



**GEOTECHNICAL INVESTIGATION
PROPOSED MIXED USE DEVELOPMENT
TOWNSHIP OF WOOLWICH (BRESLAU), ONTARIO**

**for
THOMASFIELD HOMES LIMITED**

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Mr. Tom Krizsan, President
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Dear Mr. Krizsan

**Geotechnical Investigation
Proposed Mixed Use Development
Township of Woolwich (Breslau), Ontario**

Peto MacCallum Ltd. (PML) is pleased to present the findings of our recent geotechnical investigation for the project referenced above.

The project involves a planned residential / commercial subdivision development located on two parcels of land, east of Hopewell Creek and south of Highway 7 in the Township of Woolwich, Ontario. The proposed land use for the subdivision is to comprise of residential, commercial, and office / employment land use. The development will include a school site, a 'Go' Transit Station, park land, two storm water management ponds, a sewage pumping station, access roadways and full municipal servicing.

The terms of reference for this assignment included a combined geotechnical / hydrogeological investigation for the site. The current report comprises only the geotechnical findings and recommendations; the other segments of the investigation will follow under separate cover.

We trust this report has been completed within our terms of reference, and is sufficient for your immediate requirements. If you have any questions or require further information, please do not hesitate to contact our office.

Sincerely

Peto MacCallum Ltd.



Marian S. Molodecki, P.Eng.
Senior Consultant
Geotechnical and Geoenvironmental Services

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1. INTRODUCTION

Peto MacCallum Ltd. (PML) is pleased to report the findings of the geotechnical investigation recently completed for the above noted site. Authorization was received from Mr. Stephen Collie, P.Eng. of AECOM, in a letter dated August 18, 2010.

1.1 Project Description

The project involves a planned residential / commercial subdivision development located on two parcels of land, east of Hopewell Creek and south of Highway 7 in the Township of Woolwich, Ontario. The westerly parcel, known formerly as 'Seagrams Land', is approximately 91.7 ha (226.6 acres) and is bound by Victoria Street North (Highway 7) to the north, Greenhouse Road to the east, a railway to the south, and the Hopewell Creek to the west. The easterly parcel, formerly known as 'Bisgould Land', is approximately 44.0 ha (108.6 acres) and is encompassed by Highway 7 to the north, a cemetery plot to the east, Kramp Road to the south and Greenhouse Road to the west.

The development is proposed to include the following key features, as identified on a concept plan supplied by AECOM, and shown on Drawing 1 attached:

- Low density residential housing (17.1 ha), generally located in the central portion of the former Seagrams Land;
- Medium density townhouse structures (4.3 ha), interspersed throughout the low density residential housing;
- Medium density apartment buildings (3.5 ha), located at the northwest corner of the Seagrams Land and near the southeast corner of the residential dwellings;
- Commercial land (10.7 ha), located at the north portion of the Seagrams land and the north portion of the Bisgould Land;
- Office / employment (22.2 ha), generally located near the southern portion of the Seagrams Land and the easterly portion of the Bisgould Land;
- An elementary school (2.4 ha), located near the northeast corner of the Seagrams Land;



- A 'Go Transit' station (5.8 ha), located at the southerly portion of the Seagrams Land;
- Parks (3.2 ha);
- Greenway and storm water management (SWM) ponds (6.4 ha). Two stormwater ponds are planned for north and west of the proposed 'Go Transit' station location;
- A sewage pumping station (2.2 ha), located near the northwest corner of the Seagrams Land; and,
- Access roadways (15 ha) and full municipal servicing for the proposed works.

It should be noted that as of the time of this report, the proposed works at the site were conceptual only and it has been indicated to PML that some of the proposed land use may change cognizant of this investigation's findings. Once the design is finalized, PML should be retained to check that the recommendations in this report remain applicable.

1.2 Terms of Reference

The terms of reference for this assignment included a combined geotechnical / hydrogeological investigation for this site. This report presents only the geotechnical findings and recommendations; the other segments of the assignment will follow under separate cover.

The purpose of the geotechnical investigation was to explore the subsurface soil and groundwater conditions at the site. Based on the findings, geotechnical design and construction recommendations were to be provided. Specific considerations to be addressed included:

- Stripping and site grading, including engineered fill requirements and reusability of site material for different classes of engineered fill;
- Excavation and backfilling including safe side slopes, shoring design parameters, construction groundwater control, conduit bedding requirements, soil aggressiveness to steel and concrete, material reusability for backfilling and compaction requirements;
- Preliminary foundation design parameters for structures, identification of areas where conventional footing and basement construction might not be feasible and recommended foundation options for such areas;



- Excavation dewatering and foundation design considerations specific to the planned sewage pumping station structure;
- A slope stability assessment for the creek bank slope, including setback requirements for structures;
- Feasibility of storm water recharge, including infiltration rates for the storm water management ponds and for roof water infiltration galleries;
- Vibration impacts on adjacent properties;
- Structural pavement design recommendations for the roadways; and,
- Environmental restrictions for off-site disposal of surplus soil.

The scope of work also included a supplementary test pit investigation to characterize local pockets of wetland grass vegetation in the sloped area west of the planned pumping station. The findings have been submitted as a separate report (Report 3), appended for ease of reference.

The recommendations provided in this report are for design purposes only. When the project design is complete, the general recommendations given in this report should be reviewed to ensure their applicability. It should be noted that the environmental recommendations and conclusions provided in this report are based on a preliminary screening program only, which may not necessarily have identified all occurrences of soil or groundwater impairment.

2. INVESTIGATION PROCEDURES

2.1 Field Work

The field work for the investigation was carried out between September 20 and October 4, 2010, and consisted of 45 conventional sampled boreholes at locations shown on the appended Borehole Location Plan, Drawing 1. The boreholes were advanced to depths of between 6.40 and 14.60 m below grade. Boreholes 2, 7, 11, 24, 35, 40 and 43 included 50 mm observation well installations for follow-up groundwater level monitoring as well as for the associated hydrogeological investigation.



The boreholes were advanced using a Diedrich-50, track mounted drillrig equipped with continuous flight solid stem and hollow stem augers, supplied and operated by a specialist drilling contractor.

Representative samples of the overburden were recovered at regular intervals throughout the depths explored. Standard penetration tests were carried out during sampling operations using conventional split spoon equipment. Groundwater observations were made in the boreholes and observation wells during and upon completion drilling.

The field work was supervised throughout by a member of our engineering staff who directed the drilling and sampling operation, prepared stratigraphic logs, monitored groundwater conditions, and processed the recovered samples.

The borehole locations were determined in the field by PML for coverage of the proposed works. The borehole locations and ground surface elevations were surveyed by Van Harten Surveying Inc., and provided on a site grading plan. Furthermore, Van Harten Surveying Inc. also provided a slope profile for the existing slope located near Hopewell Creek on the former Seagrams land.

It should be noted that decommissioning of the monitoring wells as required under O.Reg. 903 was not included within PML's terms of reference for this assignment and future decommissioning will be required for the PML installed monitoring wells as well as previously installed monitoring wells identified on the Seagrams property.



2.2 Laboratory Testing

All samples secured in the field were returned to our laboratory for detailed visual examination to confirm field soil classifications. The laboratory testing program included moisture content determinations on all recovered samples together with four particle size distribution analyses carried out on near surface soils (for reuse purposes) and four particle size distribution analyses carried out for assessment of the soil permeability / infiltration rates. Furthermore, two Miller box resistivity test and analyses for pH, soluble sulphate, sulphides and redox potential were conducted on representative composite samples, to determine the soil aggressiveness to buried concrete and steel.

In addition, four soil samples were submitted for environmental screening for O.Reg 153/04 metals and inorganics (M&I's). The samples submitted for analysis were all from fill deposits.

The selected soil samples were submitted to AGAT Laboratories Limited (AGAT), a Canadian Association for Laboratory Accreditation Inc. (CALA) accredited laboratory in Mississauga, Ontario. The chemical analyses conducted by AGAT were in accordance with the Ontario Regulation 153/04 Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act dated March 9, 2004.

3. SUMMARIZED FINDINGS

3.1 Site Conditions

A large portion of the Seagrams Land is used for agricultural purposes (the entire northeastern portion of the parcel); however, several structures and associated services and roadways were located on the Seagrams Land, which encompassed a former Seagrams storage yard until the late 1990's. Remnant debris and fill piles are currently located throughout the western portion of this parcel, and many of the access roadways and associated services still remain. In addition, a large, man-made pond that was used for fire prevention purposes is located along the westerly portion of this parcel. Much of the Seagrams Land comprises treed and swamp areas including three areas classified as 'wetland' by the Grand River Conservation Authority (GRCA). The



wetland areas are located near the northeast corner, the southeast corner, and Hopewell Creek, as shown on Drawing 2. A stream / drainage ditch (a Hopewell Creek tributary) cuts toward the northeast corner of the site, emanating from the Bisgould parcel.

A dwelling exists near the northeast corner of the Bisgould Land, which is to be demolished as part of the proposed works. A fairly substantial wetland / swamp area forming the headwaters of the tributary stream / drainage ditch discussed above covers the majority of the western half of the Bisgould Land. The remainder of the eastern portion of this parcel is used for agricultural purposes.

Topographically, the site is generally rough and hilly, with a total relief of approximately 18 m across the two parcels. The lowest portion of the site is located near the northwest corner of the Seagrams Land (near BH 2) at about elevation 312 and the highest portion of the site is located along the eastern edge of the Bisgould Land, at elevation 330. However, it is noted that a local plateau along Greenhouse Road (at elevation 325) accompanied by a local low area at the wetland in the Bisgould parcel (elevation of about 321) ensures that overland flow across the Bisgould parcel is generally captured by the wetland area. Overland flow on the Seagram Land's generally flows toward Hopewell Creek, adjacent to the westerly portion of the site, to the drainage ditch / wetland at the northeast corner, and to the wetland area located on the southern portion of the property.

3.2 Subsurface Conditions

Reference is made to the appended Log of Borehole sheets for detailed findings of the drilling work including soil descriptions, inferred stratigraphy, standard penetration N values, groundwater observations during and upon completion of drilling, and natural moisture content determination test results. In general, variable subsurface conditions were encountered across the two parcels, including, pavement structure / fill materials, and topsoil / organic soils, overlying discontinuous zones of silt, sand and clay based deposits.



3.2.1 Pavement Structure and Fill Materials

Pavement structure materials were penetrated in the seven boreholes located on Greenhouse Road and Kramp Road (Boreholes 27 to 33). In general, 25 mm of tar and chip was encountered throughout Greenhouse Road and was overlying between 275 and 875 mm of granular subbase type material. On Kramp Road, the boreholes encountered between 400 and 730 mm of granular subbase type material from the surface. The boreholes that contained a thinner pavement structure generally penetrated a 200 to 500 mm fill layer underlying the granular soils, which may have been an older pavement structure. In general, the pavement structure / fill materials on Greenhouse Road and Kramp Road extended to depths of between 0.70 and 1.10 m.

Furthermore, fill materials were encountered in Boreholes 4, 5, 7, 9 and 11, which were located in the general area of the former Seagrams structures and roadways. The fill materials in these boreholes extended to depths of between 0.30 and 2.10 m and generally comprised cohesionless soils including gravelly silt and sand, sand and gravel, gravelly sand and sandy silt. The fill deposits were described as compact, based on standard penetration 'N' values between 10 and 26 blows per 0.30 m of penetration of the split spoon sampler. The compact nature of the fill deposits suggests that some compactive effort was likely made during placement of the fill. The fill deposits in this area were generally described as damp to moist, with moisture contents generally less than 10%.

Particle size distribution analyses charts were completed on the surficial fill soils encountered in Boreholes 7 and 9. The results, compared to Granular B specifications, are attached in Figures 6 and 7, respectively.



3.2.2 Topsoil and Organic Soils

Surficial topsoil deposits were encountered in 31 of the 45 boreholes. In Borehole 24, 300 mm of high organic, sandy silt topsoil was penetrated, and was overlying a saturated deposit of layered, very loose, black organic silt and brown silty fine sand. The layered organic deposit extended to 1.40 m below grade. Low to medium organic topsoil was encountered in Boreholes 22, 35 and 36 and extended to depths of between 300 and 450 mm. Between 50 and 380 mm (average of 235 mm) of very low to low organic topsoil was penetrated in the remaining 27 boreholes where surficial topsoil was encountered.

In addition to the surficial topsoil deposits, buried topsoil was encountered below fill and pavement structure materials in Boreholes 9, 27, and 30 to 33. The topsoil encountered in Boreholes 9 and 31 to 33 was described as low organic while the topsoil penetrated in Boreholes 27 and 30 was described as medium organic. These deposits extended to between 0.70 and 1.40 m below grade. In addition, an olive brown organic silt alluvium deposit was encountered below the topsoil in Borehole 27 between 0.70 and 1.40 m below grade.

3.2.3 Silt Based Deposits

Predominantly silt based soils were encountered at various depths across the site, except at Boreholes 15, 33 and 36. The silt based soils included silt, silt till, sandy silt, sandy silt till, silt and sand, and silt and sand till and were generally compact to very dense based on standard penetration N values. However, isolated loose pockets were encountered, typically within 2.00 m of the existing ground surface. Moisture contents were dependent on both location and depth in the various silt deposits, however, were typically in the damp to wet range.

Particle size distribution analyses were completed on the sandy silt, silt and sand, silt till and silt and sand till soils encountered in Boreholes 5, 8, 29 and 45 and are appended as Figures 1 to 4.



3.2.4 Sand Based Deposits

Predominantly sand based soil deposits were penetrated within approximately 26 of the boreholes across the site. The discontinuous sand deposits were typically penetrated at shallower depths (less than 5.0 m), although the deposits did extend deeper in Boreholes 13, 15, 28 and 44, to the borehole termination depths. As with the silt deposits, the majority of the sand deposits were compact to very dense based on standard penetration N values. The sand deposits were often described as saturated, either with perched water above a relatively impermeable clay layer, or with long-term stabilized groundwater at depth.

Particle size distribution analyses were completed on the near surface gravelly sand, and sand and gravel deposits encountered in Boreholes 5 and 11. The results are appended as Figures 5 and 8, and are compared to Granular B specifications.

3.2.5 Clay Based Deposits

Cohesive soil units including clayey silt, clayey silt till, clay and clay till were penetrated in 34 of the boreholes, at various depths. Based on standard penetration N values, the clay based soil units were typically described as stiff to hard, other than a few localized soft zones typically within 0.50 m of the existing ground surface. In many of the boreholes, the relatively impermeable clay soils were supporting a perched groundwater level, and as such the top zone of the clay layers were typically wetter than plastic limit (WTPL). However, once further into the unit, the soils were typically described as about plastic limit (APL) to drier than plastic limit (DTPL).

3.2.6 Groundwater Observations

As noted previously, monitoring wells were installed in seven of the boreholes to more accurately define the long-term groundwater level, and for hydrogeological testing purposes.



Groundwater observations carried out during and upon completion of drilling and in the observation wells are fully summarized on the appended Log of Borehole Sheets, and Table 1 attached. Groundwater was observed in 44 of the boreholes (all except Borehole 8), and all seven of the monitoring wells. Perched water conditions were encountered in six of the boreholes, including Borehole 23, 25, 30, 31, 35 and 42. As well as perched water in the boreholes, standing water has continually been noted at several areas across the site during the course of the field work. Areas prone to standing water include the central area of the Bisgould Land (the swamp portion), and the southern portion (mostly undeveloped area) of the Seagrams Land. The long term groundwater level was encountered at highly variable depths (between 0.5 and 9.1 m below grade) and elevations (between 311.25 and 326.58, metric, geodetic).

In general, based on the groundwater observations as well as soil colouring, the groundwater level appears to roughly mimic the topographic contour of the site, generally dropping off from the east to the west. There was a substantial drop in groundwater level (elevation 326.58 to 317.93 over 300 m) toward the eastern portion of the site, while the central portion of the site showed a relatively constant groundwater level (generally between elevation 317 and 320). Another steep drop off occurs toward the western portion of the site, and Hopewell Creek (from elevation 319 to 313 over roughly 200 m). There is also a slight groundwater level depression around the general area of the swamp area in the Bisgould land site. This is likely due to relatively impermeable near surface soils in this area.

It should be noted that groundwater levels, particularly perched groundwater levels, can vary significantly in response to seasonal weather conditions and weather events.

4. DISCUSSION AND RECOMMENDATIONS

The project involves a planned residential / commercial, mixed-use subdivision. The site includes local wetland areas, a 30 m high, shallow slope alongside Hopewell Creek, full municipal servicing, two storm water management facilities on the Seagrams Land, provisions for infiltration of roof leader water, low and medium density residential housing including single detached, townhouse and apartments, commercial and office / employment buildings, an elementary school



on the Seagrams Land, a future GO Transit station, and a sewage pumping station in the northwest quadrant of the Seagrams Land.

It should be noted that at the time of this report, the proposed development details were preliminary only. Once the design details for the subdivision are finalized, the recommendations in this report should be revisited to confirm that they remain applicable.

4.1 Site Grading

The site is generally rough and hilly in areas, with a total relief of approximately 18 m across the two parcels. The site plateaus near the northeast corner of the Bisgould parcel, at an elevation of approximately 330, and generally slopes down to the west to an elevation of about 312 at Hopewell Creek.

No site grading plan was available at the time of preparation of this report, however based on the site topography, it is anticipated that some cut and fill operations will be required, with an estimated maximum depth of about 1 m.

The investigation revealed fill materials in Boreholes 4, 5, 7, 9 and 11, which were located in the general area of the former Seagrams structures and roadways. The fill materials in these boreholes extended to depths of between 0.30 and 2.10 m and generally comprised cohesionless soils including gravelly silt and sand, sand and gravel, gravelly sand and sandy silt. Although they were generally well compacted, it is unknown whether the fill was placed as engineered fill, or simply as site grading fill. In addition, some of the fill deposits were noted to be very low organic (Borehole 5), intermixed with layers of dark brown clayey silt (Borehole 7, a possible buried topsoil layer), or to be overlying topsoil (Borehole 9). As such, the fill soils would not be considered suitable for reuse as subgrade for support of building foundations, floor slabs, or other settlement sensitive structures. The non-organic fill is expected to be reusable for trench backfill /site grading purposes. The sand and gravel fill deposits (e.g., Borehole 7 to a depth of 0.70 m) may be suitable for use as Granular B for road construction or basement wall backfill, subject to further field review and confirmatory analyses at the time of construction.



Buried topsoil and organic silts were encountered in Boreholes 9 and 24, extending to 0.70 and 1.40 m below grade respectively. These organic soils should also be subexcavated as part of site grading operations, if any buildings or settlement sensitive structures will be located in these areas.

Following the stripping / removal of all surficial topsoil / buried topsoil, existing fill, loose / soft native soils, and approval of the subgrade, the grades may then be raised where required. Surficial topsoil thicknesses across the site typically averaged between approximately 200 and 400 mm, with a local maximum of 450 mm thick in Borehole 35. In calculating the approximate quantity of topsoil to be stripped, we recommend that the topsoil thickness shown on the individual borehole logs be increased by 100 mm to account for variations and some stripping of the mineral soil below.

It is noted that materials generated from grade cuts will consist of sand, silt, clayey silt and / or insitu fill soils. In general, these soils should be suitable for reuse as engineered fill, subject to geotechnical verification during construction, providing all organic, wet, saturated or WTPL soils, and otherwise deleterious soils are discarded. Sandier soils described as wet or saturated on the borehole logs should be dried prior to reuse.

Fill used to raise grades should comprise either onsite inorganic fill, native inorganic deposits or imported sand and gravel material (Granular B or local equivalent). All engineered fill materials should be pre-approved by the geotechnical consultant prior to placement. Engineered fill material should be placed in maximum 300 mm thick lifts and compacted to at least 98% standard Proctor maximum dry density (SPMDD) below footings, and 95% SPMDD below floors and pavements. In Borehole 39, a localized loose zone of sand was penetrated to a depth of 1.40 m below existing grades. This loose pocket (and any others) should also be removed prior to the placement of any structural fill or building construction. Further, generic recommendations for fill subgrade preparation and engineered fill construction are provided in Appendix A.



Soils described as silty sand, sandy silt, silt, silt and sand, clay or clayey silt are frost susceptible, and highly susceptible to moisture content variations and not well suited for engineered fill construction. Compaction to 98% SPMDD may be difficult to achieve, however these insitu soils should be acceptable for use as engineered fill where compaction to 95% SPMDD is specified providing excessively wet soils are discarded (i.e. material described as WTPL or wet / saturated on the borehole logs).

Settlement of on site soils due to the surcharge of additional properly compacted site grading fills is not expected to be of concern, provided the above mentioned areas of weak subgrade soil are subexcavated prior to fill placement.

4.2 Building Construction

4.2.1 Foundations

It is anticipated that basements will be constructed for the low and medium density residential units (Boreholes 1, 3 to 6, 10 to 13, and 20 to 22). For discussion purposes, it is assumed that foundations for the proposed low and medium density residential units will extend to depths of up to 2.0 m below final lot grades. It is anticipated that basements will not be required for the commercial (Boreholes 8, 9, 16 and 40), office / employment (Boreholes 14, 23, 34, 37 to 39, and 42 to 45), school (Boreholes 17 and 19) and Go Transit station buildings (Boreholes 15 and 25).

Foundations for the proposed pumping station (Borehole 2) are expected to extend to about 6.0 m below existing grades. Construction recommendations for the pumping station are discussed in a separate section, which follows.

Based on the investigation findings, the native inorganic soils are suitable to support the proposed buildings on conventional footing foundations. For preliminary design purposes, footings founded at least 0.50 m into the native deposits may be designed for a net bearing resistance of 150 kPa at serviceability limit state (SLS) and a net factored bearing resistance of 225 kPa at the ultimate limit state (ULS). Table 2 appended, summarizes the minimum foundation depths based on the



borehole findings. Locally, in the vicinity of Borehole 3, these values should be reduced to 150 kPa ULS and 100kPa SLS.

Although in general, footings are anticipated to be placed on native insitu soils, where required the footings may be supported on engineered structural fill, placed in accordance with the generic recommendations for engineered fill construction provided in Appendix A. Prior to placement of engineered fill, the soils should be subexcavated to competent native overburden soils (same depths as provided above). For engineered fill supporting footing loads, compaction to a minimum 98% of the materials SPMDD, should be specified, as per recommendations outlined in the preceding 'Site Grading' section of this report and in Appendix A.

Footings supported on the structural fill may then be designed for a net bearing resistance of 150 kPa at the SLS and a net factored bearing resistance of 225 kPa at the ULS.

Full time inspection of the structural fill placement by PML personnel is recommended to approve fill materials and to verify that the specified compaction levels are being achieved.

Total settlements of footings founded on the approved engineered fill or native overburden deposits, designed as outlined above are not expected to exceed 25 mm, with differential settlements between footings being no more than 50% of this value.

All exterior footings should be provided with a minimum 1.2 m of earth cover or the thermal insulation equivalent to provide adequate insulation against potential frost damage. A 25 mm thick layer of polystyrene insulation is thermally equivalent to 600 mm of soil cover.

Prior to concrete placement, all founding surfaces should be examined by PML personnel to verify the competency of the founding surfaces. This will be particularly important in the vicinity of Borehole 3, where lower strength soils were identified.

For earthquake design, a Site Class D seismic response classification may be assumed.



4.2.2 Floor Slabs

It is anticipated that ground level or basement floor slabs for the proposed structures will be founded on approved structural fill or on the competent overburden deposits and conventional slab-on-grade construction is generally feasible. We recommend a minimum 150 mm cushion of well compacted Granular A be provided directly beneath the slab to provide uniform support. A polyethylene vapour barrier should be installed directly beneath the slab if moisture sensitive floor finishes are planned.

Following removal of any loose organic material and deleterious fill, the exposed floor slab subgrade must be proofrolled with a heavy compactor to achieve 95% SPMDD. Any additional soft areas encountered in the proofrolling process should be subexcavated and backfilled with approved granular material, compacted to 95% SPMDD.

4.2.3 Foundation Drainage and Earth Pressure Parameters

Conventional foundation drainage details should be provided for units with basements. For discussion purposes, it is assumed that foundations for the proposed low to medium density residential units will extend to depths of up to 2.0 m below final lot grades. Perforated drainage pipe should be laid around the outside edge of the footings, and connected to a frost free sump system. It is recommended that the drainage pipes be surrounded with a granular filter protected with filter fabric, or alternatively wrapped with filter cloth and surrounded by concrete sand.

A "free draining" granular material or an approved drainage board product must be provided for the basement walls, in accordance with the Ontario Building Code. The onsite 'silty' soils are not suitable for use as basement wall backfill unless a drainage board product is provided. In lieu of this, PML recommends using OPS Granular B for basement wall backfill. Backfilling should not take place until the ground floor has been constructed, in order to provide lateral support for the wall.



Basement walls must be designed to resist the lateral earth pressures as determined from the following equation:

$$p = K (\gamma h + q)$$

where

- p = earth pressure acting on the wall at any depth h (kPa)
- h = depth below ground surface in metres, at which lateral pressure is calculated
- γ = unit weight of soil, assume 21.0 kN/m³ for granular backfill compacted to 95% SPMDD
- q = equivalent uniform surcharge on ground surface (kPa)
- K = coefficient of lateral earth pressure considered applicable for restrained walls = 0.5

The above pressure coefficients assume walls are backfilled with free draining granular material and that perimeter drainage is provided for all basement walls, such that hydrostatic pressures are not allowed to develop.

It should be noted that due to the relatively shallow groundwater level at isolated locations / areas, an under floor drainage system may be required for some of the basement floor slabs. This may be especially important for any buildings in the area around Borehole 12, where groundwater was contacted at about 2.4 m below grade. As such, it may be prudent to design units without basements for this area, or alternatively, to design units with a raised, walk-out style basement. For example, if the minimum foundation depth is utilized for this area, as discussed in Table 2 (as opposed to a deeper foundation with full basements), under floor drainage should not be a construction issue. Once final founding depths for the structures are established, PML can provide further recommendations for under floor drainage requirements, if necessary.



4.2.4 Pumping Station

The proposed pumping station will be located in the general area near Borehole 2 as identified on the Borehole Location Plan. The design details for the pumping station were not available at the time of this report, however, it is anticipated that the bottom of the pumping station will be located about 6 m below existing grade (around elevation 308.5).

Excavations for the pumping station will penetrate through surficial topsoil, into the native silt and sand till soils. The pumping station excavations can be conducted using conventional open cut methods; however braced excavations may be preferred to minimize the extent of excavation. In this regard, driven sheet piling will not be feasible given the very dense soils identified, and a predrilled soldier pile / timber logging system is envisaged.

Groundwater was encountered at 1.20 m below grade (elevation 313.22) at this location. Based on the proposed depth and shallow water level in this area, both open-cut and braced excavations will likely require significant construction dewatering activities, including the vacuum well points or eductor wells. However, the design of the dewatering system should be left to the Contractor's discretion, and the system should meet a performance specification to maintain and control groundwater at least 0.30 m below the excavation base level, in order to provide a stable excavation base and safe side slopes throughout construction. It is recommended that test pits be excavated during the tendering stage so that contractors bidding on the project can evaluate for themselves the groundwater conditions and dewatering requirements.

In the event that a sand and gravel layer is present below the explored depth at Borehole 2, there is a chance that blowout or quicking of the excavation base could occur, cognizant of the observed groundwater level. As such, PML should review the design of the pumping station once complete and assess the need for a deeper borehole.

It should be noted that a permit to take water (PTTW) will be required if the pumping rate exceeds 50 000 litres per day. It is likely that a PTTW would be necessary at this location. However, this will be established by the hydrogeological study.



The pumping station backfill should be placed in accordance with the general recommendations presented in the Excavation and Backfilling section of this report. Backfill should be brought up simultaneously on all sides of the structure to minimize the potential for movement and/or damage during construction. Furthermore the use of heavy equipment adjacent to structures should be prohibited. Fill materials should comprise approved on site mineral soils or imported granular soil. The allowable lift thickness will depend on the compaction equipment selected and demonstrated compaction success in the field, but should not exceed 300 mm. The backfill should be compacted to a minimum of 95% SPMDD below pavements and other settlement sensitive structures, and 90% SPMDD in non-settlement sensitive (landscaped) areas.

4.2.4.1 Footings and Base Slabs

It is anticipated that monolithic precast concrete bases will be used for the wet wells and valve chamber structures. Moreover, it is expected that the main base slab will be designed to act as a rigid raft foundation, without the need for isolated, interior column pads. The base slab for the pumping station structure will be founded on insitu silt and sand till soils. These soils can provide a net bearing resistance up to 400 kPa for the SLS, and a factored bearing resistance up to 600 kPa at the ULS. For the anticipated design, it is likely that the actual applied net load will be negative, as the weight of the structure and contents will not exceed the weight of soil removed.

Total settlement for foundations design for the SLS bearing pressure of 400 kPa is not expected to exceed 25 mm. Differential settlement of 50 to 75% of the total settlement should be expected.

Prior to placement of the bases, founding surfaces should be inspected by PML to ensure that no detritus materials are present and the required bearing capacity is available. Any unstable or disturbed material identified should be subexcavated and replaced with compacted granular fill. The base of the excavation will be located in the grey silt and sand till soil, which is in a saturated condition and will be easily disturbed by construction traffic. A 100 mm concrete working slab is recommended to protect the subgrade and facilitate placement of reinforcing steel and structural concrete.



Design provisions for earthquake loading should also be applied. For the soil conditions at the site, a class D site category may be assumed, in accordance with the 2006 Ontario Building Code.

All founding surfaces are to be provided with at least 1.2 m of earth cover, and protected from seasonal freezing conditions.

4.2.4.2 Long Term Groundwater Control and Hydrostatic Uplift Design

Considering the shallow groundwater at this location, consideration must be given to hydrostatic uplift during the design of the pumping station. The total uplift resistance will be provided by the weight of the structure, plus the buoyant weight of the backfill over the outside edge of the concrete footings, which could be extended laterally to provide additional uplift resistance if space constraints allow. Additional mechanical anchorage of the building may also be required to achieve sufficient uplift resistance.

Alternatively, consideration may be given to permanently dewatering the area around the proposed pumping station to avoid the hydrostatic uplift concern. Considering the fine grained, very dense till soil, permanent dewatering may be feasible.



4.2.4.3 Lateral Earth Pressure

All below grade walls must be designed to resist the lateral earth pressure and water pressure, which may be determined from the following equation:

$$P = K [\gamma (h-d_w) + \gamma' d_w + q] + \gamma_w d_w$$

where

- P = total lateral pressure at depth h (m) below ground surface (kPa)
- K = lateral earth pressure coefficient of compacted backfill
= 0.5
- h = depth below grade (m) at which lateral pressure is calculated
- d_w = depth below groundwater level at depth h below final exterior grade (m)
= h , when the water level is at the ground surface
- γ = unit weight of soil
= 22 kN/m³ for compacted sand and gravel at 95% SPMDD
- γ_w = unit weight of water
= 9.8 kN/m³
- γ' = buoyant unit weight of soil
= $\gamma - \gamma_w$
- q = vertical stress at depth h due to surcharge loads (kPa)

An appropriate factor of safety must be used in the design.

4.3 Excavation and Backfilling

Excavation for footings and service trenches will extend through a combination of surficial topsoil or pavement structure materials, overlying discontinuous cohesionless and cohesive soil units. Excavations will extend into water bearing (perched or stabilized groundwater) soil layers in many locations.



It will be important to ensure that the excavation(s) do not undermine existing in-ground structures, roads and or other services in the proximity of the trench, particularly on Greenhouse Road and Kramp Road. The need for underpinning or for a braced excavation can be established according to criteria illustrated in the appended Figure 10. It should be noted that a trench liner box may not be relied on for this purpose. For design of the bracing system, a soil unit weight of 21 kN/m^3 may be assumed, using trapezoidal or rectangular stress distribution in accordance with methods outlined in the Canadian Foundation Engineering Manual, and summarized on Figures 10 to 12. Appropriate factors of safety should be applied.

Seepage into the footing excavations should be expected due to perched groundwater within cohesionless soil layers, although this should be manageable by conventional sump pumping. This is particularly important for the future Go Transit station location, where perched water was encountered at 1.4 m below existing grades. If the footings extend deeper than 1.4 m for the Go Transit station, groundwater control measures such as conventional sump pumps will likely be required.

It is anticipated that basements will be constructed for the low and medium density residential units, and as such, excavations for footings are anticipated to extend to as deep as 2.0 m below final grades. Groundwater was typically contacted below 3.9 m below existing grades at these locations, and as such, would not be considered prohibitive for basement construction. However, groundwater was contacted at 2.4 m below grade in Borehole 12. As discussed above, cognizant of the shallow groundwater level, consideration should be given to designing units with no or partial basements only, in this area.



Based on the proposed sanitary sewer depths provided by AECOM, many of the sewer excavations will likely advance into water bearing soils, as per the following table:

STREET NAME	LOCATION ON STREET	RELEVANT BOREHOLE	SEWER DEPTH FROM EXISTING GROUND (m)	GROUND WATER DEPTH (m)
SEAGRAMS LANDS				
Street A	Hwy. 7	8	4	below 7.00
	Between 'C' and 'E'	10	12	5.40
	Street E	11	12	4.47
	Between 'E' and 'Q'	12	10	2.40
	Street Q	13	11	5.70
	South end	14	4	5.80
Street B	At bend	9	5	4.20
Street Q	West end	6	4	4.20
	Between west end and 'A'	5	4	5.20
	Between 'A' and Greenhouse Rd	22	8	5.80
Greenhouse Road	Near Hwy. 7	27	4	5.80
	Between Hwy. 7 and 'E'	28	4	5.80
	Between 'E' and 'Q'	29	7	5.20
	Between 'Q' and Railway	30	5	8.40
	South end	26	4	4.00
BISGOULD LAND				
Street A	Entire Length	40-43	4	1.40-4.20
Kramp Road	Between 'A' and Twp. Road 72A	33	5	1.80
	Twp. Road 72A	32	7	9.10
	Between Twp. Road 72A and Greenhouse Road	31	7	7

Sewer excavations extending below the above noted groundwater level will likely require groundwater control measures such as well points, eductors and/or sumps, depending on the local soil stratigraphy and soil types (notably, Boreholes 10 to 13, 22, 29, and 33). At the time of tendering, test pits should be excavated on site to allow prospective contractors to judge the groundwater conditions and to determine the appropriate control methods required closer to the time of construction. Based on the groundwater depth and proposed sewer depths, it is



anticipated that pumping rates will exceed 50 000 litres per day through certain sections, hence, a PTTW will be required. However, this should be confirmed from the recommended tender stage test pits.

It should be noted that at Boreholes 30, 31 and 42, perched water conditions were encountered above the proposed sewer depths. Furthermore, the excavations for several other locations are expected to extend to near the long-term stabilized groundwater level (Boreholes 6, 26, 31 and 40 to 43). It is anticipated that the perched water and the groundwater from excavations near these locations may be managed by conventional sump pumping. Groundwater conditions are subject to seasonal variations. Perched groundwater is particularly subject to variations with seasonal conditions and weather events. In this regard, a later summer construction schedule would be preferable.

No bearing problems are anticipated for pipes founded in the native mineral soils encountered at the site. On stable subgrade, a minimum 150 mm thick bedding course of Granular A material compacted to 95% SPMDD is recommended beneath the pipes. The Granular A material should extend around the pipe to at least 300 mm above the pipe obvert or as set out by Ontario Provincial Standards (OPS), or the local authority. Material that is too wet for compaction to a minimum of 95% SPMDD should be allocated for use in landscaped / non settlement sensitive locations, and compacted to at least 90% SPMDD.

Foundation backfill and backfill below pavements, floor slabs (interior backfill) and other settlement sensitive features, should be similarly compacted to 95% SPMDD. It should be noted that the clayey silt till and silt till site materials are frost susceptible and should not be used at locations where frost heave movement could have adverse effects such as at exterior doors and the like. In addition, it should be noted that the various till materials will tend to retain a voided structure when placed as fill. It will be particularly important to ensure that sufficient compaction is applied to breakdown all lumps / clods within the fill matrix to achieve a non-voided condition. Significant post-construction settlement could otherwise result. It is anticipated that suitable site material may not be available in sufficient quantities for use as interior foundation backfill, particularly during wet weather construction periods. Imported sand and gravel will likely be required for this purpose.



For slab-on-grade buildings and any walk-out style houses, exterior grades should be maintained at least 150 mm below the finished lower floor slab level and sloped to promote drainage away from the building.

4.4 Pavement Design

Based on the proposed pavement usage, frost susceptibility, and strength of the expected subgrade soils, the following pavement component thicknesses are considered suitable for local residential and minor collector traffic categories.

PAVEMENT COMPONENT	THICKNESS (mm)
HL 3 Surface Course	40
HL 4 Binder Course	40
Granular A Base	150
Granular B Subbase	350

The flexible pavement designs provided above consider that construction will be carried out during the drier time of the year and the subgrade is stable, as determined by proofrolling inspected by PML personnel. If the subgrade is wet and unstable, additional granular subbase will be required. In this regard, low strength silt subgrade could be encountered at isolated locations / sections (i.e. Borehole 3), where subexcavation and extra subbase may be required.

The pavement materials should conform to current OPS specifications. The Granular A base and Granular B subbase courses should be placed in thin lifts and compacted to a minimum of 100% SPMDD, and asphaltic concrete should be placed and compacted to between 92% and 96.5% of the material's maximum relative density (MRD). Reference is made to OPS Specification 310, revised April 2008.

During construction, testing should be conducted to confirm the gradation and compactibility characteristics of the granular base and subbase materials and the mix design properties of the asphaltic concrete.



Proofrolling procedures and the placement and compaction of all the fill and granular materials and asphaltic concrete for the pavement construction and backfilling at the site should be inspected on a continuous basis by PML technicians.

Since relatively impermeable clayey silt till or silt material will be present at shallow depth beneath the pavement structure in several areas, pavement subdrains should be provided to prevent water accumulation on the pavement subgrade surface. The subgrade should be graded so that water is directed to the catch basin structures or to the pavement edge. Subdrains should be discharged in to the catch basins. The subdrains may consist of 3 m long stubs of filter wrapped, 100 mm diameter perforated plastic pipe, set within the subbase layer at the subgrade surface. At the pavement edge, suitable pavement drainage should be provided by means of subdrains or side ditches.

4.5 Soil Aggressiveness

Two representative composite samples were subjected to multiple analyses to assess the potential for deterioration of concrete and corrosion of steel. Composite sample 1 (CS1) comprised silt and sand till that was prevalent across the site. This sample was collected from Boreholes 2 and 10, from between 4.5 and 10.5 m below grade, and included saturated soil. Composite sample 2 (CS2) also was comprised of till soils from Boreholes 4, 5, 11 and 13 and was collected from samples between 1.5 and 3.5 m below grade. Reference is given to the appended AGAT Certificates of Analysis (Appendix C) and Miller Box Resistivity of Soil (Figure 9) for the analytical results.

Based on the results, concrete pipes and foundation elements are expected to encounter silt and sand / clayey silt till with maximum, measured soluble sulphate concentrations of 69.8 and 16.1 µg/g (< 0.1%). Hence Portland cement concretes surrounded by the onsite silt and sand / clayey silt till soils will have a low degree of exposure to the sulphate attack in accordance with CSA A23.1, and Portland cement concretes should not require sulphate resistant cement.



Similarly, pH, and redox testing did not identify corrosive properties in the composite samples, and as such, corrosion protection should not be required for ductile-iron pipes located in the silt and sand / clayey silt till soils.

4.6 Storm Water Management and Soil Infiltration

Two storm water management (SWM) ponds are proposed to be located near the southern portion of the Seagrams Lands. It was indicated that the proposed depth for the SWM pond in the southwest corner (Borehole 7) will be 8 m below existing ground, and the proposed depth of the SWM pond in southeast corner (Borehole 24) will be approximately 3 m below existing ground.

In Borehole 7, fill extended to 2.10 m and was overlying clayey silt and silt to 5.4 m. Below 5.4 m, saturated silt and sand was encountered and extended to 8.40 m below grade. Below 8.4 m, and extending to the borehole termination depth of 11.9 m was a layer of clay. In Borehole 24, 300 mm of topsoil was overlying layered silts and sands to 1.40 m and sand and gravel to 2.10 m. Below this, clayey silt till extended to 5.0 m and silt and sand till extended to the borehole termination depth. Both boreholes including monitoring well installations, and showed a long-term stabilized groundwater level of 4.69 and 0.52 m below grade respectively.

Based on the subsurface soil and groundwater conditions, neither of the SWM ponds can be designed as recharge type ponds. The SWM pond located in the southwest corner can be designed as a retention type pond, however, consideration should be given to raising the depth to above the saturated silt and sand layer and into the clayey silt layer above 5.4 m below existing grades. The SWM pond located in the southeast corner should also be designed as a retention type pond.

Any SWM ponds should be inspected by PML personnel during construction to verify the presence of a suitable subgrade. In general, the slopes of the storm water management pond should be constructed at 5H:1V and be provided with vegetation cover to minimize the potential for erosion and sloughing of the side slopes.



Soil infiltration rates were estimated for the major soil units from particle size distribution charts, as follows:

SOIL TYPE	ESTIMATED COEFFICIENT OF PERMEABILITY (cm/sec)	INFILTRATION RATE (mm/hr)
Gravelly sand, trace silt	1×10^{-2}	> 500
Sand and gravel, some silt	1×10^{-3}	50
Sandy silt	1×10^{-5}	0.5
Silt and sand till	1×10^{-5}	0.05
Silt and sand	1×10^{-6}	0.005
Silt till	$< 1 \times 10^{-6}$	< 0.005
Clayey silt / clay	$< 1 \times 10^{-6}$	< 0.005

As shown, the majority of the on-site soils contain considerable amounts of fine grained soils (greater than 20% silt) and would not be feasible for source infiltration of roof leader water. Source infiltration may be feasible in areas where sand or sand and gravel deposits comprising less than 10% silt (trace silt on the Borehole Logs) are present near grade. These include Boreholes 11, 17, 23, 37, 41 and 43. It should be noted that the availability of suitable soil strata for source infiltration may be altered by cut and fill grading of the site and the final grading plan should be reviewed in this regard.

4.7 Slope Stability

A 10 m high slope is located between the proposed development and Hopewell Creek to the west. Ground surface contours provided to PML indicated that the existing ground generally sloped at about 12H:1V. At this inclination, the factor of safety against slope failure, even in the presence of groundwater, is not seen as a concern. PML does not expect Hopewell Creek to meander more than two to three metres in the next 100 years. As such, provided appropriate erosion control measures are implemented, no specific set back requirements apply.

However, visual observations of surface scour and surface water runoff were noted. In particular, there is a scoured gully formation where an existing culvert discharges to the creek in the vicinity of Boreholes 2, 11 and 3. The gully is about 2 to 3 m deep with a side slope inclination of about



2H:1V. The gully is in a designated greenway / park area and would not be expected to present a construction setback limitation; however, the setback limit can be checked by projecting a line from the bottom of the gully at an inclination of 4H:1V upwards to grade. Housing the lies beyond the soil zone above the line may be considered to have a sufficient setback.

In addition, the site ground surface topographic plan indicates a localized area of near 2H:1V slope inclination in the south west corner area of the site, in the vicinity of the roadway cul-de-sac at Borehole 6. This is believed to be a local fill deposit, which should be further explored to confirm the site grading and setback requirements for the cul-de-sac lots.

The site grading and drainage plan should be designed to prevent channelized surface water runoff down the face of the slope, and a suitable vegetative cover should be maintained to control erosion.

4.8 Environmental Considerations

Four soil samples were submitted for environmental analyses as identified on Table 3, appended. The soil samples were all fill samples that were tested for O.Reg. 153/04 metals and inorganics only. It should be noted that soil conditions between and beyond the sampled locations may differ. As noted previously, the environmental sections of this report are preliminary only, and may not necessarily have identified all occurrences of soil or groundwater impairment.

4.8.1 Soil and Groundwater Standards

In general, the applicable environmental quality guidelines depend on the site location, land use, and source of potable water at the investigation site. For the site, we selected the Generic Criteria of the O.Reg. 153/04, Soil, Groundwater and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act dated March 9, 2004 (the Standards).

It should be noted that new soil and groundwater standards under O. Reg 511/09 are scheduled to take effect in July 2011; the new standards will replace the current O.Reg 153/04 Standards. Given the likely construction schedule, and the change in regulation, the results of the



environmental screening program were also checked against the new Standards. If required, PML can provide further commentary in this regard.

The Seagrams site is located adjacent to a water body (Hopewell Creek); hence a sensitive site land use classification applies. Furthermore, as discussed previously, both the Bisgould and Seagrams sites have portions of the site that are designated by the GRCA as wetlands (as shown on Drawing 2), meaning that the Bisgould property would also be considered a sensitive site. In addition, a drainage course / tributary stream flows to Hopewell Creek from the Bisgould wetland are, crossing both Greenhouse Road and Kramp Road in the study areas, which means all these lands would also be classified as sensitive. As such, the O. Reg. 153/04 Full Depth Background Site Condition Standards (Table 1) for All Other Types of Property Use ('T1 All') is considered applicable for this site.

PML assessed two Site Condition Standards for off site disposal options, including the 'T1 All' Standards and the Table 2 Full Depth Generic Site Condition Standards in a Potable Groundwater Condition for Industrial/Commercial/Community Property Use ('T2 ICC').

4.8.2 Analytical Findings

For detailed results of the environmental screening analyses, reference is made to the AGAT Certificates of Analysis presented in Appendix B.

The environmental screening disclosed that in general, the tested soil samples met the applicable O.Reg. 153/04 T1 All Standards, except for boron detections in BH7 SS2 and BH27 AS1, and electrical conductivity (EC), sodium adsorption ratio (SAR) and chloride exceedances in BH27 AS1.

The T1 Standard for boron under O.Reg. 153/04 shows a 'No Value'; since the concentrations of boron in samples BH7 SS2 and BH27 AS1 exceeded the method detection limit (MDL), the results would be considered as an exceedance. Since the incoming regulations provide an applicable standard for boron, the concentration of the exceeding samples was also compared to the new O.Reg. 511/09 T1 All Standards. The boron concentrations did not exceed the Standard provided



in O.Reg. 511/09. However, the EC and SAR results from sample BH27 AS1 exceeded the O.Reg. 511/09 T1 All Standards. The remainder of the contaminants tested met the O.Reg. 511/09 Standards.

The samples tested generally met the 'T2 ICC' standards for the selected parameters tested except for chloride in all four samples, and EC and SAR in BH27 AS1. No Value (NV) is listed as the 'T2 ICC' standard for chloride. In the case of chloride, a 'T1 All' (sensitive site) Standard is provided, which is deemed applicable to 'T2 ICC' sites. The concentration of chloride met the 'T1 All' Standard for the samples submitted, except for BH27 AS1. The samples checked generally met the new O.Reg. 511/09 T2 ICC Standards, except for EC and SAR in sample BH27 AS1.

4.8.3 On Site Reuse

As discussed above, the subject site is considered to be a sensitive site under the current regulation. Based on the analytical results, only the soil tested from Borehole 27 failed to meet the applicable T1 All Standards, based on the EC, SAR and chloride exceedances. These exceedances are attributable to the use of de-icing salt on Greenhouse Road. However, the regulation allows an exemption for exceedances attributable to the use of deicing salt on a highway. (Note: 'Highway' is a defined term under the provisions O.Reg. 153/04, which generally can be taken to mean all publicly owned roadways and parking lots under the stewardship of a governmental authority). As such, the soil located on Greenhouse Road would not be considered contaminated in its current setting.

4.8.4 Off Site Disposal

If the soil is to be disposed of off-site, it could be subject to environmental restriction. The soil from Borehole 27 could not be exported to a T1 or a T2 ICC Site due to the EC, SAR and chloride exceedances.

However, the remainder of the soil tested may be taken to receiving sites that are considered to be 'T1 All' or 'T2 ICC' sites, and the soil from Borehole 27 may be taken to other roadway sites, providing:



- The soil meets the applicable standards for the receiving site(s), as established by the environmental consultant;
- All analytical results and environmental assessment reports have been fully disclosed to the receiving site owner/authorities and they have agreed to receive the material;
- Transportation and placement of the fill is monitored by the environmental consultant to check that all material is appropriately placed at the pre-approved site;
- The material is used for engineering purposes only.



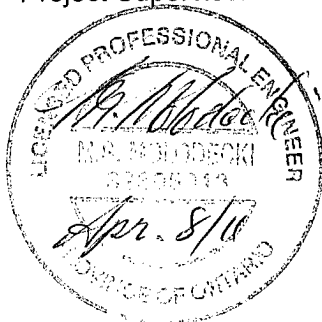
For preliminary quantity estimates, it appears that the EC, SAR and chloride exceedances are associated with de-icing of Greenhouse Road. It can be assumed that the exceedances in this soil extend to a maximum of 2.0 m below grade for the entire length of both Greenhouse Road and Kramp Road. The best approach for dealing with this contaminated material would be to leave it in place, providing the roadway remains in the procession of the Township of Woolwich. Special care must be taken to ensure that none of the contaminated material from the roadway is subexcavated and reused on either the Seagrams or Bisgould site for any construction purposes other than roadway construction.

It should be noted that the soil conditions between and beyond the sampled locations may differ and that the above environmental recommendations were preliminary and may not necessarily have identified all occurrences of soil or groundwater impairment. PML should be contacted if impacted soil conditions become apparent during construction to further assess any such materials and evaluate whether modifications to the conclusions documented in this report are necessary.

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TABLE 1
GROUNDWATER OBSERVATIONS

LOCATION	GROUND SURFACE ELEVATION (m)	PERCHED WATER (m)	INFERRED GROUNDWATER DEPTH (m)	INFERRED GROUNDWATER ELEVATION (m)
BH 1	318.15	--	3.90*	314.25
BH 2	314.44	--	1.20	313.24
BH 3	319.14	--	3.90*	315.24
BH 4	322.75	--	3.60	319.15
BH 5	322.64	--	5.20	317.44
BH 6	320.64	--	4.20	316.44
BH 7	321.80	--	4.69	317.11
BH 8	325.22	--	--	--
BH 9	322.78	--	--	--
BH 10	323.66	4.0 - 5.4	4.00	319.66
BH 11	322.39	--	4.47	317.92
BH 12	321.79	--	2.40	319.39
BH 13	322.62	--	3.65	318.97
BH 14	323.34	--	5.80**	317.54**
BH 15	323.89	--	4.20	319.69
BH 16	321.05	--	2.10	318.95
BH 17	323.42	--	3.20*	320.22*
BH 18	324.46	--	4.00	320.46
BH 19	323.35	--	4.00	319.35
BH 20	323.30	--	4.00*	319.30
BH 21	321.85	--	3.60	318.25
BH 22	322.04	--	5.80	316.24
BH 23	322.63	1.8 - 2.9	1.80	320.83
BH 24	320.91	0.5 - 2.1	0.52	320.39
BH 25	321.31	1.4 - 2.4	1.40	319.91
BH 26	321.61	--	4.00*	317.61
BH 27	322.48	--	5.80	316.68
BH 28	323.56	--	--	--
BH 29	325.70	--	3.60	322.10
BH 30	322.89	2.8	2.80	320.09
BH 31	324.99	2.1-3.9	2.10	322.90



TABLE 1
GROUNDWATER OBSERVATIONS

LOCATION	GROUND SURFACE ELEVATION (m)	PERCHED WATER (m)	INFERRED GROUNDWATER DEPTH (m)	INFERRED GROUNDWATER ELEVATION (m)
BH 32	324.57	--	9.10**	315.47**
BH 33	324.27	--	1.80*	322.47
BH 34	323.92	--	4.00*	319.92
BH 35***	321.58	0.45-1	0.45	321.13
BH 36	323.20	--	1.00	322.20
BH 37***	324.94	2.7 – 4.4	2.70	322.24
BH 38	323.13	3.2 – 4.4	3.20	319.93
BH 39	323.88	1.4	1.40*	322.48
BH 40	329.57	--	2.99	326.58
BH 41	325.93	1.4	1.40	324.53
BH 42	326.28	2.1 – 3.2	2.10	324.18
BH 43	324.37	--	2.04	322.33
BH 44	328.59	--	2.10	326.49
BH 45	325.76	--	2.90*	322.86

* Groundwater depth assumed based on soil colouring.

** Unstabilized

*** Discontinuous intermediate aquifer: BH 53 @ 3.34 m (El. 318.24); BH 37 @ 5.20 m (El. 317.53).



TABLE 2
MINIMUM FOOTING DEPTHS*

PROPOSED STRUCTURE	LOCATION	MINIMUM FOUNDATION DEPTH (m)	CORRESPONDING ELEVATION (METRIC, GEODETIC)	SOIL TYPE
Low and Medium Density Residential	BH1	0.75	317.40	Sand and silt, trace gravel
	BH3	0.50	318.64	Gravelly sand and silt, trace clay
	BH4	2.60	320.15	Silt and sand till, some gravel
	BH5	1.20	321.44	Gravelly sand, trace silt
	BH6	0.70	319.94	Gravelly silt and sand till
	BH10	0.75	322.91	Sandy silt
	BH11	0.70	321.69	Sand and gravel till, some silt
	BH12	0.55	321.24	Silty sand, some gravel
	BH13	0.60	322.02	Clayey sandy silt, some gravel
	BH20	0.75	322.55	Sandy silt till, some gravel
	BH21	0.80	321.05	Clayey silt till, some sand, some gravel
	BH22	0.90	321.14	Silt and sand
Commercial	BH8	0.85	324.37	Silt and sand till, some gravel
	BH9	1.20	321.58	Silt and sand, some gravel
	BH16	0.85	320.20	Silt, trace sand
	BH40	0.80	328.77	Sandy silt, some gravel
Office / Employment	BH14	1.10	322.24	Sand and gravel, trace silt
	BH23	0.70	321.93	Sand and gravel till, some silt
	BH34	0.70	323.22	Silt and sand till, some gravel
	BH37	0.85	324.09	Sand, some silt, some gravel
	BH38	0.75	322.38	Sand and silt till, some gravel
	BH39	0.85	323.03	Sand, some silt
	BH42	0.70	325.58	Silty sand, trace gravel
	BH43	0.65	323.72	Sand and gravel, trace silt
	BH44	0.80	327.79	Sand, some silt
	BH45	0.75	325.01	Sand and silt, some gravel
School	BH17	0.90	322.52	Sand, trace gravel, trace silt
	BH19	0.75	322.60	Silt and sand till, some gravel
Go Station	BH15	0.75	323.14	Silty sand, trace gravel
	BH25	0.70	320.61	Gravelly sand, trace silt

* Notes: - 1.20 m minimum frost cover or equivalent insulation must be maintained for exterior footings and interior unheated area footings (i.e. parking garages).
- Subject to founding subgrade inspection.



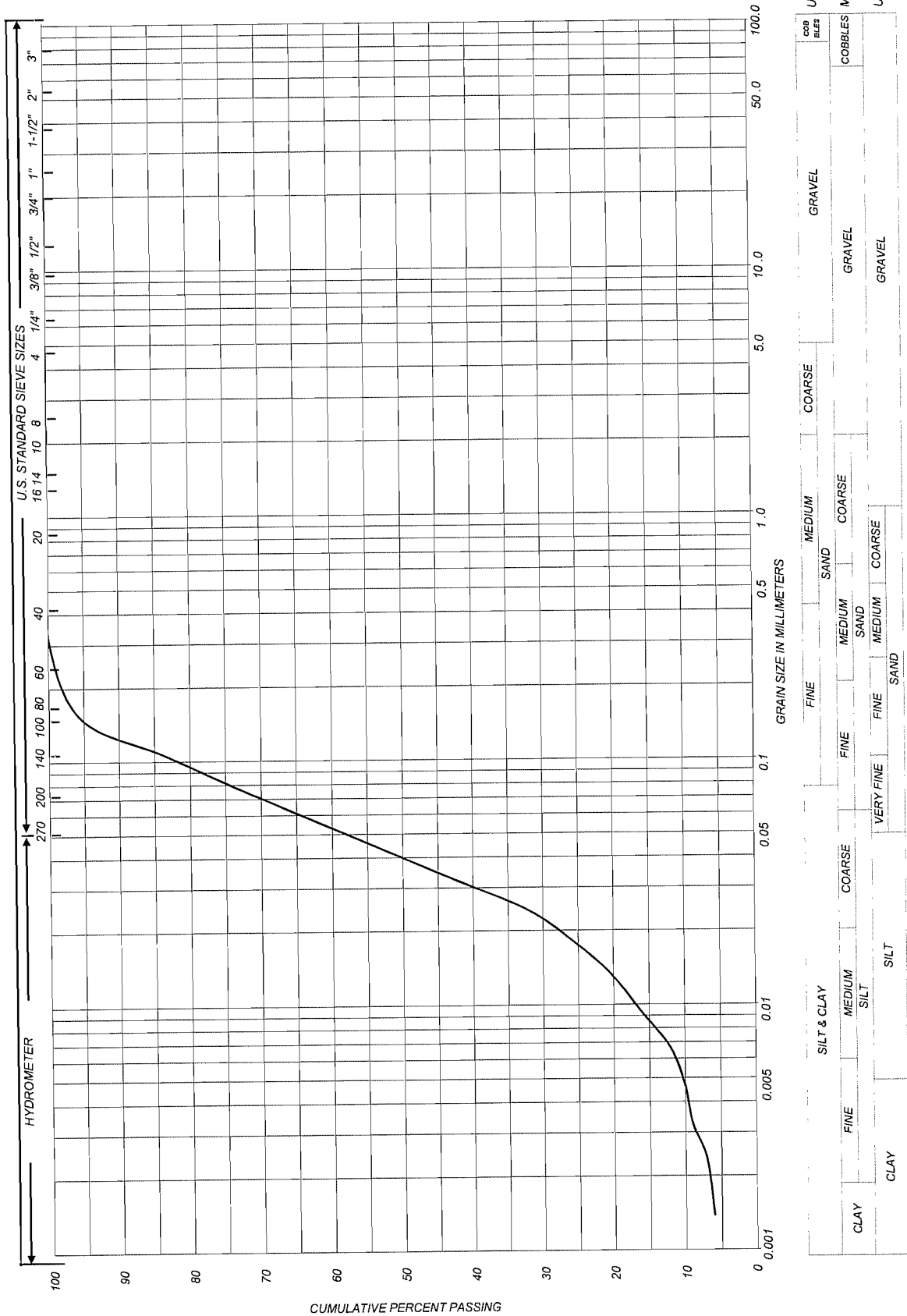
TABLE 3
SUMMARY OF CHEMICAL TESTING

LOCATION	SAMPLE ID	APPROX. DEPTH (m)	DESCRIPTION	TYPE OF CHEMICAL ANALYSIS
Borehole 7	BH7 SS2	0.75 to 1.20	Dark brown clayey silt fill, trace sand	O.Reg. 153/04 M&I
Borehole 11	BH11 SS1	0 to 0.30	Gravelly sand fill, trace silt	O.Reg. 153/04 M&I
Borehole 27	BH27 AS1	0.025 to 0.275	Pavement Structure, sand and gravel, some silt	O.Reg. 153/04 M&I
Borehole 2	BH2 SS3	1.50 to 2.00	Silt and sand till, some gravel	O.Reg. 153/04 M&I

Note:

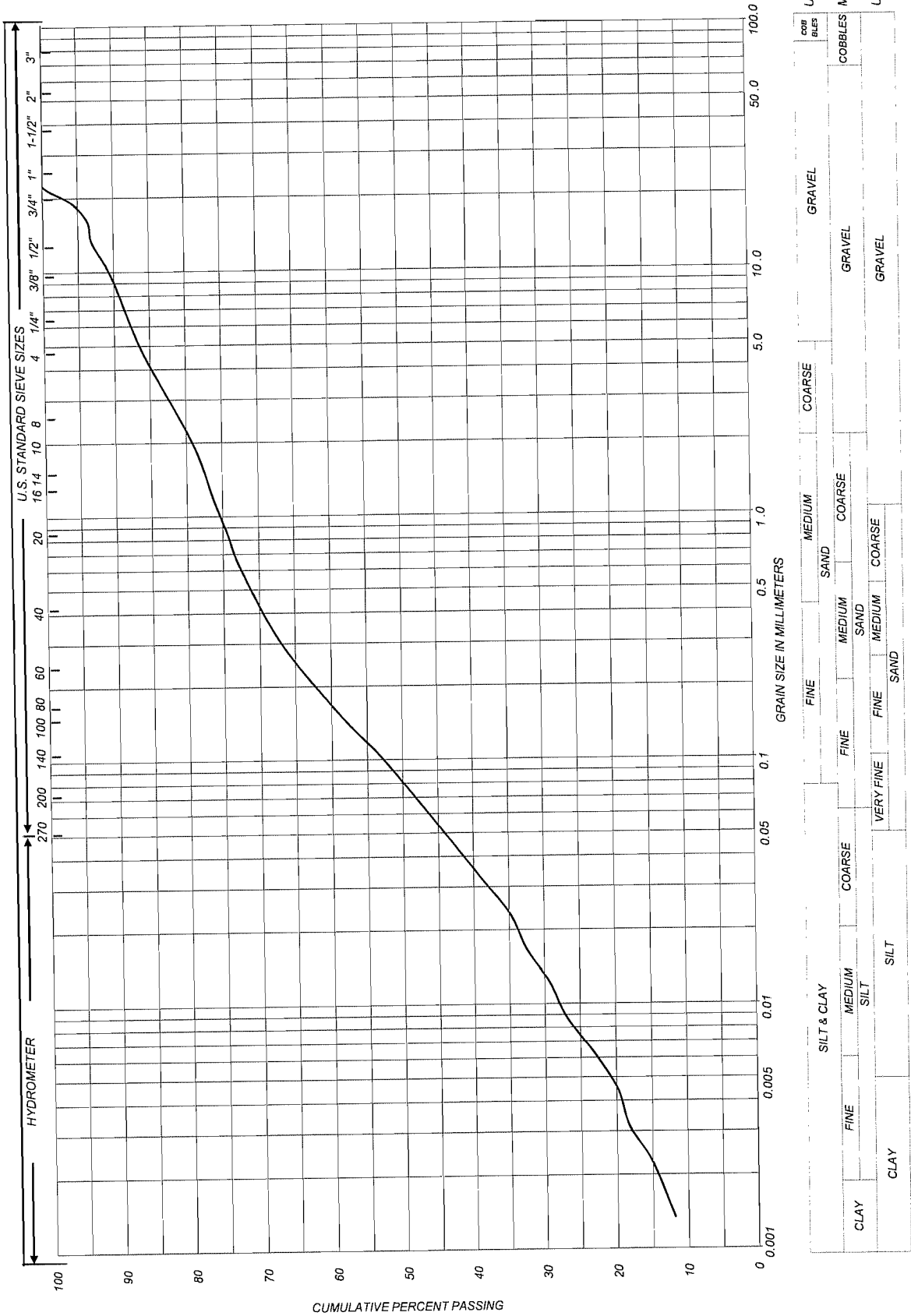
M&I – Metals and Inorganic compounds

PARTICLE SIZE DISTRIBUTION CHART

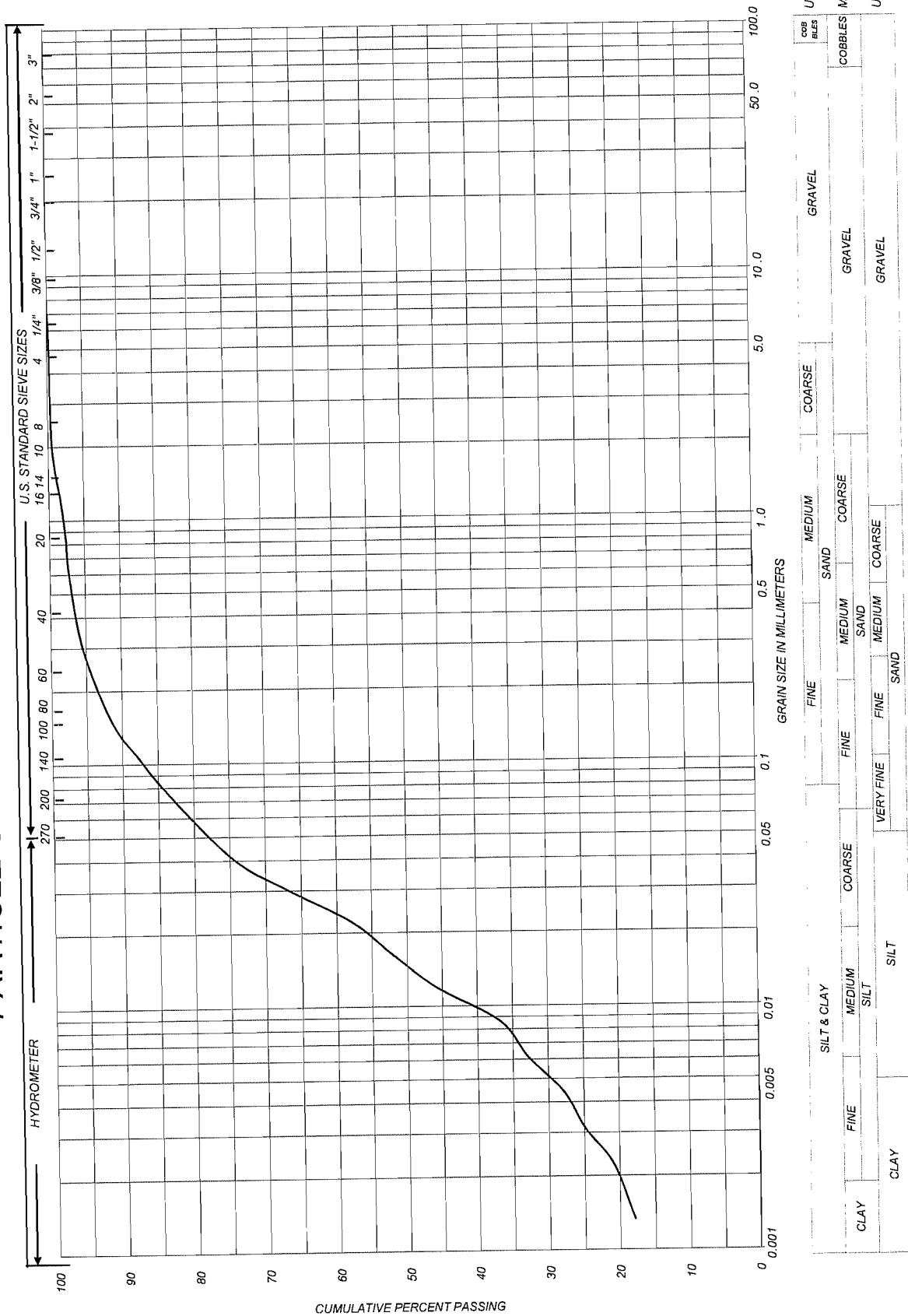


REMARKS Borehole 5, Sample SS7, Depth 6.10 to 6.55 m
FINE SANDY SILT

PARTICLE SIZE DISTRIBUTION CHART



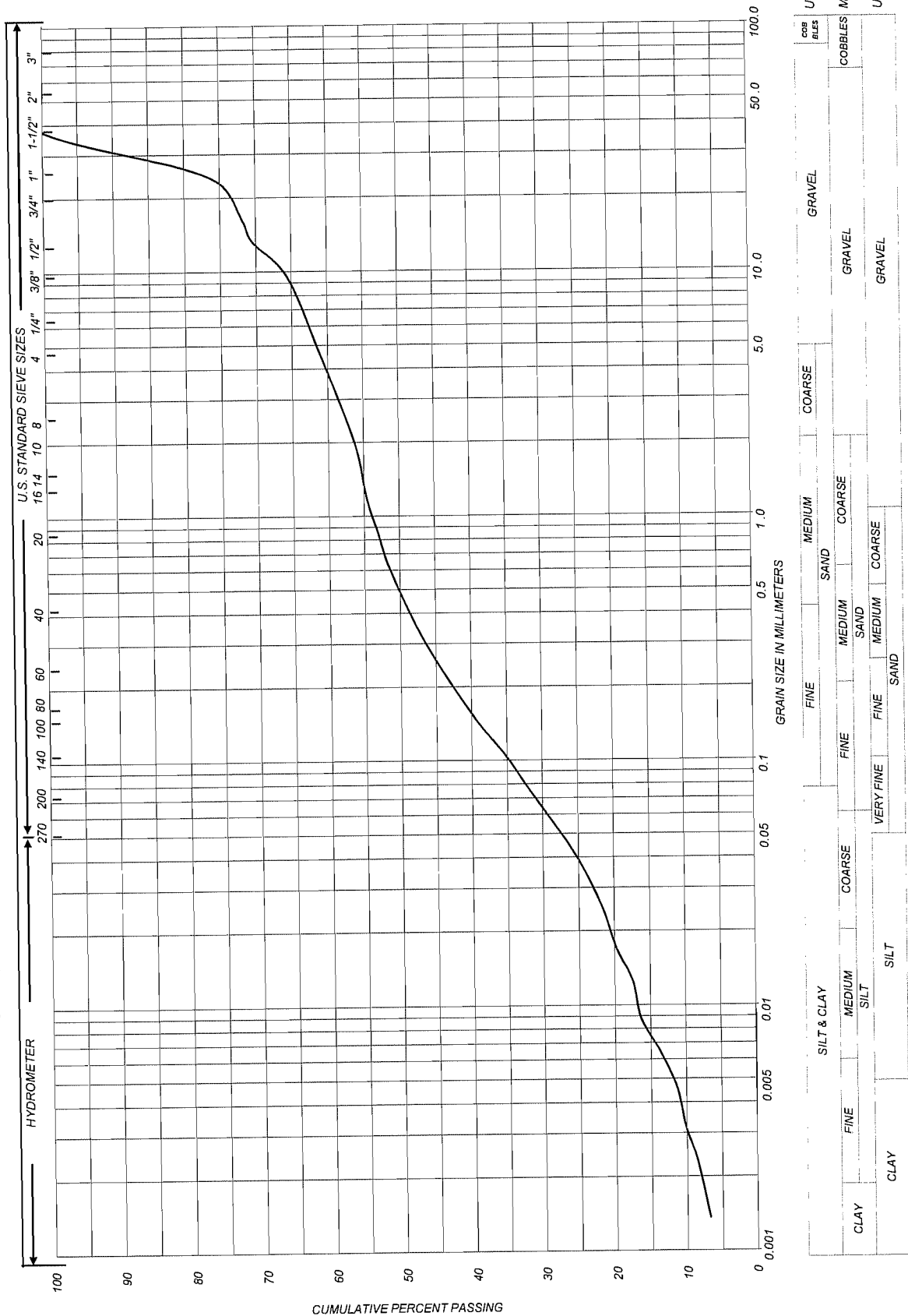
PARTICLE SIZE DISTRIBUTION CHART



REMARKS Borehole 27, Sample SS7, Depth 7.60 to 8.10 m

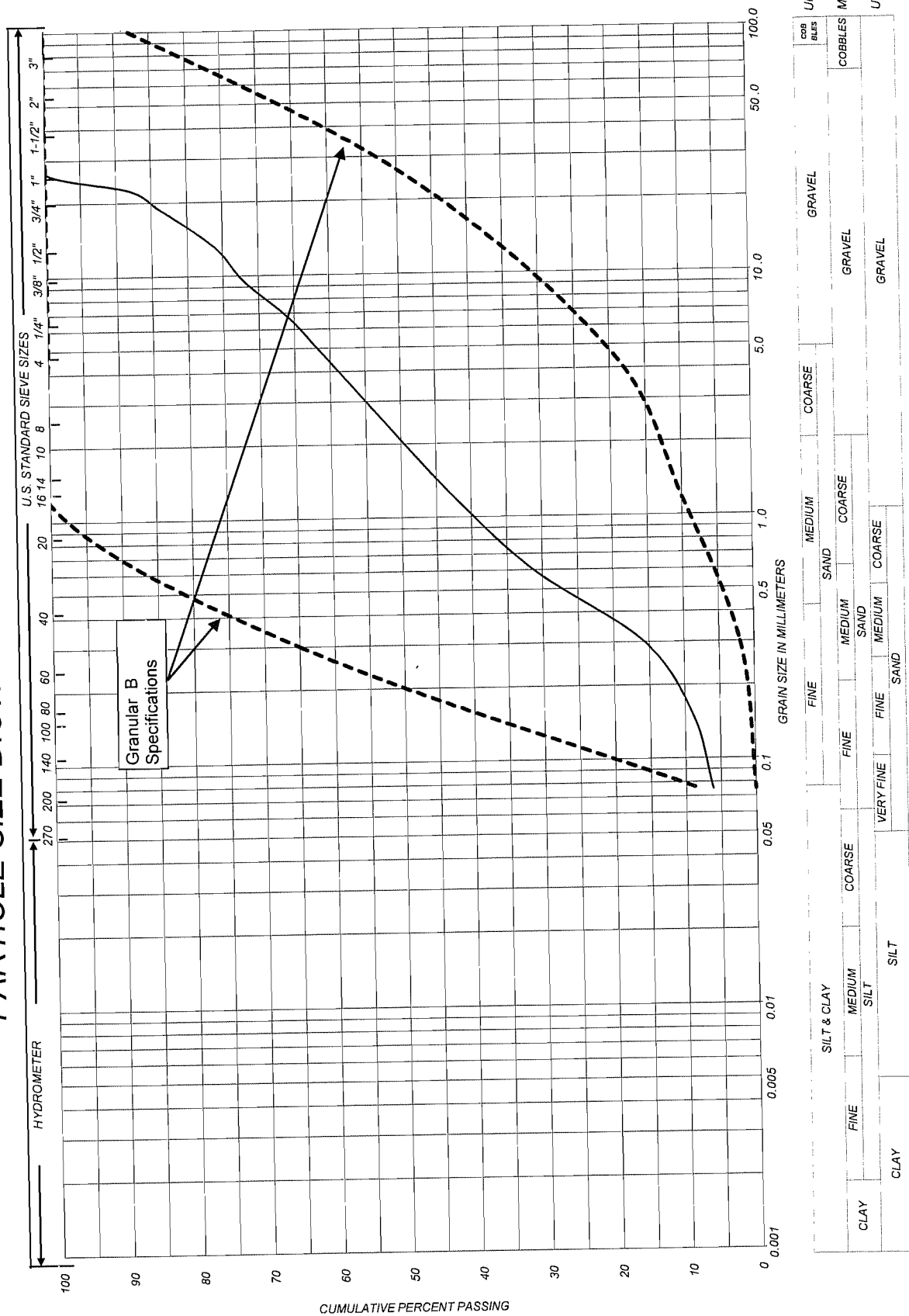
SILT TILL, SOME FINE TO MEDIUM SAND, TRACE CLAY

PARTICLE SIZE DISTRIBUTION CHART



REMARKS Borehole 45, Sample SS6, Depth 4.55 to 5.05 m
SILT AND SAND TILL, SOME GRAVEL

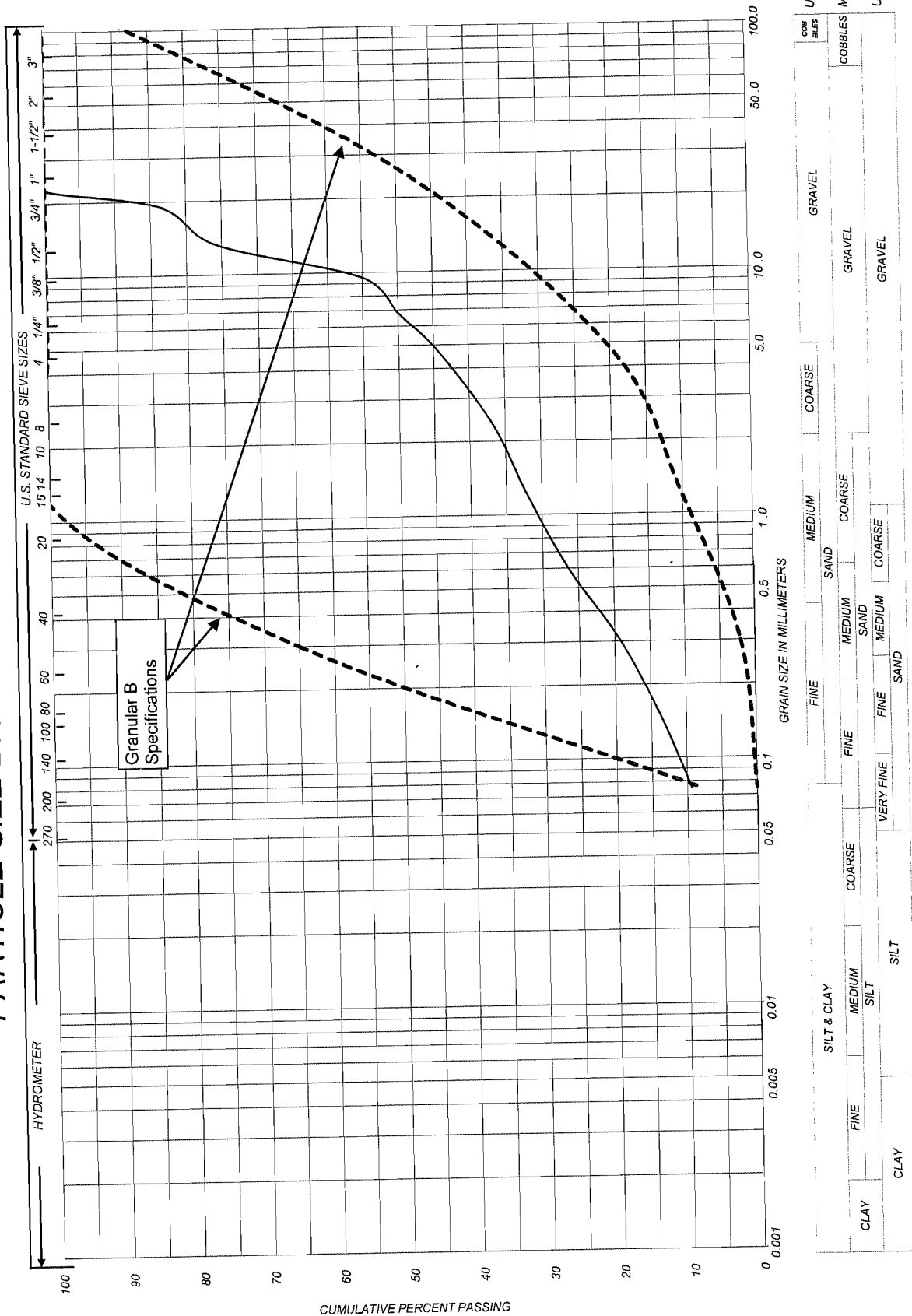
PARTICLE SIZE DISTRIBUTION CHART



REMARKS Borehole 5, Sample SS2, Depth 0.75 to 1.20 m

GRAVELLY MEDIUM TO COARSE SAND, TRACE SILT

PARTICLE SIZE DISTRIBUTION CHART



REMARKS Borehole 7, Sample SS1, Depth 0 to 0.60 m
FINE TO COARSE SAND AND GRAVEL, TRACE SILT

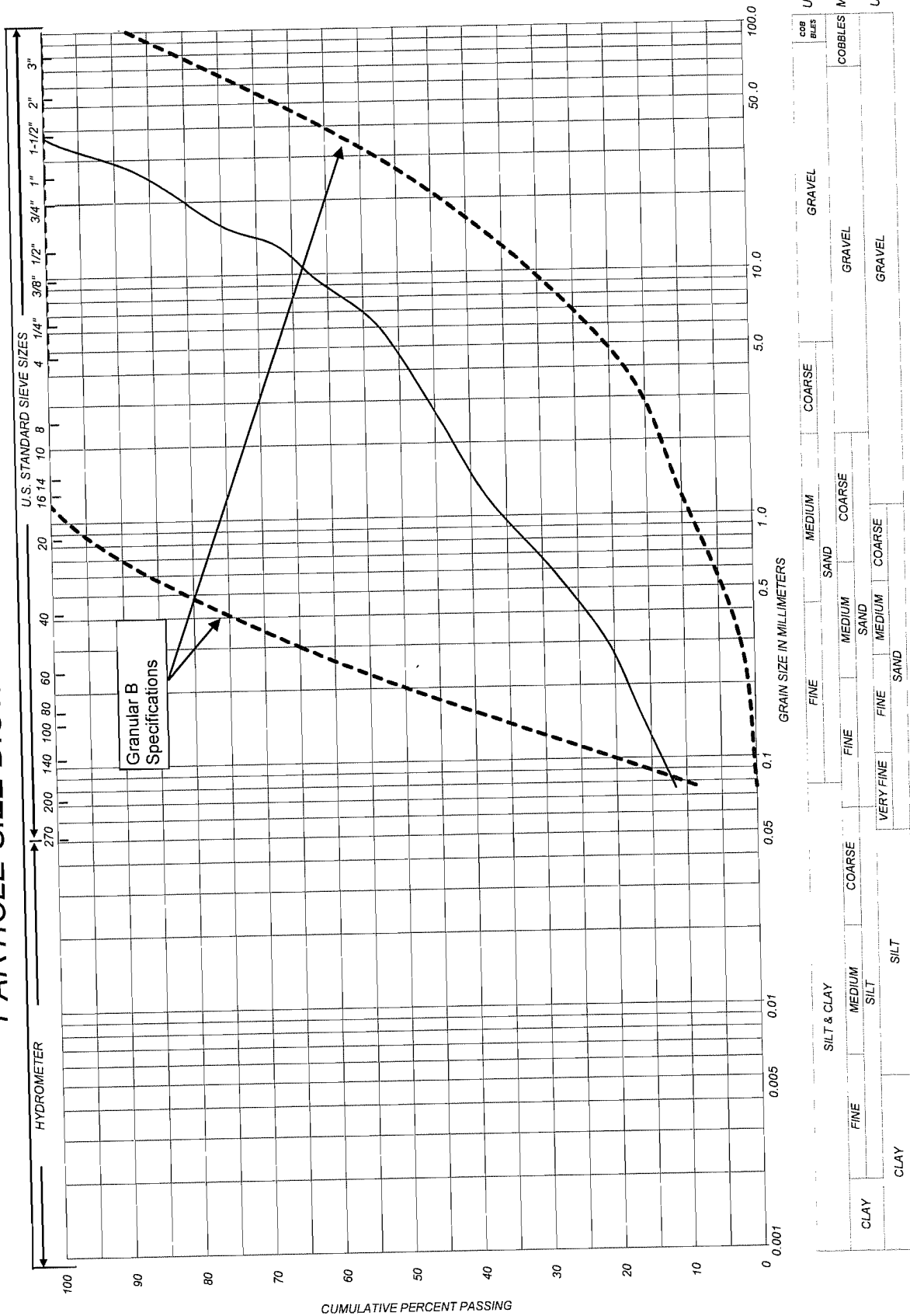
The graph is a semi-logarithmic plot used for soil classification. The vertical axis represents the 'CUMULATIVE PERCENT PASSING' from 0 to 100. The horizontal axis has two scales: 'U.S. STANDARD SIEVE SIZES' (top) and 'GRAIN SIZE IN MILLIMETERS' (bottom). The sieve sizes range from 3" down to No. 200. The millimeter sizes range from 75 mm down to 0.075 mm. A dashed line represents the upper limit of the gradation, and a solid line represents the lower limit. A box labeled 'Granular B Specifications' points to the dashed line. A solid line with arrows at both ends is also shown, representing a specific gradation curve.

U.S. Standard Sieve Size	Grain Size (mm)	Cumulative Percent Passing (Upper Limit - Dashed)	Cumulative Percent Passing (Lower Limit - Solid)
3"	75	100	100
2"	50	100	100
1 1/2"	37.5	100	100
1"	25	100	100
3/4"	18.75	100	100
1/2"	12.5	100	100
3/8"	9.375	100	100
1/4"	6.25	100	100
No. 4	4.75	100	100
No. 8	2.36	100	100
No. 16	1.18	100	100
No. 20	0.85	100	100
No. 40	0.425	100	100
No. 60	0.25	100	100
No. 80	0.18	100	100
No. 100	0.15	100	100
No. 140	0.106	100	100
No. 200	0.075	100	100

GRAVEL										COB BLES		UNIFIED
GRAVEL										COB BLES		UNIFIED
GRAVEL										COB BLES		M.I.T.
GRAVEL										COB BLES		U.S. BUREAU

REMARKS	Borehole 9, Sample SS1, Depth 0 to 0.60 m SAND AND GRAVEL, SOME SILT
---------	---

PARTICLE SIZE DISTRIBUTION CHART



REMARKS Borehole 11, Sample SS2, Depth 0.75 to 1.05 m
SAND AND GRAVEL, SOME SILT

MILLER BOX RESISTIVITY OF SOIL

CLIENT	Thomasfield Homes Limited	PML REF.	10KF058
PROJECT	Proposed Mixed Use Development	REPORT NO.	1
LOCATION	Township of Woolwich (Breslau), Ontario	FIGURE NO.	9

LOCATION	RESISTIVITY (Ω cm)		MOISTURE CONTENT	
	NATIVE CONDITION	SATURATED CONDITION	AS RECEIVED	SATURATED
Sample No. CS1	6800	4100	7.9	12.8
Sample No. CS2	15000	6000	6.8	13.0

REMARKS

NOTES

1. The need to underpin existing footings/utilities is dependent upon soil type, proximity of the existing facility to the face of the excavation, loads imposed on the foundation and permissible movements.

ZONE A: Foundations of relatively heavy and/or settlement sensitive structures/utilities located in Zone A generally require underpinning.

ZONE B: Foundations of structures located within Zone B generally do not require underpinning. Consideration should be given to underpinning of settlement sensitive utilities or heavy foundation units located in this zone.

ZONE C: Utilities and foundations located within Zone C do not normally require underpinning.

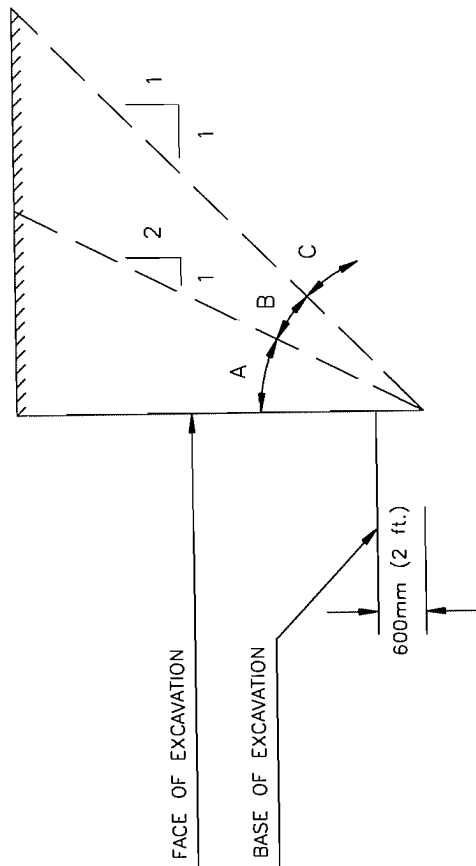
Underpinning of foundations located in Zones A and B should extend at least into Zone C.

2. As an alternative to underpinning, it may be possible to control movement of existing utilities and foundations by supporting the face of the excavation with bracing/tiebacks or a rigid (caisson) wall. Horizontal and vertical earth pressures imposed on the excavation wall by non-underpinned foundations must be considered in the design of the support system.

3. A condition survey should be conducted prior to construction and appropriate monitoring (surface and insitu) carried out during construction to monitor any movement which may occur.

4. All work should be carried out in accordance with the Occupational Health and Safety Act and local regulations. Good quality workmanship and construction practices are to be employed.

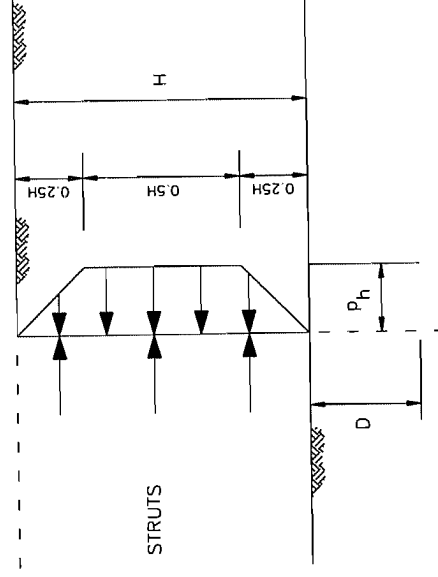
5. This sheet is to be read in conjunction with text of report for this project. Additional comments and recommendations concerning these general guidelines will be provided if required.



NOTES

1. The actual magnitude and distribution of the horizontal earth pressures which will act on the bracing system are dependent upon the permissible lateral/vertical movements adjacent to the excavation, the soil type, groundwater conditions, drainage provisions, temporary/permanent surcharge loads, the type of bracing system adopted, weather conditions, quality of workmanship and length of time the excavation will be supported. Hence, the recommended pressure diagram and design parameters should be reviewed when construction details, schedule and type of support system are established.
2. Stability of base of excavation must be confirmed when bracing system design, excavation geometry and surcharge loads are established.
3. Earth pressure diagram is applicable to maximum depth of cut of 12m (40 ft.).
4. Structural components of bracing system should be confirmed adequate for each level of excavation.
5. If sheeting will not permit drainage, bracing system must be designed to resist water pressure.
6. Surcharge loads such as street/construction traffic, supported utilities, adjacent foundations, temporary stockpiles and other loads carried by bracing system are not included in earth pressure diagram.
7. Temporary surcharge loading should not be closer to the face of the excavation than half the depth of excavation unless accounted for in bracing design.
8. If settlement sensitive structures are located near the excavation, special measures should be undertaken to control settlements. A condition survey should be conducted prior to construction and appropriate monitoring (surface and insitu) carried out during construction.
9. Earth pressure diagram is applicable for relatively short construction periods. If excavation is to be open for long periods, monitoring of deformation is essential, the earth pressure diagram must be reviewed, and remedial works may be required.
10. Earth pressure diagram does not account for extended periods of exposure of the excavation to freezing temperatures.
11. Bracing system should be regularly examined for signs of distress.
12. All work should be carried out in accordance with the Occupational Health and Safety Act and local regulations. Good quality workmanship and construction practices are to be employed.
13. This sheet should be read in conjunction with text of report for this project. Additional comments and recommendations concerning these general guidelines will be provided if required.

EARTH PRESSURE DIAGRAM



$$P_h = \text{design lateral earth pressure} \\ P_h = 0.4 \gamma H$$

where

 γ = unit weight of soil

H = depth of excavation

D = depth of embedment of soldier piles (if used).

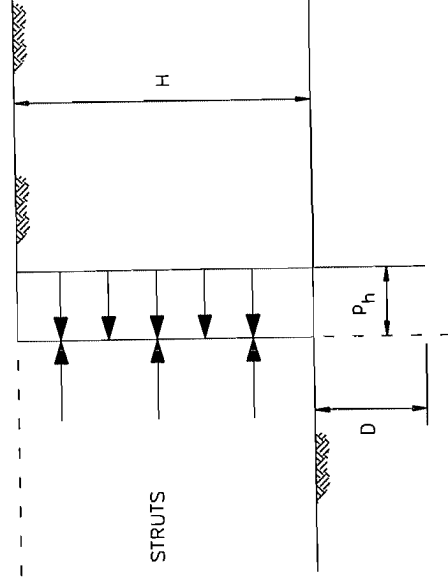
RECOMMENDED DESIGN PARAMETERS

$$\gamma = 21.0 \text{ kN/m}^3$$

NOTES

- The actual magnitude and distribution of the horizontal earth pressures which will act on the bracing system are dependent upon the permissible lateral/vertical movements adjacent to the excavation, the soil type, groundwater conditions, drainage provisions, temporary/permanent surcharge loads, the type of bracing system adopted, weather conditions, quality of workmanship and length of time the excavation will be supported. Hence, the recommended pressure diagram and design parameters should be reviewed when construction details, schedule and type of support system are established.
- Stability of base of excavation must be confirmed when bracing system design, excavation geometry and surcharge loads are established. If groundwater table is well above base of excavation and/or artesian conditions exist, local lowering of the groundwater level will be necessary to prevent bottom heave/piping of the base of the excavation.
- Earth pressure diagram is applicable to maximum depth of cut of 12m (40 ft.).
- Structural components of bracing system should be confirmed adequate for each level of excavation.
- If sheeting will not permit drainage, bracing system must be designed to resist water pressure.
- Surcharge loads such as street/construction traffic, supported utilities, adjacent foundations, temporary stockpiles and other loads carried by bracing system are not included in earth pressure diagram.
- Temporary surcharge loading should not be closer to the face of the excavation than half the depth of excavation unless accounted for in bracing design.
- If settlement sensitive structures are located near the excavation, special measures should be undertaken to control settlements. A condition survey should be conducted prior to construction and appropriate monitoring (surface and in situ) carried out during construction.
- Earth pressure diagram is applicable for relatively short construction periods. If excavation is to be open for long periods, monitoring of deformation is essential, earth pressure diagram must be reviewed, and remedial works may be required.
- Earth pressure diagram does not account for extended periods of exposure of the excavation to freezing temperatures.
- Bracing system should be regularly examined for signs of distress.
- All work should be carried out in accordance with the Occupational Health and Safety Act and local regulations. Good quality workmanship and construction practices are to be employed.
- This sheet should be read in conjunction with text of report for this project. Additional comments and recommendations concerning these general guidelines will be provided if required.

EARTH PRESSURE DIAGRAM



P_h = design lateral earth pressure
 $= 0.65 \text{ } \gamma H$

K = lateral earth pressure coefficient

γ = unit weight of soil

H = depth of excavation

D = depth of embedment of soldier piles (if used).

RECOMMENDED DESIGN PARAMETERS

$\gamma = 21 \text{ kN/m}^3$

$K = 0.35$ (movement of retained soil acceptable)
 0.50 (movement of adjacent structures/facilities unacceptable)

LATERAL EARTH PRESSURE DISTRIBUTION
 MULTI-BRACED CUTS IN COHESIONLESS SOILS

FIGURE NO. 12

LIST OF ABBREVIATIONS



PENETRATION RESISTANCE

Standard Penetration Resistance N: - The number of blows required to advance a standard split spoon sampler 0.3 m into the subsoil. - Driven by means of a 63.5 kg hammer falling freely a distance of 0.76 m.

Dynamic Penetration Resistance: The number of blows required to advance a 51 mm, 60 degree cone, fitted to the end of drill rods, 0.3 m into the subsoil. The driving energy being 475 J per blow.

DESCRIPTION OF SOIL

The consistency of cohesive soils and the relative density or denseness of cohesionless soils are described in the following terms:

<u>CONSISTENCY</u>	<u>N (blows/0.3 m)</u>	<u>c (kPa)</u>	<u>DENSENESS</u>	<u>N (blows/0.3 m)</u>
Very Soft	0 - 2	0 - 12	Very Loose	0 - 4
Soft	2 - 4	12 - 25	Loose	4 - 10
Firm	4 - 8	25 - 50	Compact	10 - 30
Stiff	8 - 15	50 - 100	Dense	30 - 50
Very Stiff	15 - 30	100 - 200	Very Dense	> 50
Hard	> 30	> 200		
WTPL	Wetter Than Plastic Limit			
APL	About Plastic Limit			
DTPL	Drier Than Plastic Limit			

TYPE OF SAMPLE

SS	Split Spoon	TW	Thinwall Open
WS	Washed Sample	TP	Thinwall Piston
SB	Scraper Bucket Sample	OS	Oosterberg Sample
AS	Auger Sample	FS	Foil Sample
CS	Chunk Sample	RC	Rock Core
ST	Slotted Tube Sample	USS	Undisturbed Shear Strength
PH	Sample Advanced Hydraulically	RSS	Remoulded Shear Strength
PM	Sample Advanced Manually		

SOIL TESTS

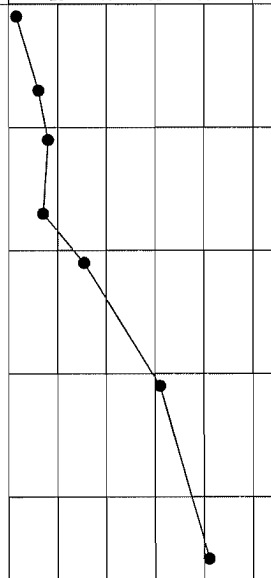
Qu	Unconfined Compression	LV	Laboratory Vane
Q	Undrained Triaxial	FV	Field Vane
Qcu	Consolidated Undrained Triaxial	C	Consolidation
Qd	Drained Triaxial		

LOG OF BOREHOLE NO. 1

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 20

OUR PROJECT NO. 10KF058
ENGINEER M Molodecki
TECHNICIAN M Rapsey

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u				LIQUID LIMIT W_L				GROUND WATER OBSERVATIONS AND REMARKS
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	50 100 150 200				PLASTIC LIMIT W_p				
							DYNAMIC CONE PENETRATION $\times$				WATER CONTENT W				
							STANDARD PENETRATION TEST $\bullet$				W_p W W_L				
							BLOWS/0.3M				WATER CONTENT %				
							20	40	60	80	10	20	30		
	GROUND ELEVATION 318.15														
0.25	TOPSOIL: Loose dark brown silt, some sand, some clay, low organic		318	1	SS	3									
0.70	SAND AND SILT: Loose to compact brown sand and silt, trace gravel, damp/ becoming predominantly silt, moist to wet		317	2	SS	12									
				3	SS	16									
1.50				316											
1.80	CLAYEY SILT TILL: Stiff brown clayey silt, some sand, some gravel, slightly plastic, WTPL.			4	SS	14									
2.90	becoming hard, sandy, DTPL		315	5	SS	31									
3.90			314												
4.50	SILT AND SAND TILL: Very dense grey gravelly silt and sand, trace clay, non-plastic, damp			6	SS	62									
			313												
6.00			312												
7.00				7	SS	82									
	BOREHOLE TERMINATED AT 7.00 m												Upon completion of drilling, borehole open with no free water		

NOTES

CHECKED BY

LOG OF BOREHOLE NO. 2

PROJECT PROPOSED MIXED USE DEVELOPMENT

LOCATION Township of Woolwich (Breslau), Ontario

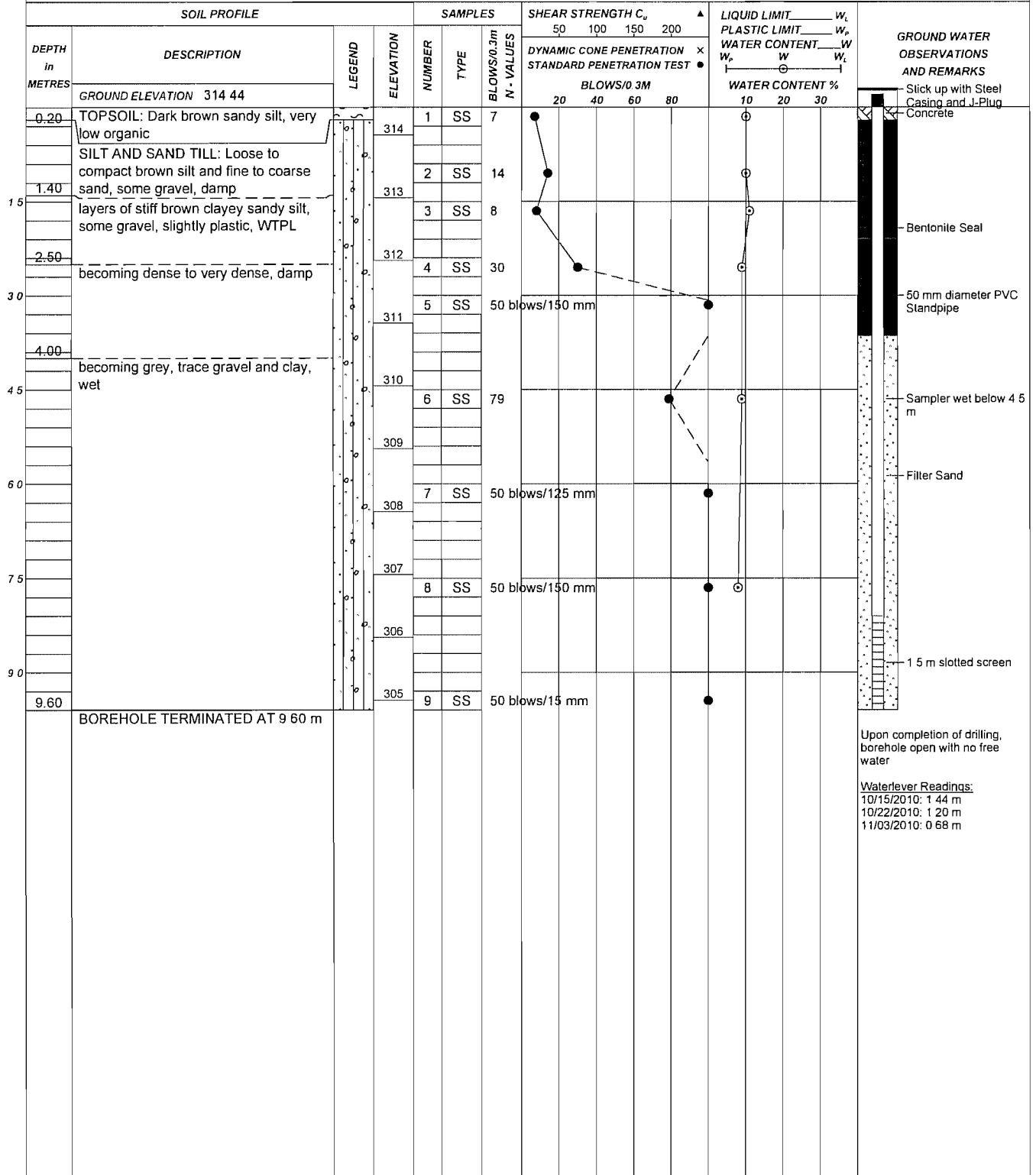
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 21

OUR PROJECT NO. 10KF058

ENGINEER M Molodecki

TECHNICIAN M Rapsey



NOTES

CHECKED BY *[Signature]*

LOG OF BOREHOLE NO. 3

PROJECT PROPOSED MIXED USE DEVELOPMENT

LOCATION Township of Woolwich (Breslau), Ontario

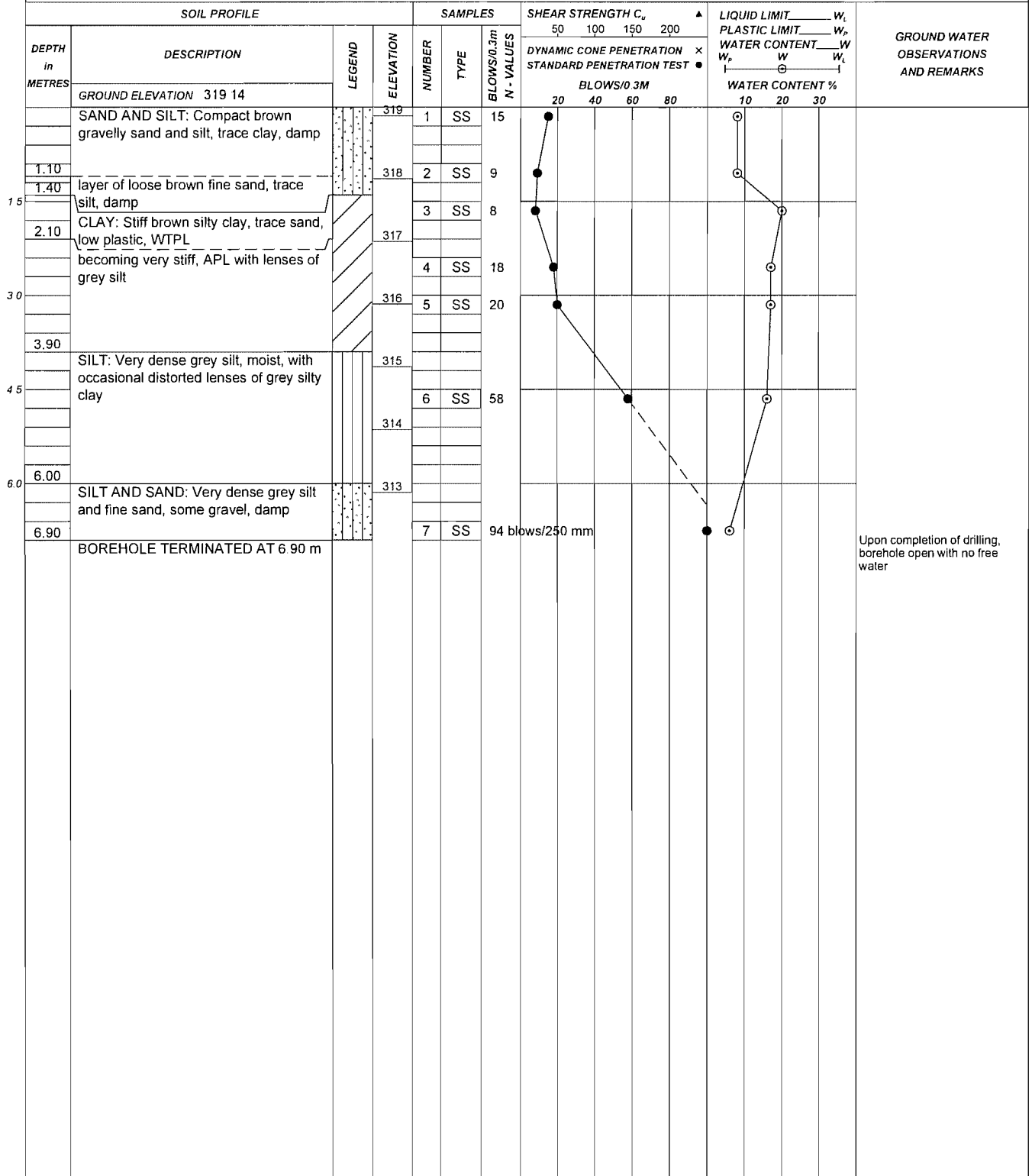
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 20

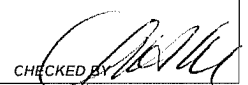
OUR PROJECT NO. 10KF058

ENGINEER M. Molodecki

TECHNICIAN M. Rapsey



NOTES

CHECKED BY 

LOG OF BOREHOLE NO. 5

PROJECT PROPOSED MIXED USE DEVELOPMENT

LOCATION Township of Woolwich (Breslau), Ontario

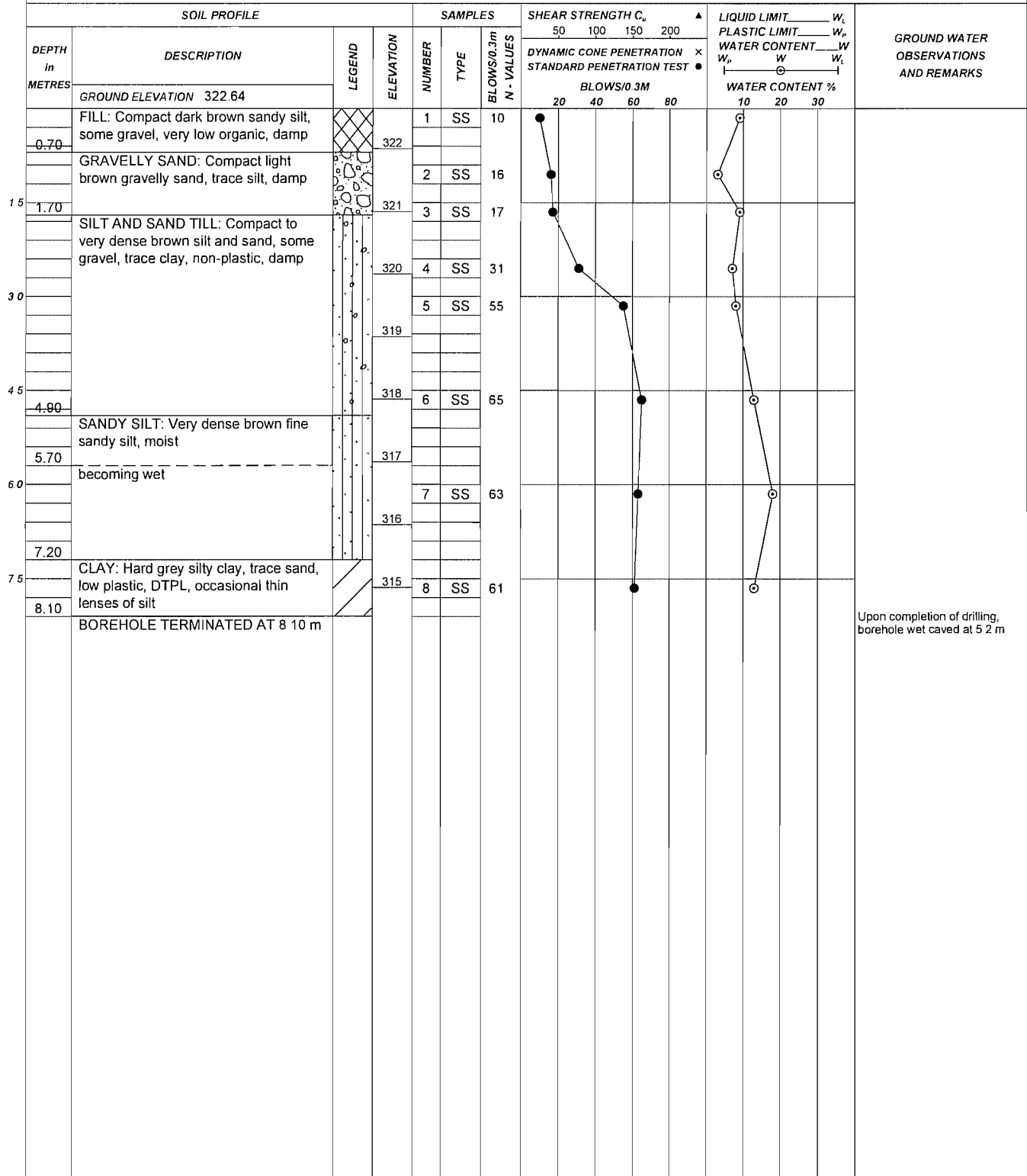
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 20

OUR PROJECT NO. 10KF058

ENGINEER M Molodecki

TECHNICIAN M Rapsey



Upon completion of drilling, borehole wet caved at 5.2 m

NOTES

CHECKED BY

LOG OF BOREHOLE NO. 6

PROJECT PROPOSED MIXED USE DEVELOPMENT

LOCATION Township of Woolwich (Breslau), Ontario

BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 20

OUR PROJECT NO. 10KF058

ENGINEER M. Molodecki

TECHNICIAN M. Rapsey

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUND WATER OBSERVATIONS AND REMARKS						
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	50	100	150	200							
							DYNAMIC CONE PENETRATION					PLASTIC LIMIT W_p					
							STANDARD PENETRATION TEST					WATER CONTENT W					
												WATER CONTENT %					
							BLOWS/0.3M		WATER CONTENT %								
0.18	TOPSOIL: Dark brown sandy silt, very low organic		320	1	SS	16	20	40	60	80	10	20	30	Free water encountered below 4.55 m			
0.70	SILT AND SAND. Compact brown silt and sand, damp			2	SS	18											
1.5	SILT AND SAND TILL: Compact brown gravelly silt and sand, trace clay, damp			319	3	SS	19										
1.80	CLAYEY SILT TILL: Stiff brown clayey silt, some sand, some gravel, slightly plastic, APL			318	4	SS	65										
2.10	SILT: Very dense brown silt, damp with distorted lenses of silty clay				5	SS	71										
3.0	SAND: Very dense silty fine sand, moist			317													
4.20	becoming dense grey, trace silt, saturated			316	6	SS	38										
4.5																	
5.70			315														
6.0	CLAYEY SILT: Hard brown to grey clayey silt, trace sand, slightly plastic, DTPL		314														
6.90	BOREHOLE TERMINATED AT 6.90 m			7	SS	86							Upon completion of drilling, borehole wet caved at 3.6 m				

NOTES

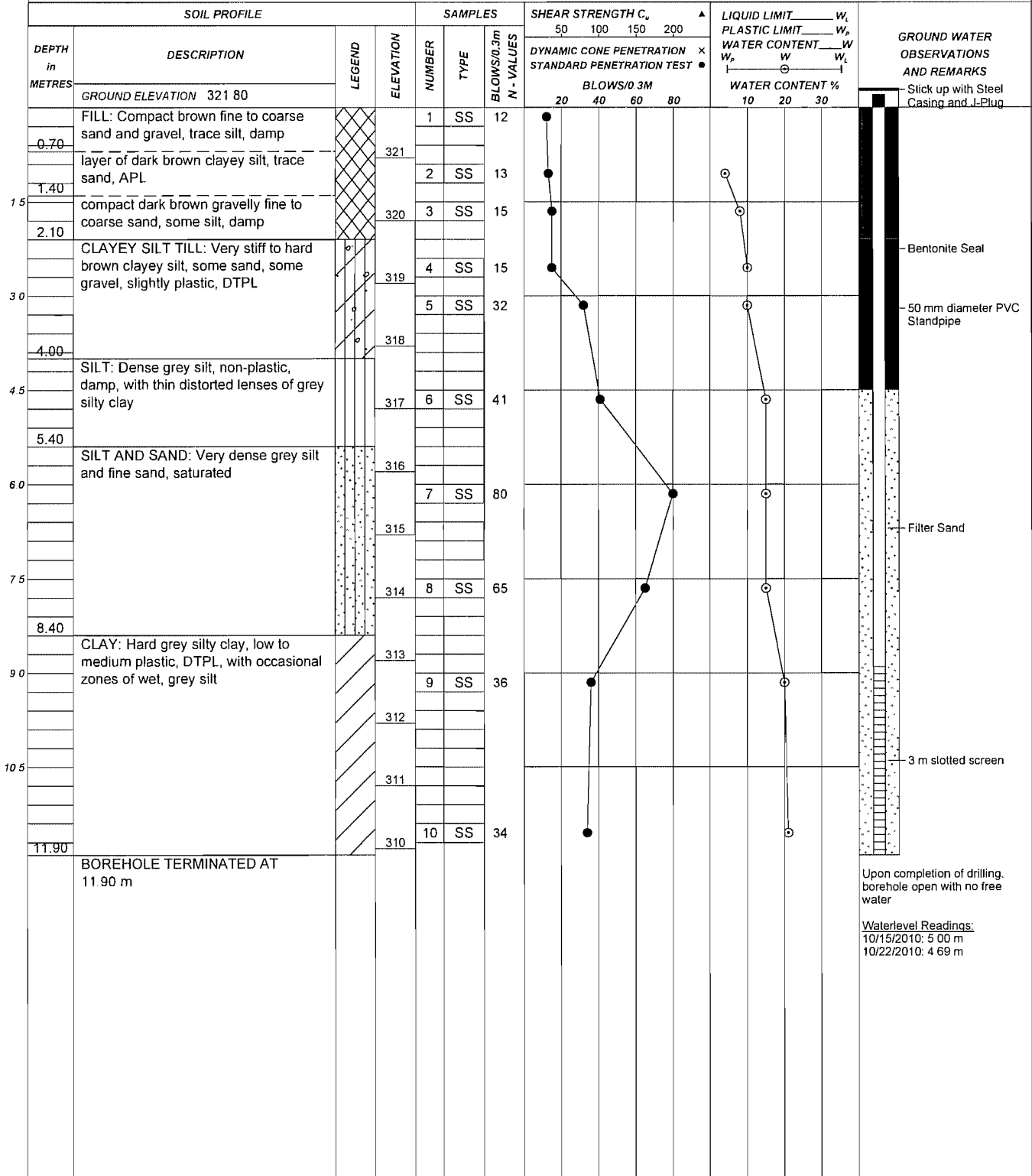
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LOG OF BOREHOLE NO. 7

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Hollow Stem Augers

BORING DATE 2010 09 23

OUR PROJECT NO. 10KF058
ENGINEER M Molodecki
TECHNICIAN M Rapsey



NOTES

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LOG OF BOREHOLE NO. 9

PROJECT PROPOSED MIXED USE DEVELOPMENT

LOCATION Township of Woolwich (Breslau), Ontario

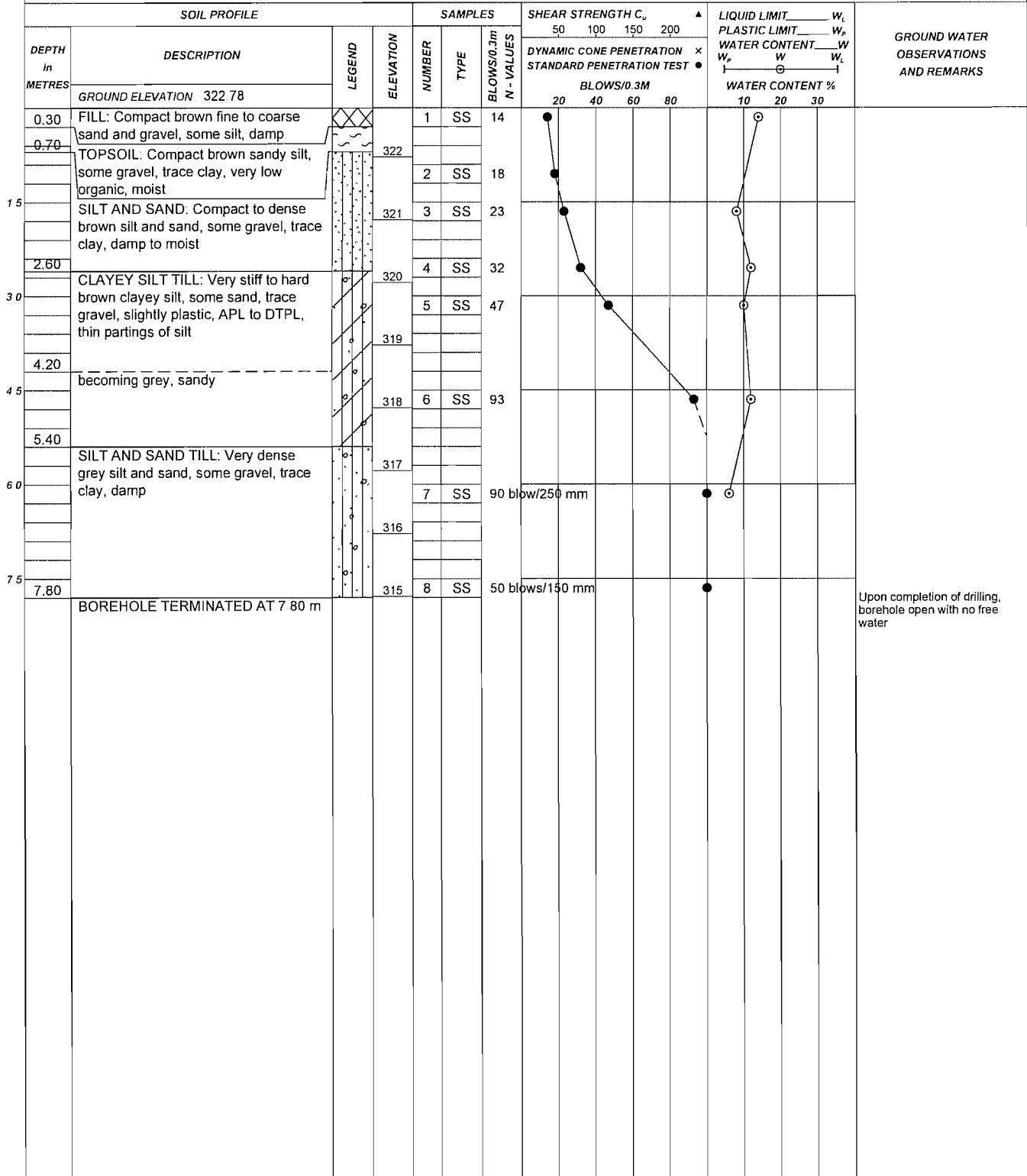
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 20

OUR PROJECT NO. 10KF058

ENGINEER M. Molodecki

TECHNICIAN M. Rapsey



Upon completion of drilling, borehole open with no free water

NOTES

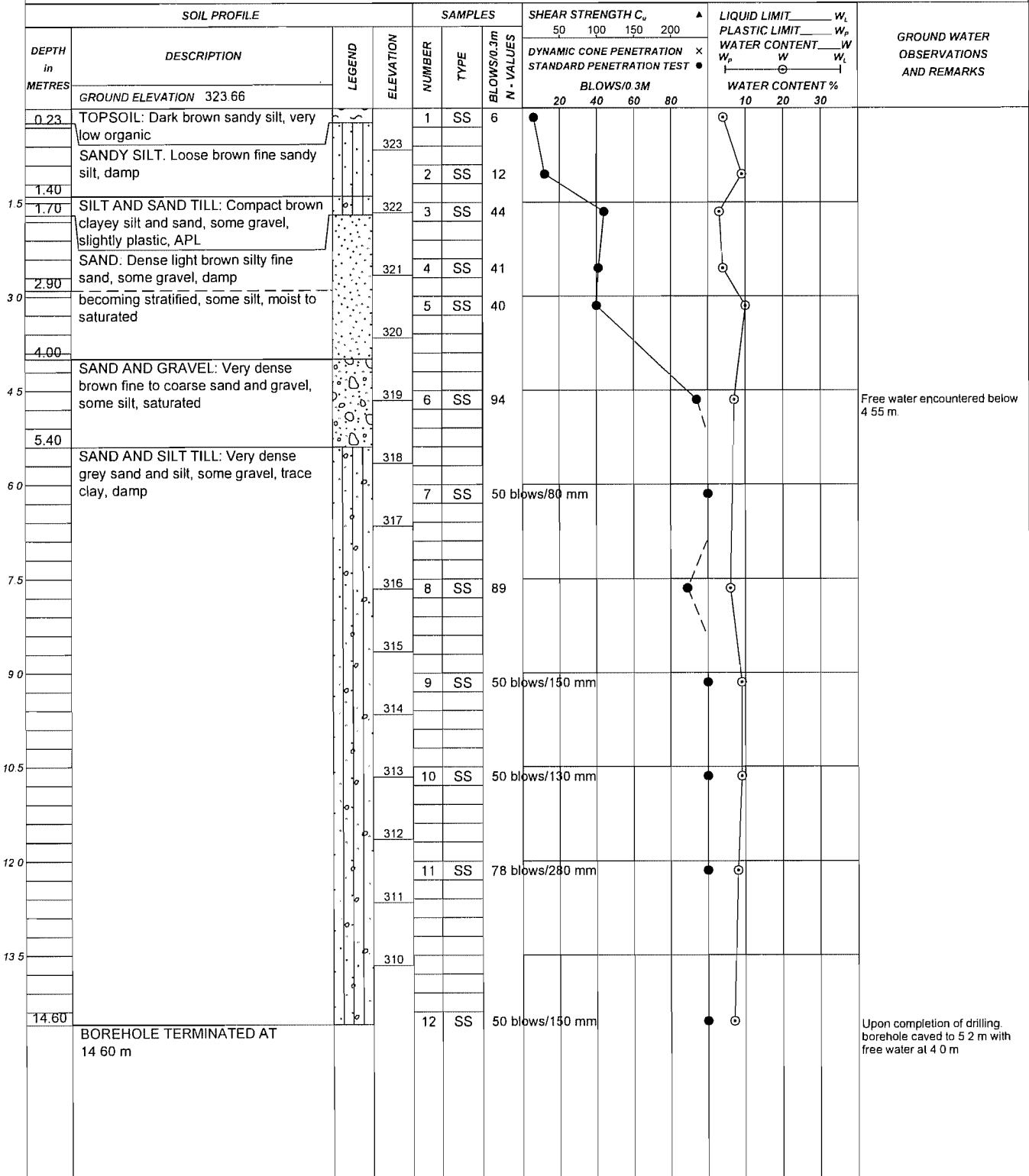
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LOG OF BOREHOLE NO. 10

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Hollow Stem Augers

BORING DATE 2010 09 21

OUR PROJECT NO. 10KF058
ENGINEER M Molodecki
TECHNICIAN M Rapsey



NOTES

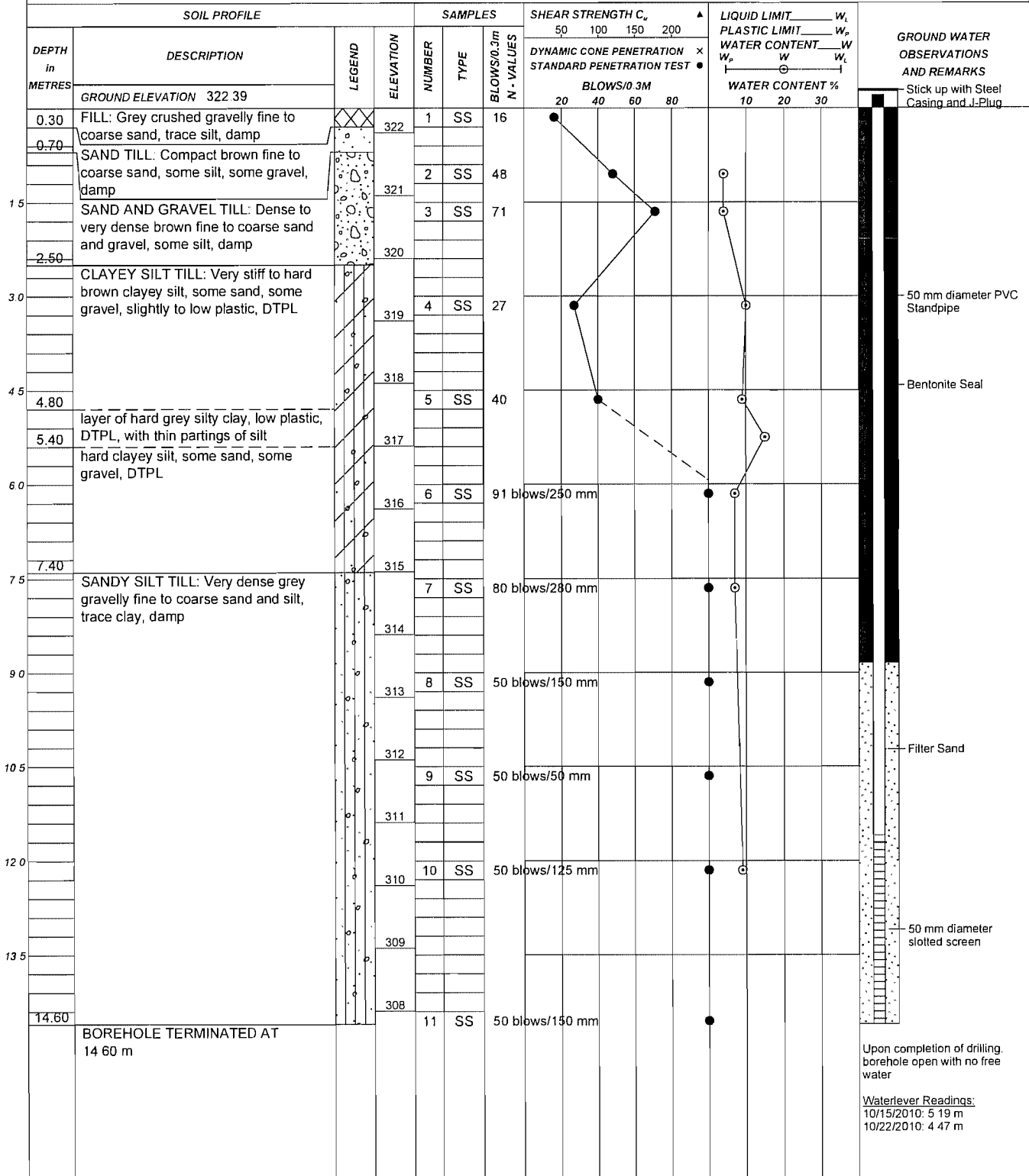
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LOG OF BOREHOLE NO. 11

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Hollow Stem Augers

BORING DATE 2010 09 21

OUR PROJECT NO. 10KF058
ENGINEER M. Molodecki
TECHNICIAN M. Rapsey



NOTES

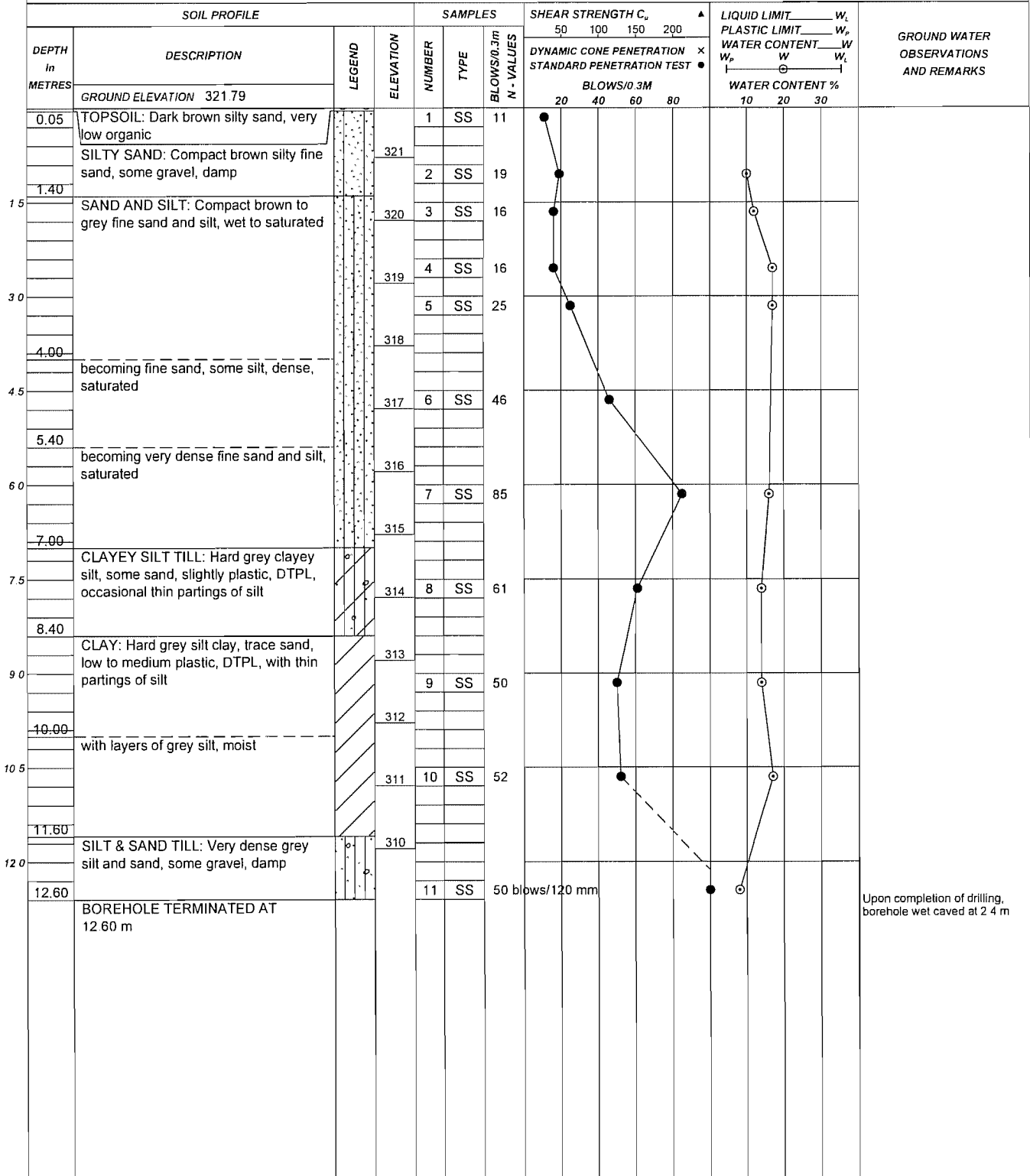
CHECKED BY

LOG OF BOREHOLE NO. 12

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Hollow Stem Augers

BORING DATE 2010 09 22

OUR PROJECT NO. 10KF058
ENGINEER M Molodecki
TECHNICIAN M Rapsey



Upon completion of drilling, borehole wet caved at 2.4 m

NOTES

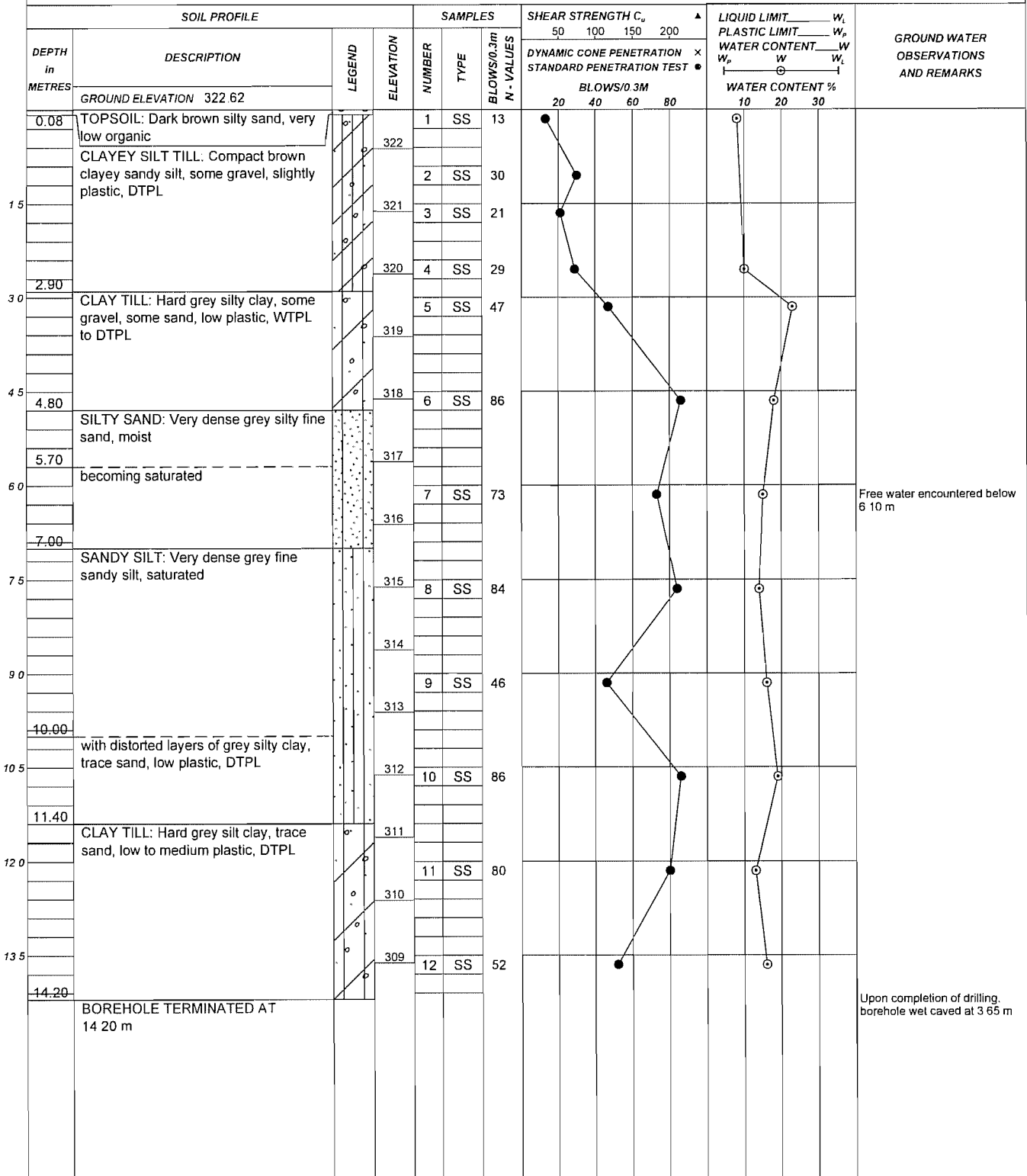
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LOG OF BOREHOLE NO. 13

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Hollow Stem Augers

BORING DATE 2010 09 22

OUR PROJECT NO. 10KF058
ENGINEER M. Molodecki
TECHNICIAN M. Rapsey



NOTES

CHECKED BY

LOG OF BOREHOLE NO. 14

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 23

OUR PROJECT NO. 10KF058
ENGINEER M Molodecki
TECHNICIAN M Rapsey

SOIL PROFILE				SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUND WATER OBSERVATIONS AND REMARKS			
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	50	100	150		200		
							DYNAMIC CONE PENETRATION $\times$ STANDARD PENETRATION TEST $\bullet$						
							BLOWS/0.3M						
							WATER CONTENT %						
	GROUND ELEVATION 323.34						20	40	60	80	10	20	30
0.60	SANDY SILT: Loose mottled brown and dark brown sandy silt, trace gravel, trace clay, damp		323	1	SS	8							
1.40	SAND AND GRAVEL: Compact brown fine to coarse sand and gravel, trace silt, damp		322	2	SS	18							
1.5				3	SS	19							
	CLAYEY SILT TILL: Very stiff to hard brown clayey silt, some sand, some gravel, slightly plastic, WTPL to DTPL		321										
				4	SS	50							
3.0			320	5	SS	37							
			319										
4.5				6	SS	33							
			318										
5.80													
6.0	CLAY TILL: Hard grey silty clay, trace sand, trace gravel, low to medium plastic, DTPL		317										
7.00				7	SS	42							
	BOREHOLE TERMINATED AT 7.00 m												
													</

NOTES

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LOG OF BOREHOLE NO. 15

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 23

OUR PROJECT NO. 10KF058
ENGINEER M. Molodecki
TECHNICIAN M. Rapsey

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u				LIQUID LIMIT W_L				GROUND WATER OBSERVATIONS AND REMARKS
DEPTH In METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	50	100	150	200	PLASTIC LIMIT W_p				
							DYNAMIC CONE PENETRATION $\times$				WATER CONTENT W				
							STANDARD PENETRATION TEST $\bullet$								
							BLOWS/0.3M				WATER CONTENT %				
	GROUND ELEVATION 323.89						20	40	60	80	10	20	30		
0.23	TOPSOIL: Dark brown silt and sand, some gravel, very low organic			1	SS	11									Free water encountered below 3.0 m
	SAND. Compact brown silty fine to medium sand, trace gravel, damp		323	2	SS	19									
1.40	becoming fine sand, trace silt		322	3	SS	19									
2.10	SAND AND GRAVEL TILL: Very dense brown sand and gravel, trace silt, damp		4	SS	57										
2.60	CLAYEY SILT TILL: Hard brown clayey sandy silt, some gravel, slightly plastic, DTPL, occasional boulders	321	5	SS	72 blows/200 mm										
		320													
4.5		319	6	SS	37										
5.70															
6.0	SILTY SAND: Dense grey silty fine to coarse sand, some gravel, saturated	318													
7.00	BOREHOLE TERMINATED AT 7.00 m	317	7	SS	31									Upon completion of drilling, borehole wet caved at 4.2 m	

NOTES

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LOG OF BOREHOLE NO. 16

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 29

OUR PROJECT NO. 10KF058
ENGINEER M. Molodecki
TECHNICIAN M. Rapsey

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u				LIQUID LIMIT w_L				GROUND WATER OBSERVATIONS AND REMARKS			
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	50	100	150	200	PLASTIC LIMIT w_p	WATER CONTENT w	WATER CONTENT w					
							DYNAMIC CONE PENETRATION $\times$				STANDARD PENETRATION TEST $\bullet$					w_p	w	w_L
							BLOWS/0.3M									WATER CONTENT %		
							20	40	60	80	10	20	30					
0.36	TOPSOIL: Dark brown sandy clayey silt, low organic		320	1	SS	7								Free water encountered below 2.3 m				
1.00	SILT. Compact brown silt, trace fine sand, wet mottled grey			2	SS	13												
				3	SS	23												
2.10		319																
2.40	SAND AND GRAVEL: Compact brown sand and gravel, some silt, saturated		318	4	SS	16												
	SILT AND SAND TILL: Compact to very dense grey silt and sand, some gravel, trace clay, moist, with occasional thin layers of wet grey silt, trace sand			5	SS	37												
4.5		317																
		316		6	SS	50 blows/125 mm												
6.0		315																
6.70	BOREHOLE TERMINATED AT 6.70 m			7	SS	50 blows/125 mm								Upon completion of drilling, borehole caved to 5.7 m with free water at 2.4 m				

NOTES

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LOG OF BOREHOLE NO. 17

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 29

OUR PROJECT NO. 10KF058
ENGINEER M Molodecki
TECHNICIAN M Rapsey

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUND WATER OBSERVATIONS AND REMARKS			
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	50	100	150	200		PLASTIC LIMIT W_p		
							DYNAMIC CONE PENETRATION $\times$					WATER CONTENT W		
							STANDARD PENETRATION TEST $\bullet$					W_p	W_L	
												WATER CONTENT %		
					20	40	60	80	10	20	30			
	GROUND ELEVATION 323.42													
0.38	TOPSOIL: Dark brown sandy silt, low organic		323	1	SS	2	$\bullet$				$\circ$			
0.70	SAND: Loose brown fine sand, some silt, damp			2	SS	12	$\bullet$				$\circ$			
1.5	becoming compact light brown fine to coarse sand, trace gravel, trace silt, damp		322	3	SS	12	$\bullet$				$\circ$			
2.10	CLAYEY SILT TILL: Very stiff brown clayey silt, some sand, some gravel, slightly to low plastic, APL to DTPL		321	4	SS	28	$\bullet$				$\circ$			
3.0	becoming grey		320	5	SS	25	$\bullet$				$\circ$			
4.5	SILT AND SAND TILL: Dense grey silt and sand, some gravel, trace clay, non-plastic, damp, with occasional thin layers of grey wet fine sand		319	6	SS	38	$\bullet$				$\circ$	Free water encountered below 4.55 m		
6.0	layers of compact brown saturated fine to coarse sand and gravel, trace silt		317	7	SS	69 blows/250 mm	$\bullet$				$\circ$	Upon completion of drilling, borehole wet caved at 4.3 m		
6.80	grey silt and sand													
7.00	BOREHOLE TERMINATED AT 7.00 m													

NOTES

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LOG OF BOREHOLE NO. 18

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 29

OUR PROJECT NO. 10KF058
ENGINEER M. Molodecki
TECHNICIAN M. Rapsey

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u				LIQUID LIMIT W_L			GROUND WATER OBSERVATIONS AND REMARKS
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	50 100 150 200				PLASTIC LIMIT W_p			
							DYNAMIC CONE PENETRATION $\times$				WATER CONTENT W			
							STANDARD PENETRATION TEST $\bullet$				W_p W W_L			
							BLOWS/0.3M				WATER CONTENT %			
	GROUND ELEVATION 324.46						20 40 60 80				10 20 30			
0.25	TOPSOIL: Dark brown sandy clayey silt, low organic		324	1	SS	5							Free water encountered below 4.55 m	
	SANDY SILT TILL. Compact brown sandy silt, some gravel, trace clay, non to slightly plastic, moist			2	SS	11								
1.40	CLAYEY SILT TILL: Very stiff brown clayey silt, some sand, some gravel, slightly to low plastic, APL to DTPL			323	3	SS	16							
				322	4	SS	27							
2.90	with occasional thin partings of fine sand			321	5	SS	20							
4.00														
4.5	SAND: Dense brown fine sand, some gravel, some silt, saturated		320	6	SS	59								
4.80	SILT: Very dense brown silt, some fine sand, some gravel, wet		319											
5.70														
6.0	CLAY TILL: Hard grey silty clay, trace sand, trace gravel, low plastic, DTPL		318											
7.00				7	SS	36								
	BOREHOLE TERMINATED AT 7.00 m												Upon completion of drilling, borehole wet caved at 4.2 m	

Free water encountered below 4.55 m

Upon completion of drilling, borehole wet caved at 4.2 m

NOTES

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LOG OF BOREHOLE NO. 19

PROJECT PROPOSED MIXED USE DEVELOPMENT

LOCATION Township of Woolwich (Breslau), Ontario

BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 29

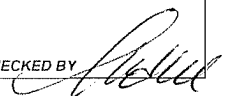
OUR PROJECT NO. 10KF058

ENGINEER M Molodecki

TECHNICIAN M Rapsey

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u				LIQUID LIMIT W_L				GROUND WATER OBSERVATIONS AND REMARKS
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	50	100	150	200	PLASTIC LIMIT W_p	WATER CONTENT W	WATER CONTENT W		
							DYNAMIC CONE PENETRATION $\times$				STANDARD PENETRATION TEST $\bullet$				
							BLOWS/0.3M				WATER CONTENT %				
							20	40	60	80	10	20	30		
							GROUND ELEVATION 323.35								
0.25	TOPSOIL: Dark brown clayey sandy silt, low organic		323	1	SS	6									
	SILT AND SAND TILL: Compact brown silt and sand, some gravel, trace clay, non-plastic, damp becoming dense		322	2	SS	26									
1.40				3	SS	35									
			321											Free water encountered below 4.55 m	
				4	SS	41									
2.90	becoming very dense		320	5	SS	95									
4.00															
	SILT: Dense brown silt, some very fine sand, saturated, with layers of brown silty fine sand, saturated		319												
4.5				6	SS	39									
			318												
5.60															
	CLAY TILL: Hard grey silty clay, some sand, trace gravel, low plastic, DTPL		317	7	SS	41								Upon completion of drilling, borehole wet caved at 4.2 m	
6.0															
			316												
7.5				8	SS	37									
8.00	BOREHOLE TERMINATED AT 8.00 m														

NOTES



LOG OF BOREHOLE NO. 20

PROJECT PROPOSED MIXED USE DEVELOPMENT

LOCATION Township of Woolwich (Breslau), Ontario

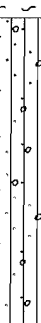
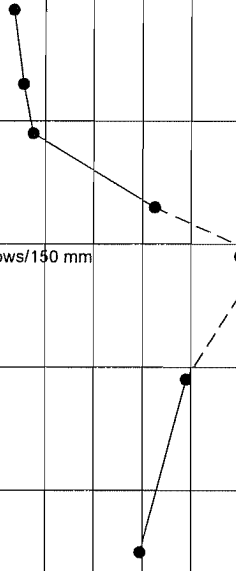
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 29

OUR PROJECT NO. 10KF058

ENGINEER M. Molodecki

TECHNICIAN M. Rapsey

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUND WATER OBSERVATIONS AND REMARKS	
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	50	100	150	200		
							DYNAMIC CONE PENETRATION $\times$ STANDARD PENETRATION TEST $\bullet$					
							BLOWS/0.3M					
GROUND ELEVATION 323.30							WATER CONTENT %					
0.25	TOPSOIL: Dark brown sandy clayey silt, low organic		323	1	SS	7						
	SANDY SILT TILL: Loose to compact brown sandy silt, some gravel, trace clay, non to slightly plastic, damp											
				2	SS	11						
1.5					3	SS	15					
2.10	becoming very dense											
					4	SS	65					
3.0					5	SS	50 blows/150 mm					
4.00	SILT: Hard grey clayey silt, trace sand, slightly to low plastic, DTPL, with distorted layers of silt											
				319								
4.5					6	SS	78					
				318								
6.0												
7.00	BOREHOLE TERMINATED AT 7.00 m			7	SS	59						
							Upon completion of drilling, borehole open with no free water					

NOTES

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LOG OF BOREHOLE NO. 21

PROJECT PROPOSED MIXED USE DEVELOPMENT

LOCATION Township of Woolwich (Breslau), Ontario

BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 29

OUR PROJECT NO. 10KF058

ENGINEER M. Molodecki

TECHNICIAN M. Rapsey

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUND WATER OBSERVATIONS AND REMARKS					
DEPTH In METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	50	100	150	200						
							DYNAMIC CONE PENETRATION $\times$ STANDARD PENETRATION TEST $\bullet$					PLASTIC LIMIT W_p				
							BLOWS/0.3M					WATER CONTENT W				
							WATER CONTENT %									
0.30	TOPSOIL: Dark brown clayey sandy silt, low organic		321	1	SS	6	20	40	60	80	10	20	30			
	CLAYEY SILT TILL: Stiff to very stiff brown clayey silt, some sand, some gravel, slightly plastic, DTPL			2	SS	15										
1.40	SANDY SILT TILL: Compact brown fine sandy silt, some gravel, trace clay, non to slightly plastic, moist			3	SS	27										
				4	SS	27										
				5	SS	42										
3.20	SILT: Dense brown to grey silt, some fine sand, moist to wet		318													
4.20			317	6	SS	60										
4.5	CLAY: Hard grey silty clay, low plastic, DTPL, with zones of silt and clayey silt		316													
6.70																
6.90	SILT: Very dense grey silt, trace very fine sand, moist		315	7	SS	70										
	BOREHOLE TERMINATED AT 6.90 m										Upon completion of drilling, borehole wet caved at 3.6 m					

LOG OF BOREHOLE NO. 22

PROJECT PROPOSED MIXED USE DEVELOPMENT

LOCATION Township of Woolwich (Breslau), Ontario

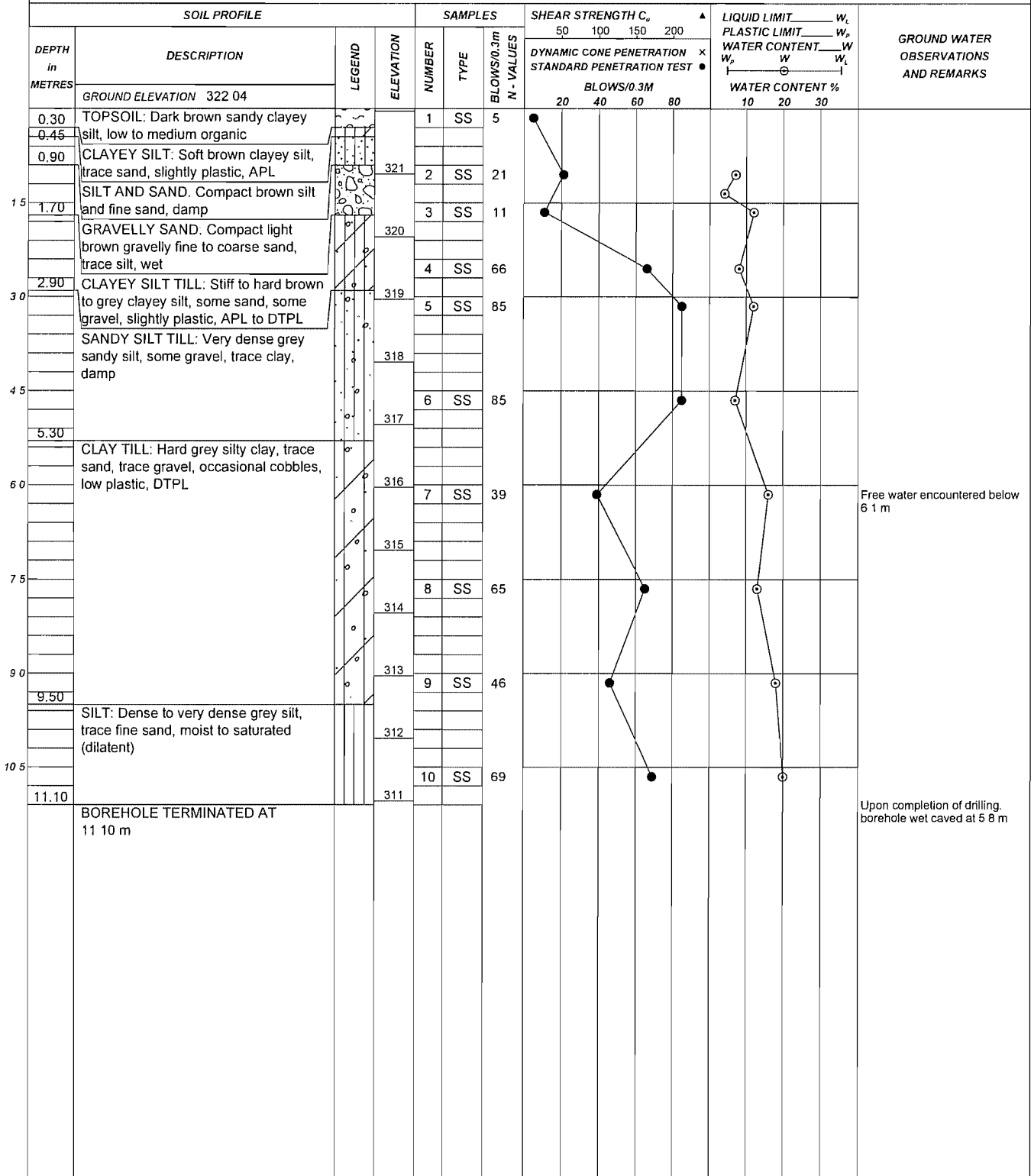
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 29

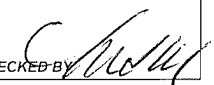
OUR PROJECT NO. 10KF058

ENGINEER M. Molodecki

TECHNICIAN M. Rapsey



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LOG OF BOREHOLE NO. 23

PROJECT PROPOSED MIXED USE DEVELOPMENT

LOCATION Township of Woolwich (Breslau), Ontario

BORING METHOD Continuous Flight Hollow Stem Augers

BORING DATE 2010 09 30

OUR PROJECT NO. 10KF058

ENGINEER M Molodecki

TECHNICIAN M Rapsey

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u				LIQUID LIMIT W_L				GROUND WATER OBSERVATIONS AND REMARKS			
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	50	100	150	200	▲	PLASTIC LIMIT W_p	WATER CONTENT W					
							DYNAMIC CONE PENETRATION $\times$				STANDARD PENETRATION TEST $\bullet$					W_p	W	W_L
							BLOWS/0.3M				WATER CONTENT %							
0.20	TOPSOIL: Dark brown sandy silt, low organic		322	1	SS	13	20	40	60	80		10	20	30	Free water encountered below 2.3 m			
	SAND AND GRAVEL TILL: Compact to very dense brown fine to coarse sand and gravel, some silt, damp			2	SS	70												
1.5				3	SS	82												
					4	SS	24											
2.10			SAND: Compact brown fine to coarse sand, some gravel, trace silt, saturated		5	SS	76											
	CLAYEY SILT TILL: Hard brown to grey clayey silt, some sand, some gravel, slightly to low plastic, DTPL		320															
2.90			6	SS	76													
3.0																		
4.5	SILT AND SAND TILL: Very dense grey silt and sand, some gravel, trace clay, non to slightly plastic, damp		318															
			7	SS	50 blows/150 mm													
5.40																		
6.0	BOREHOLE TERMINATED AT 7.70 m		317											Upon completion of drilling, borehole caved to 5.0 m with water seepage from 1.8 m				
7.5																		
7.70			316															
			315	8	SS	50 blows/100 mm												

NOTES

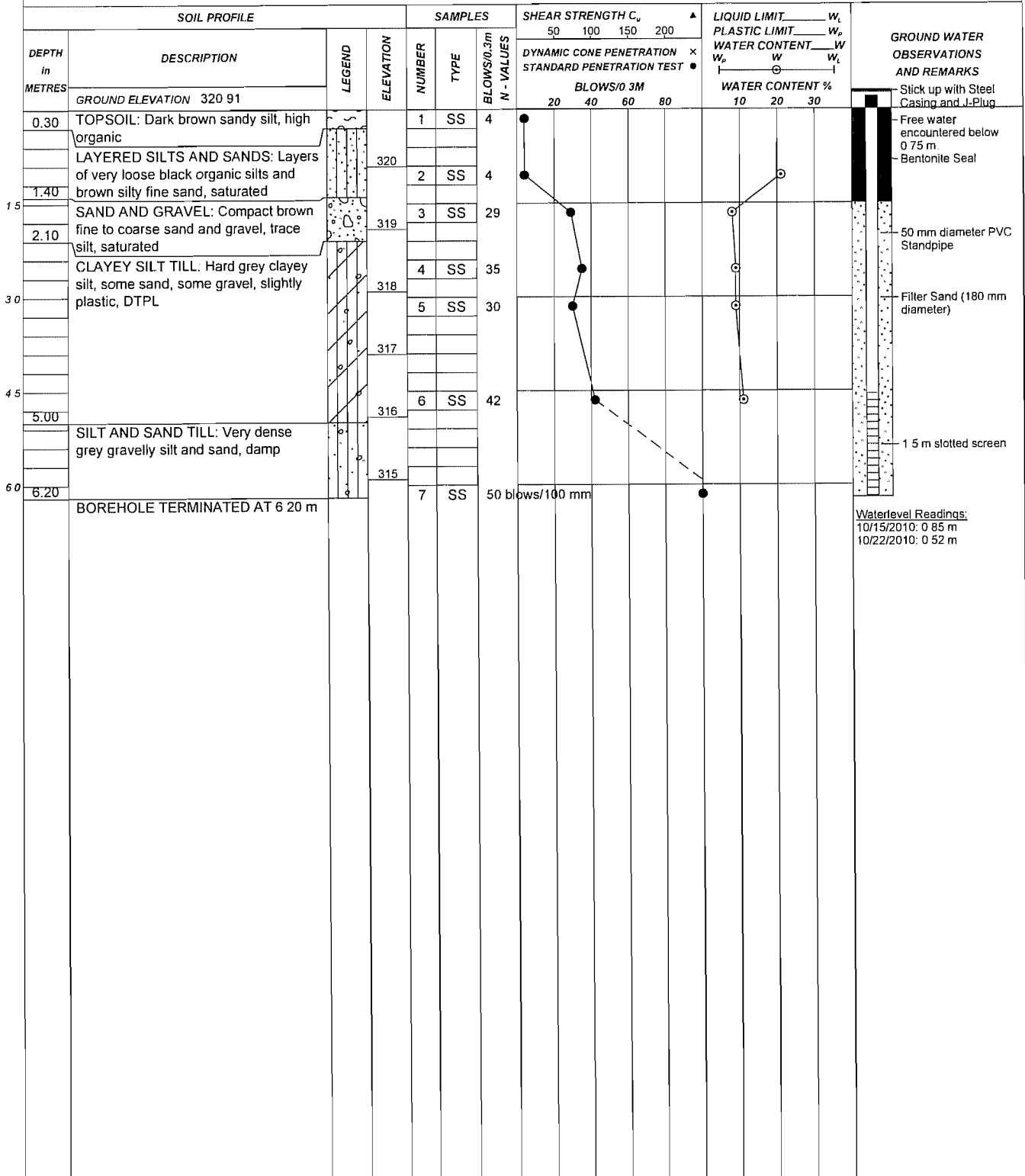
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LOG OF BOREHOLE NO. 24

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Hollow Stem Augers

BORING DATE 2010 09 23

OUR PROJECT NO. 10KF058
ENGINEER M. Molodecki
TECHNICIAN M. Rapsey



NOTES

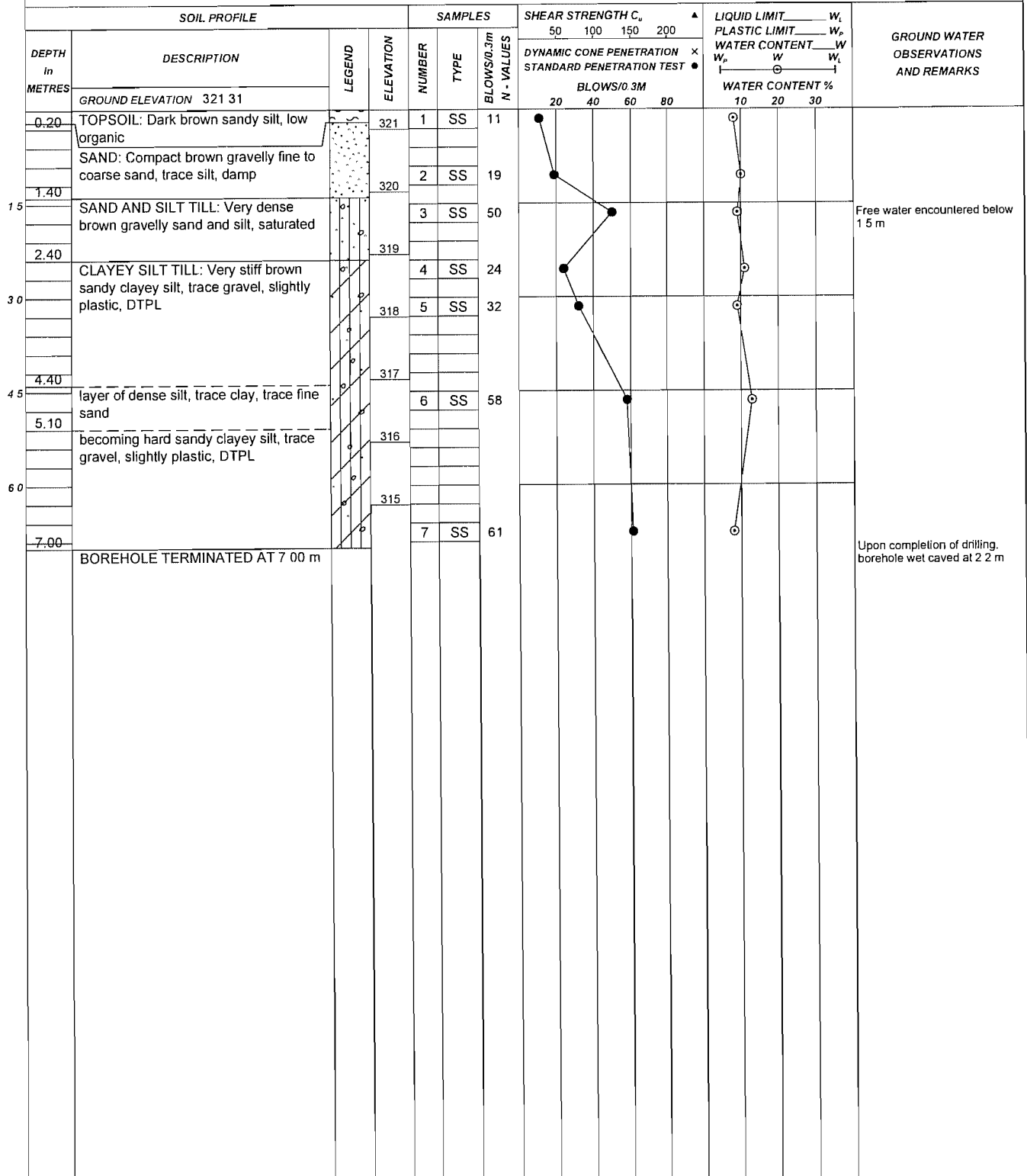
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LOG OF BOREHOLE NO. 25

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 23

OUR PROJECT NO. 10KF058
ENGINEER M Molodecki
TECHNICIAN M. Rapsey



NOTES

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LOG OF BOREHOLE NO. 26

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 24

OUR PROJECT NO. 10KF058
ENGINEER M Molodecki
TECHNICIAN M Rapsey

SOIL PROFILE				SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUND WATER OBSERVATIONS AND REMARKS		
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	50	100	150		200	
							DYNAMIC CONE PENETRATION		WATER CONTENT			
							STANDARD PENETRATION TEST		WATER CONTENT %			
	GROUND ELEVATION 321.61											
0.05	TOPSOIL: Dark brown sandy silt		321	1	SS	23						
	SAND AND GRAVEL: Compact brown fine to coarse sand and gravel, some silt, dry to damp, with layers of compact brown sandy silt, trace of gravel, trace clay, moist				2	SS	22					
1.5			320	3	SS	9						
	CLAYEY SILT TILL: Stiff to very stiff grey clayey silt, some sand, some gravel, slightly plastic, WTPL to APL											
			319	4	SS	9						
3.0												
			318	5	SS	18						
4.00												
4.5	SANDY SILT TILL: Dense to very dense grey sandy gravelly silt, trace clay, non-plastic, damp		317	6	SS	44						
			316									
6.0												
			315									
6.90	BOREHOLE TERMINATED AT 6.90 m			7	SS	85						
												Upon completion of drilling, borehole remained open with no free water

NOTES

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LOG OF BOREHOLE NO. 28

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 27

OUR PROJECT NO. 10KF058
ENGINEER M Molodecki
TECHNICIAN M Rapsey

SOIL PROFILE						SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUND WATER OBSERVATIONS AND REMARKS						
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	50	100	150	200	▲							
							DYNAMIC CONE PENETRATION						×	WATER CONTENT W				
							STANDARD PENETRATION TEST						●	WATER CONTENT %				
							BLOWS/0.3M							WATER CONTENT %				
	GROUND ELEVATION 323.56						20	40	60	80	10	20	30					
	PAVEMENT STRUCTURE: Tar and chip over 875 mm of light brown gravelly fine to coarse sand, some silt, damp		323															
0.90				1	SS	9												
1.5	SANDY SILT TILL: Compact brown fine sandy silt, some gravel, trace clay, non to slightly plastic, moist		322	2	SS	14												
2.10																		
	CLAY TILL: Very stiff brown silty clay, trace sand, trace gravel, low plastic, DTPL, occasional thin partings of silt		321	3	SS	24												
3.0				4	SS	22												
			320															
4.00																		
4.5	CLAYEY SILT TILL: Hard grey clayey silt, some sand, some gravel, slightly plastic, DTPL		319	5	SS	52												
			318															
5.80																		
6.0	SAND AND GRAVEL: Very dense brown fine to coarse sand and gravel, some silt, saturated		317	6	SS	85												
7.00																		
	BOREHOLE TERMINATED AT 7.00 m																	

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Upon completion of drilling, borehole caved to 5.7 m with free water at 4.0 m

NOTES

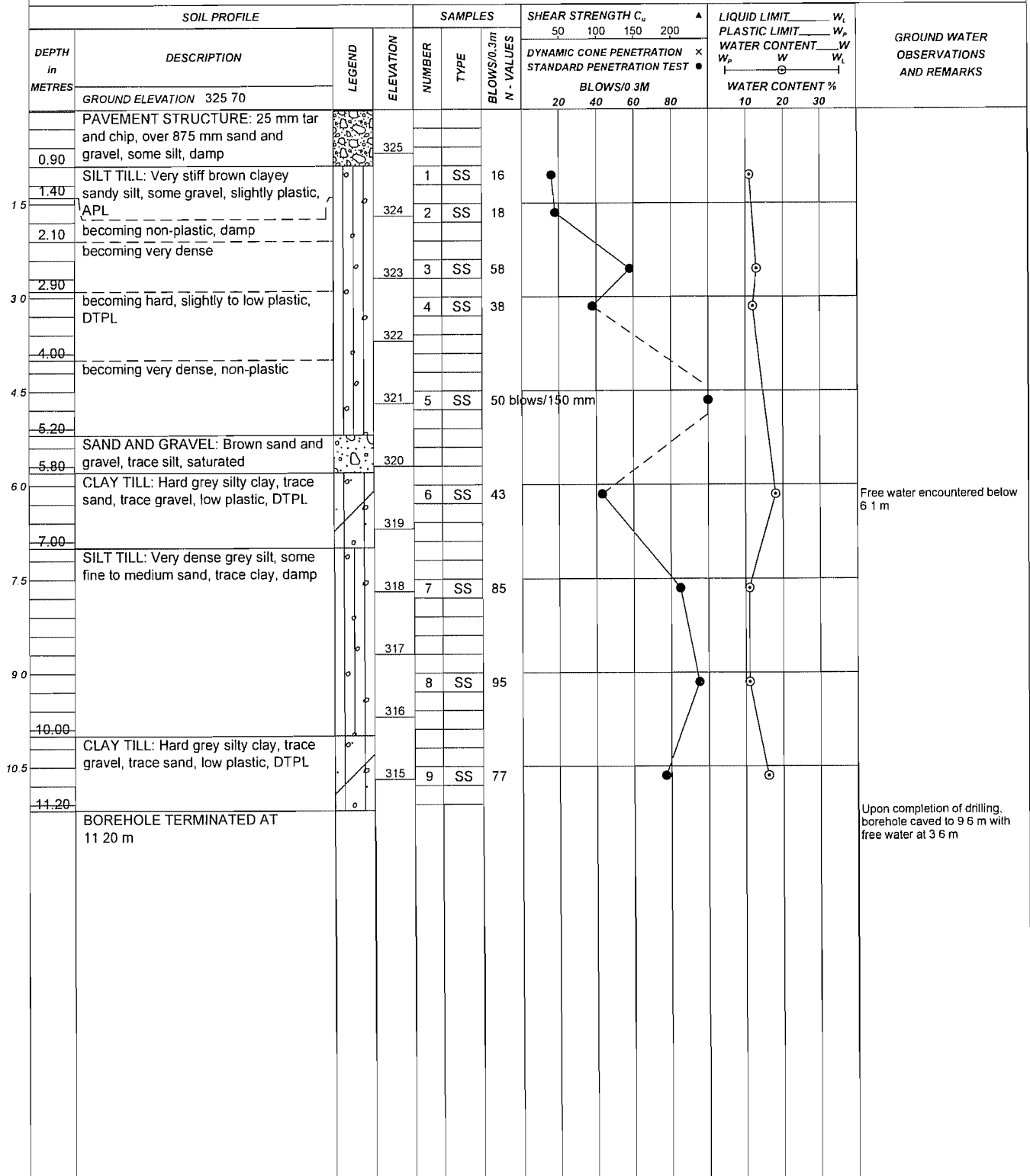
CHECKED BY

LOG OF BOREHOLE NO. 29

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 27

OUR PROJECT NO. 10KF058
ENGINEER M. Molodecki
TECHNICIAN M. Rapsey



NOTES

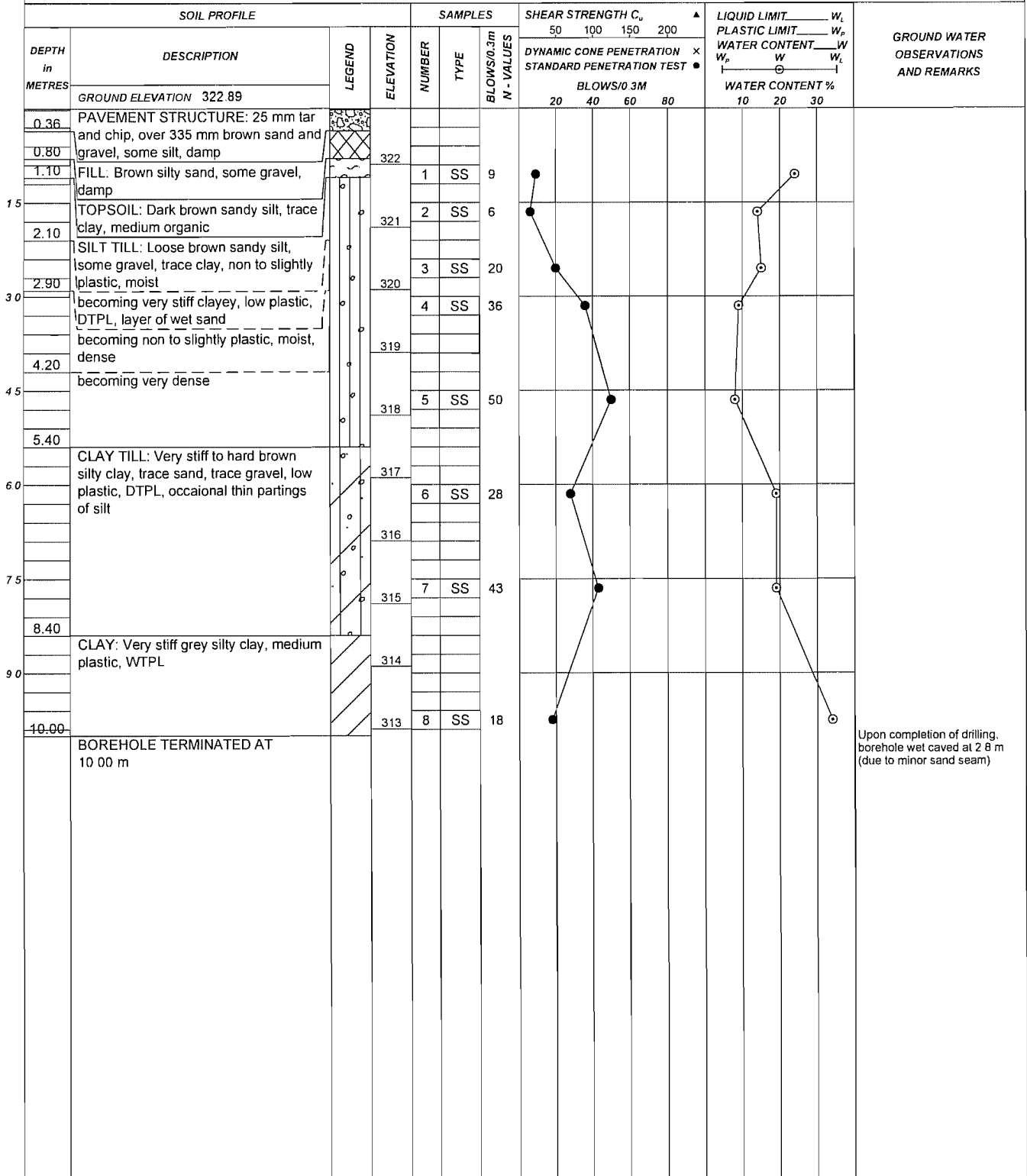
CHECKED BY 

LOG OF BOREHOLE NO. 30

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 27

OUR PROJECT NO. 10KF058
ENGINEER M. Molodecki
TECHNICIAN M. Rapsey



NOTES

CHECKED BY

LOG OF BOREHOLE NO. 31

PROJECT PROPOSED MIXED USE DEVELOPMENT

LOCATION Township of Woolwich (Breslau), Ontario

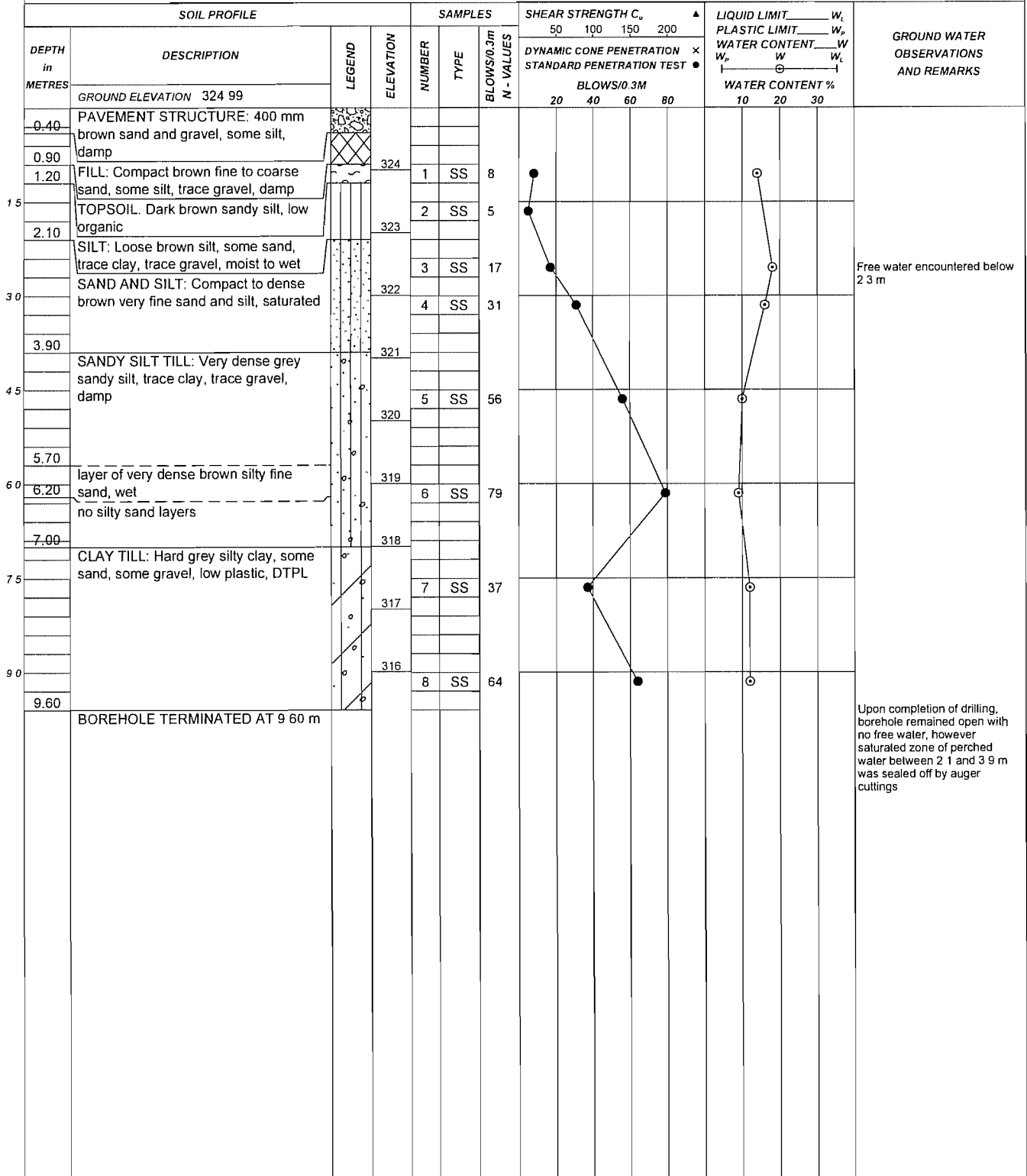
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 24

OUR PROJECT NO. 10KF058

ENGINEER M. Molodecki

TECHNICIAN M. Rapsey



NOTES

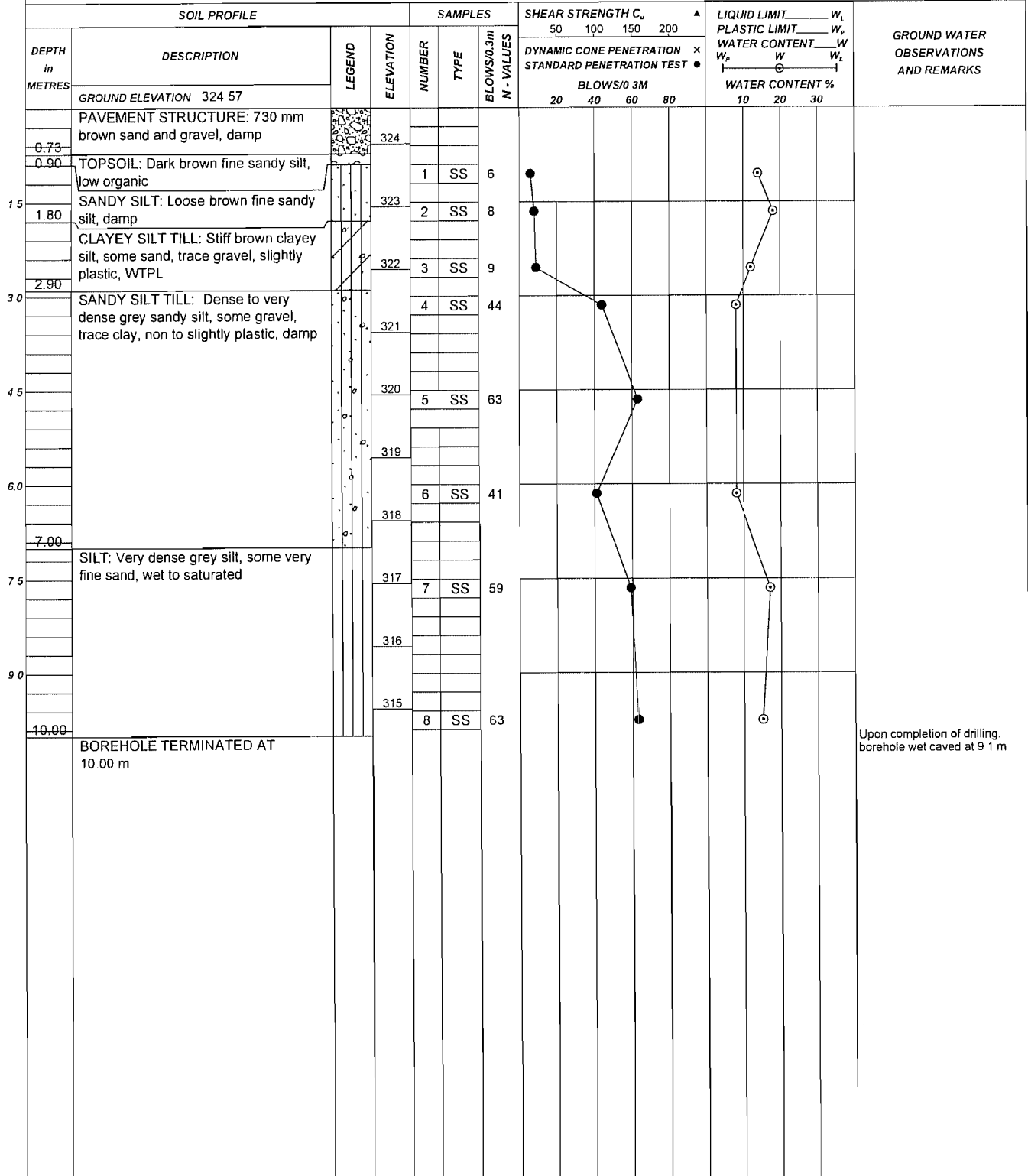
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LOG OF BOREHOLE NO. 32

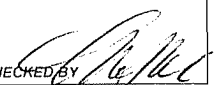
PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Hollow Stem Augers

BORING DATE 2010 09 24

OUR PROJECT NO. 10KF058
ENGINEER M. Molodecki
TECHNICIAN M. Rapsey



NOTES

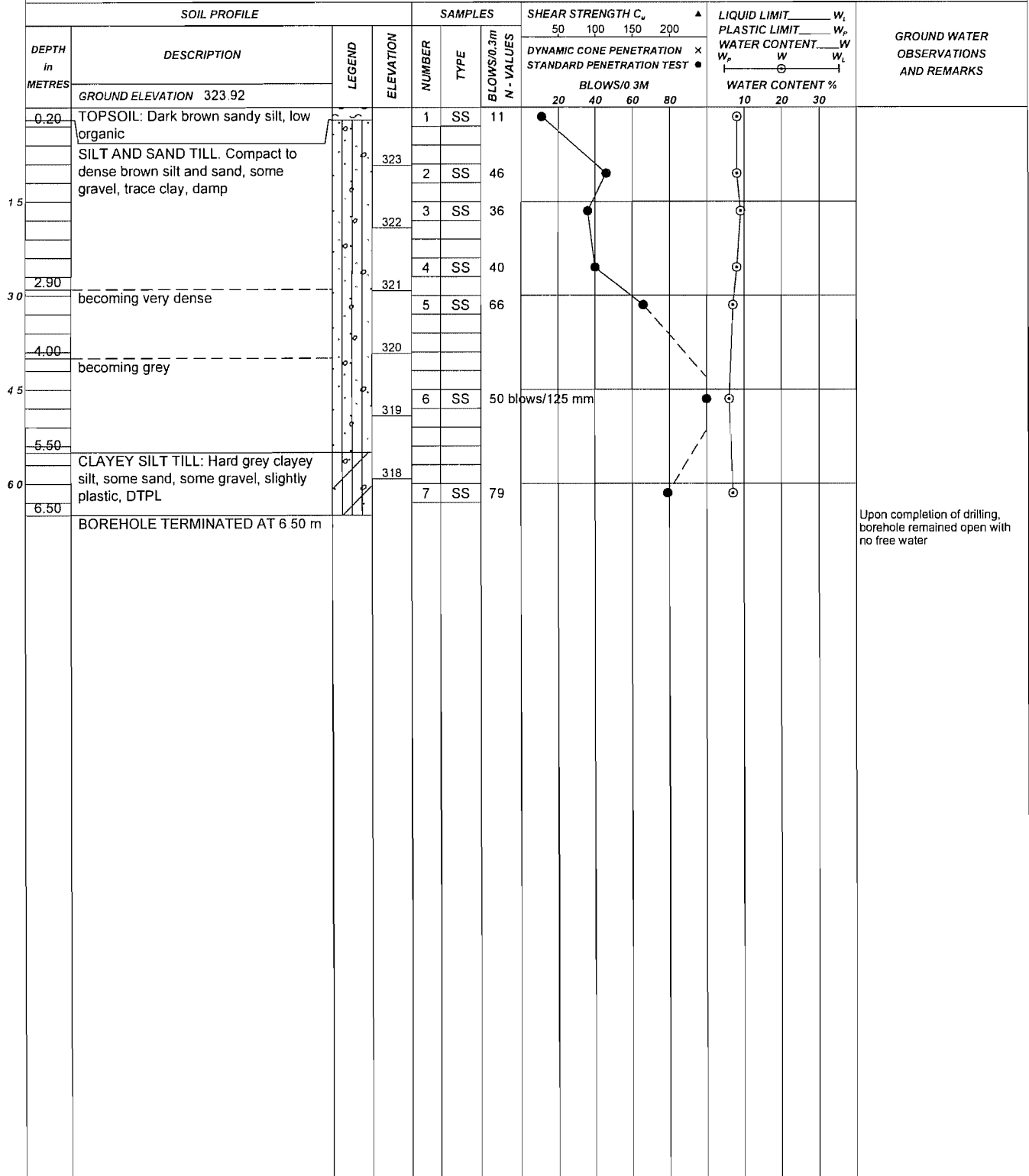
CHECKED BY 

LOG OF BOREHOLE NO. 34

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 10 01

OUR PROJECT NO. 10KF058
ENGINEER M. Molodecki
TECHNICIAN M. Rapsey



NOTES

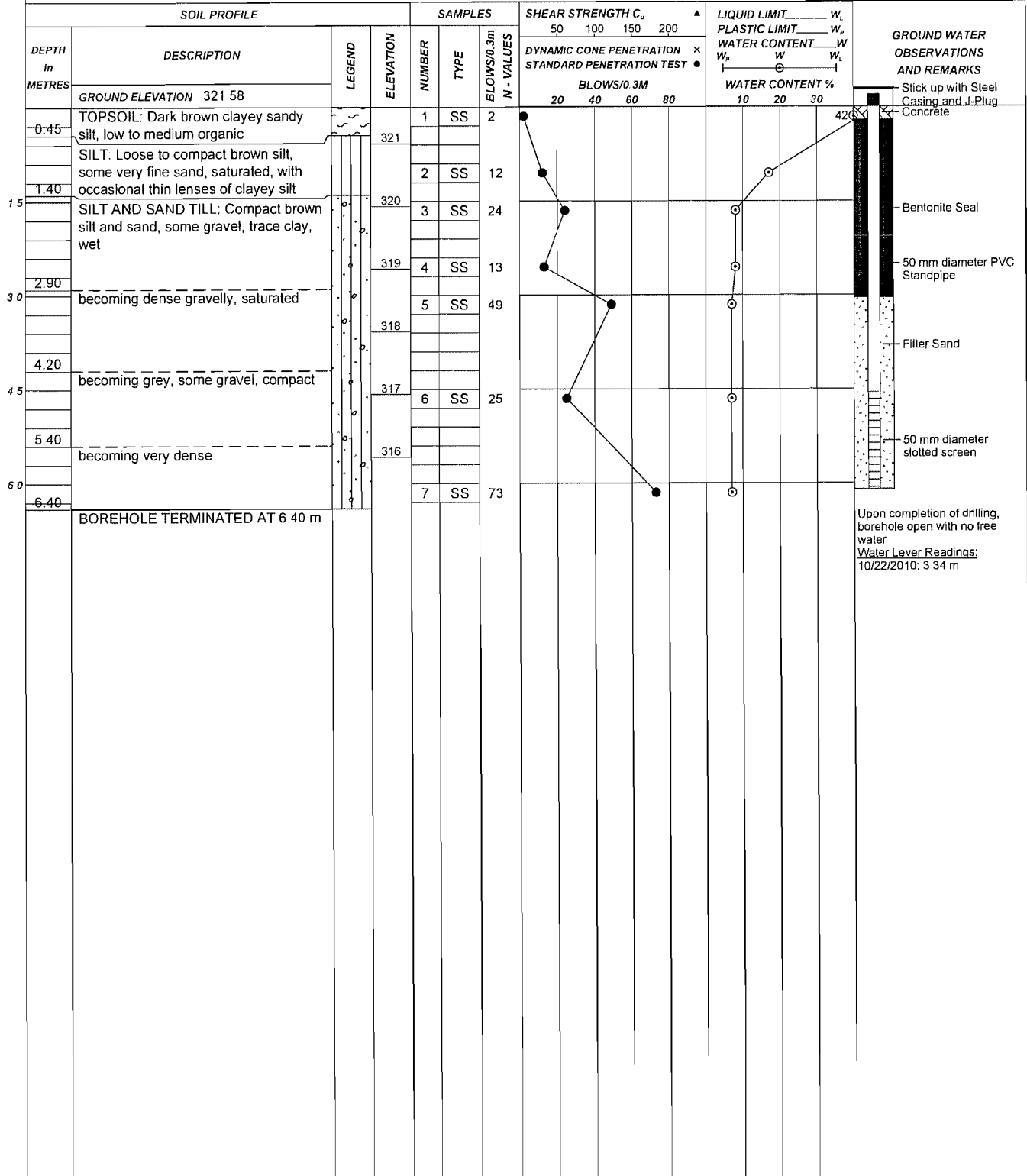
CHECKED BY

LOG OF BOREHOLE NO. 35

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Hollow Stem Augers

BORING DATE 2010 10 04

OUR PROJECT NO. 10KF058
ENGINEER M. Molodecki
TECHNICIAN M. Rapsey



NOTES

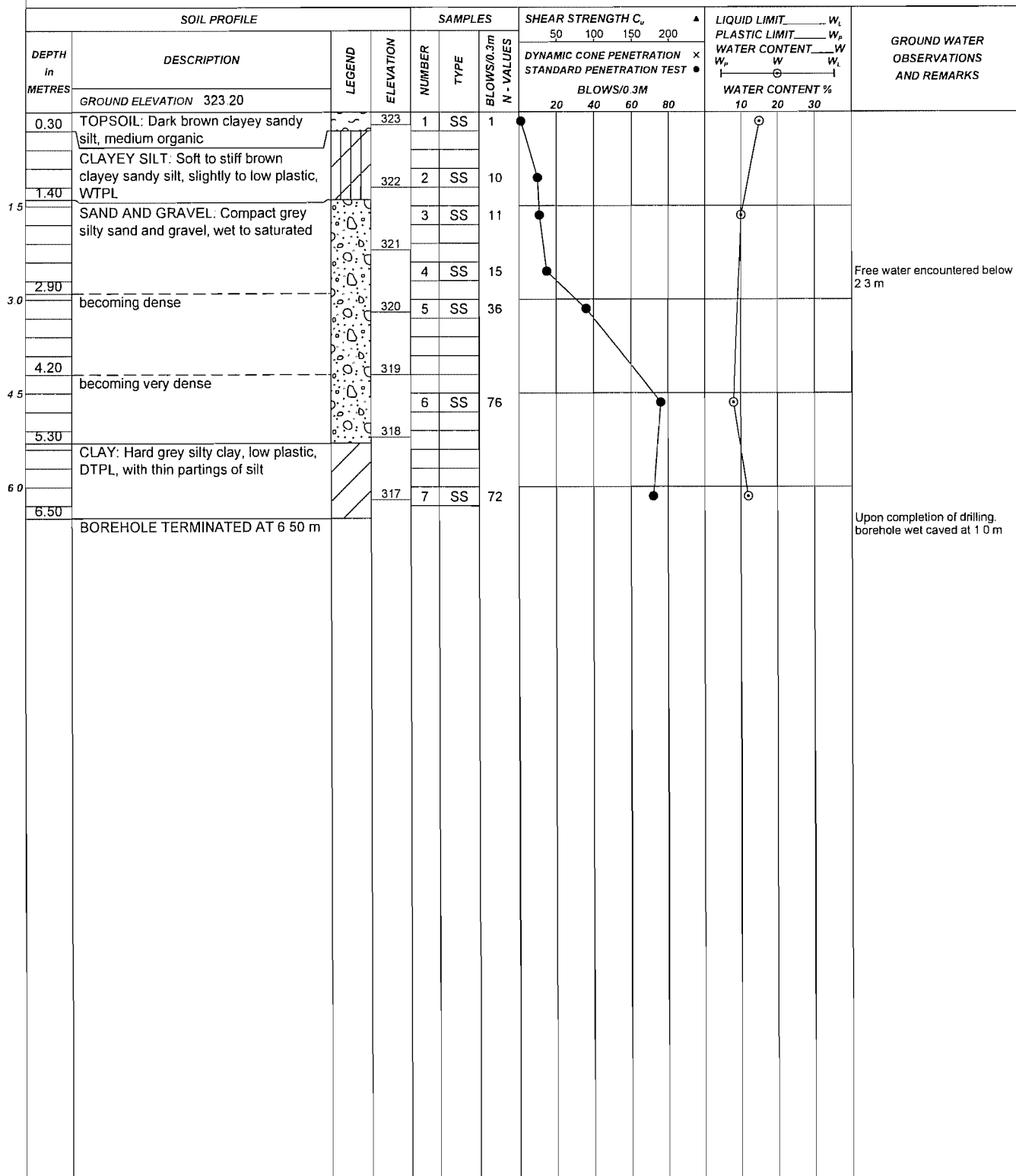
CHECKED BY *[Signature]*

LOG OF BOREHOLE NO. 36

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Hollow Stem Augers

BORING DATE 2010 10 04

OUR PROJECT NO. 10KF058
ENGINEER M Molodecki
TECHNICIAN M Rapsey



NOTES

CHECKED BY

LOG OF BOREHOLE NO. 37

PROJECT PROPOSED MIXED USE DEVELOPMENT

LOCATION Township of Woolwich (Breslau), Ontario

BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 10 01

OUR PROJECT NO. 10KF058

ENGINEER M. Molodecki

TECHNICIAN M. Rapsey

SOIL PROFILE				SAMPLES		SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUND WATER OBSERVATIONS AND REMARKS					
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	50	100	150		200	PLASTIC LIMIT W_p	WATER CONTENT W		
							DYNAMIC CONE PENETRATION $\times$				W_p	W			
							STANDARD PENETRATION TEST $\bullet$				W_p	W			
											BLOWS/0.3M		WATER CONTENT %		
											20	40	60	80	10
0.35	GROUND ELEVATION 324.94														
	TOPSOIL: Dark brown clayey sandy silt, low organic			1	SS	5									
	SAND. Compact brown fine sand, some silt, some gravel, damp		324	2	SS	13									
1.40	becoming moist			3	SS	5									
			323												
2.10	SAND AND SILT TILL: Compact brown sand and silt, some gravel, trace clay, moist to wet			4	SS	17									
			322	5	SS	22									
3.0															
3.60	SILTY SAND: Brown silty fine to medium sand, saturated														
			321												
4.40															
4.5	CLAY: Hard grey silty clay, trace sand, low to medium plastic, DTPL, with occasional thin partings of silt			6	SS	33									
			320												
6.0															
			319												
6.80															
7.00	CLAYEY SILT TILL: Hard grey clayey silt, some sand, some gravel, slightly plastic, DTPL			7	SS	49									
	BOREHOLE TERMINATED AT 7.00 m		318												

Free water encountered below 4.55 m,

Upon completion of drilling, borehole wet caved at 2.7 m

NOTES

CHECKED BY

LOG OF BOREHOLE NO. 38

PROJECT PROPOSED MIXED USE DEVELOPMENT

LOCATION Township of Woolwich (Breslau), Ontario

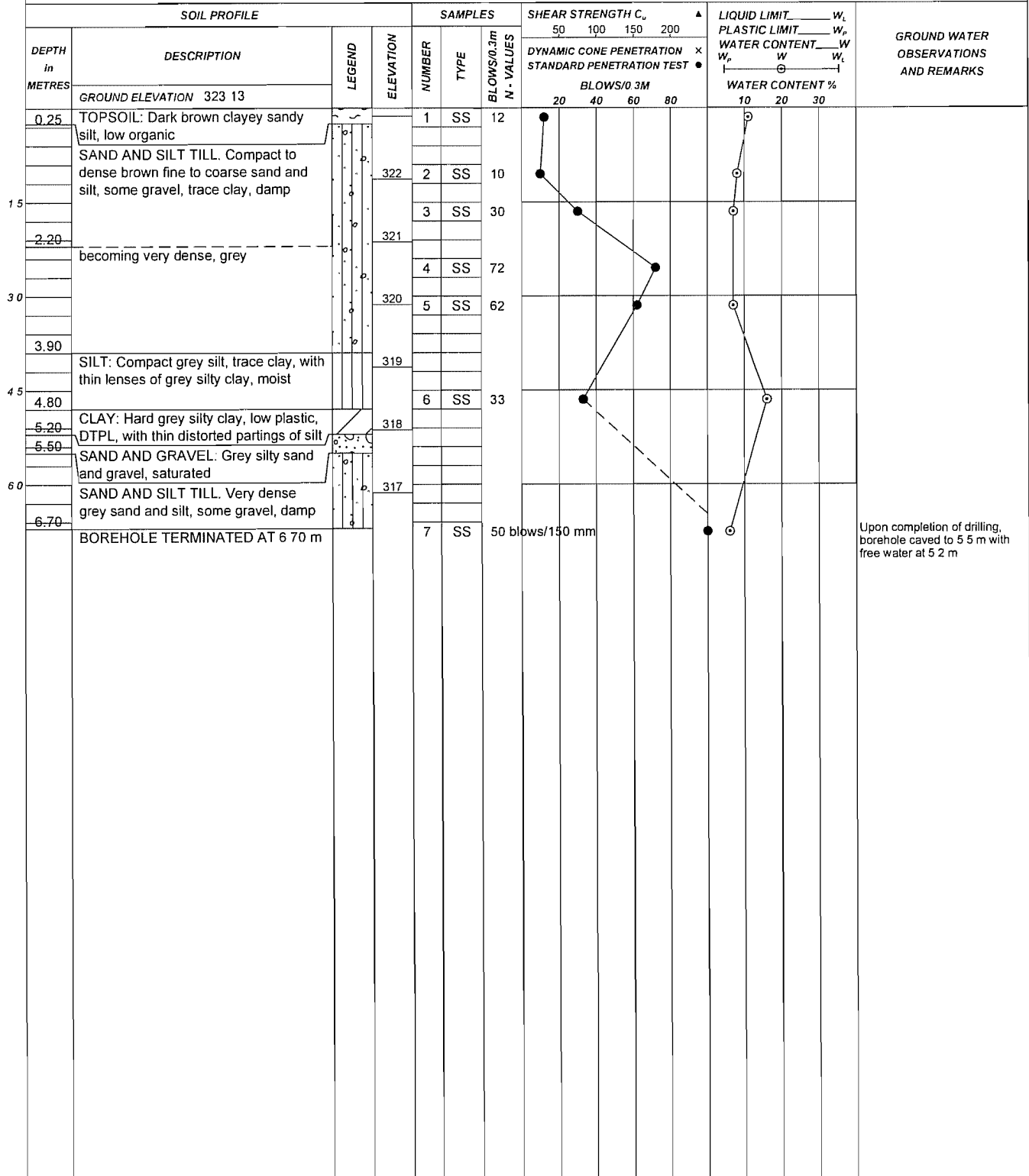
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 10 04

OUR PROJECT NO. 10KF058

ENGINEER M. Molodecki

TECHNICIAN M. Rapsey



NOTES

CHECKED BY

LOG OF BOREHOLE NO. 39

PROJECT PROPOSED MIXED USE DEVELOPMENT

LOCATION Township of Woolwich (Breslau), Ontario

BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 10 04

OUR PROJECT NO. 10KF058

ENGINEER M Molodecki

TECHNICIAN M Rapsey

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u		LIQUID LIMIT W_L		GROUND WATER OBSERVATIONS AND REMARKS						
DEPTH In METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	50	100	150	200		PLASTIC LIMIT W_p					
							DYNAMIC CONE PENETRATION $\times$					WATER CONTENT W					
							STANDARD PENETRATION TEST $\bullet$					W_p W W_L					
							BLOWS/0.3M					WATER CONTENT %					
20 40 60 80					10 20 30												
0.35	TOPSOIL: Dark brown silty sand, very low organic			1	SS	3											
	SAND: Loose brown fine to coarse sand, some silt, damp to saturated		323	2	SS	6											
1.40	SAND AND SILT TILL: Compact to very dense brown sand and silt, some gravel, trace clay, wet to damp		322	3	SS	18									Free water encountered at 1.5 m		
2.90	becoming grey, gravelly		321	4	SS	68									Upon completion of drilling, borehole remained open with no free water		
3.0			320														
4.5			319	6	SS	58											
			318														
6.0																	
6.90	BOREHOLE TERMINATED AT 6.90 m		317	7	SS	76											

NOTES

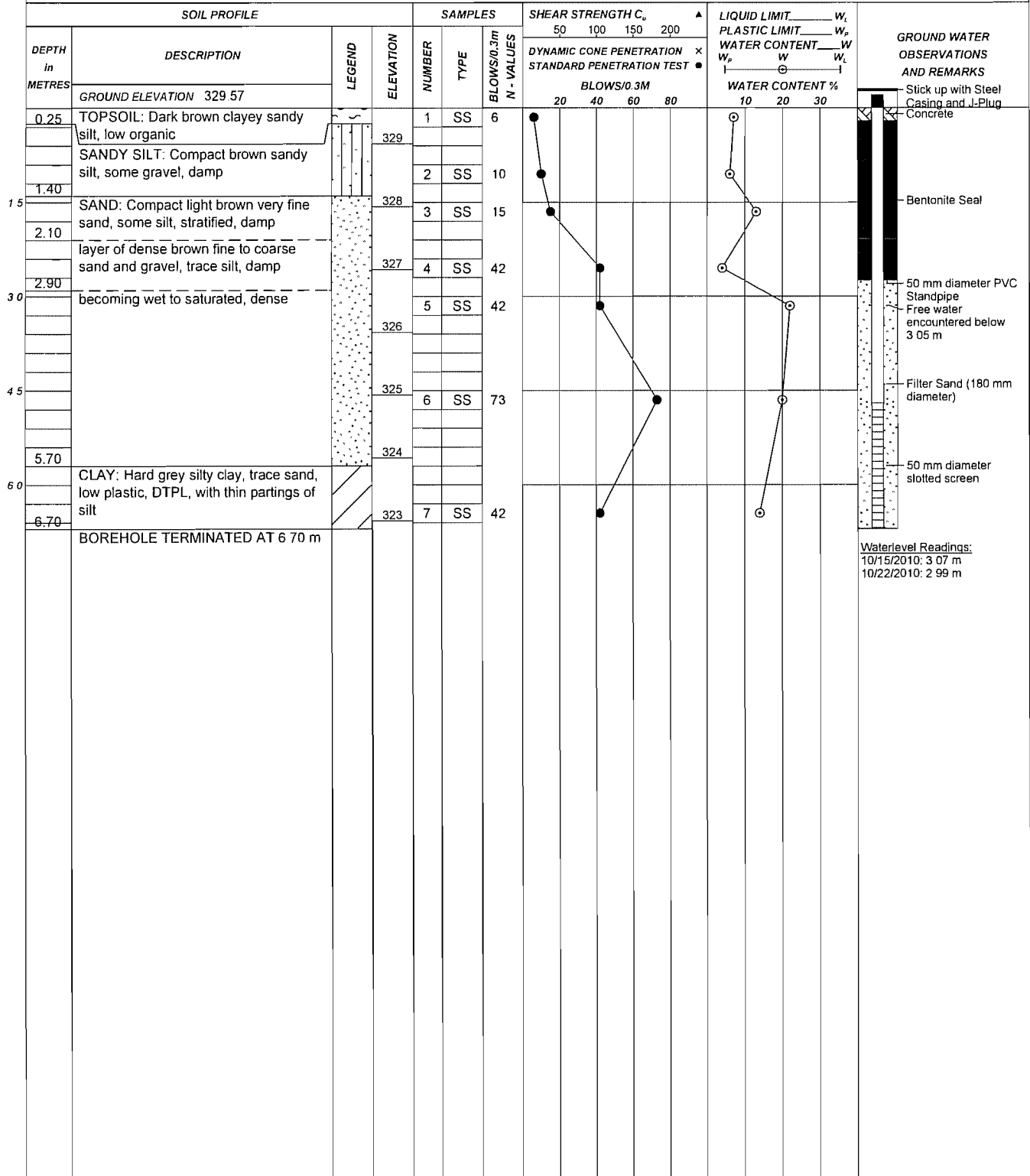
CHECKED BY

LOG OF BOREHOLE NO. 40

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Hollow Stem Augers

BORING DATE 2010 10 01

OUR PROJECT NO. 10KF058
ENGINEER M Molodecki
TECHNICIAN M Rapsey



NOTES * Sampler overfilled

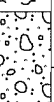
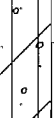
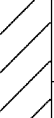
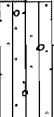
CHECKED BY *[Signature]*

LOG OF BOREHOLE NO. 41

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Solid Stem Augers

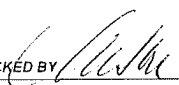
BORING DATE 2010 09 30

OUR PROJECT NO. 10KF058
ENGINEER M. Molodecki
TECHNICIAN M. Rapsey

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u		LIQUID LIMIT W_L			GROUND WATER OBSERVATIONS AND REMARKS			
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	50	100	150	200	PLASTIC LIMIT W_p				
							DYNAMIC CONE PENETRATION $\times$				WATER CONTENT W				
							STANDARD PENETRATION TEST $\bullet$				W_p		W	W_L	
											WATER CONTENT %				
							BLOWS/0.3M								
							20	40	60	80	10	20	30		
0.25	TOPSOIL: Dark brown sandy clayey silt, low organic			1	SS	12									Upon completion of drilling, borehole remained open and dry. Overnight, borehole wet caved at 1.4 m
	SAND AND GRAVEL: Compact brown sand and gravel, some silt, damp		325		2	SS	24								
1.40	LAYERED SILTS AND CLAYS: Layers of brown silt, wet, clayey silt, slightly to low plastic, APL and grey silty clay, low to medium plastic, DTPL		324	3	SS	15									
				4	SS	32									
2.90				323	5	SS	21								
3.0	CLAY: Very stiff to hard grey silty clay, trace sand, low to medium plastic, DTPL, with thin lenses and partings of silt		322												
				321	6	SS	37								
5.40	SAND AND SILT TILL: Very dense grey gravelly sand and silt, trace clay, damp		320												
				7	SS	85									
6.0															
7.00	BOREHOLE TERMINATED AT 7.00 m		319												

Upon completion of drilling, borehole remained open and dry. Overnight, borehole wet caved at 1.4 m

NOTES

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LOG OF BOREHOLE NO. 42

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 30

OUR PROJECT NO. 10KF058
ENGINEER M Molodecki
TECHNICIAN M Rapsey

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u				LIQUID LIMIT W_L				GROUND WATER OBSERVATIONS AND REMARKS
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	50	100	150	200	PLASTIC LIMIT W_p				
							DYNAMIC CONE PENETRATION $\times$				WATER CONTENT W				
							STANDARD PENETRATION TEST $\bullet$								
							BLOWS/0.3M				WATER CONTENT %				
							20	40	60	80	10	20	30		
0.18	TOPSOIL Dark brown sandy silt, some gravel, low organic		326	1	SS	5									Upon completion of drilling, borehole remained open with no free water
	SILTY SAND: Loose to compact brown silty fine sand, trace gravel, damp														
			325	2	SS	10									
1.5															
					3	SS	19								
2.10	becoming wet to saturated		324												
				4	SS	19									
3.0															
3.20	SILT AND SAND TILL: Very dense brown gravelly silt and sand, trace clay, damp		323	5	SS	69									
4.20	becoming grey		322												
4.5				6	SS	85									
6.0			320												
6.70	BOREHOLE TERMINATED AT 6.70 m			7	SS	50 blows/110 mm									

NOTES

CHECKED BY

LOG OF BOREHOLE NO. 43

PROJECT PROPOSED MIXED USE DEVELOPMENT

LOCATION Township of Woolwich (Breslau), Ontario

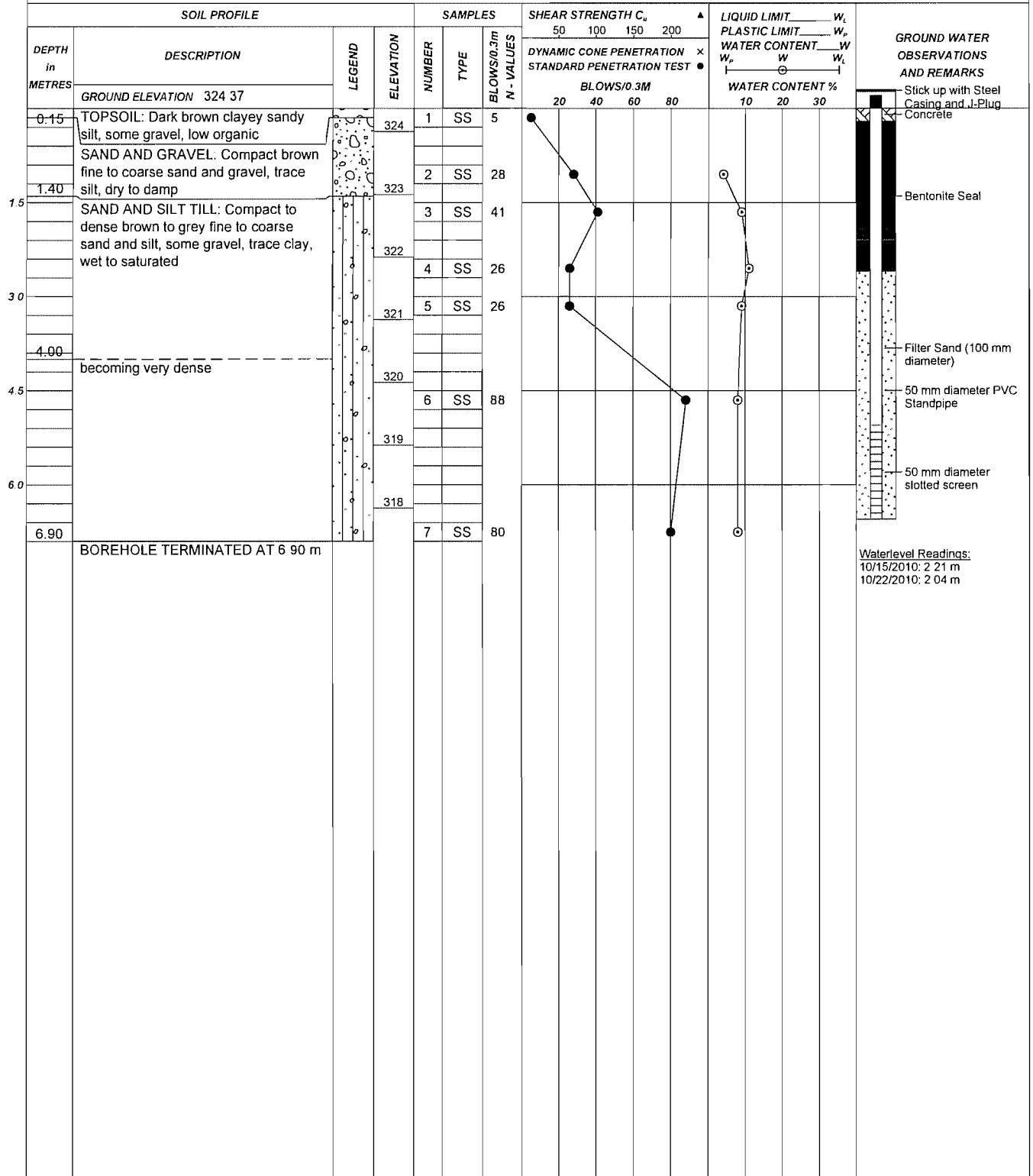
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 09 30

OUR PROJECT NO. 10KF058

ENGINEER M. Molodecki

TECHNICIAN M. Rapsey



Waterlevel Readings:
10/15/2010: 2.21 m
10/22/2010: 2.04 m

NOTES

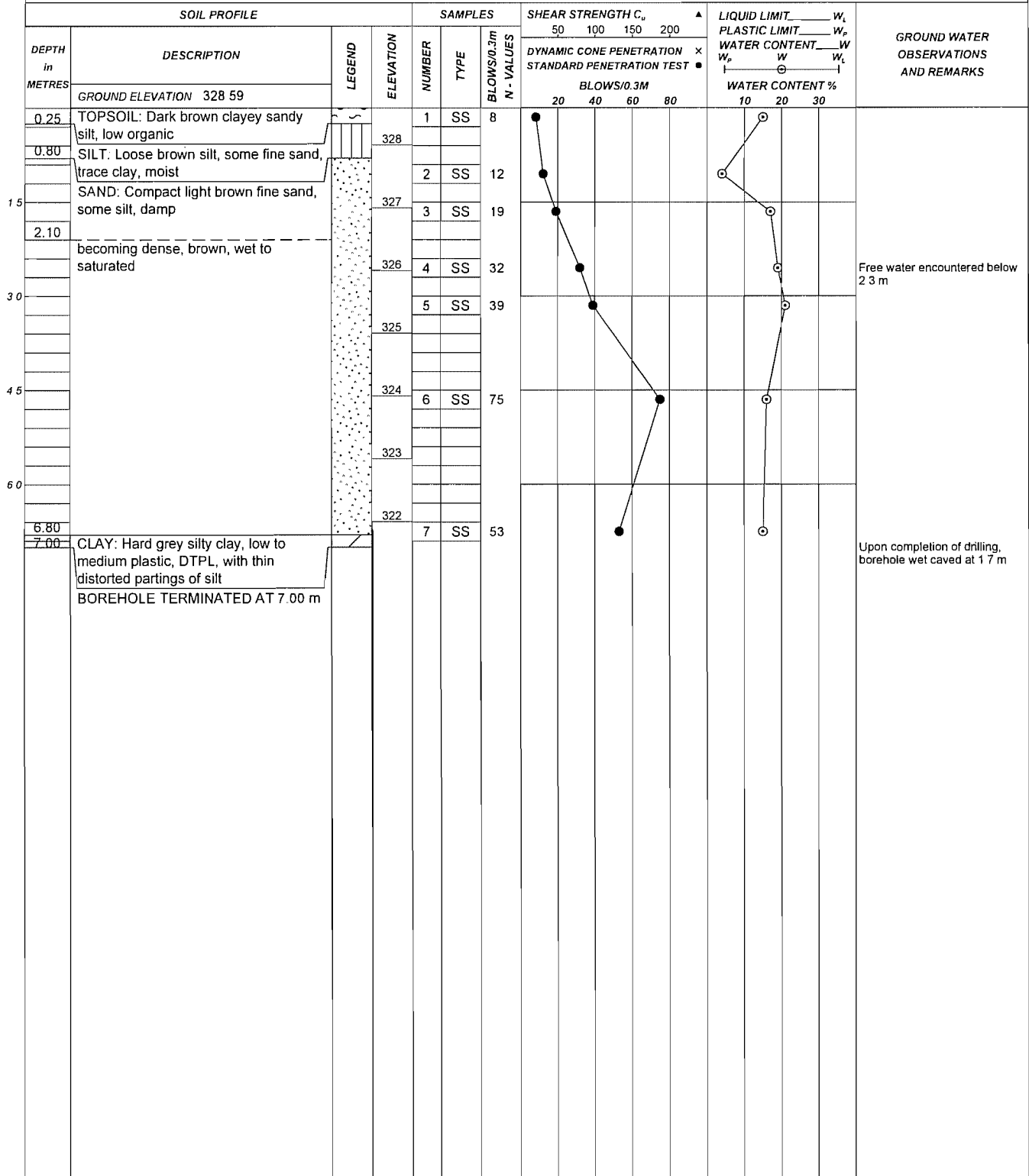
CHECKED BY

LOG OF BOREHOLE NO. 44

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE 2010 10 01

OUR PROJECT NO. 10KF058
ENGINEER M Molodecki
TECHNICIAN M Rapsey



NOTES * Sampler overfilled

CHECKED BY

LOG OF BOREHOLE NO. 45

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
BORING METHOD Continuous Flight Solid Stem Augers

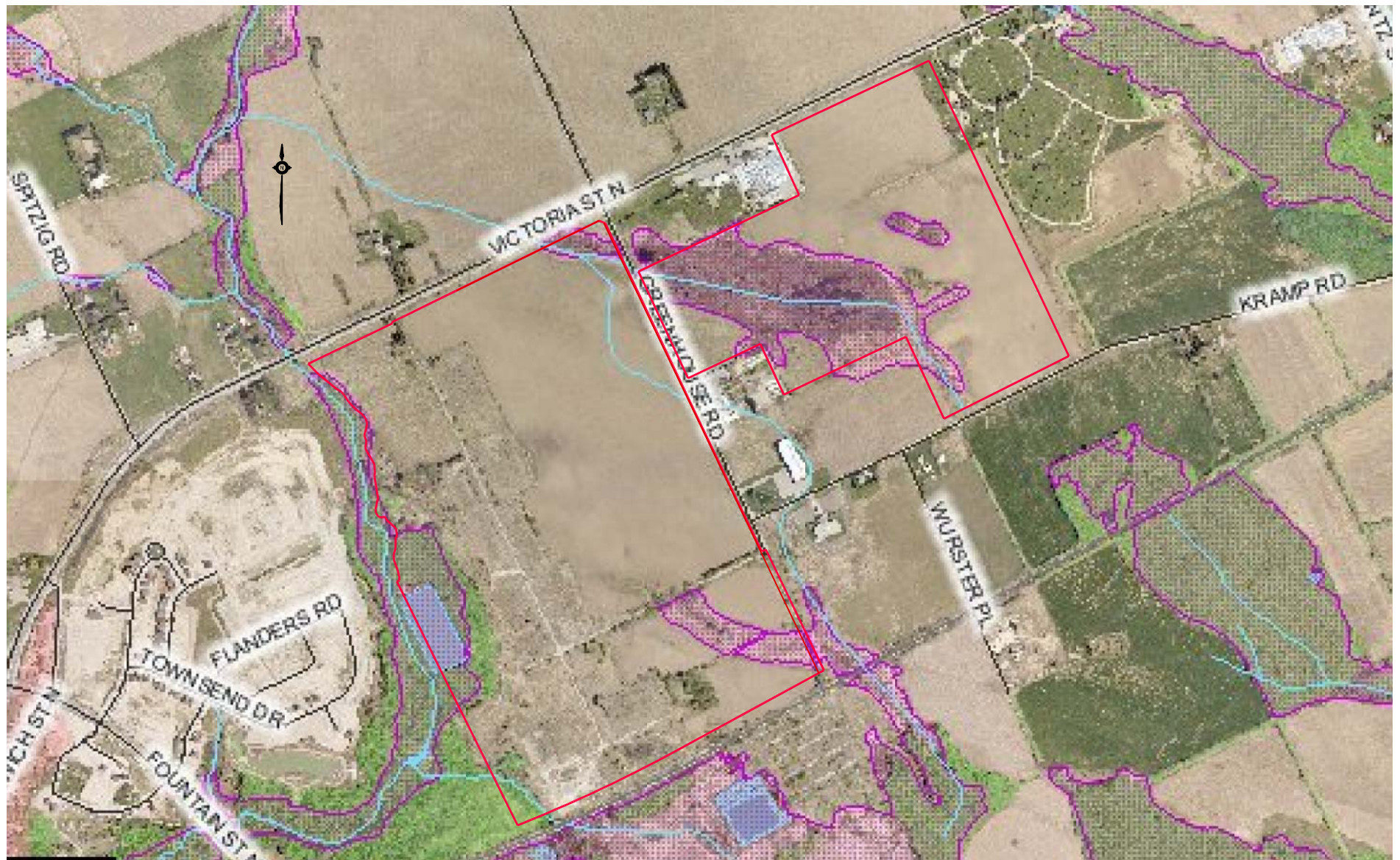
BORING DATE 2010 09 30

OUR PROJECT NO. 10KF058
ENGINEER M. Molodecki
TECHNICIAN M. Rapsey

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u				LIQUID LIMIT W_L			GROUND WATER OBSERVATIONS AND REMARKS				
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	50	100	150	200	PLASTIC LIMIT W_p	WATER CONTENT W	WATER CONTENT %					
							DYNAMIC CONE PENETRATION $\times$				STANDARD PENETRATION TEST $\bullet$				WATER CONTENT %			
							BLOWS/0.3M											
	GROUND ELEVATION 325.76						20	40	60	80	10	20	30					
0.25	TOPSOIL: Dark brown sandy clayey silt, low organic		325	1	SS	8								Upon completion of drilling, borehole remained open with no free water				
	SAND AND SILT. Compact brown sand and silt, some gravel, damp			2	SS	18												
1.40																		
1.5	SILT AND SAND TILL: Compact brown silt and sand, some gravel, trace clay, moist		324	3	SS	18												
2.10	becoming very dense, gravelly																	
2.90			323	4	SS	71												
3.0	becoming grey			5	SS	88												
			322															
4.5			321	6	SS	85												
			320															
6.0																		
6.70	BOREHOLE TERMINATED AT 6.70 m			7	SS	50 blows/150 mm												

NOTES

CHECKED BY 



LEGEND:

- GRCA WETLAND
- APPROXIMATE SITE LIMITS

THOMASFIELD HOMES LIMITED

PROPOSED MIXED USE DEVELOPMENT
SEAGRAMS AND BISGOULD LAND
TOWNSHIP OF WOOLWICH, ONTARIO

EXISTING CONDITIONS



DRAWN	K. BENDER	DATE	SCALE	PML REF.	DWG. NO.
CHECKED	M. MOLODECKI	NOVEMBER 2010	NTS	10KF058	2
APPROVED	M. MOLODECKI				



APPENDIX A

ENGINEERED FILL

The information presented in this appendix is intended for general guidance only. Site specific conditions and prevailing weather may require modification of compaction standards, backfill type or procedures. Each site must be discussed, and procedures agreed with Peto MacCallum Ltd. prior to the start of the earthworks and must be subject to ongoing review during construction. This appendix is not intended to apply to embankments. Steeply sloping ravine residential lots require special consideration.

For fill to be classified as engineered fill suitable for supporting structural loads, a number of conditions must be satisfied, including but not necessarily limited to the following:

1. Purpose

The site specific purpose of the engineered fill must be recognized. In advance of construction, all parties should discuss the project and its requirements and agree on an appropriate set of standards and procedures.

2. Minimum Extent

The engineered fill envelope must extend beyond the footprint of the structure to be supported. The minimum extent of the envelope should be defined from a geotechnical perspective by:

- at founding level, extend a minimum 1.0 m beyond the outer edge of the foundations, greater if adequate layout has not yet been completed as noted below; and
- extend downward and outward at a slope no greater than 45° to meet the subgrade

All fill within the envelope established above must meet the requirements of engineered fill in order to support the structure safely. Other considerations such as survey control, or construction methods may require an envelope that is larger, as noted in the following sections.

Once the minimum envelope has been established, structures must not be moved or extended without consultation with Peto MacCallum Ltd. Similarly, Peto MacCallum Ltd. should be consulted prior to any excavation within the minimum envelope.

3. Survey Control

Accurate survey control is essential to the success of an engineered fill project. The boundaries of the engineered fill must be laid out by a surveyor in consultation with engineering staff from Peto MacCallum Ltd. Careful consideration of the maximum building envelope is required.

During construction it is necessary to have a qualified surveyor provide total station control on the three dimensional extent of filling.

4. Subsurface Preparation

Prior to placement of fill, the subgrade must be prepared to the satisfaction of Peto MacCallum Ltd. All deleterious material must be removed and in some cases, excavation of native mineral soils may be required.

Particular attention must be paid to wet subgrades and possible additional measures required to achieve sufficient compaction. Where fill is placed against a slope, benching may be necessary and natural drainage paths must not be blocked.

5. Suitable Fill Materials

All material to be used as fill must be approved by Peto MacCallum Ltd. Such approval will be influenced by many factors and must be site and project specific. External fill sources must be sampled, tested and approved prior to material being hauled to site.

6. Test Section

In advance of the start of construction of the engineered fill pad, the Contractor should conduct a test section. The compaction criterion will be assessed in consultation with Peto MacCallum Ltd. for the various fill material types using different lift thicknesses and number of passes for the compaction equipment proposed by the Contractor.

Additional test sections may be required throughout the course of the project to reflect changes in fill sources, natural moisture content of the material and weather conditions.

The Contractor should be particularly aware of changes in the moisture content of fill material. Site review by Peto MacCallum Ltd. is required to ensure the desired lift thickness is maintained and that each lift is systematically compacted, tested and approved before a subsequent lift is commenced.

7. Inspection and Testing

Uniform, thorough compaction is crucial to the performance of the engineered fill and the supported structure. Hence, all subgrade preparation, filling and compacting must be carried out under the full time inspection by Peto MacCallum Ltd.

All founding surfaces for all buildings and residential dwellings or any part thereof (including but not limited to footings and floor slabs) on structural fill or native soils must be inspected and approved by PML engineering personnel prior to placement of the base/subbase granular material and/or concrete. The purpose of the inspection is to ensure the subgrade soils are capable of supporting the building/house foundation and floor slab loads and to confirm the building/house envelope does not extend beyond the limits of any structural fill pads.

8. Protection of Fill

Fill is generally more susceptible to the effects of weather than natural soil. Fill placed and approved to the level at which structural support is required must be protected from excessive wetting, drying, erosion or freezing. Where adequate protection has not been provided, it may be necessary to provide deeper footings or to strip and recompact some of the fill.

9. Construction Delay Time Considerations

The integrity of the fill pad can deteriorate due to the harsh effects of our Canadian weather. Hence, particular care must be taken if the fill pad is constructed over a long time period.

It is necessary therefore, that all fill sources are tested to ensure the material compactability prior to the soil arriving at site. When there has been a lengthy delay between construction periods of the fill pad, it is necessary to conduct subgrade proof rolling, test pits or boreholes to verify the adequacy of the exposed subgrade to accept new fill material.

When the fill pad will be constructed over a lengthy period of time, a field survey should be completed at the end of each construction season to verify the areal extent and the level at which the compacted fill has been brought up to, tested and approved.

In the following spring, subexcavation may be necessary if the fill pad has been softened attributable to ponded surface water or freeze/thaw cycles.

A new survey is required at the beginning of the next construction season to verify that random dumping and/or spreading of fill has not been carried out at the site.

10. Approved Fill Pad Surveillance

It should be appreciated that once the fill pad has been brought to final grade and documented by field survey, there must be ongoing surveillance to ensure that the integrity of the fill pad is not threatened.

Grading operations adjacent to fill pads can often take place several months or years after completion of the fill pad.

It is imperative that all site management and supervision staff, the staff of Contractors and earthwork operators be fully aware of the boundaries of all approved engineered fill pads.

Excavation into an approved engineered fill pad should never be contemplated without the full knowledge, approval and documentation by the geotechnical consultant.

If the fill pad is knowingly built several years in advance of ultimate construction, the areal limits of the fill pad should be substantially overbuilt laterally to allow for changes in possible structure location and elevation and other earthwork operations and competing interests on the site. The overbuilt distance required is project and/or site specified.

Iron bars should be placed at the corner/intermediate points of the fill pad as a permanent record of the approved limits of the work for record keeping purposes.

11. Unusual Working Conditions

Construction of fill pads may at times take place at night and/or during periods of freezing weather conditions because of the requirements of the project schedule. It should be appreciated therefore, that both situations present more difficult working conditions. The Owner, Contractor, Design Consultant and Geotechnical Engineer must be willing to work together to revise site construction procedures, enhance field testing and surveillance, and incorporate design modifications as necessary to suit site conditions.

When working at night there must be sufficient artificial light to properly illuminate the fill pad and borrow areas.

Placement of material to form an engineered fill pad during winter and freezing temperatures has its own special conditions that must be addressed. It is imperative that each day prior to placement of new fill, the exposed subgrade must be inspected and any overnight snow or frozen material removed. Particular attention should be given to the borrow source inspection to ensure only nonfrozen fill is brought to the site.

The Contractor must continually assess the work program and have the necessary spreading and compacting equipment to ensure that densification of the fill material takes place in a minimum amount of time. Changes may be required to the spreading methods, lift thickness, and compaction techniques to ensure the desired compaction is achieved uniformly throughout each fill lift.

The Contractor should adequately protect the subgrade at the end of each shift to minimize frost penetration overnight. Since water cannot be added to the fill material to facilitate compaction, it is imperative that densification of the fill be achieved by additional compaction effort and an appropriate reduced lift thickness. Once the fill pad has been completed, it must be properly protected from freezing temperatures and ponding of water during the spring thaw period.

If the pad is unusually thick or if the fill thickness varies dramatically across the width or length of the fill pad, Peto MacCallum Ltd. should be consulted for additional recommendations. In this case, alternative special provisions may be recommended, such as providing a surcharge preload for a limited time or increase the degree of compaction of the fill.



APPENDIX B

AGAT LABORATORIES LIMITED
CERTIFICATES OF ANALYSIS
(ENVIRONMENTAL SCREENING, O.REG. 153/04)



Certificate of Analysis

Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

AGAT WORK ORDER: 10T441190

PROJECT NO: 10KF058

ATTENTION TO: Ken Hanes

CLIENT NAME: PETO MACCALLUM LIMITED

O. Reg. 153 Metals & Inorganics in Soil - Table 1									
DATE SAMPLED: Sep 21, 2010	DATE RECEIVED: Oct 05, 2010	DATE REPORTED: Oct 22, 2010	SAMPLE TYPE: Soil						
Parameter	Unit	G / S	RDL	BH7 SS2 2040735	BH11 SS1 2040736	BH27 AS1 2040737	BH2 SS3 2040741		
Antimony	µg/g	1.0	0.8	<0.8	<0.8	<0.8	<0.8		
Arsenic	µg/g	17	1	4	2	4	2		
Barium	µg/g	210	2	65	11	31	33		
Beryllium	µg/g	1.2	0.5	0.5	<0.5	<0.5	<0.5		
Boron	µg/g		5	6	<5	6	5		
Boron (Hot Water Extractable)	µg/g		0.10	0.18	<0.10	0.74	<0.10		
Cadmium	µg/g	1.0	0.5	<0.5	<0.5	<0.5	<0.5		
Chromium	µg/g	71	2	17	6	11	11		
Cobalt	µg/g	21	0.5	6.3	1.8	3.3	4.0		
Copper	µg/g	85	1	15	7	13	13		
Lead	µg/g	120	1	18	11	20	6		
Molybdenum	µg/g	2.5	0.5	<0.5	<0.5	<0.5	<0.5		
Nickel	µg/g	43	1	12	4	6	7		
Selenium	µg/g	1.9	0.4	<0.4	0.4	0.6	<0.4		
Silver	µg/g	0.42	0.2	<0.2	<0.2	<0.2	<0.2		
Thallium	µg/g	2.5	0.4	<0.4	<0.4	<0.4	<0.4		
Uranium	µg/g		0.5	0.6	<0.5	<0.5	<0.5		
Vanadium	µg/g	91	1	30	9	17	18		
Zinc	µg/g	160	5	91	56	84	44		
Chromium, Hexavalent	µg/g	2.5	0.2	<0.2	<0.2	<0.2	<0.2		
Cyanide, Free	µg/g	0.12	0.05	<0.05	<0.05	<0.05	<0.05		
Mercury	µg/g	0.23	0.01	0.04	<0.01	0.03	<0.01		
Electrical Conductivity (2:1)	mS/cm	0.57	0.002	0.205	0.193	1.57	0.120		
Sodium Adsorption Ratio (2:1)	N/A	2.4	N/A	0.196	0.234	13.9	0.138		
pH, 2:1 CaCl2 Extraction	pH Units			7.44	8.24	7.59	7.78		
Chloride (2:1)	µg/g	330	2	5	48	802	9		
Nitrate + Nitrite	µg/g	61	1	<1	<1	<1	<1		

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard; Refers to Ti(All)

2040735-2040741 EC, SAR, Chloride & Nitrate/Nitrite were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil).
pH was determined on the extract obtained from the 2:1 leaching procedure (2 parts 0.01M CaCl2:1 part soil).

Certified By:

Stony Brook



Laboratories

Guideline Violation

AGAT WORK ORDER: 10T441190

PROJECT NO: 10KF058

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CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
2040737	BH27 AS1	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Chloride (2:1)	330	802
2040737	BH27 AS1	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Electrical Conductivity (2:1)	0.57	1.57
2040737	BH27 AS1	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Sodium Adsorption Ratio (2:1)	2.4	13.9



Laboratories

Certificate of Analysis

AGAT WORK ORDER: 10T441190

PROJECT NO: 10KF058

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CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

O. Reg. 153 Metals & Inorganics in Soil - Table 1						
DATE SAMPLED: Sep 21, 2010	DATE RECEIVED: Oct 05, 2010	DATE REPORTED: Oct 22, 2010	SAMPLE TYPE: Soil			
Parameter	Unit	G / S	RDL	BH7 SS2 2040735	BH11 SS1 2040736	BH27 AS1 2040737 BH2 SS3 2040741
Antimony	µg/g	40	0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	40	1	4	2	2
Barium	µg/g	1500	2	65	11	31
Beryllium	µg/g	1.2	0.5	0.5	<0.5	<0.5
Boron	µg/g		5	6	6	5
Boron (Hot Water Extractable)	µg/g	2.0	0.10	0.18	<0.10	<0.10
Cadmium	µg/g	12	0.5	<0.5	<0.5	<0.5
Chromium	µg/g	750	2	17	6	11
Cobalt	µg/g	80	0.5	6.3	1.8	3.3
Copper	µg/g	225	1	15	7	13
Lead	µg/g	1000	1	18	11	20
Molybdenum	µg/g	40	0.5	<0.5	<0.5	<0.5
Nickel	µg/g	150	1	12	4	6
Selenium	µg/g	10	0.4	<0.4	0.4	0.6
Silver	µg/g	40	0.2	<0.2	<0.2	<0.2
Thallium	µg/g	32	0.4	<0.4	<0.4	<0.4
Uranium	µg/g		0.5	0.6	<0.5	<0.5
Vanadium	µg/g	200	1	30	9	17
Zinc	µg/g	600	5	91	56	84
Chromium, Hexavalent	µg/g	8	0.2	<0.2	<0.2	<0.2
Cyanide, Free	µg/g	100	0.05	<0.05	<0.05	<0.05
Mercury	µg/g	10	0.01	0.04	<0.01	0.03
Electrical Conductivity (2:1)	mS/cm	1.4	0.002	0.205	0.193	1.57
Sodium Adsorption Ratio (2:1)	N/A	12	N/A	0.196	0.234	13.9
pH, 2:1 CaCl2 Extraction	pH Units			7.44	8.24	7.59
Chloride (2:1)	µg/g		2	5	48	802
Nitrate + Nitrite	µg/g		1	<1	<1	<1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard; Refers to T2(ICC)

2040735-2040741 EC, SAR, Chloride & Nitrate/Nitrite were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil).
pH was determined on the extract obtained from the 2:1 leaching procedure (2 parts 0.01M CaCl2:1 part soil).

Certified By:

Stony Brook

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Guideline Violation

AGAT WORK ORDER: 10T441190
PROJECT NO: 10KF058

ATTENTION TO: Ken Hanes

AGAT Laboratories

CLIENT NAME: PETO MACCALLUM LIMITED

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
2040737	BH27 AS1	T2(ICC)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Electrical Conductivity (2:1)	1.4	1.57
2040737	BH27 AS1	T2(ICC)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Sodium Adsorption Ratio (2:1)	12	13.9



APPENDIX C

AGAT LABORATORIES LIMITED
CERTIFICATES OF ANALYSIS
(ENVIRONMENTAL SCREENING, O.REG. 511/09)



Laboratories

Certificate of Analysis

AGAT WORK ORDER: 10T441190

PROJECT NO: 10KF058

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CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

O. Reg. 153 Metals & Inorganics in Soil - Table 1

DATE SAMPLED: Sep 21, 2010		DATE RECEIVED: Oct 05, 2010				DATE REPORTED: Oct 22, 2010		SAMPLE TYPE: Soil
Parameter	Unit	G / S	RDL	BH7 SS2 2040735	BH11 SS1 2040736	BH27 AS1 2040737	BH2 SS3 2040741	
Antimony	µg/g	40	0.8	<0.8	<0.8	<0.8	<0.8	
Arsenic	µg/g	18	1	4	2	4	2	
Barium	µg/g	670	2	65	11	31	33	
Beryllium	µg/g	8	0.5	0.5	<0.5	<0.5	<0.5	
Boron	µg/g	120	5	6	<5	6	5	
Boron (Hot Water Extractable)	µg/g	2	0.10	0.18	<0.10	0.74	<0.10	
Cadmium	µg/g	1.9	0.5	<0.5	<0.5	<0.5	<0.5	
Chromium	µg/g	160	2	17	6	11	11	
Cobalt	µg/g	80	0.5	6.3	1.8	3.3	4.0	
Copper	µg/g	230	1	15	7	13	13	
Lead	µg/g	120	1	18	11	20	6	
Molybdenum	µg/g	40	0.5	<0.5	<0.5	<0.5	<0.5	
Nickel	µg/g	270	1	12	4	6	7	
Selenium	µg/g	5.5	0.4	<0.4	0.4	0.6	<0.4	
Silver	µg/g	40	0.2	<0.2	<0.2	<0.2	<0.2	
Thallium	µg/g	3.3	0.4	<0.4	<0.4	<0.4	<0.4	
Uranium	µg/g	33	0.5	0.6	<0.5	<0.5	<0.5	
Vanadium	µg/g	86	1	30	9	17	18	
Zinc	µg/g	340	5	91	56	84	44	
Chromium, Hexavalent	µg/g	8	0.2	<0.2	<0.2	<0.2	<0.2	
Cyanide, Free	µg/g	0.051	0.05	<0.05	<0.05	<0.05	<0.05	
Mercury	µg/g	3.9	0.01	0.04	<0.01	0.03	<0.01	
Electrical Conductivity (2:1)	mS/cm	1.4	0.002	0.205	0.193	1.57	0.120	
Sodium Adsorption Ratio (2:1)	N/A	12	N/A	0.196	0.234	13.9	0.138	
pH, 2:1 CaCl2 Extraction	pH Units			7.44	8.24	7.59	7.78	
Chloride (2:1)	µg/g		2	5	48	802	9	
Nitrate + Nitrite	µg/g		1	<1	<1	<1	<1	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard; Refers to T2 (ICC) - New

2040735-2040741 EC, SAR, Chloride & Nitrate/Nitrite were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil).
pH was determined on the extract obtained from the 2:1 leaching procedure (2 parts 0.01M CaCl2:1 part soil).

Certified By:

Stony Brook



Laboratories

Guideline Violation

AGAT WORK ORDER: 10T441190

PROJECT NO: 10KF058

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CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
2040737	BH27 AS1	T2 (ICC) - New	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Electrical Conductivity (2:1)	1.4	1.57
2040737	BH27 AS1	T2 (ICC) - New	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Sodium Adsorption Ratio (2:1)	12	13.9



Laboratories

Certificate of Analysis

AGAT WORK ORDER: 10T441190

PROJECT NO: 10KF058

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CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

O. Reg. 153 Metals & Inorganics in Soil - Table 1

DATE SAMPLED: Sep 21, 2010		DATE RECEIVED: Oct 05, 2010				DATE REPORTED: Oct 22, 2010		SAMPLE TYPE: Soil
Parameter	Unit	G / S	RDL	BH7 SS2 2040735	BH11 SS1 2040736	BH27 AS1 2040737	BH2 SS3 2040741	
Antimony	µg/g	1.3	0.8	<0.8	<0.8	<0.8	<0.8	
Arsenic	µg/g	18	1	4	2	4	2	
Barium	µg/g	220	2	65	11	31	33	
Beryllium	µg/g	2.5	0.5	0.5	<0.5	<0.5	<0.5	
Boron	µg/g	36	5	6	<5	6	5	
Boron (Hot Water Extractable)	µg/g		0.10	0.18	<0.10	0.74	<0.10	
Cadmium	µg/g	1.2	0.5	<0.5	<0.5	<0.5	<0.5	
Chromium	µg/g	70	2	17	6	11	11	
Cobalt	µg/g	21	0.5	6.3	1.8	3.3	4.0	
Copper	µg/g	92	1	15	7	13	13	
Lead	µg/g	120	1	18	11	20	6	
Molybdenum	µg/g	2	0.5	<0.5	<0.5	<0.5	<0.5	
Nickel	µg/g	82	1	12	4	6	7	
Selenium	µg/g	1.5	0.4	<0.4	0.4	0.6	<0.4	
Silver	µg/g	0.5	0.2	<0.2	<0.2	<0.2	<0.2	
Thallium	µg/g	1	0.4	<0.4	<0.4	<0.4	<0.4	
Uranium	µg/g	2.5	0.5	0.6	<0.5	<0.5	<0.5	
Vanadium	µg/g	86	1	30	9	17	18	
Zinc	µg/g	290	5	91	56	84	44	
Chromium, Hexavalent	µg/g	0.66	0.2	<0.2	<0.2	<0.2	<0.2	
Cyanide, Free	µg/g	0.051	0.05	<0.05	<0.05	<0.05	<0.05	
Mercury	µg/g	0.27	0.01	0.04	<0.01	0.03	<0.01	
Electrical Conductivity (2:1)	mS/cm	0.57	0.002	0.205	0.193	1.57	0.120	
Sodium Adsorption Ratio (2:1)	N/A	2.4	N/A	0.196	0.234	13.9	0.138	
pH, 2:1 CaCl2 Extraction	pH Units			7.44	8.24	7.59	7.78	
Chloride (2:1)	µg/g		2	5	48	802	9	
Nitrate + Nitrite	µg/g		1	<1	<1	<1	<1	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard; Refers to T1 (ALL) - New

2040735-2040741 EC, SAR, Chloride & Nitrate/Nitrite were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil).

pH was determined on the extract obtained from the 2:1 leaching procedure (2 parts 0.01M CaCl2:1 part soil).

Certified By:

Stony Brook



Laboratories

Guideline Violation

AGAT WORK ORDER: 10T441190

PROJECT NO: 10KF058

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CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
2040737	BH27 AS1	T1 (ALL) - New	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Electrical Conductivity (2:1)	0.57	1.57
2040737	BH27 AS1	T1 (ALL) - New	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Sodium Adsorption Ratio (2:1)	2.4	13.9



APPENDIX D

AGAT LABORATORIES LIMITED CERTIFICATES OF ANALYSIS (RESISTIVITY PACKAGE)



Laboratories

Certificate of Analysis

AGAT WORK ORDER: 10T441190

PROJECT NO: 10KF058

5835 COOPERS AVENUE
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CLIENT NAME: PETO MACCALLUM LIMITED

ATTENTION TO: Ken Hanes

Corrosivity Package						
DATE SAMPLED: Sep 27, 2010	DATE RECEIVED: Oct 05, 2010	DATE REPORTED: Oct 22, 2010	SAMPLE TYPE: Soil			
Parameter	Unit	G / S	RDL	CS1 2040739	CS2 2040740	
Sulphide*	%		0.01	0.05	0.01	
Chloride (2:1)	µg/g	330	2.0	14.6	27.1	
Sulphate (2:1)	µg/g		2.0	69.8	16.1	
pH (2:1)	N/A		N/A	8.41	8.53	
Electrical Conductivity (2:1)	mS/cm	0.57	0.002	0.209	0.170	
Resistivity (2:1)	ohm.cm		1	4780	5880	
Redox Potential (2:1)	mV		5	219	216	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard; Refers to T1(All)
2040739-2040740 * Analysis was performed at AGAT's Mining Division.

EC, pH, Chloride and Sulphate were determined on the extract obtained from the 2:1 extraction procedure (2 parts DI water: 1 part soil).

Certified By:

Stony Brook



APPENDIX E

SUPPLEMENTARY GEOTECHNICAL INVESTIGATION (REPORT 3)

December 17, 2010

PML Ref.: 10KF058
Report 3

Mr. Tom Krizsan, President
Thomasfield Homes Limited
295 Southgate Drive
P.O. Box 1112
Guelph, Ontario
N1H 6N3

Dear Mr. Krizsan

**Supplementary Geotechnical Investigation
Proposed Mixed Use Development
Township of Woolwich (Breslau), Ontario**

Peto MacCallum Ltd. (PML) is pleased to report the findings of our recent supplementary geotechnical test pit investigation for the Mixed Use Development project.

The project involves a planned residential / commercial subdivision development located on two parcels of land, east of Hopewell Creek and south of Highway 7 in the Township of Woolwich, Ontario.

PML has completed geotechnical and hydrogeological investigations for the development, for which the following reports have been submitted:

- Draft Report 1, "Geotechnical Investigation, Mixed Use Development", dated November 18, 2010;
- "Hydrogeological Investigation for Seagrams and Biscould Lands", dated November 22, 2010.

The purpose of the current supplementary investigation assignment was to check for the potential presence of springs in the planned area of the sewage pumping station, as reported by a biological consultant conducting a plant inventory of the site. The inferred seepage locations / areas were identified on a marked aerial photograph included with an email from Aecom, received on November 29, 2010. These locations were all within a sloped land area, sloping down to the Hopewell Creek flood plain along the west edge of the site. It is noted that the slope is reposed at a relatively shallow inclination of about 12 to 14 horizontal to 1 vertical (13 to 14H:1V).

The field work was conducted on December 3, 2010, and consisted of four backhoe excavated test pits excavated to depths of 1.1 to 1.8 m. Overt indications of flowing springs were not evident at the time of the field work, and the test pit locations were established within observed patches of Canary Grass vegetation, which is understood to be a wetland grass species. The approximate test pit locations are shown on the appended drawing. The test pit locations are to be accurately surveyed at a later date, and the locations shown on the drawing are intended to identify the test pit locations on a relative basis only.

The test pits did not confirm the presence of springs at the explored locations. The soil stratigraphy generally comprised 200 to 300 mm of topsoil underlain by interlayered clayey silt, silty clay, silt, and silty sand to observed depths of between 0.8 and 1.5 m, followed by silt / sandy silt till. Slow seepage of perched groundwater from the sand layers was noted at two of the test pit locations (Test Pit 1 and 2). In Test Pit 3 about 50 m of ground water accumulation was noted in the bottom of the test pit at a depth of 1.5 m after about one hour.



As there was no perched water seepage evident in Test Pit 3, it is believed that water level at the base of the excavation could be indicative of the seasonal ground water level. In this regard, a water level reading taken in the monitoring well at Borehole 2, nearby, indicated ground water at 0.69 m below grade at a somewhat more down gradient location. The water level on October 22, 2010 was at 1.20 m depth, indicating the water table had risen after a recent period of moderate rainfall.

Accordingly, it is concluded that the wet areas containing Canary Grass vegetation are not springs, and are likely due to poor local drainage and weather dependent perching of near-surface ground water caused by the relatively impermeable cohesive soil layers the underlay the topsoil and surface runoff down the face of the slope. Similar patches of Canary Grass were observed on the flat table land areas of the site to the east. It is nevertheless probable that the long-term ground water table ground water could periodically produce seepage near the toe of the slope, beyond the planned development areas.

It is recommended that ground water conditions in the area of the creek valley slope are reviewed once design details are better established, to check that there are no long term adverse impacts associated with any ground water management measures that might be necessary.

We trust the above information is sufficient for your immediate purposes. Please contact our office if you have any questions.

Sincerely

Peto MacCallum Ltd.



Marian S. Molodecki, P.Eng.
Senior Consultant,
Geotechnical and Geoenvironmental Services

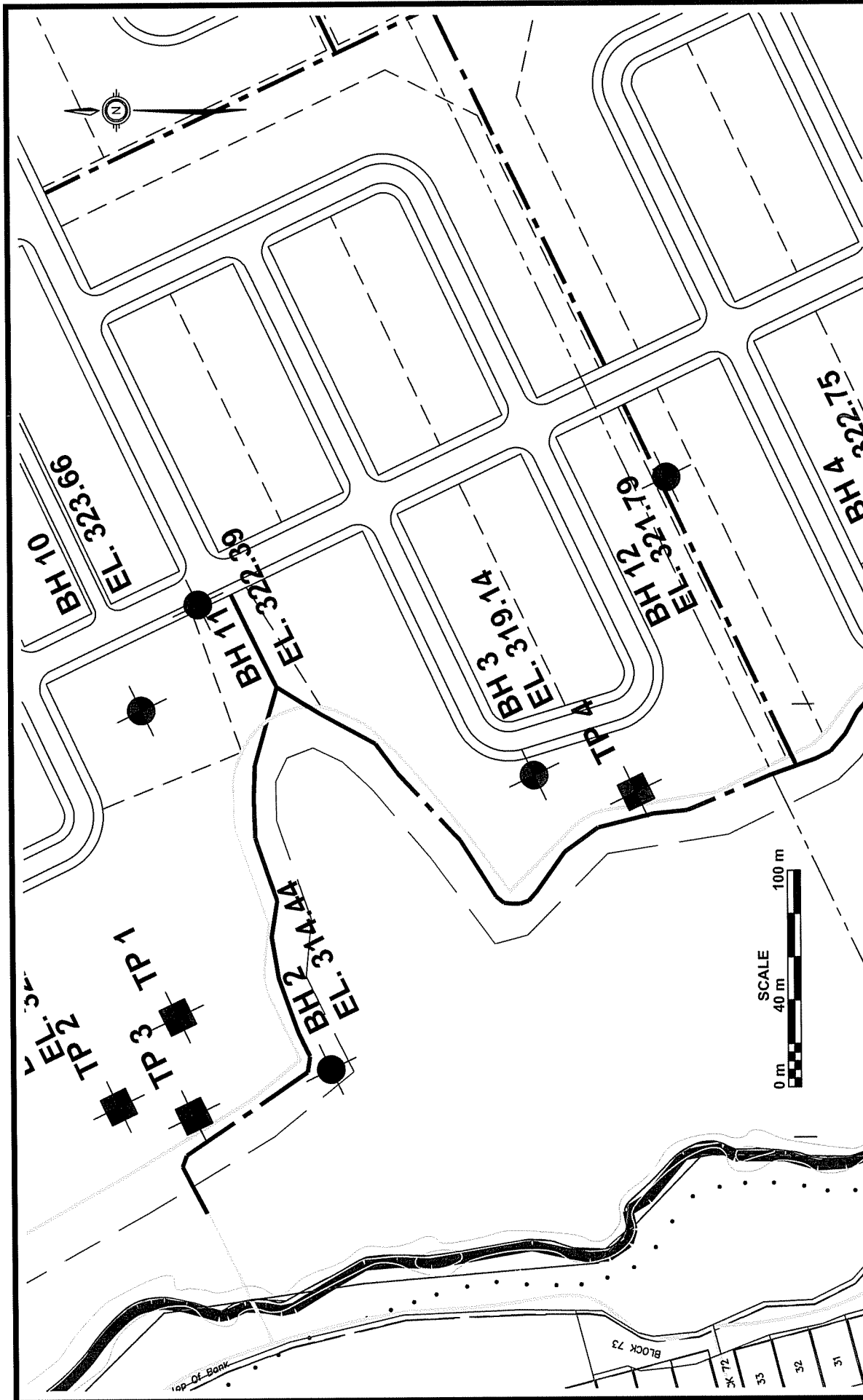
MSM.sh

Enclosure(s):

List of Abbreviations
Log of Test Pits 1 to 4
Drawing 1 - Test Pit Location Plan

Distribution:

3 cc AECOM
1 cc Thomasfield Homes Limited
1 cc PML Kitchener
1 cc PML Toronto



Peto MacCallum Ltd.
 CONSULTING ENGINEERS

DRAWN	CHECKED	APPROVED	K. BENDER	M. MOLODECKI	M. MOLODECKI	DATE	SCALE	PML REF.	DWG. NO.
						DECEMBER 2010	AS SHOWN	10KF058	1

THOMASFIELD HOMES LIMITED
PROPOSED MIXED USE DEVELOPMENT SEAGRAMS AND BISGOULD LAND TOWNSHIP OF WOOLWICH, ONTARIO
TEST PIT LOCATION PLAN

LEGEND:

- BOREHOLE
- BOREHOLE WITH MONITORING WELL
- TEST PIT

LIST OF ABBREVIATIONS



PENETRATION RESISTANCE

Standard Penetration Resistance N - The number of blows required to advance a standard split spoon sampler 0.3 m into the subsoil - Driven by means of a 63.5 kg hammer falling freely a distance of 0.76 m

Dynamic Penetration Resistance. The number of blows required to advance a 51 mm, 60 degree cone, fitted to the end of drill rods, 0.3 m into the subsoil. The driving energy being 475 J per blow

DESCRIPTION OF SOIL

The consistency of cohesive soils and the relative density or denseness of cohesionless soils are described in the following terms:

CONSISTENCY	N (blows/0.3 m)	c (kPa)	DENSENESS	N (blows/0.3 m)
Very Soft	0 - 2	0 - 12	Very Loose	0 - 4
Soft	2 - 4	12 - 25	Loose	4 - 10
Firm	4 - 8	25 - 50	Compact	10 - 30
Stiff	8 - 15	50 - 100	Dense	30 - 50
Very Stiff	15 - 30	100 - 200	Very Dense	> 50
Hard	> 30	> 200		
WTPL	Wetter Than Plastic Limit			
APL	About Plastic Limit			
DTPL	Drier Than Plastic Limit			

TYPE OF SAMPLE

SS	Split Spoon	TW	Thinwall Open
WS	Washed Sample	TP	Thinwall Piston
SB	Scraper Bucket Sample	OS	Oesterberg Sample
AS	Auger Sample	FS	Foil Sample
CS	Chunk Sample	RC	Rock Core
ST	Slotted Tube Sample	USS	Undisturbed Shear Strength
PH	Sample Advanced Hydraulically	RSS	Remoulded Shear Strength
PM	Sample Advanced Manually		

SOIL TESTS

Qu	Unconfined Compression	LV	Laboratory Vane
Q	Undrained Triaxial	FV	Field Vane
Qcu	Consolidated Undrained Triaxial	C	Consolidation
Qd	Drained Triaxial		

LOG OF TEST PIT NO. 1

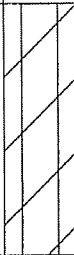
PROJECT PROPOSED MIXED USE DEVELOPMENT

PML REF. 10KF058

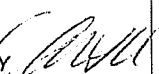
LOCATION Township of Woolwich (Breslau), Ontario

ENGINEER M. Molodecki

DATE 2010 12 03

DEPTH in METRES	DESCRIPTION	LEGEND	SAMPLE NUMBER	SHEAR STRENGTH kPa				WATER CONTENT %			GROUND WATER OBSERVATIONS AND REMARKS
	GROUND ELEVATION			50	100	150	200	10	20	30	
0.30	TOPSOIL: Dark brown sandy silt, low organic, wet										Upon completion of excavating, minor seepage from isolated 100 mm sand seams at 0.4 and 0.6 m. 40 minutes after completion, slow seepage and sloughing from silt till stratum. 100 mm of water accumulation at bottom of test pit.
1.50	SILTY CLAY: Dark brown silty clay, trace sand, some gravel, occasional silty sand seams, APL										
1.80	SILT TILL: Light brown sandy silt, trace gravel, saturated										
	TEST PIT TERMINATED AT 1.80 m										

NOTES

CHECKED BY 

LOG OF TEST PIT NO. 2

PROJECT PROPOSED MIXED USE DEVELOPMENT

PML REF. 10KF058

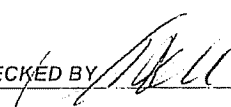
LOCATION Township of Woolwich (Breslau), Ontario

ENGINEER M. Molodecki

DATE 2010 12 03

DEPTH in METRES	DESCRIPTION	LEGEND	SAMPLE NUMBER	SHEAR STRENGTH kPa				WATER CONTENT %			GROUND WATER OBSERVATIONS AND REMARKS
	GROUND ELEVATION			50	100	150	200	10	20	30	
0.20	TOPSOIL: Dark brown sandy silt, low organic, wet										Upon completion of excavating, slow seepage from sand layer. 1 hour after completion, 100 mm of water accumulation at bottom of test pit. Minor seepage and sloughing from sand layers.
0.50	SILT: Brown silt, trace clay, trace sand, trace gravel, moist to wet										
0.80	SAND: Dark brown silty sand, gravelly, saturated (waterbearing)										
	SILT: Mottled brown/light brown silt, trace fine sand, trace clay, moist to wet										
1.20											
	TEST PIT TERMINATED AT 1.20 m										

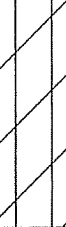
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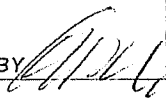
LOG OF TEST PIT NO. 3

PROJECT PROPOSED MIXED USE DEVELOPMENT
LOCATION Township of Woolwich (Breslau), Ontario
DATE 2010 12 03

PML REF. 10KF058
ENGINEER M Molodecki

DEPTH in METRES	DESCRIPTION	LEGEND	SAMPLE NUMBER	SHEAR STRENGTH kPa				WATER CONTENT %			GROUND WATER OBSERVATIONS AND REMARKS
	GROUND ELEVATION			50	100	150	200	10	20	30	
0.30	TOPSOIL: Dark brown sandy silt, low organic, wet										Upon completion of excavating, no seepage, vertical sides stable. 45 minutes after completion, 50 mm of water at bottom of test pit, but no seepage from side.
1.40	SILTY CLAY: Mottled brown/dark brown silty clay, trace sand, trace gravel, APL										
1.50	SILT TILL: Mottled grey/brown silt, trace fine sand, trace clay, wet to saturated TEST PIT TERMINATED AT 1.50 m										

NOTES

CHECKED BY 

LOG OF TEST PIT NO. 4

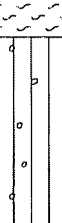
PROJECT PROPOSED MIXED USE DEVELOPMENT

PML REF. 10KF058

LOCATION Township of Woolwich (Breslau), Ontario

ENGINEER M Molodecki

DATE 2010 12 03

DEPTH in METRES	DESCRIPTION	LEGEND	SAMPLE NUMBER	SHEAR STRENGTH kPa				WATER CONTENT %			GROUND WATER OBSERVATIONS AND REMARKS
	GROUND ELEVATION			50	100	150	200	10	20	30	
0.20	TOPSOIL Dark brown sandy silt, low organic, wet										
1.10	SILT TILL: Brown sandy silt to silt, trace sand, some gravel, occasional clay seams, moist to wet										
	TEST PIT TERMINATED AT 1 10 m										Upon completion of excavating, no seepage, sides stable.

NOTES

CHECKED BY 