

DS-LEA ASSOCIATES LTD.

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GEOTECHNICAL INVESTIGATION
ATHERLEY NARROWS BRIDGE
HIGHWAY 12
ORILLIA, ONTARIO

Prepared for
DS-LEA ASSOCIATES LTD.

Prepared by
SHAHEEN & PEAKER LIMITED

Project: SP2106
January 27, 1998

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DRAWINGS

DRAWING No.

PLAN SHOWING BOREHOLE LOCATION

1

BOREHOLE LOGS

2 TO 13

1. INTRODUCTION

Shaheen & Peaker Limited was retained by the DS-Lea Associates Limited to carry out a geotechnical investigation at the Atherley Narrows bridge construction site located on Highway 12 east of Orillia, Ontario. The site location is shown on Drawing 1. Mr. Peter Ojala, P.Eng. of DS-Lea Associates Ltd. authorized the investigation.

It is understood that the new bridge piers are supported by caissons that were to be founded on the limestone bedrock at this site.

The purpose of this investigation was to determine the subsurface conditions and bedrock levels at 5 borehole locations.

2. PROCEDURE

In total eight boreholes were drilled at five pier locations at this site. The boreholes were drilled to depths ranging from 13.4 to 15.4 m. Hollow stem continuous flight auger equipment was used to drill through the upper softer sediments and the till and bedrock in some cases. In Borehole 1, the upper levels of the bedrock were penetrated to a depth about 3 m with hollow stem augers. MTO personnel on site indicated from previous experience that the till was very bouldery and was expected at about 9 m depth. The drilling of the so called bouldery till was very difficult and slow. The augers were grinding all the way and drilling was rough. The heat generated during drilling was intensive enough to fuse the teeth of the augers into the auger head. The drilling was stopped where the drilling became smoother and on an apparent flat harder layer at about 12.3 m depth. This was assumed to be the bedrock level. The material above was assumed to be boulders but after review of the subsequent cores was found to be fractured bedrock. In order to speed up the work in Borehole 2, the possible till was drilled with a tricone bit to a depth of 11.7 m. Again in this borehole the drilling was rough through the fractured bedrock (assumed to be boulders) and became smooth on a harder layer at about 11.7 m. After review of the split spoon samples from Borehole 1 in the laboratory it was not possible to confirm that till was encountered and therefore the same hard layer was drilled with an NQ core barrel. Diamond drilling with an

NQ core barrel was undertaken in the bedrock in all boreholes and in the possible till in Borehole 3.

The drilling was undertaken by a drilling sub-contractor under the direction and supervision of Shaheen & Peaker Limited personnel. In Boreholes 1, 4 and 5 soil, samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer weighing 624 N and dropping 760 mm. Soil samples were not obtained in Boreholes 2 and 3 and instead these boreholes were drilled to the till or bedrock level without sampling. The samples and rock core were logged in the field and returned to the Shaheen & Peaker Limited laboratory for detailed examination by the project engineer and for laboratory testing.

The surveying of the borehole locations was undertaken by Shaheen & Peaker Limited personnel. The ground surface elevations were surveyed by DS Lea Associates Limited.

As well as visual examination in the laboratory, all of the soil samples were tested for moisture content and selected samples for natural unit weight.

3. SUBSURFACE CONDITIONS

The borehole locations are shown on Drawing 1 and detailed subsurface conditions are presented on the borehole and core logs, Drawings 2 to 13. These are summarized as follows.

The soil in the boreholes consisted of varying depths of loose to dense fill overlying very loose peat, marl and organic silt and, soft silty clay. Rock fill was present at the location of Boreholes 1 and 2. In Boreholes 1 and 2 the weak soils were found to overlie limestone bedrock. In Boreholes 3 and 4, a thin layer of sandy silt till was found over the bedrock and in Borehole 5, stiff layered silty clay to sandy silt was found to overlie compact to very dense granular deposits of fine to coarse sand and, sand and gravel. A thin layer of till may be present over the bedrock at Borehole 5, but the sample was of poor quality.

Limestone bedrock was found at depths of 9.4 to 10.9 m across the site. The actual bedrock elevations are summarized below on Table 1.

Table 1: Bedrock Elevations

Borehole	Elevation (m)
1 and 1A	210.8
2A and 2B	211.1
3	208.7
4	209.4
5	208.5

The limestone was fine grained and contained stylolites. It was grey, unweathered and the strength was estimated to be medium (15 to 50 MPa). Bedding joints were in general at close (<5 cm) to very close (5 to 30 cm) intervals with occasional moderately (30 to 100 cm) spaced joints. Vertical cross joints were common and occasional diagonal cross joints were noted. Where the vertical joints were encountered the core was broken up and this probably accounted for some of the poor recovery. All joint surfaces were rough planar. Random clay seams were noted in some boreholes. These appeared to be very thin (< 1 to 3 mm).

4. GENERAL COMMENTS

The comments given in this report are intended only for the guidance of design engineers. The number of boreholes required to determine the localized underground conditions between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc., would be much greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

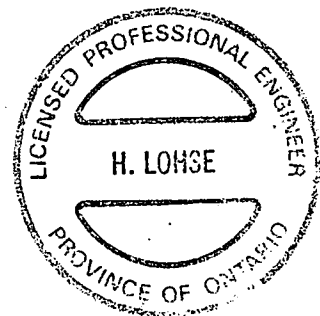
The information in this report in no way reflects on the environmental aspects of the soil and has not been addressed in this report, since this aspect is beyond the scope and terms of reference. Should specific information be required, additional testing may be required.

We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

Shaheen & Peaker Limited.



Holger Lohse, P.Eng



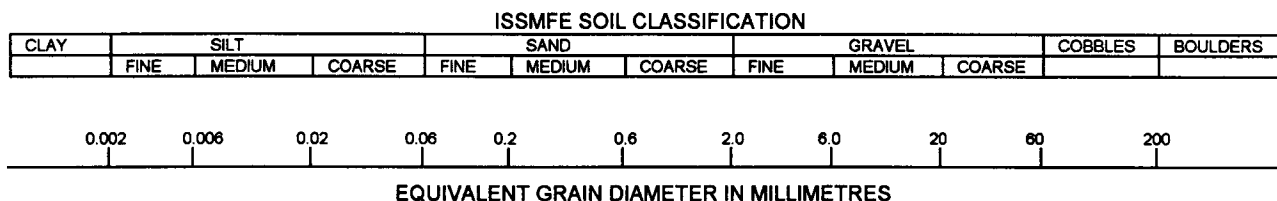
Shaheen A. Ahmad, M.A.Sc., P.Eng.



Drawings

Notes On Sample Descriptions

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Society for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by Shaheen & Peaker Limited also follow the same system. Different classification systems may be used by others; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.




CLAY (PLASTIC) TO		FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)		SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

2. **Fill:** Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.
3. **Till:** The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

EXPLANATORY SHEET TO CORE LOG

<u>Column No.</u>	<u>Description</u>
1	Elevation of geotechnical boundary.
2	Depth of geotechnical boundary in borehole.
3	Geological symbol for rock or soil material.
4	General description of geotechnical unit - qualitative description including rock type(s), percentage rock types, frequency and sizes of interbeds, colour, texture, weathering, strength, general joint spacing
5-11	Joint (discontinuity) characteristics
5	Number of joint sets: a rock mass can be intersected by a number of joint sets of varying orientations.
6	Joint type: B = Bedding Joint F = Fault C = Cross Joint S = Shear Plane
7	Orientation: only variations in dip can be identified in core; dip direction is obtained from field mapping or oriented core. F = Flat = 0 - 20° D = Dipping = 20 - 50° V = Vertical = 50 - 90°
8	Joint spacing: this is an approximate measure of spacing between joints in specific joint sets VW = Very Wide = 3 m W = Wide = 1 - 3 m M = Moderate = 30 cm - 1 m C = Close = 5 - 30 cm VC = Very Close = 5 cm
9	Roughness: RU= Rough Undulating RP = Rough Planar SU = Smooth Undulating SP = Smooth Planar LU = Slickensided Undulating LP = Slickensided Planar
10	Fillings: Approx. Ør T = Tight, hard, non-softening - O = Oxidation surface staining only 25 - 35 SA = Slightly altered; clay-free 25 - 30 S = Sandy particles, clay-free 25 - 30 Si = Sandy and silty, minor clay 20 - 25 NC = Non softening clays (< 5 mm) 16 - 24 SO = Softening clays (> 5 mm) 12 - 16 SC = Swelling clay fillings (> 5 mm) 6 - 12
11	Aperture: estimated sizes of joint opening
12	Degree of weathering of rock material:  Unweathered = no signs of discolouration or oxidation Slightly weathered = partial discolouration; fractures (joints) moderately weathered = total discolouration typically oxidized Highly weathered = total discolouration; typically friable & pitted Completely weathered = resembles a soil; rock structure usually preserved

Column No.

Description

Approx. Uniaxial
Compressive
Strength

13

Strength of rock material:

Very high strength = specimen can only be chipped by geological hammer

High strength = specimen requires a number of blows of geological hammer to fracture it; cannot be scraped with pocket knife

Medium strength = specimen can be fractured by single firm blow of geological hammer; can be scraped with pocket knife, not peeled

Low strength = shallow indentations made by firm blow with point of geological hammer; can be peeled by pocket knife with difficulty

Very low strength = crumbles under firm blow with point of geological hammer; can be peeled by pocket knife

200 MPa

50 - 200 MPa

15 - 50 MPa

4 - 15 MPa

1 - 4 MPa

14

Fracture Frequency: Number of natural joints occurring over a metre length of core. All natural joints are counted irrespective of the number of joint sets.

Fracture frequency

0.3/m

0.3 - 1/m

1 - 3/m

3 - 20/m

20/m

Joint spacing

Very wide

Wide

Moderate

Close

Very close

= 3 m

= 1 - 3 m

= 30 cm - 1 m

= 5 - 30 cm

= 5 cm

15

Run Number and Core Recovery:

(i) Drill run number;

(ii) Core Recovery is the total length of core pieces, irrespective of their individual lengths, obtained in a core run and expressed as a percentage of the length of that core run.

16

Rock Quality Designation (RQD): The total length of those pieces of sound core which are 10 cm or greater in length in a core run expressed as a percentage of the total length of that core run. Sound pieces of rock are those pieces separated by natural breaks and not machine breaks or subsequent artificial breaks.

RQD

0 - 25 %

25 - 50 %

50 - 75 %

75 - 90 %

90 - 100 %

Rock Mass Classification (After Deere)

very poor

poor

fair

good

excellent

17

Core and Casing Sizes: changes of core and casing sizes are indicated.

18

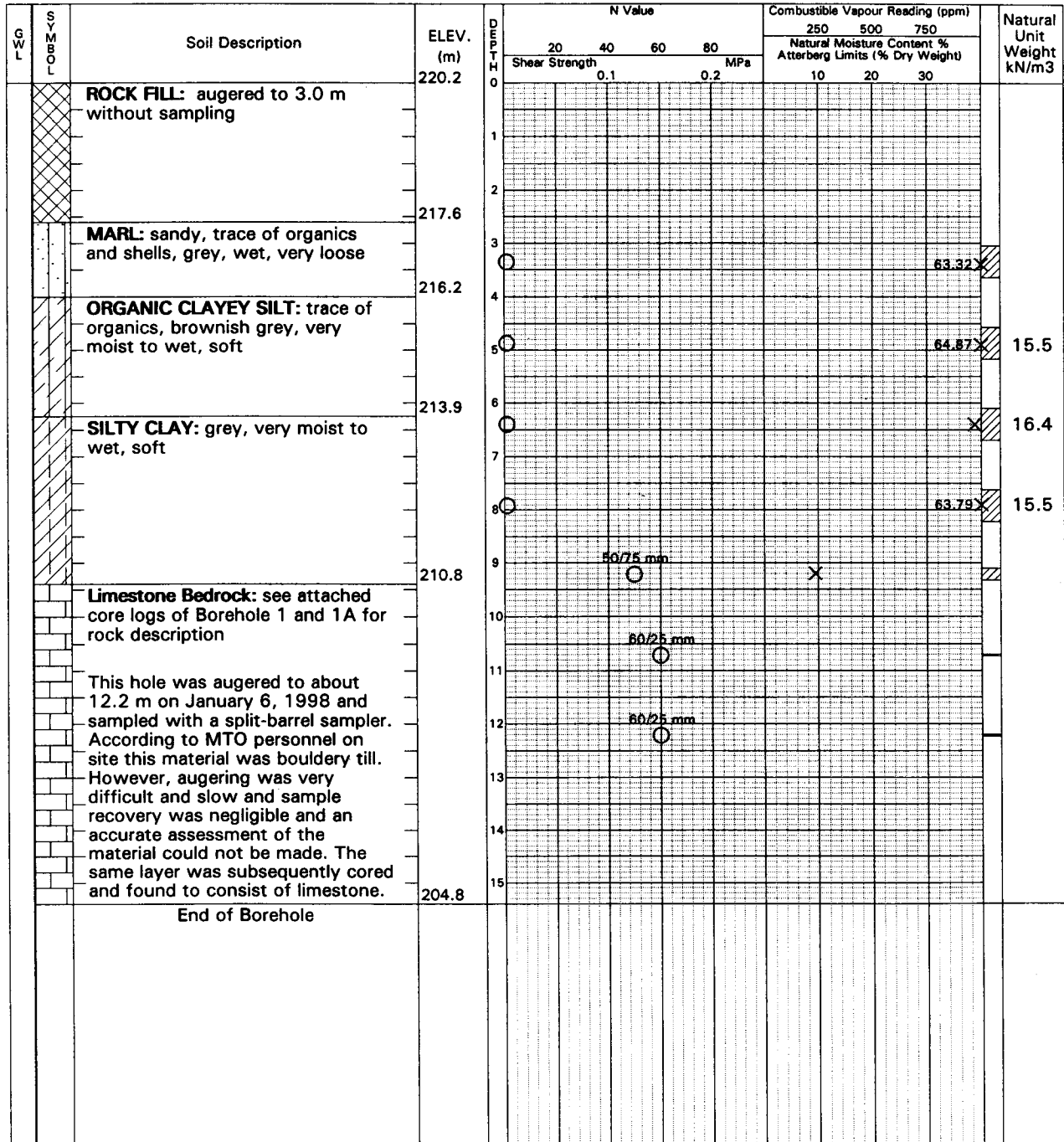
Water recovery, level and tests.

Project No. SP2106

Log of Borehole 1

Dwg No. 2Project: Atherley Narrows BridgeSheet No. 1 of 1Location: Highway 12, Orillia, OntarioDate Drilled: January 6, 1998Drill Type: Hollow Stem AugersDatum: Geodetic

Auger Sample ☒ Combustible Vapour Reading ☐
SPT (N) Value ☐ Natural Moisture ☒
Dynamic Cone Test ☐ Plastic and Liquid Limit ☐
Shelby Tube ☒ Undrained Triaxial ☐
Field Vane Test ☐ at % Strain at Failure ☐
Sensitivity ☐ Penetrometer ☒
Piezometric Water Level ☐



WATER LEVEL RECORD:

Time	Water Level (m)	Depth to Cave (m)

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CORE LOG											BH NO. 1							
PROJECT Atherley Narrows Bridge					ORIENTATION Vertical		ELEVATION (m) 220.2		DATUM Geodetic		PROJECT NO. SP2106							
LOCATION Highway 12, Orillia, Ontario					DATE STARTED 01/06/98		COMPLETED 01/06/98		LOGGED BY H. Lohse		DRAWING NO. 3							
CLIENT DS-Lea Associates Ltd.					DRILLER Malone		DRILL TYPE CME75		CORE BARREL NQ		SHEET 1 of 1							
ELEV. (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	JOINT CHARACTERISTICS							WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN No.	RECOVERY %	RQD	WATER RECOVERY %	WATER COLOUR
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERATURE (mm)								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
220.2																		
	1																	
	2																	
	3																	
	4																	
	5																	
	6		Refer to Borehole Log for soil description															
	7																	
	8																	
210.8	9																	
	10		See Borehole 1A for core log from Elevation 210.8 to 208.7 m.															
	11																	
207.9	12																	
	13		LIMESTONE: fine grained, occasional stylolites, unweathered, medium strength	1	B	F	C	RP	T	O				1	75	43	96	grey
	14		Top 0.15 m of Run 1 was broken up. Probable core loss occurred at this depth.											2	100	53	100	grey
204.8	15													3	100	67	100	grey
	16		End of Borehole															
	17																	
	18																	
	19																	

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CORE LOG											BH NO. 1A							
PROJECT Atherley Narrows Bridge					ORIENTATION Vertical		ELEVATION (m) 220.0		DATUM Geodetic		PROJECT NO. SP2106							
LOCATION Highway 12, Orillia, Ontario					DATE STARTED 01/14/98		COMPLETED 01/14/98		LOGGED BY H. Lohse		DRAWING NO. 4							
CLIENT DS-Lea Associates Ltd.					DRILLER Malone		DRILL TYPE CME75		CORE BARREL NQ		SHEET 1 of 1							
ELEV. (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	JOINT CHARACTERISTICS							WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN No.	RECOVERY %	RQD	WATER RECOVERY %	WATER COLOUR
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERATURE (mm)								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
220.0																		
	1																	
	2																	
	3																	
	4																	
	5																	
	6		Refer to Borehole Log for soil description															
	7																	
	8																	
210.8	9																	
	10		LIMESTONE: fine grained, occasional stylolites, unweathered, medium strength	2	B C	F V	C VC	RP	T	O				1A	77	21	var.	grey
	11													2A	84	22	var.	grey
208.7	12		End of Borehole Note: Core at top and bottom of Run 1 was broken up.															
	13																	
	14																	
	15																	
	16																	
	17																	
	18																	
	19																	

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Project No. SP2106

Log of Borehole 2

Dwg No. 5Project: Atherley Narrows BridgeSheet No. 1 of 1Location: Highway 12, Orillia, OntarioDate Drilled: January 7, 1998Drill Type: Hollow Stem AugersDatum: Geodetic

Auger Sample ☒
 SPT (N) Value ☐
 Dynamic Cone Test ☐
 Shelby Tube ☐
 Field Vane Test ☐
 Sensitivity ☐
 Piezometric Water Level ☐

Combustible Vapour Reading ☐
 Natural Moisture ☐
 Plastic and Liquid Limit ☐
 Undrained Triaxial at % Strain at Failure ☐
 Penetrometer ☐

GWL	SYMBOL	Soil Description	ELEV. (m)	DEPTH (m)	N Value				Combustible Vapour Reading (ppm)			Natural Unit Weight kN/m ³
					20	40	60	80	250	500	750	
					Shear Strength MPa				Natural Moisture Content %			
					0.1 0.2				Atterberg Limits (% Dry Weight)			
									10	20	30	
		Augered to approximate level of till or bedrock without sampling	220.1	0								
				1								
				2								
				3								
				4								
				5								
				6								
				7								
		Could not advance hole past 9.75 m. Auger tooth broken off while drilling through rock fill became lodged at base of hole.		8								
			211.1	9								
		PROBABLE BEDROCK: recovered numerous angular rock fragments and traces of sandy silt	210.3									
		End of Borehole										

WATER LEVEL RECORD:

Time	Water Level (m)	Depth to Cave (m)



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Project No. **SP2106**

Log of Borehole 2A

Dwg No. **6**Project: **Atherley Narrows Bridge**Sheet No. **1** of **1**Location: **Highway 12, Orillia, Ontario**Date Drilled: **January 7, 1998**Drill Type: **Hollow Stem Augers**Datum: **Geodetic**

Auger Sample ☒
SPT (N) Value ☐
Dynamic Cone Test ☐
Shelby Tube ☐
Field Vane Test ☐
Sensitivity ☐
Piezometric Water Level ☐
Combustible Vapour Reading ☐
Natural Moisture ☐
Plastic and Liquid Limit ☐
Undrained Triaxial at % Strain at Failure ☐
Penetrometer ☐

G W L	S Y M B O L	Soil Description	ELEV. (m)	D E P T H (m)	N Value				Combustible Vapour Reading (ppm)			Natural Unit Weight kN/m ³	
					20	40	60	80	250	500	750		
					Shear Strength 0.1 0.2 MPa				Natural Moisture Content % Atterberg Limits (% Dry Weight)				
		ROCK FILL: not sampled	220.0	0						10	20	30	
				1									
			217.6	2									
		MARL AND SILT CLAY: not sampled		3									
				4									
				5									
				6									
				7									
				8									
			210.9	9									
		LIMESTONE: triconed without sampling		10									
		This material was formerly thought to be bouldery till based on information from MTO personnel and was triconed without sampling.		11									
		It was subsequently cored and found to be limestone. Refer to the core logs for Boreholes 2A and 2B for rock description.	208.4	12									
		Continued on Core Log 2A		13									
				14									
			205.2										
		End of Borehole											

WATER LEVEL RECORD:

Time	Water Level (m)	Depth to Cave (m)

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CORE LOG

BH NO. 2A

PROJECT Atherley Narrows Bridge	ORIENTATION Vertical	ELEVATION (m) 220.0	DATUM Geodetic	PROJECT NO. SP2106
LOCATION Highway 12, Orillia, Ontario	DATE STARTED 01/12/98	COMPLETED 01/12/98	LOGGED BY H. Lohse	DRAWING NO. 7
CLIENT DS-Lea Associates Ltd.	DRILLER Malone	DRILL TYPE CME75	CORE BARREL NQ	SHEET 1 of 1

ELEV. (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	JOINT CHARACTERISTICS							WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN No.	RECOVERY %	RQD	WATER RECOVERY %	WATER COLOUR
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERATURE (mm)								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
220.0																		
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
208.3																		
12				1	B	F	C	RP	T	O				1	91	58	var.	lt bwn
13					C	V	VC											
14					C	D								2	77	25	var.	lt bwn
205.2																		
15																		
16																		
17																		
18																		
19																		

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CORE LOG											BH NO. 2B							
PROJECT Atherley Narrows Bridge					ORIENTATION Vertical		ELEVATION (m) 219.9		DATUM Geodetic		PROJECT NO. SP2106							
LOCATION Highway 12, Orillia, Ontario					DATE STARTED 01/19/98		COMPLETED 01/19/98		LOGGED BY H. Lohse		DRAWING NO. 8							
CLIENT DS-Lea Associates Ltd.					DRILLER Malone		DRILL TYPE CME75		CORE BARREL NQ		SHEET 1 of 1							
ELEV. (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	JOINT CHARACTERISTICS							WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN No.	RECOVERY %	RQD	WATER RECOVERY %	WATER COLOUR
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERATURE (mm)								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
219.9	1		Not sampled															
	2																	
	3																	
	4																	
	5																	
	6																	
	7																	
	8																	
211.1	9		LIMESTONE: fine grained, occasional stylolites, grey, unweathered, medium strength. Broken and rounded core at 12 m probably accounts for core loss in Run 1.	1	B	F	C	RP	T	0				1A	100	0	100	5
	10														2A	83	0100	grey
	11									SO					3A	90	10	grey
208.3	12		End of Borehole															
	13																	
	14																	
	15																	
	16																	
	17																	
	18																	
	19																	

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BH NO. 3

[illegible]

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Log of Borehole 4

Dwg No. **10**

Project: **Atherley Narrows Bridge**

Sheet No. **1** of **1**

Location: Highway 12, Orillia, Ontario

Date Drilled: **January 16, 1998**

Drill Type: **Hollow Stem**

Datum: **Geodetic**

Auger Sample ☒

SPT (N) Value ☐ ☒

Dynamic Cone Test

Shelby Tube

Field Vane Test

Sensitivity

Piezometric Water Level

Combustible Vapour Reading ☐

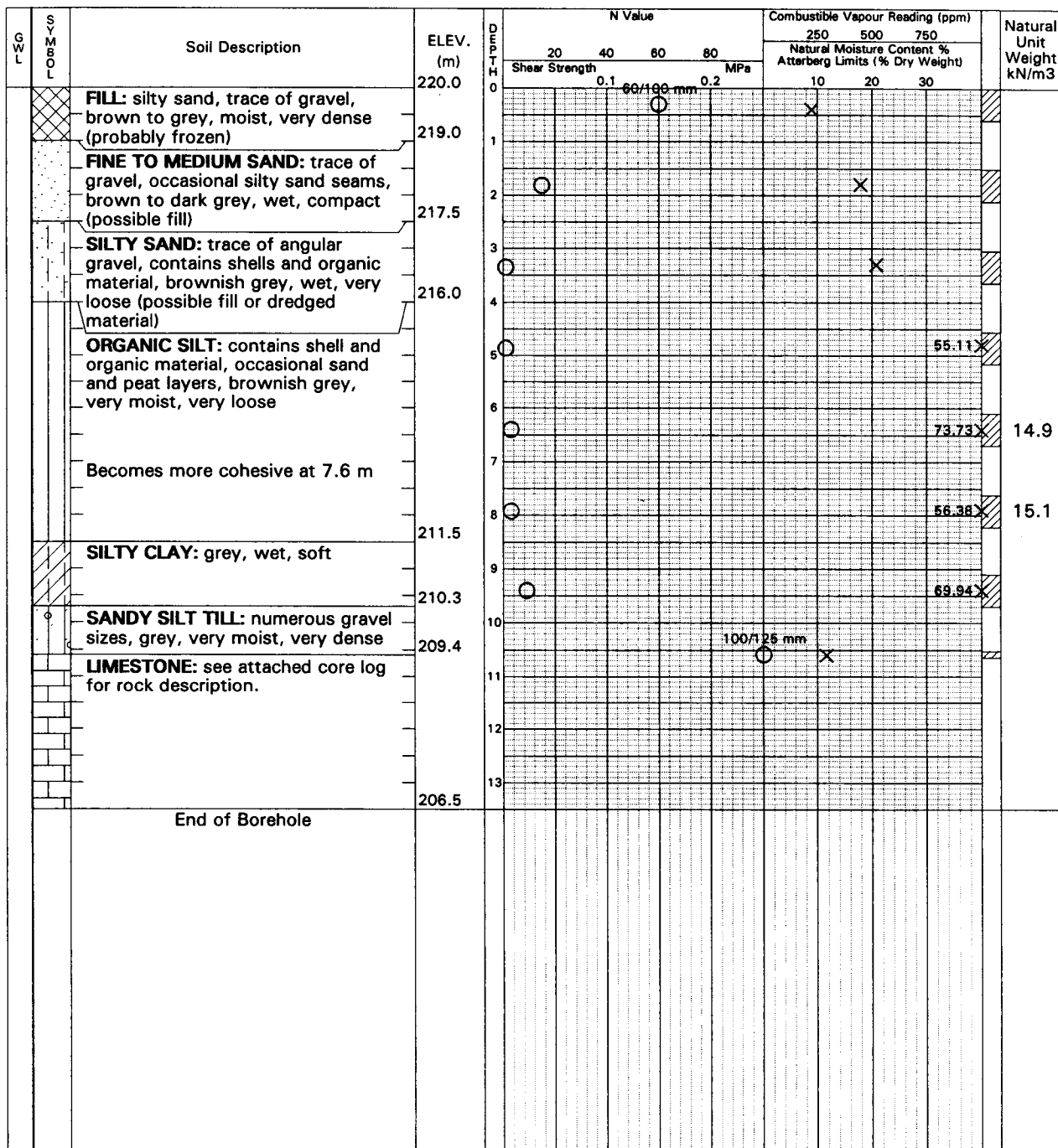
Natural Moisture ☒

Plastic and Liquid Limit

Undrained Triaxial

at % Strain at Failure \oplus

Penetrometer



WATER LEVEL RECORD:

Time	Water Level (m)	Depth to Cave (m)

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Consulting Geo-Environmental Engineers

CORE LOG

BH NO. 4

PROJECT Atherley Narrows Bridge	ORIENTATION Vertical	ELEVATION (m) 220.0	DATUM Geodetic	PROJECT NO. SP2106
LOCATION Highway 12, Orillia, Ontario	DATE STARTED 01/15/98	COMPLETED 01/15/98	LOGGED BY H.Lohse	DRAWING NO. 11
CLIENT DS-Lea Associates Ltd.	DRILLER Malone's	DRILL TYPE CME75	CORE BARREL NQ	SHEET 1 of 1

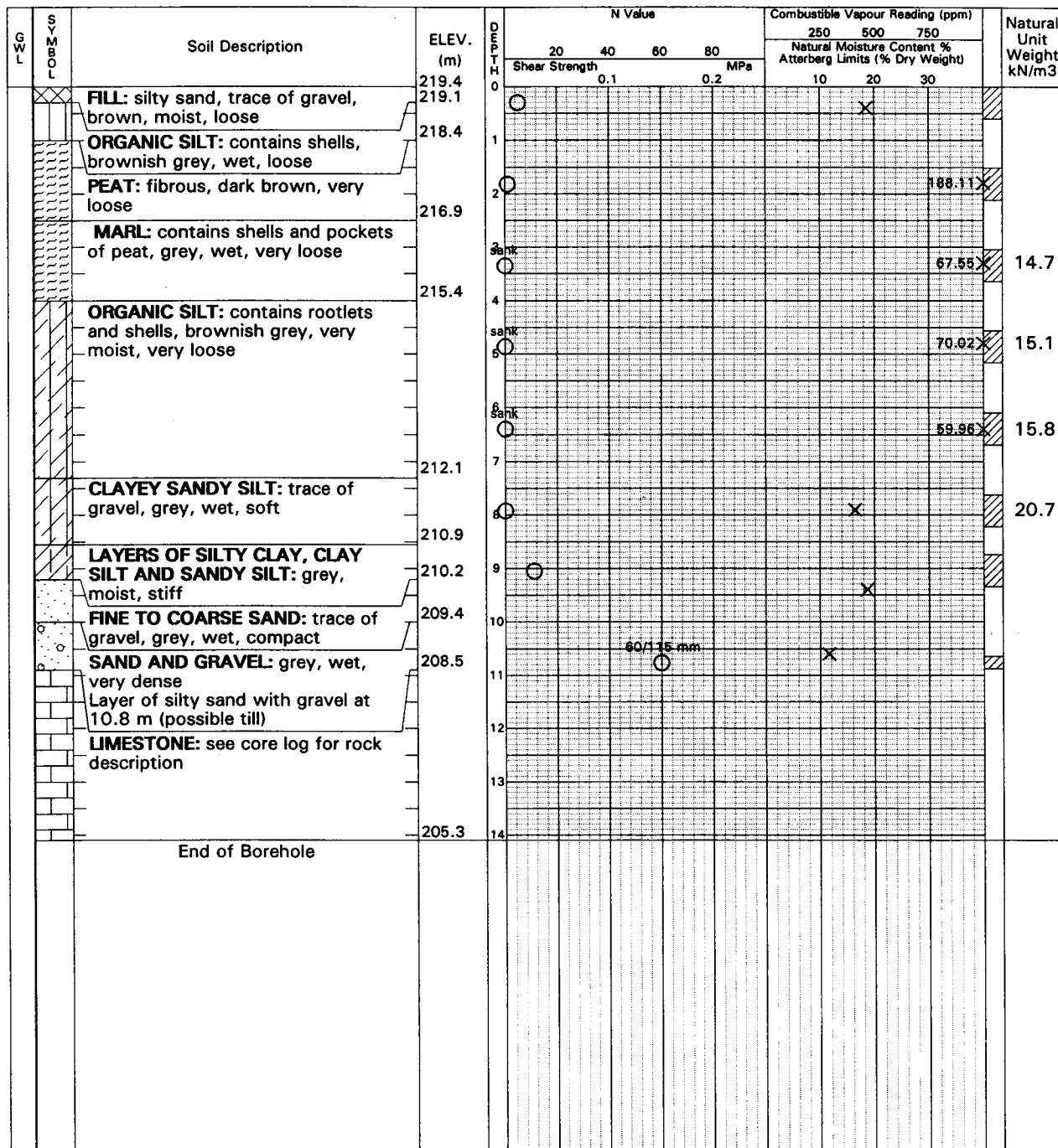
ELEV. (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	JOINT CHARACTERISTICS								WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN No.	RECOVERY %	RQD	WATER RECOVERY %	WATER COLOUR
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERATURE (mm)									
1	2	3	4	5	6	7	8	9	10	11		12	13	14	15	16	17	18	19
220.0			See Borehole log for soil description																
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
209.4			LIMESTONE: fine grained, grey, unweathered, medium strength. Core above 11 m was broken and rounded by drilling. Thin clay seams at 11.6 and 11.8 m. Core barrel dropped about 75 mm at 11.9 m.	1	B C	F V	C VC	RP	T SO SO	O					1	63	28	100	grey
															2	90	65	100	grey
206.6			End of Borehole																
14																			
15																			
16																			
17																			
18																			
19																			

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Project No. SP2106Log of Borehole 5Dwg No. 12Project: Atherley Narrows BridgeSheet No. 1 of 1Location: Highway 12, Orillia, OntarioDate Drilled: January 20, 1998Drill Type: Hollow Stem AugersDatum: Geodetic

Auger Sample ☒ Combustible Vapour Reading ☐
SPT (N) Value ☐ Natural Moisture ☒
Dynamic Cone Test ☐ Plastic and Liquid Limit ☐
Shelby Tube ☒ Undrained Triaxial ☐
Field Vane Test ☐ at % Strain at Failure ☐
Sensitivity ☐ Penetrometer ☐
Piezometric Water Level ☐



WATER LEVEL RECORD:

Time	Water Level (m)	Depth to Cave (m)



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CORE LOG

BH NO. 5

PROJECT Atherley Narrows Bridge	ORIENTATION Vertical	ELEVATION (m) 219.4	DATUM Geodetic	PROJECT NO. SP2106
LOCATION Highway 12, Orillia, Ontario	DATE STARTED 01/20/98	COMPLETED 01/20/98	LOGGED BY H.Lohse	DRAWING NO. 13
CLIENT DS-Lea Associates Ltd.	DRILLER Malone's	DRILL TYPE CME75	CORE BARREL NQ	SHEET 1 of 1

ELEV. (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	JOINT CHARACTERISTICS							WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN No.	RECOVERY %	RQD	WATER RECOVERY %	WATER COLOUR
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERATURE (mm)								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
219.4																		
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
208.5																		
11																		
12																		
13																		
205.3																		
14																		
15																		
16																		
17																		
18																		
19																		

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Log of Borehole 6-1

Dwg No. 14

Project: Atherley Narrows Bridge

Sheet No. 1 of 1

Location: Highway 12, Orillia, Ontario

Date Drilled: **February 9, 1998**

Drill Type: Hollow Stem AugersDatum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube


Field Vane Test

Sensitivity

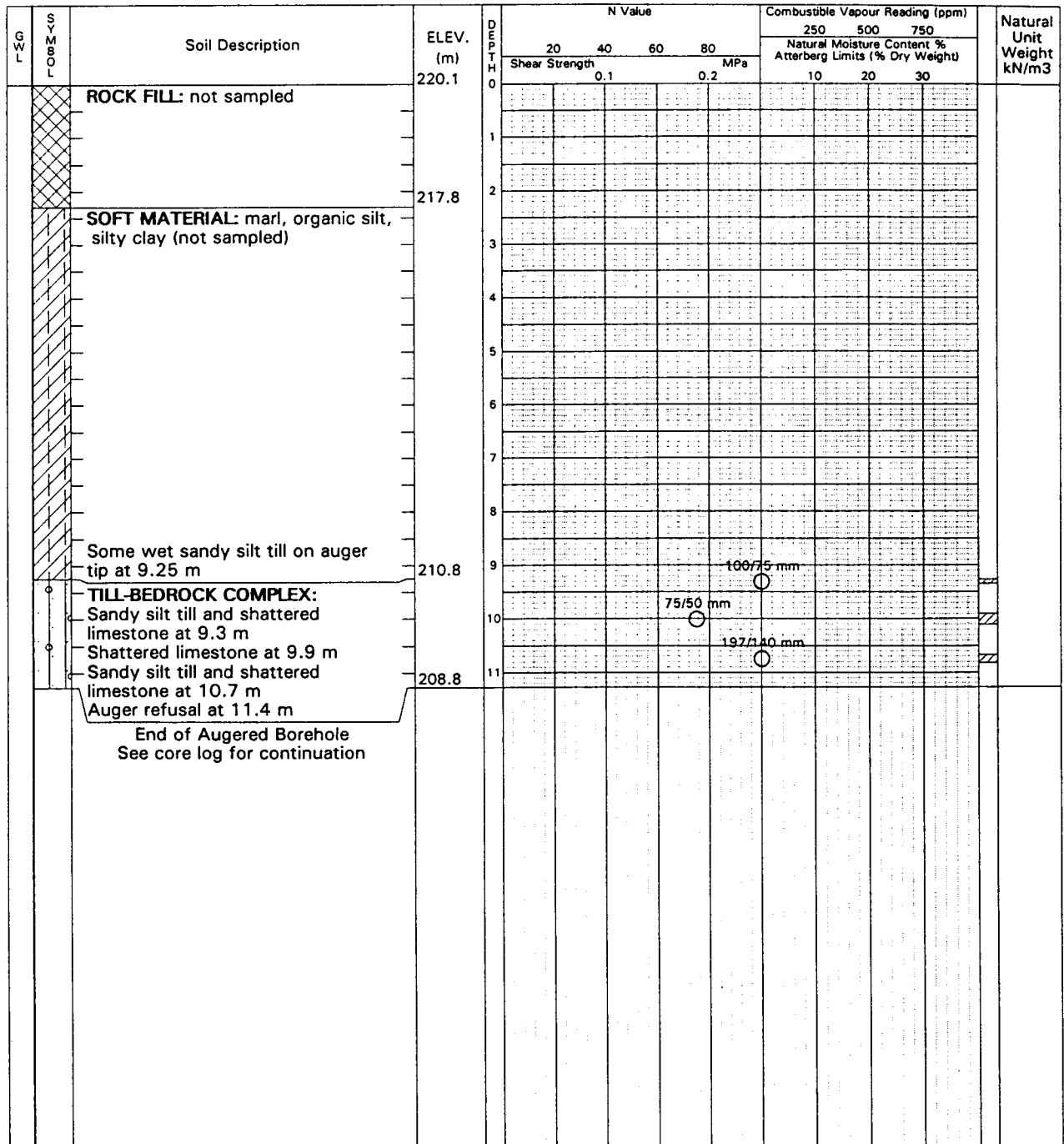
Piezometric Water Level

Combustible Vapour Reading ☐

Natural Moisture	X
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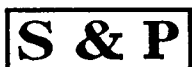
Plastic and Liquid Limit $\text{---} \bigcirc$ Undrained Triaxial
at % Strain at Failure 

Penetrometer ▲



WATER LEVEL RECORD:

Time	Water Level (m)	Depth to Cave (m)



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CORE LOG											BH NO. 6-1							
PROJECT Atherley Narrows Bridge				ORIENTATION Vertical		ELEVATION (m) 220.1		DATUM Geodetic		PROJECT NO. SP2106								
LOCATION Highway 12, Orillia, Ontario				DATE STARTED 02/09/98		COMPLETED 02/09/98		LOGGED BY H. Lohse		DRAWING NO. 15								
CLIENT DS-Lea Associates Ltd.				DRILLER Malone		DRILL TYPE CME 75		CORE BARREL NQ		SHEET 1 of 1								
ELEV. (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	JOINT CHARACTERISTICS							WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN No.	RECOVERY %	RQD	WATER RECOVERY %	WATER COLOUR
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERATURE (mm)								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
220.1																		
1																		
2																		
3			See Borehole log for soil description															
4																		
5																		
6																		
7																		
8																		
9																		
10			Piece of lithographic limestone in top 1 cm of core, probable transported material															
208.8	11																	
	12		LIMESTONE: fine grained, unweathered, medium strength 25 mm void at 12.4 m	2	C	V	C	RP	T	O				1	100	39		
207.5				1	B	F	VC											
13																		
14																		
15																		
16																		
17																		
18																		
19																		

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Log of Borehole 6-1-A

Dwg No. 16

Project: **Atherley Narrows Bridge**

Sheet No. 1 of 1

Location: **Highway 12, Orillia, Ontario**

Date Drilled: **February 10, 1998**

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Sensitivity


Piezometric Water Level

Combustible Vapour Reading ☐

Natural Moisture X

Plastic and Liquid Limit

Undrained Triaxial

at % Strain at Failure 

Penetrometer

[illegible]

WATER LEVEL RECORD:

Time	Water Level (m)	Depth to Cave (m)



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CORE LOG											BH NO.6-1-A							
PROJECT Atherley Narrows Bridge				ORIENTATION Vertical		ELEVATION (m) 220.1		DATUM Geodetic		PROJECT NO. SP2106								
LOCATION Highway 12, Orillia, Ontario				DATE STARTED 02/10/98		COMPLETED 02/10/98		LOGGED BY H. Lohse		DRAWING NO. 17								
CLIENT DS-Lea Associates Ltd.				DRILLER Malone		DRILL TYPE CME 75		CORE BARREL NQ		SHEET 1 of 1								
ELEV. (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	JOINT CHARACTERISTICS							WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN No.	RECOVERY %	RQD	WATER RECOVERY %	WATER COLOUR
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERATURE (mm)								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
220.1	1		See Borehole log for soil description															
	2																	
	3																	
	4																	
	5																	
	6																	
	7																	
	8																	
	9																	
210.5	10		LIMESTONE: fine grained, generally unweathered, medium strength Limestone fragments in Run 1 were angular to rounded by drill, there were no obvious till polished fragments Clay and silt sized material in joints at about 11 m and 11.5 m	2	B C	F V	C VC	SU RP	SC T SC	0					1	19	0	
	11														2	100	47	
	12														3	90	71	
	13														4	98	95	
206.8	14		End of Borehole															
	15		Note: Water recovery low to nil from 12.7 to 13.2 m															
	16																	
	17																	
	18																	
	19																	

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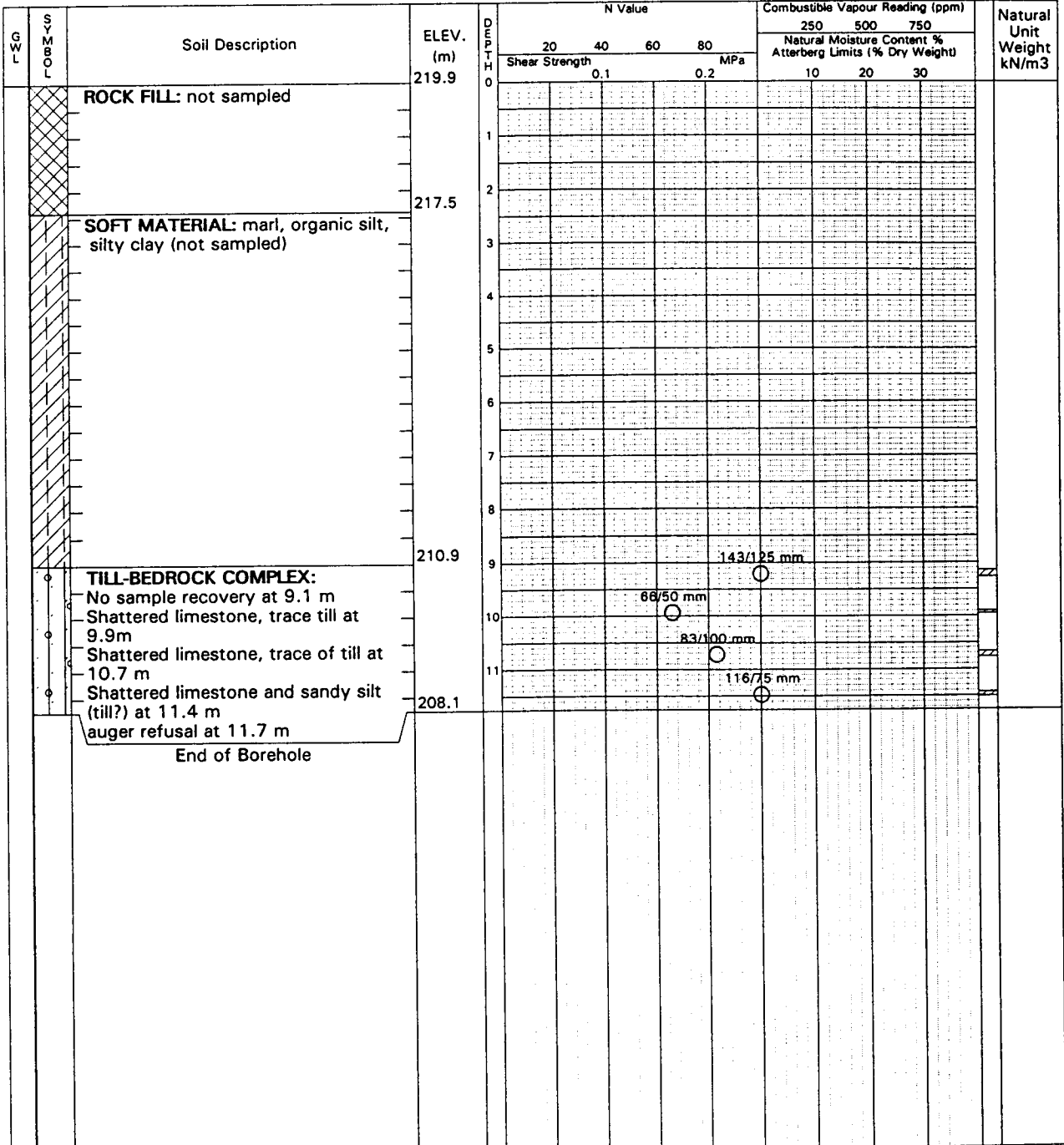
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Project No. SP2106

Log of Borehole 6-2

Dwg No. 18Project: Atherley Narrows BridgeSheet No. 1 of 1Location: Highway 12, Orillia, OntarioDate Drilled: February 11, 1998Drill Type: Hollow Stem AugersDatum: Geodetic

Auger Sample ☒ Combustible Vapour Reading ☐
SPT (N) Value ☐ Natural Moisture ☒
Dynamic Cone Test ☐ Plastic and Liquid Limit ☐
Shelby Tube ☒ Undrained Triaxial ☐
Field Vane Test ☐ at % Strain at Failure ☐
Sensitivity ☐ Penetrometer ☐
Piezometric Water Level ☐



Project No. SP2106

Log of Borehole 6-2-A

Dwg No. 19Project: Atherley Narrows BridgeSheet No. 1 of 1Location: Highway 12, Orillia, OntarioDate Drilled: February 11, 1998Drill Type: Hollow Stem AugersDatum: GeodeticAuger Sample ☒SPT (N) Value ☐Dynamic Cone Test ☐Shelby Tube ☒Field Vane Test ☐Sensitivity ☐Piezometric Water Level ☐Combustible Vapour Reading ☐Natural Moisture ☒Plastic and Liquid Limit ☐Undrained Triaxial at % Strain at Failure ☐Penetrometer ☒

G W L	S Y M B O L	Soil Description	ELEV. (m)	D E P T H (m)	N Value				Combustible Vapour Reading (ppm)			Natural Unit Weight kN/m3
					20	40	60	80	250	500	750	
					MPa				Natural Moisture Content % Atterberg Limits (% Dry Weight)			
Shear Strength					0.1	0.2			10	20	30	
		ROCK FILL: not sampled	219.9	0								
				1								
				2								
		SOFT MATERIAL:	217.5	3								
				4								
				5								
				6								
				7								
				8								
			211.1									
		SANDY SILT TILL: contains shattered rock, traces of wood or root	211.0									
		End of Augered Borehole										

WATER LEVEL RECORD:

Time	Water Level (m)	Depth to Cave (m)



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CORE LOG

BH NO.6-2-A

PROJECT Atherley Narrows Bridge	ORIENTATION Vertical	ELEVATION (m) 219.9	DATUM Geodetic	PROJECT NO. SP2106
LOCATION Highway 12, Orillia, Ontario	DATE STARTED 02/11/98	COMPLETED 02/12/98	LOGGED BY H. Lohse	DRAWING NO. 20
CLIENT DS-Lea Associates Ltd.	DRILLER Malone	DRILL TYPE CME 75	CORE BARREL NQ	SHEET 1 of 1

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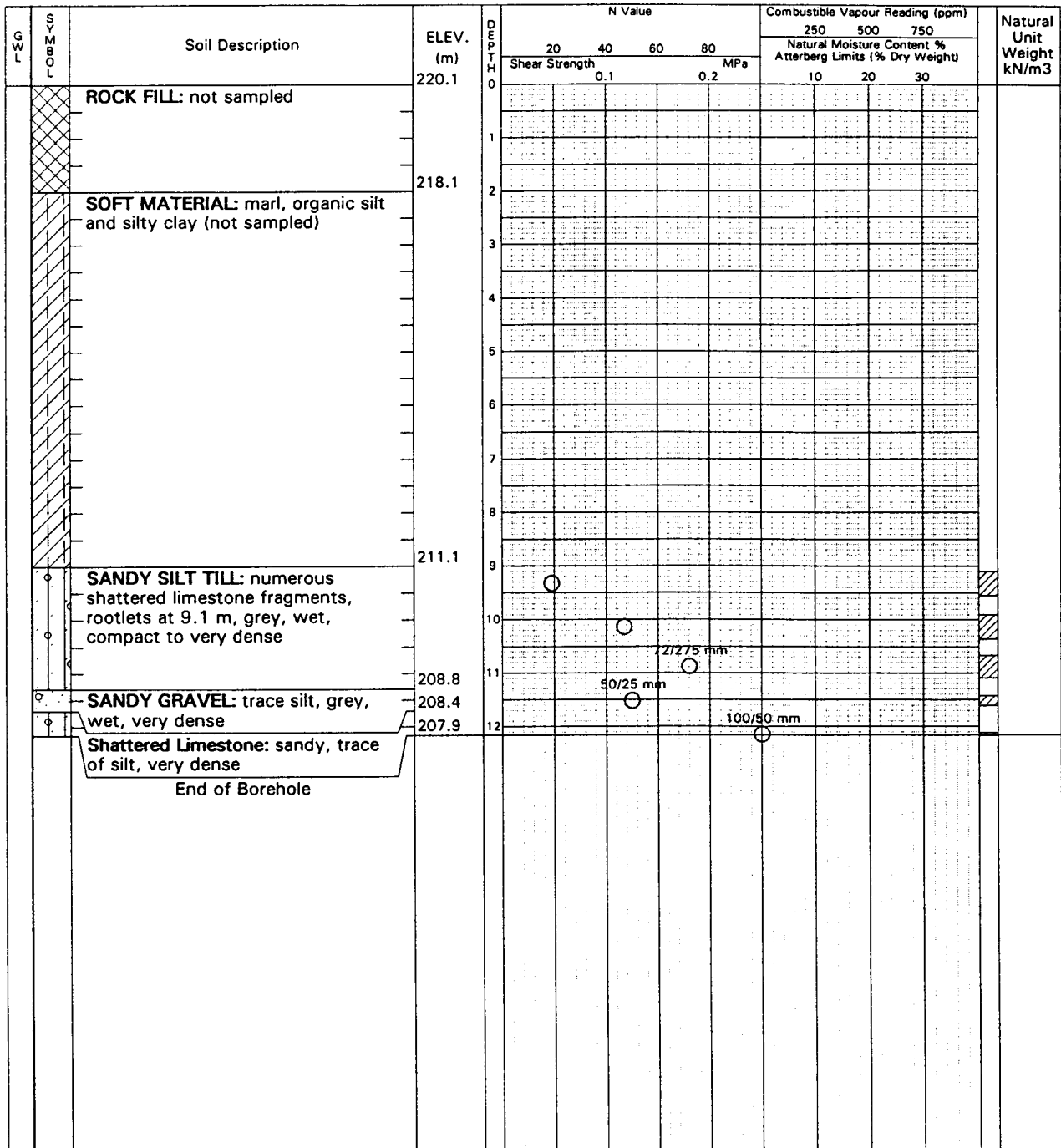
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Consulting Geo-Environmental Engineers

Project No. SP2106

Log of Borehole 7

Dwg No. 21Project: Atherley Narrows BridgeSheet No. 1 of 1Location: Highway 12, Orillia, OntarioDate Drilled: February 12, 1998Drill Type: Hollow Stem AugersDatum: Geodetic

Auger Sample ☒ Combustible Vapour Reading ☐
SPT (N) Value ☐ Natural Moisture ☒
Dynamic Cone Test ☐ Plastic and Liquid Limit ☐
Shelby Tube ☒ Undrained Triaxial ☒
Field Vane Test ☒ at % Strain at Failure ☒
Sensitivity ☒ Penetrometer ☒
Piezometric Water Level ☒



WATER LEVEL RECORD:

Time	Water Level (m)	Depth to Cave (m)



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CORE LOG

BH NO. 7A

PROJECT Atherley Narrows Bridge	ORIENTATION Vertical	ELEVATION (m) 220.0	DATUM Geodetic	PROJECT NO. SP2106
LOCATION Highway 12, Orillia, Ontario	DATE STARTED 02/12/98	COMPLETED 02/13/98	LOGGED BY H. Lohse	DRAWING NO. 22
CLIENT DS-Lea Associates Ltd.	DRILLER Malone	DRILL TYPE CME 75	CORE BARREL NQ	SHEET 1 of 1

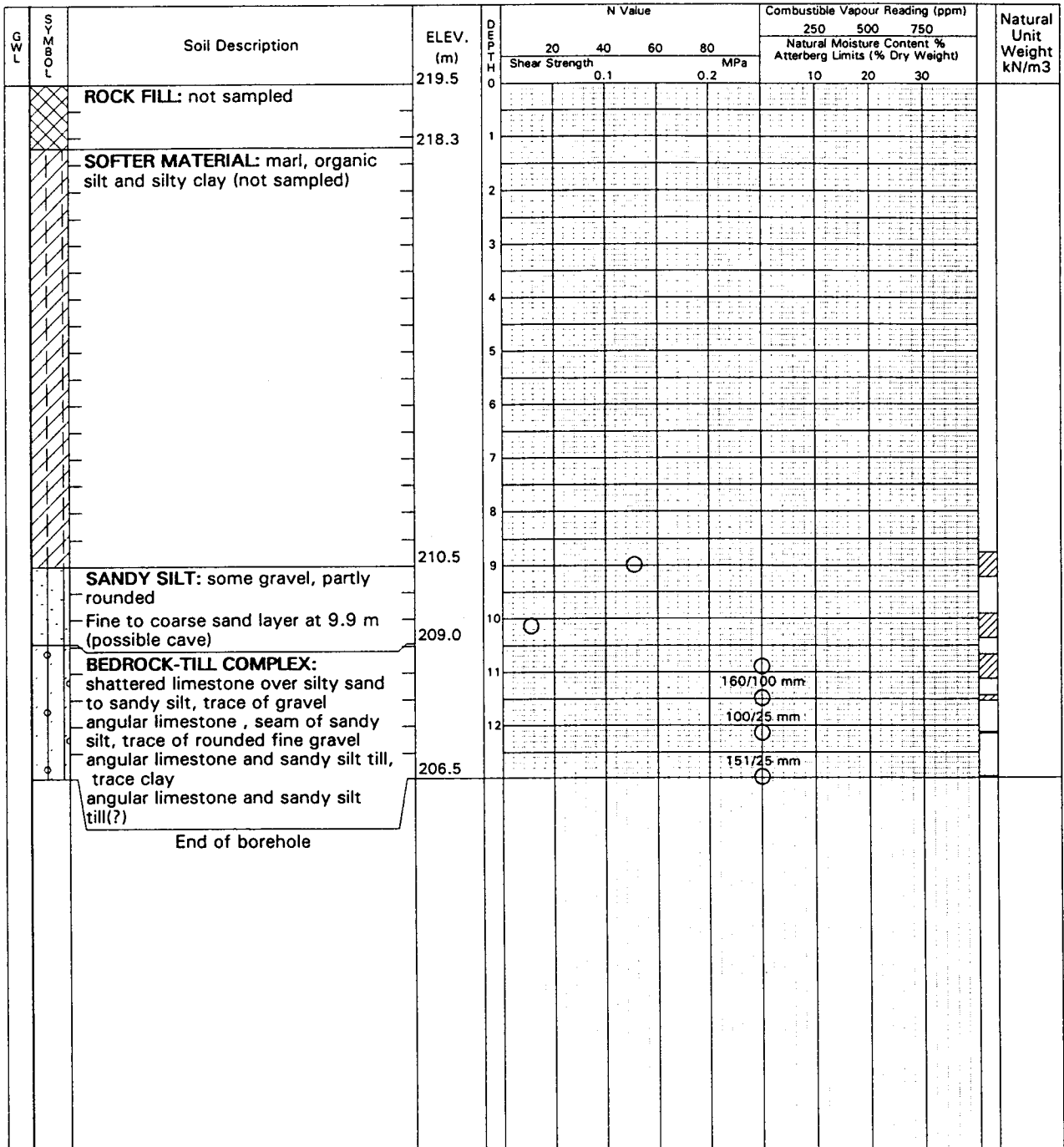
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Project No. SP2106

Log of Borehole 8

Dwg No. 23Project: Atherley Narrows BridgeSheet No. 1 of 1Location: Highway 12, Orillia, OntarioDate Drilled: February 16, 1998Drill Type: Hollow Stem AugersDatum: GeodeticAuger Sample ☒SPT (N) Value ☐Dynamic Cone Test ☐Shelby Tube ☒Field Vane Test ☐Sensitivity ☐Piezometric Water Level ☐Combustible Vapour Reading ☐Natural Moisture ☒Plastic and Liquid Limit ☐Undrained Triaxial ☐at % Strain at Failure ☐Penetrometer ☐**WATER LEVEL RECORD:**

Time	Water Level (m)	Depth to Cave (m)



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CORE LOG											BH NO. 8A							
PROJECT Atherley Narrows Bridge				ORIENTATION Vertical		ELEVATION (m) 219.5		DATUM Geodetic		PROJECT NO. SP2106								
LOCATION Highway 12, Orillia, Ontario				DATE STARTED 02/16/98		COMPLETED 02/16/98		LOGGED BY H. Lohse		DRAWING NO. 24								
CLIENT DS-Lea Associates Ltd.				DRILLER Malone		DRILL TYPE CME 75		CORE BARREL NQ		SHEET 1 of 1								
ELEV. (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	JOINT CHARACTERISTICS							WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN No.	RECOVERY %	ROD	WATER RECOVERY %	WATER COLOUR
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERATURE (mm)								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
219.5	1		See Borehole log for soil description															
	2																	
	3																	
	4																	
	5																	
	6																	
	7																	
	8																	
	9																	
	10																	
208.6	11		LIMESTONE: fine grained, generally unweathered, medium strength		C B	V F	C VC	RP	T	O				1	85	37		
	12		Re-drilled rock fragments at top of Run 1											2	90	41		
	13		Core barrel dropped ~25 mm at 12.8 m, possible void											3	85	37		
206.3	14		End of Borehole															
	15		Note: No water return below 12.9 m															
	16																	
	17																	
	18																	
	19																	

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 Consulting Geo-Environmental Engineers

Project No. SP2106

Log of Borehole 9

Dwg No. 25Project: Atherley Narrows BridgeSheet No. 1 of 1Location: Highway 12, Orillia, OntarioDate Drilled: February 17, 1998Drill Type: Hollow Stem AugersDatum: GeodeticAuger Sample ☒SPT (N) Value ☐Dynamic Cone Test ☐Shelby Tube ☐Field Vane Test ☐Sensitivity ☐Piezometric Water Level ☐Combustible Vapour Reading ☐Natural Moisture ☐Plastic and Liquid Limit ☐Undrained Triaxial ☐at % Strain at Failure ☐Penetrometer ☐

G W L	S Y M B O L	Soil Description	ELEV. (m)	D E P T H (m)	N Value				Combustible Vapour Reading (ppm)			Natural Unit Weight kN/m3
					20	40	60	80	250	500	750	
					Shear Strength	MPa			Natural Moisture Content % Atterberg Limits (% Dry Weight)			
					0.1	0.2			10	20	30	
		ROCK FILL: not sampled	219.4	0								
			218.4	1								
		SOFTER MATERIAL: marl, organic silt, silty clay (not sampled)		2								
				3								
				4								
				5								
				6								
				7								
				8								
				9								
			209.4	10								
		SANDY SILT: trace of clay and gravel, grey, wet (possible till)	208.8	11								
		SANDY SILT TILL: grey, wet, dense bottom of sample consisted of shattered limestone Coring started at this depth	208.3									

WATER LEVEL RECORD:

Time	Water Level (m)	Depth to Cave (m)



Shaheen and Peaker Limited
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CORE LOG											BH NO. 9								
PROJECT Atherley Narrows Bridge					ORIENTATION Vertical		ELEVATION (m) 219.4		DATUM Geodetic		PROJECT NO. SP2106								
LOCATION Highway 12, Orillia, Ontario					DATE STARTED 02/17/98		COMPLETED 02/17/98		LOGGED BY H. Lohse		DRAWING NO. 26								
CLIENT DS-Lea Associates Ltd.					DRILLER Malone		DRILL TYPE CME 75		CORE BARREL NQ		SHEET 1 of 1								
ELEV. (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	JOINT CHARACTERISTICS								WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN No.	RECOVERY %	RQD	WATER RECOVERY %	WATER COLOUR
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERATURE (mm)									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
219.4																			
	1		See Borehole logs for soil description																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
208.4	11		Possible Till																
207.9	12		LIMESTONE: fine grained, generally unweathered, medium strength												1	31	0		
	13		Core barrel dropped about 25 mm at 12.1 m, possible void												2	86	56		
	14														3	99	81		
205.3	15		End of Borehole																
	16																		
	17																		
	18																		
	19																		

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Project No. SP2106

Log of Borehole 9A

Dwg No. 27Project: Atherley Narrows BridgeSheet No. 1 of 1Location: Highway 12, Orillia, OntarioDate Drilled: February 17, 1998Drill Type: Hollow Stem AugersDatum: GeodeticAuger Sample ☒SPT (N) Value ☐Dynamic Cone Test ☐Shelby Tube ☒Field Vane Test ☐Sensitivity ☐Piezometric Water Level ☐Combustible Vapour Reading ☐Natural Moisture ☒Plastic and Liquid Limit ☐Undrained Triaxial ☐at % Strain at Failure ☐Penetrometer ☐

G W L	S Y M B O L	Soil Description	ELEV. (m)	D E P T H (m)	N Value				Combustible Vapour Reading (ppm)			Natural Unit Weight kN/m3	
					20	40	60	80	250	500	750		
					Shear Strength	0.1	0.2	MPa	Natural Moisture Content % Atterberg Limits (% Dry Weight)				
		Augered to 10.7 m without sampling	219.4	0									
				1									
				2									
				3									
				4									
				5									
				6									
				7									
				8									
				9									
				10									
			208.8	11									
		SANDY SILT TILL: contains shattered limestone, grey, very moist to wet, very dense Sample refusal at 11.7 m Auger refusal at about 12 m	207.5										
		End of Borehole Note: split-barrel sampler had to be pushed through cave material above 11.43 m to reach sampling depth											

WATER LEVEL RECORD:

Time	Water Level (m)	Depth to Cave (m)



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Project No. SP2106

Log of Borehole 10

Dwg No. 28Project: Atherley Narrows BridgeSheet No. 1 of 1Location: Highway 12, Orillia, OntarioDate Drilled: February 18, 1998Drill Type: Solid Stem AugersDatum: GeodeticAuger Sample ☒SPT (N) Value ☐ ☒Dynamic Cone Test ☐Shelby Tube ☒Field Vane Test ☐Sensitivity ☐Piezometric Water Level ☒Combustible Vapour Reading ☐Natural Moisture ☒Plastic and Liquid Limit ☐Undrained Triaxial ☒at % Strain at Failure ☐Penetrometer ☒

GWL	SYMBOL	Soil Description	ELEV. (m)	DEPTH (m)	N Value				Combustible Vapour Reading (ppm)			Natural Unit Weight kN/m3	
					20	40	60	80	250	500	750		
					MPa				Natural Moisture Content %				
					Shear Strength				Atterberg Limits (% Dry Weight)				
					0.1		0.2		10	20	30		
		FILL: fine to coarse sand, some gravel, brown, moist	220.3	0									
				1									
		PEAT: contains roots and wood fibers, dark brown, moist	218.8	2									
			217.9	3									
		MARL: brownish grey sandy silt, contains shells and rootlets, very moist to wet	216.8	4									
		SILTY CLAY: some gravel, grey, very moist to wet	215.8										
		End of Borehole											
		Note: Borehole was not sampled.											

WATER LEVEL RECORD:

Time	Water Level (m)	Depth to Cave (m)



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Project No. SP2106

Log of Borehole 11

Dwg No. 29Project: Atherley Narrows BridgeSheet No. 1 of 1Location: Highway 12, Orillia, OntarioDate Drilled: February 18, 1998Drill Type: Solid Stem AugersDatum: GeodeticAuger Sample ☒SPT (N) Value ☐Dynamic Cone Test ☐Shelby Tube ☒Field Vane Test ☐Sensitivity ☐Piezometric Water Level ☐Combustible Vapour Reading ☐Natural Moisture ☒Plastic and Liquid Limit ☐Undrained Triaxial ☐at % Strain at Failure ☐Penetrometer ☐

G W L	S Y M B O L	Soil Description	ELEV. (m)	D E P T H m	N Value				Combustible Vapour Reading (ppm)			Natural Unit Weight kN/m3
					20	40	60	80	250	500	750	
					Shear Strength MPa				Natural Moisture Content % Atterberg Limits (% Dry Weight)			
			220.4	0	0.1		0.2		10	20	30	
		FILL: mixture of peat and fine to coarse sand with some gravel, brown to grey, wet		1								
		PEAT: contains roots and wood fibers, dark brown, moist	218.9	2								
		SILTY CLAY: some gravel, grey, very moist	217.9	3								
		Slightly harder augering at about 4.5 m	215.9	4								
		End of Borehole Note: borehole was not sampled.										

WATER LEVEL RECORD:

Time	Water Level (m)	Depth to Cave (m)



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Log of Borehole 12

Dwg No. 30

Project: **Atherley Narrows Bridge**

Sheet No. **1** of **1**

Location: Highway 12, Orillia, Ontario

Date Drilled: **February 19, 1998**

Drill Type: **Hollow Stem Augers**

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Sensitivity

Piezometric Water Level

Combustible Vapour Reading ☐

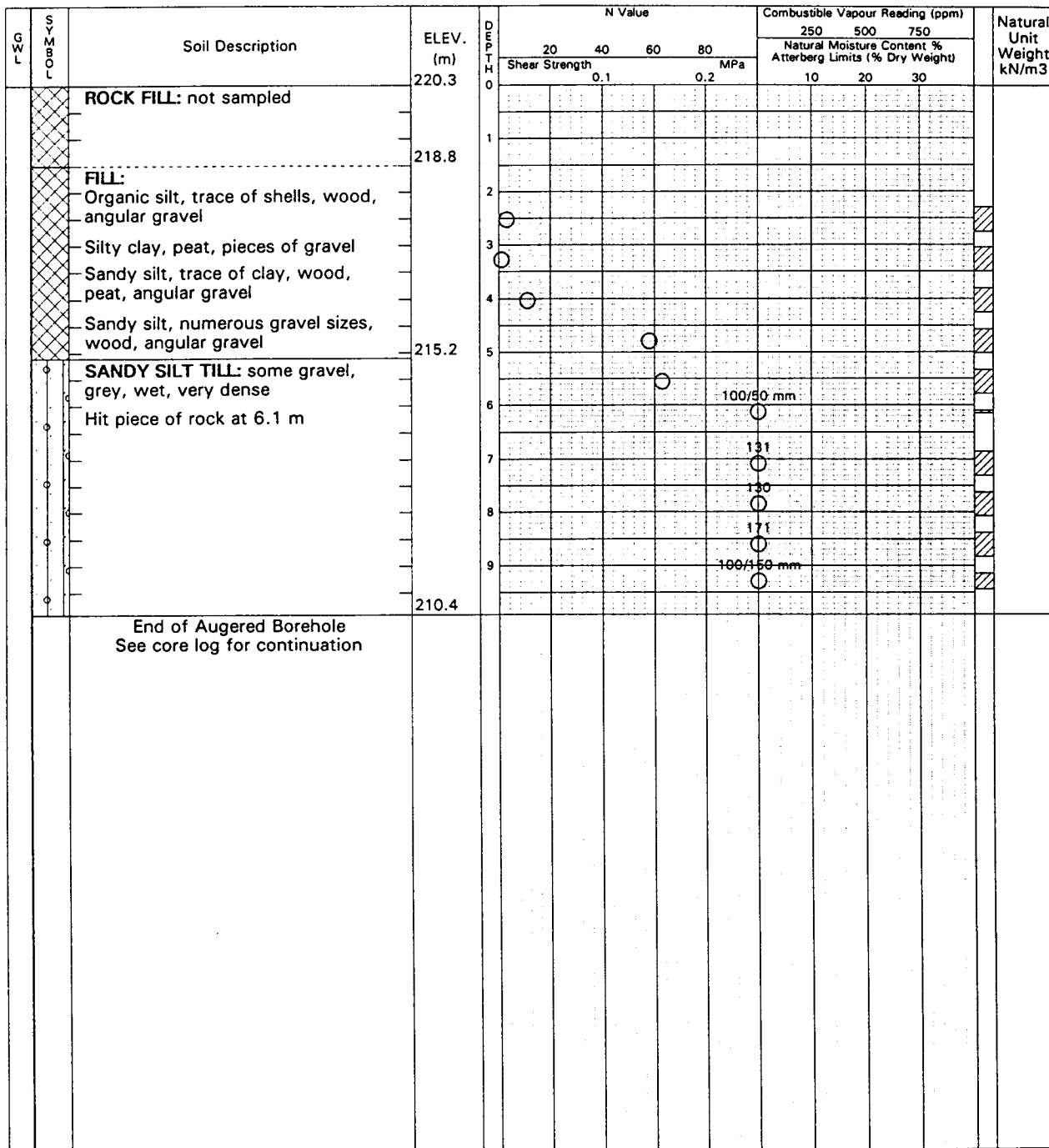
Natural Moisture	X
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Plastic and Liquid Limit

Undrained Triaxial

at % Strain at Failure

Penetrometer



WATER LEVEL RECORD:

Time	Water Level (m)	Depth to Cave (m)

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CORE LOG											BH NO. 12								
PROJECT Atherley Narrows Bridge					ORIENTATION Vertical		ELEVATION (m) 220.3		DATUM Geodetic		PROJECT NO. SP2106								
LOCATION Highway 12, Orillia, Ontario					DATE STARTED 02/19/98		COMPLETED 02/19/98		LOGGED BY H. Lohse		DRAWING NO. 31								
CLIENT DS-Lea Associates Ltd.					DRILLER Malone		DRILL TYPE CME 75		CORE BARREL NQ		SHEET 1 of 1								
ELEV. (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	JOINT CHARACTERISTICS							WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN No.	RECOVERY %	RQD	WATER RECOVERY %	WATER COLOUR	
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERATURE (mm)									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
220.3																			
	1		See Borehole log for soil description																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
210.5	9																		
	10		LIMESTONE: fine grained, generally unweathered, medium strength Core in all runs showed signs of re-drilling and was in part broken up. Vertical joint in Run 3 was coated with mud (till-like material) Core barrel dropped slightly a few times in Run 3	1	C B	D F	C M	RP	T	O				1	55	16			
	11														2	82	56		
	12														3	31	0		
	13														4	14	0		
206.8	14		End of Borehole																
	15																		
	16																		
	17																		
	18																		
	19																		

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CORE LOG											BH NO. 12A								
PROJECT Atherley Narrows Bridge					ORIENTATION Vertical			ELEVATION (m) 220.3			DATUM Geodetic			PROJECT NO. SP2106					
LOCATION Highway 12, Orillia, Ontario					DATE STARTED 02/25/98			COMPLETED 02/26/98			LOGGED BY H. Lohse			DRAWING NO. 32					
CLIENT DS-Lea Associates Ltd.					DRILLER Malone			DRILL TYPE CME75			CORE BARREL NQ			SHEET 1 of 1					
ELEV. (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	JOINT CHARACTERISTICS							WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN No.	RECOVERY %	RQD	WATER RECOVERY %	WATER COLOUR	
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERATURE (mm)									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
220.3			Augered without sampling																
	1		At 2.1 m pulled up cable with augers and drilled through about 450 mm timber																
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9		Auger refusal at 9.9 m																
210.3	10		LIMESTONE: fine grained, medium grey, generally unweathered												1	83	36	100	grey
	11		Core barrel dropped 50 mm at 10.8 m, possible void												2	80	21	100	
	12		Drilling was faster at about 12 m depth. Mud coated fractures at about 12 to 12.4 m.						NC						3	63	13	100	grey
	13			1	B	F	C	RP	T	0					4	57	17	100	grey
	14		Fractures filled with fine to medium sand at about 14.3 to 14.8 m				VC		S	10									
205.2	15		VOID: filled with fine to medium sand												5	50	13	100	grey
	16		Split-barrel sample at 15.2 m, N = 8 (top 1.1 m of Run 6 penetrated easily)																
203.1	17		LIMESTONE: fine to medium grained, medium grey, generally unweathered												6	25	21	100	grey
	18		Small 50 mm thick void at about 18 m	1	B	F	C	RP	T	0					7	94	48	100	grey
201.4	19		Sandy along fractures				VC		S						7A	100	0	100	
	20		LITHOGRAPHIC LIMESTONE: very fine grained, light grey, unweathered	1	B	F	M	RP	T	0					9	94	82	100	grey
200.2			End of Borehole																

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CORE LOG											BH NO. 13							
PROJECT Atherley Narrows Bridge					ORIENTATION Vertical		ELEVATION (m) 220.2		DATUM Geodetic		PROJECT NO. SP2106							
LOCATION Highway 12, Orillia, Ontario					DATE STARTED 02/27/98		COMPLETED 03/02/98		LOGGED BY H. Lohse		DRAWING NO. 33							
CLIENT DS-Lea Associates Ltd.					DRILLER Malone		DRILL TYPE CME75		CORE BARREL NQ		SHEET 1 of 1							
ELEV. (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	JOINT CHARACTERISTICS							WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN No.	RECOVERY %	RQD	WATER RECOVERY %	WATER COLOUR
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERATURE (mm)								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
220.2			Augered to 10.36 m without sampling															
	1																	
	2																	
	3																	
	4																	
	5																	
	6																	
	7		Casing advanced to 10.6 m															
	8																	
	9																	
	10																	
209.7	11		LIMESTONE: fine grained, generally unweathered, medium grey, moderate strength						NC					1	81	41	100	grey
	12		Mud noted on fractures from 11 to 12 m	2	B	F	C	RP	T	0				2	90	57	100	grey
	13		Oxidized fractures and a trace of mud in Run 3 (probable void)		C	D	VC							3	40	20	100	grey
	14			1	B	F	C	RP	T	0				4	82	20	100	grey
	15		Oxidized fracture in Run 5		C	V								5	69	39	100	grey
	16		Sand noted along fractures from 15.8 to 16.1 m						S					6	78	25	100	grey
	17		Trace of mud at 17.3 m		C	V								7	72	0	100	grey
	18		Limestone fragments and clay seam at 17.5 m						NC					8	90	31	100	grey
201.9	19		End of Borehole											9	53	17	100	grey

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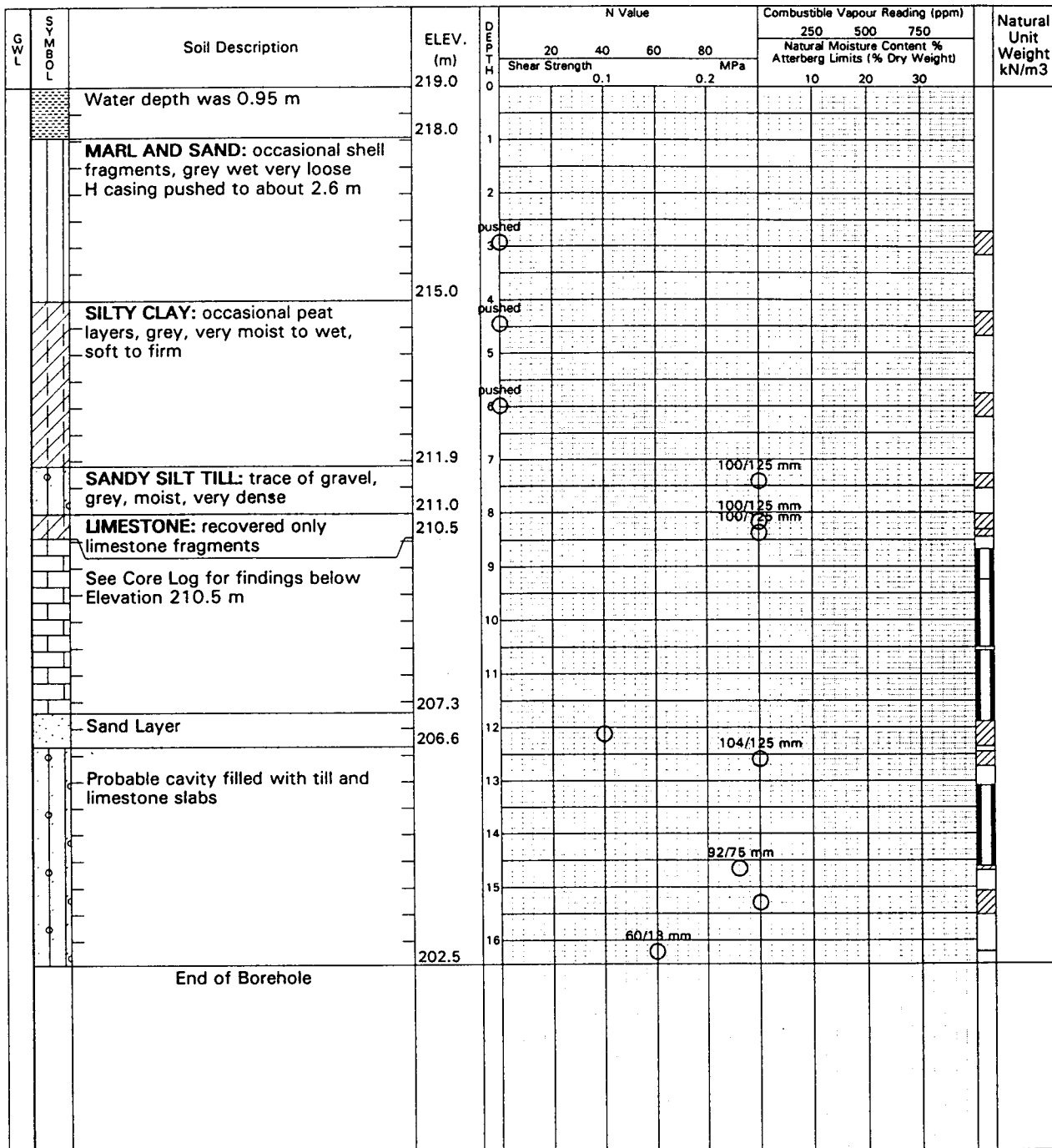
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Project No. SP2106

Log of Borehole 14

Dwg No. 34Project: Atherley Narrows BridgeSheet No. 1 of 1Location: Highway 12, Orillia, OntarioDate Drilled: March 23, 1998Drill Type: Wash BoringDatum: Geodetic

Auger Sample ☒ Combustible Vapour Reading ☐
SPT (N) Value ☐ Natural Moisture ☒
Dynamic Cone Test ☐ Plastic and Liquid Limit ☐
Shelby Tube ☒ Undrained Triaxial ☒
Field Vane Test ☐ at % Strain at Failure ☒
Sensitivity ☐ Penetrometer ☒
Piezometric Water Level ☐

**WATER LEVEL RECORD:**

Time	Water Level (m)	Depth to Cave (m)

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CORE LOG											BH NO. 14							
PROJECT Atherley Narrows Bridge					ORIENTATION Vertical		ELEVATION (m) 219.0		DATUM Geodetic		PROJECT NO. SP2106							
LOCATION Highway 12, Orillia, Ontario					DATE STARTED 03/23/98		COMPLETED 03/27/98		LOGGED BY H. Lohse		DRAWING NO. 35							
CLIENT DS-Lea Associates Ltd.					DRILLER Malone		DRILL TYPE		CORE BARREL NXL		SHEET 1 of 2							
ELEV. (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	JOINT CHARACTERISTICS							WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN No.	RECOVERY %	RQD	WATER RECOVERY %	WATER COLOUR
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERATURE (mm)								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
219.0			Water depth was 0.95 m															
218.0	1																	
	2																	
	3																	
	4																	
	5																	
	6		See borehole log for soil description															
	7																	
	8		Casing advanced to 210.3 m															
210.5	9		LIMESTONE: fine grained, medium grey, generally unweathered Core at top of Run 1 was broken up	1	B	F	C	RP	T	O				1	61	0		
							VC	RU						2	95	20		

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CORE LOG

BH NO. 14

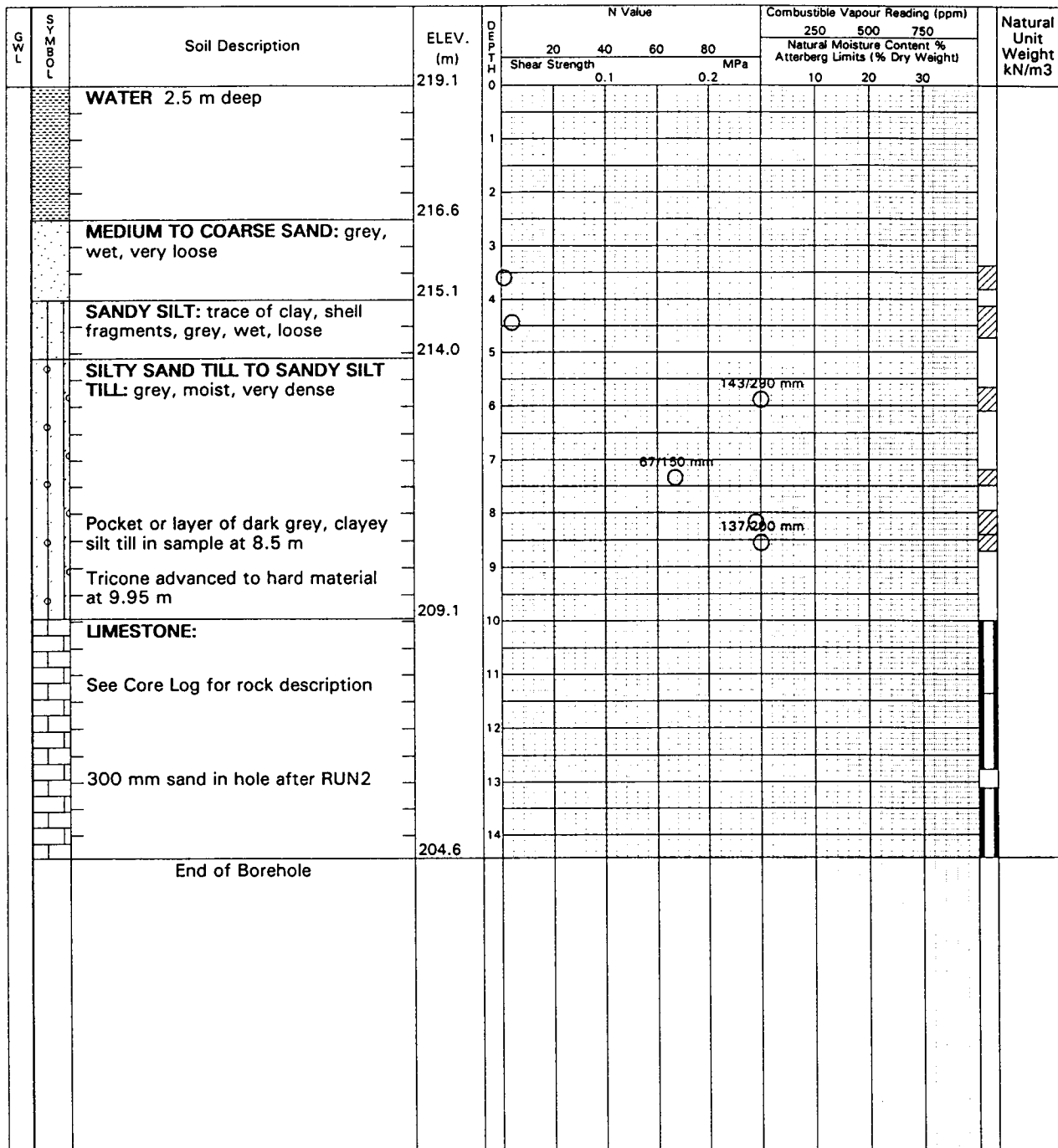
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Project No. SP2106

Log of Borehole 15

Dwg No. 37Project: Atherley Narrows BridgeSheet No. 1 of 1Location: Highway 12, Orillia, OntarioDate Drilled: April 1, 1998Drill Type: Wash BoringDatum: GeodeticAuger Sample ☒SPT (N) Value ☐Dynamic Cone Test ☐Shelby Tube ☐Field Vane Test ☐Sensitivity ☐Piezometric Water Level ☐Combustible Vapour Reading ☐Natural Moisture ☒Plastic and Liquid Limit ☐Undrained Triaxial ☐at % Strain at Failure ☐Penetrometer ☐**WATER LEVEL RECORD:**

Time	Water Level (m)	Depth to Cave (m)

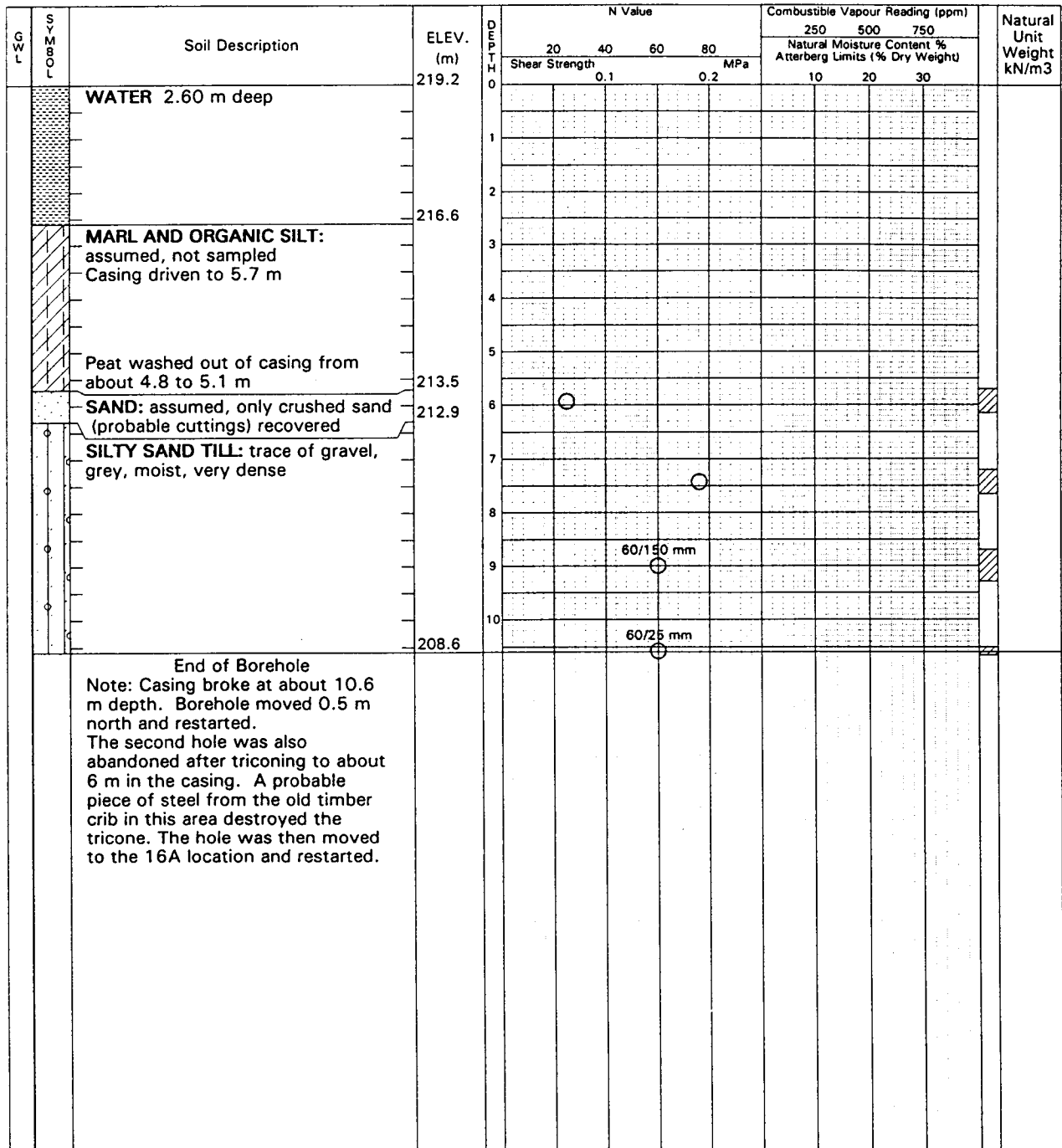


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CORE LOG											BH NO. 15							
PROJECT Atherley Narrows Bridge					ORIENTATION Vertical		ELEVATION (m) 219.1		DATUM Geodetic		PROJECT NO. SP2106							
LOCATION Highway 12, Orillia, Ontario					DATE STARTED 04/01/98		COMPLETED 04/01/98		LOGGED BY H. Lohse		DRAWING NO. 38							
CLIENT DS-Lea Associates Ltd.					DRILLER Malone		DRILL TYPE		CORE BARREL NXL		SHEET 1 of 1							
ELEV. (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	JOINT CHARACTERISTICS							WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN No.	RECOVERY %	RQD	WATER RECOVERY %	WATER COLOUR
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERATURE (mm)								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
219.1	1																	
	2																	
	3																	
	4																	
	5																	
	6																	
	7																	
	8																	
	9																	
209.0	10																	
	11		LIMESTONE: fine grained, generally unweathered, moderate strength Trace of mud on joint surfaces at 10.5 and 11 m in Run 1												1	83	20	
	12		Dipping and vertical joints with oxidized surfaces in Run 2	3	B C	F D V	C VC	RP RU	T Sa	0 to 300					2	75	41	
206.3	13		Sand layer about 300 mm thick	1	B	F	C VC	RP	T	0								
206.0	14		Core barrel was stuck in borehole in Run 3 due to sand layers. Lost core in Run 3 assumed to be left in hole.												3	76	19	
204.6	15		End of Borehole Note: Borehole blocked at 10.9 m on completion.															
	16																	
	17																	
	18																	
	19																	

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Project: Atherley Narrows BridgeSheet No. 1 of 1Location: Highway 12, Orillia, OntarioDate Drilled: April 5, 1998Drill Type: Wash BoringDatum: GeodeticAuger Sample ☒SPT (N) Value ☐Dynamic Cone Test ☐Shelby Tube ☒Field Vane Test ☐Sensitivity ☐Piezometric Water Level ☐Combustible Vapour Reading ☐Natural Moisture ☒Plastic and Liquid Limit ☐Undrained Triaxial ☐at % Strain at Failure ☐Penetrometer ☒**WATER LEVEL RECORD:**

Time	Water Level (m)	Depth to Cave (m)



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Location: Highway 12, Orillia, Ontario

Date Drilled: April 5, 1998

Drill Type: Wash Boring

Datum: **Geodetic**

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Sensitivity

Piezometric Water Level

Combustible Vapour Reading ☐

Natural Moisture X

Plastic and Liquid Limit $\text{---}\bigcirc$

Undrained Triaxial
at % Strain at Failure

Penetrometer ▲

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WATER LEVEL RECORD:

Time	Water Level (m)	Depth to Cave (m)



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G W L	S Y M B O L	Soil Description	ELEV. (m)	D e e p t h	N Value				Combustible Vapour Reading (ppm)			Natura Unit Weigh kN/m ³
					20	40	60	80	250	500	750	
					MPa				Natural Moisture Content % Atterberg Limits (% Dry Weight)			
		LIMESTONE AND SAND LAYERS: hard drilling, probable limestone	208.2	11	Shear Strength	0.1	0.2		10	20	30	
		easy drilling, probable sand	207.6									
		hard drilling, probable limestone	206.9	12								
		easy drilling, probable sand	206.8									
		hard drilling, probable limestone	206.7									
		easy drilling, probable sand	206.1									
		easy drilling with occasional hard layers	206.1	13								
		End of Borehole Note: There was insufficient time to advance the borehole deeper.	205.8									

Enlargement of Drawing 40



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WATER LEVEL RECORD:		
Time	Water Level (m)	Depth to Cave (m)

Project No. SP2106

Log of Borehole 17

Dwg No. 42Project: Atherley Narrows BridgeSheet No. 1 of 1Location: Highway 12, Orillia, OntarioDate Drilled: April 14, 1998Drill Type: Wash BoringDatum: GeodeticAuger Sample ☒SPT (N) Value ☐Dynamic Cone Test ☐Shelby Tube ☐Field Vane Test ☐Sensitivity ☐Piezometric Water Level ☐Combustible Vapour Reading ☐Natural Moisture ☐Plastic and Liquid Limit ☐Undrained Triaxial ☐at % Strain at Failure ☐Penetrometer ☐

GWL	SYMBOL	Soil Description	ELEV. (m)	DEPTH (m)	N Value				Combustible Vapour Reading (ppm)			Natural Unit Weight kN/m3
					20	40	60	80	250	500	750	
					Shear Strength MPa				Natural Moisture Content % Atterberg Limits (% Dry Weight)			
			220.0	0	0.1		0.2		10	20	30	
		FILL: sandy silt trace of clay, occasional cobbles, brown, moist, loose		1								
		Recovered only wood chips at 1.3 m		2								
			217.3	3				80/225 mm				
		SANDY SILT TILL: numerous gravel sizes, grey, moist, very dense		4								
				5								
		Encountered sand while advancing casing at about 5.2 m		6								
		Encountered sand at about 5.8 m	213.9									
		Casing bent at about 6.15 m. Hole abandoned and redrilled to 7.1 m. Coring started at 7.19 m. See Core Log.										

WATER LEVEL RECORD:

Time	Water Level (m)	Depth to Cave (m)

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BH NO. 17

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CORE LOG											BH NO. 18								
PROJECT Atherley Narrows Bridge					ORIENTATION Vertical		ELEVATION (m) 219.6		DATUM Geodetic		PROJECT NO. SP2106								
LOCATION Highway 12, Orillia, Ontario					DATE STARTED 04/21/98		COMPLETED 04/22/98		LOGGED BY H. Lohse		DRAWING NO. 44								
CLIENT DS-Lea Associates Ltd.					DRILLER Malone		DRILL TYPE CME75		CORE BARREL BX		SHEET 1 of 1								
ELEV. (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	JOINT CHARACTERISTICS							WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN No.	RECOVERY %	RQD	WATER RECOVERY %	WATER COLOUR	
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERATURE (mm)									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
219.6			Borehole advanced to with hollow stem augers to 11.7 m without sampling																
	1																		
	2																		
	3																		
	4																		
	5																		
	6																		
	7																		
	8																		
	9																		
	10																		
	11		Split-barrel sample at 11.7 m recovered very dense sandy silt till, N value was 70/40 mm Casing driven to 12.3 m																
207.9	12		TILL: recovered limestone fragments with mud coating												1	57	0	100	gr.
206.9	13		LIMESTONE: fine grained, medium grey, unweathered Small voids noted when drilling at 13.1 m. These were less than about 100 mm thick Some joint surfaces in Run 2 were mud coated						SC						2	94	13	100	gr.
	14			1	B	F	C	RP	T	O					3	91	37	100	grey
	15						VC	RU											
	16														4	93	60	100	grey
202.4	17		VERY FINE LIMESTONE: light grey, unweathered (Gull River Formation)												5	100	38	40	gr.
	18			1	B	F	C	RP	T	O					6	100	86	0	
200.6	19		End of Borehole																

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CORE LOG											BH NO. 19							
PROJECT Atherley Narrows Bridge					ORIENTATION Vertical		ELEVATION (m) 219.7		DATUM Geodetic		PROJECT NO. SP2106							
LOCATION Highway 12, Orillia, Ontario					DATE STARTED 04/23/98		COMPLETED 04/23/98		LOGGED BY H. Lohse		DRAWING NO. 45							
CLIENT DS-Lea Associates Ltd.					DRILLER Malone		DRILL TYPE CME750		CORE BARREL BX		SHEET 1 of 1							
ELEV. (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	JOINT CHARACTERISTICS							WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN No.	RECOVERY %	RQD	WATER RECOVERY %	WATER COLOUR
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERATURE (mm)								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
219.7	1		Borehole advanced with hollow stem augers and triconing to about 11.6 m depth without sampling.															
	2																	
	3																	
	4																	
	5																	
	6																	
	7																	
	8																	
	9																	
	10																	
	11																	
208.1	12		LIMESTONE: fine grained, medium grey, unweathered 100 to 125 mm void at 12 m							125				1	78	33	100	gr.
	13													2	92	23	100	grey
	14		100 mm void at 14.5 m	1	B	F	C	RP	T	0				3	95	73	100	grey
	15		Poor to no water recovery below about 15 m							100								
204.0	16		VERY FINE GRAINED LIMESTONE: unweathered, light grey	1	B	F	C	RP	T	0				4	95	76	25	grey
203.0	17		End of Borehole															
	18																	
	19																	

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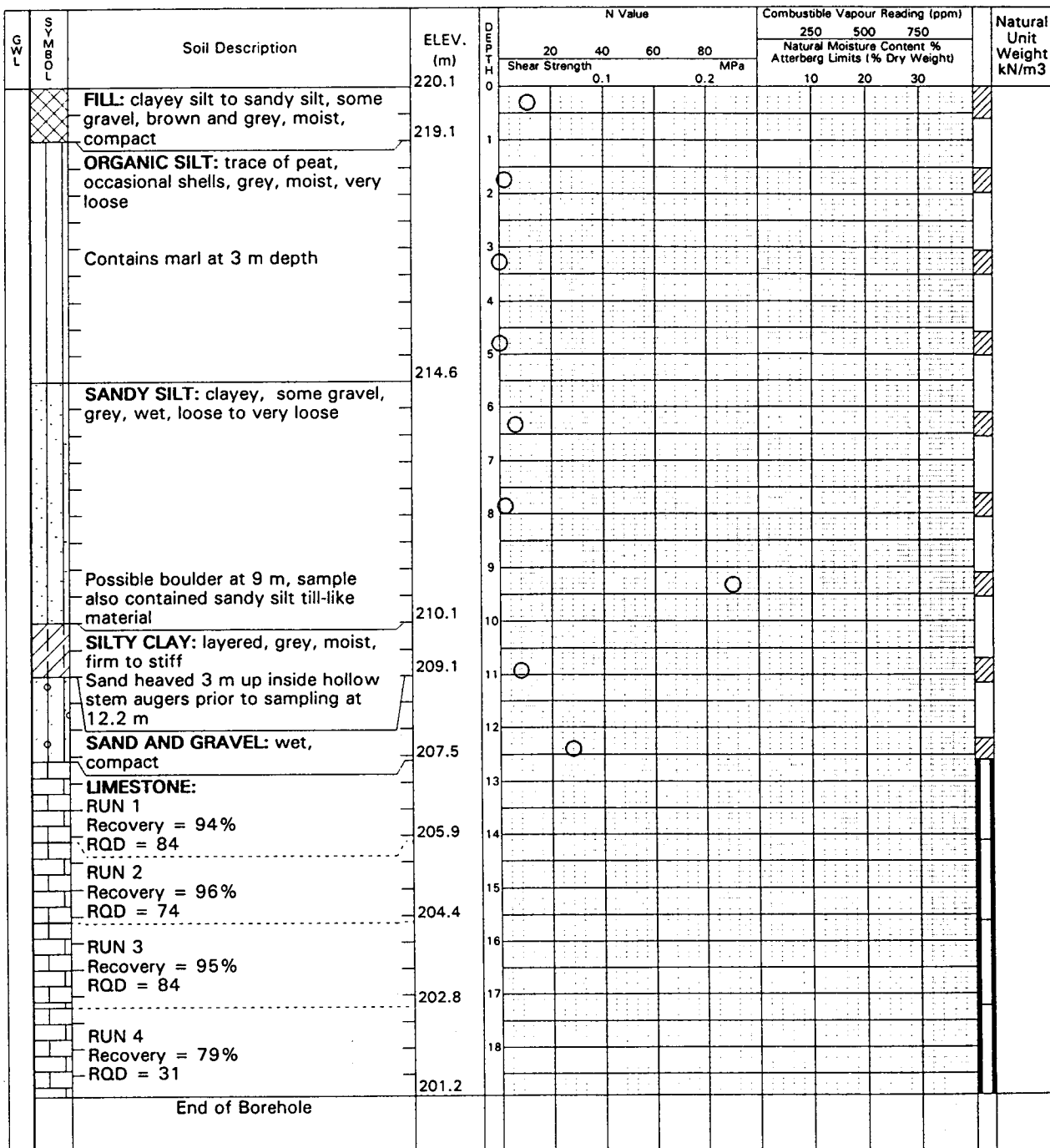
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Project No. SP2106

Log of Borehole 20

Dwg No. 46Project: Atherley Narrows BridgeSheet No. 1 of 1Location: Highway 12, Orillia, OntarioDate Drilled: May 5, 1998Drill Type: Hollow Stem AugersDatum: Geodetic

Auger Sample ☒ Combustible Vapour Reading ☐
SPT (N) Value ☐ Natural Moisture ☒
Dynamic Cone Test ☐ Plastic and Liquid Limit ☐
Shelby Tube ☒ Undrained Triaxial ☐
Field Vane Test ☐ at % Strain at Failure ☐
Sensitivity ☐ Penetrometer ☒
Piezometric Water Level ☐

**WATER LEVEL RECORD:**

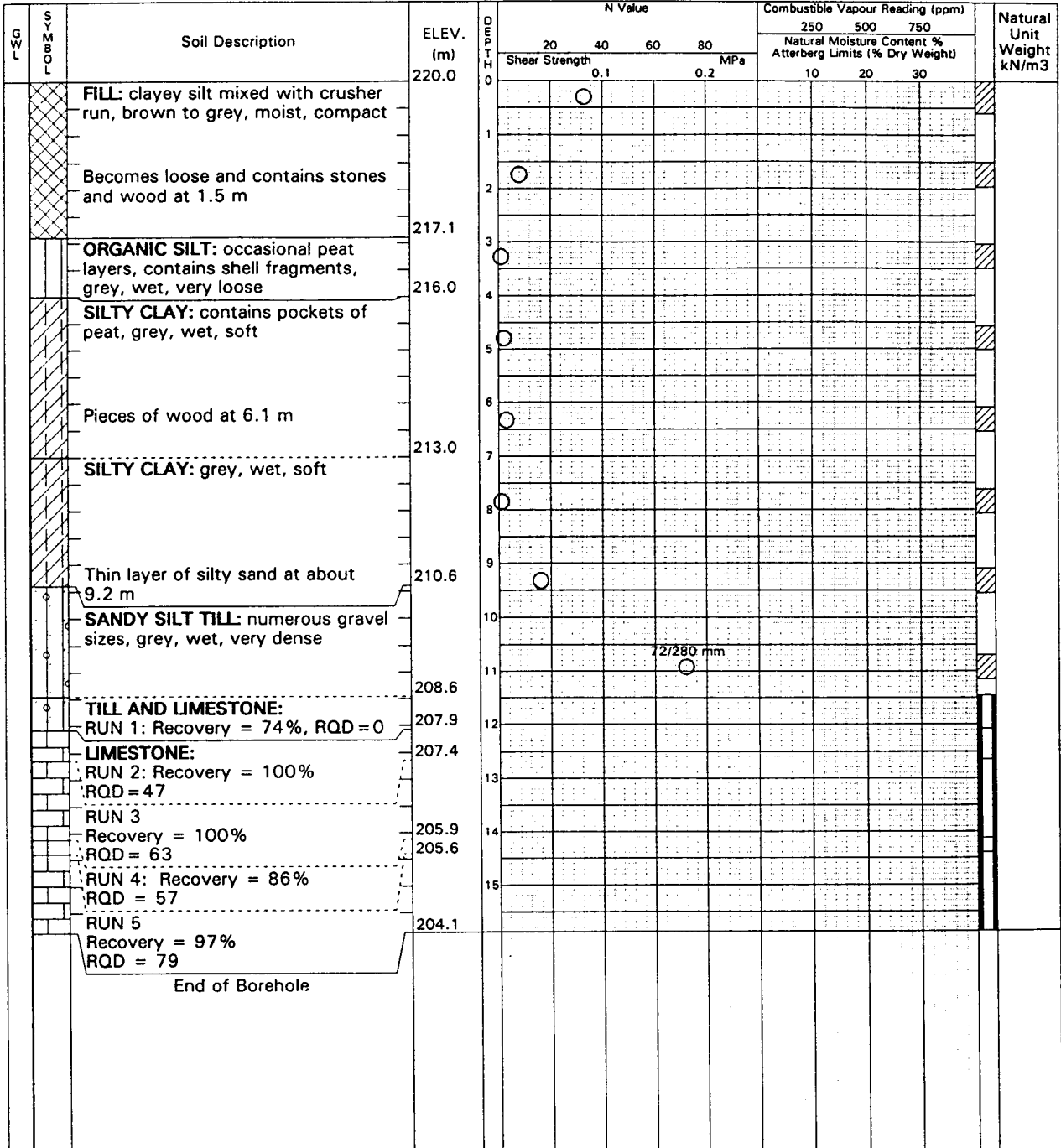
Time	Water Level (m)	Depth to Cave (m)



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Project: Atherley Narrows BridgeSheet No. 1 of 1Location: Highway 12, Orillia, OntarioDate Drilled: May 6, 1998Drill Type: Hollow Stem AugersDatum: Geodetic

Auger Sample ☒ Combustible Vapour Reading ☐
SPT (N) Value ☐ Natural Moisture ☒
Dynamic Cone Test ☐ Plastic and Liquid Limit ☐
Shelby Tube ☒ Undrained Triaxial ☒
Field Vane Test ☐ at % Strain at Failure ☒
Sensitivity ☐ Penetrometer ☒
Piezometric Water Level ☐



WATER LEVEL RECORD:

Time	Water Level (m)	Depth to Cave (m)



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Project No. SP2106

Log of Borehole 22

Dwg No. 48Project: Atherley Narrows BridgeSheet No. 1 of 1Location: Highway 12, Orillia, OntarioDate Drilled: May 7, 1998Drill Type: Hollow Stem AugersDatum: Geodetic

Auger Sample ☒ Combustible Vapour Reading ☐
SPT (N) Value ☐ Natural Moisture ☒
Dynamic Cone Test ☐ Plastic and Liquid Limit ☐
Shelby Tube ☒ Undrained Triaxial ☒
Field Vane Test ☐ at % Strain at Failure ☒
Sensitivity ☐ Penetrometer ☒
Piezometric Water Level ☐

SYMBOL	Soil Description	ELEV. (m)	DEPTH (m)	N Value				Combustible Vapour Reading (ppm)			Natural Unit Weight kN/m3
				20	40	60	80	250	500	750	
GWL				Shear Strength				Natural Moisture Content %			
				MPa				Atterberg Limits (% Dry Weight)			
				0.1		0.2		10	20	30	
	FILL: crusher run limestone	220.0	0								
	PEAT: dark brown to black, moist, very loose	219.6	1								
	SILTY CLAY: grey, wet, soft	217.5	2								
	SILTY SAND TILL: brown, moist, very dense		3								
			4								
	Turns grey and becomes wet at 4.6 m		5								
			6								
	No sample recovery at 7.6 m	212.5	7								
	LIMESTONE:	212.4	8								
	Run 1		9								
	Recovery = 99%		10								
	RQD = 69	210.8	11								
	Run 2		12								
	Recovery = 70%		13								
	RQD = 10	209.5									
	Run 3: Recovery = 66%	209.1									
	RQD = 40										
	Contains traces of till										
	Run 4										
	Recovery = 91 %	207.6									
	RQD = 56										
	Run 5										
	Recovery = 98%	206.1									
	RQD = 72										
	End of Borehole										

WATER LEVEL RECORD:

Time	Water Level (m)	Depth to Cave (m)

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CORE LOG											BH NO. 23							
PROJECT Atherley Narrows Bridge					ORIENTATION Vertical		ELEVATION (m) 219.1		DATUM Geodetic		PROJECT NO. SP2106							
LOCATION Highway 12, Orillia, Ontario					DATE STARTED 05/13/98		COMPLETED 05/21/98		LOGGED BY H. Lohse		DRAWING NO. 49							
CLIENT DS-Lea Associates Ltd.					DRILLER Malone		DRILL TYPE		CORE BARREL NX/BX		SHEET 1 of 1							
ELEV. (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	JOINT CHARACTERISTICS							WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN No.	RECOVERY %	RQD	WATER RECOVERY %	WATER COLOUR
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERATURE (mm)								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
219.1	1		WATER ~1.7 m deep															
217.4	2		Soft Material not sampled															
213.4	6		Probable Till not sampled															
	7		Casing advanced by triconing and hammering N casing															
210.9	8		Triconing very slow below about 8.25 m (Probable Limestone)															
	9		LIMESTONE WITH SAND LAYERS: fine grained, medium grey, unweathered Easy coring from about 8.35 m to 8.5 m, and from from 8.62 m to 8.75 m, sand/silt and broken rock washed out	1	B	F	C	RP	T	130				1	53	0		
	10													2	26	0		
	11		Coarse to fine sand and silt washed up between 10.49 m and 10.95 m	2	B	F	C	RP	T	0				3	45	0		
	12													4	64	0		
	13													5	57	0		
	14													6	80	46		
	15													7	75	36		
202.7	16													8	74	61		
201.3	17		VERY FINE LIMESTONE: light grey, unweathered (Gull River Formation)											9	91	61		
	18		End of Borehole															
	19																	

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 Consulting Geo-Environmental Engineers

CORE LOG

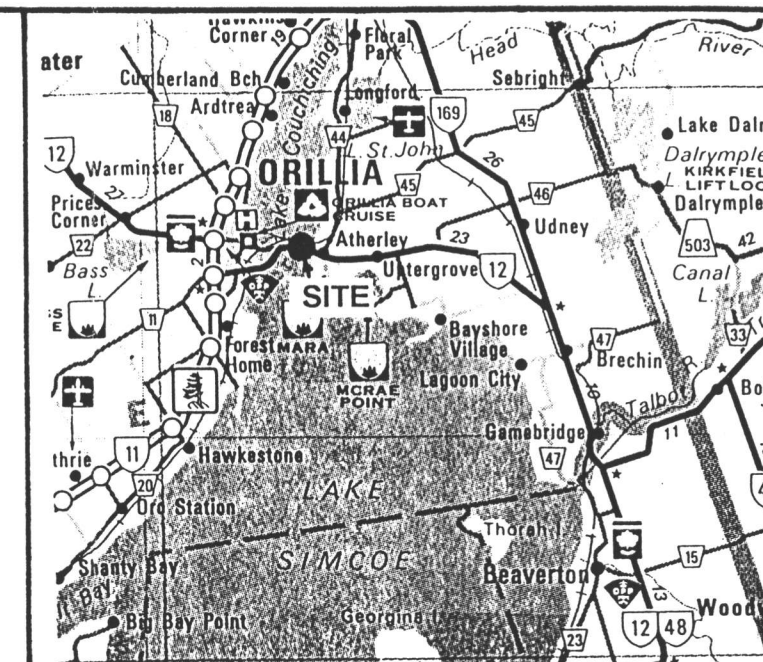
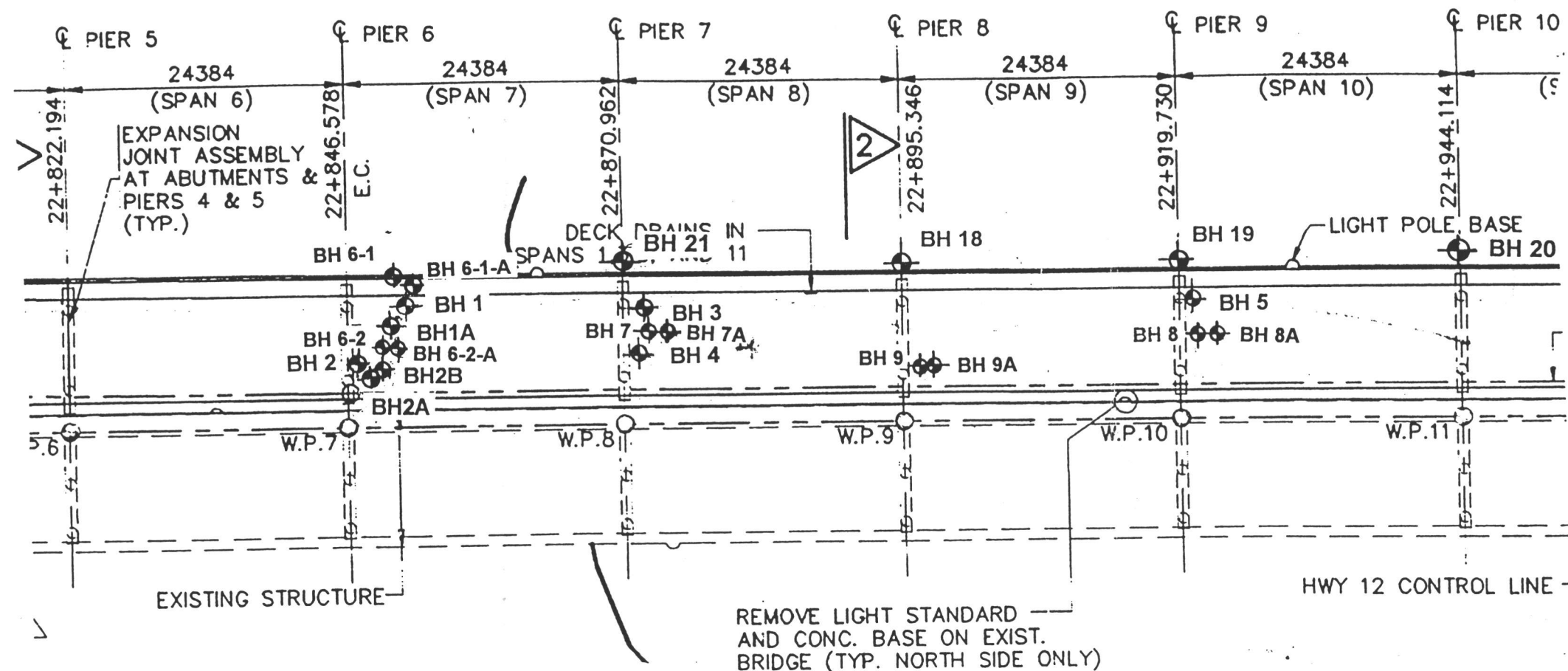
BH NO. 24

PROJECT Atherley Narrows Bridge	ORIENTATION Vertical	ELEVATION (m) 219.4	DATUM Geodetic	PROJECT NO. SP2106
LOCATION Highway 12, Orillia, Ontario	DATE STARTED 05/24/98	COMPLETED 05/25/98	LOGGED BY H. Lohse	DRAWING NO. 50
CLIENT DS-Lea Associates Ltd.	DRILLER Malone	DRILL TYPE	CORE BARREL NX/BX	SHEET 1 of 1

ELEV. (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	JOINT CHARACTERISTICS								WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN No.	RECOVERY %	ROD	WATER RECOVERY %	WATER COLOUR
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERATURE (mm)									
1	2	3	4	5	6	7	8	9	10	11		12	13	14	15	16	17	18	19
219.4	1		WATER ~ 3.0 m deep																
216.4	3		Soft Material not sampled																
213.7	6		Silt Till Casing advanced by triconing and hammering N casing																
209.5	10		GRANITIC BOULDER, ~ 80 mm, overlying: LIMESTONE WITH SAND LAYERS, fine grained, medium grey, unweathered	2	B C	F V D	C VC	RP UP	T	O					1	92	48		
	12		sand and limestone layers for ~460 mm												2	32	7		
	13														3	46	0		
	14														4	58	15		
	15		sand layer at 14.6 m, ~250 mm thick												5	40	0		
	16																		
	17																		
201.9	18		VERY FINE LIMESTONE, light grey, unweathered (Gull River Formation)												6	78	7		
201.2	19		End of Borehole																

S & P

Shaheen & Peaker Limited
Consulting Geo-Environmental Engineers



SITE LOCATION PLAN

NOTES

1. The boundaries and soil types have been established only at borehole locations. Between boreholes they are assumed and may be subject to considerable error.
2. Soil samples will be retained in storage for 3 months and then destroyed unless the client advises an extended time period is required.
3. Topsoil quantities should not be established from the information provided at the borehole locations.
4. Borehole elevations should not be used to design building(s) or floor slab(s) or parking lot(s) grades.
5. This drawing forms part of the report (project number as referenced) and should only be used in conjunction with this report.

SHAHEEN & PEAKER LIMITED

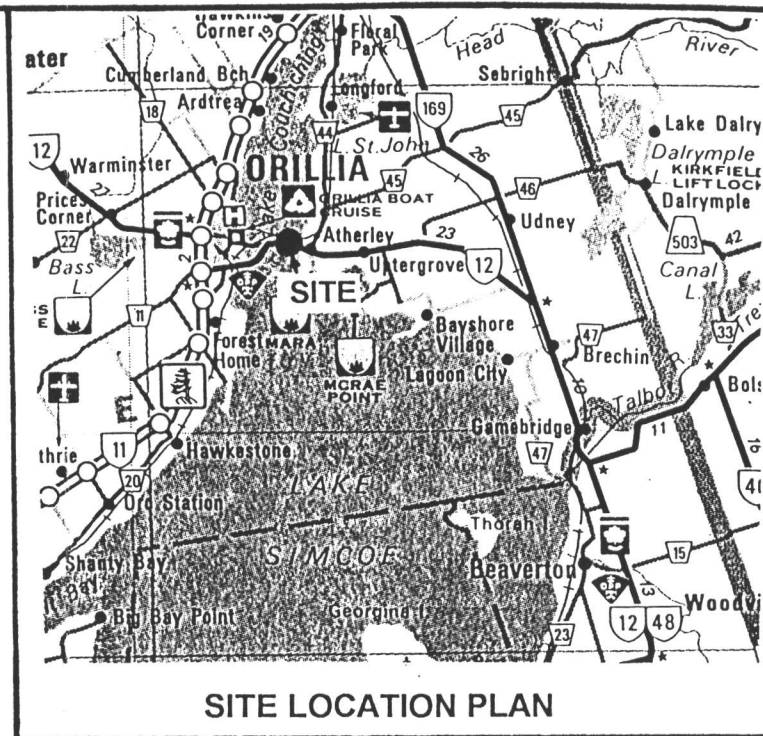
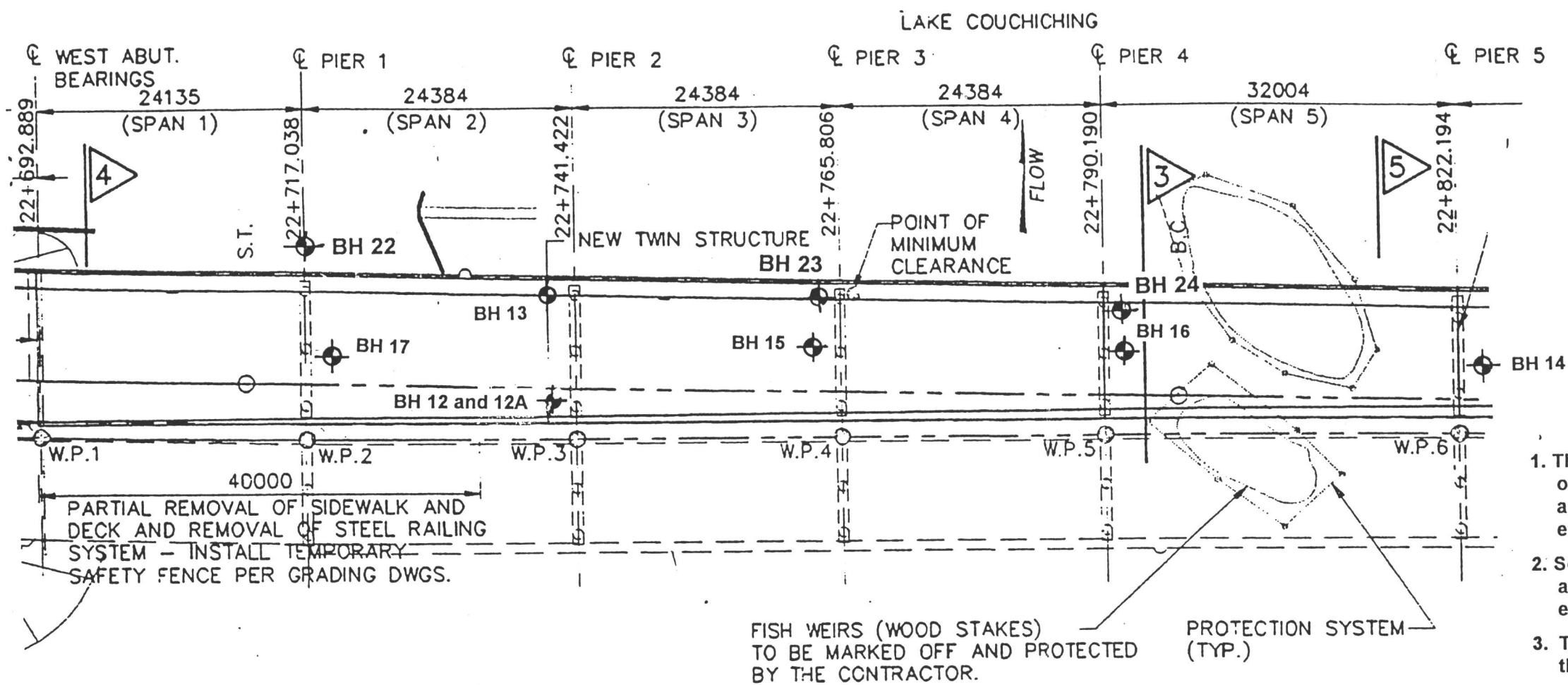
PLAN SHOWING BOREHOLE LOCATIONS

GEOTECHNICAL INVESTIGATION
ATHERLEY NARROWS BRIDGE
HIGHWAY 12
ORILLIA, ONTARIO

PROJECT: SP2106

SCALE: ~1:500

DRAWING NO. 1



NOTES

1. The boundaries and soil types have been established only at borehole locations. Between boreholes they are assumed and may be subject to considerable error.
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5. This drawing forms part of the report (project number as referenced) and should only be used in conjunction with this report.

SHAHEEN & PEAKER LIMITED		
PLAN SHOWING BOREHOLE LOCATIONS		
GEOTECHNICAL INVESTIGATION ATHERLEY NARROWS BRIDGE HIGHWAY 12 ORILLIA, ONTARIO		
PROJECT: SP2106	SCALE: ~1:500	DRAWING NO. 1A

Photographs

BOREHOLE 1A
RUN 1A →
9.19 to 10.19 m

BOREHOLE 1A
→ END
11.30 m

BOREHOLE 1A
RUN 2A →
10.19 to 11.30 m

BOREHOLE 1
RUN 1 →
12.29 to 13.51 m

BOREHOLE 1
RUN 2 →
13.51 to 14.53 m

BOREHOLE 1
RUN 3 →
14.53 to 15.25 m

BOREHOLE 1
→ END
15.25 m

END OF RUN 3 (note)

DR. LA. MONSIE



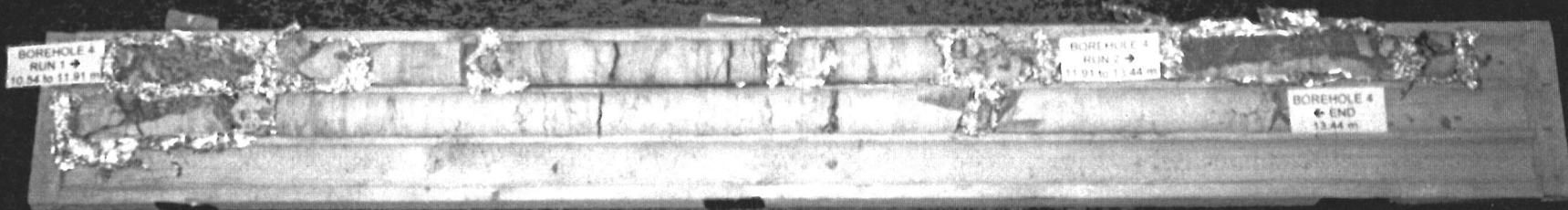
BOREHOLE 3
RUN 1
11.23 @ 11.68 m

BOREHOLE 3
RUN 1
11.23 @ 11.68 m

BOREHOLE 3
RUN 1
11.23 @ 11.68 m

BOREHOLE 3
END
14.50 m

23 10:51



BOREHOLE 4
RUN 1 →
10.94 to 11.91 m

BOREHOLE 4
RUN 2 →
11.91 to 13.44 m

BOREHOLE 4
← END
13.44 m

23 11:24

BOREHOLE 5
RUN 1 →
10.82 to 11.28 m

BOREHOLE 5
RUN 2 →
11.28 to 12.09 m

BOREHOLE 5
RUN 4 →
12.81 to 13.12 m

BOREHOLE 5
RUN 3 →
12.09 to 12.83 m

BOREHOLE 5
RUN 5 →
13.12 to 14.12 m

BOREHOLE 5
← END
14.12 m

23 12:09

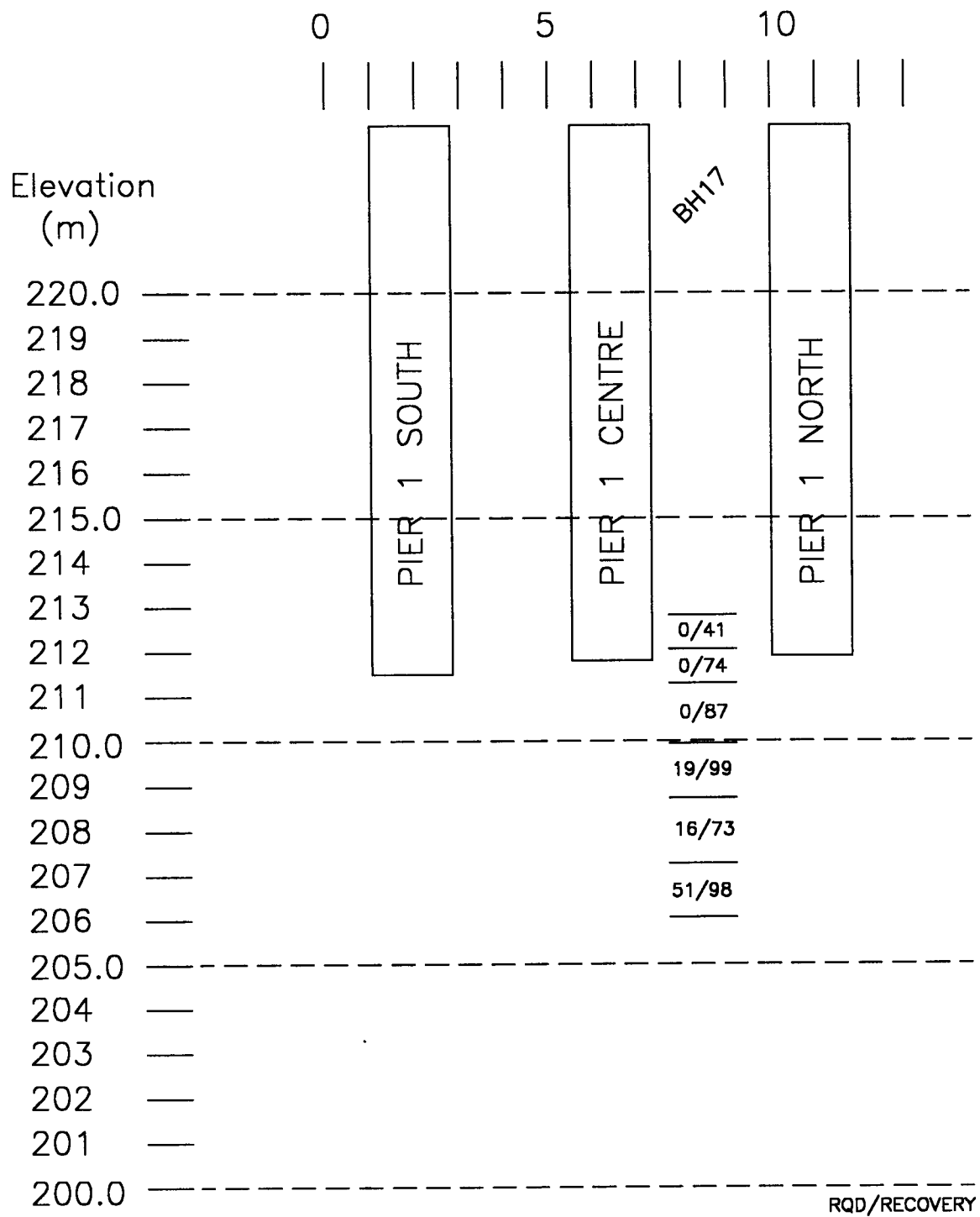
**SKETCH OF CONDITIONS AT PIERS
ATHERLEY NARROWS BRIDGE
HIGHWAY 12
ORILLIA, ONTARIO**

**Prepared for
DS-LEA ASSOCIATES LTD.**

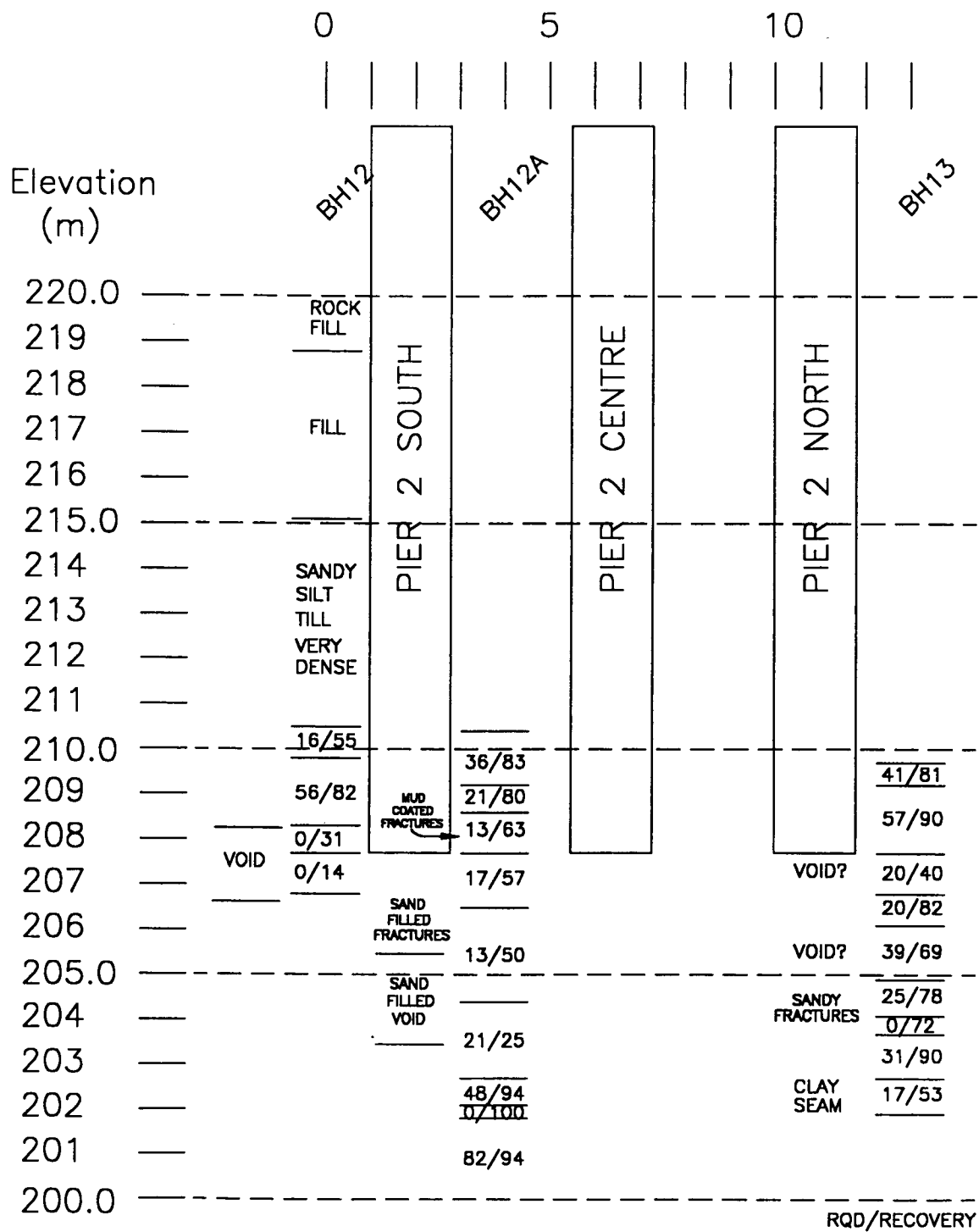
**Prepared by
SHAHEEN & PEAKER LIMITED**

**Project: SP2106
April 29, 1998**

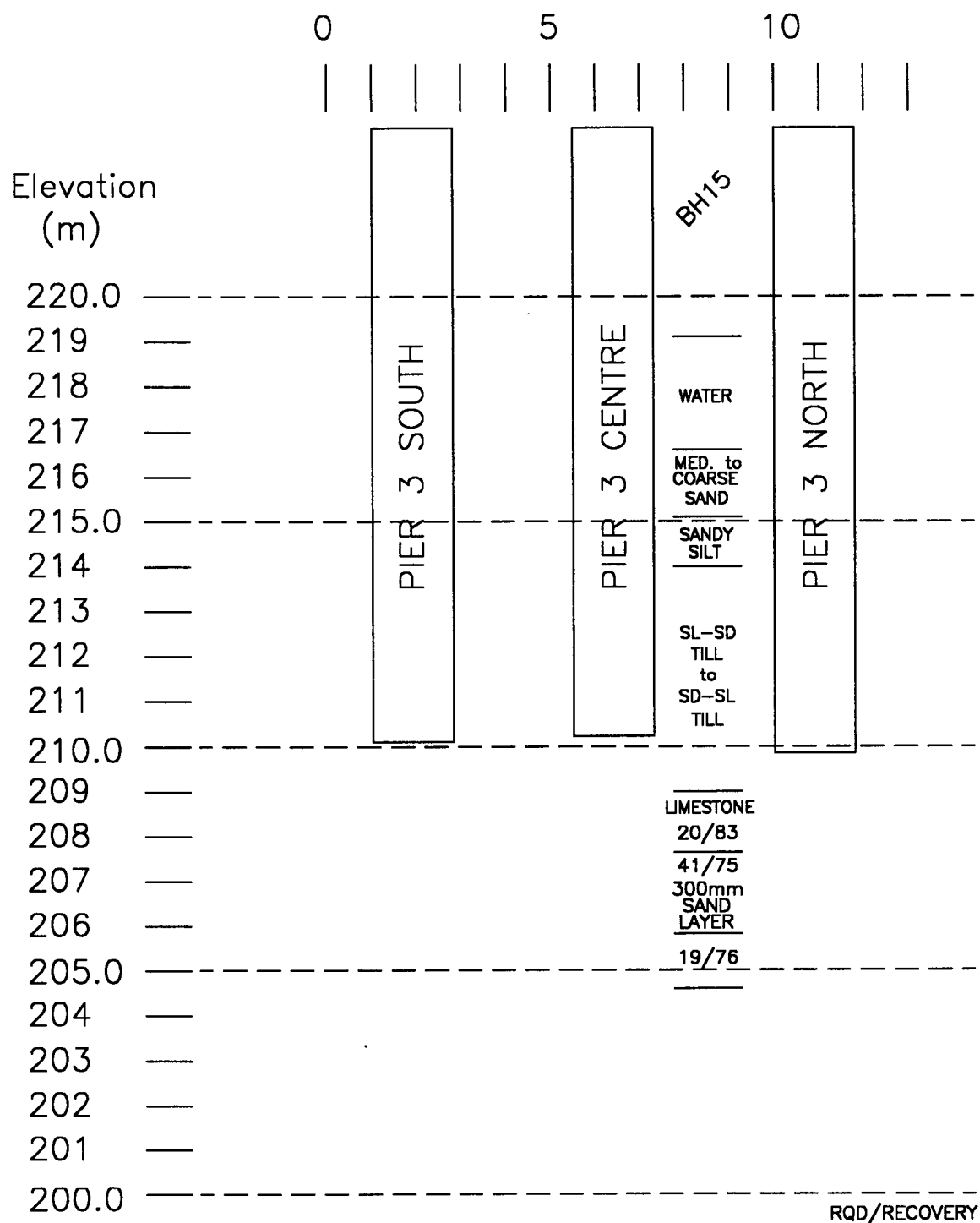
**250 Galaxy Boulevard
Etobicoke, Ontario
M9W 5R8
Tel: (416) 213-1255
Fax: (416) 213-1260**



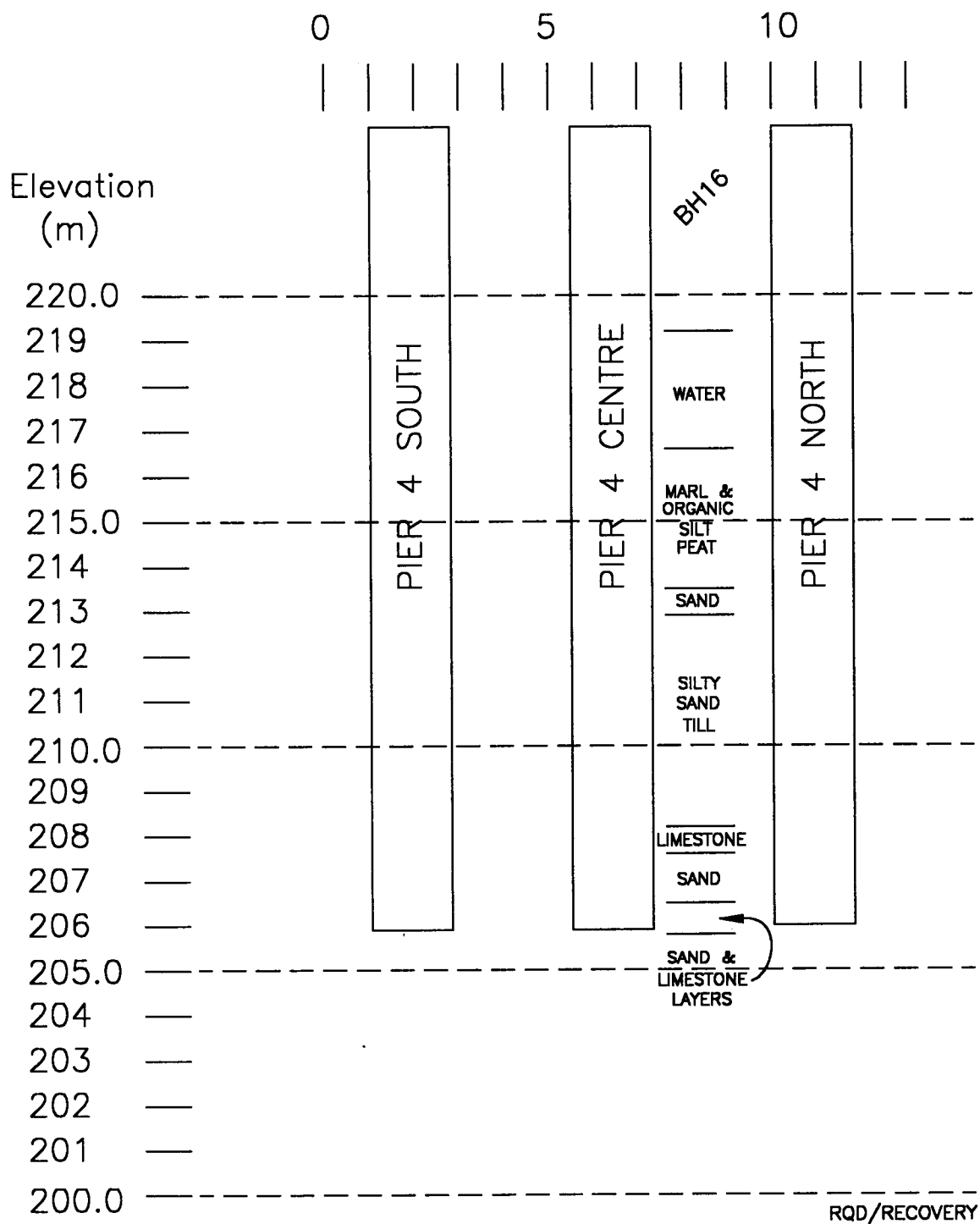
SKETCH OF CONDITIONS AT PIER 1



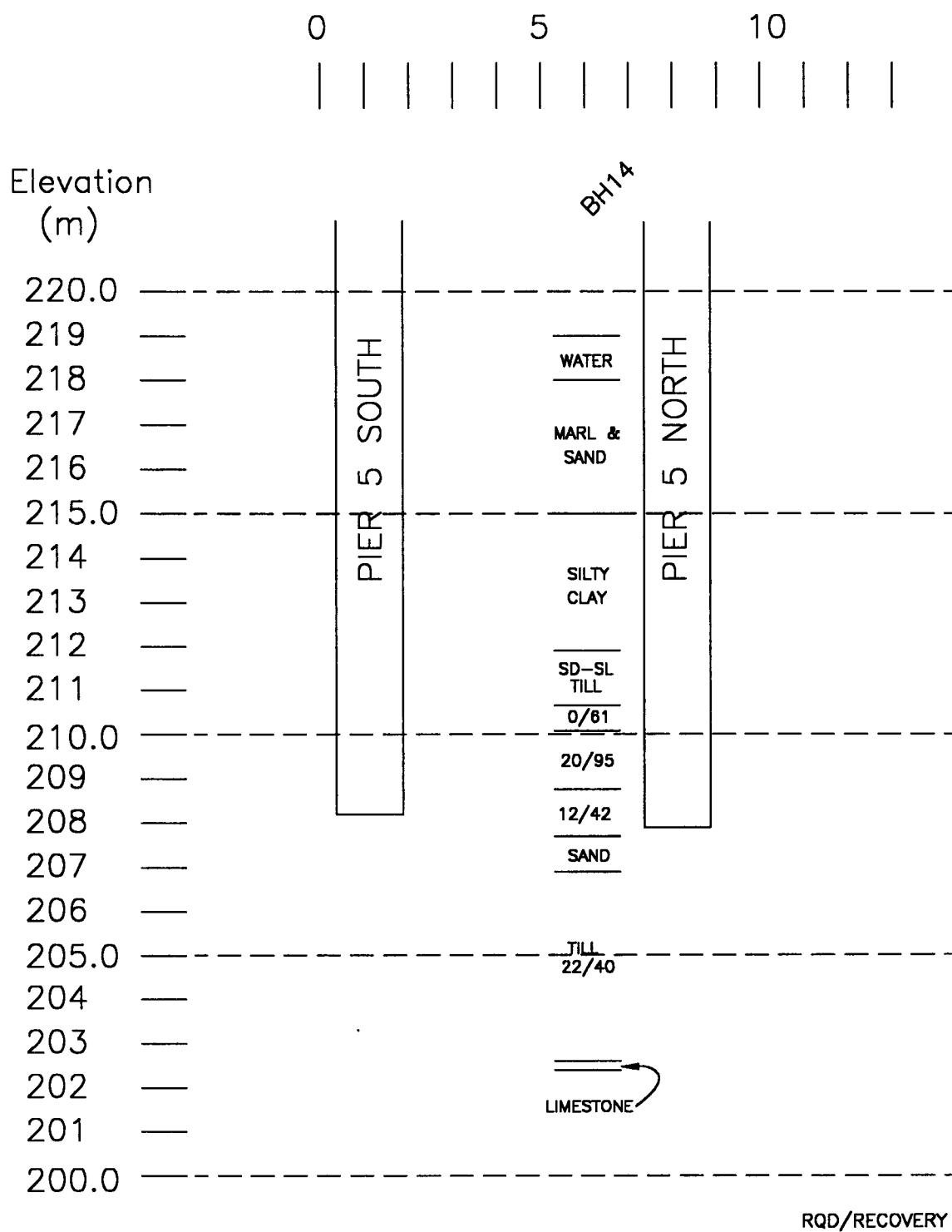
SKETCH OF CONDITIONS AT PIER 2



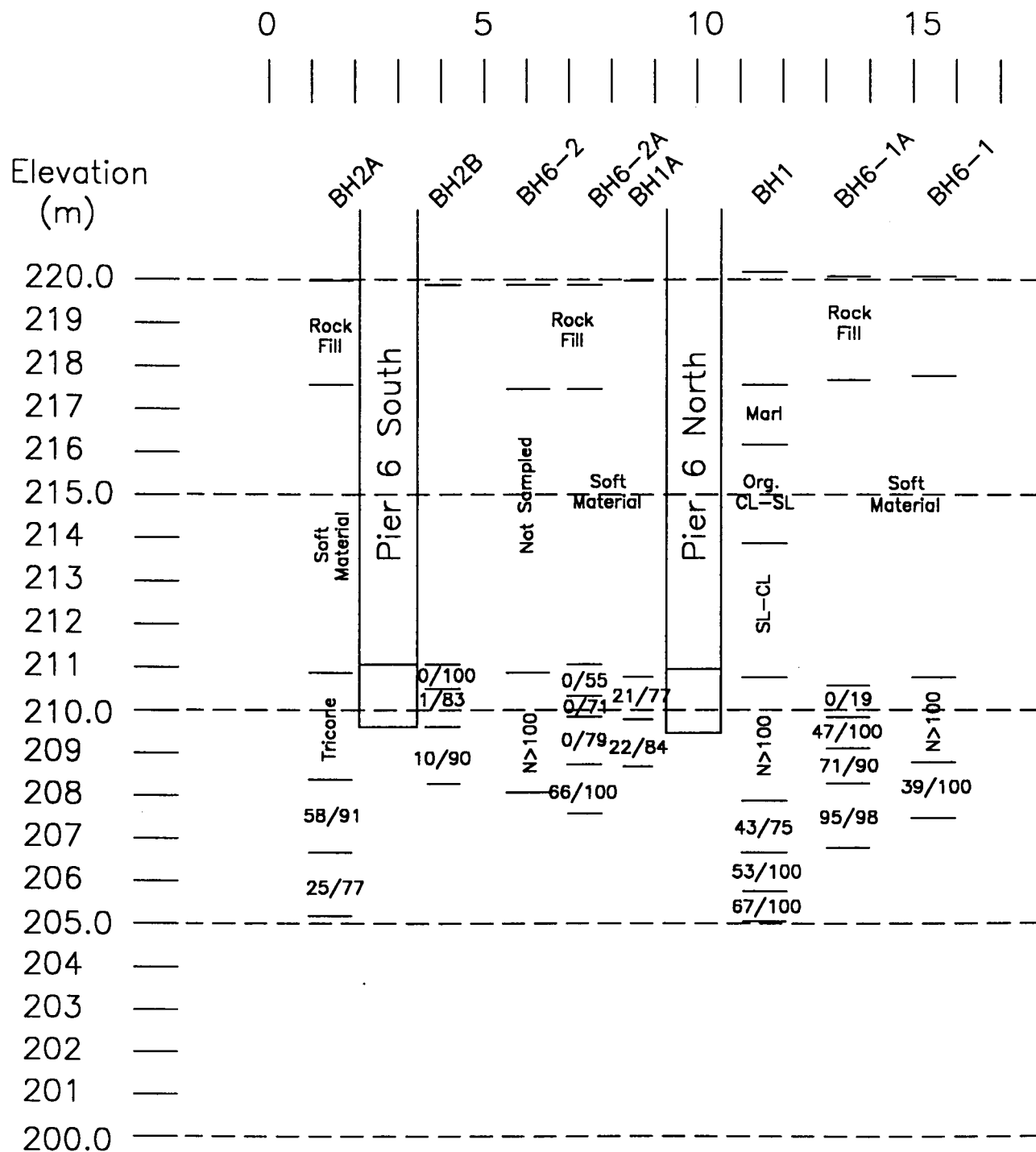
SKETCH OF CONDITIONS AT PIER 3



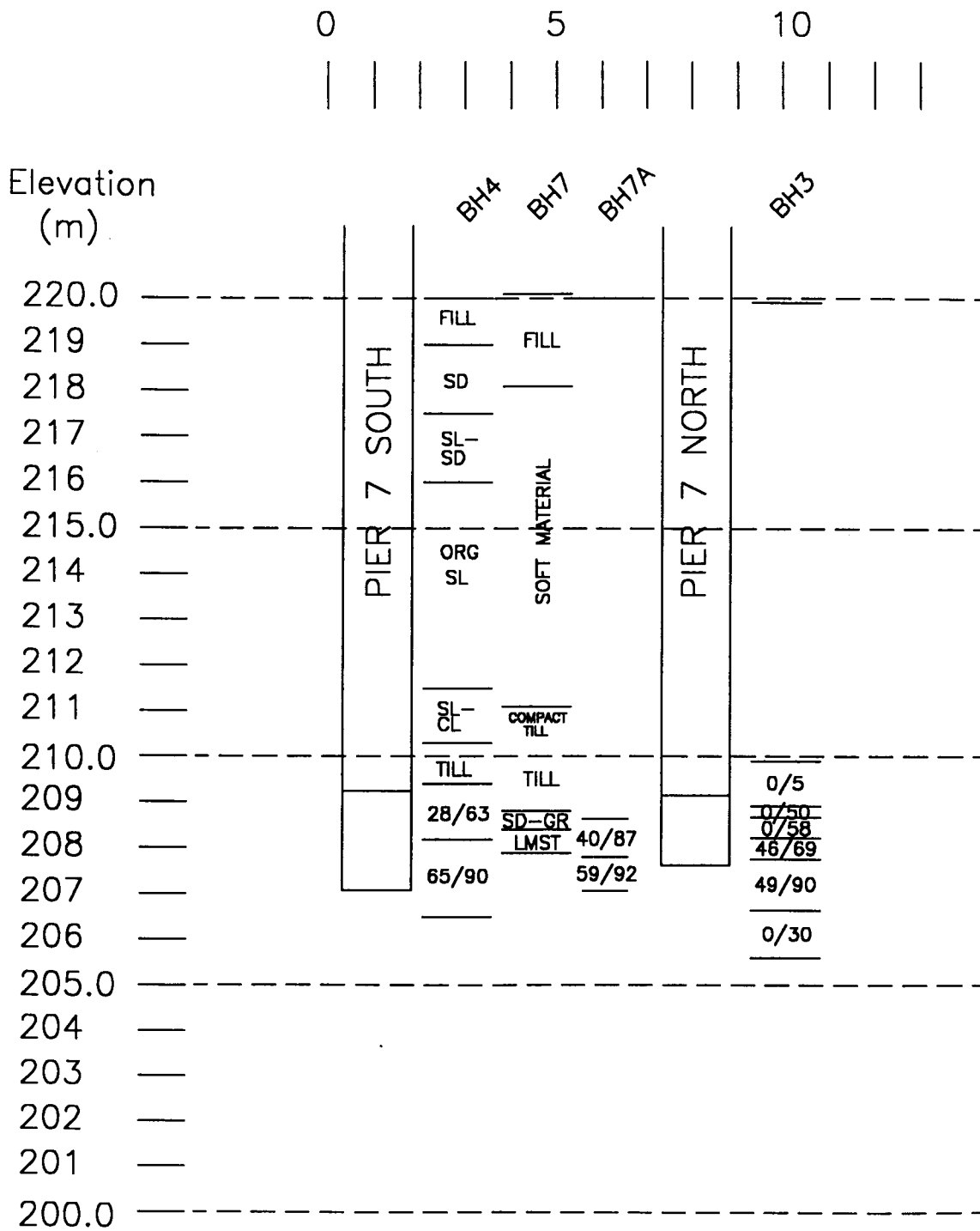
SKETCH OF CONDITIONS AT PIER 4



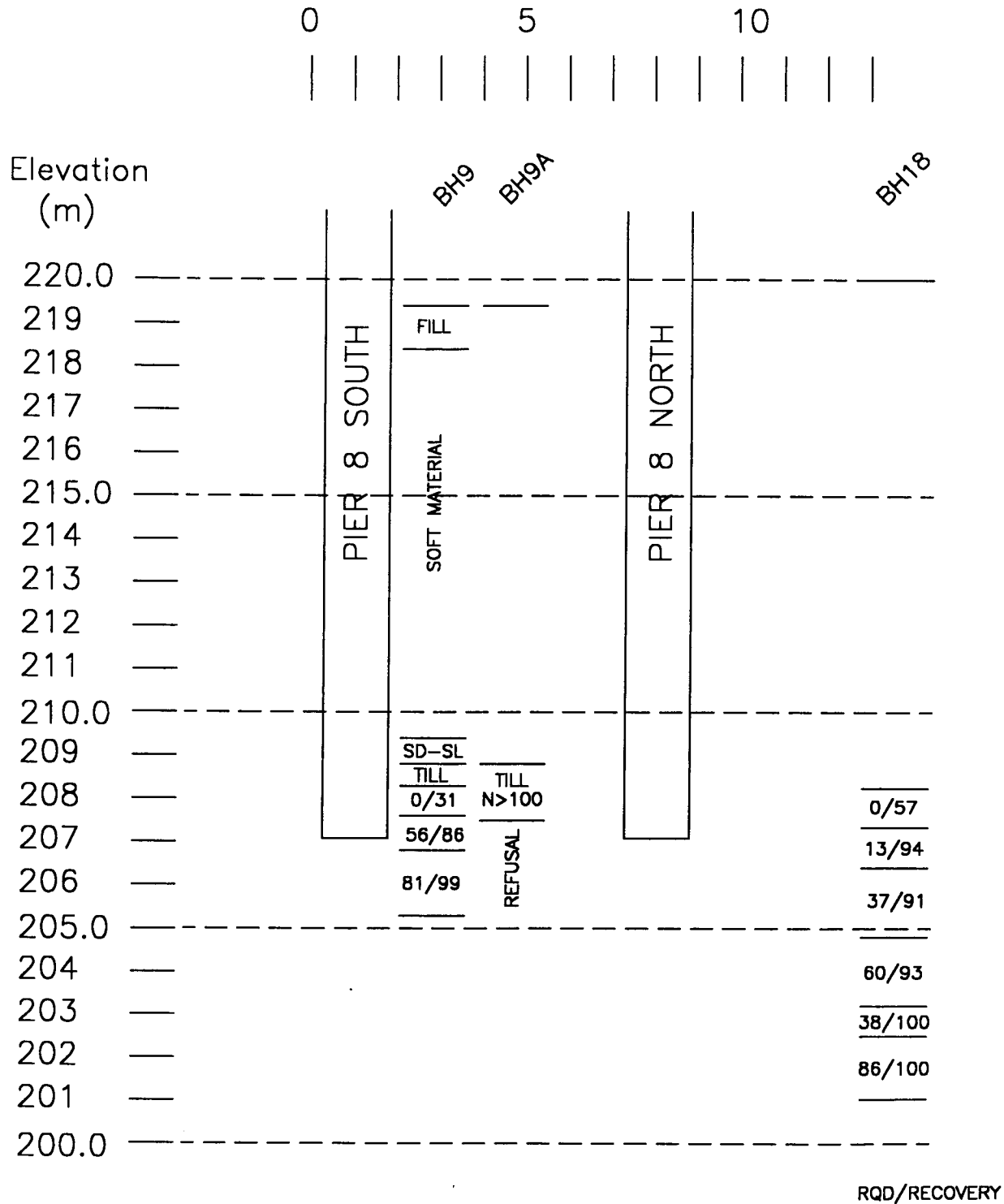
SKETCH OF CONDITIONS AT PIER 5



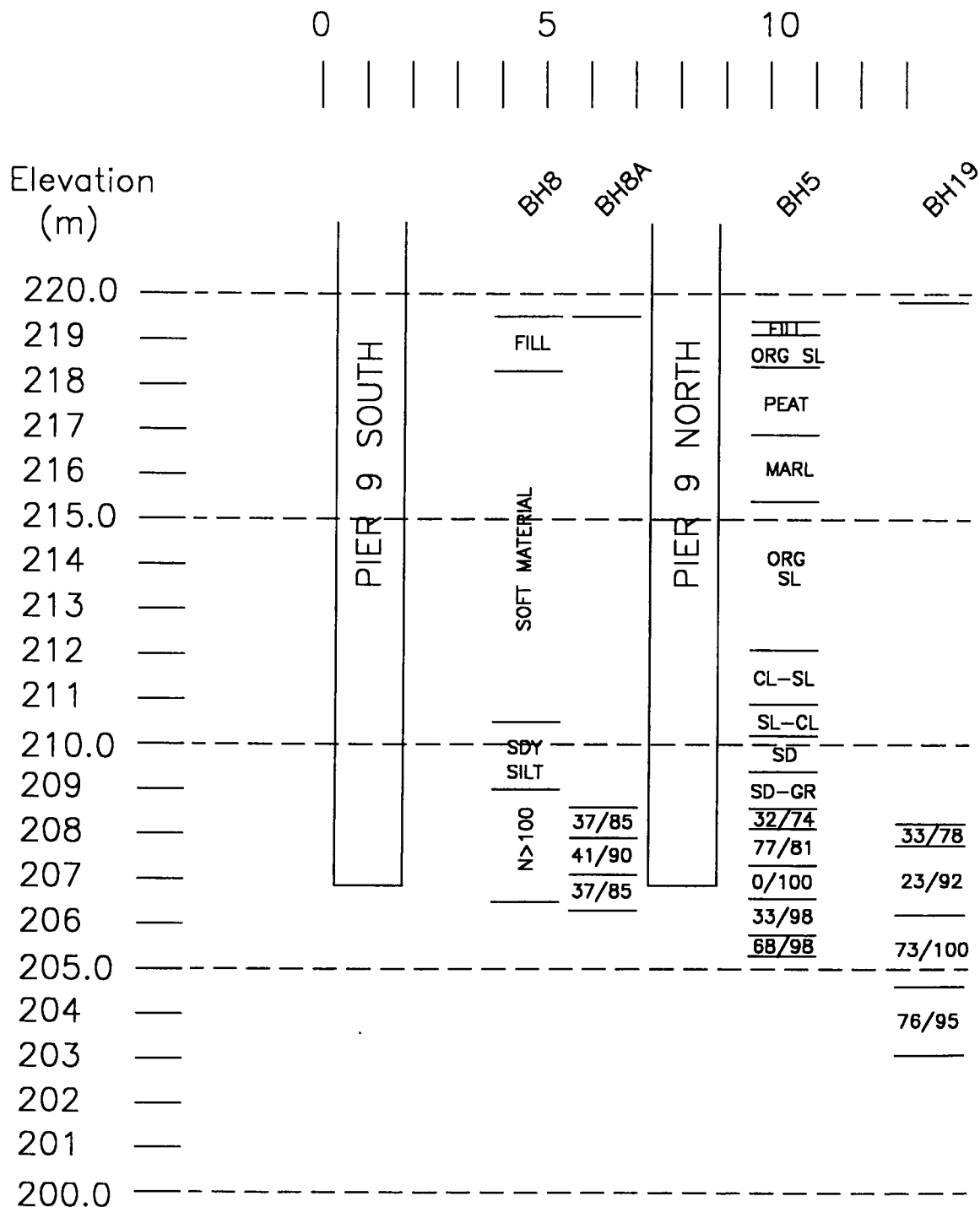
SKETCH OF CONDITIONS AT PIER 6



SKETCH OF CONDITIONS AT PIER 7



SKETCH OF CONDITIONS AT PIER 8



RQD/RECOVERY

SKETCH OF CONDITIONS AT PIER 9