Contract ID: SC-INF01-1469
Our File #: 18-304

Sanayut Consulting Professional Engineers Corporation

ENR Office

Foundation Pile Condition Assessment

PREPARED BY:

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Covering Letter

August 15, 2018

Government of the Northwest Territories
Department of Infrastructure
Projects Division
3rd floor, GNWT Multiuse Building
Bag Service #1
106 Veterans Way
Inuvik, NT X0E 0T0

Attn: Joao Nuncio

Dear Sir:

Regarding: **ENR Office Foundation Pile Condition Assessment**
Location: **Lot 4 Block 91, Inuvik, NT**

Sanayut Consulting Professional Engineers Corporation (**Sanayut**) is pleased to provide the following report regarding the foundation pile condition assessment for the above-referenced building.

This report has been prepared under my direct supervision.

We appreciate the opportunity to work with you. Please feel free to contact us if you have any questions regarding the enclosed report.

Sincerely,
Sanayut Consulting Professional Engineers Corporation

Mark Hasegawa, P.Eng.
Enclosures
MH/cms

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EXECUTIVE SUMMARY

An assessment of the pile foundation of the ENR Office building located at Lot 4 Block 91, Inuvik, was conducted on June 19, 2018.

The wooden pile foundation that formerly supported the bunkhouse building had been removed and replaced with 14 steel piles, located around the exterior of the building, supporting steel beams which span from pile to pile under the building. The topography of the ground under and around the building varies and there is a low spot under the building. During the pile inspection the location and condition of each pile was observed and documented. An assessment of the extent of pile deterioration was conducted on each pile by exposing buried portions of each pile and observing conditions. In addition, an evaluation of existing overland drainage patterns was conducted. The drainage appears to flow from the northeast down towards the southwest. There was some standing water observed in the depression beneath the building. Although this is the case, the water is not in a location where it has major impact to piles. As such, its impact is considered minor, and although it is always good practice to have positive drainage away from structures, in this case it appears to have little impact on the pile function.

The results of this report indicate that the steel piles are in relatively good condition with minor rust and flaking on the surface. Based on this analysis the foundation appears to be performing as designed.

1. EXISTING CONDITIONS

The ENR office building rests on fourteen, 12-inch diameter steel piles located outside the building footprint which support 9 steel beams that span from pile to pile underneath the building. The dimensions and pile spacings are shown on **Figure 1**, Appendix A and further described in subsequent sections.

2. METHODOLOGY

The following section includes a summary of assessment methodology for the existing pile conditions as documented in the previous section.

2.1 Project Objectives

The project objectives stated in the TOR are as follows:

"The GNWT requires consultant engineering services to complete a foundation investigation for wooden pile foundations for Beaufort Delta and Sahtu buildings and to determine remedial work required which may include the change of foundation type as part of a final report."

2.2 Project Implementation

The following is the action taken to fulfill the scope of work set forth in the TOR.

2.2.1 Data Acquisition

No design or design or construction documentation of the building such as as-builts, building plans or date of construction could be identified. In addition, an inquiry was made with the Town of Inuvik for topographical data for the area and general topographic information, but none was available.

2.2.2 Code Review and References

Code and reference reviews were conducted of key codes and regulations and include the following applicable Acts, Standards and Guidelines:

1. *Good Building Practice for Northern Facilities*, Government of the Northwest Territories
2. National Building Code 2015
3. Town of Inuvik Zoning Bylaw & Engineering Standards
4. *GNWT Deteriorated Untreated Wood Piles: Cause, Detection and Correction* document
5. Pile remediation contractors.

Since the ENR office foundation had already been repaired and there are no wood piles, no costing or recommendations with respect to repairs were made.

2.2.3 Site Visit

A site visit and inspection of each pile was conducted on June 19, 2018. The inspection for each pile included:

- Visual observation of the site and existing overland drainage patterns observed. Site drainage was observed to determine if it was potentially impacting the piles and possibly enhancing pile deterioration.
- Observations and measurements as to the general building footprint, pile types, sizes, and dimensions between piles (this information is summarized on **Figure 1)**
- Excavation around each pile and down to a maximum depth of 500mm below ground surface
- Photographs were also taken and a selection of photos illustrating findings is attached (refer to Appendix B-Photographs).

Steel Piles

- Visual inspection of pile condition
- Excavation around each pile up to 500mm below ground to evaluate pile condition
- Scratch test with screwdriver to determine depth of rust penetration if any is present

3. SUMMARY OF OBSERVATIONS

The results of this analysis are summarized in **Figure 1** (Appendix A) and **Table 1** below and the pile inventory form in Appendix B. The piles have been classified based on the structural criteria set forth in the previous section. Key parameters evaluated included:

- Diameter of pile
- Depth of deterioration
- Vertical extent of deterioration
- Existence of drainage issues or standing water.
- Remaining pile diameter with solid material

The results of the site inspection showed that piles A1, A4, B1, B7 had minimal surface rust with no penetration while the rest of the steel piles had flaking rust. There was some standing water in the depression under the building (refer to attached photographs in Appendix C) but none observed at or around the piles. The overland drainage appears to flow from the northeast down towards the southwest.

Table 1. Summary of Pile Observations

	ENR Office	Recommendations
Total Piles	**14**	
< 10% damage		
10-25% damage		
25-50% damage		
>50% damage		
Replaced with steel piles	14	none
Not inspected		

4. REPAIR/REPLACEMENT RECOMMENDATIONS

Based on this analysis the existing steel piles are in good working condition any observed rust or deterioration was minimal and not of concern. No repair or replacement action is recommended at this time.

5. COST ANALYSIS

No cost analysis was performed as no repair or replacement actions are recommended at this time.

6. SUMMARY AND CONCLUSIONS

An assessment of the pile foundations of the ENR office located at the address was conducted on June 19, 2018. A site map is shown on **Figure 1**, Appendix A.

The ENR office building rests on fourteen, 12-inch diameter exterior steel piles located outside the building footprint which support seven (7) steel beams that span from pile to pile underneath the building (refer to **Figure 1**). The ground around each pile was excavated to a maximum depth of 500mm below ground ensuring that each pile was sufficiently exposed for inspection. A visual inspection as well as a “scratch” test was performed for each steel pile to assess the extent of impact below the ground surface. In addition, an evaluation of drainage patterns was conducted. The drainage flows from the northeast to the southwest. There was standing water observed in the depression beneath the building and the overland drainage appears to flow from the northeast down towards the southwest. The existing ground topography around the office building varies which contributes to surface runoff ponding beneath the building.

Regarding the standing water was observed below the building, it is good construction and design practice to prevent standing water near structures. However, modifying the drainage at the site is difficult due to the nature of the surrounding area. In this case, the ponding does not directly affect the piles. As such, there is no immediate need, from a structural perspective, to drain the impacted areas or revise the grading around or under the building.

The results of the site inspection showed that piles A1, A4, B1, B7 had minimal surface rust with no penetration while the rest of the steel piles had flaking rust below ground level. Based on this analysis the foundation appears to be performing as designed and no repairs or replacement actions are recommended at this time.

REFERENCES

1. *Untreated Submerged Timber Pile Foundations: Part 1: Understanding Biodegradation and Compressive Strength* Dec, 2013 By Giuliana Zelada-Tumialan, P.E., William Konicki, P.E., Philip Westover, P.E. and Milan Vatovec, Ph.D., P.E. In *Articles, Structural Forensics.*

2. *Untreated Submerged Timber Pile Foundations: Part 2 – Estimating Remaining Service Life* Jan, 2014 By Giuliana Zelada-Tumialan, P.E., William Konicki, P.E., Philip Westover, P.E. and Milan Vatovec, Ph.D., P.E. In *Articles, Structural Forensics.*

3. *Deteriorated Untreated Wood Piles: Cause, Detection and Correction*. By Technical Support Services, Asset Management Division, Public Works and Services, Government of the NWT http://www.pws.gov.nt.ca

APPENDIX A

PILE INVENTORY FORM & FIGURE

Pile Inventory Form

BUILDING ASSET NUMBER:
BUILIDNG NAME: ENR OFFICE, SHELL LAKE, NT
TOTAL NUMBER OF PILES: 14
DATE INSPECTED: 19-Jun-18

WATER PONDING UNDER BUILDING: Yes
YEAR OF PILE INSTALLATION: Unknown
ADDITION: No
SKIRTING AROUND BUILDING (Y/N): No

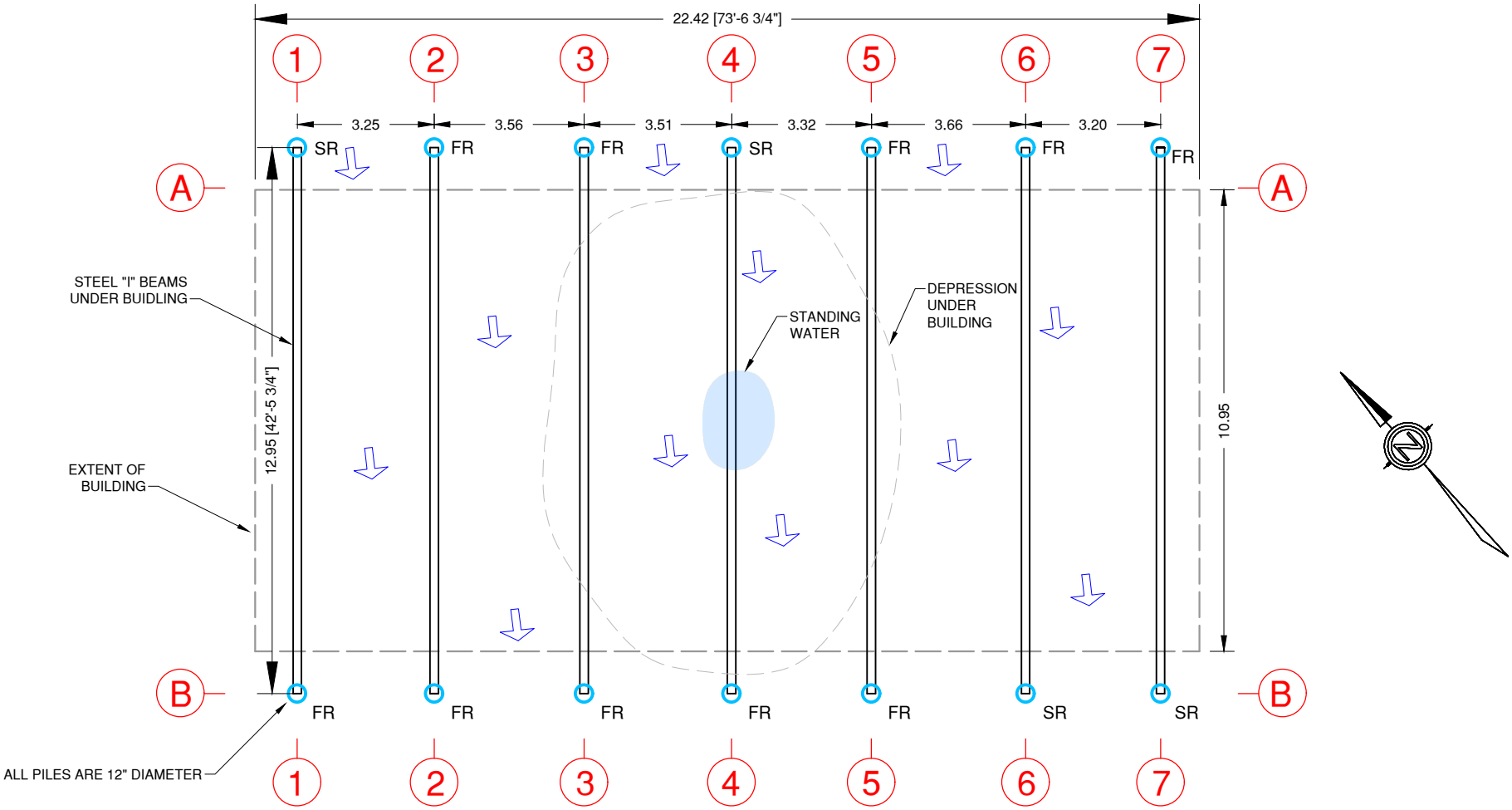
WEATHER CONDITIONS: Overcast with scattered showers

TEMPERATURE: 8ºC

PILE TYPE	
W	WOOD
S	STEEL
C	CONCRETE

	Definition - Pile Condition	Range of Rot	Count in each range	Percentage in each Range
A	Little or no rot detected, No repair req'd	0 - 10%	N/A	N/A
B	Rotted, requires monitoring	10 - 25%	N/A	N/A
C	Rotted, requires repair	25 - 50%	N/A	N/A
D	Rotted, requires immediate blocking	50 - 100%	N/A	N/A

No.	Pile Type	Pile Currently Blocked	Previously Repaired	Depth of Rot Detected	Pile Diameter	Pile Circumference	Original Area (Cross section)	Cross sectional Area of Rot	Percent Rot (Cross section)	Moisture	Pile Condition		Date Pile Blocked	Date Pile Repaired	Date Boron Treatment	Comments/Remarks
	W, S, C	Y/N	Y/N	inches	inches	inches	square inches	square inches	%	%	Def	Date				
A1	S	N	Y		12							2018-06-19				Surface rust
A2	S	N	Y		12							2018-06-19				Surface rust/some flaking
A3	S	N	Y		12							2018-06-19				Surface rust/some flaking
A4	S	N	Y		12							2018-06-19				Surface rust
A5	S	N	Y		12							2018-06-19				Surface rust/some flaking
A6	S	N	Y		12							2018-06-19				Surface rust/some flaking
A7	S	N	Y		12							2018-06-19				Surface rust/some flaking
B1	S	N	Y		12							2018-06-19				Surface rust/some flaking
B2	S	N	Y		12							2018-06-19				Surface rust/some flaking
B3	S	N	Y		12							2018-06-19				Surface rust/some flaking
B4	S	N	Y		12							2018-06-19				Surface rust/some flaking
B5	S	N	Y		12							2018-06-19				Surface rust/some flaking
B6	S	N	Y		12							2018-06-19				Surface rust/some flaking
B7	S	N	Y		12							2018-06-19				Surface rust/some flaking



LEGEND

- STEEL PILE
- A — PILE GRID ALIGNMENT
- 1 — PILE NUMBER
- NR — NO RUST
- SR — SURFACE RUST
- FR — FLAKING RUST
- APPARENT OVERLAND DRAINAGE DIRECTION

NOTE:

- BUILDING DIMENSIONS SHOWN ARE APPROXIMATE AND FOR REFERENCE ONLY
- DIMENSIONS SHOWN ARE IN METERS (m) UNLESS OTHERWISE NOTED

DRAWING STATUS: FOR REPORT

#	REVISION	DATE	BY

NOTES

CLIENT: GOVERNMENT OF NWT

PROJECT TITLE: PILE ASSESSMENT
JUNE 19, 2018

DRAWING TITLE: ENR OFFICE
INUVIK, NT

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INSPECTED BY	MO
DRAWN	MO
CHECKED	MH
APPROVED	MH
SCALE	NTS

PROJECT NUMBER	18-304
VERSION NUMBER	IFA1-1
DATE DRAWN	JULY 4, 2018
SHEET NUMBER	FIG. 1

APPENDIX B

PHOTOGRAPHS


A7


B1


B2


B3


B4


B5

Southeast corner of office building

Southwest corner of office building

Southwest corner of building. Cutoff wood piles visible

Low spot under middle of building with standing water