FUNDY Engineering ☎ 877.635.1566 fundy@fundyeng.com www.fundyeng.com

Canadian Coast Guard
c/o Aaron Slaney, P. Eng.
Newfoundland & Labrador Region
P.O. Box 5667
St John's, NL.
A1C 5X1

Job #12254
December 13, 2016

RE: GEOTECHNICAL INSPECTION
Proud Rd., Red Head, Saint John, N.B.

Dear Mr. Slaney,

Further to your request and the accepted scope of work, we have visited the above mentioned site on December 8th, 2016 to complete a Geotechnical Investigation for the proposed installation of a 34m tower. The test pits were located by Hughes Surveys in the area of the tower base and outlying guy wire attachment locations. Test pits were excavated to identify the underlying soils and bedrock depths to aid in the design of the new tower.

The test pits were excavated with a 6 ton track excavator, supplied by Mike Cunningham Excavation Ltd., under the supervision of Andy MacVey, P. Eng. of Fundy Engineering. Four test pits were excavated into soils, with the excavations all taken to the surface of the underlying Reddish Brown Conglomerate Bedrock. Test pit logs and a location plan which identifies both the surface elevation and the bedrock elevation are appended to this letter report. Bedrock elevations vary between 0.9 m to 0.250m below ground surface.

The soils identified in the test pit excavations were all deemed to be Loose to Compact Reddish to Dark Brown Silty Sand and Gravel and some rubble rock in Test Pit #3. Additional information and elevations are included on the appended Test Pit Logs.

Though no bedrock was examined, other than the excavated surface, the work completed in 1993 which included the coring of the rock in close proximity to this site, can be relied upon. A copy of this report is appended to this report. Bedrock descriptions and Tower recommendations discussed in the, Discussions and Recommendations of that report, may be relied upon for tower foundation design.

This letter covers materials inspected on the noted dates and does not extend to additional materials or construction outside of the areas noted in our inspection record, without an amending letter. No assessments concerning surrounding soil conditions, groundwater or drainage have been expressed or implied. Should you have any questions or require additional information please contact the undersigned at your convenience via telephone at 506.674.9410 or by email at andy.macvey@fundyeng.com .

Sincerely,
Fundy Engineering & Consulting Ltd.

13/12/16
Date

Andrew MacVey, P. Eng.
Geotechnical Engineer

FUNDY Engineering

27 Wellington Row
P.O. Box 6626
Saint John, NB
E2L 4S1

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fundy@fundyeng.com
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Serving Our Clients' Needs First

PROJECT NO: 12254	DESIGNED BY: AM
PLOT SCALE: 1:250	DRAWN BY: RTH
DATE: (yy/mm/dd) 16/9/14	ADDENDUM NO:

PROJECT NAME:
GEOTECHNICAL INVESTIGATION
PROUD ROAD SAINT JOHN, NB

DRAWING TITLE:
TEST PIT LOCATION PLAN

REVISION:

SHEET NO:
C-1.1

FUNDY ENGINEERING SYMBOLS AND TERMS
Borehole, Test Pit, and Monitoring Well Logs

SOIL DESCRIPTION

Behavioural properties (i.e. plasticity, permeability) take precedence over particle gradation in describing soils.

Terminology describing soil structure:

Desiccated.....having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured..... having cracks, and hence a blocky structure
Varved..... .....composed of regular alternating layers of silt and clay
Stratified.....composed of alternating layers of different soil types, e.g. silt and sand or silt and clay
Well Graded.....having wide range in grain sizes and substantial amounts of all intermediate particle sizes
Uniformly Graded.....predominantly of one grain size

Terminology used for describing soil strata based upon the proportion of individual particle sizes present:

Trace, or occasional.....less than 10%
Some.....10-20%
Adjective (e.g. silty or sandy).....20-35%
And (e.g. silt or sand.....35-50%

The standard terminology to describe cohesionless soils includes the relative density, as determined by laboratory test or by the Standard Penetration Test 'N' - value: the number of blows of 140 pound (64kg) hammer falling 30 inches (50.8mm) O.D. split spoon sampler one foot (305mm) into the soil.

RELATIVE DENSITY	N' VALUE	RELATIVE DENSITY %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

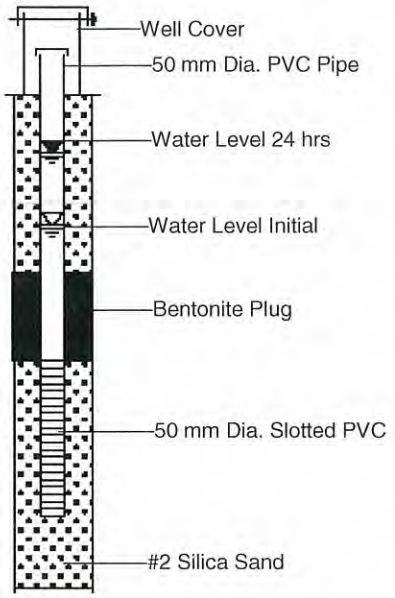
The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer test, unconfined compression tests, or occasionally by standard penetration tests.

CONSISTENCY	UNDRAINED SHEAR STRENGTH		'N' VALUE
	kips/sq.ft.	kPa	
Very Soft	<0.25	<12.5	<2
Soft	0.25-0.5	12.5-25	2-4
Firm	0.5-1.0	25-50	4-8
Stiff	1.0-2.0	50-100	8-15
Very Stiff	2.0-4.0	100-200	15-30
Hard	>4.0	>200	>30

SOILS GRAPHIC LEGEND

Clay
Silt
Sand
Gravel
Boulders & Cobbles
Asphalt
Topsoil & Root Mat
Till
Peat & Organic Silts
Fill

MONITORING WELL SCHEMATIC



BEDROCK GRAPHIC LEGEND

Sandstone
Limestone
Mudstone
Shale
Granite/Igneous
Metamorphic

SAMPLER SYMBOLS

Standard Penetration Test / Split Spoon
Rock Core
Auger / Grab

LABORATORY TESTS

MC	Moisture Content	P	Field Permeability	CD	Consolidation Drained Triaxial
SG	Specific Gravity	PF	Permeability Falling Head	CU	Consolidation Undrained Triaxial
HA	Hydrometer Analysis	PC	Permeability Constant Head	UU	Unconsolidated Undrained Triaxial
SA	Sieve Analysis	PR	Proctor	DS	Direct Shear

BEDROCK DESCRIPTION

The description of bedrock is based on the rock quality designation (RQD).

The classification is based on a modified core recovery percentage in which all pieces of sound core over 100mm long are expressed as a percentage of total recovery. The small pieces are considered to be due to close shearing, jointing, faulting, or weathering in the rock mass and are not counted. In most cases RQD is measured on NXL core.

RQD	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

FUNDY Engineering

TEST PIT LOG
No. TP 1

PROJECT: Geotechnical Investigation

CLIENT: Canadian Coast Guard **PROJECT NO.:** 12254

PROJECT LOCATION: Red Head Mountain, Saint John

DIGGING CONTRACTOR: Mike Cunningham Excavation **ELEVATION:** 142.57m

LOGGED BY: Andy MacVey **CHECKED BY:** Andy MacVey

DIGGING METHOD: Track-Mounted Excavator **DATE:** 12/8/2016

DEPTH TO - WATER> INITIAL: ▽ _____ **AFTER 24 HOURS:** ▼ _____ **CAVING>** C _____

Depth (meters)	Depth (feet)	Description	Graphic	Groundwater	Sample Type	Sample No.	Remarks
0	0	Sod over Reddish-Brown Silty Sand					
0.1							
	0.5						
0.2							
0.3	1	1.0 Dark Brown Silty Sand and Gravel					
0.4							
	1.5						
0.5							
0.6	2						
0.7							
	2.5						
0.8							
0.9	3	3.0 Bedrock (Elevation 141.66m)					

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

FUNDY Engineering

TEST PIT LOG
No. TP 2

PROJECT: Geotechnical Investigation

CLIENT: Canadian Coast Guard **PROJECT NO.:** 12254

PROJECT LOCATION: Red Head Mountain, Saint John

DIGGING CONTRACTOR: Mike Cunningham Excavation **ELEVATION:** 141.76m

LOGGED BY: Andy MacVey **CHECKED BY:** Andy MacVey

DIGGING METHOD: Track-Mounted Excavator **DATE:** 12/8/2016

DEPTH TO - WATER> INITIAL: ▽ _____ **AFTER 24 HOURS:** ▼ _____ **CAVING>** C _____

Depth (meters)	Depth (feet)	Description	Graphic	Groundwater	Sample Type	Sample No.	Remarks
0	0	Sod over Reddish-Brown Silty Sand					
0.1							
	0.5						
0.2							
0.3	1	1.0 Reddish-Brown Clayey Sand					
0.4							
	1.5						
0.5							
		1.84 Bedrock (Elevation 141.20m)					
0.6	2						

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

FUNDY Engineering

TEST PIT LOG
No. TP 3

PROJECT: Geotechnical Investigation

CLIENT: Canadian Coast Guard **PROJECT NO.:** 12254

PROJECT LOCATION: Red Head Mountain, Saint John

DIGGING CONTRACTOR: Mike Cunningham Excavation **ELEVATION:** 143.76m

LOGGED BY: Andy MacVey **CHECKED BY:** Andy MacVey

DIGGING METHOD: Track-Mounted Excavator **DATE:** 12/8/2016

DEPTH TO - WATER> INITIAL: ▽ _____ **AFTER 24 HOURS:** ▼ _____ **CAVING>** C _____

Depth (meters)	Depth (feet)	Description	Graphic	Groundwater	Sample Type	Sample No.	Remarks
0	0	Fractured Rock with Rubble and Silty Sand					
0.1							
	0.5						
0.2		.66 Bedrock (Elevation 143.55m)					
0.3	1						

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

FUNDY Engineering

TEST PIT LOG
No. TP 4

PROJECT: Geotechnical Investigation
CLIENT: Canadian Coast Guard **PROJECT NO.:** 12254
PROJECT LOCATION: Red Head Mountain, Saint John
DIGGING CONTRACTOR: Mike Cunningham Excavation **ELEVATION:** 143.22m
LOGGED BY: Andy MacVey **CHECKED BY:** Andy MacVey
DIGGING METHOD: Track-Mounted Excavator **DATE:** 12/8/2016
DEPTH TO - WATER> INITIAL: ▽ _____ **AFTER 24 HOURS:** ▼ _____ **CAVING>** C _____

Depth (meters)	Depth (feet)	Description	Graphic	Groundwater	Sample Type	Sample No.	Remarks
0	0	Sod over Reddish-Brown Silty Sand					
0.1							
	0.5						
0.2							
0.3	1	1.0 Reddish-Brown Clayey Sand					
0.4							
	1.5						
0.5							
0.6	2	2.00 Bedrock (Elevation 142.61m)					

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

GEOTECHNICAL INVESTIGATION
COMMUNICATIONS TOWER
RED HEAD MOUNTAIN
SAINT JOHN, N.B.

JUNE 1993

File: 93532

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GEOTECHNICAL INVESTIGATION
COMMUNICATIONS TOWER
RED HEAD MOUNTAIN
SAINT JOHN, N.B.

FUNDY ENGINEERING & CONSULTING LTD.

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P.O. BOX 6626
SAINT JOHN, N.B. E2L 4S1

506-635-1566
FAX: 506-635-0206

Eric O'Blenis
Telecom Engineering Workshop
Canadian Coast Guard
11A Acadia Street
Dartmouth, N.S.
B2Y 2N1

93/06/15
93532

RE: GEOTECHNICAL INVESTIGATION, COMMUNICATIONS TOWER RED HEAD MOUNTAIN, SAINT JOHN, N.B.

Dear Mr. O'Blenis:

Further to your request of 93/05/31, Fundy Engineering & Consulting Ltd. has carried out a geotechnical investigation for a proposed free standing communications tower. The purpose of the work was to obtain information on soil and bedrock conditions for the proposed structure. This report has been prepared specifically for the above project and contains our findings and general recommendations for the foundations.

SITE AND SOIL CONDITIONS

The proposed tower is to be located to the south or east of the existing control building. The relief in the tower area is a slope down from south to north with a grade change of approximately 0.2 meters across the tower area. Bedrock outcrops at various locations on and near the site.

PROCEDURE

The field investigation consisted of performing three boreholes, the locations of which were determined by the undersigned and are shown on the attached Location Plan. (532S-1).

The boreholes were performed with a CME 55 geotechnical drill rig. The field work was carried out

under the direct supervision of Fundy Engineering & Consulting Ltd. on 93/06/03. All boreholes were terminated in Bedrock. The boreholes were put down to depths ranging from 3.3 to 4.12 meters.

During the performance of the field investigation, samples were obtained from each significant stratum encountered. All samples recovered were placed in moisture proof containers or wooden core boxes and returned to our Saint John laboratory for classification and analysis. Unless otherwise advised, the samples will be discarded 180 days following the submission of this report.

SOIL PROFILE

Two soil stratum were encountered in the boreholes. The soil conditions may be summarized as Topsoil or fill over Bedrock. In Borehole 1 one meter of compact brown Sand and Gravel Fill was encountered. In Boreholes 2 and 3 a thin layer of Topsoil was encountered over the Bedrock. Details of the soil and bedrock conditions maybe found on the attached borehole logs.

BEDROCK

Bedrock was encountered in boreholes 1 to 3 at depths of 3.3 to 4.12 meters. The Bedrock encountered, a reddish brown Conglomerate, was typical of that encountered in this area and belongs to the Quaco formation. RQD'S for the bedrock range from 15 near the surface to 84 near the bottom of the boreholes. It is therefore considered to be fractured to moderately jointed.

DISCUSSIONS AND RECOMMENDATIONS

Proposed Development

It is proposed to construct a communications tower on the site. The tower will be a 150' free standing structure. It is our understanding that the structure will have both positive and negative loads. General comments on foundation design are outlined below.

Tower Foundations

All footings will be founded on undisturbed in situ Bedrock. Footings on insitu Bedrock may be designed with an allowable bearing pressure of 4.0 MPa. Total and differential settlements under the proposed loading will be in the elastic range.

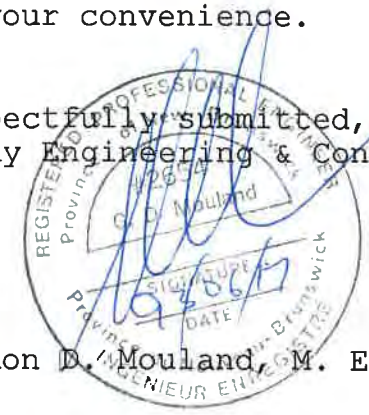
When locating tower foundations care should be taken to ensure that the zone of influence of the anchorage system does not over lap existing anchors or proposed anchors without making allowances in design. The allowable bond for grout and the Bedrock encountered at the site is 1.05 MPa. This utilizes a factor of safety of 2. When details of the proposed loads are available, we would be pleased to provide more detailed design for the anchorage system.

The recommendations made in this report are in accordance with our present understanding of the project. We request that we be permitted to review our recommendations when your drawings and specifications are complete.

A soil investigation is a random sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, we require that we be notified to permit re-assessment of our recommendations.

I trust the above information meets your present requirements. If you have any questions, please contact me at your convenience.

Respectfully submitted,
Fundy Engineering & Consulting Ltd.



Gordon D. Mouland, M. Eng., P. Eng.

SYMBOLS AND TERMS USED ON THE BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Behavioural properties (i.e. plasticity, permeability) take precedence over particle gradation in describing soils.

Terminology describing soil structure:

Desiccated	-	having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure
Varved	-	composed of regular alternating layers of silt and clay
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay
Well Graded	-	having wide range in grain sizes and substantial amounts of all intermediate particle sizes.
Uniformly Graded	-	predominantly of one grain size.

Terminology used for describing soil strata based upon the proportion of individual particle sizes present:

Trace, or occasional	less than 10%
Some	10-20%
Adjective (e.g. silty or sandy)	20-35%
And (e.g. silt and sand)	35-50%

The standard terminology to describe cohesionless soils includes the relative density, as determined by laboratory test or by the Standard Penetration Test 'N' - value: the number of blows of 140 pound (64kg) hammer falling 30 inches (760mm), required to drive a 2 inch (50.8mm) O.D. split spoon sampler one foot (305mm) into the soil.

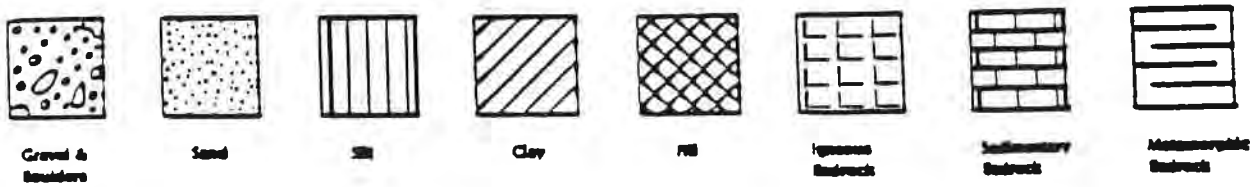
Relative Density	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer tests, unconfined compression tests, or occasionally by standard penetration tests.

Consistency	Undrained Shear Strength kips/sq.ft.	Undrained Shear Strength kPa	'N' Value
Very Soft	<0.25	<12.5	<2
Soft	0.25-0.5	12.5-25	2-4
Firm	0.5-1.0	25-50	4-8
Stiff	1.0-2.0	50-100	8-15
Very Stiff	2.0-4.0	100-200	15-30
Hard	>4.0	>200	>30

SYMBOLS AND TERMS CONTINUED

STRATA PLOT



WATER LEVEL MEASUREMENT

SAMPLES

SS.... Split spoon sample (obtained by performing the standard penetration test)
ST.... Shelby tube or thin wall tube
PS.... Piston sample
BS.... Bulk sample
WS.... Wash sample
RC.... Rock core
AXT, BXL, etc....
Rock core samples obtained with the use of standard diamond drilling bits.

OTHER TESTS

G..... Specific gravity
H..... Hydrometer analysis
S..... Sieve analysis
γ.... Unit weight
C..... Consolidation
CD.... Consolidated drained triaxial
CU.... Consolidated undrained triaxial with pore pressure measurements
UU.... Unconsolidated undrained triaxial
DS.... Direct shear
P..... Field permeability

ROCK DESCRIPTION

The description of bedrock is based on the rock quality designation (RQD).

The classification is based on a modified core recovery percentage in which all pieces of sound core over 100mm long are counted as recovery. The smaller pieces are considered to be due to close shearing, jointing, faulting, or weathering in the rock mass and are not counted. In most cases RQD is run on NXL core; however, it can be used on different core sizes if the bulk of the fractures caused by drilling stresses are easily distinguishable from normal insitu fractures.

RQD	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured.

BOREHOLE RECORD

FUNDY ENGINEERING & CONSULTING LTD

CLIENT: CANADIAN COAST GUARD
LOCATION: RED HEAD MOUNTAIN SAINT JOHN N.B.
DATE: 93-06-03 WATER LEVEL: ———
BOREHOLE NO: 1
JOB NUMBER: 93-532
CASING SIZE: NX
DATUM: ASSUMED

UNDRAINED SHEAR STRENGTH
WATER CONTENT & ATTERBERG LIMITS
DYNAMIC PENETRATION TEST
STANDARD PENETATIONTEST, N-VALUE
10 20 30 40 50 60 70 80 90

DEPTH (FT.)	DEPTH (M)	ELEVATION	SOIL DESCRIPTION	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	RECOVERY	RQD
		9.57						
			SAND AND GRAVEL FILL.					
	1	8.50	BEDROCK: FRACTURED TO MODERATELY CONGLOMERATE.		NX	1	100	15
5	2				NX	2	100	52
10	3				NX	3	100	76
	4	5.45	EOBH @ 4.12					
15	5							
20	6							
	7							
25	8							

BOREHOLE RECORD

FUNDY ENGINEERING & CONSULTING LTD

CLIENT: CANADIAN COAST GUARD
BOREHOLE NO: 2
LOCATION: RED HEAD MOUNTAIN SAINT JOHN N.B.
JOB NUMBER: 93-532
CASING SIZE: NX
DATE: 93-06-03
WATER LEVEL:
DATUM: ASSUMED

DEPTH (FT.)	DEPTH (M)	ELEVATION	SOIL DESCRIPTION	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	RECOVERY	RQD
		9.35						
		9.20	TOPSOIL					
			BEDROCK: MODERATELY JOINTED CONGLOMERATE.		NX	1	100	75
5	1							
	2				NX	2	100	74
10	3				NX	3	100	80
		6.05	EOBH @ 3.30					
	4							
15								
	5							
20	6							
	7							
25								
	8							

UNDRAINED SHEAR STRENGTH

WATER CONTENT & ATTERBERG LIMITS V_P V V_L

DYNAMIC PENETRATION TEST X

STANDARD PENETATIONTEST, N-VALUE ●

10 20 30 40 50 60 70 80 90

BOREHOLE RECORD

FUNDY ENGINEERING & CONSULTING LTD

CLIENT: CANADIAN COAST GUARD
LOCATION: RED HEAD MOUNTAIN SAINT JOHN N.B.
DATE: 93-06-03 WATER LEVEL:
BOREHOLE NO: 3
JOB NUMBER: 93-532
CASING SIZE: NX
DATUM: ASSUMED

DEPTH (FT.)	DEPTH (M)	ELEVATION	SOIL DESCRIPTION	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	RECOVERY	RQD
		9.11						
			TOPSOIL					
		8.81	BEDROCK: MODERATELY JOINTED CONGLOMERATE.					
5	1				NX	1	100	75
	2				NX	2	100	84
10	3							
		5.70	EOBH @ 3.41					
	4							
15								
	5							
20	6							
	7							
25								
	8							

UNDRAINED SHEAR STRENGTH

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST
STANDARD PENETATIONTEST, N-VALUE X ●

10 20 30 40 50 60 70 80 90

SUPPLY AND SERVICES CANADA

GEOTECHNICAL INVESTIGATION FOR A PROPOSED SELF SUPPORTED COMMUNICATIONS TOWER

ESCUMINAC, NB

PROJECT NO. 7089

REPORT TO

SUPPLY AND SERVICES CANADA

ON

GEOTECHNICAL INVESTIGATION FOR A PROPOSED SELF SUPPORTED COMMUNICATIONS TOWER

ESCUMINAC, NB

UNIC Consultants (1986) Limited
880 Riordon Drive
Bathurst, NB
E2A 4B3

Tel:(506)546-3303
Fax:(506)546-6378

July 10, 1995

TABLE OF CONTENTS

GEOTECHNICAL INVESTIGATION FOR
A PROPOSED SELF SUPPORTED
COMMUNICATIONS TOWER

ESCUMINAC, NB

1.0 INTRODUCTION

UNIC Consultants (1986) Limited, acting at the request of Ms. Jackie Smith of Supply and Services Canada, has conducted a geotechnical investigation for a proposed self supported communications tower at Escuminac, NB. The purpose of the work was to obtain information on the soil, bedrock and groundwater conditions necessary for the design of the tower foundation and related earthwork.

This report has been prepared specifically and solely for the project which is described above; it contains all of our findings, and includes recommendations for the design and construction of the foundations and associated earthworks.

2.0 SITE DESCRIPTION

The site of the proposed tower is located at the Canadian Coast Guard Lighthouse station on Escuminac Point, Northumberland County, NB. The site is generally flat and covered with gravel and a few small trees. Existing developments on the site include several small buildings, a guyed tower and a helicopter landing pad. A concrete slab is nearby the borehole location.

3.0 FIELD PROCEDURES

The field work was performed on June 27, 1995. One borehole was advanced using track mounted equipment. The location of the borehole was selected and established by Mr. Peter Oblenis, P. Eng. of the Canadian Coast Guard. The borehole was drilled at the base of the proposed tower. The test location is shown on Figure 7089-1 in the Appendix.

The borehole was advanced to a depth of 7.6 m below the existing grade. Continuous soil samples were obtained and Standard Penetration Test N-values, blows per 300 mm of penetration, were recorded for each soil sample. Bedrock was sampled with an NQ (50 mm diameter) core barrel. The soil samples were stored in moisture tight containers and returned to our laboratory in Bathurst, along with the bedrock cores, for testing and classification.

4.0 SOIL AND BEDROCK PROFILE

The strata observed at the test locations are described below and in detail on the Borehole and Auger Probe Records in the Appendix.

4.1 Brown Sand and Gravel

A layer of compact to very dense brown sand and gravel with a trace of silt and clay was observed at the surface of Borehole BH95-101. The thickness of the layer was 600 mm. The results of grain size distribution analyses of the sand and gravel are shown on the Gradation Curve Sheet in the Appendix.

4.2 Weathered Brown Sandstone Bedrock

Fractured brown sandstone bedrock was observed directly beneath the brown sand and gravel. The depth to bedrock was 600 mm below the existing grade.

The Rock Quality Designation (RQD) was determined for both the upper 4.5 m and lower 2.4 m of rock; 8% and 36% respectively. The RQD for the entire sandstone bedrock intersection was 17%.

The unconfined compressive strengths (UCS) of the bedrock cores were estimated using the Point Load Method. The point loads were multiplied by a factor of 20 to obtain the unconfined compressive strengths. The UCS of the upper bedrock ranged between 3 MPa and 55 MPa and averaged 34 MPa. The UCS of the lower section of sandstone ranged between 15 MPa and 69 MPa and averaged 56 MPa.

5.0 GROUNDWATER

Groundwater was not observed at the test location. Groundwater levels may fluctuate seasonally or following periods of heavy precipitation; therefore groundwater conditions at the time of construction may differ from those encountered during this investigation.

6.0 DISCUSSION AND RECOMMENDATIONS

It is understood that the proposed structure will be a 40 m, self supported communications tower. The tower will be a steel construction and will stand on three legs.

The sand and gravel and any organics or otherwise deleterious materials should be removed from within the areas of the tower support legs. Any loose sandstone bedrock should be removed from the excavations.

Footings for the tower legs can be placed on the fractured sandstone bedrock. An allowable, unfactored bearing pressure of 500 kPa can be used for design purposes.

The legs of the towers should be anchored to resist uplift. For the design of the anchors, the uplift capacity can be taken as the lesser of: (i) the contact area (socket or anchor hole shaft surface) times an allowable bond stress of 200 kPa or (ii) the weight of rock in a 60 degree cone; for calculation of the resisting mass, a density of 2.5 g/cm^3 can be used for the sandstone bedrock. A factor of safety of at least 1.25 should be applied to the mass.

7.0 CLOSING

The recommendations provided in this report are based upon our understanding of your project at this time. A soils investigation is a random sampling of a site. Should any conditions at the site be encountered which are different from those observed at the test locations, we request that we be notified so that we may reassess our recommendations.

This report has been prepared by Mr. Gordon Sheppard, P. Eng. and reviewed by Mr. Mike Whitford, P. Eng. We trust our report contains all the information required at this time, however, if you have any questions or comments please contact us at your convenience.

Yours truly,

UNIC CONSULTANTS (1986) LIMITED

Gordon Sheppard, P. Eng.

REGISTERED PROFESSIONAL ENGINEER
Province of New Brunswick
#M4175
Gordon Sheppard
Signature
Date
Province du Nouveau-Brunswick
INGÉNIEUR IMMATRICULÉ

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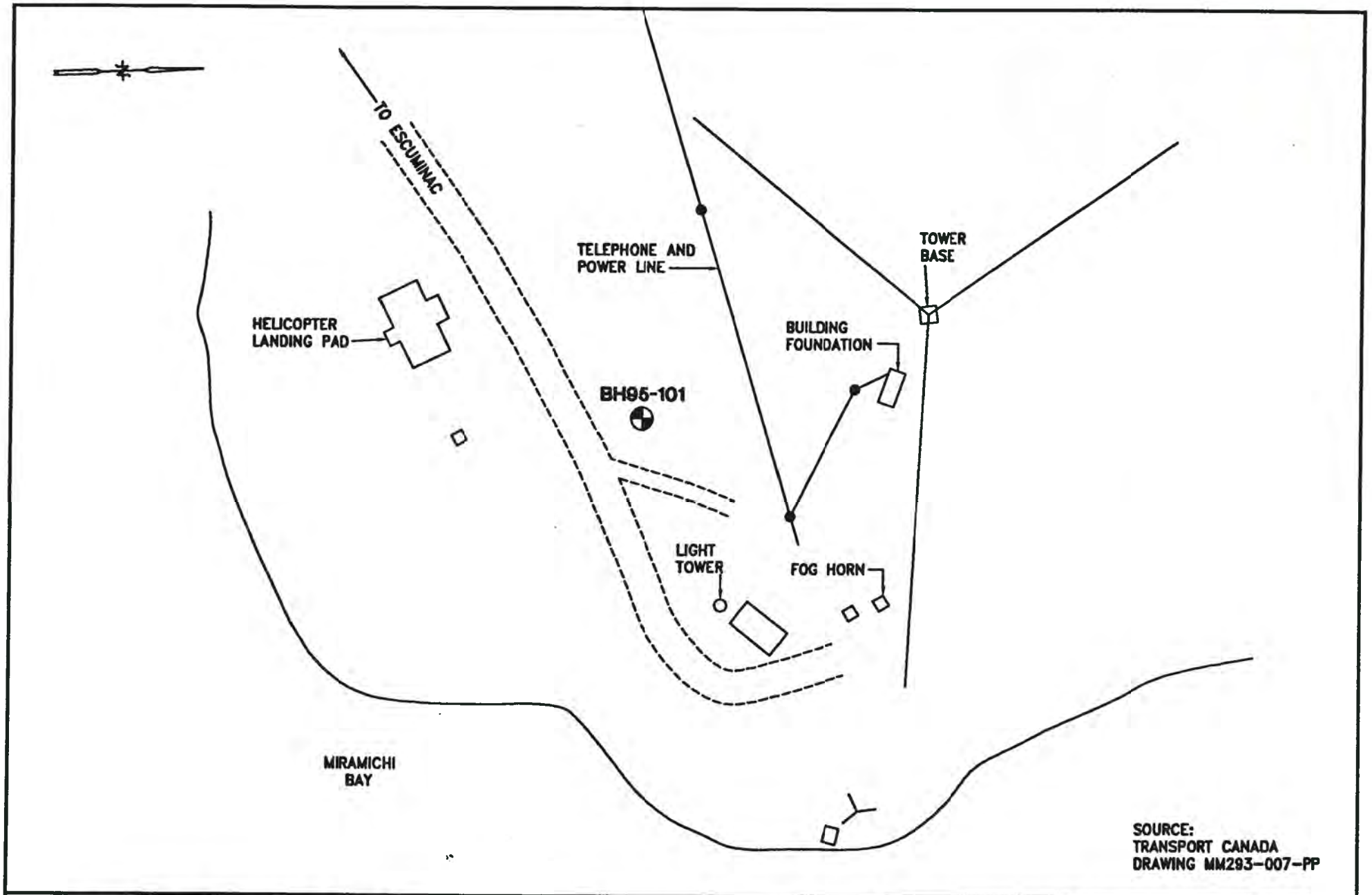
APPENDIX

FILE: 7089



SUPPLY AND SERVICES CANADA BOREHOLE LOCATION PLAN SELF SUPPORTED COMMUNICATIONS TOWER ESCUMINAC, NB	**UNIC CONSULTANTS (1986) LTD.**	DATE: JULY 6, 1995 PROJECT No.: 7089	SCALE: N.T.S. FIGURE No.: 7089-1

SYMBOLS AND TERMS USED ON THE BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Behavioural properties (i.e. plasticity, permeability) take precedence over particle gradation in describing soils.

Terminology describing soil structure:

Desiccated	-	having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure
Varved	-	composed of regular alternating layers of silt and clay
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay
Well Graded	-	having wide range in grain sizes and substantial amounts of all intermediate particle sizes
Uniformly Graded	-	predominantly of one grain size.

Terminology used for describing soil strata based upon the proportion of individual particle sizes present:

Trace, or occasional	less than 10%
Some	10-20%
Adjective (e.g. silty or sandy)	20-35%
And (e.g. silt and sand)	35-50%

The standard terminology to describe cohesionless soils includes the relative density, as determined by laboratory test or by the Standard Penetration Test 'N'-value: the number of blows of 140 pound (64kg) hammer falling 30 inches (760mm), required to drive a 2 inch (50.8mm) O.D. split spoon sampler one foot (305mm) into the soil.

Relative Density	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer tests, unconfined compression tests, or occasionally by standard penetration tests.

Consistency	Undrained Shear Strength kips/sq.ft.	Undrained Shear Strength kPa	'N' Value
Very Soft	<0.25	<12.5	<2
Soft	0.25-0.5	12.5-25	2-4
Firm	0.5-1.0	25-50	4-8
Stiff	1.0-2.0	50-100	8-15
Very Stiff	2.0-4.0	100-200	15-30
Hard	>4.0	>200	>30

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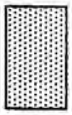
SYMBOLS AND TERMS USED ON THE BOREHOLE AND TEST PIT RECORDS

STRATA PLOT

SAND and GRAVEL

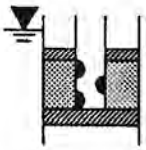


SANDSTONE

WATER LEVEL MEASUREMENT

Borehole or Standpipe (Stabilized)

Borehole or Standpipe (At Time of Drilling)



Piezometer

SAMPLES

SS.... Split spoon sample (obtained by performing the standard penetration test)
ST.... Shelby tube or thin wall tube
PS.... Piston sample
BS.... Bulk sample
WS.... Wash sample
RC.... Rock core AXT,BXL, etc.... Rock core samples obtained with the use of standard diamond drilling bits.

OTHER TESTS

G..... Specific gravity
H..... Hydrometer analysis
S..... Sieve analysis
γ..... Unit weight
C..... Consolidation
CD... Consolidated drained triaxial
CU... Consolidated undrained triaxial with pore pressure measurements
UU... Unconsolidated undrained triaxial
DS.... Direct shear
P..... Field permeability

ROCK DESCRIPTION

The description of bedrock is based on the rock quality designation (RQD).

The classification is based on a modified core recovery percentage in which all pieces of sound core over 100mm long are counted as recovery. The smaller pieces are considered to be due to close shearing, jointing, faulting, or weathering in the rock mass and are not counted. In most cases RQD is run on NXL core; however, it can be used on different core sizes if the bulk of the fractures caused by drilling stresses are easily distinguishable from normal in situ fractures.

RQD	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately joined or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured.

UNIC CONSULTANTS (1986) LTD.

BOREHOLE RECORD

BH95-101

CLIENT SUPPLY AND SERVICES CANADA

PROJECT No. 7089

LOCATION Canadian Coast Guard Tower Point Escuminac, NB

BOREHOLE No. BH95-101

DATES: BORING 95-06-27 WATER LEVEL not observed

DATUM

DEPTH (m)	ELEV. (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD
0								
0		Compact to very dense brown sand and gravel with a trace of silt and clay			SS	1	300	13
1					SS	2	300	71
		Fractured brown sandstone bedrock			RC			8
5					RC			36
7		End of Hole at 7.6 m						
10								

Undrained Shear Strength - kPa

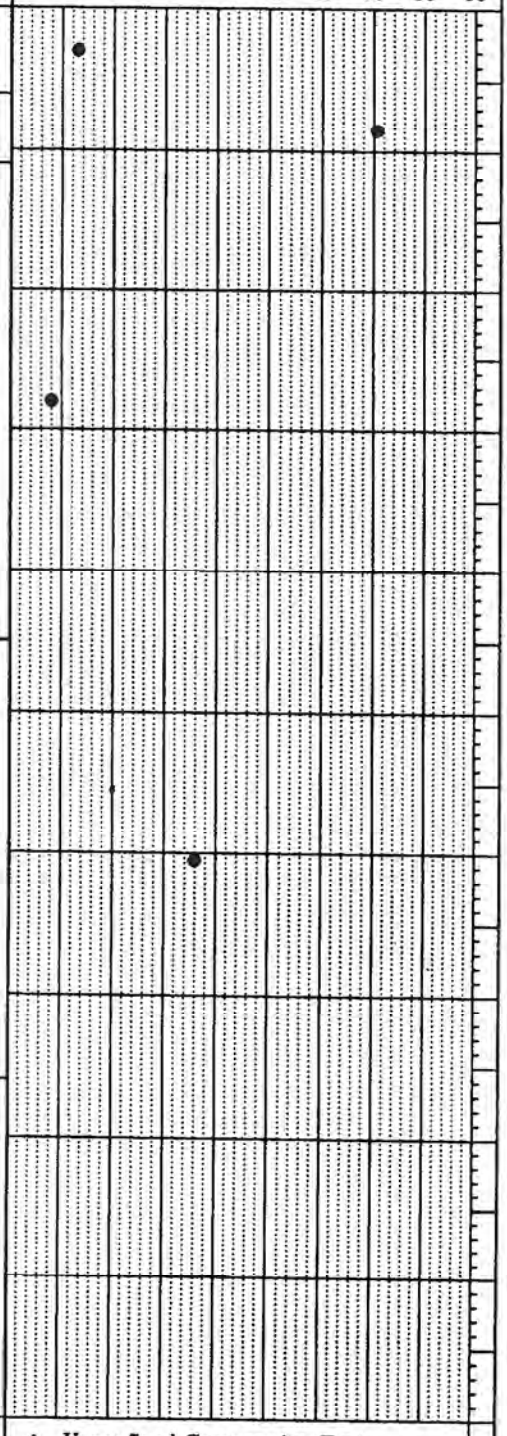
20 40 60 80

Water Content & Atterberg Limits W_P W W_L

Dynamic Penetration Test, blows/0.3m ★

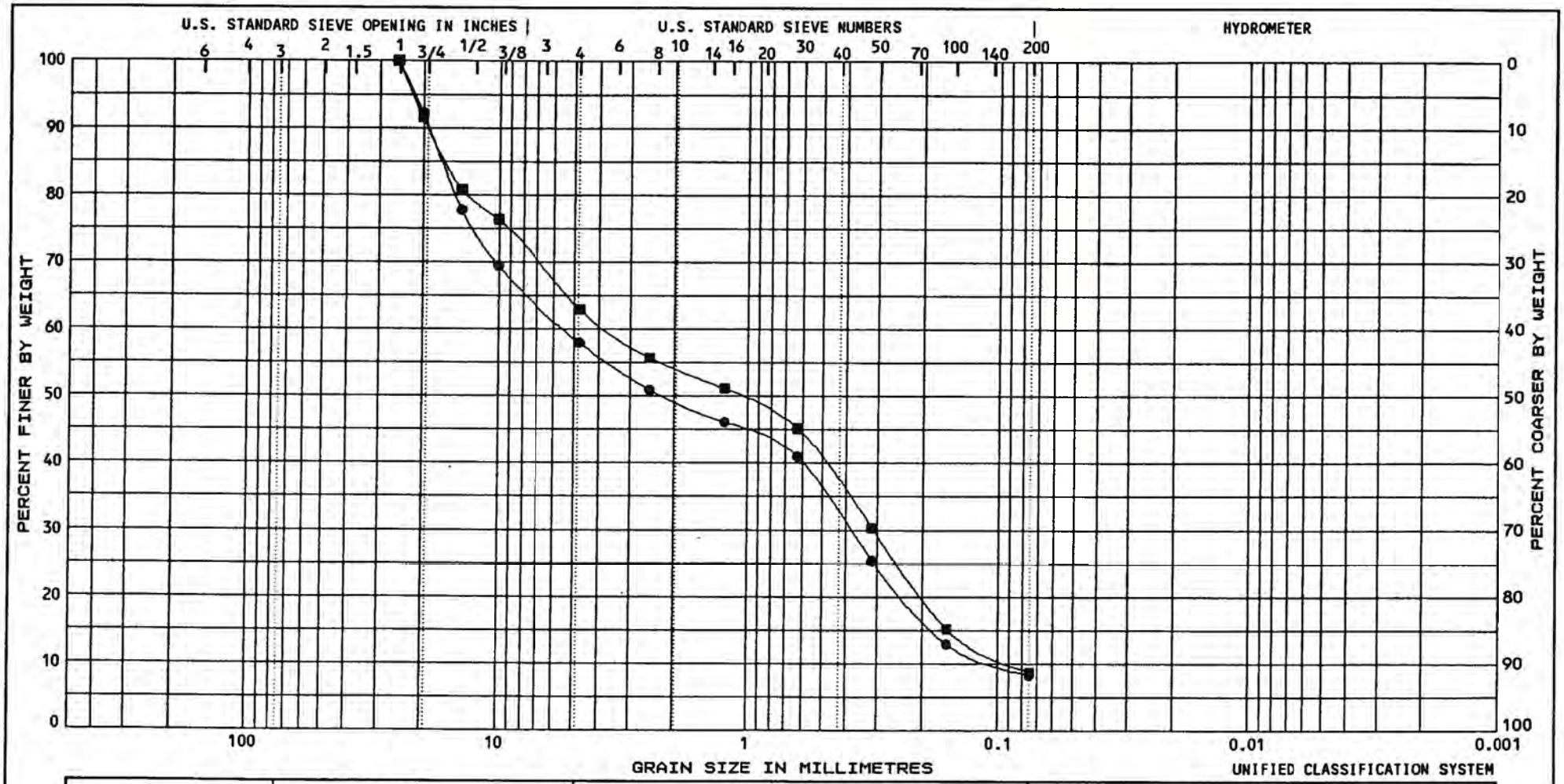
Standard Penetration Test, blows/0.3m ●

10 20 30 40 50 60 70 80 90



△ Unconfined Compression Test

□ Field Vane Test ■ Remoulded



COBBLES	GRAVEL		SAND			SILT and CLAY	
	coarse	fine	coarse	medium	fine	SILT	CLAY

	Source	Depth	Description	W%	W_L	W_P	I_P	%Gravel	%Sand	%Silt	%Clay
●	BH1-SA1	0.3	SAND and GRAVEL with a trace of silt and clay	10				42.1	49.6	8.3	
■	BH1-SA2	0.7	SAND and GRAVEL with a trace of silt and clay	8				37.1	54.2	8.7	

Project: Canadian Coast Guard Tower
Location: Point Escuminac, NB
Job No.: 7089
Notes: Communications Tower Investigation
Date: June 28, 1995
GRADATION CURVES