Part 1 ADDENDUM NO.1

1.1 General

.1 This Addendum is issued prior to tender closing and shall become an integral part of the Tender, Specifications, Drawings and Contract Documents for this project.

.2 In the event of conflicts between the various Contract Documents, the order of precedence shall be as stipulated in the General Conditions of the Contract, except that this Addendum shall take overall precedence.

Part 2 Questions

2.1 If the circled structures have been removed from the site.

The structures have been removed from site

2.2 If the Gravel Pad referenced on the site plan has already been installed (there is no specification for the gravel pad so we have assumed that it is already in place). If a gravel pad is in place, please confirm type, source and availability of gravel in the community.

There will be no gravel pad required the foundation is being modified to be an Adfreeze foundation as per the attached Geotechnical Report Modified foundation to be in addendum No. 2.

2.3 The specifications state that the site work quantities will be provided by the PM. I can't find any quantities on the drawings. There is no contours on the drawings. What do we use for bidding purposes

As we are changing the foundation to and Adfreze we will require less of a gravel base. Use 250 cubic meters of material for bidding purposes. Supply a cost for per cubic meter for placed material.

2.4 Some materials in the specifications are different than listed on the drawings…do we use the specifications for bidding?

Supply locations of conflicting materials so we can review.

2.5 Are all wood products FSC

No the wood products do not have to be FSC

2.6 Sir the mechanical specifications refer to section 01 62 00 for equals to pumps for this project. The specifications do not include this section for equals/alternates for mechanical equipment. I would appreciate if we could be sent the list of equals for all mechanical equipment.

There are no equals or alternates. If you wish to propose equals please submit them for consideration we will review and post equals.

2.7 **Can you tell us the amounts of fill you are requiring for pad and driveways. Also it is mentioned in the drawings that the Triodetic Foundation is by others. Are we to supply the Triodetic Foundation?**

.1 The Triodetic Foundation is to be changed to an Adfreeze Pile Systems. Addendum No 2 will address this issue. See Question 2.3 for amounts of fill.

2.8 **We don't see how it will be possible for anyone to construct this building properly and deliver it for 31 March 2016. We would only be able to meet the last boat of the season with the material. This boat would arrive in Pangnirtung around mid-October. At that point it would be too cold to install the SBS modified vapour barrier and complete the building envelope. If the RCMP is willing to extend the completion date to 31 October 2016 we feel you would receive more competitive pricing and a better product in the end.**

The completion date of the project is now changed to **October 31 2016**

2.9 **Good morning Reid. I need your help. How much High Trim Baseboard is required?**

The amount of high Trim Baseboard that is required is 45M on second floor and 32M on main floor. Contractor to confirm all amount lengths.

2.10 **The Ultra Oil 4 Boilers, are the Direct Vent or Chimney Vent?**

The boilers will be Chimney Vent

Part 3 **Specification**

3.1 **Add Attached Geotech Report to Specification**

3.2 **Section 07 61 00**

.1 Remove Section 2.1.1 Materials

.2 Insert the following.

2.1 Metal Roofing and Accessories

.1 Pre-Finished Sheet Steel roofing conforming to ASTM A446-76 Minimum Sheet thickness 24 Gauge, 80,000 psi (Grade E) steel.

.1 Standard of acceptance CL435 series profile

.2 Ideal Roofing Utility Panel 24 GA

.3 or approved alternate

.2 Ridge, Cap, Gable and Fascia and Trims to be Pre-formed 24 Gauge, 80,000 psi (Grade E) steel. Standard of acceptance. Vic West or approved alternate

.3 Preformed closures to be vinyl or neoprene foam strips matching roof cladding profile compress when installed. Standard of acceptance as recommended by sheet metal roofing manufacturer

.4 Metal building tape to be self-skinning, self-adhesive Tremco or approved alternate

.5 Fasters for attaching all roofing, pre-finished Fascia and trims shall be self-drilling, self-tapping, hex washer head complete with twin seal washer. Fasteners to be carbon steel cadmium plated fasteners to be epoxy panted finish to match color of cladding for pre-finished roof and fascia

.6 Colors to be determined

END OF SECTION

RCMP

Corporate Management Branch
North-West Region

Desktop Geotechnical Study

Type of Document
FINAL

Project Name
Proposed Duplex Building
Pangnirtung, Nunavut

Project Number
OTT-00227289-A0

Prepared By:

exp Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6
Canada

Date Submitted
June 30, 2015

RCMP
Corporate Management Branch
North-West Region

Attention: Mr. Ray Daumler, Project Manager

Desktop Geotechnical Study

Type of Document:
FINAL

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Date Submitted:
June 30, 2015

Legal Notification

This report was prepared by **exp** Services Inc. for the account of **RCMP.**

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. **Exp** Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project.

Executive Summary

Exp Services Inc. (**exp**) has carried out a desktop study of the site of the proposed Duplex Housing Unit (Duplex) located in the Hamlet of Pangnirtung, Nunavut. This work was requested by Mr. Ray Daumler, Project Manager with the RCMP North-West Region, Corporate Management Branch via email on June 15, 2015.

It is proposed to construct an approximately 11 m by 14 m Duplex within the south corner of the current RCMP Compound in Pangnirtung, NU. The work done consisted of a review of the available geotechnical information in the vicinity of the site, determination of the anticipated geotechnical conditions at the site and recommendations for foundation design and construction based on the review of available information.

Review of the available geotechnical information revealed that the surficial soil at the site is likely to be silty fine to medium sand with occasional cobbles and boulders. The sand is expected to extend to depths ranging from 9 m to more than 20 m throughout the community. It is considered feasible to found the proposed RCMP Duplex on Triodetic foundation system (as proposed by the RCMP), piles or granular pad with thermosyphons. The use of piles at the site is recommended by exp and the use of adfreeze piles has commonly been recommended by others throughout the community in the past. However, a review of available satellite imagery from 2009 (Google Earth) indicates that bedrock outcrops are present within approximately 75 m along the west side of the site. Therefore, it is very possible that bedrock will be encountered within the depth to which the piles are to be installed. The piles should be designed according to the recommendations presented herein.

The recommendations of this report are based on a review of reports and documents prepared by third parties. These documents have been accepted at face-value. It has been assumed that qualified geotechnical personnel will conduct a site specific geotechnical investigation to validate the recommendations contained in this report prior to finalizing foundation design.

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1 Introduction

Exp Services Inc. (**exp**) has carried out a desktop study of the site of the proposed Duplex Housing Unit (Duplex) to be located in the Hamlet of Pangnirtung, Nunavut. This work was requested by Mr. Ray Daumler, Project Manager with the RCMP North-West Region, Corporate Management Branch via email on June 15, 2015.

It is proposed to construct an approximately 11 m by 14 m Duplex within the south corner of the current RCMP Compound in Pangnirtung, NU. The purpose of the desk top study was to:

i. Review available geotechnical and geological information in the area.

ii. Determine the anticipated geotechnical conditions at the site.

iii. Provide geotechnical recommendations for foundation design and construction based on the review of available information.

2 Review of Available Information

A review of available information was undertaken. It comprised of the following documents:

1. (AMEC, 2001) Geotechnical Investigation, Proposed Sewage Treatment Plant, Pangnirtung, Nunavut, prepared for Ferguson Smith Clark Engineers and Architects by Amec Earth & Environmental Limited, Yellowknife, NT under Project YX00647, dated August 2001.
2. (AMEC, 2002) Geotechnical Desk Study, Sewage Treatment Plant, West Side, Pangnirtung, NU prepared for Ferguson Smith Clarke Engineers & Architects by Amec Earth & Environmental Limited, Yellowknife, NT under Project XY00647, dated January 30, 2002.
3. (AMEC, 2003) Geotechnical Investigation, Proposed New Health Centre, Pangnirtung, NU, prepared for Government of Nunavut Department of Public Works and Services by Ameck Earth and Environmental Ltd., Yellowknife, NT under Project YX00672, dated January 2003.
4. (EBA, 2007) Materials Sampling, Identification and Testing for Harbour, Pangnirtung, NU prepared for Fisheries and Oceans Canada by EBA Engineering Consultants Ltd., Yellwoknife, NT under Project 1700230, dated January 2007.
5. (**exp**, 2013) Desktop Geotechnical Study, Proposed Addition to Waste Water Treatment Plant, Pangnirtung, NU prepared for Government of Nunavut Community and Government Services by exp Services Inc., Ottawa, ON under Project OTT-00204430-A0, dated March 22, 2013.
6. Available satellite imagery (Google Earth, 2013).

2.1 Geotechnical Investigation, Proposed Sewage Treatment Plant, Pangnirtung, NU (Amec, 2001)

The site investigated for construction of the Sewage Treatment Plant is located about 2.3 km northeast of the RCMP Duplex site and approximately the same distance from the coastline. The geotechnical investigation comprised the drilling of four boreholes to depths ranging from 8.6 m to 9.4 m. It revealed the Sewage Treatment Plant site contains 1.3 m to 1.5 m of sand fill containing traces of gravel and silt. The fill in Borehole No. 3 was underlain by a layer of ice whereas a layer of silt extending to 3 m depth was encountered in Borehole No. 4. The fill in Boreholes Nos. 1 and 2, the ice in Borehole No. 3 and the silt in Borehole No. 4 were underlain by silty fine to medium sand with occasional boulders which extended to the entire depth investigated (up to 9.4 m below grade). Bedrock was not encountered at the borehole locations.

Eight soil samples analysed for salinity from 4 m to 9 m depth indicated salinity values of 4.0 ppt to 11.7 ppt.

The report recommended that the proposed structure should be founded on adfreeze piles. It assumed an active layer thickness of 2 m. The report also indicated that spread footing founded on permanently frozen ground were feasible. It recommended an allowable bearing capacity of 150 kPa for such footings.

2.2 Geotechnical Desk Top Study, Proposed Sewage Treatment Plant, Pangnirtung, NU (AMEC, 2002)

This desk top study was undertaken to further evaluate a second site for the Sewage Treatment Plant, located approximately 30 m west of the site outlined above and investigated by boreholes in 2001 (AMEC, 2001). The main purpose of the study was to evaluate the potential to found the structure on a slab-on-grade with thermosyphon cooling system in the gravel pad beneath. The report concluded that a slab-on-grade with a thermosyphon cooling system in the gravel pad is feasible within the community at that time. The report provided recommendations regarding thickness of the gravel pad and insulation, compaction requirements, etc.

2.3 Geotechnical Investigation, Proposed New Health Center, Pangnirtung, NU (AMEC, 2003)

The investigation evaluated two potential sites within the community for the construction of a new Health Center. Site 1 is located about 1.2 km east of the RCMP Duplex site and further inland. Site 2 is located about 1.8 km northeast of the RCMP Duplex site and approximately the same distance from the coastline. The investigation comprised of drilling eight boreholes at Site 1 to depths ranging from 1.8 m to 9.0 m and eight boreholes at Site 2 to depths ranging from 6.3 m to 9.0 m. It revealed both sites are overlain by sand with varying amounts of silt and clay through the entire depth explored. Bedrock was not encountered at any of the borehole locations and is deeper than 9.0 m below grade at both of these sites.

Two soil samples analysed for salinity from 8.5 m and 9 m depth at Site 1 indicated salinity values less than 1 ppt. Two soil samples analysed for salinity from 3.5 m and 9.0 m depth at Site 2 indicated salinity values of 14 ppt and 3 ppt, respectively.

The report recommended that the proposed structure should be founded on adfreeze piles. It assumed an active layer thickness of 2.5 m.

2.4 Material Sampling, Identification and Testing for Harbour, Pangnirtung, NU (EBA, 2003)

The site investigated during this evaluation is the local harbour, located about 0.7 km northeast of the RCMP Duplex site. The geotechnical investigation of the harbour comprised the drilling of twenty-seven boreholes during low tide to depths ranging from 4.6 m to 9.1 m. The boreholes were located along the shoreline of the harbour and extending out to the mouth of the harbour. The investigation revealed that the overburden throughout the harbour comprises of predominantly fine-grained sand with silt contents varying from trace to silty and gravel contents ranging from trace to some. The bedrock surface throughout the tidal flats along the southwest side of the harbour (near the local Hamlet Office) was observed to be either at the surface (shoreline) or relatively shallow (within 5 m depth). The bedrock surface was observed to drop off sharply toward the north and northeast, with boreholes throughout these areas not encountering bedrock to the depth explored.

The purpose of the harbour geotechnical investigation was to evaluate depth to bedrock and presence of permafrost throughout the tidal flats to support the design of long-term marine infrastructure at the harbour. No foundation recommendations were provided.

2.5 Desktop Geotechnical Study, Proposed Addition to Waste Water Treatment Plant, Pangnirtung, NU (exp, 2013)

The desktop study evaluated the Water Treatment Plant site, which is located about 2.2 km northeast of the RCMP Duplex site. It was understood that the existing Water Treatment Plant is founded on a gravel pad approximately 1.5 m to 2 m thick with a flat loop thermosyphon system. The desktop study was to evaluate potential foundation types for the addition and was to specifically evaluate the potential of founding the addition on top of a gravel pad with a flat loop thermosyphon system. Therefore, exp retained the services of Naviq Consulting Inc. (NCI) to assist with the study and carry out detailed geothermal analyses to evaluate the potential use of thermosyphon foundation for the proposed addition.

The review of available geotechnical information revealed that the surficial soil at the site is likely to be silty fine to medium sand with occasional cobbles and boulders. The sand is expected to extend to at least 9 m depth. Based on the review and analyses by NCI, it was determined that the addition could be founded on top of a 1.6 m thick gravel pad with insulation and thermosyphon system in place to protect the permafrost beneath. As an alternative, the use of adfreeze piles was also recommended for the site.

3 Site Geology

Pangnirtung is located on the southeast side of Pangnirtung Fjord. The fjord is about 30 km long and is a U-shaped valley that was created by the action of glacial ice that flowed from the highlands to the northeast.

The area is underlain by bedrock that consists of metamorphic gneiss of Precambrian Age. The bedrock is heavily jointed and faulted. The bedrock outcrops on the upper slopes of the fjord. Bedrock also outcrops along the shoreline north of the built-up portion of the community.

In the vicinity of the site, the bedrock is overlain by glacial till which consists of occasional cobbles and boulders in a dense matrix of silty sand. The maximum thickness of the glacial till is not known. However, the authors have reported that test holes drilled in the community did not encounter bedrock at depths up to 20 m.

4 Site and Soil Description

The site of the RCMP Duplex is located about 500 m northwest of the Pangnirtung Airport terminal building. The proposed Duplex is to be founded within the southwest corner of the RCMP Compound and is bounded by roads to the west and south, and developed relatively flat land with buildings to the east and north.

As indicated previously, this area of the community is expected to be underlain by silty fine to medium sand with occasional boulders which is expected to extend to a depth of 9 m to more than 20 m. However, a review of available satellite imagery from 2009 (Google Earth) indicates that bedrock outcrops are present within approximately 75 m west, 175 m north and 550 m east of the site and this portion of the community appears to be positioned atop a large bedrock terrace. Therefore, it is probable that bedrock will be encountered within the anticipated depth of piling activities as discussed within our recommendations below.

4.1 Climate

Pangnirtung is located on the southeast side of Pangnirtung Fjord within the Cumberland Peninsula of Baffin Island at approximately 66° 09' N and 65° 45' W longitude.

The mean annual air temperature was computed by Naviq Consulting Inc. based on a review of environment Canada average monthly air temperatures from 1995 to 2011. The mean annual air temperature (MAAT) was calculated by Naviq to be -7°C for the recent period of 2009 through 2011, although the long term MAAT is likely somewhat colder, such as -8°C. It is noted that full year ground temperatures were recorded by LeBlanc, Olden Barges, Sladon & Mate (2010) for this location in Pangnirtung. These data support a mean annual ground temperature of between -3°C and -7°C.

4.2 Permafrost

Pangnirtung lies within the zone of continuous permafrost. The depth of seasonal thaw has been reported to vary from 0.5 m to 1.5 m. The exception to this is the Duval River Channel and in well-drained granular deposits, in which areas the depth of thaw can range up to approximately 2.5 m.

4.3 Soil Pore Water Salinity

Salinity depresses the freezing and thawing temperature below 0°C, i.e. saline soils freeze and thaw at temperatures colder than 0°C and this depressed temperature must be used to assess the freeze-thaw behaviour of the soils.

Salinity values in the Pangnirtung area have been reported to vary from low to very high (up to 208 ppt) at low moisture contents. However, information reviewed by AMEC indicates that the salinity values near the coastline can range from low to moderate salinity. Low salinity is considered to be less than about 5 ppt and moderate salinity is considered to be between 5 and 15 ppt.

5 Foundation Recommendations

It is understood that the use of a Triodetic Space Frame foundation is being considered at the site. Based on a review of available geotechnical information and anticipated geotechnical conditions in the area, this option is technically feasible from a geotechnical perspective. However, it is noted that the technology is proprietary and the manufacturer should be consulted regarding the system design, potential usage and installation specifications. It is our understanding that the system has load restrictions and may be primarily intended for more light weight structures (i.e. single family dwellings). We are not aware if the system is capable of supporting the proposed RCMP Duplex.

Alternatively, pile foundations are typically used to support Duplex Housing Units throughout Nunavut and the Northwest Territories. The anticipated geotechnical conditions would support the use of pile foundations at the site. As noted above, bedrock outcrops can be observed within approximately 75 m west, 175 m north and 550 m east of the site and this portion of the community appears to be positioned atop a large bedrock terrace. However, we have no geotechnical information within this area of the community and without boreholes drilled throughout or near the proposed building footprint we cannot determine if the bedrock surface will be within the depth of pile installation or not. For this reason, we have provided recommendations below to support the design and installation of adfreeze piles, with an allowance to accommodate bedrock should it be encountered at the time of piling. Site specific investigation would be required to confirm depth to bedrock and determine if piles socketed into sound bedrock using grout backfill are feasible. This could potentially reduce the required embedment depth for the piles; however, the costs of the geotechnical investigation may offset any potential savings to the project.

It is noted that although the use of slab-on-grade with thermosyphon foundation is expected to be technically feasible at the site, we are not providing recommendations to support the use of such a system given the type of building being proposed. It is expected that the design and installation of this type of system will be very costly compared to pile foundation or possibly the Triodetic system. The use of such a system is typically restricted to buildings requiring heavy duty slabs (i.e. fire stations, water treatment plants, etc.), which cannot be easily raised off the ground as outlined below.

5.1 Adfreeze Piles

Adfreeze piles carry the applied loads through an adfreeze bond between the pile and the sand slurry backfill/overburden. The adfreeze bond is used to resist both compression and uplift loads. The design length of an adfreeze pile is based on limiting the anticipated creep movement of the adfreeze bond to within normally acceptable limits (i.e. 25 mm of total settlement over 25 years). The piles must be installed deep enough such that the adfreeze bond provided can resist the applied compression loads from the structure, as well as the anticipated frost jacking forces that occur when the active layer freezes back each year. For the site under consideration (assumed active layer of 2.5 m) and based on the adfreeze bond strengths presented below, the adfreeze piles would have to be installed to a minimum depth of

7.5 m or 7.0 m below finish grade for 114 mm and 141 mm O.D. piles, respectively in order to resist the anticipated frost jacking forces. The structural designer will need to determine if deeper piles are required to resist the anticipated structural loads applied in compression.

As noted above, it is possible that the bedrock surface will be encountered within the minimum depth required for the adfreeze piles. It must be appreciated that the minimum depth to resist frost jacking forces will need to be provided even if a large portion of each pile is installed below the bedrock surface. In order to provide the required uplift resistance with a shorter socket length into sound bedrock the piles would need be to backfilled between the pile and the sound bedrock with properly prepared Sika 100 Arctic grout (or equivalent) instead of the sand slurry outlined below. Additional recommendations on the design and installation of rock socket piles can be provided upon request. However, without site specific information we recommend design proceed based on adfreeze pile design at this time.

Where sound bedrock is determined to be present within the minimum depth to resist frost jacking forces, the piles can be founded on the sound bedrock and designed to resist compression loads based on the adfreeze bond strength in combination with an end bearing resistance. The design end bearing resistance for piles founded on sound bedrock can be taken as 5 MPa over the cross-sectional area of the steel pile tip. This is a factored geotechnical resistance at ultimate limit states (ULS). It is noted that piles founded on sound bedrock will have negligible settlement, whereas adfreeze piles founded in the overburden will experience ongoing creep movement as outlined above. Therefore, it is important that all piles either be founded on bedrock or founded on at least 1 m of overburden above the bedrock surface to limit differential settlement.

For this reason, it is recommended that the piling activities begin by drilling the boreholes for pile installation at the four corners of the building to determine if bedrock is present within the design length of the adfreeze piles throughout the entire building footprint. If bedrock is encountered at all four of these locations, installation should proceed based on the piles being adfreeze piles founded on bedrock. If bedrock is not encountered in all four boreholes, it is recommended that the boreholes in which bedrock was encountered should be continued below the bedrock surface such that the installed pile tip is at least 1 m above the bedrock surface (over-drill by 1 m below the adfreeze pile design length). Where over-drilling of the bedrock is required, it is recommended that the borehole be backfilled with sand slurry and the slurry be allowed to freeze back enough to enable installation of the pile to the design depth and assure that at least 1 m of sand slurry is present between the pile tip and the bedrock.

Based on results of the investigation and a review of the available information, the following parameters were used in computing the load carrying capacity of the adfreeze piles.

- Active layer thicknesses = 2.5 m
- Mean annual ground temperature = - 7°C
- Allowance for ground global warming = 1.5°C over 25 years
- Design mean annual ground temperature (including allowance for global warming) = -5.5°C
- Pore-water salinity = 15 ppt

- Pile outside diameter (O.D.) = 114 mm or 141 mm
- Allowable long term settlement of piles = 25 mm in 25 years.
- Factor of safety = 2 (design life was doubled)

The values in Table 1 below were computed for the allowable shaft stress for adfreeze piles.

Table 1 – Allowable Shaft Stress for Adfreeze Piles

Depth of Pile below final grade (m)	Allowable Adfreeze Strength 114 mm O.D. Pile (kPa)	Allowable Adfreeze Strength 141 mm O.D. Pile (kPa)
0 – 2 m	0	0
Below 2 m	50	45

The upper portion of the piles within the design 2.5 m active zone should be covered with heavy grease and wrapped with polyethylene sheets coated with heavy grease to minimize seasonal uplift forces. Even with this precaution the piles should be designed to resist anticipated frost jacking forces and provided the minimum embedment as recommended above.

It is noted that the end bearing resistance given above is dependent on proper seating of the pile on the bedrock. Therefore, the piles should be set on the bedrock surface and vibrated with the drill hammer to assure proper seat is obtained.

For lateral load design purposes, the upper 2.5 m of the piles should also be considered as unsupported.

It is essential that a good bond is developed between the pile and the frozen sand slurry. Round hollow structural section (HSS) steel is recommended as the pile material. The steel piles below 2.5 m active zone must be properly cleaned. They must be free of mill scale, paint, lacquer, oil, grease, dirt and excessive rust to ensure development of a good bond.

The piles should be installed open ended in pre-drilled oversized holes. It is recommended that the borehole diameter be at least 50 mm larger than the outside diameter of the pile. In order to obtain proper backfill around a pile, the hole should be partially backfilled with saline free sand and fresh water slurry prior to installing the pile. The pile should then be placed in the hole and vibrated down to the design depth while adding more sand and fresh water around the pile diameter. Careful measurements should be taken during pile installation to assure that the above-noted 1 m buffer is provided between the pile tip and the bottom of the borehole if bedrock is encountered in a portion of the boreholes.

The interior of the piles should be filled with dry low saline sand to the final ground elevation to prevent air circulation inside the pile.

It is noted that freeze back around the piles may take 2-3 months before full pile capacity can develop. It is recommended that a string of thermistors should be installed at various depths along the surface of

select piles to monitor the freeze back. The piles should not be fully loaded until such time that the ground temperature readings indicate stabilized frozen conditions around the piles.

The base of the heated structures should be at least 600 mm above the final grade to permit air circulation under the building. It is necessary to maintain this clear space to ensure that heat from the structure will not degrade the permafrost and reduce the pile capacity. The air space should not be hoarded and should not be used for storage. Failure to comply with this recommendation could result in poor performance of the adfreeze pile foundation.

This design of the adfreeze piles currently assumes an active layer thickness of 2.5 m. It is noted that the worst effects of climate warming on pile capacities may not be realized for 15 to 20 years in the future. The active layer is expected to deepen with time and may impact the capacity of the adfreeze piles. Rather than abandon the current pile design strategy, it is recommended that the pile design be adapted to address potential climate warming effects. Installation of ground temperature monitoring stations at several locations in and around the building footprint and thermistor beads on select piles are recommended so that local ground temperatures and the ground temperature at the pile-soil interface can be monitored in the future. If the ground temperatures are found to be warming and the active layer deepening then remedial actions can be initiated before pile capacities are compromised and building distress results. Potential mitigation strategies may include the placement of rigid insulation, the installation of thermosyphons, the installation of adjustable pile caps, etc.

The piling contractor should be advised that sloughing of soils during pile-hole drilling may occur. The contractor should have casing on hand during pile-hole drilling and use such casing as necessary to control sloughing. Furthermore, seasonal groundwater flow, particularly within the active layer may occur. Groundwater flow into pile holes should be avoided as such water may negatively impact the performance of the adfreeze piles. The use of casings or other measures may be required to address this issue.

6 Seismic Site Classification

The desktop study has revealed that the site is expected to be underlain by silty fine to medium sand with occasional boulders which is expected to extend to a depth of at least 9 m. The maximum active layer thickness was determined at 2.5 m below the soil will be permanently frozen.

On this basis, the site has been classified as Class “C” for Seismic Site Response in accordance with Table 4.1.8.4 of the National Building Code, 2005.

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7 Design Review

It is recommended that a geotechnical review of the foundation drawings and specifications should be undertaken by this office to ensure that recommendations made in the desk top study have been properly interpreted.

8 Foundation Monitoring

It is recommended that installation of the foundations at the site should be monitored by qualified geotechnical personnel. If the building is founded on piles, monitoring would comprise supervision of installation of the piles to ensure that they are installed to the specified depth, the sand slurry is made with saline free sand and fresh water, and that the upper 2.0 m of the piles are properly greased and wrapped with polyethylene sheeting to minimize the affect of adfreeze forces on the piles.

9 Closure

The findings and recommendations presented herein are based on published reports, air photographs and maps of the Pangnirtung area. Reports and documents prepared by third parties have been used and accepted at face-value. It has been assumed that qualified geotechnical personnel will obtain site-specific soil conditions for foundation design confirmation. Although no environmental concerns are noted, this does not mean that such issues that no such issues are present. If there is any reason to believe that any environmental issues are present at this site, an appropriate environmental assessment should be performed.

This report is not intended to comment either directly or indirectly on the original design of the any reviewed reports.

This preliminary report has been prepared for the exclusive use of the RCMP for the specific application described herein. It has been prepared in accordance with generally accepted permafrost and foundation engineering practices. No other warranty, expressed or implied, is made.

It is recommended that a geotechnical investigation of the site be conducted as soon as practical to assess the engineering character of the overlying soils and the depth to bedrock. Once this investigation work is completed the foundation design for the structure can be finalized. (i.e. foundation on adfreeze or end bearing adfreeze piles or rock socket piles).

Figures

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scale: AS SHOWN	CLIENT: RCMP, NORTH-WEST REGION	project no.: OTT-00227289-A0
date: JUNE 2015	GEOTECHNICAL DESKTOP STUDY RCMP Duplex, Pangnirtung, NU	
drawn by: J.R.	TITLE: Community Location Plan	FIG 1

Filename: r:\22000\227000\227289-a0 pangnirtuq, nu\227289-a0.dwg
Last Saved: 6/29/2015 11:20:14 AM
Last Plotted: 6/29/2015 11:21:24 AM Plotted by: revellj Pen Table:: trow standard, july 01, 2004.ctb

Filename: r:\220000\227000\227289-a0 pangnirtung, nu\227289-a0.dwg
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Figure 2

project no.	OTT-00227289-A0
drawn by	J.REVELL
date	JUNE 2015
scale	1:7500

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CLIENT: RCMP - NORTHWEST REGION

GEOTECHNICAL DESKTOP STUDY
RCMP Duplex, Pangnirtung, NU

TITLE: Site and Previous Investigation Location Plan

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