

DATE November 14, 2014

PROJECT No. 11-1121-0001-033

TO Troy van Haastrecht / Frank Cairo
South Kanata Development Corporation / Caivan

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**REVISED PERMISSIBLE GRADE RAISE – EAGLESON BLOCK
PROPOSED RESIDENTIAL DEVELOPMENT
MONAHAN LANDING DEVELOPMENT
OTTAWA, ONTARIO**

This memo provides updated guidelines on the permissible grade raise applicable to the extreme west part of the Monahan Landing development site, located adjacent to Eagleson Road (hereafter called the “Eagleson Block”) in Ottawa, Ontario.

The results of the geotechnical investigation for the overall Hope Lands / Monahan Landing development were provided in a report titled “Geotechnical Investigation, Proposed Residential Development, Hope Side Road, Ottawa, Ontario” dated May 2012 (report number 11-1121-0001, revision 2).

Additional geotechnical guidelines specific to the Eagleson Block were subsequently provided in a memo dated September 19, 2012 (reference number 11-1121-0001-18).

Background

The Eagleson Block is underlain by a thick deposit of sensitive and compressible silty clay. A fill layer of variable thickness, but typically about 1.5 to 2.0 metres thick, is present across the west part of the Eagleson Block. The original/native ground surface for this site (beneath the fill) is interpreted to be at about elevation 95 metres.

Due to the limited capacity of the clay deposit at depth to support additional load, the grade raises on this site will need to be restricted, to avoid excessive settlements of foundations and utilities. The feasibility of preloading the site has also been evaluated, to maximize the permissible grade raises.

The following permissible grade raise values were previously recommended to avoid overstressing the clay, which are summarized in Golder Associates’ memo of September 19, 2012 (reference number 11-1121-0001-18).

Permissible Finished Grades	Without Preloading (metres)	With Preloading (metres)
Slab-on-grade Finished Floor Slab	96.4	96.8
Slab-on-grade / Basement Unit Exterior Grade	96.2	96.5
Roadway Centreline	96.3	96.4



However, based on preliminary information provided by DSEL, it is understood that parts of Eagleson Block could have grade raises that exceed the above restrictions.

Test Filling Program

To potentially limit/avoid the use of light weight fill (LWF) for the house construction, a test fill program was subsequently initiated to confirm the permissible grade raises. Five test fill pads were established within this site, four of which are located within the northwest portion of the site (where there is existing fill and proposed grade raises will be highest) and one located within the southeast portion of the site (where there is no/less existing fill). See attached Site Plan, Figure 1.

Guidelines on the test fill design were provided in Golder Associates' draft memo of March 28, 2013 (reference number 11-1121-0001-023). The test fill pads were constructed in June 2013 and monitoring has been on-going since June 2013.

The grade raises included in the test fill program were 3.1, 2.6, 2.1, 1.8 and 1.6 metres (i.e., equivalent to imposed stress increases of 56, 47, 38, 33 and 29 kilopascals, respectively).

The results of the monitoring are provided on the attached Figures 2A and 2B and are summarized below:

- For the northwest portion of the site (where there is existing fill and proposed grade raises will be highest):
 - The test fills for grade raises of 2.6, 2.1 and 1.8 metres were quite stable (in terms of the elevations of the monitoring plates) for about 8 months (between June 2013 and February 2014).
 - The overall settlements of the test fills for grade raises of 2.1 and 1.8 metres were less than 5 millimetres over the period of monitoring, and between about 5 and 10 millimetres for the 2.6 metre test fill.
 - The test fill for a grade raise of 3.1 metres had settled by about 50 millimetres over the same period of monitoring (between June 2013 and February 2014) and the settlements showed little signs of slowing down. The height of this test fill was subsequently reduced to an equivalent of grade raise of 2.6 metres in March 2014 and monitoring of this test fill continues since to confirm that the settlement has in fact ceased.
- For the southeast portion of the site (where there is no/less existing fill):
 - The test fill for a grade raise of 1.6 metres was quite stable (in terms of the elevations of the monitoring plates) for about 8 months (between June 2013 and February 2014).
 - The overall settlements of the test fill for a grade raise of 1.6 metres were between about 5 and 10 millimetres over that initial period of monitoring.
 - The test fill was then raised to an equivalent grade raise of 2.1 metres in March 2014 and monitored for an additional 3 months (between March and June 2014). The raised test fill settled for about an additional 10 millimetres during that period of monitoring.
 - In July 2014, half of the raised test fill was subsequently reduced to 1.8 metres (equivalent grade raise) while and the other half of the test fill remained at 2.1 metres. Both test fills were monitored for an additional 3 months (between July and October 2014). The test fill for a grade raise of 1.8 meters subsequently settled by about 15 millimetres (for a cumulative settlement of about 30 millimetres). The test fill for a 2.1 metre grade raise has settled by an additional 30 to 35 millimetres and does not show signs of slowing down.
 - The full test fill pad was therefore modified to a 1.8 metre grade raise in Oct 2014 and monitoring of this test fill continues.

Based on the above, the following maximum permissible grade raise values are considered acceptable for this site (without preloading), as shown in the Figure 1.

- 2.4 metre for the west part of the site, which has previously been filled.
- 1.6 metre for the east part of the site, which has not been filled and is lower-lying.

These permissible grade raise values are relative to the original/native ground surface level (interpreted to be approximately 95 metres) but should be evaluated on a location-by-location basis from the individual borehole and test pit records.

The following additional items should be noted:

- The grade raise heights used to design the test fills were based on the governing case of either the interior backfill beneath a slab-on-grade unit or the exterior backfill of a conventional basement unit. Therefore, the above permissible grade raise values can be used for either case (based on the finished floor slab of a slab-on-grade unit or the garage threshold grade of a conventional unit).
- The above permissible grade raise values are based on the use of 50 millimetre clear stone “surge” beneath slabs/footings (with a unit weight not exceeding 15.5 kilonewtons per cubic metre) and based on the use of conventional exterior soil backfill with a unit weight not exceeding 17.5 kilonewtons per cubic metre. Silty clay (such as present on this site) would be suitable for exterior fill. Silty sand, sand and gravel, glacial till, and crushed stone typically have higher unit weights and, if these materials are to be used, the maximum permissible grade raises might be reduced and would need to be re-evaluated.
- For any units with grade raises that exceed the above permissible values, the backfill and settlement mitigation requirements would need to be reviewed on a lot-by-lot or block-by-block basis. Mitigation measures could be implemented in these cases such as backfilling the garage/porch or beneath floor slab with LWF.

Closure

We trust that this memo provides sufficient information for your present requirements. If you have any questions concerning this memo, please contact the undersigned.

Yours truly,

GOLDER ASSOCIATES LTD.



Christine Ko, P.Eng.
Geotechnical Engineer



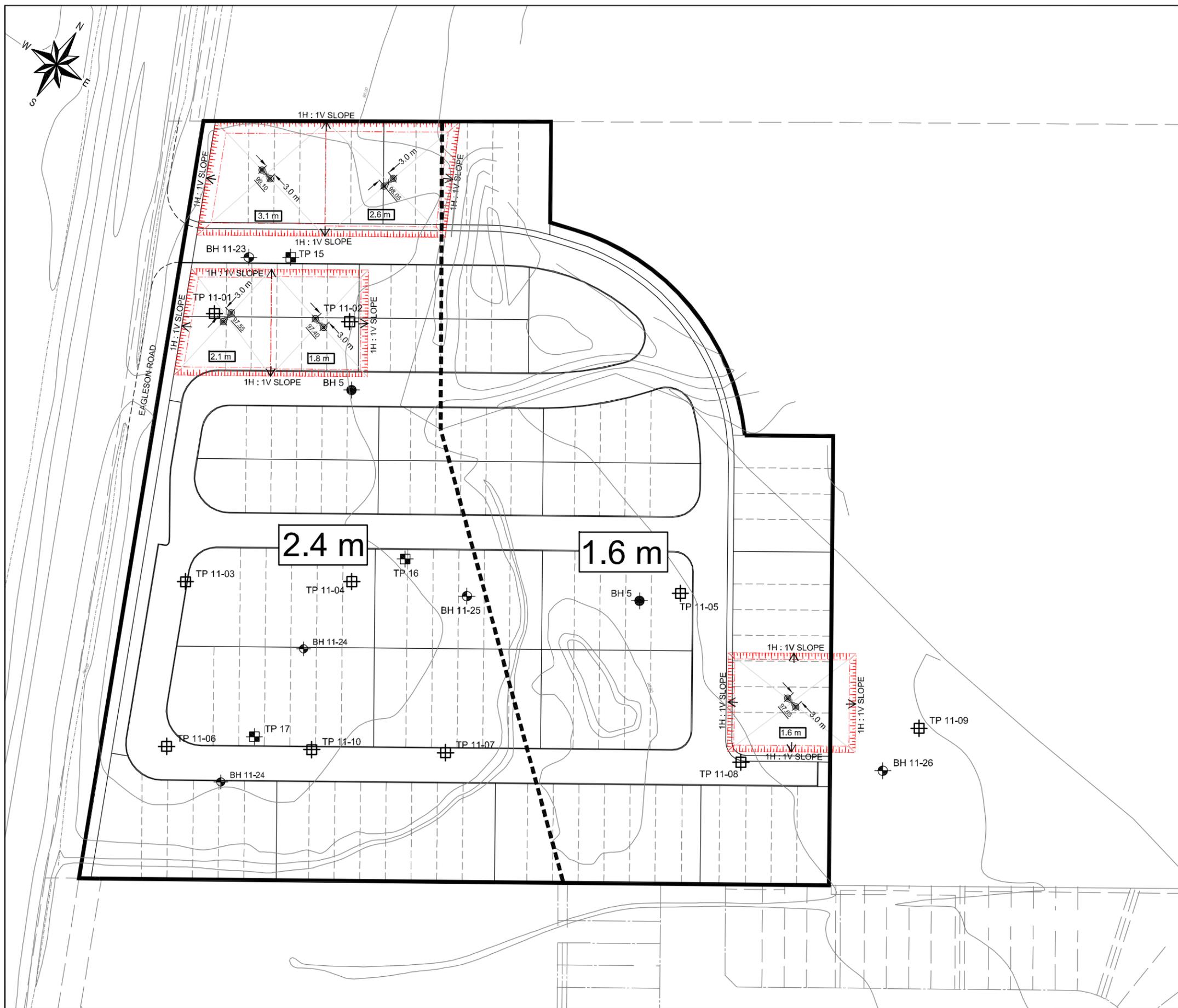
Mike Cunningham, P.Eng.
Principal, Geotechnical Engineer

CK/MIC/bg

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Attachments: Figure 1 – Test Fill Details for Eagleson Block
Figure 2A – Eagleson Test Fill Settlement Monitoring – Northwest Test Fills
Figure 2B – Eagleson Test Fill Settlement Monitoring – Southeast Test Fills

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LEGEND

- APPROXIMATE BOREHOLE LOCATION IN PLAN, CURRENT INVESTIGATION
- APPROXIMATE TEST PIT LOCATION IN PLAN, CURRENT INVESTIGATION
- APPROXIMATE BOREHOLE LOCATION IN PLAN, PREVIOUS INVESTIGATION BY PATERSON GROUP
- APPROXIMATE TEST PIT LOCATION IN PLAN, PREVIOUS INVESTIGATION BY PATERSON GROUP
- APPROXIMATE BOUNDARY BETWEEN ASSESSMENT AREAS
- LOT FOOTPRINT
- TEST FILL PILE LIMIT
- PROPOSED LOCATION FOR SETTLEMENT PLATE
- EXISTING GRADE (IN METRES)
- DESIGN FINAL GRADE (IN METRES)
- GRADE RAISE FOR TEST FILL



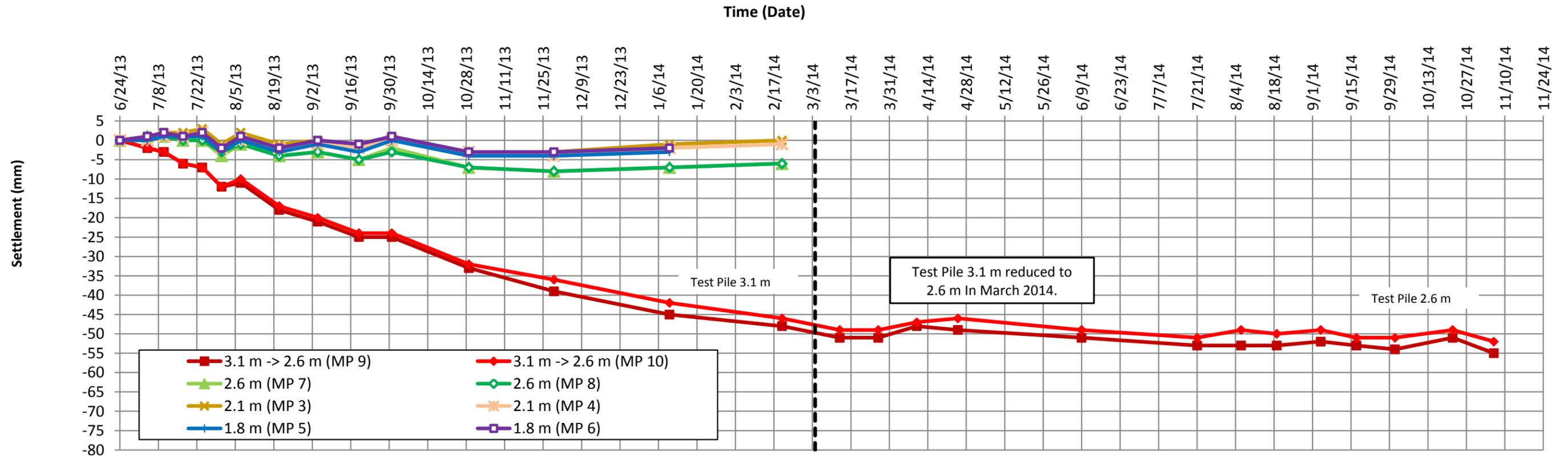
REFERENCE

BASE PLAN PROVIDED IN ELECTRONIC FORMAT BY DAVID SCHAEFFER ENGINEERING LTD.

NOTE

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. TECHNICAL MEMO No. 11-1121-0001-033
2. FINAL ELEVATION OF TEST FILL PILE DETERMINED BASED ON UNIT WEIGHT OF MATERIAL USED AND ORIGINAL GROUND IN SETTLEMENT PLATE HOLE

PROJECT			
MONAHAN LANDING DEVELOPMENT			
TITLE			
TEST FILL DETAILS FOR EAGLESON BLOCK			
	PROJECT No.	11-1121-0001	FILE No. 1111210001-8102-01.dwg
	DESIGN		SCALE AS SHOWN
	CADD	JM Nov. 14, 2014	FIGURE
	CHECK	CK Nov. 14, 2014	1
	REVIEW	MIC Nov. 14, 2014	



Notes:

1. MPs 5 and 6 not accessible on Feb 20, 2013 since the settlement rod (within protective casing) was covered with snow.
2. Monitoring of MPs 3 to 8 ceased on Feb 20, 2013.

MONAHAN LANDING DEVELOPMENT			
EAGLESON TEST FILL SETTLEMENT MONITORING			
NORTHWEST TEST FILLS			
	PROJECT No.	11-1121-0001	PHASE No. 8100
	DESIGN	CK	11/14/2014 SCALE NTS REV.
	CADD		
	CHECK	MIC	11/14/2014
	REVIEW		
			FIGURE 2A

