Exploratory soil and permafrost investigations, Norman Wells, N.W.T., 1954

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DIVISION OF BUILDING RESEARCH

EXPLORATORY SOIL AND PERMAFROST INVESTIGATIONS, NORMAN WELLS, N.W.T., 1954

by

G. H. Johnston

Report No. 68

of the

Division of Building Research

Ottawa
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PREFACE

During September, 1954 the permafrost research group of the Division carried out exploratory soil and permafrost investigations at [illegible]. The work was undertaken at the request of Mr. McMillan, Superintendent of the [illegible] Refinery, Imperial Oil Limited, to determine soil and permafrost conditions at two proposed development sites. The information in this report is based on results obtained from one bore hole drilled at each of the sites. It is expected that, after the Northern Research Laboratory of the Division is more permanently established at [illegible], more extensive investigations of the soil and permafrost conditions will be undertaken.

Ottawa,
July 20, 1955.

Robert F. Legget,
Director.

EXPLORATORY SOIL AND PERMAFROST INVESTIGATIONS, NORMAN WELLS, N.W.T., 1954

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During September, 1954, at the request of Mr. MacMillan, Superintendent, Norman Wells Refinery, one bore hole was drilled at each of two proposed development sites in the Imperial Oil Limited camp area to supply information on the soil and permafrost conditions (Fig. 1). However, general statements of soil and permafrost conditions at Norman Wells cannot be made since only one hole was drilled at each site. The results are therefore reported as logs of the bore holes with test results where samples were obtained.

Drilling

Soil samples were obtained with a special drill rig, the Concore Type E5-48 manufactured by the Frank L. Howard Engineering Company. Basically it is a concrete sampler which has been modified for drilling in permafrost. A 5-foot NXL double tube core barrel gave 2-inch diameter undisturbed samples. For some near-surface sampling a 6-inch diameter post hole auger was used.

The first hole (NWB-7) was bored in a low area which had been disturbed and some fill material placed on it. Many stones were encountered during drilling which caused much vibration of the rig and consequently little or no core was recovered. A description of the soils in this area is therefore derived from notes made while drilling and one or two tests made on the core recovered.

The second hole was drilled in a relatively higher area. The willow undergrush and moss cover had been cleared off during the summer but otherwise the area was undisturbed. Frozen ground occurred about 6 feet below the ground surface and good core recovery (75 per cent) was obtained in these soils.

Sampling and Testing

Field descriptions were recorded of the various soils as they were encountered and sufficient samples were taken to carry out pertinent soil classification tests. Moisture content samples were taken wherever frozen ground was cored. Samples for grain size determinations, Atterberg Limit, and Specific Gravity tests were taken where a change in soil type was apparent. All soil testing was carried out at the Soil Mechanics Laboratory of the Division of Building Research in Ottawa.

Summary of Findings

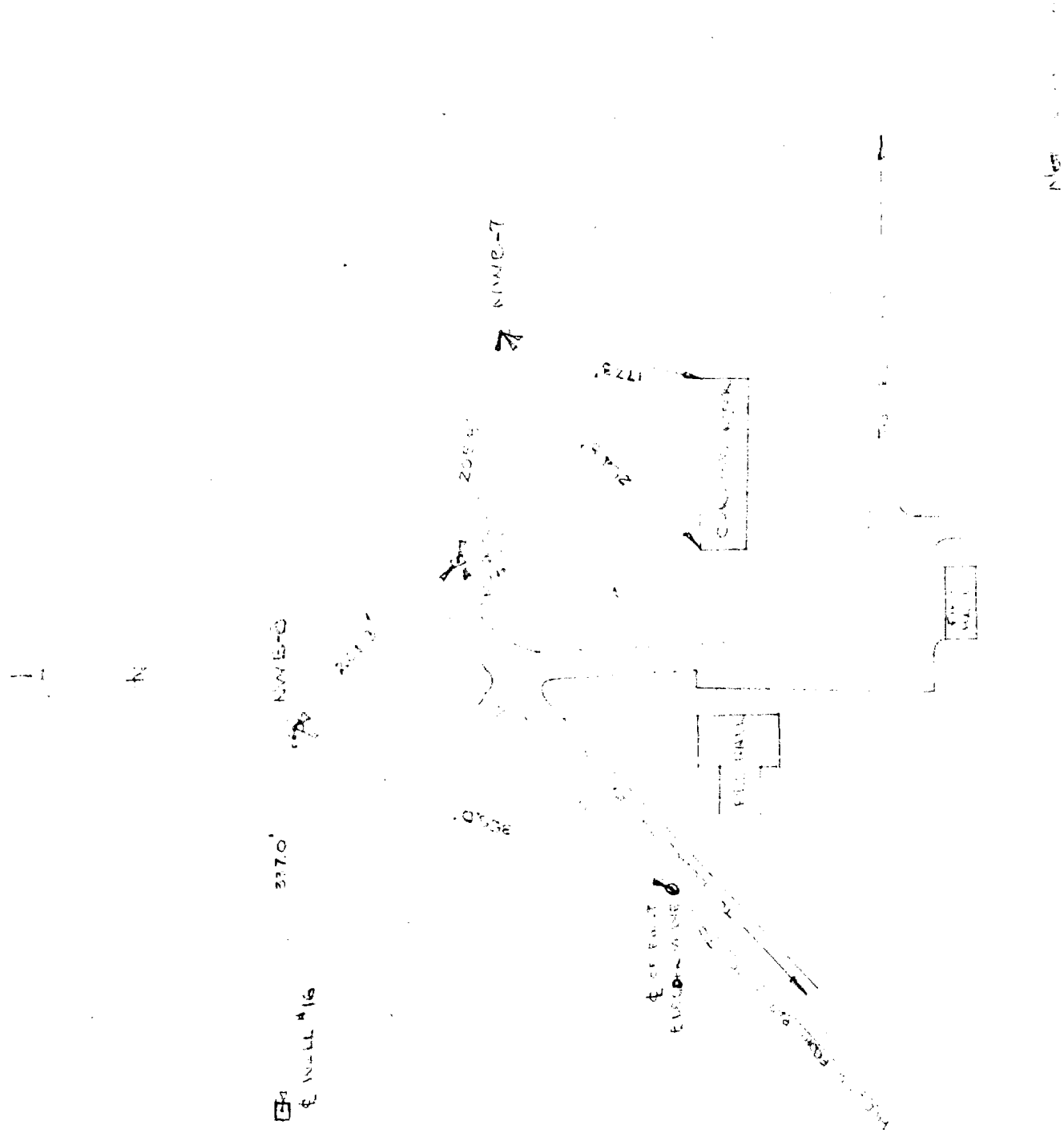
The soils at the two sites are predominantly silts with varying amounts of clay, fine sand, stones and organic material. At the first location, where many stones were encountered, the depth to bedrock, which is a friable shale appeared to be about 15 feet. At the second site, the hard strata were encountered at approximately 26 feet and were overlain by fine-grained materials, silts and fine sands.

It was impossible to determine the depth to frozen ground at the first site, if it occurred in the depth drilled. At the second location, however, frozen ground was found to be about 6 feet below the ground surface. Moisture content determinations show the soil to be at or near its liquid limit value. Thus, if the frozen material were to thaw, it would be transformed into a "liquid" or "slurry".

The low values of the Atterberg Limit tests point out the predominantly silty character of the soil, known locally as "glacial till", "lean clay" or "clayey silt".

The soils at these sites are typical of those found in the Norman Wells area and thus some care should be taken in erecting structures on them. Should construction be contemplated at these two locations then adequate drainage should be provided for in the area. In order that foundations will have good bearing, a substantial, compacted gravel mat should be laid some time in advance (one or two summers) of actual construction.

Details of the two bore holes and soil test results are given in the summary sheets.



TITLE					DRAWING No.
DRAWN:	CHECKED:	APPROVED:	DATE:	SCALE:	BR 853

TEST HOLE LOG & SOIL TESTING RESULTS

HOLE NO. NWE - 7

GRAVEL | SAND | SILT | CLAY | ORGANIC

DEPTH IN FEET

SOIL PROFILE	DESCRIPTION of SOIL	SAMPLE NO.	DEPTH FT.	SOIL TYPE	ICE SEGR. TYPE	MOISTURE CONTENT %	GRAIN SIZE - % CLAY <0.002 mm	SILT .002 to .06 mm	SAND .06 to 1-2 mm.	GRAVEL >1-2 mm	PLASTICITY L.L. / P.I.	FIELD UNIT WEIGHT LBS. / FT³	SPECIFIC GRAVITY	SOIL TEMP. °F.		
0	Little core recovered, description of soil taken from drilling notes.															
2																
4	Silty sandy fill material with many stones ranging in diameter from ¼" to 2".															
6																
8																
10																
12	Dense but friable blue grey silty clay till material with some stones. A layer of light brown sand containing an odd large stone occurred at 15'.		11		Unfrozen		23	39	38		29.2/9.1					
14																
16			15					18	80	2						
18	Dense but friable blue grey till material with many stones ranging in diameter from ¼" to 2".															
20	Bottom of hole - 20' - 8".															
22																

PROJECT: I.O.L. Investigations
SITE: Norman Wells
LOCATION: North of Curling Rink
DEPTH: 20' - 8"

BORING BY: P.R.S. DATE: 10/9/54
TESTING BY: P.R.S. DATE: 3/55
PLOTTED BY: G.H.J. DATE: 27/4/55
CHECKED BY: DATE:

ORGANIC TERRAIN:

REMARKS: Many stones - poor core recovery

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TEST HOLE LOG & SOIL TESTING RESULTS

HOLE NO. NWB - 8

GRAVEL | SAND | SILT | CLAY | ORGANIC

DEPTH IN FEET

SOIL PROFILE	DESCRIPTION of SOIL	SAMPLE NO.	DEPTH FT.	SOIL TYPE	ICE SEGR. TYPE	MOISTURE CONTENT %	GRAIN SIZE - % CLAY <0.002mm	SILT .002 to .06 mm.	SAND .06 to 1.2 mm.	GRAVEL >1.2 mm.	PLASTICITY L.L. / P.I.	FIELD UNIT WEIGHT LBS./FT³	SPECIFIC GRAVITY	SOIL TEMP. °F.
0	Light brown fine sand with odd patch of silty material.													
2														
4	Grey silt with much black organic material, some small stones and a little sand.		5	ML(Pt)	Unfrozen		24	58	18		26.8/6.6			
6			6	"	"		29	66	5		40.9/10.5			
8			8.5	"	DE f	41.8								
			9	"	"	52.7								
			9.5	"	"		25	66	9		32.0/8.4		2.76	
10			10.5	"	"	47.0								
			11	"	"	34.1								
			11.5	"	"		21	57	22		31.7/9.3			
12			12	"	"	31.0	27	57	16		29.6/8.9			
			13.5	"	BW	34.1								
			14	"	"	30.1								
14			14.5	"	"		23	71	6		35.0/11.7		2.76	
			15	"	"	27.6								
	As above but with many small stones.		16	"	"	26.1								
16			16.5	"	"		22	70	8		32.0/8.8			
			18.5	"	"	29.0								
18			19.5	"	"	28.1								
			20.5	"	"	27.9								
20			21	SM	"	21.6								
								21	52	27				
22	Silty sand with many stones ranging in diameter from ¼" to 1".		21.5	"	"	21.1								
24														
			26	"	Unfrozen			31	19	50				
26														
	Bottom of hole - 27' - 1".													
28														

PROJECT: I.O.L. Investigations
SITE: Norman Wells
LOCATION: Proposed Tennis Court
DEPTH: 27' - 1"

BORING BY: P.R.S. DATE: 13/9/54
TESTING BY: P.R.S. DATE: 3/55
PLOTTED BY: G.H.J. DATE: 27/4/55
CHECKED BY: _____ DATE: _____

ORGANIC TERRAIN: _____
REMARKS: _____

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