ATKINSON, DAVIES INC.

CONSULTING GEOTECHNICAL, ENVIRONMENTAL & MATERIALS ENGINEERS

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WEBSITE: www.atkinsondavies.com EMAIL: atkinsondavies@atkinsondavies.com

April 8, 2002

Ref.: 1-3009

Harrington Grist Mill
R.R. #3
Embro, Ontario
N0J 1J0

Attention: Mr. Trent Littleton

Dear Sirs:

Re: Geotechnical Investigation for Proposed Grist Mill Rehabilitation, Harrington, Ontario

We have completed this project in accordance with your instructions and authorization. This report contains a record of our findings and presents our recommendations with respect to the bearing capacity of the existing foundations.

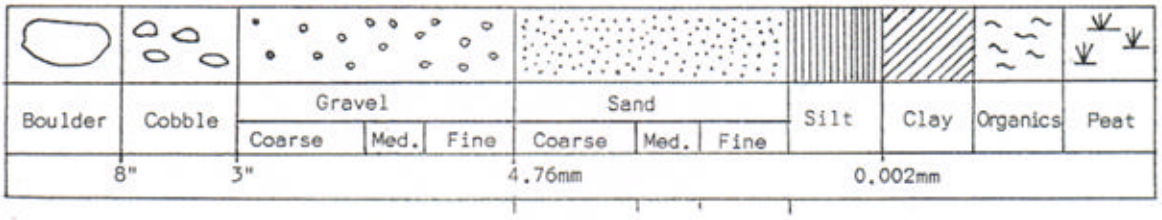
FIELD WORK

The field work, consisting of 3 sampled boreholes to depths ranging from 5.0 to 7.8 metres, was carried out on March 14, 2002, at the locations shown on Enclosure 2. The holes were advanced to the sampling depths by a power auger machine, which was equipped with hollow-stem augers and conventional soil sampling equipment.

COLIN J.W. ATKINSON M.Sc. P.Eng. PETER HOWELL DAVIES B.Sc. M.I.C.E. P.Eng.

LIST OF SYMBOLS, ABBREVIATIONS AND NOMENCLATURE

Soil Components and Ground Water Conditions



U.S. Standard Sieve Size: No.4 No.10 No.40 No.200

SAMPLE TYPES

AS	Auger sample	RC	Rock core	TP	Piston, thin-walled tube sample
CS	Sample from casing	%	Recovery	TW	Open, thin-walled tube sample
ChS	Chunk sample	SS	Split-spoon sample	WS	Wash sample

SAMPLER ADVANCED BY: static weight : w
" pressure : p
" tapping : t

OBSERVATIONS MADE WHILE CORING: Steady pressure; No pressure; Intermittant pressure; Washwater returns; Washwater last

SOIL PROPERTIES

W%	Water content	γ	Natural bulk density (unit weight)	k	Coefficient of permeability
LL%	Liquid limit	e	Void ratio	C	Shear strength — in terms of total stress
PL%	Plastic limit	RD	Relative density	ϕ	Angle of int. friction — in terms of total stress
PI%	Plasticity index	c_v	Coeff. of consolidation	C'	Cohesion — in terms of effective stress
LI	Liquidity index	m_v	Coeff. of volume compressibility	ϕ'	Angle of int. friction — in terms of effective stress

UNDRAINED SHEAR STRENGTH
- DERIVED FROM -

TRIAXIAL / UNCONFINED COMPRESSION TEST

LABORATORY / FIELD VANE TEST

POCKET PENETROMETER TEST

Strain of failure is represented by direction of stem: 20%, 15%, 5%, 10%

St : sensitivity = shear strength in undisturbed state / shear strength in remoulded state

SOIL DESCRIPTION

COHESIONLESS SOILS: RD:

Very loose	0 - 15%
Loose	15 - 35%
Compact	35 - 65%
Dense	65 - 85%
Very dense	85 - 100%

COHESIVE SOILS: C p.s.f.

Very soft	less than 250
Soft	250 - 500
Firm	500 - 1000
Stiff	1000 - 2000
Very stiff	2000 - 4000
Hard	over 4000

relative density is generally in the *compact* range as indicated by an *N* value of 14 blows for 300mm penetration of the sampler. Borehole 2 encountered weathered brown sandy clayey silt below the topsoil layer and this also may be fill material. The natural moisture content of the weathered brown sandy clayey silt was determined to be 19% from one sample. Borehole 3 encountered a sand and gravel stratum containing some organics below the topsoil layer, and this material may be a Recent alluvial deposit. The relative density of the sand and gravel is described as *compact* based on an *N* value of 13 blows. The compact sand and gravel at Borehole 3 location is underlain by silty sand and gravel to a depth of 3.4 metres, and the relative density of the silty sand and gravel is described as *dense* to *very dense* based on *N* values ranging from 42 to 77 blows. A grading analysis of a typical sample of the silty sand and gravel is shown as a grain size distribution curve on Enclosure 7.

At depths of 1.2 and 1.4 metres respectively, Boreholes 1 and 2 encountered a glacial sandy clayey silt till stratum, and the colour of the sandy clayey silt changes from brown to grey at depths of 5.0 and 4.1 metres respectively. The consistency of the brown sandy clayey silt till is described as *stiff* to *hard* based on *N* values ranging from 11 to 98 blows for 300mm penetration of the sampler, and the natural moisture content of the stiff to hard brown sandy clayey silt till was determined to range from 12% to 17%. The consistency of the grey sandy clayey silt till is described as *hard* based on *N* values ranging from 85 blows for 300mm penetration of the sampler to 100 blows for 125mm penetration of the sampler, and the natural moisture content of the hard grey sandy clayey silt till was determined to range from

7% to 17%. Borehole 1 was terminated in the hard grey sandy clayey silt till at a depth of 7.7 metres, and the lower limit of the grey sandy clayey silt till was encountered at a depth of 6.2 metres at Borehole 2 location.

At Borehole 2 location the hard grey sandy clayey silt till is underlain by grey sandy silt till in which the borehole was terminated at a depth of 7.8 metres, and a similar material was also encountered at a depth of 3.4 metres in Borehole 3. The relative density of the grey sandy silt till is described as *dense* to *very dense* based on *N* values ranging from 35 blows for 300mm penetration of the sampler to 74 blows for a 150mm penetration of the sampler, and the natural moisture content of the dense to very dense grey sandy silt till was determined to range from 7% to 14%. Grading analyses of typical samples of the brown sandy clayey silt till from Boreholes 1 and 2 are shown as grain size distribution curves on Enclosure 6.

GROUNDWATER CONDITIONS

The following water levels were observed in the boreholes during and after completion of the drilling program.

Borehole	Depth to Groundwater (metres)	Groundwater Elevation (metres)
1	5.75	96.17
2	4.1 (grey colour)	97.0
3	0.41	95.74

The water level in the adjacent creek was observed at EL. 96.00 on April 8, 2002.

DISCUSSION AND RECOMMENDATIONS

The investigation has shown that the soil profile consists of silty sand fill to a depth of 1.2 metres at Borehole 1 location and weathered sandy clayey silt to a depth of 1.4 metres at Borehole 2 location. These materials are underlain by stiff to hard brown and grey glacial sandy clayey silt till, which is followed by very dense grey sandy silt till at Borehole 2 location. Borehole 3 which was located in the flood plain area adjacent to the creek, encountered sand and gravel to a depth of 3.4 metres followed by grey glacial sandy silt till to the lower limit of the borehole at a depth of 5.0 metres. The groundwater in the boreholes is closely related to the creek level at EL. 96.0 metres.

Foundations

The creek generally flows in a south to north direction along the east side of a low-lying flood plain area, and the grist mill is benched into the easterly slope which has a vertical height of about 5 metres. Based on the borehole results it appears that the grist mill foundations in the upper part of the slope are supported by the stiff to hard brown sandy clayey silt till stratum, and the foundations adjacent to the creek in the low-lying area are supported by the sand and gravel stratum. Except for the upper 2 metres of subsoil in Borehole 1, the undisturbed native materials are competent for the support of foundations designed for a maximum allowable soil pressure of 300 kPa (6000 p.s.f.), and footings located at depths ranging from 1.2 to 2.0 metres adjacent to Borehole 1 would have an allowable bearing capacity of 150 kPa (3000 p.s.f.). These values incorporate a factor of safety of 3 against shear failure.

It would appear that the main area of the grist mill is supported on competent subgrade, and that a small area at the northeast corner of the mill has cracked and tilted due to an oversteepened section of the slope. This could be remediated by removing the damaged section, reconstructing the slope to a gradient of 2(H):1(V) and rebuilding the wall on the competent hard brown sandy clayey silt to accomodate the lateral pressure on the up-slope side. The lateral soil pressure on the up-slope side will increase uniformly with depth and it may be calculated using the following equation.

$p = K(\gamma h+q)$

where K = earth pressure coefficient, 0.4

γ = unit weight of backfill (granular), 19.0 kN/m^3

q = effective value of any surcharge acting close to the wall.

All footings must incorporate a 1.2 metre depth of soil cover between the subgrade and the finished ground surface to provide sufficient protection against heave due to frost action.

We trust that these comments are sufficient for your rehabilitation purposes, however if further discussion is required, please do not hesitate to contact us. The Statement of Limitation, Appendix 'B', should be read in connection with the report.

Yours very truly,

ATKINSON, DAVIES INC.

C.J.W. Atkinson, M.Sc., P.Eng.

CJWA/wrs

Enclosures

THE STANDARD PENETRATION TEST

In order to determine the relative density of non-cohesive soils, such as sands and gravels, the standard penetration test has been adopted. The test also gives an indication of the consistency of cohesive soils.

A two inch (50.8mm) external diameter thick-walled sample tube is driven into the ground at the bottom of the borehole by means of a 140 lb. (635 kg) hammer falling freely through 30 inches (760mm). The tube is first driven an initial 6 inches (150mm) to allow for the presence of disturbed material at the bottom of the borehole. The number of standard blows (*N*) required to drive the sampler a further 12 inches (300mm) is recorded. The sample tube is one originally developed by Raymond Concrete Pile Company in the United States, where a sufficient number of tests have been made in conjunction with field investigations to show that the results, although essentially empirical, may be applied to foundation design.

For Sands:-

Values of *N*	Density
Less than 10	*Loose*
Between 10 and 30	*Compact*
Between 30 and 50	*Dense*
Greater than 50	*Very dense*

STATEMENT OF LIMITATION

The conclusions and recommendations in this report are based on information determined at the borehole locations and on geological data of a general nature which may be available for the area investigated. Soil and groundwater conditions between and beyond the boreholes may differ from those encountered at the borehole locations and conditions may become apparent during construction which could not be detected or anticipated at the time of the soil investigation. The passage of time also must be considered, and it must be recognized that, due to natural occurrences or direct or indirect human intervention at the site or distant from it, actual conditions discovered may quickly change. The information contained within this report in no way reflects the environmental aspect of the site or soil, unless specifically reported upon.

The comments given in this report on potential construction problems and possible methods of construction are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all of the factors that may affect construction methods and costs (e.g. the thickness of surficial topsoil and fill layers can vary markedly and unpredictably). The contractors bidding on this project or undertaking the construction should therefore make their own interpretations of the presented factual information and draw their own conclusions as to how the subsurface conditions may affect their work.

We recommend that we be retained to ensure that all necessary stripping, subgrade preparation and compaction requirements are met, and to confirm that the soil conditions do not deviate materially from those encountered in the boreholes. **In cases where this recommendation is not followed, the company's responsibility is limited to interpreting accurately the information encountered at the boreholes.**

This report is applicable only to the project described in the introduction, constructed substantially in accordance with details of alignment and elevation quoted in the text.

Standard penetration tests were performed at frequent intervals of depth, as detailed in Appendix 'A', and the results are recorded on the borehole logs as *N* values. The split-spoon samples were stored in airtight containers, which were transferred to our laboratory for classification, testing and storage.

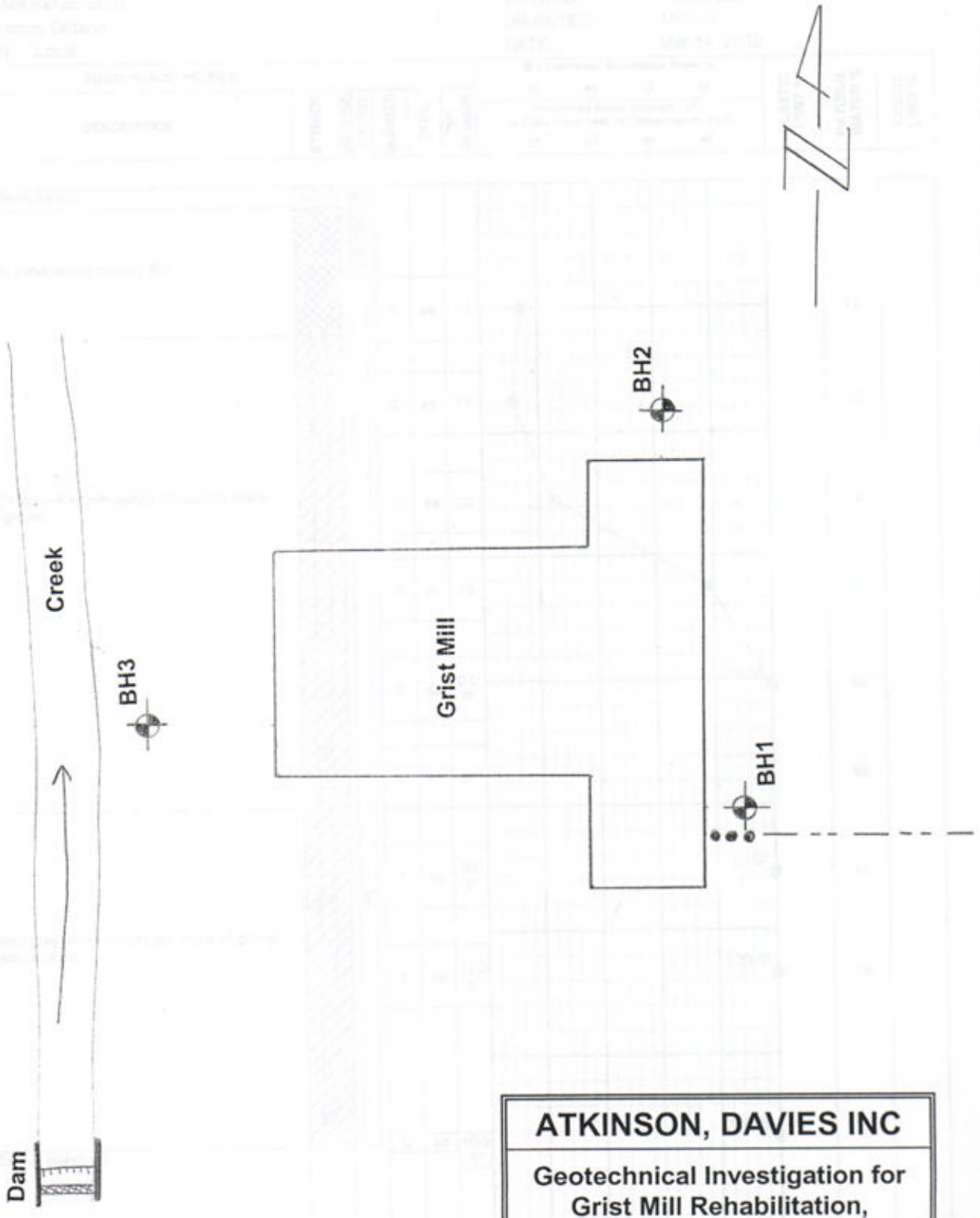
Standpipes were installed in Boreholes 1 and 3 to enable water level readings to be taken for a period of time after completion of the field work.

The field work was supervised by a technologist, who also related the ground surface elevations to a local datum. The benchmark was taken as the top of the east concrete wall of the upstream dam, adjacent to the catwalk, and it was given an assumed value, EL. 100 metres.

SUBSURFACE CONDITIONS

Detailed descriptions of the strata, which were encountered in each borehole, are given on the borehole logs comprising Enclosures 3, 4 and 5. The following notes are intended only to amplify this data.

All three boreholes encountered a thin surface layer of topsoil, which ranges in thickness from 50mm to 175mm. Borehole 1 encountered fill material below the topsoil, and the fill consists of silty sand with some topsoil. The fill extends to a depth of 1.2 metres, and the



ATKINSON, DAVIES INC			
Geotechnical Investigation for Grist Mill Rehabilitation, Harrington, Ontario			
DATE April 10, 2002	SCALE 1 : 200	JOB NUMBER 1-3009	ENCLOSURE 2

Atkinson, Davies Inc.

CONSULTING SOILS AND MATERIALS ENGINEERS

60 Meg Dr. Unit 12A, London, ON N6E 3T6 (519)685-6400 FAX (519)685-0943

REF. NO.: 1-3009
CLIENT: Trent Littleton
PROJECT: Grist Mill Rehabilation
LOCATION: Harrington, Ontario
DATUM ELEVATION: Local

LOG OF BOREHOLE NO. 1

Encl. No. 3 (Sheet 1 of 1)
DRILLING DATA: CME 55
METHOD: Hollow stem
DIAMETER: 180mm
DATE: Mar 14, 2002

SUBSURFACE PROFILE													
Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	● Penetration Resistance Blows/ft 20 40 60 80 / Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test 20 40 60 80	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
101.92	0	175mm topsoil		PIEZOMETER							
		Silty sand, some topsoil. Fill.			1	ss	14			19	
101	1				2	ss	11			16	
		Stiff to hard brown sandy clayey silt, trace of gravel			3	ss	25			12	
100	2				4	ss	78			13	
					5	ss	94/9"	94/9"		14	
99	3				6	ss	98			16	
					7	ss	94/9"	94/9"		14	
98	4				8	ss	120/8"	120/8"		15	
		Hard grey sandy clayey silt, trace of gravel, seams of silt									
97	5										
					9	ss	100/5"	100/5"		7	
96	6										
		End of Borehole									
95	7										

LOG OF BOREHOLE 1-3009.GPJ ATK_DAV.GDT 8/4/02

Atkinson, Davies Inc.

CONSULTING SOILS AND MATERIALS ENGINEERS

60 Meg Dr. Unit 12A, London, ON N6E 3T6 (519)685-6400 FAX (519)685-0943

REF. NO.: 1-3009
CLIENT: Trent Littleton
PROJECT: Grist Mill Rehabilation
LOCATION: Harrington, Ontario
DATUM ELEVATION: Local

LOG OF BOREHOLE NO.
2

Encl. No. 4 (Sheet 1 of 1)
DRILLING DATA: CME 55
METHOD: Hollow stem
DIAMETER: 180mm
DATE: Mar 14, 2002

Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	Penetration Resistance Blows/ft (20 40 60 80) / Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test (20 40 60 80)	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
101.11											
101	0	100mm topsoil									
		Weathered brown sandy clayey silt			1	ss	12			19	
100	1										
					2	ss	40			13	
99	2	Hard brown sandy clayey silt, trace of gravel									
					3	ss	84			12	
98	3										
					4	ss	80			17	
97	4										
					5	ss	71			16	
		Hard grey sandy clayey silt, trace of gravel									
					6	ss	85			17	
96	5										
95	6				7	ss	74/6"	74/6"		14	
		Very dense grey sandy silt, some gravel									
94	7				8	ss	58/6"	58/6"			
		End of borehole									

LOG OF BOREHOLE 1-3009.GPJ ATK_DAV.GDT 9/4/02

Atkinson, Davies Inc.

CONSULTING SOILS AND MATERIALS ENGINEERS

60 Meg Dr. Unit 12A, London, ON N6E 3T6 (519)685-6400 FAX (519)685-0943

REF. NO.: 1-3009
CLIENT: Trent Littleton
PROJECT: Grist Mill Rehabilitation
LOCATION: Harrington, Ontario
DATUM ELEVATION: Local

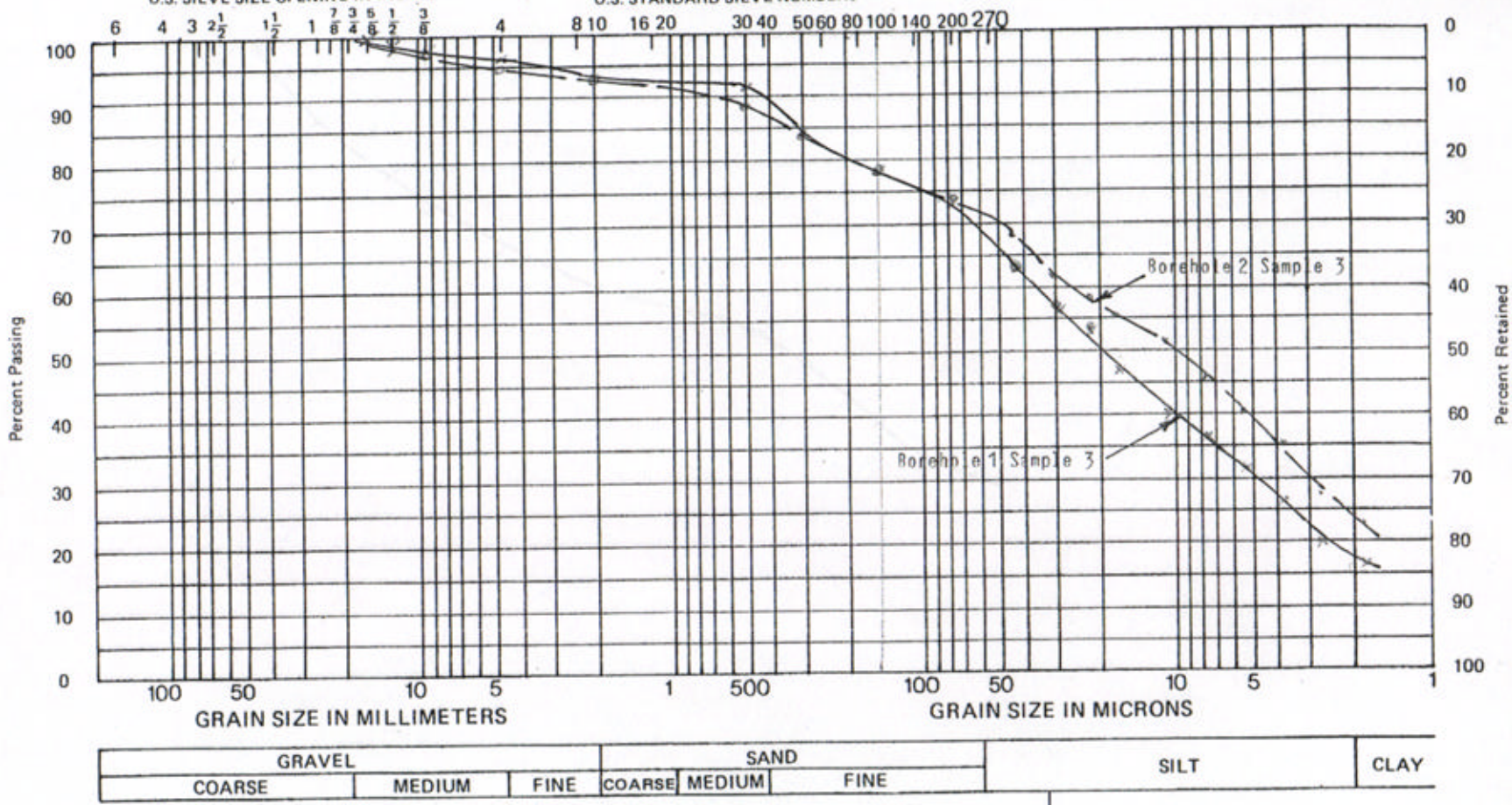
LOG OF BOREHOLE NO.
3

Encl. No. 5 (Sheet 1 of 1)
DRILLING DATA: CME 55
METHOD: Hollow stem
DIAMETER: 180mm
DATE: Mar 14, 2002

SUBSURFACE PROFILE												
Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	● Penetration Resistance Blows/ft 20 40 60 80 / Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test 20 40 60 80	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
96.15	0	50mm topsoil		PIEZOMETER							
96		Compact sand & gravel, some organics			1	ss	13				
95	1				2	ss	42			14	
	2	Dense to very dense silty sand & gravel			3	ss	77				
94					4	ss	76			6	
93	3				5	ss	38			7	
	4	Dense grey sandy silt, some gravel			6	ss	35			8	
92	5	End of Borehole									

GRAIN SIZE DISTRIBUTION

Our Reference No. 1-3009



GRAVEL			SAND			SILT	CLAY
COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

PROJECT: Harrington Grist Mill

LOCATION: Harrington, Ontario

BOREHOLE No.:	1	2
SAMPLE No.:	3	3
DEPTH:	2.6m	2.6m
ELEVATION:		

COEFFICIENT OF UNIFORMITY:

Classification of Sample and Group Symbol:

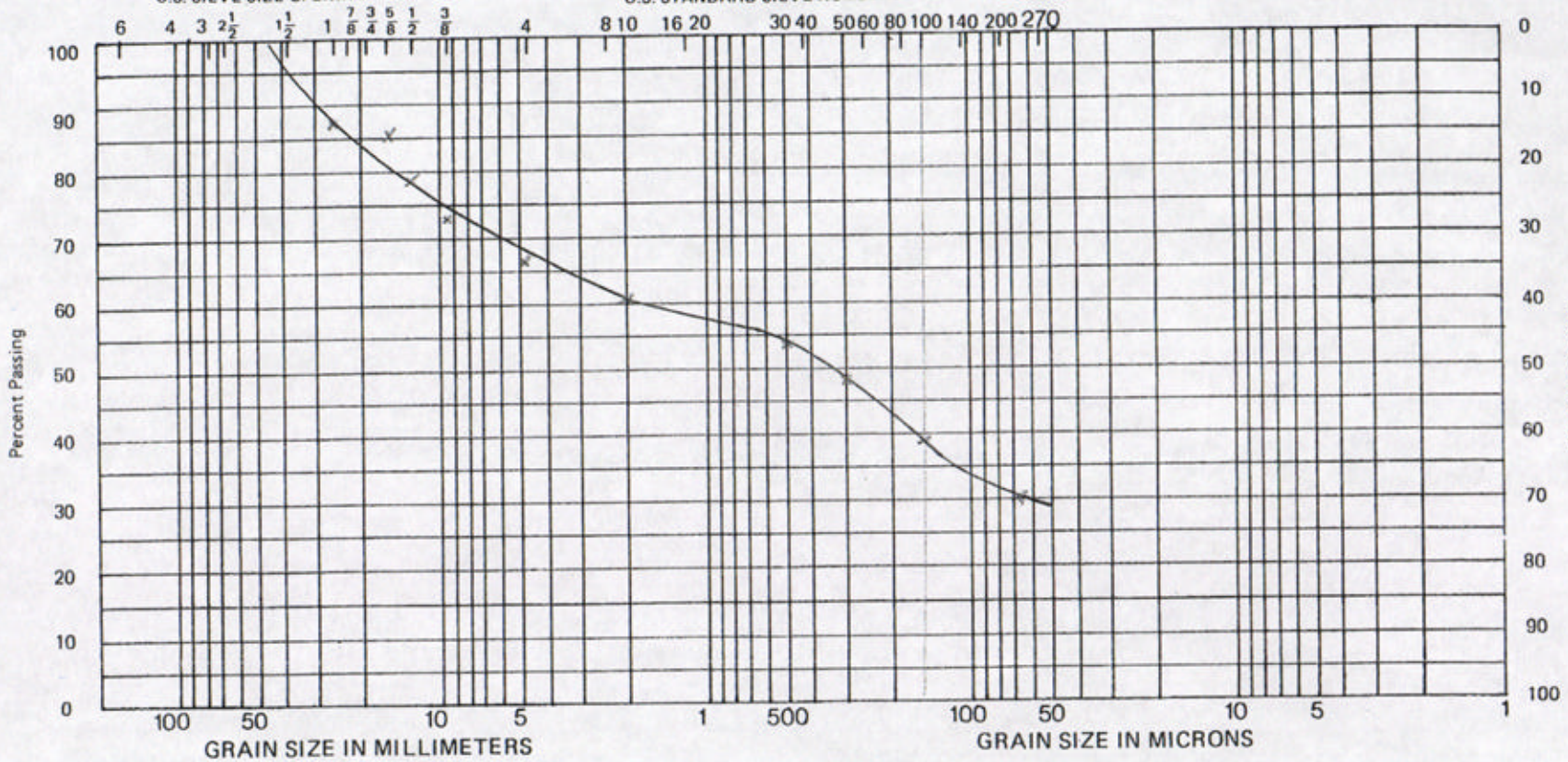
SANDY CLAYEY SILT, TRACE OF GRAVEL.

Enclosure No. 6

ATKINSON, DAVIES INC.

GRAIN SIZE DISTRIBUTION

Our Reference No. 1-3009



GRAVEL			SAND			SILT	CLAY
COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

PROJECT: Harrington Grist Mill

LOCATION: Harrington, Ontario

BOREHOLE No.: 3

SAMPLE No.: 2

DEPTH: 1.8m

ELEVATION:

COEFFICIENT OF UNIFORMITY:

Classification of Sample and Group Symbol:

SILTY SAND AND GRAVEL

Enclosure No. 7

ATKINSON, DAVIES INC.

Invoice

ATKINSON, DAVIES INC.
Consulting Engineers
12A - 60 Meg Drive, London ON N6E 3T6
Tele.: (519) 685-6400 Fax: (519) 685-0943

May 1, 2002
Project No: 1-3009
Invoice No: 0018110

GST No.: R100322437

HARRINGTON GRIST MILL
c/o MR. TRENT LITTLETON
R.R. #3
Embro ON N0J 1J0

Project: 1-3009 Grist Mill Rehabilitation, Harrington

To professional services rendered in connection with Geotechnical Invesitgation, as follows:-

Professional services from April 1, 2002 to April 30, 2002

Unit Billing			
B2 Mobilization of equipment (auger) and drill 3 boreholes		1,100.00	
B3 Sample jars	23.00 jars @ 0.50	11.50	
B4 Standpipe	36.00 feet @ 1.10	39.60	
B7 Technologist, supervision, layout layout, clearing services and travelling	8.50 hours @ 60.00	510.00	
B99 Senior Engineer, draftsman, clerical and reproduction		873.20	
Bb Kilometrage	68.00 kms @ 0.35	23.80	
4/30/02 Bc Sieve Analysis	1.00 analysis @ 69.00	69.00	
4/30/02 Bd Sieve and Hydrometer Analysis	2.00 analyses @ 110.00	220.00	
Bf Natural Moisture Content	20.00 analyses @ 7.00	140.00	
Bg less 10% of engineering fees		-188.70	
Total Units	**1.0 times**	**2,798.40**	**2,798.40**
Taxes			
Goods and Services Tax	7.00% of 2,798.40	195.89	
Total Taxes		**195.89**	**195.89**
		Total this invoice	**$2,994.29**

Net 30 days. Interest will be charged at the rate of 2% per month on accounts.