

APPENDIX 'A'

GEOTECHNICAL REPORT



**REVISED REPORT
GEOTECHNICAL INVESTIGATION
DUGALD ROAD RECONSTRUCTION
WINNIPEG, MANITOBA**

Submitted to:

City of Winnipeg
Engineering Technology Services
106 – 1155 Pacific Avenue
Winnipeg, Manitoba
R3E 3P1

Attention: Mr. Garry Campbell

Submitted by:

AMEC Earth & Environmental
A Division of AMEC Americas Limited
440 Dovercourt Drive
Winnipeg, Manitoba
R3Y 1N4

12 January 2009

AMEC File No. WX10364

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1.0 INTRODUCTION

AMEC Earth and Environmental, a division of AMEC Americas Limited (AMEC), were retained by the City of Winnipeg (COW) to conduct a geotechnical investigation for a proposed street upgrading project in Winnipeg, Manitoba. The location of the project is the eastbound lanes of Dugald Road, approximately between Terracon Place and Plessis Road.

The purpose of the investigation was to determine the pavement condition and soil profile at predetermined locations along Dugald Road.

2.0 SITE CONDITIONS

The roadway consisted of an asphalt overlay on concrete pavement. At the time of the investigation, the roadway was snow and ice covered and therefore a detailed review of the pavement condition was not possible. Typical of roads in the Winnipeg area, the road was generally flat lying and level, with local slopes between catch basins to facilitate drainage.

3.0 FIELD INVESTIGATION

The COW initially requested a total of 9 test holes, however at their request, four additional test holes were required at pavement joint locations. The initial 9 test hole locations were determined by the COW prior to the investigation. The additional four joint test hole locations (test holes TH02, TH05, TH09 and TH13) were determined by AMEC.

Prior to coring and drilling, AMEC had public underground utilities located. Due to the presence of utilities at one of the proposed test holes (TH14), the test hole could not be drilled. On December 5, 2008, following utility clearances, all remaining test hole locations, were cored prior to auger drilling in order to determine the asphalt and concrete thicknesses. All coring was completed with a 150 mm diameter diamond coring rig. Each of the cores was photographed and photos are presented in Appendix B.

On 8 and 9 December 2008, a total of thirteen (13) test holes (TH01 to TH13) were drilled on the roadway, using a truck mounted Acker MP5T drill rig operated by Paddock Drilling Ltd. of Winnipeg, and equipped with 125 mm continuous flight solid stem augers. The test hole locations are shown on Figures 1 to 4 in Appendix A.

Test hole logging and subcontractor supervision was provided on a full time basis by Mr. Blair Power of AMEC. Traffic control during the drilling operation was provided by Guardian Traffic Services.

All soils observed during test hole drilling were visually classified on site according to the Modified Unified Soil Classification System (MUSCS) and in accordance with the City of Winnipeg geotechnical guidelines. Groundwater and drilling conditions, as well as any pertinent subsurface observations, were also recorded at the time of the investigation.

Disturbed soil samples were taken at regular intervals from the auger flights in each test hole. All soil samples obtained during the field investigation were labelled, sealed in plastic bags to limit moisture loss and transported to AMEC's Soils Laboratory in Winnipeg for further examination and testing. The test hole logs are presented in Appendix A, Figures 5 to 17 and show the soil profile, results of the field and laboratory testing, and comments relative to groundwater and sloughing conditions encountered.

Each test hole was backfilled with the auger cuttings and topped with asphalt cold patch at the completion of drilling, with excess cuttings moved to the side of the road.

4.0 LABORATORY TESTING

Soil samples were returned to AMEC's Soils Laboratory in Winnipeg for geotechnical laboratory testing. All soil samples were visually classified and tested for in-situ moisture contents, and selected samples were tested for Atterberg limits and Hydrometer analysis to confirm the field classification of soils.

5.0 SUBSURFACE CONDITIONS

Although variable across the 13 test holes completed, the generalized stratigraphy of the roadway can be described as follows, as noted in descending order from the ground surface:

- Asphalt
- Concrete
- Gravel, Silt and/or Clay Fill
- Medium to High plastic clay
- Silt
- High plastic clay

Asphalt overlying concrete pavement were present at each test hole location. The asphalt thickness generally varied from 40 to 65 mm with the exception of test hole TH01, where the asphalt was 132 mm. The concrete below the asphalt overlay also varied in thickness from 76 to 206 mm. The concrete and asphalt were underlain by variable fill materials that generally consisted of gravel fill (12 test holes) underlain by clay fill (8 test holes). At the time of drilling, the gravel fill was frozen throughout its entire depth. The gravel fill again varied from about 15 mm (TH03) to 865 mm (TH04) thick (averaging about 310 mm thick) and generally consisted of 20mm granular material that was sandy, frozen and brown and ranged in moisture content from damp to wet. The clay fill was about 120 mm (TH01) to 970 mm (TH03) thick (averaged 530 mm) and was typically silty, medium to high plastic, moist, stiff (where not frozen) and grey to brown, and occasionally contained sand or gravel.

Native high plastic clay was present directly below the fill layers at 10 of the 13 locations, and was about 610 to 1800 mm thick, with an average thickness of 1150 mm. At these test holes the clay extended to the depths explored. At the other three locations (TH06, TH08 and TH11), the fill was underlain by low plastic silt which was soft to firm, moist, and occasionally sandy.

The thickness of the silt layer varied from 230 mm (TH06) to 760 mm (TH08), with an average thickness of 130 mm. Where silt was present, high plastic clay extended from below the silty clay layer to the depths explored, and was generally stiff to very stiff and moist.

Table 1, below, summarizes the thickness and types of pavements and soils encountered at each of the test hole locations. Selected test results are presented in Table 2. Detailed soil stratigraphy is illustrated in the attached test hole logs in Appendix A. Photographs of the core samples are attached in Appendix B.

Table 1: Pavement and Soil Thickness (mm)

Test Hole No.	TH01	TH02	TH03	TH04	TH05	TH06	TH07	TH08	TH09	TH10	TH11	TH12	TH13
Asphalt	132	47	48	42	56	58	45	54	42	51	43	60	65
Concrete	200	180	190	160	200	210	200	185	185	190	200	206	185
Fill – Gravel	95	160	15	865	510	495	510	65	380	520	50	N/A	120
Fill – Clay	122	330	966	N/A	N/A	N/A	460	460	610	N/A	315	954	N/A
Clay	1585	1524	915	1065	1065	N/A	914	N/A	610	N/A	1065	915	1800
Silt	N/A	N/A	N/A	N/A	N/A	230	N/A	760	N/A	N/A	305	N/A	N/A
Clay	N/A	N/A	N/A	N/A	N/A	1145	N/A	610	N/A	1220	150	N/A	N/A

Table 2: Lab Test Results

Test Hole No.	Sample Depth (m)	Moisture Content (%)	Atterberg Limits				Hydrometer Analysis			
			Liquid Limit	Plastic Limit	Plasticity Index	MUSCS Classification	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
TH06	0.9	12	35	28	8	ML (Silt)	2	44	41	13
TH07	0.9	33	46	22	24	CI (Clay)	2	22	44	32

6.0 CLOSURE

The findings of this report were based on the results of field and laboratory investigations at test hole locations as selected by the City of Winnipeg.

The site investigation was conducted for the sole purpose of profiling the pavement and subsurface conditions. Although no environmental issues were identified during the fieldwork, this does not indicate that no such issues exist. If the owner or other parties have any concern

regarding the presence of environmental issues, then an appropriate level environmental assessment should be conducted.

Soil conditions, by their nature, can be highly variable across a site. The placement of fill and prior construction activities on a site can contribute to the variability especially near surface soil conditions. A contingency should always be included in any construction budget to allow for the possibility of variation in soil conditions, which may result in modification of any potential design and construction procedures which may arise from this factual investigative report.

This report was prepared exclusively for the City of Winnipeg, and their agents for the proposed development as described in the report. The data provided herein are presented in a factual manner only with no engineering interpretation provided, and should not be used for any other purpose, or by any other parties, without review and advice from a qualified geotechnical engineer. No other warranty, expressed or implied, is given.

Yours truly,

AMEC Earth & Environmental



Robert Brown, P. Eng.
Geotechnical Engineer

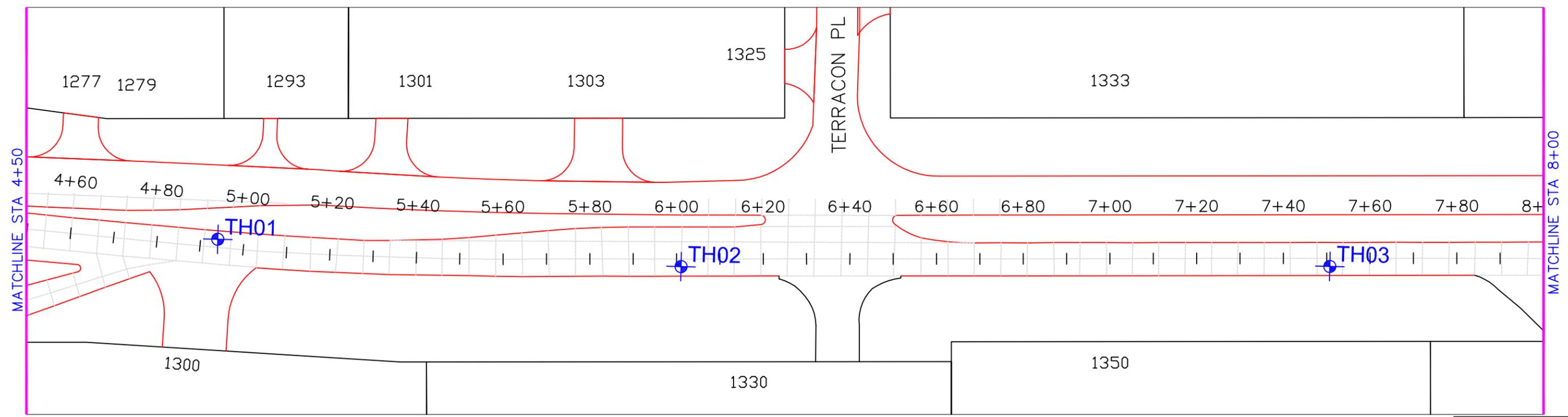
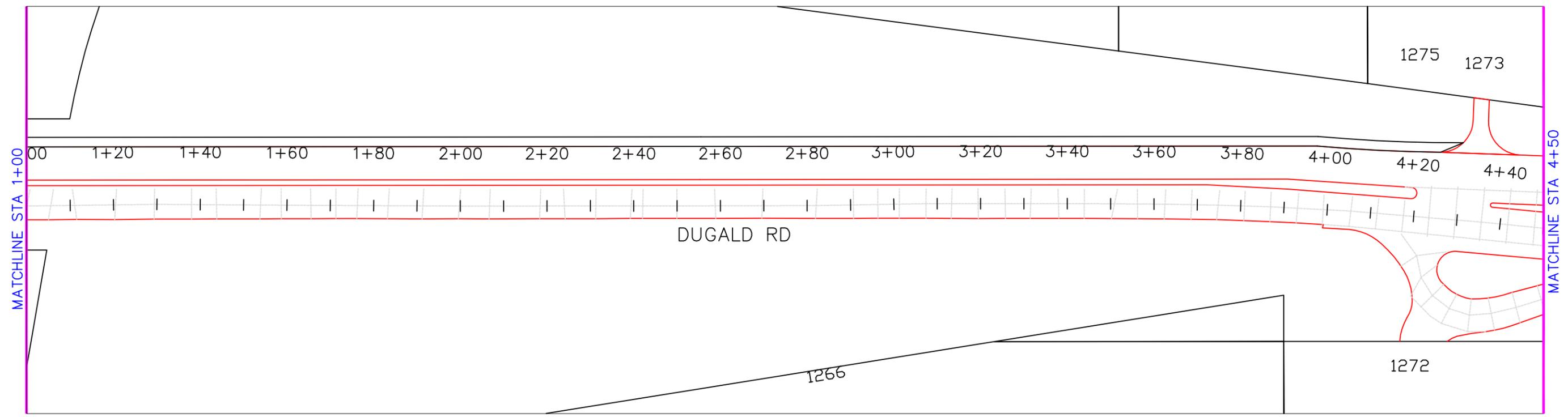
Reviewed By:



Trevor Gluck, P. Eng.
Staff Geotechnical Engineer

APPENDIX A

TEST HOLE LOCATION PLANS AND TEST HOLE LOGS



LEGEND	
	TH03 TEST HOLE LOCATIONS

NOTE: THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC EARTH & ENVIRONMENTAL REPORT No. WX10364.5000 DATED DECEMBER 2008.



CLIENT:
CITY OF WINNIPEG

AMEC Earth & Environmental
440 DOVERCOURT DRIVE
WINNIPEG, MANITOBA

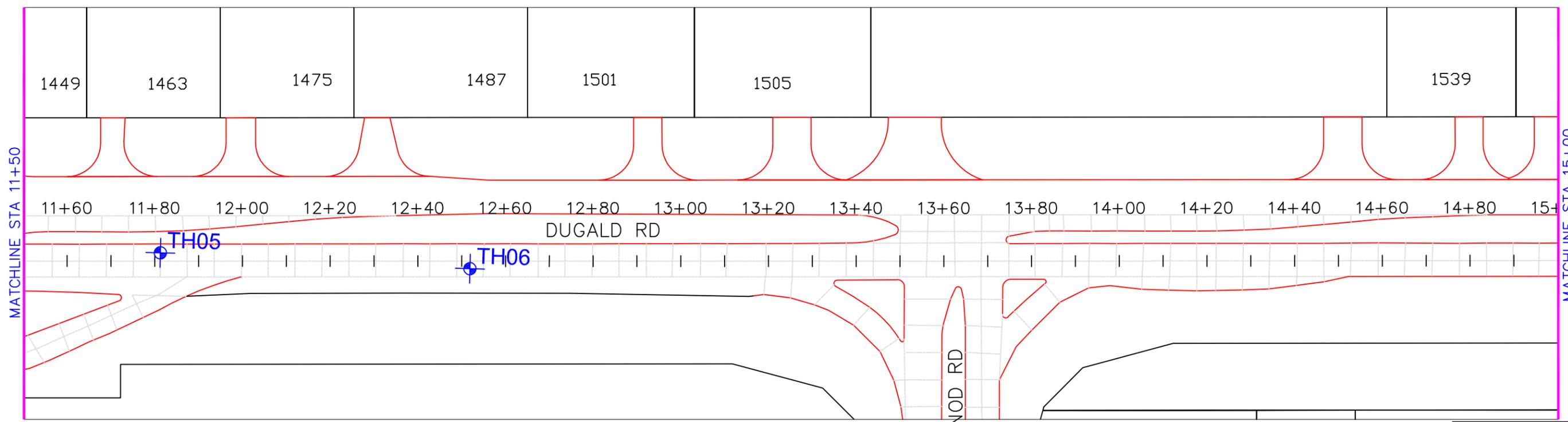
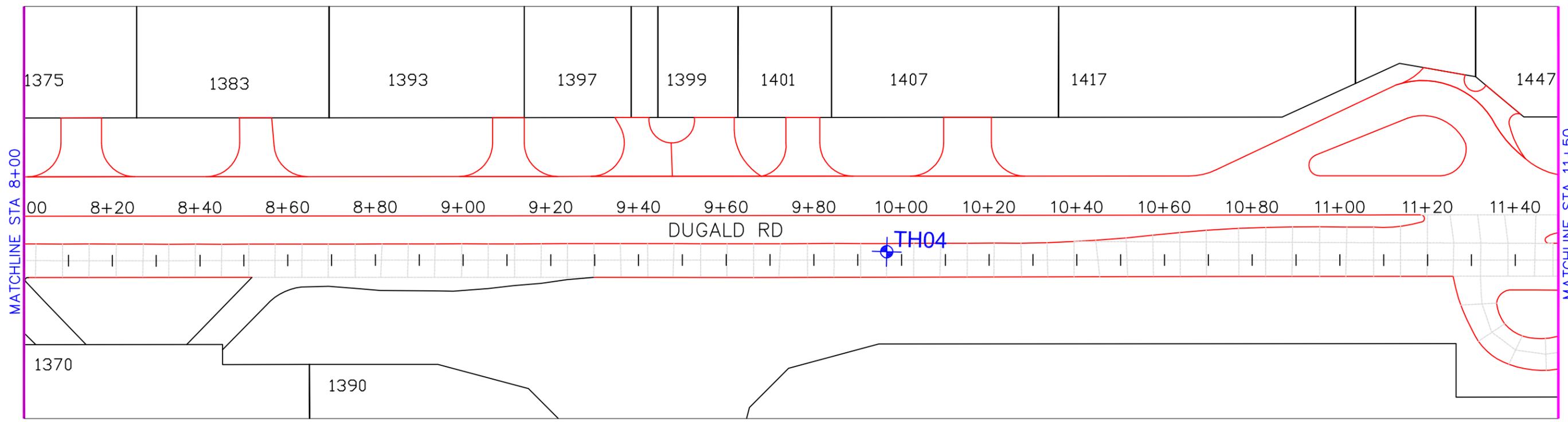


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CHK'D BY: RB
DATUM: N/A
PROJECTION: N/A
SCALE: AS SHOWN

PROJECT
**GEOTECHNICAL INVESTIGATION
DUGALD ROAD RECONSTRUCTION
WINNIPEG, MANITOBA**

TITLE
DUGALD ROAD EAST BOUND
FROM EAST BRIDGE DECK TO 300m WEST OF PLESSIS
FROM STATION 1+00 TO 8+00
TEST HOLE LOCATION PLAN

DATE: DECEMBER 2008
PROJECT NO: WX10364.5000
REV. NO.: A
FIGURE No. FIGURE 1



LEGEND	
	TH06 TEST HOLE LOCATIONS

NOTE: THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC EARTH & ENVIRONMENTAL REPORT No. WX10364.5000 DATED DECEMBER 2008.



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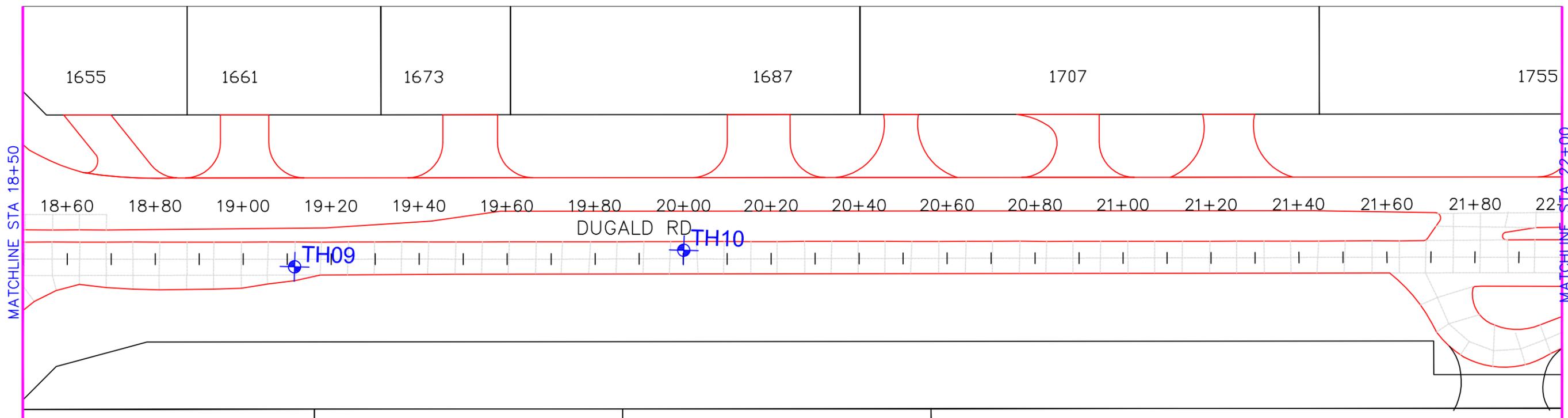
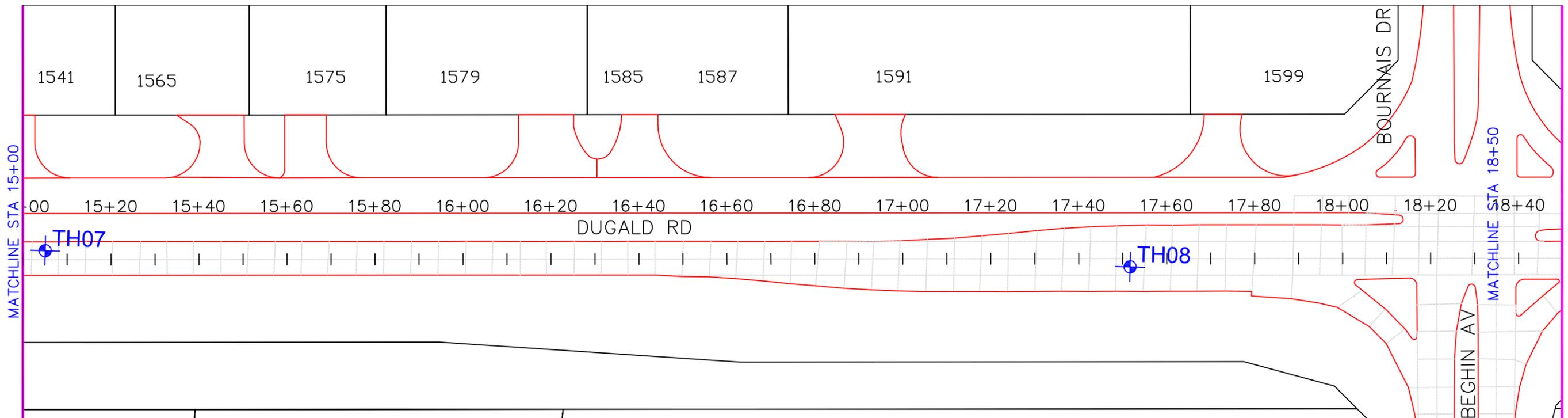


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DATUM: N/A
PROJECTION: N/A
SCALE: AS SHOWN

PROJECT
**GEOTECHNICAL INVESTIGATION
DUGALD ROAD RECONSTRUCTION
WINNIPEG, MANITOBA**

TITLE
DUGALD ROAD EAST BOUND
FROM EAST BRIDGE DECK TO 300m WEST OF PLESSIS
FROM STATION 8+00 TO 15+00
TEST HOLE LOCATION PLAN

DATE: DECEMBER 2008
PROJECT NO: WX10364.5000
REV. NO.: A
FIGURE No. FIGURE 2



LEGEND	
	TH08 TEST HOLE LOCATIONS

NOTE: THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC EARTH & ENVIRONMENTAL REPORT No. WX10364.5000 DATED DECEMBER 2008.



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WINNIPEG, MANITOBA

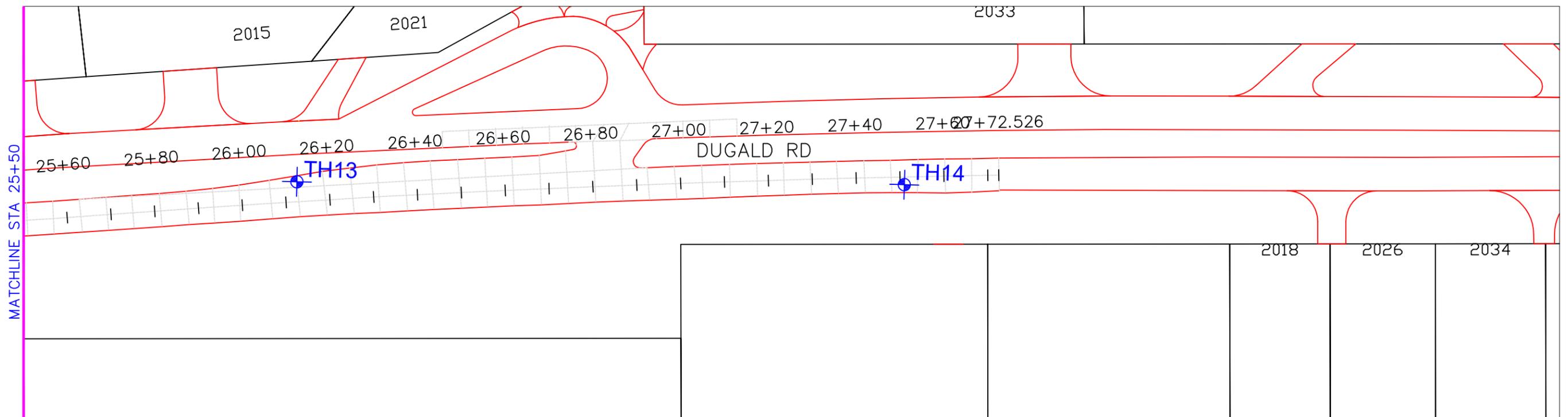
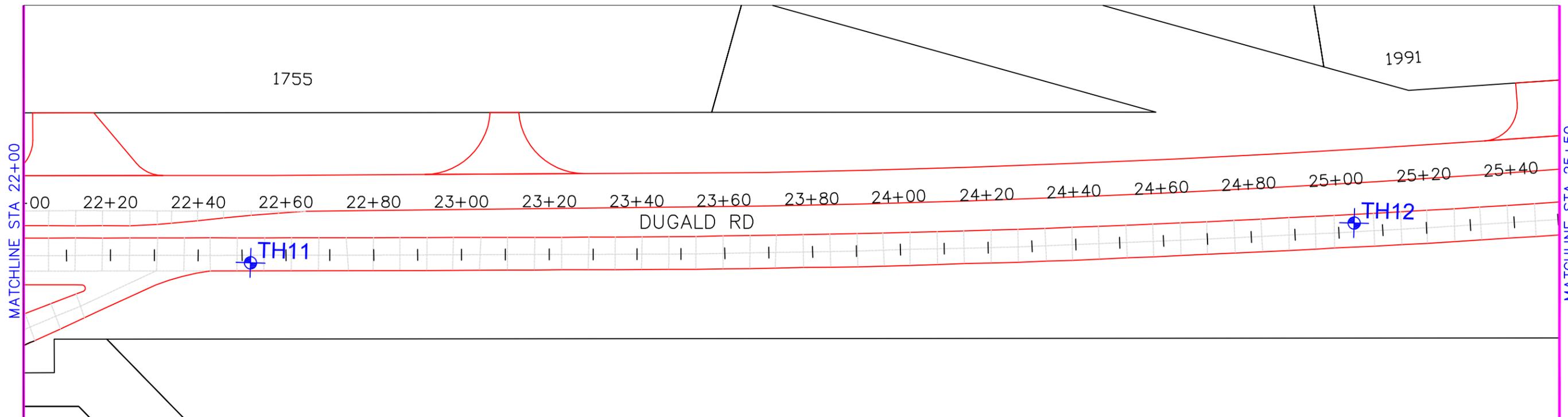


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DATUM: N/A
PROJECTION: N/A
SCALE: AS SHOWN

PROJECT
**GEOTECHNICAL INVESTIGATION
DUGALD ROAD RECONSTRUCTION
WINNIPEG, MANITOBA**

TITLE
DUGALD ROAD EAST BOUND
FROM EAST BRIDGE DECK TO 300m WEST OF PLESSIS
FROM STATION 15+00 TO 22+00
TEST HOLE LOCATION PLAN

DATE: DECEMBER 2008
PROJECT NO: WX10364.5000
REV. NO.: A
FIGURE No. FIGURE 3



LEGEND	
	TH14 TEST HOLE LOCATIONS

NOTE: THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC EARTH & ENVIRONMENTAL REPORT No. WX10364.5000 DATED DECEMBER 2008.

CLIENT LOGO



CLIENT:

CITY OF WINNIPEG

AMEC Earth & Environmental
440 DOVERCOURT DRIVE
WINNIPEG, MANITOBA

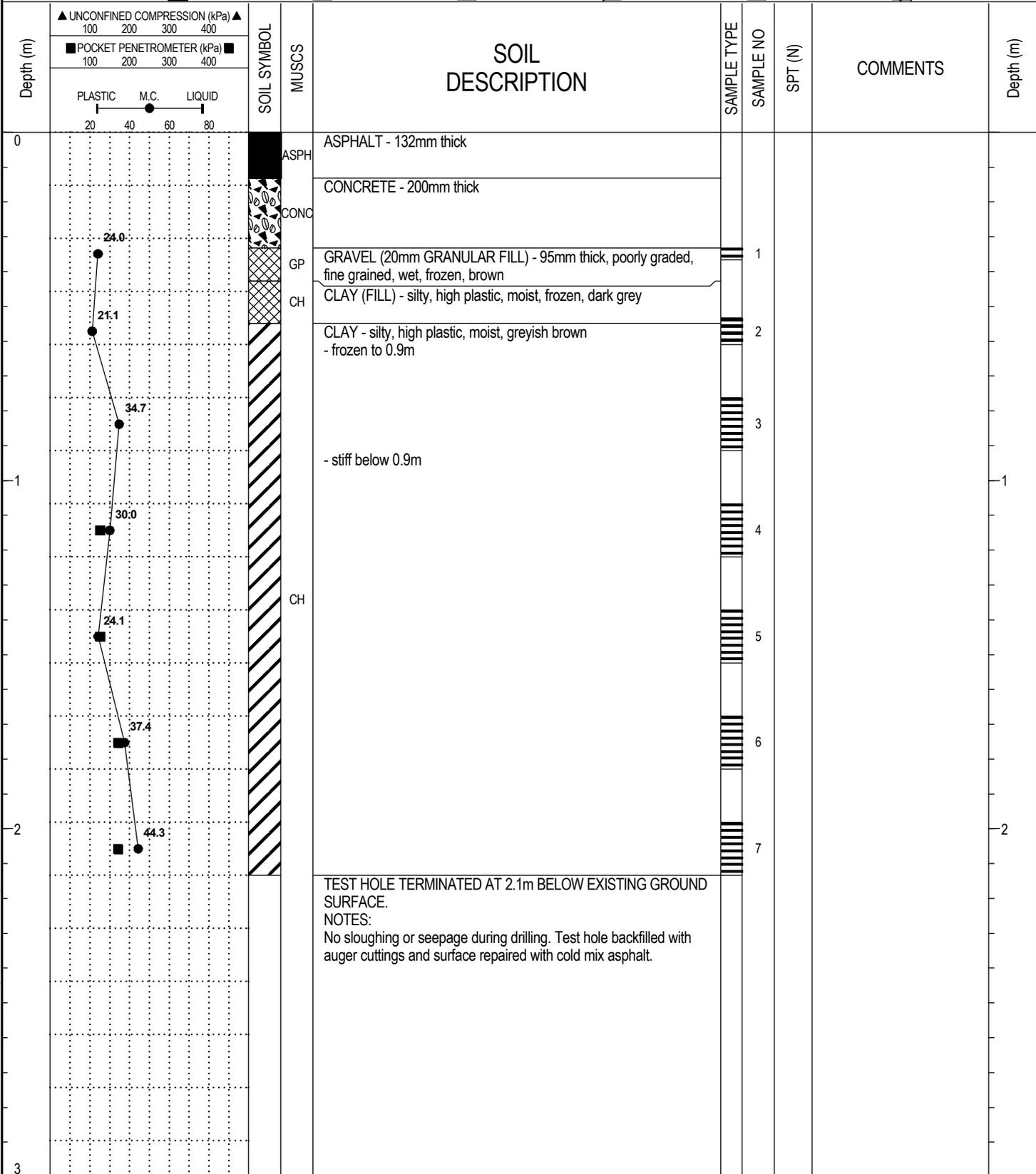


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DATUM:	N/A
PROJECTION:	N/A
SCALE:	AS SHOWN

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TITLE	DUGALD ROAD EAST BOUND FROM EAST BRIDGE DECK TO 300m WEST OF PLESSIS FROM STATION 22+00 TO 27+72.5 TEST HOLE LOCATION PLAN	PROJECT NO: WX10364.5000
		REV. NO.: A
		FIGURE No. FIGURE 4

PROJECT: Dugald Road Investigation	DRILLED BY: Paddock Drilling Ltd.	BORE HOLE NO: TH01
CLIENT: City of Winnipeg	DRILL TYPE: Truck Mounted Acker MP5T	PROJECT NO: WX10364
LOCATION: Winnipeg, Manitoba	DRILL METHOD: 125mm Solid Stem Auger	ELEVATION:

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10364 DUGALD ROAD.GPJ 09/01/12 09:53 AM (GEOTECHNICAL)



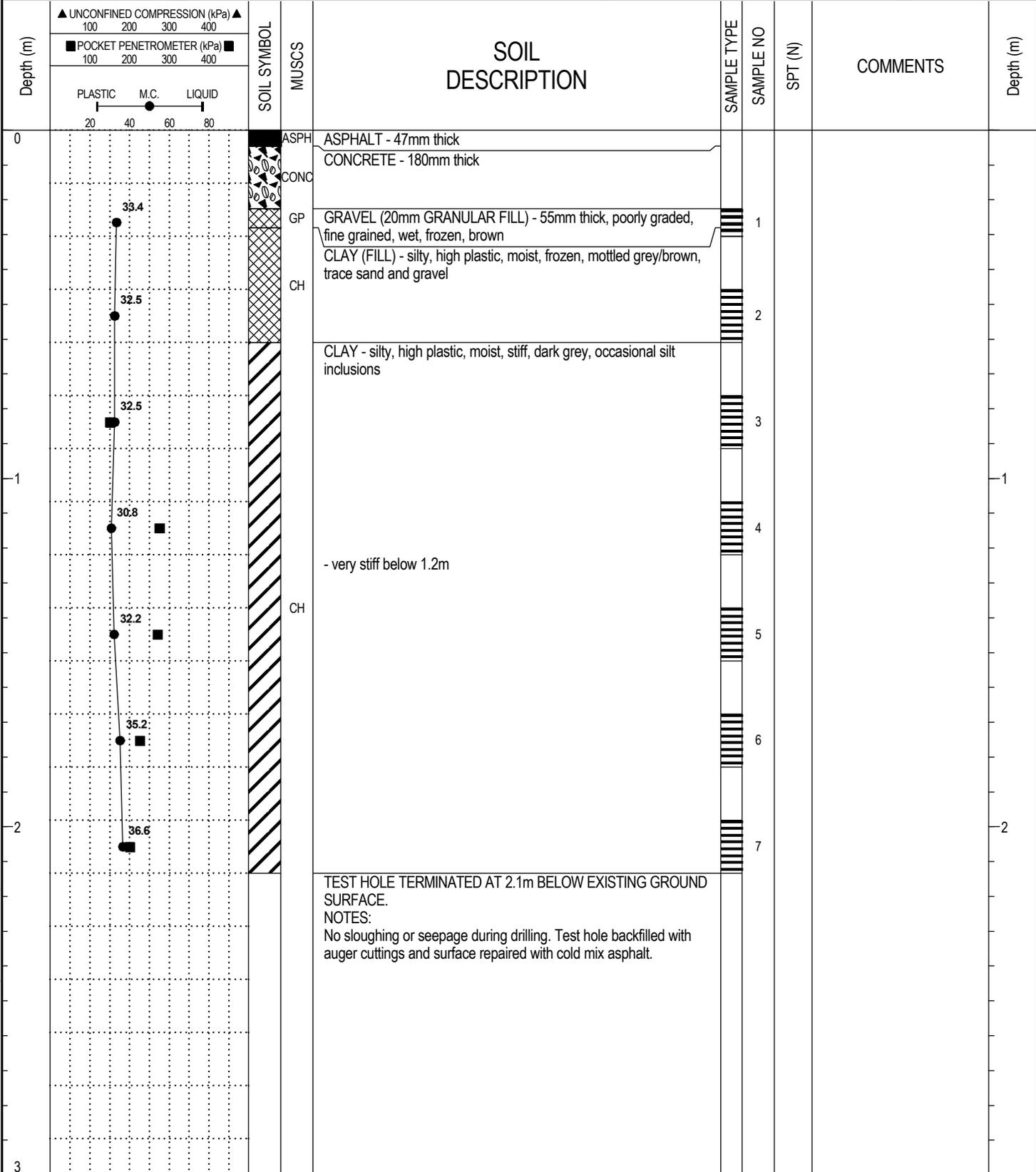
AMEC Earth and Environmental
Winnipeg, Manitoba

LOGGED BY: BP
 REVIEWED BY: RB
 Figure No. 5

COMPLETION DEPTH: 2.1 m
 COMPLETION DATE: December 8, 2008
 Page 1 of 1

PROJECT: Dugald Road Investigation	DRILLED BY: Paddock Drilling Ltd.	BORE HOLE NO: TH02
CLIENT: City of Winnipeg	DRILL TYPE: Truck Mounted Acker MP5T	PROJECT NO: WX10364
LOCATION: Winnipeg, Manitoba	DRILL METHOD: 125mm Solid Stem Auger	ELEVATION:

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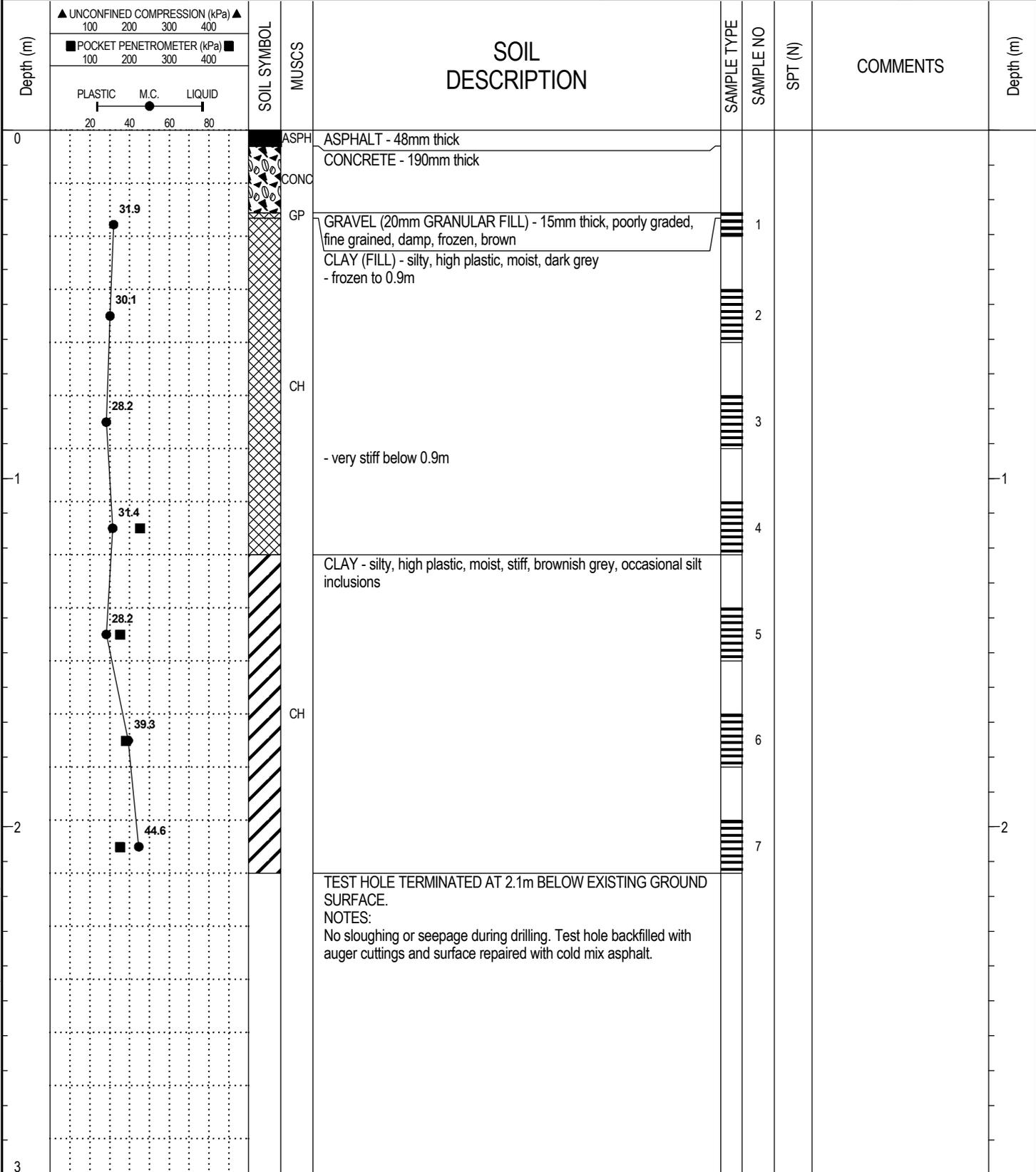
AMEC Earth and Environmental
 Winnipeg, Manitoba

LOGGED BY: BP
 REVIEWED BY: RB
 Figure No. 6

COMPLETION DEPTH: 2.1 m
 COMPLETION DATE: December 8, 2008
 Page 1 of 1

PROJECT: Dugald Road Investigation	DRILLED BY: Paddock Drilling Ltd.	BORE HOLE NO: TH03
CLIENT: City of Winnipeg	DRILL TYPE: Truck Mounted Acker MP5T	PROJECT NO: WX10364
LOCATION: Winnipeg, Manitoba	DRILL METHOD: 125mm Solid Stem Auger	ELEVATION:

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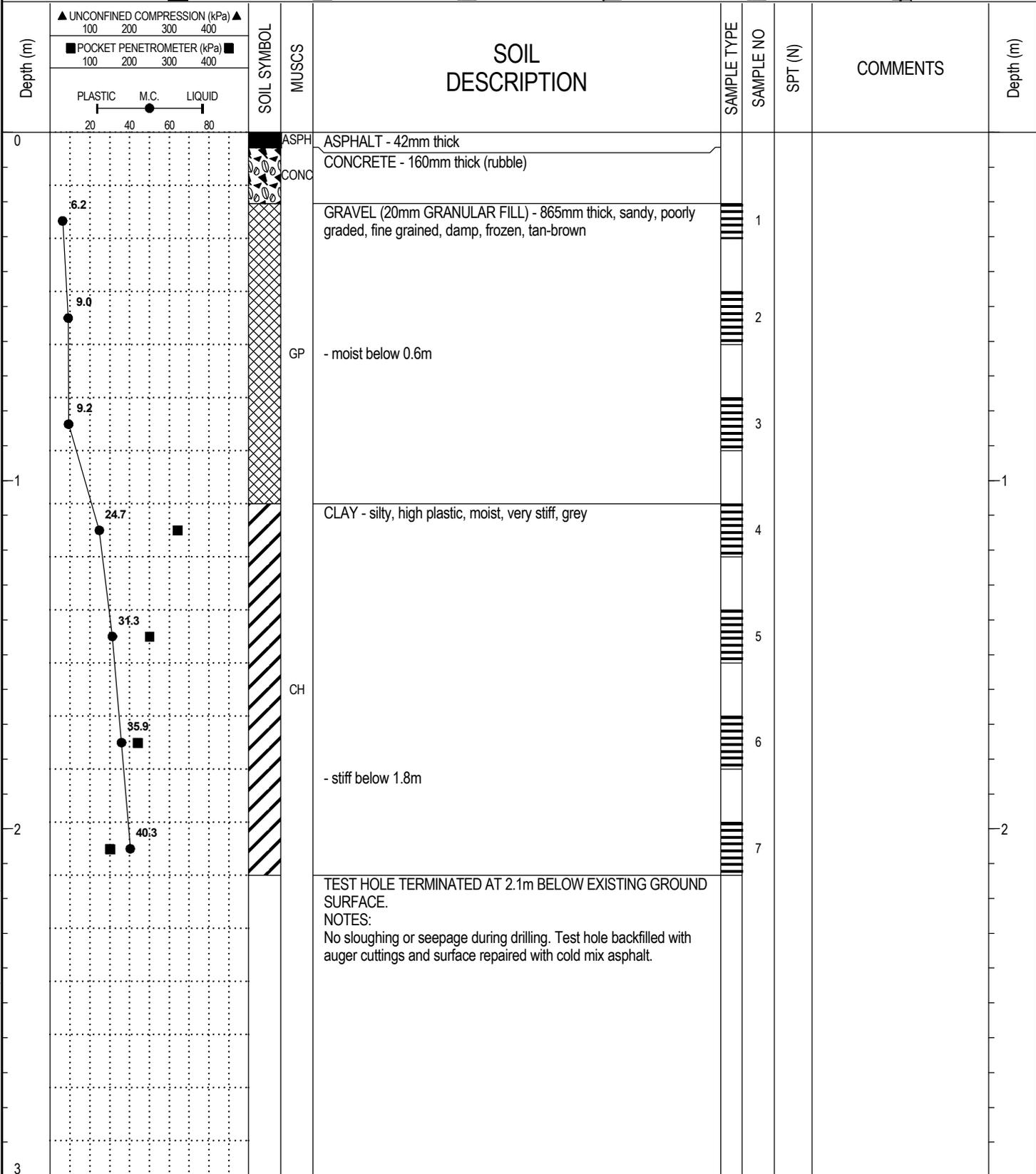
AMEC Earth and Environmental
Winnipeg, Manitoba

LOGGED BY: BP
REVIEWED BY: RB
Figure No. 7

COMPLETION DEPTH: 2.1 m
COMPLETION DATE: December 8, 2008
Page 1 of 1

PROJECT: Dugald Road Investigation	DRILLED BY: Paddock Drilling Ltd.	BORE HOLE NO: TH04
CLIENT: City of Winnipeg	DRILL TYPE: Truck Mounted Acker MP5T	PROJECT NO: WX10364
LOCATION: Winnipeg, Manitoba	DRILL METHOD: 125mm Solid Stem Auger	ELEVATION:

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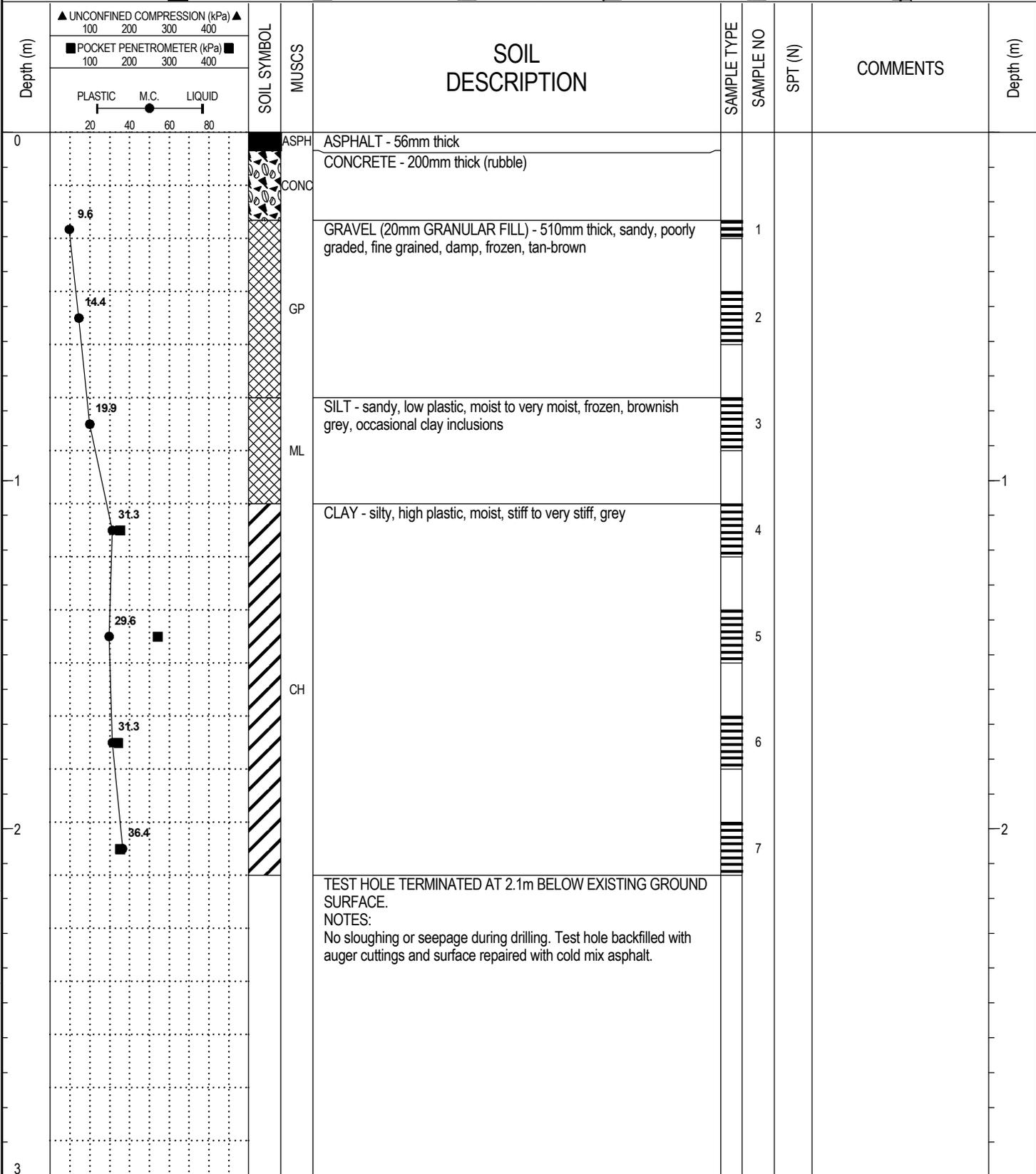
AMEC Earth and Environmental
Winnipeg, Manitoba

LOGGED BY: BP
REVIEWED BY: RB
Figure No. 8

COMPLETION DEPTH: 2.1 m
COMPLETION DATE: December 8, 2008

PROJECT: Dugald Road Investigation	DRILLED BY: Paddock Drilling Ltd.	BORE HOLE NO: TH05
CLIENT: City of Winnipeg	DRILL TYPE: Truck Mounted Acker MP5T	PROJECT NO: WX10364
LOCATION: Winnipeg, Manitoba	DRILL METHOD: 125mm Solid Stem Auger	ELEVATION:

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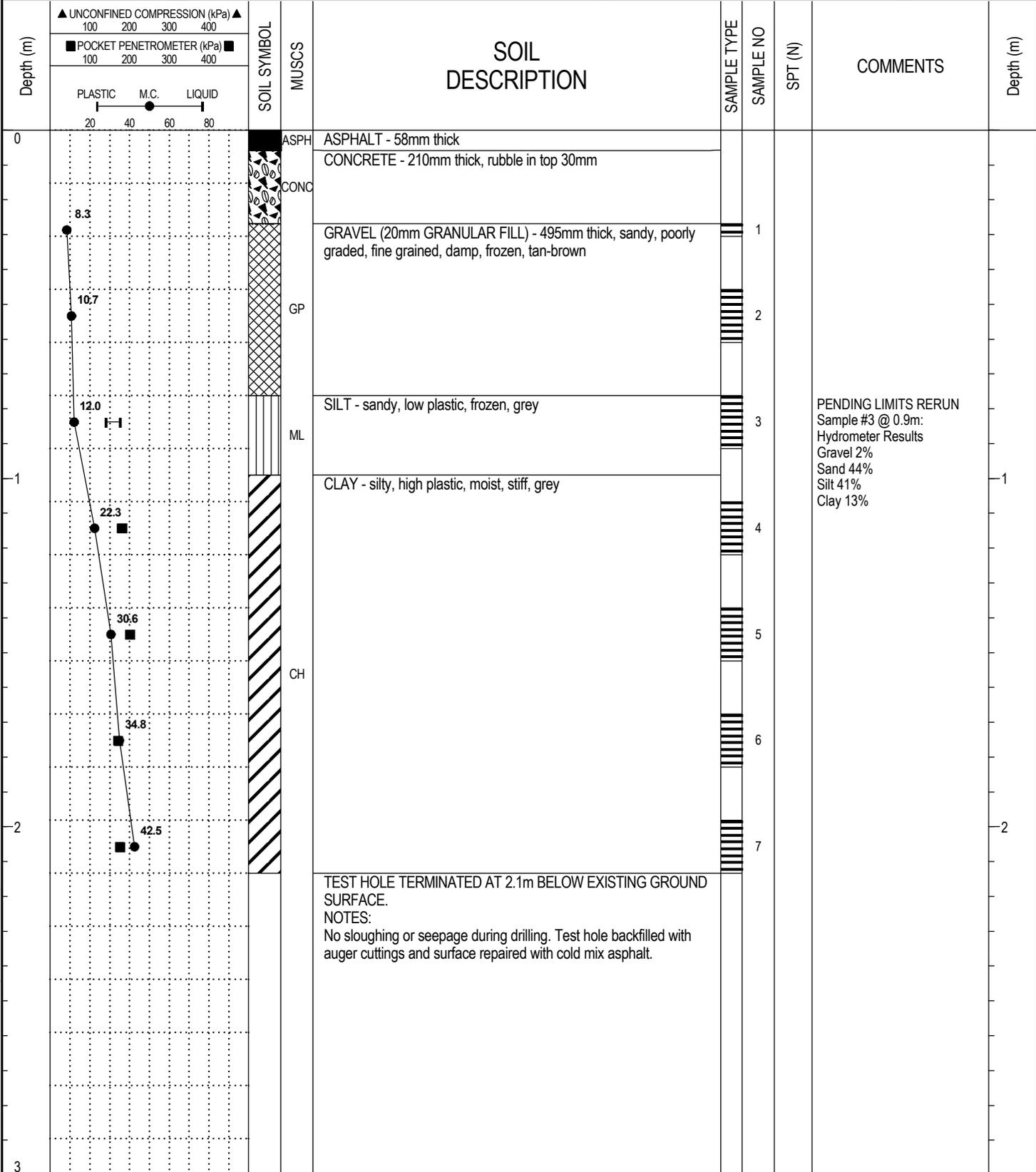
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Winnipeg, Manitoba

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REVIEWED BY: RB
Figure No. 9

COMPLETION DEPTH: 2.1 m
COMPLETION DATE: December 8, 2008

PROJECT: Dugald Road Investigation	DRILLED BY: Paddock Drilling Ltd.	BORE HOLE NO: TH06
CLIENT: City of Winnipeg	DRILL TYPE: Truck Mounted Acker MP5T	PROJECT NO: WX10364
LOCATION: Winnipeg, Manitoba	DRILL METHOD: 125mm Solid Stem Auger	ELEVATION:

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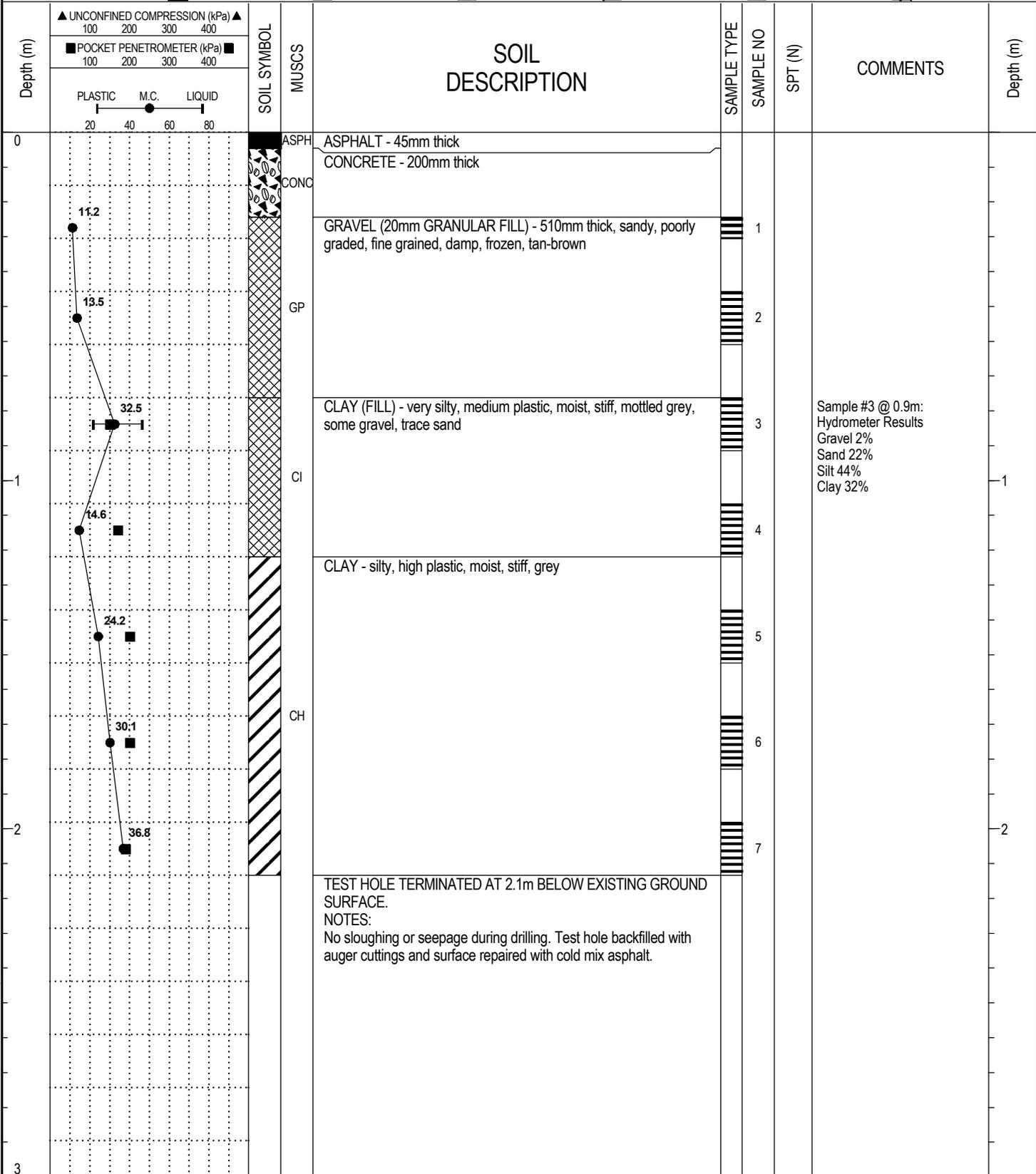
AMEC Earth and Environmental
Winnipeg, Manitoba

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REVIEWED BY: RB
Figure No. 10

COMPLETION DEPTH: 2.1 m
COMPLETION DATE: December 8, 2008

PROJECT: Dugald Road Investigation	DRILLED BY: Paddock Drilling Ltd.	BORE HOLE NO: TH07
CLIENT: City of Winnipeg	DRILL TYPE: Truck Mounted Acker MP5T	PROJECT NO: WX10364
LOCATION: Winnipeg, Manitoba	DRILL METHOD: 125mm Solid Stem Auger	ELEVATION:

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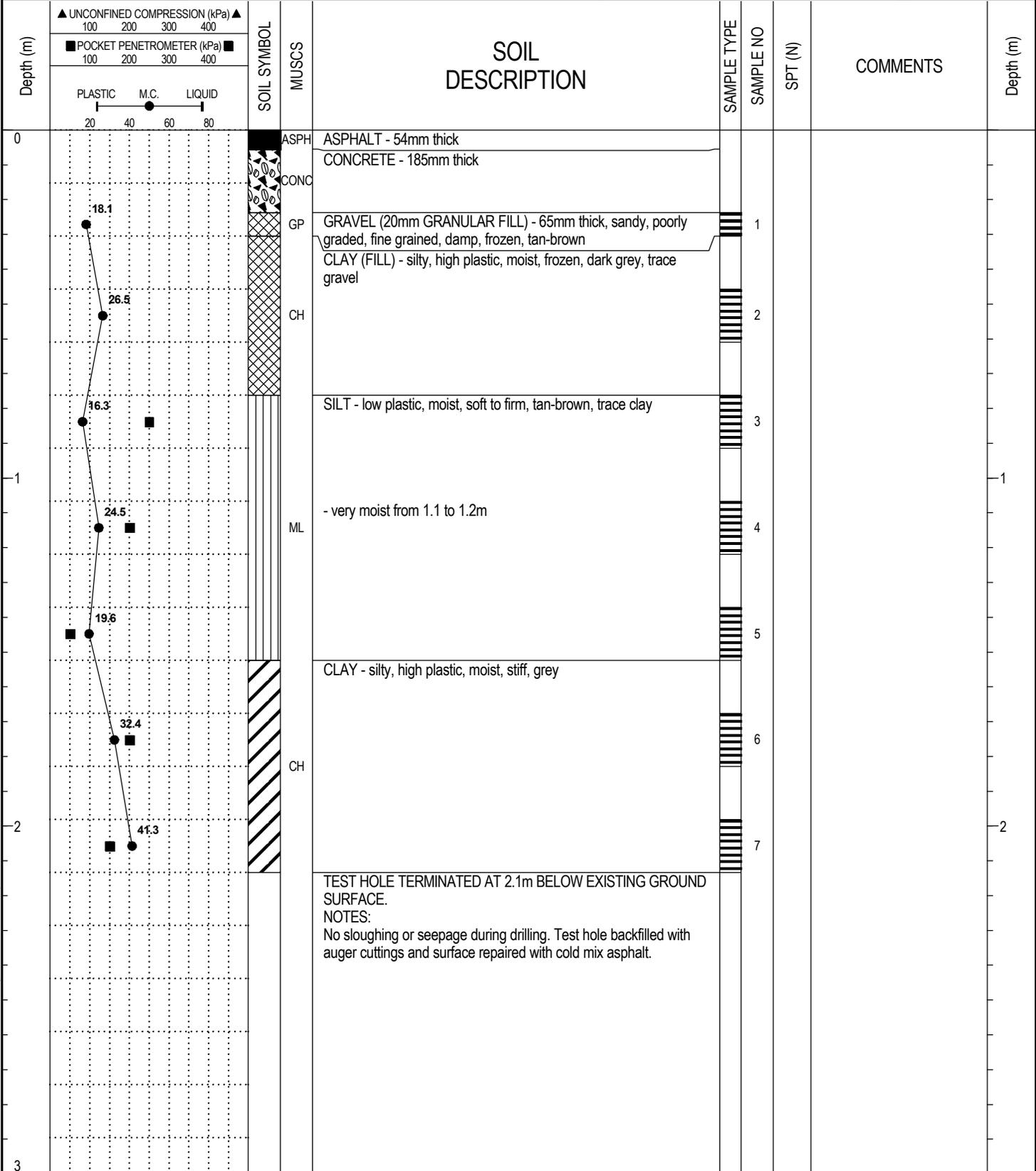
AMEC Earth and Environmental
Winnipeg, Manitoba

LOGGED BY: BP
REVIEWED BY: RB
Figure No. 11

COMPLETION DEPTH: 2.1 m
COMPLETION DATE: December 8, 2008

PROJECT: Dugald Road Investigation	DRILLED BY: Paddock Drilling Ltd.	BORE HOLE NO: TH08
CLIENT: City of Winnipeg	DRILL TYPE: Truck Mounted Acker MP5T	PROJECT NO: WX10364
LOCATION: Winnipeg, Manitoba	DRILL METHOD: 125mm Solid Stem Auger	ELEVATION:

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10364 DUGALD ROAD.GPJ 09/01/12 09:54 AM (GEOTECHNICAL)



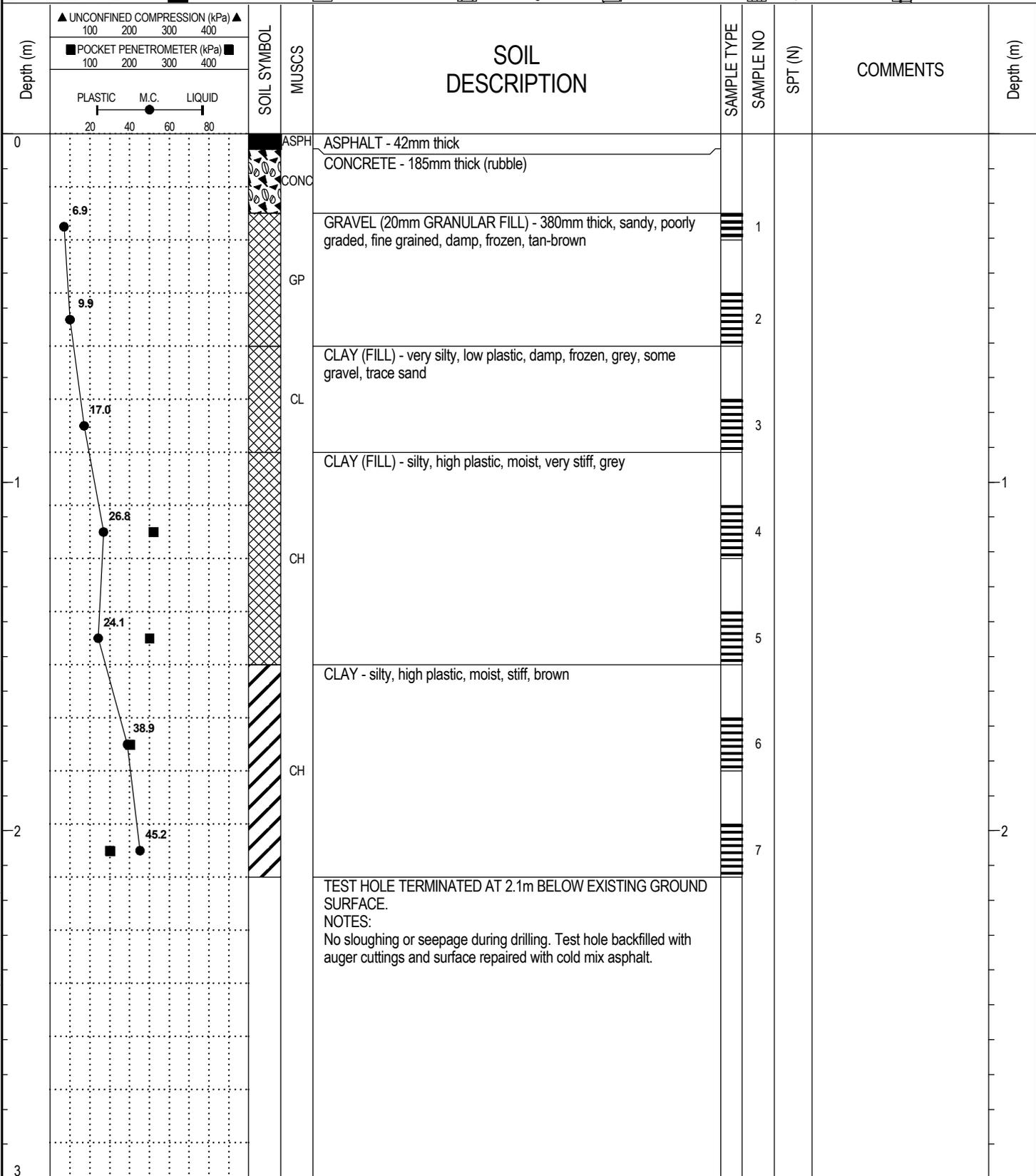
AMEC Earth and Environmental
Winnipeg, Manitoba

LOGGED BY: BP
REVIEWED BY: RB
Figure No. 12

COMPLETION DEPTH: 2.1 m
COMPLETION DATE: December 8, 2008

PROJECT: Dugald Road Investigation	DRILLED BY: Paddock Drilling Ltd.	BORE HOLE NO: TH09
CLIENT: City of Winnipeg	DRILL TYPE: Truck Mounted Acker MP5T	PROJECT NO: WX10364
LOCATION: Winnipeg, Manitoba	DRILL METHOD: 125mm Solid Stem Auger	ELEVATION:

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10364 DUGALD ROAD.GPJ 09/01/12 09:54 AM (GEOTECHNICAL)



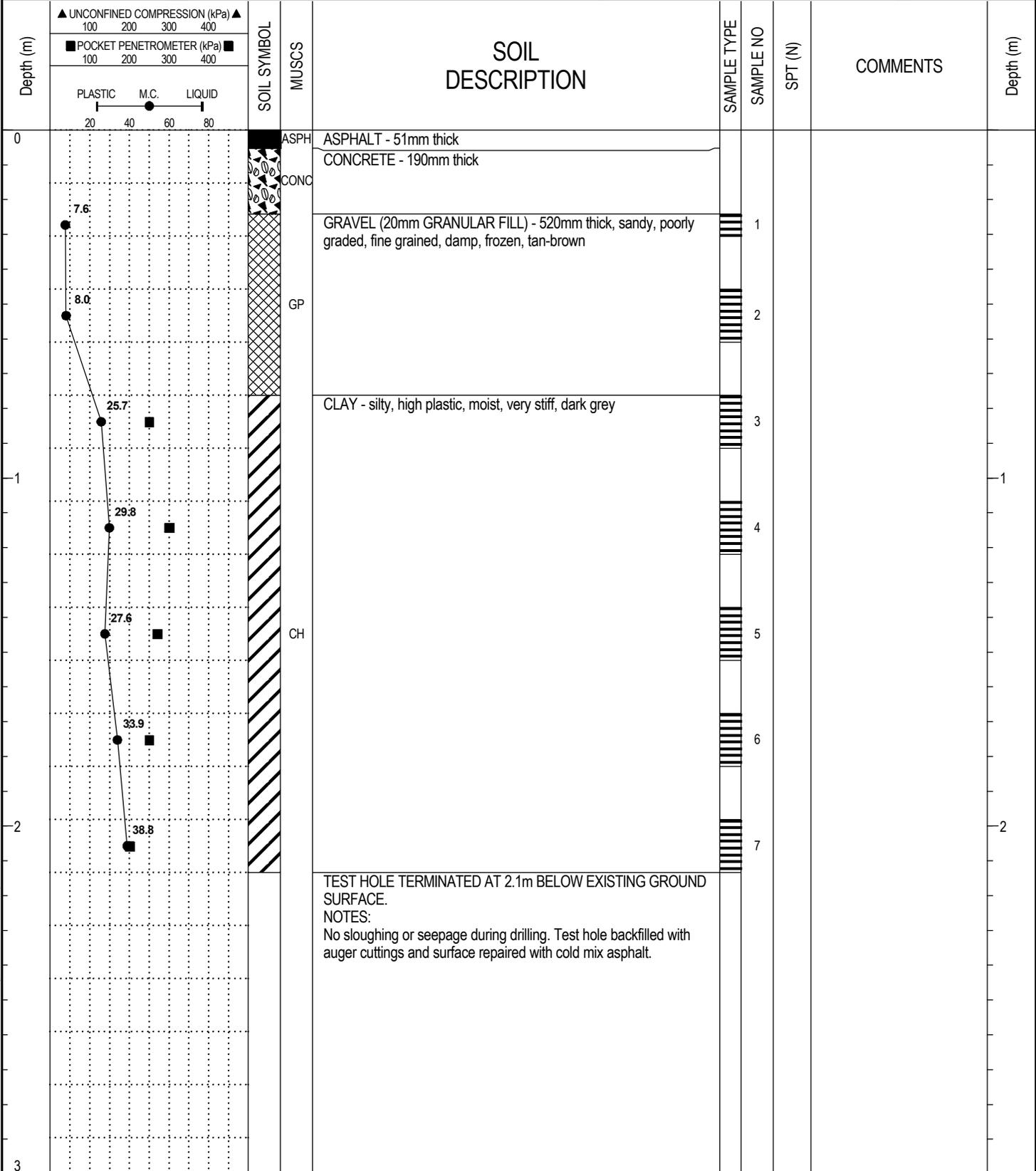
AMEC Earth and Environmental
Winnipeg, Manitoba

LOGGED BY: BP
REVIEWED BY: RB
Figure No. 13

COMPLETION DEPTH: 2.1 m
COMPLETION DATE: December 8, 2008

PROJECT: Dugald Road Investigation	DRILLED BY: Paddock Drilling Ltd.	BORE HOLE NO: TH10
CLIENT: City of Winnipeg	DRILL TYPE: Truck Mounted Acker MP5T	PROJECT NO: WX10364
LOCATION: Winnipeg, Manitoba	DRILL METHOD: 125mm Solid Stem Auger	ELEVATION:

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BACKFILL TYPE	<input checked="" type="checkbox"/> Bentonite	<input type="checkbox"/> Pea Gravel	<input checked="" type="checkbox"/> Drill Cuttings	<input type="checkbox"/> Grout	<input type="checkbox"/> Slough	<input type="checkbox"/> Sand



10364 DUGALD ROAD.GPJ 09/01/12 09:54 AM (GEOTECHNICAL)



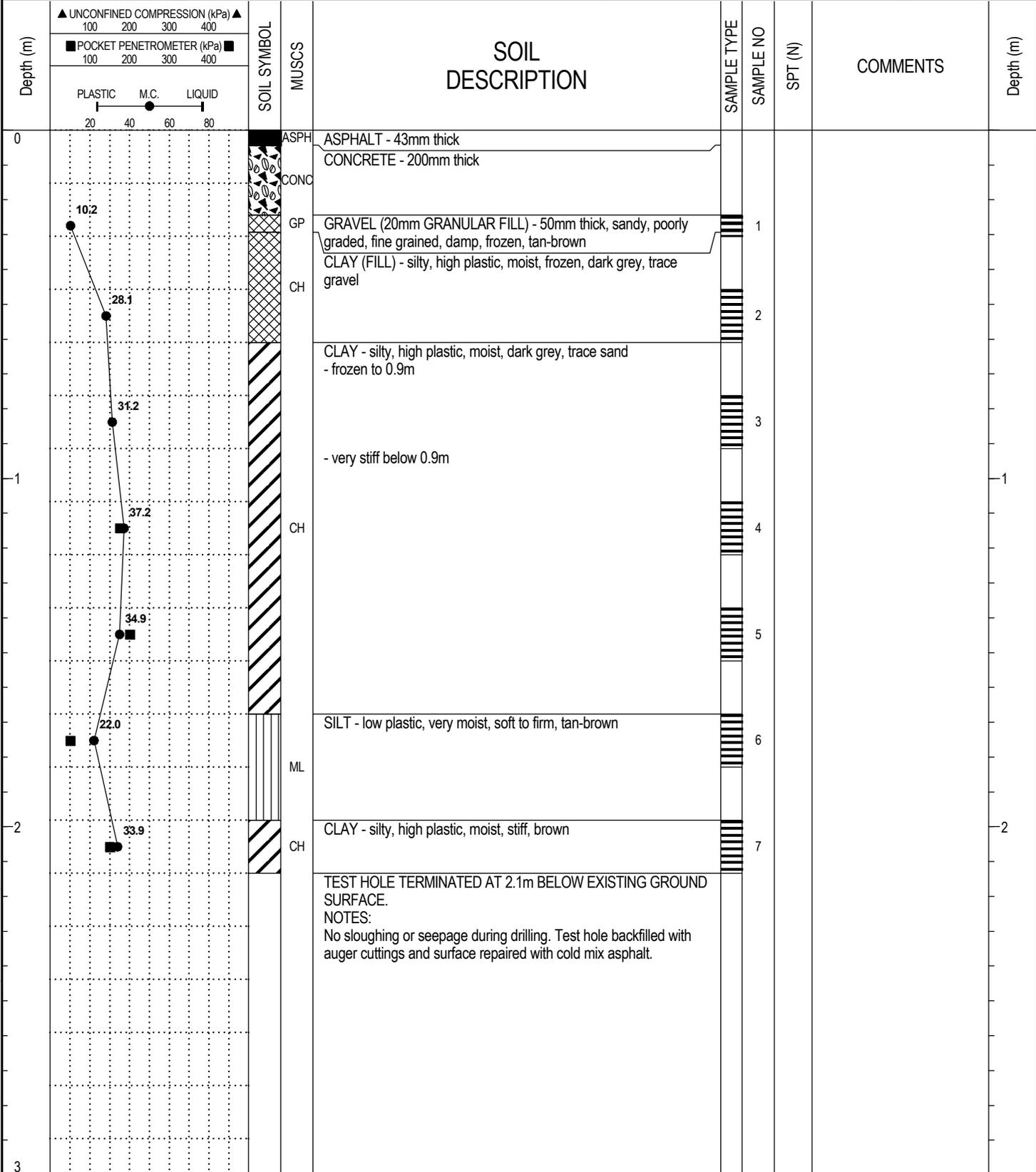
AMEC Earth and Environmental
 Winnipeg, Manitoba

LOGGED BY: BP
 REVIEWED BY: RB
 Figure No. 14

COMPLETION DEPTH: 2.1 m
 COMPLETION DATE: December 8, 2008

PROJECT: Dugald Road Investigation	DRILLED BY: Paddock Drilling Ltd.	BORE HOLE NO: TH11
CLIENT: City of Winnipeg	DRILL TYPE: Truck Mounted Acker MP5T	PROJECT NO: WX10364
LOCATION: Winnipeg, Manitoba	DRILL METHOD: 125mm Solid Stem Auger	ELEVATION:

SAMPLE TYPE	<input checked="" type="checkbox"/> Shelby Tube	<input type="checkbox"/> No Recovery	<input checked="" type="checkbox"/> SPT (N)	<input type="checkbox"/> Grab Sample	<input type="checkbox"/> Split-Pen	<input type="checkbox"/> Core
BACKFILL TYPE	<input checked="" type="checkbox"/> Bentonite	<input type="checkbox"/> Pea Gravel	<input checked="" type="checkbox"/> Drill Cuttings	<input type="checkbox"/> Grout	<input type="checkbox"/> Slough	<input type="checkbox"/> Sand



10364 DUGALD ROAD.GPJ 09/01/12 09:54 AM (GEOTECHNICAL)



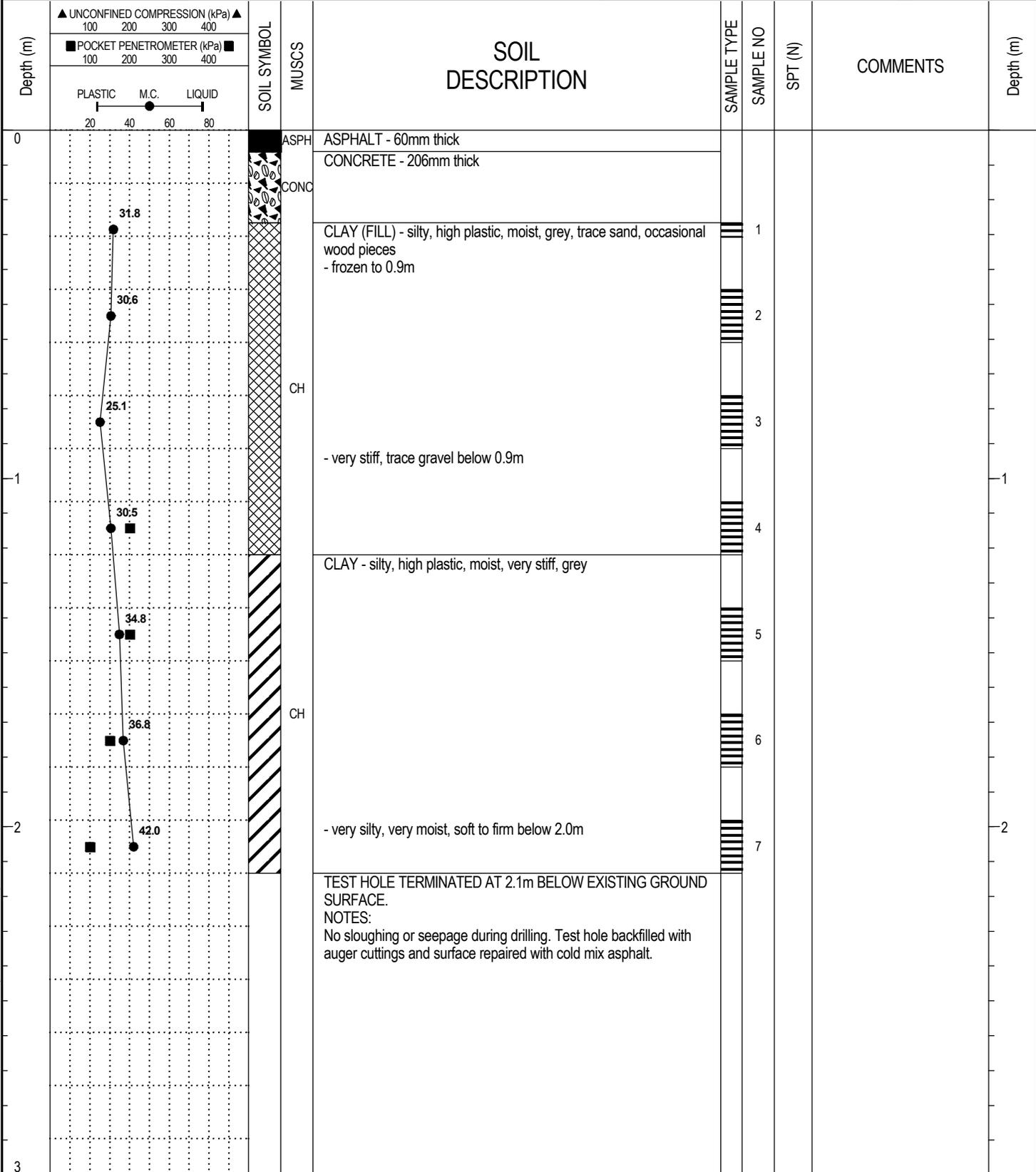
AMEC Earth and Environmental
Winnipeg, Manitoba

LOGGED BY: BP
 REVIEWED BY: RB
 Figure No. 15

COMPLETION DEPTH: 2.1 m
 COMPLETION DATE: December 8, 2008
 Page 1 of 1

PROJECT: Dugald Road Investigation	DRILLED BY: Paddock Drilling Ltd.	BORE HOLE NO: TH12
CLIENT: City of Winnipeg	DRILL TYPE: Truck Mounted Acker MP5T	PROJECT NO: WX10364
LOCATION: Winnipeg, Manitoba	DRILL METHOD: 125mm Solid Stem Auger	ELEVATION:

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BACKFILL TYPE	<input checked="" type="checkbox"/> Bentonite	<input type="checkbox"/> Pea Gravel	<input checked="" type="checkbox"/> Drill Cuttings	<input type="checkbox"/> Grout	<input type="checkbox"/> Slough	<input type="checkbox"/> Sand



10364 DUGALD ROAD.GPJ 09/01/12 09:54 AM (GEOTECHNICAL)



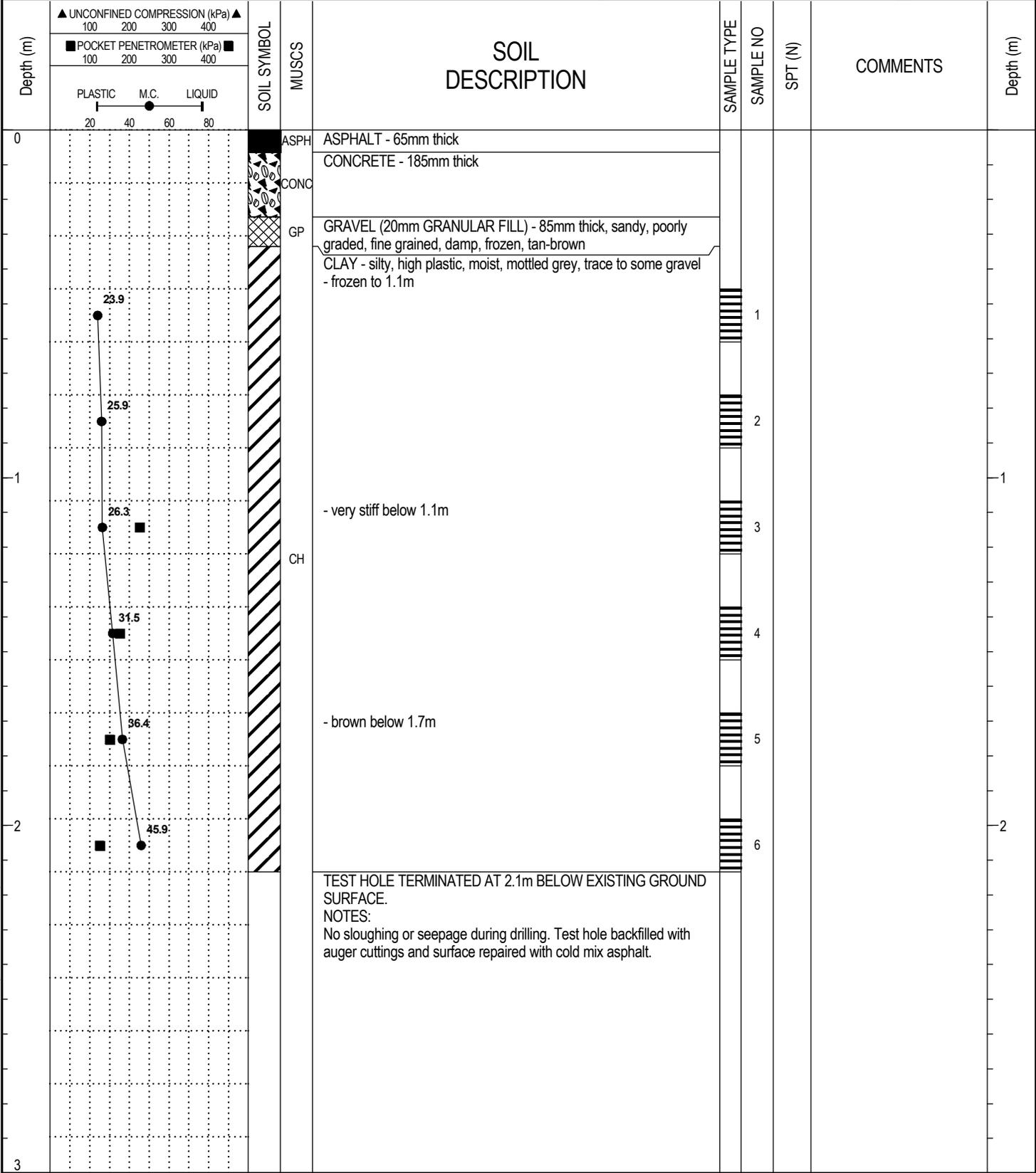
AMEC Earth and Environmental
Winnipeg, Manitoba

LOGGED BY: BP
 REVIEWED BY: RB
 Figure No. 16

COMPLETION DEPTH: 2.1 m
 COMPLETION DATE: December 8, 2008
 Page 1 of 1

PROJECT: Dugald Road Investigation	DRILLED BY: Paddock Drilling Ltd.	BORE HOLE NO: TH13
CLIENT: City of Winnipeg	DRILL TYPE: Truck Mounted Acker MP5T	PROJECT NO: WX10364
LOCATION: Winnipeg, Manitoba	DRILL METHOD: 125mm Solid Stem Auger	ELEVATION:

SAMPLE TYPE	<input checked="" type="checkbox"/> Shelby Tube	<input type="checkbox"/> No Recovery	<input checked="" type="checkbox"/> SPT (N)	<input type="checkbox"/> Grab Sample	<input type="checkbox"/> Split-Pen	<input type="checkbox"/> Core
BACKFILL TYPE	<input checked="" type="checkbox"/> Bentonite	<input type="checkbox"/> Pea Gravel	<input checked="" type="checkbox"/> Drill Cuttings	<input type="checkbox"/> Grout	<input type="checkbox"/> Slough	<input type="checkbox"/> Sand



10364 DUGALD ROAD.GPJ 09/01/12 09:54 AM (GEOTECHNICAL)



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 REVIEWED BY: RB
 Figure No. 17

COMPLETION DEPTH: 2.1 m
 COMPLETION DATE: December 8, 2008
 Page 1 of 1

APPENDIX B

CORE PHOTOS



Photo 1: Testhole 1: Eastbound Median Lane at 1300 Dugald



Photo 2: Testhole 2: Eastbound Median Lane at 1325 Dugald

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Drawn: N/A

Scale: N/A

December 2008

Project No.: WX10364

Figure: B1



Photo 3: Testhole 3: Eastbound Curb Lane at 1357 Dugald

Photo 4: Testhole 4: Eastbound Median Lane at 1407 Dugald



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Drawn: N/A

Scale: N/A

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Figure: B2



Photo 5: Testhole 5: Eastbound Median Lane, 1447/1467 Dugald



Photo 6: Testhole 6: Eastbound Curb Lane at 1487 Dugald

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Drawn: N/A	Scale: N/A	December 2008	Project No.: WX10364	Figure: B3
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Photo 7: Testhole 7: Eastbound Median Lane at 1541 Dugald

Photo 8: Testhole 8: Eastbound Curb Lane at 1599 Dugald



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Drawn: N/A

Scale: N/A

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Project No.: WX10364

Figure: B4



Photo 9: Testhole 9: Eastbound Curb Lane at 1665 Dugald



Photo 10: Testhole 10: Eastbound Median Lane at 1687 Dugald



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Drawn: N/A

Scale: N/A

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Figure: B5



Photo 11: Testhole 11: Eastbound Curb Lane at 1755/1783 Dugald

Photo 12: Testhole 12: Eastbound Median Lane at 1991 Dugald



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Drawn: N/A

Scale: N/A

December 2008

Project No.: WX10364

Figure: B6



Photo 13: Testhole 13: Eastbound Median Lane at 2015 Dugald

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Drawn: N/A	Scale: N/A	December 2008	Project No.: WX10364	Figure: B7
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