



**FOUNDATION INVESTIGATION REPORT
for
22 CULVERT REPLACEMENTS
RESURFACING FROM 0.8 KM EAST OF
HIGHWAY 17/ REGIONAL ROAD 55 INTERCHANGE AT
SUDBURY WESTERLY 21.8 KM
GEOGRAPHIC TOWNSHIPS OF DENISON, GRAHAM AND WATERS
GREATER SUDBURY AREA, ONTARIO
G.W.P. 5146-09-00**

APPENDIX A

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April 16, 2014



APPENDIX A



GEOGRAPHIC TOWNSHIP OF DENISON

	Record of Pavement Holes
Culvert A (D4) Station 13+410 EBL	A-1 to A-3 – Record of Borehole Sheets Drawing A-1 – Borehole Locations and Soil Strata Figures A-GS-1 to A-GS-5 – Grain Size Distribution Charts
Culvert B (D7) Station 15+506 C/L	B-1 to B-5 and B2-A – Record of Borehole Sheets Drawing B-1 – Borehole Locations and Soil Strata Figures B-GS-1 to B-GS-4 – Grain Size Distribution Charts Figure B-PC-1 to B-PC-4 – Plasticity Charts
Culvert C1 (D9) Station 16+110 WBL	C1-1 to C1-3 – Record of Borehole Sheets Drawing C1-1 – Borehole Locations and Soil Strata Figures C1-GS-1 and C1-GS-2 – Grain Size Distribution Charts Figure C1-PC-1 – Plasticity Charts
Culvert C2 (D9) Station 16+110 EBL	C2-1, C2-2 and C1-3 – Record of Borehole Sheets Drawing C2-1 – Borehole Locations and Soil Strata Figures C2-GS-1 to C2-GS-3 – Grain Size Distribution Charts Figure C2-PC-1 and C2-PC-2 – Plasticity Charts
Culvert D (D11) Station 16+740 C/L	D-1 to D-5 – Record of Borehole Sheets Drawings D-1 and D-2 – Borehole Locations and Soil Strata Figures D-GS-1 to D-GS-4 – Grain Size Distribution Charts Figure D-PC-1 – Plasticity Chart
Culvert E (D12) Station 16+958 C/L	E-1 to E-5 – Record of Borehole Sheets Drawing E-1 – Borehole Locations and Soil Strata Figures E-GS-1 to E-GS-5 – Grain Size Distribution Charts Figure E-PC-1 and E-PC-2 – Plasticity Charts



GEOGRAPHIC TOWNSHIP OF GRAHAM

	Record of Pavement Holes
Culvert F (G3) Station 10+525 EBL	F-1 to F-3 – Record of Borehole Sheets Drawing F-1 – Borehole Locations and Soil Strata Figures F-GS-1– Grain Size Distribution Chart
Culvert G (G4) Station 10+685 EBL	G-1 to G-3 – Record of Borehole Sheets Drawing G-1 – Borehole Locations and Soil Strata Figures G-GS-1 and G-GS-2 – Grain Size Distribution Charts
Culvert H (G5) Station 10+910 EBL	H-1 to H-3 – Record of Borehole Sheets Drawing H-1 – Borehole Locations and Soil Strata Figures H-GS-1 to H-GS-3 – Grain Size Distribution Charts Figure H-PC-1 – Plasticity Chart
Culvert I (G7) Station 12+273 C/L	I-1 to I-5 – Record of Borehole Sheets Drawing I-1 – Borehole Locations and Soil Strata Figures I-GS-1 to I-GS-3 – Grain Size Distribution Charts Figure I-PC-1 to I-PC-3 – Plasticity Charts
Culvert J1 (G8) Station 12+620 WBL	J1-1 to J1-3 – Record of Borehole Sheets Drawing J1-1 – Borehole Locations and Soil Strata Figures J1-GS-1 and J1-GS-2 – Grain Size Distribution Charts Figure J1-PC-1 and J1-PC-2 – Plasticity Charts
Culvert J2 (G9) Station 12+630 EBL	J2-1, J2-2 and J1-3 – Record of Borehole Sheets Drawing J2-1 – Borehole Locations and Soil Strata Figures J2-GS-1 to J2-GS-3 – Grain Size Distribution Charts Figure J2-PC-1 – Plasticity Charts
Culvert K (G10) Station 12+850 WBL	K-1 to K-3 – Record of Borehole Sheets Drawing K-1 – Borehole Locations and Soil Strata Figures K-GS-1 to K-GS-3 – Grain Size Distribution Charts Figure K-PC-1 and K-PC-2 – Plasticity Charts
Culvert L (G25) Station 17+894 C/L	L-1 to L-5, L2-A – Record of Borehole Sheets Drawing L-1 – Borehole Locations and Soil Strata Figures L-GS-1 to L-GS-4 – Grain Size Distribution Charts Figure L-PC-1 and L-PC-2 – Plasticity Charts
Culvert M (G26) Station 18+882 C/L	M-1 to M-5, M2-A – Record of Borehole Sheets Drawing M-1 – Borehole Locations and Soil Strata Figures M-GS-1 to M-GS-4 – Grain Size Distribution Charts Figure M-PC-1 and M-PC-2 – Plasticity Charts
Culvert N1 (G30) Station 19+820 WBL	N1-1 to N1-3 – Record of Borehole Sheets Drawing N1-1 – Borehole Locations and Soil Strata Figures N1-GS-1 and N1-GS-2 – Grain Size Distribution Charts Figure N1-PC-1 – Plasticity Chart
Culvert N2 (G31) Station 19+850 EBL	N2-1, N2-2 AND N1-3 – Record of Borehole Sheets Drawing N2-1 – Borehole Locations and Soil Strata Figures N2-GS-1 and N1-GS-2 – Grain Size Distribution Charts



GEOGRAPHIC TOWNSHIP OF WATERS

	Record of Pavement Holes
Culvert O (W4) Station 11+753 WBL	O-1 to O-3 – Record of Borehole Sheets Drawing O-1 – Borehole Locations and Soil Strata Figures O-GS-1 and O-GS-2 – Grain Size Distribution Charts
Culvert P (W14) Station 13+598 EBL	P-1 to P-3 – Record of Borehole Sheets Drawing P-1 – Borehole Locations and Soil Strata Figures P-GS-1 to P-GS-3 – Grain Size Distribution Charts Figures P-PC-1 and P-PC-2 – Plasticity Charts
Culvert Q (W17) Station 14+943 WBL	Q-1 to Q-3 – Record of Borehole Sheets Drawing Q-1 – Borehole Locations and Soil Strata Figures Q-GS-1 to Q-GS-4 – Grain Size Distribution Charts Figures Q-PC-1 to Q-PC-3 – Plasticity Charts
Culvert R (W25) Station 15+687 C/L	R-1 to R-5 – Record of Borehole Sheets Drawing R-1 – Borehole Locations and Soil Strata Figures R-GS-1 to R-GS-5 – Grain Size Distribution Charts Figures R-PC-1 and R-PC-2 – Plasticity Charts
Culvert S (W26) Station 16+125 EBL	S-1 to S-4 – Record of Borehole Sheets Drawing S-1 – Borehole Locations and Soil Strata Figures S-GS-1 to S-GS-6 – Grain Size Distribution Charts Figures S-PC-1 and S-PC-2 – Plasticity Charts



Geographic Township of Denison
Record of Pavement Holes



Culvert B (D7) Sta 15+506 CL

Highway 17 EBL Denison Township DATUM: Existing Highway 17 EBL Centreline					Highway 17 WBL Denison Township DATUM: Existing Highway 17 WBL Centreline				
15+520.0	3.3	Lt C/L	D-0.1	EP	15+490.0	2.2	Lt C/L	D-0.1	ROAD
PDA 7, At Culvert D7					PDA 5, At Culvert D7				
0	-	360	Asph		0	-	360	Asph	
360	-	500	Br Cr Sa And Gr Tr Si Moist		360	-	780	Br Cr Sa And Gr Tr Si Moist	
		500	NFP RF					SP-SM	
								w = 6%	
								% Pass	
								26.5 mm = 100	
								19.0 mm = 96	
								13.2 mm = 82	
								9.5 mm = 74	
								4.75 mm = 60	
								1.18 mm = 41	
								300 µm = 25	
								75 µm = 11	
								LSFH	
								NOT Accep GRANULAR A	
								Accep SSM	
							780	NFP RF	
15+520.0	4.7	Lt C/L	D-0.1	MSH	15+490.0	3.7	Lt C/L	D-0.1	EP
PDA 7, At Culvert D7					PDA 5, At Culvert D7				
0	-	150	Asph		0	-	380	Asph	
150	-	680	Br Cr Sa And Gr Tr Si Moist		380	-	810	Br Cr Sa And Gr Tr Si Moist	
			GP-GM				810	NFP RF	
			w = 4%						
			% Pass						
			26.5 mm = 100						
			19.0 mm = 97						
			13.2 mm = 85						
			9.5 mm = 73						
			4.75 mm = 54						
			1.18 mm = 40						
			300 µm = 23						
			75 µm = 10						
			LSFH						
			NOT Accep GRANULAR A						
			Accep GRANULAR B TYPE I						
		680	NFP RF		15+490.0	4.8	Lt C/L	D-0.1	MSH
15+520.0	6.0	Lt C/L	D-0.2	SHR	PDA 5, At Culvert D7				
PDA 7, At Culvert D7					0	-	120	Asph	
0	-	970	Br Cr Sa And Gr Tr Si Moist		120	-	800	Br Cr Sa And Gr Tr Si Moist	
		970	NFP RF				800	NFP RF	
					15+490.0	2.0	Rt C/L	D-0.1	ROAD
					PDA 5, At Culvert D7				
					0	-	340	Asph	
					340	-	790	Br Cr Sa And Gr Tr Si Moist	
							790	NFP RF	



Culvert B (D7) Sta 15+506 CL

Highway 17 EBL Denison Township DATUM: Existing Highway 17 EBL Centreline	Highway 17 WBL Denison Township DATUM: Existing Highway 17 WBL Centreline
<p>15+520.0 3.5 Rt C/L D-0.1 EP PDA 7, At Culvert D7</p> <p>0 - 390 Asph</p> <p>390 - 650 Br Cr Gr(y) Sa Tr Si Moist SP-SM % Pass 26.5 mm = 100 19.0 mm = 99 13.2 mm = 88 9.5 mm = 82 4.75 mm = 66 1.18 mm = 41 300 µm = 18 75 µm = 6 LSFH NOT Accep GRANULAR A Accep GRANULAR B TYPE I</p> <p>650 - 970 Br Gr(y) Sa Some Si Moist SP-SM w = 6% % Pass 26.5 mm = 100 19.0 mm = 94 13.2 mm = 88 9.5 mm = 81 4.75 mm = 69 1.18 mm = 56 300 µm = 31 75 µm = 11 LSFH NOT Accep GRANULAR B TYPE I Accep SSM</p> <p>970 NFP RF</p>	

Culvert C1 (D9) Sta 16+110 WBL

Highway 17 WBL Denison Township DATUM: Existing Highway 17 WBL Centreline				
16+095.0	2.6	Lt C/L	D+/-0	ROAD
At Culvert D8				
0	-	430	Asph	
430	-	700	Br Cr Sa And Gr Tr Si Moist	
		700	NFP RF	

Culvert C2 (D9) Sta 16+110 EBL

Highway 17 EBL Denison Township DATUM: Existing Highway 17 EBL Centreline				
16+125.0	2.0	Lt C/L	D+/-0	ROAD
On Existing Patch, At Culvert D9				
0	-	210	Asph	
210	-	500	Br Cr Sa And Gr Tr Si Moist	
500	-	710	Br Sa Tr Gr Tr Si Moist	
		710	NFP RF	



Culvert D (D11) Sta 16+740 CL

Highway 17 EBL Denison Township DATUM: Existing Highway 17 EBL Centreline					Highway 17 WBL Denison Township DATUM: Existing Highway 17 WBL Centreline				
16+786.0	1.9	Lt C/L	D+/-0	ROAD	16+693.0	2.3	Lt C/L	D+/-0	ROAD
At Culvert D11					At Culvert D11				
0	-	390	Asph		0	-	360	Asph	
390	-	600	Br Cr Sa And Gr Tr Si Moist		360	-	520	Br Cr Sa And Gr Tr Si Moist	
600	-	820	Br Gr(y) Sa Tr Si Moist		520	-	740	Br Sa Tr Gr Tr Si Moist	
		820	NFP RF				740	NFP RF	
16+800.0	2.0	Rt C/L	D-0.1	ROAD					
0	-	355	Asph						
355	-	680	Br Cr Sa And Gr Tr Si Moist						
680	-	900	Br Sa And Gr Tr Si Occ Cob Moist						
		900	NFP RF						

Culvert E (D12) Sta 16+958 C/L

Highway 17 EBL Denison Township DATUM: Existing Highway 17 EBL Centreline					Highway 17 WBL Denison Township DATUM: Existing Highway 17 WBL Centreline				
16+971.0	2.0	Lt C/L	D+0.1	ROAD	16+942.0	2.3	Lt C/L	D+0.1	ROAD
At Culvert D12					At Culvert D12				
0	-	340	Asph		0	-	330	Asph	
340	-	600	Br Cr Sa And Gr Tr Si Moist		330	-	810	Br Cr Sa And Gr Tr Si Moist	
600	-	1.3	Br Sa Some Gr Some Si Moist				810	NFP RF	
			SM						
			w = 9%						
			% Pass						
			26.5 mm = 100						
			19.0 mm = 100						
			13.2 mm = 97						
			9.5 mm = 95						
			4.75 mm = 90						
			1.18 mm = 75						
			300 µm = 50						
			75 µm = 16						
			LSFH						
			NOT Accep GRANULAR B TYPE I						
			Accep SSM						
		1.3	NFP RF						

GEOGRAPHIC TOWNSHIP OF DENISON

Culvert A (D4) – Station 13+410 EBL

RECORD OF BOREHOLE No A-1
1 of 1
METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 137 196.6 N; 277 313.0 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.H.S.A. and Dynamic Cone Penetration Test **COMPILED BY** A.D.
DATUM Geodetic **DATE** November 08 and 29, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		SHEAR STRENGTH kPa										WATER CONTENT (%)		
							○ UNCONFINED		+ FIELD VANE		● QUICK TRIAXIAL						× LAB VANE		
256.5	Ground surface						20	40	60	80	100	20	40	60					
0.0	Sand, trace silt organics		1	SS	3														
	Loose Brown Moist (FILL) to wet		2	SS	2														
255.1																			
1.4	Silt and sand, trace clay organics to 3.0m		3	SS	10														
	Compact Brown Wet		4	SS	16														
			5	SS	13														
			6	SS	11														
			7	SS	11														
251.5																			
5.0	Sand some silt, trace clay		8	SS	19														
	Compact Brown Moist oxidized red		9	SS	19														
249.8																			
6.7	End of borehole																		
	Probable Sand																		
	Compact																		
245.2																			
11.3	End of dynamic cone penetration test																		
	Refusal on probable bedrock																		
	 * 2012 11 08																		
	▽ Water level observed during drilling																		
	▼ Water level measured after drilling																		
	C.F.H.S.A. denotes Continuous flight hollow stem augers																		
	Dynamic cone penetration test conducted 4.0m east of borehole A-1																		

RECORD OF BOREHOLE No A-2
1 of 2
METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 137 185.7 N; 277 313.9 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.H.S.A. and Dynamic Cone Penetration Test **COMPILED BY** A.D.
DATUM Geodetic **DATE** November 08, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE										○		
								● QUICK TRIAXIAL × LAB VANE												
259.0	Ground surface						20	40	60	80	100									
0.0	140 mm asphalt over sand and gravel		1	AS	-															
258.3	Compact Brown Moist (PAVEMENT FILL)		2	SS	16		258													
0.7	Sand, trace gravel																			
	Silty sand, trace gravel (FILL)		3	SS	29		257													
256.8	Silty sand trace clay, trace gravel organics		4	SS	18															
2.2	Compact Brown Moist		5	SS	11		256													
			6	SS	23		255													
254.7	wood chips																			
4.3	Silt, with sand with clay, trace gravel organic inclusions to 8.7m		7	SS	28		254													
	Loose to compact Grey to brown Moist to wet		8	SS	14		253													
			9	SS	8		252													
						▽*	251													
			10	SS	15		250													
250.3	Silt and sand trace clay																			
8.7	Compact to loose Brown Wet		11	SS	12		249													
			12	SS	1**		248													
			13	SS	1**		247													
245.3	End of borehole Probable silt and sand						246													
13.7	Very loose to compact						245													
244.7	End of dynamic cone penetration test Refusal on probable bedrock				Cont'd						120/0cm									
14.3																				

RECORD OF BOREHOLE No A-2

2 of 2





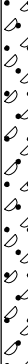

METRIC

G.W.P.	5146-09-00	LOCATION	Coords: 5 137 185.7 N; 277 313.9 E	ORIGINATED BY	F.P.
DIST	Sudbury	HWY	17	BOREHOLE TYPE	C.F.H.S.A. and Dynamic Cone Penetration Test
DATUM	Geodetic	DATE	November 08, 2012	CHECKED BY	B.R.G.

[illegible]

RECORD OF BOREHOLE No A-3
1 of 2
METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 137 156.3 N; 277 311.7 E **ORIGINATED BY** S.A.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod and Washboring + Dynamic Cone Penetration Test **COMPILED BY** A.D.
DATUM Geodetic **DATE** December 03, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE									
								● QUICK TRIAXIAL × LAB VANE									
					WATER CONTENT (%)												
250.9	Ground surface							20	40	60	80	100					
250.7	Topsoil																
0.2	Silty clay, sand seams rootlets, wood debris Grey Wet (FILL)		1	SS	1									○			
			2	SS	5									○			
			3	SS	WH**									○			
248.7																	
2.2	Silt and sand, trace clay Loose Grey Wet		4	SS	9									○			0 42 56 2
247.9																	
3.0	Silty sand trace clay, trace gravel Very loose Grey Wet to compact		5	SS	10									○			
			6	SS	6								○				
			7	SS	3								○			1 63 35 1	
			8	SS	11								○				
244.9																	
6.0	Sandy silt, trace clay Loose to Grey Wet compact		9	SS	6									○			
			10	SS	7								○			2 36 60 2	
			11	SS	6								○				
			12	SS	7								○				
240.4																	
10.5	Gravelly sand, some silt cobbles and boulders Compact to Grey Wet loose		13	SS	18									○			
			14	SS	24												
			15	SS	6								○				
236.6																	
14.3	End of borehole Probable sand																

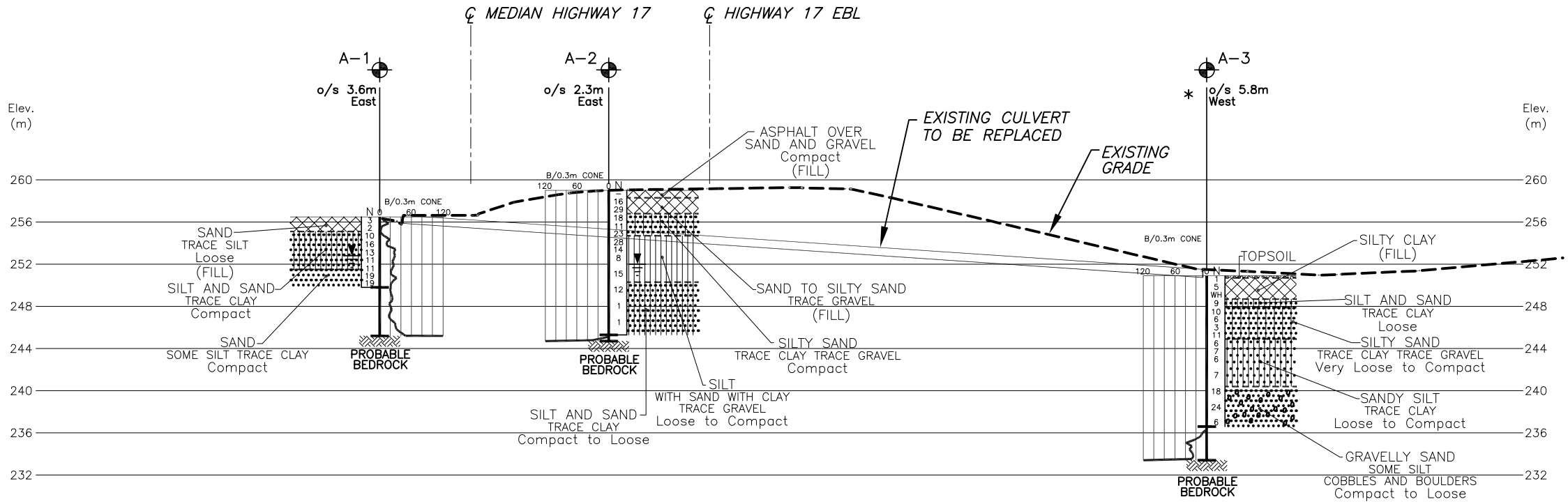
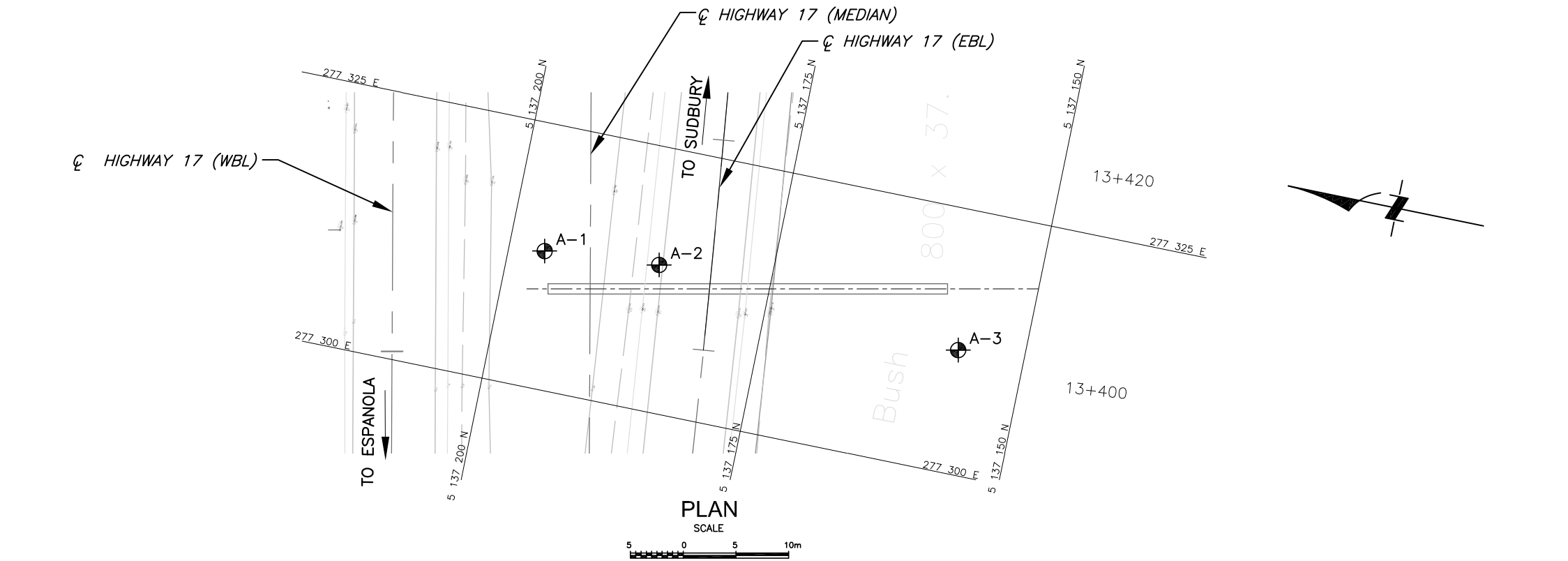
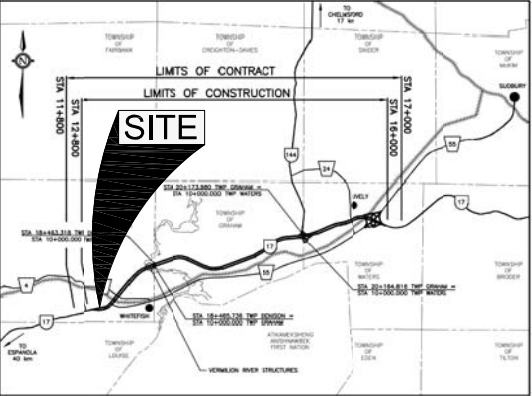
RECORD OF BOREHOLE No A-3

2 of 2

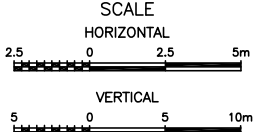
METRIC

G.W.P.	5146-09-00	LOCATION	Coords: 5 137 156.3 N; 277 311.7 E	ORIGINATED BY	S.A.
DIST	Sudbury	HWY	17	BOREHOLE TYPE	Tripod and Washboring + Dynamic Cone Penetration Test
DATUM	Geodetic	DATE	December 03, 2012	CHECKED BY	B.R.G.


SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								20 40 60 80 100	W _p W W _L							
235.9								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE								
233.4	Probable sand Compact						235									
17.5	End of dynamic cone penetration test Refusal on probable bedrock 															




PROFILE ALONG Q EXISTING CULVERT AT STA. 13+410 EBL




LEGEND

 Borehole

 Borehole and Cone


N Blows/0.3m (Std. Pen Test, 475 J/blow)


CONE Blows/0.3m (60 Cone, 475 J/blow)


 WL at time of investigation Nov. & Dec. 2012


WH Penetration due to weight of hammer

* Water level not established

 Head

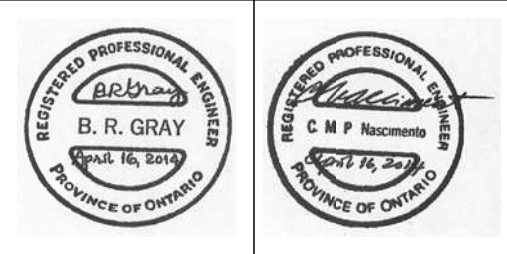
 ARTESIAN WATER

 Encountered

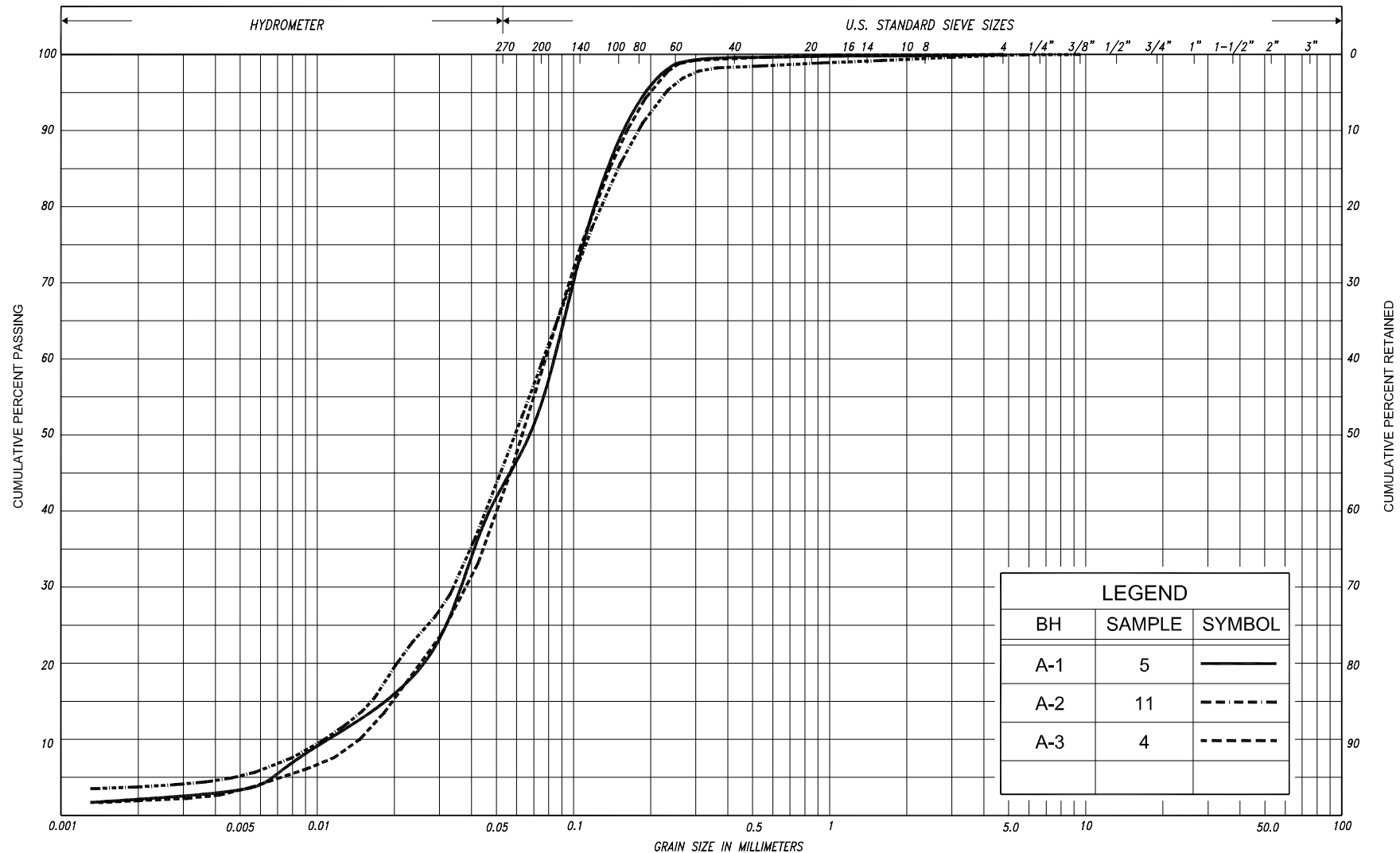
 PIEZOMETER

BH No	ELEVATION	NORTHINGS	EASTINGS
A-1	256.5	5 137 196.6	277 313.0
A-2	259.0	5 137 185.7	277 313.9
A-3	250.9	5 137 156.3	277 311.7

NOTE
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.



- NOTES:
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
 - THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION.
 - DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.



SILT & CLAY				FINE		MEDIUM		COARSE	GRAVEL			COB BLES	UNIFIED	
				SAND										
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.	
	SILT				SAND									
CLAY		SILT		V. FINE	FINE	MED.	COARSE	GRAVEL						U.S. BUREAU
				SAND										

GRAIN SIZE DISTRIBUTION

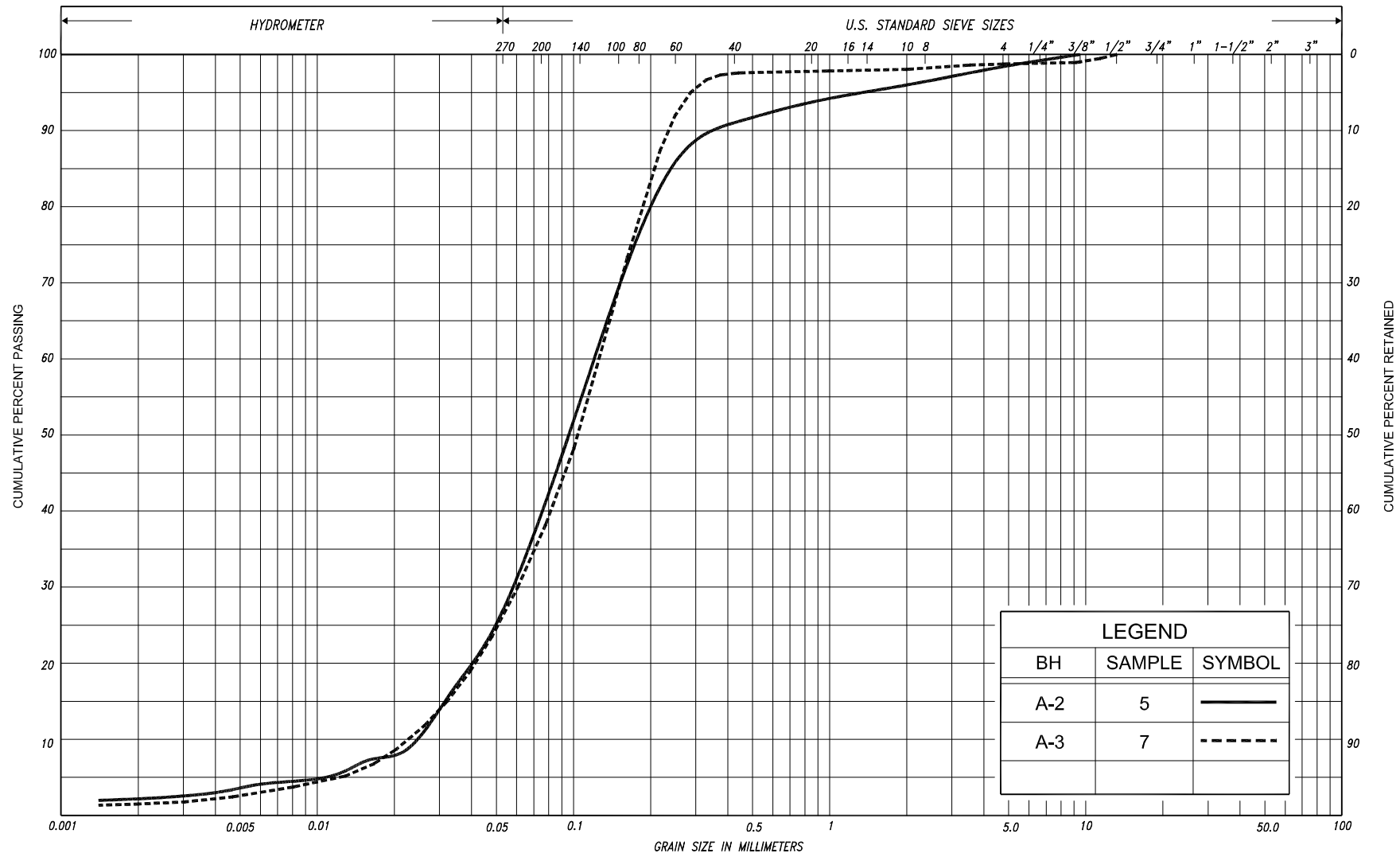
SILT AND SAND, trace clay

FIG No. A-GS-1

HWY: 17

W.P. No. 5146-09-00





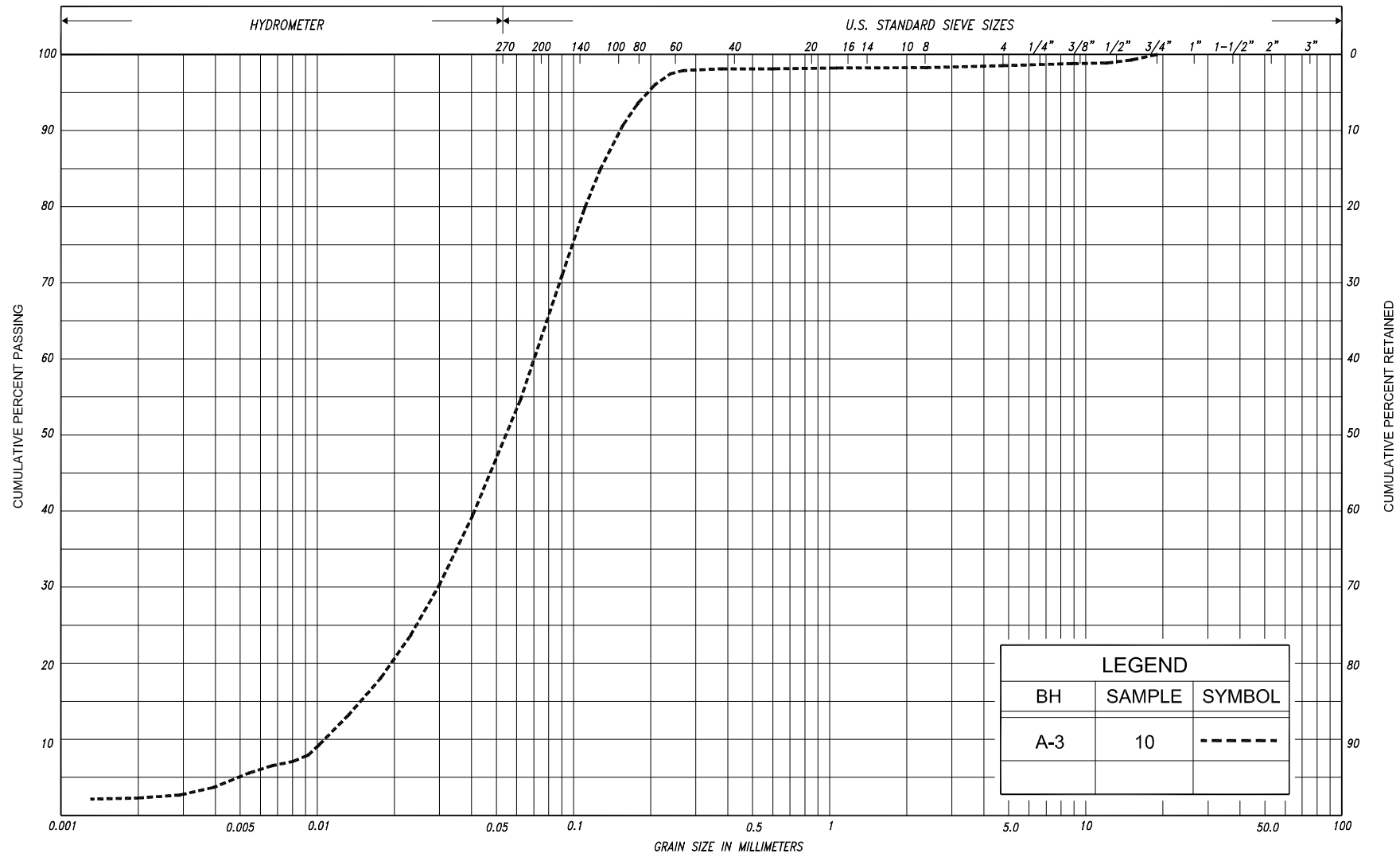
SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COB BLES	UNIFIED		
					SAND											
CLAY	FINE		MEDIUM		COARSE	FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT															
CLAY		SILT			V. FINE	FINE	MED.	COARSE		GRAVEL						U.S. BUREAU
					SAND											



GRAIN SIZE DISTRIBUTION

SILTY SAND, trace clay, trace gravel

FIG No. A-GS-2
 HWY: 17
 W.P. No. 5146-09-00



LEGEND		
BH	SAMPLE	SYMBOL
A-3	10	-----

SILT & CLAY				SAND			GRAVEL		COBBLES	UNIFIED
				FINE	MEDIUM	COARSE				
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	GRAVEL		COBBLES	M.I.T.
CLAY		SILT		V. FINE	FINE	MED.	COARSE	GRAVEL		U.S. BUREAU

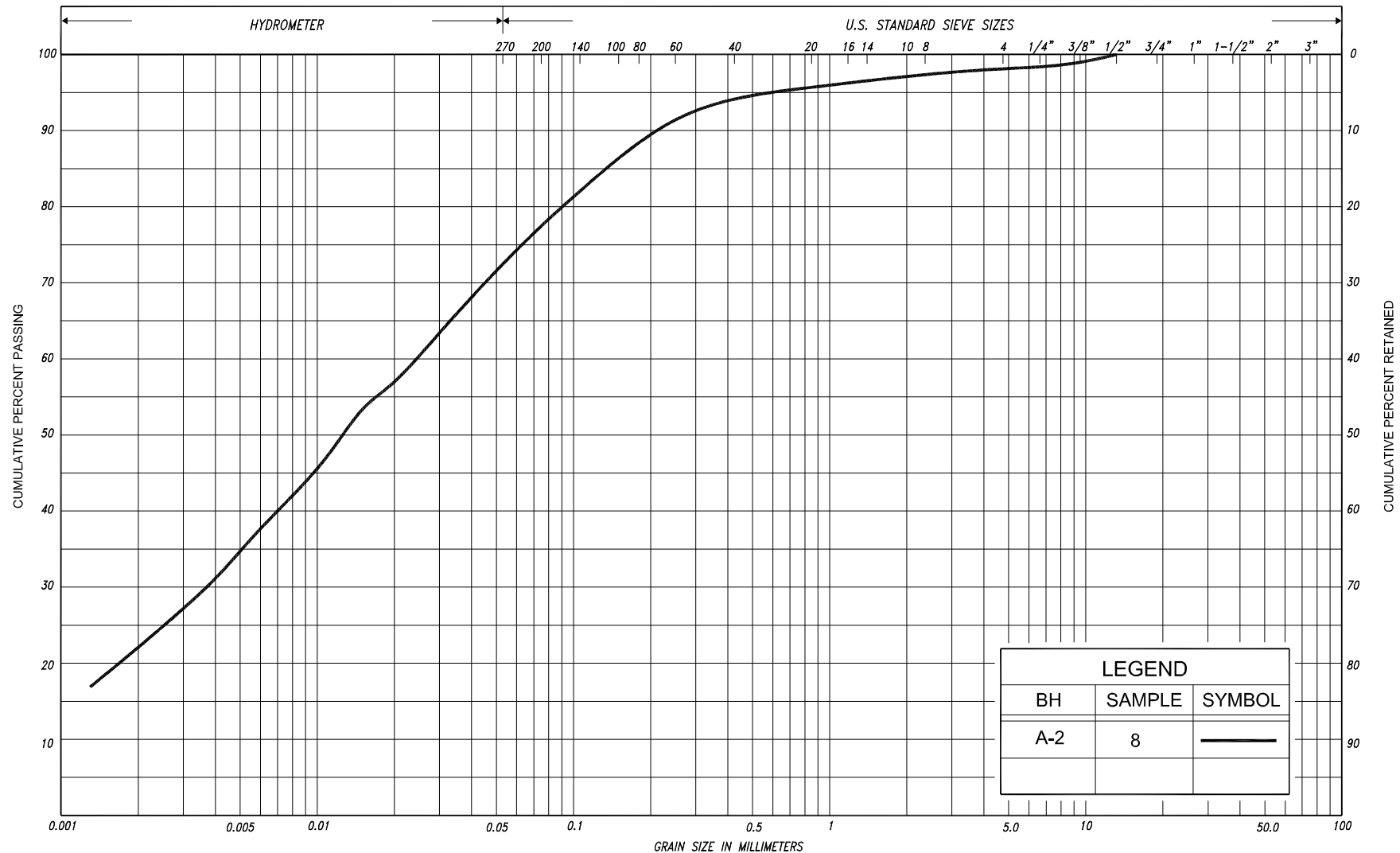


GRAIN SIZE DISTRIBUTION SANDY SILT, trace clay, trace gravel

FIG No. A-GS-3

HWY: 17

W.P. No. 5146-09-00



SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COB BLES	UNIFIED	
CLAY	FINE	MEDIUM	COARSE	SAND											
				FINE	MEDIUM	COARSE	GRAVEL			COBBLES		M.I.T.			
CLAY		SILT			V. FINE	FINE	MED.	COARSE	GRAVEL						U.S. BUREAU



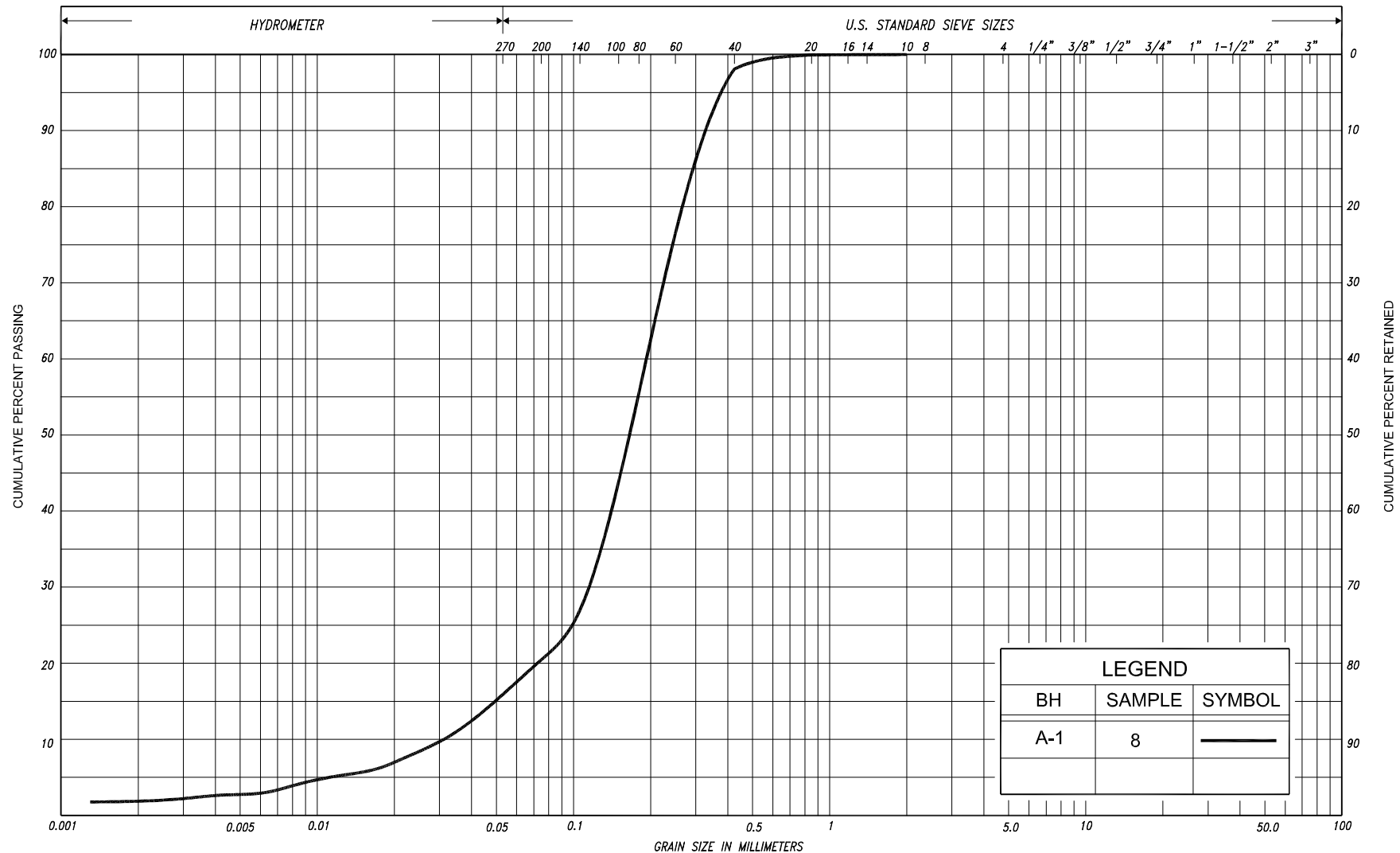
GRAIN SIZE DISTRIBUTION

SILT, with sand, with clay, trace gravel

FIG No. A-GS-4

HWY: 17

W.P. No. 5146-09-00



SILT & CLAY				FINE		MEDIUM		COARSE	GRAVEL		COB BLES	UNIFIED	
				SAND									
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM		COARSE		GRAVEL		COBBLES	M.I.T.	
	SILT												
CLAY		SILT		V. FINE	FINE	MED.	COARSE	GRAVEL					U.S. BUREAU
				SAND									



GRAIN SIZE DISTRIBUTION

SAND, some silt, trace clay

FIG No. A-GS-5
 HWY: 17
 W.P. No. 5146-09-00

GEOGRAPHIC TOWNSHIP OF DENISON

Culvert B (D7) – Station 15+506 C/L

RECORD OF BOREHOLE No B-1

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 138 491.0 N; 278 841.1 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod + Dynamic Cone Penetration tests **COMPILED BY** N.R.
DATUM Geodetic **DATE** June 11, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
260.2	Ground surface					▽ * ▲ *		20	40	60	80	100					
0.0	Peat, fine fibrous Dark brown						260										
260.0 0.2	Organic silt, trace sand trace clay, trace gravel		1	SS	1												
259.0	Very loose Grey Wet to compact		2	SS	14												
1.2	Silt, some clay trace sand, trace gravel sand seams						259										
258.2	Dense Brown Wet		3	SS	36												
2.0	End of borehole <																

RECORD OF BOREHOLE No B-2

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 138 476.5 N; 278 851.7 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Sonic + Rotary Displacement **COMPILED BY** N.R.
DATUM Geodetic **DATE** June 03, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE						
268.1	Ground surface																
0.0	100 mm asphalt over sand and gravel						268										
267.6	(PAVEMENT FILL)																
0.5	Cobbles and boulders (ROCKFILL)						267										
							266										
							265										
							264										
263.2	End of borehole																
4.9	Refusal on rockfill																
	* Borehole charged with drilling water																

RECORD OF BOREHOLE No B-2A

1 of 1

METRIC

G.W.P.	5146-09-00	LOCATION	Coords: 5 138 485.0 N; 278 859.0 E	ORIGINATED BY	F.P.
DIST	Sudbury	HWY	17	BOREHOLE TYPE	Sonic + Rotary Displacement
DATUM	Geodetic	DATE	June 03, 2013	CHECKED BY	B.R.G.

[illegible]

RECORD OF BOREHOLE No B-3
1 of 1
METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 138 462.3 N; 278 874.5 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod and 'N' Casing + Dynamic Cone Penetration test **COMPILED BY** N.R.
DATUM Geodetic **DATE** May 01, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)										
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)									
								○ UNCONFINED + FIELD VANE										○									
								● QUICK TRIAXIAL × LAB VANE																			
263.7	Ground surface						20	40	60	80	100	20	40	60	kn/m³	GR SA SI CL											
0.0	Sand, trace silt trace clay, organics Compact Brown Moist to loose _____ trace gravel		1	SS	11		263																				
			2	SS	8																						
			262																								
3	SS	8																									
261.5	Silty clay sand and gravel inclusions Hard to firm																261										
4			SS	30																							
5			SS	32																							
						260																					
	6	SS	5																								
259.2	Clayey silt trace sand, trace gravel Firm to stiff (FILL)					259																					
4.5																											
				FV																							
257.9			8	SS	14	258																					
5.8	End of borehole Refusal on probable bedrock																										
	* Borehole charged with drilling water																										
	NOTES:																										
	1: Dynamic cone penetration test was carried out 2m west of borehole B-3																										
	2: Bedrock is exposed about 19m south of borehole B-3																										

RECORD OF BOREHOLE No B-4

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 138 454.9 N; 278 882.9 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Sonic + Rotary Displacement **COMPILED BY** N.R.
DATUM Geodetic **DATE** May 27, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)
								○ UNCONFINED + FIELD VANE									
								● QUICK TRIAXIAL × LAB VANE									
265.1	Ground surface					20	40	60	80	100	20	40	60				
0.0	100 mm asphalt over sand and gravel																
264.6	(PAVEMENT FILL)																
0.5	Sand and gravel cobbles and boulders (ROCKFILL)																

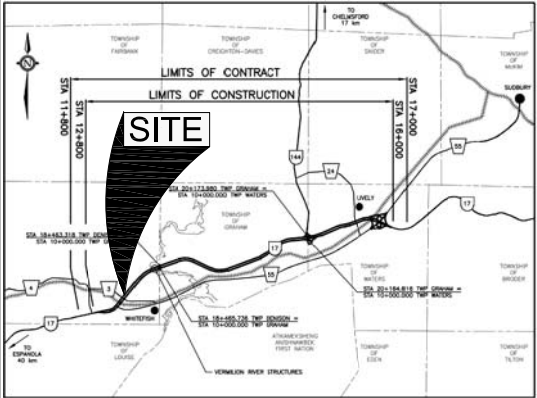
RECORD OF BOREHOLE No B-5

1 of 1

METRIC

G.W.P. <u>5146-09-00</u>	LOCATION <u>Coords: 5 138 428.3 N; 278 889.7 E</u>	ORIGINATED BY <u>S.A.</u>
DIST <u>Sudbury</u> HWY <u>17</u>	BOREHOLE TYPE <u>Tripod and Washboring + Dynamic Cone Penetration Test</u>	COMPILED BY <u>N.R.</u>
DATUM <u>Geodetic</u>	DATE <u>December 19, 2012</u>	CHECKED BY <u>B.R.G.</u>

SOIL PROFILE					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES	"N" VALUES	*GROUND WATER CONDITIONS
259.4 0.0 259.1 0.3	Ground surface Peat, amorphous Dark brown Clayey silt, trace sand organics Very soft Grey Wet		NUMBER	TYPE	*
258.0 1.4 256.3 3.1	Silt some clay, trace sand Compact Mottled Moist brown/grey some sand trace clay, trace gravel		1 SS WH** 2 SS WH 3 SS 10 4 SS 11		
256.2 3.2	End of borehole Probable silt End of dynamic cone penetration test Refusal on probable bedrock * 2012 12 19 Water level observed during drilling Water level measured after drilling WH** denotes penetration due to weight of rods and hammer DCPT was conducted 1.0m west of borehole B-5				



LEGEND			
	Borehole		
	Borehole and Cone		
	Pavement boreholes		
N	Blows/0.3m (Std. Pen Test, 475 J/blow)		
CONE	Blows/0.3m (60 Cone, 475 J/blow)		
WL	WL at time of investigation Nov. & Dec. 2012		
WH	Penetration due to weight of hammer		
*	Water level not established		
	Head		
	ARTESIAN WATER		
	Encountered		
	PIEZOMETER		

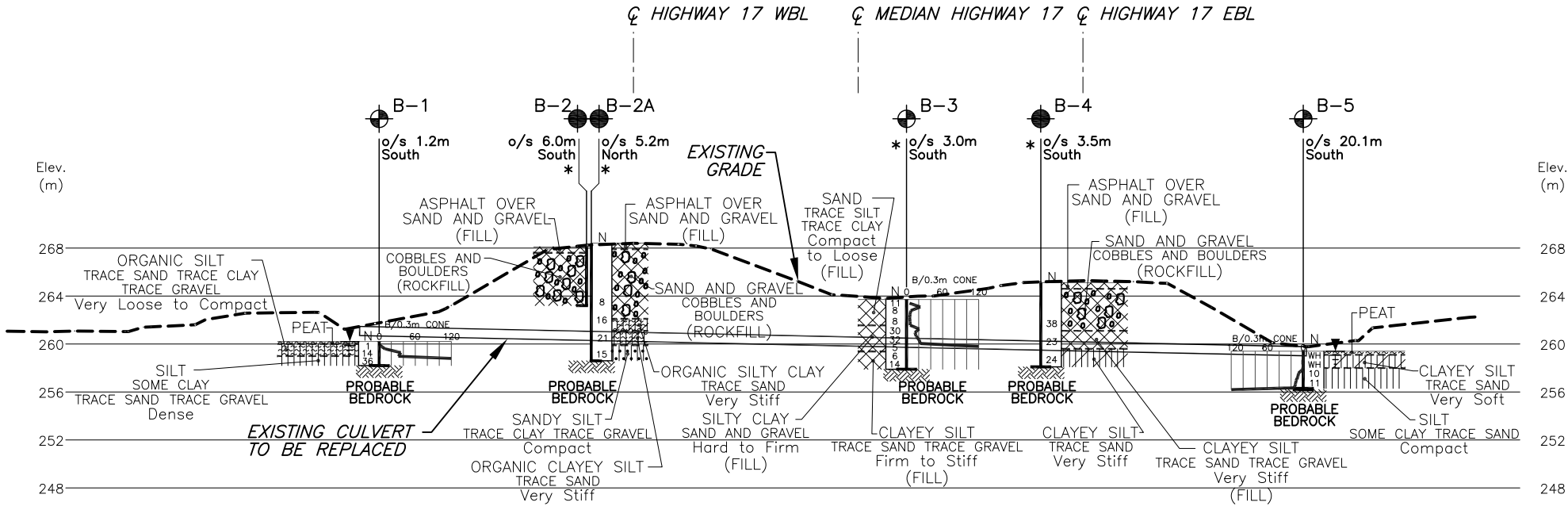
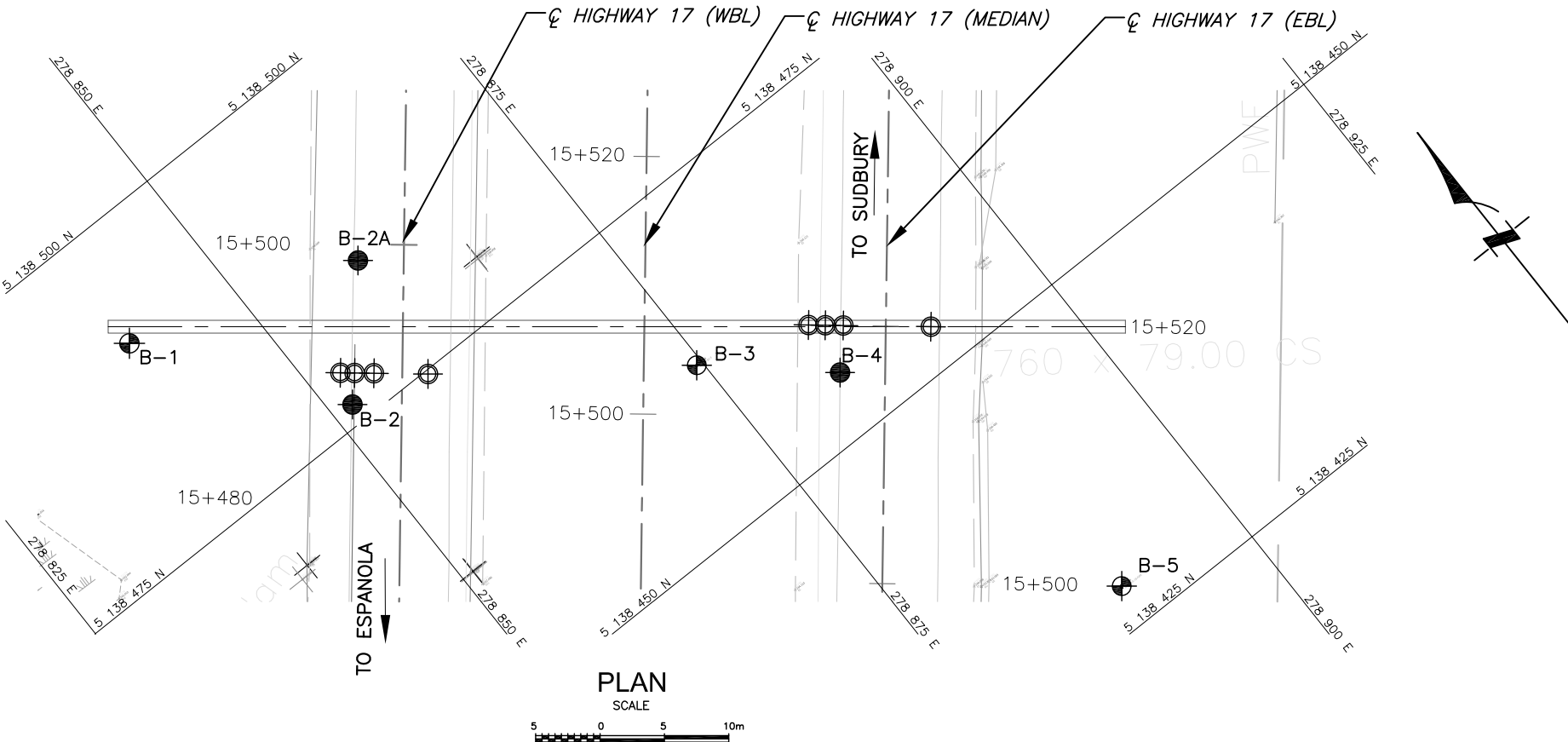
BH No	ELEVATION	NORTHINGS	EASTINGS
B-1	260.2	5 138 491.0	278 841.1
B-2	268.1	5 138 476.5	278 851.7
B-2A	268.4	5 138 485.0	278 859.0
B-3	263.7	5 138 462.3	278 874.5
B-4	265.1	5 138 454.9	278 882.9
B-5	259.4	5 138 428.3	278 889.7

NOTE
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

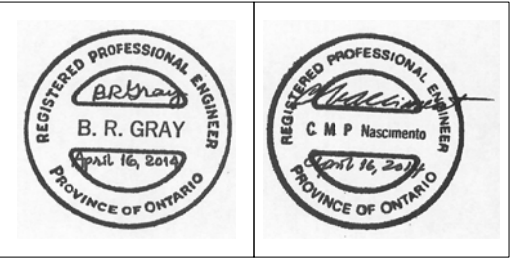
REVISIONS	DATE	BY	DESCRIPTION

Geocres No.411-299

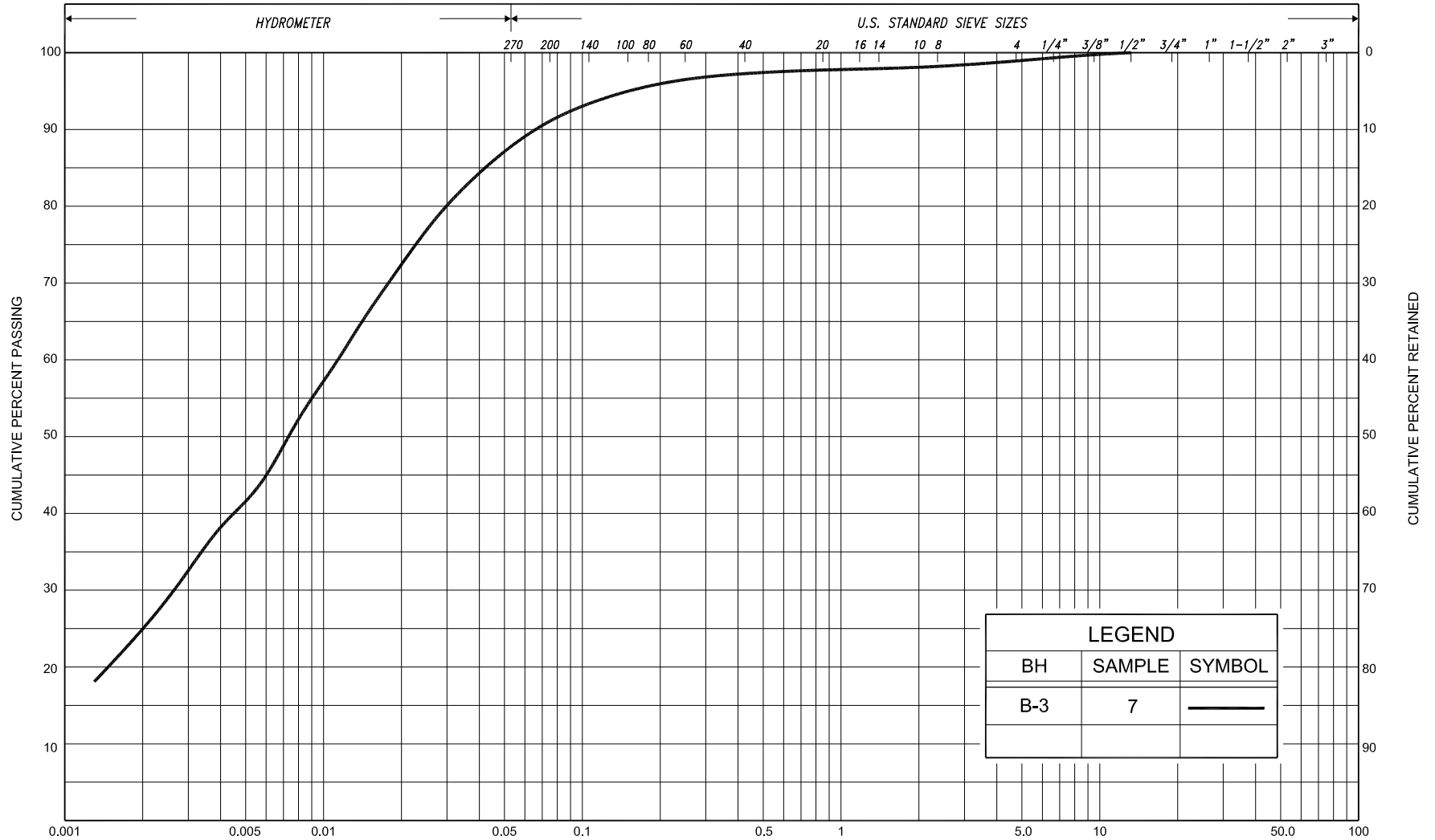
HWY No	17	DIST	Sudbury
SUBM'D	NA	CHECKED	NR
DRAWN	NA	CHECKED	BRG
APPROVED	CN	DATE	APR. 16, 2014
DWG	B-1	SITE	



- NOTES:
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
 - THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION. CULVERT PROFILE IS ESTIMATED.
 - DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.



Reference AECOM Drawings: NTB-01207011.dwg and DENISON X-SECTIONS with Culverts and viewport.dwg received on November 25, 2013 and April 01, 2014 respectively.



SILT & CLAY				FINE		MEDIUM		COARSE	GRAVEL		COBBLES	UNIFIED
CLAY	SAND			FINE		MEDIUM		COARSE	GRAVEL		COBBLES	M.I.T.
	SILT			V. FINE		FINE		MED.	COARSE	GRAVEL		U.S. BUREAU

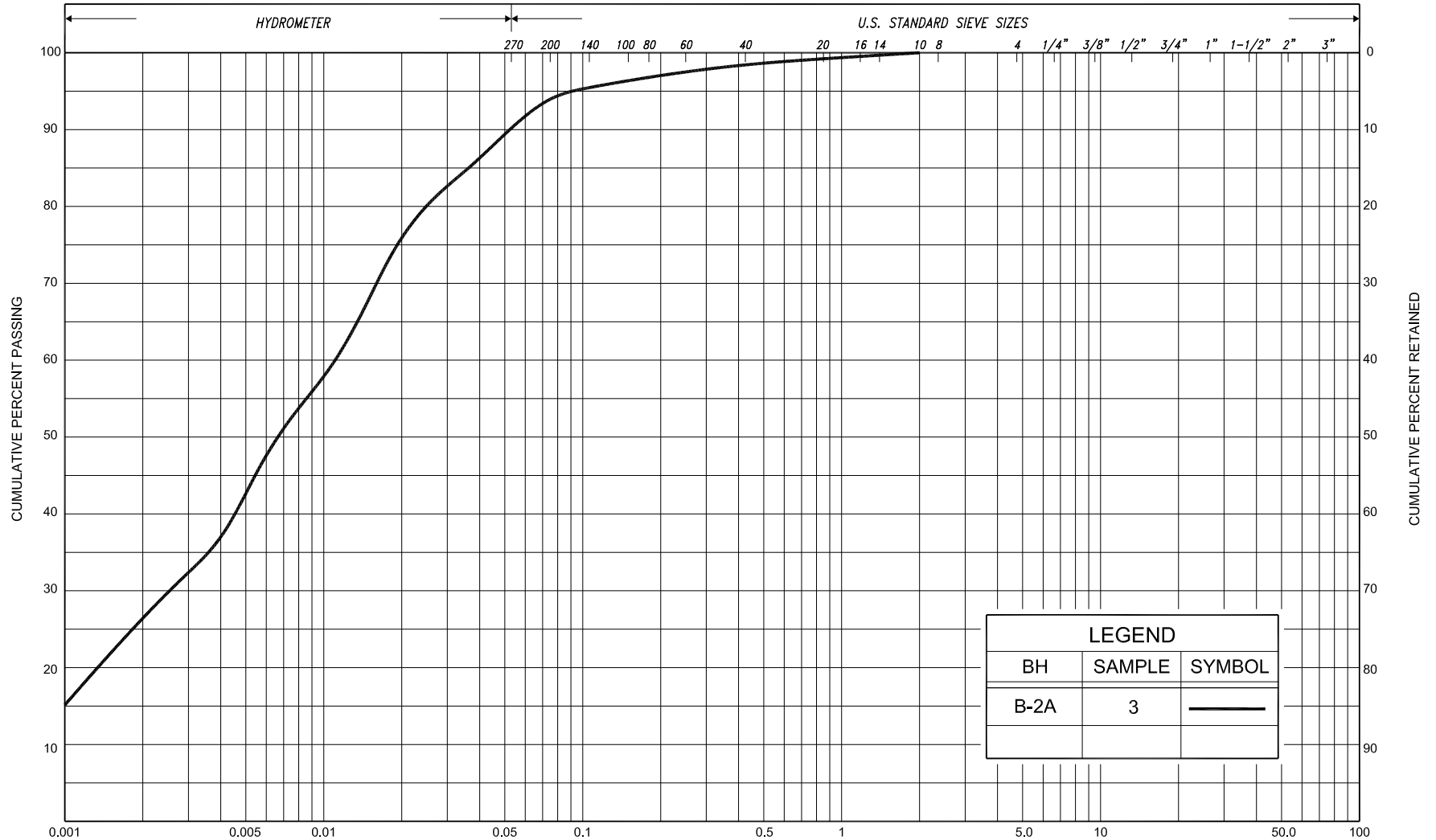


GRAIN SIZE DISTRIBUTION CLAYEY SILT, trace sand, trace gravel (CL) (FILL)

FIG No. B-GS-1

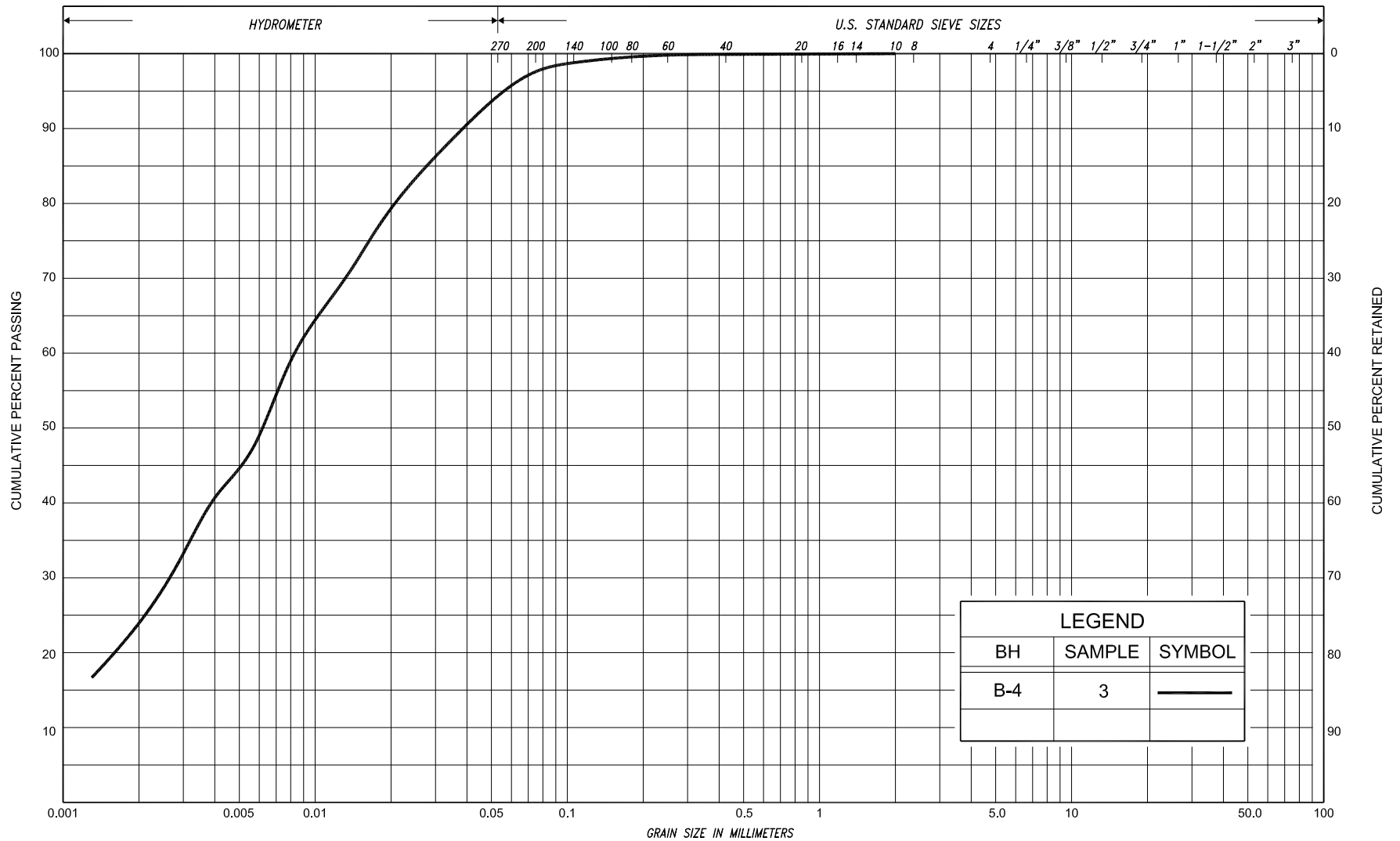
HWY: 17

G.W.P. No. 5146-09-00



LEGEND		
BH	SAMPLE	SYMBOL
B-2A	3	—

SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL				COBBLES	UNIFIED	
					SAND											
CLAY	FINE		MEDIUM		COARSE	FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT															
CLAY		SILT			V. FINE	FINE	MED.	COARSE	GRAVEL							U.S. BUREAU
					SAND											



SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL				COBBLES	UNIFIED			
					SAND													
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL				COBBLES	M.I.T.
	SILT					SAND												
CLAY		SILT			V. FINE	FINE	MED.	COARSE	GRAVEL							U.S. BUREAU		
					SAND													



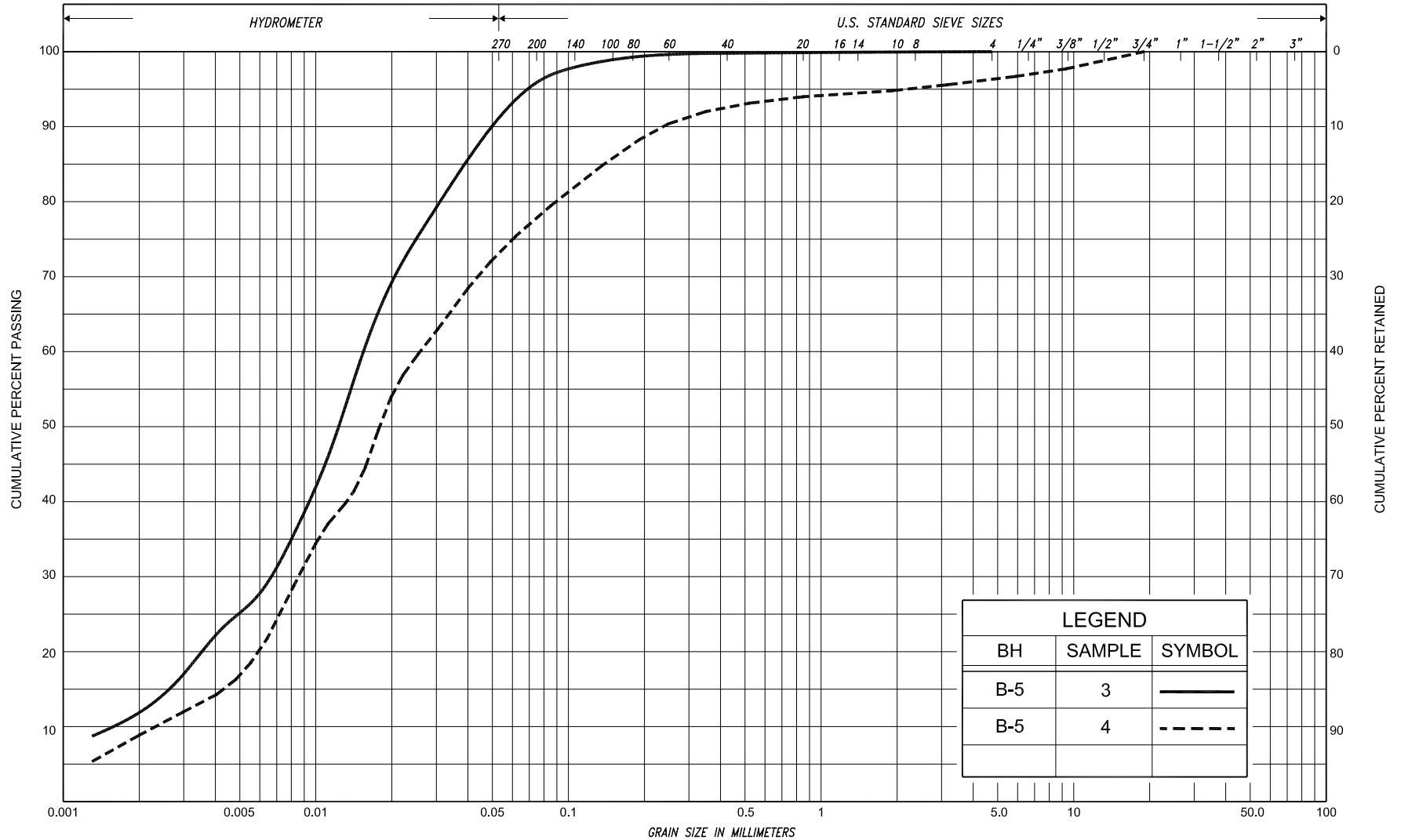
GRAIN SIZE DISTRIBUTION

CLAYEY SILT, trace sand (CL)

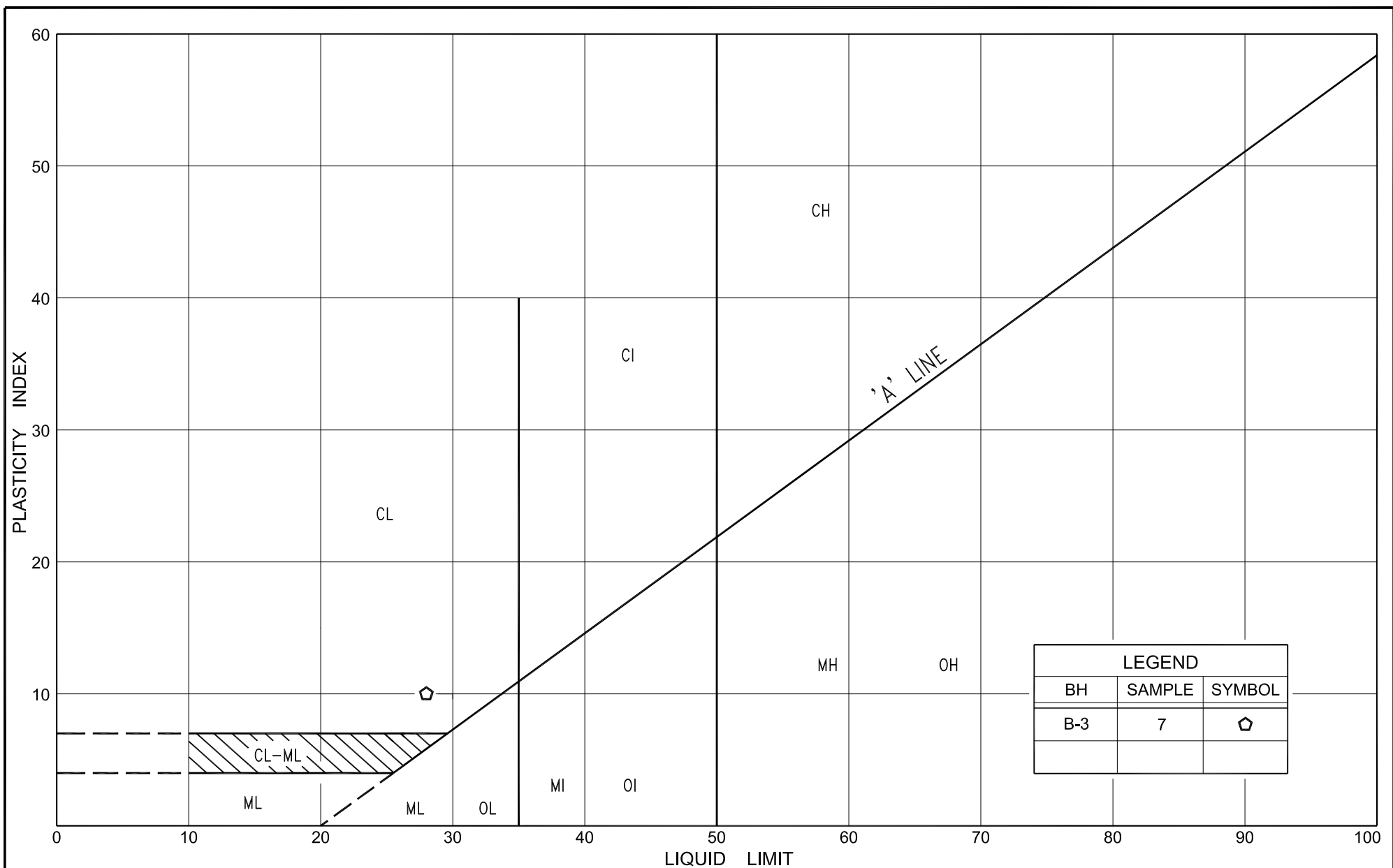
FIG No. B-GS-3

HWY: 17

G.W.P. No. 5146-09-00

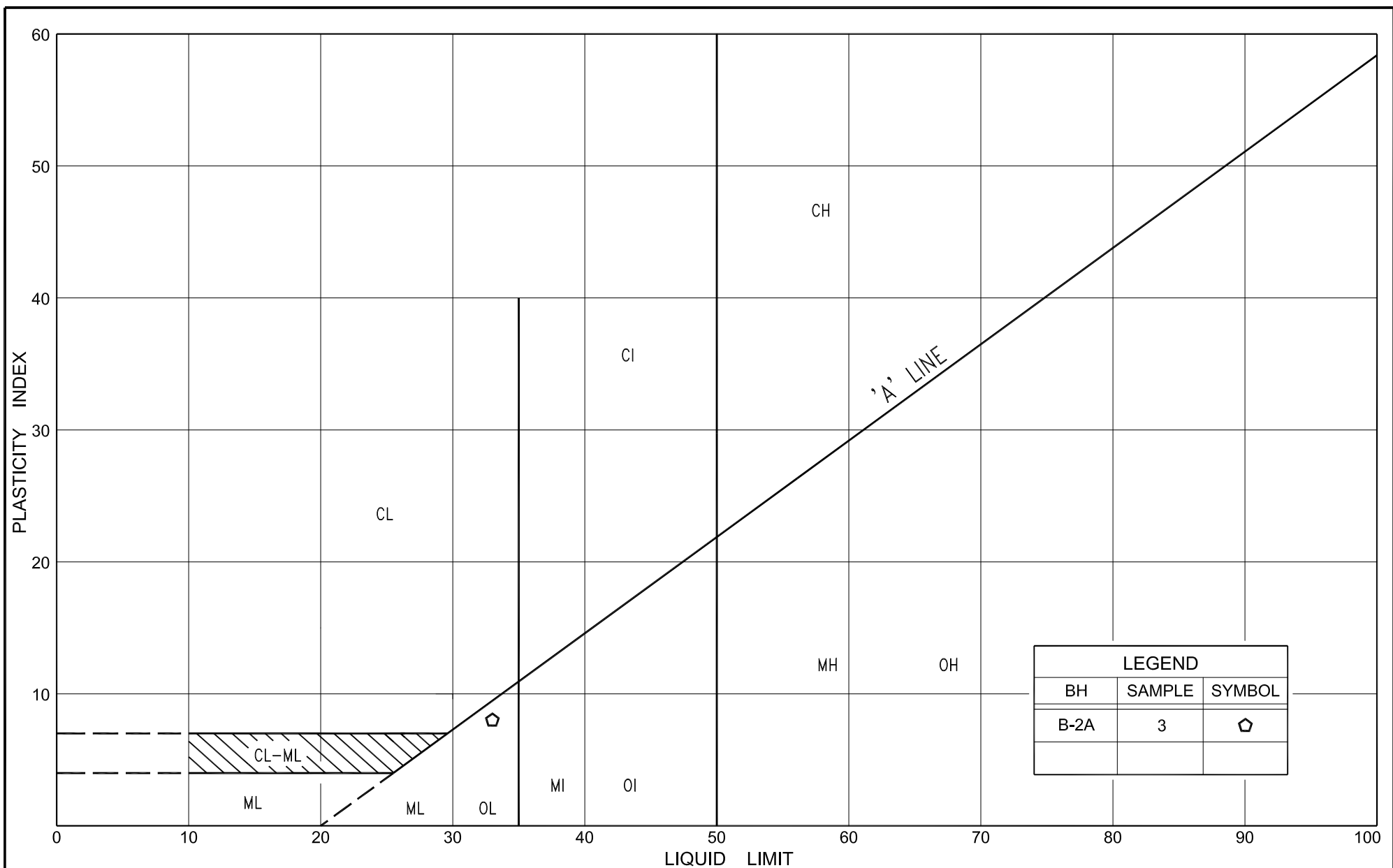


SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL				COB BLES	UNIFIED		
					SAND													
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL				COBBLES	M.I.T.
	SILT																	
CLAY			SILT			V. FINE	FINE	MED.	COARSE		GRAVEL							U.S. BUREAU
SAND																		



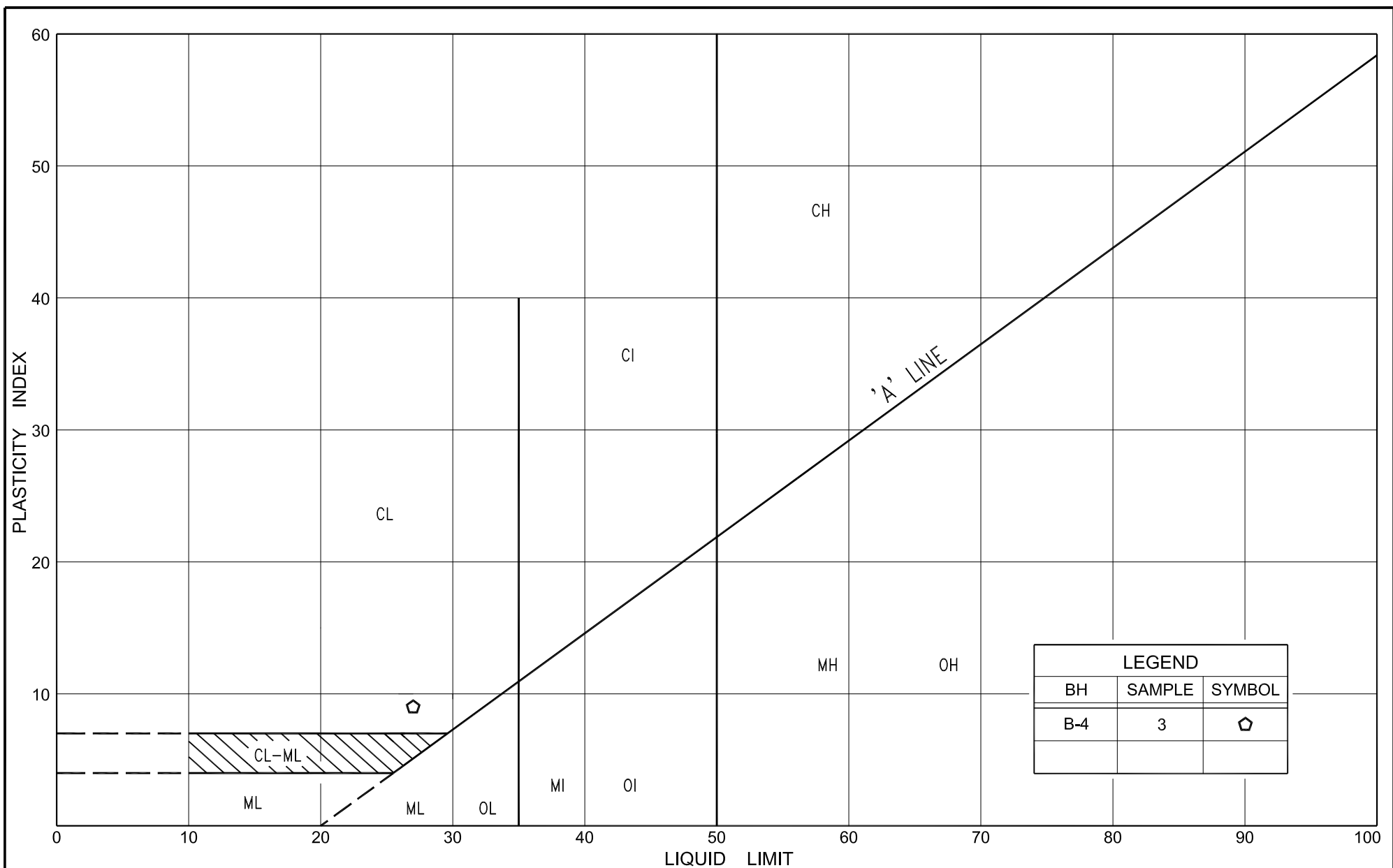
PLASTICITY CHART
 CLAYEY SILT, trace sand, trace gravel (CL)
 (FILL)

FIG No. B-PC-1
 HWY: 17
 G.W.P. No. 5146-09-00



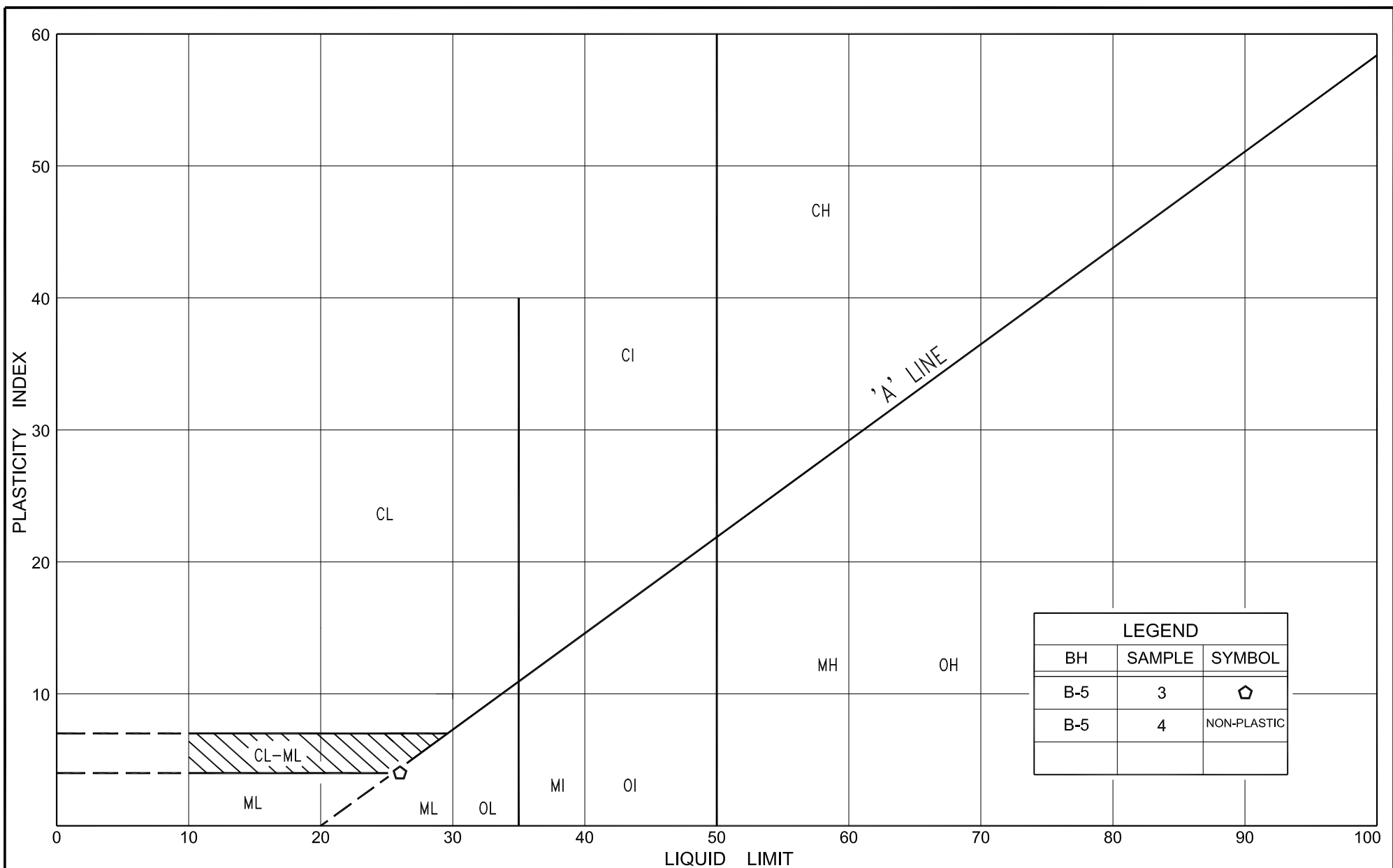
PLASTICITY CHART
 ORGANIC CLAYEY SILT, trace sand (OL)

FIG No. B-PC-2
 HWY: 17
 G.W.P. No. 5146-09-00



PLASTICITY CHART
CLAYEY SILT, trace sand (CL)

FIG No. B-PC-3
HWY: 17
G.W.P. No. 5146-09-00



PLASTICITY CHART

SILT, trace to some clay, trace gravel (CL-ML)

FIG No. B-PC-4

HWY: 17

G.W.P. No. 5146-09-00

GEOGRAPHIC TOWNSHIP OF DENISON

Culvert C1 (D9) – Station 16+110 WBL

RECORD OF BOREHOLE No C1-1

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 138 954.8 N; 279 226.0 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod and Dynamic Cone Penetration Test **COMPILED BY** N.R.
DATUM Geodetic **DATE** December 18, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED	+	FIELD VANE								
271.9	Ground surface						● QUICK TRIAXIAL	×	LAB VANE									
271.7	Topsoil																	
0.2	Silty clay, trace sand organics		1	SS	1													
	Very soft Mottled Moist to brown/grey very stiff		2	SS	15													
	Firm		3	SS	4													
269.7	Silt, trace to some sand																	
2.2	Compact Grey Wet to loose		4	SS	12													
			5	SS	11													
			6	SS	9													
267.4	Sandy silt																	
4.5	Loose Grey Wet		7	SS	5													
265.7	End of borehole		8	SS	10/15cm													
6.2	Probable sandy silt																	
265.2	Dense																	
6.7	End of dynamic cone penetration test																	
	Refusal on probable bedrock																	
	Sample 8: Sampler bouncing																	
	* 2012 12 18																	
	▽ Water level observed during drilling																	
	■ Penetrometer test																	
	Dynamic cone penetration test was carried out 1 m east of borehole C1-1																	
	Auger probe was carried out at the culvert end and 0.3m thick sand over 0.9m thick silty clay was encountered and auger probe met refusal on probable rockfill at 1.2m depth																	

RECORD OF BOREHOLE No C1-2

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 138 945.2 N; 279 233.3 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.S.S.A. and Dynamic Cone Penetration Test **COMPILED BY** N.R.
DATUM Geodetic **DATE** December 14, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		SHEAR STRENGTH kPa										WATER CONTENT (%)
							○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE							
276.4 0.0	Ground surface						20	40	60	80	100						
275.8 0.6	(FILL) Cobbles and boulders (ROCKFILL)																
273.2 3.2	Silty sand, trace gravel																
272.7 3.7	Silty clay Firm to Grey Wet stiff		1	SS	6												
			2	SS	6												
			3	SS	10												
270.3 6.1	End of borehole Probable silty clay																
269.4 7.0	Probable silt/ sandy silt Loose to compact																
264.4 12.0	Probable sand Compact to dense																
262.7 13.7	End of dynamic cone penetration test Refusal on probable bedrock * Borehole dry															'N' casing advanced from 0.6m depth C.F.S.S.A. denotes Continuous flight solid stem augers	

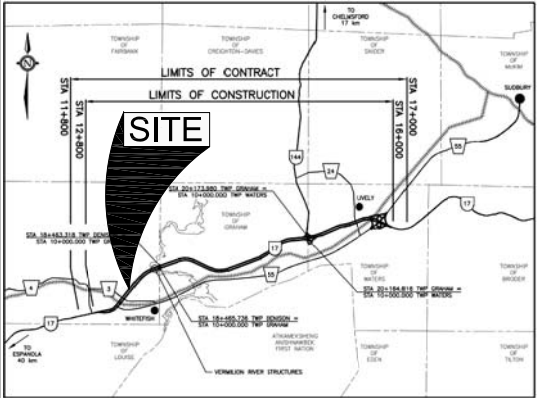
RECORD OF BOREHOLE No C1-3

1 of 1

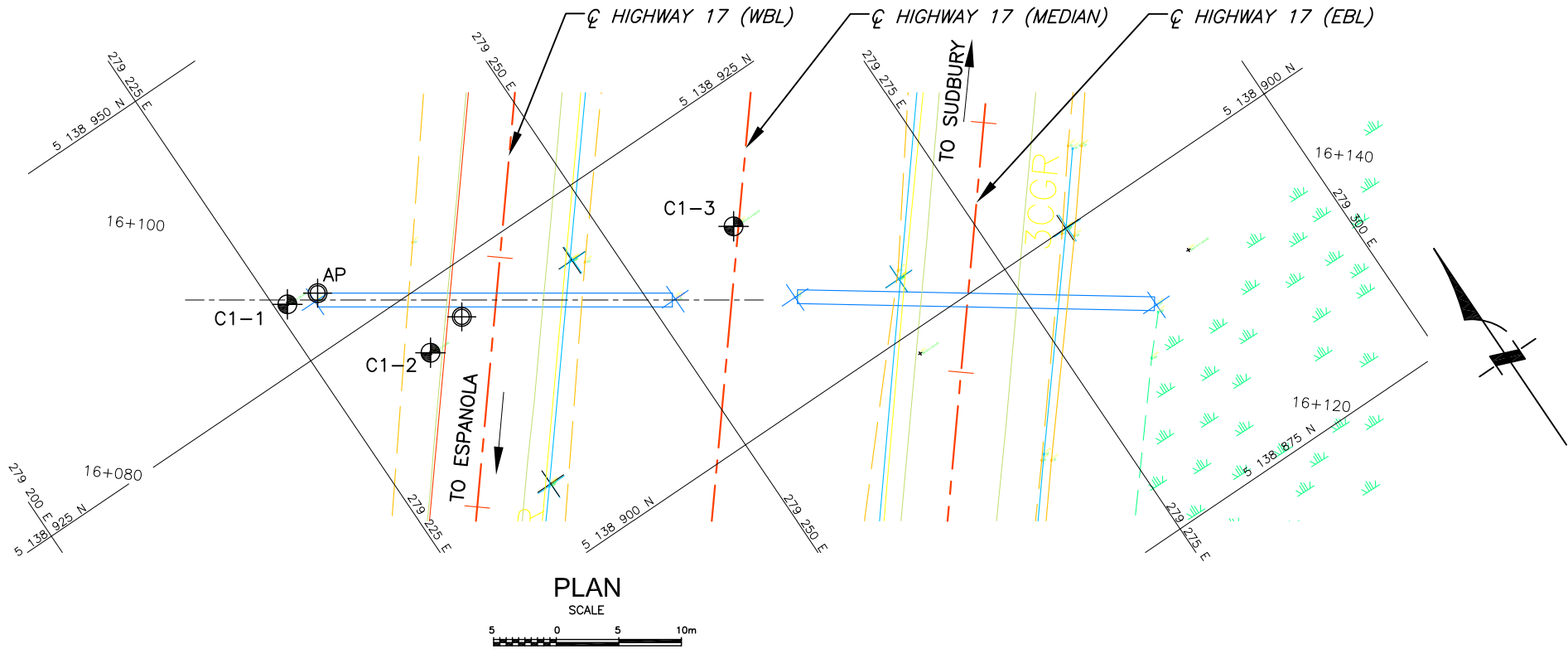
METRIC

G.W.P.	5146-09-00	LOCATION	Coords: 5 138 940.0 N; 279 259.5 E	ORIGINATED BY	F.P.
DIST	Sudbury	HWY	17	BOREHOLE TYPE	C.F.H.S.A. and Dynamic Cone Penetration Test
DATUM	Geodetic	DATE	November 09 and 30, 2012	CHECKED BY	B.R.G.

[illegible]

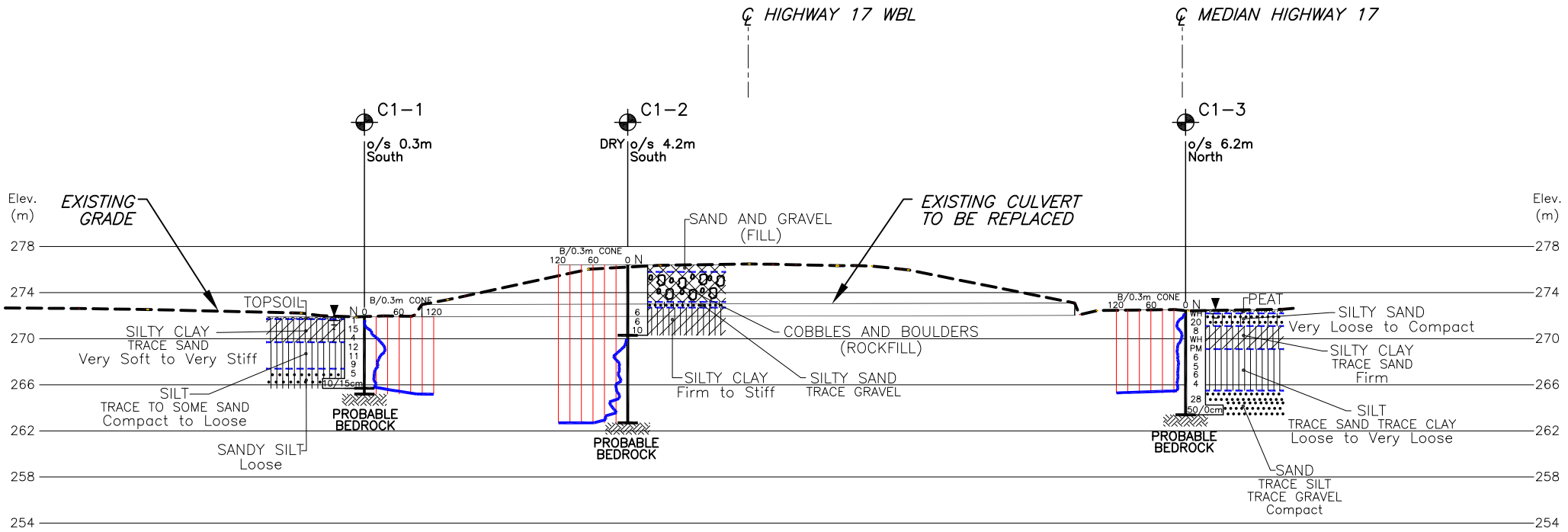


KEY PLAN

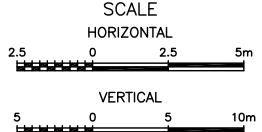


PLAN

SCALE

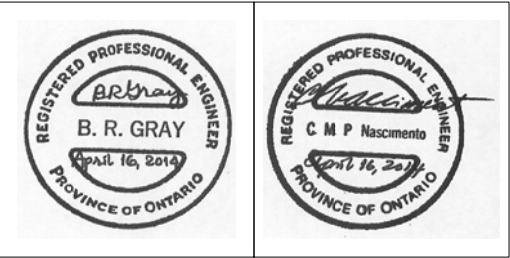


PROFILE ALONG \varnothing EXSITING CULVERT AT STA. 16+110 WBL



LEGEND			
	Borehole		
	Borehole and Cone		
	Pavement borehole/Auger probe (AP)		
N	Blows/0.3m (Std. Pen Test, 475 J/blow)		
CONE	Blows/0.3m (60 Cone, 475 J/blow)		
	WL at time of investigation Nov. & Dec. 2012		
WH	Penetration due to weight of hammer		
	Head		
	ARTESIAN WATER		
	Encountered		
	PIEZOMETER		
BH No	ELEVATION	NORTHINGS	EASTINGS
C1-1	271.9	5 138 954.8	279 226.0
C1-2	276.4	5 138 945.2	279 233.3
C1-3	272.5	5 138 940.0	279 259.5

NOTE:
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

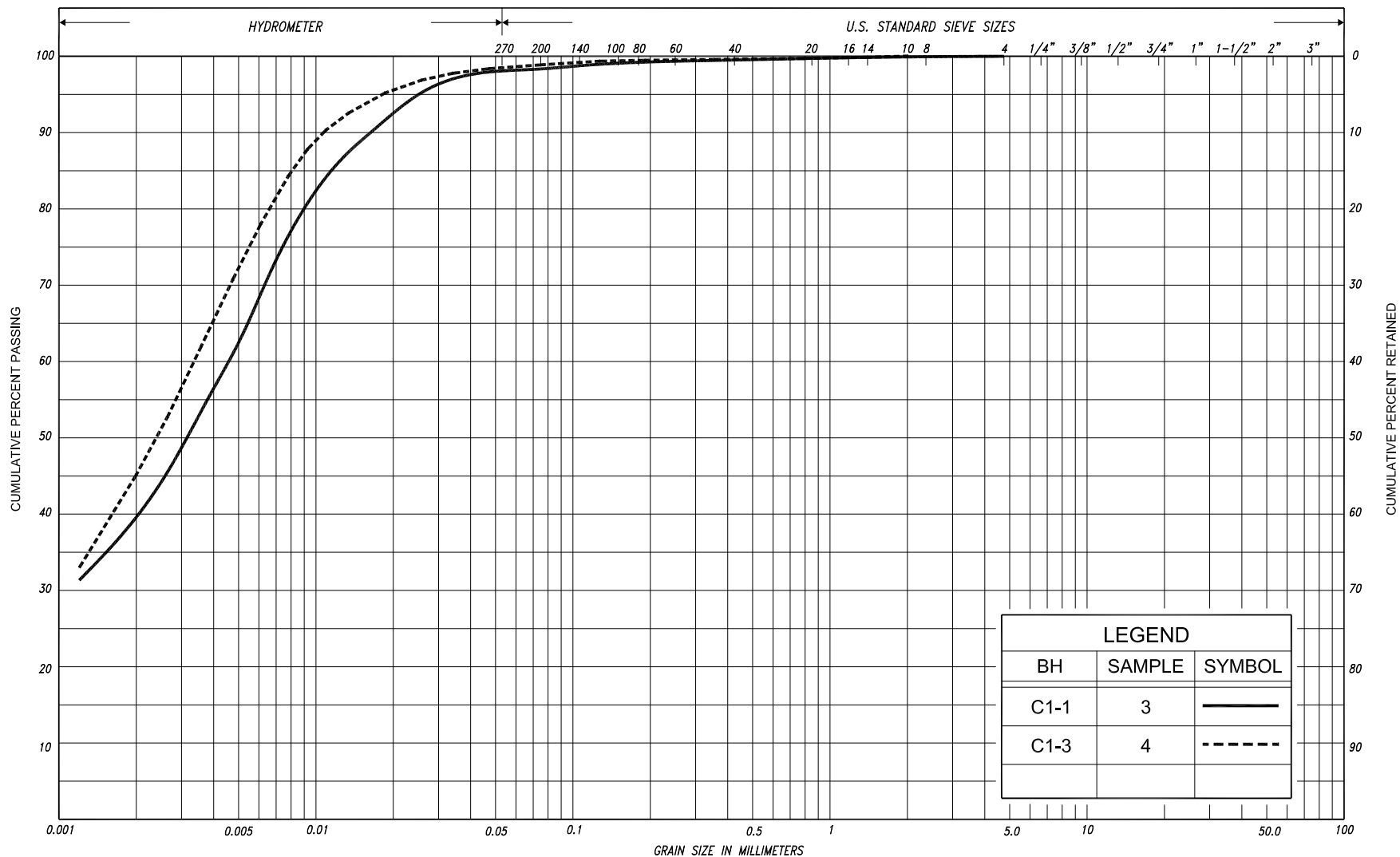


- NOTES:
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 - THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION. CULVERT PROFILE IS ESTIMATED.
 - DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.

Reference AECOM Drawings: NTB-01207011.dwg and DENISON X-SECTIONS with Culverts and viewport.dwg received on November 25, 2013 and April 01, 2014 respectively.

REVISIONS	DATE	BY	DESCRIPTION

Geocres No.411-299		DIST Sudbury	
HWY No 17	SUBM'D NA	CHECKED NR	DATE APR. 16, 2014
DRAWN NA	CHECKED BRG	APPROVED CN	DWG C1-1



SILT & CLAY			FINE			MEDIUM			COARSE			GRAVEL			COBBLES	UNIFIED
CLAY			FINE			MEDIUM			COARSE			GRAVEL			COBBLES	M.I.T.
CLAY			SILT			SAND			GRAVEL			GRAVEL			U.S. BUREAU	
CLAY			SILT			SAND			GRAVEL			GRAVEL			U.S. BUREAU	



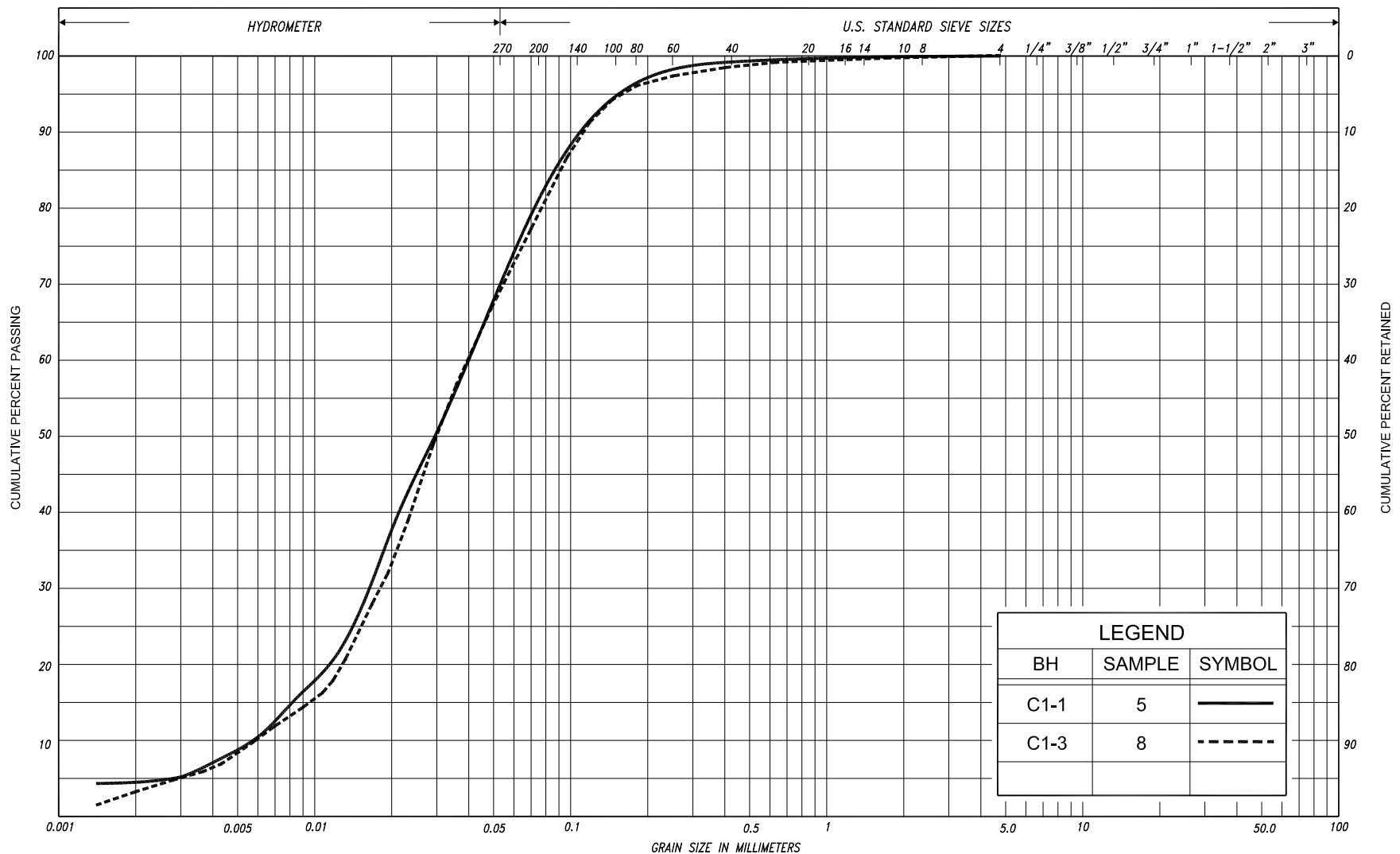
GRAIN SIZE DISTRIBUTION

SILTY CLAY, trace sand (CI)

FIG No. C1-GS-1

HWY: 17

W.P. No. 5146-09-00



SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED		
					SAND											
CLAY	FINE		MEDIUM		COARSE	FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT															
CLAY			SILT			V. FINE	FINE	MED.	COARSE		GRAVEL					U.S. BUREAU
					SAND											



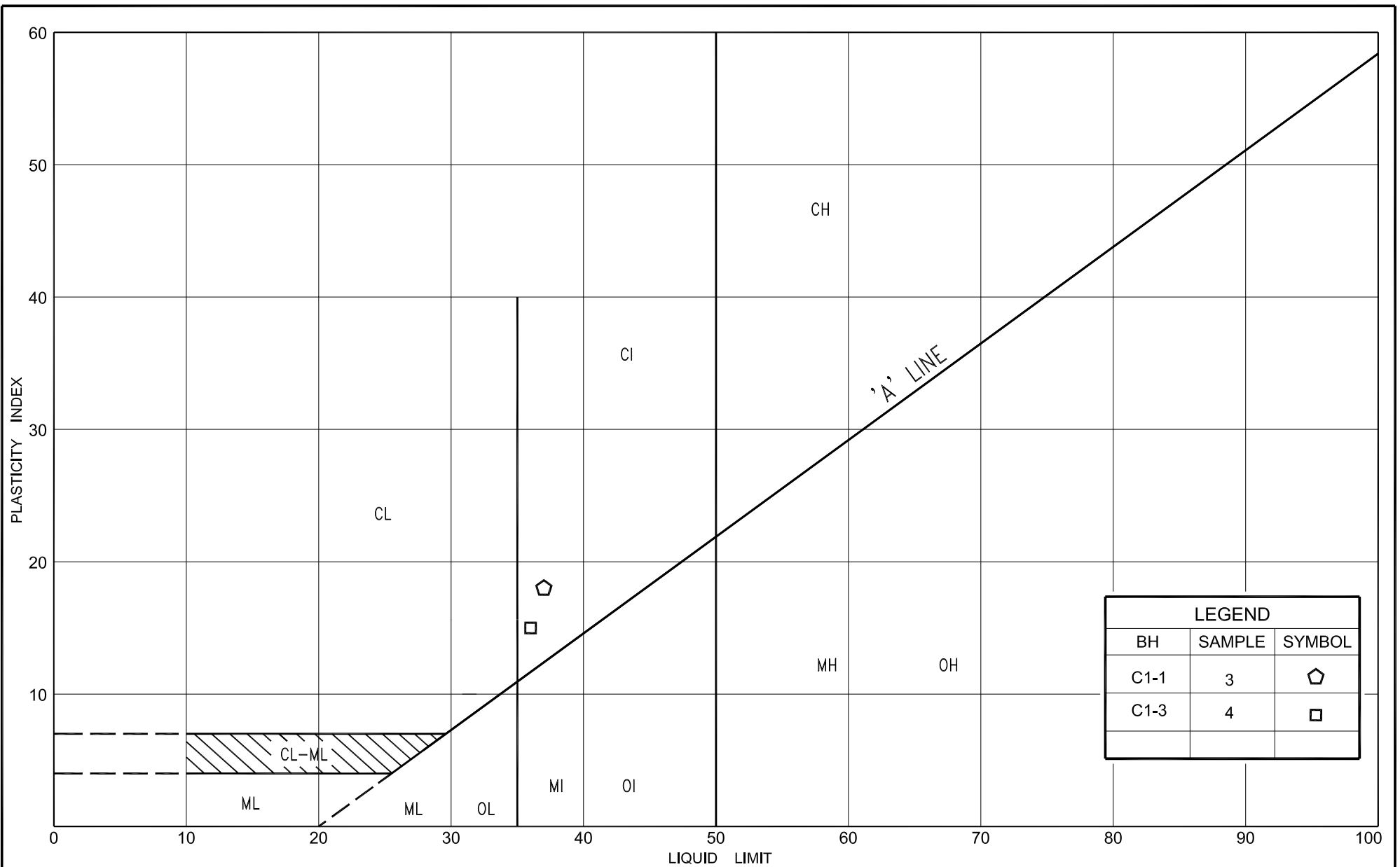
GRAIN SIZE DISTRIBUTION

SILT, some to with sand, trace clay

FIG No. C1-GS-2

HWY: 17

W.P. No. 5146-09-00



PLASTICITY CHART

SILTY CLAY, trace sand (CI)

FIG No. C1-PC-1

HWY: 17

W.P. No. 5146-09-00

GEOGRAPHIC TOWNSHIP OF DENISON

Culvert C2 (D9) – Station 16+110 EBL

RECORD OF BOREHOLE No C2-1

1 of 1

METRIC

G.W.P. <u>5146-09-00</u>	LOCATION <u>Coords: 5 138 923.2 N; 279 265.6 E</u>	ORIGINATED BY <u>F.P.</u>
DIST <u>Sudbury</u> HWY <u>17</u>	BOREHOLE TYPE <u>C.F.H.S.A. and 'N' Casing</u>	COMPILED BY <u>N.R.</u>
DATUM <u>Geodetic</u>	DATE <u>November 13, 2012</u>	CHECKED BY <u>B.R.G.</u>

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)									
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									WATER CONTENT (%)			GR	SA	SI	CL			
276.5 0.0	Ground surface 250 mm asphalt over sand and gravel		1	AS	-	*	276										7	26	54	13					
275.3 1.2	cobbles and boulders (ROCKFILL)		2	SS	32		275																		
273.5 3.0	Clayey silt with sand, trace gravel Very stiff Brown Moist to stiff to wet	3	SS	18	273																				
		4	SS	12	272																				
		5	SS	10	271																				
271.2 5.3	Silty clay, trace sand Stiff Brown Wet	6	SS	8	270																0	2	86	12	
270.5 6.0	Silt some clay, trace sand Compact Grey Wet to loose	7	SS	11	269																				
		8	SS	13	268																				
		9	SS	9	267																				
266.3 10.2	End of borehole																								
<div>* Borehole dry</div> <div>■ Penetrometer test</div> <div>C.F.H.S.A. denotes Continuous flight hollow stem augers</div> <div>'N' casing and core barrel advanced from 0.9m depth</div>																									

RECORD OF BOREHOLE No C2-2

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 138 918.1 N; 279 288.0 E **ORIGINATED BY** S.A.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod and Washboring + Dynamic Cone Penetration Test **COMPILED BY** N.R.
DATUM Geodetic **DATE** December 04, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED		+ FIELD VANE		● QUICK TRIAXIAL						× LAB VANE		
272.4	Ground surface						20	40	60	80	100									
0.0 272.1 0.3	Peat, amorphous		1	SS	WH**								○							
	Dark brown																			
	Silty clay, sand seams rootlets, peat inclusions		2	SS	15															
	Very soft to stiff																			
	Brown /grey		3	SS	11								○							
	Moist																			
	Grey																			
269.9 2.5	Silt some sand, trace clay		4	SS	9	▽*							○							
	Loose to compact																			
	Grey wet		5	SS	7								○			0 19 77 4				
			6	SS	11								○							
			7	SS	9								○							
	cobbles																			
265.7 6.7			8	SS	12								○							
265.6 6.8	End of borehole																			
	End of dynamic cone penetration test										80/8cm									
	Refusal on probable bedrock																			
													</							

* 2012 12 04

▽ Water level observed during drilling

■ Penetrometer test

WH* denotes penetration due to weight of rods and hammer

Dynamic cone test was carried out 1m south of borehole C2-2

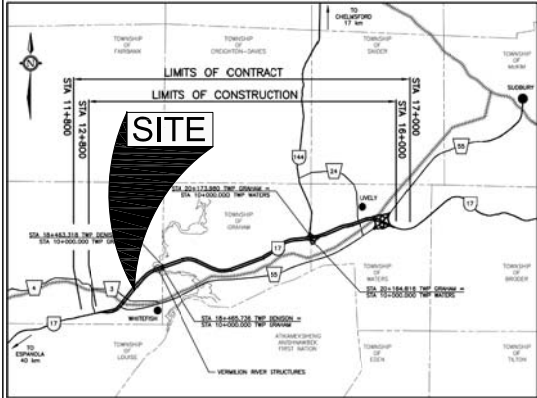
RECORD OF BOREHOLE No C1-3

1 of 1

METRIC

G.W.P.	5146-09-00	LOCATION	Coords: 5 138 940.0 N; 279 259.5 E	ORIGINATED BY	F.P.
DIST	Sudbury	HWY	17	BOREHOLE TYPE	C.F.H.S.A. and Dynamic Cone Penetration Test
DATUM	Geodetic	DATE	November 09 and 30, 2012	CHECKED BY	B.R.G.

[illegible]



KEY PLAN



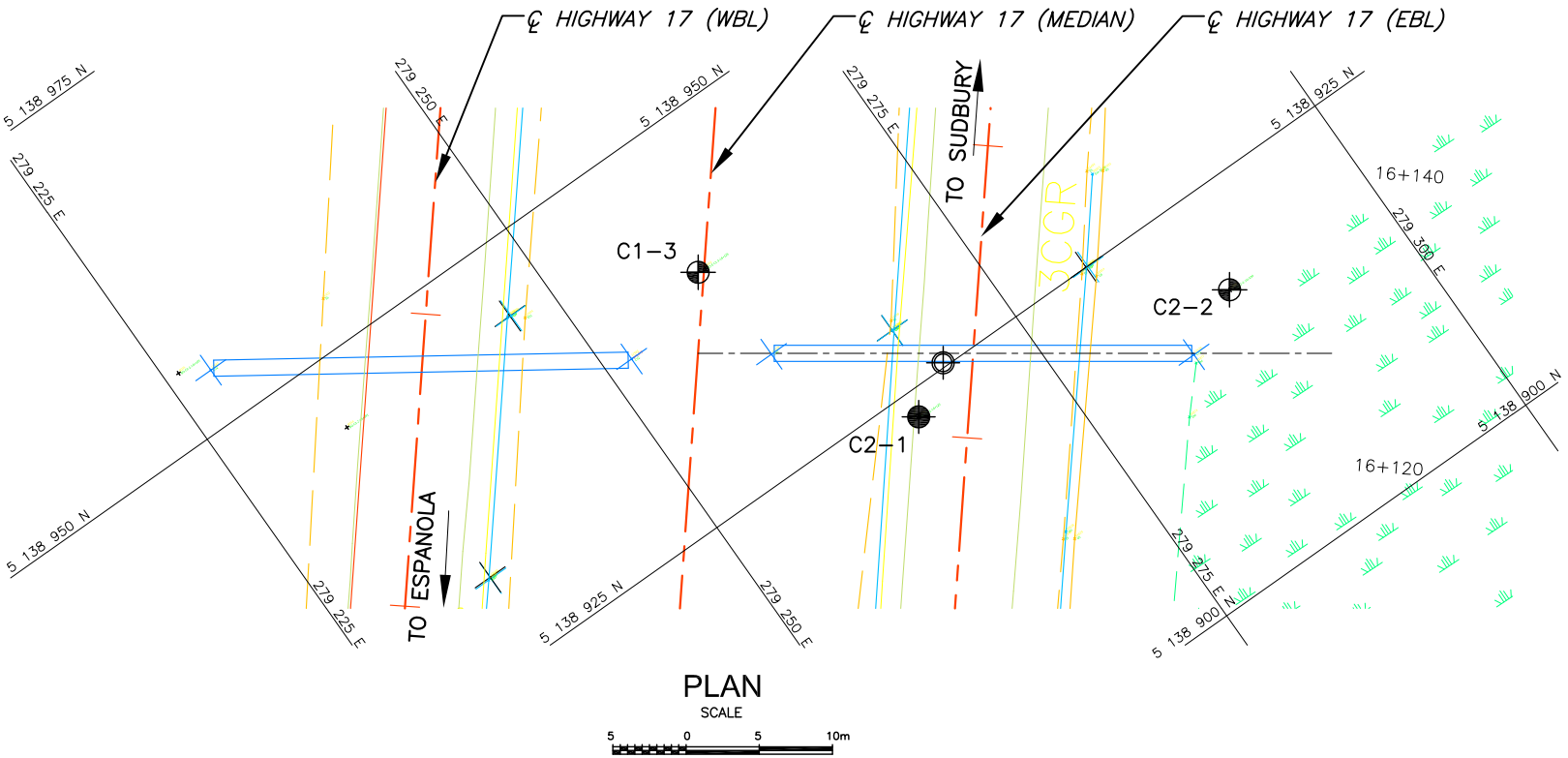
LEGEND			
	Borehole		
	Borehole and Cone		
	Pavement borehole		
N	Blows/0.3m (Std. Pen Test, 475 J/blow)		
CONE	Blows/0.3m (60 Cone, 475 J/blow)		
	WL at time of investigation Nov. & Dec. 2012		
WH	Penetration due to weight of hammer		
	Head		
	ARTESIAN WATER		
	Encountered		
	PIEZOMETER		
BH No	ELEVATION	NORTHINGS	EASTINGS
C2-1	276.5	5 138 923.2	279 265.6
C2-2	272.4	5 138 918.1	279 288.0
C1-3	272.5	5 138 940.0	279 259.5

NOTE:
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

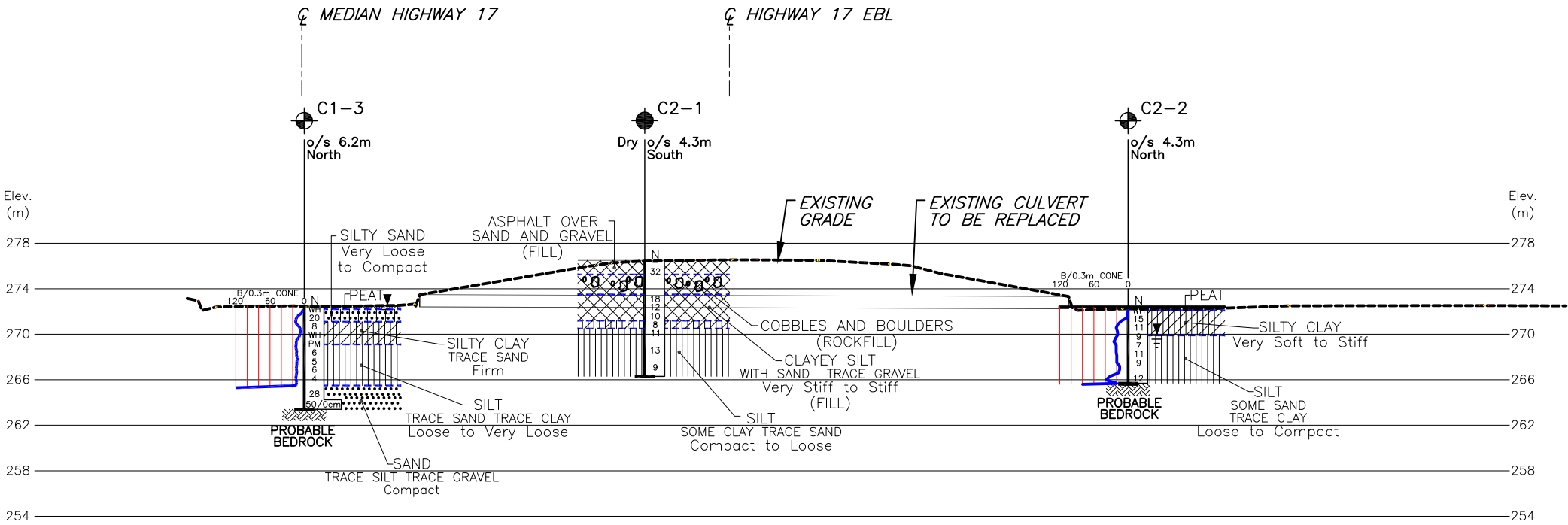
Geocres No.411-299

HWY No	17	DIST	Sudbury
SUBM'D	NA	CHECKED	NR
DRAWN	NA	CHECKED	BRG
DATE	APR. 16, 2014	APPROVED	CN
SITE		DWG	C2-1

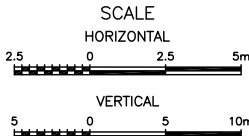


PLAN

SCALE

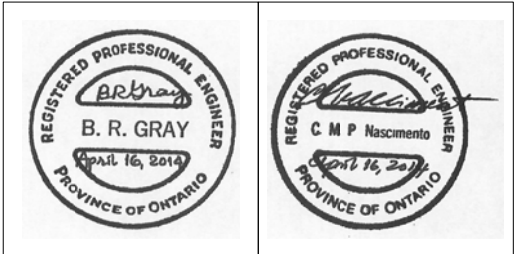


PROFILE ALONG Q EXISTING CULVERT AT STA. 16+110 EBL

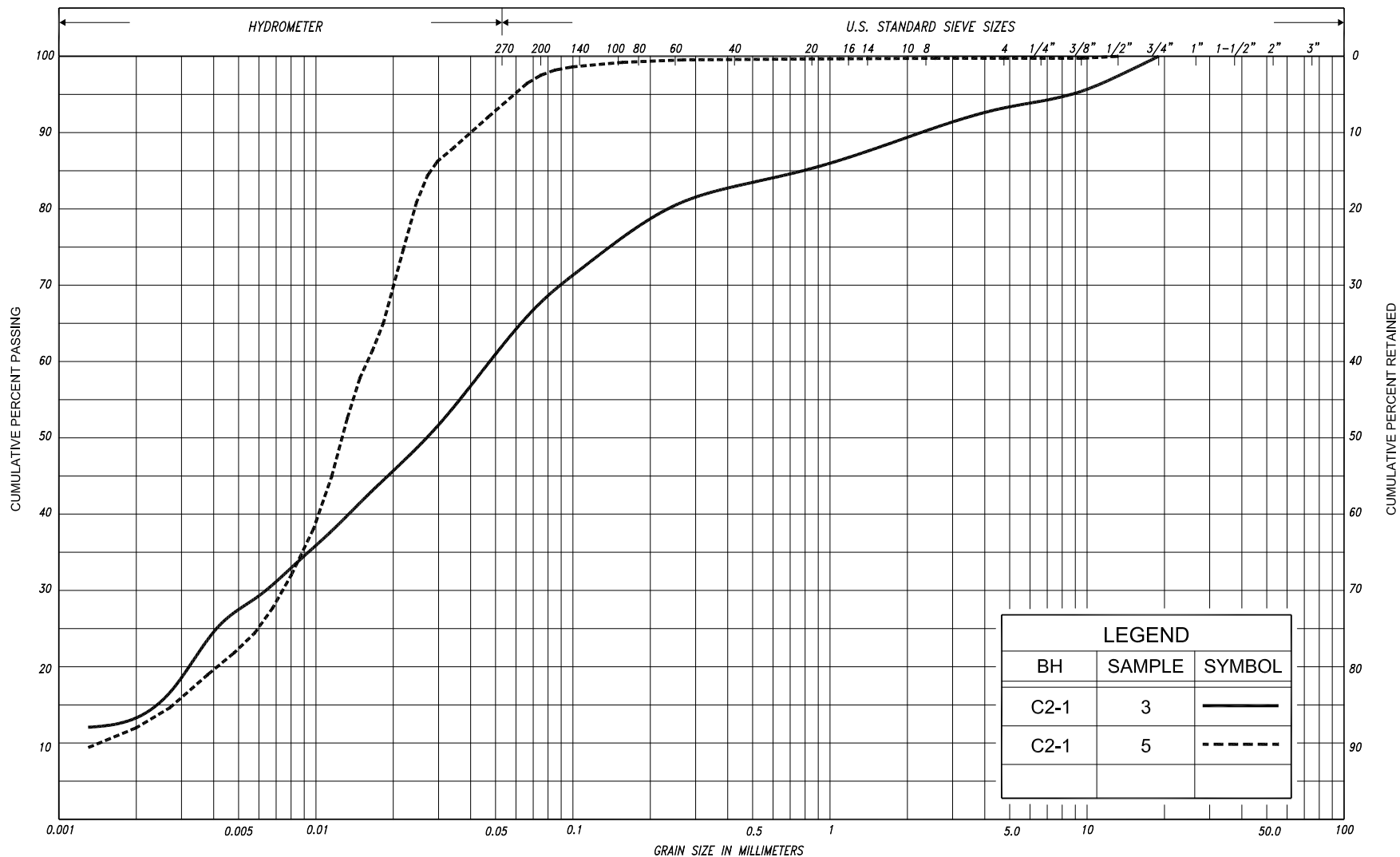


NOTES:

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Reference AECOM Drawings: NTB-01207011.dwg and DENISON X-SECTIONS with Culverts and viewport.dwg received on November 25, 2013 and April 01, 2014 respectively.



SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED		
					SAND											
CLAY	FINE		MEDIUM		COARSE	FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT															
CLAY			SILT			V. FINE	FINE	MED.	COARSE		GRAVEL					U.S. BUREAU
					SAND											



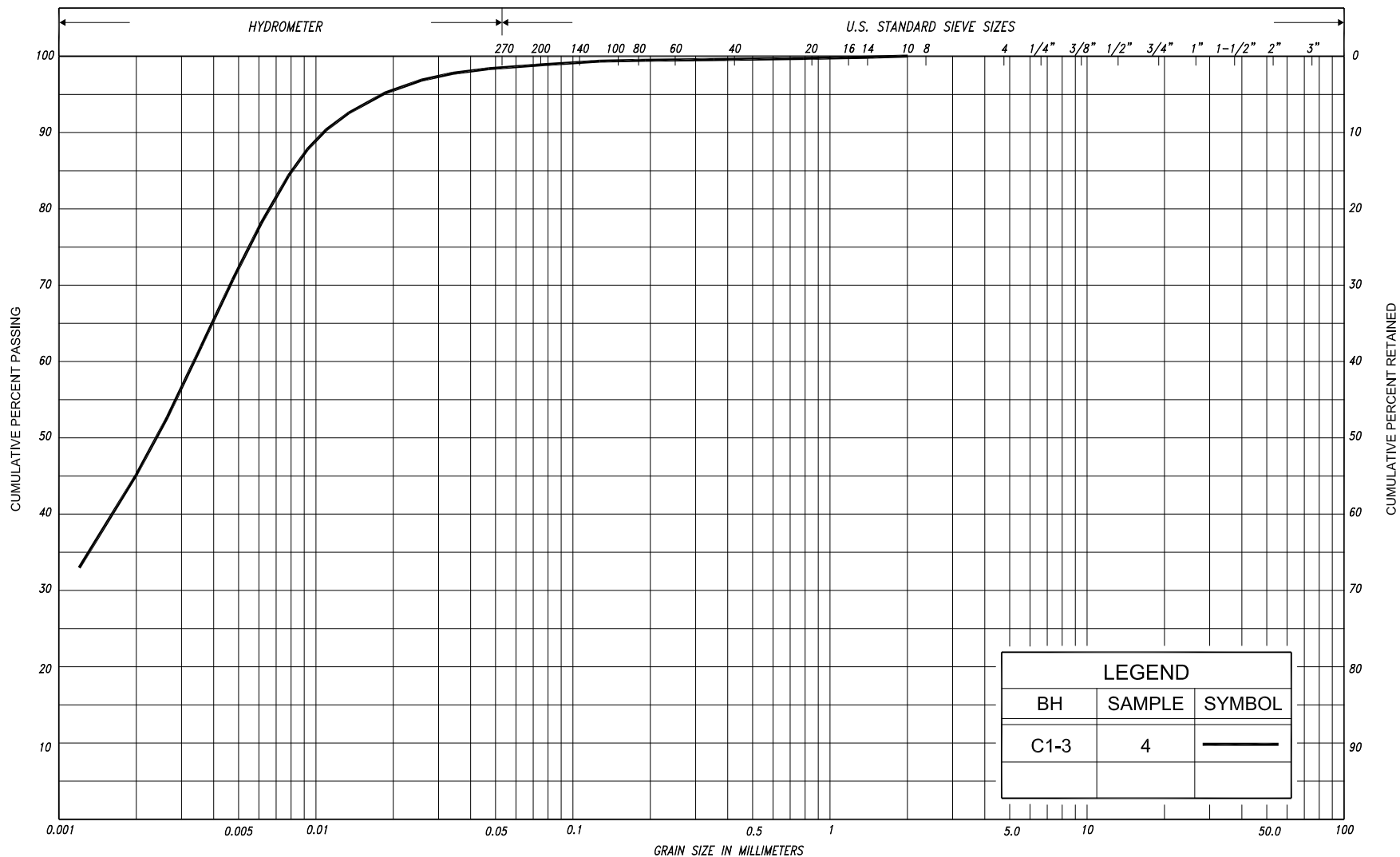
GRAIN SIZE DISTRIBUTION

CLAYEY SILT, with to trace sand, trace gravel (CL)

FIG No. C2-GS-1

HWY: 17

W.P. No. 5146-09-00



SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED		
					SAND											
CLAY	FINE		MEDIUM		COARSE	FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT															
CLAY			SILT			V. FINE	FINE	MED.	COARSE	GRAVEL						U.S. BUREAU
					SAND											

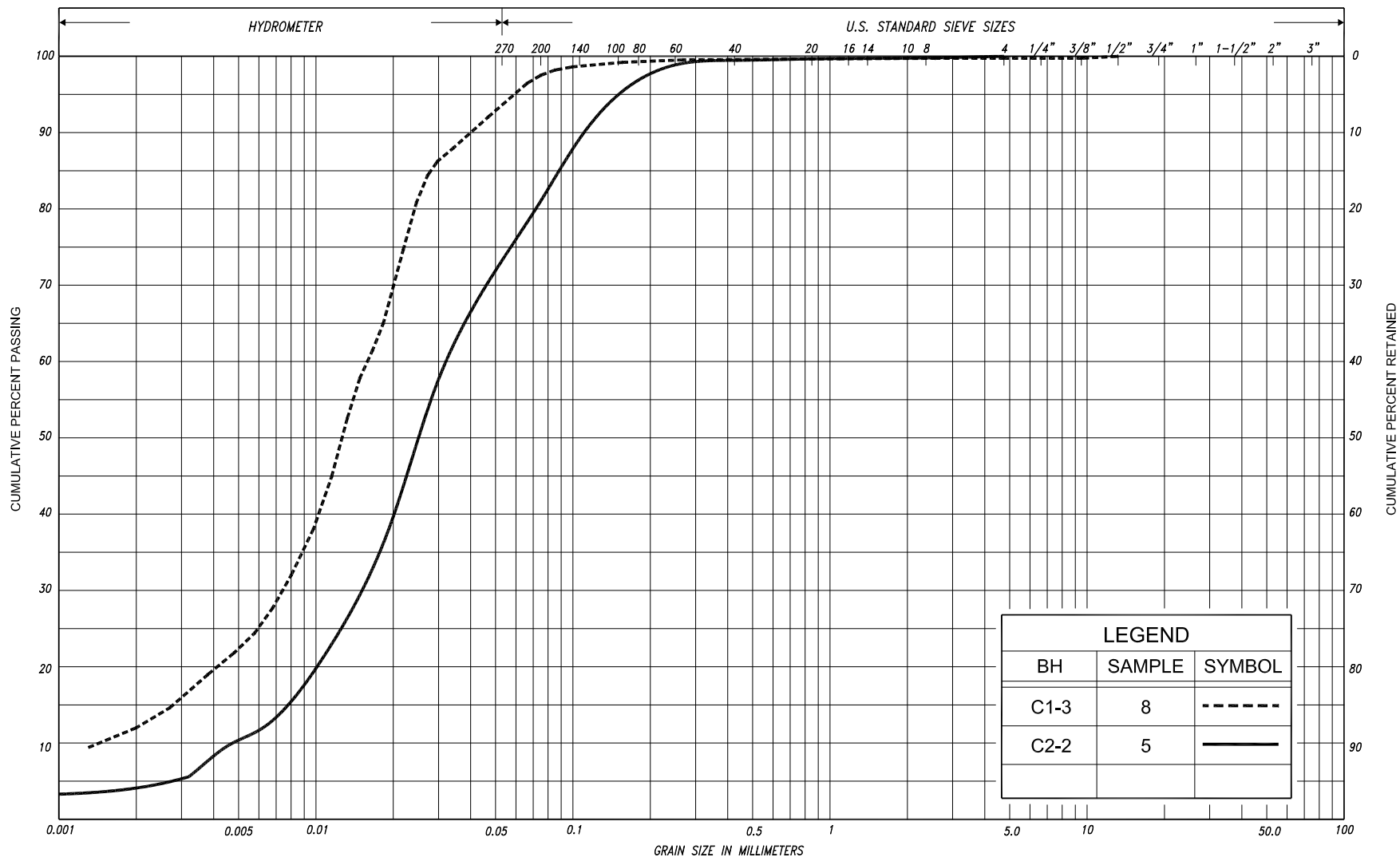


GRAIN SIZE DISTRIBUTION SILTY CLAY, trace sand (CL)

FIG No. C2-GS-2

HWY: 17

W.P. No. 5146-09-00



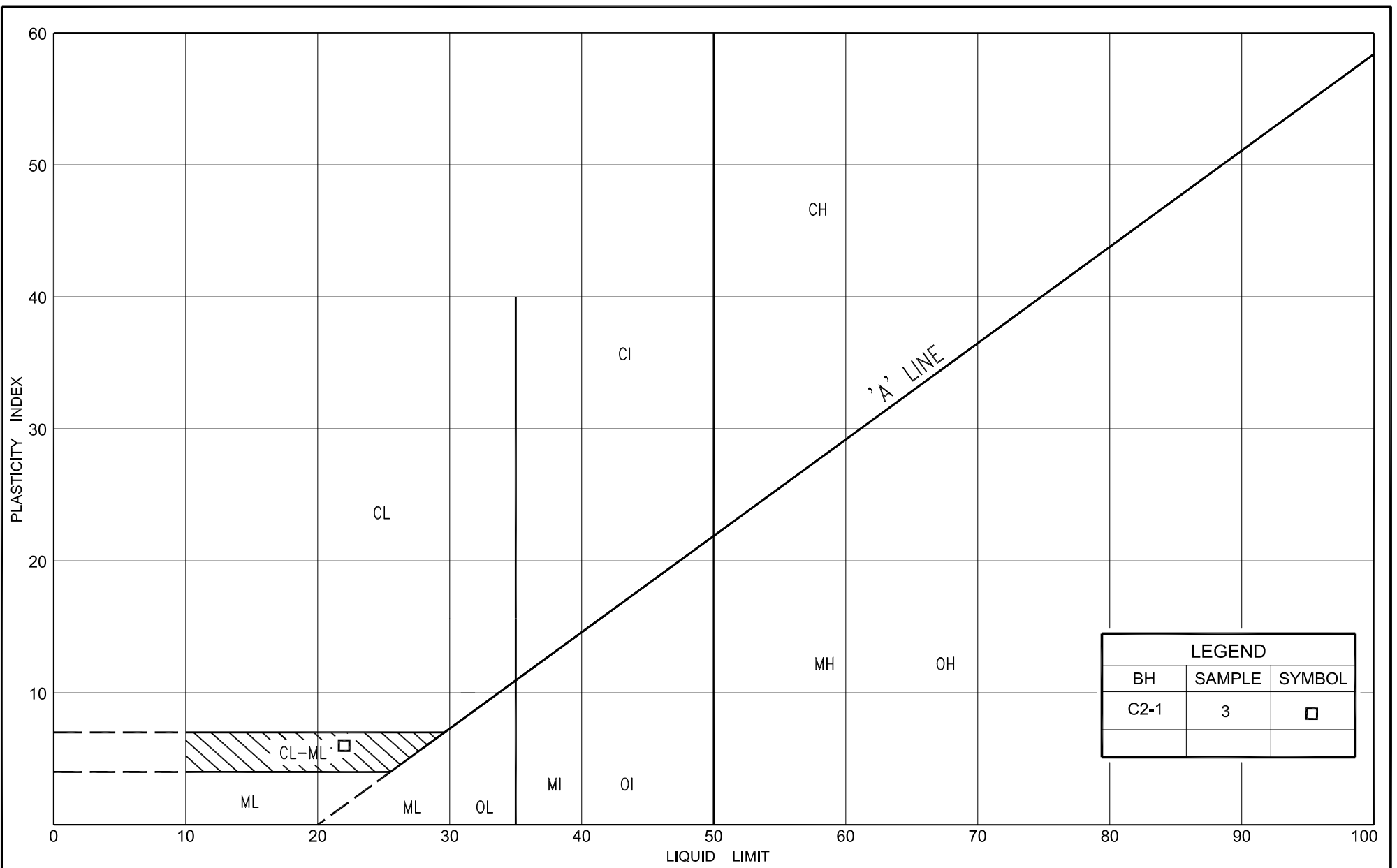
SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL			COBBLES	UNIFIED		
					SAND												
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT																
CLAY			SILT			V. FINE		FINE		MED.		COARSE		GRAVEL			U.S. BUREAU
					SAND												



GRAIN SIZE DISTRIBUTION

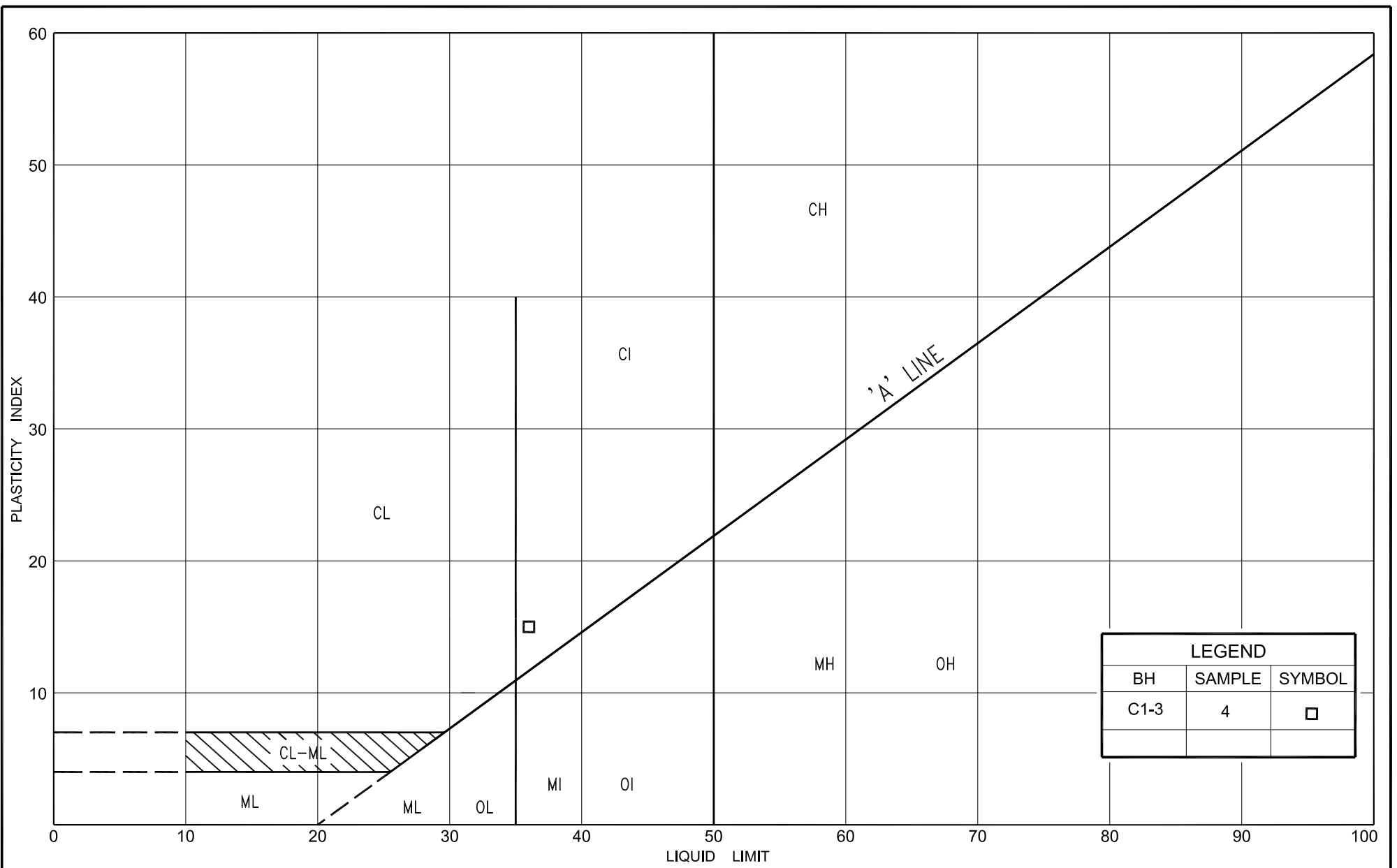
SILT, some to with sand, trace clay

FIG No. C2-GS-3
 HWY: 17
 W.P. No. 5146-09-00



PLASTICITY CHART
CLAYEY SILT, with sand, trace gravel (CL-ML)

FIG No.	C2-PC-1
HWY:	17
W.P. No.	5146-09-00



PLASTICITY CHART SILTY CLAY, trace sand (CI)

FIG No. C2-PC-2

HWY: 17

W.P. No. 5146-09-00

GEOGRAPHIC TOWNSHIP OF DENISON

Culvert D (D11) – Station 16+740 C/L

RECORD OF BOREHOLE No D-1

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 139 386.9 N; 279 572.1 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod + Dynamic Cone Penetration Test **COMPILED BY** N.R.
DATUM Geodetic **DATE** February 28, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED		+ FIELD VANE		● QUICK TRIAXIAL						× LAB VANE		
261.9 0.0	Top of Snow / Ice							20	40	60	80	100								
261.3 0.6	Snow and ice					▽* ▼*														
261.3 0.6	Sand, organics																			
260.8 1.1	Compact Dark grey Moist		1	SS	11		261							o						
260.4 1.5	Silt, trace sand																			
260.4 1.5	Compact Grey Wet		2	SS	24		260							o			5 43 48 4			
	Sand and silt trace clay, trace gravel																			
	Compact Grey Wet to dense		3	SS	55									o						
258.9 3.0							259													
258.8 3.1	End of borehole																			
	Probable sand and silt																			
	End of dynamic cone penetration test																			
	Refusal on probable bedrock																			
	 * 2013 02 28																			
	▽ Water level observed during drilling																			
	▼ Water level measured after drilling																			
	Dynamic cone penetration test was carried out 2 m north of borehole D-1.																			
	NOTES: Auger probe #1 was carried out 0.5 m east of culvert north end. Silty sand containing organics was encountered to 1.5 m depth.																			
	Auger probe # 2 was carried at the north end of the culvert, auger refusal on rockfill at 1.1 m depth.																			

RECORD OF BOREHOLE No D-2

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 139 408.5 N; 279 614.9 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Sonic + Rotatory Displacement **COMPILED BY** N.R.
DATUM Geodetic **DATE** May 31, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE									
269.1	Ground surface							20	40	60	80	100					GR SA SI CL			
0.0	Asphalt over sand and gravel						269										3 33 53 11			
268.6	(PAVEMENT FILL)																			
0.5	Sand and gravel cobbles and boulders (ROCKFILL)						268													
							267													
							266													
264.8							265													
4.3	Sandy silt some clay, trace gravel		1	SS	10		264							○						
	Compact to Brown Moist very dense																			
			2	SS	21		263							○						
							262													
261.1			3	SS	34/23cm															
8.0	End of borehole																			
	Refusal on probable bedrock																			
	* Borehole charged with drilling water																			

RECORD OF BOREHOLE No D-3

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 139 411.5 N; 279 645.3 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod + 'N' Casing + Dynamic Cone Penetration Test **COMPILED BY** N.R.
DATUM Geodetic **DATE** April 30, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						
263.3 0.0	Ground surface							20	40	60	80	100				
263.1 0.2	Topsoil		1	SS	9		263									
	Silty clay, trace sand organics inclusions		2	SS	9		262									
	Stiff Grey Moist															
			3	SS	15		261									
			4	SS	12											
			5	SS	10		260									
259.8 3.5	End of borhole															
	Refusal on probable bedrock															

RECORD OF BOREHOLE No D-4

1 of 1

METRIC

G.W.P.	5146-09-00	LOCATION	Coords: 5 139 440.1 N; 279 689.1 E	ORIGINATED BY	F.P.
DIST	Sudbury	HWY	17	BOREHOLE TYPE	Sonic + Rotatory Displacement
DATUM	Geodetic	DATE	May 27, 2013	CHECKED BY	B.R.G.
COMPILED BY N.R.					

[illegible]

RECORD OF BOREHOLE No D-5

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 139 448.0 N; 279 736.8 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod + Dynamic Cone Penetration Test **COMPILED BY** N.R.
DATUM Geodetic **DATE** February 26, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		SHEAR STRENGTH kPa										WATER CONTENT (%)
							○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE							
258.0	Top of Snow/Ice						20	40	60	80	100						
0.0 257.7	Snow & Ice					▽*											
0.3 257.4	Peat, coarse fibrous Dark brown		1	SS	7												
0.6	Organic clayey silt																
256.9 1.1	Firm Dark Moist grey		2	SS	9												
	Silty clay, trace sand organics		3	SS	8												
	Very stiff Mottled Moist to firm brown/ grey																
	sand seams		4	SS	5												
	Grey		5	SS	2												
				FV													
254.2 3.8	Silt trace sand, trace clay Compact Grey Wet		6	SS	7												
			7	SS	7												
			8	SS	11												
			9	SS	9												
249.8 8.2	End of borehole Probable silt																
248.9 9.1	Compact End of dynamic cone penetration test																
* 2013 02 26																	
▽ Water level observed during drilling																	
■ Penetrometer test																	
NOTE: Dynamic cone penetration test was carried out 2 m north of borehole D-5																	

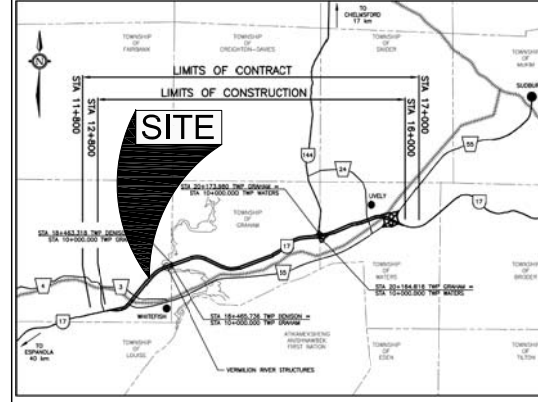
CONT No

GWP No 5146-09-00

REPLACEMENT CULVERT D
HIGHWAY 17 STA 16+740 CL
GEOGRAPHIC TOWNSHIP OF DENISON
BOREHOLE LOCATIONS



SHEET



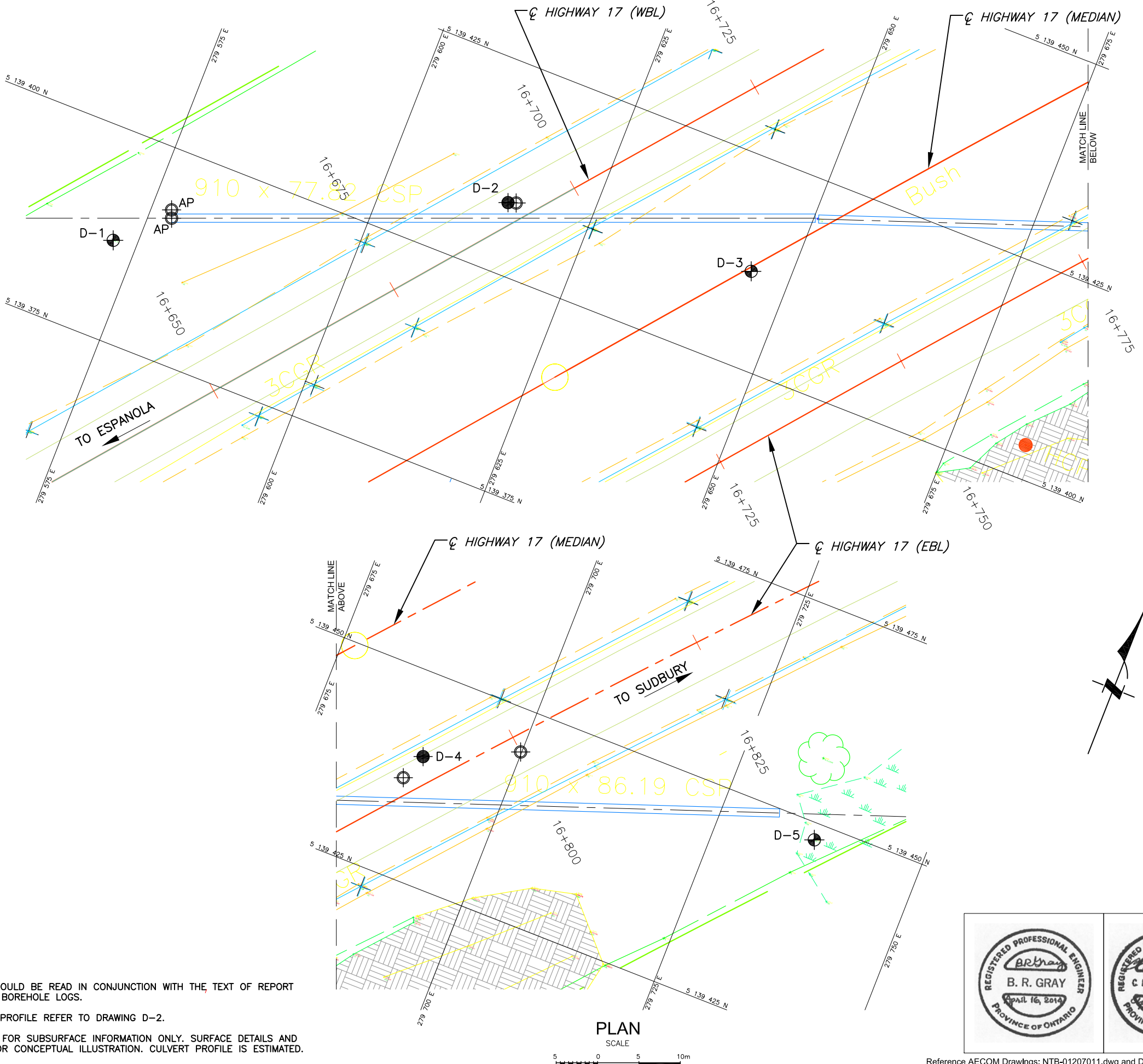
LEGEND			
	Borehole		
	Borehole and Cone		
	Pavement borehole/Auger probe (AP)		
N	Blows/0.3m (Std. Pen Test, 475 J/blow)		
CONE	Blows/0.3m (60 Cone, 475 J/blow)		
	WL at time of investigation Nov. & Dec. 2012		
WH	Penetration due to weight of hammer		
	Head		
	ARTESIAN WATER		
	Encountered		
	PIEZOMETER		

BH No	ELEVATION	NORTHINGS	EASTINGS
D-1	261.9	5 139 386.9	279 572.1
D-2	269.1	5 139 408.5	279 614.9
D-3	263.3	5 139 411.5	279 645.3
D-4	267.6	5 139 440.1	279 689.1
D-5	258.0	5 139 448.0	279 736.8

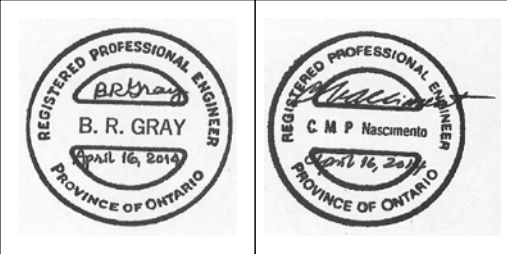
NOTE:
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

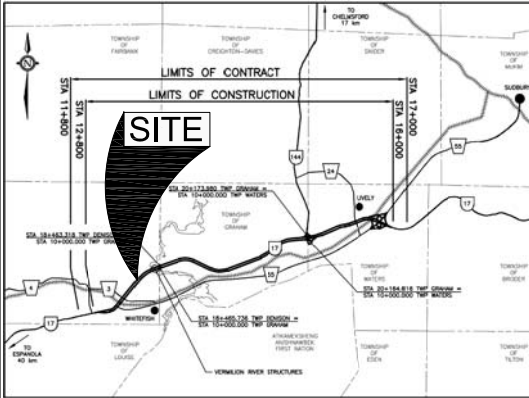
HWY No	17	DIST	Sudbury
SUBM'D	NA	CHECKED	NR
DRAWN	NA	CHECKED	BRG
DATE	APR. 16, 2014	APPROVED	CN
SITE		DWG	D-1



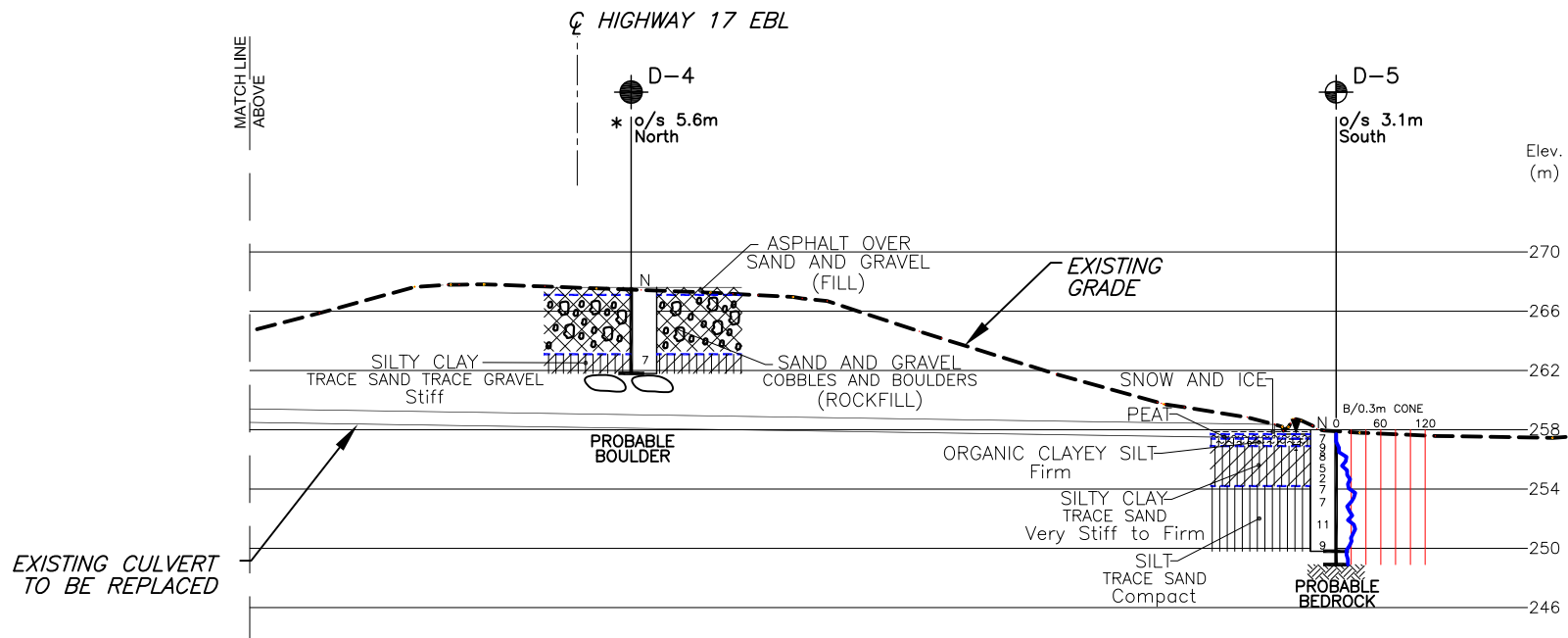
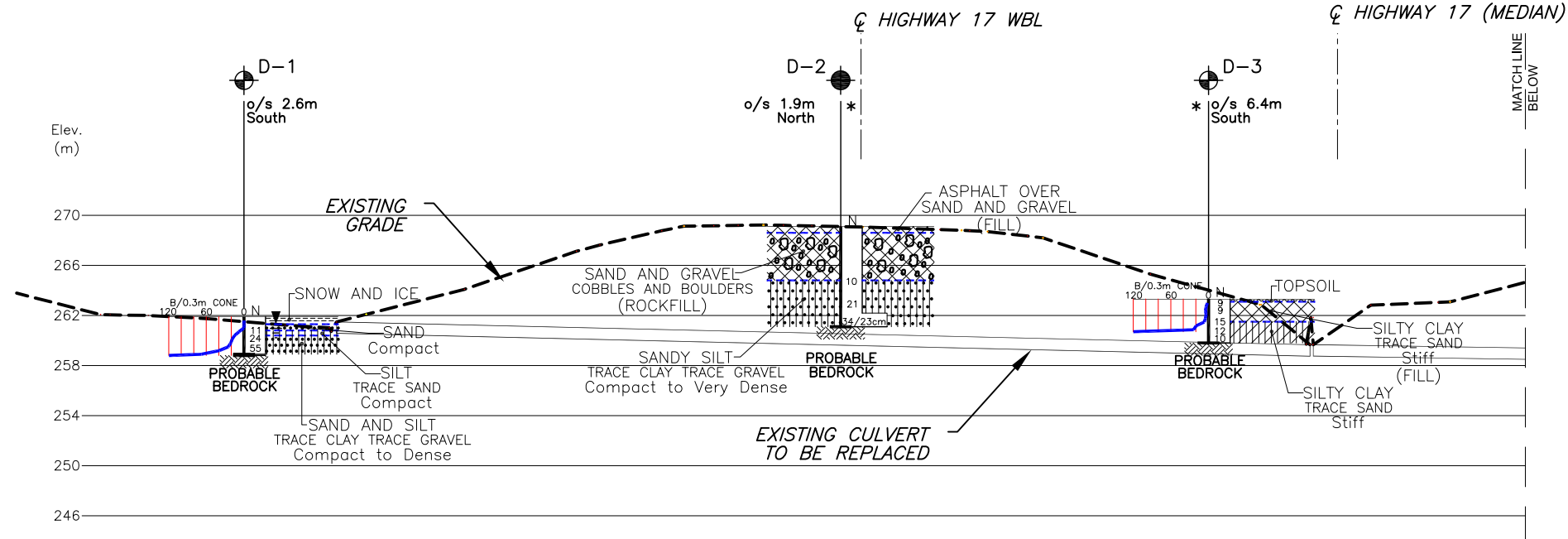
- NOTES:
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
 - FOR CENTRELINE PROFILE REFER TO DRAWING D-2.
 - THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION. CULVERT PROFILE IS ESTIMATED.
 - DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.



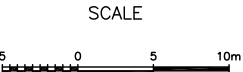
Reference AECOM Drawings: NTB-01207011.dwg and DENISON X-SECTIONS with Culverts and viewport.dwg received on November 25, 2013 and April 01, 2014 respectively.



KEY PLAN



PROFILE ALONG \varnothing EXISTING CULVERT AT STA. 16+740 CL



NOTES:

- DRAWINGS D-1 AND D-2 SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
- FOR BOREHOLE LOCATIONS PLAN REFER TO DRAWING D-1.
- THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION. CULVERT PROFILE IS ESTIMATED
- DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.

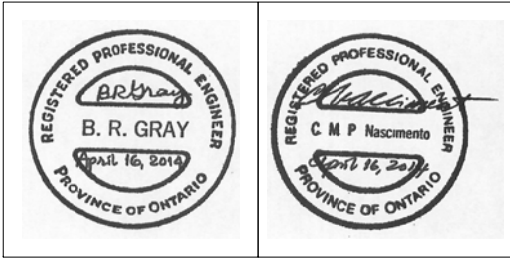
LEGEND			
	Borehole		
	Borehole and Cone		
N	Blows/0.3m (Std. Pen Test, 475 J/blow)		
CONE	Blows/0.3m (60 Cone, 475 J/blow)		
	WL at time of investigation Nov. & Dec. 2012		
WH	Penetration due to weight of hammer		
*	Water level not established		
	Head		
	ARTESIAN WATER		
	Encountered		
	PIEZOMETER		

BH No	ELEVATION	NORTHINGS	EASTINGS
FOR DETAILS REFER TO DRAWING D-1			

NOTE:
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

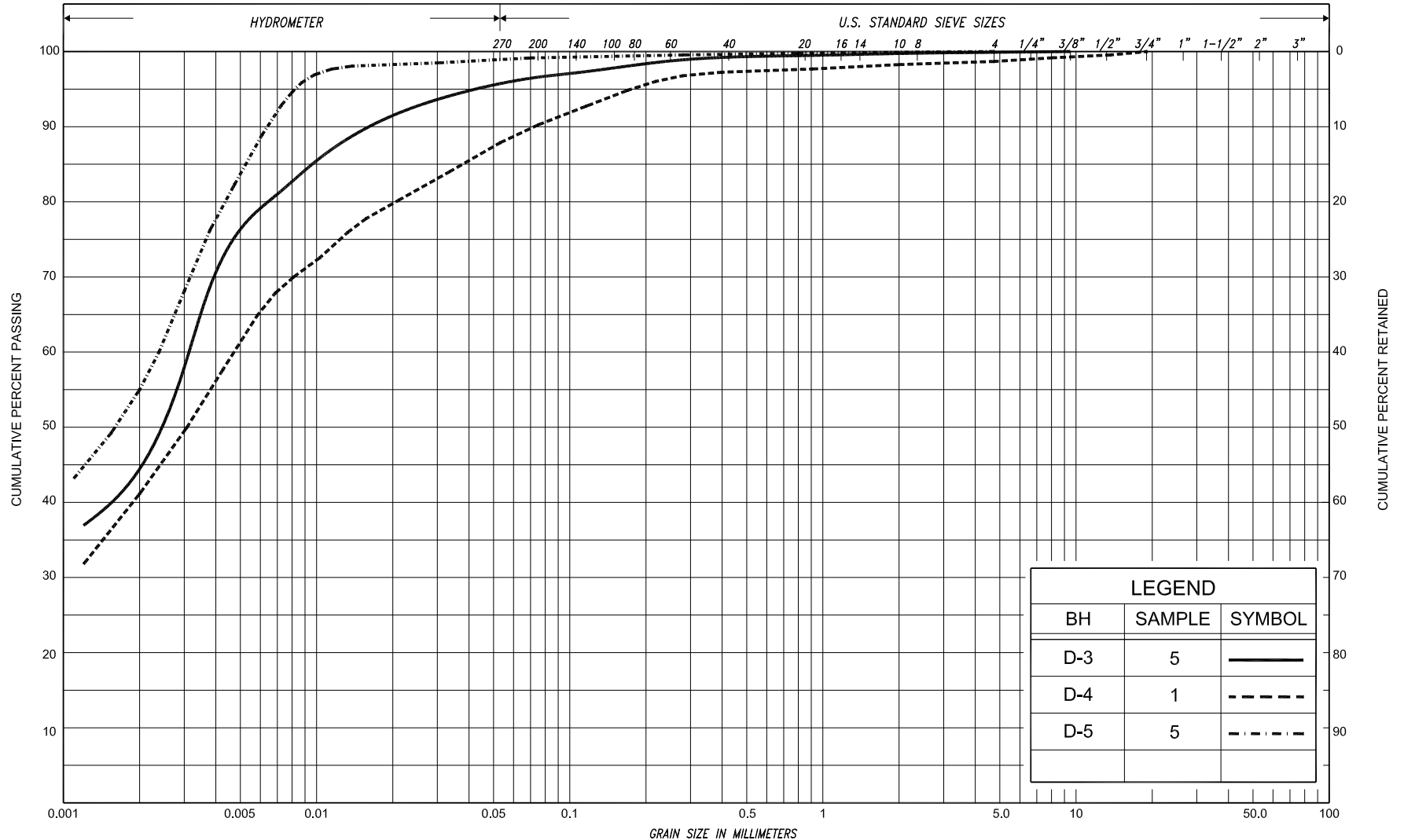
REVISIONS	DATE	BY	DESCRIPTION

Geocres No.411-299



Reference AECOM Drawings: NTB-01207011.dwg and DENISON X-SECTIONS with Culverts and viewport.dwg received on November 25, 2013 and April 01, 2014 respectively.

HWY No	17	DIST	Sudbury
SUBM'D	NA	CHECKED	NR
DATE	APR. 16, 2014	DATE	APR. 16, 2014
DRAWN	NA	CHECKED	BRG
APPROVED	CN	DWG	D-2



LEGEND		
BH	SAMPLE	SYMBOL
D-3	5	————
D-4	1	- - - - -
D-5	5	- . - . -

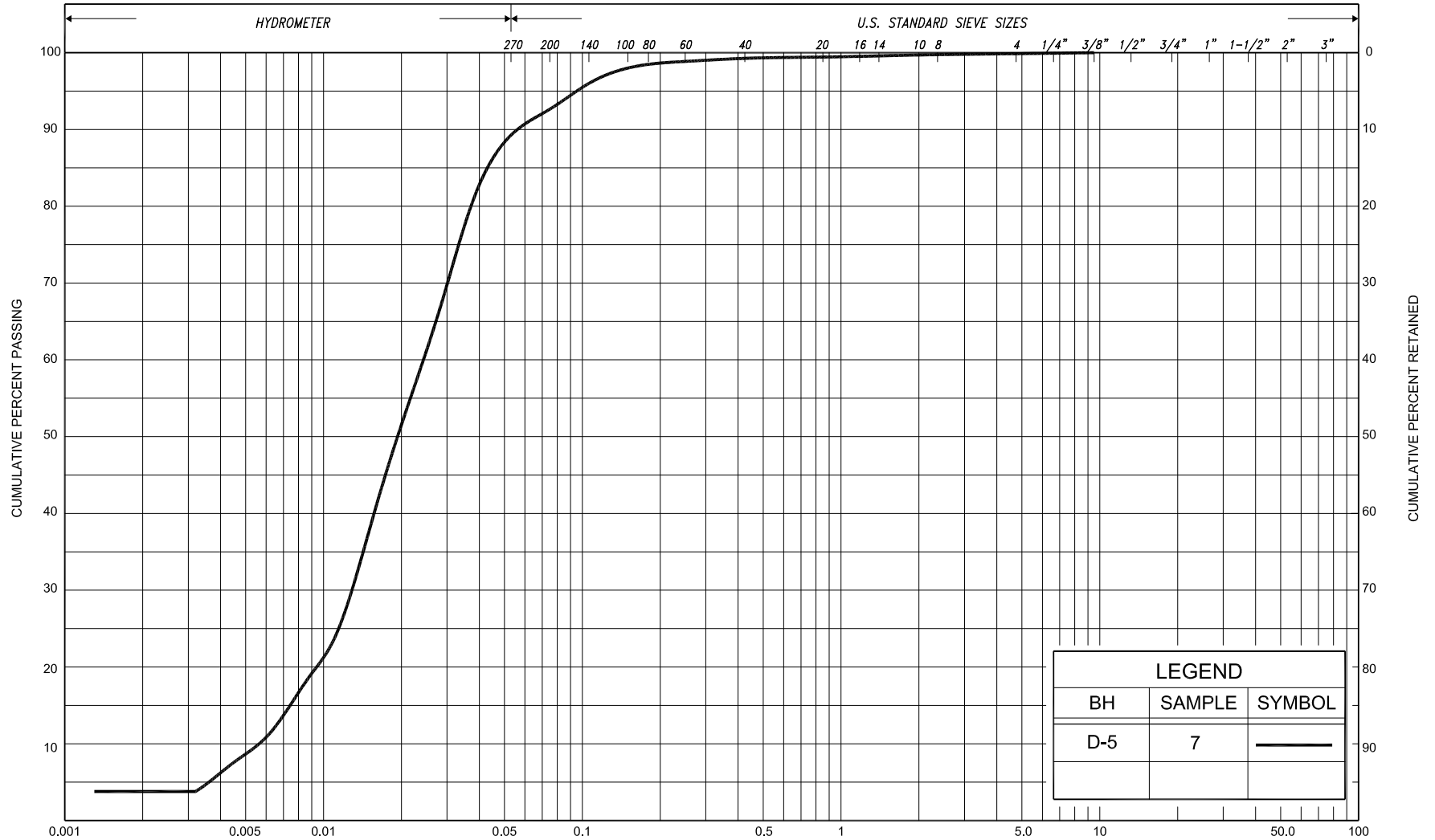
SILT & CLAY				SAND			GRAVEL		COBBLES	UNIFIED
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	GRAVEL		COBBLES	M.I.T.
CLAY		SILT		V. FINE	FINE	MED.	COARSE	GRAVEL		U.S. BUREAU
				SAND						



GRAIN SIZE DISTRIBUTION

SILTY CLAY, trace sand, trace gravel (CI)

FIG No.	D-GS-1
HWY:	11
G.W.P. No.	5146-09-00



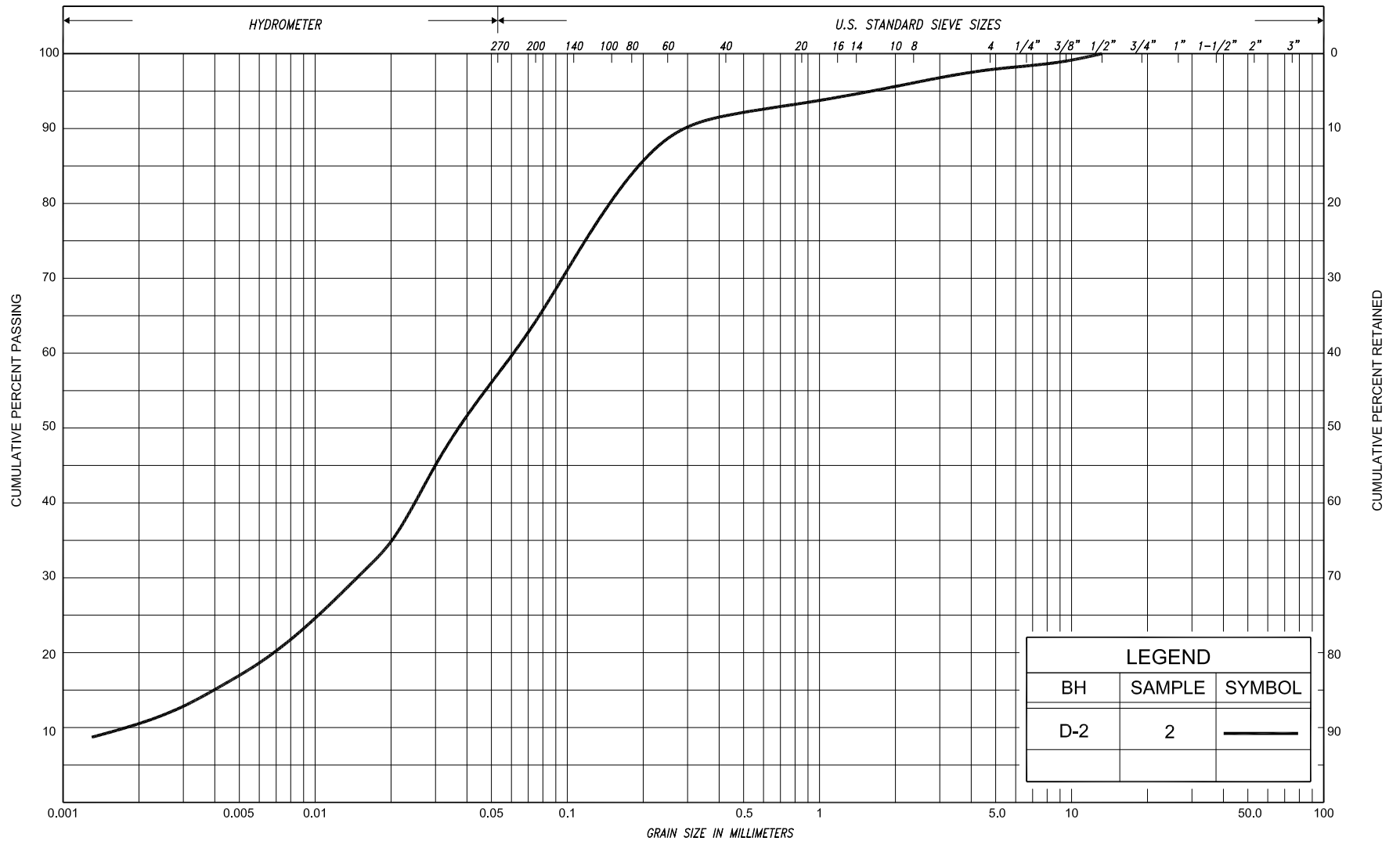
SILT & CLAY				FINE		MEDIUM		COARSE	GRAVEL		COBBLES	UNIFIED			
				SAND											
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL	COBBLES	M.I.T.
	SILT														
CLAY		SILT			V. FINE		FINE		MED.		COARSE		GRAVEL		U.S. BUREAU
					SAND										



GRAIN SIZE DISTRIBUTION

SILT, trace clay, trace sand

FIG No. D-GS-2
 HWY: 17
 G.W.P. No. 5146-09-00



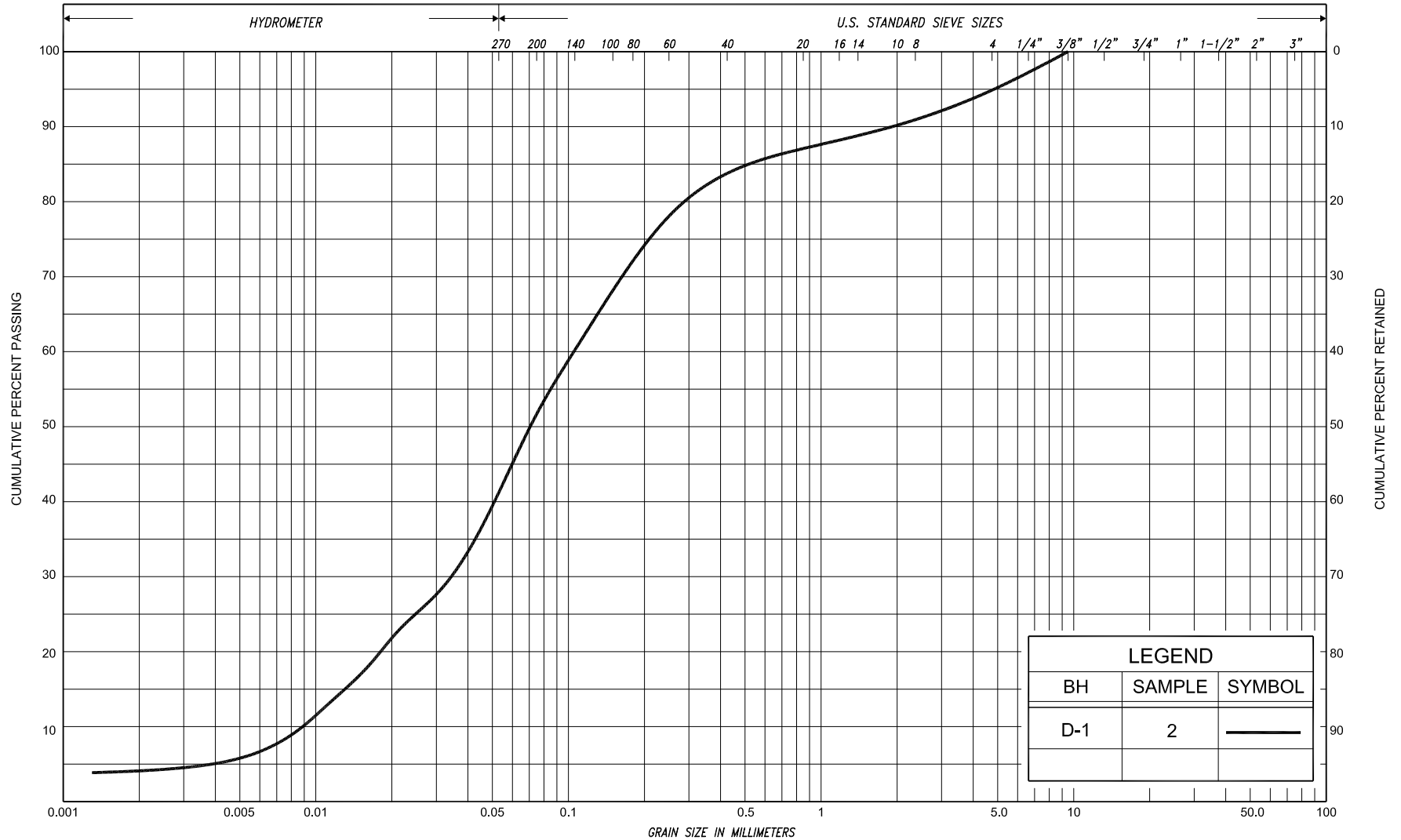
LEGEND		
BH	SAMPLE	SYMBOL
D-2	2	—

SILT & CLAY					FINE			MEDIUM			COARSE		GRAVEL					COBBLES	UNIFIED		
					SAND																
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM			COARSE		GRAVEL					COBBLES	M.I.T.	
	SILT										SAND										
CLAY			SILT			V. FINE	FINE		MED.	COARSE		GRAVEL								U.S. BUREAU	
						SAND															



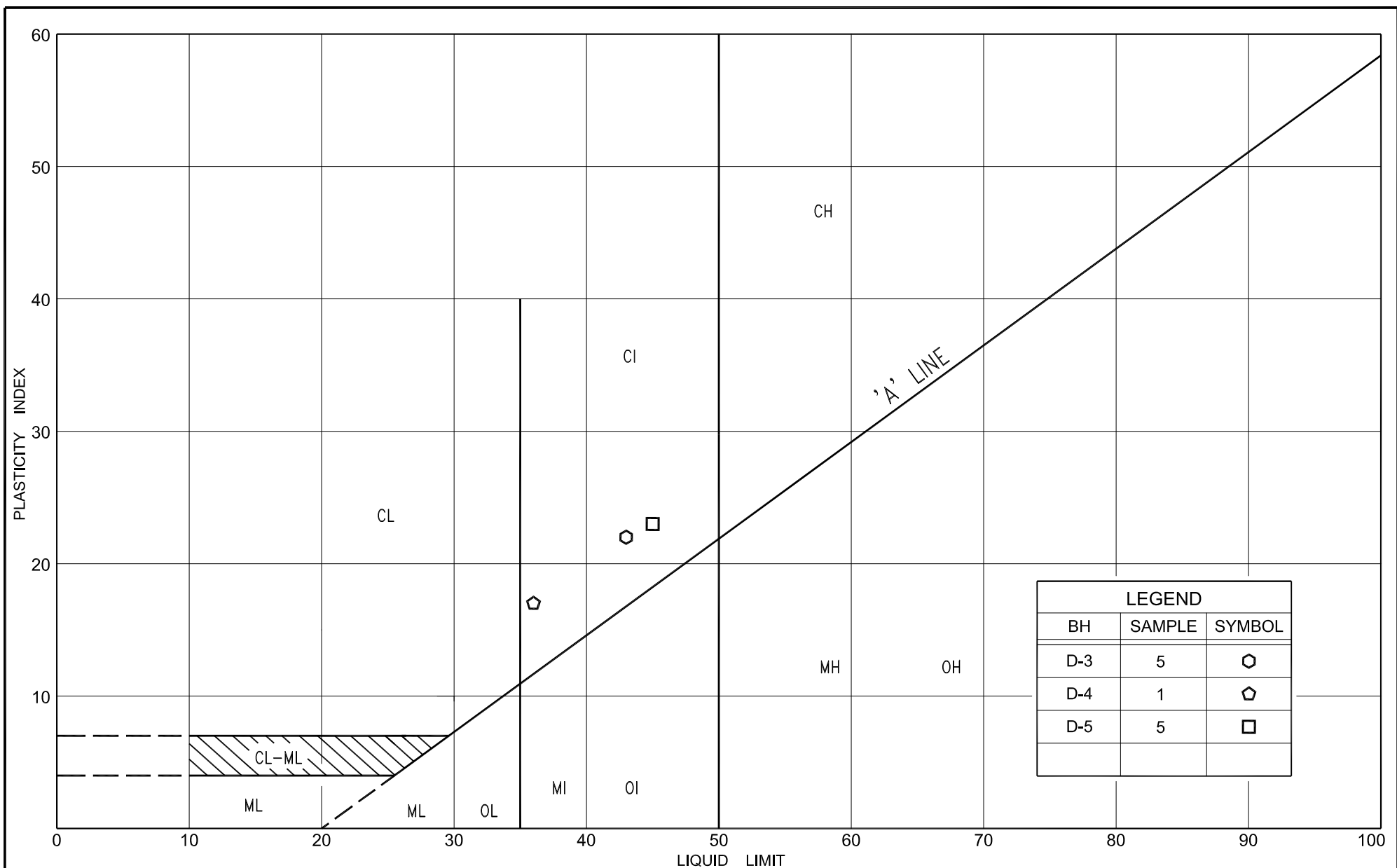
GRAIN SIZE DISTRIBUTION
SANDY SILT, some clay, trace gravel

FIG No. D-GS-3
HWY: 17
G.W.P. No. 5146-09-00



LEGEND		
BH	SAMPLE	SYMBOL
D-1	2	—

SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL			COB BLES	UNIFIED		
					SAND												
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT																
CLAY			SILT			V. FINE		FINE		MED.		COARSE		GRAVEL			U.S. BUREAU
						SAND											



PLASTICITY CHART

SILTY CLAY, trace sand, trace gravel (CI)

FIG No. D-PC-1

HWY: 17

G.W.P. No. 5146-09-00

GEOGRAPHIC TOWNSHIP OF DENISON

Culvert E (D12) – Station 16+958 C/L

RECORD OF BOREHOLE No E-1

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 139 607.6 N; 279 766.1 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod + Dynamic Cone Penetration Test **COMPILED BY** N.R.
DATUM Geodetic **DATE** March 04, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED		+ FIELD VANE								○		
							20	40	60	80	100									
257.2	Ground surface																			
0.0 256.9	Snow and ice					▽*														
0.3 256.6	Peat																			
0.6	Silty clay, organics		1	SS	1															
256.0	Very soft Dark Moist to firm brown (FILL)		2	SS	4															
1.2	Clayey silt trace sand																			
	Firm Mottled Moist to soft grey/brown		3	SS	4															
	silt seams and partings		4	SS	3											0 1 57 42				
	Grey																			
254.0	Silt some sand, trace clay clayey silt seams		5	SS	11															
3.2	Compact Grey Wet to loose		6	SS	7															
			7	SS	8											0 14 83 3				
251.4	Silt and sand trace clay, trace gravel																			
5.8	Compact Brown Wet		8	SS	16															

RECORD OF BOREHOLE No E-2

1 of 2

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 139 592.6 N; 279 780.5 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Sonic + Rotatory Displacement **COMPILED BY** N.R.
DATUM Geodetic **DATE** June 03, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT										PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		SHEAR STRENGTH kPa					WATER CONTENT (%)									
							○ UNCONFINED + FIELD VANE					○ UNCONFINED + FIELD VANE									
							● QUICK TRIAXIAL × LAB VANE					○ UNCONFINED + FIELD VANE									
263.8	Ground surface						20	40	60	80	100										
0.0	100 mm thick asphalt over sand and gravel																				
263.3	(PAVEMENT FILL)																				
0.5	Cobbles and boulders																				
	(ROCKFILL)																				
259.5																					
4.3	Silty clay, sand and gravel organics																				
259.1	(POSSIBLE FILL)																				
4.7	Silty clay, trace sand organics to 5.8m depth		1	SS	23																
	Very stiff Dark Moist to firm grey/brown																				
			2	SS	12																
			3	SS	5																
				FV																	
255.1																					
8.7	Silt trace sand, trace clay																				
	Compact Grey Wet to loose		4	SS	13																
			5	SS	2**																
252.2																					
11.6	Sand, trace silt																				
	Compact Grey Wet		6	SS	25/15cm																
	gravelly																				
			7	SS	16																
249.5																					
14.3	End of borehole																				
	Cont'd																				

Cont'd

RECORD OF BOREHOLE No E-2

2 of 2

METRIC

G.W.P.	5146-09-00	LOCATION	Coords: 5 139 592.6 N; 279 780.5 E	ORIGINATED BY	F.P.
DIST	Sudbury	HWY	17	BOREHOLE TYPE	Sonic + Rotatory Displacement
DATUM	Geodetic	DATE	June 03, 2013	CHECKED BY	B.R.G.
				COMPILED BY	N.R.

[illegible]

RECORD OF BOREHOLE No E-3

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 139 583.1 N; 279 804.2 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod + 'N' Casing + Dynamic Cone Penetration Test **COMPILED BY** N.R.
DATUM Geodetic **DATE** May 02, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE						
258.4 0.0	Ground surface						20	40	60	80	100						
258.2 0.2	Topsoil																
	Silty clay, trace sand organics		1	SS	1												
256.9 1.5	Very soft to firm Grey-brown (FILL)		2	SS	5												
	Silty clay, trace sand organics		3	SS	15												
	Stiff to firm Mottled grey/brown			FV													
			4	SS	14												
254.7 3.7				FV													
			5	SS	5												
				FV													
	Silt with sand, trace clay		6	SS	31												
252.6 5.8	Dense to compact Dark grey																
			7	SS	19												
251.7 6.7	Sand and silt trace clay																
	Compact Grey Wet		8	SS	12												
	End of borehole																
	Probable sand and silt																
247.7 10.7	Compact to very dense																
	End of dynamic cone penetration test																

RECORD OF BOREHOLE No E-4

1 of 2

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 139 574.9 N; 279 817.6 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Sonic + Rotatory Displacement **COMPILED BY** N.R.
DATUM Geodetic **DATE** May 28, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE									
								● QUICK TRIAXIAL × LAB VANE									
							WATER CONTENT (%)										
263.3	Ground surface						20	40	60	80	100						
0.0	100 mm thick asphalt over sand and gravel																
262.8	(PAVEMENT FILL)																
0.5	Cobbles and boulders																
	(ROCKFILL)																
259.0																	
4.3	Silty clay trace sand, trace gravel organics to 7.3m																
	Very stiff Mottled Moist to stiff grey/ to wet brown		1	SS	26												
	sand layer																
			2	SS	13												
			3	SS	9												
				FV													
	Firm Grey		4	SS	WH**												
				FV													
252.9																	
10.4	Clayey silt, trace sand																
	Very soft Dark Wet grey		5	SS	WH												
251.6																	
11.7	Silt, some sand trace clay, trace gravel																
	Loose to Grey Wet dense		6	SS	5												
			7	SS	10												

Cont'd

+7, X⁵:

Numbers refer to Sensitivity

20
15—5
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No E-4

2 of 2

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 139 574.9 N; 279 817.6 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Sonic + Rotatory Displacement **COMPILED BY** N.R.
DATUM Geodetic **DATE** May 28, 2013 **CHECKED BY** B.R.G.




SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								<div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div>												
248.3								20	40	60	80	100								
247.6			8	SS	32		248													
15.7	End of borehole																			
	<div>* Borehole charged with drilling water</div> <div>■ Penetrometer test</div> <div>WH** denotes penetration due to weight of rods and hammer</div>																			

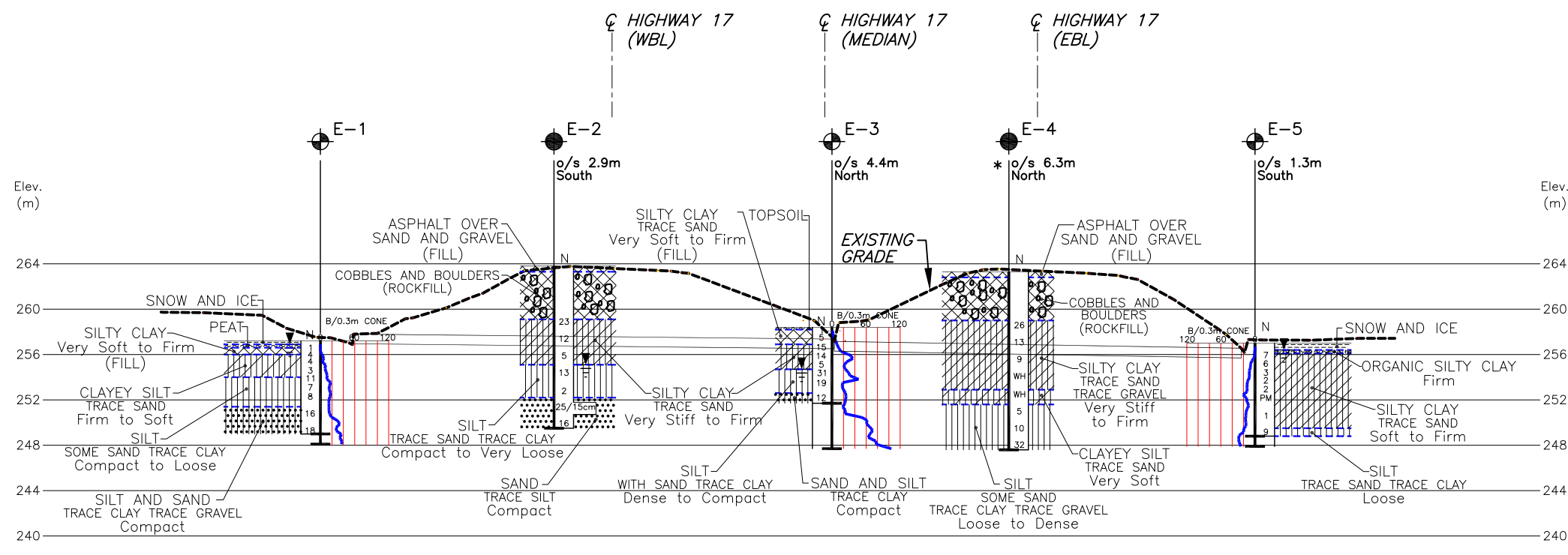
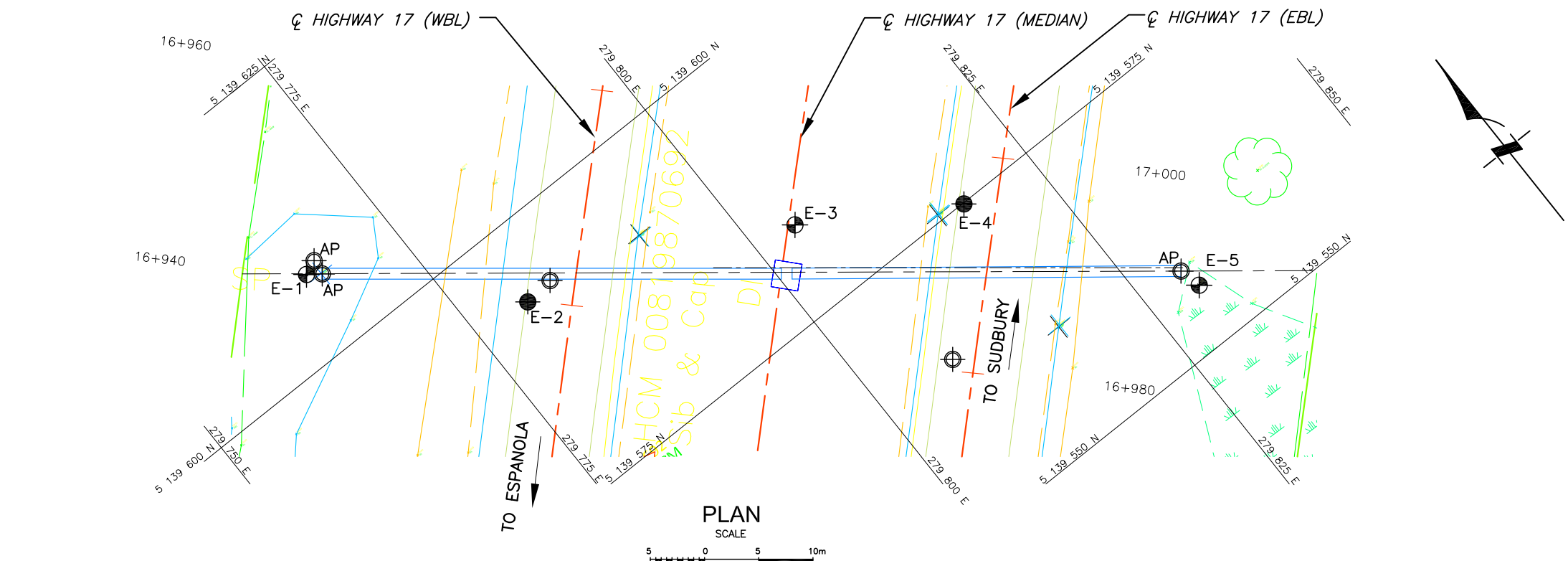
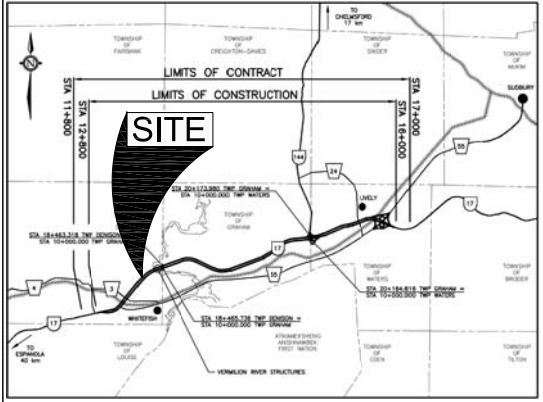
RECORD OF BOREHOLE No E-5

1 of 1

METRIC

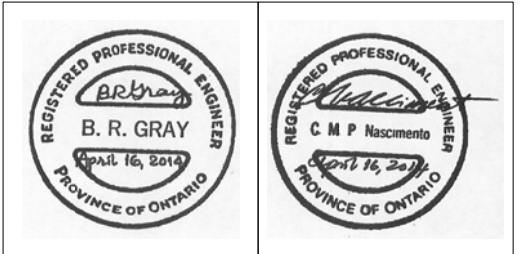
G.W.P. 5146-09-00 **LOCATION** Coords: 5 139 555.5 N; 279 829.9 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod + 'N' Casing + Dynamic Cone Penetration Test **COMPILED BY** N.R.
DATUM Geodetic **DATE** March 25, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE		SHEAR STRENGTH kPa					W _p	w	W _L		
257.0	Top of Snow/Ice					20	40	60	80	100					
0.0	Snow & ice														
256.4	Organic silty clay														
0.6	Firm Dark brown Moist		1	SS											
256.1	Silty clay, trace sand														
0.9	Firm Mottled Wet grey/brown		2	SS											
			3	SS											
			4	SS											
				FV											
			5	SS											
				FV											
			6	TW											
				FV											
			7	SS											
				FV											
249.5	Silt trace sand, trace clay														
7.5			8	SS											
248.8	Loose Grey Wet														
8.2	End of borehole														
	Probable silt														
247.9	Compact														
9.1	End of dynamic cone penetrometer test														
* 2013 03 25  Water level observed during drilling  Water level measured after drilling  Penetrometer test NOTES: Dynamic cone penetration test was carried out 3 m east of borehole E-5. Auger probe was carried out at culvert end, silty sand containing organics encountered to 0.5 m. Refusal on rockfill.															



LEGEND			
	Borehole		
	Borehole and Cone		
	Pavement borehole/Auger probe (AP)		
N	Blows/0.3m (Std. Pen Test, 475 J/blow)		
CONE	Blows/0.3m (60 Cone, 475 J/blow)		
	WL at time of investigation Nov. & Dec. 2012		
WH	Penetration due to weight of hammer		
*	Water level not established		
	Head		
	ARTESIAN WATER		
	Encountered		
	PIEZOMETER		
BH No	ELEVATION	NORTHINGS	EASTINGS
E-1	257.2	5 139 607.6	279 766.1
E-2	263.8	5 139 592.6	279 780.5
E-3	258.4	5 139 583.1	279 804.2
E-4	263.3	5 139 574.9	279 817.6
E-5	257.0	5 139 555.5	279 829.9

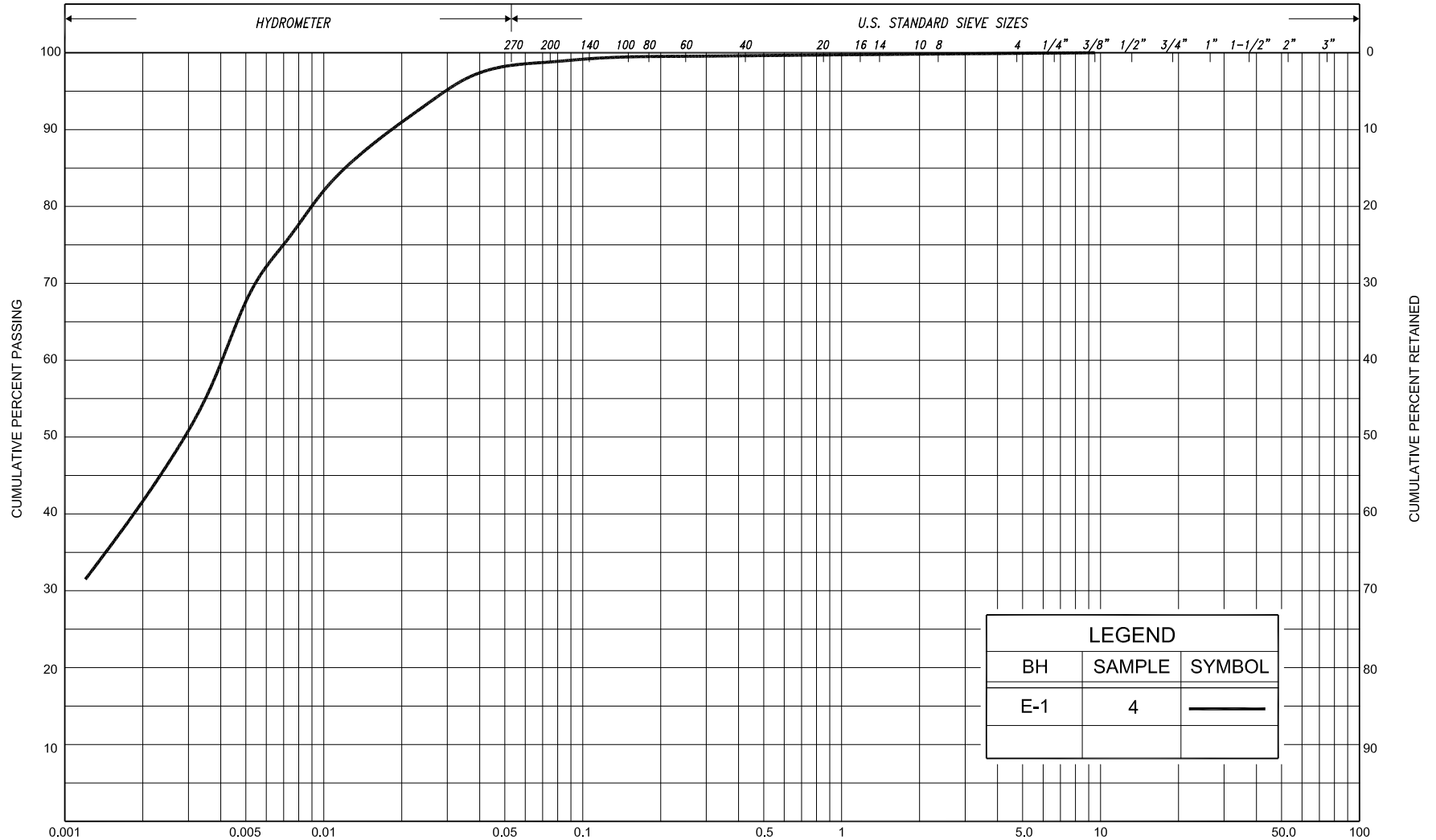
- NOTES:
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
 - THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION. CULVERT PROFILE IS ESTIMATED.
 - DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.



NOTE:
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

HWY No 17	SUBM'D NA	CHECKED NR	DATE APR. 16, 2014	DIST Sudbury
DRAWN NA	CHECKED BRG	APPROVED CN	SITE	DWG E-1



LEGEND		
BH	SAMPLE	SYMBOL
E-1	4	—

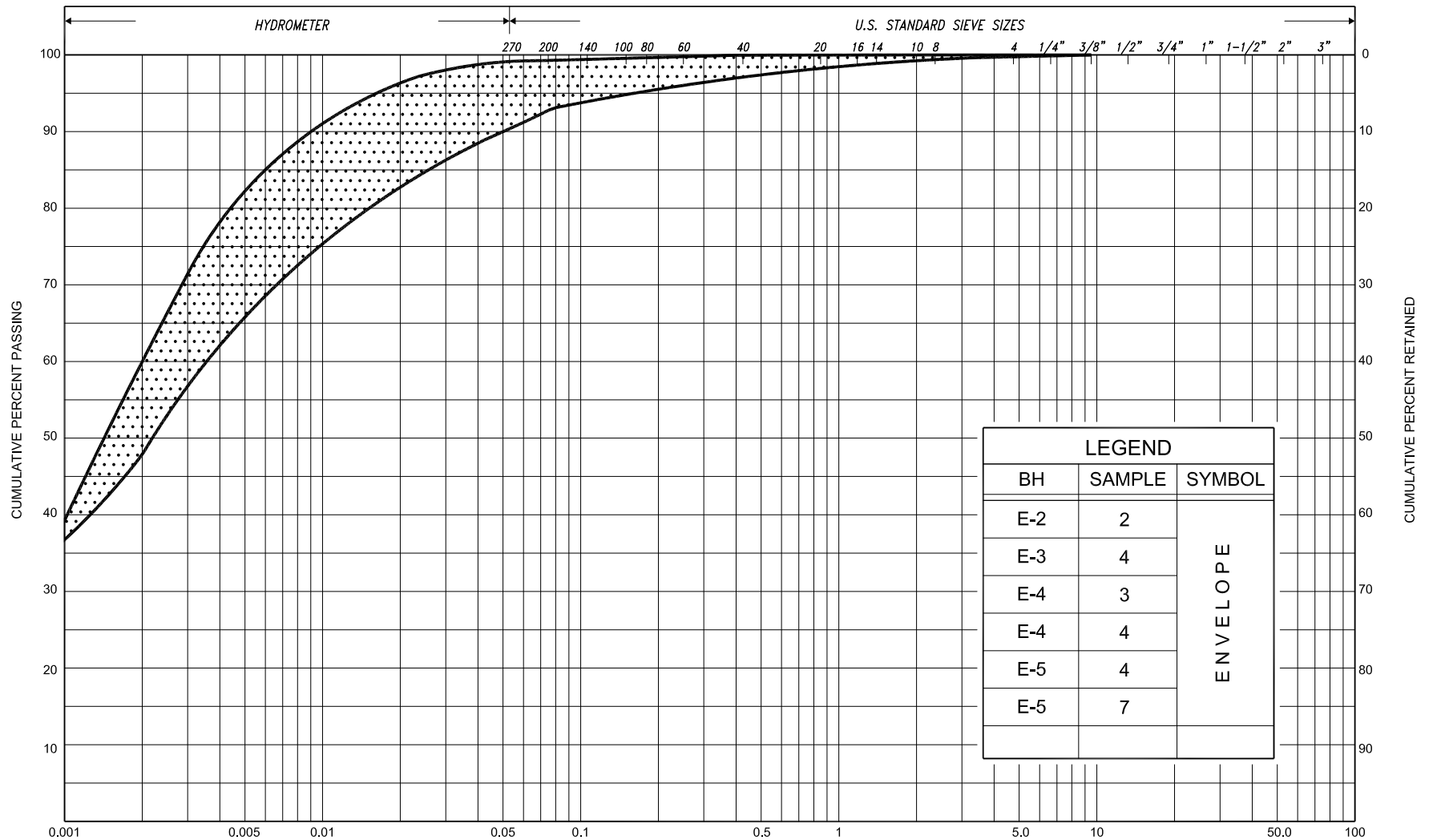
SILT & CLAY				SAND			GRAVEL		COBBLES	UNIFIED
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	GRAVEL		COBBLES	M.I.T.
										U.S. BUREAU



GRAIN SIZE DISTRIBUTION

CLAYEY SILT, trace sand (CH)

FIG No.	E-GS-1
HWY:	17
G.W.P. No.	5146-09-00



SILT & CLAY				FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED
CLAY	FINE	MEDIUM		COARSE	FINE	MEDIUM		COARSE	GRAVEL			COBBLES	M.I.T.
	SILT			SAND									
CLAY		SILT		V. FINE	FINE	MED.	COARSE	GRAVEL					U.S. BUREAU
				SAND									



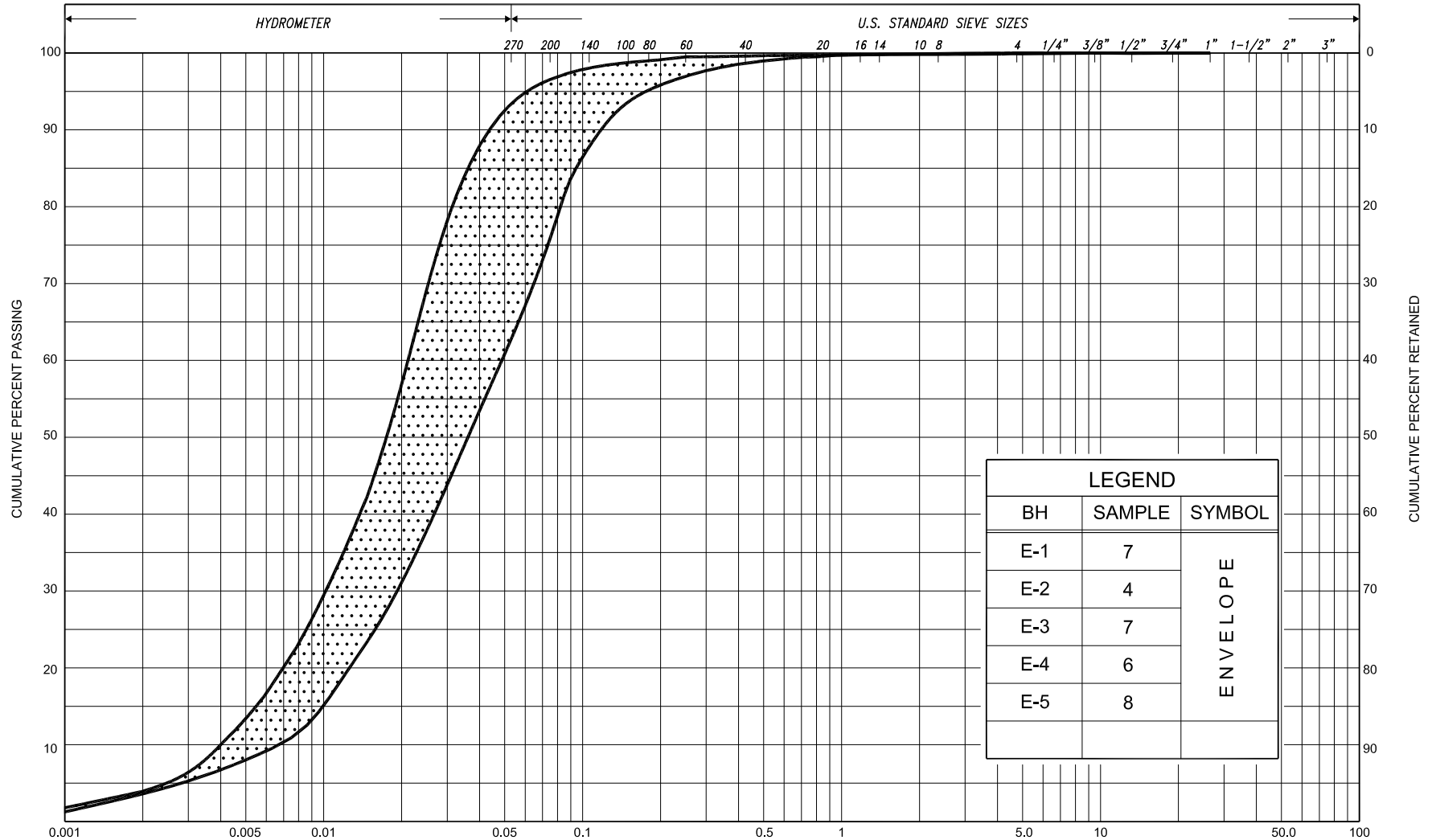
GRAIN SIZE DISTRIBUTION

SILTY CLAY, trace sand (CI)

FIG No. E-GS-2

HWY: 17

G.W.P. No. 5146-09-00



SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL				COB BLES	UNIFIED			
					SAND														
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL				COBBLES	M.I.T.	
	SILT					SAND													
CLAY			SILT			V. FINE	FINE	MED.	COARSE		GRAVEL								U.S. BUREAU



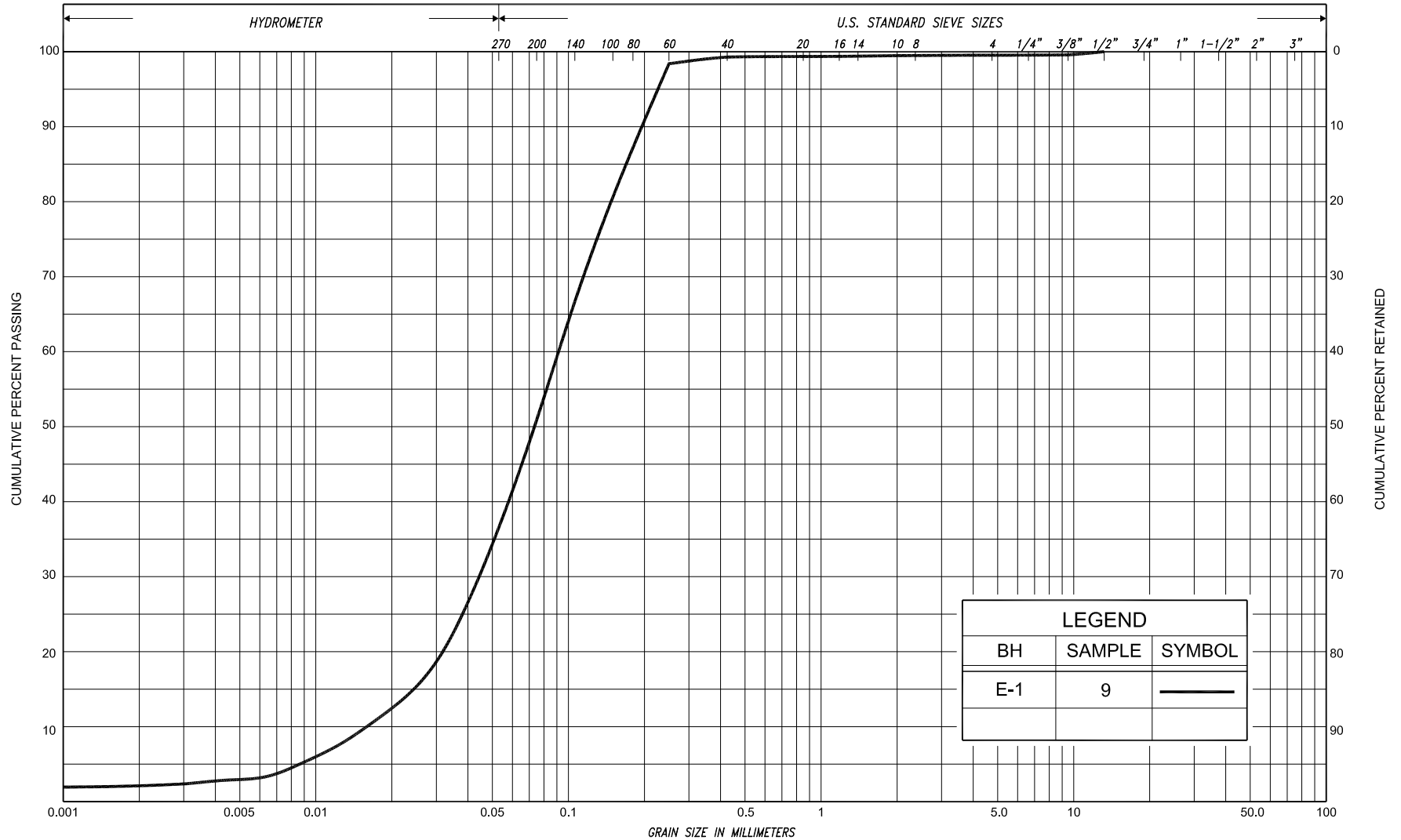
GRAIN SIZE DISTRIBUTION

SILT, trace to with sand, trace clay

FIG No. E-GS-3

HWY: 17

G.W.P. No. 5146-09-00



SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COB BLES	UNIFIED		
					SAND											
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL		COBBLES	M.I.T.
	SILT					SAND										
CLAY		SILT			V. FINE	FINE	MED.	COARSE		GRAVEL						U.S. BUREAU
					SAND											



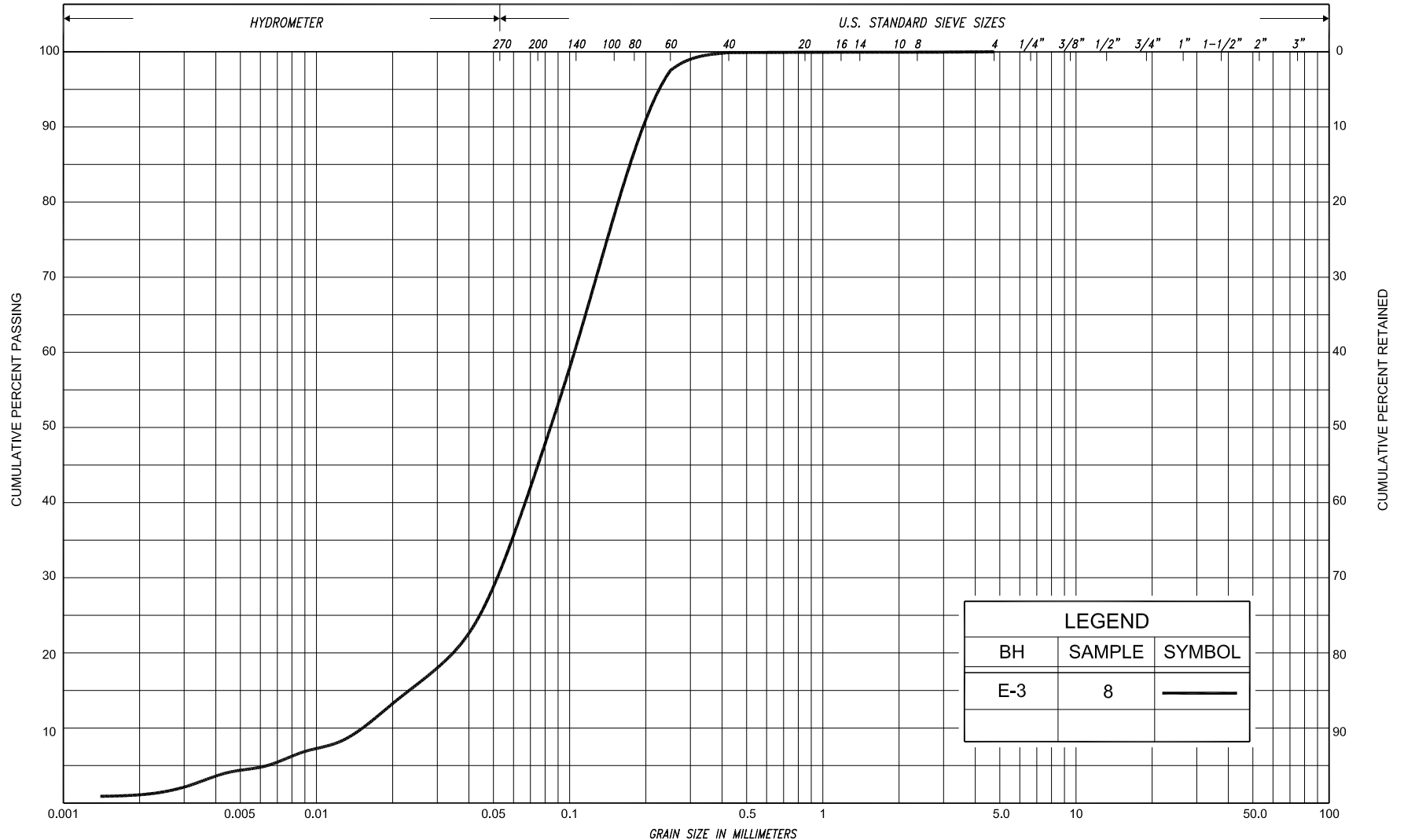
GRAIN SIZE DISTRIBUTION

SILT AND SAND, trace clay

FIG No. E-GS-4

HWY: 17

G.W.P. No. 5146-09-00



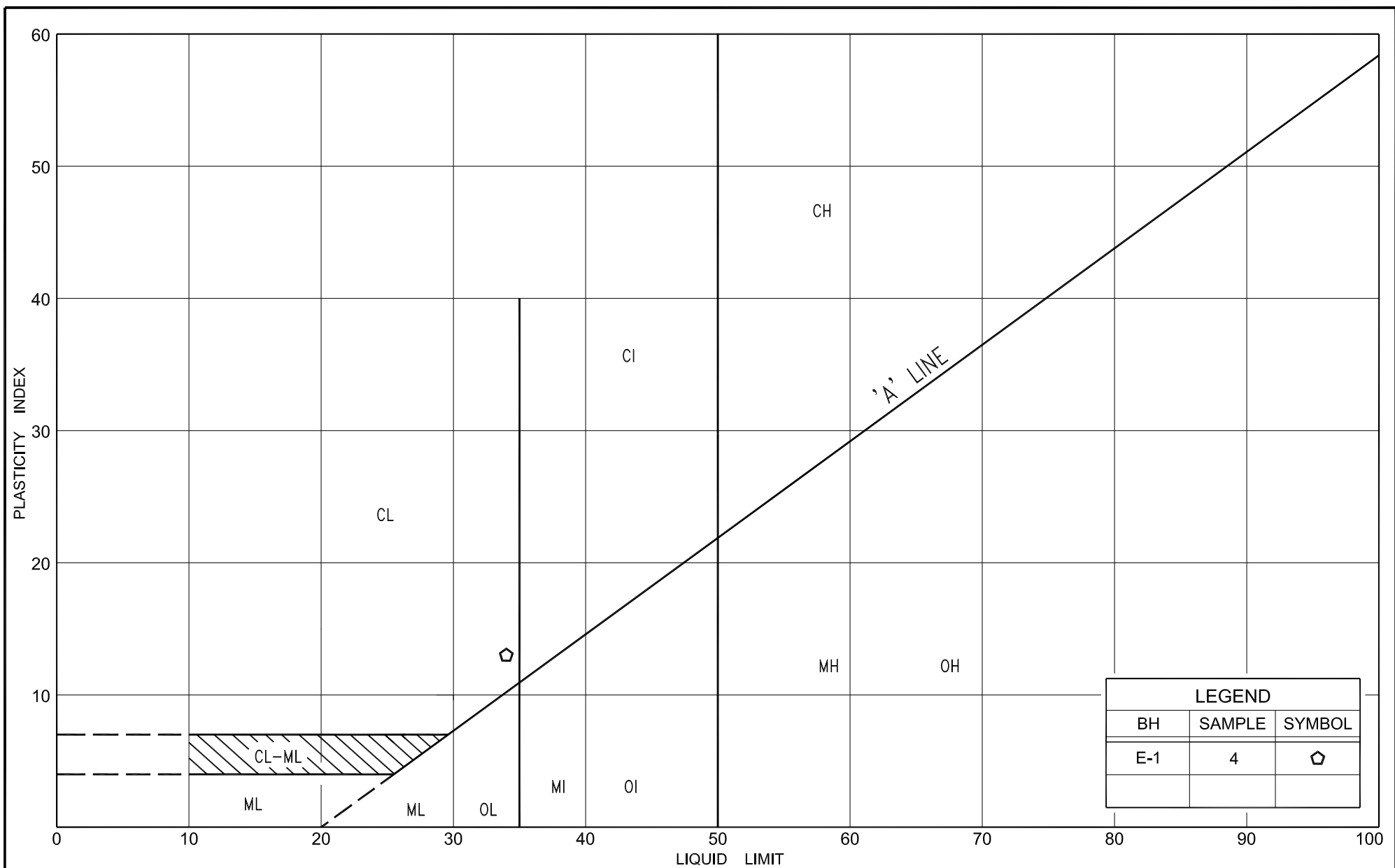
SILT & CLAY				FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED
				SAND									
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM		COARSE	GRAVEL				COBBLES	M.I.T.
	SILT												
CLAY		SILT		V. FINE	FINE	MED.	COARSE	GRAVEL					U.S. BUREAU
				SAND									



GRAIN SIZE DISTRIBUTION

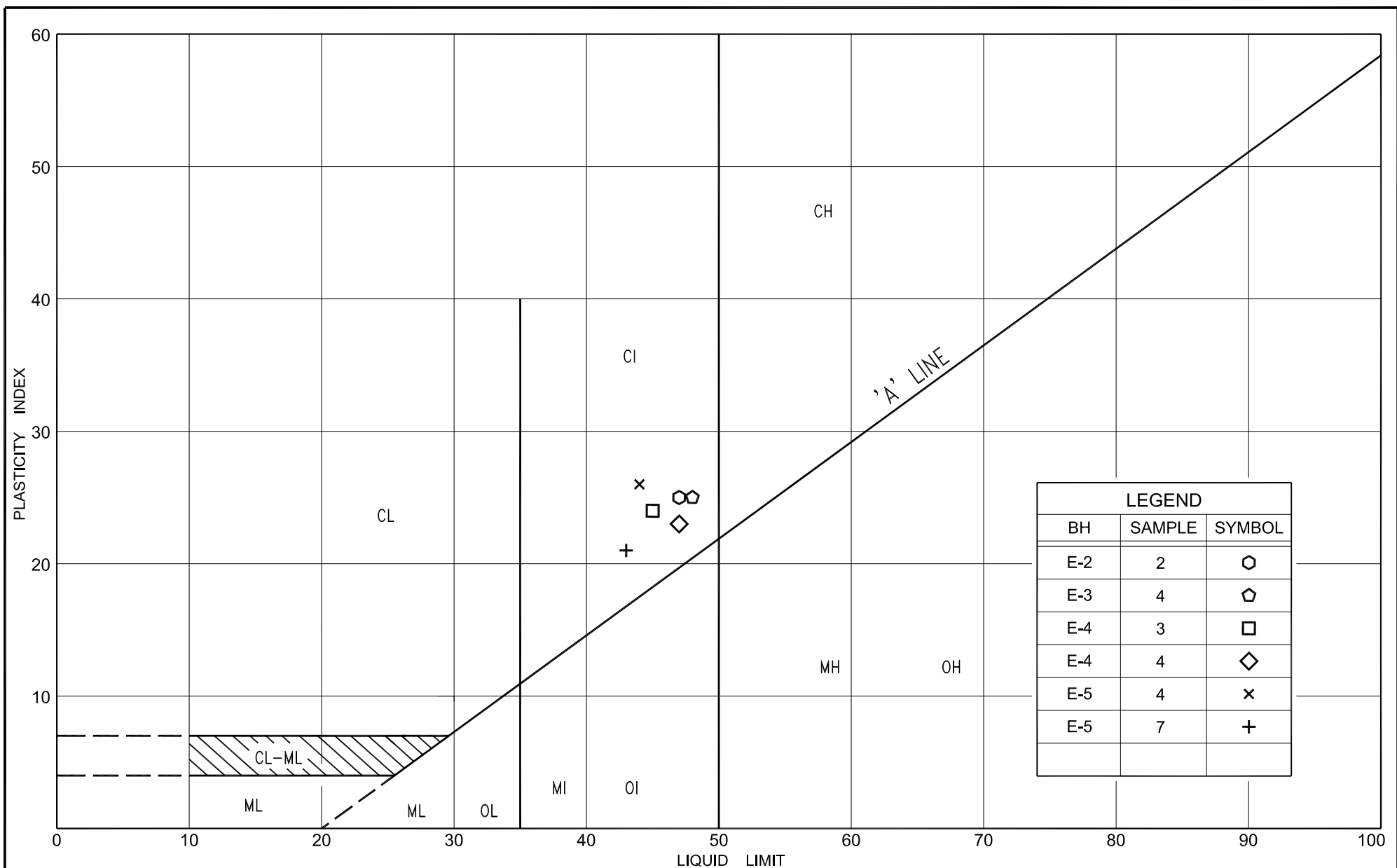
SAND AND SILT, trace clay

FIG No. E-GS-5
 HWY: 17
 G.W.P. No. 5146-09-00



PLASTICITY CHART
CLAYEY SILT, trace sand (CL)

FIG No. E-PC-1
HWY: 17
G.W.P. No. 5146-09-00



PLASTICITY CHART

CLAY, trace sand (CH)

FIG No. E-PC-2

HWY: 17

G.W.P. No. 5146-09-00



Geographic Township of Graham
Record of Pavement Holes

Culvert F (G3) Sta 10+525 EBL

Highway 17 EBL Denison Township DATUM: Existing Highway 17 EBL Centreline				
10+533.0	2.0	Lt C/L	D+/-0	ROAD
At Culvert G3				
0	-	450	Asph/Prob BTB	
450	-	730	Br Cr Sa And Gr Tr Si Moist	
		730	NFP RF	

Culvert G (G4) Sta 10+685 EBL

Highway 17 EBL Denison Township DATUM: Existing Highway 17 EBL Centreline				
10+685.0	2.2	Lt C/L	D+/-0	ROAD
At Culvert G4				
0	-	320	Asph	
320	-	470	Br Cr Sa And Gr Tr Si Moist	
470	-	710	Br Sa Tr Gr Tr Si Moist	
		710	NFP RF	

Culvert H (G5) Sta 10+910 EBL

Highway 17 EBL Denison Township DATUM: Existing Highway 17 EBL Centreline				
10+916.0	2.1	Lt C/L	D+/-0	ROAD
At Culvert G5				
0	-	370	Asph/Prob BTB	
370	-	650	Br Cr Sa And Gr Tr Si Moist	
		650	NFP Bld	



Culvert I (G7) Sta 12+273 CL

Highway 17 EBL Denison Township DATUM: Existing Highway 17 EBL Centreline					Highway 17 WBL Denison Township DATUM: Existing Highway 17 WBL Centreline				
12+273.0	2.0	Lt C/L	D+/-0	ROAD	12+278.0	2.1	Rt C/L	D+/-0	ROAD
At Culvert G7					At Culvert G7				
0	-	100	Asph		0	-	350	Asph	
100	-	600	Br Cr Sa And Gr Tr Si Moist		350	-	550	Br Cr Sa And Gr Tr Si Moist	
		600	NFP RF		550	-	680	Br Sa Some Gr Tr Si Moist	
							680	NFP RF	

Culvert J1 (G8) Sta 12+620 WBL

Highway 17 WBL Denison Township DATUM: Existing Highway 17 WBL Centreline				
12+635.0	2.6	Lt C/L	D+/-0	ROAD
At Culvert G8				
0	-	180	Asph	
180	-	290	Gry Sa(y) Gr Tr Si Moist	
		290	NFP RF	

Culvert J2 (G9) Sta 12+630 EBL

Highway 17 EBL Denison Township DATUM: Existing Highway 17 EBL Centreline				
12+617.0	1.8	Lt C/L	D+/-0	ROAD
At Culvert G9				
0	- 340	Asph		
340	- 690	Br Cr Sa And Gr Tr Si Moist		
690	- 1.8	Br Sa Some Gr Tr Si Moist		
	1.8	NFP RF		

Culvert K (G10) Sta 12+865 WBL

Highway 17 WBL Denison Township DATUM: Existing Highway 17 WBL Centreline				
12+860.0	2.0	Rt C/L	D-0.1	ROAD
At Culvert G10				
0	-	330	Asph	
330	-	450	Br Cr Sa And Gr Tr Si Moist	
450	-	630	Br Sa Tr Gr Tr Si Moist	
		630	NFP RF	



Culvert L (G25) Sta 17+894 CL

Highway 17 EBL Denison Township DATUM: Existing Highway 17 EBL Centreline					Highway 17 WBL Denison Township DATUM: Existing Highway 17 WBL Centreline				
17+902.0	1.9	Lt C/L	D+/-0	ROAD	17+892.0	1.7	Rt C/L	D+/-0	ROAD
At Culvert G25					At Culvert G25				
0	-	320	Asph		0	-	280	Asph	
320	-	480	Br Cr Sa And Gr Tr Si Dry		280	-	480	Br Cr Sa And Gr Tr Si Dry	
			w = 2%					w = 2%	
480	-	865	Br Sa Some Gr Tr Si Moist		480	-	730	Br Sa Tr Gr Tr Si Moist	
			w = 5%					w = 6%	
		865	NFP RF				730	NFP RF	



Culvert M (G26) Sta 18+882 CL

Highway 17 EBL Denison Township DATUM: Existing Highway 17 EBL Centreline	Highway 17 WBL Denison Township DATUM: Existing Highway 17 WBL Centreline
18+875.0 6.9 Rt C/L D-0.3 SHR PDA 3, At Culvert G26	17+902.0 1.9 Lt C/L D+/-0 ROAD At Culvert G25
0 - 760 Br Cr Sa And Gr Tr Si Moist 760 NFP Bld	0 - 320 Asph 320 - 480 Br Cr Sa And Gr Tr Si Dry w = 2% 480 - 865 Br Sa Some Gr Tr Si Moist w = 5% 865 NFP RF

Culvert N1 (G30) Sta 19+820 WBL

Highway 17 WBL Denison Township DATUM: Existing Highway 17 WBL Centreline				
19+820.0	2.0	Lt C/L	D+/-0	ROAD
At Culvert G30				
0	-	410	Asph	
410	-	570	Br Cr Sa And Gr Tr Si Moist	
570	-	820	Br Sa Some Gr Tr Si Moist	
		820	NFP RF	

Culvert N2 (G31) Sta 19+850 EBL

Highway 17 EBL Denison Township DATUM: Existing Highway 17 EBL Centreline				
19+825.0	1.7	Lt C/L	D+/-0	ROAD
At Proposed Staging Area, At Culvert G31				
0	-	130	Asph	
130	-	580	Br Cr Sa And Gr Tr Si Dry	
			w = 2%	
580	-	925	Br Sa Tr Gr Tr Si Moist	
			w = 9%	
		925	NFP RF	
19+825.0	4.7	Lt C/L	D-0.1	MSH
At Proposed Staging Area, At Culvert G31				
0	-	075	Asph	
075	-	490	Br Cr Sa And Gr Tr Si Moist	
490	-	800	Br Sa W Gr Tr Si Moist	
		800	NFP RF	

GEOGRAPHIC TOWNSHIP OF GRAHAM



Culvert F (G3) – Station 10+525 EBL

RECORD OF BOREHOLE No F-1

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 140 400.9 N; 281 663.6 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.H.S.A. and 'N' Casing **COMPILED BY** H.G.
DATUM Geodetic **DATE** November 27, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED		+ FIELD VANE		● QUICK TRIAXIAL						× LAB VANE		
247.6	Ground surface						20	40	60	80	100									
0.0	Sand and gravel cobbles and boulders (ROCKFILL)						247													
							246													
244.9							245													
2.7	Sand and gravel with cobbles		1	SS	36		244													
243.6	End of borehole																			
4.0	Refusal on probable bedrock 																			

RECORD OF BOREHOLE No F-2

1 of 1

METRIC

G.W.P. <u>5146-09-00</u>	LOCATION <u>Coords: 5 140 389.3 N; 281 674.8 E</u>	ORIGINATED BY <u>F.P.</u>
DIST <u>Sudbury</u> HWY <u>17</u>	BOREHOLE TYPE <u>C.F.H.S.A. and 'N' Casing</u>	COMPILED BY <u>H.G.</u>
DATUM <u>Geodetic</u>	DATE <u>December 03, 2012</u>	CHECKED BY <u>B.R.G.</u>

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
251.9 0.0	Ground surface 450mm asphalt over sand and gravel trace silt																			
251.0 0.9	(FILL) cobble and boulders (ROCKFILL)						251													
							250													
							249													
							248													
							247													
246.6 5.3	Silt some sand, trace clay Dense Brown Wet		1	SS	-		246													
			2	SS	31		245													
244.6 7.3	Sand, trace silt Very dense Grey Wet		3	SS	88		244													
243.2 8.7	Bedrock						243													
242.9 9.0	End of borehole Refusal on bedrock 																			

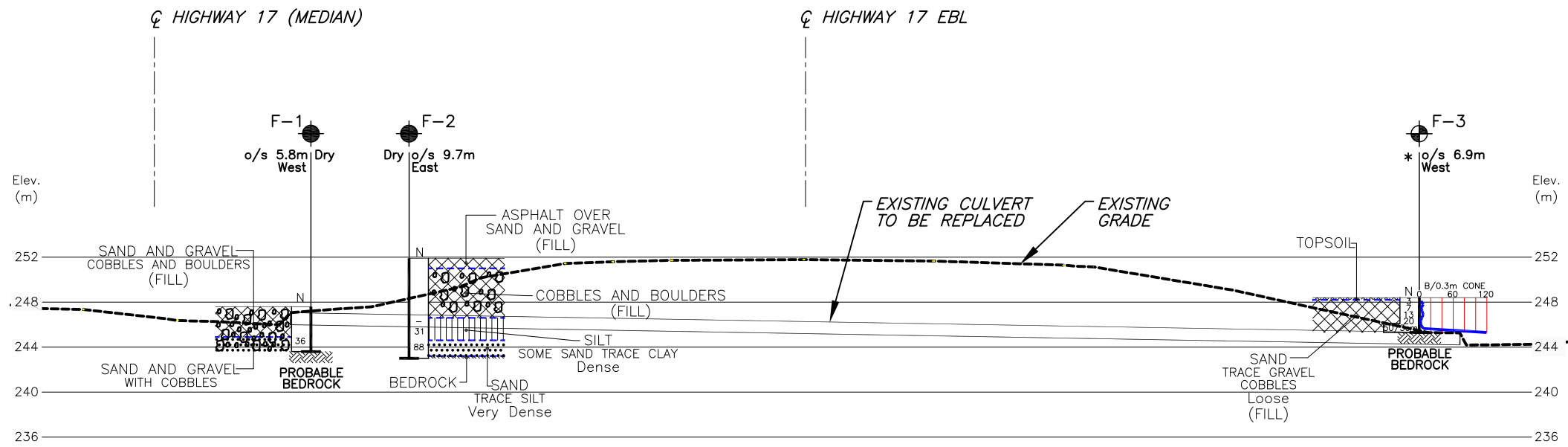
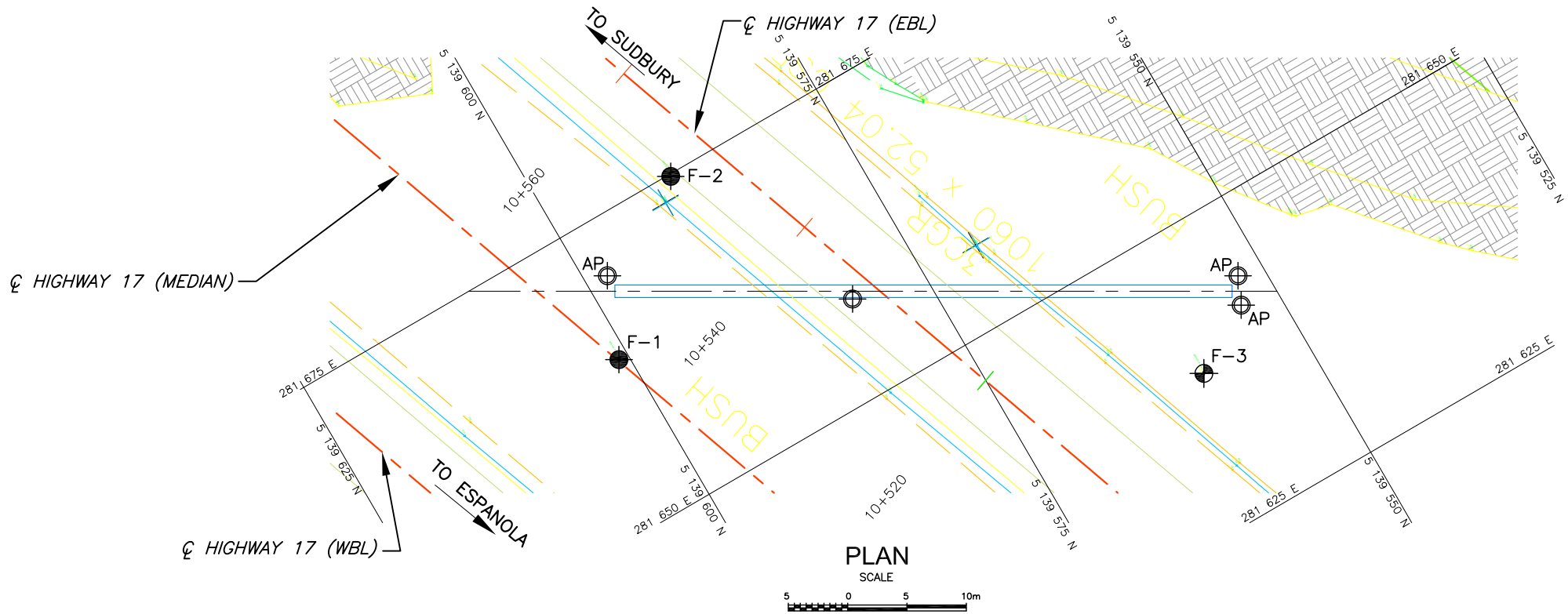
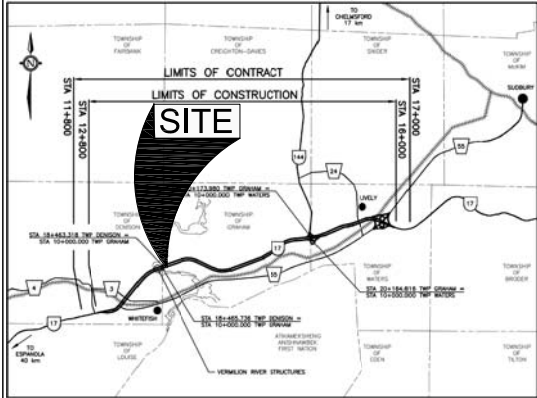
RECORD OF BOREHOLE No F-3

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 140 358.8 N; 281 637.8 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod and Washboring + Dynamic Cone Penetration Test **COMPILED BY** H.G.
DATUM Geodetic **DATE** December 11, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
248.4	Ground surface							20	40	60	80	100								
248.2	Topsoil																			
0.2	Sand, trace gravel cobbles		1	SS	3		248													
	Loose Grey Wet																			
	peat layers		2	SS	7		247													
	(FILL)		3	SS	13															
	some gravel		4	SS	20		246													
245.3			5	SS	50/3cm															
3.1	End of borehole																			
	Refusal on probable bedrock																			
	Sample 5: Sampler bouncing																			
	* Borehole charged with drilling water																			
	Two hand auger probes advanced near borehole. Both probes encountered refusal at 0.8m on boulders.																			
					</															



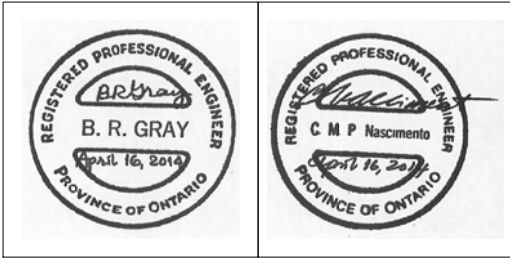
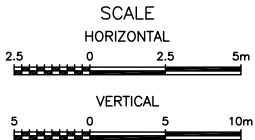
LEGEND

- Borehole
- Borehole and Cone
- Pavement borehole/Auger probe (AP)
- N Blows/0.3m (Std. Pen Test, 475 J/blow)
- CONE Blows/0.3m (60 Cone, 475 J/blow)
- WL at time of investigation Nov. & Dec. 2012
- WH Penetration due to weight of hammer
- * Water level not established
- Head
- ARTESIAN WATER
- Encountered
- PIEZOMETER

BH No	ELEVATION	NORTHINGS	EASTINGS
F-1	247.6	5 140 400.9	281 663.6
F-2	251.9	5 140 389.3	281 674.8
F-3	248.4	5 140 358.8	281 637.8

NOTE:
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

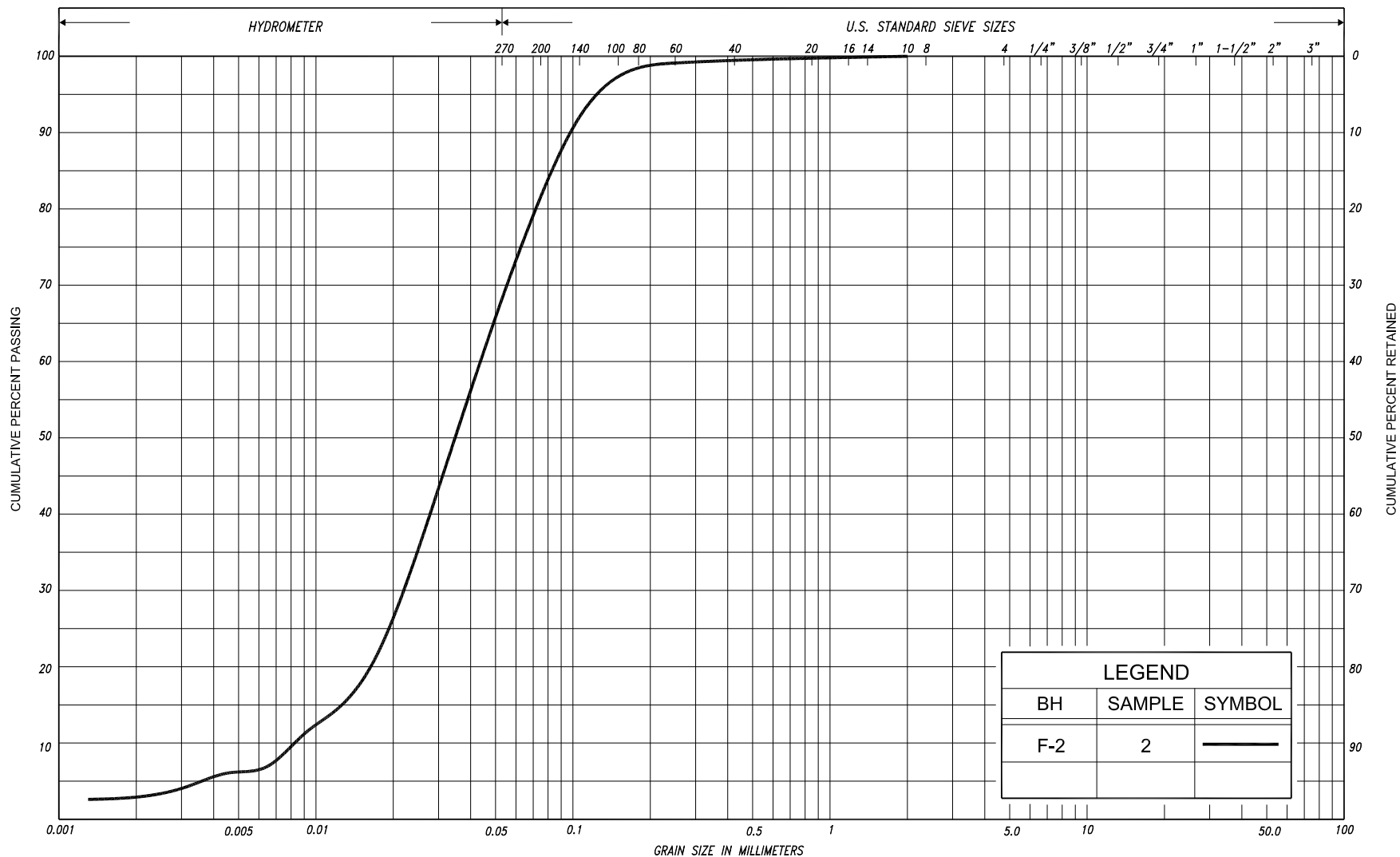
- NOTES:
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
 - THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION. CULVERT PROFILE IS ESTIMATED.
 - DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.



Reference AECOM Drawings:
NTB-01207011.dwg and GRAHAM X-SECTIONS with Culverts and viewport.dwg
received on November 25, 2013 and April 01, 2014 respectively.

REVISIONS	DATE	BY	DESCRIPTION

Geocres No.411-299	HWY No 17	DIST Sudbury
SUBM'D NA	CHECKED NR	DATE APR. 16, 2014
DRAWN NA	CHECKED BRG	APPROVED CN
		DWG F-1



SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED		
					SAND											
CLAY	FINE		MEDIUM		COARSE	FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT															
CLAY			SILT			V. FINE	FINE	MED.	COARSE		GRAVEL					U.S. BUREAU
					SAND											



GRAIN SIZE DISTRIBUTION

SILT, some sand, trace clay

FIG No. F-GS-1

HWY: 17

W.P. No. 5146-09-00

GEOGRAPHIC TOWNSHIP OF GRAHAM

Culvert G (G4) – Station 10+685 EBL

RECORD OF BOREHOLE No G-1

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 140 445.9 N; 281 791.7 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.H.S.A. and 'N' Casing **COMPILED BY** H.G.
DATUM Geodetic **DATE** November 22 and 23, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
248.3	Ground surface					*		20	40	60	80	100					
0.0	Sand and gravel cobbles and boulders (ROCKFILL)						248										
							247										
							246										
245.5	Organic silt		1	CB	-												
2.8																	
245.2	Dark brown						245										
3.1	Silt trace sand, trace clay		2	SS	17												
	Compact Grey Wet to loose with sand, trace gravel						244										
			3	SS	8												
							243										
242.5	Sand some silt, trace gravel																
5.8	Compact Grey Wet		4	SS	23		242										
241.0	End of borehole						241										
7.3	Refusal on probable bedrock																
	* Borehole dry																
	C.F.H.S.A. denotes Continuous Flight Hollow Stem Augers																
	'N' casing advanced from 0.9m depth																
	Auger probe advanced at Sta. 10+700 EBL encountered 0.6m of water over 0.8m of clayey silt. Similar conditions were encountered on the west side of culvert with refusal at 1.2m on probable rockfill. No refusal encountered on the east side of culvert.																

RECORD OF BOREHOLE No G-2

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 140 436.0 N; 281 806.0 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.H.S.A. and 'N' Casing **COMPILED BY** H.G.
DATUM Geodetic **DATE** December 03 to 05, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE												
								● QUICK TRIAXIAL × LAB VANE												
254.6	Ground surface						20	40	60	80	100									
0.0	320mm asphalt over sand and gravel trace silt																			
253.7	(FILL)						254													
0.9	cobbles and boulders																			
	(ROCKFILL)						253													
							252													
							251													
							250													
							249													
							248													
247.4							247													
7.2	Sand and silt trace clay, trace gravel Compact Grey Wet		1	SS	23		246													
	cobbles		2	SS	12		245													
244.5																				
10.1	End of borehole																			
	* Borehole dry																			
	'N' casing advanced from 0.9m depth																			
	C.F.H.S.A. denotes Continuous flight hollow stem augers																			

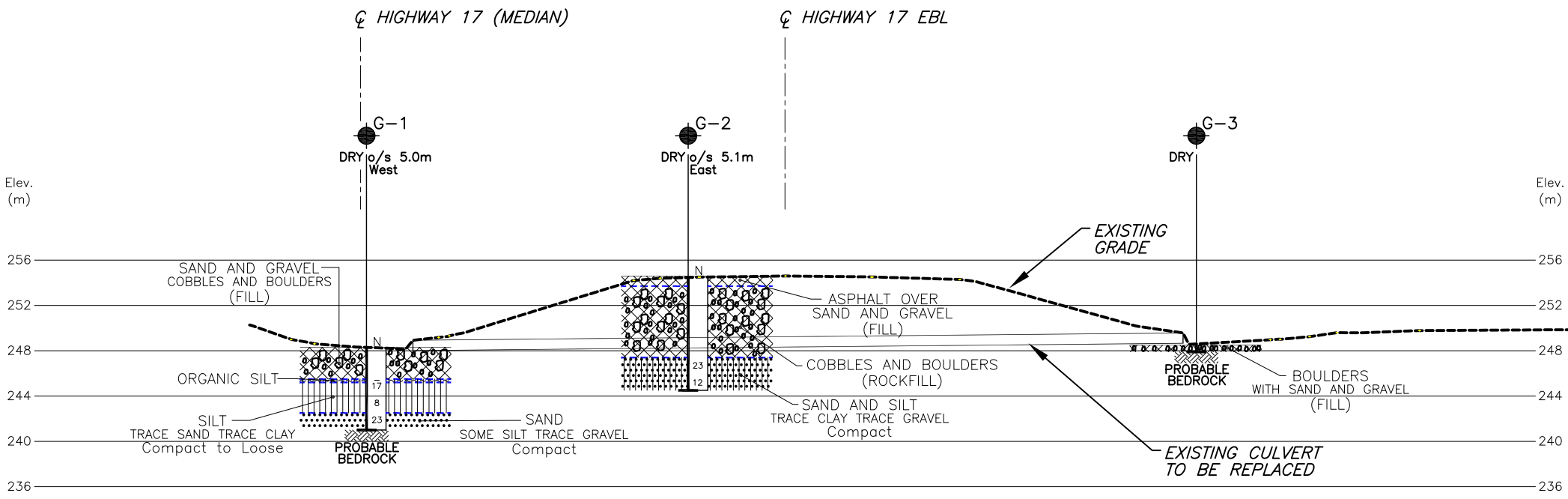
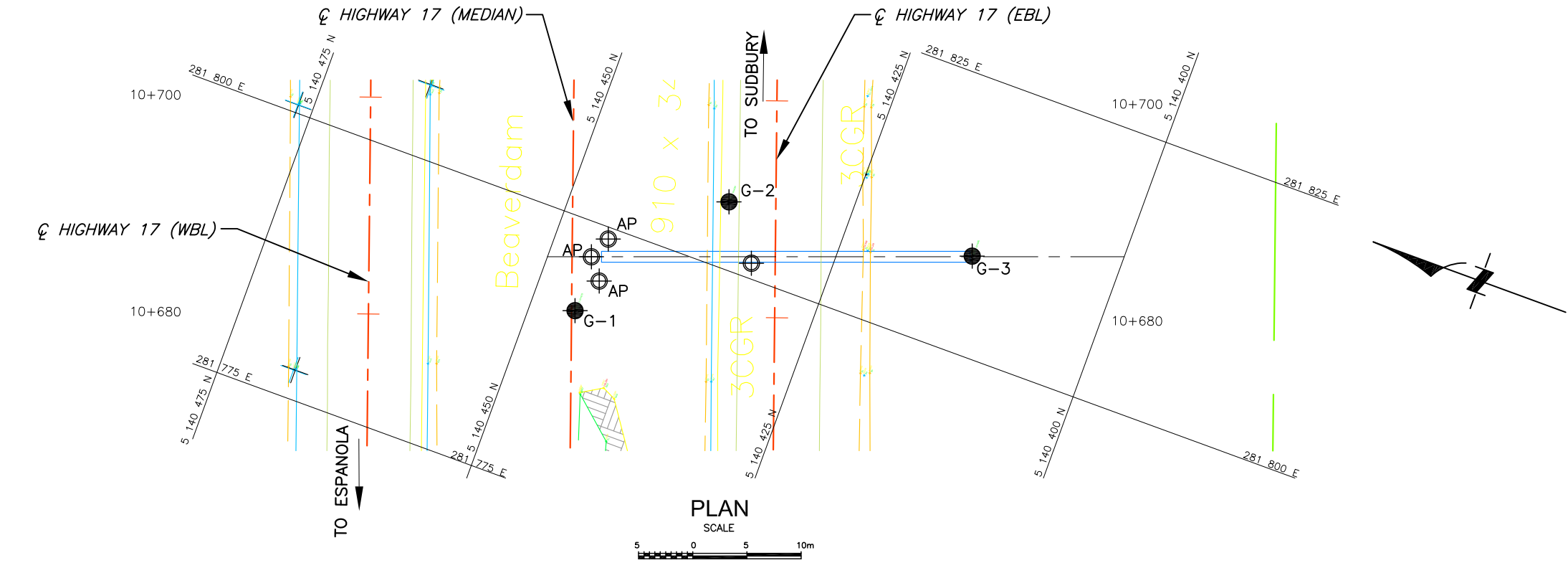
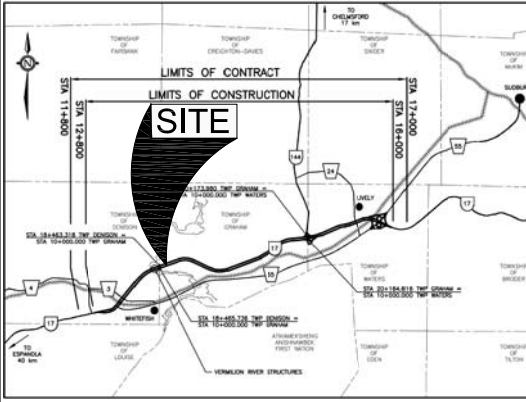
RECORD OF BOREHOLE No G-3

1 of 1

METRIC

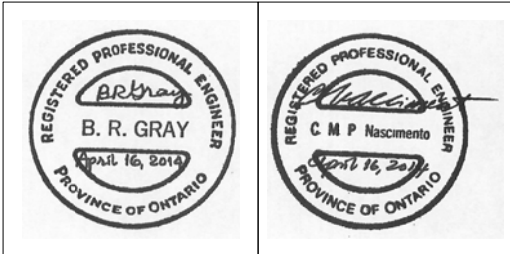
G.W.P. 5146-09-00 **LOCATION** Coords: 5 140 413.2 N; 281 809.0 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Power Auger **COMPILED BY** H.G.
DATUM Geodetic **DATE** December 19, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
248.5	Ground surface							20	40	60	80	100								
0.0	Boulders with sand and gravel																			
247.9	(FILL)						248													
0.6	End of borehole																			
	Refusal on probable boulders																			
	* Borehole dry																			



LEGEND				
	Borehole			
	Borehole and Cone			
	Pavement borehole/Auger probe (AP)			
N	Blows/0.3m (Std. Pen Test, 475 J/blow)			
CONE	Blows/0.3m (60 Cone, 475 J/blow)			
	WL at time of investigation Nov. & Dec. 2012			
WH	Penetration due to weight of hammer			
	Head			
	ARTESIAN WATER			
	Encountered			
	PIEZOMETER			
BH No	ELEVATION	NORTHINGS	EASTINGS	
G-1	248.3	5 140 445.9	281 791.7	
G-2	254.6	5 140 436.0	281 806.0	
G-3	248.5	5 140 413.2	281 809.0	

- NOTES:
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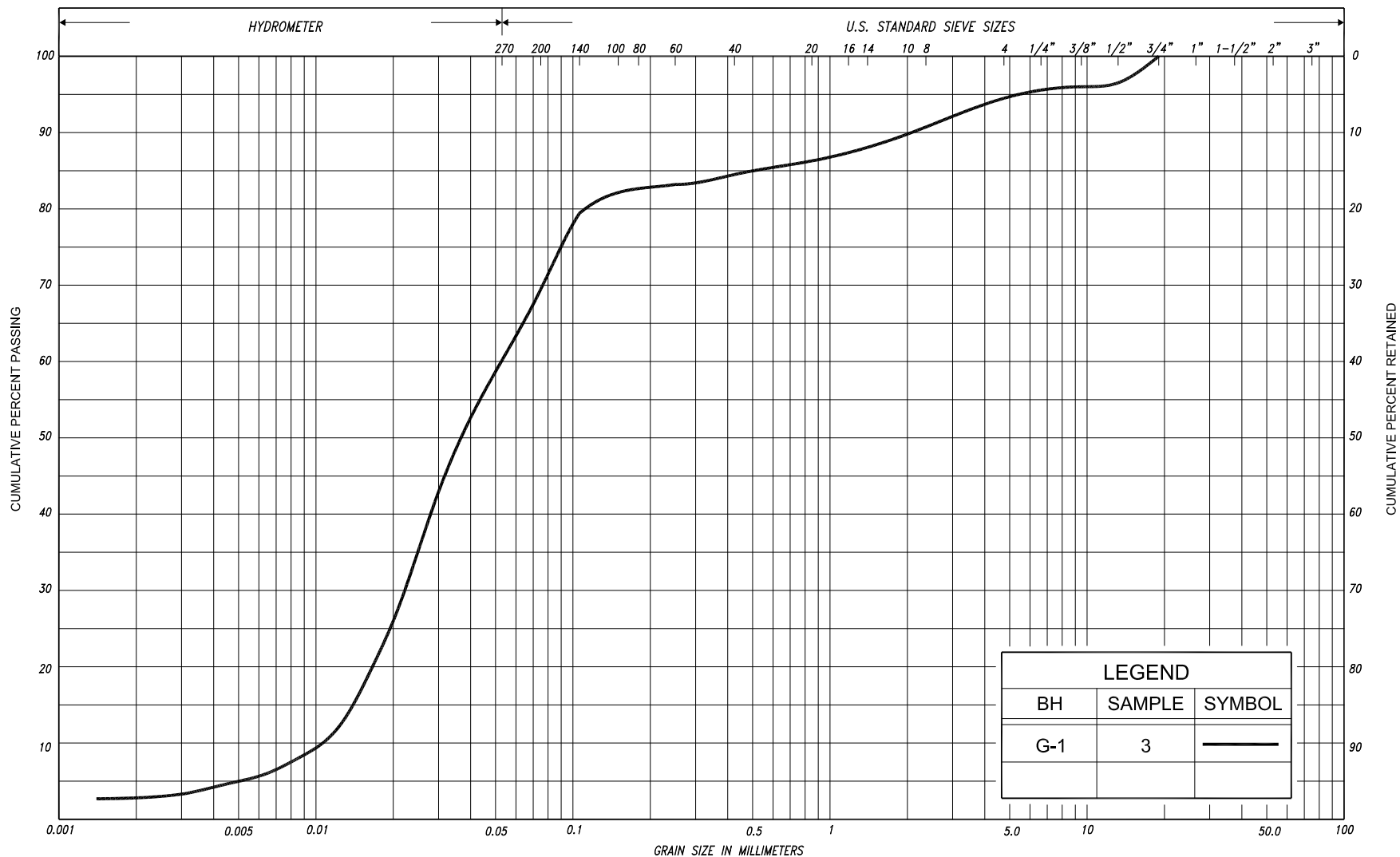


Reference AECOM Drawings:
NTB-01207011.dwg and GRAHAM X-SECTIONS with Culverts and viewport.dwg
received on November 25, 2013 and April 01, 2014 respectively.

NOTE:
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

Geocres No.411-299				
HWY No	17	DIST		Sudbury
SUBM'D	NA	CHECKED	NR	DATE APR. 16, 2014
DRAWN	NA	CHECKED	BRG	APPROVED CN
DWG				G-1



SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL			COBBLES	UNIFIED		
					SAND												
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT																
CLAY			SILT			V. FINE		FINE		MED.		COARSE		GRAVEL			U.S. BUREAU
						SAND											



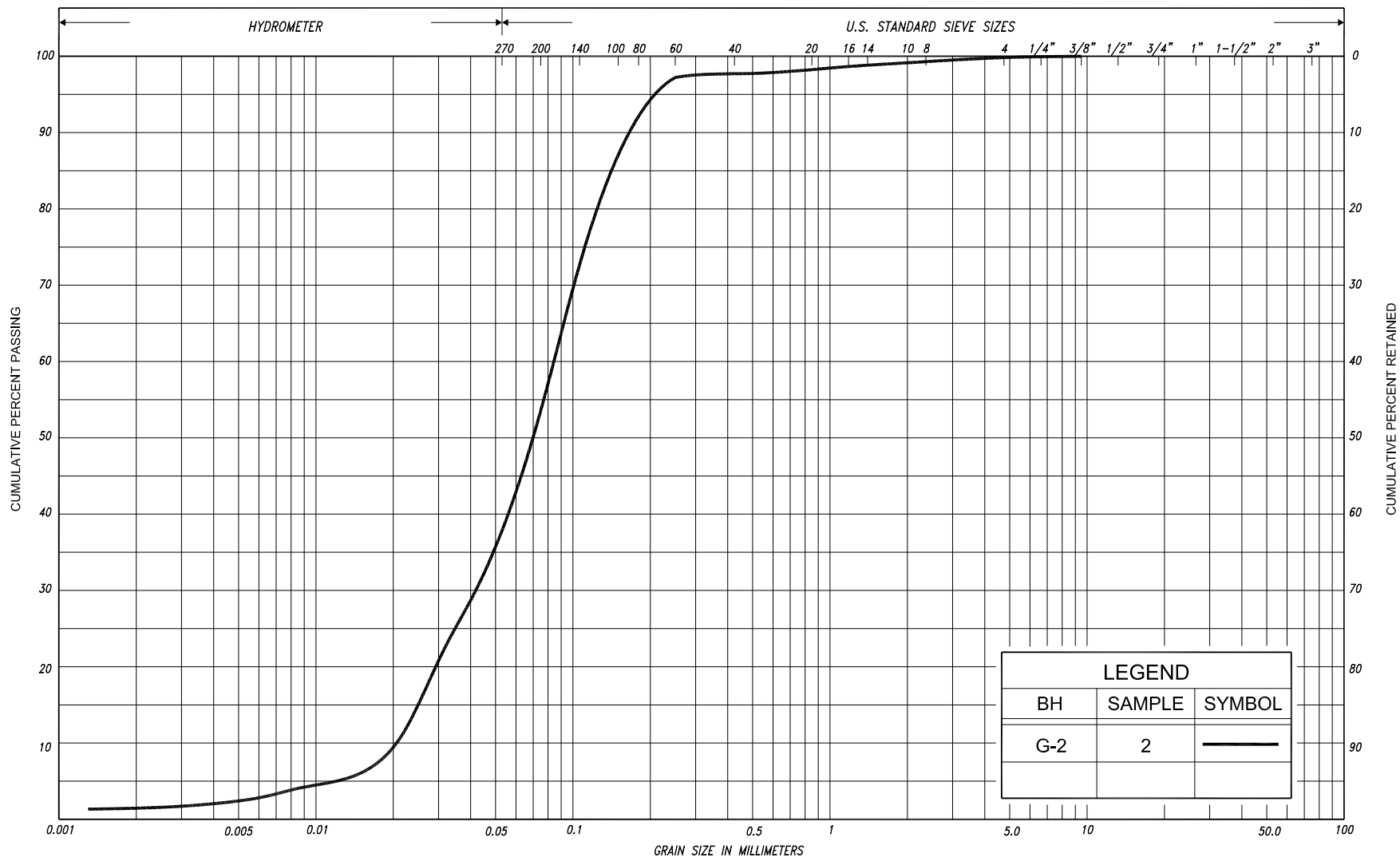
GRAIN SIZE DISTRIBUTION

SILT, with sand, trace clay, trace gravel

FIG No. G-GS-1

HWY: 17

W.P. No. 5146-09-00



SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED		
					SAND											
CLAY	FINE		MEDIUM		COARSE	FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT															
CLAY			SILT			V. FINE	FINE	MED.	COARSE		GRAVEL					U.S. BUREAU
					SAND											



GRAIN SIZE DISTRIBUTION SILT AND SAND, trace clay

FIG No. G-GS-2

HWY: 17

W.P. No. 5146-09-00

GEOGRAPHIC TOWNSHIP OF GRAHAM

Culvert H (G5) – Station 10+910 EBL

RECORD OF BOREHOLE No H-1

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 140 523.0 N; 282 010.0 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.H.S.A. and Dynamic Cone Penetration Test **COMPILED BY** H.G.
DATUM Geodetic **DATE** November 26, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								<div><div><div></div><div></div><div></div><div></div><div></div></div><div>20406080100</div></div> <div>○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE</div>										<div><div><div></div><div></div><div></div></div><div>204060</div></div>		
257.3	Ground surface																			
257.1 0.2	Topsoil		1	SS	4		257													
256.6 0.7	Silty sand, trace gravel																			
	Loose Brown Moist (FILL)																			
	Silty clay trace sand, trace gravel		2	SS	25		256													
	Very stiff Brown Moist to hard		3	SS	22															
255.1 2.2	End of borehole		4	SS	30/3cm		255													
254.9 2.4	Probable silty clay																			
	End of dynamic cone penetration test																			
	Refusal on probable boulders																			
	* Borehole dry																			
	C.F.H.S.A. denotes Continuous flight hollow stem augers																			
	Hand sugar probe advanced at Sta. 10+900 on WBL median encountered 0.4m of water underlain by brown clayey silt with organics to 1.1m (no refusal)																			

RECORD OF BOREHOLE No H-2

1 of 1

METRIC

G.W.P. 5146-09-00	LOCATION Coords: 5 140 510.9 N; 282 019.0 E	ORIGINATED BY F.P.
DIST Sudbury HWY 17	BOREHOLE TYPE Continuous Flight Hollow Stem Augers	COMPILED BY H.G.
DATUM Geodetic	DATE December 05, 2012	CHECKED BY B.R.G.

[illegible]

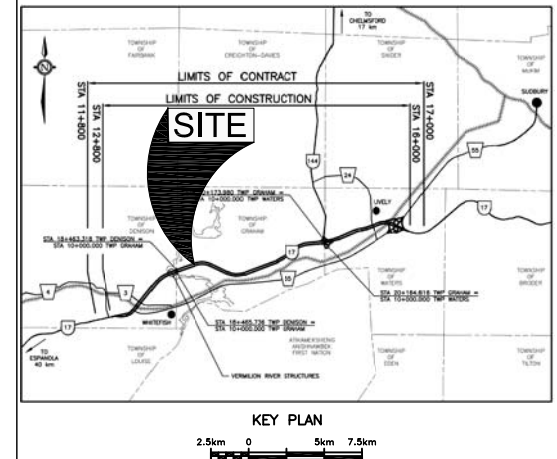
RECORD OF BOREHOLE No H-3

1 of 1

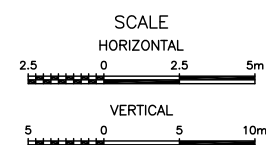
METRIC








G.W.P. 5146-09-00 **LOCATION** Coords: 5 140 477.9 N; 282 013.5 E **ORIGINATED BY** S.A.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod and Washboring + Dynamic Cone Penetration Test **COMPILED BY** H.G.
DATUM Geodetic **DATE** December 06 and 07 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
256.0 0.0	Ground surface							20	40	60	80	100								
255.9 0.1	Topsoil		1	SS	5															
	Clayey silt, trace sand rootlets, organics																			
255.0 1.0	Firm Brown/ Wet grey (FILL)		2	SS	21		255													
	Clayey silt, some sand trace gravel, rootlets sand seams		3	SS	11															
253.8 2.2	Stiff to Brown/ Moist very stiff grey						254													
	Sandy silt, some gravel trace clay, cobbles		4	SS	21			120/23cm												
253.1 2.9	Compact Grey Wet																			
	End of borehole																			
	Refusal on probable bedrock																			
	* Borehole charged with drilling water																			
	Hand auger probe advanced at Sta. 10+900 on EBL encountered 0.3m of water underlain by clayey silt, trace sand, trace gravel, organics to 1.1m. No refusal was encountered on east side while refusal on probable boulders was encountered at 0.8m on west side.																			



1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
2. THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION. CULVERT PROFILE IS ESTIMATED.
3. DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.



LEGEND			
	Borehole		
	Borehole and Cone		
	Pavement borehole/Auger probe (AP)		
N	Blows/0.3m (Std. Pen Test, 475 J/blow)		
CONE	Blows/0.3m (60 Cone, 475 J/blow)		
	WL at time of investigation Nov. & Dec. 2012		
WH	Penetration due to weight of hammer		
*	Water level not established		
	Head		
ARTESIAN WATER			
	Encountered		
	PIEZOMETER		
BH No	ELEVATION	NORTHINGS	EASTINGS
H-1	257.3	5 140 523.0	282 010.0
H-2	261.0	5 140 510.9	282 019.0
H-3	256.0	5 140 477.9	282 013.5

- NOTE -

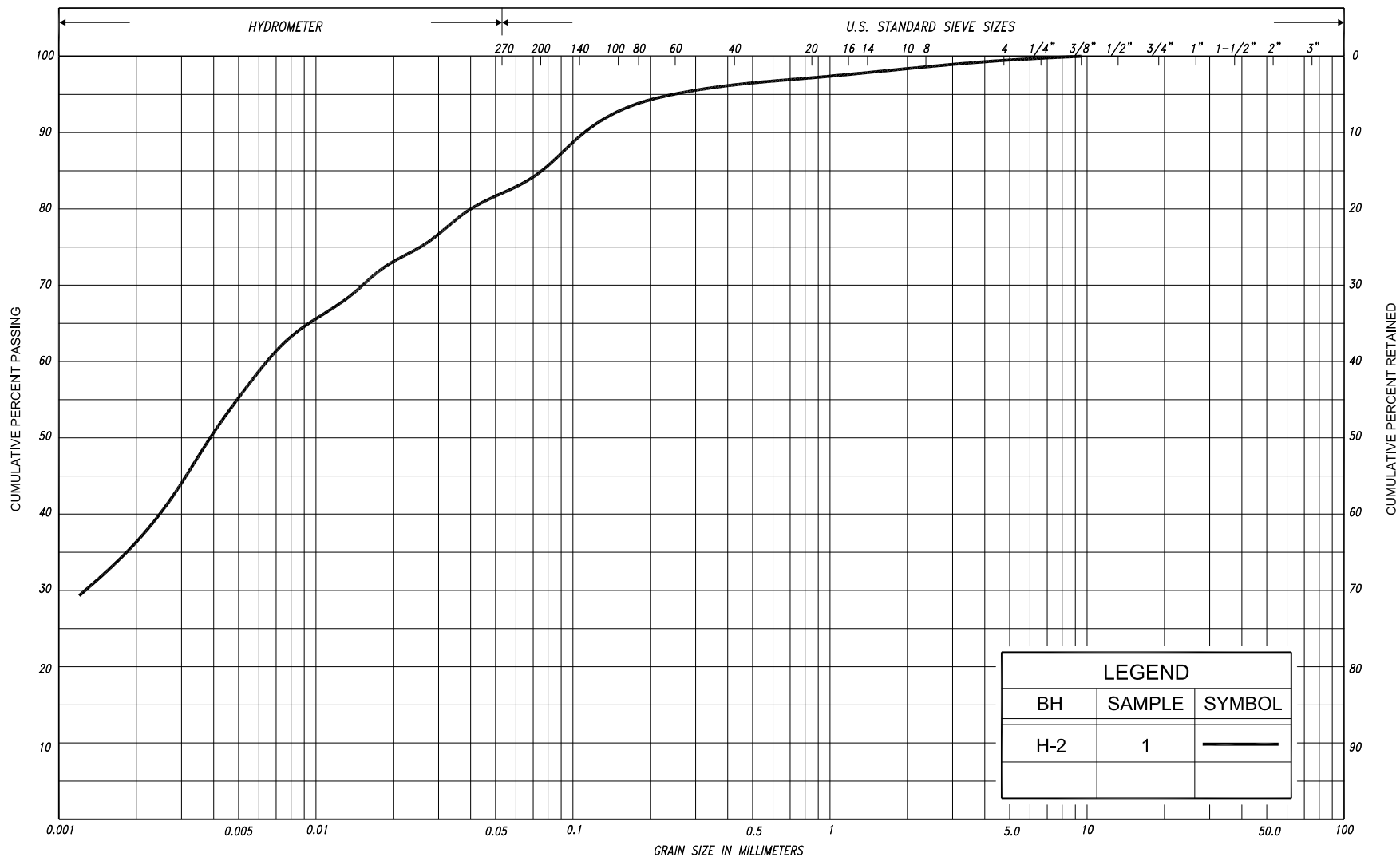
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

REVISIONS		
DATE	BY	DESCRIPTION

Geocres No.411-299

HWY No	17			DIST	Sudbury
SUBM'D	NA	CHECKED	NR	DATE	APR. 16, 2014
DRAWN	NA	CHECKED	BRG	APPROVED	CN
				DWG	H-1

Reference AECOM Drawings: NTB-01207011.dwg and GRAHAM X-SECTIONS with Culverts and viewport.dwg received on November 25, 2013 and April 01, 2014 respectively.

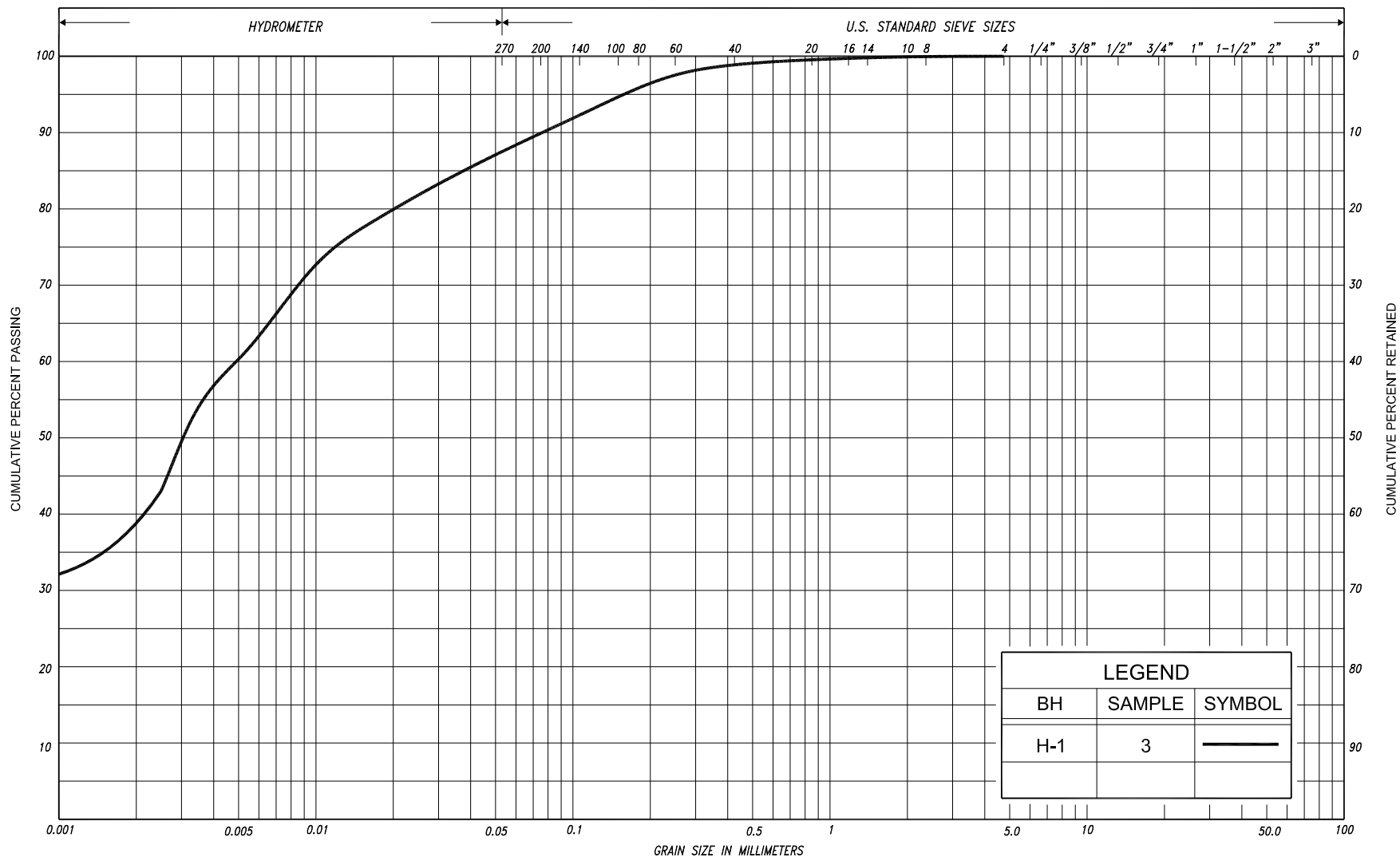


SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED		
					SAND											
CLAY	FINE		MEDIUM		COARSE	FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT															
CLAY			SILT			V. FINE	FINE	MED.	COARSE		GRAVEL					U.S. BUREAU
					SAND											



GRAIN SIZE DISTRIBUTION SILTY CLAY, some sand (CI) (FILL)

FIG No. H-GS-1
HWY: 17
W.P. No. 5146-09-00



SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL			COBBLES	UNIFIED		
					SAND												
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE			GRAVEL			COBBLES
	SILT							SAND									
CLAY			SILT			V. FINE		FINE	MED.	COARSE		GRAVEL				U.S. BUREAU	
					SAND												

GRAIN SIZE DISTRIBUTION

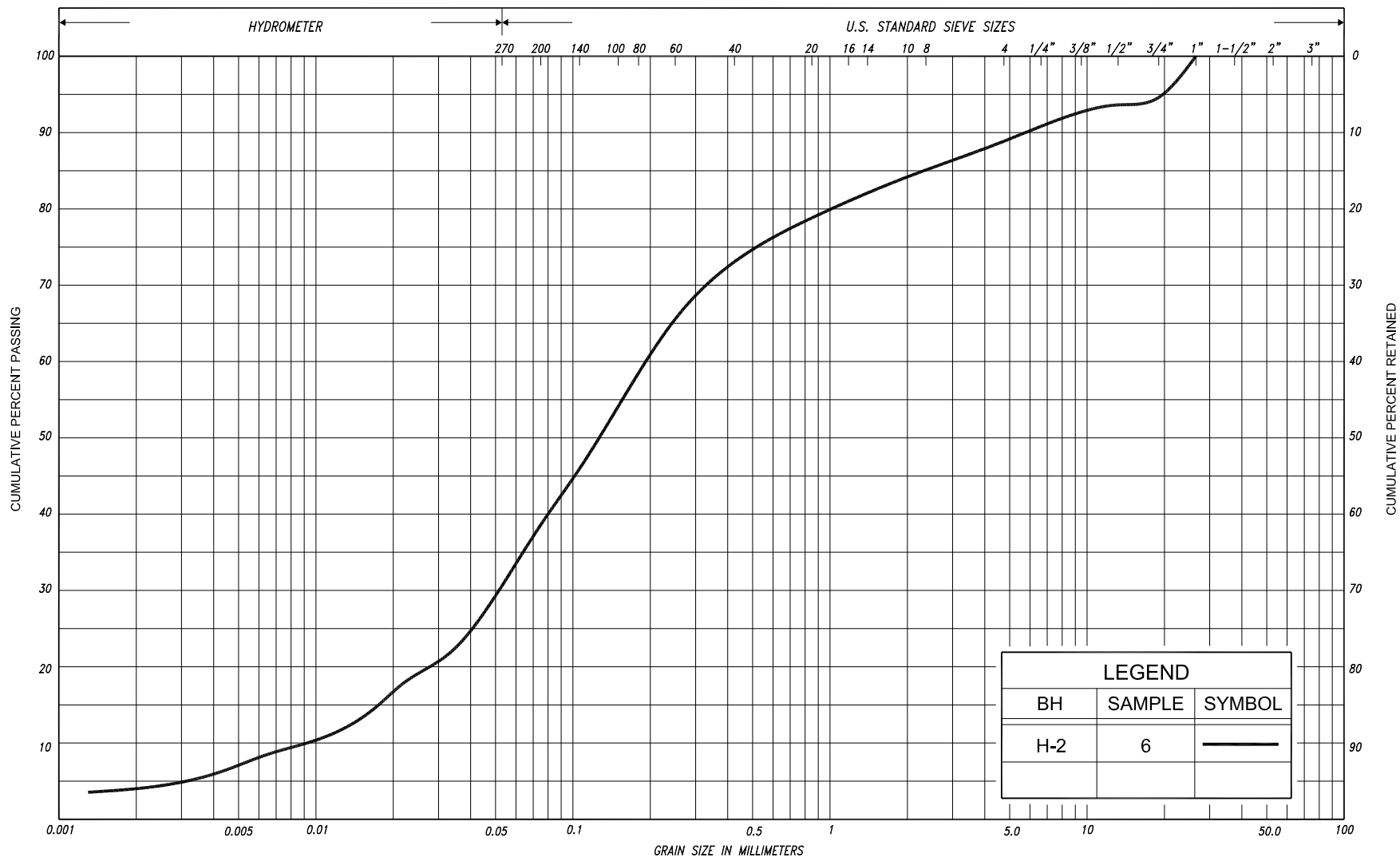
SILTY CLAY, trace sand (CI)

FIG No. H-GS-2

HWY: 17

W.P. No. 5146-09-00





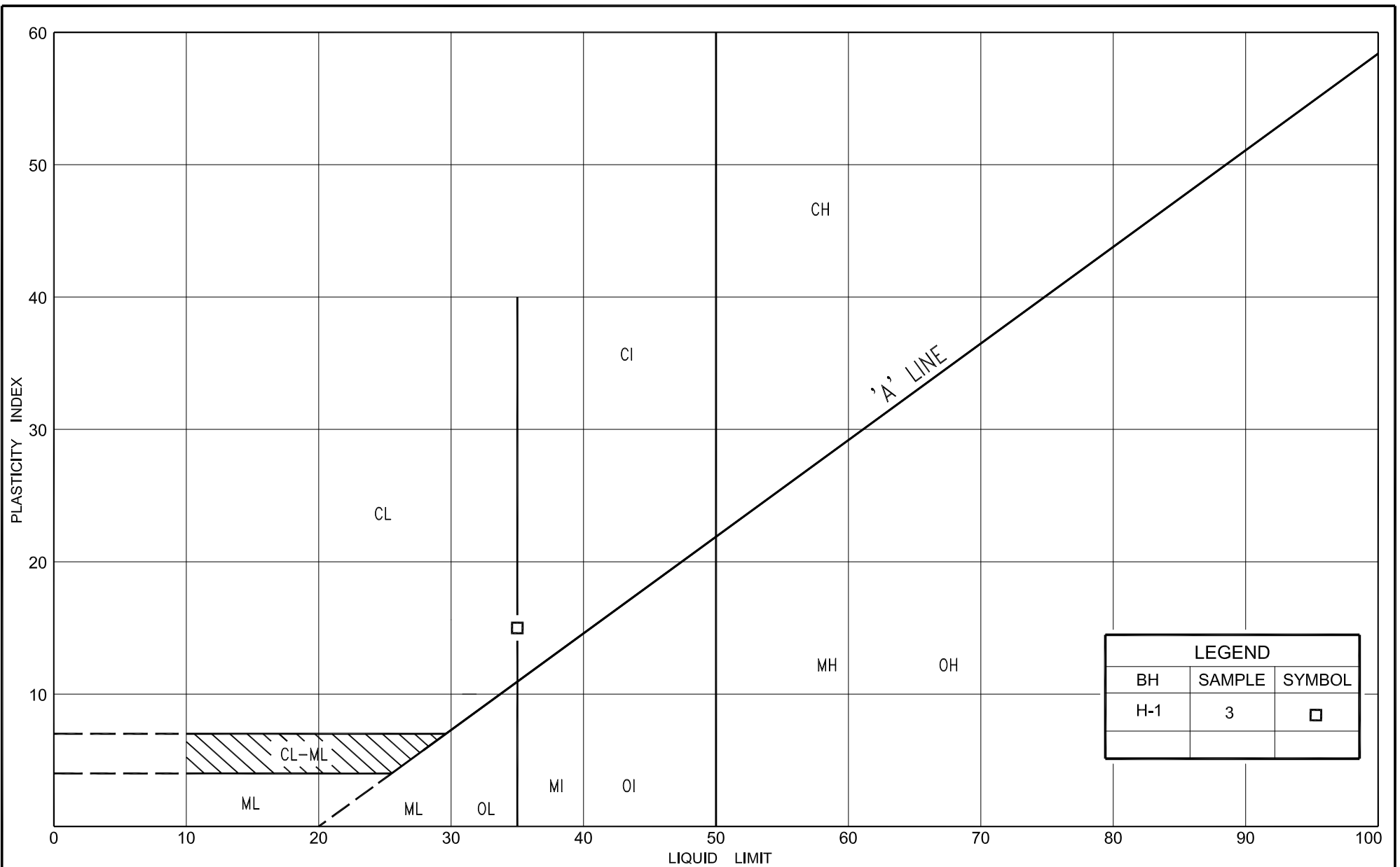
SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL			COBBLES	UNIFIED		
					SAND												
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE			GRAVEL			COBBLES
	SILT																
CLAY			SILT			V. FINE		FINE	MED.	COARSE		GRAVEL					U.S. BUREAU
SAND																	



GRAIN SIZE DISTRIBUTION

SILTY SAND, some gravel, trace clay

FIG No. H-GS-3
 HWY: 17
 W.P. No. 5146-09-00



PLASTICITY CHART

SILTY CLAY, trace sand (CI)

FIG No. H-PC-1

HWY: 17

W.P. No. 5146-09-00

GEOGRAPHIC TOWNSHIP OF GRAHAM
Culvert I (G7) – Station 12+273 C/L

RECORD OF BOREHOLE No I-1

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 140 567.2 N; 283 315.6 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.H.S.A. and Dynamic Cone Penetration Test **COMPILED BY** N.R.
DATUM Geodetic **DATE** November 19, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE				SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
256.0	Ground surface						20	40	60	80	100							
255.8 0.2	Topsoil																	
	Silty clay, trace sand		1	SS	7													
	Firm Brown Wet (FILL)																	
			2	SS	7													
254.6 1.4	Clay, trace sand organics to 2.2m																	
	Stiff Dark Wet to firm grey		3	SS	12													
	Brown																	
			4	SS	8													
	silt partings																	
	Mottled grey/brown		5	SS	7													
252.3 3.7	Silty clay, trace sand varved																	
	Firm Reddish Moist brown		6	SS	4													
			7	SS	WH**													
				FV														
	Grey		8	TW	-													
				FV														
			9	SS	WH													
				FV														
248.1 7.9	End of borehole		10	SS	6/15cm													
247.6 8.4	Probable silty clay																	
	Very stiff																	
	End of dynamic cone penetration test																	
	Refusal on probable bedrock																	
	Sample 10: Sampler bouncing																	
												</						

RECORD OF BOREHOLE No I-2

1 of 2

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 140 535.6 N; 283 316.5 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Sonic + Rotatory Displacement **COMPILED BY** N.R.
DATUM Geodetic **DATE** June 5 and 6, 2013 **CHECKED BY** B.R.G.



SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)	
								○ UNCONFINED		+ FIELD VANE							○	
								● QUICK TRIAXIAL		× LAB VANE								
264.8	Ground surface																	
0.0	100mm thick asphalt over sand and gravel																	
264.3	(PAVEMENT FILL)																	
0.5	Cobbles and boulders (ROCKFILL)																	
							264											
							263											
							262											
							261											
							260											
							259											
							258											
							257											
							256											
							255											
254.2	Silty clay, trace sand organics						254											
10.6	Stiff Mottled Moist grey/brown		1	SS	12										0 8 48 44			
							253											
			2	SS	WH**													
				FV			252											
			3	SS	WH		251								0 2 44 54			
				FV														
							250											

RECORD OF BOREHOLE No I-2

2 of 2

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 140 535.6 N; 283 316.5 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Sonic + Rotatory Displacement **COMPILED BY** N.R.
DATUM Geodetic **DATE** June 5 and 6, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
249.8							20	40	60	80	100	20	40	60						
248.3 16.5	Silty clay, trace sand sand partings					249														
	Stiff Grey Wet (Cont'd.)		4	SS	WH															
				FV																
247.6 17.2	Sand trace silt, trace gravel					248														
Compact Grey Wet	5		SS	22																
	End of borehole Refusal on probable bedrock																			
	* Borehole charged with drilling water WH** denotes penetration due to weight of rods																			

RECORD OF BOREHOLE No I-3

1 of 2

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 140 513.3 N; 283 308.1 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.H.S.A. and 'N' Casing **COMPILED BY** N.R.
DATUM Geodetic **DATE** November 20 and 21, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)	
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE							
263.4	Ground surface						20	40	60	80	100							
0.0	Sand and gravel		1	AS	-													
262.8	(PAVEMENT FILL)																	
0.6	Cobbles and boulders																	
	(ROCKFILL)																	
259.7							263											
3.7	Silty clay trace sand, trace gravel		2	SS	4													
	Firm to Grey Wet stiff																	
	(FILL)		3	SS	6													
				FV														
			4	SS	7													
			5	SS	7													
	wood chips and organics		6	SS	8													
254.9																		
8.5	Clay, trace sand silt partings																	
	Very stiff Mottled Wet to stiff grey/ brown		7	SS	13													
			8	SS	4***													
				FV														
251.8																		
11.6	Silty clay		9	SS	WH**													
	Firm Grey Wet																	
	silt partings		10	SS	WH													
248.5																		

RECORD OF BOREHOLE No I-3

2 of 2

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 140 513.3 N; 283 308.1 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.H.S.A. and 'N' Casing **COMPILED BY** N.R.
DATUM Geodetic **DATE** November 20 and 21, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED		+ FIELD VANE		● QUICK TRIAXIAL						× LAB VANE		
248.4		• •					20	40	60	80	100	20	40	60						
14.9	Silty sand, trace clay	• •	11	SS	10/8cm		248													
248.0	Dense Grey Wet																			
15.4	End of borehole																			
	Refusal on probable bedrock																			
	Sample 11: Sampler bouncing																			
										</										

RECORD OF BOREHOLE No I-4

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 140 494.8 N; 283 313.3 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Sonic + Rotatory Displacement **COMPILED BY** N.R.
DATUM Geodetic **DATE** May 28, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE						
263.9	Ground surface																
0.0	100mm thick asphalt over sand and gravel																
263.4	(PAVEMENT FILL)																
0.5	Cobbles and boulders (ROCKFILL)																
							263										
							262										
							261										
							260										
							259										
							258										
							257										
							256										
255.4	Silty clay, trace sand organics						255										
8.5	Stiff to firm Mottled grey/brown Moist to wet		1	SS	10												
				FV			254										
							253										
			2	SS	WH**												
				FV			252										
							251										
			3	SS	WH												
				FV													
250.2	End of borehole																
13.7	Refusal on probable bedrock																
	* Borehole charged with drilling water																
	■ Penetrometer test																
																WH** denotes penetration due to weight of rods and hammer	

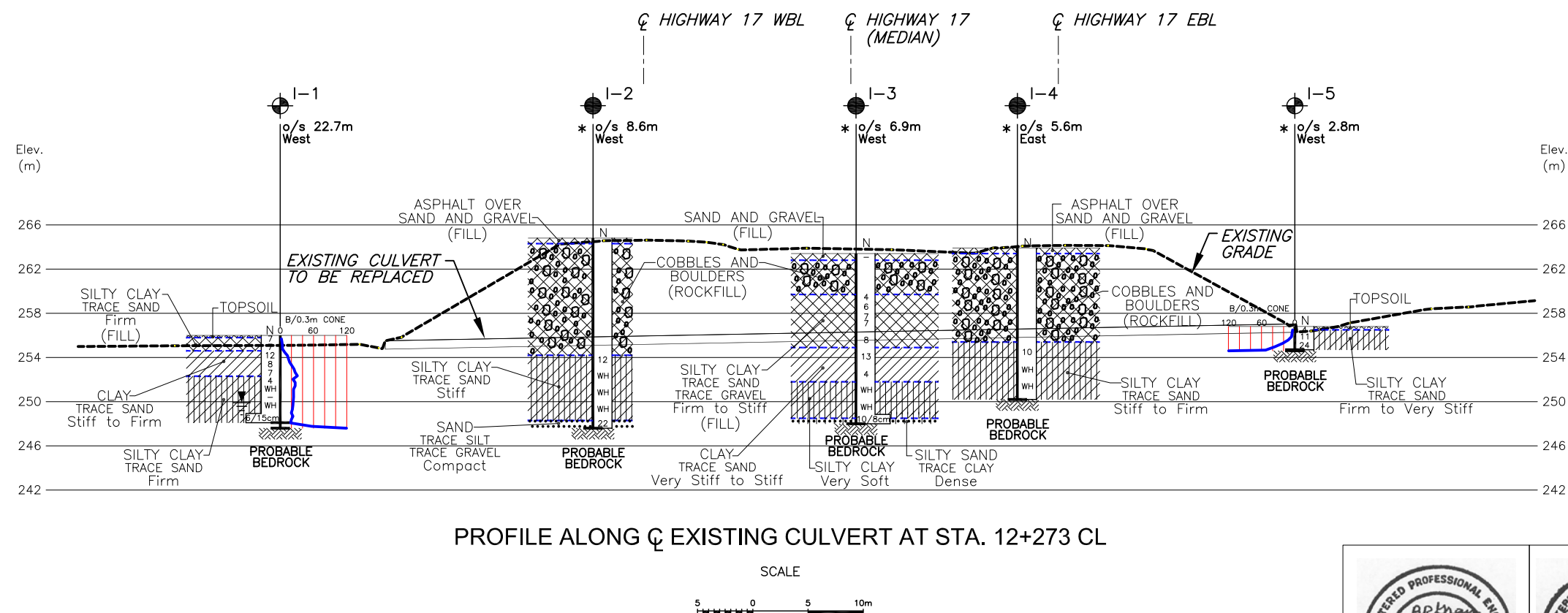
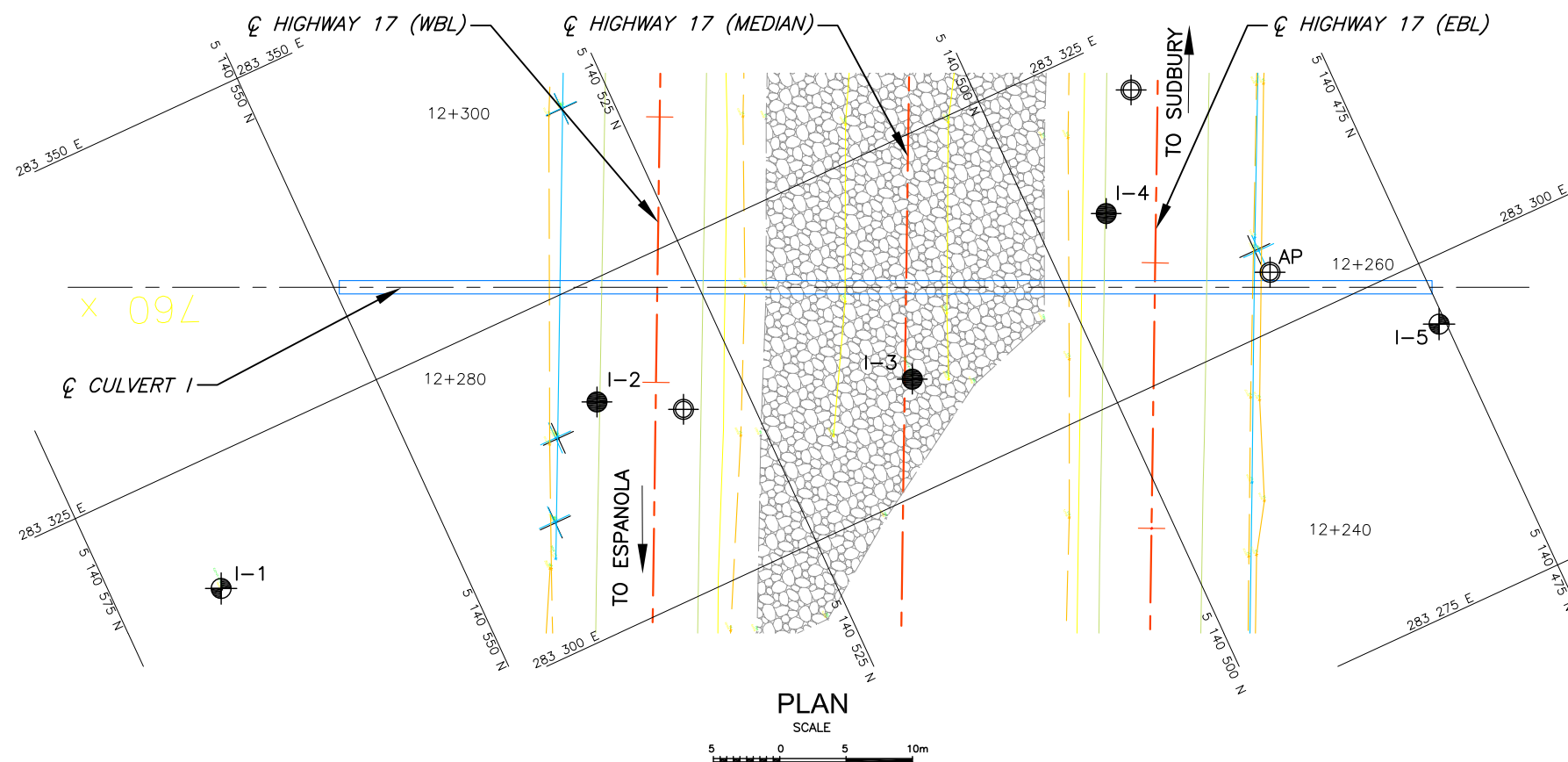
RECORD OF BOREHOLE No I-5

1 of 1

METRIC


G.W.P. 5146-09-00 **LOCATION** Coords: 5 140 475.5 N; 283 295.2 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod + Casing + Dynamic Cone Penetration Test **COMPILED BY** N.R.
DATUM Geodetic **DATE** May 03 and 06, 2013 **CHECKED BY** B.R.G.

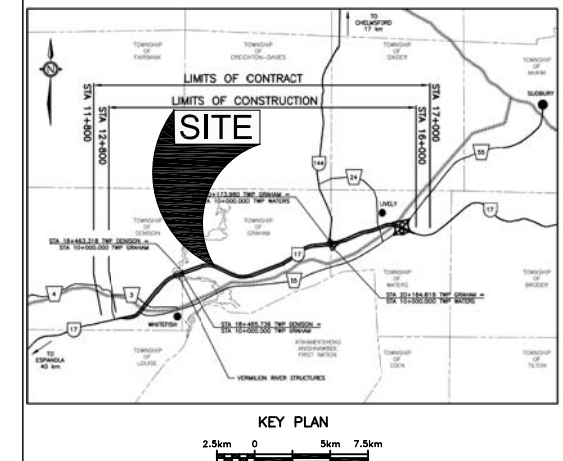
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
256.8	Ground surface																			
0.0 256.5 0.3	Topsoil		1	SS	4															
	Silty clay, trace sand organics		2	SS	11															
	Firm to Mottled Moist very stiff grey/ brown																			
254.7 2.1	clayey silt layers		3	SS	24															
254.6 2.2	End of borehole																			
	End of dynamic cone penetration test																			
	Refusal on probable bedrock																			
	* Borehole charged with drilling water																			
	■ Penetrometer test																			
	NOTE: Dynamic cone penetration test was carried out 2m west of borehole I-5.																			
	Auger probe was carried out east end toe of slope, silty clay was encountered to 0.7m, refusal on rockfill																			











NOTES:

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2. THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION. CULVERT PROFILE IS ESTIMATED.
3. DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.

CONT No GWP No 5146-09-00	
REPLACEMENT CULVERT I HIGHWAY 17 STA 12+273 CL GEOGRAPHIC TOWNSHIP OF GRAHAM BOREHOLE LOCATIONS AND SOIL STRATA	SHEET



LEGEND			
	Borehole		
	Borehole and Cone		
	Pavement borehole/Auger probe (AP)		
N	Blows/0.3m (Std. Pen Test, 475 J/blow)		
CONE	Blows/0.3m (60 Cone, 475 J/blow)		
	WL at time of investigation Nov. 2012, May & June 2013		
WH	Penetration due to weight of hammer		
*	Water level not established		
	Head		
	ARTESIAN WATER		
	Encountered		
	PIEZOMETER		
BH No	ELEVATION	NORTHINGS	EASTINGS
I-1	256.0	5 140 567.2	283 315.6
I-2	264.8	5 140 535.6	283 316.5
I-3	263.4	5 140 513.3	283 308.1
I-4	263.9	5 140 494.8	283 313.3
I-5	256.8	5 140 475.5	283 295.2

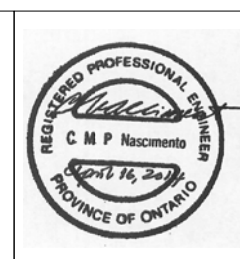
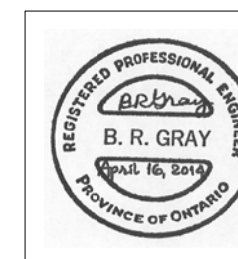
- NOTE -

The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

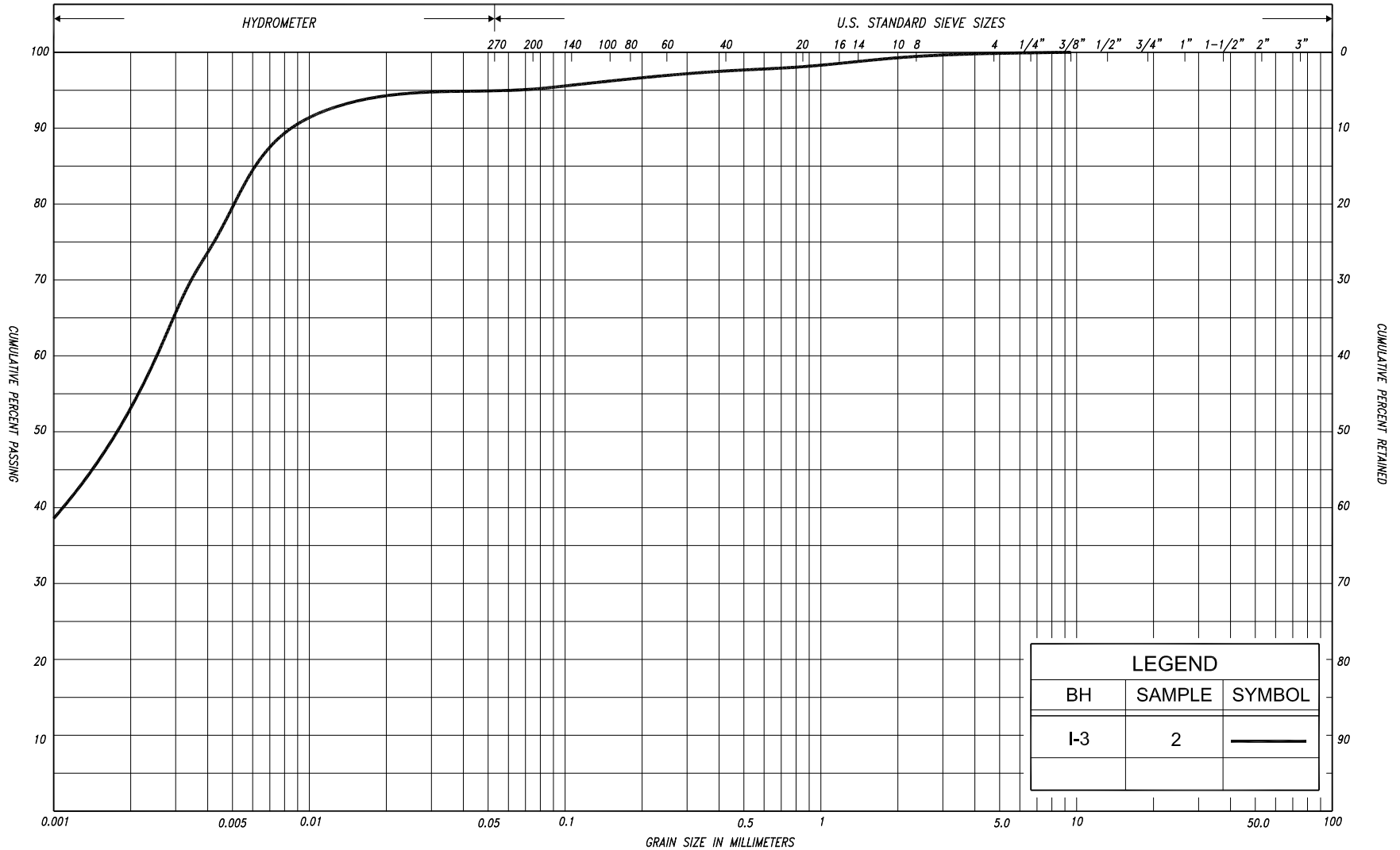
REVISIONS			
	DATE	BY	DESCRIPTION

Geocres No.411-299

HWY No	17			DIST	Sudbury
SUBM'D	NA	CHECKED	NR	DATE	APR. 16, 2014
DRAWN	NA	CHECKED	BRG	APPROVED	CN
				DWG	I-1



Reference AECOM Drawings:
NTB-01207011.dwg and GRAHAM X-SECTIONS with Culverts and viewport.dwg
received on November 25, 2013 and April 01, 2014 respectively.



SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL				COB BLES	UNIFIED			
					SAND														
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL				COBBLES	M.I.T.	
	SILT																		
CLAY			SILT			V. FINE	FINE	MED.	COARSE		GRAVEL								U.S. BUREAU
						SAND													

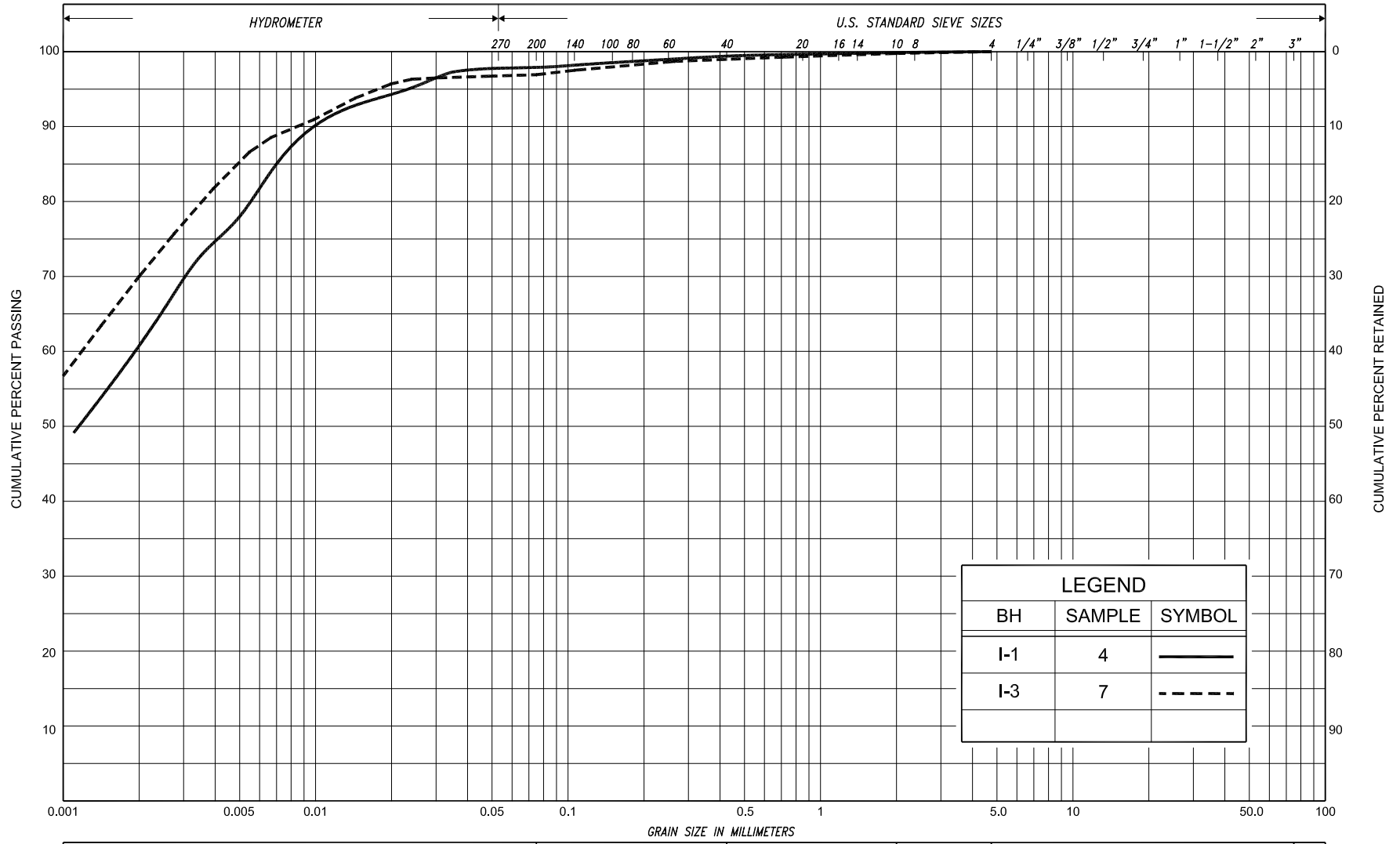
GRAIN SIZE DISTRIBUTION SILTY CLAY, trace sand (CI) (FILL)

FIG No. I-GS-1

HWY: 17

G.W.P. No. 5146-09-00





LEGEND		
BH	SAMPLE	SYMBOL
I-1	4	————
I-3	7	-----

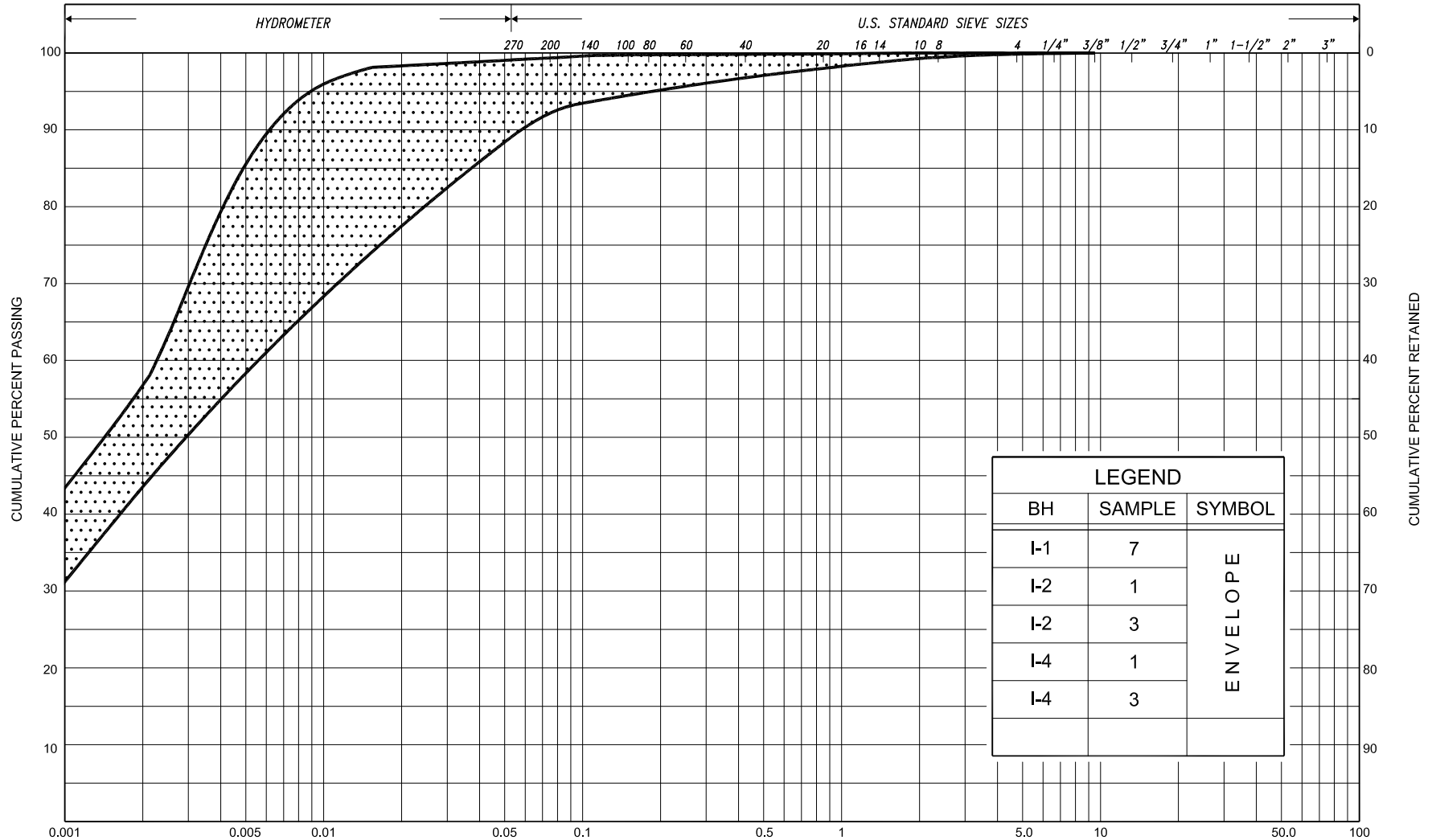
SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED		
					SAND											
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL			COBBLES
						SAND										
CLAY		SILT			V. FINE	FINE	MED.	COARSE		GRAVEL					U.S. BUREAU	
					SAND											



GRAIN SIZE DISTRIBUTION

CLAY, trace sand (CH)

FIG No.	I-GS-2
HWY:	17
G.W.P. No.	5146-09-00



LEGEND		
BH	SAMPLE	SYMBOL
I-1	7	ENVELOPE
I-2	1	
I-2	3	
I-4	1	
I-4	3	

SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL				COBBLES	UNIFIED		
					SAND													
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL				COBBLES	M.I.T.
	SILT																	
CLAY		SILT			V. FINE	FINE	MED.	COARSE		GRAVEL							U.S. BUREAU	
					SAND													



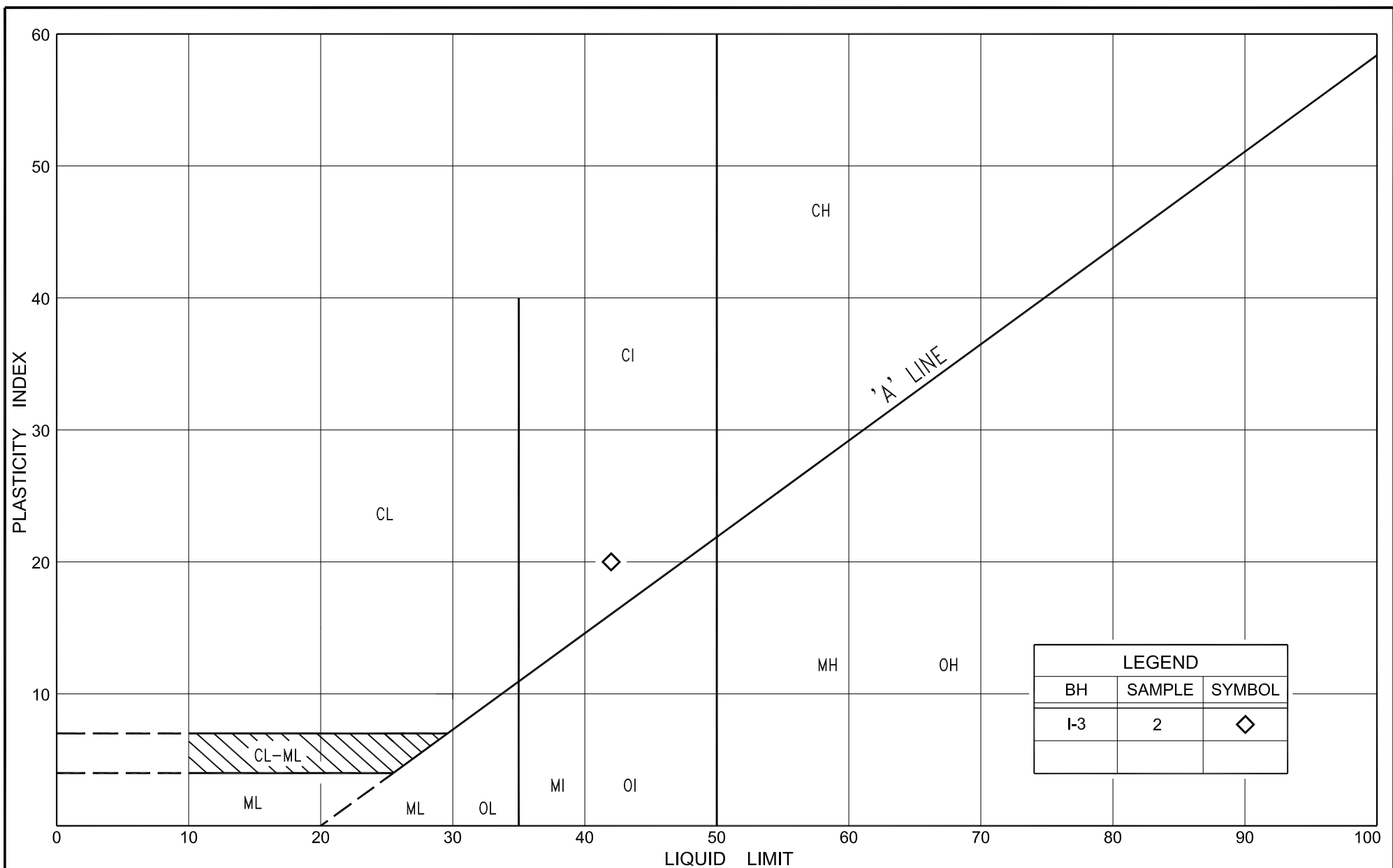
GRAIN SIZE DISTRIBUTION

SILTY CLAY, trace sand (CI)

FIG No. I-GS-3

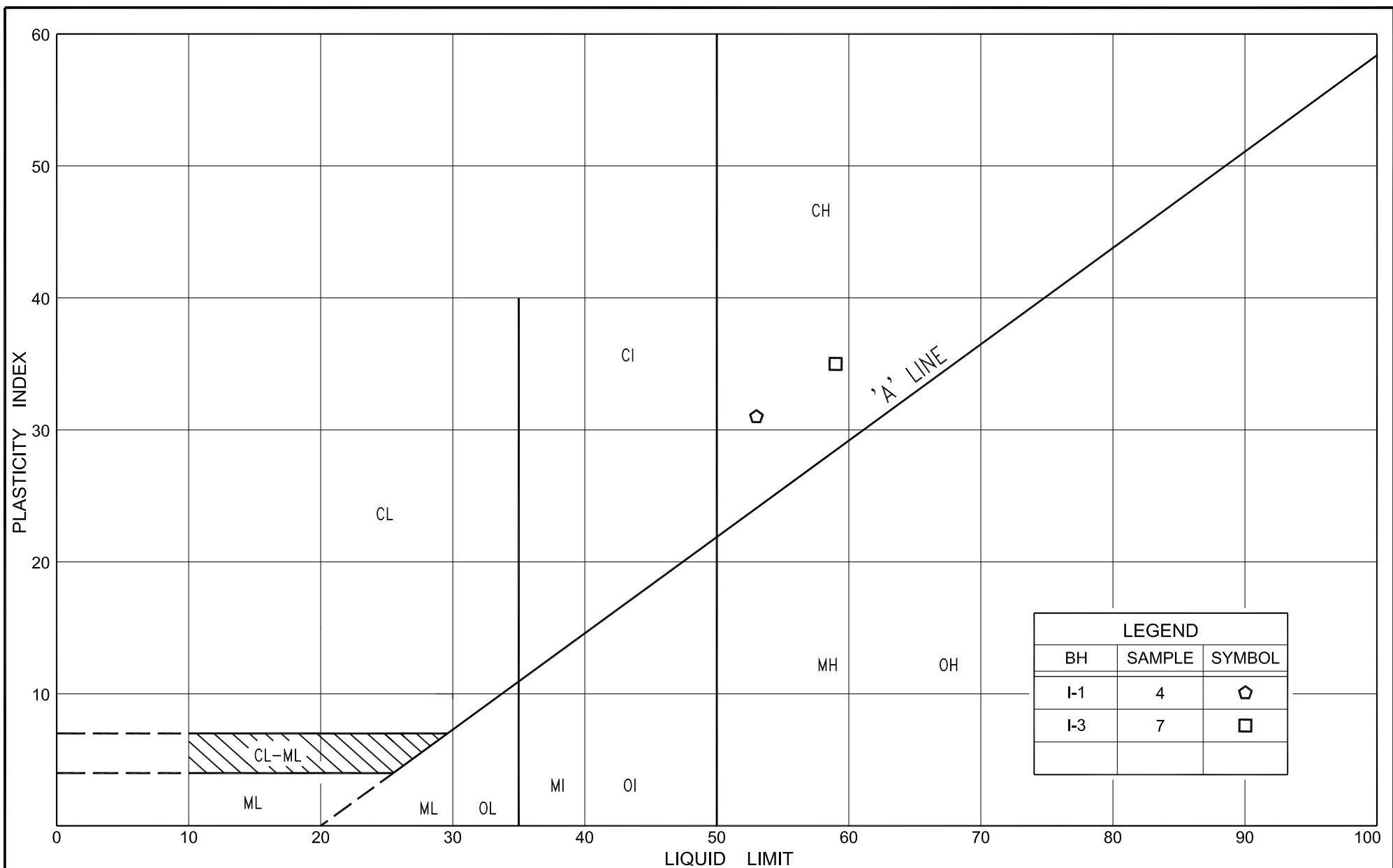
HWY: 17

G.W.P. No. 5146-09-00



PLASTICITY CHART
SILTY CLAY, trace sand (CI)
(FILL)

FIG No. I-PC-1
HWY: 17
G.W.P. No. 5146-09-00



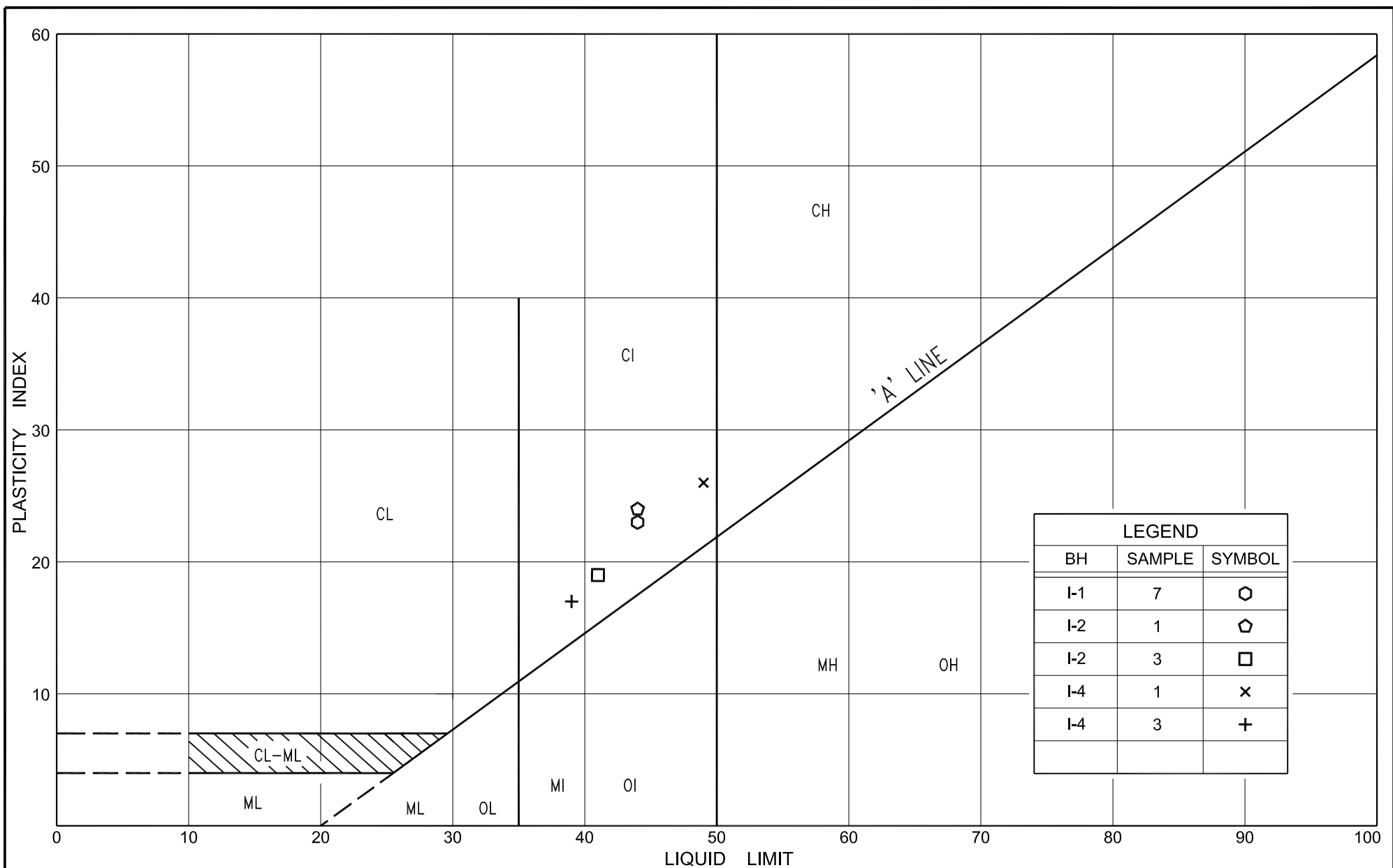
PLASTICITY CHART

CLAY, trace sand (CH)

FIG No. I-PC-2

HWY: 17

G.W.P. No. 5146-09-00



PLASTICITY CHART
 SILTY CLAY, trace sand (CI)

FIG No. I-PC-3
 HWY: 17
 G.W.P. No. 5146-09-00

GEOGRAPHIC TOWNSHIP OF GRAHAM
Culvert J1 (G8) – Station 12+620 WBL

RECORD OF BOREHOLE No J1-1

1 of 1

METRIC

G.W.P. 5146-09-00

LOCATION Coords: 5 140 387.2 N; 283 654.1 E

ORIGINATED BY F.P.

DIST Sudbury

HWY 17

BOREHOLE TYPE C.F.H.S.A. and Dynamic Cone Penetration Test

COMPILED BY N.R.

DATUM Geodetic

DATE November 19, 2012

CHECKED BY B.R.G.

[illegible]

RECORD OF BOREHOLE No J1-2

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 140 379.3 N; 283 644.3 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.S.S.A. and 'N' Casing **COMPILED BY** N.R.
DATUM Geodetic **DATE** November 15, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE										○ QUICK TRIAXIAL × LAB VANE		
								20	40	60	80	100						20	40	60
254.8	Ground surface																			
0.0	150 mm thick asphalt over sand and gravel																			
254.0	Rock fill sand and gravel cobbles and boulders (ROCKFILL)						254													
0.8																				

RECORD OF BOREHOLE No J1-3

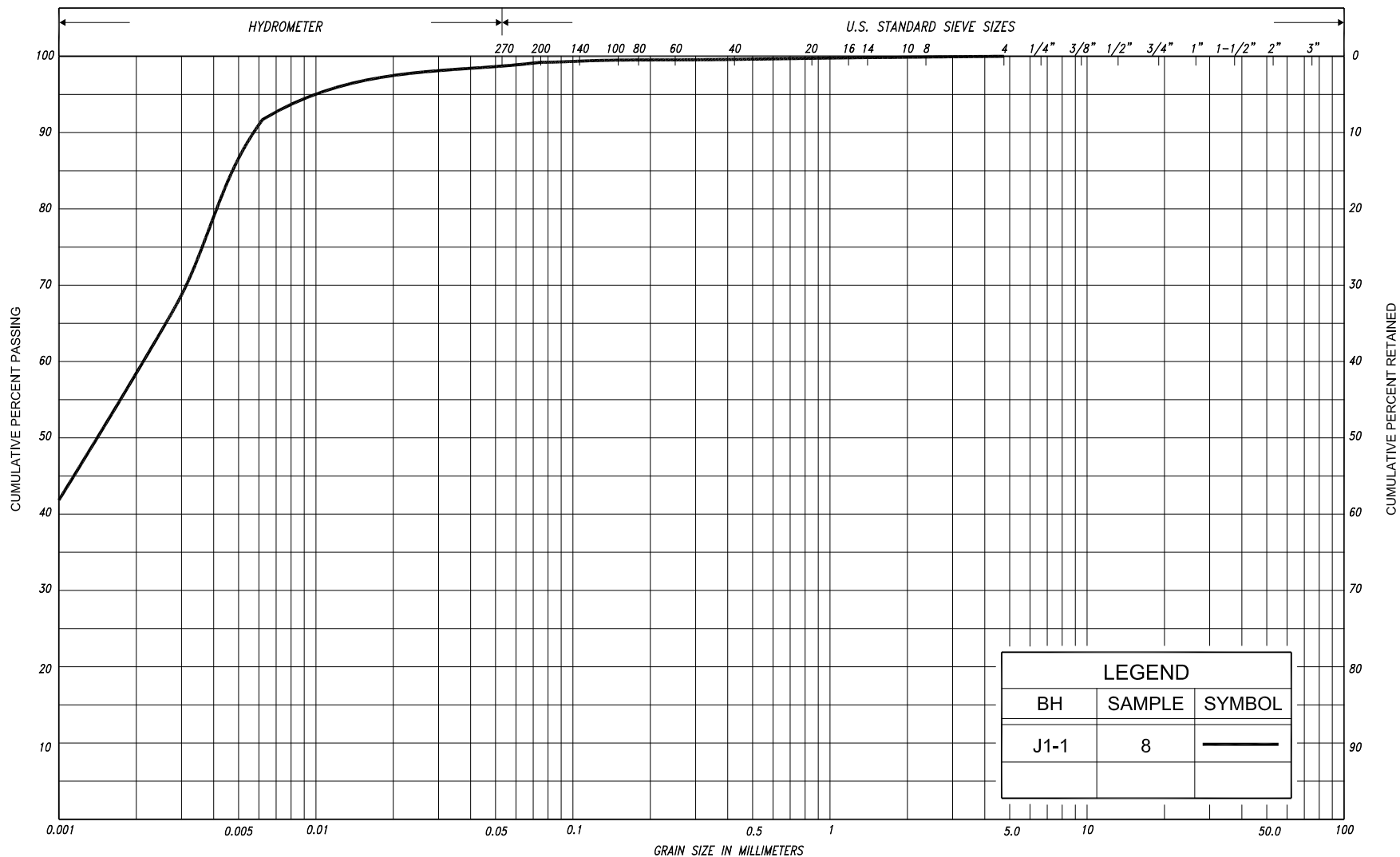
1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 140 372.5 N; 283 610.9 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.H.S.A. and Dynamic Cone Penetration Test **COMPILED BY** N.R.
DATUM Geodetic **DATE** November 20, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		SHEAR STRENGTH kPa										WATER CONTENT (%)
							○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE							
250.7	Ground surface						20	40	60	80	100						
0.0	Peat, fine fibrous		1	SS	WH**										206		
	Dark brown																
	Wet		2	SS	WH	▽* ▼*									464		
	Amorphous, with shells		3	SS	WH										319		
			4	SS	WH										499		
			5	SS	WH										503		
246.6	Silt, trace clay		6	SS	3												
4.1	Very loose Grey Moist																
246.2	Clay, trace sand		7	SS	2												
4.5	Soft to Grey Moist firm		8	TW	-												
				FV													
			9	SS	WH												
				FV													
			10	SS	4												
242.0	End of borehole																
8.7	Probable sandy silt																
	Compact																
239.4	End of dynamic cone penetration test																
11.3	Refusal on probable bedrock																
	* 2012 11 20																
	▽ Water level observed during drilling																
	▼ Water level measured after drilling																
	WH** denotes penetration due to weight of rods and hammer																
	C.F.H.S.A. denotes Continuous Flight Hollow Stem Augers																

NOTE: Two auger probes advanced east and west of south end of the culvert to 1.4m where refusal was not met.



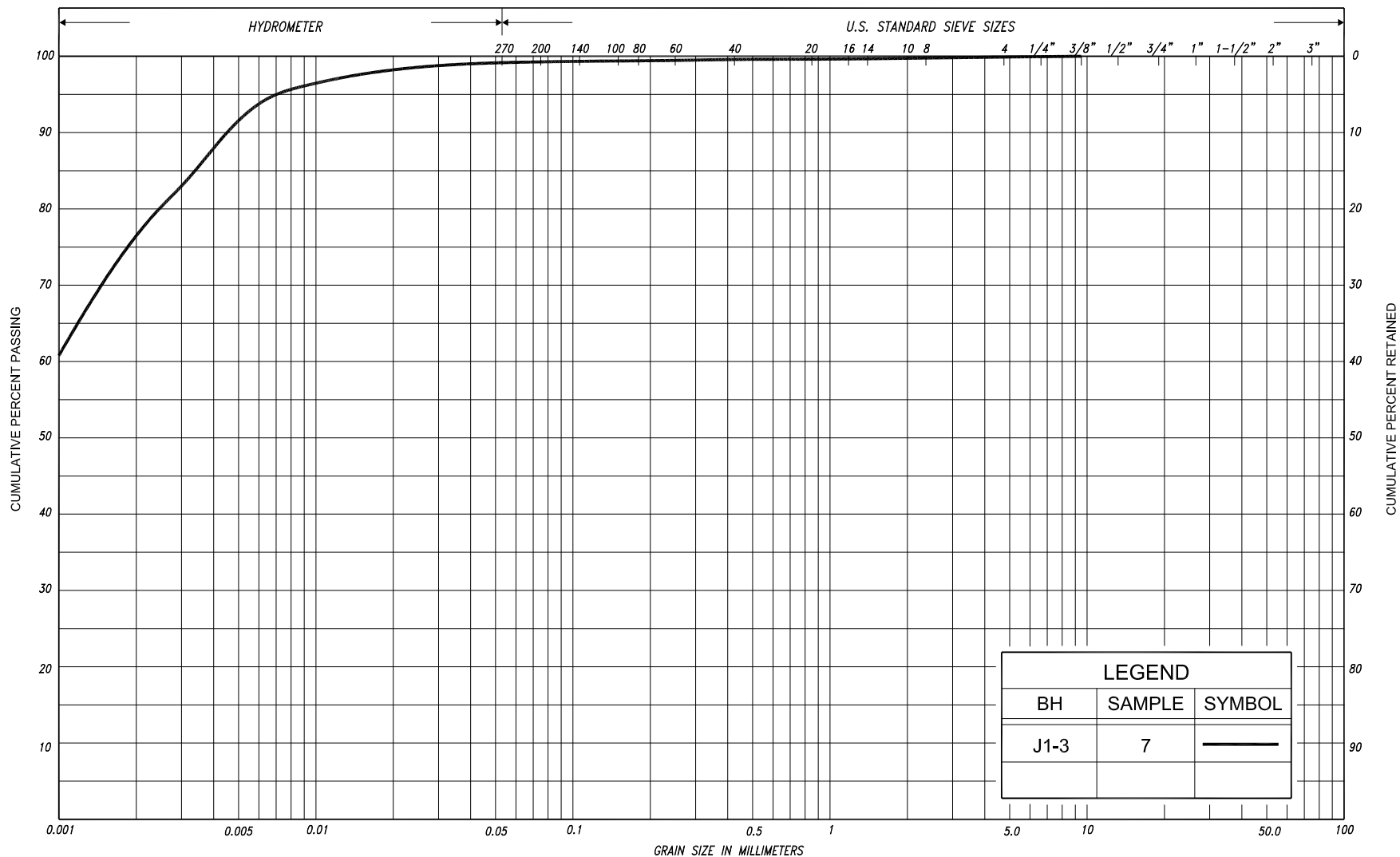
SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COB BLES	UNIFIED		
CLAY	FINE		MEDIUM	COARSE	FINE		MEDIUM		COARSE	GRAVEL			COBBLES	M.I.T.		
	SILT				SAND									U.S. BUREAU		
CLAY		SILT			V. FINE	FINE	MED.	COARSE	GRAVEL							
				SAND												



GRAIN SIZE DISTRIBUTION

SILTY CLAY, trace sand (CI)

FIG No. J1-GS-1
 HWY: 17
 W.P. No. 5146-09-00



SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COB BLES	UNIFIED		
					SAND											
CLAY	FINE		MEDIUM		COARSE	FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT							SAND								
CLAY		SILT			V. FINE	FINE	MED.	COARSE		GRAVEL						U.S. BUREAU
					SAND											



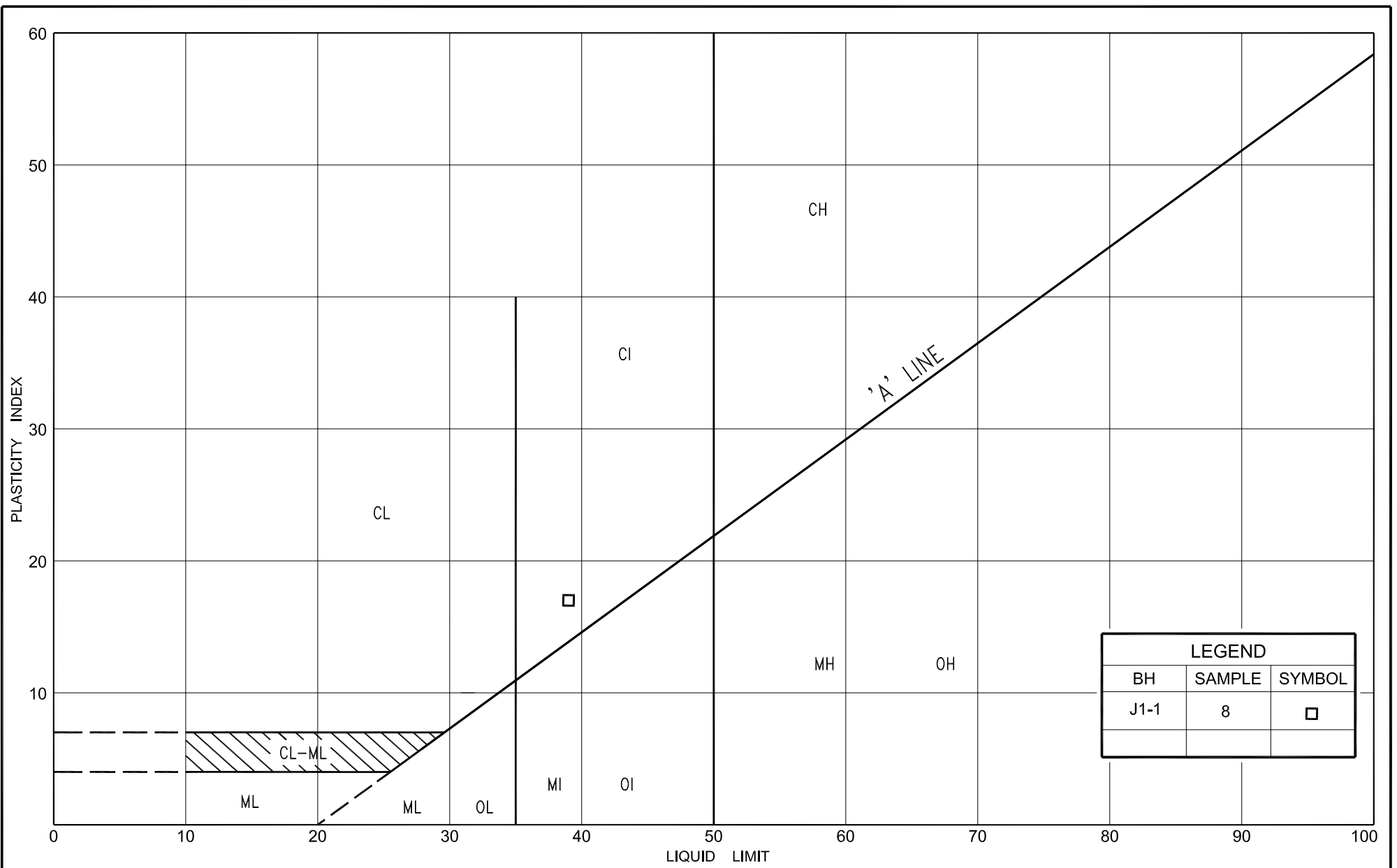
GRAIN SIZE DISTRIBUTION

CLAY, trace sand (CH)

FIG No. J1-GS-2

HWY: 17

W.P. No. 5146-09-00



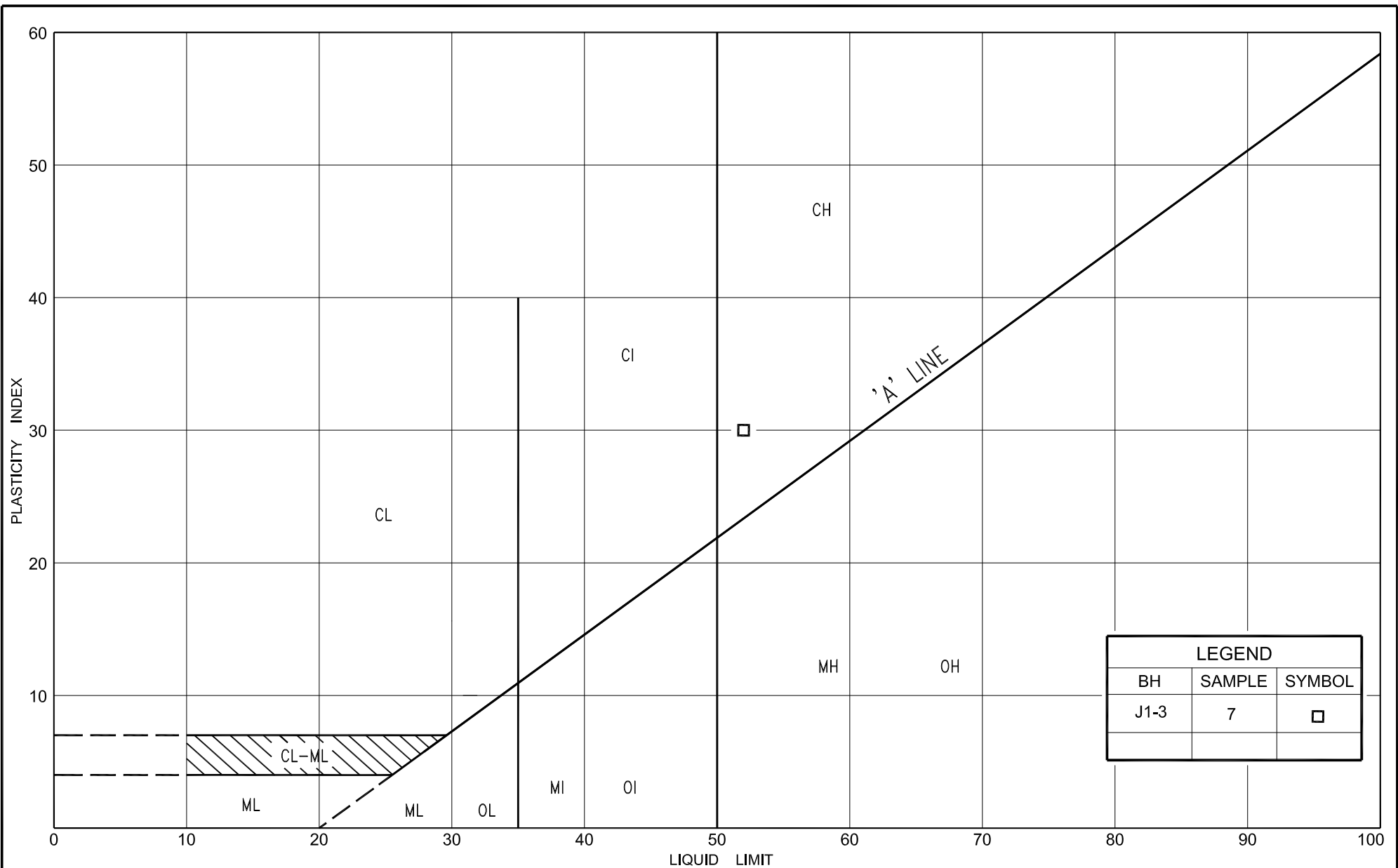
PLASTICITY CHART

SILTY CLAY, trace sand (CI)

FIG No. J1-PC-1

HWY: 17

W.P. No. 5146-09-00



PLASTICITY CHART

CLAY, trace sand (CH)

FIG No.	J1-PC-2
HWY:	17
W.P. No.	5146-09-00

GEOGRAPHIC TOWNSHIP OF GRAHAM
Culvert J2 (G9) – Station 12+630 EBL

RECORD OF BOREHOLE No J2-1

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 140 341.5 N; 283 636.2 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.H.S.A. and 'N' Casing **COMPILED BY** N.R.
DATUM Geodetic **DATE** November 29, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE									
								● QUICK TRIAXIAL × LAB VANE									
					WATER CONTENT (%)												
254.2	Ground surface						20	40	60	80	100	20	40	60			
0.0	Sand and gravel		1	AS	-		254										
	Brown																
253.5	Rockfill with sand and gravel pockets						253										
0.7	(FILL)						252										
							251										
							250										
							249										
248.2	Sand, with gravel some silt, trace clay		2	SS	31		248					o				27 54 17 2	
6.0	Compact Grey Moist						247										
246.7	Gravel, rock fragments		3	SS	32/15cm												
7.5																	
246.3	End of borehole																
7.9	Refusal on probable bedrock																

RECORD OF BOREHOLE No J2-2

1 of 1

METRIC

G.W.P. 5146-09-00	LOCATION Coords: 5 140 323.8 N; 283 629.3 E	ORIGINATED BY S.A.
DIST Sudbury HWY 17	BOREHOLE TYPE Tripod and Washboring + Dynamic Cone Penetration Test	COMPILED BY N.R.
DATUM Geodetic	DATE December 05, 2012	CHECKED BY B.R.G.











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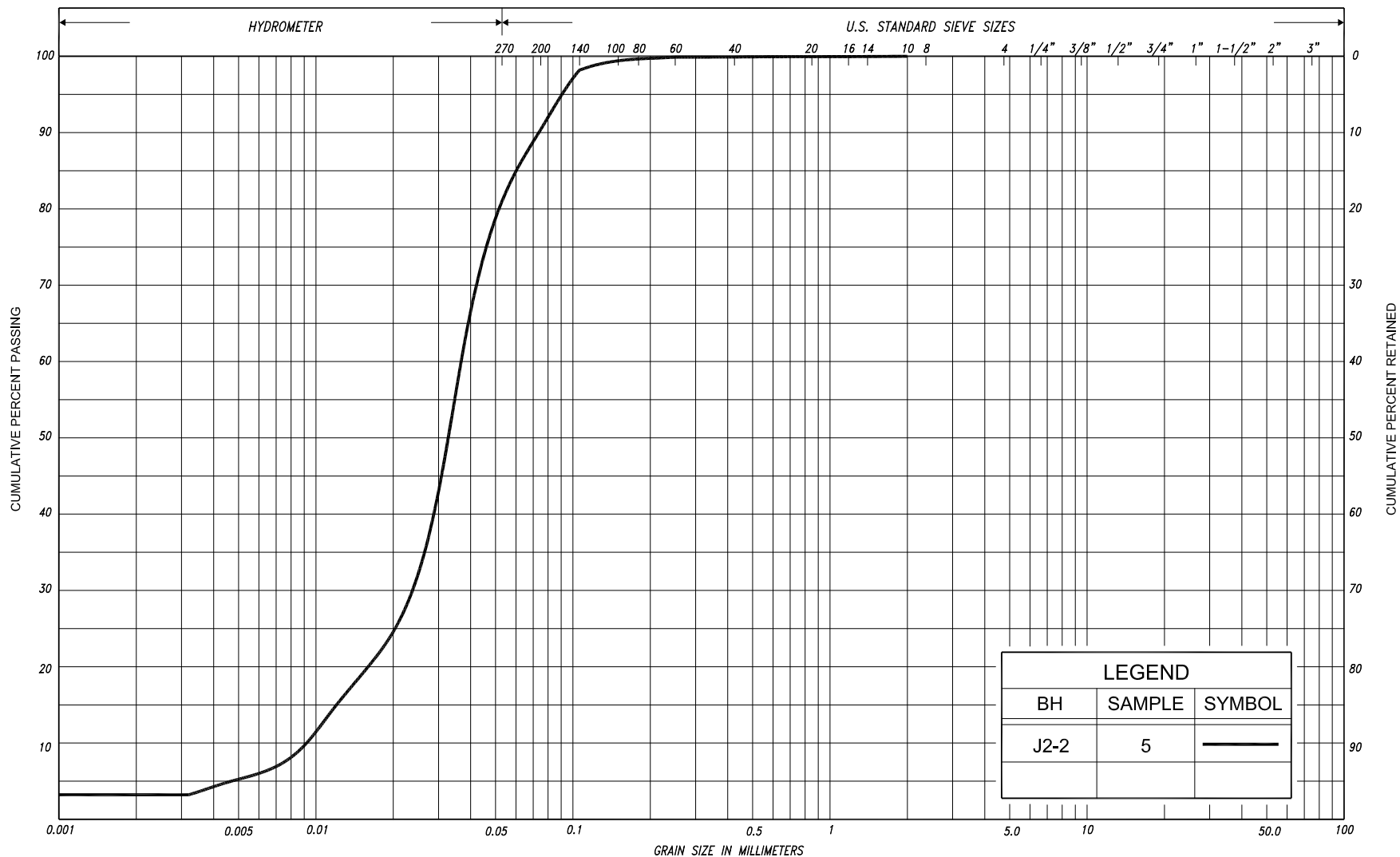
RECORD OF BOREHOLE No J1-3

1 of 1

METRIC

G.W.P. 5146-09-00 LOCATION Coords: 5 140 372.5 N; 283 610.9 E ORIGINATED BY F.P.
DIST Sudbury HWY 17 BOREHOLE TYPE C.F.H.S.A. and Dynamic Cone Penetration Test COMPILED BY N.R.
DATUM Geodetic DATE November 20, 2012 CHECKED BY B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)		
								○ UNCONFINED		+ FIELD VANE									
250.7	Ground surface						20	40	60	80	100								
0.0	Peat, fine fibrous Dark brown		1	SS	WH**										206				
	Wet		2	SS	WH	 *  *									464				
	Amorphous, with shells		3	SS	WH										319				
			4	SS	WH										499				
			5	SS	WH										503				
246.6	Silt, trace clay		6	SS	3														
4.1	Very loose Grey Moist		7	SS	2														
246.2	Clay, trace sand		8	TW	-														
4.5	Soft to Grey Moist firm				FV														
			9	SS	WH														
					FV														
			10	SS	4														
242.0	End of borehole																		
8.7	Probable sandy silt Compact																		
239.4	End of dynamic cone penetration test																		
11.3	Refusal on probable bedrock																		
	* 2012 11 20																		
	 Water level observed during drilling																		
	 Water level measured after drilling																		
	WH** denotes penetration due to weight of rods and hammer																		
	C.F.H.S.A. denotes Continuous Flight Hollow Stem Augers																		



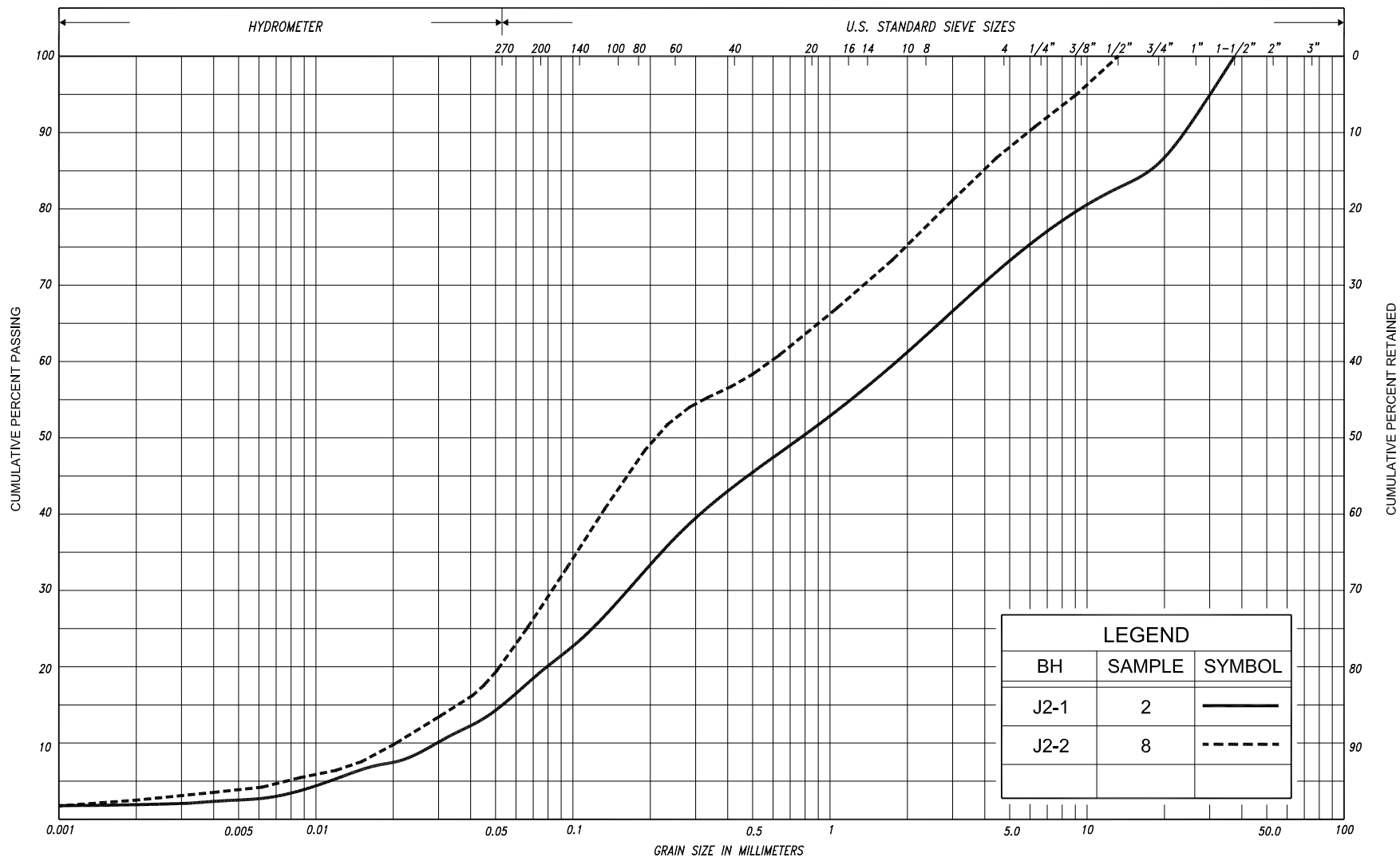
SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED		
					SAND											
CLAY	FINE		MEDIUM		COARSE	FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT															
CLAY			SILT			V. FINE	FINE	MED.	COARSE	GRAVEL						U.S. BUREAU
					SAND											

GRAIN SIZE DISTRIBUTION

SILT, trace sand, trace clay



FIG No. J2-GS-1
 HWY: 17
 W.P. No. 5146-09-00



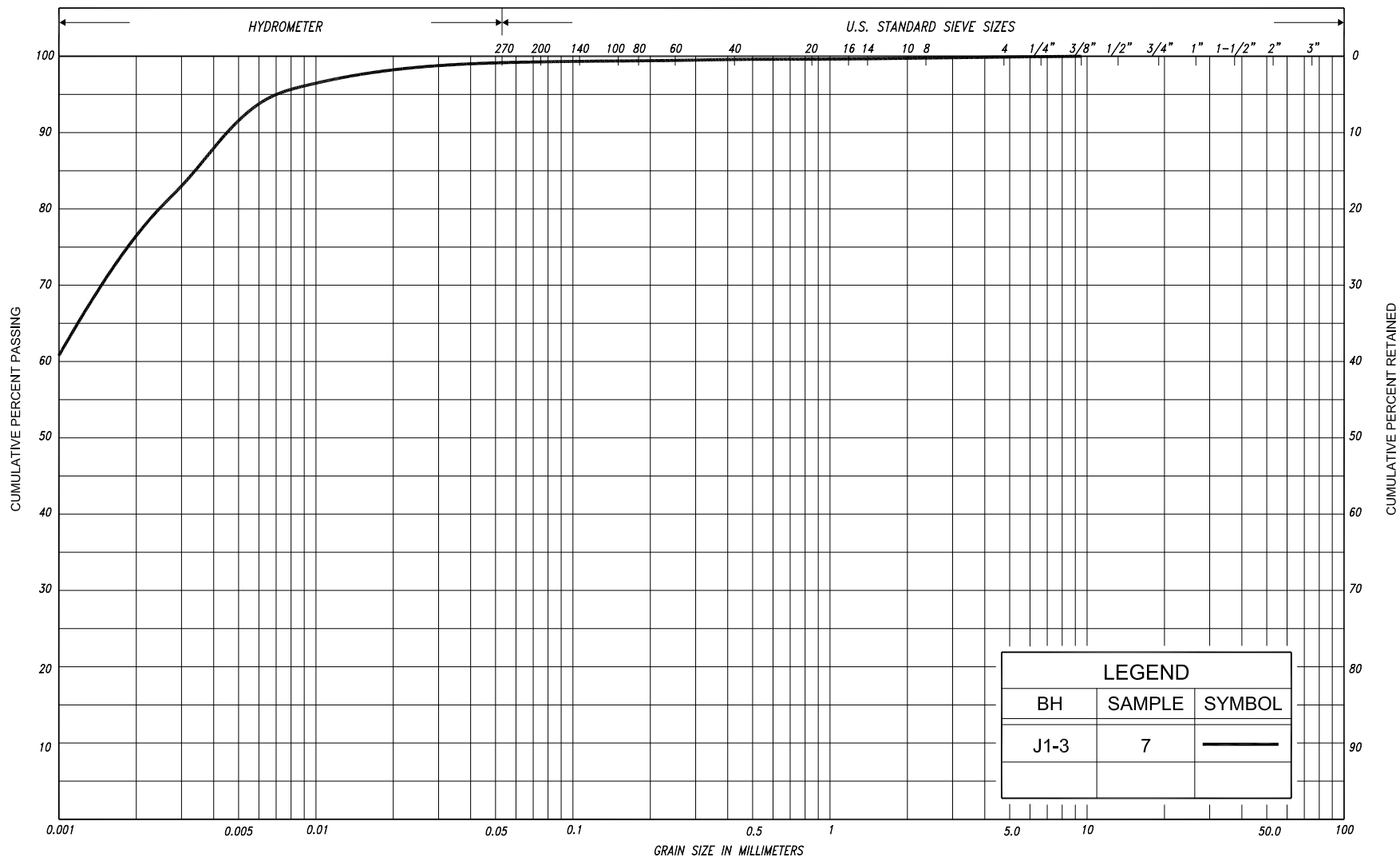
LEGEND		
BH	SAMPLE	SYMBOL
J2-1	2	—
J2-2	8	- - -

SILT & CLAY				FINE		MEDIUM		COARSE		GRAVEL		COBBLES	UNIFIED		
				SAND											
CLAY	FINE		MEDIUM SILT		COARSE		FINE		MEDIUM SAND		COARSE		GRAVEL	COBBLES	M.I.T.
CLAY		SILT			V. FINE		FINE		MED.		COARSE		GRAVEL		U.S. BUREAU



GRAIN SIZE DISTRIBUTION
 SAND, with to some gravel, some to with silt, trace clay

FIG No. J2-GS-2
 HWY: 17
 W.P. No. 5146-09-00



SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL			COB BLES	UNIFIED		
					SAND												
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT						SAND										
CLAY		SILT			V. FINE		FINE		MED.		COARSE		GRAVEL			U.S. BUREAU	
					SAND												

GRAIN SIZE DISTRIBUTION

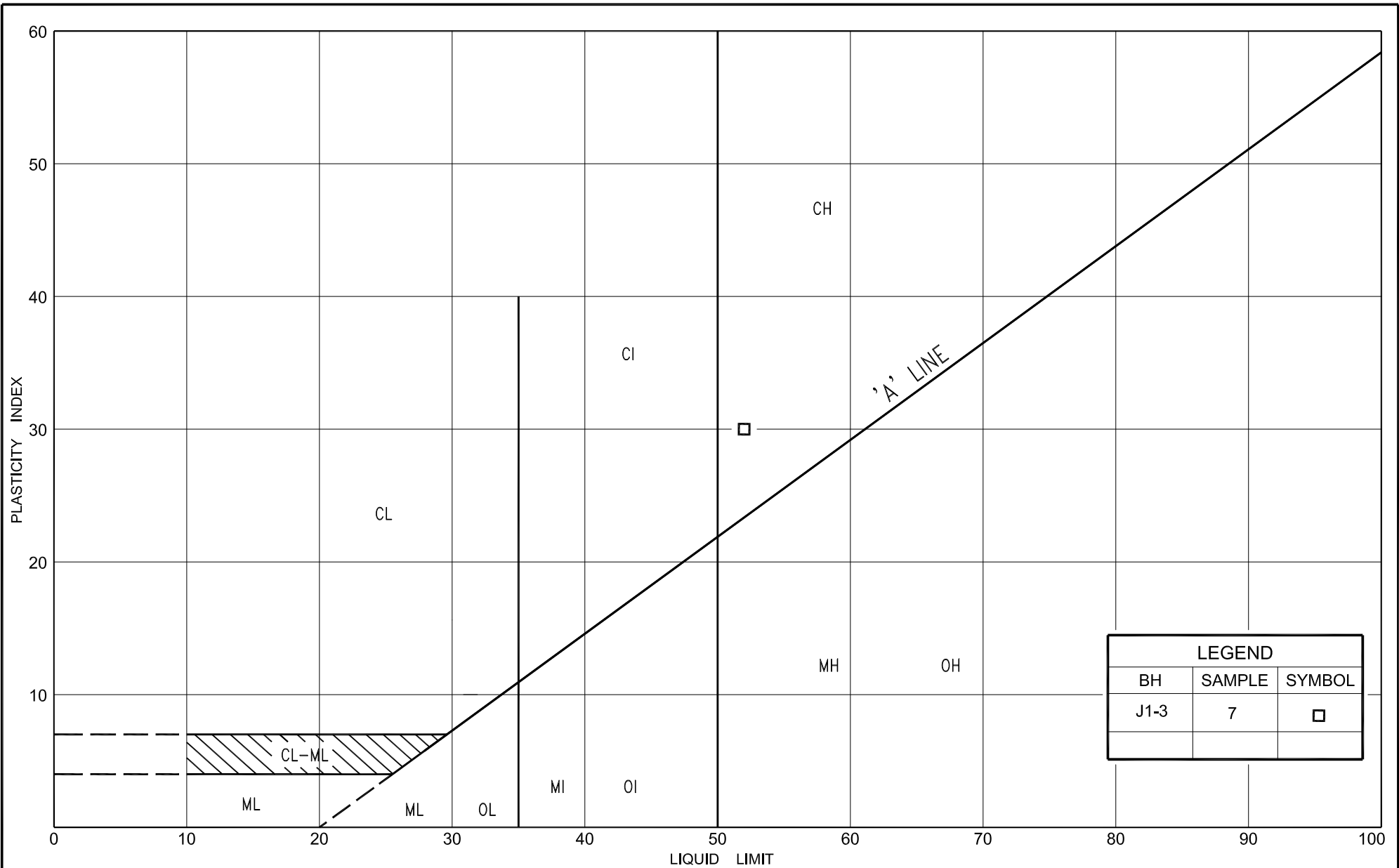
CLAY, trace sand (CH)

FIG No. J2-GS-3

HWY: 17

W.P. No. 5146-09-00





PLASTICITY CHART

CLAY, trace sand (CH)

FIG No.	J2-PC-1
HWY:	17
W.P. No.	5146-09-00

GEOGRAPHIC TOWNSHIP OF GRAHAM
Culvert K (G10) – Station 12+850 WBL

RECORD OF BOREHOLE No K-1

1 of 1

METRIC

G.W.P.	5146-09-00	LOCATION	Coords: 5 140 286.1 N; 283 867.4 E	ORIGINATED BY	F.P.
DIST	Sudbury	HWY	17	BOREHOLE TYPE	C.F.H.S.A. and Dynamic Cone Penetration Test
DATUM	Geodetic	DATE	November 16 and 30, 2012	CHECKED BY	B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	DYNAMIC CONE PENETRATION RESISTANCE PLOT						PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		SHEAR STRENGTH kPa											WATER CONTENT (%)		
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE													
251.3 0.0	Ground surface Peat, fine fibrous Dark brown Moist layers of clayey silt Grey Wet		1	SS	2		251													
250.1 1.2	Silty clay, trace sand Stiff to firm Grey Wet		2	SS	2		250													
			3	SS	8		249													
			4	SS	5		248													
			5	TW			247													
			FV				246													
			6	SS	5		245													
			7	TW	PH		244													
			FV				243													
245.0 6.3	Sandy silt trace clay, trace gravel Compact Grey Wet		8	SS	WH**	242														
244.1 7.2	(TILL) End of borehole Probable sandy silt Compact		9	SS	15															
241.7 9.6	End of dynamic cone penetration test Refusal on probable bedrock																			
<div>* Borehole dry</div> <div>■ Penetrometer test</div> <div>WH** denotes penetration due to weight of rods and hammer</div> <div>C.F.H.S.A. denotes Continuous Flight Hollow Stem Augers</div> <div>NOTE: Refusal at 1.1m on probable rockfill. Power augered at Sta. 12+865 WBL, toe of slope.</div>																				

RECORD OF BOREHOLE No K-2

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 140 276.7 N; 283 837.9 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Continuous Flight Hollow Stem Augers + 'N' Casing **COMPILED BY** N.R.
DATUM Geodetic **DATE** November 14, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE									
								● QUICK TRIAXIAL × LAB VANE									
					WATER CONTENT (%)												
252.9	Ground surface																
0.0	100mm asphalt over sand, trace gravel		1	AS	-												
	Brown																
251.9	FILL)		2	SS	25/3cm		252										
1.0	cobbles and boulders						251										
	(ROCKFILL)						250										
249.6	Sandy silt, trace gravel		3	SS	11		249										
3.3	Compact Grey Wet																
249.1	Silty clay trace sand, trace gravel		4	SS	4		248										
3.8	Firm Grey Wet		5	SS	5												
							247										
247.6	Clay, trace sand		6	SS	3		246										
5.3	Soft to Grey Wet firm		7	SS	WH**		245										
				FV			244										
	varved						243										
	Firm		8	SS	WH												
				FV													
244.1	Sandy silt trace clay, trace gravel		9	SS	23												
8.8	Compact Grey Wet																
	(TILL)																
242.4	End of borehole																
10.5	Refusal on probable bedrock																
	* Borehole charged with drilling water																
	■ Penetrometer test																
	WH** denotes penetration due to weight of rods and hammer																

* Borehole charged with drilling water
 ■ Penetrometer test
 WH** denotes penetration due to weight of rods and hammer

RECORD OF BOREHOLE No K-3

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 140 277.5 N; 283 801.6 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.H.S.A. and Dynamic Cone Penetration Test **COMPILED BY** N.R.
DATUM Geodetic **DATE** November 22, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		SHEAR STRENGTH kPa										
							○ UNCONFINED + FIELD VANE										
							● QUICK TRIAXIAL × LAB VANE										
							WATER CONTENT (%)										
							20 40 60 80 100					20 40 60					
250.7	Ground surface																
0.0 250.4	Topsoil		1	SS	3												
0.3	Silt, some clay trace sand, trace gravel organics to 1.6m																
	Loose to compact Dark grey Wet		2	SS	13												
249.1	some sand, trace clay																
1.6	Grey		3	SS	5												
	Silty clay, trace sand																
	Firm to Grey Wet		4	SS	5												
	stiff																
			5	SS	9												
			6	TW	PH												
				FV													
246.1	Clay, trace sand		7	SS	2												
4.6	Firm Grey Wet			FV													
			8	SS	1												
				FV													
			9	SS	WH**												
				FV													
243.4	Sandy silt trace clay, trace gravel																
7.3	Loose Grey Wet		10	SS	7												
	(TILL)																
242.0	End of borehole																
8.7	Refusal on probable bedrock																
												</					

* 2012 11 22

▽ Water level observed during drilling

▼ Water level measured after drilling

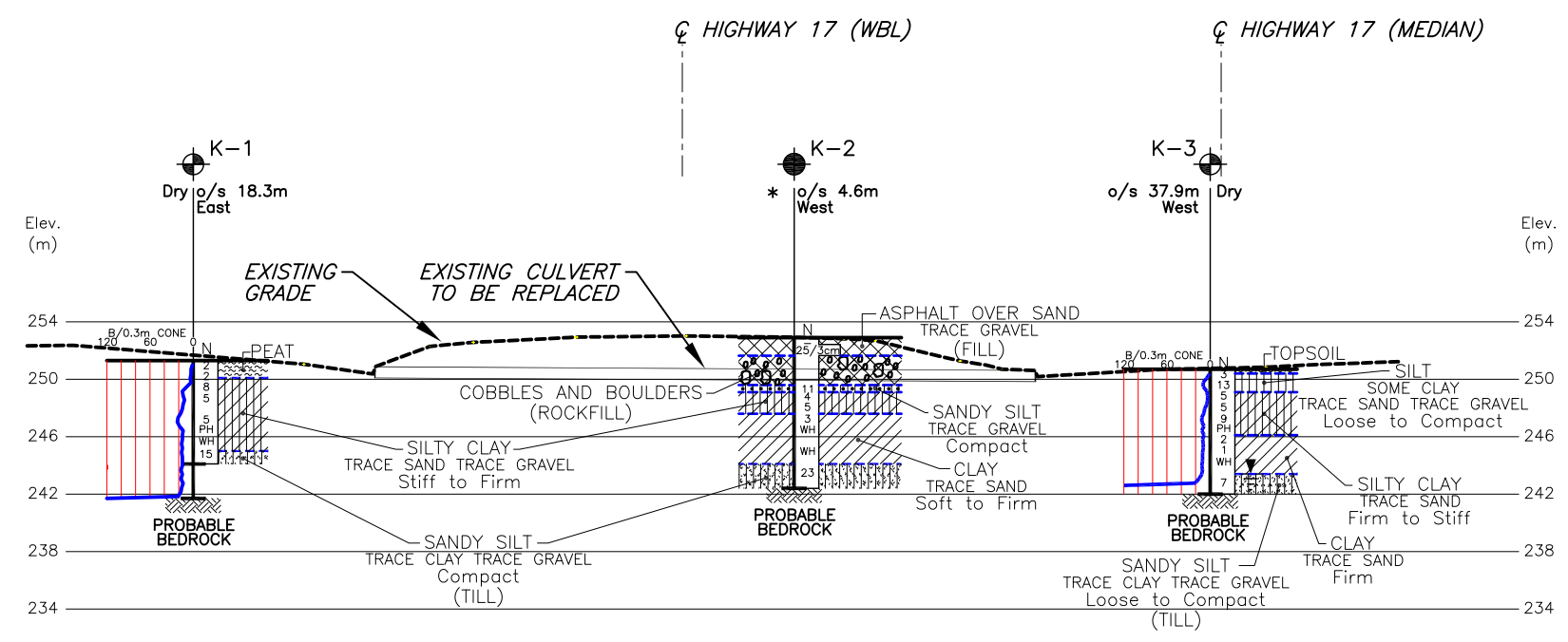
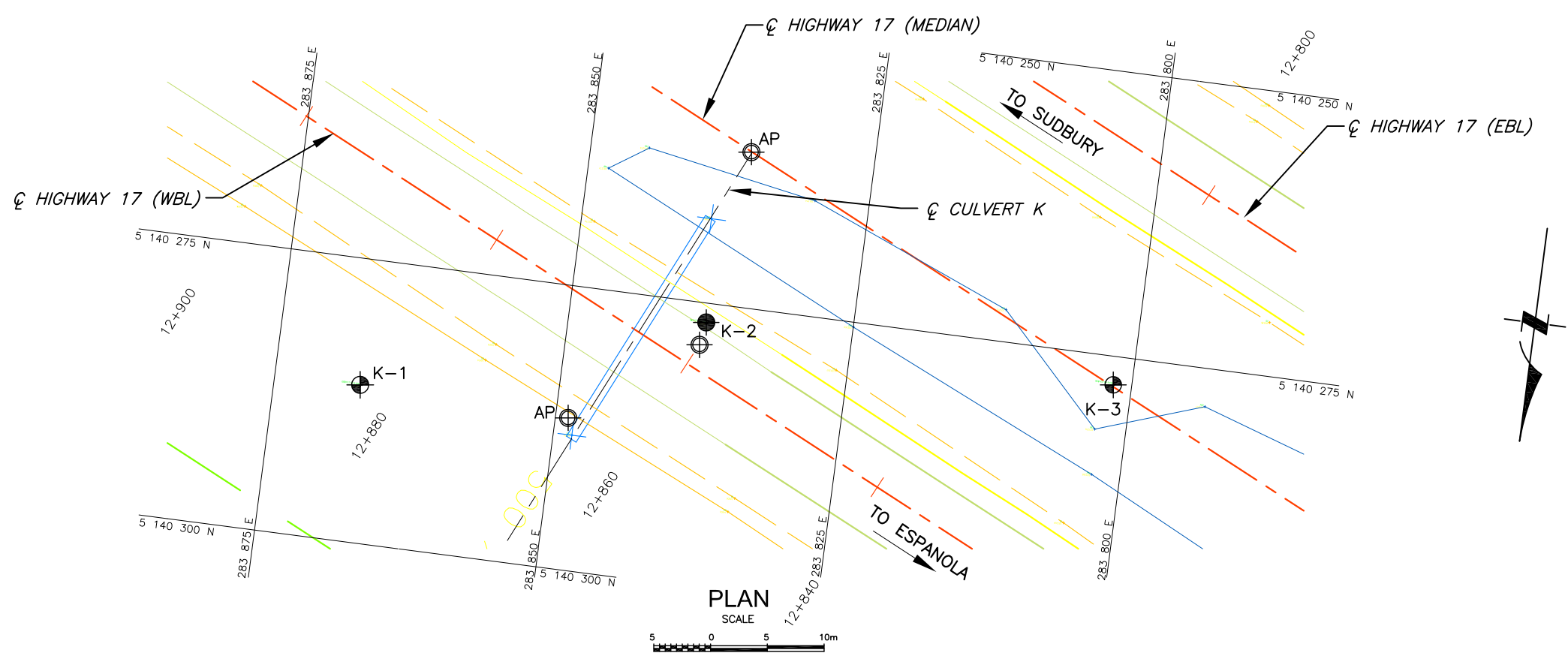
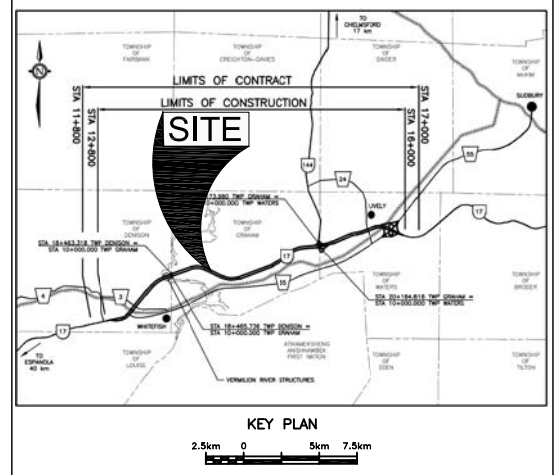
■ Penetrometer test

WH** denotes penetration due to weight of rods and hammer

C.F.H.S.A. denotes Continuous Flight Hollow Stem Augers

NOTE: Refusal at 1.4m on probable bedrock. Power augered at Sta. 12+865 CL Median.

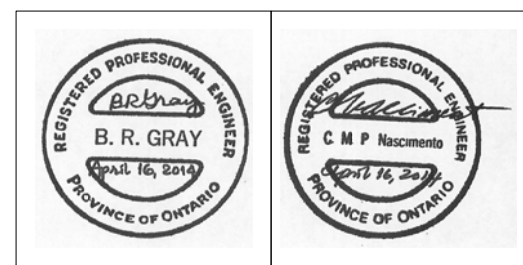
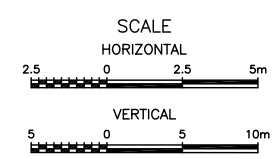
+7, X⁵: Numbers refer to Sensitivity
20
15—5
10
(%) STRAIN AT FAILURE



LEGEND				
	Borehole			
	Borehole and Cone			
	Pavement borehole/Auger probe (AP)			
N	Blows/0.3m (Std. Pen Test, 475 J/blow)			
CONE	Blows/0.3m (60 Cone, 475 J/blow)			
	WL at time of investigation November 2012			
WH	Penetration due to weight of hammer			
*	Water level not established			
	Head			
	ARTESIAN WATER			
	Encountered			
	PIEZOMETER			
BH No	ELEVATION	NORTHINGS	EASTINGS	
K-1	251.3	5 140 286.1	283 867.4	
K-2	252.9	5 140 276.7	283 837.9	
K-3	250.7	5 140 277.5	283 801.6	

NOTE:
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

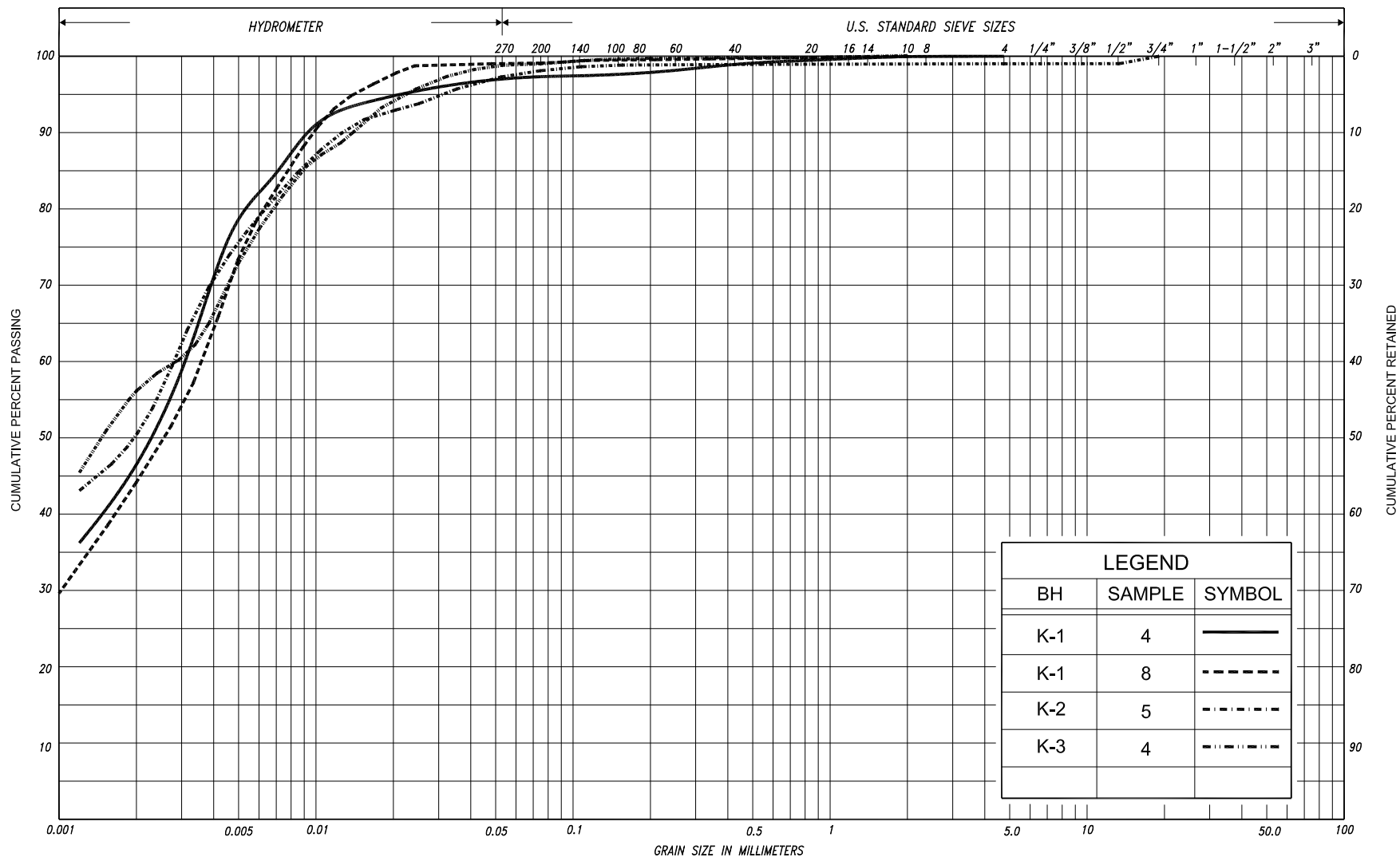
- NOTES:
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
 - THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION. CULVERT PROFILE IS ESTIMATED.
 - DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.



Reference AECOM Drawings:
NTB-01207011.dwg and GRAHAM X-SECTIONS with Culverts and viewport.dwg
received on November 25, 2013 and April 01, 2014 respectively.

REVISIONS	DATE	BY	DESCRIPTION

Geocres No.411-299				
HWY No	17	DIST Sudbury		
SUBM'D	NA	CHECKED NR	DATE APR. 16, 2014	SITE
DRAWN	NA	CHECKED BRG	APPROVED CN	DWG K-1



SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED		
					SAND											
CLAY	FINE		MEDIUM		COARSE	FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT															
CLAY			SILT			V. FINE	FINE	MED.	COARSE		GRAVEL					U.S. BUREAU
					SAND											



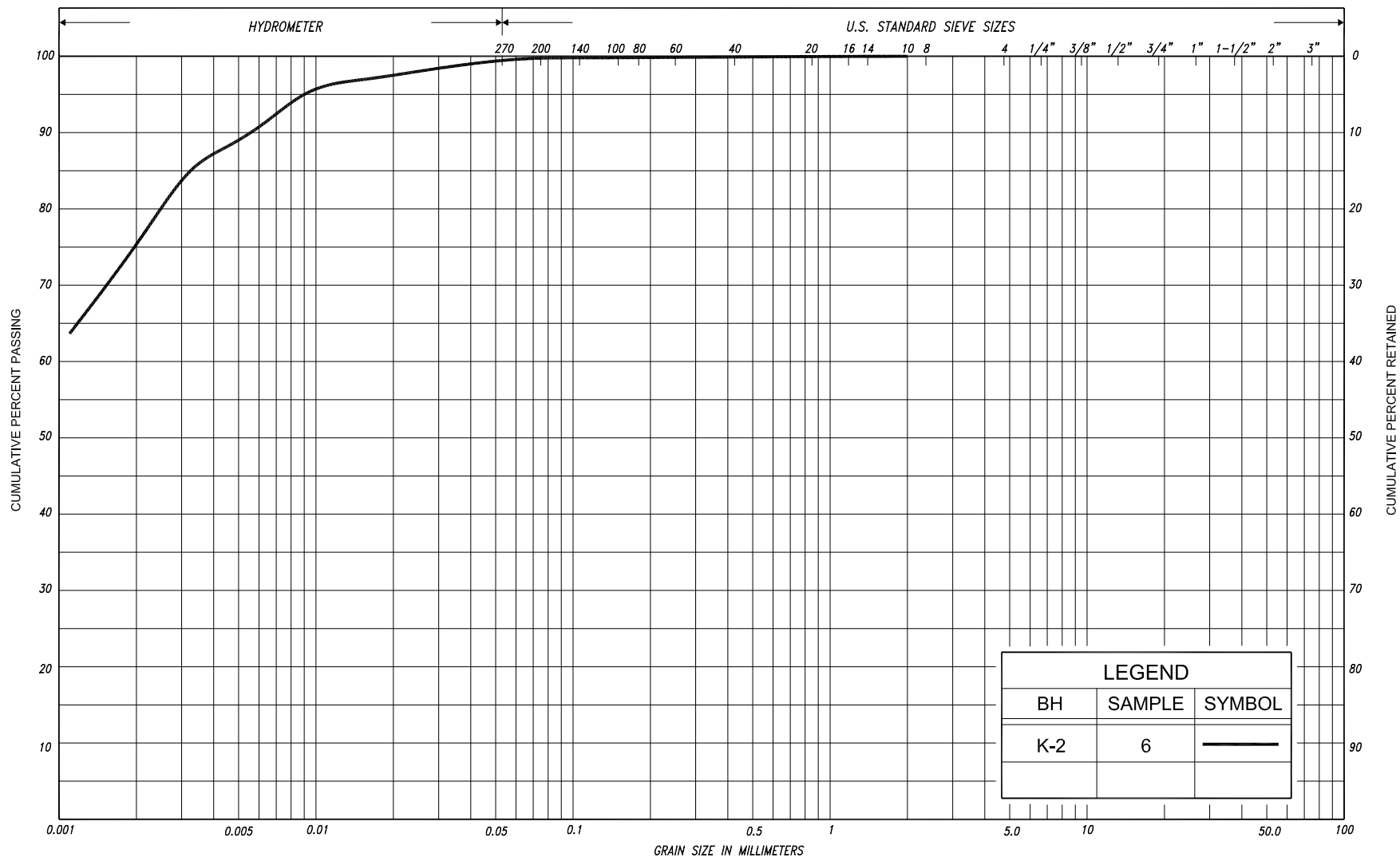
GRAIN SIZE DISTRIBUTION

SILTY CLAY, trace sand (CI)

FIG No. K-GS-1

HWY: 17

W.P. No. 5146-09-00



SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL			COBBLES	UNIFIED		
					SAND												
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT																
CLAY			SILT			V. FINE		FINE		MED.		COARSE		GRAVEL			U.S. BUREAU
					SAND												



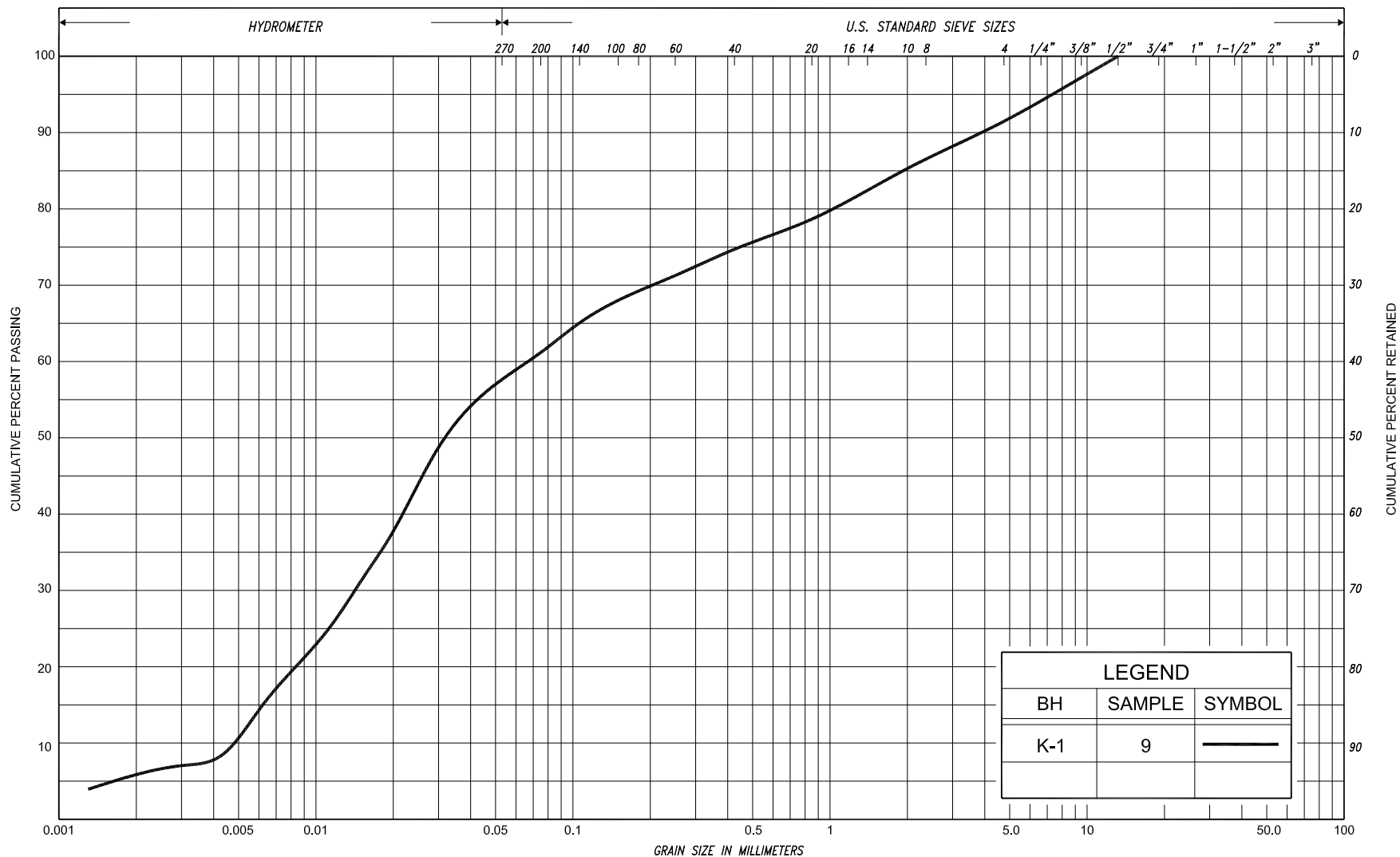
GRAIN SIZE DISTRIBUTION

CLAY, trace sand (CH)

FIG No. K-GS-2

HWY: 17

W.P. No. 5146-09-00



SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED		
					SAND											
CLAY	FINE		MEDIUM		COARSE	FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT															
CLAY			SILT			V. FINE	FINE	MED.	COARSE	GRAVEL					U.S. BUREAU	
					SAND											

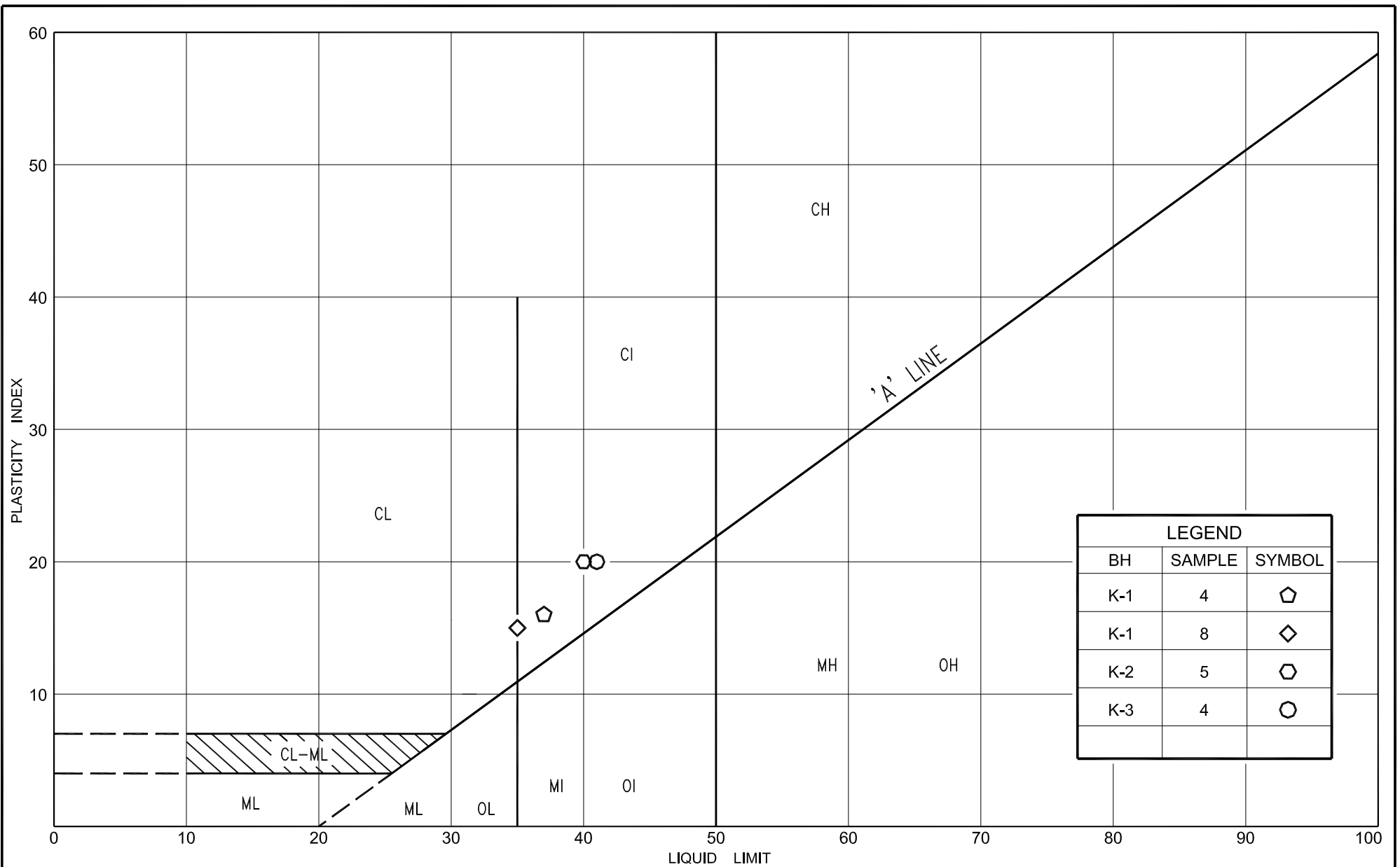


GRAIN SIZE DISTRIBUTION SANDY SILT, trace clay, trace gravel (TILL)

FIG No. K-GS-3

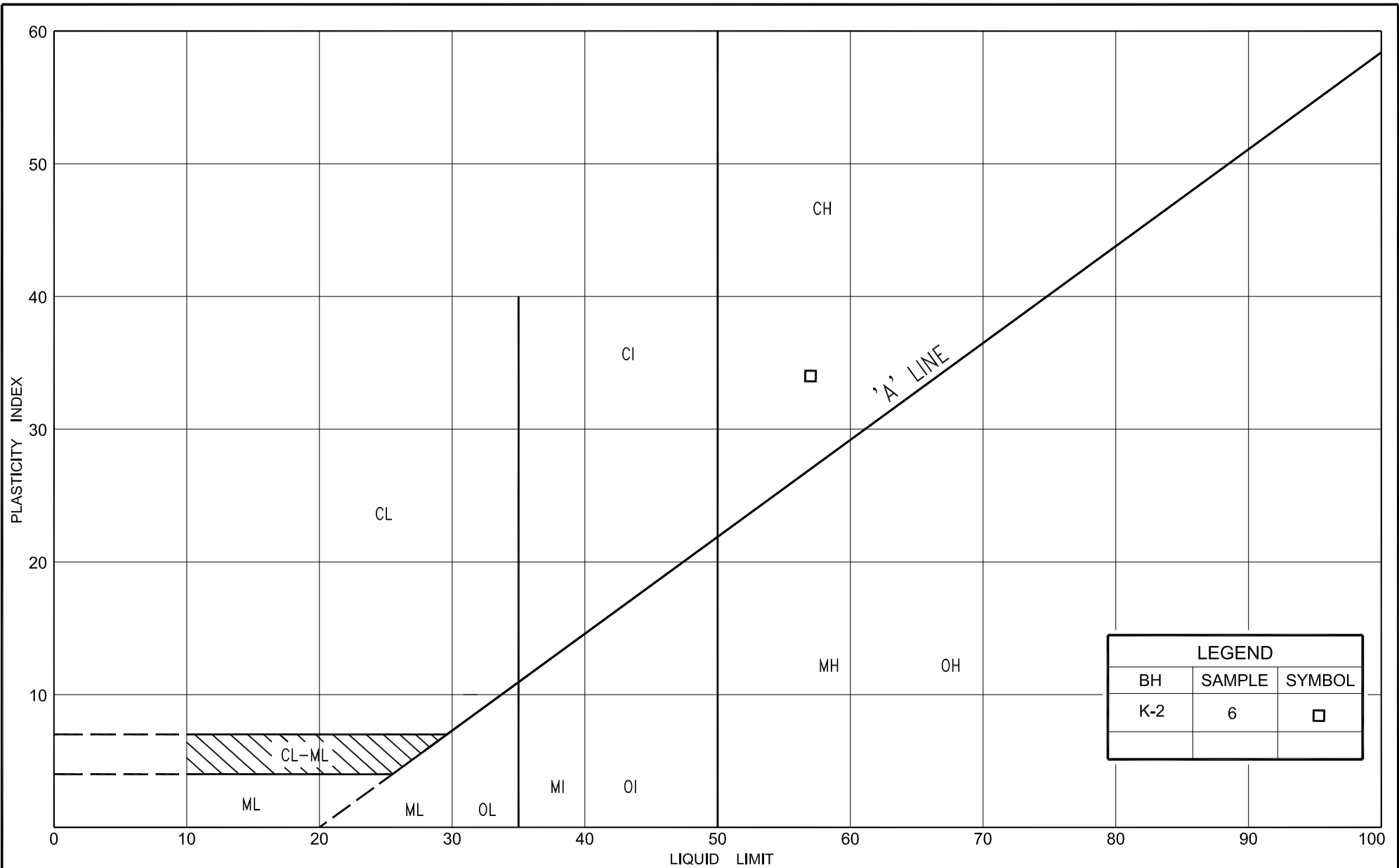
HWY: 17

W.P. No. 5146-09-00



PLASTICITY CHART
SILTY CLAY, trace sand (CI)

FIG No. K-PC-1
HWY: 17
W.P. No. 5146-09-00



PLASTICITY CHART

CLAY, trace sand (CH)

FIG No.	K-PC-2
HWY:	17
W.P. No.	5146-09-00

GEOGRAPHIC TOWNSHIP OF GRAHAM
Culvert L (G25) – Station 17+894 C/L

RECORD OF BOREHOLE No L-1

1 of 1

METRIC

G.W.P. <u>5146-09-00</u>	LOCATION <u>Coords: 5 141 414.9 N; 288 422.3 E</u>	ORIGINATED BY <u>F.P.</u>
DIST <u>Sudbury</u> HWY <u>17</u>	BOREHOLE TYPE <u>Tripod + Wash boring + Dynamic Cone Penetration Test</u>	COMPILED BY <u>N.R.</u>
DATUM <u>Geodetic</u>	DATE <u>May 06 and 07, 2013</u>	CHECKED BY <u>B.R.G.</u>

[illegible]

RECORD OF BOREHOLE No L-2

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 141 382.5 N; 288 434.6 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Sonic / Rotary Displacement **COMPILED BY** N.R.
DATUM Geodetic **DATE** May 30, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE						
253.1	Ground surface																
0.0	250mm thick asphalt over sand and gravel						253										
252.6	(PAVEMENT FILL)																
0.5	Sand and gravel cobbles and boulders (ROCKFILL)						252										
							251										
							250										
							249										
248.2	End of borehole																
4.9	Refusal on rockfill																
	</																

RECORD OF BOREHOLE No L-2A

1 of 2

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 141 391.0 N; 288 445.1 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Sonic **COMPILED BY** N.R.
DATUM Geodetic **DATE** June 05, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)
								○ UNCONFINED	+	FIELD VANE							
								● QUICK TRIAXIAL	×	LAB VANE							
253.2	Ground surface						20	40	60	80	100						
0.0	250mm thick asphalt over sand and gravel																
252.7	(PAVEMENT FILL)																
0.5	Sand and gravel cobbles and boulders (ROCKFILL)																

Cont'd

RECORD OF BOREHOLE No L-2A

2 of 2

METRIC

G.W.P.	5146-09-00	LOCATION	Coords: 5 141 391.0 N; 288 445.1 E	ORIGINATED BY	F.P.
DIST	Sudbury	HWY	17	BOREHOLE TYPE	Sonic
DATUM	Geodetic	DATE	June 05, 2013	CHECKED BY	B.R.G.




[illegible]

RECORD OF BOREHOLE No L-3

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 141 372.1 N; 288 456.4 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Power Auger **COMPILED BY** N.R.
DATUM Geodetic **DATE** April 29, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
251.0	Ground surface							20	40	60	80	100								
0.0	Sand and gravel silty sand inclusions																			
250.5	(FILL)																			
0.5	(ROCKFILL)						250													
249.5	End of borehole																			
1.5	Refusal on probable rockfill																			
	* Borehole dry																			

RECORD OF BOREHOLE No L-4

1 of 1

METRIC

G.W.P.	5146-09-00	LOCATION	Coords: 5 141 353.2 N; 288 471.1 E	ORIGINATED BY	F.P.
DIST	Sudbury	HWY	17	BOREHOLE TYPE	Sonic / Rotary Displacement
DATUM	Geodetic	DATE	May 29, 2013	COMPILED BY	N.R.
				CHECKED BY	B.R.G.

SOIL PROFILE				SAMPLES		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS
251.8 0.0	Ground surface					
251.3 0.5	300mm thick asphalt over sand and gravel (PAVEMENT FILL) Sand and gravel cobbles and boulders (ROCKFILL)					
245.4 6.4	Silty clay, trace sand organics Firm to Mottled Moist very stiff grey/ to wet brown		1	SS	7	
243.0 8.8	Silt trace sand, trace clay					▽*
242.2 9.6	Compact Grey Wet		3	SS	16	
	End of borehole Refusal on probable bedrock					
	* 2013 05 29 ▽ Water level observed during drilling					

RECORD OF BOREHOLE No L-5

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 141 337.4 N; 288 486.9 E **ORIGINATED BY** S.A.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod and Washboring + Dynamic Cone Penetration Test **COMPILED BY** N.R.
DATUM Geodetic **DATE** December 13, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa										
						20 40 60 80 100										
						20 40 60 80 100										
244.5 0.1	Ground surface															
244.3 0.3	Topsoil		1	SS	2											
	Clayey silt topsoil inclusions															
	Dark brown Silty clay, rootlets		2	SS	7											
	Soft to Brown/ Moist very stiff grey															
			3	SS	16											
242.3 2.3	Clay, trace sand		4	SS	13											
	Stiff to Brown/ Moist soft grey															
	cobbles		5	SS	14											
			6	SS	2											
				FV												
238.4 6.2	Silt, some sand trace clay, trace gravel		7	SS	10											
	Compact Grey Wet (TILL)															
			8	SS	22											
236.3 8.3	End of borehole															
	Probable silt (TILL)															
235.5 9.1	End of dynamic cone penetration test															
	Refusal on probable bedrock															
								</								

CONT No

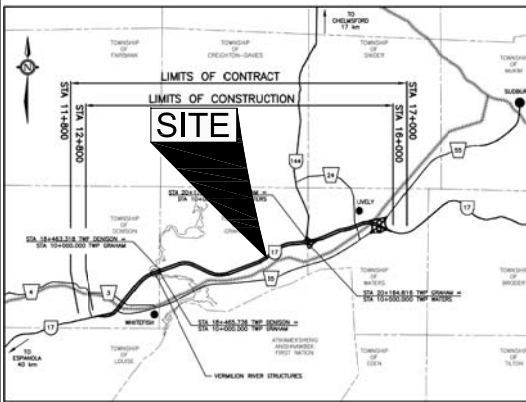
GWP No 5146-09-00

REPLACEMENT CULVERT L
HIGHWAY 17 STA 17+894 CL
GEOGRAPHIC TOWNSHIP OF GRAHAM
BOREHOLE LOCATIONS AND SOIL STRATA



SHEET

PML Peto MacCallum Ltd.
CONSULTING ENGINEERS



KEY PLAN

LEGEND

- Borehole
- Borehole and Cone
- Pavement borehole
- N Blows/0.3m (Std. Pen Test, 475 J/blow)
- CONE Blows/0.3m (60 Cone, 475 J/blow)
- WL at time of investigation November 2012, May & June 2013
- WH Penetration due to weight of hammer
- Head
- ARTESIAN WATER
- Encountered
- PIEZOMETER

BH No	ELEVATION	NORTHINGS	EASTINGS
L-1	245.8	5 141 414.9	288 422.3
L-2	253.1	5 141 382.5	288 434.6
L-2A	253.2	5 141 391.0	288 445.1
L-3	251.0	5 141 372.1	288 456.4
L-4	251.8	5 141 353.2	288 471.1
L-5	244.6	5 141 337.4	288 486.9

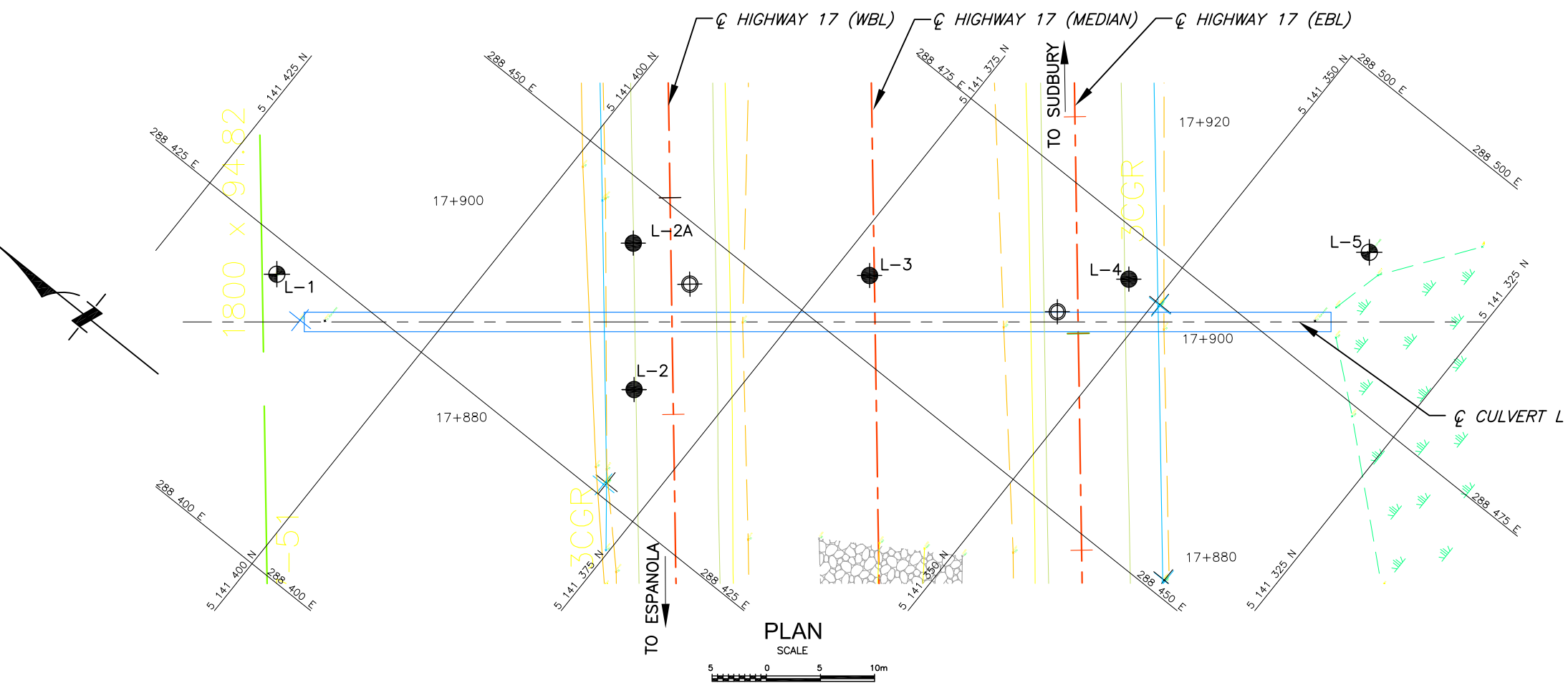
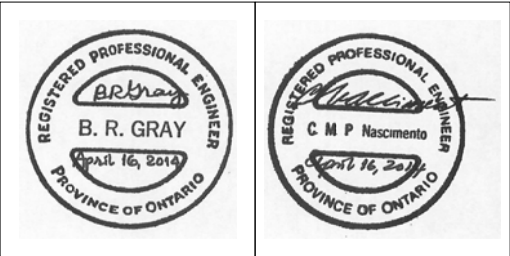
NOTE:
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

Geocres No.411-299

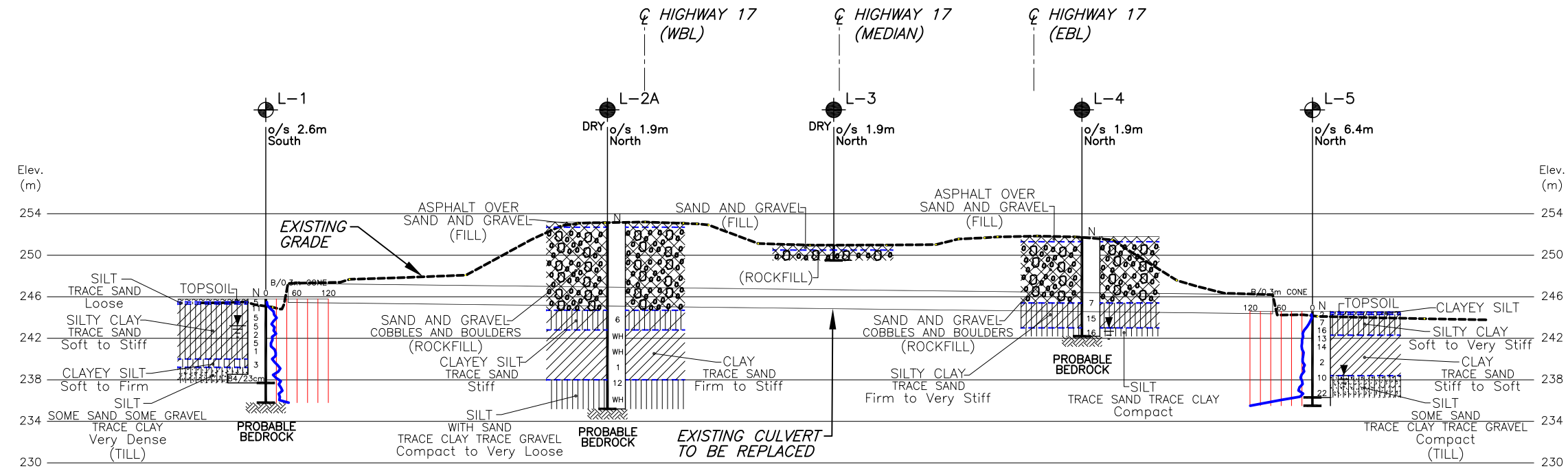
HWY No	17	DIST	Sudbury
SUBM'D	NA	CHECKED	NR
DRAWN	NA	CHECKED	BRG
DATE	APR. 16, 2014	APPROVED	CN
SITE		DWG	L-1

Reference AECOM Drawings:
NTB-01207011.dwg and GRAHAM X-SECTIONS with Culverts and viewport.dwg
received on November 25, 2013 and April 01, 2014 respectively.



PLAN

SCALE
5 0 5 10m



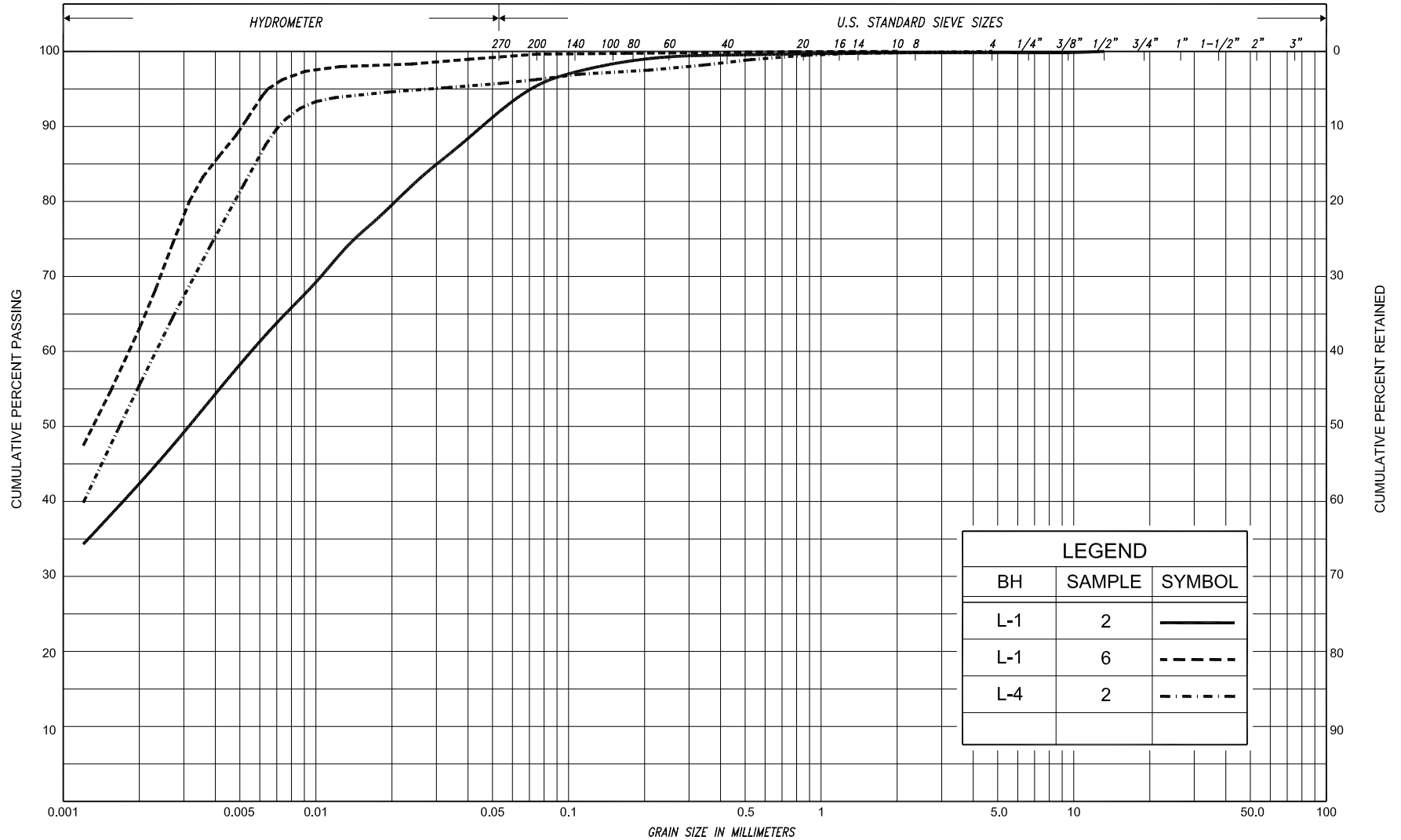
PROFILE ALONG \varnothing EXISTING CULVERT AT STA. 17+894 CL

SCALE

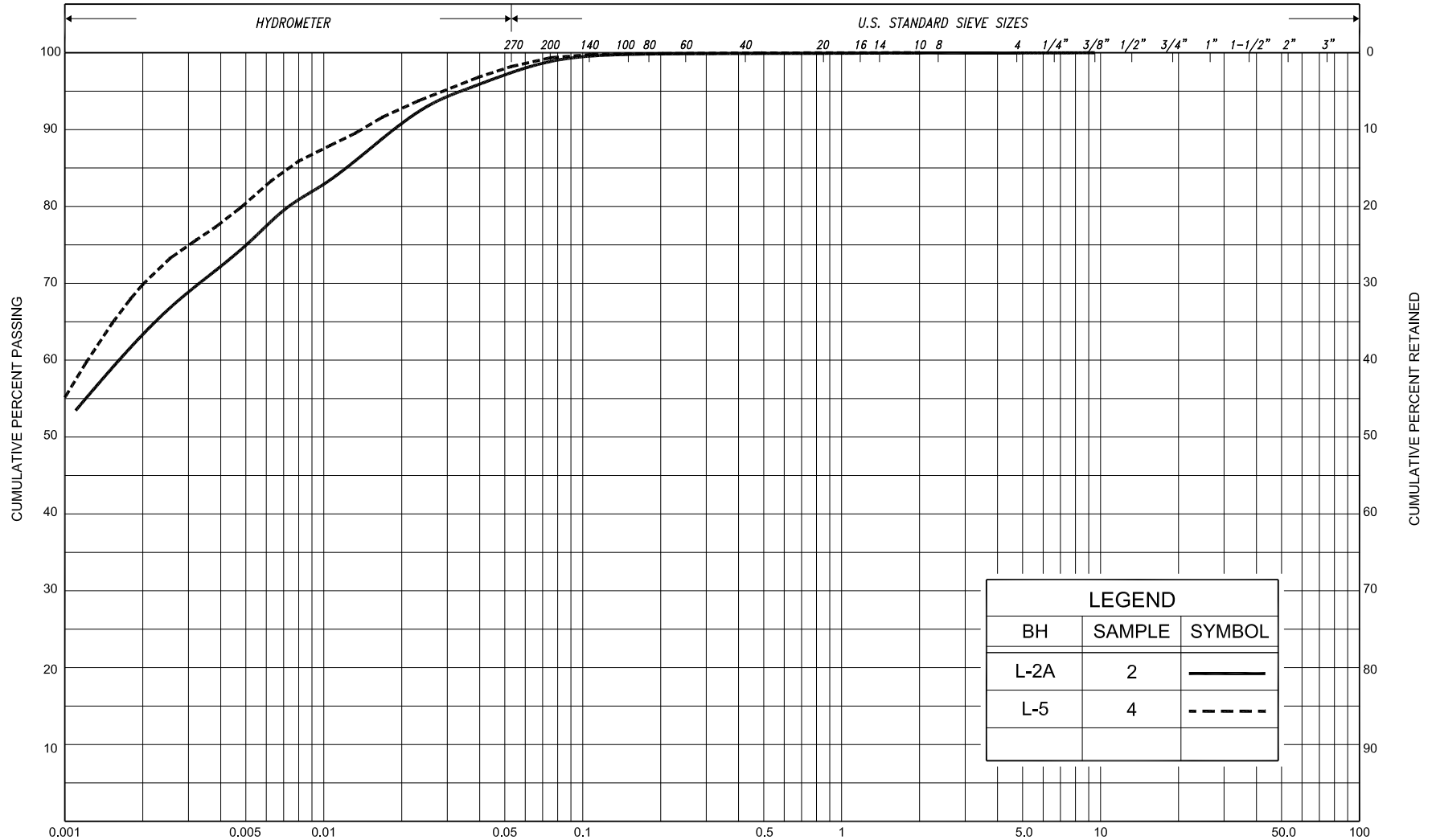
5 0 5 10m

NOTES:

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SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL				COBBLES	UNIFIED		
					SAND													
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL				COBBLES	M.I.T.
	SILT																	
CLAY			SILT			V. FINE	FINE	MED.	COARSE		GRAVEL						U.S. BUREAU	
					SAND													



LEGEND		
BH	SAMPLE	SYMBOL
L-2A	2	————
L-5	4	-----

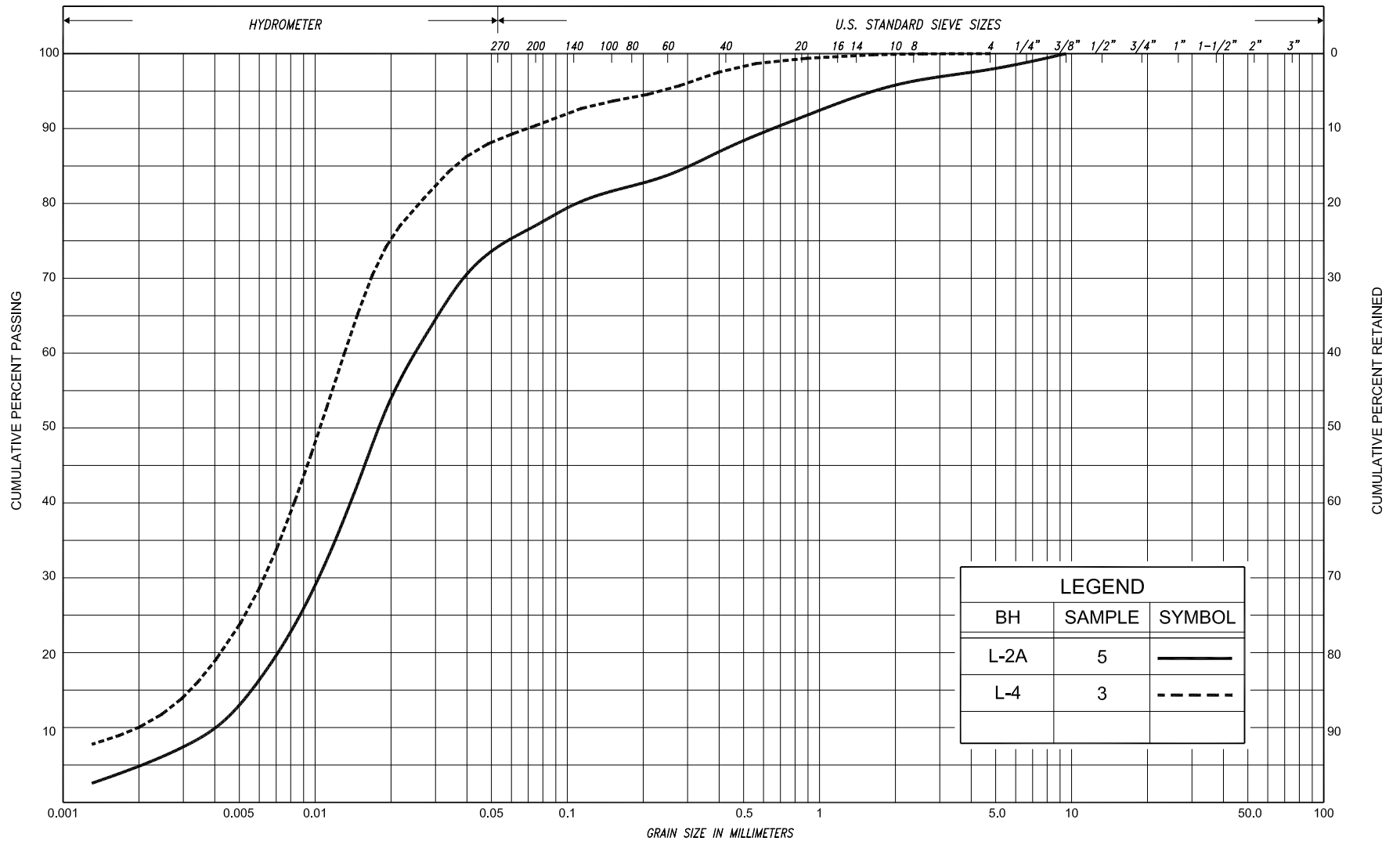
SILT & CLAY				FINE SAND			MEDIUM SAND		COARSE SAND	GRAVEL			COBBLES	UNIFIED
														M.I.T.
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE							COBBLES	
														U.S. BUREAU
				V. FINE	FINE	MED.	COARSE							



GRAIN SIZE DISTRIBUTION

CLAY, trace sand (CH)

FIG No.	L-GS-2
HWY:	17
G.W.P. No.	5146-09-00



SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL					COBBLES	UNIFIED	
CLAY	FINE		MEDIUM		COARSE		SAND					GRAVEL					COBBLES	M.I.T.
	SILT					FINE		MEDIUM		COARSE								
CLAY			SILT			V. FINE	FINE	MED.	COARSE		GRAVEL							U.S. BUREAU
					SAND													



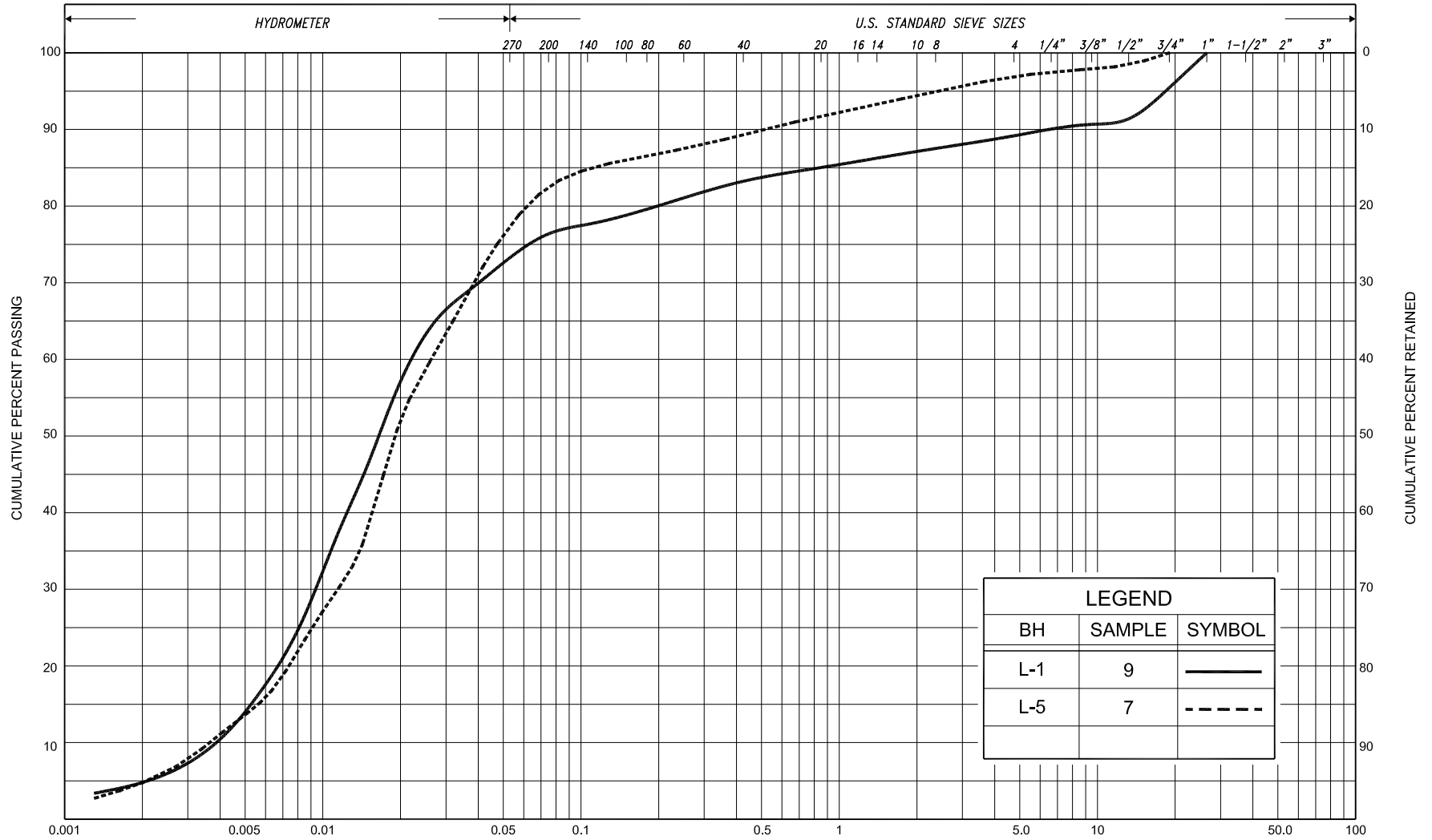
GRAIN SIZE DISTRIBUTION

SILT, with sand, trace clay, trace gravel

FIG No. L-GS-3

HWY: 17

G.W.P. No. 5146-09-00

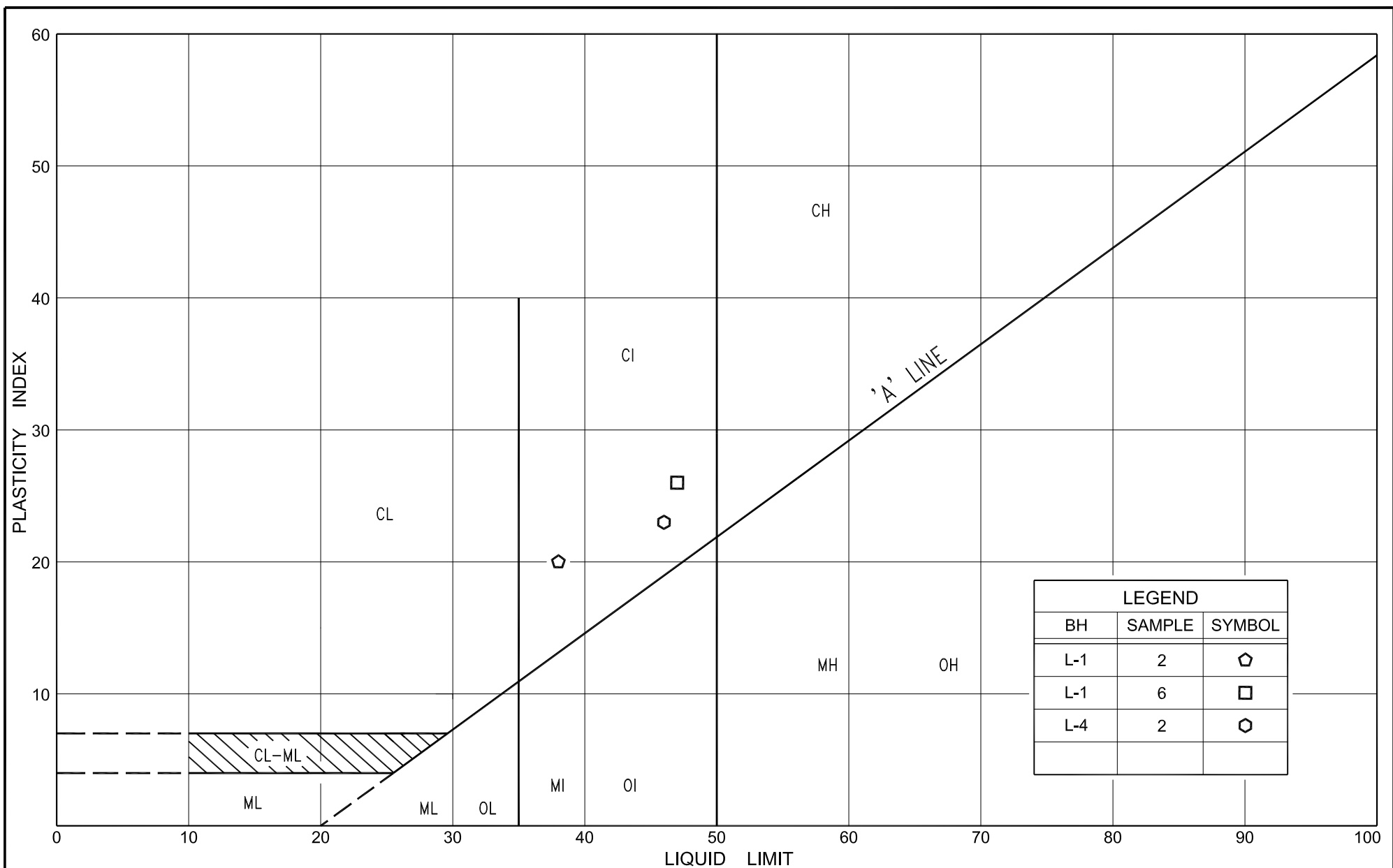


SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL				COBBLES	UNIFIED		
					SAND													
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL				COBBLES	M.I.T.
	SILT																	
CLAY		SILT			V. FINE	FINE	MED.	COARSE	GRAVEL							U.S. BUREAU		
					SAND													



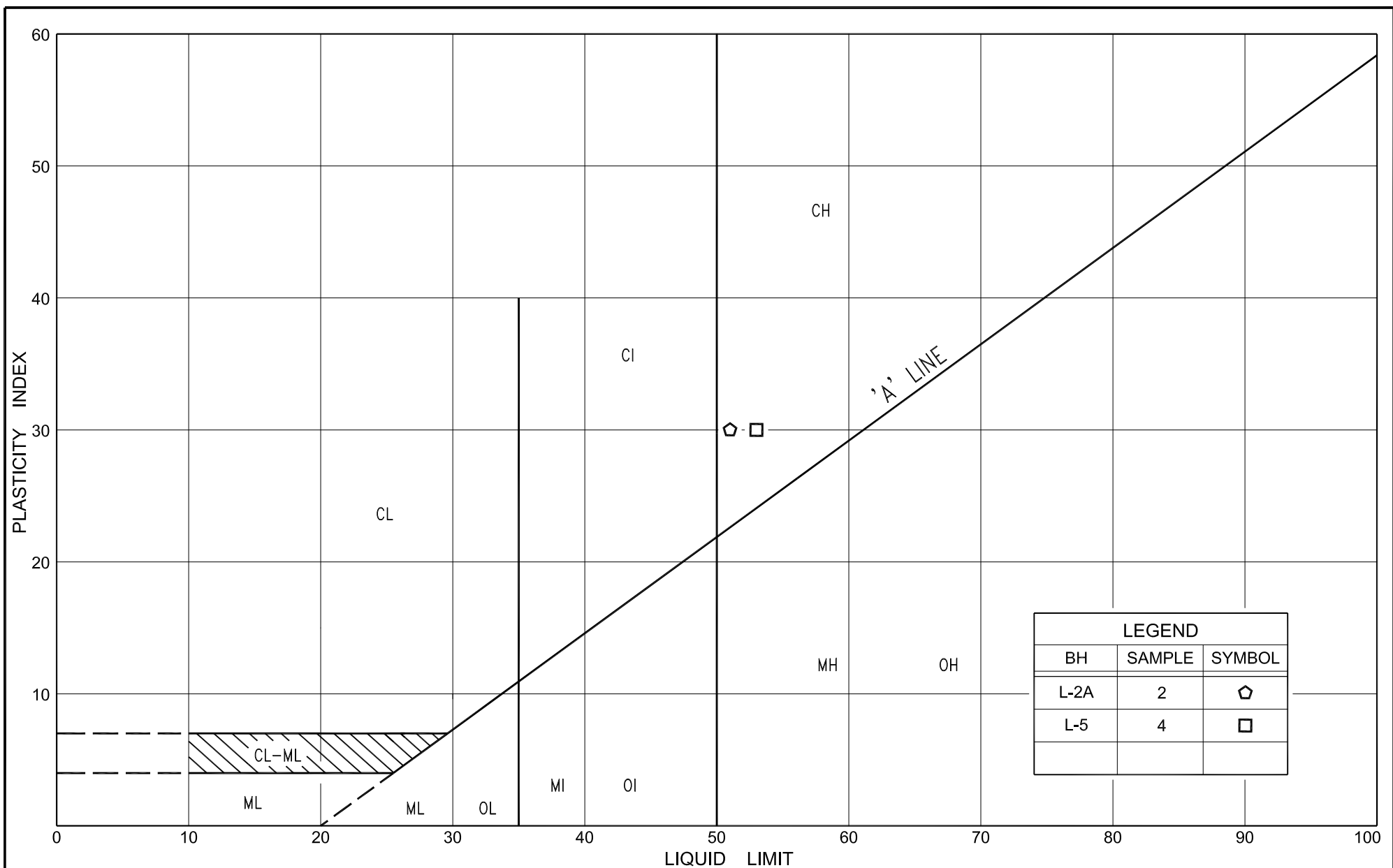
GRAIN SIZE DISTRIBUTION
 SILT, some sand, trace to some gravel, trace clay
 (TILL)

FIG No. L-GS-4
 HWY: 17
 G.W.P. No. 5146-09-00



PLASTICITY CHART
SILT CLAY, trace sand (CI)

FIG No. L-PC-1
HWY: 17
G.W.P. No. 5146-09-00



PLASTICITY CHART

CLAY, trace sand (CH)

FIG No. L-PC-2

HWY: 17

G.W.P. No. 5146-09-00

GEOGRAPHIC TOWNSHIP OF GRAHAM
Culvert M (G26) – Station 18+882 C/L

RECORD OF BOREHOLE No M-1

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 141 902.1 N; 289 296.9 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod + Dynamic Cone Penetration tests **COMPILED BY** N.R.
DATUM Geodetic **DATE** June 10, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE									
								● QUICK TRIAXIAL × LAB VANE									
							WATER CONTENT (%)										
248.1	Ground surface						20 40 60 80 100	20 40 60 80 100	20 40 60								
0.0	Topsoil																
247.8	Silty clay, trace sand organics to 0.9m Stiff Grey Moist to firm Mottled grey/brown		1	SS	6												
0.3																	
				2	SS	9											
				3	SS	4											
				4	SS	1											
244.9				FV													
3.2	Clayey silt trace sand, trace gravel Very soft Grey Wet to firm		5	SS	WH**												
				FV													
				6	SS	WH											
243.4				FV													
4.7	Silt some sand, trace clay		7	SS	5												
242.8	Loose to Grey Moist compact		8	SS	10												
5.3	Sand and silt some gravel, trace clay																
242.1	Compact Grey Wet (TILL)		9	SS	10												
6.0	Sand trace silt, trace gravel																
241.5	Compact Grey Wet																
6.6	End of borehole																
	Refusal on probable boulder																
										</							

* Borehole charged with
drilling water

 WH** denotes penetration
due to weight of rods
and hammer

 NOTE: Dynamic cone
penetration test was
carried-out 2m south
of borehole M-1 (3m
east of culvert end)

RECORD OF BOREHOLE No M-2

1 of 1

METRIC

G.W.P.	5146-09-00	LOCATION	Coords: 5 141 883.0 N; 289 306.4 E	ORIGINATED BY	F.P.
DIST	Sudbury	HWY	17	BOREHOLE TYPE	Sonic
DATUM	Geodetic	DATE	May 30, 2013	CHECKED BY	B.R.G.

[illegible]

RECORD OF BOREHOLE No M-2A

1 of 2

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 141 876.3 N; 289 295.2 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Sonic **COMPILED BY** N.R.
DATUM Geodetic **DATE** June 04, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)
								○ UNCONFINED + FIELD VANE										
								● QUICK TRIAXIAL × LAB VANE										
256.8	Ground surface						20	40	60	80	100							
0.0	200mm thick asphalt over sand and gravel																	
256.3	(PAVEMENT FILL)																	
0.5	Sand and gravel cobbles and boulders (ROCKFILL)																	
							256											
							255											
							254											
							253											
							252											
							251											
							250											
							249											
							248											
							247											
							246											
245.2							245											
11.6	Silty clay some sand, trace gravel organic inclusions		1	SS	13													
	Stiff to Dark Moist very stiff grey/brown		2	SS	9													
				FV														
	trace sand																	
	Firm Mottled Wet grey/brown		3	SS	WH**													
				FV														
							243											
							242											

RECORD OF BOREHOLE No M-2A

2 of 2

METRIC

G.W.P.	5146-09-00	LOCATION	Coords: 5 141 876.3 N; 289 295.2 E	ORIGINATED BY	F.P.
DIST	Sudbury	HWY	17	BOREHOLE TYPE	Sonic
				COMPILED BY	N.R.
DATUM	Geodetic	DATE	June 04, 2013	CHECKED BY	B.R.G.


SOIL PROFILE			SAMPLES		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES
241.8					
238.8					
18.0	Silt trace sand sand partings				
238.1	Very dense Grey Wet		6	SS	22/23cm
18.7	End of borehole Refusal on probable bedrock				
	* Borehole charged with drilling water WH** denotes penetration due to weight of rods and hammer				

RECORD OF BOREHOLE No M-3

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 141 859.0 N; 289 311.2 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** 'N' Casing **COMPILED BY** N.R.
DATUM Geodetic **DATE** November 28, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT						PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											WATER CONTENT (%)		
								○ UNCONFINED			+ FIELD VANE								● QUICK TRIAXIAL		
252.7	Ground surface							20	40	60	80	100									
0.0	Cobbles and boulders with sand and gravel pockets (ROCKFILL)						252														
							251														
250.1	End of borehole																				
2.6	Refusal on probable rockfill * Borehole charged with drilling water																				

RECORD OF BOREHOLE No M-4

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 141 835.2 N; 289 306.5 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Sonic / Rotary Displacement **COMPILED BY** N.R.
DATUM Geodetic **DATE** May 29, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED		+ FIELD VANE		● QUICK TRIAXIAL						× LAB VANE		
256.6	Ground surface						20	40	60	80	100									
0.0	200mm thick asphalt over sand and gravel																			
256.1	(PAVEMENT FILL)																			
0.5	Sand and gravel cobbles and boulders (ROCKFILL)																			
							</													

RECORD OF BOREHOLE No M-5

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 141 818.5 N; 289 323.2 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod + 'N' Casing **COMPILED BY** N.R.
DATUM Geodetic **DATE** December 07, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE									
								● QUICK TRIAXIAL × LAB VANE									
							WATER CONTENT (%)										
246.9	Ground surface							20	40	60	80	100					
246.7 0.2	Peat, frozen Dark brown Organic clayey silt Dark grey		1	SS	1		246										
			2	SS	4												
			3	SS	8		245										
244.7 2.2	Silty clay, trace sand silt partings Soft to Brown Moist firm		4	SS	6		244										
			5	SS	4												
				FV			243			8							0 1 38 61
			6	SS	1		242										
				FV						8							
							241										
			7	TW	PH												
				FV			240			6							
239.4 7.5	Silt trace sand, trace clay sand seams		8	SS	8		239										0 7 88 5
238.5 8.4	Loose Grey Wet																
	End of borehole Refusal on probable bedrock																
	* Borehole charged with drilling water																

CONT No

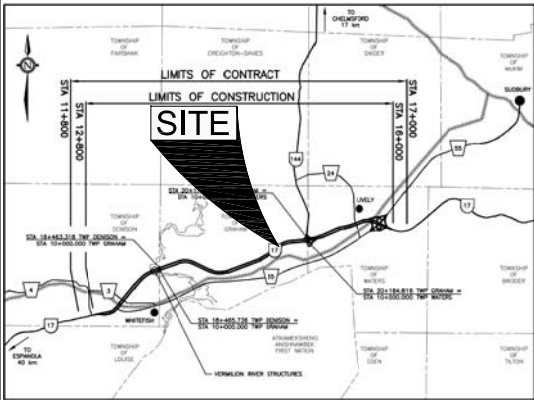
GWP No 5146-09-00

REPLACEMENT CULVERT M
HIGHWAY 17 STA 18+882 CL
GEOGRAPHIC TOWNSHIP OF GRAHAM
BOREHOLE LOCATIONS AND SOIL STRATA



SHEET

PML Peto MacCallum Ltd.
CONSULTING ENGINEERS



KEY PLAN

2.5km 0 5km 7.5km

LEGEND

- Borehole
- Borehole and Cone
- Pavement borehole
- N Blows/0.3m (Std. Pen Test, 475 J/blow)
- CONE Blows/0.3m (60 Cone, 475 J/blow)
- WL at time of investigation November 2012
- WH Penetration due to weight of hammer
- * Water level not established
- Head
- ARTESIAN WATER
- Encountered
- PIEZOMETER

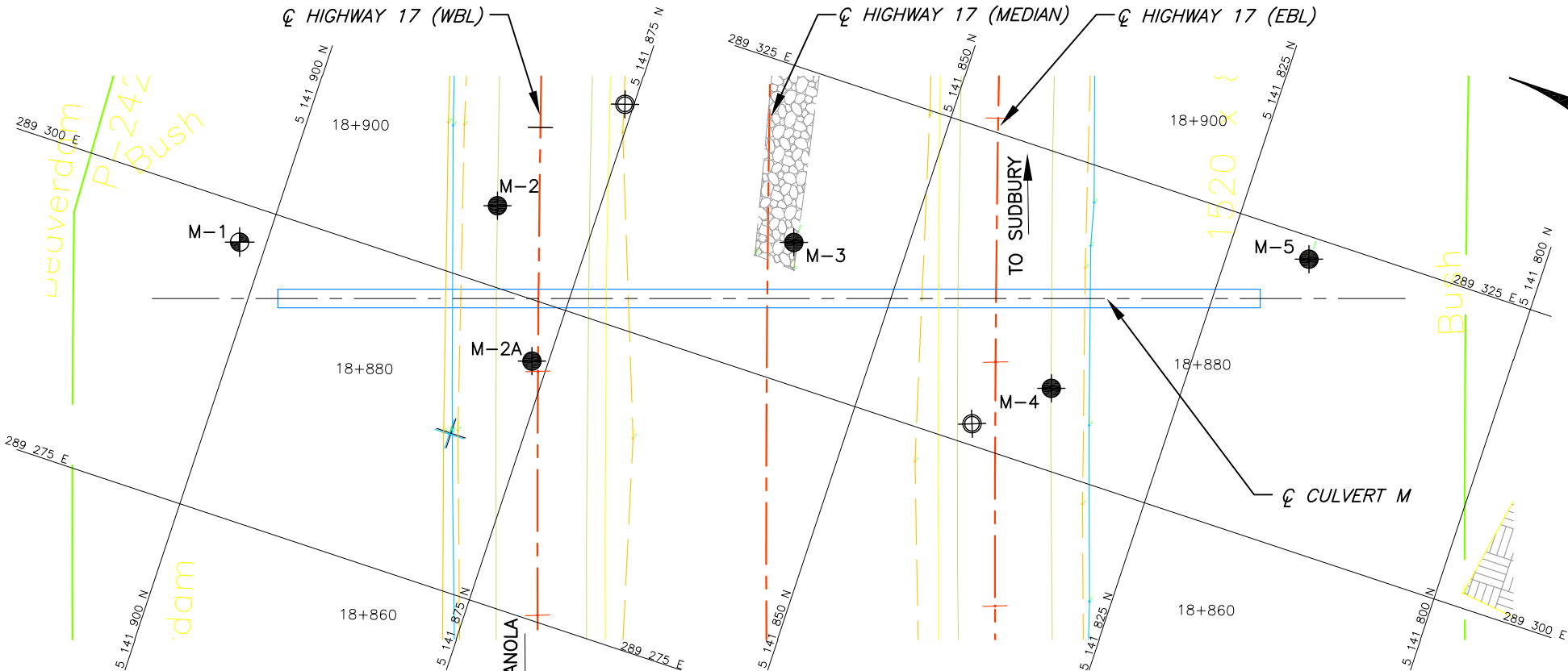
BH No	ELEVATION	NORTHINGS	EASTINGS
M-1	248.1	5 141 902.1	289 296.9
M-2	256.7	5 141 883.0	289 306.4
M-2A	256.8	5 141 876.3	289 295.2
M-3	252.7	5 141 859.0	289 311.2
M-4	256.6	5 141 835.2	289 306.5
M-5	246.9	5 141 818.5	289 323.2

NOTE:
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

Geocres No.411-299

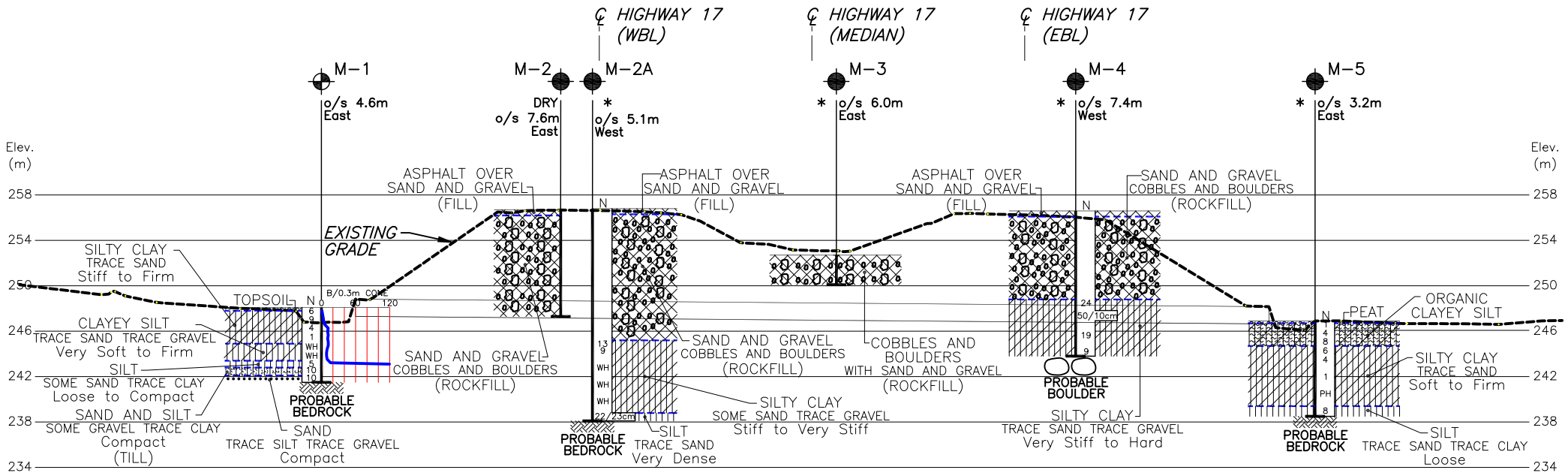
HWY No	17	DIST	Sudbury
SUBM'D	NA	CHECKED	NR
DRAWN	NA	CHECKED	BRG
DATE	APR. 16, 2014	APPROVED	CN
SITE		DWG	M-1



PLAN

SCALE

5 0 5 10m



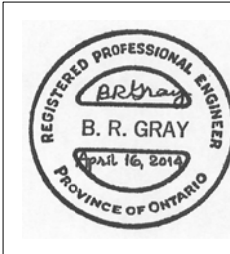
PROFILE ALONG C EXISTING CULVERT AT STA. 17+894 CL

SCALE

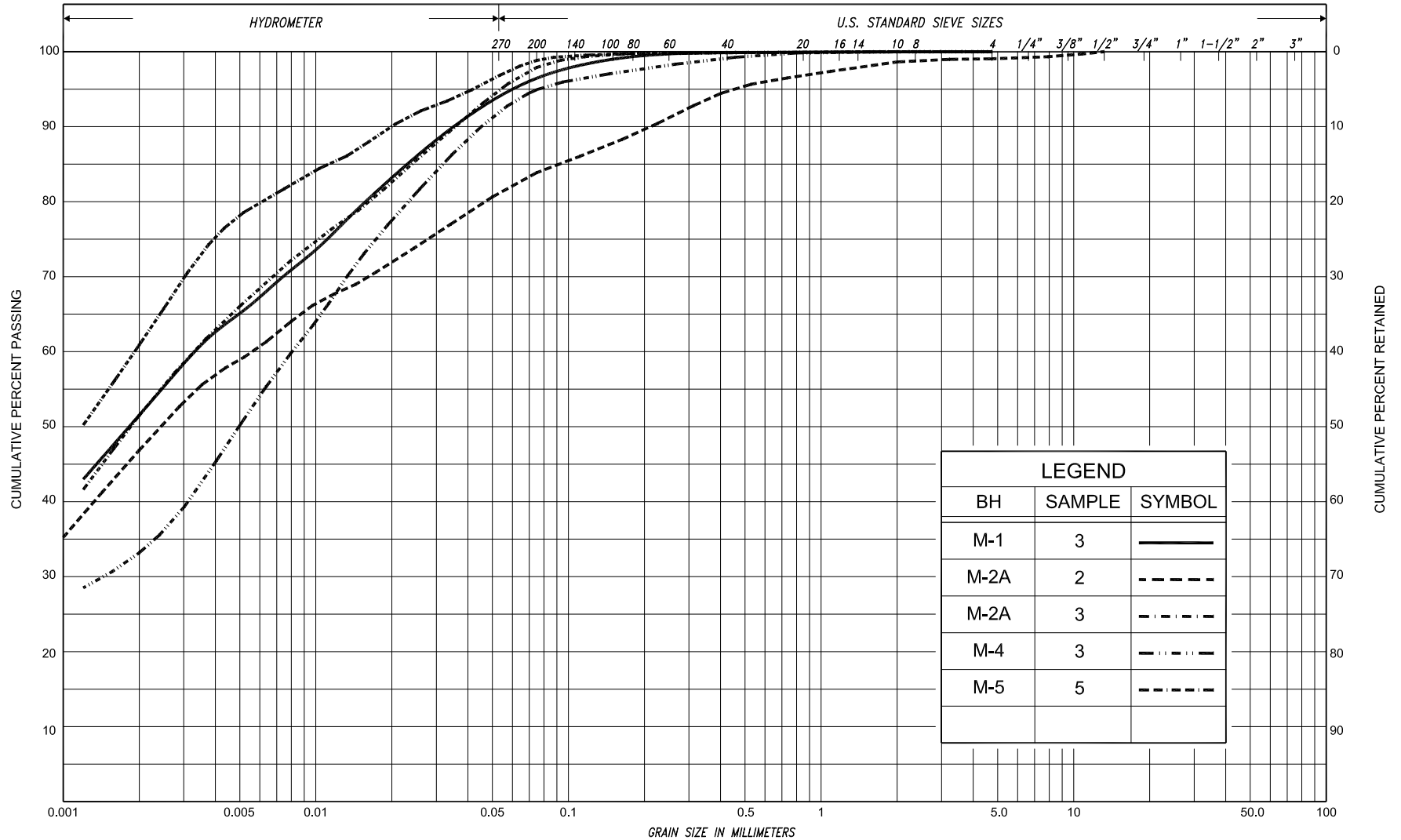
5 0 5 10m

NOTES:

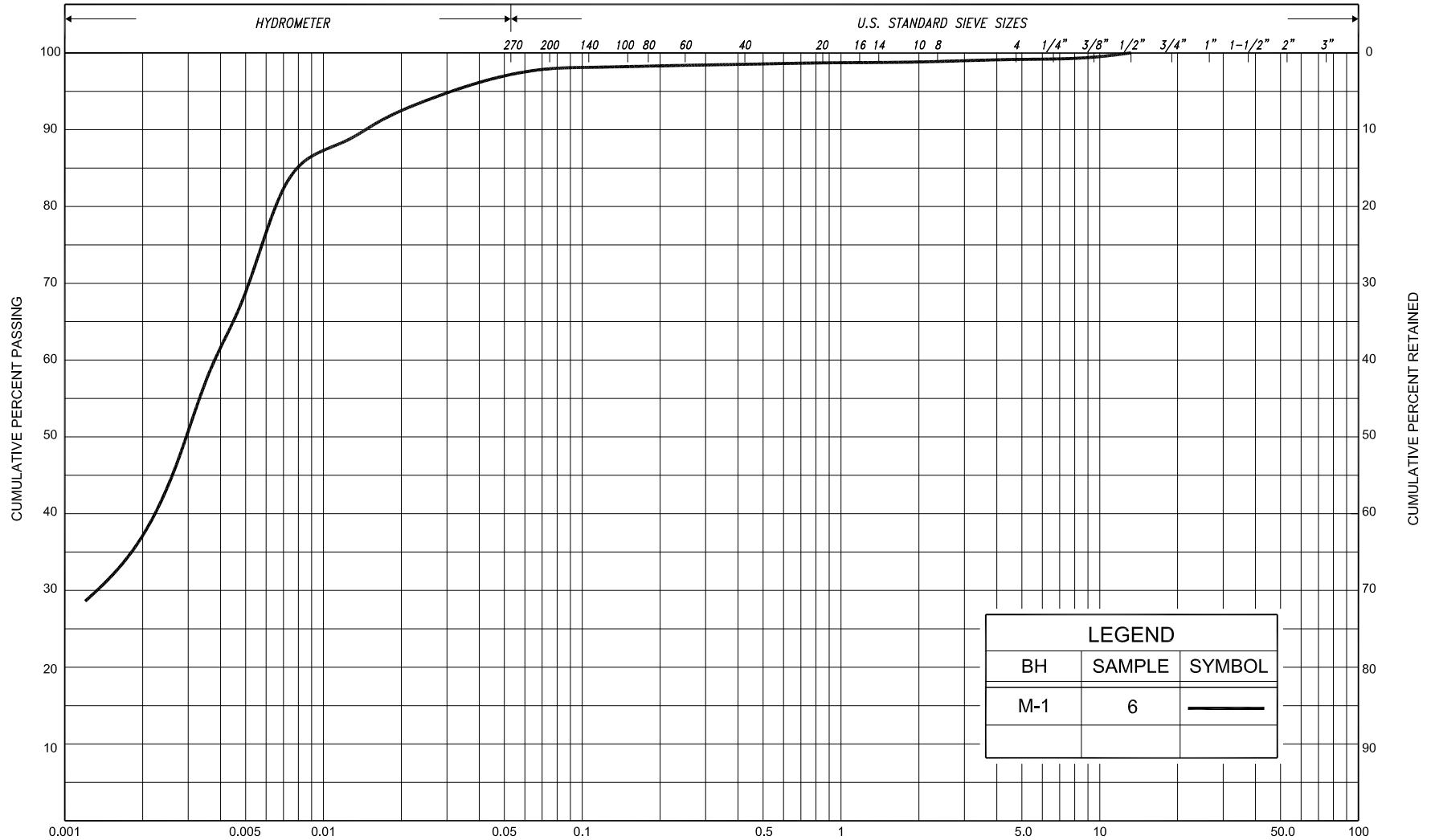
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
- THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION. CULVERT PROFILE IS ESTIMATED.
- DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.



Reference AECOM Drawings:
NTB-01207011.dwg and GRAHAM X-SECTIONS with Culverts and viewport.dwg
received on November 25, 2013 and April 01, 2014 respectively.



SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL			COB BLES	UNIFIED		
					SAND												
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT					SAND											
CLAY		SILT			V. FINE		FINE		MED.		COARSE		GRAVEL			U.S. BUREAU	
					SAND												



SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL				COBBLES	UNIFIED			
					SAND													
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL				COBBLES	M.I.T.
	SILT					SAND												
CLAY		SILT			V. FINE	FINE	MED.	COARSE		GRAVEL							U.S. BUREAU	
					SAND													



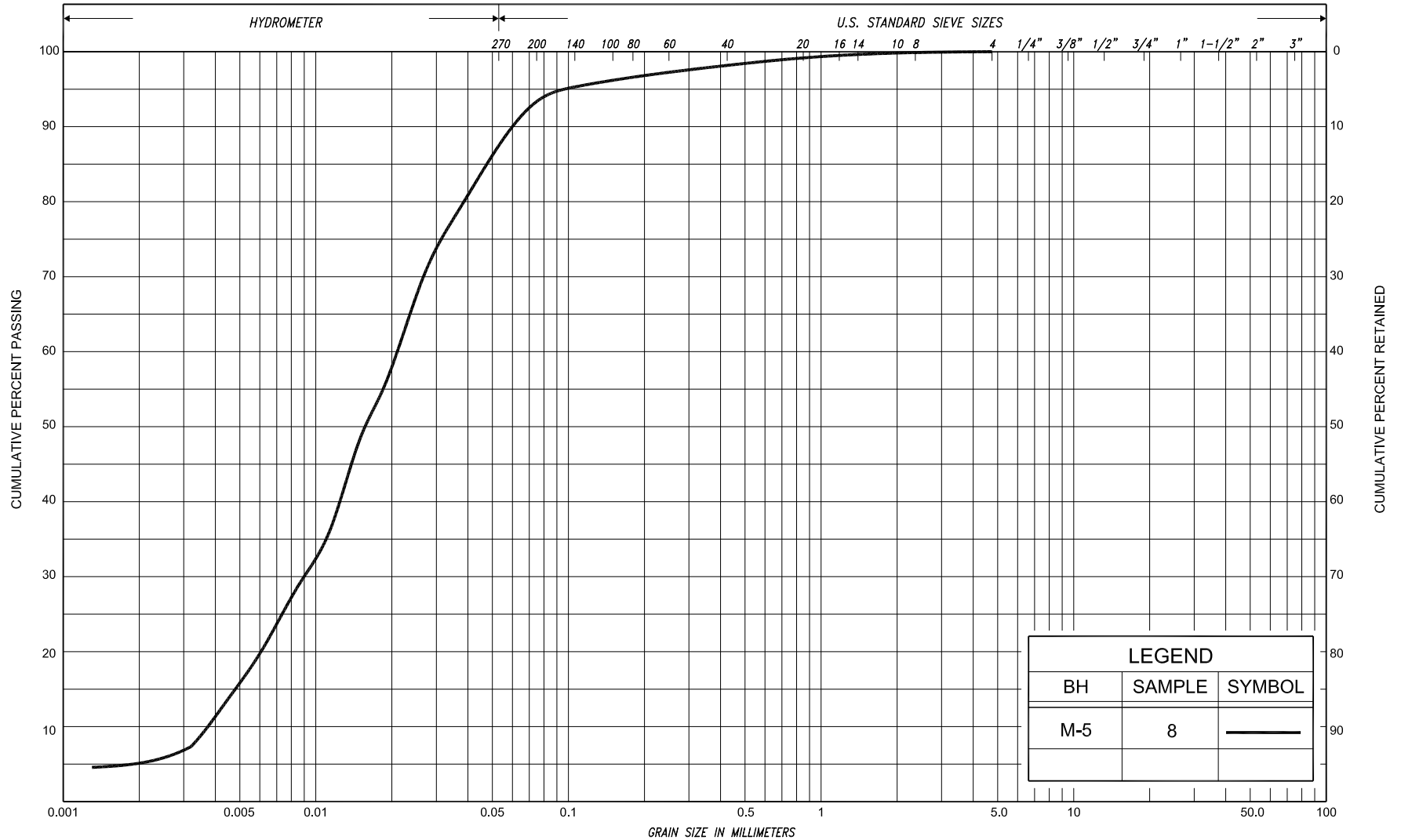
GRAIN SIZE DISTRIBUTION

CLAYEY SILT, trace sand, trace gravel (CL)

FIG No. M-GS-2

HWY: 17

G.W.P. No. 5146-09-00



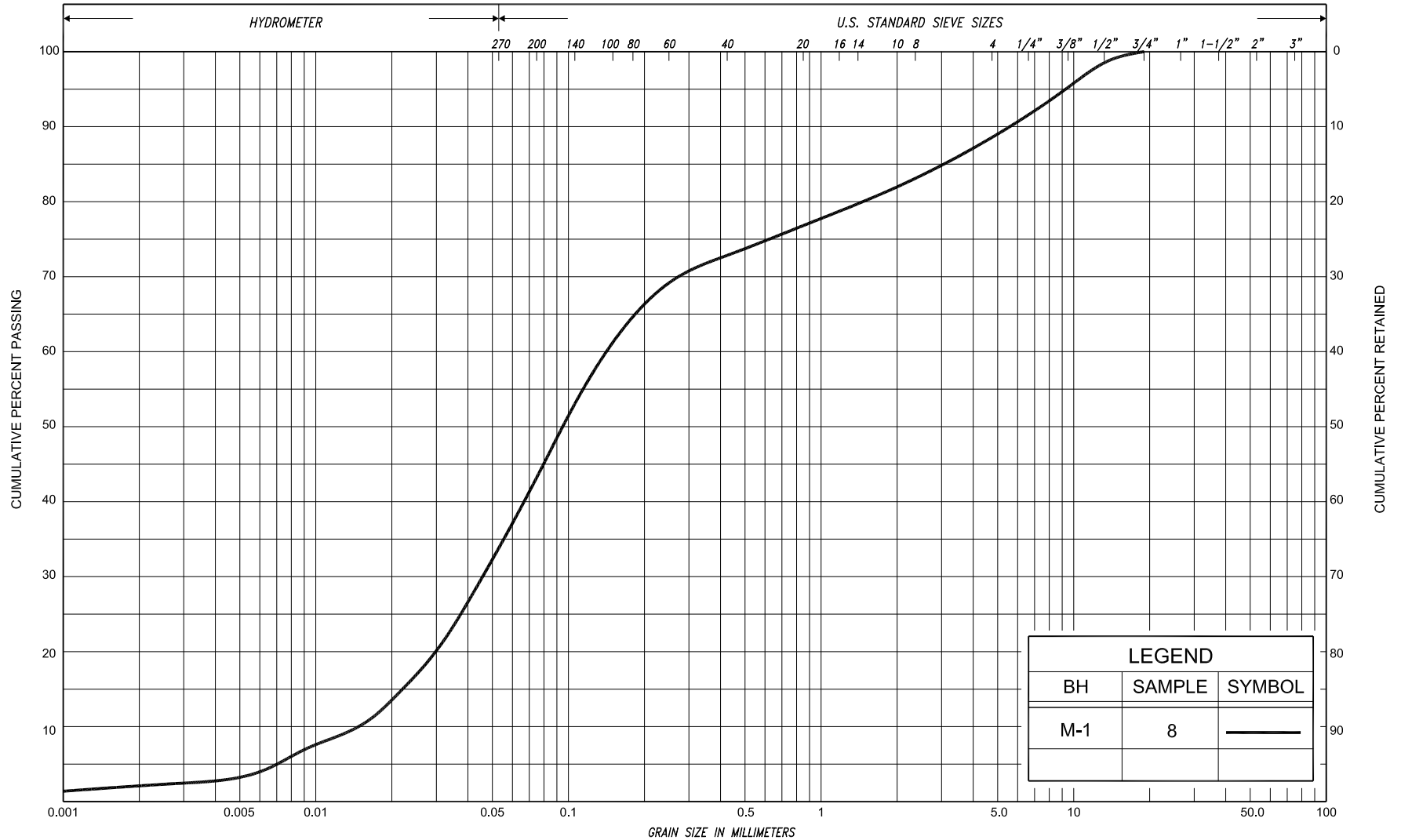
SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL				COBBLES	UNIFIED			
					SAND													
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL				COBBLES	M.I.T.
	SILT					SAND												
CLAY		SILT			V. FINE	FINE	MED.	COARSE		GRAVEL							U.S. BUREAU	
					SAND													



GRAIN SIZE DISTRIBUTION

SILT, trace sand, trace clay

FIG No. M-GS-3
 HWY: 17
 G.W.P. No. 5146-09-00

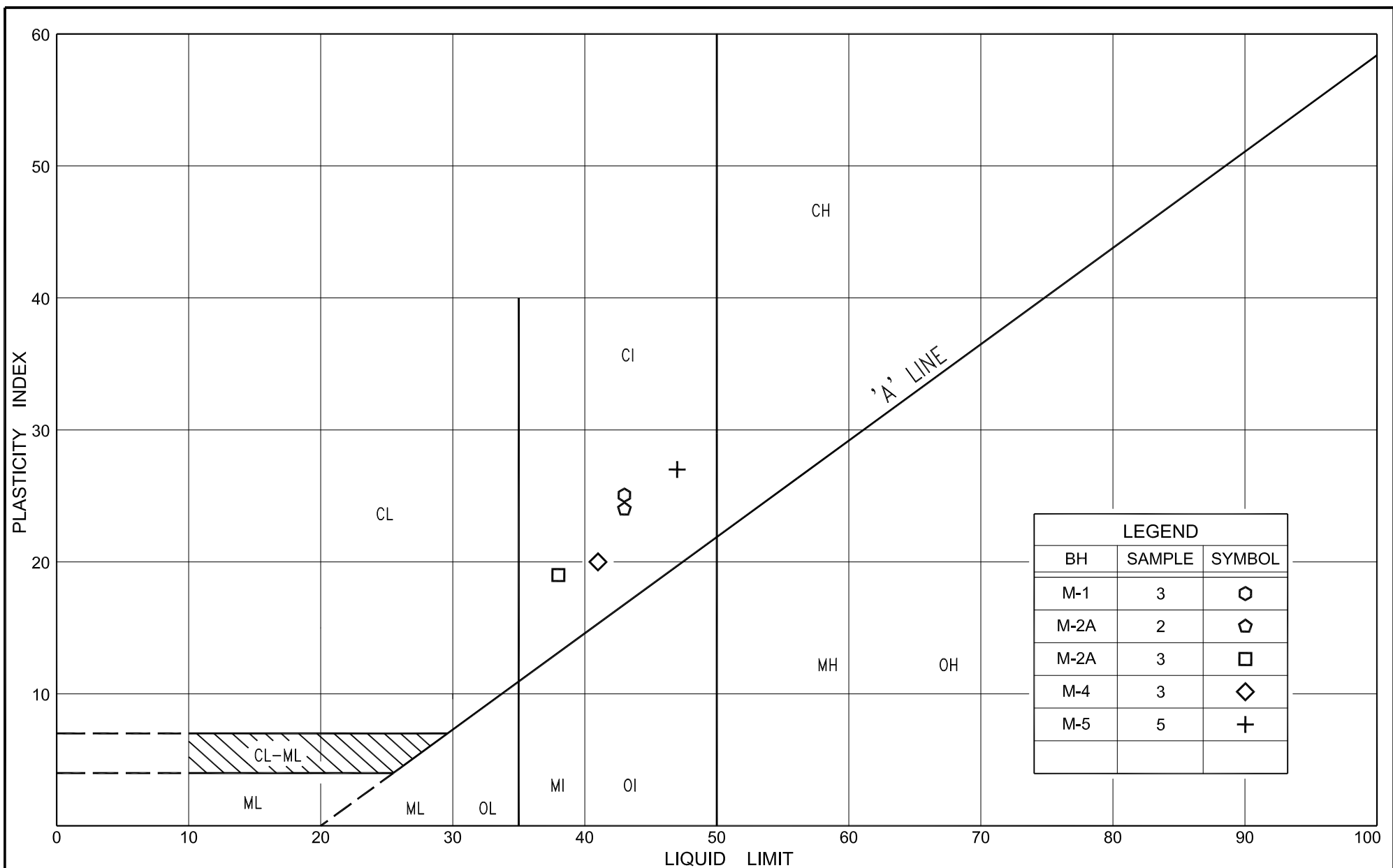


SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL				COBBLES	UNIFIED				
					SAND														
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL				COBBLES	M.I.T.	
	SILT																		
CLAY			SILT			V. FINE	FINE	MED.	COARSE		GRAVEL							U.S. BUREAU	
						SAND													



GRAIN SIZE DISTRIBUTION SAND AND SILT, some gravel, trace clay (TILL)

FIG No. M-GS-4
 HWY: 17
 G.W.P. No. 5146-09-00



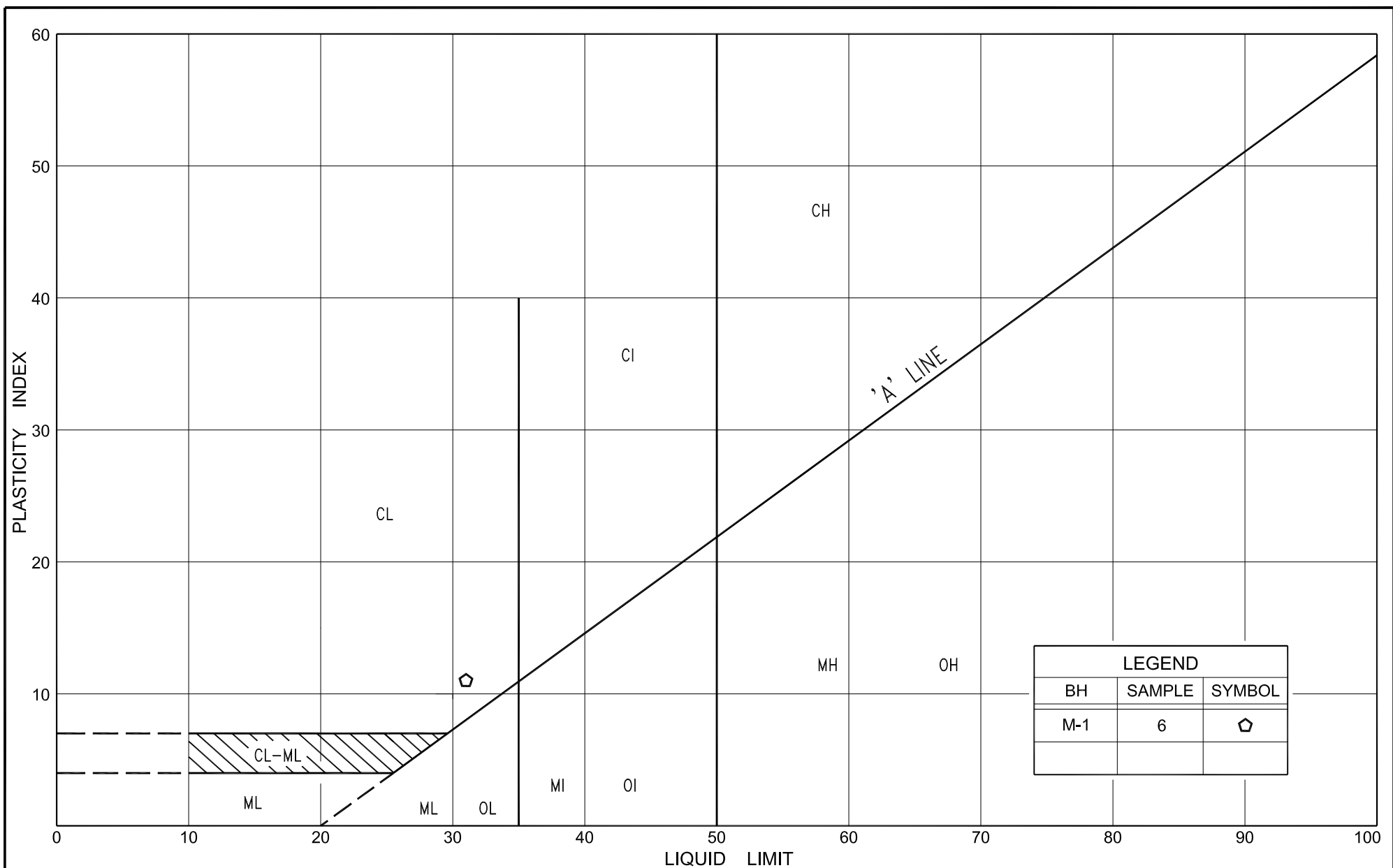
PLASTICITY CHART

SILTY CLAY, trace to some sand, trace gravel (CI)

FIG No. M-PC-1

HWY: 17

G.W.P. No. 5146-09-00



PLASTICITY CHART
CLAYEY SILT, trace sand, trace gravel (CL)

FIG No. M-PC-2
HWY: 17
G.W.P. No. 5146-09-00


GEOGRAPHIC TOWNSHIP OF GRAHAM
Culvert N1 (G30) – Station 19+820 WBL

RECORD OF BOREHOLE No N1-1

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 142 035.2 N; 290 210.5 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Power Auger **COMPILED BY** N.R.
DATUM Geodetic **DATE** December 18, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
256.7	Ground surface							20	40	60	80	100								
0.0	Sand and gravel (FILL)						256													
255.6	End of borehole Refusal on probable bedrock																			
1.1	* Borehole dry NOTES: 1: Refusal at 0.8 m depth. Drilled 2.0 m west of borehole N1-1. 2 Exposed bedrock at 19+813, 2.0m north of borehole N1-1																			

RECORD OF BOREHOLE No N1-2

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 142 027.3 N; 290 211.6 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.S.S.A. and 'N' Casing **COMPILED BY** N.R.
DATUM Geodetic **DATE** December 13, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE									
								● QUICK TRIAXIAL × LAB VANE									
					WATER CONTENT (%)												
260.9 0.0	Ground surface Sand and gravel (FILL)						20	40	60	80	100						
259.8 1.1	cobbles and boulders (ROCKFILL)																
258.7 2.2	Silty clay, trace sand Stiff to Brown/ Moist very soft grey		1	SS	15								○				
			2	SS	10								⊖	⊖		0 2 43 55	
			3	SS	6									○			
			4	SS	1								⊖	⊖		0 1 49 50	
255.3 5.6	Silty sand	●		FV		▽*				+	4						
254.7 6.2	Loose Brown Wet	●	5	SS	9								○				
	End of borehole Refusal on probable bedrock		6	SS	20/15cm												
	 * 2012 12 13 ▽ Water level observed during drilling 'N' casing advanced from 1.1 m depth C.F.S.S.A. denotes continuous flight solid stem augaers																

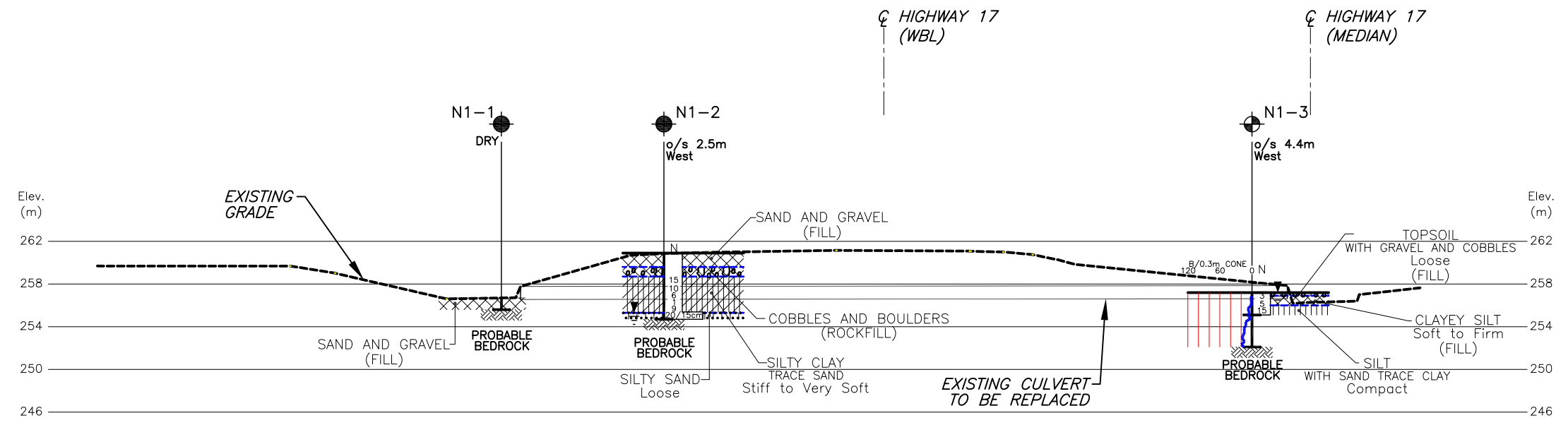
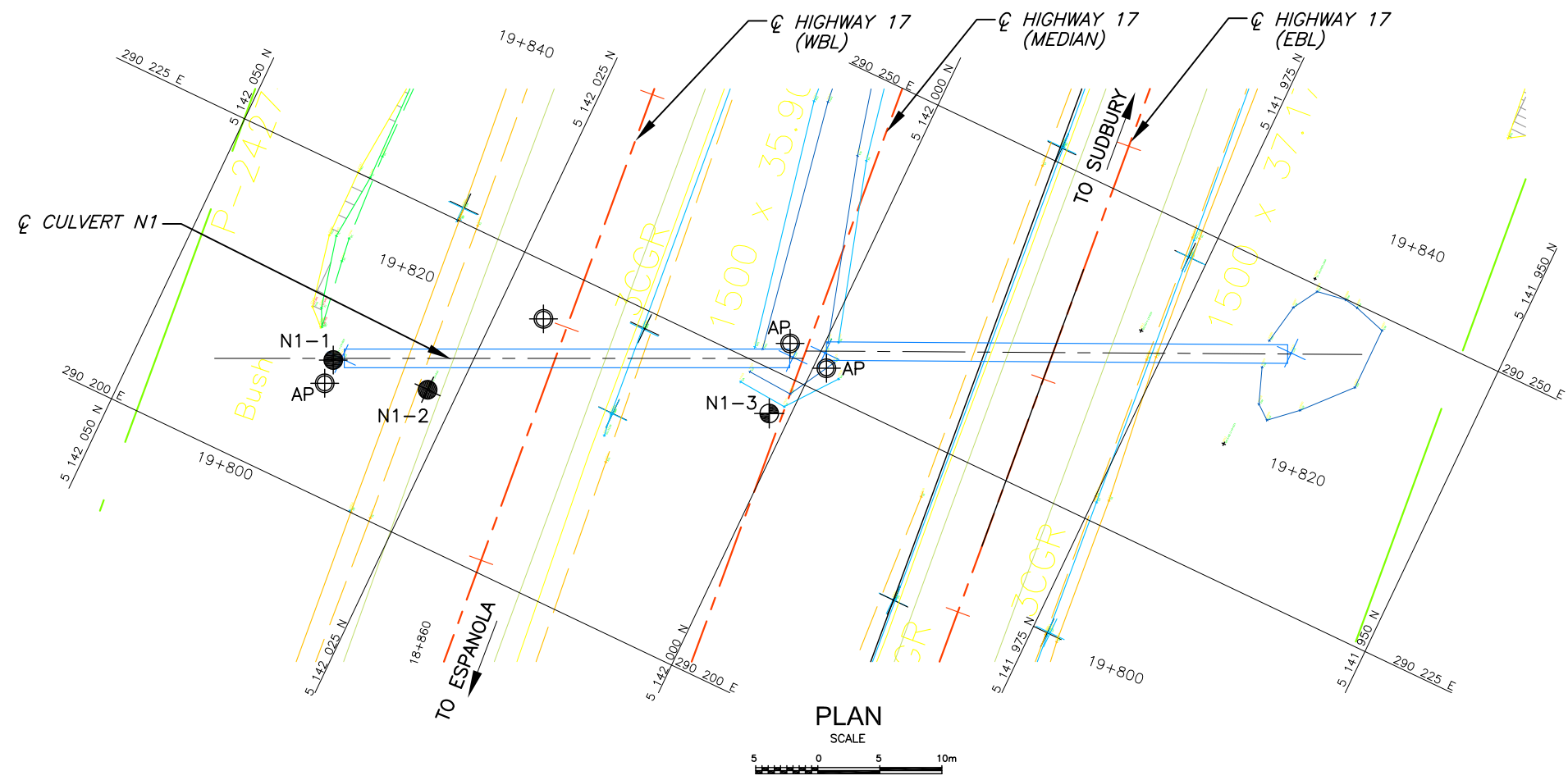
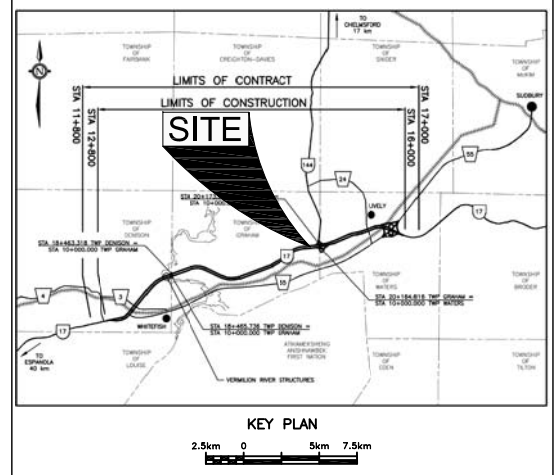
RECORD OF BOREHOLE No N1-3

1 of 1

METRIC

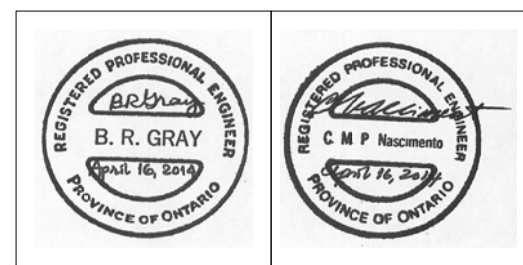
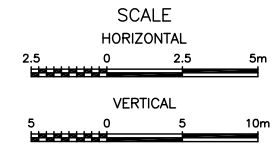
G.W.P. 5146-09-00 **LOCATION** Coords: 5 142 001.6 N; 290 221.7 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod and 'N' Casing **COMPILED BY** N.R.
DATUM Geodetic **DATE** April 29, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
257.2	Ground surface					▽*		20	40	60	80	100								
0.0 256.9 0.3	Topsoil with gravel and cobbles		1	SS	3		257									103				
	Loose Dark Moist brown																			
256.0	Clayey silt organic inclusions		2	SS	5	▽*	256													
1.2	Soft to Grey Moist firm (FILL)																			
255.1	Silt, with sand trace clay, organics sand partings		3	SS	15		255										0 22 69 9			
2.1	Compact Dark Moist brown						254													
	End of borehole Refusal on probable boulder Probable silt						253													
252.1	End of dynamic cone penetration test																			
5.1																				
<div>* 2013 04 29</div> <div>▽ Water level observed during drilling</div> <div>▼ Water level measured after drilling</div> <div>NOTES:<div>1: Dynamic cone penetration test was conducted 2m northwest of borehole N1-3</div><div>2: Auger probe at south end of WBL culvert in the median to 1.4m, no refusal</div><div>3: Auger probe at north end of EBL culvert in the median at Sta. 19+825 met refusal at 0.5m on probable boulder</div></div>																				



LEGEND				
	Borehole			
	Borehole and Cone			
	Pavement borehole/Auger probe (AP)			
N	Blows/0.3m (Std. Pen Test, 475 J/blow)			
CONE	Blows/0.3m (60 Cone, 475 J/blow)			
	WL at time of investigation November 2012			
WH	Penetration due to weight of hammer			
	Head			
	ARTESIAN WATER			
	Encountered			
	PIEZOMETER			
BH No	ELEVATION	NORTHINGS	EASTINGS	
N1-1	256.7	5 142 035.2	290 210.5	
N1-2	260.9	5 142 027.3	290 211.6	
N1-3	257.2	5 142 001.5	290 221.7	

- NOTES:
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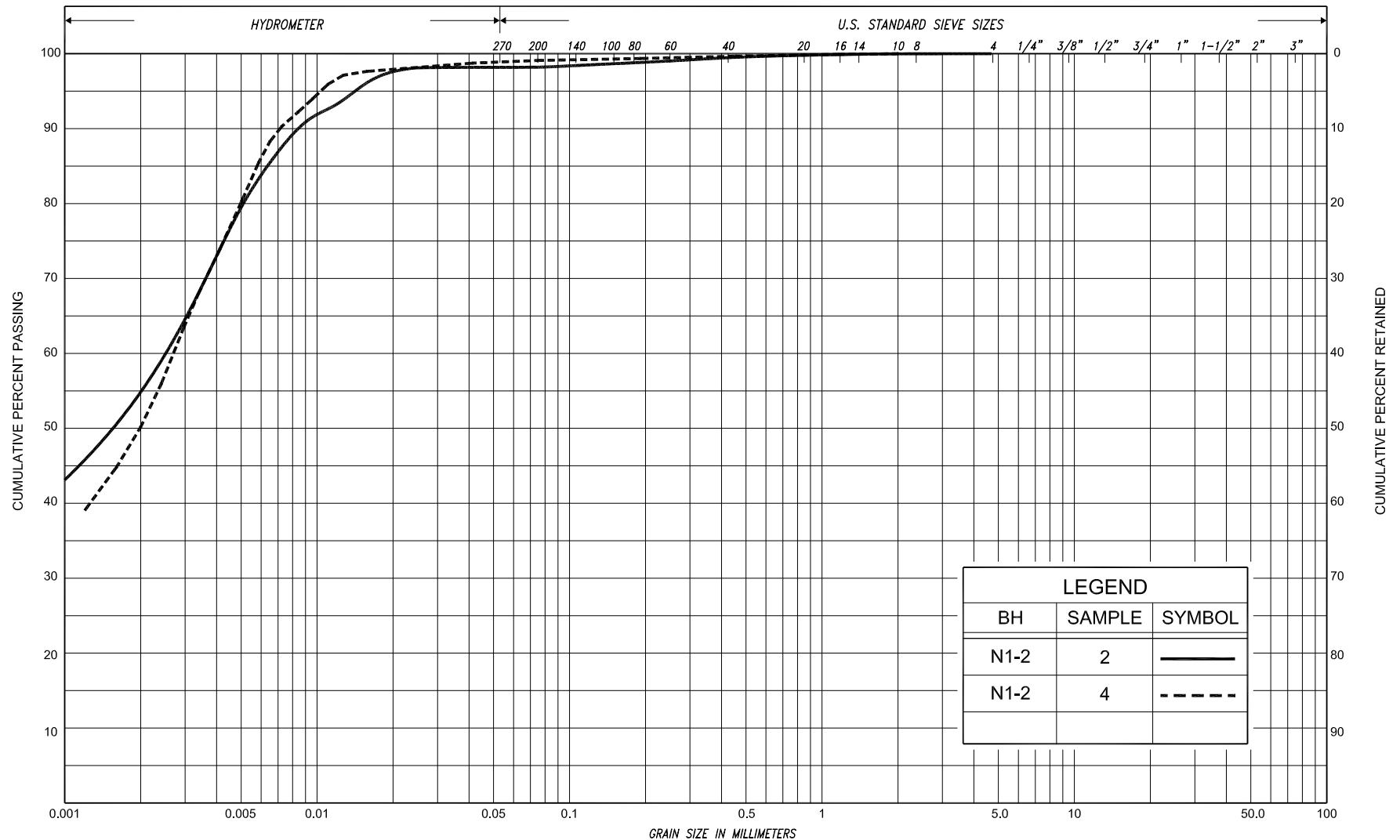


NOTE:
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

Reference AECOM Drawings:
NTB-01207011.dwg and GRAHAM X-SECTIONS with Culverts and viewport.dwg
received on November 25, 2013 and April 01, 2014 respectively.

Geocres No.411-299		DIST Sudbury	
HWY No 17	SUBM'D NA	CHECKED NR	DATE APR. 16, 2014
DRAWN NA	CHECKED BRG	APPROVED CN	DWG N1-1



SILT & CLAY				FINE		MEDIUM		COARSE		GRAVEL				COB BLES	UNIFIED			
				SAND														
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL				COBBLES	M.I.T.
	SILT																	
CLAY		SILT			V. FINE	FINE	MED.	COARSE	GRAVEL							U.S. BUREAU		
					SAND													



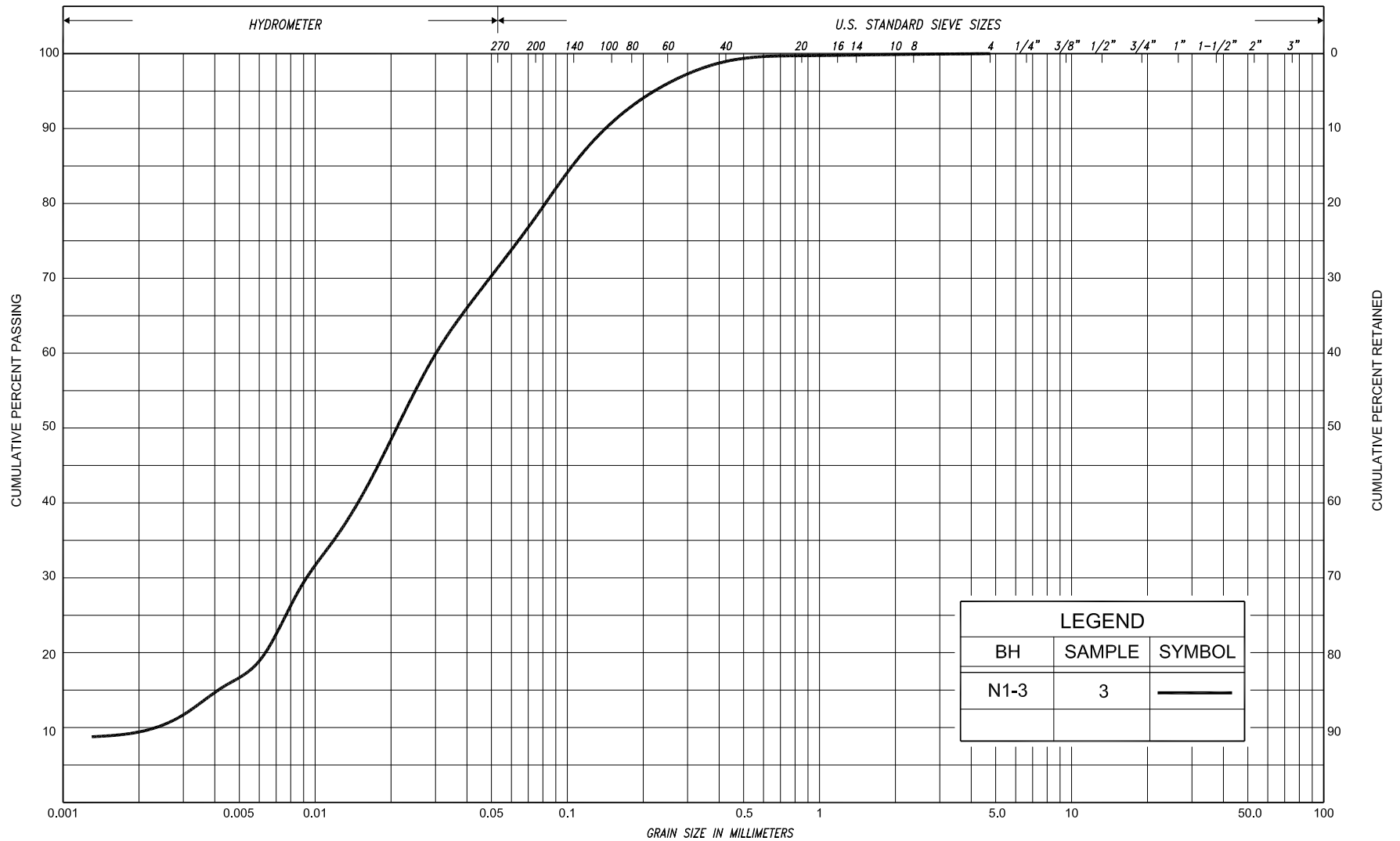
GRAIN SIZE DISTRIBUTION

SILTY CLAY, trace sand (CI)

FIG No. N1-GS-1

HWY: 17

G.W.P. No. 5146-09-00



LEGEND		
BH	SAMPLE	SYMBOL
N1-3	3	—

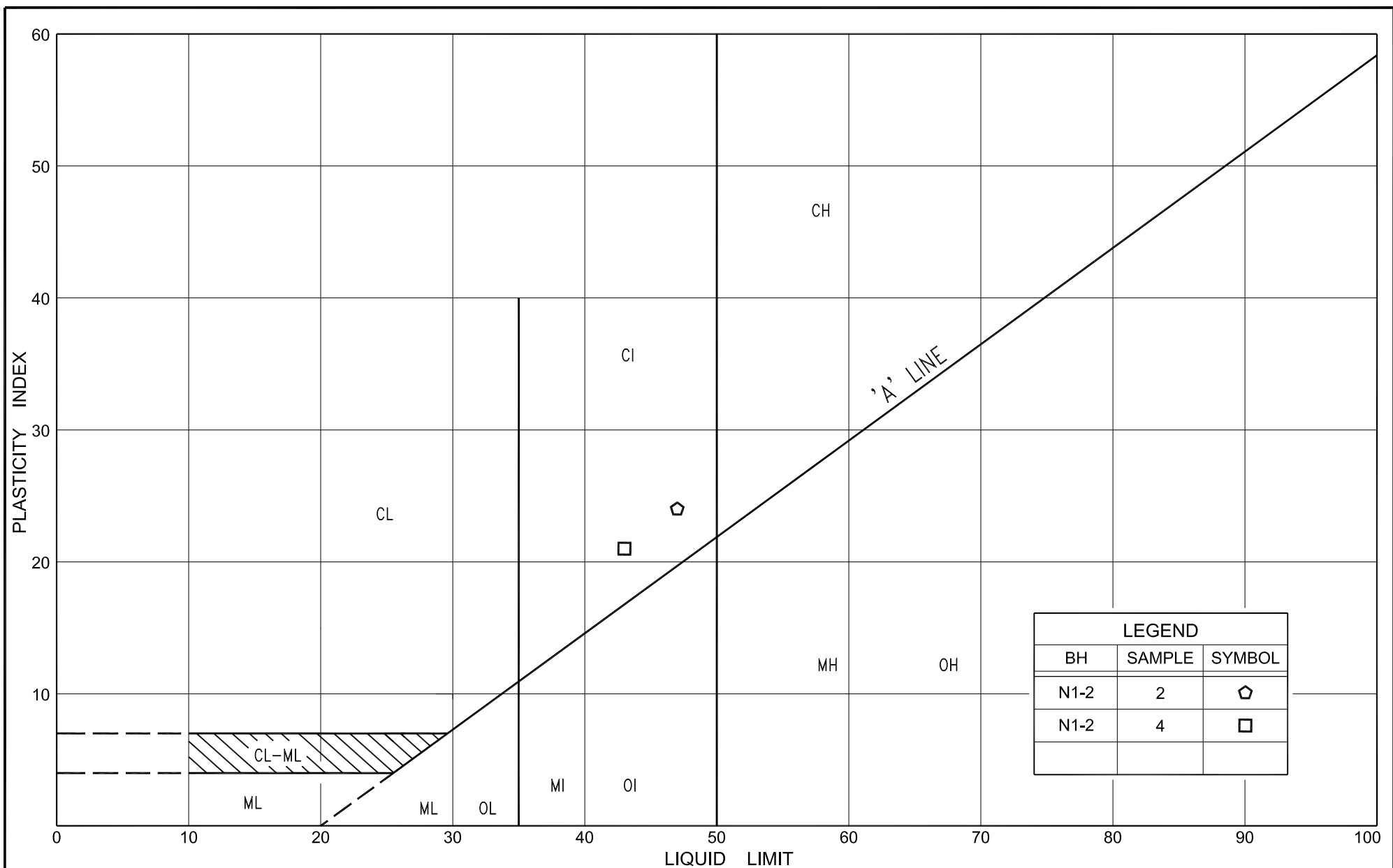
SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED		
					SAND											
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL		COBBLES	M.I.T.
	SILT															
CLAY		SILT			V. FINE	FINE	MED.	COARSE		GRAVEL					U.S. BUREAU	
					SAND											



GRAIN SIZE DISTRIBUTION

SILT, some sand, trace clay

FIG No.	N1-GS-2
HWY:	17
G.W.P. No.	5146-09-00



PLASTICITY CHART
SILTY CLAY, trace sand (CI)

FIG No. N1-PC-1
HWY: 17
G.W.P. No. 5146-09-00

GEOGRAPHIC TOWNSHIP OF GRAHAM
Culvert N2 (G31) – Station 19+850 EBL

RECORD OF BOREHOLE No N2-1

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 141 977.4 N; 290 240.6 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.H.S.A. and 'N' Casing **COMPILED BY** N.R.
DATUM Geodetic **DATE** December 06, 2012 **CHECKED BY** B.R.G.


SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE										○		
								● QUICK TRIAXIAL × LAB VANE												
260.8 0.0	Ground surface Sand and gravel (FILL) cobbles and boulders (ROCKFILL)						20	40	60	80	100	20	40	60						
260.0 0.8							260													
							259													
							258													
							257													
256.3 4.5	clayey silt, organics Firm Dark grey boulder		1	SS	5		256						○							
			2	SS	50/13cm															
255.0 5.8	Sand, trace silt trace clay, trace gravel Compact Grey Wet with silt, some gravel		3	SS	10		255													
							254													
			4	SS	23		253						○			11 61 26 2				
252.1 8.7	End of borehole Refusal on probable bedrock Sample 2: Sampler bouncing * Borehole charged with drilling water 'N' casing advanced from 0.8 m depth																			

RECORD OF BOREHOLE No N2-2

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 141 967.5 N; 290 235.2 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod and 'N' casing + D.C.P.T. **COMPILED BY** N.R.
DATUM Geodetic **DATE** December 18, 2012 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
257.3	Ground surface																			
257.1	Topsoil																			
0.2	Silt some clay, trace sand			1	SS	6														
	Loose to compact Greyish Moist brown																			
			2	SS	18															
255.9	End of borehole																			
1.4	Refusal on probable bedrock																			
	<p>* Borehole charged with drilling water</p> <p>D.C.P.T. denotes Dynamic cone penetration test</p> <p>NOTES:</p> <p>1: Auger probe 3.0m south of borehole met refusal at 0.8m on probable bedrock</p> <p>2: Auger probes advanced at east and west sides of the north end of culvert to 1.4m, no refusal was met</p>																			

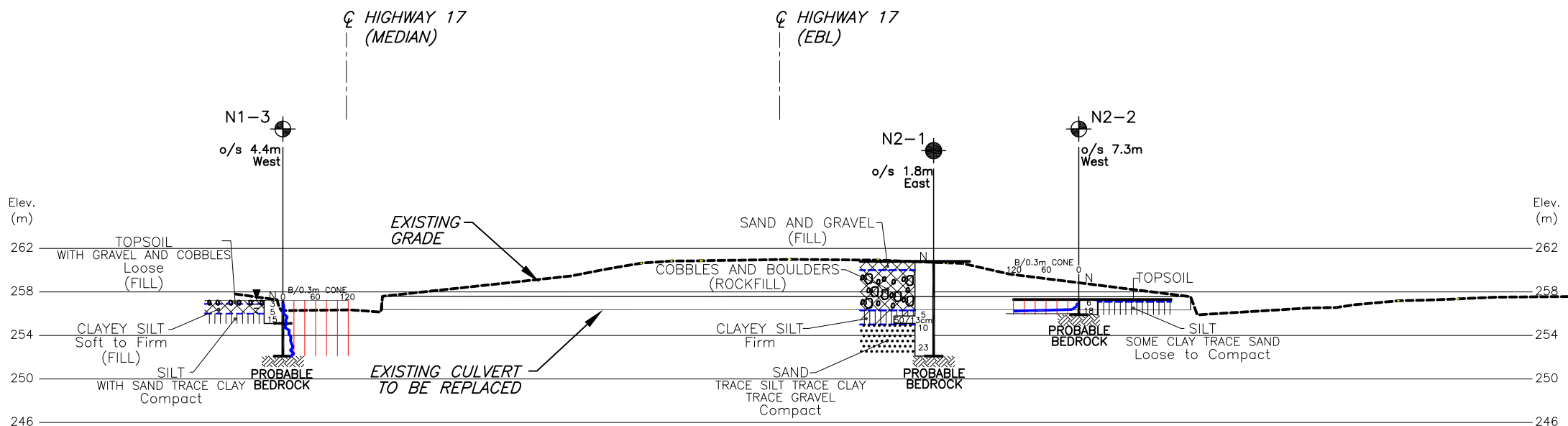
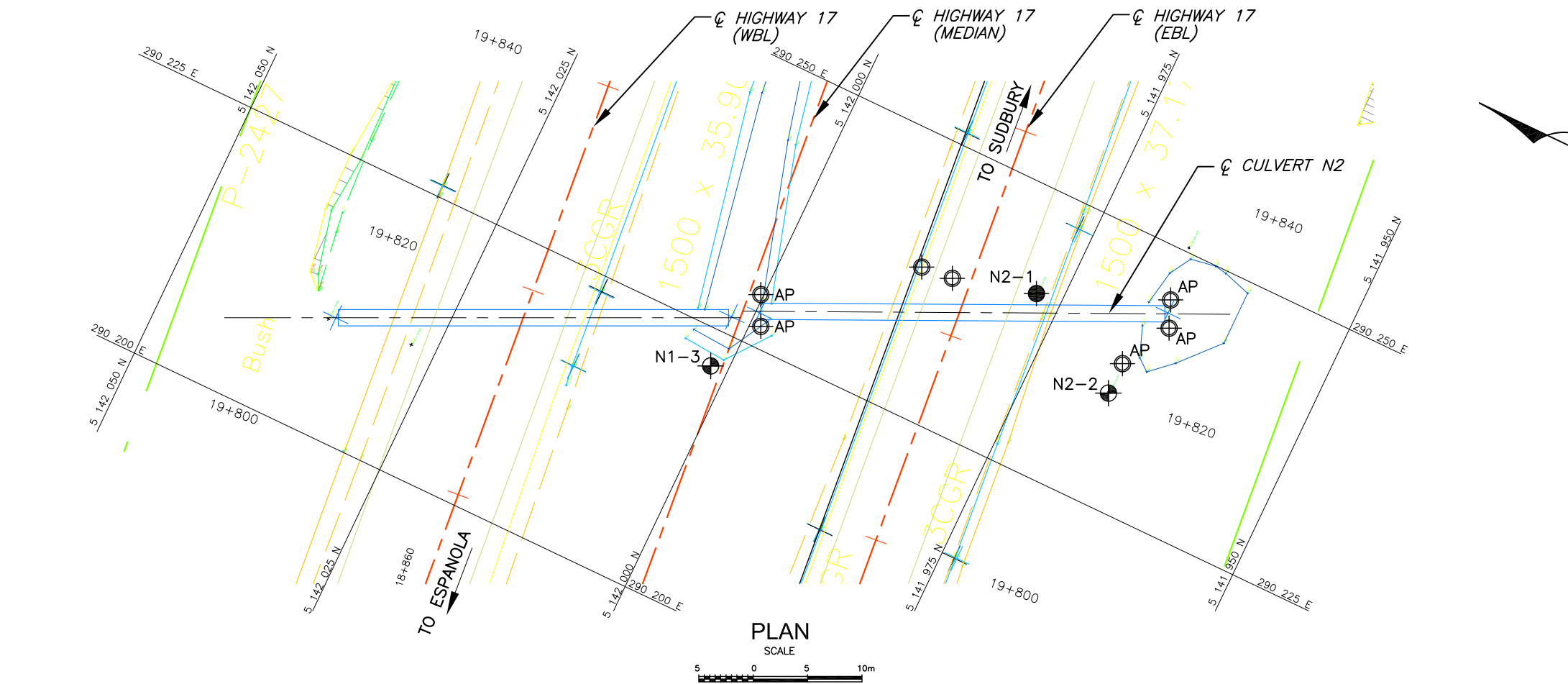
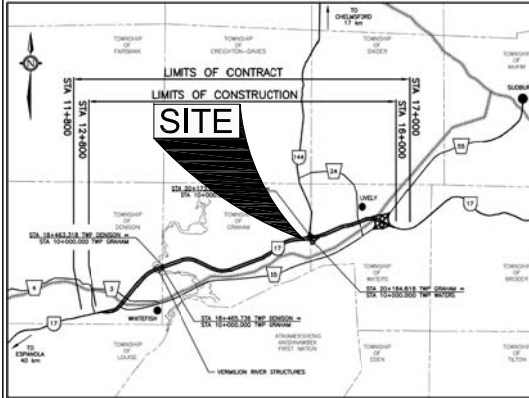
RECORD OF BOREHOLE No N1-3

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 142 001.6 N; 290 221.7 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod and 'N' Casing **COMPILED BY** N.R.
DATUM Geodetic **DATE** April 29, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								20 40 60 80 100										20 40 60		
257.2	Ground surface					▽*														
0.0 256.9 0.3	Topsoil with gravel and cobbles		1	SS	3		257								103					
	Loose Dark Moist brown																			
256.0	Clayey silt organic inclusions		2	SS	5	▽*	256													
1.2	Soft to Grey Moist firm (FILL)																			
255.1	Silt, with sand trace clay, organics sand partings		3	SS	15		255									0 22 69 9				
2.1	Compact Dark Moist brown						254													
	End of borehole Refusal on probable boulder Probable silt						253													
252.1	End of dynamic cone penetration test																			
5.1																				
* 2013 04 29																				
▽ Water level observed during drilling																				
▼ Water level measured after drilling																				
NOTES:																				
1: Dynamic cone penetration test was conducted 2m northwest of borehole N1-3																				
2: Auger probe at south end of WBL culvert in the median to 1.4m, no refusal																				
3: Auger probe at north end of EBL culvert in the median at Sta. 19+825 met refusal at 0.5m on probable boulder																				



LEGEND			
	Borehole		
	Borehole and Cone		
	Pavement borehole/Auger probe (AP)		
N	Blows/0.3m (Std. Pen Test, 475 J/blow)		
CONE	Blows/0.3m (60 Cone, 475 J/blow)		
	WL at time of investigation December 2012		
WH	Penetration due to weight of hammer		
	Head		
	ARTESIAN WATER		
	Encountered		
	PIEZOMETER		

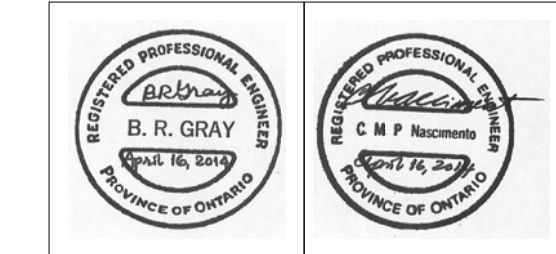
BH No	ELEVATION	NORTHINGS	EASTINGS
N2-1	260.8	5 141 977.4	290 240.6
N2-2	257.3	5 141 967.5	290 235.2
N1-3	257.2	5 142 001.5	290 221.7

NOTE:
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

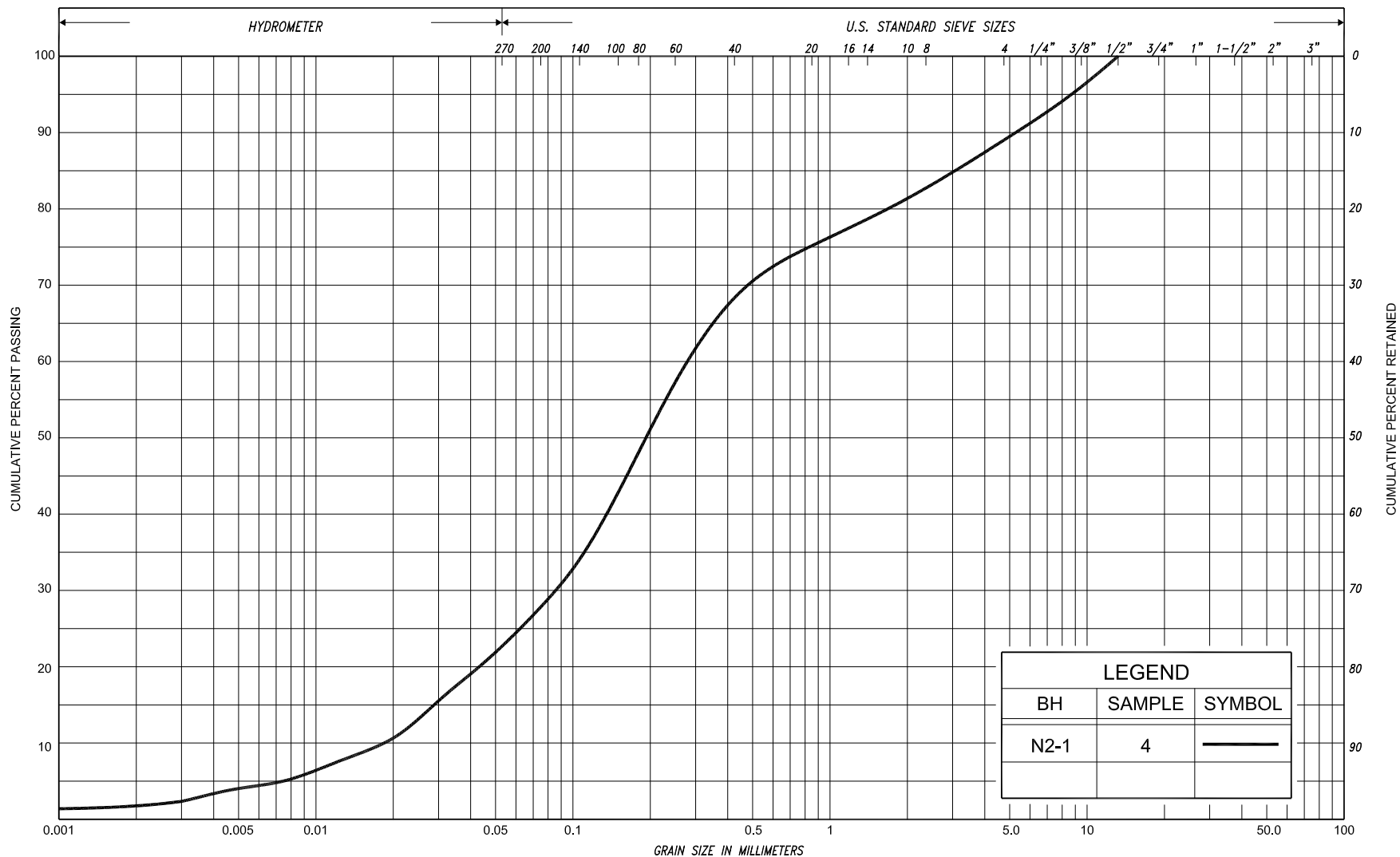
REVISIONS	DATE	BY	DESCRIPTION

Geocres No.411-299			
HWY No 17	SUBM'D NA	CHECKED NR	DATE APR. 16, 2014
DRAWN NA	CHECKED BRG	APPROVED CN	DWG N2-1

- NOTES:
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
 - THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION. CULVERT PROFILE IS ESTIMATED.
 - DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.



Reference AECOM Drawings:
NTB-01207011.dwg and GRAHAM X-SECTIONS with Culverts and viewport.dwg
received on November 25, 2013 and April 01, 2014 respectively.



SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL			COB BLES	UNIFIED		
					SAND												
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT																
CLAY			SILT			V. FINE	FINE	MED.	COARSE		GRAVEL					U.S. BUREAU	
					SAND												

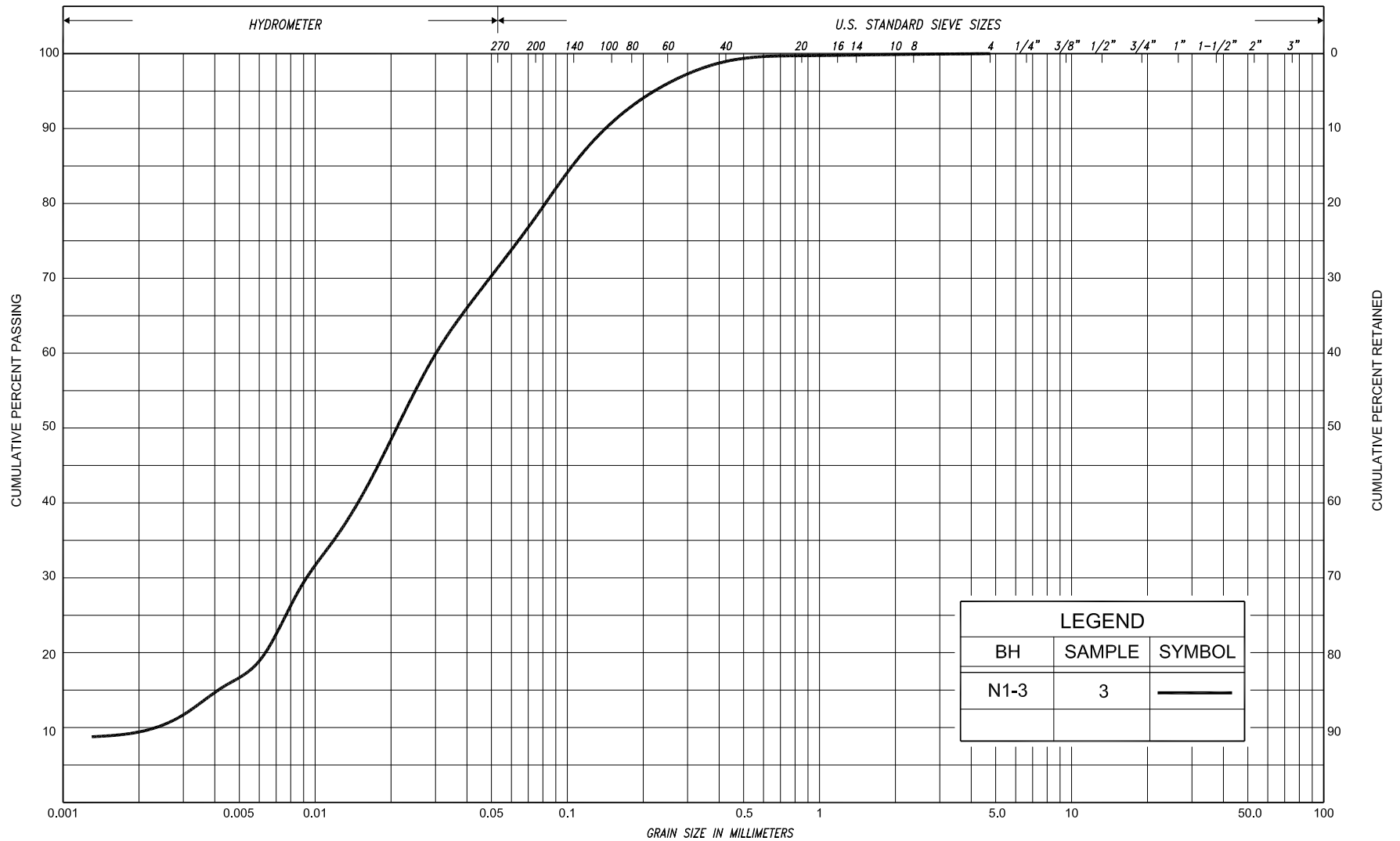
GRAIN SIZE DISTRIBUTION

SAND, trace silt, trace clay, trace gravel

FIG No. N2-GS-1

HWY: 17

W.P. No. 5146-09-00



LEGEND		
BH	SAMPLE	SYMBOL
N1-3	3	—

SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED		
					SAND											
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL		COBBLES	M.I.T.
	SILT					SAND										
CLAY		SILT			V. FINE	FINE	MED.	COARSE		GRAVEL						U.S. BUREAU
					SAND											



GRAIN SIZE DISTRIBUTION

SILT, some sand, trace clay

FIG No.	N1-GS-2
HWY:	17
G.W.P. No.	5146-09-00



Geographic Township of Waters
Record of Pavement Holes

Culvert O (W4) Sta 11+753 WBL

Highway 17 WBL Denison Township DATUM: Existing Highway 17 WBL Centreline				
11+750.0	1.9	Lt C/L	D-0.1	ROAD
At Culvert W4				
0	-	380	Asph	
380	-	550	Br Cr Sa And Gr Tr Si Moist	
550	-	950	Br Sa Some Gr Tr Si Moist	
		950	NFP RF	

Culvert P (W14) Sta 13+598 EBL

Highway 17 EBL Denison Township				
DATUM: Existing Highway 17 EBL Centreline				
13+600.0	2.1	Rt C/L	D+/-0	ROAD
At Culvert W13				
0	-	310	Asph	
310	-	450	Br Cr Sa And Gr Tr Si Moist	
			GW-GM	
			w = 5%	
			% Pass	
			26.5 mm = 100	
			19.0 mm = 99	
			13.2 mm = 90	
			9.5 mm = 75	
			4.75 mm = 52	
			1.18 mm = 28	
			300 µm = 18	
			75 µm = 6	
			LSFH	
			NOT Accep GRANULAR A	
			Accep GRANULAR B TYPE I	
450	-	800	Br Sa Tr Gr Tr Si Moist	
		800	NFP RF	
13+600.0	5.2	Rt C/L	D-0.1	MSH
At Culvert W13				
0	-	410	Dk Br Cr Sa And Gr Tr Si Moist	
410	-	660	Br Sa Tr Gr Tr Si Moist	
		660	NFP RF	
13+601.0	11.6	Lt C/L	D-2.6	HA
At Culvert W13 (North Culvert End - In Median)				
0	-	105	Wat	
105	-	290	Dk Br F-Co Fib Org M Wet	
290	-	600	Gry Si(y) Sa Tr Gr Tr Cl Occ Cob Wet	
600	-	1.5	Br/Gry Si(y) Cl Some Sa Firm Moist-Wet	
13+601.0	13.5	Rt C/L	D-2.7	HA
At Culvert W13 (South Culvert End)				
0	-	200	Wat	
200	-	360	Dk Br F-Co Fib Org M Wet	
360	-	1.5	Gry Si(y) Sa Tr Cl Wet	

Culvert Q (W17) Sta 14+943 WBL

Highway 17 WBL Denison Township DATUM: Existing Highway 17 WBL Centreline				
14+956.0	2.1	Lt C/L	D+/-0	ROAD
PDA 1, At Culvert W17				
0	-	160	Asph	
160	-	390	Br Cr Sa And Gr Tr Si Moist	
390	-	660	Br Sa Tr Gr Tr Si Occ Cob Moist	
660			NFP RF	



Culvert R (W25) Sta 15+687 CL

Highway 17 EBL Denison Township DATUM: Existing Highway 17 EBL Centreline	Highway 17 WBL Denison Township DATUM: Existing Highway 17 WBL Centreline
15+668.0 1.7 Lt C/L D+/-0 ROAD At Culvert W25 0 - 380 Asph 380 - 610 Br Cr Sa And Gr Tr Si Moist 610 - 980 Br Sa Tr Gr Tr Si Moist NFP RF	15+705.0 1.9 Rt C/L D+/-0 ROAD At Culvert W25 0 - 340 Asph 340 - 680 Br Cr Sa And Gr Tr Si Moist 680 - 980 Gry Si Some Sa Moist 980 - 1.5 Br/Gry Cl(y) Si Tr Sa Moist

GEOGRAPHIC TOWNSHIP OF WATERS

Culvert O (W4) – Station 11+753 WBL

RECORD OF BOREHOLE No O-1

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 142 581.2 N; 292 225.1 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod and 'N' casing + D.C.P.T. **COMPILED BY** N.R.
DATUM Geodetic **DATE** March 05, 2013 **CHECKED BY**











SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p W W _L				
263.4	Ground surface																
0.0	Snow and ice					▽*	▼*										
263.1																	
0.3	Open water																
262.3																	
1.1																	
262.2	Peat		1	SS	1												
1.2	Silty clay, organics																
	Very soft Grey Moist to soft		2	SS	2												
261.1	Mottled grey/brown																
2.3	Silt trace sand, trace clay		3	SS	8												
	Loose Mottled Wet grey/brown		4	SS	4												
259.6	Grey Wet																
3.8	Sand trace silt, trace clay		5	SS	5												
	Loose to Grey Wet compact																
	trace gravel		6	SS	8												
	some silt		7	SS	19												
256.5																	
6.9	End of borehole																
	Refusal on probable bedrock																
												</					

RECORD OF BOREHOLE No O-2

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 142 572.2 N; 292 227.4 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.H.S.A. and 'N' Casing **COMPILED BY** N.R.
DATUM Geodetic **DATE** December 07 and 11, 2012 **CHECKED BY** B.R.G.






SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
267.1 0.0	Ground surface Sand and gravel (FILL)					▽*	267													
266.3 0.8	cobbles and boulders (ROCKFILL)						266													
							265													
264.3 2.8	Clayey silt trace sand, trace gravel organics Firm to Brown Moist stiff		1	SS	5		264													
			2	SS	10		263													
			3	SS	9		262													
	Grey		4	SS	5		261													
			5	SS	1		260													
				FV																
259.8 7.3	Sand, some silt Loose Grey Wet		6	SS	7		259													
258.6 8.5	End of borehole Refusal on probable bedrock																			
	* 2012 12 11 ▽ Water level observed during drilling 'N' casing advanced from 0.8 m depth																			

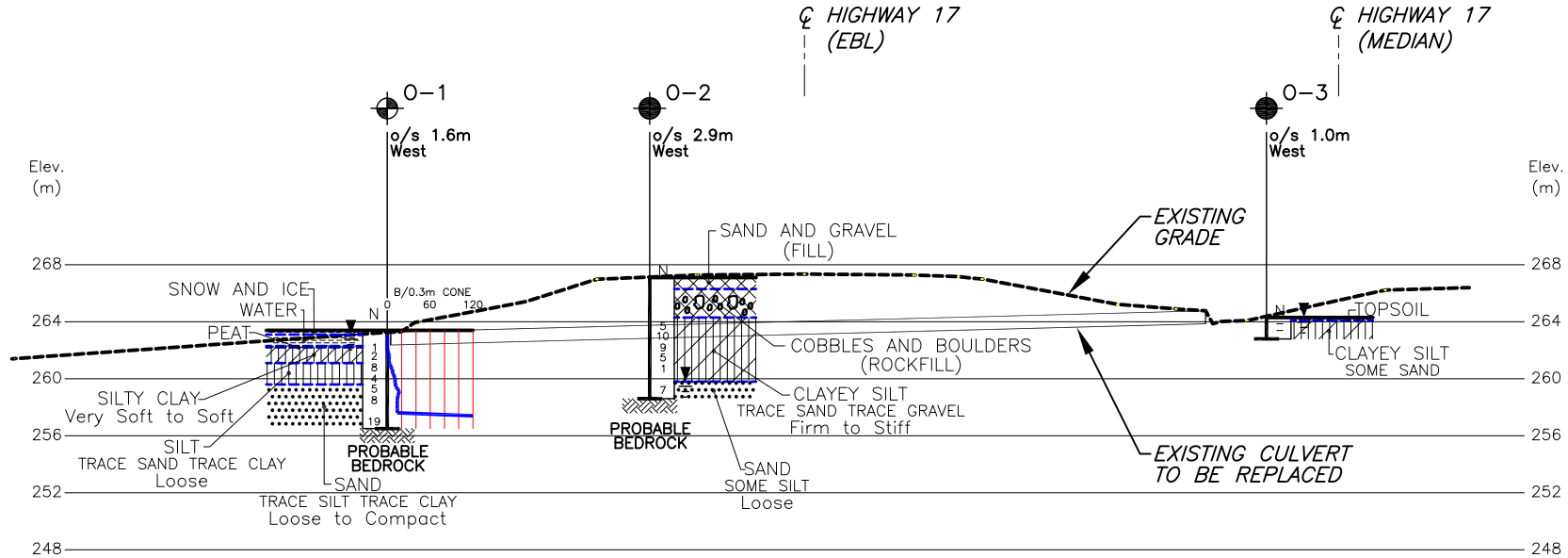
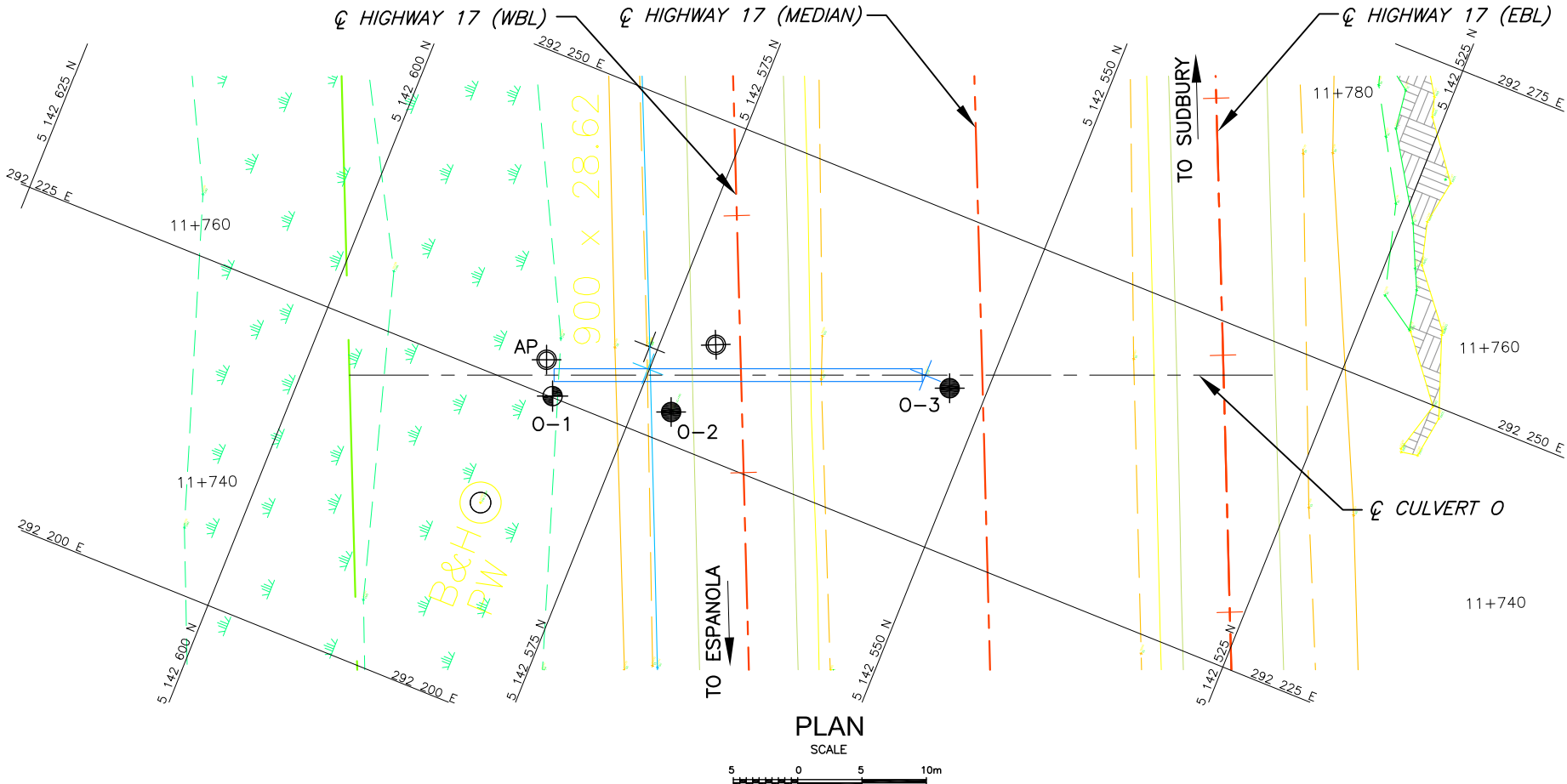
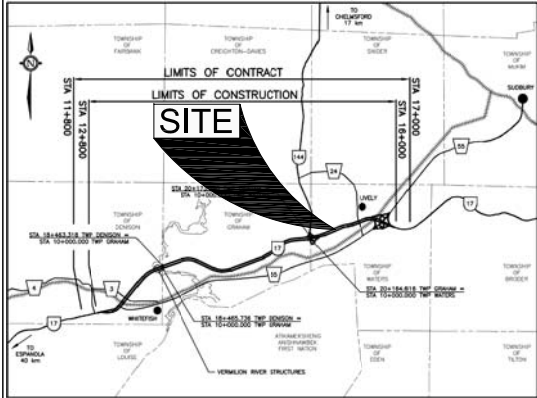
RECORD OF BOREHOLE No O-3

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 142 552.8 N; 292 237.2 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Power Auger **COMPILED BY** N.R.
DATUM Geodetic **DATE** October 31, 2013 **CHECKED BY**

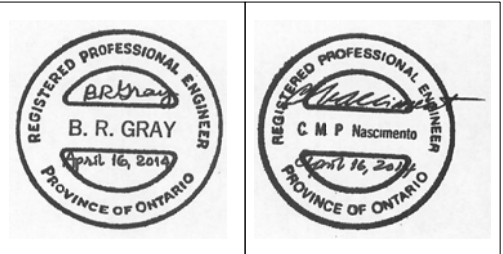
SOIL PROFILE			SAMPLES			*GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	*"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED	+	FIELD VANE	● QUICK TRIAXIAL	×						LAB VANE		
264.3	Ground surface																			
0.0	Topsoil																			
264.1 0.2	Clayey silt, some sand Grey Wet																			
262.8 1.5	End of borehole																			
	<div> Water level observed during drilling</div> <div> Water level measured after drilling</div>																			



LEGEND			
	Borehole		
	Borehole and Cone		
	Pavement borehole/Auger probe (AP)		
N	Blows/0.3m (Std. Pen Test, 475 J/blow)		
CONE	Blows/0.3m (60 Cone, 475 J/blow)		
	WL at time of investigation December 2012		
WH	Penetration due to weight of hammer		
	Head		
	ARTESIAN WATER		
	Encountered		
	PIEZOMETER		
BH No	ELEVATION	NORTHINGS	EASTINGS
O-1	263.4	5 142 581.2	292 225.1
O-2	267.1	5 142 572.2	292 227.4
O-3	264.3	5 142 552.8	292 237.2

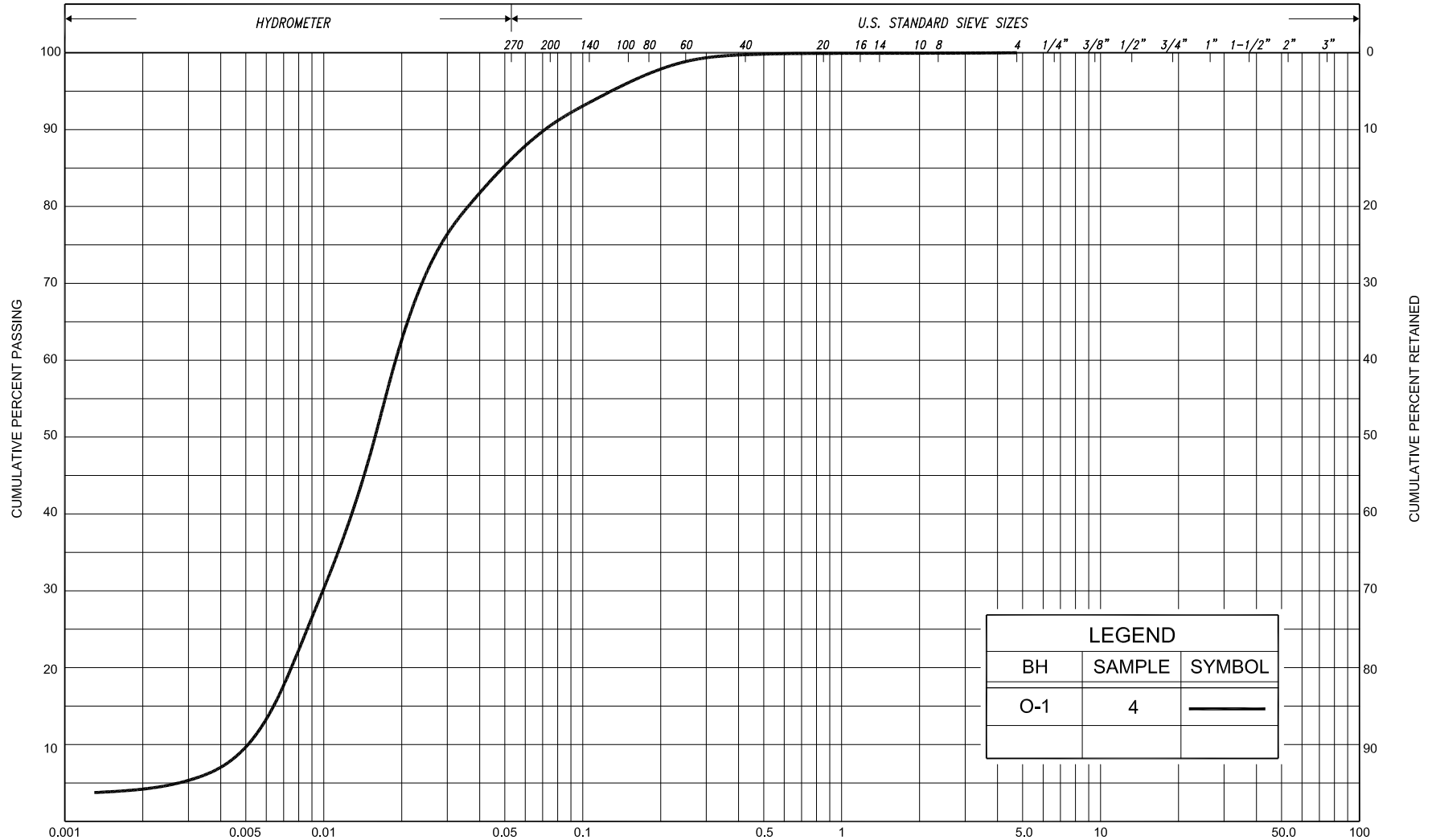
— NOTE —
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

- NOTES:
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
 - THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION. CULVERT PROFILE IS ESTIMATED.
 - DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.



Reference AECOM Drawings:
NTB-01207011.dwg and WATERS X-SECTIONS with Culverts and viewport.dwg
received on November 25, 2013 and April 01, 2014 respectively.

REVISIONS		DATE	BY	DESCRIPTION
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LEGEND		
BH	SAMPLE	SYMBOL
O-1	4	—

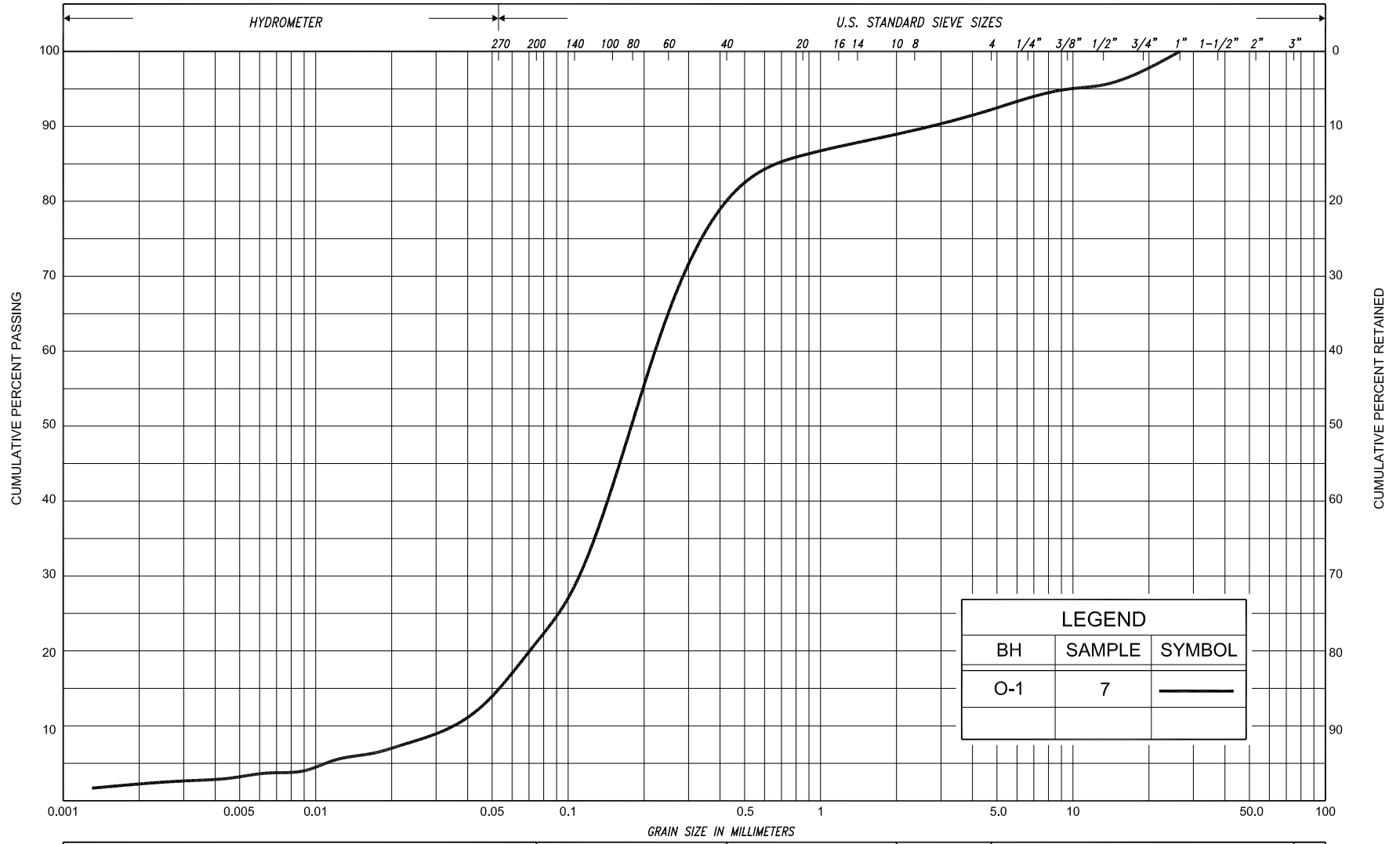
SILT & CLAY				FINE			MEDIUM			COARSE			GRAVEL				COBBLES	UNIFIED
CLAY				FINE			MEDIUM			COARSE			GRAVEL				COBBLES	M.I.T.
				V. FINE			FINE			MED.			COARSE					U.S. BUREAU



GRAIN SIZE DISTRIBUTION

SILT, trace sand, trace clay

FIG No.	O-GS-1
HWY:	17
G.W.P. No.	5146-09-00



SILT & CLAY				FINE		MEDIUM		COARSE		GRAVEL			COB BLES	UNIFIED			
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL		COBBLES	M.I.T.	
	SILT				SAND												
CLAY		SILT				V. FINE		FINE		MED.		COARSE		GRAVEL			U.S. BUREAU
				SAND													



GRAIN SIZE DISTRIBUTION
 SAND, some silt, trace clay, trace gravel

FIG No. O-GS-2
 HWY: 17
 G.W.P. No. 5146-09-00

GEOGRAPHIC TOWNSHIP OF WATERS

Culvert P (W14) – Station 13+598 EBL

RECORD OF BOREHOLE No P-1

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 143 122.9 N; 293 985.9 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod + Dynamic Cone Penetration Test **COMPILED BY** N.R.
DATUM Geodetic **DATE** June 12, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						
245.9	Ground surface															
0.0 245.6	Peat, amorphous Dark brown		1	SS	2	▽*										
0.3 245.3	Silt, trace sand trace gravel, organics															
0.6	Very loose Grey Wet		2	SS	25											
	Silt, trace sand trace clay, trace gravel															
244.5 1.4	Compact Brown Moist (TILL)		3	SS	5											
	Silty clay silt partings			FV												
	Stiff Brown Wet to firm		4	SS	4											
				FV												
			5	SS	3											
				FV												
			6	SS	1											
				FV												
241.0 4.9	Silt, some to trace clay trace sand		7	SS	3											
	Very loose Grey Wet to loose			FV												
			8	SS	6											
				FV												
			9	SS	6											
238.2 7.7	End of borehole Probable silt		10	SS	25/10cm											
237.4 8.5	End of dynamic cone penetration test Refusal on probable boulder Sample 10: Sampler bouncing * 2013 06 12 ▽ Water level observed during drilling ▽ Water level measured after drilling ■ Penetrometer test Notes: Dynamic cone penetration test was carried-out 1m east of borehole P-1 Auger probes were carried out either side of culvert, refusal on rockfill at 0.6 and 0.8m															

RECORD OF BOREHOLE No P-2

1 of 1

METRIC

G.W.P.	5146-09-00	LOCATION	Coords: 5 143 103.1 N; 293 989.6 E	ORIGINATED BY	F.P.
DIST	Sudbury	HWY	17	BOREHOLE TYPE	Continuous Flight Solid Stem Augers + 'N' Casing
DATUM	Geodetic	DATE	December 12 and 13, 2012	CHECKED BY	B.R.G.

[illegible]

RECORD OF BOREHOLE No P-3

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 143 095.6 N; 293 998.2 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod + 'N' Casing + Dynamic Cone Penetration Test **COMPILED BY** N.R.
DATUM Geodetic **DATE** March 06, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
245.8	Ground surface							20 40 60 80 100							
0.0 245.5	Snow and ice							20 40 60 80 100							
0.3	Topsoil														
245.3 0.5	Organic clayey silt trace sand		1	SS	7										
244.4	Firm to Mottled Moist grey/brown		2	SS	5										
1.4	Silty clay, trace sand		3	SS	4										
	Stiff Grey Moist to firm Brown		4	SS	2										
			5	SS	2										
				FV											
241.5 4.3	Clayey silt, trace sand		6	SS	WH**										
	Firm Grey Moist			FV											
239.6 6.2	Silt some sand, trace clay		7	SS	5										
	Loose Grey Wet														
237.6 8.2	End of borehole		8	SS	5										
	Probable silt														
236.7 9.1	End of dynamic cone penetration test														
<div>* 2013 03 06</div> <div><div>▽</div> Water level observed during drilling</div> <div><div>▼</div> Water level measured after drilling</div> <div><div>■</div> Penetrometer test</div> <div>WH** denotes penetration due to weight of rods and hammer</div> <div>DCPT was carried out 2m east of borehole P-3</div> <div>Auger probes were carried out on either side of culvert end; silty clay to 1.4 and 1.5m encountered at west and east sides respectively.</div>															

* 2013 03 06

▽ Water level observed
during drilling

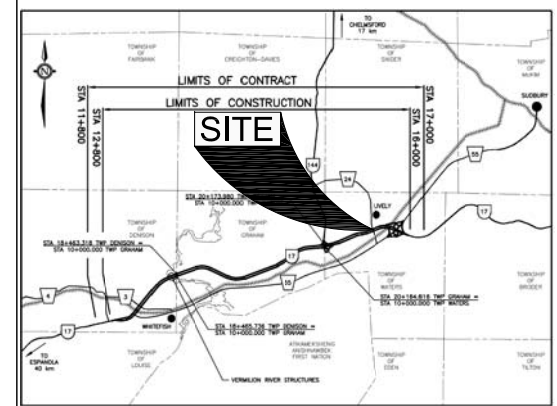
▼ Water level measured
after drilling

■ Penetrometer test

WH** denotes penetration
due to weight of rods
and hammer

DCPT was carried out 2m
east of borehole P-3

Auger probes were carried
out on either side of
culvert end; silty clay to
1.4 and 1.5m encountered at
west and east sides
respectively.



KEY PLAN



LEGEND

- Borehole
- Borehole and Cone
- Pavement borehole/Auger probe (AP)
- N Blows/0.3m (Std. Pen Test, 475 J/blow)
- CONE Blows/0.3m (60 Cone, 475 J/blow)
- WL at time of investigation December 2012, March & June 2013
- WH Penetration due to weight of hammer
- Head
- ARTESIAN WATER Encountered
- PIEZOMETER

BH No	ELEVATION	NORTHINGS	EASTINGS
P-1	245.9	5 143 122.9	293 985.9
P-2	248.7	5 143 103.1	293 989.6
P-3	245.8	5 143 095.6	293 998.2

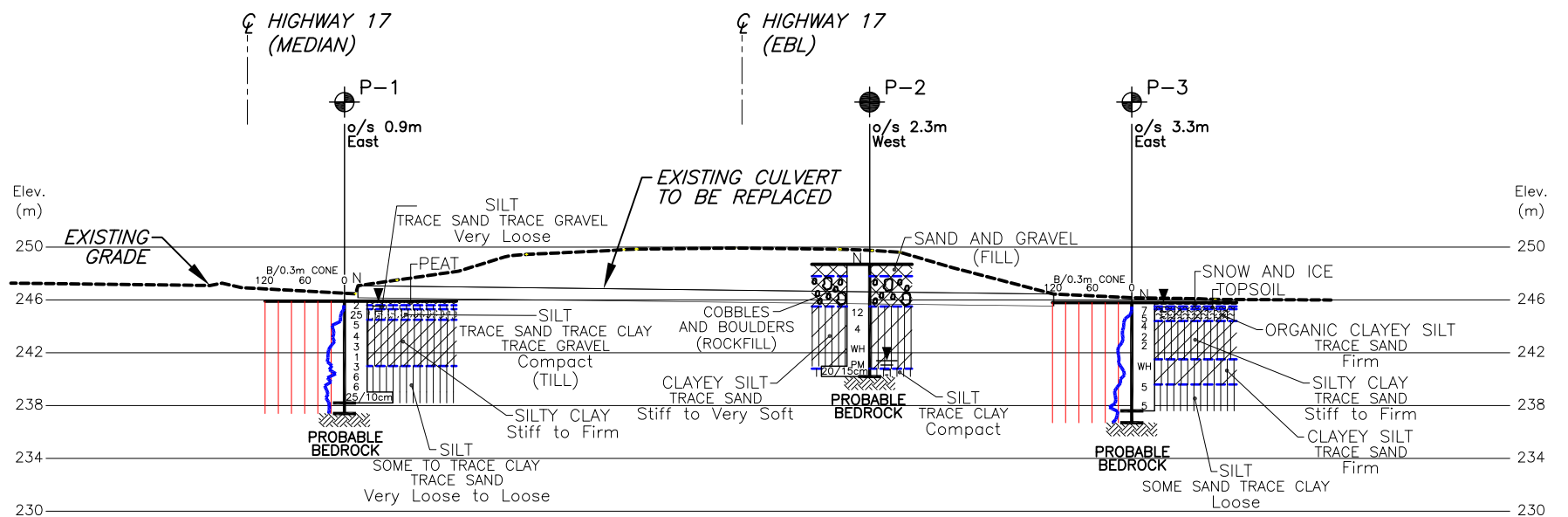
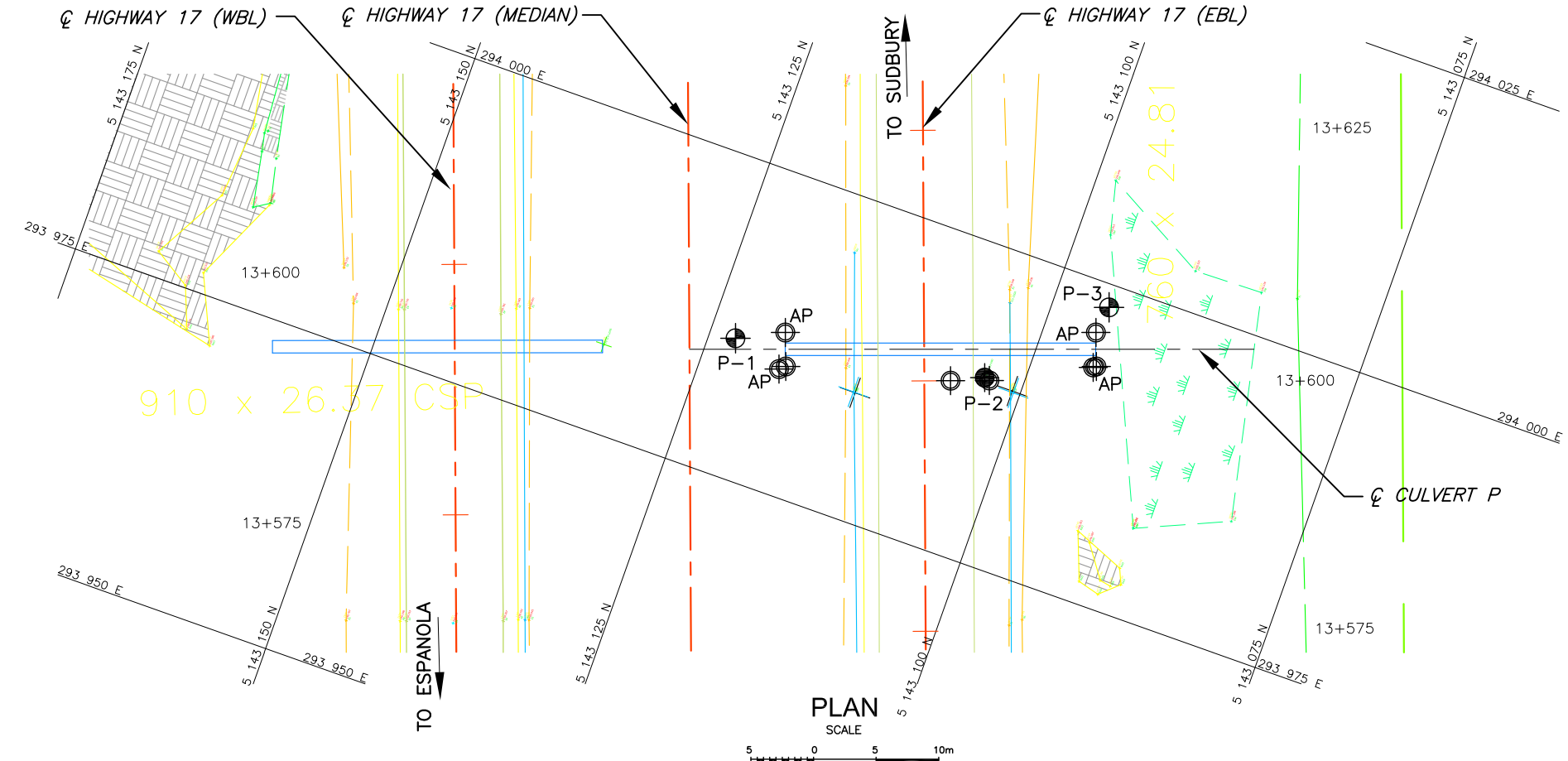
NOTE

The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

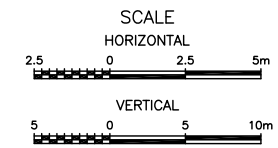
REVISIONS	DATE	BY	DESCRIPTION

Geocres No.411-299

HWY No	17	DIST	Sudbury
SUBM'D	NA	CHECKED	NR
DRAWN	NA	CHECKED	BRG
DATE	APR. 16, 2014	APPROVED	CN
SITE		DWG	P-1

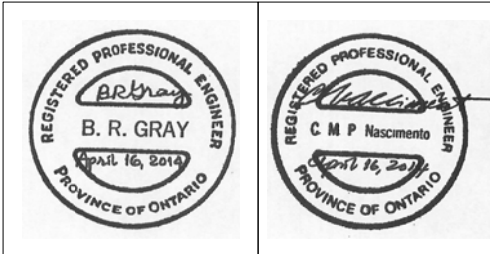


PROFILE ALONG Q EXISTING CULVERT AT STA. 13+598 EBL

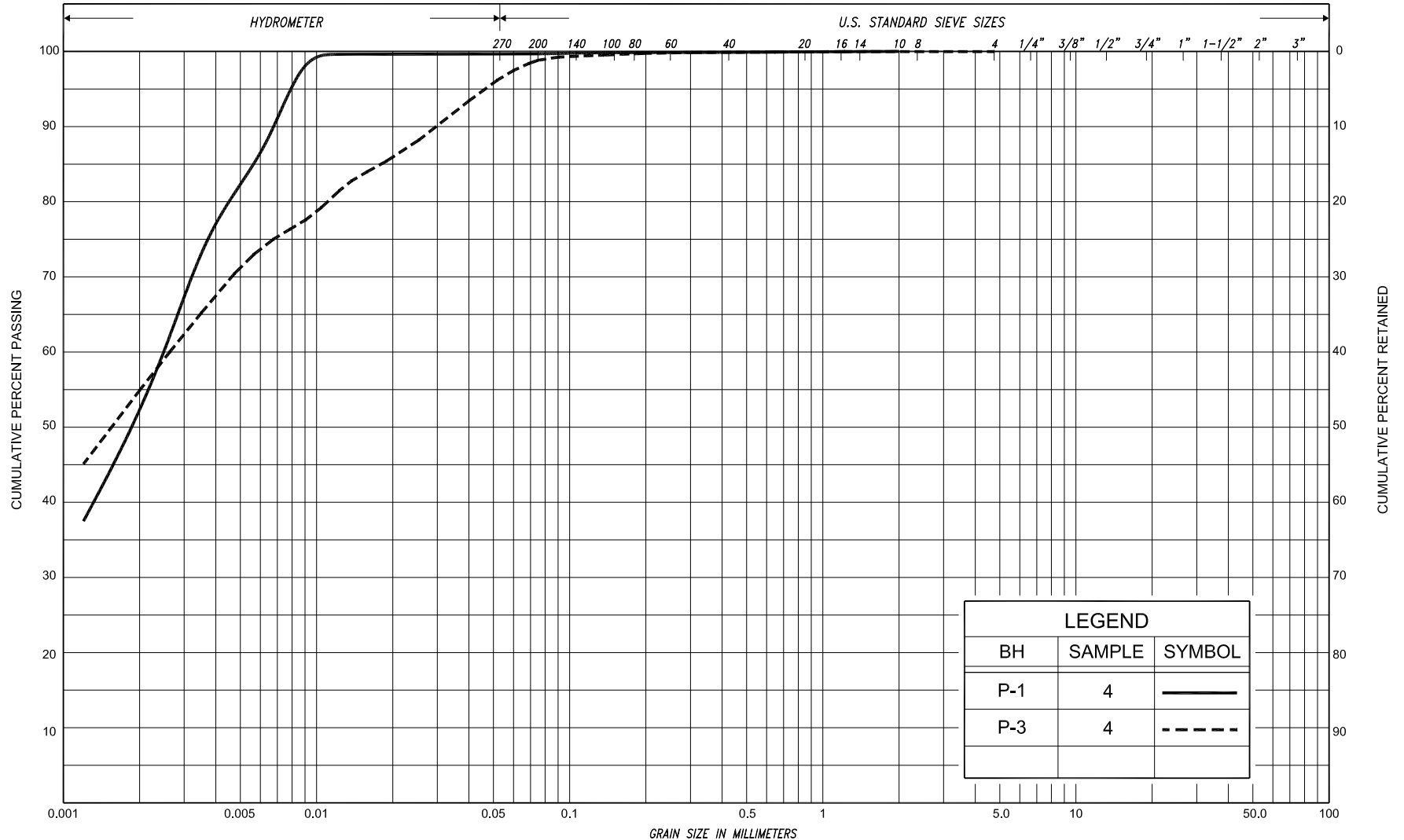


NOTES:

- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
- THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION. CULVERT PROFILE IS ESTIMATED.
- DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.



Reference AECOM Drawings:
NTB-01207011.dwg and WATERS X-SECTIONS with Culverts and viewport.dwg
received on November 25, 2013 and April 01, 2014 respectively.

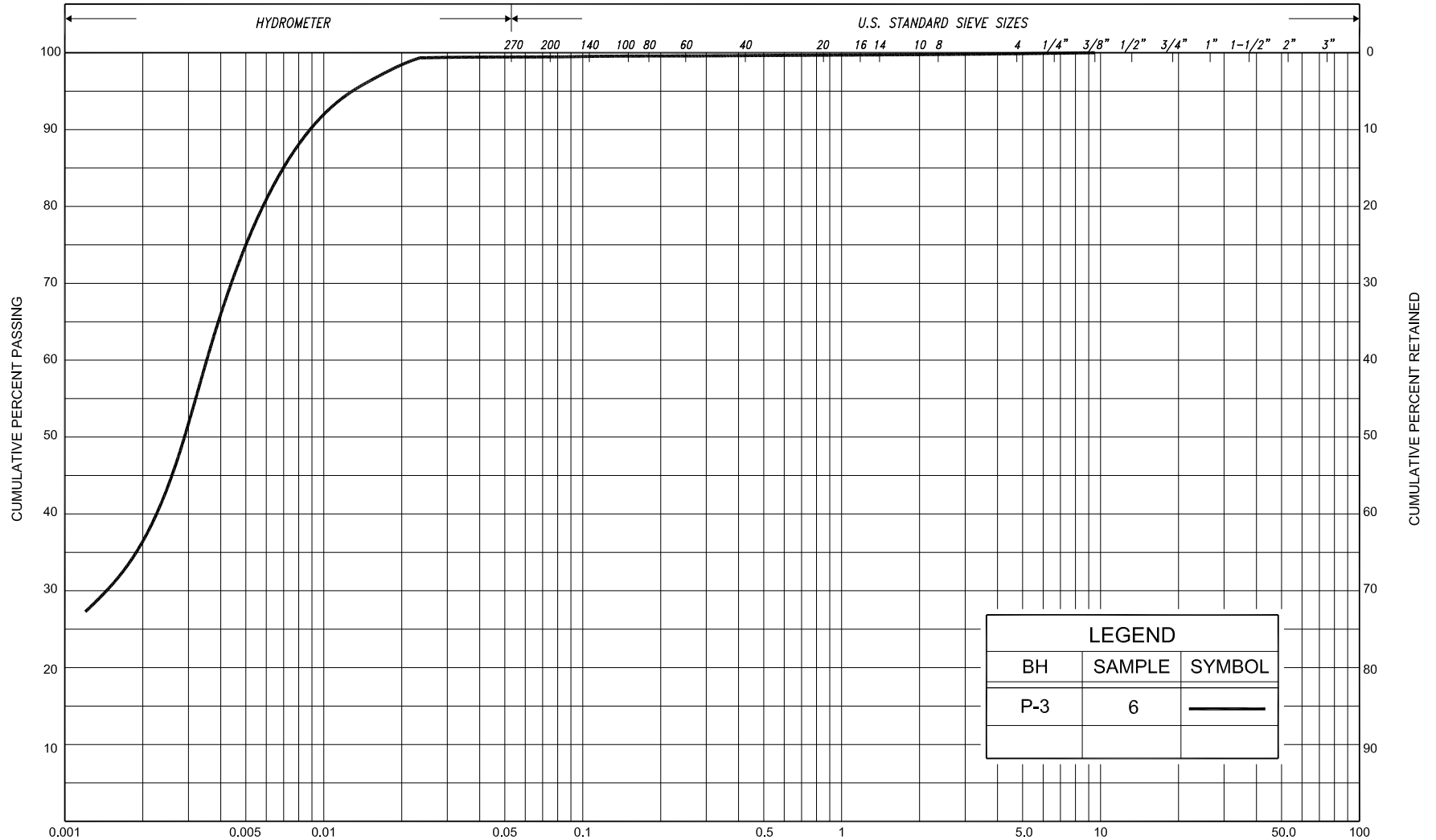


GRAIN SIZE DISTRIBUTION SILT CLAY, trace sand (CI)

FIG No. P-GS-1

HWY: 17

G.W.P. No. 5146-09-00



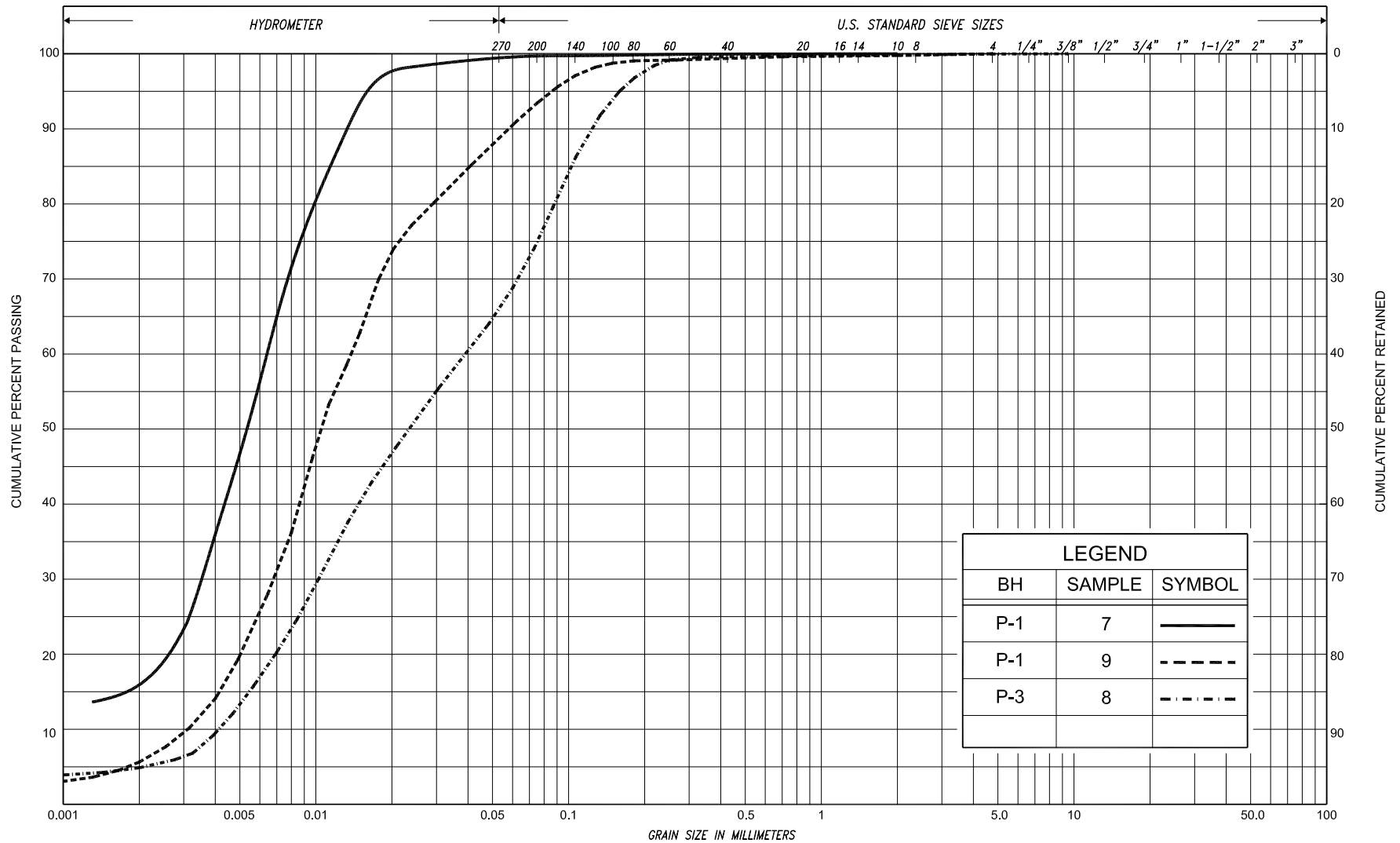
SILT & CLAY				GRAIN SIZE IN MILLIMETERS			COBBLES	UNIFIED
				FINE	MEDIUM	COARSE		
CLAY	FINE	MEDIUM	COARSE	SAND			GRAVEL	M.I.T.
	SILT			FINE	MEDIUM	COARSE		
CLAY		SILT		V. FINE	FINE	MED.	COARSE	U.S. BUREAU
				SAND			GRAVEL	



GRAIN SIZE DISTRIBUTION

CLAYEY SILT, trace sand (CL)

FIG No. P-GS-2
 HWY: 17
 G.W.P. No. 5146-09-00



SILT & CLAY				FINE		MEDIUM		COARSE		GRAVEL			COBBLES	UNIFIED			
				SAND													
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL		COBBLES	M.I.T.	
	SILT																
CLAY		SILT			V. FINE	FINE	MED.	COARSE	GRAVEL							U.S. BUREAU	
								SAND									



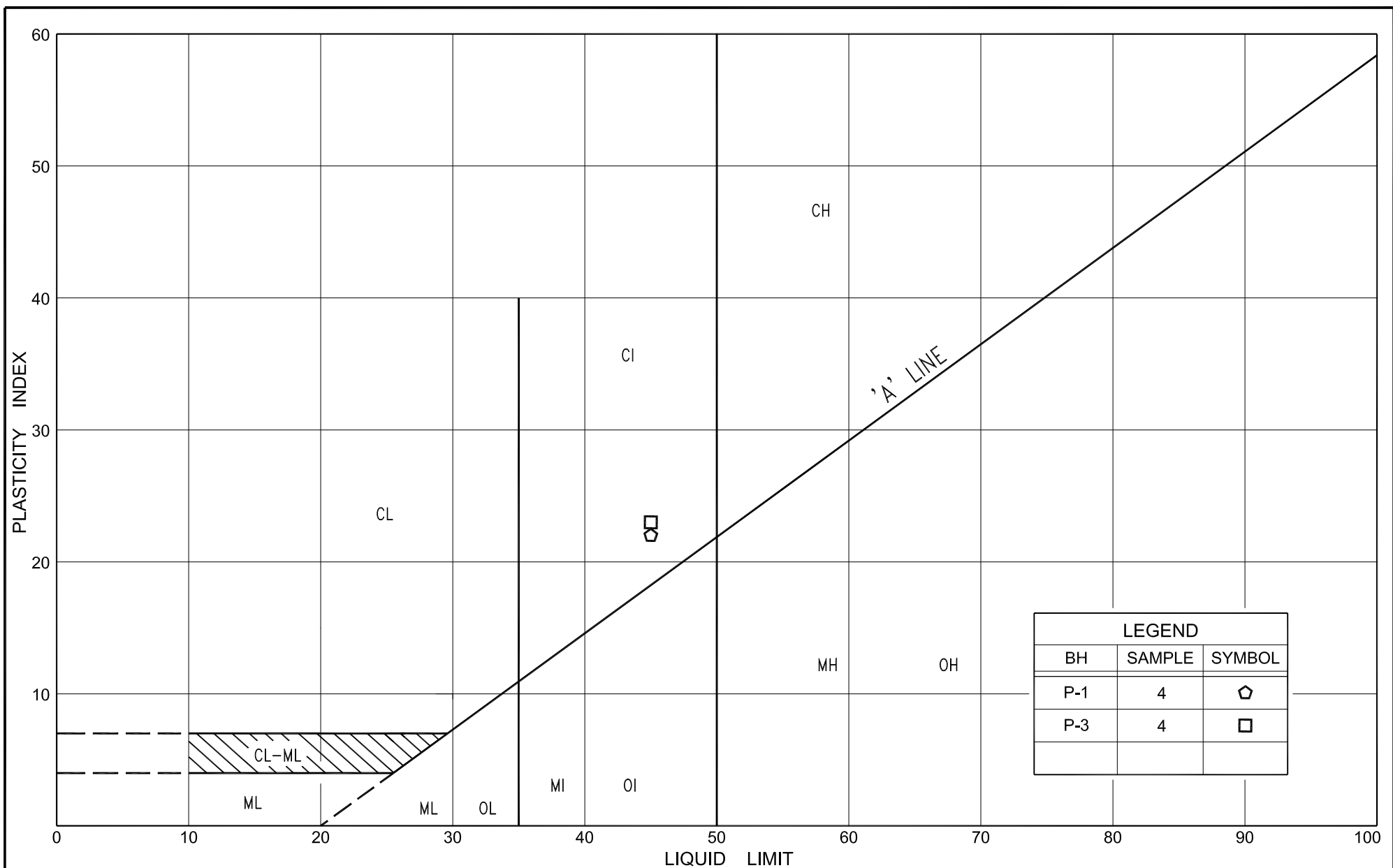
GRAIN SIZE DISTRIBUTION

SILT, trace to some sand, trace to some clay

FIG No. P-GS-3

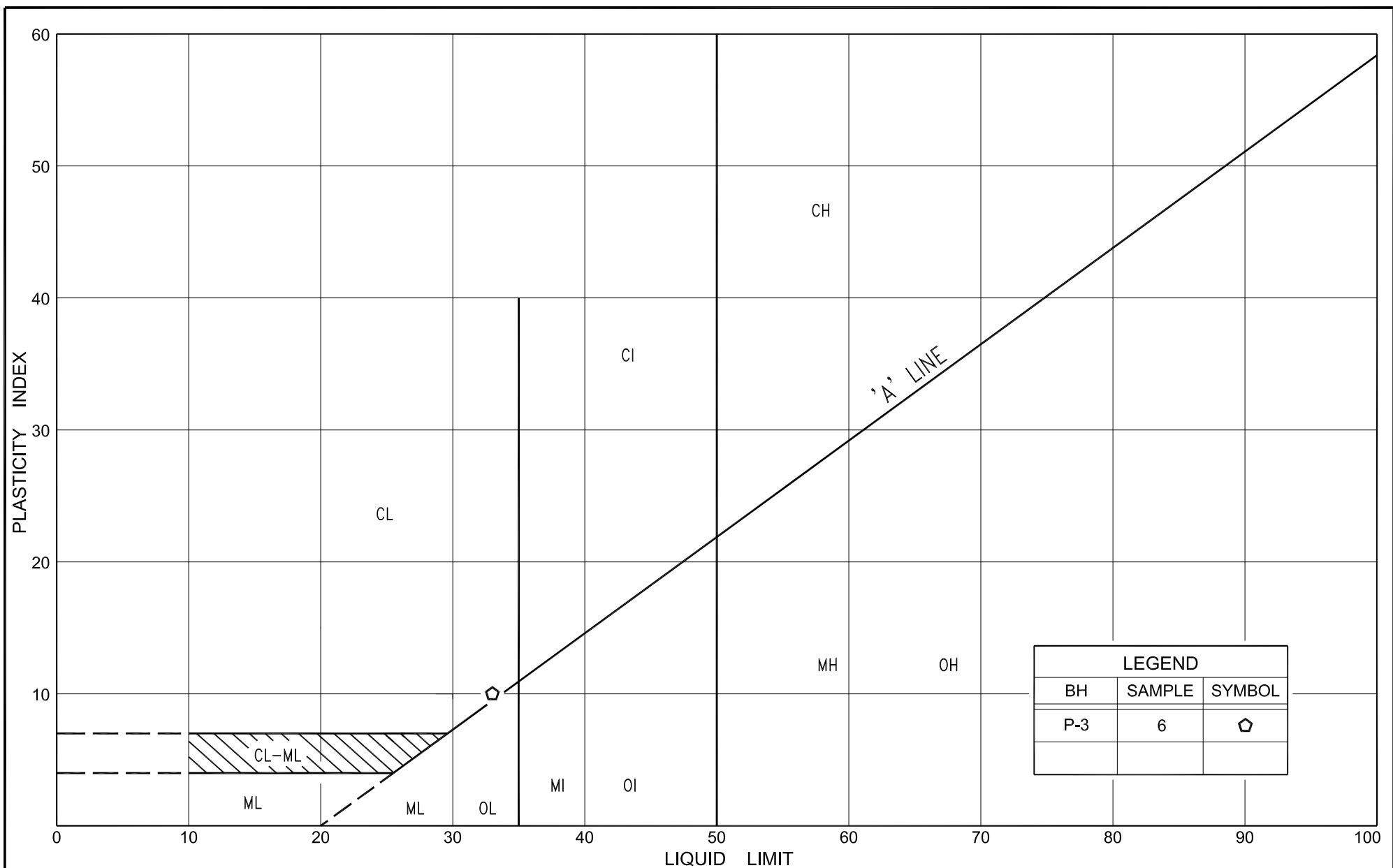
HWY: 11

G.W.P. No. 5146-09-00



PLASTICITY CHART
SILT CLAY, trace sand (CI)

FIG No. P-PC-1
HWY: 17
G.W.P. No. 5146-09-00



PLASTICITY CHART
CLAYEY SILT, trace sand (CL)

FIG No. P-PC-2
HWY: 17
G.W.P. No. 5146-09-00

GEOGRAPHIC TOWNSHIP OF WATERS

Culvert Q (W17) – Station 14+943 WBL

RECORD OF BOREHOLE No. Q-1

1 of 1

METRIC

G.W.P. <u>5146-09-00</u>	LOCATION <u>Coords: 5 143 251.8 N; 295 285.0 E</u>	ORIGINATED BY <u>F.P.</u>
DIST <u>Sudbury</u> HWY <u>17</u>	BOREHOLE TYPE <u>Tripod + Dynamic Cone Penetration tests</u>	COMPILED BY <u>N.R.</u>
DATUM <u>Geodetic</u>	DATE <u>June 19, 2013</u>	CHECKED BY <u>B.R.G.</u>

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS ▽ * ▼ *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT						UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT w_p w w_L WATER CONTENT (%)							
263.1 0.0	Ground surface Sand, some silt organics Loose Dark grey Wet	•••••	1	SS	9		263								
262.1 1.0	Silty clay, trace sand Firm to stiff Brown Moist	/ / / / /	2	SS	7		262								
		/ / / / /	3	SS	5		261								
		/ / / / /	4	SS	4		260								
		/ / / / /	FV				259								
		/ / / / /	5	SS	4		258								
		/ / / / /	FV				257								
	silt seams	/ / / / /	6	SS	6		256								
		/ / / / /	FV				255								
258.5 4.6	Silt some clay, trace sand Compact Grey Wet		7	SS	22										
			8	SS	18										
			9	SS	16										
			10	SS	18										
254.1 9.0	End of borehole Refusal on probable bedrock Sample 11: Sampler bouncing		11	SS	20/15cm										
	* 2013 06 19 ▽ Water level observed during drilling ▼ Water level measured after drilling ■ Penetrometer test Dynamic cone penetration test was carried-out 2m south of borehole Q-1 Two auger probes were advanced through sand, some silt to 1.4m on either side of the north end of the culvert.														

RECORD OF BOREHOLE No. Q-2

1 of 2

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 143 235.3 N; 295 284.9 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.S.S.A. and 'N' Casing **COMPILED BY** N.R.
DATUM Geodetic **DATE** April 25, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		SHEAR STRENGTH kPa									
							○ UNCONFINED + FIELD VANE									
							● QUICK TRIAXIAL × LAB VANE									
							WATER CONTENT (%)									
269.3	Ground surface						20	40	60	80	100	20	40	60		
0.0	150 mm asphalt over sand and gravel		1	AS	-											
268.5	cobbles and boulders (ROCKFILL)															(See Note)
0.8																
263.7	Silt some clay, organics sand and gravel pockets (FILL)		2	SS	6											
5.6			3	SS	WH**											
262.9	Clayey silt, trace sand organics			FV												
6.4	Very stiff Mottled Moist brown/grey		4	SS	16											0 4 62 34
	Stiff		5	SS	9											
260.5	Clay, trace sand															
8.8	Firm to stiff Brown Wet		6	SS	3											0 1 37 62
				FV												
			7	SS	5											
257.4	Silt, some clay															
11.9	Compact Brown Moist		8	SS	15											
	silty sand seams Wet		9	SS	13											
254.7	End of borehole															
14.6																

RECORD OF BOREHOLE No. Q-2

2 of 2

METRIC

G.W.P.	5146-09-00	LOCATION	Coords: 5 143 235.3 N; 295 284.9 E	ORIGINATED BY	F.P.
DIST	Sudbury	HWY	17	BOREHOLE TYPE	C.F.S.S.A. and 'N' Casing
DATUM	Geodetic	DATE	April 25, 2013	CHECKED BY	B.R.G.


[illegible]

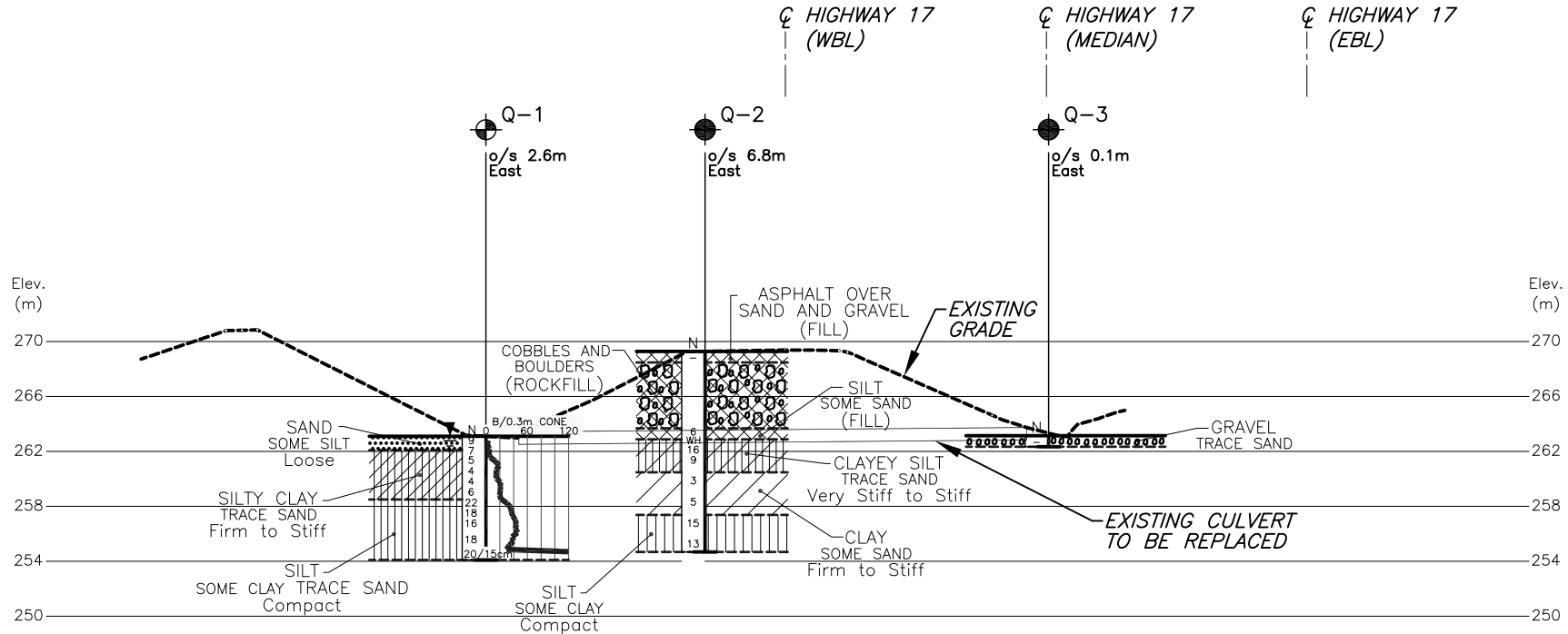
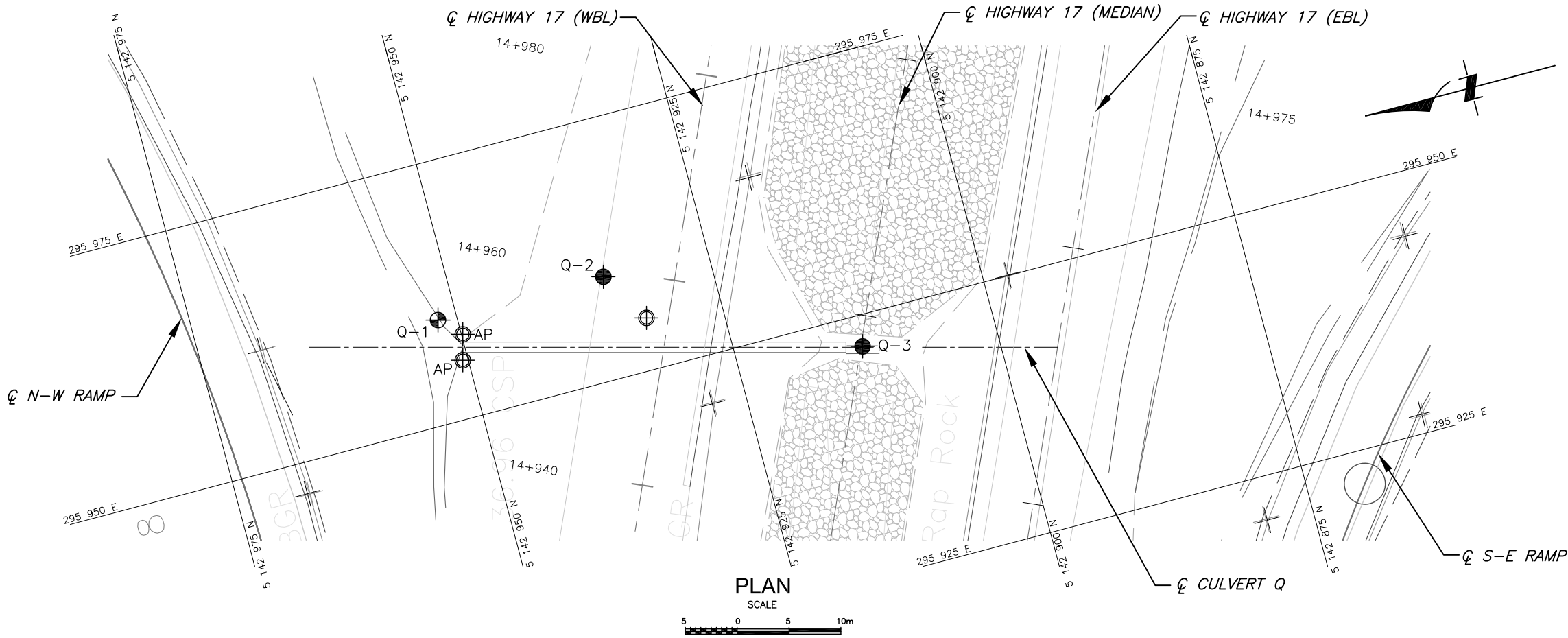
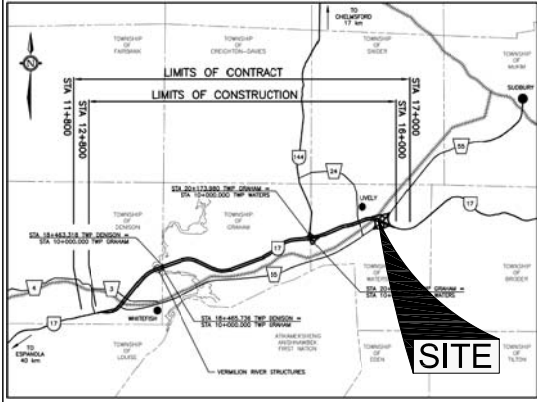
RECORD OF BOREHOLE No. Q-3

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 143 212.9 N; 295 272.0 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** 'N' Casing **COMPILED BY** N.R.
DATUM Geodetic **DATE** April 11, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
263.1	Ground surface						20	40	60	80	100									
0.0	Gravel, trace sand						263													
262.3	End of borehole																			
0.8	Refusal on probable rockfill under median culvert (EBL)																			
	 <																			

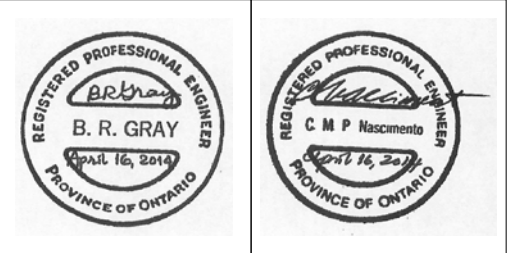


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LEGEND			
	Borehole		
	Borehole and Cone		
	Pavement borehole/Auger probe (AP)		
N	Blows/0.3m (Std. Pen Test, 475 J/blow)		
CONE	Blows/0.3m (60 Cone, 475 J/blow)		
	WL at time of investigation April & May 2013		
WH	Penetration due to weight of hammer		
	Head		
	ARTESIAN WATER		
	Encountered		
	PIEZOMETER		

BH No	ELEVATION	NORTHINGS	EASTINGS
Q-1	263.1	5 143 251.8	295 285.0
Q-2	269.3	5 143 235.3	295 284.9
Q-3	263.1	5 143 212.9	295 272.0

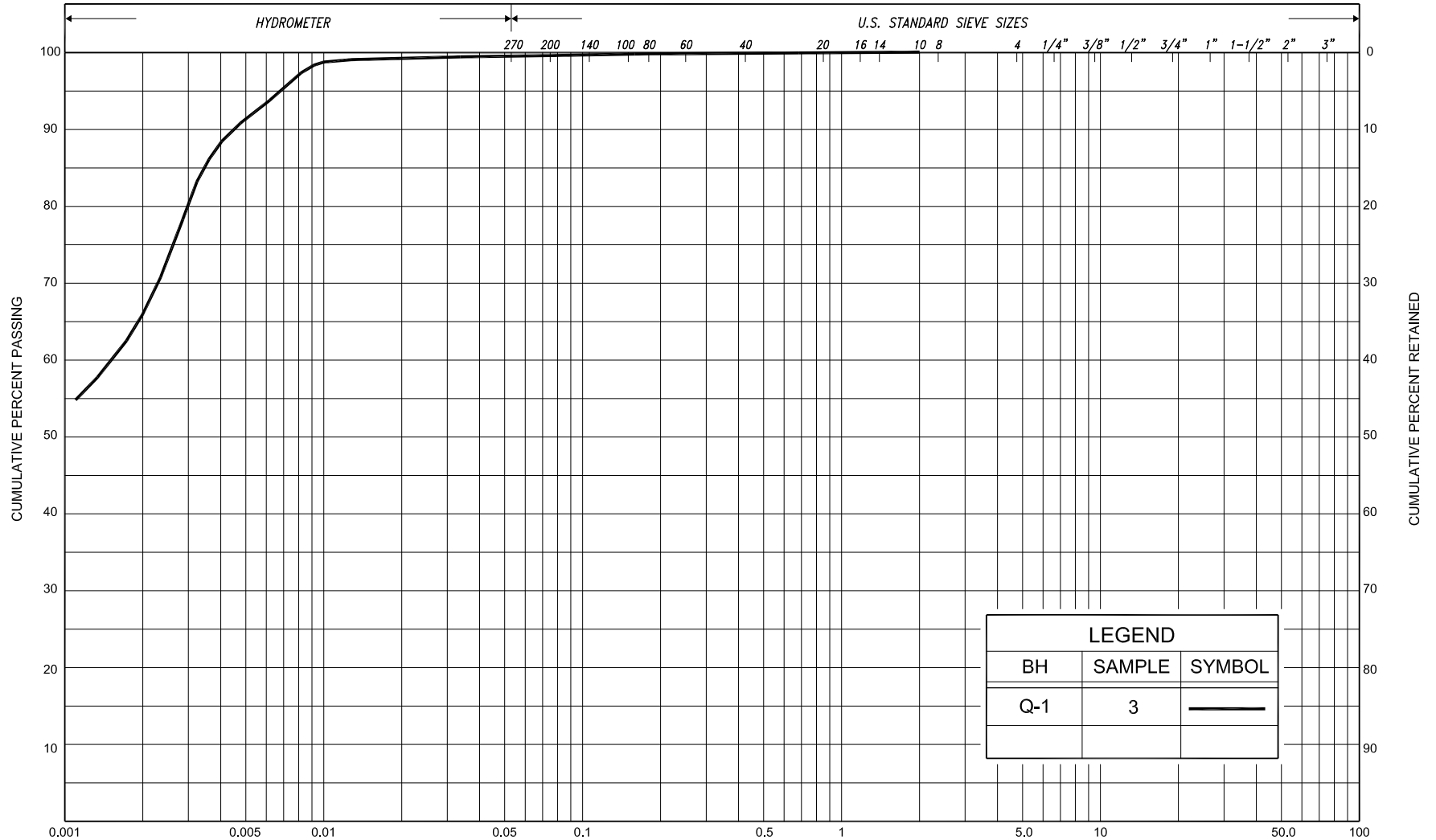
NOTE:
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.



Reference Drawings:
Culvert at 14+953.474.dwg and WATERS X-SECTIONS with Culverts and viewport.dwg, by exp. received via email dated February 26, 2014 and April 01, 2014 respectively.

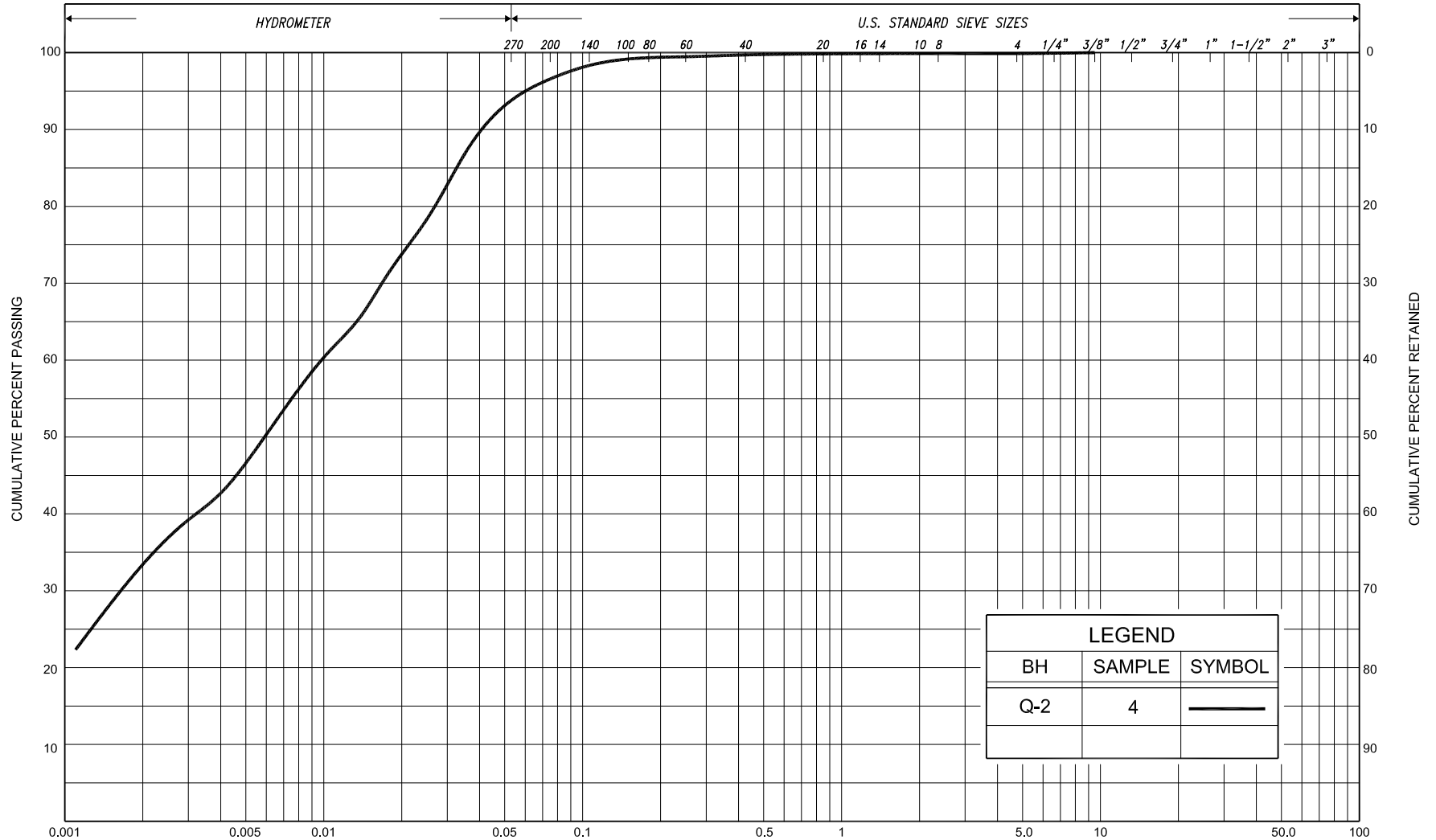
REVISIONS	DATE	BY	DESCRIPTION

Geocres No. 411-299			
HWY No	17	DIST	Sudbury
SUBM'D	NA	CHECKED	NR
DRAWN	NA	CHECKED	BRG
DATE	APR. 16, 2014	APPROVED	CN
SITE		DWG	Q-1



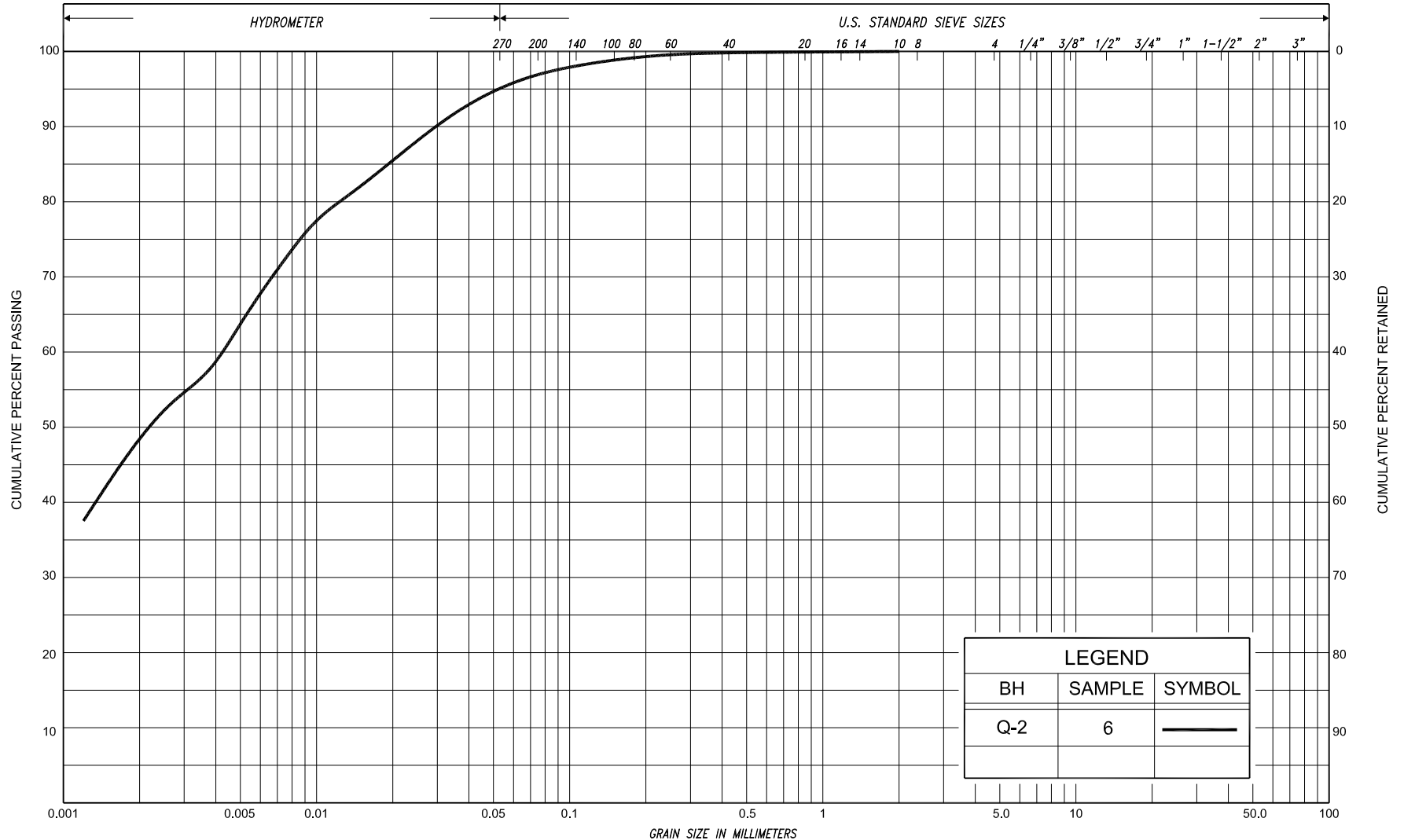
LEGEND		
BH	SAMPLE	SYMBOL
Q-1	3	—

SILT & CLAY				FINE		MEDIUM		COARSE		GRAVEL			COBBLES	UNIFIED		
				SAND												
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL		COBBLES	M.I.T.
	SILT															
CLAY		SILT				V. FINE	FINE		MED.		COARSE		GRAVEL			U.S. BUREAU
						SAND										



LEGEND		
BH	SAMPLE	SYMBOL
Q-2	4	—

SILT & CLAY				FINE		MEDIUM		COARSE		GRAVEL			COBBLES	UNIFIED		
				SAND												
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL		COBBLES	M.I.T.
	SILT															
CLAY		SILT			V. FINE	FINE		MED.		COARSE		GRAVEL			U.S. BUREAU	
					SAND											



SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL				COB BLES	UNIFIED	
					SAND												
CLAY	FINE		MEDIUM		COARSE	FINE		MEDIUM		COARSE		GRAVEL				COBBLES	M.I.T.
	SILT																
CLAY		SILT			V. FINE	FINE	MED.	COARSE		GRAVEL					U.S. BUREAU		
					SAND												



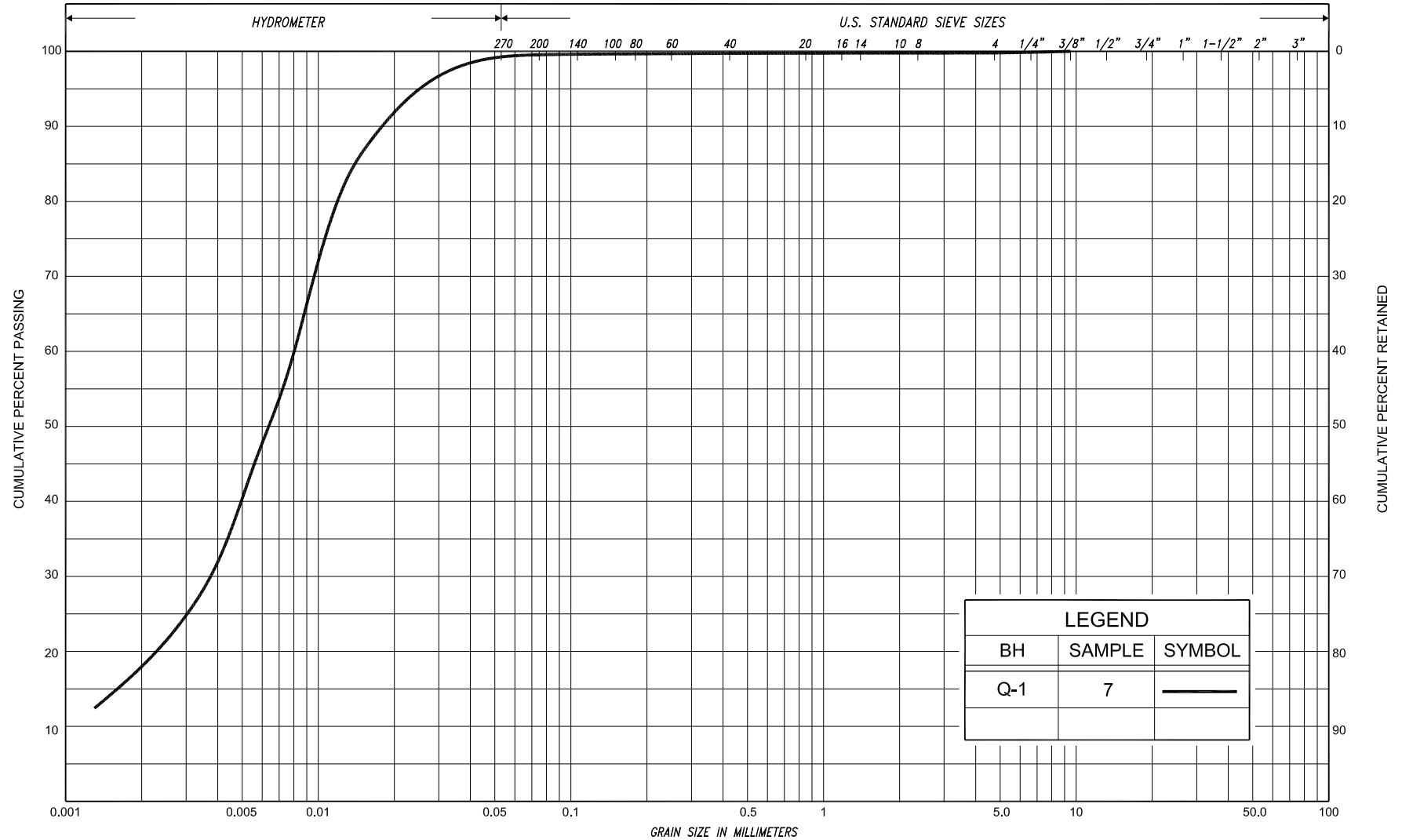
GRAIN SIZE DISTRIBUTION

CLAY, trace sand (CH)

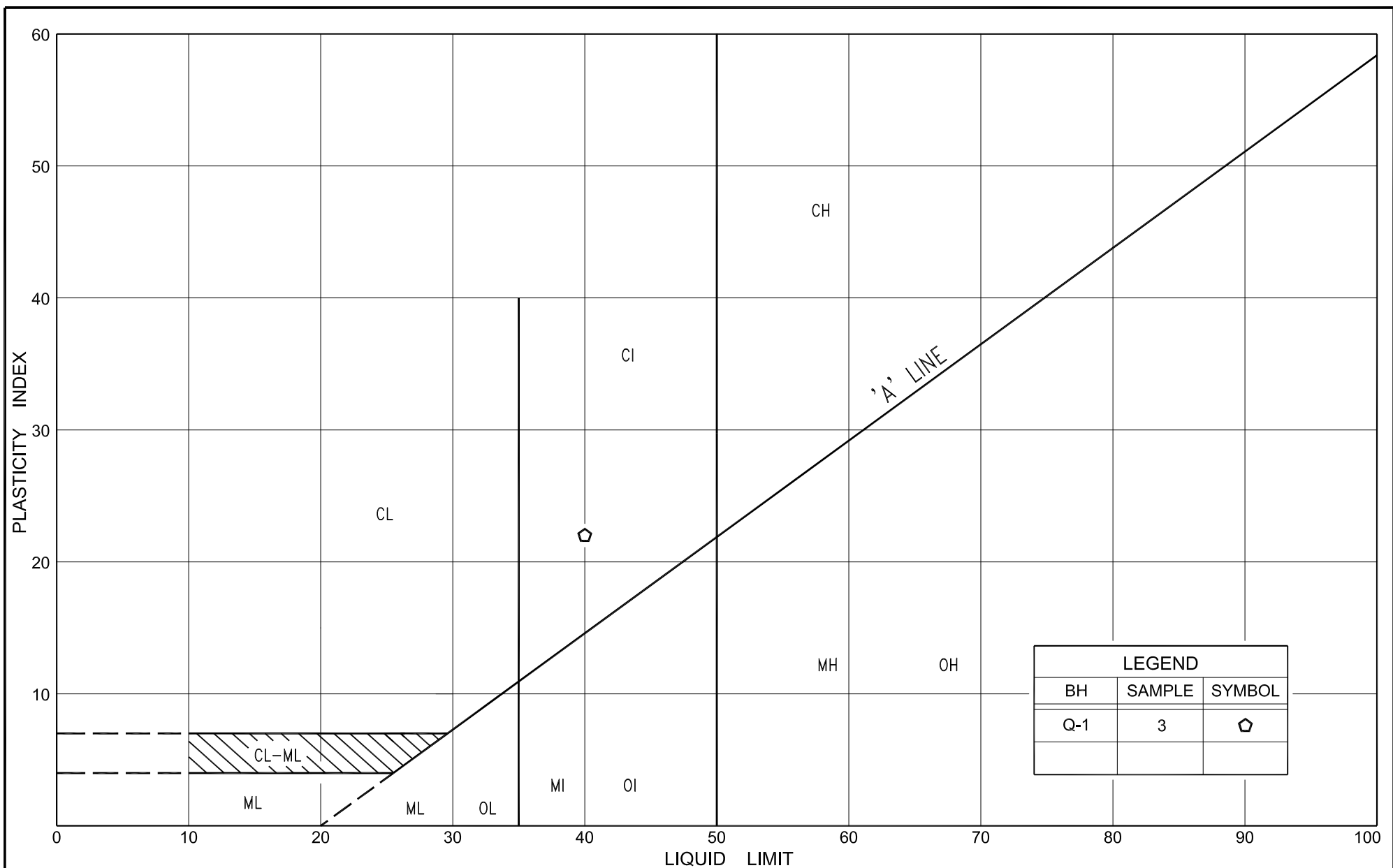
FIG No. Q-GS-3

HWY: 17

G.W.P. No. 5146-09-00



SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL				COBBLES	UNIFIED
CLAY	FINE	MEDIUM		COARSE	FINE		MEDIUM		COARSE		GRAVEL				COBBLES	M.I.T.
	SILT				SAND											
CLAY		SILT			V. FINE	FINE	MED.	COARSE		GRAVEL						U.S. BUREAU



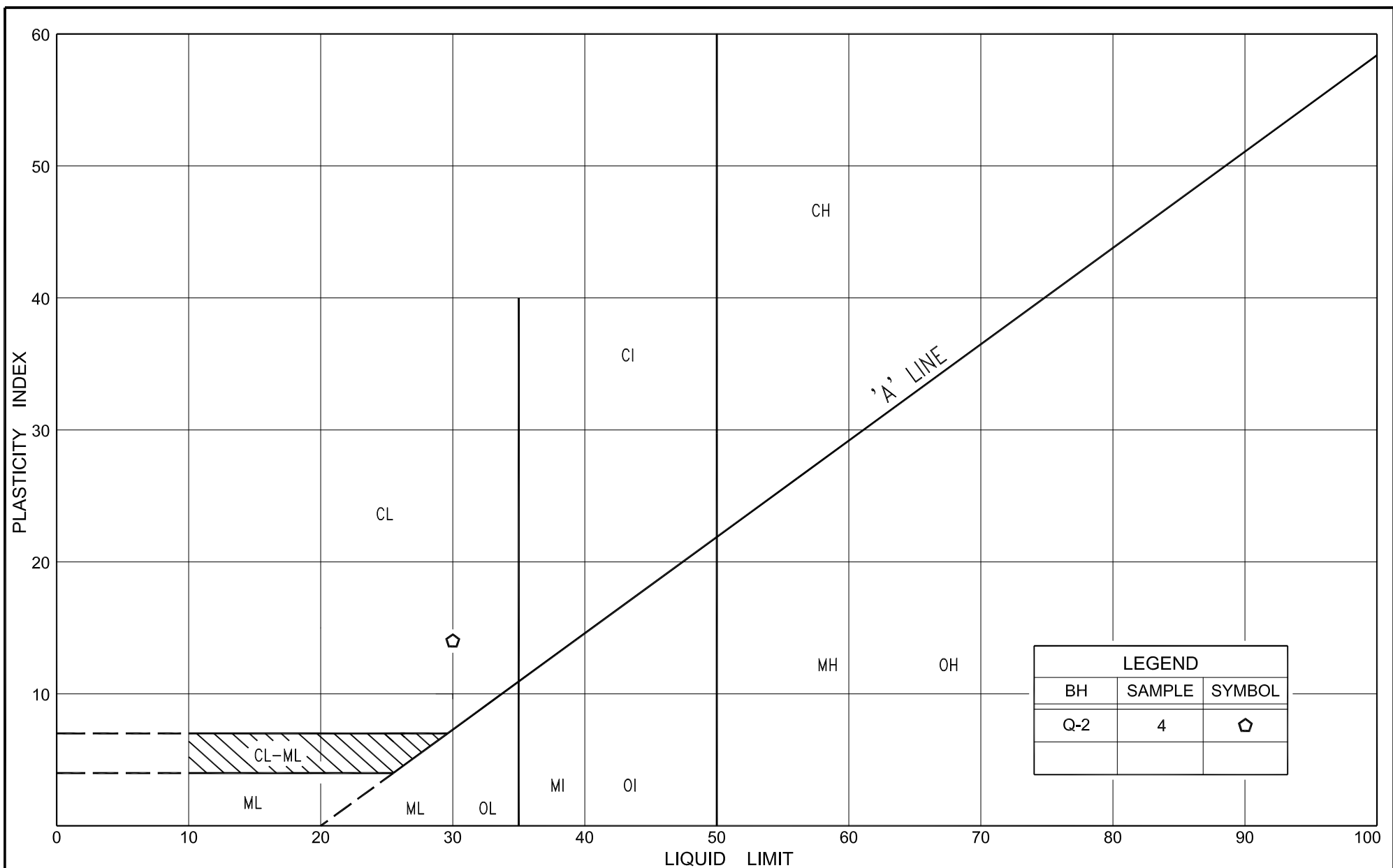
PLASTICITY CHART

SILTY CLAY, trace sand (CI)

FIG No. Q-PC-1

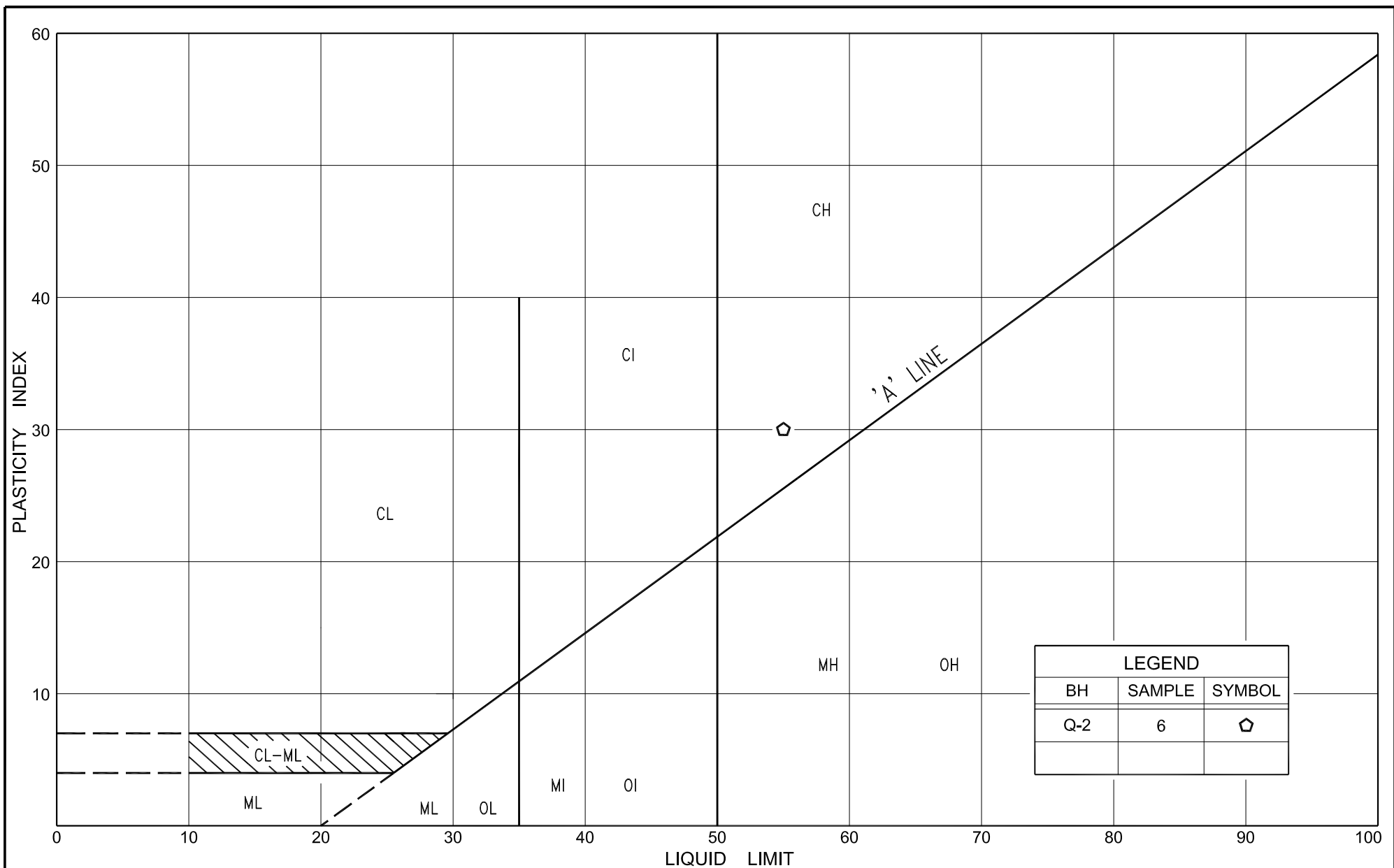
HWY: 17

G.W.P. No. 5146-09-00



PLASTICITY CHART
CLAYEY SILT, trace sand (CL)

FIG No. Q-PC-2
HWY: 17
G.W.P. No. 5146-09-00



PLASTICITY CHART

CLAY, trace sand (CH)

FIG No. Q-PC-3

HWY: 17

G.W.P. No. 5146-09-00

GEOGRAPHIC TOWNSHIP OF WATERS

Culvert R (W25) – Station 15+687 C/L

RECORD OF BOREHOLE No R-1

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 142 946.7 N; 295 984.8 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod + Casing + Dynamic Cone Penetration Test **COMPILED BY** N.R.
DATUM Geodetic **DATE** May 08, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		SHEAR STRENGTH kPa										WATER CONTENT (%)		
							20 40 60 80 100										20 40 60		
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
252.5 0.0	Ground surface																		
252.3 0.2	Topsoil																		
251.3 1.2	Organic silt trace clay, trace sand		1	SS	3	▽*													
	Loose Dark Moist grey		2	SS	7														
	Silt, some sand, trace clay Compact Brown Wet																		
			3	SS	17														
			4	SS	12														
	5	SS	13																
			6	SS	15														
248.2 4.3	Sandy silt, trace clay																		
	Loose to Brown Wet compact		7	SS	6														
			8	SS	11														
245.0 7.5	Silt and sand, trace clay																		
244.3 8.2	Loose Brown Wet		9	SS	8														
	End of borehole																		
	Probable sandy silt																		
242.5 10.0	End of dynamic cone penetration test																		
* 2013 05 08																			
▽ Water level observed during drilling																			
Borehole caved-in at 4.6m																			
DCPT was carried out 2.0m N of borehole R-1																			

RECORD OF BOREHOLE No R-2

1 of 1

METRIC

G.W.P. <u>5146-09-00</u>	LOCATION <u>Coords: 5 142 928.3 N; 295 950.9 E</u>	ORIGINATED BY <u>F.P.</u>
DIST <u>Sudbury</u> HWY <u>17</u>	BOREHOLE TYPE <u>Continuous Flight Hollow Stem Augers</u>	COMPILED BY <u>N.R.</u>
DATUM <u>Geodetic</u>	DATE <u>April 11, 2013</u>	CHECKED BY <u>B.R.G.</u>

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		SHEAR STRENGTH kPa										WATER CONTENT (%)		
							20 40 60 80 100										20 40 60		
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
257.8 0.0	Ground surface Sand and gravel cobble		1	SS	18	257 256 255 254 253 252 251 250 249 248 247 246 245													
257.0 0.8	Silt trace sand, trace clay Loose Brown Moist		2	SS	4														
			3	SS	5														
			4	SS	5														
254.8 3.0	clayey silt trace to some sand organics Firm to stiff (FILL)		5	SS	7														
			6	SS	11														
			7	SS	14														
251.8 6.0	Silt trace sand, trace clay Compact Brown Moist Wet		8	SS	23														
			9	SS	10														
			10	SS	5														
			11	SS	12														
			12	SS	11														
			13	SS	11														
245.0 12.8	End of borehole																		
<div>* 2013 04 11</div> <div>▽ Water level observed during drilling</div> <div>▼ Water level measured after drilling</div>																			

RECORD OF BOREHOLE No R-3

1 of 2

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 142 911.2 N; 295 947.4 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.H.S.A. and Dynamic Cone Penetration Test **COMPILED BY** N.R.
DATUM Geodetic **DATE** April 10, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE		SHEAR STRENGTH kPa				W _p	W	W _L		
257.0	Ground surface					○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				WATER CONTENT (%)				
0.0	Topsoil					20 40 60 80 100				20	40	60		
256.7						20 40 60 80 100								
0.3	Silt, trace sand		1	SS										
	Loose Grey/brown Moist													
	trace gravel		2	SS										
	Compact		3	SS										
254.8														
2.2	Clayey silt trace sand, trace gravel		4	SS										
	Firm to Grey Wet stiff													
			5	SS										
			6	SS										
	organic inclusions													
			7	SS										
			8	SS										
	wood chips													
	(FILL)		9	SS										
250.0														
7.0	Sandy silt		10	SS										
	Compact Grey Wet													
			11	SS										
248.5														
8.5	Silt, trace sand													
	Compact Grey Wet		12	SS										
			13	SS										
			14	SS										
			15	SS										
242.0														

RECORD OF BOREHOLE No R-3

2 of 2

METRIC

G.W.P.	5146-09-00	LOCATION	Coords: 5 142 911.2 N; 295 947.4 E	ORIGINATED BY	F.P.
DIST	Sudbury	HWY	17	BOREHOLE TYPE	C.F.H.S.A. and Dynamic Cone Penetration Test
DATUM	Geodetic	DATE	April 10, 2013	CHECKED BY	B.R.G.

[illegible]

RECORD OF BOREHOLE No R-4

1 of 2

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 142 900.8 N; 295 944.5 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** C.F.H.S.A. and 'N' Casing **COMPILED BY** N.R.
DATUM Geodetic **DATE** April 24, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		SHEAR STRENGTH kPa										WATER CONTENT (%)
							20 40 60 80 100										
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE										
258.0	Ground surface																
0.0	150mm thick asphalt over sand and gravel (PAVEMENT FILL)		1	AS	-												
256.8			2	SS	26												
1.2	Cobbles and boulders (ROCKFILL)																
254.8																	
3.2	Silt trace sand, trace clay clay pockets		3	SS	34												
	Dense to Brown Moist compact		4	SS	19												
	some clay, organics (FILL)		5	SS	26												
252.0																	
6.0	Clayey silt Firm Brown Moist to grey Wet		6	SS	9												
			7	SS	5												
249.2																	
8.8	Clayey silt, some sand rootlets Stiff to Brown Moist very stiff to grey to wet		8	SS	12												
			9	SS	17												
246.0																	
12.0	Silt trace sand, trace clay Compact Grey Wet		10	SS	16												
244.0																	
14.0	Sand, trace silt Compact Grey Wet		11	SS	15												
243.2																	
14.8	Silty sand																

RECORD OF BOREHOLE No R-4

2 of 2

METRIC

G.W.P.	5146-09-00	LOCATION	Coords: 5 142 900.8 N; 295 944.5 E	ORIGINATED BY	F.P.
DIST	Sudbury	HWY	17	BOREHOLE TYPE	C.F.H.S.A. and 'N' Casing
DATUM	Geodetic	DATE	April 24, 2013	CHECKED BY	B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT			NATURAL MOISTURE CONTENT			LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p			W			W _L				GR	SA	SI	CL
								○ UNCONFINED	● QUICK TRIAXIAL	+	×	FIELD VANE	LAB VANE	WATER CONTENT (%)												
243.0																										
242.2	Silty sand Compact Grey Wet		12	SS	16																					
15.8	End of borehole																									
	<div>* 2013 04 24</div> <div>▽ Water level observed during drilling</div> <div>▼ Water level measured after drilling</div> <div>C.F.H.S.A. denotes continuous flight hollow stem augers</div> <div>NOTE: Borehole caved-in at 6.4m</div>																									

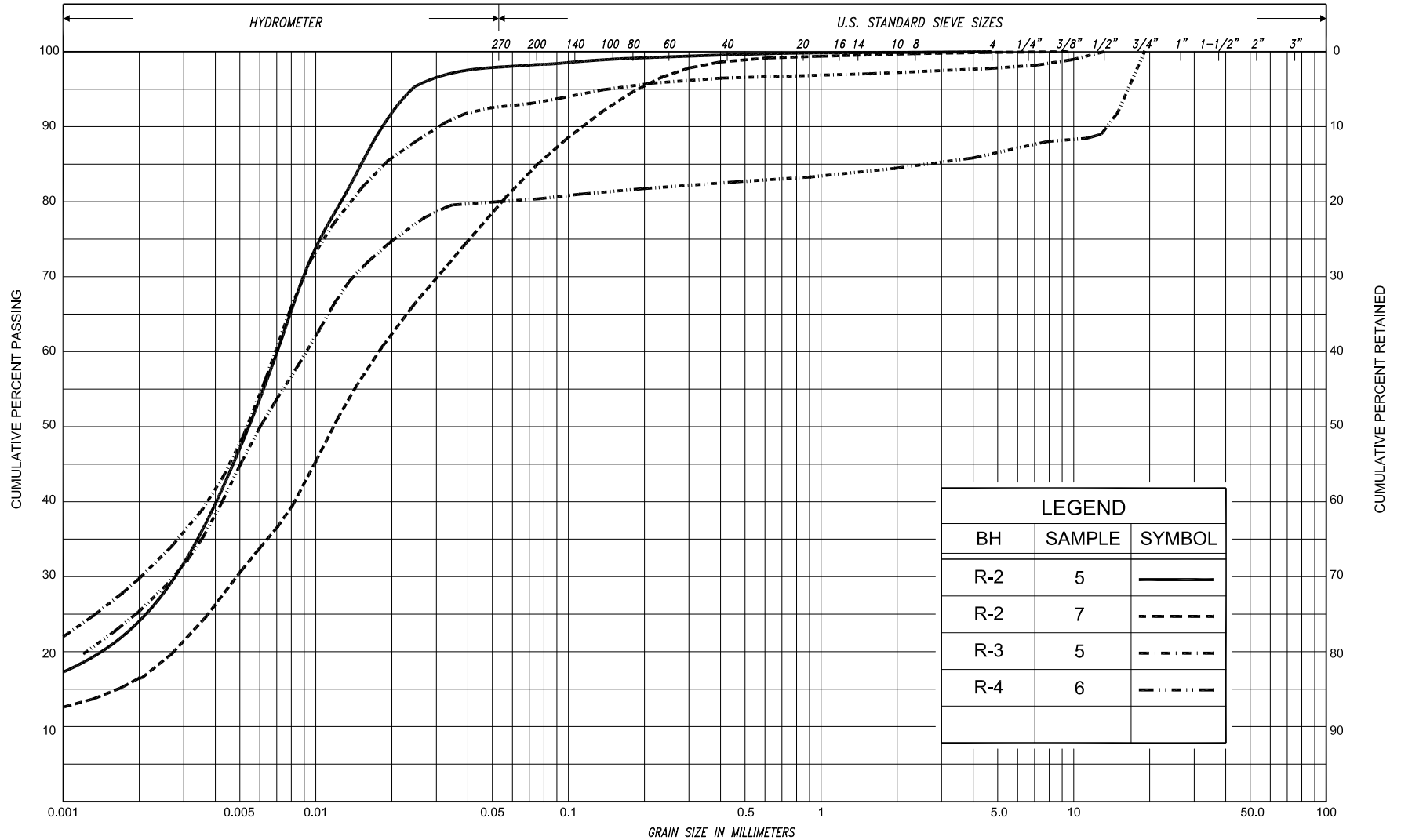
RECORD OF BOREHOLE No R-5

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 142 871.4 N; 295 913.1 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Power Auger **COMPILED BY** N.R.
DATUM Geodetic **DATE** May 09, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								<div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div>												
248.4	Ground surface							20	40	60	80	100					GR SA SI CL			
0.0	Clayey silt, trace sand trace gravel, organics		1	AS	-		248													
247.8	Grey Moist		2	AS	-															
0.6	Silt, some clay trace sand, trace gravel		3	AS	-															
247.2	Grey Wet																			
1.2	End of borehole																			
								</												



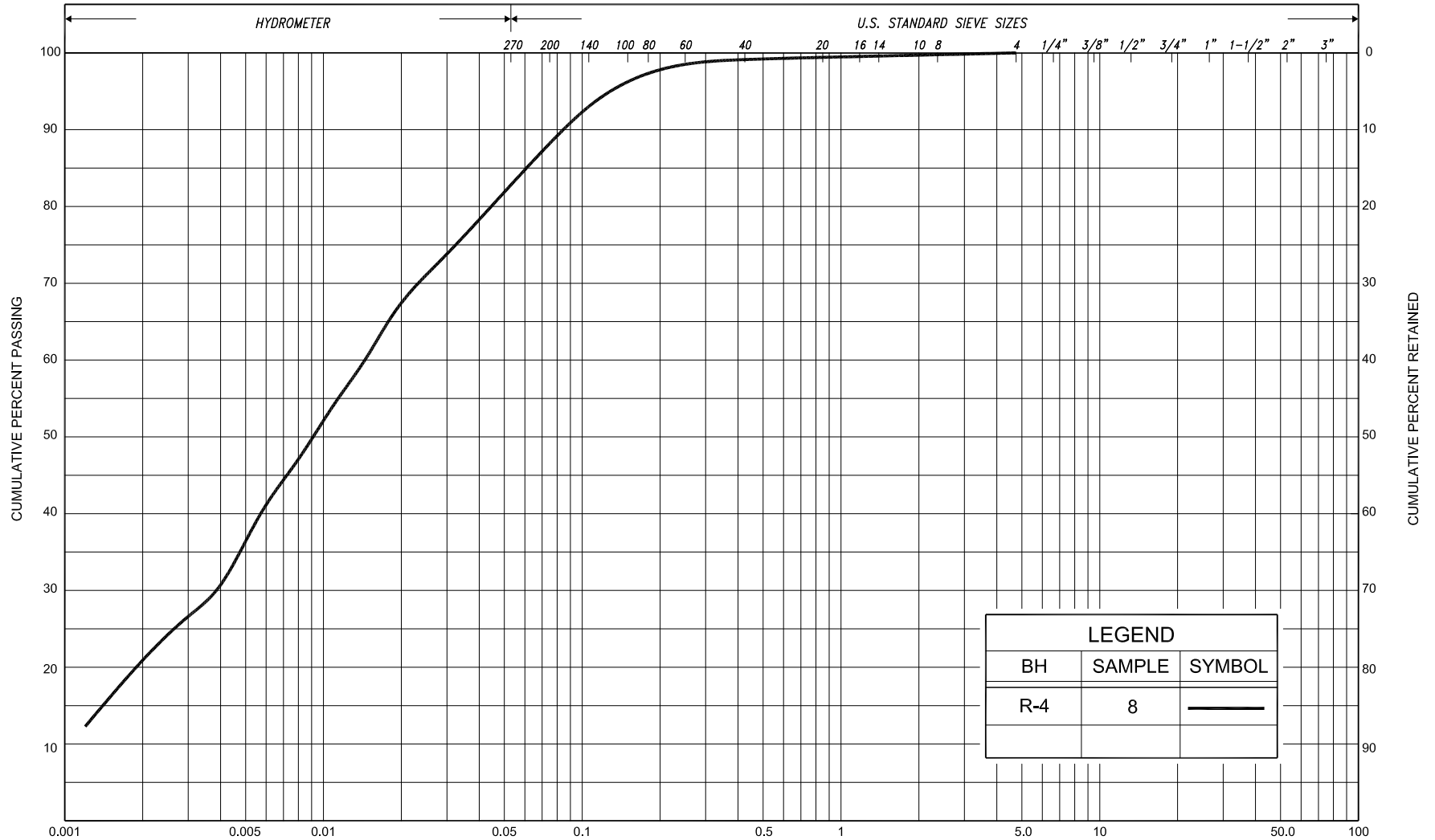
SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL			COB BLES	UNIFIED	
					SAND											
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL		COBBLES	M.I.T.
	SILT					SAND										
CLAY		SILT			V. FINE		FINE		MED.		COARSE		GRAVEL			U.S. BUREAU
					SAND											



GRAIN SIZE DISTRIBUTION

CLAYEY SILT, trace to some sand, trace to some gravel (CL, CL-ML)
(FILL)

FIG No. R-GS-1
HWY: 17
G.W.P. No. 5146-09-00



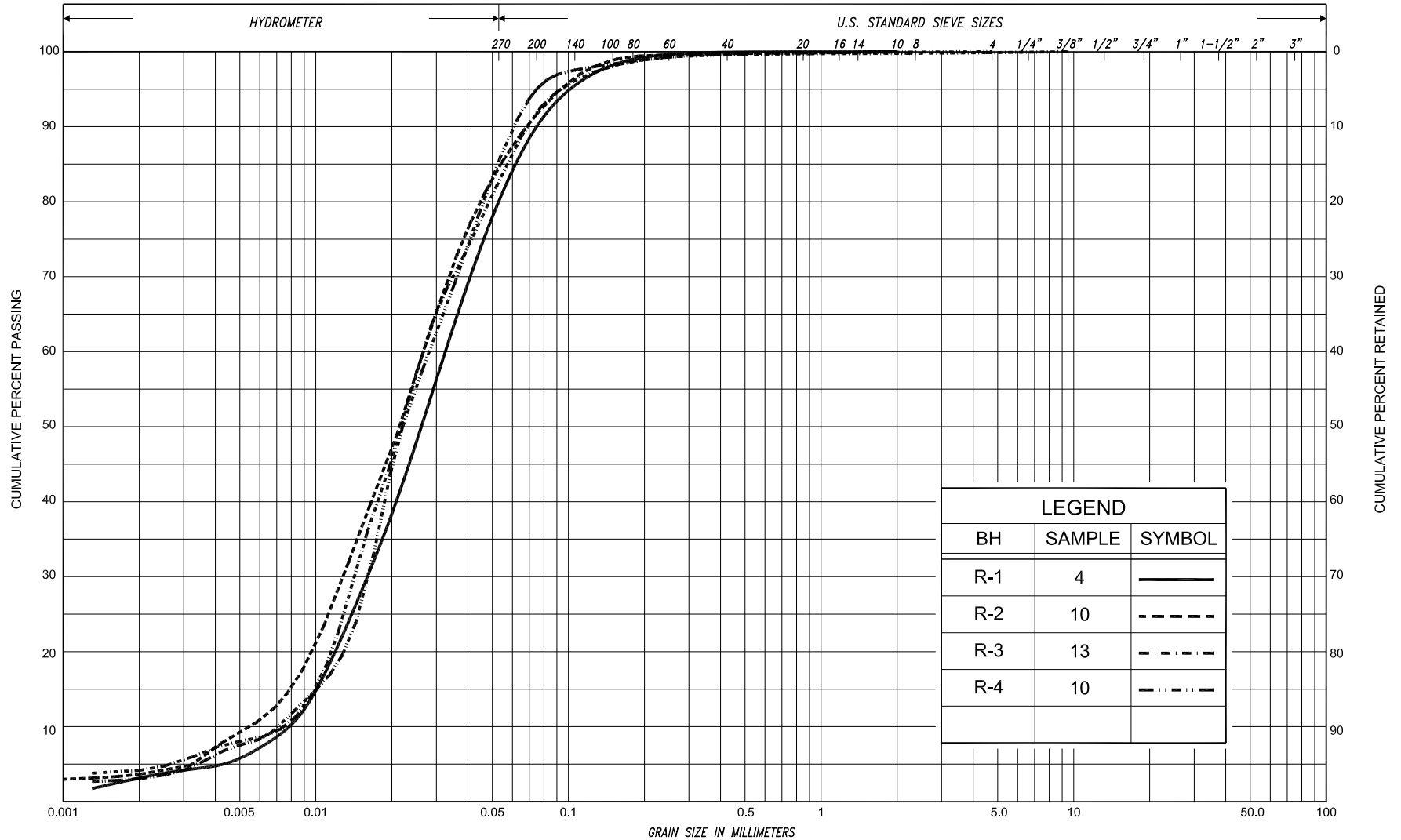
SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL				COBBLES	UNIFIED			
					SAND													
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL				COBBLES	M.I.T.
	SILT																	
CLAY			SILT			V. FINE	FINE	MED.	COARSE		GRAVEL						U.S. BUREAU	
						SAND												



GRAIN SIZE DISTRIBUTION

CLAYEY SILT, some sand (CL)

FIG No. R-GS-2
 HWY: 17
 G.W.P. No. 5146-09-00



SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COB BLES	UNIFIED		
CLAY	FINE		MEDIUM		COARSE	FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT					SAND						GRAVEL			COBBLES	M.I.T.
CLAY		SILT			V. FINE	FINE	MED.	COARSE		GRAVEL						U.S. BUREAU
					SAND											



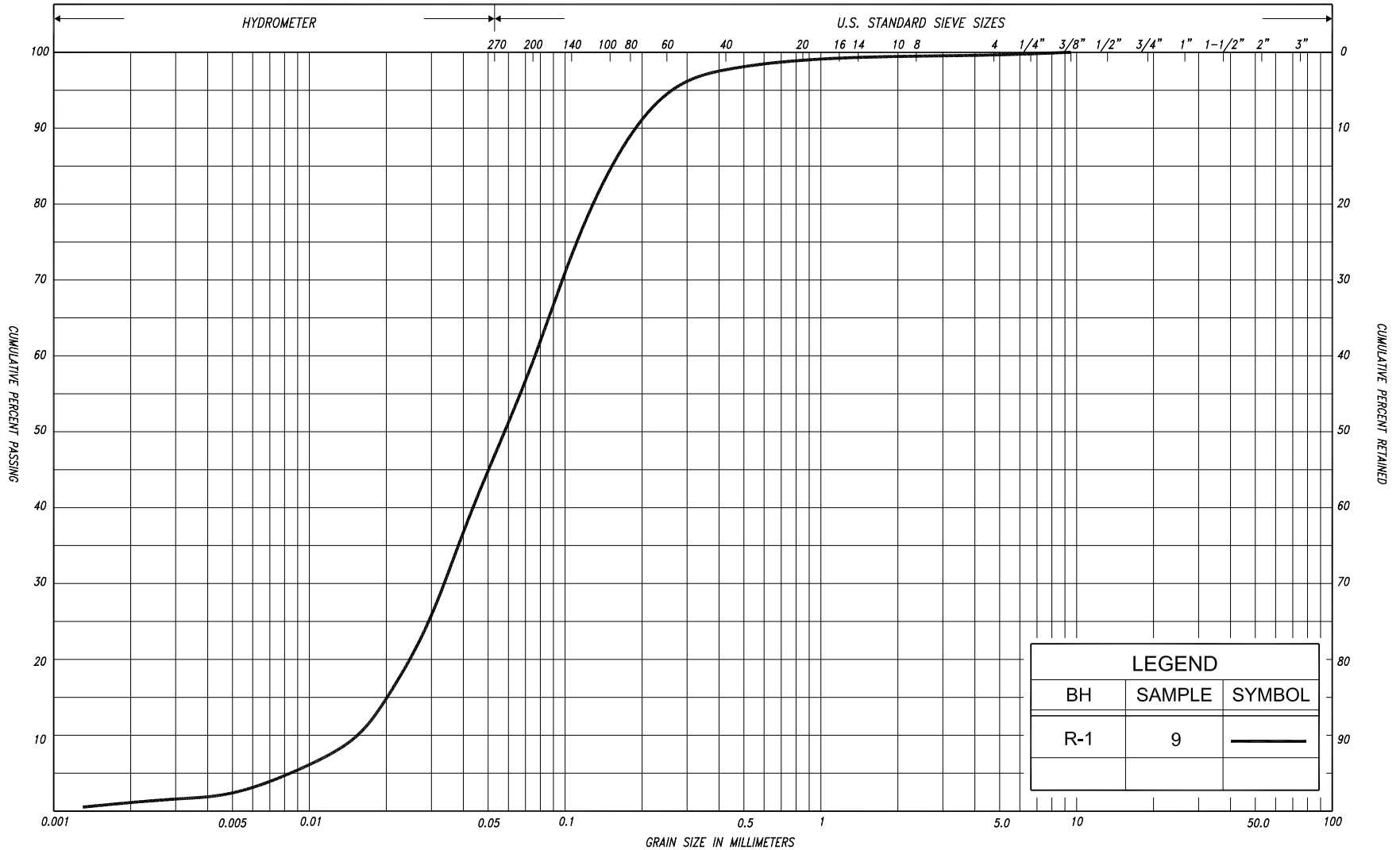
GRAIN SIZE DISTRIBUTION

SILT, trace sand, trace clay

FIG No. R-GS-3

HWY: 17

G.W.P. No. 5146-09-00



LEGEND		
BH	SAMPLE	SYMBOL
R-1	9	—

SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COB BLES	UNIFIED	
					SAND										
CLAY	FINE		MEDIUM		COARSE	FINE		MEDIUM		COARSE	GRAVEL			COBBLES	M.I.T.
	SILT				SAND										
CLAY		SILT			V. FINE	FINE	MED.	COARSE	GRAVEL						U.S. BUREAU
					SAND										



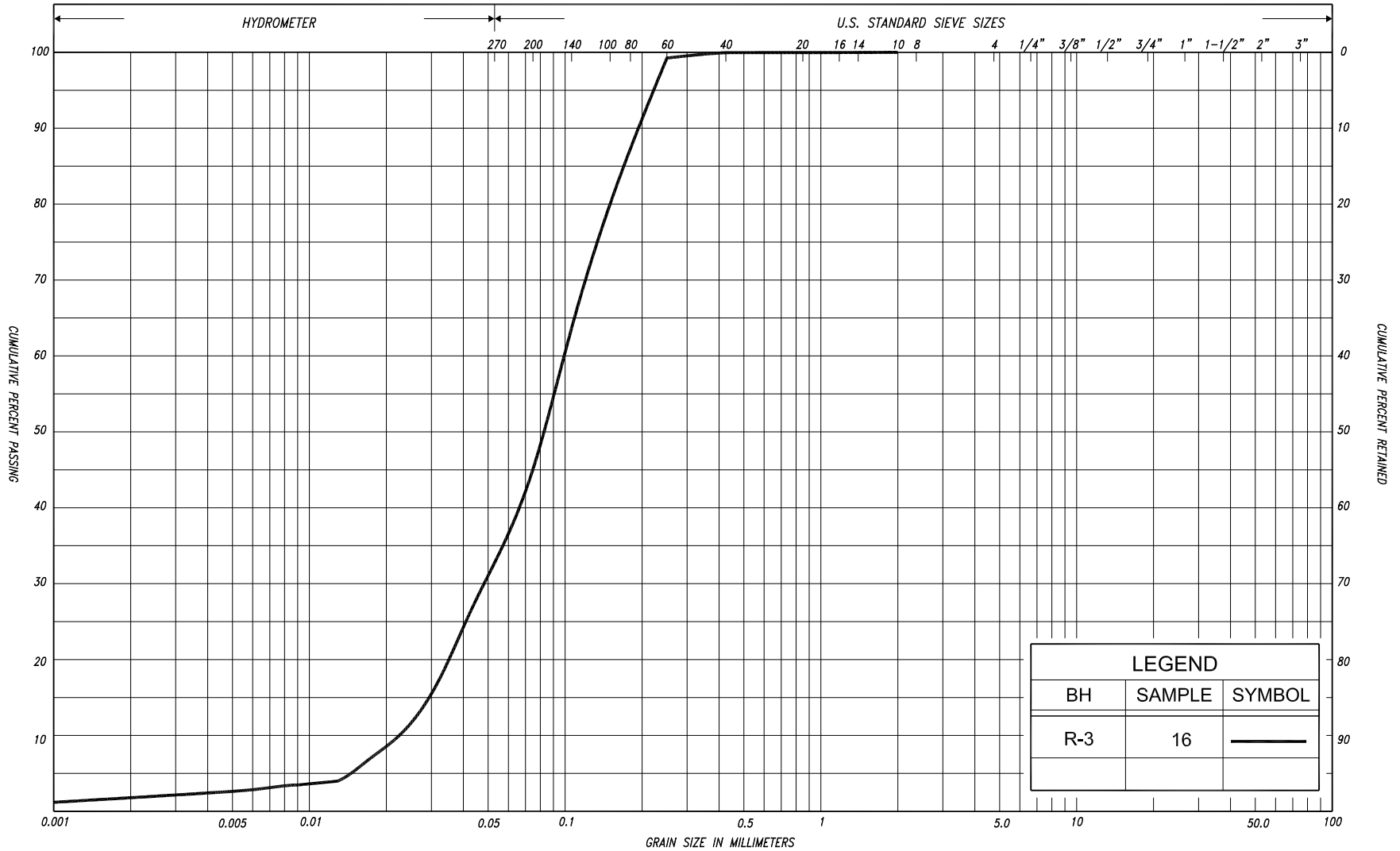
GRAIN SIZE DISTRIBUTION

SILT AND SAND, trace clay

FIG No. R-GS-4

HWY: 17

G.W.P. No. 5146-09-00



SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL				COB BLES	UNIFIED		
					SAND												
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT																
CLAY		SILT			V. FINE	FINE	MED.	COARSE		GRAVEL							U.S. BUREAU
					SAND												



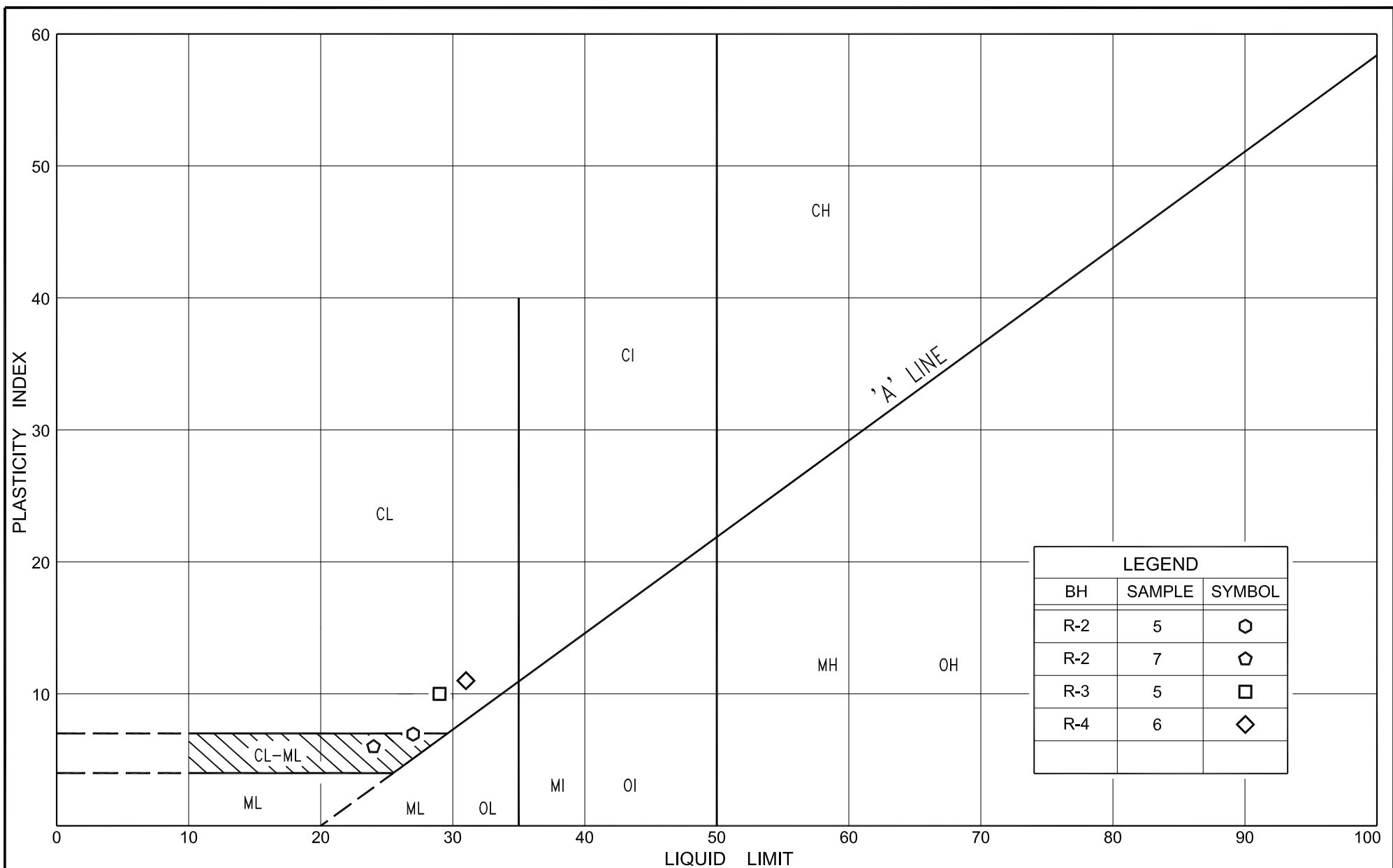
GRAIN SIZE DISTRIBUTION

SAND AND SILT, trace clay

FIG No. R-GS-5

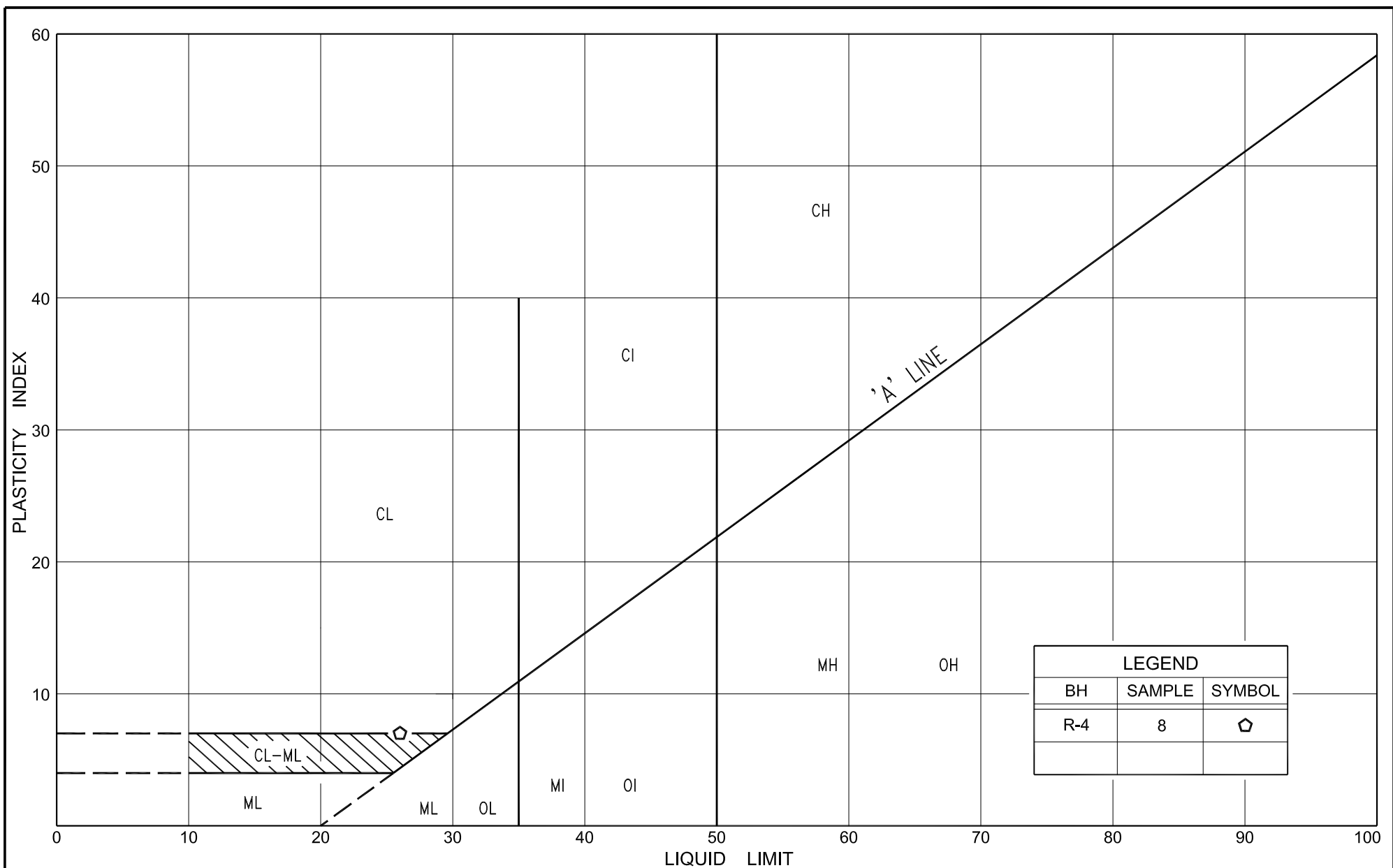
HWY: 17

G.W.P. No. 5146-09-00



PLASTICITY CHART
 CLAYEY SILT, trace to some sand, trace to some gravel (CL, CL-ML)
 (FILL)

FIG No.	R-PC-1
HWY:	17
G.W.P. No.	5146-09-00



PLASTICITY CHART
CLAYEY SILT, some sand (CL-ML)

FIG No. R-PC-2
HWY: 17
G.W.P. No. 5146-09-00

GEOGRAPHIC TOWNSHIP OF WATERS

Culvert S (W26) – Station 16+125 EBL

RECORD OF BOREHOLE No S-1

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 142 752.1 N; 296 373.2 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod + Dynamic Cone Penetration tests **COMPILED BY** N.R.
DATUM Geodetic **DATE** June 14, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE									
								● QUICK TRIAXIAL × LAB VANE									
					WATER CONTENT (%)												
250.3	Ground surface						20	40	60	80	100						
0.0	Sand and gravel, organics pockets of clayey silt		1	SS	15		250										
	Compact Brown Wet (FILL)																
249.4							249										
0.9	Silt, with sand trace clay, trace gravel		2	SS	10												
	Loose Mottled Wet grey/brown																
	(TILL)		3	SS	8											4 23 68 5	
248.1							248										
2.2	Silt some to with sand trace clay		4	SS	14												
	Compact Mottled Wet to loose grey/brown																
			5	SS	20		247										
			6	SS	12		246										
	Grey																
			7	SS	8		245									0 19 78 3	
			8	SS	10		244										
			9	SS	9		243										
242.1																	
8.2	Sandy silt, trace clay		10	SS	16		242										
	Compact Grey Wet																
			11	SS	16		241									0 31 67 2	
240.6																	
9.7	End of borehole						240										
239.6																	
10.7	End of dynamic cone penetration test																

* 2013 06 14

▽ Water level observed
during drilling

▼ Water level measured
after drilling

■ Penetrometer test

Dynamic cone penetration
test was carried-out 2m
south of borehole S-1

RECORD OF BOREHOLE No S-2

1 of 2

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 142 731.3 N; 296 370.7 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Continuous Flight Hollow Stem Augers **COMPILED BY** N.R.
DATUM Geodetic **DATE** April 23, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE									
								● QUICK TRIAXIAL × LAB VANE									
					WATER CONTENT (%)												
256.3	Ground surface						20	40	60	80	100						
0.0	50 mm asphalt over sand and gravel		1	AS	-												
255.7	(PAVEMENT FILL)																
0.6	Silt some sand, some clay		2	SS	6												
	Loose to Brown Moist compact																
			3	SS	10											0 14 75 11	
	trace sand, trace clay organic inclusions		4	SS	24												
	Loose Moist		5	SS	3											0 2 92 6	
			6	SS	5												
	(FILL)		7	SS	6												
250.7	Topsoil		8	SS	3												
5.6	Silt trace sand, trace clay organics																
250.5	Compact Grey Moist to loose to wet		9	SS	11	▽*											
5.8			10	SS	11											0 1 90 9	
			11	SS	12	▽*											
	Grey																
			12	SS	5												
	with sand, trace clay																
	Loose Grey Wet																
			13	SS	7											0 20 78 2	
			14	SS	7												
			15	SS	9												
242.0	End of borehole																
14.3																	
	Cont'd																

Cont'd

RECORD OF BOREHOLE No S-2

2 of 2

METRIC

G.W.P. <u>5146-09-00</u>	LOCATION <u>Coords: 5 142 731.3 N; 296 370.7 E</u>	ORIGINATED BY <u>F.P.</u>
DIST <u>Sudbury</u> HWY <u>17</u>	BOREHOLE TYPE <u>Continuous Flight Hollow Stem Augers</u>	COMPILED BY <u>N.R.</u>
DATUM <u>Geodetic</u>	DATE <u>April 23, 2013</u>	CHECKED BY <u>B.R.G.</u>

[illegible]

RECORD OF BOREHOLE No S-3

1 of 2

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 142 715.8 N; 296 365.2 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Continuous Flight Hollow Stem Augers **COMPILED BY** N.R.
DATUM Geodetic **DATE** April 23, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE										○		
								● QUICK TRIAXIAL × LAB VANE												
256.7	Ground surface						20	40	60	80	100					GR	SA	SI	CL	
0.0	Sand and gravel		1	AS	-															
	(PAVEMENT FILL)																			
255.9	Sand and silt		2	SS	24															
0.8	trace clay, trace gravel																			
	Compact Brown Moist to loose		3	SS	9															
	(FILL)																			
	Silt		4	SS	26															
	trace sand, trace clay																			
	Compact Brown Moist to loose		5	SS	17															
			6	SS	6															
			7	SS	12															
	Clayey silt																			
	sandy silt pockets		8	SS	1															
	Silt																			
	trace sand, trace clay																			
	organics inclusions		9	SS	9															
	Clayey silt, trace sand																			
250.0	Silty clay, trace sand		10	SS	WH**															
6.7	Firm to Red Wet stiff brown			FV																
			11	SS	1															
				FV																
247.7	Silt		12	SS	9															
9.0	trace sand, trace clay																			
	silt layers and seams																			
	Loose Brown Wet to grey		13	SS	8															
			14	SS	2															
			15	SS	8															
242.4	End of borehole																			
14.3																				

RECORD OF BOREHOLE No S-3

2 of 2

METRIC

G.W.P. <u>5146-09-00</u>	LOCATION <u>Coords: 5 142 715.8 N; 296 365.2 E</u>	ORIGINATED BY <u>F.P.</u>
DIST <u>Sudbury</u> HWY <u>17</u>	BOREHOLE TYPE <u>Continuous Flight Hollow Stem Augers</u>	COMPILED BY <u>N.R.</u>
DATUM <u>Geodetic</u>	DATE <u>April 23, 2013</u>	CHECKED BY <u>B.R.G.</u>

[illegible]

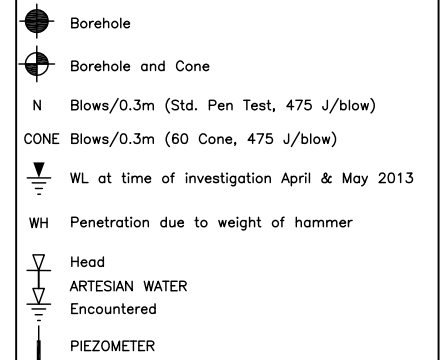
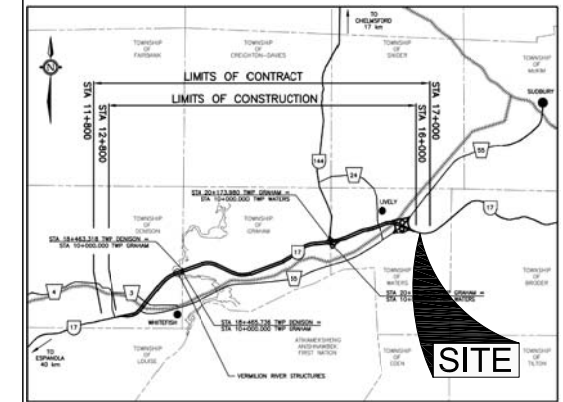
RECORD OF BOREHOLE No S-4

1 of 1

METRIC

G.W.P. 5146-09-00 **LOCATION** Coords: 5 142 706.3 N; 296 348.8 E **ORIGINATED BY** F.P.
DIST Sudbury **HWY** 17 **BOREHOLE TYPE** Tripod + Dynamic Cone Penetration tests **COMPILED BY** N.R.
DATUM Geodetic **DATE** June 13, 2013 **CHECKED BY** B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		SHEAR STRENGTH kPa									
							○ UNCONFINED + FIELD VANE									
							● QUICK TRIAXIAL × LAB VANE									
					WATER CONTENT (%)											
249.8	Ground surface						20	40	60	80	100					
0.0	Organic silty sand		1	SS	2											
249.2	Very loose Dark brown Wet															
0.6	(FILL)		2	SS	4											
	Clayey silt trace sand, trace gravel organics to 1.4m															
	Firm Mottled Moist brown/grey		3	SS	5											
247.6				FV												
2.2	Silt trace sand, trace clay		4	SS	7											
	Loose to Grey Wet compact															
			5	SS	11											
			6	SS	7											
			7	SS	11											
244.6																
5.2	Sandy silt, trace clay															
	Compact Brown Wet															
	Grey		8	SS	12											
			9	SS	16											
			10	SS	11											
			11	SS	19											
240.1	End of borehole															
9.7																
239.4	End of dynamic cone penetration tests															
10.4																



BH No	ELEVATION	NORTHINGS	EASTINGS
S-1	250.3	5 142 752.1	296 373.2
S-2	256.3	5 142 731.3	296 370.7
S-3	256.7	5 142 715.8	296 365.2
S-4	249.8	5 142 706.3	296 348.8

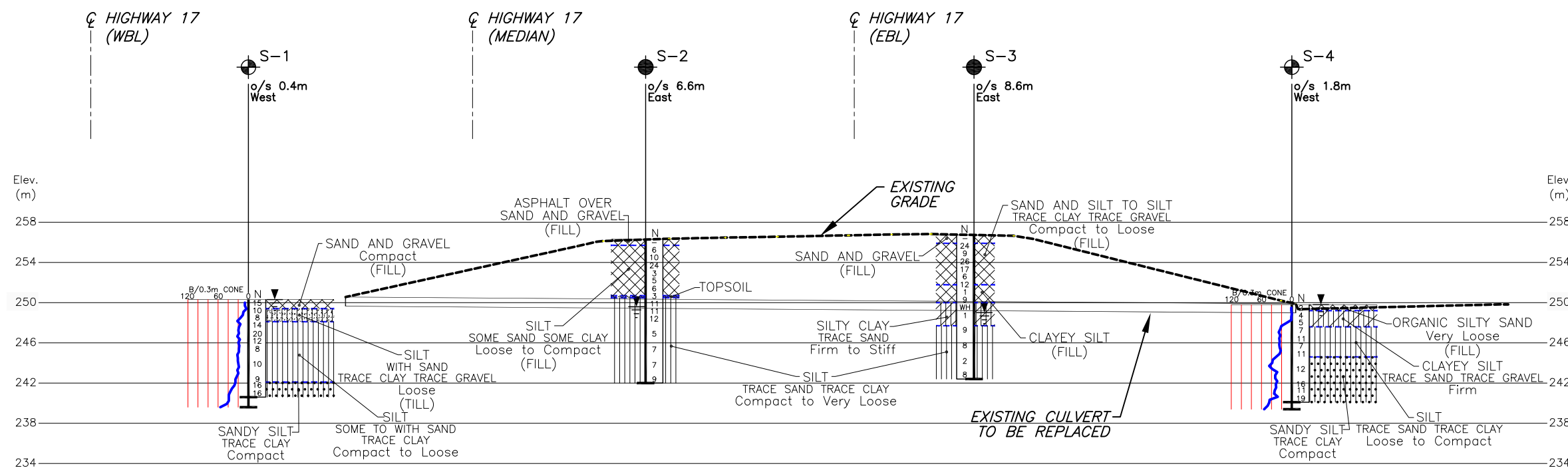
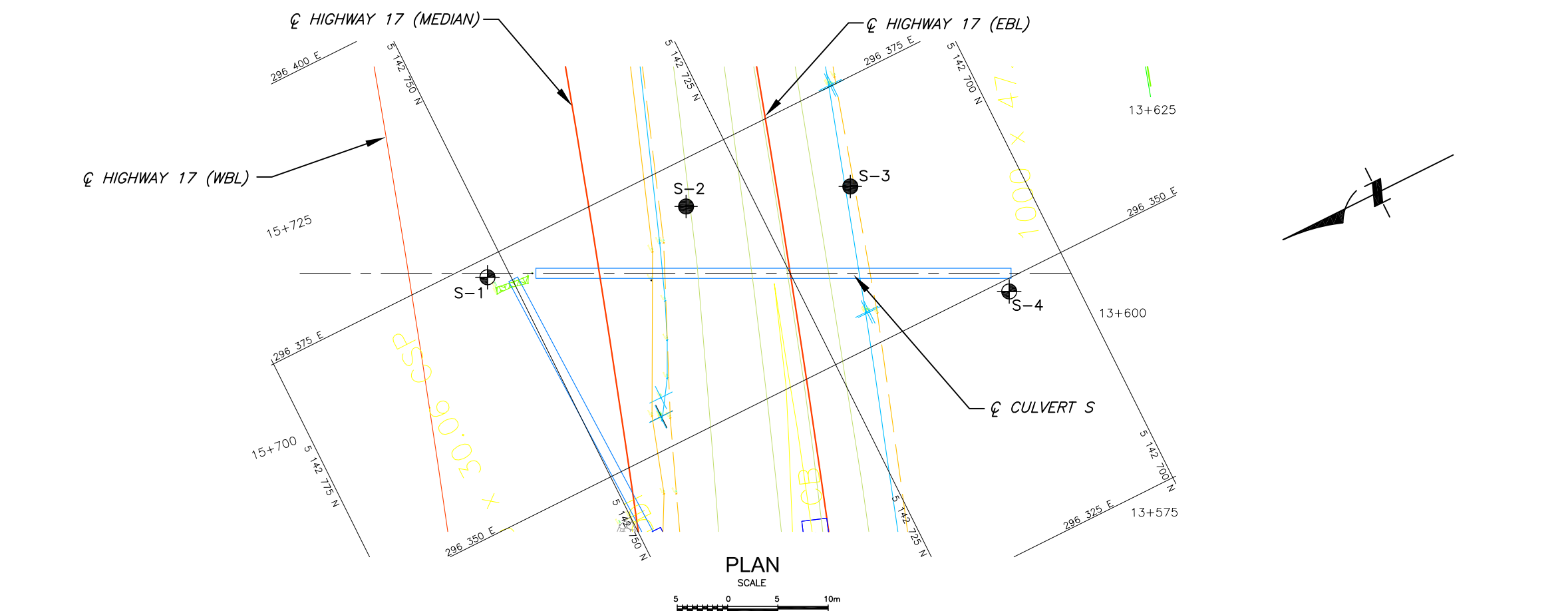
- NOTE -

The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

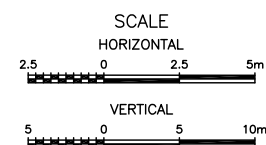
REVISIONS		
DATE	BY	DESCRIPTION

Geocres No.411-299

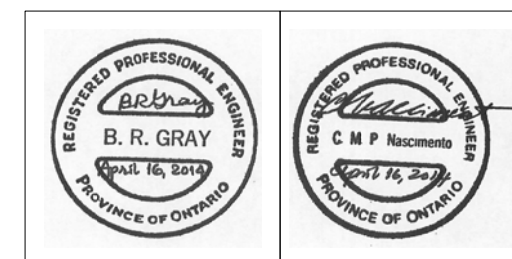
HWY No	17			DIST	Sudbury
SUBM'D	NA	CHECKED	NR	DATE	APR. 16, 2014
DRAWN	NA	CHECKED	BRG	APPROVED	CN
					DWG S-1



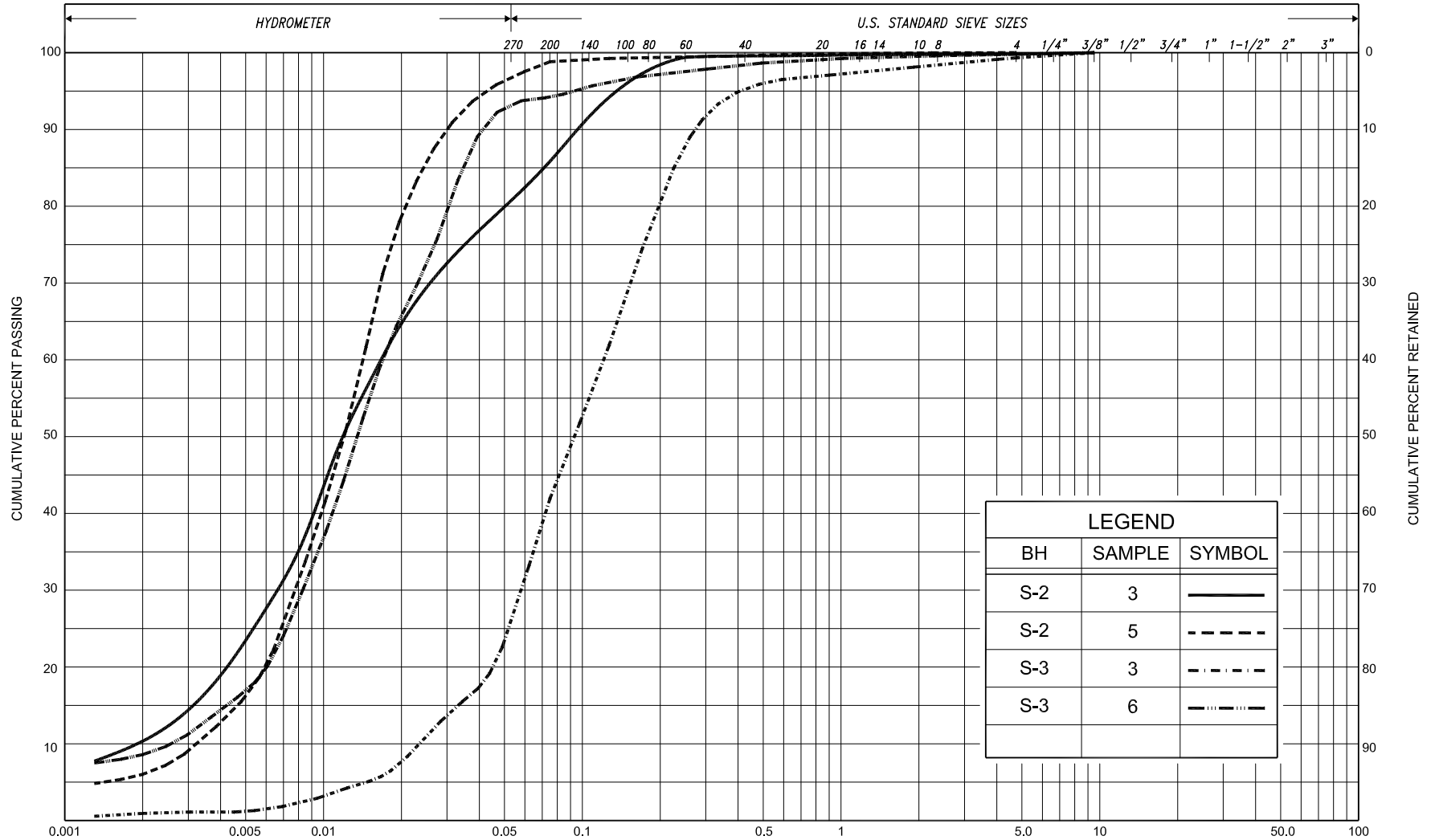
PROFILE ALONG \varnothing EXISTING CULVERT AT STA. 16+125 EBL



1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
2. THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION. CULVERT PROFILE IS ESTIMATED.
3. DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.



Reference AECOM Drawings:
NTB-01207011.dwg and WATERS X-SECTIONS with Culverts and viewport.dwg
received on November 25, 2013 and April 01, 2014 respectively.



SILT & CLAY				FINE		MEDIUM		COARSE	GRAVEL		COBBLES	UNIFIED
CLAY	SAND			FINE		MEDIUM		COARSE	GRAVEL		COBBLES	
	FINE	MEDIUM	COARSE	FINE	MEDIUM	SAND	COARSE					
CLAY		SILT		V. FINE		FINE	MED.	COARSE	GRAVEL			U.S. BUREAU
				SAND								



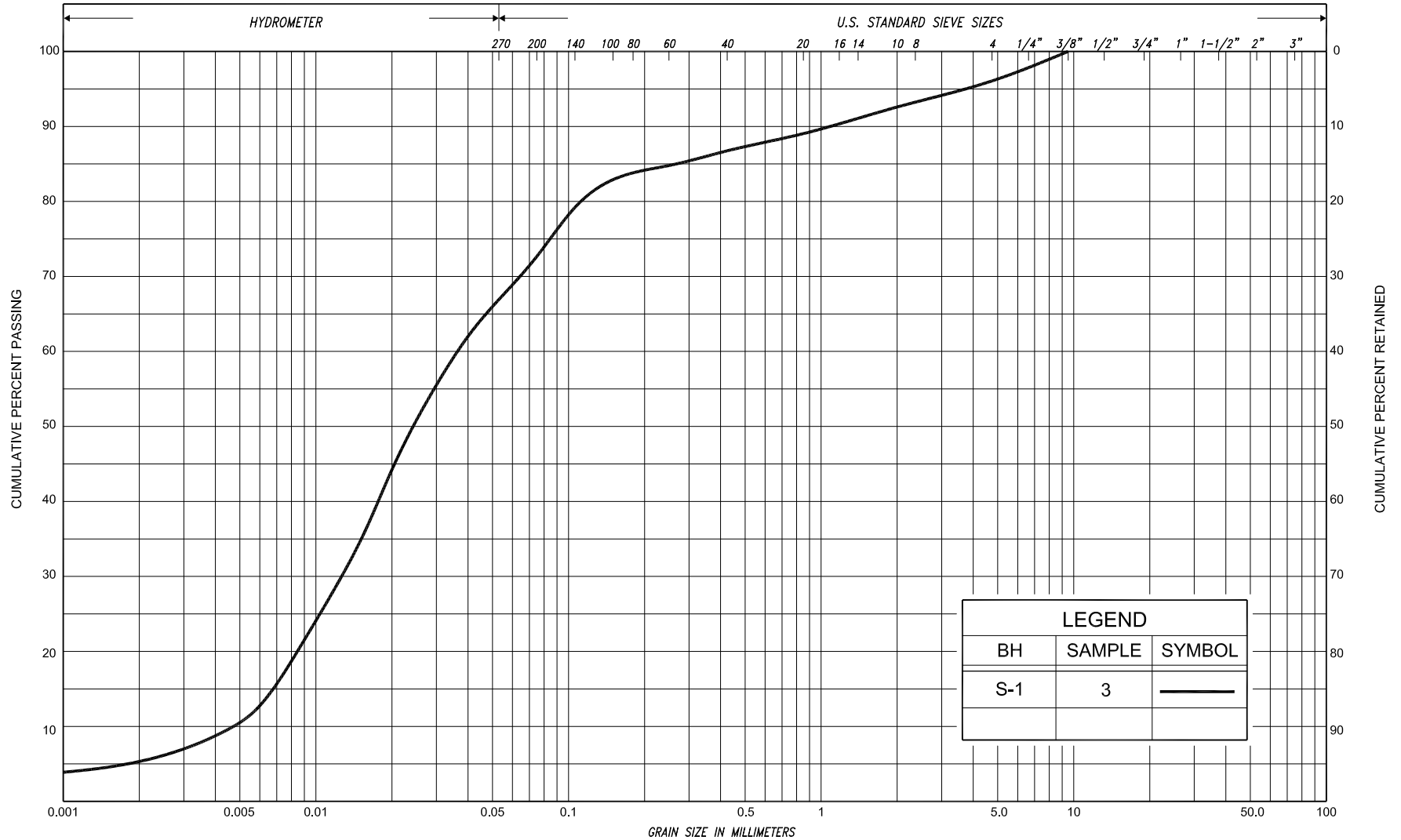
GRAIN SIZE DISTRIBUTION

SILT to SAND AND SILT, trace to some clay, trace gravel
(FILL)

FIG No. S-GS-1

HWY: 17

G.W.P. No. 5146-09-00



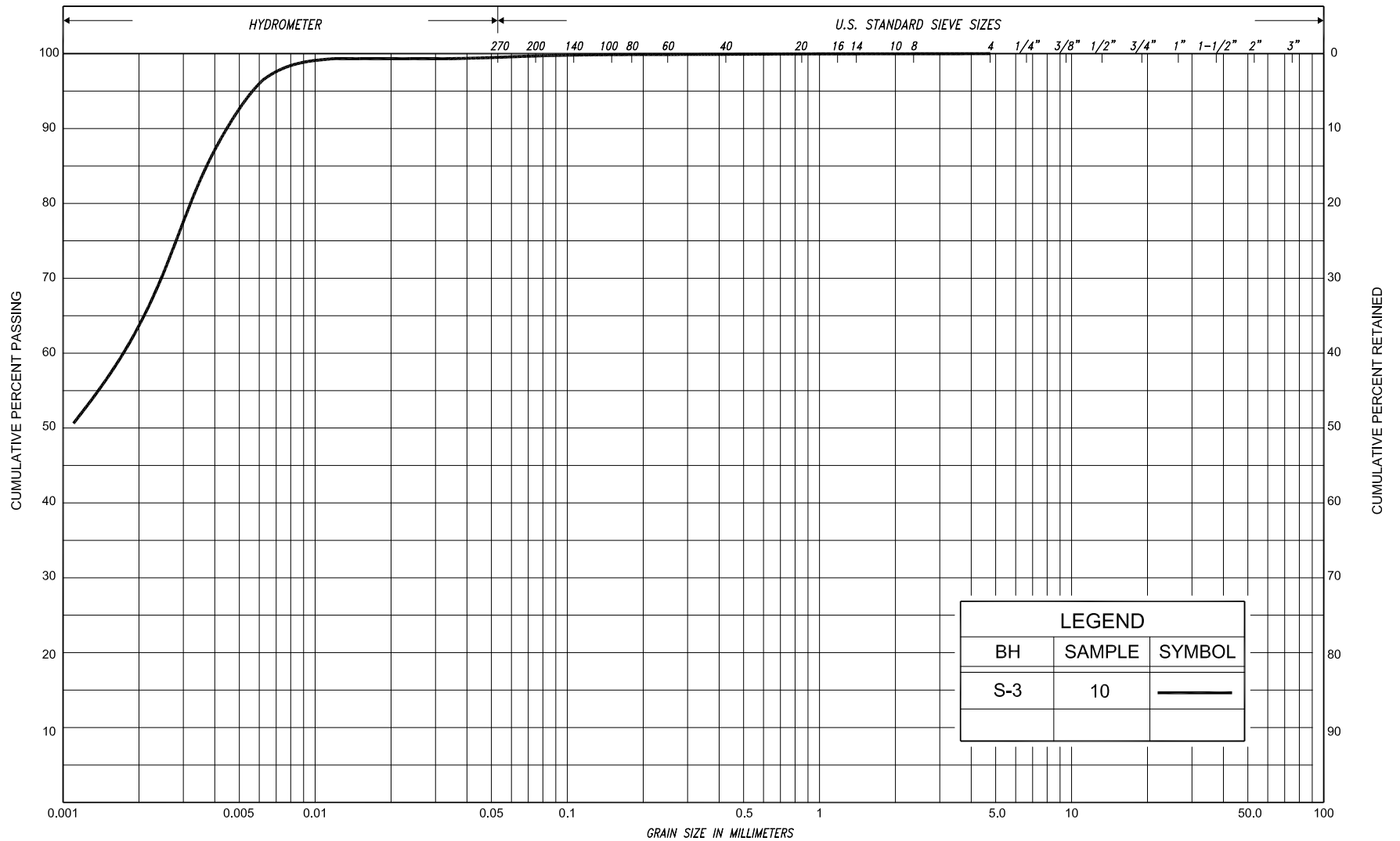
SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL				COBBLES	UNIFIED	
CLAY	FINE		MEDIUM		COARSE	FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT					SAND										
CLAY		SILT			V. FINE	FINE	MED.	COARSE		GRAVEL						U.S. BUREAU
				SAND												



GRAIN SIZE DISTRIBUTION

SILT, with sand, trace clay, trace gravel
(TILL)

FIG No. S-GS-2
HWY: 17
G.W.P. No. 5146-09-00



LEGEND		
BH	SAMPLE	SYMBOL
S-3	10	—

SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED		
					SAND											
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL		COBBLES	M.I.T.
	SILT					SAND										
CLAY		SILT			V. FINE	FINE	MED.	COARSE	GRAVEL							U.S. BUREAU
					SAND											

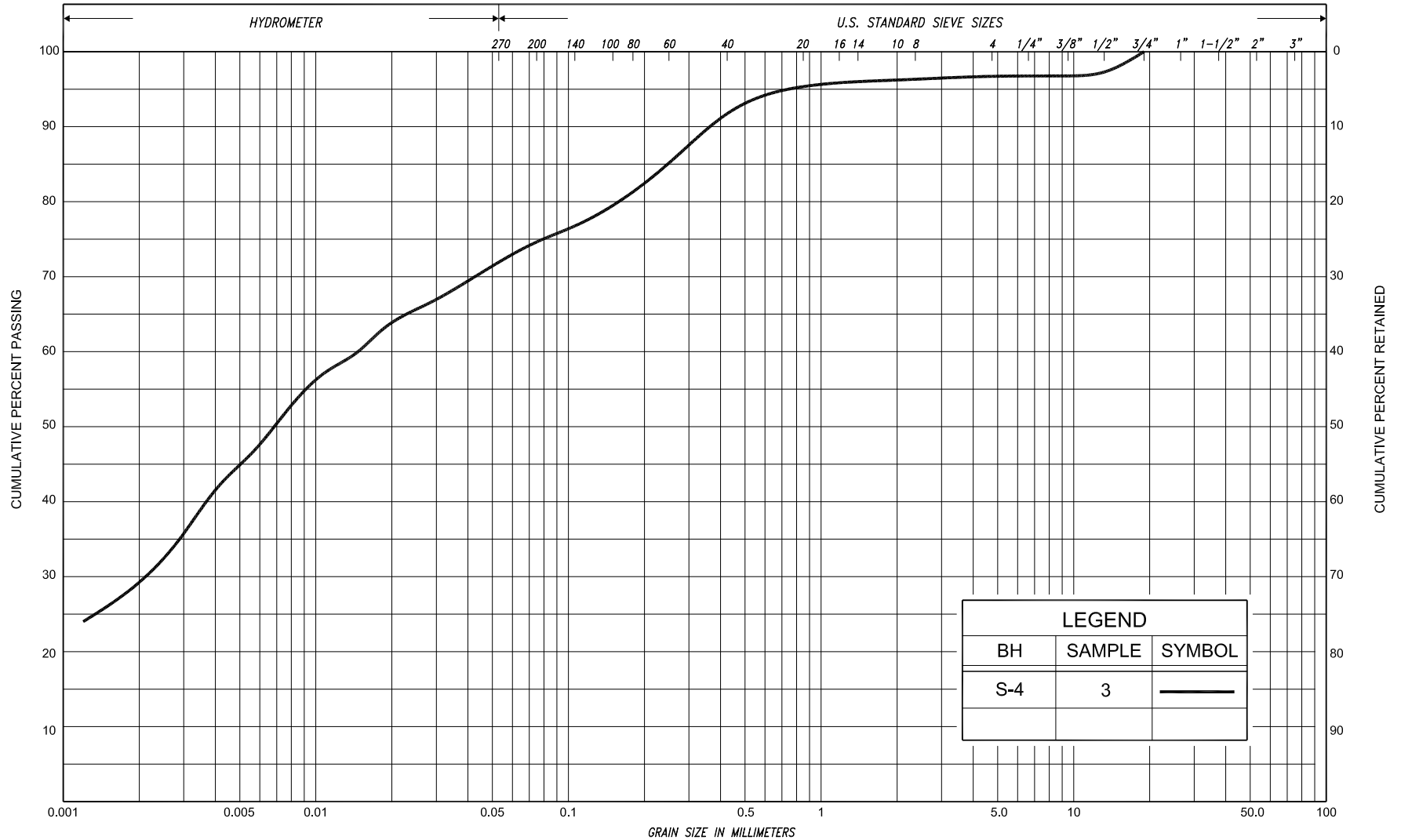


GRAIN SIZE DISTRIBUTION SILTY CLAY (CI)

FIG No. S-GS-3

HWY: 17

G.W.P. No. 5146-09-00



SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COB BLES	UNIFIED			
					SAND												
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT																
CLAY		SILT			V. FINE	FINE	MED.	COARSE		GRAVEL						U.S. BUREAU	
					SAND												



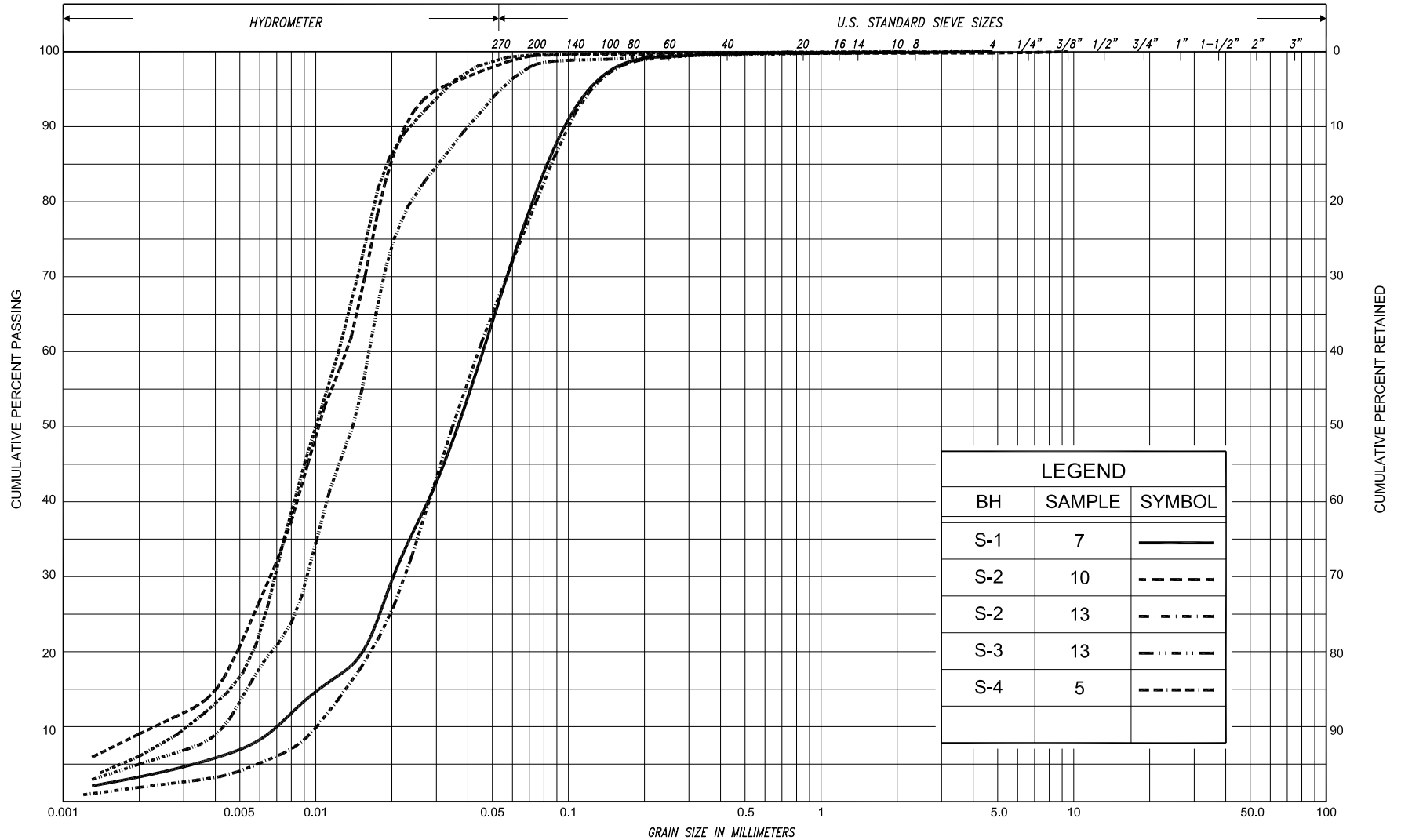
GRAIN SIZE DISTRIBUTION

CLAYEY SILT, some sand, trace gravel (CL)

FIG No. S-GS-4

HWY: 17

G.W.P. No. 5146-09-00



SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL			COB BLES	UNIFIED				
					SAND														
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.		
	SILT					SAND													
CLAY		SILT			V. FINE	FINE	MED.	COARSE		GRAVEL								U.S. BUREAU	
							SAND												



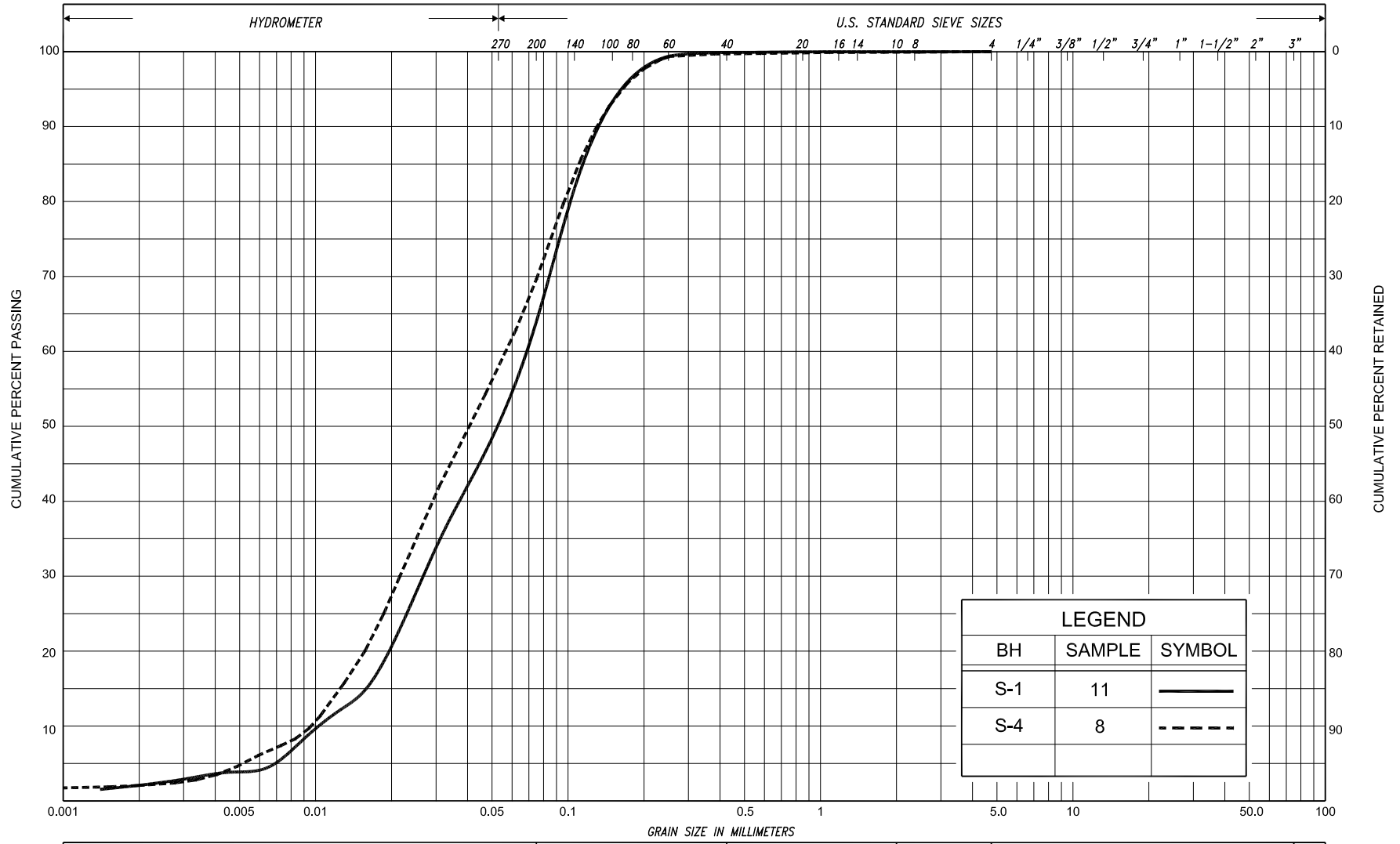
GRAIN SIZE DISTRIBUTION

SILT, trace to some sand, trace clay

FIG No. S-GS-5

HWY: 17

G.W.P. No. 5146-09-00



LEGEND		
BH	SAMPLE	SYMBOL
S-1	11	————
S-4	8	-----

SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL				COB BLES	UNIFIED		
					SAND													
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL				COBBLES	M.I.T.
	SILT																	
CLAY		SILT			V. FINE	FINE	MED.	COARSE		GRAVEL								U.S. BUREAU
					SAND													

GRAIN SIZE DISTRIBUTION

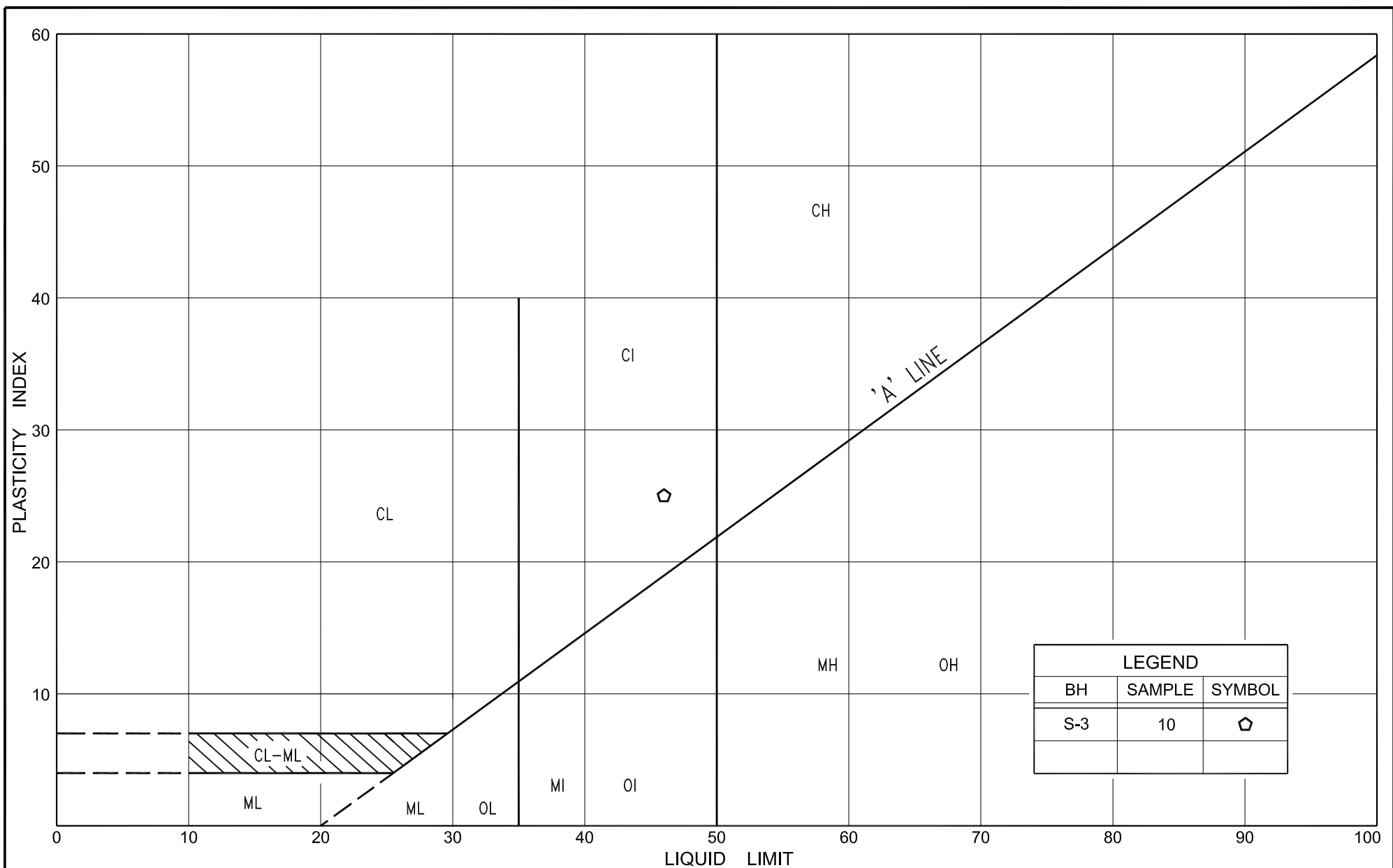
SANDY SILT, trace clay

FIG No. S-GS-6

HWY: 17

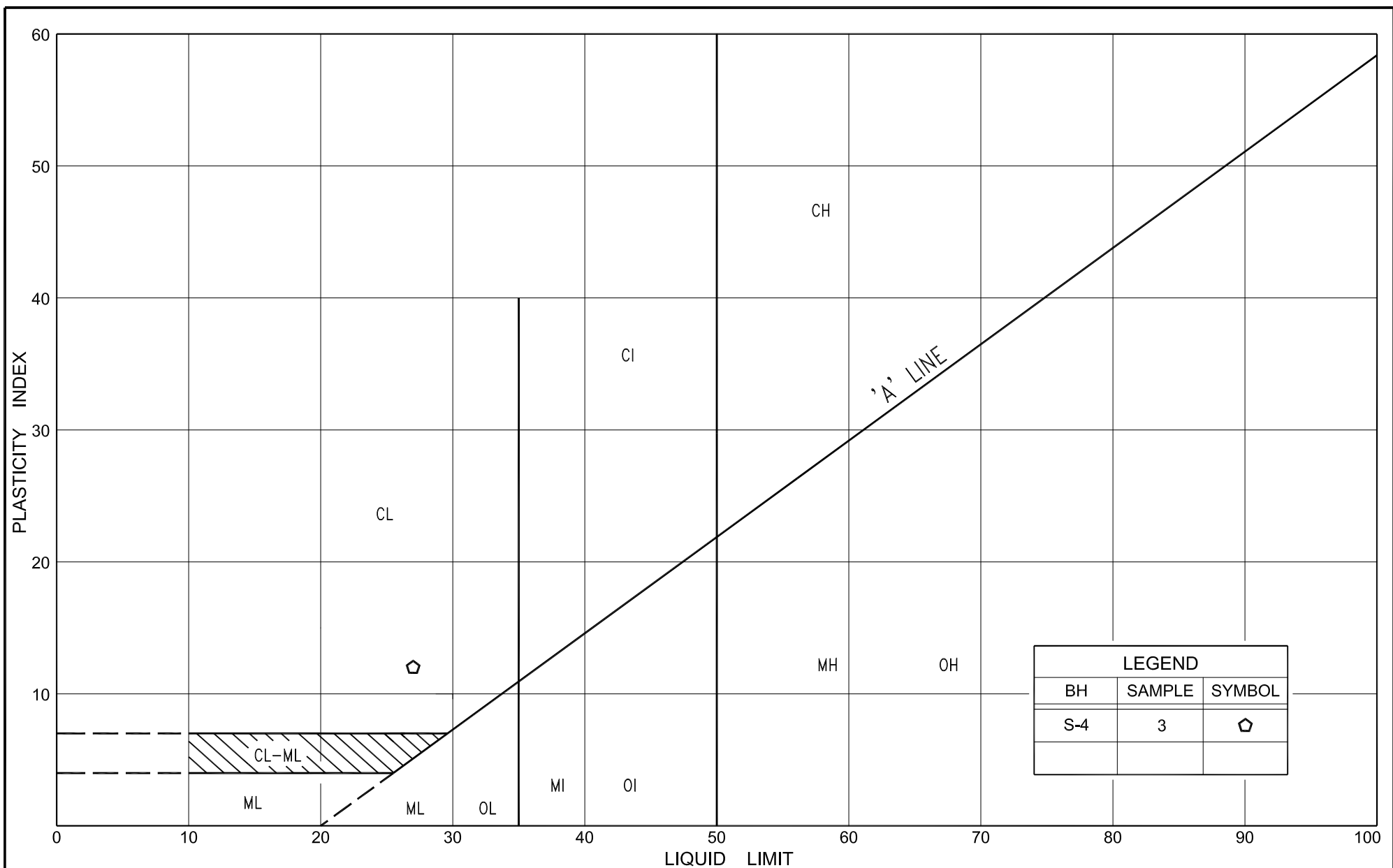
G.W.P. No. 5146-09-00





PLASTICITY CHART
 CLAYEY SILT, trace sand, trace gravel (CL)
 (FILL)

FIG No. S-PC-1
 HWY: 17
 G.W.P. No. 5146-09-00



PLASTICITY CHART
CLAYEY SILT, some sand, trace gravel (CL)

FIG No. S-PC-2
HWY: 17
G.W.P. No. 5146-09-00