APPENDIX A Geotechnical Report



GEOTECHNICAL INVESTIGATION PRAIRIE INDUSTRIAL PARK NEAR MAZENOD AND CAMIEL SYS WINNIPEG, MANITOBA

Submitted to:

Terracon Developments

1 Terracon Place Winnipeg, Manitoba R2J 4B3

Attention: Mr. Paul Kingerski

Submitted by:

AMEC Environment & Infrastructure A Division of AMEC Americas Limited

440 Dovercourt Drive Winnipeg, Manitoba R3Y 1N4

23 September 2013

AMEC File No. WX17188



TABLE OF CONTENTS

| | | | PAGE | | | | |
|-----|------|----------------------------------|-------------|--|--|--|--|
| 1.0 | INTR | RODUCTION | 1 | | | | |
| 2.0 | PRO | POSED DEVELOPMENT | 1 | | | | |
| 3.0 | SITE | CONDITIONS | 1 | | | | |
| 4.0 | FIEL | _D INVESTIGATON | 2 | | | | |
| 5.0 | LAB | ORATORY TESTING | 3 | | | | |
| 6.0 | SUB | SSURFACE CONDITIONS | 3 | | | | |
| | 6.1 | SLOUGHING AND SEEPAGE CONDITIONS | 7 | | | | |
| | 6.2 | AUGER REFUSAL | 7 | | | | |
| 7.0 | DISC | DISCUSSIONS AND RECOMMENDATIONS | | | | | |
| | 7.1 | LIFT STATION | 7 8 9 | | | | |
| | 7.2 | SITE GRADING & ROADWAYS | 11 | | | | |
| | 7.3 | PONDS | 12 | | | | |
| | 7.4 | PIPING7.4.1 Backfill | | | | | |
| | 7.5 | FOUNDATION CONCRETE TYPE | 14 | | | | |
| 8.0 | TEST | TING AND MONITORING | 14 | | | | |
| 9.0 | CLO | OSURE | 16 | | | | |



LIST OF TABLES

| Table 1: Moisture Content Summary - Organic Clay | 4 |
|---|---|
| Table 2: Pocket Penetrometer Testing in Clay | |
| Table 3: Moisture Content Summary - Clay | |
| Table 4: Unconfined Compressive Strength Testing in Clay | |
| Table 5: Hydrometer and Atterberg Limit Results - Glaciolacustrine Clay | |
| Table 6: Moisture Content Summary - Silt | |
| Table 7: Hydrometer and Atterberg Limit Results - Silt | |

LIST OF APPENDICES

Appendix A Site Plan & Borehole Logs Appendix B Lateral Earth Pressures



1.0 INTRODUCTION

AMEC Environment & Infrastructure, a division of AMEC Americas Limited (AMEC), were retained by Terracon Developments Ltd. (Terracon) to conduct a geotechnical investigation for the proposed Prairie Industrial project in Winnipeg, Manitoba. The location of the project is in the St Boniface Industrial park, near Mazenod and Camiel Sys and south of the Winnipeg aqueduct line.

The purpose of the investigation was to determine the soil profile at locations along the proposed roadways and underground utility lines and to provide some general geotechnical recommendations relating to construction of the these facilitites. Foundation recommendations for a proposed lift station as well as general comments relating to retention pond design and construction were also to be provided.

A Phase I Environmental Site Assessment (ESA) report, dated 11 July 2013, was also completed by AMEC for the site and was issued under separate cover.

2.0 PROPOSED DEVELOPMENT

Based on information provided by Morrison Hershfield during our May 27 site meeting, it is understood that the industrial park will have the following infrastructure;

- 2590 m of road work;
- 3210 m of water main;
- 2290 m of waste water sewers;
- 270 m of force water main;
- 650 m of land drainage sewer;
- · One Lift Station; and
- One Retention Pond.

Some of the utilities will need to cross under the existing GWWD railway line as such boreholes were advanced as close as possible to the rail line as possible.

3.0 SITE CONDITIONS

The site is irregular in shape, is located to the south of the existing St. Boniface Industrial Park, and is bounded by Canadian National Railway's Symington Yards to the south, an undeveloped field followed by a railroad to the west, and an aqueduct to the north. At the time of AMEC's investigation, the site consisted mostly of an undeveloped field with several treed areas, and with a large proportion of the site covered in shallow water with rushes and reeds. The site surface is generally flat lying with the majority covered with grasses, surface vegetation such as weeds, bull rushes and moss.

The site outline and borehole location plan is provided in Appendix A, Figure 1.



4.0 FIELD INVESTIGATION

A geotechnical field investigation was conducted at the site between the dates of 11 July and 26 August 2013. The geotechnical investigation included the following boreholes;

- A total of 53 boreholes were completed along the proposed roadways (RD01 to RD53). They were advanced every 50m along the proposed road, to a depth of 2m below grade with every second borehole advanced to a depth of 6m below grade. The boreholes were generally located along the centerline of the proposed road.
- A total of four boreholes (P01 to P04) were drilled to a depth of 9 m within the proposed retention pond.
- One borehole (LS01) was advanced for the proposed lift station to a depth of 12m below present grade.
- A total of 3 boreholes (AX03, AX04 and RD27) were advanced at 2 of the 3 proposed water main aqueduct crossings to a depth of about 9m below present grade. The remaining planned crossing bore holes (AX01, AX02 and AX04 were not accessible at the time of drilling.
- Three boreholes (LDS01 to LDS04) were advanced along Mazenod road north of the aqueduct to a depth of about 6 to 7m below present grade for assessment of soil conditions along the proposed Land Drainage Sewer (LDS).
- Three boreholes (SY01 to SY03) along the property boundary between Symington yard and the site for environmental screening. These boreholes are provided for information only in this report.

All boreholes were surveyed using AMEC's survey grade GPS equipment. The majority of the boreholes were completed by Maple Leaf Drilling Ltd., under the full-time supervision of AMEC personnel. The boreholes were advanced with a track mounted drill rig equipped with 125 mm diameter solid stem augers. Some supplemental drilling of the shallow boreholes were advanced using hand augered equipment (i.e. 100mm diameter flight augers) operated by AMEC field staff. The borehole locations are shown on the Borehole Location Plan, Figure 1 in Appendix A.

All soils observed during borehole drilling were visually classified on site according to the Modified Unified Soil Classification System. Sloughing, seepage 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 cuttings. Additional sampling consisted of relatively undisturbed Shelby tube samples for the lift station foundation design at borehole LS01. Testing conducted during the field investigation consisted of pocket penetrometer tests at regular intervals in all of the boreholes.



All soil samples obtained during the field investigation were labelled, sealed in plastic bags to limit moisture loss and transported to AMEC's Winnipeg soils laboratory for further examination and testing.

All of the boreholes were backfilled with auger cuttings and a layer of bentonite on completion of drilling, after verification of short-term sloughing and seepage conditions. Excess auger cuttings were left adjacent to the boreholes.

The borehole logs are included in Appendix A and show the soil profile, results of the field and laboratory testing and comments relative to sloughing and seepage conditions encountered.

5.0 LABORATORY TESTING

Soil samples were returned to AMEC's Soils Laboratory in Winnipeg for geotechnical laboratory testing. All soil samples were visually classified. Testing included moisture contents on a large number of samples, with select samples tested for Atterberg limits and Hydrometer analysis. For all Shelby tube samples, the unconfined compressive strength was determined.

6.0 SUBSURFACE CONDITIONS

The general soil stratigraphy across the site was as follows:

- Surface Organics
- Clay Fill or Organic Clay
- Clay with Silt Layer

Surface Organics

Across the site, a layer of surface organics (moss) was present and ranged in thickness between 0.25 m and 0.75 m. The layer was generally wet and very soft at the time of the investigation. The thicker organics generally corresponded to a number of low lying wet areas.

Clay Fill

Clay fill was found beneath the surface organics in two of the boreholes, both of which were in proximity to the rail track. The clay fill was silty, high plastic, moist, firm to very stiff, and contained varying amounts of sand. The clay fill extended to depths of 0.3 m (RD53) and 1.1 m (LDS02). A single moisture content test was conducted on the fill, with a result of 24%.

Organic Clay

Below the surface organics, across approximately half of the site, a layer of organic clay was found. The organic clay was generally silty, moist, dark grey and contained traces of rootlets and organics. The layer extended to depths ranging between 50 mm and 0.45 m, averaging



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Organic Clay

Below the surface organics, across approximately half of the site, a layer of organic clay was found. The organic clay was generally silty, moist, dark grey and contained traces of rootlets and organics. The layer extended to depths ranging between 50 mm and 0.45 m, averaging



about 0.3 m. Laboratory testing of the organic clay was limited to moisture content determination and two organic contents (ASTM D2974), with the results summarized in Table 1.

Table 1: Moisture Content Summary - Organic Clay

| Number of Tests | Maximum Moisture Content (%) | Minimum Moisture Content (%) | Average Moisture Content (%) | Organic Content |
|--------------------|------------------------------------|---------------------------------------|------------------------------------|--|
| 12 | 50.0 | 27.0 | 43.1 | 5.3 % @ RD32 – 0.3m 7.2 % @ RD26 – 0.3m |

Native Clay with Silt Layer

Clay

The predominant soil encountered at the site was high plastic clay. The clay was encountered below the surficial organic soils in all boreholes and extended to the maximum depths explored (12.2 m). The clay was generally described as silty, moist, stiff, and brownish grey. Occasional thin silt laminations were present within the clay throughout the depths explored. Generally the shear strength of the clay decreased with increasing depth, becoming firm to stiff below depths of about 5 m to 6 m. Sulphate inclusions and gypsum crystals were present within the clay, typically below about 3 m. The clay became mottled brown and grey, then grey with increasing depth. Oxidation was also found within the clay, generally within the upper 7 m.

Field testing within the clay was limited to pocket penetrometers testing to assess relative undrained shear strengths. Results of the testing is summarized in Table 2. While the maximum and minimum results from pocket penetrometers testing indicate a wide range of undrained shear strengths, average undrained shear strengths were generally slightly above 100 kPa in the upper 3 m to 6 m, decreasing to about 50 to 75 kPa below 6 m.

Table 2: Pocket Penetrometer Testing in Clay

| Number of Tests | Undrained Shear Strength Maximum (kPa) | Undrained Shear Strength Minimum (kPa) | Average Shear Strength (kPa) | |
|-----------------|---|--|---------------------------------|--|
| 608 | 420 | 10 | 103 | |

Laboratory testing of the clay material consisted of unconfined compressive strength testing, moisture content determination, Atterberg limit testing and hydrometer grain size analyses.

Moisture content testing, which is summarized in Table 4, indicated in-situ moisture contents ranging between about 23.6% and 58.6%. Generally moisture contents were highly variable in



the upper 3 m, varying between about 23% and 55%, while below 3 m moisture contents were much more closely grouped at between about 45% and 60%.

Table 3: Moisture Content Summary - Clay

| Number of Tests | Maximum Moisture Content (%) | Minimum Moisture Content (%) | Average Moisture Content (%) | | |
|-----------------|------------------------------|---------------------------------|------------------------------|--|--|
| 255 | 58.6 | 23.6 | 39.3 | | |

Unconfined compressive strength testing, which is summarized in Table 4, indicated the clay to have unconfined compressive strengths of about 75 to 90 kPa throughout it's depth. Although slightly inconsistent with pocket penetrometers readings, which indicated a slight decreasing trend in strength with depth, unconfined compressive strength testing is a more accurate determination of soil strength than are field pocket penetrometers tests, which are subject to sample disturbance which is greater with depth.

Table 4: Unconfined Compressive Strength Testing in Clay

| Test Data | Unconfined Compressive Strength (kPa) | Strain (%) | | |
|----------------------------------|---|------------|--|--|
| LS01 Sample 7 – 4.6 m to 5.2 m | 88.9 | 3.6 | | |
| LS01 Sample 10 – 7.6 m to 8.2 m | 75.9 | 2.2 | | |
| LS01 Sample 13 – 10.7m to 11.3 m | 89.8 | 3.2 | | |

Hydrometer and Atterberg Limits tests were conducted on the clays encountered and are summarized in Table 5. For the soils tested, hydrometer and Atterberg Limits results suggest that the soil generally corresponds to a CH classification in the MUSCS. The percentage of particles was relatively consistent at 82 to 83% clay, 17 to 18% silt and no sand or gravel. Liquid limits varied from about 83% to 94% and plastic limits were from 28% to 30%.

Table 5: Hydrometer and Atterberg Limit Results - Glaciolacustrine Clay

| Hydrometer and Atterberg Limit Analyses Results | | | | | | | | |
|---|-----------|-----------|-----------|-------------|----------------------|-----------------------|----------|--|
| Sample Information | % Clay | % Silt | % Sand | % Gravel | Liquid Limit % | Plastic Limit % | MUSCS | |
| RD20 Sample 4 – 1.0 m RD31 Sample 7 – 2.0 m | 83 82 | 17 18 | 0 0 | 0 0 | 83 94 | 30 28 | CH CH | |



Silt

Within the clay, a layer of silt was present in approximately half of the boreholes. The silt layer was generally low plastic, moist, soft to firm and light brown. Traces of clay were generally found within the silt. The silt layer was found at depths ranging between 0.3 m to 2.3 m, and was between 0.15 m and 1.4 m thick.

Laboratory testing of the silt material consisted of, moisture content determination, Atterberg limit testing, and hydrometer grain size analyses.

Moisture content testing, which is summarized in Table 6, indicated in-situ moisture contents ranging between about 19.7% and 42.2%. Moisture contents overall followed a slightly increasing trend with depth, however the degree of this increase was relatively small.

Table 6: Moisture Content Summary - Silt

| Number of Tests | Maximum Moisture Content (%) | Minimum Moisture Content (%) | Average Moisture Content (%) |
|-----------------|------------------------------|---------------------------------|------------------------------|
| 30 | 42.2 | 19.7 | 26.4 |

Hydrometer and Atterberg Limits tests were conducted on the silts encountered and are summarized in Table 7. For the soils tested, hydrometer and Atterberg Limits results suggest that the soil generally corresponds to either a CI or CL-ML classification in the MUSCS. The percentage of particles varied between 21% and 56% clay, 44% to 46%%, 0 to 22% sand and 0% to 11% gravel. Liquid limits varied from about 26% to 38% and plastic limits were the same at 18%.

Table 7: Hydrometer and Atterberg Limit Results – Silt

| Hydrometer and Atterberg Limit Analyses Results | | | | | | | | | |
|---|-----------|-----------|-----------|-------------|----------------------|-----------------------|-------------|--|--|
| Sample Information | % Clay | % Silt | % Sand | % Gravel | Liquid Limit % | Plastic Limit % | MUSCS | | |
| RD29 Sample 2 – 0.5 m RD39 Sample 2 – 0.5 m | 20 36 | 79 60 | 1 4 | 0 | 26 38 | 18 18 | CL-ML CI | | |



6.1 SLOUGHING AND SEEPAGE CONDITIONS

The boreholes were left open for approximately 10 minutes after completion of drilling to observe short-term sloughing and seepage conditions. Some slight to moderate seepage and sloughing was noted within the upper 3 m of some of the boreholes generally from the silt or organic layers.

It should be noted that only short-term seepage and sloughing conditions were observed and that ground water levels can fluctuate annually, seasonally or as a result of construction activity.

6.2 AUGER REFUSAL

Practical auger refusal was not observed in any of the boreholes advanced at the site.

7.0 DISCUSSIONS AND RECOMMENDATIONS

7.1 LIFT STATION

7.1.1 General Evaluation

The soil conditions encountered at the Lift Station borehole location (LS01) are considered suitable for design and construction of the Lift Station. It is anticipated that the Lift Station will most likely comprise of a concrete structure supported on a clay subgrade. Based on the design embedment depth (i.e. 5m below grade) and expected light foundation loads, it is expected that the tank foundation could be designed on the basis of maintaining a <u>net bearing pressure</u> of zero (ie weight of structure is equal to or less than the weight of the soil being removed).

The following sections provide discussion and recommendations as they pertain to design and construction of the lift station, specifically: 'Ultimate' bearing pressure, lateral earth pressures for below grade walls; temporary construction dewatering requirements; and foundation concrete type.



7.1.2 Excavation Stability

7.1.2.1 Shoring

Based on the proximity of the rail line, it is envisioned that shoring or some other form of excavation support will be required to maintain excavation stability for construction of the lift station. The use of sloped excavations is likely not considered feasible to attain a base elevation of about 5m below current grade, either from the perspective of available space to construct sloped walls, nor from a short or long term stability perspective. In this regard, an open excavation would require side slopes of 2:1 or flatter, resulting in an extremely large excavation (25 m by 25 m at surface).

Currently, it is envisaged that suitable excavation support systems would consist of one of the following:

- A steel casing of sufficient diameter advanced to the required embedment using a piling rig; or
- A braced excavation box inclusive of lateral struts such that lateral support is provided to all four sides of the excavation. Due to the limited width of the excavation, the use of internal rakers would preclude work within the excavation, and as such, are not considered feasible for use as excavation support.

7.1.2.2 Lateral Earth Pressure

Given the firm to stiff consistency of the native clay overburden, the distribution of earth pressures against the walls of a braced shoring system will adopt the stress distribution illustrated in Figure B1, Appendix B. This figure should be used in sizing, and spacing of the struts.

Notwithstanding strut support requirements, the factor of safety of the braced shoring against base heave of the underlying soft normally consolidated lacustrine clay should be checked. The following expression may be used to check the factor of safety with respect to base heave, FS_b ,:

$$FS_b = \frac{N_b S_u}{XH + q_s}$$

where: $FS_b = Factor of Safety against base heave$

 N_b = Stability factor dependent upon geometry of the excavation (Assume 8.5 for

a rectangular foundation with a depth to embedment ratio of 2)

S_u = Undrained shear strength (Assume 35 kPa below base of excavation)

 γ = Bulk unit weight of the overburden (Assume 17 kN/m³)

H = height of wall (m)

 q_s = surcharge load (kN/m²)



To preclude having to extend the shoring beyond the base of the excavation, a minimum factor of safety of 1.5 must be maintained. Based on a proposed excavation depth of about 5 m below current grades, FS_b is estimated to be about 2.0 assuming no surcharge loading adjacent to the excavation. Where surcharge loading adjacent to the excavation decreases the factor of safety to less than 1.5, the shoring must extend below the base of the excavation, and this office should be contacted for review and additional recommendations.

The effects of surcharge load should be applied where required. The surcharge considered should include the effects of loads from street traffic, construction equipment, and any other loads that may be transferred to the walls of the excavation during the construction period.

7.1.2.3 Construction Dewatering

Significant seepage and sloughing within the clay overburden above the anticipated excavation depth of about 5 m is not expected. Fluctuations in groundwater elevation can occur seasonally due to heavy rains and/or rises in the river level and therefore depending on when construction occurs, changes in groundwater levels may occur.

It is anticipated that where groundwater is observed within the excavation, it could be managed under normal conditions with an internal dewatering system comprised of construction sump and submersible pumps.

Primary concerns associated with using an internal dewatering system include the risk of loss of ground or washing of fines. The washing of fines and/or loss of ground could result in the siltation of collected groundwater, possibly resulting in a subsequent requirement to remove the fines (i.e. by sedimentation or filtering) prior to disposal in City storm sewers. Furthermore, the loss of ground is a serious concern where soils with potential for piping are present. Although the soils at the site are not considered particularly susceptible to piping under the anticipated excavation conditions, the loss of ground behind the shoring should be monitored, particularly where any silt layers are observed.

7.1.3 Lift Station Foundation

7.1.3.1 Ultimate Bearing Pressure

As previously discussed, it is envisaged that the outfall chamber will comprise a concrete foundation bearing on a clay subgrade at about 5 m below existing grade. Based on soil conditions encountered at the borehole location (LS01), subgrade conditions within the footprint of the lift station are expected to consist of firm to stiff native highly plastic clay. Given the soil conditions noted at the site, it is recommended that an unfactored Ultimate Limit State (ULS) bearing pressure of 300 kPa could be assumed in design of the lift station. In order to limit settlements to less than 25mm, the 'serviceability' limit state (SLS) should be designed for an applied bearing pressure of 90 kPa, which is roughly the weight of the soil being removed. It is cautioned however that additional settlement potential could be induced by disturbance and/or softening of the subgrade during construction.



The bearing surface of the lift station should be excavated in a manner to minimize disturbance of the subgrade. Further, the bearing surface should be trimmed free of softened or loose soil, protected against swelling and desiccation, kept free of water, and protected from any other detrimental environmental effects. The total elapsed time between the time foundation excavation is complete and the reinforcement steel and foundation concrete is placed should be kept to a minimum.

7.1.3.2 Buoyancy

Based on an assumed groundwater level at the site, the lift station will be subject to uplift due to buoyancy. For design purposes, the buoyancy force may be estimated assuming a groundwater table located at about 2 m below grade. This assumes that there is no subdrainage system installed around the lift station. This also assumes that the upper pprtion of the lift station, as a minimum, will be backfilled with clay.

Resistance to buoyancy will be provided by the dead weight of the lift station and soil friction along the exterior sidewalls of the lift station. The available side friction resistance along the perimeter walls of the lift station will depend upon the construction method and/or backfill used along the perimeter of the structure. If the dead weight of the lift station is insufficient to resist buoyancy forces, AMEC can provide a recommended friction value for along the perimeter of the structure once final construction and backfill details are known.

7.1.3.3 Lateral Earth Pressures on Lift Station Walls

The permanent walls of the lift station will be required to resist lateral earth pressures and hydrostatic pressure from the surrounding soil and groundwater. Provided that the backfill placed against the wall is lightly compacted, the lateral soil pressure (*p*) distribution may be assumed to be trapezoidal in shape and increase linearly with depth as illustrated on Figure B2, Appendix B.

Lightly to moderately compacted backfill typically corresponds to soils placed and compacted to between 93 percent and 95 percent of standard Proctor maximum dry density (SPMDD). Settlements under the self weight of such compacted backfill is dependent on the soil type used, however usually do not exceed 2 percent of the fill height. In cases where the backfill is well to highly compacted, the additional lateral pressures induced on the wall by compaction must also be considered in the design of the below grade walls. AMEC can provide lateral earth pressure distributions for highly compactive backfill upon request.

It is anticipated that a braced excavation will be formed against the face of the excavation, and as such, limited relaxation of the retained soils will occur. As such, the use of the 'at-rest' lateral earth pressure coefficient K_o in the design of unyielding lift station walls is recommended. Outlined below in Table 8 are assumed design values for the 'at rest' lateral earth pressure coefficient as well as bulk unit weight of native highly plastic clay:



Table 8: Lateral Earth Pressure Coefficients and Total Unit Weights for Light to Moderately Compacted Soil

| Soil Type | Angle of Internal Friction, w (°) | 'at-rest' Earth Pressure, K _o | Total Unit Weight, x1 (kN/m³) |
|---------------------|-----------------------------------|--|-------------------------------|
| Highly Plastic Clay | 18 | 0.69 | 17 |
| Granular | 30 | 0.50 | 20 |

The earth pressure coefficient outlined in Table 8 is unfactored, and does not include any factor of safety.

It is recommended that a cap of clay, concrete or asphalt be placed at the ground surface adjacent to the foundation walls to reduce the migration of surface water into the underlying granular backfill materials. If a clay cap is used, a minimum thickness of approximately 0.5 m is recommended.

7.1.4 Frost Considerations

Based on local experience, an average annual frost penetration depth of 2.4 m is expected at the site. With respect to the potential for adfreeze and frost heave of the lift station, the base of the lift station will be located well below the depth of frost penetration at a depth of about 5m below grade. As such, the risk of frost uplift of lift station is considered low to negligible.

However, notwithstanding the above, the lift station will be required to extend through the zone of frost penetration. Portions of the lift station located within the depth of frost penetration must be structurally designed to resist increased lateral pressures induced by frost. In the case of unyielding walls exposed to frost penetration above the groundwater table, it is recommended that $K_0 = 1.0$, be used to account for lateral frost pressures¹.

7.2 SITE GRADING & ROADWAYS

Prior to rough site grading, fill areas and areas providing subgrade support (i.e. grade supported slab footprints, pavement areas, etc.) should be cleared of trees, stumps, brush, ground plants, and matted vegetation. Trees, brush, stumps, roots, etc. should be removed from site. Furthermore, organic topsoil, mineral soils with an organic content greater than about 6 to 7 percent (i.e. the surface organics noted on the logs as "moss"), and other deleterious material should be stripped and stockpiled outside of the footprint of cut and fill areas and areas providing subgrade support. Low organic mineral soils such as the organic clay noted below the surface organics (moss layer) containing less than 6 to 7 percent organic by weight may be considered relatively unaffected by the organic content from a subgrade suitability standpoint, and may be left in place in pavement areas, but should be removed from within building footprints to preclude any requirement for the installation of a methane extraction system within crawlspaces. Stockpiled topsoil and organic material may be re-used for landscaping only.

¹ As per Canadian Foundation Engineering Manual, 3st Edition, P. 429, an earth pressure coefficient K=1 should be used in combination with insulation for highly frost susceptible soils.



Based on the borehole information, the exposed subgrade following site clearing and stripping of unsuitable materials is expected to consist of highly plastic clay, organic clays with less than 6 percent by organic content or potentially a shallow soft and wet silt layer. Typically, prior to the placement of any fill to achieve subgrade design elevations or final surface grades, exposed cohesive subgrades are scarified, moisture conditioned to within two to three percent of optimum moisture content (OMC), and compacted to at least 95 percent of standard Proctor maximum dry density (SPMDD). However, in the case of areas having wet silts at or just below subgrade, which are highly susceptible to disturbance (i.e. rutting, spreading, etc.) under concentrated loads, compaction of the natural subgrade may not be possible. This should be assessed at the time of construction.

It is understood that most of the roads constructed at the site will be raised well above the current grades. Accordingly, the construction and performance of asphalt and concrete pavements at this site will likely not be impacted in a significant way by the silt layers noted in the boreholes. In this regard, raising of site grades should provide an overall benefit to long term performance. Conversely, if there are areas where grades are at or below the current site grades, additional construction complications are likely to result and appropriate methods for dealing with the silt will be required. Given the thickness of the silt identified during the investigation, complete removal would likely not be cost effective and therefore other means of limiting the impact of the silt should be considered. Traditionally in the Winnipeg area, silts exposed at or near the subgrade elevation are sub-excavated to about 300 to 400mm below the design subgrade elevation and backfilled with 100 to 150mm crushed limestone rock placed on a geotextile fabric.

It is understood that standard Winnipeg road designs are to be utilized. Where requested, AMEC can provide site specific pavement designs, based on anticipated traffic loadings and design life.

7.3 PONDS

It is understood that a retention pond will be constructed as part of the industrial park. Four boreholes were advanced within the pond areas and the soils conditions generally consisted of native high plastic clay with 3 of 4 holes having a silt layer noted in the upper 1 to 2m. It is understood that the standard City of Winnipeg retention pond design (consisting of a 7H:1V slope below and above the summer water level) will be adopted. This City of Winnipeg design is understood to have been used successfully at numerous locations in the city and therefore represents an appropriate target level of stability (standard of practice) for the proposed retention pond.

Given the soil conditions noted (i.e. high plastic clay), typical excavation techniques are considered appropriate. Regardless of the slope design used in the pond area, special attention should be paid to any silt layers encountered during construction. Silt layers above the normal water level should be daylighted in the pond slopes with an appropriate filter (granular of synthetic) to drain groundwater carried in the silt layer and avoid the accumulation of



groundwater pressures which can cause stability concerns. Under no circumstances should the silt layer be capped with clay where it intersects the slope.

7.4 PIPING

Underground service utilities are commonly installed in the Winnipeg area using trenching methods. On that basis, typical construction methods are considered appropriate for the installation of underground utilities.

Standard excavation of trenches is considered suitable at this location for purposes of installing underground services and piping, provided that trench excavations will be less than about 3 m in depth. Trench excavations should include minimum slopes of 1:1. Alternatively, trench walls can be cut vertical or near vertical provided that a trench cage is used to protect down hole workers. As a minimum, all trench excavations should comply with the requirements of the Manitoba Workplace Safety and Health Act and Guidelines, and the Workers Compensation Board. The trenching work should be undertaken by experienced contractors and should also be closely supervised by knowledgeable safety personnel. Trench excavations which experience unusual difficulties should be brought to the immediate attention of the geotechnical consultant so that remedial work can be undertaken.

The trench should be cut to a width a minimum of 0.6 m plus the pipe diameter to accommodate placement and compaction of granular bedding material. Bedding material at least 0.3 m thick placed above and below the pipes should be used to provide suitable load distribution. The bedding material should be nominally compacted to a maximum of 95% of standard Proctor maximum dry density (SPMDD). Excessive compaction of the bedding material should be avoided to prevent damage to the utilities.

It is understood that the pipes will need to be protected from freezing conditions, which may be accomplished by providing a sufficient thickness of cover material (soil or granular), utilizing insulated and heat traced pipes or by providing a sufficient thickness of synthetic insulation. About 2.4 m of soil cover is generally sufficient in the Winnipeg area.

7.4.1 Backfill

Fill used to backfill trench excavations should be compacted to a standard that is in keeping with the performance requirements of the finished area. If the area is not planned for an end use (such as for landscaping, staging areas, etc.), a minimum compaction standard and common fill materials could be considered. For finished areas that require a higher level of performance (such as roadways) a compaction level in the order of about 95 to 98% of SPMDD is recommended. As well, select fill materials should be used and in this regard, the native excavated soils are not recommended for such areas, as they can be difficult to compact within confined areas. Trench backfill should consist of materials consistent with the City of Winnipeg Standard Construction specification for underground works.



7.5 FOUNDATION CONCRETE TYPE

Where concrete elements outlined in this report and all other concrete in contact with the local soil will be subjected in service to weathering, sulphate attack, a corrosive environment, or saturated conditions, the concrete should be designed, specified, and constructed in accordance with concrete exposure classifications outlined in CSA standard A23.1-09, Concrete Materials and Methods of Concrete Construction. In addition, all concrete must be supplied in accordance with current Manitoba and National Building Code requirements.

Based on AMEC's experience in Winnipeg, water soluble sulphate concentrations in the soil are typically in the range of 0.2% to 2.0%. As such, the degree of sulphate exposure at the site may be considered as 'severe' in accordance with current CSA standards, and the use of sulphate resistance cement (Type HS or HSb) is recommended for concrete in contact with the local soil. Furthermore, air entrainment should be incorporated into any concrete elements that are exposed to freeze-thaw to enhance its durability.

It should be recognized that there may be structural and other considerations, which may necessitate additional requirements for subsurface concrete mix design.

8.0 TESTING AND MONITORING

All engineering design recommendations presented in this report are based on the assumption that an adequate level of testing and monitoring will be provided during construction and that all construction will be carried out by a suitably qualified contractor experienced in foundation and earthworks construction. An adequate level of testing and monitoring is considered to be:

- for excavations: monitor the groundwater conditions prior to construction.
 - evaluate the excavation base after completion of excavation to assess the basal stability and seepage conditions for dewatering assessment
 - monitor the installation of sheet piles
 - monitor vertical and horizontal shoring movements
- for foundations:

 design review and review of the bearing surface prior to placement of concrete.
- for concrete construction: testing of plastic and hardened concrete in accordance with CSA A23.1-09 and A23.2-09.
 - review of concrete supplier's mix designs for conformance with prescribed and/or performance concrete specifications.

AMEC requests the opportunity to review the design drawings and the installation of the lift station to confirm that the geotechnical recommendations have been correctly interpreted. AMEC further requests the opportunity to review the soil and groundwater conditions encountered as excavation proceed so that the assumptions made in preparing this report can either be confirmed, or so that recommendations provided in this report can be modified to reflect such different conditions as are encountered.



The contractor should be advised that it is anticipated that the geotechnical engineer will not be on site on a full-time basis. Therefore, the timely reporting by contractor staff of unusual events such as, but not limited to, loss of ground, changes in soil behaviour, movements of roadway surfaces and shoring, and changes in dewatering volumes will be very important in ensuring a suitably rapid response to potentially serious circumstances.

AMEC would be pleased to provide any further information that may be needed during design and to advise on the geotechnical aspects of specifications for inclusion in contract documents.



9.0 **CLOSURE**

The findings and recommendations presented herein for design of the proposed Lift Station and development are based on a geotechnical evaluation of the findings in the geotechnical boreholes drilled at the site. If conditions are encountered that appear to be different from those shown in the borehole log and described in this report, or if the assumptions stated herein are not in keeping with the design, AMEC should be notified and given the opportunity to review the current recommendations in light of any new findings. Recommendations presented herein may not be valid if an adequate level of inspection is not provided during construction, or if relevant building code requirements are not met.

Soil conditions, by their nature, can be highly variable across a construction site. placement of fill during and prior to construction activities on a site can contribute to variable soil conditions. A contingency amount should be included in the construction budget to allow for the possibility of variations in soil conditions, which may result in modification of the design, and/or changes in construction procedures.

This report has been prepared for the exclusive use of Terracon Developments, and their design agents, for specific application to the development described within this report. The data and recommendations provided herein should not be used for any other purpose, or by any other parties, without review and written advice from AMEC.

The findings and recommendations of this report have been prepared in accordance with generally accepted soil and foundation engineering practices. No other warranty is made, either expressed or implied.

Respectfully submitted,

AMEC Environmental & Infrastructure a division of AMEC Americas Limited

Trevor Gluck, P. Eng.

Senior Geotechnical Engineer

Reviewed By:

Harley Pankratz, P. Eng.

VP: Eastern Prairies/Northern Alberta

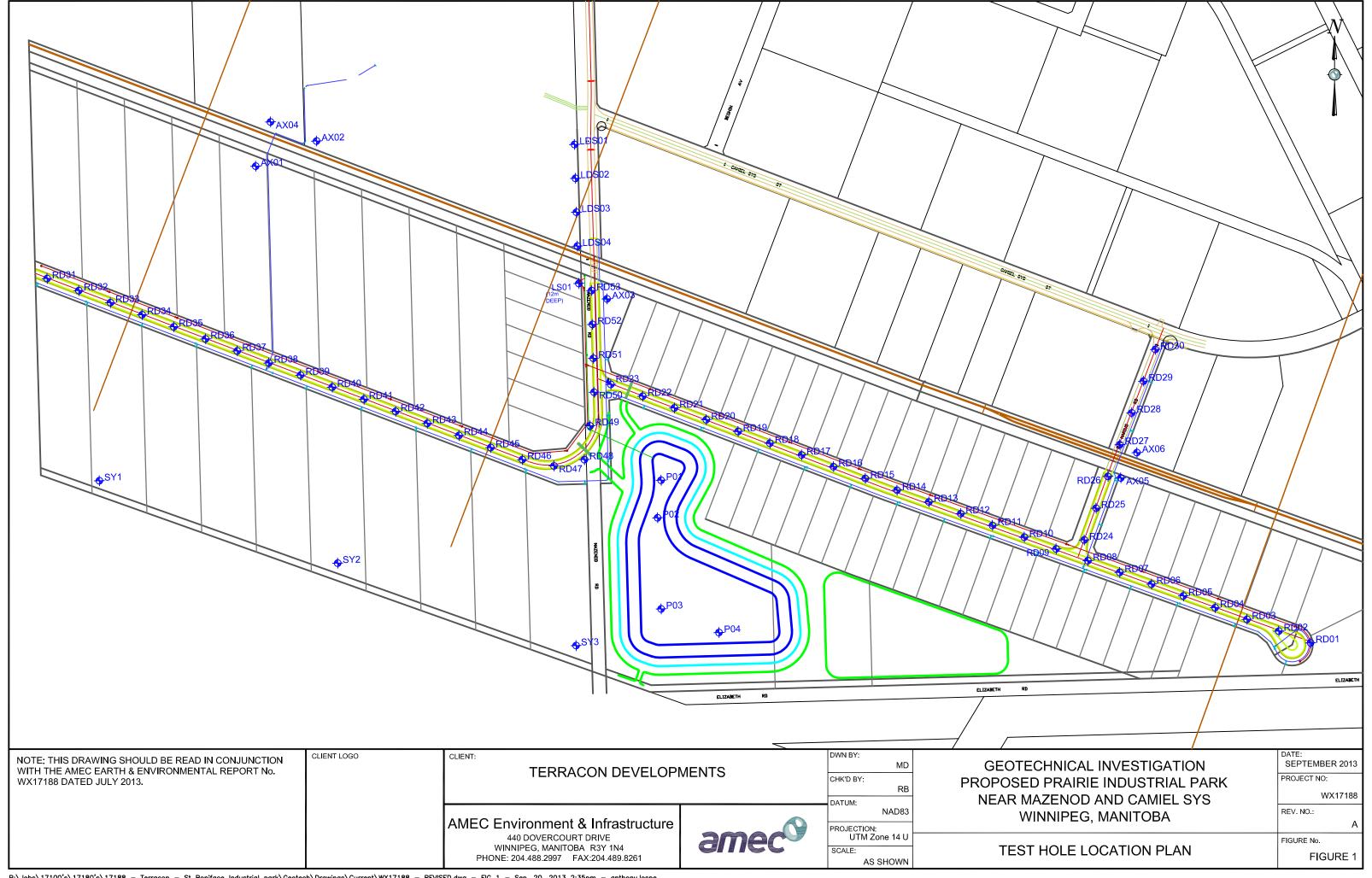
Certificate of Authorization AMEC Environment & Infrastructure, a **Division of AMEC Americas Limited**

No. 555



APPENDIX A

SITE PLAN & BOREHOLE LOGS



| PR | OJECT: Prairie Industrial P | ark | DRILLED BY: Maple Leaf Drilling Ltd. | | | | | BORE HOLE NO: AX03 | | |
|--|---|---|--------------------------------------|--|--|---|---------------------|--------------------|---------------------------|---|
| CL | IENT: Terracon Developme | nts | | DRILL TYPE: Track Mounted DR150 | | | PROJECT NO: WX17188 | | | |
| - | CATION: Winnipeg, Manito | ba | | DRILL METHO | | id Stem Augers | | | ATION: | |
| SA | MPLE TYPE She | elby Tube | No Recov | | | Grab Sample | | ∏Split-Pe | · | |
| ВА | | ntonite | Pea Grav | rel Dri | Il Cuttings | Grout | [| Slough | Sand | |
| (m) | ■ PLASTIC M.C. LIQU 20 40 60 8 | Pa) Pa) S S S S S S S S S S S S S S S S S S S | | DESC | SOIL CRIPTION | | SAMPLE TYPE | SPT (N) | COMMENTS | Depth (m) |
| _ 0 _ _ _ | | | | ORGANICS (Moss ty, trace rootlets, tra | | h plastic, moist, firm, | | 1 | | - - - - |
| - - - -1 | | | H | | | | | 2 | | - - - -1 |
| - - - - | • | N | L | e clay, low plastic, | moist, soft, tan to | o light brown | | 3 | | - |
| - -2 - - | | | CLAY - silf | st below 1.7m iy, high plastic, moi I oxidation and occa | st, firm - stiff, gre asional silt inclus | yish brown, ions | | 4 | | 2 2 |
| - - - -3 - | | | | | | | | 5 | | 3 |
| REVISED) | | c | н | | | | | 6 | | - - - -4 - - |
| 9:15 AM (GEOTECHNICAL | | | | | | | | | | - - - -5 - - |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL | | | NOTES: No slough hole remai | ing or seepage was ined open to 6.1m a | encountered du and was dry upoi | EXISTING GRADE ring drilling. Test n completion of ttings and bentonite. | | 7 | | - - - 6 - - - - - |
| RRACON - ST BONIFACE IN | | | | | | | | | | 7 |
| 荆 | | AMEC | Environmen | ıt & Infrastructu | | ED BY: AL | | | ETION DEPTH: 6.1 m | M2 |
| 17188 - | amec [©] | | Winnipeg, | | Figure | WED BY: RB | | COMPL | ETION DATE: August 21, 20 | 013 e 1 of 1 |
| ~ | | 1 | | | i igui e | | | l | i ay | - 1011 |

| PROJ | ECT: Prairie Industrial Pa | ark | DRILLE | DRILLED BY: Maple Leaf Drilling Ltd. | | | BORE HOLE NO: AX05 | | |
|--|---|-------------------|--|---|---------------------------|-------------|---------------------|--------------------------------|---|
| CLIEN | NT: Terracon Developmer | nts | DRILL | DRILL TYPE: Track Mounted DR150 | | | PROJECT NO: WX17188 | | |
| LOCA | TION: Winnipeg, Manitob | oa | DRILL | METHOD: 125mm | Solid Stem Augers | | ELEVA | ATION: | |
| SAMF | PLE TYPE Shell | lby Tube | No Recovery | SPT (N) | Grab Sample | | ∏Split-Pe | | |
| BACK | | tonite | Pea Gravel | Drill Cuttings | Grout | [| Slough | Sand | 1 |
| Depth (m) | ■ UNCONFINED COMPRESSION (I 100 200 300 40 40 40 60 80 40 40 40 40 40 40 40 40 40 40 40 40 40 | SOIL SYMBOL MUSCS | | SOIL DESCRIPTION | ON | SAMPLE TYPE | SPT (N) | COMMENTS | Depth (m) |
| - 0 - - - -1 | | OH OH | ORGANIC CLAY - s grey CLAY - silty, trace ro | ootlets to 0.3m, high psional silt inclusions | l organics, moist, dark | | 2 | | -1 |
| -2 2 3 | | | firm, brown, occasi | onal sulphate inclusio | ons below 2.3m | | 1 | | -2 |
| -4 | | | trace sand, occasion | | ate inclusions at 3.1m | | | | -4 |
| CHNICAL REVISED) | | | - firm, occasional to | frequent silt inclusion | s ~3mm dia. below 6.1m | | 7 | | - - - - - - - - - - - - - - - - - - - |
| PJ 13/09/24 09:15 AM (GEOTE | ■ 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | - | soft to firm, dark gr | eyish brown below 7. | 6m | | 3 | | |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL DE CONTROL DE CO | | | NOTES: Very slight squeezin seepage was encou open to 8.5m and wa | NATED AT 9.1m BEL g was observed belo ntered during drilling. | on of drilling. Test hole | |) | | |
| & 11 E | | | | , , LO | OGGED BY: AL | | COMPL | <u> </u> ETION DEPTH: 9.1 m | Г |
| 1 2 3 | <u>mec[©]</u> | | rironment & Infra innipeg, Manitob | istructure R | EVIEWED BY: RB | | | ETION DATE: July 12, 2013 | |
| 171 | リリてし | Į vvi | mmpeg, maniton | Fi | gure No. 3 | | | Page | e 1 of 1 |

| Р | ROJ | ECT: Prairie Industrial Pa | ırk | | DRILLED BY: Maple I | eaf Drilling Ltd. | | BORE | HOLE NO: LDS01 | |
|--|-----------|---|----------|-------|--|---|-------------|----------------------|---------------------------|---|
| С | LIEN | NT: Terracon Developmer | nts | | DRILL TYPE: Track N | ounted DR150 | | PROJ | ECT NO: WX17188 | |
| L | OCA | TION: Winnipeg, Manitob | a | | DRILL METHOD: 125 | mm Solid Stem Augers | | | ATION: | |
| S | AMF | PLE TYPE Shell | by Tube | | ✓ No Recovery SPT (N) | Grab Sampl | | ∭Split-P€ | | |
| В | ACK | FILL TYPE Bent | onite | | Pea Gravel Drill Cutting | s Grout | | Slough | Sand | |
| | Depth (m) | ■ UNCONFINED COMPRESSION (k 100 200 300 400 ■ POCKET PENETROMETER (kP 100 200 300 400 PLASTIC M.C. LIQUID 20 40 60 80 | R SYMBOL | MUSCS | SOIL DESCRIP | | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) |
| - (- - - |) | | | OR | SURFACE ORGANICS (Moss) - ~25r CLAY - silty, trace rootlets, high plast grey to dark grey, occasional oxidatio | c, moist, stiff to very stiff, | | 1 | | - |
| - - -1 - | 1 | | | | - trace fine grained sand, stiff, grey be | elow 0.8m | | 2 | | - - -1 - |
| - - - - - |) | | | | - brown, stiff to firm below 1.5m - frequent silt lenses approximately 20 | Omm thick from 1.5m to 1. | 7m | 3 | | - - - - - |
| - - - - - | _ | | | | - firm below 2.3m | | | 4 | | - |
| - - - - - - - - | 3 | | | СН | - occasional sulphate inclusions below | v 3m | | 5 | | -3 3 |
| 2:15 AM (GEOTECHNICAL REVISED) | 4 | | | | - dark greyish brown below 4.6m | | | 6 | | |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK GPJ 13/09/24 09:15 AM (GEOTECHNICAL | 7 | | | | TEST HOLE TERMINATED AT 6.1m NOTES: - No sloughing or seepage was encound hole remained open to 6.1m and was drilling. Test hole was backfilled with | intered during drilling. Test dry upon completion of | DE st | 7 | | - - - - - - - - - - - - - - - - - - - |
| | | | АМІ | -C E | nvironment & Infrastructure | LOGGED BY: AL | 1 1 | | ETION DEPTH: 6.1 m | 1 |
| 17188 - | 7 | mec ⁹ | AIVII | | Winnipeg, Manitoba | REVIEWED BY: RB | | COMPL | ETION DATE: August 26, 20 | |
| 1 | | | 1 | | | Figure No. 4 | | | Page | e 1 of 1 |

| PRC | DJECT: Prairie Industrial Pa | ark | DRILLED B | Y: Maple Leaf D | illing Ltd. | | BORE | HOLE NO: LDS02 | |
|--|--|-------------------|--|------------------------|-----------------------|-------------|-----------|---------------------------|---------------------------------|
| CLIE | ENT: Terracon Developmer | nts | DRILL TYPE | E: Track Mounte | d DR150 | | PROJ | ECT NO: WX17188 | |
| LOC | ATION: Winnipeg, Manitob | oa | | HOD: 125mm S | olid Stem Augers | | | ATION: | |
| SAM | IPLE TYPE Shel | by Tube | | SPT (N) | Grab Sample | | ∏Split-Pe | | |
| BAC | KFILL TYPE Bent | tonite | Pea Gravel | Drill Cuttings | Grout | [| Slough | Sand | |
| Depth (m) | ▲ UNCONFINED COMPRESSION (I 100 200 300 401 ■ POCKET PENETROMETER (KP 100 200 300 401 PLASTIC M.C. LIQUII 20 40 60 80 | L SYMBOL MUSCS | | SOIL SCRIPTION | | SAMPLE TYPE | SPT (N) | COMMENTS | Depth (m) |
| _ 0 - - - | | OR | \SURFACE ORGANICS (N CLAY (FILL) - silty, some greyish brown | | | | 1 | | - |
| - - - - -1 | | • | - grey, trace wood debris, 0.6m | | | | 2 | | - - -1 |
| - - - - - - | | | CLAY - silty, trace rootlets greyish brown, occasiona | | | | 3 | | - |
| -2 - - - - - | | | - frequent silt lenses appr 2.1m to 2.3m | oximately 20mm th | ick, firm, brown from | | 4 | | -2 - - - - |
| - -3 - - - - - - - | | CH | - greyish brown, occasion | al oxidation inclusion | ons below 3m | | 5 | | -3 3 |
| (GEOTECHNICAL REVISED) | | | - dark greyish brown belo | w 4.6m | | | 6 | | -4 4 |
| PARK.GPJ 13/09/24 09:15 AM | | | - grey to dark grey, soft, of below 5.5m TEST HOLE TERMINATE NOTES: - No sloughing or seepage | ED AT 6.1m BELOV | V EXISTING GRADE | | 7 | | - - - - - - 6 |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK GPJ 13/09/24 09:15 AM (GEOTECHNICAL | | | hole remained open to 6.° drilling. Test hole was bac | 1m and was dry up | on completion of | | | | 7 7 |
| ERRA 8 | | | | , LOGO | GED BY: AL | | COMPL | LETION DEPTH: 6.1 m | |
| - 88 | emec [©] | AMEC E | Environment & Infrastru Winnipeg, Manitoba | REVI | EWED BY: RB | | | ETION DATE: August 26, 20 | |
| 17188 | <i>リロ</i> し | | Timmpey, maintoba | Figure | e No. 5 | | | Page | e 1 of 1 |

| PRO | JECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple I | eaf Drilling Ltd. | | BORE | HOLE NO: LDS03 | |
|--|--|---|-------|--|--|-------------|----------------------|---------------------------|--|
| CLIE | NT: Terracon Developmen | nts | | DRILL TYPE: Track M | lounted DR150 | | PROJ | IECT NO: WX17188 | |
| LOC | ATION: Winnipeg, Manitob | oa | | | mm Solid Stem Augers | | | ATION: | |
| SAM | IPLE TYPE Shel | by Tube | | No Recovery SPT (N) | Grab Sample | | ∭Split-Pe | | |
| BAC | | tonite | | Pea Gravel Drill Cutting | s Grout | | Slough | Sand | |
| Depth (m) | ▲ UNCONFINED COMPRESSION (I 100 200 300 40 | O Pa)■ NO N | MUSCS | SOIL DESCRIP | TION | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) |
| - 0 - - - - | | | | SURFACE ORGANICS (Moss) - ~50r CLAY - silty, trace fine grained sand, greyish brown, occasional oxidation in | high plastic, moist, very stiff, | | 1 | | - |
| - - - -1 - - | | | | | | | 2 | | - - - -1 - |
| - - - - - - -2 | | | | - brown, stiff, occasional sulphate incl | usions below 1.5m | | 3 | | - - - - -2 |
| - | | | | - occasional sulphate lenses approxir firm from 2.1m to 2.3m | nately 20mm thick, brown, | | 4 | | - |
| - -3 - - - | | | | - occasional to frequent sulphate and below 3m | oxidation inclusions, soft | | 5 | | -3 3 |
| 15 AM (GEOTECHNICAL REVISED) | | | | - occasional oxidation and sulphate ir | iclusions below 4.6m | | 6 | | - -4 - - - - - - - - - - - - - - - - - |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL | | | | TEST HOLE TERMINATED AT 6.1m NOTES: - No sloughing or seepage was encount hole remained open to 6.1m and was drilling. Test hole was backfilled with a second secon | intered during drilling. Test dry upon completion of | | 7 | | 6 6 7 |
| ERRA 8 | | A 145 | `- | duammant O listurat | LOGGED BY: AL | | COMPL | LETION DEPTH: 6.1 m | |
| 17188 - 1 | emec [©] | ANIE | | vironment & Infrastructure /innipeg, Manitoba | REVIEWED BY: RB | | | ETION DATE: August 26, 20 | |
| 7 6 | JI I I C | | *1 | pog, maintoba | Figure No. 6 | | 1 | Page | e 1 of 1 |

| PRC | DJECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple I | Leaf Drilling Ltd. | | BOR | E HOLE NO: LDS04 | |
|--|--|------------|-------|--|--|-------------|----------------------|----------------------------|--------------------|
| CLIE | ENT: Terracon Developmer | nts | | DRILL TYPE: Track N | Nounted DR150 | | PRO. | JECT NO: WX17188 | |
| | ATION: Winnipeg, Manitob | oa | | | mm Solid Stem Augers | | | /ATION: | |
| SAM | IPLE TYPE Shell | by Tube | | ✓ No Recovery SPT (N) | Grab Sample | | ∭Split-F | | |
| BAC | | tonite | | Pea Gravel Drill Cutting | gs Grout | [| Slough | n Sand | |
| Depth (m) | ▲ UNCONFINED COMPRESSION (100 200 300 40) ■ POCKET PENETROMETER (kF 100 200 300 40) PLASTIC M.C. LIQUI 20 40 60 80 | SOIL SYMB(| MUSCS | SOIL DESCRIP | TION | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) |
| - 0 - - - | | | OR | SURFACE ORGANICS (Moss) - ~50r CLAY - silty, high plastic, moist, stiff, oxidation inclusions | | | 1 | | - |
| - - -1 - | | | | | | | 2 | | - - -1 -1 |
| - - - - - - - | | | | - brown, occasional sulphate and silt | inclusions below 1.5m | | 3 | | - |
| - - - - - | | | | - firm below 2.3m | | | 4 | | - |
| - -3 - - - - - | | | СН | - occasional to frequent sulphate, firm | n below 3m | | 5 | | - -3 - - |
| 15 AM (GEOTECHNICAL REVISED) | | | | - dark greyish brown below 4.6m | | | 6 | | |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL | | | | TEST HOLE TERMINATED AT 6.1m NOTES: - No sloughing or seepage was encount hole remained open to 6.1m and was drilling. Test hole was backfilled with | untered during drilling. Test dry upon completion of | | 7 | | 6 6 7 7 |
| TERR | | ANGE | | nvironment & Infrastructure | LOGGED BY: AL | | COMP | LETION DEPTH: 6.1 m | |
| 17188 - | emec [©] | AIVIE | | Winnipeg, Manitoba | REVIEWED BY: RB | | COMP | LETION DATE: August 26, 20 | |
| 4 | | | | I 0/ | Figure No. 7 | | 1 | Page | e 1 of 1 |

| PRO | JECT: Prairie Industri | ial Park | DI | DRILLED BY: Maple Leaf Drilling Ltd. | | | BORE | BORE HOLE NO: LS01 | | | |
|--|---|-------------|--|---|---|-------------|---------------------------|--|--------------------|--|--|
| - | NT: Terracon Develo | • | | RILL TYPE: Track M | | | | PROJECT NO: WX17188 | | | |
| - | ATION: Winnipeg, Ma | _ | | | nm Solid Stem Augers | | | ATION: | | | |
| | PLE TYPE | Shelby Tube | No Recovery | | Grab Sample | | Split-P | | | | |
| BAC | KFILL TYPE | Bentonite | Pea Gravel | Drill Cuttings | Grout | 1 1 | Slough | Sand | 1 | | |
| Depth (m) | ■ UNCONFINED COMPRES 100 200 300 ■ POCKET PENETROME1 100 200 300 PLASTIC M.C. 20 40 60 | | | SOIL DESCRIP | ΓΙΟΝ | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) | | |
| -1 -1 -2 -3 | | OR | CLAY - silty, tr grey, occasion - no rootlets ar | RGANICS (Moss) - ~25m race rootlets, trace organ nal oxidation inclusions and organics, greyish bro rown below 2.3m | ics high plastic, moist, stiff | , | 1 2 3 4 5 | | -1-2-2-3 | | |
| 5 | | СН | - grey, stiff bel | | | | 8 | Unconfined Compressive Strength @4.6m: 88.9 kPa @ 3.6% Strain | 5 | | |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) | | | - soft to firm be | elow 9.1m | | | 9 10 11 12 13 | Unconfined Compressive Strength @4.6m: 75.9 kPa @ 2.2% Strain Unconfined Compressive Strength @4.6m: 89.8 kPa @ 3.2% Strain | -7 8 9 10 | | |
| 378ACON - ST BONIFACE INDUS 11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | | | NOTES: No sloughing of hole remained | or seepage was encount open to 12.1m and was | BELOW EXISTING GRAD ered during drilling. Test dry upon completion of uger cuttings and bentonite | | 14 | | 12 | | |
| 荆 | | AMEC F | nvironment & | Infrastructure | LOGGED BY: AL | | _ | LETION DEPTH: 12.2 m | 040 | | |
| 7188 | emec ^o | | Winnipeg, Ma | | REVIEWED BY: RB Figure No. 8 | | COMP | COMPLETION DATE: August 21, 2013 | | | |
| # | | 1 | | | ı ıgul e INU. U | | 1 | Pa | ge 1 of 1 | | |

| Р | ROJI | ECT: Prairie Industrial Pa | rk | | DRILLED BY: Maj | | | | | BORE HOLE NO: P01 | | |
|--|-----------------------|--|----------|----------|--|--|---------------------------------|-------------|-----------------------|---------------------------|---|--|
| С | LIEN | IT: Terracon Developmen | ts | | DRILL TYPE: Trac | ck Mounted [| DR150 | | PROJ | ECT NO: WX17188 | | |
| L | OCA ⁻ | TION: Winnipeg, Manitob | а | | DRILL METHOD: | 125mm Solid | d Stem Augers | | ELEV | ATION: | | |
| S | AMP | LE TYPE Shelt | y Tube | | ✓ No Recovery SPT (N | l) | Grab Sample | | ∏Split-Pe | | | |
| В | ACK | FILL TYPE Bento | onite | | Pea Gravel Drill Cu | uttings | Grout | \square | Slough | Sand | | |
| | Depth (m) | ■ UNCONFINED COMPRESSION (k 100 200 300 400 ■ POCKET PENETROMETER (kPx 100 200 300 400 PLASTIC M.C. LIQUIE 20 40 60 80 | L SYMBOL | MUSCS | | DIL RIPTION | | SAMPLE TYPE | SAMIPLE NO SPT (N) | COMMENTS | Depth (m) | |
| - (- - - - |) | | | OR CH | SURFACE ORGANICS (Moss) - CLAY -silty, trace organics, trace mottled grey and dark grey | rootlets, high | | | 1 | | - | |
| - - - - - - - - - | 1 | | | ML | - stiff, greyish brown, frequent silt rootlets below 0.8m SILT - trace clay, low plastic, moi occasional oxide inclusions below CLAY - silty, high plastic, moist, sto frequent silt inclusions, occasional oxide inclusional oxide inclus | st, firm to soft, v 0.9m stiff to very stiff | tan-brown, , brown, occasional | | 4 | | - -1 - - - - | |
| - - - - - - | 2 | | | | - firm, occasional silty inclusions | | JS10115 | | 5 | | _2 2 | |
| - - - - - - - - - - | 3 | | | | | | | | 6 | | 3 | |
| - - - - - - - - - - - | 1 | | | | | | | | 7 | | -4 4 | |
| CHNICAL REVISED) | | | | CH | - soft, grey below 6.4m | | | | 3 | | 5 6 | |
| GPJ 13/09/24 09:15 AM (GEOTE | | | | | | | | | 9 | | 7 8 | |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK GPJ 13/09/24 09:15 AM (GEOTECHNICAL | | | | | TEST HOLE TERMINATED AT 9 NOTES: No sloughing or seepage was enhole remained open to 9.1m and drilling. Test hole was backfilled was | countered duri | ng drilling. Test completion of | | 0 | | - - - - - - - - - - - - - - - - - - - | |
| TERF | | | A 8.47 | | | LOGGE | D BY: AL | | COMPL | LETION DEPTH: 9.1 m | 1 | |
| 88 | | mer | AMI | | nvironment & Infrastructure Winnipeg, Manitoba | REVIEW | /ED BY: RB | | | ETION DATE: August 21, 20 | | |
| 17188 | AMEC Environm Winnipe | | | | pcg, maintoba | Figure N | lo. 9 | | | Page | e 1 of 1 | |

| PROJ | ECT: Prairie Industrial I | Park | DRILLED BY | DRILLED BY: Maple Leaf Drilling Ltd. | | | BORE HOLE NO: P02 | | |
|---|---|------------|---|---|--|-------------|----------------------|--|-------------------|
| CLIEN | NT: Terracon Developm | nents | DRILL TYPE | : Track Mounte | d DR150 | | PROJ | ECT NO: WX17188 | |
| LOCA | TION: Winnipeg, Manit | oba | | | olid Stem Augers | | ELEV | ATION: | |
| SAMF | PLE TYPE St | helby Tube | No Recovery | SPT (N) | Grab Sample | | ∭Split-Pe | | |
| BACK | | entonite | Pea Gravel | Drill Cuttings | Grout | [| Slough | Sand | |
| Depth (m) | POCKET PENETROMETER 100 200 300 PLASTIC M.C. LIQ | 400 | DE | SOIL SCRIPTION | N | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) |
| - 0 - | | OR CH | SURFACE ORGANICS (M CLAY -silty, high plastic, n | noist, stiff, mottled | grey and dark grey | | 1 | | - |
| Ē | | | SILT - trace clay, low plast | | | | 2 | | Ē, |
| - I | | | CLAY -silty, high plastic, n occasional oxide inclusion | noist, stiff to very s s, occasional sulfa | tiff, greyish brown, ite inclusions | | 3 | | |
| -2 - - - - - | | | | | | | 4 | | <u>-2</u> |
| -3 3 | | - | - firm to stiff, brown below | 3.0m | | | 5 | | 3 |
| -4 -4 - - - | | | - occasional silt inclusions | below 4.6m | | | 6 | | -4 4 |
| - - - - - - - - - - - - - - - - - - - | | СН | | | | | | | - -5 - - |
| CHNICAL REVISE | | | - soft, grey below 6.4m | | | | 7 | | - -6 - |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPU 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17.188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPU 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17.188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPU 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17.188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPU 13/09/24 09:15 AM (GEOTECHNICAL REVISED) | | | | | | | 8 | | -7 7 |
| TRIAL PARK.GPJ 13/0 | | | TEST HOLE TERMINATE | D AT Q 1m REI (1) | N EXISTINIC CDADE | | 9 | | 9 |
| - ST BONIFACE INDUS | | | NOTES: No sloughing or seepage whole remained open to 9.1 drilling. Test hole was back | was encountered om and was dry up | during drilling. Test on completion of | | | | 10 |
| NO. | | | | | | | | | Ē |
| <u></u> 11 | | | | 100 | GED BY: AL | | COMDI | ETION DEPTH: 9.1 m | <u> </u> |
| 11 - 8 | <u>mec[©]</u> | AMEC Env | rironment & Infrastruc | MILIPA | EWED BY: RB | | | ETION DEPTH. 9.1111 ETION DATE: August 21, 20 | 13 |
| 1718 | | Wi | innipeg, Manitoba | | e No. 10 | | 1 | | 1 of 1 |

| PRO | JECT: Prairie Industrial P | ark | | DRILLED BY: Maple Leaf Drilling Ltd. | | | BORE HOLE NO: P03 | | |
|--|---|--------------------|--|---|---|-------------|----------------------|---------------------------|----------------|
| CLIE | NT: Terracon Developme | nts | | DRILL TYPE: Track N | Mounted DR150 | | PROJ | ECT NO: WX17188 | |
| | ATION: Winnipeg, Manito | ba | | DRILL METHOD: 125 | | | | ATION: | |
| SAM | PLE TYPE She | elby Tube | No Recove | <u> </u> | Grab Sam | | ∭Split-P€ | | |
| BACI | KFILL TYPE Ber | ntonite | Pea Gravel | Drill Cuttin | gs Grout | [| Slough | Sand | |
| Depth (m) | ▲ UNCONFINED COMPRESSION 100 200 300 4(■ POCKET PENETROMETER (k 100 200 300 4(PLASTIC M.C. LIQU 20 40 60 8 | Pa) ID SOIL SYMBOL | | SOIL DESCRIP | TION | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) |
| - 0 | | OF | | ORGANICS (Moss) - ~25 | | | 1 | | - |
| - | · · · · · · · · · · · · · · · · · · · | | CLAY - silty, | , high plastic, moist, stiff, | greyish brown | | 2 | | E |
| -1 -1 2 2 | | | 1.5m | silt inclusions, occasional | | N = | 3 | | 1 |
| <u>-</u> 3 | | | firm brown | a bolow 2 Om | | | 5 | | _3 |
| 4 | | CH | | n below 3.0m | ons below 4.6m | | 6 | | 4 4 5 |
| AM (GEOTECHNICAL REVISED | | | - grey, soft, l | no oxide inclusions belov | v 6.7m | | 7 | | -6 7 |
| RIAL PARK.GPJ 13/09/24 09:16 | | | | | | | 9 | | |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL | | | NOTES: No sloughing hole remains | E TERMINATED AT 9.1m g or seepage was encou ed open to 9.1m and was t hole was backfilled with | ntered during drilling. Tes dry upon completion of auger cuttings and bento | st | | | |
| 荆 | | AMEC | Environment | & Infrastructure | LOGGED BY: AL | | | ETION DEPTH: 9.1 m | 40 |
| 17188 | emec [©] | | Winnipeg, N | | REVIEWED BY: RB Figure No. 11 | | COMPL | ETION DATE: August 21, 20 | 13 e 1 of 1 |
| 7 | | 1 | | | i igui e i vo. I i | | 1 | raye | ו וט ו |

| PR | ROJ | IECT: Prairie Industrial Pa | rk | | DRILLED BY: Maple I | DRILLED BY: Maple Leaf Drilling Ltd. | | | BORE HOLE NO: P04 | | |
|---|-----------------------|--|----------|----------------|--|---|-------------|----------------------|----------------------------|-------------------------|--|
| _ | | NT: Terracon Developmen | | | DRILL TYPE: Track M | | | + | PROJECT NO: WX17188 | | |
| | | TION: Winnipeg, Manitob | | | | mm Solid Stem Augers | | | ATION: | | |
| _ | | _ | y Tube | | No Recovery SPT (N) | Grab Sample | | Split-Pe | | | |
| BA | CK | FILL TYPE Bento | | 1 | Pea Gravel Drill Cutting | s Grout | [| Slough | Sand | | |
| (m) 44000 | Deptn (m) | ■ UNCONFINED COMPRESSION (k 100 200 300 400 ■ POCKET PENETROMETER (kPx 100 200 300 400 PLASTIC M.C. LIQUID 20 40 60 80 | L SYMBOL | MUSCS | SOIL DESCRIP | | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) | |
| - 0 - - - - - - 1 | | | | OR CH ML | SURFACE ORGANICS (Moss) - ~25r CLAY - silty, trace rootlets, trace orga very stiff, dark brownish grey - greyish brown, occasional sulfate in SILT - trace clay, low plastic, damp, fi | nics, medium plastic, moist, clusions below 0.8m riable, crumbly, light brown t | | 1 2 3 4 | | <u>-</u> 1 | |
| -2 | | | | | tan, occasional sulfate and occasional CLAY - silty, high plastic, moist, very occasional sulfate and occasional silt - frequent silt layers (~25mm thick), fi 1.5m and 1.m - stiff, brown, frequent silty and frequent 2.3m | stiff, greyish brown, inclusions rm to stiff, brown between | | 6 | | -2 | |
| -3 - - - - - - - - - - - | | | | | - firm, occasional silt and occasional soxidation inclusions below 3.0m | sulfate, and occasional | | 7 | | -3 - - - -4 | |
| 5 | | | | СН | - no sulfate inclusions below 4.6m | | | 8 | | 5 | |
| SEOTECHNICAL REVISED | | | | | | | | 9 | | -6 | |
| ARK.GPJ 13/09/24 09:15 AM (G | | | | | - grey, soft below 7.0m | | | 10 | | 8 | |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL) | | | | | TEST HOLE TERMINATED AT 9.1m NOTES: No sloughing or seepage was encour hole remained open to 9.1m and was drilling. Test hole was backfilled with a | itered during drilling. Test dry upon completion of | | 11 | | | |
| # <u>'</u> | | | A RAF | | nvironment 9 Infrastructure | LOGGED BY: AL | | COMPL | ETION DEPTH: 9.1 m | | |
| 17188 - | | mer | AWI | | nvironment & Infrastructure Winnipeg, Manitoba | REVIEWED BY: RB | | COMPL | ETION DATE: August 21, 020 | | |
| [7] | AMEC Environm Winnipe | | | | | Figure No. 12 | | | Page | e 1 of 1 | |

| TEST HOLE TERMINATED AT 6.1m BELOW EXISTING GRADE TO THE STANDE TERMINATED AT 6.1m BELOW EXISTING THE STANDE TERMINATED AT 6.1m BELOW EXISTING THE STANDE TERMINATED AT 6.1m BE | PRC | DJECT: Prairie Industrial Pa | | DRILLED BY: Maple Leaf Drilling Ltd. | | | E | BORE HOLE NO: RD01 | | | | |
|--|--------------|--|------------------|--|---|--|--|--------------------|----------------------------|-----------|--------------------------|----------------------------|
| SAME I TYPE BACKFILL | CLIE | NT: Terracon Developme | nts | | DRILL TYP | E: Track Mo | unted DR150 | | F | PROJE | ECT NO: WX17188 | |
| BACKFILL TYPE Description | LOC | ATION: Winnipeg, Manitol | ра | | DRILL MET | HOD: 125m | m Solid Stem Aug | gers | E | ELEVA | ATION: | |
| ANADONESCONTESSOURISM A SE SOLUTION PASTIC MC DOUD O | SAM | IPLE TYPE She | lby Tube | ✓ No Reco | very | SPT (N) | Grab Sa | ample | | Split-Per | | |
| SOIL DESCRIPTION PASTO MC DOUD NO 40 80 80 80 80 80 80 80 80 80 80 80 80 80 | BAC | KFILL TYPE Ben | tonite | Pea Grav | rel 🛮 | Drill Cuttings | Grout | | | Slough | Sand | |
| SURFACE ORGANIC SLAV - 25mm thick organics, moist, dark grey Start, dark grey CH - 2 - 2 - 3 - 4 - 3 - 3 - 4 - 3 - 3 - 3 - 4 - 3 - 3 | Depth (m) | POCKET PENETROMETER (kF 100 200 300 40 | Pa) ■ OSIT SAMB(| NOON NOON NOON NOON NOON NOON NOON NOO | DE | | ION | SAMPLE TYPE | SAMPLE NO | SPT (N) | COMMENTS | Depth (m) |
| AMEC Environment & Infrastructure Winnipeg, Manitoba LOGGED BY: AL REVIEWED BY: RB COMPLETION DEPTH: 6.1 m REVIEWED BY: RB Figure No. 13 Page 1.0 | REVISED) | | | TEST HOI NOTES: No slough hole rema | ty, trace organicy from the comment of the comment | ED AT 6.1m BE was encounte 1m and was dr | ELOW EXISTING Gred during drilling. Tyupon completion of the second seco | RADE | 2 3 4 5 6 7 | | | - - - - - - |
| THOUGHOUTH THE PROPERTY OF THE | 17188 - TERF | AMEC Environmer Winnipeg, | | | | cture | | 3 | _ | | ETION DATE: July 11, 20° | 3 age 1 of 1 |

| PROJ | IECT: Prairie Industrial | l Park | DRILLED | DRILLED BY: Maple Leaf Drilling Ltd. | | | BORE HOLE NO: RD02 | | |
|--|--|-------------|--|--|--|--------------------------|--------------------|---|-----------|
| CLIEN | NT: Terracon Developr | ments | DRILL TY | PE: Track Mounte | ed DR150 | | PROJ | ECT NO: WX17188 | |
| LOCA | TION: Winnipeg, Man | nitoba | | ETHOD: 125mm S | | | ELEV | ATION: | |
| SAMP | PLE TYPE : | Shelby Tube | No Recovery | SPT (N) | Grab Sample | | Split-Pe | | |
| BACK | | Bentonite | Pea Gravel | Drill Cuttings | Grout | \square | Slough | Sand | |
| Depth (m) | ■ UNCONFINED COMPRESSI 100 200 300 ■ POCKET PENETROMETEI 100 200 300 PLASTIC M.C. L. 20 40 60 | | | SOIL DESCRIPTIO | N | SAMPLE TYPE SAMPLE NO | SPT (N) | COMMENTS | Depth (m) |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 8 | | CI | GRGANIC CLAY - silty grey CLAY - silty, trace orga moist, stiff, greyish bro - brown, occasional silt | ATED AT 3.1m BELO ge was encountered 3.1m and was dry up | W EXISTING GRADE during drilling. Test on completion of | 1 2 3 4 5 6 7 8 8 8 | | | |
| 17188 - TER | mec | AMEC | Environment & Infrast Winnipeg, Manitoba | REV | GED BY: AL EWED BY: RB e No. 14 | | | ETION DEPTH: 3.1 m ETION DATE: July 11, 2013 Page | 1 of 1 |

| PRO | OJECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple I | DRILLED BY: Maple Leaf Drilling Ltd. | | | BORE HOLE NO: RD03 | | |
|--|--|-------------|-------|---|---|--------------------|----------------------|---------------------------|------------|--|
| CLIE | ENT: Terracon Developmer | nts | | DRILL TYPE: Track N | Nounted DR150 | | PROJ | ECT NO: WX17188 | | |
| LOC | CATION: Winnipeg, Manitob | oa | | DRILL METHOD: 125 | mm Solid Stem Aug | | | ATION: | | |
| SAN | MPLE TYPE Shell | by Tube | | ✓ No Recovery SPT (N) | Grab Sa | | ∭Split-Pe | | | |
| BAC | | tonite | | Pea Gravel Drill Cutting | s Grout | [| Slough | Sand | | |
| Depth (m) | ▲ UNCONFINED COMPRESSION (I 100 200 300 40 | SOIL SYMBOL | MUSCS | SOIL DESCRIP | | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) | |
| - 0 | | | OR OH | SURFACE ORGANICS (Moss) - ~25r ORGANIC CLAY - silty, trace rootlets grey CLAY - silty, trace rootlets to 0.3m, hi grey to black - some silt and clay lenses ~15mm th SILT - trace clay, low plastic, moist to occasional oxidation inclusions CLAY - silty, high plastic, moist, firm to | and organics, moist, d gh plastic, moist, stiff, ick at 1.8m very moist, firm, tan-b | dark | 1 2 3 4 5 6 6 7 8 8 | | 1 1 | |
| RRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL | | | | - occasional silt inclusions below 4.6r TEST HOLE TERMINATED AT 6.1m NOTES: - no sloughing or seepage was encoundle remained open to 6.1m and was drilling. Test hole was backfilled with | BELOW EXISTING GF intered during drilling. dry upon completion o | RADE Test of | 9 10 COMPL | ETION DEPTH: 6.1 m | | |
| 88 - T | amac ^V | AME | | nvironment & Infrastructure Winnipeg, Manitoba | REVIEWED BY: RB | | | ETION DATE: July 11, 2013 | | |
| 17188 | AMEC Environme Winnipeg | | | wiiiiipeg, waiiitoba | Figure No. 15 | | | Page | 1 of 1 | |

| PROJ | OJECT: Prairie Industrial Park | | | | DRILLED BY: Maple | DRILLED BY: Maple Leaf Drilling Ltd. | | | BORE HOLE NO: RD04 | | |
|---|---|---|--------|-------|--|---|-------------|----------|---|-----------|--|
| CLIEN | NT: Terracon De | evelopment | S | | DRILL TYPE: Track N | Nounted DR150 | | PROJ | ECT NO: WX17188 | | |
| LOCA | TION: Winnipe | g, Manitoba | ì | | DRILL METHOD: 125 | mm Solid Stem Augers | | ELEV | ATION: | | |
| SAMP | PLE TYPE | Shelby | y Tube | | ☑ No Recovery ☑ SPT (N) | Grab Sample | | Split-Pe | | | |
| BACK | FILL TYPE | Bentor | nite | | Pea Gravel Drill Cutting | gs Grout | | Slough | Sand | | |
| Depth (m) | ■ UNCONFINED CO 100 200 ■ POCKET PENET 100 200 PLASTIC M 20 40 | 300 400 TROMETER (kPa) 300 400 I.C. LIQUID | | MUSCS | SOIL DESCRIP | | SAMPLE TYPE | SPT (N) | COMMENTS | Depth (m) | |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) | | | | CH ML | SURFACE ORGANICS (Moss) - ~25i ORGANIC CLAY - silty, trace rootlets grey CLAY - silty, trace organics and rootle moist, stiff, grey to dark grey SILT - some clay, low to medium plas - moist to very moist, firm to soft belo CLAY - silty, high plastic, moist, stiff, TEST HOLE TERMINATED AT 3.1m NOTES: - No sloughing or seepage was encountly remained open to 3.1m and was drilling. Test hole was backfilled with | and organics, moist, dark ets to 0.6m, high plastic, etic, moist, firm, tan-brown w 1.8m greyish brown BELOW EXISTING GRADE untered during drilling. Test dry upon completion of | | 2 | | | |
| 17188 - TERRA | me | | AMI | | nvironment & Infrastructure Winnipeg, Manitoba | LOGGED BY: AL REVIEWED BY: RB Figure No. 16 | | | ETION DEPTH: 3.1 m ETION DATE: July 11, 2013 Page | 1 of 1 | |

| PROJ | ECT: Prairie Industrial Pa | rk | DRILLED B | DRILLED BY: Maple Leaf Drilling Ltd. | | | BORE HOLE NO: RD05 | | |
|--|--|------------------|---|--|---|---|--------------------|---|--|
| CLIEN | NT: Terracon Developmen | ts | DRILL TYPI | E: Track Mount | ed DR150 | | PROJE | ECT NO: WX17188 | |
| LOCA | TION: Winnipeg, Manitob | а | | | Solid Stem Augers | | | ATION: | |
| SAMF | PLE TYPE Shelt | by Tube | | SPT (N) | Grab Sample | | Split-Pe | | |
| BACK | FILL TYPE Bento | | Pea Gravel | Drill Cuttings | Grout | | Slough | Sand | |
| Depth (m) | ■ UNCONFINED COMPRESSION (k 100 200 300 400 ■ POCKET PENETROMETER (kPz 100 200 300 400 PLASTIC M.C. LIQUID 20 40 60 80 | L SYMB(| | SOIL SCRIPTIO | | SAMPLE TYPE | SPT (N) | COMMENTS | Depth (m) |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) The state of t | | CF | CRGANIC CLAY - silty, tr grey CLAY - silty, trace organic moist, stiff, dark grey to b | ED AT 6.1m BELO e was encountere 1m and was dry up | W EXISTING GRADE d during drilling. Test con completion of | 1 1 2 3 3 4 4 5 6 6 7 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 | | | -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 - |
| 188 - TERRACC | mec | AMEC | Environment & Infrastru Winnipeg, Manitoba | REV | GED BY: AL IEWED BY: RB | | | ETION DEPTH: 6.1 m ETION DATE: July 11, 20 | |
| ₽ | | - - : | Figu | re No. 17 | | | ŀ | Page 1 of 1 | |

| PROJ | IECT: Prairie Industrial F | Park | DRILL | DRILLED BY: Maple Leaf Drilling Ltd. | | | BORE HOLE NO: RD06 | | |
|--|----------------------------|---|---|---|--|--------------------------|--------------------|---------------------------|-----------|
| CLIEN | NT: Terracon Developme | ents | DRILL | _ TYPE: Track Mount | ed DR150 | | PROJI | ECT NO: WX17188 | |
| LOCA | TION: Winnipeg, Manito | oba | DRILL | METHOD: 125mm | Solid Stem Augers | | ELEV | ATION: | |
| SAMP | PLE TYPE Sh | nelby Tube | ✓ No Recovery | SPT (N) | Grab Sample | |]Split-Pe | | |
| BACK | FILL TYPE Be | entonite | Pea Gravel | Drill Cuttings | Grout | | Slough | Sand | |
| Depth (m) | PLASTIC M.C. LIQ | (kPa) ■ W S S S S S S S S S S S S S S S S S S | | SOIL DESCRIPTIO | N | SAMPLE TYPE SAMPLE NO | SPT (N) | COMMENTS | Depth (m) |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK, GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK, GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK, GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) | | | TEST HOLE TERM NOTES: - No sloughing or shole remained oped drilling. Test hole v | MINATED AT 3.1m BELC seepage was encountere in to 3.1m and was dry u was backfilled with auger | organics, moist, dark astic, moist, stiff, dark ions below 0.6m OW EXISTING GRADE d during drilling. Test | 1 2 3 4 5 6 7 8 8 | | ETION DEPTH: 3.1 m | |
| 17188 - TE | mec | AMEC | Environment & Info Winnipeg, Manito | rastructure REV | /IEWED BY: RB | | | ETION DATE: July 11, 2013 | 1 of 1 |

| PRO | JECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple | DRILLED BY: Maple Leaf Drilling Ltd. | | | BORE HOLE NO: RD07 | | |
|--|--|-------------|----------|---|---|-------------|----------------------|----------------------------|---|--|
| CLIE | NT: Terracon Developmen | nts | | DRILL TYPE: Track N | Nounted DR150 | | PROJ | JECT NO: WX17188 | | |
| | ATION: Winnipeg, Manitob | ра | | DRILL METHOD: 125 | mm Solid Stem Auger | | | ATION: | | |
| SAM | PLE TYPE She | by Tube | | No Recovery SPT (N) | Grab Sam | | ∭Split-Po | | | |
| BAC | | tonite | | Pea Gravel Drill Cutting | gs Grout | [| Slough | Sand | | |
| Depth (m) | ▲ UNCONFINED COMPRESSION (100 200 300 40 ■ POCKET PENETROMETER (kF 100 200 300 40 PLASTIC M.C. LIQUI 20 40 60 86 | SOIL SYMBOL | MUSCS | SOIL DESCRIP | TION | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) | |
| _ 0 | | | OR OH | SURFACE ORGANICS (Moss) - ~25i ORGANIC CLAY - silty, trace rootlets grey CLAY - silty, trace rootlets to 0.3m, hi grey - dark greyish brown below 0.6m - brown, occasional sulphate inclusio - firm below 2.1m | and organics, moist, dar | | 1 2 3 4 5 6 6 7 | | - - - - - - - - - - - - - - - - - - - | |
| -3 3 | | | СН | - occasional to frequent sulphate incl | usions at 3.1m | | 8 | | - - - - - - - - - - - - - - - - - - - | |
| :15 AM (GEOTECHNICAL REVISED) | | | | - occasional sulphate inclusions belo | w 4.6m | | 9 | | 4 | |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL | | | | TEST HOLE TERMINATED AT 6.1m NOTES: - No sloughing or seepage was encount hole remained open to 6.1m and was drilling. Test hole was backfilled with | untered during drilling. To dry upon completion of | NDE est | 10 | | | |
| TER | ^ | ДМЕ | CF | nvironment & Infrastructure | LOGGED BY: AL | | | LETION DEPTH: 6.1 m | | |
| 17188 - | | | | Winnipeg, Manitoba | REVIEWED BY: RB | | COMPL | LETION DATE: July 11, 2013 | 1 -5 4 | |
| 1 | dillec Winnipe | | | · - | Figure No. 19 | | 1 | Page | 1 of 1 | |

| PROJ | IECT: Prairie Industri | ial Park | DRILLED BY: Ma | DRILLED BY: Maple Leaf Drilling Ltd. | | | BORE HOLE NO: RD08 | | |
|---|---|-------------|--|---|-------------|----------|---|-----------|--|
| CLIEN | NT: Terracon Develop | pments | DRILL TYPE: Tra | ack Mounted DR150 | | PROJE | ECT NO: WX17188 | | |
| LOCA | TION: Winnipeg, Ma | anitoba | DRILL METHOD: | 125mm Solid Stem Augers | | ELEVA | ATION: | | |
| SAMP | PLE TYPE | Shelby Tube | ✓ No Recovery SPT | <u> </u> | | Split-Pe | | | |
| BACK | FILL TYPE | Bentonite | Pea Gravel Drill (| Cuttings Grout | | Slough | Sand | | |
| Depth (m) | ■ UNCONFINED COMPRES 100 200 300 ■ POCKET PENETROMET 100 200 300 PLASTIC M.C. 20 40 60 | | | OIL RIPTION | SAMPLE TYPE | SPT (N) | COMMENTS # | Deptn (m) | |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) | | | NOTES: - No sloughing or seepage was hole remained open to 3.1m and drilling. Test hole was backfilled. | rootlets and organics, moist, dark rootlets to 0.3m, high plastic, and brown thick at 1.8m 3.1m BELOW EXISTING GRADE encountered during drilling. Test d was dry upon completion of l with auger cuttings and bentonite | | | -1 -2 -3 -5 -7 | | |
| 17188 - TE | mec | AMEC | Environment & Infrastructure Winnipeg, Manitoba | REVIEWED BY: RB Figure No. 20 | | | ETION DEPTH. 3.1 m ETION DATE: July 11, 2013 Page 1 o | of 1 | |

| PROJECT: Prairie Ind | ustrial Park | D | DRILLED BY: Maple Leaf Drilling Ltd. | | BORE HOLE NO: RD09 | | | |
|--|---------------------------------------|---|--|--|--------------------|----------|---|-----------|
| CLIENT: Terracon De | velopments | D | RILL TYPE: Track Mo | ounted DR150 | | | ECT NO: WX17188 | |
| LOCATION: Winnipeg | | | RILL METHOD: 125m | | | 1 | ATION: | |
| SAMPLE TYPE | Shelby Tube | No Recovery | | Grab Sample | | Split-Pe | | |
| BACKFILL TYPE | Bentonite | Pea Gravel | Drill Cuttings | Grout | | Slough | Sand | 1 |
| © PLASTIC M.C | 300 400 ROMETER (kPa) ■ 300 400 | MOSCS | SOIL DESCRIPT | | SAMPLE TYPE | SPT (N) | COMMENTS | Depth (m) |
| 4 CEONIFACE INDUSTRIAL PARK (GP.15 AM (GEOTECHNICAL REVISED) | | ORGANIC CL grey CLAY - silty, tr grey to grey, fr - soft to firm, grey to firm, occase - firm, mottled - soft to firm, comment - brown, occase - firm, mottled - greyish brow - soft to firm, comment - brown, occase - firm, mottled | dark greyish brown below 3.1m greyish brown below 0.6m t silt lenses ~25mm thick sional oxidation inclusion: grey and brown below 2.5mm below 3.1m dark greyish brown below 2.5mm g or seepage was encound open to 6.1mm and was designed to 6.1mm g or seepage was encound open to 6.1mm and was designed to 6.1mm and was design | nd organics, moist, dark n plastic, moist, firm, light n thick below 0.9m s below 1.2m 1m 5.9m ELOW EXISTING GRADE tered during drilling. Test | | 3 | | |
| amec | AME | Environment & Winnipeg, Ma | Intrastructure | LOGGED BY: AL REVIEWED BY: RB Figure No. 21 | | | LETION DEPTH: 6.1 m LETION DATE: July 11, 2013 Page | 1 of 1 |

| PROJ | JECT: Prairie Industrial P | ark | | DRILLED BY: Maple I | DRILLED BY: Maple Leaf Drilling Ltd. | | | BORE HOLE NO: RD10 | | |
|--|--|---|-----------|--|---|-------------|----------|----------------------------|------------|--|
| CLIEN | NT: Terracon Developme | ents | | DRILL TYPE: Track N | Nounted DR150 | | PROJ | ECT NO: WX17188 | | |
| LOCA | ATION: Winnipeg, Manito | ba | | DRILL METHOD: 125 | mm Solid Stem Augers | | ELEV | ATION: | | |
| SAMP | PLE TYPE She | elby Tube | | ✓ No Recovery SPT (N) | Grab Sample | | Split-Pe | | | |
| BACK | KFILL TYPE Ber | ntonite | | Pea Gravel Drill Cutting | gs Grout | | Slough | <u>∵</u> Sand | | |
| Depth (m) | POCKET PENETROMETER (k 100 200 300 4l PLASTIC M.C. LIQU | Pa) | MUSCS | SOIL DESCRIP | TION | SAMPLE TYPE | SPT (N) | COMMENTS & | Deptin (m) | |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK, GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK, GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK, GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) | | | OCH ML CH | SURFACE ORGANICS (Moss) - ~25r ORGANIC CLAY - silty, trace rootlets grey CLAY - silty, trace rootlets to 0.3m, hi greyish brown, occasional oxidation in - stiff below 0.9m - firm to stiff, frequent silt inclusions b SILT - trace clay, low plastic, very mo CLAY - silty, high plastic, moist, firm to - firm, brownish grey below 2.9m TEST HOLE TERMINATED AT 3.1m NOTES: - No sloughing was encountered during was observed below 1.7m below grace remained open to 3.1m and water levelow grade upon completion of drilling with auger cuttings and bentonite. | and organics, moist, dark gh plastic, moist, firm, nclusions elow 1.1m ist to wet, soft, tan-brown o stiff, greyish brown BELOW EXISTING GRADE ng drilling. Slight seepage le during drilling. Test hole el was measured at 1.7m | | | -1 -2 -3 -5 -6 | | |
| 17188 - TERI | mec | AME | | nvironment & Infrastructure Winnipeg, Manitoba | LOGGED BY: AL COMPLETION DEPTH: 3.1 m REVIEWED BY: RB COMPLETION DATE: July 11, 2013 Figure No. 22 Page | | | | of 1 | |

| PROJ | ECT: Prairie Industrial Pa | rk | D | DRILLED BY: Maple Leaf Drilling Ltd. | | | BORE | BORE HOLE NO: RD11 | | |
|---|--|----------|---|--|--|-------------|---------------------------|---------------------------|-----------|--|
| CLIEN | IT: Terracon Developmen | ts | | RILL TYPE: Track Mo | | | PROJ | ECT NO: WX17188 | | |
| | TION: Winnipeg, Manitob | а | | | nm Solid Stem Augers | | | ATION: | | |
| | _ | y Tube | No Recovery | SPT (N) | Grab Sample | | Split-Pe | | | |
| BACK | FILL TYPE Bento | | Pea Gravel | Drill Cuttings | Grout | 1 1 | Slough | Sand | 1 | |
| Depth (m) | ■ UNCONFINED COMPRESSION (k 100 200 300 400 ■ POCKET PENETROMETER (kPx 100 200 300 400 PLASTIC M.C. LIQUIE 20 40 60 80 | L SYMBOL | | SOIL DESCRIPT | ΓΙΟΝ | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) | |
| 100S1RAF FARX. 6FJ 1308/24 09: 19 AM (GEOTECHNICAL REVISED) 1 | | | ORGANIC CL grey CLAY - silty, to brown - brown below - stiff below 0. - occasional of SILT - trace of occasional sul - very moist to CLAY - silty, h silt inclusions - firm, greyish TEST HOLE 1 NOTES: - No sloughing was observed remained oper below grade u | race organics, high plast 0.6m 9m xidation below 1.2m ay, low plastic, moist, so phate and oxidation incli wet, soft below 1.8m igh plastic, moist, firm to brown below 3.1m TERMINATED AT 6.1m E g was encountered during below 1.8m below grade in to 6.1m and water leve pon completion of drilling | and organics, moist, dark ic, moist, firm, greyish ft to firm, tan-brown, | | 1 2 3 4 5 6 7 8 8 9 10 10 | | -1-23 | |
| | with auge | | | tings and bentonite. | | | | | - | |
| | | A 2450 | | Information of the | LOGGED BY: AL | | COMPL | ETION DEPTH: 6.1 m | | |
| | | | | Infrastructure | REVIEWED BY: RB | | | ETION DATE: July 11, 2013 | | |
| | amec | | Winnipeg, Ma | iiiUua | Figure No. 23 | | | Pag | e 1 of 1 | |

| PROJ | IECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple I | _eaf Drilling Ltd. | | BORE | HOLE NO: RD12 | |
|---|---|-------------|----------|--|---|-------------|---------------------------------|---|-----------|
| CLIEN | NT: Terracon Developme | nts | | DRILL TYPE: Track N | Nounted DR150 | | PROJ | ECT NO: WX17188 | |
| LOCA | TION: Winnipeg, Manitol | ра | | DRILL METHOD: 125 | mm Solid Stem Augers | | ELEV | ATION: | |
| SAMP | PLE TYPE She | lby Tube | | ✓ No Recovery SPT (N) | Grab Sample | | ∏Split-Pe | | |
| BACK | FILL TYPE Ben | tonite | | Pea Gravel Drill Cutting | gs Grout | | Slough | <u>::</u> Sand | |
| Depth (m) | ■ UNCONFINED COMPRESSION (100 200 300 40 ■ POCKET PENETROMETER (kF 100 200 300 40 PLASTIC M.C. LIQUI 20 40 60 80 | SOIL SYMBOL | MUSCS | SOIL DESCRIP | TION | SAMPLE TYPE | SPT (N) | COMMENTS | Depth (m) |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK,GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK,GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK,GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) | | | CH ML CH | SURFACE ORGANICS (Moss) - ~25r ORGANIC CLAY - silty, trace rootlets grey CLAY - silty, trace organics and rootle moist, firm, greyish brown - firm to stiff below 0.9m - stiff, brown below 1.2m - occasional sulphate and oxidation in - occasional to frequent oxidation and SILT - trace clay, low plastic, very modeline trace of the company of the compan | and organics, moist, dark ets to 0.3m, high plastic, nclusions below 1.5m I silt inclusions below 1.8m ist to wet, soft, tan-brown brown to tan, frequent silt BELOW EXISTING GRADE ng drilling. Slight seepage de during drilling. Test hole el was measured at 2.9m ng. Test hole was backfilled | | 1 2 3 3 4 4 5 5 6 6 7 7 8 8 9 9 | | |
| 17188 - TE. | mec | AME | | nvironment & Infrastructure Vinnipeg, Manitoba | LOGGED BY: AL REVIEWED BY: RB Figure No. 24 | | | ETION DEPTH: 3.1 m ETION DATE: July 11, 2013 Page | 1 of 1 |

| PROJEC | CT: Prairie Industrial Pa | ark | | DRILLED BY: Maple L | eaf Drilling Ltd. | | BORE | HOLE NO: RD13 | |
|---|--|-------------|-------|--|---|-------------|----------------------|---|---------------|
| CLIENT: | : Terracon Developme | nts | | DRILL TYPE: Track M | ounted DR150 | | PROJ | IECT NO: WX17188 | |
| LOCATION | ON: Winnipeg, Manitol | ра | | DRILL METHOD: 125 | mm Solid Stem Augers | | ELEV | ATION: | |
| SAMPLE | E TYPE She | lby Tube | | ☑ No Recovery ☑ SPT (N) | Grab Sample | | ∏Split-Pe | | |
| BACKFIL | LL TYPE Ben | tonite | | Pea Gravel Drill Cutting | s Grout | | Slough | Sand | |
| - 1 | NUNCONFINED COMPRESSION (100 200 300 40 ■ POCKET PENETROMETER (kF 100 200 300 40 PLASTIC M.C. LIQUI 20 40 60 88 | SOIL SYMBOL | MUSCS | SOIL DESCRIP | | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) |
| TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 8 1 | | | OH CH | SURFACE ORGANICS (Moss) - ~25m ORGANIC CLAY - silty, trace rootlets grey CLAY - silty, trace organic to 0.3m, hig dark grey - mottled grey and brown below 0.6m - stiff, brown below 0.9m - occasional oxidation and sulphate in - firm below 1.8m SILT - trace clay, low plastic, moist to CLAY - silty, high plastic, moist, firm to occasional silt inclusions TEST HOLE TERMINATED AT 6.1m In NOTES: - Very slight sloughing was encounter during drilling. Moderate seepage was below grade during drilling. Test hole water level was measured at 3.1m bel of drilling. Test hole was backfilled wit bentonite. | clusions below 1.5m SELOW EXISTING GRADE ed below 2.4m below grade closerved below 2.4m emained open to 5.8m and ow grade upon completion | | 1 | | -1-1-2-3 |
| 17188 - TERRAC | mec | AME | | nvironment & Infrastructure Winnipeg, Manitoba | LOGGED BY: AL REVIEWED BY: RB Figure No. 25 | | | ETION DEPTH: 6.1 m ETION DATE: July 11, 2013 Page | + e 1 of 1 |

| PROJ | IECT: Prairie Indus | strial Park | | DRILLED BY: Maple I | _eaf Drilling Ltd. | | BORE | HOLE NO: RD14 | |
|---|--|-------------|-------|--|---|-------------|----------|--|-----------|
| CLIEN | NT: Terracon Deve | elopments | | DRILL TYPE: Track M | Nounted DR150 | | PROJ | ECT NO: WX17188 | |
| LOCA | TION: Winnipeg, | Manitoba | | DRILL METHOD: 125 | mm Solid Stem Augers | | ELEV | ATION: | |
| SAMP | PLE TYPE | Shelby Tube | | ✓ No Recovery ✓ SPT (N) | Grab Sample | | Split-Pe | | |
| BACK | FILL TYPE | Bentonite | | Pea Gravel Drill Cutting | gs Grout | | Slough | Sand | |
| Depth (m) | ■POCKET PENETROI 100 200 3 PLASTIC M.C. | 500 400 | MUSCS | SOIL DESCRIP | | SAMPLE TYPE | SPT (N) | COMMENTS | Depth (m) |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) | | | CH CH | SURFACE ORGANICS (Moss) - ~25r ORGANIC CLAY - silty, trace rootlets grey CLAY - silty, trace organics and rootle moist, firm, grey to dark grey - greyish brown, occasional oxidation - firm to stiff below 0.9m - stiff below 1.2m - brown below 1.5m SILT - some clay, low to medium plas CLAY - silty, high plastic, moist, stiff, and oxidation inclusions - firm to stiff, greyish brown below 2.7 TEST HOLE TERMINATED AT 3.1m NOTES: - No sloughing or seepage was encountly remained open to 3.1m and was drilling. Test hole was backfilled with a silting or seepage. | and organics, moist, dark ets to 0.3m, high plastic, inclusions below 0.6m etic, moist, firm, tan-brown tan-brown, occasional silt m BELOW EXISTING GRADE untered during drilling. Test dry upon completion of | | 3 | ETION DEPTH: 3.1 m | 1 |
| 17188 - T | mec | AM | | nvironment & Infrastructure Winnipeg, Manitoba | REVIEWED BY: RB Figure No. 26 | | | ETION DET 111: 3.1111 ETION DATE: July 11, 2013 Page 1 | of 1 |

| PROJ | JECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple L | eaf Drilling Ltd. | | BORE | HOLE NO: RD15 | |
|---|---|------------|-------|--|---|---|----------|---|---|
| CLIEN | NT: Terracon Developmer | nts | | DRILL TYPE: Track M | lounted DR150 | | PROJ | ECT NO: WX17188 | |
| LOCA | ATION: Winnipeg, Manitob | ра | | DRILL METHOD: 125 | mm Solid Stem Augers | | ELEV | ATION: | |
| SAMF | PLE TYPE Shel | lby Tube | | ✓ No Recovery SPT (N) | Grab Sample | | Split-Pe | | |
| BACK | FILL TYPE Bent | tonite | | Pea Gravel Drill Cutting | s Grout | | Slough | Sand | |
| Depth (m) | ▲ UNCONFINED COMPRESSION (I 100 200 300 40) ■ POCKET PENETROMETER (kF 100 200 300 40) PLASTIC M.C. LIQUII 20 40 60 80 | TORWAS NOS | MUSCS | SOIL DESCRIP | | SAMPLE TYPE | SPT (N) | COMMENTS | Depth (m) |
| OTECHNICAL REVISED) | | | CH CH | SURFACE ORGANICS (Moss) - ~25r ORGANIC CLAY - silty, trace rootlets grey CLAY - silty, trace organics and rootle moist, stiff, grey to dark grey - greyish brown, occasional oxidation SILT - some clay, low plastic, moist, fi CLAY - silty, high plastic, moist, stiff, ginclusions - stiff to very stiff below 1.8m - firm to stiff, dark greyish brown below - abundant silt lenses ~20mm thick, m | and organics, moist, dark ets to 0.3m, high plastic, inclusions below 0.9m rm, tan-brown greyish brown, occasional silt | 1 1 2 2 3 3 4 4 4 5 5 6 6 6 7 7 7 7 8 8 8 8 8 8 8 8 8 8 8 8 8 | | | |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL) | | | | - grey to dark grey below 5.9m TEST HOLE TERMINATED AT 6.1m NOTES: - No sloughing or seepage was encoun hole remained open to 6.1m and was drilling. Test hole was backfilled with a | intered during drilling. Test dry upon completion of auger cuttings and bentonite. | 1 | | ETION DEDTH: 6.1 m | -5 - |
| " | | AMI | | nvironment & Infrastructure | LOGGED BY: AL REVIEWED BY: RB | | | ETION DEPTH: 6.1 m ETION DATE: July 11, 2013 | |
| 17188 | <u>mec[©]</u> | | | Winnipeg, Manitoba | Figure No. 27 | | OOIVII"L | • | 1 of 1 |

| PROJ | IECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple I | _eaf Drilling Ltd. | | BORE | HOLE NO: RD16 | |
|---|---|------------|----------|---|---|-------------|---|---|-----------|
| CLIEN | NT: Terracon Developmer | nts | | DRILL TYPE: Track M | Nounted DR150 | | PROJ | ECT NO: WX17188 | |
| LOCA | ATION: Winnipeg, Manitob | oa | | DRILL METHOD: 125 | mm Solid Stem Augers | | ELEV | ATION: | |
| SAMP | PLE TYPE Shell | by Tube | | ☑ No Recovery ☑ SPT (N) | Grab Sample | | ∏Split-Pe | | |
| BACK | (FILL TYPE Bent | tonite | | Pea Gravel Drill Cutting | gs Grout | | Slough | <u>:::</u> Sand | |
| Depth (m) | ■ POCKET PENETROMETER (kF 100 200 300 40) ■ POCKET PENETROMETER (kF 100 200 300 40) PLASTIC M.C. LIQUII 20 40 60 80 | TORWAS NOS | MUSCS | SOIL DESCRIP | TION | SAMPLE TYPE | SPT (N) | COMMENTS | Depth (m) |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) | | | OR OH CH | SURFACE ORGANICS (Moss) - ~25r ORGANIC CLAY - silty, trace rootlets grey CLAY - silty, trace sand, high plastic, tan and grey, frequent silt inclusions SILT - clayey, low to medium plastic, CLAY - silty, high plastic, moist, stiff, inclusions - occasional silt inclusions below 1.2n - frequent silt lenses ~5mm thick at 1 brown, occasional oxidation inclusion - firm, greyish brown below 2.9m TEST HOLE TERMINATED AT 3.1m NOTES: - No sloughing or seepage was encountly remained open to 3.1m and was drilling. Test hole was backfilled with a silt inclusion. | and organics, moist, dark moist, soft to firm, mottled moist, soft to firm, tan-brown greyish brown, frequent silt n .5m ns below 1.8m BELOW EXISTING GRADE untered during drilling. Test dry upon completion of | | 1 2 2 3 3 4 4 5 5 6 5 7 7 3 3 3 4 4 4 5 5 6 6 7 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | | |
| 17188 - TER | mec | AMI | | nvironment & Infrastructure Winnipeg, Manitoba | LOGGED BY: AL REVIEWED BY: RB Figure No. 28 | | | ETION DEPTH: 3.1 m ETION DATE: July 11, 2013 Page | 1 of 1 |

| PROJ | ECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple I | eaf Drilling Ltd. | | BOR | E HOLE NO: RD17 | |
|---|--|-------------|-------|---|--|-------------|-----------------------|---|---|
| - | NT: Terracon Developmer | | | DRILL TYPE: Track M | | | | JECT NO: WX17188 | |
| | TION: Winnipeg, Manitob | | | | mm Solid Stem Augers | | | VATION: | |
| | <u></u> | by Tube | | No Recovery SPT (N) | Grab Sample | | Split-l | | |
| BACK | FILL TYPE Bent | tonite | | Pea Gravel Drill Cutting | s Grout | | Sloug | h Sand | 1 |
| Depth (m) | ■ UNCONFINED COMPRESSION (I 100 200 300 40 | SOIL SYMBOL | MUSCS | SOIL DESCRIP | TION | SAMPLE TYPE | SAMPLE NO | COMMENTS | Depth (m) |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK, GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 8 | | | CH | SURFACE ORGANICS (Moss) - ~25r ORGANIC CLAY - silty, trace rootlets grey CLAY - silty, trace organics lenses ~5 plastic, moist, firm to stiff, mottled bro - some organics at 0.6m - stiff, brown below 0.9m - greyish brown below 1.2m - occasional sulphate inclusions below - firm, dark greyish brown below 3.1m TEST HOLE TERMINATED AT 6.1m NOTES: - No sloughing or seepage was encount hole remained open to 6.1m and was drilling. Test hole was backfilled with a drilling. Test hole was backfilled with a drilling. | and organics, moist, dark imm thick to 0.3m, high wn to dark grey v 1.8m BELOW EXISTING GRADE untered during drilling. Test dry upon completion of | | 1 2 3 4 5 6 7 8 8 9 9 | | -1 -111 |
| 17188 - TERRA | mec | AME | | nvironment & Infrastructure Winnipeg, Manitoba | LOGGED BY: AL REVIEWED BY: RB Figure No. 29 | | | PLETION DEPTH: 6.1 m PLETION DATE: July 11, 2013 Page | 1 of 1 |

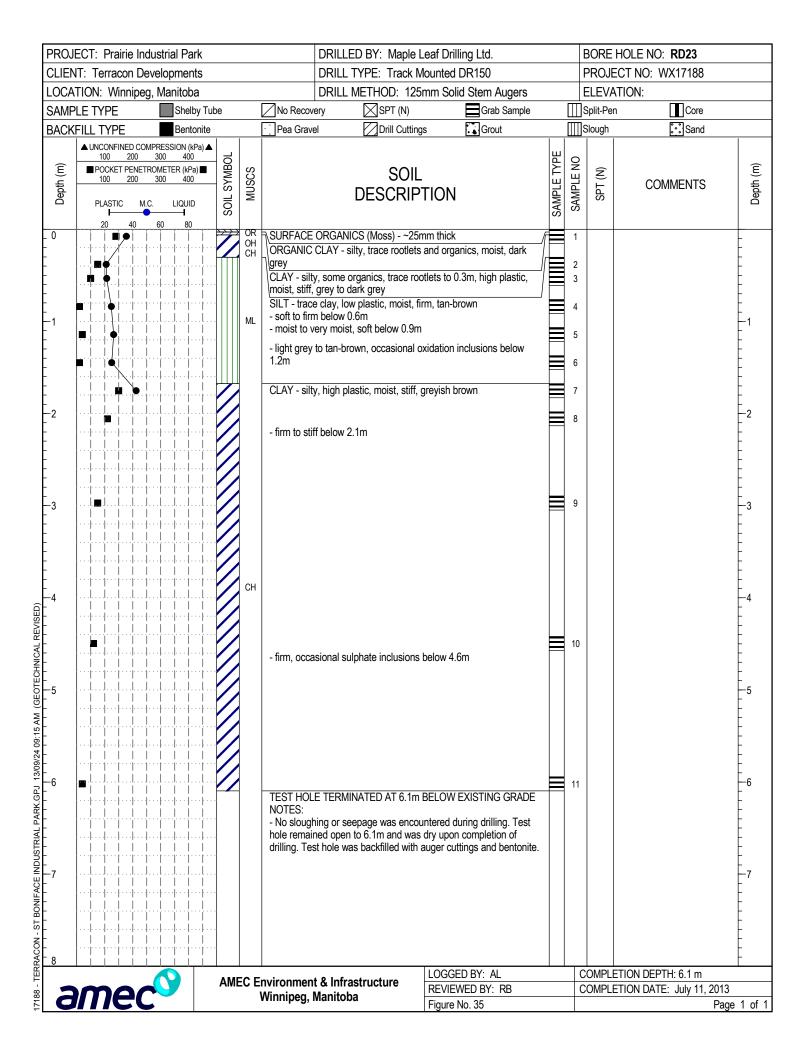
| PROJ | IECT: Prairie Industrial | Park | | DRILLED BY: Maple L | eaf Drilling Ltd. | | BORE | HOLE NO: RD18 |
|---|-----------------------------------|------------|-------|--|---|-------------|----------|--|
| CLIEN | NT: Terracon Developm | nents | | DRILL TYPE: Track M | lounted DR150 | | PROJ | ECT NO: WX17188 |
| LOCA | ATION: Winnipeg, Manit | toba | | DRILL METHOD: 125 | mm Solid Stem Augers | | ELEV | ATION: |
| SAMP | PLE TYPE S | helby Tube | | ✓ No Recovery SPT (N) | Grab Sample | | Split-Pe | |
| BACK | (FILL TYPE | entonite | [| Pea Gravel Drill Cutting | s Grout | | Slough | Sand |
| Depth (m) | ■ POCKET PENETROMETER 100 200 300 | 400 | MUSCS | SOIL DESCRIP | | SAMPLE TYPE | SPT (N) | COMMENTS (E) |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) | | | OR E | SURFACE ORGANICS (Moss) - ~25r ORGANIC CLAY - silty, trace rootlets grey CLAY - silty, trace organics to 0.3m, r stiff, grey to dark grey - brown, occasional oxidation inclusio - stiff below 0.9m - very stiff, occasional to frequent oxid - mottled tan and brown, occasional to oxidation inclusions below 1.8m SILT - trace clay, low plastic, moist, st occasional oxidation inclusions CLAY - silty, high plastic, moist, stiff, g TEST HOLE TERMINATED AT 3.1m NOTES: - No sloughing was encountered durir was observed below 1.7m below grad remained open to 3.1m and water lev below grade upon completion of drillir with auger cuttings and bentonite. | and organics, moist, dark high plastic, moist, firm to his below 0.6m dation inclusions below 1.5m his frequent sulphate and hoft to firm, tan-brown, greyish brown BELOW EXISTING GRADE high drilling. Slight seepage le during drilling. Test hole le was measured at 1.7m | | 22 | = -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 |
| 17188 - 1 | mec [©] | AME | | vironment & Infrastructure Vinnipeg, Manitoba | REVIEWED BY: RB Figure No. 30 | | | ETION DATE: July 11, 2013 Page 1 of |

| PRO | JECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple I | Leaf Drilling Ltd. | | BOR | E HOLE NO: RD19 | |
|--|--|-------------|-------|---|---|-------------|----------------------|----------------------------|---|
| CLIE | NT: Terracon Developmen | nts | | DRILL TYPE: Track N | Nounted DR150 | | PRO | JECT NO: WX17188 | |
| | ATION: Winnipeg, Manitob | oa | | DRILL METHOD: 125 | mm Solid Stem Auge | | | /ATION: | |
| SAM | PLE TYPE Shell | by Tube | | ✓ No Recovery SPT (N) | Grab Sam | | Split-F | | |
| BAC | | tonite | _[| Pea Gravel Drill Cutting | gs Grout | | Slough | n Sand | 1 |
| Depth (m) | ▲ UNCONFINED COMPRESSION (I 100 200 300 40 ■ POCKET PENETROMETER (kF 100 200 300 40 PLASTIC M.C. LIQUI 20 40 60 80 | SOIL SYMBOL | MUSCS | SOIL DESCRIP | TION | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) |
| _ 0 - - - - - - - - 1 - - - - - - - - - - | | | OR E | SURFACE ORGANICS (Moss) - ~25i ORGANIC CLAY - silty, trace rootlets grey CLAY - silty, some organics to 0.3m, grey to brown - stiff, greyish brown below 0.6m - brown below 1.2m - brown to light brown, occasional silt | and organics, moist, da | | 1 2 3 4 5 6 | | - - - - - - - - - - - - - - - - - - - |
| 2 2 | | | | | | | 7 | | 2 |
| REVISED) | | | CH | - firm, greyish brown below 3.1m | | | | | - - - - - - - - - - - - - - - - - - - |
| 13/09/24 09:15 AM (GEOTECHNICAL | | | | - grey, occasional sulphate inclusions | s below 4.6m | | 9 | | - - - - - - - - - - - - - - - - - - - |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL | | | | TEST HOLE TERMINATED AT 6.1m NOTES: - No sloughing or seepage was encound hole remained open to 6.1m and was drilling. Test hole was backfilled with | untered during drilling. T dry upon completion of auger cuttings and bent | est | 10 | | 6 |
| TER | | AME | C Er | nvironment & Infrastructure | LOGGED BY: AL | | | LETION DEPTH: 6.1 m | |
| 17188 - | emec [©] | | | Vinnipeg, Manitoba | REVIEWED BY: RB Figure No. 31 | | COMP | LETION DATE: July 11, 2013 | 1 of 1 |
| | | 1 | | | 1 | | 1 | i ago | |

| PROJ | ROJECT: Prairie Industrial Park LIENT: Terracon Developments DCATION: Winnipeg, Manitoba | | | | | | DRIL | LED BY: Maple I | Leaf Drilling Lt | d. | | BORI | HOLE NO: RD20 | |
|---|--|----------------------------|--------------------------------------|------------------------------------|-------------|------------|--|---|--|--|-------------|----------|---|---|
| CLIEN | NT: Terrac | on Deve | elopme | ents | | | DRIL | L TYPE: Track N | Nounted DR15 | 0 | | PRO | JECT NO: WX17188 | |
| LOCA | TION: Wi | nnipeg, l | Manito | ba | | | DRIL | L METHOD: 125 | | | | ELEV | 'ATION: | |
| SAMP | PLE TYPE | | She | elby Tu | ıbe | | No Recovery | SPT (N) | | Grab Sample | | ∏Split-P | | |
| BACK | FILL TYPE | Ē | Ber | ntonite | | | Pea Gravel | Drill Cutting | gs 🖫 (| Grout | \Box | Slough | Sand | |
| Depth (m) | ▲UNCONFIN 100 ■ POCKET 100 PLASTIC 1-20 | 200 3 PENETROI 200 3 | 800 41 METER (k 800 41 LIQU | 00 :Pa) ■ 00 | SOIL SYMBOL | MUSCS | | SOIL DESCRIP | | | SAMPLE TYPE | SPT (N) | COMMENTS | Depth (m) |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) | | | | | | CH CH | ORGANIC CLAY grey CLAY - silty, trace greyish brown, occasional rootl - brown, occasion - occasional to free 1.7m - firm below 2.7m TEST HOLE TER NOTES: - No sloughing or hole remained op drilling. Test hole | al sulphate and oxicequent silt lenses ~1 | and organics, r nigh plastic, mo nclusions dation inclusions Omm thick betw BELOW EXIST untered during of | ist, stiff, s below 1.5m ween 1.5m to ING GRADE drilling. Test letion of and bentonite. | | 7 | Hydrometer Analysis Results @ "1.1m": Gravel= 0.0% Sand= 0.5% Silt= 16.5% Clay= 83.0% | -1 -1 -2 -3 -4 1 5 6 |
| 17188 - T | AMEC Environme Winnipeg | | | nvironment & In Winnipeg, Manit | | REVIEWED E | SY: RB | | | LETION DATE: July 11, 2013 | e 1 of 1 | | | |

| PROJI | ECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple L | eaf Drilling Ltd. | | BORE | HOLE NO: RD21 | |
|---|--|------------|-------|--|---|-------------|-------------------------|---|-----------|
| | IT: Terracon Developmer | | | DRILL TYPE: Track M | ounted DR150 | | | ECT NO: WX17188 | |
| | TION: Winnipeg, Manitob | | | | mm Solid Stem Augers | _ | _ | ATION: | |
| | _ | lby Tube | | No Recovery SPT (N) | Grab Sample | | Split-Pe | | |
| BACK | | tonite | | Pea Gravel Drill Cutting | s Grout | | Slough | :: Sand | 1 |
| Depth (m) | ■ UNCONFINED COMPRESSION (I 100 200 300 40 | SOIL SYMB(| MUSCS | SOIL DESCRIP | TION | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) | | | OR OH | SURFACE ORGANICS (Moss) - ~25r ORGANIC CLAY - silty, trace rootlets grey CLAY - silty, trace organics to 0.3m, here to grey, occasional oxidation inclocasional silt inclusions below 0.6m - greyish brown below 0.9m - brown below 1.5m TEST HOLE TERMINATED AT 6.1m NOTES: - No sloughing or seepage was encountly remained open to 6.1m and was drilling. Test hole was backfilled with a drilling. Test hole was backfilled with a series of the series of t | and organics, moist, dark ligh plastic, moist, stiff, dark usions 1 BELOW EXISTING GRADE Intered during drilling. Test dry upon completion of | | 1 2 3 4 5 6 6 7 8 8 9 9 | | |
| 17188 - TERRA | mec | AME | | │ nvironment & Infrastructure Winnipeg, Manitoba | LOGGED BY: AL REVIEWED BY: RB Figure No. 33 | | | LETION DEPTH: 6.1 m LETION DATE: July 11, 2013 Page | e 1 of 1 |

| | PROJ | PROJECT: Prairie Industrial Park CLIENT: Terracon Developments OCATION: Winnipeg, Manitoba | | | | | | DRILL | ED BY: Maple | Leaf Drillin | ng Ltd. | | [| BORE | HOLE NO: RD22 | |
|--|----------------------|---|--|-------------------|-------------|-----------------|-----------------------|-----------------------|---|-----------------------------|----------------------------------|-------------|-----------|-------------|---------------------------|----------------|
| j | CLIEN | IT: Terracon De | evelopmer | nts | | | | DRILL | TYPE: Track N | Mounted D | R150 | | _ | PROJ | ECT NO: WX17188 | |
| | LOCA | TION: Winnipe | g, Manitob | ра | | | | DRILL | METHOD: 125 | 5mm Solid | Stem Augers | | E | ELEV | ATION: | |
| | SAMP | LE TYPE | Shel | lby Tul | be | | No Recov | ery | SPT (N) | | Grab Sample | | | Split-Pe | en Core | |
| | BACK | FILL TYPE | Bent | tonite | | | Pea Grave | el | Drill Cuttin | ngs | Grout | | | Slough | <u>≎≎</u> Sand | |
| | | ▲ UNCONFINED COI | MPRESSION (I 300 400 | kPa) ▲ | | | | | | | | П | _ | | | |
| | Depth (m) | ■ POCKET PENET 100 200 | | Pa) 🔳 | SOIL SYMBOL | MUSCS | | | SOIL | _ | | SAMPLE TYPE | SAMPLE NO | SPT (N) | COMMENTS | Depth (m) |
| | Deptl | PLASTIC M. | .C. LIQUII | D | OIL S | MUS | | | DESCRIP | PTION | | MPL | AMP | SPT | COMMENTS | Deptl |
| | | 20 40 | 60 80 |) | Š | ΛÞ | - 011554.05 | 00011 | 100 (11) 05 | | | /S | 0) | | | |
| | _ 0 _ | | | | | OR OH | | | ICS (Moss) - ~25 silty, trace rootlets | | ics, moist, dark | | 1 | | | - |
| | - | | | ¦ | | СН | ∖grey CLAY - silt | y, trace o | organics to 0.3m, | high plastic | , moist, stiff, dark | | 2 | | | - |
| | - - - | | | | | ML | | | asional rootlets ar ow to medium pla | | inclusions firm, mottled grey | | 3 | | | F |
| | - 1 - | iiii | iii I i i i | <u>i</u> | Щ | | and brown | | | | own, occasional silt | | 4 | | | -1 |
| | - | - | | | | | inclusions | y, mgn p | iastic, moist, stiii, | , greyisii bic | iwii, occasionai siit | | | | | - |
| | - | | | | | | - stiff to ver | y stiff be | low 1.5m | | | | 5 | | | - |
| | | | | | | | | | | | | | 6 | | | E |
| | —2 _ | | llll | l | | СН | - firm to sti | ff bolow ' | 2.1m | | | Ħ | 7 | | | <u>-2</u> |
| | - | | | | | - 111111 10 501 | II DEIOW A | 2. 1111 | | | | | | | - | |
| | - | | | | | | | | | | | | | | | - |
| | - | | | · · · j · · | | | | | | | | | 8 | | | + |
| | 3 - - | | | | | | | E TERM | INATED AT 3.1m | n BELOW E | XISTING GRADE | Т | U | | | -3 - |
| | - | | | <u>j</u> | | | NOTES: - No slough | ning or se | eepage was enco | ountered du | ing drilling. Test | | | | | E |
| | _ | | | | | | drilling. Tes | ned oper st hole w | n to 3.1m and was as backfilled with | s dry upon o auger cutti | ngs and bentonite. | | | | | E |
| | - - -1 | | | [| | | | | | | | | | | | |
| SED) | - | | | | | | | | | | | | | | | - |
| REVISED) | - | | | | | | | | | | | | | | | - |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK GPJ 13/09/24 09:15 AM (GEOTECHNICAL | | | | | | | | | | | | | | | | E |
| ECH | - | | | | | | | | | | | | | | | - |
| 3EO1 | ─5 - | |] l J . | l | | | | | | | | | | | | - 5 |
| NM. | | | ··· ·· ·· | | | | | | | | | | | | | F |
| 9:15 / | | | | · · · · · · | | | | | | | | | | | | F |
| /24 0 | - | | - | | | | | | | | | | | | | F |
| 3/09 | - | | | | | | | | | | | | | | | - |
| . Lds | - -6 - | | | | | | | | | | | | | | | - 6 |
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| L PA | - | | | ij | | | | | | | | | | | | ļ. |
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| Щ Щ | - 7 | l l J l l | llll I I I | l | - | | | | | | | | | | | _7 |
| IFAC | L | | | | | | | | | | | | | | | E |
| BON | | | | | | | | | | | | | | | | F |
| -ST | Ē | | | | | | | | | | | | | | | F |
| NO. | <u> </u> | | | | | | | | | | | | | | | F |
| 3RAC | - 8 | | لليلنا | | | | | | | 1 | D. C. A.: | | | | ETION PETER : | <u> </u> |
| <u>-</u> | | | P | | AMI | EC E | nvironmen | t & Infr | astructure | LOGGE | | | | | ETION DEPTH: 3.1 m | |
| 188 | 7 | mea | | | | | Winnipeg, | | | Figure N | ED BY: RB | | + 0 | UIVIPL | ETION DATE: July 11, 2013 | 1 of 1 |
| ₩. | | AMEC Environ Winnip | | | | | | i igui e iv | υ. υ τ | | | | raye | , , ,, ,, , | | |



| PROJ | ECT: Prairie Industri | ial Park | | DRILLED BY: Maple L | eaf Drilling Ltd. | | BORE | HOLE NO: RD24 | |
|--|--|-------------|--|---|---|-------------|------------------|---------------------------|----------------------------|
| CLIEN | NT: Terracon Develop | pments | | DRILL TYPE: Track M | ounted DR150 | | PROJ | ECT NO: WX17188 | |
| | TION: Winnipeg, Ma | anitoba | | DRILL METHOD: 125 | | | 1 | ATION: | |
| | PLE TYPE | Shelby Tube | No Recove | <u> </u> | Grab Sample | | Split-Pe | | |
| BACK | (FILL TYPE | Bentonite | Pea Grave | I Drill Cutting | s Grout | | Slough | Sand | 1 |
| Depth (m) | ■ UNCONFINED COMPRES: 100 200 300 ■ POCKET PENETROMET 100 200 300 PLASTIC M.C. 20 40 60 | | WICKS | SOIL DESCRIP | TION | SAMPLE TYPE | SPT (N) | COMMENTS | Depth (m) |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK GPU 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 8 | | | CLAY - silty - greyish brown SILT - trace CLAY - silty sulphate and - very stiff, but the company of the comp | r, high plastic, moist, stiff, g d silt inclusions prown below 1.8m ment silt lenses ~25mm thic v 2.9m E TERMINATED AT 3.1m I ging was encountered during as observed below 1.4m be- mained open to 3.1m and | nclusions below 0.9m very moist, soft, tan-brown greyish brown, occasional k between 2.1m and 2.3m BELOW EXISTING GRADE g drilling. Very slight | | 2 3 4 5 | | |
| ACON - ST BONIFACE | | | | | | | | | - - - - - - |
| AR 8 | | | <u> </u> | 016 4 4 | LOGGED BY: AL | | COMPL | LETION DEPTH: 3.1 m | 1 |
| - 88 | mec | AMEC | Environment Winnipeg, N | & Infrastructure | REVIEWED BY: RB | | | ETION DATE: July 12, 2013 | |
| 171 | IIIICU | | winnipeg, N | nantuva | Figure No. 36 | | | Page | 1 of 1 |

| PRO | JECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple I | eaf Drilling Ltd. | | BOR | E HOLE NO: RD25 | |
|--|--|------------|-------|--|---|-------------|----------------------|----------------------------|------------|
| CLIE | NT: Terracon Developmen | nts | | DRILL TYPE: Track N | ounted DR150 | | PRO. | JECT NO: WX17188 | |
| LOC | ATION: Winnipeg, Manitob | ра | | DRILL METHOD: 125 | mm Solid Stem A | lugers | ELE\ | /ATION: | |
| SAM | PLE TYPE She | by Tube | [| ✓ No Recovery SPT (N) | Grab | | ∭Split-F | | |
| BAC | | tonite | | Pea Gravel Drill Cutting | s Grout | t [| Slough | Sand | |
| Depth (m) | ▲ UNCONFINED COMPRESSION (100 200 300 40 ■ POCKET PENETROMETER (kF 100 200 300 40 PLASTIC M.C. LIQUI 20 40 60 88 | SOIL SYMB(| MUSCS | SOIL DESCRIP | TION | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) |
| | | | OH CH | SURFACE ORGANICS (Moss) - ~25r ORGANIC CLAY - silty, trace rootlets grey CLAY - silty, trace organics and rootle moist, firm, dark greyish brown - stiff, brown, occasional silt inclusion - firm, greyish brown, occasional oxid | and organics, mois ets to 0.3m, high pla s below 0.6m | astic, | 1 2 3 4 5 6 7 7 8 | | -1-1-2-1-3 |
| 4 09:15 AM (GEOTECHNICAL REVISED) | | | | - soft to firm below 4.6m | | | 9 | | -4 |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL | | | | TEST HOLE TERMINATED AT 6.1m NOTES: - No sloughing or seepage was encount hole remained open to 6.1m and was drilling. Test hole was backfilled with | untered during drillin dry upon completio | ng. Test | 10 | | |
| TER | | AM⊑/ | ` E. | nvironment & Infrastructure | LOGGED BY: AL | | | LETION DEPTH: 6.1 m | • |
| 17188 - | emec [©] | AIVIE | | Vinnipeg, Manitoba | REVIEWED BY: I | RB | COMP | LETION DATE: July 12, 2013 | |
| <u>+</u> | <i>// / / / / / / / / / / / / / / / / / /</i> | | | I - 3, | Figure No. 37 | | | Page | 1 of 1 |

| PRO | JECT: Prairie Industrial Pa | ark | | DRILLED BY: AMEC | | | BORE | HOLE NO: RD26 | |
|--|--|--------------------|---|--|--|-------------|----------|---------------------------|-----------|
| CLIE | NT: Terracon Developme | nts | | | | | PROJE | ECT NO: WX17188 | |
| LOC | ATION: Winnipeg, Manitol | ра | | DRILL METHOD: Hai | nd Auger | | ELEVA | ATION: | |
| SAM | PLE TYPE She | lby Tube | ✓ No Recov | <u> </u> | Grab Sample | | Split-Pe | | |
| BAC | | tonite | Pea Grav | vel Drill Cutting | gs Grout | | Slough | Sand | |
| Depth (m) | ▲ UNCONFINED COMPRESSION (100 200 300 40 ■ POCKET PENETROMETER (kf. 100 200 300 40 PLASTIC M.C. LIQUI 20 40 60 88 | Pa)■ OOIT SYMB(| NOSCO. | SOIL DESCRIP | | SAMPLE TYPE | SPT (N) | COMMENTS | Depth (m) |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 8 | | | - frequent - silt lamin - firm belor TEST HOI NOTES: - No sloug hole remai drilling. Te | LE TERMINATED 3.0m BE whing or seepage was encounted open to 3.0m and was set hole was backfilled with | greyish brown, frequent greyish brown ow 1.0m LOW GRADE untered during drilling. Test dry upon completion of auger cuttings. | | COMPL | ETION DEPTH: 3 m | |
| L-88-1 | mac | AMEC | | nt & Infrastructure | REVIEWED BY: RB | | | ETION DATE: July 26, 2013 | |
| 171 | AMEC Environme Winnipeg. | | | Manifolia | Figure No. 38 | | | | 1 of 1 |

| PRO | DJECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple | DRILLED BY: Maple Leaf Drilling Ltd. | | | ВС | BORE HOLE NO: RD27 | | |
|---|---|----------------|-----------|---|--------------------------------------|--------------------------|-------------|-------------|-------------------------|---|--|
| CLIE | ENT: Terracon Developmer | nts | | DRILL TYPE: Track | Mounted D | R150 | | PR | ROJECT NO: WX17188 | | |
| | CATION: Winnipeg, Manitob | oa | | DRILL METHOD: 12 | 5mm Solid | Stem Augers | | | EVATION: | | |
| SAN | MPLE TYPE Shel | by Tube | | No Recovery SPT (N) | | Grab Sample | | Spli | | | |
| BAC | | tonite | <u> </u> | Pea Gravel Drill Cutting | igs | Grout | [| Slou | ugh Sand | | |
| Depth (m) | ▲ UNCONFINED COMPRESSION (I 100 200 300 400 100 200 300 400 100 200 300 400 100 200 300 400 100 100 100 100 100 100 100 100 1 | SOIL SYMBOL | MUSCS | SOII DESCRIF | PTION | | SAMPLE TYPE | SAMPLE NO | COMMENTS | Depth (m) | |
| - 0 - - | | | 7 | SURFACE ORGANICS (Moss) - ~38 CLAY - silty, trace fine grained sand greyish brown | | c, moist, very stiff, | | 1 | | - - - - | |
| - | | | | - stiff below 0.9m | | | | 3 | | - - - - | |
| F' | | | | | | | | 4 | | F' | |
| Ė | | | | - occasional sulphate inclusions belo | | | | 5 | | - | |
| - | | | - | - brown, occasional silt inclusions be | low 1.5m | | | 6 | | - | |
| -2 | | | | | | | | | | -2 | |
| - | | | | | | | | 7 | | - - - | |
| - - - -3 - - - | | | CH _ | - firm, dark greyish brown below 3m | | | | 8 | | -3 | |
| I (GEOTECHNICAL REVISED) | | | - | - soft to firm below 4.6m | | | | 9 | | -4 4 | |
| J 13/09/24 09:15 AM | | | - | - grey below 5.5m | | | | 10 | | - - - - - - - - - | |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL) | | | - c | TEST HOLE TERMINATED AT 6.1n NOTES: No sloughing and seepage encoundrilling. Test hole remained open to completion. Test hole was backfilled | tered upon o 6.10m belov | completion of grade upon | | | | - - - - - - - - - - - - - - - - - - - | |
| ACON - ST BONIFACE | | | | | | | | | | - - - - - - - - | |
| ERRA 8 | | | | du | LOGGED | BY: AL | | CON | MPLETION DEPTH: 6.1 m | | |
| - 88 | AMEC Environment Winnipeg, N | | | rironment & Infrastructure innipeg, Manitoba | REVIEW | ED BY: RB | | | MPLETION DATE: August 2 | | |
| 17188 | <i>フロ 1</i> | mmpeg, mamioba | Figure No | o. 39 | | | | Page 1 of 1 | | | |

| PROJ | ECT: Prairie Ir | ndustrial Pa | ırk | | | DRI | LLED BY: AMEC | | | ВО | RE HOLE NO: RD28 | |
|---|--|---|--------------------|-------------|-------|--|--|--------------------------|-------------|-----------------|------------------------------|-----------|
| CLIEN | NT: Terracon D | Developmer | nts | | | | | | | PR | OJECT NO: WX17188 | |
| LOCA | TION: Winnipe | eg, Manitob | a | | | DRI | LL METHOD: Han | d Auger | | ELE | EVATION: | |
| SAMF | PLE TYPE | Shell | by Tub | е | | No Recovery | SPT (N) | Grab Sample | e | ∭Split | | |
| BACK | FILL TYPE | Bent | onite | | | Pea Gravel | Drill Cuttings | Grout | | Slou | gh Sand | |
| Depth (m) | ■ POCKET PENE 100 200 ■ POCKET PENE 100 200 PLASTIC 1 20 40 | OMPRESSION (k 300 400 ETROMETER (kP 300 400 M.C. LIQUIE 60 80 | (a) = () | SOIL SYMBOL | MUSCS | | SOIL DESCRIP | ΓΙΟΝ | SAMPLE TYPE | SAMPLE NO | COMMENTS | Depth (m) |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) | | | | | OR CH | CLAY - silty, hig rootlets - dark grey betwe - brownish grey b - brown below 1. - stiff to very stiff - occasional silt i - firm below 2.9m TEST HOLE TENOTES: - No sloughing on hole remained of drilling. Test hole | een 0.5m and 0.6m pelow 0.6m 2m below 1.5m Inclusions below 1.8m RMINATED 3.0m BEL In seepage was encoupen to 3.0m and was a was backfilled with a | o stiff, brown, frequent | | 1 2 3 4 5 6 7 8 | IPLETION DEPTH: 3 m | |
| 188 - T | me | | | AME | | nvironment & Ir Winnipeg, Mani | | REVIEWED BY: RB | | | IPLETION DATE: July 26, 2013 | 1 of 1 |
| #I 🕶 | | | | | | Figure No. 40 | | 1 | rage | 1 of 1 | | |

| PROJEC | T: Prairie Industrial Pa | ark | | DRILLED BY: Maple L | eaf Drilling Ltd. | | BORE | HOLE NO: RD29 | | | | |
|--|---|----------|----------------|---|---|-------------|-------------------------|--|--------------------------------------|--|--|--|
| CLIENT: | Terracon Developmer | nts | | DRILL TYPE: Track M | DRILL TYPE: Track Mounted DR150 | | | | PROJECT NO: WX17188 | | | |
| LOCATIO | DN: Winnipeg, Manitob | ра | | DRILL METHOD: 125 | | | ELEV | ATION: | | | | |
| SAMPLE | TYPE Shel | by Tube | | ✓ No Recovery SPT (N) | Grab Sample | | ∏Split-P | | | | | |
| BACKFIL | L TYPE Bent | tonite | | Pea Gravel Drill Cutting | s Grout | [| Slough | Sand | | | | |
| | UNCONFINED COMPRESSION (I 100 200 300 400 100 200 300 400 100 100 100 100 100 100 100 100 1 | C SYMBOL | MUSCS | SOIL DESCRIP | | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) | | | |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 8 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) | 20 40 00 00 00 00 00 00 00 00 00 00 00 00 | | OR CH ML CH ML | SURFACE ORGANICS (Moss) - ~38n CLAY - silty, high plastic, moist, stiff, r frequent lenses approximately 20mm SILT - trace clay, low plastic, moist to tan-brown, occasional oxidation inclus - occasional clay lenses approximatel below 0.9m CLAY - silty, high plastic, moist, stiff, g inclusions SILT - trace clay, low plastic, moist, fil CLAY - silty, high plastic, moist, stiff, g inclusions - firm, occasional sulphate and oxidat TEST HOLE TERMINATED AT 6.1m NOTES: - No sloughing and seepage encounted drilling. Test hole remained open to 6. completion. Test hole was backfilled w | mottled grey and tan, stiff, thick very moist, soft to firm, sions y 15mm thick, soft to firm greyish brown, occasional silt m, tan-brown greyish brown, frequent silt on inclusions below 2.1m BELOW EXISTING GRADE ered upon completion of 10m below grade upon | | 1 2 3 4 5 6 6 7 8 8 9 9 | Hydrometer Analysis Results @ "0.5m": Gravel= 0.0% Sand= 1.6% Silt= 78.5% Clay= 19.9% | -1 -1 -2 -3 -4 5 6 | | | |
| 3 [17188 - TERF | nec® | AME | | nvironment & Infrastructure Winnipeg, Manitoba | LOGGED BY: AL REVIEWED BY: RB Figure No. 41 | | | LETION DEPTH: 6.1 m LETION DATE: August 26, 201 Page | 13 1 of 1 | | | |

| PROJ | IECT: Prairie Industrial F | Park | | DRILLED BY: | AMEC | | | BORE | HOLE NO: RD30 | |
|--|----------------------------|--|---|---|--|--|-------------|---------------------------|---|-----------|
| CLIEN | NT: Terracon Developme | ents | | | | | | PROJ | ECT NO: WX17188 | |
| LOCA | TION: Winnipeg, Manito | oba | | DRILL METHO | | | | ELEV | ATION: | |
| SAMP | PLE TYPE Sh | elby Tube | ✓ No Recov | | SPT (N) | Grab Sample | | ∏Split-Pe | | |
| BACK | | entonite | Pea Grav | el 🔲 🗆 | rill Cuttings | Grout | | Slough | Sand | |
| Depth (m) | PLASTIC M.C. LIQI | (kPa) ■ (MAS) SO (MAS) MAS MAS | | DES | SOIL CRIPTIO | N | SAMPLE TYPE | SPT (N) | COMMENTS | Depth (m) |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 8 | | | CLAY - sil inclusions, - stiff to ve 0.6m - firm, grey SILT - trac CLAY - silf frequent si - frequent : TEST HOL NOTES: - No sloug hole remai | e clay, low plastic y, high plastic, mo It inclusions silt layers (~40mn | oist, firm, brown frequent rootlets at onal rootlets at stiff, damp to robist, stiff to very in thick) below 1 3.0m BELOW Gives encountered and was dry upilled with auger of the stiff to | s between 0.5m and 1m noist, tan-brown stiff, mottled brown, 8m sRADE during drilling. Test on completion of cuttings. | | 1 2 2 3 3 4 4 5 5 6 6 7 7 | | |
| 17188 - TEI | <u>mec[®]</u> | AMEC | Environmen Winnipeg, | it & Infrastruct Manitoba | REV | GED BY: SK EWED BY: RB e No. 42 | | | .ETION DEPTH: 3 m .ETION DATE: July 26, 2013 Page | 1 of 1 |

| PRO | JECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple I | DRILLED BY: Maple Leaf Drilling Ltd. | | | BORE HOLE NO: RD31 | | | | |
|--|---|-------------|-------|--|--|-------------|-------------------------|---|---------------------|--|--|--|
| CLIE | NT: Terracon Developme | nts | | DRILL TYPE: Track N | DRILL TYPE: Track Mounted DR150 | | | | PROJECT NO: WX17188 | | | |
| LOC | ATION: Winnipeg, Manitol | oa | | DRILL METHOD: 125 | mm Solid Stem A | ugers | ELEV | ATION: | | | | |
| SAM | _ | lby Tube | | No Recovery SPT (N) | Grab | | Split-Pe | | | | | |
| BAC | | tonite | | Pea Gravel Drill Cutting | s Grou | t [| Slough | Sand | 1 | | | |
| Depth (m) | ▲ UNCONFINED COMPRESSION (100 200 300 40 ■ POCKET PENETROMETER (kf 100 200 300 40 PLASTIC M.C. LIQUI 20 40 60 86 | SOIL SYMBOL | MUSCS | SOIL DESCRIP | TION | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) | | | |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 8 | | | CH | SURFACE ORGANICS (Moss) - ~25r CLAY - silty, trace rootlets, high plast dark grey - no rootlets, stiff, occasional silt inclu - greyish brown, occasional sulphate - 75mm thick silt layer at 1.2m - brown below 1.5m - occasional oxidation inclusions below - firm to stiff below 2.1m TEST HOLE TERMINATED AT 6.1m NOTES: - No sloughing and seepage encount drilling. Test hole remained open to 6 completion. Test hole was backfilled was backfilled to | c, moist, firm to stiff sions below 0.6m inclusions below 0.9 w 1.8m | GRADE on of | 1 2 3 4 5 6 6 7 8 8 9 9 | Hydrometer Analysis Results @ "2.0m": Gravel= 0.0% Sand= 0.2% Silt= 18.2% Clay= 81.6% | -1-1-2-3 | | | |
| - TER | mec | AME | | nvironment & Infrastructure | LOGGED BY: AL REVIEWED BY: | | | ETION DEPTH: 6.1 m ETION DATE: August 26, 20 | 13 | | | |
| 17188 | <i>HIIEC</i> | | 1 | Winnipeg, Manitoba | Figure No. 43 | | COIVIL | | 1 of 1 | | | |

| _ | | | | | | | | | | | | |
|---|---|--|----------|---|---|--|--|--|-------------|--------------------------|-----------------------------|-----------|
| PROJ | PROJECT: Prairie Industrial Park | | | | DRILLED BY: AMEC | | | BORE HOLE NO: RD32 | | | | |
| CLIEN | NT: Terracon Devel | opments | | | | | | | | PRO | DJECT NO: WX17188 | |
| LOCA | TION: Winnipeg, M | lanitoba | | | DRILL | METHOD: Hai | nd Auger | | | ELE | VATION: | |
| SAMF | PLE TYPE [| Shelby Tube | | No Recov | ery | SPT (N) | | Grab Sample | | ∏Split- | Pen Core | |
| BACK | FILL TYPE | Bentonite | | Pea Grav | el | Drill Cuttine | gs | Grout | | ∭Sloug | jh 🚉 Sand | |
| Depth (m) | ▲ UNCONFINED COMPRE 100 200 30 ■ POCKET PENETROM 100 200 30 PLASTIC M.C. 20 40 60 | 0 400 ETER (kPa) ■ 0 400 LIQUID | | | | SOIL DESCRIP | TION | | SAMPLE TYPE | SAMPLE NO | COMMENTS | Depth (m) |
| 17188 - TERRACON - ST BONFAGE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL REVISED) 8 | | | OR OH CH | CLAY - silt rootlets - brown be - frequents - mottled b - light brow - occasiona - and silt b - frequents - dark brow TEST HOL NOTES: - No slougl below grad depth to www.as backfi | CLAY - s y, high pla low 0.6m silt layers rown, occ n below al sulphat etween 2. silt inclusi yn below le. TERMI hing obse le. Test h ater at 1.0 lled with a | (~10mm thick) to casional to frequent 1.7m e inclusions at 2. 6m and 2.7m ons at 2.7m 2.9m NATED AT 3.0m rived, moderate is ole remained ope of the properties of the properti | moist, firm, to stiff, grey o 1.4m ent silt layer Om BELOW E seepage en en to 3.0m b upon comple | x, occasional s to 1.8m XISTING GRADE countered at 1.0m below grade and | | 1 2 3 4 5 6 7 8 9 10 COM | PLETION DEPTH: 3 m | |
| 7188 - | mec |) Al | | nvironmen Winnipeg, | | | | ED BY: RB | | | PLETION DATE: July 23, 2013 | 1 of 1 |
| | SIIICC Willingeg | | | | | | i iyure ivi | ノ. TT | | | raye | 1 UI I |

| PRC | DJECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple Leaf Drilling Ltd. | | | BC | BORE HOLE NO: RD33 | | | |
|--|-----------------------------------|-------------|--|--|--|----------------------------------|-------------|---------------------|------------|--------------------|-----------|
| CLIE | NT: Terracon Developme | nts | | DRILL TYPE: Track Mounted DR150 | | | PR | PROJECT NO: WX17188 | | | |
| LOC | ATION: Winnipeg, Manitol | ра | | DRILL METHOD: | 125mm Soli | d Stem Augers | | EL | EVATION | l: | |
| SAM | IPLE TYPE She | lby Tube | ✓ No Recov | ery SPT | (N) | Grab Sample | | Spli | it-Pen | Core | |
| BAC | KFILL TYPE Ben | tonite | Pea Grave | el Drill (| Cuttings | Grout | | Slo | ugh | Sand | |
| Depth (m) | ■ PLASTIC M.C. LIQUI 20 40 60 88 | SOIL SYMBOL | | DESCI | OIL RIPTION | | SAMPLE TYPE | SAMPLE NO | (N) LdS | COMMENTS | Depth (m) |
| _ 0 - - - - - - - - - - - - - - - - - - - | | | CLAY - silty grey to dark - greyish br - firm to stif | ORGANICS (Moss) y, trace rootlets and of k grey, occasional ox rown, firm, no organic ff, occasional oxidation ff below 1.2m | organics, high pridation inclusions and rootlets | ns below 0.6m | | 1 2 3 4 5 5 | | | -1 |
| - - -2 - - - - - | | | - firm below | v 2.1m | | | | 7 | | | -2 |
| - -3 - - - - - - - - - - - - - - - - - | | | н | | | | | 8 | | | -3 |
| 09:15 AM (GEOTECHNICAL REVISED) | | | - occasiona | al sulphate and silt in | clusions, soft to | firm below 4.6m | | 9 | | | -5 |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK GPJ 13/09/24 09:15 AM (GEOTECHNICAL | | | NOTES: - No slough drilling. Tes | v 5.8m E TERMINATED AT ning and seepage enst hole remained ope. Test hole was back | countered upor n to 6.10m belo | n completion of ow grade upon | | 10 | | | |
| HER | | AMEC | Environmon | t & Infrastructure | | D BY: AL | | | | DEPTH: 6.1 m | |
| 17188 - | <u>emec[©]</u> | AIVIEU | Winnipeg, I | | REVIE | VED BY: RB | | CON | MPLETION | DATE: August 26, 2 | |
| 17 | | | | Figure I | No. 45 | | | | Pa | ge 1 of 1 | |

| CLIENT: Terracon Developments LOCATION: Winnipeg, Manitoba DRILL METHOD: Hand Auger ELEVATION: DRILL METHOD: Hand Auger ELEVATION: | |
|--|-------------|
| | |
| CAMPIETY OF THE | |
| SAMPLE TYPE Shelby Tube No Recovery SPT (N) Grab Sample Split-Pen Core | |
| BACKFILL TYPE Bentonite Pea Gravel Drill Cuttings Grout Slough | |
| A UNCONFINED COMPRESSION (kPa) A 100 200 300 400 TO MAN A 100 200 300 TO MAN A 100 200 300 TO MAN A 100 200 TO MAN A 100 20 | Depth (m) |
| OR SURFACE ORGANICS (Moss) - 38mm thick organized to the control of the control o | -11 |
| を「8 | |
| AMEC Environment & Infrastructure REVIEWED BY: RB COMPLETION DATE: July 23, | 2013 |
| AMEC Environment & Infrastructure Winnipeg, Manitoba LOGGED BY: SK COMPLETION DEPTH: 3 m REVIEWED BY: RB COMPLETION DATE: July 23, Figure No. 46 | Page 1 of 1 |

| | PROJI | ECT: Prairie Industrial Pa | rk | | DRILLED BY: Maple I | DRILLED BY: Maple Leaf Drilling Ltd. | | | BORE HOLE NO: RD35 | | |
|--|---------------------------|---|-----------|--------------------|--|---|-------------|---------------------------|---------------------|--------------|--|
| | CLIEN | IT: Terracon Developmen | ıts | | DRILL TYPE: Track N | lounted DR150 | | PROJ | PROJECT NO: WX17188 | | |
| | LOCA | TION: Winnipeg, Manitob | а | | | mm Solid Stem Augers | | ELEV | ATION: | | |
| | SAMP | LE TYPE Shell | by Tube | | ✓ No Recovery SPT (N) | Grab Sample | | Split-Pe | | | |
| | BACK | FILL TYPE Bent | onite | | Pea Gravel Drill Cutting | s Grout | [| Slough | Sand | , | |
| | Depth (m) | ▲ UNCONFINED COMPRESSION (k 100 200 300 400 ■ POCKET PENETROMETER (kP 100 200 300 400 PLASTIC M.C. LIQUID 20 40 60 80 | L SYMBOL | MUSCS | SOIL DESCRIP | TION | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) | |
| | . 0 | | | OR | SURFACE ORGANICS (Moss) - ~50r CLAY - silty, trace organics and rootle greyish brown, occasional oxidation in - no organics and rootlets, stiff below | ets, high plastic, moist, firm nclusions | | 1 2 | | - | |
| | -1 -1 - | | | СН | - brown below 1.2m | | | 3 4 5 | | - -1 - | |
| | • | | | | - occasional silt inclusions, brown to I SILT - trace clay, low plastic, moist to | - | | 6 | | | |
| | -2 | | l | ML | occasional oxidation inclusions | To y moiot, doit, tairbiowi | | 7 | | <u>-2</u> | |
| | -3 | | | | CLAY - silty, high plastic, moist, firm to occasional oxidation and silt inclusion | o stiff, greyish brown, s | | 8 | | -3 | |
| 9:15 AM (GEOTECHNICAL REVISED) | -4 4 5 | | | СН | - firm, grey below 4.6m | | | 9 | | | |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:15 AM (GEOTECHNICAL | -6 7 | | | | TEST HOLE TERMINATED 6.1m BEI NOTES: - No sloughing was encountered durit seepage below 5.2m. Test hole rema filled with water to top of grade. Test l auger cuttings. | ng drilling. Very slight ined open to 6.1m and was | | 10 | | | |
| TER | | | АМ | C F | nvironment & Infrastructure | LOGGED BY: AL | | | ETION DEPTH: 6.1 m | | |
| 17188 - | AMEC Environmen Winnipeg, | | | Winnipeg, Manitoba | REVIEWED BY: RB | | COMPL | ETION DATE: August 26, 20 | | | |
| 1 | | | l | | | Figure No. 47 | | 1 | Page | 1 of 1 | |

| PRO.I | JECT: Prairie Industrial Pa | ark | | DRILLED BY: AMEC | | | R | ORE HOLE NO: RD36 | |
|--|---|------------|----------|--|--------------------------------|-------------|--------------|-----------------------------|----------------|
| | NT: Terracon Developmer | | | DIVILLED DT. 74VILO | | | - | ROJECT NO: WX17188 | |
| | ATION: Winnipeg, Manitob | | | DRILL METHOD: Har | nd Augar | | - | LEVATION: | |
| | | by Tube | | No Recovery SPT (N) | Grab Sample | | | olit-Pen Core | |
| | | | | Pea Gravel Drill Cutting | | | ∭Sk | | |
| BACK | | tonite | | Fea Gravei Side Cutting | gs Grout | I | <u>П</u> Пэк | ougn [*.]Sand | 1 |
| Depth (m) | ▲ UNCONFINED COMPRESSION (# 100 200 300 400 100 200 300 400 100 200 300 400 100 100 100 100 100 100 100 100 1 | SOIL SYMB(| MUSCS | SOIL DESCRIP | | SAMPLE TYPE | SAMPLE NO | COMMENTS | Depth (m) |
| _ 0 - - | | | OR OH | \SURFACE ORGANICS (Moss) - ~25r ORGANIC CLAY - silty, high plastic, i | moist, firm, dark grey | | 1 | | - |
| - - - | | | СН | CLAY - silty, high plastic, moist, stiff, (~2mm thick) | grey, frequent silt inclusions | | 2 | | - |
| -1 -1 | | | | SILT - some clay, some sand, trace g | ravel moist soft tan-brown | | 3 | | -1 |
| <u> </u> | - | | ML | - trace sand, frequent clay lamination | | | 5 | | - - |
| <u> </u> | | | | CLAY - silty, high plastic, moist, stiff, occasional silt inclusions (~10mm thic | light brown to brown, | | 6 | | <u> </u> |
| -2 - - | | | СН | - occasional sulfate inclusions below | 2.1m | | 7 8 | | -2 - - |
| - | | | OIT | | | | 9 | | - |
| 3 3 | | | | TEST HOLE TERMINATED 3.0m BE | LOW GRADE | | 10 | | -3 |
| - - - - - | | | | NOTES: - No sloughing observed during drillin observed 1.2m below grade. Test hol depth to water upon completion was abackfilled with auger cuttings. | e remained open to 3.0m and | | | | |
| REVISED) | | l | | | | | | | -4 - - |
| | | | | | | | | | |
|) - -5 - | | | | | | | | | 5 5 |
| 4 09:16 AM | | | | | | | | | - |
| 9 13/09/2 | | | | | | | | | 6 |
| L PARK.G | | | | | | | | | - |
| DUSTRIA | | | | | | | | | - - - |
| -7 - - - | | [| | | | | | | - 7 |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:16 AM (GEOTECHNICAL CALL) | | | | | | | | | |
| 新 8 8 | | | | <u> </u> | LOGGED BY: SK | | CO | DMPLETION DEPTH: 3 m | |
| - 88 | mac | AME | | nvironment & Infrastructure | REVIEWED BY: RB | | _ | OMPLETION DATE: July 24, 20 | 13 |
| | AMEC Environmer Winnipeg, | | | Winnipeg, Manitoba | Figure No. 48 | | | • | age 1 of 1 |

| PRC | JECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple I | BORE HOLE NO: RD37 | | | | |
|--|---|---|----------|---|--|-------------|----------------------|---|------------------|
| CLIE | NT: Terracon Developmer | nts | | DRILL TYPE: Track N | Nounted DR150 | | PRO | JECT NO: WX17188 | |
| LOC | ATION: Winnipeg, Manitob | oa | | | imm Solid Stem Augers | | | /ATION: | |
| SAM | IPLE TYPE Shel | lby Tube | | No Recovery SPT (N) | Grab Sample | | ∭Split-P | | |
| BAC | KFILL TYPE Bent | tonite | | Pea Gravel Drill Cutting | gs Grout | | Slough | Sand | , |
| Depth (m) | ▲ UNCONFINED COMPRESSION (I 100 200 300 40) ■ POCKET PENETROMETER (kF 100 200 300 40) PLASTIC M.C. LIQUII 20 40 60 80 | ■ © © © © © © © © © © © © © © © © © © © | MUSCS | SOIL DESCRIP | | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) |
| _ 0 _ _ _ _ | | | OR CH | SURFACE ORGANICS (Moss) - ~35r CLAY - silty, trace rootlets and organi moist, very stiff, dark grey, occasiona | ics, high plastic, damp to all oxidation inclusions | | 1 2 | | - |
| - | | | | - dark grey to grey, stiff, moist, occasi 0.6m SILT - trace clay, low plastic, moist, s | | | 3 | | - |
| -1 - - | = | | ML | occasional clay inclusions - soft, moist to very moist below 1.2m | | Ħ | 4 | | <u>-</u> 1 |
| - | | | | | | Ħ | 5 | | - |
| - - -2 | | | | CLAY - silty, high plastic, moist, very | stiff, brown | | 7 | | |
| - - - - | | | | - stiff, occasional oxidation and silt inc | stiff, occasional oxidation and silt inclusions below 2.1m | | | | - - - - |
| - - -3 - - - - | | | | - greyish brown, firm below 3m | | | 8 | | 3 |
| 6 AM (GEOTECHNICAL REVISED) | | | CH | - occasional sulphate inclusions below | | 9 | | - 4 - - - - - - - - - - - - - - - - - | |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:16 AM (GEOTECHNICAL | | | | TEST HOLE TERMINATED 6.1m BEI NOTES: - No sloughing or seepage was encou hole remained open to 6.1m and was drilling. Test hole was backfilled with | untered during drilling. Tes | | 10 | | |
| TERRA 8 | | A NAT- | C F | nvironment © Infrast | LOGGED BY: AL | | COMP | LETION DEPTH: 6.1 m | |
| 17188 - 1 | emec [©] | AIVIE | | nvironment & Infrastructure Winnipeg, Manitoba | ment & Intrastructure REVIEWED BY: RB | | | COMPLETION DATE: August 26, 2013 | |
| 5 6 | | | | | Figure No. 49 | | | Page | 1 of 1 |

| PROJ | IECT: Prairie Industrial Pa | ırk | DRILLED BY: N | Maple Leaf Drilling Ltd. | BORE HOLE NO: RD38 | | | |
|---|---|-------------|--|---|--------------------|----------|---------------------------------------|----------------------|
| CLIEN | NT: Terracon Developmer | nts | DRILL TYPE: T | rack Mounted DR150 | | PROJE | ECT NO: WX17188 | |
| LOCA | TION: Winnipeg, Manitob | a | DRILL METHOL | D: 125mm Solid Stem Augers | | ELEVA | ATION: | |
| SAMP | PLE TYPE Shell | by Tube | ✓ No Recovery ✓ SP | <u> </u> | | Split-Pe | | |
| BACK | FILL TYPE Bent | onite | Pea Gravel Dril | l Cuttings Grout | | Slough | Sand | |
| Depth (m) | ■ UNCONFINED COMPRESSION (k 100 200 300 400 ■ POCKET PENETROMETER (kP 100 200 300 400 PLASTIC M.C. LIQUID 20 40 60 80 | SOIL SYMBOL | | SOIL CRIPTION | SAMPLE TYPE | SPT (N) | COMMENTS | Depth (m) |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:16 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:16 AM (GEOTECHNICAL REVISED) 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:16 AM (GEOTECHNICAL REVISED) | | | grey to grey, occasional sulph - stiff, grey, no organics, occas SILT - trace clay, low plastic, it - tan, occasional grey clay stre 1.2m - moist to very moist, soft beloc CLAY - silty, high plastic, moist oxidation inclusions - firm to stiff, dark greyish brown TEST HOLE TERMINATED 3. NOTES: - No sloughing or seepage wa | titlets, high plastic, moist, firm, dark ate inclusions sional silt inclusions below 0.6m moist, soft to firm, tan-brown eak approximately 3mm thick below w 1.5m st, stiff, greyish brown, occasional wn below 2.1m Om BELOW GRADE s encountered during drilling. Test and was dry upon completion of ed with auger cuttings. | | COMPL | ETION DEPTH: 3 m | -1 -2 -3 -6 |
| 17188 - | mec | AIVIEU | Winnipeg, Manitoba | | | | ETION DATE: August 26, 2013 Page 1 | 1 of 1 |

| PRC | DJECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple Leaf Drilling Ltd. | | | | BORE HOLE NO: RD39 | | | |
|---|---|---------------------------------------|---|--|------------------------------------|-------------|----------------------------------|--------------------|---|-----------|--|
| CLIE | NT: Terracon Developmer | nts | | DRILL TYPE: Track | Mounted DR1 | 50 | | PROJ | ECT NO: WX17188 | | |
| LOC | ATION: Winnipeg, Manitob | а | | DRILL METHOD: 12 | 25mm Solid St | em Augers | | ELEV | ATION: | | |
| SAM | IPLE TYPE Shel | by Tube | ☑ No Recov | <u> </u> | | Grab Sample | | Split-Pe | | | |
| BAC | KFILL TYPE Bent | tonite | Pea Grave | el Drill Cutti | ngs |]Grout | | Slough | Sand | | |
| Depth (m) | ■ UNCONFINED COMPRESSION (I 100 200 300 400 100 200 300 400 100 200 300 400 100 100 100 100 100 100 100 100 1 | O O O O O O O O O O O O O O O O O O O | | SOI DESCRII | | | SAMPLE TYPE SAMPLE NO | SPT (N) | COMMENTS | Depth (m) | |
| -1 -2 -3 - | 18 38 | | ORGANIC moist, soft, SILT - trace, plastic, moi CLAY - silt, oxide incluser | ORGANICS (Moss) - ~5 CLAY - silty, trace rootle dark grey to black e clay, occasional rootlet ist, very soft, tan-brown y, high plastic, moist, stif sions al silt inclusions below 1. | ts, trace organions, occasional or | ganics, low | 1 2 3 4 5 6 7 7 8 8 | | Hydrometer Analysis Results @ "0.5m": Gravel= 0.0% Sand= 3.8% Silt= 60.0% Clay= 36.2% | | |
| /24 09:16 AM (GEOTECHNICAL REVISED) | | | - soft, occa | sional silt inclusions beld | ow 4.6m | | 9 | | | | |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:16 AM (GEOTECHNICAL) | | NOTES: No sloughii hole remair | E TERMINATED AT 6.1ing or seepage was enconed open to 6.1m and wast hole was backfilled wit | untered during o | drilling. Test | 10 | | | 6 | | |
| E TEN | A | AMEC | Environmen | mont & Infractructure LOGGED BY: AL | | | | ETION DEPTH: 6.1 m | • | | |
| 17188 - | emec [©] | AIVIEC | | nent & Infrastructure eg, Manitoba | | | COMPLETION DATE: August 21, 2013 | | | | |
| 4 | | | | · · · · · | Figure No. 5 | 1 | | | Page | 1 of 1 | |

| | | | | | | | | 1 | | | | | | | | |
|--|-----------|---|--|-----------------|-------------|-----------|--|--|--|---|--------------------------------------|---|-----------------------|-----------------|---------------|---|
| | PROJE | PROJECT: Prairie Industrial Park CLIENT: Terracon Developments | | | | | | DRILLED BY: AMEC | | | BORE HOLE NO: RD40 | | | | | |
| | CLIEN | IT: Terracon Deve | lopmen | nts | | | | | | | | | PF | ROJEC | T NO: WX17188 | |
| | LOCA | TION: Winnipeg, N | Manitob | а | | | | DRILL | METHOD: Ha | nd Auger | | | EL | EVAT | ION: | |
| | SAMP | LE TYPE | Shell | by Tul | be | | No Recov | ery | SPT (N) | | Grab Sample | | ∭Sp | lit-Pen | Core | |
| | | FILL TYPE | Bent | onite | | | Pea Grav | el | Drill Cuttin | ngs | Grout | Ī | — ∭Slo | ough | Sand | |
| | 27.101.1 | ▲ UNCONFINED COMPR | _ | | | | | | 12_2 | | | | | Ť | | |
| | Depth (m) | 100 200 3 POCKET PENETRON 100 200 3 PLASTIC M.C. | 00 400 METER (kP: 00 400 LIQUIE | 0 (a) ■ 0 | SOIL SYMBOL | MUSCS | | | SOII DESCRIF | | | SAMPLE TYPE | SAMPLE NO | SPT (N) | COMMENTS | Depth (m) |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GP.J 13/09/24 09:16 AM (GEOTECHNICAL REVISED) | - 0 | | | | | OR OH | ORGANIC Occasional CLAY - silt - firm to sti - brownish - firm, occa - brown be TEST HOL NOTES: - No sloug seepage o open to 3.0 | CLAY -: I layers o y, high p ff below f grey below assional si low 2.7m LE TERM thing was bserved om and w | ow 1.0m Ilt inclusions below INATED AT 3.0m encountered dur from surface of g | moist, firm thick) , grey to da w 2.3m n BELOW E ring drilling, rade. Test | rk grey EXISTING GRADE Significant | | 1 2 3 4 5 6 7 8 9 110 | | | -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 - |
| RRA | <u> </u> | | | | | | 10005 | D DV: CV | | | MDIET | ION DEDTU- 2 | | | | |
| Ξ | _ | | 7 | | AMI | EC E | nvironmen | t & Infr | astructure | LOGGED BY: SK REVIEWED BY: RB | | | | TION DEPTH: 3 m | 112 | |
| 7188 | 7 | | | | | Winnipeg, | | | | | | COMPLETION DATE: July 24, 2013 Page 1 of 7 | | | | |
| 17 | | Winnip | | | | | | | Figure N | 10. 32 | Page 1 | | | aye i 01 l | | |

| PRO | JECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple Leaf Drilling Ltd. | | | | BORE HOLE NO: RD41 | | | |
|--|--|---|-----------------------------------|---|--|---|--|----------------------|-----------|-----------------------------|--|
| CLIE | NT: Terracon Developmen | nts | | DRILI | L TYPE: Track | Mounted D | R150 | | PRC | JECT NO: WX17188 | |
| LOC | ATION: Winnipeg, Manitob | oa | | DRILI | L METHOD: 12 | 5mm Solid | Stem Augers | | ELE | VATION: | |
| SAM | PLE TYPE Shell | by Tube | ☑No R | ecovery | SPT (N) | | Grab Sample | | ∭Split- | | |
| BAC | KFILL TYPE Bent | tonite | Pea | Gravel | Drill Cuttir | ngs | Grout | [| Sloug | h Sand | |
| Depth (m) | ▲ UNCONFINED COMPRESSION (I 100 200 300 40) ■ POCKET PENETROMETER (kF 100 200 300 40) PLASTIC M.C. LIQUI | O Pa) ■ O S S S S S S S S S S S S S S S S S S | NO SON | | SOII DESCRIF | | | SAMPLE TYPE | SAMPLE NO | COMMENTS | Depth (m) |
| _ 0 _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ | | C | ORGA plastic SILT - occasi CLAY | NIC CLAY - , moist, soft, trace clay, I onal clay ler - silty, high | NICS (Moss) - ~50 silty, trace rootlet, dark grey to grey ow plastic, moist theses (~3mm thick) plastic, moist, stiffick), stiff, below 2. | s and trace o very moist o, greyish bro | | | 1 2 3 4 5 | | 1 |
| - - -2 - - - - | | | | | | | | | 7 | | - - -2 - - |
| -3 | | | - firm t | firm below 3.0m | | | | 8 | | -3 3 4 | |
| 9:16 AM (GEOTECHNICAL REVISED) | | no silt lenses below 4.6m | | | 9 | | - - - - - - - - - 5 - - | | | | |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:16 AM (GEOTECHNICAL | | | NOTE: No slo hole re | S: ughing or se mained ope | MINATED AT 6.1n eepage was encou en to 6.1m and wa was backfilled with | intered durir s dry upon c n auger cuttii | ng drilling. Test ompletion of ngs and bentonite. | | 10 | | - -6 - - - - - - - - - - - - - - - - - |
| Ħ . | | nent & Inf | rastructure | LOGGED | | | | PLETION DEPTH: 6.1 m | 40 | | |
| 17188 | emec [©] | | | eg, Manito | | Figure No | ED BY: RB | | COM | PLETION DATE: August 21, 20 | e 1 of 1 |
| _ | | 1 | | | | 1. 19 01 0 1 10 | | | 1 | i ug | • 1 |

| | | ROJECT: Prairie Industrial Park | | | | | | DDILLED BY: AMEC | | | | | | DODE HOLE NO. DD42 | | |
|---|---------------------------------|---|---------------------------------|--------------|-------------|-------|--|--|--|--|---|--------------------|---|--------------------|-----------------|-----------------------|
| | PROJ | PROJECT: Prairie Industrial Park CLIENT: Terracon Developments | | | | | | DRILLED BY: AMEC | | | | BORE HOLE NO: RD42 | | | | |
| | CLIEN | NT: Terracon Deve | elopmen | ts | | | | | | | | | P | ROJE | ECT NO: WX17188 | |
| | LOCA | TION: Winnipeg, | Manitob | a | | | | DRILL | METHOD: Ha | nd Auger | | | E | LEVA | ATION: | |
| | SAMP | PLE TYPE | Shelb | y Tuk | ре | | No Recov | ery | SPT (N) | | Grab Sample | | ∭s₁ | plit-Per | n Core | |
| | BACK | FILL TYPE | Bento | onite | | | Pea Grav | el | Drill Cuttin | gs | Grout | Ī | <u> </u> | lough | Sand | |
| | | ▲ UNCONFINED COMPF | RESSION (ki | | | | | | | <u> </u> | | | | Ī | | |
| | Depth (m) | 100 200 3 ■ POCKET PENETROI 100 200 3 PLASTIC M.C. | METER (kPa 300 400 LIQUID | a) II | SOIL SYMBOL | MUSCS | | | SOIL DESCRIP | | | SAMPLE TYPE | SAMPLE NO | SPT (N) | COMMENTS | Depth (m) |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:16 AM (GEOTECHNICAL REVISED) | -0 -0 | - | 1 | | | OR OH | ORGANIC grey, abun CLAY - silt rootlets - brown be - abundant 1.9m and 2 TEST HOL NOTES: - No slougl seepage o remained or | CLAY - sident root y, high pi low 1.5m t silt lamin 2.0m | tlets, occasional s lastic, moist, stiff, | igh plastic, silt layers (- brownish of the province of the plant of t | sions between DE Significant face. Test hole with water to a | \(\sigma \) | 1 2 3 4 5 6 7 8 8 | | | |
| ACON - ST BONI | - - - - - - 8 | | | | - | | | | | | | | | | | - - - - - |
| ERR | AMEC Environment Winnipeg, N | | | | | | LOGGF | D BY: SK | | CC | OMPLE | ETION DEPTH: 3 m | 1 | | | |
| F - 8 | | maa | | | AMI | | | | astructure | | /ED BY: RB | | COMPLETION DEPTH: 3 III COMPLETION DATE: July 26, 2013 | | | |
| 1718 | | | | | | _ ' | Winnipeg, | wanitol | oa | Figure N | | | Page 1 of | | 1 of 1 | |
| • | | THE C | | | | | | Figure No. 54 | | | | | | | | |

| PRO | OJECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple Leaf Drilling Ltd. | | | | BORE HOLE NO: RD43 | | | |
|---|--|-------------|-------|---|--|-------------|----------------------|----------------------------------|----------------------------|--|--|
| CLI | ENT: Terracon Developmer | nts | | DRILL TYPE: Track N | ounted DR150 | | PRO | JECT NO: WX17188 | | | |
| LOC | CATION: Winnipeg, Manitob | a | | DRILL METHOD: 125 | mm Solid Stem Auger | | _ | 'ATION: | | | |
| SAN | MPLE TYPE Shell | by Tube | | ✓ No Recovery SPT (N) | Grab Sam | • | ∭Split-P | | | | |
| BAC | | onite | | Pea Gravel Drill Cutting | s Grout | [| Slough | Sand | | | |
| Depth (m) | ▲ UNCONFINED COMPRESSION (I 100 200 300 40 | SOIL SYMBOL | MUSCS | SOIL DESCRIP | TION | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) | | |
| _ 0 _ - - - - - | | | OR | SURFACE ORGANICS (Moss) - ~25r CLAY - silty, trace rootlets and trace of firm, greyish brown - stiff, no rootlets and organics below | organics, high plastic, mo | pist, | 1 2 | | | | |
| - 1 - - - - | | | ML | - occasional silt and occasional silt in SILT - trace clay, low plastic, moist, s | | | 3 4 | | - 1 - - - - | | |
| - - -2 - - | | | IVIL | oxidation inclusions CLAY - silty, high plastic, moist, stiff, inclusions - firm to stiff, brown below 2.1m | | | 7 | | - - -2 - | | |
| - - - 3 - - - - | | | | - firm to soft below 3m | | | 8 | | -3 | | |
| (GEOTECHNICAL REVISED) | | | CH | | | | 9 | | 4 4 | | |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:16 AM (GEOTECHNICAL) | | | | TEST HOLE TERMINATED AT 6.1m NOTES: No sloughing or seepage was encour hole remained open to 6.1m and was drilling. Test hole was backfilled with | ntered during drilling. Test dry upon completion of | ADE st | 10 | | | | |
| TERR | | AME | C E | nvironment & Infrastructure | LOGGED BY: AL | | | LETION DEPTH: 6.1 m | | | |
| 17188 - | <u>əmec[©]</u> | AIVIE | | Winnipeg, Manitoba | ed Manitoha | | | COMPLETION DATE: August 21, 2013 | | | |
| 7 | | | | 1 0 | Figure No. 55 | | | Page | 1 of 1 | | |

| PROJECT Praire Industrial Park CLIENT: Terror Developments LOCATION: Winnings, Maniloba SMMPLE TYPE Shart Too Service ADMINISTRATION SINGUISTRATION SIN | | | ?O.IECT: Prairie Industrial Park | | | | | | | | | | | | DODE HOLENO BRAA | | |
|--|--|-----------|----------------------------------|--------------------------------|--------------|-------------|-------------|--|---|---|---|-----------------------------|-------------|---------------------------------|------------------|-----------------|---------------------------------------|
| Dear Time Dear Sample De | | | | | | | | DRILLED BY: AMEC | | | E | | | | | | |
| SAMPLE TYPE British Tube Bri | | CLIEN | IT: Terracon Deve | lopmen | ıts | | | | | | | | | F | PROJE | ECT NO: WX17188 | |
| BACKFILL TYPE Benchie Pee Greek Ont Currings Good Automatic Condition (1998) Both Conditi | | LOCA | TION: Winnipeg, N | Manitob | a | | | | DRILL | . METHOD: Har | nd Auger | | | E | ELEVA | ATION: | |
| BACKFILL TYPE Benchie Pee Greek Ont Currings Good Automatic Condition (1998) Both Conditi | | SAMP | LE TYPE | Shelb | by Tuk | ре | | No Recov | ery | SPT (N) | | Grab Sample | | Mis | Split-Per | n Core | |
| A COCAMMENT CONTRESSOR OF A COCAMMENTS SOIL DESCRIPTION PASTO MAD LOUD PASTO MAD LOUD ON DESCRIPTION SURFACE DRAINES (Mass) - 25mm thick CLAY - sity, high plastic, moist, soft, grey, frequent rooftels - firm to siff below 0.3m - frequent oxide inclusions below 1.8m - frequent oxide inclusions at 2.7m TEST HOLE TERMINATED 3.0m BELOW GRADE NOTES - Trace soughing was encountered 0.15m below grade. Significant seepage was encountered 0.15m below grade. Significant seepage was encountered 0.15m below grade. Significant seepage was encountered 0.15m below grade. Test those tracking below the significant seepage was encountered 0.15m below grade. Test those tracking below the significant seepage was encountered 0.15m below grade. Test those tracking below to 3.m and see slided with water to poly grade. Test those was back filled with augar cuttings. | | BACK | FILL TYPE | Bento | onite | | | Pea Grav | el | | gs | Grout | | <u></u> | Slough | | |
| SOIL DESCRIPTION Soil | | 27.10.1 | , | _ | | | | | | | <u> </u> | | | ш. | <u>_</u> | | |
| OR SURFACE ORANICS (Moss) - 25mm thick CLAY - silty, high plastic, moist, soft, grey, frequent noticets - firm to stiff below 0.3m - firm to stiff below 0.3m - firm below 2.3m - frequent oxide inclusions below 1.8m - frequent oxide inclusions at 2.7m - frequent oxide inclusions at 2.7m - TEST HOLE TERMINATED 3.0m BELOW GRADE NOTES - Supplicant seepage was encountered 1.5m below grade Supplicant seepage was encountered at grade. Test hole remained open to 3.0m and was filled with valeer to top of grade Test hole was back filled with auger outlings. | | Depth (m) | PLASTIC M.C. | METER (kPa 00 400 LIQUID | a) II | SOIL SYMBOL | MUSCS | | | | | | SAMPLE TYPE | SAMPLE NO | SPT (N) | COMMENTS | Depth (m) |
| - firm to stiff below 0.3m - firm to stiff below 0.3m - firm below 2.3m - frequent oxide inclusions at 2.7m TEST HOLE TERMINATED 3.0m BELOW GRADE NOTES TRes sleughing was encountered 1.15m below grade. Significant seepage was encountered at grade. Test tole remained open to 3.0m and was filled with water to top of grade. Test hole was back filled with auger cuttings. | | _ 0 | 20 40 6 | 0 80 | ī | | OR | SURFACE | ORANIC | CS (Moss) - ~25mi | m thick | | 7 | | | | <u> </u> |
| AMEC Environment & Infrastructure Winnipeg, Manitoba Completion Depth: 3 m Reviewed By: RB Completion Date: July 23, 2013 Figure No. 56 Page | ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:16 AM (GEOTECHNICAL REVISED) | | | | | | | - firm to sti - firm below - frequent of TEST HOL NOTES: - Trace slo Significant remained of the stiff of the | y, high p ff below (al sulpha v 2.3m oxide inc E TERM ughing w seepage open to 3 | lastic, moist, soft, 0.3m lusions at 2.7m IINATED 3.0m BE was encountered 0 be was encountered 3.0m and was filled | w 1.8m LOW GRA 0.15m below d at grade. d with wate | DE w grade. Test hole | | 2 3 4 5 6 7 8 | | | -1 -1 -2 -3 -4 -5 6 |
| AMEC Environment & Infrastructure Winnipeg, Manitoba LOGGED BY: SK REVIEWED BY: RB Figure No. 56 COMPLETION DEPTH: 3 m REVIEWED BY: RB Figure No. 56 Page | N | 8 | | | | | | | | | | | | | + | | |
| AMEC Environment & Infrastructure Winnipeg, Manitoba LOGGED BY: SK REVIEWED BY: RB Figure No. 56 COMPLETION DEPTH: 3 m REVIEWED BY: RB Figure No. 56 Page | MCC | | | | | | | | | | | | | ļ. | | | |
| AMEC Environment & Infrastructure Winnipeg, Manitoba REVIEWED BY: RB COMPLETION DATE: July 23, 2013 Figure No. 56 Page | ERR | | | | | | | LOGGED BY: SK | | COMPLETION DEPTH: 3 m | | | | | | | |
| Figure No. 56 Page | 38 - T | | mec | | | AMI | | | | | | | | | | | |
| · · · · · · · · · · · · · · · · · · · | 1718 | | Winnipeg | | | | vviriripeg, | ıvıarııt0l | ua ———————————————————————————————————— | Figure No. 56 | | | Page 1 of | | | | |

| PRO | JECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple I | DRILLED BY: Maple Leaf Drilling Ltd. | | | | |
|--|---|-------------|-------|--|--|-------------------------|-----------------------------|--|--|
| CLIE | NT: Terracon Developme | nts | | DRILL TYPE: Track M | lounted DR150 | | PROJ | ECT NO: WX17188 | |
| LOC | ATION: Winnipeg, Manitol | оа | | DRILL METHOD: 125 | mm Solid Stem A | ugers | ELEV | ATION: | |
| SAM | PLE TYPE She | lby Tube | | ✓ No Recovery SPT (N) | Grab : | | ∭Split-Pe | | |
| BAC | KFILL TYPE Ben | tonite | | Pea Gravel Drill Cutting | s Grout | [| Slough | Sand | |
| Depth (m) | ▲ UNCONFINED COMPRESSION (100 200 300 40 ■ POCKET PENETROMETER (kF 100 200 300 40 PLASTIC M.C. LIQUI 20 40 60 88 | SOIL SYMBOL | MUSCS | SOIL DESCRIP | | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK. GPJ 13:09/24 09:16 AM (GEOTECHNICAL REVISED) - TERRACON - ST BONIFACE INDUSTRIAL PARK. GPJ 13:09/24 09:16 AM (GEOTECHNICAL REVISED) - TERRACON - ST BONIFACE INDUSTRIAL PARK. GPJ 13:09/24 09:16 AM (GEOTECHNICAL REVISED) - TERRACON - ST BONIFACE INDUSTRIAL PARK. GPJ 13:09/24 09:16 AM (GEOTECHNICAL REVISED) | | | CH | SURFACE ORGANICS (Moss) - ~25r CLAY - silty, trace rootlets, trace orga greyish brown - dark greyish brown, firm to stiff, trace organics, occasional silt inclusions be - stiff below 0.9m - brown, occasional sulfate inclusions below 1.2m - firm to stiff below 1.8m TEST HOLE TERMINATED AT 12.1n NOTES: No sloughing or seepage was encour hole remained open to 12.1m and wa drilling. Test hole was backfilled with a drilling. Test hole was backfilled with a second content of the se | nics, high plastic, me to some rootlets at low 0.6m In BELOW EXISTING tered during drilling, so dry upon completions. | anics GRADE Test on of | 1 2 3 4 5 6 6 7 8 8 9 9 110 | | -1 |
| 17188 - TERRA | emec ⁹ | AME | | nvironment & Infrastructure Winnipeg, Manitoba | LOGGED BY: AL REVIEWED BY: F Figure No. 57 | RB | | LETION DEPTH: 6.1 m LETION DATE: August 21, 20° Page | 13 13 of 1 |

| PROJ | ECT: Prairie Industrial P | ark | | DRILLED BY: AMEC | DRILLED BY: AMEC | | | | | |
|--|---------------------------|---|----------|--|---|-------------|-----------------------------|--|-----------|--|
| CLIEN | NT: Terracon Developme | ents | | | | | PROJ | ECT NO: WX17188 | | |
| LOCA | TION: Winnipeg, Manito | ba | | DRILL METHOD: Har | id Auger | | ELEV | ATION: | | |
| SAMP | PLE TYPE She | elby Tube | | ✓ No Recovery SPT (N) | Grab Sample | | Split-Pe | | | |
| BACK | FILL TYPE Ber | ntonite | | Pea Gravel Drill Cutting | s Grout | | Slough | Sand | | |
| Depth (m) | PLASTIC M.C. LIQU | Pa)■ 00 N N N N N N N N N N N N N N N N N N | MUSCS | SOIL DESCRIP | | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) | |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:16 AM (GEOTECHNICAL REVISED) 8 | | | OR OH | SURFACE ORGANICS (Moss) - ~25r ORGANIC CLAY - silty, high plastic, r frequent rootlets CLAY - silty, high plastic, moist, stiff, s - brown below 0.3m - occasional sulphate inclusions below - firm, brownish grey below 2.1m TEST HOLE TERMINATED 3.0m BEI NOTES: - No sloughing or seepage was encountly hole remained open to 3.0m and was drilling. Test hole was backfilled with a series of the se | noist, firm to stiff, dark grey, grey, abundant silt inclusions v 1.2m OW GRADE untered during drilling. Test dry upon completion of auger cuttings. | | 1 2 3 4 4 5 6 6 7 8 8 9 110 | | | |
| 17188 - TE | mec | AME | | nvironment & Infrastructure Vinnipeg, Manitoba | ntrastructure REVIEWED BY: RR | | | COMPLETION DEPTH: 3 m COMPLETION DATE: July 23, 2013 Page 1 of 1 | | |

| PRO | JECT: Prairie Industrial Pa | ark | DRILLED BY: Maple Leaf Drilling Ltd. | | | | BORE HOLE NO: RD47 | | | |
|--|---|---------------|--|--|--|----------------|----------------------------------|--------------------|--|--|
| CLIE | NT: Terracon Developmen | nts | DRILL T | YPE: Track Mounte | d DR150 | | PROJ | ECT NO: WX17188 | | |
| LOC | ATION: Winnipeg, Manitob | oa | DRILL M | ETHOD: 125mm S | olid Stem Augers | | ELEV | ATION: | | |
| SAM | PLE TYPE Shel | by Tube | No Recovery | SPT (N) | Grab Sample | | Split-Pe | | | |
| BAC | KFILL TYPE Bent | tonite | Pea Gravel | Drill Cuttings | Grout | \blacksquare | Slough | Sand | | |
| Depth (m) | ▲ UNCONFINED COMPRESSION (I 100 200 300 40) ■ POCKET PENETROMETER (kF 100 200 300 40) PLASTIC M.C. LIQUII 20 40 60 86 | L SYMB(NUSCS) | [| SOIL DESCRIPTION | N | SAMPLE TYPE | SPT (N) | COMMENTS | Depth (m) | |
| _ 0 - - - - - | | OF OF | CLAY - silty, trace roo black | tlets, high plastic, mois | st, stiff, dark grey to | 1 2 | | | - | |
| -1 - | | | SILT - trace clay, low occasional grey clay in | plastic, moist, firm to s nclusions | tiff, light brown, | 4 | | | <u>-</u> 1 | |
| <u> </u> | | | CLAY - silty, high plas sulfate and occasiona | tic, moist, stiff, greyish | brown, occasional | 5 | | | | |
| - | | | - brown below 1.7m | | | | | | - | |
| - -2 - - | | | - firm to stiff below 1.8 | im | | 7 | | | 2 2 | |
| - - - - 3 - - - - | | CH | | | | 3 | | | -3 | |
| :16 AM (GEOTECHNICAL REVISED) | | | - firm to stiff below 4.6 | im | | 9 | | | -4 - - - - - - - - - - - - - - - - - - | |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:16 AM (GEOTECHNICAL | | | TEST HOLE TERMIN, NOTES: No sloughing or seepa hole remained open to drilling. Test hole was | age was encountered of 6.1m and was dry up | during drilling. Test on completion of | | | | - - - - - - - - - - - - - - - - - - - | |
| TERRA 8 | | ABATO | Invited the Control | LOG | GED BY: AL | | COMPL | ETION DEPTH: 6.1 m | | |
| 17188 - 1 | emec [©] | AMEC | =nvironment & Infras Winnipeg, Manitoba | ment & Intrastructure REVIEWED BY: RB | | | COMPLETION DATE: August 21, 2013 | | | |
| 17 | <i>) </i> | | pog,aiiitoba | Figur | e No. 59 | | | Pag | e 1 of 1 | |

| PROJ | IECT: Prairie Industrial Pa | ark | | DRILLED BY: AMEC | | | | BORE HOLE NO: RD48 | | |
|--|--|----------------------|--|---|--------------------------------------|--|-------------|---------------------------|------------------|-----------|
| CLIEN | NT: Terracon Developmer | nts | | | | | | PROJ | ECT NO: WX17188 | |
| LOCA | TION: Winnipeg, Manitob | oa | | | THOD: Hand Au | ger | | ELEV | ATION: | |
| SAMP | PLE TYPE Shell | by Tube | ✓ No Recov | | SPT (N) | Grab Sample | | ∏Split-Pe | | |
| BACK | | tonite | Pea Grav | rel | Drill Cuttings | Grout | [| Slough | Sand | , |
| Depth (m) | ■ UNCONFINED COMPRESSION (I 100 200 300 40) ■ POCKET PENETROMETER (kF 100 200 300 40) PLASTIC M.C. LIQUII 20 40 60 80 | SOIL SYMB(| 200 | Dŧ | SOIL ESCRIPTIC | N | SAMPLE TYPE | SPT (N) | COMMENTS | Depth (m) |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:16 AM (GEOTECHNICAL REVISED) 8 | | | CLAY - silt - trace roo - occasion SILT - trace CLAY - silt rootlets - occasions H - stiff below TEST HOL NOTES: - Trace slc seepage c 3.0m below below grace | tets below 0.6 al silt lamination te clay, low platic ty, high plastic ty, high plastic al silt inclusion w 2.7m LE TERMINAT bughing encoupleserved from w grade prior to the test hole be | en below 0.9m astic, moist, soft, ta | stiff, dark grey ish grey n brown greyish brown, trace GRADE 2m to 1.3m. Slight thole remained open to n to water was 2.0m | | COMPI | ETION DEPTH: 3 m | |
| 17188 - TI | mec | Environmer Winnipeg, | | ucture | /IEWED BY: RB | | | ETION DATE: July 23, 2013 | 1 of 1 | |

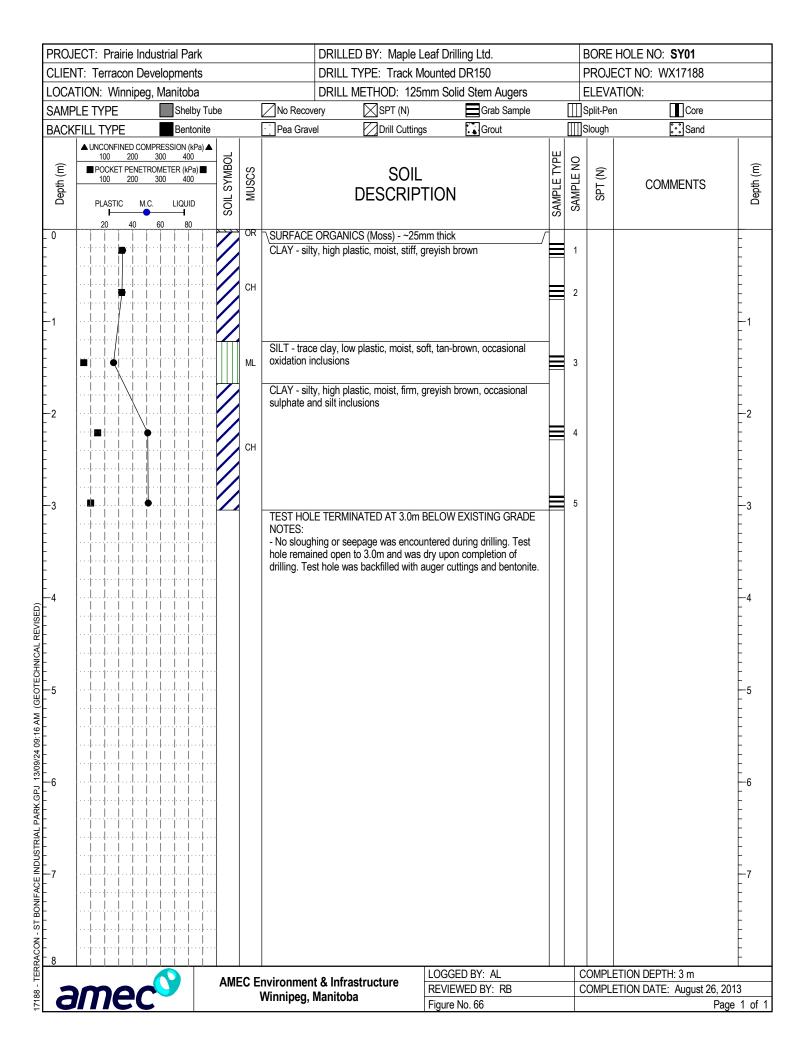
| PR | OJECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple I | eaf Drilling Ltd. | | BORI | E HOLE NO: RD49 | |
|---|---|---|----------------|--|---|-------------|----------------------|----------------------------|------------------|
| CLI | ENT: Terracon Development | nts | | DRILL TYPE: Track M | lounted DR150 | | PRO | JECT NO: WX17188 | |
| LO | CATION: Winnipeg, Manitol | оа | | | mm Solid Stem Augers | | | 'ATION: | |
| SAI | MPLE TYPE She | lby Tube | | ✓ No Recovery SPT (N) | Grab Sample | | ∭Split-P | | |
| BAG | | tonite | | Pea Gravel Drill Cutting | s Grout | [| Slough | Sand | 1 |
| Depth (m) | ▲ UNCONFINED COMPRESSION (100 200 300 40 ■ POCKET PENETROMETER (kf 100 200 300 40 PLASTIC M.C. LIQUI 20 40 60 88 | O D O O O O O O O O O O O O O O O O O O | MUSCS | SOIL DESCRIP | TION | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) |
| - 0 - - - - | | | OR OH CH | SURFACE ORGANICS (Moss) - ~25r ORGANIC CLAY - silty, trace rootlets grey CLAY - silty, trace organics to 0.3m, h very stiff, grey to dark grey | and organics, moist, dark | | 1 2 | | - - - - |
| - - -1 | | | | very stiff, grey to dark grey - stiff, greyish brown below 0.6m - firm below 0.9m | <u> </u> | | 3 | | _ - -1 |
| - | | i | ML | SILT - trace clay, low platic, moist, so inclusions | π, tan-drown, occasional c | lay | 5 | | - - - |
| - | | | | moist to very moist below 1.5m CLAY - silty, high plastic, moist, stiff, | greyish brown, occasional | silt | 6 | | Ė |
| | | | | inclusions | , | | _ | | _ 2 |
| - | | | | - occasional silt lenses ~20mm thick l | pelow 2.1m | | 7 | | - - - |
| - - - - 3 - - - - - - | | | СН | - abundant silt lenses ~40mm thick be | etween 3.1m to 3.2m | | 8 | | -3 |
| AM (GEOTECHNICAL REVISED) | | | СП | - soft, grey to dark grey below 4.6m | | | 9 | | -4 4 |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:16 AM (GEOTECHNICAL) | | | | - occasional oxidation inclusions belo TEST HOLE TERMINATED AT 6.1m NOTES: - No sloughing or seepage was encound to the remained open to 6.1m and was drilling. Test hole was backfilled with the second to the seco | BELOW EXISTING GRAD intered during drilling. Tes dry upon completion of | t | 10 | | |
| ERRA 8 | | | | | LOGGED BY: AL | | COMP | LETION DEPTH: 6.1 m | |
| 1 - 88 - T | <u>əmec[©]</u> | AME | | nvironment & Infrastructure Winnipeg, Manitoba | REVIEWED BY: RB | | | LETION DATE: July 12, 2013 | |
| 17188 | コロー | | | rriniipey, mailitoba | Figure No. 61 | | | Page | 1 of 1 |

| CLIE | DJECT: Prairie ENT: Terracon CATION: Winnip MPLE TYPE CKFILL TYPE | Developmer Deg, Manitob | nts | | | | DRILLED BY: Maple DRILL TYPE: Track | | | | _ | RE HOLE NO: RD50 OJECT NO: WX17188 | |
|--|---|---------------------------------------|-----------------|--------------|----------|------------------------|---|------------------------------|-----------|--------------|-----------|--|-----------|
| LOC | CATION: Winnip MPLE TYPE CKFILL TYPE | peg, Manitol | | | | | DRILL TYPE: Track I | Mounted DD150 | | | DD | ∩ IECT NO: \N/¥17188 | |
| - | IPLE TYPE | | าล | | | | DIVILL I II L. HACK | viourited DK 130 | | | | OULOT NO. VVX17100 | |
| SAM | KFILL TYPE | Cha | - | | | | DRILL METHOD: 12 | 5mm Solid Stem Au | gers | | ELE | EVATION: | |
| | 1 | Sne | lby Tub | ре | | No Recove | ery SPT (N) | Grab S | ample | | Spli | -Pen Core | |
| BAC | A LINCONEINED | Ben | tonite | | | Pea Grave | el Drill Cuttin | gs Grout | | | ∭Slou | gh 🚉 Sand | |
| | 100 200 | COMPRESSION () 300 40 | kPa) ▲ | | | | | | | ш | | | |
| Œ | | IETROMETER (KF | Pa) ■ | SOIL SYMBOL | SS | | SOIL | | | SAMPLE TYPE | SAMPLE NO | | Œ |
| Depth (m) | | | | LSY | MUSCS | | DESCRIF | | | IP LE | MP F | COMMENTS | Depth (m) |
| | PLASTIC - | M.C. LIQUI | D | SOI | | | | | | SAI | S | | |
| _ 0 | 20 40 | 60 80 |) | } | OR OH | \SURFACE (| ORGANICS (Moss) - ~25 | mm thick | ſr | \vdash | | | |
| - | | | · · · · į · · · | | OH CH | ORGANIC (| CLAY - silty, trace rootlet | | dark | Ħ | 1 | - | |
| - | | | | | | ∖grey ∖CLAY - siltv | , trace organics and root | ets to 0.3m, high plas | tic, | | 2 | - | |
| - | | | | | ML | moist, soft to | to firm, dark grey | | - 1 | | | - | |
| Ē, | | | [| | IVIL | clay lenses | e clay, low plastic, moist, a ~10mm thick | soft, tan-brown, occas | ional | Ħ | 3 | | 1 |
| <u></u> | | | | | | CLAY - silty | , high plastic, moist, very | stiff, greyish brown, f | requent | | 4 | | ' |
| - | | . į . į . į | | | | silt lenses ~ | 15mm thick | | | | 5 | - | |
| - | | | | | | - light greyis | sh brown, occasional silt | nclusions below 1.5m | | | 3 | | |
| F | | | | | | atiff avaida | sh brown below 1.8m | | | | 6 | - | |
| -2 | | | <u>l</u> | | СН | - Sun, greyis | SII DIOWII DEIOW 1.0III | | | | 7 | -2 | 2 |
| - | | | · · · · · · · | | | - firm below | 2.1m | | | | | | |
| - | | | | | | | | | | | | - | |
| - | | | | | | | | | | | | - | |
| | | | | | | | | | | | 8 | | 2 |
| - | | | | | | | E TERMINATED AT 3.1m | BELOW EXISTING (| GRADE | П | | [| J |
| - | | . į. į. į. į | į | | | NOTES: - No sloughi | ing or seepage was enco | untered during drilling | . Test | | | - | |
| - | | | | | | hole remain | ned open to 3.1m and war of hole was backfilled with | dry upon completion | of | | | - | |
| F | | | | | | unling. 165 | tiole was backlilled with | auger cuttings and be | ontonite. | | | - | |
| <u>=</u> 4 | lll | | l | | | | | | | | | -4 | 4 |
| REVISED) | | | | | | | | | | | | _ | |
| | 1 | | | | | | | | | | | - | |
| S - - - - | | · · · · · · · · · · · · · · · · · · · | | | | | | | | | | - | |
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| P P | | | | | | | | | | | | - | |
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| 109/24 | | | | | | | | | | | | - | |
| 6 | | į į į | | | | | | | | | | -6 | 6 |
| ₹. Б. | | | | | | | | | | | | | |
| L PAF | | | | | | | | | | | | | |
| TRIA | | | | | | | | | | | | - | |
| SDQL _ | 1 1 1 1 | | | | | | | | | | | | _ |
| ACE 7 | | | | | | | | | | | | <u></u> | 1 |
| ONIF. | | | | | | | | | | | | [| |
| STB | | | | | | | | | | | | [| |
| NO - | | | . | | | | | | | | | | |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:16 AM (GEOTECHNICAL | | | | | | | | LOCCED DV: AL | | | 1001 | IDLETION DEDTUGA 4 | |
| 8 - TE | eme | | | AME | | | & Infrastructure | LOGGED BY: AL REVIEWED BY: R | В | | | IPLETION DEPTH: 3.1 m IPLETION DATE: July 12, 2013 | |
| 1718 | ガロ に | | | | | Winnipeg, N | Wanitoba | Figure No. 62 | | | | Page 1 | of 1 |

| PROJECT: Prairie Industrial P | ark | DRILLED BY: Maple L | eaf Drilling Ltd. | BORE | E HOLE NO: RD51 |
|---|---|--|---|----------------------|--|
| CLIENT: Terracon Developme | ents | DRILL TYPE: Track M | lounted DR150 | | JECT NO: WX17188 |
| LOCATION: Winnipeg, Manito | ba | | mm Solid Stem Augers | | 'ATION: |
| SAMPLE TYPE She | elby Tube | No Recovery SPT (N) | Grab Sample | ∭Split-P | |
| BACKFILL TYPE Ber | ntonite | Pea Gravel Drill Cutting | s Grout | Slough | Sand |
| E POCKET PENETROMETER (k | © Pa) ■ O O O O O O O O O O O O O O O O O O | SOIL DESCRIP | TION | SAMPLE NO SPT (N) | COMMENTS (E) |
| 20 40 60 8 60 1 20 1 3000/24 03:16 PARK GEO 1 3000/24 03:16 PARK GEO 1 2000/24 03:16 PARK GEO 1 | OR OR OH | SURFACE ORGANICS (Moss) - ~25r ORGANIC CLAY - silty, trace rootlets grey CLAY - silty, trace organics and rootle moist, stiff, grey to dark grey, occasio - greyish brown, occasional silt lenses - firm, occasional oxidation inclusions SILT - trace clay, low platic, moist, so oxidation inclusions - moist to very moist below 1.5m CLAY - silty, high plastic, moist, stiff, linclusions - firm, abundant silt lenses ~25mm this inclusions - stiff, greyish brown, occasional sulple - stiff, greyish brown, occasional sulple - stiff, greyish brown below 4.6m TEST HOLE TERMINATED AT 6.1m NOTES: - Slight to moderate sloughing and me encountered 1.1m below grade during open to 1.2m and was dry upon comp was backfilled with auger cuttings and | and organics, moist, dark ets to 0.3m, high plastic, nal sulphate inclusions s ~5mm thick below 0.6m below 0.9m ft, tan-brown, occasional orown, occasional silt ock between 2.1m and 2.3m BELOW EXISTING GRADE oderate seepage was g drilling. Test hole remained eletion of drilling. Test hole | 1 1 2 3 4 5 6 7 8 8 | -1 -1 -2 -3 -4 -5 -6 |
| amec 88 TERRACON . | AMEC E | Environment & Infrastructure Winnipeg, Manitoba | LOGGED BY: AL REVIEWED BY: RB Figure No. 63 | _ | LETION DEPTH: 6.1 m LETION DATE: July 12, 2013 Page 1 of 1 |

| | PROJI | ECT: Prairie Indus | strial Pa | ark | | | | DRILL | .ED BY: Maple I | Leaf Drillin | g Ltd. | | E | BORE | HOLE NO: RD52 | |
|--|----------------|--------------------|-------------------------------|--------------------|----------------|----------|------------------------------|--------------------------|---|-------------------------------|--------------------------------|-------------|-----------|----------|---------------------------|----------------|
| | CLIEN | IT: Terracon Deve | elopmer | nts | | | | DRILL | . TYPE: Track N | Mounted DI | R150 | | F | PROJ | ECT NO: WX17188 | |
| | LOCA | TION: Winnipeg, I | Manitob | а | | | | DRILL | METHOD: 125 | 5mm Solid | Stem Augers | | E | ELEV | ATION: | |
| | SAMP | LE TYPE | Shell | by Tul | be | | No Recov | ery | SPT (N) | | Grab Sample | | | Split-Pe | n Core | |
| | BACK | FILL TYPE | Bent | onite | | | Pea Grav | el | Drill Cuttino | gs | Grout | | | Slough | <u>∵</u> Sand | |
| | | ▲ UNCONFINED COMPF | RESSION (k | kPa) ▲ | | | | | | | | ш | | | | |
| | (m) r | ■ POCKET PENETRO! | 00 400 METER (kP 00 400 | a) 🔳 | SOIL SYMBOL | SCS | | | SOIL | _ | | SAMPLE TYPE | SAMPLE NO | <u>S</u> | OOM MENTO | (E) |
| | Depth (m) | PLASTIC M.C. | LIQUI | D | OIL S | MUSCS | | | DESCRIP | NOIT | | MPL | AMPI | SPT (N) | COMMENTS | Depth (m) |
| | | 20 40 6 | 0 80 | | Š | OB | - 01/1054.05 | 00011 | | | | /S | 0) | | | |
| | _ 0 _ | | - | · · · · · · | | OR OH | | | IICS (Moss) - ~25i silty, trace rootlets | | cs, moist, dark | | 1 | | | - |
| | - - | | - | ¦ | | | grey CLAY - silt | y, trace s | sand, gravel and r | ootlets to 0. | 3m, high plastic, | | 2 | | | - |
| | _ | | | | | | moist, firm - stiff, grey | to stiff, o to dark (| dark grey to brown grey below 0.6m | 1 | | | 3 | | | - |
| | _ _1 | ijiij | iij. | İ | | | - dark grey | ish brow | n, occasional oxid | dation inclusi | ions below 0.9m | | | | | -1 |
| | - | | - - | · · · · · | | | | | | | | | 4 | | | - |
| | - | | - - | | | СН | | | | | | Ħ | 5 | | | - |
| | - | | | | | | - arevish b | rown fre | equent silt lenses ~ | ~15mm thick | below 1.8m | Ħ | 6 | | | |
| | 2 - | | l l l . | l | | | 9.07.02 | | | | | Ħ | 7 | | | 2 - |
| | - | | | | | | - abundant | silt inclu | usions between 2.3 | 3m to 2.6m | | | 8 | | | |
| | - | | ļļļ. | | | | | | | | | | | | | |
| | - -3 | | ;;;. | · · · j · · | | | | | | | | | 9 | | | - |
| | | | | | | - | | E TERM | IINATED AT 3.1m | BELOW EX | (ISTING GRADE | | Ū | | | - 3 |
| | - | | ļ. <u>ļ</u> . ļ. | <u>.</u> | | | NOTES: - No sloug | ning or s | eepage was enco | untered duri | ng drilling. Test | | | | | - |
| | - | | - - | j | | | hole remai drilling. Te | ned oper st hole w | n to 3.1m and was as backfilled with | s dry upon co auger cuttin | ompletion of gs and bentonite. | | | | | |
| | - - -4 | | | · · · į · · · į | | | | | | | | | | | | |
| SED) | - " | | - | | | | | | | | | | | | | - |
| REVISED) | - - | | ļ <u>ļ</u> ļ. | <u>į</u> | | | | | | | | | | | | - |
| | - | | - | | | | | | | | | | | | | F |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:16 AM (GEOTECHNICAL | - | | | ¦ | | | | | | | | | | | | F |
| EOTE | - 5 | | lll. | ļ | | | | | | | | | | | | - 5 |
| 9 | E | | jjj. | | | | | | | | | | | | | E |
| 16 A | _ | | ¦¦ . | | | | | | | | | | | | | E |
| 4 09 | _ | | - | | | | | | | | | | | | | E |
| 3/09/2 | _ | | - | | | | | | | | | | | | | L |
| 7 | - 6 | l l l l l l | llJ. I I I | l I | | | | | | | | | | | | -6 |
| ₹.G | _ | | | | | | | | | | | | | | | |
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| UST | F | | | | | | | | | | | | | | | F |
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| STE | <u> </u> | | 1 I I - | | | | | | | | | | | | | <u> </u> |
| Š | E | | i i | į | | | | | | | | | | | | E |
| RAC | 8 | | 1 T''1 | | | | | | | | | | | | | L |
| TER | | | 0 | | ΔМ | EC E | nvironmen | t & Infr | astructure | LOGGED | | | | | ETION DEPTH: 3.1 m | |
| - 88 | | mec | | | \(\mathbb{I}\) | | Winnipeg, | | | | D BY: RB | | C | OMPL | ETION DATE: July 12, 2013 | |
| 17 | | | | | | | pog, | | ~~ | Figure No | . 64 | | | | Page | 1 of 1 |

| PROJ | ECT: Prairie Industrial Pa | ark | | DRILLED BY: Maple L | eaf Drilling Ltd. | | BORE | HOLE NO: RD53 | |
|--|---|------------|----------|---|--|-------------|-------------------------------|---|-----------------------------------|
| CLIEN | NT: Terracon Developmer | nts | | DRILL TYPE: Track M | lounted DR150 | | PROJ | ECT NO: WX17188 | |
| LOCA | TION: Winnipeg, Manitob | oa | | DRILL METHOD: 125 | mm Solid Stem Augers | | ELEV | ATION: | |
| SAMP | PLE TYPE Shel | by Tube | | ☑ No Recovery ☑ SPT (N) | Grab Sample | | ∭Split-Pe | | |
| BACK | FILL TYPE Bent | tonite | | Pea Gravel Drill Cutting | s Grout | | Slough | <u>∵</u> Sand | |
| Depth (m) | ■ UNCONFINED COMPRESSION (I 100 200 300 400 100 200 300 400 100 200 300 400 100 100 100 100 100 100 100 100 1 | SOIL SYMB0 | MUSCS | SOIL DESCRIP | | SAMPLE TYPE | SAMPLE NO SPT (N) | COMMENTS | Depth (m) |
| - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:16 AM (GEOTECHNICAL REVISED) 8 | | | OR OH CH | SURFACE ORGANICS (Moss) - ~25n ORGANIC CLAY - silty, trace rootlets grey CLAY (FILL) - silty, some sand to san high plastic, moist, firm, dark greyish I CLAY - silty, trace organics and rootle moist, stiff, grey to dark grey, occasio - dark greyish brown below 0.9m - greyish brown below 1.5m - brown, occasional silt inclusions below - firm, abundant silt lenses ~25mm this silty inclusions below - soft, grey below 5.5m TEST HOLE TERMINATED AT 6.1m NOTES: - No sloughing or seepage was encounted remained open to 6.1m and was drilling. Test hole was backfilled with a drilling. Test hole was backfilled with a silty inclusions. | and organics, moist, dark dy, trace gravel and rootlets, brown ts to 0.5m, high plastic, nal sulphate inclusions bw 1.8m ck at 2.4m below 4.6m BELOW EXISTING GRADE intered during drilling. Test dry upon completion of | | 1 2 3 4 5 6 6 7 8 8 9 110 111 | | -1 -1 -2 3 4 5 |
| 17188 - TER | mec | AME | | nvironment & Infrastructure Winnipeg, Manitoba | LOGGED BY: AL REVIEWED BY: RB Figure No. 65 | | | ETION DEPTH: 9.1 m ETION DATE: July 12, 2013 Page | e 1 of 1 |



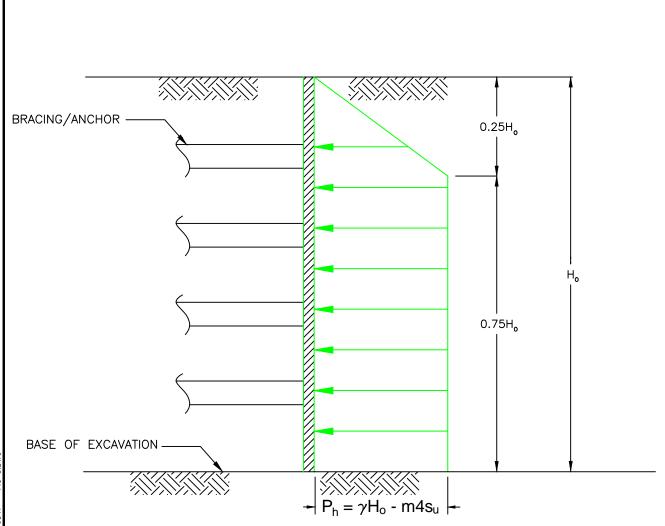
| | PROJ | ECT: Prairie Indus | strial Pa | rk | | | | DRILL | ED BY: Maple | Leaf Drilli | ng Ltd. | | E | BORE | HOLE NO: SY02 | |
|---|--|--|--|--------------|-------------|-------|--|--|---|-------------|--|-------------|-----------|----------|----------------------------|-------------|
| | CLIEN | IT: Terracon Deve | lopmen | ıts | | | | DRILL | TYPE: Track | Mounted D |)R150 | | F | PROJI | ECT NO: WX17188 | |
| | LOCA | TION: Winnipeg, N | Manitob | а | | | | DRILL | METHOD: 12 | 5mm Solid | Stem Augers | | E | ELEVA | ATION: | |
| | SAMP | LE TYPE | Shelb | by Tub | ре | | No Recov | ery | SPT (N) | | Grab Sample | | | Split-Pe | n Core | |
| | BACK | FILL TYPE | Bento | onite | | | Pea Grave | el | Drill Cuttir | ngs | Grout | | | Slough | <u>∵</u> Sand | |
| | Depth (m) | ■ POCKET PENETRON 100 200 3 PLASTIC M.C. | 00 400 METER (kPa 00 400 LIQUID | a) II | SOIL SYMBOL | MUSCS | | | SOII DESCRIF | | | SAMPLE TYPE | SAMPLE NO | SPT (N) | COMMENTS | Depth (m) |
| 17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK.GPJ 13/09/24 09:16 AM (GEOTECHNICAL REVISED) | - 0 1 1 2 3 4 5 6 7 7 | - | | | | CH | - grey to da - brown, oc - firm belov - greyish be TEST HOL NOTES: - No slougt | y, high p nd sulph ark grey, ccasional v 2.3m rown belining or so | stiff below 0.8m stiff below 0.8m sulphate inclusion ow 2.4m INATED AT 3.0n eepage was enco | n BELOW E | lets below 1.5m XISTING GRADE ring drilling. Test | VS | 1 2 3 5 | | | |
| SON | F | | - | | | | | | | | | | | | | F |
| RRAC | - 8 | | | | | | | | | 1.000= | 2 DV 41 | | L | 01/2 | ETION DEDTIL 2 | <u> </u> |
| Ξ. | | mec | 7 | | AME | EC E | nvironmen | t & Infr | astructure | | DBY: AL | | | | ETION DEPTH: 3 m | 3 |
| 7188 | 2 | mec | | | | | Winnipeg, | | | Figure N | ED BY: RB | | + | UIVIPL | ETION DATE: August 26, 201 | 3 1 of 1 |
| 1 | | | | | | | | | | i igure N | 0. 01 | | | | rage | ı UI I |

| BACKFILL TYPE Bentonite AUNCONFINED COMPRESSION (kPa) A 100 200 300 400 POCKET PENETROMETER (kPa) A 100 200 300 400 PLASTIC M.C. LIQUID 20 40 60 80 OR SURF CLAY Very s - stiff, | DRILLED BY: Maple Leaf Drilling Ltd. BORE HOLE NO: SY03 DRILL TYPE: Track Mounted DR150 PROJECT NO: WX17188 |
|--|--|
| LOCATION: Winnipeg, Manitoba SAMPLE TYPE Shelby Tube No F BACKFILL TYPE Bentonite Pea DIVIDING PRESSION (kPa) DIVIDING POCKET PENETROMETER (kPa) DIVI | DDILL TVDE: Track Mounted DD150 DD0 IECT NO: WY17188 |
| SAMPLE TYPE BACKFILL TYPE Bentonite Pea AUNCONFINED COMPRESSION (kPa) A 100 200 300 400 PLASTIC M.C. LIQUID 20 40 60 80 OR SURF CLAY Very s - stiff, | DRIEL TIFE. TIACK MOUNTED DRIED PROJECT NO. WATT 100 |
| BACKFILL TYPE Bentonite AUNCONFINED COMPRESSION (kPa) A 100 200 300 400 POCKET PENETROMETER (kPa) III 100 200 300 400 PLASTIC M.C. LIQUID 20 40 60 80 OR SURF CLAY Very s - stiff, | DRILL METHOD: 125mm Solid Stem Augers ELEVATION: |
| © | Recovery SPT (N) Grab Sample Split-Pen Core |
| 100 200 300 400 100 200 300 400 200 30 | Gravel Drill Cuttings Grout Slough Sand |
| OR SURF CLAY very s | SOIL DESCRIPTION SAMPLE TYPE SAMPLE TYPE SAMPLE TYPE (N) SPT (|
| - firm - firm TEST NOTE - No s hole r | FACE ORGANICS (Moss) - ~25mm thick - silty, trace coarse grained sand, high plastic, moist, stiff to stiff, greyish brown - coccasional silt inclusions below 0.8m - 1 - 2 - 3 - 3 - HOLE TERMINATED AT 3.0m BELOW EXISTING GRADE |
| ACON-ST BONIFACE INDUSTRIA | -7 |
| & 8 | LOGGED BY: AL COMPLETION DEPTH: 3 m |
| AMEC Environ | ment & Infrastructure REVIEWED RV: RR COMPLETION DATE: August 26, 2013 |
| AMEC Environ Winnip | Figure No. 68 Page 1 of 1 |

Geotechnical Investigation Proposed Prairie Industrial Park Winnipeg, Manitoba



APPENDIX B LATERAL EARTH PRESSURES



WHERE: $P_h = DESIGN LATERAL PRESSURE MAGNITUDE (kPa)$

 γ = BULK UNIT WEIGHT OF SOIL (ASSUME γ =17kN/m³)

 $H_0 = EMBEDMENT DEPTH OF WALL BELOW GRADE (m)$

m = 0.4 FOR SOFT, NORMALLY CONSOLIDATED CLAY

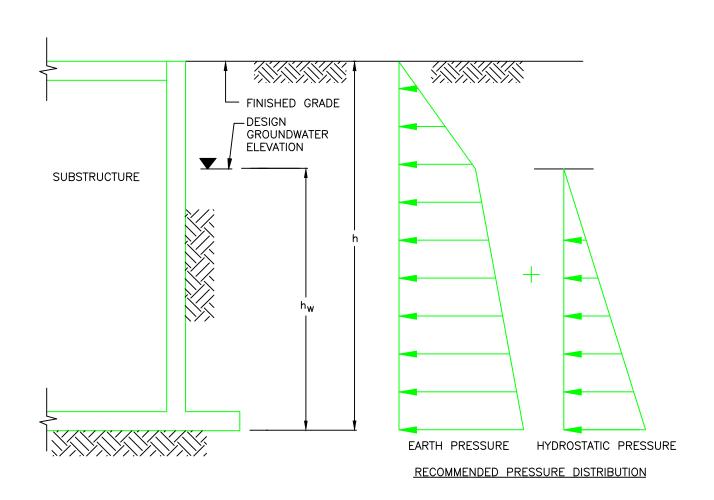
 S_{II} = UNDRAINED SHEAR STRENGTH (ASSUME 35 kPa)

NOTEC

1. LATERAL PRESSURE DUE TO SURCHARGE LOAD AT THE SURFACE MUST BE ADDED TO THE ABOVE PRESSURE DIAGRAM.

| 88 | CLIENT: | DWN BY: | PROJECT: | DATE: |
|----------|--|--------------|---|----------------|
| 17 | TERRACON DEVELOPMENTS | AL | GEOTECHNICAL INVESTIGATION | SEPTEMBER 2013 |
| ્ર | CLIENT: TERRACON DEVELOPMENTS | CHK'D BY: | PRAIRIE INDUSTRIAL PARK | PROJECT No.: |
| <u>3</u> | | TG | NEAR MAZENOD AND CAMIEL SYS | wx17188 |
| .2/1 | | DATUM: | WINNIPEG, MANITOBA | REV. No.: |
| 17100'S | amec | PROJECTION: | TITLE: | В |
| | 440 DOVERCOURT DRIVE | - | | FIGURE No.: |
| \SBOL\ | WINNIPEG, MANITOBA R3Y 1N4 PHONE: 204.488.2997 FAX:204.489.8261 | SCALE: | TEMPORARY BRACED EXCAVATIONS IN SOFT, NORMALLY CONSOLIDATED CLAY | EICUDE D4 |
| ų. | 1700.201 | NOT TO SCALE | NORWALL I CONSOLIDATED CLAT | FIGURE B1 |

P:\JOBS\17100'S\17180'S\17188 - TERRACON - ST BONIFACE INDUSTRIAL PARK\GEOTECH\DRAWINGS\WX16347 - FIG 3.DWG



$$P_h = K\gamma(h-h_w) + K\gamma'h_w + \gamma_w h_w$$

WHERE: P_h = LATERAL EARTH PRESSURE (kPa)

 γ = UNIT WEIGHT OF SOIL (SEE TEXT OF REPORT)

 γ' = BUOYANT UNIT WEIGHT OF SOIL (SEE TEXT OF REPORT)

 $\gamma_{
m W}=$ UNIT WEIGHT OF WATER (USE $\gamma_{
m W}=$ 9.8 kN/m 3)

h = HEIGHT OF WALL FROM FINISHED GRADE TO BASE OF WALL (m)

 $h_{\boldsymbol{W}}$ = HEIGHT OF GROUNDWATER TABLE ABOVE BASE OF WALL (m)

K = LATERAL EARTH PRESSURE COEFFICIENT (K - SEE REPORT TEXT)

NOTES:

1. SEE TEXT OF REPORT FOR UNIT WEIGHTS AND LATERAL EARTH PRESSURE COEFFICIENTS.

2. A HYDROSTATIC COMPONENT NEED ONLY BE INCLUDED WHERE A PERCHED GROUND WATER TABLE WERE TO OCCUR WITHIN THE LEVEL OF SUB-STRUCTURE IN COMBINATION WITH NO SUB-DRAINAGE.

| Ξ. | CLIENT: | DWN BY: | PROJECT: | DATE: |
|-------|--|------------------------|---------------------------------|---------------|
| 450 | TERRACON DEVELOPMENTS | AL | GEOTECHNICAL INVESTIGATION | SEPTEMBER2013 |
| 8 | TERRACON DEVELOPMENTS | CHK'D BY: | PRAIRIE INDUSTRIAL PARK | PROJECT No.: |
| ₹. | | TG | NEAR MAZENOD AND CAMIEL SYS | WX17188 |
| 9 | | DATUM: | WINNIPEG, MANITOBA | REV. No.: |
| ဦ | amec | - | · | |
| 0200 | OITICL | PROJECTION: | TITLE: | В |
| S | 440 DOVERCOURT DRIVE | - | LATERAL EARTH PRESSURES | FIGURE No.: |
| Sqor\ | WINNIPEG, MANITOBA R3Y 1N4 PHONE: 204.488.2997 FAX:204.489.8261 | SCALE: NOT TO SCALE | ON PERMANENT GATE CHAMBER WALLS | FIGURE B2 |
| ïL | | NOT TO SCALE | | I IGUNE BZ |



Stantec Consulting Ltd. 500-311 Portage Avenue, Winnipeg MB R3B 2B9

November 24, 2015 File: 116809351

Attention: Maqbool Hussain 500 - 311 Portage Avenue Winnipeg, MB R3B 2B9

Dear Mr. Hussain,

Reference: St. Boniface Industrial Lift Station

Stantec was retained to perform a geotechnical investigation to evaluate the existing soils conditions and provide foundation recommendations for the proposed St. Boniface Industrial Lift Station located in Winnipeg, Manitoba. The purpose of the geotechnical investigation was to determine subsurface conditions and provide foundation recommendations. In addition to the foundation review, a slope stability analysis of proposed excavations was also performed in order to determine the maximum side slopes during excavation for the tanks.

Outlined below is a description of the proposed lift station, a summary of the geotechnical investigation, foundation recommendations and the results of the slope stability analysis.

1.0 PROPOSED LIFT STATION

The project site is located within the St. Boniface Industrial Park, just east of Mazenod Road as shown on Figure 1 in Appendix B. The proposed works at this site consists of the design and construction of the St. Boniface Industrial Lift Station. The currently proposed Lift Station consists of the following:

- Two discrete 3 m diameter by 10 m deep tanks. To facilitate a connection of the tanks near the tank base, it is likely that the tanks will be installed by mass excavation, and would be founded on a common concrete slab;
- A heated building will be constructed overtop one of the tanks

2.0 GEOTECHNICAL INVESTIGATION

The geotechnical drilling and sampling program was performed on November 19, 2015, with drilling services provided by Maple Leaf Drilling Ltd. and continuous Stantec supervision. The drilling was performed using a track mounted Mobile B37X drill rig. One testhole was drilled at this site, with the location shown on Figure 1 in Appendix B. The testhole was drilled approximately 15 m south of the proposed lift station location. Partially frozen/wet conditions created poor rig access and therefore the testhole was drilled at the closest feasible location to the proposed lift station (photograph included within Appendix B). The drilling program consisted of advancing 125 mm solid stem augers through the native overburden materials to power auger refusal. Overburden soil samples were retrieved directly off the auger flights at approximately 0.75 to 1.5 m intervals. Attempts were also made to advance 35 mm inside diameter split spoon samples in cohesionless samples to obtain Standard Penetration Test (SPT) "N" values. All samples were visually inspected in the field for material types and consistency.



November 24, 2015 Magbool Hussain Page | 2

Reference: St. Boniface Industrial Lift Station

Field torvanes were performed on all cohesive samples to estimate clay material undrained shear strength.

INVESTIGATION RESULTS

The overall stratigraphic conditions of the site have been based upon the investigation results obtained during the field drilling program and are outlined below.

Based upon testhole TH1, the stratigraphy consisted of a surficial layer of topsoil overlying native silty clay overlying silt till. A description of the soil stratigraphy is given below, with the detailed testhole log included in Appendix C. Also included in Appendix C are the symbols and terms used on borehole and test pit records.

Organics/Topsoil

A surface layer of organic/topsoil material was encountered from ground surface. The topsoil was black in colour, moist and was approximately 150 mm thick.

Native Silty Clay

Native silty clay was encountered underlying the upper organic/topsoil material. The silty clay material was black to brown in colour and moist. The thickness of the silty clay layer was observed to be 17.2 m. The undrained shear strength of the silty clay layer ranged from 22 to 92 kPa (average of 45 kPa), classifying this material as soft to stiff in consistency.

Silt Till

A layer of silt till was observed underlying the native silty clay material. The till was layer was first encountered at a depth of 17.35 m below grade, with auger refusal occurring at a depth of 18.1 m below grade within the till layer. The till was brown to tan in colour, moist, non-plastic, with sand, with fine gravel. One standard penetration tests (SPT) was completed within the till layer which resulted in SPT refusal consisting of 50 blows for 75 mm of penetration.

Groundwater and Soil Sloughing Conditions

Minor groundwater seepage was observed at an approximate depth of 1 m below ground surface. Upon completion of the testhole, the groundwater was observed at a depth of 9.5 m. This measured water level within the testhole at completion of drilling should not be considered the long term groundwater level in the area. The actual groundwater level will vary by season/precipitation, but may be conservatively assumed at 2 m below existing grade. Soil sloughing was observed within the silt till layer at a depth of 17.1 m below ground surface.

3.0 FOUNDATION REVIEW AND RECOMMENDATIONS

Based upon the results of the geotechnical investigation, a foundation review has been performed for both the proposed tank slab and the proposed heated structure.

Tank Slab

The individual tanks or tank slab may be founded directly on the native silty clay at 10 m depth.

Design with community in mind



November 24, 2015 Magbool Hussain

Page | 3

Reference: St. Boniface Industrial Lift Station

Bearing capacity at 10 m depth may be taken as the bearing capacity at ULS at 10 m depth, plus the total weight of soil removed for each tank, minus the weight of the tank and any water or sewage within the tank.

For design purposes, a bearing capacity at the underside of the tanks may be taken as 300 kPa (at ULS and SLS), minus the weight of the tanks and its contents (i.e. water, sewage, etc).

The empty tanks would have a buoyant force of 700 kN (not including the weight of the tank, and assuming a groundwater level at surface to represent the worst case scenario). Assuming the tank remains empty, the buoyant force would be resisted by friction along the sidewalls of the tank. This frictional resistance would be dependent on the tank installation methodology, and whether the sidewalls of the tank are in contact with native clay or granular backfill. Assuming native clay contact, the uplift shaft resistance may be taken as 1100 kN at ULS. Assuming granular backfill is in contact with the tank sidewalls (and GWL at 2 m below ground surface), the uplift shaft resistance is 1000 kN at ULS. Based upon the above, it would therefore appear that buoyancy failure is not a concern for the proposed tanks.

Building Foundation

The foundation for the proposed building is dependent on the tank installation methodology. If the tanks can be installed without the need for mass excavation (i.e. soil removal via auger and tanks lowered into place), the building foundation could likely be cast-in-place concrete friction piles. Our current understanding of the tank installation consists of a mass excavation with the excavation material (i.e. native clay) used to backfill the excavation once the tank installation is complete. The recompaction of the native clay to the in-situ density is not considered practical, and some long term settlement of the recompacted material is likely. Settlement of the recompacted material would induce downdrag forces on friction piles, and therefore friction piles are not recommended.

The proposed building foundation should therefore consist of driven end bearing piles that are driven to refusal in the underlying till. The surface of the till layer was encountered at a depth of 17.4 m below ground surface, with pile end and bearing refusal likely at approximately 18 m depth below existing grade.

The driven piles may consist of either precast concrete piles or steel piles. Pile capacities at ultimate limit states (ULS) are provided for driven precast concrete piles and driven steel piles in Table 1 and Table 2 below, respectively. For design purposes, the pile capacity at Serviceability Limit State (SLS) may be taken as the ULS capacity. The unfactored downdrag force along the upper 10 m of the pile length has been included in the tables below.

Table 1- Driven Precast Concrete Pile Capacity

| Pile Diameter | Pile Capacity at ULS | Unfactored Downdrag Force | Refusal Criteria |
|---------------|----------------------|---------------------------|------------------|
| 305 mm | 550 kN | 350 kN | 5 Blows/ 25 mm |
| 356 mm | 750 kN | 400 kN | 8 Blows/ 25 mm |
| 400 mm | 1000 kN | 450 kN | 12 Blows/25 mm |



November 24, 2015 Maqbool Hussain Page | 4

Reference: St. Boniface Industrial Lift Station

The refusal criteria indicated in the above table should be achieved at least 3 times for the final resistance. The hammer should be capable of delivering a minimum rated energy of 40 kJ/Blow. Pre-boring to a depth of approximately 3 m should be considered for all driven piles to enhance pile alignment and reduce vibration levels during pile driving. The prebored hole diameter should be slightly larger than the nominal pile diameter. All piles should be driven continuously to their required depth once driving is initiated. Pile heave for piles within 5 pile diameters of each other should be monitored and redriving should be done where pile heave occurs. Pile spacing should not be less than 2.5 pile diameters, measured center to center. Precast concrete piles driven to practical refusal will develop the majority of their capacity from toe resistance, and therefore, a reduction in pile capacity is generally not required for group action. If pile groups are required for the proposed additions, we should be contacted to review the requirement for a group reduction factor.

Table 2- Driven Steel Pile Capacity

| Pile Size | Pile Capacity at ULS | Unfactored Downdrag Force | Refusal Criteria |
|-----------|----------------------|---------------------------|------------------|
| HP310x110 | 1200 kN | 300 kN | 20 Blows/ 25 mm |

Recommendations for design and installation of steel H piles are provided below.

- 1. Pile spacing within pile groups should be a minimum of 2.5 pile diameters measured centre to centre. Provided that pile heave is monitored and piles are redriven when pile heave is observed, no reduction in pile capacity is required due to group action. Redriving of all piles in groups should be specified along with the requirement to monitor pile heave.
- 2. Prior to the pile installation, the piles should be inspected to confirm that the material specifications are satisfied. As a minimum, steel H-piles should meet the requirements of CAN/CSA-G40.20/G40.21, Grade 350 W. The piles should be free from protrusions, which could create voids in the soil around the pile during driving.
- 3. The piles should be fitted with a driving shoe to help minimize damage to the end of the pile during the driving process. The driving shoe should not extent beyond the outside face of the pile to prevent disturbance of the soils adjacent to the pile as it is being driven.
- 4. The maximum compression and tension stresses developed within any pile during installation (commonly referred to as the driving stresses) should be limited to $0.9 \, F_y$.
- 5. The piles should be driven to practical refusal with a diesel hammer having a minimum rated energy of 50 kJ per blow. Practical pile refusal can generally be considered to be three consecutive sets of 20 blows per 25 mm of pile penetration.
- 6. Monitoring of the pile installation by an experienced inspector is recommended to verify that the piles are installed in accordance with design assumptions and the driving criteria are satisfied. For each pile, a complete driving record in terms of the number of blows per 300 mm of penetration should be recorded.

Because of the potential settlement of the recompacted clay material, the building floor should be supported by a structural slab.

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November 24, 2015 Maqbool Hussain Page | 5

Reference: St. Boniface Industrial Lift Station

4.0 STABILITY REVIEW OF TANK EXCAVATION

As stated previously, it is our current understanding that the proposed tanks will be installed using a mass excavation that is 10 m deep. A slope stability review has been performed to identify the maximum side slopes that can be utilized during the excavation. The slope stability analysis was performed using the software SLOPE\W, developed by Geoslope International Inc. The computer model investigates a large number of potential failure surfaces and depending on the method of analysis used can present the results in the form of contours of computed factors of safety against sliding.

The stability of a slope is typically generalized as a ratio of the forces that drive the failure divided by the forces that resist failure. The unitless fraction is called a Factor of Safety (FS). Factors of Safety that are unity (1.0) or less indicate that driving forces exceed resisting forces and from a geotechnical engineering perspective the slip has failed or is highly unstable.

As per the Canadian Foundation Engineering Manual (CFEM), temporary excavations in clay material should be reviewed using undrained strength parameters. The temporary excavation side slope geometry should be such that a minimum overall slip surface Factor of Safety (FS) of 1.5 be maintained for this site.

The slope stability review has consisted of evaluating the FS for the critical overall slip surface for assumed excavation side slopes of 1H:1V, 2H:1V, and 3H:1V. For the analysis, as undrained shear strength of 45 KPa has been used for the native clay material. The results of the slope stability analysis are included in Appendix D. As shown, a temporary excavation side slope of **2H:1V** is required to meet the target of FS of 1.5.

5.0 ANCILLARY ISSUES

The following is a summary of recommendations related to the temporary excavation.

- As material is excavated, it should be stockpiled no closer than 20 m from the edge of the excavation. The height of the stockpile should be a maximum of 5 m.
- During the temporary excavation, there should be no need for significant dewatering, as groundwater infiltration is expected to be minimal. Any surface or groundwater infiltration into the excavation should be pumped to an appropriate discharge point.
- The analysis for the side slope stability has assumed a <u>temporary</u> condition. As such, the time that the excavation remains open should be minimized, and no longer than 3 weeks.
- When the excavated material is placed back in the excavation, it should be placed in lifts not
 exceeding 200 mm and be compacted to a minimum of 97% the materials Standard Proctor
 Maximum Dry Density (SPMDD) within 4% of the optimum moisture content.

60. CLOSURE

This report has been prepared for the sole benefit of St. Boniface Industrial Lift Station and its agents, and may not be used by any third party without the express written consent of Stantec Consulting Ltd.

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November 24, 2015 Maqbool Hussain

Page | 6

Reference: St. Boniface Industrial Lift Station

Any use, which a third party makes of this report, is the responsibility of such third party. Use of this report is subject to the Statement of General Conditions provided in **Appendix A**. It is the responsibility of St. Boniface Lift Station who is identified as "the Client" within the Statement of General Conditions, and its agents to review the conditions and to notify Stantec Consulting Ltd. should any of these not be satisfied. The Statement of General Conditions addresses the following:

- Use of the report
- Basis of the report
- Standard of care
- Interpretation of site conditions
- Varying or unexpected site conditions
- Planning, design or construction

We trust the above information meets with your present requirements. Should you have any questions or require further information, please contact us. This report has been prepared by Rhett Bonham, B.Sc, E.I.T. and reviewed by Thomas Crilly P.Eng.

We appreciate the opportunity to assist you in this project.

Regards,

STANTEC CONSULTING LTD.

Tom Crilly, M.Sc., P.Eng.

Principal and Senior Geotechnical Engineer

Phone: (204) 928-8825 Fax: (204) 284-4795

Thomas.Crilly@stantec.com

Attached:

Appendix A Statement of General Conditions

Appendix B Site Location Appendix C Testhole Log

Appendix D Slope Stability Review

Certificate of Authorization
Stantec Consulting Ltd.
No. 1301

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APPENDIX A STATEMENT OF GENERAL CONDITIONS

Appendix A: Statement of Terms and Conditions

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec and the Client. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Stantec's present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Stantec is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Stantec must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Stantec will not be responsible to any party for damages incurred as a result of failing to notify Stantec that differing site or sub-surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Stantec cannot be responsible for site work carried out without being present

APPENDIX B SITE LOCATION





Photo 1: View of frozen/wet area, looking northwest - November 19, 2015



Photo 2: View of drilling operation – November 19, 2015

APPENDIX C
TESTHOLE LOG

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

| Rootmat | vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface |
|---------|---|
| Topsoil | - mixture of soil and humus capable of supporting vegetative growth |
| Peat | - mixture of visible and invisible fragments of decayed organic matter |
| Till | - unstratified glacial deposit which may range from clay to boulders |
| Fill | - material below the surface identified as placed by humans (excluding buried services) |

Terminology describing soil structure:

| Desiccated | - having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc. |
|------------|--|
| Fissured | - having cracks, and hence a blocky structure |
| Varved | - composed of regular alternating layers of silt and clay |
| Stratified | - composed of alternating successions of different soil types, e.g. silt and sand |
| Layer | - > 75 mm in thickness |
| Seam | - 2 mm to 75 mm in thickness |
| Parting | - < 2 mm in thickness |

Terminology describing soil types:

The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488) which excludes particles larger than 75 mm. For particles larger than 75 mm, and for defining percent clay fraction in hydrometer results, definitions proposed by Canadian Foundation Engineering Manual, 4th Edition are used. The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):

Terminology describing materials outside the USCS, (e.g. particles larger than 75 mm, visible organic matter, and construction debris) is based upon the proportion of these materials present:

| Trace, or occasional | Less than 10% |
|----------------------|---------------|
| Some | 10-20% |
| Frequent | > 20% |

Terminology describing compactness of cohesionless soils:

The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test (SPT) N-Value - also known as N-Index. The SPT N-Value is described further on page 3. A relationship between compactness condition and N-Value is shown in the following table.

| Compactness Condition | SPT N-Value |
|-----------------------|-------------|
| Very Loose | <4 |
| Loose | 4-10 |
| Compact | 10-30 |
| Dense | 30-50 |
| Very Dense | >50 |

Terminology describing consistency of cohesive soils:

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests. Consistency may be crudely estimated from SPT N-Value based on the correlation shown in the following table (Terzaghi and Peck, 1967). The correlation to SPT N-Value is used with caution as it is only very approximate.

| Consistency | Undrained Sh | Approximate | |
|-------------|--------------|-------------|-------------|
| Consistency | kips/sq.ft. | kPa | SPT N-Value |
| Very Soft | <0.25 | <12.5 | <2 |
| Soft | 0.25 - 0.5 | 12.5 - 25 | 2-4 |
| Firm | 0.5 - 1.0 | 25 - 50 | 4-8 |
| Stiff | 1.0 - 2.0 | 50 – 100 | 8-15 |
| Very Stiff | 2.0 - 4.0 | 100 - 200 | 15-30 |
| Hard | >4.0 | >200 | >30 |

ROCK DESCRIPTION

Except where specified below, terminology for describing rock is as defined by the International Society for Rock Mechanics (ISRM) 2007 publication "The Complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006"

Terminology describing rock quality:

| 3 1 1 1 1 | | |
|-----------|-------------------|--|
| RQD | Rock Mass Quality | |
| 0-25 | Very Poor Quality | |
| 25-50 | Poor Quality | |
| 50-75 | Fair Quality | |
| 75-90 | Good Quality | |
| 90-100 | Excellent Quality | |

| Alternate (Colloquial) Rock Mass Quality | | |
|--|--------------------------|--|
| Very Severely Fractured Crushed | | |
| Severely Fractured | Shattered or Very Blocky | |
| Fractured | Blocky | |
| Moderately Jointed | Sound | |
| Intact | Very Sound | |

RQD (Rock Quality Designation) denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run. RQD is determined in accordance with ASTM D6032.

SCR (Solid Core Recovery) denotes the percentage of solid core (cylindrical) retrieved from a borehole of any orientation. All pieces of solid (cylindrical) core are summed and divided by the total length of the core run (It excludes all portions of core pieces that are not fully cylindrical as well as crushed or rubble zones).

Fracture Index (FI) is defined as the number of naturally occurring fractures within a given length of core. The Fracture Index is reported as a simple count of natural occurring fractures.

Terminology describing rock with respect to discontinuity and bedding spacing:

| Spacing (mm) | Discontinuities | Bedding |
|--------------|-----------------|------------------|
| >6000 | Extremely Wide | - |
| 2000-6000 | Very Wide | Very Thick |
| 600-2000 | Wide | Thick |
| 200-600 | Moderate | Medium |
| 60-200 | Close | Thin |
| 20-60 | Very Close | Very Thin |
| <20 | Extremely Close | Laminated |
| <6 | - | Thinly Laminated |

Terminology describing rock strength:

| Strength Classification | Grade | Unconfined Compressive Strength (MPa) |
|-------------------------|-------|---------------------------------------|
| Extremely Weak | RO | <1 |
| Very Weak | R1 | 1 – 5 |
| Weak | R2 | 5 – 25 |
| Medium Strong | R3 | 25 – 50 |
| Strong | R4 | 50 – 100 |
| Very Strong | R5 | 100 – 250 |
| Extremely Strong | R6 | >250 |

Terminology describing rock weathering:

| Term | Symbol | Description |
|---------------|--------|--|
| Fresh | W1 | No visible signs of rock weathering. Slight discoloration along major discontinuities |
| Slightly | W2 | Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored. |
| Moderately | W3 | Less than half the rock is decomposed and/or disintegrated into soil. |
| Highly | W4 | More than half the rock is decomposed and/or disintegrated into soil. |
| Completely | W5 | All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact. |
| Residual Soil | W6 | All the rock converted to soil. Structure and fabric destroyed. |

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.





















Boulders Cobbles Gravel

Clay

Concrete

Igneous Bedrock

morphic

Bedrock

Sedimentary Bedrock

SAMPLE TYPE

| SS | Split spoon sample (obtained by performing the Standard Penetration Test) |
|-------------------|---|
| ST | Shelby tube or thin wall tube |
| DΡ | Direct-Push sample (small diameter tube |
| DI | sampler hydraulically advanced) |
| PS | Piston sample |
| BS | Bulk sample |
| HQ. NQ. BQ. etc. | Rock core samples obtained with the use |
| ria, na, ba, elc. | of standard size diamond coring bits. |

WATER LEVEL MEASUREMENT



measured in standpipe, piezometer, or well



inferred

RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

N-VALUE

Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (63.5 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (300 mm) into the soil. In accordance with ASTM D1586, the N-Value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (150 to 450 mm). However, when a 24 in. (610 mm) sampler is used, the number of blows (N) required to drive the sampler over the interval of 12 to 24 in. (300 to 610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-Values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75). Some design methods make use of N-values corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

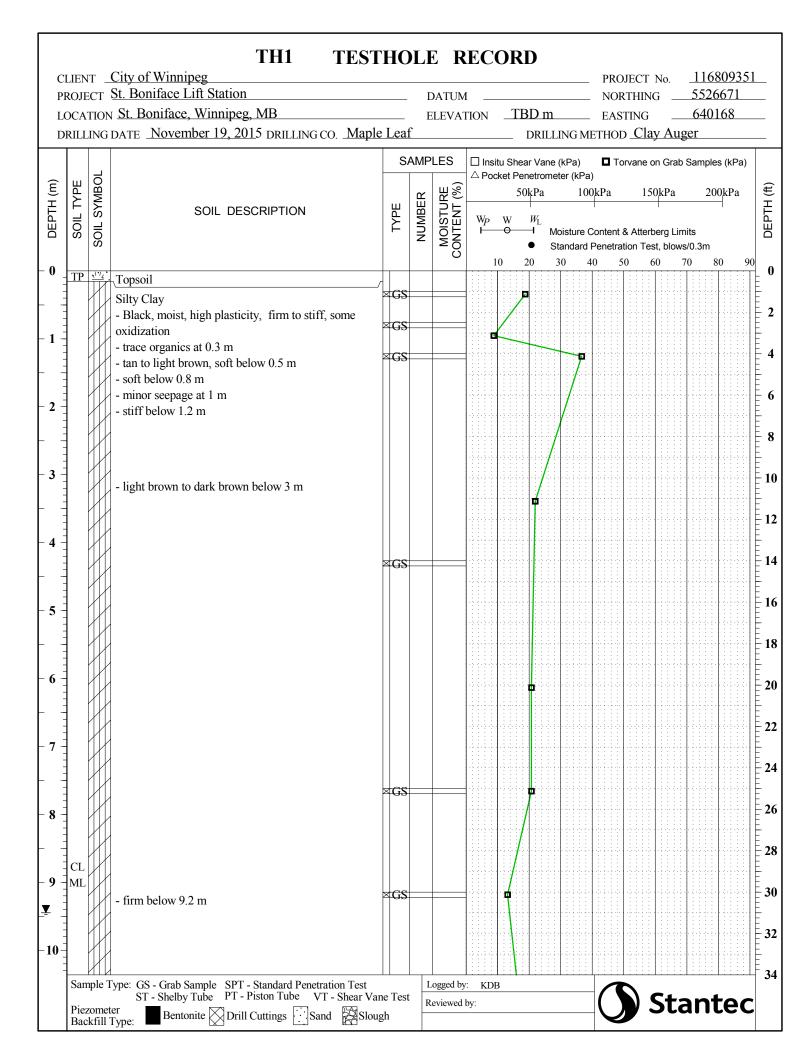
DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to 'A' size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (300 mm) into the soil. The DCPT is used as a probe to assess soil variability.

OTHER TESTS

| S | Sieve analysis | |
|----|--|--|
| Н | Hydrometer analysis | |
| k | Laboratory permeability | |
| Υ | Unit weight | |
| Gs | Specific gravity of soil particles | |
| CD | Consolidated drained triaxial | |
| CU | Consolidated undrained triaxial with pore | |
| | pressure measurements | |
| UU | Unconsolidated undrained triaxial | |
| DS | Direct Shear | |
| С | Consolidation | |
| Qυ | Unconfined compression | |
| | Point Load Index (Ip on Borehole Record equals | |
| Ιp | $I_{p}(50)$ in which the index is corrected to a | |
| | reference diameter of 50 mm) | |

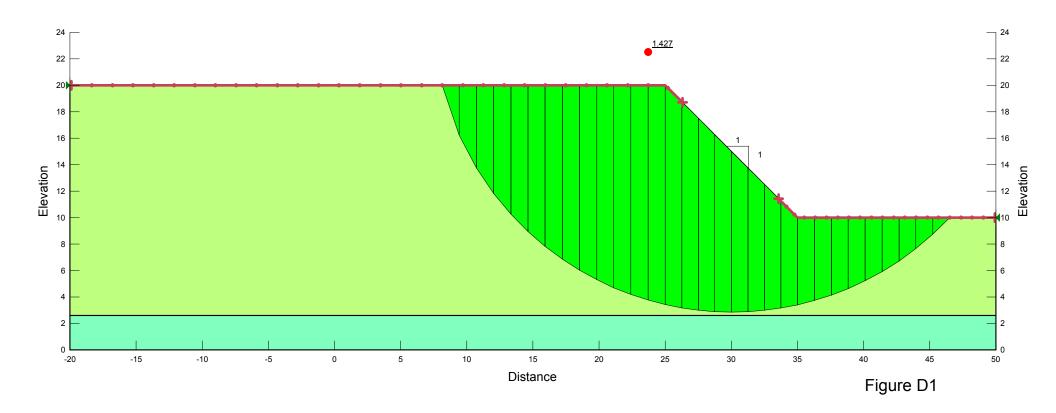
| Ţ | Single packer permeability test; test interval from depth shown to bottom of borehole |
|---|---|
| | Double packer permeability test; test interval as indicated |
| O | Falling head permeability test using casing |
| | Falling head permeability test using well point or piezometer |



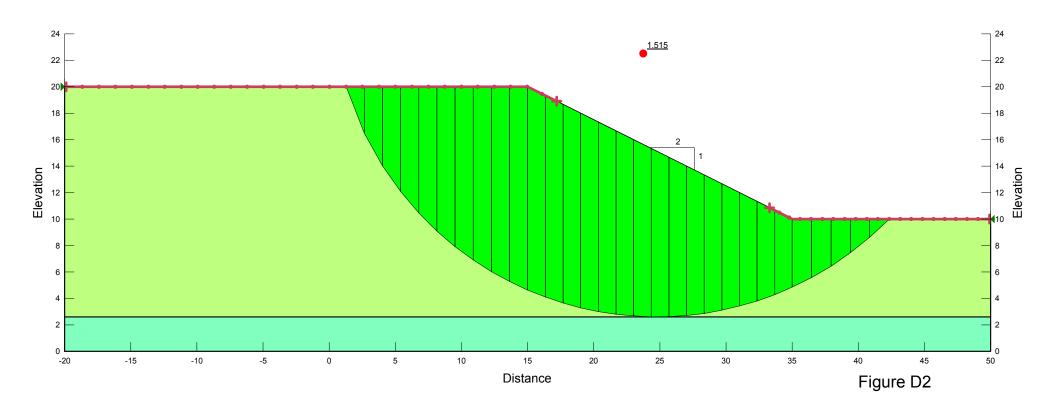
| TH1 TESTHOLE RECORD CLIENT City of Winnipeg | | | | | | | | | | | | | | PROJECT No. | | | | cont'd _116809351_ | | | | |
|--|--|-------------|--|------|----------|-------------------------|---|---|-----------------------|---|------------|-------------------------------|---|---------------------------------|---------|--------|------|-----------------------|------------|---------------------|--|--|
| ı | ROJI | | DATUM | | | | | | | | NORTHING _ | | | | 5526671 | | | | | | | |
| LOCATION St. Boniface, Winnipeg, MB ELEVATION TBD m DRILLING DATE November 19, 2015 DRILLING CO. Maple Leaf DRILL | | | | | | | | | | | | LING METHOD <u>Clay Auger</u> | | | | | | | | | | |
| | Tall | 1110 | DATE TOTAL TOTAL DATE DATE IN CO. TANDA | | | | | | | | | | | ■ Torvane on Grab Samples (kPa) | | | | | | | | |
| ڪ ا | | SOIL SYMBOL | SOIL DESCRIPTION | | | | △ Pocket Penetrometer (kPa) | | | | | | | | | | | | | $\overline{}$ | | |
| ОЕРТН (m) | ΙŁ | | | TYPE | NUMBER | MOISTURE CONTENT (%) | 50kPa W _P W W _L I → I | | Pa | a 100kP | | cPa | Pa 150kPa | | Pa | 200kPa | | a | DEPTH (ft) | | | |
| DEP. | SOIL TYPE | | | | | | | | W _L I M | Moisture Conten Standard Penetr | | | ontent & Atterberg Lir Penetration Test, blow 0 50 60 | | | | | | DEP | | | |
| | | Ñ | | | | | 10 20 | | | | | | | | | | | | 90 | | | |
| ļ | | Ж | | | | | | | | | | | | | | | | | | 34 | | |
| -11 | | | | ⊠GS | | | | | | | | | | | | | | | | 36 | | |
| 11 | | | | | | | | | | | | | | | | | | | | - | | |
| - | | | | | | | | | | | | | | | | | | | | 38 | | |
| -12 | | | | | | | | | | | | | | | | | | | | 40 | | |
| | | | | | | | -2-6-1-2- | | 3 | | | | | | | | | | | - | | |
| | | X | | | | | | | | | | | | | | | | | | 42 | | |
| -13 | | | | | | | | | | | | | | | | | | | | - | | |
| | | | | | | | | | | | | | | | | | | | :: | - 44 | | |
| -14∙ | | | | | | | | • | | | | | | | | | | | | 46 | | |
| | | | | | | | | | | | | | | | | | | | | - | | |
| - | | | | | | | | | | | | | | | | | | | | 48 | | |
| 15 | | | | | | | | | | | | | | | | | | | | - | | |
| L . | | | | | | | | • | | | | | | | | | | | | 50 | | |
| | | | | | | | | | | | | | | | | | | | | 52 | | |
| -16 | | X | | | | | | | | | | | | | | | | | | - - - | | |
| ļ . | | | | | | | | | | | | | | | | | | | | 54 | | |
| -17 | | | | ⊠GS | ; | | | † | | | | | | | | | | | | 56 | | |
| | | | CL TH | _ | | | | / | | | | | | | | | | | | _ 30 - - - | | |
| | TL | 0 - 0 | Silt Till - Tan to light brown, moist, low plasticity, with sand, | ⊠GS | ; | | | 4 | | 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - | | | | | | | | | | 58 | | |
| -18- | | ۵۱۵ | with fine gravel | ¥GS | | | | | | | | | | | | | 5 | 0/75n > | ım ->• | - | | |
| <u> </u> | | | Auger refusal in silt till at 18.1 m depth - Drill time: 9:30 am to 12:00 pm | SS | | | | | | | | | | | | | | | | 60 | | |
| 10 | | | Minor groundwater seepage at 1 m depthTesthole open to 17.1 m upon removal of augers at | | | | | | | | | | | | | | | | | 62 | | |
| -19 | | | completion of drilling | | | | | | | | | | | | | | | | | _ | | |
| <u> </u> | | | - Groundwater level observed at a depth of 9.4 m upon completion of drilling | | | | | | | | | | | | | | | | | 64 | | |
| -20 | | | - Testhole backfilled with clay cuttings, sealed at top | | | | | | | | | | | | | | | | | 66 | | |
| | | | and bottom with bentonite chips | | | | | | | | | | | | | | | | | - 66 - | | |
| _ · | Sar | nnle T | Sype: GS - Grab Sample SPT - Standard Penetration Test | | Т. | ogged by | : KDI |] : : : : : : : : : : : : : : : : : : : | | | | | | | | | Liii | | Щ | 68 | | |
| | ST - Shelby Tube PT - Piston Tube VT - Shear Vane Test | | | | | | | Reviewed by: | | | | | | | S | ta | an | te | C | | | |
| Piezometer Backfill Type: Bentonite Drill Cuttings Sand Slough | | | | | | | | | | | V | | | | ~•• | | _ | | | | | |

APPENDIX D SLOPE STABILITY REVIEW

Name: Silty Clay (TSA) Model: Undrained (Phi=0) Unit Weight: 18 kN/m³ Cohesion': 45 kPa Name: Silt Till (TSA) Model: Undrained (Phi=0) Unit Weight: 20 kN/m³ Cohesion': 100 kPa



Name: Silty Clay (TSA) Model: Undrained (Phi=0) Unit Weight: 18 kN/m³ Cohesion': 45 kPa Name: Silt Till (TSA) Model: Undrained (Phi=0) Unit Weight: 20 kN/m³ Cohesion': 100 kPa



Name: Silty Clay (TSA) Model: Undrained (Phi=0) Unit Weight: 18 kN/m³ Cohesion': 45 kPa Name: Silt Till (TSA) Model: Undrained (Phi=0) Unit Weight: 20 kN/m³ Cohesion': 100 kPa

