	25	10	-
NW-4	15	26	11	-
NW-5	15	25	10	-

6.0 ENGINEERING ANALYSIS

6.1 Paved Traffic Areas

6.1.1 Northeast Development Area

The existing fill ranges from medium dense to dense. Frost classification of the fill indicates it is non-frost susceptible (NFS) with less than 3 percent fines passing the 0.02 mm sieve. DCP testing indicates a CBR value of 20 was attained at approximately 8 inches of depth. From observation and the DCP test, the existing fill surface is loose and must be compacted before placement of additional fill or a pavement section. In general, the existing fill in the northeast is a suitable subgrade for pavement applications if the upper 12 inches of existing fill surface is compacted to a dense state.

Total departures by specific aircraft were determined based on 2013 fleet mixes and activity forecasts taken from the Alaska Aviation System Plan (AASP) project. A structural section design was run with the following inputs:

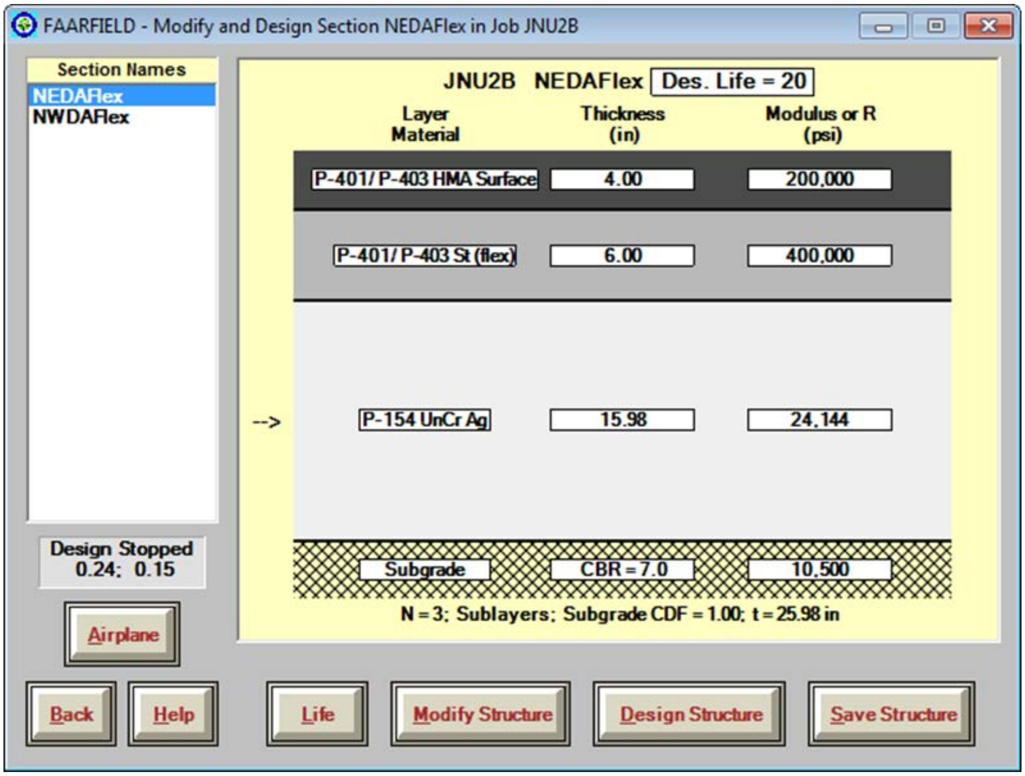
- Aviation Aircraft Inputs

Aircraft Type	Departures	Gross Taxi Weight LBS
Stationair-206: Misc. Single Engine	3,048	3,067
Single Wheel 5: Beaver	1,545	3,676
Navajo-C	3,558	4,074
Dual Wheel 15: Beech 1900	759	4,591
GrnCaravan-CE-208B	3,662	6,709
B737-900 ER	99	163,399
B737-800	190	151,807
B737-700	124	132,571
B737-400	4,195	125,928

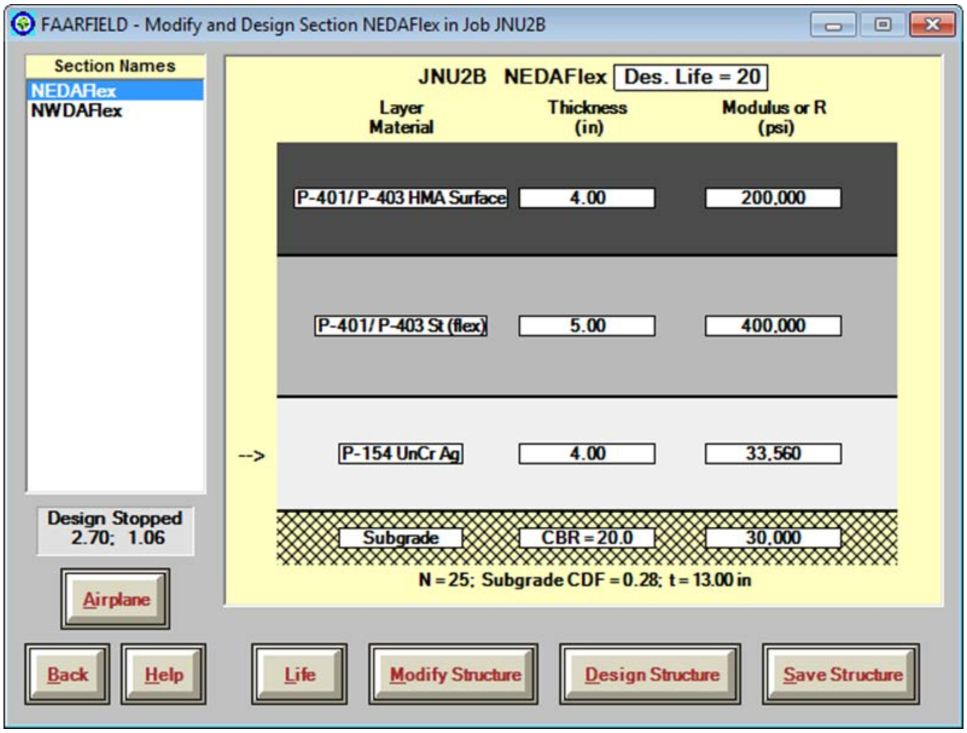
- Annual growth rate of 2.0 percent
- CBR of 20

The Federal Aviation Administration requires the use of stabilized bases for all pavements that will be required to support aircraft weighing 45,350 kg (100,000 lbs) or more. Since all of the Boeing aircraft in the forecast meet this requirement, an asphalt treated base was used in the design for the NEDA. The result of the first analysis was minimum material layer thicknesses.

The pavement design program does not converge on a layer thicknesses and defaults to a minimum thickness. The analysis was re-run using the reduced subgrade method with a CBR of 7 (FG-2 soil frost group) and determined the following section:



The analysis was re-run with a CBR of 20.0 and determined the following section:



For constructability and aggregate interlock, the minimum section was developed into the recommended section reported in the recommendations section.

6.1.2 Northwest Development Area

The existing fill averages as a dense fill. Frost classification of the fill indicates frost susceptible and potentially frost susceptible (PFS) soils in NW-1, NW-2, and NW-5 classifying as S2, PFS, and F2 respectively. The remaining borings indicated NFS soil including TH-9 near the apron area. DCP testing indicates a CBR value of 50 at approximately 4 to 12 inches of depth.

For borings NW-1 and NW-5, the frost susceptible soils are within 2 feet of the ground surface and are expected to be removed and replaced with the pavement section. Remaining areas with potentially frost susceptible soils (fines content of 7 percent to 9 percent) are typically not removed and replaced to protect against frost heave in these conditions because the water table is several feet below the frost depth. Additionally, pavement at this site was observed to maintain low moisture contents in the underlying soils further reducing the risk of frost heave.

Total departures by specific aircraft were determined based on 2013 fleet mixes and activity forecasts taken from the Alaska Aviation System Plan (AASP) project. A structural section design was run with the following inputs:

- General Aviation Aircraft Inputs

Aircraft Type	Departures	Gross Taxi Weight LBS
Stationair-206: Misc. Single Engine	3,048	3,067
Single Wheel 5: Beaver	1,545	3,676
Navajo-C	3,558	4,074
Dual Wheel 15: Beech 1900	759	4,591
GrnCaravan-CE-208B	3,662	6,709

- Annual growth rate of 2.0 percent
- CBR of 33.3 (the maximum CBR value for FAARFIELD)

The aircraft in the forecast are so light that the pavement design program does not converge on a material layer thickness and defaults to a minimum thickness. Therefore, the critical design vehicles for the NWDA are the Aircraft Rescue and Fire Fighting (ARFF) vehicle and snow removal equipment (SRE), deicing fluid truck, and the large loaders. Two Single Wheel aircraft were added to the aircraft inputs to represent the SRE and loaders and two Dual Wheel aircraft were added to represent the deicing truck.

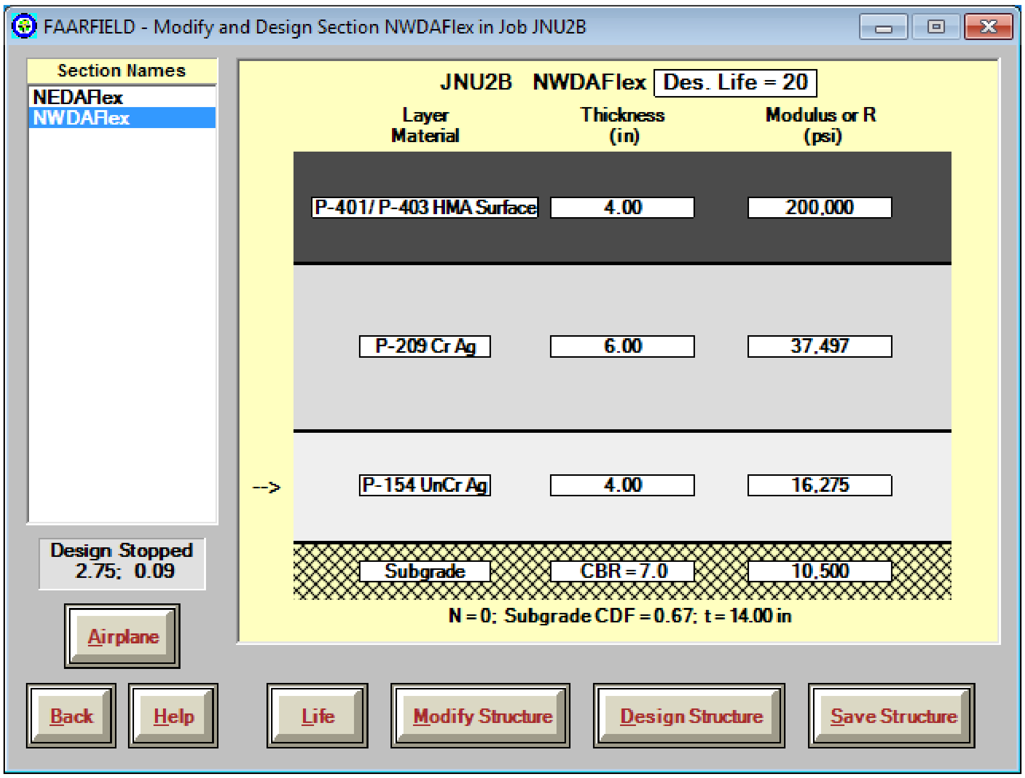
The analysis was run with the critical design vehicles added to the aircraft inputs and using the reduced subgrade method with a CBR of 7 (FG-2 soil frost group):

- Aviation Aircraft Inputs:

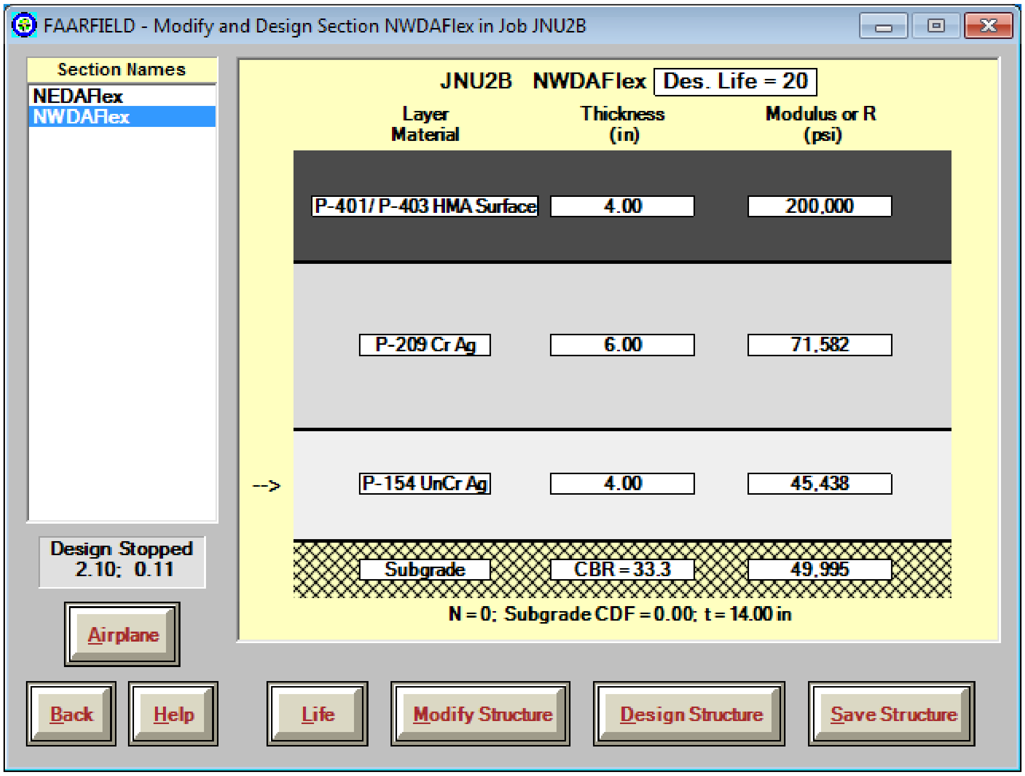
Aircraft Type	Departures	Gross Taxi Weight LBS
Stationair-206: Misc. Single Engine	3,048	3,067
Single Wheel 5: Beaver	1,545	3,676
Navajo-C	3,558	4,074
Dual Wheel 15: Beech 1900	759	4,591
GrnCaravan-CE-208B	3,662	6,709
Sngl Whl-30	100	29,000
Sngl Whl-30	100	29,000
Sngl Whl-30	200	29,000
Sngl Whl-30	200	29,000
Dual Whl-45	200	40,000
Dual Whl-45	200	40,000

- Annual growth rate of 2.0 percent for forecasted fleet mix
- The ARFF vehicle has an assumed 100 departures and a 0.0 percent growth rate
- The SRE has an assumed 200 departures and a 0.0 percent growth rate
- The deicing truck has an assumed 200 departures and a 0.0 percent growth rate

The analysis was re-run to include the ARFF and SRE vehicles resulting in the following section:



The analysis was re-run with a CBR of 33.3 resulting in the following section:



For constructability and aggregate interlock, the minimum section was developed into the recommended section reported in the recommendations section.

6.2 Earthwork

Existing Fill. The existing controlled fill present on the site to depths of about 5 feet to 8 feet below existing grade is generally suitable for support of pavement sections; however the fill varies in relative density from medium dense to dense. Additional compaction may be necessary to remove disturbed or loose areas and create a uniform subgrade for pavement sections. Because the sand is sensitive to disturbance after compaction, approximately 6 inches of structural fill would provide support for wheeled traffic and equipment and dramatically improve constructability in sandy areas with very low fines content.

Cut Slopes. Temporary cut slopes for utility trenches and for foundation excavations in both granular and fine-grained soils have been known to stand temporarily at very steep angles; however, they also have been known to fail suddenly, without warning, claiming lives. It is the responsibility of the contractor to determine appropriate temporary cut slopes or shoring for excavations and trenches for the site soils, and surface loading conditions. As a minimum, the contractor should be in full compliance with all federal, state, and local safety requirements for trenching and shoring.

6.3 Dewatering

Based on the measured depth of groundwater, construction dewatering may not be necessary. The measured groundwater elevation is on the order of 7 feet to 10 feet below the bottom of the planned excavation depth for the pavement. Excavations deeper than 9 feet below the existing ground surface may encounter water and potentially running sands.

It is essentially impossible to adequately place and compact structural fill if there is standing water in the excavation. Dewatering the excavations until they are properly backfilled is necessary.

7.0 RECOMMENDATIONS

These recommendations are based on professional judgment and experience and the data collected during the site exploration and soil laboratory tests. These recommendations may not represent the only possible solution, but rather indicate an appropriate option based on the information available and the experience of the designer.

7.1 Pavement Recommendations

The following minimum pavement sections are recommended:

Northeast (NEDA) Pavement Section

- 4 inches of hot mix asphalt (HMA), over
- 6 inches of asphalt treated base course, over
- 6 inches of uncrushed aggregate subbase.

Northwest (NWDA) Pavement Section

- 4 inches of hot mix asphalt (HMA), over
- 6 inches of crushed granular base, over
- 6 inches of uncrushed aggregate subbase.

The NEDA asphalt pavement mix should comply with FAA specifications for heavy aircraft for Type V, Class S. The NWDA asphalt pavement mix should comply with CBJ specifications for Type II-A, Class A.

The crushed granular base should comply with the CBJ and State of Alaska Department of Transportation & Public Facilities specifications. The crushed granular base should be compacted to a minimum of 95 percent of the maximum density as determined by modified Proctor, ASTM D1557.

The uncrushed aggregate subbase should comply with the gradation provided herein for structural fill. The uncrushed aggregate subbase should be compacted to a minimum of 95 percent of the maximum dry density as determined by modified Proctor, ASTM D1557.

7.2 Earthwork

Excavation. Any frozen or otherwise unsuitable soil, such as debris or organics, must be removed from beneath the building and paved areas and replaced with structural fill.

Soils that are disturbed, pumped, or rutted by construction activity should be redensified, if possible, or completely removed and replaced with structural fill.

Existing Fill Surfaces. Existing fill surfaces receiving structural fill or pavement sections must be compacted to a density of at least 95 percent of the maximum dry density as determined by modified Proctor, ASTM D1557. Additionally, to identify loose or soft areas the subgrade may be proof rolled with a front-end loader with a loaded bucket or other heavy equipment assuming the surface does not loosen with traffic.

Frozen Soils. Do not place fill, construct foundations, slab-on-grade, or asphalt pavement over frozen soils. Do not fill or backfill with frozen soils.

Structural Fill. Structural fill is defined as load-bearing fill placed under structures, taxiways, aprons, or pavement. All structural fill should consist of non-frost susceptible (NFS) or possibly frost susceptible (PFS) gravel and contain no lumps, frozen material, organic matter, or other deleterious matter. Structural fill shall meet the following gradation requirements:

Sieve Size	Percent Finer
3”	100*
1-1/2”	70-100
3/4”	30-100
½”	25-100
No. 4	20-49
No. 40	0-25
No. 200	0-6
0.02mm	0-3

* The fill may contain up to 10 percent cobbles.

The upper 6 inches of structural fill below pavements should not contain gravel larger than 2 inches to facilitate fine grading.

Other fill material, which does not meet this gradation requirement, may be acceptable for use. However, the gradation of such material should be evaluated by the project geotechnical engineer prior to its use.

Limits of Fill and Backfill. Structural fill and backfill should extend laterally from the edge of pavements one-foot for each foot of fill beneath the slab or pavement. Slopes receiving fill greater than 5H:1V (horizontal:vertical) such as the original Duck Creek channel should be benched into suitable soil removing loose or unsuitable material as described in the excavation section.

Utility Trench Backfill. A suitable granular bedding material meeting the gradation requirements below should be placed and compacted to a depth of at least six inches below all utility lines. This bedding material should extend six inches above the top of pipe, and should be compacted to 95 percent of the maximum dry density as determined by modified Proctor, ASTM D1557. The remainder of the trench should be backfilled with classified material. This material should be compacted in lifts not exceeding one foot in thickness to 95 percent of the maximum dry density as determined by modified Proctor, ASTM D1557.

Fill Placement. Structural fill should be placed and compacted in lifts not exceeding 12 inches in loose thickness if a large vibratory compactor is used, or not exceeding 6 inches in loose thickness if a hand-operated compactor is used. Each lift of structural fill should be compacted throughout its entire depth to a density of at least 95 percent of the maximum dry density as determined by modified Proctor ASTM D1557. All excavations should be completely dewatered before placement of structural fill.

Fill Testing. Frequent, in-place density tests should be performed in each lift of fill to verify that the fill has been properly compacted prior to placing subsequent lifts. The number of tests performed in each lift should be commensurate with the size of the area worked by the contractor, the variability of the soil types used as fill, and the amount of time an inspector spends on site observing the work. At a minimum, we recommend the following inspection and testing program:

- Full-time inspection of excavation and backfill operations,

- One in-place density test per 5,000 square feet of pavement, curb, and sidewalk, per lift; and,
- One in-place density test per 100 lineal feet of utility trench, every lift.

7.3 Dewatering and Drainage

It is important that all water be removed from excavations until they are properly backfilled. It is the contractor's responsibility to determine the appropriate dewatering techniques for the construction methods chosen and for the soil and water conditions encountered.

7.4 Observations

It is important to the performance of the pavement that any unsuitable soils are removed where specified, that subgrade surfaces are uniformly compact without loose areas, and that structural fill and pavement sections consists of proper materials and are adequately compacted. It is recommended that all excavation and backfill operations be observed by qualified inspection/testing personnel under the supervision of a geotechnical engineer. Frequent in-place density tests should be performed in each lift of the structural fill to verify that minimum fill densities are being attained.

The inspection/testing personnel should be employed by the owner or owner’s representative, not by the contractor, to avoid any inherent conflict of interest and to better ensure that the required level of quality assurance is achieved.

8.0 LIMITATIONS

This report has been prepared for the use of the City and Borough of Juneau in design of the NEDA and NWDA pavements located at the Juneau International Airport in Juneau, Alaska. Changes to the design, layout, or location of the facilities should be provided to the project geotechnical engineer for review. Significant changes may alter the conclusions and recommendations presented in this report.

Ground conditions between borings may be different than inferred and changes may occur over time. Without additional subsurface exploration, variations in the ground conditions may be encountered during construction. It is important to communicate unanticipated soil conditions to the project geotechnical engineer to evaluate if the conditions may influence the conclusions and recommendations. No warranty is expressed or implied by this report or the recommendations. The geotechnical field program and recommendations followed the standard of care expected of professionals performing similar work in the State of Alaska.

9.0 REFERENCES

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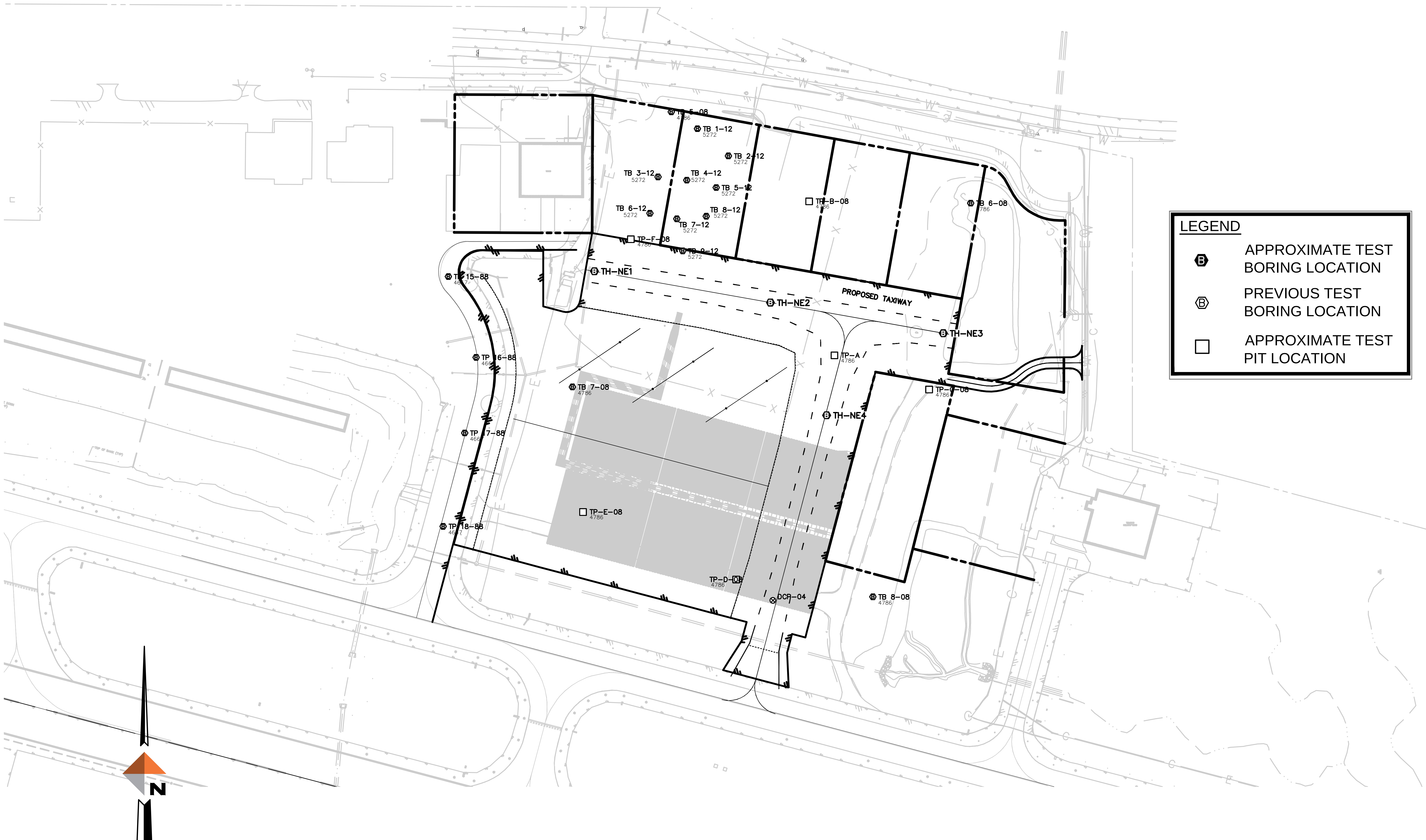
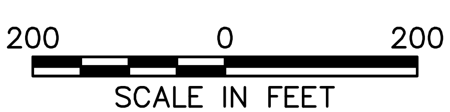
APPENDIX A

Test Boring Location Maps





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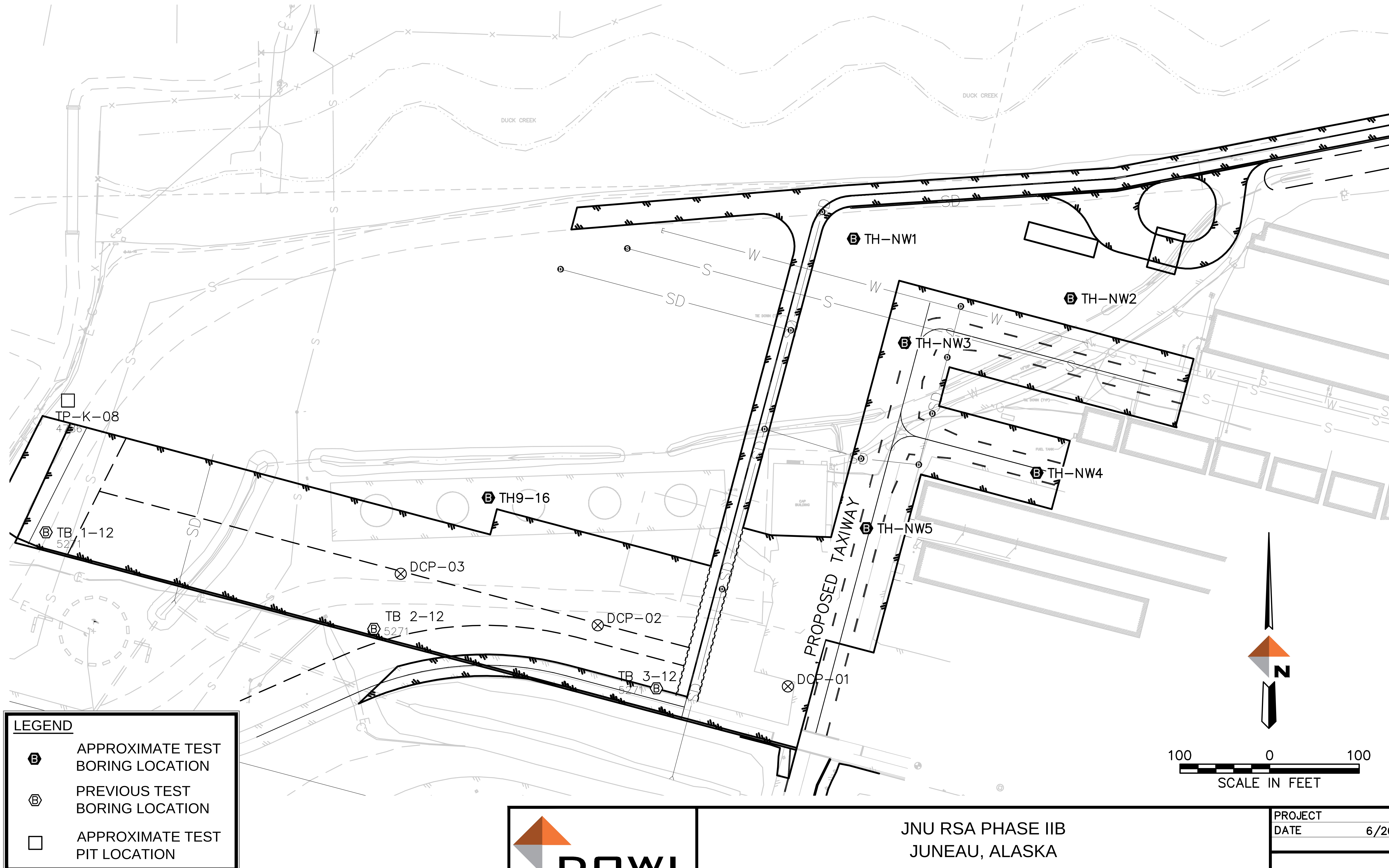
JNU RSA PHASE IIB
JUNEAU, ALASKA
TEST BORING/ TEST PIT LOCATION MAP

PROJECT	62033
DATE	6/20/2016

FIGURE A-1

C:\Civil 3D Projects\23\62033-01\Geotechnical\SA14-GT-GTB-62033.dwg PLOT DATE 2016-6-20 04:24 SAVED DATE 2016-06-20 04:18 USER: cslatten



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JNU RSA PHASE IIB
JUNEAU, ALASKA
TEST BORING/TEST PIT LOCATION MAP

PROJECT	62033
DATE	6/20/2016

FIGURE A-2

APPENDIX B

Test Boring Logs and Descriptive Guide

Historic Test Boring and Test Pit Logs

TEST BORING NE-1

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION: 26.0 ft
SURFACE: SAND

Depth (feet)	Other Tests	Moisture Content (%)	Blows / Foot	Sample No.	Soil Class	Frost Class	Description	Depth
0–6.3	FC	2		1	SP	NFS	**FILL**, **POORLY GRADED SAND**, brown, 31% gravel, 5% silt, medium to coarse sand, moist, medium dense	
	MA	5	21	2				
		8	25	3				6.3
6.3–12.0		5	25	4	SP	NFS	**POORLY GRADED SAND WITH GRAVEL**, gray, about 15% gravel, 5% silt, medium to coarse sand, moist to wet, medium dense, iron stains Groundwater was encountered at 10 feet while drilling	
		14	23	5				12.0
12.0–21.0		14	29*	6	SP	NFS	**POORLY GRADED SAND**, gray, about 5% gravel, 5% silt, subangular to subrounded 5/8", medium to coarse sand, wet, medium dense *Blow counts may be elevated due to full sampler	
		20	25*	7			*Blow counts may be elevated due to full sampler	21.0

TD=21.0'

TEST BORING COMPLETED ON 5-3-16

DEPTH (FEET): 0, 5, 10, 15, 20, 25, 30

KEY
MA = Mechanical Analysis
FC = Frost Classification
TD = Total Depth
☐ = Grab Sample
◪ = SPT Sample
Ⓢ = Shelby Tube - pushed
= Direct Push Sample
= 2.5" I.D. Spoon Sample 340# weight, 30" fall

DRILLING CO.: Denali Drilling, Inc.
EQUIPMENT: MOBILE B-61 Truck
OPERATOR: Kelly Hill
METHOD: 8 in. OD hollow-stem auger

CLIENT: City & Borough of Juneau
PROJECT: JNU RSA Phase IIB
LOGGED BY: Jeremiah Holland, P.E.
TEST BORING COMPLETED: 5-3-16
W.O. 1123.62033.01

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LOG OF TEST BORING NE-1

FIGURE B-1

TEST BORING NE-2

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION: 27.0 ft
SURFACE: SAND

Other Tests	Moisture Content (%)	Blows / Foot	Sample No.	Soil Class	Frost Class	Description	DEPTH
	0.2		1	SP	NFS	**FILL**, **POORLY GRADED SAND**, brown, about 5% silt, medium to coarse sand, dry to moist	2.5
	12	30	2	SP-SM	PFS	**POORLY GRADED SAND WITH SILT**, brown, 5% gravel, 6% silt, gravel subangular to subrounded to 3/4", medium to coarse sand, moist, medium dense, iron stains	
MA	10	17	3				7.0
LMA	24	18	4	SM	F2	**SILTY SAND WITH GRAVEL**, gray to brown, interbedded with poorly graded sand, about 41% gravel, 16% silt, gravel subangular to subrounded to 3/8", medium sand, moist, medium dense	9.0
	10	22	5	SP	NFS	Groundwater was encountered at 11 feet while drilling	
	7	17	6			**POORLY GRADED SAND WITH GRAVEL**, gray, about 25% gravel, 5% silt, gravel subangular to subrounded to 1.5", medium to coarse sand, moist to wet, medium dense	18.0
	15	30*/6"	7	SP	NFS	**POORLY GRADED SAND**, gray, about 5% silt, medium to coarse sand, wet, medium dense *Blow counts may be elevated due to full sampler	21.0

TD=21.0'

DEPTH (FEET): 0, 5, 10, 15, 20, 25, 30

TEST BORING COMPLETED ON 5-3-16

KEY
- MA = Mechanical Analysis
- LMA = Limited Mechanical Analysis
- TD = Total Depth
- = Grab Sample
- = SPT Sample
- = Shelby Tube - pushed
- = Direct Push Sample
- = 2.5" I.D. Spoon Sample 340# weight, 30" fall

DRILLING CO.: Denali Drilling, Inc.
EQUIPMENT: MOBILE B-61 Truck
OPERATOR: Kelly Hill
METHOD: 8 in. OD hollow-stem auger

CLIENT: City & Borough of Juneau
PROJECT: JNU RSA Phase IIB
LOGGED BY: Jeremiah Holland, P.E.
TEST BORING COMPLETED: 5-3-16
W.O. 1123.62033.01

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LOG OF TEST BORING NE-2

FIGURE B-2

TEST BORING NE-3

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION: 28.0 ft
SURFACE: SAND

Depth (feet)	Other Tests	Moisture Content (%)	Blows / Foot	Sample No.	Soil Class	Frost Class	Description	Depth
0								
		4		1				
		3	37	2	SP	NFS	**FILL**, **POORLY GRADED SAND**, brown, 13% gravel, 3% silt, gravel subangular to subrounded to 3/4", medium to coarse sand, moist, medium dense	
5								
		6	36	3				
								7.0
		10	27	4				
10								
		5	24	5				
							Groundwater was encountered at 12.5 feet while drilling	
					SP	PFS	**POORLY GRADED SAND**, brown to gray, about 5% silt, gravel subangular to subrounded to 1/2", medium to coarse sand, moist to wet, medium dense	
15								
	MA	14	20	6				
20								
		15	39*/9"	7			*Blow counts may be elevated due to full sampler	
							TD=21.3'	21.3
25								
30								

TEST BORING COMPLETED ON 5-3-16
PVC STANDPIPE INSTALLED TO 21'
GROUNDWATER MEASURED AT 11.7' ON 5-4-2016

KEY
MA = Mechanical Analysis
TD = Total Depth
= Groundwater After Drilling
= Grab Sample
= SPT Sample
= Shelby Tube - pushed
= Direct Push Sample
= 2.5" I.D. Spoon Sample 340# weight, 30" fall

DRILLING CO.: Denali Drilling, Inc.
EQUIPMENT: MOBILE B-61 Truck
OPERATOR: Kelly Hill
METHOD: 8 in. OD hollow-stem auger

CLIENT: City & Borough of Juneau
PROJECT: JNU RSA Phase IIB
LOGGED BY: Jeremiah Holland, P.E.
TEST BORING COMPLETED: 5-3-16
W.O. 1123.62033.01

LOG OF EXPLORATION 62033.GPJ BLANK2.GDT 6/22/16

DOWL

LOG OF TEST BORING NE-3

FIGURE B-3

TEST BORING NE-4

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION: 27.0 ft
SURFACE: SAND

Other Tests	Moisture Content (%)	Blows / Foot	Sample No.	Sample Type	Soil Graph	Soil Class	Frost Depth	Frost Class	Description	DEPTH
FC	1		1							
MA	4	23	2			SP		NFS	**FILL**, **POORLY GRADED SAND**, brown to gray, 5% gravel, 5% silt, gravel subangular to subrounded to 3/8", medium to coarse sand, moist, medium dense	
	9	12	3							7.5
	16	12	4			SM		F2	**SILTY SAND**, brown, about 20% silt, moist, medium dense, iron stains	8.0
LMA	11	13	5						Groundwater was encountered at 11 feet while drilling	
	12	44*	6			SP		NFS	**POORLY GRADED SAND WITH GRAVEL**, brown to gray, 33% gravel, 4% silt, gravel subangular to subrounded to 5/8", medium to coarse sand, moist to wet, medium dense *Blow counts may be elevated due to full sampler	
	15	13	7						sandier with depth	21.5

DEPTH (FEET): 0, 5, 10, 15, 20, 25, 30

TD=21.5'

TEST BORING COMPLETED ON 5-3-16

KEY
MA = Mechanical Analysis
FC = Frost Classification
LMA = Limited Mechanical Analysis
TD = Total Depth
☐ = Grab Sample
◪ = SPT Sample
= Shelby Tube - pushed
= Direct Push Sample
= 2.5" I.D. Spoon Sample 340# weight, 30" fall

DRILLING CO.: Denali Drilling, Inc.
EQUIPMENT: MOBILE B-61 Truck
OPERATOR: Kelly Hill
METHOD: 8 in. OD hollow-stem auger

CLIENT: City & Borough of Juneau
PROJECT: JNU RSA Phase IIB
LOGGED BY: Jeremiah Holland, P.E.
TEST BORING COMPLETED: 5-3-16
W.O. 1123.62033.01

LOG OF EXPLORATION 62033.GPJ BLANK2.GDT 6/22/16

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LOG OF TEST BORING NE-4

FIGURE B-4

TEST BORING NW-1

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION: 24.0 ft
SURFACE:

Other Tests	Moisture Content (%)	Blows / Foot	Sample No.	Sample Type	Soil Graph	Soil Class	Frost Depth	Frost Class
FC	3		1			SW/SM		S2
MA	6	33	2			SP		NFS
MA	8	41	3			SP		NFS
	10	72	4			SP		NFS
	5	16	5			SP		NFS
	11	16	6			SP		NFS
	17	35*/9"	7			SP		NFS

Soil Class	Frost Class	Description	DEPTH
SW/SM	S2	**FILL**, **WELL GRADED SAND WITH SILT**, brown, 8% gravel, 9% silt	2.5
SP	NFS	**FILL**, **POORLY GRADED SAND**, brown, 13% gravel, 5% silt, gravel subangular to subrounded to 1/2", medium to coarse sand, moist, dense Groundwater was encountered at 7.5 feet while drilling	8.0
SP	NFS	**POORLY GRADED SAND WITH GRAVEL**, brown, about 30-40% gravel, 5% silt, gravel subangular to subrounded to 1", medium to coarse sand, wet, medium dense to very dense, iron stains	12.0
SP	NFS	**POORLY GRADED SAND**, brown, about 0-5% gravel, 5% silt, medium to coarse sand, wet, medium dense *Blow counts may be elevated due to full sampler	21.3

DEPTH (FEET): 0, 5, 10, 15, 20, 25, 30

TD=21.3'

TEST BORING COMPLETED ON 5-2-16
PVC STANDPIPE INSTALLED TO 21.3'
GROUNDWATER MEASURED AT 10.8' ON 5-4-2016

KEY
MA = Mechanical Analysis
FC = Frost Classification
TD = Total Depth
= Groundwater After Drilling
= Grab Sample
= SPT Sample
= Shelby Tube - pushed
= Direct Push Sample
= 2.5" I.D. Spoon Sample
340# weight, 30" fall

DRILLING CO.: Denali Drilling, Inc.
EQUIPMENT: MOBILE B-61 Truck
OPERATOR: Kelly Hill
METHOD: 8 in. OD hollow-stem auger

CLIENT: City & Borough of Juneau
PROJECT: JNU RSA Phase IIB
LOGGED BY: Jeremiah Holland, P.E.
TEST BORING COMPLETED: 5-2-16
W.O. 1123.62033.01

LOG OF EXPLORATION 62033.GPJ BLANK2.GDT 6/22/16

DOWL

LOG OF TEST BORING NW-1

FIGURE B-5

TEST BORING NW-2

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION: 25.0 ft
SURFACE: Parking Area

Depth (ft)	Other Tests	Moisture Content (%)	Blows / Foot	Sample No.	Soil Class	Frost Class	Description	Depth
		4		1				
		10	30	2	SP/SM	PFS	**FILL**, **POORLY GRADED SAND WITH SILT AND GRAVEL**, brown, 32% gravel, 9% silt, nonplastic, medium to coarse sand, moist to wet, medium dense to dense	
		7	44	3				7.0
	MA	12	20	4			Groundwater was encountered at 8.5 feet while drilling	
			33	5	SP/SM	PFS	**POORLY GRADED SAND WITH SILT AND GRAVEL**, gray to brown, 39% gravel, 8% silt, nonplastic, gravel subangular to subrounded to 1", medium to coarse sand, moist to wet, medium dense no sample recovered - driving a cobble ahead of sampler	
		12	17	6				18.0
		20	36*/11	7	SP	NFS	**POORLY GRADED SAND**, gray, about 5% silt, nonplastic, medium to coarse sand, wet, medium dense *Blow counts may be elevated due to full sampler	21.0

TD=21.0'

TEST BORING COMPLETED ON 5-3-16
PVC STANDPIPE INSTALLED TO 21.0'
GROUNDWATER MEASURED AT 9.0' ON 5-4-2016

DEPTH (FEET): 0, 5, 10, 15, 20, 25, 30

KEY
MA = Mechanical Analysis
TD = Total Depth
= Groundwater After Drilling
= Grab Sample
= SPT Sample
= Shelby Tube - pushed
= Direct Push Sample
= 2.5" I.D. Spoon Sample 340# weight, 30" fall

DRILLING CO.: Denali Drilling, Inc.
EQUIPMENT: MOBILE B-61 Truck
OPERATOR: Kelly Hill
METHOD: 8 in. OD hollow-stem auger

CLIENT: City & Borough of Juneau
PROJECT: JNU RSA Phase IIB
LOGGED BY: Jeremiah Holland, P.E.
TEST BORING COMPLETED: 5-3-16
W.O. 1123.62033.01

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LOG OF TEST BORING NW-2

FIGURE B-6

TEST BORING NW-3

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION: 25.0 ft
SURFACE: Parking Area

Other Tests	Moisture Content (%)	Blows / Foot	Sample No.	Sample Type	Soil Class	Frost Class
	2		1		SP	NFS
MA	5	41	2	SPT Sample		
	7	33	3	SPT Sample		
	4	19	4	SPT Sample	SP	NFS
	12	10	5	SPT Sample		
	16	13/6"	6	SPT Sample	SP	NFS
	19	17	7	SPT Sample		

Description	Depth
FILL, **POORLY GRADED SAND**, brown, 16% gravel, 5% silt, nonplastic, medium to coarse sand, moist, medium dense	6.5
POORLY GRADED SAND WITH GRAVEL, brown, about 25-30% gravel, 5% silt, nonplastic, gravel subangular to subrounded to 5/8", medium to coarse sand, moist to wet, medium dense Groundwater was encountered at 10 feet while drilling	12.0
Heaving sand conditions encountered **POORLY GRADED SAND**, brown, about 0-5% gravel, 5% silt, nonplastic, gravel subangular to subrounded to 3/8", medium to coarse sand, wet, medium dense Heaving sand conditions encountered	21.8

TD=21.8'

TEST BORING COMPLETED ON 5-3-16

DEPTH (FEET): 0, 5, 10, 15, 20, 25, 30

KEY
- MA = Mechanical Analysis
- TD = Total Depth
- ☐ = Grab Sample
- ◪ = SPT Sample
- = Shelby Tube - pushed
- = Direct Push Sample
- = 2.5" I.D. Spoon Sample 340# weight, 30" fall

DRILLING CO.: Denali Drilling, Inc.
EQUIPMENT: MOBILE B-61 Truck
OPERATOR: Kelly Hill
METHOD: 8 in. OD hollow-stem auger

CLIENT: City & Borough of Juneau
PROJECT: JNU RSA Phase IIB
LOGGED BY: Jeremiah Holland, P.E.
TEST BORING COMPLETED: 5-3-16
W.O. 1123.62033.01

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LOG OF TEST BORING NW-3

FIGURE B-7

TEST BORING NW-4

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION: 26.0 ft
SURFACE: Hangar Parking

Depth (feet)	Other Tests	Moisture Content (%)	Blows / Foot	Sample No.	Soil Class	Frost Class	Description	Depth
0								
		0.5		1				
		5	37	2	SP	NFS	**FILL**, **POORLY GRADED SAND**, brown, about 5-10% gravel, 5% silt, medium to coarse sand, moist, dense	
5		9	40	3				
					SM	F2	**SILTY SAND**, gray, Possible Fill/Disturbed Surface, about 5% gravel, 20% silt, medium sand, moist, medium dense	7.5 / 8.0
		19 / 4	37	4A / 4B				
10		10	14	5	SP	NFS	**POORLY GRADED SAND WITH GRAVEL**, brown, about 20-30% gravel, 5% silt, medium to coarse sand, moist to wet, medium dense to dense. Groundwater was encountered at 11 feet while drilling	12.5
15	MA	18	15	6	SP	NFS	*Blow counts may be elevated due to full sampler. **POORLY GRADED SAND**, gray, 13% gravel, 2% silt, gravel subangular to subrounded to 3/4", medium to coarse sand, wet, medium dense	
20		15	24	7				21.5

TD=21.5'

TEST BORING COMPLETED ON 5-3-16

Depth scale: 0, 5, 10, 15, 20, 25, 30 — DEPTH (FEET)

KEY
MA = Mechanical Analysis
TD = Total Depth
□ = Grab Sample
◩ = SPT Sample
▧ = Shelby Tube - pushed
⍐ = Direct Push Sample
⧗ = 2.5" I.D. Spoon Sample 340# weight, 30" fall

DRILLING CO.: Denali Drilling, Inc.
EQUIPMENT: MOBILE B-61 Truck
OPERATOR: Kelly Hill
METHOD: 8 in. OD hollow-stem auger

CLIENT: City & Borough of Juneau
PROJECT: JNU RSA Phase IIB
LOGGED BY: Jeremiah Holland, P.E.
TEST BORING COMPLETED: 5-3-16
W.O. 1123.62033.01

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LOG OF TEST BORING NW-4

FIGURE B-8

TEST BORING NW-5

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION: 25.0 ft
SURFACE: ASPHALT PAVEMENT

Depth (feet)	Other Tests	Moisture Content (%)	Blows / Foot	Sample No.	Soil Class	Frost Class	Description	Depth
0							**ASPHALT PAVEMENT**, existing hangar access and parking area	1.0
	FC	0.4		1	SM	F2	**FILL**, **SILTY SAND WITH GRAVEL**, brown, 19% gravel, 19% silt, nonplastic	2.5
	MA	3	26	2	SP	NFS	**FILL**, **POORLY GRADED SAND WITH GRAVEL**, brown, about 25% gravel, 5% silt, nonplastic, medium to coarse sand, moist, medium dense	4.5
5		2	34	3	SP	NFS	**POORLY GRADED SAND WITH GRAVEL**, brown to gray, about 30-35% gravel, 5% silt, nonplastic, gravel subangular to subrounded to 3/4", medium to coarse sand, moist to wet, medium dense	
		2	23	4				
10		9	12	5			Groundwater was encountered at 10 feet while drilling	13.0
15		17	15	6	SP	NFS	**POORLY GRADED SAND**, gray, about 5% gravel, 5% silt, nonplastic, gravel subangular to subrounded to 3/4", medium to coarse sand, wet, medium dense	
20		18	42*	7			*Blow counts may be elevated due to full sampler	21.5

TD=21.5'

TEST BORING COMPLETED ON 5-3-16

DEPTH (FEET): 0, 5, 10, 15, 20, 25, 30

KEY
MA = Mechanical Analysis
FC = Frost Classification
TD = Total Depth
□ = Grab Sample
◩ = SPT Sample
= Shelby Tube - pushed
= Direct Push Sample
= 2.5" I.D. Spoon Sample 340# weight, 30" fall

DRILLING CO.: Denali Drilling, Inc.
EQUIPMENT: MOBILE B-61 Truck
OPERATOR: Kelly Hill
METHOD: 8 in. OD hollow-stem auger

CLIENT: City & Borough of Juneau
PROJECT: JNU RSA Phase IIB
LOGGED BY: Jeremiah Holland, P.E.
TEST BORING COMPLETED: 5-3-16
W.O. 1123.62033.01

LOG OF EXPLORATION 62033.GPJ BLANK2.GDT 6/22/16

DOWL

LOG OF TEST BORING NW-5

FIGURE B-9

DCP TEST DATA

File Name:

Project: *JNU RSA Phase II B* **Date:** 4-May-16
Location: DCP-1 **Soil Type(s):** SP

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
1	14	1
2	35	1
3	62	1
3	87	1
5	123	1
5	147	1
10	197	1
5	220	1
5	240	1
10	293	1
10	331	1
10	365	1
10	398	1
20	455	1
		1
		1
		1
		1
		1
		1
		1
		1
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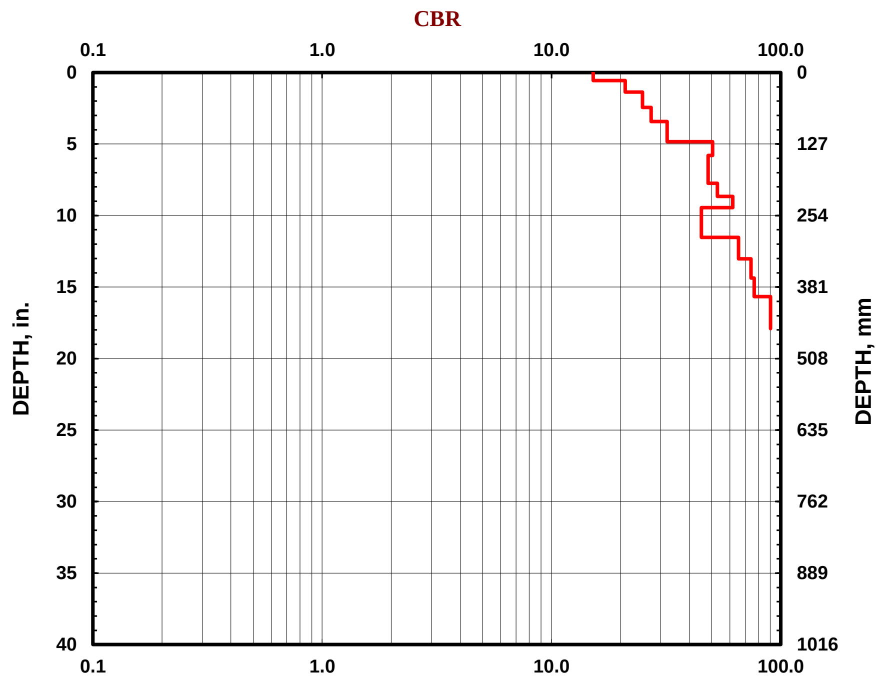

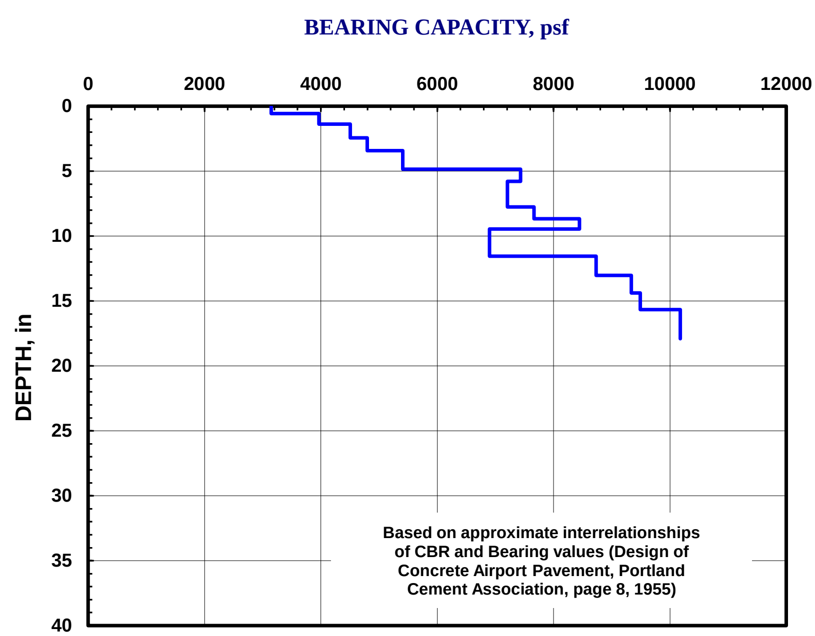

FIGURE B-10

DCP TEST DATA

File Name:

Project: *JNU RSA Phase II B* **Date:** 4-May-16

Location: DCP-2 **Soil Type(s):** SP

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
1	20	1
3	60	1
5	95	1
5	120	1
10	165	1
20	224	1
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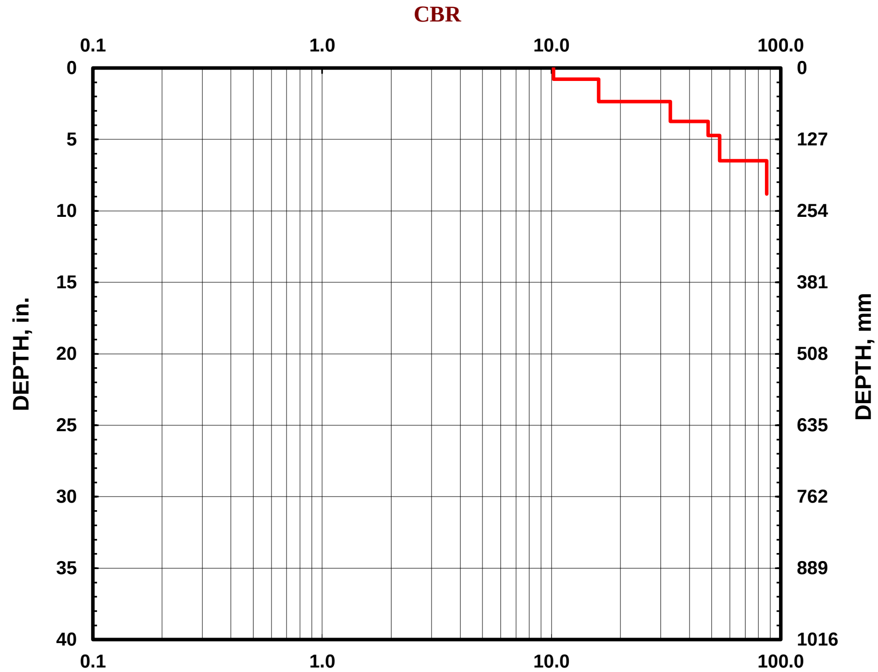

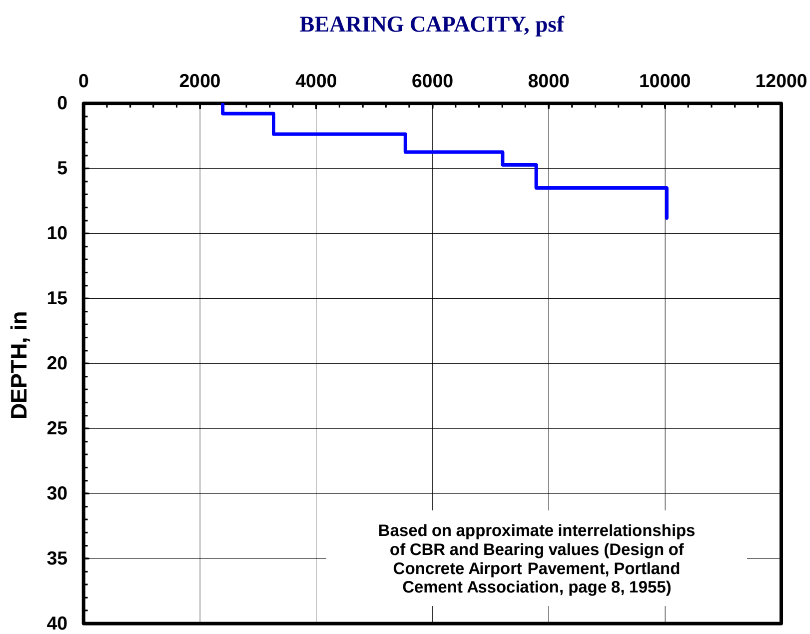

FIGURE B-11

DCP TEST DATA

File Name:

Project: *JNU RSA Phase II B* **Date:** 4-May-16
Location: DCP-3 **Soil Type(s):** SP

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
3	38	1
5	90	1
5	135	1
5	165	1
5	195	1
5	225	1
5	250	1
5	275	1
5	300	1
5	324	1
5	348	1
		1
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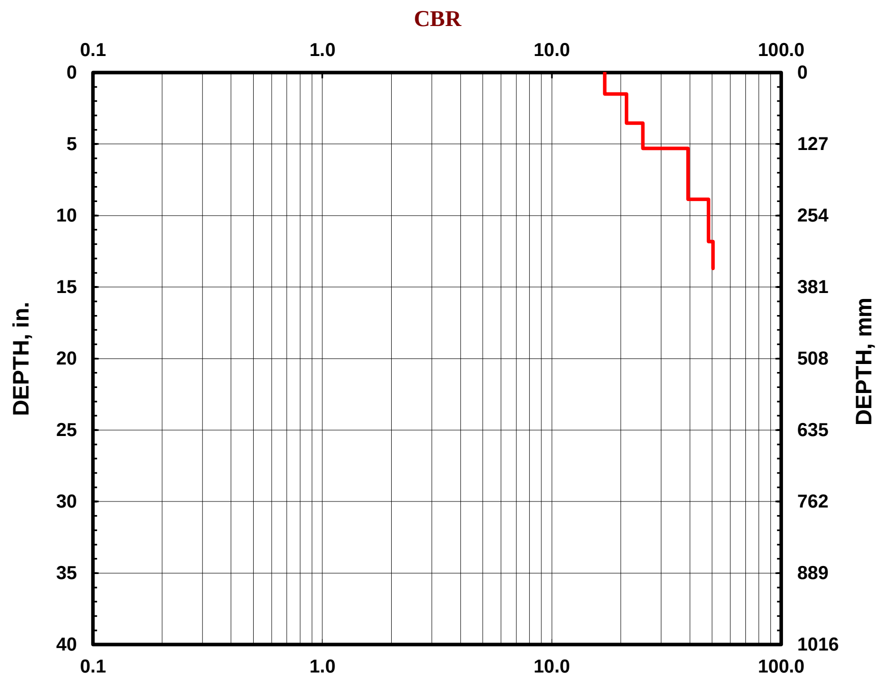

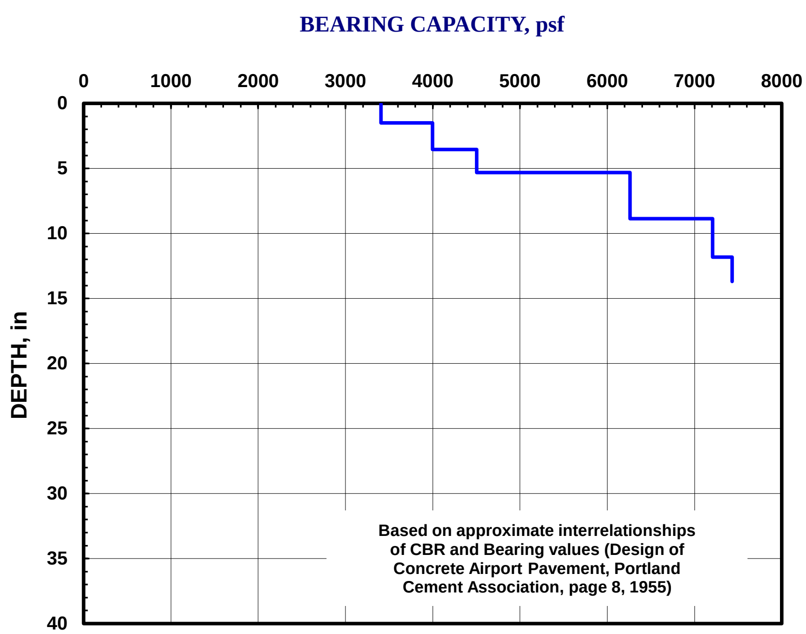

FIGURE B-12

DCP TEST DATA

File Name:

Project: *JNU RSA Phase II B* **Date:** 4-May-16
Location: DCP-4 **Soil Type(s):** SP

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
1	62	1
1	100	1
1	133	1
1	158	1
1	182	1
1	200	1
1	217	1
2	235	1
2	260	1
3	295	1
3	326	1
3	355	1
		1
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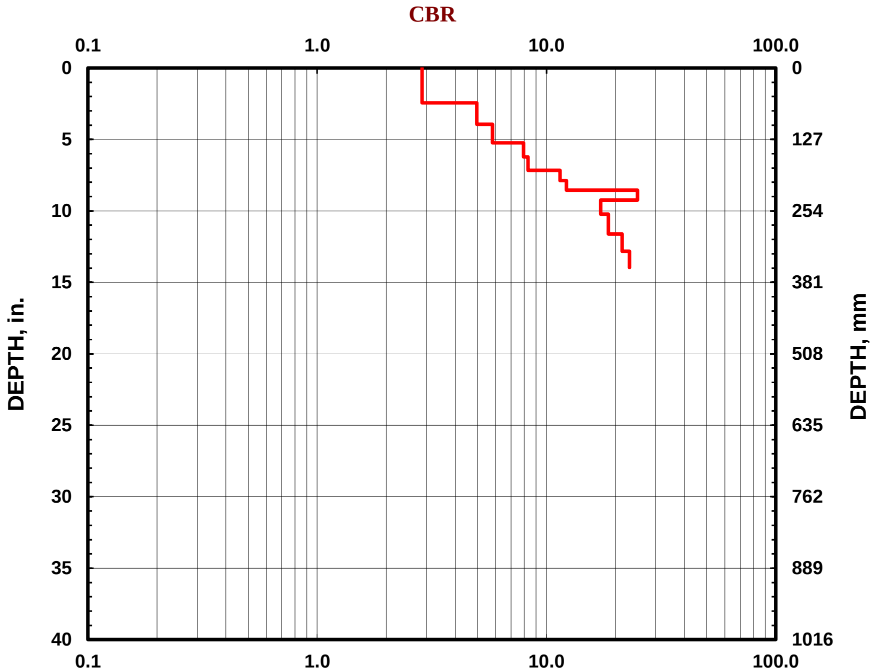


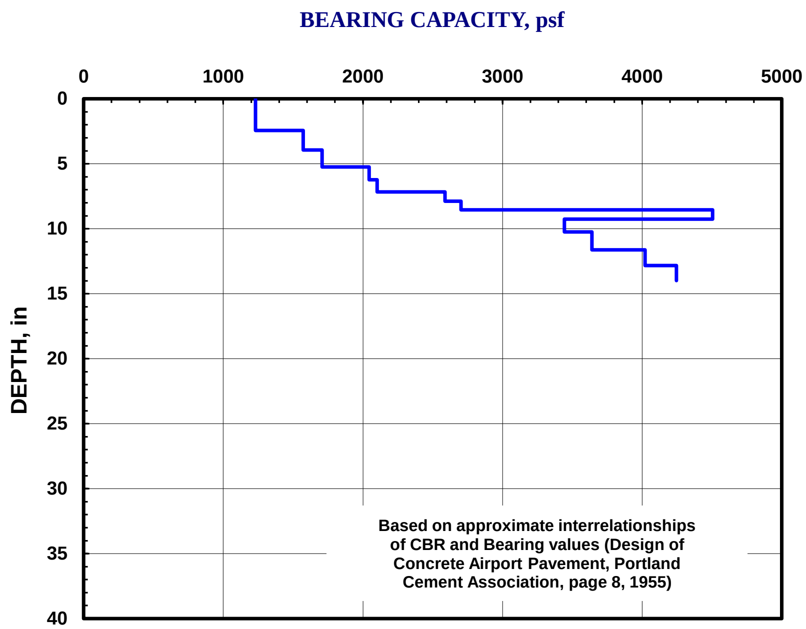


FIGURE B-13

TP-10-88

LOOSE, GRAY SILT

MOTTLED RED BROWN & BROWN, CLEAN GRAVELLY SAND

GRAY, CLEAN, WEAKLY STRATIFIED, SANDY GRAVEL. MAXIMUM PARTICLE SIZE: 2"

TP-11-88

LOOSE, GRAY SILT WITH ROOTS

MOTTLED RED BROWN & BROWN SAND WITH SOME GRAVEL

SILT LENSE

GRAY, CLEAN, WEAKLY STRATIFIED, SANDY GRAVEL

TP-12-88

4" LOOSE, GRAY SILT

MOTTLED RED BROWN & BROWN, CLEAN SAND WITH SOME FINE GRAVEL

GRAY, CLEAN, WEAKLY STRATIFIED, SANDY GRAVEL WITH SCATTERED LENSES OF RED BROWN STAINED GRAVEL

TP-13-88

7" GRAY SILT

MOTTLED, RED BROWN & BROWN SAND WITH SOME GRAVEL

GRAY, CLEAN, FINE TO COARSE SAND WITH A TRACE OF FINE GRAVEL

GRAY, FINE TO COARSE, SANDY GRAVEL, CLEAN. MAXIMUM PARTICLE SIZE 2"

MATERIAL CAVES AT WATER LEVEL

TP-14-88

6" GRAY SILT

MOTTLED GRAY SAND AND GRAY SAND INTERSTRATIFIED

GRAY, CLEAN, FINE TO COARSE SAND WITH LENSES OF RED BROWN SAND

GRAY, GRAVELLY SAND, WEAKLY STRATIFIED WITH GRAVEL TO 2"

TP-15-88

0"-2" - ROOT MAT

2"-6" - SOFT, GRAY SILT

6"-26" - LOOSE, GRAY BROWN, CLEAN SAND WITH IRON-STAINED BANDS

26"-36" - LOOSE, BROWN GRAY, CLEAN SAND, 20% GRAVEL

BOTTOM OF BORING

TP-16-88

0"-2" - ROOT MAT

2"-9" - SOFT, GRAY SILT

9"-30" - LOOSE, MOTTLED TO GRAY BROWN, CLEAN, COARSE TO MEDIUM SAND WITH 20% GRAVEL TO 2"

BOTTOM OF BORING

TP-18-88

0"-2" - ROOT MAT

2"-10" - SOFT, GRAY SILT

10"-15" - LOOSE, RED BROWN CLEAN SAND

15"-30" - LOOSE, LIGHT BROWN, CLEAN SAND WITH 20% GRAVEL TO 1"

BOTTOM OF BORING

FIGURE B-14

TEST BORING 5

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION:

GRASS SURFACE

Depth (feet)	Other Tests	Moisture Content (%)	Blows / Foot	Sample No.	Sample Type	Soil Class	Frost Depth	Frost Class	Description	Depth
0–4.5		12	25	1	SPT	SP		NFS	**POORLY GRADED SAND WITH GRAVEL**, gray, about 45% sand, 5% silt, gravel subrounded to 1", medium sand, damp, medium dense. Groundwater encountered at 4' while drilling	4.5
4.5–9.5		17	8	2	SPT	SP/SM		F2	**POORLY GRADED SAND WITH SILT AND GRAVEL**, gray, about 15% gravel, 10% silt, gravel subrounded to 1", medium sand, saturated, loose	9.5
9.5–16.5		15	21	3	SPT	SP		NFS	**POORLY GRADED SAND**, tan, about 5% gravel, 5% silt, gravel subrounded to 1/2", medium sand, saturated, medium dense	
		14	17	4	SPT					16.5

TD=16.5'

TEST BORING COMPLETED ON 11-6-07
PVC STANDPIPE INSTALLED TO 15'
GROUNDWATER MEASURED AT 4' ON 11/17/07

DEPTH (FEET): 0, 5, 10, 15, 20, 25, 30, 35

KEY
TD = Total Depth
= Groundwater After Drilling
= Grab Sample
= SPT Sample
= Shelby Tube - pushed
= 2.5" I.D. Spoon Sample
340# weight, 30" fall

DRILLING CO.: Denali Drilling, Inc.
EQUIPMENT: CME-55 Nodwell
OPERATOR: James (Buck) Voeller
METHOD: 4.25 in. ID hollow-stem auger

CLIENT: Toner-Nordling & Associates
PROJECT: Juneau Float Plane AIP
LOGGED BY: John A. Rego, Jr.
TEST BORING COMPLETED: 11-6-07
W.O. D59440

DOWL ENGINEERS

LOG OF TEST BORING 5

FIGURE B-5

TEST BORING 6

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION:

Depth (feet)	Other Tests	Moisture Content (%)	Blows / Foot	Sample No.	Sample Type	Soil Class	Frost Depth	Frost Class	Description	DEPTH
0						ML		F4	**GRASS SURFACE**	
									SILT, light brown, indicated by cuttings	1.0
						SP		NFS	**POORLY GRADED SAND WITH GRAVEL**, gray, about 15% gravel, 5% silt, gravel subrounded to 1/2", medium sand, wet, medium dense	
3–4		16	15	1	SPT					
4									Groundwater encountered at 4' while drilling	
5–6		18	12	2	SPT				becoming more gravelly, about 25% gravel, 5% silt, gravel subrounded to 1", saturated	
10–11		16	25	3	SPT				becoming sandier, about 15% gravel, 5% silt, gravel subrounded to 3/4"	
15–16.5		16	33	4	SPT				becoming more gravelly, about 20% gravel, 5% silt, gravel subrounded to 1", dense	16.5

TD=16.5'

TEST BORING COMPLETED ON 11-6-07
PVC STANDPIPE INSTALLED TO 16.5'
GROUNDWATER MEASURED AT 4' ON 11/17/07

DEPTH (FEET): 0, 5, 10, 15, 20, 25, 30, 35

KEY
TD = Total Depth
▼ = Groundwater After Drilling
☐ = Grab Sample
◪ = SPT Sample
▨ = Shelby Tube - pushed
☒ = 2.5" I.D. Spoon Sample
340# weight, 30" fall

DRILLING CO.: Denali Drilling, Inc.
EQUIPMENT: CME-55 Nodwell
OPERATOR: James (Buck) Voeller
METHOD: 4.25 in. ID hollow-stem auger

CLIENT: Toner-Nordling & Associates
PROJECT: Juneau Float Plane AIP
LOGGED BY: John A. Rego, Jr.
TEST BORING COMPLETED: 11-6-07
W.O. D59440

DOWL ENGINEERS

LOG OF TEST BORING 6

FIGURE B-6

TEST BORING 7

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION:

Depth (feet)	Other Tests	Moisture Content (%)	Blows / Foot	Sample No.	Sample Type
2.5		30		1	SPT Sample
3.5		14	11	1A	SPT Sample
6		23	6	2	SPT Sample
11		17	18	3	SPT Sample
16		12	16	4	SPT Sample

Soil Class	Frost Class	Description	Depth
		GRASS SURFACE	0
ML	F4	**SANDY SILT**, light brown, about 30% sand, low plasticity, fine sand, damp, stiff, **ORGANICS** present ~10% by volume (plants)	3.0
SP	NFS	**POORLY GRADED SAND WITH GRAVEL**, brown, about 15% gravel, 5% silt, gravel subrounded to 3/4", medium sand, wet, medium dense Groundwater encountered at 4' while drilling saturated, loose	9.5
SP	NFS	**POORLY GRADED SAND**, brown, about 10% gravel, 5% silt, gravel subrounded to 1/2", medium sand, saturated, medium dense	16.5

TD=16.5'

TEST BORING COMPLETED ON 11-6-07
PVC STANDPIPE INSTALLED TO 15'
GROUNDWATER MEASURED AT 4' ON 11/17/07

DEPTH (FEET)

KEY
TD = Total Depth
= Groundwater After Drilling
= Grab Sample
= SPT Sample
= Shelby Tube - pushed
= 2.5" I.D. Spoon Sample
340# weight, 30" fall

DRILLING CO.: Denali Drilling, Inc.
EQUIPMENT: CME-55 Nodwell
OPERATOR: James (Buck) Voeller
METHOD: 4.25 in. ID hollow-stem auger

CLIENT: Toner-Nordling & Associates
PROJECT: Juneau Float Plane AIP
LOGGED BY: John A. Rego, Jr.
TEST BORING COMPLETED: 11-6-07
W.O. D59440

DOWL ENGINEERS

LOG OF TEST BORING 7

FIGURE B-7

TEST BORING 8

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION:

Depth (feet)	Other Tests	Moisture Content (%)	Blows / Foot	Sample No.	Sample Type	Soil Graph	Soil Class	Frost Depth	Frost Class	Description	Depth
0										**GRASS SURFACE**	
		14	9	1	SPT		SP		NFS	**POORLY GRADED SAND**, brown, about 10% gravel, 5% silt, gravel subrounded to 1", medium sand, damp, loose Groundwater encountered at 4' while drilling	
5		20	5	2	SPT					becoming sandier, about 5% gravel, 5% silt, gravel subrounded to 3/4", saturated, very loose	
10		16	6	3	SPT					becoming more gravelly, about 10% gravel, 5% silt, loose	
15		17	27	4	SPT					becoming sandier, about 5% gravel, 5% silt, gravel subrounded to 1/2", medium dense	16.5

TD=16.5'

TEST BORING COMPLETED ON 11-6-07
PVC STANDPIPE INSTALLED TO 16.5'
GROUNDWATER MEASURED AT 4' ON 11/17/07

DEPTH (FEET): 0, 5, 10, 15, 20, 25, 30, 35

KEY
TD = Total Depth
= Groundwater After Drilling
= Grab Sample
= SPT Sample
= Shelby Tube - pushed
= 2.5" I.D. Spoon Sample
340# weight, 30" fall

DRILLING CO.: Denali Drilling, Inc.
EQUIPMENT: CME-55 Nodwell
OPERATOR: James (Buck) Voeller
METHOD: 4.25 in. ID hollow-stem auger

CLIENT: Toner-Nordling & Associates
PROJECT: Juneau Float Plane AIP
LOGGED BY: John A. Rego, Jr.
TEST BORING COMPLETED: 11-6-07
W.O. D59440

LOG OF EXPLORATION 59440.GPJ BLANK2.GDT 12/7/07

DOWL ENGINEERS

LOG OF TEST BORING 8

FIGURE B-8

TEST PIT A

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Depth (feet)	Other Tests	Moisture Content (%)	Sample No.	Sample Type	Soil Graph	Soil Class	Frost Depth	Frost Class	Description	Depth
0									**~2" GRASS SURFACE**	
		41	1			ML		F4	**SANDY SILT**, gray, about 30% sand, low plasticity, medium sand, damp, **ORGANICS** present ~20% by volume (roots)	1.0
	MA	8	2			SP/SM		F2	**POORLY GRADED SAND WITH SILT AND GRAVEL**, reddish brown, 33% gravel, 6% silt, gravel subrounded to 1", medium sand, damp	2.0
								NFS	**POORLY GRADED SAND WITH GRAVEL**, brown, about 15% gravel, 5% silt, gravel subrounded to 1", medium sand, damp	
5									⊻ Groundwater encountered at 5' while excavating	
		6	3			SP			becoming more gravelly, about 40% gravel, 5% silt, saturated	
10									sidewalls collapsing, pit will not remain open	10.0

TD=10.0'

TEST PIT COMPLETED ON 11-19-07

DEPTH (FEET): 0, 5, 10, 15

KEY
MA = Mechanical Analysis
TD = Total Depth
☐ = Grab Sample
◪ = SPT Sample
▧ = Shelby Tube - pushed
☒ = 2.5" I.D. Spoon Sample 340# weight, 30" fall

EXCAVATOR: City and Borough of Juneau
EQUIPMENT: Hitachi 200C
OPERATOR: Corey
METHOD: Excavator

CLIENT: Toner-Nordling & Associates
PROJECT: Juneau Float Plane AIP
LOGGED BY: John A. Rego, Jr.
TEST PIT COMPLETED: 11-19-07
W.O. D59440

DOWL ENGINEERS

LOG OF TEST PIT A

FIGURE B-31

TEST PIT B

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Depth (feet)	Other Tests	Moisture Content (%)	Sample No.	Sample Type	Soil Graph	Soil Class	Frost Depth	Frost Class	Description	DEPTH
0						ML		F4	**~2" GRASS SURFACE** **SANDY SILT**, brown, about 30% sand, low plasticity, medium sand, damp, **ORGANICS** present ~20% by volume (roots)	0.5
						SP SM		F2	**POORLY GRADED SAND WITH SILT AND GRAVEL**, reddish brown, about 20% gravel, 10% silt, gravel subrounded to 3/4", medium sand, damp	1.0
						SM		F4	**SILTY SAND WITH GRAVEL**, gray, about 20% gravel, 30% silt, nonplastic, gravel subrounded to 3/4", medium sand, damp	1.7
5						SP		NFS	**POORLY GRADED SAND WITH GRAVEL**, tan, about 20% gravel, 5% silt, gravel subrounded to 1", medium sand, damp Groundwater encountered at 5.5' while excavating	7.0
10		13	1			GP		NFS	**POORLY GRADED GRAVEL WITH SAND**, gray, about 35% sand, 5% silt, gravel subrounded to 2", medium sand, saturated sidewalls collapsing, pit will not remain open	12.0

TD=12.0'

TEST PIT COMPLETED ON 11-19-07

15

DEPTH (FEET)

EXCAVATOR: City and Borough of Juneau
EQUIPMENT: Hitachi 200C
OPERATOR: Corey
METHOD: Excavator

CLIENT: Toner-Nordling & Associates
PROJECT: Juneau Float Plane AIP
LOGGED BY: John A. Rego, Jr.
TEST PIT COMPLETED: 11-19-07
W.O. D59440

KEY
TD = Total Depth
☐ = Grab Sample
◪ = SPT Sample
▨ = Shelby Tube - pushed
☒ = 2.5" I.D. Spoon Sample 340# weight, 30" fall

DOWL ENGINEERS

LOG OF TEST PIT B

FIGURE B-32

TEST PIT C

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Depth (feet)	Other Tests	Moisture Content (%)	Sample No.	Soil Class	Frost Class	Description	DEPTH
0				ML	F4	**~2" GRASS SURFACE** **SANDY SILT**, gray, about 30% sand, low plasticity, medium sand, damp	0.5
	MA	8	1	SP SM	F2	**POORLY GRADED SAND WITH SILT**, reddish brown, 15% gravel, 10% silt, gravel subrounded to 3/4", medium sand, damp	1.5
		8	2	SP	NFS	**POORLY GRADED SAND**, tan, about 5% silt, medium sand, damp	4.0
5	MA	5	3	SP	NFS	Groundwater encountered at 5' while excavating **POORLY GRADED SAND WITH GRAVEL**, gray, 38% gravel, 1% silt, gravel subrounded to 2", medium sand, wet to saturated; sidewalls collapsing, pit will not remain open	10.0
10						TD=10.0'	
15							

DEPTH (FEET)

TEST PIT COMPLETED ON 11-19-07

KEY
MA = Mechanical Analysis
TD = Total Depth
☐ = Grab Sample
◪ = SPT Sample
▧ = Shelby Tube - pushed
☒ = 2.5" I.D. Spoon Sample
340# weight, 30" fall

EXCAVATOR: City and Borough of Juneau
EQUIPMENT: Hitachi 200C
OPERATOR: Corey
METHOD: Excavator

CLIENT: Toner-Nordling & Associates
PROJECT: Juneau Float Plane AIP
LOGGED BY: John A. Rego, Jr.
TEST PIT COMPLETED: 11-19-07
W.O. D59440

LOG OF EXPLORATION 59440.GPJ BLANK2.GDT 12/7/07

DOWL ENGINEERS

LOG OF TEST PIT C

FIGURE B-33

TEST PIT D

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Depth (ft)	Other Tests	Moisture Content (%)	Sample No.	Sample Type	Soil Class	Frost Depth	Frost Class	Description	DEPTH
0					ML		F4	**~2" GRASS SURFACE** **SANDY SILT**, gray, about 30% sand, nonplastic, medium sand, damp	0.5
					SP SM		F2	**POORLY GRADED SAND WITH SILT**, reddish brown, about 10% gravel, 10% silt, gravel subrounded to 3/4", medium sand, damp	1.0
					SM		F3	**SILTY SAND**, tan, about 20% silt, nonplastic, medium sand, damp	2.0
					SP		NFS	**POORLY GRADED SAND WITH GRAVEL**, gray, about 20% gravel, 5% silt, gravel subrounded to 1", medium sand, wet to saturated ∇ Groundwater encountered at 4.5' while excavating sidewalls collapsing, pit will not remain open	11.5

TD=11.5'

TEST PIT COMPLETED ON 11-19-07

DEPTH (FEET): 0, 5, 10, 15

KEY
TD = Total Depth
☐ = Grab Sample
◪ = SPT Sample
▧ = Shelby Tube - pushed
☒ = 2.5" I.D. Spoon Sample
340# weight, 30" fall

EXCAVATOR: City and Borough of Juneau
EQUIPMENT: Hitachi 200C
OPERATOR: Corey
METHOD: Excavator

CLIENT: Toner-Nordling & Associates
PROJECT: Juneau Float Plane AIP
LOGGED BY: John A. Rego, Jr.
TEST PIT COMPLETED: 11-19-07
W.O. D59440

LOG OF EXPLORATION 59440.GPJ BLANK2.GDT 12/7/07

DOWL ENGINEERS

LOG OF TEST PIT D

FIGURE B-34

TEST PIT E

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Depth (feet)	Other Tests	Moisture Content (%)	Sample No.	Sample Type	Soil Graph	Soil Class	Frost Depth	Frost Class	Description	Depth
0						ML		F4	**~2" GRASS SURFACE** **SILT WITH SAND**, gray, about 20% sand, low plasticity, fine sand, damp	0.5
						SP SM		F2	**POORLY GRADED SAND WITH SILT**, reddish brown, about 5% gravel, 10% silt, gravel subrounded to 3/4", medium sand, damp	1.0
						SP		NFS	**POORLY GRADED SAND**, white, about 5% silt, medium sand, damp	3.0
5	MA	7	1			SP		NFS	**POORLY GRADED SAND WITH GRAVEL**, gray, 46% gravel, 1% silt, gravel subrounded to 1.5", medium sand, wet to saturated Groundwater encountered at 5' while drilling becoming sandier, about 45% sand, 5% silt, saturated sidewalls collapsing, pit will not remain open	
10						TD=10.0'				10.0
15										

DEPTH (FEET)

TEST PIT COMPLETED ON 11-19-07

KEY
MA = Mechanical Analysis
TD = Total Depth
☐ = Grab Sample
= SPT Sample
= Shelby Tube - pushed
= 2.5" I.D. Spoon Sample 340# weight, 30" fall

EXCAVATOR: City and Borough of Juneau
EQUIPMENT: Hitachi 200C
OPERATOR: Corey
METHOD: Excavator

CLIENT: Toner-Nordling & Associates
PROJECT: Juneau Float Plane AIP
LOGGED BY: John A. Rego, Jr.
TEST PIT COMPLETED: 11-19-07
W.O. D59440

LOG OF EXPLORATION 59440.GPJ BLANK2.GDT 12/7/07

DOWL ENGINEERS

LOG OF TEST PIT E

FIGURE B-35

TEST PIT F

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Moisture Content (%)	Sample No.	Sample Type	Soil Graph	Soil Class	Frost Depth	Frost Class	Material Description	DEPTH
								~2" GRASS SURFACE	
					ML		F4	**SILT**, gray, about 10% sand, low plasticity, fine sand, damp, **ORGANICS** present ~10% by volume (roots)	0.5
					SP / SM		F2	**POORLY GRADED SAND WITH SILT AND GRAVEL**, reddish brown, about 15% gravel, 10% silt, gravel subrounded to 1", medium sand, damp	1.5
					GP		NFS	**POORLY GRADED GRAVEL WITH SAND**, white, about 45% sand, 5% silt, gravel subrounded to 1.5", medium sand, damp	3.0
					SP		NFS	**POORLY GRADED SAND WITH GRAVEL**, gray, about 40% gravel, 5% silt, gravel subrounded to 1", medium sand, wet to saturated Groundwater encountered at 5' while excavating sidewalls collapsing, difficult to keep pit open	11.0

DEPTH (FEET): 0, 5, 10, 15

TD=11.0'

TEST PIT COMPLETED ON 11-19-07

KEY
TD = Total Depth
☐ = Grab Sample
= SPT Sample
= Shelby Tube - pushed
= 2.5" I.D. Spoon Sample 340# weight, 30" fall

EXCAVATOR: City and Borough of Juneau
EQUIPMENT: Hitachi 200C
OPERATOR: Corey
METHOD: Excavator

CLIENT: Toner-Nordling & Associates
PROJECT: Juneau Float Plane AIP
LOGGED BY: John A. Rego, Jr.
TEST PIT COMPLETED: 11-19-07
W.O. D59440

DOWL ENGINEERS

LOG OF TEST PIT F

FIGURE B-36

APPENDIX C

Laboratory Test Results

Table C-1 Limited Mechanical Analyses

Test Boring No.	Sample No.	Depth (feet)	Gravel (%)	Sand (%)	Silt (%)	Group Name
NE-2	4	7.5	41	43	16	Silty Sand with Gravel
NE-4	5	10	33	63	4	Poorly Graded Sand with Gravel

Table C-2: Sand Equivalent Testing Results

Borehole	Sample Number	Depth (ft)	USCS Classifcation	Sand Equivalent Average
NE-1	1	0-2.5	Poorly Graded Sand	84
NE-2	1	0-2.5	Poorly Graded Sand	71
NE-3	1	0-2.5	Poorly Graded Sand	58
NE-4	1	0-2.5	Poorly Graded Sand	79
NW-1	1	0-2.5	Poorly Graded Sand	67
NW-2	1	0-2.5	Poorly Graded Sand	77
NW-3	1	0-2.5	Poorly Graded Sand	71
NW-4	1	0-2.5	Poorly Graded Sand	73
NW-5	1	0-2.5	Poorly Graded Sand with Gravel	52

DOWL

Client: City & Borough of Juneau
Project: JNU RSA
Work Order: D62033

Particle Size Distribution

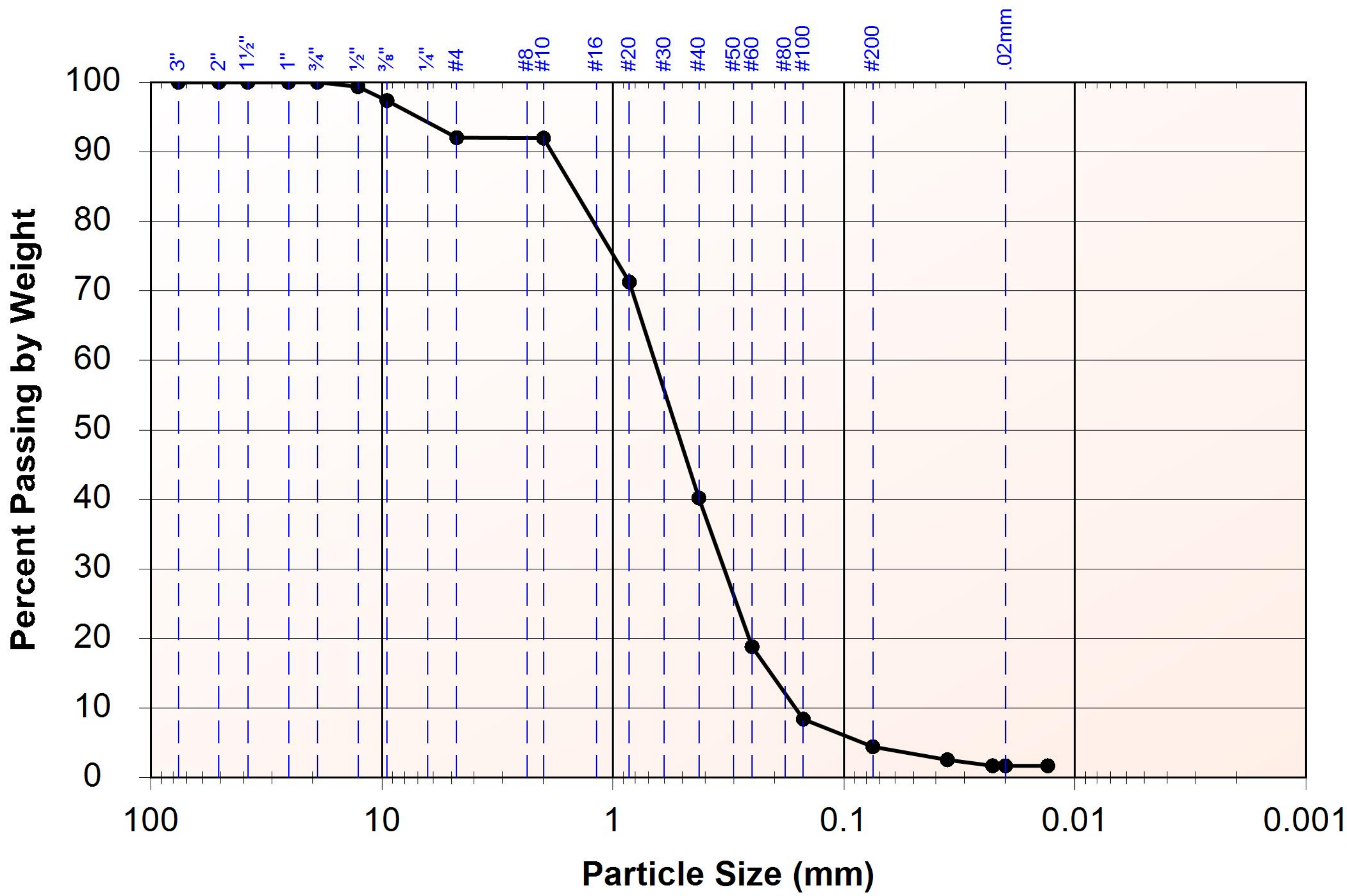
ASTM D422

Lab Number	2016-217
Received	5/11/2016
Reported	5/19/2016

Location: Test Boring NE1
Sample 1
Depth 0'-2.5'

Engineering Classification: **Poorly Graded Sand, SP**

Frost Classification: **NFS**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	99%	
⅜"	97%	
#4	92%	
Total Weight of Sample 553.3g		
#10	92%	
#20	71%	
#40	40%	
#60	19%	
#100	8%	
#200	4.5%	
Total Weight of Fine Fraction 107.55g		
0.02 mm	1.7%	

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Work Order: D62033

Particle Size Distribution

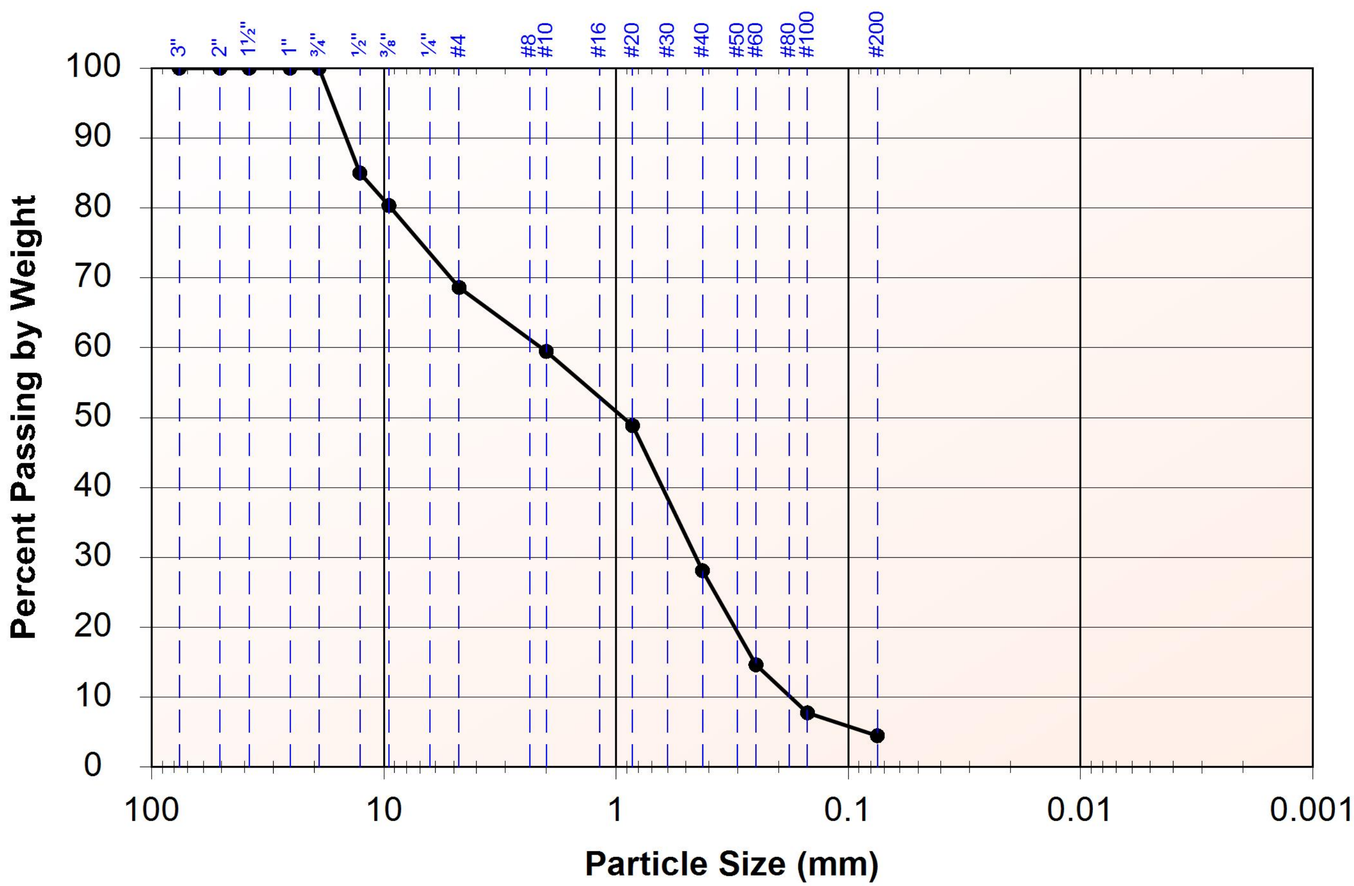
ASTM D422

Lab Number	2016-218
Received	5/11/2016
Reported	5/19/2016

Location: Test Boring NE1
Sample 2
Depth 2.5

Engineering Classification: **Poorly Graded Sand with Gravel, SP**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	85%	
⅜"	80%	
#4	69%	
Total Weight of Sample 580g		
#10	59%	
#20	49%	
#40	28%	
#60	15%	
#100	8%	
#200	4.5%	
Total Weight of Fine Fraction 398g		

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Particle Size Distribution

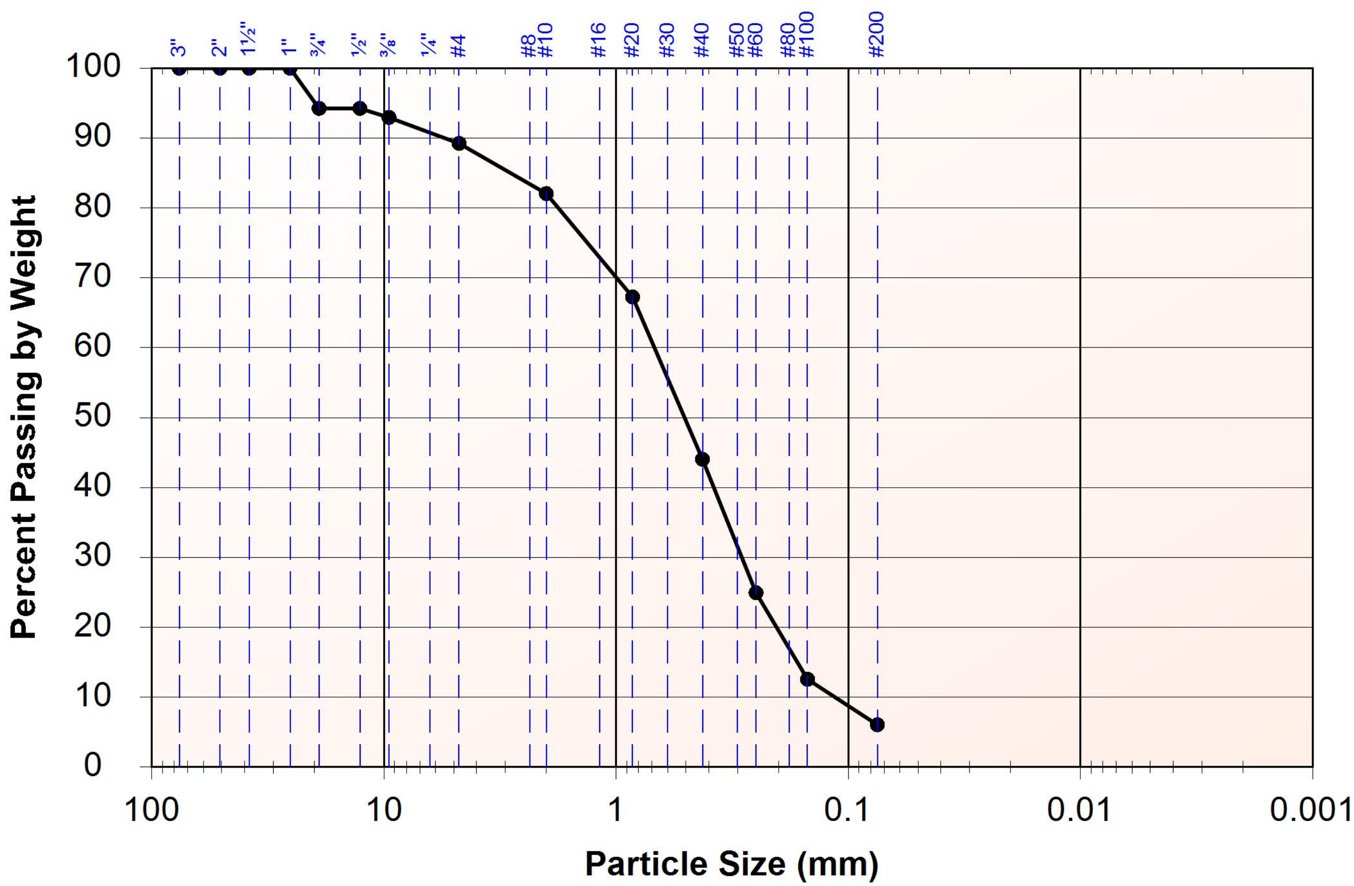
ASTM D422

Lab Number	2016-220
Received	5/11/2016
Reported	5/19/2016

Location: Test Boring NE2
Sample 3
Depth 5

Engineering Classification: **Poorly Graded Sand with Silt, SP-SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	94%	
½"	94%	
⅜"	93%	
#4	89%	
Total Weight of Sample 538.7g		
#10	82%	
#20	67%	
#40	44%	
#60	25%	
#100	13%	
#200	6.1%	
Total Weight of Fine Fraction 480g		

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Client: City & Borough of Juneau
Project: JNU RSA
Work Order: D62033

Particle Size Distribution

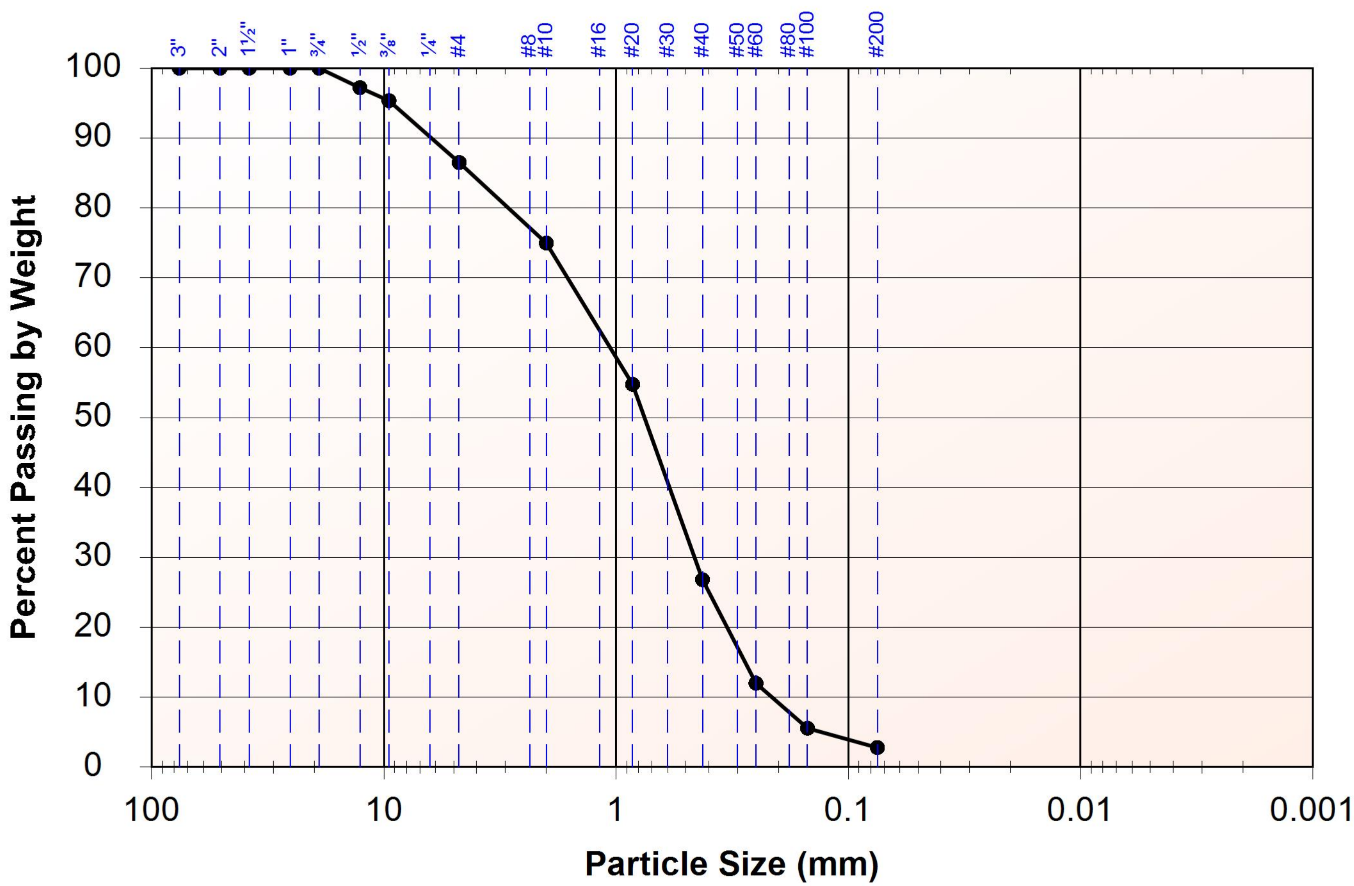
ASTM D422

Lab Number	2016-223
Received	5/11/2016
Reported	5/19/2016

Location: Test Boring NE3
Sample 6
Depth 15'

Engineering Classification: Poorly Graded Sand, SP

Frost Classification: NFS



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	97%	
⅜"	95%	
#4	87%	
Total Weight of Sample 644.9g		
#10	75%	
#20	55%	
#40	27%	
#60	12%	
#100	6%	
#200	2.8%	
Total Weight of Fine Fraction 437.8g		

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Work Order: D62033

Particle Size Distribution

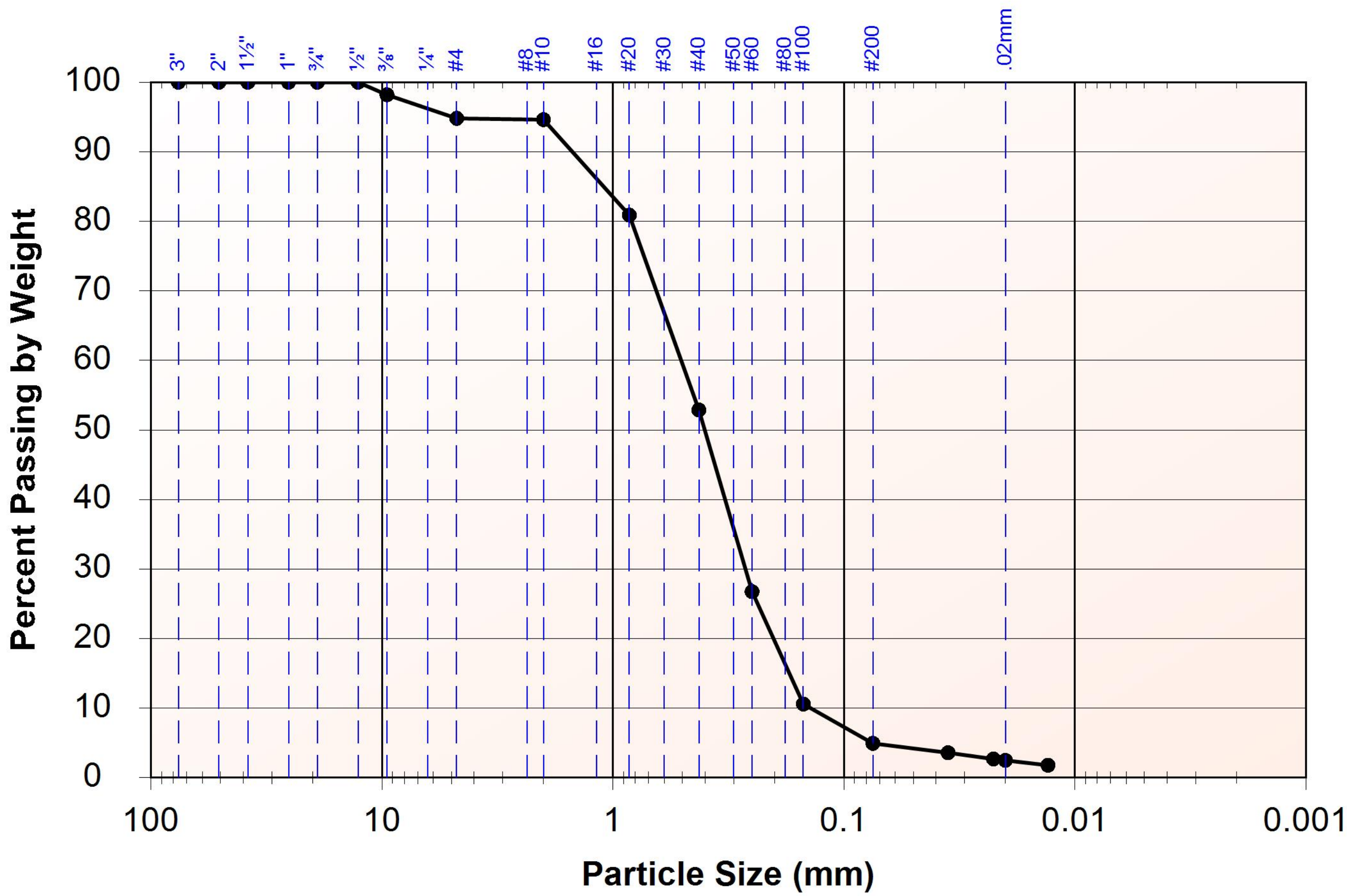
ASTM D422

Lab Number	2016-224
Received	5/11/2016
Reported	5/19/2016

Location: Test Boring NE4
Sample 1
Depth 0'-2.5'

Engineering Classification: **Poorly Graded Sand, SP**

Frost Classification: **NFS**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	100%	
⅜"	98%	
#4	95%	
Total Weight of Sample 460g		
#10	95%	
#20	81%	
#40	53%	
#60	27%	
#100	11%	
#200	4.9%	
Total Weight of Fine Fraction 105.6g		
0.02 mm	2.5%	

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Client: City & Borough of Juneau
Project: JNU RSA
Work Order: D62033

Particle Size Distribution

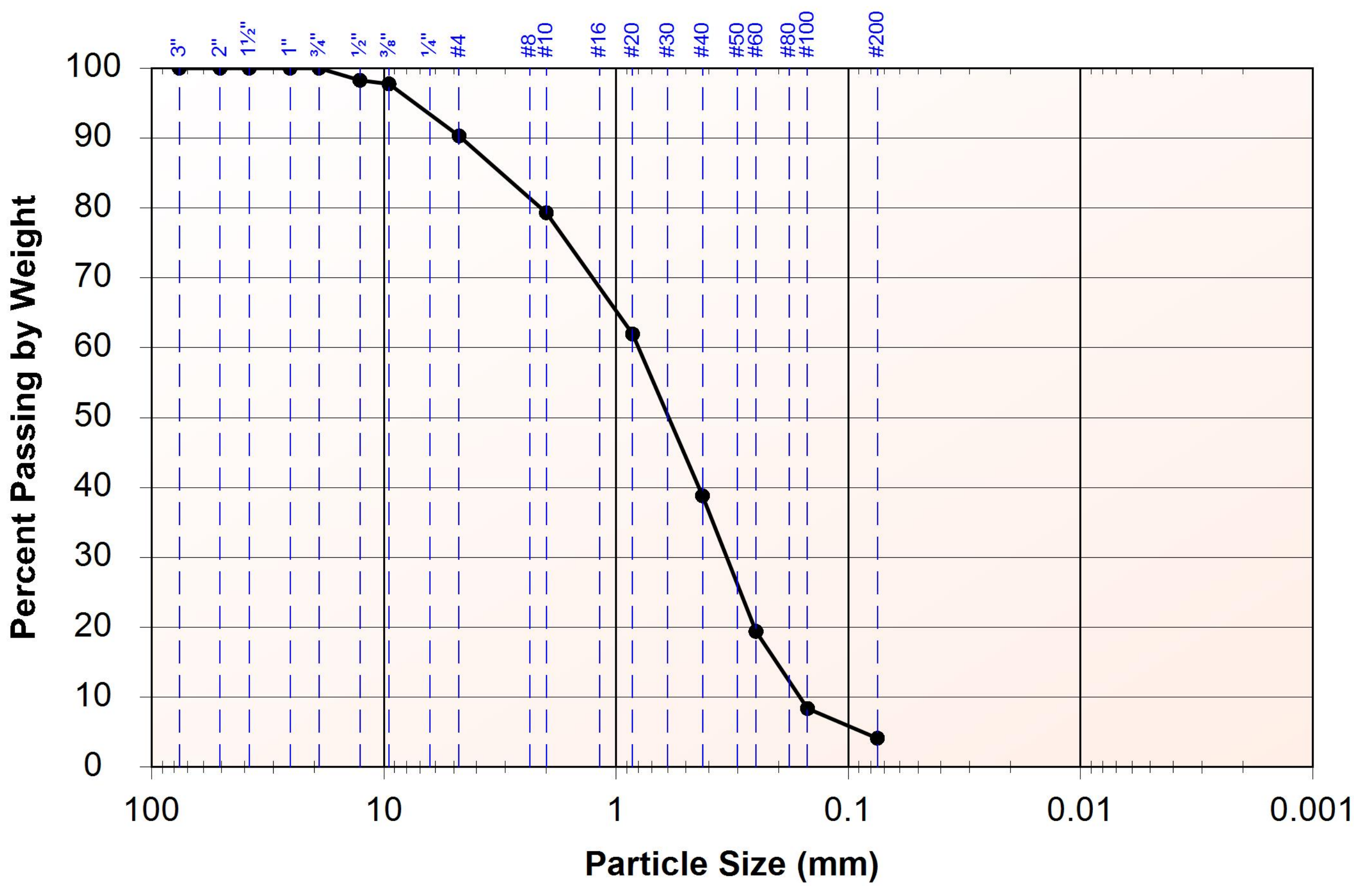
ASTM D422

Lab Number	2016-225
Received	5/11/2016
Reported	5/19/2016

Location: Test Boring NE4
Sample 2
Depth 2.5'

Engineering Classification: **Poorly Graded Sand, SP**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	98%	
⅜"	98%	
#4	90%	
Total Weight of Sample 577.4g		
#10	79%	
#20	62%	
#40	39%	
#60	19%	
#100	8%	
#200	4.1%	
Total Weight of Fine Fraction 521g		

DOWL

Client: City & Borough of Juneau
Project: JNU RSA
Work Order: D62033

Particle Size Distribution

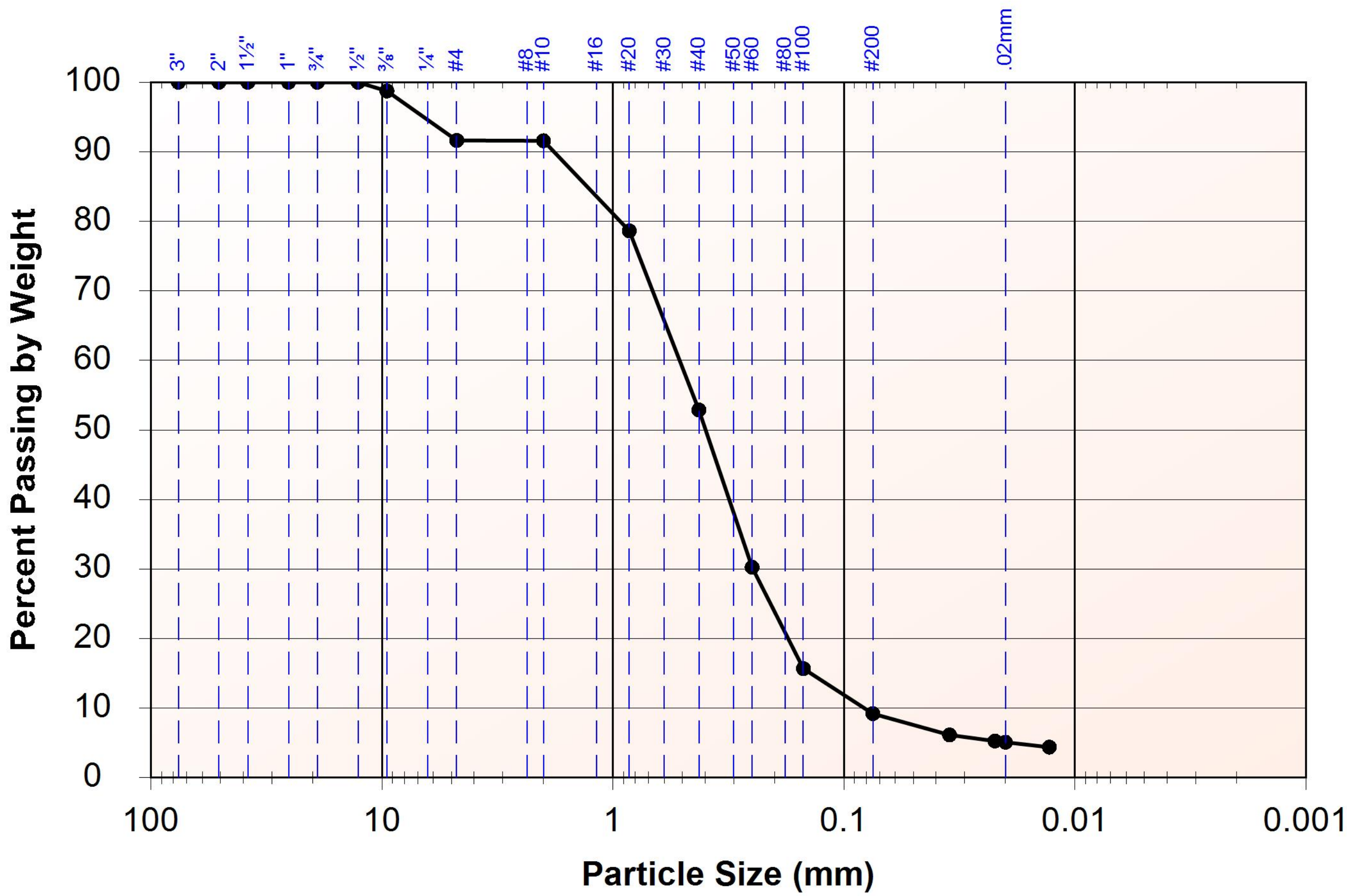
ASTM D422

Lab Number	2016-227
Received	5/11/2016
Reported	5/19/2016

Location: Test Boring NW1
Sample 1
Depth 0'-2.5'

Engineering Classification: **Well Graded Sand with Silt, SW-SM**

Frost Classification: **S2**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	100%	
⅜"	99%	
#4	92%	
Total Weight of Sample 397.1g		
#10	92%	
#20	79%	
#40	53%	
#60	30%	
#100	16%	
#200	9.2%	
Total Weight of Fine Fraction 104.5g		
0.02 mm	5.1%	

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Client: City & Borough of Juneau
Project: JNU RSA
Work Order: D62033

Particle Size Distribution

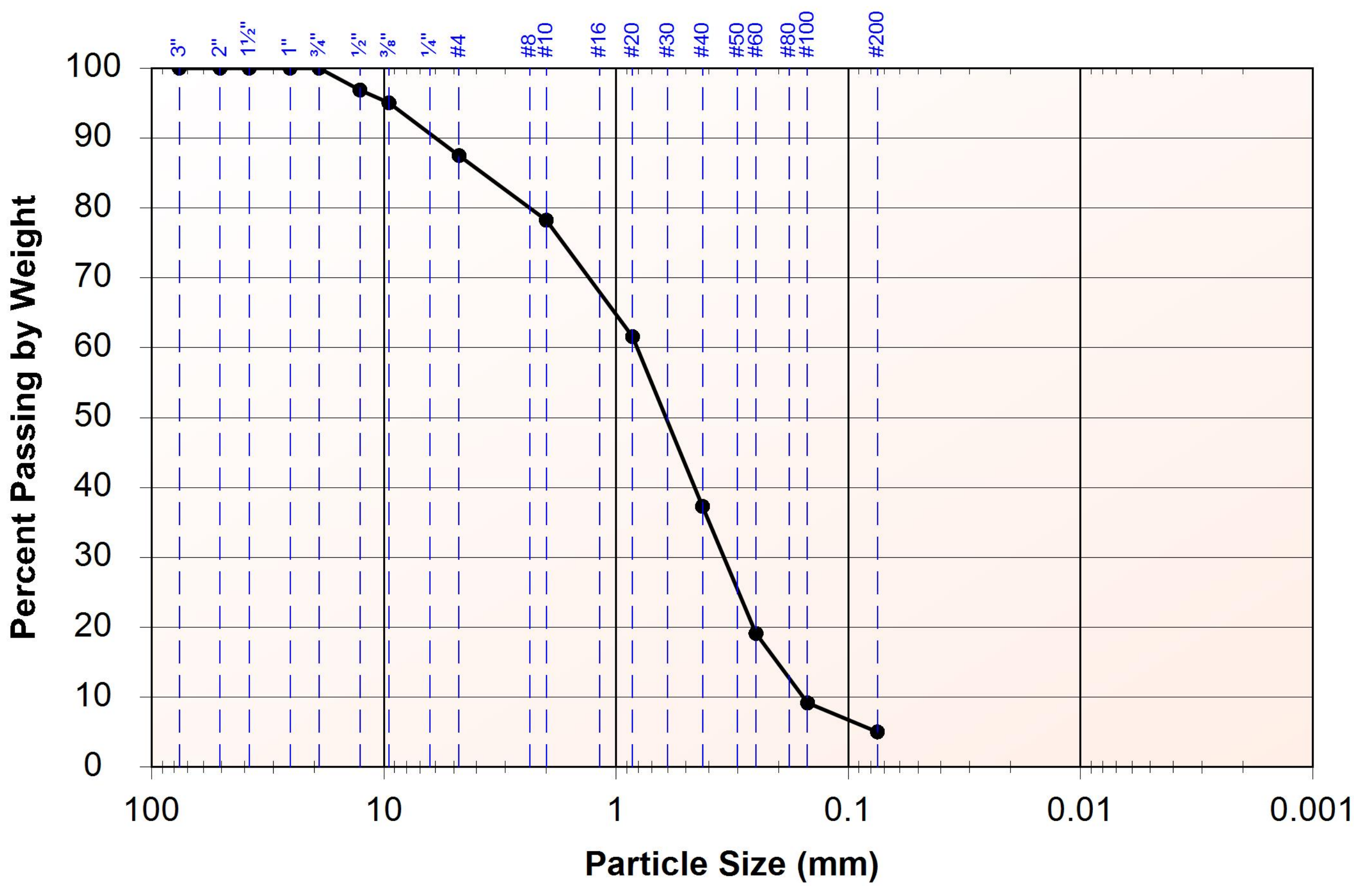
ASTM D422

Lab Number	2016-228
Received	5/11/2016
Reported	5/19/2016

Location: Test Boring NW1
Sample 2
Depth 2.5'

Engineering Classification: **Poorly Graded Sand with Silt, SP-SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	97%	
⅜"	95%	
#4	87%	
Total Weight of Sample 767.1g		
#10	78%	
#20	62%	
#40	37%	
#60	19%	
#100	9%	
#200	5.0%	
Total Weight of Fine Fraction 523.4g		

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Client: City & Borough of Juneau
Project: JNU RSA
Work Order: D62033

Particle Size Distribution

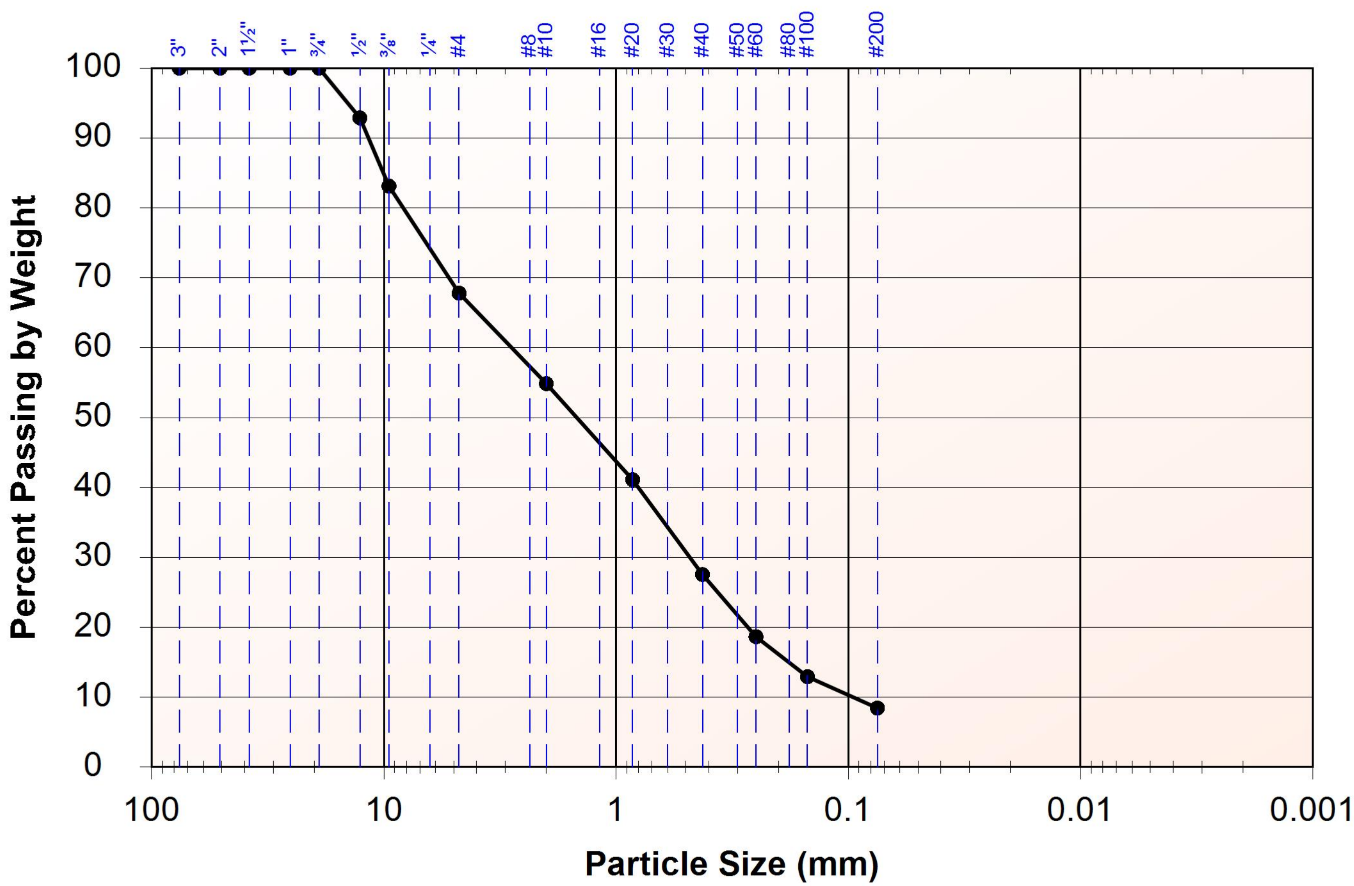
ASTM D422

Lab Number	2016-230
Received	5/11/2016
Reported	5/19/2016

Location: Test Boring NW2
Sample 3
Depth 5

Engineering Classification: **Poorly Graded Sand with Silt and Gravel, SP-SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	93%	
⅜"	83%	
#4	68%	
Total Weight of Sample 646.1g		
#10	55%	
#20	41%	
#40	28%	
#60	19%	
#100	13%	
#200	8.5%	
Total Weight of Fine Fraction 438g		

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Client: City & Borough of Juneau
Project: JNU RSA
Work Order: D62033

Particle Size Distribution

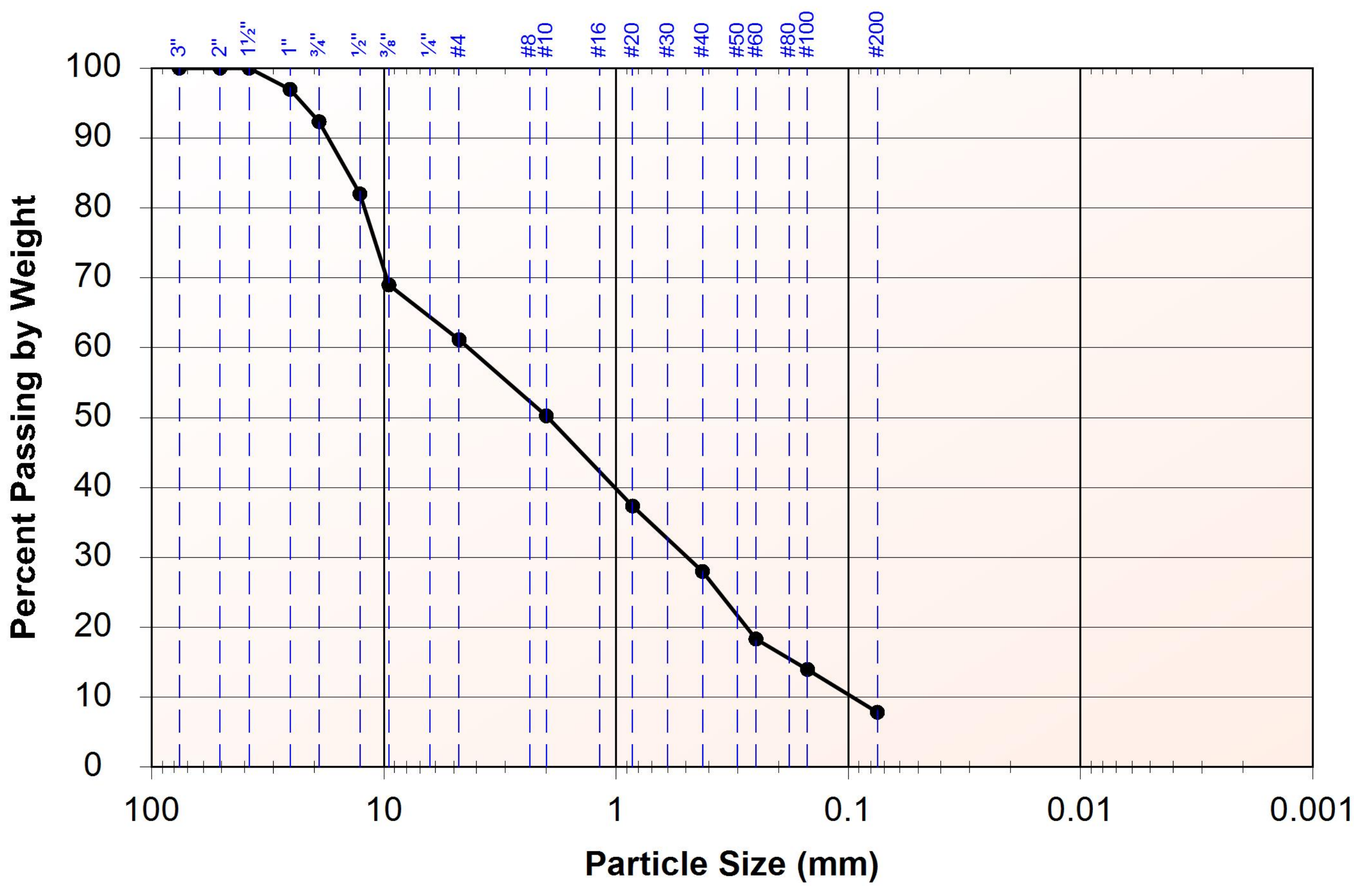
ASTM D422

Lab Number	2016-231
Received	5/11/2016
Reported	5/19/2016

Location: Test Boring NW2
Sample 4
Depth 7.5'

Engineering Classification: **Poorly Graded Sand with Silt and Gravel, SP-SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	97%	
¾"	92%	
½"	82%	
⅜"	69%	
#4	61%	
Total Weight of Sample 561.1g		
#10	50%	
#20	37%	
#40	28%	
#60	18%	
#100	14%	
#200	7.8%	
Total Weight of Fine Fraction 343g		

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Client: City & Borough of Juneau
Project: JNU RSA
Work Order: D62033

Particle Size Distribution

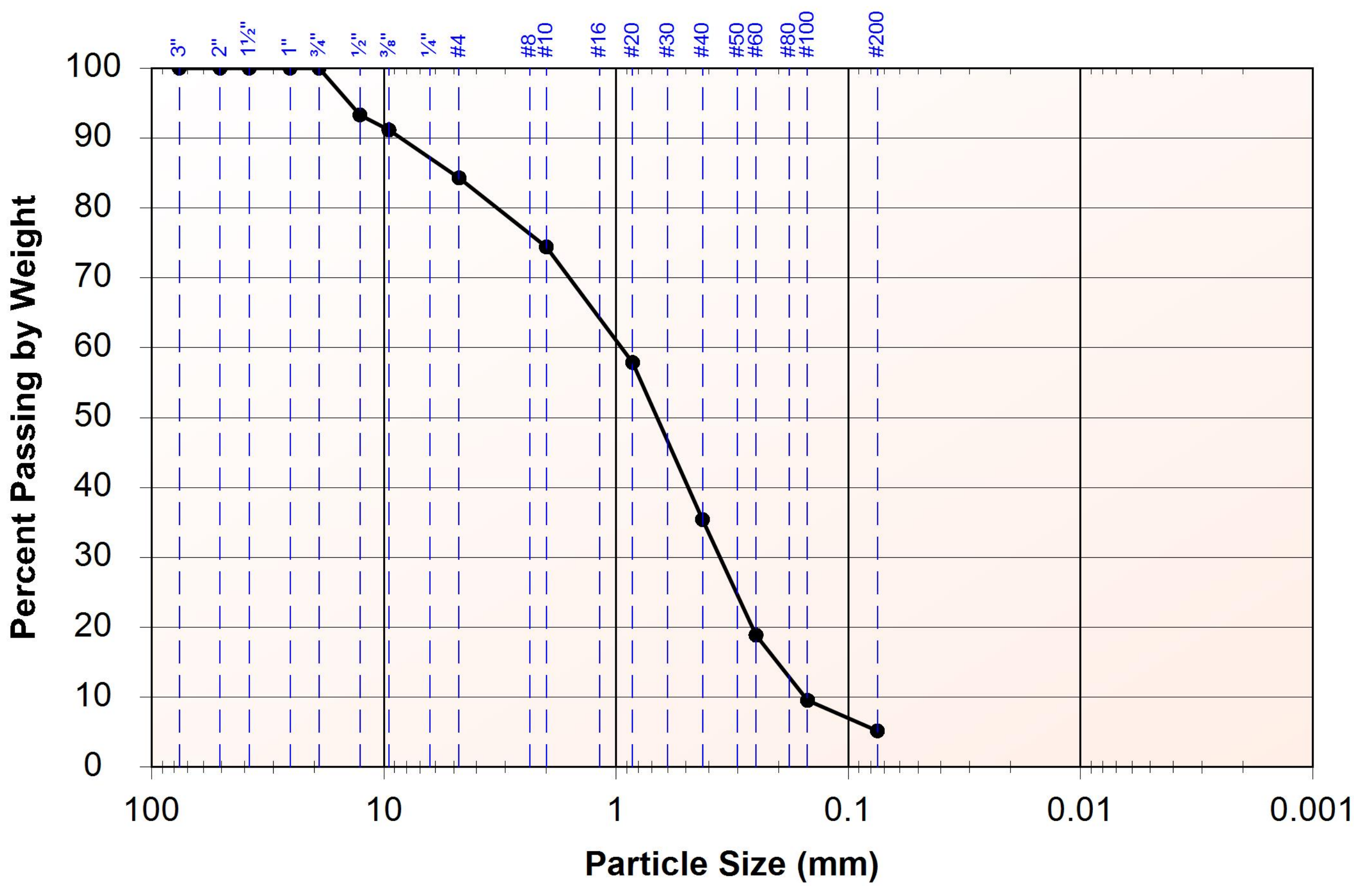
ASTM D422

Lab Number	2016-233
Received	5/11/2016
Reported	5/19/2016

Location: Test Boring NW3
Sample 2
Depth 2.5'

Engineering Classification: **Poorly Graded Sand with Silt and Gravel, SP-SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	93%	
⅜"	91%	
#4	84%	
Total Weight of Sample 699.1g		
#10	74%	
#20	58%	
#40	35%	
#60	19%	
#100	10%	
#200	5.2%	
Total Weight of Fine Fraction 480.7g		

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DOWL

Client: City & Borough of Juneau
Project: JNU RSA
Work Order: D62033

Particle Size Distribution

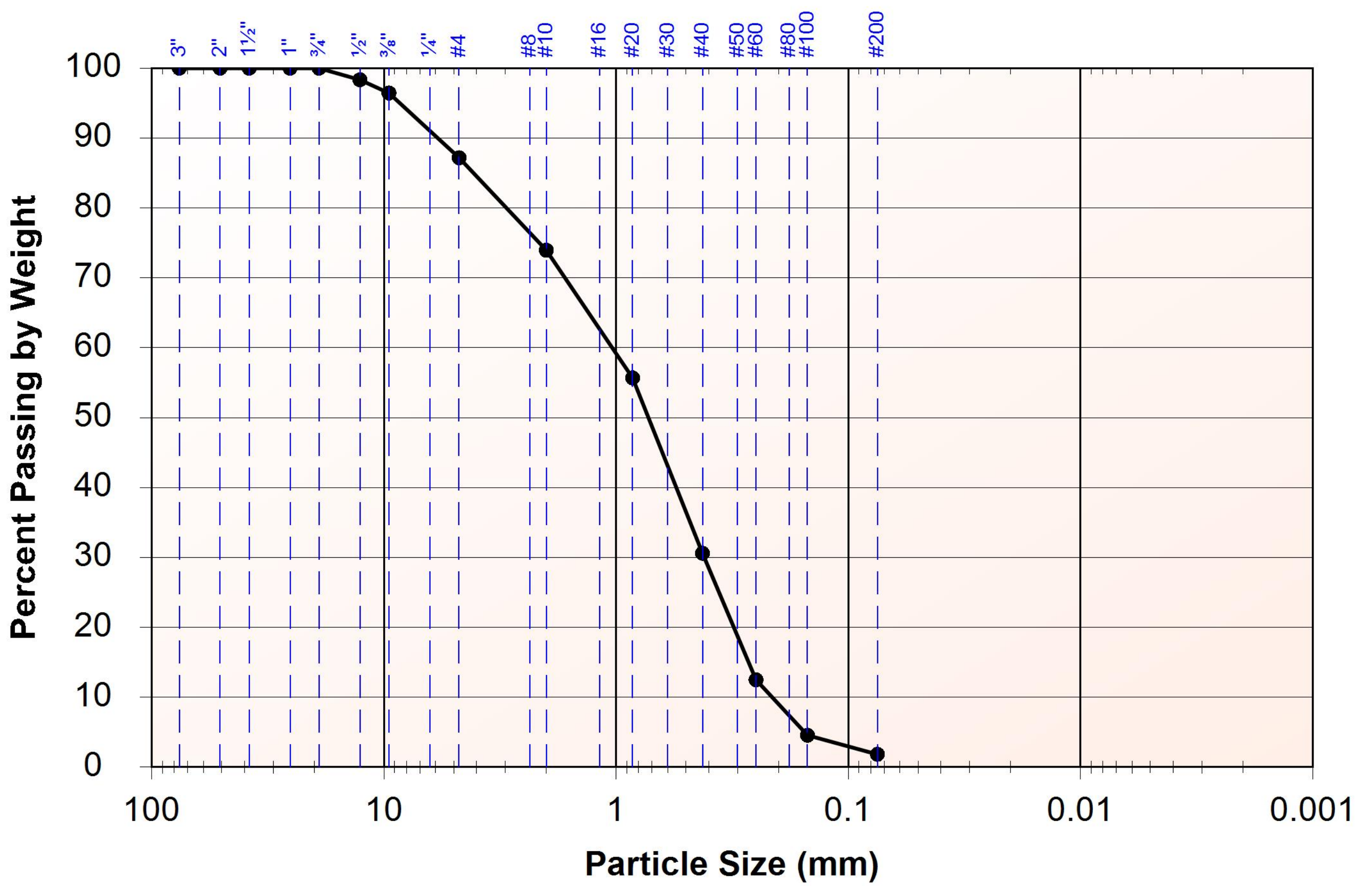
ASTM D422

Lab Number	2016-235
Received	5/11/2016
Reported	5/19/2016

Location: Test Boring NW4
Sample 6
Depth 15'

Engineering Classification: **Poorly Graded Sand, SP**

Frost Classification: **NFS**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	98%	
⅜"	96%	
#4	87%	
Total Weight of Sample 421.3g		
#10	74%	
#20	56%	
#40	31%	
#60	12%	
#100	5%	
#200	1.8%	
Total Weight of Fine Fraction 367g		

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Client: City & Borough of Juneau
Project: JNU RSA
Work Order: D62033

Particle Size Distribution

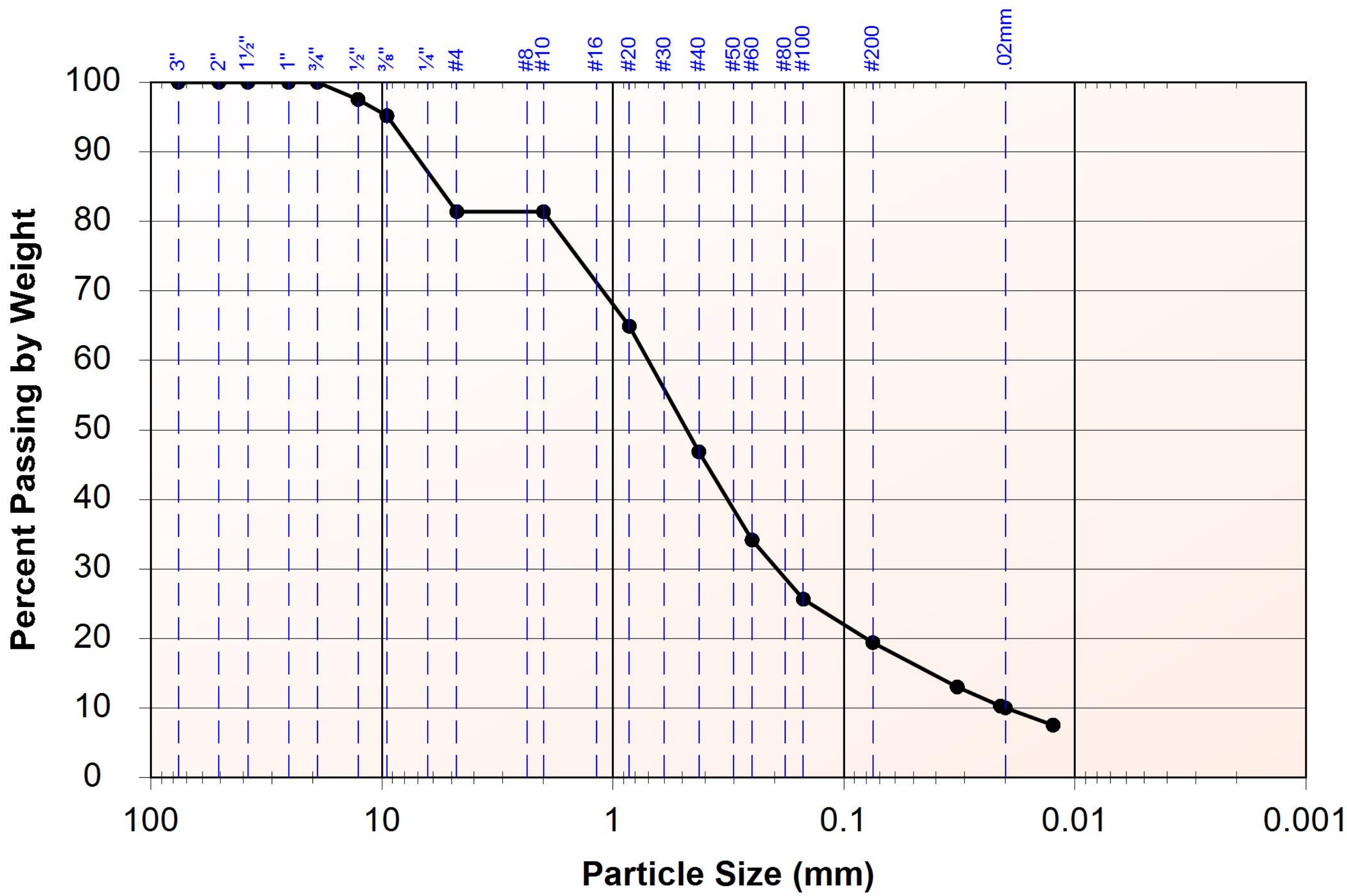
ASTM D422

Lab Number	2016-236
Received	5/11/2016
Reported	5/19/2016

Location: Test Boring NW5
Sample 1
Depth 0'-2.5'

Engineering Classification: **Silty Sand with Gravel, SM**

Frost Classification: **F2**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	98%	
⅜"	95%	
#4	81%	
Total Weight of Sample 677.42g		
#10	81%	
#20	65%	
#40	47%	
#60	34%	
#100	26%	
#200	19.4%	
Total Weight of Fine Fraction 118.6g		
0.02 mm	10.1%	

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DOWL

Client: City & Borough of Juneau
Project: JNU RSA
Work Order: D62033

Particle Size Distribution

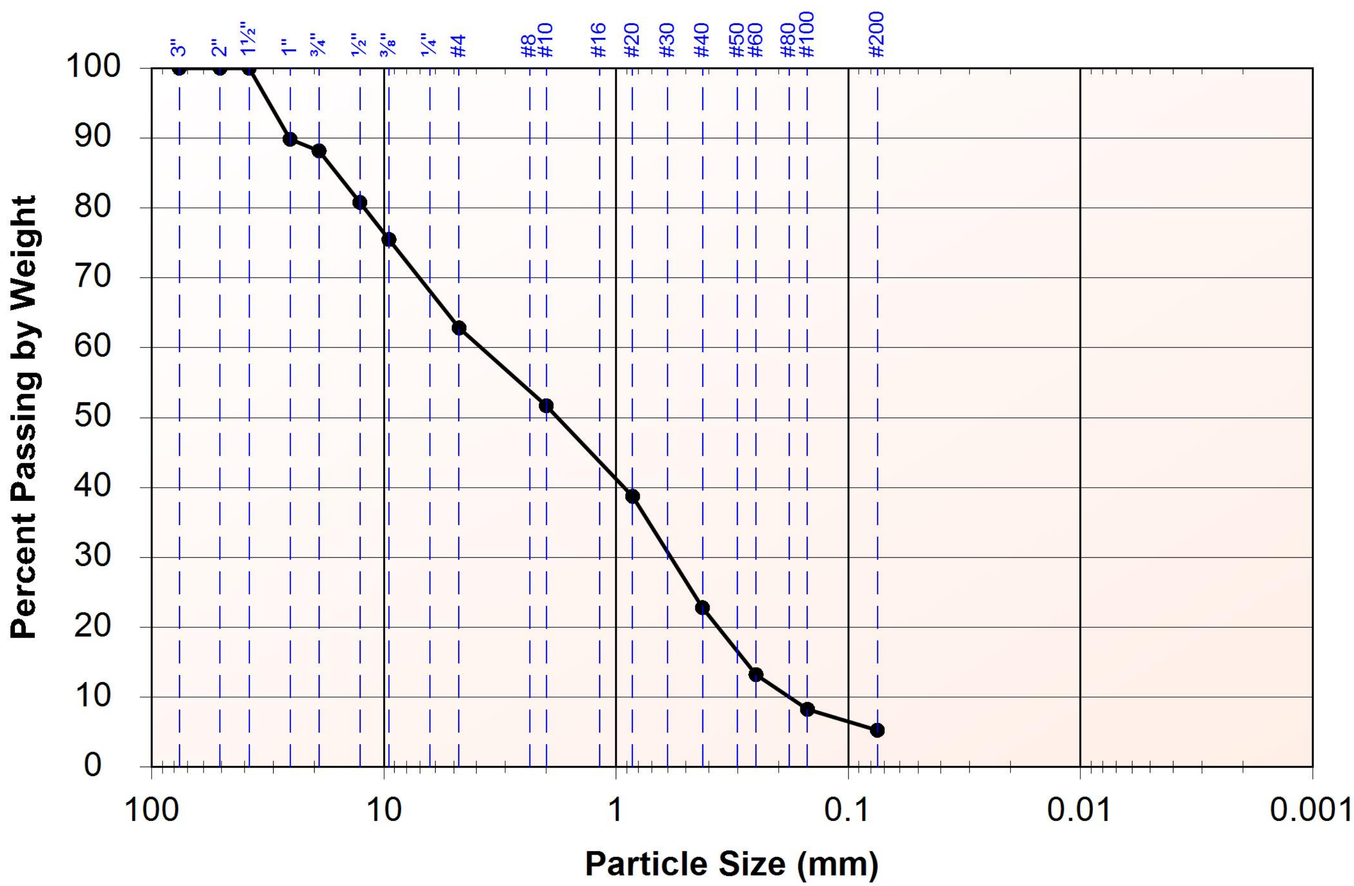
ASTM D422

Lab Number	2016-237
Received	5/11/2016
Reported	5/19/2016

Location: Test Boring NW5
Sample 2
Depth 2.5'

Engineering Classification: **Poorly Graded Sand with Silt and Gravel, SP-SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	90%	
¾"	88%	
½"	81%	
⅜"	75%	
#4	63%	
Total Weight of Sample 718.3g		
#10	52%	
#20	39%	
#40	23%	
#60	13%	
#100	8%	
#200	5.3%	
Total Weight of Fine Fraction 451.5g		

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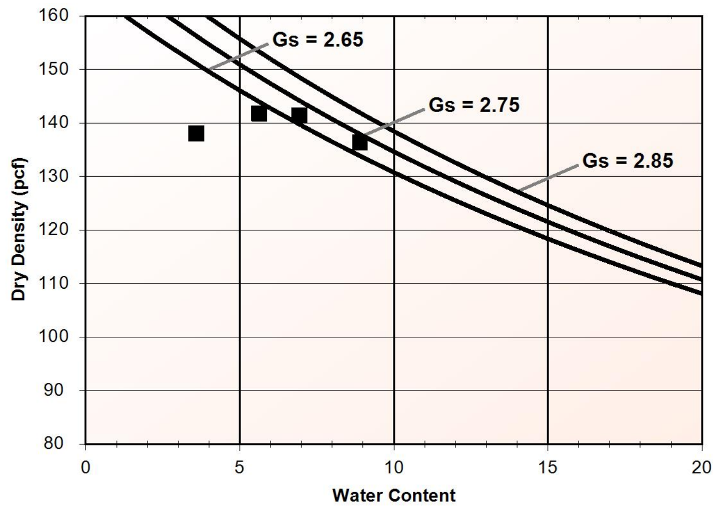
DOWL

Client: ECI/Hyer, Inc.
Project: JNU SREF
Work Order: D62133

Modified Proctor

ASTM D1557 C

Lab Number	2016-342
Received	5/25/2016
Reported	5/31/2016



Location:
TH9-S1/TH7-S1
SAND EQUIVALENT = 64

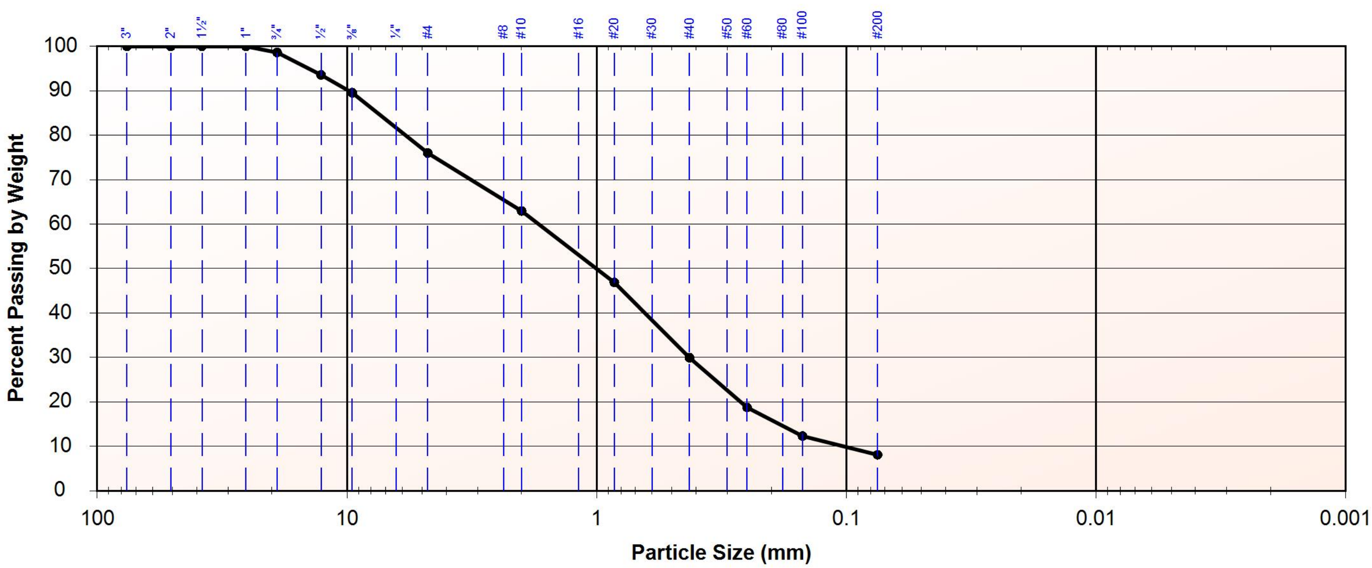
Uncorrected Max Density: 142 pcf

Uncorrected Optimum: 5.5%

Moist Preparation
Mechanical Compaction

Engineering Classification: **Well Graded Sand with Silt and Gravel, SW-SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	99%	
½"	94%	
⅜"	90%	
#4	76%	
Total Weight of Sample 13321g		
#10	63%	
#20	47%	
#40	30%	
#60	19%	
#100	12%	
#200	8.1%	
Total Weight of Fine Fraction 448.6g		