White Church Boundary Expansion Area

Sub-Watershed Study

January 2025

Submitted by:

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SCS Project Number: 2600
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Submission History

Submission	Date	In Support Of	Distributed To
1st	January 2025	OPA for Urban Boundary Expansion	City of Hamilton

1.0 Introduction

SCS Consulting Group Ltd. and Beacon Environmental (Beacon) have been retained by Whitechurch Landowners Group Inc. to prepare a Subwatershed Study (SWS) in support of the White Church Road lands, located in the City of Hamilton.

Beacon was retained by the Whitechurch Landowners Group to complete an Environmental Impact Study to characterize the natural heritage and hydrological features on the study area and to assess the impacts of bringing these lands within the urban boundary for the City of Hamilton.

1.1 Purpose

The Subwatershed Study has been prepared in support of the Official Plan Amendment application for the Subject Lands. The SWS has been prepared in accordance with the City of Hamilton Draft Framework for Urban Boundary Expansion Applications, Niagara Peninsula Conservation Authority (NPCA), and the Ministry of Environment, Conservation and Parks (MECP) guidelines.

The Subwatershed Study has been prepared following a phased approach as described in the City of Hamilton Draft Framework for Processing and Evaluating Urban Boundary Expansion Applications under the Proposed Provincial Planning Statement (2024). Phase 1 has been completed in support of an Urban Boundary Expansion application and Phase 2 will be completed in the future through the Secondary Planning process. A summary of requirements for each component of the Subwatershed Study during Phases 1 and 2 is provided in **Table 1**:

Table 1: Subwatershed Study Phase 1 & 2 Summary Table

Subwatershed Study Component	Phase 1 – Identification of Existing Conditions and Initial Assessment	Phase 2 – Completion of Impact Assessment and Development of Land Use Scenario
Stormwater Management Strategy	• Identification of subwatershed objectives and applicable watershed runoff control criteria for the Welland River and Twenty Mile Creek with the City and Niagara Peninsula	• Evaluation and refinement of the use of alternative SWM practices including low impact development techniques, lot level, conveyance and end-of-pipe solutions to recommend practices to be incorporation into development plans;

Subwatershed Study Component	**Phase 1 – Identification of Existing Conditions and Initial Assessment**	**Phase 2 – Completion of Impact Assessment and Development of Land Use Scenario**
	Conservation Authority (NPCA); • Identification of existing storm drainage boundaries; • Preparation of hydrological modelling for existing conditions for the purpose of confirming stormwater management objectives; and • Preparation of hydrological modelling for the preliminary land use scenario in support of the Initial Assessment.	• Identification of proposed overland flow drainage patterns and drainage boundaries; and • Preparation of preliminary stormwater management facility designs.
Water Budget and Low Impact Development Strategy	• A summary of the existing conditions and proposed unmitigated water balance assessment is to be provided within the Hydrogeological Study.	• A comprehensive analysis of low impact development measures, including the evaluation of various alternatives and selection of preliminary low impact development strategies and locations in accordance with the targets established and City of Hamilton Complete Streets Design Guidelines; • Preliminary design of water balance mitigation measures; and • A summary of the proposed conditions with mitigation water balance is to be provided within the Hydrogeological Study.

Subwatershed Study Component	**Phase 1 – Identification of Existing Conditions and Initial Assessment**	**Phase 2 – Completion of Impact Assessment and Development of Land Use Scenario**
Environmental Impact Study	• Identification of natural heritage and hydrologic features and functions in the study area; • Complete initial assessment of the potential impact of development on the water resource and natural systems	• Evaluation of the study area from a habitat perspective to determine potential impacts from proposed development and necessary mitigation measures to be implemented on site; • A Linkage Assessment to identify and assesses vegetative, wildlife and landscape linkages for potential impacts of development/site alteration on the viability and integrity of the linkages; • Recommendations to protect, enhance or mitigate impacts on existing linkages and their functions; • A General Vegetation Inventory to ensure the applicant considers existing natural features and, where possible, incorporates them into site design at an early stage to maximize vegetation preservation; and • Identification of appropriate buffer zones and ultimate layout of the Land Use Plan for the White Church Secondary Plan to ensure the natural heritage and hydrologic features are known, incorporated into the Land Use Plan and appropriately protected

Subwatershed Study Component	**Phase 1 – Identification of Existing Conditions and Initial Assessment**	**Phase 2 – Completion of Impact Assessment and Development of Land Use Scenario**
		through setbacks and buffer zones.
Hydrogeological and Geotechnical Study	• Analysis of sub-surface conditions of the properties which make up the White Church Secondary Plan study area to gain an understanding of the soil characteristics and hydrogeological conditions of the land; • Hydrogeological reporting including water balance, groundwater contour mapping, borehole and piezometer location mapping, and discussion of the characteristics of local aquifers or aquitards; • Identification of feature based water balance requirements in accordance with the TRCA Wetland Water Balance Risk Evaluation document; and • One (1) year of baseline groundwater monitoring.	• Recommendations of key construction and design components including building foundations, excavations, subgrade soils, lateral earth pressures, site servicing and pond liner considerations, bedding and backfill considerations and pavement design. • Updated hydrogeological reporting including proposed conditions with mitigation water balance and dewatering considerations.

1.2 Study Area

The Subject Lands comprise a grouping of parcels generally bounded by Upper James Street to the west, Airport Road East to the north, Miles Road to the east and White Church Road East to the south (see **Figure 1.1**). The study area is approximately 364 ha in size.

The existing Subject Lands are primarily comprised of agricultural land, a golf course, rural residential, and open space areas. The Subject Lands are located within the Twenty Mile Creek and the Upper Welland River watersheds. Two existing pipelines, owned by Enbridge and Westover Express Pipeline Limited, traverse the subject lands from east to west.

2.0 Grading

2.1 Existing Grading Conditions

Under existing conditions, the southwest portion of the Subject Lands generally slopes south toward White Church Road East. The west portion of the Subject Lands generally slopes southwest toward Upper James Street. The northeast portion of the Subject Lands slopes east toward the intersection of Airport Road East and Miles Road. The existing topography has slopes up to 4.0%. The ground surface elevations through the study area range from approximately 220 m to approximately 232 m.

2.2 Proposed Grading Concept

The Subject Lands will be graded in a manner which will satisfy Hamilton Comprehensive Development Guidelines and Financial Policies Manual (2019) to match to the existing surrounding grades and provide conveyance stormwater runoff. A preliminary grading plan is provided in the Stormwater Management Report (refer to **Appendix C**).

The preliminary grading plan will be further refined at the Secondary Planning stage.

3.0 Geotechnical

A Geotechnical Investigation was completed by Landtek Limited Consulting Engineers (November 20, 2024) for the White Church Boundary Expansion Area in support of an Urban Boundary Expansion application.

The study confirmed that below the surficial layer of organic topsoil, the native soils consist of silt, clayey silt/silty clay, and till deposits extending to maximum depths between 6.0 m and 12.6 m. Topsoil depths observed in boreholes ranged from approximately 50 to 200 mm in depth. Variance in topsoil layer thickness may occur, especially in wetland areas or agricultural lands that have historically been plowed.

Groundwater was not encountered at time of borehole drilling completion. However, wet soils were identified at various depths throughout the site. Stabilized groundwater record was included in **Section 4.0.**

Refer to **Appendix A** for the Geotechnical Investigation.

4.0 Hydrogeology

4.1 Preliminary Hydrogeological Investigation

A Preliminary Hydrogeological Investigation was completed by Landtek Limited Consulting Engineers (January 31, 2025) for the White Church Boundary Expansion Area in support of an Urban Boundary Expansion application.

The study determined that the native overburden soils are predominantly composed of low hydraulic conductivity silt, clayey silt/silty clay, and till deposits.

The site is not located within a Wellhead Protection Area (WPA) or an Intake Protection Zone (IPZ).

Groundwater flow appears to follow the general topography of the site. Groundwater within the north east portion of the site flows north east towards Lake Ontario while groundwater within the remaining balance of the site flows south to tributaries of the Welland River. Groundwater depths were measured in fifteen (15) monitoring wells throughout the site between July and September 2024 and indicate depth of groundwater ranged from 0.21 m to 7.4 m below existing grades. Further monitoring is on-going to determine the seasonal highest groundwater level. Groundwater samples were collected from three (3) monitoring wells and analyzed for Provincial Water Quality Objective (PWQO) parameters.

A preliminary water budget was completed and the study determined an existing annual infiltration volume of 742,690 m^3/yr. Further investigation shall be undertaken at the Secondary Planning stage to ensure minimal impact from future development.

Refer to **Appendix B** for the Preliminary Hydrogeological Investigation.

4.2 Source Water Protection

The subject lands are located in the Niagara Peninsula Source Protection Area. According to the Ontario Source Protection Information Atlas, the Subject Lands contain areas of Significant Groundwater Recharge Areas (SGRA) and Highly Vulnerable Aquifers (HVA). Figures from the Source Protection Atlas are included in **Appendix B**.

5.0 Hydrology and Hydraulics

5.1 Hydrologic Modelling

Hydrologic modelling was undertaken using the Visual Otthymo Version 6.2 software (VO6) based on the 3-hour Chicago, 12-hour AES and 24-hour SCS Distribution methods. The Mount Hope IDF rainfall information was obtained from Hamilton Comprehensive Development Guidelines and Financial Policies Manual to determine the existing peak flows to outlet locations. The proposed end-of-pipe stormwater management facilities will be controlled to existing release rates before releasing to existing storm outlets.

Refer to the Stormwater Management Report for target release rates (**Appendix C**). The preliminary grading and storage requirements for the end-of-pipe SWM facilities will be provided at the Secondary Planning stage with the Phase 2 SWS.

5.2 Hydraulics

All the drainage features on the Subject Lands have drainage areas less than 125 ha and therefore do not contain regulated floodplains as confirmed with NPCA.

6.0 Surface Water Quality

6.1 Purpose

Per the Draft Subwatershed Planning Guide (MECP January 2022), water quality describes the physical, chemical, and biological characteristics of water and aquatic ecosystems which influence the ability of water to support the uses designated for it. The main objectives of water quality assessment in the context of subwatershed planning are to use existing information where possible to characterize status and trends of water quality to:

- Ensure water quality meet and continue to meet water quality objectives,
- To determine the impact of water management on water quality, and
- How future land uses or infrastructure may impact water quality, including assimilative capacity of the received water body.

Surface water quality parameters are compared to the Provincial Water Quality Objectives (PWQO) and include general water parameters including metals, nitrate, total phosphorus, chloride, and sodium in order to establish a baseline condition, evaluate future impacts, and prepare management recommendations.

6.2 Background Information

The following background documents were reviewed with respect to surface water quality for the Subject Lands:

- Twenty Mile Creek Watershed Plan (NPCA, 2006);
- Upper Welland River Watershed Plan (NPCA, March 2011);
- Niagara Peninsula Conservation Authority Water Quality Monitoring Program Summary Report 2023 (NPCA, June 2024);
- City of Hamilton Surface Water Quality Program;

6.2.1 Twenty Mile Creek Watershed Plan (2006)

The Twenty Mile Creek Watershed Plan (2006) did not identify any water quality monitoring sites in the immediate area around the Subject Lands.

6.2.2 Upper Welland River Watershed Plan (2011)

The Upper Welland River Watershed Plan (2011) identifies the Subject Lands in the Local Management Area 2.1. Water quality monitoring site WR003 is located downstream of the subject lands, which is located approximately 6 km downstream where the Welland River West enters Lake Niapenco. The study notes that WR003 is most impacted by nutrient enrichment and elevated concentrations of suspended solids. Sources of these pollutants are noted to include agriculture, soil erosion, sewage discharge, and animal waste. The report notes that WR003 is identified as “poor” water quality index, a bioMAP rating of “impaired”, and notes the following factors impacting water quality and comments:

- Exceedances of chloride, copper, total phosphorus, suspended solids and zinc,
- Inadequate upstream forest and riparian buffer,
- Sedimentation caused by upstream agricultural runoff,
- Evidence of nutrient enrichment,
- Elevated concentrations of total phosphorus are a widespread cause of water quality impairment in the Welland River. 100% exceedance is observed at station WR003, with total phosphorus concentrations up to 20 times greater than the provincial objective.

6.2.3 Niagara Peninsula Conservation Authority Water Quality Monitoring Program Summary Report 2023

The NPCA Water Quality Monitoring Program collects surface water quality samples at 84 sites throughout the NPCA jurisdiction. Generally, the surface water results indicate that many of the NPCA’s watersheds have marginal to poor water quality. Major sources of pollutants causing impairment include agricultural/livestock runoff contributing to elevated total phosphorus, E. coli, suspended solids, and chlorides.

The Twenty Mile Creek watershed contains water quality monitoring site TN002, which is located approximately 1.4 km north of the Subject Lands on the Three Mile Creek watercourse at English Church Road. Runoff from the Subject Lands does not contribute to this monitoring site. Elevated concentrations of total phosphorus are a widespread cause of water quality impairment in the Twenty Mile Creek watershed. E. coli and total suspended solids frequently exceed the provincial objective in Twenty Mile Creek watershed.

The Welland River watershed contains water quality monitoring site WR020, which is located on the downstream side of the watercourse at the Hwy 6 and Chippewa Road East intersection. The watercourse receives runoff from approximately the western third of the Subject Lands. Results from the monitoring site show exceedances in chloride, copper, E. coli, total phosphorus, and total suspended solids, with potential stressors attributed to agricultural and roadway runoff. Water quality monitoring site WR003 continues to be monitored and reported in this study, which has shown decreasing total suspended solids, stable E. coli and total phosphorus, and increasing chloride trends from 2019 to 2023 and potential stressors attributed to agricultural and roadway runoff.

6.2.4 City of Hamilton Surface Water Quality Program

The City of Hamilton’s Water Division undertakes surface water quality monitoring at sampling locations in the City’s watercourses. According to the City’s Open Hamilton Data Portal there are no water quality monitoring locations in the Twenty Mile Creek nor the Upper Welland River watersheds, therefore, the City of Hamilton Surface Water Quality Program does not provide any relevant data to the SWS.

6.3 Recommendations

There are existing surface water monitoring stations and ongoing monitoring by the NPCA within the watersheds that the Subject Lands. This ongoing monitoring and reporting characterize the existing surface water quality of the watersheds. Stormwater management quality control targets for proposed development are established by MECP criteria and are independent of watershed surface water monitoring, therefore, no further surface water monitoring is recommended. Applying the applicable stormwater management criteria per MECP criteria for future development is recommended to mitigate impacts to the surface water quality.

7.0 Terrestrial and Aquatic Ecology

7.1 Aquatic Ecology

The Subject Lands are located within the Whitchurch Secondary Boundary Expansion Area, which is bound by Airport Road East to the North, Miles Road to the east, Whitechurch Road East to the south and Upper James Street to the west. The Subject Lands are located on a watershed divide, resulting in the drainage features being partially within both the Twenty Mile Creek Watershed and the Upper Welland River Watershed.

The Twenty Mile Creek watershed is located on the north-northeast side of the study area, and is the second largest watershed within the jurisdiction of the Niagara Peninsula Conservation Authority (NPCA), and it is located in the City of Hamilton, and the Regional Municipality of Niagara including the Town of Lincoln, Township of West Lincoln, and Town of Grimsby (NPCA 2006). The total drainage of the watershed is 291 square kilometres. Drainage Features (DF) 1 through 5 (**EIS Figure 2, Appendix E**) are associated with the main branch of the Twenty Mile Creek subwatershed.

The Upper Welland River watershed is located on the south-southwest side of the study area has a total drainage of 480 square kilometres. DFs 6 through 19 are associated with the Welland River West subwatershed (Local Management Area 2.1). Area 2.1 includes the entire headwaters region of the Welland River, Lake Niapenco, and downstream to the confluence of Elsie Creek and the Welland River (NPCA 2011).

7.1.1 Fish and Fish Habitat

All headwater drainage features assessed were ephemeral or intermittent headwaters that did not contain fish or direct fish habitat.

The watercourse on the golf course appears to be a permanent feature and has been identified as fish habitat.

7.1.2 Headwater Drainage Feature Assessment

Headwater drainage features assessments were completed in 2023 and 2024 in accordance with the Toronto Region Conservation Authority's *Evaluation Classification and Management of Headwater Drainage Feature Guidelines* (2014). A total of 18 HDF were identified and assessed on the subject property. Each feature was given and a management recommendation based on the TRCA guidelines. The majority of the features can be mitigated through low impact development practices (LIDs).

7.2 Terrestrial Ecology

Vegetation communities were mapped and described following the protocols of the Ecological Land Classification (ELC) System for Southern Ontario (Lee *et al.* 1998).

The study area is predominantly agricultural, with woodlands and wetland communities throughout.

Vegetation communities were categorized into natural communities (forests and wetlands), aquatic communities (open water ponds), cultural communities (meadows, thickets) and hedgerows.

7.2.1 Woodland

Woodland communities were identified on Parcels 10 and 20 (**EIS Figure 3, Appendix E**). The woodland communities on Parcel 10 are comprised of Sugar Maple hardwood forests and Sugar Maple-Beech deciduous forest. Species that are dominant in the hardwood forest include, Sugar Maple (*Acer saccarum*), Basswood (*Tillia americana*), Shagbark Hickory (*Carya ovata*), and Black Walnut (*Juglans nigra*). The other community is dominated by Sugar Maple, American Beech (*Fagus grandifolia*), Shagbark Hickory and Eastern Cottonwood (*Populus deltoides*).

7.2.2 Wetland

There are a number of wetland communities that were identified throughout the study area. Mineral swamp communities were identified on Parcel 48 and Parcel 1. These communities on Parcel 47 were dominated by Trembling Aspen (*Populus tremuloides*) and American Elm (*Ulmus americana*). The Parcel 1 wetland community was dominated by Crack Willow (*Salix X fragills*) with the occasional Silver Maple (*Acer saccharinum*). Other wetland communities include mineral meadow marsh which are comprised of Reed Canary Grass, and mineral shallow marsh which is dominated almost entirely by narrowleaf cattail (*Typha angustifolia*) and broadleaf cattail (*Typha latifolia*).

7.2.3 Cultural Communities

These communities are found throughout the subject property which include meadows, thickets and cultural woodlands. Cultural meadows are found throughout all the of the parcels and are dominated by plants such as Queen Anne's Lace (*Daucus carrota*), Redtop (*Agrostis gigantea*), and Reed Canary Grass. Cultural thickets are found on Parcel 56 and is comprised of Grey Dogwood and Hawthrone Species. Cultural woodlands were identified on Parcels 1 and 3. This is a successional community comprised of young Trebling Aspen (*Populus tremuloides*), Staghorn Sumac (*Rhus typhina*), Common Buckthorn (*Rhamnus* cathartica) and Black Locust (*Robinia pseudoacacia*).

7.2.4 Flora

A total of 221 vascular plant species were recorded in the study area during ELC surveys conducted by Beacon between August, 2023 and October, 2024. Of these, 149 (67%) of the species are considered native to Ontario, and 72 (33%) are non-native to Ontario, which is reflective of the agricultural land use history of the study area. One hundred and forty-seven of the native species are considered provincially common and secure (ranked S5 or S4 provincially by NHIC), one species is considered rare to uncommon Pignut Hickory (*Carya glabra*), and one doesn't have an S-Ranking (SNA). The remaining 72 species are considered provincially exotic (SE). The Carolinian Zone species list ranked 123 of the native species as common (C), and 2 native species as rare (R); these are Pignut Hickory and Switch Grass (*Panicum virgatum*). Similar to the NHIC ranking, 69 of the species are considered introduced (I), and 27 do not have any rank.

7.3 Breeding Birds

Roving breeding bird surveys were conducted in June 2023 and 2024. Species were noted as confirmed or probably breeders or migrants. A total of 50 species were observed breeding in the study area. Species observed is reflective of the available habitat present which is predominantly agricultural areas, in addition to wetlands, woodlands and meadow. Least Bittern, a provincially and federally threatened bird was identified in the MAS2-1 on Parcel 52.

7.4 Reptiles and Amphibians

7.4.1 Breeding Amphibians

Breeding amphibian surveys were conducted in 2023 and 2024 where suitable wetland habitat was identified. A total of 18 stations were surveyed (**EIS Figure 3, Appendix E**), with 15 of the stations recording at least one species of frog. A total of six species of frogs were detected throughout the survey period: Grey Treefrog, pring Peeper, Western Chorus Frog, Northern Leopard Frog, Green Frog, and American Toad.

Survey Station 3 meets the requirements to be significant wildlife habitat based on the habitat type (wetland within a woodland) and the full chorus of Grey Tree Frog and Spring Peepers. While a number of frogs were recorded at the other stations they do not meet the minimum requirements to be considered significant wildlife habitat.

7.4.2 Reptiles

Surveys for turtles were completed in 2024 following the Ontario Blanding's Turtle survey protocol (MNRF, 2015). Midland Painted Turtle (*Chrysemys picta*) is widespread, with sightings in nearly all of the ponds with the exception of survey locations 12 and 14 (**Figure 3**). Snapping Turtle (*Chelydra serpentina*) was found at one location; however basking surveys do not reliably detect this species and it is likely also widespread. One individual of the non-native Red-eared Slider (*Trachemys scripta*) was observed. No turtles were observed within the forested wetlands towards the eastern end of the subject property. No threatened or endangered species were recorded.

7.5 Bat and Acoustic Monitoring

Based on the results of the bat habitat assessment, acoustic monitoring for bats was conducted from May 31 to June 30, 2024.

Among the 32 acoustic monitoring locations, eight bat species were documented within the subject property: Big Brown Bat (*Eptesicus fuscus*), Eastern Red Bat (*Lasiurus borealis*), Hoary Bat (*Lasiurus cinereus*), Silver-haired Bat (*Lasionycteris noctivagans*), Eastern Small-footed Myotis (*Myotis leibii*), Little Brown Myotis (*Myotis lucifugus*), Northern Long-Eared Myotis (*Myotis septentrionalis*) and Tri-colored Bat (*Perimyotis subflavus*). Of the bat species recorded four of the species at listed both federally and provincially as threatened. These species will be addressed in accordance with the requirements of the *Endangered Species Act*.

7.6 Endangered or Threatened Species

A desktop review of available information sources was undertaken the determine potential species at risk on the subject property. A habitat assessment was also undertaken as apart of this study to determine if potential habitat for endangered or threatened species identified in the desktop screening is present. The desktop screening resulted in the potential for 18 species to be present on the subject property. Of the 18 species the Eastern Small-footed Myotis, Little Brown Myotis, Northern Myotis and Tri-coloured Bat were confirmed to be present within the woodlands of the subject property.

Least Bittern did not appear in the background search, but it was confirmed that a Least Bittern is using the wetlands community located on Parcel 52. Least Bittern is listed as endangered and is protected under the *Endangered Species* Act and the Species at Risk Act.

7.7 Significant Wildlife Habitat

Significant Wildlife Habitat (SWH) designation is the responsibility of the planning authority and determination of it on a site-by-site basis is generally not an appropriate method to determine this constraint given that it is necessary to understand the context of the habitat within the local environment. In this case, the City of Hamilton has not identified SWH within their jurisdiction.

Based on the analysis of SWH for the subject property, it has been determined that there are three types of SWH. Under the Seasonal Concentration Areas of Animals category, is Bat Maternity Colonies, under the Specialized Wildlife Habitat is Amphibian Breeding Habitat (Woodlands) and under Habitat for Conservation Concern, Special Concern and Rare Wildlife Species.

8.0 Opportunities and Constraints

8.1 Opportunities

The lands within the study area are primarily agricultural with sod farms and row crops. The lands on the west side of the study area are anthropogenic and have been modified by golf course operations. The lands identified as agricultural or anthropogenic do not represent a formal vegetation community as per the ELC methodology and provide opportunities for development from a natural heritage perspective

8.2 Constraints

There a number of natural heritage features within the subject area including wetlands, woodlands and watercourses. Through the planning process a determination of vegetation protection zones will be determined. The City of Hamilton Official Plan, identifies the VPZs to natural features as follows:

- 15 m – Unevaluated/Locally Significant Wetlands;
- 10 m – Woodlands;
- 15 m – Warmwater Watercourses and Important or Marginal Fish Habitat; and
- 30 m – Cool or Coldwater Watercourses or Critical Fish Habitat.

Threatened and endangered species were recorded on the subject property including endangered bats and Least Bittern, consultation with the Ministry of Environment Conservation and Parks will be required in order to ensure the requirements of the Endangered Species Act are addressed.

It is not anticipated that there will be negative impacts to the natural heritage features from bringing the study area into the urban boundary of the City of Hamilton.

Should there be any future development on these lands an impact assessment related to the development will be undertaken to ensure that any impacts to features are avoided, minimized and mitigated. Should impacts be proposed, opportunities for compensation and restoration would be envisioned.

9.0 Stormwater Management Strategy

The stormwater management strategies have been developed in accordance with City of Hamilton Draft Framework for Urban Boundary Expansion Applications, the City of Hamilton Comprehensive Development Guidelines and Financial Policies Manual, the Niagara Peninsula Conservation Authority, and the Ministry of Environment, Conservation and Parks design criteria and policies. A SWM Report prepared by SCS Consulting Group Ltd. (December 2024) in support of the Phase 1 SWS is included in **Appendix C**.

Per the Ministry of the Environment, Conservation and Parks (MECP) Consolidated Linear Infrastructure Environmental Compliance Approval (CLI ECA) process, 90th percentile runoff volume control is required to achieve quality control, erosion control, and water balance criteria. Should on-site constraints render the 90th percentile runoff volume control infeasible, conventional stormwater management practices must be implemented consistent with City of Hamilton, NPCA, and MECP guidelines.

In order to achieve the 90th percentile runoff volume control a treatment train approach including Low Impact Development (LID) measures, on-site controls, and end-of-pipe facilities. The following LID measures are contemplated in the SWM Report:

- Roof leader discharge to surface;
- Roof leader discharge to soakaway pits;
- Porous pavement (for residential driveways);
- Pervious pavement (for commercial driveways);
- Pervious pipe systems; and
- Pervious catchbasin systems.

The following on-site controls are contemplated in the SWM Report for proposed commercial areas:

- Rooftop storage;
- Parking lot storage; and
- Manufactured Treatment Devices.

In order to provide the required control of post development peak flows to existing condition peak runoff rates for the 2 through 100 year storm events to satisfy quantity control criteria, the following end-of-pipe facilities are contemplated in the SWM Report:

- Wet ponds;
- Dry ponds; and
- Wetland or Hybrid facilities.

An erosion assessment to confirm extended detention requirements will be prepared as part of the Phase 2 SWS. At a minimum, the end of pipe SWM facilities will be required to detain runoff from a 25 mm - 4 hour Chicago rainfall event for a minimum of 24 hours.

A feature based water balance assessment may be required for the terrestrial and aquatic features identified in Section 7.0, pending the completion of a risk assessment completed as part of the Phase 2 SWS per the procedures outlined in the Wetland Water Balance Risk Evaluation guidelines prepared by TRCA (November 2017).

10.0 Summary

This Subwatershed Study has been prepared in support of the Official Plan Amendment application to designate the Subject Lands part of the Urban Boundary, in the City of Hamilton.

Respectfully Submitted:

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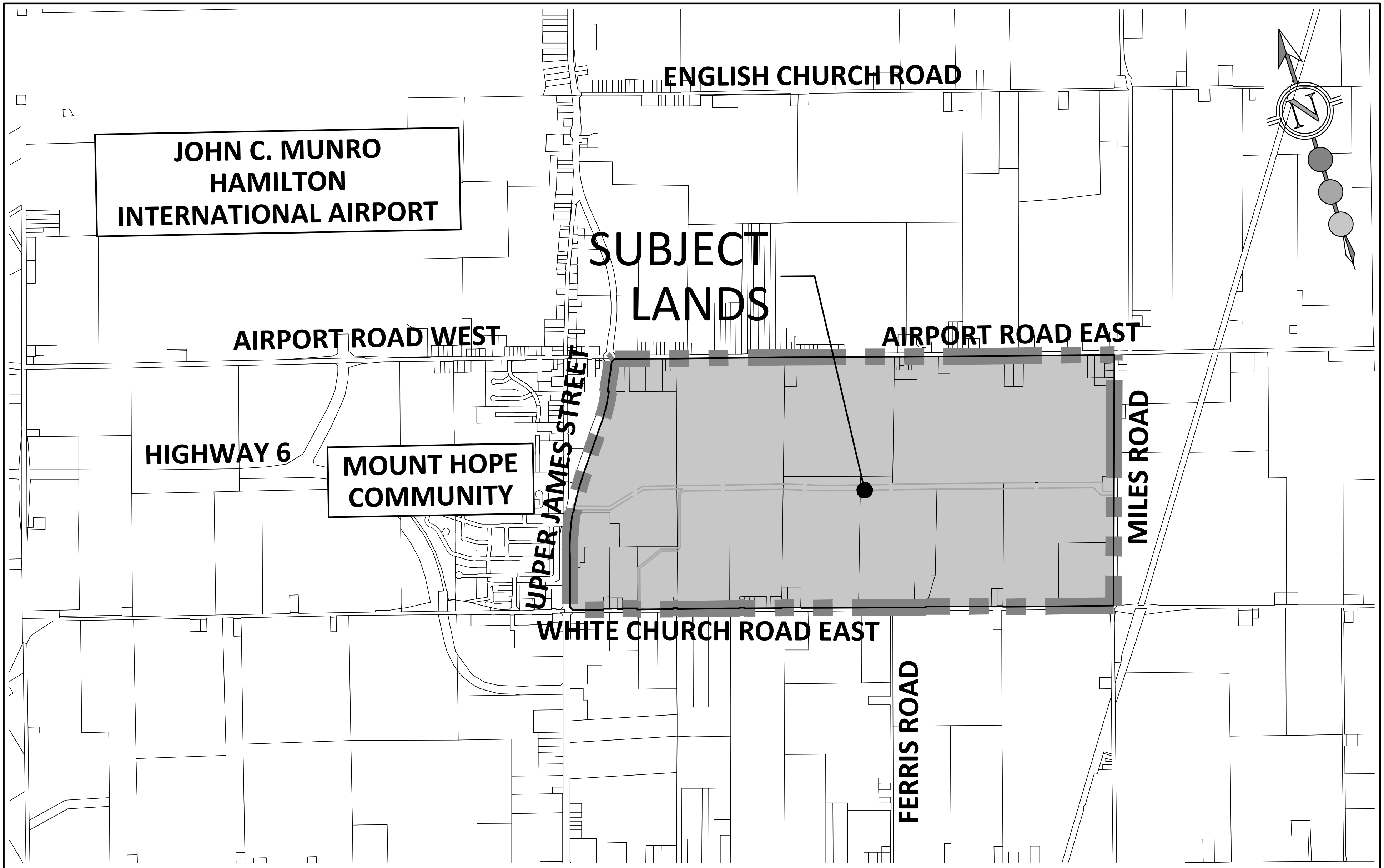

WHITECHURCH
LANDOWNERS GROUP INC.

WHITE CHURCH ROAD
PHASE 1 SWS REPORT

SITE LOCATION PLAN

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FIGURE No: 1.1

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Appendix A Geotechnical

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Geotechnical Investigation
Proposed Development of the White Church Lands

White Church Road and Upper James Street
Hamilton, Ontario

Prepared for:

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Landtek File: 23354
December 12, 2024

EXECUTIVE SUMMARY

SCOPE OF SERVICES

Proposed Development	It is understood that any future development to be undertaken at the site is likely to comprise of single-detached, townhouse and residential condominium development for low density zones, low- to mid-rise towers and stacked townhouses in medium-density zones and high-rise towers in high-density zones. The development is also expected to include for community parks, institutional and community centre blocks, woodland lots and Storm Water Management ponds.
Report Deliverables	The Preliminary Geotechnical Investigation Report is required to provide an understanding of the subsurface conditions underlying the site and to provide preliminary design and construction recommendations for the proposed new residential development.

SITE DETAILS AND SETTING

Coordinates	589650, 4777630	**Geodetic Elevation**	220 m to 232 m

Site Description	The development area is situated along both White Church Road and Airport Road, is approximately 3,644,000 m^2 (364.4 hectares) in plan area and is semi-rectangular in shape. The site is of a generally agricultural use, with some small-scale commercial use and limited areas of rural, residential use also noted. The topography of the development area is generally of an undulating, glacial horizon.
Geology	Organic soil was encountered at the ground surface. Interbedded deposits of silt, clayey silt/silty clay and till deposits were encountered underlying the organic material in all boreholes and extends to the maximum dill depths of between 6.0 m and 12.6 m below the ground surface.
Groundwater	Groundwater or water seepages were not encountered during drilling, with all boreholes remaining open and dry to completion, though wet soils, particularly the silt till and deeper clayey silt till, were noted at variable depth across the development area. It should be noted that groundwater conditions are expected to vary according to the time of the year and seasonal precipitation levels.

GENERAL ENGINEERING CONSIDERATIONS

Foundations	Based on the ground conditions observed at the borehole locations and though there are no designs are available for the property at this time, it is considered by Landtek that the anticipated lightly and moderately loaded structures of low to moderate intensity development may be supported by the native soils underlying the site using conventional, concrete strip or pads foundations.
Settlements	The general limiting of the total settlement to 25 mm and the differential settlement to 19 mm by the recommended geotechnical reaction at the SLS is considered appropriate for foundations.
Earthquake Considerations	Based on the soil conditions encountered, and in accordance with Table 4.1.8.4.A. of the current Ontario Building Code (*OBC*), the site is considered to be a 'D' Site Class.
Damp Proofing and Waterproofing	Any future, at-grade will not require damp proofing or waterproofing, though any associated service or elevator pits should be damp proofed as a minimum. Where habitable basement or parking lot levels are proposed, the subsurface areas (i.e., basement walls and floor slabs etc.) should be damp proofed where above the groundwater levels provided by Landtek's Hydrogeological Assessment, and appropriately waterproofed, where below groundwater. Municipal approval will be required for long-term (permanent) groundwater dewatering.

GENERAL CONSTRUCTION CONSIDERATIONS

Excavations	The subsurface soils to be encountered during excavation at the site are expected to behave as "Type 2" materials according to the OHSA classification in Part III. It should be possible to excavate the overburden soils with a hydraulic backhoe. Moist Type 2 soils are expected to remain stable for 'short' construction periods at battered slopes of 45°, per OHSA requirements.
Short-Term (Construction) Dewatering	Elements of the development are expected to include multiple levels of basement. As such, for short-term dewatering, groundwater is expected to be encountered within basement excavations, particularly where two or more basement levels are proposed. Considerations and parameters regarding construction dewatering, including the "*seasonally highest groundwater level*", are provided by Landtek's Hydrogeological Assessment for the site, as reported under separate cover.

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1.0 INTRODUCTION

Landtek Limited (herein "*Landtek*") is pleased to submit this Preliminary Geotechnical Investigation report for the proposed development located at the site identified as White Church Lands at White Church Road and Airport Road in Hamilton, Ontario. Authorization to proceed with the work was received from Mr. Nicholas McIntosh, P. Eng., of SCS Consulting Group Ltd. (herein "*SCS*") on August 28, 2023, acting on behalf of the White Church Landowners Group Inc.

At the time of issue of this report, Landtek understands that no designs are available for the development area other than the preliminary layout of low- medium- and high-density zoning. It is understood however, that any development to be undertaken at the site is likely to comprise of single-detached, townhouse and residential condominium development for low density zones, low- to mid-rise towers and stacked townhouses in medium-density zones and high-rise towers in high-density zones.

The development is also expected to include for community parks, institutional and community centre blocks, woodland lots and Storm Water Management (herein "*SWM*") ponds. New municipal and private road pavement structures and services are also anticipated.

Given the absence of concise development plan, this investigation is to be considered preliminary until such time that a development concept is available for each development parcel and an appropriate, more detailed investigation is completed to compliment the development plan. On this basis, the primary objectives of this investigation are:

- To provide an outline understanding of the subsurface soil and groundwater conditions for foundation design and construction;
- Provide outline and generalized design and construction recommendations with regards to building foundations, at-grade floor slabs, pavement structures, and subsurface drainage and utilities using trenched and trenchless excavation methodologies; and,
- Assess the characteristics, from a geotechnical perspective, of the soils to be excavated and their potential impact on excavatability, reuse and shoring systems.

This Geotechnical Investigation report has been prepared for the Client, the nominated engineers, designers, and project managers pertaining to the proposed development site identified as the "*White Church Lands*", located in Hamilton, Ontario. Reliance on this report is also extended to Municipalities and Regulatory Authorities but is limited to the intended purpose of the report only.

Any further dissemination of this report outside of those parties previously detailed is not permitted without Landtek's prior written approval. Further details of the limitations of this report are presented in Appendix A.

2.0 SITE SETTING

2.1 Site Location and Description

The development site is located in Hamilton, Ontario, and is centered at approximate grid reference 589650, 4777630 (UTM 17T coordinates). The Geodetic elevation of the ground surface at the site is approximately 220 m to 232 m.

The site location is shown in Figure 2.1.1 below.

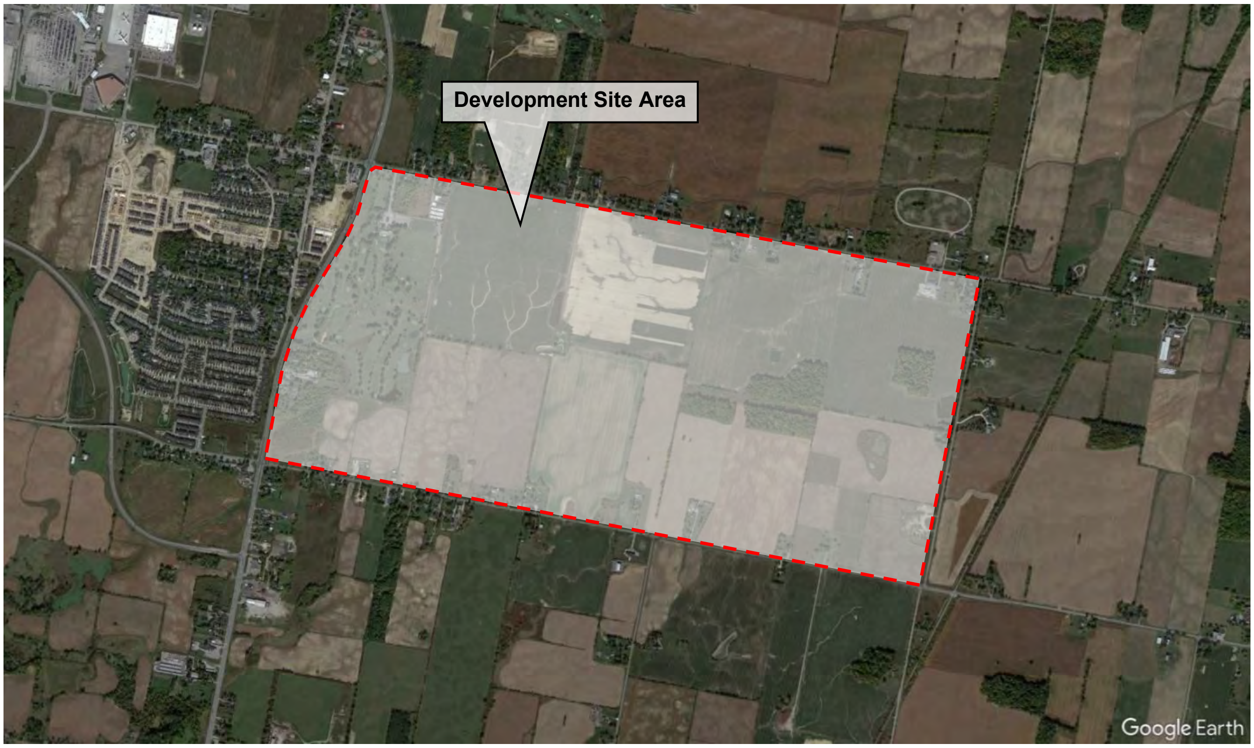


Figure 2.1.1: *Development Site Area and Surrounding*

The development area is broken into two parcels, is situated along both White Church Road and Airport Road, is approximately 3,644,000 m^2 (364.4 hectares) in plan area and is semi-rectangular in shape. The site is of a generally agricultural use, with some small-scale commercial use and limited areas of rural, residential use also noted.

The primary, larger Parcel A of the development area is situated to the north of White Church Road. This parcel is bound to the north by Airport Road, to the east by Miles Road, and to the west by Upper James Street. The secondary, smaller Parcel B is situated to the south of White Church Road and is bound to the east, south and west by agricultural and rural residential properties.

The topography of the development area is generally of an undulating, glacial horizon, with a range in Geodetic elevation between approximately 232 m in the north and 220 in the south. The general trend of slope in topography is towards south and southwest.

2.2 Published Geology

Based on previous geotechnical experience for the area and a review of the existing geological publications for the site area, Ontario Geological Survey (herein "*OGS*") Map P. 993 "*Quaternary Geology of the Grimsby Area*", the site is underlain by deposits of glaciolacustrine clay and silt, and clay and silt tills of the Halton Till formation.

The Ontario Department of Mines (herein "*ODM*") Map 2343 "*Paleozoic Geology of the Grimsby Area*" indicates that the superficial geology is underlain by brown or tan dolostone of the Guelph Formation.

Information provided by historical borehole records from within the vicinity of the site, and held by the OGS, generally confirms the anticipated geological conditions beneath the site. Based on the data from records for Borehole ID 853160, located approximately 1 km west of the site, the soil profile comprises of a veneer of clay and silt deposits to a depth of 23.3 m.

2.3 Published Hydrology and Hydrogeology

Based on publicly available information held by both Hamilton and Niagara Peninsula Conservation Authorities (herein "*HCA*" and "*NPCA*", respectively), the nearest surface water features are Three Mile Creek and Twenty Mile Creek, the tributaries of which are noted to transect the site. Localized ponds and wetlands are also noted within the development area.

According to the OGS, static groundwater levels in the vicinity of the site are generally associated with the deeper till deposits and strata of the Guelph Formation bedrock. Publicly available documentation for groundwater levels in the area report variable groundwater levels, but generally within the range of 10.6 m to 18.3 m below existing ground level.

The groundwater data is also supported by previous, intrusive investigations completed by Landtek and others in the vicinity of the property. Historical reporting identifies groundwater levels at approximately 2.5 m to 11.0 m depth and have been attributed to both locally perched groundwaters and site-wide groundwater regimes.

3.0 FIELDWORK AND INVESTIGATION METHODOLOGY

Fieldwork undertaken at the site by Landtek included clearance of underground services, borehole layout, borehole drilling and soil sampling, and field supervision. A total of eighteen boreholes (boreholes BH1 to BH20, excluding BH14 and BH15) were drilled in phases on March 11, and between July 4 and August 8, 2024. All boreholes were logged using those standard symbols and terms defined in Appendix B. The Exploratory Hole Location Plan, Drawing 23354-01, and associated borehole logs are provided in Appendix C.

The boreholes were drilled using a Dietrich D-50 track mounted drill rig equipped with continuous flight, solid stem augers to a maximum depth of between approximately 6.0 m and 12.1 m. Full time supervision of drilling and soil sampling operations was carried out by a representative of Landtek. Standard Penetration Tests (SPT's) and split spoon samples were taken during drilling at selected depths. Boreholes encountering ultimate auger refusal were extended from bedrock refusal using NQ-gauge, rotary coring methodologies.

Thirteen (13) boreholes were completed as monitoring wells and re-identified as boreholes BH/MW3S/D (nested), BH/MW4, BH/MW6, BH/MW8, BH/MW9, BH/MW10, BH/MW11, BH/MW12, BH/MW16, BH/MW17, BH/MW18, BH/MW19S/D (nested) and BH/MW20. The monitoring wells consisted of new/sealed 50 mm polyvinyl chloride (PVC) screen with No.10 slots threaded onto a matching riser. The screens and risers were pre-threaded including o-ring seals such that no glues or solvents were used to connect the pipe sections. The annular space between the PVC well and the borehole was backfilled to approximately 0.3 m above the top of the screen section with sand pack, and then with bentonite to existing ground level. A J-Plug lockable air-tight cap was installed on the riser. The monitoring well installation details are presented on the respective borehole logs.

All soil samples were transported to the Landtek's in-house, Canadian Council of Independent Laboratories (CCIL) certified laboratory and visually examined to determine their textural classification. Moisture content testing was carried out on all samples. Twelve selected, composite soil samples were submitted to Paracel Laboratories (herein "*Paracel*") for Soil Corrosivity parameter testing. No further chemical testing was proposed for the Geotechnical Investigation element.

The borehole locations were established by Landtek relative to site measurements and existing site features. All depth-related remarks relative to topographical survey information available for the site, drawing reference 365466-T, as completed by A. T. McLaren Ltd.

4.0 SUBSURFACE CONDITIONS

4.1 Overview

The borehole information is generally consistent with the geological data identified in Section 2.2, with the predominant soils comprising of glaciolacustrine clays, silts and tills.

The detailed borehole logs are presented in Appendix C, with the ground conditions encountered by the boreholes discussed in the following sections.

4.2 Organic Material

An approximately 50 mm to 200 mm thick layer of topsoil was encountered from ground surface in all boreholes.

Organic soil thicknesses may vary across the site, particularly in areas of wetland or agricultural land where ploughing has occurred. As such, the thicknesses measured at the borehole locations should be taken as indicative and may not be representative of the organic soil depth across the site in its entirety.

4.3 Silt

Silt deposits were encountered in borehole BH/MW6 and BH/MW8 underlying the clayey silt deposits at a depth of 1.5 m to 2.3 m below ground level. The silt deposits encountered are primarily brown in colour and include trace fractions of grey clay seams and iron staining.

An SPT ''N'' value of 25 were reported, indicating the silt to be of a loose to compact, but generally compact consistency. Moisture contents in the silt deposits were 20 %, which is representative of a moist to wet soil with silt as the primary constituent. The moisture content testing results are presented on the borehole logs in Appendix C.

4.4 Clayey Silt to Silty Clay

Clayey silt to silty clay deposits were encountered in all boreholes except borehole BH1 below the organic material, and range in depth between approximately 0.1 m to 4.5 m below the ground surface. The clayey silt to silty clay deposits encountered are primarily brown in colour, and includes variable fractions of gravel, iron staining, red shale fragments, grey clay seams, and sand.

SPT ''N'' values ranging from 4 to 55 were reported, indicating the clayey silt to silty clay to be of a soft to hard, but generally very stiff consistency. Moisture contents in the clayey silt to silty clay deposits range between 13 % and 37 %, which are representative of a moist to wet soil with silt and clay as primary constituents. The moisture content testing results are presented on the borehole logs in Appendix C.

4.5 Silt Till

Silt till deposits were encountered in boreholes BH1 and nested boreholes BH/MW3S/D underlying the clayey silt and clayey silt to silty clay till deposits, ranging in depth between approximately 0.7 m to the maximum drill depth of 6.0 m below ground level. The silt till deposits encountered are primarily grey in colour and include variable fractions of clay, iron staining and gravel.

SPT ‘‘N’’ values ranging from 14 to 42 were reported, indicating the silt till to be of a compact to dense, but generally compact consistency. Moisture contents in the silt till deposits range between 14 % and 19 %, which are representative of a moist to wet soil with silt as the primary constituent. The moisture content testing results are presented on the borehole logs in Appendix C.

4.6 Silty Clay to Clayey Silt Till

Silty clay to clayey silt till deposits were encountered in all boreholes below the silty clay to clayey silt deposits and organic material, and range in depth between approximately 0.7 m to the maximum drill depth of approximately 12.6 m below the ground surface. The till deposits encountered are primarily brown, and grey at depth in colour and include variable fractions of gravel, iron staining, cobbles, grey clay seams and red shale fragments.

SPT ‘‘N’’ values ranging from 10 to 54 were reported, indicating the till to be of a stiff to hard, but generally very stiff consistency. Moisture contents in the till deposits range between 13 % and 25 %, which are representative of a moist to wet soil with silt and clay as primary constituents. The moisture content testing results are presented on the borehole logs in Appendix C.

4.7 Bedrock

Bedrock was not encountered during this investigation.

4.8 Groundwater

Groundwater or water seepages were not encountered during drilling, with all boreholes remaining open and dry to completion though wet soils, particularly the silt till and deeper clayey silt till, were noted at variable depth across the development area.

At the time of authoring this report, four groundwater monitoring well visits had been completed at the site as part of Landtek’s ongoing Hydrogeological Investigation for the development area. The preliminary results of the groundwater monitoring are presented in Table 4.8.1 following.

Table 4.8.1: Summary of Water Level Measurements

MW ID	Monitoring Well Details			Groundwater Monitoring Results (m)							
	Surface Elevation	Screen Depth	Wet Soils	19-Jul-24		16-Aug-24		28-Aug-24		18-Sep-24	
				Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.
BH/MW3S	-	1.5 m – 3.0 m	2.5 m	0.89	-	1.06	-	1.28	-	2.42	-
BH/MW3D	-	3.0 m – 6.0 m	2.5 m	0.71	-	1.17	-	1.39	-	4.63	-
BH/MW4	-	3.0 m – 6.0 m	5.5 m	0.21	-	0.78	-	1.99	-	3.44	-
BH/MW6	-	3.0 m – 6.0 m	-	0.4	-	0.88	-	1.06	-	5.61	-
BH/MW8	-	3.0 m – 6.0 m	-	0.48	-	1.18	-	1.45	-	2.08	-
BH/MW9	-	6.0 m – 9.0 m	-	7.44	-	5.75	-	6.12	-	3.97	-
BH/MW10	-	3.0 m – 6.0 m	-	0.43	-	0.50	-	0.57	-	0.68	-
BH/MW11	-	3.0 m – 6.0 m	-	0.78	-	1.17	-	1.35	-	1.69	-
BH/MW12	-	3.0 m – 6.0 m	-	-	-	0.98	-	1.68	-	1.73	-
BH/MW16	-	3.0 m – 6.0 m	-	-	-	1.00	-	1.17	-	1.49	-
BH/MW17	-	3.0 m – 6.0 m	-	-	-	5.29	-	4.39	-	5.15	-
BH/MW18	-	5.4 m – 8.4 m	-	-	-	1.77	-	1.03	-	1.31	-
BH/MW19S	-	1.5 m – 3.0 m	2.8 m	-	-	1.31	-	1.44	-	1.67	-
BH/MW19D	-	3.0 m – 6.0 m	3.0 m	-	-	1.38	-	1.47	-	1.69	-
BH/MW20	-	3.0 m – 6.0 m	-	-	-	1.23	-	1.54	-	2.18	-

It should be noted that groundwater conditions and surface water flow conditions are expected to vary according to the time of the year and seasonal precipitation levels. Water seepage is also expected from soil fissures and fractures above the water table.

Further information pertaining to groundwater conditions is provided by Landtek's Hydrogeological Assessment for the site, as reported under separate cover.

5.0 FOUNDATION DESIGN CONSIDERATIONS

The recommended limit state bearing capacities provided in this report are based on the preliminary dataset compiled by this investigation paired with publicly available borehole data and Landtek's knowledge of the geotechnical and geological history of the area.

On this basis, the recommendations and considerations are provided on the understanding that more detailed investigations will be undertaken once specific development concepts and site layouts are developed.

5.1 Shallow Foundation Considerations

5.1.1 Foundations in Native Soils

Based on the ground conditions observed at the borehole locations and though there are no designs are available for the property at this time, it is considered by Landtek that the anticipated lightly and moderately loaded structures of low to moderate intensity development (i.e., townhomes, low- to mid-rise towers etc.) may be supported by the native soils underlying the site using conventional, concrete strip or pads foundations.

Table 5.1.1.1 summarizes preliminary, recommended geotechnical reactions at the Serviceability Limit State (herein "*SLS*") and factored geotechnical resistances at the Ultimate Limit State (herein "*ULS*") for the native soils expected to be encountered at founding depths. It should be noted that the design parameters have been determined by Landtek for the preliminary design stage only. It is also important to note that, where the bearing levels of the footings are at different design elevations, the footing base levels should be stepped along a line of 7V:10H, drawn upwards from the lowest footing, to avoid overlapping stresses.

In accordance with the Ontario Building Code (herein "*OBC*"), 9.12.2.2 (5), and based on local experience, the shallowing of exterior and interior footings to 0.9 m and 0.6 m depth below the basement finished floor level respectively, may be adopted for the development. Such shallowing of foundations is to be limited to only those areas where a minimum of one basement level is to be included.

Table 5.1.1.1: Preliminary Limit State Foundation Design Values

General Founding Depth Ranges	Founding Stratum	Foundation Design Value	
		SLS [1 2]	ULS [3 4]
1.5 m – 2.5 m	Clayey Silt/Silty Clay/Silt Till/Clayey Silt Till/Silty Clay Till	200 kPa	300 kPa
2.5 m – 6.0 m	Clayey Silt/Silty Clay/Silt Till/Clayey Silt Till/Silty Clay Till	200 kPa	300 kPa
6.0 m – 7.0 m	Clayey Silt Till/Silty Clay Till/ Silt Till	300 kPa	500 kPa

Notes:
1. The National Building Code general safety criterion for the serviceability limit states is: SLS resistance ≥ effect of service loads.
2. Recommended SLS bearing values conform to Estimated Values based on soil types given in Tables K-8 and K-9 of the National Building Codes User's Guide.
3. The ULS resistance factor for shallow foundations is 0.5, as given in Table K-1 of the National Building Code User's Guide.
4. The National Building Code general safety criterion for the ultimate limit states is: factored ULS resistance ≥ effect of factored loads.

Subsurface conditions can vary over relatively short distances, and the subsurface conditions revealed at the borehole locations may not be representative of subsurface conditions across the site. As such, a further, more detailed Geotechnical Investigation will be required once a development concept plan for the site has been established.

Design factors related to structural loads will determine the most cost-effective foundation system for the proposed development. The impact on foundation size and soil bearing pressure is illustrated in Figure 5.1.1.1 and emphasizes that foundation design sizes, bearing pressures, and bearing levels must be taken into account to avoid excessive consolidation settlements.

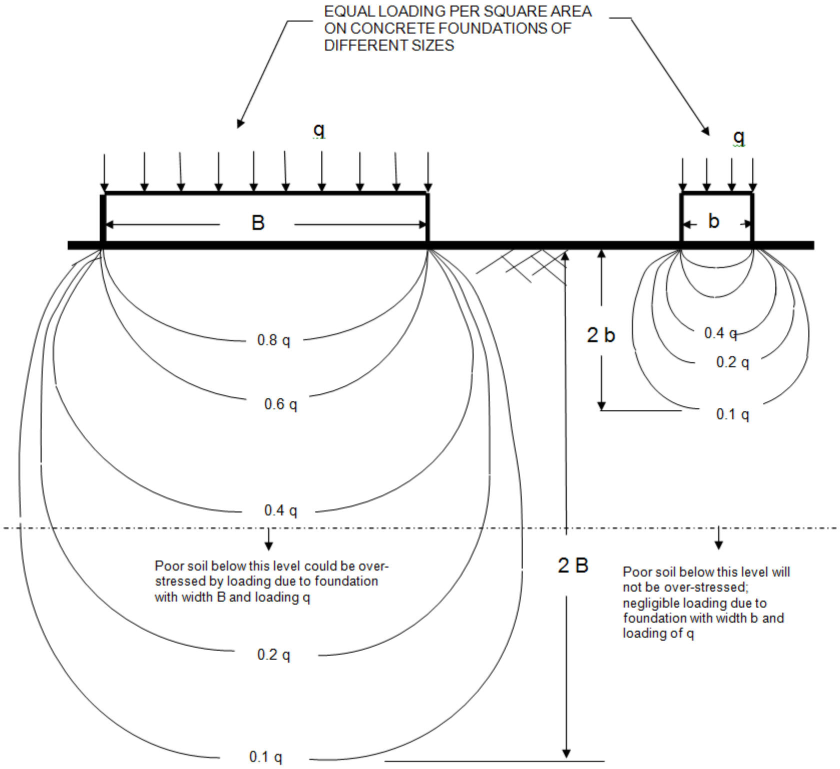


Figure 5.1.1.1: Illustration of Load Distribution below Variable Size Foundations with the Same Applied Loading

Footing foundations may be considered an appropriate option, though the acceptability of footings will depend upon design issues such as the elevation of the lowest floor level and the structural loading. If the footing design criteria provided in this report cannot be satisfied then an alternative solution may be considered, such as a piled solution, particularly if the proposed structures are of a generally high loading than anticipated.

5.1.2 Foundations on Engineered Fill

If engineered fill is required to support founding elements of the development, it is considered by Landtek that relatively lightly loaded structures can be adequately supported by conventional strip or pad footings founded on the engineered fill for a geotechnical reaction at the SLS of 100 kPa, and a factored geotechnical resistance at the ULS of 150 kPa.

It should be noted however, that this is very much dependent upon the nature and condition of the fill placed, the condition of the sub-grade upon which it is being placed, and the methods adopted for the placement and compaction of the fill materials. The engineered fill must be selected with care, then placed and compacted under strictly controlled conditions.

The following recommendations are provided to address the selection of fill material as well as the placement and compaction of engineered fill:

- Processed imported granular material or consistent quality imported clean earth fill, can be considered for engineered fill provided the soil moisture content is within about 2 % of the optimum value of the material. Imported fill should meet the environmental requirements established for the site;
- Engineered fill should only be placed in an area that has been satisfactorily prepared by stripping existing fill and organic soils, and proof rolling the native exposed soil with at least five passes of a minimum 10-ton static pad-foot steel drum type roller;
- Engineered fill should be placed in maximum 300 mm, loose lifts and compacted to a target value of 100 % Standard Proctor Maximum Dry Density (herein "*SPMDD*"). The placement and compaction of each lift should be monitored full time by Landtek, with in-place compaction determined using nuclear moisture/density testing equipment;
- Fill layers that do not meet the compaction requirements, or become wet or frozen, should not be approved for the placement of additional material;
- For engineered fill placement over large areas of varying elevation, the locations of quality control density tests should be recorded by total station survey; and,
- As a precautionary measure and to mitigate cracking, it is recommended that reinforcing steel be provided in footings on engineered fill, and at the top of poured concrete foundation walls. Two 15M bars (continuous) are recommended as a minimum for footing placement. The Structural Engineer should be consulted to confirm the design of such reinforcement.

5.2 Raft Foundation Considerations

For foundations for higher loaded structures than those detailed in Section 5.1, the soil conditions encountered indicate that a raft foundation may be considered an appropriate, shallow-founded alternative to strip or spread foundations.

Design values for the modulus of subgrade reaction generally decrease when the size of the loaded plate (or footing) is larger than 0.3 m by 0.3 m. For granular soils, if the loaded area on the soil is a width of b, the modulus of subgrade reaction can be taken as:

$$K_{\mathrm{vb}} = K_{\mathrm{v1}}\left(\frac{b+0.3}{2b}\right)^2$$

where:

k_{v1} = modulus of subgrade reaction for a loaded plate of dimensions 0.3 m x 0.3 m;
= 25 MPa/m, considered representative of the predominant soil bearing conditions at depth across the site;
b = raft foundation width in metres;
k_{vb} = modulus of subgrade reaction in MPa/m for actual foundation dimension b

For cohesive soils, if the loaded area on the soil is a width of b and a length (as a ratio to b) of mb, the modulus of subgrade reaction can be taken as:

$$K_{\mathrm{vb}} = \left(\frac{K_{\mathrm{v1}}}{b}\right)\left(\frac{m+0.15}{1.5m}\right)$$

where:

k_{v1} = modulus of subgrade reaction for a loaded plate of dimensions 0.3 m x 0.3 m;
= 30 MPa/m, considered representative of the predominant soil bearing conditions at depth across the site;
b = raft foundation width in metres;
m = ratio of foundation length to width where length, L, = mb
k_{vb} = modulus of subgrade reaction in MPa/m for actual foundation dimension b

The soil parameters to be used in the raft foundation design process include the modulus of subgrade reaction, corrected for the building footprint size, and the limiting average pressure at the underside of the raft foundation. The net average bearing pressure at the SLS acting on the underside of the raft is expected to be in the order of 150 kPa to 250 kPa for the native soils underlying the site at depths of approximately 3.0 m to 7.0 m below existing ground level.

5.3 Deep Foundation Considerations

5.3.1 Piled Foundations

If higher bearing capacities are required to support the building loads, then an alternative, deeper founding solution may be required, such as the following:

- "*Cast in Place*" concrete caissons, which could be constructed without any unexpected difficulties but based on the conditions of deeper groundwaters, should incorporate the use of liners. It is anticipated that a dewatering system will not be required provided that liners are used appropriately to control the piezometric water level conditions encountered at depth; or,
- Continuous Flight Auger (CFA) piles.

For piles seated within the silt and clay deposits, the point resistance at the bottom is expected to range between 200 kPa and 300 kPa at the SLS. The frictional resistance (skin friction) developed in the drilled shaft should be calculated as follows:

$$Q_s = 0.42D_s\,[100L_1]$$

where:

D_s = Diameter of drilled shaft
L_1 = Length of pile within the clayey silt to clay
Q_s = value in kN

Alternatively, the piles may be extended to bedrock, though the depths to bedrock are quite significant and in excess of this preliminary investigation. Based on publicly available information, dolostone bedrock is anticipated at depths of approximately 18 m to 25 m below ground level at its shallowest.

Based on generalised rock strength parameter testing, the dolostone bedrock underlying the site may be capable of supporting a factored geotechnical resistance of 2.0 MPa at the ULS as a minimum. This is on condition that any piled foundation is seated at a depth to provide a minimum 0.5 m rock socket (i.e., founded at a minimum of 0.5 m penetration depth into the weathered bedrock). This given however, the bedrock is expected to be capable of supporting more significant loads and further investigation will determine the site-specific rock strength parameters.

The following parameters may be applied for the bedrock when considering lateral pressures on loaded piles:

$$K_p = \text{Rankine passive pressure coefficient} = \tan^2(45 + \phi/2)$$

For the weathered dolostone:

- Internal angle of friction (ϕ) should be taken as 26°; and,
- Bulk unit weight (Υ) should be taken as 24 kN/m^3.

For the competent dolostone:

- Internal angle of friction (ϕ) should be taken as 26°; and,
- Bulk unit weight (Υ) should be taken as 26.5 kN/m^3.

This given however, that the bedrock is expected to be capable of supporting more significant loads and that further investigation will be required to determine the site-specific geotechnical resistances for the bedrock at depth.

In addition, the final design and seating depths for any piled foundation solution is to be based on the findings of the additional investigation required and specific pile-driving and pile load tests undertaken at the site prior to construction.

5.3.2 Settlement Considerations for Piled Foundations

For competent bedrock, the SLS condition will not govern the foundation design as the stress required to induce 25 mm of movement (typical settlement criteria for SLS) is anticipated to exceed the ULS. Therefore, any anticipated settlements for foundations seated within dolostone bedrock underlying the site should be considered negligible (i.e., less than 15 mm).

5.4 Piled Raft Foundation Considerations

If the option of a raft alone cannot be satisfied or a deeper founding solution is not viable, another alternative to consider is a "*piled raft foundation*". In the design, the piles act as "*settlement reducers*" and the reduction of the length of piles can be achieved as the raft resistance is also considered in the design.

Tables 5.4.1 and 5.4.2 below provide estimated ultimate load carrying capacities for drilled shafts with the base of the shaft seated within silt and clay till horizons. Pile displacement may be conservatively set at 20 mm for preliminary consideration, compared with the allowable foundation settlement of 25 mm.

Table 5.4.1: Estimate of Ultimate Load Capacity: 1.2 m Diameter Pile

Length of Drilled Shaft (m)	Estimated Ultimate Load Capacity (kN)
5	900
10	1,800
15	2,600
20	3,400
25	4,300

Table 5.4.2: Estimate of Ultimate Load Capacity: 1.6 m Diameter Pile

Length of Drilled Shaft (m)	Estimated Ultimate Load Capacity (kN)
5	1,500
10	2,800
15	4,000
20	5,200
25	6,500

5.5 Frost Susceptibility

The shallow soils encountered across the site are considered sensitive to water and frost, and their physical and mechanical properties are dependent on in-situ moisture content. As such, the founding soils at the site are considered to have a moderate to high frost susceptibility, being classified as Frost Group "*F4*" (Table 13.1 of the "*Canadian Foundation Engineering Manual*", 4th Edition). However, the indicative depths given for foundations in Sections 5.1.1 and 5.1.2 are considered below the maximum extents of influence from frost penetration in the Hamilton area.

Should any re-grading be proposed as part of the development and is situated adjacent to new or existing structures, it will be important to ensure that the associated exterior footings will have a minimum of 1.2 m of soil cover, or equivalent suitable insulation, for frost protection.

5.6 Settlement Considerations

Based on the outline information provided for the nature of the proposed redevelopment of the site, it is anticipated that the loads to be applied to the ground by any such structure will be generally low to moderate intensity.

As such, associated settlements are not expected to be large. Therefore, the general limiting of the total settlement to 25 mm and the differential settlement to 19 mm by the recommended geotechnical reaction at the SLS is considered appropriate.

5.7 Existing Building Demolition

It is expected that all existing structures and associated infrastructure, including pavements and services, will be removed prior to development. Excavations created by the demolition of existing structures will require backfilling with engineered fill prior to commencing development.

Material controls and placement requirements for such fill materials are provided in Sections 5.1.2 and 10.0 of this report.

5.8 Seismic Design Considerations

Based on the soil conditions encountered, and in accordance with Table 4.1.8.4.A. of the current Ontario Building Code (herein "*OBC*"), the site is generally indicated to be a 'C' Site Class. The acceleration and velocity-based site coefficients, F_a and F_v, should be determined from Tables 4.1.8.4.B. and 4.1.8.4.C. respectively of the OBC for the above recommended Site Class. The seismic design data given in Table 1.2 of Supplementary Standard SB-1 in Volume 2 of the OBC, for selected Municipal locations, should be used to complete the seismic analysis.

Should a higher classification be required (i.e., Class B or higher), then Shear Wave Velocity Testing should be undertaken for each specific development parcel using Multichannel Analysis of Surface Waves (MASW) methodologies. However, this assessment will not necessarily guarantee a change of classification, as it is wholly dependent on the ground conditions beneath the site being assessed.

5.9 Damp Proofing and Waterproofing Considerations

For any future structures that are to be constructed at-grade, no damp proofing or waterproofing to foundation walls is required. This given however, any subsurface areas such as service or elevator pits associated with the at-grade structure should be damp proofed as a minimum.

Where habitable basement or parking lot levels are proposed, the subsurface areas (i.e., basement walls and floor slabs etc.) above established groundwater levels should be damp proofed and comply with the OBC requirements. As a minimum it is recommended that the damp proofing system include a Delta Drainage Board or MiraDrain 2000 series product, or an approved alternative, along with an asphalt-based spray-on wall coating.

Should habitable basement or parking lot levels or any associated subsurface areas such as service or elevator pits be seated below the groundwater levels provided by Landtek's

Hydrogeological Assessment, as reported under separate cover, then such structures are to be appropriately waterproofed. The waterproofing should include for the required buffer zone (nominally 1.0 m to 1.5 m) above the stabilized or highest recorded groundwater level.

6.0 FLOOR SLAB AND PERIMETER DRAINAGE CONSIDERATIONS

Based on the borehole soil conditions and information provided to Landtek, it should be possible to construct conventional, at-grade and basement floor slabs using slab-on-grade methods. The subgrade support conditions are anticipated to be clays, silts and tills, or a combination thereof, which should provide competent conditions for placing the vapour barrier material.

After the subgrade has been prepared to the underfloor design elevation it is recommended that the area be proof-rolled with a loaded tandem axle dump truck to delineate if there are soft or unstable ground conditions that require repair. This operation should be completed before the underfloor vapour barrier granular material is placed.

It is recommended that a minimum 200 mm layer of clear, 19 mm crushed quarried stone be used as the vapour barrier under the floor slab. The vapour barrier stone should meet the requirements of Ontario Provincial Standard Specifications (herein "*OPSS*") 1004 for 19 mm Type II clear stone. If a graded crushed stone is substituted for clear stone, the material should be limited to a maximum of 5 % fines (passing the 0.075 mm sieve). The floor slab thickness should meet the specifications of the project based on anticipated floor loadings.

The finished exterior ground surface should be sloped away from the buildings at a grade in the order of 2 %.

The concrete properties should meet the requirements of OPSS 1350. Contraction and isolation jointing practices should be in accordance with current Portland Cement Association recommendations, as given in the engineering bulletin "*Concrete Floors on Ground*", second edition, by R. E. Spears, and W. C. Panarese.

The design of concrete slabs on native soils may be made on the basis of a value of modulus of subgrade reaction of 25 MPa/m for native silt and clay subgrade soils.

Perimeter drainage should be provided around all subsurface floor areas where water may accumulate unless the proposed structures are to be waterproofed as prescribed in Section 5.9. This, however, is subject to the Municipal approval allowing for the discharge of groundwater into the Municipal storm system where the perimeter drainage is going to be installed at a depth below the established groundwater level.

Underfloor drains may be also required depending on the provision of waterproofing, or excavation and groundwater seepage conditions, particularly where below the groundwater level. Groundwater should be anticipated within excavation profiles for structures that include two or more levels of basement, though groundwater levels may be locally shallower.

Drainage systems should comply with the current OBC and associated amendments. Further details pertaining to perimeter and underfloor drainage systems are provided in Drawings 23354-02 and 23354-03 respectively, in Appendix D.

7.0 EARTH PRESSURE CONSIDERATIONS FOR SUBSURFACE WALLS

7.1 General Earth Pressure Considerations

The earth pressure, p, acting on subsurface walls at any depth, h, in metres below the ground surface assumes an equivalent triangular fluid pressure distribution and may be calculated using the expression below. It is assumed that granular material is used as backfill. Allowances for pressure due to compaction operations should be included in the earth pressure determinations and a value of 12 kPa is applicable for a vibratory compactor and granular material.

If the structure retaining soil can move slightly, the active earth pressure case can be used in determining the lateral earth pressure. For restrained structures and no yielding an “at rest” earth pressure condition should be used. The determination of the earth pressures should be based on the following expression:

$$P_1 = K (\delta h + q)$$

where:

P_1 = the pressure in kPa acting against any subsurface wall at depth, h, in metres (feet) below the ground surface;
K = the at rest earth pressure coefficient considered appropriate for subsurface walls; OPSS 1010 Granular B Type 1 (pit-run sand and gravel) material has an effective angle of friction estimated to be 32° with a corresponding at rest earth pressure coefficient, K_o, of 0.45; and,
δ = the moist bulk unit weight of the retained backfill; 21.5 kN/m^3.

and,

q = the value for any adjacent surcharge in kPa, which may be acting close to the wall; and,
h = the depth, in m, at which the pressure is calculated

Backfill materials required for behind the retaining structure is assumed to meet an OPSS 1010 Granular B Type 1 pit-run sand and gravel material or OPSS 1010 Granular A. The granular fill should be compacted to a minimum of 98 % of the material’s SPMDD, or to the levels and backfilling procedures specified. Table 7.1 below provides those lateral earth pressure parameters for the predominant soils anticipated at the site.

Table 7.1: Recommended Lateral Pressure Parameters

Parameter	Site Soils (Generalized)	OPSS 1010 Granular A	OPSS 1010 Granular B Type I
Angle of Internal Friction, ϕ	38°	35°	32°
Unit Weight (KN/m^3)	19.5	23	22
Passive Earth Pressure Coefficient, K_p	4.20	3.70	3.25
At-Rest Earth Pressure Coefficient, K_o	0.38	0.43	0.47
Active Earth Pressure Coefficient, K_a	0.24	0.27	0.31

7.2 Hydrostatic Pressure Considerations

For waterproofed, subsurface walls below the established groundwater level, the pressure distribution on the wall should include the hydrostatic pressure. The determination of hydrostatic pressure should be based on the following expression:

$$P_2 = \delta_w h_w$$

where:

P_2 = hydrostatic pressure;
δ_w = unit weight of water; 9.8 kN/m^3; and,
h_w = depth of wall, below reported water level.

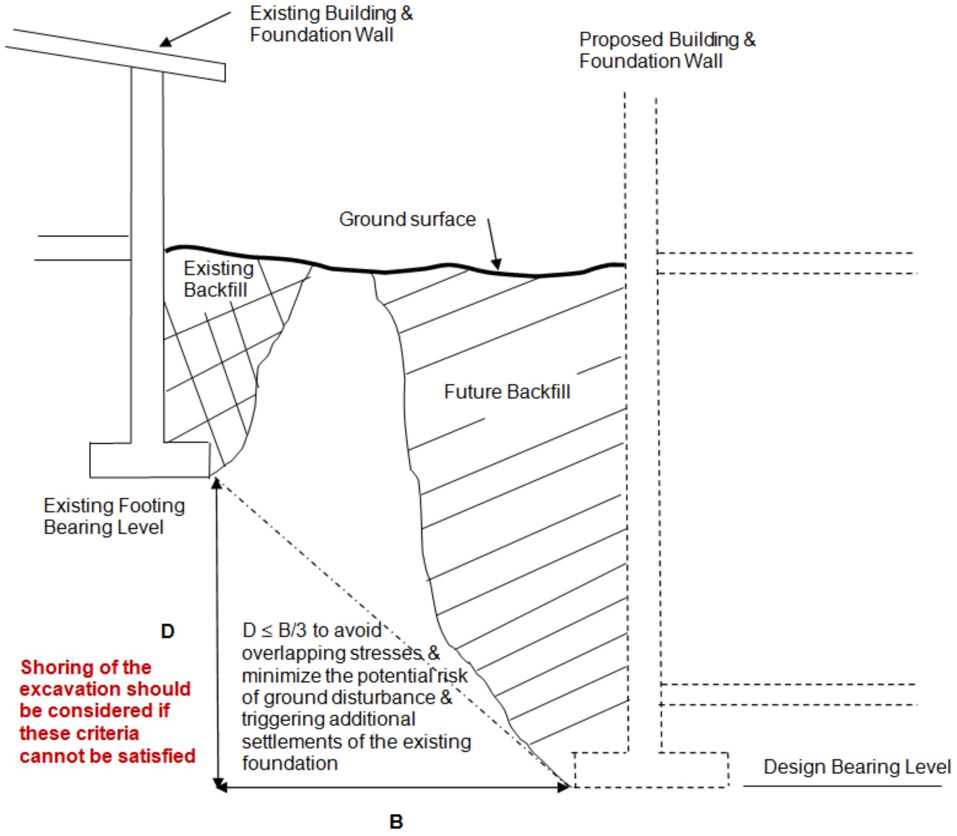
8.0 EXCAVATION AND BACKFILL CONSIDERATIONS FOR CONSTRUCTION

8.1 General Excavation Considerations for Soils

All temporary excavations and unbraced side slopes in the soils should conform to standards set out in the Occupational Health and Safety Act, Ontario Regulation 213/91 "*Construction Projects*" (herein "*OHSA*"). The subsurface soils to be encountered during excavation at the site are expected to behave as "*Type 2*" materials according to the OHSA classification in Part III. Type 2 soils are characteristic of the "*clayey silt to silty clay, silt till, and clayey silt to silty clay till*" deposits encountered beneath the site.

It should be possible to excavate the overburden soils with a hydraulic backhoe. Moist Type 2 soils are expected to be stable for short construction periods at slopes of approximately 45° to the horizontal (i.e., 1V:1H). According to the OHSA the excavation slope should be cut and shaped to meet the OHSA requirements for the soil with the highest classification number.

Excavations for new foundations will be required to satisfy the criteria given in the example shown in Figure 8.1.1. This is to avoid overlapping stresses and minimize the risk of undermining existing adjacent structures, including utilities, and/or triggering additional settlements of the existing structures due to soil disturbance.



Example: If the separation between existing and new proposed footings is 2 m the difference in bearing elevation should not exceed 0.67 m.

Figure 8.1.1: Criteria for Assessing Excavation Shoring Requirements (Not to Scale)

Consideration should be given to any existing trench excavations and associated backfill that may be present directly behind cut slopes within native soils that may appear to be stable on first excavation. In these circumstances, slopes can suddenly slough or collapse due to the effects of the adjacent backfill.

Consequently, for excavation conditions that cannot satisfy the OHSA requirements for unbraced 1H:1V side slopes, a trench box system should be used, or temporary shoring should be installed to maintain safe working conditions. Outline considerations for temporary shoring are provided in Section 8.4 of this report. In any event, the shoring design should be based on the procedures outlined in the latest edition of the "*Canadian Foundation Engineering Manual*".

8.2 Short-Term (Construction) Dewatering Considerations

Though no conceptual development plans have been provided at the time of issue of this report, elements of the site development are expected to include multiple levels of basement. As such, groundwater is expected to be encountered within basement excavations, particularly where two or more basement levels are proposed.

Considerations and parameters regarding dewatering, including the "*seasonally highest groundwater level*", are provided by Landtek's Hydrogeological Assessment for the White Church Road development, as reported under separate cover.

8.3 General Backfill Considerations

Backfill next to foundation walls should be selected to be compactable in narrow trench conditions. The native soils encountered at the site are expected to be reusable as trench backfill and backfill around the proposed structures on the site. Any variation in the moisture contents of the soils encountered may require selective separation of material to avoid the use of wet soil.

During inclement weather the native soils may become too wet to achieve satisfactory compaction. If construction is proposed for late in the year, a reduced level of trench compaction with a higher risk of future settlements is to be anticipated, and it is recommended that provisional contract quantities be established for the supply and placement of imported granular fill under such circumstances. The imported granular should meet the requirements of OPSS 1010 for Granular B Type I material as a minimum requirement.

8.4 Temporary Shoring Considerations

The installation of temporary shoring is also recommended to maintain safe working conditions and eliminate the possibility of loss of ground and damage to nearby structures and buried utilities on the adjacent road allowances during excavation for basement construction.

The requirement and application of shoring to support excavation side slopes will be dependent on the required excavation depth and the proximity of existing or newly constructed infrastructure adjacent to the excavation.

The preferred method of shoring for deeper excavation is expected to consist of a concrete caisson wall, though timber lagging may be considered for shallower basement excavations (i.e., one to two basement levels). This type of system is expected to provide the additional benefit of sealing the excavation from water penetration and loss of soil fines into the open excavation. Soldier piles and timber lagging may be considered as an option for a shoring system, though this type of system may require measures to prevent the loss of soil between the spaces of lagging boards where a wet or flowing soil layer may be present.

The shoring methods may provide lateral restraining force through the use of rakers or tieback anchors. Tieback anchors provide additional advantage since they do not protrude into the excavations as rakers would. However, the use of tieback anchors is also dependent upon whether permission is needed or whether it is physically possible to extend the anchors to the required distance into neighbouring properties.

Consideration should be also given to lateral and vertical movement of shoring systems being monitored during construction to ensure that movements are within the acceptable range.

It should be noted that the design of any temporary shoring system is the responsibility of the Contractor. Therefore, a specialist shoring contractor should be consulted to provide the most appropriate shoring type method and associated installation procedures. In any event, the shoring design should be based on the procedures outlined in the latest edition of the Canadian Foundation Engineering Manual. It is also recommended that lateral and vertical movement of the shoring system be monitored during construction to ensure that movements are within the acceptable range.

9.0 UTILITIES AND SERVICING CONSIDERATIONS

9.1 Service Installation Using Trenchless Methodologies

9.1.1 General Background

It is anticipated that deeper, truck services will be installed using trenchless methodologies. A brief summary of tunnelling methodology options is provided in Table 9.1.1.1, though it is anticipated that "*Jack and Bore*" (horizontal auger boring) methodologies will be the preferred. A specialist Tunneling Contractor should, however, be consulted to determine the most appropriate methodology.

Table 9.1.1.1: Summary of Tunneling Options

Method	Comments	Recommendations
Jack and Bore	• Dewatering may be required depending on the long-term groundwater conditions. • Requires installation of the launch and reception shafts and the thrust block. • No active control of ground loss at the face.	• May be a suitable option but does not allow active control of ground loss. • Boulders and cobbles pose considerable challenge for the method.
Horizontal Directional Drilling (HDD)	• Angle of entrance and exiting may be too steep, but not impossible.	• This method can be used for most ground conditions except for the presence of obstructions such as cobbles and boulders. • HDD may be deemed appropriate for poorer soil conditions, as per OPSS 450.
Pipe Ramming	• Dewatering may be required depending on long term groundwater condition.	• Minimizes the face ground loss but may cause unacceptable levels of vibrations.
Tunnel Boring Machine (TBM)	• Active control of face pressure and ground loss. • Requires installation of the launch and reception shafts and the thrust block. • Large cobbles may pose a challenge.	• May be a suitable option. Cost could be a consideration.
Pipe Jacking with TBM	• Considered uneconomical.	• May be objectionable based on cost.
Micro-Tunneling	• Active control of face pressure and ground loss. • Requires installation of the launch and reception shafts and the thrust block. • Remote control requires highly specialised contractor. • Large cobbles may pose a challenge.	• May be a suitable option. • Cost could be a consideration.

9.1.2 Subsurface Conditions along the Tunnel Alignments

Based on the profiles provided and the ground conditions encountered, the proposed tunnel at the site will be driven primarily through stiff and very stiff, silty clay and clayey silt deposits, though locally sandy deposits are also expected. The expected soil behaviour is such that excessive settlements during and post tunnelling are not anticipated (i.e., not greater than 5 mm).

The investigation identified groundwater within the screened native soils and therefore, groundwater within the tunnel alignment should be anticipated.

9.1.3 Tunnel Support

The design of any required waterproof primary liner will be the responsibility of the nominated

Contractor. In the selection of the type of support, consideration shall be given to the presence of water within the silty and clayey strata, the stabilized groundwater levels reported along the proposed tunnel alignment and the need to prevent the infiltration of any fines into the tunnel opening, as this may result in the loss of ground support and the eventual overstressing or even the collapse of the primary liner system.

The design of the flexible primary tunnel support is to consider the following loading conditions:

- Ring loads caused by uniformly distributed radial earth pressure assumed to be equal to the full vertical earth pressure at the spring line of the tunnel. A unit weight of 20.5 kN/m^3 is to be assumed for the native soils overlying the spring line. Below the groundwater table the submerged unit weight should be used but the full piezometric groundwater pressure should be added to the earth pressure. In addition, loads from any existing underground utilities and structures that may cause stresses on the tunnel liner should be included;
- Bending and shear stresses caused by the anticipated distortion of the flexible liner. A diametral distortion of not less than 0.5 % of the tunnel diameter is to be assumed, though this could be larger if the contact between the soil and tunnel support around the tunnel is not uniform. This may result from over excavation or the loss of lateral support, particularly where any variability in soil strength is exposed within the tunnel (i.e., locally limited sand or silt seams etc.); and,
- Adequate provision shall be made in the design to prevent buckling by assuring uniform filling and grouting of the annular space behind the liner.

The service being installed should be designed for the full vertical pressure measured at spring line and for a horizontal earth pressure equal to 75 % of the full vertical pressure.

9.1.4 Dewatering

It is anticipated that the primary liner of the tunnels will be watertight. Therefore, dewatering will not be required. However, if the tunnel liners are not to be watertight, then the dewatering requirements provided by the Hydrogeological Assessment report should be applied.

The external water head acting on the shield shall be taken to be equal to the difference between the groundwater elevation measured in the vicinity of the particular section of tunnel and the elevation of the tunnel invert.

9.1.5 Temporary Access Shafts

Anticipated Ground Conditions

Superficial deposits anticipated at shaft locations should be readily excavatable using a suitably sized, hydraulic excavator or a clam shell.

Groundwater conditions are expected to be variable, but generally in the order of approximately 4.0 m to 6.0 m below ground level. Limited piezometric groundwater conditions are also anticipated.

Material Stockpile Management

Exposed, excavated soil stockpiles that are to be re-used as fill on site, should be temporarily covered during wet weather to help maintain their original moisture content. Such stockpiles are prone to wet weather exposure and, as such, the increased moisture contents will make these materials too wet to achieve the required levels of compaction.

Shaft Backfill

Access and egress shafts may be backfilled with on site, native, inorganic materials which have moisture content within ±1 % above and ±2 % below the optimum and are environmentally acceptable. Alternatively, imported granular materials can be used. If long term settlements are to be avoided, then the backfill materials should be placed in maximum 300 mm loose lifts and compacted to a minimum 98 % SPMDD. As an alternative, high performance bedding stone (HBP) or unshrinkable fill (U-fill) could be used.

9.1.6 Construction Instrumentation and Monitoring

Settlement Monitoring

Ground movements and deformations of the existing ground surface within the zone of influence (i.e., settlement trough) of the service pipe should be closely monitored during construction by installing surface monitoring points at ground surface either on or immediately beside any existing structures or underground utilities. Settlement monitoring points should be also installed near the launching shaft in order to estimate from these the expected movements of the structures and/or existing service pipes ahead of undertaking the tunnelling work.

All monitoring points will require installation at a time such that monitoring can be completed for a period of at least seven days before any tunnelling work is commenced. The monitoring of the settlement points will require completion on a daily basis by an Ontario Licenced Surveyor and will be reported in writing to the Geotechnical Engineer within one hour of survey completion.

Monitoring is to continue throughout the duration of the tunnelling works and for a period of two weeks after installation completion, maintaining the same monitoring frequency. If little or no settlement is reported during the post-installation monitoring period then the monitoring frequency is to be reduced to once every four weeks for 12 weeks.

Suggested settlement limits and alert levels that may be applied are provided in Table 9.1.6.1 following.

Table 9.1.6.1: Limits of Tunnelling Settlements

Measured Level of Movement	Alert Level
Review (notify CA Project Manager immediately, proceed with caution, monitor hourly for 3 hours)	5 mm to 9 mm
lert (stop work, notify CA Project Manager immediately, determine resolution before recommencing work)	10 mm or greater

Vibration Monitoring

Full time vibration monitoring is recommended during the shaft and tunnel excavation to protect the existing service and road infrastructure, and adjacent residential properties from the adverse impacts of vibration.

The following 9.1.6.2 provides vibration criteria that are to be applied for any neighbouring structure only.

Table 9.1.6.2: Limits of Vibrations

Frequency (Hz)	Peak particle Velocity (PPV) (mm/s)
Less than 4	8
From 4 to 10	15
More than 10	25

The criteria for "*annoyance*" are more stringent than for those that may result in structural damage. The recommended cautionary vibration criteria are summarized in the following table, Table 9.1.6.3.

Table 9.1.6.3: Suggested Cautionary Vibration Criteria

Structure	Peak Particle Velocity (PPV) (mm/s)	Frequency (Hz)
Residential and Commercial Buildings	8	All frequencies
Buried Services	8	All frequencies

Additional Monitoring Requirements

In addition to the monitoring requirements described in the preceding sections, the following should also be monitored:

- Shaft wall deflection by the installation and monitoring of inclinometers and convergence points;
- Groundwater pumping rates and groundwater levels to prevent excessive groundwater drawdown;
- Removed soil volumes per meter of tunnel excavated and grout volumes to monitor over-excavation; and,
- The soil types encountered at the tunnel face.

9.2 Service Installation By Trench Excavation

All temporary, open-cut service excavations and unbraced side slopes in the soils should conform to standards set out in the Occupational Health and Safety Act (herein "*OHSA*"). The subsurface soils to be encountered during excavation at the site are expected to behave as "*Type 2*" materials according to the OHSA classification in Part III. Type 2 soils are characteristic of the "*clayey silt to silty clay, silt till, and clayey silt to silty clay till*" deposits encountered beneath the site.

It should be possible to excavate service trenches through the overburden soils using a hydraulic backhoe. Moist Type 2 and Type 3 soils are expected to be stable for short construction periods at slopes of approximately 45° to the horizontal (i.e., 1V:1H). However, there may be service trenches and backfill situated directly behind cut slopes that appear to be stable. In these cases, slopes can suddenly slough or collapse due to the adjacent backfill. Consequently, for trench conditions that cannot satisfy the OHSA requirements for unbraced 1H:1V side slopes, a trench box system should be used to maintain safe working conditions.

Based on the findings of each borehole location and the proposed service installation depths, significant ground vibrations resulting from open-trench, excavation works are not expected other than those associated with normal construction activities.

Considerations regarding trench excavation dewatering are provided in Landtek's Hydrogeological Assessment report for the site, as reported under separate cover.

As required by the Corporation of the City of Hamilton (herein "*City of Hamilton*"), the trench is to be backfilled with either selected, approved excavated native soil or OPSS 1010.MUNI Granular "A" or "B" Type II material, though maximising the re-use of excavated native soils is preferred and can be managed based on the findings of Landtek's Soil Classification Report, as provided under separate cover.

The trench backfill should be uniformly compacted to a density that minimizes the risk of long-term settlements. The target compaction specification for trench backfill is 95 % Standard Proctor Maximum Dry Density (herein "*SPMDD*").

The excavated native soil should generally be considered to be re-usable from a geotechnical perspective, though may subject to any required moisture conditioning. Where used, and during inclement weather, the excavated soils may become too wet to achieve satisfactory compaction. If construction is proposed for late in the year, a reduced level of compaction with a higher risk of future settlements is to be anticipated. Therefore, it is advised that the fill placement and compaction protocol be discussed and agreed upon at a preconstruction meeting to minimize the risk of settlements.

9.3 Municipal Sewer Pipe Installation

9.3.1 Pipe Installation Considerations

It is expected that new storm sewer infrastructure will be installed below the minimum cover depth of 1.2 m below existing pavement surface and new sanitary sewer infrastructure below the minimum cover depth of 2.75 m below existing pavement surface, as per City of Hamilton Engineering Standards requirements. The subgrade support conditions under the sewer pipes are anticipated to be primarily of native silty and clayey deposits. It is considered that the native soils generally present favorable support conditions for sewer installation.

Should soft or very loose soils be encountered during construction, such soft areas should be sub-excavated and replaced with suitably compacted, engineered fill and approved by a Geotechnical Engineer to redevelop the required subgrade. A Geotechnical Engineer should be engaged during construction to examine the exposed sub-soil quality and condition, and confirm the subsurface conditions are consistent with design assumptions. This is in compliance with field review requirements in the National Building Code, Volume 1, Clause 4.2.2.3.

9.3.2 Foundation Considerations for Associated Infrastructure

Founding Subgrade Considerations

It is expected that any proposed access or connection chambers associated with the proposed sewers installations, can be founded in the undisturbed, native soils for a geotechnical reaction of 100 kPa at the SLS, and for a factored geotechnical resistance of 150 kPa at the ULS.

Subsurface conditions can vary over relatively short distances, and the subsurface conditions revealed at the test locations may not be representative of subsurface conditions across the site. Therefore, a Geotechnical Engineer should be engaged during construction to examine the exposed sub-soil quality and condition, and confirm the subsurface conditions are consistent with design assumptions. This is in compliance with field review requirements in the National Building Code, Volume 1, Clause 4.2.2.3.

Settlement Considerations

It is anticipated that the loads to be applied to the ground by any such structures will be generally very low in intensity. As such, associated settlements are not expected to be large. Therefore, the general limiting of the total settlement to 25 mm and the differential settlement to 19 mm by the recommended geotechnical reaction at the SLS is considered appropriate.

Seismic Design Considerations

In accordance with Table 4.1.8.4.A. of the current Ontario Building Code (herein "*OBC*") the subject property is considered to be a "D" Site Class. The acceleration and velocity-based site coefficients, F_a and F_v, should be determined from Tables 4.1.8.4.B. and 4.1.8.4.C. respectively of the OBC for the above recommended Site Class. The seismic design data given in Table 1.2 of Supplementary Standard SB-1 in Volume 2 of the OBC, for selected Municipal locations, should be used to complete the seismic analysis.

9.3.3 Bedding Cover and Backfill

There is no indication that special pipe bedding materials or procedures are required for the installation of rigid sewer pipes. All bedding cover and backfill materials should be selected in accordance with OPSS 1010 Aggregates – Base, Subbase, Select Subgrade, and Backfill Material, or City of Hamilton requirements, whichever is more stringent.

The pipes should be placed with a minimum bedding thickness in conformance of OPSD 802.010 series (typical 150 mm for rigid pipes, OPSD 802.010, 802.013 and 802.014). The use of normal Class B type bedding is applicable for the pipe.

Bedding material shall be placed in layers not exceeding 300 mm in thickness, loose measurement, and compacted to 100 % of the SPMDD before a subsequent layer is placed. Bedding on each side of the pipe shall be completed simultaneously. At no time shall the fill levels on each side of the storm and sanitary sewer pipe differ by more than one, 300 mm uncompacted layer.

9.4 Municipal Watermain Installation

9.4.1 Watermain Installation Considerations

As is expected that new watermain will be installed such that the top of pipe will be at depths of greater than 1.6 m below existing pavement surface, per City of Hamilton Engineering Standards requirement. At this depth, it is expected that native silty and clayey soils will be encountered. It is considered that the native soils generally present favorable support conditions for watermain installation and thrust block design and construction. Where fill materials are encountered at subgrade levels, inspection and localized remediation works may be required to overcome any potential for differential settlements to the service installation.

When backfilling the trench excavation, consideration should be also given to the requirement of clay seals or "*water stops*", as defined by OPSD 802.095. Clay seals prevent erosive run-off velocities from developing in the trench and are typically constructed of geotextile socks filled with less pervious, organic-free soils (i.e., soil permeability k< 10^{-8} m/s).

The spacing of clay seals is to be selected based on a detailed Hydraulic Assessment, but 50 m to 100 m spacing is generally used for preliminary design purposes. In general, clay seals may not be required for fall gradients of less than 0.5 %. It should be noted however, that clay seals are required at all watercourse crossings, regardless of the fall gradient. It should be also noted that clay seal design is beyond the scope of geotechnical design.

In addition to clay seals and for proposed watermain installations, concrete thrust blocks should be installed against competent native soils, as per the requirements of the OPSD 1101 Series. It is recommended that the thrust blocks bear against native undisturbed soils and be designed for an average allowable resistance bearing pressure of 75 kPa.

Disturbed soil is subject to compression upon loading and therefore does not present favourable bearing conditions to support the proposed watermain installation. Therefore, should localized fill or other previously disturbed soil conditions be encountered during installation, alternative pipe restraint methods should be used, such as a mechanical joint pipe. Any areas of softer soils that yield notable deflection should be sub-excavated and replaced with suitably compacted, engineered fill and approved by a Geotechnical Engineer.

9.4.2 Foundation Considerations for Associated Infrastructure

Founding Subgrade Considerations

Based on the findings of the investigation, it is considered by Landtek that any proposed access chambers or valve boxes associated with the proposed service installations, can be founded in the undisturbed, native soils for a geotechnical reaction of 100 kPa at the SLS, and for a factored geotechnical resistance of 150 kPa at the ULS.

Subsurface conditions can vary over relatively short distances and the subsurface conditions revealed at the test locations may not be representative of subsurface conditions across the site. Therefore, a Geotechnical Engineer should be engaged during construction to examine the exposed sub-soil quality and condition, and confirm the subsurface conditions are consistent with design assumptions. This is in compliance with field review requirements in the National Building Code, Volume 1, Clause 4.2.2.3.

Settlement Considerations

It is anticipated that the loads to be applied to the ground by any such structures will be generally very low in intensity. As such, associated settlements in soils are not expected to be large. Therefore, the general limiting of the total settlement to 25 mm and the differential settlement to 19 mm by the recommended geotechnical reaction at the SLS is considered appropriate.

Seismic Design Considerations

In accordance with Table 4.1.8.4.A. of the current OBC the subject property is considered to be a "*D*" Site Class. The acceleration and velocity-based site coefficients, F_a and F_v, should be determined from Tables 4.1.8.4.B. and 4.1.8.4.C. respectively of the OBC for the above recommended Site Class. The seismic design data given in Table 1.2 of Supplementary Standard SB-1 in Volume 2 of the OBC, for selected Municipal locations, should be used to complete the seismic analysis.

9.4.3 Watermain Bedding and Cover

Watermain bedding and cover material shall be placed in accordance with the City of Hamilton specification for the installation of watermains.

All bedding cover and backfill materials should be selected in accordance with OPSS.MUNI 1010 Aggregates – Base, Subbase, Select Sub-grade, and Backfill Material, with bedding consisting of Granular “A” material per City of Hamilton requirements. Bedding and cover for small diameter water services shall be Granular “D” material.

Bedding material shall be placed in layers not exceeding 300 mm in thickness, loose measurement, and compacted to 100 % of the SPMDD before a subsequent layer is placed. Bedding on each side of the pipe shall be completed simultaneously. At no time shall the fill levels on each side of the watermain pipe differ by more than one, 300 mm uncompacted layer.

9.5 Private Servicing Considerations

There is no indication that special pipe bedding materials or procedures are required for the installation of private services. All bedding cover and backfill materials should be selected in accordance with OPSS 1010 Aggregates – Base, Subbase, Select Subgrade, and Backfill Material.

Service pipes and conduits should be placed with a minimum bedding thickness in conformance of Ontario Provincial Standard Drawing (herein “*OPSD*”) 802.010, 802.013 and 802.014 for flexible pipe and OPSD 802.030, 031, 032, 033 and 034 for rigid pipes. The type of bedding shall be selected to suit the applicable pipe strength and site conditions.

Bedding material shall be placed in layers not exceeding 300 mm in thickness, loose measurement, and compacted to 95 % of the SPMDD before a subsequent layer is placed. Site servicing trench backfill should be uniformly compacted to a density that minimizes the risk of long-term settlements. Bedding on each side of the pipe shall be completed simultaneously. At no time should the levels on each side differ by more than the 300 mm uncompacted layer. The remainder of the trench should be backfilled as per the requirements defined in Sections 5.1.2 and 8.0 of this report.

It is assumed all private services will have a minimum of 1.2 m of soil cover for frost protection. For services installed at shallower depths, suitable insulation for frost protection is recommended.

9.6 Stormwater Management Pond Considerations

At the time of issue of this report, it is understood that seven Storm Water Management (herein “*SWM*”) ponds are proposed across the White Church Road development site area. It is expected that the pond designs will be of a pond with a permanent level of water retention and will be constructed by excavation into native soils.

In accordance with the City of Hamilton document “*City of Hamilton Criteria and Guidelines for Stormwater Infrastructure Design*”, dated April 16, 2009, the requirements for new Stormwater Management Pond design include for the side slopes to be of an angle no greater than 4H:1V.

It is anticipated that outfalls of the ponds will be such that the ponds will be retaining water during rainfall or snow melt events and will be in the order of 1.5 m to 2.0 m above the pond base. The high-water (100-year ponding) level of the ponds will be in the order of 3.0 m to 3.5 m above the pond base. On this basis and based on the findings of the investigation completed at the site, particularly the absence of groundwater within the anticipated SWM pond profile, it is anticipated that the pond base will be above any static or piezometric groundwater regime beneath the site and thus will not require any considerations towards hydraulic uplift.

It is considered that pond construction will only require the inclusion of a ‘standard’ liner to reduce any potential communication between any deeper groundwater system and the stormwater retained by the pond. This is in accordance with the “*City of Hamilton Criteria and Guidelines for Stormwater Infrastructure Design*” and will be required for each SWM pond location. The following recommendations and general comments are provided for consideration for the SWM pond liner design:

- Clay liner materials required should be of high clay-containing soils of low permeability; in the order of 1 x 10^{-6} to 1 x 10^{-7} cm/s to prevent water permeation and maintain their nominal density. There is potential for such native materials to be available from within the development site area, particularly where silty clay non-till soils are present;
- A minimum clay liner thickness of 300 m is considered appropriate at this preliminary stage for pond liner structures, though may be increased if groundwater is present at shallow depths;
- A geo-synthetic liner may be considered as an alternative to the clay liner material if grading or excavation for the required pond liner subgrade presents any issues, groundwater is present at shallow depth, or to ensure total separation of the water retained in the pond from the local groundwater regime. If this alternative is considered then a Bentofix SNRWL Series product is recommended, specifically a Thermal Lock ® Geosynthetic Clay Liner (GCL), consisting of 90% montmorillonite clay as a minimum, with reinforced geotextile upper and lower layers; and,
- Pond side slopes of 4H:1V should be protected from erosion by an appropriate vegetative cover.

10.0 SOIL CORROSIVITY AND SUBSURFACE CONCRETE

10.1 Soil Corrosivity

Twelve selected, composite soil samples were obtained from the boreholes associated with the proposed development and submitted to Paracel Laboratories for analysis of pH, soil conductivity, resistivity and concentrations of sulphates, and chlorides (Soil Corrosivity).

The American Water Works Association (AWWA) document, "*Polyethylene Encasement for Ductile-Iron Pipe Systems*" *ANSI/AWWA C105/A21.5-18,* dated December 1, 2018, uses a 10-point scoring method to determine the soil corrosivity potential. For each given soil sample, points were assigned to the different parameters to evaluate their contribution towards the corrosivity of soil.

The test results are provided in Appendix E and are summarized in Table 10.1.1.

Table 10.1.1: Results of Soil Corrosivity Testing

Borehole and Sample ID	Chloride (µg/g)	Sulphate (µg/g)	pH (pH units)	Resistivity (ohm.cm)	Moisture (%)	Total ANSI/AWWA Points
BH1 - SS4 and SS5	<10	199	7.78	3530	18.1	1
BH3 - SS4 and SS5	<10	962	7.78	1270	23.5	3
BH4 - SS3 and SS5	<10	199	7.78	3530	18.1	1
BH6 - SS4 and SS5	<10	962	7.78	1270	23.5	3
BH8 - SS4 and SS5	<10	199	7.78	3530	18.1	1
BH9 - SS3 and SS5	<10	962	7.78	1270	23.5	3
BH10 - SS3 and SS5	<10	199	7.78	3530	18.1	1
BH11 - SS3 and SS5	<10	962	7.78	1270	23.5	3
BH13 - SS3 and SS5	<10	199	7.78	3530	18.1	1
BH16 - SS3 and SS5	<10	962	7.78	1270	23.5	3
BH17 - SS6 and SS7	<10	199	7.78	3530	18.1	1
BH20 - SS6 and SS7	<10	962	7.78	1270	23.5	3

Corrosion protection for buried ductile-iron pipes is recommended, when a score of 10 points or greater is reported. Based on the total ANSI/AWWA values above of 1 to 3, ductile-iron pipes used at the site will not require corrosion protective measures such as cathodic protection. It should be noted that the analytical results only provide an indication of the potential for corrosion.

The contribution of chloride ions to soil corrosivity towards buried metallic improvements or steel structures is very significant. According to the Corrosion Guidelines (Caltrans, January 2015, version 2.1), a site is considered corrosive if, "*chloride concentration is 500 ppm or greater, sulphate concentration is 2,000 ppm or greater, or the pH is 5.5 or less*. "

In addition, the Canadian Standards Association (CSA) A23.1-14 "*Concrete materials and methods of concrete construction*", Table 3, "*Additional requirements for concrete subjected to sulphate attack*", states that design requirements for sulphate resistant concrete are only necessary when the water-soluble sulphate content of the soil in which the concrete is to be embedded is greater than 0.1 % (1,000 µg/g).

The representative soil samples at the site are reported to contain chloride ion concentrations of <10 µg/g (<0.01 %), and sulphate concentrations between 199 µg/g (0.0199 %) and 962 µg/g (0.0962 %). These equate to an average of <10 µg/g and 581 µg/g, respectively, and indicate a very limited, local potential (i.e., "*low risk*") of sulphate attack on buried reinforced concrete structures.

10.2 Concrete Class Considerations

The requirements for subsurface concrete subject to a sulphate and chloride environment are presented in Canadian Standards Association specification, CSA A23.1-14 *"Concrete Materials and Methods of Concrete Construction, Tables 1-4"*. Experience in the area indicates that the native soils generally have a mild sulphate environment and a low chloride concentration. It is recommended that subsurface concrete at the site have the characteristics for normal (GU) Portland cement.

For parking garage decks and ramps where proposed, it is recommended that the concrete exposure class be C-1 and the concrete have the following minimum properties:

- minimum 56-day compressive strength: 35 MPa;
- maximum water to cement ratio: 0.40;
- chloride ion penetrability requirement: < 1500 coulombs (within 91 days)
- cementing materials: GU (general use hydraulic cement) or GUb (blended general use)
- air content: as per CSA A23.1-14 Table 4, air content category 1 (freeze-thaw environment)

The concrete should be placed without segregation and should be consolidated to achieve a uniform dense mass.

10.3 Methods for Specifying Concrete

Alternative methods of specifying concrete for a project are outlined in CSA A23.1-14 and allow for "*Performance*" or "*Prescription*" based methods. Each method attaches different levels of responsibility to the owner, the contractor, and the concrete supplier. The pros and cons of each method should be examined prior to completion of the specifications for the project.

11.0 SOIL MANAGEMENT CONSIDERATIONS

It is anticipated that the various parcels of development at the site will involve some element of cut and fill operations. From a geotechnical perspective, and in order to optimize the use of the on-site soils, a Soil Management Plan should be established in accordance with the requirements of Ontario Regulation (herein "*O. Reg.*") 406/19 for excess soils and O. Reg. 153/04 for soil stockpiles.

The plan objective should be to achieve a self-sustainable development with respect to excavated materials and control the placement of organic soils so that there is negligible impact on the settlement performance of the compacted fill material. The soil management criteria should be per the following sections, as a minimum:

11.1 Organic and Deleterious Materials

Surface vegetation, topsoil and organic soils should not be placed within the proposed roadways, below finished subgrade level for pavement construction or building limits. These materials should be placed in landscaped areas where settlements are not critical.

11.2 Materials Reuse Management

11.2.1 Fill Compaction Requirements

Excavated soils for structural fill in pavement areas and building floor slab areas, which do not have topsoil or organic matter and are compactable with moisture contents within 2 % to 3 % of the optimum value, should be placed and compacted to a target density of 97 % of the SPMDD with no individual test result below 95 % SPMDD.

If engineered fill is required to support building foundations:

- the engineered fill should be placed and compacted in lifts to a target density of 100 % SPMDD with no individual tests below 98 % SPMDD; and,
- the soil should be placed in a loose lift thickness not exceeding 250 mm and should be compacted using a large (10 ton or larger) pad-foot type roller with vibratory capability.

If engineered fill to support building foundations is being considered, it is recommended that a pre-construction meeting be scheduled to review the proposed fill materials, fill placement and compaction procedures, and the testing and inspection requirements.

Soils to be placed in landscaped areas where settlements are not critical should receive nominal compaction effort in order to achieve at least 90 % of the SPMDD.

11.2.2 Structural Fill Subgrades

Prior to the placement of any structural fill materials, the exposed subgrade soil should be inspected and proof-rolled using a loaded tandem axle truck and traversing the exposed subgrade for full coverage. The proof-rolling should be monitored by a geotechnical representative of this office to delineate any soft areas which may require repair.

12.0 PAVEMENT CONSIDERATIONS

12.1 Private At-Grade Asphalt Pavement Design Considerations

Though no design plans have been provided to Landtek at the time of issue of this report, the proposed development is anticipated to include both Municipally adopted and private pavement structures. Private pavements are expected to include new access routes, condominium road and deck pavements.

Recommended pavement structure layer thicknesses for private pavements are provided in Table 12.1.1. The recommended pavement design section considers the accepted design practice that the total pavement structure thickness should meet or exceed one-half the anticipated depth of frost penetration for the geographical area (i.e., approximately 1.2 m) or as close as practicable.

Table 12.1.1: Recommended Private Asphalt Pavement Structure Layer Thicknesses

Pavement Layer	Light Duty Pavement Areas	Access and Fire Routes
Surface Course Asphalt OPSS HL 3	40 mm	40 mm
Binder Course Asphalt OPSS HL 8	50 mm	60 mm
Granular Base OPSS Granular A	150 mm	150 mm
Granular Subbase OPSS Granular B, Type II	300 mm[1]	350 mm[1]
Total Thickness	540 mm	600 mm

Notes:

1. If construction proceeds late in the year (i.e., November and December), the design thickness of pavement granular materials may have to be increased to address potential problems with subgrade instability and facilitate construction vehicle and truck access.

12.2 Municipal At-Grade Asphalt Pavement Design Considerations

It is anticipated that Municipally adopted pavements to be constructed for the development will comprise primarily of ‘residential local’ or ‘residential collector’ road pavement classifications.

The full-depth pavement structure designs presented in Table 12.2.1 are the standard designs presented by the City of Hamilton’s document “*Pavement Design and Rehabilitation Criteria*”, dated 2023.

Table 12.2.1: Recommended Municipal Pavement Structure Layer Thicknesses

Pavement Layer	Pavement Material	City of Hamilton Pavement Class	
		Residential Local	Residential Collector
Surface Course	SP12.5 (Traffic Category C)	40	40
Binder Course	SP19.0 (Traffic Category C)	80	100
Base Course	OPSS Granular A	150	150
Subbase Course	OPSS Granular B Type II	300	300
	Total Thickness	±570 mm	±590 mm

12.3 Sub-grade Preparation and Drainage

The overall performance of the pavement structure will greatly depend upon the support provided by the developed subgrade. A number of factors should be considered at the construction stages to ensure that an acceptable subgrade condition is developed and maintained:

- Sub-drains should be installed and should be 100 mm diameter perforated plastic pipe, with outfalls to catch basins at a continuous and uniform grade. The sub-drains and associated connections are to be installed in accordance with the City of Hamilton's Engineering Standards or OPSD 216.01;
- Any soft areas of notable deflection to the subgrade should be sub-excavated and replaced with a suitable backfill material approved by a qualified Geotechnical Engineer and compacted to 98 % of its SPMDD;
- The subgrade should be properly shaped, crowned and then proof-rolled under the full-time observation of a geotechnical representative of this office to delineate any soft areas which may require repair before placing the granular materials; and,
- Surface water should not be allowed to pond on the surface of or adjacent to the outside edges of any developed subgrade.

Should pavements proposed for the development be constructed as a two-stage paving operation it will be important to ensure that the following is undertaken to develop the surface of the binder course being used as a "*temporary*" surface during the construction phase:

- The surface is thoroughly cleaned and power washed to remove all residual contaminants;
- All deficiencies are corrected to meet the required design specifications; and,
- A suitable tack coat is appropriately applied immediately prior to the placement of the upper asphaltic concrete course(s).

Such preparatory works are to be completed in accordance with the appropriate OPSS, as required.

12.4 Deck Pavement Design Considerations

It is understood that the proposed development will include for medium-and high-rise structures and are likely to include for multiple level of basement parking that cover the structure footprint in full. Pavements for such structured are anticipated to be deck structures rather than standalone or at-grade pavements.

Such deck pavements should comprise a minimum 50 mm cover of OPSS HL 3 asphalt. The bedding or grading material to be placed between the concrete deck and the asphalt pavement surface should comprise either blinding sand or OPSS Granular A material, depending on the thickness of the layer required.

12.5 Pavement Materials

12.5.1 Granular Base Course

If the option with granular base material is used, the granular base course material should meet OPSS Granular "A" specifications. Quarried 20 mm limestone crushed to Granular "A" gradation specifications is recommended.

12.5.2 Hot Mix Asphalt

The surface and binder course asphalt of private pavement structures should meet current specifications for HL 3 and HL 8, respectively, as prescribed by the City of Hamilton or, alternatively, OPSS 1150.

For Municipal pavement structures, the binder course and surface course asphalt should meet current specifications for SP19.0 Traffic Category C and SP12.5 Traffic Category C, respectively per the City of Hamilton’s Engineering Standards Form 800.

The standard asphalt binder grade for the climate conditions in Hamilton is PG 58-28. Given the anticipated low volume of commercial truck traffic it is considered that there is no requirement for a bump up to a higher PG grade of asphalt cement.

12.5.3 Material Placement and Compaction

The placing, spreading and rolling of the asphalt should be in accordance with current provincial standards or the City of Hamilton’s Engineering Standards Form 800.

Granular base course and subbase course fill material should be compacted to 100 % SPMDD. Hot mix asphalt should be compacted to the criteria set out by the City of Hamilton’s Engineering Standards Form 800.

Connections and tie-ins to existing pavement structures should be completed in accordance with OPSS.MUNI.310.

12.6 Sidewalk Considerations

Sidewalk and Multi-Use Pavement Considerations

The design and construction of concrete sidewalks should be completed to the satisfaction of the City of Hamilton’s Engineering Standards, and as detailed in Table 12.6.1. The concrete and aggregates should be produced and placed to meet those standards also stipulated by the City of Hamilton’s Engineering Standards.

Table 12.6.1: Recommended Minimum Concrete Sidewalk Specifications

Materials	Compaction Requirements	Layer Thickness
Normal Portland GU (32 MPa) (CAN3-CSA A23.1) - Class C-2	N/A	125 mm
Granular “A” Base	95 % SPMDD*	150 mm

* Standard Proctor Maximum Dry Density

Construction joints in concrete sidewalks should be properly sealed (e.g., bitumen filler) to minimize the water migration

It should be noted that the concrete sidewalk design specified in Table 12.6.1 addresses a use by pedestrian traffic only and does not include for use by vehicular traffic. For multi-use sidewalk pavements (i.e., where both pedestrian and bicycle traffic is to be accommodated), the following Table 12.6.2 provides the recommended pavement structure design.

Table 12.6.2: Recommended Multi-Use Sidewalk Pavement Specifications

Pavement Layer	Pavement Material	Recommended Layer Thickness
Surface Course	SP12.5 (Traffic Category C)	80 mm
Granular Base	OPSS Granular “A”	400 mm

The subgrade conditions and bearing strength may be variable along the sidewalk section and some subgrade improvements should be anticipated. It is recommended that prior to the placement of pavement granular fill, the exposed subgrade soil should be inspected and proof-rolled using a loaded tandem axle truck to traverse the exposed subgrade and provide for full coverage. The proof-rolling should be monitored by a geotechnical representative of this office to delineate any soft areas which may require repair. Repairs should be undertaken to avoid creating "*bathtub*" conditions in the subgrade within the pavement structure.

Where finished sidewalks are on level ground, and to ensure that they remain free of ponding water, a final slope/gradient of the sidewalk surface of at least 2 % should be maintained.

13.0 CLOSURE

The Limitations of Report, as stated in Appendix A, are an integral part of this report.

Soil samples will be retained and stored by Landtek for a period of three months after the report is issued. The samples will be disposed of at the end of the three-month period unless a written request from the client to extend the storage period is received.

We trust this report will be of assistance with the design and construction of the proposed development. Should you have any questions, please do not hesitate to contact our office.

Yours sincerely,

LANDTEK LIMITED

LICENSED PROFESSIONAL ENGINEER
R. DI CIENZO
Dec. 12/24
PROVINCE OF ONTARIO

James Dann, B. Eng. (Hons.) ACSM
Manager, Geotechnical Projects

Ralph Di Cienzo, P. Eng.
Consulting Engineer

APPENDIX A
LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the borehole locations. Subsurface and ground water conditions between and beyond the Boreholes may be different from those encountered at the borehole locations, and conditions may become apparent during construction that could not be detected or anticipated at the time of the geotechnical investigation. It is recommended practice that Landtek be retained during construction to confirm that the subsurface conditions throughout the site are consistent with the conditions encountered in the Boreholes.

The comments made in this report on potential construction problems and possible remedial methods are intended only for the guidance of the designer. The number of Boreholes may not be sufficient to determine all the factors that may influence construction methods and costs. For example, the thickness and quality of surficial topsoil or fill layers may vary markedly and unpredictably. Additionally, bedrock contact depths throughout the site may vary significantly from what was encountered at the exact borehole locations. Contractors bidding on the project, or undertaking construction on the site should make their own interpretation of the factual borehole information, and establish their own conclusions as to how the subsurface conditions may affect their work.

The survey elevations in the report were obtained by Landtek Limited or others, and are strictly for use by Landtek in the preparation of the geotechnical report. The elevations should not be used by any other parties for any other purpose.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Landtek Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

This report does not reflect environmental issues or concerns related to the property unless otherwise stated in the report. The design recommendations given in the report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, it is recommended that Landtek Limited be retained during the final design stage to verify that the design is consistent with the report recommendations, and that the assumptions made in the report are still valid.

APPENDIX B
SYMBOLS AND TERMS USED IN THE REPORT

CLAY	SILT	SAND	GRAVEL	FILL	ORGANIC SOIL	PEAT	TILL	SHALE	LIMESTONE
▨	▨	▨	▨	▨	▨	▨	▨	▨	▨

RELATIVE PROPORTIONS

Term	**Range**
Trace	0 - 5%
A Little	5 – 15%
Some	15 – 30%
With	30 – 50%

CLASSIFICATION BY PARTICLE SIZE

Boulder -------------------- > 200 mm
Cobble --------------------- 80 mm – 200 mm
Gravel -
  Coarse ---------- 19 mm – 80 mm
  Fine -------------- 4.75 mm – 19 mm
Sand -
  Coarse ---------- 4.75 mm – 2 mm
  Medium -------- 2 mm – 0.425 mm
  Fine -------------- 0.425 mm – 0.75 mm
Silt -------------------------- 0.075 mm – 0.002 mm
Clay ------------------------- < 0.002 mm

DENSITY OF NON-COHESIVE SOILS

Descriptive Term	**Relative Density**	**Standard Penetration Test**
Very Loose	0 – 15%	0 – 4 Blows Per 300 mm Penetration
Loose	15 – 35%	4 – 10 Blows Per 300 mm Penetration
Compact	35 – 65%	10 – 30 Blows Per 300 mm Penetration
Dense	65 – 85%	30 – 50 Blows Per 300 mm Penetration
Very Dense	85 – 100%	Over 50 Blows Per 300 mm Penetration

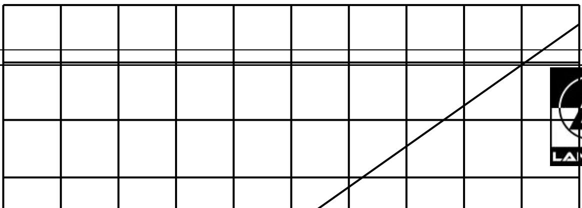
CONSISTENCY OF COHESIVE SOILS

Descriptive Term	**Undrained Shear Strength kPa (psf)**	**N Value Standard Penetration Test**	**Remarks**
Very Soft	< 12 (< 250)	< 2	Can penetrate with fist
Soft	12 – 25 (250 – 500)	2 – 4	Can indent with fist
Firm	25 – 50 (500 –1000)	4 – 8	Can penetrate with thumb
Stiff	50 – 100 (1000 – 2000)	8 – 15	Can indent with thumb
Very Stiff	100 – 200 (2000 – 4000)	15 – 30	Can indent with thumb-nail
Hard	> 200 (> 4000)	> 30	Can indent with thumb-nail

Notes: 1. Relative density determined by standard laboratory tests.
2. N value – blows/300 mm penetration of a 623 N (140 Lb.) hammer falling 760 mm (30 in.) on a 50 mm O.D. split spoon soil sampler. The split spoon sampler is driven 450 mm (18 in.) or 610 mm (24 in.). The “N” value is the Standard Penetration Test (SPT) value and is normally taken as the number of blows to advance the sampler the last 300 mm.

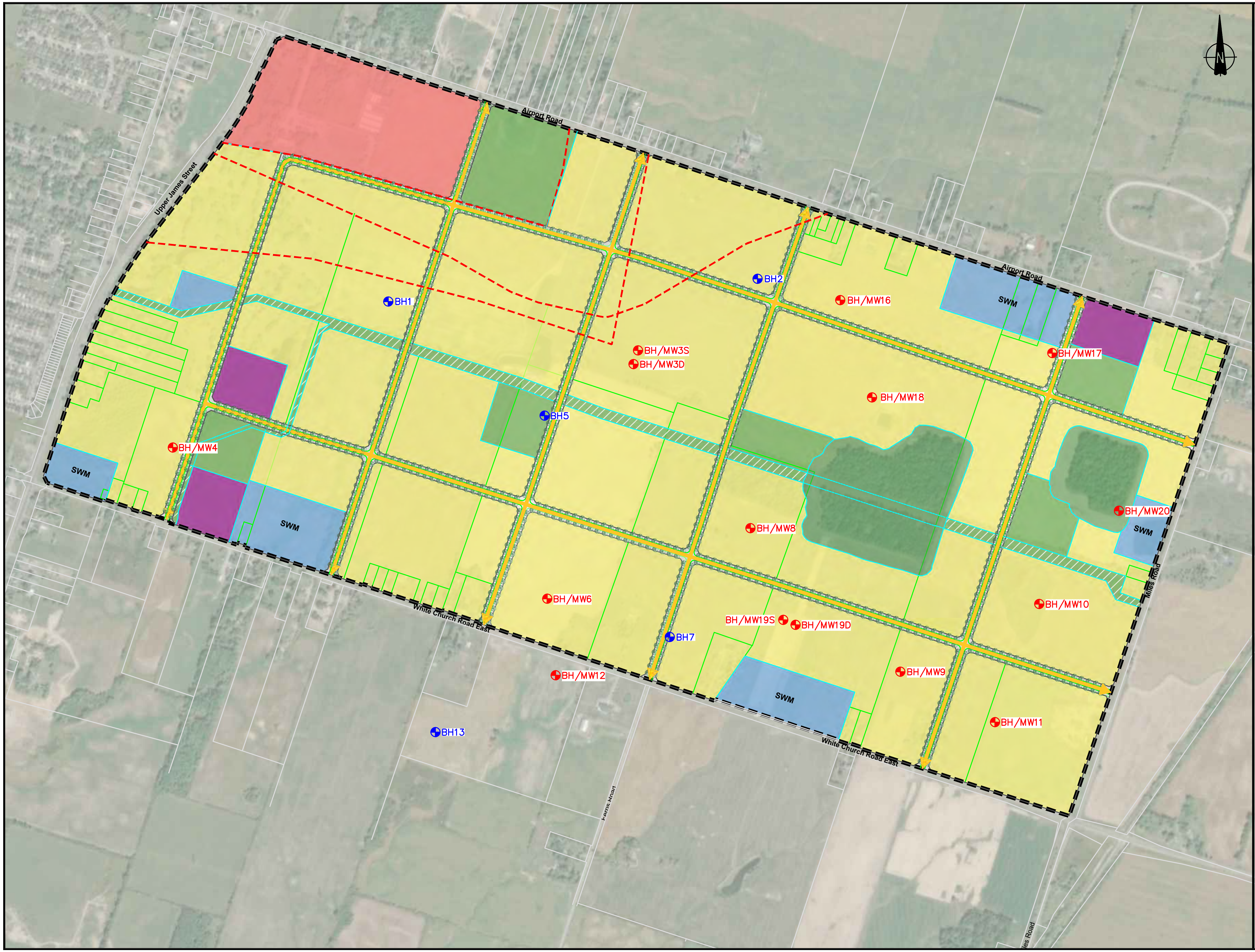
APPENDIX B CONTINUED
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES
ASTM Designation: D 2487 - 69 AND D 2488 – 69
(Unified Soil Classification System)

Major Divisions			Group Symbols	Typical Names	Classification Criteria		
Coarse-grained soils More than 50% retained on No. 200 sieve *	Gravels 50% or more of coarse fraction retained on No. 4 sieve	Clean gravels	**GW**	Well-graded gravels and gravel-sand mixtures, little or no fines	Classification on basis of percentage of fines Less than 5% pass No. 200 sieve . . . . . . GW, GP, SW, SP More than 12% pass No. 200 sieve . . . . . GM, GC, SM, SC 5 to 12% pass No.200 sieve . . . . Borderline classifications requiring use of dual symbols	C_u=D60/D10 greater than 4; C_z = $(D30)^2/(D10xD60)$ between 1 and 3	
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines		Not meeting both criteria for GW	
		Gravels with fines	**GM**	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
	Sands More than 50% of coarse fraction passes No. 4 sieve	Clean Sands	**SW**	Well-graded sands and gravelly sands, little or no fines		C_u=D60/D10 greater than 6; C_z = $(D30)^2/ (D10xD60)$ between 1 and 3	
			SP	Poorly graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW	
		Sands with fines	**SM**	Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
Fine-grained soils 50% or more passes No. 200 sieve *	Silts and clays Liquid limit 50% or less		**ML**	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	Plasticity Chart For classification of fine-grained soils and fine fraction of coarse-grained soils. Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols. Equation of A-line: PI=0.73 (LL-20) 60 50 CH Plasticity 40 Index 30 OH and MH 20 CL 10 CL – ML ML and OL 0 10 20 30 40 50 60 70 80 90 100 Liquid Limit		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silts			
			OL	Organic silts and organic silts of low plasticity			
	Silts and clays Liquid limit greater than 50%		**MH**	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts			
			CH	Inorganic clays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity			
	Highly organic soils		**Pt**	Peat, much and other highly organic soils	* Based on the material passing the 3 in. (76mm) sieve.		



APPENDIX C

DRAWING 23354-01 – EXPLORATORY HOLE LOCATION PLAN
BOREHOLE LOGS



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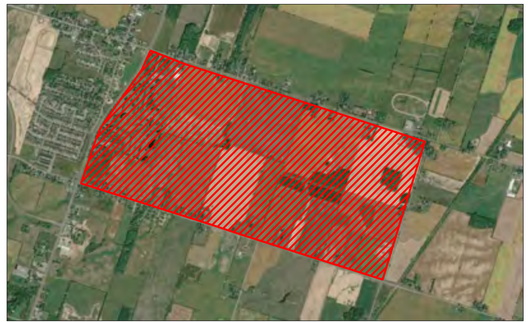
project location



Key plan an extract from Google Earth Pro©

Key:

●	Approximate location of boreholes drilled by Landtek Limited between 3 and 8 july 2024.
●	Approximate location of monitoring wells installed by Landtek Limited between 3 july and 8 august 2024.
🟨	Future Residential Development
🟥	Future Commercial Development
🟪	Future Institutional Development
▨	Existing and Future Greenspace (Woodland, Parkland)

Notes:

Base plan taken from the drawing "*White Church Boundary Expansion Area*", as issued by Urban Solutions Planning & Land Development, with a background extract provided by A. T. McLaren and Aerial Imagery from Google Earth Pro©.

revisions/submissions

#	date	description
1	7 july 2024	issued for draft report
2	28 october 2024	updated property boundary
3	2 december 2024	updated property boundary

client

White Church Landowners Group Inc.

municipality

The Corporation of the City of Hamilton

project

Geotechnical Investigation White Church Lands

sheet

Borehole and Monitoring Well Location Plan

date: 7 july 2024
drawn: mdc
checked: jd
project #: 23354
scale: 1:10,000

23354-01

LOG OF BOREHOLE BH1

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-03-11
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.149397
Easting: -79.908197
Ground Surface Elevation: 0

Subsurface Conditions – Description	Number	Type	Blow Counts/150 mm	N Value
Organic Material ~100 mm. Clayey silt, some organics. Brown, moist. **Clayey Silt Till** some grey clay seams, trace gravel. Firm, brown, moist.	1	SS	1 1 6 7	7
Silt Till some iron staining, trace gravel. Compact, brown, moist.	2	SS	7 9 15	24
	3	SS	8 10 14	24
Clayey Silt Till trace gravel, trace cobbles, trace iron staining. Very stiff, brown, moist.	4	SS	6 10 15	25
...with iron staining. Hard, brown and grey.	5	SS	16 15 16	31
...no cobbles, no iron staining, some gravel. Very stiff, grey.	6	SS	7 9 11	20
...trace gravel.	7	SS	6 8 10	18
End of Log				

Depth Scale (m): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
Depth/Elevation (m): -1.0, -2.0, -3.0, -4.0, -5.0, -6.0, -7.0, -8.0, -9.0, -10.0

Well Details | Groundwater Conditions | Headspace / PID (ppm) [LEL(%)] / ppm | Comments

Penetration / Strength Results

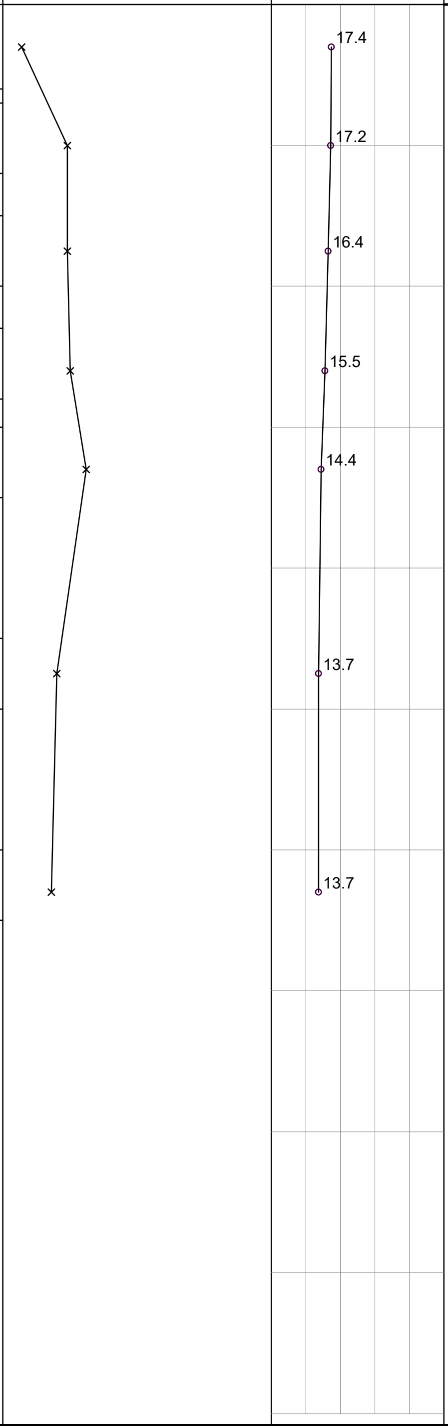
Undrained Shear Strength Values ▲ (kPa) ▲ 40 80 120 160

Penetration Test Values × (Blows / 0.3m) × 20 40 60 80

Moisture / Plasticity

PL MC LL

Moisture / Plasticity ○ ○ 10 20 30 40



Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BH2

SHEET 1 of 1

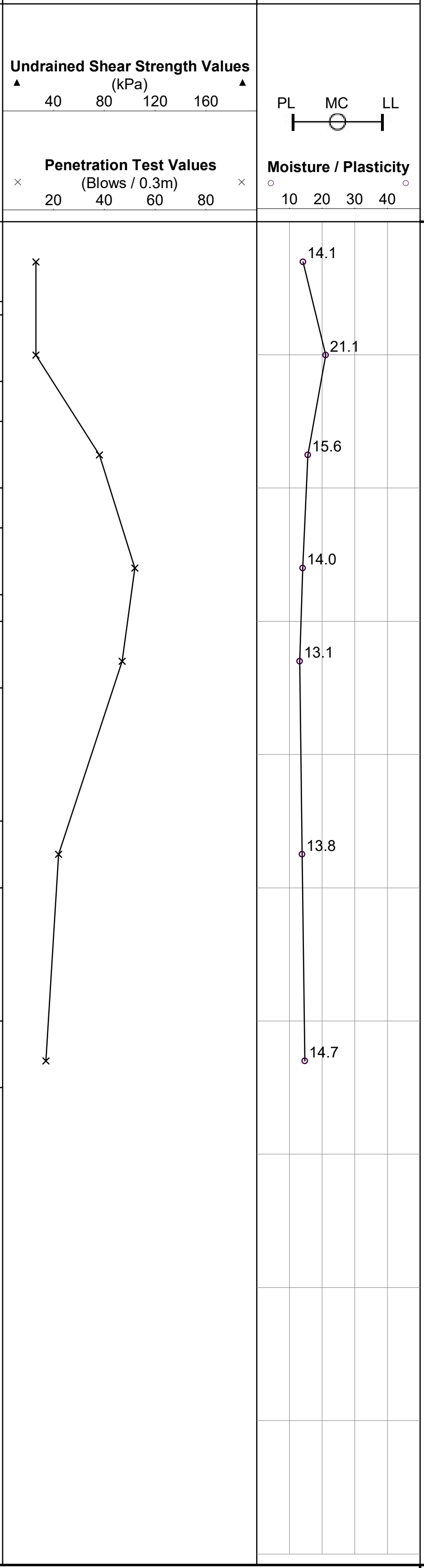
Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-04
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.149763
Easting: -79.896422
Ground Surface Elevation: 0

Subsurface Conditions

Description	Number	Type	Blow Counts/150 mm	N Value
Organic Material ~100 mm. Clayey silt, some organics. Brown, dry to moist. **Clayey Silt** some iron staining, trace grey clay seams. Stiff, brown, moist.	1	SS	3 6 7 6	13
	2	SS	3 5 8	13
...trace iron staining. Hard.	3	SS	7 17 21	38
Clayey Silt Till trace gravel, trace iron staining. Hard, grey, moist.	4	SS	11 19 33	52
	5	SS	9 21 26	47
...no iron staining. Very stiff.	6	SS	4 10 12	22
	7	SS	6 5 12	17
End of Log				



Depth Scale (m): 1 2 3 4 5 6 7 8 9 10
Depth/Elevation (m): -1.0 -2.0 -3.0 -4.0 -5.0 -6.0 -7.0 -8.0 -9.0 -10.0

Well Details | Groundwater Conditions | Headspace / PID (ppm) [LEL(%)] / ppm | Comments

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LOG OF BOREHOLE BH3D

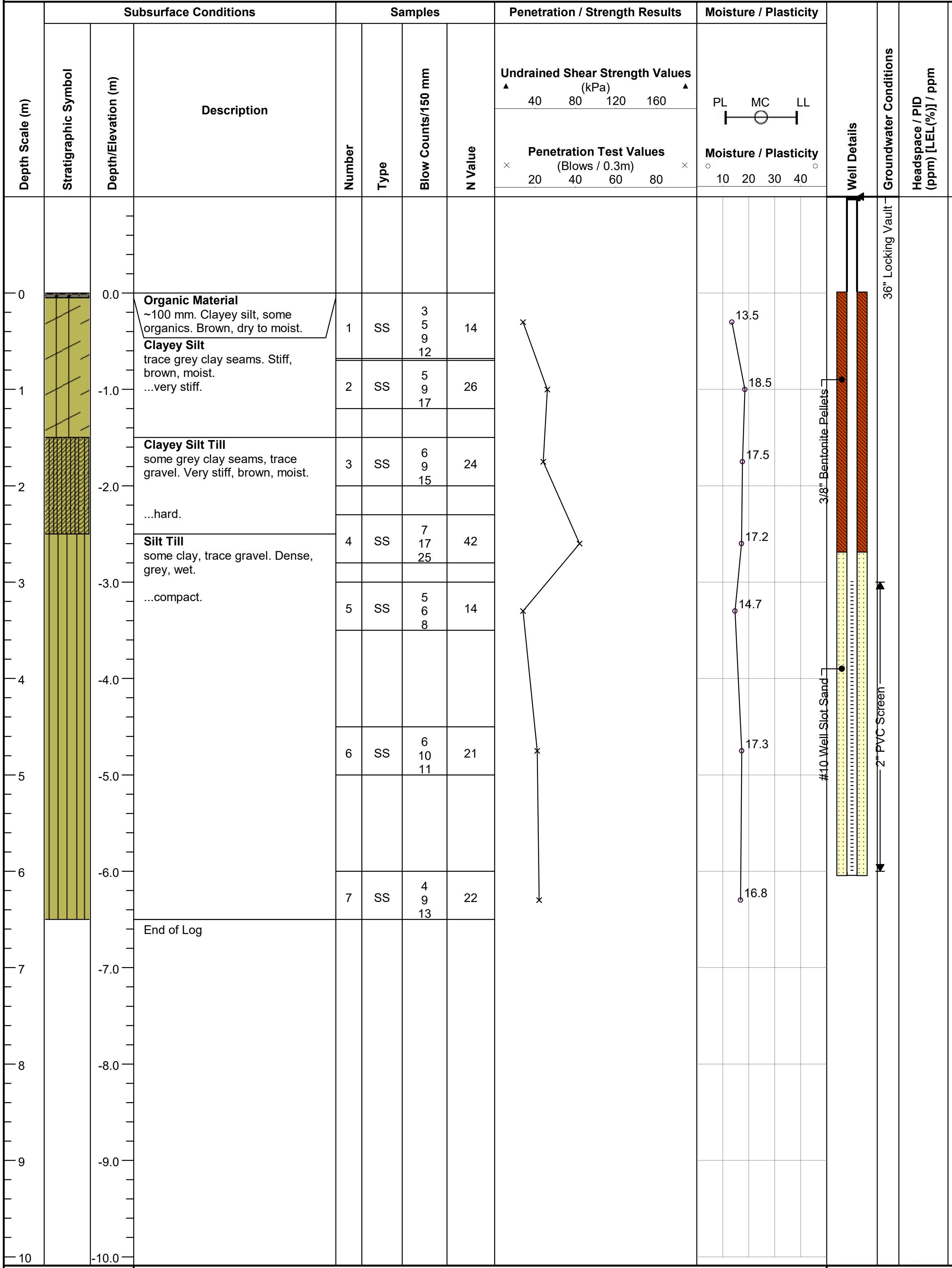
SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-04
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.148164
Easting: -79.900243
Ground Surface Elevation: 0

Subsurface Conditions	Samples			
Description	Number	Type	Blow Counts/150 mm	N Value
Organic Material ~100 mm. Clayey silt, some organics. Brown, dry to moist. **Clayey Silt** trace grey clay seams. Stiff, brown, moist.	1	SS	3 5 9 12	14
...very stiff.	2	SS	5 9 17	26
Clayey Silt Till some grey clay seams, trace gravel. Very stiff, brown, moist.	3	SS	6 9 15	24
...hard.	4	SS	7 17 25	42
Silt Till some clay, trace gravel. Dense, grey, wet. ...compact.	5	SS	5 6 8	14
	6	SS	6 10 11	21
	7	SS	4 9 13	22
End of Log				



Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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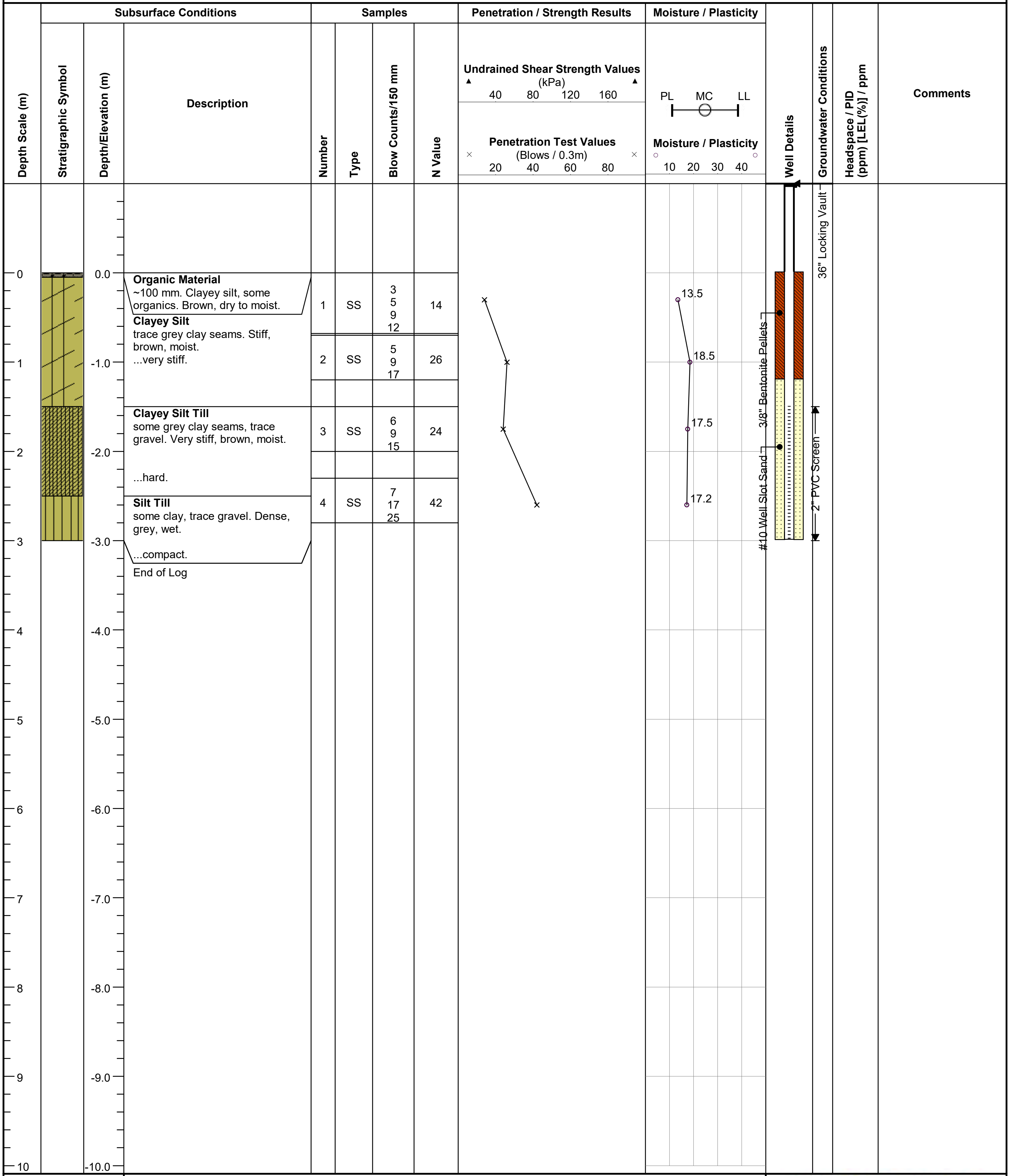
LOG OF BOREHOLE BHMW3S

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-04
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.148049
Easting: -79.900399
Ground Surface Elevation: 0



Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Moisture / Plasticity
0.0	**Organic Material** ~100 mm. Clayey silt, some organics. Brown, dry to moist.	1	SS	3 5 9 12	14	13.5
	Clayey Silt trace grey clay seams. Stiff, brown, moist. ...very stiff.	2	SS	5 9 17	26	18.5
	Clayey Silt Till some grey clay seams, trace gravel. Very stiff, brown, moist. ...hard.	3	SS	6 9 15	24	17.5
	Silt Till some clay, trace gravel. Dense, grey, wet. ...compact.	4	SS	7 17 25	42	17.2
	End of Log					

Additional Notes:
1. Borehole open to approximately 3.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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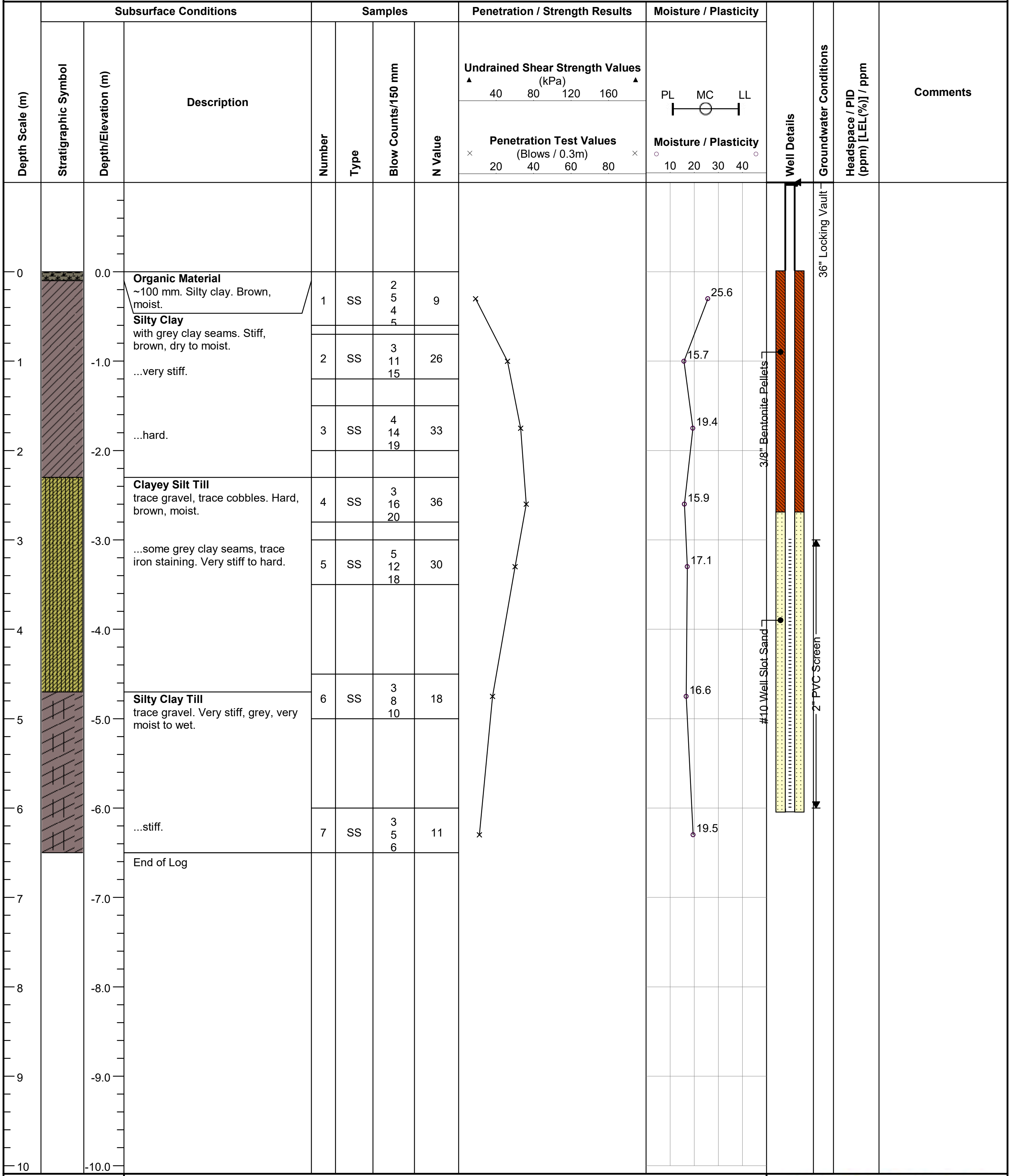
LOG OF BOREHOLE BHMW4

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-09
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.145765
Easting: -79.915462
Ground Surface Elevation: 0



Description	Number	Type	Blow Counts/150 mm	N Value	Moisture
Organic Material ~100 mm. Silty clay. Brown, moist. **Silty Clay** with grey clay seams. Stiff, brown, dry to moist.	1	SS	2 5 4 5	9	25.6
...very stiff.	2	SS	3 11 15	26	15.7
...hard.	3	SS	4 14 19	33	19.4
Clayey Silt Till trace gravel, trace cobbles. Hard, brown, moist.	4	SS	3 16 20	36	15.9
...some grey clay seams, trace iron staining. Very stiff to hard.	5	SS	5 12 18	30	17.1
Silty Clay Till trace gravel. Very stiff, grey, very moist to wet.	6	SS	3 8 10	18	16.6
...stiff.	7	SS	3 5 6	11	19.5
End of Log					

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BH5

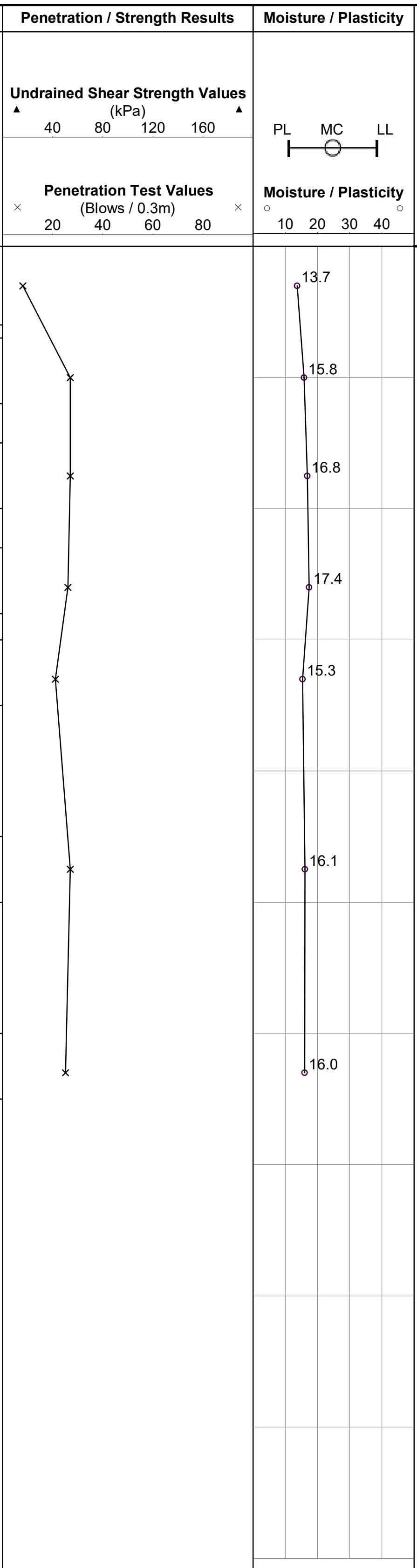
SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-04
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.146519
Easting: -79.903092
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Well Details	Groundwater Conditions	Headspace / PID (ppm) [LEL(%)] / ppm	Comments
		Organic Material ~50 mm. Clayey silt, trace organics. Brown, dry.	1	SS	3 4 4 5	8				
		Clayey Silt trace iron staining. Firm to stiff, brown, dry.								
1	-1.0	...very stiff.	2	SS	5 12 15	27				
		...moist.	3	SS	6 11 16	27				
2	-2.0									
		Clayey Silt Till trace gravel, trace iron staining. Very stiff, brownish grey, moist.	4	SS	5 10 16	26				
3	-3.0		5	SS	6 8 13	21				
4	-4.0									
		...grey, wet.	6	SS	5 12 15	27				
5	-5.0									
6	-6.0	...moist.	7	SS	4 8 17	25				
		End of Log								
7	-7.0									
8	-8.0									
9	-9.0									
10	-10.0									



Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BHMW6

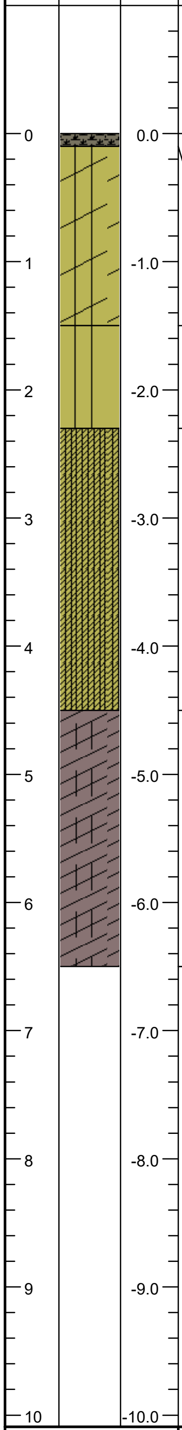
SHEET 1 of 1

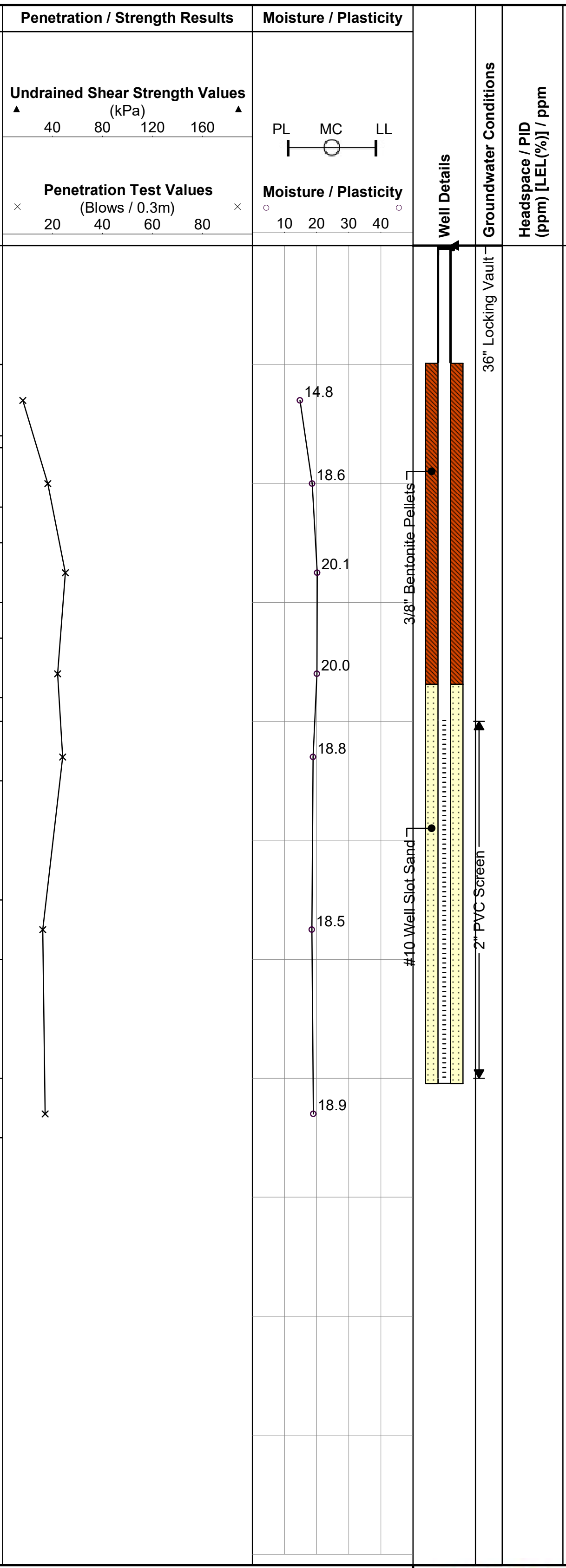
Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-04
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.141969
Easting: -79.903206
Ground Surface Elevation: 0

Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value
0.0	**Organic Material** ~100 mm. Silty clay, trace organics. Brown, dry to moist.	1	SS	4 2 6 3	8
	Clayey Silt some iron staining, trace grey clay seams. Firm to stiff, brown, moist. ...very stiff.	2	SS	3 8 10	18
	Silt trace grey clay seams, trace iron staining. Compact, brown, moist.	3	SS	4 10 15	25
	Clayey Silt Till some gravel, some iron staining. Very stiff, grey, moist.	4	SS	6 10 12	22
		5	SS	5 10 14	24
	Silty Clay Till trace gravel. Very stiff, grey, moist.	6	SS	3 8 8	16
		7	SS	4 7 10	17
	End of Log				





Comments

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BH7

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-05
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.141126
Easting: -79.899115
Ground Surface Elevation: 0

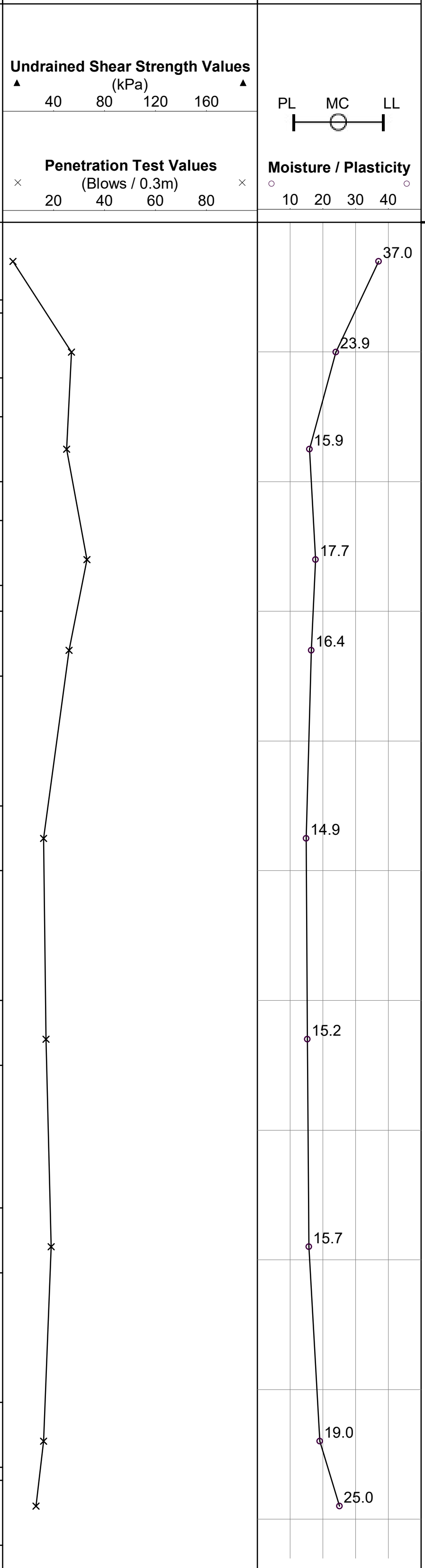
Subsurface Conditions

Depth/Elevation (m)	Description
0	**Organic Material** ~100 mm. Silty clay, some organics and wood debris. Brown, moist.
	Clayey Silt trace sand, trace gravel. Soft to firm, brown, dry to moist.
-1.0	...very stiff.
	...trace grey clay seams, trace red shale fragments.
-2.0	**Clayey Silt Till** trace gravel. Hard, brown, moist.
-3.0	...some iron staining. Very stiff.
-4.0	...grey.
-6.0	...very moist.
	...stiff, very moist to wet.
-10.0	End of Log

Samples

Number	Type	Blow Counts/150 mm	N Value
1	SS	1 2 2 3	4
2	SS	4 13 14	27
3	SS	5 10 15	25
4	SS	7 13 20	33
5	SS	5 12 14	26
6	SS	4 7 9	16
7	SS	5 7 10	17
8	SS	6 9 10	19
9	SS	3 6 10	16
10	SS	4 5 8	13

Penetration / Strength Results — Moisture / Plasticity



Well Details | Groundwater Conditions | Headspace / PID (ppm) [LEL(%)] / ppm | Comments

Additional Notes:
1. Borehole open to approximately 9.3 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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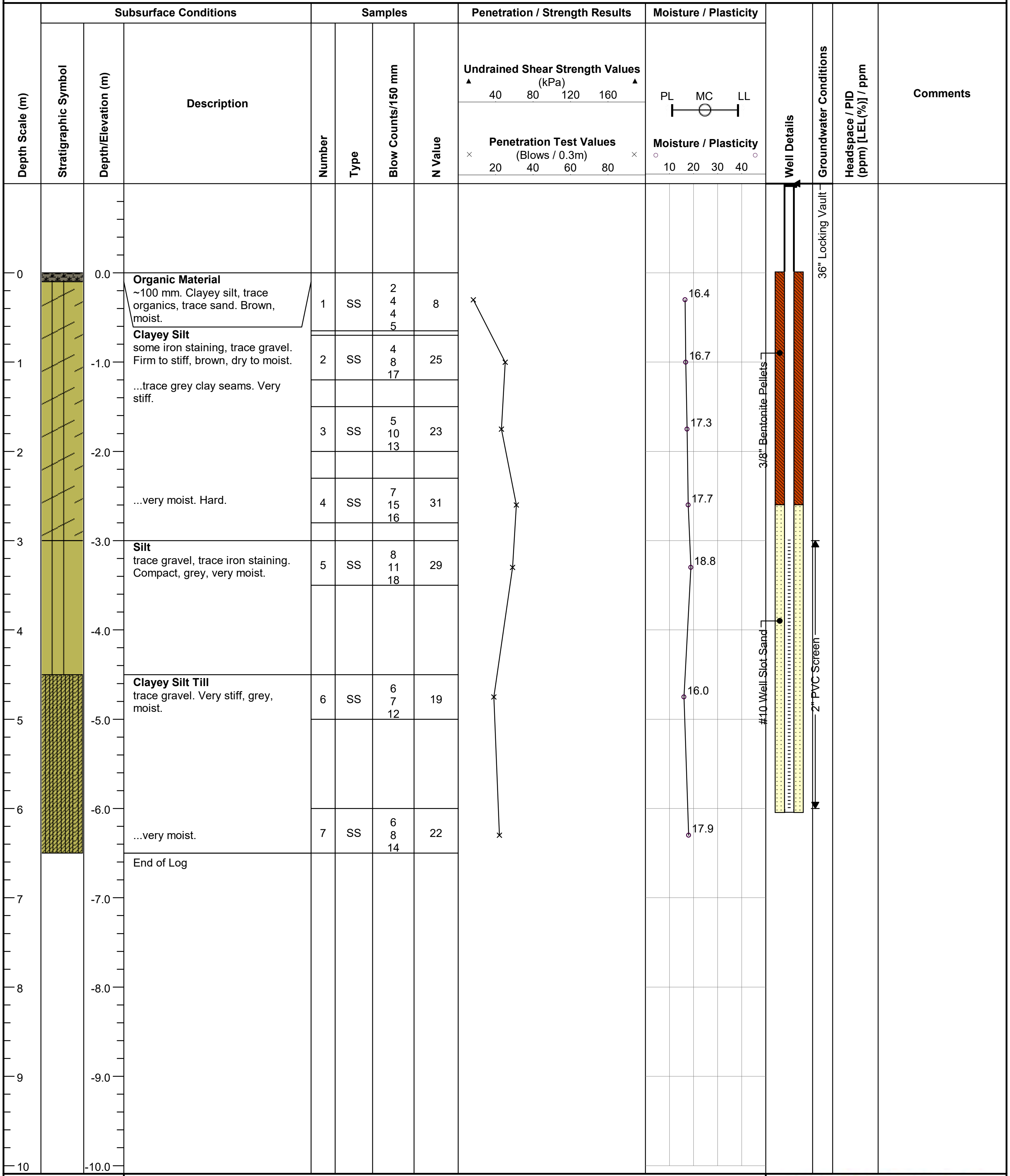
LOG OF BOREHOLE BHMW8

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-05
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.143731
Easting: -79.896422
Ground Surface Elevation: 0



Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value
0.0	**Organic Material** ~100 mm. Clayey silt, trace organics, trace sand. Brown, moist.	1	SS	2 4 4 5	8
	Clayey Silt some iron staining, trace gravel. Firm to stiff, brown, dry to moist.	2	SS	4 8 17	25
	...trace grey clay seams. Very stiff.	3	SS	5 10 13	23
	...very moist. Hard.	4	SS	7 15 16	31
-3.0	**Silt** trace gravel, trace iron staining. Compact, grey, very moist.	5	SS	8 11 18	29
	Clayey Silt Till trace gravel. Very stiff, grey, moist.	6	SS	6 7 12	19
	...very moist.	7	SS	6 8 14	22
	End of Log				

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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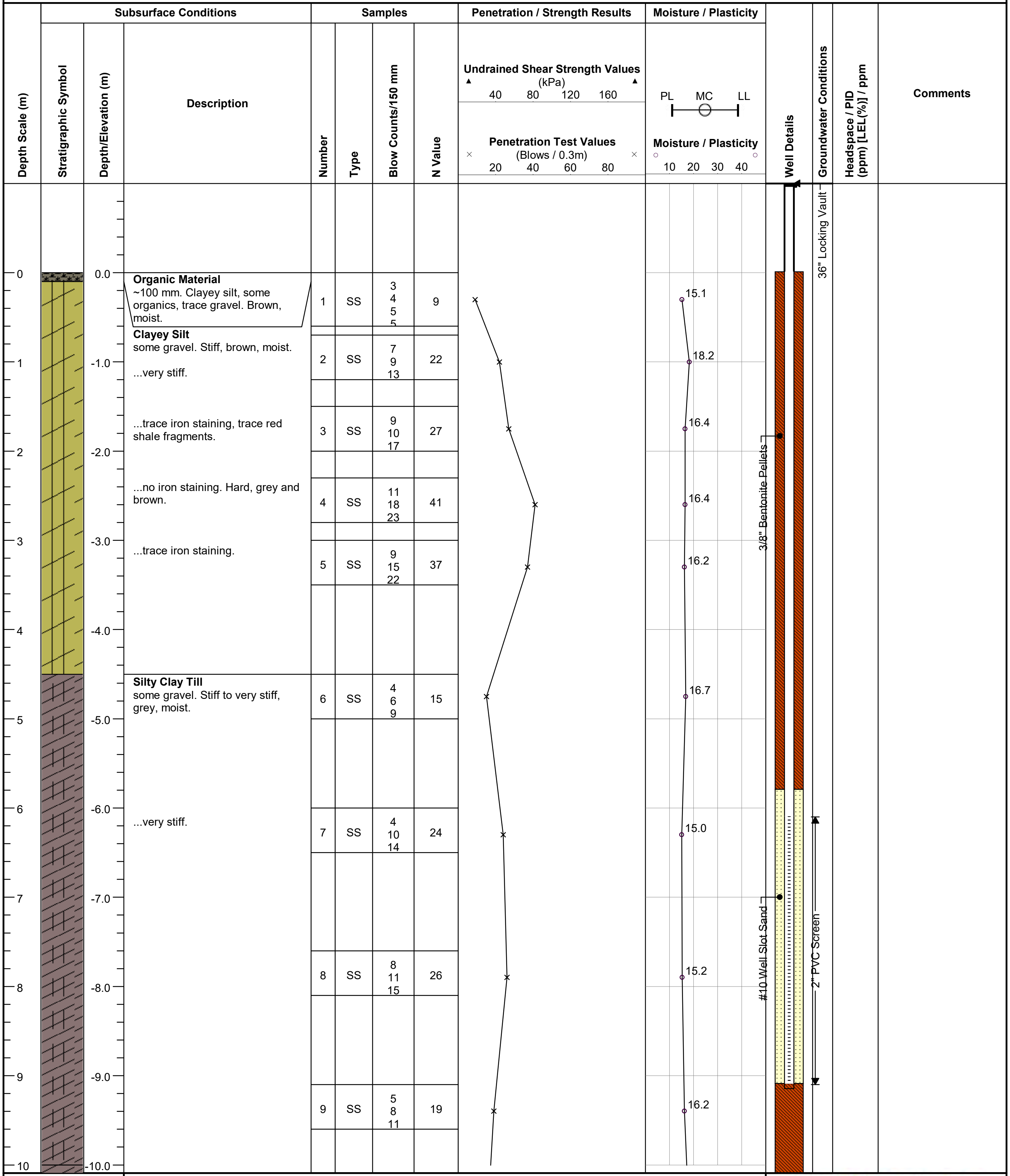
LOG OF BOREHOLE BHMW9

SHEET 1 of 2

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-08
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.139595
Easting: -79.892163
Ground Surface Elevation: 0



Depth/Elevation (m)	Description
0.0	**Organic Material** ~100 mm. Clayey silt, some organics, trace gravel. Brown, moist.
	Clayey Silt some gravel. Stiff, brown, moist.
	...very stiff.
	...trace iron staining, trace red shale fragments.
	...no iron staining. Hard, grey and brown.
-3.0	...trace iron staining.
	Silty Clay Till some gravel. Stiff to very stiff, grey, moist.
-6.0	...very stiff.
-10.0	

Number	Type	Blow Counts/150 mm	N Value	Moisture (%)
1	SS	3 4 5 5	9	15.1
2	SS	7 9 13	22	18.2
3	SS	9 10 17	27	16.4
4	SS	11 18 23	41	16.4
5	SS	9 15 22	37	16.2
6	SS	4 6 9	15	16.7
7	SS	4 10 14	24	15.0
8	SS	8 11 15	26	15.2
9	SS	5 8 11	19	16.2

Additional Notes:
1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LOG OF BOREHOLE BHMW9

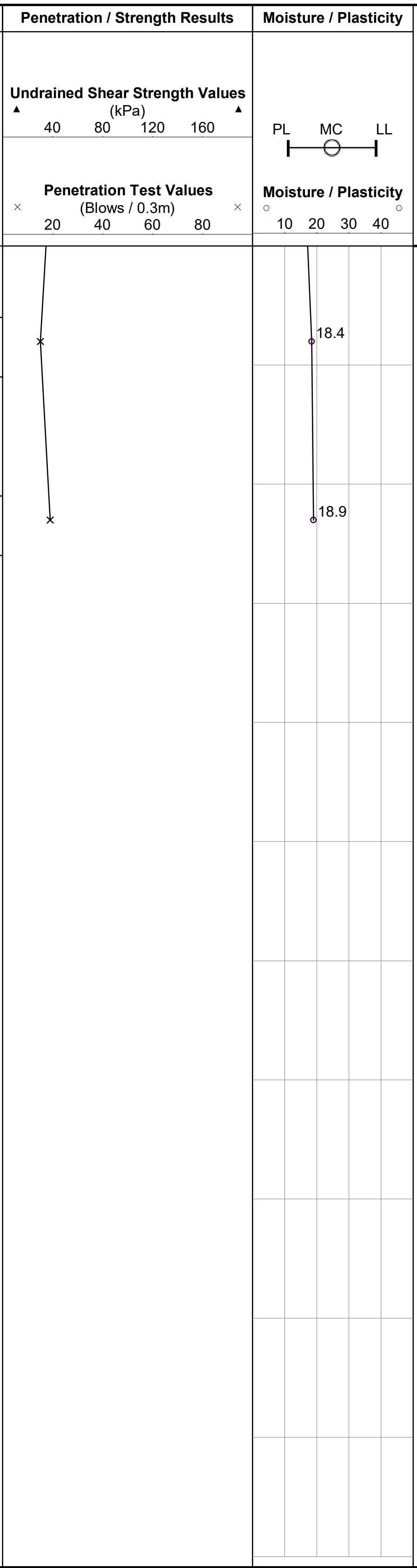
SHEET 2 of 2

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-08
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.139595
Easting: -79.892163
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Subsurface Conditions: Description	Samples: Number	Samples: Type	Samples: Blow Counts/150 mm	Samples: N Value	Moisture / Plasticity: MC (%)	Well Details	Groundwater Conditions	Headspace / PID (ppm) [LEL(%)] / ppm	Comments
		(continued)									
11	-11.0	...stiff to very stiff, moist to very moist.	10	SS	5 7 8	15	18.4				
12	-12.0	...very stiff.	11	SS	4 8 11	19	18.9				
		End of Log									



Additional Notes:
1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BHMW10

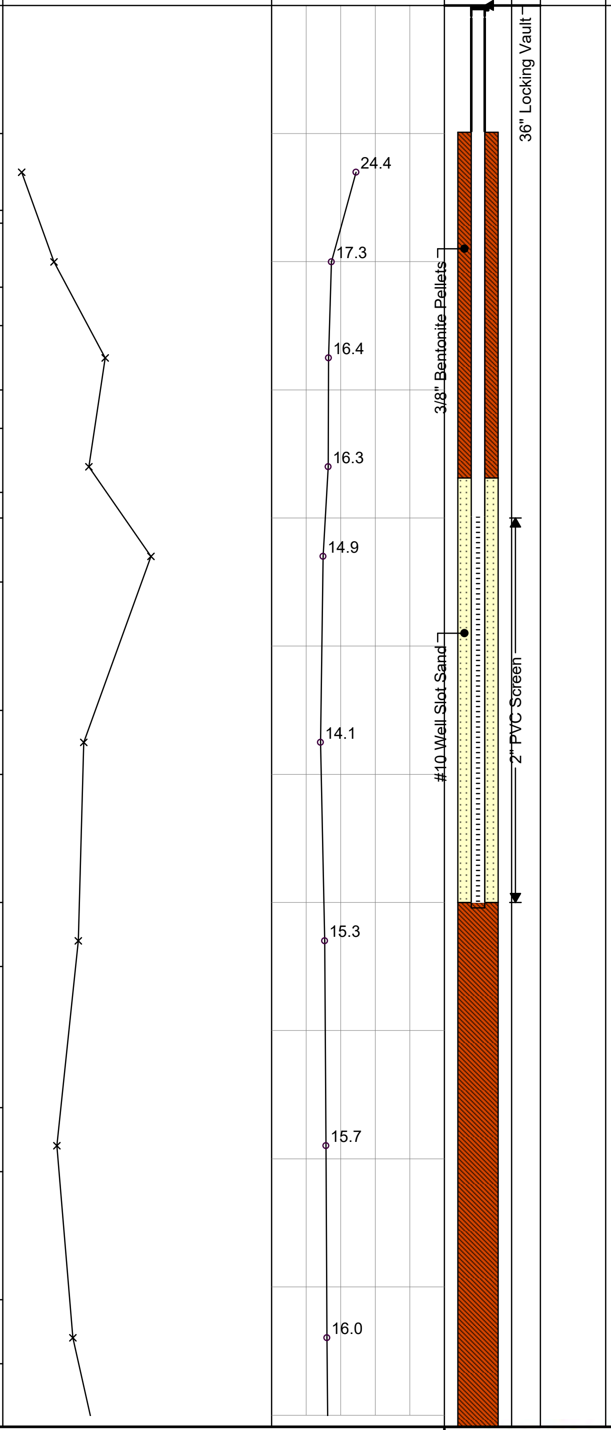
SHEET 1 of 2

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-08
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.142154
Easting: -79.886746
Ground Surface Elevation: 0

Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value
0.0	**Organic Material** ~200 mm. Clayey silt, with organics. Brown, moist. **Clayey Silt** trace grey clay seams. Firm, brown, moist.	1	SS	2 3 4 5	7
-1.0	...very stiff.	2	SS	5 7 12	19
	...trace iron staining. Hard.	3	SS	6 18 21	39
-2.0		4	SS	8 12 20	32
-3.0		5	SS	15 25 30	55
-4.0	**Clayey Silt Till** trace gravel. Very stiff to hard, grey and brown, moist.	6	SS	9 13 17	30
-5.0 -6.0	...very stiff.	7	SS	7 11 17	28
-7.0	**Silty Clay Till** trace gravel. Very stiff, grey, moist.	8	SS	5 8 12	20
-8.0 -9.0		9	SS	5 11 15	26
-10.0					



Additional Notes:
1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BHMW10

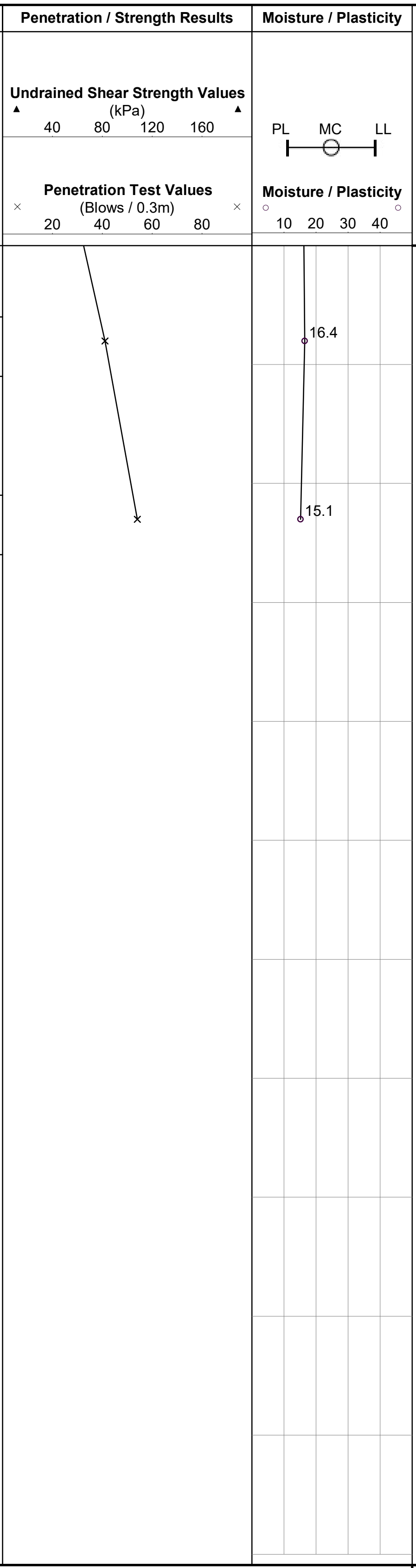
SHEET 2 of 2

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-08
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.142154
Easting: -79.886746
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
		(continued)					
11	-11.0	...hard, moist to very moist.	10	SS	9 20 21	41	
12	-12.0	...very moist.	11	SS	16 26 28	54	
		End of Log					



Additional Notes:
1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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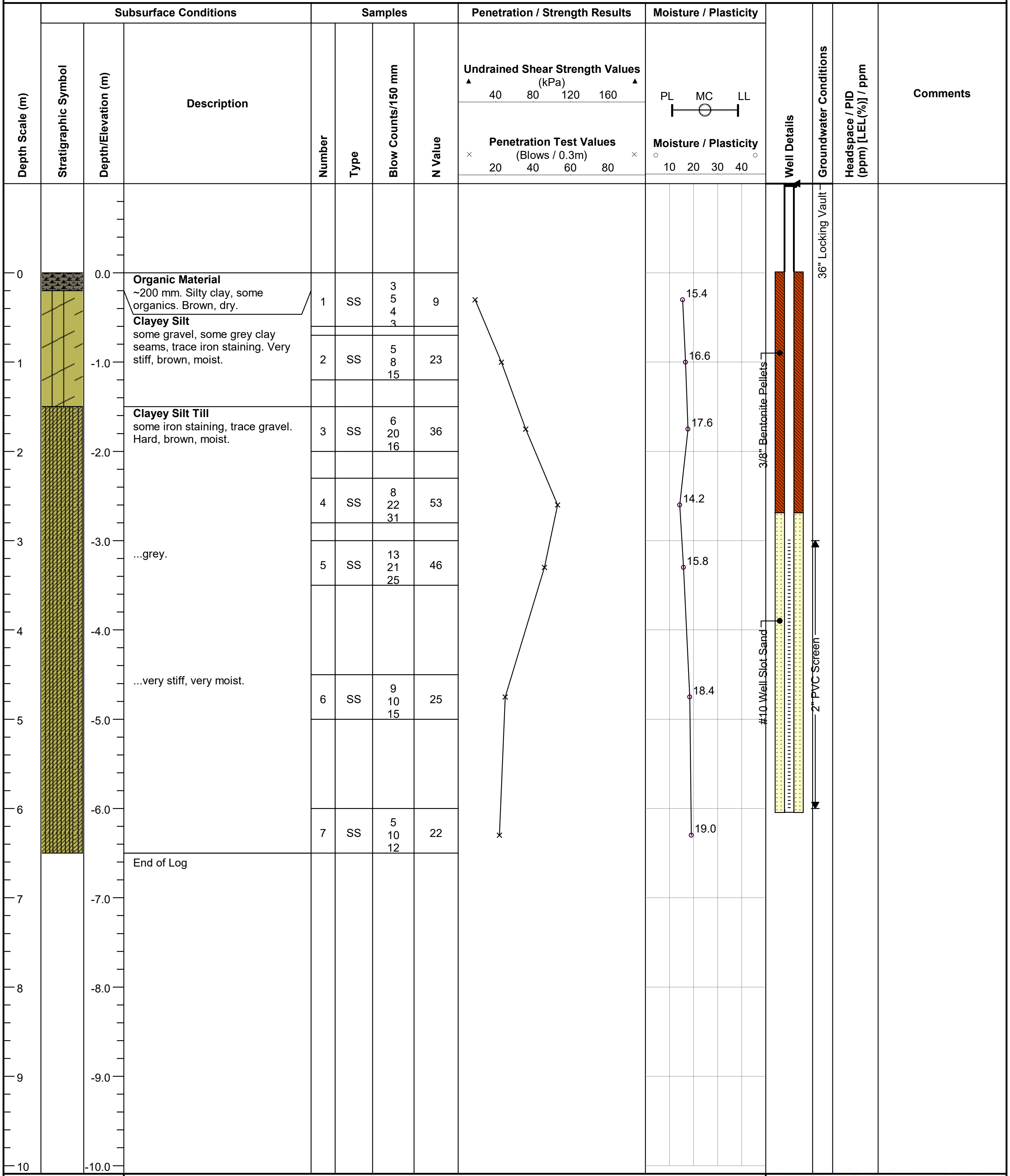
LOG OF BOREHOLE BHMW11

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-08
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.13907
Easting: -79.888437
Ground Surface Elevation: 0



Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value
0.0	**Organic Material** ~200 mm. Silty clay, some organics. Brown, dry.	1	SS	3 5 4 3	9
	Clayey Silt some gravel, some grey clay seams, trace iron staining. Very stiff, brown, moist.	2	SS	5 8 15	23
	Clayey Silt Till some iron staining, trace gravel. Hard, brown, moist.	3	SS	6 20 16	36
		4	SS	8 22 31	53
	...grey.	5	SS	13 21 25	46
	...very stiff, very moist.	6	SS	9 10 15	25
		7	SS	5 10 12	22
	End of Log				

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BHMW12

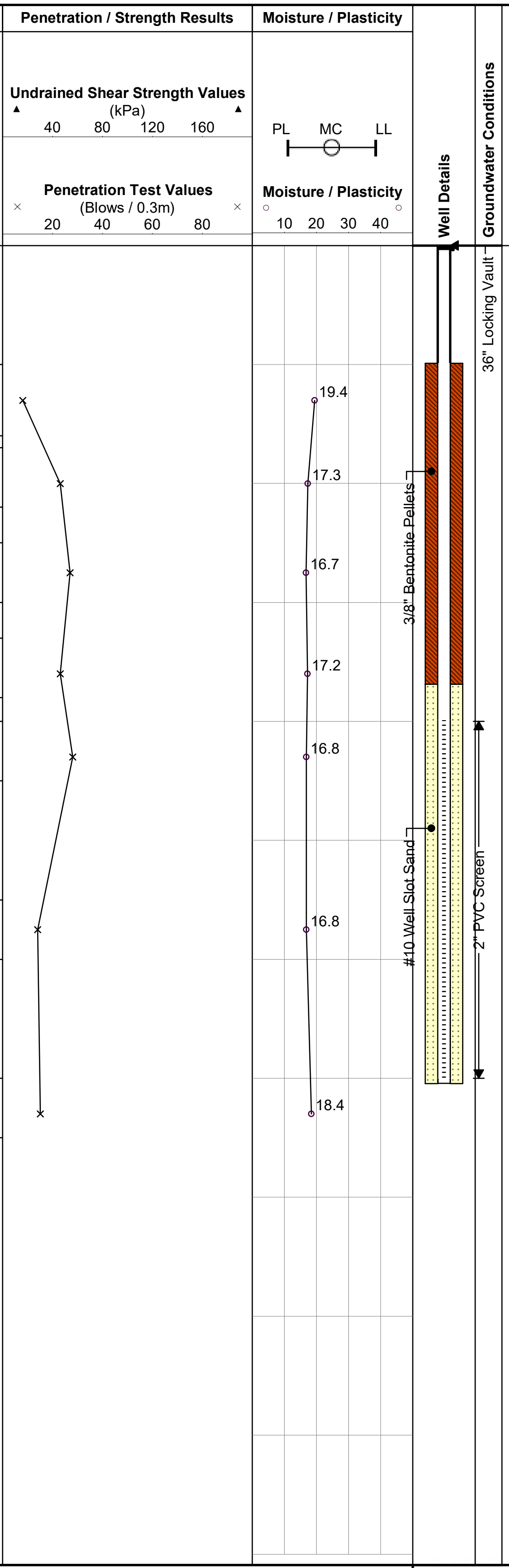
SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-05
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.140212
Easting: -79.902967
Ground Surface Elevation: 0

Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value
0.0	**Organic Material** ~100 mm. Clayey silt, trace organics. Brown, moist.	1	SS	2 4 4 5	8
	Clayey Silt trace iron staining, trace grey clay seams. Firm to stiff, brown, moist.				
-1.0	...very stiff.	2	SS	4 10 13	23
-2.0		3	SS	6 12 15	27
	...moist to very moist.	4	SS	5 8 15	23
-3.0		5	SS	5 11 17	28
-4.0	**Silty Clay Till**				
-5.0	...trace gravel. Stiff, grey, moist.	6	SS	4 7 7	14
-6.0	...trace red shale fragments. Stiff to very stiff, very moist.	7	SS	4 6 9	15
	End of Log				



Comments

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BH13

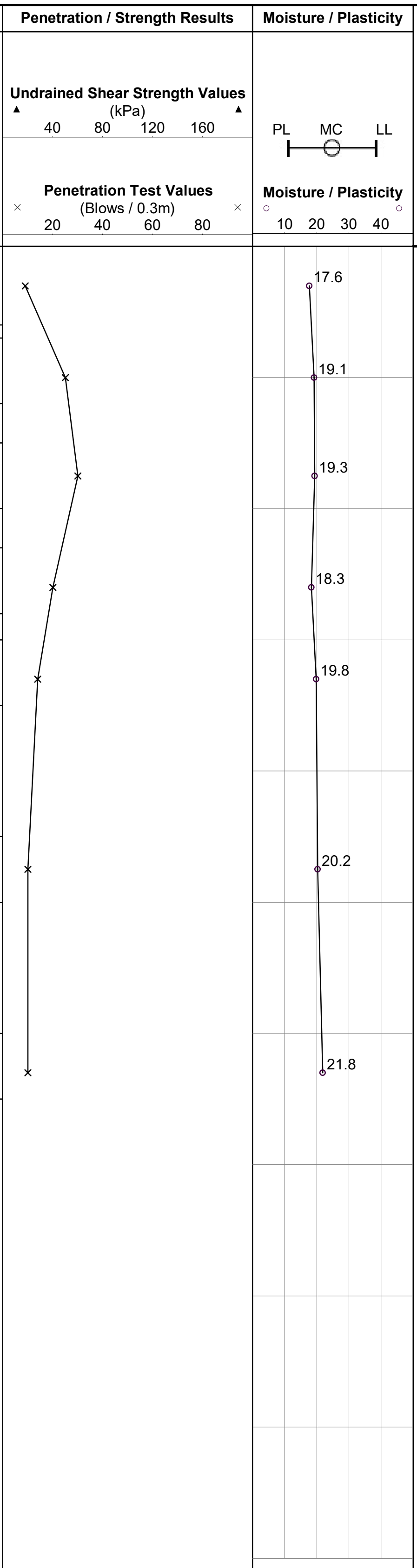
SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-04
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.138818
Easting: -79.90685
Ground Surface Elevation: 0

Subsurface Conditions: Description	Samples: Number	Type	Blow Counts/150 mm	N Value	Moisture / Plasticity: MC
Organic Material ~50 mm. Silt, trace clay, trace organics. Brown, moist. **Clayey Silt** trace grey clay seams. Stiff, brown, moist.	1	SS	4 5 4 4	9	17.6
...very stiff.	2	SS	4 7 18	25	19.1
Clayey Silt Till trace gravel, trace iron staining. Very stiff to hard, grey, moist.	3	SS	5 10 20	30	19.3
...no iron staining. Very stiff.	4	SS	4 8 12	20	18.3
...stiff.	5	SS	3 6 8	14	19.8
	6	SS	2 5 5	10	20.2
...very moist.	7	SS	2 4 6	10	21.8
End of Log					



Well Details | Groundwater Conditions | Headspace / PID (ppm) [LEL(%)] / ppm | Comments

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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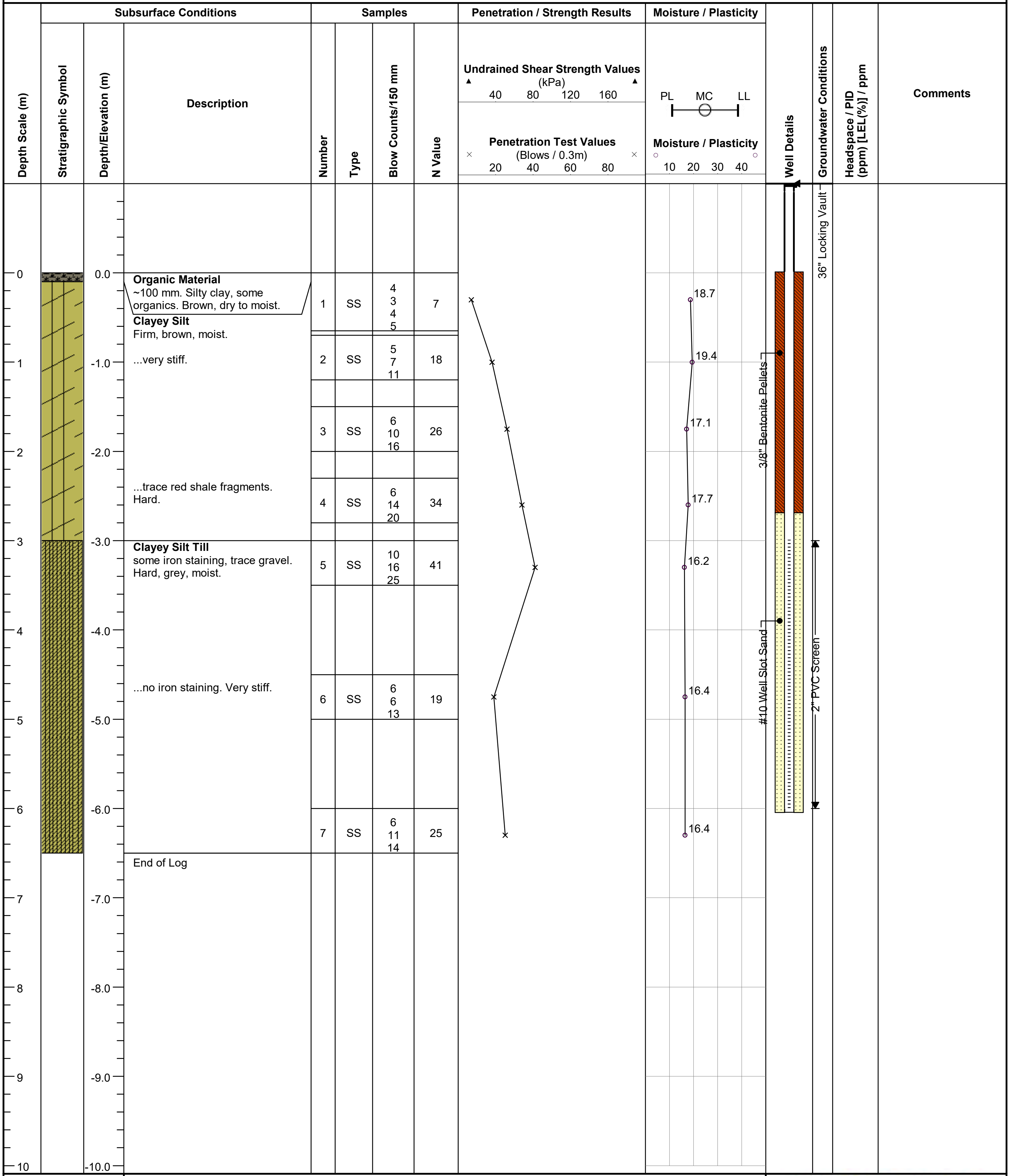
LOG OF BOREHOLE BHMW16

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-08-06
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.14914
Easting: -79.893228
Ground Surface Elevation: 0



Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Moisture (%)
0.0	**Organic Material** ~100 mm. Silty clay, some organics. Brown, dry to moist. **Clayey Silt** Firm, brown, moist.	1	SS	4 3 4 5	7	18.7
	...very stiff.	2	SS	5 7 11	18	19.4
		3	SS	6 10 16	26	17.1
	...trace red shale fragments. Hard.	4	SS	6 14 20	34	17.7
-3.0	**Clayey Silt Till** some iron staining, trace gravel. Hard, grey, moist.	5	SS	10 16 25	41	16.2
	...no iron staining. Very stiff.	6	SS	6 6 13	19	16.4
		7	SS	6 11 14	25	16.4
	End of Log					

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BHMW17

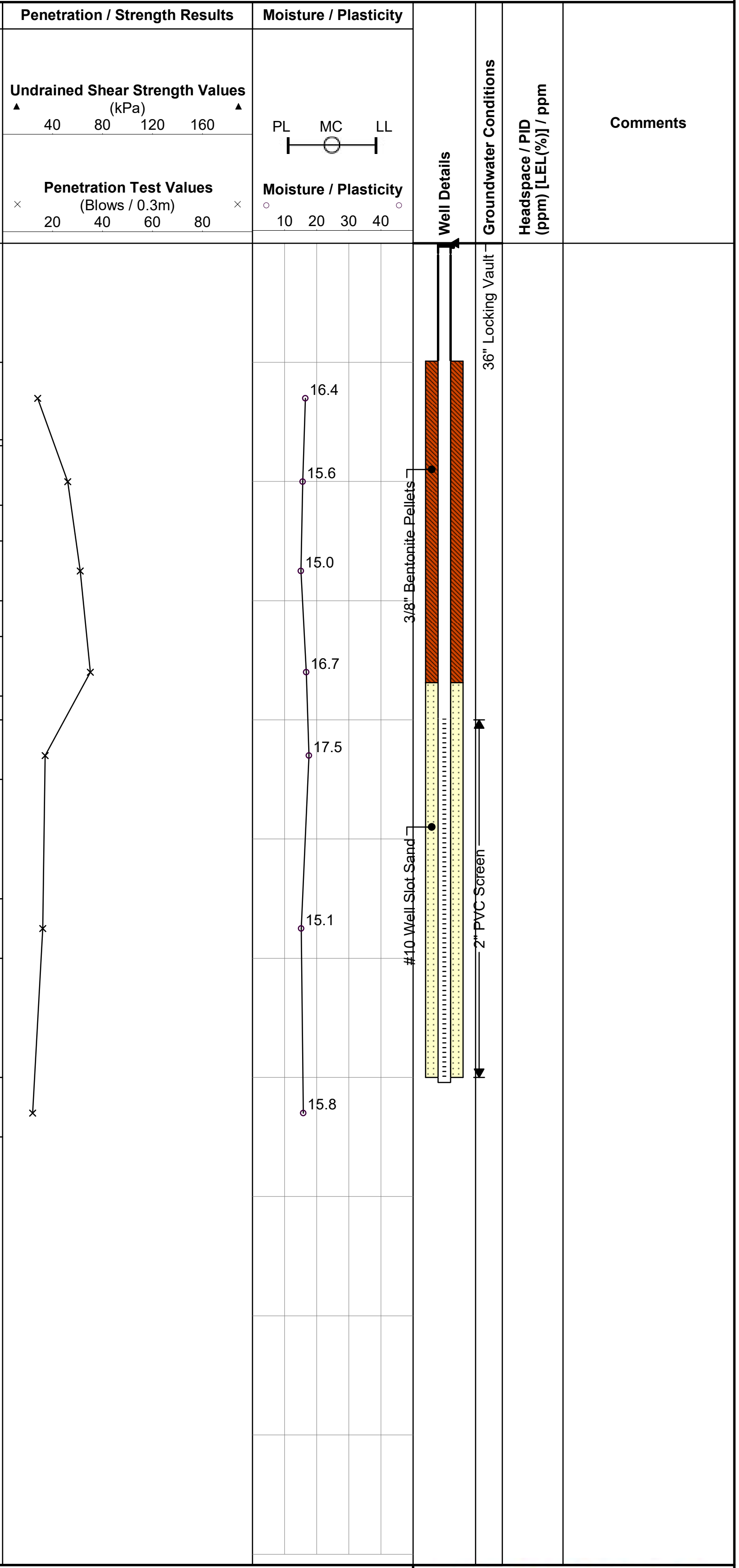
SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-08-06
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.147912
Easting: -79.886182
Ground Surface Elevation: 0

Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value
0.0	**Organic Material** ~100 mm. Silty clay, trace organics. Brown, moist. **Silty Clay** trace gravel. Stiff, brown, moist.	1	SS	3 6 8 7	14
	...very stiff.	2	SS	7 11 15	26
	...hard, brown and grey.	3	SS	10 15 16	31
	Clayey Silt Till trace gravel. Hard, grey, moist.	4	SS	10 16 19	35
-3.0	**Silty Clay Till** trace gravel. Very stiff, grey, moist.	5	SS	5 7 10	17
		6	SS	4 7 9	16
	...stiff, very moist.	7	SS	3 5 7	12
	End of Log				



Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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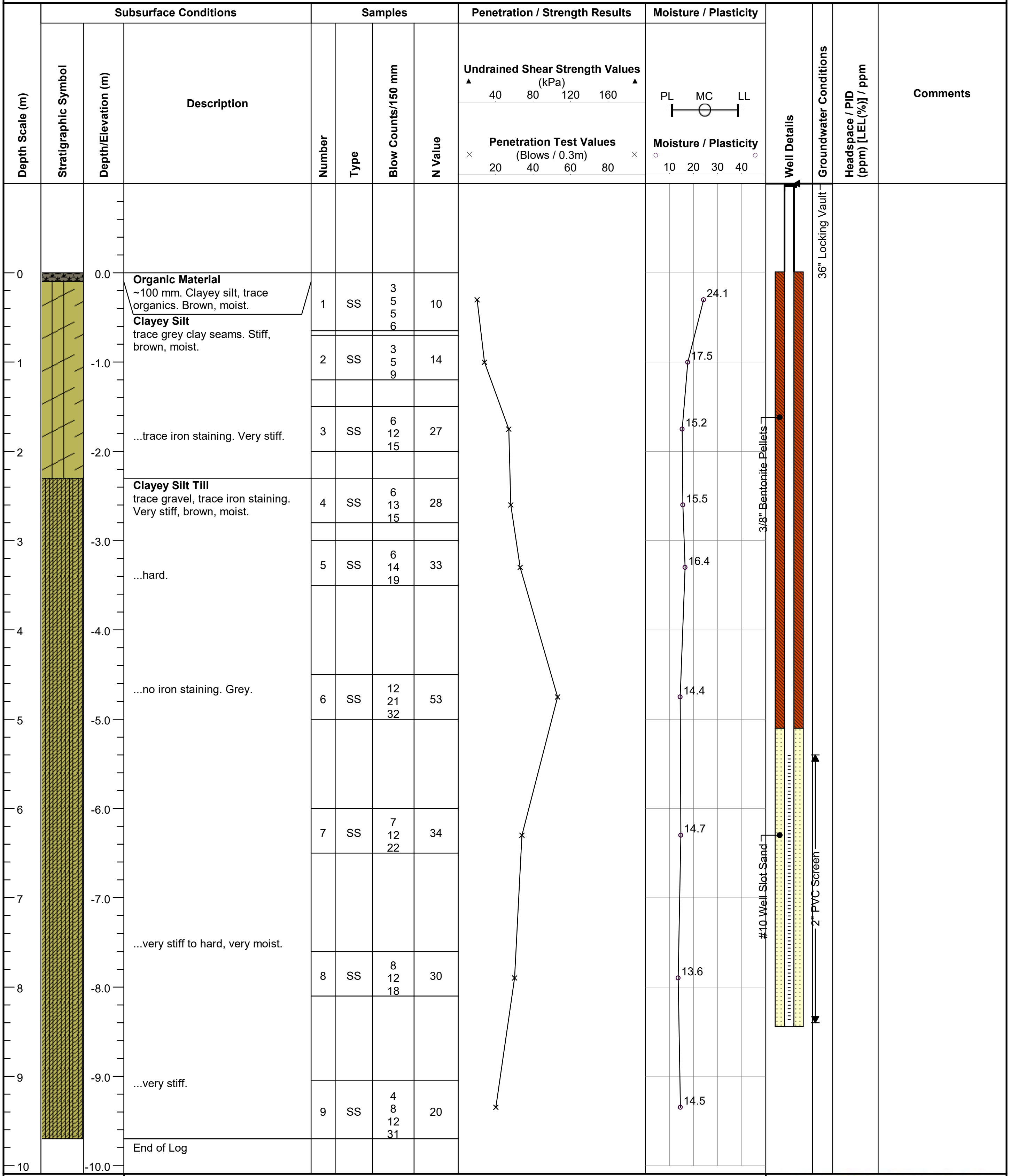
LOG OF BOREHOLE BHMW18

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-08-08
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.147067
Easting: -79.892351
Ground Surface Elevation: 0



Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Moisture (%)
0.0	**Organic Material** ~100 mm. Clayey silt, trace organics. Brown, moist.	1	SS	3 5 5 6	10	24.1
	Clayey Silt trace grey clay seams. Stiff, brown, moist.	2	SS	3 5 9	14	17.5
	...trace iron staining. Very stiff.	3	SS	6 12 15	27	15.2
	Clayey Silt Till trace gravel, trace iron staining. Very stiff, brown, moist.	4	SS	6 13 15	28	15.5
	...hard.	5	SS	6 14 19	33	16.4
	...no iron staining. Grey.	6	SS	12 21 32	53	14.4
		7	SS	7 12 22	34	14.7
	...very stiff to hard, very moist.	8	SS	8 12 18	30	13.6
	...very stiff.	9	SS	4 8 12 31	20	14.5
	End of Log					

Additional Notes:
1. Borehole open, with cave, to approximately 8.4 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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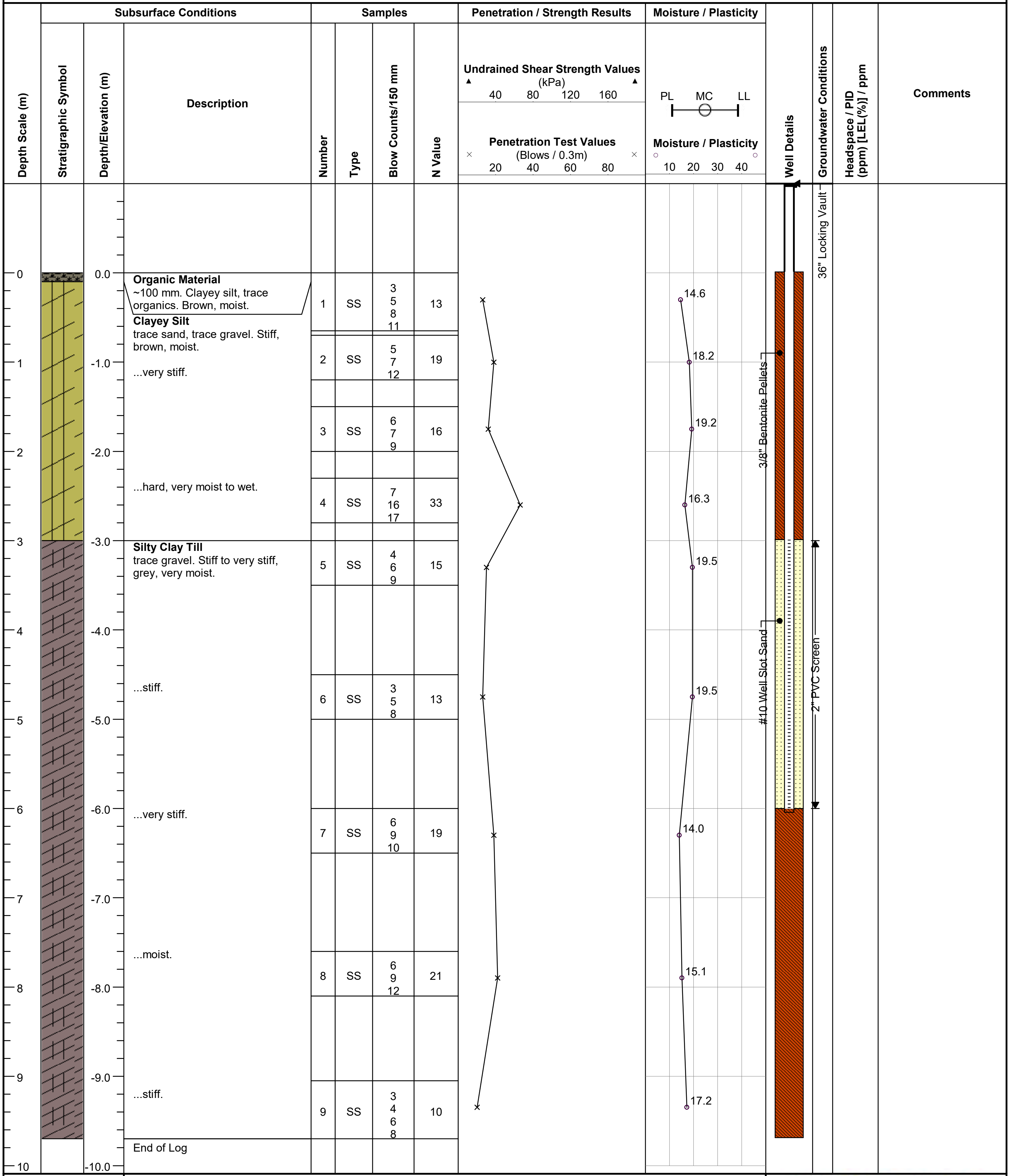
LOG OF BOREHOLE BHMW19D

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-08-07
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.141857
Easting: -79.894982
Ground Surface Elevation: 0



Depth/Elevation (m)	Description
0.0	**Organic Material** ~100 mm. Clayey silt, trace organics. Brown, moist.
	Clayey Silt trace sand, trace gravel. Stiff, brown, moist. ...very stiff. ...hard, very moist to wet.
-3.0	**Silty Clay Till** trace gravel. Stiff to very stiff, grey, very moist. ...stiff. ...very stiff. ...moist. ...stiff.
	End of Log

Number	Type	Blow Counts/150 mm	N Value	Moisture / Plasticity
1	SS	3 5 8 11	13	14.6
2	SS	5 7 12	19	18.2
3	SS	6 7 9	16	19.2
4	SS	7 16 17	33	16.3
5	SS	4 6 9	15	19.5
6	SS	3 5 8	13	19.5
7	SS	6 9 10	19	14.0
8	SS	6 9 12	21	15.1
9	SS	3 4 6 8	10	17.2

Additional Notes:
1. Borehole open to approximately 9.1 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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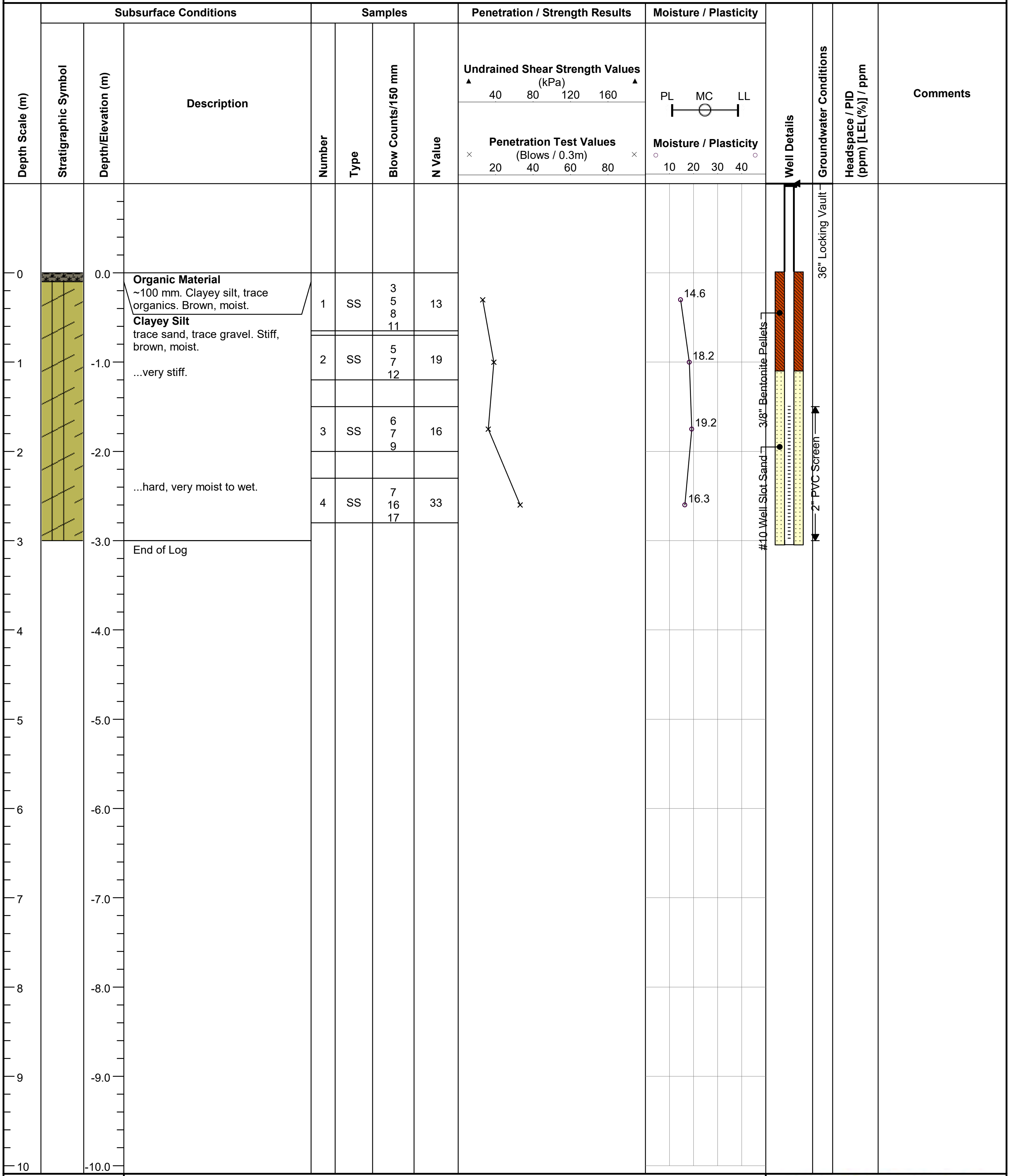
LOG OF BOREHOLE BHMW19S

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-08-07
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.141812
Easting: -79.894825
Ground Surface Elevation: 0



Depth/Elevation (m)	Description
0.0	**Organic Material** ~100 mm. Clayey silt, trace organics. Brown, moist. **Clayey Silt** trace sand, trace gravel. Stiff, brown, moist.
-1.0	...very stiff.
	...hard, very moist to wet.
-3.0	End of Log

Number	Type	Blow Counts/150 mm	N Value
1	SS	3 5 8 11	13
2	SS	5 7 12	19
3	SS	6 7 9	16
4	SS	7 16 17	33

Additional Notes:
1. Borehole open to approximately 3.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BHMW20

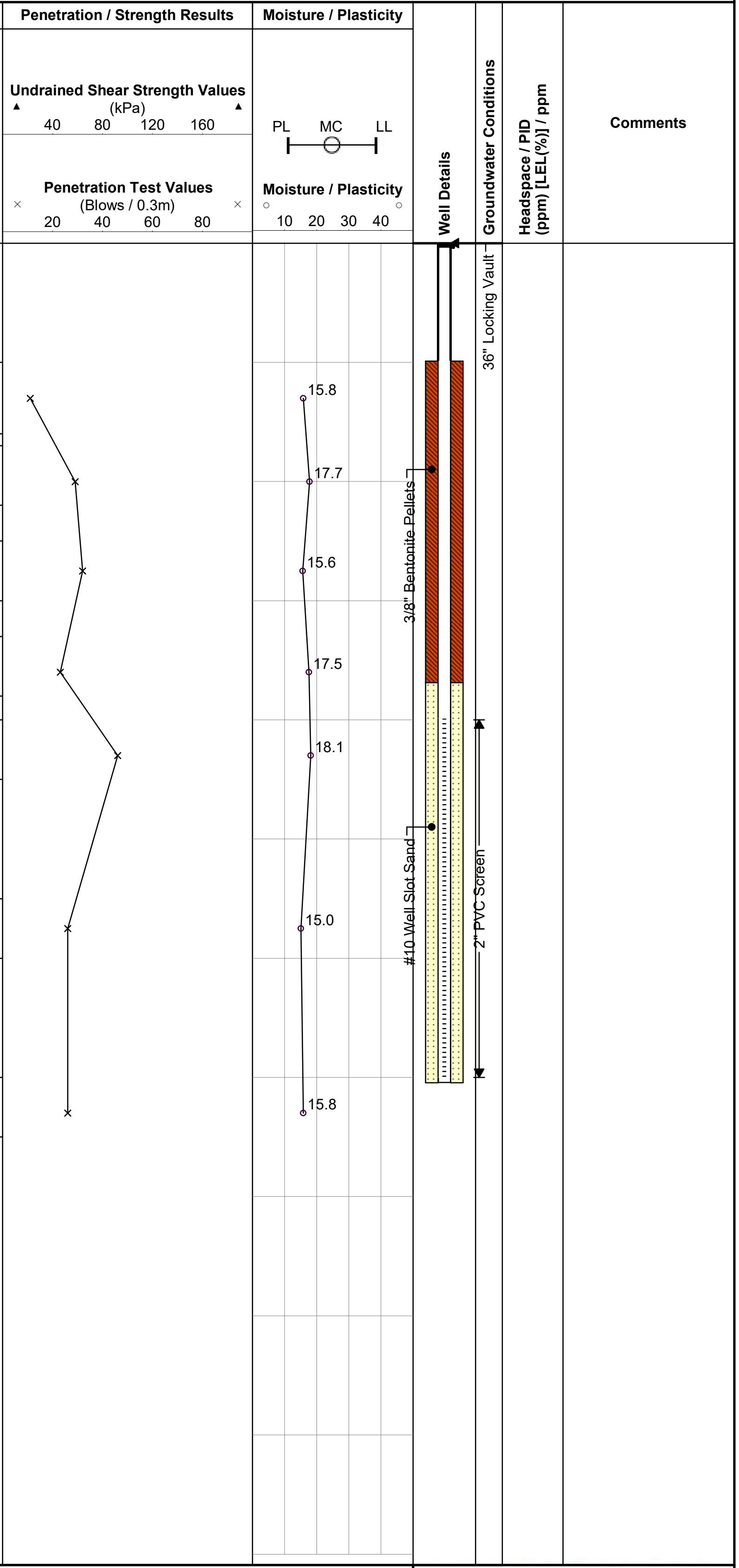
SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-08-07
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.144462
Easting: -79.884115
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value
0	0.0	**Organic Material** ~100 mm. Clayey silt, some organics. **Clayey Silt** trace sand, trace grey clay seams. Stiff, brown, moist.	1	SS	4 5 6 8	11
1	-1.0	...trace iron staining. Very stiff.	2	SS	6 8 21	29
2	-2.0	...no iron staining. Hard.	3	SS	7 11 21	32
			4	SS	4 8 15	23
3	-3.0	**Clayey Silt Till** trace gravel, trace grey clay seams. Hard, grey and brown, very moist.	5	SS	10 20 26	46
4	-4.0					
5	-5.0	...no grey clay seams. Very stiff, grey, moist.	6	SS	4 11 15	26
6	-6.0		7	SS	5 10 16	26
7	-7.0	End of Log				
8	-8.0					
9	-9.0					
10	-10.0					



Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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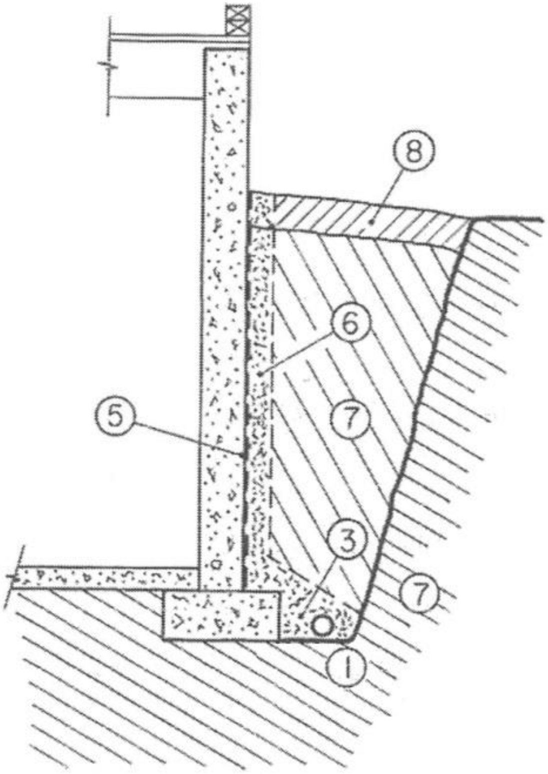
APPENDIX D

DRAWING 23354-02 - ENGINEERING COMMENTARIES – GENERAL REQUIREMENTS FOR DRAINAGE TO BASEMENT STRUCTURES

DRAWING 23354-03 - ENGINEERING COMMENTARIES – GENERAL REQUIREMENTS FOR UNDERFLOOR DRAINAGE SYSTEMS



① 100 mm, perforated or slotted pipe placed below the upper level of the floor slab.;
③ Filter material that is compatible with the grain size characteristics of the fine grained foundation and backfill soils, as well as with the perforations of the pipe;
④ Filter material continuously or intermittently placed next to the foundation wall to intercept water draining from window wells, down exterior walls and from low areas near the building;
⑤ Damp-proofing on wall – optional depending on the quality of the concrete wall;
⑥ Optional use of sheet drain, or synthetic fire blanket, next to the foundation wall to replace the soil filter according to ④;
⑦ Foundation and backfill soils, which may contain fine grained and erosion-susceptible materials;
⑧ "*Topping off*" material is to be graded such that it slopes outwards to lead surface water away from the building. It is usually desirable to use low permeability topsoil to reduce the risk of overloading the drainage pipe.

Based on Figure 12.1, Canadian Foundation Engineers Manual, Fourth Edition, 2006.

Additional Notes:

1. The perforated or slotted drainage pipe is to lead to a positive drainage sump or outlet. The invert of the pipe is to be a minimum of 150 mm below the underside of the proposed floor slab.
2. Backfill materials to the interior of the foundation walls may be clean, organic-free soils that can be compacted to the specified density within in a confined space.
3. Heavy, vibratory compaction equipment should not be used within 450 mm of the foundation wall. Fill is not to be placed or compacted within 1.8 m of the wall unless fill is being placed simultaneously on both sides of the wall.
4. The moisture barrier beneath the floor slab is to comprise at least 200 mm of compacted19mm clear stone or an equivalent free-draining material.
5. Should the 19 mm clear stone require surface blinding then 6mm stone chips are to be used.
6. The slab on grade should not be structurally connected to the foundation wall or footing.

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engineering@landteklimited.com
www.landteklimited.com

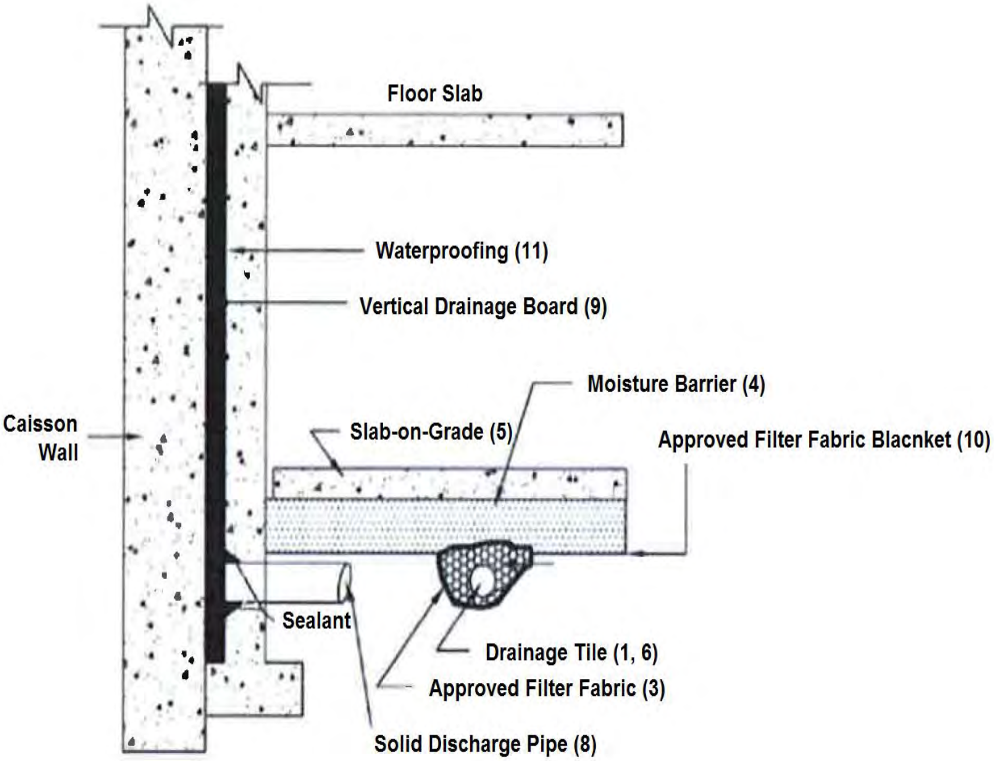
General Requirements for Drainage to Basement Structures

client **White Church Landowners Group Inc.**

project White Church Lands, Hamilton, Ontario

project # 23354

drawing # 23354-02



Notes:

1. Drainage tile, if required for permanent dewatering, to consist of 100 mm diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet, spaced between columns;
2. 19 mm clear stone – 150 mm top and side of drain. If the drain is not on the footing then place 100 mm of 19 mm clear stone below the drain;
3. Wrap the clear stone with an approved filter fabric (e.g., Terrafix 270R or equivalent);
4. Moisture barrier to be at least 200 mm of compacted, 19 mm clear stone or equivalent (and approved), free-draining material. A vapour barrier may be required for specialty floor coverings;
5. Typically, the slab-on-grade is not structurally connected to the wall or footing. However, if it is connected to the walls it should be designed accordingly;
6. Underfloor drain invert, where to be installed, to be at least 300 mm below underside of floor slab. Drainage tile should be placed in parallel rows 6 m to 8 m centres one way. Place drains on 100 mm of 19 mm clear stone and 150 mm of 19 mm clear stone on top and sides. Enclose clear stone with filter fabric as prescribed in Note (3);
7. Do not connect any underfloor drainage to perimeter drainage. The two systems are to remain separate.
8. Locate solid discharge at the middle of each bay between soldier piles;
9. Vertical drainage board (e.g., MiraDrain 6000 or equivalent) with filter cloth should be continuous from bottom to 1.2 m below exterior finished grade;
10. The entire subgrade is to be sealed with an approved filter fabric as in Note (3) where non-cohesive (silty/sandy/granular) soils are encountered below the groundwater table;
11. Where no permanent dewatering is proposed, the basement walls must be waterproofed below the seasonally highest groundwater level (plus 1.0 m to 1.5 m buffer) using bentonite or an equivalent waterproofing system;
12. The Geotechnical Report should be reviewed for site-specific details. Final detail must be approved before system is considered acceptable.

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General Requirements for Underfloor Drainage Systems

client **White Church Landowners Group Inc.**

project White Church Lands, Hamilton, Ontario

project # 23354

drawing # 23354-03

APPENDIX E

CHEMICAL LABORATORY TESTING RESULTS

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Hamilton, ON L8H 7P4
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

Landtek Limited
205 Nebo Road, Unit 3
Hamilton, ON L8W 2E1
Attn: Marco Di Cienzo

Report Date: 30-Aug-2024
Order Date: 28-Aug-2024

Client PO: 23354
Project: 23354
Custody: 73194

Order #: 2435247

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2435247-01	BH1-SS4 & SS5
2435247-02	BH3-SS4 & SS5
2435247-03	BH4-SS3 & SS5
2435247-04	BH6- SS4 & SS5
2435247-05	BH8- SS4 & SS5
2435247-06	BH9- SS3 & SS5
2435247-07	BH10- SS3 & SS5
2435247-08	BH11- SS3 & SS5
2435247-09	BH13- SS3 & SS5
2435247-10	BH16- SS3 & SS5
2435247-11	BH17- SS6 & SS7
2435247-12	BH20-SS6 & SS7

Approved By:

Alex Enfield, MSc

Lab Manager

Certificate of Analysis

Report Date: 30-Aug-2024

Client: **Landtek Limited**

Order Date: 28-Aug-2024

Client PO: 23354

Project Description: 23354

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	29-Aug-24	29-Aug-24
Conductivity	MOE E3138 - probe @25 °C, water ext	29-Aug-24	29-Aug-24
Moisture, %	CWS Tier 1 - Gravimetric	28-Aug-24	29-Aug-24
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	28-Aug-24	29-Aug-24
Resistivity	EPA 120.1 - probe, water extraction	29-Aug-24	29-Aug-24
Solids, %	CWS Tier 1 - Gravimetric	28-Aug-24	29-Aug-24

Certificate of Analysis

Report Date: 30-Aug-2024

Client: **Landtek Limited**

Order Date: 28-Aug-2024

Client PO: 23354

Project Description: 23354

	Client ID:	BH1-SS4 & SS5	BH3-SS4 & SS5	BH4-SS3 & SS5	BH6- SS4 & SS5	-	-
	Sample Date:	27-Aug-24 11:00	27-Aug-24 11:00	27-Aug-24 11:00	27-Aug-24 11:00		
	Sample ID:	2435247-01	2435247-02	2435247-03	2435247-04		
	Matrix:	Soil	Soil	Soil	Soil		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	87.3	86.5	85.5	84.6	-	-
% Moisture	0.1 % by Wt.	12.7	13.5	14.5	15.4	-	-
General Inorganics							
Conductivity	5 uS/cm	507	143	217	129	-	-
pH	0.05 pH Units	7.71	7.81	7.81	7.77	-	-
Resistivity	0.10 Ohm.m	19.7	69.9	46.0	77.5	-	-
Anions							
Chloride	5 ug/g	<5	10	<5	11	-	-
Sulphate	5 ug/g	616	63	149	109	-	-

	Client ID:	BH8- SS4 & SS5	BH9- SS3 & SS5	BH10- SS3 & SS5	BH11- SS3 & SS5	-	-
	Sample Date:	27-Aug-24 11:00	27-Aug-24 11:00	27-Aug-24 11:00	27-Aug-24 11:00		
	Sample ID:	2435247-05	2435247-06	2435247-07	2435247-08		
	Matrix:	Soil	Soil	Soil	Soil		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	85.9	86.7	86.6	87.0	-	-
% Moisture	0.1 % by Wt.	14.1	13.3	13.4	13.0	-	-
General Inorganics							
Conductivity	5 uS/cm	639	165	127	549	-	-
pH	0.05 pH Units	7.80	7.82	7.84	7.87	-	-
Resistivity	0.10 Ohm.m	15.7	60.5	78.6	18.2	-	-
Anions							
Chloride	5 ug/g	<5	<5	<5	<5	-	-
Sulphate	5 ug/g	934	42	29	770	-	-

Certificate of Analysis

Report Date: 30-Aug-2024

Client: **Landtek Limited**

Order Date: 28-Aug-2024

Client PO: 23354

Project Description: 23354

Client ID:		BH13- SS3 & SS5	BH16- SS3 & SS5	BH17- SS6 & SS7	BH20-SS6 & SS7	-	-
Sample Date:		27-Aug-24 11:00	27-Aug-24 11:00	27-Aug-24 11:00	27-Aug-24 11:00		
Sample ID:		2435247-09	2435247-10	2435247-11	2435247-12		
Matrix:		Soil	Soil	Soil	Soil		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	85.5	85.4	86.9	87.2	-	-
% Moisture	0.1 % by Wt.	14.5	14.6	13.1	12.8	-	-
General Inorganics							
Conductivity	5 uS/cm	387	151	483	340	-	-
pH	0.05 pH Units	7.87	7.84	7.88	7.89	-	-
Resistivity	0.10 Ohm.m	25.9	66.3	20.7	29.4	-	-
Anions							
Chloride	5 ug/g	<5	6	<5	<5	-	-
Sulphate	5 ug/g	479	116	672	428	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions								
Chloride	ND	5	ug/g					
Sulphate	ND	5	ug/g					
General Inorganics								
Conductivity	ND	5	uS/cm					
Resistivity	ND	0.10	Ohm.m					

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	5.01	5	ug/g	ND			NC	20	
Sulphate	627	5	ug/g	616			1.8	20	
General Inorganics									
Conductivity	526	5	uS/cm	507			3.7	5	
pH	7.44	0.05	pH Units	7.47			0.4	10	
Resistivity	19.0	0.10	Ohm.m	19.7			3.7	20	
Physical Characteristics									
% Moisture	11.2	0.1	% by Wt.	10.3			8.2	25	
% Solids	88.8	0.1	% by Wt.	89.7			1.0	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	11.4	5	ug/g	ND	109	80-120			
Sulphate	71.3	5	ug/g	61.6	97.7	80-120			

Appendix B Hydrogeology

Preliminary Hydrogeological Investigation
Proposed Development
White Church Road East and Upper James Street,
Hamilton, Ontario

Prepared for:

White Church Landowners Group Inc.
% SCS Consulting Group
30 Centurian Drive, #100
Markham, Ontario
L3R 8B8

Landtek File: 23355
January 30, 2025

■ FOUNDATION INVESTIGATIONS ■ ENVIRONMENTAL SITE ASSESSMENTS AND CLEANUP ■ GROUNDWATER STUDIES ■ SLOPE STABILITY STUDIES
■ ASPHALT TECHNOLOGY ■ ASPHALT MIX DESIGNS ■ PAVEMENT PERFORMANCE ANALYSIS ■ CONSTRUCTION MATERIALS TESTING & INSPECTION
■ ANALYSIS OF SOIL CORROSION POTENTIAL ■ PAVEMENT REHABILITATION & TENDER SPECIFICATIONS ■ CONCRETE QUALITY ASSURANCE TESTING
■ ROOF INSPECTIONS ■ INFRASTRUCTURE NEEDS STUDIES ■ FAILURE ANALYSIS AND EXPERT WITNESS SERVICES ■ AGGREGATE EVALUATION

EXECUTIVE SUMMARY

SCOPE OF SERVICES	
Proposed Development	It is understood that any future development to be undertaken at the site is likely to comprise of single-detached, townhouse and residential condominium development for low density zones, low- to mid-rise towers and stacked townhouses in medium-density zones and high-rise towers in high-density zones. The development is also expected to include for community parks, institutional and community centre blocks, woodland lots and Storm Water Management ponds.
Report Deliverables	The Preliminary Hydrogeological Investigation Report is required to provide an understanding of the current site groundwater conditions, and a preliminary determination of the potential development effects of the proposed development.
SITE DETAILS AND SETTING	
Coordinates	589650, 4777630
Geodetic Elevation	220 m to 232 m
Site Description	The site is situated along both White Church Road and Airport Road, it is approximately 3,644,000 m2 (364.4 hectares) in plan area and is semi-rectangular in shape. The site is of agricultural and commercial use during most of the year, with a few areas of residential use. It is bound to the south by White Church Road, to the west by Upper James Street, to the north by Airport Road, and to the east by Miles Road. The topography of the site is generally of an undulating, glacial horizon.
Geology	Organic soil was encountered at the ground surface. Interbedded deposits of silt, clayey silt/silty clay and till deposits were encountered underlying the organic material in all boreholes and extends to the maximum dill depths of between 6.0 m and 12.6 m below the ground surface.
Groundwater Analysis	Groundwater samples were collected from 3 monitoring wells at the Site analyzed for the Provincial Water Quality Objective (PWQO) parameters. All analyzed parameters were within guideline Limits with the exception of Total Cobalt, Total Iron, Total Silver, and Total Uranium as shown in Section 3.12 of this report.
DEWATERING CONSIDERATIONS	
Short Term and Long Term	Given the absence of a development plan, this investigation is to be considered preliminary until such time that a development concept is available for each development parcel and an appropriate, more detailed investigation is completed to complement the development plan. As a result, detailed water taking evaluation and impact assessment could not be completed at this time.
Monitoring and Mitigation Plans	This will be provided when a development concept is available for each development parcel and an appropriate, more detailed investigation is completed to compliment the development plan.
PERMIT CONSIDERATIONS	
EASR or PTTW	This will be provided when a development concept is available for each development parcel and an appropriate, more detailed investigation is completed to compliment the development plan, if applicable.
IMPACTS CONSIDERATION	
Impacts	This will be provided when a development concept is available for each development parcel and an appropriate, more detailed investigation is completed to compliment the development plan.

Table of Contents

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Appendix G – Root Crop/Pasture and Scrubs Area Water Budget & Run-Off
Appendix H – Wooded Areas Water Budget & Run-Off

1.0 INTRODUCTION

1.1 Background

Landtek Limited (Landtek) has been retained by Mr. Nicholas Mcintosh, P. Eng., of SCS Consulting Group Ltd. (herein "*SCS*") on August 28, 2023, acting on behalf of the White Church Landowners Group Inc. to complete a Preliminary Hydrogeological Investigation for the proposed development located at the site identified as White Church Lands at White Church Road and Airport Road in Hamilton, Ontario (the Site or development).

The area comprises primarily of agricultural land used for arable purposes. Existing residential properties fringe the area, following the Municipal Road corridors that form the area boundaries, with the existing Southern Pines Golf and Country Club is located in the northwestern corner.

The site is located in Hamilton, Ontario, and is centered at approximate grid reference 589650, 4777630 (UTM 17T coordinates). The Geodetic elevation of the ground surface at the site is approximately 220 m to 230 m. It has a total area of approximately 3,643,670 m^2 (364.367 hectares) in plan area and is semi-rectangular in shape. The site includes the lands bound by Upper James Street to the west, Miles Road to the east, Airport Road East to the north, and mostly by White Church Road East to the south, with the exception of Parcel C4 which abuts to the south. The Site location, and Concept Plan are shown on Figures 1 and 2 in Appendix A, respectively.

At the time of issue of this report, Landtek understands that no designs are available for the development area other than the preliminary layout of low- medium- and high-density zoning. It is understood however, that any development to be undertaken at the site is likely to comprise of single-detached, townhouse and residential condominium development for low density zones, low- to mid-rise towers and stacked townhouses in medium-density zones and high-rise towers in high-density zones.

The development is also expected to include for community parks, an institutional and community centre block, and Storm Water Management (herein "*SWM*") ponds. New municipal and private road pavement structures and services are also anticipated.

Given the absence of a development plan, this investigation is to be considered preliminary until such a time that a development concept is available for each development parcel and an appropriate, more detailed investigation is completed to compliment the development plan. On this basis, the primary objectives of this investigation are to evaluate the groundwater conditions at the site. Specifically, the report provides the following:

- A description of the hydrogeologic setting of the Site and a summary of the existing soil/bedrock and groundwater conditions at the site.
- Identification of hydrogeologic features such as zones of significant groundwater recharge and discharge.
- Assessment of preliminary potential impacts resulting from development at the site.

1.2 Scope of work

It is understood that a Hydrogeological Investigation is required for the proposed development in order to determine the hydrogeological condition at the site and potential impacts of proposed developments.

The hydrogeological investigation shall include a complete site assessment of existing conditions along with recommendations required in support of a Plan approval. The investigation should be completed in such a manner to be compatible with future additional investigations required for detailed municipal engineering design and construction considerations.

The following scope of work is based on the terms of reference for the hydrogeological investigation.

- Review of available hydrogeological information and MECP well records; site inspection, including walking all drainage features for evidence of seeps, areas of closed drainage, erosion
- Installation of monitoring wells to a depth of 6.0 m below ground surface (mbgs).
- Installation of monitoring wells to a depth of 10.0 mbgs.
- Installation of nested monitoring wells to a depth of 3.0 mbgs.
- Installation of piezometers to ascertain significance of groundwater discharge to adjacent features
- Completion of groundwater level monitoring for a period of twelve months.
- Observation of surface water flow at water drainage features.
- Installation of dataloggers for continuous groundwater level monitoring
- Completion of in-situ hydraulic conductivity testing at selected monitoring wells.
- Completion of groundwater sampling analysis for PWQS parameters analyses.
- Completion of preliminary water balance and development impact assessment.
- Completion of a report and data analyses to include groundwater contour mapping/flow direction, dewatering considerations, and discussion of the characteristics of local aquifers or aquitards

1.3 Proposed Investigation

This investigation includes the following:

- Review of available background information. A review of published works of available geologic and hydrogeologic information for the site including topographical and geological maps and water well records. A review of Meteorological data to assess the local climate.

- Site Assessment. A detailed visual inspection of the site and surrounding area to identify and document local topography, surface water drainage features, and the potential presence of significant hydrogeological features such as closed depressions (areas of ground water recharge), seeps, springs, or the presence of phreatophytic vegetation.

- A subsurface investigation. Drilling of boreholes and monitoring wells at the Site to characterize the subsurface soil and/or bedrock as well as assess the site-specific groundwater conditions.

- Hydraulic Conductivity Tests. In-situ rising head tests in selected installed monitoring wells to assess the subsurface soil and/or bedrock hydraulic conductivity.

- Groundwater Monitoring. Groundwater level monitoring in all monitoring wells in order to assess the depth of groundwater level across the site.

2.0 METHODOLOGY

2.1 Desktop Study

A review of published available geological and hydrogeological information for the site including topographic and geological maps was completed.

The Ministry of Environment, Conservation and Park (MECP) water well database for the local area was also accessed and the individual well record obtained for wells located within 500 m radius of the Site.

2.2 Site Inspection to Assess Hydrogeologic Features

A detailed visual inspection of the site and surrounding areas was conducted on June 12, 2024, to assess the presence of features which may be significant from a hydrogeologic viewpoint. In particular, the site was inspected to assess the following:

- The presence of closed drainage features, depressions, or sandy areas which may allow for ponding and significant or enhanced infiltration of water.
- Assessment of the presence of phreatophytic vegetation which may indicate seasonally high groundwater levels and/or groundwater discharge and seepage.
- Identification of any zones of visible seepage or groundwater discharge.

2.3 Field Investigation

2.3.1 Drilling and Well Installation

Fieldwork undertaken at the site by Landtek included clearance of underground services, borehole layout, borehole drilling and soil sampling, and field supervision. A total of twenty-one boreholes (boreholes BH1 to BH24, excluding BH14, BH15 and BH21) were drilled in phases on March 11, and between July 4 and August 8, 2024. Boreholes BH22, BH23 and BH24 were drilled on January 6, 2025.

The boreholes were drilled using a Dietrich D-50 track mounted drill rig equipped with continuous flight, solid stem augers to a maximum depth of between approximately 6.0 m and 12.1 m. Full time supervision of drilling and soil sampling operations was carried out by a representative of Landtek.

Fifteen (15) boreholes were completed as monitoring wells and re-identified as boreholes BH/MW3S/D (nested), BH/MW4, BH/MW6, BH/MW8, BH/MW9, BH/MW10, BH/MW11, BH/MW12, BH/MW16, BH/MW17, BH/MW18, BH/MW19S/D (nested), BH/MW20, BH/MW22 and BH/MW24. The monitoring wells consisted of new/sealed 50 mm polyvinyl chloride (PVC) screen with No.10 slots threaded onto a matching riser. The screens and risers were pre-threaded including o-ring seals such that no glues or solvents were used to connect the pipe sections. The annular space between the PVC well and the borehole was backfilled to approximately 0.3 m above the top of the screen section with sand pack, and then with bentonite to existing ground level. A J-Plug lockable air-tight cap was installed on the riser. The monitoring well installation details are presented on the respective borehole logs provided in Appendix B. The locations of these boreholes are shown on Figure 3 in Appendix A.

The boreholes were advanced using a continuous flight power auger track-mounted drill rig equipped with conventional soil sampling and testing tools. The drilling was conducted by an experienced drilling contractor under the supervision of a member of Landtek staff who logged the borings and examined the samples as they were obtained.

The borehole locations were established by Landtek relative to site measurements and existing site features. All depth-related remarks relative to topographical survey information available for the site, drawing reference 365466-T, as completed by A. T. McLaren Ltd.

A summary of the monitoring well installation details is presented on below in Table 1.

Table 1. Monitoring Wells Construction Details

Monitoring Well ID	Easting* (NAD83)	Northing* (NAD83)	Well Depth (mbgs)	Stick-up (m)	Screened Interval (m)	Screened Material
BH/MW3S	589468	4777821	3.0	1.07	1.5-3.0	Clayey Silt Till/Silt Till
BH/MW3D	589468	4777821	6.0	1.15	3.0-6.0	Silt Till
BH/MW4	588218	4777526	6.0	1.01	3.0-6.0	Clayey Silt Till/Silty Clay Till
BH/MW6	589149	4777202	6.0	1.16	3.0-6.0	Clayey Silt/Silty Clay Till
BH/MW8	589744	4777357	6.0	0.95	3.0-6.0	Silt Till/Clayey Silt Till
BH/MW9	590102	4776924	9.0	1.13	6.0-9.0	Silty Clay Till
BH/MW10	590528	4777243	6.0	1.12	3.0-6.0	Clayey Silt/Clayey Silt Till
BH/MW11	590475	4776897	6.0	1.09	3.0-6.0	Clayey Silt Till
BH/MW12	589299	4776966	6.0	1.10	3.0-6.0	Clayey Silt/Silty Clay Till
BH/MW16	589889	4777957	6.0	1.20	3.0-6.0	Clayey Silt/Clayey Silt Till
BH/MW17	590572	4777889	6.0	1.04	3.0-6.0	Silty Clay Till
BH/MW18	590082	4777727	8.4	1.06	5.4-8.4	Clayey Silt Till
BH/MW19S	589840	4777144	3.0	1.30	1.5-3.0	Clayey Silt Till
BH/MW19D	589840	4777144	6.0	1.30	3.0-6.0	Silty Clay Till
BH/MW20	590742	4777461	6.0	1.10	3.0-6.0	Clayey Silt Till

Notes:
masl = meters above sea level
mbgs = meters below ground level
m = meters
* Values are approximate by GPS +/- 4 m

2.3.2 Drive-Point Piezometers Installation

On July 3rd and 4th, 2024, Landtek personnel installed eight (8) drive-point piezometers, consisting of deep piezometers (i.e., DP1, DP2, DP3, DP4, DP5, DP6, DP7, and DP9) at surface water bodies locations determined by Beacon Environmental (Figure 4). The piezometers were installed to evaluate whether these water bodies function as a groundwater recharge feature (i.e., contributes water to subsurface), discharge feature (receives water from the subsurface), or a combination of both.

Each drive-point piezometer is constructed of a 0.31 m long stainless-steel screen (25 mm diameter) that is connected to a 0.31 m long, 25 mm diameter steel riser pipes. Landtek personnel drove the drive-point piezometers into the substrate using a sledgehammer in accordance with standard procedure.

A summary of the construction details for the drive-point piezometers installation is presented on the following page in Table 2, and the locations of the piezometers are shown on Figure 4, in Appendix A.

Table 2. Piezometers Construction Details

Piezometer ID	Easting* (NAD83)	Northing* (NAD83)	Depth (mbgs)	Stick-up (m)
DP1	589573	4777750	0.90	0.90
DP2	589060	4777084	0.90	0.90
DP3	589248	4776879	0.90	0.90
DP4	589722	4777464	0.90	0.90
DP5	589808	4777427	0.90	0.90
DP6	590035	4777362	0.90	0.90
DP7	590064	4777583	0.90	0.90
DP9	590413	4777269	0.90	0.90

Notes:
masl = meters above sea level
mbgs = meters below ground level
m = meters
* Values are approximate by GPS +/- 4 m

2.3.3 Monitoring Well Development

Well Development: Each of the installed monitoring wells was developed to remove any sediment that may have been introduced during installation and to improve the hydraulic properties of the formation against which the wells were screened. The monitoring wells were developed by Landtek staff on July 19 and August 12, 2024. Development employed electric well pump/waterra tubing with foot valves and each well was developed until a visible decrease in turbidity and steady flow were observed.

2.3.4 Groundwater Monitoring

Depths to groundwater in all monitoring wells, were obtained manually by Landtek staff on July 19, August 12, August 16, August 28, September 18, and November 21, 2024.

2.3.5 Groundwater Sampling

On September 18, 2024, groundwater samples were collected from monitoring wells MW3D, MW4, and MW10 after purging. All collected samples were stored in a cooler with freezer packs after collection and during transport to AGAT Laboratories in Mississauga, Ontario. The collected samples were analyzed for the Provincial Water Quality Objective (PWQO) Analysis. ALS is accredited by the *Canadian Associations for Laboratory Accreditation Inc*. (CALA).

2.3.6 Hydraulic Conductivity Testing

On September 5, 2024, hydraulic conductivity tests were completed in monitoring wells MW1, MW3S, MW3D, MW4, MW6, MW9, MW10, and MW18 to provide estimates of the hydraulic conductivity for the zones against which the screens for the wells were set. The tests involved the extraction of a volume of groundwater to displace the water level. A datalogger programed at 2 second intervals were used to record the water level response during the tests.

Data Analysis: The rising head test data were analyzed using AqteSolve Professional Version 4.5 software package developed by Glenn M. Duffield of HydroSOLVE Inc. applying the Hvorslev analysis solutions, depending on hydrogeology.

3.0 FINDINGS

3.1 Topography, Drainage and Hydrology

The Geodetic elevation of the ground surface at the site is approximately 220 m to 232 m.

Ground water flow is known to be from areas of higher elevation to areas of lower elevation. Based on topography and mapping information of the area, the ground surface elevations at the site indicate there is a drainage split where the northeast part of the site drains northeast towards Lake Ontario, while the majority of the site drains south to tributaries of the Welland River, which drains south-eastward.

The Site is located within the Niagara Peninsula Conservation Authority (NPCA) Watershed. Based on the Ontario Source Protection Information Atlas, the Site is not within a *Wellhead Protection Area* (“WPA”) and *Intake Protection Zone* (IPZ”). However, there are areas of *Highly Vulnerable Aquifer Areas* (“HVA”) which vary across the Site with Scores ranging from 0 to 6.

Based on the Karst Map of Southern Ontario, the Site is located within an area of Potential Karst described as areas of carbonate rock units identified as most susceptible to karst processes, a thick cover of drift.

3.2 Regional Physiography

The Site is located within the physiographical regions of the Haldimand Clay Plain comprised of till moraines and clay plains according to the “Physiography Map of South-Central Portion of Southern Ontario” (Map 2226, Scale 1:253,440) prepared by the Ontario Department of Mines and Northern Affairs and based on the database maintained by Ontario Geological Survey (“OGS”).

3.3 Climate

The site is located in the Mixedwood Plains ecozone of Ontario (Natural Resources Canada, 2012). The general climate data presented below in Table 3 was obtained from Environment Canada publications and from the Environment Canada online database. Average climate data was taken from the Hamilton A station (Hamilton Airport) for the period of 1981 to 2010.

Table 3. 1981 to 2010 Climate Normals for Hamilton A Station (as averages)

	Daily Average Temperature (°C)	Average Rainfall (mm)	Average Snowfall (cm)	Average Precipitation (mm)
January	-5.5	29.7	40.8	64.0
February	-4.6	28.2	35.1	57.8
March	-0.1	42.6	26.5	68.4
April	6.7	71.3	8.4	79.1
May	12.8	78.7	0.5	79.4
June	18.3	84.9	0.0	84.9
July	20.9	100.7	0.0	100.7
August	20.0	79.2	0.0	79.2
September	15.8	81.9	0.0	81.9
October	9.3	76.5	0.7	77.4
November	3.7	74.4	11.0	84.3
December	-2.3	43.8	33.5	73.0

Year	7.9	791.7	156.5	929.8

3.4 Regional Geology

The City of Hamilton is underlain by clastic and carbonate sedimentary rocks of Late Ordovician to Middle Silurian age, which make up parts of three major depositional sequences (Johnson et al., 1992). The oldest bedrock unit outcropping in the area, the Queenston Formation, is predominantly dark red, fissile, hematitic, calcareous shale (Liberty et al., 1976).

The Queenston Formation is found north of the Niagara Escarpment and consists in many places of up to 4 feet (1.2 m) of very weathered bedrock (red clay) which grades downward into typical brick-red shale. The Queenston shale is overlain by Halton Till in the area of the site.

The Late Wisconsinan Halton Till is a clay to clayey silt till and is exposed in the form of a till plain from Lake Ontario southward to the Niagara Escarpment. It is the youngest glacial unit in the region and has been found to be relatively thick (up to 30 m) in the buried bedrock valley between Grimsby and Grimsby Beach. The basal part of the till is red, relatively coarser textured, and consists almost entirely of Queenston shale. Proglacial Lake Iroquois clay, silt and sand is mapped as overlying the Queenston shale in the southern portion of the site. The lake terrace is mainly underlain by Queenston shale and Halton Till although a sheet of predominantly fine sand was deposited along the shoreline and is relatively thicker (up to 4.5 m) in the vicinity of Grimsby (Feenstra, 1974).

Surficial Geology

Based on the OGS surficial geology Map, the Site is generally covered with fine-textured glaciolacustrine deposits; and till (clay to silt-textured till, derived from glaciolacusrine deposits or shale.

Bedrock Geology

Based on the Bedrock Geology of Ontario Southern Sheet, Map 2544 (1: 1,000,000) by OGS, the bedrock at the Site consisted of sandstone, shale, dolostone and siltstone of Guelph Formation.

3.5 Local and Regional Hydrogeology

Local hydrogeology conditions were assessed on the basis of local water well records and available ground investigation reports for the area.

The hydrostratigraphy (i.e., the vertical sequence and horizontal extent of aquifers and aquitards) in the overburden and bedrock generally follows the geologic layering. Till formations in the overburden act as aquitards while the sandier units generally behave as aquifers. Shale generally acts as an aquitard with an upper weathered bedrock aquifer layer (City of Hamilton, 2010).

The Halton till has low infiltration potential due to the composition of the clay and density of the till. The groundwater recharge potential is classified as moderate to low in the area.

3.6 MECP Water Well Records and Groundwater Resources

The Ministry of Environment, Conservation and Park (MECP) Water Well Information System is a publicly available database which contains information such as groundwater well location, well construction details, static water level, geologic units encountered with depth, general water quality observations, water use, date of construction, and screened interval.

The MECP records for wells located within approximately 500 meters of the site were reviewed to assess the general nature and use of the groundwater resource in the area and to characterize local hydrogeologic conditions.

Desk Top Studies

The MECP records for wells located within approximately 500 meters of the twelve (12) Parcels at site were reviewed to assess the general nature and use of the groundwater resource in the area and to characterize local hydrogeologic conditions.

Parcel A

A desktop search of the MECP water well records within approximately 500 m of the site, conducted on March 8, 2024, returned a total of 139 wells comprising of 119 water wells, seventeen (17) observation wells, two (2) abandoned wells, and 1 well with unknown use. The records were reviewed to assess the general nature of the groundwater resource in the area and to characterize local hydrogeologic conditions. The locations of the wells are shown on Figure 1 in Appendix C. The well records summary is provided in Table 1, Appendix D.

A summary of the data obtained from the well survey is presented below.

Well Construction

Wells terminated in bedrock	29
Wells terminated in overburden	106
Wells with unknown construction	4
Total	**139**

Well Uses

Domestic Water Supply	109
Commercial Water Supply	3
Public Water Supply	2
Industrial Water Supply	1
Irrigation Water Supply	4
Monitoring/Test Hole	17
Abandoned Wells	2
No Records	1
Total	**139**

Well Depth

Less than 15 m	14
15 to 30 m	15
Greater than 30 m	107

No Data	3
Total	**139**

Based on the well records review, it was determined that there are one hundred and nineteen (119) water wells within 500 m radius of the Site.

Parcel B

A desktop search of the MECP water well records within approximately 500 m of the site, conducted on March 8, 2024, returned a total of 57 wells comprising 43 water wells, 12 observation wells, one (1) abandoned well, and one (1) well without information. The records were reviewed to assess the general nature of the groundwater resource in the area and to characterize local hydrogeologic conditions. The locations of the wells are shown on Figure 2 in Appendix C. The well records summary is provided in Table 2, Appendix D.

A summary of the data obtained from the well survey is presented below.

Well Construction

Wells terminated in bedrock	13
Wells terminated in overburden	43
Wells with unknown construction	1
Total	**57**

Well Uses

Water Supply	43
Abandoned	1
Observation	12
No Records	1
Total	**57**

Well Depth

Less than 15 m	12
15 to 30 m	6
Greater than 30 m	38
No Data	1
Total	**57**

Based on the well records review, it was determined that there are forty-three (43) water wells within 500 m radius of the Site.

Parcel C1

A desktop search of the MECP water well records within approximately 500 m of the site, conducted on March 12, 2024, returned a total of 10 wells comprising of 10 water wells. The records were reviewed to assess the general nature of the groundwater resource in the area and to characterize local hydrogeologic conditions. The locations of the wells are shown on Figure 3 in Appendix C. The well records summary is provided in Table 3, Appendix D.

A summary of the data obtained from the well survey is presented on the following page.

Well Construction

Wells terminated in bedrock	2
Wells terminated in overburden	8
Total	**10**

Well Uses

Domestic Water Supply	6
Irrigation Water Supply	4
Total	**10**

Well Depth

Less than 15 m	0
15 to 30 m	0
Greater than 30 m	10
Total	**10**

Based on the well records review, it was determined that there are ten (10) water wells within 500 m radius of the Site.

Parcel C2

A desktop search of the MECP water well records within approximately 500 m of the site, conducted on March 12, 2024, returned a total of 17 wells comprising of 17 water wells. The records were reviewed to assess the general nature of the groundwater resource in the area and to characterize local hydrogeologic conditions. The locations of the wells are shown on Figure 4 in Appendix C. The well records summary is provided in Table 4, Appendix D.

A summary of the data obtained from the well survey is presented below.

Well Construction

Wells terminated in bedrock	5
Wells terminated in overburden	12
Total	**17**

Well Uses

Domestic Water Supply	16
Livestock	1
Total	**17**

Well Depth

Less than 15 m	0
15 to 30 m	3
Greater than 30 m	14
Total	**17**

Based on the well records review, it was determined that there are seventeen (17) water wells within 500 m radius of the Site.

Parcel C3

A desktop search of the MECP water well records within approximately 500 m of the site, conducted on March 12, 2024, returned a total of 14 wells comprising of 14 water wells. The records were reviewed to assess the general nature of the groundwater resource in the area and to characterize local hydrogeologic conditions. The locations of the wells are shown on Figure 5 in Appendix C. The well records summary is provided in Table 5, Appendix D.

A summary of the data obtained from the well survey is presented below.

Well Construction

Wells terminated in bedrock	1
Wells terminated in overburden	13
Total	**14**

Well Uses

Domestic Water Supply	13
Irrigation Water Supply	1
Total	**14**

Well Depth

Less than 15 m	0
15 to 30 m	1
Greater than 30 m	13
Total	**14**

Based on the well records review, it was determined that there are fourteen (14) water wells within 500 m radius of the Site.

Parcel C4

A desktop search of the MECP water well records within approximately 500 m of the site, conducted on March 12, 2024, returned a total of 17 wells comprising of 17 water wells. The records were reviewed to assess the general nature of the groundwater resource in the area and to characterize local hydrogeologic conditions. The locations of the wells are shown on Figure 6 in Appendix C. The well records summary is provided in Table 6, Appendix D.

A summary of the data obtained from the well survey is presented below.

Well Construction

Wells terminated in bedrock	1
Wells terminated in overburden	16
Total	**17**

Well Uses

Domestic Water Supply	16
Irrigation Water Supply	1
Total	**17**

Well Depth

Less than 15 m	1
15 to 30 m	4
Greater than 30 m	12
Total	**17**

Based on the well records review, it was determined that there are seventeen (17) water wells within 500 m radius of the Site.

Parcel D1

A desktop search of the MECP water well records within approximately 500 m of the site, conducted on July 9, 2024, returned a total of 13 wells comprising of 11 water wells, one (1) abandoned well, and one (1) well with unknown use. The records were reviewed to assess the general nature of the groundwater resource in the area and to characterize local hydrogeologic conditions. The locations of the wells are shown on Figure 7 in Appendix C. The well records summary is provided in Table 7, Appendix D.

A summary of the data obtained from the well survey is presented below.

Well Construction

Wells terminated in bedrock	0
Wells terminated in overburden	12
Wells with unknown construction	1
Total	**13**

Well Uses

Domestic	11
Abandoned	1
No Record	1
Total	**13**

Well Depth

Less than 15 m	0
15 to 30 m	1
Greater than 30 m	11
No Data	1
Total	**13**

Based on the well records review, it was determined that there are eleven (11) water wells within 500 m radius of the Site.

Parcel D2

A desktop search of the MECP water well records within approximately 500 m of the site, conducted on July 9, 2024, returned a total of 11 wells comprising of 8 water wells, 1 (one) abandoned well, and 2 wells with unknown use. The records were reviewed to assess the general nature of the groundwater resource in the area and to characterize local hydrogeologic conditions. The locations of the wells are shown on Figure 8 in Appendix C. The well records summary is provided in Table 8, Appendix D.

A summary of the data obtained from the well survey is presented below.

Well Construction

- Wells terminated in bedrock 3
- Wells terminated in overburden 7
- Wells with unknown construction 1
- **Total..11**

Well Uses

- Domestic 8
- Abandoned Well 1
- No Records 2
- **Total..11**

Well Depth

- Less than 15 m 0
- 15 to 30 m 0
- Greater than 30 m 9
- No Data 2
- **Total..11**

Based on the well records review, it was determined that there are eight (8) water wells within 500 m radius of the Site.

Parcel D3

A desktop search of the MECP water well records within approximately 500 m of the site, conducted on July 9, 2024, returned a total of 7 wells comprising of 6 water wells, and 1 well with unknown use. The records were reviewed to assess the general nature of the groundwater resource in the area and to characterize local hydrogeologic conditions. The locations of the wells are shown on Figure 9 in Appendix C. The well records summary is provided in Table 9, Appendix D.

A summary of the data obtained from the well survey is presented below.

Well Construction

- Wells terminated in bedrock 3
- Wells terminated in overburden 3
- Wells with unknown construction 1
- **Total..7**

Well Uses

Domestic	6
No Record	1
Total	**7**

Well Depth

Less than 15 m	0
15 to 30 m	0
Greater than 30 m	6
No Data	1
Total	**7**

Based on the well records review, it was determined that there are six (6) water wells within 500 m radius of the Site.

Parcel E1

A desktop search of the MECP water well records within approximately 500 m of the site, conducted on August 6, 2024, returned a total of 20 wells comprising of fifteen water wells, two (2) abandoned wells, and 3 wells with unknown use. The records were reviewed to assess the general nature of the groundwater resource in the area and to characterize local hydrogeologic conditions. The locations of the wells are shown on Figure 10 in Appendix C. The well records summary is provided in Table 10, Appendix D.

A summary of the data obtained from the well survey is presented below.

Well Construction

Wells terminated in bedrock	13
Wells terminated in overburden	4
Wells with unknown construction	3
Total	**20**

Well Uses

Domestic Water Supply	15
Abandoned Well	1
No Records	4
Total	**20**

Well Depth

Less than 15 m	0
15 to 30 m	3
Greater than 30 m	14
No Data	3
Total	**20**

Based on the well records review, it was determined that there are fifteen (15) water wells within 500 m radius of the Site.

Parcel E2

A desktop search of the MECP water well records within approximately 500 m of the site, conducted on August 6, 2024, returned a total of 14 wells comprising of 12 water wells, one (1) abandoned well, and one (1) well with unknown use. The records were reviewed to assess the general nature of the groundwater resource in the area and to characterize local hydrogeologic conditions. The locations of the wells are shown on Figure 11 in Appendix C. The well records summary is provided in Table 11, Appendix D.

A summary of the data obtained from the well survey is presented below.

Well Construction

• Wells terminated in bedrock	8
• Wells terminated in overburden	6
• **Total**	**14**

Well Uses

• Domestic Water Supply	11
• Livestock Water Supply	1
• Abandoned	1
• No Records	1
• **Total**	**14**

Well Depth

• Less than 15 m	0
• 15 to 30 m	2
• Greater than 30 m	11
• No Data	1
• **Total**	**14**

Based on the well records review, it was determined that there are twelve (12) water wells within 500 m radius of the Site.

Parcel E3

A desktop search of the MECP water well records within approximately 500 m of the site, conducted on August 6, 2024, returned a total of 7 wells comprising of 5 water wells, one (1) abandoned well, and 1 (one) well with unknown use. The records were reviewed to assess the general nature of the groundwater resource in the area and to characterize local hydrogeologic conditions. The locations of the wells are shown on Figure 12 in Appendix C. The well records summary is provided in Table 12, Appendix D.

A summary of the data obtained from the well survey is presented below.

Well Construction

• Wells terminated in bedrock	2
• Wells terminated in overburden	4
• Wells with unknown construction	1
• **Total**	**7**

<u>Well Uses</u>

Domestic Water Supply	5
Abandoned Well	1
No Records	1
Total	**7**

<u>Well Depth</u>

Less than 15 m	0
15 to 30 m	0
Greater than 30 m	6
No Data	1
Total	**7**

Based on the well records review, it was determined that there are seven (7) water wells within 500 m radius of the Site.

3.7 Results of Site Inspection

A detailed site inspection was conducted by Landtek on June 22, 2023, to assess the presence of features which may be significant from a hydrogeologic viewpoint. In particular, the site was inspected to assess the following:

- The presence of closed drainage features, depressions, or sandy areas which may allow for ponding and significant or enhanced infiltration of water.

- Assessment of the presence of phreatophytic vegetation which may indicate seasonally high groundwater levels and/or groundwater discharge and seepage.

- Identification of any zones of visible seepage or groundwater discharge.

The observations made during the inspection include surface drainage features (streams), and ponds. Five (5) streams, and seven (7) ponds were identified within the Site These are presented on Figure 5 in Appendix A.

3.8 Results of Subsurface Investigation

The borehole information is generally consistent with the geological data of the area, with the predominant soils comprising of glaciolacustrine clays, silts and tills.

Detailed monitoring wells logs are presented in Appendix B, and the lithologies encountered during drilling are discussed further in the following sections.

<u>Organic Soil</u>

An approximately 50 mm to 200 mm thick layer of topsoil was encountered from ground surface in all boreholes.

Silt

Silt deposits were encountered in boreholes BH/MW6, BH/MW8, BH/MW22, BH23 and BH/MW24 underlying the organic material and clayey silt deposits at a depth of 1.5 m to 7.6 m below ground level. The silt deposits encountered are primarily brown, and grey at depth in colour and include trace fractions of grey clay seams and iron staining.

Clayey Silt to Silty Clay

Clayey silt to silty clay deposits were encountered in all boreholes except boreholes BH1, BH23 and BH/MW24 below the organic material, and range in depth between approximately 0.1 m to 6.0 m below the ground surface. The clayey silt to silty clay deposits encountered are primarily brown, and grey at depth in colour, and includes variable fractions of gravel, iron staining, red shale fragments, grey clay seams, and sand.

Silt Till

Silt till deposits were encountered in boreholes BH1, nested boreholes BH/MW3S/D, BH23 and BH/MW24 underlying the silt, clayey silt and clayey silt to silty clay till deposits, ranging in depth between approximately 0.7 m to 8.1 m below ground level. The silt till deposits encountered are primarily grey in colour and include variable fractions of clay, iron staining and gravel.

Silty Clay to Clayey Silt Till

Silty clay to clayey silt till deposits were encountered in all boreholes except BH23 and BH/MW24 below the silty clay to clayey silt deposits and organic material, and range in depth between approximately 0.7 m to the maximum drill depth of approximately 12.6 m below the ground surface. The till deposits encountered are primarily brown, and grey at depth in colour and include variable fractions of gravel, iron staining, cobbles, grey clay seams and red shale fragments.

Bedrock

Bedrock was not encountered during this investigation.

Groundwater

Groundwater or water seepages were not encountered during drilling, with all boreholes remaining open and dry to completion though wet soils, particularly the silt till and deeper clayey silt till, were noted at variable depth across the development area.

3.9 Groundwater Monitoring

Depths to groundwater in monitoring wells MW3S, MW3D, MW4, MW6. MW8, MW9, MW10, MW11, MW12, MW16, MW17, MW18, MW19S, MW19D, and MW 20 were obtained manually by Landtek staff on July 19, August 12, August 16, August 28, September 18, and November 21, 2024. The readings are presented on the following page in Table 4. It should be noted that groundwater level monitoring is ongoing to determine the seasonal highest groundwater level which usually occurs in Spring due to rain and snow melt.

Table 4. Groundwater Monitoring Data

MW ID	Date	Total Depth (mbgs)	Water Strike (mbgs)*	Stick-up (m)	Water Level (mbgs)
BH/MW3S	19-Jul-24	3.0	None	1.07	0.89
	12-Aug-24				-
	16-Aug-24				1.06
	28-Aug-24				1.28
	18-Sep-24				2.42
	21-Nov-24				2.70
BH/MW3D	19-Jul-24	6.0	None	1.15	0.71
	12-Aug-24				-
	16-Aug-24				1.17
	28-Aug-24				1.39
	18-Sep-24				4.63
	21-Nov-24				2.90
BH/MW4	19-Jul-24	6.0	None	1.01	0.21
	12-Aug-24				-
	16-Aug-24				0.78
	28-Aug-24				2.00
	18-Sep-24				3.44
	21-Nov-24				1.55
BH/MW6	19-Jul-24	6.0	None	1.16	0.40
	12-Aug-24				-
	16-Aug-24				0.88
	28-Aug-24				1.06
	18-Sep-24				5.61
	21-Nov-24				1.58
BH/MW8	19-Jul-24	6.0	None	0.95	0.48
	12-Aug-24				-
	16-Aug-24				1.18
	28-Aug-24				1.45
	18-Sep-24				2.07
	21-Nov-24				1.36
BH/MW9	19-Jul-24	9.0	None	1.13	7.44
	12-Aug-24				-
	16-Aug-24				5.75
	28-Aug-24				6.12
	18-Sep-24				3.96
	21-Nov-24				2.62
BH/MW10	19-Jul-24	6.0	None	1.12	0.43
	12-Aug-24				-
	16-Aug-24				0.50
	28-Aug-24				0.57
	18-Sep-24				0.68
	21-Nov-24				0.15
BH/MW11	19-Jul-24	6.0	None	1.09	0.78
	12-Aug-24				-
	16-Aug-24				1.17
	28-Aug-24				1.35
	18-Sep-24				1.69
	21-Nov-24				1.32
BH/MW12	19-Jul-24	6.0	None	1.10	1.46
	12-Aug-24				-
	16-Aug-24				0.98
	28-Aug-24				1.68
	18-Sep-24				1.73
	21-Nov-24				1.31
BH/MW16	19-Jul-24	6.0	None	1.20	-
	12-Aug-24				1.03

	16-Aug-24				1.00
	28-Aug-24				1.17
	18-Sep-24				1.49
	21-Nov-24				2.09
BH/MW17	19-Jul-24	6.0	None	1.04	-
	12-Aug-24				5.53
	16-Aug-24				5.29
	28-Aug-24				4.39
	18-Sep-24				5.15
	21-Nov-24				3.94
BH/MW18	19-Jul-24	8.4	None	1.06	-
	12-Aug-24				4.22
	16-Aug-24				1.77
	28-Aug-24				1.03
	18-Sep-24				1.31
	21-Nov-24				1.57
BH/MW19S	19-Jul-24	3.0	None	1.30	-
	12-Aug-24				1.27
	16-Aug-24				1.31
	28-Aug-24				1.44
	18-Sep-24				1.67
	21-Nov-24				2.08
BH/MW19D	19-Jul-24	6.0	None	1.30	-
	12-Aug-24				1.31
	16-Aug-24				1.38
	28-Aug-24				1.47
	18-Sep-24				1.67
	21-Nov-24				0.98
BH/MW20	19-Jul-24	6.0	None	1.10	-
	12-Aug-24				1.16
	16-Aug-24				1.23
	28-Aug-24				1.54
	18-Sep-24				2.18
	21-Nov-24				3.03

Notes:
[*] water strike/groundwater seepage
mbgs = meters below ground surface
masl = meters above sea-level

3.10 Hydraulic Gradients and Flow

Vertical Hydraulic Gradient

Groundwater generally flows from the shallow to deeper aquifers as leakage across the aquitards. However, this may vary locally, and the direction of vertical flow depends on the relative heads in the different layers. Leakage rates vary locally depending on the magnitude of the vertical gradients and on the thickness and hydraulic conductivity of the confining units (City of Hamilton, 2010).

Horizontal Hydraulic Gradient

Ground water flow is known to be from areas of higher elevation to areas of lower elevation. Based on topography and mapping information of the area, the ground surface elevations at the site indicate there is a drainage split where the northeast part of the site drains northeast towards Lake Ontario, while the majority of the site drains south to tributaries of the Welland River, which drains south-eastward.

3.11 Estimated Hydraulic Conductivity

3.11.1 Hydraulic Conductivity Tests Analysis

The analyses were completed using the Hvorslev method (Fetter, 1994). The graphical results of the hydraulic conductivity analysis are presented in Appendix D, and the results are summarized below in Table 5.

Table 5. Hydraulic Conductivity Results

Monitoring Well	Hydraulic Conductivity (m/s)	Screened Material
MW3S	4.689×10^{-8}	Clayey Silt Till/Silt Till
MW3D	1.470×10^{-8}	Silt Till
MW4	1.738×10^{-8}	Clayey Silt Till/Silty Clay Till
MW6	9.618×10^{-9}	Clayey Silt/Silty Clay Till
MW9	3.133×10^{-8}	Silty Clay Till
MW10	1.482×10^{-9}	Clayey Silt/Clayey Silt Till
MW18	6.416×10^{-10}	Clayey Silt Till

The results indicate that the hydraulic conductivity of the screened till material at the site range from 6.416×10^{-10} m/s to 4.689×10^{-8} m/s, with a geometric mean of 8.583×10^{-9} m/s.

In theoretical terms, hydraulic conductivity is a measure of how easily water can pass through soil or rock. High values indicate permeable material through which water can pass easily, and low values indicate that the material is less permeable. The above value of 8.583×10^{-9} m/s is considered as low.

3.12 Groundwater Quality

Copies of the laboratory Certificates of Analysis are provided in Appendix E. The results of the analyzed groundwater samples collected from monitoring wells MW3D, MW4 and MW10 were compared to the Provincial Water Quality Objective (PWQO) Analysis parameters.

All analyzed parameters were within guideline Limits with the exception of Total Cobalt, Total Iron, Total Silver, and Total Uranium as shown in red in the Table 6 below.

Table 6. Laboratory Analysis Results

Monitoring Well	**Parameter**	**PWQO**
MW3D	Total Cobalt	0.0019 mg/L* (Guideline = 0.0009 mg/L)
MW3D	Total Iron	0.863 mg/L* (Guideline = 0.3 mg/L)
MW4	Total Cobalt	0.0048 mg/L* (Guideline = 0.0009 mg/L)
MW4	Total Silver	0.0001 mg/L* (Guideline = 0.0001 mg/L)
MW4	Total Uranium	0.0067 mg/L* (Guideline = 0.005 mg/L)
MW10	Total Cobalt	0.0023 mg/L* (Guideline = 0.0009 mg/L)
MW10	Total Uranium	0.0078 mg/L* (Guideline = 0.005 mg/L)

[*] Exceedance

4.0 WATER TAKING EVALUATION & IMPACT ASSESSMENT

Given the absence of a development plan, this investigation is to be considered preliminary until such a time that a development concept is available for each development parcel and an appropriate, more detailed investigation is completed to complement the development plan.

Based on the above, detailed water taking evaluation and impact assessment could not be completed at this time. However, the following insights are provided

Construction Excavation Dewatering

Based on the boreholes and monitoring wells completed at the site, and groundwater level monitoring completed so far, depth to ground water from the ground surface was encountered at varying depths. Groundwater level monitoring is ongoing to determine the highest groundwater level which usually occurs in Spring.

Groundwater control for shallow depth excavations could be handled by standard construction sump pump/well points or equivalent. However, a more robust and elaborate groundwater control measures, such as deep wells and well points, may be considered for deeper overburden excavations depending on depth to groundwater.

5.0 WATER BUDGET

The following discussion and recommendations are based on the data gathered for the study and are presented for site planning purposes.

5.1 Existing Site Development

Existing Site Development (Pre-Development)

The following two areas were identified at the Site:

1. Areas with moderately rooted crop/pasture and scrubs
2. Significant Woodlands

Based on the above existing conditions, pre-development water budget was completed for each of the identified areas. Post-development water budget will be completed at the Secondary Planning stage when the proposed development plan is available.

Areas with moderately rooted crop/pasture and scrubs

The following summarizes the approximate existing land coverage areas for the site:

Building roof area	1.447 ha
Hardscape area	4.344 ha
Softscape area	340.996 ha
Total Area	**346.787 ha**

Significant Woodland Area

The following summarizes the approximate existing land coverage areas for the site:

Building roof area	0 ha
Hardscape area	0 ha
Wooded area	17.580 ha
Total Area	**17.580 ha**

5.2 Principal Hydrogeologic Features and Functions

The results of the study indicate that the site hydrogeologic characteristics are as follows:

- Groundwater flow at the site is controlled by the topography present across the area. The overburden present at surface includes the low permeability clayey silt which may have hydraulic conductivity values as low as 10^{-9} m/s, resulting in relatively low amount of groundwater infiltration or recharge. As a result, surface water will tend to flow overland and/or pool in low lying area after rainfall or melt. The recharge rate for a clayey silt is approximately 100 mm/year (City of Hamilton "Guidelines for Hydrogeological Studies and Technical Standards for Private Services, 2013").

- Depths to groundwater in all monitoring wells installed at the site were obtained manually by Landtek staff on July 19, August 12, August 16, August 28, September 18, and November 21, 2024. The highest groundwater level recorded so far was 0.21 mbgs at BH/MW4 on July 19, 2024.

- During drilling activities, the underlying clayey silt was found to be firm and moist. Based on the physical characteristics of the till and the assumed low hydraulic conductivities, infiltration will be relatively low.

The above noted hydrogeological characteristics should be considered in conjunction with the requirement for future site development plans and in particular storm water management practices at the site. Additional information regarding water budget at the site is presented in the following section.

5.3 Water Budget

The surface soils at the site will provide limited water recharge into the shallow groundwater system. This is as a result of the relatively impermeable clayey silt soil encountered below surface across the site. Based on the subsurface investigation completed for the site, no enhanced zones of groundwater flow or transmission were identified across the site.

Evapotranspiration represents the transport of water from the earth back to the atmosphere and is an important component to water balance calculation. The Thornthwaite method was used to calculate potential evapotranspiration typical for the region. By using equations 8, 9, and 10 in Thornthwaite (1948), the potential evapotranspiration for the region was found to be 609 mm/year. The calculation is included in Appendixes G and H.

As was presented in Table 3 of this report, the annual total precipitation was taken from the Hamilton A climate station for the period of 1981 to 2010. Total monthly average precipitation for the area is 930 mm/year, and the mean daily temperature is 7.9 °C.

The total shallow groundwater recharge rate for the site is estimated to be 100 mm/year. This recharge was referenced from the *MOE Hydrogeological Technical Information (April 1995) - Infiltration Factors (Table 2)*. The post-development water budget can not be completed as the development site plan has not been completed.

Areas with moderately rooted crop/pasture and scrubs

The water budget and run-off calculations of areas with moderately rooted crop/pasture and scrubs of the existing site water are presented in Appendixes G. The Annual Pre-Development Water Budget and a summary are presented below in Tables 7 and 8, respectively.

Table 7. Annual Pre-Development Water Budget

Land Use	Area (m^2)	Precipitation (m^2)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Building Roofs	14,471	13,458	-	-	13,458
Green Space	3,409,960	3,171,263	2,076,666	340,996	753,601
Hardscape Area	43,442	40, I01	-	-	40,401
TOTAL	3,467,874	3,225,122	2,076,666	340,996	807,461

Table 8. Moderately Rooted Crop/Pasture and Scrubs Area Water Budget

Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
3,225,122	2,076,666	340,996	807,461

The above-noted values and associated calculations found in Appendix G are considered to be conservative and are based on the following assumptions:

- No infiltration will occur beneath paved roads and building locations.
- No evapotranspiration will occur at paved roads and building locations.

Significant Woodland Area

The water budget and run-off calculations of significant woodland areas of the existing site water are presented in Appendixes H. The Annual Pre-Development Water Budget and a summary are presented below in Tables 9 and 10, respectively.

Table 9. Annual Pre-Development Water Budget

Land Use	Area (m^2)	Precipitation (m^2)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Building Roofs	0	0	-	-	0
Green Space	175,800	163,494	107,062	17,580	38,852
Hardscape Area	0	0	-	-	0
TOTAL	175,800	163,494	107,062	17,580	38,852

Table 10. Significant Woodland Water Budget

Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
163,494	107,062	17,580	38,852

The above-noted values and associated calculations found in Appendix H are considered to be conservative and are based on the following assumptions:

- Infiltration will occur at wooded areas.
- Evapotranspiration will occur at wooded areas.

6.0 SUMMARY AND CONCLUSIONS

The following summarizes the results of the investigation:

- The borehole information is generally consistent with the geological data of the area, with the predominant soils comprising of glaciolacustrine clays, silts and tills.
- Significant hydrogeologic features identified during the inspection conducted by Landtek on June 22, 2023, include surface drainage features (streams), and ponds. These include five (5) streams, and seven (7) ponds were identified within the Site
- The Geodetic elevation of the ground surface at the site is approximately 220 m to 232 m. Groundwater typically follows the general path of the surface water courses and flows to lower elevations. In this study area, the inferred local groundwater flow direction varies. It mostly southwest over the site, with exception that flow is northeast at the northeast area.
- Depths to groundwater in all fifteen (15) monitoring wells at the site were obtained manually by Landtek staff on July 19, August 12, August 16, August 28, and September 18, 2024. The readings are presented on the in Table 4 of this report. It should be noted that groundwater level monitoring is ongoing to determine the seasonal highest groundwater level which usually occurs in Spring due to rain and snow melt.
- Groundwater samples were collected from 3 monitoring wells at the Site analyzed for the Provincial Water Quality Objective (PWQO) parameters. ALS is accredited by the *Canadian Associations for Laboratory Accreditation Inc*. (CALA). All analyzed parameters were within guideline Limits with the exception of Total Cobalt, Total Iron, Total Silver, and Total Uranium as shown in Section 3.12 of this report.
- Pre-development water budget was completed for each of the identified areas at the site (Areas with moderately rooted crop/pasture and scrubs; and Significant Woodlands), which determined the precipitation, evapotranspiration, infiltration, and run-off at each area.
- Post-development water budget will be completed at the Secondary Planning stage when the proposed development plan is available.

7.0 CLOSURE

We trust this report is satisfactory for your purposes. If you have any questions regarding our submission, please do not hesitate to contact Landtek.

Yours truly,

Landtek Limited

PROFESSIONAL GEOSCIENTIST
HENRY N. EREBOR
PRACTISING MEMBER
2792
ONTARIO

Henry Erebor, M.Sc., P.Geo.,
Senior Hydrogeologist

8.0 REFERENCES

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9.0 LIMITATIONS

The conclusions and recommendations given in this report are based on information determined at the borehole locations. Subsurface and ground water conditions between and beyond the boreholes may be different from those encountered at the borehole locations, and conditions may become apparent during construction that could not be detected or anticipated at the time of the geotechnical investigation. It is recommended practice that Landtek be retained during construction to confirm that the subsurface conditions throughout the site are consistent with the conditions encountered in the boreholes.

The comments made in this report on potential construction problems and possible remedial methods are intended only for the guidance of the designer. The number of boreholes may not be sufficient to determine all the factors that may influence construction methods and costs. For example, the thickness and quality of surficial topsoil or fill layers may vary markedly and unpredictably. Contractors bidding on the project or undertaking construction on the site should make their own interpretation of the factual borehole information and establish their own conclusions as to how the subsurface conditions may affect their work.

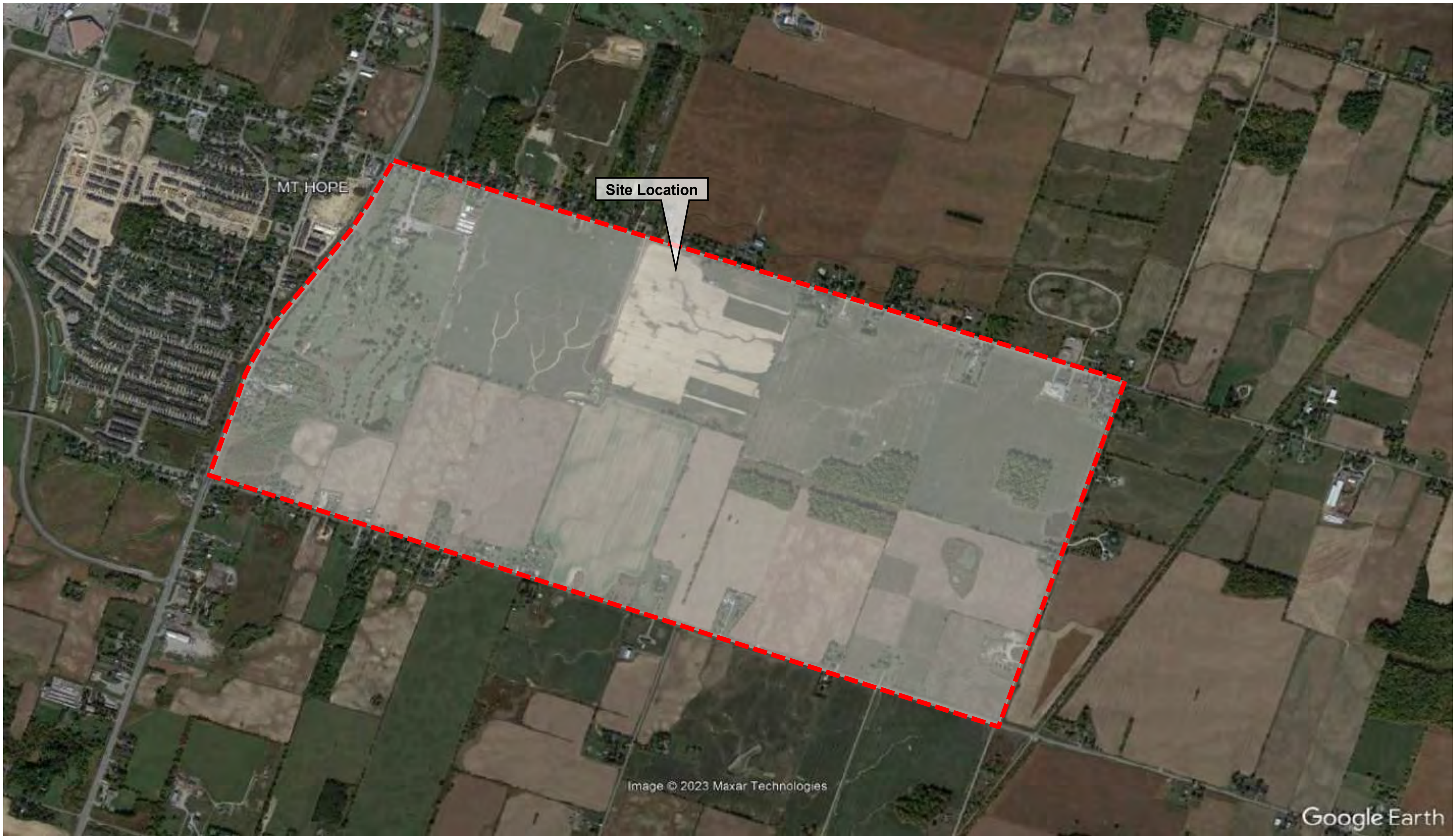
The survey elevations in the report were obtained by Landtek or others and are strictly for use by Landtek in the preparation of the geotechnical report. The elevations should not be used by any other parties for any other purpose.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Landtek accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

This report does not reflect environmental issues or concerns related to the property unless otherwise stated in the report. The design recommendations given in the report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, it is recommended that Landtek be retained during the final design stage to verify that the design is consistent with the report recommendations, and that the assumptions made in the report are still valid.

APPENDIX A

FIGURES



LANDTEK LIMITED

CONSULTING ENGINEERS

205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1

	Scale: On Map	Date: September 2024
Project:	Hydrogeological Desktop Study White Church Road East & Upper James Street Hamilton, Ontario	
Title:	Figure 1: Site Location	
Project No.	23355	

WHITE CHURCH
BOUNDARY EXPANSION AREA

SCALE 1:9000

0 100 200 300 400 500

NOTES:

- Base information prepared by A.T. McLaren Limited
- Aerial Imagery: Google Earth 2023

URBAN SOLUTIONS est. 2014 10 Years!
PLANNING & LAND DEVELOPMENT

LEGEND

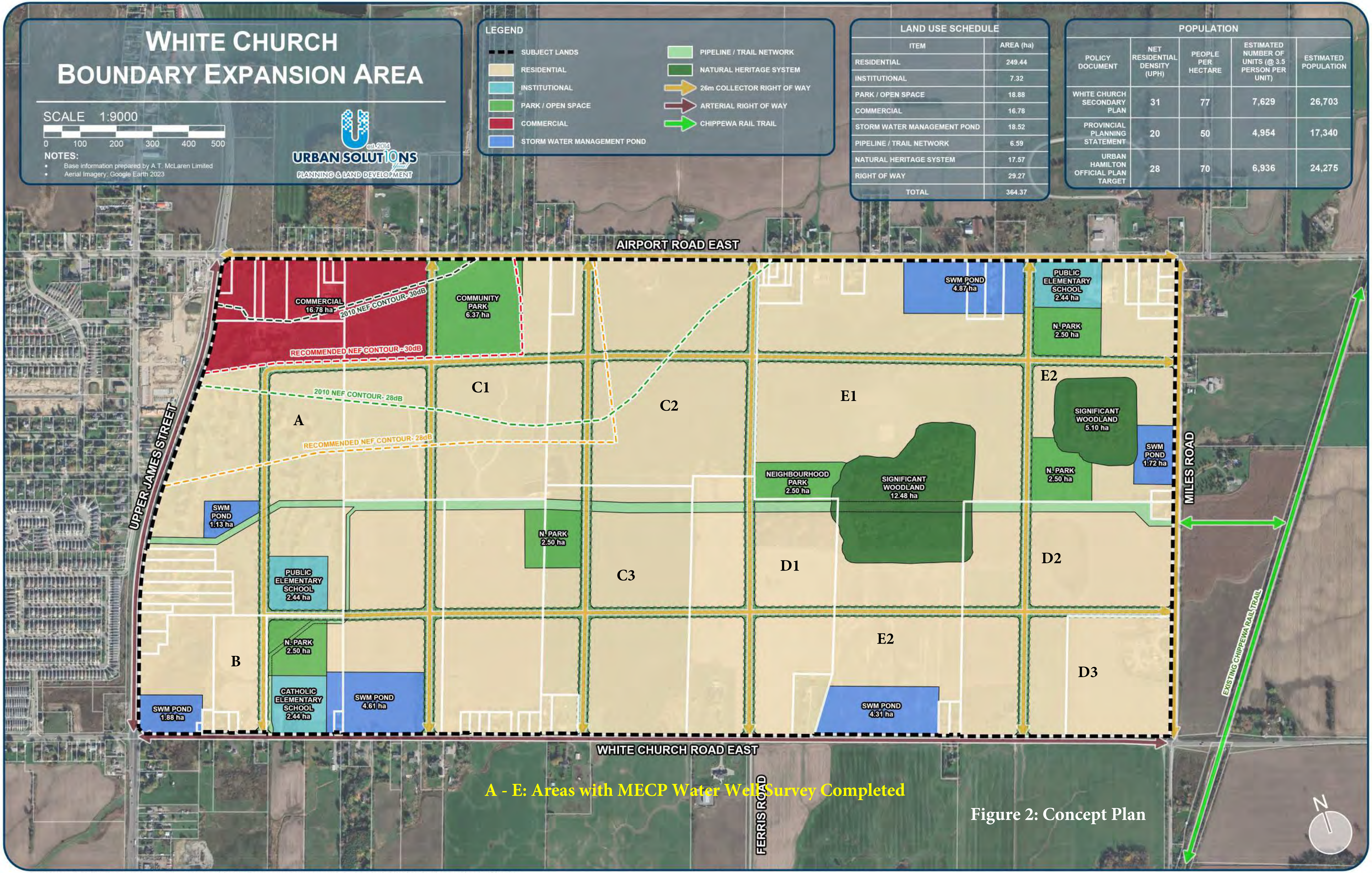
▬ ▬ ▬	SUBJECT LANDS
🟨	RESIDENTIAL
🟦	INSTITUTIONAL
🟩	PARK / OPEN SPACE
🟥	COMMERCIAL
🟦	STORM WATER MANAGEMENT POND
🟩	PIPELINE / TRAIL NETWORK
🟩	NATURAL HERITAGE SYSTEM
➡	26m COLLECTOR RIGHT OF WAY
➡	ARTERIAL RIGHT OF WAY
➡	CHIPPEWA RAIL TRAIL

LAND USE SCHEDULE

ITEM	AREA (ha)
RESIDENTIAL	249.44
INSTITUTIONAL	7.32
PARK / OPEN SPACE	18.88
COMMERCIAL	16.78
STORM WATER MANAGEMENT POND	18.52
PIPELINE / TRAIL NETWORK	6.59
NATURAL HERITAGE SYSTEM	17.57
RIGHT OF WAY	29.27
TOTAL	364.37

POPULATION

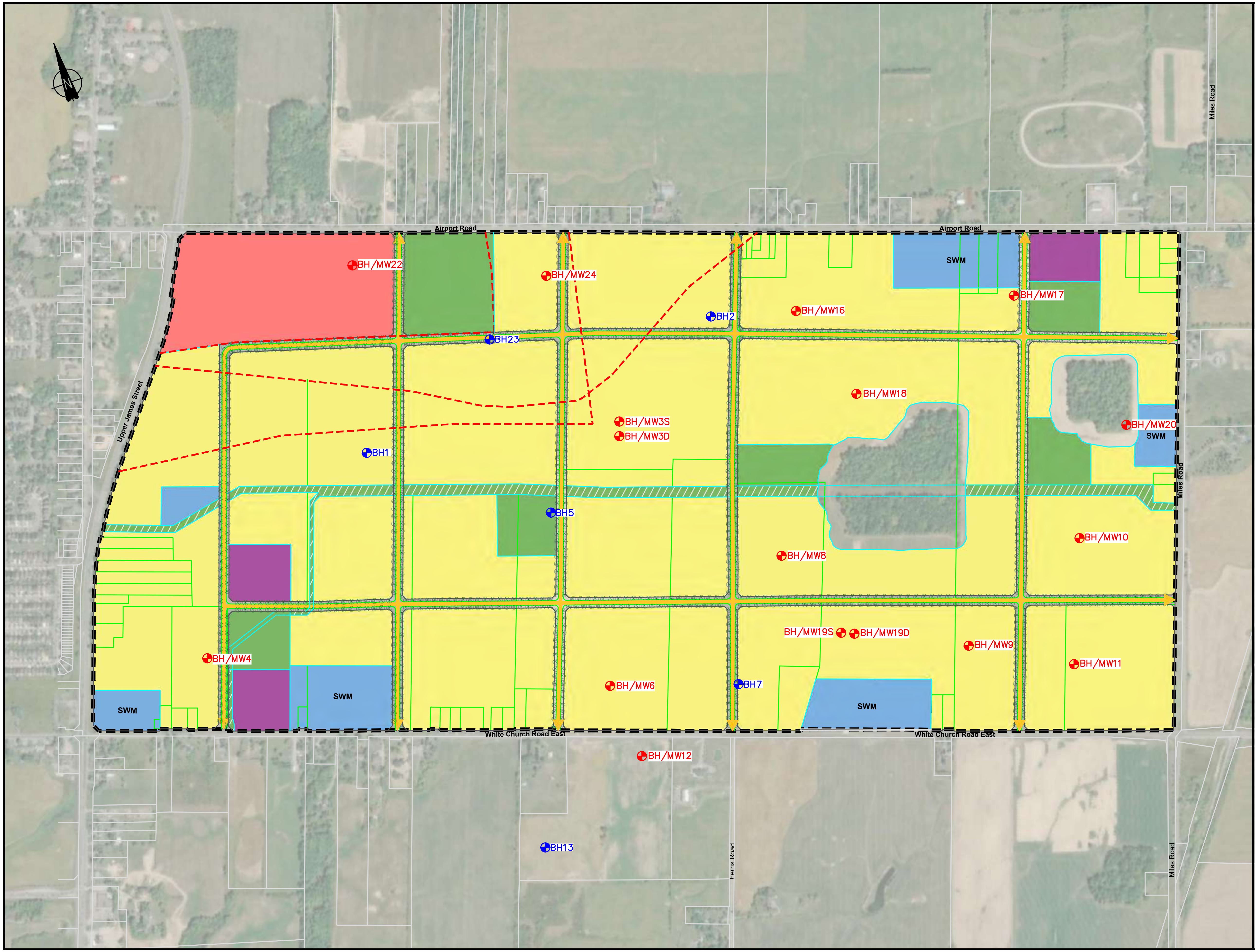
POLICY DOCUMENT	NET RESIDENTIAL DENSITY (UPH)	PEOPLE PER HECTARE	ESTIMATED NUMBER OF UNITS (@ 3.5 PERSON PER UNIT)	ESTIMATED POPULATION
WHITE CHURCH SECONDARY PLAN	31	77	7,629	26,703
PROVINCIAL PLANNING STATEMENT	20	50	4,954	17,340
URBAN HAMILTON OFFICIAL PLAN TARGET	28	70	6,936	24,275



A - E: Areas with MECP Water Well Survey Completed

Figure 2: Concept Plan

C:\Users\StephenEricksonBACPT\OneDrive - Urban Solutions\Documents - Active Projects\464-22 - Whitechurch Secondary Plan\2 - Drawings\1 - Urbansolutions\Secondary Plan\2025\464-22 - Boundary Expansion Concept - 2025-01-08.dwg



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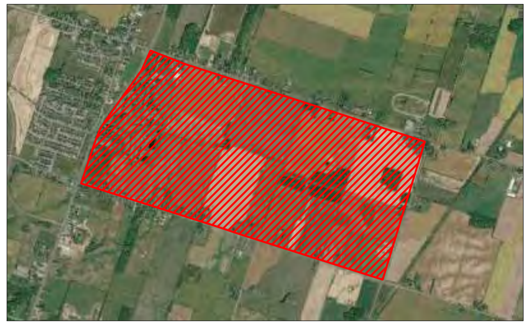
project location



Key plan an extract from Google Earth Pro©

Key:

- ● Approximate location of boreholes drilled by Landtek Limited between 3 and 8 july 2024.
- ● Approximate location of monitoring wells installed by Landtek Limited between 3 july and 8 august 2024.
- 🟨 Future Residential Development
- 🟥 Future Commercial Development
- 🟪 Future Institutional Development
- 🟩 Existing and Future Greenspace (Woodland, Parkland)

Notes:

Base plan taken from the drawing "*White Church Boundary Expansion Area*", as issued by Urban Solutions Planning & Land Development, with a background extract provided by A. T. McLaren and Aerial Imagery from Google Earth Pro©.

revisions/submissions

#	date	description
1	7 july 2024	issued for draft report
2	28 october 2024	updated property boundary
3	2 december 2024	updated property boundary

client

White Church Landowners Group Inc.

municipality

The Corporation of the City of Hamilton

project

Geotechnical Investigation White Church Lands

sheet

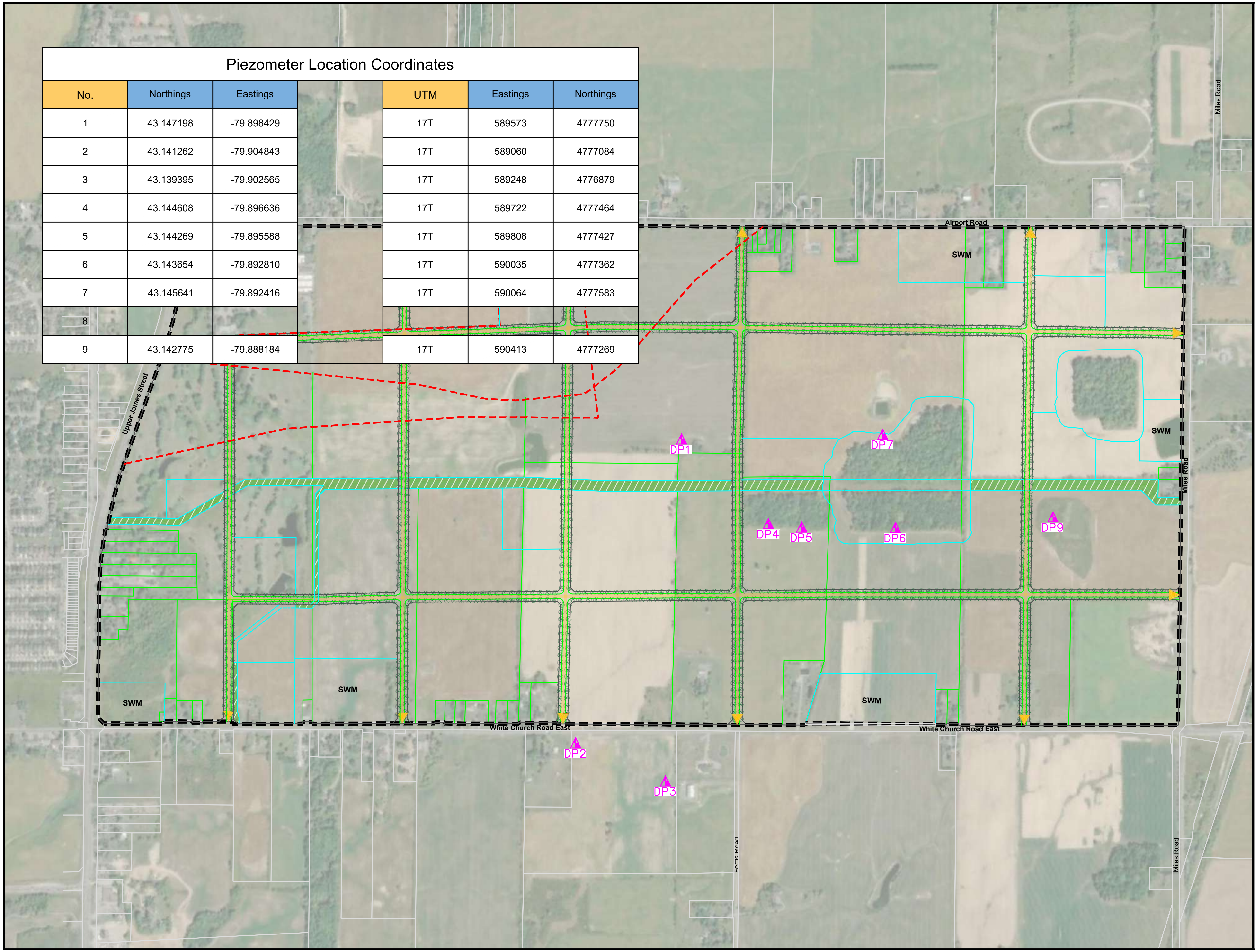
Borehole and Monitoring Well Location Plan

date: january 2025
drawn: mdc
checked: jd
project #: 23354
scale: 1:10,000

23354-01

Piezometer Location Coordinates

No.	Northings	Eastings	UTM	Eastings	Northings
1	43.147198	-79.898429	17T	589573	4777750
2	43.141262	-79.904843	17T	589060	4777084
3	43.139395	-79.902565	17T	589248	4776879
4	43.144608	-79.896636	17T	589722	4777464
5	43.144269	-79.895588	17T	589808	4777427
6	43.143654	-79.892810	17T	590035	4777362
7	43.145641	-79.892416	17T	590064	4777583
8					
9	43.142775	-79.888184	17T	590413	4777269



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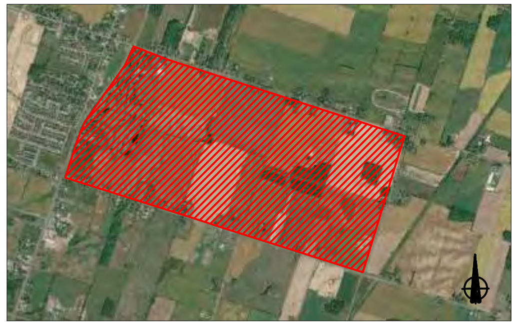
project location



Key plan an extract from Google Earth Pro©

Key:

▲ Approximate location of piezometer installed by Landtek Limited between July 3rd and 4th, 2023.

Notes:

Base plan and extract from the preliminary drawing "Urban Hamilton Official Plan", reference Map B.5.5-1 - Land Use Plan dated November 2023, as issued by The City of Hamilton

revisions/ submissions

#	date	description

client
Urban Solutions

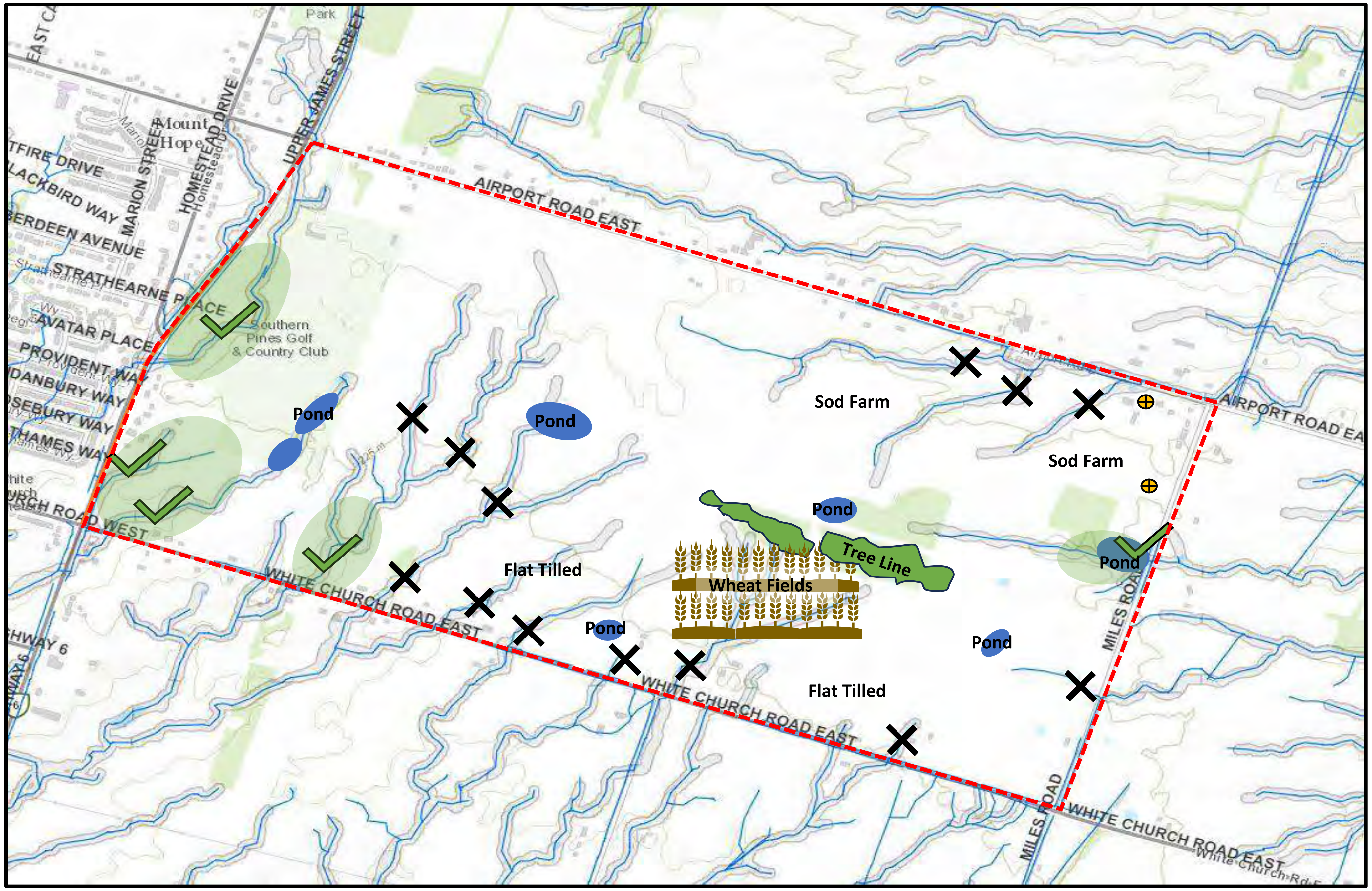
municipality
The Region of the City of Hamilton

project
HydroGeological Investigation
White Church Lands

sheet
Piezometer Location Plan
Figure 4

date: December, 2024
drawn: mdc
checked: jd
project #: 23355
scale: 1:10,00

23355-01



✓ Visible Watershed Features

● Ponds or Pooling

⊕ Monitoring Well

✗ Non-Visible Watershed Features

🟩 Visible Reaches of Features

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Scale:	NTS	Date: June 2023
Project:	Hydrogeological Investigation	
	White Church Road E & Upper James Street	
	Hamilton , Ontario	
Title:	Figure 5: Site Visit Map	
Project No.	23355	

APPENDIX B

BOREHOLES AND MONITORING WELLS LOGS

LOG OF BOREHOLE BH1

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-03-11
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.149397
Easting: -79.908197
Ground Surface Elevation: 227.7

Depth Scale (m)	Depth/Elevation (m)	Subsurface Conditions Description	Samples Number	Type	Blow Counts/150 mm	N Value	Moisture / Plasticity	Well Details	Groundwater Conditions	Headspace / PID (ppm) [LEL(%)] / ppm	Comments
		Organic Material ~100 mm. Clayey silt, some organics. Brown, moist. **Clayey Silt Till** some grey clay seams, trace gravel. Firm, brown, moist.	1	SS	1 1 6 7	7	17.4				
1	227.0	**Silt Till** some iron staining, trace gravel. Compact, brown, moist.	2	SS	7 9 15	24	17.2				
2	226.0		3	SS	8 10 14	24	16.4				
	225.0	**Clayey Silt Till** trace gravel, trace cobbles, trace iron staining. Very stiff, brown, moist.	4	SS	6 10 15	25	15.5				
3		...with iron staining. Hard, brown and grey.	5	SS	16 15 16	31	14.4				
4 5	224.0 223.0	...no cobbles, no iron staining, some gravel. Very stiff, grey.	6	SS	7 9 11	20	13.7				
6	222.0	...trace gravel.	7	SS	6 8 10	18	13.7				
	221.0	End of Log									
7	220.0										
8	219.0										
9	218.0										
10											

Penetration / Strength Results

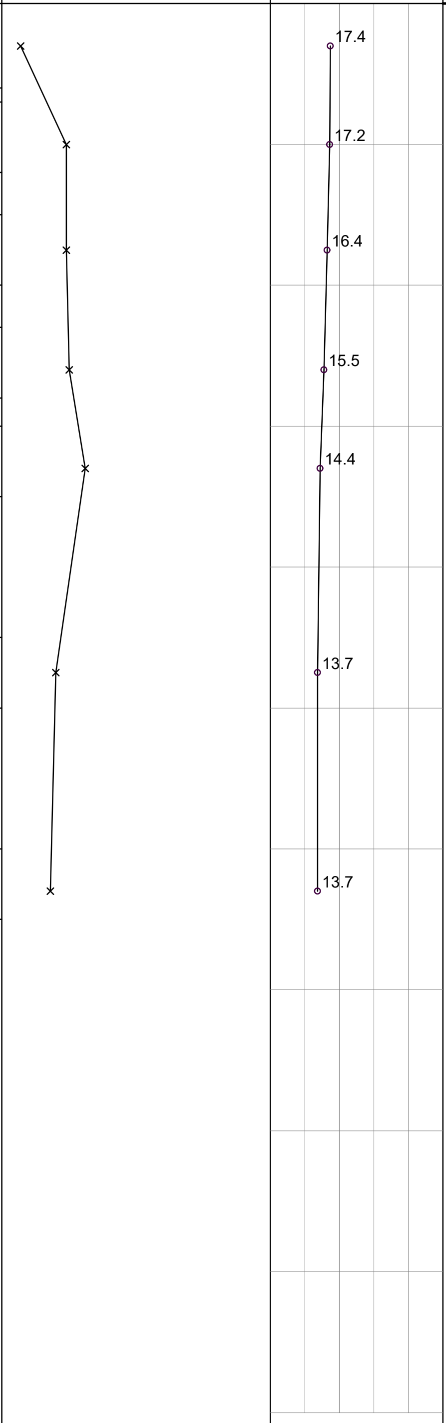
Undrained Shear Strength Values ▲ (kPa) ▲
40 80 120 160

Penetration Test Values × (Blows / 0.3m) ×
20 40 60 80

Moisture / Plasticity

PL MC LL

Moisture / Plasticity ○ ○
10 20 30 40



Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BH2

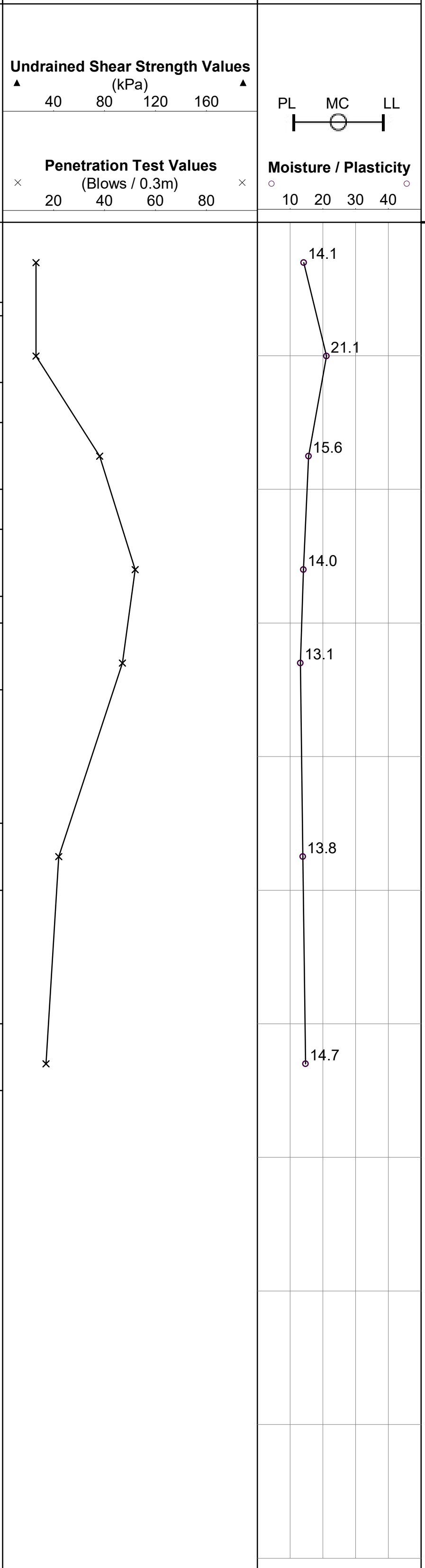
SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-04
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.149763
Easting: -79.896422
Ground Surface Elevation: 227.5

Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Moisture / Plasticity (MC)	Well Details	Groundwater Conditions	Headspace / PID (ppm) [LEL(%)] / ppm	Comments
	Organic Material ~100 mm. Clayey silt, some organics. Brown, dry to moist.	1	SS	3 6 7 6	13	14.1				
227.0	**Clayey Silt** some iron staining, trace grey clay seams. Stiff, brown, moist.									
		2	SS	3 5 8	13	21.1				
226.0	...trace iron staining. Hard.	3	SS	7 17 21	38	15.6				
225.0	**Clayey Silt Till** trace gravel, trace iron staining. Hard, grey, moist.	4	SS	11 19 33	52	14.0				
		5	SS	9 21 26	47	13.1				
224.0										
223.0	...no iron staining. Very stiff.	6	SS	4 10 12	22	13.8				
222.0										
		7	SS	6 5 12	17	14.7				
221.0	End of Log									
220.0										
219.0										
218.0										



Depth Scale (m): 1 2 3 4 5 6 7 8 9 10

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BHMW3S

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-04
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.148049
Easting: -79.900399
Ground Surface Elevation: 230

Depth Scale (m)	Depth/Elevation (m)	Description
0	230.0	**Organic Material** ~100 mm. Clayey silt, some organics. Brown, dry to moist. **Clayey Silt** trace grey clay seams. Stiff, brown, moist. ...very stiff.
1	229.0	
		Clayey Silt Till some grey clay seams, trace gravel. Very stiff, brown, moist. ...hard.
2	228.0	
		Silt Till some clay, trace gravel. Dense, grey, wet. ...compact.
3	227.0	End of Log
4	226.0	
5	225.0	
6	224.0	
7	223.0	
8	222.0	
9	221.0	
10	220.0	

Samples

Number	Type	Blow Counts/150 mm	N Value	Moisture (%)
1	SS	3 5 9 12	14	13.5
2	SS	5 9 17	26	18.5
3	SS	6 9 15	24	17.5
4	SS	7 17 25	42	17.2

Penetration / Strength Results

Undrained Shear Strength Values ▲ (kPa) ▲ 40 80 120 160

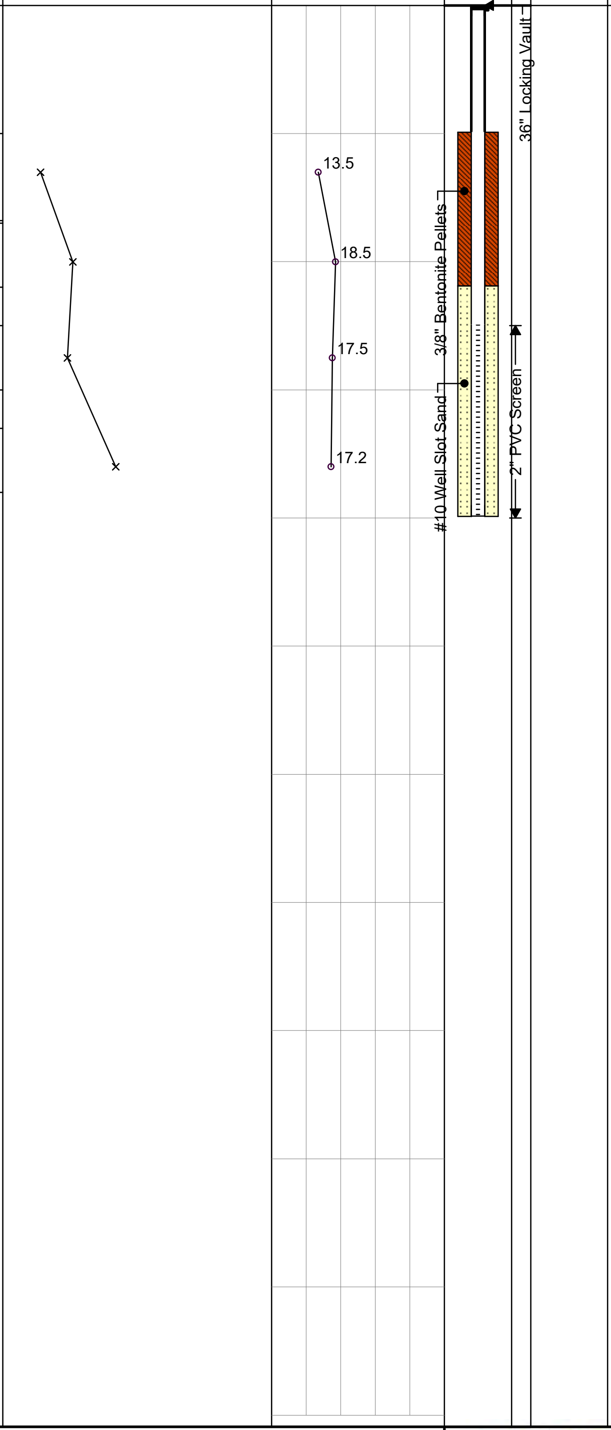
Penetration Test Values × (Blows / 0.3m) × 20 40 60 80

Moisture / Plasticity

PL MC LL

Moisture / Plasticity ○ 10 20 30 40 ○

Well Details | Groundwater Conditions | Headspace / PID (ppm) [LEL(%)] / ppm | Comments



Additional Notes:
1. Borehole open to approximately 3.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BH3D

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-04
Drilling Method: Solid Stem
Datum: Geodetic

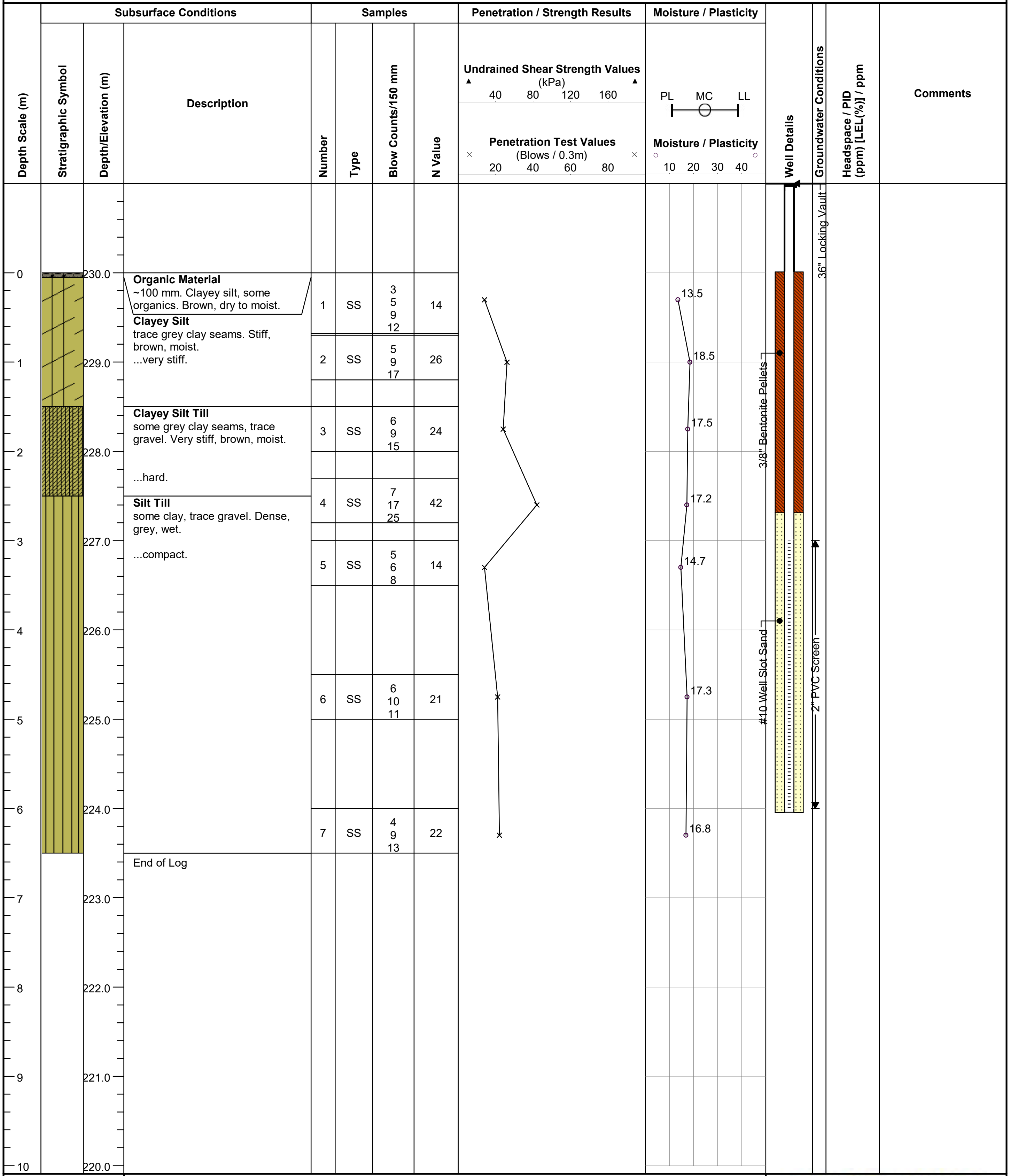
Northing: 43.148164
Easting: -79.900243
Ground Surface Elevation: 230

Subsurface Conditions

Description
Organic Material ~100 mm. Clayey silt, some organics. Brown, dry to moist.
Clayey Silt trace grey clay seams. Stiff, brown, moist. ...very stiff.
Clayey Silt Till some grey clay seams, trace gravel. Very stiff, brown, moist. ...hard.
Silt Till some clay, trace gravel. Dense, grey, wet. ...compact.
End of Log

Samples

Number	Type	Blow Counts/150 mm	N Value
1	SS	3 5 9 12	14
2	SS	5 9 17	26
3	SS	6 9 15	24
4	SS	7 17 25	42
5	SS	5 6 8	14
6	SS	6 10 11	21
7	SS	4 9 13	22



Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BHMW4

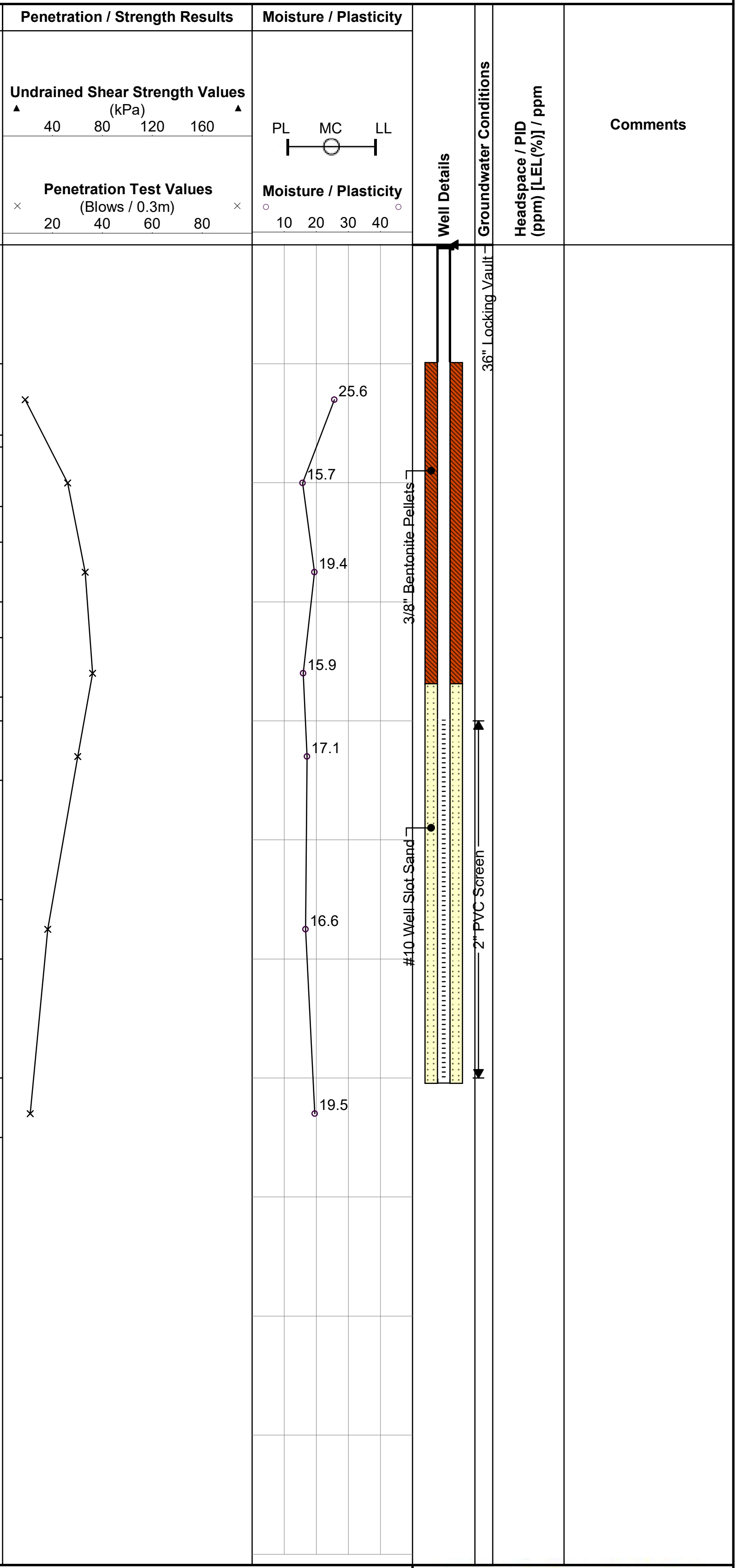
SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-09
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.145765
Easting: -79.915462
Ground Surface Elevation: 222.5

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value
	223.0					
0		**Organic Material** ~100 mm. Silty clay. Brown, moist. **Silty Clay** with grey clay seams. Stiff, brown, dry to moist.	1	SS	2 5 4 5	9
1	222.0	...very stiff.	2	SS	3 11 15	26
2	221.0	...hard.	3	SS	4 14 19	33
3	220.0	**Clayey Silt Till** trace gravel, trace cobbles. Hard, brown, moist.	4	SS	3 16 20	36
4	219.0	...some grey clay seams, trace iron staining. Very stiff to hard.	5	SS	5 12 18	30
5	218.0	**Silty Clay Till** trace gravel. Very stiff, grey, very moist to wet.	6	SS	3 8 10	18
6	217.0	...stiff.	7	SS	3 5 6	11
7	216.0	End of Log				
8	215.0					
9	214.0					
10	213.0					



Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BH5

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-04
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.146519
Easting: -79.903092
Ground Surface Elevation: 227

Subsurface Conditions

Depth Scale (m)	Depth/Elevation (m)
1	226.0
2	225.0
3	224.0
4	223.0
5	222.0
6	221.0
7	220.0
8	219.0
9	218.0
10	217.0

Description

Organic Material
~50 mm. Clayey silt, trace organics. Brown, dry.

Clayey Silt
trace iron staining. Firm to stiff, brown, dry.

...very stiff.

...moist.

Clayey Silt Till
trace gravel, trace iron staining. Very stiff, brownish grey, moist.

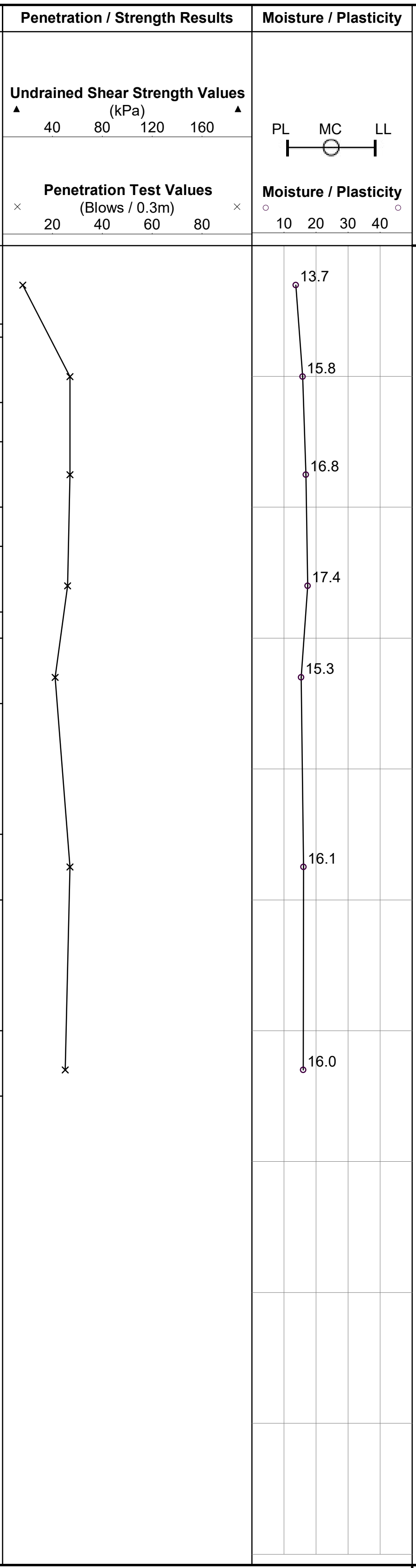
...grey, wet.

...moist.

End of Log

Samples

Number	Type	Blow Counts/150 mm	N Value
1	SS	3 4 4 5	8
2	SS	5 12 15	27
3	SS	6 11 16	27
4	SS	5 10 16	26
5	SS	6 8 13	21
6	SS	5 12 15	27
7	SS	4 8 17	25



Well Details | Groundwater Conditions | Headspace / PID (ppm) [LEL(%)] / ppm | Comments

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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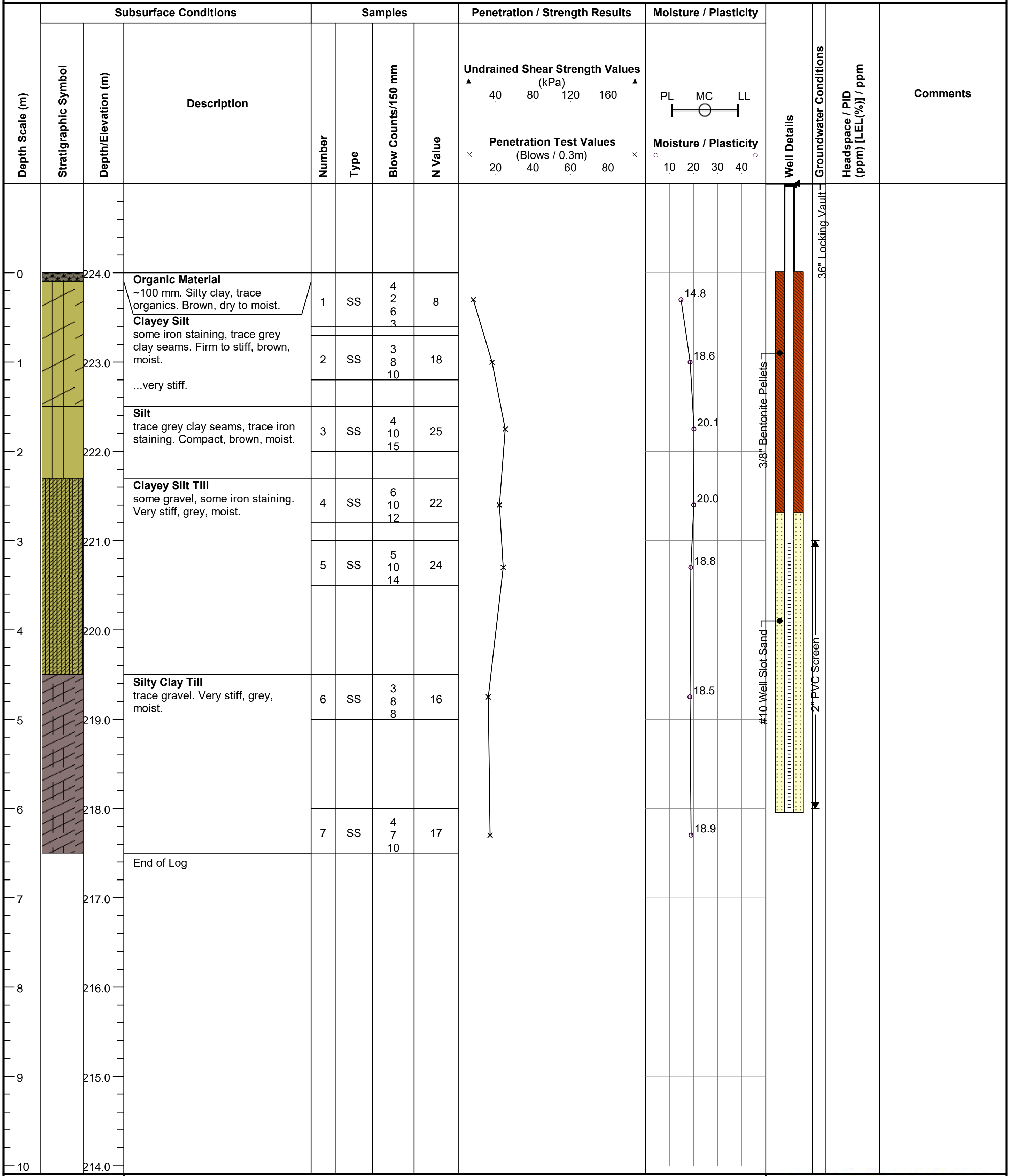
LOG OF BOREHOLE BHMW6

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-04
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.141969
Easting: -79.903206
Ground Surface Elevation: 224



Description	Number	Type	Blow Counts/150 mm	N Value	Moisture (%)
Organic Material ~100 mm. Silty clay, trace organics. Brown, dry to moist.	1	SS	4 2 6 3	8	14.8
Clayey Silt some iron staining, trace grey clay seams. Firm to stiff, brown, moist. ...very stiff.	2	SS	3 8 10	18	18.6
Silt trace grey clay seams, trace iron staining. Compact, brown, moist.	3	SS	4 10 15	25	20.1
Clayey Silt Till some gravel, some iron staining. Very stiff, grey, moist.	4	SS	6 10 12	22	20.0
	5	SS	5 10 14	24	18.8
Silty Clay Till trace gravel. Very stiff, grey, moist.	6	SS	3 8 8	16	18.5
	7	SS	4 7 10	17	18.9
End of Log					

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BH7

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-05
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.141126
Easting: -79.899115
Ground Surface Elevation: 224.1

Subsurface Conditions

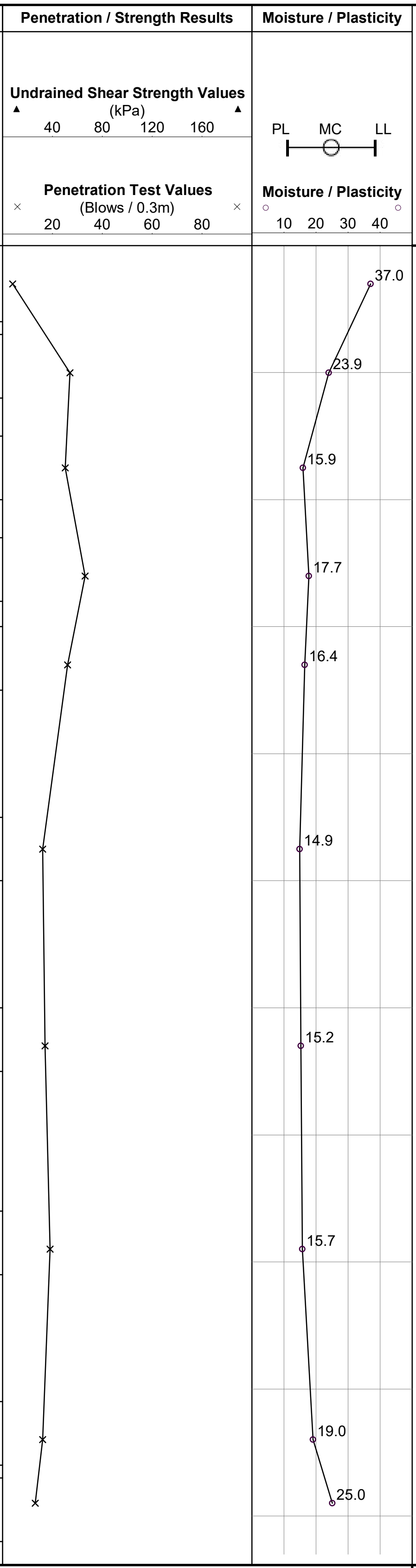
Depth/Elevation (m)	Description
224.0	**Organic Material** ~100 mm. Silty clay, some organics and wood debris. Brown, moist.
	Clayey Silt trace sand, trace gravel. Soft to firm, brown, dry to moist.
223.0	...very stiff.
	...trace grey clay seams, trace red shale fragments.
222.0	**Clayey Silt Till** trace gravel. Hard, brown, moist.
221.0	...some iron staining. Very stiff.
	...grey.
218.0	...very moist.
	...stiff, very moist to wet.
214.0	End of Log

Samples

Number	Type	Blow Counts/150 mm	N Value
1	SS	1 2 2 3	4
2	SS	4 13 14	27
3	SS	5 10 15	25
4	SS	7 13 20	33
5	SS	5 12 14	26
6	SS	4 7 9	16
7	SS	5 7 10	17
8	SS	6 9 10	19
9	SS	3 6 10	16
10	SS	4 5 8	13

Depth Scale (m): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Depth/Elevation (m): 224.0, 223.0, 222.0, 221.0, 220.0, 219.0, 218.0, 217.0, 216.0, 215.0, 214.0



Well Details | Groundwater Conditions | Headspace / PID (ppm) [LEL(%)] / ppm | Comments

Additional Notes:
1. Borehole open to approximately 9.3 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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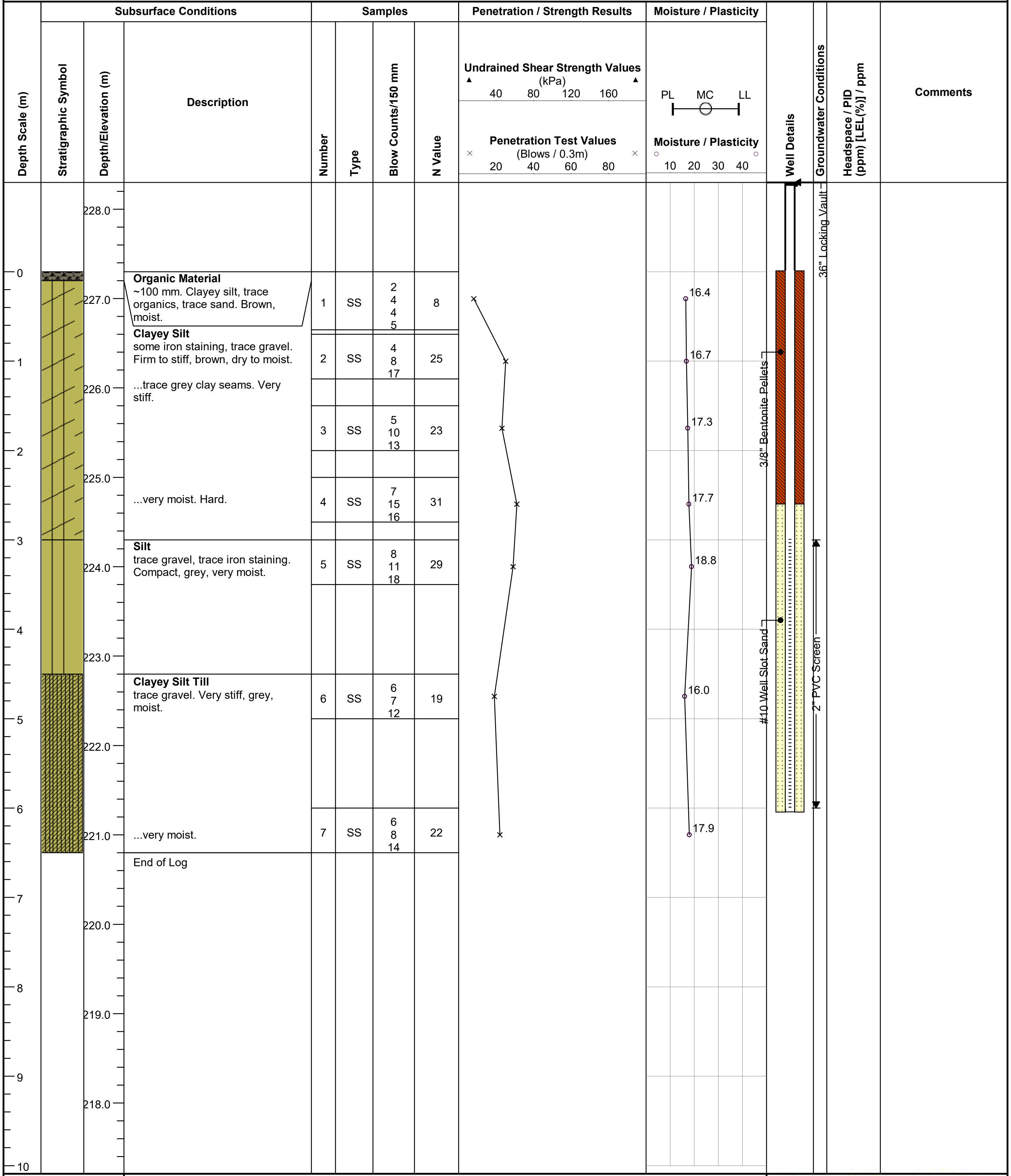
LOG OF BOREHOLE BHMW8

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-05
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.143731
Easting: -79.896422
Ground Surface Elevation: 227.3



Description	Number	Type	Blow Counts/150 mm	N Value
Organic Material ~100 mm. Clayey silt, trace organics, trace sand. Brown, moist.	1	SS	2 4 4 5	8
Clayey Silt some iron staining, trace gravel. Firm to stiff, brown, dry to moist.	2	SS	4 8 17	25
...trace grey clay seams. Very stiff.	3	SS	5 10 13	23
...very moist. Hard.	4	SS	7 15 16	31
Silt trace gravel, trace iron staining. Compact, grey, very moist.	5	SS	8 11 18	29
Clayey Silt Till trace gravel. Very stiff, grey, moist.	6	SS	6 7 12	19
...very moist.	7	SS	6 8 14	22
End of Log				

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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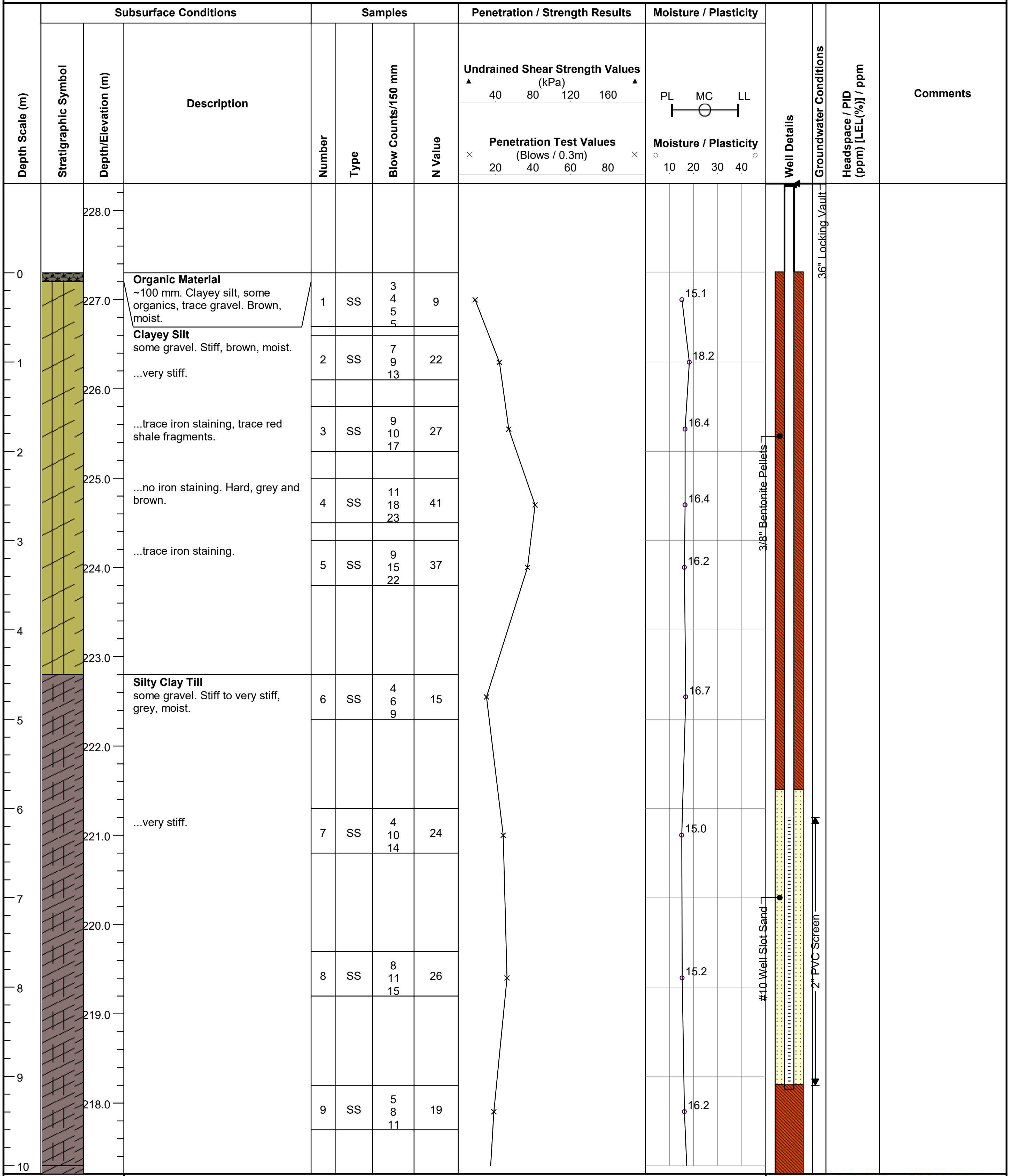
LOG OF BOREHOLE BHMW9

SHEET 1 of 2

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-08
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.139595
Easting: -79.892163
Ground Surface Elevation: 227.3



Description	Number	Type	Blow Counts/150 mm	N Value	Moisture (MC)
Organic Material ~100 mm. Clayey silt, some organics, trace gravel. Brown, moist.	1	SS	3 4 5 5	9	15.1
Clayey Silt some gravel. Stiff, brown, moist.					
...very stiff.	2	SS	7 9 13	22	18.2
...trace iron staining, trace red shale fragments.	3	SS	9 10 17	27	16.4
...no iron staining. Hard, grey and brown.	4	SS	11 18 23	41	16.4
...trace iron staining.	5	SS	9 15 22	37	16.2
Silty Clay Till some gravel. Stiff to very stiff, grey, moist.	6	SS	4 6 9	15	16.7
...very stiff.	7	SS	4 10 14	24	15.0
	8	SS	8 11 15	26	15.2
	9	SS	5 8 11	19	16.2

Additional Notes:
1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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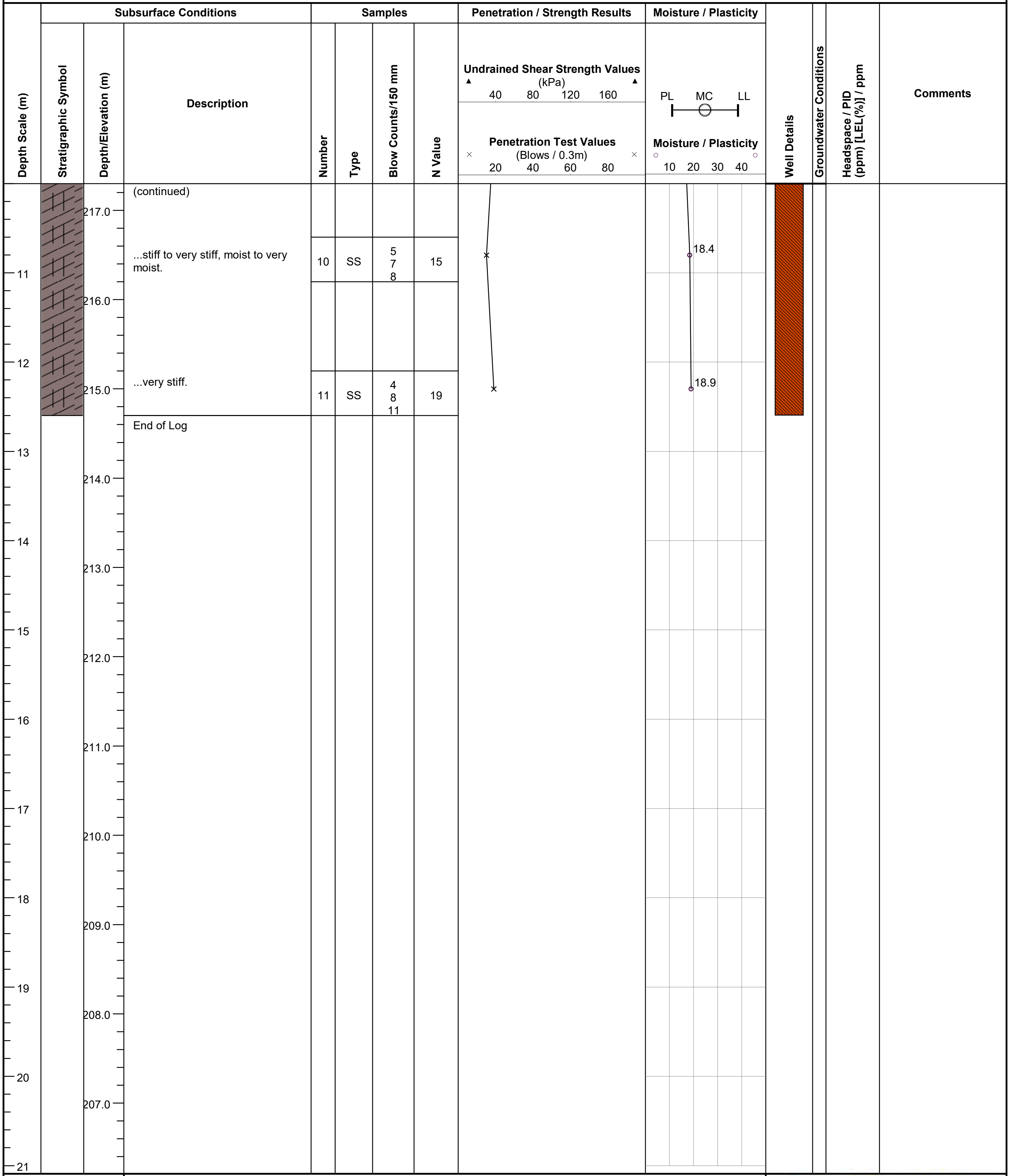
LOG OF BOREHOLE BHMW9

SHEET 2 of 2

Project No.: 23354	**Drill Date:** 2024-07-08	**Northing:** 43.139595
Project Name: White Church Lands	**Drilling Method:** Solid Stem	**Easting:** -79.892163
Location: White Church Rd. & Airport Rd., Hamilton	**Datum:** Geodetic	**Ground Surface Elevation:** 227.3



Description	Number	Type	Blow Counts/150 mm	N Value	Moisture (%)
(continued)					
...stiff to very stiff, moist to very moist.	10	SS	5 7 8	15	18.4
...very stiff.	11	SS	4 8 11	19	18.9
End of Log					

Additional Notes:

1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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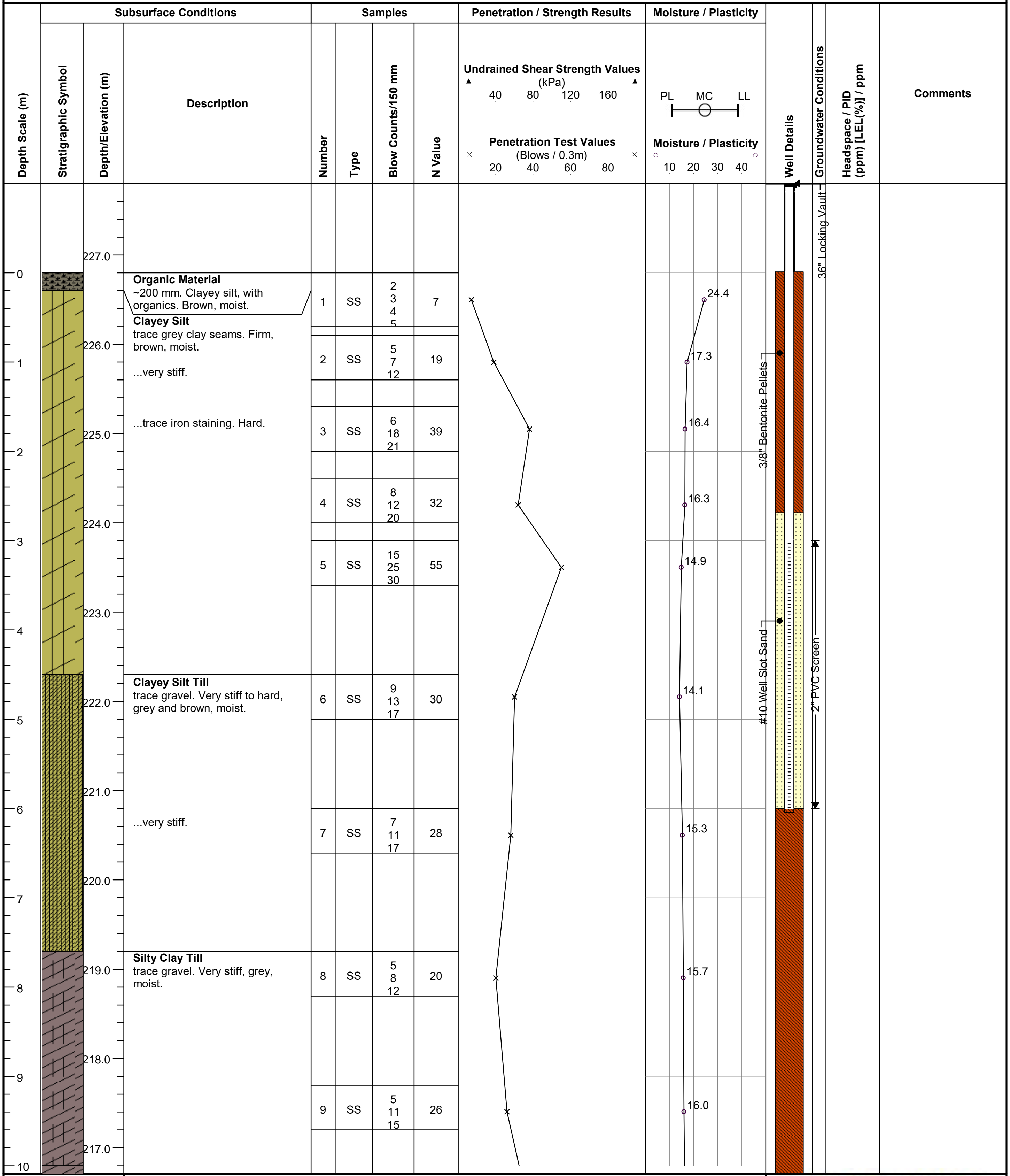
LOG OF BOREHOLE BHMW10

SHEET 1 of 2

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-08
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.142154
Easting: -79.886746
Ground Surface Elevation: 226.8



Description

Organic Material
~200 mm. Clayey silt, with organics. Brown, moist.

Clayey Silt
trace grey clay seams. Firm, brown, moist.

...very stiff.

...trace iron staining. Hard.

Clayey Silt Till
trace gravel. Very stiff to hard, grey and brown, moist.

...very stiff.

Silty Clay Till
trace gravel. Very stiff, grey, moist.

Number	Type	Blow Counts/150 mm	N Value
1	SS	2 3 4 5	7
2	SS	5 7 12	19
3	SS	6 18 21	39
4	SS	8 12 20	32
5	SS	15 25 30	55
6	SS	9 13 17	30
7	SS	7 11 17	28
8	SS	5 8 12	20
9	SS	5 11 15	26

Additional Notes:
1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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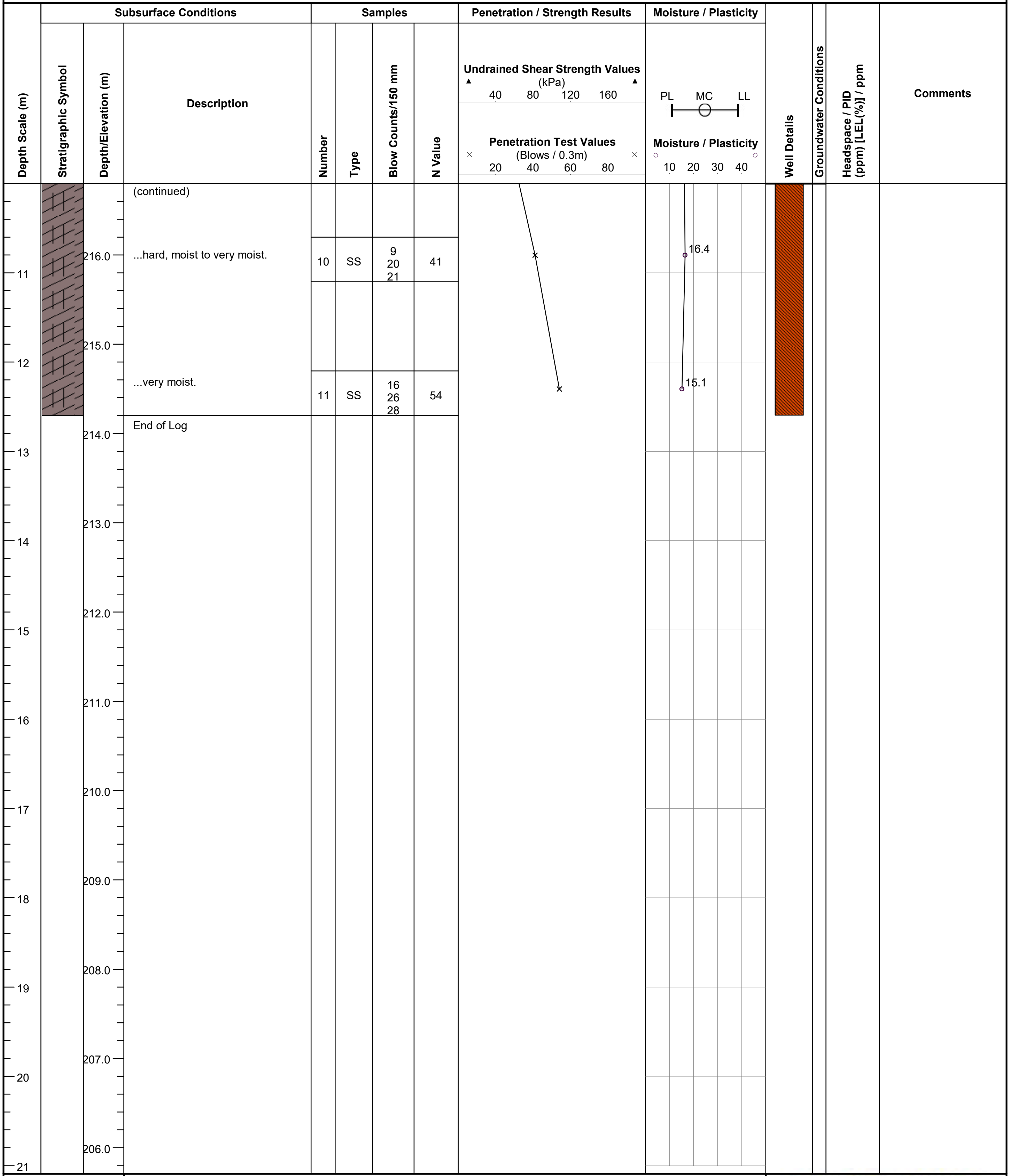
LOG OF BOREHOLE BHMW10

SHEET 2 of 2

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-08
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.142154
Easting: -79.886746
Ground Surface Elevation: 226.8



Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Moisture / Plasticity
	(continued)					
216.0	...hard, moist to very moist.	10	SS	9 20 21	41	16.4
215.0	...very moist.	11	SS	16 26 28	54	15.1
214.0	End of Log					

Additional Notes:
1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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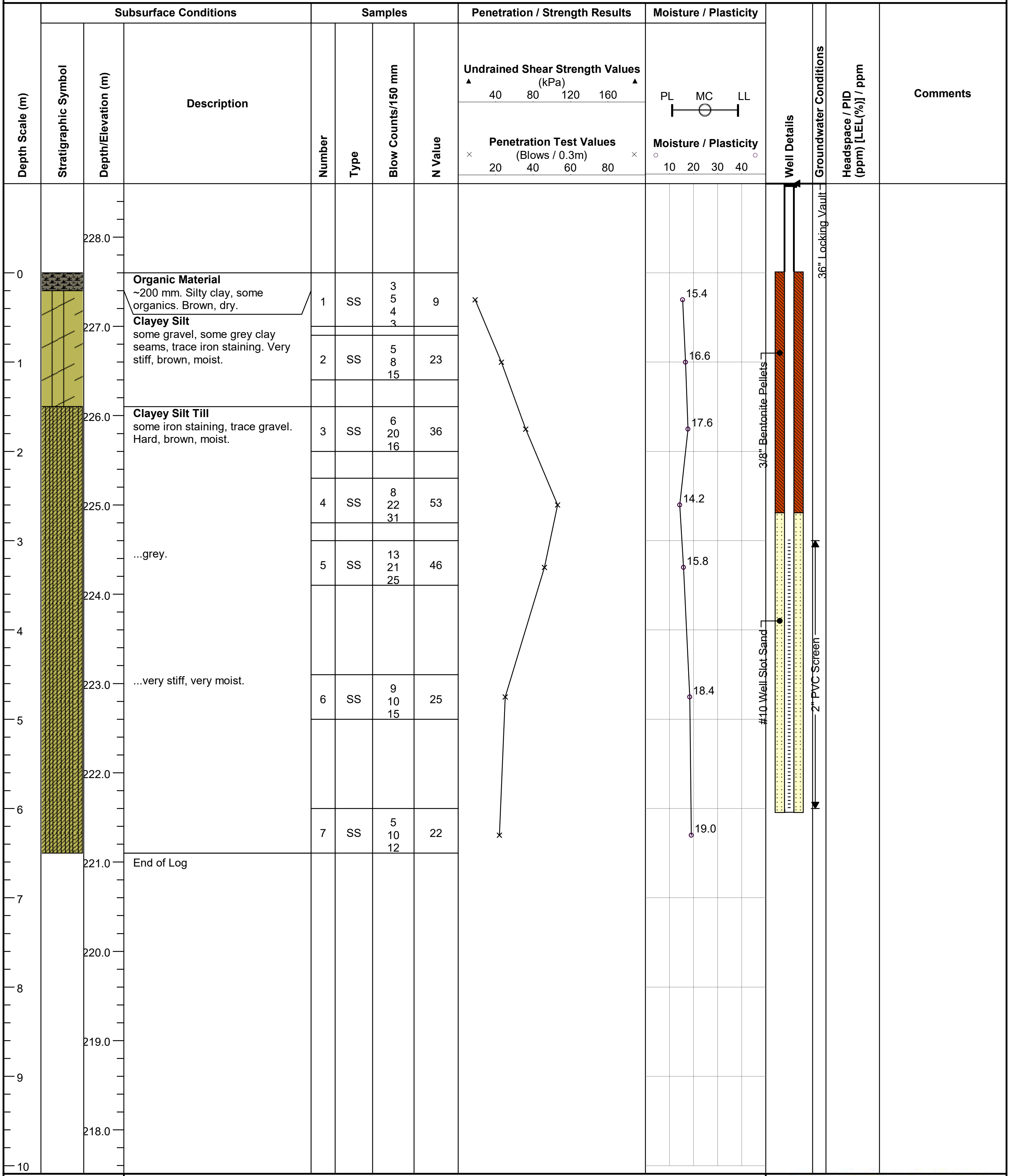
LOG OF BOREHOLE BHMW11

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-08
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.13907
Easting: -79.888437
Ground Surface Elevation: 227.6



Depth/Elevation (m)	Description
227.6	**Organic Material** ~200 mm. Silty clay, some organics. Brown, dry.
	Clayey Silt some gravel, some grey clay seams, trace iron staining. Very stiff, brown, moist.
226.1	**Clayey Silt Till** some iron staining, trace gravel. Hard, brown, moist.
	...grey.
	...very stiff, very moist.
221.1	End of Log

Number	Type	Blow Counts/150 mm	N Value	Moisture (%)
1	SS	3 5 4 3	9	15.4
2	SS	5 8 15	23	16.6
3	SS	6 20 16	36	17.6
4	SS	8 22 31	53	14.2
5	SS	13 21 25	46	15.8
6	SS	9 10 15	25	18.4
7	SS	5 10 12	22	19.0

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BHMW12

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-05
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.140212
Easting: -79.902967
Ground Surface Elevation: 222.4

Subsurface Conditions

Organic Material
~100 mm. Clayey silt, trace organics. Brown, moist.

Clayey Silt
trace iron staining, trace grey clay seams. Firm to stiff, brown, moist.

...very stiff.

...moist to very moist.

Silty Clay Till

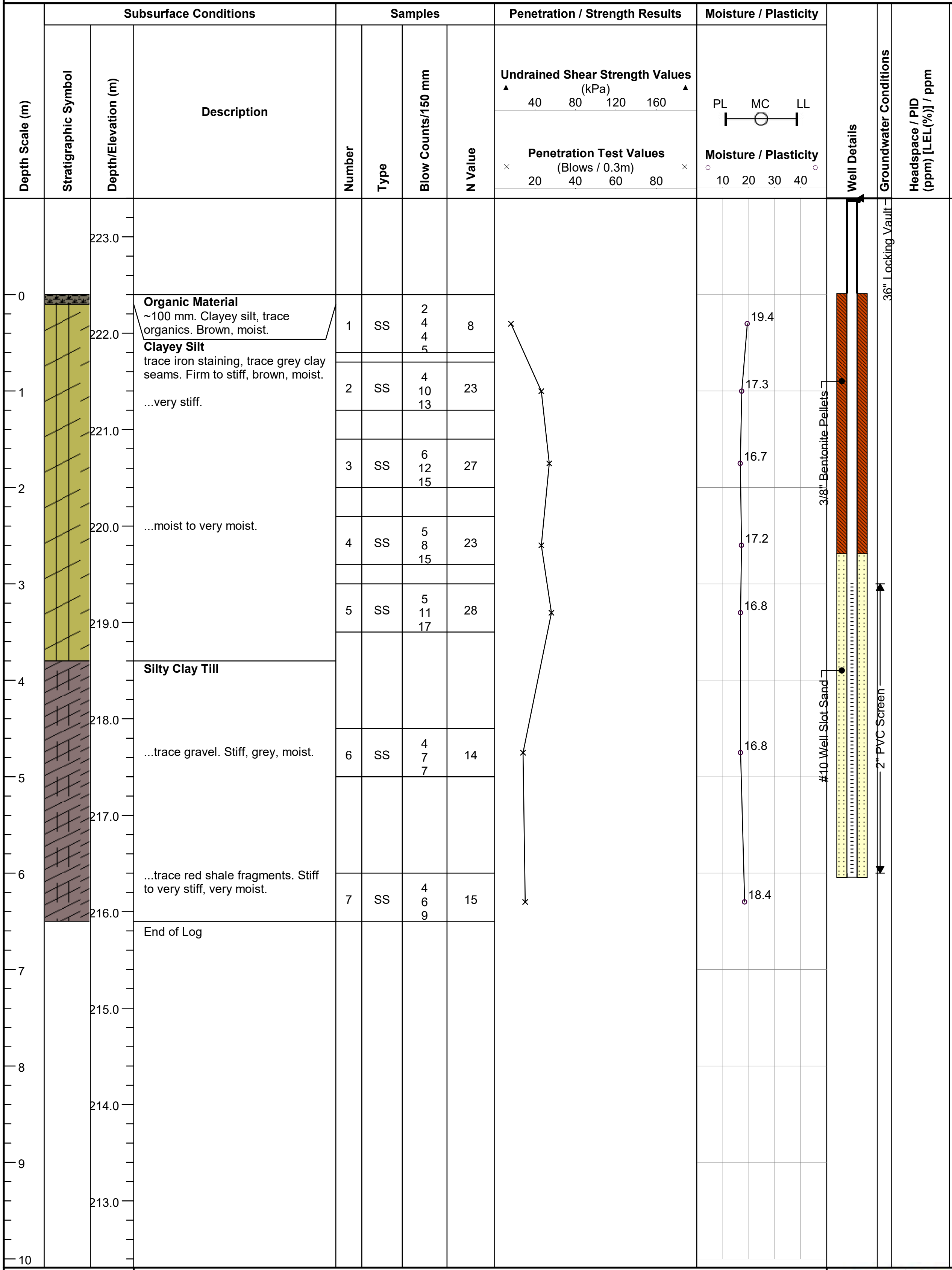
...trace gravel. Stiff, grey, moist.

...trace red shale fragments. Stiff to very stiff, very moist.

End of Log

Samples

Number	Type	Blow Counts/150 mm	N Value	Moisture (%)
1	SS	2 4 4 5	8	19.4
2	SS	4 10 13	23	17.3
3	SS	6 12 15	27	16.7
4	SS	5 8 15	23	17.2
5	SS	5 11 17	28	16.8
6	SS	4 7 7	14	16.8
7	SS	4 6 9	15	18.4



Comments

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BH13

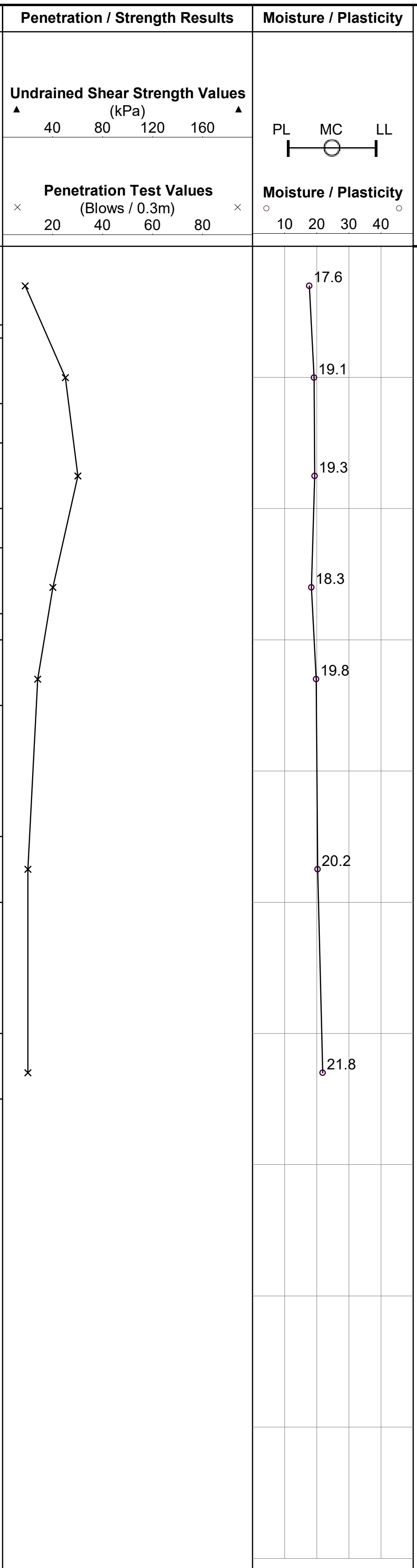
SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-07-04
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.138818
Easting: -79.90685
Ground Surface Elevation: 220.1

Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Moisture / Plasticity (MC)
220.0	**Organic Material** ~50 mm. Silt, trace clay, trace organics. Brown, moist. **Clayey Silt** trace grey clay seams. Stiff, brown, moist.	1	SS	4 5 4 4	9	17.6
219.0	...very stiff.	2	SS	4 7 18	25	19.1
	Clayey Silt Till trace gravel, trace iron staining. Very stiff to hard, grey, moist.	3	SS	5 10 20	30	19.3
218.0	...no iron staining. Very stiff.	4	SS	4 8 12	20	18.3
217.0	...stiff.	5	SS	3 6 8	14	19.8
216.0						
215.0		6	SS	2 5 5	10	20.2
214.0	...very moist.	7	SS	2 4 6	10	21.8
	End of Log					
213.0						
212.0						
211.0						



Well Details | Groundwater Conditions | Headspace / PID (ppm) [LEL(%)] / ppm | Comments

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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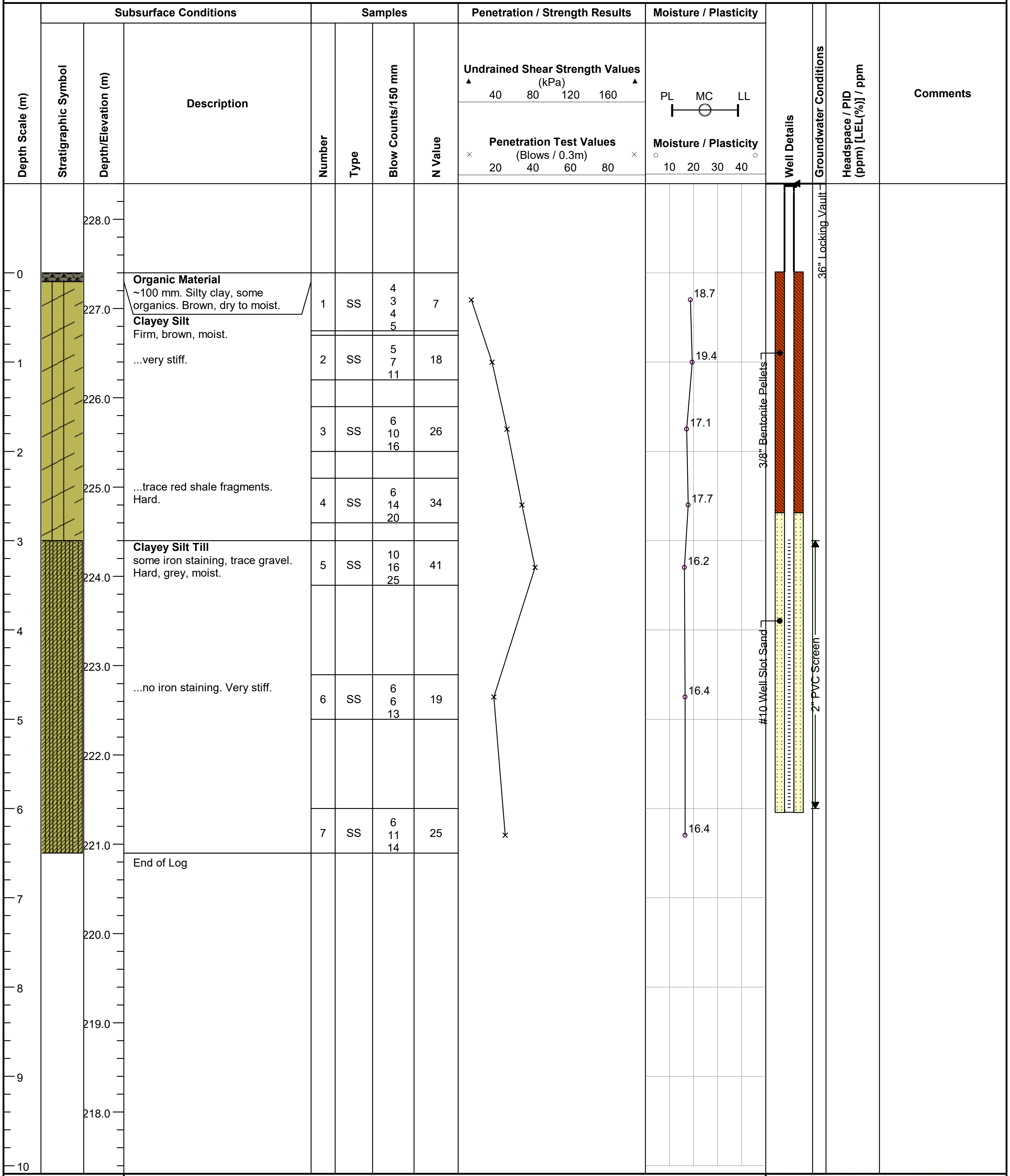
LOG OF BOREHOLE BHMW16

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-08-06
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.14914
Easting: -79.893228
Ground Surface Elevation: 227.4



Description	Number	Type	Blow Counts/150 mm	N Value	Moisture (%)
Organic Material ~100 mm. Silty clay, some organics. Brown, dry to moist. **Clayey Silt** Firm, brown, moist.	1	SS	4 3 4 5	7	18.7
...very stiff.	2	SS	5 7 11	18	19.4
	3	SS	6 10 16	26	17.1
...trace red shale fragments. Hard.	4	SS	6 14 20	34	17.7
Clayey Silt Till some iron staining, trace gravel. Hard, grey, moist.	5	SS	10 16 25	41	16.2
...no iron staining. Very stiff.	6	SS	6 6 13	19	16.4
	7	SS	6 11 14	25	16.4
End of Log					

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BHMW17

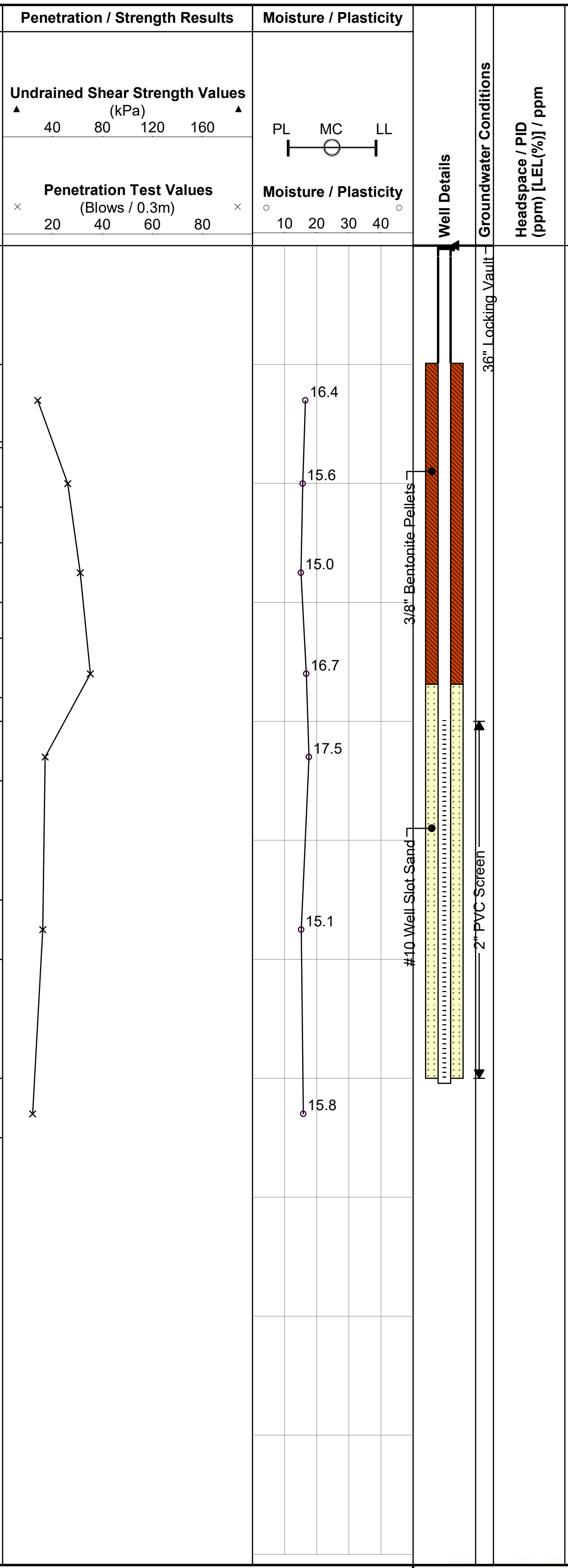
SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-08-06
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.147912
Easting: -79.886182
Ground Surface Elevation: 223.9

Description	Number	Type	Blow Counts/150 mm	N Value	Moisture (%)
Organic Material ~100 mm. Silty clay, trace organics. Brown, moist.	1	SS	3 6 8 7	14	16.4
Silty Clay trace gravel. Stiff, brown, moist.					
...very stiff.	2	SS	7 11 15	26	15.6
...hard, brown and grey.	3	SS	10 15 16	31	15.0
Clayey Silt Till trace gravel. Hard, grey, moist.	4	SS	10 16 19	35	16.7
Silty Clay Till trace gravel. Very stiff, grey, moist.	5	SS	5 7 10	17	17.5
	6	SS	4 7 9	16	15.1
...stiff, very moist.	7	SS	3 5 7	12	15.8
End of Log					



Depth Scale (m): 0 1 2 3 4 5 6 7 8 9 10
Depth/Elevation (m): 224.0 223.0 222.0 221.0 220.0 219.0 218.0 217.0 216.0 215.0 214.0

Comments

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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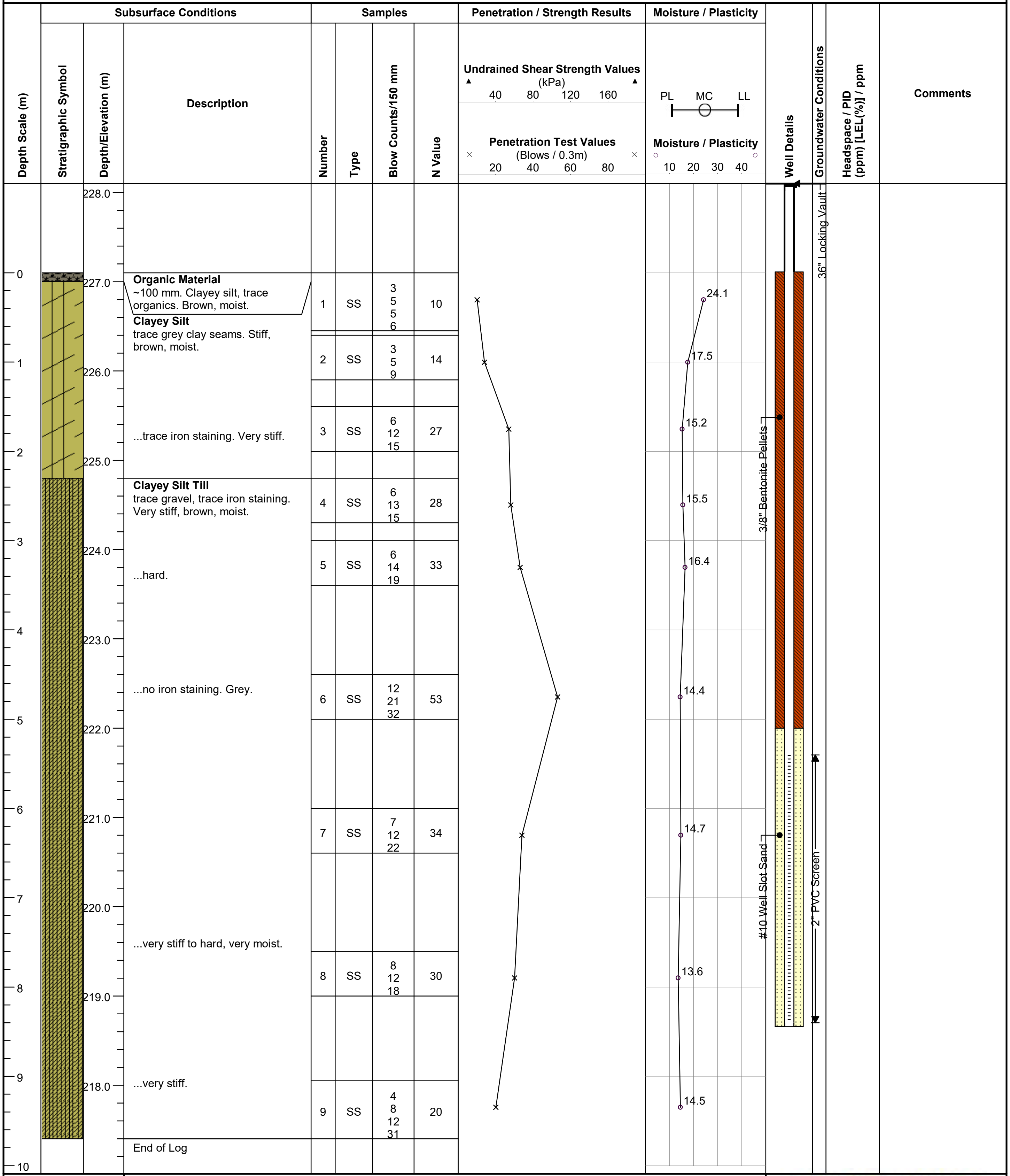
LOG OF BOREHOLE BHMW18

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-08-08
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.147067
Easting: -79.892351
Ground Surface Elevation: 227.1



Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Moisture (%)
227.0	**Organic Material** ~100 mm. Clayey silt, trace organics. Brown, moist. **Clayey Silt** trace grey clay seams. Stiff, brown, moist.	1	SS	3 5 5 6	10	24.1
226.0		2	SS	3 5 9	14	17.5
	...trace iron staining. Very stiff.	3	SS	6 12 15	27	15.2
225.0	**Clayey Silt Till** trace gravel, trace iron staining. Very stiff, brown, moist.	4	SS	6 13 15	28	15.5
224.0	...hard.	5	SS	6 14 19	33	16.4
223.0	...no iron staining. Grey.	6	SS	12 21 32	53	14.4
221.0		7	SS	7 12 22	34	14.7
220.0	...very stiff to hard, very moist.	8	SS	8 12 18	30	13.6
218.0	...very stiff.	9	SS	4 8 12 31	20	14.5
	End of Log					

Additional Notes:
1. Borehole open, with cave, to approximately 8.4 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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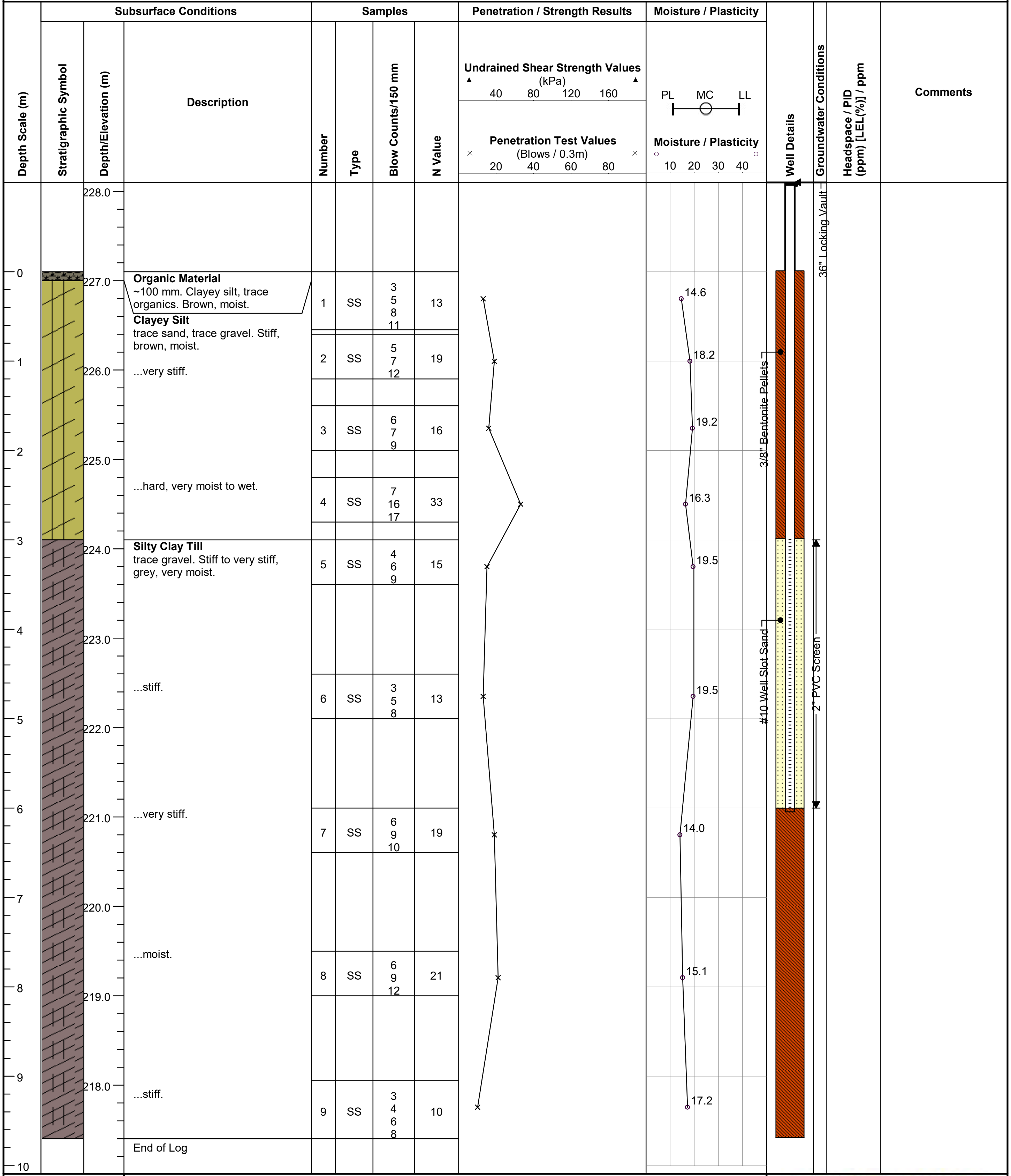
LOG OF BOREHOLE BHMW19D

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-08-07
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.141857
Easting: -79.894982
Ground Surface Elevation: 227.1



Description	Number	Type	Blow Counts/150 mm	N Value	Moisture (%)
Organic Material ~100 mm. Clayey silt, trace organics. Brown, moist.	1	SS	3 5 8 11	13	14.6
Clayey Silt trace sand, trace gravel. Stiff, brown, moist.					
...very stiff.	2	SS	5 7 12	19	18.2
	3	SS	6 7 9	16	19.2
...hard, very moist to wet.	4	SS	7 16 17	33	16.3
Silty Clay Till trace gravel. Stiff to very stiff, grey, very moist.	5	SS	4 6 9	15	19.5
...stiff.	6	SS	3 5 8	13	19.5
...very stiff.	7	SS	6 9 10	19	14.0
...moist.	8	SS	6 9 12	21	15.1
...stiff.	9	SS	3 4 6 8	10	17.2
End of Log					

Additional Notes:
1. Borehole open to approximately 9.1 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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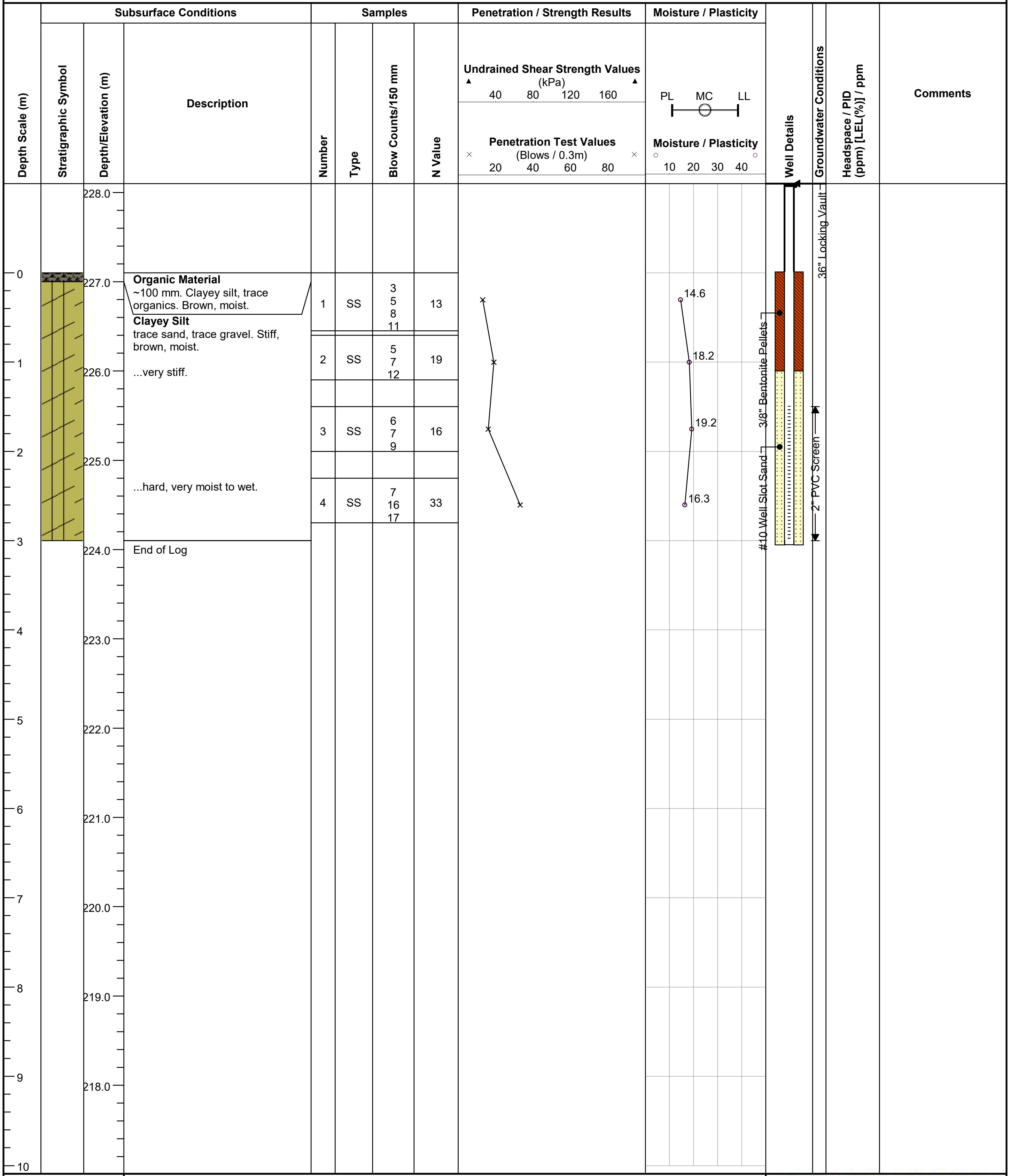
LOG OF BOREHOLE BHMW19S

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-08-07
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.141812
Easting: -79.894825
Ground Surface Elevation: 227.1



Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value
227.0	**Organic Material** ~100 mm. Clayey silt, trace organics. Brown, moist.	1	SS	3 5 8 11	13
	Clayey Silt trace sand, trace gravel. Stiff, brown, moist.	2	SS	5 7 12	19
	...very stiff.	3	SS	6 7 9	16
	...hard, very moist to wet.	4	SS	7 16 17	33
224.0	End of Log				

Additional Notes:
1. Borehole open to approximately 3.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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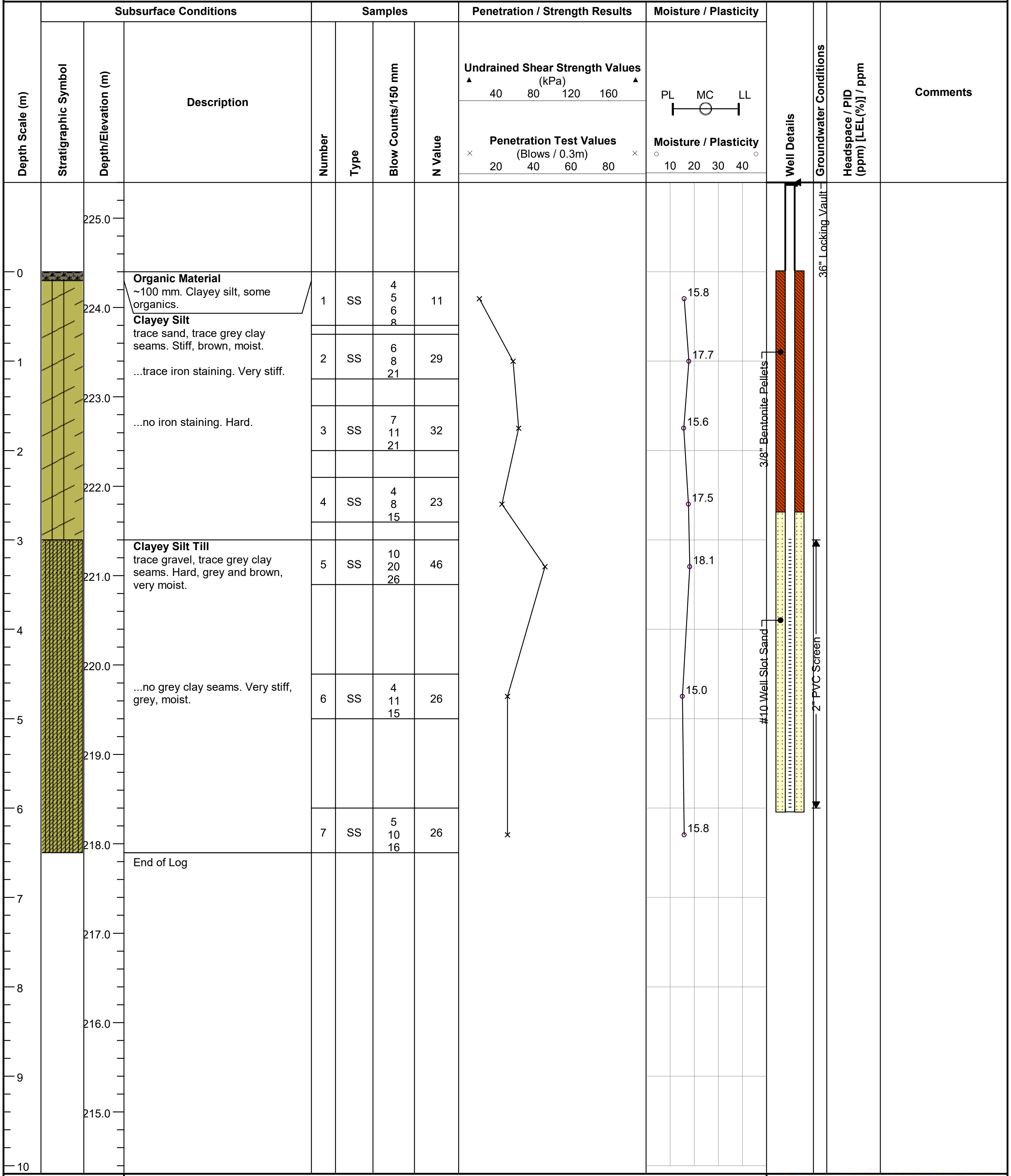
LOG OF BOREHOLE BHMW20

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2024-08-07
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.144462
Easting: -79.884115
Ground Surface Elevation: 224.4



Description	Number	Type	Blow Counts/150 mm	N Value	Moisture (%)
Organic Material ~100 mm. Clayey silt, some organics.	1	SS	4 5 6 8	11	15.8
Clayey Silt trace sand, trace grey clay seams. Stiff, brown, moist. ...trace iron staining. Very stiff.	2	SS	6 8 21	29	17.7
...no iron staining. Hard.	3	SS	7 11 21	32	15.6
	4	SS	4 8 15	23	17.5
Clayey Silt Till trace gravel, trace grey clay seams. Hard, grey and brown, very moist.	5	SS	10 20 26	46	18.1
...no grey clay seams. Very stiff, grey, moist.	6	SS	4 11 15	26	15.0
	7	SS	5 10 16	26	15.8
End of Log					

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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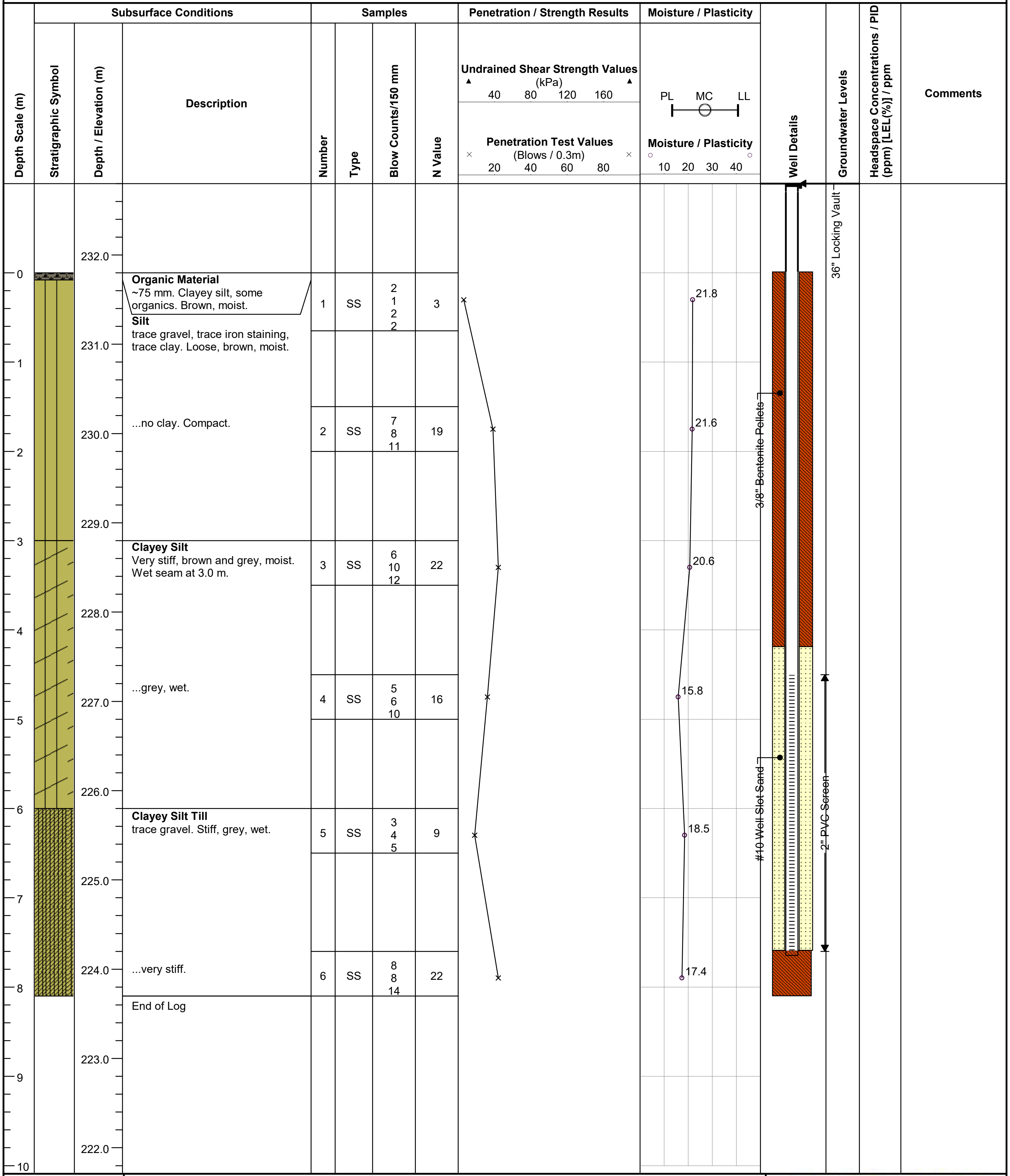
LOG OF BOREHOLE BH/MW22

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2025-01-06
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.153432
Easting: -79.906401
Ground Surface Elevation: 231.8



Description	Number	Type	Blow Counts/150 mm	N Value
Organic Material ~75 mm. Clayey silt, some organics. Brown, moist. **Silt** trace gravel, trace iron staining, trace clay. Loose, brown, moist.	1	SS	2 1 2 2	3
...no clay. Compact.	2	SS	7 8 11	19
Clayey Silt Very stiff, brown and grey, moist. Wet seam at 3.0 m.	3	SS	6 10 12	22
...grey, wet.	4	SS	5 6 10	16
Clayey Silt Till trace gravel. Stiff, grey, wet.	5	SS	3 4 5	9
...very stiff.	6	SS	8 8 14	22
End of Log				

Additional Notes:
1. Borehole open to approximately 7.6 m depth on completion.
2. Groundwatere or water seepage encountered during drilling at approximately 3.0 m depth below the ground surface.
3.
4.

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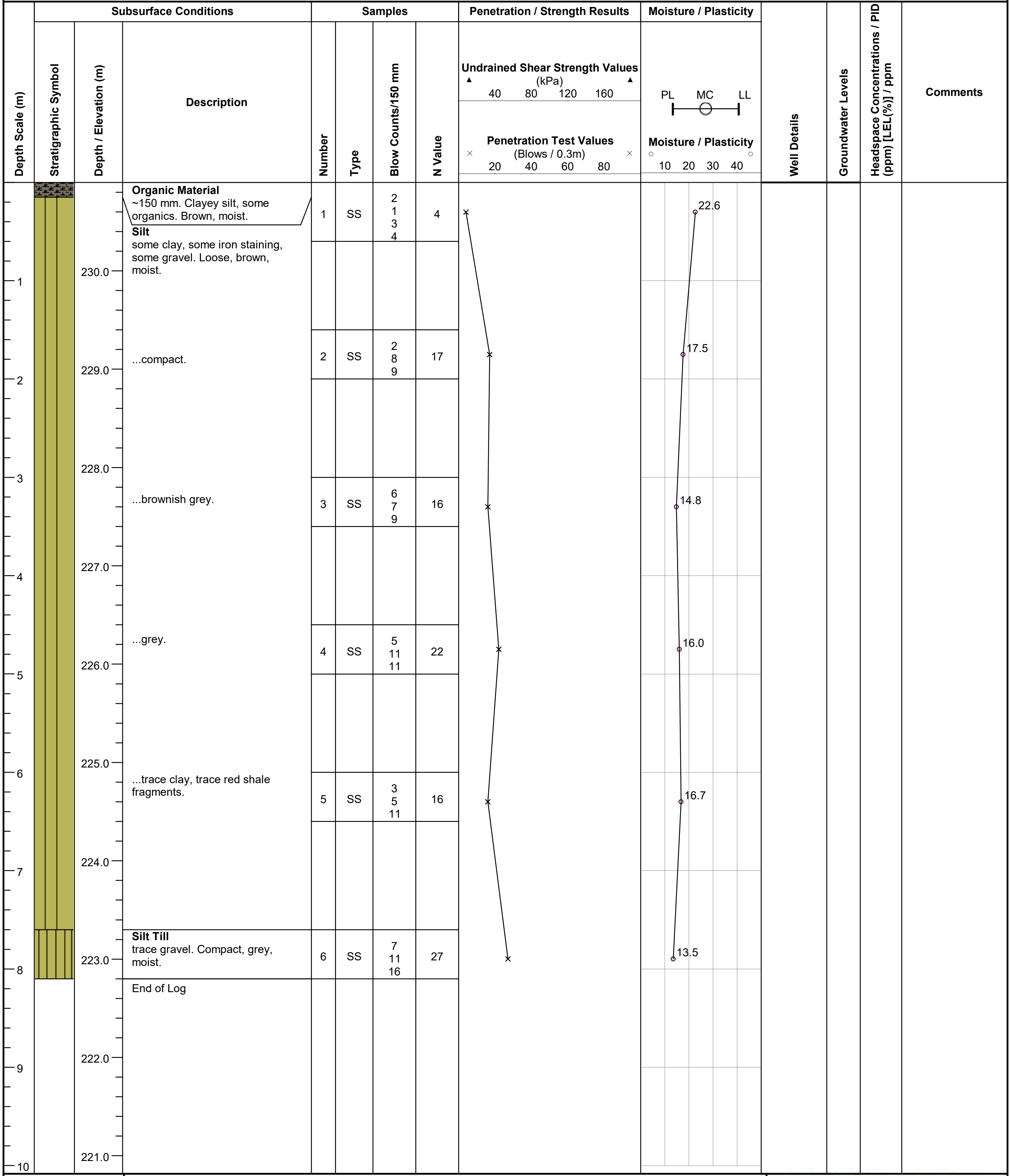
LOG OF BOREHOLE BH23

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2025-01-06
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.150856
Easting: -79.903838
Ground Surface Elevation: 230.9



Subsurface Conditions: Description	Samples: Number	Type	Blow Counts/150 mm	N Value
Organic Material ~150 mm. Clayey silt, some organics. Brown, moist.	1	SS	2 1 3 4	4
Silt some clay, some iron staining, some gravel. Loose, brown, moist.				
...compact.	2	SS	2 8 9	17
...brownish grey.	3	SS	6 7 9	16
...grey.	4	SS	5 11 11	22
...trace clay, trace red shale fragments.	5	SS	3 5 11	16
Silt Till trace gravel. Compact, grey, moist.	6	SS	7 11 16	27
End of Log				

Additional Notes:
1. Borehole open to approximately 7.6 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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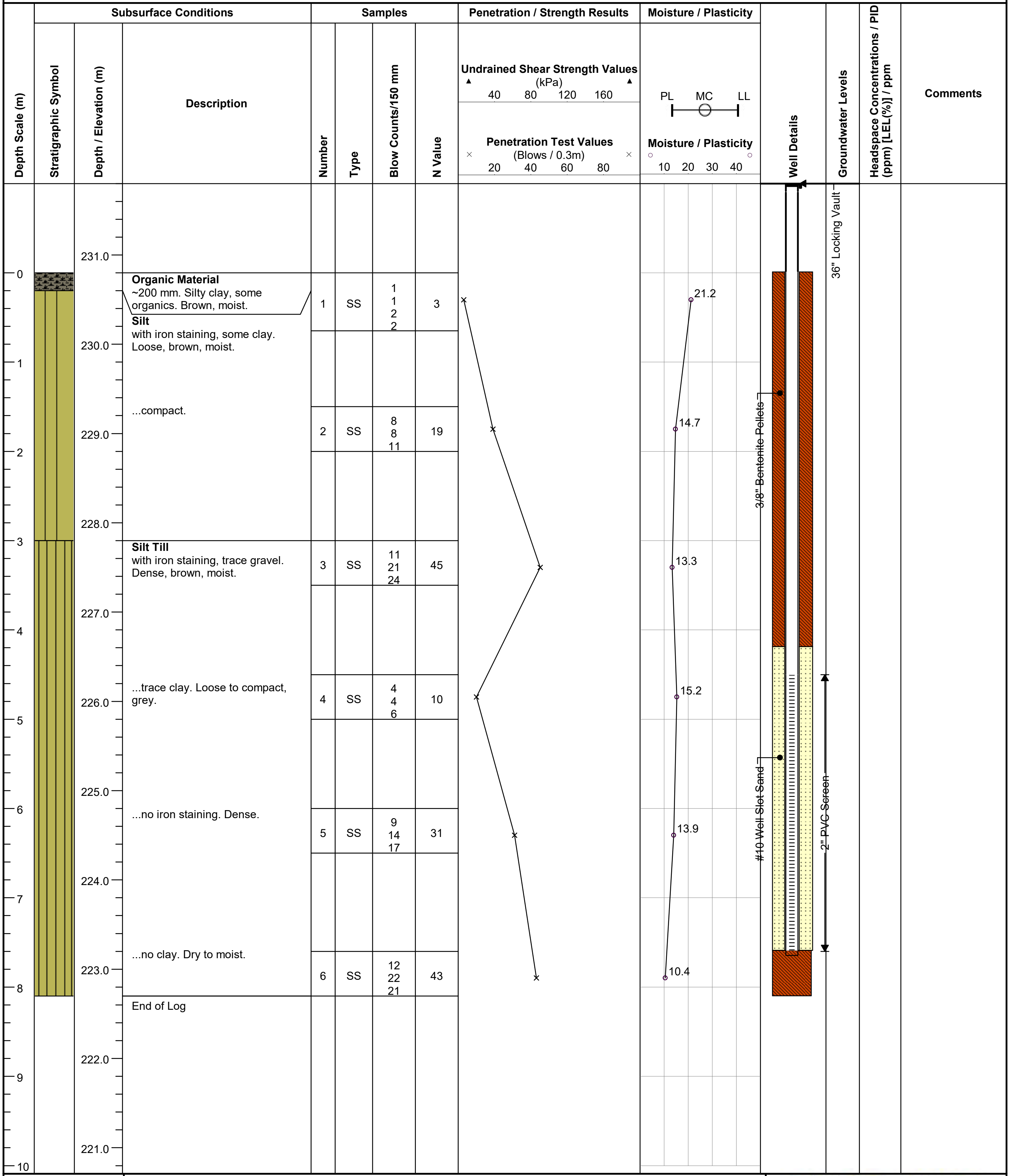
LOG OF BOREHOLE BH/MW24

SHEET 1 of 1

Project No.: 23354
Project Name: White Church Lands
Location: White Church Rd. & Airport Rd., Hamilton

Drill Date: 2025-01-06
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.151608
Easting: -79.900743
Ground Surface Elevation: 230.8

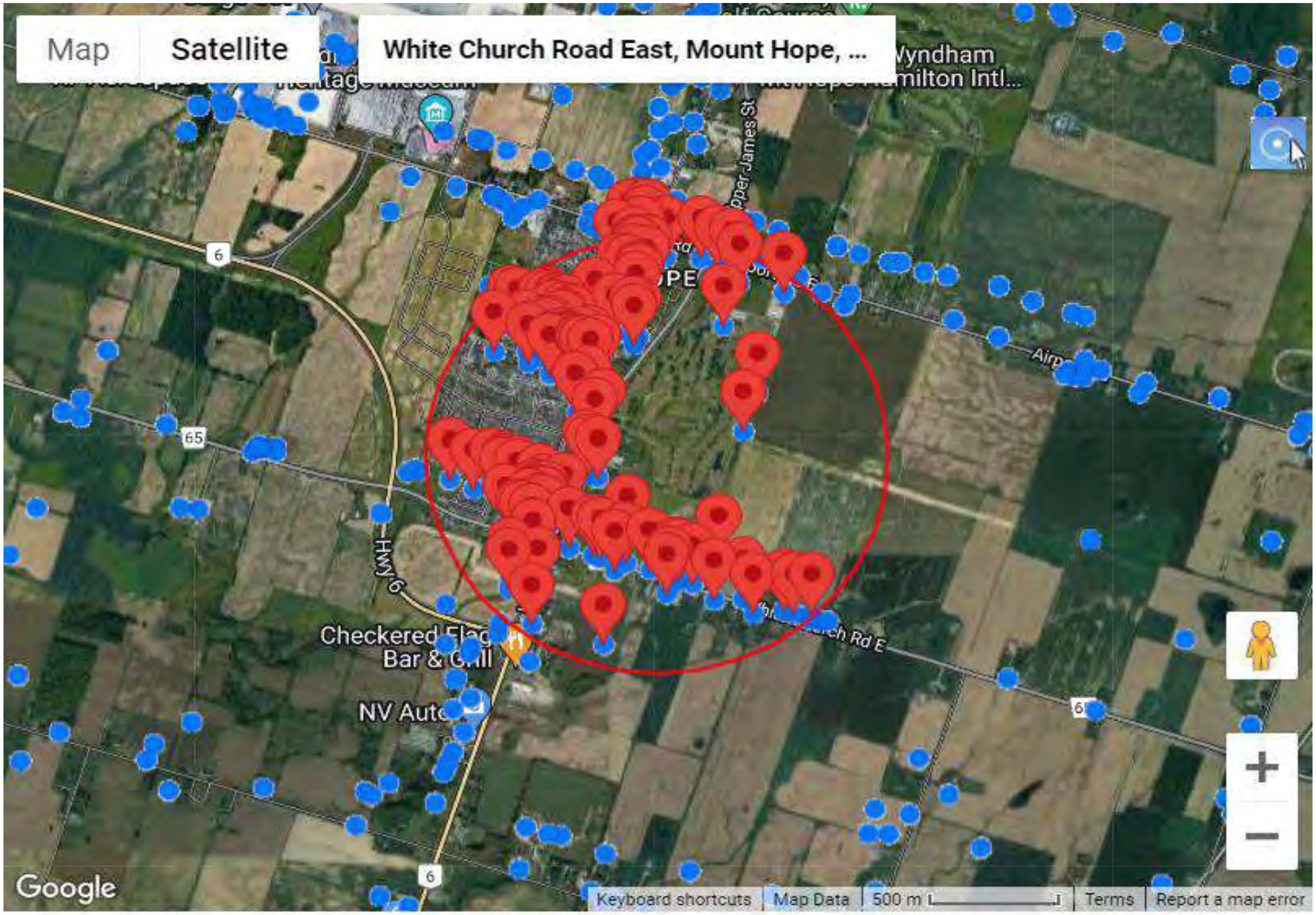


Description	Number	Type	Blow Counts/150 mm	N Value	Moisture / Plasticity
Organic Material ~200 mm. Silty clay, some organics. Brown, moist.	1	SS	1 1 2 2	3	21.2
Silt with iron staining, some clay. Loose, brown, moist.					
...compact.	2	SS	8 8 11	19	14.7
Silt Till with iron staining, trace gravel. Dense, brown, moist.	3	SS	11 21 24	45	13.3
...trace clay. Loose to compact, grey.	4	SS	4 4 6	10	15.2
...no iron staining. Dense.	5	SS	9 14 17	31	13.9
...no clay. Dry to moist.	6	SS	12 22 21	43	10.4
End of Log					

Additional Notes:
1. Borehole open to approximately 7.6 m depth on completion.
2. Groundwatere or water seepage not encountered during drilling.
3.
4.

APPENDIX C

MECP WELLS LOCATIONS



Latitude:43.14513, Longitude:-79.88302 (UTM Zone:17, Easting:590829, Northing:4777537)

● MECP Wells

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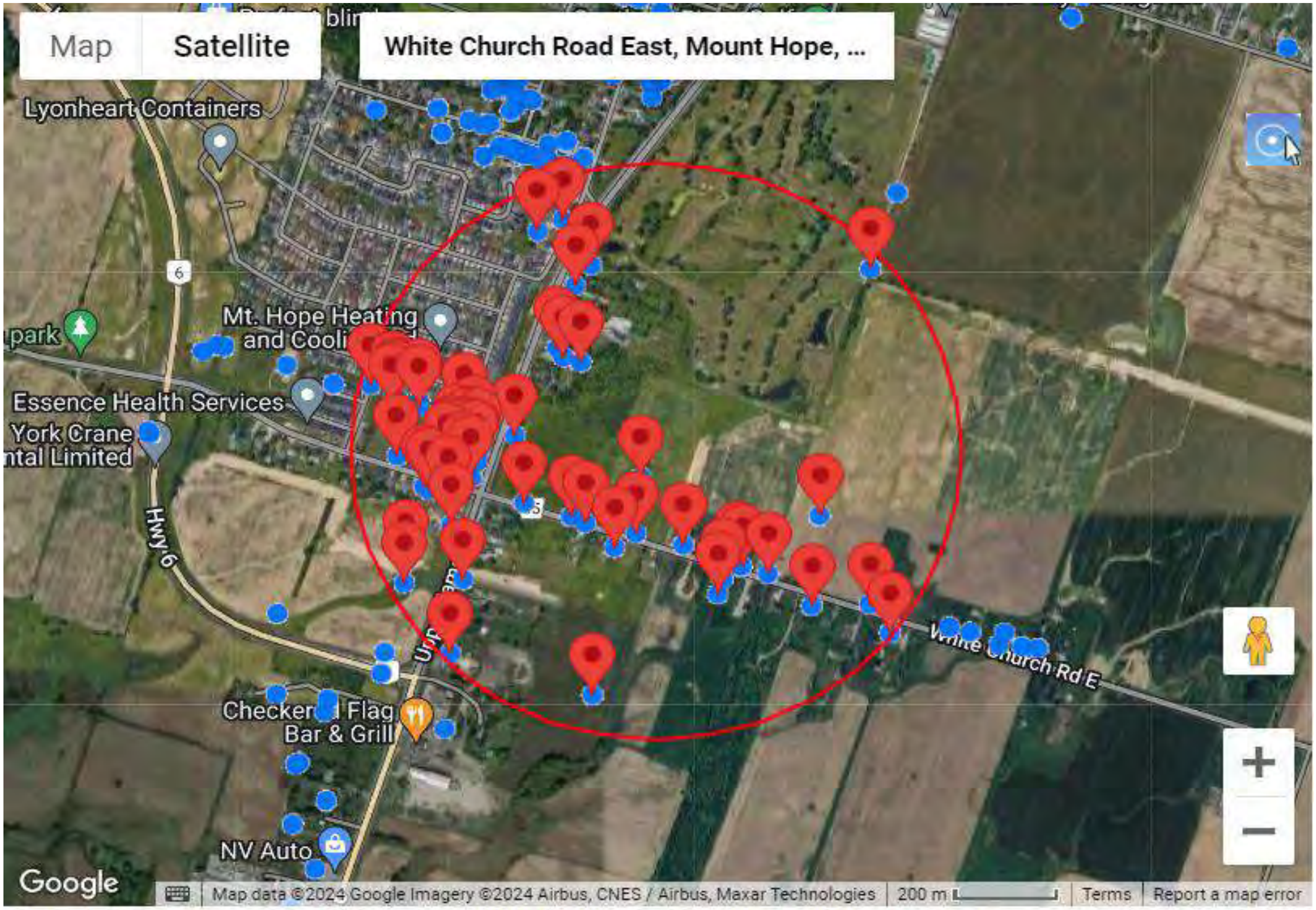
205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1

	Scale: On Map	Date:September 2024
Project:	Hydrogeological Investigation White Church Road East & Upper James Street Hamilton, Ontario	
Title:	Figure 1: MECP Wells Locations	
Project No.	23355	



Latitude:43.13742, Longitude:-79.92808 (UTM Zone:17, Easting:587176, Northing:4776633)

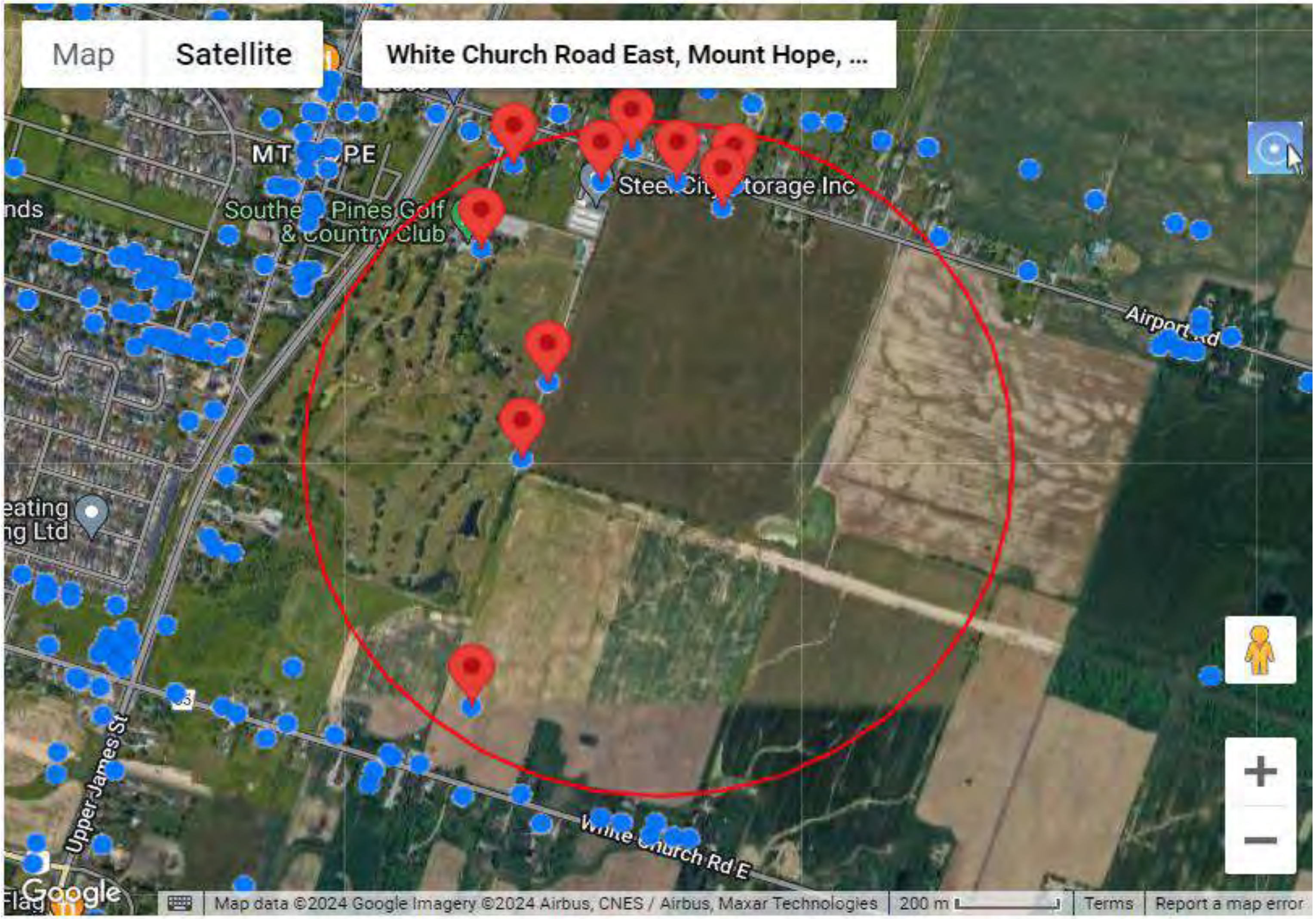
● MECP Wells

LANDTEK LIMITED

CONSULTING ENGINEERS

205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1

	Scale: On Map	Date:September 2024
Project:	Hydrogeological Investigation White Church & Upper James Street Hamilton, Ontario	
Title:	Figure 2: MECP Wells Locations	
Project No.	23355	



Latitude:43.14412, Longitude:-79.89135 (UTM Zone:17, Easting:590153, Northing:4777416)

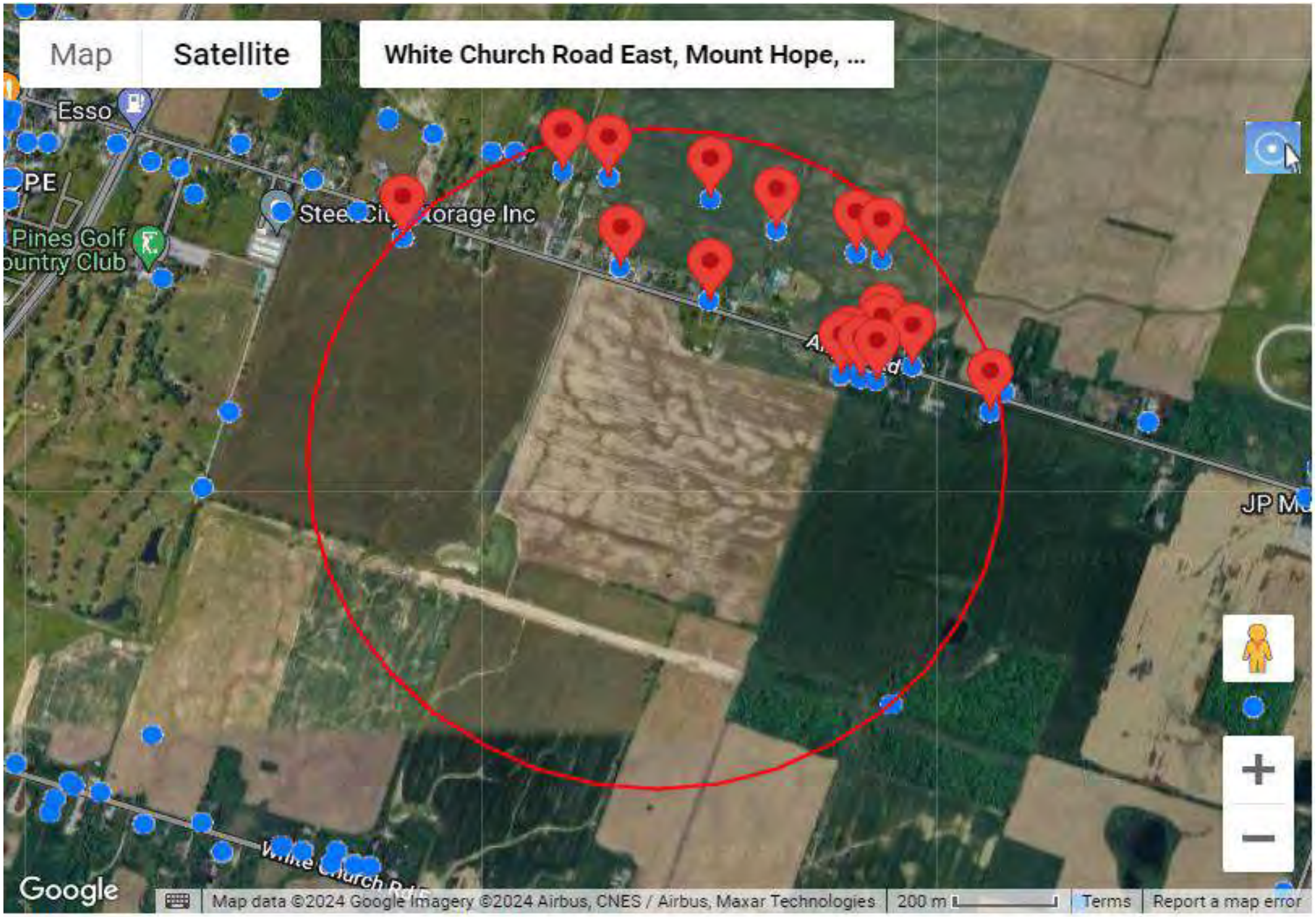
● MECP Wells

LANDTEK LIMITED

CONSULTING ENGINEERS

205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1

	Scale: On Map	Date:September 2024
Project:	Hydrogeological Investigation	
	White Church & Upper James Street	
	Hamilton, Ontario	
Title:	Figure 3: MECP Wells Locations	
Project No.	23355	



Latitude:43.15756, Longitude:-79.88371 (UTM Zone:17, Easting:590755, Northing:4778917)

● MECP Wells

LANDTEK LIMITED

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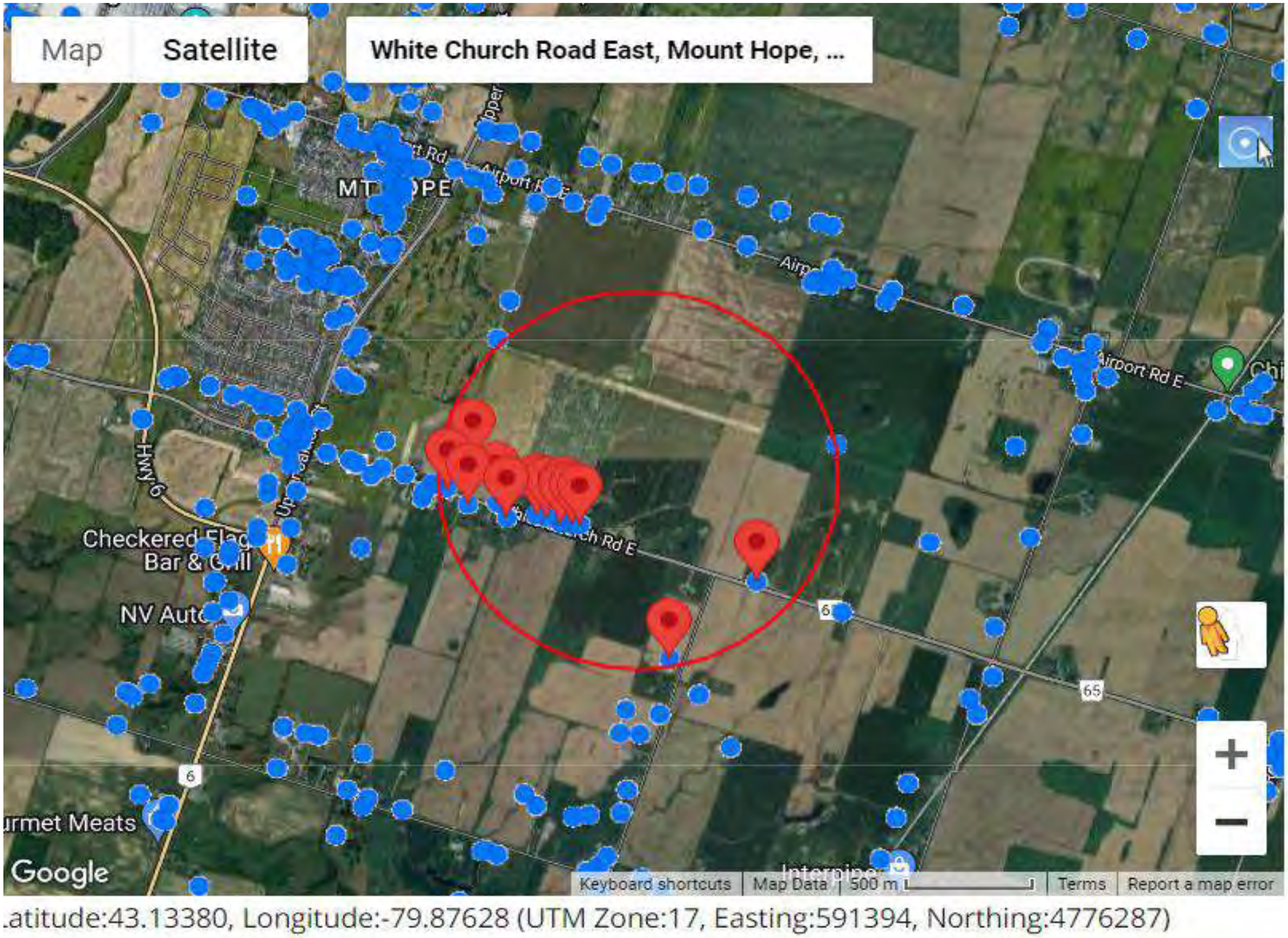
205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1

	Scale: On Map	Date:September 2024
Project:	Hydrogeological Investigation White Church & Upper James Street Hamilton, Ontario	
Title:	Figure 4: MECP Wells Locations	
Project No.	23355	



.atitude:43.13380, Longitude:-79.87628 (UTM Zone:17, Easting:591394, Northing:4776287)

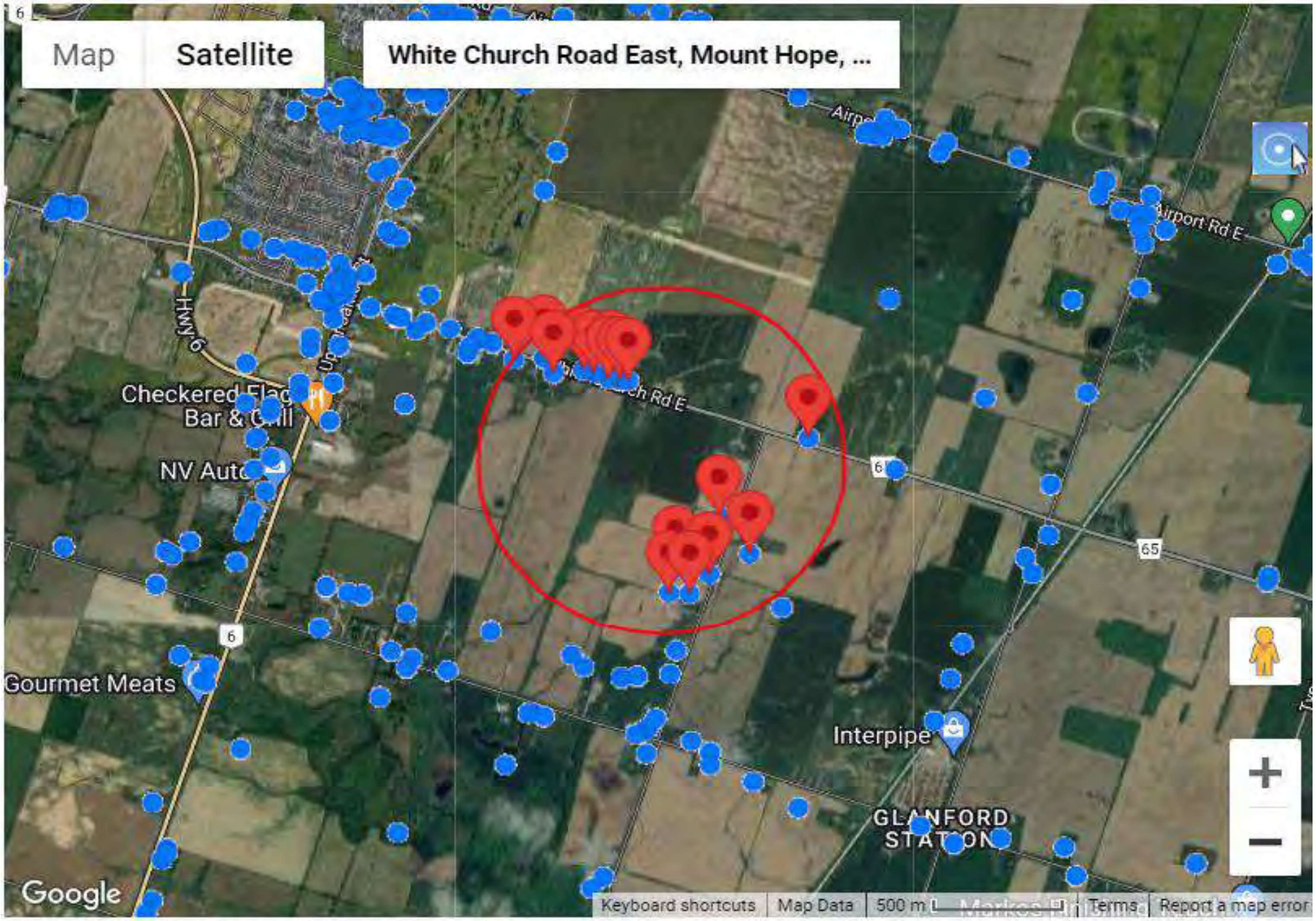
● MECP Wells

LANDTEK LIMITED

CONSULTING ENGINEERS

205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1

	Scale: On Map	Date:September 2024
Project:	Hydrogeological Investigation White Church & Upper James Street Hamilton, Ontario	
Title:	Figure 5: MECP Wells Locations	
Project No.	23355	



Latitude:43.12677, Longitude:-79.87989 (UTM Zone:17, Easting:591111, Northing:4775501)

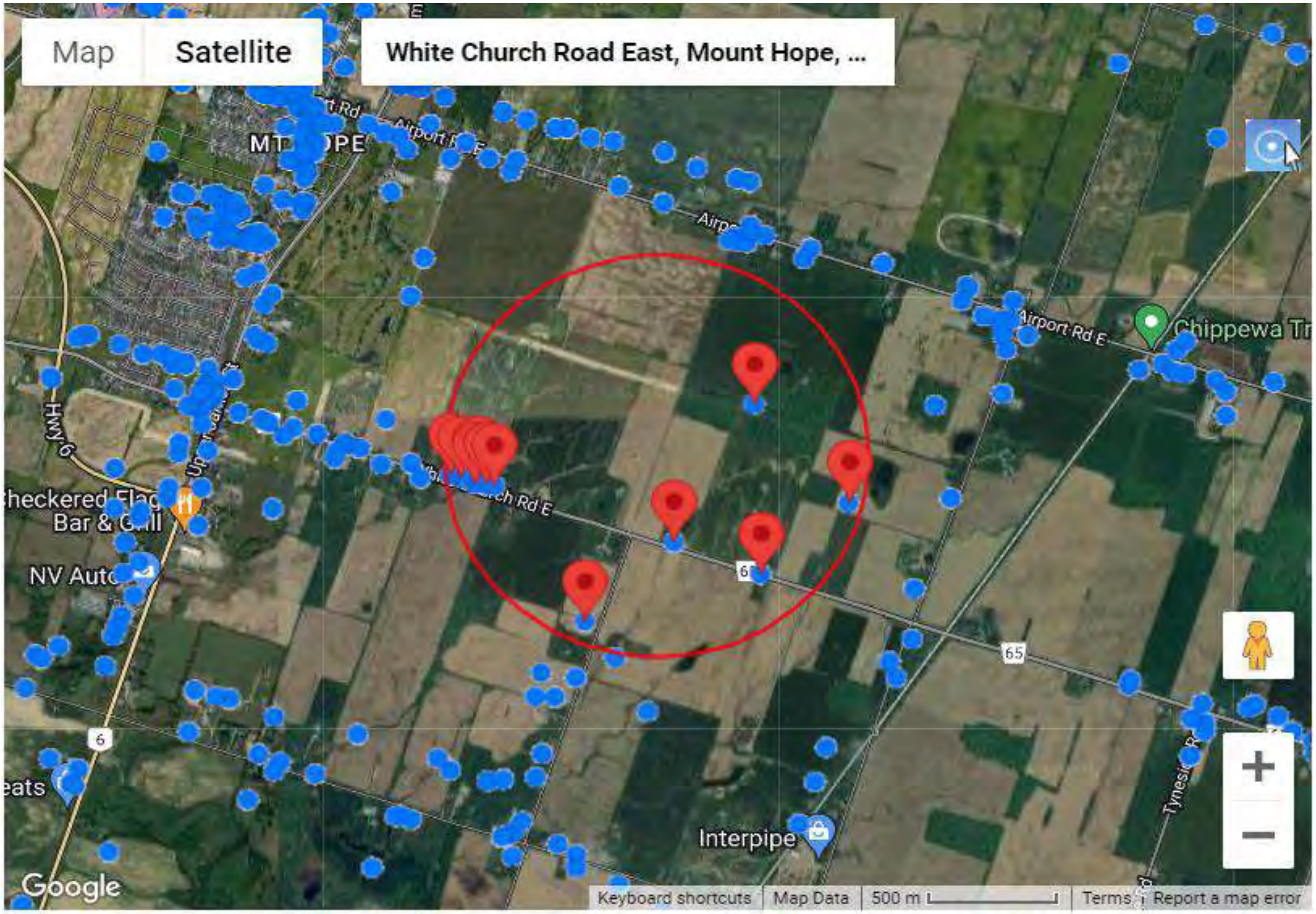
● MECP Wells

LANDTEK LIMITED

CONSULTING ENGINEERS

205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1

	Scale: On Map	Date:September 2024
Project:	Hydrogeological Investigation White Church & Upper James Street Hamilton, Ontario	
Title:	Figure 6: MECP Wells Locations	
Project No.	23355	



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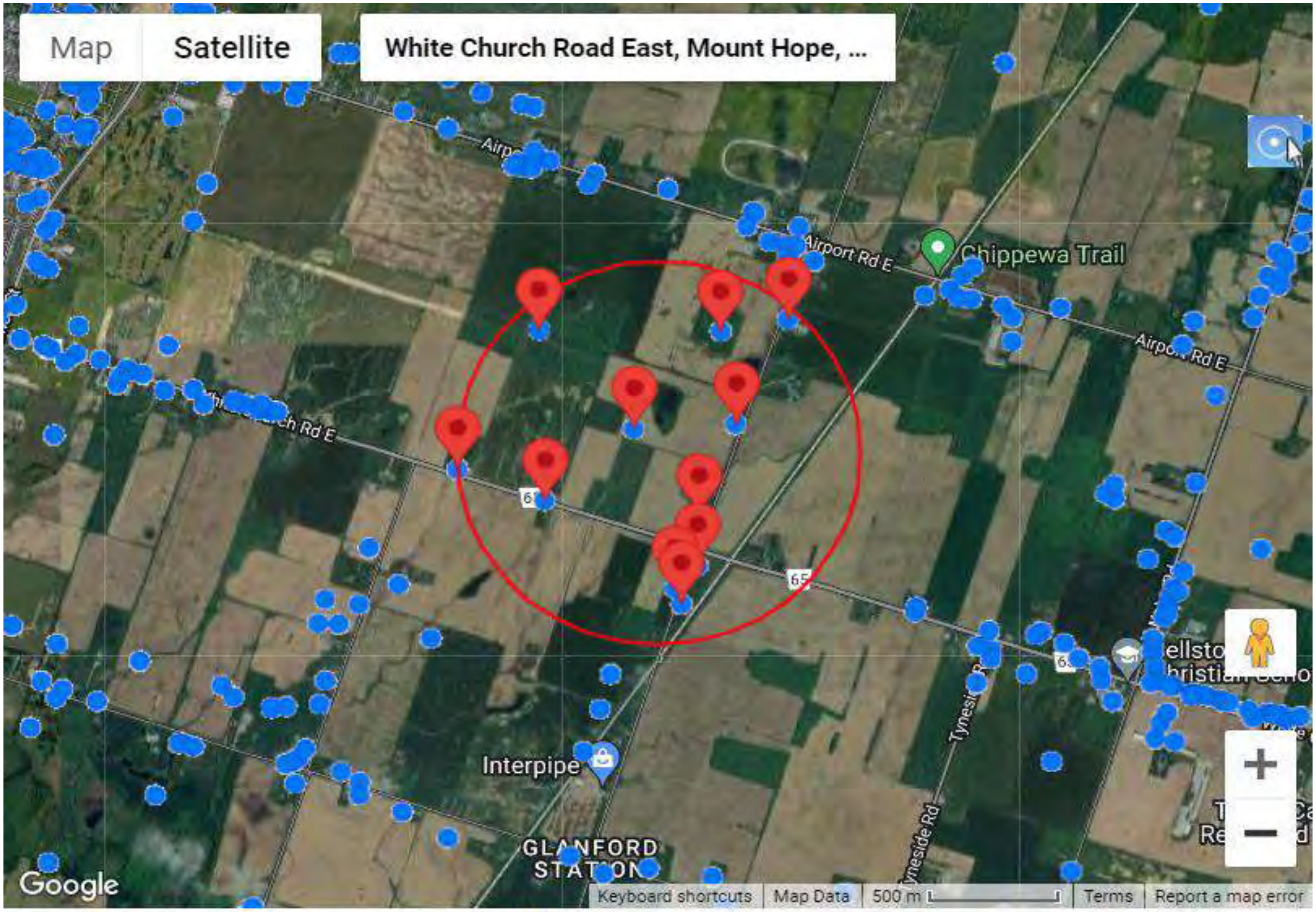
● MECP Wells

LANDTEK LIMITED

CONSULTING ENGINEERS

205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1

	Scale: On Map	Date:September 2024
Project:	Hydrogeological Investigation White Church & Upper James Street Hamilton, Ontario	
Title:	Figure 7: MECP Wells Locations	
Project No.	23355	



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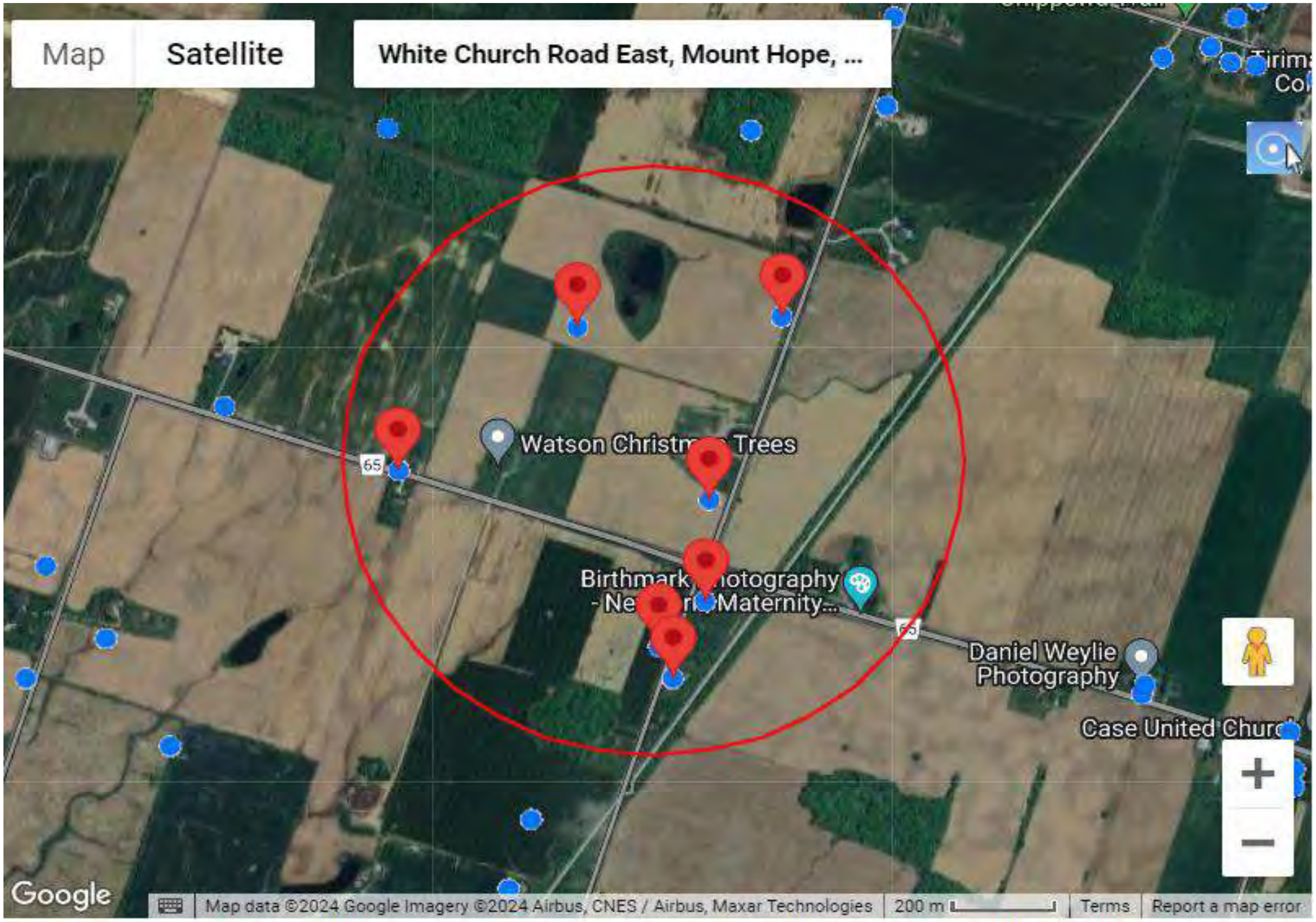
● MECP Wells

LANDTEK LIMITED

CONSULTING ENGINEERS

205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1

	Scale: On Map	Date:September 2024
Project:	Hydrogeological Investigation White Church & Upper James Street Hamilton, Ontario	
Title:	Figure 8: MECP Wells Locations	
Project No.	23355	



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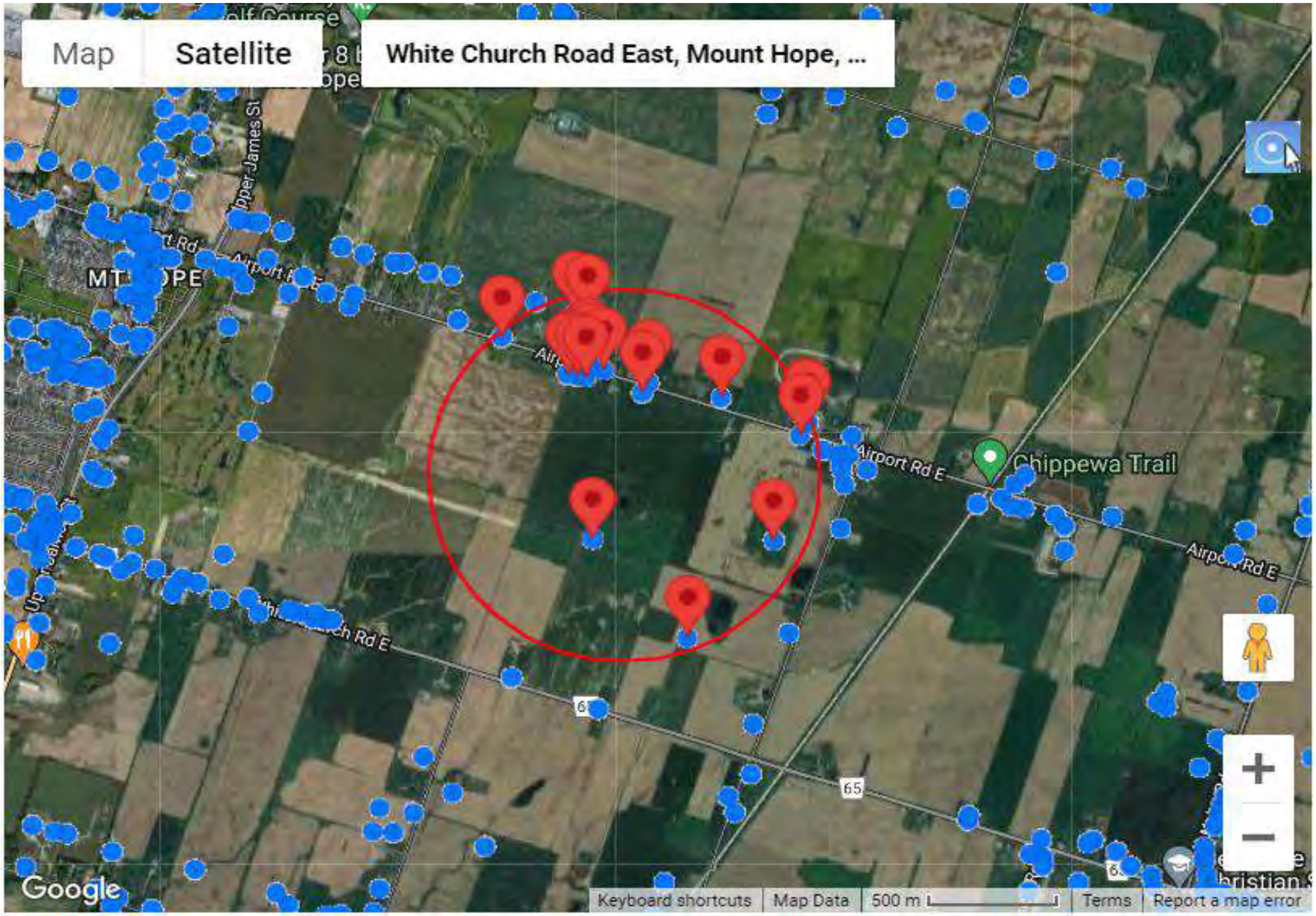
● MECP Wells

LANDTEK LIMITED

CONSULTING ENGINEERS

205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1

	Scale: On Map	Date:September 2024
Project:	Hydrogeological Investigation White Church & Upper James Street Hamilton, Ontario	
Title:	Figure 9: MECP Wells Locations	
Project No.	23355	



Latitude:43.13734, Longitude:-79.86947 (UTM Zone:17, Easting:591942, Northing:4776687)

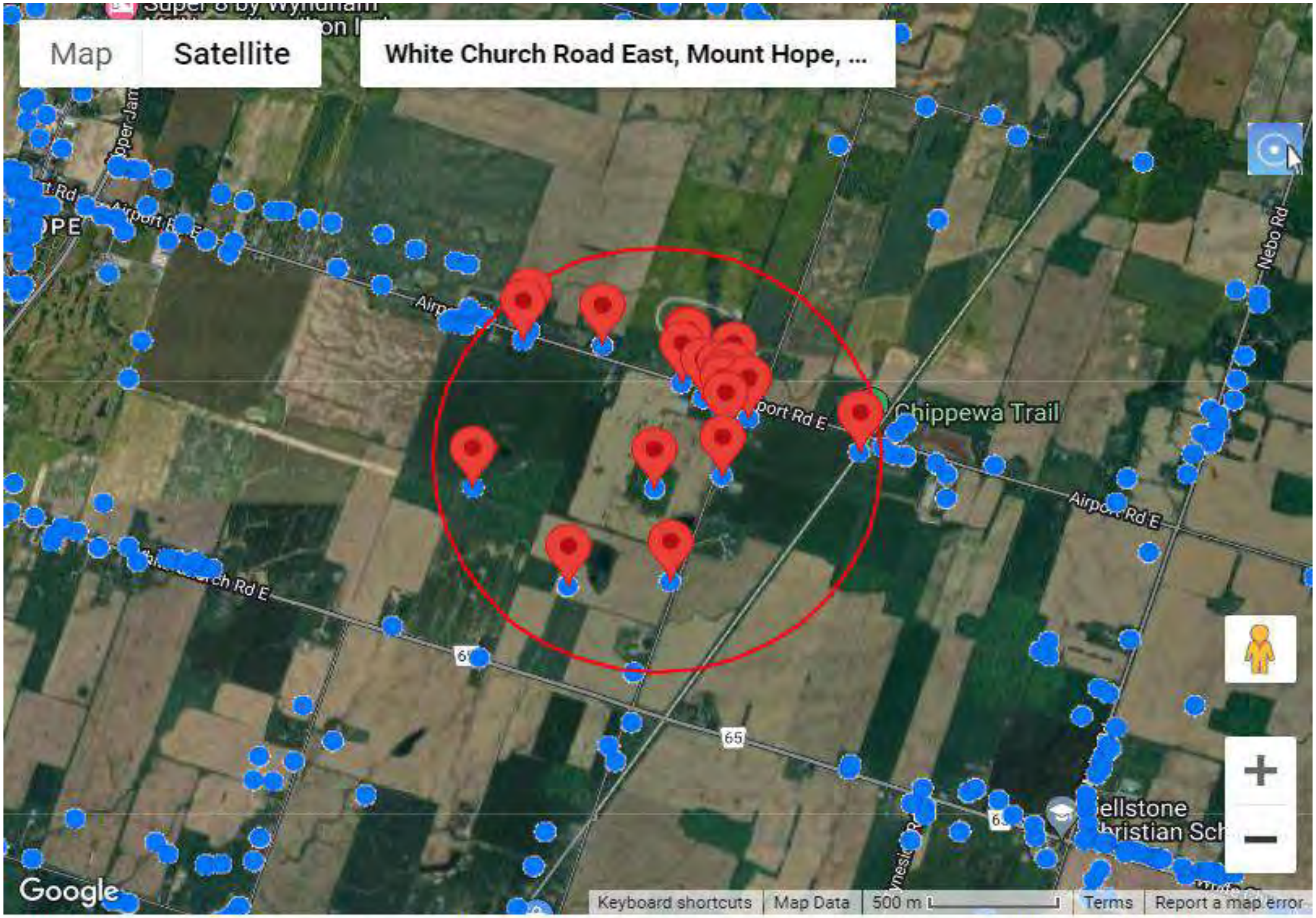
● MECP Wells

LANDTEK LIMITED

CONSULTING ENGINEERS

205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1

	Scale: On Map	Date:September 2024
Project:	Hydrogeological Investigation White Church & Upper James Street Hamilton, Ontario	
Title:	Figure 10: MECP Wells Locations	
Project No.	23355	



Latitude:43.13347, Longitude:-79.85776 (UTM Zone:17, Easting:592901, Northing:4776270)

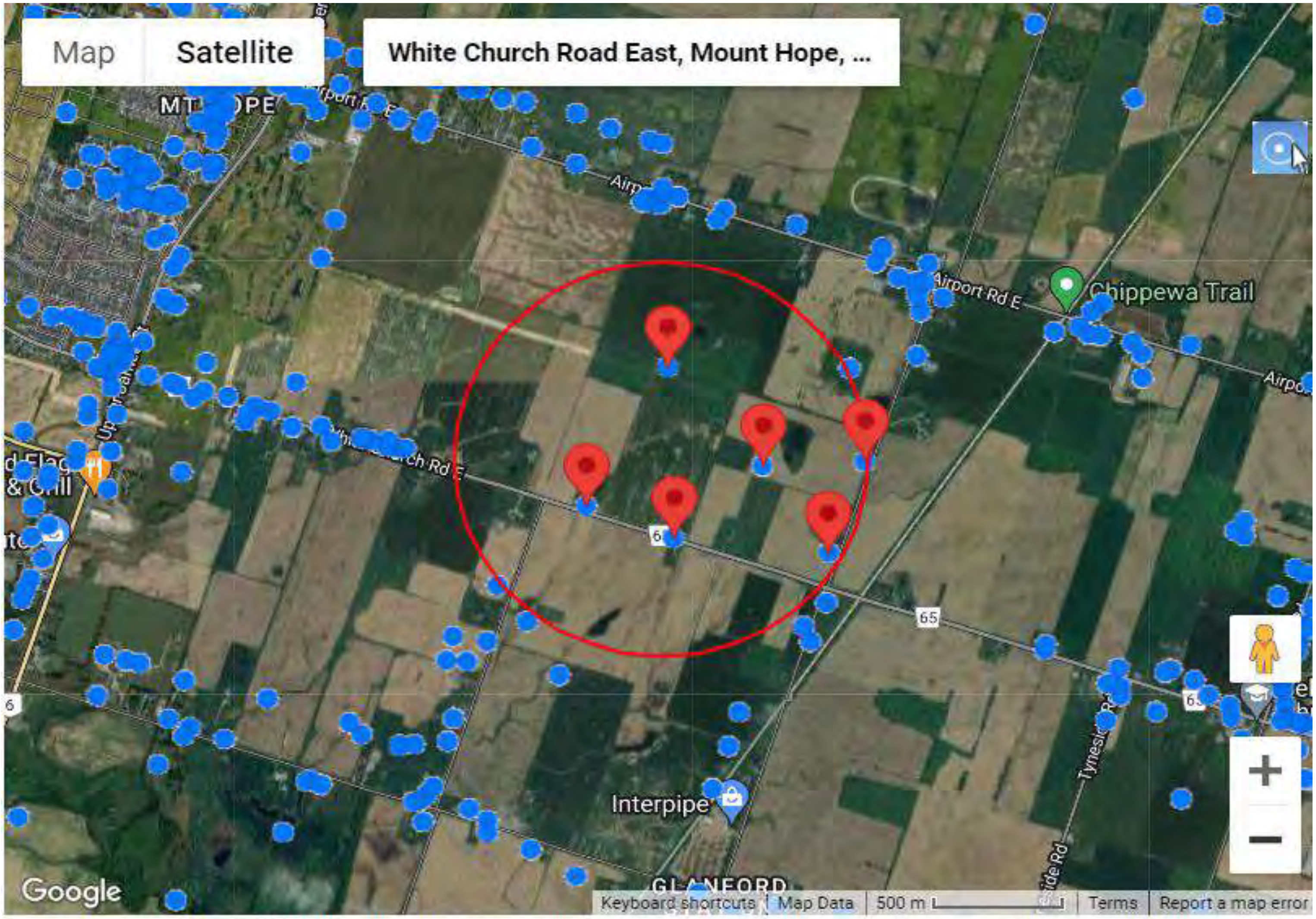
● MECP Wells

LANDTEK LIMITED

CONSULTING ENGINEERS

205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1

	Scale: On Map	Date:September 2024
Project:	Hydrogeological Investigation White Church & Upper James Street Hamilton, Ontario	
Title:	Figure 11: MECP Wells Locations	
Project No.	23355	



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● MECP Wells

LANDTEK LIMITED

CONSULTING ENGINEERS

205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1

	Scale: On Map	Date:September 2024
Project:	Hydrogeological Investigation White Church & Upper James Street Hamilton, Ontario	
Title:	Figure 12: MECP Wells Locations	
Project No.	23355	

APPENDIX D

SUMMARY OF MECP WELLS RECORDS

Summary of MECP Well Records: Table 1

Well #	WELL_ID	DIAMETER (inches)	DATE_COMPLETED	EAST83	NORTH83	WATER_FOUND_DEPTH (FT)	Static Water Level (ft)	KIND	FINAL_STATUS	USE_1ST	USE_2ND	DEPTH_TO (ft)	DEPTH_TO (m)	Well Construction	STREET	CITY/TOWNSHIP
1	6803950	6	29/Aug/58	588582.1	4778560	113	30	Fresh	Water Suppy	Domestic	NA	113	34.45	CLAY	NA	Wentworth
2	6804002	6	25/Apr/47	588150.4	4778728	NA	40	Fresh	Water Suppy	Domestic	NA	108	32.93	QSND	NA	Wentworth
3	6804003	6	28/Jul/49	588198.4	4778661	100	25	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY/QSND	NA	Wentworth
4	6804004	5	18/May/51	588197.4	4778736	106	27	Fresh	Water Suppy	Domestic	NA	107	32.62	CLAY	NA	Wentworth
5	6804005	6	14/Jul/51	588173.4	4778583	112	12	Fresh	Water Suppy	Domestic	NA	112	34.15	CLAY	NA	Wentworth
6	6804006	6	24/Jan/53	588180.4	4778581	112	12	Fresh	Water Suppy	Domestic	NA	114	34.76	CLAY	NA	Wentworth
7	6804007	6	25/Apr/53	588184.4	4778581	108	18	Fresh	Water Suppy	Domestic	NA	109	33.23	CLAY	NA	Wentworth
8	6804008	6	10/Jun/53	588097.4	4778347	100	16	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY	NA	Wentworth
9	6804009	6	20/Aug/53	588147.4	4778505	110	10	Fresh	Water Suppy	Domestic	NA	114	34.76	CLAY	NA	Wentworth
10	6804011	6	7/Aug/54	587973.4	4778203	100	35	Fresh	Water Suppy	Domestic	NA	101	30.79	CLAY	NA	Wentworth
11	6804012	6	16/Sep/54	588187.4	4778580	111	18	Fresh	Water Suppy	Domestic	NA	112	34.15	CLAY	NA	Wentworth
12	6804013	6	3/Jun/55	588041.4	4778176	108	25	Fresh	Water Suppy	Domestic	NA	109	33.23	CLAY	NA	Wentworth
13	6804014	6	14/Oct/55	587923.4	4778180	105	22	Fresh	Water Suppy	Domestic	NA	109	33.23	CLAY/LMSN	NA	Wentworth
14	6804015	6	20/Mar/56	587938.4	4778180	101	25	Fresh	Water Suppy	Domestic	NA	103	31.40	CLAY	NA	Wentworth
15	6804016	6	11/May/56	587977.4	4778167	101	25	Fresh	Water Suppy	Domestic	NA	102	31.10	CLAY/MSND	NA	Wentworth
16	6804017	6	1/Jun/56	587856.4	4778244	107	30	Fresh	Water Suppy	Domestic	NA	107	32.62	CLAY/LMSN	NA	Wentworth
17	6804018	6	25/Jul/56	587923.4	4778186	100	45	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY/LMSN	NA	Wentworth
18	6804019	6	19/Sep/56	587906.4	4778194	100	45	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY/LMSN	NA	Wentworth
19	6804020	6	24/Oct/56	588009.4	4778160	104	18	Fresh	Water Suppy	Domestic	NA	104	31.71	CLAY/QSND	NA	Wentworth
20	6804021	6	8/Nov/56	587847.4	4778176	100	60	Fresh	Water Suppy	Domestic	NA	105	32.01	CLAY/LMSN	NA	Wentworth
21	6804022	6	2/Dec/56	587877.4	4778197	107	45	Fresh	Water Suppy	Domestic	NA	107	32.62	CLAY	NA	Wentworth
22	6804023	6	29/Jan/57	587956.4	4778173	105	45	Fresh	Water Suppy	Domestic	NA	105	32.01	CLAY	NA	Wentworth
23	6804024	6	24/May/57	587906.4	4778279	100	40	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY	NA	Wentworth
24	6804026	6	20/May/58	588002.4	4778046	107	27	Fresh	Water Suppy	Domestic	NA	109	33.23	CLAY	NA	Wentworth
25	6804028	6	2/Aug/58	587696.4	4778371	112	40	Fresh	Water Suppy	Domestic	NA	112	34.15	CLAY	NA	Wentworth
26	6804029	6	26/Aug/58	587880.4	4778343	97	30	Fresh	Water Suppy	Domestic	NA	97	29.57	CLAY	NA	Wentworth
27	6804030	6	19/Sep/58	587719.4	4778363	103	30	Fresh	Water Suppy	Domestic	NA	103	31.40	CLAY	NA	Wentworth
28	6804031	6	30/Sep/58	587859.4	4778312	98	40	Fresh	Water Suppy	Domestic	NA	100	30.49	MUCK/LMSN	NA	Wentworth
29	6804032	6	3/Oct/58	588008.4	4778209	100	30	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY	NA	Wentworth
30	6804033	6	6/Nov/58	587940.4	4778292	96	40	Fresh	Water Suppy	Domestic	NA	96	29.27	CLAY	NA	Wentworth
31	6804034	6	14/Nov/58	588185.4	4778738	100	28	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY/MSND	NA	Wentworth
32	6804035	6	31/Dec/58	587933.4	4778297	90	20	Fresh	Water Suppy	Domestic	NA	90	27.44	CLAY	NA	Wentworth
33	6804036	6	12/Jan/59	587844.4	4778241	100	20	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY/LMSN	NA	Wentworth
34	6804037	6	6/May/59	587869.4	4778344	90	20	Fresh	Water Suppy	Domestic	NA	93	28.35	CLAY/QSND	NA	Wentworth
35	6804038	6	24/Sep/59	587896.4	4778334	102	62	Fresh	Water Suppy	Domestic	NA	102	31.10	CLAY/QSND	NA	Wentworth
36	6804039	6	13/Oct/59	587965.4	4778171	103	45	Fresh	Water Suppy	Domestic	NA	103	31.40	CLAY	NA	Wentworth
37	6804040	5	27/Oct/59	587842.4	4778368	100	45	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY	NA	Wentworth
38	6804041	6	29/Oct/59	587816.4	4778249	110	60	Fresh	Water Suppy	Domestic	NA	110	33.54	CLAY/QSND	NA	Wentworth
39	6804042	6	8/Jan/60	587838.4	4778353	102	62	Fresh	Water Suppy	Domestic	NA	102	31.10	CLAY/QSND	NA	Wentworth
40	6804043	5	14/Jan/60	587870.4	4778316	101	30	Fresh	Water Suppy	Domestic	NA	101	30.79	CLAY	NA	Wentworth
41	6804044	6	11/Jun/60	587830.4	4777514	103	40	Fresh	Water Suppy	Commercial	NA	103	31.40	CLAY/QSND	NA	Wentworth
42	6804045	6	12/Sep/60	587811.4	4778361	100	60	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY/QSND	NA	Wentworth
43	6804046	6	6/Oct/60	587904.4	4778305	95	28	Fresh	Water Suppy	Domestic	NA	97	29.57	CLAY	NA	Wentworth
44	6804047	6	9/Nov/60	587912.4	4778334	102	40	Fresh	Water Suppy	Domestic	NA	104	31.71	CLAY	NA	Wentworth
45	6804049	6	4/Sep/62	587907.4	4778187	94	30	Fresh	Water Suppy	Domestic	NA	98	29.88	CLAY/LMSN	NA	Wentworth
46	6804050	6	24/Sep/62	588184.4	4778664	102	60	Fresh	Water Suppy	Domestic	NA	104	31.71	CLAY	NA	Wentworth
47	6804051	6	15/Oct/62	587893.4	4778194	94	35	Fresh	Water Suppy	Domestic	NA	96	29.27	CLAY	NA	Wentworth
48	6804052	6	28/Jun/63	588216.4	4778705	112	40	Sulphur	Water Suppy	Domestic	NA	112	34.15	CLAY/QSND	NA	Wentworth
49	6804053	6	8/Jul/63	588105.4	4778647	105	40	Fresh	Water Suppy	Domestic	NA	105	32.01	CLAY/QSND	NA	Wentworth
50	6804056	6	7/Aug/64	588117.4	4778510	105	57	Fresh	Water Suppy	Domestic	NA	108	32.93	CLAY/LMSN	NA	Wentworth
51	6804057	6	2/Feb/65	588224.4	4778729	112	55	Sulphur	Water Suppy	Commercial	NA	114	34.76	CLAY	NA	Wentworth
52	6804058	6	22/Aug/66	588171.4	4778619	100	60	Fresh	Water Suppy	Domestic	NA	101	30.79	CLAY	NA	Wentworth
53	6804059	6	12/Apr/49	588220.4	4778589	110	30	Fresh	Water Suppy	Domestic	NA	115	35.06	CLAY/QSND	NA	Wentworth
54	6804060	5	22/Jun/50	588225.4	4778589	98	23	Fresh	Water Suppy	Domestic	NA	102	31.10	CLAY/QSND	NA	Wentworth
55	6804061	6	7/Jul/51	588195.4	4778464	126	30	Fresh	Water Suppy	Domestic	NA	131	39.94	CLAY/LMSN	NA	Wentworth
56	6804062	6	15/Jun/53	588059.4	4777955	100	30	Fresh	Water Suppy	Domestic	NA	100	30.49	LOAM	NA	Wentworth
57	6804063	6	8/Oct/53	588188.4	4778469	106	23	Fresh	Water Suppy	Domestic	NA	108	32.93	CLAY/LMSN	NA	Wentworth
58	6804064	6	24/May/55	588026.4	4777436	110	35	Fresh	Water Suppy	Domestic	NA	120	36.59	CLAY/LMSN	NA	Wentworth
59	6804065	6	13/Jun/55	588042.4	4777754	110	100	Fresh	Abandoned-Other	Not Used	NA	115	35.06	CLAY/LMSN	NA	Wentworth
60	6804066	6	23/Jun/55	588007.4	4777764	100	20	Fresh	Water Suppy	Domestic	Livestock	108	32.93	CLAY/LMSN	NA	Wentworth
61	6804067	6	25/Oct/55	588190.4	4778479	108	24	Fresh	Water Suppy	Domestic	NA	110	33.54	CLAY/LMSN	NA	Wentworth
62	6804068	6	27/Mar/58	588429.4	4778662	111	35	Fresh	Water Suppy	Domestic	NA	112	34.15	CLAY	NA	Wentworth
63	6804069	7	25/Mar/60	588247.4	4777380	105	28	Fresh	Water Suppy	Domestic	Commercial	104	31.71	CLAY	NA	Wentworth
64	6804070	6	24/May/60	588220.4	4778544	104	45	Fresh	Water Suppy	Domestic	NA	104	31.71	CLAY	NA	Wentworth
65	6804071	6	24/Aug/60	588552.4	4778614	120	40	Fresh	Water Suppy	Domestic	NA	120	36.59	CLAY	NA	Wentworth
66	6804072	6	4/Oct/61	588521.4	4778386	112	50	Fresh	Water Suppy	Irrigation	NA	112	34.15	CLAY/QSND	NA	Wentworth
67	6804073	6	7/May/62	588606.4	4777954	122	40	Fresh	Water Suppy	Irrigation	NA	124	37.80	CLAY/QSND	NA	Wentworth
68	6804074	6	12/May/62	588029.4	4777912	118	30	Fresh	Water Suppy	Domestic	NA	120	36.59	CLAY/FSND/LMSN	NA	Wentworth
69	6804075	8	30/Jun/64	588656.4	4778112	135	55	Fresh	Water Suppy	Irrigation	NA	191	58.23	CLAY/QSND	NA	Wentworth
70	6804076	6	16/Sep/64	588362.4	4777337	102	35	Fresh	Water Suppy	Domestic	NA	105	32.01	CLAY/SILT	NA	Wentworth
71	6804077	6	21/Jan/65	588496.4	4778627	120	50	Fresh	Water Suppy	Domestic	NA	121	36.89	CLAY/QSND	NA	Wentworth
72	6804078	6	31/Jan/67	588755.4	4778526	130	83	Fresh	Water Suppy	Domestic	NA	133	40.55	CLAY/LMSN	NA	Wentworth
73	6804082	6	27/Apr/59	588879.4	4777207	105	30	Fresh	Water Suppy	Domestic	NA	105	32.01	CLAY/QSND	NA	Wentworth
74	6804083	6	17/Aug/59	588811.4	4777207	116	50	Fresh	Water Suppy	Domestic	NA	117	35.67	CLAY/FSND	NA	Wentworth
75	6804084	6	6/Jun/63	588771.4	4777217	113	35	Fresh	Water Suppy	Domestic	NA	114	34.76	CLAY	NA	Wentworth
76	6804085	6	27/Mar/65	588771.4	4777217	112	30	Fresh	Water Suppy	Domestic	NA	112	34.15	CLAY/QSND	NA	Wentworth
77	6804132	6	10/Sep/51	587681.4	4777675	97	6	Fresh	Water Suppy	Domestic	NA	97	29.57	LOAM/LMSN	NA	Wentworth
78	6804133	6	21/Mar/54	587681.4	4777667	120	40	Fresh	Water Suppy	Domestic	NA	120	36.59	CLAY/LMSN	NA	Wentworth
79	6804134	6	16/Mar/57	587726.4	4777670	90	10	Fresh	Water Suppy	Domestic	NA	91	27.74	CLAY	NA	Wentworth
80	6804135	6	30/Apr/57	587558.4	4777702	114	40	Fresh	Water Suppy	Domestic	NA	114	34.76	CLAY	NA	Wentworth
81	6804136	6	13/Jun/57	587630.4	4777702	110	32	Fresh	Water Suppy	Domestic	NA	116	35.37	CLAY	NA	Wentworth

Summary of MECP Well Records: Table 1

82	6804138	6	17/Jun/58	587673.4	4777662	105	25	Fresh	Water Suppy	Commercial	NA	105	32.01	CLAY	NA	Wentworth
83	6804139	6	27/Aug/58	587683.4	4777557	76	14	Fresh	Water Suppy	Domestic	NA	79	24.09	CLAY	NA	Wentworth
84	6804143	6	7/Feb/58	587676.4	4777685	108	20	Fresh	Water Suppy	Public	NA	108	32.93	CLAY	NA	Wentworth
85	6804144	6	4/Mar/61	587726.4	4777657	100	30	Fresh	Water Suppy	Public	NA	102	31.10	CLAY/LMSN	NA	Wentworth
86	6804145	6	5/Aug/61	587465.4	4777740	102	35	Fresh	Water Suppy	Domestic	NA	104	31.71	CLAY/LMSN	NA	Wentworth
87	6804151	6	13/May/47	587786.4	4777474	NA	20	Fresh	Water Suppy	Domestic	NA	120	36.59	QSND/LMSN	NA	Wentworth
88	6804152	6	15/Nov/48	587914.4	4777602	113	35	Fresh	Water Suppy	Domestic	NA	118	35.98	CLAY/MSND	NA	Wentworth
89	6804154	6	2/Oct/53	587781.4	4777542	73	4	Fresh	Water Suppy	Domestic	NA	75	22.87	CLAY/LMSN	NA	Wentworth
90	6804155	6	29/Sep/54	588163.4	4777518	113	35	Fresh	Water Suppy	Domestic	NA	113	34.45	CLAY/FSND	NA	Wentworth
91	6804156	6	8/Dec/54	587746.4	4777487	102	35	Fresh	Water Suppy	Domestic	NA	111	33.84	CLAY	NA	Wentworth
92	6804159	7	18/Aug/59	587701.4	4777294	100	50	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY	NA	Wentworth
93	6804160	6	17/Oct/59	587704.4	4777339	100	50	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY	NA	Wentworth
94	6804168	6	2/Dec/67	588073.4	4777068	114	30	Fresh	Water Suppy	Domestic	NA	115	35.06	CLAY	NA	Wentworth
95	6806912	6	26/Apr/68	587994.4	4777783	115	85	Sulphur	Water Suppy	Domestic	NA	120	36.59	CLAY/LMSN	NA	Wentworth
96	6806915	6	24/Jun/68	588174.4	4778303	106	60	Fresh	Water Suppy	Domestic	NA	106	32.32	CLAY	NA	Wentworth
97	6807084	6	21/Apr/69	587954.4	4778023	93	32	Fresh	Water Suppy	Domestic	NA	102	31.10	CLAY	NA	Wentworth
98	6807293	6	1/Sep/69	587754.4	4778273	85	43	Fresh	Water Suppy	Domestic	NA	105	32.01	CLAY/LMSN	NA	Wentworth
99	6807492	6	18/Feb/70	588254.4	4778663	112	42	Fresh	Water Suppy	Domestic	NA	112	34.15	CLAY	NA	Wentworth
100	6807546	6	28/Aug/70	588654.4	4777203	106	50	Fresh	Water Suppy	Domestic	NA	106	32.32	CLAY	NA	Wentworth
101	6807997	6	17/Aug/71	588199.4	4778733	114	75	Fresh	Water Suppy	Domestic	NA	115	35.06	CLAY	NA	Wentworth
102	6808170	6	6/Apr/72	588614.4	4777263	112	45	Fresh	Water Suppy	Domestic	NA	112	34.15	CLAY	NA	Wentworth
103	6808326	6	23/Mar/72	588294.4	4778663	112	64	Fresh	Water Suppy	Domestic	NA	113	34.45	CLAY	NA	Wentworth
104	6808327	16	7/Jun/72	587764.4	4778223	109	55	Fresh	Water Suppy	Domestic	NA	110	33.54	CLAY/LMSN	NA	Wentworth
105	6808435	6	19/Jan/73	588154.4	4777403	125	50	Fresh	Water Suppy	Domestic	NA	126	38.41	CLAY/LMSN	NA	Wentworth
106	6808728	6	15/Dec/73	587794.4	4777150	98	20	Fresh	Water Suppy	Industrial	NA	100	30.49	CLAY	NA	Wentworth
107	6808779	6	30/Nov/73	587897.4	4778270	106	39	Fresh	Water Suppy	Domestic	NA	107	32.62	CLAY/LMSN	NA	Wentworth
108	6809339	6	29/Oct/75	588183.4	4778435	106	50	Sulphur	Water Suppy	Domestic	NA	106	32.32	CLAY	NA	Wentworth
109	6809521	6	7/Jun/76	588514.4	4777443	215	70	Sulphur	Water Suppy	Irrigation	NA	247	75.30	CLAY/LMSN	NA	Wentworth
110	6809560	6	19/Mar/76	588054.4	4777423	109	45	Fresh	Water Suppy	Domestic	NA	109	33.23	CLAY	NA	Wentworth
111	6809565	6	1/Jul/76	587934.4	4777463	108	49	Fresh	Water Suppy	Domestic	NA	108	32.93	CLAY	NA	Wentworth
112	6809566	6	3/Aug/76	588414.4	4777323	115	55	Fresh	Water Suppy	Domestic	NA	115	35.06	CLAY	NA	Wentworth
113	6809577	6	11/Nov/76	588354.4	4777343	110	40	Fresh	Water Suppy	Domestic	NA	110	33.54	CLAY	NA	Wentworth
114	6809628	6	2/Jun/77	587814.4	4777643	97	45	Fresh	Water Suppy	Domestic	NA	97	29.57	CLAY	NA	Wentworth
115	6810803	6	19/Jun/84	588112.4	4777373	109	60	Fresh	Water Suppy	Domestic	NA	115	35.06	CLAY	NA	Wentworth
116	6811407	6	24/Mar/88	588316.2	4777280	102	40	Fresh	Water Suppy	Domestic	NA	110	33.54	CLAY	NA	Wentworth
117	6812313	6	30/Nov/92	587792.4	4777415	89	35	Sulphur	Water Suppy	Commercial	NA	92	28.05	CLAY	NA	Wentworth
118	6812466	6	20/Jun/94	587738.4	4777493	130	55	Fresh	Water Suppy	Domestic	NA	135	41.16	CLAY/LMSN	NA	Wentworth
119	6812613	6	8/Jun/95	588325.2	4777309	99	50	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY	NA	Wentworth
120	6814029	6	11/Jun/04	588500.0	4777258	103	41	Fresh	Water Suppy	Domestic	NA	104	31.71	CLAY	8321 White Church Rd	Wentworth
121	7268137	8	24/May/16	587817.0	4777303	NA	NA	NA	Observation Wells	Monitoring	NA	30	9.15	CLAY/SILT	3659 Upper James St	Wentworth
122	7282068	2	22/Dec/16	588026.0	4778406	NA	NA	NA	Observation Wells	Monitoring	NA	25	7.62	CLAY	80 Mario St C Approc 40m East OGF Marion St	Mount Hope
123	7305831	2	30/Nov/12	588192.0	4778335	NA	NA	NA	Observation Wells	Monitoring	Test Hole	22	6.71	CLAY	3311 Homestead RD	Mount Hope
124	7308095	NA	12/Feb/18	588176.0	4778545	NA	NA	NA	Observation Wells	Test Hole	NA	66	20.12	TILL/CLAY	3253 Homestead DR	Mount Hope
125	7318512	6	25/Jun/18	588175.0	4778335	NA	NA	NA	Observation Wells	Monitoring	Test Hole	NA	NA	NA	3311 Homestead DR	Mount Hope
126	7318513	6	25/Jun/18	588169.0	4778333	NA	NA	NA	Observation Wells	Monitoring	Test Hole	NA	NA	NA	3311 Homestead DR	Mount Hope
127	7338140	NA	9/Jul/19	587633.0	4778268	NA	NA	NA	Abandoned-Other	Not Used	NA	91	27.74	NA	91 Strothearne PL	Wentworth
128	7342203	8	2/Jul/19	587813.0	4777552	NA	NA	NA	Observation Wells	Monitoring	NA	25	7.62	CLAY	3530 Upper James St	Wentworth
129	7342204	4	2/Jul/19	587831.0	4777550	NA	NA	NA	Observation Wells	Monitoring	NA	25	7.62	SAND/CLAY	3530 Upper James St	Wentworth
130	7342205	4	2/Jul/19	587841.0	4777547	NA	NA	NA	Observation Wells	Monitoring	NA	30	9.15	SAND/CLAY	3530 Upper James St	Wentworth
131	7342206	4	3/Jul/19	587845.0	4777570	NA	NA	NA	Observation Wells	Monitoring	NA	25	7.62	SAND/CLAY	3530 Upper James St	Wentworth
132	7342207	4	2/Jul/19	587832.0	4777574	NA	NA	NA	Observation Wells	Monitoring	NA	20	6.10	GRVL/CLAY	3530 Upper James St	Wentworth
133	7348321	6	4/Oct/19	587799.0	4777577	NA	NA	NA	Observation Wells	Monitoring	NA	25	7.62	SAND	3530 Highway 6	Wentworth
134	7348322	6	4/Oct/19	587836.0	4777595	NA	NA	NA	Observation Wells	Monitoring	NA	25	7.62	SILT/CLAY	3530 Highway 6	Wentworth
135	7375111	6	28/Oct/20	587816.0	4777524	NA	NA	NA	Observation Wells	Monitoring	NA	15	4.57	CLAY	3530 Upper James St	Wentworth
136	7375112	6	29/Oct/20	587792.0	4777555	NA	NA	NA	Observation Wells	Monitoring	NA	15	4.57	CLAY	3530 Upper James St	Wentworth
137	7375113	6	29/Oct/20	587819.0	4777570	NA	NA	NA	Observation Wells	Monitoring	NA	17	5.18	CLAY	3530 Upper James St	Wentworth
138	7375114	6	29/Oct/20	587840.0	4777547	NA	NA	NA	Observation Wells	Monitoring	NA	15	4.57	SAND/CLAY	3530 Upper James St	Wentworth
139	7433892	6	30/Oct/22	587788.0	4777549	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Wentworth

Summary of MECP Well Records: Table 2

Well #	WELL_ID	DIAMETER (inches)	DATE_COMPLETED	EAST83	NORTH83	WATER_FOUND_DEPTH (FT)	Static Water Level (ft)	KIND	FINAL_STATUS	USE_1ST	USE_2ND	DEPTH_TO (ft)	DEPTH_TO (m)	Well Construction	STREET	CITY/TOWNSHIP
1	6804026	6	20/May/58	588002.4	4778046	107	27	Fresh	Water Suppy	Domestic	NA	109	33.23	CLAY	NA	Wentworth
2	6804044	6	11/Jun/60	587830.4	4777514	103	40	Fresh	Water Suppy	Commercial	NA	103	31.40	CLAY/QSND	NA	Wentworth
3	6804062	6	15/Jun/53	588059.4	4777955	100	30	Fresh	Water Suppy	Domestic	NA	100	30.49	LOAM	NA	Wentworth
4	6804064	6	24/May/55	588026.4	4777436	110	35	Fresh	Water Suppy	Domestic	NA	120	36.59	CLAY/LMSN	NA	Wentworth
5	6804065	6	13/Jun/55	588042.4	4777754	110	100	Fresh	Abandoned-Other	Not Used	NA	115	35.06	CLAY/LMSN	NA	Wentworth
6	6804066	6	23/Jun/55	588007.4	4777764	100	20	Fresh	Water Suppy	Domestic	Livestock	108	32.93	CLAY/LMSN	NA	Wentworth
7	6804069	7	25/Mar/60	588247.4	4777380	105	28	Fresh	Water Suppy	Domestic	Commercial	104	31.71	CLAY	NA	Wentworth
8	6804073	6	7/May/62	588606.4	4777954	122	40	Fresh	Water Suppy	Irrigation	NA	124	37.80	CLAY/QSND	NA	Wentworth
9	6804074	6	12/May/62	588029.4	4777912	118	30	Fresh	Water Suppy	Domestic	NA	120	36.59	CLAY/FSND/LMSN	NA	Wentworth
10	6804076	6	16/Sep/64	588362.4	4777337	102	35	Fresh	Water Suppy	Domestic	NA	105	32.01	CLAY/SILT	NA	Wentworth
11	6804132	6	10/Sep/51	587681.4	4777675	97	6	Fresh	Water Suppy	Domestic	NA	97	29.57	LOAM/LMSN	NA	Wentworth
12	6804133	6	21/Mar/54	587681.4	4777667	120	40	Fresh	Water Suppy	Domestic	NA	120	36.59	CLAY/LMSN	NA	Wentworth
13	6804134	6	16/Mar/57	587726.4	4777670	90	10	Fresh	Water Suppy	Domestic	NA	91	27.74	CLAY	NA	Wentworth
14	6804136	6	13/Jun/57	587630.4	4777702	110	32	Fresh	Water Suppy	Domestic	NA	116	35.37	CLAY	NA	Wentworth
15	6804138	6	17/Jun/58	587673.4	4777662	105	25	Fresh	Water Suppy	Commercial	NA	105	32.01	CLAY	NA	Wentworth
16	6804139	6	27/Aug/58	587683.4	4777557	76	14	Fresh	Water Suppy	Domestic	NA	79	24.09	CLAY	NA	Wentworth
17	6804143	6	7/Feb/58	587676.4	4777685	108	20	Fresh	Water Suppy	Public	NA	108	32.93	CLAY	NA	Wentworth
18	6804144	6	4/Mar/61	587726.4	4777657	100	30	Fresh	Water Suppy	Public	NA	102	31.10	CLAY/LMSN	NA	Wentworth
19	6804151	6	13/May/47	587786.4	4777474	NA	20	Fresh	Water Suppy	Domestic	NA	120	36.59	QSND/LMSN	NA	Wentworth
20	6804152	6	15/Nov/48	587914.4	4777602	113	35	Fresh	Water Suppy	Domestic	NA	118	35.98	CLAY/MSND	NA	Wentworth
21	6804154	6	2/Oct/53	587781.4	4777542	73	4	Fresh	Water Suppy	Domestic	NA	75	22.87	CLAY/LMSN	NA	Wentworth
22	6804155	6	29/Sep/54	588163.4	4777518	113	35	Fresh	Water Suppy	Domestic	NA	113	34.45	CLAY/FSND	NA	Wentworth
23	6804156	6	8/Dec/54	587746.4	4777487	102	35	Fresh	Water Suppy	Domestic	NA	111	33.84	CLAY	NA	Wentworth
24	6804159	7	18/Aug/59	587701.4	4777294	100	50	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY	NA	Wentworth
25	6804160	6	17/Oct/59	587704.4	4777339	100	50	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY	NA	Wentworth
26	6804168	6	2/Dec/67	588073.4	4777068	114	30	Fresh	Water Suppy	Domestic	NA	115	35.06	CLAY	NA	Wentworth
27	6806912	6	26/Apr/68	587994.4	4777783	115	85	Sulphur	Water Suppy	Domestic	NA	120	36.59	CLAY/LMSN	NA	Wentworth
28	6807084	6	21/Apr/69	587954.4	4778023	93	32	Fresh	Water Suppy	Domestic	NA	102	31.10	CLAY	NA	Wentworth
29	6807546	6	28/Aug/70	588654.4	4777203	106	50	Fresh	Water Suppy	Domestic	NA	106	32.32	CLAY	NA	Wentworth
30	6808170	6	6/Apr/72	588614.4	4777263	112	45	Fresh	Water Suppy	Domestic	NA	112	34.15	CLAY	NA	Wentworth
31	6808435	6	19/Jan/73	588154.4	4777403	125	50	Fresh	Water Suppy	Domestic	NA	126	38.41	CLAY/LMSN	NA	Wentworth
32	6808728	6	15/Dec/73	587794.4	4777150	98	20	Fresh	Water Suppy	Industrial	NA	99	30.18	CLAY	NA	Wentworth
33	6809521	6	7/Jun/76	588514.4	4777443	215	70	Sulphur	Water Suppy	Irrigation	NA	247	75.30	CLAY/LMSN	NA	Wentworth
34	6809560	6	19/Mar/76	588054.4	4777423	109	45	Fresh	Water Suppy	Domestic	NA	109	33.23	CLAY	NA	Wentworth
35	6809565	6	1/Jul/76	587934.4	4777463	108	49	Fresh	Water Suppy	Domestic	NA	108	32.93	CLAY	NA	Wentworth
36	6809566	6	3/Aug/76	588414.4	4777323	115	55	Fresh	Water Suppy	Domestic	NA	115	35.06	CLAY	NA	Wentworth
37	6809577	6	11/Nov/76	588354.4	4777343	110	40	Fresh	Water Suppy	Domestic	NA	110	33.54	CLAY	NA	Wentworth
38	6809628	6	2/Jun/77	587814.4	4777643	97	45	Fresh	Water Suppy	Domestic	NA	97	29.57	CLAY	NA	Wentworth
39	6810803	6	19/Jun/84	588112.4	4777373	109	60	Fresh	Water Suppy	Domestic	NA	115	35.06	CLAY	NA	Wentworth
40	6811407	6	24/Mar/88	588316.2	4777280	102	40	Fresh	Water Suppy	Domestic	NA	110	33.54	CLAY	NA	Wentworth
41	6812313	6	30/Nov/92	587792.4	4777415	89	35	Sulphur	Water Suppy	Commercial	NA	92	28.05	CLAY	NA	Wentworth
42	6812466	6	20/Jun/94	587738.4	4777493	130	55	Fresh	Water Suppy	Domestic	NA	135	41.16	CLAY/LMSN	NA	Wentworth
43	6812613	6	8/Jun/95	588325.2	4777309	99	50	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY	NA	Wentworth
44	6814029	6	11/Jun/04	588500.0	4777258	103	41	Fresh	Water Suppy	Domestic	NA	104	31.71	CLAY	8321 White Church Rd	Wentworth
45	7268137	8	24/May/16	587817.0	4777303	NA	NA	NA	Observation Wells	Monitoring	NA	30	9.15	CLAY/SILT	3659 Upper James St	Wentworth
46	7342203	8	2/Jul/19	587813.0	4777552	NA	NA	NA	Observation Wells	Monitoring	NA	25	7.62	CLAY	3530 Upper James St	Wentworth
47	7342204	4	2/Jul/19	587831.0	4777550	NA	NA	NA	Observation Wells	Monitoring	NA	25	7.62	SAND/CLAY	3530 Upper James St	Wentworth
48	7342205	4	2/Jul/19	587841.0	4777547	NA	NA	NA	Observation Wells	Monitoring	NA	30	9.15	SAND/CLAY	3530 Upper James St	Wentworth
49	7342206	4	3/Jul/19	587845.0	4777570	NA	NA	NA	Observation Wells	Monitoring	NA	25	7.62	SAND/CLAY	3530 Upper James St	Wentworth
50	7342207	4	2/Jul/19	587832.0	4777574	NA	NA	NA	Observation Wells	Monitoring	NA	20	6.10	GRVL/CLAY	3530 Upper James St	Wentworth
51	7348321	6	4/Oct/19	587799.0	4777577	NA	NA	NA	Observation Wells	Monitoring	NA	25	7.62	SAND	3530 Highway 6	Wentworth
52	7348322	6	4/Oct/19	587836.0	4777595	NA	NA	NA	Observation Wells	Monitoring	NA	25	7.62	SILT/CLAY	3530 Highway 6	Wentworth
53	7375111	6	28/Oct/20	587816.0	4777524	NA	NA	NA	Observation Wells	Monitoring	NA	15	4.57	CLAY	3530 Upper James St	Wentworth
54	7375112	6	29/Oct/20	587792.0	4777555	NA	NA	NA	Observation Wells	Monitoring	NA	15	4.57	CLAY	3530 Upper James St	Wentworth
55	7375113	6	29/Oct/20	587819.0	4777570	NA	NA	NA	Observation Wells	Monitoring	NA	17	5.18	CLAY	3530 Upper James St	Wentworth
56	7375114	6	29/Oct/20	587840.0	4777547	NA	NA	NA	Observation Wells	Monitoring	NA	15	4.57	SAND/CLAY	3530 Upper James St	Wentworth
57	7433892	6	30/Oct/22	587788.0	4777549	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Wentworth

Summary of MECP Well Records: Table 3

Well #	WELL_ID	DIAMETER (inches)	DATE_COMPLETED	EAST83	NORTH83	WATER_FOUND_DEPTH (FT)	Static Water Level (ft)	KIND	FINAL_STATUS	USE_1ST	USE_2ND	DEPTH_TO (ft)	DEPTH_TO (m)	Well Construction	STREET	CITY/TOWNSHIP
1	6803950	6	29-Aug-58	588582.1	4778560	113	30	Fresh	Water Suppy	Domestic	NA	113	34.45	CLAY/SHLE	NA	Wentworth
2	6804072	6	4-Oct-61	588521.4	4778386	112	50	Fresh	Water Suppy	Irrigation	NA	112	34.15	CLAY/QSND	NA	Wentworth
3	6804073	6	7-May-62	588606.4	4777954	122	40	Fresh	Water Suppy	Irrigation	NA	124	37.80	CLAY/QSND	NA	Wentworth
4	6804075	8	30-Jun-64	588656.4	4778112	135/190	45	Fresh/Sulphur	Water Suppy	Irrigation	NA	191	58.23	CLAY/QSND	NA	Wentworth
5	6804078	6	31-Jan-67	588755.4	4778526	130	83	Fresh	Water Suppy	Domestic	NA	133	40.55	CLAY	NA	Wentworth
6	6804079	6	16-May-56	588993.4	4778476	124	40	Fresh	Water Suppy	Domestic	NA	124	37.80	CLAY/QSND	NA	Wentworth
7	6808175	6	20-May-72	588814.4	4778593	130	45	Fresh	Water Suppy	Domestic	NA	138	42.07	CLAY	NA	Wentworth
8	6809329	6	3-May-75	589014.4	4778523	104	61	Fresh	Water Suppy	Domestic	NA	106	32.32	CLAY	NA	Wentworth
9	6809521	6	7-Jun-76	588514.4	4777443	215	70	Sulphur	Water Suppy	Irrigation	NA	247	75.30	CLAY/LMSN	NA	Wentworth
10	6811559	6	21-Sep-88	616391.6	4861579	102	60	Fresh	Water Suppy	Domestic	NA	104	31.71	CLAY	NA	Wentworth

Summary of MECP Well Records: Table 4

Well #	WELL_ID	DIAMETER (inches)	DATE_COMPLETED	EAST83	NORTH83	WATER_FOUND_DEPTH (FT)	Static Water Level (ft)	KIND	FINAL_STATUS	USE_1ST	USE_2ND	DEPTH_TO (ft)	DEPTH_TO (m)	Well Construction	STREET	CITY/TOWNSHIP
1	6803965	6	2-Oct-56	589303.4	4778618	108	20	Fresh	Water Suppy	Domestic	NA	110	33.54	CLAY	NA	Wentworth
2	6803971	6	31-Jul-57	589724.4	4778501	110	45	Fresh	Water Suppy	Domestic	NA	110	33.54	CLAY	NA	Wentworth
3	6803973	5	16-May-59	589880.4	4778456	103	38	Fresh	Water Suppy	Domestic	NA	105	32.01	CLAY	NA	Wentworth
4	6803974	6	3-Jun-61	589393.4	4778606	112	55	Fresh	Water Suppy	Domestic	NA	114	34.76	CLAY	NA	Wentworth
5	6803975	4	29-Oct-54	589930.4	4778443	99	23	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY/MSND	NA	Wentworth
6	6804079	6	16-May-56	588993.4	4778476	124	40	Fresh	Water Suppy	Domestic	NA	133	40.55	CLAY/QSND	NA	Wentworth
7	6804086	6	6-Sep-56	589893.4	4778197	98	30	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY	NA	Wentworth
8	6804087	6	24-May-58	589871.4	4778217	98	37	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY	NA	Wentworth
9	6806911	6	12-Aug-68	589594.4	4778353	99	65	Fresh	Water Suppy	Domestic	NA	102	31.10	CLAY	NA	Wentworth
10	6807395	6	21-Nov-69	589924.4	4778193	120	40	Fresh	Water Suppy	Domestic	NA	140	42.68	CLAY/QSND	NA	Wentworth
11	6809305	6	7-Jun-75	590147.4	4778131	100	49	Fresh	Water Suppy	Domestic	NA	110	33.54	CLAY/LMSN	NA	Wentworth
12	6810236	6	8-Oct-80	589594.4	4778563	83	45	Fresh	Water Suppy	Livestock	NA	150	45.73	CLAY/LMSN	NA	Wentworth
13	6810237	6	7-Jul-80	589994.4	4778223	95	56	Fresh	Water Suppy	Domestic	NA	96	29.27	CLAY/LMSN	NA	Wentworth
14	6810238	6	30-Jun-80	589934.4	4778243	95	64	Fresh	Water Suppy	Domestic	NA	99	30.18	CLAY/LMSN	NA	Wentworth
15	6810239	6	25-Jun-80	589934.4	4778263	89	50	Fresh	Water Suppy	Domestic	NA	90	27.44	CLAY	NA	Wentworth
16	6810369	6	18-Aug-81	589854.4	4778203	96	72	Fresh	Water Suppy	Domestic	NA	132	40.24	CLAY/LMSN	NA	Wentworth
17	6812962	6	29-Jul-97	589419.2	4778420	87	45	Not Stated	Water Suppy	Domestic	NA	90	27.44	CLAY	NA	Wentworth

Summary of MECP Well Records: Table 5

Well #	WELL_ID	DIAMETER (inches)	DATE_COMPLETED	EAST83	NORTH83	WATER_FOUND_DEPTH (FT)	Static Water Level (ft)	KIND	FINAL_STATUS	USE_1ST	USE_2ND	DEPTH_TO (ft)	DEPTH_TO (m)	Well Construction	STREET	CITY/TOWNSHIP
1	6804080	6	4/Jul/56	588914.4	4777179	82	10	Fresh	Water Suppy	Domestic	Livestock	84	25.61	CLAY	NA	Wentworth
2	6804081	6	20/Jan/59	588869.4	4777182	115	30	Fresh	Water Suppy	Domestic	NA	115	35.06	CLAY	NA	Wentworth
3	6804082	6	27/Apr/59	588879.4	4777207	105	30	Fresh	Water Suppy	Domestic	NA	105	32.01	CLAY/QSND	NA	Wentworth
4	6804083	6	17/Aug/59	588811.4	4777207	116	50	Fresh	Water Suppy	Domestic	NA	117	35.67	CLAY	NA	Wentworth
5	6804084	6	6/Jun/63	588771.4	4777217	113	35	Fresh	Water Suppy	Domestic	NA	114	34.76	CLAY	NA	Wentworth
6	6804085	6	27/Mar/65	588771.4	4777217	112	30	Fresh	Water Suppy	Domestic	NA	112	34.15	CLAY/QSND	NA	Wentworth
7	6804088	6	23/Apr/59	588944.4	4777176	102	30	Fresh	Water Suppy	Domestic	NA	102	31.10	CLAY/QSND	NA	Wentworth
8	6807546	6	28/Aug/70	588654.4	4777203	106	50	Fresh	Water Suppy	Domestic	NA	106	32.32	CLAY	NA	Wentworth
9	6808170	6	6/Apr/72	588614.4	4777263	112	45	Fresh	Water Suppy	Domestic	NA	112	34.15	CLAY	NA	Wentworth
10	6809521	6	7/Jun/76	588514.4	4777443	215	70	Sulphur	Water Suppy	Irrigation	NA	247	75.30	CLAY/LMSN	NA	Wentworth
11	6809566	6	3/Aug/76	588414.4	4777323	115	55	Fresh	Water Suppy	Domestic	NA	115	35.06	CLAY	NA	Wentworth
12	6811293	6	25/May/87	589652.2	4776949	105	55	Fresh	Water Suppy	Domestic	NA	105	32.01	CLAY	NA	Wentworth
13	6812123	6	16/Aug/91	589309.2	4776618	110	40	Fresh	Water Suppy	Domestic	NA	110	33.54	CLAY	NA	Wentworth
14	6814029	6	11/Jun/04	588500.0	4777258	103	41	Fresh	Water Suppy	Domestic	NA	104	31.71	CLAY	White Church Rd	Wentworth

Summary of MECP Well Records: Table 6

Well #	WELL_ID	DIAMETER (inches)	DATE_COMPLETED	EAST83	NORTH83	WATER_FOUND_DEPTH (FT)	Static Water Level (ft)	KIND	FINAL_STATUS	USE_1ST	USE_2ND	DEPTH_TO (ft)	DEPTH_TO (m)	Well Construction	STREET	CITY/TOWNSHIP
1	6804080	6	4/Jul/56	588914.4	4777179	82	10	Fresh	Water Suppy	Domestic	Livestock	84	25.61	CLAY	NA	Wentworth
2	6804081	6	20/Jan/59	588869.4	4777182	115	30	Fresh	Water Suppy	Domestic	NA	115	35.06	CLAY	NA	Wentworth
3	6804082	6	27/Apr/59	588879.4	4777207	105	30	Fresh	Water Suppy	Domestic	NA	105	32.01	CLAY/QSND	NA	Wentworth
4	6804083	6	17/Aug/59	588811.4	4777207	116	50	Fresh	Water Suppy	Domestic	NA	117	35.67	CLAY	NA	Wentworth
5	6804084	6	6/Jun/63	588771.4	4777217	113	35	Fresh	Water Suppy	Domestic	NA	114	34.76	CLAY	NA	Wentworth
6	6804085	6	27/Mar/65	588771.4	4777217	112	30	Fresh	Water Suppy	Domestic	NA	112	34.15	CLAY/QSND	NA	Wentworth
7	6804088	6	23/Apr/59	588944.4	4777176	102	30	Fresh	Water Suppy	Domestic	NA	102	31.10	CLAY/QSND	NA	Wentworth
8	6804176	6	14/May/58	589138.4	4776405	83	40	Fresh	Water Suppy	Domestic	NA	83	25.30	CLAY	NA	Wentworth
9	6804177	6	17/Nov/60	589115.4	4776307	90	28	Fresh	Water Suppy	Domestic	NA	92	28.05	CLAY/LMSN	NA	Wentworth
10	6807546	6	28/Aug/70	588654.4	4777203	106	50	Fresh	Water Suppy	Irrigation	NA	106	32.32	CLAY	NA	Wentworth
11	6808170	6	6/Apr/72	588614.4	4777263	112	45	Fresh	Water Suppy	Domestic	NA	112	34.15	CLAY	NA	Wentworth
12	6810248	6	2/Jul/80	589194.4	4776303	59	35	Fresh	Water Suppy	Domestic	NA	60	18.29	CLAY	NA	Wentworth
13	6811293	6	25/May/87	589652.2	4776949	105	55	Fresh	Water Suppy	Domestic	NA	105	32.01	CLAY	NA	Wentworth
14	6811483	6	18/Jun/88	589273.2	4776386	88	35	Fresh	Water Suppy	Domestic	NA	88	26.83	CLAY	NA	Wentworth
15	6812123	6	16/Aug/91	589309.2	4776618	110	40	Fresh	Water Suppy	Domestic	NA	110	33.54	CLAY	NA	Wentworth
16	6813257	6	6/Dec/99	589427.2	4776471	113	52	Fresh	Water Suppy	Domestic	NA	113	34.45	CLAY/SAND	NA	Wentworth
17	6814029	6	11/Jun/04	588500.0	4777258	103	41	Fresh	Water Suppy	Domestic	NA	104	31.71	CLAY	White Church Rd	Wentworth

Summary of MECP Well Records: Table 7

Well #	WELL_ID	DIAMETER (inches)	DATE_COMPLETED	EAST83	NORTH83	WATER_FOUND_DEPTH (FT)	Static Water Level (ft)	KIND	FINAL_STATUS	USE_1ST	USE_2ND	DEPTH_TO (ft)	DEPTH_TO (m)	Well Construction	STREET	CITY/TOWNSHIP
1	6804080	6	4/Jul/56	588914.4	4777179	82	10	Fresh	Water Suppy	Domestic	Livestock	84	25.61	CLAY	NA	Wentworth
2	6804081	6	20/Jan/59	588869.4	4777182	115	30	Fresh	Water Suppy	Domestic	NA	115	35.06	CLAY	NA	Wentworth
3	6804082	6	27/Apr/59	588879.4	4777207	105	30	Fresh	Water Suppy	Domestic	NA	105	32.01	CLAY/QSND	NA	Wentworth
4	6804083	6	17/Aug/59	588811.4	4777207	116	50	Fresh	Water Suppy	Domestic	NA	117	35.67	CLAY	NA	Wentworth
5	6804084	6	6/Jun/63	588771.4	4777217	113	35	Fresh	Water Suppy	Domestic	NA	114	34.76	CLAY	NA	Wentworth
6	6804085	6	27/Mar/65	588771.4	4777217	112	30	Fresh	Water Suppy	Domestic	NA	112	34.15	CLAY/QSND	NA	Wentworth
7	6804088	6	23/Apr/59	588944.4	4777176	102	30	Fresh	Water Suppy	Domestic	NA	102	31.10	CLAY/QSND	NA	Wentworth
8	6807880	6	24/Aug/71	589994.4	4776823	101	48	Fresh	Water Suppy	Domestic	NA	101	30.79	CLAY	NA	Wentworth
9	6812846	6	2/May/97	589962.4	4777525	107	52	Not Stated	Water Suppy	Domestic	NA	110	33.54	CLAY	NA	Wentworth
10	6812847	6	2/May/97	589962.4	4777525	NA	NA	Not Stated	Abandoned-Other	Not Used	NA	100	30.49	PRDG	NA	Wentworth
11	6811293	6	25/May/87	589652.2	4776949	105	55	Fresh	Water Suppy	Domestic	NA	105	32.01	CLAY	NA	Wentworth
12	6812123	6	16/Aug/91	589309.2	4776618	110	40	Fresh	Water Suppy	Domestic	NA	110	33.54	CLAY	NA	Wentworth
13	7447983	6	2/Mar/23	590338.0	4777122	NA	NA	Not Stated	NA	NA	NA	NA	NA	NA	NA	Wentworth

Summary of MECP Well Records: Table 8

Well #	WELL_ID	DIAMETER (inches)	DATE_COMPLETED	EAST83	NORTH83	WATER_FOUND_DEPTH (FT)	Static Water Level (ft)	KIND	FINAL_STATUS	USE_1ST	USE_2ND	DEPTH_TO (ft)	DEPTH_TO (m)	Well Construction	STREET	CITY/TOWNSHIP
1	6804181	6	9/Feb/53	590534.4	4776403	114	24	Fresh	Water Suppy	Domestic	Livestock	118	35.98	CLAY	NA	Wentworth
2	6807153	6	27/Jun/69	590934.4	4777583	96	55	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY/LMSN	NA	Wentworth
3	6811165	6	17/Jun/86	590506.2	4776468	100	50	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY	NA	Wentworth
4	6812252	6	7/Oct/92	590736.2	4777147	100	60	Fresh	Water Suppy	Domestic	NA	118	35.98	CLAY/LMSN	NA	Wentworth
5	6812646	6	24/Jul/95	590600.2	4776770	122	75	Sulphur	Water Suppy	Domestic	NA	130	39.63	CLAY/LMSN	NA	Wentworth
6	6807880	6	24/Aug/71	589994.4	4776823	101	48	Fresh	Water Suppy	Domestic	NA	101	30.79	CLAY	NA	Wentworth
7	6812846	6	2/May/97	589962.4	4777525	107	52	Not Stated	Water Suppy	Domestic	NA	110	33.54	CLAY	NA	Wentworth
8	6812847	6	2/May/97	589962.4	4777525	NA	NA	Not Stated	Abandoned-Other	Not Used	NA	100	30.49	PRDG	NA	Wentworth
9	6811293	6	25/May/87	589652.2	4776949	105	55	Fresh	Water Suppy	Domestic	NA	105	32.01	CLAY	NA	Wentworth
10	7447985	6	2/Mar/23	590672.0	4777529	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Wentworth
11	7447983	6	2/Mar/23	590338.0	4777122	NA	NA	Not Stated	NA	NA	NA	NA	NA	NA	NA	Wentworth

Summary of MECP Well Records: Table 9

Well #	WELL_ID	DIAMETER (inches)	DATE_COMPLETED	EAST83	NORTH83	WATER_FOUND_DEPTH (FT)	Static Water Level (ft)	KIND	FINAL_STATUS	USE_1ST	USE_2ND	DEPTH_TO (ft)	DEPTH_TO (m)	Well Construction	STREET	CITY/TOWNSHIP
1	6804181	6	9/Feb/53	590534.4	4776403	114	24	Fresh	Water Suppy	Domestic	Livestock	118	35.98	CLAY	NA	Wentworth
2	6804094	6	19/Jun/62	590594.4	4776563	112	60	Fresh	Water Suppy	Domestic	NA	130	39.63	CLAY/LMSN	NA	Wentworth
3	6811165	6	17/Jun/86	590506.2	4776468	100	50	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY	NA	Wentworth
4	6812252	6	7/Oct/92	590736.2	4777147	100	60	Fresh	Water Suppy	Domestic	NA	118	35.98	CLAY/LMSN	NA	Wentworth
5	6812646	6	24/Jul/95	590600.2	4776770	122	75	Sulphur	Water Suppy	Domestic	NA	130	39.63	CLAY/LMSN	NA	Wentworth
6	6807880	6	24/Aug/71	589994.4	4776823	101	48	Fresh	Water Suppy	Domestic	NA	101	30.79	CLAY	NA	Wentworth
7	7447983	6	2/Mar/23	590338.0	4777122	NA	NA	Not Stated	NA	NA	NA	NA	NA	NA	NA	Wentworth

Summary of MECP Well Records: Table 10

Well #	WELL_ID	DIAMETER (inches)	DATE_COMPLETED	EAST83	NORTH83	WATER_FOUND_DEPTH (FT)	Static Water Level (ft)	KIND	FINAL_STATUS	USE_1ST	USE_2ND	DEPTH_TO (ft)	DEPTH_TO (m)	Well Construction	STREET	CITY/TOWNSHIP
1	6803973	6	16/May/59	589880.4	4778456	103	38	Fresh	Water Suppy	Domestic	NA	105	32.01	CLAY/LMSN	NA	Wentworth
2	6803975	6	29/Oct/54	589930.4	4778443	99	23	Fresh	Water Suppy	Domestic	NA	100	30.49	MSND/LMSN	NA	Wentworth
3	6811750	6	8/Jul/89	590798.2	4778017	90	40	Fresh	Water Suppy	Domestic	NA	111	33.84	CLAY/LMSN	NA	Wentworth
4	6812846	6	2/May/97	589962.4	4777525	107	52	Not Stated	Water Suppy	Domestic	NA	110	33.54	CLAY	NA	Wentworth
5	6812847	6	2/May/97	589962.4	4777525	NA	NA	Not Stated	Abandoned-Other	Not Used	NA	100	30.49	PRDG	NA	Wentworth
6	6804086	6	6/Sep/56	589893.4	4778197	98	30	Fresh	Water Suppy	Domestic	NA	98	29.88	CLAY/LMSN	NA	Wentworth
7	6804087	6	24/May/58	589871.4	4778217	98	37	Fresh	Water Suppy	Domestic	NA	113	34.45	CLAY/LMSN	NA	Wentworth
8	6806911	6	12/Aug/68	589594.4	4778353	99	65	Fresh	Water Suppy	Domestic	NA	102	31.10	CLAY/LMSN	NA	Wentworth
9	6807395	6	21/Nov/69	589924.4	4778193	120	40	Fresh	Water Suppy	Domestic	NA	140	42.68	QSND/LMSN	NA	Wentworth
10	6810237	6	7/Jul/80	589994.4	4778223	95	56	Fresh	Water Suppy	Domestic	NA	96	29.27	CLAY/LMSN	NA	Wentworth
11	6807848	6	15/Jul/71	590174.4	4778173	90	40	Fresh	Water Suppy	Domestic	NA	110	33.54	CLAY/LMSN	NA	Wentworth
12	6810238	6	30/Jun/80	589934.4	4778243	95	64	Fresh	Water Suppy	Domestic	NA	99	30.18	CLAY/LMSN	NA	Wentworth
13	6809305	6	7/Jun/75	590147.4	4778131	100	49	Fresh	Water Suppy	Domestic	NA	110	33.54	CLAY/LMSN	NA	Wentworth
14	6810239	6	25/Jun/80	589934.4	4778263	89	50	Fresh	Water Suppy	Domestic	NA	90	27.44	CLAY	NA	Wentworth
15	6810369	6	18/Aug/81	589854.4	4778203	96	72	Fresh	Water Suppy	Domestic	NA	132	40.24	CLAY/LMSN	NA	Wentworth
16	6812866	6	17/Mar/97	590458.2	4778114	95	40	Fresh	Water Suppy	Domestic	NA	105	32.01	CLAY/LMSN	NA	Wentworth
17	7048155	6	13/Jun/07	590792.0	4778025	NA	33	Fresh	Abandoned-Other	NA	NA	113	34.45	PRDR	NA	Wentworth
18	7447983	6	2/Mar/23	590338.0	4777122	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Wentworth
19	7447984	6	6/Mar/23	590770.0	4777964	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Wentworth
20	7447985	6	2/Mar/23	590672.0	4777529	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Wentworth

Summary of MECP Well Records: Table 11

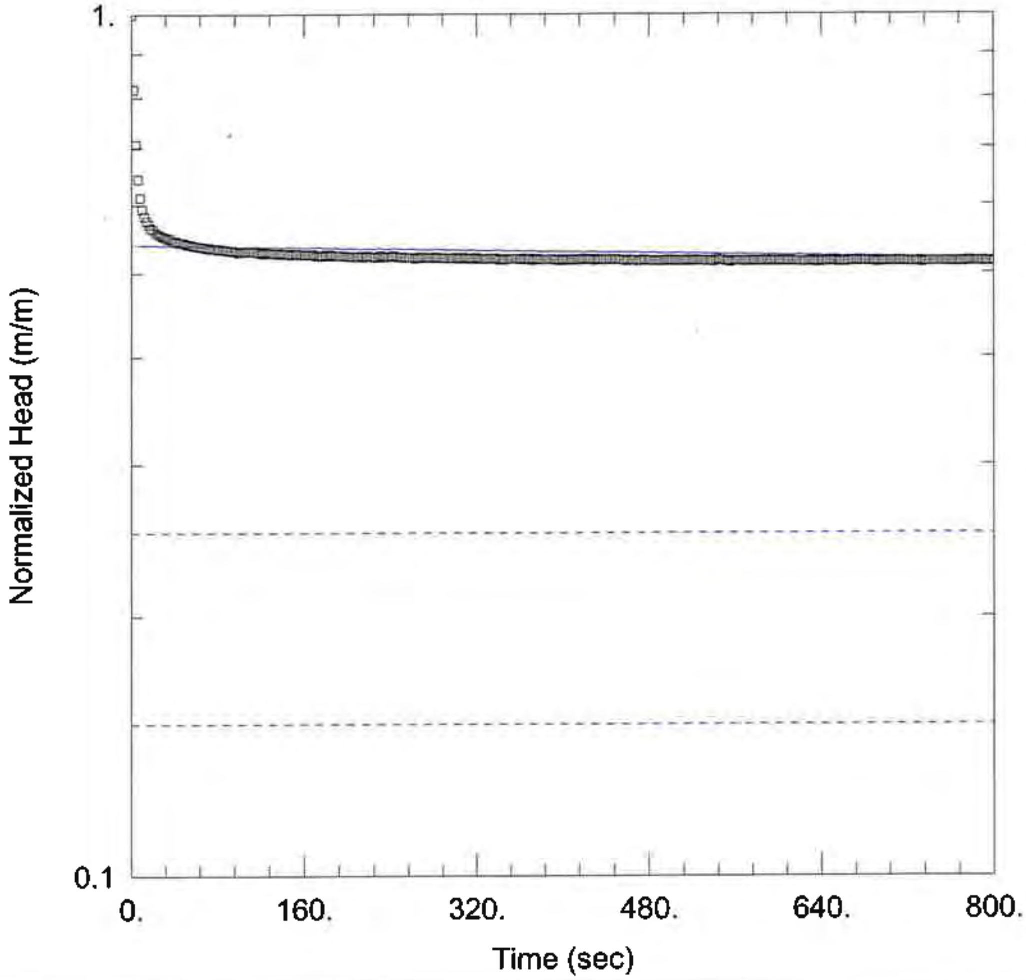
Well #	WELL_ID	DIAMETER (inches)	DATE_COMPLETED	EAST83	NORTH83	WATER_FOUND_DEPTH (FT)	Static Water Level (ft)	KIND	FINAL_STATUS	USE_1ST	USE_2ND	DEPTH_TO (ft)	DEPTH_TO (m)	Well Construction	STREET	CITY/TOWNSHIP
1	6812252	6	7/Oct/92	590736.2	4777147	100	60	Fresh	Water Suppy	Domestic	NA	118	35.98	CLAY/LMSN	NA	Wentworth
2	6812575	6	1/Dec/94	590964.2	4777885	98	65	Sulphur	Water Suppy	Domestic	NA	110	33.54	CLAY/LMSN	NA	Wentworth
3	6811750	6	8/Jul/89	590798.2	4778017	90	40	Fresh	Water Suppy	Domestic	NA	111	33.84	CLAY/LMSN	NA	Wentworth
4	6812846	6	2/May/97	589962.4	4777525	107	52	Not Stated	Water Suppy	Domestic	NA	110	33.54	CLAY	NA	Wentworth
5	6812847	6	2/May/97	589962.4	4777525	NA	NA	Not Stated	Abandoned-Other	Not Used	NA	100	30.49	PRDG	NA	Wentworth
6	6804089	6	10/Feb/52	590939.4	4777890	94	20	Fresh	Water Suppy	Domestic	NA	98	29.88	CLAY/QSND	NA	Wentworth
7	6804090	6	19/Oct/61	590931.4	4777842	100	35	Fresh	Water Suppy	Domestic	NA	113	34.45	CLAY/LMSN	NA	Wentworth
8	6804091	6	26/Feb/64	590921.4	4777887	108	60	Fresh	Water Suppy	Domestic	Livestock	110	33.54	CLAY/LMSN	NA	Wentworth
9	6804092	6	1/Apr/48	591470.4	4777689	106	18	Fresh	Water Suppy	Livestock	NA	107	32.62	CLAY	NA	Wentworth
10	6807153	6	27/Jun/69	590934.4	4777583	96	55	Fresh	Water Suppy	Domestic	NA	100	30.49	CLAY	NA	Wentworth
11	6807848	6	15/Jul/71	590174.4	4778173	90	40	Fresh	Water Suppy	Domestic	NA	110	33.54	CLAY/LMSN	NA	Wentworth
12	6808140	6	17/Mar/72	590974.4	4777963	76	32	Fresh	Water Suppy	Domestic	NA	76	23.17	CLAY	NA	Wentworth
13	6809305	6	7/Jun/75	590147.4	4778131	100	49	Fresh	Water Suppy	Domestic	NA	110	33.54	CLAY/LMSN	NA	Wentworth
14	6811170	6	29/Apr/86	590947.2	4777765	96	50	Fresh	NA	NA	NA	NA	NA	CLAY/LMSN	NA	Wentworth

Summary of MECP Well Records: Table 12

Well #	WELL_ID	DIAMETER (inches)	DATE_COMPLETED	EAST83	NORTH83	WATER_FOUND_DEPTH (FT)	Static Water Level (ft)	KIND	FINAL_STATUS	USE_1ST	USE_2ND	DEPTH_TO (ft)	DEPTH_TO (m)	Well Construction	STREET	CITY/TOWNSHIP
1	6812252	6	7/Oct/92	590736.2	4777147	100	60	Fresh	Water Suppy	Domestic	NA	118	35.98	CLAY/LMSN	NA	Wentworth
2	6812646	6	24/Jul/95	590600.2	4776770	122	75	Sulphur	Water Suppy	Domestic	NA	130	39.63	CLAY/LMSN	NA	Wentworth
3	6807880	6	24/Aug/71	589994.4	4776823	101	48	Fresh	Water Suppy	Domestic	NA	101	30.79	CLAY	NA	Wentworth
4	6812846	6	2/May/97	589962.4	4777525	107	52	Not Stated	Water Suppy	Domestic	NA	110	33.54	CLAY	NA	Wentworth
5	6812847	6	2/May/97	589962.4	4777525	NA	NA	Not Stated	Abandoned-Other	Not Used	NA	100	30.49	PRDG	NA	Wentworth
6	6811293	6	25/May/87	589652.2	4776949	105	55	Fresh	Water Suppy	Domestic	NA	105	32.01	CLAY	NA	Wentworth
7	7447983	6	2/Mar/23	590338.0	4777122	NA	NA	Not Stated	NA	NA	NA	NA	NA	NA	NA	Wentworth

APPENDIX E

HYDRAULIC CONDUCTIVITY TESTING ANALYSIS RESULTS



HDROGEOLOGICAL INVESTIGATION

Data Set: M:\...\MW3S.aqt
Date: 09/30/24 Time: 13:47:02

PROJECT INFORMATION

Company: Landtek Limited
Client: White Church Landowners Group
Project: 23355
Location: White Church Rd E /Upper James
Test Well: MW3S
Test Date: September 5, 2024

AQUIFER DATA

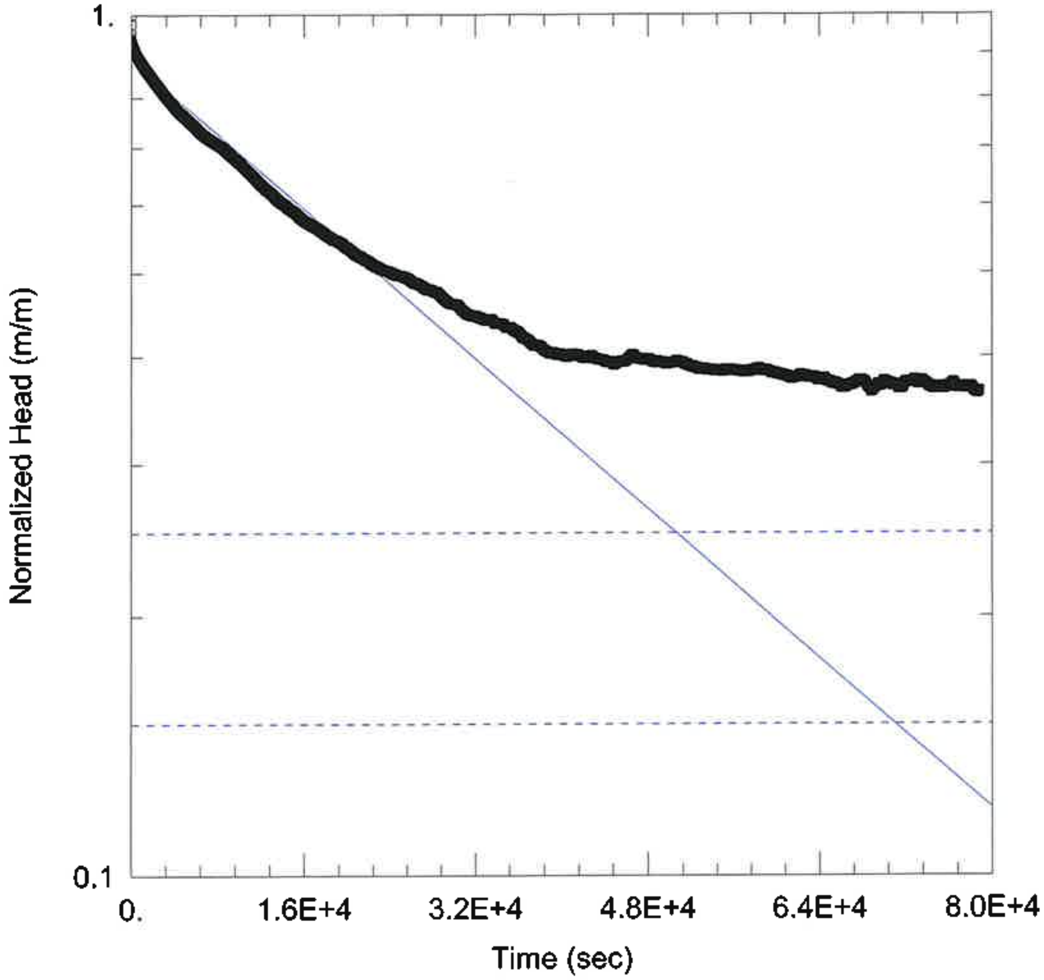
Saturated Thickness: 1.67 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW3S)

Initial Displacement: 0.4086 m
Total Well Penetration Depth: 1.67 m
Casing Radius: 0.0254 m
Static Water Column Height: 1.67 m
Screen Length: 1.5 m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 4.689E-8 m/sec
y0 = 0.2202 m



HDROGEOLOGICAL INVESTIGATION

Data Set: M:\...\MW3D.aqt
Date: 09/30/24 Time: 13:46:41

PROJECT INFORMATION

Company: Landtek Limited
Client: White Church Landowners Group
Project: 23355
Location: White Church Rd E /Upper James
Test Well: MW3D
Test Date: September 5, 2024

AQUIFER DATA

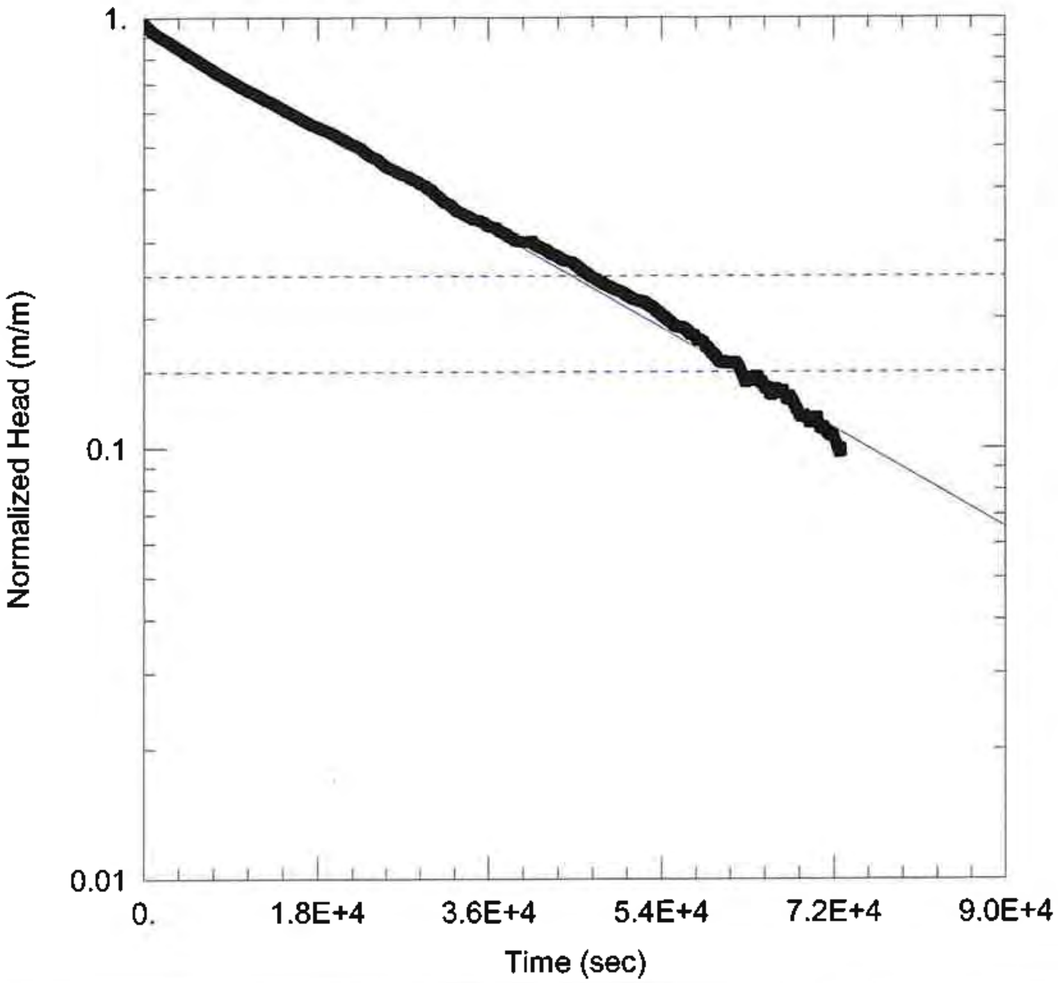
Saturated Thickness: 4.59 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW3D)

Initial Displacement: 0.3989 m
Total Well Penetration Depth: 5.59 m
Casing Radius: 0.0254 m
Static Water Column Height: 4.59 m
Screen Length: 3. m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 1.47E-8 m/sec
y0 = 0.3533 m



HDROGEOLOGICAL INVESTIGATION

Data Set: M:\...\MW4.aqt
Date: 09/30/24 Time: 13:47:29

PROJECT INFORMATION

Company: Landtek Limited
Client: White Church Landowners Group
Project: 23355
Location: White Church Rd E /Upper James
Test Well: MW4
Test Date: September 5, 2024

AQUIFER DATA

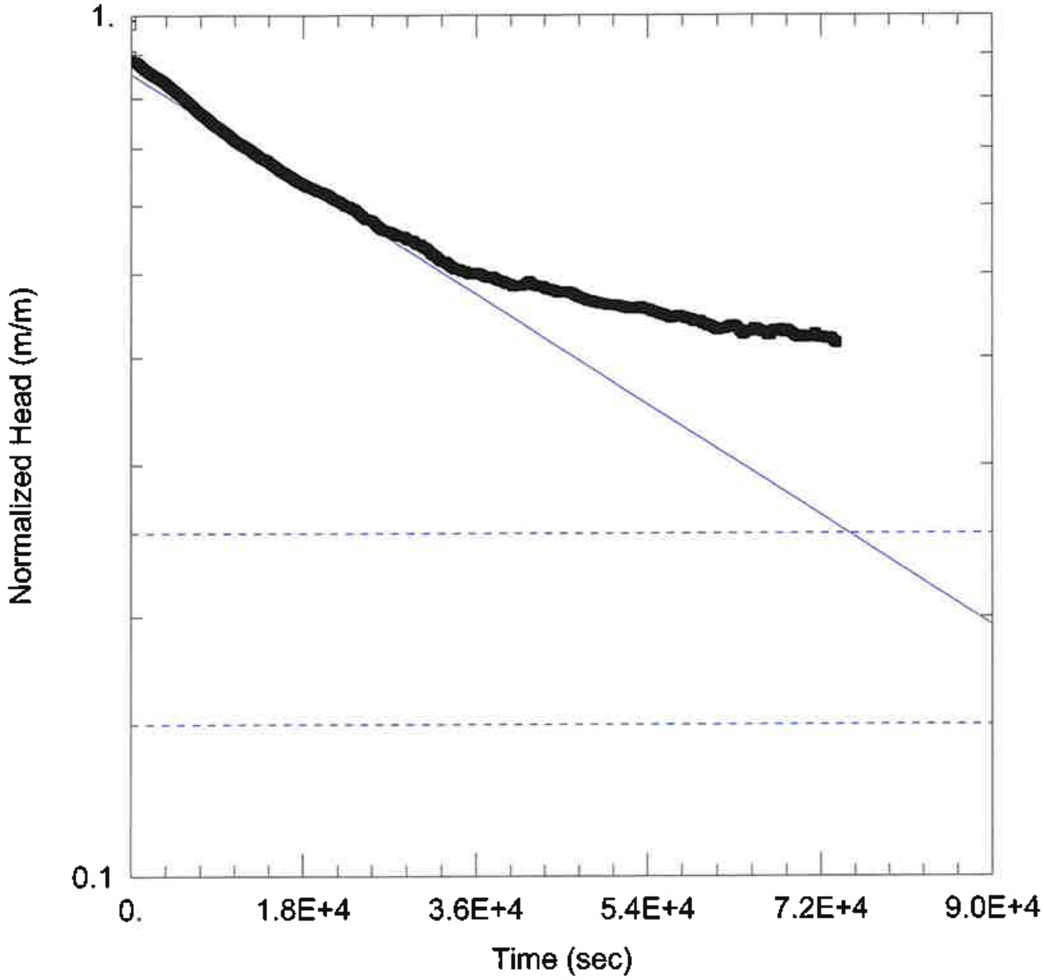
Saturated Thickness: 4.97 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW4)

Initial Displacement: 0.3913 m
Total Well Penetration Depth: 4.97 m
Casing Radius: 0.0254 m
Static Water Column Height: 4.97 m
Screen Length: 3. m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 1.738E-8 m/sec
y0 = 0.366 m



HDROGEOLOGICAL INVESTIGATION

Data Set: M:\...\MW6.aqt
Date: 09/30/24
Time: 13:47:58

PROJECT INFORMATION

Company: Landtek Limited
Client: White Church Landowners Group
Project: 23355
Location: White Church Rd E /Upper James
Test Well: MW6
Test Date: September 5, 2024

AQUIFER DATA

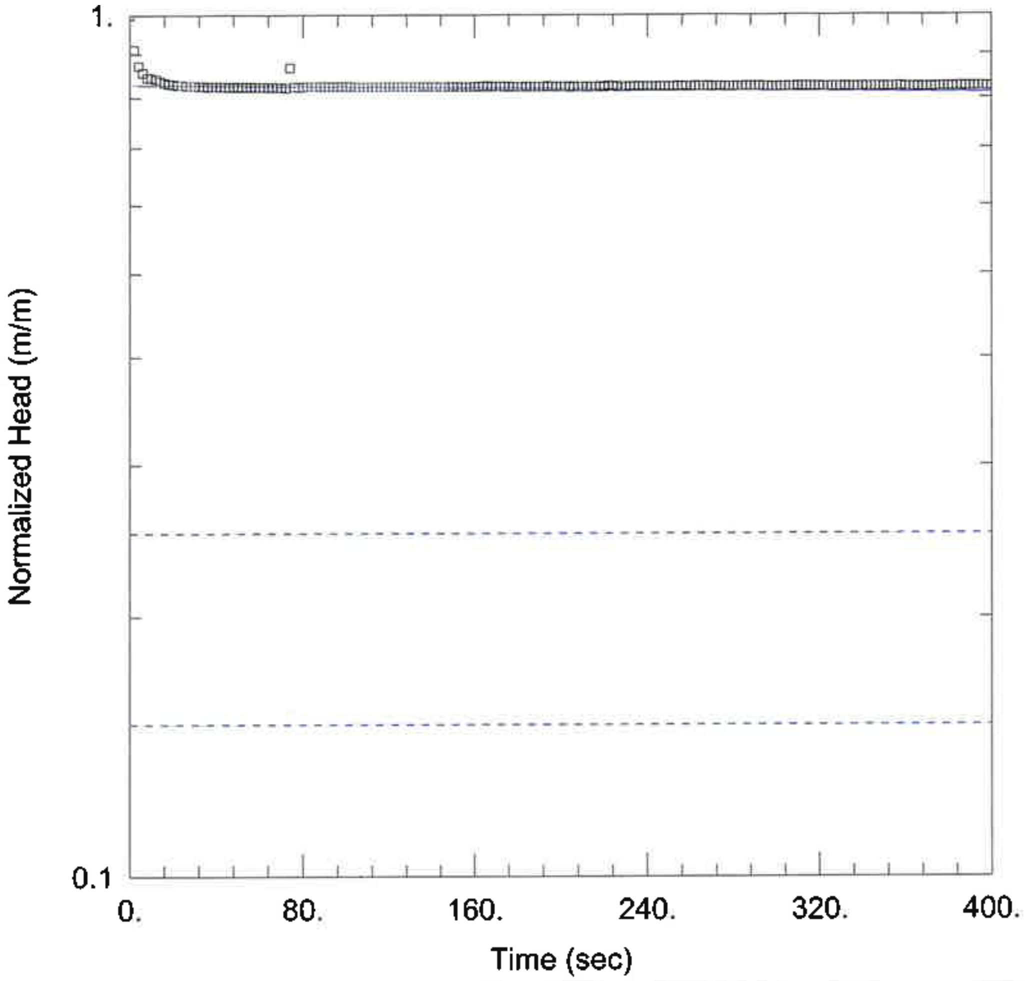
Saturated Thickness: 5.15 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW6)

Initial Displacement: 0.4343 m
Total Well Penetration Depth: 5.15 m
Casing Radius: 0.0254 m
Static Water Column Height: 5.15 m
Screen Length: 3. m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 9.618E-9 m/sec
y0 = 0.3704 m



HDROGEOLOGICAL INVESTIGATION

Data Set: M:\...\MW9.aqt
Date: 09/30/24 Time: 13:48:15

PROJECT INFORMATION

Company: Landtek Limited
Client: White Church Landowners Group
Project: 23355
Location: White Church Rd E /Upper James
Test Well: MW9
Test Date: September 5, 2024

AQUIFER DATA

Saturated Thickness: 4.43 m
Anisotropy Ratio (Kz/Kr): 1.

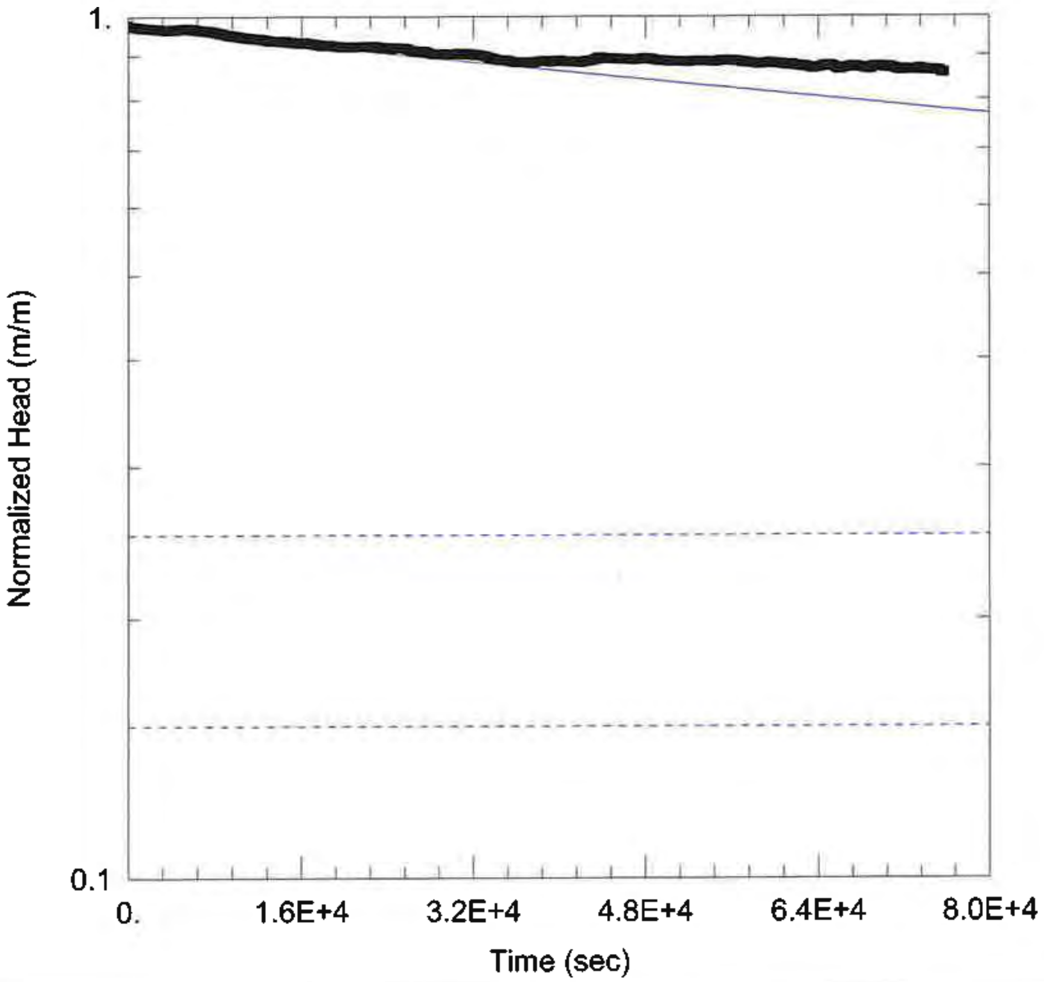
WELL DATA (MW9)

Initial Displacement: 0.4521 m
Total Well Penetration Depth: 4.43 m
Casing Radius: 0.0254 m
Static Water Column Height: 4.43 m
Screen Length: 3. m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev

K = 3.133E-8 m/sec
y0 = 0.3745 m



HDROGEOLOGICAL INVESTIGATION

Data Set: M:\...\MW10.aqt
Date: 09/30/24 Time: 13:48:43

PROJECT INFORMATION

Company: Landtek Limited
Client: White Church Landowners Group
Project: 23355
Location: White Church Rd E /Upper James
Test Well: MW10
Test Date: September 5, 2024

AQUIFER DATA

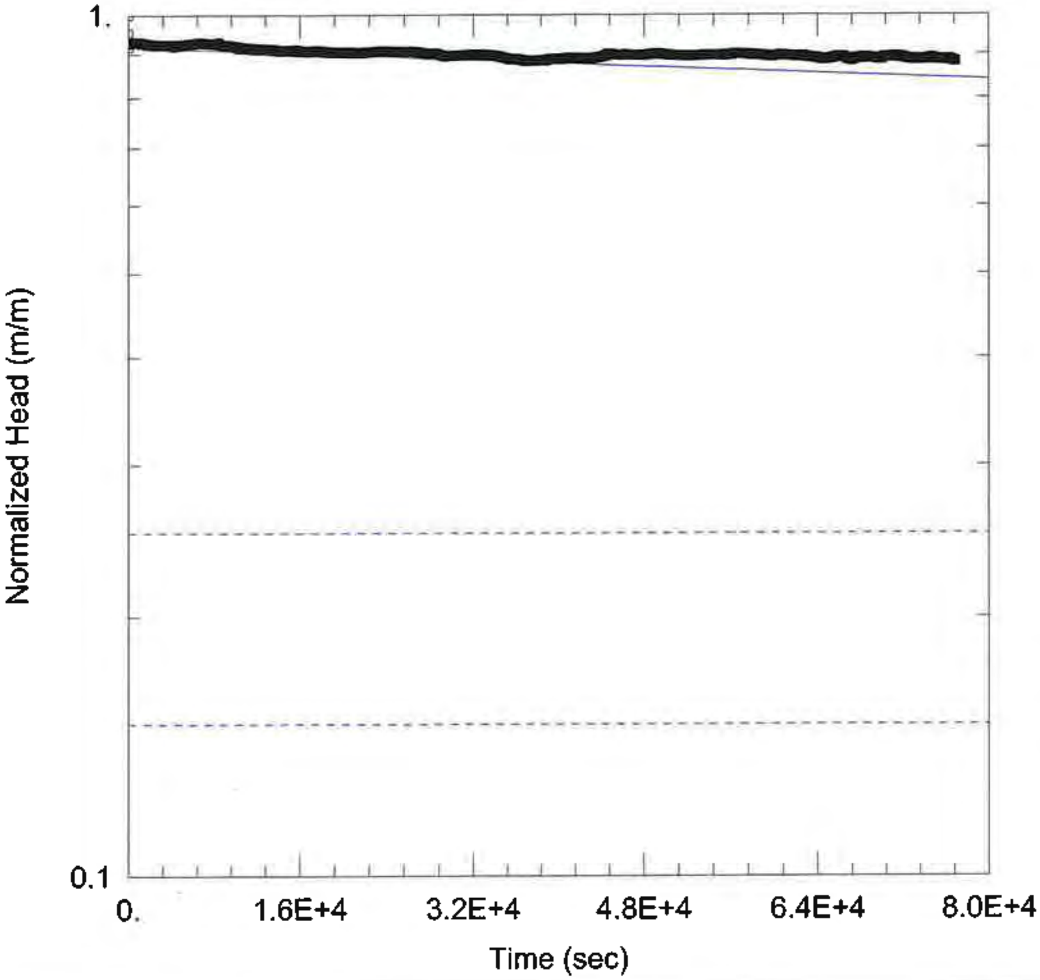
Saturated Thickness: 5.735 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW10)

Initial Displacement: 0.4216 m
Total Well Penetration Depth: 5.735 m
Casing Radius: 0.0254 m
Static Water Column Height: 5.735 m
Screen Length: 3. m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 1.482E-9 m/sec
y0 = 0.4086 m



HDROGEOLOGICAL INVESTIGATION

Data Set: M:\...\MW18.aqt
Date: 09/30/24 Time: 13:49:13

PROJECT INFORMATION

Company: Landtek Limited
Client: White Church Landowners Group
Project: 23355
Location: White Church Rd E /Upper James
Test Well: MW18
Test Date: September 5, 2024

AQUIFER DATA

Saturated Thickness: 7.42 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW18)

Initial Displacement: 0.4525 m
Total Well Penetration Depth: 7.42 m
Casing Radius: 0.0254 m
Static Water Column Height: 7.42 m
Screen Length: 3. m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 6.416E-10 m/sec
y0 = 0.4144 m

APPENDIX F

LABORATORY CERTIFICATE OF ANALYSIS

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

CLIENT NAME: LANDTEK LTD.
205 NEBO ROAD, UNIT 3
HAMILTON, ON L8W2E1
(905) 383-3733

ATTENTION TO: Henry Erebor

PROJECT: 23355

AGAT WORK ORDER: 24H198294

MICROBIOLOGY ANALYSIS REVIEWED BY: Nivine Basily, Inorganic Team Lead

TRACE ORGANICS REVIEWED BY: Neli Popnikolova, Senior Chemist

WATER ANALYSIS REVIEWED BY: Nivine Basily, Inorganic Team Lead

DATE REPORTED: Sep 27, 2024

PAGES (INCLUDING COVER): 43

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
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- *All reportable information is available on request from AGAT Laboratories, in accordance with ISO/IEC 17025:2017, ISO/IEC 17025:2005 (Quebec), DR-12-PALA and/or NELAP Standards.*
- *This document is signed by an authorized signatory who meets the requirements of the MELCCFP, CALA, CCN and NELAP.*
- *For environmental samples in the Province of Quebec: The analysis is performed on and results apply to samples as received. A temperature above 6°C upon receipt, as indicated in the Sample Reception Notification (SRN), could indicate the integrity of the samples has been compromised if the delay between sampling and submission to the laboratory could not be minimized.*

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Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

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CLIENT NAME: LANDTEK LTD.
ATTENTION TO: Henry Erebor
SAMPLING SITE:White Church Lands
SAMPLED BY:LB

E.Coli (MI-Agar)

DATE RECEIVED: 2024-09-18
DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4	MW10
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00	2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	6154183
Escherichia coli	CFU/100mL	100		0	0	0

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to PWQO * Variable - refer to guideline reference document
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

6154165-6154183 Escherichia coli RDL = 1 CFU/100mL.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
NIVINE BASILY
CHEMIST

Certificate of Analysis

AGAT WORK ORDER: 24H198294
PROJECT: 23355

CLIENT NAME: LANDTEK LTD.
SAMPLING SITE:White Church Lands

ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Base Neutrals and Acids [Water]

DATE RECEIVED: 2024-09-18

DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4	MW10
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00	2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	6154183
Naphthalene	µg/L	7	0.30	<0.30	<0.30	<0.30
Acenaphthylene	µg/L		0.31	<0.31	<0.31	<0.31
Acenaphthene	µg/L		0.30	<0.30	<0.30	<0.30
Fluorene	µg/L	0.2	0.31	<0.31	<0.31	<0.31
Phenanthrene	µg/L	0.03	0.32	<0.32	<0.32	<0.32
Anthracene	µg/L	0.0008	0.30	<0.30	<0.30	<0.30
Fluoranthene	µg/L	0.0008	0.27	<0.27	<0.27	<0.27
Pyrene	µg/L		0.20	<0.20	<0.20	<0.20
Benzo(a)anthracene	µg/L	0.0004	0.20	<0.20	<0.20	<0.20
Chrysene	µg/L	0.0001	0.27	<0.27	<0.27	<0.27
Benzo(b)fluoranthene	µg/L		0.20	<0.20	<0.20	<0.20
Benzo(k)fluoranthene	µg/L	0.0002	0.20	<0.20	<0.20	<0.20
Benzo(a)pyrene	µg/L		0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	µg/L		0.20	<0.20	<0.20	<0.20
Dibenzo(a,h)anthracene	µg/L	0.002	0.20	<0.20	<0.20	<0.20
Benzo(g,h,i)perylene	µg/L	0.00002	0.20	<0.20	<0.20	<0.20
Phenol	µg/L		1.0	<1.0	<1.0	<1.0
Bis(2-chloroethyl)ether	µg/L		0.5	<0.5	<0.5	<0.5
2-Chlorophenol	µg/L		0.5	<0.5	<0.5	<0.5
o-Cresol	µg/L	1	0.5	<0.5	<0.5	<0.5
Bis(2-chloroisopropyl)ether	µg/L		0.5	<0.5	<0.5	<0.5
m&p-Cresol	µg/L		0.5	<0.5	<0.5	<0.5
Hexachloroethane	µg/L		0.5	<0.5	<0.5	<0.5
2,4-Dimethylphenol	µg/L		0.5	<0.5	<0.5	<0.5
2,4-Dichlorophenol	µg/L		0.3	<0.3	<0.3	<0.3
1,2,4-Trichlorobenzene	µg/L		0.5	<0.5	<0.5	<0.5
p-Chloroaniline	µg/L		1.0	<1.0	<1.0	<1.0
Hexachlorobutadiene	µg/L		0.4	<0.4	<0.4	<0.4
2-and 1-methyl Napthalene	µg/L	2	0.5	<0.5	<0.5	<0.5

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CLIENT NAME: LANDTEK LTD.
SAMPLING SITE:White Church Lands

ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Base Neutrals and Acids [Water]

DATE RECEIVED: 2024-09-18

DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4	MW10
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00	2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	6154183
2,4,6-Trichlorophenol	µg/L	18	0.2	<0.2	<0.2	<0.2
2,4,5-Trichlorophenol	µg/L	18	0.2	<0.2	<0.2	<0.2
1,1-Biphenyl	µg/L		0.5	<0.5	<0.5	<0.5
Dimethyl phthalate	µg/L		0.5	<0.5	<0.5	<0.5
2,6-Dinitrotoluene	µg/L		0.5	<0.5	<0.5	<0.5
2,4-Dinitrotoluene	µg/L		0.5	<0.5	<0.5	<0.5
2,3,4,6-Tetrachlorophenol	µg/L	1	0.5	<0.5	<0.5	<0.5
Diethyl phthalate	µg/L		0.5	1.4	<0.5	<0.5
Hexachlorobenzene	µg/L	0.0065	0.5	<0.5	<0.5	<0.5
Pentachlorophenol	µg/L		0.5	<0.5	<0.5	<0.5
3,3'-dichlorobenzidine	µg/L		0.5	<0.5	<0.5	<0.5
Bis(2-Ethylhexyl)phthalate	µg/L		0.5	<0.5	<0.5	<0.5
2,4-Dinitrophenol	µg/L		10	<10	<10	<10
Sediment				3	3	3
Surrogate	Unit	Acceptable Limits				
2-Fluorophenol	%	50-140		74	71	85
phenol-d6 surrogate	%	50-140		85	85	99
2,4,6-Tribromophenol	%	50-140		99	99	85
Chrysene-d12	%	50-140		85	74	96

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to PWQO * Variable - refer to guideline reference document
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

6154165-6154183 Note: The result for Benzo(b)Fluoranthene is the total of the Benzo(b)&(j)Fluoranthene isomers because the isomers co-elute on the GC column.
2- and 1-Methyl Naphthalene is a calculated parameter. The calculated value is the sum of 2-Methyl Naphthalene and 1-Methyl Naphthalene.

Sediment parameter is comment only based on visual inspection of the sample prior to extraction and is not an accredited test.
Legend: 1 = no sediment present; 2 = sediment present; 3 = sediment present in trace amounts

Analysis performed at AGAT Toronto (unless marked by *)

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CLIENT NAME: LANDTEK LTD.

SAMPLING SITE:White Church Lands

ATTENTION TO: Henry Erebor

SAMPLED BY:LB

Carbamate Pesticides (Water)

DATE RECEIVED: 2024-09-18

DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4	MW10
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00	2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	6154183
Aldicarb	µg/L		2.0	<2.0	<2.0	<2.0
Bendiocarb	µg/L		2	<2	<2	<2
Carbofuran	µg/L		5	<5	<5	<5
Carbaryl	µg/L		5	<5	<5	<5
Diuron	µg/L		10	<10	<10	<10
Triallate	µg/L		1	<1	<1	<1
Temephos	µg/L		10	<10	<10	<10

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

6154165-6154183 Results relate only to the items tested.

Analysis performed at AGAT Toronto (unless marked by *)

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CLIENT NAME: LANDTEK LTD.
ATTENTION TO: Henry Erebor
SAMPLING SITE:White Church Lands
SAMPLED BY:LB

Diquat/Paraquat in Water (µg/L)

DATE RECEIVED: 2024-09-18
DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4	MW10
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00	2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	6154183
Diquat	µg/L		5	<5	<5	<5
Paraquat	µg/L		1	<1	<1	<1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By: NPopukolof

CLIENT NAME: LANDTEK LTD.
SAMPLING SITE:White Church Lands

ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Ethanolamines in Water by HPLC - Low Level

DATE RECEIVED: 2024-09-18

DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4	MW10
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00	2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	6154183
Diethanolamine (DEA)	mg/L		0.040	<0.04	<0.04	<0.04
Ethanolamine (MEA)	mg/L		0.05	<0.05	<0.05	<0.05
Diisopropanolamine (DIPA)	mg/L		0.1	<0.1	<0.1	<0.1
Monoisopropanolamine (MIPA)	mg/L		0.1	<0.1	<0.1	<0.1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Calgary (unless marked by *)

Certified By: NPopukolof

Certificate of Analysis

AGAT WORK ORDER: 24H198294
PROJECT: 23355

CLIENT NAME: LANDTEK LTD.
SAMPLING SITE:White Church Lands

ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Glycols Analysis in Water

DATE RECEIVED: 2024-09-18

DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4	MW10
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00	2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	6154183
Propylene Glycol	mg/L		10	<10	<10	<10
Monoethylene Glycol	mg/L		8	<8	<8	<8
Diethylene Glycol	mg/L		5.0	<5	<5	<5
Triethylene Glycol	mg/L		8	<8	<8	<8
Tetraethylene Glycol	mg/L		10	<10	<10	<10
Surrogate	Unit	Acceptable Limits				
Heptanol	%	50-140		94	94	81

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

6154165-6154183 Analysis by GC/FID.
Identification based on retention time relative to standards.

Analysis performed at AGAT Calgary (unless marked by *)

Certified By:

Certificate of Analysis

AGAT WORK ORDER: 24H198294
PROJECT: 23355

CLIENT NAME: LANDTEK LTD.
SAMPLING SITE:White Church Lands

ATTENTION TO: Henry Erebor
SAMPLED BY:LB

OC Pesticides + PCBs (Water)

DATE RECEIVED: 2024-09-18

DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4	MW10
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00	2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	6154183
Gamma-Hexachlorocyclohexane	ug/L		0.01	<0.01	<0.01	<0.01
Heptachlor	ug/L		0.01	<0.01	<0.01	<0.01
Aldrin	ug/L		0.01	<0.01	<0.01	<0.01
Heptachlor Epoxide	ug/L		0.01	<0.01	<0.01	<0.01
Endosulfan I	µg/L		0.05	<0.05	<0.05	<0.05
Endosulfan II	µg/L		0.05	<0.05	<0.05	<0.05
Endosulfan	ug/L		0.05	<0.05	<0.05	<0.05
alpha - chlordane	µg/L		0.1	<0.1	<0.1	<0.1
gamma-Chlordane	µg/L		0.2	<0.2	<0.2	<0.2
Chlordane	ug/L		0.04	<0.04	<0.04	<0.04
op'-DDE	µg/L		0.01	<0.01	<0.01	<0.01
pp'-DDE	µg/L		0.01	<0.01	<0.01	<0.01
DDE	ug/L		0.01	<0.01	<0.01	<0.01
op'-DDD	µg/L		0.05	<0.05	<0.05	<0.05
pp'-DDD	µg/L		0.05	<0.05	<0.05	<0.05
DDD	ug/L		0.05	<0.05	<0.05	<0.05
op'-DDT	µg/L		0.04	<0.04	<0.04	<0.04
pp'-DDT	µg/L		0.05	<0.05	<0.05	<0.05
DDT	ug/L		0.04	<0.04	<0.04	<0.04
Dieldrin	ug/L		0.02	<0.02	<0.02	<0.02
Endrin	ug/L		0.05	<0.05	<0.05	<0.05
Methoxychlor	ug/L		0.04	<0.04	<0.04	<0.04
Hexachlorobenzene	ug/L	0.0065	0.01	<0.01	<0.01	<0.01
Hexachlorobutadiene	ug/L		0.01	<0.01	<0.01	<0.01
Hexachloroethane	ug/L		0.01	<0.01	<0.01	<0.01
Aroclor 1242	ug/L		0.1	<0.1	<0.1	<0.1
Aroclor 1248	ug/L		0.1	<0.1	<0.1	<0.1
Aroclor 1254	ug/L		0.1	<0.1	<0.1	<0.1
Aroclor 1260	ug/L		0.1	<0.1	<0.1	<0.1

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http://www.agatlabs.com

CLIENT NAME: LANDTEK LTD.
SAMPLING SITE:White Church Lands

ATTENTION TO: Henry Erebor
SAMPLED BY:LB

OC Pesticides + PCBs (Water)

DATE RECEIVED: 2024-09-18

DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4	MW10
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00	2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	6154183
Polychlorinated Biphenyls	ug/L	0.001	0.1	<0.1	<0.1	<0.1
Surrogate	Unit	Acceptable Limits				
TCMX	%	50-140		72	76	75
Decachlorobiphenyl	%	50-140		102	83	103

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to PWQO * Variable - refer to guideline reference document
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6154165-6154183 DDT total is a calculated parameter. The calculated value is the sum of op'DDT and pp'DDT.
DDD total is a calculated parameter. The calculated value is the sum of op'DDD and pp'DDD.
DDE total is a calculated parameter. The calculated value is the sum of op'DDE and pp'DDE.
Endosulfan total is a calculated parameter. The calculated value is the sum of Endosulfan I and Endosulfan II.
Chlordane total is a calculated parameter. The calculated value is the sum of Alpha-Chlordane and Gamma-Chlordane.
PCB total is a calculated parameter. The calculated value is the sum of Aroclor 1242, Aroclor 1248, Aroclor 1254 and Aroclor 1260.
The calculated parameters are non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: NPopukolof

CLIENT NAME: LANDTEK LTD.
SAMPLING SITE:White Church Lands
ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Oil and Grease (Total) in Water

DATE RECEIVED: 2024-09-18
DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4	MW10
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00	2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	6154183
Total Oil and Grease in water	mg/L		0.5	<0.5	<0.5	<0.5

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
Analysis performed at AGAT Toronto (unless marked by *)

Certified By: NPopukolof

Certificate of Analysis

AGAT WORK ORDER: 24H198294
PROJECT: 23355

CLIENT NAME: LANDTEK LTD.
SAMPLING SITE:White Church Lands

ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Phenoxy Acid Herbicides (Water)

DATE RECEIVED: 2024-09-18

DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4	MW10
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00	2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	6154183
2,4-D	µg/L		0.5	<0.5	<0.5	<0.5
2,4,5-T	µg/L		0.5	<0.5	<0.5	<0.5
2,4,5-TP	µg/L		0.5	<0.5	<0.5	<0.5
Dicamba	µg/L		0.5	<0.5	<0.5	<0.5
Dichlorprop	µg/L		0.5	<0.5	<0.5	<0.5
Dinoseb	µg/L		0.5	<0.5	<0.5	<0.5
Picloram	µg/L		0.5	<0.5	<0.5	<0.5
Diclofop-methyl	µg/L		0.5	<0.5	<0.5	<0.5
2,3,4,6-Tetrachlorophenol	µg/L	1	0.5	<0.5	<0.5	<0.5
2,4-Dichlorophenol	µg/L		0.2	<0.2	<0.2	<0.2
2,4,5-Trichlorophenol	µg/L	18	0.5	<0.5	<0.5	<0.5
2,4,6-Trichlorophenol	µg/L	18	0.5	<0.5	<0.5	<0.5
Bromoxynil	µg/L		0.3	<0.3	<0.3	<0.3
MCPA	µg/L		5.0	<5.0	<5.0	<5.0
MCPP	µg/L		5.0	<5.0	<5.0	<5.0
Pentachlorophenol	µg/L		0.1	<0.1	<0.1	<0.1
Surrogate	Unit	Acceptable Limits				
DCAA	%	50-140		100	104	96

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to PWQO * Variable - refer to guideline reference document
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

Results relate only to the items tested. Results apply to samples as received.

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CLIENT NAME: LANDTEK LTD.
SAMPLING SITE:White Church Lands

ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Polycyclic Aromatic Hydrocarbons in Water - Ultra-Low Level

DATE RECEIVED: 2024-09-18

DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4	MW10
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00	2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	6154183
1-Methylnaphthalene, Ultra-low	µg/L		0.001	0.103	<0.001	<0.001
2-Methylnaphthalene, Ultra-low	µg/L		0.001	0.160	0.142	<0.001
Acenaphthene, Ultra-low	µg/L		0.001	<0.001	<0.001	<0.001
Acenaphthylene, Ultra-low	µg/L		0.001	<0.001	<0.001	<0.001
Acridine, Ultra-low	µg/L		0.001	<0.001	<0.001	<0.001
Anthracene, Ultra-low	µg/L		0.001	<0.001	<0.001	<0.001
Benzo(a)anthracene, Ultra-low	µg/L		0.001	<0.001	<0.001	<0.001
Benzo(a)pyrene, Ultra-low	µg/L		0.001	<0.001	<0.001	<0.001
Benzo(b)fluoranthene, Ultra-low	µg/L		0.001	<0.001	<0.001	<0.001
Benzo(j+k)fluoranthene	µg/L		0.001	<0.01	<0.01	<0.01
Benzo(e)pyrene, Ultra-low	µg/L		0.001	<0.001	<0.001	<0.001
Benzo(ghi)perylene, Ultra-low	µg/L		0.001	<0.001	<0.001	<0.001
Chrysene, Ultra-low	µg/L		0.001	<0.001	<0.001	<0.001
Dibenzo(a,h)anthracene, Ultra-low	µg/L		0.001	<0.001	<0.001	<0.001
Fluoranthene, Ultra-low	µg/L		0.001	0.200	0.180	0.112
Fluorene, Ultra-low	µg/L		0.001	<0.001	<0.001	<0.001
Indeno(1,2,3-cd)pyrene, Ultra-low	µg/L		0.001	<0.001	<0.001	<0.001
Naphthalene, Ultra-low	µg/L		0.001	<0.001	<0.001	<0.001
Perylene, Ultra-low	µg/L		0.001	<0.001	<0.001	<0.001
Phenanthrene, Ultra-low	µg/L		0.001	<0.001	<0.001	<0.001
Pyrene, Ultra-low	µg/L		0.001	<0.001	<0.001	<0.001
Quinoline, Ultra-low	µg/L		0.001	<0.001	<0.001	<0.001
Sediment				N	N	N
PAH - Extraction (Ultra-low)				Y	Y	Y
Surrogate	Unit	Acceptable Limits				
Naphthalene-d8	%	50-140		86	91	86
Terphenyl-d14	%	50-140		90	95	78
Pyrene-d10	%	50-140		84	89	87

Certified By: NPopukolof

Polycyclic Aromatic Hydrocarbons in Water - Ultra-Low Level

DATE RECEIVED: 2024-09-18
DATE REPORTED: 2024-09-27

Comments:	RDL - Reported Detection Limit; G / S - Guideline / Standard
6154165-6154183	Benzo(b)fluoranthene may include contributions from benzo(j)fluoranthene, if also present in the sample. Sediment parameter is comment only based on visual inspection of the sample prior to extraction and is not an accredited test.

Analysis performed at AGAT Halifax (unless marked by *)

Certified By: NPopukolof

Certificate of Analysis

AGAT WORK ORDER: 24H198294
PROJECT: 23355

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

CLIENT NAME: LANDTEK LTD.
SAMPLING SITE:White Church Lands

ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Resin and Fatty acid (water)

DATE RECEIVED: 2024-09-18

DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4	MW10
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00	2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	6154183
Linoleic acid	µg/L		10	<10	<10	<10
Linolenic acid	µg/L		10	<10	<10	<10
Oleic acid	µg/L		10	<10	<10	<10
9,10-Dichlorostearic acid	µg/L		10	<10	<10	<10
Stearic acid	µg/L		10	<10	13	<10
Fatty acid total	µg/L		10	<10	13	<10
Pimaric acid	µg/L		10	<10	<10	<10
Sandaracopimaric acid	µg/L		10	<10	<10	<10
Isopimaric acid	µg/L		10	<10	<10	<10
Palustric acid	µg/L		10	<10	<10	<10
Levopimaric acid	µg/L		10	<10	<10	<10
Dehydroabietic acid	µg/L		10	<10	<10	<10
Abietic acid	µg/L		10	<10	<10	<10
Neoabietic acid	µg/L		10	<10	<10	<10
14-Chlorodehydroabietic acid	µg/L		10	<10	<10	<10
12-Chlorodehydroabietic acid	µg/L		10	<10	<10	<10
12,14-Dichlorodehydroabietic acid	µg/L		10	<10	<10	<10
Resin acid total	µg/L		10	<10	<10	<10
Resin and Fatty acid total	µg/L		10	<10	13	<10
Surrogate	Unit	Acceptable Limits				
O-methylpodocarpic	%	40-140		79	87	82

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

6154165-6154183 Elevated RDLs indicate the degree of sample dilutions prior to the analysis to keep analytes within the calibration range or reduce matrix interference.

Sample was analyzed in Montreal.

Analysis performed at AGAT Montréal (unless marked by *)

Certified By: NPopukolof

5835 COOPERS AVENUE
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FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: LANDTEK LTD.
SAMPLING SITE:White Church Lands

ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Triazine Pesticides [Water]

DATE RECEIVED: 2024-09-18

DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4	MW10
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00	2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	6154183
Trifluralin	µg/L		1.0	<1.0	<1.0	<1.0
Simazine	µg/L		1.0	<1.0	<1.0	<1.0
Atrazine	µg/L		0.5	<0.5	<0.5	<0.5
Metribuzin	µg/L		0.25	<0.25	<0.25	<0.25
Prometryne	µg/L		0.25	<0.25	<0.25	<0.25
Metolachlor	µg/L		0.11	<0.11	<0.11	<0.11
Alachlor	µg/L		0.5	<0.5	<0.5	<0.5
Cyanazine	µg/L		1.0	<1.0	<1.0	<1.0
Surrogate	Unit	Acceptable Limits				
Triphenyl phosphate (surr)	%	30-130		104	107	79

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ODWS - Table D
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

6154165-6154183 Results relate only to the items tested.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: NPopukolof

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

CLIENT NAME: LANDTEK LTD.
SAMPLING SITE:White Church Lands

ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Volatile Organic Compounds in Water (ug/L)

DATE RECEIVED: 2024-09-18

DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4	MW10
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00	2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	6154183
Dichlorodifluoromethane	µg/L		0.40	<0.40	<0.40	<0.40
Chloromethane	µg/L	700	0.20	<0.20	<0.20	<0.20
Vinyl Chloride	µg/L	600	0.17	<0.17	<0.17	<0.17
Bromomethane	µg/L	0.9	0.20	<0.20	<0.20	<0.20
Chloroethane	µg/L		0.20	<0.20	<0.20	<0.20
Trichlorofluoromethane	µg/L		0.40	<0.40	<0.40	<0.40
Acetone	µg/L		1.0	<1.0	<1.0	<1.0
1,1-Dichloroethylene	µg/L		0.2	<0.2	<0.2	<0.2
Methylene Chloride	µg/L	100	0.30	<0.30	<0.30	<0.30
trans- 1,2-dichloroethylene	µg/L	200	0.20	<0.20	<0.20	<0.20
Methyl tert-butyl ether	µg/L	200	0.20	<0.20	<0.20	<0.20
1,1-Dichloroethane	µg/L	200	0.30	<0.30	<0.30	<0.30
Methyl Ethyl Ketone	µg/L	400	1.0	<1.0	<1.0	<1.0
cis- 1,2-Dichloroethylene	µg/L	200	0.20	<0.20	<0.20	<0.20
Chloroform	µg/L		0.20	<0.20	<0.20	<0.20
1,2-Dichloroethane	µg/L	100	0.20	<0.20	<0.20	<0.20
1,1,1-Trichloroethane	µg/L	10	0.30	<0.30	<0.30	<0.30
Carbon Tetrachloride	µg/L		0.20	<0.20	<0.20	<0.20
Benzene	µg/L	100	0.20	<0.20	<0.20	<0.20
1,2-Dichloropropane	µg/L	0.7	0.20	<0.20	<0.20	<0.20
Trichloroethylene	µg/L	20	0.20	<0.20	<0.20	<0.20
Bromodichloromethane	µg/L	200	0.20	<0.20	<0.20	<0.20
cis-1,3-Dichloropropene	µg/L		0.20	<0.20	<0.20	<0.20
Methyl Isobutyl Ketone	µg/L		1.0	<1.0	<1.0	<1.0
trans-1,3-Dichloropropene	µg/L	7	0.30	<0.30	<0.30	<0.30
1,1,2-Trichloroethane	µg/L	800	0.20	<0.20	<0.20	<0.20
Toluene	µg/L	0.8	0.20	<0.20	<0.20	<0.20
2-Hexanone	µg/L		1.0	<1.0	<1.0	<1.0
Dibromochloromethane	µg/L	40	0.10	<0.10	<0.10	<0.10

Certified By: NPopukolof

Certificate of Analysis

AGAT WORK ORDER: 24H198294
PROJECT: 23355

5835 COOPERS AVENUE
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TEL (905)712-5100
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http://www.agatlabs.com

CLIENT NAME: LANDTEK LTD.
SAMPLING SITE:White Church Lands

ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Volatile Organic Compounds in Water (ug/L)

DATE RECEIVED: 2024-09-18

DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4	MW10
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00	2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	6154183
Ethylene Dibromide	µg/L	5	0.10	<0.10	<0.10	<0.10
Tetrachloroethylene	µg/L	50	0.20	<0.20	<0.20	<0.20
1,1,1,2-Tetrachloroethane	µg/L	20	0.10	<0.10	<0.10	<0.10
Chlorobenzene	µg/L	15	0.10	<0.10	<0.10	<0.10
Ethylbenzene	µg/L	8	0.10	<0.10	<0.10	<0.10
m & p-Xylene	µg/L	32	0.20	<0.20	<0.20	<0.20
Bromoform	µg/L	60	0.10	<0.10	<0.10	<0.10
Styrene	µg/L	4	0.10	<0.10	<0.10	<0.10
1,1,2,2-Tetrachloroethane	µg/L	70	0.10	<0.10	<0.10	<0.10
o-Xylene	µg/L	40	0.10	<0.10	<0.10	<0.10
1,3-Dichlorobenzene	µg/L	2.5	0.10	<0.10	<0.10	<0.10
1,4-Dichlorobenzene	µg/L	4	0.10	<0.10	<0.10	<0.10
1,2-Dichlorobenzene	µg/L	2.5	0.10	<0.10	<0.10	<0.10
1,2,4-Trichlorobenzene	µg/L	0.5	0.30	<0.30	<0.30	<0.30
1,3-Dichloropropene (Cis + Trans)	µg/L		0.30	<0.30	<0.30	<0.30
Xylenes (Total)	µg/L		0.20	<0.20	<0.20	<0.20
n-Hexane	µg/L		0.20	<0.20	<0.20	<0.20
Surrogate	Unit	Acceptable Limits				
Toluene-d8	% Recovery	50-140		99	98	98
4-Bromofluorobenzene	% Recovery	50-140		91	94	92

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to PWQO * Variable - refer to guideline reference document
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

6154165-6154183 Xylenes total is a calculated parameter. The calculated value is the sum of m&p-Xylene + o-Xylene.
1,3-Dichloropropene total is a calculated parameter. The calculated value is the sum of Cis-1,3-Dichloropropene and Trans-1,3-Dichloropropene. The calculated parameter is non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: NPopukolof

Certificate of Analysis

AGAT WORK ORDER: 24H198294
PROJECT: 23355

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CLIENT NAME: LANDTEK LTD.
SAMPLING SITE:White Church Lands

ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Dissolved Oxygen in Water - mg/L

DATE RECEIVED: 2024-09-18

DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4	MW10
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00	2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	6154183
Dissolved Oxygen	mg/L		0.05	7.88	5.12	8.08

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

6154165-6154183 Dissolved Oxygen was measured on as received sample. Due to the potential for rapid change in sample equilibrium chemistry laboratory results may differ from field measured results.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

NIVINE BASILY

Certificate of Analysis

AGAT WORK ORDER: 24H198294
PROJECT: 23355

CLIENT NAME: LANDTEK LTD.
SAMPLING SITE:White Church Lands

ATTENTION TO: Henry Erebor
SAMPLED BY:LB

PWQO Parameters

DATE RECEIVED: 2024-09-18

DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4	MW10
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00	2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	6154183
pH	pH Units	6.5-8.5	NA	7.79	7.68	7.79
Cyanide, WAD	mg/L	0.005	0.002	<0.002	<0.002	<0.002
Alkalinity (as CaCO3)	mg/L		5	456	405	319
Turbidity	NTU		0.5	4.7	4.4	2.7
Sulphide	mg/L		0.01	<0.01	<0.01	<0.01
Phenols	mg/L	0.001	0.001	<0.001	<0.001	<0.001
Ammonia as N	mg/L		0.02	<0.02	<0.02	<0.02
Ammonia-Un-ionized	mg/L	0.02	NA	<0.000002	<0.000002	<0.000002
Total Phosphorus	mg/L	*	0.02	0.07	0.06	1.38
Aluminum-dissolved	mg/L	*	0.004	<0.004	0.011	<0.004
Total Antimony	mg/L	0.020	0.003	<0.003	<0.003	<0.003
Total Arsenic	mg/L	0.1	0.003	0.005	<0.003	<0.003
Total Barium	mg/L		0.002	0.085	0.033	0.036
Total Boron	mg/L	0.2	0.010	0.121	0.072	0.186
Total Cadmium	mg/L	0.0002	0.0001	0.0001	<0.0001	<0.0001
Total Chromium	mg/L		0.003	<0.003	<0.003	<0.003
Total Cobalt	mg/L	0.0009	0.0005	0.0019	0.0048	0.0023
Total Copper	mg/L	0.005	0.002	<0.002	<0.002	<0.002
Total Iron	mg/L	0.3	0.050	0.863	0.172	0.153
Total Lead	mg/L	*	0.0005	<0.0005	<0.0005	<0.0005
Dissolved Mercury	mg/L	0.0002	0.0001	<0.0001	<0.0001	<0.0001
Total Molybdenum	mg/L	0.040	0.002	0.002	0.002	<0.002
Total Nickel	mg/L	0.025	0.003	<0.003	0.004	0.003
Total Selenium	mg/L	0.1	0.002	<0.002	0.004	<0.002
Total Silver	mg/L	0.0001	0.0001	<0.0001	0.0002	<0.0001
Total Thallium	mg/L	0.0003	0.0003	<0.0003	<0.0003	<0.0003
Total Tungsten	mg/L	0.030	0.010	<0.010	<0.010	<0.010
Total Uranium	mg/L	0.005	0.0005	0.0028	0.0067	0.0078
Total Vanadium	mg/L	0.006	0.002	<0.002	<0.002	<0.002

Certified By:

NIVINE BASILY

CLIENT NAME: LANDTEK LTD.
SAMPLING SITE:White Church Lands

ATTENTION TO: Henry Erebor
SAMPLED BY:LB

PWQO Parameters

DATE RECEIVED: 2024-09-18

DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4	MW10
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00	2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	6154183
Total Zinc	mg/L	0.030	0.020	<0.020	0.026	<0.020
Total Zirconium	mg/L	0.004	0.004	<0.004	<0.004	<0.004
Lab Filtration Aluminum Dissolved				1	1	1
Lab Filtration mercury				1	1	1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to PWQO * Variable - refer to guideline reference document
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
NIVINE BASILY
CHEMIST

Certificate of Analysis

AGAT WORK ORDER: 24H198294
PROJECT: 23355

CLIENT NAME: LANDTEK LTD.
SAMPLING SITE:White Church Lands

ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Residual Chlorine

DATE RECEIVED: 2024-09-18

DATE REPORTED: 2024-09-27

			SAMPLE DESCRIPTION:	MW3D	MW4		MW10
			SAMPLE TYPE:	Water	Water		Water
			DATE SAMPLED:	2024-09-18 09:50	2024-09-18 12:00		2024-09-18 11:00
Parameter	Unit	G / S	RDL	6154165	6154182	RDL	6154183
Total Residual Chlorine	mg/L		0.02	0.36	0.25	0.01	0.16

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

6154165-6154182 Due to the instability of chlorine in aqueous solutions, the results reported may be biased low and should be reviewed with discretion.

Dilution required, RDL has been increased accordingly.

6154183 Due to the instability of chlorine in aqueous solutions, the results reported may be biased low and should be reviewed with discretion.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

NIVINE BASILY

Exceedance Summary

AGAT WORK ORDER: 24H198294

PROJECT: 23355

CLIENT NAME: LANDTEK LTD.

ATTENTION TO: Henry Erebor

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
6154165	MW3D	ON PWQO	PWQO Parameters	Total Cobalt	mg/L	0.0009	0.0019
6154165	MW3D	ON PWQO	PWQO Parameters	Total Iron	mg/L	0.3	0.863
6154182	MW4	ON PWQO	PWQO Parameters	Total Cobalt	mg/L	0.0009	0.0048
6154182	MW4	ON PWQO	PWQO Parameters	Total Silver	mg/L	0.0001	0.0002
6154182	MW4	ON PWQO	PWQO Parameters	Total Uranium	mg/L	0.005	0.0067
6154183	MW10	ON PWQO	PWQO Parameters	Total Cobalt	mg/L	0.0009	0.0023
6154183	MW10	ON PWQO	PWQO Parameters	Total Uranium	mg/L	0.005	0.0078

Quality Assurance

CLIENT NAME: LANDTEK LTD.
PROJECT: 23355
SAMPLING SITE:White Church Lands

AGAT WORK ORDER: 24H198294
ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Microbiology Analysis

RPT Date: Sep 27, 2024			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
E.Coli (MI-Agar)															
Escherichia coli	6154253		0	0	NA										

Comments: NA - % RPD Not Applicable.

Certified By: NIVINE BASILY

Quality Assurance

CLIENT NAME: LANDTEK LTD.

PROJECT: 23355

SAMPLING SITE:White Church Lands

AGAT WORK ORDER: 24H198294

ATTENTION TO: Henry Erebor

SAMPLED BY:LB

Trace Organics Analysis

RPT Date: Sep 27, 2024			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Base Neutrals and Acids [Water]															
Naphthalene	6163229		<0.30	<0.30	NA	< 0.30	93%	50%	140%	76%	50%	140%	78%	50%	140%
Acenaphthylene	6163229		<0.31	<0.31	NA	< 0.31	79%	50%	140%	74%	50%	140%	86%	50%	140%
Acenaphthene	6163229		<0.30	<0.30	NA	< 0.30	85%	50%	140%	67%	50%	140%	72%	50%	140%
Fluorene	6163229		<0.31	<0.31	NA	< 0.31	106%	50%	140%	104%	50%	140%	74%	50%	140%
Phenanthrene	6163229		<0.32	<0.32	NA	< 0.32	99%	50%	140%	90%	50%	140%	93%	50%	140%
Anthracene	6163229		<0.30	<0.30	NA	< 0.30	96%	50%	140%	91%	50%	140%	79%	50%	140%
Fluoranthene	6163229		<0.27	<0.27	NA	< 0.27	98%	50%	140%	76%	50%	140%	92%	50%	140%
Pyrene	6163229		<0.20	<0.20	NA	< 0.20	95%	50%	140%	76%	50%	140%	70%	50%	140%
Benzo(a)anthracene	6163229		<0.20	<0.20	NA	< 0.20	92%	50%	140%	73%	50%	140%	76%	50%	140%
Chrysene	6163229		<0.27	<0.27	NA	< 0.27	92%	50%	140%	84%	50%	140%	69%	50%	140%
Benzo(b)fluoranthene	6163229		<0.20	<0.20	NA	< 0.20	80%	50%	140%	95%	50%	140%	67%	50%	140%
Benzo(k)fluoranthene	6163229		<0.20	<0.20	NA	< 0.20	88%	50%	140%	108%	50%	140%	96%	50%	140%
Benzo(a)pyrene	6163229		<0.01	<0.01	NA	< 0.01	87%	50%	140%	116%	50%	140%	100%	50%	140%
Indeno(1,2,3-cd)pyrene	6163229		<0.20	<0.20	NA	< 0.20	86%	50%	140%	109%	50%	140%	99%	50%	140%
Dibenzo(a,h)anthracene	6163229		<0.20	<0.20	NA	< 0.20	70%	50%	140%	71%	50%	140%	74%	50%	140%
Benzo(g,h,i)perylene	6163229		<0.20	<0.20	NA	< 0.20	79%	50%	140%	91%	50%	140%	72%	50%	140%
Phenol	6163229		<1.0	<1.0	NA	< 1.0	90%	50%	140%	76%	50%	140%	77%	50%	140%
Bis(2-chloroethyl)ether	6163229		<0.5	<0.5	NA	< 0.5	82%	50%	140%	72%	50%	140%	92%	50%	140%
2-Chlorophenol	6163229		<0.5	<0.5	NA	< 0.5	86%	50%	140%	96%	50%	140%	72%	50%	140%
o-Cresol	6163229		<0.5	<0.5	NA	< 0.5	80%	50%	140%	87%	50%	140%	78%	50%	140%
Bis(2-chloroisopropyl)ether	6163229		<0.5	<0.5	NA	< 0.5	70%	50%	140%	69%	50%	140%	94%	50%	140%
m&p-Cresol	6163229		<0.5	<0.5	NA	< 0.5	97%	50%	140%	81%	50%	140%	50%	50%	140%
Hexachloroethane	6163229		<0.5	<0.5	NA	< 0.5	82%	50%	140%	62%	50%	140%	95%	50%	140%
2,4-Dimethylphenol	6163229		<0.5	<0.5	NA	< 0.5	104%	30%	130%	107%	30%	130%	104%	30%	130%
2,4-Dichlorophenol	6163229		<0.3	<0.3	NA	< 0.3	88%	50%	140%	97%	50%	140%	78%	50%	140%
1,2,4-Trichlorobenzene	6163229		<0.5	<0.5	NA	< 0.5	88%	50%	140%	68%	50%	140%	65%	50%	140%
p-Chloroaniline	6163229		<1.0	<1.0	NA	< 1.0	71%	50%	140%	68%	50%	140%	112%	50%	140%
Hexachlorobutadiene	6163229		<0.4	<0.4	NA	< 0.4	90%	50%	140%	62%	50%	140%	86%	50%	140%
2,4,6-Trichlorophenol	6163229		<0.2	<0.2	NA	< 0.2	81%	50%	140%	116%	50%	140%	79%	50%	140%
2,4,5-Trichlorophenol	6163229		<0.2	<0.2	NA	< 0.2	92%	50%	140%	62%	50%	140%	82%	50%	140%
1,1-Biphenyl	6163229		<0.5	<0.5	NA	< 0.5	92%	50%	140%	75%	50%	140%	65%	50%	140%
Dimethyl phthalate	6163229		<0.5	<0.5	NA	< 0.5	86%	50%	140%	67%	50%	140%	74%	50%	140%
2,6-Dinitrotoluene	6163229		<0.5	<0.5	NA	< 0.5	97%	50%	140%	92%	50%	140%	103%	50%	140%
2,4-Dinitrotoluene	6163229		<0.5	<0.5	NA	< 0.5	94%	50%	140%	66%	50%	140%	81%	50%	140%
2,3,4,6-Tetrachlorophenol	6163229		<0.5	<0.5	NA	< 0.5	97%	50%	140%	72%	50%	140%	104%	50%	140%
Diethyl phthalate	6163229		<0.5	<0.5	NA	< 0.5	104%	50%	140%	101%	50%	140%	79%	50%	140%
Hexachlorobenzene	6163229		<0.5	<0.5	NA	< 0.5	100%	50%	140%	73%	50%	140%	62%	50%	140%
Pentachlorophenol	6163229		<0.5	<0.5	NA	< 0.5	84%	50%	140%	91%	50%	140%	91%	50%	140%
3,3'-dichlorobenzidine	6163229		<0.5	<0.5	NA	< 0.5	106%	30%	130%	76%	30%	130%	76%	30%	130%

Quality Assurance

CLIENT NAME: LANDTEK LTD.
PROJECT: 23355
SAMPLING SITE:White Church Lands

AGAT WORK ORDER: 24H198294
ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Trace Organics Analysis (Continued)

RPT Date: Sep 27, 2024			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Bis(2-Ethylhexyl)phthalate	6163229		<0.5	<0.5	NA	< 0.5	90%	50%	140%	110%	50%	140%	74%	50%	140%
2,4-Dinitrophenol	6163229		<10	<10	NA	< 10	64%	30%	130%	41%	30%	130%	113%	30%	130%
Carbamate Pesticides (Water)															
Aldicarb	6155223		< 2.0	< 2.0	NA	< 2.0	89%	50%	140%	92%	50%	140%	100%	50%	140%
Bendiocarb	6155223		< 2	< 2	NA	< 2	90%	50%	140%	89%	50%	140%	96%	50%	140%
Carbofuran	6155223		< 5	< 5	NA	< 5	101%	50%	140%	100%	50%	140%	91%	50%	140%
Carbaryl	6155223		< 5	< 5	NA	< 5	88%	50%	140%	89%	50%	140%	83%	50%	140%
Diuron	6155223		< 10	< 10	NA	< 10	96%	50%	140%	93%	50%	140%	99%	50%	140%
Triallate	6155223		< 1	< 1	NA	< 1	100%	50%	140%	97%	50%	140%	101%	50%	140%
Temephos	6155223		< 10	< 10	NA	< 10	93%	60%	130%	99%	60%	130%	95%	60%	130%
OC Pesticides + PCBs (Water)															
Gamma-Hexachlorocyclohexane	6141817		< 0.01	< 0.01	NA	< 0.01	91%	50%	140%	108%	50%	140%	109%	50%	140%
Heptachlor	6141817		< 0.01	< 0.01	NA	< 0.01	110%	50%	140%	104%	50%	140%	107%	50%	140%
Aldrin	6141817		< 0.01	< 0.01	NA	< 0.01	93%	50%	140%	99%	50%	140%	94%	50%	140%
Heptachlor Epoxide	6141817		< 0.01	< 0.01	NA	< 0.01	80%	50%	140%	84%	50%	140%	86%	50%	140%
Endosulfan I	6141817		< 0.05	< 0.05	NA	< 0.05	90%	50%	140%	96%	50%	140%	97%	50%	140%
Endosulfan II	6141817		< 0.05	< 0.05	NA	< 0.05	87%	50%	140%	100%	50%	140%	99%	50%	140%
alpha - chlordane	6141817		< 0.1	< 0.1	NA	< 0.1	92%	50%	140%	100%	50%	140%	99%	50%	140%
gamma-Chlordane	6141817		< 0.2	< 0.2	NA	< 0.2	88%	50%	140%	96%	50%	140%	97%	50%	140%
op'-DDE	6141817		< 0.01	< 0.01	NA	< 0.01	105%	50%	140%	94%	50%	140%	109%	50%	140%
pp'-DDE	6141817		< 0.01	< 0.01	NA	< 0.01	99%	50%	140%	104%	50%	140%	104%	50%	140%
op'-DDD	6141817		< 0.05	< 0.05	NA	< 0.05	107%	50%	140%	85%	50%	140%	109%	50%	140%
pp'-DDD	6141817		< 0.05	< 0.05	NA	< 0.05	91%	50%	140%	99%	50%	140%	114%	50%	140%
op'-DDT	6141817		< 0.04	< 0.04	NA	< 0.04	113%	50%	140%	112%	50%	140%	108%	50%	140%
pp'-DDT	6141817		< 0.05	< 0.05	NA	< 0.05	86%	50%	140%	104%	50%	140%	106%	50%	140%
Dieldrin	6141817		< 0.02	< 0.02	NA	< 0.02	90%	50%	140%	99%	50%	140%	101%	50%	140%
Endrin	6141817		< 0.05	< 0.05	NA	< 0.05	111%	50%	140%	102%	50%	140%	88%	50%	140%
Methoxychlor	6141817		< 0.04	< 0.04	NA	< 0.04	80%	50%	140%	94%	50%	140%	86%	50%	140%
Hexachlorobenzene	6141817		< 0.01	< 0.01	NA	< 0.01	99%	50%	140%	101%	50%	140%	92%	50%	140%
Hexachlorobutadiene	6141817		< 0.01	< 0.01	NA	< 0.01	106%	50%	140%	95%	50%	140%	92%	50%	140%
Hexachloroethane	6141817		< 0.01	< 0.01	NA	< 0.01	92%	50%	140%	108%	50%	140%	94%	50%	140%
Aroclor 1242	6141817		< 0.1	< 0.1	NA	< 0.1	102%	60%	140%	NA	60%	140%	NA	60%	140%
Aroclor 1248	6141817		< 0.1	< 0.1	NA	< 0.1	92%	60%	140%	NA	60%	140%	NA	60%	140%
Aroclor 1254	6141817		< 0.1	< 0.1	NA	< 0.1	106%	60%	140%	NA	60%	140%	NA	60%	140%
Aroclor 1260	6141817		< 0.1	< 0.1	NA	< 0.1	98%	60%	140%	NA	60%	140%	NA	60%	140%
Polychlorinated Biphenyls	6141817		< 0.1	< 0.1	NA	< 0.1	104%	60%	140%	92%	60%	140%	NA	60%	140%
Phenoxy Acid Herbicides (Water)															
2,4-D			< 0.5	< 0.5	NA	< 0.5	97%	50%	140%	90%	50%	140%	NA	50%	140%

Quality Assurance

CLIENT NAME: LANDTEK LTD.
PROJECT: 23355
SAMPLING SITE:White Church Lands

AGAT WORK ORDER: 24H198294
ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Trace Organics Analysis (Continued)

RPT Date: Sep 27, 2024			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
2,4,5-T			< 0.5	< 0.5	NA	< 0.5	87%	50%	140%	82%	50%	140%	NA	50%	140%
2,4,5-TP			< 0.5	< 0.5	NA	< 0.5	90%	50%	140%	90%	50%	140%	NA	50%	140%
Dicamba			< 0.5	< 0.5	NA	< 0.5	92%	50%	140%	91%	50%	140%	NA	50%	140%
Dichlorprop			< 0.5	< 0.5	NA	< 0.5	86%	50%	140%	80%	50%	140%	NA	50%	140%
Dinoseb			< 0.5	< 0.5	NA	< 0.5	72%	50%	140%	79%	50%	140%	NA	50%	140%
Picloram			< 0.5	< 0.5	NA	< 0.5	80%	50%	140%	80%	50%	140%	NA	50%	140%
Diclofop-methyl			< 0.5	< 0.5	NA	< 0.5	90%	50%	140%	86%	50%	140%	NA	50%	140%
2,3,4,6-Tetrachlorophenol			< 0.5	< 0.5	NA	< 0.5	97%	50%	140%	92%	50%	140%	NA	50%	140%
2,4-Dichlorophenol			< 0.2	< 0.2	NA	< 0.2	90%	50%	140%	80%	50%	140%	NA	50%	140%
2,4,5-Trichlorophenol			< 0.5	< 0.5	NA	< 0.5	91%	50%	140%	81%	50%	140%	NA	50%	140%
2,4,6-Trichlorophenol			< 0.5	< 0.5	NA	< 0.5	97%	50%	140%	94%	50%	140%	NA	50%	140%
Bromoxynil			< 0.3	< 0.3	NA	< 0.3	98%	50%	140%	84%	50%	140%	NA	50%	140%
MCPA			< 5.0	< 5.0	NA	< 5.0	97%	50%	140%	92%	50%	140%	NA	50%	140%
MCPP			< 5.0	< 5.0	NA	< 5.0	101%	50%	140%	88%	50%	140%	NA	50%	140%
Pentachlorophenol			< 0.1	< 0.1	NA	< 0.1	100%	50%	140%	98%	50%	140%	NA	50%	140%
Triazine Pesticides [Water]															
Trifluralin	6151779		< 1.0	< 1.0	NA	< 1.0	109%	50%	140%	111%	50%	140%	95%	50%	140%
Simazine	6151779		< 1.0	< 1.0	NA	< 1.0	114%	50%	140%	99%	50%	140%	93%	50%	140%
Atrazine	6151779		< 0.5	< 0.5	NA	< 0.5	110%	50%	140%	96%	50%	140%	89%	50%	140%
Metribuzin	6151779		< 0.25	< 0.25	NA	< 0.25	112%	50%	140%	92%	50%	140%	78%	50%	140%
Prometryne	6151779		< 0.25	< 0.25	NA	< 0.25	92%	50%	140%	96%	50%	140%	96%	50%	140%
Metolachlor	6151779		< 0.11	< 0.11	NA	< 0.11	113%	50%	140%	99%	50%	140%	110%	50%	140%
Alachlor	6151779		< 0.5	< 0.5	NA	< 0.5	105%	50%	140%	110%	50%	140%	112%	50%	140%
Cyanazine	6151779		< 1.0	< 1.0	NA	< 1.0	108%	50%	140%	91%	50%	140%	106%	50%	140%
Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).															
Volatile Organic Compounds in Water (ug/L)															
Dichlorodifluoromethane	6154183	6154183	<0.40	<0.40	NA	< 0.40	91%	50%	140%	74%	50%	140%	63%	50%	140%
Chloromethane	6154183	6154183	<0.20	<0.20	NA	< 0.20	79%	50%	140%	66%	50%	140%	64%	50%	140%
Vinyl Chloride	6154183	6154183	<0.17	<0.17	NA	< 0.17	116%	50%	140%	93%	50%	140%	81%	50%	140%
Bromomethane	6154183	6154183	<0.20	<0.20	NA	< 0.20	109%	50%	140%	74%	50%	140%	85%	50%	140%
Chloroethane	6154183	6154183	<0.20	<0.20	NA	< 0.20	95%	50%	140%	83%	50%	140%	81%	50%	140%
Trichlorofluoromethane	6154183	6154183	<0.40	<0.40	NA	< 0.40	103%	50%	140%	97%	50%	140%	76%	50%	140%
Acetone	6154183	6154183	<1.0	<1.0	NA	< 1.0	94%	50%	140%	88%	50%	140%	88%	50%	140%
1,1-Dichloroethylene	6154183	6154183	<0.2	<0.2	NA	< 0.2	93%	50%	140%	77%	60%	130%	92%	50%	140%
Methylene Chloride	6154183	6154183	<0.30	<0.30	NA	< 0.30	96%	50%	140%	78%	60%	130%	117%	50%	140%
trans- 1,2-dichloroethylene	6154183	6154183	<0.20	<0.20	NA	< 0.20	102%	50%	140%	77%	60%	130%	92%	50%	140%
Methyl tert-butyl ether	6154183	6154183	<0.20	<0.20	NA	< 0.20	103%	50%	140%	68%	60%	130%	91%	50%	140%
1,1-Dichloroethane	6154183	6154183	<0.30	<0.30	NA	< 0.30	105%	50%	140%	77%	60%	130%	99%	50%	140%

Quality Assurance

CLIENT NAME: LANDTEK LTD.
PROJECT: 23355
SAMPLING SITE:White Church Lands

AGAT WORK ORDER: 24H198294
ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Trace Organics Analysis (Continued)

RPT Date: Sep 27, 2024			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Methyl Ethyl Ketone	6154183	6154183	<1.0	<1.0	NA	< 1.0	104%	50%	140%	89%	50%	140%	110%	50%	140%
cis- 1,2-Dichloroethylene	6154183	6154183	<0.20	<0.20	NA	< 0.20	104%	50%	140%	84%	60%	130%	107%	50%	140%
Chloroform	6154183	6154183	<0.20	<0.20	NA	< 0.20	113%	50%	140%	85%	60%	130%	95%	50%	140%
1,2-Dichloroethane	6154183	6154183	<0.20	<0.20	NA	< 0.20	96%	50%	140%	77%	60%	130%	86%	50%	140%
1,1,1-Trichloroethane	6154183	6154183	<0.30	<0.30	NA	< 0.30	101%	50%	140%	80%	60%	130%	80%	50%	140%
Carbon Tetrachloride	6154183	6154183	<0.20	<0.20	NA	< 0.20	112%	50%	140%	92%	60%	130%	92%	50%	140%
Benzene	6154183	6154183	<0.20	<0.20	NA	< 0.20	76%	50%	140%	73%	60%	130%	68%	50%	140%
1,2-Dichloropropane	6154183	6154183	<0.20	<0.20	NA	< 0.20	78%	50%	140%	73%	60%	130%	71%	50%	140%
Trichloroethylene	6154183	6154183	<0.20	<0.20	NA	< 0.20	89%	50%	140%	64%	60%	130%	80%	50%	140%
Bromodichloromethane	6154183	6154183	<0.20	<0.20	NA	< 0.20	97%	50%	140%	66%	60%	130%	83%	50%	140%
cis-1,3-Dichloropropene	6154183	6154183	<0.20	<0.20	NA	< 0.20	84%	50%	140%	65%	60%	130%	70%	50%	140%
Methyl Isobutyl Ketone	6154183	6154183	<1.0	<1.0	NA	< 1.0	113%	50%	140%	98%	50%	140%	98%	50%	140%
trans-1,3-Dichloropropene	6154183	6154183	<0.30	<0.30	NA	< 0.30	120%	50%	140%	79%	60%	130%	93%	50%	140%
1,1,2-Trichloroethane	6154183	6154183	<0.20	<0.20	NA	< 0.20	111%	50%	140%	86%	60%	130%	96%	50%	140%
Toluene	6154183	6154183	<0.20	<0.20	NA	< 0.20	112%	50%	140%	101%	60%	130%	87%	50%	140%
2-Hexanone	6154183	6154183	<1.0	<1.0	NA	< 1.0	98%	50%	140%	97%	50%	140%	95%	50%	140%
Dibromochloromethane	6154183	6154183	<0.10	<0.10	NA	< 0.10	114%	50%	140%	105%	60%	130%	108%	50%	140%
Ethylene Dibromide	6154183	6154183	<0.10	<0.10	NA	< 0.10	109%	50%	140%	94%	60%	130%	99%	50%	140%
Tetrachloroethylene	6154183	6154183	<0.20	<0.20	NA	< 0.20	112%	50%	140%	105%	60%	130%	106%	50%	140%
1,1,1,2-Tetrachloroethane	6154183	6154183	<0.10	<0.10	NA	< 0.10	114%	50%	140%	103%	60%	130%	112%	50%	140%
Chlorobenzene	6154183	6154183	<0.10	<0.10	NA	< 0.10	113%	50%	140%	94%	60%	130%	100%	50%	140%
Ethylbenzene	6154183	6154183	<0.10	<0.10	NA	< 0.10	117%	50%	140%	80%	60%	130%	90%	50%	140%
m & p-Xylene	6154183	6154183	<0.20	<0.20	NA	< 0.20	117%	50%	140%	82%	60%	130%	97%	50%	140%
Bromoform	6154183	6154183	<0.10	<0.10	NA	< 0.10	119%	50%	140%	75%	60%	130%	111%	50%	140%
Styrene	6154183	6154183	<0.10	<0.10	NA	< 0.10	113%	50%	140%	68%	60%	130%	92%	50%	140%
1,1,2,2-Tetrachloroethane	6154183	6154183	<0.10	<0.10	NA	< 0.10	107%	50%	140%	65%	60%	130%	100%	50%	140%
o-Xylene	6154183	6154183	<0.10	<0.10	NA	< 0.10	113%	50%	140%	80%	60%	130%	105%	50%	140%
1,3-Dichlorobenzene	6154183	6154183	<0.10	<0.10	NA	< 0.10	115%	50%	140%	71%	60%	130%	103%	50%	140%
1,4-Dichlorobenzene	6154183	6154183	<0.10	<0.10	NA	< 0.10	109%	50%	140%	68%	60%	130%	102%	50%	140%
1,2-Dichlorobenzene	6154183	6154183	<0.10	<0.10	NA	< 0.10	104%	50%	140%	67%	60%	130%	104%	50%	140%
1,2,4-Trichlorobenzene	6154183	6154183	<0.30	<0.30	NA	< 0.30	104%	50%	140%	64%	60%	130%	81%	50%	140%
n-Hexane	6154183	6154183	<0.20	<0.20	NA	< 0.20	101%	50%	140%	113%	60%	130%	100%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Oil and Grease (Total) in Water															
Total Oil and Grease in water	6116773		< 0.5	< 0.5	NA	< 0.5	98%	70%	130%	85%	70%	130%	110%	70%	130%
Polycyclic Aromatic Hydrocarbons in Water - Ultra-Low Level															
Benzo(j+k)fluoranthene	1	6166573	< 0.001	< 0.001	NA	< 0.001	101%	50%	140%	131%	50%	140%	110%	50%	140%

Quality Assurance

CLIENT NAME: LANDTEK LTD.
PROJECT: 23355
SAMPLING SITE:White Church Lands

AGAT WORK ORDER: 24H198294
ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Trace Organics Analysis (Continued)

RPT Date: Sep 27, 2024			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution. Matrix spike performed on a different sample than the duplicate.
If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

Resin and Fatty acid (water)

Fatty acid total	1	NA	NA	NA	0.0%	< 10	NA	70%	130%	86%	70%	130%	NA	70%	130%
Resin acid total	1	NA	NA	NA	0.0%	< 10	NA	70%	130%	78%	70%	130%	NA	70%	130%
Resin and Fatty acid total	1	NA	NA	NA	0.0%	< 10	NA	70%	130%	82%	70%	130%	NA	70%	130%
O-methylpodocarpic	1	NA	NA	NA	0.0%	108	NA	40%	140%	81%	40%	140%	NA	40%	140%

Comments: The QC criteria are only applicable to the total resins and total fatty acids.

NA : Non applicable.

If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

NA in the spike blank or CRM indicates that it is not required by the procedure.

Glycols Analysis in Water

Propylene Glycol	971	6162721	<10	<10	NA	< 10	110%	50%	140%	112%	50%	140%	107%	50%	140%
Monoethylene Glycol	971	6162721	<8	<8	NA	< 8	108%	50%	140%	110%	50%	140%	105%	50%	140%
Diethylene Glycol	971	6162721	<5	<5	NA	< 5.0	107%	50%	140%	111%	50%	140%	106%	50%	140%
Triethylene Glycol	971	6162721	<8	<8	NA	< 8	107%	50%	140%	114%	50%	140%	109%	50%	140%
Tetraethylene Glycol	971	6162721	<10	<10	NA	< 10	100%	50%	140%	99%	50%	140%	93%	50%	140%

Comments: Duplicate NA: results are less than 5X the RDL and RDP will not be calculated.
The sample spikes and dups are not from the same sample ID.

Ethanolamines in Water by HPLC - Low Level

Diethanolamine (DEA)	1359	6154165	<0.04	<0.04	NA	< 0.040	104%	80%	120%	102%	70%	130%	105%	60%	140%
Ethanolamine (MEA)	1359	6154165	<0.05	<0.05	NA	< 0.05	100%	80%	120%	100%	70%	130%	99%	60%	140%
Diisopropanolamine (DIPA)	1359	6154165	<0.1	<0.1	NA	< 0.1	101%	80%	120%	106%	70%	130%	94%	60%	140%
Monoisopropanolamine (MIPA)	1359	6154165	<0.1	<0.1	NA	< 0.1	115%	80%	120%	102%	70%	130%	106%	60%	140%

Comments: Duplicate NA: results are less than 5X the RDL and RDP will not be calculated.
The sample spikes and dups are not from the same sample ID.

Certified By:

Quality Assurance

CLIENT NAME: LANDTEK LTD.
PROJECT: 23355
SAMPLING SITE:White Church Lands

AGAT WORK ORDER: 24H198294
ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Water Analysis

RPT Date: Sep 27, 2024			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Dissolved Oxygen in Water - mg/L															
Dissolved Oxygen	6154165	6154165	7.88	7.72	2.1%	< 0.1	NA								

Comments: NA signifies Not Applicable.
Duplicate NA: results are under 5X the RDL and will not be calculated.

PWQO Parameters															
pH	6154204		6.98	7.00	0.3%	NA	100%	90%	110%						
Cyanide, WAD	6148769		<0.002	<0.002	NA	< 0.002	107%	70%	130%	87%	80%	120%	99%	70%	130%
Alkalinity (as CaCO3)	6154204		164	166	1.2%	< 5	98%	80%	120%						
Turbidity	6154165	6154165	4.7	5.3	12.0%	< 0.5	89%	80%	120%						
Sulphide	6159442		<0.01	<0.01	NA	< 0.01	103%	90%	110%	102%	90%	110%	101%	80%	120%
Phenols	6151508		<0.001	<0.001	NA	< 0.001	103%	90%	110%	95%	90%	110%	100%	80%	120%
Ammonia as N	6154165	6154165	<0.02	<0.02	NA	< 0.02	91%	70%	130%	99%	80%	120%	83%	70%	130%
Total Phosphorus	6151121		6.49	6.50	0.2%	< 0.02	99%	70%	130%	101%	80%	120%	NA	70%	130%
Aluminum-dissolved	6162681		0.006	<0.004	NA	< 0.004	95%	70%	130%	101%	80%	120%	76%	70%	130%
Total Antimony	6154165	6154165	<0.003	<0.003	NA	< 0.003	103%	70%	130%	102%	80%	120%	102%	70%	130%
Total Arsenic	6154165	6154165	0.005	<0.003	NA	< 0.003	101%	70%	130%	101%	80%	120%	97%	70%	130%
Total Barium	6154165	6154165	0.085	0.087	2.3%	< 0.002	99%	70%	130%	102%	80%	120%	102%	70%	130%
Total Boron	6154165	6154165	0.121	0.118	2.5%	< 0.010	100%	70%	130%	102%	80%	120%	103%	70%	130%
Total Cadmium	6154165	6154165	0.0001	<0.0001	NA	< 0.0001	100%	70%	130%	100%	80%	120%	100%	70%	130%
Total Chromium	6154165	6154165	<0.003	<0.003	NA	< 0.003	100%	70%	130%	98%	80%	120%	98%	70%	130%
Total Cobalt	6154165	6154165	0.0019	0.0021	NA	< 0.0005	96%	70%	130%	97%	80%	120%	102%	70%	130%
Total Copper	6154165	6154165	<0.002	<0.002	NA	< 0.002	103%	70%	130%	103%	80%	120%	102%	70%	130%
Total Iron	6154165	6154165	0.863	0.909	5.2%	< 0.050	93%	70%	130%	98%	80%	120%	99%	70%	130%
Total Lead	6154165	6154165	<0.0005	<0.0005	NA	< 0.0005	98%	70%	130%	99%	80%	120%	95%	70%	130%
Dissolved Mercury	6154165	6154165	<0.0001	<0.0001	NA	< 0.0001	98%	70%	130%	96%	80%	120%	105%	70%	130%
Total Molybdenum	6154165	6154165	0.002	0.002	NA	< 0.002	100%	70%	130%	110%	80%	120%	108%	70%	130%
Total Nickel	6154165	6154165	<0.003	0.005	NA	< 0.003	96%	70%	130%	98%	80%	120%	100%	70%	130%
Total Selenium	6154165	6154165	<0.002	<0.002	NA	< 0.002	99%	70%	130%	100%	80%	120%	101%	70%	130%
Total Silver	6154165	6154165	<0.0001	<0.0001	NA	< 0.0001	99%	70%	130%	111%	80%	120%	106%	70%	130%
Total Thallium	6154165	6154165	<0.0003	<0.0003	NA	< 0.0003	98%	70%	130%	98%	80%	120%	96%	70%	130%
Total Tungsten	6154165	6154165	<0.010	<0.010	NA	< 0.010	98%	70%	130%	102%	80%	120%	97%	70%	130%
Total Uranium	6154165	6154165	0.0028	0.0028	0.0%	< 0.0005	103%	70%	130%	106%	80%	120%	100%	70%	130%
Total Vanadium	6154165	6154165	<0.002	<0.002	NA	< 0.002	94%	70%	130%	103%	80%	120%	107%	70%	130%
Total Zinc	6154165	6154165	<0.020	<0.020	NA	< 0.020	96%	70%	130%	103%	80%	120%	107%	70%	130%
Total Zirconium	6154165	6154165	<0.004	<0.004	NA	< 0.004	103%	70%	130%	105%	80%	120%	102%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate NA: results are under 5X the RDL and will not be calculated.

Matrix spike NA: Spike level < native concentration. Matrix spike acceptance limits do not apply and are not calculated.

Quality Assurance

CLIENT NAME: LANDTEK LTD.
PROJECT: 23355
SAMPLING SITE:White Church Lands

AGAT WORK ORDER: 24H198294
ATTENTION TO: Henry Erebor
SAMPLED BY:LB

Water Analysis (Continued)

RPT Date: Sep 27, 2024			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Residual Chlorine															
Total Residual Chlorine	6137904		0.05	0.05	0%	< 0.01	94%	80%	120%	97%	90%	110%	90%	80%	120%

Comments: NA signifies Not Applicable.
Duplicate NA: results are under 5X the RDL and will not be calculated.

Certified By:

NIVINE BASILY

Method Summary

CLIENT NAME: LANDTEK LTD.
PROJECT: 23355
SAMPLING SITE:White Church Lands

AGAT WORK ORDER: 24H198294
ATTENTION TO: Henry Erebor
SAMPLED BY:LB

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Microbiology Analysis			
Escherichia coli	MIC-93-7010	EPA 1604	Membrane Filtration

Method Summary

CLIENT NAME: LANDTEK LTD.
PROJECT: 23355
SAMPLING SITE:White Church Lands

AGAT WORK ORDER: 24H198294
ATTENTION TO: Henry Erebor
SAMPLED BY:LB

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Naphthalene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Acenaphthylene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Acenaphthene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Fluorene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Phenanthrene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Anthracene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Fluoranthene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Pyrene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Benzo(a)anthracene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Chrysene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Benzo(b)fluoranthene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Benzo(k)fluoranthene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Benzo(a)pyrene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Indeno(1,2,3-cd)pyrene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Dibenzo(a,h)anthracene	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Benzo(g,h,i)perylene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Phenol	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Bis(2-chloroethyl)ether	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
2-Chlorophenol	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
o-Cresol	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Bis(2-chloroisopropyl)ether	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
m&p-Cresol	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Hexachloroethane	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
2,4-Dimethylphenol	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
2,4-Dichlorophenol	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
1,2,4-Trichlorobenzene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
p-Chloroaniline	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS

Method Summary

CLIENT NAME: LANDTEK LTD.
PROJECT: 23355
SAMPLING SITE:White Church Lands

AGAT WORK ORDER: 24H198294
ATTENTION TO: Henry Erebor
SAMPLED BY:LB

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Hexachlorobutadiene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
2-and 1-methyl Napthalene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
2,4,6-Trichlorophenol	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
2,4,5-Trichlorophenol	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
1,1-Biphenyl	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Dimethyl phthalate	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
2,6-Dinitrotoluene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
2,4-Dinitrotoluene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
2,3,4,6-Tetrachlorophenol	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Diethyl phthalate	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Hexachlorobenzene	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Pentachlorophenol	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
3,3'-dichlorobenzidine	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Bis(2-Ethylhexyl)phthalate	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
2,4-Dinitrophenol	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
2-Fluorophenol	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
phenol-d6 surrogate	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
2,4,6-Tribromophenol	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Chrysene-d12	ORG-91-5114	modified from EPA 3510C, 8270E & ON MOECC E3265	GC/MS
Sediment			N/A
Aldicarb	ORG-91-5101	EPA 632 531.1 & MOE E3158	HPLC
Bendiocarb	ORG-91-5101	EPA 632 531.1 & MOE E3158	HPLC
Carbofuran	ORG-91-5101	EPA 632 531.1 & MOE E3158	HPLC
Carbaryl	ORG-91-5101	EPA 632 531.1 & MOE E3158	HPLC
Diuron	ORG-91-5101	EPA 632 531.1 & MOE E3158	HPLC
Triallate	ORG-91-5101	EPA 632 531.1 & MOE E3158	HPLC
Temephos	ORG-91-5101	EPA 632 531.1 & MOE E3158	HPLC
Diquat	ORG-91-5102	EPA 549.1	HPLC
Paraquat	ORG-91-5102	EPA 549.1	HPLC
Diethanolamine (DEA)	TO-2240	"In house" developed method	HPLC/UV
Ethanolamine (MEA)	TO-2240	"In house" developed method	HPLC/UV
Diisopropanolamine (DIPA)	TO-2240	"In house" developed method	HPLC/UV
Monoisopropanolamine (MIPA)	TO-2240	"In house" developed method	HPLC/UV
Propylene Glycol	TO-1410	EPA SW-846 8015	GC/FID
Monoethylene Glycol	TO-1410	EPA SW-846 8015	GC/FID

Method Summary

CLIENT NAME: LANDTEK LTD.
PROJECT: 23355
SAMPLING SITE:White Church Lands

AGAT WORK ORDER: 24H198294
ATTENTION TO: Henry Erebor
SAMPLED BY:LB

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Diethylene Glycol	TO-1410	EPA SW-846 8015	GC/FID
Triethylene Glycol	TO-1410	EPA SW-846 8015	GC/FID
Tetraethylene Glycol	TO-1410	EPA SW-846 8015	GC/FID
Heptanol	TO-1410	EPA SW-846 8015	GC/FID
Gamma-Hexachlorocyclohexane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Heptachlor	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Aldrin	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Heptachlor Epoxide	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Endosulfan I	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Endosulfan II	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Endosulfan	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
alpha - chlordane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
gamma-Chlordane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Chlordane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
op'-DDE	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
pp'-DDE	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
DDE	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
op'-DDD	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
pp'-DDD	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
DDD	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
op'-DDT	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
pp'-DDT	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
DDT	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	CALCULATION
Dieldrin	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Endrin	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Methoxychlor	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Hexachlorobenzene	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Hexachlorobutadiene	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Hexachloroethane	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Aroclor 1242	ORG-91-5112	modified from EPA SW-846 3510C & 8082A	GC/ECD

Method Summary

CLIENT NAME: LANDTEK LTD.
PROJECT: 23355
SAMPLING SITE:White Church Lands

AGAT WORK ORDER: 24H198294
ATTENTION TO: Henry Erebor
SAMPLED BY:LB

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Aroclor 1248	ORG-91-5112	modified from EPA SW-846 3510C & 8082A	GC/ECD
Aroclor 1254	ORG-91-5112	modified from EPA SW-846 3510C & 8082A	GC/ECD
Aroclor 1260	ORG-91-5112	modified from EPA SW-846 3510C & 8082A	GC/ECD
Polychlorinated Biphenyls	ORG-91-5112	modified from EPA SW-846 3510C & 8082A	GC/ECD
TCMX	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Decachlorobiphenyl	ORG-91-5112	modified from EPA SW-846 3510C & 8081B	GC/ECD
Total Oil and Grease in water	VOL-91-5011	SM 5520 & EPA SW846 3510C & EPA 1664	BALANCE
2,4-D	ORG-91-5110	modified from EPA 515.2, EPA SW-846 8151A	GC/ECD
2,4,5-T	ORG-91-5510	modified from EPA 515.2, EPA SW-846 8151A	GC/ECD
2,4,5-TP	ORG-91-5110	modified from EPA 515.2, EPA SW-846 8151A	GC/ECD
Dicamba	ORG-91-5110	modified from EPA 515.2, EPA SW-846 8151A	GC/ECD
Dichlorprop	ORG-91-5110	modified from EPA 515.2, EPA SW-846 8151A	GC/ECD
Dinoseb	ORG-91-5110	modified from EPA 515.2, EPA SW-846 8151A	GC/ECD
Picloram	ORG-91-5110	modified from EPA 515.2, EPA SW-846 8151A	GC/ECD
Diclofop-methyl	ORG-91-5110	modified from EPA 515.2, EPA SW-846 8151A	GC/ECD
2,3,4,6-Tetrachlorophenol	ORG-91-5110	modified from EPA 515.2, EPA SW-846 8151A	GC/ECD
2,4-Dichlorophenol	ORG-91-5110	modified from EPA 515.2, EPA SW-846 8151A	GC/ECD
2,4,5-Trichlorophenol	ORG-91-5100	modified from EPA 515.2, EPA SW-846 8151A	GC/ECD
2,4,6-Trichlorophenol	ORG-91-5110	modified from EPA 515.2, EPA SW-846 8151A	GC/ECD
Bromoxynil	ORG-91-5110	modified from EPA 515.2, EPA SW-846 8151A	GC/ECD
MCPA	ORG-91-5110	modified from EPA 515.2, EPA SW-846 8151A	GC/ECD
MCPP	ORG-91-5110	modified from EPA 515.2, EPA SW-846 8151A	GC/ECD
Pentachlorophenol	ORG-91-5110	modified from EPA 515.2, EPA SW-846 8151A	GC/ECD
DCAA	ORG-91-5110	EPA SW-846 8151	GC/ECD
1-Methylnaphthalene, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
2-Methylnaphthalene, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
Acenaphthene, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
Acenaphthylene, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
Acridine, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
Anthracene, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
Benzo(a)anthracene, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
Benzo(a)pyrene, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS

Method Summary

CLIENT NAME: LANDTEK LTD.
PROJECT: 23355
SAMPLING SITE:White Church Lands

AGAT WORK ORDER: 24H198294
ATTENTION TO: Henry Erebor
SAMPLED BY:LB

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Benzo(b)fluoranthene, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
Benzo(j+k)fluoranthene	ORG-120-5119	EPA 3510C/8270E	GC/MS
Benzo(e)pyrene, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
Benzo(ghi)perylene, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
Chrysene, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
Dibenzo(a,h)anthracene, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
Fluoranthene, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
Fluorene, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
Indeno(1,2,3-cd)pyrene, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
Naphthalene, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
Perylene, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
Phenanthrene, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
Pyrene, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
Quinoline, Ultra-low	ORG-120-5119	EPA 3510C/8270E	GC/MS
Sediment			GC/MS/FID
Naphthalene-d8	ORG-120-5119	EPA 3510C/8270E	GC/MS
Terphenyl-d14	ORG-120-5119	EPA 3510C/8270E	GC/MS
Pyrene-d10	ORG-120-5119	EPA 3510C/8270E	GC/MS
PAH - Extraction (Ultra-low)			GC/MS
Linoleic acid	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
Linolenic acid	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
Oleic acid	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
9,10-Dichlorostearic acid	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
Stearic acid	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
Fatty acid total	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
Pimaric acid	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
Sandaracopimaric acid	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
Isopimaric acid	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
Palustric acid	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
Levopimaric acid	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
Dehydroabietic acid	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
Abietic acid	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
Neoabietic acid	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
14-Chlorodehydroabietic acid	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
12-Chlorodehydroabietic acid	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
12,14-Dichlorodehydroabietic acid	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
Resin acid total	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
Resin and Fatty acid total	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
O-methylpodocarpic	ORG-100-5112F	MA.414–Aci-g-r 1.0	GC/MS
Trifluralin	ORG-91-5104	EPA SW-846 3510C, 8270D & MOE E3121	GC/MS
Simazine	ORG-91-5104	EPA SW-846 3510C, 8270D & MOE E3121	GC/MS
Atrazine	ORG-91-5104	EPA SW-846 3510C, 8270D & MOE E3121	GC/MS
Metribuzin	ORG-91-5104	EPA SW-846 3510C, 8270D & MOE E3121	GC/MS
Prometryne	ORG-91-5104	EPA SW-846 3510C, 8270D & MOE E3121	GC/MS
Metolachlor	ORG-91-5104	EPA SW-846 3510C, 8270D & MOE E3121	GC/MS

Method Summary

CLIENT NAME: LANDTEK LTD.
PROJECT: 23355
SAMPLING SITE:White Church Lands

AGAT WORK ORDER: 24H198294
ATTENTION TO: Henry Erebor
SAMPLED BY:LB

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Alachlor	ORG-91-5104	EPA SW-846 3510C, 8270D & MOE E3121	GC/MS
Cyanazine	ORG-91-5104	EPA SW-846 3510C, 8270D & MOE E3121	GC/MS
Triphenyl phosphate (surr)	ORG-91-5104	EPA SW-846 3510C, 8270D & MOE E3121	GC/MS
Dichlorodifluoromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Chloromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Vinyl Chloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Bromomethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Chloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Trichlorofluoromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Acetone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methylene Chloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
trans- 1,2-dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methyl tert-butyl ether	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1-Dichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
cis- 1,2-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Chloroform	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,1-Trichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Benzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichloropropane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Trichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Bromodichloromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
cis-1,3-Dichloropropene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Methyl Isobutyl Ketone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
trans-1,3-Dichloropropene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS

Method Summary

CLIENT NAME: LANDTEK LTD.
PROJECT: 23355
SAMPLING SITE:White Church Lands

AGAT WORK ORDER: 24H198294
ATTENTION TO: Henry Erebor
SAMPLED BY:LB

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
1,1,2-Trichloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Toluene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
2-Hexanone	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Dibromochloromethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Ethylene Dibromide	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Tetrachloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,1,2-Tetrachloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Chlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Ethylbenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
m & p-Xylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Bromoform	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Styrene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,2,2-Tetrachloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
o-Xylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,3-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2,4-Trichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,3-Dichloropropene (Cis + Trans)	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Xylenes (Total)	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
n-Hexane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Toluene-d8	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS

Method Summary

CLIENT NAME: LANDTEK LTD.
PROJECT: 23355
SAMPLING SITE:White Church Lands

AGAT WORK ORDER: 24H198294
ATTENTION TO: Henry Erebor
SAMPLED BY:LB

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Dissolved Oxygen	INOR-93-6006	Modified from SM 4500-O G	DO METER
pH	INOR-93-6000	modified from SM 4500-H+ B	PC TITRATE
Cyanide, WAD	INOR-93-6052	modified from ON MOECC E3015,SM 4500-CN- I, G-387	SEGMENTED FLOW ANALYSIS
Alkalinity (as CaCO3)	INOR-93-6000	Modified from SM 2320 B	PC TITRATE
Turbidity	INOR-93-6000	modified from SM 2130 B	PC TITRATE
Sulphide	INOR-93-6054	modified from SM 4500 S2- D	SPECTROPHOTOMETER
Phenols	INOR-93-6072	modified from SM 5530 D	LACHAT FIA
Ammonia as N	INOR-93-6059	modified from SM 4500-NH3 H	LACHAT FIA
Ammonia-Un-ionized		MOE REFERENCE, PWQOs Tab 2	CALCULATION
Total Phosphorus	INOR-93-6022	modified from SM 4500-P B and SM 4500-P E	SPECTROPHOTOMETER
Aluminum-dissolved	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Total Antimony	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Arsenic	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Barium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Boron	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cadmium	MET -93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Chromium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cobalt	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Copper	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Iron	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Lead	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Dissolved Mercury	MET-93-6100	modified from EPA 245.2 and SM 3112 B	CVAAS
Total Molybdenum	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Nickel	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Selenium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Silver	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Thallium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Tungsten	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Uranium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Vanadium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Zinc	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS

Method Summary

CLIENT NAME: LANDTEK LTD.
AGAT WORK ORDER: 24H198294
PROJECT: 23355
ATTENTION TO: Henry Erebor
SAMPLING SITE:White Church Lands
SAMPLED BY:LB

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Total Zirconium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Lab Filtration Aluminum Dissolved	SR-78-9001		FILTRATION
Lab Filtration mercury	SR-78-9001		FILTRATION
Total Residual Chlorine	INOR-93-6060	modified from SM 4500-CL- G	SPECTROPHOTOMETER

AGAT Laboratories

Have feedback?
Scan here for a quick survey!

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Short Holding Time

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 24H198294

Cooler Quantity: 6 LG COOLERS
Arrival Temperatures: SEE ATTACHED
Depot Temperatures:
Custody Seal Intact: ☐Yes ☐No ☐N/A
Notes: LOOSE ICE

Report Information:

Company: LANDTEK LIMITED
Contact: HENRY EKEBOR
Address: 205 NEBO RD UNIT 4B
HAMILTON
Phone: 905-383-3733 Fax:
Reports to be sent to:
1. Email: henry@landtek.ca
2. Email:

Regulatory Requirements:

(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One)
☐Ind/Com
☐Res/Park
☐Agriculture
Soil Texture (Check One)
☐Coarse
☐Fine

☐ Regulation 406
Table (Indicate One)
☐Ind/Com
☐Res/Park
☐Agriculture
☐ Regulation 558
☐ CCME

☐ Sewer Use
☐Sanitary ☐ Storm
Region
☒ Prov. Water Quality Objectives (PWQO)
☐ Other
Hamilton
Indicate One

Turnaround Time (TAT) Required:

Regular TAT ☒ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CSR

Project Information:

Project: 23355
Site Location: White Church lands
Sampled By: LB
AGAT Quote #: 21194787640 PO: 23355
Please note: If quotation number is not provided, client will be billed full price for analysis.

Is this submission for a Record of Site Condition (RSC)? ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Legal Sample ☐

Invoice Information:

Bill To Same: Yes ☒ No ☐

Company: LANDTEK
Contact: KATHY CRISTOI
Address: 205 NEBO RD, HAMILTON
Email: Kathy@landtek.ca

Sample Matrix Legend

GW	Ground Water	SD	Sediment
O	Oil	SW	Surface Water
P	Paint	R	Rock/Shale
S	Soil		

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC Y/N	O. Reg 153 Metals & Inorganics	O. Reg 153 Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	O. Reg 153 BTEX, F1-F4 PHCs	VOC	PAHs	PCBs: Aroclors ☐	O. Reg 406 Regulation 406 Characterization Package pH, Metals, BTEX, F1-F4	O. Reg 406 EC, SAR	O. Reg 406 Regulation 406 SPLP Rainwater Leach mSPLP: ☐ Metals ☐ VOCs ☐ SVOCs ☐ OC	O. Reg 558 Landfill Disposal Characterization TCLP: TCLP: ☐M&I ☐VOCs ☐ABNs ☐B(a)P ☐PCBs	Corrosivity: ☐ Moisture ☐ Sulphide	PWQO						Potentially Hazardous or High Concentration (Y/N)
1. MW3D	Sept.18	9:50 [✓ AM] PM	44	GW		N												X						
2. MW4	Sept18	12:00 AM [✓ PM]	44	GW		N												X						
3. MW1D	Sept.18	11.00 [✓ AM] PM	44	GW		N												X						
4.		AM PM																						
5.		AM PM																						
6.		AM PM																						
7.		AM PM																						
8.		AM PM																						
9.		AM PM																						
10.		AM PM																						
11.		AM PM																						

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Lawren Blair	Sept.18	1:00pm	DTAC	Sept18/24	1pm
Lauren Blair	Sept.18	1:00pm	AB	18Sept	16:00
DTAC	Sept18/24	3pm			

Page ____ of ____

Nº: T - 162310

Pink Copy - Client | Yellow Copy - AGAT | White Copy- AGAT

AGAT Laboratories

Sample Temperature Log

Client: LANDTEK.

Work Order #: 24H198294.

Arrival Temperatures - Branch/Driver

Cooler #1:	16.6	16.8	17.0
Cooler #2:	18.0	18.6	18.2
Cooler #3:	17.4	17.0	17.9
Cooler #4:	16.0	16.5	17.0
Cooler #5:	14.7	14.9	15.2
Cooler #6:	17.2	17.7	18.0
Cooler #7:			
Cooler #8			
Cooler #9:			
Cooler #10:			

IR Gun ID: ______

Taken By: ______

Date (mm/dd/yy): ______ Time: ___:___ AM / PM

Arrival Temperatures - Laboratory

Cooler #1:	3.8	4.1	4.4
Cooler #2:	4.5	4.6	4.9
Cooler #3:	5.1	4.7	4.8
Cooler #4:	3.9	4.2	4.5
Cooler #5:	4.6	4.8	5.4
Cooler #6:	4.9	5.1	5.2
Cooler #7:			
Cooler #8			
Cooler #9:			
Cooler #10:			

IR Gun ID: AB

Taken By: Anmol Batth

Date (mm/dd/yy): 18 Sept Time: 16:00 AM / PM

Document ID: SR-78-9511.001
Date Issued: February 24, 2015

Page: ______

SGS

Request for Laboratory Services and CHAIN OF CUSTODY (specific SDWA/HPPA - 1st Party)

SGS Environmental Services - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Toll Free: 877-747-7658 Fax: 705-652-6365 Web: www.ca.sgs.com

Laboratory Information Section

Received Date (mm/dd/yyyy): SEP 20 2024

Received Time (After Hours Only):

LAB LIMS #: Sup 18886

Temperature Upon Receipt (°C): 14+3

Billing & Reporting Information

Invoice/ Receipt to:	Company:	Accounts Payable
	Attention:	AGAT Laboratories - Mississauga
	Address:	5835 Coopers Avenue, Mississauga, ON, L4Z1Y2
	Email:	janzen@agatlabs.com

Report to: {3}	Attention:	Eva Janzen; Neil Ramnaraign	PO #:	227847
	Email:	janzen@agatlabs.com; ramnaraign@agatlabs.com	Job #:	24H198294
	Phone:	905-712-5096; 905-712-5131	Fax:	

Quote #: N/A

Attached Parameter List: ☐ YES ☑ NO

Turnaround Time

Is *Rush Turnaround Time Required? ☐ YES ☑ NO

Specify: Regular TAT

* Rush TA Requests Require Lab Approval

Drinking Water System Information (Exceedance Reporting Information)

Client Lab #:

System Name:		**Waterworks/DWS #:**	
Physical Address:		**Contact Phone Number:**	
Contact Name:		**Contact Fax Number:**	
MOH Unit (Ministry of Health):		**Day Care Licence # or SFIS #:**	

Please check the regulation that applies to your water samples: O.Reg. 170/03 ☐ O.Reg 318/08 O.Reg 319/08 ☐ O.Reg 243/07 ☐ Certificate of Approval Requirement ☐ Samples NOT Regulated ☑

As per the Ontario Safe Drinking Water Act and Health Protection and Promotion Act, the water facility information and the sample information sections **must be filled out prior to processing samples**. Sample Source Codes * indicate whether samples are Reportable or Not Reportable. The laboratory will report all exceedances to the SDWA/HPPA as per sample the applicable regulation and source codes.

Sample Information

NR ↓ as per selected regulation. CA

Bottle #	Sample Source Code*	Sample Location Name	Check if Re-Sample From an Adverse Report	Date Sampled (mm/dd/yy)	Time Sampled	# of Bottles	Field Total Residual Chlorine	Field Free Residual Chlorine	Analysis Requested (please enter the analysis required below and check off which analysis applies to each sample) Bisphenol A (unpreserved)				
1	GW	24H198294 - 6154165 - MW3D		9/9/2024	9:50	2			x				
2	GW	24H198294 - 6154182 - MW4		9/9/2024	12:00	2			x				
3	GW	24H198294 - 6154183 - MW10		9/9/2024	11:00	2			x				
4													
5													
6													
7													
8													
9													
10													
11						For NP/NPE work please report in mg/L							
12													

Sampled By {1}: (Name) (Signature) Date: ___ / ___ / ___ (mm/dd/yy)

Relinquished by {2}: (Name) Jackal Ly (Signature) Date: 09 / 18 / 24 (mm/dd/yy)

*** Sample Source Codes**

DW-Distribution Water: Water in the DWS that is in the distribution system. These samples are reportable under applicable Ontario drinking water regulations

TW-Treated Water: Water in the DWS at the point of entry to the distribution system. These samples are reportable under applicable Ontario drinking water regulations

RW-Raw Water: Water source for a DWS that has a treatment system. These samples are not for consumption and not reportable under applicable Ontario drinking water regulations

RWFC-Raw Water For Consumption: Water source for a DWS that <u>does not</u> have a treatment system. These samples <u>are for consumption</u> and are reportable under applicable Ontario drinking water regulations

TAP-Tap Water: Water taken for the purposes of lead testing under O.Reg. 243/07

NR-Not Reportable: Water samples that are not reportable under applicable Ontario drinking water regulations

Note: {1} Submission of samples to SGS is acknowledgement that you have been provided direction on sample collection/handling and transportation of samples. {2} Submission of samples to SGS is considered authorization for completion of work. Signatures may appear on this form or be retained on file in the contract, or in an alternative format (e.g. shipping documents). {3} Results may be sent by email to an unlimited number of addresses for no additional cost. Fax is available upon request.

334936086969

AIC 10:15

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

25-September-2024

AGAT Laboratories - Mississauga
Attn : Eva Janzen

5835 Coopers Avenue
Mississauga, ON
L4Z 1Y2, Canada

Phone: 905-712-5096
Fax:

Date Rec. : 20 September 2024
LR Report: **CA18886-SEP24**
Reference: PO#: 227847 - AGAT Job #: 24H198294

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Sample ID	Sample Date & Time	Temperature Upon Receipt °C	Bisphenol A ug/L
1: Analysis Start Date		---	23-Sep-24
2: Analysis Start Time		---	12:49
3: Analysis Completed Date		---	25-Sep-24
4: Analysis Completed Time		---	12:32
5: MDL		---	1
6: NR 24H198294 - 6154165 - MW3D	09-Sep-24 09:50	14.0	< 1
7: NR 24H198294 - 6154182 - MW4	09-Sep-24 12:00	14.0	< 1
8: NR 24H198294 - 6154183 - MW10	09-Sep-24 11:00	14.0	< 1

MDL - SGS Method Detection Limit
NR - Not regulated under applicable Provincial drinking water regulations as per client.

Method Descriptions

Parameter	Description	SGS Method Code	Reference Method Code
Bisphenol A	SVOC wtr - custom	ME-CA-[ENV]GC-LAK-AN-005	EPA 3510C/8270D

Kimberley Didsbury
Project Specialist,
Environment, Health & Safety

Quality Control Report

Organic Analysis													
Parameter	Reporting Limit	Unit	Method Blank	Duplicate				LCS / Spike Blank			Matrix Spike / Reference Material		
				Result 1	Result 2	RPD	Acceptance Criteria	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
							%		Low	High		Low	High
Semi-Volatile Organics - QCBatchID: GCM0313-SEP24													
Bisphenol A	1	ug/L	< 1			NSS	30	107	50	140	NSS	50	140

CERTIFICATE OF ANALYSIS

Work Order	: **WT2427747**	Page	: 1 of 3
Amendment	: **1**		
Client	: **AGAT Laboratories Ltd.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Eva Janzen	Account Manager	: Emily Smith
Address	: 8600 Glenlyon Parkway Burnaby BC Canada V5J 0B6	Address	: 60 Northland Road, Unit 1 Waterloo ON Canada N2V 2B8
Telephone	: ----	Telephone	: +1 519 886 6910
Project	: 24H198294	Date Samples Received	: 19-Sep-2024 14:20
PO	: 227836	Date Analysis Commenced	: 23-Sep-2024
C-O-C number	: ----	Issue Date	: 26-Sep-2024 07:38
Sampler	: ----		
Site	: ----		
Quote number	: 2022 Price List		
No. of samples received	: 3		
No. of samples analysed	: 3		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Sarah Birch	VOC Section Supervisor	VOC, Waterloo, Ontario

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
µg/L	micrograms per litre

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Workorder Comments

Amendment (26/09/2024): This report has been amended following minor LIMS report formatting corrections. All analysis results are as per the previous report.

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	**24H198294-615 4165 (ZI, Zm, Zn)-MW3D**	**24H198294-615 4182 (ZI, Zm, Zn)-MW4**	**24H198294-615 4183 (ZI, Zm, Zn)-MW10**	----	----
				Client sampling date / time	19-Sep-2024 06:50	19-Sep-2024 09:00	19-Sep-2024 08:00	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	**WT2427747-001**	**WT2427747-002**	**WT2427747-003**	--------	--------
					Result	Result	Result	----	----
Volatile Organic Compounds									
Dioxane, 1,4-	123-91-1	E611I/WT	20	µg/L	<20	<20	<20	----	----
Volatile Organic Compounds Surrogates									
Bromofluorobenzene, 4-	460-00-4	E611I/WT	1.0	%	88.2	88.5	89.6	----	----
Difluorobenzene, 1,4-	540-36-3	E611I/WT	1.0	%	101	100	101	----	----

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

ALS Canada Ltd.

right solutions.
right partner.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order : **WT2427747**
Amendment : **1**
Client : **AGAT Laboratories Ltd.**
Contact : Eva Janzen
Address : 8600 Glenlyon Parkway
Burnaby BC Canada V5J 0B6
Telephone : ----
Project : 24H198294
PO : 227836
C-O-C number : ----
Sampler : ----
Site : ----
Quote number : 2022 Price List
No. of samples received : 3
No. of samples analysed : 3

Page : 1 of 5
Laboratory : ALS Environmental - Waterloo
Account Manager : Emily Smith
Address : 60 Northland Road, Unit 1
Waterloo, Ontario Canada N2V 2B8
Telephone : +1 519 886 6910
Date Samples Received : 19-Sep-2024 14:20
Issue Date : 26-Sep-2024 07:38

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method Container / Client Sample ID(s)	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
			Preparation Date	*Holding Times Rec*	*Holding Times Actual*	*Eval*	*Analysis Date*	*Holding Times Rec*	*Holding Times Actual*	*Eval*
Volatile Organic Compounds : VOCs (Dioxane) by Headspace GC-MS										
Compliant container 24H198294-6154165 (ZI, Zm, Zn)-MW3D	E611I	19-Sep-2024	23-Sep-2024	14 days	4 days	✓	23-Sep-2024	14 days	4 days	✓
Volatile Organic Compounds : VOCs (Dioxane) by Headspace GC-MS										
Compliant container 24H198294-6154182 (ZI, Zm, Zn)-MW4	E611I	19-Sep-2024	23-Sep-2024	14 days	4 days	✓	23-Sep-2024	14 days	4 days	✓
Volatile Organic Compounds : VOCs (Dioxane) by Headspace GC-MS										
Compliant container 24H198294-6154183 (ZI, Zm, Zn)-MW10	E611I	19-Sep-2024	23-Sep-2024	14 days	4 days	✓	23-Sep-2024	14 days	4 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
VOCs (Dioxane) by Headspace GC-MS	E611I	1667345	1	17	5.8	5.0	✓
Laboratory Control Samples (LCS)							
VOCs (Dioxane) by Headspace GC-MS	E611I	1667345	1	17	5.8	5.0	✓
Method Blanks (MB)							
VOCs (Dioxane) by Headspace GC-MS	E611I	1667345	1	17	5.8	5.0	✓
Matrix Spikes (MS)							
VOCs (Dioxane) by Headspace GC-MS	E611I	1667345	1	17	5.8	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	*Method / Lab*	*Matrix*	*Method Reference*	*Method Descriptions*
VOCs (Dioxane) by Headspace GC-MS	E611I ALS Environmental - Waterloo	Water	EPA 8260D/1624C (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.

Preparation Methods	*Method / Lab*	*Matrix*	*Method Reference*	*Method Descriptions*
VOCs Preparation for Headspace Analysis	EP581 ALS Environmental - Waterloo	Water	EPA 5021A (mod)	Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler. An aliquot of the headspace is then injected into a GC-MS-FID.

QUALITY CONTROL REPORT

Work Order	:**WT2427747**	Page	: 1 of 3
Amendment	:**1**		
Client	:AGAT Laboratories Ltd.	Laboratory	:ALS Environmental - Waterloo
Contact	:Eva Janzen	Account Manager	:Emily Smith
Address	:8600 Glenlyon Parkway Burnaby BC Canada V5J 0B6	Address	:60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	:----	Telephone	:+1 519 886 6910
Project	:24H198294	Date Samples Received	:19-Sep-2024 14:20
PO	:227836	Date Analysis Commenced	:23-Sep-2024
C-O-C number	:----	Issue Date	:26-Sep-2024 07:38
Sampler	:----		
Site	:----		
Quote number	:2022 Price List		
No. of samples received	:3		
No. of samples analysed	:3		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Sarah Birch	VOC Section Supervisor	Waterloo VOC, Waterloo, Ontario

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Volatile Organic Compounds (QC Lot: 1667345)											
EO2408068-001	Anonymous	Dioxane, 1,4-	123-91-1	E611I	20	µg/L	<20	<20	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	*Result*	*Qualifier*
Volatile Organic Compounds (QCLot: 1667345)						
Dioxane, 1,4-	123-91-1	E611I	20	µg/L	<20	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 1667345)									
Dioxane, 1,4-	123-91-1	E611I	20	µg/L	100 µg/L	102	70.0	130	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 1667345)										
EO2408068-001	Anonymous	Dioxane, 1,4-	123-91-1	E611I	91 µg/L	100 µg/L	91.1	60.0	140	----

ALS www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

COC Number: **21 -**

Page | of \

Environmental Division
Waterloo
Work Order Reference
WT2427747

Telephone : +1 519 886 6910

Report To	Contact and company name below will appear on the final report
Company:	AGAT Laboratories
Contact:	Eva Janzen; Neil Ramnaraign
Phone:	905-712-5096; 905-712-5131
	Company address below will appear on the final report
Street:	5835 Coopers Avenue
City/Province	Mississauga/ON
Postal Code:	L4Z 1Y2
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	
Contact:	

Reports / Recipients

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Merge QC/QCI Reports with COA ☐ YES ☑ NO ☐ N/A
☑ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax janzen@agatlabs.com
Email 2 ramnaraign@agatlabs.com
Email 3

Invoice Recipients

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax janzen@agatlabs.com
Email 2 ramnaraign@agatlabs.com

Turnaround Time (TAT) Requested

☑ Routine [R] if received by 3pm M-F - no surcharges apply
☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimun
☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimu
☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimu
☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimur
☐ Same day [E2] if received by 10am M-S - 200% rush surcharge.
Additional fees may apply to rush requests on weekends.
Date and Time Required for all E&P TATs:

For all tests with rush TATs requested, please contact your AM to confirm availability.

Project Information

ALS Account # / Quote #:
Job #: 24H198294
PO / AFE: 227836
LSD:

ALS Lab Work Order # (ALS use only): WT2427747 AH

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#
Major/Minor Code: Routing Code:
Requisitioner:
Location:
ALS Contact: **Sampler:**

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	1, 4-Dioxane	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	24H198294 - 6154165 (ZI, Zm, Zn) - MW3D	18-Sep-24	9:50	GW	3	R			
	24H198294 - 6154182 (ZI, Zm, Zn) - MW4	18-Sep-24	12:00	GW	3	R			
	24H198294 - 6154183 (ZI, Zm, Zn) - MW10	18-Sep-24	11:00	GW	3	R			

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?
☐ YES ☐ NO
Are samples for human consumption/ use?
☐ YES ☐ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

Ontario Provincial Water Quality Objectives (JULY, 1994)

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☐ NONE ☐ ICE ☑ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED
Submission Comments Identified on Sample Receipt Notification: ☐ YES ☐ NO
Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A
INITIAL COOLER TEMPERATURES °C:
FINAL COOLER TEMPERATURES °C: 4.8

SHIPMENT RELEASE (client use)
Released by: Jackal Ly
Date: Sep 18 2024
Time: 6PM

INITIAL SHIPMENT RECEPTION (ALS use only)
Received by:
Date:
Time:

FINAL SHIPMENT RECEPTION (ALS use only)
Received by: VM
Date: 9-19-24
Time: 17:20

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

AUG 2020 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

[1] If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

VW-066

Chain of Custody (COC) / Analytical Request Form

COC Number: **21 -**

Page 1 of 1

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Environmental Division
Waterloo
Work Order Reference
WT2427747

Telephone : +1 519 886 6910

Report To Contact and company name below will appear on the final report

Company: AGAT Laboratories
Contact: Eva Janzen; Neil Ramnaraign
Phone: 905-712-5096; 905-712-5131

Company address below will appear on the final report

Street: 5835 Coopers Avenue
City/Province: Mississauga/ON
Postal Code: L4Z 1Y2

Invoice To Same as Report To ☑ YES ☐ NO
Copy of Invoice with Report ☑ YES ☐ NO
Company:
Contact:

Reports / Recipients

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Merge QC/QCI Reports with COA ☐ YES ☑ NO ☐ N/A
☑ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax janzen@agatlabs.com
Email 2 ramnaraign@agatlabs.com
Email 3

Invoice Recipients

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax janzen@agatlabs.com
Email 2 ramnaraign@agatlabs.com

Turnaround Time (TAT) Requested

☑ Routine [R] if received by 3pm M-F - no surcharges apply
☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum
☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum
☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum
☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum
☐ Same day [E2] if received by 10am M-S - 200% rush surcharge.
Additional fees may apply to rush requests on weekends,

Date and Time Required for all E&P TATs:

For all tests with rush TATs requested, please contact your AM to confirm availability.

Project Information

ALS Account # / Quote #:
Job #: 24H198294
PO / AFE: 227836
LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center:
PO#
Major/Minor Code:
Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (ALS use only): WT2427747 AH

ALS Contact:

Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	1, 4-Dioxane	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	24H198294 - 6154165 (Zl, Zm, Zn) - MW3D	18-Sep-24	9:50	GW	3	R			
	24H198294 - 6154182 (Zl, Zm, Zn) - MW4	18-Sep-24	12:00	GW	3	R			
	24H198294 - 6154183 (Zl, Zm, Zn) - MW10	18-Sep-24	11:00	GW	3	R			

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?
☐ YES ☐ NO
Are samples for human consumption/ use?
☐ YES ☐ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

Ontario Provincial Water Quality Objectives (JULY, 1994)

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☐ NONE ☐ ICE ☑ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED
Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO
Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C

FINAL COOLER TEMPERATURES °C
4.8

SHIPMENT RELEASE (client use)

Released by: Jackal Ly
Date: Sep 18 2024
Time: 6pm

INITIAL SHIPMENT RECEPTION (ALS use only)

Received by:
Date:
Time:

FINAL SHIPMENT RECEPTION (ALS use only)

Received by: VM
Date: 9-19-24
Time: 17:20

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

AUG 2020 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

VW-066

APPENDIX G

ROOTED CROPS/PASTURE & CROP AREA WATER BUDGET AND RUN-OFF

APPENDIX G: ROOTED CROPS/PASTURE SCRUBS AREA, PRE-DEVELOPMENT WATER BUDGET- White Church Rd. E. Upper James St. Hamilton

1. Climate Information

Precipitation (collected from Env. Canada data)	930	mm/a
Evapotranspiration (calculated by Thornthwaite method)	609	mm/a
Water Surplus	321	mm/a

2. Infiltration Rates

MOE Hydrogeological Technical Information (April 1995) - Infiltration Factors (Table 2)

Flat Land (average slope 2.8 m to 3.8 m per km)	0.2
Medium combinations of clay and loam	0.2
Cultivated Lands	0.1
TOTAL	0.5

Infiltration	161	mm/a
Run-off	161	mm/a

Typical Recharge Rates (Table 3)

Clayey Silt/Clayey Silt	100	mm/a
Silt	125-150	mm/a
silty sand to sandy silt	150-200	mm/a

Site development area is underlain by glaciolacustrine material (clayey silt/silty clay material).

Based on the above, the recharge rate is approximately 100 mm/a

with runoff of 221 mm/a

3. Site Statistics

Pre-Development:

Building roof Area	1.447	ha	14,471	m^2
Hardscape Area	4.344	ha	43,442	m^2
Softscape Area	340.996	ha	3,409,960	m^2
TOTAL	346.787	ha	3,467,874	m^2

APPENDIX G: ROOTED CROPS/PASTURE SCRUBS AREA, PRE-DEVELOPMENT WATER BUDGET- White Church Rd. E. Upper James St. Hamilton

4. Annual Pre-Development Water Balance

Land Use	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Building Roofs	14,471	13,458	-	-	13,458
Green Space	3,409,960	3,171,263	2,076,666	340,996	753,601
Roads, Other impervious	43,442	40,401	-	-	40,401
TOTAL	3,467,874	3,225,122	2,076,666	340,996	807,461

5. Pre-Development Water Balance Summary

		Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Pre-Development		3,225,122	2,076,666	340,996	807,461

APPENDIX G: Thornthwaite Method For Calculating Evapotranspiration

Thornthwaite method for determining potential evapotranspiration

A monthly index is obtained from the equation:

$i = (t/5)^{1.514}$

Summation of the 12 monthly values gives an appropriate heat index, I.

To calculate a, the expression is:

$a = 0.000000675I^3 - 0.0000771I^2 + 0.01792I + 0.49239$

From these relations, a general equation for potential evapotranspiration is obtained. It is:

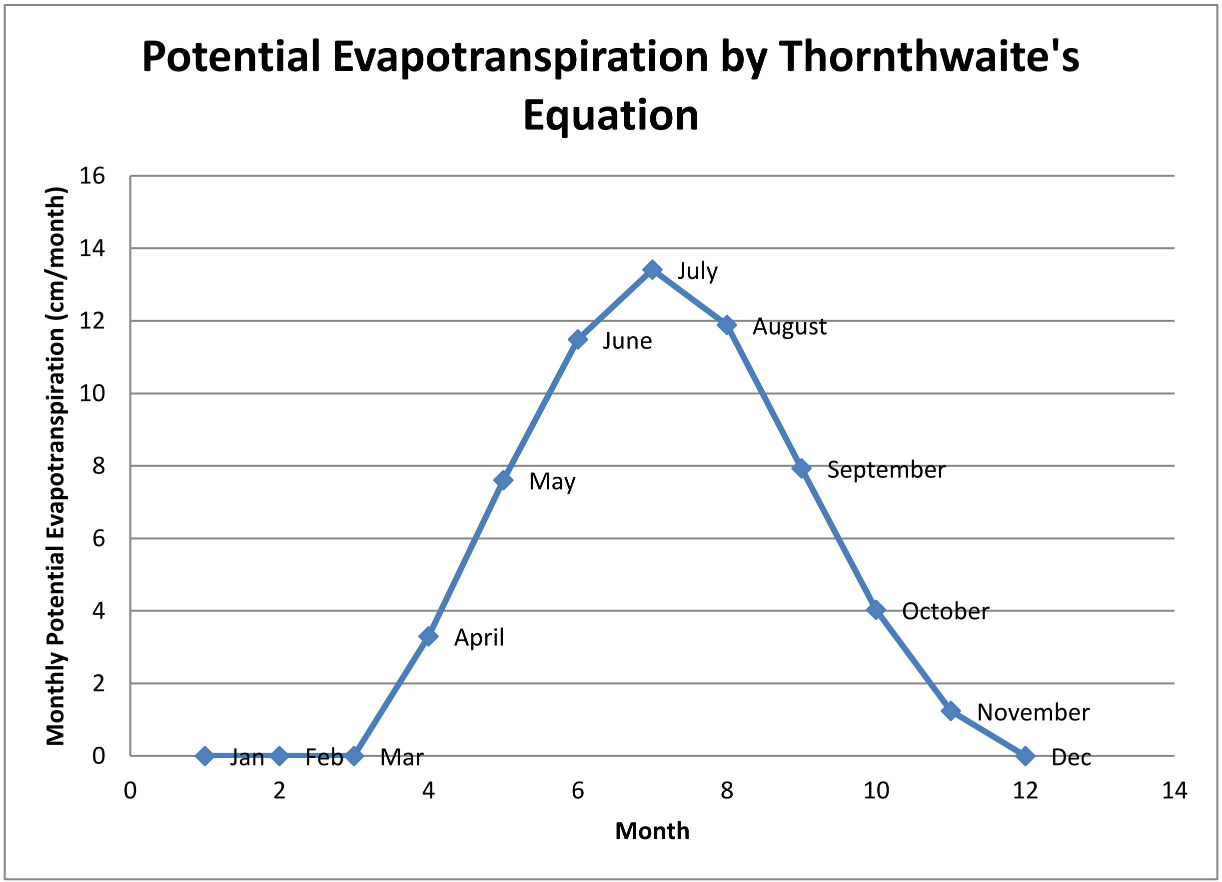
$$e = 1.6\left(\frac{10t}{I}\right)^a$$

in which a has the value given in the equation above.

APPENDIX G: Thornthwaite Method For Calculating Evapotranspiration

Hamilton Airport Climate Data

	Daily Average Temp (C^o)	Monthly index (i)	Potential Evapotranspiration (cm)	Adjusted Potential Evaportranspiration (cm)
Jan	-5.5			0
Feb	-4.6			0
Mar	-0.1			0
April	6.7	1.557530876	2.946791827	3.300406846
May	12.8	4.150260027	6.038429267	7.608420877
June	18.3	7.13034204	8.973741023	11.48638851
July	20.9	8.718883818	10.39718	13.4123622
August	20	8.156781464	9.902149829	11.88257979
September	15.8	5.708555702	7.625570812	7.930593644
October	9.3	2.558836857	4.238152363	4.026244745
November	3.7	0.633894267	1.526004012	1.236063249
Dec	-2.3			0
	HEAT INDEX (I) =	38.61508505		**60.88 cm/year**
				608.83 mm/year
	a =	1.108273042		



Annual to Monthly Pre-Development Surface Water Run-Off Values

Pre-Development Breakdown

Annual Pre-Development Precipitation and Run-Off

Land Use	*Area (m^2)*	*Precip. (m^3)*	*Run-Off (m^3)*
Building Roofs	14,471	13,458	**13,458**
Impevous Area	43,442	40,401	**40,401**
Landscape Area	3,409,960	3,171,263	**753,601**
Totals	3,467,873	3,225,122	**807,460**

Snow Water Equivalency (SWE) Factor

Canadian historical Snow Water Equivalent dataset (CanSWE, 1928-2023)

Temperature	*mm of Snow per 1 mm Water*	
-40°C to -29°C	100 mm	0.1
-28°C to -18°C	50 mm	0.5
-17°C to -13°C	40 mm	0.6
-12°C to -10°C	30 mm	0.7
-9°C to -7°C	20 mm	0.8
-6°C to -3°C	15 mm	0.85
-2°C to 1°C	10 mm	0.9

Monthly Water Balance Summary

Month	*Average Temperature*		*Average Snowfall*			*Average Rainfall*		*Average Precipitation*		*Average Monthly Run-Off*	
	Daily (°C)	*Active Factor*	*Monthly (cm)*	*Ratio (%)*	*SWE (mm)*	*Monthly (mm)*	*Ratio (%)*	*Monthly (mm)*	*Ratio (%)*	*Run-Off Factor*	*Run-Off (m^3)*
January	-5.5	0	32.4	27.43	27.54	27.4	3.51	56.8	6.33	Sub-zero	0
February	-4.6	0	31.1	26.33	26.44	26.4	3.38	57.2	6.37	Sub-zero	0
March	-0.1	0	18.3	15.50	16.47	43.3	5.55	63.7	7.10	Sub-zero	0
April	6.7	1	2.8	2.37	2.52	70.1	8.98	73.3	8.17	6.51%	233,189
May	12.8	1	0.00	0.00	0.00	85.5	10.96	85.5	9.53	6.83%	244,683
June	18.3	1	0.00	0.00	0.00	72.7	9.32	72.7	8.10	5.81%	46,884
July	20.9	1	0.00	0.00	0.00	82.7	10.60	82.7	9.22	6.61%	53,333
August	20	1	0.00	0.00	0.00	89.7	11.50	89.7	10.00	7.16%	57,847
September	15.8	1	0.00	0.00	0.00	80.9	10.37	80.9	9.02	6.46%	52,172
October	9.3	1	0.00	0.00	0.00	71.6	9.18	71.6	7.98	5.72%	46,174
November	3.7	1	7.5	6.35	6.60	83.2	10.66	91.3	10.17	9.06%	73,178
December	-2.3	0	26	22.02	25.10	46.8	6.00	71.9	8.01	Sub-zero	0
		Totals	118.1		105	780.3		897.3		Total Run-Off (m^3)	807,460

NOTES:

Dataset: 1981 to 2010 Climate Normals for Hamilton Airport (as averages)

Rationale of the assessment is based on the relationships between monthly averages of temperature, precipitation and snowfall (SWE).

Snow melt periods based on Environment Canada data and Farmers Almanac for Southern Ontario. Defined as March/April and May.

APPENDIX H

WOODED AREAS WATER BUDGET AND RUN-OFF

APPENDIX H: SIGNIFICANT WOODLAND AREA, PRE-DEVELOPMENT WATER BALANCE - White Church Rd. E. Upper James St. Hamilton

1. Climate Information

Precipitation (collected from Env. Canada data)	930	mm/a
Evapotranspiration (calculated by Thornthwaite method)	609	mm/a
Water Surplus	321	mm/a

2. Infiltration Rates

MOE Hydrogeological Technical Information (April 1995) - Infiltration Factors (Table 2)

Flat Land (average slope 2.8 m to 3.8 m per km)	0.2	
Medium combinations of clay and loam	0.2	
Cultivated Lands	0.2	
TOTAL	0.6	
Infiltration	193	mm/a
Run-off	128	mm/a

Typical Recharge Rates (Table 3)

Clayey Silt/Clayey Silt	100	mm/a
Silt	125-150	mm/a
silty sand to sandy silt	150-200	mm/a

Site development area is underlain by glaciolacustrine material (clayey silt/silty clay material).

Based on the above, the recharge rate is approximately 100 mm/a

with runoff of 221 mm/a

3. Site Statistics

<u>Pre-Development:</u>

Building roof Area	0.000	ha	0	m^2
Hardscape Area	0.000	ha	0	m^2
Wooded Area	17.580	ha	175,800	m^2
TOTAL	17.580	ha	175,800	m^2

APPENDIX H: SIGNIFICANT WOODLAND AREA, PRE-DEVELOPMENT WATER BALANCE - White Church Rd. E. Upper James St. Hamilton

4. Annual Pre-Development Water Balance

Land Use	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Building Roofs	0	0	-	-	0
Green Space	175,800	163,494	107,062	17,580	38,852
Roads, Other impervious	0	0	-	-	0
TOTAL	175,800	163,494	107,062	17,580	38,852

5. Pre-Development Water Balance Summary

		Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Pre-Development		163,494	107,062	17,580	38,852

Thornthwaite method for determining potential evapotranspiration

A monthly index is obtained from the equation:

$i = (t/5)^{1.514}$

Summation of the 12 monthly values gives an appropriate heat index, I.

To calculate a, the expression is:

$a = 0.000000675I^3 - 0.0000771I^2 + 0.01792I + 0.49239$

From these relations, a general equation for potential evapotranspiration is obtained. It is:

$$e = 1.6\left(\frac{10t}{I}\right)^{a}$$

in which a has the value given in the equation above.

APPENDIX H: Thornthwaite Method For Calculating Evapotranspiration

Hamilton Airport Climate Data

	Daily Average Temp (C°)	Monthly index (i)	Potential Evapotranspiration (cm)	Adjusted Potential Evaportranspiration (cm)
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Mar	-0.1			0
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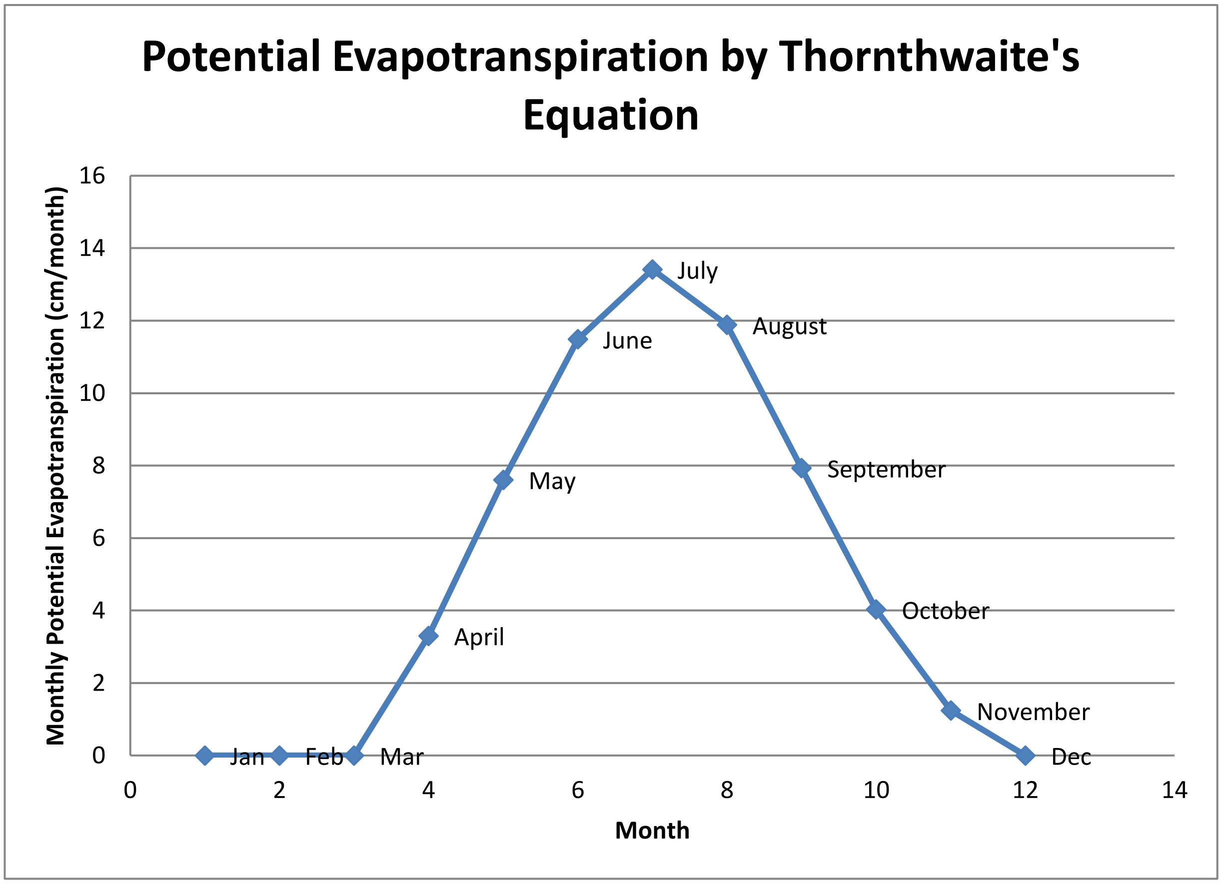
May	12.8	4.150260027	6.038429267	7.608420877
June	18.3	7.13034204	8.973741023	11.48638851
July	20.9	8.718883818	10.39718	13.4123622
August	20	8.156781464	9.902149829	11.88257979
September	15.8	5.708555702	7.625570812	7.930593644
October	9.3	2.558836857	4.238152363	4.026244745
November	3.7	0.633894267	1.526004012	1.236063249
Dec	-2.3			0
	HEAT INDEX (I) =	38.61508505		**60.88 cm/year**
				608.83 mm/year
	a =	1.108273042		



Annual to Monthly Pre-Development Surface Water Run-Off Values

Pre-Development Breakdown

Annual Pre-Development Precipitation and Run-Off

Land Use	*Area (m^2)*	*Precip. (m^3)*	*Run-Off (m^3)*
Building Roofs	0	0	**0**
Impevous Area	0	0	**0**
Landscape Area	175,800	163,494	**38,852**
Totals	175,800	163,494	**38,852**

Snow Water Equivalency (SWE) Factor

Canadian historical Snow Water Equivalent dataset (CanSWE, 1928-2023)

Temperature	*mm of Snow per 1 mm Water*	
-40°C to -29°C	100 mm	0.1
-28°C to -18°C	50 mm	0.5
-17°C to -13°C	40 mm	0.6
-12°C to -10°C	30 mm	0.7
-9°C to -7°C	20 mm	0.8
-6°C to -3°C	15 mm	0.85
-2°C to 1°C	10 mm	0.9

Monthly Water Balance Summary

Month	*Average Temperature*		*Average Snowfall*			*Average Rainfall*		*Average Precipitation*		*Average Monthly Run-Off*	
	Daily (°C)	*Active Factor*	*Monthly (cm)*	*Ratio (%)*	*SWE (mm)*	*Monthly (mm)*	*Ratio (%)*	*Monthly (mm)*	*Ratio (%)*	*Run-Off Factor*	*Run-Off (m^3)*
January	-5.5	0	32.4	27.43	27.54	27.4	3.51	56.8	6.33	Sub-zero	0
February	-4.6	0	31.1	26.33	26.44	26.4	3.38	57.2	6.37	Sub-zero	0
March	-0.1	0	18.3	15.50	16.47	43.3	5.55	63.7	7.10	Sub-zero	0
April	6.7	1	2.8	2.37	2.52	70.1	8.98	73.3	8.17	6.51%	11,220
May	12.8	1	0.00	0.00	0.00	85.5	10.96	85.5	9.53	6.83%	11,773
June	18.3	1	0.00	0.00	0.00	72.7	9.32	72.7	8.10	5.81%	2,256
July	20.9	1	0.00	0.00	0.00	82.7	10.60	82.7	9.22	6.61%	2,566
August	20	1	0.00	0.00	0.00	89.7	11.50	89.7	10.00	7.16%	2,783
September	15.8	1	0.00	0.00	0.00	80.9	10.37	80.9	9.02	6.46%	2,510
October	9.3	1	0.00	0.00	0.00	71.6	9.18	71.6	7.98	5.72%	2,222
November	3.7	1	7.5	6.35	6.60	83.2	10.66	91.3	10.17	9.06%	3,521
December	-2.3	0	26	22.02	25.10	46.8	6.00	71.9	8.01	Sub-zero	0
		Totals	118.1		105	780.3		897.3		Total Run-Off (m^3)	38,852

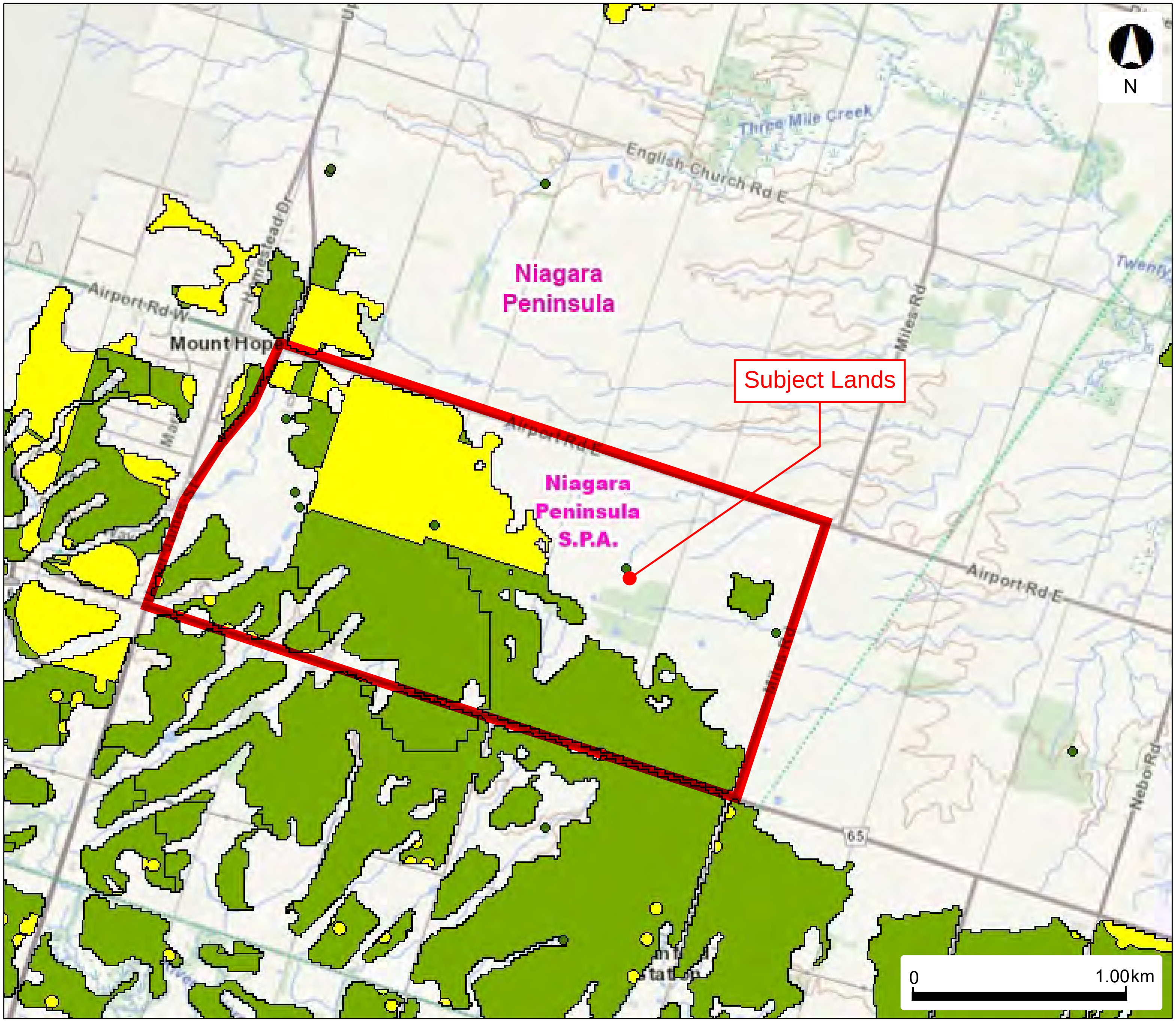
NOTES:

Dataset: 1981 to 2010 Climate Normals for Hamilton Airport (as averages)

Rationale of the assessment is based on the relationships between monthly averages of temperature, precipitation and snowfall (SWE).

Snow melt periods based on Environment Canada data and Farmers Almanac for Southern Ontario. Defined as March/April and May.

White Church Road Lands Source Protection Maps - Groundwater Recharge Area



Legend

- ● Permits To Take Water: Active
- 🟩 Intake Protection Zone Q
- 🟥 Wellhead Protection Area Q1
- 🟦 Wellhead Protection Area Q2
- Significant Groundwater Recharge Area
  - 🟧 N/A
  - 🟩 0
  - 🟩 2
  - 🟩 4
  - 🟨 6
- 🟪 Source Protection Areas
- 🟪 Source Protection Regions

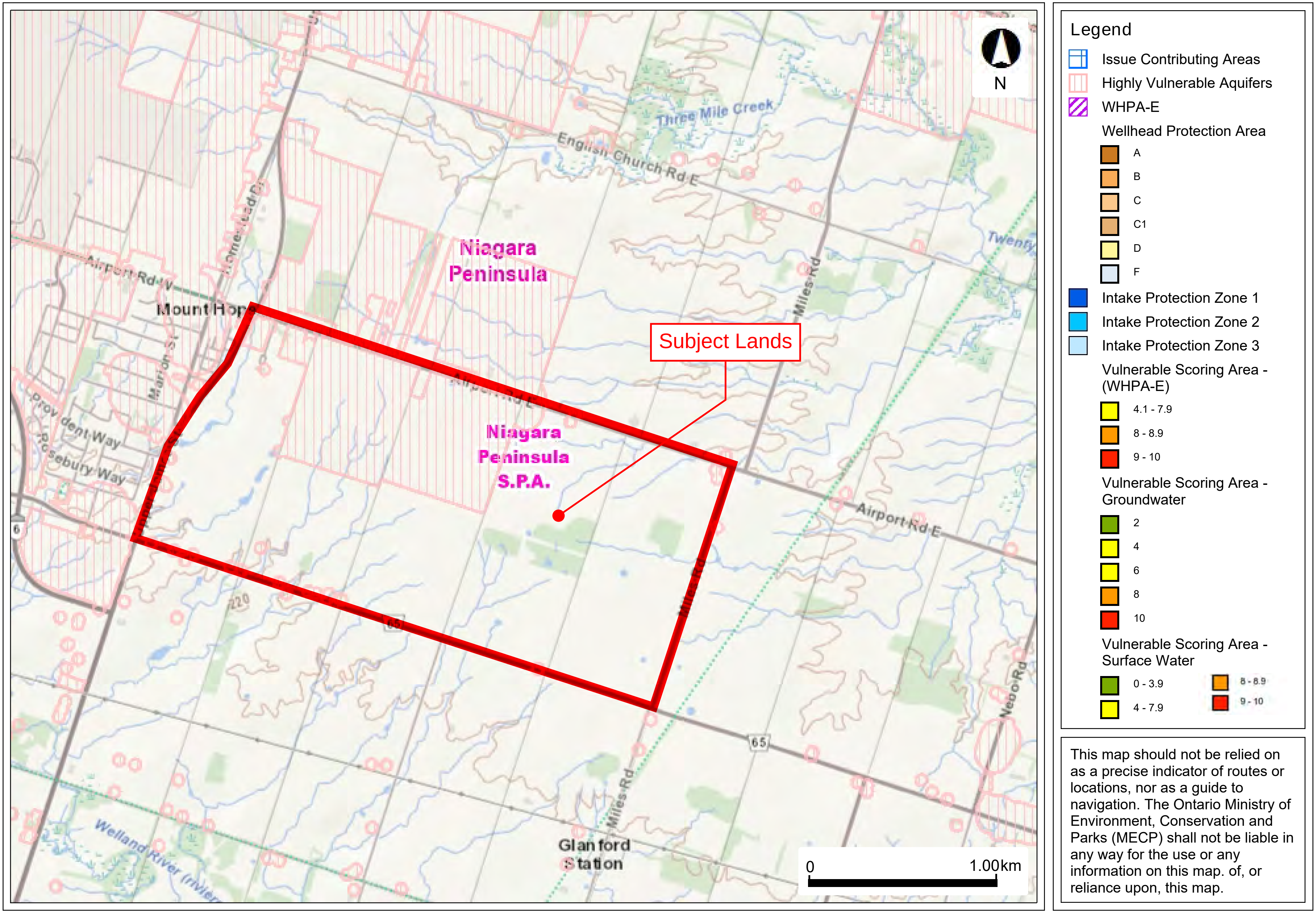
This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Environment, Conservation and Parks (MECP) shall not be liable in any way for the use or any information on this map. of, or reliance upon, this map.

Ontario

THIS IS NOT A PLAN OF SURVEY.

Map Created: 12/2/2024
Map Center: 43.14892 N, -79.89435 W

White Church Road Lands Source Protection Maps - Water Quality



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Ontario

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Map Created: 12/2/2024
Map Center: 43.14892 N, -79.89435 W

Appendix C Hydrology and Hydraulics

SCS consulting group ltd

White Church Boundary Expansion Area

Stormwater Management Report

January 2025

Submitted by:

SCS Consulting Group Ltd
30 Centurian Drive, Suite 100
Markham, ON, L3R 8B8
Phone 905 475 1900
Fax 905 475 8335

Project Number: 2600

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Submission History

Submission	Date	In Support Of	Distributed To
1st	January 2025	OPA for Urban Boundary Expansion	City of Hamilton, NPCA

1.0 Introduction

SCS Consulting Group Ltd. has been retained by Whitechurch Landowners Group Inc. to prepare a Stormwater Management (SWM) Report in support of the White Church Road lands, located in the City of Hamilton.

1.1 Purpose

This SWM Report has been prepared for the Phase 1 Subwatershed Study (SWS) in support of the Official Plan Amendment application to designate the Subject Lands part of the Urban Boundary. The Concept Plan is provided in **Appendix A**. The Concept Plan consists of the following land uses:

- residential,
- institutional,
- park/open space,
- commercial,
- stormwater management pond blocks,
- pipeline/trail network,
- natural heritage system, and
- proposed arterial and collector roads.

The purpose of this report is to support the SWS components of hydrology, hydraulics, and stormwater management, in accordance with the City of Hamilton Draft Framework for Urban Boundary Expansion Applications, Hamilton Comprehensive Development Guidelines and Financial Policies Manual, Niagara Peninsula Conservation Authority (NPCA), and the Ministry of Environment, Conservation and Parks (MECP) guidelines.

1.2 Study Area

The Subject Lands comprise a grouping of parcels generally bounded by Upper James Street to the west, Airport Road East to the north, Miles Road to the east and White Church Road East to the south (see **Figure 1.1**). The study area is approximately 364 ha in size.

In the existing condition, the Subject Lands are primarily comprised of agricultural land, a golf course, rural residential, and open space areas. The Subject Lands are located within the Twenty Mile Creek and the Upper Welland River watersheds. Two existing pipelines, owned by Enbridge and Westover Express Pipeline Limited, traverse the Subject Lands from east to west.

1.3 Background Information

In preparation of the SWM strategies, the following design guidelines and standards were used:

- Ministry of Environment, Conservation and Parks (MECP) Municipal Consolidated Linear Infrastructure Environmental Compliance Approvals (CLI-ECA), June 2023;
- Hamilton Draft Framework for Processing and Evaluating Urban Boundary Expansion Applications, prepared by City of Hamilton, dated August 13, 2024;
- Hamilton Complete Streets Guidelines (June 2022);
- Hamilton Comprehensive Development Guidelines and Financial Policies Manual (2019);
- Niagara Peninsula Conservation Authority Stormwater Management Guidelines (March 2010); and
- Ministry of Environment, Conservation and Parks (MECP) Stormwater Management Planning and Design Manual (March 2003).

The SWM strategies in this report are based on the following reports:

- Preliminary Hydrogeological Investigation, prepared by Landtek Limited, dated January 31, 2025;
- Geotechnical Investigation Proposed Development of the White Church Lands, prepared by Landtek Limited, dated November 20, 2024; and
- Upper Welland River Watershed Plan (Draft), prepared by Niagara Peninsula Conservation Authority, dated March 2011.

Refer to **Appendix B-1** for Relevant Excerpts. Refer to SWS Appendix B and C for Geotechnical Investigation and Preliminary Hydrogeological Investigation respectively.

The SWM strategies in this report are based on the following drawings:

- Bridge White Church Road prepared by City of Hamilton dated May 2017; and
- Drawing 95-W-66 Cayuga Water System Trunk Watermain (Mount Hope to Caledonia), prepared by Thorburn Penny Consulting Engineers, dated February 1994.

Refer to **Appendix B-2** for Relevant Engineering Drawings.

A pre-consultation meeting with City of Hamilton was held on October 2, 2023 which confirmed the following:

- SWS Terms of Reference (TOR) Scope;
- White Church Secondary Plan is located within the headwaters of the Twenty Mile Creek and the Upper Welland River;
- The objective will be to generally maintain the existing drainage divides;
- NPCA advised that no floodplain mapping is required within the proposed development limit, as the drainage areas upstream of any drainage features are less than 125 ha;
- Stormwater management will consider quality, quantity and erosion control;
- Control of post to pre peak flows for the 2 through 100 year storm events is anticipated based on NPCA criteria. NPCA do not typically consider control of Regional storm flows, unless there is a known flood concern;
- Under existing conditions, the site drains to multiple small drainage features. The SWS will consider erosion thresholds at the proposed storm facility outlets and receiving drainage features;
- The entire Secondary Plan area should be included. The TOR should highlight that a high level analysis will be completed for non-participating properties;
- The SWS will include overall site water budget for existing conditions, post-development without mitigation and post-development with mitigation;
- One year of baseline groundwater monitoring is required by NPCA;
- The TOR should reference the TRCA Wetland Water Balance Risk; Evaluation document;
- Reference Hamilton Complete Streets Design Guidelines with respect to potential LIDs within municipal roads; and
- City of Hamilton noted that SWS should aim to maximize opportunities for LIDs, and ensure that the LIDs can be implemented through the future Secondary Planning stage and detailed design processes.

Refer to **Appendix B-4** for the pre-consultation meeting summary.

2.0 Geotechnical and Hydrogeological Conditions

2.1 Soils

The soil classifications were identified in the Geotechnical Investigation prepared by Landtek Limited, dated November 20, 2024 based on land uses visible in recent aerial photography and site reconnaissance. The Geotechnical Investigation notes that the predominant soil types are silt, clayey silt/silty clay, and till deposits.

Refer to SWS Appendix B for the Geotechnical Investigation.

The site soils are considered Hydrologic Soil Group BC and C according to the MTO Drainage Management Manual (1997) Design Chart 1.08. The Soil Conservation Service Curve Number (CN) and runoff coefficient used for both the Hydrologic Soil Group C are shown in **Table 2.1**.

Table 2.1: CN and Runoff Coefficient Summary

Land Use or Surface Classification	CN for Soil Group C	Runoff Coefficient for Soil Group C[1]
Woodland	73	0.08
Pasture	76	0.10
Cultivated	82	0.22
Impervious Area	98	0.90

Source: MTO Drainage Management Manual (1997)
Note: [1] Runoff Coefficients used are for flat topography

Hydraulic conductivity was tested ranging between $6.42x10^{-10}$ to $4.69x10^{-8}$ m/s (Preliminary Hydrological Investigation, December 2024).

2.2 Groundwater

A Preliminary Hydrogeological Investigation for the Subject Lands has been prepared by Landtek Limited, dated December 16, 2024. Landtek Limited is actively monitoring groundwater levels across the site with readings from July 19, 2024 to September 18, 2024. Further groundwater monitoring is ongoing and will continue to ensure the spring high groundwater level is observed. Based on the groundwater levels collected to date, the minimum depth of seasonally high groundwater observed is approximately 0.21 m below existing ground (BH/MW4) to 7.4 m below existing ground (BH/MW9).

Refer to SWS Appendix C for the Preliminary Hydrogeological Investigation including the groundwater monitoring results.

3.0 Topography and Grading

3.1 Existing Conditions

3.1.1 Topography

Under existing conditions, the southwest portion of the Subject Lands generally slopes south toward White Church Road East. The west portion of the Subject Lands generally slopes southwest toward Upper James Street. The northeast portion of the Subject Lands slopes east toward the intersection of Airport Road East and Miles Road. The existing topography has slopes up to 4.0%. The ground surface elevations through the study area range from approximately 220 m to approximately 232 m.

3.1.2 Floodplain

All drainage features within the Subject Lands have drainage areas less than 125 ha and therefore do not contain regulated floodplains, as confirmed with NPCA.

3.2 Proposed Conditions

3.2.1 Site Grading

In general, the proposed development will be graded in a manner which will satisfy the following goals:

- Satisfy the City of Hamilton lot and road grading criteria including:
  - Minimum Road Grade: 0.75%
  - Maximum Road Grade: 6.0% (5.0% for Major Collector)
  - Maximum Road Grade for Through Roads at Intersections: 3.5% (3.0% for Major Collector)
  - Maximum Road Grade for Stop Roads at Intersections: 2.5% (2% for Major Collector)
  - Maximum Lot Grade: 5%
- Provide continuous road grades for overland flow conveyance;
- Minimize the need for retaining walls;
- Minimize the volume of earth to be moved and minimize cut/fill differential;
- Minimize the need for rear lot catchbasins; and
- Achieve the stormwater management objectives required for the proposed development.

A preliminary grading plan is provided on **Figure 3.1**.

The proposed grades generally match to existing grades at the existing pipelines, natural feature boundaries, and the boundary roads.

At the detailed design stage, the preliminary grading shown on **Figure 3.1** will be subject to a more in-depth analysis in an attempt to balance the cut and fill volumes and minimize slopes and walls.

4.0 Storm Drainage

4.1 Existing Storm Drainage

An existing storm drainage plan was prepared for the Subject Lands. The drainage boundaries were determined using a combination of detailed ground based topographic survey and remote sensing completed by A.T. Mclaren in 2023. The existing storm drainage plan is shown in **Figure 4.1.**

Under existing conditions, storm runoff from approximately 129 ha drains northeast to drainage features which are tributary to Twenty Mile Creek via existing 600 mm to 800 mm culverts under Airport Road East and 600 mm culverts under Miles Road. Storm runoff from approximately 210 ha drains south to existing drainage features which are tributary to the Upper Welland River, via existing 400 mm to 1000 mm culverts under White Church Road East. Also within the Upper Welland River Subwatershed, storm runoff from approximately 22 ha drains west to the tributary of Welland River, which outlets to existing culverts under Upper James Street.

There are several existing ponds located within the Subject Lands. Refer to the Existing Conditions – Terrestrial Resources Figure in the SWS Appendix F for existing pond locations.

Through the Upper Welland River Watershed Plan, a municipal drain has been identified within the Subject Land. Refer to **Appendix B-1** for Upper Welland River Watershed Municipal Drains Figure. The municipal drain will be assessed at the Secondary Planning stage.

4.2 Proposed Storm Drainage

Seven stormwater management facilities (SWMF) are proposed to service the Subject Lands. The proposed SWMFs have been situated to generally maintain the existing drainage boundaries to the extent feasible. The proposed drainage boundaries take into account the existing topography and existing gas pipelines. Storm sewer crossing elevations and allowable grading criteria associated with the gas pipelines have been taken into consideration in establishing the proposed stormwater drainage plan. A detailed subsurface investigation of the pipeline elevation will be undertaken at the Secondary Planning stage. The proposed storm drainage plan is shown on **Figure 4.2**.

Runoff from the western portion of Catchment 201 (27.22 ha) will drain to the proposed SWMF 1, outletting to an existing 1200 mm x 1200 mm open bottom box culvert located on Upper James Street.

Runoff from Catchment 202 (29.23 ha) will drain southwest to the proposed SWMF 2, discharging to an existing 1000 mm diameter culvert located on White Church Road East.

Runoff from Catchment 203 (80.15 ha) will drain south to SWMF 3 discharging to an existing 900 mm diameter culvert located on White Church Road East.

Runoff from Catchment 204a (54.37 ha) will drain south contributing to SWMF 4 located south of White Church Road East via the future storm sewer network. Catchment 204b (7.36 ha) represents the area associated with the SWMF 4 block and runoff from this catchment will drain directly to SWMF 4 via overland flow. Catchment 204b is located south of White Church Road within the Greenbelt lands, outside of any natural heritage features and associated buffers, on lands owned by a participating landowner in the Whitechurch Landowners Group.

Runoff from Catchment 205 (40.45 ha) will drain south to the proposed SWMF 5 discharging to an existing 700 mm diameter existing culvert located on White Church Road East.

Runoff from Catchment 206 (23.17 ha) will drain east to the proposed SWMF 6 discharging to the existing culvert located on Miles Road.

Runoff from Catchment 207 (104.06 ha) will drain north to the proposed SWMF 7 discharging to the existing culvert located on Airport Road East.

On-site controls are proposed for Catchment 208 (5.50 ha). Catchment 208 is a proposed residential block located at the intersection of Airport Road East and Miles Road. On-site control details will be provided at Secondary Planning stage and will outlet to an existing culvert located on Airport Road East.

5.0 Stormwater Management

5.1 Stormwater Management Criteria

The following stormwater runoff control criteria have been established based on the greatest requirements of each of the design guidelines and standards listed in **Section 1.3** and discussions with agencies. The stormwater runoff criteria are summarized below in **Table 5.1**:

Table 5.1: Stormwater Runoff Control Criteria

Criteria	Control Measure
Quality Control: Total Suspended Solid and Total Phosphorous	Total Suspended Solids (TSS): Control 90th percentile storm event and if conventional methods are necessary, then MECP Enhanced Level Protection (80% TSS Removal). (CLI ECA) A minimum of "Normal" level of water quality treatment, as defined in the MOE design guidelines (2003) is required for all SWM facilities. This is equivalent to a 70% TSS reduction. (NPCA) "Enhanced" level of water quality treatment (80% TSS reduction) will be required for stormwater discharging to all watercourses containing Type 1 – critical fish habitat. (NPCA) The SWM Facility for a development site is required to include measures to eliminate or mitigate adverse temperature impacts due to the increase in impervious surfaces and the ponding of water in SWM ponds. Particular attention is to be given to those systems discharging to coolwater or coldwater receiving systems. (NPCA) Post-development water temperature regime is to mimic or enhance the pre-development regime. (NCPA) Total Phosphorous: Phosphorus removal targets will be typically provided for in the TSS removal targets, unless specific targets are developed through a management strategy (NPCA).

Criteria	Control Measure
Erosion Control	Erosion control to detain and release the 25 mm, 4-hour Chicago design storm over a 24-hour period shall be provided for all receiving systems that are demonstrated to be stable watercourses or for proposed development that comprise less than 10% of the total area that drains to the receiving system (NPCA). The geomorphologic assessments and criteria contained in the SWM Design Manual (MOE, 2003) shall be used for all receiving systems that are unstable under existing conditions or for proposed developments that comprise a significant proportion of the total area draining to the receiving system (NPCA) Criteria identified in larger-scale studies that have directly evaluated the receiving systems, such as Subwatershed Studies or Master Drainage Plans, shall take precedence over the criteria presented herein (NPCA).
Water Budget	Water balance impacts should be evaluated during the design of a site stormwater management system. All efforts should be made to match pre- and post-development infiltration volumes in order to maintain groundwater recharge. (NPCA) Untreated stormwater shall be prevented from being directly infiltrated. (NPCA) Control as per the evaluation of anticipated changes in water balance between existing and proposed assessed through a stormwater management plan. The assessment should include sufficient detail to be used at a local site level. If it is demonstrated, using the approved water balance estimation methods that the site's proposed to existing water balance cannot be met, and Maximum Extent Possible has been attained ….. (CLI ECA)
Quantity Control	Match or reduce post-development peak flows to pre-development peak flows for a range of design storm events (2, 5, 25 and 100 year storm events) (NPCA). Different design storm distributions and durations shall be assessed in order to determine the critical storm that yields the lowest pre-development peak flow and the highest post-development peak flow. At a minimum, the 3-hour Chicago, 12-hour AES and 24-hour SCS distributions should be considered. (NPCA)

*Refer to City of Hamilton Consolidated Linear Infrastructure Environmental Compliance Approval Number 005-S701, Appendix A (included in **Appendix B-3**) for further explanation on design criteria.

Based on the Sustainable Technology Evaluation Program (STEP) LID wiki, the 90th Percentile Volume Target for the site is approximately the 28.5 mm rainfall event (refer to Figure 3.67 in **Appendix B-1**).

5.2 Stormwater Management Plan

In accordance with the Ministry of Environment Stormwater Management Planning and Design Manual (2003), a review of stormwater management best practices was completed using a treatment train approach, which evaluated lot-level, conveyance system and end-of-pipe alternatives.

The following study area characteristics and constraints were taken into consideration:

- The ground elevations through the study area range from approximately 220 m in the south to approximately 232 m in the north;
- Based on the Geotechnical investigation, study area soils consist of clayey silt to silty clay, silty clay to clayey silt till, silt and silt till;
- Hydraulic conductivity was tested ranging between $6.42\text{x}10^{-10}$ to $4.69\text{x}10^{-8}$ m/s;
- Within the installed site wells, groundwater was observed at depths ranging between 0.21 m to 7.44 m below existing grade;
- The proposed urban boundary expansion is approximately 364 ha and consists of residential, commercial, institutional uses and natural heritage features and associated buffer; and,
- The majority of the study area drains south to the Upper Welland River watershed via culverts under White Church Road East and Upper James Street, while the remainder of the area drains north east to the Twenty Mile Creek watershed via culverts under Airport Road East and Miles Road.

In addition, the Hamilton Comprehensive Development Guidelines and Financial Policies Manual, a wide range of stormwater management techniques has been considered including lot-level, conveyance system and end-of-pipe controls. Tables G.1 and G.2 of the Hamilton Guidelines provide a comprehensive list of stormwater management practices and the City's perspective on each practice. Based on these tables and the Subject Lands characteristics and constraints, the feasibility of at-source, conveyance and end-of-pipe SWM controls were evaluated for use in the Subject Lands to achieve the design criteria provided in **Section 5.1**. Refer to **Appendix D** for a summary of the feasibility evaluation. Based on the feasibility evaluation, the proposed SWM Plan will include a treatment train of the following LID measures and SWM controls within the residential areas:

- Roof leader discharge to surface
- Roof leader discharge to soakaway pits
- Porous pavement (for residential driveways)
- Pervious pavement (for driveways)
- Pervious pipe systems
- Pervious catchbasin systems

Within the commercial area of the Subject Lands, the following additional stormwater management practices will be considered:

- Rooftop storage
- Parking lot storage
- Manufactured Treatment devices (oil grit separators)

Refer to **Sections 5.2.1** and **5.2.4**, below, for additional information on LID measures and end-of-pipe SWM facilities, respectively.

At the Secondary Planning stage, a hydrogeology assessment and water balance evaluation will be completed to confirm the recommended Low Impact Development (LID) techniques and to quantify the proposed rainwater retention volume.

Per the City of Hamilton Guidelines, end-of-pipe facilities may include wet ponds, dry ponds, wetland or hybrid stormwater management facilities. The City of Hamilton guidelines allow for superpipes for redevelopment of existing areas, where it can be demonstrated that there is no suitable alternative. Additional end-of-pipe facilities such as infiltration trenches may be considered subject to a geotechnical assessment.

Beacon Environmental has advised that the Subject Lands are located within the Bird Hazard zones associated with the Hamilton Airport. Therefore, it is desirable to minimize wet ponds. Where wet ponds are proposed, design measures such as steep slopes and dense plantings will be provided to discourage use by water fowl.

5.2.1 Water Quality: TSS and Total Phosphorous

Water quality control will be provided by a treatment train of low impact development techniques and end-of-pipe facilities. As described in **Section 5.2**, low impact development techniques may include:

- Roof leader discharge to surface
- Roof leader discharge to soakaway pits

- Pervious pavement (for driveways)
- Pervious pipe systems
- Pervious catchbasin systems

All efforts should be made to achieve the 90th percentile control target. If the 90th percentile control target cannot be achieved due to site constraints, then conventional methods for quality control are required to achieve an Enhanced Level of Protection (80% TSS Removal). Total phosphorus will be removed as part of TSS removal, no additional phosphorus budget assessment or removal rate is required.

Based on the NPCA criteria, it is anticipated that “Normal” level of water quality treatment (70% TSS reduction) will be provided for all SWMF. If critical fish habitat is identified through the ecological studies, “Enhanced” level of water quality treatment (80% TSS reduction) will be provided for the associated SWMF.

As noted in **Section 5.2**, if wet pond features are utilized, appropriate mitigative measures shall be implemented based on the proximity of the facilities within the Bird Hazard zones associated with the Hamilton Airport. Measures may include steep slopes and dense plantings will be provided to discourage use by water fowl.

5.2.2 Erosion Control

The attenuation of the extended detention volume in the SWMFs will provide erosion protection for the downstream watercourses as well as promote sediment removal for water quality. The extended detention volume for the proposed SWMFs will be sized based on the detention of the 25 mm - 4-hour Chicago rainfall event. The volume calculated for the extended detention will be attenuated for a minimum of 24 hours. At the Secondary Planning stage, an erosion assessment will be completed at each SWMF outlet, and the extended detention volume may be released over a longer duration if warranted.

5.2.3 Water Budget

The assessment and quantification of infiltration across the study site is discussed in the Preliminary Hydrogeological Investigation prepared by Landtek Limited, dated December 16, 2024. The report also provides preliminary pre-development water budget calculations for the subject site.

Based on the Preliminary Hydrogeological Investigation, the total pre-development annual infiltration rate is 742,690 m^3/year. This serves as the target infiltration rate for the development in order to mitigate the loss of infiltration associated with development. The post-development unmitigated and mitigated water balance assessments will be provided at Secondary Planning Stage.

Through the Existing Conditions – Terrestrial Resources Figure, prepared by Beacon Environmental dated December 2024 (refer to SWS Appendix F), a number of drainage features has been identified for the existing conditions as shown on **Figure 5.1**. A feature based water balance risk assessment will be assessed at the Secondary Planning stage after the lands are designated Urban to determine the appropriate feature based water balance approach for each feature.

5.2.4 Quantity Control

Hydrologic modelling was undertaken using the Visual Otthymo Version 6.2 software (VO6) based on the 3-hour Chicago, 12-hour AES and 24-hour SCS Distribution methods. The study area is located within the City of Hamilton, therefore, the Mount Hope IDF rainfall information was obtained from the Hamilton Comprehensive Development Guidelines and Financial Policies Manual to determine the existing peak flows to outlet locations. The existing flows from the study area to the outlet locations are summarized in **Appendix C**.

A summary of modelling parameters and an existing VO6 schematic are provided in **Appendix C**. A digital download page with the VO6 hydrology model is also provided in **Appendix C**.

Table 5.2 summarizes the existing catchments used to establish the existing release rates for each SWMF outlet.

Table 5.2: Summary of SWMF Outlet Parameters for Existing Release Rate Determination

SWMF	Description of Outlet Location	Existing Catchment ID	Existing Catchment Area (ha)
SWMF 1	1200 mm x 1200 mm box Open Bottom Concrete Culvert	101	25.42
SWMF 2	1000 mm dia. Culvert	102	45.95
SWMF 3	900 mm dia. Culvert	104	43.99
SWMF 4	Twin 1000 mm dia. Culverts	107, 108, 120	28.74
SWMF 5	Twin 600 mm dia. Culverts and a 400 mm dia. Culvert	109	23.26
SWMF 6	600 mm dia Culvert	116	41.99
SWMF 7	800 mm dia. Culvert	118	63.51

The target flows for each of the SWMFs, based on the existing peak flow and uncontrolled post development peak flow rates to the corresponding outlet locations, are summarized in **Table 5.3**- **Table 5.9**.

Table 5.3: SWMF 1 Release Rates

Return Period Storm	Existing Release Rates (NHYD 101)			Proposed Unmitigated Release Rates (NHYD 201)		
	3 Hour Chicago (m^3/s)	12 Hour AES (m^3/s)	24 Hour SCS (m^3/s)	3 Hour Chicago (m^3/s)	12 Hour AES (m^3/s)	24 Hour SCS (m^3/s)
2 Year	0.150	0.139	0.264	2.600	0.555	2.699
5 Year	0.342	0.267	0.507	4.096	0.845	4.150
10 Year	0.502	0.365	0.693	5.118	1.054	5.159
25 Year	0.736	0.503	0.957	6.560	1.350	6.450
50 Year	0.909	0.612	1.149	7.605	1.560	7.478
100 Year	1.119	0.727	1.350	8.781	1.776	8.413

Table 5.4: SWMF 2 Release Rates

Return Period Storm	Existing Release Rates (NHYD 102)			Proposed Unmitigated Release Rates (NHYD 202)		
	3 Hour Chicago (m^3/s)	12 Hour AES (m^3/s)	24 Hour SCS (m^3/s)	3 Hour Chicago (m^3/s)	12 Hour AES (m^3/s)	24 Hour SCS (m^3/s)
2 Year	0.178	0.218	0.311	2.045	0.459	2.267
5 Year	0.405	0.425	0.606	3.337	0.737	3.605
10 Year	0.596	0.586	0.831	4.327	0.941	4.570
25 Year	0.874	0.810	1.153	5.525	1.220	5.904
50 Year	1.081	0.988	1.387	6.607	1.433	6.768
100 Year	1.330	1.175	1.634	7.614	1.656	7.798

Table 5.5: SWMF 3 Release Rates

Return Period Storm	Existing Release Rates (NHYD 104)			Proposed Unmitigated Release Rates (NHYD 203)		
	3 Hour Chicago (m^3/s)	12 Hour AES (m^3/s)	24 Hour SCS (m^3/s)	3 Hour Chicago (m^3/s)	12 Hour AES (m^3/s)	24 Hour SCS (m^3/s)
2 Year	0.387	0.318	0.680	4.878	1.176	5.405
5 Year	0.872	0.600	1.278	7.969	1.888	8.665
10 Year	1.269	0.810	1.719	10.363	2.420	11.018
25 Year	1.833	1.095	2.330	13.532	3.142	14.479
50 Year	2.246	1.315	2.766	16.185	3.696	16.653
100 Year	2.737	1.543	3.219	18.728	4.293	19.247

Table 5.6: SWMF 4 Release Rates

Return Period Storm	Existing Release Rates (NHYD 22)			Proposed Unmitigated Release Rates (NHYD 11)		
	3 Hour Chicago (m^3/s)	12 Hour AES (m^3/s)	24 Hour SCS (m^3/s)	3 Hour Chicago (m^3/s)	12 Hour AES (m^3/s)	24 Hour SCS (m^3/s)
2 Year	0.281	0.216	0.509	4.177	1.047	4.762
5 Year	0.636	0.407	0.955	7.007	1.715	7.651
10 Year	0.924	0.550	1.284	9.198	2.198	9.709
25 Year	1.334	0.741	1.739	12.048	2.816	12.474
50 Year	1.637	0.888	2.064	14.103	3.308	14.292
100 Year	1.993	1.040	2.401	16.607	3.821	16.466

Table 5.7: SWMF 5 Release Rates

Return Period Storm	Existing Release Rates (NHYD 109)			Proposed Unmitigated Release Rates (NHYD 205)		
	3 Hour Chicago (m^3/s)	12 Hour AES (m^3/s)	24 Hour SCS (m^3/s)	3 Hour Chicago (m^3/s)	12 Hour AES (m^3/s)	24 Hour SCS (m^3/s)
2 Year	0.135	0.164	0.230	2.731	0.650	3.126
5 Year	0.295	0.305	0.428	4.580	1.074	5.002
10 Year	0.422	0.410	0.572	5.941	1.382	6.358
25 Year	0.602	0.551	0.769	7.855	1.794	8.176
50 Year	0.732	0.660	0.909	9.219	2.119	9.380
100 Year	0.885	0.772	1.054	10.770	2.446	10.808

Table 5.8: SWMF 6 Release Rates

Return Period Storm	Existing Release Rates (NHYD 116)			Proposed Unmitigated Release Rates (NHYD 206)		
	3 Hour Chicago (m^3/s)	12 Hour AES (m^3/s)	24 Hour SCS (m^3/s)	3 Hour Chicago (m^3/s)	12 Hour AES (m^3/s)	24 Hour SCS (m^3/s)
2 Year	0.251	0.300	0.426	1.246	0.302	1.543
5 Year	0.546	0.557	0.788	2.130	0.501	2.443
10 Year	0.781	0.747	1.053	2.777	0.659	3.138
25 Year	1.111	1.003	1.415	3.716	0.872	4.085
50 Year	1.349	1.200	1.672	4.509	1.040	4.815
100 Year	1.630	1.403	1.937	5.243	1.219	5.484

Table 5.9: SWMF 7 Release Rates

Return Period Storm	Existing Release Rates (NHYD 118)			Proposed Unmitigated Release Rates (NHYD 207)		
	3 Hour Chicago (m^3/s)	12 Hour AES (m^3/s)	24 Hour SCS (m^3/s)	3 Hour Chicago (m^3/s)	12 Hour AES (m^3/s)	24 Hour SCS (m^3/s)
2 Year	0.306	0.394	0.526	6.721	1.697	7.573
5 Year	0.672	0.741	0.985	11.274	2.784	12.209
10 Year	0.967	1.002	1.325	14.605	3.564	15.459
25 Year	1.386	1.355	1.795	19.291	4.626	19.852
50 Year	1.690	1.630	2.131	22.838	5.430	23.174
100 Year	2.051	1.915	2.479	26.391	6.283	26.233

As shown, the proposed unmitigated peak flows would exceed the existing release rates, therefore the proposed end-of-pipe SWM facilities are required to control proposed flows from the site to existing flow rates for the 2 to 100 year storm events. The preliminary grading and storage requirements for the end-of-pipe SWM facilities will be provided at the Secondary Planning stage.

6.0 Erosion and Sediment Control During Construction

During the detailed design stage, erosion and sediment control measures will be designed with a focus on erosion control practices (such as stabilization, track walking, staged earthworks, etc.) as well as sediment controls (such as fencing, mud mats, catchbasin sediment control devices, rock check dams and temporary sediment control ponds). These measures will be designed and constructed as per the “Erosion and Sediment Control Guide for Urban Construction” document (NCPA, December 2006). A detailed erosion and sediment control plan will be prepared for review and approval by the Municipality and Conservation Authority prior to any proposed grading being undertaken. This plan will address phasing, inspection and monitoring aspects of erosion and sediment control. All reasonable measures will be taken to ensure sediment loading to the adjacent watercourses and properties are minimized both during and following construction.

7.0 Summary

This Stormwater Management Report has been prepared in support of the Official Plan Amendment application to designate the Subject Lands part of the Urban Boundary, in the City of Hamilton. This report outlines the means by which the proposed development can be graded and have stormwater management provided in accordance with the City of Hamilton Draft Framework for Urban Boundary Expansion Applications, Hamilton Comprehensive Development Guidelines and Financial Policies Manual, the Niagara Peninsula Conservation Authority, and the Ministry of Environment, Conservation and Parks design criteria and policies.

General Information

- The existing land use is primarily agricultural and an existing golf course, rural residential, and open space areas;
- The proposed development is located in the Twenty Mile Creek and Upper Welland River watersheds; and
- The proposed development consists of residential, park, natural open space, institutional, commercial, stormwater management ponds, pipeline/trail network, and proposed arterial and collector roads.

Topography and Grading

- No regulated floodplains exist on the Subject Lands;
- The proposed development grading has been developed to match to the existing surrounding grades, and provide conveyance of stormwater runoff; and
- The site grading will be subject to further grading design at the detailed design stage.

Stormwater Management

- The 90th Percentile Volume Target for the site is approximately the 28.5 mm rainfall event;
- Quality Control: MECP Enhanced (Level 1) water quality protection will be provided by a treatment train of low impact development techniques and end-of-pipe facilities;
- Erosion Control: The runoff volume from a 25 mm – 4 hour Chicago rainfall event will be detained over 24 hours by proposed SWM facilities. An erosion threshold analysis will be provided at the Secondary Planning stage.
- Quantity Control: Quantity control will be provided via proposed SWM facilities to control proposed runoff rates in the 2 through 100 year storm events to existing rates; and

- Water Budget: Landtek Limited has completed a water budget analysis to identify the existing annual infiltration volume of 742,690 m^3/yr. A proposed and proposed with mitigation water budget will be completed at the Secondary Planning stage when preliminary designs for low impact development measures are available.

Erosion and Sediment Control during Construction

- An erosion and sediment control plan will be prepared at the Secondary Planning stage, in accordance with the "Erosion and Sediment Control Guideline for Urban Construction" document (NPCA, December 2006).

Respectfully Submitted:

SCS Consulting Group Ltd.

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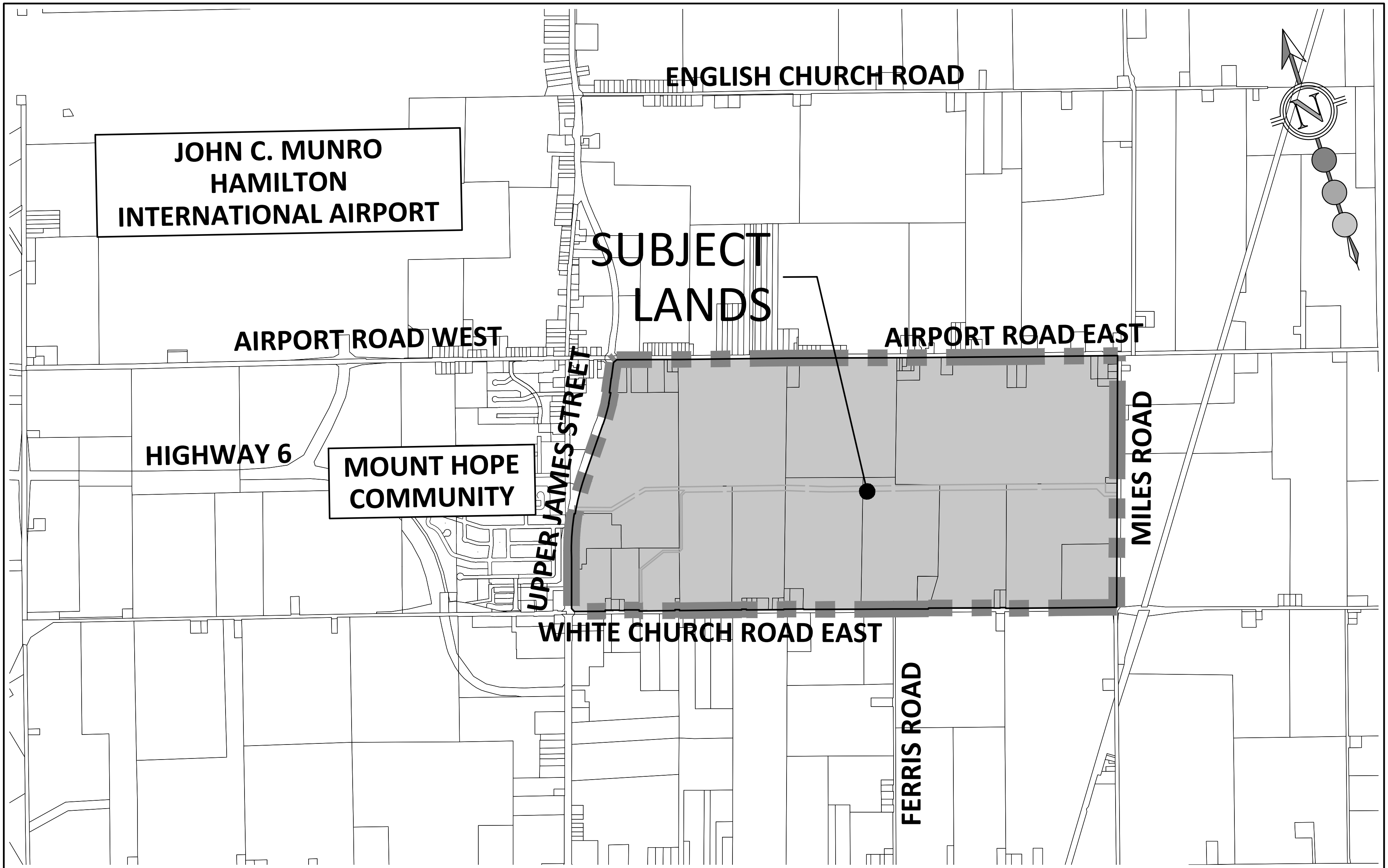
Figures



WHITECHURCH LANDOWNERS GROUP INC.	WHITE CHURCH ROAD PHASE 1 SWS - SWM REPORT	SITE LOCATION PLAN

SCS consulting group ltd
30 CENTURIAN DRIVE, SUITE 100
MARKHAM, ONTARIO L3R 8B8
TEL: (905) 475-1900
FAX: (905) 475-8335

DESIGNED BY:	JAS	CHECKED BY:	ETCK	PROJECT No:	FIGURE No:
SCALE:	1:1000	DATE:	JANUARY 2025	2600	1.1

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*NOTE: LAYOUT IS SCHEMATIC ONLY, DETAILS TO BE PROVIDED AT DETAILED DESIGN STAGE.

WHITECHURCH LANDOWNERS
GROUP INC.

SCS consulting group ltd
30 CENTURIAN DRIVE, SUITE 100
MARKHAM, ONTARIO L3R 8B8
TEL: (905) 475-1900
FAX: (905) 475-8335

LEGEND:

▬ ▪ ▪ ▬	LIMIT OF STUDY AREA
× 194.98	PROPOSED ELEVATION
× 189.94EX	EXISTING ELEVATION
0.5% →	ROAD SLOPE
221.00	EXISTING CONTOUR
↗	PROPOSED HIGH POINT
↗	PROPOSED LOW POINT

WHITE CHURCH ROAD
PHASE 1 SWS - SWM REPORT

PRELIMINARY
GRADING PLAN

DESIGNED BY: JAS
CHECKED BY: ETCK
SCALE: 1:4000
DATE: JANUARY 2025
PROJECT No: 2600
FIGURE No: 3.1

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WHITECHURCH LANDOWNERS
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30 CENTURIAN DRIVE, SUITE 100
MARKHAM, ONTARIO L3R 8B8
TEL: (905) 475-1900
FAX: (905) 475-8335

LEGEND:

▬ ▬ ▬	LIMIT OF STUDY AREA
212.00	EXISTING CONTOUR AND ELEVATION
▬▬▬	EXISTING STORM DRAINAGE BOUNDARY
L=367m - - - -	TIME OF PEAK FLOW PATH AND LENGTH
17.87ha	DRAINAGE AREA (HECTARES)
13%	PERCENT (%) IMPERVIOUS
101	CATCHMENT ID
▮▮▮▮▮▮	SUBWATERSHED DIVIDE
⇨	MAJOR SYSTEM - OVERLAND FLOW
━	POND OR POOLING (REFER TO PRELIMINARY HYDROGEOLOGICAL INVESTIGATION PREPARED BY LANDTEK CONSULTING ENGINEERS LTD.)
━	WHITECHURCH ROAD DRAIN (FROM ONTARIO OPEN MAPS HYDRO NETWORK - WATERWAYS)

WHITE CHURCH ROAD
PHASE 1 SWS - SWM REPORT

EXISTING
STORM DRAINAGE PLAN

DESIGNED BY:	JAS	CHECKED BY:	ETCK
SCALE:	1:4000	DATE:	JANUARY 2025

PROJECT No: 2600

FIGURE No: 4.1

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WHITECHURCH LANDOWNERS
GROUP INC.

SCS consulting group ltd
30 CENTURIAN DRIVE, SUITE 100
MARKHAM, ONTARIO L3R 8B8
TEL: (905) 475-1900
FAX: (905) 475-8335

LEGEND:

▬ ▬ ▬	LIMIT OF STUDY AREA
▬	PROPOSED DRAINAGE BOUNDARY
▬	WHITECHURCH ROAD DRAIN (FROM ONTARIO OPEN MAPS HYDRO NETWORK - WATERWAYS)
0.04ha / 104 79%	DRAINAGE AREA (Ha); PERCENT (%) IMPERVIOUS; CATCHMENT ID
221.00	EXISTING CONTOUR
AREA / ID %	EXTERNAL STORM DRAINAGE AREA (HECTARES); PERCENT (%) IMPERVIOUS; CATCHMENT ID
▬	EXTERNAL STORM DRAINAGE BOUNDARY
▬	ESTIMATED STORMWATER MANAGEMENT POND BOUNDARY
➡	PROPOSED FLOW DIRECTION OUT OF SWM POND
⇨	PROPOSED OVERLAND FLOW DIRECTION

WHITE CHURCH ROAD
PHASE 1 SWS - SWM REPORT

PRELIMINARY
PROPOSED DRAINAGE PLAN

DESIGNED BY: JAS
CHECKED BY: ETCK
SCALE: 1:4000
DATE: JANUARY 2025
PROJECT No: 2600
FIGURE No: 4.2

Appendix A Concept Plan

SCS consulting group ltd

WHITE CHURCH BOUNDARY EXPANSION AREA

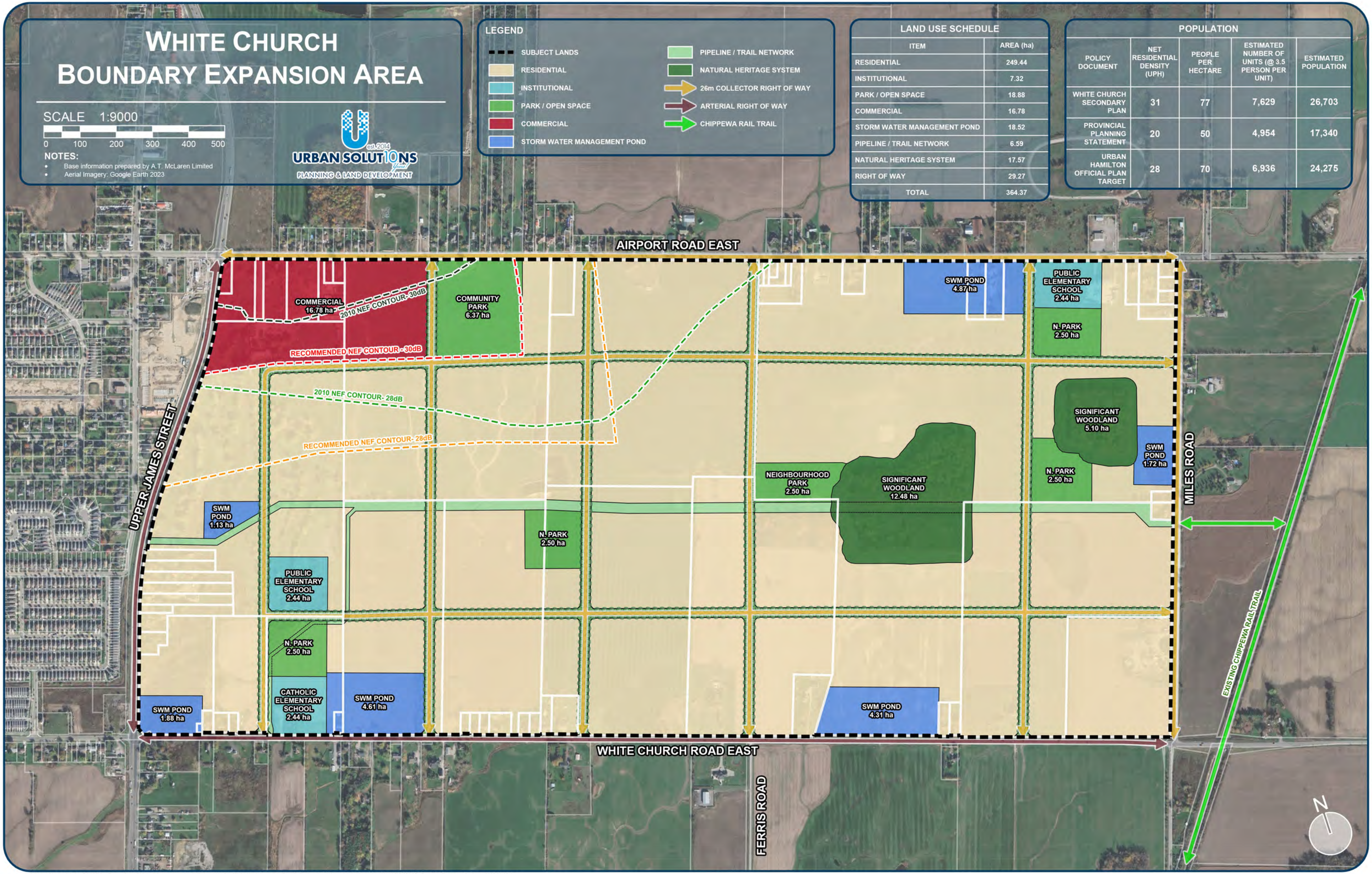
SCALE 1:9000

0 100 200 300 400 500

NOTES:

- Base information prepared by A.T. McLaren Limited
- Aerial Imagery: Google Earth 2023

URBAN SOLUTIONS est. 2014 10 Years!
PLANNING & LAND DEVELOPMENT



LEGEND

- - -	SUBJECT LANDS
🟨	RESIDENTIAL
🟦	INSTITUTIONAL
🟩	PARK / OPEN SPACE
🟥	COMMERCIAL
🟦	STORM WATER MANAGEMENT POND
🟩	PIPELINE / TRAIL NETWORK
🟩	NATURAL HERITAGE SYSTEM
➡	26m COLLECTOR RIGHT OF WAY
➡	ARTERIAL RIGHT OF WAY
➡	CHIPPEWA RAIL TRAIL

LAND USE SCHEDULE

ITEM	AREA (ha)
RESIDENTIAL	249.44
INSTITUTIONAL	7.32
PARK / OPEN SPACE	18.88
COMMERCIAL	16.78
STORM WATER MANAGEMENT POND	18.52
PIPELINE / TRAIL NETWORK	6.59
NATURAL HERITAGE SYSTEM	17.57
RIGHT OF WAY	29.27
TOTAL	364.37

POPULATION

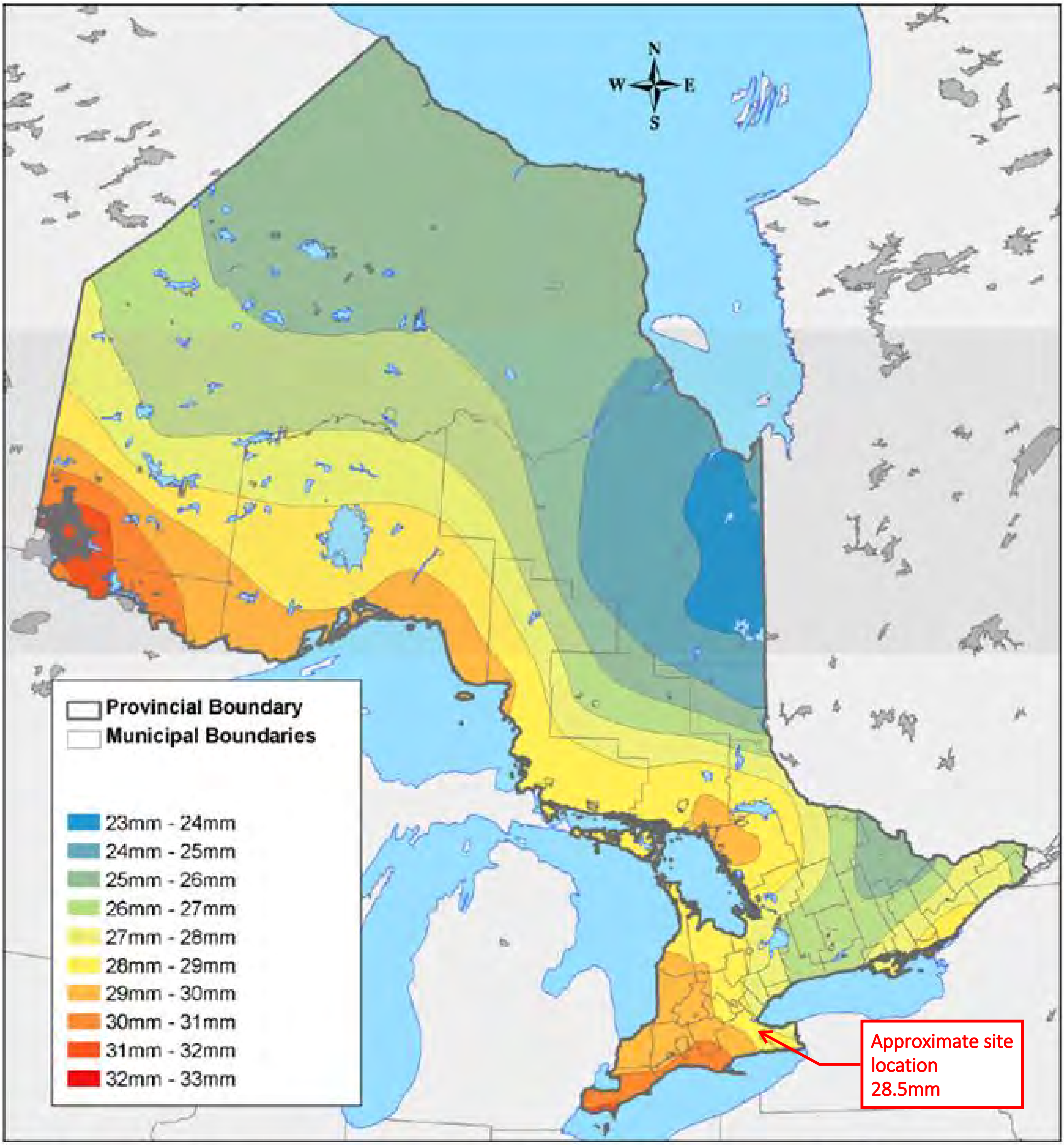
POLICY DOCUMENT	NET RESIDENTIAL DENSITY (UPH)	PEOPLE PER HECTARE	ESTIMATED NUMBER OF UNITS (@ 3.5 PERSON PER UNIT)	ESTIMATED POPULATION
WHITE CHURCH SECONDARY PLAN	31	77	7,629	26,703
PROVINCIAL PLANNING STATEMENT	20	50	4,954	17,340
URBAN HAMILTON OFFICIAL PLAN TARGET	28	70	6,936	24,275

C:\Users\StephenEricksonBACPT\OneDrive - Urban Solutions\Documents - Active Projects\464-22 - Whitechurch Secondary Plan\2 - Drawings\1 - Urbansolutions\Secondary Plan\2025\464-22 - Boundary Expansion Concept - 2025-01-08.dwg

Appendix B Background Information

SCS consulting group ltd

Appendix B-1 Relevant Excepts



Approximate site location 28.5mm

Figure 3.67 – Recommended Regional 90% Percentile Volume Targets for Ontario

(represented by the 95th percentile daily rainfall contours April - October, where daily volume exceeds 2mm).

Source: STEP LID Wiki (retrieved October 2024)

UPPER WELLAND RIVER WATERSHED PLAN

DRAFT

MARCH 2011

NIAGARA PENINSULA CONSERVATION AUTHORITY
250 THOROLD ROAD WEST, 3RD FLOOR
WELLAND, ONTARIO L3C 3W2
(905) 788-3135
www.npca.ca

Municipal Drains

Under the Ontario Drainage Act (R.S.O. 1990, Chapter D.17) drainage works "*include a drain constructed by any means, including the improving of a natural watercourse, and includes works necessary to regulate the water table or water level within or on any lands or to regulate the level of the waters of a drain, reservoir, lake or pond, and includes a dam, embankment, wall, protective works or any combination thereof*."

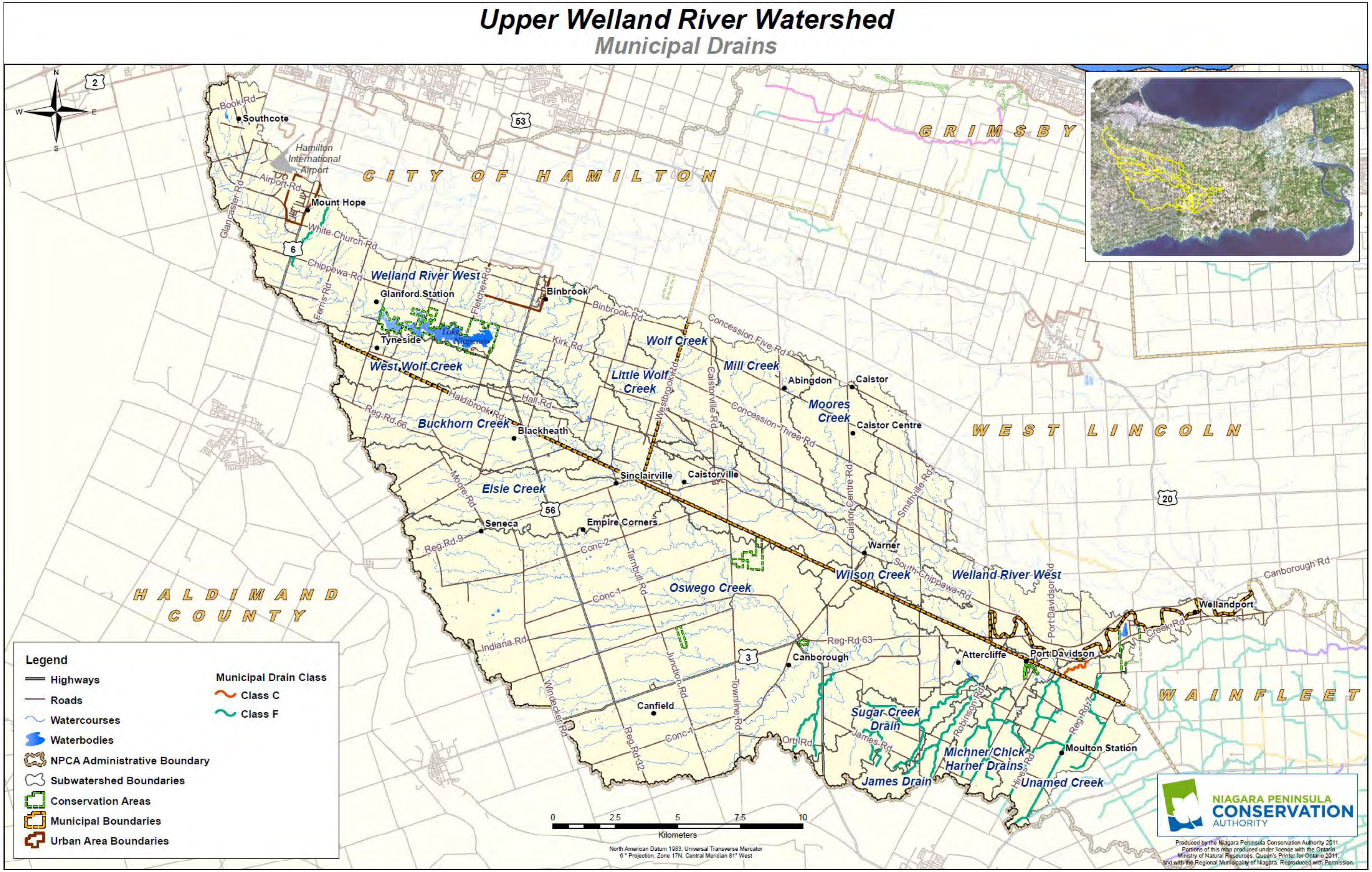
Numerous municipal drains exist in the Upper Welland River watershed (Figure 14). Even though their purpose is to remove excess water from the land, municipal and agricultural drains do contain fish habitat. To better manage these drains, Fisheries and Oceans Canada has developed a classification system that identifies municipal drains as Types A through F using variables such as flow conditions, temperature, fish species present, and the length of time since the last clean out (Fisheries and Oceans Canada No Date). For example, a Class A drain has permanent flow with cold or cool water temperature and no presence of trout or salmon present. A Type C drain has a permanent flow with warm water temperatures and baitfish present in the drain. Type F drains are characterized by intermittent flow (Fisheries and Oceans Canada No Date). This classification system has been created for use by municipal drainage superintendents for the purpose of drain maintenance. Therefore, the classification assigned to a drain is subject to change frequently.

For a watercourses or pipe to become a municipal drain there must be a by-law adopting an engineer‟s report. Once the municipal drain has been constructed under the by-law, it becomes part of the infrastructure of the respective municipality. The local municipality is therefore responsible for repairing and maintaining the drain.

In the Upper Welland River watershed, almost 70 kilometres of watercourses have been classified as municipal drains. The drainage classifications are either a Class C or Class F; the majority have a Class F designation (Table 7).

Table 7: Municipal Drains in the Upper Welland River Watershed Plan Study Area

Class	Drain Name	Subwatershed
C	Carter Drain	Unamed Creek
F	Carter Drain	Unamed Creek
F	Brown Drain	Unamed Creek
F	Charles Angle Drain	Unamed Creek
F	Black Creek Drain	Unamed Creek
F	Corbett Drain	Unamed Creek
F	Bouch & Moyer	Unamed Creek
F	Whitechurch Road Drain	Welland River West
F	Puhringer Drain	Welland River West
F	Baker Drain	Oswego Creek
F	Sugar Creek Drain	Sugar Creek Drain
F	Siddal Drain	Sugar Creek Drain
F	Allen Drain	Sugar Creek Drain
F	Holtrop Drain	Sugar Creek Drain
F	Babiy Drain	Sugar Creek Drain
F	Barry Drain	Sugar Creek Drain
F	James Drain	James Drain
F	Waines Drain	James Drain
F	Chick-Harnett Drain	Chick Hartner Drain
F	Bouch & Moyer	Chick Hartner Drain
F	Michner Drain	Michner Drain



North American Datum 1983, Universal Transverse Mercator
6 ° Projection, Zone 17N, Central Meridian 81° West

Produced by the Niagara Peninsula Conservation Authority 2011.
Portions of this map produced under licence with the Ontario
Ministry of Natural Resources, Queen's Printer for Ontario 2011,
and with the Regional Municipality of Niagara. Reproduced with Permission.

Figure 14: Municipal Drains

Authority: Item 12, Committee of the Whole
Report 10-022 (PW10076)
CM: August 12, 2010

Bill No. 194

CITY OF HAMILTON

BY-LAW NO. 10-194

Whitechurch Road Municipal Drain By-law, 2010

Being a by-law to provide for the maintenance and extension of the Whitechurch Road Municipal Drain in the City of Hamilton

WHEREAS the Council of the City of Hamilton in accordance with the provisions of the Drainage Act has received a request for the maintenance and extension of the Whitechurch Road Municipal Drain (the "drainage works") which comprises parts of Lots 6 and 7, Concessions 5 and 6 in the former Township of Glanbrook, now part of the City of Hamilton;

AND WHEREAS the Council of the City of Hamilton has procured an engineer's report prepared by Spriet Associates of London, Ontario, dated May 3, 2010 (the "engineer's report"), and the engineer's report is attached to and forms part of this By-law;

AND WHEREAS the estimated total cost of construction for the maintenance and extension of the drainage works is $21,600.00;

AND WHEREAS the Council of the City of Hamilton is of the opinion that the maintenance and extension of the drainage works is desirable;

THEREFORE, the Council of the City of Hamilton under the Drainage Act enacts as follows:

1. The engineer's report is hereby adopted, and the maintenance and extension of the drainage works as therein indicated and set forth are hereby authorized and shall be completed in accordance therewith.

2. A special annual rate sufficient to recover the costs of the maintenance and extension of the drainage works and associated interest costs shall be levied upon the lands within the drainage works area as set forth in the engineer's report, to be collected in the same manner and at the same time as other taxes are collected in each year for five years after the passing of this By-law.

3. This By-law comes into force on the passing thereof and may be cited as the "Whitechurch Road Municipal Drain By-law, 2010."

READ A FIRST AND SECOND TIME AND PROVISIONALLY ADOPTED THIS 12th day of August, 2010.

Fred Eisenberger
Mayor

Rose Caterini
City Clerk

READ A THIRD TIME AND PASSED THIS 15th day of December, 2010.

R. BRATINA
Mayor

Rose Caterini
City Clerk

WHITE CHURCH ROAD DRAIN

City of Hamilton

SPRIET
ASSOCIATES
ENGINEERS & ARCHITECTS

155 York Street
London, Ontario N6A 1A8
Tel. (519) 672-4100
Fax (519) 433-9351
E-mail MAIL@SPRIET.ON.CA

Job No. 208237

May 3, 2010

London, Ontario
May 3, 2010

WHITE CHURCH ROAD DRAIN

City of Hamilton

To the Mayor and Council
of the City of Hamilton

Mayor and Council:

We are pleased to present our report on the reconstruction of the White Church Road Municipal Drain serving parts of Lots 6 and 7, Concessions 5 and 6 in the geographical Township of Glanford which in now part of the City of Hamilton. The total watershed area contains approximately 80 hectares.

AUTHORIZATION

This report was prepared pursuant to Section 78 of the Drainage Act in accordance with instructions received from your Municipality with respect to a motion of Council in accordance with Section 8 of the Drainage Act.

The work on the existing Drain 'A' open portion was initiated by a request signed by an affected landowner, located at the end point of the works, which were constructed under the 1982 report and bylaw. This property is identified by roll no. 26-102-52 and is owned by L. Shalmi-Dolina. The request is for an extension of the existing municipal drain downstream and an improvement to the existing ditch to correct a flooding problem on the property.

HISTORY

The White Church Road Drain was originally constructed pursuant to a report submitted by J.K. Young, P. Eng., O.L.S. dated August 27,1982 and consisted of 664 meters of open Drains 'A' and 'B', to be constructed south of White Church Road. The drain was petitioned by the Regional Engineer for the Regional Municipality of Hamilton-Wentworth. The work also involved the construction of two new Regional road culverts one on each of drains 'A' and 'B'.

EXISTING DRAINAGE CONDITIONS

A site meeting was held with respect to the section 78 request on August 14, 2009 on the road allowance opposite 8421 White Church Road. The purpose of the meeting was to inform all property owners previously assessed in the 1982 report, of the request for improvements to Drain 'A' in the Shalmi-Dolina property. It was pointed out by this owner that flooding of the hay field at the south end of this property was an ongoing problem. In this area the municipal drain was too shallow and did not provide a sufficient outlet. A request was made to extend the municipal drain downstream, thereby correcting the flooding and resulting crop damages.

EXISTING DRAINAGE CONDITIONS (cont'd)

There were no other ratepayers in attendance that requested improvements to either drain 'A' or 'B' at this site meeting.

A field investigation and survey was made starting at Highway No. 6 culvert on the existing watercourse as shown on the attached plan. The watercourse passes through 4 properties south of the end point of drain 'A' of the 1982 drain at Sta.0+831. The total distance surveyed was 1034 meters. Drain 'A' originally ended 57 meters north of the south limit of the Shalmi-Dolina property. The elevation change in the waterway over the distance surveyed was 5.8 meters.

Further to the field survey, the watershed limits were field checked with respect to the proposed extension of Drain 'A' downstream to a sufficient outlet.

Preliminary design, cost estimates and assessments were prepared and an informal public meeting was held to review the findings and the proposed improvements. There were questions from many of ratepayers in attendance with respect to the municipal drain process, construction and assessments. The meeting concluded with a request to proceed with the final report.

RECOMMENDATIONS

We are therefore recommending the following:

- That the municipal Drain 'A' be constructed downstream from the 1982 end point for a distance of 346 meters.
- That the drain channel be deepened through the Shalmi-Dolina property for a distance of 250 meters to reduce flooding of the property.
- That a 3 meter wide buffer strip of existing vegetation between the top of the bank and the cultivated lands on both sides of the ditch shall be maintained as part of the open portion of the drain.
- That a farm crossing loss of access allowance be made to property roll no. 26-102-28 to cover part of the cost of a future farm crossing should one be required.
- That the above loss of access allowance be registered in accordance with Section 68 of The Drainage Act.

We are also recommending that the following erosion and sediment control measures be included as part of our construction proposal to help mitigate any potential adverse impacts of the proposed drainage works on water quality and fishery habitat:

- Timing of construction is to be only at times of low or no flow
- That two sediment basins are to be constructed along the course of the drain at the locations specified on the plan
- A temporary flow check of straw bales or silt fencing is to be installed for the duration of the construction at the end point of the ditching work.
- That exposed banks be seeded to revegetate the channel side slopes

SUMMARY OF PROPOSED WORK

The proposed work consists of approximately 551 lineal meters open ditch construction and reconstruction including bank seeding and sediment basins.

SCHEDULES

Four schedules are attached hereto and form part of this report, being Schedule 'A' - Allowances, Schedule 'B' - Cost Estimate, Schedule 'C' - Assessment for Construction and Schedule 'D' – Assessment for Maintenance.

Schedule 'A' - Allowances. In accordance with Sections 29, 30 and 33 of the Drainage Act, allowances are provided for right-of-way, damages to lands and crops along the route of the drain as defined below and loss of access.

Schedule 'B' - Cost Estimate. This schedule provides for a detailed cost estimate of the proposed work which is in the amount of $21,600.00. This estimate includes construction, allowances, interest, engineering and administrative costs associated with this project.

Schedule 'C' - Assessment for Construction. This schedule outlines the distribution of the total estimated cost of construction over the roads and lands which are involved.

Schedule 'D' – Assessment for Maintenance. In accordance with Section 38 of the Drainage Act, this schedule outlines the distribution of future repair and/or maintenance costs for this portion of Drain 'A'.

Drawing No. 1, Job No. 208237 and specifications form part of this report. They show and describe in detail the location and extent of the work to be done and the lands which are affected.

ALLOWANCES

DAMAGES: Section 30 of the Drainage Act provides for the compensation to landowners along the drain for damages to lands and crops caused by the construction of the drain. The amounts granted are based on the construction for open ditch work with excavated material levelled adjacent to drain ($2,480.00/ha.). This base rate is multiplied by the hectares derived from the working widths shown on the plans and the applicable lengths.

RIGHT-OF-WAY: Section 29 of the Drainage Act provides for an allowance to the owners whose land must be used for the construction, repair, or future maintenance of a drainage works. For open ditches, the allowance provides for the loss of land due to the construction provided for in the report. The amounts granted are based on the value of the land, and the rate used was $8,645.00/ha. When any buffer strip is incorporated and/or created, the allowance granted is for any land beyond a 1.8 meter width deemed to have always been part of the drain. For existing open ditches, the right-of-way to provide for the right to enter restriction imposed on those lands is deemed to have already been granted.

ASSESSMENT DEFINITIONS

In accordance with the Drainage Act, lands that make use of a drainage works are liable for assessment for part of the cost of constructing and maintaining the system. These assessments are known as benefit, outlet liability and special benefit as set out under Sections 22,23,24 and 26 of the Act.

BENEFIT as defined in the Drainage Act means the advantages to any lands, roads, buildings or other structures from the construction, improvement, repair or maintenance of a drainage works such as will result in a higher market value or increased crop production or improved appearance or better control of surface water, or any other advantages relating to the betterment of lands, roads, buildings or other structures.

OUTLET Liability is assessed to lands or roads that may make use of a drainage works as an outlet either directly or indirectly through the medium of any other drainage works or of a swale, ravine, creek or watercourse.

ASSESSMENT

A modified "Todgham Method" was used to calculate the assessments shown on Schedule 'C' – Assessment for Construction. This entailed breaking down the costs of the drain into sections along its route.

The benefit cost is distributed to those properties receiving benefit as defined under "Assessment Definitions", with such properties usually being located along or close to the route of the drain. The Outlet Costs are distributed to all properties within the watershed area of that section on an adjusted basis. The areas are adjusted for location along that section, and relative run-off rates. Due to their different relative run-off rates, forested lands have been assessed for outlet at lower rates than cleared lands. Also, roads and residential properties, have been assessed for outlet at higher rates that cleared farm lands.

The actual cost of the work involving this report is to be assessed on a pro-rata basis against the lands and roads liable for assessment for benefit and outlet as shown on Schedule 'C' - Assessment for Construction.

GRANTS

In accordance with the provisions of Section 85 of the Drainage Act, a grant **may** be available for assessments against privately owned parcels of land which are used for agricultural purposes and eligible for the Farm Property Class Tax rate. Section 88 of the Drainage Act directs the Municipality to make application for this grant upon certification of completion of this drain. The Municipality will then deduct the grant from the assessments prior to collecting the final assessments.

MAINTENANCE

Upon completion of construction, all owners are hereby made aware of Sections 80, 82 and 83 of the Drainage Act which forbid the obstruction of, damage or injury to, and pollution of a municipal drain.

After completion, this section of the White Church Road Drain 'A' shall be maintained by the City of Hamilton at the expense of all upstream lands and roads assessed in the Schedule 'D'-Assessment for Maintenance and in the same relative proportions, until such time as the assessment is changed under the Drainage Act.

Respectfully submitted,

SPRIET ASSOCIATES LONDON LIMITED

J R Spriet

J. R. Spriet, P. Eng.

sjs

WHITE CHURCH ROAD DRAIN

City of Hamilton

In accordance with Sections 29, 30 and 33 of the Drainage Act, we determine the allowances payable to owners entitled thereto as follows:

CONCESSION	LOT	ROLL NUMBER (Owner)	Section 29 Right-of-Way	Section 30 Damages	Section 33 Loss of Access	TOTALS
DRAIN " A " (Sta. 0+485 - 1+034)						
6	Pt. 6	26-102-22 (A. Faustini)	$ 140.00	$ 250.00	$	$ 390.00
6	Pt. 6	26-102-28 (S.G. Wojnar)	420.00	770.00	900.00	2,090.00
6	Pt. 6	26-102-52 (L. Shalmi-Dolina)	520.00	930.00		1,450.00
6	Pt. 6	26-102-54 (J. Legault)	20.00	40.00		60.00
		Total Allowances	$ 1,100.00	$ 1,990.00	$ 900.00	$ 3,990.00

Total Allowances under Sections 29, 30 and 33 of the Drainage Act on DRAIN " A " (Sta. 0+485 - 1+034) **$ 3,990.00**

SCHEDULE 'B' - COST ESTIMATE

WHITE CHURCH ROAD DRAIN

City of Hamilton

We have made an estimate of the cost of the proposed work which is outlined in detail as follows:

OPEN PORTION (CONSTRUCTION)		
551 meters of open ditch excavation (Approx. $900m^3$)	$	3,200.00
Levelling of excavated material	$	1,500.00
Hand seeding of ditch banks	$	600.00
Brushing, clearing and grubbing	$	1,500.00
Contingencies	$	400.00
Allowances under Sections 29, 30 and 33 of the Drainage Act	$	3,990.00
ADMINISTRATION		
Interest	$	300.00
Survey, Plan and Report	$	8,660.00
Assistance and Expenses	$	590.00
Supervision and Final Inspection	$	860.00
TOTAL ESTIMATED COST	$	21,600.00

SCHEDULE ' C ' - ASSESSMENT FOR CONSTRUCTION

WHITE CHURCH ROAD DRAIN

City of Hamilton

Job No. 208237

May 3, 2010

DRAIN " A " (Sta. 0+485 - 1+034)

	CON.	LOT	HECTARES AFFECTED	ROLL No. (OWNER)	BENEFIT	OUTLET	TOTAL
*	5	Pt. 6	0.03	25-105-06 (J. Wanders)	$	$ 30.00	$ 30.00
	5	Pt. 6	0.5	25-105-05 (F.&C. Cimino, C.&C. Pagliaro)		83.00	83.00
	5	Pt. 6	3.9	25-105-04 (M. Isotti)		718.00	718.00
*	5	Pt. 6	0.14	25-105-02 (W. Taylor)		30.00	30.00
	5	SW¼ 7	14.2	25-105-00 (D. Gavin)		2,613.00	2,613.00
	5	Pt.SE¼ 7	4.9	25-104-90 (J. Difederico)		902.00	902.00
	5	N½ 7	19.0	25-104-38 (T. Hickey)		3,496.00	3,496.00
*	6	Pt. 6	0.20	26-102-44 (D. William)		31.00	31.00
*	6	Pt. 6	0.47	26-102-50 (J. Banyard)		75.00	75.00
	6	Pt. 6	1.6	26-102-51 (W. & W. Millar Est.)		256.00	256.00
*	6	Pt. 6	0.23	26-102-5175 (P. Millar)		37.00	37.00
*	6	Pt. 6	0.05	26-102-42 (B. Caltagirone)		30.00	30.00
*	6	Pt. 6	0.04	26-102-40 (M. Winger)		30.00	30.00
*	6	Pt. 6	0.04	26-102-38 (P. Stevanovic)		30.00	30.00
*	6	Pt. 6	0.05	26-102-36 (N.W. Sweers)		30.00	30.00
	6	Pt. 6	7.1	26-102-28 (S.G. Wojnar)	3,300.00	420.00	3,720.00
	6	Pt. 6	0.4	26-102-22 (A. Faustini)	950.00	30.00	980.00
	6	Pt. 6	4.0	26-102-52 (L. Shalmi-Dolina)	6,300.00	552.00	6,852.00
	6	Pt. 6	2.4	26-102-54 (J. Legault)	250.00	442.00	692.00
*	6	Pt. 7	0.17	26-102-56 (H. Hardmeier)		31.00	31.00
	6	Pt. 7	1.2	26-102-58 (D. Robins)		221.00	221.00
	6	Pt. 7	0.1	26-102-60 (R. Marshall)		30.00	30.00
	6	Pt. 7	0.3	26-102-62 (T. Peck)		55.00	55.00
				TOTAL ASSESSMENT ON LANDS	$ 10,800.00	$ 10,172.00	$ 20,972.00
	White Church Road		0.9	City of Hamilton	$	$ 628.00	$ 628.00
				TOTAL ASSESSMENT ON ROADS	$	$ 628.00	$ 628.00

TOTAL ASSESSMENT ON DRAIN " A " (Sta. 0+485 - 1+034) **$ 21,600.00**

NOTE: All of the above lands, with the exception of those noted with an asterisk, are classified as agricultural.

SCHEDULE 'D' - ASSESSMENT FOR MAINTENANCE

WHITE CHURCH ROAD DRAIN

City of Hamilton

Job No. 208237

May 3, 2010

	CON.	LOT	HECTARES AFFECTED	ROLL No. (OWNER)	PERCENTAGE OF MAINTENANCE COST
	DRAIN " A " (Sta. 0+485 - 1+034)				
*	5	Pt. 6	0.0	25-105-06 (J. Wanders)	0.19 %
	5	Pt. 6	0.5	25-105-05 (F.&C. Cimino, C.&C. Pagliaro)	0.51
	5	Pt. 6	3.9	25-105-04 (M. Isotti)	4.43
*	5	Pt. 6	0.1	25-105-02 (W. Taylor)	0.19
	5	SW¼ 7	14.2	25-105-00 (D. Gavin)	16.12
	5	Pt.SE¼ 7	4.9	25-104-90 (J. Difederico)	5.57
	5	N½ 7	19.0	25-104-38 (T. Hickey)	21.57
*	6	Pt. 6	0.2	26-102-44 (D. William)	0.19
*	6	Pt. 6	0.5	26-102-50 (J. Banyard)	0.46
	6	Pt. 6	1.6	26-102-51 (W. & W. Millar Est.)	1.58
*	6	Pt. 6	0.2	26-102-5175 (P. Millar)	0.23
*	6	Pt. 6	0.0	26-102-42 (B. Caltagirone)	0.19
*	6	Pt. 6	0.0	26-102-40 (M. Winger)	0.19
*	6	Pt. 6	0.0	26-102-38 (P. Stevanovic)	0.19
*	6	Pt. 6	0.0	26-102-36 (N.W. Sweers)	0.19
	6	Pt. 6	7.1	26-102-28 (S.G. Wojnar)	12.78
	6	Pt. 6	0.4	26-102-22 (A. Faustini)	3.12
	6	Pt. 6	4.0	26-102-52 (L. Shalmi-Dolina)	22.84
	6	Pt. 6	2.4	26-102-54 (J. Legault)	3.50
*	6	Pt. 7	0.2	26-102-56 (H. Hardmeier)	0.19
	6	Pt. 7	1.2	26-102-58 (D. Robins)	1.36
	6	Pt. 7	0.1	26-102-60 (R. Marshall)	0.19
	6	Pt. 7	0.3	26-102-62 (T. Peck)	0.34
					=======
			TOTAL ASSESSMENT ON LANDS		96.12 %
					=======
	White Church Road		0.9	City of Hamilton	3.88
					=======
			TOTAL ASSESSMENT ON ROADS		3.88 %
					=======
			TOTAL ASSESSMENT FOR MAINTENANCE OF DRAIN " A " (Sta. 0+485 - 1+034)		**100.0 %**

NOTE: All of the above lands, with the exception of those noted with an asterisk, are classified as agricultural.

SPECIFICATIONS FOR CONSTRUCTION
OF
MUNICIPAL DRAINAGE WORKS

GENERAL INDEX

SECTION A - GENERAL CONDITIONS

INDEX

SECTION A

GENERAL CONDITIONS

A.1 SCOPE

The work to be done under this specification consists of supplying all labour, materials and equipment to construct the work as outlined on the drawing(s). In some Municipalities, the Contractor shall supply all materials while in other Municipalities, he shall supply only certain materials. The form of Tender and Agreement lists which materials are to be supplied by the Contractor.

A.2 TENDERS

Tenders are to be submitted on a lump sum basis for the complete works or a portion thereof, as set out in the Form of Tender and Agreement.

A.3 DRAWINGS AND SPECIFICATIONS

The tenderer must satisfy himself that he understands the meaning and intent of the drawings and specifications before submission of his tender. The standard specifications have been separated into sections for reference purpose only. They shall be considered complementary and, where a project is controlled under one of the sections, the remaining sections will still apply for miscellaneous works. In case of any inconsistency or conflict in the Tender Documents, the following order of precedence shall apply:

- Contract Drawings
- Form of Tender and Agreement
- General Conditions
- Standard Specifications (Open Drain, Tile Drain, Specifications for Municipal Drain Crossing County Roads)
- Standard Drawings

A.4 PAYMENT

Progress payments equal to 87±% of the value of the work done and materials incorporated in the work will be made to the Contractor on the written request of the Contractor to the Engineer. An additional 10±% will be paid 45 days after the final acceptance by the Engineer. Before this payment is released, the Contractor shall provide the Municipality with a Statutory Declaration that all material and/or labour incorporated in the work has been fully paid for, along with a Certificate of Clearance from the Workplace Safety and Insurance Board stating that all compensation has been paid. The Municipality will reserve 3%± of the Contract Price for one year as warranty. After the completion of the work, any part of this reserve may be used to correct defects which may develop within that time from faulty workmanship or material or loose backfill, provided that notice shall first be given to the Contractor and that he may promptly make good such defects, if he desires.

A.5 SUPERINTENDENT

The word "Superintendent", as used hereinafter in these specifications, shall refer to a Drainage Superintendent, appointed by the Municipality. The Superintendent will act as the Engineer's representative. The Superintendent shall have the power to direct the execution of the work and to make any necessary minor adjustments. Adjustments in tile sizes or gradients shall not be made without the approval of the Engineer. Any instructions given by the Superintendent, which changes considerably the proposed work or with which the Contractor does not agree, shall be referred to the Engineer for his decision.

A.6 COMMENCEMENT AND COMPLETION OF WORK

The work must commence immediately after the Contractor is notified of the acceptance of his tender or at a later date, if set out as a condition of the tender. If weather creates poor ground or working conditions, the Contractor may be required, at the discretion of the Engineer, to postpone or halt work until conditions become acceptable.

The Contractor shall give the Engineer and Superintendent a minimum of forty-eight (48) hours notice before commencement of work on any municipal drain. As noted on the plan, he can then arrange for a meeting to be held on the site with the Contractor and affected owners attending to review in detail the construction scheduling and other details. The Contractor's costs for attending this meeting shall be included in his lump sum tender price. If the Contractor leaves the job site for a period of time after initiation of work, he shall give the Engineer and the Superintendent a minimum of twenty-four (24) hours notice prior to returning to the project.

The work must be proceeded with in such a manner as to ensure its completion at the earliest possible date and within the time limit set out in the tender or in the contract documents.

A.7 WORKING AREA AND ACCESS

The working area available to the Contractor to construct the drain and related works including an access route to the drain shall be as specified on the drawings.

Should the specified widths become inadequate due to unusual conditions, the Contractor shall notify the Engineer immediately in order that negotiations with the affected owners can take place.

Where a Contractor exceeds the specified widths due to the nature of his operations and without authorization he shall be held responsible for the costs of all additional damages and the amount shall be deducted from his contract price and paid to the affected owners by the Municipality.

A.8 SUPERVISION

The Contractor shall give the work his constant supervision and shall keep a competent foreman in charge at the site.

A.9 INSPECTION

Final inspection by the Engineer will be made within twenty days after he has received notice in writing from the Contractor that the work is complete.

Periodic inspections by the Engineer or Superintendent will be made during the performance of the work. These interim inspections are required to check such items as location of drainage course and structures, tile grades prior to backfilling, backfilling and miscellaneous work items.

A.10 ALTERATIONS AND ADDITIONS

The Engineer shall have the power to make alterations in the work shown or described in the drawings or specifications and the Contractor shall proceed to make such changes without causing delay. In every such case, the price agreed to be paid for the work under the contract shall be increased or decreased as the case may require according to a fair and reasonable valuation of the work added or deleted. The valuation shall be determined as a result of negotiations between the Superintendent, the Contractor, and the Engineer, but in all cases, the Engineer shall maintain the final responsibility for the decision. Such alterations and variations shall in no way render void the contract. No claim for variations or alterations in the increased or decreased price shall be valid unless done in pursuance of an order from the Engineer and/or Superintendent and notice of such claims made in writing before commencement of such work. In no case shall the Contractor commence work which he considers to be extra work before receiving the Engineer's and/or Superintendent's approval in writing.

A.11 MAINTENANCE

The Contractor shall repair and make good any damages or faults in the drain that may appear within one year after its completion (as dated on the final completion certificate) as the result of imperfect or defective work done or materials furnished by the Contractor. Nothing herein contained shall be construed as in any way restricting or limiting the liability of the Contractor under the laws of the Country, Province or Locality in which the work is being done.

A.12 INSURANCE

1) Bodily Injury Liability: The Contractor shall effect and maintain, a Comprehensive General Liability Policy or its equivalent, covering claims for bodily injury, including death arising from and during operations under his Contract whether performed by himself, by a sub-contractor or by anyone directly or indirectly employed by either of them in the sum of $ 2,000,000.00.
2) Property Damage: The Contractor shall effect and maintain Property Damage Liability Insurance to cover his and the sub-contractor's operations in the sum of $ 1,000,000.00.
3) Fire Insurance: The Contractor shall procure fire and extended coverage insurance on the work to 100% of the Contract Amount.
4) The following are to be named as co-insured:
   Successful Contractor
   Sub-Contractor
   Municipality
   Spriet Associates London Limited
5) Within 7 days of award of Contract and prior to commencing work, the successful Contractor shall file with the Municipality, a copy of each insurance policy and certificate required. All such insurance shall be maintained until final completion of the work including the making good of faulty work or materials; except that coverage of completed operations liability shall in any event be maintained for twelve (12) months from the date of final completion as certified by the Engineer.

A.13 LIMITATIONS OF OPERATIONS

Except for such work as may be required by the Engineer to maintain the works in a safe and satisfactory condition, the Contractor shall not carry on his operations under the contract on Sundays without permission in writing of the Municipality.

A.14 LOSSES

The Contractor shall take all risks from floods or casualties of any kind.

A.15 SUB-CONTRACTORS

The Contractor shall not sublet the whole or any part of the contract without the approval of the Engineer or Superintendent.

A.16 PERMITS, NOTICES, LAWS AND RULES

The Contractor shall ensure that all necessary permits or licences required for the execution of the work have been obtained (but this shall not include M.T.O. encroachment permits, County Road Permit, permanent easements or rights of servitude). The Contractor shall give all necessary notices and pay all fees required by law and comply with all laws, ordinances, rules and regulations (including the Occupational Health and Safety Act) relating to the work and to the preservation of the public's health and safety and if the specifications and drawings are at variance therewith, any resulting additional expenses incurred by the Contractor shall constitute an addition to the contract price.

A.17 ROAD CROSSINGS

.1 General

.1 Scope: These specifications apply to all road crossings - Municipal, County, Regional, or Highway Roads. Where the word "Authority" is used, it shall be deemed to apply to the appropriate owning authority. These specifications in no way limit the Authority's Specifications and Regulations governing the construction of drains on their Road Allowance. The Authority will supply no labour, equipment or materials for the construction of the road crossing unless otherwise noted on the drawings.

.2 Road Occupancy Permit: Where applicable the Contractor must submit an Application for a Road Occupancy Permit to the Authority and allow a minimum of 5 working days (exclusive of holidays) for its review and issuance.

.3 Road Closure Request and Construction Notification: The Contractor shall submit written notification of construction and request for road closure (if applicable) to the Road Authority/Public Works Manager and the Drainage Engineer or Superintendent for review and approval a minimum of five (5) working days (exclusive of holidays) prior to proceeding with any work on road allowance. It shall be the Road Authority's responsibility to notify all the applicable emergency services, schools, etc. of the road closure or construction taking place.

.4 Traffic Control: Where the Contractor is permitted to close the road to through traffic, the Contractor shall provide for and adequately sign the detour route to the satisfaction of the Road Authority. Otherwise, the Contractor shall keep the road open to traffic at all times. The Contractor shall provide, for the supply, erection and maintenance, suitable warning signs and/or flagmen in accordance with the Manual of Uniform Traffic Control Devices and to the satisfaction of the Road Authority to notify the motorists of work on the road ahead.

.5 Site Meeting/Inspection: A site meeting shall be held with the affected parties to review in detail the crossing and/or its related works. The Authority's Inspector and/or the Drainage Engineer will inspect the work while in progress to ensure that the work is done in strict accordance with the specifications.

.6 Weather: No construction shall take place during inclement weather or periods of poor visibility.

.7 Equipment: No construction material and/or equipment is to be left within 3 meters of the edge of pavement overnight or during periods of inclement weather.

.2 Jacking and Boring

.1 Material: The bore pipe shall consist of new, smooth wall steel pipe, meeting the requirements of H20 loading for road crossings and E80 loading for railway crossings. The minimum size, wall thickness and length shall be as shown on the drawings. Where welding is required, the entire circumference of any joint shall be welded using currently accepted welding practices.

.2 Site Preparation and Excavation: Where necessary, fences shall be carefully taken down as specified in the General Conditions. Prior to any excavation taking place, all areas which will be disturbed shall be stripped of topsoil. The topsoil is to be stockpiled in locations away from the bore operation, off the line of future tile placement and out of existing water runs or ditches. The bore pit shall be located at the upstream end of the bore unless otherwise specified or approved. Bore pits shall be kept back at least 1 meter from the edge of pavement and where bore pits are made in any portion of the shoulder, the excavated material shall be disposed of off the road allowance and the pit backfilled with thoroughly compacted Granular "A" for its entire depth.

.3 Installation: The pipe shall be installed in specified line and grade by a combination of jacking and boring. Upon completion of the operations, both ends of the bore pipe shall be left uncovered until the elevation has been confirmed by the Engineer or Superintendent. The ends of the bore pipe shall be securely blocked off and the location marked by means of a stake extending from the pipe invert to 300mm above the surrounding ground surface.

.2 **Jacking and Boring** (cont'd)

.4 Unstable Soil or Rock:The Contractor shall contact the Engineer immediately should unstable soil be encountered or if boulders of sufficient size and number to warrant concern are encountered. Any bore pipe partially installed shall be left in place until alternative methods or techniques are determined by the Engineer after consultation with the Contractor, the Superintendent and the owning authority.

.5 Tile Connections: Prior to commencement of backfilling, all tile encountered in excavations shall be reconnected using material of a size comparable to the existing material. Where the excavation is below the tile grade, a compacted granular base is to be placed prior to laying the tile. Payment for each connection will be made at the rate outlined in the Form of Tender and Agreement.

.6 Backfill: Unless otherwise specified, the area below the proposed grade shall be backfilled with a crushed stone bedding. Bore pits and excavations outside of the shoulder area may be backfilled with native material compacted to a density of 95% Standard Proctor. All disturbed areas shall be neatly shaped, have the topsoil replaced and hand seeded. Surplus material from the boring operation shall be removed from the site at the Contractor's expense.

.7 Restoration: The entire affected area shall be shaped and graded to original lines and grades, the topsoil replaced, and the area seeded down at the rate of 85 kg/per ha. unless otherwise specified or in accordance with the M.T.O. Encroachment Permit. Fences shall be restored to their original condition in accordance with the General Conditions.

.8 Acceptance: All work undertaken by the Contractor shall be to the satisfaction of the Engineer.

.3 **Open Cut**

.1 Material: The culvert or sub-drain crossing pipe material shall be specified on the drawings.

.2 Site Preparation and Excavation: Where necessary, fences shall be carefully taken down as specified in the general conditions. Prior to any excavation taking place, the areas which will be disturbed shall be stripped of topsoil. The topsoil is to be stockpiled in locations away from the construction area.

.3 Installation: The pipe shall be installed using bedding and cover material in accordance with Standard Detailed Drawing No. 2 or detail provided on drawings.

.4 Unstable Soil or Rock:The Contractor shall contact the Engineer immediately should unstable soil be encountered or if boulders of sufficient size and number to warrant concern are encountered.

.5 Tile Connections: Prior to commencement of backfilling, all tiles encountered in excavations shall be reconnected using material of a size comparable to the existing material. Where the excavation is below the tile grade, a compacted granular base is to be placed prior to laying the tile. Payment for connections not shown on the drawings shall be an extra to the contract.

.6 Backfill: Backfill from the top of the cover material up to the under side of road base shall meet the requirements for M.T.O. Granular "B". The backfill shall be placed in lifts not exceeding 300mm in thickness and each lift shall be thoroughly compacted to produce a density of 98% Standard Proctor. Granular "B" road base for County Roads and Highways shall be placed to a 450mm thickness and Granular "A" shall be placed to a thickness of 200mm, both meeting M.T.O. requirements. Granular road base materials shall be thoroughly compacted to produce a density of 100% Standard Proctor.

Where the road surface is paved, the Contractor shall be responsible for placing an HL-4 Hot Mix Asphalt patch of the same thickness as the existing pavement. The asphalt patch shall be flush with the existing roadway on each side and not overlap. If specified, the asphalt patch shall not be placed immediately over the road base and the Granular "A" shall be brought up flush with the existing asphalt and a liberal amount of calcium chloride shall be spread on the gravel surface. The asphalt patch must be completed within the time period set out on the drawing.

.3 **Open Cut** (cont'd)

The excavated material from the trench beyond a point 1.25 meters from the travelled portion or beyond the outside edge of the gravel shoulder, may be used as backfill in the trench in the case of covered drains. This material should be compacted in layers not exceeding 600mm.

A.18 FENCES

No earth shall be placed against fences and all fences removed by the Contractor are to be replaced by him in as good condition as found. In general, the Contractor will not be allowed to cut existing fences but shall disconnect existing fences at the nearest anchor post or other such fixed joint and shall carefully roll it back out of the way. Where the distance to the closest anchor post or fixed joint exceeds 50 meters, the Contractor will be allowed to cut and splice in accordance with accepted methods and to the satisfaction of the owner and the Engineer or Superintendent. Where existing fences are deteriorated to the extent that existing materials are not salvageable for replacement, the Contractor shall notify the Engineer or the Superintendent prior to dismantling. Fences damaged beyond salvaging by the Contractor's negligence shall be replaced with new materials, similar to those existing, at the Contractor's expense. The replacement of the fences shall be done to the satisfaction of the owner and the Engineer or Superintendent. The site examination should indicate to the Contractor such work, if any, and an allowance should be made in the tendered price.

The Contractor shall not leave any fence open when he is not at work in the immediate vicinity.

A.19 LIVESTOCK

The Contractor shall provide each property owner with 48 hours notice prior to removing any fences along fields which could possibly contain livestock. Thereafter, the property owner shall be responsible to keep all livestock clear of the construction areas until further notified. Where necessary, the Contractor will be directed to erect temporary fences. The Contractor shall be held responsible for loss or injury to livestock or damage caused by livestock, where the injury or damage is caused by his failure to notify the property owner or through negligence or carelessness on the part of the Contractor.

The Contractor constructing a tile drain shall not be held responsible for damages or injury to livestock occasioned by leaving trenches open for inspection by the Engineer if he notifies the owner at least 48 hours prior to commencement of the work on that portion. The Contractor will be held liable for such damages or injury if the backfilling of such trenches is delayed more than 1 day after acceptance by the Engineer.

A.20 STANDING CROPS

The Contractor shall not be held responsible for damages to standing crops within the working area available and the access route provided if he notifies the owner thereof at least 48 hours prior to commencement of the work on that portion.

A.21 SURPLUS GRAVEL

If as a result of any work, gravel or crushed stone is required and not all the gravel or crushed stone is used in the construction of the works, the Contractor shall haul away such surplus gravel or stone unless otherwise approved.

A.22 RAILWAYS, HIGHWAYS, UTILITIES

A minimum of forty-eight (48) hours notice to Railways, Highways and Utilities, exclusive of Saturdays, Sundays and Holidays, shall be required by the Contractor prior to any work being performed and in the case of a pipe being installed by open cutting or boring under a Highway or Railway, a minimum of 72 hours notice is required.

A.23 UTILITIES

The attention of the Contractor is drawn to the presence of utilities along the course of the drain. The contractor will be responsible for determining the location of all utilities and will be held liable for any damage to all utilities caused by his operations. The Contractor shall co-operate with all authorities to ensure that all utilities are protected from damage during the performance of the work. The cost of any necessary relocation work shall be borne by the utility. No allowance or claims of any nature will be allowed on account for delays or inconveniences due to utilities relocation, or for inconveniences and delays caused by working around or with existing utilities not relocated.

A.24 TERMINATION OF CONTRACT BY THE MUNICIPALITY

If the Contractor should be adjudged bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency, or if he should refuse or fail to supply enough properly skilled workmen or proper materials after having received seven (7) days notice in writing from the Engineer to supply additional workmen or materials, or if he should fail to make prompt payment to sub-contractors or for material or labour or persistently disregarding laws, ordinances, or the instruction of the Engineer, or otherwise being guilty of a substantial violation of the provisions of the contract, then the Municipality, upon the certification of the Engineer that sufficient cause exists to justify such action, may without prejudice to any other right or remedy, by giving the contractor written notice, terminate the employment of the contractor and take possession of the premises and of all materials, tools and appliances, thereon, and complete the work by whatever method the Engineer may deem expedient, but without undue delay or expense. In such case, the Contractor shall not be entitled to receive any further payment until the work is completed. If the unpaid balance of the contract price exceeds the expense of completing the work, including compensation to the Engineer for his additional services, such excess shall be paid to the Contractor. If such expense does not exceed such unpaid balance, the Contractor shall pay the difference to the Municipality. The expense incurred by the Municipality, as herein provided, shall be certified by the Engineer. Where a Contractor fails to commence work within seven (7) days of his commencement date as indicated by him on his Tender Form, and such extension of time as allowed due to poor weather or ground conditions, then the Municipality shall have the option, after providing the Contractor with seven (7) days notice of their intention to terminate the contract, award the contract to another Contractor at their discretion by retendering the project, inviting bids or by appointment. The additional costs of the above or retendering, and all other administration costs shall be deducted from the Contractor's bid deposit and the balance, if any, returned to him.

A.25 ERRORS AND UNUSUAL CONDITIONS

The Contractor shall notify the Engineer immediately of any error or unusual condition which may be found. Any attempt by the Contractor to make changes because of the error or unusual condition on his own shall be done at his own risk. Any additional cost incurred by the Contractor to remedy a wrong decision on his part shall be borne by the Contractor.

The Engineer shall make the alteration necessary to correct errors or to adjust for unusual conditions during which time it will be the Contractor's responsibility to keep his men and equipment gainfully employed elsewhere on the project. The contract amount shall be adjusted in accordance with a fair evaluation of the work added or deleted.

A.26 IRON BARS

The Contractor shall be held liable for the cost of an Ontario Land Surveyor to replace any iron bars destroyed during the course of construction.

A.27 STAKES

At the time of the survey, stakes are set along the course of the drain at intervals of 50 meters. The Contractor shall ensure that the stakes are not disturbed unless approval is obtained from the Engineer. Any stakes removed by the Contractor without the authority of the Engineer, shall be replaced at the expense of the Contractor. At the request of the Contractor, any stakes which are removed or disturbed by others or by livestock, shall be replaced at the expense of the drain.

A.28 RIP-RAP

Rip-rap shall be specified on the drawings and shall conform to the following:

.1 **Quarry Stone**: shall range in size from 150mm to 300mm evenly distributed and shall be placed to a 300mm thickness on a filter blanket at a 1.5 : 1 slope unless otherwise noted. Filter blanket to be Mirafi 160N or approved equal.

.2 **Broken Concrete**: may be used in areas outside of regular flows if first broken in maximum 450mm sized pieces and mixed to blend with quarry stone as above. No exposed reinforcing steel shall be permitted.

.3 **Shot Rock**: shall range in size from 150mm to 600mm placed to a depth of 450mm thickness on a filter blanket at a 1.5:1 slope unless otherwise noted. Filter blanket to be Mirafi 160N or approved equal.

A.29 GABION BASKETS

Supply and install gabion basket rip-rap protection as shown on the drawings.

Gabion baskets shall be as manufactured by Maccaferri Gabions of Canada Ltd. or approved equal and shall be assembled and installed in strict accordance with the manufacturer's recommendations.

The gabion fill material shall consist solely of fractured field stone or gabion stone graded in size from 100mm to 200mm (4" to 8") and shall be free of undersized fragments and unsuitable material.

A.30 RESTORATION OF LAWNS

.1 **General**: Areas noted on the drawings to be restored with seeding or sodding shall conform to this specification, and the contractor shall allow for all costs in his lump sum bid for the following works.

.2 **Topsoil**: Prior to excavation, the working area shall be stripped of existing topsoil. The topsoil stockpile shall be located so as to prevent contamination with material excavated from the trench. Upon completion of backfilling operations, topsoil shall be spread over the working area to a depth equal to that which previously existed but not less than the following:

Seeding and sodding	-	minimum depth of 100mm
Gardens	-	minimum depth of 300mm

In all cases where a shortfall of topsoil occurs, whether due to lack of sufficient original depth or rejection of stockpiled material due to contractors operations, imported topsoil from acceptable sources shall be imported at the contractors expense to provide the specified depths. Topsoil shall be uniformly spread, graded and cultivated prior to seeding or sodding. All clods or lumps shall be pulverized and any roots or foreign matter shall be raked up and removed as directed.

.3 **Sodding**

.1 **Materials**: Nursery sod to be supplied by the contractor shall meet the current requirements of the Ontario Sod Growers Association for No. 1 Bluegrass Fescue Sod.

.2 **Fertilizer**: Prior to sod placement, approved fertilizer shall be spread at the rate of 5kg/100m^2 of surface area and shall be incorporated into such surfaces by raking, discing or harrowing. All surfaces on which sod is to be placed shall be loose at the time of placing sod to a depth of 25mm.

.3 **Placing Sod**: Sod shall be laid lengthwise across the face of slopes with ends close together. Sod shall be counter sunk along the joints between the existing grade and the new sodding to allow for the free flow of water across the joint. Joints in adjacent rows shall be staggered and all joints shall be pounded and rolled to a uniform surface.

A.30 RESTORATION OF LAWNS (cont'd)

On slopes steeper than 3:1, and in unstable areas, the engineer may direct the contractor to stake sod and/or provide an approved mesh to prevent slippages. In all cases where such additional work is required, it will be deemed an extra to the contract and shall be paid for in accordance with the General Conditions.
No sod shall be laid when frozen nor upon frozen ground nor under any other condition not favourable to the growth of the sod. Upon completion of sod laying the contractor shall thoroughly soak the area with water to a depth of 50mm. Thereafter it will be the responsibility of the property owner to maintain the area in a manner so as to promote growth.

.4 **Seeding**: Seed to be supplied by the contractor shall be "high quality grass seed" harvested during the previous year, and shall be supplied to the project in the suppliers original bags on which a tag setting out the following information is affixed:

- Year or Harvest - recommended rate of application
- Type of Mixture - fertilizer requirements

Placement of seed shall be by means of an approved mechanical spreader. All areas on which seed is to be placed shall be loose at the time of placing seed, to a depth of 25mm. Seed and fertilizer shall be spread in accordance with the suppliers recommendations unless otherwise directed by the Engineer. Thereafter it will be the responsibility of the property owner to maintain the area in a manner so as to promote growth.

.5 **Settlement**: The contractor shall be responsible during the one year guarantee period for the necessary repair of restored areas due to trench settlement. Areas where settlement does not exceed 50mm may be repaired by top dressing with fine topsoil. In areas where settlement exceeds 50mm, the contractor will be required to backfill the area with topsoil and restore with seeding and/or sodding as originally specified.

A.31 RESTORATION OF ROADS AND LANEWAYS

.1 **Gravel**: Restoration shall be in accordance with the applicable standard detailed drawing or as shown on the drawings.

.2 **Asphalt and Tar and Chip**: Prior to restoration all joints shall be neatly sawcut. Restoration shall be as a in gravel above with the addition of the following:
.1 Roads shall have the finished grade of Granular 'A', allow two courses of hot-mix asphalt (M.T.O. 310), 80mm HL6 and 40mm HL3 or to such greater thickness as may be required to match the existing.
.2 Laneways shall have the finished grade of Granular 'A' allow one 50mm minimum course of hot-mix asphalt (HL3) or greater as may be required to match existing.

SECTION B - OPEN DRAIN

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SECTION B

OPEN DRAIN

B.1 PROFILE

The profile drawing shows the depth of cuts from the ground beside the stake to the final invert of the ditch in meters and decimals of a meter and also the approximate depth of cuts from the existing bottom of the ditch to the elevation of the ditch bottom. These cuts are established for the convenience of the Contractor; however, bench marks will govern the final elevation of the drain. Bench marks have been established along the course of the drain and their locations and elevations are noted on the profile drawing. A uniform grade shall be maintained between stakes in accordance with the profile drawing.

B.2 ALIGNMENT

The drain shall be constructed in a straight line and shall follow the course of the present drain or water run unless otherwise noted on the drawings. Where it is necessary to straighten any bends or irregularities in alignment not noted on the drawings, the Contractor shall contact the Engineer or Superintendent before commencing the work.

B.3 CLEARING AND GRUBBING

Prior to commencement of work, all trees, scrub, fallen timber and debris shall be removed from the side slopes of the ditch and for such a distance on the working side so as to eliminate any interference with the construction of the drain or the spreading of the spoil. The side slopes shall be neatly cut and cleared flush with slope whether or not they are affected directly by the excavation. With the exception of large stumps causing damage to the drain, the sideslope shall not be grubbed. All other cleared areas shall be grubbed and the stumps put into piles for disposal by the owner.

All trees or limbs 150mm (6") or larger, that it is necessary to remove, shall be considered as logs and shall be cut and trimmed, and left in the working width separte from the brush, for use or disposal by the owner. Trees or limbs less than 150mm in diameter shall be cut in lengths not greater than 5 meters and placed in separate piles with stumps spaced not less than 75 meters apart in the working width, for the use or disposal of the owner. In all cases, these piles shall be placed clear of excavated materials, and not be piled against standing trees. No windrowing will be permitted. The clearing and grubbing and construction of the drain are to be carried out in two separate operations and not simultaneously at the same location.

B.4 EXCAVATION

The bottom width and the side slopes of the ditch shall be those shown on the profile drawing.

Unless otherwise specified on the drawings, only the existing ditch bottom is to be cleaned out and the side slopes are not to be disturbed. Where existing side slopes become unstable because of construction, the Contractor shall immediately contact the Engineer or Superintendent. Alternative methods of construction and/or methods of protection will then be determined, prior to continuing the work.

Where an existing drain is being relocated or where a new drain is being constructed, the Contractor shall, unless otherwise specified, strip the topsoil for the full width of the drain, including the location of the spoil pile. Upon completion of levelling, the topsoil shall be spread to an even depth across the full width of the spoil.

B.5 EXCAVATED MATERIAL

Excavated material shall be deposited on either or both sides of the drain as indicated on the drawings or as directed by the Engineer or Superintendent. A buffer strip of not less than 3 meters in width through farmed lands and 2 meters in width through bush areas shall be left along the top edges of the drain. The buffer strip shall be seeded and/or incorporated as specified on the drawings. The material shall be deposited beyond the specified buffer strip.

No excavated material shall be placed in tributary drains, depressions, or low areas which direct water into the ditch so that water will be trapped behind the spoilbank. The excavated material shall be placed and levelled to a minimum width to depth ratio of 50:1 unless instructed otherwise. The edge of the spoilbank away from the ditch shall be feathered down to the existing ground; the edge of the spoilbank nearest the ditch shall have a maximum slope of 2 to 1. The material shall be levelled such that it may be cultivated with ordinary farm equipment without causing undue hardship on machinery and personnel. No excavated material shall cover any logs, scrub, debris, etc. of any kind.

Where it is necessary to straighten any unnecessary bends or irregularities in the alignment of the ditch, the excavated material from the new cut shall be used for backfilling the original ditch. Regardless of the distance between the new ditch and the old ditch no extra compensation will be allowed for this work and must be included in the Contractor's lump sum price for the open work.

Any stones 150mm or larger left exposed on top of the levelled excavated material shall be removed and disposed of as an extra to the contract unless otherwise noted on plans.

B.6 EXCAVATION THROUGH BRIDGES AND CULVERTS

The Contractor shall excavate the drain to the full specified depth and width under all bridges. Where the bridge or culvert pipe is located within a road allowance, the excavated material shall be levelled within the road allowance. Care shall be taken not to adversely affect existing drainage patterns. Temporary bridges may be carefully removed and left on the bank of the drain but shall be replaced by the Contractor when the excavation is completed unless otherwise specified. Permanent bridges must be left intact. All necessary care and precautions shall be taken to protect the structure. The Contractor shall notify the Engineer or Superintendent if excavation may cause the structure to undermine or collapse.

B.7 PIPE CULVERTS

Where specified on the drawings, the existing culvert shall be carefully removed, salvaged and either left at the site for the owner or reinstalled at a new grade or location. The value of any damage caused to the culvert due to the Contractor's negligence in salvage operation will be determined and deducted from the contract price.

All pipe culverts shall be installed in accordance with the standard detail drawings as noted on the drawings. If couplers are required, 5 corrugation couplers shall be used for up to and including 1200mm dia. pipe and 10 corrugation couplers for greater than 1200mm dia.

B.8 MOVING DRAINS OFF ROADS

Where an open drain is being removed from a road allowance, it must be reconstructed wholly on the adjacent lands with a minimum distance of 2.0 meters between the property line and the top of the bank, unless otherwise noted on the drawings. The excavated material shall be used to fill the existing open ditch and any excess excavated material shall be placed and levelled on the adjacent lands beyond the buffer strip, unless otherwise noted. Any work done on the road allowance, with respect to excavation, disposal of materials, installation of culverts, cleaning under bridges, etc., shall be to the satisfaction of the Road Authority and the Engineer.

B.9 TRIBUTARY OUTLETS

The Contractor shall guard against damaging the outlets of tributary drains. Prior to commencement of excavation on each property the Contractor shall contact the owner and request that all known outlet pipes be marked by the owner. All outlets so marked or visible or as noted on the profile, and subsequently damaged by the Contractor's operations will be repaired by the Contractor at his cost. All outlet pipes repaired by the Contractor under direction of the Drainage Superintendent or Engineer which were not part of the Contract shall be considered an extra to the contract price.

B.10 SEDIMENT BASINS AND TRAPS

The Contractor shall excavate sediment basins prior to commencement of upstream work as shown on the plan and profile. The dimension of the basin will be in a parabolic shape with a depth of 450mm below the proposed ditch bottom and the basin will extend along the drain for a minimum length of 15 meters.

A sediment trap 300mm deep and 5 meters long with silt fence placed across ditch bottom on the downstream end of the trap shall be constructed prior to and maintained during construction, to prevent silt from flushing downstream. The silt fence shall be removed and disposed of after construction.

B.11 SEEDING

.1 **Delivery**: The materials shall be delivered to the site in the original unopened containers which shall bear the vendor's guarantee of analysis and seed will have a tag showing the year of harvest.

.2 **Hydro Seeding**: Areas specified on drawings shall be hydro seeded and mulched upon completion of construction in accordance with O.P.S.S. 572 and with the following application rates:

Primary Seed (85 kg/ha.):	50% Creeping Red Fescue
	40% Perennial Ryegrass
	5% White Clover
Nurse Crop	Italian (Annual) Ryegrass at 25% of Total Weight
Fertilizer (300 kg/ha.)	8-32-16
Hydraulic Mulch (2000 kg/ha.)	Type "B"
Water (52,700 litres/ha.)	

Seeding shall not be completed after September 30.

.3 **Hand Seeding**: Hand seeding shall be completed daily with the seed mixture and fertilizer and application rate shown under "Hydro Seeding" above. Placement of the seed shall be by means of an approved mechanical spreader. Seeding shall not be completed after September 30.

SECTION C - TILE DRAIN

INDEX

SECTION C

TILE DRAIN

C.1 PIPE MATERIALS

.1 **Concrete Tile**: All tile installed under these specifications shall be sound and of first quality and shall meet all A.S.T.M. Specifications current at the time of tendering. Concrete tile shall conform to Designation C412 "Extra Quality" except that the minimum compression strengths shall be increased by 25%. Heavy Duty tile shall conform to Designation C412 "Heavy Duty Extra Quality".

.2 **Corrugated Steel Pipe**: Unless otherwise specified all metal pipe shall be corrugated, rivetted steel pipe or helical corrugated steel pipe with a minimum wall thickness of 1.6mm (16 gauge) and shall be fully galvanized.

.3 **Plastic Tubing**: The plans will specify the type of tubing or pipe, such as non-perforated or perforated (with or without filter material).
i) Corrugated Plastic Drainage Tubing shall conform to the current O.F.D.A. Standards
ii) Heavy Duty Corrugated Plastic Pipe shall be "Boss 1000" manufactured by the Big 'O' Drain Tile Co. Ltd. or approved equal

.4 **Concrete Sewer Pipe**: The Designations for concrete sewer pipe shall be C14 for concrete sewer pipe 450mm (18") diameter or less; and C76 for concrete sewer pipe greater than 450mm (18") diameter. Where closed joints are specified, joints shall conform to the A.S.T.M. Specification C443.

Where concrete sewer pipe "seconds" are permitted the pipe should exhibit no damages or cracks on the barrel section and shall be capable of satisfying the crushing strength requirements for No. 1, Pipe Specifications (C14 or C76). The pipe may contain cracks or chips in the bell or spigot which could be serious enough to prevent the use of rubber gaskets but which are not so severe that the joint could not be mortared conventionally.

.5 **Plastic Sewer Pipe**: The plans will specify the type of sewer pipe, such as non-perforated or perforated (with or without filter material). All plastic sewer pipe and fittings shall be "Boss Poly-Tite", ULTRA-RIB", "Challenger 3000" or approved equal with a minimum stiffness of 320 kpa at 5% deflection..

.6 **Plastic Fittings**: All plastic fittings shall be "Boss 2000" or "Challenger 2000" with split coupler joints or approved equal.

C.2 TESTING

The manufacturer shall provide specimens for testing if required. The random selection and testing procedures would follow the appropriate A.S.T.M. requirements for the material being supplied. The only variation is the number of tile tested: 200mm to 525mm dia. - 5 tile tested, 600mm to 900mm dia. - 3 tile tested. The drain will be responsible for all testing costs for successful test results. Where specimens fail to meet the minimum test requirements, the manufacturer will be responsible for the costs of the unsuccessful tests. Alternately, the Engineer may accept materials on the basis of visual inspections and the receipt in writing from the Manufacturer of the results of daily production testing carried out by the Manufacturer for the types and sizes of the material being supplied.

C.3 LINE

Prior to stringing the tile, the Contractor shall contact the Superintendent or the Engineer in order to establish the course of the drain.

Where an existing drain is to be removed and replaced in the same trench by the new drain or where the new drain is to be installed parallel to an existing drain, the Contractor shall excavate test holes to locate the existing drain (including repairing drainage tile) at intervals along the course of the drain as directed by the Engineer and/or the Superintendent. The costs for this work shall be included in the tender price.

C.3 LINE (cont'd)

Where an existing drain is to be removed and replaced in the same trench by the new drain, all existing tiles shall be destroyed and all broken tile shall be disposed of off site.

The drain shall run in as straight a line as possible throughout its length, except that at intersections of other water courses or at sharp corners, it shall run on a curve of at least a 15 meter radius. The new tile drain shall be constructed at an offset from and generally parallel with any ditch or defined watercourse in order that fresh backfill in the trench will not be eroded by the flow of surface water. The Contractor shall exercise care not to disturb any existing tile drain or drains which parallel the course of the new drain, particularly where the new and the existing tile act together to provide the necessary capacity.

C.4 CLEARING AND GRUBBING

Prior to commencement of drain construction, all trees, scrub, fallen timber and debris shall be cleared and grubbed from the working area. Unless otherwise specified, the minimum width to be cleared and grubbed shall be 20 meters in all hardwood areas and 30 meters in all softwood areas (willow, poplar, etc.), the width being centred on the line of the drain.

All trees or limbs 150mm (6") or larger, that it is necessary to remove, shall be considered as logs and shall be cut and trimmed, and left in the working width separte from the brush, for use or disposal by the owner. Trees or limbs less than 150mm in diameter shall be cut in lengths not greater than 5 meters and placed in separate piles with stumps spaced not less than 75 meters apart in the working width, for the use or disposal of the owner. In all cases, these piles shall be placed clear of excavated materials, and not be piled against standing trees. No windrowing will be permitted. The clearing and grubbing and construction of the drain are to be carried out in two separate operations and not simultaneously at the same location.

C.5 PROFILE

The profile drawing shows the depth of cuts from the ground beside the stake to the final invert of the drain in meters and decimals of a meter. These cuts are established for the convenience of the Contractor; however, bench marks will govern the final elevation of the drain. Bench marks have been established along the course of the drain and their locations and elevations are noted on the profile drawing.

C.6 GRADE

The Contractor shall provide and maintain in good working condition, an approved system of establishing a grade sight line to ensure the completed works conform to the profile drawing. In order to confirm the condition of his system and to eliminate the possibility of minor errors on the drawings, he shall ensure his grade sight line has been confirmed to be correct between a minimum of two control points (bench marks) and shall spot check the actual cuts and compare with the plan cuts prior to commencement of tile installation. He shall continue this procedure from control point to control point as construction of the drain progresses. When installing a drain towards a fixed point such as a bore pipe, the Contractor shall uncover the pipe and confirm the elevation, using the sight line, a sufficient distance away from the pipe in order to allow for any necessary minor grade adjustments to be made in order to conform to the as built elevation of the bore pipe. All tile improperly installed due to the Contractor not following these procedures shall be removed and replaced entirely at the Contractor's cost.

When following the procedures and a significant variation is found, the Contractor shall immediately cease operations and advise the Engineer.

C.7 EXCAVATION

.1 **Trench:** Unless otherwise specified, all trenching shall be done with a recognized farm tiling machine approved by the Engineer or Superintendent. The machine shall shape the bottom of the trench to conform to the outside diameter of the pipe for a minimum width of one-half of the outside diameter. The minimum trench width shall be equal to the outside diameter of the tile to be installed plus 100mm (4") on each side unless otherwise approved. The maximum trench width shall be equal to the outside diameter of the tile to be installed plus 250mm (10") on each side unless otherwise approved.

.2 **Scalping**: Where the depths of cuts in isolated areas along the course of the drain as shown on the profile exceed the capacity of the Contractor's tiling machine, he shall lower the surface grade in order that the tiling machine may trench to the correct depth. Topsoil is to be stripped over a sufficient width that no subsoil will be deposited on top of topsoil. Subsoil will then be removed to the required depth and piled separately. Upon completion of backfilling, the topsoil will then be replaced to an even depth over the disturbed area. The cost for this work shall be included in his tender price.

.3 **Excavator**: Where the Contractor's tiling machine consistently does not have the capacity to dig to the depths required or to excavate the minimum trench width required, he shall indicate in the appropriate place provided on the tender form his proposed methods of excavation.
Where the use of an excavator is either specified on the drawings or approved as evidenced by the acceptance of his tender on which he has indicated the proposed use of a backhoe he shall conform to the following requirements:

a) the topsoil shall be stripped and replaced in accordance with Section .2 "Scalping".
b) all tile shall be installed on a bed of 19mm crushed stone with a minimum depth of 150mm which has been shaped to conform to the lower segment of the tile.
c) the Contractor shall allow for the cost of the preceding requirements (including the supply of the crushed stone) in his lump sum tender price unless it is otherwise provided for in the contract documents.

.4 **Backfilling Ditch**: Where the contract includes for a closed drain to replace an open drain and the ditch is to be backfilled, the Contractor shall install the tile and backfill the trench prior to backfilling the ditch unless otherwise noted. The distance the trench shall be located away from the ditch shall be as noted on the drawings, (beyond area required for stockpiling topsoil and backfilling). After tile installation is complete topsoil (if present) shall be stripped and stockpiled within the above limits prior to backfilling of ditch. Only tracked equipment shall be permitted to cross backfilled tile trench and must be at 90 degrees to line of tile.

C.8 INSTALLATION

The tile is to be laid with close fitting joints and in regular grade and alignment in accordance with the plan and profile drawings. The tiles are to be bevelled, if necessary, to ensure close joints (in particular around curves). Where, in heavy clay soils, the width of a joint exceeds 10mm the joint shall be wrapped with filter cloth as below. Where the width of a joint exceeds 12mm the tile shall first be removed and the joint bevelled to reduce the gap. The maximum deflection of one tile joint shall be 15 degrees. Where a drain connects to standard or ditch inlet catchbasins or junction box structures, the Contractor shall include in his tender price for the supply and installation of compacted Granular 'A' bedding under areas backfilled from the underside of the pipe to undisturbed soil. The connections will then be grouted.

Where a tile drain passes through a bore pit, the Tile Contractor shall include in his tender price for the supply and placement of compacted Granular "A" bedding from the underside of the pipe down to undisturbed soil within the limits of the bore pit.

As above and where soil conditions warrant, the Engineer may require (or as specified on the drawings) that each tile joint be wrapped with synthetic filter cloth. The width of the filter cloth shall be 300mm wide for tile sizes of 150mm to 300mm and 400mm wide for sizes of 350mm to 750mm. The filter cloth shall cover the full perimeter of the tile and overlap a minimum of 100mm or as specified on the drawings. The type of cloth shall be Mirafi 140NL for loam soils and 150N for sandy soil. Any such work not shown on the drawings shall be considered as an addition to the contract price unless specified on the drawings.

C.9 ROAD AND LANEWAY SUB-SURFACE CROSSINGS

All road and laneway crossings may be made with an open cut in accordance with standard detailed drawings in the specifications or on the drawings. The exact location of the crossing shall be verified and approved by the Road Authority and the Engineer and/or superintendent.

C.10 BACKFILLING

As the laying of the tile progresses, blinding up to the springline including compaction by tamping (by hand) is to be made on both sides of the tile. No tile shall be backfilled until inspected by the Engineer or Drainage Superintendent unless otherwise approved by the Engineer.

The remainder of the trench shall be backfilled with special care being taken in backfilling up to a height approximately 150mm above the top of the tile to ensure that no tile breakage occurs. During the backfilling operation no equipment shall be operated in a way that would transfer loads onto the tile trench. Surplus material is to be mounded over the tile trench so that when settlement takes place the natural surface of the ground will be restored. Upon completion, a minimum cover of 600mm is required over all tile. Where stones larger than 150mm are present in the backfill material, they shall be separated from the material and disposed of by the Contractor.

Where a drain crosses a lawn area, the backfilling shall be carried out as above except that, unless otherwise specified, the backfill material shall be mechanically compacted to eliminate settlement.

C.11 UNSTABLE SOIL

The Contractor shall immediately contact the Engineer or Superintendent if quicksand is encountered, such that installation with a tiling machine is not possible. The Engineer shall, after consultation with the Superintendent and Contractor, determine the action necessary and a price for additions or deletions shall be agreed upon prior to further drain installation. Where directed by the Engineer, test holes are to be dug to determine the extent of the affected area. Cost of test holes shall be considered an addition to the contract price.

C.12 ROCKS

The Contractor shall immediately contact the Engineer or Superintendent if boulders of sufficient size and number are encountered such that the Contractor cannot continue trenching with a tiling machine. The Engineer or Superintendent may direct the Contractor to use some other method of excavating to install the drain. The basis of payment for this work shall be determined by the Engineer and Drainage Superintendent.

If only scattered large stones or boulders are removed on any project, the Contractor shall haul same to a nearby bush or fenceline, or such other convenient location as approved by the Landowners(s).

C.13 BROKEN, DAMAGED TILE OR EXCESS TILE

The Contractor shall remove and dispose of off-site all broken (existing or new), damaged or excess tile or tiles. If the tile is supplied by the Municipality, the Contractor shall stockpile all excess tile in readily accessible locations for pickup by the Municipality upon the completion of the job.

C.14 TRIBUTARY DRAINS

Any tributary tile encountered in the course of the drain shall be carefully taken up by the Contractor and placed clear of the excavated earth. If the tributary tile drains encountered are clean or reasonably clean, they shall be connected into the new drain. Where existing drains are full of sediment, or contain pollutants, the decision to connect those drains to the new drain shall be left to the Engineer or Superintendent. Each tributary tile connection made by the Contractor shall be located and marked with a stake and no backfilling shall take place until the connection has been approved by the Engineer or Superintendent.

C.14 TRIBUTARY DRAINS (cont'd)

For tributary drains 150mm dia. or smaller connected to new tiles 250mm dia. or larger, and for 200mm dia. connected to 350mm dia. or larger, the Contractor shall neatly cut a hole in the middle of a tile length. The connections shall be made using a pre-fabricated adaptor. All other connections shall be made with pre-fabricated wyes or tees conforming to Boss 2000 split coupler or approved equal.

Where an open drain is being replaced by a new tile drain, existing tile outlets entering the ditch from the side opposite the new drain shall be extended to the new drain. All existing metal outlet pipes shall be carefully removed, salvaged, and left for the owner. Where the grade of the connection passes through the newly placed backfill in the ditch, the backfill material below the connection shall be thoroughly compacted and metal pipe of a size compatible with the tile outlet shall be installed so that a minimum length of 2 meters at each end is extending into undisturbed soil.

Where locations of tiles are shown on the drawings the Contractor shall include in his tender price, all costs for connecting those tiles to the new drain regardless of length.

Where tiles not shown on the drawings are encountered in the course of the drain, and are to be connected to the new drain, the Contractor shall be paid for each connection at the rate outlined in the Form of Tender and Agreement.

C.15 OUTLET PIPES

Corrugated steel pipe shall be used to protect the tile at its outlet. It shall have a hinged metal grate with a maximum spacing between bars of 40mm. The corrugated steel pipe shall be bevelled at the end to generally conform to the slope of the ditch bank and shall be of sufficient size that the tile can be inserted into it to provide a solid connection. The connection will then be grouted immediately.

The installation of the outlet pipe and the required rip-rap protection shall conform to the standard detailed drawing as noted on the drawing.

C.16 CATCHBASINS AND JUNCTION BOXES

.1 **Catchbasins**: Unless otherwise noted or approved, catchbasins shall be in accordance with O.P.S.D. 705.010, 705.030. All catchbasins shall include two - 150mm riser sections for future adjustments. All ditch inlet catchbasins shall include one 150mm riser section for future adjustments. The catchbasin top shall be a "Bird Cage" type substantial steel grate, removable for cleaning and shall be inset into a recess provided around the top of the structure. The grate shall be fastened to the catchbasin with bolts into the concrete. Spacing of bars on grates for use on 600mmx600mm structures shall be 65mm centre to centre. Spacing of bars on grates for use on structures larger than 600mmx600mm shall be 90mm with a steel angle frame.

The exact location and elevation of catchbasins shall be approved by the Road Authority or the Engineer/Superintendent. Catchbasins offset from the drain shall have "Boss 2000" 200mm diameter leads or approved equal unless otherwise noted and the leads shall have a minimum of 600mm of cover. The leads shall be securely grouted at the structures and the drain.

.2 **Junction Boxes**: Junction boxes shall be the precast type unless otherwise approved. Dimensions for precast junction boxes shall conform to those for catchbasins. The inside dimensions of the box shall be a minimum of 100mm larger than the outside diameter of the largest pipe being connected. The minimum cover over the junction box shall be 600mm. Benching to spring line shall be supplied with all junction boxes.

.3 **Connections**: Catchbasins and junction boxes shall not be ordered until elevations of existing pipes being connected have been verified in the field as indicated on the drawings. All connections shall be securely grouted at both the inside and outside walls of the structure.

.4 **Installation**: Where the native material is clay, all catchbasins shall be backfilled with an approved granular material placed and compacted to a minimum width of 300mm on all sides with the following exception. Where the native material is sandy or granular in nature it may be used as backfill. Filter cloth shall be placed between the riser sections of all catchbasins.

C.16 CATCHBASINS AND JUNCTION BOXES (cont'd)

Where the Contractor has over excavated or where ground conditions warrant, the structure shall be installed on a compacted granular base.

The Contractor shall include in his tender price for the construction of a berm behind all ditch inlet structures. The berm shall be constructed of compacted clay keyed 300mm into undisturbed soil. Topsoil shall be distributed to a 65mm thickness and seeded unless otherwise specified. The Contractor shall also include for regrading, shaping and seeding of road ditches for a maximum of 15 meters each way from all catchbasins.

C.17 BLIND INLETS

Where specified, blind inlets shall be installed along the course of the drain. In accordance with details on the drawings.

C.18 GRASSED WATERWAY

Topsoil to be stripped from construction area and stockpiled prior to construction of waterway. Waterway to be graded into a parabolic shape to the width shown on the drawings. Topsoil to be relevelled over the waterway and other areas disturbed by construction.

Waterway to be prepared for seeding by harrowing and then seeded by drilling followed by rolling. Seeding rate to be 85 Kg/Ha with the following mixture:

30%	Canon Canada Bluegrass
25%	Koket Chewings Fescue
30%	Rebel Tall Fescue
15%	Diplomat Perennial Rye

Plus #125 Birdsfoot Trefoil (25% of Total Weight)

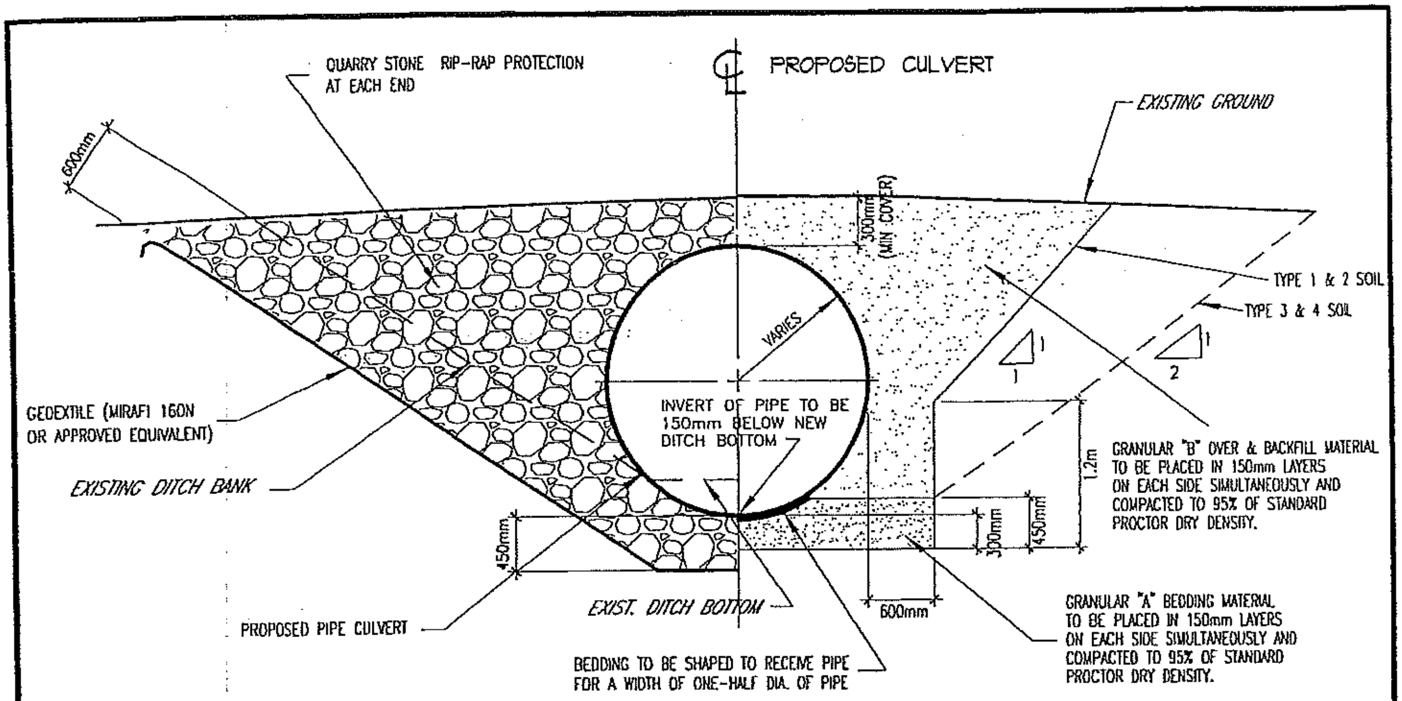
C.19 BACKFILLING EXISTING DITCHES

The Contractor shall backfill the ditch sufficiently for traversing by farm machinery. If sufficient material is not available from the old spoil banks to fill in the existing ditch, the topsoil shall be stripped and the subsoil shall be bulldozed into the ditch and the topsoil shall then be spread over the backfilled ditch unless otherwise specified on the contract drawings. The Contractor shall ensure sufficient compaction of the backfill and if required, repair excess settlement up to the end of the warranty period. The final grade of the backfilled ditch shall provide an outlet for surface water.

C.20 RECOMMENDED PRACTICE FOR CONSTRUCTION OF SUBSURFACE DRAINAGE SYSTEM

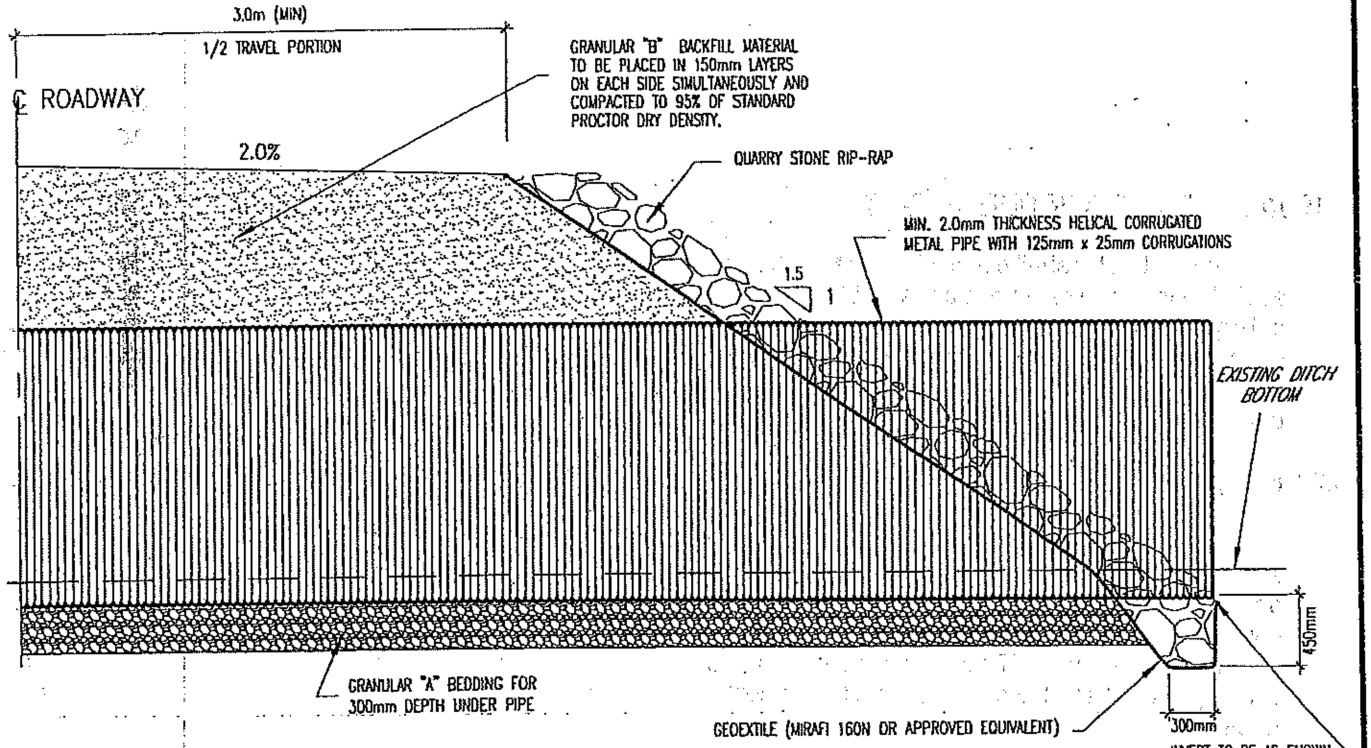
Drainage guide for Ontario, Ministry of Agriculture, Food and Rural Affairs Publication Number 29 and its amendments, dealing with the construction of Subsurface Drainage systems, shall be the guide to all methods and materials to be used in the construction of tile drains except where superseded by other specifications of this contract.

The requirements of licensing of operators, etc. which apply to the installation of closed drains under the Tile Drainage Act shall also be applicable to this contract in full unless approval otherwise is given in advance by the Engineer.



HALF ELEVATION

HALF SECTION



HALF SECTION THROUGH PIPE

NOTES

1) WHERE THE CULVERT IS TO BE INSTALLED IN POOR SOIL CONDITIONS, THE BEDDING MATERIAL SHALL BE 19mm CRUSHED STONE COMPLETELY WRAPPED IN GEOTEXTILE SUCH AS MIRAFI 160N OR APPROVED EQUIVALENT.

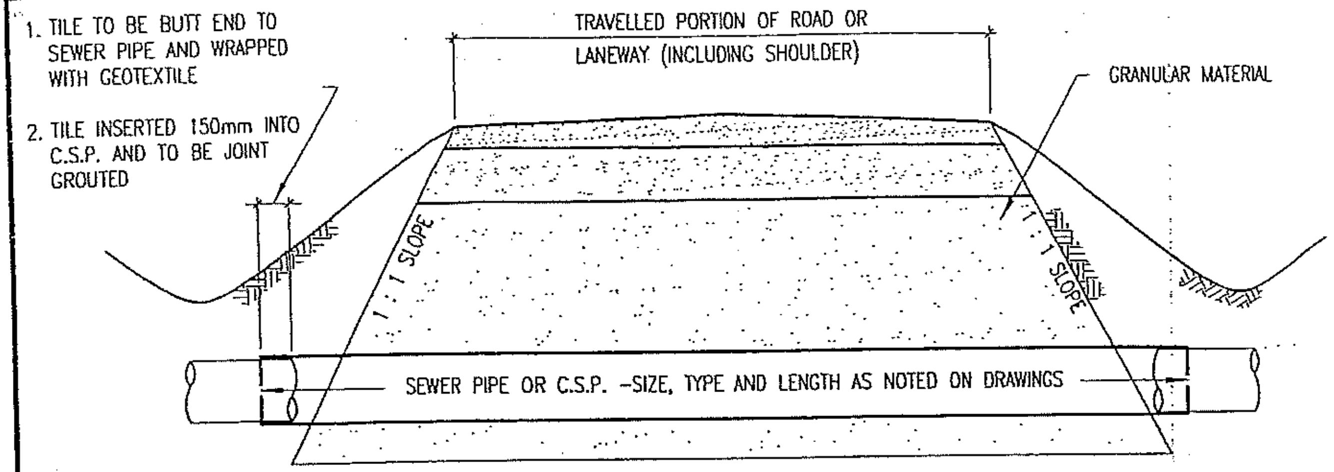
TYPICAL FARM CULVERT INSTALLATION DETAIL

Scale: N.T.S.	Approved by:	Date: January 1983
Drawn by: jk	M.P.D.	Revised: November 2000

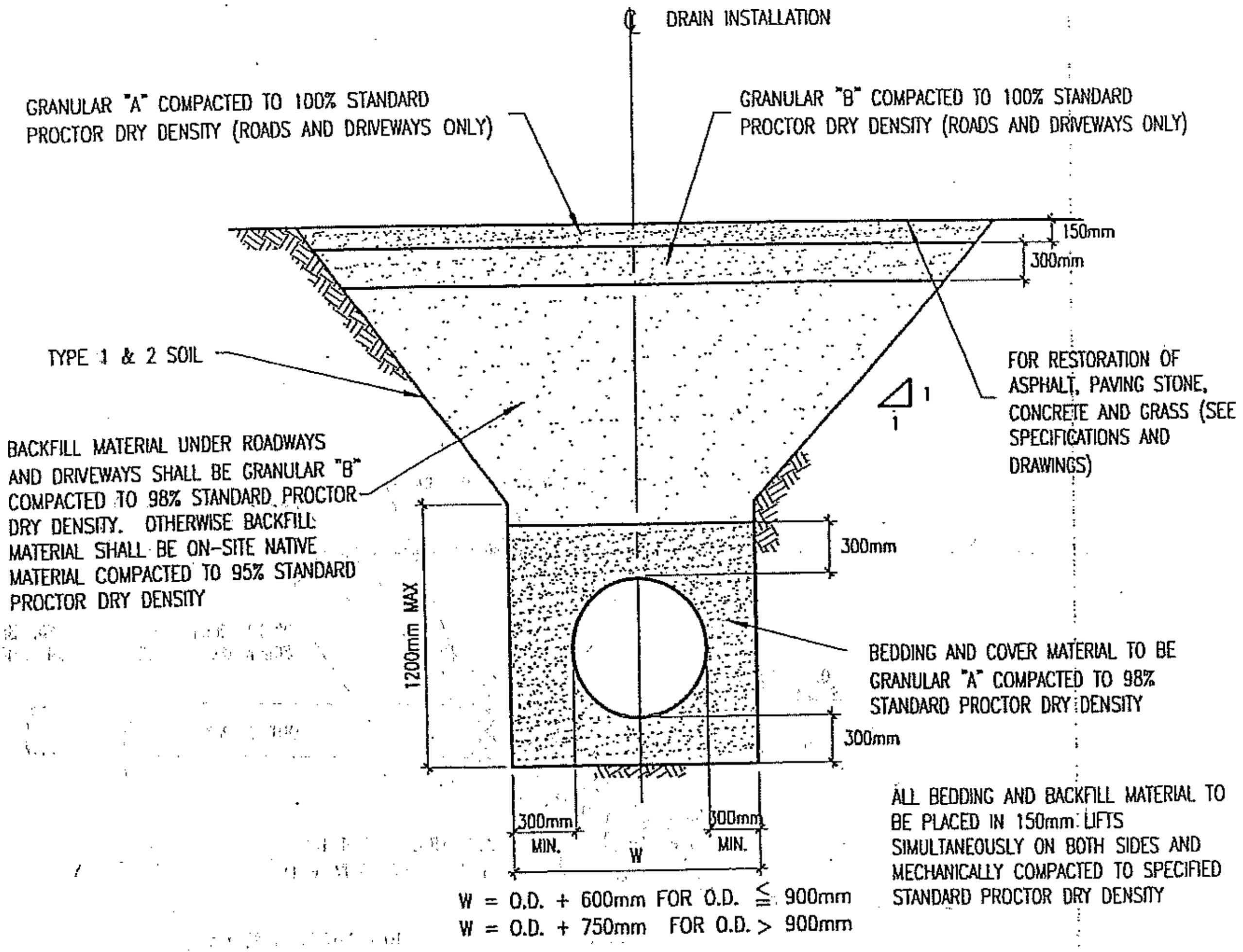
ELEVATION & SECTION

STANDARD
DETAILED
DRAWING
No. 01

SPRIET ASSOCIATES LONDON LIMITED
CONSULTING ENGINEERS ARCHITECTS



SECTION THROUGH PIPE



CROSS SECTION

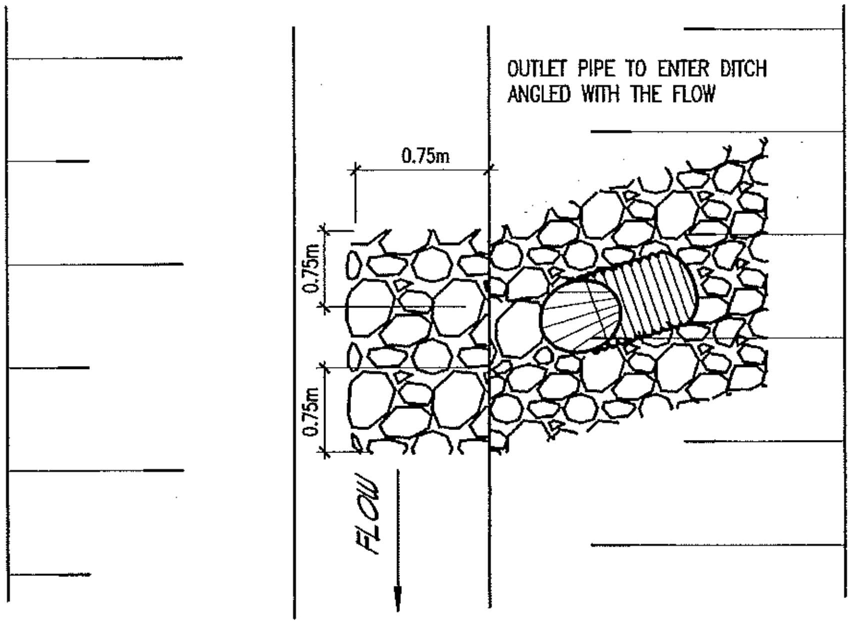
TYPICAL INSTALLATION DETAIL
FOR FLEXIBLE PIPE

Scale: N.T.S.	Approved by: M.P.D.	Date: January 1983
Drawn by: jk		Revised: November 2000

ELEVATION & SECTION

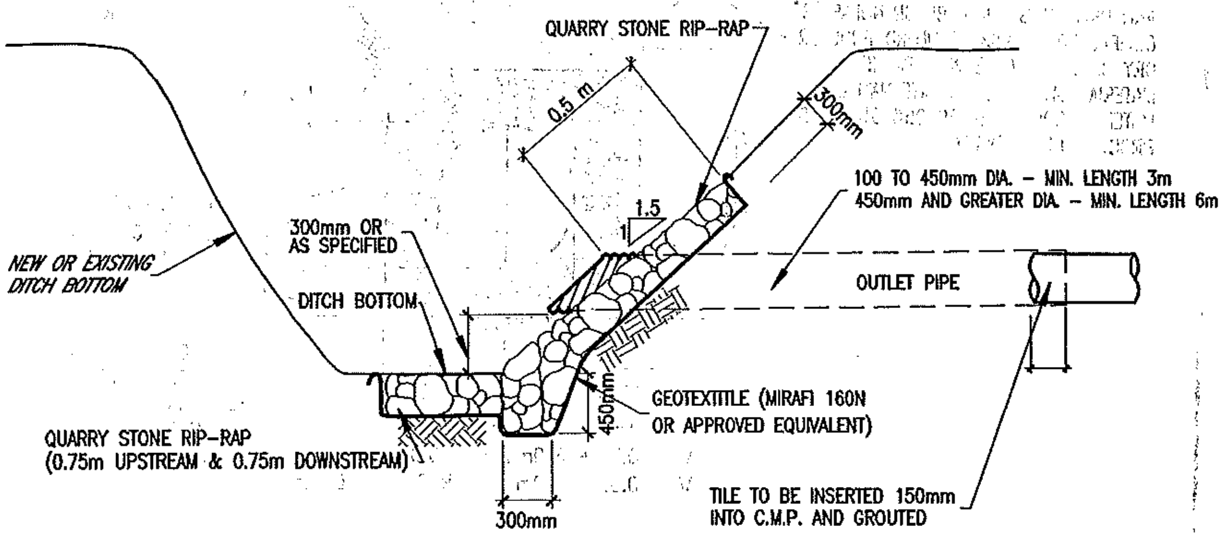
STANDARD DETAILED DRAWING No. 02

SPRIET ASSOCIATES LONDON LIMITED
CONSULTING ENGINEERS ARCHITECTS



PLAN

NOTES
1. WHERE THE DISTURBED AREA EXCEEDS THE MIN. WIDTHS, RIP-RAP TO EXTEND TO A MIN. OF 600mm BEYOND THE DISTURBED AREA



TYPICAL OUTLET RIP-RAP

NOTES
1. RIP-RAP TO EXTEND UP THE SLOPE 0.5 METER ABOVE TOP OF OUTLET
2. WHERE SURFACE RUN ENTERS DITCH AT OUTLET PIPE, A ROCK CHUTE SHALL BE INSTALLED (SEE S.D.D. No. 05) AND PIPE SHALL BE INSTALLED ADJACENT TO ROCK CHUTE.
3. HINGED RODENT GATE TO BE AFFIXED TO END OF OUTLET PIPE.

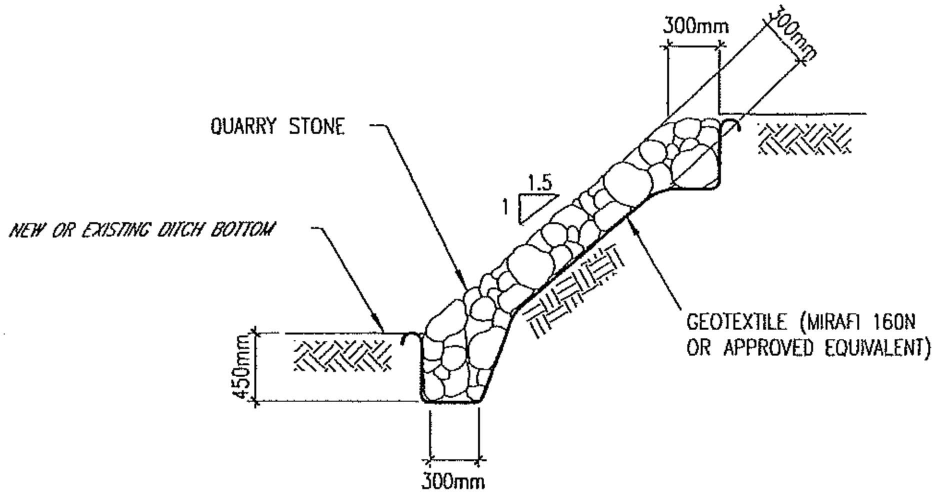
TYPICAL OUTLET RIP-RAP THROUGH SIDE SLOPE OF DITCH

Scale: N.T.S.
Approved by: M.P.D.
Date: November 2000
Drawn by: jk
Revised: January 2009

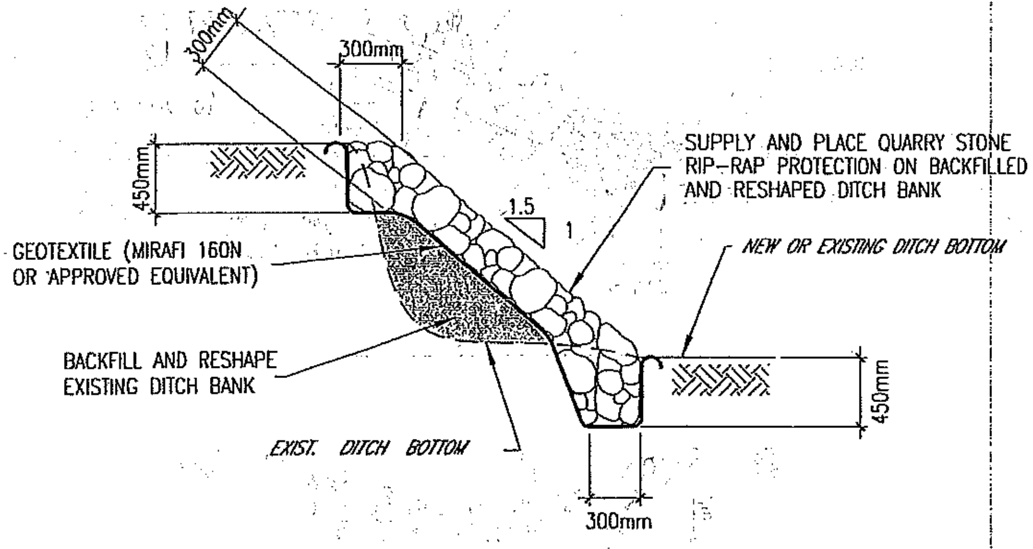
PLAN & SECTION

SPRIET ASSOCIATES LONDON LIMITED
CONSULTING ENGINEERS ARCHITECTS

STANDARD DETAILED DRAWING
No. 03



TYPICAL DITCH BANK RIP-RAP



TYPICAL DITCH BANK RIP-RAP
WITH BACKFILLING OF WASHOUT

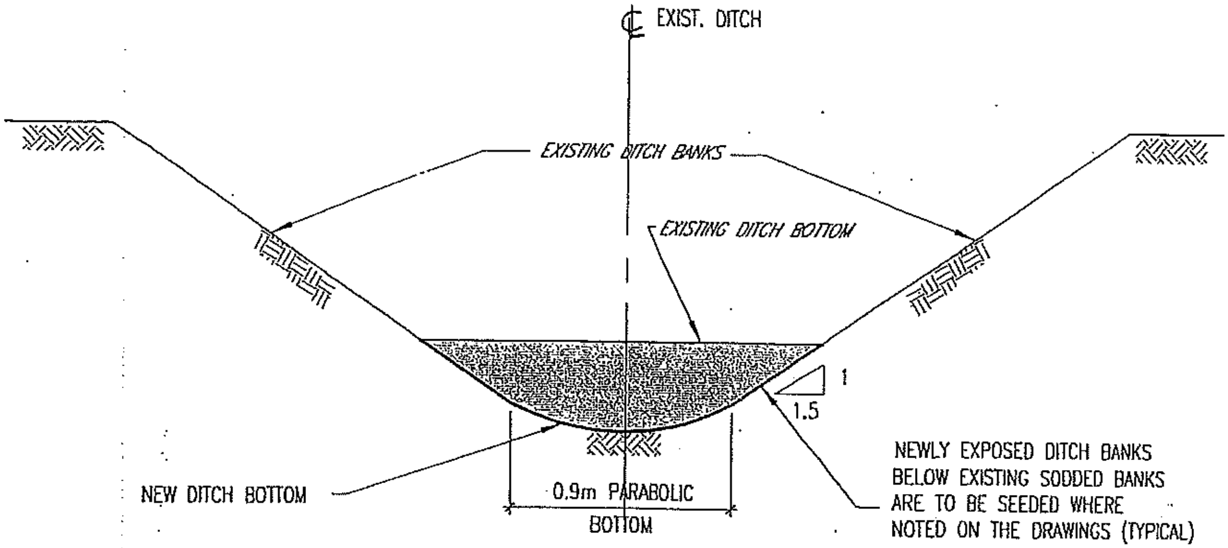
TYPICAL DITCH BANK RIP-RAP DETAILS

Scale: N.T.S.	Approved by:	Date: July 2000
Drawn by: jk	M.P.D.	Revised: November 2000

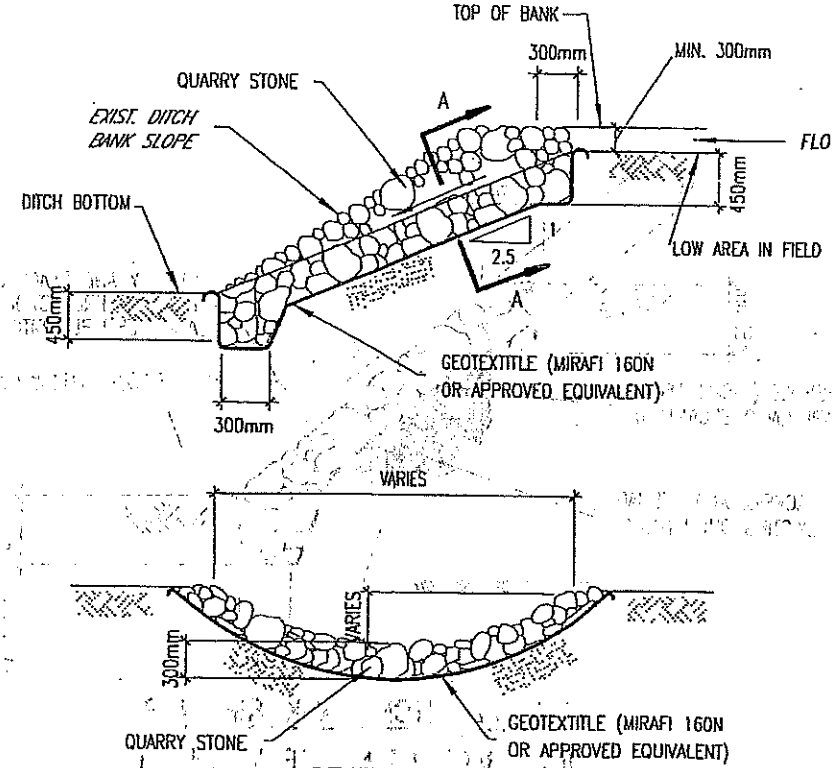
SECTIONS

STANDARD
DETAILED
DRAWING
No. 04

SPRIET ASSOCIATES LONDON LIMITED
CONSULTING ENGINEERS ARCHITECTS



TYPICAL DITCH BOTTOM CLEANOUT



SECTION A–A

TYPICAL ROCK CHUTE

TYPICAL DITCH BOTTOM CLEANOUT
TYPICAL ROCK CHUTE CONSTRUCTION

Scale: N.T.S.	Approved by:	Date: November 2000
Drawn by: jk	M.P.D.	Revised:

SECTIONS

SPRIET ASSOCIATES LONDON LIMITED
CONSULTING ENGINEERS ARCHITECTS

STANDARD DETAILED DRAWING
No. 05

SCHEDULE OF NET ASSESSMENT

WHITE CHURCH ROAD DRAIN

City of Hamilton

(FOR INFORMATION PURPOSES ONLY)

Job No. 208237

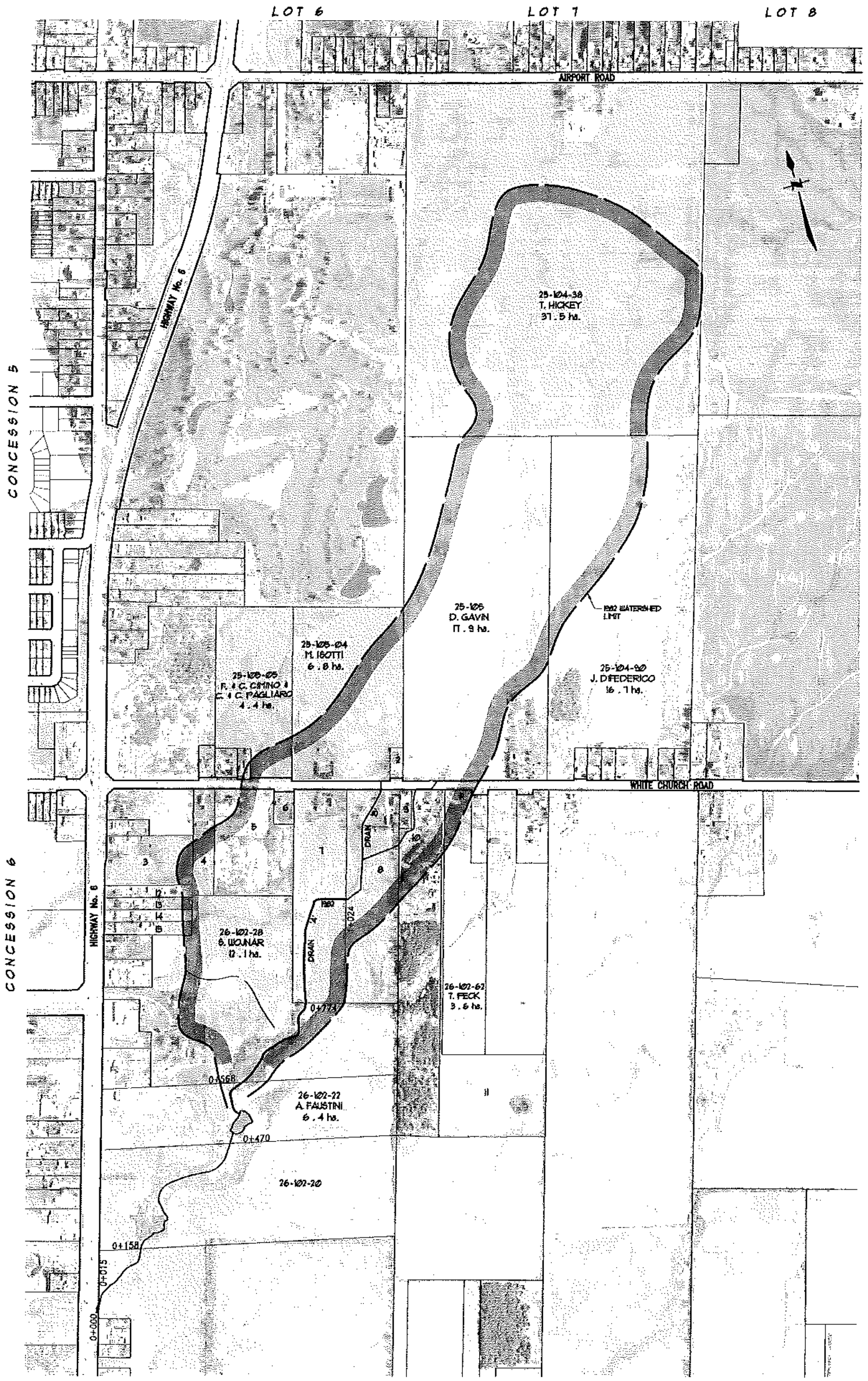
May 3, 2010

CODE	ROLL NUMBER (OWNER)	TOTAL ASSESSMENT	GRANT	ALLOWANCES	APPROX. NET
*	25-105-06 (J. Wanders)	$ 30.00	$	$	$ 30.00
	25-105-05 (F.&C. Cimino, C.&C. Pagliaro)	83.00	28.00		55.00
	25-105-04 (M. Isotti)	718.00	239.00		479.00
*	25-105-02 (W. Taylor)	30.00			30.00
	25-105-00 (D. Gavin)	2,613.00	871.00		1,742.00
	25-104-90 (J. Difederico)	902.00	301.00		601.00
	25-104-38 (T. Hickey)	3,496.00	1,165.00		2,331.00
*	26-102-44 (D. William)	31.00			31.00
*	26-102-50 (J. Banyard)	75.00			75.00
	26-102-51 (W. & W. Millar Est.)	256.00	85.00		171.00
*	26-102-5175 (P. Millar)	37.00			37.00
*	26-102-42 (B. Caltagirone)	30.00			30.00
*	26-102-40 (M. Winger)	30.00			30.00
*	26-102-38 (P. Stevanovic)	30.00			30.00
*	26-102-36 (N.W. Sweers)	30.00			30.00
	26-102-28 (S.G. Wojnar)	3,720.00	1,240.00	2,090.00	390.00
	26-102-22 (A. Faustini)	980.00	327.00	390.00	263.00
	26-102-52 (L. Shalmi-Dolina)	6,852.00	2,284.00	1,450.00	3,118.00
	26-102-54 (J. Legault)	692.00	231.00	60.00	401.00
*	26-102-56 (H. Hardmeier)	31.00			31.00
	26-102-58 (D. Robins)	221.00	74.00		147.00
	26-102-60 (R. Marshall)	30.00	10.00		20.00
	26-102-62 (T. Peck)	55.00	18.00		37.00
*	White Church Road	628.00			628.00
TOTALS		**$ 21,600.00**	**$ 6,873.00**	**$ 3,990.00**	**$ 10,737.00**

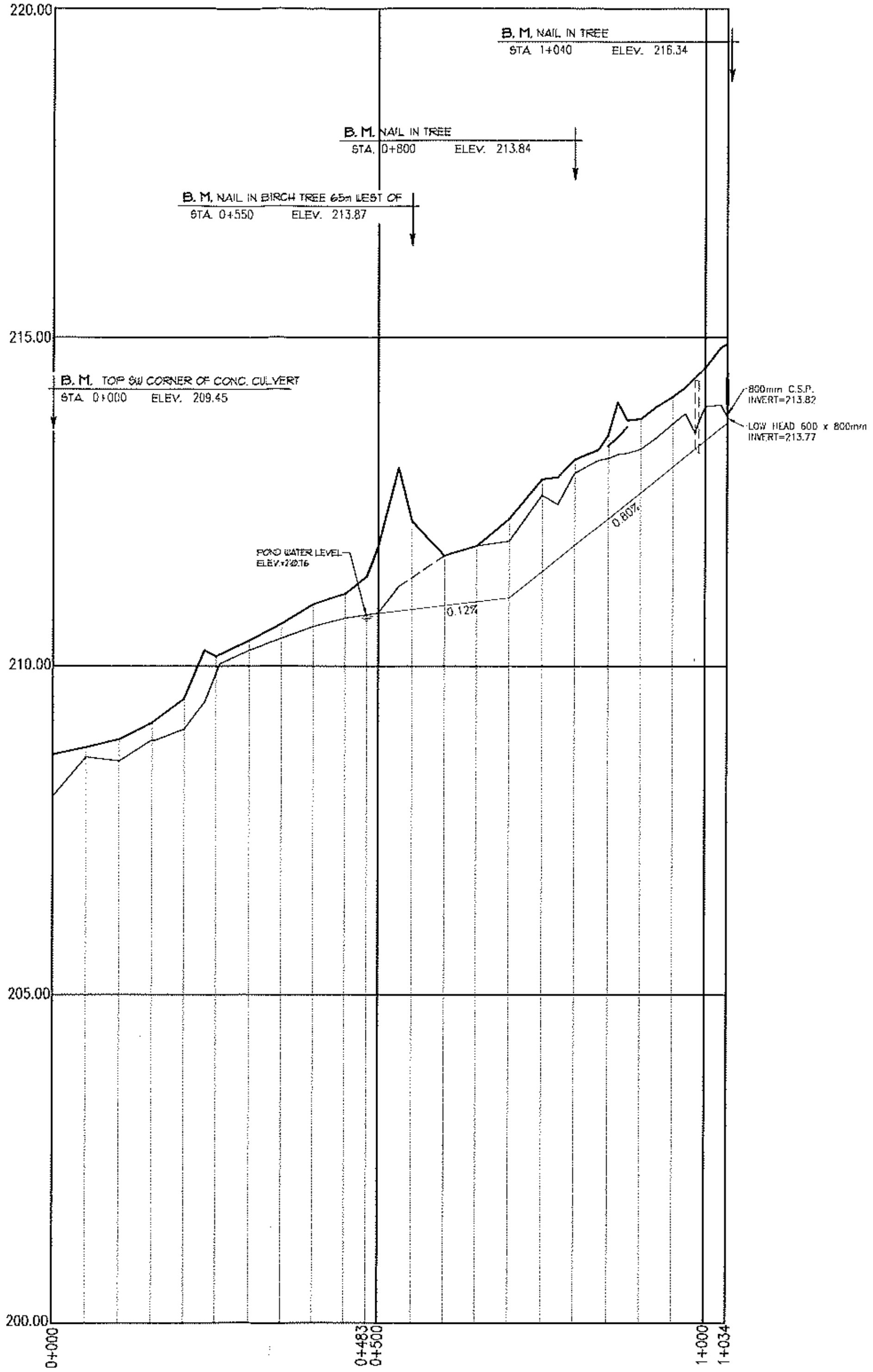
* = Non-agricultural

Appendix B-2 Engineering Drawings

SCS consulting group ltd



PLAN SCALE 1: 5,000



PROFILES

SCALE : HOR. 1 : 5,000
VERT. 1 : 50

LOT LEGEND

	ROLL NO.	OWNERSHIP	HECTARES OWNED
1)	25-102-06	J. WANDERS	0.15
2)	25-105-02	W. TAYLOR	0.14
3)	26-102-44	D. WILLIAM	1.50
4)	26-102-50	J. BANYARD	0.80
5)	26-102-51	W. & W. MILLAR ESTATE	2.78
6)	26-102-5175	P. MILLAR	0.23
7)	26-102-52	L. SHALMI-DOLINA	4.00
8)	26-102-54	J. LEGAULT	4.00
9)	26-102-56	H. HARDMEIER	0.17
10)	26-102-58	D. ROBBINS	5.10
11)	26-102-60	R. MARSHALL	3.40
12)	26-102-42	B. CALTAGIRONE	0.38
13)	26-102-40	M. WINGER	0.38
14)	26-102-38	P. STEVANOVIC	0.38
15)	26-102-36	N. SWEERS	0.41

PLAN LEGEND

- LIMIT OF WATERSHED AREA
- PROPOSED DRAINAGE WORKS
- EXTERIOR OR INTERIOR WATERSHED
- EXIST. DRAIN TO BE INCLUDED
- EXIST. MUNICIPAL DRAIN
- PRIVATE TILE OR SURFACE WATER RUN
- EXIST. WATERCOURSE OR PRIVATE DITCH

10 - 029	ASSESSMENT ROLL NUMBER
J. SMITH	OWNERS NAME
40.5 ha.	HECTARES OWNED

WHITE CHURCH ROAD DRAIN

CITY OF HAMILTON

Drainage Superintendent:
BOB PAUL
(905) 546-2424 EXT. 7641

No.	REVISIONS	DATE

Drawn By: AH
Date: NOV, 2009
Field Book B-154
JOB No. 208231
Drawing No. 1 of 1

PLAN & PROFILE

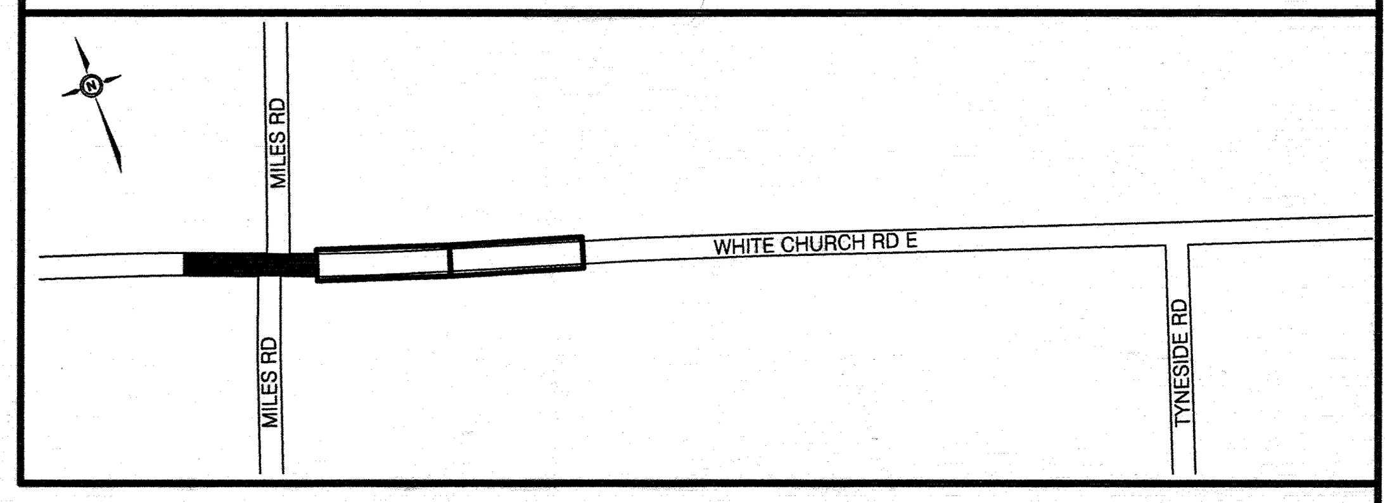
SPRIET ASSOCIATES
LONDON LIMITED

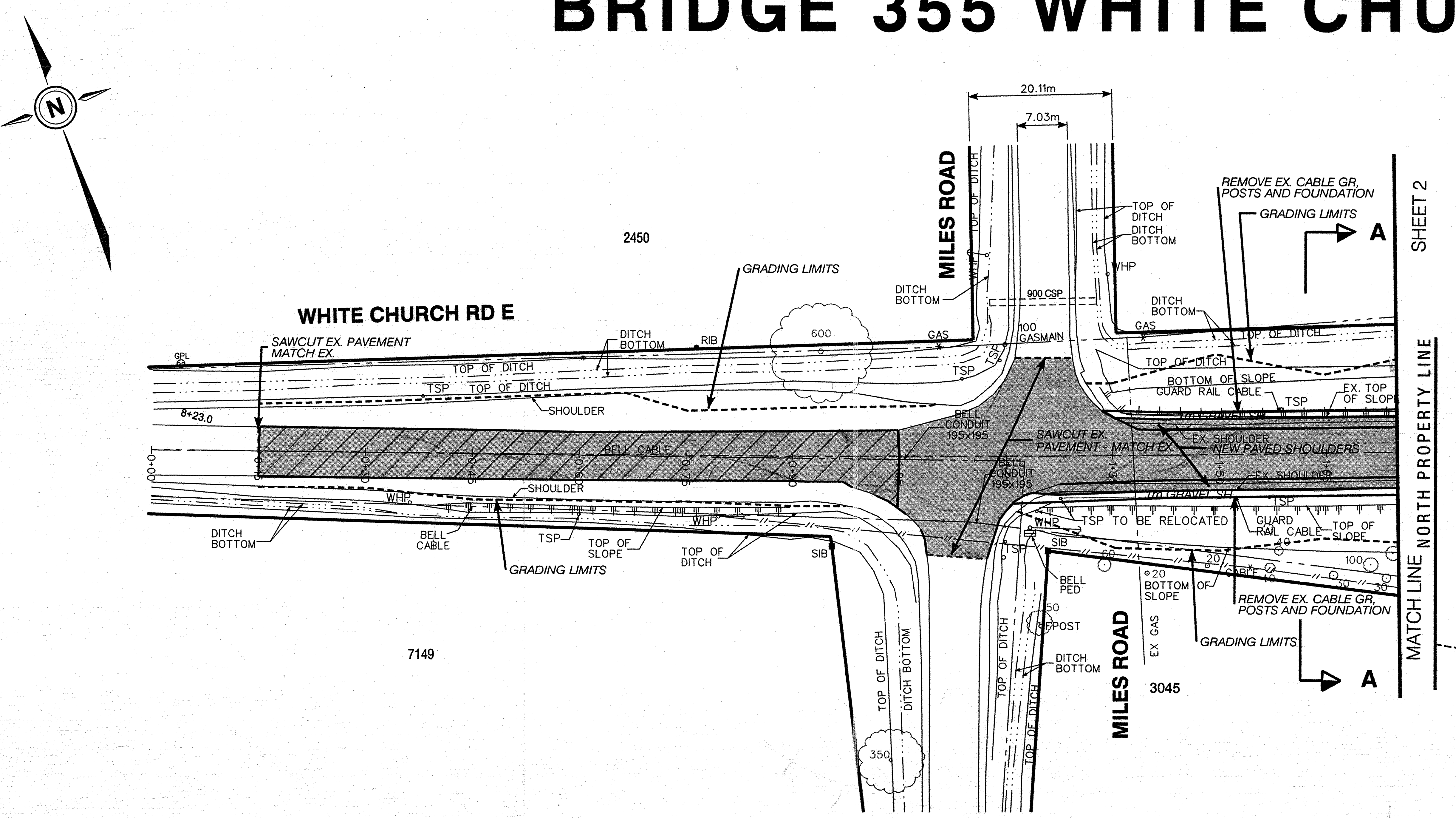
BRIDGE 355 WHITE CHURCH ROAD

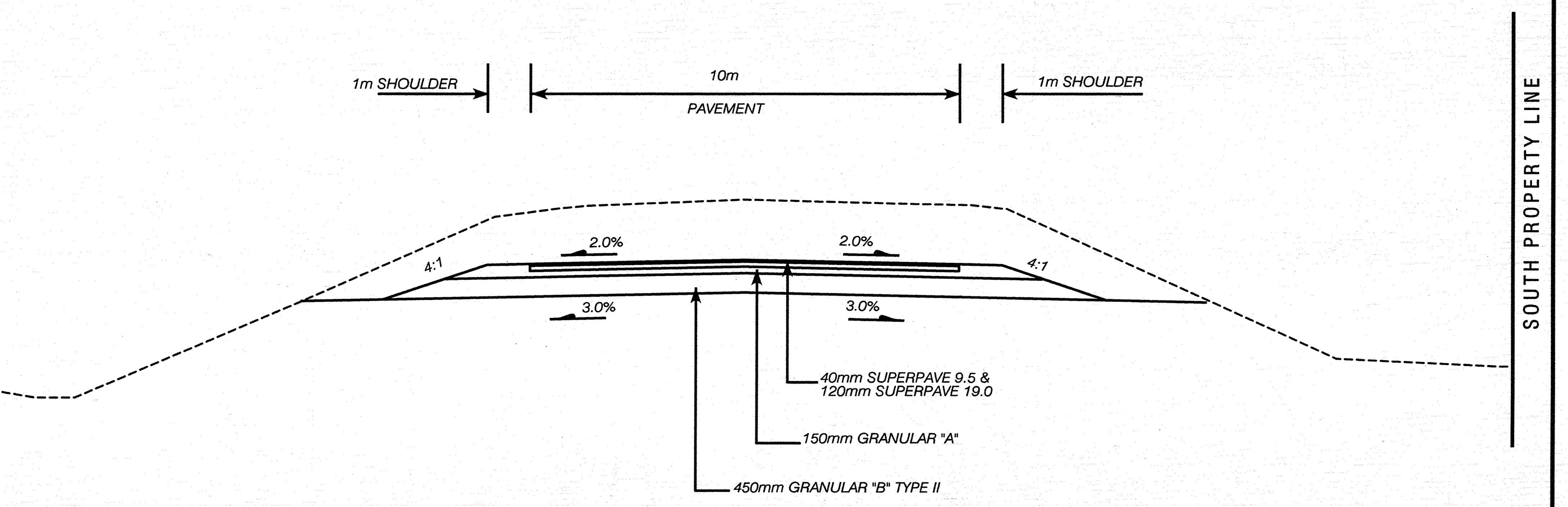
BRIDGE 355 WHITE CHURCH ROAD

FILE No.	CONTRACT No. C15-34-17 (BR) DRAWING No. 14-M-31	SHEET No. 1 OF 6

DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED

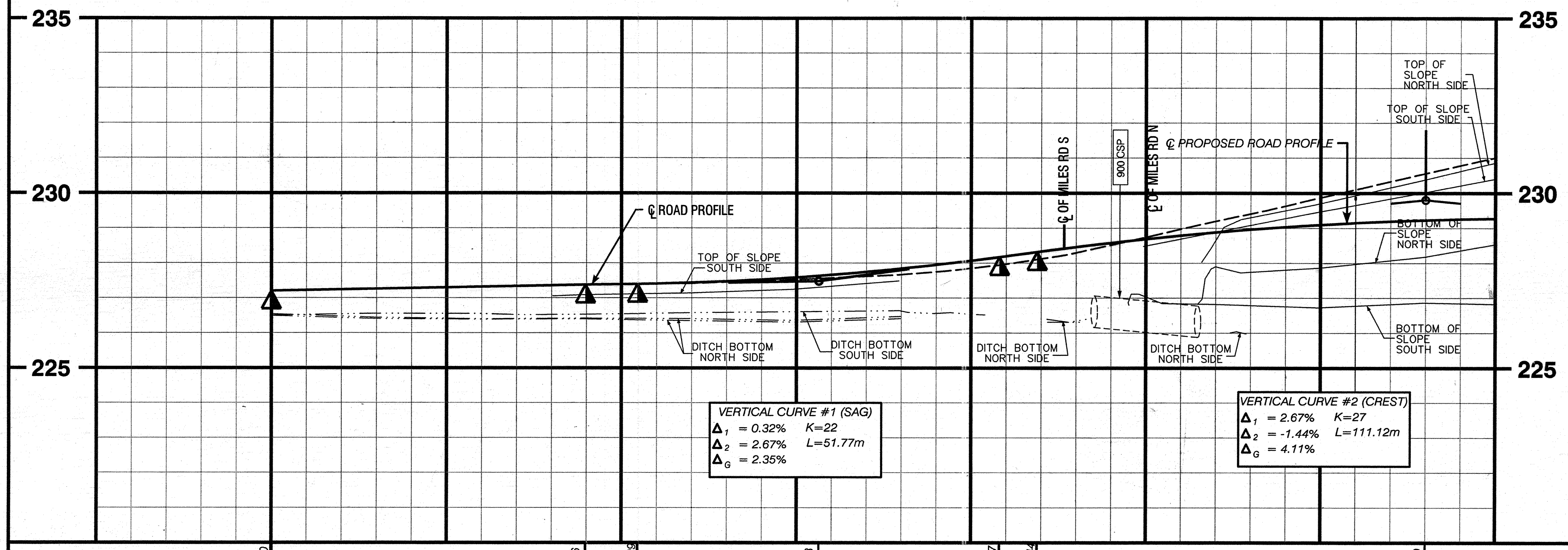






ROADWAY CROSS-SECTION

SECTION A-A
SCALE 1:100



VERTICAL CURVE #1 (SAG)
Δ_1 = 0.32% K=22
Δ_2 = 2.67% L=51.77m
Δ_G = 2.35%

VERTICAL CURVE #2 (CREST)
Δ_1 = 2.67% K=27
Δ_2 = -1.44% L=111.12m
Δ_G = 4.11%

LEGEND

▩ FULL DEPTH CONSTRUCTION
SUPPLY AND PLACE - SURFACE: 40mm SUPERPAVE 9.5, TRAFFIC CATEGORY "C", PG 64-28
SUPPLY AND PLACE - BINDER: 120mm SUPERPAVE 19.0, TRAFFIC CATEGORY "C", PG 64-28
SUPPLY AND PLACE - GRANULAR "A" - 150mm
SUPPLY AND PLACE - GRANULAR "B" - TYPE II - 450mm

▨ STRIP EXISTING ASPHALT 80-130mm DEPTH.
SUPPLY AND PLACE - SURFACE: 40mm SUPERPAVE 9.5, TRAFFIC CATEGORY "C", PG 64-28.
SUPPLY AND PLACE - BINDER: 120mm SUPERPAVE 19.0, TRAFFIC CATEGORY "C", PG 64-28.
PADDING - WITH GRANULAR "A" AS REQUIRED

PROPOSED ROAD ELEVATIONS
PVI 0+00.00 Elev 227.20
PVI 0+44.86 Elev 227.38
PVC 0+52.29 Elev 227.40
PVI 0+78.18 Elev 227.48
PVT 1+04.07 Elev 228.17
PVC 1+09.44 Elev 228.32
PVI 1+65.00 Elev 229.80

PROPOSED ROAD GRADES
44.86@ 0.39%
33.32m@ 0.32%
86.82m @ 2.67%
428.61m @ 1.44%

EXISTING ℄ OF ROAD PROFILE ELEVATIONS	227.20	227.25	227.32	227.38	227.42	227.53	227.67	227.97	228.52	229.20	229.87	230.56	231.00
EXISTING ℄ OF ROAD ALLOWANCE CHAINAGE	0+00	0+15	0+30	0+45	0+60	0+75	0+90	1+05	1+20	1+35	1+50	1+65	1+75

No.	REVISIONS	INITIAL	DATE

DRAWN BY: LC, FAS
DATE: May 3, 2017
REFERENCE MATERIAL:
Surveyed By : J. Hough
Sewer Plans : 83-H-68, 85-H-101
Geodetic Bench Mark Index No. 07720030064 Elevation=220.010m
Borehole Report - GTR_1750

SCALES
0 5m 10m 20m
HORIZONTAL 1:500
0 1m 2m 4m
VERTICAL 1:100

Project Manager (Design)
Farida Saad
Farida A. Saad, P. Eng.
Manager of Design
Susan Jacob
Susan Jacob, P. Eng.

CITY OF
HAMILTON
Public Works Department

BRIDGE 355 WHITE CHURCH ROAD
Bridge Removal and Road Construction
From : 100m West of Miles Road
To : 480m East of Miles Road

14-M-31 (1)

222.10	CASING	220.31			CASING	CHAMBER	45° BEND	45° BEND	223.00	224.45	225.44	226.18	226.60	226.96	GROUND ELEVATION
220.39	216.70	216.70			216.70	216.70	216.70	217.42	218.38	222.39	225.67	224.22	224.76	225.26	TOP OF WATERMAIN
12+500.0	12+543.5	12+550.0	12+568.2	12+571.5	12+577.0	12+580.0	12+585.0	12+591.5	12+600.0	12+650.0	12+700.0	12+750.0	12+800.0	12+850.0	CHAINAGE

NOTES:

∗ INDICATES OFFSET FROM PROPERTY LINE

No.	DATE	REVISION	BY
5	SEPT/95	RECORD DRAWING	
4	JULY/94	REVISED AS PER MTO COMMENTS	
3	JUNE/94	REVISED AS PER RMHW COMMENTS	
2	MAY/94	ISSUED FOR TENDER	
1	APR./94	ISSUED FOR REVIEW	

THORBURN PENNY
Consulting Engineers
Milton, Ontario

R.L. SMITH

D.C. PAYNTER
03/3/95

REGIONAL MUNICIPALITY OF HALDIMAND–NORFOLK
ENGINEERING DEPARTMENT

TITLE:
CAYUGA WATER SYSTEM
TRUNK WATERMAIN
(MOUNT HOPE TO CALEDONIA)
STATION 12+500.0 – 12+850.0

DRAWN BY:	SCALE:	DATE:	REV:
A.F./J.C.	AS NOTED	FEBRUARY 1994	
C'KD BY: D.C./D.P.	DRAWING No. G34		CONTRACT 3

130.17D03440 10/31/95

95-W-66

Appendix B-3 City of Hamilton CLI-ECA

ENVIRONMENTAL COMPLIANCE APPROVAL
For a Municipal Stormwater Management System

ECA Number: 005-S701
Issue Number: 1

Pursuant to the *Environmental Protection Act*, R.S.O 1990, c. E. 19 (EPA*)*, and the regulations made thereunder and subject to the limitations thereof, this environmental compliance approval is issued under section 20.3 of Part II.1 of the EPA to:

Hamilton, City of

700 Woodward Ave
Hamilton, ON L8H 6P4

For the following Sewage Works:

City of Hamilton Stormwater Management System

This Environmental Compliance Approval (ECA) includes the following:

Schedule	Description
Schedule A	System Information
Schedule B	Municipal Stormwater Management System Description
Schedule C	List of Notices of Amendment to this ECA: Additional Approved Works
Schedule D	General
Schedule E	Operating Conditions
Schedule F	Residue Management
Appendix A	Stormwater Management Criteria

Except where specified otherwise, all prior ECAs, or portions thereof, issued by the Director for Sewage Works described in section 1 of Schedule B are revoked and replaced by this Approval.

DATED at TORONTO this ${DAY} day of ${MONTH}, ${YEAR}

Signature

${CURRENTUSER}, P.Eng.
Director, Part II.1, *Environmental Protection Act*

Schedule A: System Information

System Owner	**Hamilton, City of**
ECA Number	**005-S701**
System Name	**City of Hamilton Stormwater Management System**
ECA Issue Date	**${MONTH} ${DAY}, ${YEAR}**

1.0 ECA Information and Mandatory Review Date

ECA Issue Date	${MONTH} ${DAY}, ${YEAR}
Application for ECA Review Due Date	May 15, 2026

1.1 Pursuant to section 20.12 of the EPA, the Owner shall submit an application for review of the Approval no later than the Application for ECA Review Date indicated above.

2.0 Related Documents

2.1 Other Documents

Document Title	Version
Design Criteria for Sanitary Sewers, Storm Sewers, and Forcemains for future Alterations Authorized under ECA	v.1 (Apr. 22, 2022)

3.0 Stormwater Master Plan and Asset Management Plan

Document Title	Version
City of Hamilton Stormwater Master Plan – Class Environmental Assessment Report (City-Wide)	v.1 (May, 2007)
Corporate Asset Management Plan Overview	June, 2022

4.0 Operating Authority

System	Operating Authority
SW Hamilton-Collection	Hamilton, City of

Schedule B: Municipal Stormwater Management System Description

System Owner	**Hamilton, City of**
ECA Number	**005-S701**
System Name	**City of Hamilton Stormwater Management System**
ECA Issue Date	**${MONTH} ${DAY}, ${YEAR}**

1.0 System Description

1.1 The following is a summary description of the Sewage Works comprising the Municipal Stormwater Management System:

Overview

The Municipal Stormwater Management (SWM) System serving the City of Hamilton's drainage area, is a separate system for stormwater (i.e. designed not to convey sanitary sewage, combined sewage) within the Hamilton Conservation ~~sub watershed~~, Halton Conservation ~~sub watershed,~~ Niagara Peninsula Conservation ~~watershed,~~ and Grand River Conservation watersheds. The Municipal SWM System consists of storm sewers, Stormwater Management Facilities and outlets.

This ECA covers the entire Municipal SWM System owned and operated by the City of Hamilton. This ECA does not cover municipally or privately owned sewage works on industrial, institutional or commercial land.

Sewage Collection System

1.2 The Authorized System comprises:

1.2.1 The Sewage Works described and depicted in each document or file identified in column 1 of Table B1.

Table B1: Infrastructure Map	
Column 1 Document or File Name	Column 2 Date
Storm Sewer Map for CLI ECA Application	January 11, 2022

1.2.2 Storm Sewers, Stormwater Management Facilities, stormwater pumping stations and Sewage Works associated with a Third Pipe Collection System that have been added, modified, replaced, or extended through authorization provided in a Schedule C Notice respecting this Approval, where Completion occurs on or after the date identified in column 2 of Table B1 for each document or file identified in column 1.

1.2.3 Storm Sewers, Stormwater Management Facilities and Sewage Works associated with a Third Pipe Collection System that have been added, modified, replaced, or extended through authorization provided by Schedule D of this Approval, where Completion occurs on or after the date identified in column 2 of Table B1 for each document or file identified in column 1.

1.2.4 Any Sewage Works described in conditions 1.3 through 1.8 below.

Stormwater Collection System

1.3 Categorization of the Authorized System at the date of issue of this Approval is as follows:

Table B2. Stormwater Collection System by Diameter

System Type	Pipe Diameter (mm)	Length (km)	System Totals (km)
Storm Sewers	Up to 250	19.46	--
Storm Sewers	> 250 - 500	514.94	--
Storm Sewers	> 500 - 1050	519.41	--
Storm Sewers	> 1050	196.54	--
Total Storm Sewers	N/A	--	1250.53
Ditches / Swales	N/A	--	Not available
Total System Length (km)	N/A	--	1250.53

Table B3. Summary of Stormwater Management Facilities by Type and Pumping Stations

Facility Type	Basic Treatment for Suspended Solids*	Normal Treatment for Suspended Solids *	Enhanced Treatment for Suspended Solids *	Other Treatment Level for Suspended Solids**	Total Quality Control	Total Quantity Control	Total Number of Facilities
LID Facilities - Retention (infiltration, evapotranspiration, harvest)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LID Facilities - Filtration	N/A	N/A	N/A	N/A	N/A	N/A	4
Stormwater Management Ponds – Wet (includes wetlands, hybrids)	N/A	N/A	N/A	N/A	N/A	N/A	74

Stormwater Management Ponds - Dry	N/A			N/A	N/A	N/A	61
Super Pipe / Storage Facility	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Filtration MTD - Filter Unit	N/A	N/A	N/A	N/A	N/A		N/A
Sedimentation MTD - OGS	N/A	N/A	N/A	N/A	N/A		85
Pumping Stations							2
Other	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Number of Facilities	N/A	N/A	N/A	N/A	N/A	N/A	N/A

* Basic, normal, and enhanced treatment correspond to 60%, 70% and 80% suspended solids removal on an annual average long-term basis, respectively.

** Treatment levels below 60% suspended solids removal on an annual average long-term basis.

Table B4. Third Pipe Collection System

Description	Pipe Diameter (mm)	Length (km)	Quantity	System Totals
Third Pipe Sewer	Up to 250	N/A	N/A	N/A
Third Pipe Sewer	> 250 - 500	N/A	N/A	N/A
Third Pipe Sewer	> 500	N/A	N/A	N/A
Total	N/A	N/A	N/A	Km
Other Infrastructure Components (e.g., storage tank)	N/A	N/A	N/A	N/A

Table B5. Sewage Works on Private Land that are part of the Municipal Stormwater Treatment Train*

Description	Location	ECA # (if applicable)
N/A		

* Identifies privately owned Sewage Works that are not part of the Authorized System, but are part of a Stormwater Treatment Train

Stormwater Management Facilities

1.4 The following are Stormwater Management Facilities in the Authorized System:

1-Dry Pond-1172 Old Mohawk Road-Ancaster

Location	-79.9386, 43.232
Watershed/Subwatershed	Chedoke Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.938853, 43.232132
Catchment Area	29.44 ha
Level of Treatment for suspended solids	Not available at this time

Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	563 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

2-Dry Pond-52 Sulphur Springs Road-Ancaster

Location	-79.9788, 43.226
Watershed/Subwatershed	Sulphur Creek
Receiver of discharge	Cootes Paradise
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	430 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

3-Dry Pond-86 Galley Road-Ancaster

Location	-80.005, 43.2073
Watershed/Subwatershed	Big Creek
Receiver of discharge	Lake Erie
Outlet location	-80.005322, 43.207046
Catchment Area	31.34 ha

Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	7000 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

4-Dry Pond-Beside 156 Valridge Drive-Ancaster

Location	-80.0094, 43.2137
Watershed/Subwatershed	Big Creek
Receiver of discharge	Lake Erie
Outlet location	-80.009975, 43.212959
Catchment Area	23.95 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	2942 m3
Design Storm	Not available at this time
Reference ECA(s)	3-0844-95-006
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

5E-Wet Pond-Beside 1404 Cormorant Road South-Ancaster

Location	-80.0265, 43.1862
Watershed/Subwatershed	Big Creek
Receiver of discharge	Lake Erie
Outlet location	-80.028981, 43.18518

Catchment Area	~~84.4~~79 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~19310 m3~~
Design Storm	Not available at this time
Reference ECA(s)	9195-6FBJLM
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

5W-Wet Pond-Beside 1404 Cormorant Road South-Ancaster

Location	-80.0265, 43.1862
Watershed/Subwatershed	Big Creek
Receiver of discharge	Lake Erie
Outlet location	-80.028981, 43.18518
Catchment Area	5.4 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	9195-6FBJLM
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

6-Dry Pond-295 Nakoma Road-Ancaster

Location	-79.9947, 43.2077

Watershed/Subwatershed	Big Creek
Receiver of discharge	Lake Erie
Outlet location	-79.994685, 43.206629
Catchment Area	34.99 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	14000 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

7-Dry Pond-6 Cedargrove Court-Ancaster

Location	-79.968, 43.2273
Watershed/Subwatershed	Ancaster Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.967805, 43.227859
Catchment Area	1.54 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	588 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

8-Dry Pond-721 Deervalley Road-Ancaster

Location	-79.9581, 43.2362
Watershed/Subwatershed	Tiffany Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.957521, 43.236481
Catchment Area	28 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	350 m3
Design Storm	Not available at this time
Reference ECA(s)	3-1187-96-006
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

9-Dry Pond-Beside 54 Derbyshire Street-Ancaster

Location	-79.9855, 43.2015
Watershed/Subwatershed	Big Creek
Receiver of discharge	Lake Erie
Outlet location	-79.985732, 43.201354
Catchment Area	10.36~~2.57~~ ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	7260 m3
Design Storm	Not available at this time
Reference ECA(s)	3-1449-96-976
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

10-Dry Pond-334 Wilson Street West-Ancaster

Location	-80.000000 43.208100
Watershed/Subwatershed	Big Creek
Receiver of discharge	Grand River
Outlet location	
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	Not available at this time
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

11-Dry Pond-228 Greenbriar Road-Ancaster

Location	-79.9638, 43.2162
Watershed/Subwatershed	Ancaster Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.963856, 43.216269
Catchment Area	16.83 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	416 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

12-Dry Pond-Beside 34 Anderson Court-Ancaster

Location	-80.0162, 43.2129
Watershed/Subwatershed	Big Creek
Receiver of discharge	Lake Erie
Outlet location	-80.01711, 43.212385
Catchment Area	38.2 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	11600 m3
Design Storm	Not available at this time
Reference ECA(s)	3-1299-96-006
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

13-Dry Pond-200 Hostein Drive-Ancaster

Location	-79.9652, 43.2163
Watershed/Subwatershed	Ancaster Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.965887, 43.216322
Catchment Area	2.78 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	2375 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

14-Dry Pond-157 Miller Drive-Ancaster

Location	-79.9741, 43.2061
Watershed/Subwatershed	Ancaster Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.974692, 43.207024
Catchment Area	104.01 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	11101 m3
Design Storm	Not available at this time
Reference ECA(s)	5787-69EU6U
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

15-Dry Pond-Beside 99 Panabaker Drive-Ancaster

Location	-79.9965, 43.2032
Watershed/Subwatershed	Big Creek
Receiver of discharge	Lake Erie
Outlet location	-79.9974078, 43.2029226
Catchment Area	9.5~~18.97~~ ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	13000 m3
Design Storm	Not available at this time
Reference ECA(s)	3-0094-98-006
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

16-Dry Pond-47 Bloomsbury Court-Ancaster

Location	-79.9841, 43.2061
Watershed/Subwatershed	Big Creek
Receiver of discharge	Lake Erie
Outlet location	-79.984078, 43.2057196
Catchment Area	6.26 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	1820 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

17-Dry Pond-52 Millcreek Court-Ancaster

Location	-79.9743, 43.2364
Watershed/Subwatershed	Ancaster Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.9739727, 43.2363505
Catchment Area	12.25 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	1646 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

18-Dry Pond-Beside 103 Oneida Boulevard-Ancaster

Location	-79.9568, 43.2268
Watershed/Subwatershed	Tiffany Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.9564408, 43.2269647
Catchment Area	4.03 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	531 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

19-Dry Pond-201 Golf Links Road-Ancaster

Location	-79.9793, 43.222
Watershed/Subwatershed	Ancaster Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.9795301, 43.2219882
Catchment Area	10.34 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	260 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

20-Dry Pond-3 Oldoakes Place-Ancaster

Location	-79.9623, 43.2224
Watershed/Subwatershed	Ancaster Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.9624276, 43.2224343
Catchment Area	1.41 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	225 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

21A-Wetland-1165 Old Mohawk Road-Ancaster

Location	-79.9396, 43.24
Watershed/Subwatershed	Chedoke Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.938365, 43.240875
Catchment Area	2.93 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	13500 m3
Design Storm	Not available at this time
Reference ECA(s)	3-1010-84-006
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wetland
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

21B-Wetland-1165 Old Mohawk Road-Ancaster

Location	-79.9363, 43.2416
Watershed/Subwatershed	Chedoke Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.934018, 43.240947
Catchment Area	2.93 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	18500 m3
Design Storm	Not available at this time
Reference ECA(s)	3-1010-84-006
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wetland
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

22-Dry Pond-27 Harrington Place-Ancaster

Location	-79.9872, 43.2256
Watershed/Subwatershed	Sulphur Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.987225, 43.2257385
Catchment Area	2.854 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	536 m3
Design Storm	Not available at this time
Reference ECA(s)	3-0889-97-006
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

23-Wet Pond-Beside 109 Woodview Crescent-Ancaster

Location	-79.9952, 43.2311
Watershed/Subwatershed	Sulphur Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.99541, 43.231412
Catchment Area	87.98 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	8414 m3
Design Storm	Not available at this time
Reference ECA(s)	0327-4TKQUH
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

24-Dry Pond-71 Cross Street-Dundas

Location	-79.9485, 43.2743
Watershed/Subwatershed	Lower Spencer Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.947466, 43.274488
Catchment Area	46.9 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	3100 m3
Design Storm	Not available at this time
Reference ECA(s)	5487-693MX2
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

25-Dry Pond-Beside 1 Gillespie Crescent-Dundas

Location	-79.9883, 43.2561
Watershed/Subwatershed	Middle Spencer Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.987981, 43.255951
Catchment Area	12.28~~2~~ ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	3400 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

26-Dry Pond-51 Davidson Boulevard-Dundas

Location	-79.9844, 43.2617
Watershed/Subwatershed	Middle Spencer Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.982484, 43.262061
Catchment Area	69.97 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	26000 m3
Design Storm	Not available at this time
Reference ECA(s)	3-1271-86-957
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

27-Wet Pond-238 Carlisle Road-Flamborough

Location	-79.9837, 43.3916
Watershed/Subwatershed	Bronte Creek Upper Main Branch
Receiver of discharge	Lake Ontario
Outlet location	-79.983559, 43.391357
Catchment Area	~~N/A~~16 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~1400 m3~~
Design Storm	Not available at this time
Reference ECA(s)	3-0215-90-006
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

28-Wetland-10 Tews Lane-Flamborough

Location	-79.9789, 43.2836
Watershed/Subwatershed	Logie's Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.978226, 43.28353
Catchment Area	~~31.33~~20.53 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~5811 m3~~
Design Storm	Not available at this time
Reference ECA(s)	3-0649-97-006
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wetland
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

29-Dry Pond-Beside 23 Karendale Crescent-Flamborough

Location	-80.0473, 43.4009
Watershed/Subwatershed	Strabane Creek
Receiver of discharge	Lake Ontario
Outlet location	-80.047235, 43.400444
Catchment Area	15.37 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	2957.5 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

30-Dry Pond-1 Blackberry Place-Flamborough

Location	-79.977, 43.4064
Watershed/Subwatershed	Flamboro Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.975653, 43.406812
Catchment Area	~~N/A~~9.92 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	2700 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

31-Dry Pond-Beside 1 Wildan Drive-Flamborough

Location	-80.0242, 43.3958
Watershed/Subwatershed	Bronte Creek Upper Main Branch
Receiver of discharge	Lake Ontario
Outlet location	-80.023659, 43.395688
Catchment Area	0.16 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	2380 m3
Design Storm	Not available at this time
Reference ECA(s)	3-1299-92-937
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

32-Dry Pond-10 Gwyneth Drive-Flamborough

Location	-79.9743, 43.403
Watershed/Subwatershed	Bronte Creek Upper Main Branch
Receiver of discharge	Lake Ontario
Outlet location	-79.9742523, 43.4026858
Catchment Area	19.47 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	855 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

33-Wet Pond-165 Boulding Avenue-Flamborough

Location	-79.8914, 43.3458
Watershed/Subwatershed	Grindstone Creek 218
Receiver of discharge	Hamilton Harbour
Outlet location	-79.892086, 43.345746
Catchment Area	20.44 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~17000 m3~~
Design Storm	Not available at this time
Reference ECA(s)	3-0716-91-006
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

34-Low Impact Development-55 Rockcliffe Road-Flamborough

Location	-79.8989, 43.324
Watershed/Subwatershed	Grindstone Creek 228
Receiver of discharge	Hamilton Harbour
Outlet location	-79.8988417, 43.3239713
Catchment Area	1.~~36~~ 66 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	120 m3
Design Storm	Not available at this time
Reference ECA(s)	3-0634-99-006
Reference Sewage Works as part of treatment train	N/A
Brief Description	Low Impact Development
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

35-Dry Pond-71 Innovation Drive-Flamborough

Location	-79.9167, 43.3057
Watershed/Subwatershed	Grindstone Creek 232
Receiver of discharge	Hamilton Harbour
Outlet location	-79.915283, 43.30632
Catchment Area	~~15.66~~52 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	16500 m3
Design Storm	Not available at this time
Reference ECA(s)	3-0350-94-006
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

36-Dry Pond-12 Peebles Drive-Flamborough

Location	-80.0278, 43.3922
Watershed/Subwatershed	Bronte Creek Upper Main Branch
Receiver of discharge	Lake Ontario
Outlet location	-80.0272173, 43.3918193
Catchment Area	~~N/A~~20.02 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	9000 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

37-Dry Pond-441 Ofield Road South-Flamborough

Location	-79.9789, 43.2922
Watershed/Subwatershed	Logie's Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.977806, 43.2921846
Catchment Area	26.37 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	10441 m3
Design Storm	Not available at this time
Reference ECA(s)	3-1820-90-916
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

38-Dry Pond-7 Kyle Court-Flamborough

Location	-80.092, 43.2528
Watershed/Subwatershed	Big Creek
Receiver of discharge	Lake Erie
Outlet location	-80.091775, 43.252549
Catchment Area	20.07 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	398 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

39-Wet Pond-6 Oldenburg Road-Flamborough

Location	-79.9739, 43.4074
Watershed/Subwatershed	Flamboro Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.974348, 43.407511
Catchment Area	22.53 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	3380 m3
Design Storm	Not available at this time
Reference ECA(s)	3-344-0-97-006~~3-0161-97-006~~
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

40-Wet Pond-55 Palomino Drive-Flamborough

Location	-79.9723, 43.4092
Watershed/Subwatershed	Flamboro Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.972331, 43.409291
Catchment Area	3.64 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~442 m3~~
Design Storm	Not available at this time
Reference ECA(s)	5883-542KRA
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A

Notes	N/A

41-Dry Pond-11 Blueheron Lane-Flamborough

Location	-79.9746, 43.3928
Watershed/Subwatershed	Bronte Creek Upper Main Branch
Receiver of discharge	Lake Ontario
Outlet location	-79.975002, 43.393194
Catchment Area	48.87 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	2000 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

42-Dry Pond-21 Blueheron Lane-Flamborough

Location	-79.9727, 43.3939
Watershed/Subwatershed	Bronte Creek Upper Main Branch
Receiver of discharge	Lake Ontario
Outlet location	-79.972379, 43.394543
Catchment Area	48.87 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	3000 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond

Receive Emergency Sanitary Overflows	N/A
Notes	N/A

~~43-Dry Pond-Beside 112 Grindstone Way-Flamborough~~

~~Location~~	~~-79.9065, 43.3163~~
~~Watershed/Subwatershed~~	~~Grindstone Creek 228~~
~~Receiver of discharge~~	~~Hamilton Harbour~~
~~Outlet location~~	~~-79.906053, 43.316433~~
~~Catchment Area~~	~~9.71 ha~~
~~Level of Treatment for suspended solids~~	~~Not available at this time~~
~~Treatment for other Contaminants, as required~~	~~Not available at this time~~
~~Level of Volume control~~	~~2832 m3~~
~~Design Storm~~	~~Not available at this time~~
~~Reference ECA(s)~~	~~9543-6ZWJHH~~
~~Reference Sewage Works as part of treatment train~~	~~N/A~~
~~Brief Description~~	~~Dry pond~~
~~Receive Emergency Sanitary Overflows~~	~~N/A~~
~~Notes~~	~~N/A~~

44-Dry Pond-40 Riley Street-Flamborough

Location	-79.903, 43.3291
Watershed/Subwatershed	Borer’s Creek
Receiver of discharge	Coote’s Paradise
Outlet location	-79.905746, 43.326953
Catchment Area	10.52 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	27000 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A

Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

45-Dry Pond-30 Parkshore Place-Flamborough

Location	-79.97, 43.3961
Watershed/Subwatershed	Bronte Creek Upper Main Branch
Receiver of discharge	Lake Ontario
Outlet location	-79.970509, 43.395402
Catchment Area	1.93 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	3800 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

46-Dry Pond-Beside 114 Grindstone Way-Flamborough

Location	-79.9058, 43.3171
Watershed/Subwatershed	Grindstone Creek 228
Receiver of discharge	Hamilton Harbour
Outlet location	-79.905797, 43.316832
Catchment Area	9.71 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	2832 m3
Design Storm	Not available at this time
Reference ECA(s)	9543-6ZWJHH

Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

47-Dry Pond-44 Waterwheel Crescent-Flamborough

Location	-79.9045, 43.3194
Watershed/Subwatershed	Grindstone Creek 228
Receiver of discharge	Hamilton Harbour
Outlet location	-79.904084, 43.319478
Catchment Area	14.01 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	1430 m3
Design Storm	Not available at this time
Reference ECA(s)	9543-6ZWJHH
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

48-Dry Pond-16 Stonebury Place-Flamborough

Location	-80.0072, 43.4174
Watershed/Subwatershed	Mountsberg Creek
Receiver of discharge	Lake Ontario
Outlet location	-80.006875, 43.417674
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	2200 m3
Design Storm	Not available at this time

Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

49-Dry Pond-Beside 76 Oak Avenue-Flamborough

Location	-80.0058, 43.2659
Watershed/Subwatershed	Middle Spencer Creek
Receiver of discharge	Cootes Paradise
Outlet location	-80.005659, 43.266412
Catchment Area	74.1~~9.16~~ ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	6710 m3
Design Storm	Not available at this time
Reference ECA(s)	3-0884-97-006
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

52-Dry Pond-204 Stagecoach Drive-Glanbrook

Location	-79.8906, 43.1901
Watershed/Subwatershed	Twenty Mile Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.890817, 43.189735
Catchment Area	13.94 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	6200 m3

Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

53-Dry Pond-2624 Upper James Street-Glanbrook

Location	-79.9075, 43.1733
Watershed/Subwatershed	Twenty Mile Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.907086, 43.173398
Catchment Area	11.65 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	954~~2~~ m3
Design Storm	Not available at this time
Reference ECA(s)	3-1466-92-006
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

60A-Dry Pond-Beside 32 Redfern Avenue-Hamilton

Location	-79.916, 43.2422
Watershed/Subwatershed	Chedoke Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.916687, 43.242641
Catchment Area	48.2 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time

Level of Volume control	~~15100~~ 6205 m3
Design Storm	Not available at this time
Reference ECA(s)	3-1052-97-006
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

62-Wet Pond-86 Christopher Drive-Hamilton

Location	-79.9026, 43.2004
Watershed/Subwatershed	Twenty Mile Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.90188, 43.1996435
Catchment Area	195.07 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~9600 m3~~
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	~~Wet pond~~ Online Quality Control Pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

64-Wet Pond-44 Shadetree Crescent-Stoney Creek

Location	-79.7955, 43.184
Watershed/Subwatershed	Upper Davis Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.795875, 43.184508
Catchment Area	44.68 ha
Level of Treatment for suspended solids	Not available at this time

Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~9818 m3~~
Design Storm	Not available at this time
Reference ECA(s)	8304-4LXP4A
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

65-Wet Pond-Beside 29 Pinewoods Drive-Stoney Creek

Location	-79.774, 43.1812
Watershed/Subwatershed	Stoney Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.7735612, 43.1810465
Catchment Area	22.87 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~9311 m3~~
Design Storm	Not available at this time
Reference ECA(s)	7255-7PYJQQ
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

66-Wetland-18 Windemere Road-Stoney Creek

Location	-79.6286, 43.2273
Watershed/Subwatershed	WC 11
Receiver of discharge	Lake Ontario
Outlet location	-79.6284715, 43.2284325
Catchment Area	43.9 ha

Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	4900 m3
Design Storm	Not available at this time
Reference ECA(s)	7576-4L8QBX
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wetland
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

67-Wet Pond-167 Candlewood Drive-Stoney Creek

Location	-79.7821, 43.1752
Watershed/Subwatershed	Sinkhole Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.782501, 43.174798
Catchment Area	~~22.81~~20.77 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~7242 m3~~
Design Storm	Not available at this time
Reference ECA(s)	5253-6EALRQ
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

~~68-Dry Pond-9 Glencrest Avenue-Stoney Creek~~

~~Location~~	~~-79.7054, 43.2132~~
~~Watershed/Subwatershed~~	~~Stoney Creek WC5~~
~~Receiver of discharge~~	~~Lake Ontario~~
~~Outlet location~~	~~-79.7048, 43.2133~~

~~Catchment Area~~	~~18.07 ha~~
~~Level of Treatment for suspended solids~~	~~Not available at this time~~
~~Treatment for other Contaminants, as required~~	~~Not available at this time~~
~~Level of Volume control~~	~~2111 m3~~
~~Design Storm~~	~~Not available at this time~~
~~Reference ECA(s)~~	~~N/A~~
~~Reference Sewage Works as part of treatment train~~	~~N/A~~
~~Brief Description~~	~~Dry pond~~
~~Receive Emergency Sanitary Overflows~~	~~N/A~~
~~Notes~~	~~N/A~~

69-Dry Pond-Beside 268 Winterberry Drive-Stoney Creek

Location	-79.8015, 43.1911
Watershed/Subwatershed	Upper Davis Creek
Receiver of discharge	Hamilton Harbor
Outlet location	-79.798253, 43.191807
Catchment Area	302.7 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	44770 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

70-Dry Pond-799 Golf Links Road-Ancaster

Location	-79.9516, 43.2286
Watershed/Subwatershed	Tiffany Creek
Receiver of discharge	Cootes Paradise

Outlet location	-79.951326, 43.229627
Catchment Area	25.72 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	374390 m3
Design Storm	Not available at this time
Reference ECA(s)	9553-5TVKMS
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

71-Dry Pond-933 Golf Links Road-Ancaster

Location	-79.9458, 43.2279
Watershed/Subwatershed	Tiffany Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.94788, 43.228647
Catchment Area	267 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	62230 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

72-Dry Pond-40 Cloverleaf Drive-Ancaster

Location	-79.9453, 43.2262
Watershed/Subwatershed	Tiffany Creek

Receiver of discharge	Cootes Paradise
Outlet location	-79.94577, 43.226621
Catchment Area	14.91 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	554 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

73-Wet Pond-34 Mapleleaf Trail-Glanbrook (PRIVATE POND WITH EASEMENT)

Location	-79.91 43.20
Watershed/Subwatershed	Twenty Mile Creek
Receiver of discharge	Lake Ontario
Outlet location	
Catchment Area	88.67 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	8430-5CJKRN
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

74-Wet Pond-Beside 3140 Regional Road 56-Glanbrook

Location	-79.8075, 43.1179

Watershed/Subwatershed	Welland River West
Receiver of discharge	Lake Ontario
Outlet location	-79.8077236, 43.1175299
Catchment Area	18.65 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~2558 m3~~
Design Storm	Not available at this time
Reference ECA(s)	5100-6QSNGV
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

75-Wet Pond-Beside 239 Southbrook Drive-Glanbrook

Location	-79.8029, 43.1135
Watershed/Subwatershed	Welland River West
Receiver of discharge	Lake Ontario
Outlet location	-79.802443, 43.113508
Catchment Area	7.21 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~2647 m3~~
Design Storm	Not available at this time
Reference ECA(s)	3327-4T8JR7
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

76-Wet Pond-36 Joshua Avenue-Ancaster

Location	-79.945, 43.2234
Watershed/Subwatershed	Tiffany Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.9453469, 43.2246975
Catchment Area	~~46.47~~25.72 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	28530 m3
Design Storm	Not available at this time
Reference ECA(s)	8304-5B7LKK
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

78-Dry Pond-Beside 2527 Binbrook Road-Glanbrook

Location	-79.7997, 43.1137
Watershed/Subwatershed	Welland River West
Receiver of discharge	Lake Ontario
Outlet location	-79.79849, 43.113507
Catchment Area	237.38 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	~~84592~~ 87000 m3
Design Storm	Not available at this time
Reference ECA(s)	3327-4T8JR7
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

79-Wet Pond-Beside 2527 Binbrook Road-Glanbrook

Location	-79.8017, 43.1138
Watershed/Subwatershed	Welland River West
Receiver of discharge	Lake Ontario
Outlet location	-79.801214, 43.113516
Catchment Area	52.36 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~12468 m3~~
Design Storm	Not available at this time
Reference ECA(s)	3327-4T8JR7
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

81-Wet Pond-401 Mount Albion Road-Hamilton

Location	-79.8019, 43.2079
Watershed/Subwatershed	Montgomery Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.8015713, 43.2085715
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~1100 m3~~
Design Storm	Not available at this time
Reference ECA(s)	4366-4YQQVE
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

82-Dry Pond-940 Arvin Avenue-Stoney Creek

Location	-79.6741, 43.2171
Watershed/Subwatershed	WC7
Receiver of discharge	Lake Ontario
Outlet location	-79.673805, 43.2174495
Catchment Area	2.05 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	25000 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

83-Dry Pond-Garth Street interchange and Linc-Hamilton

Location	-79.9071, 43.2235
Watershed/Subwatershed	Chedoke Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.908043, 43.224242
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	6500 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

84-Wetland-Dartnall Road and Linc-Hamilton

Location	-79.8249, 43.1984
Watershed/Subwatershed	Upper Ottawa
Receiver of discharge	Lake Ontario
Outlet location	-79.8247714, 43.1995346
Catchment Area	12.01 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	5400 m3
Design Storm	Not available at this time
Reference ECA(s)	4366-4YQQVE~~No ECA on record~~
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wetland
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

85-Dry Pond-Upper Wentworth St and Linc-Hamilton

Location	-79.8666, 43.2147
Watershed/Subwatershed	Upper Ottawa
Receiver of discharge	Lake Ontario
Outlet location	-79.867229, 43.214508
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	N/A
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

~~86-Wet Pond-1199 Upper Ottawa Street-Hamilton~~

~~Location~~	~~-79.8363, 43.2043~~
~~Watershed/Subwatershed~~	~~Upper Ottawa~~
~~Receiver of discharge~~	~~Lake Ontario~~
~~Outlet location~~	~~N/A~~
~~Catchment Area~~	~~4.25 ha~~
~~Level of Treatment for suspended solids~~	~~Not available at this time~~
~~Treatment for other Contaminants, as required~~	~~Not available at this time~~
~~Level of Volume control~~	~~Not available at this time~~
~~Design Storm~~	~~Not available at this time~~
~~Reference ECA(s)~~	~~7946-AA9NYD~~
~~Reference Sewage Works as part of treatment train~~	~~N/A~~
~~Brief Description~~	~~Wet pond~~
~~Receive Emergency Sanitary Overflows~~	~~N/A~~
~~Notes~~	~~N/A~~

87-Wet Pond-401 Mount Albion Road-Hamilton

Location	-79.8053, 43.2058
Watershed/Subwatershed	Montgomery Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.8050979, 43.2061129
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~500 m3~~
Design Storm	Not available at this time
Reference ECA(s)	4366-4YQQVE
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

88-Wetland-439 Garner Road West-Ancaster

Location	-80.0029, 43.1988
Watershed/Subwatershed	Big Creek
Receiver of discharge	Lake Erie
Outlet location	-80.003083, 43.198509
Catchment Area	11.5 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~3974 m3~~
Design Storm	Not available at this time
Reference ECA(s)	6429-5QCHRF
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wetland
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

89-Wet Pond-22 Brooking Court-Ancaster

Location	-80.0121, 43.1996
Watershed/Subwatershed	Big Creek
Receiver of discharge	Lake Erie
Outlet location	-80.012676, 43.199338
Catchment Area	12 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~2610 m3~~
Design Storm	Not available at this time
Reference ECA(s)	3277-6FLH8A
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

90-Wet Pond-120 Dundas Street East-Flamborough

Location	-79.9078, 43.3136
Watershed/Subwatershed	Grindstone Creek 228
Receiver of discharge	Hamilton Harbour
Outlet location	-79.906872, 43.313013
Catchment Area	~~29~~ 41 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~21000 m3~~
Design Storm	Not available at this time
Reference ECA(s)	5136-6QHHTN
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

91-Wet Pond-Beside 3288 Regional Road 56-Glanbrook

Location	-79.8089, 43.1147
Watershed/Subwatershed	Welland River West
Receiver of discharge	Lake Ontario
Outlet location	-79.809035, 43.114461
Catchment Area	21.95 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	4975 m3
Design Storm	Not available at this time
Reference ECA(s)	2251-6BMNQS
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

92-Wet Pond-Beside 3205 Binbrook Road-Glanbrook

Location	-79.8115, 43.122
Watershed/Subwatershed	Welland River West
Receiver of discharge	Lake Ontario
Outlet location	-79.81195, 43.121569
Catchment Area	77 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~4074 m3~~
Design Storm	Not available at this time
Reference ECA(s)	0964-6LFMMD
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

93-Wet Pond-Beside 97 Bradley Avenue-Glanbrook

Location	-79.8135, 43.1194
Watershed/Subwatershed	Welland River West
Receiver of discharge	Lake Ontario
Outlet location	-79.8132385, 43.1189163
Catchment Area	23 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~2171 m3~~
Design Storm	Not available at this time
Reference ECA(s)	0964-6LFMMD
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

97- Wet Pond- Beside 463 Dundas Street East-Flamborough

Location	-79.880295, 43.344356
Watershed/Subwatershed	Grindstone Creek Watershed
Receiver of discharge	Lake Ontario
Outlet location	-79.883547, 43.340399
Catchment Area	29.2 Ha
Level of Treatment for suspended solids	Enhanced
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	21, 159 m3
Design Storm	Not available at this time
Reference ECA(s)	2959-AAFRGM
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet Pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

99-Wet Pond-Beside 48 Fletcher Road-Glanbrook

Location	-79.8074, 43.1794
Watershed/Subwatershed	Upper Davis Creek
Receiver of discharge	Hamilton Harbor
Outlet location	-79.80704, 43.180334
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~17100 m3~~
Design Storm	Not available at this time
Reference ECA(s)	7814-6CXPBQ
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

101-Wet Pond-55 Copperwood Avenue-Hamilton

Location	-79.9237, 43.2158
Watershed/Subwatershed	Tiffany Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.924068, 43.215418
Catchment Area	5.84 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~1563 m3~~
Design Storm	Not available at this time
Reference ECA(s)	2941-6QJSEG
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

102-Dry Pond-Beside 48 Westridge Road-Ancaster

Location	-79.9289, 43.221
Watershed/Subwatershed	Tiffany Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.929223, 43.220893
Catchment Area	3.76 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	545 m3
Design Storm	Not available at this time
Reference ECA(s)	2263-6ZR2VS
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

103-Wetland-69 Chiara Drive-Stoney Creek

Location	-79.6703, 43.2273
Watershed/Subwatershed	WC6
Receiver of discharge	Lake Ontario
Outlet location	-79.6698325, 43.2280855
Catchment Area	6.32 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~3188 m3~~
Design Storm	Not available at this time
Reference ECA(s)	7490-5VURPL
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wetland
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

104-Wet Pond-Beside 35 Springbreeze Heights-Stoney Creek

Location	-79.6745, 43.2277
Watershed/Subwatershed	WC6
Receiver of discharge	Lake Ontario
Outlet location	-79.6749713, 43.2280459
Catchment Area	17.06 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~2050 m3~~
Design Storm	Not available at this time
Reference ECA(s)	7353-6C5K38
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

105-Wet Pond-Beside 127 Galileo Drive-Stoney Creek

Location	-79.6804, 43.2313
Watershed/Subwatershed	WC5
Receiver of discharge	Lake Ontario
Outlet location	-79.679839, 43.2312382
Catchment Area	10.~~66~~ 86 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~1394 m3~~
Design Storm	Not available at this time
Reference ECA(s)	9540-6VLM2J
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

106-Wet Pond-3 Montreal Circle-Stoney Creek

Location	-79.6367, 43.2254
Watershed/Subwatershed	WC 10.1
Receiver of discharge	Lake Ontario
Outlet location	-79.636603, 43.2266662
Catchment Area	143.75 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~2962 m3~~
Design Storm	Not available at this time
Reference ECA(s)	2740-7A2QPC
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

107-Dry Pond-155 First Road West-Stoney Creek

Location	-79.7836, 43.1864
Watershed/Subwatershed	Upper Davis Creek
Receiver of discharge	Hamilton Harbour
Outlet location	-79.78424, 43.186543
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	11500 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

108-Wet Pond-94 Greenhill Avenue-Hamilton

Location	-79.8022, 43.2137
Watershed/Subwatershed	Red Hill Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.801724, 43.21439
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~2925 m3~~
Design Storm	Not available at this time
Reference ECA(s)	1328-5SJHBR
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A

Notes	N/A

109-Wet Pond-94 Greenhill Avenue-Hamilton

Location	-79.8001, 43.2199
Watershed/Subwatershed	Red Hill Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.7998695, 43.2202686
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~2790 m3~~
Design Storm	Not available at this time
Reference ECA(s)	1328-5SJHBR
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

110A-Wet Pond-320 Albright Road-Hamilton

Location	-79.7966, 43.2223
Watershed/Subwatershed	Red Hill Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.79674, 43.221715
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~1380 m3~~
Design Storm	Not available at this time
Reference ECA(s)	1328-5SJHBR
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond

Receive Emergency Sanitary Overflows	N/A
Notes	N/A

110B-Wet Pond-320 Albright Road-Hamilton

Location	-79.7966, 43.2218
Watershed/Subwatershed	Red Hill Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.79674, 43.221715
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~1880 m3~~
Design Storm	Not available at this time
Reference ECA(s)	1328-5SJHBR
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

111-Wet Pond-Beside 3 Cherry Road-Hamilton

Location	-79.7857, 43.2301
Watershed/Subwatershed	Red Hill Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.785861, 43.231913
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~8085 m3~~
Design Storm	Not available at this time
Reference ECA(s)	1328-5SJHBR
Reference Sewage Works as part of treatment train	N/A

Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

112-Wet Pond-Beside 111 Pottruff Road North-Hamilton

Location	-79.7813, 43.2329
Watershed/Subwatershed	Red Hill Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.781292, 43.233823
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~7305 m3~~
Design Storm	Not available at this time
Reference ECA(s)	1328-5SJHBR
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

113-Wet Pond-Beside 167 Pottruff Road North-Hamilton

Location	-79.778, 43.2348
Watershed/Subwatershed	Red Hill Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.777652, 43.235994
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~1205 m3~~
Design Storm	Not available at this time
Reference ECA(s)	1328-5SJHBR

Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

114-Wet Pond-Barton Street and RHVP-Hamilton

Location	-79.7725, 43.2394
Watershed/Subwatershed	Red Hill Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.773143, 43.239908
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~5570 m3~~
Design Storm	Not available at this time
Reference ECA(s)	1328-5SJHBR
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

115-Wet Pond-Barton Street and RHVP-Hamilton

Location	-79.7724, 43.2421
Watershed/Subwatershed	Red Hill Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.77194, 43.242835
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~1600 m3~~
Design Storm	Not available at this time

Reference ECA(s)	1328-5SJHBR
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

116-Wet Pond-Linc and RHVP-Stoney Creek

Location	-79.8131, 43.1979
Watershed/Subwatershed	Montgomery Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.812679, 43.198774
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~6000 m3~~
Design Storm	Not available at this time
Reference ECA(s)	1328-5SJHBR
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

117-Wet Pond-94 Greenhill Avenue-Hamilton

Location	-79.8104, 43.2053
Watershed/Subwatershed	Red Hill Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.81051, 43.20529
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~5995 m3~~

Design Storm	Not available at this time
Reference ECA(s)	1328-5SJHBR
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

118-Dry Pond-86 Claudette Gate-Hamilton

Location	-79.919, 43.2114
Watershed/Subwatershed	Twenty Mile Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.916546, 43.210737
Catchment Area	77.9 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	5600 m3
Design Storm	Not available at this time
Reference ECA(s)	2846-75WHY6
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

120-Wet Pond-461 Valridge Drive-Ancaster

Location	-80.0078, 43.2081
Watershed/Subwatershed	Big Creek
Receiver of discharge	Lake Erie
Outlet location	-80.008444, 43.208124
Catchment Area	9.52 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time

Level of Volume control	Not available at this time~~2524 m3~~
Design Storm	Not available at this time
Reference ECA(s)	5342-7FWG4N
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

122-Wet Pond-109 Cloverleaf Drive-Ancaster

Location	-79.9397, 43.225
Watershed/Subwatershed	Tiffany Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.9405823, 43.2256736
Catchment Area	46.67 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~6990 m3~~
Design Storm	Not available at this time
Reference ECA(s)	1088-5QZRS8
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

123-Wet Pond-768 Mountain Brow Boulevard-Hamilton

Location	-79.8212, 43.2003
Watershed/Subwatershed	upper Ottawa
Receiver of discharge	Lake Ontario
Outlet location	-79.82055, 43.200321
Catchment Area	~~N/A~~2426 ha
Level of Treatment for suspended solids	Not available at this time

Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	N/A
Design Storm	Not available at this time
Reference ECA(s)	7050-632GW6
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

124-Wet Pond-79 Cranston Street-Ancaster

Location	-79.9552, 43.2119
Watershed/Subwatershed	Tiffany Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.954231, 43.212732
Catchment Area	15.88 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~8310 m3~~
Design Storm	Not available at this time
Reference ECA(s)	6240-7XWSLE
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

127-Wet Pond-5 Wimberly Avenue-Flamborough

Location	-79.9134, 43.3313
Watershed/Subwatershed	Borer's Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.91383, 43.331336
Catchment Area	6.76 ha

Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~4742 m3~~
Design Storm	Not available at this time
Reference ECA(s)	0488-7UMH8Q
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

129-Dry Pond-1530 Upper Sherman Avenue-Hamilton

Location	-79.8641, 43.1995
Watershed/Subwatershed	Upper Ottawa
Receiver of discharge	Lake Ontario
Outlet location	-79.864199, 43.199924
Catchment Area	29.88 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	~~3414~~ 1868 m3
Design Storm	Not available at this time
Reference ECA(s)	2967-84XPLS
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

131-Wet Pond-Beside 1411 Rymal Road East-Hamilton

Location	-79.8285, 43.1878
Watershed/Subwatershed	Hannon Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.828252, 43.18809

Catchment Area	71.66 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~42630 m3~~
Design Storm	Not available at this time
Reference ECA(s)	9543-85VRP5
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

~~132-Wet Pond-391 Rymal Road West-Hamilton~~

~~Location~~	~~-79.9113, 43.2063~~
~~Watershed/Subwatershed~~	~~Twenty Mile Creek~~
~~Receiver of discharge~~	~~Lake Ontario~~
~~Outlet location~~	~~-79.911247, 43.205964~~
~~Catchment Area~~	~~130 ha~~
~~Level of Treatment for suspended solids~~	~~Not available at this time~~
~~Treatment for other Contaminants, as required~~	~~Not available at this time~~
~~Level of Volume control~~	~~Not available at this time8940 m3~~
~~Design Storm~~	~~Not available at this time~~
~~Reference ECA(s)~~	~~No ECA on record~~
~~Reference Sewage Works as part of treatment train~~	~~N/A~~
~~Brief Description~~	~~Wet pond~~
~~Receive Emergency Sanitary Overflows~~	~~N/A~~
~~Notes~~	~~N/A~~

137-Wet Pond-96 Sutherland Crescent-Ancaster

Location	-79.9359, 43.2175
Watershed/Subwatershed	Tiffany Creek
Receiver of discharge	Cootes Paradise

Outlet location	-79.935366, 43.218239
Catchment Area	~~68.57~~38.12 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	24492 m3
Design Storm	Not available at this time
Reference ECA(s)	1323-82GL59
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

140-Wet Pond-214 Upper Mount Albion Road-Stoney Creek

Location	-79.8075, 43.1955
Watershed/Subwatershed	Montgomery Creek
Receiver of discharge	Hamilton Harbor
Outlet location	-79.80922, 43.196093
Catchment Area	29.58 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~20730 m3~~
Design Storm	Not available at this time
Reference ECA(s)	4578-7B3K2G
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

141-Wet Pond-76 Macbean Crescent-Flamborough

Location	-79.9153, 43.3348
Watershed/Subwatershed	Borer's Creek

Receiver of discharge	Cootes Paradise
Outlet location	-79.91641, 43.333763
Catchment Area	12.1 ha
Level of Treatment for suspended solids	~~Not available at this time~~Enhanced (80%)
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	2937-9VYRLQ
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

147-Wet Pond-2010 Rymal Road East-Glanbrook

Location	-79.8034, 43.1788
Watershed/Subwatershed	Upper Davis Creek
Receiver of discharge	Hamilton Harbor
Outlet location	-79.804227, 43.179324
Catchment Area	~~N/A~~17.17 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	N/A
Design Storm	Not available at this time
Reference ECA(s)	0548-8VDP7K
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

152-Wet Pond-147 King Street East-Dundas

Location	-79.943, 43.2708
Watershed/Subwatershed	Lower Spencer Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.942636, 43.2712
Catchment Area	84.91 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~9169 m3~~
Design Storm	Not available at this time
Reference ECA(s)	5487-693MX2
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

155-Wet Pond-47 Greti Drive-Glanbrook

Location	-79.882, 43.1845
Watershed/Subwatershed	Twenty Mile Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.8832141, 43.1840323
Catchment Area	~~N/A~~37.7 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~5352 m3~~
Design Storm	Not available at this time
Reference ECA(s)	0968-7K3PNJ
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

162-Dry Pond-18 Huntingwood Avenue-Dundas

Location	-79.9744, 43.2601
Watershed/Subwatershed	Middle Spencer Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.971742, 43.26086
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	34000 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

165-Dry Pond-863 Nebo Road-Glanbrook

Location	-79.8438, 43.1741~~-79.8438, 43.1741~~
Watershed/Subwatershed	Hannon Creek
Receiver of discharge	Hamilton Harbor
Outlet location	-79.84212, 43.1749093
Catchment Area	10.55 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	8387 m3
Design Storm	Not available at this time
Reference ECA(s)	5740-86UR7R
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	Includes 7 bioswales

166-Wet Pond-1199 Upper Ottawa Street-Hamilton

Location	-79.8106, 43.2117
Watershed/Subwatershed	Red Hill Creek
Receiver of discharge	Lake Ontario
Outlet location	-79.8123, 43.2109
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	5000 m3
Design Storm	Not available at this time
Reference ECA(s)	Not available at this time
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

167-Wet Pond-555 Dartnall Road-Glanbrook

Location	-79.8375, 43.1738
Watershed/Subwatershed	Hannon Creek
Receiver of discharge	Hamilton Harbor
Outlet location	-79.83873, 43.174328
Catchment Area	12.8 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	~~10000 m3~~Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	8535-8UML4B
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A

Notes	N/A

170- Dry Pond- 80 Kinsam Drive-Glanbrook

Location	-79.819361, 43.127614
Watershed/Subwatershed	Welland River West
Receiver of discharge	Lake Ontario
Outlet location	Not available at this time
Catchment Area	17.9 ha
Level of Treatment for suspended solids	Normal (70%)
Treatment for other Contaminants, as required	N/A
Level of Volume control	3215 m3
Design Storm	Not available at this time
Reference ECA(s)	6531-9WEQGL
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	Dry Pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

171- Dry Pond- 410 MacIntosh Drive- Stoney Creek

Location	-79.712157, 43.222506
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Lake Ontario
Outlet location	Not available at this time
Catchment Area	3.16 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	2615 m3
Design Storm	Not available at this time
Reference ECA(s)	6610-9EGMTE
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry Pond

Receive Emergency Sanitary Overflows	N/A
Notes	N/A

173-Dry Pond-Beside 1238 Highway 8-Stoney Creek

Location	-79.6541, 43.2073
Watershed/Subwatershed	WC9
Receiver of discharge	Lake Ontario
Outlet location	-79.654047, 43.207424
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	800 m3
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

174-Dry Pond-Beside 145 Magnolia Drive-Hamilton

Location	-79.9193, 43.2317
Watershed/Subwatershed	Chedoke Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.918979, 43.232544
Catchment Area	60 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	15150 m3
Design Storm	Not available at this time
Reference ECA(s)	8566-98SK3C
Reference Sewage Works as part of treatment train	N/A

Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

176-Low Impact Development-Beside 69 South Street-Hamilton

Location	-79.8932, 43.248
Watershed/Subwatershed	Chedoke Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.893054, 43.248341
Catchment Area	0.55 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	100 m3
Design Storm	Not available at this time
Reference ECA(s)	5677-97SPGA
Reference Sewage Works as part of treatment train	N/A
Brief Description	Low Impact Development
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

177-Low Impact Development-355 Orkney Road-Flamborough

Location	-80.0974, 43.2605
Watershed/Subwatershed	Fairchild Creek
Receiver of discharge	Lake Erie
Outlet location	-80.096993, 43.259427
Catchment Area	16.38 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	N/A
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record

Reference Sewage Works as part of treatment train	N/A
Brief Description	Low Impact Development
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

178-Wet Pond-161 Parkside Drive-Flamborough

Location	-79.9145, 43.3305
Watershed/Subwatershed	Borer's Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.913788, 43.330625
Catchment Area	~~14.56~~11.3 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time~~8359 m3~~
Design Storm	Not available at this time
Reference ECA(s)	8001-8WJPUP
Reference Sewage Works as part of treatment train	N/A
Brief Description	Wet pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

~~200-Wet Pond-391 Rymal Road West-Hamilton~~

~~Location~~	~~N/A~~
~~Watershed/Subwatershed~~	~~Twenty Mile Creek~~
~~Receiver of discharge~~	~~Lake Ontario~~
~~Outlet location~~	~~-79.913174, 43.206113~~
~~Catchment Area~~	~~55.9 ha~~
~~Level of Treatment for suspended solids~~	~~Not available at this time~~
~~Treatment for other Contaminants, as required~~	~~Not available at this time~~
~~Level of Volume control~~	~~Not available at this time4350 m3~~
~~Design Storm~~	~~Not available at this time~~

~~Reference ECA(s)~~	~~No ECA on record~~
~~Reference Sewage Works as part of treatment train~~	~~N/A~~
~~Brief Description~~	~~Wet pond~~
~~Receive Emergency Sanitary Overflows~~	~~N/A~~
~~Notes~~	~~N/A~~

~~201-Wet Pond-391 Rymal Road West-Hamilton~~

~~Location~~	~~N/A~~
~~Watershed/Subwatershed~~	~~Twenty Mile Creek~~
~~Receiver of discharge~~	~~Lake Ontario~~
~~Outlet location~~	~~-79.913174, 43.206113~~
~~Catchment Area~~	~~N/A55.9 ha~~
~~Level of Treatment for suspended solids~~	~~Not available at this time~~
~~Treatment for other Contaminants, as required~~	~~Not available at this time~~
~~Level of Volume control~~	~~Not available at this time4430 m3~~
~~Design Storm~~	~~Not available at this time~~
~~Reference ECA(s)~~	~~No ECA on record~~
~~Reference Sewage Works as part of treatment train~~	~~N/A~~
~~Brief Description~~	~~Wet pond~~
~~Receive Emergency Sanitary Overflows~~	~~N/A~~
~~Notes~~	~~N/A~~

~~202-Wet Pond-391 Rymal Road West-Hamilton~~

~~Location~~	~~N/A~~
~~Watershed/Subwatershed~~	~~Twenty Mile Creek~~
~~Receiver of discharge~~	~~Lake Ontario~~
~~Outlet location~~	~~-79.913174, 43.206113~~
~~Catchment Area~~	~~N/A~~
~~Level of Treatment for suspended solids~~	~~Not available at this time~~
~~Treatment for other Contaminants, as required~~	~~Not available at this time~~
~~Level of Volume control~~	~~14020 m3~~

~~Design Storm~~	~~Not available at this time~~
~~Reference ECA(s)~~	~~No ECA on record~~
~~Reference Sewage Works as part of treatment train~~	~~N/A~~
~~Brief Description~~	~~Wet pond~~
~~Receive Emergency Sanitary Overflows~~	~~N/A~~
~~Notes~~	~~N/A~~

~~205-Wet Pond-391 Rymal Road West-Hamilton~~

~~Location~~	~~N/A~~
~~Watershed/Subwatershed~~	~~Twenty Mile Creek~~
~~Receiver of discharge~~	~~Lake Ontario~~
~~Outlet location~~	~~-79.913174, 43.206113~~
~~Catchment Area~~	~~171 ha~~
~~Level of Treatment for suspended solids~~	~~Not available at this time~~
~~Treatment for other Contaminants, as required~~	~~Not available at this time~~
~~Level of Volume control~~	~~Not available at this time8530 m3~~
~~Design Storm~~	~~Not available at this time~~
~~Reference ECA(s)~~	~~No ECA on record~~
~~Reference Sewage Works as part of treatment train~~	~~N/A~~
~~Brief Description~~	~~Wet pond~~
~~Receive Emergency Sanitary Overflows~~	~~N/A~~
~~Notes~~	~~N/A~~

~~211-Wet Pond-391 Rymal Road West-Hamilton~~

~~Location~~	~~N/A~~
~~Watershed/Subwatershed~~	~~Twenty Mile Creek~~
~~Receiver of discharge~~	~~Lake Ontario~~
~~Outlet location~~	~~-79.913174, 43.206113~~
~~Catchment Area~~	~~N/A~~

~~Level of Treatment for suspended solids~~	~~Not available at this time~~
~~Treatment for other Contaminants, as required~~	~~Not available at this time~~
~~Level of Volume control~~	~~20500 m3~~
~~Design Storm~~	~~Not available at this time~~
~~Reference ECA(s)~~	~~No ECA on record~~
~~Reference Sewage Works as part of treatment train~~	~~N/A~~
~~Brief Description~~	~~Wet pond~~
~~Receive Emergency Sanitary Overflows~~	~~N/A~~
~~Notes~~	~~N/A~~

~~212-Wet Pond-391 Rymal Road West-Hamilton~~

~~Location~~	~~N/A~~
~~Watershed/Subwatershed~~	~~Twenty Mile Creek~~
~~Receiver of discharge~~	~~Lake Ontario~~
~~Outlet location~~	~~-79.913174, 43.206113~~
~~Catchment Area~~	~~37 73 ha~~
~~Level of Treatment for suspended solids~~	~~Not available at this time~~
~~Treatment for other Contaminants, as required~~	~~Not available at this time~~
~~Level of Volume control~~	~~Not available at this time6550 m3~~
~~Design Storm~~	~~Not available at this time~~
~~Reference ECA(s)~~	~~No ECA on record~~
~~Reference Sewage Works as part of treatment train~~	~~N/A~~
~~Brief Description~~	~~Wet pond~~
~~Receive Emergency Sanitary Overflows~~	~~N/A~~
~~Notes~~	~~N/A~~

~~215-Wet Pond-391 Rymal Road West-Hamilton~~

~~Location~~	~~-79.9067, 43.2056~~
~~Watershed/Subwatershed~~	~~Twenty Mile Creek~~
~~Receiver of discharge~~	~~Lake Ontario~~
~~Outlet location~~	~~Not available at this time~~

~~Catchment Area~~	~~Not available at this time~~
~~Level of Treatment for suspended solids~~	~~Not available at this time~~
~~Treatment for other Contaminants, as required~~	~~Not available at this time~~
~~Level of Volume control~~	~~26700 m3~~
~~Design Storm~~	~~Not available at this time~~
~~Reference ECA(s)~~	~~No ECA on record~~
~~Reference Sewage Works as part of treatment train~~	~~N/A~~
~~Brief Description~~	~~Wet pond~~
~~Receive Emergency Sanitary Overflows~~	~~N/A~~
~~Notes~~	~~N/A~~

219-Dry Pond-1000 Main Street East-Hamilton

Location	79.8268, 43.2418
Watershed/Subwatershed	Urban Core
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	Not available at this time
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	Not available at this time
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

220-Wet Pond-1086 West 5th Street-Hamilton

Location	79.8958, 43.2091
Watershed/Subwatershed	Upper Ottawa
Receiver of discharge	Lake Ontario

Outlet location	-79.894802, 43.209477
Catchment Area	51.6 ha
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	6170-ADBRAA
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	Not available at this time
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

222-Wet Pond-behind 1041 West 5th Street-Hamilton

Location	79.892301, 43.210326
Watershed/Subwatershed	Upper Ottawa
Receiver of discharge	Lake Ontario
Outlet location	-79.8915, 43.2106
Catchment Area	14.05
Level of Treatment for suspended solids	Enhanced (80%)
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	2970
Design Storm	Not available at this time
Reference ECA(s)	8865-B65QNW
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	Not available at this time
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

225-Low Impact Development-South Street East-Dundas

Location	N/A
Watershed/Subwatershed	Lower Spencer Creek
Receiver of discharge	Cootes Paradise
Outlet location	-79.943306, 43.26135
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	~~N/A~~199 m3
Design Storm	Not available at this time
Reference ECA(s)	2481-AQPLAH
Reference Sewage Works as part of treatment train	N/A
Brief Description	Low Impact Development
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

231-Dry Pond-841 Arvin Ave-Stoney Creek

Location	N/A
Watershed/Subwatershed	WC6
Receiver of discharge	Lake Ontario
Outlet location	-79.681859, 43.223037
Catchment Area	N/A
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	N/A
Design Storm	Not available at this time
Reference ECA(s)	No ECA on record
Reference Sewage Works as part of treatment train	N/A
Brief Description	Dry pond
Receive Emergency Sanitary Overflows	N/A
Notes	N/A

~~141-Wet Pond-76 Macbean Crescent-Flamborough~~

~~Location~~	~~-79.9153, 43.3348~~
~~Watershed/Subwatershed~~	~~Borer's Creek~~
~~Receiver of discharge~~	~~Cootes Paradise~~
~~Outlet location~~	~~-79.91641, 43.333763~~
~~Catchment Area~~	~~20.9 ha~~
~~Level of Treatment for suspended solids~~	~~Not available at this time~~
~~Treatment for other Contaminants, as required~~	~~Not available at this time~~
~~Level of Volume control~~	~~7042 m3~~
~~Design Storm~~	~~Not available at this time~~
~~Reference ECA(s)~~	~~2937-9VYRLQ~~
~~Reference Sewage Works as part of treatment train~~	~~N/A~~
~~Brief Description~~	~~Wet pond~~
~~Receive Emergency Sanitary Overflows~~	~~N/A~~
~~Notes~~	~~N/A~~

~~162-Dry Pond-18 Huntingwood Avenue-Dundas~~

~~Location~~	~~-79.9744, 43.2601~~
~~Watershed/Subwatershed~~	~~Middle Spencer Creek~~
~~Receiver of discharge~~	~~Cootes Paradise~~
~~Outlet location~~	~~-79.971742, 43.26086~~
~~Catchment Area~~	~~Not available at this time~~
~~Level of Treatment for suspended solids~~	~~Not available at this time~~
~~Treatment for other Contaminants, as required~~	~~Not available at this time~~
~~Level of Volume control~~	~~34000 m3~~
~~Design Storm~~	~~Not available at this time~~
~~Reference ECA(s)~~	~~No ECA on record~~
~~Reference Sewage Works as part of treatment train~~	~~N/A~~
~~Brief Description~~	~~Dry pond~~
~~Receive Emergency Sanitary Overflows~~	~~N/A~~
~~Notes~~	~~N/A~~

219-Dry Pond ~~<Null>~~-1000 Main Street East-Hamilton

Location	79.8268, 43.2418
Watershed/Subwatershed	Urban Core
Receiver of discharge	~~Not available at this time~~Hamilton Harbour
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	Not available at this time
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	Not available at this time
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

~~220-Wet Pond-1086 West 5th Street-Hamilton~~

~~Location~~	~~79.8958, 43.2091~~
~~Watershed/Subwatershed~~	~~Upper Ottawa~~
~~Receiver of discharge~~	~~Lake Ontario~~
~~Outlet location~~	~~-79.894802, 43.209477~~
~~Catchment Area~~	~~Not available at this time~~
~~Level of Treatment for suspended solids~~	~~Not available at this time~~
~~Treatment for other Contaminants, as required~~	~~Not available at this time~~
~~Level of Volume control~~	~~Not available at this time~~
~~Design Storm~~	~~Not available at this time~~
~~Reference ECA(s)~~	~~6170-ADBRAA~~
~~Reference Sewage Works as part of treatment train~~	~~Not available at this time~~
~~Brief Description~~	~~Not available at this time~~
~~Receive Emergency Sanitary Overflows~~	~~Not available at this time~~
~~Notes~~	~~Not available at this time~~

222-Wet Pond-1400 Upper James-Hamilton

Location	79.89 43.21
Watershed/Subwatershed	Upper Ottawa
Receiver of discharge	Red Hill Creek
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	8865-B65QNW
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	Not available at this time
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

AL12B072-OGS-Silver Maple Dr-Ancaster

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	7657-5ZDJ7C
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

AM06B058-OGS-Deervalley Rd.-Ancaster

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	7657-5ZDJ7C
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

DA11B078-OGS-Mcmaster & Marimat Cr-Dundas

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	8507-7AXNSM
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

HG14B145-OGS-Springvally Crescent-Hamilton

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	1133-A29JG6
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

HG20B028-OGS-Raiano Crt & Chesley St.-Hamilton

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	4134-5WFLQK
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

HJ22B042-OGS-Jessica St. & Onyx Dr.-Hamilton

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	3400-5WFNF
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

HJ22B058-OGS-Wagner Dr. beside #4 Turquoise Dr.-Hamilton

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	0032-5X7LXZ
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

AJ09B102-OGS-27 Harrington Pl.-Ancaster

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	3-0889-97-006
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

DG07B122-OGS-25 Ormerod Cres.-Dundas

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	3-0177-97-006
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

DG08B144-OGS-20 Ormerod Cres.-Dundas

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	3-0177-97-006
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

DG08B146-OGS-9 Ormerod Cres.-Dundas

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	3-0177-97-006
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

FB06B044-OGS-Near # 71 & 76 Appaloosa Trail -Flamborough

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	5883-542KRA
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

GL01B014-OGS-Trinity Church Rd-Glanbrook

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	9543-85VRP5
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

HI19B104-OGS-34 Timothy Pl. @ Crerar Dr.-Hamilton

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	3-0558-98-006
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

SC17B096-OGS-100 Carlson St.-Stoney Creek

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	0076-7U8K6E
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

SG05B190-OGS-48 Sasha Crt.-Stoney Creek

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	1919-6EFQKK
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

SH05B144-OGS-367 Macintosh Dr.-Stoney Creek

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	3-1641-97-006
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

SJ02B076-OGS-Galileo Dr.-Stoney Creek

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	5058-54BKA6
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

SL03B032-OGS-52 Seabreeze Crt-Stoney Creek

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	1156-777K4T
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

SN04B070-OGS-4 Sonoma Lane-Stoney Creek

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	5875-53NQDE
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

SN04B078-OGS-164 Benziger Lane-Stoney Creek

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	7185-5QTQ85
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

SN05B001-OGS-Chianti Cres.-Stoney Creek

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	3-1312-96-006
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

SO02B006 / SO02B090-OGS-185 Halifax St.-Stoney Creek

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	5333-5J9RXB
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

Sundusk Estates-OGS-Oak Ave.-Flamborough

Location	Not available at this time
Watershed/Subwatershed	Not available at this time
Receiver of discharge	Not available at this time
Outlet location	Not available at this time
Catchment Area	Not available at this time
Level of Treatment for suspended solids	Not available at this time
Treatment for other Contaminants, as required	Not available at this time
Level of Volume control	Not available at this time
Design Storm	Not available at this time
Reference ECA(s)	3-0884-97-006
Reference Sewage Works as part of treatment train	Not available at this time
Brief Description	OGS Unit
Receive Emergency Sanitary Overflows	Not available at this time
Notes	Not available at this time

Stormwater Pumping Stations

1.5 The following are identified Stormwater pumping stations in the Authorized System:

HSS01-20 Grafton Avenue

Asset ID and Name	HSS01-20 Grafton Avenue
Site Location	20 Grafton Avenue, Hamilton, ON L8H 7E7
Watershed/Subwatershed	N/A
Latitude and Longitude	-79.78620295, 43.28012265
Coordinates (optional)	N/A
Description	Stormwater Pumping Station
Pumping Station Capacity	2600 L/s
Equipment	4 pumps (3 duty 1 standby). The station is connected to twin 900mm diameter forcemains.
Emergency Storage	N/A
Equipment: Associated controls and Appurtenances	N/A
Overflow	Eastport Drive ditch, west of the QEW discharging to Hamilton Harbour
Standby Power	N/A

Notes	3238-8SNQXB dated 4/19/12

HSS02-Centennial Parkway

Asset ID and Name	HSS02-395 Centennial Parkway
Site Location	377 Centennial Parkway, Hamilton, ON L8E 2X6
Watershed/Subwatershed	N/A
Latitude and Longitude	-79.75863643, 43.24188327
Coordinates (optional)	N/A
Description	Stormwater Pumping Station
Pumping Station Capacity	770 L/s
Equipment	3 pumps (2 duty 1 standby) and wet well of capacity 258m3. The station is connected to 600mm diameter forcemain.
Emergency Storage	55 m3
Equipment: Associated controls and Appurtenances	N/A
Overflow	Storm sewer across Centennial Parkway discharging to Confederation Park Marsh
Standby Power	N/A
Notes	0955-9LPU40 dated 8/29/14

Third Pipe Collection System

1.6 The following are identified third pipe systems in the Authorized System.

[*Asset ID* (e.g., Third Pipe 10]

Asset ID and Name	N/A
Location	
Watershed/Subwatershed	
Receiver of discharge	
Outlet location	
Catchment Area	
Treatment, if applicable	
Reference ECA(s), if applicable	
Brief Description	
Notes	

Other Works:

1.7 The following works are part of Authorized System:

Table B6: Other Works			
Column 1 Asset ID / Name	Column 2 Site Location (Latitude & Longitude)	Column 3 Component	Column 4 Description
N/A			

Developer-Operated Facilities:

1.8 The following facilities are part of the Authorized System, have been constructed, and are being operated by the developer under the authority of an agreement entered into with the Owner of the system.

Table B7: Developer-Operated Facilities			
Asset ID	Type of Facility	Location	Developer Name
203-Wet Pond-391 Rymal Road West-Hamilton	Wet Pond	391 Rymal Road West, Hamilton	N/A
204-Wet Pond-391 Rymal Road West-Hamilton	Wet Pond	391 Rymal Road West, Hamilton	N/A
206-Wet Pond-391 Rymal Road West-Hamilton	Wet Pond	391 Rymal Road West, Hamilton	N/A
207-Wet Pond-391 Rymal Road West-Hamilton	Wet Pond	391 Rymal Road West, Hamilton	N/A
208-Wet Pond-391 Rymal Road West-Hamilton	Wet Pond	391 Rymal Road West, Hamilton	N/A
209-Wet Pond-391 Rymal Road West-Hamilton	Wet Pond	391 Rymal Road West, Hamilton	N/A
210-Wet Pond-391 Rymal Road West-Hamilton	Wet Pond	391 Rymal Road West, Hamilton	N/A
213-Wet Pond-391 Rymal Road West-Hamilton	Wet Pond	391 Rymal Road West, Hamilton	N/A
214-Wet Pond-391 Rymal Road West-Hamilton	Wet Pond	391 Rymal Road West, Hamilton	N/A
~~215-Wet Pond-391 Rymal Road West-Hamilton~~	~~Wet Pond~~	~~391 Rymal Road West, Hamilton~~	~~N/A~~
~~54-Dry Pond-63 Spitfire Drive-Glanbrook~~	~~Dry Pond~~	~~63 Spitfire Drive, Glanbrook~~	~~N/A~~
~~63-Wet Pond-Beside 185 Thames Way-Glanbrook~~	~~Wet Pond~~	~~Beside 185 Thames Way, Glanbrook~~	~~N/A~~
~~68-Dry Pond-9 Glencrest Avenue-Stoney Creek~~	~~Dry Pond~~	~~9 Glencrest Avenue, Stoney Creek~~	~~N/A~~
73-Wet Pond-Beside 34 Mapleleaf Trail-Glanbrook	Wet Pond	Beside 34 Mapleleaf Trail, Glanbrook	N/A
~~86-Wet Pond-1199 Upper Ottawa Street-Hamilton~~	~~Wet Pond~~	~~1199 Upper Ottawa Street, Hamilton~~	~~N/A~~
94-Wet Pond-Beside 2311 Regional Road 56-Glanbrook	Wet Pond	Beside 2311 Regional Road 56, Glanbrook	N/A
95-Dry Pond-Beside 30 Mason Drive-Ancaster	Dry Pond	Beside 30 Mason Drive, Ancaster	N/A
96-Dry Pond-94 Dundas Street East-Flamborough	Dry Pond	94 Dundas Street East, Flamborough	N/A
~~97-Wet Pond-Beside 463 Dundas Street East-Flamborough~~	~~Wet Pond~~	~~Beside 463 Dundas Street East, Flamborough~~	~~N/A~~
100-Wet Pond-120 Horseshoe Crescent-Flamborough	Wet Pond	120 Horseshoe Crescent, Flamborough	N/A
128-Wet Pond-19 Cole Street-Flamborough	Wet Pond	19 Cole Street, Flamborough	N/A
135-Wet Pond-38 Trafalgar Drive-Stoney Creek	Wet Pond	38 Trafalgar Drive, Stoney Creek	N/A

139-Dry Pond-Beside 7 Butternut Grove Lane-Ancaster	Dry Pond	Beside 7 Butternut Grove Lane, Ancaster	N/A
142-Wet Pond-1277 Arvin Avenue-Stoney Creek	Wet Pond	1277 Arvin Avenue, Stoney Creek	N/A
143-Wet Pond-60 Prudham Crescent-Flamborough	Wet Pond	60 Prudham Crescent, Flamborough	N/A
144-Wet Pond-69 Marshboro Avenue-Flamborough	Wet Pond	69 Marshboro Avenue, Flamborough	N/A
145-Wet Pond-21 Sadielou Boulevard-Flamborough	Wet Pond	21 Sadielou Boulevard, Flamborough	N/A
148-Wetland-Beside 6 Oakhaven Place-Ancaster	Wetland	Beside 6 Oakhaven Place, Ancaster	N/A
149-Wetland-Behind 121 Oakhaven Place-Ancaster	Wetland	Behind 121 Oakhaven Place, Ancaster	N/A
157-Wet Pond-134 Rembrandt Court-Ancaster	Wet Pond	134 Rembrandt Court, Ancaster	N/A
163-Wet Pond-165 John Frederick Drive-Ancaster	Wet Pond	165 John Frederick Drive, Ancaster	N/A
164-Wet Pond-Beside 316 Crafter Crescent-Stoney Creek	Wet Pond	Beside 316 Crafter Crescent, Stoney Creek	N/A
~~166-Wet Pond-94 Greenhill Avenue-Hamilton~~	~~Wet Pond~~	~~94 Greenhill Avenue, Hamilton~~	~~N/A~~
168-Wet Pond-Beside 603 Glenariff Drive-Flamborough	Wet Pond	Beside 603 Glenariff Drive, Flamborough	N/A
~~170-Dry Pond-80 Kinsman Drive-Glanbrook~~	~~Dry Pond~~	~~80 Kinsman Drive, Glanbrook~~	~~N/A~~
~~171-Dry Pond-410 MacIntosh Drive-Stoney Creek~~	~~Dry Pond~~	~~410 MacIntosh Drive, Stoney Creek~~	~~N/A~~
172-Wet Pond-235 Stonehenge Drive-Ancaster	Wet Pond	235 Stonehenge Drive, Ancaster	N/A
175-Wet Pond-323 Windwood Drive-Glanbrook	Wet Pond	323 Windwood Drive, Glanbrook	N/A
179-Wet Pond-160 Bedrock Drive-Stoney Creek	Wet Pond	160 Bedrock Drive, Stoney Creek	N/A
180-Wet Pond-36 Thornbury Court-Stoney Creek	Wet Pond	36 Thornbury Court, Stoney Creek	N/A
181-Wet Pond-115 Upper Mount Albion Road-Stoney Creek	Wet Pond	115 Upper Mount Albion Road, Stoney Creek	N/A
182-Low Impact Development-501 Shaver Road-Ancaster	Low Impact Development	501 Shaver Road, Ancaster	N/A
184-Wet Pond-145 John Frederick Drive-Ancaster	Wet Pond	145 John Frederick Drive, Ancaster	N/A
185-Wet Pond-9 Dougherty Court-Ancaster	Wet Pond	9 Dougherty Court, Ancaster	N/A
186-Wet Pond-33 Robarts Drive-Ancaster	Wet Pond	33 Robarts Drive, Ancaster	N/A
187-Wet Pond-91 Riverwalk Drive-Flamborough	Wet Pond	91 Riverwalk Drive, Flamborough	N/A
188-Wet Pond-33 Mountainside Place-Flamborough	Wet Pond	33 Mountainside Place, Flamborough	N/A

189-Wet Pond-1389 Wilson Street West-Ancaster	Wet Pond	1389 Wilson Street West, Ancaster	N/A
197-Dry Pond-27 & 30 Aeropark Boulevard-Glanbrook	Dry Pond	27 & 30 Aeropark Boulevard, Glanbrook	N/A
198-Dry Pond-100 Sonoma Lane-Stoney Creek	Dry Pond	100 Sonoma Lane, Stoney Creek	N/A
199-Wet Pond-12 Frontier Trail-Flamborough	Wet Pond	12 Frontier Trail, Flamborough	N/A
216-Wet Pond-97 Queen Mary Blvd-Stoney Creek	Wet Pond	97 Queen Mary Blvd, Stoney Creek	N/A
217-Wet Pond-74 Rockledge Drive-Glanbrook	Wet Pond	74 Rockledge Drive, Glanbrook	N/A
218-Wet Pond-343 Dalgleish Trail-Glanbrook	Wet Pond	343 Dalgleish Trail, Glanbrook	N/A
221-Dry Pond-39 Carmel Drive-Hamilton	Dry Pond	39 Carmel Drive, Hamilton	N/A
222-Wet Pond-~~-<Null>-~~1420 Upper James St-Hamilton	Wet Pond~~<Null>~~	1420 Upper James St, Hamilton	N/A
223-Wet Pond-12 Centennial Parkway S-Hamilton	Wet Pond	12 Centennial Parkway S, Hamilton	N/A
224-Wet Pond-139 Steel City Court-Hamilton	Wet Pond	139 Steel City Court, Hamilton	N/A
226-Wet Pond-52 Borers Creek Circle-Flamborough	Wet Pond	52 Borers Creek Circle, Flamborough	N/A
227-Wet Pond-39 Pond View Gate-Flamborough	Wet Pond	39 Pond View Gate, Flamborough	N/A
228-Dry Pond-80 Cesar Place-Ancaster	Dry Pond	80 Cesar Place, Ancaster	N/A
229-Wet Pond-9350 White Church Rd W-Glanbrook	Wet Pond-	White Church Rd W, Glanbrook	N/A
230-Wet Pond-167 Rosebury Way-Glanbrook	Wet Pond-	Rosebury Way, Glanbrook	N/A
233-<Null>-Cormorant Rd-Ancaster	<Null>	Cormorant Rd, Ancaster	N/A
232-<Null>-North Waterdown Rd/Cole St-Waterdown	<Null>	North Waterdown Rd/Cole St, Waterdown	N/A

1.9 The Owner shall notify the Director, using the Director Notification Form, within thirty (30) days where the operation of any Facility identified in Table B7 has been:

1.9.1 Incorporated into the overall Stormwater Management System and assumed by an Operating Authority identified in Schedule B of this Approval.

1.9.2 Has been transferred from the developer identified in Table B7 to another party.

Transitional – Facilities with Individual ECAs

1.10 The following Facilities are connected to the Authorized System, but ownership has not been assumed by the Owner. These Sewage Works are not part of the Authorized System and will continue to have separate ECAs until the Facilities are assumed by the Owner.

Table B8: Facilities with Individual ECAs

Asset ID	Type of Facility	Location	ECA Number	Developer Name
N/A				

1.11 The Owner shall notify the Director, using the Director Notification Form, within thirty (30) days where the ownership of any Facility identified in Table B8 has been assumed by the Owner.

1.12 The Director Notification required in condition 1.11 shall include:

1.12.1 A request from the developer to revoke the ECA identified in Table B8; or

1.12.2 A copy of an agreement or other documentation that demonstrates that the municipality has assumed ownership of the Facility and that the ECA identified in Table B8 should be revoked.

Schedule C: List of Notices of Amendment to this ECA: Additional Approved Sewage Works

System Owner	**Hamilton, City of**
ECA Number	**005-S701**
System Name	**City of Hamilton Stormwater Management System**
ECA Issue Date	**${MONTH} ${DAY}, ${YEAR}**

1.0 General

1.1 Table C1 provides a list of all notices of amendment to this Approval that have been issued pursuant to clause 20.3(1) of the EPA that impose terms and conditions in respect of the Authorized System after consideration of an application by the Director (Schedule C Notices).

Table C1: Schedule C Notices

Column 1 Issue #	Column 2 Issue Date	Column 3 Description	Column 4 Status	Column 5 DN#
N/A	N/A	N/A	N/A	N/A

Schedule D: General

System Owner	**Hamilton, City of**
ECA Number	**005-S701**
System Name	**City of Hamilton Stormwater Management System**
ECA Issue Date	**${MONTH} ${DAY}, ${YEAR}**

1.0 Definitions

1.1 For the purpose of this Approval, the following definitions apply:

“Adverse Effect(s)” has the same meaning as defined in section 1 of the EPA.

“Alteration(s)” includes the following, in respect of the Authorized System, but does not include repairs to the system:

a) An extension of the system,

b) A replacement or retirement of part of the system, or

c) A modification of, addition to, or enlargement of the system.

“Appendix A” means Appendix A of this Approval.

“Approval” means this Environmental Compliance Approval including any Schedules attached to it.

“Appurtenance(s)” has the same meaning as defined in O. Reg. 525/98 (Approval Exemptions) made under the OWRA.

“Authorized System” means the Sewage Works comprising the Municipal Stormwater Management System authorized under this Approval”.

"Class Environmental Assessment Project" means an Undertaking that does not require any further approval under the EAA if the proponent complies with the process set out in the Municipal Engineers Association Class Environmental Assessment document, (Municipal Class Environmental Assessment approved by the Lieutenant Governor in Council on October 4, 2000 under Order in Council 1923/2000), as amended from time to time.

“Combined Sewer(s)” means pipes that collect and transmit both sanitary Sewage and other Sewage from residential, commercial, institutional, and industrial buildings and facilities and Stormwater through a single-pipe system, but does not include Nominally Separate Sewers.

“Completion” means substantial performance as described in s.2 (1) of the *Construction Act*, R.S.O. 1990, c. C.30.

“Compound of Concern” means a Contaminant that is discharged from the Facility in an amount that is not negligible.

“Contaminant” has the same meaning as defined in section 1 of the EPA.

“CSO” means a combined sewer overflow which is a discharge to the environment at designated location(s) from a Combined Sewer or Partially Separated Sewer that usually occurs as a result of precipitation when the capacity of the Sewer is exceeded. An intervening time of twelve hours or greater separating a CSO from the last prior CSO at the same location is considered to separate one overflow Event from another.

"CWA" means the *Clean Water Act*, R.S.O. 2006, c.22.

“Design Criteria” means the design criteria set out in the Ministry’s publication “Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under Environmental Compliance Approval”, (as amended from time to time).

“Design Guidelines for Sewage Works” means the Ministry document titled “Design Guidelines for Sewage Works”, 2008 (as amended from time to time).

"Director" means a person appointed by the Minister pursuant to section 5 of the EPA for the purposes of Part II.1 of EPA (Environmental Compliance Approvals).

“Director Notification Form” means the most recent version of the Ministry form titled Director Notification – Alterations to a Municipal Stormwater Management System, as obtained directly from the Ministry or from the Ministry’s website.

"District Manager" means the district manager or a designated representative of the Local Ministry Office.

"EAA" means the *Environmental Assessment Act*, R.S.O. 1990, c. E.18.

"EPA" means the *Environmental Protection Act*, R.S.O. 1990, c.E.19.

“ESC” means erosion and sediment control.

“Facility” means the entire operation located on the property where the Sewage Works or equipment is located.

“Form SW1” means the most recent version of the Ministry form titled Record of Future Alteration Authorized for Storm Sewers/Ditches/Culverts as obtained directly from the Ministry or from the Ministry’s website.

“Form SW2” means the most recent version of the Ministry form titled Record of Future Alteration Authorized for Stormwater Management Facilities as obtained directly from the Ministry or from the Ministry’s website.

“Form SW3” means the most recent version of the Ministry form titled Record of Future Alteration Authorized for Third Pipe Collection Systems as obtained directly from the Ministry or from the Ministry’s website.

"Licensed Engineering Practitioner” means a person who holds a licence, limited licence, or temporary licence under the *Ontario Professional Engineers Act* R.S.O. 1990, c. P.28.

"LID" means “low impact development” a Stormwater management strategy that seeks to mitigate the impacts of increased runoff and Stormwater pollution by managing runoff as close to its source as possible. LID comprises a set of site design strategies that minimize runoff and distributed, small scale structural practices that mimic natural or predevelopment hydrology through the processes of infiltration, evapotranspiration, harvesting, filtration, and detention of Stormwater.

“Local Ministry Office” means the local office of the Ministry responsible for the geographic area where the Authorized System is located.

"Minister" means the Minister of the Ministry or such other member of the Executive Council as may be assigned the administration of the EPA and OWRA under the *Executive Council Act*, R.S.O. 1990, c. E.25.

"Ministry" means the Ministry of the Minister and includes all employees or other persons acting on its behalf.

“Monitoring Plan” means the monitoring plan prepared and maintained by the Owner under condition 4.1 in Schedule E of this Approval.

“MTD” means manufactured treatment device.

“Municipal Drain” has the same meaning as drainage works as defined in section 1 of the *Drainage Act* R.S.O. 1990, c. D.17.

“Municipal Drainage Engineer’s Report” means a report signed by a drainage engineer employed or contracted by a municipality and approved in writing by municipal council or equivalent.

“Municipal Sewage Collection System” means all Sewage Works, located in the geographical area of a municipality, that collect and transmit sanitary Sewage and are owned, or may be owned pursuant to an agreement with a municipality entered into under the *Planning Act* or *Development Charges Act*, 1997, by:

a) A municipality, a municipal service board established under the *Municipal Act*, 2001 or a city board established under the *City of Toronto Act*, 2006; or

b) A corporation established under sections 9, 10, and 11 of the *Municipal Act*, 2001 in accordance with section 203 of that Act or under sections 7 and 8 of the *City of Toronto Act*, 2006 in accordance with sections 148 and 154 of that Act.

“**Municipal Stormwater Management System”** means all Sewage Works, located in the geographical area of a municipality, that collect, transmit, or treat Stormwater and are owned, or may be owned pursuant to an agreement entered into under the *Planning Act* or *Development Charges Act*, 1997, by:

a) A municipality, a municipal service board established under the *Municipal Act*, 2001 or a city board established under the *City of Toronto Act*, 2006; or

b) A corporation established under sections 9, 10, and 11 of the *Municipal Act*, 2001 in accordance with section 203 of that Act or under sections 7 and 8 of the *City of Toronto Act*, 2006 in accordance with sections 148 and 154 of that Act.

“Natural Environment” has the same meaning as defined in section 1 of the EPA.

"Nominally Separate Sewer(s)" mean Separate Sewers that also have connections from roof leaders and foundation drains, and are not considered to be Combined Sewers.

“OGS” means Oil and Grit Separators;

“Operating Authority” means, in respect of the Authorized System, the person, entity, or assignee that is given responsibility by the Owner for the operation, management, maintenance, or Alteration of the Authorized System, or a portion of the Authorized System.

"Owner" for the purposes of this Approval means the City of Hamilton, and includes its successors and assigns.

"OWRA" means the *Ontario Water Resources Act*, R.S.O. 1990, c. O.40.

"O&M Manual" means the operation and maintenance manual prepared and maintained by the Owner under condition 3.2 in Schedule E of this Approval.

"Partially Separated Sewer(s)" means Combined Sewers that have been retrofitted to transmit sanitary Sewage but in which roof leaders or foundation drains still contribute Stormwater inflow to the Partially Separated Sewer.

"Pre-development" means the more stringent of a site's:

a) Existing condition prior to proposed development or construction activities; or

b) Condition as defined by the local municipality.

"Prescribed Person" means a person prescribed in O. Reg. 208/19 (Environmental Compliance Approval in Respect of Sewage Works) for the purpose of ss. 20.6 (1) of the EPA, and where the alteration, extension, enlargement, or replacement is carried out under an agreement with the Owner.

"**Privately Owned Stormwater Works"** means Stormwater Sewage Works on private land that are privately owned and, while not part of the Authorized System, are considered part of a Stormwater Treatment Train.

"Qualified Person (QP)" means persons who have obtained the relevant education and training and have demonstrated experience and expertise in the areas relating to the work required to be carried out by this Approval.

"Schedule C Notice(s)" means a notice(s) of amendment to this Approval issued pursuant to clause 20.3(1) of the EPA that imposes terms and conditions in respect of the Authorized System after consideration of an application by the Director.

"Separate Sewer(s)" means pipes that collect and transmit sanitary Sewage and other Sewage from residential, commercial, institutional, and industrial buildings.

"Sewage" has the same meaning as defined in section 1 of the OWRA.

"Sewage Works" has the same meaning as defined in section 1 of the OWRA.

“Sewer” has the same meaning as defined in section 1 of O. Reg. 525/98 under the OWRA.

"Significant Drinking Water Threat" has the same meaning as defined in section 2 of the CWA.

“Significant Snowmelt Event(s)” means the melting of snow at a rate which adversely affects the performance and function of the Authorized System and/or the Sewage Treatment Plant(s) identified in Schedule A of this Approval.

“Significant Storm Event(s)” means a minimum of 25 mm of rain in any 24 hours period.

“Source Protection Authority” has the same meaning as defined in section 2 of the CWA.

"Source Protection Plan" means a drinking water source protection plan prepared under the CWA.

“SSO” means a sanitary sewer overflow which is a discharge of Sewage from a Separate Sewer or Nominally Separate Sewer to the environment from designated location(s) in the Authorized System.

“Standard Operating Policy for Sewage Works” means the standard operating policy developed by the Ministry to assist in the implementation of Source Protection Plan policies related to Sewage Works and providing minimum design and operational standards and considerations to mitigate risks to sources of drinking water, as amended from time to time.

“Storm Sewer” means Sewers that collect and transmit, but not exfiltrate or lose by design, Stormwater resulting from precipitation and snowmelt.

“Stormwater” means rainwater runoff, water runoff from roofs, snowmelt, and surface runoff.

“Stormwater Management Facility(ies)” means a Facility for the treatment, retention, infiltration, or control of Stormwater.

“Stormwater Management Planning and Design Manual” means the Ministry document titled “Stormwater Management Planning and Design Manual”, 2003 (as amended from time to time).

“Stormwater Treatment Train” means a series of Stormwater Management Facilities designed to meet Stormwater management objectives (e.g., Appendix A) for a given area, and can consist of a combination of MTDs, LIDs and end-of-pipe controls.

“TRCA” means the Toronto Region Conservation Authority.

“Third Pipe Collection System” means Sewage Works designed to collect and transmit foundation drainage and/or groundwater to a receiving surface water or dry well;

"Undertaking" has the same meaning as in the EAA.

“Vulnerable Area(s)” has the same meaning as in the CWA.

2.0 General Conditions

2.1 The works comprising the Authorized System shall be constructed, installed, used, operated, maintained, replaced, or retired in accordance with the conditions of this Approval, which includes the following Schedules:

Schedule A – System Information

Schedule B – Municipal Stormwater Management System Description

Schedule C – List of Notices of Amendment to this ECA

Schedule D – General

Schedule E – Operating Conditions

Schedule F – Residue Management

Appendix A – Stormwater Management Criteria

2.2 The issuance of this Approval does not negate the requirements of other regulatory bodies, which includes but is not limited to, the Ministry of Northern Development, Mines, Natural Resources and Forestry and the local Conservation Authority.

2.3 Where there is a conflict between a provision of any document referred to in this Approval and the conditions of this Approval, the conditions in this Approval shall take precedence. Where there is a conflict between the information in a Schedule C Notice and another section of this Approval, the document bearing the most recent date shall prevail.

2.4 The Owner shall ensure that any person authorized to carry out work on or operate any aspect of the Authorized System is provided with a print or electronic copy of this Approval and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.

2.5 The conditions of this Approval are severable. If any condition of this Approval, or the application of any requirement of this Approval to any circumstance, is held invalid or unenforceable, the application of such condition to other circumstances and the remainder of this Approval shall not be affected thereby.

3.0 Alterations to the Municipal Stormwater Management System

3.1 For greater certainty, the Alterations authorized under this Approval are limited to Sewage Works comprising the Authorized System which does not include municipally or Privately Owned Stormwater Works:

3.1.1 On industrial, commercial, or institutional land;

3.1.2 Serving a single parcel of land, ~~unless the stormwater management facility is located on a municipally owned park or community center;~~

3.1.3 That are operated as waste disposal sites defined under the EPA, and snow dump/melt facilities; or

3.1.4 That propose to collect, store, treat, or discharge stormwater containing substances or pollutants (other than Total Suspended Solids, or oil and grease) detrimental to the environment or human health; Any Schedule C Notice shall provide authority to alter the Authorized System in accordance with the conditions of this Approval.

3.2 All Schedule C Notices issued by the Director for the Municipal Stormwater Management System shall form part of this Approval.

3.3 The Owner and a Prescribed Person shall ensure that the documentation required through conditions in this Approval and the documentation required in the Design Criteria are prepared for any Alteration of the Authorized System.

3.4 The Owner shall notify the Director within thirty (30) calendar days of placing into service or Completion of any Alteration of the Authorized System which had been authorized:

3.4.1 Under Schedule D to this Approval where the Alteration results in a change to Sewage Works specifically described in Schedule B of this Approval;

3.4.2 Through a Schedule C Notice respecting Sewage Works other than Storm Sewers; or

3.4.3 Through another approval that was issued under the EPA prior to the issue date of this Approval.

3.5 The notification requirements set out in condition 3.5 do not apply to any Alteration in respect of the Authorized System which:

3.5.1 Is exempt under section 53(6) of the OWRA or by O. Reg. 525/98;

3.5.2 Constitutes maintenance or repair of the Authorized System; or

3.5.3 Is a Storm Sewer, ditch, or culvert authorized by condition 4.1 of Schedule D of this Approval.

3.6 The Owner shall notify the Director within ninety (90) calendar days of:

3.6.1 The discovery of existing Sewage Works not described or depicted in Schedule B, or

3.6.2 Additional or revised information becoming available for any Sewage Works described in Schedule B of this Approval.

3.7 The notifications required in condition 3.5 and 3.7 shall be submitted to the Director using the Director Notification Form.

3.8 The Owner shall ensure that any chemicals, coagulants, or polymers used in the stormwater management system have obtained written approval from the Director prior to use, unless required for spill control or spill clean-up.

3.9 The Owner shall ensure that an ESC plan is prepared, and temporary ESC measures are installed in advance of and maintained during any construction activity on the Authorized System, subject to the following conditions:

3.9.1 Inspections of ESC measures are to be conducted at a frequency specified per the ESC plan, for dry weather periods (active and inactive construction phases), after Significant Storm Events and Significant Snowmelt Events, and after any extreme weather events.

3.9.2 Any deficiencies shall be addressed, and any required maintenance actions(s) shall be undertaken as soon as practicable once they have been identified.

3.9.3 Inspections and maintenance of the temporary ESC measures shall continue until they are no longer required.

3.10 The Owner shall ensure that records of inspections required by this Approval during any construction activity, including those required under condition ~~3.10~~3.9:

3.10.1 Include the name of the inspector, date of inspection, visual observations, and the remedial measures, if any, undertaken to maintain the temporary ESC measures.

3.10.2 Be retained with records relating to the Alteration that the construction relates to, such as the form required in conditions 4.4.1, 5.5.1, and 6.2.1 of Schedule D, or the Schedule C Notice.

3.10.3 Be retrievable and made available to the Ministry upon request.

3.11 The document(s) or file(s) referenced in Table B1 (Infrastructure Map) of Schedule B of this Approval shall:

3.11.1 Be retained by the Owner;

3.11.2 Include at a minimum:

a) Identification of Storm Sewers, which shall include the following information:

i Location relative to street names or easements; and

ii Sewer diameters.

b) Identification of existing municipally owned Stormwater Sewage Works, including but not limited to ~~ditches, swales,~~ culverts, outlets, wet pond, dry pond, ~~Stormwater Management Facilities, sedimentation MTD (for example~~ oil grit separators~~)~~, ~~filtration MTD, LID,~~ end of pipe controls, Third Pipe Collection Systems, and pumping stations, including any applicable Asset IDs.

c) Identification of the main tributaries and receiving water bodies to that the Sewage Works discharge to.

d) Delineation of municipal, watershed, and subwatershed boundaries, as available.

e) Identification of the storm sewersheds for each outlet.

f) Identification of any source protection Vulnerable Areas.

g) Identification of any Sewage Works that receive SSOs or CSOs.

3.11.3 Be updated to include:

a) Alterations authorized under Schedule D of this Approval or through a Schedule C Notice within twelve (12) months of the Alteration being placed into service.

b) Updates to information contained in the document(s) or files(s) not associated with an Alteration within twelve (12) months of becoming aware of the updated information.

3.12 An Alteration is not authorized under Schedule D of this ECA for projects that impact Indigenous treaty rights or asserted rights where:

3.12.1 The project is on Crown land or would alter access to Crown land;

3.12.2 The project is in an open or forested area where hunting, trapping or plant gathering occur;

3.12.3 The project involves the clearing of forested land unless the clearing has been authorized by relevant municipal, provincial, or federal authorities, where applicable;

3.12.4 The project alters access to a water body;

3.12.5 The proponent is aware of any concerns from Indigenous communities about the proposed project and these concerns have not been resolved; or,

3.12.6 Conditions respecting Indigenous consultation in relation to the project were placed in another permit or approval and have not been met.

3.13 No less than ~~60~~ 90 days prior to construction associated with an Alteration the Director may notify the Owner in writing that a project is not authorized through Schedule D of this ECA where:

3.13.1 Concerns regarding treaty rights or asserted rights have been raised by one or more Indigenous communities that may be impacted by the Alteration; or

3.13.2 The Director believes that it is in the public interest due to site specific, system specific, or project specific considerations.

3.14 Where an Alteration is not authorized under condition 3.13 or 3.14 above:

3.14.1 An application respecting the Alteration shall be submitted to the Ministry; and,

3.14.2 The Alteration shall not proceed unless:

a) Approval for the Alteration is granted by the Ministry (i.e., a Schedule C Notice); or,

b) The Director provides written notice that the Alteration may proceed in accordance with conditions in Schedule D of this ECA.

4.0 Authorizations of Future Alterations to Storm Sewers, Ditches, or Culverts - Additions, Modifications, Replacements and Extensions

4.1 The Owner or a Prescribed Person may alter the Authorized System by adding, modifying, replacing, or extending a Storm Sewer, ditch, or culvert within the Authorized System subject to the following conditions and conditions 4.2 and 4.3 below:

4.1.1 The design of the addition, modification, replacement, or extension:

a) Has been prepared by a Licensed Engineering Practitioner;

b) Has been designed only to collect and transmit Stormwater;

c) Has not been designed to collect or treat any sanitary Sewage;

d) Has not been designed to collect, store, treat, control, or manage groundwater, unless for the purpose of foundation drains, road subdrains, or LIDs;

e) Satisfies the Design Criteria or any municipal criteria that have been established that exceed the minimum requirements set out in the Design Criteria;

f) Satisfies the standards set out in Ontario Provincial Standard Specifications (OPSS) and Ontario Provincial Standard ~~Drawings~~ (OPSD), as applicable to ditches and culverts;

g) Is consistent with or otherwise addresses the design objectives contained within the Design Guidelines for Sewage Works;

h) Is planned, designed, and built to be consistent with the Stormwater Management Planning and Design Guidance Manual. If there is a conflict with Appendix A of this Approval, then Appendix A shall prevail; and

i) Includes design considerations to protect sources of drinking water, including those set out in the Standard Operating Policy for Sewage Works, and any applicable local Source Protection Plan policies.

4.1.2 The addition, modification, replacement, or extension shall be designed so that it will:

a) Not adversely affect the ability to maintain a gravity flow in the Authorized System without overflowing or increase surcharging any maintenance holes as per design; and

b) Provide smooth flow transition to existing gravity Storm Sewers;

4.1.3 The Alteration shall not result in:

a) Adverse Effects; or

b) A deterioration of the approved effluent quality or quantity of downstream Stormwater Management Facilities which results in not being able to achieve the overall Stormwater performance criteria per Appendix A.

4.1.4 The Storm Sewer, ditch or culvert addition, modification, replacement, or extension is wholly located within the municipal boundary over which the Owner has jurisdiction or there is a written agreement in place with the adjacent property owner respecting the Alteration and resulting Sewage Works.

4.1.5 The Owner consents in writing to the addition, modification, replacement, or extension.

4.1.6 A Licensed Engineering Practitioner has verified in writing that the addition, modification, replacement, or extension meets the requirements of conditions 4.1.1 a) to h), 4.3.9, and 4.3.10.

4.1.7 The Owner has verified in writing that the addition, modification, replacement, or extension has complied with inspection and testing requirements in the Design Criteria.

4.1.8 The Owner has verified in writing that the addition, modification, replacement, or extension meets the requirements of conditions 4.1.1 i), 4.1.2 to 4.1.6, 4.3.7, and 7.2.

4.2 The addition of Storm Sewers or ditches can be constructed but not operated until the Stormwater Management Facilities required to service the new Storm Sewers or ditches are in operation.

4.3 The Owner or a Prescribed Person is not authorized to undertake an Alteration described above in condition 4.1 where the Alteration relates to the addition, modification, replacement, or extension of a Storm Sewer that:

4.3.1 Passes under or through a body of surface water, unless trenchless construction methods are used or the local Conservation Authority has authorized an alternative construction method.

4.3.2 Has a nominal diameter greater than 3600~~2,400~~ mm, or equivalent sizing.

4.3.3 Is a Combined Sewer.

4.3.4 Is a concrete channel.

4.3.5 Is designed to, at any time, transmit, store, or control sanitary Sewage.

4.3.6 Converts rural road cross section ditches to curb, gutter, and Storm Sewers if the Stormwater volume and/or peak flow is increased and no water quality treatment is planned or demonstrated to be achieved, in accordance with this Approval and Appendix A, to offset the increase in Stormwater.

4.3.7 Results in new discharges or increased discharges to a Municipal Drain without written approval by the Owner and a signed Municipal Drainage Engineer's Report in accordance with the *Drainage Act* R.S.O. 1990, c. D.17.

4.3.8 Establishes a new outlet with direct discharge into the Natural Environment without monitoring in accordance with this Approval and without achieving the requirements set in Appendix A.

4.3.9 Increases Stormwater flow of an existing Storm Sewer or ditch without achieving water quality criteria set in Appendix A in accordance with this Approval unless the existing downstream Municipal Stormwater Management System has sufficient residual transmission and treatment capacity to accommodate the additional Stormwater.

4.3.10 Increases local hydraulic capacity of an existing Storm Sewer or ditch to accommodate new Stormwater flows unless the existing downstream Municipal Stormwater Management System has sufficient residual hydraulic capacity to accommodate the additional Stormwater.

4.3.11 Connects to another Municipal Stormwater Management System, unless:

a) Prior to construction, the Owner of the Authorized System obtains written consent from the Owner or Owner's delegate of the Municipal Stormwater System being connected to; and

b) The Owner of the Authorized System retains a copy of the written consent from the Owner or Owner's delegate of the Municipal Stormwater Management System being connected to as part of the record that is recorded and retained under condition 4.4.

4.3.12 Is part of an Undertaking in respect of which:

a) A request under s.16(6) of the EAA has been made, namely a request that the Minister make an order under s.16;

b) The Minister has made an order under s.16; or

c) The Director under that EAA has given notice under s.16.1 (2) that the Minister is considering making an order under s.16.

4.4 The consents and verifications required in conditions 4.1 and 4.3, if applicable, shall be:

4.4.1 Recorded on SW1, prior to the Storm Sewer, ditch, or culvert addition, modification, replacement, or extension being placed into service; and

4.4.2 Retained for a period of at least ten (10) years by the Owner.

4.5 For greater certainty, the verification requirements set out in condition 4.4 do not apply to any Alteration in respect of the Authorized System which:

4.5.1 Is exempt under section 53(6) of the OWRA or by O. Reg. 525/98; or

4.5.2 Constitutes maintenance or repair of the Authorized System.

5.0 Authorizations of Future Alterations to Stormwater Management Facilities - Additions, Modifications, Replacement, and Extensions

5.1 Subject to conditions 5.2 and 5.3, the Owner or a Prescribed Person may alter the Stormwater Management Facilities in the Authorized System by adding, modifying, replacing, or extending the following components:

5.1.1 Rooftop storage

5.1.2 Parking lot storage

5.1.3 Superpipe storage

5.1.4 Reduced lot grading

5.1.5 Roof leader to ponding area

5.1.6 Roof leader to soakaway pit

5.1.7 Infiltration trench

5.1.8 Engineered grassed swales / bioswale

5.1.9 Pervious pipes

5.1.10 Pervious catchbasins

5.1.11 Vegetated filter strips

5.1.12 Natural buffer strips

5.1.13 Green roofs/Rooftop gardens

5.1.14 Wet pond

5.1.15 Engineered wetland

5.1.16 Dry pond

5.1.17 Hybrid Facility

5.1.18 Infiltration basin

5.1.19 Filtration MTD

5.1.20 Sedimentation MTD - OGS

5.1.21 LID that relies on one or more of the following mechanisms to achieve treatment and control:

a) Evapotranspiration;

b) Infiltration into the ground; or

c) Filtration.

5.1.22 Any other Stormwater Management Facilities where the Director has provided authorization in writing to proceed with the Alteration.

5.2 Any Alteration to the Authorized System authorized under condition 5.1 is subject to the following conditions:

5.2.1 The design of the Alteration shall:

a) Be prepared by a Licensed Engineering Practitioner;

b) Be designed only to collect, receive, treat, or control only Stormwater and has not been designed to collect, receive, treat, or control sanitary Sewage;

c) Is planned, designed, and built to be consistent with the Stormwater Management Planning and Design Guidance Manual. If there is a conflict with Appendix A of this Approval, then Appendix A shall prevail;

d) Satisfy the Design Criteria or any municipal criteria that have been established that exceed the minimum requirements set out in the Design Criteria;

e) Be part of a Stormwater Treatment Train approach that satisfies the requirements outlined in Appendix A, or transmits Stormwater to a Stormwater Management Facility that satisfies the requirements outlined in Appendix A;

f) Includes an outlet or an emergency overflow for the Sewage Works, with the verification of the location, route, and capacity of the receiving major system to accommodate overflows; and

g) Include design considerations to protect sources of drinking water, including those set out in the Standard Operating Policy for Sewage Works and any applicable local Source Protection Plan policies.

5.2.2 The Alteration shall not result in:

a) Adverse Effects; or

b) A deterioration on the approved effluent quality or quantity of downstream Stormwater Management Facilities which results in not being able to achieve the overall Stormwater performance criteria per Appendix A.

5.2.3 The Alteration may incorporate co-benefits, but in doing so shall not diminish functionality or efficiency of any Stormwater Management Facility(ies) that may be impacted by the Alteration.

5.2.4 Any new sedimentation MTD that is part of the Alteration shall meet the following requirements:

a) Tested in accordance with the TRCA protocol Procedure for Laboratory Testing of OGSs and testing data verified in accordance with the ISO 14034 Environmental Technology Verification (ETV) protocol. The suspended solids removal claimed for the sedimentation MTD in achieving the water quality criteria in Appendix A, and the sizing methodology used to determine the appropriate sedimentation MTD dimensions for the particular site, shall be based on the verified removal efficiency for all particle size fractions comprising the particle size distribution specified within the testing protocol.

b) Using the verified sediment removal efficiencies for the respective surface loading rates specified in the testing protocol, the sedimentation MTD sizing methodology shall use linear interpolation to calculate sediment removal efficiencies for surface loading rates that lie between the specified surface loading rates. For surface loading rates less than the lowest specified and tested surface loading rate, the sediment removal efficiency shall be assumed to be identical to the verified removal efficiency for the lowest specified and tested surface loading rate. Where available, 15 min rainfall stations shall be used for sizing the sedimentation MTD.

c) When two or more sedimentation MTD are installed in series, no additional sediment removal credit shall be applied beyond the sediment removal credit of the largest device in the series.

d) The sediment removal rate at the specified surface loading rates determined for the tested full scale, commercially available MTD may be applied to similar MTDs of smaller or larger size by proper scaling. Scaling the performance results of the tested MTD to other model sizes without completing additional testing is acceptable provided that:

  i The claimed sediment removal efficiencies for the similar MTD are the same or lower than the tested MTD at identical surface loading rates; and

  ii The similar MTD is scaled geometrically proportional to the tested unit in all inside dimensions of length and width and a minimum of 85% proportional in depth.

e) The units must be installed in an off-line configuration if the unit had an effluent concentration greater than 25 mg/L at any of the surface loading rates conducted during the sediment scour and resuspension test as part of the ISO 14034 verification.

f) The sedimentation MTD should be sized for the highest suspended solids percent removal physically and economically practicable, and used as a pre-treatment device in a treatment train designed to achieve the water quality criteria in Appendix A.

5.2.5 Any new filtration MTD that is part of the Alteration shall meet the following requirements:

a) Field tested and verified in accordance with a minimum of one of the following protocols:

  i Washington State Technology Assessment Protocol - Ecology (TAPE) General Use Level Designation (GULD); and

    1. Has ISO 14034 ETV verification to satisfy ETV Canada requirements;

            2. The field monitoring data set used to obtain GULD certification should include a minimum of three (3) events that exceed 75th percentile rainfall event with at least one hour with an intensity of 6 mm/h or greater.

        ii Another testing and verification method, where the Director has communicated acceptability in writing.

    b) Where available, 15 min rainfall stations shall be used for sizing the filtration MTD using the rainfall intensity corresponding to 90% of annual runoff volume;

    c) The SS removal rate determined for the tested full scale, commercially available filtration MTD, or single full-scale commercially available cartridge or filtration module, may be applied to other model sizes of that filtration MTD provided that appropriate scaling principles are applied. Scaling the tested filtration MTD or single full-scale commercially available cartridge or filtration module, to determine other model sizes and performance without completing additional testing is acceptable provided that:

        i Depth of media, composition of media, and gradation of media remain constant.

        ii The ratio of the maximum treatment flow rate to effective filtration treatment area (filter surface area) is the same or less than the tested filtration MTD;

        iii The ratio of effective sedimentation treatment area to effective filtration treatment area is the same or greater than the tested filtration MTD; and

        iv The ratio of wet volume to effective filtration treatment area is the same or greater than the tested filtration MTD.

5.2.6 When it is necessary to use Privately Owned Stormwater Works in the Stormwater Treatment Train to achieve Appendix A criteria as part of or as a result of an Alteration, the following conditions apply:

    a) The Owner shall, through legal instruments or binding agreements, obtain the right to access, operate, and maintain the Privately Owned Sewage Works;

    b) The Owner shall ensure that the right to access, operate and maintain the Privately Owned Sewage Works described in condition 5.2.6 a) above is maintained at all times that the works are in service and used to achieve Appendix A criteria.

c) The Owner shall ensure on-going operation and maintenance of the Privately Owned Stormwater Works;

d) The Owner ensures on-going operation and maintenance of the Privately Owned Stormwater Works; and

e) The Owner shall ensure that the Privately Owned Stormwater Works have obtained separate approval(s) under the EPA, as required.

5.2.7 The Alteration is wholly located within the municipal boundary over which the Owner has jurisdiction or there is a written agreement in place with the adjacent municipality respecting the Alteration and resulting Sewage Works.

5.2.8 The Owner consents in writing to the Alteration authorized under condition 5.1.

5.2.9 A Licensed Engineering Practitioner has verified in writing that the Alteration authorized under condition 5.1 meets the design requirements of conditions 5.2.1 a) to f), 5.2.4 and 5.2.5.

5.2.10 The Owner has verified in writing that the Alteration authorized under condition 5.1 meets the requirements of conditions 5.2.1 g), 5.2.2, 5.2.6 to 5.2.9, 5.3, 5.4, and 7.2.

5.3 The authorization in condition 5.1 does not apply:

5.3.1 To the establishment of a regional end-of-pipe flood control Facility;

5.3.2 Where the Alteration will result in new or increased discharges to a Municipal Drain without written approval by the Owner and a signed Municipal Drainage Engineer’s Report in accordance with the *Drainage Act* R.S.O. 1990, c. D.17;

5.3.3 To the establishment of a new outlet with direct discharge into the Natural Environment without treatment and monitoring in accordance with this Approval;

5.3.4 Where the Alteration will service a drainage area greater than 65 ha;

5.3.5 Where the Alteration will result in conversion of an existing Stormwater Management Facility into another type of Stormwater Management Facility;

5.4 Any Alteration to LID or end-of-pipe Stormwater Management Facilities shall be inspected before operation of the Alteration to confirm construction as per specifications (including depth, as applicable).

5.5 The consents and verifications required in conditions 5.2.8 to 5.2.10 if applicable, shall be:

5.5.1 Recorded on Form SW2, prior to undertaking the Alteration; and

5.5.2 Retained for a period of at least ten (10) years by the Owner.

5.6 For greater certainty, the verification requirements set out in condition 5.5 do not apply to any Alteration in respect of the Authorized System which:

5.6.1 Is exempt under section 53(6) of the OWRA or by O. Reg. 525/98; or

5.6.2 Constitutes maintenance or repair of the Authorized System.

6.0 Authorizations of Future Alterations for Third Pipe Collection System Additions, Modifications, Replacements and Extensions

6.1 The Owner or a Prescribed Person may alter the Authorized System by adding, modifying, replacing, or extending, and operating works comprising a municipal Third Pipe Collection System to collect foundation drainage and groundwater where:

6.1.1 The design of the Alteration:

a) Has been prepared by a Licensed Engineering Practitioner;

b) Is limited to collection, transmission, reuse and/or treatment of only foundation drainage and groundwater, and is not designed to collect or treat sanitary Sewage;

c) Satisfies the Design Criteria or any municipal criteria that have been established that exceed the minimum requirements set out in the Design Criteria; and

d) Is scoped so that the resulting Sewage Works are intended to:

i Primarily function for the non-potable reuse, as deemed acceptable by the Owner and the local health unit, of foundation drainage and/or groundwater, and no discharge to a Storm Sewer or Separate Sewer if there is excess volume that cannot be reused; and/or

ii Provide wetland recharge, in which case, collection of rooftop runoff will also be acceptable.

6.1.2 The Alteration is not located on a contaminated site, or where natural occurring conditions result in contaminated discharge, or where the site receives contaminated groundwater or foundation drainage from another site, unless the discharge being received has been remediated or treated prior to acceptance by the Third Pipe Collection System.

6.1.3 The Owner has undertaken a site assessment for water quantity, water quality, and hydrogeological site conditions regarding the Alteration.

6.1.4 The Alteration will not result in Adverse Effects.

6.1.5 The Alteration is wholly located within the municipal boundary over which the Owner has jurisdiction or there is a written agreement in place with the adjacent property owner respecting the Alteration and resulting Sewage Works.

6.1.6 The Owner consents in writing to the Alteration.

6.1.7 A Licensed Engineering Practitioner has verified in writing that the Alteration meets the requirements of condition 6.1.1.

6.1.8 The Owner has verified in writing that the Alteration meets the requirements of conditions 6.1.2 to 6.1.7.

6.2 The consents, verifications and documentation required in conditions 6.1.7 and 6.1.8 shall be:

6.2.1 Recorded on Form SW3 prior to undertaking the Alteration; and

6.2.2 Retained for a period of at least ten (10) years by the Owner.

6.3 For greater certainty, the verification requirements set out in condition 6.2 do not apply to any Alteration in respect of the Authorized System which:

6.3.1 Is exempt under section 53(6) of the OWRA or by O. Reg. 525/98; or

6.3.2 Constitutes maintenance or repair of the Authorized System, including changes to software for an existing SCADA system resulting from Alterations authorized in condition 6.1.

6.4 The Owner shall update, within twelve (12) months of the Alteration of the Sewage Works being placed into service, any drawings maintained for the Municipal Stormwater Management System to reflect the Alterations of the Sewage Works, where applicable.

7.0 Outlets

7.1 Any outlet established or altered as part of an Alteration authorized through conditions 4, 5, or 6 of Schedule D in this Approval shall have regard to the 2012 TRCA Stormwater Management Criteria document, Appendix E, for outlets as amended from time to time.

7.2 Any outlet established as part of an Alteration authorized through conditions 4, 5, or 6 of Schedule D in this Approval shall not:

7.2.1 Increase discharge or create a new point source discharge to privately owned land unless there is express written consent of the owner(s) of such private land(s).

7.2.2 Result in Adverse Effects.

8.0 Previously Approved Sewage Works

8.1 If approval for an Alteration to the Authorized System was issued under the EPA and is revoked by this Approval, the Owner may make the Alteration in accordance with:

8.1.1 The terms of this Approval; or

8.1.2 The terms and conditions of the revoked approval as of the date this approval was issued, provided that the Alteration is commenced within five (5) years of the date that the revoked approval was issued.

9.0 Transition

9.1 An Alteration of the Authorized System is exempt from the requirements in clause (e) of condition 4.1.1, clause (d) of condition 5.2.1, and clause (c) of condition 6.1.1 where:

9.1.1 Effort to undertake the Alteration, such as tendering or commencement of construction of the Sewage Works associated with the Alteration, begins on or before May 21, 2023.

9.1.2 The design of the Alteration conforms to the Stormwater Management Planning and Design Manual, and where applicable, Design Guidelines for Sewage Works;

9.1.3 The design of the Alteration was completed on or before the issue date of this Approval or a ~~Class~~ Environmental Assessment was completed for the Alteration and changes to the design result in significant cost increase or significant project delays; and

9.1.4 The Alteration would be otherwise authorized under this Approval.

Schedule E: Operating Conditions

System Owner	**Hamilton, City of**
ECA Number	**005-S701**
System Name	**City of Hamilton Stormwater Management System**
ECA Issue Date	**${MONTH} ${DAY}, ${YEAR}**

1.0 General Operations

1.1 The Owner shall ensure that, at all times, the Sewage Works comprising the Authorized System and the related equipment and Appurtenances used to achieve compliance with this Approval are properly operated and maintained.

1.2 Prescribed Persons and Operating Authorities shall ensure that, at all times, the Sewage Works under their care and control and the related equipment and Appurtenances used to achieve compliance with this Approval are properly operated and maintained.

1.3 In conditions 1.1 and 1.2 “properly operated and maintained” includes effective performance, adequate funding, adequate operator staffing and training, including training in applicable procedures and other requirements of this Approval and the EPA, OWRA, CWA, and regulations, adequate laboratory services, process controls and alarms and the use of process chemicals and other substances used in the Authorized System.

1.4 The Owner ensure that Sewage Works are operated with the objective that the effluent from the Sewage Works is essentially free of floating and settleable solids and does not contain oil or any other substance in amounts sufficient to create a visible film, sheen, foam, or discoloration on the receiving waters, and shall evaluate the need for maintenance if the objective is not being met.

1.5 The Owner shall ensure that any Storm Sewers or ditches authorized under Schedule D of this approval are not placed into operation until the associated Stormwater Management Facilities to provide treatment are constructed and operated.

2.0 Duties of Owners and Operating Authorities

2.1 The Owner, Prescribed Persons, and any Operating Authority shall ensure the following:

2.1.1 At all times that the Sewage Works within the Authorized System are in service the Sewage Works are:

a) Operated in accordance with the requirements under the EPA and OWRA, and

b) Maintained in a state of good repair.

2.1.2 The Authorized System is operated by persons that are familiar with the requirements of this Approval.

2.1.3 All sampling, testing, monitoring, and reporting requirements under the EPA and this Approval that relate to the Authorized System are complied with.

2.1.4 All necessary steps are taken to ensure that operations of the Sewage Works and any associated physical structures do not constitute a safety or health hazard to the general public.

2.1.5 Where a Stormwater Management Facility ceases to function as a Stormwater Management Facility, whether by intent, accident, or otherwise (e.g., a CSO or an SSO), a workplan shall be developed that includes local community notification, plans for rehabilitating the Stormwater Management Facility to proper function in a reasonable time, identification of actions that will be taken to prevent reoccurrences, and timelines for implementing the workplan.

2.1.6 That operations and maintenance activities are undertaken at the frequency and in conformance with the procedures set out in the O&M Manual.

a) A Prescribed Person or Operating Authority shall only undertake operations and maintenance activities where they have been delegated the authority to undertake such activities by the Owner or the Owner has expressly approved the activity(ies).

2.2 For clarity, the requirements outlined in the above conditions 2.1 for Prescribed Persons and any Operating Authority only apply to Sewage Works within the Authorized System where they are responsible for the operation.

2.3 The Owner, Prescribed Persons, and Operating Authority shall take all reasonable steps to minimize and ameliorate any Adverse Effect on the Natural Environment or impairment of the quality of water of any waters resulting from the operation of the Authorized System, including such accelerated or additional monitoring as may be necessary to determine the nature and extent of the effect or impairment.

3.0 Operations and Maintenance

3.1 Inspection

3.1.1 The Owner shall ensure that all Sewage Works within the Authorized System are inspected at the frequency and in accordance with procedures set out in their O&M Manual.

3.1.2 The owner shall ensure that:

a) Any Stormwater Management Facilities, pumping stations, and any outlets that discharge to a receiver, are inspected at least once before December 31, 2026, if these have not been inspected since January 1, 2018 and thereafter as required by the O&M Manual; and

b) Any Stormwater Management Facilities, pumping stations, and any outlets that discharge to a receiver, established, or replaced within the Authorized System after the date of issuance of this Approval, are inspected within one year of being placed into service and thereafter as required by the O&M Manual.

3.1.3 The Owner shall clean and maintain Sewage Works within the Authorized System to ensure the Sewage Works perform as designed.

3.1.4 The Owner shall inspect the Stormwater Management Facilities in the Authorized System after significant flooding events as defined in, and in accordance with procedures documented in, the O&M Manual.

3.1.5 The Owner shall maintain records of the results of the inspections required in condition 3.1.1, 3.1.2 and 3.1.4 and any cleaning and maintenance operations undertaken, and shall make available the records for inspection by the Ministry upon request. The records shall include the following:

a) Asset ID and name of the Sewage Works;

b) Date and results of each inspection, maintenance, or cleaning;

c) Name of person who conducted the inspection, maintenance, or the name of the inspecting official, where applicable, and

d) As applicable to the type of works, observations resulting from the inspection including, at a minimum:

i Hydraulic operation of the works (e.g., length of occurrence since the last rainfall event, evidence or occurrence of overflows).

ii Condition of vegetation in and around the works.

iii Occurrence of obstructions at the inlet and outlet of the works.

iv Evidence of spills and/or oil/grease contamination.

v Presence of trash build-up, and

vi Measurements of other parameters as required in the Monitoring Plan.

3.2 Operations & Maintenance (O&M) Manual

3.2.1 The Owner shall prepare and implement an operations and maintenance manual for Sewage Works within the Authorized System on or before May 21, 2023, that includes or references, but is not necessarily limited to, the following information:

a) Procedures for the routine operation of the Sewage Works;

b) Inspection programs, including the frequency of inspection, and the methods or tests employed to detect when maintenance is necessary, including:

i Presence of algae and/or invasive species impairing the Works (e.g., phragmites, goldfish);

ii Measurements of sediment depth, manual water levels (staff gauge) and/or visual observations, as appropriate to the Stormwater Management Facilities.

c) Maintenance and repair programs, including:

i The frequency of maintenance and repair for the Sewage Works;

ii Stormwater pond sediment cleanout, dewatering, and management;

iii Excavation, modification, replacement of LID soil/media/aggregate/geotextile, such as bioretention cells, green roof, permeable pavement; and

iv The frequency of maintenance for any other Stormwater Management Facilities identified in Schedule B that collect sediment.

d) Operational and maintenance requirements to protect sources of drinking water, such as those included in the Standard

Operating Policy for Sewage Works, and any applicable local Source Protection Plan policies;

e) Procedures for routine physical inspection and calibration of monitoring equipment or components in accordance with the Monitoring Plan;

f) Emergency Response, Spill Reporting and Contingency Plans and Procedures for dealing with equipment breakdowns, potential spills, and any other abnormal situations, including notification to the Spills Action Centre, the Medical Officer of Health, and the District Manager, as applicable;

g) Procedures for receiving, responding, and recording public complaints, including recording any follow-up actions taken; and

h) As-built drawings or record drawings of the Sewage Works for stormwater works constructed after 2010 and where available, for stormwater works constructed before 2010.

3.2.2 The Owner shall review and update the O&M Manual and ensure that access to a copy is readily available for each Stormwater Management Facility for the operational life of the works.

3.2.3 The Owner shall provide a copy of the O&M Manual to Ministry staff, upon request.

3.2.4 The Owner shall revise the O&M Manual to include procedures necessary for the operation and maintenance of any Sewage Works within the Authorized System that are established, altered, extended, replaced, or enlarged after the date of issuance of this approval prior to placing into service those Sewage Works.

3.2.5 For greater certainty, the O&M Manual may be a single document or a collection of documents that, when considered together, apply to all parts of the Authorized System.

3.3 On or before May 21, 2025, the Owner shall establish signage to notify the public at any Stormwater Management Facility identified in Schedule B that is a wet pond, dry pond, hybrid Facility, or engineered wetland. The signage shall include the following minimum information:

3.3.1 Identification that the site contains a Stormwater Management Facility;

3.3.2 Identification of potential hazards and limitations of water use, as applicable;

3.3.3 Identification of the purpose of the Facility;

3.3.4 ECA approval number and/or asset ID; and

3.3.5 Owner’s contact information.

3.4 Prior to any maintenance of Sewage Works comprising the Authorized System, the Owner shall ensure that all applicable permits or authorizations have been obtained from Federal or Provincial agencies having legislative mandates relating to species at risk or water resources.

4.0 Monitoring Plan

4.1 On or before May 21, 2024 or within twenty-four (24) months of the date of the publication of the Ministry’s monitoring guidance, whichever is later, the Owner shall develop and implement a monitoring plan for the Authorized System. The monitoring plan shall be:

4.1.1 Signed and approved by management with the authority delegated by the Owner to do so;

4.1.2 Peer-reviewed by a third-party Qualified Person (QP), external to the development of the Monitoring Plan, to verify the adequacy of the Monitoring Plan in complying with conditions 4.4 and 4.5 of Schedule E. The results of the peer review shall include:

a) Written confirmation from the QP that they have the experience and qualifications to carry out the work; and

b) Written confirmation from the QP of the adequacy of the Monitoring Plan.

4.2 The Owner, or a QP designated by the Owner, may jointly develop the Monitoring Plan in partnership with Owner(s) of other Municipal Stormwater Management Systems as long as the Municipal Stormwater Management Systems are within the same watershed.

4.3 The Owner shall ensure the Monitoring Plan is implemented and any resulting monitoring data is recorded in an electronic database.

4.4 The Monitoring Plan shall include:

4.4.1 Procedures to verify that the operational performance of the Authorized System is as designed/planned;

4.4.2 Procedures to assess the environmental impact of the Municipal Stormwater Management System; and

4.4.3 Procedures for any corrective action that may be required to address any performance deficiencies or environmental impacts identified from above conditions 4.4.1 or 4.4.2.

4.5 The Monitoring Plan shall also include, but not be limited to:

4.5.1 Identification of the Sewage Works to be monitored, including outlets and any works that provide quality and/or quantity control;

4.5.2 Identification of the key receivers to be monitored within the Owner's municipal boundaries and the monitoring locations;

4.5.3 Consideration of relevant municipal land use and environmental planning documents (e.g., Stormwater Management Master Plan, Class Environmental Assessment Project, asset management plan, subwatershed studies, and planned development);

4.5.4 Characterization of water quality and quantity conditions and identification of water users to be protected, based on conditions 4.5.2 and 4.5.3;

4.5.5 Identification of water quality and quantity goals, as it relates to Stormwater management, using the information collected in condition 4.5.4;

4.5.6 Identification of locations of rainfall gauges to be used;

4.5.7 Identification of inspections, measurements, sampling, analysis and/or other monitoring activities that were used as the basis for or will inform future updates to the procedures identified in condition 4.4.

4.5.8 Details respecting a monitoring program for the works and the receivers, that includes, at a minimum:

a) Hydrological, chemical, physical, and biological parameters, as appropriate, in alignment with the goals;

b) Ensures water level of the Stormwater Measurement Facilities, excluding MTDs, are measured at regular intervals~~ with a water level gauge~~;

c) Monitoring methodology, including the frequency and protocols for sampling, analysis, and recording, with consideration of dry and wet weather events and timing of sampling during wet weather events.

d) Ensures that the time of all samples or measurements are recorded.

4.5.9 An implementation plan for the monitoring program that identifies timelines and, if the monitoring occurs on a rotational basis, provides a description of the rotational schedule and associated works.

4.5.10 Includes a summary of all monitoring data along with an interpretation of the data and any conclusion drawn from the data evaluation about the need for future modifications to the Authorized System or system operations, and

4.5.11 Consideration of adaptive management practices (e.g., evidence-based decision making).

4.6 The Owner shall ensure that the Monitoring Plan is updated where necessary within twelve (12) months of any Alteration to the Authorized System, or more frequently as required by the Monitoring Plan.

4.7 The Owner shall, on request and without charge, provide a copy of the Monitoring Plan and any resulting monitoring data to members of the public.

5.0 Reporting

5.1 The Owner shall, upon request, make all manuals, plans, records, data, procedures and supporting documentation available to Ministry staff.

5.2 The Owner shall prepare an annual performance report for the Authorized System that:

5.2.1 Is submitted to the Director on or before April 30th of each year and covers the period from January 1st to December 31st of the preceding calendar year.

a) For clarity, the first report shall cover the period of January 1, 2023 to December 31st, 2023 and be submitted to the Director on or before April 30th, 2024.

5.2.2 Includes a summary of all monitoring data along with an interpretation of the data and an overview of the condition and operational performance of the Authorized System and any Adverse Effects on the Natural Environment;

5.2.3 Includes a summary and interpretation of environmental trends based on all monitoring information and data for the previous five (5) years;

5.2.4 Includes a summary of any operating problems encountered and corrective actions taken;

5.2.5 Includes a summary of all inspections, maintenance, and repairs carried out on any major structure, equipment, apparatus, mechanism, or thing forming part of the Authorized System;

5.2.6 Includes a summary of the calibration and maintenance carried out on all monitoring equipment;

5.2.7 Includes a summary of any complaints related to the Sewage Works received during the reporting period and any steps taken to address the complaints;

5.2.8 Includes a summary of all Alterations to the Authorized System within the reporting period that are authorized by this Approval including a list of Alterations that pose a Significant Drinking Water Threat;

5.2.9 Includes a summary of all spills or abnormal discharge events;

5.2.10 Includes a summary of actions taken, including timelines, to improve or correct performance of any aspect of the Authorized System; and

5.2.11 Includes a summary of the status of actions for the previous reporting year.

5.3 The report described in condition 5.2 shall be:

5.3.1 Made available, on request and without charge, to members of the public who are served by the Authorized System; and

5.3.2 Made available, by June 1st of the same reporting year, to members of the public without charge by publishing the report on the Internet, if the Owner maintains a website on the Internet.

6.0 Record Keeping

6.1 The Owner shall retain for a minimum of ten (10) years from the date of their creation:

6.1.1 All records, reports and information required by this Approval and related to or resulting Alterations to the Authorized System, and

6.1.2 All records, report and information related to the operation, maintenance and monitoring activities required by this Approval.

6.2 The Owner shall update, within twelve (12) months of any Alteration to the Authorized System being placed into service, any drawings maintained for the Municipal Stormwater Management System to reflect the Alteration of the Sewage Works, where applicable.

7.0 Review of this Approval

7.1 No later than the date specified in Condition 1 of Schedule A of this Approval, the Owner shall submit to the Director an application to have the Approval reviewed. The application shall, at minimum:

7.1.1 Include an updated description of the Sewage Works within the Authorized System, including any Alterations to the Sewage Works that were made since the Approval was last issued; and

7.1.2 Be submitted in the manner specified by Director and include any other information requested by the Director.

8.0 Source Water Protection

8.1 The Owner shall ensure that any Alteration in the Authorized System is designed, constructed, and operated in such a way as to be protective of sources of drinking water in Vulnerable Areas as identified in the Source Protection Plan, if available.

8.2 The Owner shall prepare a “Significant Drinking Water Threat Assessment Report for Proposed Alterations” for the Authorized System on or before May 21, 2023 that includes, but is not necessarily limited to:

8.2.1 An outline of the circumstances under which proposed Alterations could pose a Significant Drinking Water Threat based on the Director’s Technical Rules established under the CWA.

8.2.2 An outline of how the Owner assesses the proposed Alterations to identify drinking water threats under the CWA.

8.2.3 For any proposed Alteration a list of components, equipment, or Sewage Works that are being altered and have been identified as a Significant Drinking Water Threat.

8.2.4 A summary of design considerations and other measures that have been put into place to mitigate risks resulting from construction or operation of the components, equipment, or Sewage Works identified in condition 8.2.3, such as those included in the Standard Operating Policy for Sewage Works.

8.3 The Owner shall make any necessary updates to the report required in condition 8.2 at least once every twelve (12) months.

8.4 Any components, equipment, or Sewage Works added to the report required in condition 8.2 shall be include in the report for the operational life of the Sewage Works.

8.5 Upon request, the Owner shall make a copy of the report required in condition 8.2 available to the Ministry or Source Protection Authority staff.

9.0 Storm Sewer Catchment Asset Inventory

9.1 The Owner shall prepare and submit to the Director an inventory of the storm sewersheds and classify in accordance with Tables E1 and E2, on or before May 21, 2025. Minimum classification of the level of Stormwater management is as follows:

9.1.1 Level A – Stormwater receives treatment for water quality and quantity prior to discharge to the environment;

9.1.2 Level B – Stormwater receives treatment for water quality but no water quantity prior to discharge to the environment; and

9.1.3 Level C – Stormwater receives no treatment for water quality prior to discharge to the environment.

Table E1. Storm Sewershed and Associated Treatment

Outlet Asset ID	Sewershed Catchment Area (ha)	Tributary or Receiver	Subwatershed/ Watershed	Stormwater Management Level (A, B or C)	Treatment provided by other municipality (if applicable)

Table E2. Summary of Storm Sewersheds

Stormwater Management Level	Total Number of Outlets to Environment	Total Sewershed Catchment Area (ha)
Level A		
Level B		
Level C		

9.2 Within 12 (twelve) months of the date that the inventory required in condition 9.1 is submitted to the Director, the document(s) or file(s) referenced in Table B1 of Schedule B of this Approval shall be updated to identify the storm sewersheds for each outlet and their level of Stormwater management.

Schedule F: Residue Management

System Owner	**Hamilton, City of**
ECA Number	**005-S701**
System Name	**City of Hamilton Stormwater Management System**
ECA Issue Date	**${MONTH} ${DAY}, ${YEAR}**

1.0 Residue Management System

1.1 Not Applicable.

Appendix A – Stormwater Management Criteria

1.0 Applicability of Criteria

1.1 The criteria listed under Table A1 of this Appendix applies to all drainage areas greater than 0.1 ha, with the construction erosion and sediment control criteria applying also to sites <0.1 ha;

1.2 Despite condition 1.1 of Appendix A, if some or all of the criteria listed under Table A1 of this Appendix have been assessed for and addressed in other adjacent developed lands to the project site through a subwatershed plan or equivalent study, then those criteria may not be applicable to the project site.

Table A1. Performance Criteria

Water Balance [1]	**FOR DEVELOPMENT SCENARIOS** [2] **Assessment Studies:** i) Control [3] as per the criteria identified in the water balance assessment completed in one or more of the following studies [15], if undertaken: a watershed/subwatershed plan; Source Protection Plan (Assessment Report component); Master Stormwater Management Plan, Master Environmental Servicing Plan; Class EA, or similar approach that transparently considers social, environmental and financial impacts; or local site study including natural heritage, Ecologically significant Groundwater Recharge Areas (EGRA), inflow and infiltration strategies. The assessment should include sufficient detail to be used at a local site level and consistent with the various level of studies; OR **IF Assessment Studies in i) NOT completed:** ii) Control [3] the recharge [4] to meet Pre-development [5] conditions on property; **OR** iii) Control [3] the runoff from the 90th percentile storm event. **Lake Simcoe Watershed Municipalities:** iv) Control [3] as per the evaluation of anticipated changes in water balance between Pre-development and post-development assessed through a Stormwater management plan in support of an application for Major Development [6]. The assessment should include sufficient detail to be used at a local site level. If it is demonstrated, using the approved water balance estimation methods **[7]**, that the site's post to Pre-development water balance cannot be met, and Maximum Extent Possible [8] has been attained, the proponent may use Lake Simcoe and Region Conservation Authority's (LSRCA) Recharge Compensation Program [9]. **FOR RETROFIT SCENARIOS** [10] **Assessment Studies:**

	i) Control as per criteria identified in the water balance assessment completed in one or more of the following studies: a watershed/subwatershed plan, Source Protection Plan (Assessment Report component), Master Stormwater Management Plan, Master Environmental Servicing Plan, Class EA, or local site study including natural heritage, EGRA, inflow and infiltration strategies, if undertaken. The assessment should include sufficient detail to be used at a local site level and consistent with the various level of studies; **OR** ii) If constraints [11] identified in i), then control [3] as per Maximum Extent Possible [8] based on environmental site feasibility studies or address local needs[14]. **IF Assessment Studies in i) NOT completed:** iii) Control [3] the recharge [4] to meet Pre-development [5] conditions on property; **OR** iv) Control [3] the runoff from the 90th percentile storm event.
Water Quality [1]	**FOR DEVELOPMENT SCENARIOS** [2] All of the following criteria must be met for development scenarios: **General:** i) Characterize the water quality to be protected and Stormwater Contaminants (e.g., suspended solids, nutrients, bacteria, water temperature) for potential impact on the Natural Environment, and control as necessary, **OR** ii) As per the watershed/subwatershed plan, similar area-wide Stormwater study, or Stormwater management plan to minimize, or where possible, prevent increases in Contaminant loads and impacts to receiving waters. **Suspended Solids:** i) Control [3] 90th percentile storm event and if conventional methods are necessary, then enhanced, normal, or basic levels of protection (80%, 70%, or 60% respectively) for suspended solids removal (based on the receiver). **Phosphorus:** i) Minimize existing phosphorus loadings to Lake Erie and its tributaries, as compared to 2018 or conditions prior to the proposed development, **OR** ii) Minimize phosphorus loadings to Lake Simcoe and its tributaries. Proponents with development sites located in the Lake Simcoe watershed shall evaluate anticipated changes in phosphorus loadings between Pre-development and post-development through a Stormwater management plan in support of an application for Major Development [6]. The assessment should include sufficient detail to be used at a local site level. If, using the approved phosphorus budget tool [12], it is demonstrated that the site's post to Pre-development phosphorus budget cannot be met, and Maximum Extent Possible [8] has been attained, the proponent may use LSRCA's Phosphorus Offsetting Policy [9]. **FOR RETROFIT SCENARIOS** [10] i) Improve the level of water quality control currently provided on site; **AND** ii) As per the 'Development' criteria for Suspended Solids, **OR**

	iii) **If ‘Development’ criteria for Suspended Solids cannot be met**, Works are designed as a multi-year retrofit project, in accordance with a rehabilitation study or similar area-wide Stormwater study, such that the completed treatment train will achieve the ‘Development’ criteria for Suspended Solids or local needs[14], within ten (10) years; **OR** iv) If constraints [11] identified in ii) and iii), then control [3] as per Maximum Extent Possible [8] based on environmental site feasibility studies.
Erosion Control (Watershed) [1]	**FOR DEVELOPMENT SCENARIOS** [8] i) As per erosion assessment completed in watershed/subwatershed plan, Master Stormwater Management Plan, Master Environmental Servicing Plan, Drainage Plan, Class EA, local site study, geomorphologic study, or erosion analysis; **OR** ii) As per the Detailed Design Approach or Simplified Design Approach methods described in the Stormwater Management Planning and Design Manual: a. The Detailed Design Approach may be selected by the proponent for any development regardless of size and location within the watershed provided technical specialists are available for the completion of the technical assessments; or considered more appropriate than the simplified approach given the size and location of the development within the watershed and the sensitivity of the receiving waters in terms of morphology and habitat function. b. The Simplified Design Approach may be adopted for watersheds whose development area is generally less than twenty hectares AND either one of the following two conditions apply: 1) The catchment area of the receiving channel at the point-of-entry of Stormwater drainage from the development is equal to or greater than twenty-five square kilometres; or 2) Meets the following conditions: • The channel bankfull depth is less than three quarters of a metre; • The channel is a headwater stream; • The receiving channel is not designated as an Environmentally Sensitive Area (ESA) or Area of Natural or Scientific Interest (ANSI) and does not provide habitat for a sensitive aquatic species; • The channel is stable to transitional; and • The channel is slightly entrenched; **OR** iii) In the absence of a guiding study, detain at minimum, the runoff volume generated from a 25 mm storm event over 24 to 48 hours. **FOR RETROFIT SCENARIOS** [10] i) If approaches i-iii) under ‘Development Scenarios’ are not feasible as per identified constraints [11], then improve the level of erosion control [3] currently provided on site to Maximum Extent Possible [8] based on environmental site feasibility studies or address local needs[14].
Water Quantity (Minor and Major System) [1]	**i)** As per municipal standards, Master Stormwater Management Plan, Class EA, Individual EA and/or ECA, as appropriate for the type of project [13]

Flood Control (Watershed Hydrology) [1]	**FOR DEVELOPMENT SCENARIOS** [2] i) Manage peak flow control as per watershed/subwatershed plans, municipal criteria being a minimum 100 year return storm (except for site-specific considerations and proximity to receiving water bodies), municipal guidelines and standards, Individual/Class EA, ECA, Master Plan, as appropriate for the type of project [13]. **FOR RETROFIT SCENARIOS** [10] i) If approaches i) under 'Development Scenarios' are not feasible as per identified constraints [11], then improve the level of flood control [3] currently provided on site to Maximum Extent Possible [8] based on environmental site feasibility studies.
Construction Erosion and Sediment Control	i) Manage construction erosion and sediment control through development and implementation of an erosion and sediment control (ESC) plan. The ESC plan shall: a. Have regard to Canadian Standards Association (CSA) W202 Erosion and Sediment Control Inspection and Monitoring Standard (as amended); OR b. Have regard to Erosion and Sediment Control Guideline for Urban Construction 2019 by TRCA (as amended). ii) Be prepared by a QP for sites with drainage areas greater than 5 ha or if specified by the Owner for a drainage lower than 5 ha. iii) Installation and maintenance of the ESC measures specified in the ESC plan shall have regard to CSA W208:20 Erosion and Sediment Control Installation and Maintenance (as amended). iv) For sites with drainage areas greater than 5 ha, a QP shall inspect the construction ESC measures, as specified in the ESC plan.
Footnote	1. Where the opportunity exists on your project site or the same subwatershed, reallocation of development elements may be optimal for management as described in footnote [3]. 2. Development includes new development, redevelopment, infill development, or conversion of a rural cross-section into an urban cross-section. 3. Stormwater volumes generated from the geographically specific 90th percentile rainfall event on an annual average basis from all surfaces on the entire site are targeted for control. Control is in the following hierarchical order, with each step exhausted before proceeding to the next: 1) retention (infiltration, reuse, or evapotranspiration), 2) LID filtration, and 3) conventional Stormwater management. Step 3, conventional Stormwater management, should proceed only once Maximum Extent Possible [8] has been attained for Steps 1 and 2 for retention and filtration. 4. Recharge is the infiltration and movement of surface water into the soil, past the vegetation root zone, to the zone of saturation, or water table. 5. Pre-development is defined as the more stringent of the two following scenarios: 1) a site's existing condition, or 2) as defined by the local municipality. 6. Major Development has the same meaning as in the Lake Simcoe Protection Plan, 2009. 7. Currently, the approved tool by LSRCA for calculating the water balance is the Thornthwaite-Mather Method. Other tools agreed upon by relevant approval agencies (e.g., LSRCA, municipality, or Ministry) may also be acceptable, subject to written acceptance by the Director. 8. Maximum Extent Possible means maximum achievable Stormwater volume control through retention and LID filtration engineered/landscaped/technical Stormwater practices, given the site constraints [11].

	9. Information pertaining to LSRCA's Recharge Compensation Program and Phosphorus Offsetting Policy is available on LSRCA's website (lsrca.on.ca), or in "Water Balance Recharge Policy for the Lake Simcoe Protection Plan", dated July 2021, and prepared by Lake Simcoe Region Conservation Authority and "Phosphorus Offsetting Policy", dated July 2021, and prepared by Lake Simcoe Region Conservation Authority. 10. Retrofit means: 1) a modification to the management of the existing infrastructure, 2) changes to major and minor systems, or 3) adding Stormwater infrastructure, in an existing area on municipal right-of-way, municipal block, or easement. It does not include conversion of a rural cross-section into an urban cross-section. 11. Site constraints must be documented. A list of site constraints can be found in Table A2. 12. Tools for calculating phosphorus budgets may include the Ministry's Phosphorus Tool, the Low Impact Development Treatment Train Tool developed in partnership by TRCA, LSRCA, and Credit Valley Conservation (CVC), or other tools agreed upon by the LSRCA and other relevant approval agencies including the municipality. 13. Possible to look at combined grey infrastructure and LID system capacity jointly. 14. Local needs include requirements for water quality, erosion, and/or water balance retrofits identified by the owner through ongoing operation and maintenance of the stormwater system, including inspection of local receiving systems and the characterization of issues requiring remediation through retrofit controls. 15. All studies shall conform with Ministry policies. If any conclusions in the studies negate policy, then the project will require a direct submission to the Ministry for review through an application pertaining to a Schedule C Notice.

Table A2. Stormwater Management Practices Site Constraints

Site Constraints	
a)	Shallow bedrock [1], areas of blasted bedrock [2], and Karst;
b)	High groundwater [1] or areas where increased infiltration will result in elevated groundwater levels which can be shown through an appropriate area specific study to impact critical utilities or property (e.g., susceptible to flooding);
c)	Swelling clays [3] or unstable sub-soils;
d)	Contaminated soils (e.g., brownfields);
e)	High Risk Site Activities including spill prone areas;
f)	Prohibitions and or restrictions per the approved Source Protection Plans and where impacts to private drinking water wells and /or Vulnerable Domestic Well Supply Areas cannot be appropriately mitigated;
g)	Flood risk prone areas or structures and/ or areas of high inflow and infiltration (I/I) where wastewater systems (storm and sanitary) have been shown through technical studies to be sensitive to groundwater conditions that contribute to extraneous flow rates that cause property flooding / Sewer back-ups;

h)	For existing municipal rights-of-way infrastructure (e.g., roads, sidewalks, utility corridor, Sewers, LID, and trails) where reconstruction is proposed and where surface and subsurface areas are not available based on a site-specific assessment completed by a QP;
i)	For developments within partially separated wastewater systems where reconstruction is proposed and where, based on a site-specific assessment completed by a QP, can be shown to: i Increase private property flood risk liabilities that cannot be mitigated through design; ii Impact pumping and treatment cost that cannot be mitigated through design; or iii Increase risks of structural collapse of Sewer and ground systems due to infiltration and the loss of pipe and/or pavement support that cannot be mitigated through design.
j)	Surface water dominated or dependent features including but not limited to marshes and/or riparian forest wetlands which derive all or a majority of their water from surface water, including streams, runoff, and overbank flooding. Surface water dominated or dependent features which are identified through approved site specific hydrologic or hydrogeologic studies, and/or Environmental Impact Statements (EIS) may be considered for a reduced volume control target. Pre-consultation with the MECP and local agencies is encouraged;
k)	Existing urban areas where risk to water distribution systems has been identified through assessments to meet applicable drinking water requirements, including Procedures F-6 and F-6-1, and substantiated by a QP through an appropriate area specific study and where the risk cannot be reasonably mitigated per the relevant design guidelines;
l)	Existing urban areas where risk to life, human health, property, or infrastructure has been is identified and substantiated by a QP through an appropriate area specific study and where the risk cannot be reasonably mitigated per the relevant design guidelines;
m)	Water reuse feasibility study has been completed to determine non-potable reuse of Stormwater for onsite or shared use;
n)	Economic considerations set by infrastructure feasibility and prioritization studies undertaken at either the local/site or municipal/system level [4].

Footnote:

1. May limit infiltration capabilities if bedrock and groundwater is within 1m of the proposed Facility invert per Table 3.4.1 of the LID Stormwater Planning and Design Guide (2010, V1.0 or most recent by TRCA/CVC). Detailed assessment or studies are required to demonstrate infiltration effects and results may permit relaxation of the minimum 1m offset.
2. Where blasting is more localized, this constraint may not be an issue elsewhere on the property. While infiltration-based practices may be limited in blasted rock areas, other forms of LID, such as filtration, evapotranspiration, etc., are still viable options that should be pursued.
3. Swelling clays are clay soils that is prone to large volume changes (swelling and shrinking) that are directly related to changes in water content.
4. Infrastructure feasibility and prioritization studies should comprehensively assess Stormwater site opportunities and constraints to improve cost effectiveness, environmental performance, and overall benefit to the receivers and the community. The studies include assessing and prioritizing municipal infrastructure for upgrades in a prudent and economically feasible manner.

Appendix B-4 Pre-Consultation Summary

SCS consulting group ltd

SCS consulting group ltd

MEETING MINUTES

File #: **2600**
Date: **October 13, 2023**

Project:	**White Church Secondary Plan**
Purpose:	**Subwatershed Study Terms of Reference**
Date/Time of Meeting:	**October 2, 2023**
Location:	**Zoom**
Next Meeting:	**October 6, 2023**

	Recipient(s):	Email:
Attendees:	Mr. Mark Kehler, Hamilton	Mark.Kehler@hamilton.ca
	Mr. Gavin Norman, Hamilton	Gavin.Norman@hamilton.ca
	Ms. Melanie Pham, Hamilton	Melanie.Pham@hamilton.ca
	Mr. Binu Korah, Hamilton	Mark.Hartley@hamilton.ca
	Mr. Mark Hartley, Hamilton	Binu.Korah@hamilton.ca
	Ms. Melissa Kiddie, Hamilton	Melissa.Kiddie@hamilton.ca
	Mr. David Deluce, NPCA	ddeluce@npca.ca
	Mr. Matt Johnson, Urban Solutions	mjohnston@urbansolutions.info
	Mr. Scott Beedie, Urban Solutions	sbeedie@urbansolutions.info
	Ms. Kristi Quinn, Beacon Environmental	kquinn@beaconenviro.com
	Ms. Lindsay Moore, SCS Consulting Group	lmoore@scsconsultinggroup.com
Absentees:	Ms. Jessica Abrahamse, Hamilton	Jessica.Abrahamse@hamilton.ca
cc:		

The following is considered to be a true and accurate record of the items discussed. Any errors or omissions in these minutes should be provided in writing to the author immediately.

Item:	**Action:**
1.0 Subwatershed Study Terms of Reference Scope	
➝ SWS to include EIS, Geomorphic Assessment, Stormwater Management, Water Budget and Conceptual LID measures ➝ Correspondence with City to be directed through Mark Kehler	Info
2.0 Stormwater Management	

Item:	**Action:**
White Church Secondary Plan is located within the headwaters of the Twenty Mile Creek and the Upper Welland River	
SCS noted that existing hydrology models exist, HEC-HMS for Twenty Mile Creek and V04 for the Welland River	
City noted that two separate models may be required, one for Flood Hazard and one for stormwater management	
City inquired regarding potential diversions between the two watersheds	
SCS noted that the objective will be to generally maintain the existing drainage divides	
NPCA noted that questions should be directed through David Deluce (Planner)	
NPCA Water Resource Engineer for this project is Carly Mason	
NPCA advised that no floodplain mapping is required within the proposed development limit, as the drainage areas upstream of any drainage features are less than 125 ha	
SCS noted that stormwater management will consider quality, quantity and erosion control	
SCS noted that control of post to pre peak flows for the 2 through 100 year storm events is anticipated based on NPCA criteria	
NPCA noted that they do not typically consider control of Regional storm flows, unless there is a known flood concern	
NPCA to confirm if there are any known downstream flooding concerns to be considered in the SWS	NPCA
SCS noted that under existing conditions the site drains to multiple small drainage features. The SWS will consider erosion thresholds at the proposed storm facility outlets and receiving drainage features.	

Item:	**Action:**
3.0 EIS	
→ Beacon provided an overview of the EIS scope of work → City noted that the entire Secondary Plan area should be included. The TOR should highlight that a high level analysis will be completed for non-participating properties → City noted that the TOR should identify specify months for various field surveys, rather than general seasons. Beacon to confirm number and types of surveys required consistent with City EIS guidelines.	Info
4.0 Hydrogeology	
→ SCS noted that the SWS will include overall site water budget for existing conditions, post development without mitigation and post development with mitigation → SCS noted that SWS will include identification of feature based water balance requirements → One year of baseline groundwater monitoring is required by NPCA → The TOR should reference the TRCA Wetland Water Balance Risk Evaluation document → City noted that new guidelines are coming for LIDs on private lands → SCS to reference Hamilton Complete Streets Design Guidelines with respect to potential LIDs within municipal roads → City noted that SWS should aim to maximize opportunities for LIDs, and ensure that the LIDs can be implemented through the future Draft Plan and detailed design processes.	Info

SCS Consulting Group Ltd.

Lindsay Moore, P.Eng.
Associate
lmoore@scsconsultinggroup.com

P:\2600 White Church Road Secondary Plan\Correspondence\Meetings\2023 10(Oct) 02 - SWS.docx

Appendix C Hydrologic Modelling

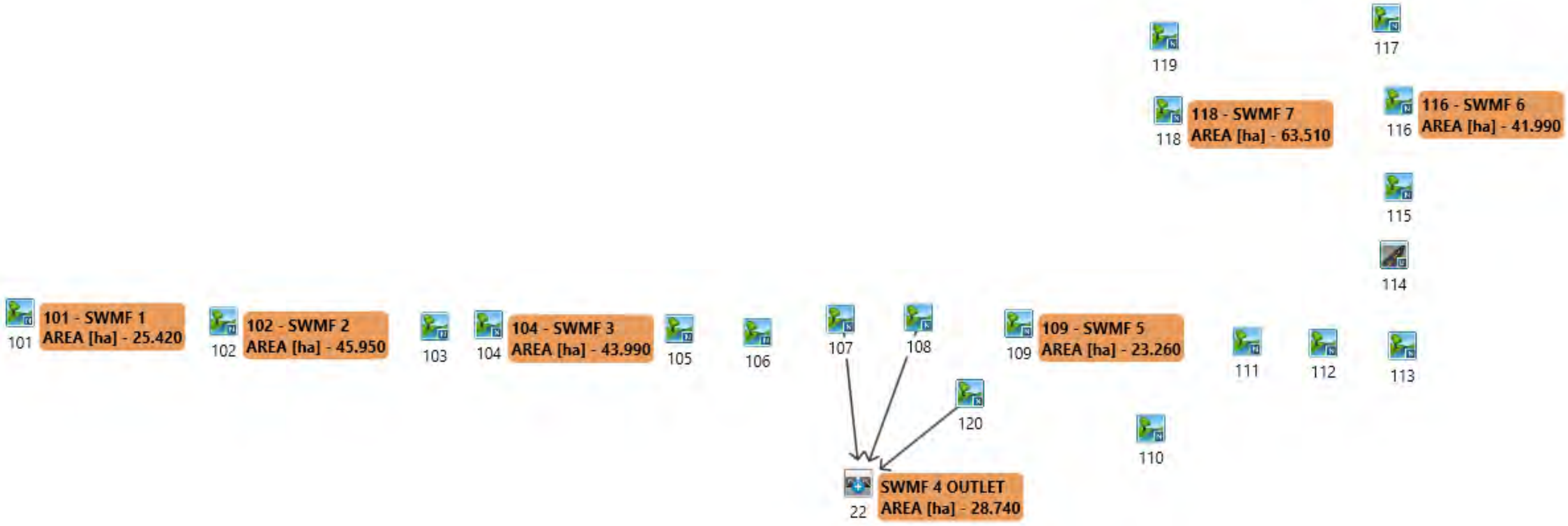
The following secure link is being provided by **SCS Consulting Group Ltd.** to share White Church Boundary Expansion Area related files:

https://filesafecloud.scsconsultinggroup.com/url/qebhgv5gjupwtfmi

Please click on the link and download all files from this location.

- Visual Otthymo modelling files

SCS consulting group ltd	**Existing Condition VO6 Schematic**	White Church Boundary Expansion Area Project Number: 2600 Date: January 2025



Existing Conditions
VO6 Parameter Summary

NASHYD

Number	101	102	103	104	105	106	107	108	109	110	111	112	113	115	116	117	118	119	120
Description																			
DT(min)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Area (ha)	25.42	45.95	4.32	43.99	27.82	13.22	14.58	6.80	23.26	2.51	13.32	7.83	1.79	7.59	41.99	13.40	63.51	2.62	7.36
CN*	67.0	66.0	67.0	75.00	77.0	78.0	78.0	77.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	75.0	75.0	75.0	72.0
IA(mm)	7.4	7.9	7.9	7.9	8.0	7.5	8.0	6.9	8.2	7.4	7.8	7.6	8.0	7.7	8.0	8.9	7.8	6.6	8.0
TP Method	Uplands	Uplands	Uplands	Uplands	Uplands	Uplands	Uplands	Uplands	Uplands	Uplands	Uplands	Uplands	Uplands	Uplands	Uplands	Uplands	Uplands	Uplands	Uplands
TP (hr)	0.84	1.37	0.18	0.71	1.40	0.68	0.89	0.30	1.47	0.22	0.35	0.45	0.45	0.60	1.44	0.46	1.63	0.21	0.34

STANDHYD

Number	114
Description	
DT(min)	1
Area (ha)	4.35
XIMP^{1,2}	0.01
TIMP^{2}	0.25
CN*	78.0
IA(mm)	8.0
SLPP(%)	2
LGP(m)	40
MNP	0.25
DPSI (mm)	1.0
SLPI(%)	1
LGI(m)	170.29
MNI	0.013

Total Area = 371.7 ha

White Church Boundary Expansion Area
Project Number: 2600
Date: January 2025
Designer Initials: S.G.

Existing Conditions
CN Calculations

Site Soils: OMAFRA Wentworth County Soils Mapping

Soil Type	**Hydrologic Soil Group**
Alberton Silty Clay Loam, Brantford Silt Loam, Smithville Silt Loam.	BC
Beverly Silt Loam), Binbrook Silt Loam, Toledo Silty Clay Loam.	C

TABLE OF CURVE NUMBERS (CN's)**

Land Use	Hydrologic Soil Type							Manning's	Source
	A	AB	B	BC	C	CD	D	'n'	
Meadow "Good"	30	44	58	64.5	71	74.5	78	0.40	MTO
Woodlot "Fair"	36	48	60	66.5	73	76	79	0.40	MTO
Gravel	76	80.5	85	87	89	90	91	0.30	USDA
Lawns "Good"	39	50	61	67.5	74	77	80	0.25	USDA
Pasture/Range	58	61.5	65	70.5	76	78.5	81	0.17	MTO
Crop	66	70	74	78	82	84	86	0.13	MTO
Fallow (Bare)	77	82	86	89	91	93	94	0.05	MTO
Low Density Residences	57	64.5	72	76.5	81	83.5	86	0.25	USDA
Streets, paved	98	98	98	98	98	98	98	0.01	USDA

1. MTO Drainage Manual (1997), Design Chart 1.09-Soil/Land Use Curve Numbers
2. USDA (1986), Urban Hydrology for Small Watersheds, Table 2.2-Runoff Curve Numbers for Urban Areas

HYDROLOGIC SOIL TYPE (%) - Existing Conditions

	Hydrologic Soil Type							
Catchment	A	AB	B	BC	C	CD	D	TOTAL
101				100.0				100
102				77.5	22.5			100
103				100.0				100
104				49.0	51.0			100
105				37.0	63.0			100
106				7.1	92.9			100
107				7.3	92.7			100
108				0.4	99.6			100
109					100.0			100
110					100.0			100
111					100.0			100
112					100.0			100
113					100.0			100
115					100.0			100
116				7.8	92.2			100
117				33.8	66.2			100
118				29.9	70.1			100
119				1.9	98.1			100
120				100.0				100
114					100.0			100

Existing Conditions
CN Calculations

White Church Boundary Expansion Area
Project Number: 2600
Date: January 2025
Designer Initials: S.G.

LAND USE (%) - Existing Conditions

Catchment	Meadow	Woodlot	Gravel	Lawns	Pasture Range	Crop	Fallow (Bare)	Low Density Residences	Impervious	Total
101	90.7								9.3	100.0
102	87.1				11.5				1.4	100.0
103	42.4				55.3				2.3	100.0
104	1.6	0.5			96.3				1.6	100.0
105		0.8		0.1	98.3				0.7	100.0
106				10.3	86.3				3.4	100.0
107					99.7				0.3	100.0
108				31.0	65.6				3.4	100.0
109		15.0		3.1	81.3				0.6	100.0
110				18.7	80.1				1.2	100.0
111				3.5	95.5				1.0	100.0
112				9.3	89.3				1.4	100.0
113					100.0					100.0
115					95.8				4.2	100.0
116					99.6				0.4	100.0
117	16.1	69.6			6.2				8.1	100.0
118				4.3	94.5				1.2	100.0
119				45.8	53.4				0.8	100.0
120					100.0					100.0
114					100.0					100.0

Note: Where STANDHYD command used (shaded), impervious fraction is not considered in CN determination, since %Imp directly input in STANDHYD command

CURVE NUMBER (CN) - Existing Conditions

Catchment	Meadow	Woodlot	Gravel	Lawns	Pasture Range	Crop	Fallow (Bare)	Low Density Residences	Impervious	Weighted CN
101	58.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1	68
102	57.4	0.0	0.0	0.0	8.3	0.0	0.0	0.0	1.4	67
103	27.3	0.0	0.0	0.0	39.0	0.0	0.0	0.0	2.3	69
104	1.1	0.3	0.0	0.0	70.6	0.0	0.0	0.0	1.5	74
105	0.0	0.6	0.0	0.1	72.7	0.0	0.0	0.0	0.7	74
106	0.0	0.0	0.0	7.6	65.3	0.0	0.0	0.0	3.3	76
107	0.0	0.0	0.0	0.0	75.4	0.0	0.0	0.0	0.3	76
108	0.0	0.0	0.0	23.0	49.8	0.0	0.0	0.0	3.3	76
109	0.0	11.0	0.0	2.3	61.8	0.0	0.0	0.0	0.6	76
110	0.0	0.0	0.0	13.9	60.9	0.0	0.0	0.0	1.2	76
111	0.0	0.0	0.0	2.6	72.6	0.0	0.0	0.0	1.0	76
112	0.0	0.0	0.0	6.9	67.8	0.0	0.0	0.0	1.4	76
113	0.0	0.0	0.0	0.0	76.0	0.0	0.0	0.0	0.0	76
115	0.0	0.0	0.0	0.0	72.8	0.0	0.0	0.0	4.1	77
116	0.0	0.0	0.0	0.0	75.3	0.0	0.0	0.0	0.4	76
117	11.1	49.2	0.0	0.0	4.6	0.0	0.0	0.0	8.0	73
118	0.0	0.0	0.0	3.1	70.2	0.0	0.0	0.0	1.2	75
119	0.0	0.0	0.0	33.8	40.6	0.0	0.0	0.0	0.7	75
120	0.0	0.0	0.0	0.0	70.5	0.0	0.0	0.0	0.0	71
114	0.0	0.0	0.0	0.0	76.0	0.0	0.0	0.0	0.0	76

** AMC II assumed

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White Church Boundary Expansion Area
Project Number: 2600
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Existing Conditions
CN Calculations

Input Values

Step	Subcatchment:	101		102	103	104	105	106	107	108	109	110	111	112	113	115	116	117	118	119	120	114
1	**CN (AMC II):**	**68**		**67**	**69**	**74**	**74**	**76**	**76**	**76**	**76**	**76**	**76**	**76**	**76**	**77**	**76**	**73**	**75**	**75**	**71**	**76**
2	CN (AMC III) =	84		83	84	88	88	89	89	89	89	89	89	89	89	89	89	87	88	88	86	89
3	100 Year Precipitation, P =	126.5	mm	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5

$$Q = \frac{(P - Ia)^2}{(P - Ia) + S} \qquad S = \frac{(P - Ia)^2}{Q} - (P - Ia)$$

Q = rainfall excess or runoff, mm
S = potential maximum retention or available storage, mm

$$CN = \frac{25400}{S + 254} \qquad S = \frac{25400}{CN} - 254$$

CN* = modified SCS curve # that better reflects Ia conditions in Ontario

Output Values

Step	Subcatchment:	101		102	103	104	105	106	107	108	109	110	111	112	113	115	116	117	118	119	120	114
	S_{III} =	48.38	mm	52.02	48.38	34.64	34.64	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	31.39	37.95	34.64	34.64	41.35	31.39
	SCS Assumption of 0.2 S = Ia =	9.68	mm	10.40	9.68	6.93	6.93	6.28	6.28	6.28	6.28	6.28	6.28	6.28	6.28	6.28	6.28	7.59	6.93	6.93	8.27	6.28
4	Q_{III} =	82.61	mm	80.17	82.61	92.72	92.72	95.33	95.33	95.33	95.33	95.33	95.33	95.33	95.33	95.33	95.33	90.14	92.72	92.72	87.60	95.33
	Preferred Initial Abstraction, Ia =	7.4	mm	7.9	7.9	7.9	8.0	7.5	8.0	6.9	8.2	7.4	7.8	7.6	8.0	7.7	8.0	8.9	7.8	6.6	8.0	8.0
5	S^*_{III} =	52.53	mm	56.82	51.74	33.09	33.00	29.57	28.83	30.50	28.55	29.75	29.05	29.35	28.80	29.18	28.84	35.82	33.27	35.19	41.81	28.80
6	CN^*_{III} =	82.86	mm	81.72	83.08	88.48	88.50	89.57	89.81	89.28	89.90	89.52	89.74	89.64	89.81	89.70	89.80	87.64	88.42	87.83	85.87	89.81
	CN^*_{III}=	**83**	Rounded	**82**	**83**	**88**	**89**	**90**	**90**	**89**	**90**	**90**	**90**	**90**	**90**	**90**	**90**	**88**	**88**	**88**	**86**	**90**
7	**CN^*_{II}=**	**67**	convert	**66**	**67**	**75**	**77**	**78**	**78**	**77**	**78**	**78**	**78**	**78**	**78**	**78**	**78**	**75**	**75**	**75**	**72**	**78**

Explanation of Procedure

1 Determine CN based on typical AMC II conditions (attached)
2 Convert CN from AMC II to AMC III conditions (standard SCS tables)
3 Get precipitation depth P for 100 year storm
4 Using CN_{III} with Ia = 0.2S, compute Q_{III} for 100 year precipitation
5 For the same Q_{III}, compute S^*_{III} using Ia=1.5mm (or otherwise determined)
6 Compute CN^*_{III} using S^*_{III}
7 Calculate CN^*_{II} using SCS conversion table

Existing Conditions
IA Calculations

White Church Boundary Expansion Area
Project Number: 2600
Date: January 2025
Designer Initials: S.G.

LAND USE (%) - Existing Conditions

Catchment	Meadow	Woodlot	Gravel	Lawns	Pasture Range	Crop	Fallow (Bare)	Low Density Residences	Impervious	Total
101	90.7								9.3	100.0
102	87.1				11.5				1.4	100.0
103	42.4				55.3				2.3	100.0
104	1.6	0.5			96.3				1.6	100.0
105		0.8		0.1	98.3				0.7	100.0
106				10.3	86.3				3.4	100.0
107					99.7				0.3	100.0
108				31.0	65.6				3.4	100.0
109		15.0		3.1	81.3				0.6	100.0
110				18.7	80.1				1.2	100.0
111				3.5	95.5				1.0	100.0
112				9.3	89.3				1.4	100.0
113					100.0					100.0
115					95.8				4.2	100.0
116					99.6				0.4	100.0
117	16.1	69.6			6.2				8.1	100.0
118				4.3	94.5				1.2	100.0
119				45.8	53.4				0.8	100.0
120					100.0					100.0
114					100.0					100.0

IA VALUES (mm) - Existing Conditions

Catchment	Meadow	Woodlot	Gravel	Lawns	Pasture Range	Crop	Fallow (Bare)	Low Density Residences	Impervious	Total
IA (mm)	8	10	2	5	8	8	3	2	2	
101	7.3								0.2	7.4
102	7.0				0.9				0.0	7.9
103	3.4				4.4				0.0	7.9
104	0.1	0.1			7.7				0.0	7.9
105		0.1		0.0	7.9				0.0	8.0
106				0.5	6.9				0.1	7.5
107					8.0				0.0	8.0
108				1.6	5.2				0.1	6.9
109		1.5		0.2	6.5				0.0	8.2
110				0.9	6.4				0.0	7.4
111				0.2	7.6				0.0	7.8
112				0.5	7.1				0.0	7.6
113					8.0					8.0
115					7.7				0.1	7.7
116					8.0				0.0	8.0
117	1.3	7.0			0.5				0.2	8.9
118				0.2	7.6				0.0	7.8
119				2.3	4.3				0.0	6.6
120					8.0					8.0
114					8.0					8.0

* IA values based on TRCA guidelines

White Church Boundary Expansion Area
Project Number: 2600
Date: January 2025
Designer Initials: S.G.

Existing Conditions
Percent Impervious Calculations

			StandHyd IDs	
			114	
Catchment Area (ha)			4.35	
Land Use Areas	**Timp**	**Ximp**	**Land Use Areas**	**Total**
Existing Impervious Area	100%	0%	1.09	1.09
Grass	0%	0%	3.26	3.26
		Total Land Use =	4.35	4.35
		Timp =	25%	25%
		Ximp =	0%	0%

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Existing Conditions
Time to Peak Calculations

White Church Boundary Expansion Area
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Date: January 2025
Designer Initials: S.G.

Uplands Method:

Catchment ID	High Elevation	Low Elevation	Length (m)	Slope (%)	Land Cover Type	Velocity (m/s)	Time of Concentration (s)	Time of Concentration (hr)	Time to Peak (hr)
101a	232.15	226.48	432	1.31	Pasture	0.25	1732.2	0.48	0.32
101b	226.48	226.06	39	1.08	Waterway	0.49	79.8	0.02	0.01
101c	226.06	223.80	191	1.18	Pasture	0.24	807.0	0.22	0.15
101d	223.80	223.74	129	0.05	Waterway	0.11	1204.4	0.33	0.22
101e	223.74	222.03	68	2.51	Pasture	0.35	196.4	0.05	0.04
101f	222.03	221.87	100	0.16	Waterway	0.19	514.1	0.14	0.10
101									**0.84**
102a	233.51	225.32	826	0.99	Cultivated Straight Row	0.28	2966.7	0.82	0.55
102b	225.32	224.84	100	0.48	Waterway	0.33	302.4	0.08	0.06
102c	224.84	223.81	119	0.87	Pasture	0.20	588.8	0.16	0.11
102d	223.81	223.78	63	0.05	Waterway	0.11	581.5	0.16	0.11
102e	223.78	216.56	660	1.09	Pasture	0.23	2901.3	0.81	0.54
102									**1.37**
103a	225.18	219.12	270	2.24	Pasture	0.33	825.9	0.23	0.15
103b	219.12	217.53	52	3.06	Pasture	0.38	135.9	0.04	0.03
103									**0.18**
104a	233.34	228.53	467	1.03	Cultivated Straight Row	0.28	1645.9	0.46	0.31
104b	228.53	217.97	1037	1.02	Waterway	0.48	2180.6	0.61	0.41
104									**0.71**
105a	230.93	228.30	304	0.87	Pasture	0.20	1504.2	0.42	0.28
105b	228.30	228.26	181	0.02	Waterway	0.07	2481.5	0.69	0.46
105c	228.26	218.91	821	1.14	Pasture	0.23	3536.5	0.98	0.66
105									**1.40**
106a	230.38	222.75	784	0.97	Cultivated Straight Row	0.28	2842.1	0.79	0.53
106b	222.75	220.99	173	1.02	Pasture	0.22	788.9	0.22	0.15
106									**0.68**
107a	229.67	222.13	933	0.81	Pasture	0.20	4778.9	1.33	0.89
107									**0.89**
108a	227.29	225.52	201	0.88	Cultivated Straight Row	0.26	766.0	0.21	0.14
108b	225.52	223.38	197	1.09	Pasture	0.23	869.3	0.24	0.16
108									**0.30**
109a	229.80	228.93	171	0.51	Pasture	0.16	1103.2	0.31	0.21
109b	228.93	228.22	279	0.25	Woodland	0.08	3662.1	1.02	0.68
109c	228.22	223.45	604	0.79	Pasture	0.19	3129.3	0.87	0.58
109									**1.47**
110a	226.88	224.01	264	1.09	Pasture	0.23	1164.6	0.32	0.22
110									**0.22**
111a	228.25	226.05	315	0.70	Cultivated Straight Row	0.23	1346.1	0.37	0.25
111b	226.05	224.90	114	1.01	Pasture	0.22	522.5	0.15	0.10
111									**0.35**

White Church Boundary Expansion Area
Project Number: 2600
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Existing Conditions
Time to Peak Calculations

112a	227.85	224.85	434	0.69	Pasture	0.18	2406.7	0.67	0.45
112									**0.45**
113a	227.81	226.52	329	0.39	Pasture	0.14	2430.7	0.68	0.45
113									**0.45**
115a	227.84	225.40	493	0.49	Pasture	0.15	3235.8	0.90	0.60
115									**0.60**
116a	229.03	228.83	71	0.28	Pasture	0.11	620.7	0.17	0.12
116b	228.83	226.21	388	0.67	Woodland	0.12	3123.7	0.87	0.58
116c	226.21	223.25	530	0.56	Pasture	0.16	3269.2	0.91	0.61
116d	223.25	223.21	73	0.05	Waterway	0.11	637.4	0.18	0.12
116e	223.21	223.13	14	0.56	Pasture	0.16	86.0	0.02	0.02
116									**1.44**
117a	227.70	220.32	594	1.24	Pasture	0.24	2448.7	0.68	0.46
117									**0.46**
118a	232.81	223.00	1525	0.64	Pasture	0.17	8764.9	2.43	1.63
118									**1.63**
119a	231.66	229.47	279	0.78	Cultivated Straight Row	0.25	1125.5	0.31	0.21
119									**0.21**
120a	222.50	219.32	367	0.87	Pasture	0.20	1814.8	0.50	0.34
120									**0.34**

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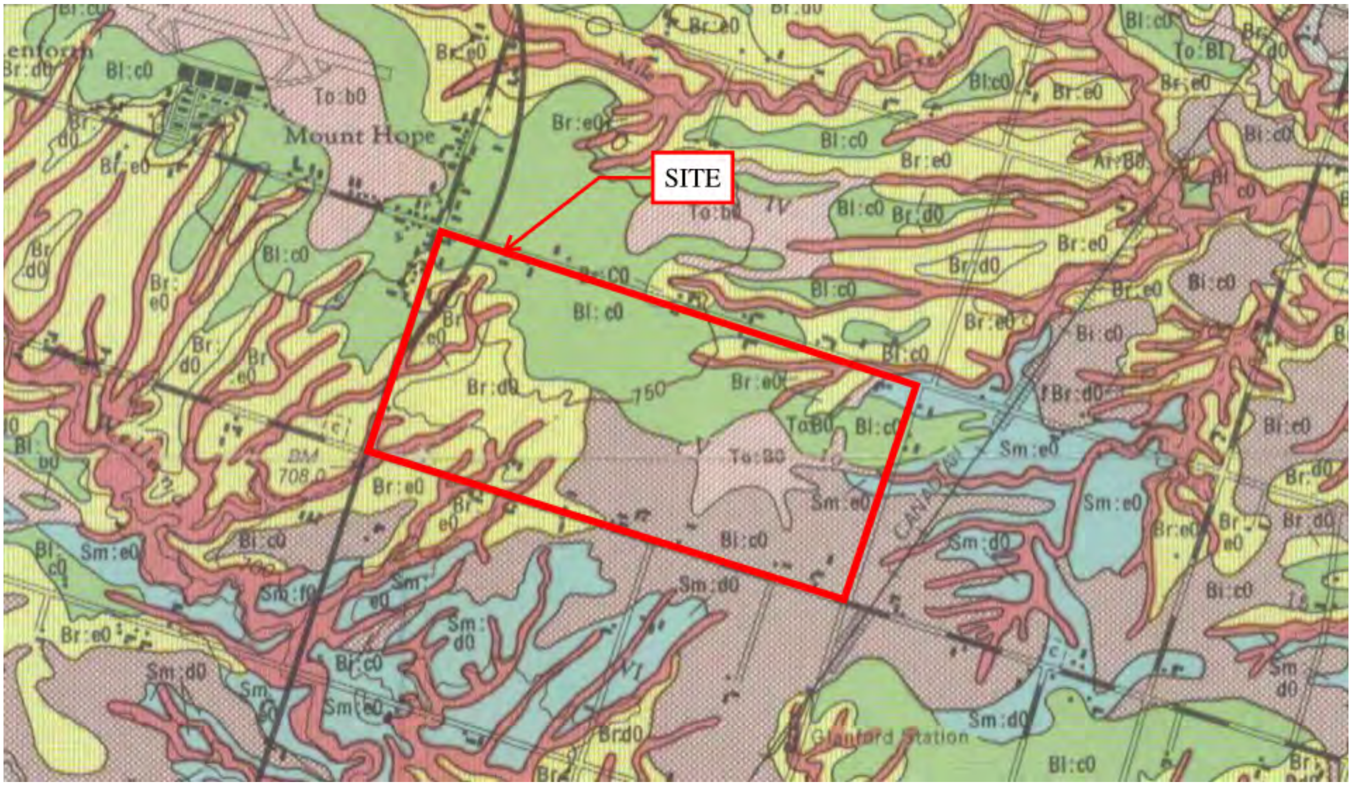
White Church Boundary Expansion Area

Soil Map of Wentworth County

Project Number: 2600
Date: January 2025



LEGEND

MAP SYMBOL AND COLOUR	SOIL SERIES	SOIL TYPE	GREAT SOIL GROUP	DRAINAGE	PARENT MATERIALS
Ai	Alberton	Silty CLay Loam	Mull Regosol	Variable	Silty clay loam over clay
Bl	Beverly	Silt Loam	Grey-Brown Podzolic	Imperfectly drianed	Lacustrine silty clay loam and silty clay
Bi	Binbrook	Silt Loam	Grey-Brown Podzolic	Imperfectly drained	Silt loam over clay
Br	Brantford	Silt Loam	Grey-Brown Podzolic	Well drained	Lacustrine silty clay loam and silty clay
Sm	Smithville	Loam	Grey-Brown Podzolic	Moderately well drained	Silt loam over clay till
To	Toledo	Silty Clay Loam	Humic Gleysol	Poorly drained	Lacustrine silty clay loam and silty clay

CHART H2-6A - HYDROLOGIC SOIL GROUPS FOR PRINCIPAL SOIL TEXTURES IDENTIFIED ON AGRICULTURAL SOILS MAPS (6)

Soils Series	Soil Texture	Hyd. Soil Grp.	Soils Series	Soil Texture	Hyd. Soil Grp.	Soils Series	Soil Texture	Hyd. Soil Grp.
Alberton	si l	BC	Bolingbr.	s	A	"	c	C
Allendale	s l	B	Bondhead	s l	AB	"	l	BC
Alliston	s l	AB	"	l	B	Camilla	s l	AB
Almonte	si c l	C	Bookton	s l	AB	"	si l	BC
Ameliasbg	c l	C	Boomer	l	B	Campbell	si c	C
"	l	B	Brady	s l	AB	Cane	si l	BC
Ancaster	si l &s	B	"	s	A	"	si c l	C
"	si l	BC	Brant	s &si l	B	Carp	c &c l	C
Anstruther	s	A	Brantford	si l	BC	Casey	si l	BC
Appleton	si l & s	B	"	si c l	C	Cashel	c	D
Atherley	c	C	"	l	BC	Castor	s l	AB
"	si c l	C	"	c l	D	"	si l	BC
Athol	s l	A	Brentha	s l	A	"	c	C
Atwood	c	C	"	l	B	Chesley	si l	BC
Ayr	s l	B	Brethour	si l	BC	"	si c l	C
Bainsville	s	B	Breypen	limest.	B	"	c l	C
"	si l	B	Bridgman	s	A	Chinguac'y	l	BC
Balderson	s l	B	Brighton	s	A	"	si l	BC
mford	s	AB	"	s l	AB	"	c l	C
croft	s	A	Brisbane	s g	AB	"	c	D
"	s l	B		l	B	Christy	s l	B
Bass	c	D	Brockport	c	D	Clyde	l	BC
Bastard	s	A	Brooke	l	B	"	si l	BC
Battersea	si l	BC	Brookston	s l	B	"	c l	C
"	s l	AB	"	l	C	"	c	C
Bearbrook	s l	B	"	si l	C	Colborne	s	A
"	si c l	C	"	si c l	C	Colwood	s l	B
"	c	C	"	c l	C	"	si l	B
Belmeade	m & c	B	"	c	C	"	l	BC
Bennington	s l	B	Bucke	s	AB	Codrington	si l	BC
"	s	A	"	s l	AB	Conestogo	l	BC
"	si l	A	Burford	s l	A	Conover	c l	C
Berrien	s	AB	"	l	AB	"	l	BC
"	s l	AB	Burnbrae	l	B	Cooksville	c	D
Berriedale	s & si	AB	Burnstown	l	B	Coutts	s l	AB
Beverly	l	BC	Burpee	s	A	"	l	BC
"	si l	C	Burris	c l	C	Craigleith	c	C
"	si c l	C	Buzwah	si c l	C	Cramahe	s g	A
Binbrook	si l	C	Buzwah	c l	D	Crombie	s l	B
Blackwell	c	C	Caledon	s l	A	"	si l	BC
Blanche	si l	BC	"	l	B	Dack	c	D
Blue	c l	C	Caistor	c l	C	Dalton	s	AB

Notes: 1. See footnotes to Chart H2-2.

2. Key to abbreviations: c - clay; f - fine; g - gravel; l - loam; ma - marl; m - muck; p - peat; r - rock; s - sand; si - silt.

CHART H2-6A - continued

Soils Series	Soil Texture	Hyd. Soil Grp.	Soils Series	Soil Texture	Hyd. Soil Grp.	Soils Series	Soil Texture	Hyd. Soil Grp.
Darlington	s	B	"	c l	C	Heidelburg	f s l	B
"	l	C	Ferndale	si l	BC	Hendrie	s /g	AB
Dawson	s l	A	"	c l	C	Henwood	s /g	A
"	l	B	Flamboro	s	B	Hespeler	s l	B
Deloro	l	B	"	s l	B	Hillier	c &c l	C
Devlin	si c /	C	Floradale	l	B	Hillsburgh	s l	A
	c l		Fonthill	g	A	Himsworth	si l	BC
Dinorwic	c	BC	"	l	B	Hinchinbr.	s l	B
Dobie	c /l	BC	Font	g s l	A	"	l	BC
Doe	s l	B	Forbes	c	D	"	si l	BC
"	si l	BC	Fox	s	A	Honeywood	s l	AB
Donald	l	B	"	s l	AB	"	si l	BC
Donnybrook	s g	A	"	gr l	AB	"	s	A
"	s l	AB	Foxboro	s	A	Howland	s l	B
"	l	B	Franktown	l	B	"	l	BC
Dorion	c /l	C	Freeport	s l	B	Huron	s l	B
Dorking	si c l	BC	Galesburg	s l	A	"	l	BC
Dumfries	s l	A	"	l	AB	"	si l	BC
"	l	AB	Gameland	s /g	AB	"	c l	CorD
Dummer	s l	A	Gananoque	c	C	"	c	D
"	l	B	Gerow	c l	C	Innisville	s l	B
Dundonald	s l	AB	Gilford	s l	B	Jeddo	l	BC
Dunedin	c	D	"	l	B	"	c l	C
Dymond	s l	AB	Gordon	si c	C	"	c	D
"	l	B	Granby	s	B	Kagawong	si l	BC
Eagle Lake	s /g	AB	"	s l	B	Kars	s /g	A
Eamer	l	BC	Grand	l	B	"	s l	B
Earlton	si l	B	Grenville	s l	A	Kemble	si l	BC
"	c l	C	"	l	BC	"	si c l	C
Eastport	s	A	Grimsby	s l	A	"	si c	C
Edenvale	s	AB	Guelph	s l	A	"	c l	D
"	s l	B	"	l	BC	Kenabeek	s	B
Eganville	l	B	"	si l	BC	"	s l	B
Elderslie	si l	BC	Guerin	s l	AB	Killean	l /s l	AB
"	si c l	C	"	l	B	King	si l	BC
"	c l	C	Gwillimb.	g	AB	"	c l	C
Eldorado	s l	A	Haileybury	si c l	C	Kirkland	s l	A
"	l	B	"	si c	C	Kossuth	s l	B
Elk Pit	s g	A	"	c	CD	L'Achigan	s	AB
Ellwood	c l	C	Haldimand	si l	BC	Lambton	l	BC
Elmbrook	si l	BC	"	si c l	C	"	si l	BC
"	c l	C	"	c	CorD	Lanark	c	C
"	c	C	"	c l	C	Lansdowne	c /si l	C
Elmira	l	B	Hanbury	si c l	C	Leech	si c l	C
Elmsley	s l	B	"	si c	C	"	c l	D
Embro	s l	BC	"	c	D	Leitrim	g	B
"	si l	C	Harkaway	l	B	Leith	si l	BC
Emily	l	B	"	si l	BC	Lily	l /s l	B
Emo	c & p	C	Harriston	l	BC	Lincoln	si c	C
Englehart	s l	B	"	si l	BC	"	c	C
Evanturel	si l	BC	Harrow	s	A	Lindsay	c l	C
"	si c l	C	"	s l	AB	"	c	C
Falardeau	si l	BC	"	l	B	Lisbon	s l	A
"	si c l	C	Havelock	s /g	A	Listowel	l	B/BC
Farmington	s l	A	Hawkesvi.	l	B	"	si l	BC
"	l	B	Haysville	s l	AB	Little Cur.	c	C

CHART H2-6A - continued

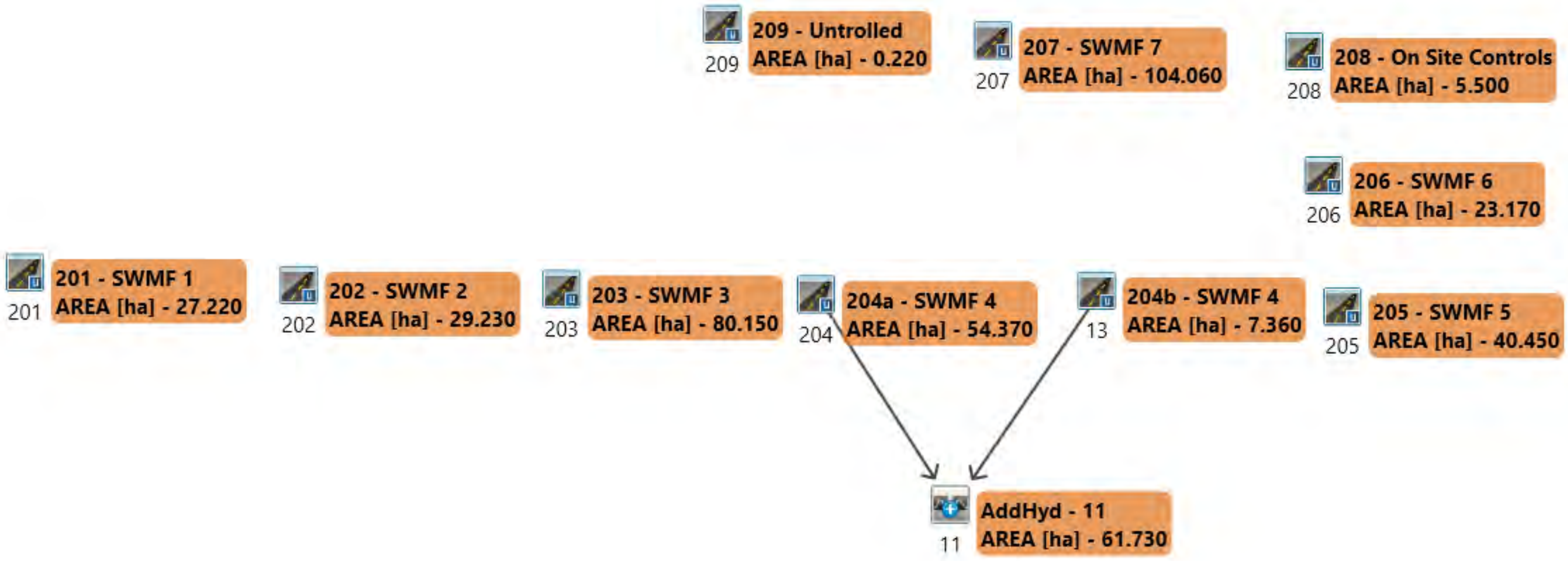
Soils Series	Soil Texture	Hyd. Soil Grp.	Soils Series	Soil Texture	Hyd. Soil Grp.	Soils Series	Soil Texture	Hyd. Soil Grp.
Lockport	c	D	Mountain	s l	AB	"	l	C
London	l	BC	Muck	m	B	"	si l	C
"	si l	BC	Murray	si l /f		"	si c l	CD
Lovering	si c l	C		s	B	"	c l	CD
"	c	D	Napanee	c /si l	C	"	c	CD
"	c l	CD	Neebing	s /si	B	Petherwick	si l	BC
Lyons	l	B	Nepean	s	AB	Phipps	si c l	C
Macton	l	B	Newburgh	s l	A	"	c l	C
Magnetawan	si l	BC	"	si l	BC	Piccadilly	s l	B
Mallard	s	AB	Newcastle	l	BC	"	l	BC
"	s l	AB	"	c l	C	"	si l	BC
Malton	c	C	"	si l	BC	Pike	c	D
Mannheim	l	B	Newton	s l	B	Pike Lake	l	B
Manotick	s	AB	Nelson	c	D	Plainfield	s	A
Maplewood	si l	BC	New lisk.	si c	C	Pontypool	s	A
Marionville	s	B	"	c	C	"	s l	AB
"	s l	B	Niagara	c	D	Powassan	si l	BC
Martin	s /g	AB	Nipissing	s /si	B	Preston	s l	B
Maryhill	l	BC	Norham	si l	BC	Raglan	s /g	A
Matilda	l	BC	North Gow.	c l	C	Rainy Riv.	p	B
Matson	si l	BC	"	c	C	Renfrew	c l	C
Medonte	si l	BC	O'Connor	c	D	"	l	BC
"	si c l	C	Oliver	l /si l	B-BC	Rideau	c l	D
cCool	c	C	Oneida	l	BC	"	c	D
McInnis Cr	c l/l		"	si l	BC	Rosslyn	s /g	A
	&P	BC	"	si c l	C	Rubicon	s	AB
McIntyre	s	AB	"	c l	D	"	s l	AB
Miami	l	BC	Ontario	l	BC	Sandford	c	D
"	si l	BC	Osgoode	l	BC	Sargent	s /g	A
"	c l	D	"	si l	BC	"	s l	AB
"	g l	AB	"	si c l	C	Saugeen	si l	BC
Milberta	c /si		Oshtemo	s	A	"	si c l	C
	c l	C	Osnabruck	c l	C	"	c l	D
Mill	s	B	Osprey	s l	A	Schomberg	si l	BC
	s l	B	"	l	B	"	si c l	C
Milliken	s l	AB	Otonabee	s l	A	"	c l	C
"	l	BC	"	l	B	Scoble	si c	C
Minesing	ma si		Otterskin	s l	B	Seely's Bay	si c l	C
	c l	BC	Oxdrift	c	D	Shashawan	l	B
"	ma c	C	Paipoonge	c	C	Shenston	c l &p	BC
Mississauga	c	C	Parkhill	l	BC	Sidney	c	C
Monaghan	l	BC	"	si l	BC	Sifton	si c /c	
"	si l	BC	Peat	p	B		l	C
"	c l	C	Peel	c	D	Simcoe	si l	BC
Monteagle	s l	A	Pelham	s l	A	"	si c l	C
"	sl + r	B	Pense	si l	BC	"	c l	C
Moose	s l	B	Pense	si c l	C	Slate River	s /l	B
"	l	BC	Perch	c	C	Smithfield	si l	C
Morley	c si		Percy	s	A	"	si l	C
	c l	C	"	f s l	B	"	c l	CD
Morrisburg	c	C	"	s l	B	Smithville	l	BC
Moscow	si c	C	Perth	s l	AB	"	si c l	C

CHART H2-6A - continued

Soils Series	Soil Texture	Hyd. Soil Grp.	Soils Series	Soil Texture	Hyd. Soil Grp.	Soils Series	Soil Texture	Hyd. Soil Grp.
"	si l	BC	Uplands	s	A			
Snedden	si c l	C	"	s l	A			
Solmesville	c l	C	Upsala	f s	AB			
South Bay	c l	D	Vars	l	B			
"	c	D	Vasey	s l	AB			
Spohn	s /g /		"	l	B			
	c	BC	Vergennes	si l	BC			
Springvale	s l	A	"	l	BC			
Stafford	l	B	"	c	C			
Stockdale	si l/f		Vincent	si l	BC			
	s	B	"	si c l	C			
St. Clem.	s l	A	"	c l	D			
"	si c l	C	Vineland	s l	AB			
St. Jacobs	l	B	Wabi	s l	A			
St. Peter	s /g	A	"	l	B			
St. Rosalie	c	C	Wabigoon	c	C			
St. Samuel	s	B	Waterloo	s	A			
"	s l	B	"	s l	A			
St. Thomas	s	A	Watrin	s	B			
Sullivan	s	A	Waupoos	c l	D			
"	s l	A	"	c	D			
Sutton Bay	s	B	Wauseon	s l	B			
"	s l	B	Wayside	s	AB			
Tansley	c	D	Welland	c	C			
Tavistock	s l	AB	Wellesley	s l	AB			
"	si l	BC	"	si c l	C			
Tecumseth	s	AB	Wemyss	s l	AB			
			Wendigo	s	A			
Teeswater	si l	B	"	s l + r	AB			
Temisk'g	r &c	C	"	s l	AB			
Tennyson	s l	A	Wendover	c l	D			
Thames	c l	D	"	c	D			
Thorah	s	B	Westmeath	s	A			
Thornloe	c	C	Whitby	l	BC			
Thwaites	si l	BC	White Lake	s /g	A			
Tioga	s	A	Whitfield	si l	B			
"	s l	A	Wiarton	l	B			
Toledo	si l	BC	"	si l	BC			
"	si c l	C	Wilmot	s l	B			
"	c l	C	"	si c l	C			
"	c	C	Winona	s l	AB			
Trafalgar	c	D	Woburn	s l	A			
Trent	s	AB	"	l	B*			
Tuscola	s l	AB	Wolford	c l	D			
"	si l	BC	Wolsey	si c	C			
Tweed	s l	A	Wooler	si l/f				
"	s l + r	AB		s	AB			
"	r	AB	Woolwich	l	BC			
Undiffer'd	s l + r	AB or B(dep. on depth)	Worthing.	s /g /c	BC			
			Wyevale	s /g	A			

Proposed Condition VO6 Schematic

White Church Road
Project Number: 2600
Date: January 2025



Proposed Conditions
VO Parameter Summary

STANDHYD

Number	**201**	**202**	**203**	**204a**	**204b**	**205**	**206**	**207**	**208**	**209**
Description	SWMF 1	SWMF 2	SWMF 3	SWMF 4 (north of White Church Road)	SWMF 4 (south of White Church Road)	SWMF 5	SWMF 6	SWMF 7	On-site Controls	Uncontrolled to Airport Road
DT(min)	1	1	1	1	1	1	1	1	1	1
Area (ha)	27.22	29.23	80.15	54.37	7.36	40.45	23.17	104.06	5.50	0.22
TIMP[2]	0.78	0.69	0.65	0.73	0.50	0.68	0.55	0.72	0.75	0.75
XIMP[1,2]	0.54	0.37	0.37	0.34	0.50	0.34	0.28	0.36	0.35	0.35
CN*	66.0	66.0	67.0	73.0	73.0	73.0	72.0	72.0	67.0	66.0
IA(mm)	5.0	5.0	5.0	5.0	5.0	5.3	6.1	5.5	5.0	5.0
SLPP(%)	2	2	2	2	2	2	2	2	2	2
LGP(m)	40	40	40	40	40	40	40	40	40	40
MNP	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
DPSI (mm)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SLPI(%)	1	1	1	1	1	1	1	1	1	1
LGI(m)	425.99	441.44	730.98	602.05	221.51	519.29	393.02	832.91	191.49	38.30
MNI	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013

Total Area = 371.7 ha

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Proposed Conditions
CN Calculations

White Church Boundary Expansion Area
Project Number: 2600
Date: January 2025
Designer Initials: S.G.

Site Soils: OMAFRA Wentworth County Soils Mapping

Soil Type	**Hydrologic Soil Group**
Alberton Silty Clay Loam, Brantford Silt Loam, Smithville Silt Loam.	BC
Beverly Silt Loam), Binbrook Silt Loam, Toledo Silty Clay Loam.	C

TABLE OF CURVE NUMBERS (CN's)**

Land Use	Hydrologic Soil Type							Manning's 'n'	Source
	A	AB	B	BC	C	CD	D		
Meadow "Good"	30	44	58	64.5	71	74.5	78	0.40	MTO
Woodlot "Fair"	36	48	60	66.5	73	76	79	0.40	MTO
Gravel	76	80.5	85	87	89	90	91	0.30	USDA
Lawns "Good"	39	50	61	67.5	74	77	80	0.25	USDA
Pasture/Range	58	61.5	65	70.5	76	78.5	81	0.17	MTO
Crop	66	70	74	78	82	84	86	0.13	MTO
Fallow (Bare)	77	82	86	89	91	93	94	0.05	MTO
Low Density Residences	57	64.5	72	76.5	81	83.5	86	0.25	USDA
Streets, paved	98	98	98	98	98	98	98	0.01	USDA

1. MTO Drainage Manual (1997), Design Chart 1.09-Soil/Land Use Curve Numbers
2. USDA (1986), Urban Hydrology for Small Watersheds, Table 2.2-Runoff Curve Numbers for Urban Areas

HYDROLOGIC SOIL TYPE (%) - Proposed Conditions

Catchment	Hydrologic Soil Type							TOTAL
	A	AB	B	BC	C	CD	D	
201				100.0				100
202				100.0				100
203				57.4	42.6			100
204a				5.3	94.7			100
204b				3.0	97.0			100
205					100.0			100
206				14.2	85.8			100
207				20.3	79.7			100
208				62.0	38.0			100
209				100.0				100

LAND USE (%) - Proposed Conditions

Catchment	Meadow	Woodlot	Gravel	Lawns	Pasture Range	Crop	Fallow (Bare)	Low Density Residences	Impervious	Total
201				100.0						100.0
202				100.0						100.0
203				100.0						100.0
204a				100.0						100.0
204b				100.0						100.0
205		6.2		93.8						100.0
206		22.0		78.0						100.0
207		9.5		90.5						100.0
208				100.0						100.0
209				100.0						100.0

Note: Where STANDHYD command used (shaded), impervious fraction is not considered in CN determination, since %Imp directly input in STANDHYD command

CURVE NUMBER (CN) - Proposed Conditions

Catchment	Meadow	Woodlot	Gravel	Lawns	Pasture Range	Crop	Fallow (Bare)	Low Density Residences	Impervious	Weighted CN
201	0.0	0.0	0.0	67.5	0.0	0.0	0.0	0.0	0.0	68
202	0.0	0.0	0.0	67.5	0.0	0.0	0.0	0.0	0.0	68
203	0.0	0.0	0.0	70.3	0.0	0.0	0.0	0.0	0.0	70
204a	0.0	0.0	0.0	73.7	0.0	0.0	0.0	0.0	0.0	74
204b	0.0	0.0	0.0	73.8	0.0	0.0	0.0	0.0	0.0	74
205	0.0	4.5	0.0	69.4	0.0	0.0	0.0	0.0	0.0	74
206	0.0	15.9	0.0	57.0	0.0	0.0	0.0	0.0	0.0	73
207	0.0	6.8	0.0	65.8	0.0	0.0	0.0	0.0	0.0	73
208	0.0	0.0	0.0	70.0	0.0	0.0	0.0	0.0	0.0	70
209	0.0	0.0	0.0	67.5	0.0	0.0	0.0	0.0	0.0	68

** AMC II assumed

Proposed Conditions
CN Calculations

White Church Boundary Expansion Area
Project Number: 2600
Date: January 2025
Designer Initials: S.G.

Step	**Input Values**												
	Subcatchment:			201	202	203	204a	204b	205	206	207	208	209
1	**CN (AMC II):**			**68**	**68**	**70**	**74**	**74**	**74**	**73**	**73**	**70**	**68**
2	CN (AMC III) =			84	84	85	88	88	88	87	87	85	84
3	100 Year Precipitation, P =	126.5	mm	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5

$Q = \frac{(P - Ia)^2}{(P - Ia) + S}$ $S = \frac{(P - Ia)^2}{Q} - (P - Ia)$

Q = rainfall excess or runoff, mm
S = potential maximum retention or available storage, mm

$CN = \frac{25400}{S + 254}$ $S = \frac{25400}{CN} - 254$

CN* = modified SCS curve # that better reflects Ia conditions in Ontario

	Output Values												
	Subcatchment:			201	202	203	204a	204b	205	206	207	208	209
	S_{III} =		mm	48.38	48.38	44.82	34.64	34.64	34.64	37.95	37.95	44.82	48.38
	SCS Assumption of 0.2 S = Ia =		mm	9.68	9.68	8.96	6.93	6.93	6.93	7.59	7.59	8.96	9.68
4	Q_{III} =		mm	82.61	82.61	85.09	92.72	92.72	92.72	90.14	90.14	85.09	82.61
	Preferred Initial Abstraction, Ia =		mm	5.0	5.0	5.0	5.0	5.0	5.3	6.1	5.5	5.0	5.0
5	S^*_{III} =		mm	57.19	57.19	52.00	37.72	37.72	37.22	40.42	41.47	52.00	57.19
6	CN^*_{III} =		mm	81.62	81.62	83.01	87.07	87.07	87.22	86.27	85.96	83.01	81.62
	CN^*_{III}=		Rounded	**82**	**82**	**83**	**87**	**87**	**87**	**86**	**86**	**83**	**82**
7	**CN^*_{II}=**		convert	**66**	**66**	**67**	**73**	**73**	**73**	**72**	**72**	**67**	**66**

Explanation of Procedure

1 Determine CN based on typical AMC II conditions (attached)
2 Convert CN from AMC II to AMC III conditions (standard SCS tables)
3 Get precipitation depth P for 100 year storm
4 Using CN_{III} with Ia = 0.2S, compute Q_{III} for 100 year precipitation
5 For the same Q_{III}, compute S^*_{III} using Ia=1.5mm (or otherwise determined)
6 Compute CN^*_{III} using S^*_{III}
7 Calculate CN^*_{II} using SCS conversion table

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Proposed Conditions
IA Calculations

White Church Boundary Expansion Area
Project Number: 2600
Date: January 2025
Designer Initials: S.G.

LAND USE (%) - Proposed Conditions

Catchment	Meadow	Woodlot	Gravel	Lawns	Pasture Range	Crop	Fallow (Bare)	Low Density Residences	Impervious	Total
201				100.0						100.0
202				100.0						100.0
203				100.0						100.0
204a				100.0						100.0
204b				100.0						100.0
205		6.2		93.8						100.0
206		22.0		78.0						100.0
207		9.5		90.5						100.0
208				100.0						100.0
209				100.0						100.0

IA VALUES (mm) - Proposed Conditions

Catchment	Meadow	Woodlot	Gravel	Lawns	Pasture Range	Crop	Fallow (Bare)	Low Density Residences	Impervious	Total
IA (mm)	8	10	2	5	8	8	3	2	2	
201				5.0						5.0
202				5.0						5.0
203				5.0						5.0
204a				5.0						5.0
204b				5.0						5.0
205		0.6		4.7						5.3
206		2.2		3.9						6.1
207		0.9		4.5						5.5
208				5.0						5.0
209				5.0						5.0

* IA values based on TRCA guidelines

White Church Boundary Expansion Area
Project Number: 2600
Date: January 2025
Designer Initials: S.G.

Proposed Conditions
Percent Impervious Calculations

			StandHyd IDs										
			201	**202**	**203**	**204a**	**204b**	**205**	**206**	**207**	**208**	**209**	
Catchment Area (ha)			27.22	29.23	80.15	54.37	7.36	40.45	23.17	104.06	5.50	0.22	
Land Use Areas	**Timp**	**Ximp**	**Land Use Areas**										**Total**
Parks	10%	5%		0.57	9.51	1.26			1.27	2.5			15.1122
School Block	80%	80%		2.44	2.45					2.44			7.3289
SWM Pond	50%	50%	1.13	1.90	4.61		7.36	4.31	1.72	4.89			25.9239
Commerical	85%	85%	10.19		6.61								16.8
Residential	75%	35%	15.90	22.86	54.98	53.11		33.50	15.08	94.23	5.50	0.22	
Woodland	10%	5%		1.45	1.99			2.64	5.10				11.1825
		Total Land Use =	27.22	29.23	80.15	54.37	7.36	40.45	23.17	104.06	5.50	0.22	371.73
		Timp =	78%	69%	65%	73%	50%	68%	55%	72%	75%	75%	10%
		Ximp =	54%	37%	37%	34%	50%	34%	28%	36%	35%	35%	9%

Appendix D Stormwater Management

Low Impact Development Measure Matrix

Project Name: White Church Boundary Expansion Area
Project Number: 2600
Date: January 2025
Designer Initials: S.G.

Stormwater Management Practice		Description	Quality Control	Quantity Control	Erosion Control	Water Budget	Volume Control	Contraints/ Controls /Requirements	Feasible (Yes/No)	Recommended (Yes/No)
Lot-Level Controls	Increased Topsoil Depth	An increase in the restored topsoil depth on lots can be used to promote lot level infiltration and evapotranspiration. Increased topsoil depth will contribute to lot-level quality and water balance control.	X			X	X	No guidance is provided by the NPCA or the City of Hamilton. Majority of site is proposed to be filled.	Yes	Yes
	Bio-Retention	Planting of gardens and other vegetation designed to minimize local runoff or use rainwater as a watering source can be used to reduce rainwater runoff by increasing evaporation, transpiration, and infiltration. By promoting infiltration through bioretention, water quality and quantity control is provided for the volume of water retained.	X			X	X	No guidance is provided by the City of Hamilton. NPCA encourages the use of LIDs using bioretention to promote infiltration.	Yes	Yes
	Passive Landscaping	Planting of gardens and other vegetation designed to minimize local runoff or use rainwater as a watering source can be used to reduce rainwater runoff by increasing evaporation, transpiration, and infiltration. By promoting infiltration through passive landscaping, water quality and quantity control is provided for the volume of water retained.	X			X	X	No guidance is provided by the NPCA or the City of Hamilton.	Yes	Yes
	Roof Runoff to Soak-away Pits	Directing roof runoff to subsurface soak-away pits can be used to promote infiltration. By promoting infiltration, water quality and quantity control is provided for the volume of water retained.	X			X	X	City of Hamilton Design Criteria (2019) discourages the practice of discharging roof leaders to soakaway pits due to required maintenance and impact to the use of rear yards.	Yes	No
	Roof Runoff to Retention Cisterns	Directing roof runoff to rainwater retention cisterns (i.e. rain barrels or rainwater re-use) will contribute to water quality and water balance control. The retained rainwater can be harvested for re-use such as irrigation and/or rainwater re-use.	X			X	X	City of Hamilton Design Criteria (2019) specifies that roof leaders must discharge to surface onto splash pads and then to a grassed or landscaped area atleast 0.6m away from the building face.	Yes	No
	Green Roofs	Best suited for flat roofs, greenroofs provide rainwater retention in the growing medium where it is evaporated, evapo-transpirated, or slowly drains away after the rainfall event.	X	X		X	X	Flat roof areas allowing for rain to accumulate over vegetated areas for evapotranspiration, which are not suitable for single family units. However, may be implemented within the proposed commerical block. Must be dscussed with the City.	Yes (For Commercial Block)	Yes (For Commercial Block)
	Rooftop and/or Parking Lot Detention Storage	Often employed with large rooftop or parking lot footprints, flow attenuation for quantity or extended detention control can be provided via a flow restriction with stormwater storage provided via ponding either on rooftops or parking lots.		X				City of Hamilton Design Criteria (2019) discourages the use of rooftop storage due to the lack of municipal control. Parking lot storage may only be implemented with municipal control.	Yes	No
	Roof Overflow to Grassed Areas	Directing roof leaders to grassed areas will contribute to water quality and water balance control by encouraging stormwater retention.	X			X	X	Encouraged by the City of Hamilton.	Yes	Yes
	Pervious Pavement	By encouraging infiltration and filtration, pervious pavement can contribute to water quality, balance and erosion control.	X		X	X	X	For Commercial Blocks: Can be implemented within commerical block, however, may be restricted to due presence of high groundwater.	Yes (For Commercial Block)	Yes (For Commercial Block)
	Vegetated Filter Strip	At source filtration and infiltration may be encouraged through the use of vegetated filter strips by directing sheet flow from impermeable areas to the strip prior to being collected via the storm system. Vegetated filter strips are best suited to parking lot areas with landscaped borders or islands.	X			X	X	City of Hamilton Design Critera specifies that vegetated filter strips may only be implemented as part of a treatment train approach.	Yes	Yes
	Rear Lot Infiltration Trenches	At source infiltration may be encouraged by use of infiltration trenches collecting flow from the rear roofs via the roof leaders discharging to rear yards and conveyed overland to the infiltration trenches.	X			X	X	City of Hamilton Design Criteria (2019) states that an easement is required to ensure proper maintenance of the trench is provided. Soil conditions must also be suitable.	Yes	Yes

Low Impact Development Measure Matrix

Project Name: White Church Boundary Expansion Area
Project Number: 2600
Date: January 2025
Designer Initials: S.G.

Stormwater Management Practice		Description	Quality Control	Quantity Control	Erosion Control	Water Budget	Volume Control	Contraints/ Controls /Requirements	Feasible (Yes/No)	Recommended (Yes/No)
Conveyance Controls	Grassed Swales	A grassed swale will promote infiltration, filtration, and evapotranspiration, contributing to water quality and quantity control. Grassed swales need an unimpeded and relatively wide stretch of landscaped area, such as within a wide boulevard with no driveways, to function properly.	X			X	X	Encouraged by the City of Hamilton where applicable.	Yes	Yes
	Exfiltration at Rear Lot Catchbasins	Where rear lot catchbasins are required due to grading constraints, a perforated pipe system could be incorporated into the rear lot catchbasin design to promote infiltration of 'clean' stormwater runoff. By promoting infiltration, water quality and quantity control is provided for the volume of water retained.	X			X	X	City of Hamilton Design Criteria (2019) sepcifies that these systems are applicable in specialized applications.	Yes	Yes
	Catchbasin Filtration Trench	Proposed to treat runoff from the street via a connection from the street catchbasin to a filtration trench located in the road boulevard. Where feasible, the trench will be sized for the volume control or water quality control criteria, whichever is a greater volume.	X				X	City of Hamilton Design Criteria (2019) sepcifies that these systems are applicable in specialized applications.	Yes	Yes
	Catchbasin Infiltration Trench	Proposed to treat runoff from the street via a connection from the street catchbasin to an infiltration trench located in the road boulevard, dependent on local groundwater depths. Where feasible, the trench will be sized for the volume control, water quantity control, or water balance criteria, whichever is a greater volume.	X			X	X	City of Hamilton Design Criteria (2019) sepcifies that these systems are applicable in specialized applications.	Yes	Yes
End-of-Pipe Controls	Stormwater Detention Facility	To meet quantity erosion control targets, stormwater runoff storage and attenuation through the use of flow restrictors can be used to control stormwater release rates. To accommodate the reduced release rate, stormwater detention facilities are required to store stormwater runoff.	X	X	X			City of Hamilton Design Criteria (2019) specifies that dry ponds required minimum drainage area of 5ha to be feasible.	Yes	Yes
	Wet Ponds, Wetlands, Dry Ponds	Sized in accordance with the MECP criteria, these end of pipe facilities can provide water quality, quantity, and erosion control treatment.	X	X	X			City of Hamilton Design Criteria (2019) specifies that wet ponds require minimum drainage area of 5 ha to be feasible.	Yes	Yes
	Filtration Trench	To provide additional water quality control, volume control and extended detention through filtration, end-of-pipe stormwater filtration systems can be provided in areas where high groundwater does not allow infiltration	X				X	City of Hamilton Design Criteria (2019) specifies that infiltration methods are best used in residential land use areas for drianage catchments of 2 ha or less.	Yes	Yes
	Manufactured Treatment Device (MTD): Oil-Grit Separator or Strom Filter	A properly sized manufactured treatment device (MTD) can assist in providing MECP Enhanced (Level 1) treatment and can contribute to the treatment train approach for water quality control. The MTD unit specified (Jellyfish JF4-2-1 unit) is Environmental Technology Verification (ETV) certified, to provide 80% TSS removal. Therefore, at-source and conveyance controls will work in conjunction with the MTD unit to provide overall Enhanced quality control.	X				X (Filter Only)	City of Hamilton Design Criteria (2019) specifies that MTDs may not be used as a stand-alone SWM practice and should be primarily applied in commercial/industrial land use areas. The NPCA discourages the use of MDTs outside of commerical, industrial and in-fill developments.	Yes	Yes

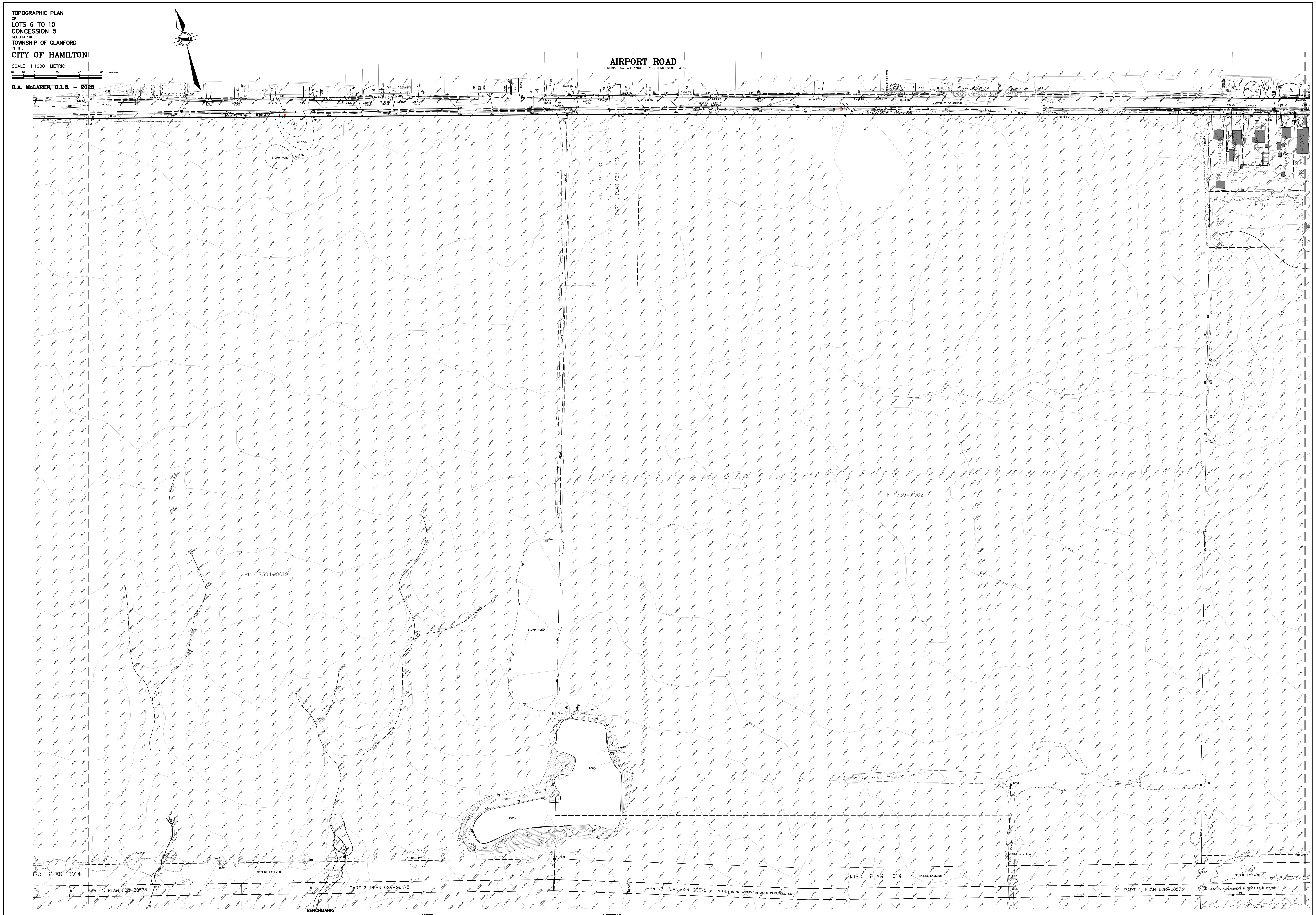
Appendix E Topographic Survey

SCS consulting group ltd

TOPOGRAPHIC PLAN
OF
LOTS 6 TO 10
CONCESSION 5
GEOGRAPHIC
TOWNSHIP OF GLANFORD
IN THE
CITY OF HAMILTON

SCALE 1:1000 METRIC

R.A. McLAREN, O.L.S. – 2023



BEARING NOTE:

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NOTE:

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.999665630

INTEGRATION DATA

OBSERVED REFERENCE POINTS (ORP's): UTM ZONE 17, NAD83 (CSRS) (2010.0).
COORDINATES TO URBAN ACCURACY PER SEC. 14(2) OF O.REG. 216/10

POINT ID	NORTHING	EASTING
ORP Ⓐ	4777899.510	591087.225
ORP Ⓑ	4776589.116	590723.591
ORP Ⓒ	4778704.028	588447.874
ORP Ⓓ	4777494.192	587828.981

COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.

BENCHMARK:

MONUMENT 07720030064

ROUND IRON BAR WITH BRASS CAP

LOCATED IN THE NORTHEAST CORNER OF THE INTERSECTION OF AIRPORT ROAD EAST AND MILES ROAD 19.0m NORTH OF THE CENTRELINE OF AIRPORT ROAD EAST AND 9.0m EAST OF THE CENTRELINE OF MILES ROAD

ELEVATION: 220.014 metres CGVD–1928:1978

NOTE:

UNDERLINE ELEVATIONS WERE DERIVED FROM 20cm ORTHOPHOTO MAPPING

NOTE:

UNDERGROUND SERVICE AND UTILITY LOCATIONS MUST BE VERIFIED PRIOR TO CONSTRUCTION

INVERTS MUST BE VERIFIED PRIOR TO CONSTRUCTION

LEGEND:

☐	DENOTES	MONUMENT SET
■	"	MONUMENT FOUND
IB	"	IRON BAR
PB	"	PLASTIC BAR
CC	"	CUT CROSS
SIB	"	STANDARD IRON BAR
SSIB	"	SHORT STANDARD IRON BAR
824	"	A.T. McLAREN, O.L.S.
OU	"	ORIGIN UNKNOWN
Msd	"	MEASURED
P1	"	
LS	"	LIGHT STANDARD
LP	"	LIGHT POST
CV	"	CULVERT
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MH	"	MANHOLE
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WRW	"	WOOD RETAINING WALL
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FH	"	FIRE HYDRANT
WV	"	WATER VALVE
VC	"	VALVE CHAMBER
SS	"	STOP SIGN
MPS	"	MOVEABLE PLASTIC SHED
PIL	"	PILLAR
FMICV	"	FLUSH MOUNT IRRIGATION VALVE
WS	"	WOOD STAKE
WP	"	WOOD POST
LSA	"	LANDSCAPED AREA
GV	"	GAS VALVE
EVG	"	EVERGREEN
ø	"	DIAMETER
//	"	NOT TO SCALE

SHEET 2

METRIC NOTE:

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DATE

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A.T. McLaren Limited
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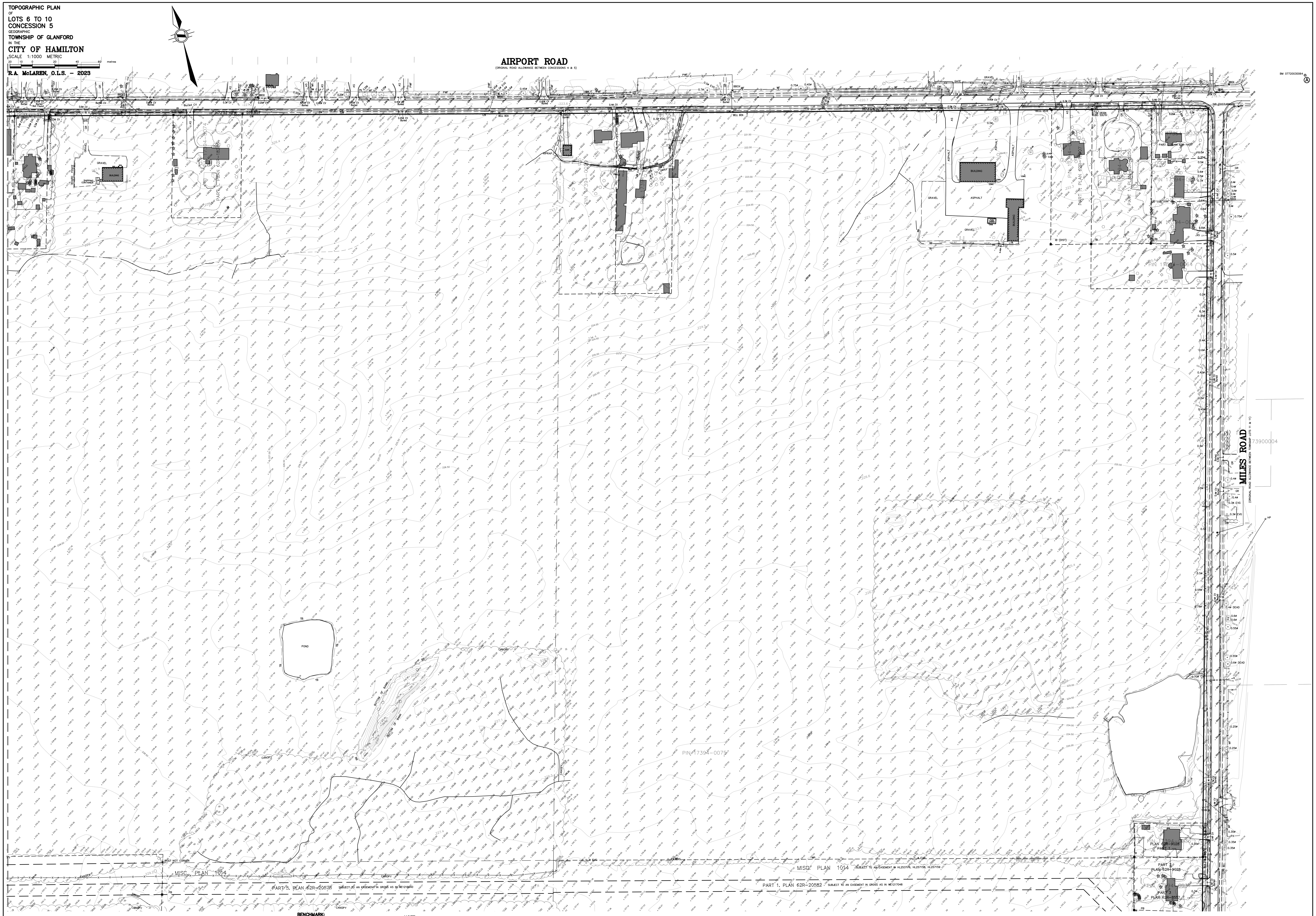
69 JOHN STREET SOUTH, SUITE 230
HAMILTON, ONTARIO, L8N 2B9
PHONE (905) 527-8559 FAX (905) 527-0032

Drawn	Checked	Crew Chief	Scale	
JB	DG	MWjr	1:1000	Dwg.No. 37339-2

FILE NAME: 37339 Topo NAD83–Ground – Airport, White Church, Miles, Upper James.dwg LAYOUT: Sheet 2
LAST SAVED BY: David Gunstensen DATE: September 22, 2023

TOPOGRAPHIC PLAN
OF
LOTS 6 TO 10
CONCESSION 5
GEOGRAPHIC
TOWNSHIP OF GLANFORD
IN THE
CITY OF HAMILTON
SCALE 1:1000 METRIC
20 10 0 20 40 60 metres

R.A. McLAREN, O.L.S. – 2023



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INTEGRATION DATA

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SS	"	STOP SIGN
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FMICV	"	FLUSH MOUNT IRRIGATION VALVE
WS	"	WOOD STAKE
WP	"	WOOD POST
LSA	"	LANDSCAPED AREA
GV	"	GAS VALVE
EVG	"	EVERGREEN
ø	"	DIAMETER

SHEET 3

METRIC NOTE:

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DATE

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Drawn	Checked	Crew Chief	Scale	
JB	DG	MWjr	1:1000	Dwg.No. 37339–3

FILE NAME: 37339 Topo NAD83–Ground – Airport, White Church, Miles

TOPOGRAPHIC PLAN
OF
LOTS 6 TO 10
CONCESSION 5
GEOGRAPHIC
TOWNSHIP OF GLANFORD
IN THE
CITY OF HAMILTON
SCALE 1:1000 METRIC
20 10 0 20 40 60 metres

R.A. McLAREN, O.L.S. – 2023

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SHEET 4

METRIC NOTE:

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DATE

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PHONE (905) 527-8559 FAX (905) 527-0032

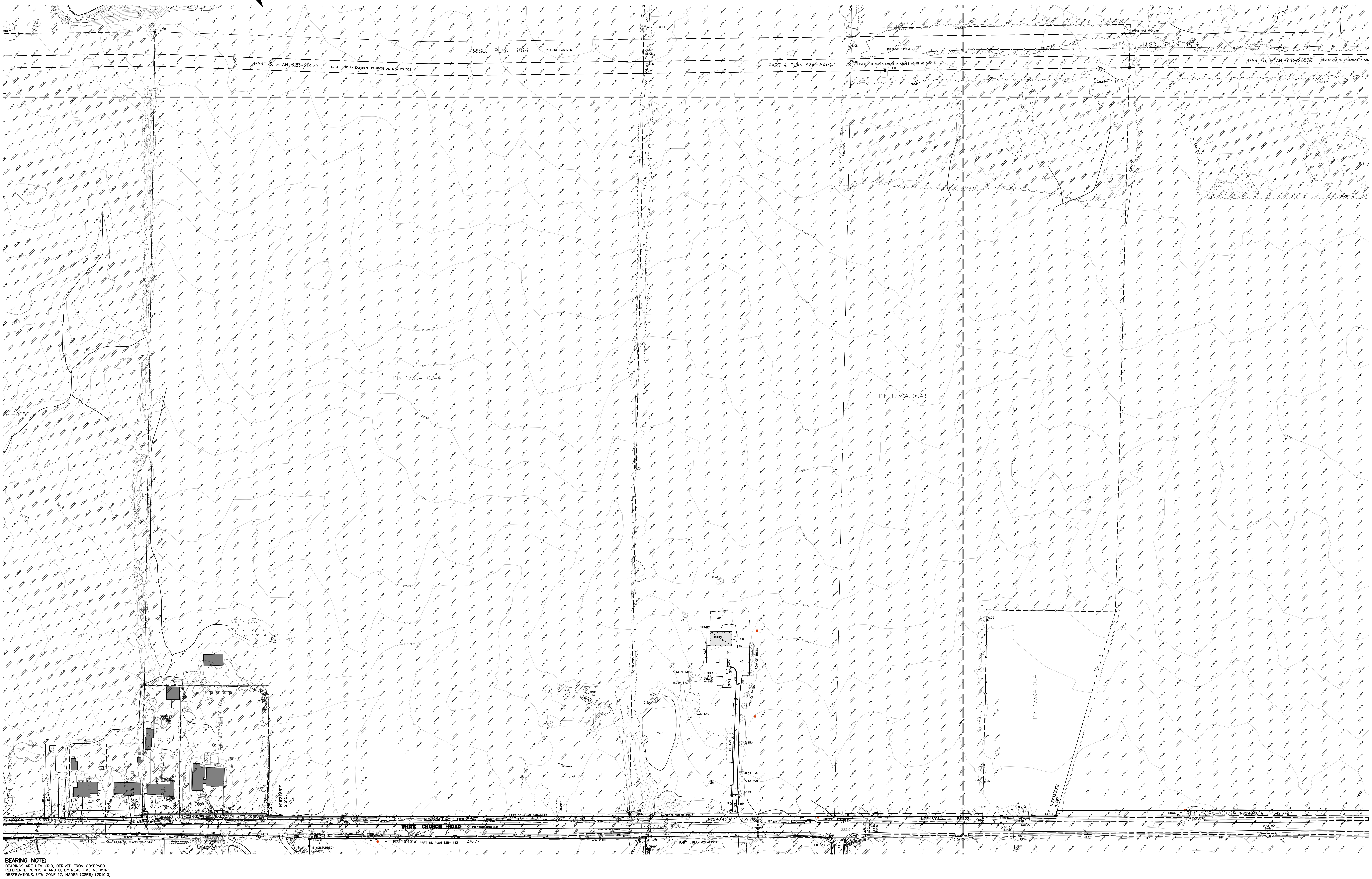
Drawn	Checked	Crew Chief	Scale	
JB	DG	MWjr	1:1000	Dwg.No. 37339-4

FILE NAME: 37339 Topo NAD83-Ground – Airport, White Church, Miles, Upper James.dwg LAYOUT: Sheet 4
LAST SAVED BY: David Gunstensen DATE: September 22, 2023

TOPOGRAPHIC PLAN
OF
LOTS 6 TO 10
CONCESSION 5
GEOGRAPHIC
TOWNSHIP OF GLANFORD
IN THE
CITY OF HAMILTON
SCALE 1:1000 METRIC

20 10 0 20 40 60 metres

S.D. McLAREN, O.L.S. – 2023



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Drawn	Checked	Crew Chief	Scale	Dwg.No. 37339-5
JB	DG	MWjr	1:1000	

SHEET 5

FILE NAME: 37339 Topo NAD83–Ground – Airport, White Church, Miles, Upper James.dwg LAYOUT: Sheet 5
LAST SAVED BY: David Gunstensen DATE: September 22, 2023

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SHEET 6

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Drawn	Checked	Crew Chief	Scale	
JB	DG	MWjr	1:1000	Dwg.No. 37339–6

FILE NAME: 37339 Topo NAD83–Ground – Airport, White Church, Miles, Upper James.dwg LAYOUT: Sheet 6
LAST SAVED BY: David Gunstensen DATE: September 22, 2023

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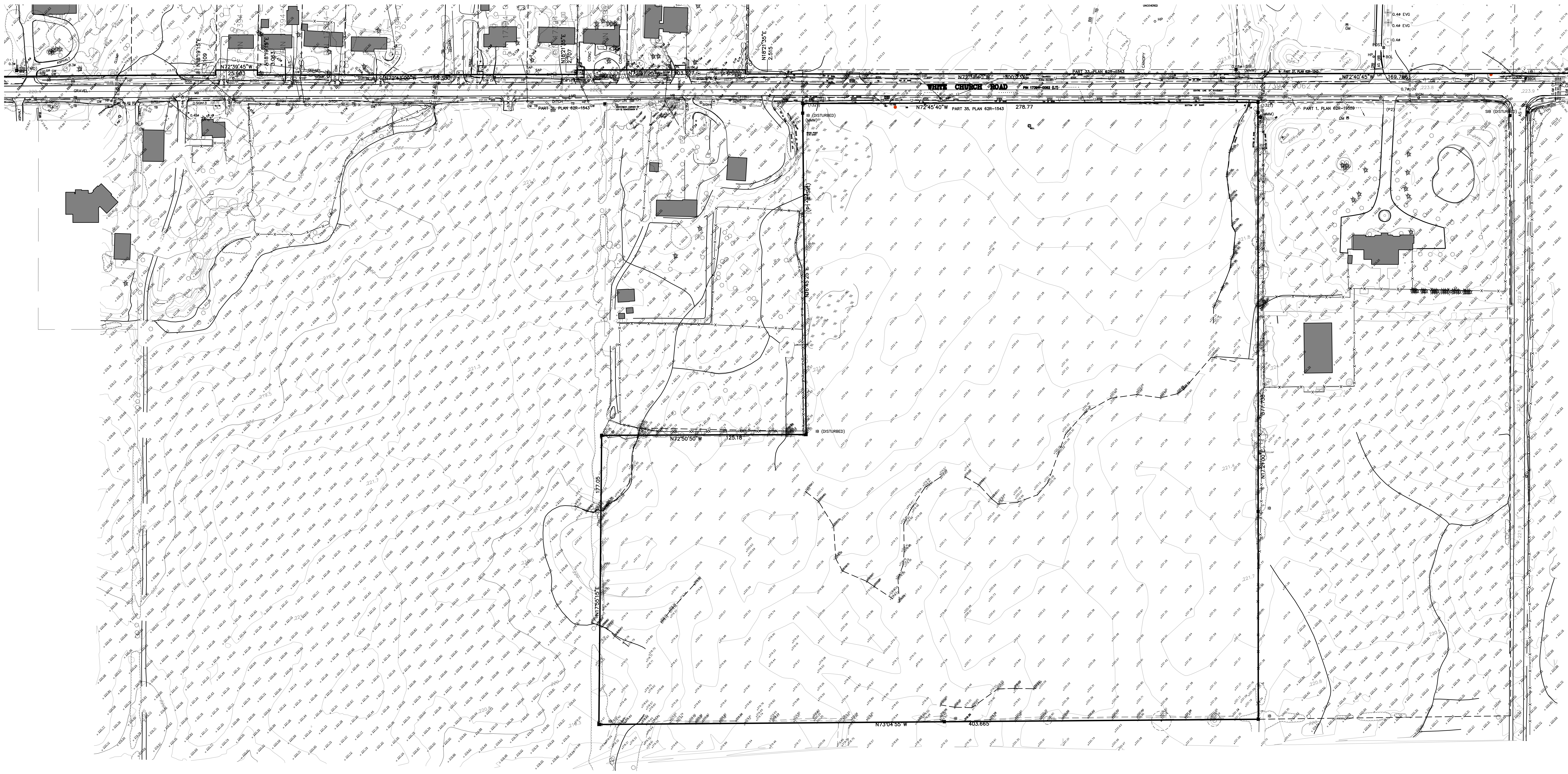

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UNDERLINED ELEVATIONS WERE DERIVED FROM 20cm ORTHOPHOTO MAPPING

NOTE:

UNDERGROUND SERVICE AND UTILITY LOCATIONS MUST BE VERIFIED PRIOR TO CONSTRUCTION

INVERTS MUST BE VERIFIED PRIOR TO CONSTRUCTION

LEGEND:

□	DENOTES	MONUMENT SET	LS	"	LIGHT STANDARD	CRB	"	CONCRETE CURB	FMICV	"	FLUSH MOUNT IRRIGATION VALVE
■	"	MONUMENT FOUND	LP	"	LIGHT POST	ILS	"	INTER–LOCKING STONE	WS	"	WOOD STAKE
IB	"	IRON BAR	CV	"	CULVERT	CONCHW	"	CONCRETE HEADWALL	WP	"	WOOD POST
PB	"	PLASTIC BAR	INV	"	INVERT	HP	"	HYDRO POLE	LSA	"	LANDSCAPED AREA
CC	"	CUT CROSS	AS	"	ASPHALT	GW	"	GUY WIRE	GV	"	GAS VALVE
SIB	"	STANDARD IRON BAR	GR	"	GRAVEL	U	"	OVERHEAD UTILTIES	EVG	"	EVERGREEN
SSIB	"	SHORT STANDARD IRON BAR	MH	"	MANHOLE	BBOX	"	BELL BOX	ø	"	DIAMETER
824	"	A.T. McLAREN, O.L.S.	BMH	"	BELL MANHOLE	UB	"	UTILITY BOX	//	"	NOT TO SCALE
OU	"	ORIGIN UNKNOWN	PWF	"	POST & WIRE FENCE	EB	"	ELECTRICAL BOX			
Msd	"	MEASURED	CLF	"	CHAIN LINK FENCE	FH	"	FIRE HYDRANT			
P1	"		BF	"	BOARD FENCE	WV	"	WATER VALVE			
			WF	"	WIRE FENCE	VC	"	VALVE CHAMBER			
			MF	"	METAL FENCE	SS	"	STOP SIGN			
			WRW	"	WOOD RETAINING WALL	MPS	"	MOVEABLE PLASTIC SHED			
			CRW	"	CONCRETE RETAINING WALL	PIL	"	PILLAR			

METRIC NOTE:
DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

SHEET 6

DATE

R.A. McLAREN, O.L.S.

A.T. McLaren Limited
LEGAL AND ENGINEERING SURVEYS
69 JOHN STREET SOUTH, SUITE 230
HAMILTON, ONTARIO, L8N 2B9
PHONE (905) 527–8559 FAX (905) 527–0032

Drawn	Checked	Crew Chief	Scale	
JB	DG	MWjr	1:1000	Dwg.No. 37339–6

FILE NAME: 37339 Topo NAD83–Ground – Airport, White Church, Miles, Upper James.dwg LAYOUT: Sheet 7
LAST SAVED BY: David Gunstensen DATE: September 22, 2023

SCS Consulting Group Ltd
30 Centurian Drive, Suite 100
Markham, ON, L3R 8B8
Phone 905 475 1900
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Appendix D Surface Water Quality

UPPER WELLAND RIVER WATERSHED PLAN

MARCH 2011

NIAGARA PENINSULA CONSERVATION AUTHORITY
250 THOROLD ROAD WEST, 3RD FLOOR
WELLAND, ONTARIO L3C 3W2
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Water Quality

NPCA Water Quality Monitoring Program

The Ontario Ministry of Environment and Energy (MOEE) has established a set of *Provincial Water Quality Objectives* (PWQO) that are intended to be used to guide respective agencies when making water quality management decisions. The surface water quality management goal is "*To ensure that the surface waters of the province are of a quality which is satisfactory for aquatic life and recreation"* [MOEE 1994 (Section 3.1)]. Table 8 summarizes indicator parameters that are the most useful in assessing relative water quality. They include: total phosphorus, nitrate, copper, lead, zinc, *Escherichia coli*, chloride, suspended solids and benthic invertebrates (NPCA 2010a). The PWQO are useful indicators but other non-chemical factors such as for example, loss of habitat, sedimentation, and indigenous species must also be considered when assessing ecosystem health.

Table 8: Water Quality Parameters (NPCA 2010a)

Category	Indicator Parameter	Objective	Reference
Nutrients	Total Phosphorus	0.03 mg/L	PWQO (MOE 1994)
Nutrients	Nitrate	13 mg/L	CWQG (CCME 2007)
Metals	Copper	0.005 mg/L	PWQO (MOE 1994)
Metals	Lead	0.005 mg/L	PWQO (MOE 1994)
Metals	Zinc	0.02 mg/L	PWQO (MOE 1994)
Microbiological	*Escherichia coli*	100 counts/100mL	PWQO (MOE 1994)
Other	Chloride	100 mg/L	CWQG (CCME 2005)
Other	Suspended Solids	25 mg/L	BC MOE (2001)
Biological	Benthic Invertebrates	Unimpaired	BioMAP (Griffiths1999)

The Water Quality Index (WQI) is used by the NPCA to summarize water quality data collected from NPCA surface water quality monitoring stations for reporting and communication purposes. The WQI was developed by a sub-committee established under the Canadian Council for Ministers of the Environment (CCME) Water Quality Guidelines Task Group to provide a convenient means of summarizing complex water quality information and communicating it to the public (CCME 2001). The WQI incorporates the number of parameters where water quality objectives have been exceeded, the frequency of exceedances within each parameter, and the amplitude of each exceedance (NPCA 2010a). The index produces a number between 0 and 100 which represents the worst and best water quality, respectively. These numbers are divided into five descriptive categories that range from *poor* to *excellent* (Table 9).

Surface water quality is monitored at 14 stations by the NPCA in the Upper Welland River watershed through the collection of grab samples on a monthly basis during the ice-free season. (Figure 15) Water quality sampling was initiated between 2002 and 2007 and samples are analyzed for several parameters including nutrients, metals, bacteria, suspended solids and general chemistry (Table 8). The sampling sites are as follows: 2 stations are located in Buckhorn Creek, 2 stations in Oswego Creek, 1 station in Elsie Creek, 1 station in Mill Creek, and 8 stations in Welland River West. Three of the Welland River monitoring stations (WR000, WR001 and WR002) have been established to monitor water quality impacts of the Hamilton International Airport. Both Buckhorn Creek stations BU000 and BU001 monitor potential impacts of the Glanbrook Landfill.

The summarized water quality data collected between 2002 and 2009 indicates that all stations for the Welland River and its tributaries in the study area have a water quality index rating of poor with mean total phosphorus at all stations greatly exceeding the provincial objective. Sources of total phosphorus include manure from livestock operations, sewage discharges, soil erosion, fertilizers, and pesticides (NPCA 2010a).

The headwater stations (WR00A, WR000) are impacted by elevated concentrations of *E. coli* and phosphorus (Table 11). Sources of phosphorus and bacteria include runoff from agricultural land use, animal waste, soil erosion and sewage discharge (NPCA 2010a). The baseflow at both stations is influenced by groundwater discharge and during summer months station WR00A is sustained entirely by groundwater discharge (NPCA 2010a). The poor water quality rating at headwater stations WR001 and WR002 is due to elevated concentrations of chloride, phosphorus, *E. coli*, copper and zinc. All samples collected were found to exceed the provincial objective for zinc (Table 11). A potential source of zinc could be leaching from galvanized roofing material from the Hamilton airport complex (NPCA 2010a). In addition, stormwater and glycol discharges from the airport are also sources of impairment at these stations (NPCA 2010a). The remainder of the Welland River water quality stations (WR003 to WR006) in the study area are most impacted by nutrient enrichment and elevated concentrations of suspended solids. As previously indicated, sources of nutrients and suspended solids include runoff from agricultural land use, soil erosion, sewage discharge and animal waste (NPCA 2010a).

Table 9: CCME Water Quality Index Categories (CCME 2001)

Category	**Water Quality Index**	**Description**
Excellent	95-100	Water quality is protected with a virtual absence of threat or impairment; conditions very close to natural or pristine levels.
Good	80-94	Water quality is protected with only a minor degree of threat or impairment; conditions rarely depart from natural or desirable levels.
Fair	65-79	Water quality is usually protected but occasionally threatened or impaired; conditions sometimes depart from natural or desirable levels.
Marginal	45-64	Water quality is frequently threatened or impaired; conditions often depart from natural or desirable levels
Poor	0-44	Water quality is almost always threatened or impaired; conditions usually depart from natural or desirable levels.

The remaining water quality stations in the study area (Oswego Creek, Buckhorn Creek, Mill Creek, and Elsie Creek) report frequent exceedances of the provincial objective for *E. coli.* Sources of *E.coli*. in these tributaries include runoff from urban and agricultural land use, sewage discharges, and the presence of waterfowl (NPCA 2010a). Elsie Creek, Oswego Creek, and Buckhorn Creek stations also report frequent exceedances of chloride for the guideline for irrigation water. Likely sources of chloride in these tributaries include stormwater runoff, de-icing salt applied to roads, and sewage discharges (NPCA 2010a). In addition, the water quality in Oswego Creek is also being impacted by elevated concentrations of suspended solids as a result of soil erosion and agricultural land use.

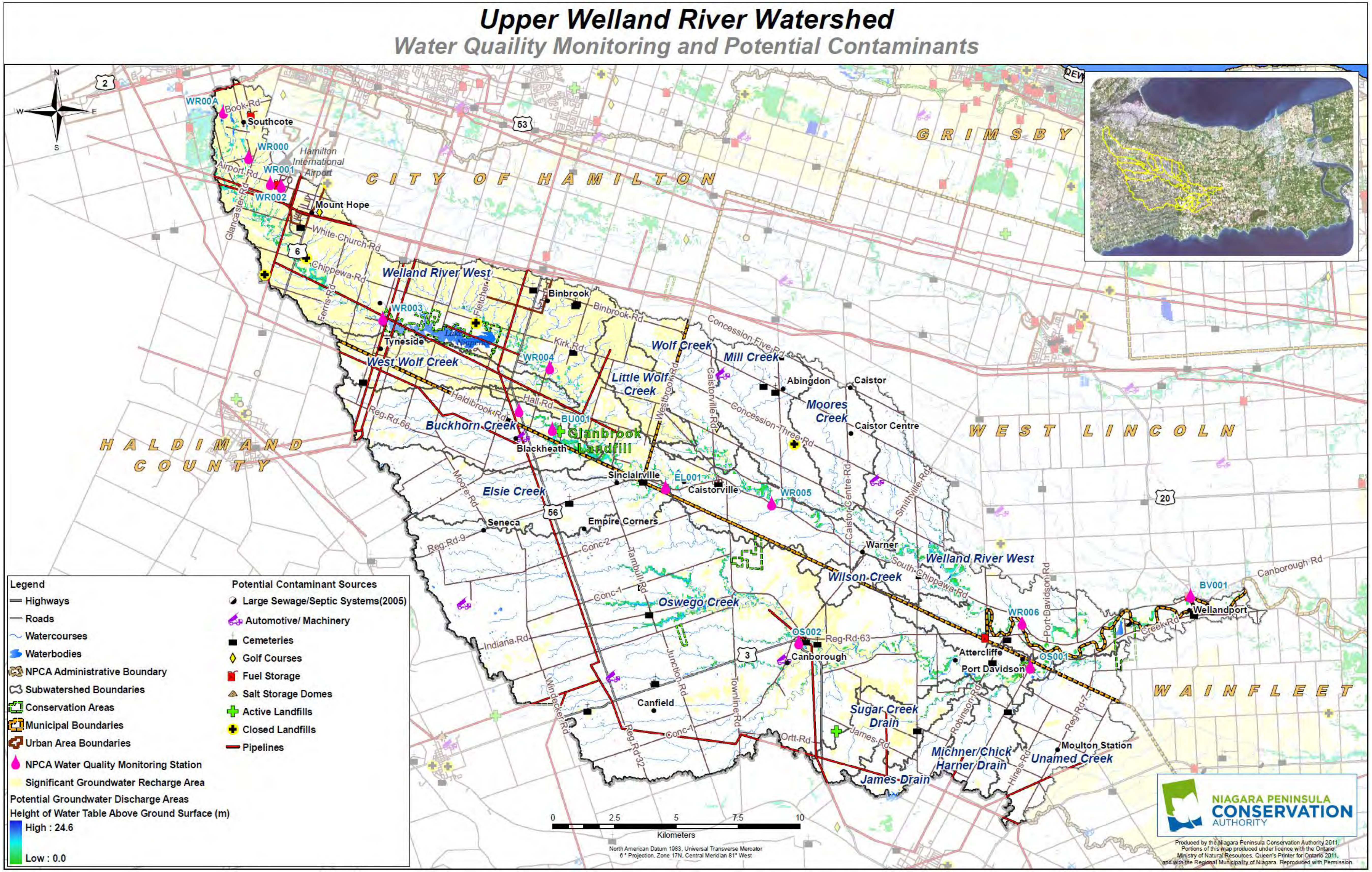

Figure 15: Water Quality and Potential Contaminants

Table 11: Water Quality Data Monitored by the NPCA in 2010

Station	Water Quality Index	BioMAP Rating	Factors Affecting Water Quality
Buckhorn Creek BU000	Poor	Impaired	• Exceedances of *E. coli*, chloride and total phosphorus • High sediment loading evident from upstream erosion and runoff • Evidence of nutrient enrichment • Low baseflow conditions in summer • Adequate upstream forest and riparian buffer.
Buckhorn Creek BU001	Poor	Impaired	• Exceedances of *E. coli*, chloride, and total phosphorus • High sediment loading evident from upstream erosion and runoff • Evidence of nutrient enrichment • Low baseflow conditions in summer • Adequate upstream forest and riparian buffer
Elsie Creek EL001	Poor	Impaired	• Exceedances of chloride, *E. coli* and total phosphorus • High sediment loading evident from upstream erosion and runoff • Nutrient enrichment from upstream agricultural areas • Algae observed during summer months
Oswego Creek OS001	Poor	Impaired	• Exceedances of *E. coli*, total phosphorus and suspended solids
Oswego Creek OS002	Poor	Impaired	• Exceedances of chloride, *E. coli*, total phosphorus and suspended solids • Sediment loading evident from upstream erosion or runoff • Nutrient enrichment from upstream agricultural areas
Mill Creek MI001	Poor	Impaired	• Exceedances of total phosphorus and *E. coli*
Welland River WR00A	Poor	Impaired	• Exceedances of *E. coli* and total phosphorus • Site has continuous baseflow due to sustained groundwater discharge but hydrology has been altered upstream • Inadequate upstream forest and riparian buffer
Welland River WR000	Poor	Impaired	• Exceedances of *E. coli* and total phosphorus • Site is vulnerable to intermittent baseflow due to seasonal fluctuations in groundwater discharge • Adequate upstream forest and riparian buffer • This section of the watercourse supports some sensitive taxa such as stoneflies and mayflies
Welland River WR001	Poor	Impaired	• Exceedances of chloride, *E. coli*, total phosphorus and zinc • Watercourse is contaminated by runoff from airport property • Sedimentation caused by erosion and stormwater runoff
Welland River WR002	Poor	Impaired	• Exceedances of chloride, *E. coli*, total phosphorus and zinc • Watercourse is contaminated by runoff from airport property • Sedimentation caused by erosion and stormwater runoff
Welland River WR003	Poor	Impaired	• Exceedances of chloride, copper, total phosphorus, suspended solids and zinc • Inadequate upstream forest and riparian buffer • Sedimentation caused by upstream agricultural runoff • Evidence of nutrient enrichment
Welland River WR004	Poor	Grey Zone	• Exceedances of copper, *E. coli*, total phosphorus, suspended solids and zinc • Adequate upstream forest and riparian buffer • Site supports some sensitive taxa such as stoneflies and mayflies • Sedimentation caused by upstream agricultural runoff • Evidence of nutrient enrichment
Welland River WR005	Poor	Impaired	• Exceedances of nitrate, total phosphorus and suspended solids • Sedimentation caused by upstream agricultural runoff • Evidence of nutrient enrichment
Welland River WR006	Poor	Impaired	• Exceedances of nitrate, total phosphorus and suspended solids • Sedimentation caused by upstream agricultural runoff • Evidence of nutrient enrichment

Welland River West Subwatershed

Table 13: Welland River West Subwatershed Characteristics		
Attribute	**Description**	**Comments**
Area	145.8 km^2	
Land Use	Mix of Urban and Rural Residential and Agriculture	Portions of Binbrook and Mount Hope; Southcote, Glanford Station, Caistorville, Warner, and Wellandport
Municipal Water and Sewer Services	Partial servicing	Urban areas of Mount Hope and Binbrook receive water and wastewater services from Woodward Treatment Plant in Hamilton
Aquatic Resources		
Length of Watercourse	510.6km	
Fish Habitat	Critical: Main Channel Important: Most tributaries	Some of the smaller tributaries and the watercourses within City of Hamilton have not been evaluated in terms of importance for fish habitat.
Municipal Drains	Puhringer Drain and Whitechurch Road Drain	Both Drains have been evaluated as Class F Drains
Water Quality	8 Stations Stations:WR00A, WR001, WR002, WR003, WR005, WR006 Water Quality Index: Poor BioMAP Rating: Impaired Station: WR004 Water Quality Index: Poor BioMAP Rating: Grey Zone	All stations report exceedances of total phosphorus. Elevated concentrations of total phosphorus are a widespread cause of water quality impairment in the Welland River. 100% exceedance is observed at stations WR003 though WR007, with total phosphorus concentrations up to 20 times greater than the provincial objective(NPCA2010). Station WR004 falls into the grey zone BioMAP category. The continuous flow from the Binbrook Reservoir and improved habitat are likely causes for the higher BioMAP rating at this station (NPCA 2010)
Groundwater Vulnerability	Predominantly Low Groundwater Vulnerability with areas of medium vulnerability. The headwaters have been identified as having a mix of high and medium vulnerability. In addition, pockets of high vulnerability to groundwater contamination are present	Land use in the high vulnerability area includes the urban areas of Binbrook and Mount Hope as well as Hamilton International Airport. In addition, transport pathways such as private wells (active and inactive), unknown status oil and gas wells have been identified as posing a high vulnerability to groundwater through SWP Program
Natural Heritage Resources		
Riparian Cover	42.3	EC recommends 75% with 30m buffer
Upland Habitat	14.0	EC recommends 30% to support viable wildlife population
Wetland Habitat	15.0	EC recommends 10% or to historic value
ANSI, Conservation Areas	Sinclairville Meander Basin Swamp ANSI, Caistor-Canborough Slough Forest ANSI,	2 Life Science ANSI's and 3 Conservation Areas

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level is commonly used in statistical methods to test for statistical significance. It should be noted that a value of α = 0.05 means there is a 5 percent possibility of falsely rejecting the null hypothesis that no trend exists. Probability values of less than 0.05 mean there was statistically significant trend (increasing or decreasing). Trend analysis using the Seasonal Mann-Kendall Test was conducted on chloride, *E. coli*, total phosphorus and total suspended solids concentrations at all stations with 5 or more years of data using software provided by the U.S. Geological Survey (Helsel *et al.*, 2005). Trend analysis for copper, lead, nitrate, and zinc parameters could only be conducted on a small number of stations because many concentrations found were below the laboratory detections limits. These were reported as “non-detect” or a “less than” the laboratory detection limit. Trend analysis with many non-detections or less than values was not favourable for analysis and therefore was excluded from most stations.

4.2 Welland River Watershed

The Welland River is the largest watershed in the NPCA jurisdiction with a total drainage area of 1,023 km^2. The watershed covers eleven local municipalities, originating in the Town of Ancaster and spanning the center of the Niagara Peninsula to its physical outlet in the City of Niagara Falls at the Niagara River (**Figure 2**). Over 70% of the watershed is classified as rural. The Welland River is part of the Niagara River Area of Concern (AOC). As shown in **Appendix A**, 30 of the 84 surface water quality monitoring stations are in the Welland River watershed, and 14 of these 30 stations are located on the main Welland River channel.

4.2.1 Welland River: Canadian Water Quality Index

The calculated WQI for the Welland River ranges from *poor* to *fair*. Based on the 2019 to 2023 data collected, six of fourteen Welland River stations have *poor* water quality, six stations were rated as *marginal*, and two stations were rated as fair. WQI results are illustrated in **Appendix A**. Mapping showing the spatial distribution and boxplots of the eight indicator parameters from 2019 to 2023 are found in **Appendix B and C**. In 2022, a new site was added (WR003A) on Harrison Road, however, there is insufficient data to include it in this report. Highlights of the water quality monitoring in the Welland River are summarized in **Table 4**.

Figure 2: Welland River watershed.

Table 4: Summary of NPCA water quality data for the Welland River (2019-2023).

Site	WQI Rating ↔ Stable ↓ Declining ↑ Improving	Hilsenhoff Family Biotic Index Rating	Factors Affecting Water Quality (% percentage reported if >50)	Indicator Parameter Trends (2019-2023)
WR00A	Marginal ↔	Fairly Poor	• Exceedances in copper, E. coli, lead, total phosphorus (95%), total suspended solids, and zinc • Potential stressors include agricultural and roadway run-off • Groundwater discharge sustains baseflow	• Decreasing total phosphorus and total suspended solids • Stable E. coli • Increasing chloride
WR000	Good ↑	Very Poor	• Exceedances in E. coli and total phosphorus (67%) • Potential stressors include agricultural and roadway run-off • Groundwater discharge provides intermittent baseflow but the watercourse will dry up in the summer when groundwater levels drop	• Decreasing phosphorus and E.coli concentrations • Stable total suspended solids and chloride
WR001	Marginal ↔	Poor	• Exceedances in chloride, copper, E. coli (58%), total phosphorus (77%), total suspended solids, and zinc • Potential stressors include agricultural, airport and roadway run-off	• Indicator parameters remain stable
WR002	Poor ↔	Fairly Poor	• Exceedances of chloride (93%), copper (55%), E. coli, lead, total phosphorus, total suspended solids, and zinc (90%) • Potential stressors include agricultural, airport and roadway run-off	• Indicator parameters remain stable
WR020	Marginal ↔	Insufficient Data	• Exceedances in chloride (73%), copper, E. coli, total phosphorus (95%), and total suspended solids • Potential stressors include agricultural and roadway run-off	• Indicator parameters remain stable

WR003	Marginal ↑	Poor	• Exceedances of chloride (56%), coper, E. coli, nitrate, total phosphorus (97%), total suspended solids and zinc • Potential stressors include: agricultural and roadway run-off	• Decreasing total suspended solid • Stable E. coli and total phosphorus • Increasing chloride
WR004	Fair ↔	Very Poor	• Exceedances of E. coli, total phosphorus (81%) and total suspended solids • Potential stressors include agricultural and roadway run-off • Lake Niapenco is improving the water quality the Welland River at this site	• Decreasing E.coli, total phosphorus and total suspended solids • Stable chloride
WR003A	Insufficient Data	Fairly Poor	• Potential stressors include agricultural and roadway run-off. Development occurring upstream	• Insufficient data
WR005	Poor ↔	Fairly Poor	• Exceedances of chloride, copper, E. coli (57%), nitrate, total phosphorus (100%), suspended solids (54%) and zinc. • Potential stressors include agricultural and roadway run-off	• Indicator parameters remain stable
WR006	Marginal ↔	Poor	• Exceedances of copper, E. coli, nitrate, total phosphorus (100%), suspended solids and zinc • Potential stressors include agricultural and roadway run-off • Algae and duckweed observed during summer months	• Indicator parameters remain stable
WR007	Poor ↔	Very Poor	• Exceedances of copper, E. coli, nitrate, total phosphorus (100%), total suspended solids and zinc • Potential stressors include agricultural, roadway run-off • Algae and duckweed observed during summer months • Non-native Zebra Mussels present	• Stable chloride and total phosphorus • Increasing E. coli and total suspended solids

WR009B	Marginal ↔	Insufficient Data	• Exceedances of copper, E. coli (51%), total phosphorus (95%), total suspended solid and zinc • Potential stressors include sewage treatment plant effluent and agricultural and urban run-off • Site strongly influenced by Niagara River backwater which has the potential to improve water quality	• Decreasing chloride • Stable E. coli, total phosphorus and total suspended solid
WR010	Marginal ↔	Insufficient Data	• Exceedances of copper, E. coli, total phosphorus (93%), total suspended solids and zinc • Potential stressors include sewage treatment plant effluent and agricultural and urban run-off • Site strongly influenced by Niagara River backwater which has the potential to improve water quality	• Indicator parameters remain stable
WR011	Fair ↑	Insufficient Data	• Exceedances of copper, E. coli, total phosphorus (79%) and total suspended solids • Potential stressors include sewage treatment plant effluent and agricultural and urban run-off • Site strongly influenced by Niagara River backwater which has the potential to improve water quality	• Decreasing E. coli • Stable total phosphorus and total suspended solids • Increasing chloride concentrations
WR012	Fair ↔	Insufficient Data	• Exceedances of E. coli, total phosphorus and total suspended solids • Potential stressors include urban run-off • Site strongly influenced by Niagara River backwater which has the potential to improve water quality	• Indicator parameters remain stable

4.2.2 Welland River: Hilsenhoff Biotic Index Results

Hilsenhoff Biotic Index (HBI) results indicate that water quality at most stations in the Welland River ranged from *Very Poor* to *Fairly Poor* (**Table 4**). Results from Hilsenhoff Biotic Index assessments completed between 2019 and 2023 are illustrated in **Appendix B**.

Low HBI scores observed in the Welland River mainly are due to road salts and metals in stormwater, sediment loading, lack of in-stream habitat, and nutrient enrichment. A biological assessment was not completed for WR009B, WR010, WR011 and WR012 due to high water depth and channel morphology. These stations are located at the siphon where the Welland River flows beneath the Welland Canal and would require boat access for sample collection.

4.2.3 Welland River: Key Findings

Based on the 2019-2023 data, elevated concentrations of total phosphorus are a widespread cause of water quality impairment in the Welland River. Greater than 95% of samples collected in the main Welland River exceeded the PWQO with some concentrations greater than 20 times the PWQO. High phosphorus in the Welland River has stimulated the overgrowth of algae and duckweed throughout the watershed. When these plants transpire, and decompose they deplete dissolved oxygen in the water and this in turn stresses aquatic organisms such as fish and benthic invertebrates. Manure from livestock operations, sewage discharges, soil erosion, fertilizers, and pesticides are sources of total phosphorus in the Welland River.

Figure 3: Excessive algae growth in the Central Welland River

Generally, the overall water quality of the Welland River downstream of the City of Welland is less stressed than the water upstream of the City of Welland. This is caused by the redirection of the Niagara River water down the Welland River in Chippawa for Ontario Power Generation (OPG). This results in a dilution effect that reduces the concentrations of water quality parameters. This effect is observed to the east side of the City of Welland. However, upstream of the City of Welland, the river flow pattern caused by OPG operations and canal siphons are likely restricting the natural flushing of sediment, nutrients and other contaminates from the central Welland River watershed and exacerbating water quality conditions in this watershed.

Water quality stations in the vicinity of Hamilton Airport (HIA) continue to have water quality designated as *poor* due to elevated concentrations of chloride and zinc. Chloride concentrations are stable at WR001 but increasing at WR002 despite the recent removal of the road salt storage pad. Zinc concentrations found at these stations consistently exceed the PWQO and are the highest observed in the NPCA water quality network. The current information that the HIA has suggests that zinc is coming off the brake system of the airplanes. It should be noted that zinc concentrations have been decreasing at both stations. The NPCA also has not observed any propylene glycol discharge in WR001 or WR002 this year. In 2011, the HIA expanded its facilities and upgraded its water quality safeguards to WR001 and WR002. Continued monitoring by the NPCA will track water quality changes at these tributaries. The NPCA does not monitor the water quality of the Hamilton Airport tributary identified as the potential source of Per- and polyfluoroalkyl substances (PFAS) that has been found in turtle/fish tissue sampled at Binbrook Conservation Area. PFAS are a man-made compound belonging to a large family of compounds known as perfluorinated chemicals. These compounds do not readily breakdown and have the potential to bioaccumulate in animal tissue. MECP continues to provide fish consumption guidelines based on fish samples they have collected for this area and information is found on (https://www.ontario.ca/page/guide-eating-ontario-fish). The NPCA continues to notify Binbrook Conservation Area Park users about the new fish consumption guidelines and information regarding PFAS has been posted on the NPCA website: https://npca.ca/parks-recreation/conservation-areas/binbrook. Since 2015, Transport Canada and Procurement Canada have retained Arcadis Canada Inc. to conduct a risk assessment to investigate presence and distribution of PFAS in the Welland River downstream of the HIA. Through this assessment process Arcadis has released project updates to property owners and other groups with an interest in the risk assessment area. The final report is still pending. The NPCA Watershed Monitoring and Reporting division has added PFAS sampling in 2012 as part of special project monitoring program at Binbrook Reservoir and this information can be found in Section 6.5.

4.4 Twenty Mile Creek Watershed

The Twenty Mile Creek watershed is the second largest watershed in the NPCA jurisdiction with a total drainage area of 302 km^2. Ten of 84 NPCA surface water quality monitoring stations are located within the Twenty Mile Creek watershed. There are six stations on the main channel. There are also monitoring stations for each of the subwatersheds which include Sinkhole Creek, Spring Creek, North Creek and Gavora Ditch (**Figure 5**).

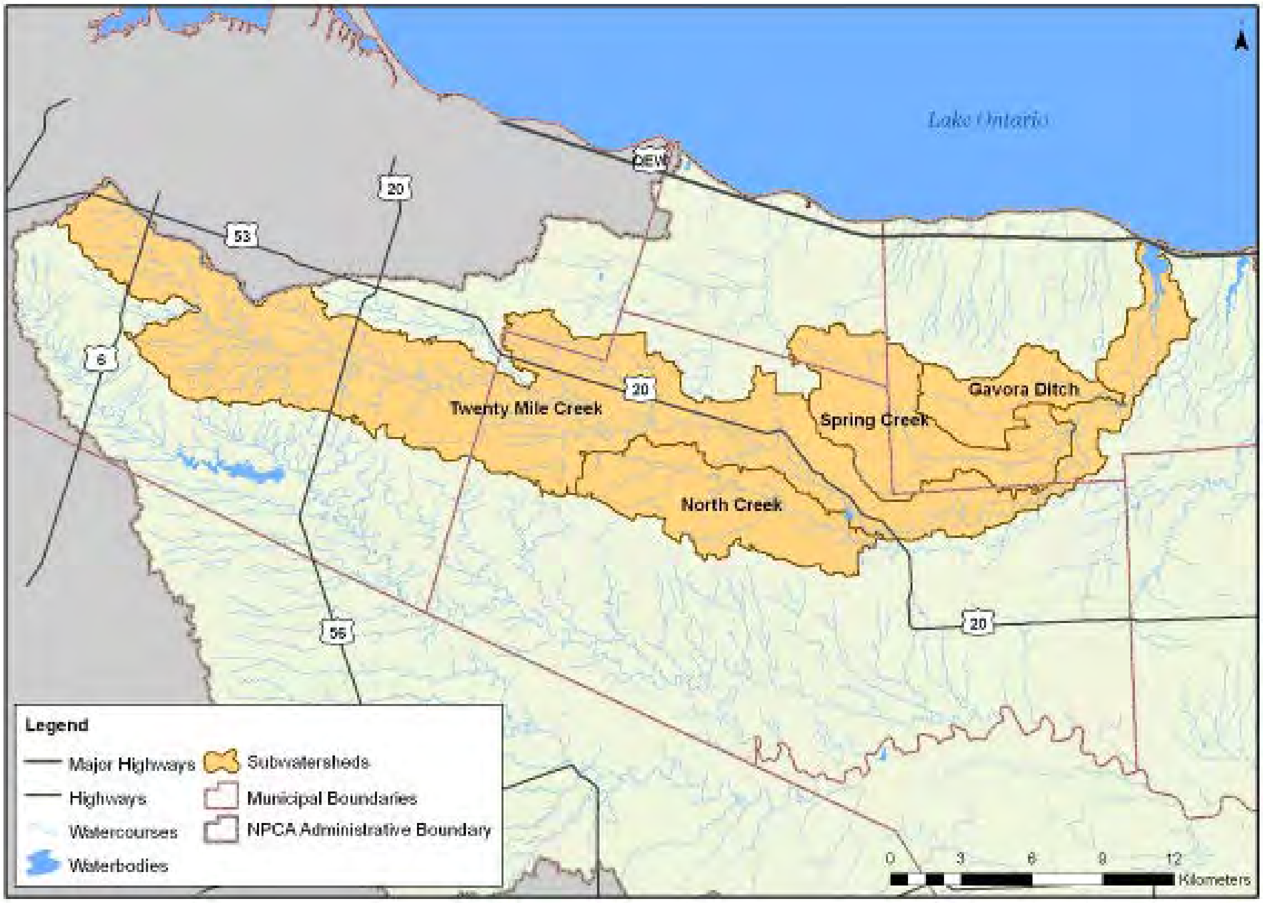


Figure 5: Map of Twenty Mile Creek watershed

4.4.1 Twenty Mile Creek Watershed: Canadian Water Quality Index

Based on the results of the WQI five of nine Twenty Mile Creek watershed stations have water quality that is rated as *marginal*. WQI results are illustrated in **Appendix A**. Mapping showing the spatial distribution and boxplots of the eight indicator parameters from 2019 to 2023 are found in **Appendix B** and **Appendix E**. Sinkhole Creek was added in 2022 and therefore has insufficient data for this report. Highlights of the water quality monitoring in the Twenty Mile Creek are summarized in **Table 6.**

Table 6: Summary of NPCA water quality data for Twenty Mile Creek watershed (2019-2023).

Site	WQI Rating ↔ Stable ↓ Declining ↑ Improving	Hilsenhoff Family Biotic Index Rating	Factors Affecting Water Quality (% percentage reported if >50)	Indicator Parameter Trends (2019-2023)
TN001	Marginal ↑	Poor	• Exceedances in chloride, copper, E. coli (54%), lead, total phosphorus (92%), total suspended solids, and zinc • Potential stressors include agricultural and urban run-off • Invasive Chinese Mystery Snails present • Excessive algae growth in summer	• Decrease in total phosphorus • E. coli, total suspended solids, and chloride remain stable
TN002	Fair ↑	Good	•Exceedances in chloride, copper, E. coli, total phosphorus (90%), and total suspended solids •Potential stressors include agricultural and urban run-off •Prone to zero baseflow in summer	• Decrease in total phosphorus • E. coli, total suspended solids, and chloride remain stable
TN003	Marginal ↔	Fairly Poor	• Exceedances in chloride, copper, E. coli, nitrate, total phosphorus (100%), total suspended solids, and zinc • Potential stressors include agricultural and urban run-off • Significant algae growth during summer	• Decrease in total suspended solids • Total phosphorus, E. coli, and chloride remain stable
TN003A	Marginal ↑	Fairly Poor	• Exceedances in chloride, copper, E. coli (50%), nitrate, total phosphorus (100%), total suspended solids, and zinc • Potential stressors include agricultural and urban run-off • Significant algae growth during summer	• Indicator parameters remain stable
TN004	Poor ↔	Fairly Poor	• Exceedances in chloride, copper, E. coli (68%), nitrate, total phosphorus (100%), total suspended solids, and zinc • Potential stressors include agricultural and urban run-off • Significant algae growth during summer	• Increase in chloride • Total phosphorus, E. coli, and total suspended solids remain stable

TN006	Poor ↔	Poor	• Exceedances in chloride, copper, E. coli, nitrate, total phosphorus (100%), total suspended solids, and zinc • Potential stressors include agricultural and road run-off • Significant algae growth in summer	• Indicator parameters remain stable
NC001 **North Creek**	Poor ↔	Fairly Poor	• Exceedances in chloride, copper, E. coli (74%), nitrate, total phosphorus (97%), total suspended solids, and zinc • Potential stressors include agricultural and road run-off • Prone to excessive algae growth and zero baseflow in summer	• Decrease in total suspended solids • Increase in chloride • Total phosphorus and E. coli remain stable
SP001 **Spring Creek**	Marginal ↔	Fairly Poor	• Exceedances in chloride, copper, E. coli (65%), lead, total phosphorus (100%), and zinc • Potential stressors include agricultural and road run-off • Prone to excessive algae growth and zero baseflow in summer	• Decrease in total suspended solids • Increase in chloride • Total phosphorus and E. coli remain stable
GV001 **Gavora Ditch**	Marginal ↔	Fairly Poor	• Exceedances in copper, E. coli (54%), and total phosphorus (100%) • Potential stressors include agricultural and road run-off • Prone to zero baseflow during summer	• Decrease in total suspended solids • Total phosphorus, E. coli, and chloride remain stable
SK001 **Sinkhole Creek**	Insufficient Data	Poor	• Potential stressors include urban and agricultural run-off • Prone to zero baseflow during summer	• Insufficient data

4.4.2 Twenty Mile Creek Watershed: Hilsenhoff Biotic Index Results

HBI results indicate that water quality is ranged from *poor* to *fairly poor* at most Twenty Mile Creek monitoring stations (**Table 6**). Results from biological assessments completed between 2019 and 2023 are illustrated in **Appendix B.** Reduced baseflow, high sediment loading due to erosion, lack of in-stream habitat, and nutrient enrichment are primary causes of impairment at these stations.

4.4.3 Twenty Mile Creek Watershed: Key Findings

Based on the 2019-2023 data, elevated concentrations of total phosphorus are a widespread cause of water quality impairment in the Twenty Mile watershed. Approximately 95% of samples collected from the Twenty Mile watershed exceeded the PWQO with some concentrations greater than 30 times the PWQO.

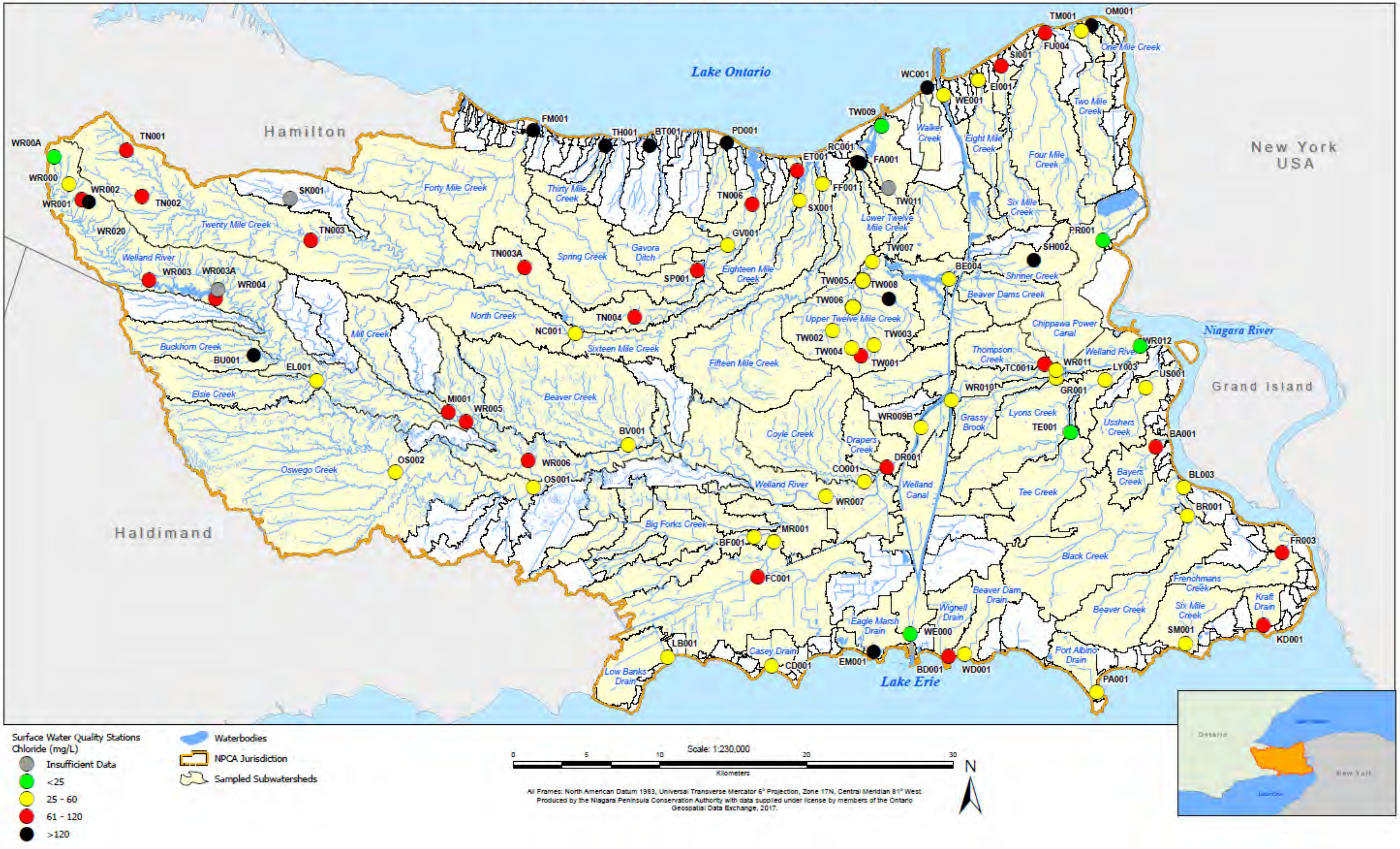
Figure 6: Longnose Gar in Twenty Mile Creek.

E. coli and total suspended solid concentrations frequently exceed the provincial objective in Twenty Mile Creek watershed. It is recommended that this subwatershed be prioritized by Best Management Practice programs such as those provided by the NPCA to reduce sources of *E. coli* in this watershed.

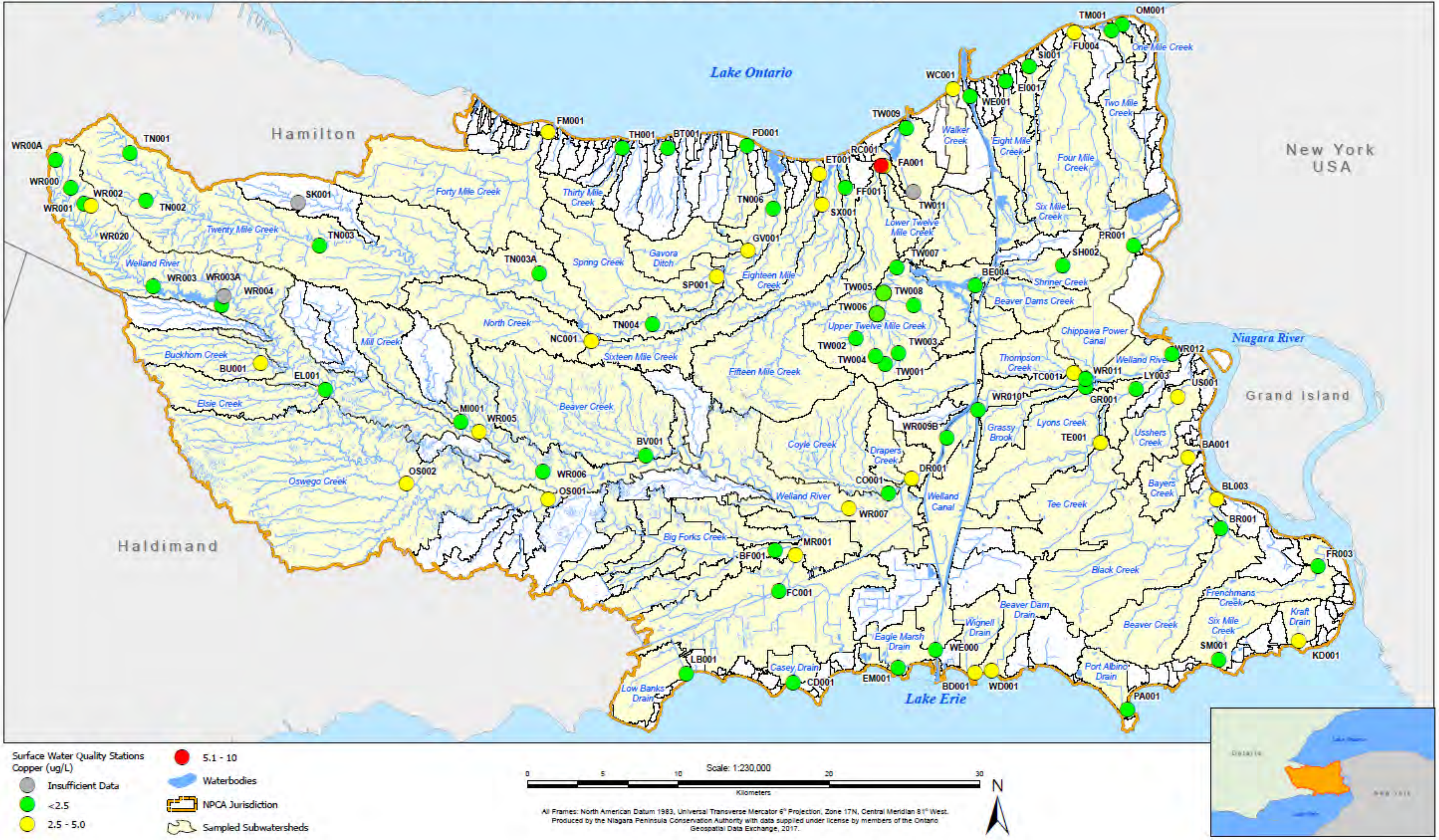
Appendix B

Water Quality Indicator Median Concentrations Maps 2019-2023

Niagara Peninsula Conservation Authority
Median Chloride Concentrations 2019 - 2023

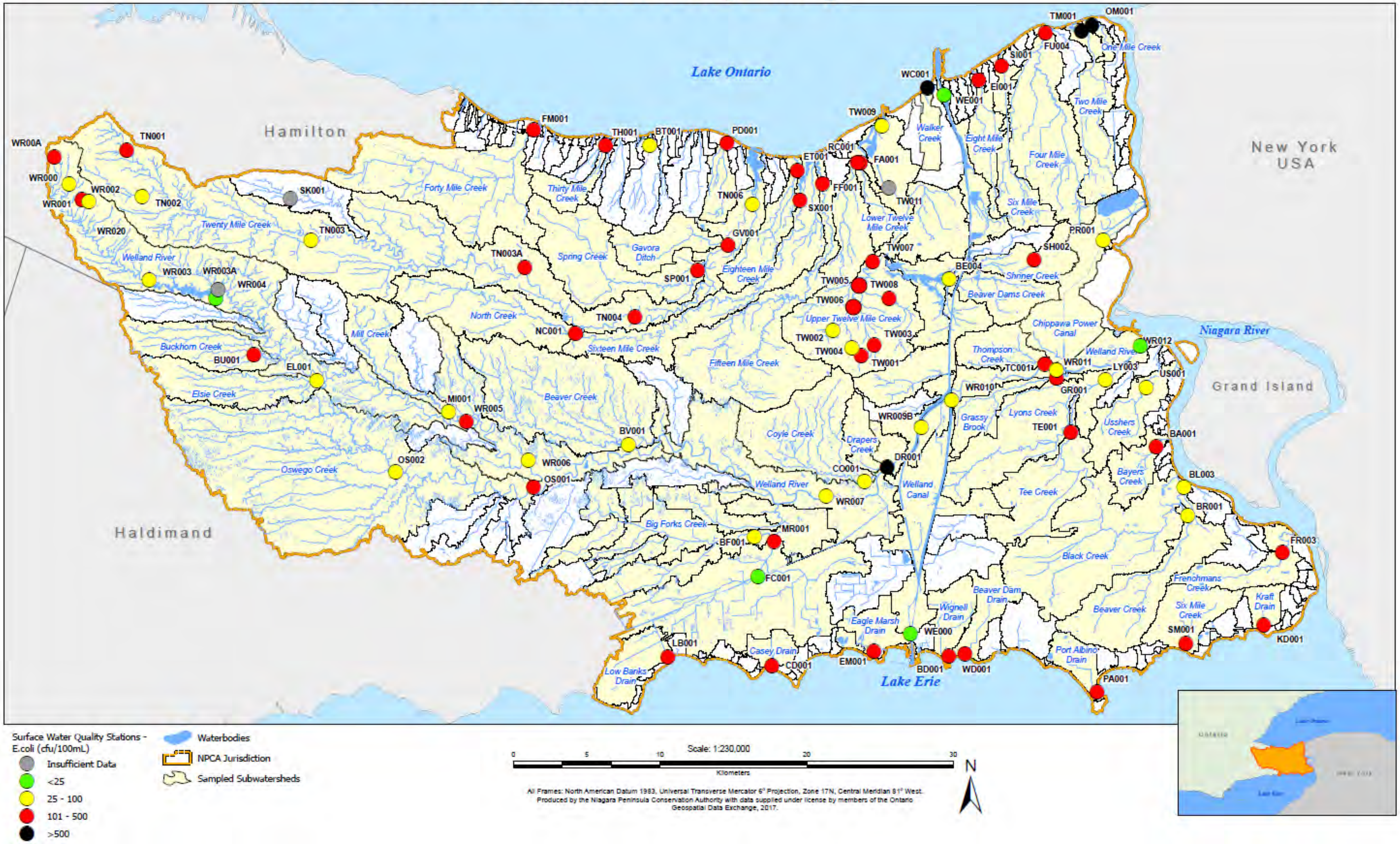


Niagara Peninsula Conservation Authority
Median Copper Concentrations 2019 - 2023



All Frames: North American Datum 1983, Universal Transverse Mercator 6° Projection, Zone 17N, Central Meridian 81° West. Produced by the Niagara Peninsula Conservation Authority with data supplied under license by members of the Ontario Geospatial Data Exchange, 2017.

Niagara Peninsula Conservation Authority
Median E.coli Concentrations 2019 - 2023



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Niagara Peninsula
CONSERVATION
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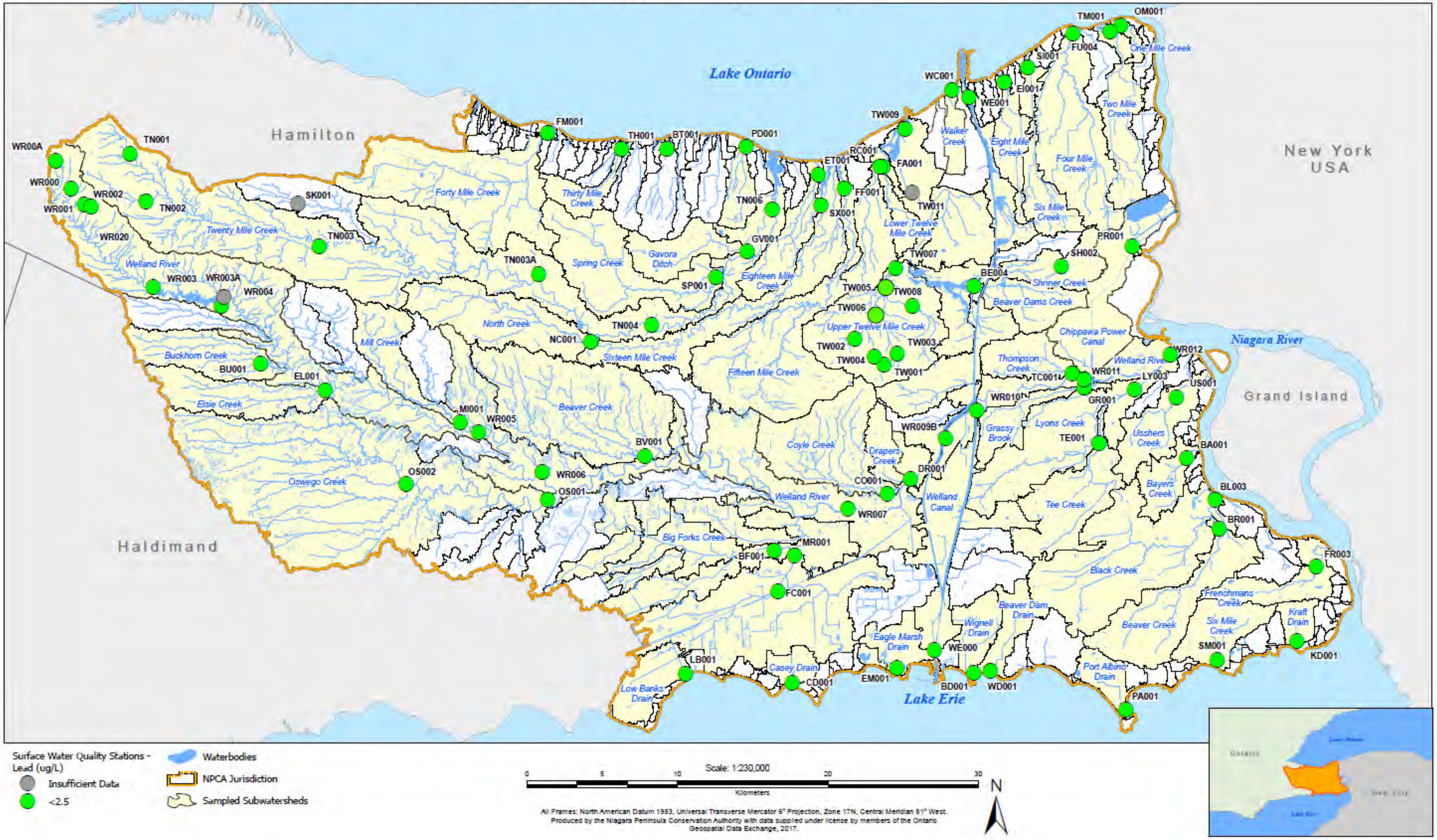
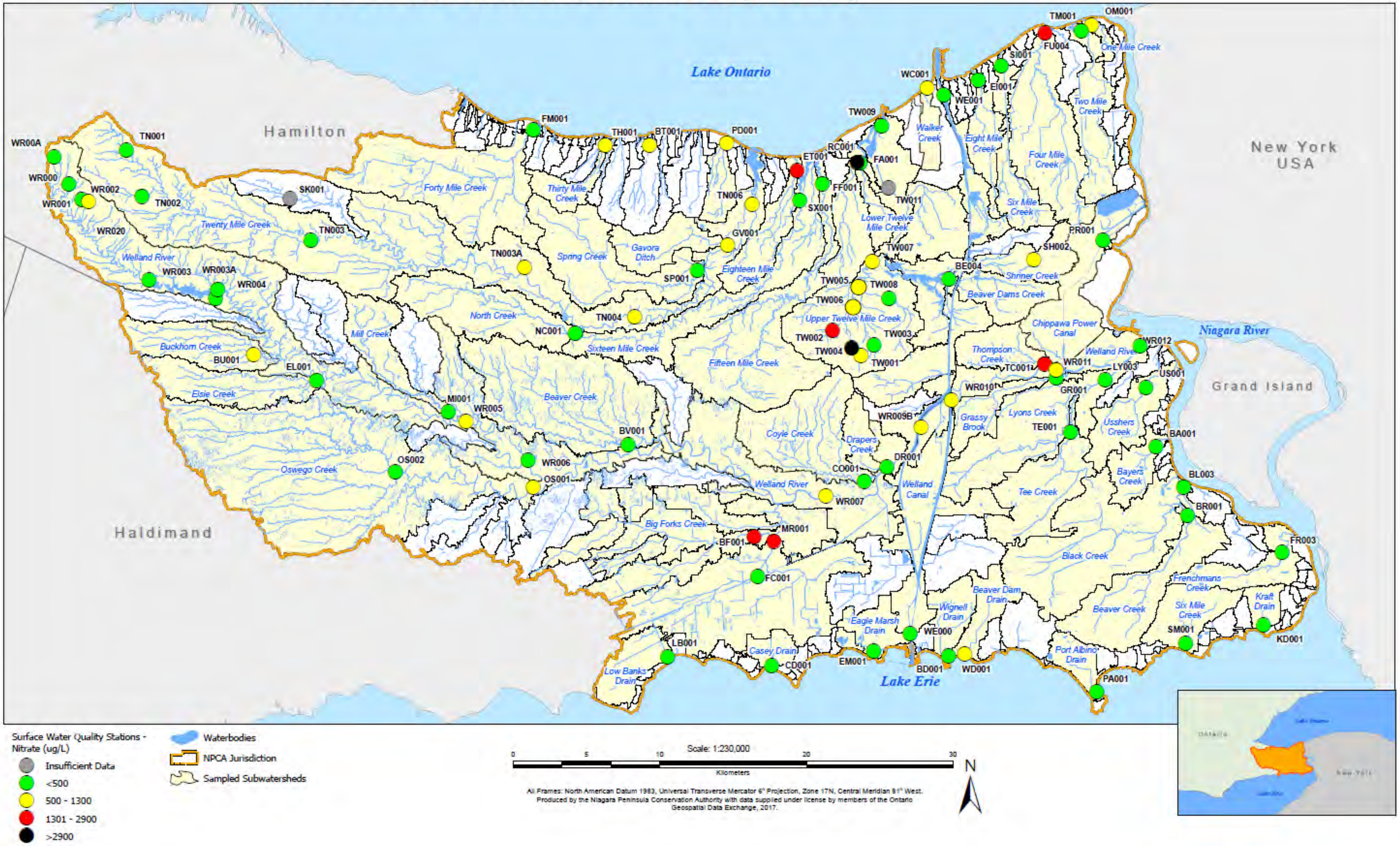
Niagara Peninsula Conservation Authority
Median Lead Concentrations 2019 - 2023

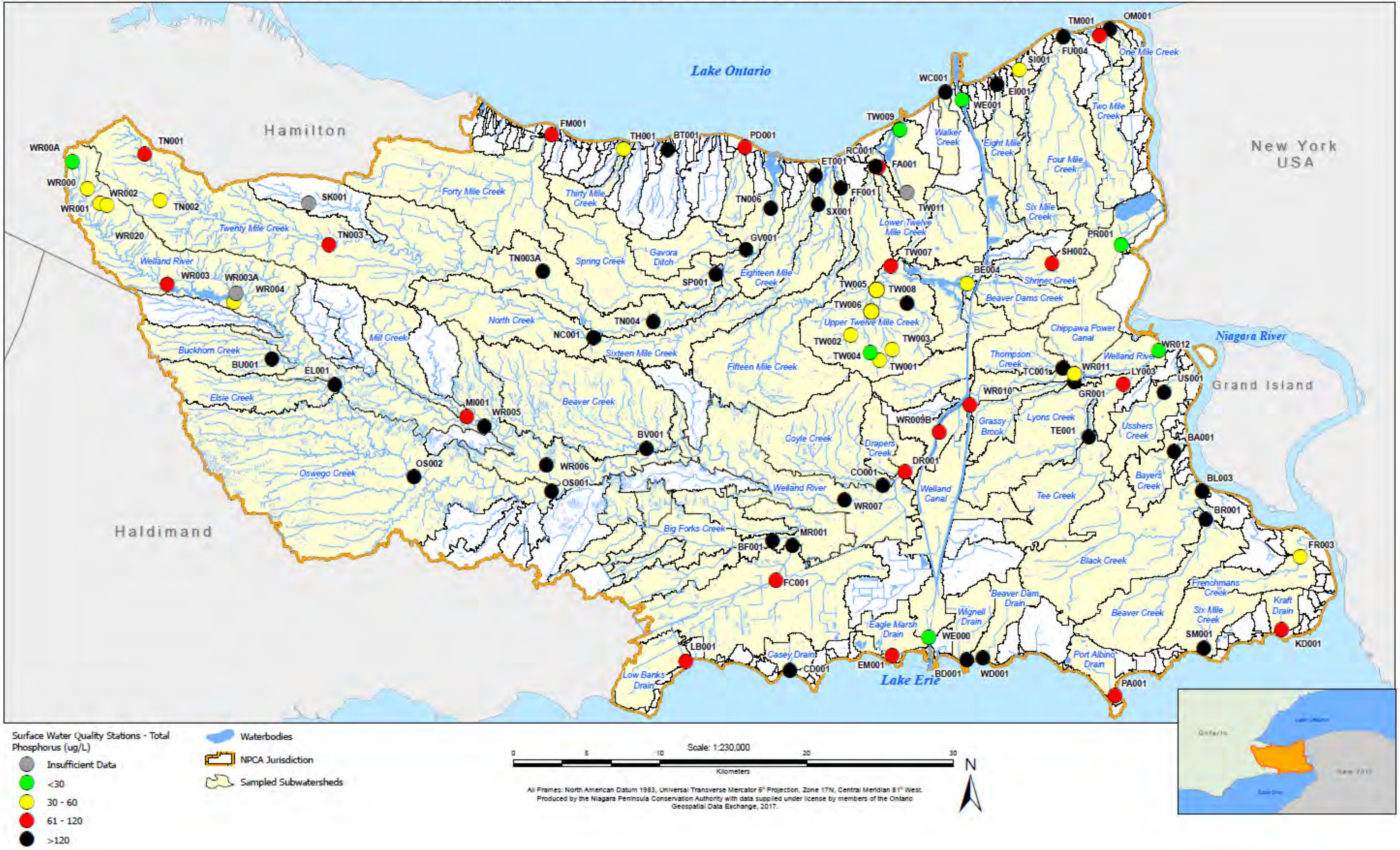


Niagara Peninsula
CONSERVATION
nature for all

Niagara Peninsula Conservation Authority
Median Nitrate Concentrations 2019 - 2023



Niagara Peninsula Conservation Authority
Median Total Phosphorus Concentrations 2019 - 2023



All Frames: North American Datum 1983, Universal Transverse Mercator 6° Projection, Zone 17N, Central Meridian 81° West. Produced by the Niagara Peninsula Conservation Authority with data supplied under license by members of the Ontario Geospatial Data Exchange, 2017.

Niagara Peninsula
CONSERVATION
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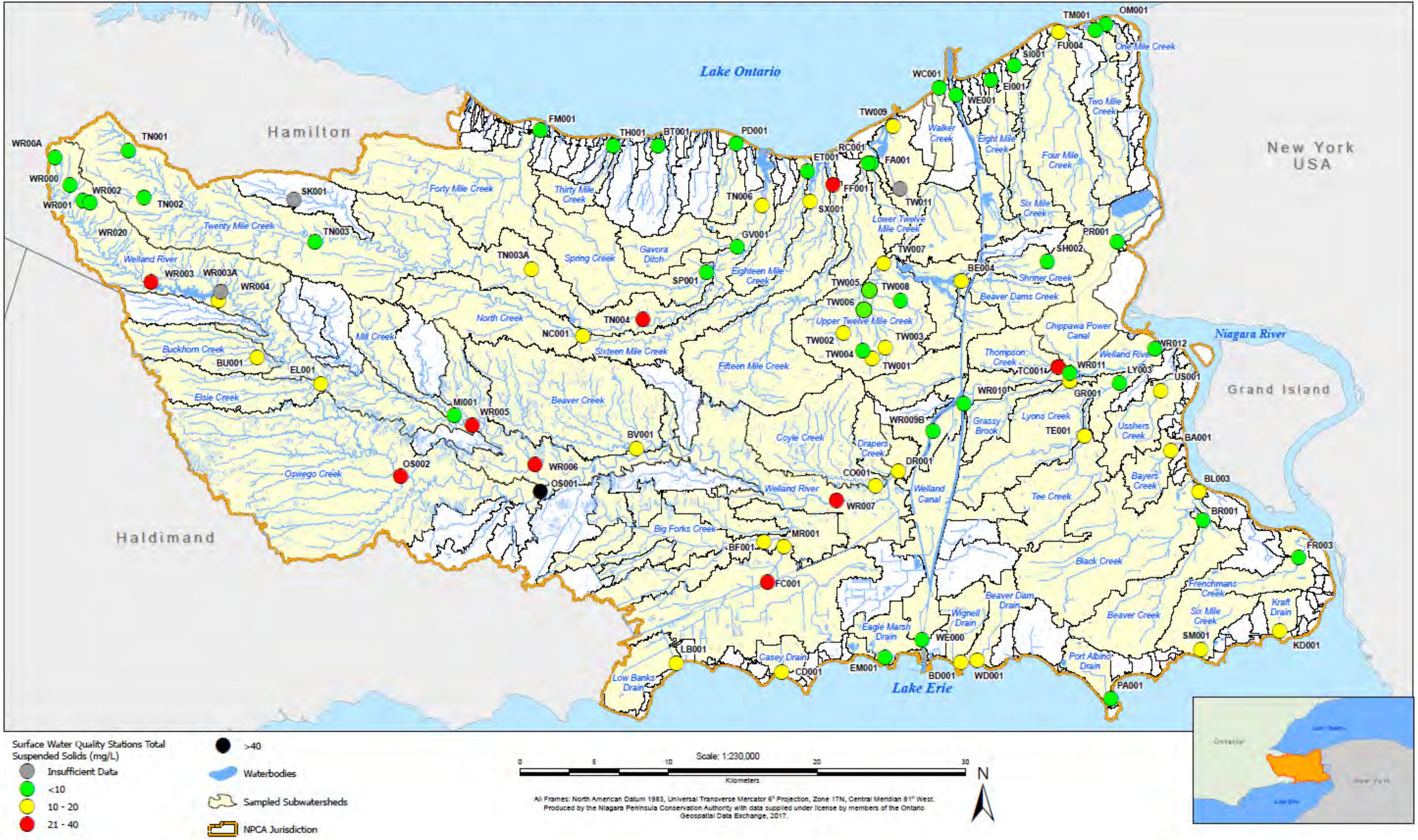
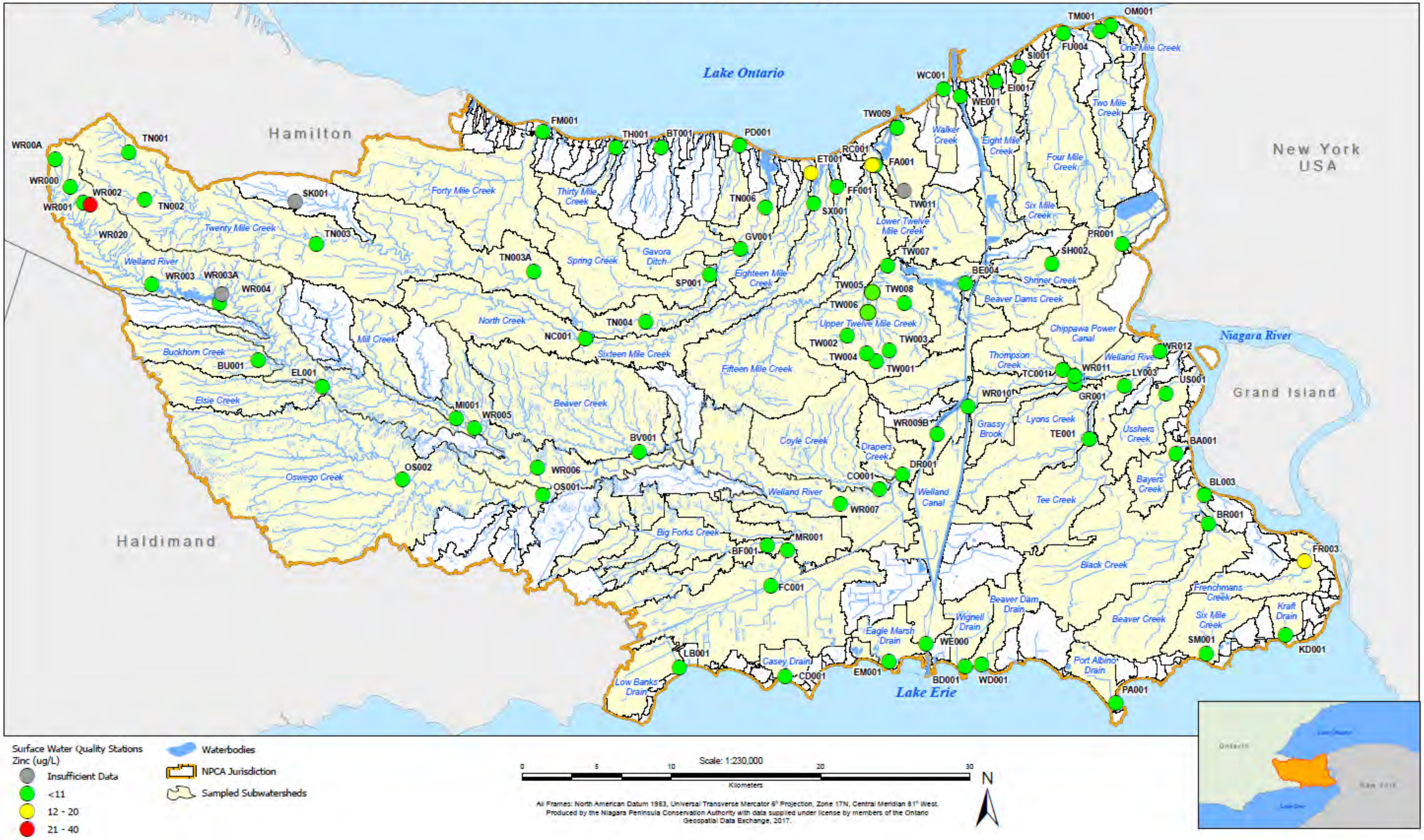
Niagara Peninsula Conservation Authority
Median Total Suspended Solids Concentrations 2019 - 2023

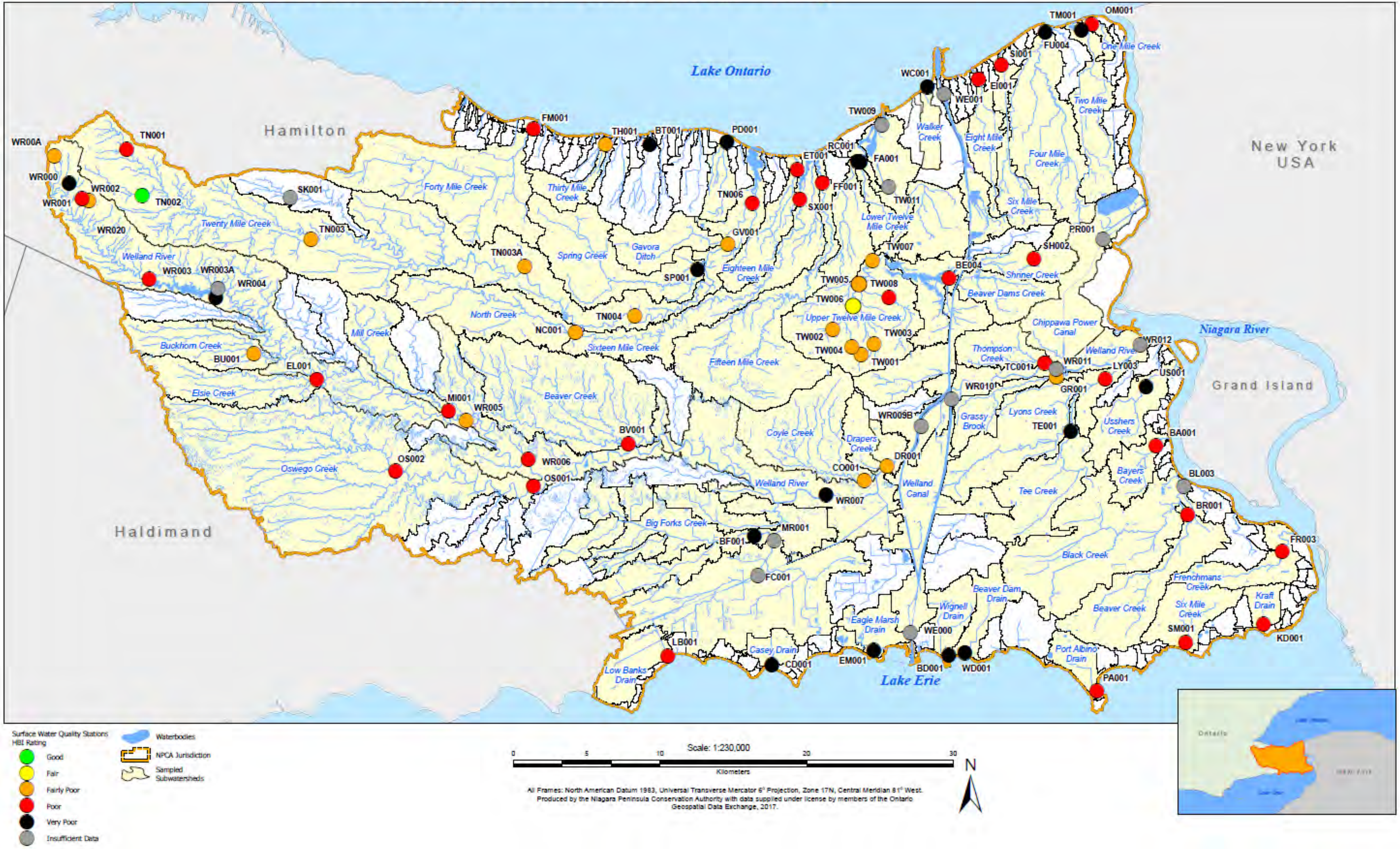


All Frames: North American Datum 1983, Universal Transverse Mercator 6° Projection, Zone 17N, Central Meridian 81° West.
Produced by the Niagara Peninsula Conservation Authority with data supplied under license by members of the Ontario Geospatial Data Exchange, 2017.

Niagara Peninsula Conservation Authority
Median Zinc Concentrations 2019 - 2023



Niagara Peninsula Conservation Authority
Hilsenoff Family Biotic Index 2019 - 2023



All Frames: North American Datum 1983, Universal Transverse Mercator 6° Projection, Zone 17N, Central Meridian 81° West.
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Appendix E Terrestrial and Aquatic Ecology

Environmental Impact Study White Church Urban Boundary Expansion

Prepared For:

Whitechurch Landowners Group Inc

Prepared By:

Beacon Environmental Limited

Date:	*Project:*
2024-12-17	**223152**

BEACON ENVIRONMENTAL

GUIDING SOLUTIONS IN THE NATURAL ENVIRONMENT

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Report Versions Issued

Version	Date	Revisions
1.	December 2023	
2.	December 2024	Section 4- Updated Existing Conditions

1. Introduction

Beacon Environmental Limited (Beacon) was retained by the Whitechurch Landowners Group Inc to complete an Environmental Impact Study (EIS) for participating landowners within the White Church Urban Boundary Expansion Area in the City of Hamilton. The majority of the 364 hectare (ha) properties (hereafter referred to as Study Area) are bounded by Airport Road East to the north, Miles Road to the east, White Church Road East to the south and Upper James Street to the west. The location of the Urban Boundary Expansion Area and the Study Area which include the participating landholdings are shown on **Figure 1**.

The northwest corner of the Study Area falls within the Airport Influence Area. The subject lands are currently designated as ‘Agriculture’, ‘Rural’ and ‘Open Space’ in the Rural Hamilton Official Plan. The natural heritage features mapped by the City of Hamilton on these properties are shown only on the Schedules of the Rural Hamilton Official Plan. Schedule B of the Rural Official Plan shows Core Areas of the Natural Heritage System on several of the properties within the Study Area. The Niagara Peninsula Conservation Authority (NPCA) mapping does not show any flood plain within the Study Area. However, several watercourses and associated regulated areas are identified on the NPCA mapping within the Study Area.

The purpose of the EIS is to characterize the natural heritage and hydrological features associated with the Study Area and to present the City’s Natural Heritage System (NHS) that is consistent with current natural heritage planning policies, guidelines, and criteria. Detailed seasonal surveys were completed to confirm feature limits and to develop a natural heritage system, as required by the City of Hamilton.

The study area was historically within the City’s Rural Area, outside the Urban Boundary. It was added to the City’s Urban Boundary by the Province of Ontario in 2022 through Official Plan Amendment No. 167, and then returned back outside the City’s Urban Boundary through the Province’s implementation of the Planning Statute Amendment Act in 2023. Since then, the new Provincial Planning Statement was brought into force which permits privately initiated applications for Urban Boundary Expansions of any size. This EIS was prepared to support bringing the study area into the urban boundary for the City of Hamilton.

This report provides the findings of the seasonal surveys conducted on the participating properties.

2. Policy Review

This section provides a summary of environmental legislation, regulations and policies at the federal, provincial, and local level that would apply to the Study Area.

2.1 Species at Risk *Act* (2002)

The federal *Species at Risk Act* (SARA; 2002) is intended to prevent federally endangered or threatened wildlife (including plants) from becoming extinct in the wild, and to help in the recovery of these species. The Act is also intended to help prevent species listed as special concern from becoming endangered or threatened.

To ensure the protection of Species at Risk, SARA contains prohibitions that make it an offence to kill, harm, harass, capture, take, possess, collect, buy, sell, or trade an individual of a species listed in Schedule 1 of SARA as endangered, threatened, or extirpated.

SARA applies primarily to lands under federal jurisdiction and relies on provincial laws to protect federal SAR habitat. On private land, SARA prohibitions apply only to aquatic species (see **Section 2.2** below) and migratory birds that are also listed in the *Migratory Birds Convention Act* (1994). The intent of SARA is to protect residences and critical habitat as much as possible through voluntary actions and stewardship measures.

2.2 Fisheries *Act* (1985)

Fish and fish habitat are protected under the federal Fisheries *Act* which is administered by the Fish and Fish Habitat Protection Program (FFHPP) within Fisheries and Oceans Canada (DFO). The protection provisions of the Fisheries *Act* apply to all fish and fish habitat throughout Canada and the *Act* sets out authorities for the regulation of works, undertakings or activities that risk harming fish and fish habitat.

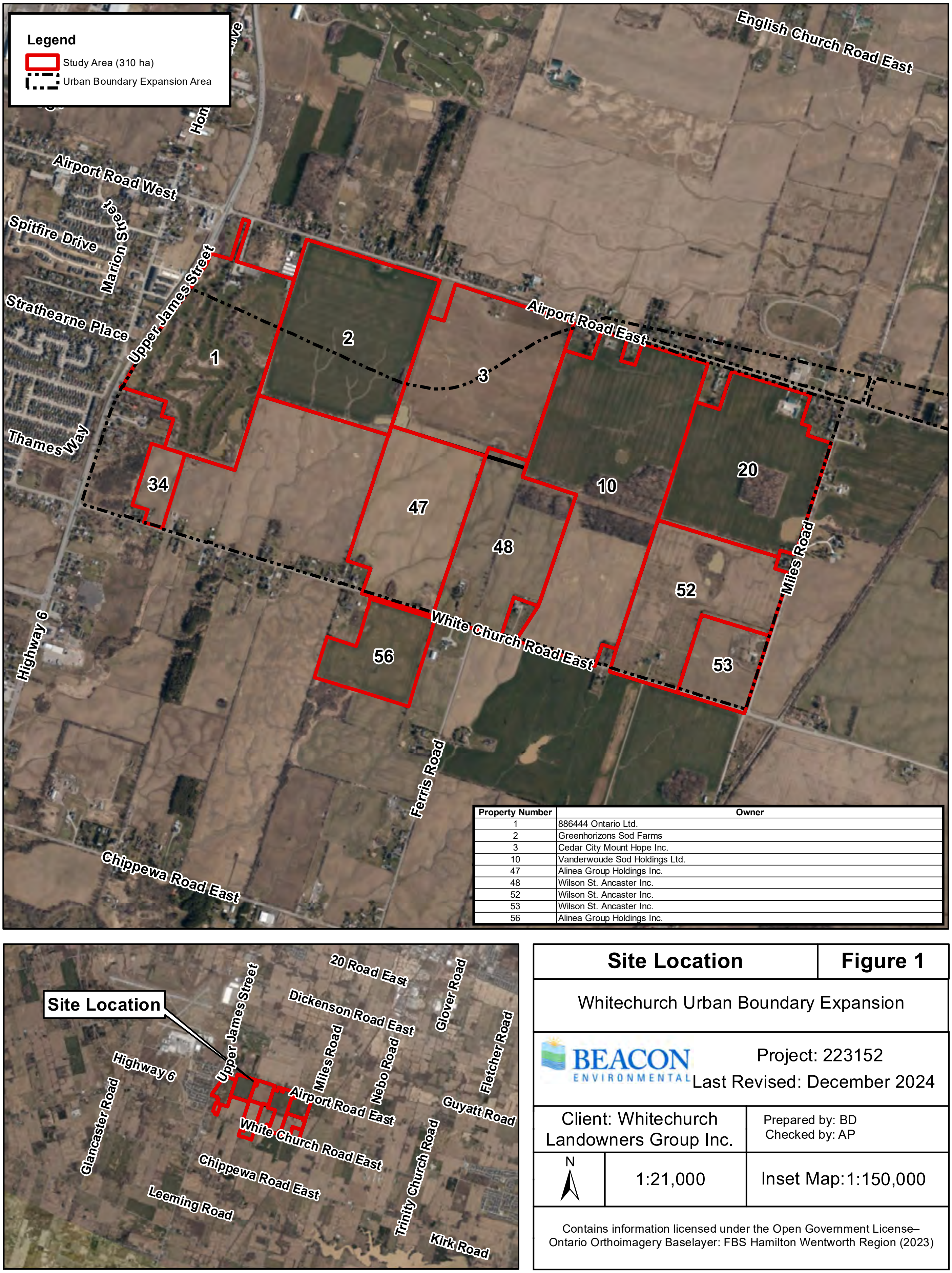
Fish habitat is defined in subsection 2(1) of the Fisheries *Act* to include all waters frequented by fish and any other areas upon which fish depend directly or indirectly to carry out their life processes. The types of areas that can directly or indirectly support life processes include, but are not limited to, spawning grounds and nursery, rearing, food supply and migration areas. Critical habitat is defined in subsection 2(1) of SARA as the habitat necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species.

Section 35 of the Fisheries *Act*, which prohibits the carrying out of any work, undertaking, or activity that results in the harmful alteration, disruption, or destruction of fish habitat, applies to all fish habitat, including the critical habitat of endangered and threatened species listed under Schedule 1 of SARA. Under section 73 of SARA, the Minister may enter into an agreement with a person, or issue a permit to a person, authorizing the person to engage in an activity affecting a listed aquatic species, any part of its critical habitat, or the residences of its individuals, provided that the following requirements are met.

The FFHPP ensures compliance with relevant provisions under the Fisheries *Act* and SARA by reviewing proposed works, undertakings and activities that may impact fish and fish habitat. If a project is taking place in or near water, the proponent is responsible for understanding project related impacts on fish and fish habitat and applying measures to avoid and/or mitigate potential impacts (i.e., harmful, alteration, disruption, or destruction) to fish and fish habitat. Per Section 73(3)(c) of SARA an activity would be considered to jeopardize the survival or recovery of a species at risk if it would prevent the "attainment of the population and distribution objectives described within the recovery strategy". It is DFO's responsibility to complete an assessment to determine whether an activity would jeopardize the survival or recovery of the species on a case-by-case basis.

2.3 Endangered Species Act (2007)

The provincial *Endangered Species Act* (ESA, 2007) primarily protects species listed as Threatened or endangered by the Committee on the Status of Species at Risk in Ontario (COSSARO).



Property Number	Owner
1	886444 Ontario Ltd.
2	Greenhorizons Sod Farms
3	Cedar City Mount Hope Inc.
10	Vanderwoude Sod Holdings Ltd.
47	Alinea Group Holdings Inc.
48	Wilson St. Ancaster Inc.
52	Wilson St. Ancaster Inc.
53	Wilson St. Ancaster Inc.
56	Alinea Group Holdings Inc.

Site Location **Figure 1**

Whitechurch Urban Boundary Expansion

BEACON ENVIRONMENTAL

Project: 223152
Last Revised: December 2024

Client: Whitechurch Landowners Group Inc.

Prepared by: BD
Checked by: AP

1:21,000

Inset Map:1:150,000

Contains information licensed under the Open Government License–Ontario Orthoimagery Baselayer: FBS Hamilton Wentworth Region (2023)

C:\ODB\OneDrive - Beacon Environmental\GeoSpatial\Geo Projects\2023\223152 Mount Hope Secondary Plan Extension Area EIS\MXD\20241204_Figure01_SiteLocation_223152.mxd

Threatened or endangered species are protected, as is their habitat. Depending on the time of a species' listing, habitat is protected either under a General Habitat protection provision or a Species-Specific Habitat protection provision.

The ESA generally prohibits the killing or harming of a threatened or endangered species (Section 9), as well as the destruction of its habitat (Section 10). Where activities are likely to adversely affect threatened or endangered species or their habitat, permitting may be required under Section 17(2)(c) of the ESA.

2.4 Provincial Planning Statement (2024)

The Provincial Planning Statement (PPS) was issued under section 3 of the *Planning Act* and came into effect October 20, 2024. It replaces the Provincial Policy Statement that came into effect May 1, 2020.

Chapter 4.1 of the PPS provides direction to regional and local municipalities regarding planning policies specifically for the protection and management of natural heritage features and their ecological functions.

The PPS provides planning policies for the following features:

- Significant wetlands;
- Significant coastal wetlands;
- Significant woodlands;
- Significant valleylands;
- Significant wildlife habitat;
- Significant Areas of Natural and Scientific Interest (ANSIs);
- Fish habitat; and
- Habitat, and significant habitat, of endangered and threatened species.

Each of these features is afforded varying levels of protection subject to guidelines, and in some cases, regulations. Identification of the various natural heritage features noted above is a responsibility shared by Ministry of Natural Resources and Forestry (MNRF), Ministry of Environment Conservation and Parks (MECP), Fisheries and Oceans Canada (DFO) and the local planning authority.

MNRF is responsible for the Areas of Natural and Scientific Interest (ANSIs), while MECP is responsible for the confirmation of habitat of endangered species and threatened species, and for its regulation under the *Endangered Species Act*.

Local and regional planning authorities are responsible for the identification of significant wetlands, significant woodlands, significant valleylands, and significant wildlife habitat, with support from applicable guidance documents (i.e., Natural Heritage Reference Manual [MNR 2010]; Significant Wildlife Habitat Technical Guidelines [MNR 2000]; and Significant Wildlife Habitat Criteria for Ecoregion 6E, [MNRF 2015]). Identification and verification of fish habitat is now self-regulated although enforcement of the related policies and regulations is still managed by MNRF and regulated by the DFO.

In areas where significant natural heritage features are present, the boundaries of natural heritage features are further refined through site-specific studies undertaken as part of the planning process and in accordance with the requirements of municipal policies.

Policy 4.1.4 and 4.1.5 of the PPS state that development and site alteration shall not be permitted in natural features listed above unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions.

Policy 4.1.8 states that development of lands adjacent to natural features is not permitted unless the ecological function has been evaluated and it has been demonstrated that there will be no negative impacts on features or functions. Further, policies 4.1.6 and 4.1.7 state that development shall not be permitted in fish habitat or habitat of threatened and endangered species, expect in accordance with provincial and federal requirements.

2.5 Green Belt Plan (2017)

A portion of the Study Area (Parcel 56) is currently located within the protected countryside of the Greenbelt Plan. This Natural Heritage Assessment was prepared on the basis that the Study Area lands are outside the Greenbelt Plan Area and therefore not subject to the policies of the Greenbelt Plan.

2.6 City of Hamilton Urban Official Plan (2022)

The northwest corner of the Study Area is currently located outside the Urban Boundary within the Airport Influence Area.The subject lands are currently designated as ‘Agriculture’, Rural’ and ‘Open Space’ in the Rural Hamilton Official Plan. The remainder of the lands north of White Church Road East fall within the Urban Expansion Area-Neighborhoods. This EIS report was prepared on the basis of the Study Area being brought into the urban area at some point in the future and subject to the policies of the City’s Urban Official Plan.

Section C.2.0 of the City’s Urban Official Plan contains policies pertaining to the protection of the Natural Heritage Systems (NHS) in the urban area of the City of Hamilton.

The Natural Heritage System consists of Core Areas, Linkages, and the matrix of lands between them which may be suitable for restoration. Core Areas include key natural heritage features, key hydrologic features, and associated vegetation protection zones.

Minor refinements to the boundaries of Core Areas may occur through Environmental Impact Statements, watershed studies or other appropriate studies accepted by the City of Hamilton without an amendment to the Plan.

The following are policy excerpts relevant to natural heritage features on the Study Area:

> *“C.2.3.3 Any development or site alteration within or adjacent to Core Areas shall not negatively impact their environmental features or ecological functions. “*
>
> *“C.2.5.2 New development and site alteration shall not be permitted within provincially significant wetlands, significant coastal wetlands or significant habitat of threatened and endangered species.”*

"C.2.5.3 New development and site alteration shall not be permitted within fish habitat, except in accordance with provincial and federal requirements."

"C.2.5.4 New development and site alteration shall not be permitted within significant woodlands, significant wildlife habitat, significant valleylands, and significant areas of natural and scientific interest it has been demonstrated that there shall be no negative impacts on the natural features or their ecological functions. "

"C.2.5.5 New development or site alteration shall not be permitted on adjacent land to the natural heritage features and aeras identified in Sections C.2.3.2 to C.2.5.4 unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated that there shall be no negative impacts on the natural features or on their ecological functions."

"C.2.5.7 Streams are mapped in Schedule B - Natural Heritage System. Streams have been separated into two classes: Coldwater Watercourse/Critical Habitat and Warmwater Watercourse/Important/Marginal Habitat. If the stream has not been classified as part of an EIS, subwatershed study, or other study, a scoped EIS is required to determine the classification."

"C.2.5.8 New development or site alteration subject to Policies C.2.5.3 to C.2.5.7 requires, prior to approval, the submission and approval of an Environmental Impact Statement which demonstrates to the satisfaction of the City and the relevant Conservation Authority that:

a) There shall be no negative impacts on the Core Area's natural features or their ecological functions.

b) Connectivity between Core Areas shall be maintained, or where possible, enhanced for the movement of surface and ground water, plants and wildlife across the landscape.

c) The removal of other natural features shall be avoided or minimized by the planning and design of the proposed use or site alteration wherever possible."

"C. 2.5.9 An Environmental Impact Statement shall propose a vegetation protection zone which:

a) has sufficient width to protect the Core Area and its ecological functions from impacts of the proposed land use or site alteration occurring during and after construction, and where possible and deemed feasible to the satisfaction of the City, restores or enhances the Core Area and/or its ecological functions; and

b) is established to achieve, and be maintained as natural self-sustaining vegetation. "

"2.5.10 Where vegetation protection zone widths have not been specified by watershed and sub-watershed plans, secondary, Environmental assessments and other studies, the following vegetation protection zone widths shall be evaluated and addressed by Environmental Impact Statements. Other agencies, such as Conservation Authorities, may have different vegetation protection zone requirements.

a) Coldwater Watercourse and Critical Habitat – 30-metre vegetation protection zone on each side of the watercourse, measured from the bankfull channel.

b) Warmwater Watercourse and Important and Marginal Habitat – 15 metre vegetation protection zone on each side of the watercourse, measured from the bankfull channel.

> *c) Provincially Significant Wetlands – 30-metre vegetation protection zone, measured from the boundary of the wetland, as approved by the Conservation Authority or Ministry of Natural Resources.*
> *d) Unevaluated wetlands – Unevaluated wetlands and locally significant wetlands require a 15 metre vegetation protection zone, measured from the boundary of the wetland, as approved by the Conservation Authority or Ministry of Natural Resources, unless an Environmental Impact Statement recommends a more appropriate vegetation protection zone.*
> *e) Woodlands – 10-metre vegetation protection zone, measured from the edge (drip line) of the woodland.*
> *f) Significant woodlands – 15-metre vegetation protection zone, measured from the edge (drip line) of the significant woodland.*
> *g) Areas of Natural and Scientific Interest (ANSIs) – Life and Earth Science ANSIs require a 15-metre vegetation protection zone.*
> *h) Significant Valleylands – As required by the relevant Conservation Authority.*
> *i) Significant Habitat of Threatened or Endangered Species and Significant Wildlife Habitat: the minimum vegetation protection zone shall be determined through Environmental Impact Statements, dependent on the sensitivity of the feature. "*

> *"C.2.5.11 Vegetation protection zone widths greater or less than those specified in a) to i) above may be required if ecological features and functions warrant it, as determined through an approved Environmental Impact Statement. Widths shall be determined on a site-specific basis, by considering factors such as the sensitivity of the habitat, the potential impacts of the proposed land use, the intended function of the vegetation protection zone, and the physiography of the site."*

> *"C.2.5.12 Permitted uses within a vegetation protection zone shall be dependent on the sensitivity of the feature, and determined through approved studies. Generally, permitted uses within a vegetation protection zone shall be limited to low impact uses, such as vegetation restoration, resource management, and open space. Permitted uses within the vegetation protection zone shall be the same uses as those within the Core Area in Policy C.2.5.1 and the vegetation protection zone should remain in or be returned to a natural state. "*

> *"C.2.5.13 All plantings within vegetation protection zones shall use only non-invasive plant species native to Hamilton. The City may require that applicants for development or site alteration develop a restoration or management plan for the vegetation protection zone as a condition of approval. "*

Section 2.7 of the Urban Official Plan contains policies applicable to Linkages. Linkages are natural areas within the landscape that ecologically connect Core Areas. Linkages are a component of the Natural Heritage System shown on Schedule B of the Official Plan.

> *"C.2.7.5 Where new development or site alteration is proposed within a Linkage in the Natural Heritage System as identified in Schedule B – Natural Heritage System, the applicant shall prepare a Linkage Assessment. On sites where an Environmental Impact Statement (EIS) is being prepared, the Linkage Assessment can be included as part of the EIS report. Any required Linkage Assessment shall be completed in accordance with Policy F.3.2.1.11 - Linkage Assessments. "*

> *"C.2.7.6 Linkage Assessments shall include the following information:*
>
> > *a) identify and assess the Linkage including its vegetative, wildlife, and/or landscape features or functions;*
> > *b) assess the potential impacts on the viability and integrity of the Linkage as a result of the development proposal; and,*
> > *c) make recommendations on how to protect, enhance or mitigate impacts on the Linkage(s) and its functions through planning, design and construction practices."*
>
> *"C.2.7.7 In addition to the Linkages identified on Schedule B – Natural Heritage System, there may be Hedgerows that are worthy of protection, especially where:*
>
> > *a) they are composed of mature, healthy trees and generally provide a wide, unbroken linkage between Core Areas;*
> > *b) there is evidence that wildlife regularly use them as movement corridors or habitat;*
> > *c) they contain tree species which are threatened, endangered, special concern, provincially or locally rare; or,*
> > *d) groupings of trees which are greater than 100 years old."*

2.7 Niagara Peninsula Conservation Authority Regulations and Policy

2.7.1 Conservation Authorities Act (Ontario Regulation 41/24)

Part VI of the *Conservation Authorities Act* (*CA Act*; 2024) sets out the regulatory powers of conservation authorities. The *CA Act* prohibits, in the absence of a permit, development activities to straighten, change, divert or interfere in any way with the existing channel of a river, creek, stream or watercourse or to change or interfere in any way with a wetland are prohibited. Development activities are also prohibited in hazardous lands in the absence of a permit issued by the NPCA.

Under Ontario Regulation 41/24 (2024) of the *CA Act*, the NPCA regulates hazard lands including floodplains, watercourses, valleylands, shorelines, and wetlands. NPCA also regulates other areas which include areas within 30 m of a wetland.

The NPCA may issue a permit for a prohibited activity if, in its opinion,

- the activity is not likely to affect the control of flooding, erosion, dynamic beaches, or unstable soil or bedrock.
- the activity is not likely to create conditions or circumstances that, in the event of a natural hazard, might jeopardize the health or safety of persons or result in the damage or destruction of property; and
- any other requirements that may be prescribed by the regulations are met.

The NPCA may issue a permit with or without conditions.

Portions of the Study Area are situated within the regulated area of the NPCA.

3. Methodology

The following sections describe the various field investigations and analyses undertaken to characterize the biophysical functions and significant ecological features associated with the Study Area.

3.1 Background Review

Background information was gathered and reviewed at the outset of the project. This involved consideration of the following documents or information sources relevant to the Study Area:

- Current and historic aerial imagery;
- Provincially Tracked Species data from Land Information Ontario (LIO);
- Ontario Breeding Bird Atlas;
- Ontario Reptile and Amphibian Atlas;
- Natural Heritage Information Centre (NHIC) Data via the Make-A-Map application;
- Species at risk range maps https://www.ontario.ca/environment-and-energy/species-risk-ontario-list;
- Natural and physical feature layers from LIO, including wetlands and watercourses with thermal regime; and
- Physiography of Southern Ontario (Chapman and Putnam 1984).

3.1.1 Desktop Species at Risk Habitat Screening

A desktop review of available information sources was undertaken to determine potential species at risk. As part of the desktop screening, the following information sources were reviewed:

- Natural Heritage Information Centre (NHIC) Data via the Make-A-Map application;
- Databases of the Ontario Breeding Bird Atlas (OBBA) project;
- Ontario Reptile and Amphibian Atlas (ORAA);
- SAR range maps https://www.ontario.ca/environment-and-energy/species-risk-ontario-list;
- Aquatic SAR maps http://www.dfo-mpo.gc.ca/species-especes/fpp-ppp/index-eng.htm;
- High Resolution aerial photography of the property; and
- Natural and physical feature layers from Land Information Ontario (LIO).

The information sources referenced above were reviewed in a Geographic Information System (GIS) mapping environment that Beacon uses to assess the likelihood that sensitive fish habitat or potential endangered or threatened species are present in an area of interest. This system allows Beacon to combine the most current information provided by MNRF through the LIO portal with GIS layers from provincial floral and faunal atlases. All relevant layers can then be overlaid on the most recent high resolution ortho-imagery. The screening process helps identify areas that can then be targeted (for example, potential habitat) during field assessment to maximize the efficiency and effectiveness of on-site investigations.

3.2 Field investigations

Field investigations of natural heritage features on the Study Area were conducted throughout 2023 and 2024 by Beacon's team of ecologists specializing in terrestrial and aquatic inventory and assessment protocols. The following sections describe the field surveys completed and associated methodologies. Survey types and dates are summarized in **Table 1.**

Table 1. Summary of Field Surveys and Dates

Survey Type	Dates of Surveys
Ecological Land Classification and Flora Inventory	August 9, 17 and 25, 2023, April 23 and 24, 2024, June 03, 2024, August 22, 2024, and October 02, 2024.
Breeding Bird Surveys	June 5, 6, 7, 23, 24 and 25, July 8, 2023, May 31, June 11 and July 8, 2024
Amphibian Surveys	May 23, June 19 and 26, 2023, April 1, May 27, and June 24, 2024
Headwater Drainage Feature & Aquatic Habitat Assessments	April 6 and June 6, 2023, April 16, May 31, and July 8,2024.
Turtle Basking Surveys	May 1, May 8, May 27, June 6, June 12, 2024
Snag Surveys	April 23 and 24, 2024
Bat Acoustic Monitoring	May 31 to June 30, 2024

3.2.1 Headwater Drainage Features Assessment

Two rounds of surveys were conducted in 2023 on April 6 and June 6. A third round was not required as flow conditions were dry in all identified reaches during the round 2 survey. Additional field investigations were completed in 2024 on April 16, May 31 and July 8.

An assessment of the drainage features within the Study Area was completed in accordance with TRCA's *Evaluation, Classification and Management of Headwater Drainage Features Guidelines* (2014). Drainage features were characterized based on flow regime, form, riparian vegetation, fish and fish habitat, and terrestrial habitat. Each drainage feature reach was evaluated individually based on each of these parameters and assigned a rating of important, valued, contributing, or limited based on functional significance. These ratings were then used to determine an overall management recommendation for each reach based on the following categories:

- *Protection* – Important Functions: i.e., swamps with amphibian breeding habitat; perennial headwater drainage features; seeps and springs; Species at Risk (SAR) habitat; permanent fish habitat with woody riparian cover;
- *Conservation* – Valued Functions: i.e., seasonal fish habitat; with woody riparian cover; marshes with amphibian breeding habitat; or general amphibian habitat with woody riparian cover;
- *Mitigation* – Contributing Functions: i.e., contributing fish habitat with meadow vegetation or limited cover;

- *Recharge Protection* – Recharge Functions: i.e., features with no flow with sandy or gravelly soils;
- *Maintain or Replicate Terrestrial Linkage* – Terrestrial Functions: i.e., features with no flow with woody riparian vegetation and connects two other natural features identified for protection; and
- *No Management Required* – Limited Functions: i.e., features with no or minimal flow; cropped land or no riparian vegetation; no fish or fish habitat; and no amphibian habitat.

Speculative management recommendations were provided for the unassessed watercourses based on background information and data collected from the ELC surveys.

3.2.2 Ecological Land Classification

Ecological communities in the Study Area were mapped and classified in accordance with the protocols of the Ecological Land Classification (ELC) System for Southern Ontario (Lee *et al.* 1998). Communities were surveyed in the summer of 2023 and 2024 (see **Table 1** for specific dates).

3.2.3 Flora Inventory

A flora inventory was completed for the Study Area on the above noted dates. A list was compiled of all observed vascular plant species. Follow-up visits were conducted in spring on April 22 and June 03, 2024; and in fall on October 02, 2024 to complete the 3-season flora inventory in accordance with the City's requirements.

3.2.4 Breeding Bird Surveys

Two rounds of breeding bird surveys were conducted on the Study Area lands on June 5, 6, 7, 2023 (Round 1) and June 23, 24 and 25, 2024 (Round 2), in the early mornings (start times between 6:40 and 7:25), when temperatures were within 5° C of seasonal norms, and without precipitation or persistent winds given their potential interference with survey results. The breeding bird community was surveyed by walking all parts of the Study Area to within 50 m of all habitats to document individuals and breeding evidence. Species were noted as confirmed or probable breeders, or migrants. All observations were noted on an aerial photograph of the site.

An additional survey was completed on July 8, 2023, specifically surveying the open meadow and grassland areas for the grassland bird species at risk, Bobolink (*Dolichonyx oryzivorus*) and Eastern Meadowlark (*Sturnella magna*). Thus, the areas with suitable habitat for these species were surveyed three times, whereas the remainder of the habitat had two survey visits.

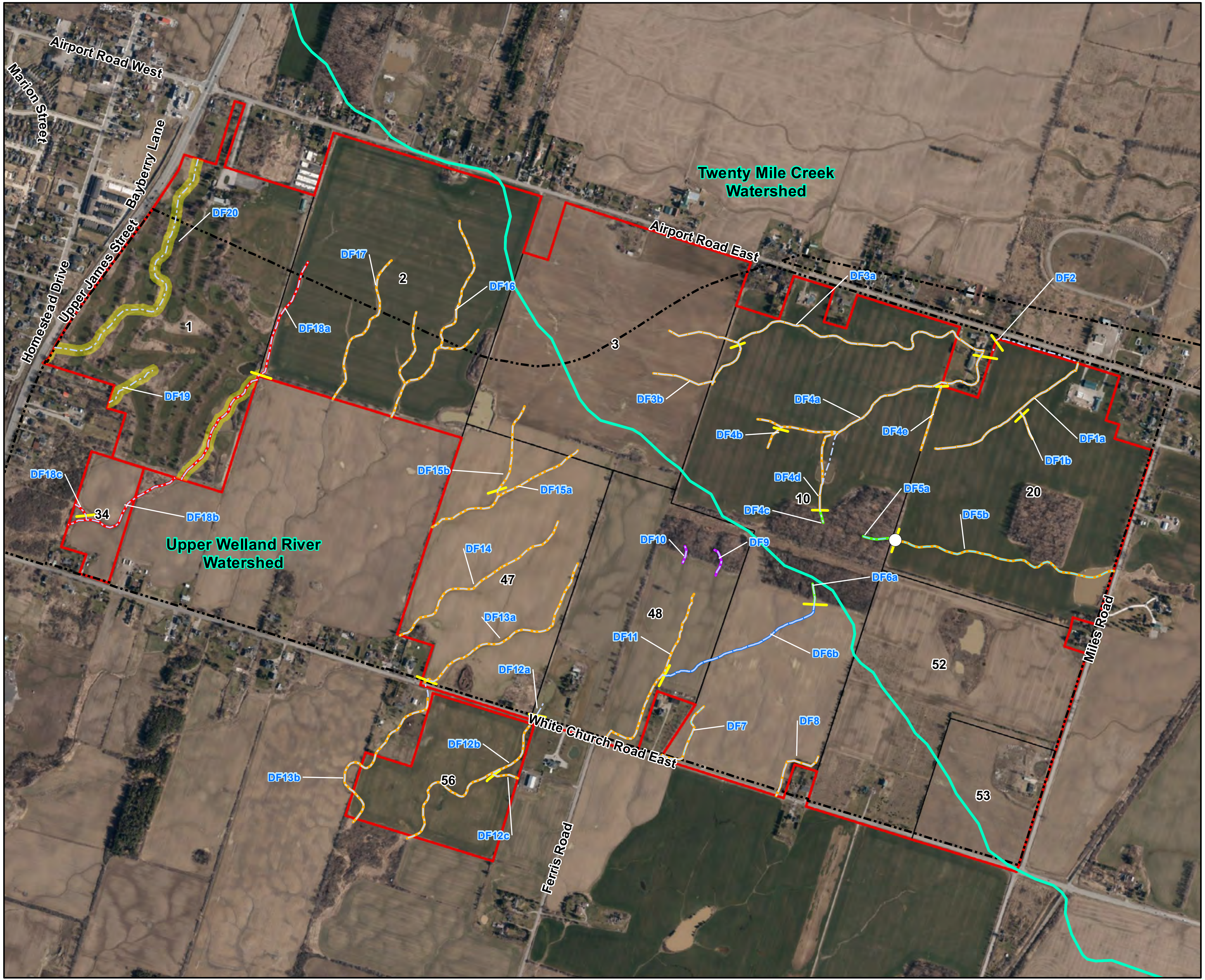
3.2.5 Amphibian Surveys

Six rounds of surveys were conducted within the subject area to survey for breeding amphibians across 2023 and 2024. These surveys took place on May 23, June 19, and June 26, 2023, and April1, May 27, and June 24, 2024. Seventeen survey locations within the subject area were placed in proximity to wetland habitat considered suitable to support breeding amphibians (**Figure 2**). The surveys were conducted as per the protocol outlined in the Great Lakes Marsh Monitoring Program (Bird Studies Canada, 2009).

Existing Conditions - Aquatic Resources

Figure 2

Whitechurch Urban Boundary Expansion



Legend

- 🟥 Study Area (310 ha)*
- ☐ Parcel Boundaries*
- ☐ Secondary Plan Area
- 🟩 Sub Watershed Boundaries
- Tiled Drainage Feature
- Headwater Drainage Features
- Headwater Drainage Features
- ○ Drain
- Reach Break
- 🟨 Further Study (3.38 ha)

HDFA Management Recommendations

- Protection
- Conservation
- Mitigation
- Maintain Recharge
- No Management

*Boundaries are approximate

BEACON ENVIRONMENTAL

Project: 223152
Last Revised: December 2024

Client: Whitechurch Landowners Group Inc.

Prepared by: BD
Checked by: AP

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C:\ODB\OneDrive - Beacon Environmental\GeoSpatial\Geo Projects\2023\223152 Mount Hope Secondary Plan Extension Area EIS\MXD\20240926_Figure02_ExistingConditionsAquaticResources_223152.mxd

Surveys consisted of auditory surveys undertaken during the prime breeding period to record calling males that are present, spread throughout the breeding season to include the short temporal peak for each species of interest. The surveys involved visiting the site after dusk when minimum night-time air temperatures of at least 5°C during the first visit, 10°C during the second visit and 17°C during the third visit. These windows were met for each point across the six surveys completed. Calling amphibians, if present, were identified to species and chorus activity was assigned a code from the following options:

0 No calls;
1 Individuals of one species can be counted, calls not simultaneous;
2 Some calls of one species simultaneous, numbers can be reliably estimated and shown in brackets; and
3 Full chorus, calls continuous and overlapping.

3.2.6 Turtle Surveys

Turtle surveys were completed on May 1, May 8, May 27, June 6, June 12, 2024 in accordance with the Ontario Blanding's Turtle survey protocol (OMNRF 2015). Surveys were conducted in appropriate weather conditions, that is, sunny weather with temperatures between 5 and 15 degrees Celsius, or sunny to partly cloudy days with temperatures up to 25 degrees Celsius. All ponds within the subject property were visited and thoroughly scanned with binoculars to detect basking turtles. One pond has dense emergent vegetation around the permitter and at that pond observers also walked through the vegetation to spot hidden turtles.

3.2.7 Bat Habitat Assessment

A bat habitat assessment was undertaken in accordance with the Ministry of the Environment Conservation and Parks (MECP) updated '*Bat Survey Standards*' guideline (undated). As per Step 1 of the protocol (*Treed Habitats, Maternity and Day Roosts*), any coniferous, deciduous or mixed wooded ecosite that include trees at least 10 cm diameter at breast height (DBH) are considered candidate maternity roost habitat.

All treed communities within the study area were surveyed.

Detailed bat snag surveys were undertaken on April 23 and 24, 2024 to determine the occurrence of snag trees in accordance with Step 1 of the protocol (*Treed Habitats, Maternity and Day Roosts*). The survey was completed during leaf off, and under suitable conditions (i.e., no precipitation, not immediately following heavy snowfall). Snag trees with characteristics favourable to Myotis species were considered as well as any maple or oak species with a DBH greater than 10 cm was noted to consider habitat for Tri-coloured Bat.

3.2.8 Bat Acoustic Monitoring

Based on the results of the bat habitat assessment, acoustic monitoring for bats was conducted from May 31 to June 30, 2024. Following the MECP protocol "Treed Habitats, Maternity Roost Surveys" (undated), this deployment period provided at least ten nights of data recorded under suitable weather conditions (air temp ≥10°C, low winds, and minimal precipitation).

Sixteen detectors were deployed over two rounds of acoustic monitoring in four woodland communities on the subject property, for a total of 32 acoustic monitoring locations (**Figure3**). The monitoring locations were selected based on potential impacts of the project, the range of the acoustic monitor and the location of potential roost trees.

At each of the acoustic monitoring locations an SM4BAT passive monitor equipped with a SMM-U1 or SMM-U2 ultrasonic microphone was installed. Microphones were oriented to optimize the echolocation detections. Each monitor was programmed to record during triggered events each night for a period of six hours beginning at sunset. A 12dB gain setting, was selected based on the SMM-U1 or SMM-U2 microphone and the surrounding habitat and proximity to potential roost trees. The unit was programmed to record in full spectrum with a 256 kHz sample rate. The high pass filter was set to 16 kHz to eliminate low frequency noise but to still capture the lowest frequency bat calls. The trigger level was set to +18SNR with a 0.5 second minimum call duration trigger. All files were recorded as full spectrum in .WAV format.

Recordings from both rounds for each of the 16 monitors were analyzed using Kaleidoscope Pro software. A combination of auto-identification and manual analysis was applied to call files to make species determinations. All unclassified files (No ID Files) were manually reviewed for call frequency to determine if unclassified calls fell within the 40 kHz Myotis species and Tri-Colored Bat range. If the call did not fall within the approximate 40 kHz range, it was not analyzed further as it is likely not an endangered species of bat. Furthermore, a random selection of noise files was reviewed to ensure that the batch filters functioned as intended.

3.2.9 Species at Risk Habitat Assessment

An assessment of the property was conducted for potential habitat for endangered or threatened species known to occur in the general vicinity of the Study Area based on NHIC records, wildlife atlases, recovery strategies, and other background resources.

4. Existing Conditions

4.1 Aquatic Resources

There is a watershed divide within the Study Area and the drainage features are associated with the Twenty Mile Creek or Upper Welland River watersheds (**Figure 2**).

The Twenty Mile Creek watershed is the second largest watershed within the jurisdiction of the Niagara Peninsula Conservation Authority (NPCA), and it is located in the City of Hamilton, and the Regional Municipality of Niagara including the Town of Lincoln, Township of West Lincoln, and Town of Grimsby (NPCA 2006). The total drainage of the watershed is 291 square kilometres. Drainage Features (DF) 1 through 5 located in the northeast portion of Parcel 10 are associated with the main branch of the Twenty Mile Creek subwatershed.

The Upper Welland River watershed has a total drainage of 480 square kilometres. DFs 6 through 18 are associated with the Welland River West subwatershed (Local Management Area 2.1). Area 2.1 includes the entire headwaters region of the Welland River, Lake Niapenco, and downstream to the confluence of Elsie Creek and the Welland River (NPCA 2011).

4.1.1 Fish and Fish Habitat

All of the drainage features that were assessed were ephemeral or intermittent and did not contain fish or direct fish habitat. The watercourse that is located on the Southern Pines Golf Course appears to be a permanent feature and likely provides fish habitat.

NPCA conducted sampling in 2007 at five stations in the Welland River headwaters, ranging 21 km upstream from the Binbrook reservoir. Species caught were Black Bullhead (*Ameiurus melas*), Black Crappie (*Pomoxis nigromaculatus*), Bluntnose Minnow (*Pimephales notatus*), Brown Bullhead (*Ameiurus nebulosus*), Central Mudminnow (*Umbra limi*), Common Carp (*Cyprinus carpio*), Grass Pickerel (*Esox americanus vermiculatus*), Green Sunfish (*Lepomis cyanellus*), Golden Shiner (*Notemigonus crysoleucas*) Johnny Darter (*Etheostoma nigrum*), Largemouth Bass (*Micropterus nigricans*), Northern Pike (*Esox lucius*), Pumpkinseed (*Lepomis gibbosus*), Tadpole Madtom (*Noturus gyrinus*), White Crappie (*Pomoxis annularis*), White Sucker (*Catostomus commersonii*), Yellow Bullhead (*Ameiurus natalis*), and Yellow Perch (*Perca flavescens*) (NPCA 2011).

4.1.2 Threatened and Endangered Species

Fisheries and Oceans Canada (DFO) Mapping identified Grass Pickerel (*Esox americanus vermiculatus*) within the Welland River watershed. The Grass Pickerel is listed provincially as Special Concern and is found in wetlands, ponds, slow-moving streams and shallow bays of larger lakes with warm, shallow, clear water and an abundance of aquatic plants (Government of Ontario 2014). DFO Species at Risk mapping does not have the Grass Pickerel present upstream of Lake Niapenco, approximately 10km from the study area.

4.1.3 Headwater Drainage Feature Assessment

In total, 18 headwater drainage features (HDFs) were identified and assessed in 2023 and 2024 (**Figure 2**). HDFs were assessed following the Ontario Stream Assessment Protocol Headwater Drainage Feature Module (Stanfield *et al.* 2014). Drainage features (DFs) 1 through 8 were assessed in 2023, while DFs 9 through 18 were assessed in 2024. All features were flowing in during the Round 1 assessments, however no permanent features were found on the subject property. Photos referenced in the below descriptions can be found in **Appendix A**.

DF1a and 1b were small swales with no defined banks that originated in the Parcel 20 agricultural field and drained into the roadside ditch along Airport Road East (DF2) (**Photographs 1-5**). Both features had flow in Round 1, and no flow in Round 2.

DF3 had two branches which originated in the Parcel 3 agricultural field and flowed eastward into Parcel 10, having a confluence near the west boundary of the parcel. It then meandered eastward through the neighbouring property and into DF2. DF3a was a large swale with poorly defined banks, with a wetted width measuring 1m at the widest (**Photographs 6-7**). DF3b was a small swale with no defined banks (**Photograph 8**). Both features associated with DF3 were flowing during the Round 1 assessment and dry during the Round 2 assessment.

DF4 had three branches originating within the Parcel 10 agricultural field that connected with DF4a. All features associated with DF4 had flow in Round 1, and no flow in Round 2. DF4a had a maximum wetted width and depth of 1.50 m and 0.08 m, respectively (**Photographs 9-10**).

DFs 4b and 4e gathered overland flow from the agricultural field before forming small, poorly defined swales and merging with DF4a (**Photographs 11 and 17**). DFs 4c and 4d were part of one continuous feature, gathering overflow from vernal pools within the woodlot and flowing into the online irrigational pond in the center of Parcel 10 (**Photographs 12-16**).

DF5a was a small, poorly defined channel that gathered overflow from vernal pools within the forested area located in the central area of Parcel 10 (**Photographs 18-19**). It exited the forested area into a tile drain which flowed eastward into the pond along the east perimeter of the study area (**Photograph 20**). All features associated with DF5 had flow in Round 1, and no flow in Round 2.

DF6a and 6b are part of one continuous feature, which originated within the wooded area where a series of vernal pools overflowed into a small channel within the agricultural field (**Photographs 21-23**). Flow continued southwest into Parcel 48 to merge with DF11. DF6b had a maximum wetted width and depth of 0.75 m and 0.10 m, respectively. All features associated with DF6 had flow in Round 1, and no flow in Round 2.

DF7 was a tiled feature that had no surface flow (**Photograph 24**). DF7 had flow in Round 1, and no flow in Round 2.

DF8 gathered overland flow from the surrounding agricultural field into a small, poorly defined swale before it flowed into the roadside ditch along White Church Road East (**Photographs 25-26**). DF8 had flow in Round 1, and no flow in Round 2.

The gradient of the field on Parcel 48 did not allow DFs 9 and 10 to connect with DF11. Instead, overland flow gathered in pools adjacent to the woodlot before forming poorly defined channels flowing into the woodlot (**Photographs 27-28**). Both features had flow entering the woodlot in Round 1, and no flow in Round 2. Pooling water remained within each feature in the woodlot forming a Mineral Meadow Marsh (MAM2).

DF11 gathered overland flow into a poorly defined channel that flowed south to White Church Road (**Photographs 29-30**). DF11 had flow in Round 1, and no flow in Round 2.

DF12a drained an online pond under White Church Road into Parcel 56 where a poorly defined swale meandered southward through the field (**Photographs 31-33**). DF12c was a poorly defined swale that drained a small, vegetated area into DF12b (**Photographs 34-35**). All features associated with DF12 had flow in Round 1, and no flow in Round 2. Standing water was present in DFs 12b and 12c during the Round 2 assessment.

All reaches associated with DFs 13, 14 and 15 were poorly defined swales that originated in the northern portion of Parcel 47 and flowed southwest through the field (**Photographs 36-42**). Both reaches of DF15 originated in the southern portion of Parcel 3. There was no connection to the pond located in the southwest corner of Parcel 3. DF13b meandered into the western portion of Parcel 56 briefly before it continued off the subject property to the south. All reaches associated with DFs 13, 14, 15 were flowing during Round 1, and had no flow during Round 2.

The field on Parcel 2 which contained DFs 16, 17 and 18 had already been tilled before the Round 1 assessment was completed. The flow paths associated with each feature on **Figure 2** are the original MNRF (MNRF, 2011) mapping lines. The hydrology of each feature was able to be assessed as flow crossing south into the neighbouring parcels was still observable in Round 1. DFs 16 and 17 were found dry during the Round 2 assessment (**Photographs 43-46**).

DF18a gathered overland flow from the northwestern portion of Parcel 2 before forming a poorly defined swale flowing southward into a heavily vegetated area in the southwestern portion of the parcel (**Photograph 47**). Flow from DF18a entered a small, corrugated plastic pipe (HDPE) culvert at the property boundary with the adjacent golf course (**Photographs 48-49**). Water flowed through a series of retention ponds on the golf course lands before it continued into Parcel 34 as DF18b.

DF18b flowed into Parcel 34 as a poorly defined, grassy channel with a wetted width and depth of 0.7 m and 0.05 m, respectively (**Photographs 50-52**). DF18b branched with DF18c in the western portion of the parcel before flowing off property (**Photographs 53-55**). The entirety of DF18 was found to have intermittent hydrology, having flow present in both the Rounds 1 and 2 assessments, but no flow observed in Round 3. It should be noted that irrigational activities on the golf course could have altered the hydrology downstream of the golf course. Dense vegetation occupied the western portions of DF18b and DF18c. No fish were observed during any of the assessments.

4.1.4 Drainage Feature Recommendations

Features were classified following the Evaluation, Classification and Management of Headwater Drainage Features Guidelines (TRCA, 2014). Most features on the property can be mitigated through low-impact developments (LIDs) due to their ephemeral hydrology, lack of riparian vegetation, and lack of terrestrial or fish habitat. Five reaches are classified as conservation or protection due to their connection to the surrounding forest features and riparian vegetation. A HDF management recommendations summary can be found in **Table 2.**

No Management Required

DFs 9 and 10 do not connect with any downstream feature and do not require any management.

Mitigation

All features listed as mitigation exhibited ephemeral hydrology and contributing fish habitat with limited riparian vegetation and terrestrial habitat. Flow associated with spring freshet and heavy rain events can be mitigated through LIDs.

The pond associated with DF4a remained wet year-round and supported breeding amphibians. Further hydrogeology studies are required to determine the hydrology of the pond, however it is assumed that the pond is used as a retention pond for crop irrigation. The guidelines recommend conservation, however due to the likely anthropogenic alteration of the pond and the presence of breeding amphibian habitat nearby, Beacon recommends that it be decommissioned, and its hydrology mitigated through LIDs.

Conservation

DF18b and 18c exhibited valued hydrology and are situated within a Cattail Mineral Shallow Marsh (MAM-2). The guidelines and Beacon recommend that the feature be conserved, and the riparian zone corridor be maintained, relocated, or enhanced.

Protection

DFs 4c, 5a, and 6a are within woodland and wetland communities and have permanent, standing water. These portions of the headwaters act as a breeding ground for amphibian species found within the Fresh-Moist Sugar Maple – Hardwood Deciduous Forest (FOD6-5) communities surrounding the features. The importance of the surrounding riparian vegetation and terrestrial habitat result in the guidelines and Beacon recommending that these features be protected

Table 2. Summary of Drainage Feature Mitigation Recommendations

Drainage Feature Segment	Hydrology	Modifiers	Riparian	Fish Habitat	Terrestrial Habitat	HDFA Management Recommendations	Beacon Management Recommendations
DF1a	Contributing	None	Limited	Contributing	Limited	Mitigation	Mitigation
DF1b	Contributing	None	Limited	Contributing	Limited	Mitigation	Mitigation
DF2	Contributing	Drainage Ditch	Limited	Contributing	Limited	Mitigation	Mitigation
DF3a	Contributing	None	Limited	Contributing	Limited	Mitigation	Mitigation
DF3b	Contributing	None	Limited	Contributing	Limited	Mitigation	Mitigation
DF4a	Contributing	None	Limited	Contributing	Limited	Mitigation	Mitigation
DF4b	Contributing	None	Limited	Contributing	Limited	Mitigation	Mitigation
DF4c	Contributing	None	Important	Contributing	Important	Protection	Protection
DF4d	Contributing	Online Pond	Limited	Contributing	Important	Conservation	Mitigation
DF4e	Contributing	None	Limited	Contributing	Limited	Mitigation	Mitigation
DF5a	Contributing	None	Important	Contributing	Important	Protection	Protection
DF5b	Contributing	Tiled Feature	None	None	None	Mitigation	Mitigation
DF6a	Valued	None	Important	Contributing	Important	Protection	Protection
DF6b	Contributing	None	Limited	Contributing	Limited	Mitigation	Mitigation
DF7	Contributing	Tiled Feature	None	None	None	Mitigation	Mitigation
DF8	Contributing	None	Limited	Contributing	Limited	Mitigation	Mitigation
DF9	Contributing	Unconnected	Important	None	Important	No Management Required	No Management Required
DF10	Contributing	Unconnected	Important	None	Important	No Management Required	No Management Required
DF11	Contributing	None	Limited	Contributing	Limited	Mitigation	Mitigation

Drainage Feature Segment	Hydrology	Modifiers	Riparian	Fish Habitat	Terrestrial Habitat	HDFA Management Recommendations	Beacon Management Recommendations
DF12a	Contributing	Online Pond	Limited	Contributing	Limited	Mitigation	Mitigation
DF12b	Contributing	None	Limited	Contributing	Limited	Mitigation	Mitigation
DF12c	Contributing	None	Limited	Contributing	Limited	Mitigation	Mitigation
DF13a	Contributing	None	Limited	Contributing	Limited	Mitigation	Mitigation
DF13b	Contributing	None	Limited	Contributing	Limited	Mitigation	Mitigation
DF14	Contributing	None	Limited	Contributing	Limited	Mitigation	Mitigation
DF15a	Contributing	None	Limited	Contributing	Limited	Mitigation	Mitigation
DF15b	Contributing	None	Limited	Contributing	Limited	Mitigation	Mitigation
DF16	Contributing	None	Limited	Contributing	Limited	Mitigation	Mitigation
DF17	Contributing	None	Limited	Contributing	Limited	Mitigation	Mitigation
DF18a	Valued	None	Limited	Contributing	Limited	Mitigation	Mitigation
DF18b	Valued	None	Important	Contributing	Limited	Conservation	Conservation
DF18c	Valued	None	Important	Contributing	Limited	Conservation	Conservation

4.2 Ecological Communities

Vegetation communities were mapped and described following the protocols of the Ecological Land Classification (ELC) System for Southern Ontario (Lee *et al.* 1998). This involves delineating vegetation communities on aerial photographs and recording species composition and abundance for each vegetation community. Information on dominant species cover, community structure, level of disturbance, presence of indicator species, vascular plant species and other notable features are also recorded. Both native and non-native species that were encountered were noted and are listed in **Appendix B**.

The ELC groups vegetation communities into two broad categories, naturally occurring communities, and cultural communities. Cultural communities represent vegetated areas that support a plant community that has been strongly influenced by human activities, both past and present, for example the naturalization of a fallowed agricultural field. Vegetation communities on the Study Area are illustrated in **Figure 3.** Photos of the vegetation communities can be found in Appendix B.

Natural Communities

Fresh – Moist Sugar Maple Hardwood Forest (FOD6-5)

This community is found in two locations on Parcel 10 and Parcel 20 of the Study Area. Typical of fresh to moist communities a mixture of upland and wetland species are common due to the presence of ephemeral ponds within the forest. Hence, some wetland species such as Jewelweed (*Impatiens capensis*), Fox Sedge (*Carex vulpinoidea*), and Bladder Sedge (*Carex intumescens*) were also observed. The canopy is primarily comprised of mature Sugar Maple (*Acer saccharum*) in association with Basswood (*Tilia americana*), Shagbark Hickory (*Carya ovata*) and Black Walnut (*Juglans nigra*). Sugar Maple is also dominant in the sub-canopy in association with other trees of mixed ages, including American Beech (*Fagus grandifolia*), Basswood, White Ash (*Fraxinus americana*), and a rare occasion of Ironwood (*Ostrya virginiana*), The understory is sparse and comprised of a mix of White Ash, Choke Cherry (*Prunus virginiana*), and American Beech. The abundance of the last two species varies between polygons. Other species contributing to the diversity of the understory include Ironwood (*Ostrya virginiana*), and Musclewood (*Carpinus caroliniana*), but these species are found in low numbers. The ground layer is equally dominated by Broadleaf Enchanter's Night Shade (*Circea canadensis*), and Rough Avens (*Geum laciniatum*), with occasional patches of Poison Ivy (*Toxicodendron radicans*)

Dry - Fresh Sugar Maple – Beech Deciduous Forest (FOD5 - 2)

This community is found on Parcel 48. This community is dominated by mature Sugar Maple and American Beech. The canopy is predominantly Sugar Maple in association with American Beech, Shagbark Hickory, and Eastern Cottonwood, as well as rare occurrences of Red Oak and Black Cherry. Sugar Maple and American Beech are also equally dominant in the sub-canopy, with Ironwood and Basswood contributing to its diversity. The understory is dominated by Gray Dogwood and Choke Cherry in association with young Ironwood trees. The ground layer is sparse and dominated by patches of Poison Ivy (*Toxicodendron radicans*), and Thicket Creeper (*Parthenocissus vitacea*), but occasionally Frost Aster (*Symphyotrichum pilosum*) stems are found in areas with canopy breaks.

Ephemeral Ponds

Several small ponds (<0.5 ha) are situated within the Fresh Moist Sugar Maple Harwood Forest and a few in Dry – Fresh Sugar Maple – Beech Forest and have been mapped as inclusions due to their small size. Most of these ponds are vegetated, but a few are unvegetated (open water). The plant forms vary from floating to emergent broadleaf and narrowleaf. Three types of vegetation communities are common in these forests. Jewelweed Mineral Shallow Marsh (*MAM2-9*) dominated by Jewelweed in association with Bladder Sedge and Hope Sedge (*Carex lupulina*). *False Nettle Mineral Shallow Marsh* (*MAM2*) is dominated by False Nettle (*Boehmeria cylindrica*) but Jewelweed, Hope Sedge (*Carex lupulina*), and Sensitive Fern (*Onoclea sensibilis*) are notable. Reed Canary Grass Mineral Shallow Marsh (*MAS2*) dominated by Reed Canary Grass (*Phalaris arundinacea*) with occasional Hope Sedge and Sallow Sedge (*Carex lurida*). Common Duckweed (*Lemna minor*) is the most common floating species in the open water areas of these ponds. Non-carex emergent species Rice-cut Grass (*Leersia oryzoides*) and Broadleaf Cattail (*Typha latifolia*) are also common in both communities.

Mineral Swamp Communities (SWD)

Silver Deciduous Swamp (SWD3-2)

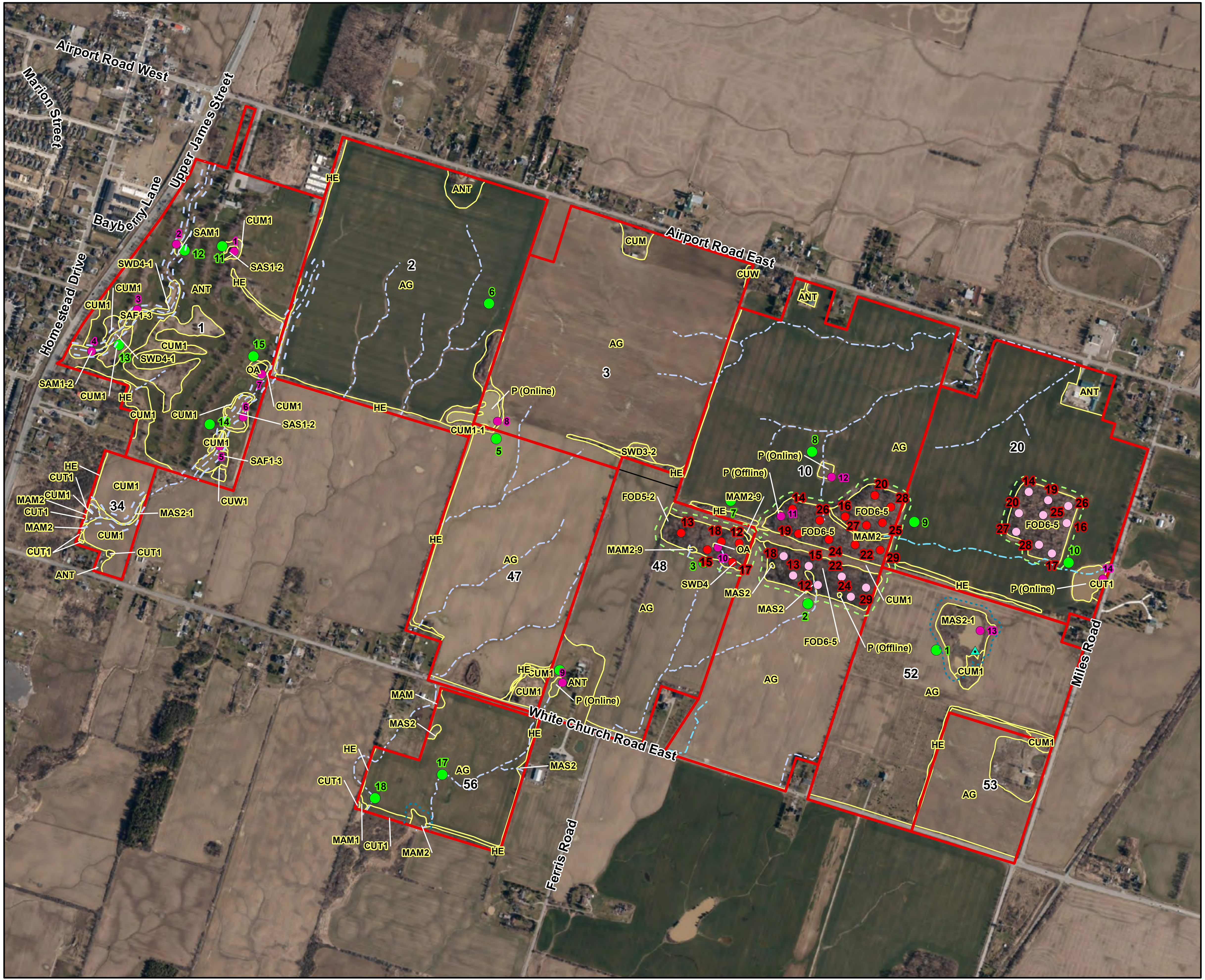
This is a swamp wetland situated in the southeastern limit of Parcel 3. The swamp supports a mixed age of Silver Maple (*Acer saccharinum*), notably in the canopy and sub-canopy. There is a little understory layer and is comprised of a few scattered Red Osier Dogwood (*Cornus sericea*), and young Silver Maple. The ground layer is dominated by Reed Canary Grass, but Jewelweed (*Impatiens capensis*), Beggar Ticks (*Bidens frondosa*), and Lanceleaf Aster (*Symphyotrichum lancaeolatum*) also occur in the peripheries of the wetland.

Trembling Aspen Mineral Deciduous Swamp Type (SWD 4)

This community is situated in the southeastern portion of the Sugar Maple–Beech Forest on Parcel 48 and comprised of a mix of wet and dry knolls. This swamp is dominated by a mixed age stand of Trembling Aspen (*Populus tremuloides*) in association with American Elm (*Umus americana*) in its canopy and sub-canopy. The trembling Aspen is found on dry knolls within the swamp. Its understory is comprised of a mix of Silky Dogwood (C*ornus obliqua*), Meadow Sweet (*Spirea alba*), and Trembling Aspen as well as rare occurrences of American Elm. Wetland obligate species, Common Hope Sedge is dominant in the ground layer, but other species such as Fox Sedge, Lanceleaf Aster (*Symphyotrichum lancaeolatum*) and Reed Canary Grass also contribute to the ground layer diversity).

Willow Mineral Deciduous Swamp Type (SWD 4-1)

Two polygons of this community are situated along the drain west of Parcel 1 (**Figure 3**). The canopy of this swamp is dominated by Crack Willow (*Salix X fragilis*) with rare occasions of Silver Maple (*Acer saccharinum*). The sub-canopy is sparse and dominated by Crack Willow. Silky Dogwood is the most common understory species but mixed with Common Buckthorn (*Rhamnus catharica*) and Tatarian Honey Suckle (*Lonicera tatarica*), especially on the edges of the swamp.



Existing Conditions - Terrestrial Resources

Figure 3

Whitechurch Urban Boundary Expansion

Legend

🟥 Study Area (310 ha)*
☐ Parcel Boundaries*
☐ Ecological Communities
Tiled Drainage Feature
Headwater Drainage Features
Drainage Features + 15 m (City of Hamilton OP)
Wetlands + 15 m (City of Hamilton OP)
Woodlands + 15 m (City of Hamiton OP)
● Amphibian Sample Locations
● Turtle Survey Locations
▲ Threatened and Endangered
● Acoustic Bat Detectors (Round 1)
● Acoustic Detector Locations (Round 2)

Code	Wetland Communities
MAM2	Mineral Meadow Marsh
MAM	Meadow Marsh
MAM1	Bedrock Meadow Marsh
MAM2-9	Jewelweed Mineral Meadow Marsh
MAS2	Mineral Shallow Marsh
MAS2-1	Cattail Mineral Shallow Marsh
SWD4	Mineral Deciduous Swamp
SWD4-1	Willow Mineral Deciduous Swamp
	Aquatic Communities
OA	Open Water
P (Offline)	Pond
P (Online)	Pond
SA	Shallow Water
SAF1-3	Duckweed Floating-leaved Shallow Aquatic
SAM1	Mixed Shallow Aquatic
SAM1-2	Duckweed Mixed Shallow Aquatic
SAS1-2	Waterweed Submerged Shallow Aquatic
	Forest Communities
FOD6-5	Fresh-Moist Sugar Maple - Hardwood Deciduous Forest
FOD5-2	Dry - Fresh Sugar Maple - Beech Deciduous Forest
	Cultural Communities
CUM1	Mineral Cultural Meadow
CUM1-1	Dry - Moist Old Field Meadow
CUW1	Mineral Cultural Woodland
CUT	Cultural Thicket
CUT1	Mineral Cultural Thicket
CUM	Cultural Meadow
CUW	Cultural Woodland
	Other Communities
AG	Agricultural
ANT	Anthropogenic
HE	Hedgerow

*Boundaries are approximate

BEACON ENVIRONMENTAL

Project: 223152
Last Revised: December 2024

Client: Whitechurch Landowners Group Inc.

Prepared by: BD
Checked by: AP

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The ground layer is comprised of a mixture of Jewelweed, Narrowleaf Cattail (*Typha latifolia*), and American Bugleweed (*Lycopus americanus*) on the banks of the drain. Tatarian Honeysuckle saplings are also notable in the peripheries of the swamp.

Mineral Marsh Communities (MAM)

These communities are associated with a network of drainage features that traverses all subject properties, but a few are associated with shallow ponds (**Figure 3**). Two types of marsh communities were identified during the ELC surveys include:

Meadow Marsh/Mineral Meadow Marsh (MAM/MAM2)

These communities are small areas throughout the study area which are dominated by Reed Canary Grass, with rare occasions of cattail species.

MAS2 Mineral Shallow Marsh/MAS2-1 Cattail Mineral Shallow Marsh (MAS2/MAS2-1)

This community is dominated almost entirely by Narrowleaf Cattail and Broadleaf Cattail mixed with Reed Canary Grass. There are open water communities within the marsh area. It is our understanding from the Landowner Group that this wetland community was historically an irrigation pond used for agricultural purposes.

Aquatic Communities

These communities are found in shallow water ponds associated with the drain network that traverses the Study Area. Most of these ponds are vegetated, but a few are unvegetated (i.e., open water). The dominant plant forms are floating and submergent, but emergent broadleaf and narrowleaf also occur. The aquatic communities identified during ELC surveys are as follows:

Open Water/Open Aquatic (OA/OAO)

These are shallow water unvegetated ponds that have been historically dug and used for anthropogenic purposes, specifically irrigation.

SAF1-3 Duckweed Floating-leaved Shallow Aquatic

This community is dominated by floating emergent Common Duckweed, but non-carex broadleaf emergent species such as Rice-cut Grass, Reed Canary Grass, and Broadleaf Cattail are also found in very shallow ends of the pond. Other species include Purple Loosestrife (*Lythrum salicaria*), American Bugleweed, and Riverbank Grape which form a vegetation cover on the banks. A few shrub species such as Sandbar Willow (*Salix interior*) and Red Osier Dogwood (*Cornus sericea*) form the understory but are rare within this community).

Mixed Shallow Aquatic/Duckweed Mixed Shallow Aquatic (SAM1/SAM1-2)

This community is dominated by Common Duckweed in association with submergent Canadian Waterweed (*Elodea canadensis*). Broadleaf Cattail, Narrowleaf Cattail, and Rice-cut Grass are occasional in the edges of water. The Mixed Shallow Aquatic community composition is similar to the Duckweed Mixed Shallow Aquatic but has a notable abundancy of algae species.

SAS1-2 Waterweed Submerged Shallow Aquatic

This community is dominated by Canadian Waterweed, but its banks are covered with broadleaf wetland species such as Fox Sedge, Common Beggar-ticks (*Bidens frondosa*), and American Bugleweed.

Cultural Communities (CU)

These communities are found throughout the subject properties and include meadows, thickets, and woodlands. The description of these communities is presented below.

Cultural Meadow/Dry - Moist Old Field Meadow (CUM1/CUM1-1)

These communities are found in all subject properties. Some occur as inclusions in the peripheries of ponds. Cultural meadow communities are often dominated by herbaceous species typically found in plant communities that were previously or recently influenced by human activity. Species such as Queen Ann's Lace (*Daucus carrota*), Redtop (*Agrostis gigantea*), and Reed Canary Grass (*Phalaris arundinacea*) are the most notable in the ground layer, but Common Milkweed (*Asclepias syriaca*) and Tall Goldenrod (*Solidago altissima*) occasionally present throughout the area. Saplings of Gray Dogwood, Hawthorn (Crataegus sp.), Staghorn Sumac (*Rhus typhina*), Silky Dogwood, as well as tree species including American Elm, Eastern Cottonwood (*Populus deltoides*) and White Ash (*Fraxinus americana*), are also present but on rare occasions.

Cultural Woodland/Mineral Cultural Woodland (CUW/CUW1)

Two polygons of this community type are found in Parcels 1 & 3 (**Figure 3**). This successional community dominated by a mix of mid-age and young poplar trees. Trembling Aspen is dominant species in the sub-canopy and the understory; but Staghorn Sumac and non-native the European Buckthorn and Black Locust also comprise the understory. In contrast, the canopy is sparse and comprised of mature Silver Maples. The ground layer is typical of the pioneer communities, dominated by species often found in cultural meadows these include Redtop, Tall Goldenrod and Lanceleaf Aster. Other ground layer species include Rough Avens, Field Strawberry (*Fragaria virginana*), Heal-all (*Prunella vulgaris*), and Riverbank Grape (*Vitis riparia*) scattered among Tall Goldenrod and Lanceleaf Aster patches.

Mineral Cultural Thicket (CUT)

Two polygons of this community type are situated in the southern portions of Parcel 56. This community is comprised mostly of Grey Dogwood with Hawthorn species. Dogwood is the most notable of two shrubs in the understory. Wild Raspberry and Tall Goldenrod are the most common herbaceous species in the ground layer.

Hedgerow (*HE*)

Hedgerows occur on all properties within the subject lands, but the species composition varies between properties. These communities often support a mix of shrub species, including Common Buckthorn, Downy Hawthorn (*Crataegus mollis*), Gray Dogwood (*Corns racemosa*), Silky Dogwood, Tatarian Honey Suckle, and Staghorn Sumac. They also support an array of tree species, including Freeman's Maple (*Acer X fremanii*), Sugar Maple, Shagbark Hickory, White Spruce (*Picea glauca*), and Trembling Aspen. The ground cover is represented by a mix of native and non-native species such as Fox Sedge, Tall Goldenrod, Garlic Mustard (*Alliaria petiolata*), Redtop, Lanceleaf Aster, Grass-leaf Goldenrod (*Euthamia graminifolia*), and Queen Ann's Lace.

4.3 Flora

A total of 221 vascular plant species were recorded in the study area during ELC surveys conducted by Beacon between August 2023 and October 2024. Of these, 149 (67%) of the species are considered native to Ontario, and 72 (33%) are non-native to Ontario, which is reflective of the agricultural land use history of the study area. 147 of the native species are considered provincially common and secure (ranked S5 or S4 provincially by NHIC), one species is considered rare to uncommon Pignut Hickory (*Carya glabra*), and one doesn't have an S-Ranking (SNA). The remaining 72 species are considered provincially exotic (SE). Additionally, the Carolinian Zone species list ranked 123 of the native species as common (C), and 2 native species as rare (R); these are Pignut Hickory and Switch Grass (*Panicum virgatum*). Similar to the NHIC raking, 69 of the species are considered introduced (I), and 27 do not have any rank. A plant list is included in **Appendix B.**

4.4 Breeding Birds

A total of 50 species of breeding birds were observed to be breeding in the Study Area (**Appendix C**). This species diversity is reflective of the habitat present dominated by agricultural areas in addition to areas of woodland, wetland and meadow as discussed in the preceding sections. Observations were made throughout the study area however were largely concentrated within the woodlands and hedgerows.

The avian community was comprised mostly of generalist and open habitat species, with some edge and forest specialists. The most numerous species included Red-winged Blackbird (*Agelaius phoeniceus*), American Robin (*Turdus migratorius*), Song Sparrow (*Melospiza melodia*), and Savannah Sparrow (*Passerculus sandwichensis*).

These species had total territories ranging between 96 and 28. Other species with multiple observations, however in less abundance, included Brown-headed Cowbird (*Molothrus ater*), European Starling (*Sturnus vulgaris*), Yellow Warbler (*Setophaga petechia*), and American Goldfinch (*Spinus tristis*).

In addition to the woodland species, the wetland communities on the subject property supported several species that typically rely on or are closely associated with wetland habitats to fulfill their life cycle. Such species included: Yellow Warbler (*Setophaga petechia*), Common Yellowthroat, Red-winged Blackbird, Spotted Sandpiper (*Actitis macularia*), Swamp Sparrow (*Melospiza georgiana*), Mallard (*Anas platyrhynchos*), Green Heron (*Butorides virescens*), and Willow Flycatcher (*Empidonax traillii*).

The open landscape which dominated the Study Area supported both agricultural and grassland elements, and supported birds such as Savannah Sparrow, Vesper Sparrow (*Pooecetes gramineus*), Killdeer (*Charadrius vociferus*), and Song Sparrow.

As discussed in the preceding sections, a number of hardwood forests were delineated on the property and subsequently supported woodland specialist birds. These included Rose-breasted Grosbeak (*Pheucticus ludovicianus*), Red-bellied Woodpecker (*Melanerpes carolinus*), Northern Flicker (*Colaptes auratus*), Eastern Wood-Pewee (*Contopus virens*), and Carolina Wren (*Thryothorus ludovicianus*).

Area-sensitive birds are those that require larger tracts of suitable habitat in which to breed or are those that have a higher breeding success in larger areas of suitable habitat. Three such species were recorded. Two of these were considered to be forest-sensitive species: White-breasted Nuthatch (*Sitta carolinensis*) and American Redstart (*Setophaga ruticilla*). The remaining species, Savannah Sparrow, was considered a grassland area-sensitive species. Three territories of White-breasted Nuthatch were recorded, two of American Redstart, and 28 of Savannah Sparrow.

Least Bittern, a provincially and federally threatened bird was recorded on Parcel 52 in the MAS 2-1 community. No other provincially ranked as S1 through S3 (Critically Imperiled through Vulnerable) were recorded nesting, nor were any nesting species regulated under the ESA. Bank Swallow was documented foraging during a breeding bird survey, however, it is unlikely to be nesting anywhere on the properties as no open bank nesting habitat for burrowing was observed. Eastern Wood-Pewee (*Contopus virens*) is listed as Special Concern, and Barn Swallow (*Hirundo rustica*) is listed as Special Concern and both were recorded within the Study Area.

Three territories of Eastern Wood-Pewee were recorded in three wooded valleyland areas on property 10a, 10b and 10c. Though this species is special concern provincially and federally based on a declining trend over their range, these birds remain relatively common in both urban and urbanizing woodlands. They are somewhat tolerant of forest fragmentation and will live in both edge habitats and forest interiors. Barn Swallows could be nesting on the outside or inside of any buildings on the property, and one building was noted as a likely nesting site on Parcel 52. Bank Swallows were recorded solely foraging through the site and are not breeding as no open bank nesting habitat for burrowing was observed.

4.5 Reptiles and Amphibians

4.5.1 Breeding Amphibians

Breeding amphibian surveys were conducted in 2023 and 2024. In total, six species of amphibians have been detected on the subject property: Grey Treefrog, Spring Peeper, Western Chorus Frog, Northern Leopard Frog, Green Frog, and American Toad. All survey stations were surveyed at least once in each of the three survey windows across both years.

See **Table 3** below for a summary of results by survey location, and **Figure 3** for a map of survey locations.

Table 3. Breeding Amphibian Survey Results

Station	Results
1	This wetland supports large numbers of amphibians, with Spring Peepers and Gray Treefrogs found in large numbers, and Green Frog and American Toad also detected.
2	Spring Peeper was found in large numbers in these forested wetlands
3	Spring Peeper and Gray Treefrog are found in large numbers in these forested wetlands, with American Toad also detected.
4	Small numbers of Gray Treefrog were found in this pond.
5	Large numbers of American Toad, and small numbers of Green Frog and Gray Treefrog were found in this artificial pond.
6	No amphibian species were detected at this location.
7	Large numbers of Spring Peeper and Gray Treefrog were found at these forested wetlands.
8	The only amphibian detected in this artificial pond were small numbers of Green Frog
9	No amphibian species were detected at this location.
10	The only amphibians detected at this location were one Green Frog and two American Toads.
11	Small numbers of Green Frogs were detected at this pond.
12	Small numbers of Green Frogs were detected at this pond.
13	Small numbers of Green Frogs and Gray Treefrogs were detected at this pond.
14	Small numbers of Green Frogs were detected at this pond.
15	Single Green Frog and Northern Leopard Frog were detected at this pond.
17	No amphibians were detected at this location, and the previously identified habitat is no longer present.
18	Small numbers of Western Chorus Frog and Gray Treefrog were heard calling at this location from a pond outside the subject property.

4.5.2 Reptiles

Surveys completed for turtles revealed that several species of turtles occur within the subject property **see Figure 3** for a map of survey locations.

Midland Painted Turtle (*Chrysemys picta*) is widespread, with sightings in nearly every permanent waterbody, with the exception of the ponds adjacent to amphibian survey points 8 and 10 (**Figure 3**). Snapping Turtle (*Chelydra serpentina*) was found at one location; however basking surveys do not reliably detect this species, and it is likely also widespread. One individual of the non-native Red-eared Slider (*Trachemys scripta*) was observed. No turtles were observed within the forested wetlands towards the eastern end of the subject property.

One species of snake, Eastern Gartersnake (*Thamnophis sirtalis sirtalis*) was also observed during field investigations.

4.6 Bat Acoustic Analysis

Thirty-two acoustic monitoring locations were installed within suitable habitat (i.e. woodlands) within the study area. Eight bat species were documented within the subject property: Big Brown Bat (*Eptesicus fuscus*), Eastern Red Bat (*Lasiurus borealis*), Hoary Bat (*Lasiurus cinereus*), Silver-haired Bat (*Lasionycteris noctivagans*), Eastern Small-footed Myotis (*Myotis leibii*), Little Brown Myotis (*Myotis lucifugus*), Northern Long-Eared Myotis (*Myotis septentrionalis*) and Tri-colored Bat (*Perimyotis subflavus*). Additionally, unidentified Myotis species were recorded. As the call spectrograms of all three Myotis species have overlapping characteristics, it can sometimes be difficult to differentiate between them. The results of the acoustic analysis are summarized in **Appendix D,** listing the total number of detections of each species over the monitoring period.

Of the species recorded, four are listed as endangered under the ESA: Little Brown Myotis, Eastern Small-footed Myotis, Northern Long-Eared Myotis, and Tri-colored Bat.

An analysis of the data was conducted and the acoustic monitoring results indicate the following:

- A total of 612 Eastern Small-footed Myotis calls were recorded in FOD6-5, which suggests that the FOD6-5 on the subject property provides general habitat for Eastern Small-footed Myotis.
- A total of 15 Little Brown Myotis calls were recorded in FOD5-2, this suggests that the FOD5-2 on the subject property provides general habitat for Little Brown Myotis.
- Northern Myotis calls were recorded twice within FOD6-5, this suggests that the FOD6-5 on the subject property does not serve as general habitat for Northern Myotis.
- One Tri-Colored Bat call was recorded in FOD6-5, this suggests that the FOD6-5 on the subject property does not serve as general habitat for Tri-colored bats.

4.7 Endangered or Threatened Species

As described in the preceding sections, Beacon staff conducted both desktop and on-site investigations to assess whether any endangered or threatened species were likely to occur on or within a 5-kilometer (km) radius of the subject property. **Table 4** provides Beacon's assessment based on the results of field and desktop investigations combined with knowledge of the habitat preferences and natural history of the species being considered.

Table 4. Endangered or Threatened Species

Species	Status on SARO List	Were Species and or/Habitat Documented during on-site Assessment?
Birds		
Acadian Flycatcher, *Empidonax virescens*	END	**No**, these birds nest in large mixed woodlands and were not detected during breeding bird surveys.
Bank Swallow, *Riparia riparia*	THR	**Yes**, a Bank Swallow was documented foraging during a breeding bird survey, however, it is unlikely to be nesting anywhere on the properties as no open bank nesting habitat for burrowing was observed.
Barn Owl, *Tyto alba*	END	**No,** this species generally nests in structures or mature tree hollows and were not detected during surveys. This species is understood to be exceptionally rare in Ontario.
Bobolink, *Dolichonyx oryzivorus*	THR	**No,** this species was not recorded during breeding bird surveys, as it requires extensive meadow habitat which is absent on the property.
Chimney Swift, *Chaetura pelagica*	THR	**No,** this species was not recorded during breeding bird surveys, and it is unlikely to be on property as suitable habitat, vertical columns, are absent.
Eastern Meadowlark, *Sturnella magna*	THR	**No,** this species was not recorded during breeding bird surveys, as it requires extensive meadow habitat which is absent on the property.
Least Bittern, *Ixobrychus exilis*	THR	**Yes,** this species was recorded during the breeding bird surveys using the MAS2-1 on Parcel 52 to carry out its life processes.
Louisiana Waterthrush, *Parkesia motacilla*	THR	**No,** this species was not documented during breeding bird surveys, and it is unlikely to be on property, as it is usually found in steep, forested ravines with fast-flowing streams, which are absent on the property.
Red-headed Woodpecker, *Melanerpes erythrocephalus*	END	**No,** none were documented during breeding bird surveys, suitable habitat includes open woodland, which is present on the property.
Short-eared Owl, *Asio flammeus*	THR	**No,** none were documented during field investigations, suitable habitat includes grasslands, which are present in the property, however the bulk of the property was agricultural.
Yellow-breasted Chat, *Icteria virens*	END	**No,** none were documented during field investigations, and suitable habitat is thickets and scrub, which is absent on the property.
Mammals		
Eastern Small-footed Myotis, *Myotis leibii*	END	**Yes**, suitable habitat for endangered bats is present in the FOD 5-2 and FOD 6-5 on the subject property as discussed in section 4.6.
Little Brown Myotis, *Myotis lucifugus*	END	
Northern Myotis, *Myotis septentrionalis*	END	
Tri-coloured Bat, *Perimyotis subflavus*	END	

Species	Status on SARO List	Were Species and or/Habitat Documented during on-site Assessment?
Aquatic Species		
Black Redhorse, *Moxostoma duquesnei*	THR	**No,** perennial watercourses and suitable habitat are absent in subject area. Suitable habitat may be present in extended 5-km radius.
Vascular Plants (Dicots)		
Butternut, *Juglans cinerea*	END	**No**, species was not recorded during field surveys, however, suitable habitat for Butternut is present in the edges of the treed communities and the hedgerows within the Study Area.
Spotted Wintergreen, *Chimaphila maculata*	THR	**No**, species was not recorded during field surveys, there are no dry-fresh oak dominated or Oak Pine Mixed forests within the Study Area.
Amphibians		
Jefferson's Salamander, *Ambystoma jeffersonianum*	END	**No**, suitable habitat for Jefferson's Salamander is not present due to absence of vernal pools.

Key: SARO Species at Risk in Ontario List EN: Endangered; THR Threatened; ORAA Ontario Reptile and Amphibian Atlas; NHIC Natural Heritage Information Centre

4.8 Significant Wildlife Habitat (SWH)

SWH designation is the responsibility of the planning authority and determination of it on a site-by-site basis is generally not an appropriate method to determine this constraint given that it is necessary to understand the context of the habitat within the local environment. In this case, the City of Hamilton has not identified SWH within their jurisdiction. There is guidance provided in two provincial documents: the Significant Wildlife Technical Guide (OMNR 2000), the Natural Heritage Reference Manual (MNRF 2010), and the Significant Wildlife Habitat Criteria Schedules for Ecoregion 7E (MNRF 2015).

According to the Significant Wildlife Technical Guidelines (OMNR 2000), there are four main categories of Significant Wildlife Habitat (SWH):

- Seasonal Concentration Areas of Animals;
- Rare Vegetation Communities or Specialized Habitat for Wildlife;
- Habitat for Species of Conservation Concern; and
- Animal Movement Corridors.

Within each of these categories, there are multiple types of SWH, each intended to capture a specialized type of habitat that may or may not be captured by other existing feature-based categories (e.g., significant wetlands, significant woodlands).

The Significant Wildlife Habitat Criteria Schedules for Ecoregion 7E (MNRF 2015) was used to screen for potential SWH. The analysis and results of this screening are presented in **Table 5**.

Table 5. Assessment of Significant Wildlife Habitat Within Study Area

Wildlife Habitat Category	Presence or Absence on Subject Lands Based on MNRF Criteria for Ecoregion 7E	
	Absent	Confirmed Present
Seasonal Concentration Areas for Wildlife Species		
Waterfowl Stopover and Staging Areas (Terrestrial)	X	
Waterfowl Stopover and Staging Areas (Aquatic)	X	
Shorebird Migratory Stopover Area	X	
Raptor Wintering Area	X	
Bat Hibernacula	X	
Bat Maternity Colonies		X
Bat Migratory Stopover Area	X	
Turtle Wintering Areas	X	
Reptile Hibernaculum	X	
Colonially-Nesting Bird Breeding Habitat (Bank and Cliff)	X	
Colonially-Nesting Bird Breeding Habitat (Tree/Shrubs)	X	
Colonially-Nesting Bird Breeding Habitat (Ground)	X	
Migratory Butterfly Stopover Areas	X	
Land bird Migratory Stopover Areas	X	
Deer Yarding Areas	X	
Deer Winter Congregation Areas	X	
Rare Vegetation Communities		
Cliffs and Talus Slopes	X	
Sand Barren	X	
Alvar	X	
Old Growth Forest	X	
Tallgrass Prairie	X	
Savannah	X	
Provincially Rare S1, S2 and S3 vegetation communities	X	

Wildlife Habitat Category	Presence or Absence on Subject Lands Based on MNRF Criteria for Ecoregion 7E	
	Absent	Confirmed Present
Regionally or Locally Rare vegetation communities	X	
Specialized Habitats of Wildlife		
Waterfowl Nesting Area	X	
Bald Eagle and Osprey Nesting, Foraging and Perching Habitat	X	
Woodland Raptor Nesting Habitat	X	
Turtle Nesting Areas	X	
Seeps and Springs	X	
Amphibian Breeding Habitat (Woodland)		X
Amphibian Breeding Habitat (Wetlands)	X	
Woodland Area-Sensitive Bird Breeding Habitat	X	
Habitats of Species of Conservation Concern		
Marsh Bird Breeding Habitat	X	
Open Country Bird Breeding Habitat	X	
Shrub/Early Successional Bird Breeding Habitat	X	
Terrestrial Crayfish	X	
Special Concern and Rare Wildlife Species		X
Animal Movement Corridors		
Amphibian Movement Corridors	X	
Deer Movement Corridors	X	

In summary, this analysis has determined that there are three types of significant wildlife habitat. The categories where SWH occur are the Seasonal Concentration Areas for Wildlife Species category, bat maternity colonies, Specialized Habitat of Wildlife Amphibian Breeding Habitat (woodlands) and Habitats of Species of Conservation Concern. A bat habitat assessment was conducted in April 2024 which identified the areas of suitable habitat for endangered bats. Based on the results of the breeding amphibian surveys, a full chorus of Spring Peepers and Grey Treefrog were recorded calling during the survey period. Due to the number of amphibians recorded and available wetland habitat within the woodland has determined that Station 3 is considered SWH. Three territories of Eastern Wood Peewee were also recorded on the subject property within the woodland community.

4.9 Summary of Key Natural Features

Table 6 provides a summary of the natural heritage features that have been identified and which need to be addressed with respect to potential development impacts based on field investigations completed in 2023 and 2024.

Table 6. Summary of Natural Heritage Features

Feature	Key Functions and Attributes
Provincially Significant Wetlands	• Based on LIO data, no Provincially Significant Wetlands (PSW) have been identified by MNRF within the Study Area.
Other Wetlands	• Additional wetland units that were present through field surveys as well and are indicated as additional wetland units on **Figure 3**. • Botanical composition and characterization of the identified wetlands is provided under Section 4.2. • Wetland communities include all SWD and MAM communities.
Watercourses & Fish Habitat	• Two watercourses are present on the golf course lands on the western proportion of the property and is considered fish habitat. • Additional DFs are present which are ephemeral in nature as shown on **Figure 2.** • Man-made irrigation ponds are present on the property. • Fish Habitat is not present within the DFs, but is likely present in the golf course watercourse.
Significant Wildlife Habitat	• SWH was identified for the following categories: o Bat maternity colonies; o Amphibian Breeding Habitat (woodlands)
Threatened and Endangered Species Habitat	• Seasonal surveys have confirmed that there is suitable habitat for endangered bats within the FOD 5-2 and FOD 6-5. Should any removals be proposed, consultation with MECP will be required to ensure compliance with the ESA. • Least Bittern, a provincially and federally threatened bird, was recorded in the MAS2-1 on property 52. This species is protected under the ESA and SARA, and consultation with MECP will be required to develop or remove the feature.
Significant Woodlands	• Based on the criteria set out by the City of Hamilton, significant woodlands are present within the Study Area including FOD communities.

5. City of Hamilton Natural Heritage System

The City of Hamilton Official Plan presents a Natural Heritage System (NHS) which consists of the Niagara Escarpment Plan area, and Core Areas and Linkages identified by the City, based on requirements of the Provincial Planning Statement. The NHS approach of the City of Hamilton involves delineating a NHS which includes Core Areas, as well as supportive features (Linkages) that maintain the ecological functionality and connectivity of the natural system. The NHS for the Study Area is shown on Schedule B of the Rural Hamilton Official Plan.

Figure 4 illustrates the natural features present within the Study Area in accordance with the City's mapping and NHS criteria based on seasonal surveys conducted to date. The presence of these features does not impede the lands from being brought into a Settlement Area; rather this information can be used to develop a fulsome NHS as the project moves forward.

5.1.1 Environmentally Significant Areas

No Environmentally Significant Areas have been identified within the study area on the City of Hamilton Official Plan Mapping.

5.1.2 Aquatic Habitat and Drainage Features

Drainage features and associated aquatic habitat within the Study Area based on seasonal surveys have been illustrated on **Figure 4**.

5.1.3 Wetlands

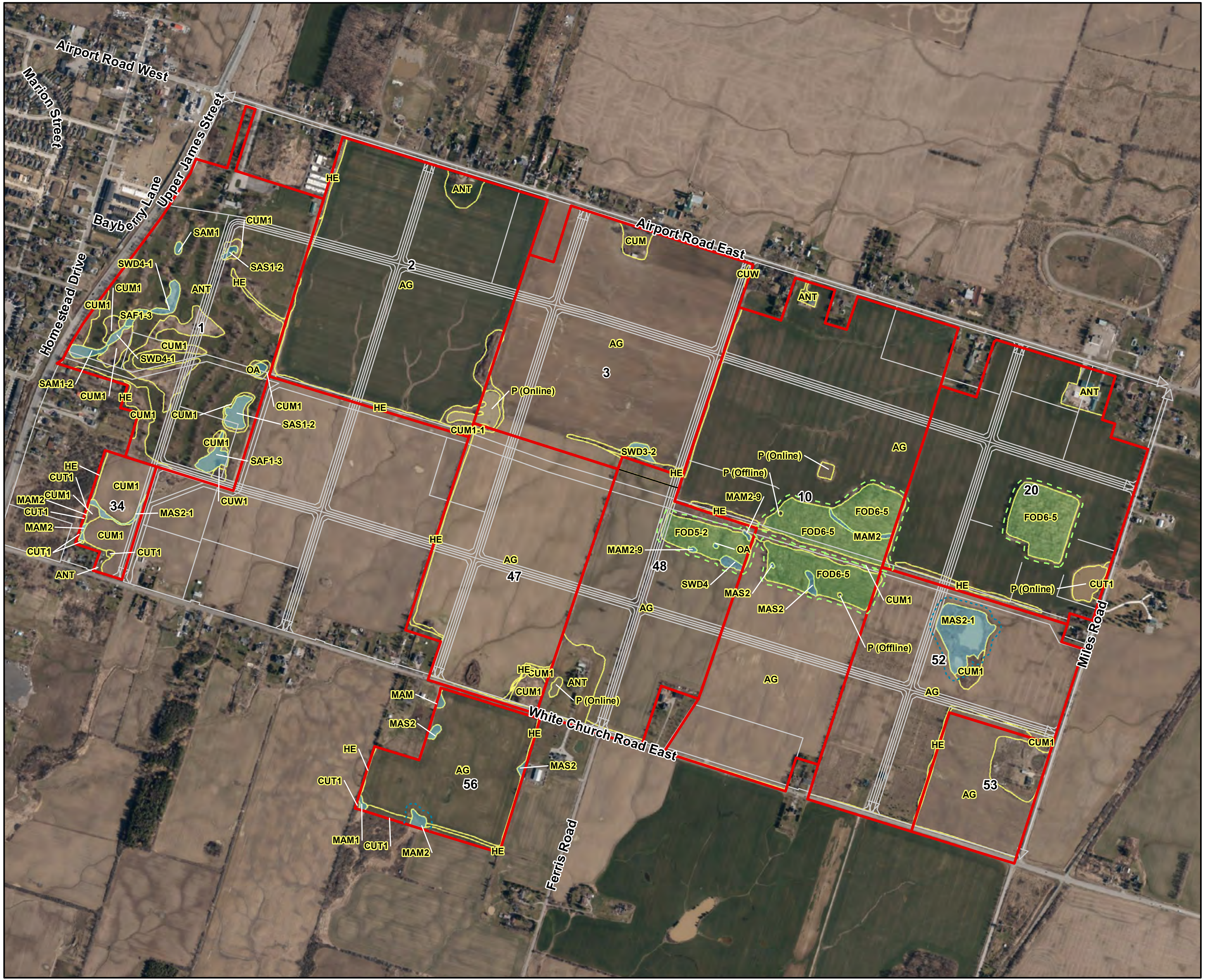
No wetlands are shown on Schedule B4 of the Official Plan. Wetlands were identified during field investigations within the study area and are illustrated on **Figure 4**. No PSW were identified on the subject property.

A single wetland on Parcel 52 was identified as habitat for a threatened species.

5.1.4 Significant Woodlands

Significant Woodlands are generally depicted in Schedule B2 of the City's Official Plan. In the City of Hamilton, a woodland must meet at least two of the following criteria to qualify as significant:

- Size – Minimum patch size for significance is based on forest cover by planning unit:
    - < 5 % forest cover - 1 ha;
    - 5-10 % forest cover - 2 ha;
    - 11-15 % forest cover - 4 ha;
    - 16-20 % forest cover - 10 ha;
    - 21-30 % forest cover - 15 ha;



Boundary Expansion and Natural Features

Figure 4

Whitechurch Urban Boundary Expansion

Legend

- 🟥 Study Area (310 ha)*
- ☐ Parcel Boundaries*
- — Proposed Development
- ☐ Ecological Communities
- 🟦 Wetlands (Beacon)
- - - - Wetlands + 15 m (City of Hamilton OP)
- 🟩 Woodlands (Beacon)
- - - - Woodlands + 10 m (City of Hamilton OP)

*Boundaries are approximate

BEACON ENVIRONMENTAL

Project: 223152
Last Revised: December 2024

Client: Whitechurch Landowners Group Inc.

Prepared by: BD
Checked by: AP

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Contains information licensed under the Open Government License– Ontario Orthoimagery Baselayer: FBS Hamilton Wentworth Region (2023)

C:\ODB\OneDrive - Beacon Environmental\GeoSpatial\Geo Projects\2023\223152 Mount Hope Secondary Plan Extension Area EIS\MXD\20241206_Figure04_BoundaryExpansionandNaturalFeatures_223152.mxd

- Interior Forest - Woodlands that contain interior forest habitat. Interior forest habitat is defined as 100 metres from edge;
- Proximity/Connectivity - Woodlands that are located within 50 metres of a significant natural area (defined as wetlands 0.5 hectares or greater in size, ESAs, PSWs, and Life Science ANSIs);
- Proximity to Water - Woodlands where any portion is within 30 metres of any hydrological feature, including all streams, headwater areas, wetlands, and lakes;
- Age - Woodlands with trees of 100 years or more in age; and
- Rare Species - any woodland containing threatened, endangered, special concern, provincially or locally rare plant or wildlife species.

In determining significance, the Official Plan states that “woodlands shall meet a minimum average width of 40 metres.”

Schedule B-2 of The City’s Rural Official Plan identifies a number of “Significant Woodlands” within the Study Area. These woodlands identified by the OP and through seasonal surveys have been illustrated on **Figure 4**.

5.1.5 Threatened and Endangered Species Habitat

Habitat for threatened or endangered was identified though desktop review and field investigations for endangered bats and Least Bittern.

5.2 Buffers/Vegetation Protection Zones

The physical separation of development or land use changes from a natural feature (e.g., woodlands, wetlands, watercourses) using buffers or vegetated protection zones (VPZs) is often used for softening or reducing the impacts of land use changes on adjacent natural features (OMNR 2010). Buffers or VPZs can provide a number of benefits to natural features including reducing encroachments, reducing noise and light impact (particularly if the buffers contain dense vegetation), protecting root zones, enhancing woodland interior, and attenuating runoff (OMNR 2010).

While buffers or VPZs may sometimes be prescribed based on policy, determining whether a buffer is required and/or establishing an appropriate buffer width requires consideration of the sensitivity of the feature and its ecological functions and the nature of the proposed change in adjacent land uses or activities. Buffers/VPZs are recommended based on their ability to protect existing natural features and their associated ecological functions from changes to adjacent land uses and activities. Buffers represent one of many tools available for mitigating impacts to natural heritage features.

Policy 2.5.10 of the City of Hamilton Urban Official Plan provides the following guidance for minimum vegetation protection zones. The Official Plan allows for the determination of vegetation protection zone widths through the completion of a subwatershed study as per Section 2.1.10.

Based on the sensitivity, ecological and hydrological functions of the core NHS components within the Study Area, the minimum MVPZs outlined below are considered appropriate for the Study Area; therefore, the following VPZ were applied:

Woodlands

A 10 m VPZ from all woodlands is sufficient as it will protect the health and condition of the trees. By applying a 10 m VPZ it will also protect critical root zones for individual trees within the woodland community from potential impacts during construction (Carolinian Canada 2003).

Wetlands

There are no PSWs within the Study area however PSWs will require a 30 m VPZ should they be identified. Unevaluated or locally significant wetlands will require 15 m VPZ. A 15 m VPZ is sufficient within the study area given that the wetlands are commonly disturbed from ongoing uses (e.g., golf course or agricultural). These communities are relatively monocultural, have lower biodiversity and habitat functions.

Watercourses and Fish Habitat

A watercourse on the Southern Pines Golf course has been identified as a fish habitat. The following buffers are prescribed based on thermal regime and type of fish habitat.

Warmwater Watercourses and Important or Marginal Fish Habitat will require a 15 m VPZ to protect the feature and its functions.

Cool or Coldwater Watercourses or Critical Fish Habitat will require a 30 m VPZ due to the sensitivity of the feature and habitat.

Habitat of Threatened and Endangered Species

In accordance with the Endangered Species Act requirements consultation with MECP will be required to confirm the recommended buffers on the habitat features is sufficient for the species identified in the Study Area.

It is recommended that VPZs be planted with native species to restore and enhance the ecological condition and function of the VPZs, particularly where they extend over previously disturbed areas such agricultural fields. VPZ should be preserved in a naturalized condition to maintain their protective ecological functions.

These VPZs have been applied to the features identified on **Figure 4**.

5.3 Linkages

The importance of maintaining, and where possible improving, connections between and among protected natural features and areas, particularly in urbanizing settings, is well-recognized in the scientific literature (e.g., see papers cited in Environment Canada 2013).

The City of Hamilton Official Plan defines Linkages as natural areas within the landscape that ecologically connect Core Areas. Connections between natural areas provide opportunities for plant and animal movement, hydrological and nutrient cycling, and maintain ecological health and integrity of the overall NHS. It is intended that Linkages be protected, restored, and enhanced to sustain the Natural Heritage System wherever possible.

No linkage features have been identified within the Study Area in the Official Plan mapping.

5.4 Restoration and Enhancement Areas

The City's Official Plan recognizes Core Areas, Linkages, "and the matrix of lands between them which may be suitable for restoration" as components of the NHS. This approach implements PPS natural heritage s. 2.1.2 which states that the: "The diversity and connectivity of natural features in an area … should be maintained, restored or, where possible, improved…" and the definition of Natural Heritage System which includes "...lands which have been restored or have the potential to be restored to a natural state…". These policies recognize that the ecological integrity of natural areas is often impaired due to land use transformations (e.g., clearing for agriculture or urbanization) and that in such areas, opportunities may exist to restore or enhance core areas of the NHS through a variety of management and stewardship measures either within or adjacent to core areas.

Any non-significant natural heritage features that are proposed for removal must be compensated within and connected to the NHS to prevent fragmented portions of natural features across the landscape. Removal of natural features should be considered a last-case resort where no other alternatives are viable or feasible to maintain the features in place.

Restoration areas are not explicitly identified or mapped in the City's Official Plan and have not been addressed in this report and will be identified as part of the Phase 2 SWS Report within the Proposed NHS.

5.5 Natural Hazard Constraints

Natural hazards, including areas prone to flooding and erosion, are not identified by the City of Hamilton as Core Areas of the NHS; however, such areas are regulated by the Niagara Peninsula Conservation Authority and Section 4.1 of the PPS has policies governing development within and adjacent to natural hazards.

The NPCA mapping does not show any floodplain within the Study Area. This will be confirmed by the project engineer in consultation with the NPCA and City. If present, the natural hazards incorporated into the NHS mapping should it be required.

6. Impact Assessment

The lands within the study area have undergone detailed seasonal surveys to identify natural features in accordance with the City's OP. The findings of these surveys did not reveal any features or functions that would be negatively impacted as a result of the lands being brought into the City of Hamilton Urban Boundary. As discussed in Section 5, the Official Plan provides guidance for the identification of features and associated minimum vegetation protection zones on key natural heritage and hydrologic features.

Should there be any future development on these lands an impact assessment related to the development will be undertaken to ensure that any impacts to features are avoided, minimized and mitigated. Should impacts be proposed, opportunities for compensation and restoration would be envisioned.

7. Conclusion & Next Steps

Beacon was retained to undertake the necessary ecological investigations, analyses, and evaluations required to identify an NHS for the Whitechurch Landowners Group.

The assignment included the characterization of natural heritage and hydrological features and linkages within the study area, based on a review of the Rural Hamilton Official Plan mapping and seasonal field investigations. An evaluation of their significance using provincial and municipal criteria and guidelines, and identification of a NHS in accordance with the goals, objectives and polices of the Provincial Planning Statement (PPS) and the City of Hamilton Official Plan was undertaken.

Based on information collected through the background review and field investigations, the ecological functions and significance of natural heritage and hydrologic features within the study area were described.

Key natural heritage and hydrological features mapped in the Rural Hamilton Official Plan were identified as Core Areas of the Natural Heritage System in accordance with the policies of the City of Hamilton Urban Official Plan. Supporting features including vegetation protection zones identified for the study area. Restoration and enhancement opportunities will be addressed in the Phase 2 SWS.

The Study Area supports woodlands, wetlands and watercourse features that provide a level of ecological or hydrological functions and/or meet the provincial or municipal significance criteria of Core Areas.

The City of Hamilton Official Plan applies a systems approach to natural heritage system planning, which involves delineating a Natural Heritage System to include Core Areas and supportive features, such as linkages and restoration areas that maintain the ecological functionality and connectivity of the natural system. The NHS for the Study Area was delineated based on the Schedules of the Rural Hamilton Official Plan and seasonal field surveys. The presence of these features does not impede the lands from being brought into a Settlement Area; rather this information can be used to develop a fulsome NHS as the project moves forward.

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Appendix A

Headwater Drainage Feature Photo log

Photograph 1. Upstream View of DF1A from Round 1	View: S
Date Taken: April 6, 2023	
Site: Parcel 20	

Photograph 2. Upstream View of DF1A Taken During Round 2.	View: S
Date Taken: June 6, 2023	
Site: Parcel 20	

Photograph 3. Downstream View of DF1B from Round 1.	View: N
Date Taken: April 6, 2023	
Site: Parcel 20	

Photograph 4. Downstream View of DF2 Taken During Round 1	View: E
Date Taken: April 6, 2023	
Site: Parcel 20	

Photograph 5. Downstream View of DF2 Taken During Round 2.	**View: E**
Date Taken: June 6, 2023	
Site: Parcel 20	

Photograph 6. Upstream view of DF3a Taken During Round 1.	**View: W**
Date Taken: April 6, 2023	
Site: Parcel 10	

Photograph 7. Upstream view of DF3a Taken During Round 2.	**View: W**
Date Taken: June 6, 2023	
Site: Parcel 10	

Photograph 8. Downstream view of DF3b Taken During Round 1.	**View: N**
Date Taken: April 6, 2023	
Site: Parcel 3 (left) & Parcel 10 (right)	

Photograph 9. Upstream View of DF4a Near the Confluence with DF4f.	View: W
Date Taken: April 6, 2023	
Site: Parcel 10	

Photograph 10. Upstream View of DF4a Near the Confluence with DF4f.	View: W
Date Taken: June 6, 2023	
Site: Parcel 10	

Photograph 11. Upstream View of DF4b taken during Round 1.	View: S
Date Taken: April 6, 2023	
Site: Parcel 10	

Photograph 12. Upstream View of DF4c Taken During Round 1.	View: S
Date Taken: April 6, 2023	
Site: Parcel 10	

Photograph 13. Upstream View of the Pond Associated with DF4d Taken During Round 1.	View: S
Date Taken: April 6, 2023	
Site: Parcel 10	

Photograph 14. Upstream View of the Pond Associated with DF4d Taken During Round 2.	View: S
Date Taken: June 6, 2023	
Site: Parcel 10	

Photograph 15. Upstream View of DF4d Taken During Round 1.	View: S
Date Taken: April 6, 2023	
Site: Parcel 10	

Photograph 16. Upstream View of DF4d Taken During Round 2.	View: S
Date Taken: June 6, 2023	
Site: Parcel 10	

Photograph 17. Upstream View of DF4e Taken During Round 1.	View: S
Date Taken: April 6, 2023	
Site: Parcel 10	

Photograph 18. Upstream View of DF5a Taken During Round 1.	View: W
Date Taken: April 6, 2023	
Site: Parcel 10	

Photograph 19. Upstream View of DF5a Taken During Round 2.	View: W
Date Taken: June 6, 2023	
Site: Parcel 10	

Photograph 20. Downstream View of DF5b Taken During Round 1.	View: E
Date Taken: April 6, 2023	
Site: Parcel 20	

Photograph 21. Upstream View of DF6a Taken During Round 1.	View: N
Date Taken: April 6, 2023	
Site: Parcel 10	

Photograph 22. Upstream View of DF46b Taken During Round 1.	View: E
Date Taken: April 6, 2023	
Site: Parcel 10	

Photograph 23. Upstream View of DF46b Taken During Round 2.	View: E
Date Taken: June 6, 2023	
Site: Parcel 10	

Photograph 24. Upstream View of Tile Drain Outlet (arrow) Associated with DF7 Taken During Round 1.	View: N
Date Taken: April 6, 2023	
Site: Parcel 10	

Photograph 25. Downstream View of DF8 Taken During Round 1.	View: N
Date Taken: April 6, 2023	
Site: Parcel 10	

Photograph 26. Downstream View of the White Church Road Drainage Ditch. No Flow Was Observed During the Round 2 Assessment.	View: W
Date Taken: June 6, 2023	
Site: Parcel 10	

Photograph 27. Downstream View of DF9 as the Feature Enters the Woodlot. Taken In Round 1.	View: N
Date Taken: April 16, 2024	
Site: Parcel 48	

Photograph 28. Downstream View of DF10 as the Feature Enters the Woodlot. Taken In Round 1.	View: N
Date Taken: April 16, 2024	
Site: Parcel 48	

Photograph 29. Downstream View of DF11 Taken During Round 1.	**View: S**
Date Taken: April 16, 2024	
Site: Parcel 48	

Photograph 30. Downstream View of DF11 Taken During Round 2.	**View: S**
Date Taken: May 31, 2024	
Site: Parcel 48	

Photograph 31. Upstream View of DF12a Taken During Round 1.	**View: N**
Date Taken: April 16, 2024	
Site: Parcel 48	

Photograph 32. Downstream View of DF12b Taken Downstream of the DF12c Confluence. Taken During Round 1.	**View: S**
Date Taken: April 16, 2024	
Site: Parcel 56	

Photograph 33. Downstream View of DF12b Taken Downstream of the DF12c Confluence. Taken During Round 2.	View: S
Date Taken: May 31, 2024	
Site: Parcel 56	

Photograph 34. Upstream View of DF12c Taken In Round 1.	View: E
Date Taken: April 16, 2024	
Site: Parcel 56	

Photograph 35. Upstream View of DF12c Taken During Round 2. Water in Photo was Standing.	View: E
Date Taken: May 31, 2024	
Site: Parcel 56	

Photograph 36. Upstream View of DF13a Taken During Round 1.	View: N
Date Taken: April 16, 2024	
Site: Parcel 47	

Photograph 37. Upstream View of DF13a Taken During Round 2.	View: N
Date Taken: May 31, 2024	
Site: Parcel 47	

Photograph 38. Downstream View of DF13b Taken During Round 1.	View: S
Date Taken: April 16, 2024	
Site: Parcel 56	

Photograph 39. Upstream View of DF14 Taken During Round 1.	View: N
Date Taken: April 16, 2024	
Site: Parcel 47	

Photograph 40. Upstream View of DF14 Taken During Round 2.	View: N
Date Taken: May 31, 2024	
Site: Parcel 47	

Photograph 41. Upstream View of DF15a (right) and DF15b (left) Taken at Their Confluence in Round 1.	View: N
Date Taken: April 16, 2024	
Site: Parcel 47	

Photograph 42. Upstream View of DF15a Taken in Round 2.	View: N
Date Taken: May 31, 2024	
Site: Parcel 47	

Photograph 43. Upstream View of DF16 Taken During Round 1.	View: N
Date Taken: March 27, 2024	
Site: Parcel 2	

Photograph 44. Upstream View of DF16 Taken During Round 2.	View: N
Date Taken: May 31, 2024	
Site: Parcel 2	

Photograph 45. Upstream View of DF17 Taken During Round 1.	View: N
Date Taken: March 27, 2024	
Site: Parcel 2	

Photograph 46. Upstream View of DF17 Taken During Round 2.	View: N
Date Taken: May 31, 2024	
Site: Parcel 2	

Photograph 47. Upstream View of DF18a Taken Round 1.	View: N
Date Taken: April 16, 2024	
Site: Parcel 2	

Photograph 48. Upstream View of Flow Entering Culvert Associated with DF18a Taken in Round 2.	View: N
Date Taken: May 31, 2024	
Site: Parcel 2	

Photograph 49. Upstream View of No Flow Entering Culvert Associated with DF18a Taken in Round 3.	View: N
Date Taken: July 8, 2024	
Site: Parcel 2	

Photograph 50. Upstream View of DF18b Taken During Round 1.	View: N
Date Taken: April 16, 2024	
Site: Parcel 34	

Photograph 51. Upstream View of DF18b Taken During Round 2.	View: N
Date Taken: May 31, 2024	
Site: Parcel 34	

Photograph 52. Upstream View of DF18b Taken During Round 3. Channel was Dry and Overgrown.	View: N
Date Taken: July 8, 2024	
Site: Parcel 34	

Photograph 53. Downstream View of DF18c Taken During Round 2.	View: W
Date Taken: April 16, 2024	
Site: Parcel 34	

Photograph 54. Downstream View of DF18c Taken During Round 2.	View: W
Date Taken: May 31, 2024	
Site: Parcel 34	

Photograph 55. Downstream View of DF18c Taken During Round 3.	View: W
Date Taken: July 8, 2024	
Site: Parcel 34	

Appendix B

Ecological Land Classification photolog and botanical list

Appendix B

Ecological Land Classification photolog

Photograph 1: Sugar Maple Hardwood Forest Community (August 09, 2023)

Photograph 2: Sugar Maple-Beech Community (August 09, 2023)

Photograph 3: Ephemeral Pond within a Forest Community (August 09, 2023)

Photograph 4: A Silver Maple Swamp (August 25, 2023)

Photograph 5: Poplar Swamp Community (August 25, 2023)

Photograph 6: Reed Canary Grass Marsh Community (August 09, 2023)

Photograph 7: Cultural Meadow Community (August 22, 2024)

Photograph 8: Open Water Aquatic Community (August 25, 2023)

Photograph 9: Duckweed Floating-leaved Shallow Aquatic Community (August 25, 2023)

Photograph 10: Mixed Shallow Aquatic Community (August 17, 2023)

Photograph 11: Waterweed Submerged Shallow Aquatic Community (August 25, 2023)

Photograph 12: Hedgerow (August 09, 2023)

Appendix B

Botanical List

Scientific Name	Common Name	Family	COSEWIC	SARO	SRank	Hamilton	Nat Status
Acer negundo	Manitoba Maple	Aceraceae			S5	C	N
Acer platanoides	Norway Maple	Aceraceae			SE5	IX	I
Acer saccharinum	Silver Maple	Aceraceae			S5	C	N
Acer saccharum	Sugar Maple	Aceraceae			S5	C	N
Acer x freemanii	(Acer rubrum X Acer saccharinum)	Aceraceae			SNA	hyb	N
Achillea millefolium	Common Yarrow	Asteraceae			SE5?	IX	I
Actaea pachypoda	White Baneberry	Ranunculaceae			S5	C	N
Agrostis gigantea	Redtop	Poaceae			SE5	IX	I
Alisma triviale	Northern Water-plantain	Alismataceae			S5	X	N
Alliaria petiolata	Garlic Mustard	Brassicaceae			SE5	IC	I
Ambrosia artemisiifolia	Common Ragweed	Asteraceae			S5	C	N
Ambrosia trifida	Great Ragweed	Asteraceae			S5	U	N
Amphicarpaea bracteata	American Hog-peanut	Fabaceae			S5	C	N
Anemonastrum canadense	Canada Anemone	Ranunculaceae			S5	C	N
Anemone virginiana	Tall Anemone	Ranunculaceae			S5	C	N
Apocynum androsaemifolium	Spreading Dogbane	Apocynaceae			S5	C	N
Arctium lappa	Great Burdock	Asteraceae			SE5	IX	I
Arctium minus	Common Burdock	Asteraceae			SE5	IC	I
Arisaema triphyllum	Jack-in-the-pulpit	Araceae			S5	C	N
Asclepias syriaca	Common Milkweed	Apocynaceae			S5	C	N
Atriplex patula	Spear Saltbush	Chenopodiaceae			SE5	IU	I
Bidens cernua	Nodding Beggarticks	Asteraceae			S5	C	N
Bidens frondosa	Devil's Beggarticks	Asteraceae			S5	C	N
Boehmeria cylindrica	Small-spike False Nettle	Urticaceae			S5	C	N
Brassica nigra	Black Mustard	Brassicaceae			SE5	IR	I

Scientific Name	Common Name	Family	COSEWIC	SARO	SRank	Hamilton	Nat Status
Bromus inermis	Smooth Brome	Poaceae			SE5	IC	I
Carex bebbii	Bebb's Sedge	Cyperaceae			S5	C	N
Carex cristatella	Crested Sedge	Cyperaceae			S5	C	N
Carex interior	Inland Sedge	Cyperaceae			S5	U	N
Carex intumescens	Bladder Sedge	Cyperaceae			S5	C	N
Carex lupulina	Hop Sedge	Cyperaceae			S5	C	N
Carex pedunculata	Long-stalked Sedge	Cyperaceae			S5	C	N
Carex pensylvanica	Pennsylvania Sedge	Cyperaceae			S5	C	N
Carex plantaginea	Plantain-leaved Sedge	Cyperaceae			S5	C	N
Carex rosea	Rosy Sedge	Cyperaceae			S5	C	N
Carex scoparia	Pointed Broom Sedge	Cyperaceae			S5	C	N
Carex tribuloides	Blunt Broom Sedge	Cyperaceae			S4	C	N
Carex vulpinoidea	Fox Sedge	Cyperaceae			S5	C	N
Carpinus caroliniana	Blue-beech	Betulaceae			S5	C	N
Carya glabra	Pignut Hickory	Juglandaceae			S3	R	N
Carya ovata	Shagbark Hickory	Juglandaceae			S5	C	N
Caulophyllum thalictroides	Blue Cohosh	Berberidaceae			S5	C	N
Cephalanthus occidentalis	Eastern Buttonbush	Rubiaceae			S5	C	N
Cerastium fontanum	Common Mouse-ear Chickweed	Caryophyllaceae			SE5	IC	I
Cichorium intybus	Wild Chicory	Asteraceae			SE5	IC	I
Cicuta maculata	Spotted Water-hemlock	Apiaceae			S5		N
Circaea canadensis	Broad-leaved Enchanter's Nightshade	Onagraceae			S5	C	N
Cirsium arvense	Canada Thistle	Asteraceae			SE5	IC	I
Cirsium vulgare	Bull Thistle	Asteraceae			SE5	IX	I
Claytonia virginica	Eastern Spring Beauty	Portulacaceae			S5	C	N
Collinsonia canadensis	Canada Horsebalm	Lamiaceae			S4	C	N
Cornus obliqua	Silky Dogwood	Cornaceae			S5	C	N
Cornus racemosa	Grey Dogwood	Cornaceae			S5	C	N
Cornus sericea	Red-osier Dogwood	Cornaceae			S5	C	N
Crataegus douglasii	Douglas' Hawthorn	Rosaceae			S4?		N

Scientific Name	Common Name	Family	COSEWIC	SARO	SRank	Hamilton	Nat Status
Crataegus mollis	Downy Hawthorn	Rosaceae			S4S5		N
Crataegus monogyna	English Hawthorn	Rosaceae			SE4	IX	I
Cyperus strigosus	Straw-coloured Flatsedge	Cyperaceae			S5	U	N
Dactylis glomerata	Orchard Grass	Poaceae			SE5	IC	I
Daucus carota	Wild Carrot	Apiaceae			SE5	IC	I
Desmodium canadense	Canada Tick-trefoil	Fabaceae			S4	C	N
Dianthus armeria	Deptford Pink	Caryophyllaceae			SE5	IC	I
Dipsacus fullonum	Common Teasel	Dipsacaceae			SE5	IX	I
Echinochloa crus-galli	Large Barnyard Grass	Poaceae			SE5	IC	I
Elaeagnus umbellata	Autumn Olive	Elaeagnaceae			SE3	IX	I
Eleocharis erythropoda	Red-stemmed Spikerush	Cyperaceae			S5	C	N
Eleocharis obtusa	Blunt Spikerush	Cyperaceae			S5	C	N
Elodea canadensis	Canada Waterweed	Hydrocharitaceae			S5	C	N
Elymus hystrix	Bottlebrush Grass	Poaceae			S5	C	N
Epilobium ciliatum	Northern Willowherb	Onagraceae			S5		N
Epilobium coloratum	Purple-veined Willowherb	Onagraceae			S5	C	N
Erechtites hieraciifolius	Eastern Burnweed	Asteraceae			S5	U	N
Erigeron annuus	Annual Fleabane	Asteraceae			S5	C	N
Erigeron canadensis	Canada Horseweed	Asteraceae			S5	C	N
Erythronium americanum	Yellow Trout-lily	Liliaceae			S5	C	N
Euonymus obovatus	Running Strawberry-bush	Celastraceae			S4	C	N
Eupatorium perfoliatum	Common Boneset	Asteraceae			S5	C	N
Eurybia macrophylla	Large-leaved Aster	Asteraceae			S5	C	N
Euthamia graminifolia	Grass-leaved Goldenrod	Asteraceae			S5	C	N
Fagus grandifolia	American Beech	Fagaceae			S4	C	N
Fragaria virginiana	Wild Strawberry	Rosaceae			S5		N
Fraxinus americana	White Ash	Oleaceae			S4	C	N
Fraxinus pennsylvanica	Red Ash	Oleaceae			S4	C	N
Galium tricornutum	Rough-fruit Corn Bedstraw	Rubiaceae			SEH		I
Geranium maculatum	Spotted Geranium	Geraniaceae			S5	C	N
Geranium robertianum	Herb-Robert	Geraniaceae			S5	C	N
Geum canadense	Canada Avens	Rosaceae			S5	C	N
Geum laciniatum	Rough Avens	Rosaceae			S4	C	N
Glechoma hederacea	Ground-ivy	Lamiaceae			SE5	IC	I

Scientific Name	Common Name	Family	COSEWIC	SARO	SRank	Hamilton	Nat Status
Glyceria septentrionalis	Eastern Mannagrass	Poaceae			S4	C	N
Hackelia virginiana	Virginia Stickseed	Boraginaceae			S5	C	N
Helianthus tuberosus	Jerusalem Artichoke	Asteraceae			SU	IX	N
Hesperis matronalis	Dame's Rocket	Brassicaceae			SE5	IC	I
Hordeum jubatum	Foxtail Barley	Poaceae			S5?		N
Hydrophyllum virginianum	Virginia Waterleaf	Hydrophyllaceae			S5	C	N
Hypericum perforatum	Common St. John's-wort	Clusiaceae			SE5	IC	I
Impatiens capensis	Spotted Jewelweed	Balsaminaceae			S5	C	N
Inula helenium	Elecampane	Asteraceae			SE5	IX	I
Iris versicolor	Harlequin Blue Flag	Iridaceae			S5	C	N
Juglans nigra	Black Walnut	Juglandaceae			S4?	C	N
Juncus dudleyi	Dudley's Rush	Juncaceae			S5	C	N
Juncus effusus	Soft Rush	Juncaceae			S5		N
Juncus tenuis	Path Rush	Juncaceae			S5	C	N
Juniperus virginiana	Eastern Red Cedar	Cupressaceae			S5	C	N
Lactuca serriola	Prickly Lettuce	Asteraceae			SE5	IX	I
Leersia oryzoides	Rice Cutgrass	Poaceae			S5	C	N
Lemna minor	Small Duckweed	Lemnaceae			S5?	C	N
Lepidium campestre	Field Peppergrass	Brassicaceae			SE5	IX	I
Ligustrum vulgare	European Privet	Oleaceae			SE5	IX	I
Lobelia cardinalis	Cardinal Flower	Campanulaceae			S5	C	N
Lolium arundinaceum	Tall Ryegrass	Poaceae			SE5	IX	I
Lolium perenne	Perennial Ryegrass	Poaceae			SE4	IC	I
Lonicera tatarica	Tatarian Honeysuckle	Caprifoliaceae			SE5	IX	I
Lotus corniculatus	Garden Bird's-foot Trefoil	Fabaceae			SE5	IC	I
Lycopus americanus	American Water-horehound	Lamiaceae			S5	C	N
Lycopus uniflorus	Northern Water-horehound	Lamiaceae			S5	C	N
Lythrum salicaria	Purple Loosestrife	Lythraceae			SE5	IC	I
Maianthemum racemosum	Large False Solomon's Seal	Liliaceae			S5	C	N
Malus pumila	Common Apple	Rosaceae			SE4	IX	I

Scientific Name	Common Name	Family	COSEWIC	SARO	SRank	Hamilton	Nat Status
Matteuccia struthiopteris	Ostrich Fern	Dryopteridaceae			S5	C	N
Medicago lupulina	Black Medick	Fabaceae			SE5	IC	I
Melilotus albus	White Sweet-clover	Fabaceae			SE5	IC	I
Melilotus officinalis	Yellow Sweet-clover	Fabaceae			SE5	IC	I
Menispermum canadense	Canada Moonseed	Menispermaceae			S4	C	N
Mentha canadensis	Canada Mint	Lamiaceae			S5	C	N
Nepeta cataria	Catnip	Lamiaceae			SE5	IX	I
Oenothera biennis	Common Evening-primrose	Onagraceae			S5	C	N
Onoclea sensibilis	Sensitive Fern	Dryopteridaceae			S5	C	N
Ostrya virginiana	Eastern Hop-hornbeam	Betulaceae			S5	C	N
Oxalis stricta	Upright Yellow Wood-sorrel	Oxalidaceae			S5	C	N
Panicum capillare	Common Panicgrass	Poaceae			S5	C	N
Panicum dichotomiflorum	Fall Panicgrass	Poaceae			SE5	IX	I
Panicum virgatum	Old Switch Panicgrass	Poaceae			S4	R	N
Parthenocissus vitacea	Thicket Creeper	Vitaceae			S5	C	N
Penthorum sedoides	Ditch Stonecrop	Crassulaceae			S5	C	N
Persicaria lapathifolia	Pale Smartweed	Polygonaceae			S5	C	N
Persicaria maculosa	Spotted Lady's-thumb	Polygonaceae			SE5	IC	I
Phalaris arundinacea	Reed Canarygrass	Poaceae			S5	C	N
Phleum pratense	Common Timothy	Poaceae			SE5	IC	I
Phragmites australis	Common Reed	Poaceae			S4?		N
Picea abies	Norway Spruce	Pinaceae			SE3	IR	I
Picea glauca	White Spruce	Pinaceae			S5	C	N
Picea pungens	Blue Spruce	Pinaceae			SE1	IR	I
Pilea pumila	Dwarf Clearweed	Urticaceae			S5	C	N
Pilosella caespitosa	Meadow Hawkweed	Asteraceae			SE5	IX	I
Pinus strobus	Eastern White Pine	Pinaceae			S5	C	N
Pinus sylvestris	Scots Pine	Pinaceae			SE5	IX	I
Poa palustris	Fowl Bluegrass	Poaceae			S5	C	N
Poa pratensis	Kentucky Bluegrass	Poaceae			S5		N
Podophyllum peltatum	May-apple	Berberidaceae			S5	C	N

Scientific Name	Common Name	Family	COSEWIC	SARO	SRank	Hamilton	Nat Status
Populus deltoides	Eastern Cottonwood	Salicaceae			S5		N
Populus tremuloides	Trembling Aspen	Salicaceae			S5	C	N
Potentilla recta	Sulphur Cinquefoil	Rosaceae			SE5	IX	I
Prunella vulgaris	Common Self-heal	Lamiaceae			S5		N
Prunella vulgaris ssp. lanceolata	Lance-leaved Self-heal	Lamiaceae			S5	C	N
Prunus avium	Sweet Cherry	Rosaceae			SE4	IX	I
Prunus serotina	Black Cherry	Rosaceae			S5	C	N
Prunus virginiana	Chokecherry	Rosaceae			S5	C	N
Pyrus communis	Common Pear	Rosaceae			SE4	IX	I
Quercus rubra	Northern Red Oak	Fagaceae			S5	C	N
Ranunculus caricetorum	Northern Swamp Buttercup	Ranunculaceae			S5	C	N
Reynoutria japonica	Japanese Knotweed	Polygonaceae			SE5	IX	I
Rhamnus cathartica	European Buckthorn	Rhamnaceae			SE5	IC	I
Rhus typhina	Staghorn Sumac	Anacardiaceae			S5	C	N
Ribes americanum	American Black Currant	Grossulariaceae			S5	C	N
Robinia pseudoacacia	Black Locust	Fabaceae			SE5	IC	I
Rosa multiflora	Multiflora Rose	Rosaceae			SE5	IC	I
Rosa rubiginosa	Sweetbriar Rose	Rosaceae			SE4		I
Rubus allegheniensis	Allegheny Blackberry	Rosaceae			S5	C	N
Rubus occidentalis	Black Raspberry	Rosaceae			S5	C	N
Rumex crispus	Curled Dock	Polygonaceae			SE5	IX	I
Salix amygdaloides	Peach-leaved Willow	Salicaceae			S5	C	N
Salix bebbiana	Bebb's Willow	Salicaceae			S5	C	N
Salix discolor	Pussy Willow	Salicaceae			S5	C	N
Salix eriocephala	Cottony Willow	Salicaceae			S5	C	N
Salix interior	Sandbar Willow	Salicaceae			S5	C	N
Salix x fragilis	(Salix alba X Salix euxina)	Salicaceae			SNA	hyb	I
Sambucus canadensis	Common Elderberry	Caprifoliaceae			S5	C	N
Sanguinaria canadensis	Bloodroot	Papaveraceae			S5	C	N
Schoenoplectus tabernaemontani	Soft-stemmed Bulrush	Cyperaceae			S5	C	N
Scirpus atrocinctus	Black-girdled Bulrush	Cyperaceae			S5		N

Scientific Name	Common Name	Family	COSEWIC	SARO	SRank	Hamilton	Nat Status
Scirpus cyperinus	Common Woolly Bulrush	Cyperaceae			S5	C	N
Setaria pumila	Yellow Foxtail	Poaceae			SE5	IX	I
Setaria viridis	Green Foxtail	Poaceae			SE5	IX	I
Sium suave	Common Water-parsnip	Apiaceae			S5	C	N
Solanum dulcamara	Bittersweet Nightshade	Solanaceae			SE5	IC	I
Solanum nigrum	Black Nightshade	Solanaceae			SE1	IR	I
Solidago altissima	Tall Goldenrod	Asteraceae			S5		N
Solidago flexicaulis	Zigzag Goldenrod	Asteraceae			S5	C	N
Solidago juncea	Early Goldenrod	Asteraceae			S5	C	N
Sonchus arvensis	Field Sow-thistle	Asteraceae			SE5	IX	I
Sorbus aucuparia	European Mountain-ash	Rosaceae			SE4	IX	I
Spiraea alba	White Meadowsweet	Rosaceae			S5	C	N
Symphyotrichum ericoides	White Heath Aster	Asteraceae			S5		N
Symphyotrichum lanceolatum	Panicled Aster	Asteraceae			S5	C	N
Symphyotrichum novae-angliae	New England Aster	Asteraceae			S5	C	N
Symphyotrichum pilosum	Old Field Aster	Asteraceae			S5		N
Syringa vulgaris	Common Lilac	Oleaceae			SE5	IR	I
Taraxacum officinale	Common Dandelion	Asteraceae			SE5	IC	I
Thelypteris palustris	Marsh Fern	Thelypteridaceae			S5	C	N
Thlaspi arvense	Field Pennycress	Brassicaceae			SE5	IC	I
Thuja occidentalis	Eastern White Cedar	Cupressaceae			S5	C	N
Tilia americana	Basswood	Tiliaceae			S5	C	N
Toxicodendron radicans	Poison Ivy	Anacardiaceae			S5		N
Trifolium hybridum	Alsike Clover	Fabaceae			SE5	IC	I
Trifolium pratense	Red Clover	Fabaceae			SE5	IC	I
Triticum aestivum	Common Wheat	Poaceae			SE1	IR	I
Tussilago farfara	Coltsfoot	Asteraceae			SE5	IX	I
Typha angustifolia	Narrow-leaved Cattail	Typhaceae			SE5	IX	I
Typha latifolia	Broad-leaved Cattail	Typhaceae			S5	C	N
Ulmus americana	White Elm	Ulmaceae			S5	C	N
Urtica dioica	Stinging Nettle	Urticaceae			S5		N

Scientific Name	Common Name	Family	COSEWIC	SARO	SRank	Hamilton	Nat Status
Verbascum thapsus	Common Mullein	Scrophulariaceae			SE5	IC	I
Verbena hastata	Blue Vervain	Verbenaceae			S5	C	N
Veronica officinalis	Common Speedwell	Scrophulariaceae			SE5	IC	I
Viburnum acerifolium	Maple-leaved Viburnum	Caprifoliaceae			S5	C	N
Viburnum opulus ssp. trilobum	Highbush Cranberry	Caprifoliaceae			S5	C	N
Vicia cracca	Tufted Vetch	Fabaceae			SE5	IC	I
Viola pubescens	Yellow Violet	Violaceae			S5	C	N
Viola sororia	Woolly Blue Violet	Violaceae			S5	C	N
Vitis riparia	Riverbank Grape	Vitaceae			S5	C	N
							N

KEY

S-Rank (from Natural Heritage Information Centre) for breeding status: S1 (Extremely Rare), S2 (Very Rare), S3 (Rare to Uncommon) (S4 (Common), S5 (Very Common) SNA (Not applicable…'because the species is not a suitable target for conservation activities'; includes non-native species), E (Exotic)

I introduced; thought to have been present in the Carolinian Zone or individual CZ area prior to European settlement; believed to be deliberately or inadvertently introduced to the CZ by humans (followed by a status, below)

C	common
N	Native
U	uncommon
R	rare
H	historic records only (generally >30 years)
X	present; status unknown or not specified in source lists
?	unconfirmed report
hyb	hybrid

Appendix C

Breeding Bird Species List

Appendix C

Breeding Bird Species List

Common Name	Scientific Name	Status				# Breeding Pairs/ Territories[4]
		COSEWIC[1]	COSSARO[2]	SRANK[3]	AREA SENSITIVE?	
Mallard	*Anas platyrhynchos*			S5		3
Mourning Dove	*Zenaida macroura*			S5		14
Killdeer	*Charadrius vociferus*			S5		15
Spotted Sandpiper	*Actitis macularius*			S5		3
Green Heron	*Butorides virescens*			S4		1
Great Blue Heron	*Ardea herodias*			S5		F
Turkey Vulture	*Cathartes aura*			S4		F
Red-tailed Hawk	*Buteo jamaicensis*			S5		F
Downy Woodpecker	*Dryobates pubescens*			S5		3
Red-bellied Woodpecker	*Melanerpes carolinus*			S4		3
Northern Flicker	*Colaptes auratus*			S4		4
Eastern Wood-Pewee	*Contopus virens*	Special Concern	Special Concern	S4		3
Willow Flycatcher	*Empidonax traillii*			S5		4
Great Crested Flycatcher	*Myiarchus crinitus*			S5		6
Eastern Kingbird	*Tyrannus tyrannus*			S5		7
Warbling Vireo	*Vireo gilvus*			S5		4
Red-eyed Vireo	*Vireo olivaceus*			S5		5
Common Raven	*Corvus corax*			S5		1
American Crow	*Corvus brachyrhynchos*			S5		2
Blue Jay	*Cyanocitta cristata*			S5		5
Black-capped Chickadee	*Poecile atricapillus*			S5		7
Horned Lark	*Eremophila alpestris*			S5		11
Tree Swallow	*Tachycineta bicolor*			S5		2
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*			S5		2
Bank Swallow	*Riparia riparia*	Threatened	Threatened	S5		F
Barn Swallow	*Hirundo rustica*	Threatened	Special Concern	S5		12
Cliff Swallow	*Petrochelidon pyrrhonota*			S5		1
White-breasted Nuthatch	*Sitta carolinensis*			S5	x	3

Common Name	Scientific Name	Status				# Breeding Pairs/ Territories[4]
		COSEWIC[1]	COSSARO[2]	SRANK[3]	AREA SENSITIVE?	
House Wren	*Troglodytes aedon*			S5		5
Carolina Wren	*Thryothorus ludovicianus*			S4		2
European Starling	*Sturnus vulgaris*			SNA		17
Gray Catbird	*Dumetella carolinensis*			S5		12
Chipping Sparrow	*Spizella passerina*			S5		10
Field Sparrow	*Spizella pusilla*			S5		4
Vesper Sparrow	*Pooecetes gramineus*			S4		3
Savannah Sparrow	*Passerculus sandwichensis*			S5	x	30
Song Sparrow	*Melospiza melodia*			S5		102
Swamp Sparrow	*Melospiza georgiana*			S5		1
Orchard Oriole	*Icterus spurius*			SZB		2
Baltimore Oriole	*Icterus galbula*			S4		9
Red-winged Blackbird	*Agelaius phoeniceus*			S5		110
Brown-headed Cowbird	*Molothrus ater*			S5		30
Common Grackle	*Quiscalus quiscula*			S5		18
American Robin	*Turdus migratorius*			S5		88
Cedar Waxwing	*Bombycilla cedrorum*			S5		10
Common Yellowthroat	*Geothlypis trichas*			S5		3
Yellow Warbler	*Setophaga petechia*			S5		20
American Redstart	*Setophaga ruticilla*			S5		2
House Finch	*Haemorhous mexicanus*			SE		7
American Goldfinch	*Spinus tristis*			S5		19
Northern Cardinal	*Cardinalis cardinalis*			S5		8
Indigo Bunting	*Passerina cyanea*			S5		4
Rose-breasted Grosbeak	*Pheucticus ludovicianus*			S5		1
House Sparrow	*Passer domesticus*			SNA		8

[1] Committee on the Status of Endangered Wildlife in Canada

[2] Committee on the Status of Species at Risk in Ontario

[3] Provincial Conservation Status: S4=Apparently Secure, S5=Secure, SNA=Status Not Applicable

[4] F=Flyover (not breeding on property)

BEACON
ENVIRONMENTAL

Appendix D

Bat Analysis Data

Appendix D

Bat Analysis Data

Detector #	ELC Community	Big Brown Bat	Eastern Red Bat	Hoary Bat	Silver-haired Bat	Eastern Small-footed Myotis	Little Brown Myotis	Northern Myotis	Myotis Species	Tri-Colored Bat	Total
12A	FOD5-2	0	0	9	7	0	0	0	0	0	16
12B	FOD6-5(a)	1519	1	201	633	0	0	0	3	0	2357
13A	FOD5-2	105	0	32	50	0	0	0	2	0	189
13B	FOD6-5(a)	66	0	88	125	0	0	0	0	0	279
14A	FOD6-5(b)	97	0	57	69	0	0	0	0	0	223
14B	FOD6-5(c)	104	0	147	60	43	0	0	83	0	437
15A	FOD5-2	191	0	45	69	0	4	0	13	0	322
15B	FOD6-5(a)	1716	57	467	358	47	1	0	20	0	2666
16A	FOD6-5(b)	107	0	53	7	18	0	0	10	0	195
16B	FOD6-5(c)	39	0	6	7	5	1	1	23	0	82
17A	SWD4	7	0	15	19	0	1	0	0	0	42
17B	FOD6-5(c)	671	28	335	246	29	0	0	168	0	1477
18	FOD6-5	121	3	60	82	9	0	0	39	0	314
19A	FOD6-5(b)	745	1	306	221	17	0	0	83	0	1373
19B	FOD6-5(c)	349	2	225	69	61	0	0	63	0	769
20A	FOD6-5(b)	163	11	175	72	2	7	0	113	0	543
20B	FOD6-5(c)	87	0	57	60	0	0	0	2	0	206
22A	FOD6-5(b)	66	0	57	21	127	0	0	38	0	309
22B	FOD6-5(a)	202	5	444	408	108	0	0	124	0	1291
24A	FOD6-5(b)	181	0	53	42	12	0	0	23	0	311
24B	FOD6-5(a)	461	37	290	397	11	1	0	267	0	1464
25A	FOD6-5(b)	10	0	63	17	0	0	0	3	0	93

Detector #	ELC Community	Big Brown Bat	Eastern Red Bat	Hoary Bat	Silver-haired Bat	Eastern Small-footed Myotis	Little Brown Myotis	Northern Myotis	Myotis Species	Tri-Colored Bat	Total
25B	FOD6-5(c)	124	11	42	17	17	0	0	25	0	236
26A	FOD6-5(b)	57	0	21	21	19	0	0	40	0	158
26B	FOD6-5(c)	419	0	46	46	2	0	0	0	0	513
27A	FOD6-5(b)	37	0	61	9	2	0	0	0	0	109
27B	FOD6-5(c)	170	0	41	70	0	0	0	0	0	281
28A	FOD6-5(b)	295	0	327	167	49	0	0	72	0	910
28B	FOD6-5(c)	541	0	166	173	28	0	1	44	1	954
29A	FOD6-5(b)	6	0	9	2	0	0	0	1	0	18
29B	FOD6-5(a)	82	0	110	40	6	0	0	3	0	241
	Total	**8738**	**156**	**4008**	**3584**	**612**	**15**	**2**	**1262**	**1**	**18378**

Appendix F Concept Plan

SCS consulting group ltd

WHITE CHURCH BOUNDARY EXPANSION AREA

SCALE 1:9000

0 100 200 300 400 500

NOTES:

- Base information prepared by A.T. McLaren Limited
- Aerial Imagery: Google Earth 2023

URBAN SOLUTIONS est. 2014 10 Years! PLANNING & LAND DEVELOPMENT

LEGEND

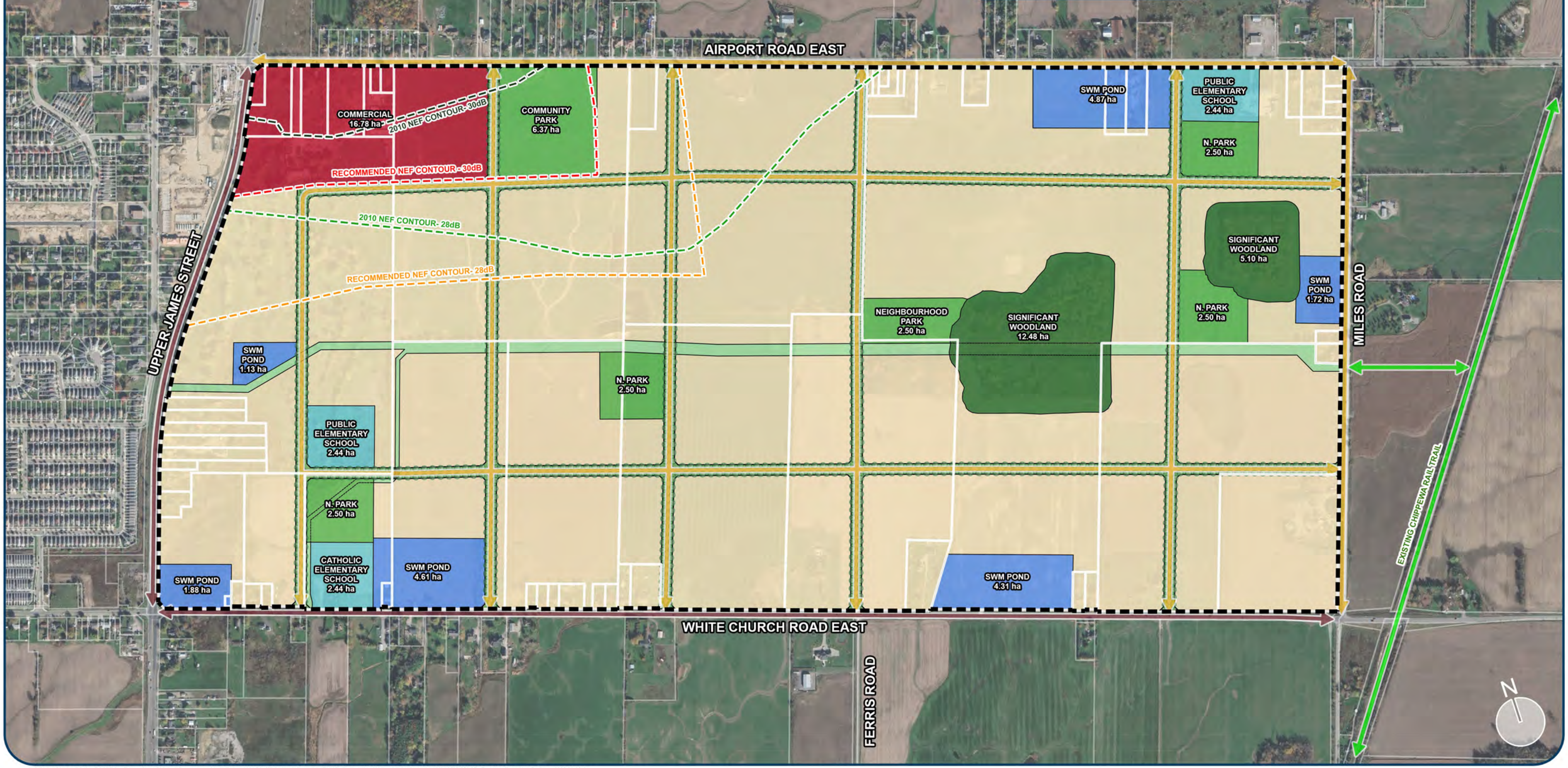
- ▬ ▬ SUBJECT LANDS
- ▨ RESIDENTIAL
- ▨ INSTITUTIONAL
- 🟩 PARK / OPEN SPACE
- 🟥 COMMERCIAL
- 🟦 STORM WATER MANAGEMENT POND
- ▨ PIPELINE / TRAIL NETWORK
- 🟩 NATURAL HERITAGE SYSTEM
- ➡ 26m COLLECTOR RIGHT OF WAY
- ➡ ARTERIAL RIGHT OF WAY
- ➡ CHIPPEWA RAIL TRAIL

LAND USE SCHEDULE

ITEM	AREA (ha)
RESIDENTIAL	249.44
INSTITUTIONAL	7.32
PARK / OPEN SPACE	18.88
COMMERCIAL	16.78
STORM WATER MANAGEMENT POND	18.52
PIPELINE / TRAIL NETWORK	6.59
NATURAL HERITAGE SYSTEM	17.57
RIGHT OF WAY	29.27
TOTAL	364.37

POPULATION

POLICY DOCUMENT	NET RESIDENTIAL DENSITY (UPH)	PEOPLE PER HECTARE	ESTIMATED NUMBER OF UNITS (@ 3.5 PERSON PER UNIT)	ESTIMATED POPULATION
WHITE CHURCH SECONDARY PLAN	31	77	7,629	26,703
PROVINCIAL PLANNING STATEMENT	20	50	4,954	17,340
URBAN HAMILTON OFFICIAL PLAN TARGET	28	70	6,936	24,275



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