Appendix C:
Preliminary Geotechnical Engineering Report

SUBMITTED TO:

CRW Engineering Group, LLC
3940 Arctic Boulevard, Suite 300
Anchorage, Alaska 99503

BY:

Shannon & Wilson, Inc.
5430 Fairbanks Street, Suite 3
Anchorage, Alaska 99518

907.561.2120
www.shannonwilson.com

PRELIMINARY GEOTECHNICAL ENGINEERING REPORT

Shotgun Cove Road Extension

WHITTIER, ALASKA

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

May 2018

S&W No: 32-1-20071r1

Shotgun Cove Road Extension
Whittier, Alaska

Preliminary Geotechnical Engineering Report

Shannon & Wilson participated in this project as a subconsultant to CRW Engineering Group, LLC (CRW). Our scope of services was specified in a contract signed by Mr. Pete Bellezza, Principal on December 7, 2017.

This report was prepared and reviewed by:

for: Katra Wedeking, CPG
Senior Geologist
Role: Primary author

STATE OF ALASKA
49TH
Kyle Brennan
CE-11122
5-25-18
REGISTERED PROFESSIONAL ENGINEER

Kyle Brennan, PE
Vice President
Role: Supervision and review

CONTENTS

Exhibits

Figures

Appendices

1 INTRODUCTION

This revised report documents the results of reconnaissance studies by Shannon & Wilson, Inc. for the Shotgun Cove Road extension project in Whittier, Alaska. The revision to this report incorporates March 29, 2018 comments provided by CRW. The project includes extension of the existing road to provide access for future development. The purpose of this study was to conduct reconnaissance services and provide preliminary recommendations for the proposed new road extension. Presented in this report are descriptions of the site and project, a description of our reconnaissance efforts and field observations, and our preliminary geotechnical engineering recommendations for design and construction of the proposed improvements. Note that additional explorations and engineering analysis will be needed to support the final design of the project.

2 SITE AND PROJECT DESCRIPTION

We understand that the City of Whittier plans to extend Shotgun Cove Road approximately 2.5 miles from its current constructed location at Mile 2.0. The new road is expected to be a two-lane, gravel surfaced roadway with drainage provisions. At the time of our site visit, we traversed the approximate proposed corridor provided by CRW using ArcGIS and the collector app for location control. We understand that the new roadway alignment will be established to complement planned development and that a final alignment has not been selected at this point in the project planning.

A site map is included as Figure 1 which provides an overview of the project area including observation points and probe depths.

3 FIELD RECONNAISSANCE

The reconnaissance effort took place on December 12, 2017, and was conducted on-foot by Katra Wedeking and Kyle Brennan, from our Anchorage office. Our field explorations included surface observations and hand-pushed probing along the potential project corridor. Probing was conducted using a 5-foot long, ½ inch diameter steel rod that was pushed into the ground by hand. We made observations along the project corridor at discrete locations (observation points) that were recorded using a handheld Global Positioning System (GPS) unit. Additionally, generalized bedrock reconnaissance was conducted at two locations where outcrops were exposed, one in a creek bed, and one along the beach. Approximate locations of the observation stations are shown on the site plan included as Figure 1. Note that as of the date of this letter, we understand that the final road alignment has not been selected. Our location control was gained through a potential corridor provided by CRW and generally followed using ArcGIS and the collector app on a mobile device.

4 OBSERVATIONS

The project area generally includes treed areas, muskegs, and several major water crossings. The treed areas typically contain mature trees, underbrush, and likely have an average of 2 feet of overburden (consisting predominately of moss and roots) over bedrock. The muskeg surficial organics ranged from 2 to 7.5 feet based on probing, and had an average of about 4 feet. Additionally, occasional sloping muskegs were observed. It is likely that the bedrock is also sloping in these areas. Within the major stream crossings, soil was thin and localized. It is not likely that there will be a substantial amount of soil within the project area. In addition to the major stream crossings, numerous small creeks were observed along the entire project area with the majority noted cross cutting the muskegs. These small drainages appeared to be well established and were flowing swiftly during our reconnaissance. Exposed bedrock consists of meta-shale or slate with bedding and joints that were recorded and are presented on Figure 1. The following exhibit provides an overview of the observations noted during our reconnaissance.

Exhibit 4-1: Field Observations

Point Identification	Observation Noted
OP-01	Stream crossing, 2 to 5 feet of surface organics over shallow bedrock
OP-02	Stream crossing, 1 to 2 feet moss over bedrock
OP-03	Stream crossing, less than 2 feet moss over bedrock
OP-04	Small creek through muskeg, organics likely less than 3 feet thick, gravel alluvium in creek bed
OP-05	Sloping muskeg, recommend alignment stay high or low
OP-06	Small creek, rock less than 2 feet below ground surface
OP-07	Small creek, less than 5 feet soil over rock
OP-08	Creek, rock less than 3 feet below ground surface
OP-09	Muskeg, sloping above, recommend alignment stay low here
OP-10	Steep slope, exposed rock, less than 1 foot soil over rock
OP-11	Trail creek crossing, very steep rock slopes, gets steeper and higher upstream

NOTES:

1 See site plan presented as Figure 1 for approximate locations of Observation Points.

5 CONCLUSIONS AND RECOMMENDATIONS

The sections below present preliminary, generalized geotechnical recommendations for site preparation and subgrade development, embankment development, and structural section recommendations. We also provide discussion of issues related to drainage, structural fill, compaction, and the availability of local borrow materials.

Our reconnaissance revealed conditions that generally consisted of mature treed areas, open, grassy muskegs, and several significant drainage features. In addition to the major drainage features, frequent small, streams were observed, especially cross cutting the muskegs. We generally observed organic material overlying bedrock across the project area. The organic material was an average of 2 feet thick in the treed areas and an average of 4 feet thick in the muskegs. In addition, several sloping muskegs were observed within the project area. It is our opinion that muskegs on slopes of approximately 6 horizontal (H) to 1 vertical (V) or steeper should be avoided during alignment selection if possible. These features can be problematic if the new roadway cuts across the slope where the muskegs lie. If the roadway must traverse these areas, special attention will need to be given to designing the embankments across these features. Stability issues may be experienced related to uneven consolidation of organic soils under the embankment and potential soil creep and horizontal displacements in the embankment over time.

Substantial amounts of soil were not observed during our reconnaissance except for the occasional alluvial deposits that were localized within the small cross cutting streams. Development of the new roadway will need to consider the extensive organic material, the steep slopes, the shallow bedrock, and the drainage provisions. Ideally, all organic material will be removed prior to development of the roadway structural section. However, development of the new roadway may be accomplished across the muskegs over the organic material if differential settlement is planned for and can be accommodated.

Based on our observations, shallow bedrock could be encountered along the entire corridor. It is likely that several areas will require cuts into the bedrock depending on the final alignment selection. Bedrock observed within outcrops generally consisted of meta-shale or slate which may vary in strength and ripability characteristics. Based on our observations, we believe that the bedrock may be rippable to several feet or more below the soil/rock horizon, depending on the degree of weathering and the orientation of the bedding and jointing. We recommend that bedrock cut slopes be established at 1/3 H to 1 V for preliminary planning purposes. The actual steepness of rock cut slopes will need to be determined through final design (and verified through inspection during construction) and will be dependent on the orientation of the cut slope and actual rock structure orientation along the project corridor.

5.1 Site Preparation and Subgrade Development

We anticipate that the proposed road will be constructed with portions at or above the existing ground surface and other areas that require cuts. Our reconnaissance indicates general conditions consist of an organic layer of variable thickness overlying bedrock. Ideally, cut areas and surfaces that will receive fill need to be stripped of vegetation (grass, shrubs, trees, etc.), and the upper layer of organics (organic silt, peat, etc.). Based on probing and observations, we believe that the average thickness of surface organics (muskegs and treed areas) within in the corridor is likely approximately 3 feet. After grubbing, the exposed grade should be probed and closely observed to look for unsuitable soils, such as loose or soft sand and silt, soils with a high water content, or soils susceptible to long term settlements. We believe that the presence of unsuitable soil under the surface organics is likely limited to isolated areas. In areas to be filled, these soils should be excavated and replaced with compacted Selected Material Type B or shot rock. Excavations to remove unsuitable soils should extend out laterally so that the embankment side slopes can be developed at the angle recommended in Section 5.2. The material should be removed until firm, native, mineral soils or bedrock is exposed over the entire excavation bottom. The structural section may be developed over native granular materials or bedrock as recommended in Section 5.4. The embankments and structural section should be developed on firm native, unyielding ground in order to withstand loading from construction equipment.

If excavating the thick areas of peat within the muskegs is cost prohibitive, the organic material (peat, organic soil, etc.) may be left in place with the understanding that the roadway surface may require additional maintenance or repair. If this option is selected, we recommend that the upper vegetation within the new embankment footprint be cut to within 6 inches of the ground surface with the root matter left intact. A woven geofabric (like that described in Section 5.6) should be placed on top of the prepared peat surface prior to placement of embankment fills.

5.2 Embankment Development

New embankments may include fill placed on the native subgrade up to (but not including) the road structural section and should provide stable support for the roadway structural section. Elements that will contribute to this overall goal include proper site preparation, appropriate embankment slopes, and utilizing good construction controls (compaction and material gradation).

Since our explorations indicate that bedrock is shallow within the project limits, we assume that much of the fill material to construct the embankments will be constructed of rock removed in cut areas, most likely unprocessed shot rock. Developing consistent and stable embankments with unprocessed shot rock can be difficult in some cases. It is our opinion that side slopes in shot rock can be established at 2H to 1V. We do not recommend applying a surface topsoil layer as the relatively free draining nature of the fill will likely cause topsoil to be washed away on surface pop outs during periods of high rain. Care should be taken to place and compact shot rock fill in such a manner that voids are not allowed to form around larger diameter particles. Shot rock placement recommendations are included in Section 5.7.

5.3 Site Drainage

Several major creeks and numerous small drainage features were observed across the project area. Additionally, although frozen during our field reconnaissance, it is likely that the muskegs will be saturated and very soft when thawed.

In general, excavation and backfill work should be closely coordinated such that seepage and surface runoff is not allowed to collect and stand in open trenches for long time periods. The ground surface around excavations should be contoured to drain away from the excavation and the excavation bottoms should be graded to drain to a sump or topographic low.

We recommend that the new road grade, after improvements, should be at least 12 inches above the surrounding ground surface. This is intended to provide vertical separation of the road surface and the surrounding ground for drainage purposes. The surface of the roadway should be crowned and or sloped a minimum of 3 to 4 percent to allow for surface drainage of the driving surface and into ditches.

Drainage ditches should be constructed along the road to control surface water infiltration into the road section and to reduce the effects of seasonal frost. The project area experiences a high volume of rainfall which will saturate the material below the roadway and may cause strength loss. In order to mitigate adverse effects of saturated soils within and around the roadway, we recommend that surface water be intercepted and redirected away from the roadway structural section. Drainage ditches with frequent culverts on the uphill side of the roadway would serve this purpose.

Permanent ditch side slopes should be constructed with 3H to 1V gradients. Ditches in the areas near the sloping muskegs should be constructed wider (5 feet wide, with a flat bottom). Rock lining may be required to maintain the side slopes.

5.4 Roadway Structural Section

Design of the structural section requires consideration of the density of soils, site drainage, frost susceptibility of subgrade soils, load requirements, and grade requirements. We assume that the critical loading on the proposed road are the anticipated loads from heavy equipment during construction. After construction, the road will likely be traveled by lightly loaded vehicular traffic.

We recommend the structural section for the new road consist of a minimum of 6 inches of E-1 surface course over 20 inches of Selected Material Type A structural fill as defined by the Alaska Department of Transportation (ADOT) standard specifications. Gradation requirements are provided in Figure 2, and structural fill should be placed in accordance with the recommendations included in Section 5.7. This section may experience some vertical displacement during freezing and thawing cycles and minor subgrade strength loss during the spring thawing cycle. Careful preparation of the subgrade prior to construction of the structural section will directly correlate with roadway performance. If the organic material (peat within muskegs, moss and surface material within the treed areas, roots, woody material, any other organic-rich soil) is not completely removed beneath the structural section, the performance of the roadway may be negatively impacted which could include, but not be limited to, difficulties supporting construction equipment, increased maintenance costs, strength loss during spring due to thaw weakening, and more frequent grading to remediate differential settlement that may occur over time. In order to reduce these risks, all organic material should be removed beneath the footprint of the proposed roadway and replaced with compacted structural fill.

The performance of the section is controlled by the details of construction and will depend on the quality (gradation characteristics) of the materials used to develop the needed structural section, drainage details, and the extent to which seasonal frost action causes softening of the subgrade during breakup. This section assumes that site improvements will be designed with appropriate drainage to direct surface waters away from the area and not into the structural section. Likewise, the subgrade (native soil or bedrock) surface below the structural section should be sloped such that water drains away from the structural section soils.

5.5 Embankment Settlement

If the new embankments are constructed on top of peat (such as within the muskegs where it is thickest), there will likely be measurable consolidation of the soft, native material which will cause differential settlement. The actual magnitude of settlement of peat is difficult to estimate due to material variability and is dependent on the preloaded degree of consolidation, nature of the peat, and the amount of fill placed over the peat. For rough estimating purposes, the total settlement of new embankments over peat (within the muskegs) can be estimated at 20 to 40 percent of the original peat thickness under the fill. Additional settlement of existing embankments that are increased in height can be estimated at 10 to 30 percent of the original peat thickness. Consolidation will take place over the life of the roadway, but the rate of consolidation will be highest within approximately six months of construction, such that long term differential settlement will be relatively minor. New embankments constructed over compact mineral soil or bedrock are unlikely to experience settlement.

5.6 Geotextile Separation/Reinforcement Fabric

We have included recommendations for incorporation of a geotextile fabric to provide reinforcement and separation purposes between the organic (or silty soil if encountered) and fill material if the organics (within the muskegs) are not removed from beneath the structural section. Geofabric used for this project should consist of a woven geotextile material such as Mirafi RS380i or equivalent. This geofabric layer will increase the stability or strength of the subgrade and should prevent intermixing of the native soils with structural fill thereby maintaining the fill quality and improving fill placement/compaction efficiency. We recommend the following minimum material properties when selecting an equivalent geofabric for this application in the project based on Minimum Average Roll Values (MARV).

Exhibit 5-6: Woven Geotextile

Apparent Opening Size by ASTMD4751	US Sieve 40
Permittivity by ASTM D4491	0.9 sec^{-1}
Flow Rate by ASTM D4491	75 $gal/min/ft^2$
Interaction Coefficient by ASTM D5321	0.9
Tensile Modulus by ASTM D4595	51,000 lbs/ft at 2 percent strain
Factory Seam Strength by ASTM D4355	80 percent strength retained

The manufacturer's recommendations should be used for placement of geofabric. In the absence of manufacturer recommendations, the recommendations below should be followed. To minimize the impact of horizontal unconformities due to seams, seams should be sewn on roll side and end seams. Joining of the geofabric should be in accordance with guidelines presented by the Federal Highway Administration (FHWA), *Geosythetic Design and Construction Guidelines*, *Publication No. FHWA-HI-95-038*, as applicable. End seams should also be staggered by a distance equal to the roll width.

5.7 Structural Fills and Compaction

Structural fill will be needed to construct embankments, in the structural section of the new roadway, and to replace unsuitable soils. Structural fill that is placed in the structural section of the new roadway should be clean, well-graded, granular soil to provide drainage and frost protection. These soils should contain less than about six percent (by weight, based on the minus 3-inch portion) passing the No. 200 sieve. Generally, Selected Material Type A as specified by the ADOT meets these requirements and may be placed in both wet and dry conditions. Selected Material Type B as specified by the ADOT or shot rock can be used to construct embankments below the structural section. Gradation requirements for Selected Type A and B are included as Figure 2.

Soil fills in the new embankment and for the structural section should be placed in lifts not to exceed 10 to 12 inches loose thickness, and compacted to at least 95 percent of the maximum dry density as determined by the Modified Proctor compaction procedure (ASTM D-1557). During soil fill placement, we recommend that large cobbles or boulders with dimensions in excess of 8 inches be removed.

We understand that it is likely that shot rock will be used in the development of embankments during the construction of project. It is our opinion that this may be done as long as several provisions be made in the final design drawings. The greatest risk of instability associated with the use of shot rock in embankment fills is the development of large voids resulting from the use of potentially large, angular cobbles and boulders. If shot rock is to be used in the development of embankments, we recommend that the rock be spread in loose lifts not to exceed 2 feet in depth. Due to the angular nature of shot rock, it will be difficult to test the effectiveness of compaction techniques as the fills are placed. Rock fills should therefore be placed and worked with a blade so that voids caused by larger particles would be minimized. We recommend that maximum particle size be limited to 2 feet in shot rock fill embankments at depths greater than 5 feet below the design grade of the roadway. Between 5 and 2 feet below the final roadway grade, the maximum particle size should be limited to 1-foot. We do not recommend developing structural sections with shot rock.

6 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 conclusions and recommendations contained in this report are based on information provided from the observed site conditions and other conditions described herein. The analyses, conclusions and recommendations contained in this report are based on site conditions as they presently exist. It is assumed that the exploratory hand probes 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 and prior 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 and recommendations 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 to determine if they are consistent with our recommendations. In addition, we should be retained to observe construction, particularly the compaction of structural fill and site excavations, and also to make field measurements of ground displacements and such other field observations as may be necessary.

Unanticipated soil conditions are commonly encountered and cannot fully be determined by merely conducting the surface reconnaissance. 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 attachments in Appendix A *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 signatory at the beginning of this report. We appreciate this opportunity to be of service. Please contact us at (907) 561-2120 with questions or comments concerning the contents of this report.

APPENDIX A: IMPORTANT INFORMATION

Appendix A

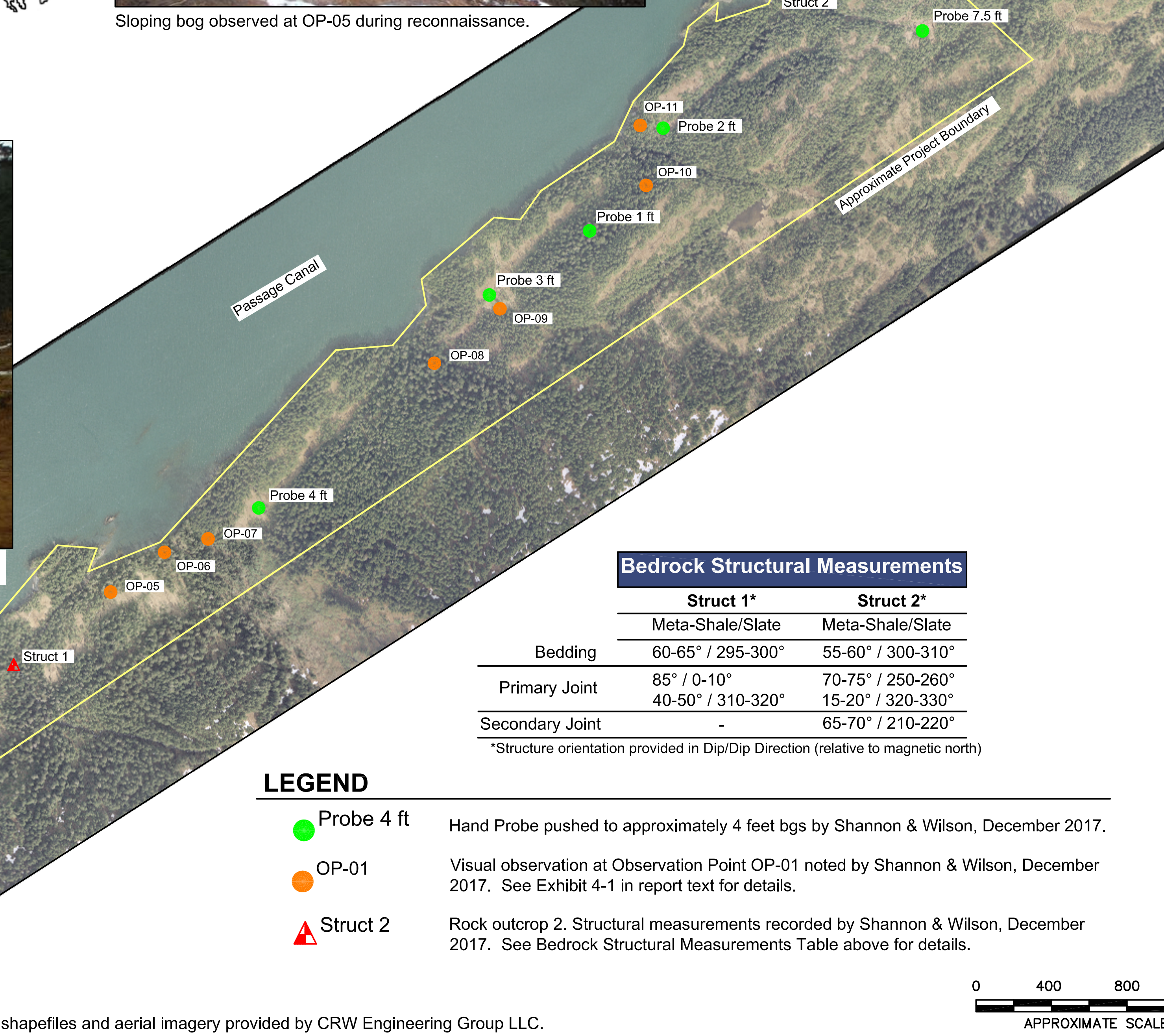
IMPORTANT INFORMATION

About Your Geotechnical/Environmental Report

Sloping bog observed at OP-05 during reconnaissance.

Typical muskeg. Photo taken at probe location near Observation Point OP-09.

Bedrock within creek bed observed and measured at Struct 1 location.



Map adapted from shapefiles and aerial imagery provided by CRW Engineering Group LLC.

Bedrock Structural Measurements

	Struct 1*	Struct 2*
	Meta-Shale/Slate	Meta-Shale/Slate
Bedding	60-65° / 295-300°	55-60° / 300-310°
Primary Joint	85° / 0-10° 40-50° / 310-320°	70-75° / 250-260° 15-20° / 320-330°
Secondary Joint	-	65-70° / 210-220°

*Structure orientation provided in Dip/Dip Direction (relative to magnetic north)

LEGEND

- Probe 4 ft — Hand Probe pushed to approximately 4 feet bgs by Shannon & Wilson, December 2017.
- OP-01 — Visual observation at Observation Point OP-01 noted by Shannon & Wilson, December 2017. See Exhibit 4-1 in report text for details.
- Struct 2 — Rock outcrop 2. Structural measurements recorded by Shannon & Wilson, December 2017. See Bedrock Structural Measurements Table above for details.

N

0 400 800 1,600
APPROXIMATE SCALE IN FEET

Shotgun Cove Road Extension
Whittier, Alaska

SITE PLAN

May 2018 32-1-20071r1

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 1

GRADATION AND DURABILITY REQUIREMENTS

After: Alaska Department of Transportation
Standard Specifications for Highway Construction (2015)

E-1 Surface Course

U.S. STANDARD SIEVE SIZE English	Metric	PERCENT PASSING BY WEIGHT
1 in.	25 mm	100
3/4 in.	19 mm	70 - 100
3/8 in.	9.5 mm	50 - 85
No. 4	4.75 mm	35 - 65
No. 8	2.36 mm	20 - 50
No. 50	0.300 mm	15 - 30
No. 200	0.075 mm	8 - 15

Selected Material Type A

U.S. STANDARD SIEVE SIZE English	Metric	PERCENT PASSING BY WEIGHT
No. 4	4.75 mm	20 - 60
No. 200	0.075 mm	6 Max. on minus 3-in. portion

Aggregate containing no muck, frozen material, roots, sod or other deleterious matter and with a plasticity index not greater than 6 as tested by ATM 204 and ATM 205. Meet the gradation as tested by ATM 304.

Selected Material Type B

U.S. STANDARD SIEVE SIZE English	Metric	PERCENT PASSING BY WEIGHT
No. 200	0.075 mm	10 Max. on minus 3-in. portion

Aggregate containing no muck, frozen material, roots, sod or other deleterious matter and with a plasticity index not greater than 6 as tested by ATM 204 and ATM 205. Meet the gradation as tested by ATM 304.

Shotgun Cove Road Extension
Whittier, Alaska

GRADATION REQUIREMENTS

May 2018 32-1-20071r1

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

FIG. 2

APPENDIX A: IMPORTANT INFORMATION

Appendix A

IMPORTANT INFORMATION

About Your Geotechnical/Environmental Report

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

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 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, Maryland