# Lisgar District Pumping Stations Schedule "B" Municipal Class Environmental Assessment

Lisgar District Pumping Stations – Project File Report
City of Mississauga
Project # WW21011023

Prepared for:

**City of Mississauga**
201 City Centre Drive, Mississauga, Ontario L5B 3C1

September 20, 2022

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**Project # WW21011023**

**Prepared for:**
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**20-Sep-22**

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| | | |
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# 1.0 Introduction

## 1.1 Study Area

The Lisgar District is situated in the northwest corner of the City of Mississauga and is bounded by the Canadian Pacific Railway (CPR) tracks to the north, Britannia Road West to the south, Ninth Line to the west and Tenth Line to the east. It is located within the Sixteen Mile Creek watershed and surface water drains to a tributary of the East Branch of Sixteen Mile Creek (Figure 1.1).

The Lisgar District mainly consists of single-family homes which were largely built over a 25-year period starting in the early 1980s (Figure 1.2).

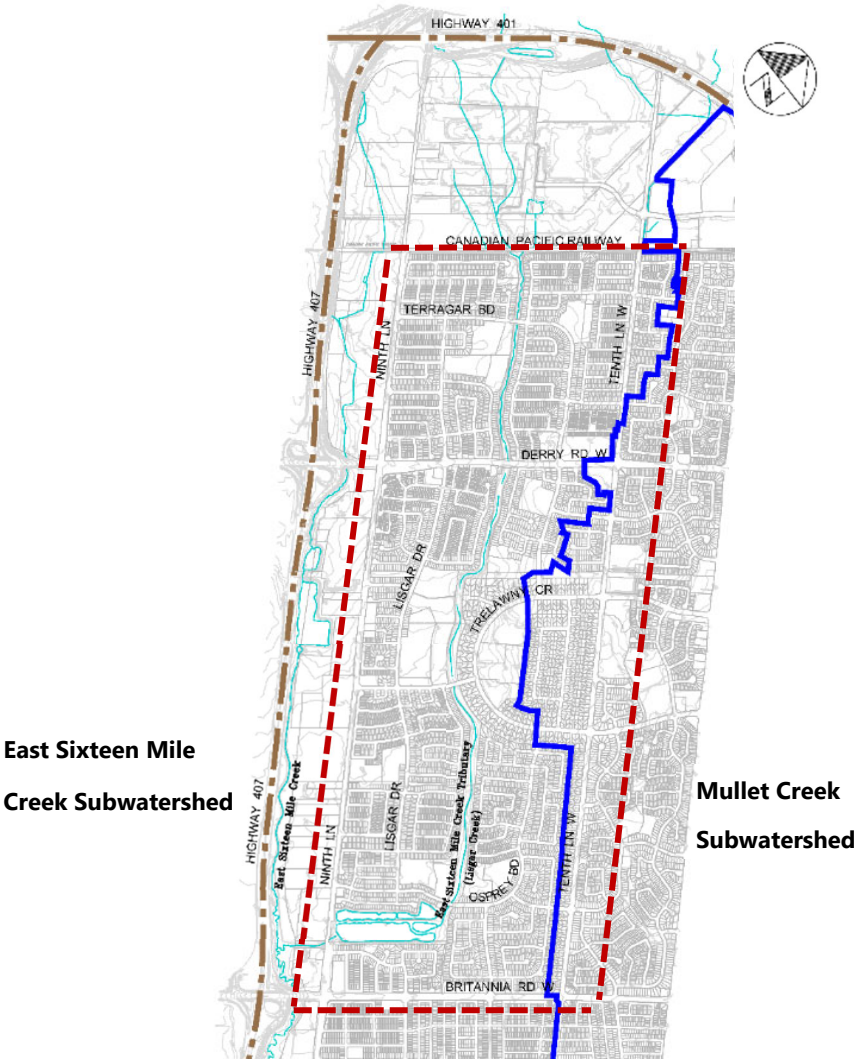


**Figure 1.1. Subwatershed Map**

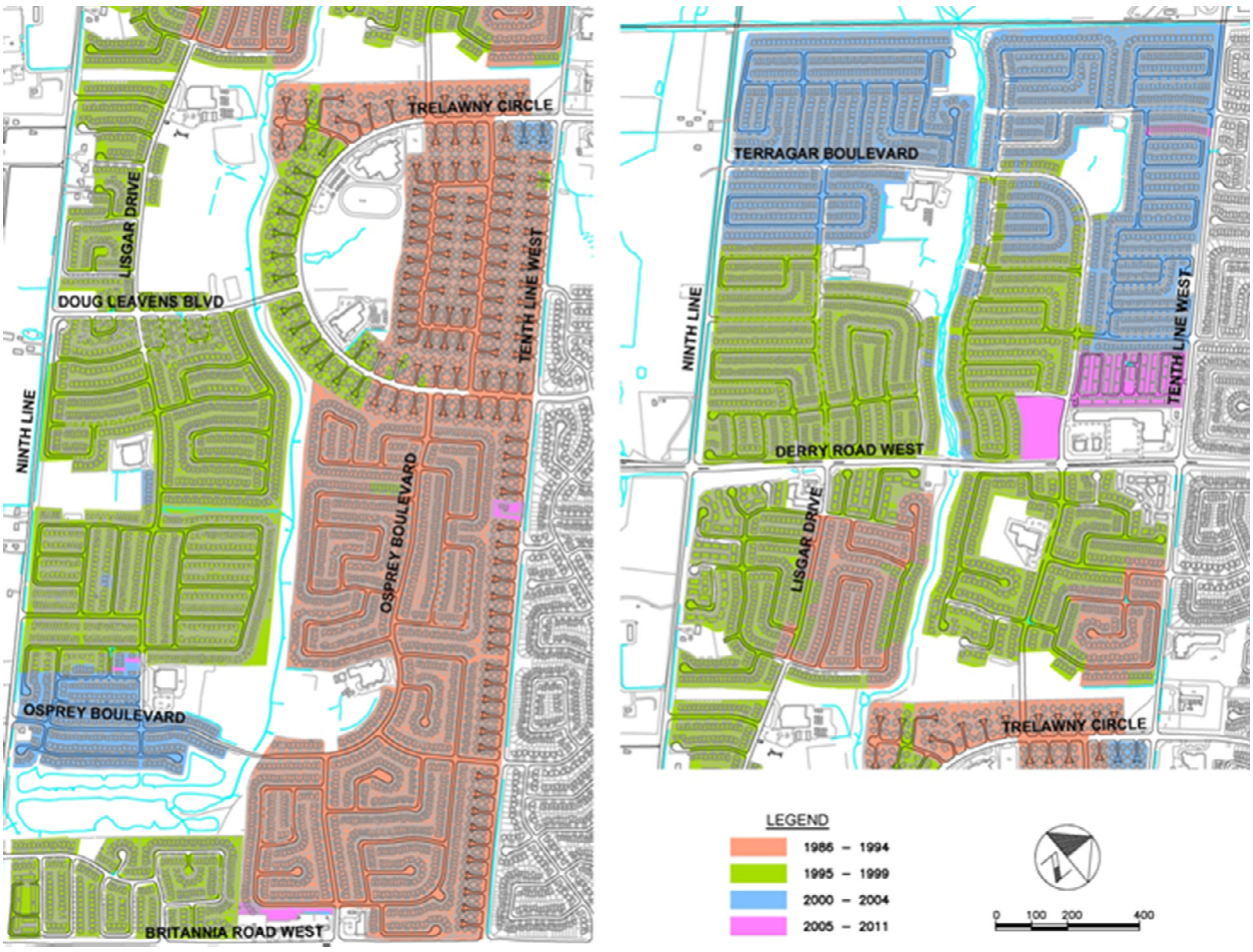


**Figure 1.2. Historic Development of Lisgar**

## 1.2 Background & Overview

Commencing in 2008, a number of homes in the Lisgar District experienced water seeping into their basements following certain rainfall events. Almost 200 homes are known to have been affected to date (2018); Figure 1.3 generally depicts the areas affected. The majority of homes were affected by the October 19/20, 2011 event (141 homes); others have been affected by subsequent events, including multiple times for many residences. Since Wood began monitoring in 2012, reported basement water infiltration events include:

- January 13, 2013 (7 homes)
- July 14, 2017 (36 homes)
- January 11-12, 20220 (41 Homes)
- August 28, 2021 (5 homes)

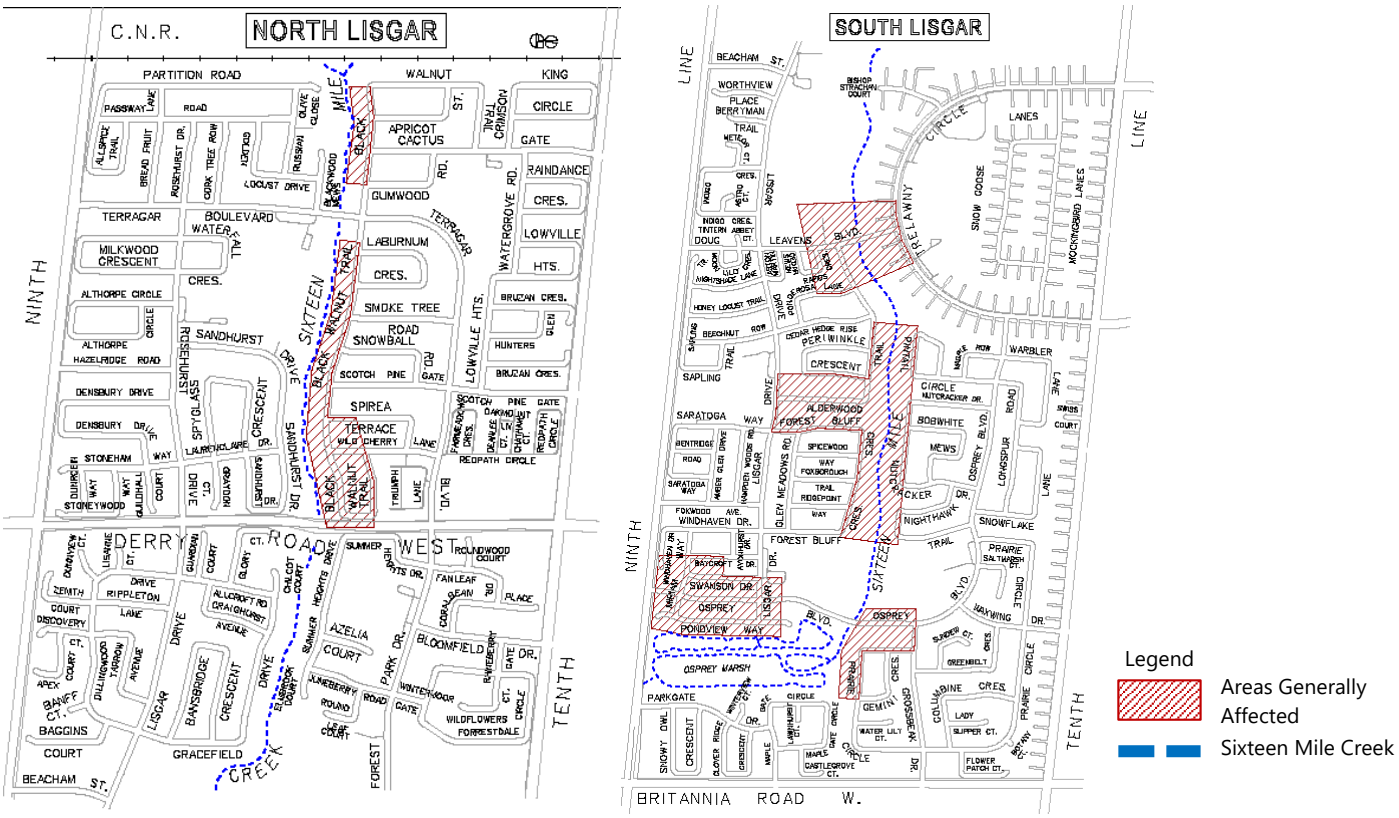


**Figure 1.3. Areas Affected by Basement Water Infiltration**

After becoming aware of the scale of this issue, the City undertook a number of actions, including:

- Video inspection and cleaning of the foundation drain collector (FDC) system;
- Removal of vegetation along Sixteen Mile Creek;
- Clean-out of bridge crossings and storm outfalls to Sixteen Mile Creek;
- Sealing selected Foundation Drain Collector (FDC) manholes and pipe joints;
- Adjustment to the Osprey Marsh Stormwater Pond outlet upstream of Ninth Line; and
- Putting in place a High Water Protocol (deploying temporary portable pumps during major storms).

The High Water Protocol (HWP) consists of City staff continuously monitoring weather forecasts and other weather-related information, such as High Water Bulletins from local Conservation Authorities. When unfavorable weather conditions are predicted, City staff and/or its contractors are deployed to three (3) locations within the Lisgar District with portable pumps on standby to pump water from the FDC system, if required (typically if the water level in the pipe exceeds the springline/50% of full sewer depth).

Furthermore, the City retained a consultant to conduct an investigation of the problem. Specifically, in October 2011, AMEC Environment & Infrastructure (now known as Wood Environment & Infrastructure Solutions Canada Limited (Wood)) was retained to undertake an engineering study to determine the cause(s) of basement water infiltration and recommend corrective measures.

In an effort to reduce the ingress of water into the drainage systems serving the area, impermeable collars were constructed across storm sewer outfalls in the fall of 2014 at two (2) locations; Scotch Pine Gate in the north (outfall to Lisgar Creek) and Pondview Way in the south (outfall to the Osprey Marsh SWM Facility). The collars were intended to prevent the backflow of surface water into the utility trench which contain the sanitary, storm and FDC systems.

After comprehensive monitoring and analysis (as outlined in subsequent sections), the engineering study related to causes, determined the problem to be primarily related to the build-up of water in the bedding material of the utility trenches that contain the storm, sanitary and FDC sewer systems.

In March 2015 the results of the engineering study were presented to the public which outlined a multi-component Mitigation Plan. The Plan recommended the following measures as the highest priorities for the City to deal with the basement water infiltration issue and reduction of sources of unintended inflow to the FDC sewer:

- Strategic lining of priority storm sewers to minimize leakage;
- Construction of a utility trench dewatering system;
- Build permanent FDC pumping stations for high flows; and
- Replace hydraulically deficient FDC pipe lengths when they reach the end of their engineered lifespan.

Following the release of the March 2015 Public Summary Report (refer to Appendix A), Wood was subsequently retained by the City of Mississauga to support the implementation (design, approvals, and construction) of the various remediation works, with the highest priority items being storm sewer lining (to reduce leakage) and the design of a utility trench dewatering system (to reduce the build-up of water in the utility trench). In addition, Wood continued to undertake monitoring of the drainage systems within the Lisgar District area to provide ongoing verification of the effectiveness of remedial measures, as they were constructed, and to also allow for further data collection in the event of FDC surcharging or basement water infiltration events, should they occur.

As part of the implementation of the Prioritized Action Plan, storm sewer lining works were completed for the highest priority area (Phase 1 - Black Walnut Trail) between December 2016 and March 2017. Extents are presented in Figure 1.4.

A second phase of storm sewer lining was planned for the next highest priority area (Doug Leavens Boulevard, Alderwood Trail, and Osprey Boulevard) for later in 2017. However, post-lining storm sewer leakage tests completed in April 2017 indicated a similar rate of leakage under post-lining conditions as under pre-lining, which was unexpected. The City of Mississauga and Wood investigated further, conducting additional testing into the leakage mechanisms, and determined a high potential for leakage from the subdrains in the catchbasins. On this basis, City staff ultimately proceeded with the installation of catchbasin sub-drain plugs along Black Walnut Trail in October and November of 2017, with a second phase of plugs (Doug Leavens Boulevard to Osprey Boulevard) installed in January of 2018. Locations are included in the 2017 Annual Monitoring Report (Wood, March 2020). The effectiveness of these plugs has continued to be evaluated over the course of 2018 and beyond.

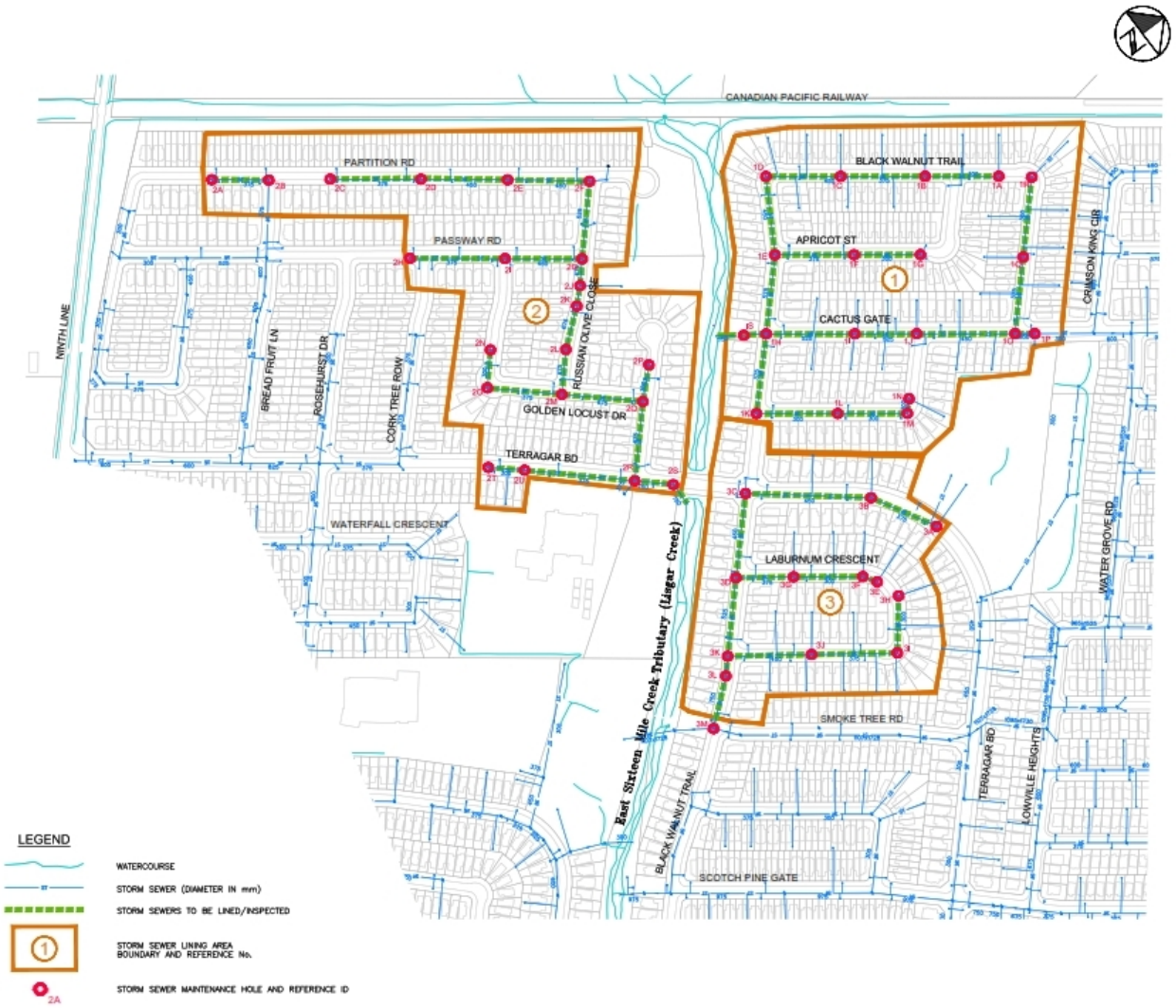


**Figure 1.4. Phase 1 Storm Sewer Lining Areas**

On July 13-14, 2017, between approximately 11:50 PM and 12:30 AM, a local convective (thunderstorm type) system affected the Black Walnut Trail area of the Lisgar District area. The storm event resulted in reported basement water infiltration for 35 (+/-) residences, the majority (34) located along Black Walnut Trail (1 along Golden Locust Drive). Based on post-event questionnaires completed by affected residents, the infiltrated water was generally characterized as clear, and sourced from around the perimeter of the home.

A public meeting was held on October 18, 2017 to provide the Public with an update on the ongoing works being completed for the Lisgar District Basement Water Infiltration Study, as well as to provide a characterization and analysis of the July 13-14, 2017 storm event. As part of the public meeting, an Updated Action Plan was presented. In addition to previously proposed activities (addressing roadway sub-drain leakage, utility trench dewatering system), an FDC pumping station (similar to that proposed in the March 2015 Public Report) was advanced as a higher priority mitigation measure to be assessed, planned, designed and constructed in 2018/2019.

In September 2018, a Class Environmental Assessment (EA) was completed for the Black Walnut Trail area pumping station system. The purpose of the Class EA was to identify the location and preferred approach

for a pumping station within the Lisgar District. Integrated hydrologic/hydraulic (PCSWMM) modelling software was used to assess expected rates of flow within the FDC system during storm events, and the associated effectiveness of potential pumping strategies (locations, numbers, and pump station sizing/capacities). Two (2) locations were short-listed through this process: Cactus Gate Parkette and Smoke Tree Road Parkette. The hydraulic modelling results indicated that in general, an FDC pumping system at Smoke Tree Road would be more effective at reducing FDC water levels in downstream areas than one located further upstream at Cactus Gate. However, an FDC pumping system at Cactus Gate would be more effective at reducing FDC water levels in the upstream area, and in particular removing excess flows from this area, which was indicated as having a relatively higher rate of flow contribution to the FDC system. As such, the preferred solution identified within the Class EA was the construction of an FDC pumping system at the Cactus Gate Parkette, west of Black Walnut Trail and Cactus Gate The preferred pumping approach was a combined high flow (directly from the FDC sewer) – low flow (utility trench bedding) pumping system given the associated efficiencies around construction and design, and also long-term operation and maintenance.

The construction of the Cactus Gate pumping station began in December 2019 and the pumping station was commissioned in March 2021. Since then, several major rainfall events have occurred in Lisgar District, and on August 28, 2021, a major storm event occurred. The storm event resulted in five (5) incidents of reported basement water infiltration. This was the most intense local rainfall on record within the past ten (10) years, including the aforementioned storm on July 14, 2017. A review of the effectiveness and impact of the Cactus Gate Pumping Station (ref. Wood, October 15, 2021) was completed to assess the subject storm event and the associated drainage system performance. It was concluded that the Cactus Gate Pumping station helped mitigate the impacts of the storm, along with the High Water Protocol temporary pumping which was active during that event. However, it was noted that FDC surcharging continues to occur and that additional remedial measures are needed.

Continuing from the Class Environmental Assessment (EA) completed in 2018, the current Class EA has specifically been advanced to determine the preferred locations and form of Pumping Stations within the entirety of the Lisgar District (as per Figure 1.1) as a form of master plan, to further reduce the potential for basement water infiltration. This study will determine and confirm the number of required FDC pumping stations and priority sequence for implementation within the Lisgar District as a whole.

A public meeting was held on November 19, 2021 to provide the Public with an update on the Cactus Gate Pumping Station and Monitoring Program, information regarding this Class EA, and an overview of the High Water Protocol. Two (2) Question and Answer sessions were also held with the responses compiled and released publicly thereafter (refer to Appendix G).

## 1.3 Class Environmental Assessment Process

**Overview**

This study has followed the process outlined in the Municipal Engineers Association (MEA), Municipal Class Environmental Assessment (EA), October 2000 (as amended in 2007, 2011, and 2015). The Municipal Class EA process defines mandatory principles, details of project consultation and technical requirements. A Municipal Class EA is considered a legal document which outlines municipal project recommendations and next steps, based on technical assessments, public input and consultation with technical practitioners, agencies and engagement with Indigenous Peoples and Nations.

**Municipal Class EA Process**

Each Municipal Class EA undertaking, depending on the scope of work and the range of predicted environmental impacts, is classified using Schedules. The Schedule to apply, typically depends on the scope

and estimated capital cost of the recommended works. Based on a review of similar forms of infrastructure (in the absence of any precedents with foundation drainage pumping stations), Wood and the City selected Schedule B as being appropriate on the basis of the required level of study and consultation for similar works (ref. Figure 1.5). The various phases of the Class EA process have been conducted by this study based on the Schedule (i.e., Schedule B: Phases 1 and 2), while Phase 5 will be conducted based on the recommendations herein being continued through to detail design and subsequently construction and monitoring.

As part of the Class EA process the following key principles are considered:

- Establish a Problem and Opportunity Statement;
- Consult with affected parties early in, and throughout the process, such that the planning process is a cooperative venture;
- Consider a reasonable range of alternatives, both functionally different "alternatives" and "alternative methods" of implementing the solution;
- Systematic evaluation of alternatives in terms of their advantages and disadvantages, to determine their net environmental effects; and,
- Provision of clear and complete documentation of the planning process followed, to allow "traceability" of decision-making with respect to the project.

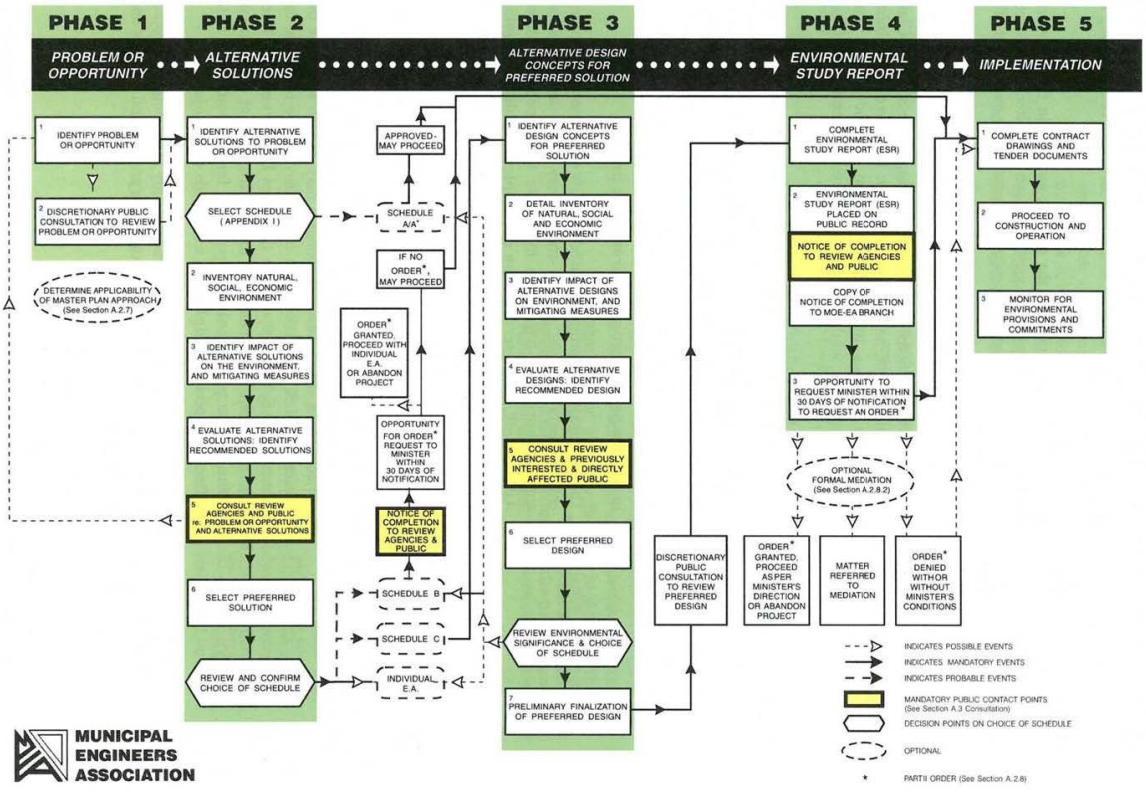


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**Figure 1.5. Municipal Engineers Association (MEA), Municipal Class Environmental Assessment, October 2000 (as amended in 2007, 2011 and 2015)**

This Municipal Class EA was completed to determine the preferred locations and form of Pumping Stations within the Lisgar District to further reduce the potential for basement water infiltration. Through this study, multiple Pumping Station Alternatives (location and form) have been developed and evaluated by the Project Team and refined through stakeholder and public consultation. The Project Team selected a Preferred Alternative, which consisted of three locations for installing pumping stations. This Project File Report was developed to document the entire study process for review by the public, Indigenous Nations, Government Agencies, and interested stakeholders(ref. Figure 1.6).

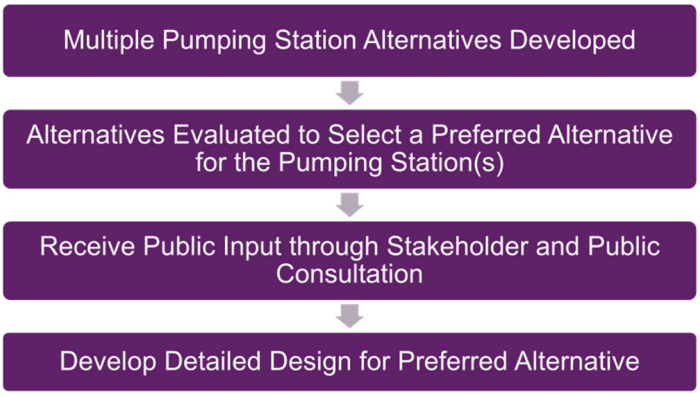



**Figure 1.6. Municipal Class EA Process for Lisgar District Pumping Stations**

**Public and Agency Consultation and Indigenous Engagement**

In accordance with the Municipal Class EA process, consultation has been undertaken with the Public and Regulatory Agencies, and engagement with relevant Indigenous Peoples and Nations. A Public Information Centre (PIC) was held on November 17, 2021; notification for the PIC was sent to stakeholders, local residents and agencies by mail. Conservation Halton (CH) provided comments regarding areas of interest or concern on the project, which was followed by correspondence between CH and the Project Team in order to address these concerns. The City received direction from the Ministry of Environment, Conservation, and Parks (MECP) regarding Indigenous Peoples and Nations that may have an interest in the project. Accordingly, letters of notice and project summaries were provided to the Mississaugas of the Credit First Nations (MCFN), Huron-Wendat Nation (HWN), Six Nations of the Grand River (SNGR) and the Haudenosaunee Confederacy Chiefs Council (HCCC).

## 1.4 Lisgar District Drainage Systems Overview

When agricultural or open space lands are converted to urban uses, such as residential or employment, municipal services including watermains, sanitary sewers and storm sewers are typically constructed within road allowances or public easements to support these developments. The City of Mississauga is responsible for managing all aspects of stormwater within its jurisdiction, whereas the Region of Peel is responsible for stormwater on Regional roads, as well as drinking water, wastewater and solid waste management.

Storm sewers are designed to capture surface runoff from rainfall or snowmelt and then convey this water safely to a waterbody such as a creek, river or lake. In areas with stormwater management facilities (commonly referred to as ponds), which are routinely designed to provide water quality and/or flood and erosion control, this water would first outlet into these ponds for treatment before being released to a waterbody. Where the waterbody is comparatively deep in relation to the surrounding lands, the storm sewers can be built sufficiently deep below the ground surface to concurrently capture and convey water draining from the weeping tiles around the basement foundations of homes (Figure 1.7). Alternatively, where the receiving waterbody is high (or shallow) compared to the surrounding lands and basement

foundations, the weeping tiles around the homes would not be able to drain by gravity into the storm sewers. In these circumstances, one of two systems would be required to drain the foundation around the homes:

- Sump Pumps; or
- Dedicated Foundation Drain Collector.

A sump pump is a mechanical system used to remove water captured by the weeping tiles around the basement foundations of homes that has been collected in a sump pit (basin) in the residential basement. Water from the sump pit would either be pumped to the ground surface where it would drain across the yard to the storm sewer or underground into a shallow storm sewer (however this is not currently permitted in the City of Mississauga); refer to Figure 1.8.

A Foundation Drain Collector (FDC), typically located in the same utility trench as other municipal services, is a sewer system dedicated to only collect and drain water from weeping tiles around homes to an outlet by gravity flow (Figure 1.9). The FDC system is often referred to as part of a 3-pipe system, the other two being the storm and sanitary systems. At the time of its construction in the Lisgar District, the FDC system was considered to be a preferred solution for many new areas. In fact, the textbook *Modern Sewer Design (Canadian Edition, 1980)* states: "*This system virtually eliminates the probability of back-ups into foundation drains, which have caused considerable flooding, and damage to basements*". Figure 1.10 depicts the limits of the Lisgar District within Mississauga served by an FDC system.

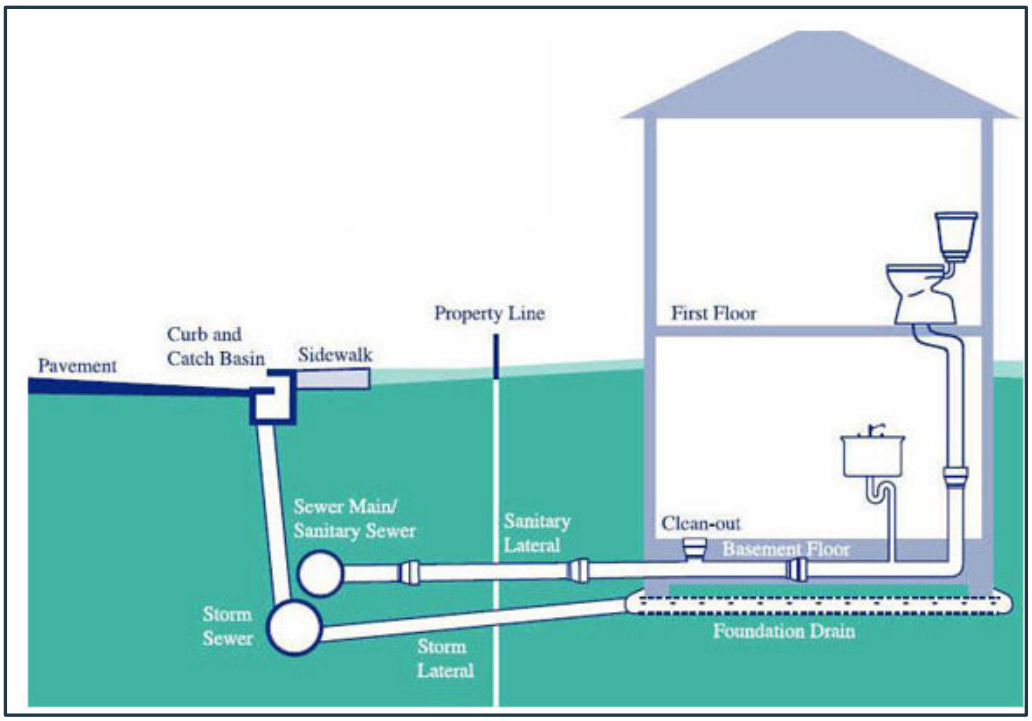



**Figure 1.7. Conventional Foundation Drain Connected to Storm Sewer**

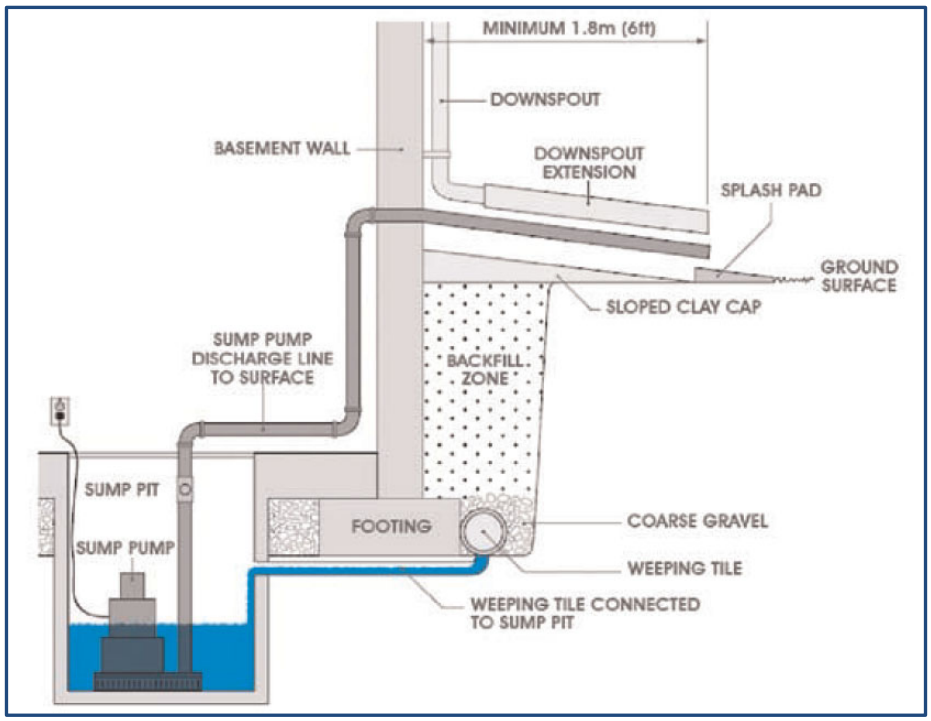



**Figure 1.8. Sump Pump to Front/Year Yards or Storm Sewer**

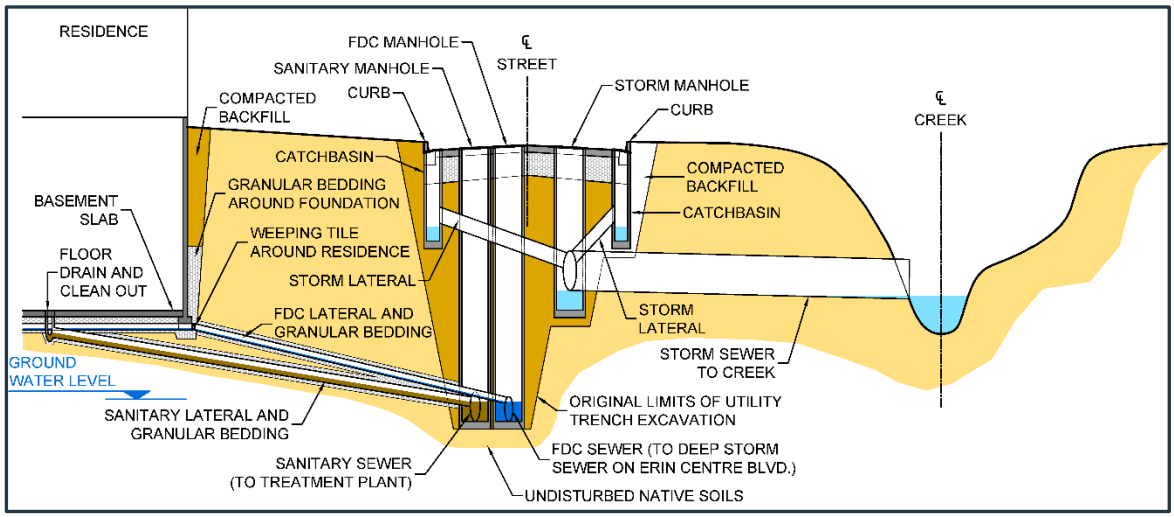



**Figure 1.9. Foundation Drain Collector as found in the Lisgar District**

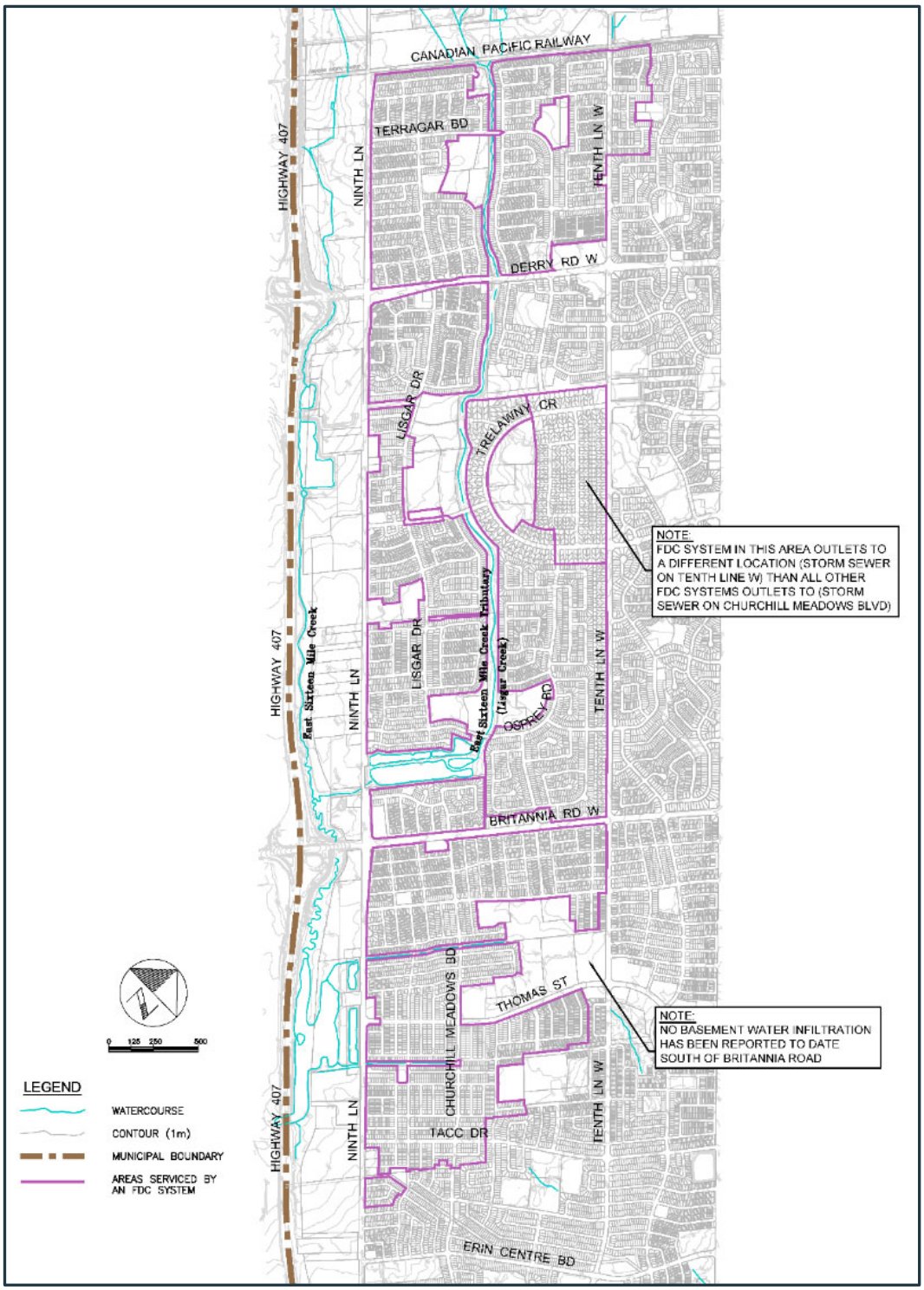



**Figure 1.10. Servicing Limits of FDC System in Mississauga**

Table 1.1 provides a brief summary of the advantages and disadvantages of these three distinct foundation drainage systems.

**Table 1.1. Advantages and Disadvantages of Three Distinct Foundation Drainage Systems**

| Type | Advantages | Disadvantage |
|---|---|---|
| **Gravity to Storm Sewer** | • No additional infrastructure<br>• Comparatively low cost<br>• No reliance on mechanical system or power | • May back up if storm sewer is overwhelmed<br>• Some additional cost to upsize storm sewers |
| **Sump Pump** | • Disconnected from municipal system | • Requires homeowner to operate and maintain the system<br>• Mechanical system needs to operate to function<br>• Relies on power |
| **Foundation Drain Collector** | • Dedicated, providing drainage for foundation only<br>• No reliance on mechanical system or power<br>• At the time of implementation was considered to reduce the probability of back-ups into foundation drains<br>• Allows for smaller sized storm sewers<br>• Successfully installed in numerous other municipalities without incident (Brampton, Vaughan, Barrie) | • Comparatively high cost to install additional deep and long pipe systems |

It should be noted that the technical term 'surcharge' is often used in this report when referring to the flow conditions of sewers. This term refers to a gravity sewer that is overloaded beyond its pipe full flow capacity such that the flow is under pressure.

## 1.5 Problem Statement

Commencing in 2008 a number of homes in the Lisgar District experienced water seeping into their basements following certain rainfall events. To address the basement water infiltration issue, the City developed a comprehensive Action Plan in 2015. Following Public and Agency consultation, as well as additional monitoring and investigations, an Updated Action Plan was developed in 2017 based on additional information on system performance through monitoring the July 13-14, 2017 storm and various testing activities. The FDC Pumping Systems must consider several constraints and opportunities related to the drainage area served, property suitability, and the number of houses in proximity that reported basement water infiltration. The Preferred Alternative must address the Problem while balancing study area constraints and opportunities, in order to best mitigate the basement water infiltration and the interests of local residents. Two forms of mechanical pumping were recommended in 2015 and 2017 to reduce water levels in the utility trench and FDC respectively. A Class EA was completed in 2018 with the preferred approach of a combined high flow – low flow pumping system at Cactus Gate Parkette and the pumping station came into operation in 2021.

Based on ongoing monitoring results and reports of continued areas subject to basement water infiltration, additional measures are required to reduce basement water infiltration within the entirety of the Lisgar District. The current study is intended to determine the number, location and priority of pumping stations to address ongoing basement water infiltration for the overall Lisgar District as per the limits presented in Figure 1.1.

# 2.0 Studies and Investigations

As outlined in Section 1.2, in response to the initial reports of basement water infiltration in 2008, several works and activities were initiated by the City; these generally can be categorized as:

i. Works led by City forces directly

ii. System monitoring to collect data on drainage system performance

iii. System testing to validate theories and directly assess performance of certain components

iv. Analyses of the data to determine extent, scale and source of problem.

v. Assessments of Existing Conditions

## 2.1 City-Led

When the City of Mississauga first became aware of basement water infiltration, the causes of this unexpected problem were not known. In response, the City proactively undertook a number of precautionary, investigative and maintenance actions on the storm and FDC sewer systems, the tributary of the East Branch of Sixteen Mile Creek, and the Osprey Marsh Stormwater Management Pond. Table 2.1 summarizes the work completed by the City in the Lisgar District prior to March 2015. These activities are further described in the Summary Report (March 2015) for the Lisgar District Basement Water Infiltration Investigation (ref. Appendix A).

**Table 2.1. City-Led Activities Completed Prior to March 2015**

| | |
|---|---|
| **FDC and Storm Sewers** | Video inspection and Flushing of FDC and Storm Sewer Systems |
| | Identifying Sewer Cross-connections |
| | Sealing FDC Maintenance Access Lids and Cracks |
| | Cleaning Storm Sewer Outfalls to Creek |
| | Improvements to Overland Flow Routes |
| | High Water Protocol |
| **East Sixteen Mile Creek Tributary and Osprey Marsh Stormwater Management Pond** | Creek Vegetation Trimming and Debris Removal |
| | Sediment and Vegetation Removal from Bridge Crossings and Storm Outfalls |
| | Creek Inspection Protocol |
| | Reconfiguration of Osprey Marsh Stormwater Management Pond Outlet |

The City has continued to undertake additional activities following the release of the March 2015 Public Report, including continuation of the High Water Protocol (temporary pumping). A change was made to one (1) of the pumping locations, effective in 2021. In addition, the City purchased three (3) new high capacity 6" pumps which have a much greater capacity than the previously employed pumps (became active in 2020).

Further, the City has continued other supporting activities, such as FDC smoke testing (to identify cross-connections to the FDC system), ongoing CCTV inspection and flushing of the FDC system, and the ongoing sump pump subsidy to residents.

## 2.2 Studies and Investigations Completed Prior to the release of the March 2015 Public Summary Report

**Monitoring Work**

Wood initiated field monitoring activities in support of the Lisgar District Basement Water Infiltration study in late 2011 and early 2012. These monitoring activities were intended to collect data in order to better inform the understanding of the operational mechanisms of the drainage systems in the Lisgar District and help identify the source(s) of the basement water infiltration occurrences in this neighbourhood.

Monitoring was conducted for the Foundation Drain Collector (FDC) sewer system, the storm sewer system, surface water (Lisgar Creek), as well as the groundwater system. A comprehensive monitoring program has continued annually since its initiation, to collect field data needed to help understand the cause(s) of basement water infiltration and to provide guidance in finding the appropriate/preferred mitigation measures and also offer feedback on the efficacy of mitigation solutions. The monitoring work has been invaluable in allowing the Team to better understand the drainage systems' response to storm events and help lead the Team towards identifying the cause(s) of basement water infiltration and efficacy of solutions. Table 2.2 provides a summary of the monitoring work completed between 2011 and 2014. Detailed summaries are provided in the 2015 Summary Report (refer to Appendix A) which provide a year-by-year summary of activities and findings of the monitoring effort.

**Table 2.2. Monitoring Work Completed between 2011 and 2015**

| Stormwater System Component | Findings |
|---|---|
| ***Groundwater:*** | |
| • Monitoring wells were installed at four main sites.<br>• Both water level and water temperature were monitored continuously at these sites. | • Groundwater temperatures in the native soils do not vary greatly and are not affected by precipitation events.<br>• The shallow groundwater levels in the native soils do not increase rapidly enough during precipitation events which proves that basement water infiltration is not caused by flow through the native soils. |
| ***FDC and Storm Sewer System:*** | |
| • Water level monitoring gauges were installed at various locations within the FDC and storm sewer systems.<br>• Both water level and water temperature were monitored continuously at these sites. | • The FDC system has been observed to surcharge rapidly in response to intense rainfall events along the Black Walnut Trail area. The more downstream areas (Osprey Boulevard) tends to respond more to longer-lasting, higher duration rainfalls and saturated\frozen ground conditions.<br>• Surcharging is most common along Black Walnut Trail and in the vicinity of Doug Leavens Boulevard and Osprey Boulevard, which is generally consistent with locations of reported basement water infiltration.<br>• The short period of time in which the water level in the FDC system has been observed to surcharge and then quickly drop back down strongly suggests that the water is coming in from surface water sources rather than groundwater.<br>• The water temperature data from the observed surcharge events also suggest that the water is coming from surface water sources.<br>• Water levels in the storm sewer along Erin Centre Boulevard, which takes drainage from the FDC system, show that it is not the cause of FDC surcharging. |

| Stormwater System Component | Findings |
|---|---|
| ***Tributary and Stormwater Management Pond:***<br>• Water level monitoring gauges were installed and monitored at five different locations along the creek, and one directly within the pond.<br>• A temporary rainfall gauge was installed for two of the earliest monitoring years. | There is nominal creek flow from the GO Station channel, and no apparent connection between these flows and FDC surcharging.<br>• There is no apparent connection between creek flows and FDC surcharging.<br>• There is no apparent connection between water levels within the Osprey Marsh Stormwater Management Pond and FDC surcharging. |

### Testing Work

To better understand the interactions between the various water sources and components of the drainage system in the Lisgar District, testing work was also undertaken through water sampling and 'in-ground' pilot projects to validate some of the theories. Table 2.3 provides an overview of these findings.

**Table 2.3. Testing Work Completed between 2011 and 2015**

| Stormwater System Component | Findings |
|---|---|
| ***Water Quality Characterization:***<br>• A characterization program was completed to assess the chemical properties of the water found in:<br>– Native soils (i.e. the groundwater);<br>– Utility trench (i.e. where the municipal services are);<br>– Creek;<br>– Osprey Marsh Stormwater Management Pond; and<br>– FDC system.<br>• The testing was able to identify commonalities among the various different water sources, and in particular the source of the water in the FDC. | • Under expected operating conditions the quality of the water in the FDC system should show some similarities with the shallow groundwater. However, water in the FDC system water was found to be salt rich, similar to the utility trench, the tributary and the pond. This suggests that the water in the FDC system is very similar to surface water (and dissimilar to groundwater). |
| ***Storm Sewer Leakage Testing:***<br>• Storm sewer leakage testing was undertaken at three sites where basement water infiltration occurred.<br>• The tests were comprised of:<br>– Blocking the storm sewers and filling them with water to replicate surcharge conditions (under pressure);<br>– Addition of a green fluorescent dye to the storm sewer; and<br>– Monitoring of the dye concentrations and water levels in the utility trench, groundwater and FDC system. | • At all three sites, the storm sewers leaked and at two sites (Wild Cherry Lane and Scotch Pine Gate), the dye was detected in the FDC after two hours.<br>• Tests have proven that there is a flow path from the storm sewer to the FDC through the utility trench with a response time consistent with that observed between major storm events and instances of basement water infiltration. |
| | |

| Stormwater System Component | Findings |
|---|---|
| ***Storm Sewer Outfall Collar Testing:***<br>• Impermeable concrete collars were installed in the utility trench near the outfall of the storm sewers at two locations:<br>– Sixteen Mile Creek (Scotch Pine Gate); and<br>– Osprey Marsh SWM Pond (Pondview Way).<br>• These collars were installed with backflow valves that allow water from the utility trench to drain to the tributary and pond, but not in the other direction in order to attempt to limit surface water inflow to the utility trench. | • Monitoring (ref. 2015 Annual Report) indicated a limited benefit at the Scotch Pine Gate Site. A localized benefit was indicated at the Pondview Way site but this was attributable more to enhanced passive dewatering of the sewer trench to the Osprey Marsh SWM.<br>• In both cases it was concluded that upstream storm sewer leakage was a greater factor than backflow from receiving waterbodies. |

Field monitoring activities have continued in parallel annually, in order to support these activities by assessing the effectiveness of mitigation works after implementation and observed changes in drainage system performance over time.

**Analysis Work**

Wood has used the data collected over the monitoring periods, as well as additional information provided by the City on the FDC system and area services, to conduct a series of technical analyses as follows:

**Table 2.4. Analysis Work Completed between 2011 and 2015**

| Monitoring Component | Findings |
|---|---|
| ***Groundwater Analysis***<br>• Testing work and analyses were undertaken for native soils and granular materials | • Permeability in the utility trench is up to 10 million times greater than the native soils. This has further confirmed that the utility trench is the primary linkage for surface water to reach the FDC system. |
| ***Design Check of the FDC Sewer System***<br>• Larger number of residences are currently connected to the FDC system than what was intended in the original design; This was known by the City and area developers and computer modelling demonstrated that the system could accept the higher number of connected residences.<br>• Comparison of original design sizes and slopes of the FDC sewers with as-constructed characteristics demonstrated that some sections of the FDC trunk sewer were constructed flatter than intended, which is expected to decrease the available flow capacity. | • Deficiencies in the as-constructed design of the FDC trunk sewer system may contribute marginally to FDC surcharge, however, given the results of the FDC monitoring, these deficiencies are not considered to be a material contributor to FDC surcharging or a cause of the basement infiltration issue.<br>• Observed FDC surcharging has also been noted in areas which are a considerable distance away from FDC sewer deficiencies, which further suggests that these deficiencies are not a material contributor to the FDC surcharging or a cause of the basement infiltration issue. |
| | |

| Monitoring Component | Findings |
|---|---|
| ***Computer Modelling of the FDC System*** | |
| • Computer modelling was completed for the FDC sewer system. | • Findings located in the March 2015 Summary Report (Appendix A). |

The findings from the monitoring, testing and analysis work completed between 2011 and March 2015 resulted in the identification of the primary cause of infiltration (detailed in Section 3.0) and a Prioritized Action plan (detailed in Section 4.0). This information was presented in the Public Report at a presentation in March 2015 (Appendix A), subsequent to which, the City's focus shifted towards implementation of remediation activities, in order to work towards mitigating the identified cause(s) of the observed basement water infiltration.

## 2.3 Studies and Investigations Completed Following the release of the March 2015 Public Summary Report

### Monitoring Work

Annual monitoring continued following the March 2015 Public Summary Report. Annual monitoring reports have been prepared to summarize these results between 2015 and 2021 inclusive. Additional gauges were added as required to support assessment of specific remedial measures, including storm sewer lining in 2016-2017 (Phase 1 – Black Walnut Trail) and 2017 (Phase 2 – Osprey Boulevard Area; subsequently cancelled). Additional monitoring gauges (FDC and utility trench) were implemented in 2021 following the construction of the permanent FDC pumping station at the Cactus Gate Parkette. Daily data are also available from the pumping station control systems. A general summary of the results of this monitoring is presented in Table 2.5; for more specific and detailed results, refer to the annual monitoring reports.

**Table 2.5. Monitoring Work Completed in 2015-2021**

| Monitoring Component | Findings |
|---|---|
| ***Surface Water:*** | |
| • Surface water monitoring gauges were maintained or re-installed in key locations throughout the study area to monitor changes in both water levels, as well as water temperature.<br>• Between 26 and 35 water level and water temperature gauges were active during this period:<br>– Between 19 and 24 gauges in the FDC sewer system<br>– Between 3 and 8 gauges in the storm sewer system<br>– Between 2 and 6 gauges in the surface water system (Lisgar Creek and Osprey Marsh SWMF) | • The FDC system has been observed to surcharge rapidly in response to intense rainfall events along the Black Walnut Trail area. The more downstream areas (Osprey Boulevard) tends to respond more to longer-lasting, higher duration rainfalls and saturated\frozen ground conditions.<br>• Surcharging is most common along Black Walnut Trail and in the vicinity of Doug Leavens Boulevard and Osprey Boulevard, which is generally consistent with locations of reported basement water infiltration.<br>• The permanent FDC pumping station is operating as expected and runs regularly for the low flow component as well as during FDC surcharge events. The pumping station has been beneficial in reducing FDC surcharging during several major event.<br>• FDC surcharging continues to occur despite remedial measures (storm sewer lining, catchbasin subdrain plugs, permanent FDC pumping station). |

| Monitoring Component | Findings |
|---|---|
| | • Extraneous inflow continues to enter the FDC system; private side connections (i.e. downspouts discharging below surface to the weeping tile) should be disconnected. |
| ***Groundwater:***<br>• Monitoring wells were maintained or installed in different zones across the study area, including:<br>– Black Walnut Trail (Cactus Gate, Golden Locust, Scotch Pine Gate)<br>– Alderwood Trail<br>– Osprey Boulevard, Waxwing Drive, Prairie Circle, and Waxwing Drive | • Background groundwater monitors (within surficial soils) continue to indicate minimal response to storm events and no correlation to FDC surcharging<br>• Utility trench water levels continue to indicate a much clearer and regular rise and fall in response to storm events<br>• Utility trench water levels downstream of the Cactus Gate FDC pumping station indicated a localized decrease following commissioning, suggesting the pumping station is locally reducing utility trench water levels |

**Testing Work**

Additional storm sewer leakage testing was completed following the first round of storm sewer lining in April 2017. The leakage testing indicated a similar rate of leakage under post-lining conditions as under pre-lining, which was unexpected. The City of Mississauga and Wood investigated further, conducting additional testing into the leakage mechanisms, and determined a high potential for leakage from the subdrains in the catchbasins. On this basis, City staff ultimately proceeded with the installation of catchbasin sub-drain plugs along Black Walnut Trail in October and November of 2017, with a second phase of plugs (Doug Leavens Boulevard to Osprey Boulevard) installed in January of 2018. No additional leakage testing or other direct testing work has been completed since that time.

**Analysis Work**

In support of the 2018 Class EA, hydraulic modelling of the FDC trunk sewer system was completed using PCSWMM. A unit hydrograph modelling approach was applied for a series of select observed major storm events which resulted in FDC sewer surcharging in order to calibrate the simulated water level responses to observed data from the FDC sewer monitoring gauges noted previously. These analyses allowed for a greater understanding of areas of relatively higher unitary inflows to the FDC sewer system, while also permitting an assessment of potential benefits of flow diversions to FDC pumping stations and estimated pump capacities. The preceding was then used as part of the detailed design effort for the Cactus Gate FDC pumping station. Further details are provided in the 2018 Class EA and the current Hydraulic Assessment Report (refer to Section 5 and Appendix E).

## 2.4 Summary of Potential Causes

As noted earlier, based on the comprehensive monitoring, testing and analysis work completed prior to March 2015, Wood concluded that the primary cause of the basement water infiltration relates to stormwater entering the utility trench.

As storm sewers are not built to be watertight, and due to cracks and leaks expected through aging, as well as potential other cross-connections from various drainage system components, stormwater is able to leak out during storm events and migrate into the utility trench, where the bedding material, made of gravel and other granular soils can allow water to move very quickly. Over time, water builds up in the utility trench from storm sewer leakage, as well as through other sources (other utilities, groundwater, etcetera),

and is unable to drain away quickly due to the relatively impermeable nature of the native soils surrounding the trench.

It is this situation, in combination with certain storm conditions and local lot drainage where issues may arise. For instance, where the ground and utility trench are already wet, possibly from an earlier storm event, and rainfall subsequently occurs, this may create a condition where there is enough leakage from the storm sewer system during the rainfall event to fill an already wet utility trench and push water up the bedding material around the FDC laterals servicing the homes and into the foundation weeping tiles. This water then drains directly into the FDC pipes through the weeping tiles, which may result in excess flow in the FDC system (surcharge). However, this condition by itself may not lead to basement water seepage. It is this condition, in combination with certain storm conditions (preceding rainfall followed by a sufficiently large storm event) and local lot drainage that may lead to water around the weeping tiles being unable to drain and potentially seeping into the basements of homes. This process is illustrated in Figures 2A to 2F.

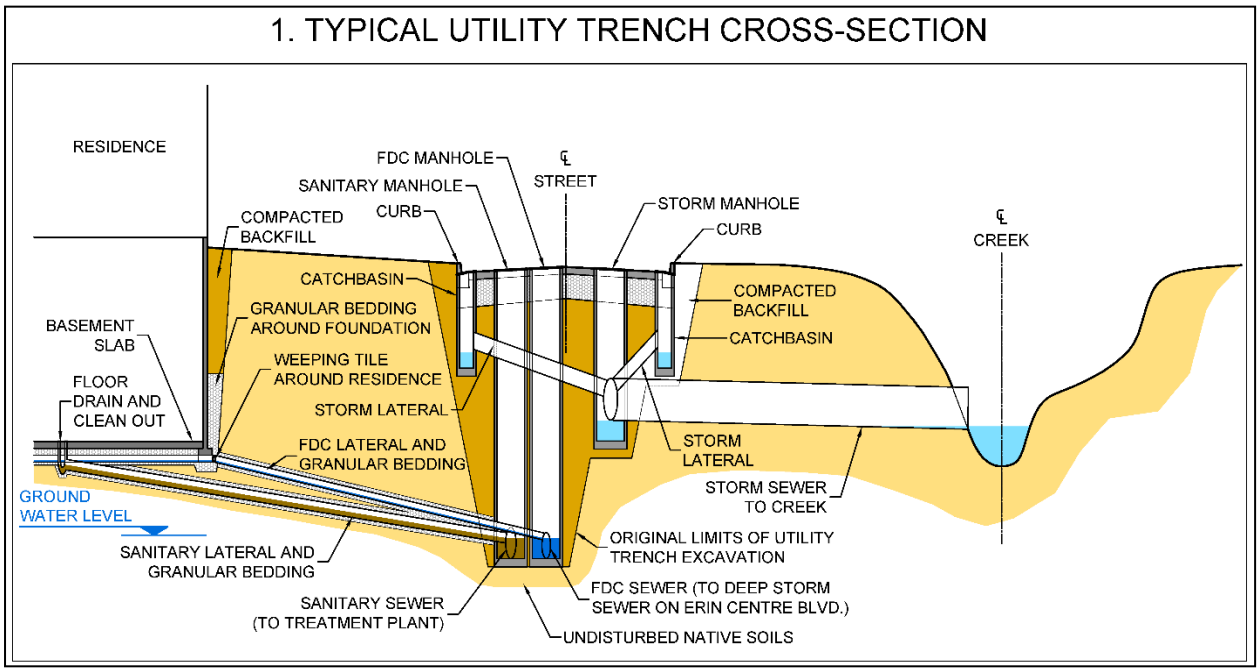



**Figure 2A. Typical Residential Roadway Cross-Section showing Utility Trench**

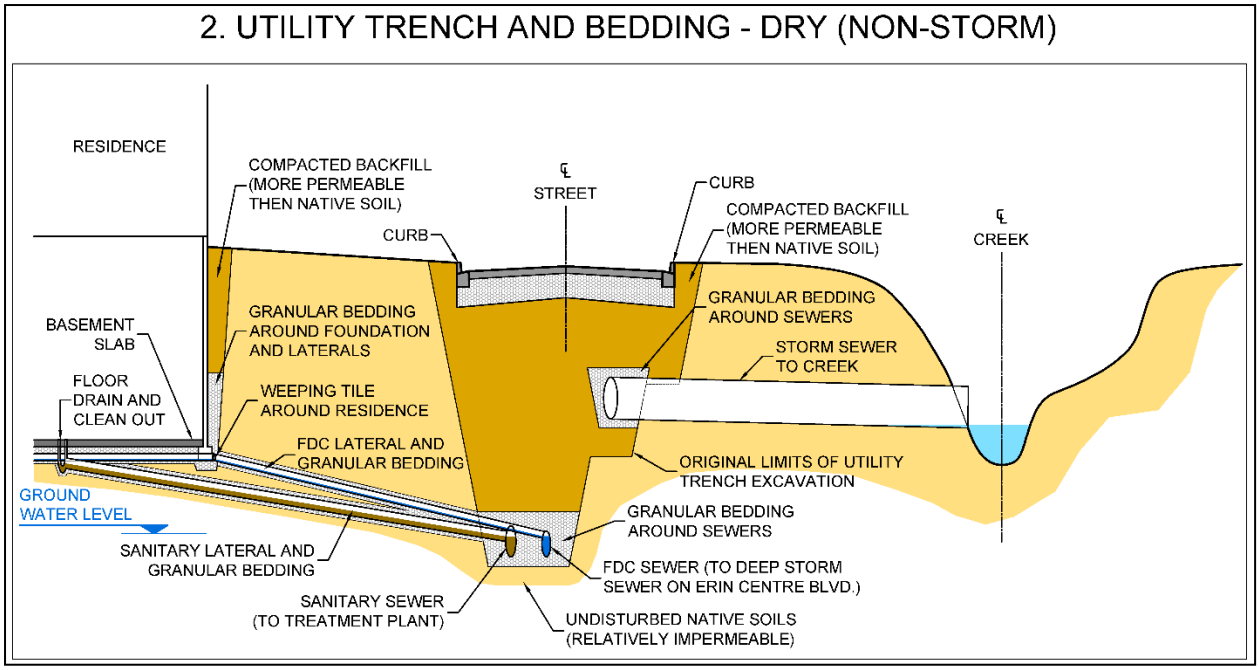



**Figure 2B. Cross-Section showing Utility Trench and Granular Bedding during Dry Period**

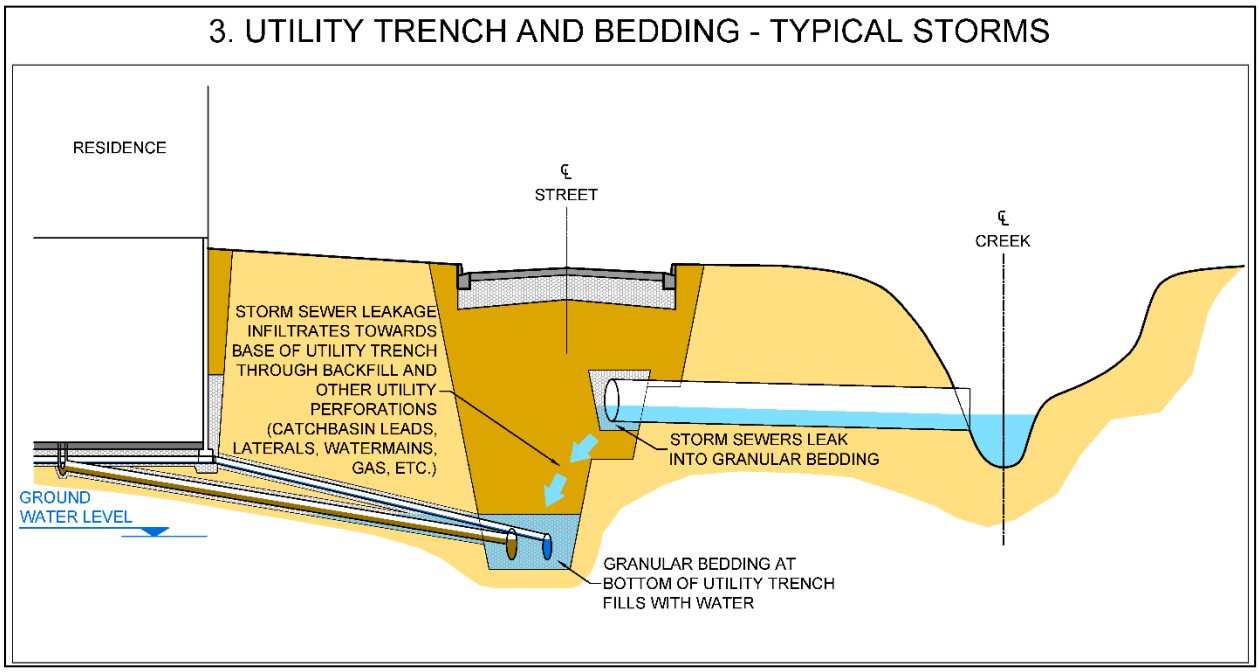



**Figure 2C. Cross-Section showing Utility Trench and Granular Bedding During a Typical Storm**

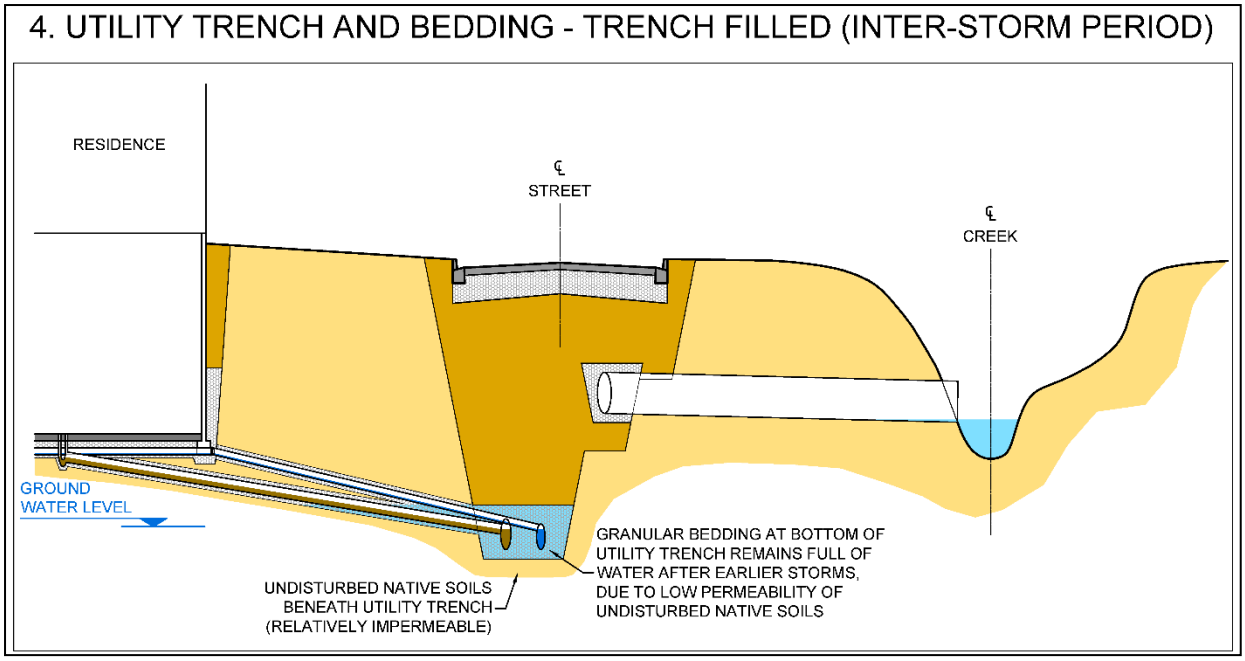



**Figure 2D. Cross-Section showing Filling of Utility Trench from preceding Storm Event**

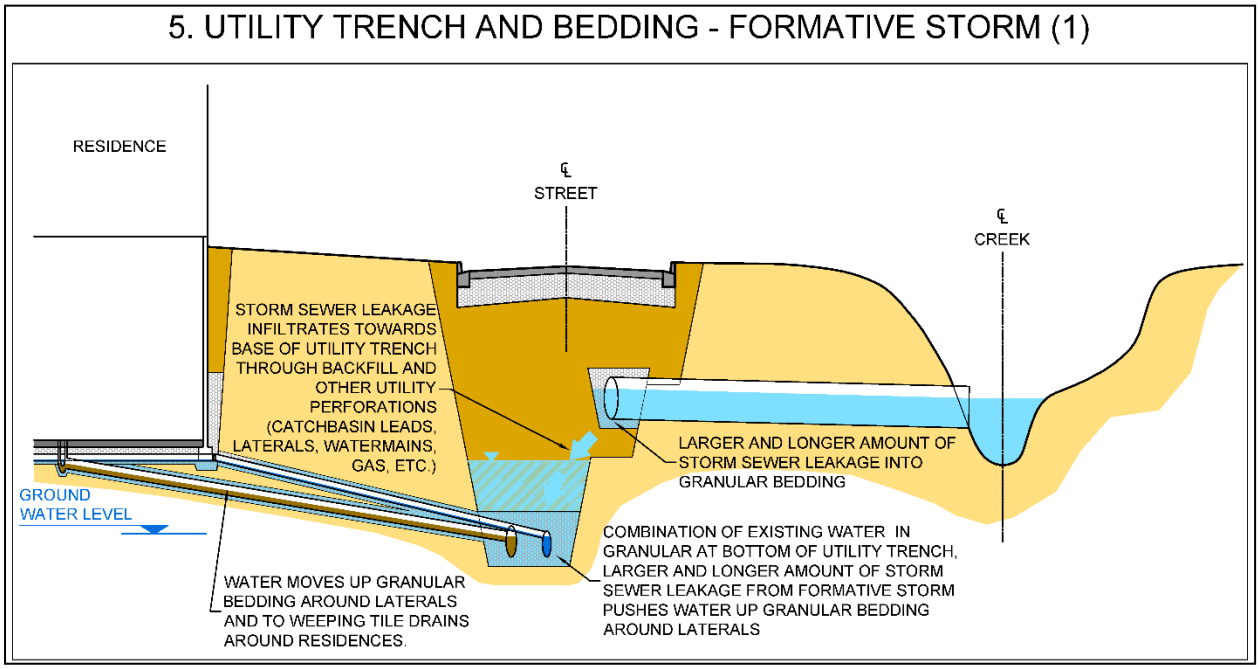



**Figure 2E. Cross-Section showing Cumulative Impact during a Formative Storm**

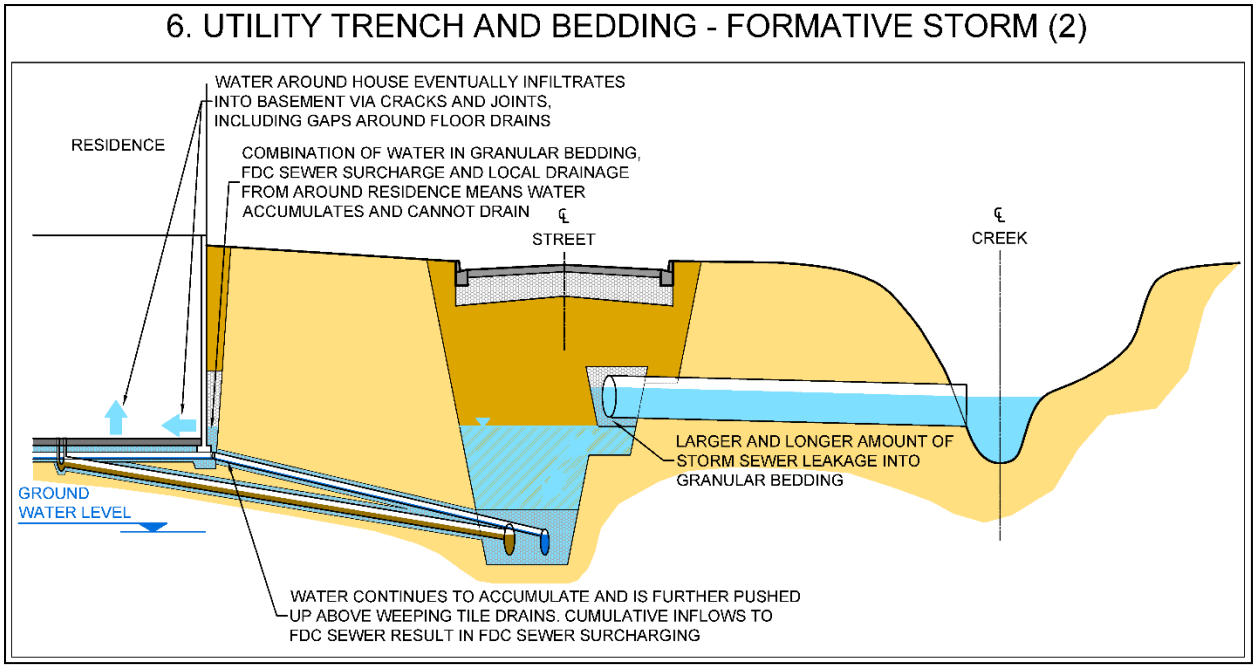



**Figure 2F. Cross-Section showing Cumulative Impact during a formative Storm**

The exact reasons why homes in the Lisgar District have not had basement water seepage before 2008 are not known. It is however considered that the increasing leakage of water from the storm system through normal aging has gradually increased the volume of water collected in the trenches over time, ultimately contributing to the problems first experienced in 2008.

The risk of basement water infiltration is also connected to the relative depths of the FDC system and basements of homes in the different areas of the Lisgar District. Under the condition where water has moved up the bedding material surrounding the FDC laterals to the homes, the homes placed at greatest risk of basement water infiltration would be those where the FDC system (and thus the utility trench) is the shallowest. In other words, the less vertical separation between the FDC pipe/utility trench and the basements, the more susceptible basements will be to water seepage.

A number of other factors have been identified which may be also impacting the overall operation of the FDC system, however, none of them, either alone or in combination, would cause water to seep in to basements to the extent reported. Table 2.6 provides a summary of Wood's conclusions with respect to the potential contributing factors in the basement water infiltration investigation.

**Table 2.6. Summary of Assessment of Potential Factors in Basement Water Infiltration**

| Potential Factor | Level of Influence |
|---|---|
| Stormwater to Utility Trench | Primary Cause |
| FDC and Utility Trench Depths | May increase risk of basement water infiltration at specific locations |
| Groundwater | May contribute additional/excess flows to the FDC and utility trench (Not sufficient to cause problem) |
| Creek Backwater | |
| Osprey Marsh Pond (SWM) Backwater | |
| Basement Walkouts | |
| Inflow/Infiltration to FDC | |
| FDC Hydraulics | May impair conveyance capacity of FDC system (Not sufficient to cause problem) |
| FDC Design | |
| FDC Tailwater | |
| FDC Maintenance | |
| FDC Construction | |
| Cross-Connections | Not Applicable |
| Creek Maintenance | |
| GO Station | |
| Sanitary System | |
| Lot Grading | Insufficient information |
| Basement Construction / Changes | |

# 3.0 Mitigation Plan for Reducing Basement Flooding

The basement water infiltration investigation and the foregoing conclusions led to a prioritized action plan in 2015, which identified potential mitigation measures intended to reduce the risk of future basement water infiltration. The action plan was subsequently updated in 2017 following further investigations. The plan has not been updated since 2017, although it is periodically revisited by City staff as remediation activities advance and based on supplemental annual monitoring findings.

## 3.1 Prioritized Action Plan 2015

To address the basement water infiltration issue, eleven (11) alternative actions were developed and evaluated for potential implementation and documented for Public Review in March of 2015. These eleven (11) actions were analyzed by the City and Wood for effectiveness (ability of proposed actions to reduce basement water infiltration) and feasibility (ease of implementation). Through this process, five (5) actions were carried forward to form a Prioritized Action Plan to reduce the risk of basement water infiltration while six (6) actions were screened out. A detailed matrix summarizing each of the eleven (11) alternative actions is provided in Appendix A. The following five actions (ref. Table 3.1) were recommended to be carried forward as mitigation actions to reduce extraneous sources of inflow to the FDC or remove them, based on their effectiveness and feasibility.

**Table 3.1. Prioritized Action Plan 2015**

| Item # | Action | Description |
|---|---|---|
| 1 | Strategic Lining of Storm Sewers | Sealing the inside surface of storm sewers in strategic locations with an impermeable liner to reduce/eliminate leakage into bedding (and ultimately into FDC system). |
| 2 | Construction of a Utility Trench Dewatering System | Dewater bedding material around the FDC system to limit the accumulation of water in the utility trench and provide additional storage volume during storm events. |
| 3 | Construction of FDC Pumping Stations | Install pumping stations at key locations of the FDC system which will activate when the system either approaches or reaches surcharge conditions and pump water to the ground surface. |
| 4 | FDC Sewer Upgrades | Upsizing selected FDC sewers to increase their conveyance capacity and reduce surcharge. |
| 5 | Sump Pumps | Homeowner installs a new basement sump pump system to help to drain the weeping tile system around the home; sump pump would discharge to ground surface. |

## 3.2 Updated Action Plan 2017

As discussed earlier, a storm event on July 13-14, 2017 resulted in reported instances of basement water infiltration in the Lisgar District. A total of thirty-five (35) residences within the Lisgar District reported basement water infiltration from the July 13-14, 2017 storm event. All of the affected properties were located along the west side of Black Walnut Trail (i.e. backing onto Lisgar Creek), with the exception of one property located along Golden Locust Trail. This is consistent with the location of previously reported instances of basement water infiltration in this area. The July 13-14, 2017 event is notable in that it was the first reported instance of basement water infiltration in this area (Black Walnut Trail) for which field monitoring data are available. Monitoring gauges were in place for the January 13, 2013 event (for which

seven (7) residences reported basement water infiltration), however all of these residences were in the vicinity of Osprey Boulevard.

Wood summarized and interpreted available monitoring data for the storm event, as well as suggested additional analyses and next steps. A public meeting was subsequently held on October 18, 2017 to provide an update on the ongoing works being completed for the Lisgar District Basement Water Infiltration Study. As part of the public meeting, an Updated Action Plan was presented to remove and respond to sources of excess water to the utility trench and FDC system (ref. Table 3.2).

**Table 3.2. Updated Action Plan 2017**

| Item # | City Actions | Current Status (2022) |
|---|---|---|
| **1** | **Address Roadway Sub-Drain Leakage** | |
| | • Pursue prototype of roadway sub-drain plugs | Complete |
| | • Installation of plugs along Black Walnut Trail and other areas | Complete |
| | • Expansion to other areas within Lisgar District | Ongoing (part of this study) |
| **2** | **Construction of a Utility Trench Dewatering System** | |
| | • Carry Out Municipal Class EA Study | Complete |
| | • Complete detailed design work | Complete |
| | • Construction | Complete |
| **3** | **Construction of a FDC Pumping Station** | |
| | • Carry out Municipal Class EA Study | Complete |
| | • Conduct Hydraulic Modelling Analysis | Complete |
| | • Complete detailed design work | Complete |
| | • Construction | Complete |
| **4** | **Amend Sump Pump Subsidy Program** | |
| | • Increased Program Subsidy | Complete |
| **5** | **Continue with High Water Protocol** | |
| | • Continue to monitor and initiate pumping protocol as required | Ongoing |
| **6** | **Monitoring** | |
| | • Implement additional monitoring gauges in key study areas | Complete |
| | • Monitoring to verify effectiveness of implemented measures | Ongoing |

A summary of the work completed since the 2015 Public Report, including many of the tasks noted in Table 3.2, was presented previously in Section 2.3. An FDC Pumping Station (both low and high flow components) was constructed at the Cactus Gate Parkette between 2020 and 2021, based on the recommendations of the 2018 Class EA report.

In addition, one of the actions recommended as part of the Updated Action Plan 2017 was the expansion of the resolution of sub-drain leakage to other areas in Lisgar. In addition, a recommendation was to continue monitoring of the Lisgar District Drainage systems to verify effectiveness of implemented measures. Continued instances of FDC system surcharge were observed after the 2017 Action Plan, including the January 11-12, 2020 event, which resulted in a number of reported incidents of basement water infiltration by area residents. The City of Mississauga therefore initiated the current study (Lisgar District Pumping Stations Class Environmental Assessment) in order to undertake an overall assessment of the Lisgar District drainage system, and to make recommendations for a longer-term plan for the number, preferred locations, and types of pumping stations with the Lisgar District necessary to reduce the potential for basement water infiltration. The review and screening of pumping station alternatives is discussed further in subsequent sections.

# 4.0 Pumping Stations Alternatives Assessment

## 4.1 Long-List of Alternative Locations

The Cactus Gate FDC Pumping Station was prioritized in 2018 for construction based on the reported instances of basement water infiltration on Black Walnut Trail based on the assessments completed as part of the 2018 Class EA. For the current Class EA, potential additional locations have been developed for the entirety of the Lisgar District. Fourteen (14) total Potential FDC Pumping Station Locations have been identified, as per Drawing 1 (attached). Long-listed locations have been identified based on:

- Public Land Ownership (park land generally)
- Proximity to the FDC trunk sewer (along Black Walnut Trail and then along Lisgar Creek)
- Proximity to the number of houses with reported incidents of basement water infiltration

The fourteen (14) locations are dispersed along the path of the trunk FDC sewer within the Lisgar District between the CPR (north) and Britannia Road (south) as follows:

- Three (3) north of Derry Road
- Three (3) near Trelawny Circle
- Five (5) between Doug Leavens Boulevard and Osprey Boulevard
- Three (3) near Osprey Marsh

The fourteen (14) long-listed potential alternative locations are as follows:

Location 1. Russian Olive Close at Buttonbush Park

Location 2. Black Walnut Trail at Smoke Tree Road Parkette

Location 3. Black Walnut Trail at Scotch Pine Gate Parkette

Location 4. Lisgar Creek at Forest Park

Location 5. Gracefield Drive at Lisgar Meadowbrook Trail

Location 6. Lisgar Creek at Lisgar Fields

Location 7. Lisgar Creek at Doug Leavens Boulevard

Location 8. Lisgar Creek at Pintail Circle

Location 9. Lisgar Creek at Nutcracker Drive (North)

Location 10. Lisgar Creek at Nutcracker Drive (South)

Location 11. Lisgar Creek at Lisgar Green Park

Location 12. Osprey Marsh at Prairie Circle

Location 13. Osprey Marsh at Lisgar Drive

Location 14. Osprey Marsh at Ninth Line

## 4.2 Supporting Existing Conditions Assessments

### 4.2.1 Stage 1 Archaeological Assessment

Wood completed a Stage 1 Archaeological Assessment (AA) in November 2021 to support of this Class EA. Copies of the report were shared with indigenous nations as documented in Section 4.6.3 and Appendix G. The complete report is included in Appendix B for reference. The Study Area for the Stage 1 AA was restricted to the 14 potential pumping station locations along the path of the trunk FDC sewer pipe, covering approximately 9.9 hectares of land (as per Section 4.1; refer to Drawing 1).

Previously, two (2) archaeological assessment reports were completed (by others) detailing archaeological work conducted within 50 metres (m) of the Study Area. Between 1966 and 1985, land use within the Study Area was agricultural, but subdivision development expanded both sides of Sixteen Mile Creek between 1985 and 2005.

Based on the property inspection carried out by Wood on August 13, 2021 the Study Area has general archaeological potential due to the location of natural water sources within 300 m, (including Sixteen Mile Creek), farmsteads and historic roads within 100 m (as per 1858 and 1877 historical atlas mapping), and 40 registered sites within 1 km, including eight (8) registered sites within 300 m of the Study Area. However, based on background research, the entire Study Area has been disturbed. The Stage 1 AA concluded that the Study Area has low archaeological potential due to extensive and intensive disturbance and does not require further archaeological assessment (i.e. does not require a Stage 2 AA). The project information was acknowledged by the Ministry of Heritage, Sport, Tourism and Cultural Industries on August 13, 2021 with the issuance of PIF number P362-0318-2021 (Stage 1).

### 4.2.2 Cultural Heritage Screening Checklist

Wood completed a Cultural Heritage Screening Checklist to assess the presence of potential Cultural Heritage Features within the study area; a copy is included in Appendix C. Based on the assessment, there are no identified or potential properties of Cultural Heritage Value within the Study Area. Due to this, a Cultural Heritage Evaluation Report (CHER) or Heritage Impact Assessment (HIA) is not required for the Lisgar District for the current Class EA.

### 4.2.3 Natural Environment Assessment

Existing ecological and aquatic conditions within the study area component of the Lisgar District were evaluated in the Natural Environment Report (NER) completed by Wood in August 2021. A copy of the report is included in Appendix D. The Study Area for the NER includes a 120 m buffer around the Project Location, as depicted in Figure 4.1.

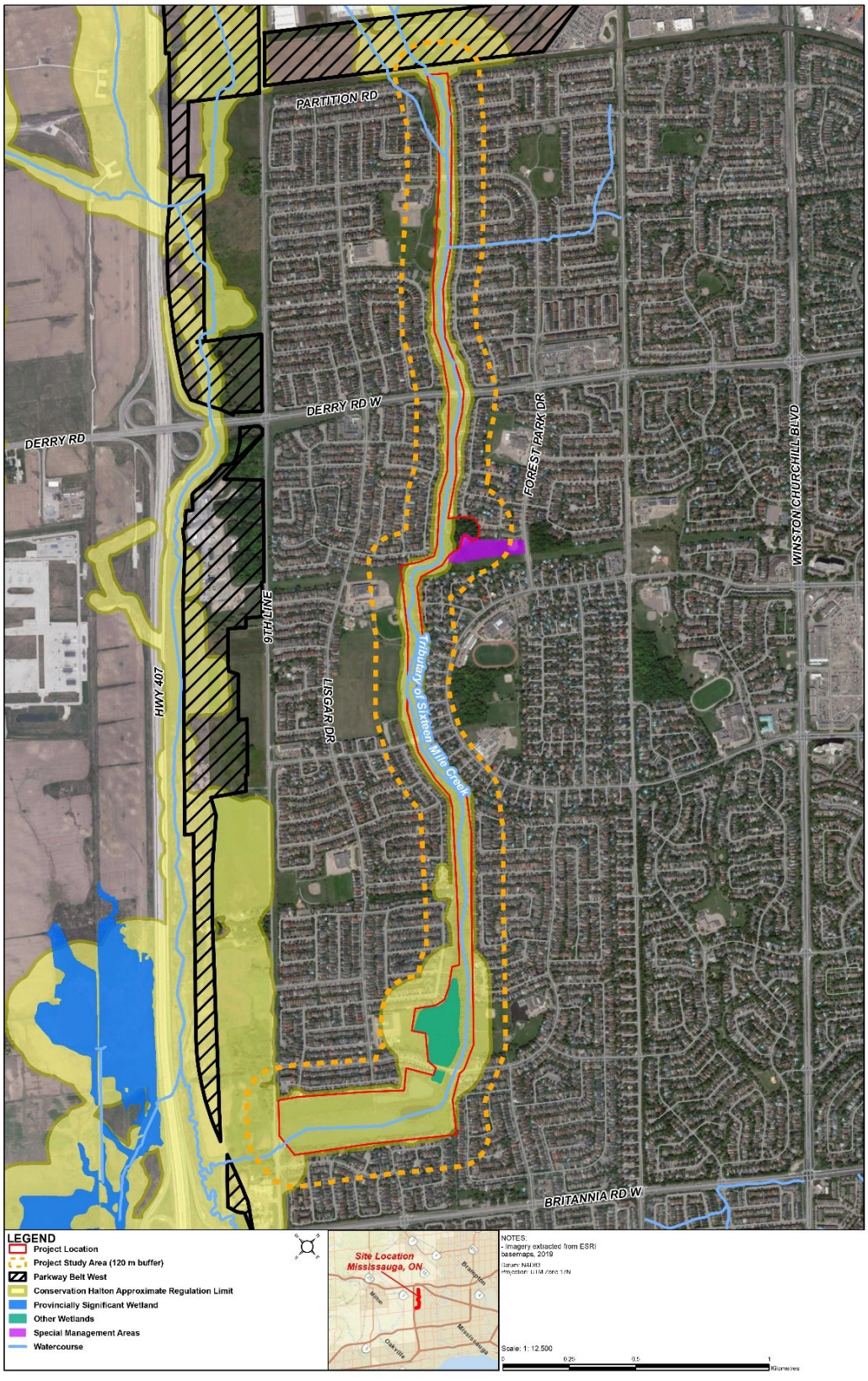



**Figure 4.1. Natural Heritage Features within Lisgar District**

Terrestrial field investigations were undertaken on May 13, 2021 to confirm vegetation communities, collect botanical information and denote presence of incidental wildlife to support secondary source data. An Ecological Land Classification (ELC) was completed for naturalized vegetation areas within and surrounding the Study Area and then cross referenced with provincially significant vegetation communities identified in the Significant Wildlife Habitat Technical Guide and in the Natural Heritage Information Centre. The remaining naturalized vegetation within the Study Area is along the banks of the tributary of Sixteen Mile Creek, stormwater management ponds, and few small forest patches, with the remaining Study Area used for residential properties, manicured parks, roads, and trails.

Based on background information, 199 species of birds, 56 species of butterflies, 42 species of mammals, 13 species of amphibians, and nine species of reptiles are reported to occur within the Study Area, however the exact locations of species occurrences and ranges were not available. Table 6-1 within the NER examines 24 Species at Risk (SAR) based on probabilities of occurrences and frequency within the Study Area. None of the SAR are defined as "High", meaning that none of those species have a high probability of occurrence within the habitats available within the Study Area. However, there is a "Moderate" potential for the following SAR to be within the Study Area: Canada Warbler, Eastern Wood-pewee, Red-headed Woodpecker, Snapping Turtle, Tricolored Bat, Little Brown Myotis, Northern Myotis, Eastern Small-footed Myotis, and Monarch.

An aquatic habitat assessment was completed on August 25, 2021 with a detailed assessment 50 m downstream to 20 m upstream of the Project Location. 18 species of fish are within vicinity of the Study Area, none of which are SAR.

There are two wetlands present within the Study Area (in the vicinity of Osprey Woods), designated as "Other Wetlands" in the City of Mississauga's Official Plan and "non-Provincially Significant Wetland" by the Ministry of Natural Resources and Forestry (MNRF). Under Section 6.3.12.g of the City's Official Plan, any wetland greater than 0.5 ha should be assessed for local significance, thus the larger wetland (north side of Osprey Boulevard) was classified as a Locally Significant Wetland as it is 3.11 ha. The other wetland (south side of Osprey Boulevard) is 0.16 ha and does not require assessment. The Study Area is located within a Significant Natural Area associated with a tributary of Sixteen Mile Creek, thus Significant Valley lands are present in the Study Area. Overall, the natural heritage features within the area include:

- Public and Private Open Spaces as illustrated in Schedule 4 of the City's Official Plan (2021);
- Green System as illustrated in Schedule A1 of the City's Official Plan (2021);
- Significant Natural Areas and Natural Green Spaces, Special Management Areas, other wetlands, Natural Hazards as illustrated in Schedule 3 of the City's Official Plan;
- One Locally Significant Wetland;
- Five Significant Woodlands; and
- Significant Valley Lands

The following candidate Significant Wildlife Habitat Types are also present within the Study Area:

- Bat Maternity Colonies: The FOD2-2, FOD9-4 and SWD3-1 within the Project Location are considered candidate bat maternity roost habitat
- Turtle Wintering Areas: The tributary of Sixteen Mile Creek and the OAO feature (i.e., natural pond), which are located within the Project Location is considered candidate Turtle Wintering Habitat.
- Reptile Hibernaculum: A total of four potentially suitable rockpiles were present within the Study Area that could indicate SWH
- Amphibian Breeding Habitat (Woodland and Wetland): Some features present within the Study Area may provide suitable habitat for amphibian breeding.
- Habitat for Special Concern Species.

Deadfall in Osprey Woods, providing potential wildlife habitat.

Muskrat in Creek at Osprey Woods.

Osprey Boulevard Bridge habitat facing upstream.

Regenerating habitat along pedestrian path on south end of Study Area.

## 4.3 Alternative Location Evaluation

### 4.3.1 Evaluation Criteria

The principal Evaluation Criteria have been identified as follows:

- ***Drainage Area Served****:* The amount of nearby land that will be serviced by the Pumping Stations. A larger drainage area would be considered more positively.
- ***Property Suitability***: The suitability of the property based on public land ownership and local property constraints, such as the amount of public space available (parkette versus City owned easement) and ease of access both for construction and longer-term operations and maintenance. Additional factors related to baseline studies for archaeology, cultural heritage, and ecology (as per Section 4.2) would also be considered under this criterion (i.e. any expected negative impacts related to the social or ecological environment from the proposed works).
- ***Number of Houses in Proximity that Reported Basement Water Infiltration****:* The Pumping Station should be located in proximity to the greatest number of houses that reported basement water infiltration in order to best address the issue. In addition, frequency and severity of observed FDC system surcharging is an additional consideration of risk. Locating a pumping station slightly upstream of directly affected areas generally has the potential for the greatest effectiveness.

As noted, public (City) land ownership contiguous with the creek is considered an important factor/requirement (which was considered as part of the long-listing described in Section 4.1), given the likely inability of the local storm sewer system to serve as the receiver of pumped FDC flows due to its limited capacity (i.e. storm sewers within the Lisgar District originally designed to a 2-year return period standard, given shallow grades and lack of ground cover), and therefore it is considered preferable that any FDC pumping station have a "free" outlet, likely to a surface drainage feature with a direct connection to Lisgar Creek. This would restrict potential FDC pumping stations to locations with immediate access to the creek, given that private property acquisition is considered cost-prohibitive and unlikely to be supported by area property owners.

### 4.3.2 Evaluation of Long-List of Alternatives

The fourteen (14) long-listed alternatives have been assessed relative to the three (3) principal evaluation criteria previously noted. The scoring has been assessed as either positive, neutral, or negative. The results are presented in Table 4.1.

**Table 4.1. Long-List of Alternatives**

| Potential Pumping Station Locations | Evaluation Criteria | | | Evaluation |
|---|---|---|---|---|
| | Drainage Area Served | Property Suitability | # of Reported Cases | Screened/ Short-listed |
| 1. Russian Olive Close at Buttonbush Park | 🔴 | 🟢 | 🟡 | Screened out |
| 2. Black Walnut Trail at Smoke Tree Road Parkette | 🟡 | 🟢 | 🟢 | Short-listed |
| 3. Black Walnut Trail at Scotch Pine Gate Parkette | 🟡 | 🟢 | 🟢 | Short-listed |
| 4. Lisgar Creek at Forest Park | 🟢 | 🟡 | 🔴 | Screened out |
| 5. Gracefield Drive at Lisgar Meadowbrook Trail | 🟢 | 🔴 | 🔴 | Screened out |
| 6. Lisgar Creek at Lisgar Fields | 🟢 | 🔴 | 🔴 | Screened out |
| 7. Lisgar Creek at Doug Leavens Boulevard | 🟢 | 🟡 | 🟢 | Short-listed |
| 8. Lisgar Creek at Pintail Circle | 🟢 | 🟡 | 🟡 | Short-listed |
| 9. Lisgar Creek at Nutcracker Drive (North) | 🟢 | 🔴 | 🟡 | Screened out |
| 10. Lisgar Creek at Nutcracker Drive (South) | 🟢 | 🔴 | 🟡 | Screened out |
| 11. Lisgar Creek at Lisgar Green Park | 🟢 | 🟡 | 🟢 | Short-listed |
| 12. Osprey Marsh at Prairie Circle | 🟢 | 🟡 | 🟢 | Short-listed |
| 13. Osprey Marsh at Lisgar Drive | 🟢 | 🔴 | 🟡 | Screened out |
| 14. Osprey Marsh at Ninth Line | 🟢 | 🟡 | 🔴 | Screened out |

🟢 Positive 🟡 Neutral 🔴 Negative

Based on the preceding screening and evaluation of alternatives, two (2) locations within three (3) separate areas of interest have been short-listed for an FDC pumping system.

- Black Walnut Trail Area
  - Location 2 – Black Walnut Trail at Smoke Tree Road Parkette
  - Location 3 – Black Walnut Trail at Scotch Pine Gate Parkette
- Doug Leavens Boulevard and Pintail Circle Area
  - Location 7 – Lisgar Creek south of Doug Leavens Boulevard
  - Location 8 – Lisgar Creek at Pintail Circle
- Osprey Boulevard Area
  - Location 11 – Lisgar Creek at Lisgar Green Park
  - Location 12 – Osprey Marsh at Prairie Circle

The six (6) short-listed locations have been further assessed through additional technical analyses (individually and in combination) using integrated hydrologic/hydraulic modelling; this is summarized in Section 4.5. All six locations are on public lands, in close proximity to FDC trunk sewer and near areas with greater instances of reported basement water infiltration or observed FDC surcharging. Further discussion of each of the short-listed locations is provided in Section 4.3.3.

### 4.3.3 Details of Short-Listed Locations

#### 4.3.3.1 Location 2: Black Walnut Trail at Smoke Tree Road Parkette

This location refers to the parkette on the west side of Black Walnut Trail, directly adjacent to Smoke Tree Road. An FDC pumping system in this location would serve an area of approximately 38.6 ha. This includes overlap with the upstream area served by the existing Cactus Gate FDC pumping station (9.8 ha). Contributing drainage areas are presented in Drawing 2 (attached).

The parkette is publicly owned (City of Mississauga), which is clearly advantageous. This location would also avoid having operating components of the system within the roadway right-of-way, which would be a long-term operations and maintenance concern. The parkette is wider than others in the area (27 m).

Local traffic would be impacted during the construction work, as it is expected that the intersection would need to be closed during construction, as was the case for the pumping station at Cactus Gate. There are no MiWay transit routes which use this section of Black Walnut Trail. Pedestrian access would be a concern, as the site includes a section of the Lisgar Meadowbrook Trail and a pedestrian bridge across Lisgar Creek to Stonewood Park. Impacts to this feature would need to be carefully considered, including potential to keep the bridge open during construction. The access to Black Walnut Trail via the parkette would have to be closed regardless, which would temporarily direct pedestrians 200 m +\- to the south to Scotch Pine Gate to access the trail at that point.

No constraints associated with archaeology, cultural heritage, or ecology were identified with the site. Although not considered directly in the ecological assessment, there are at least five (5) trees which would require removal; there are another three (3) trees which would require further assessment to determine the need for removal. A portion of the site would be within the regulated area of Conservation Halton (floodplain and stable top of bank hazards for Lisgar Creek) and would necessitate a permit application and careful attention to grading disturbances within these areas.

Based on comments from the City's Parks group (as provided to Wood July 29, 2022), the Smoke Tree site (Location 2) is generally preferred over the Scotch Pine Gate site (Location 3) as it has less trees which require removal, although efforts to retain as many trees as possible should be made. The importance of retaining the pathway between Black Walnut Trail and the Lisgar Meadowbrook Trail post-construction was noted, as was maintaining access to the pedestrian bridge throughout construction.

A summary of affected properties upstream of the Smoke Tree Road location is presented in Table 4.2. For the purposes of quantifying the potential benefit, properties located within 1 km upstream and downstream of the site have been considered to provide a reasonable estimate of the extent of direct potential benefit.

**Table 4.2. Summary of Previously Affected Properties near Smoke Tree Road**

| Storm Event | Total # Affected | Total # Upstream within 1 km of Potential Location | Total # Downstream within 1 km of Potential Location | Total # Within 1 km of Potential Location |
|---|---|---|---|---|
| October 19/20, 2011 | 141 | 17 | 26 | 43 |
| January 13, 2013 | 7 | 0 | 0 | 0 |
| July 14, 2017 | 36 | 15 | 21 | 36 |
| January 11-12, 2020 | 41 | 0 | 8 | 8 |
| August 28, 2021 | 5 | 0 | 4 | 4 |
| **TOTAL[1]** | **230** | **32 (14%)** | **59 (26%)** | **91 (40%)** |

1. Includes properties affected multiple times

Based on the data provided in Table 4.2, a large number of previously affected properties would be in proximity to the proposed pumping station and potentially benefit from the PS. Upstream of the potential location, between 15 and 17 properties would have benefitted for two (2) storm events. Downstream of the potential location, between 4 and 26 properties would have benefitted for four (4) storm events.

In addition to the material presented in Table 4.2, it is noted that frequent FDC surcharging has been observed at this location. Smoke Tree Road is just downstream of monitoring gauge F1 which based on previous annual monitoring reports has experienced FDC surcharging (of varying degrees) 28 times since monitoring began in 2012 to the end of 2021 (or an average of 2.8 times per year). This is the most frequently observed surcharging location of all available monitoring gauges within the Lisgar FDC system.

#### 4.3.3.2 Location 3: Black Walnut Trail at Scotch Pine Gate Parkette

This location refers to the parkette on the west side of Black Walnut Trail, directly adjacent to Scotch Pine Gate. An FDC pumping system in this location would serve an area of approximately 86.1 ha (this again includes overlap with the Cactus Gate FDC pumping station serving 9.8 ha). Relative to Location 2, the total area served for Location 3 includes an additional 2.8 ha of drainage contributing to Black Walnut Trail and a portion of Snowball Road, and a much larger area served by the FDC system along Scotch Pine Gate (approximately 44.6 ha). Contributing drainage areas are presented in Drawing 2 (attached).

The parkette is publicly owned (City of Mississauga), which as noted is clearly advantageous. This location would also avoid having operating components of the system within the roadway right-of-way, which would be a long-term operations and maintenance concern. The parkette is slightly narrower than Location 2 (24 m as compared to 27 m).

Local traffic would be impacted during the construction work, as it is expected that the intersection would need to be closed during construction, as was the case for the pumping station at Cactus Gate. There are no MiWay transit routes which use this section of Black Walnut Trail. There is an access to the Lisgar Meadowbrook Trail through the parkette which would need to be closed during construction. Access would be diverted to Smoke Tree Road. The potential to keep the main trail open during construction would need to be confirmed.

No constraints associated with archaeology, cultural heritage, or ecology were identified with the site. Although not assessed in the ecology report, there are approximately 10 +\- trees that may require removal; further assessment would be required. A portion of the site would be within the regulated area of Conservation Halton (floodplain and stable top of bank hazards for Lisgar Creek) and would necessitate a permit application.

As noted in the discussion of Location 2, the City's Parks Department noted (comments received July 29, 2022) that the Scotch Pine Gate site was less preferred than the Smoke Tree Road site, given the larger number of tree removals required.

A summary of affected properties upstream of the Scotch Pine Gate location is presented in Table 4.3. For the purposes of quantifying the potential benefit, properties located within 1 km upstream and downstream of the site have been considered to provide a reasonable estimate of direct potential benefit.

**Table 4.3. Summary of Previously Affected Properties near Scotch Pine Gate**

| Storm Event | Total # Affected | Total # Upstream within 1 km of Potential Location | Total # Downstream within 1 km of Potential Location | Total # Within 1 km of Potential Location |
|---|---|---|---|---|
| October 19/20, 2011 | 141 | 27 | 16 | 43 |
| January 13, 2013 | 7 | 0 | 0 | 0 |
| July 14, 2017 | 36 | 24 | 12 | 36 |
| January 11-12, 2020 | 41 | 4 | 4 | 8 |
| August 28, 2021 | 5 | 2 | 2 | 4 |
| **TOTAL[1]** | **230** | **57 (25%)** | **34 (15%)** | **91 (40%)** |

1. Includes properties affected multiple times

Based on the data provided in Table 4.3, the total number of properties within 1 km would be consistent with those for the Smoke Tree Road Location. In this case there would be a greater number of potentially benefitting properties upstream of the location, due to the shift downstream. Between 2 and 27 properties would have benefitted upstream (4 storm events), while between 2 and 16 properties would have benefitted downstream (4 storm events).

In addition to the information presented in Table 4.3, it is noted that frequent FDC surcharging has been observed in this area. Scotch Pine Gate is just upstream of monitoring gauge F6. Based on previous annual monitoring reports, this location has experienced FDC surcharging (of varying degrees) 16 times since monitoring began in 2012 to the end of 2021 (or an average of 1.6 times per year). Observed FDC surcharging upstream (at gauge F1) occurs even more frequently, as noted previously.

Monitoring has previously been undertaken for the large contributing area along Scotch Pine Gate (44.6 ha) to confirm the proportion of FDC flows from this area. Gauge F27 was located between Terragar Boulevard and Lowville Heights (sufficiently upstream to avoid backwater from the trunk FDC) and recorded data for the 2018, 2019 and early 2020 monitoring periods. For observed surcharge events along Black Walnut Trail (including July 5 and August 21, 2018, and January 11-12, 2020) a minimal response was indicated at this location; no surcharging was indicated for either of the 2018 storm events that resulted in notable surcharging along Black Walnut Trail. For the January 11-12, 2020 event (which resulted in observed basement water infiltration), the results do indicate a minor FDC surcharge at this location for the January 12, 2020 storm only (0.69 m relative to 0.375 m pipe diameter) which was far less than the observed surcharging along Black Walnut Trail relative to the contributing drainage area, suggesting that much greater inflows are occurring closer to this area, and not from the Scotch Pine Gate branch. Gauges along Black Walnut Trail also indicated a surcharge for the January 11, 2020 storm, while there was no observable response at gauge F27.

#### 4.3.3.3 Location 7: Lisgar Creek south of Doug Leavens Boulevard

This location refers to the area of open space along the east side of Lisgar Creek, just south of Doug Leavens Boulevard. An FDC pumping system in this location would serve a total area of 211.9 ha. Contributing drainage areas are presented in Drawing 2 (attached).

The area within the creek block is publicly owned (City of Mississauga), which as noted is clearly advantageous. This location would also avoid having operating components of the system within the roadway right-of-way, which would be a long-term operations and maintenance concern. Access would still be via a primary road.

Local traffic would be slightly impacted during the construction work, as it is expected that a construction access and staging area would likely be required along Doug Leavens Boulevard. The road is 3 lanes wide and thus could accommodate a temporary lane closure for construction. There are no MiWay transit routes which use this section of Doug Leavens Boulevard. The section of Lisgar Meadowbrook Trail in this area is currently temporarily closed by the City and therefore would not be expected to impact construction. Any future plans for the trail would however need to be considered as part of the design.

No constraints associated with archaeology, cultural heritage, or ecology were identified with the site. Some localized tree removals would likely be required in order to develop the access from Doug Leavens Boulevard. A portion of the site would be within the regulated area of Conservation Halton (floodplain and stable top of bank hazards for Lisgar Creek) and would necessitate a permit application.

A summary of affected properties in the vicinity of the site is presented in Table 4.4. For the purposes of quantifying the potential benefit, properties located within 1 km upstream and downstream of the site have been considered to provide a reasonable estimate of direct potential benefit.

**Table 4.4. Summary of Previously Affected Properties near Doug Leavens Boulevard**

| Storm Event | Total # Affected | Total # Upstream within 1 km of Potential Location | Total # Downstream within 1 km of Potential Location | Total # Within 1 km of Potential Location |
|---|---|---|---|---|
| October 19/20, 2011 | 141 | 9 | 48 | 57 |
| January 13, 2013 | 7 | 0 | 1 | 1 |
| July 14, 2017 | 36 | 0 | 0 | 0 |
| January 11-12, 2020 | 41 | 0 | 11 | 11 |
| August 28, 2021 | 5 | 0 | 0 | 0 |
| **TOTAL[1]** | **230** | **9 (4%)** | **60 (26%)** | **69 (30%)** |

1. Includes properties affected multiple times

Based on the data provided in Table 4.4, the majority of properties which would benefit from a PS in this location would be downstream of the potential location, most notably along the Alderwood Trail area. A number of properties are indicated in this location for the October 19/20, 2011 and January 11-12, 2020 events.

In addition to the material presented in Table 4.4, it is noted that frequent FDC surcharging has been observed in this area. Gauge F3 is located near the location of the potential pumping station location along the FDC trunk sewer. Based on previous annual monitoring reports, this location has experienced FDC surcharging (of varying degrees) 25 times since monitoring began in 2012 to the end of 2021 (or an average of 2.5 times per year). This is one of the most frequently observed surcharging location of all available monitoring gauges within the FDC system, second only to locations along Black Walnut Trail.

#### 4.3.3.4 Location 8: Lisgar Creek at Pintail Circle

This location refers to the area of open space along the east side of Lisgar Creek, adjacent to a pedestrian walkway from Pintail Circle. An FDC pumping system in this location would serve a total area of 220.0 ha. Contributing drainage areas are presented in Drawing 2 (attached).

The area within the creek block is publicly owned (City of Mississauga), which is clearly advantageous. This location would also avoid having operating components of the system within the roadway right-of-way, which would be a long-term operations and maintenance concern.

Construction access would be a challenge for this location. Although manual access is possible via the pedestrian pathway from Pintail Circle, the access is considered too narrow to permit construction vehicle access (as well as longer-term operations and maintenance access). The location is currently used as a High Water Protocol temporary pumping site; access is from Lisgar Green Park to the south along the Lisgar Meadowbrook Trail (nearly 1 km to the south). It is expected the entire section of the Lisgar Meadowbrook Trail would require temporary closure during construction.

No constraints associated with archaeology, cultural heritage, or ecology were identified with the site. Some localized tree removals would potentially be required in order to support construction. A portion of the site would be within the regulated area of Conservation Halton (floodplain and stable top of bank hazards for Lisgar Creek) and would necessitate a permit application.

A summary of affected properties in the vicinity of the site is presented in Table 4.5. For the purposes of quantifying the potential benefit, properties located within 1 km upstream and downstream of the site have been considered to provide a reasonable estimate of direct potential benefit.

**Table 4.5. Summary of Previously Affected Properties near Pintail Circle**

| Storm Event | Total # Affected | Total # Upstream within 1 km of Potential Location | Total # Downstream within 1 km of Potential Location | Total # Within 1 km of Potential Location |
|---|---|---|---|---|
| October 19/20, 2011 | 141 | 10 | 47 | 57 |
| January 13, 2013 | 7 | 0 | 1 | 1 |
| July 14, 2017 | 36 | 0 | 0 | 0 |
| January 11-12, 2020 | 41 | 0 | 11 | 11 |
| August 28, 2021 | 5 | 0 | 0 | 0 |
| **TOTAL[1]** | **230** | **10 (4%)** | **59 (26%)** | **69 (30%)** |

1. Includes properties affected multiple times

Based on the data provided in Table 4.5, the potentially benefitting properties would generally be common to those for Location 7, generally downstream of the proposed location. As noted for Location 7, FDC sewer surcharging is frequently noted at the upstream gauge F3 near Doug Leavens Boulevard, as well as a gauge on the local FDC sewer from Alderwood Trail which is generally affected by tailwater levels from the trunk sewer along Lisgar Creek.

#### 4.3.3.5 Location 11: Lisgar Creek at Lisgar Green Park

This location refers to the area of open space along the east side of Lisgar Creek, adjacent to the Lisgar Meadow Brook Trail in Lisgar Green Park. An FDC pumping system in this location would serve a total area of 258.2 ha. Contributing drainage areas are presented in Drawing 2 (attached).

The area within the creek block is publicly owned (City of Mississauga), which is clearly advantageous. This location would also avoid having operating components of the system within the roadway right-of-way, which would be a long-term operations and maintenance concern.

No direct traffic impacts would be expected given the location is not along a roadway. Construction access would likely be via the main entrance to Lisgar Green Park at Osprey Boulevard and Grossbeak Drive. This access would need to be carefully managed to ensure safe access for pedestrians and also vehicles. It is likely that a portion of the park would need to be closed during construction. The portion of Lisgar Meadowbrook Trial would also likely need to be closed during construction.

No constraints associated with archaeology, cultural heritage, were identified with the site.

Ecological constraints have been identified given that the existing FDC sewer is located along the edge of Osprey Woods and the associated wetland area. Any works in this area would likely require additional review with MECP for Species at Risk, and may require further study. It is expected that some localized tree removals would potentially be required, in order to allow for a diversion from the trunk FDC sewer, which is located in the wooded area on the west side of Lisgar Meadowbrook Trail.

A portion of the site would also be within the regulated area of Conservation Halton (floodplain and stable top of bank hazards for Lisgar Creek) and would necessitate a permit application.

A summary of affected properties in the vicinity of the site is presented in Table 4.6. For the purposes of quantifying the potential benefit, properties located within 1 km upstream and downstream of the site have been considered to provide a reasonable estimate of direct potential benefit.

**Table 4.6. Summary of Previously Affected Properties near Lisgar Green Park**

| Storm Event | Total # Affected | Total # Upstream within 1 km of Potential Location | Total # Downstream within 1 km of Potential Location | Total # Within 1 km of Potential Location |
|---|---|---|---|---|
| October 19/20, 2011 | 141 | 45 | 64 | 109 |
| January 13, 2013 | 7 | 1 | 6 | 7 |
| July 14, 2017 | 36 | 0 | 0 | 0 |
| January 11-12, 2020 | 41 | 11 | 20 | 31 |
| August 28, 2021 | 5 | 0 | 0 | 0 |
| **TOTAL[1]** | **230** | **57 (25%)** | **90 (39%)** | **147 (64%)** |

1. Includes properties affected multiple times

Based on the data provided in Table 4.6, there is a split of potentially benefitting properties upstream and downstream of the proposed location. Upstream areas generally include the Alderwood Trail area; downstream areas include Osprey Boulevard and Prairie Circle, and Pondview Way.

In addition to the information presented in Table 4.6, it is noted that frequent FDC surcharging has been observed in this area. Gauge F4 is located along the trunk FDC sewer along the Osprey Marsh berm. Based on previous annual monitoring reports, this location has experienced FDC surcharging (of varying degrees) 18 times since monitoring began in 2012 to the end of 2021 (or an average of 1.8 times per year).

#### 4.3.3.6 Location 12: Osprey Marsh at Prairie Circle

This location refers to the area of open space along Lisgar Meadowbrook Trail on the east side of Osprey Marsh, south of Osprey Boulevard. An FDC pumping system in this location would serve a total area of 311.2 ha. Contributing drainage areas are presented in Drawing 2 (attached).

The Osprey Marsh area is publicly owned (City of Mississauga), which is clearly advantageous. This location would also avoid having operating components of the system within the roadway right-of-way, which would be a long-term operations and maintenance concern.

No direct traffic impacts would be expected given the location is not along a roadway. Construction access would likely be via the Lisgar Meadowbrook Trail at Osprey Boulevard. This portion of Lisgar Meadowbrook Trail would also likely need to be closed during construction.

Temporary High Water Protocol (HWP) pumping is currently undertaken at this location. This would need to be relocated during construction, potentially downstream to Lisgar Drive\Pondview Way or Ninth Line.

No constraints associated with archaeology, cultural heritage, were identified with the site.

It is noted that there is a small area of identified wetland in proximity to the site, however no direct impacts to this area are expected as it is located on the far side of the existing creek. Buffer requirements would still need to be considered. Some localized tree removals may be required. Grading requirements and potential impacts to the creek would require further assessment.

A portion of the site would be within the regulated area of Conservation Halton (floodplain and stable top of bank hazards for Lisgar Creek) and would necessitate a permit application.

A summary of affected potential benefitting properties in the vicinity of the site is presented in Table 4.7. For the purposes of quantifying the benefit, properties located within 1 km upstream and downstream of the site have been considered to provide a reasonable estimate of direct potential benefit.

**Table 4.7. Summary of Previously Affected Properties near Osprey Marsh**

| Storm Event | Total # Affected | Total # Upstream within 1 km of Potential Location | Total # Downstream within 1 km of Potential Location | Total # Within 1 km of Potential Location |
|---|---|---|---|---|
| October 19/20, 2011 | 141 | 83 | 26 | 109 |
| January 13, 2013 | 7 | 7 | 0 | 7 |
| July 14, 2017 | 36 | 0 | 0 | 0 |
| January 11-12, 2020 | 41 | 31 | 0 | 31 |
| August 28, 2021 | 5 | 0 | 0 | 0 |
| **TOTAL[1]** | **230** | **121 (53%)** | **26 (11%)** | **147 (64%)** |

1. Includes properties affected multiple times

The data provided in Table 4.7 are generally similar to those for Site 11. The balance between locations upstream and downstream is shifted slightly, with a greater number upstream. Localized observed FDC surcharging in this area would be consistent with results noted previously for Site 11 for the gauge along the Osprey Marsh berm.

## 4.4 Types of Pumping Stations

### 4.4.1 Utility Trench Dewatering Pumping System (Low Flow)

A Utility Trench Dewatering Pumping Station is a system that operates to dewater the utility trench (granular stone bedding) by removing small amounts of water on a continuous basis, much like a residential sump pump. The intent of the utility trench dewatering system for the Lisgar District is to dewater bedding material within the sewer utility trench to limit the accumulation of water, and thus provide additional storage volume during storm events.

The previously constructed system at the Cactus Gate Parkette included a low flow (utility trench) dewatering pumping system; relevant drawings and excerpts are included in Appendix E. The constructed design included a granular area (filled with clearstone) around the utility trench (FDC and sanitary sewers), surrounded by a geomembrane to limit interaction with groundwater in the surrounding native soils (the geomembrane is open at the upstream limits to allow inflow however). At the downstream end, a concrete collar was constructed along the lowest portion of the utility trench system (FDC and sanitary sewers) to block the movement of infiltrated water from travelling further downstream. Backflow valves were included as overflows to the granular bedding downstream in the event of an excessive accumulation of utility trench water, while preventing backflow from the downstream area. The clearstone drainage collection area is

then drained by a series of perforated pipes which direct drainage to a new maintenance hole. The collected flow is then directed to the pumping station wet well.

It is expected that not all of the proposed locations will incorporate the utility trench dewatering pumping system. Locations near or along residential roads (where there would be numerous residential lateral connections and a connected utility trench) would be the focus for this form of pumping system. Short-listed locations 2 and 3 would therefore potentially include a low flow pumping system, consistent with that implemented at the Cactus Gate FDC pumping station. Locations which may be located along the FDC trunk sewer along Lisgar Creek (i.e. short-listed locations 7, 8, 11 and 12) would likely not warrant this component, given the longer distance from residential street utility trenches and the greater potential for a disconnection in the utility trench bedding to these areas.

### 4.4.2 FDC Pumping System (High Flow)

An FDC Pumping Station differs from a utility trench dewatering system in that it operates to remove water from the FDC pipe network directly during periods of high flow. This pump would be larger but operate less frequently and only during certain storm or snowmelt events.

In general, this system would require a new diversion sewer to be connected to the FDC pipe system. The diversion pipe would be set somewhat above the elevation of the existing pipe, such that it would not activate until FDC water levels exceed the capacity of the existing pipe. The diversion pipe would need to be sufficiently sized to ensure conveyance of FDC surcharge flows to a dedicated pumping system, notionally a large diameter maintenance hole or underground tank with a wet well to capture excess flow. Pumps within this system would then re-direct the diverted water to Lisgar Creek, similar to the low flow system described earlier. Unlike the low flow system however, much larger capacity pumps would be required to ensure that pumping rates are sufficient to re-direct FDC surcharge at approximately the rate of inflow.

The constructed system at the Cactus Gate Parkette included a high flow component (refer to drawings included in Appendix E). The diversion sewer was set at the springline (half-way elevation) of the existing FDC sewer to divert high flows towards a wet well, which in turn discharges flows to surface to Lisgar Creek. The pumps were sized based on the expected required capacity for the high flow system since as noted, this governs over the low flow pumping requirements.

It is expected that all of the proposed FDC pumping systems will include the high flow component, as this is fundamental to the intent of managing FDC surcharging and associated impacts to basement water infiltration.

## 4.5 Technical Evaluation of Short-Listed Alternatives

### 4.5.1 Overview and Methodology

In order to support an informed planning process for the locations and capacities of potential FDC pumping stations, an analytical (modelling) tool is required to assess expected rates of flow within the FDC system during storm events, and the associated effectiveness of potential pumping strategies (locations, numbers, and pump station sizing/capacities). The focus of this assessment has been upon the observed response and associated capacity during high flow events, as these events would govern the capacity of the required pumping systems and mitigation measures.

Note that due to the nature of the Low Flow System (utility trench dewatering), there is no valid technical analysis technique to evaluate the distinct performance of one site versus another site. As such, for the technical evaluation, only the high flow system has been assessed, with the inherent understanding that the

low flow system (utility trench dewatering) would share the same location where such a system is considered appropriate (i.e. namely locations 2 and 3). Notionally, by capturing infiltrated water from the utility trench system on an ongoing basis, it is expected to further improve the overall performance of the combined system. Low flow operations also have the benefit of exercising the pumps regularly, rather than being on standby until a sufficiently large storm event occurs.

A hydraulic model of the FDC sewer system was previously developed (PCSWMM modelling software) as part of the assessment work in support of the March 2015 Public Summary Report. This model was used for a number of different assessments, including forensic modelling of an actual storm event based on available FDC monitoring data.

This hydraulic modelling was then further refined as part of the previously completed Class EA (2018). A key refinement incorporated into that modelling was the application of a unit hydrograph type approach to "calibrate" the modelling to the observed water level responses in the FDC sewer system (as available from monitoring gauges) for several formative storm events. This pseudo-calibration approach identified areas of greater and lesser relative inflows to the FDC system using a linear scaling factor, along with the contributing drainage areas to each inflow point. Once calibrated, the modelling was then applied to assess mitigation measures, specifically flow diversions to potential FDC pumping stations. Based on this modelling approach, the Cactus Gate Parkette was identified as the preferred location.

As part of the current study, a similar approach has been applied. Further details are provided in the Hydraulic Assessment Report (refer to Appendix F). The scope of the modelling has been extended however to include the entirety of the FDC sewershed network, down to the FDC trunk sewer outlet to the deep storm sewer system along Churchill Meadows Boulevard just south of Erin Centre Boulevard. In addition, an updated review of potential storm events was completed, using the most currently available monitoring data. Events were selected based on the magnitude of observed FDC surcharging and reports of basement water infiltration, as well as geographic impact to ensure that all areas were considered. As noted previously, water levels in the north area (Black Walnut) tend to increase very quickly to thunderstorm type events whereas the water levels in the south area (Doug Leavens to Osprey) tend to increase more to long-lasting saturated ground type events. Based on the screening completed, simulation events included:

- January 13, 2013
- June 12, 2014
- April 16, 2018
- January 11-12, 2020
- August 3, 2020
- August 28, 2021

For several of the preceding events, the City's High Water Protocol (HWP) was in place. As such, representation of the performance benefits associated with the pumps was necessarily included in the forensic modelling to ensure an accurate representation of flows and water levels.

Once developed, the modelling has been applied to assess the short-listed FDC pumping stations noted previously (with the assumption of no HWP in place). Overall, it is considered appropriate to approach the modelling assessment from upstream to downstream, given that any mitigation measures constructed upstream would be expected to benefit areas downstream as well. As such, any pumping stations recommended for upstream areas are included in the assessment of downstream areas.

Furthermore, a preference is noted for minimizing the number of additional pumping stations, if possible. Even though two (2) locations have been short-listed for each area, if the modelling indicates that one (1) pumping station is sufficient to address the FDC surcharge or if upstream pumping stations can address the issues, this would be the preference due to the associated costs, construction timelines, and long-term

operations and maintenance. If two (2) pumping stations are within close proximity, the more upstream location would benefit the greater number of properties.

A detailed technical summary of the hydraulic modelling has been included in Appendix F; the following provides a summary of the work completed and the associated findings.

### 4.5.2 Results

#### 4.5.2.1 Black Walnut Trail Area

The key storm events selected for simulation of this area were:

- January 11-12, 2020
- August 3, 2020
- August 28, 2021

Within this area, the Cactus Gate Pumping Station was previously constructed and began operating in March 2021. However, it is considered there is limited to no additional capacity within this pumping station, as such the focus is upon potential additional pumping stations at location 2 (Smoke Tree Road) and/or location 3 (Scotch Pine Gate).

An additional pumping station at Smoke Tree Road was found to be beneficial in reducing FDC system surcharging. A peak flow of up to 0.13 $m^3/s$ (130 L/s) would be required to be pumped based on the modelling.

A second pumping station at Scotch Pine Gate is considered to be of limited value as it reduces the effectiveness of the upstream location, but this option can be reviewed in the future with supplemental monitoring data. A stand-alone pumping station at Scotch Pine Gate (i.e. instead of one at Smoke Tree Road) would provide a similar overall benefit.

Residual FDC sewer surcharging was noted in some upstream areas. Given that the Cactus Gate pumping station cannot reasonably address all FDC surcharging in that area, other mitigation measures, such as local conveyance (FDC sewer pipe) upgrades (exact extents to be determined as part of future study) and measures to reduce FDC system inflows (such as downspout disconnections), are recommended, as a high number of connections have been observed in this area specifically. This area may also benefit from additional flow diversions and pumping stations downstream.

#### 4.5.2.2 Doug Leavens Boulevard and Pintail Circle Area

The key storm events selected for simulation of this area were:

- June 12, 2014
- April 16, 2018
- January 11-12, 2020
- August 28, 2021

Potential pumping stations at locations 7 (Doug Leavens Boulevard) and 8 (Pintail Circle) were assessed using the preceding events. It was determined that an additional pumping station at Doug Leavens Boulevard would be beneficial in reducing FDC system surcharging. A peak flow of up to 0.22 $m^3/s$ (220 L/s), would be required to be pumped based on the modelling.

A second pumping station at Pintail Circle is considered to be of limited value as it reduces the effectiveness of the upstream location, but this option can be reviewed in the future with supplemental monitoring. Location 7 is considered preferred as a stand-alone location to Location 8 for non-technical reasons, in

particular its ease of access for construction and longer-term operations and maintenance (access to Pintail Circle would require access via Osprey Boulevard and Lisgar Green Park some 1 km to the south).

Residual FDC sewer surcharging was noted in some upstream areas along Lisgar Creek. Given the limited number of residences affected by surcharge in this area, additional measures may warrant further consideration, such as local conveyance (FDC sewer pipe) upgrades (exact extents to be confirmed as part of future study) and measures to reduce FDC system inflows (such as downspout disconnections). This area may also benefit from additional flow diversions and pumping stations downstream.

#### 4.5.2.3 Osprey Boulevard Area

The key storm events selected for simulation of this area were:

- January 13, 2013
- April 16, 2018
- January 11-12, 2020
- August 28, 2021

Potential pumping stations at locations 11 (Lisgar Green Park) and 12 (Osprey Marsh) were assessed using the preceding events. Based on a further technical review, a pumping station at location 11 was determined to be infeasible due to a conflict with the existing trunk sanitary sewer. As such, only the technical benefit of location 12 (Osprey Marsh) was assessed further. A pumping station at Osprey Marsh would be beneficial in reducing FDC system surcharging. Modelling indicates a peak flow of up to 0.27 $m^3/s$ (270 L/s). Given the large capacity required in this case, a greater amount of space may be required for a pumping station which may necessitate localized adjustments to grading, potentially requiring a scoped re-alignment of Lisgar Creek at Osprey Marsh. This would need to be considered further as part of preliminary and detailed design.

Downstream of Osprey Marsh along Ninth Line, there is a residual FDC surcharge indicated for the area and further considerations may be required, including a potential additional pumping station closer to Ninth Line and conveyance upgrades (FDC sewer upsizing or relief sewers; exact extents to be determined as part of future study). Optimization of the proposed Osprey Marsh pumping station, such as some type of restrictor to limit discharge to the FDC sewer, is considered to be the preferred approach, given the challenges associated with other potential measures.

Residual FDC surcharging also continues to be indicated in upstream areas along Lisgar Creek (Derry Road to Doug Leavens Boulevard). Further pump station optimization and localized conveyance upgrades should again be considered in this area. Overall, downspout disconnections and other additional measures to reduce FDC system inflows should also be pursued.

#### 4.5.2.4 Summary of Recommendations and Additional Considerations

Based on the technical hydraulic modelling assessment, future FDC pumping stations are recommended at:

- **Location 2 - Smoke Tree Road Parkette**
- **Location 7 – Doug Leavens Boulevard**
- **Location 12 – Osprey Marsh**

It should be noted that the benefits of a pumping station at Location 3 – Scotch Pine Gate are however generally similar to Location 2 (Smoke Tree Road) and could be considered as an alternative location depending on other non-technical factors. Overall, Location 2 is a slightly wider parkette, on a slightly less busy road, and is nearer to the most frequent area of observed FDC surcharge as compared to Location 3 and has therefore been advanced as the preliminary preferred location.

Given the nature of the proposed locations, a combined low flow and high flow pumping system is recommended for Location 2 (Smoke Tree Road). Locations 7 and 12 are located along the trunk FDC sewer further downstream and away from urban road utility trenches; as such only high flow pumping systems are recommended at these locations.

In addition, several aspects should be considered with respect to the proposed mitigation measures, summarized below.

- Regardless of the recommendations for permanent pumping stations, reduction of inflow into the FDC sewer should be maintained as a primary focus for the City as this will reduce demands of any retrofit mitigation measures and result in both immediate and long-term benefit to reducing the potential for basement water infiltration. The primary focus would be expected to be disconnection of residential roof downspouts which discharge below surface and presumably into the weeping tile system (and thus into the FDC sewer system).
- Residual capacity and future retrofitting potential (wet well, pumps and forcemain sizing) should be incorporated as part of the overall pump station design effort to provide additional resiliency in the event of future inflows greater than those estimated by the modelling work.
- Refinements and adjustment to the preliminary pump station capacities and layouts will likely occur as part of the preliminary and detailed design, and considerations should be made for diversion pipe sizing, wet well dimensions, pump capacities, grading, and utilities. This would also be expected to include orifice plates or other restrictors to force a greater proportion of FDC sewer flow to pump stations and away from the FDC sewer system.
- A backup generator is recommended to be included for all pumping stations so that the system can continue to function in the event of a potential power failure.
- Other remedial measures, including localized FDC sewer upgrades (especially between Gracefield Drive and Doug Leavens Boulevard due to the general unobstructed nature of the area; exact extents to be confirmed as part of future study) may potentially be a more cost-effective solution than additional pumping stations (above and beyond the primary recommended locations). Localized upgrades in the upper area of the sewershed (Terragar Boulevard and Golden Locust Drive area) are also recommended.

- Annual monitoring of the FDC network and related drainage systems should be continued to evaluate system performance and incremental benefit of remedial measures. Pumping station control systems should also be designed to incorporate data loggers to record pumped flows and volumes at a sufficient time step to support integration with the overall monitoring program.

## 4.6 Consultation Program

Engagement has been undertaken with Indigenous Nations, government agencies, the public, and property owners, for comments and feedback on the expansion of pumping stations within the Lisgar District. Formal consultation was initiated with the Notice of Commencement publication on April 29, 2021. Various methods of informal and formal communication have been employed throughout Class EA process, which are documented in Appendix G.

A Public Information Centre (PIC) was held to present the preceding findings to the public on November 17, 2021. Notification was issued in advance to area residents, key stakeholders, and indigenous communities. Copies of relevant materials are included in Appendix G.

### 4.6.1 Communication and Engagement Activities

To ensure that Indigenous Nations and stakeholders had the opportunity to influence the Project design, opportunities for engagement and comment were provided in a diverse set of engagement methods, including:

- Online engagement at www.mississauga.ca, where participants could learn more about the project and provide feedback via email or comment form;
- Notifications and email updates;
- Correspondence with utilities, conservation authorities;
- Notifications to, and discussions with, Property Owners;
- Notifications to Indigenous Nations; and
- Virtual Public Meeting.

### 4.6.2 Key Project Contacts and Stakeholders

A project contact list was developed at the outset of the Project and maintained throughout the duration. The list consisted of the following groups: members of the public, property owners, Indigenous Nations, review agencies (federal, provincial, municipal and conservation authorities), elected representatives, utility companies, transit authorities, community/interest groups and others.

***Agencies***

**Provincial and Municipal Government, Conservation Authorities and Related Municipal Bodies**

- Ministry of the Environment, Conservation and Parks (MECP)
- Ministry of, Tourism, Culture and Sport (MTCS)
- Region of Peel
- Credit Valley Conservation
- Conservation Halton

***Elected Officials***

Members of Parliament (MPs)

- Mississauga-Streetsville – Rechie Valdez

Members of Ontario Provincial Parliament (MPPs)

- Mississauga-Streetsville – Nina Tangri

City/Town Councillors and Regional Councillors

- City of Mississauga – Sue McFadden (Ward 10)

***Other Stakeholders***

Rail

- Canadian National Rail

Utilities

- Alectra
- Hydro One Networks
- Enbridge Pipelines Inc.

- Bell Canada

Stakeholder Groups / Public

- Lisgar Residents' Association
- Directly impacted property owners
- General public

### 4.6.3 Indigenous Consultation

Indigenous Nation engagement is a key component of the Class EA process. As previously noted, the Ministry of the Environment, Conservation and Parks (MECP) delegated the procedural aspects of the duty to consult to the City of Mississauga in its response to the Notice of Commencement on May 21, 2021. On May 21, 2021, the MECP advised that engagement should occur with the following Indigenous Nations:

- Haudenosaunee Confederacy Council as represented by the Haudenosaunee Development Institute (HDI),
- Huron-Wendat Nation (HWN),
- Mississaugas of the Credit First Nation (MCFN), and
- Six Nations of the Grand River (SNGR).

The official delegation of the duty to consult from the MECP was received on June 16, 2021. Following understood consultation protocols with for these Indigenous Nations, Wood contacted the Nations at specific milestones throughout the Study. On July 19, 2021, Wood provided each Nation with a cover letter, a plain language project summary and Notice of Study Commencement. Wood followed up by phone and email with each Nation to determine interest in the Study on August 6, 2021.

On February 1, 2022, Wood provided the Nations with an update on the Study, the Notice of PIC, the PIC slides, draft Stage 1 Archaeological Assessment and draft Natural Heritage Existing Conditions Report. Due to the COVID-19 pandemic, many of the Nations preferred correspondence and information to be conveyed by email.

A summary of consultation with each Indigenous Nation is provided below, and records of Indigenous Consultation are provided in Appendix G.

#### *4.6.3.1 Haudenosaunee Confederacy Council as represented by the Haudenosaunee Development Institute (HDI)*

Following the initial outreach on July 19, 2021, and August 6, 2021, the following engagement occurred with HDI:

- July 27, 2021 (phone call and email) and August 6, 2021 (phone call and email), HDI identified interest to receive /review natural environment studies, and participation opportunities in fieldwork.
- September 9, 2021 (email), the Project Team responded explaining the aquatic and terrestrial fieldwork was completed on May 13, 2021 and apologized for the oversight in failing to inform HDI prior to the activity. There was no further response from HDI on this matter.
- February 1, 2022 (email), the Project Team provided an update on the Study, including links to the PIC slides and the draft Stage 1 Archaeological Assessment and Natural Heritage Existing Conditions Report. The Project Team followed-up via email and phone on February 23, 2022 to ensure HDI confirmed receipt of the reports and to seek any feedback from HDI regarding the reports provided.

- No comments were received.

#### *4.6.3.2 Huron-Wendat Nation (HWN)*

Following the initial outreach on July 19, 2021, and August 6, 2021, the following engagement occurred with HWN:

- August 11, 2021 (email), HWN identified interest to participate in all archaeological fieldwork for this Study, and to receive copies of the draft reports for review and comment.
- August 17, 2021 (email), the Project Team identified the Stage 1 Archaeological Assessment was ongoing and the draft report will be provided to HWN for review and comment.
- February 1, 2022 (email), the Project Team provided an update on the Study, including links to the PIC slides and the draft Stage 1 Archaeological Assessment and Natural Heritage Existing Conditions Report. The Project Team followed-up via email and phone on February 23, 2022 to ensure HWN confirmed receipt of the reports and to seek any feedback from HWN regarding the reports provided.
- February 10, 2022 (email), HWN responded asking if there are any archaeological studies or fieldwork necessary for this Study and if there was funding available to review the reports and provide recommendations.
- February 14, 2022 (email), the Project Team responded to HWN to state there was no fieldwork left to be conducted, and the City would provide funding for report review.
- February 16, 2022 (email), HWN asked if comments could be submitted by April 1, 2022.
- February 23, 2022 (email), the Project Team confirmed that April 1, 2022 was acceptable for the comment deadline for the Stage 1 Archaeological Assessment and Natural Heritage Existing Conditions Report. The Project Team followed up on April 28, 2022 to ask for a timeline to receive the comments.
- No comments were received.

#### *4.6.3.3 Mississaugas of the Credit First Nation (MCFN)*

Following the initial outreach on July 19, 2021, and August 6, 2021, the following engagement occurred with MCFN:

- August 6, 2021 (email), MCFN responded identifying interest in participating in the field work.
- September 9, 2021 (email), the Project Team responded explaining the aquatic and terrestrial fieldwork was completed on May 13, 2021 and apologized for the oversight in failing to inform MCFN prior to the activity. There was no further response from MCFN on this matter.
- February 1, 2022 (email), the Project Team provided an update on the Study, including links to the PIC slides and the draft Stage 1 Archaeological Assessment and Natural Heritage Existing Conditions Report. The Project Team followed-up via email and phone on February 23, 2022 to ensure MCFN confirmed receipt of the reports and to seek any feedback from MCFN regarding the reports provided.
- February 23, 2022 (email): MCFN stated file access issues with the links provided, which the Project Team rectified on the same day and MCFN confirmed access to the files..
- No comments were received.

#### *4.6.3.4 Six Nations of the Grand River (SNGR)*

Following the initial outreach on July 19, 2021, and August 6, 2021, the following engagement occurred with SNGR:

- February 1, 2022, the Project Team provided an update on the Study, including links to the PIC slides and the draft Stage 1 Archaeological Assessment and Natural Heritage Existing Conditions Report.
- February 1, 2022 (email), SNGR stated file access issues with the links provided, which the Project Team rectified on the same day and SNGR confirmed access to the files..
- March 16, 2022 (email), SNGR requested access to the draft Stage 1 Archaeological Assessment, which the Project Team provided on the same day.
- No comments were received.

### 4.6.4 Project Notices

The Notice of Commencement was published through the Mississauga News on April 21, 2021. A public notice was published through the Mississauga News prior to the Public Information Centre (PIC), as well as prior to the Notice of Commencement and Notice of Completion. Table 4.8 below summarizes all notices circulated as part of the Project. Copies of these notices can be found in Appendix G.

**Table 4.8: Summary of Notices**

| Type | Medium | Language | Location | Date |
|---|---|---|---|---|
| Notice of Commencement | Newspaper | English | Mississauga News | April 21, 2021 |
| Notice of Public Information Centre | Virtual | English | Email | November 5, 2021 |

### 4.6.5 Public Consultation

On November 17, 2021 from 7:00 to 8:30pm EST the City of Mississauga hosted the Public Information Centre (PIC) for the Lisgar District Pumping Station EA and Town Hall. Due to the ongoing COVID-19 pandemic and gathering restrictions the meeting was held virtually through www.mississauga.ca. Notification for the PIC was sent to residents and the Lisgar Residents' Association ahead of time via email. Consultation and feedback from the Lisgar Residents' Association is available in Appendix G.

The session was planned as a dual-purpose information event, with a presentation of both the findings of the current Class EA as well as an overall Town Hall Update Session to explain the City's High Water Protocol program (including recent improvements) as well as other ongoing initiatives (FDC smoke testing for cross-connections, ongoing sump pump subsidy program, etcetera). Councilor Sue McFadden provided an introduction to the PIC due to her involvement in the community and past projects within the Lisgar District. As well, the meeting provided the opportunity to understand any concerns surrounding the project so responses can be incorporated into the final reports.

The project website was: https://www.mississauga.ca/projects-and-strategies/environmental-assessments/lisgar-district-pumping-stations-study/ and participants could communicate by submitting a Comment Form via email to the City by December 1, 2021. The Public Information Centre Presentation can be found in Appendix G. Letters to property owners adjacent to the three proposed pumping station were provided after the PIC for further follow up and feedback from directly affected property owners.

Residents were provided the opportunity to submit written questions during the event. City and Wood staff provided answers live during the event as well. Questions received during the event as well as those sent thereafter were compiled into a summary Question and Answer summary (refer to Appendix G).

Questions relevant to the current Class EA included those regarding the existing Cactus Gate Pumping Station as well as Future Pumping Stations. There were questions regarding the capacity of the existing Cactus Gate Pumping Station and concern about the proximity of the proposed additional pumping station at Smoke Tree Road, including its potential impact to the pedestrian bridge and access to the adjacent park and schools. Pumping station capacity and size was an area of interest, as were aesthetics (potential to construct features below ground to the extent possible) and noise impacts and disruption to adjacent residents. A complete copy of questions and answers has been included along with copies of the PIC materials in Appendix G.

**Table 4.9: Summary of Key Public Information Centre Details**

| Category | Details |
|---|---|
| Date | November 17, 2021 from 7:00pm to 8:30pm EST |
| Location | www.mississauga.ca. |
| Number of Attendees | Approximately 40 |
| Number of Questions/Comments Received | 47 (refer to Appendix G for questions and responses) |
| Project Information Presented | • Background Information and Update on Cactus Gate Pumping Station and Monitoring Program – provided a history of basement water infiltration issues in the area, previous public consultation, and the construction and implementation of the Cactus Gate Pumping Station<br>• Lisgar District Pumping Station Class Environmental Assessment – description of Class EA, location assessment for potential pumping stations, and introduction of preliminary preferred solution |

# 5.0 Preferred Solution and Implementation Plan

## 5.1 Pumping Stations and Implementation

The alternative assessment (ref. Section 4) has determined the Preferred Solution to involve the construction of three (3) separate FDC pumping systems. Overall, it is considered preferred to implement the pumping stations in sequence from upstream to downstream, as the flow reduction benefits of removing extraneous water upstream will also benefit downstream FDC trunk sewer capacity. In general, a greater number of affected properties are located upstream (i.e. along Black Walnut Trail). Based on the preceding, the proposed prioritization in order from highest to lowest is:

1) Location 2 - Black Walnut Trail and Smoke Tree Road
2) Location 7 – Lisgar Creek south of Doug Leavens Boulevard
3) Location 12 - Osprey Marsh

Preliminary concept plans for each of the preceding three (3) locations have been presented in Drawings 3a, 3b, and 3c respectively. These concept plans are necessarily generalized. It is expected that these plans will be further refined as part of the subsequent preliminary and detailed design process.

Location 2 is proposed as a combined low flow\high flow pumping system. Locations 7 and 12 are proposed as high flow only pumping stations.

As noted previously, and consistent with some comments received from area residents (refer to Section 4.6), the design effort should consider residual capacity and future retrofitting potential (wet well, pumps and forcemain sizing) to provide additional resiliency in the event of future inflows greater than those estimated by the modelling work. Additional considerations should also be made for diversion pipe sizing, and the need to consider orifice plates or other restrictors to force a greater proportion of FDC sewer flow to pump stations and away from the FDC sewer system for further optimize their function. Other typical detailed design factors would require consideration, including potential utility conflicts and also servicing requirements (electrical and natural gas supplies). Backup generators are recommended to be included for all FDC pumping stations, so that they can continue to operate in the event of a power failure (which could occur during a storm event, particular a thunderstorm).

Given that the works will be designed and implemented sequentially, opportunities for design improvements should be considered where feasible (i.e. "lessons learned" from previous projects).

It is expected that City staff will seek Council approval for the required capital funding to support the preliminary and detailed design and construction of the preferred solution (i.e. 3 FDC pumping stations). As per the November 17, 2021 PIC, the City has proposed to sequence the works on an annual basis (subject to council approval):

- Location 2 (Smoke Tree Road)
    - Design and tender preparation over the course of 2022
    - Construction over the course of 2023
- Location 7 (Doug Leavens Boulevard)
    - Design and tender preparation over the course of 2023
    - Construction over the course of 2024
- Location 12 (Osprey Marsh)
    - Design and tender preparation over the course of 2024
    - Construction over the course of 2025

## 5.2 Potential Impacts and Mitigation

Based on the preceding, further potential impacts and issues have been considered, along with a proposed mitigation strategy. These considerations are presented generally (for all three (3) sites) in Table 5.1. The preceding potential impacts and mitigation measures should be implemented into the subsequent detailed design phase for the FDC pumping systems. Specific considerations for each of the three (3) sites, building off the alternative evaluation considerations noted in Section 4.3.3, are presented thereafter in Tables 5.2 to 5.4.

**Table 5.1. General Mitigation Considerations**

| Subject | Impact / Issue | Mitigation / Action |
|---|---|---|
| Construction | • Traffic<br>• Noise<br>• Dust<br>• Vibration<br>• Excess Soil | • Management plan (staging, traffic management, erosion and sediment control) required to meet City standards<br>• Contractor will ensure City requirements are met<br>• Pre-construction condition surveys of adjacent residences are proposed<br>• Active vibration and settlement monitoring during construction<br>• Ensure requirements of Excess Soil Regulations are followed including characterization and appropriate off-site re-use or disposal depending on results |
| Operation | • Noise<br>• Odour<br>• Maintenance | • Pumps will be deep below ground and operate infrequently; noise would be expected to be minimal<br>• Backup generator would operate infrequently; an enclosed model should be considered, and a noise assessment undertaken if required as part of environmental approvals process<br>• Discharges would be stormwater flows (not sanitary) filtered through aggregate material - no odour is anticipated<br>• Purposeful maintenance access to be specifically designed from adjacent roadways<br>• Provide consideration of interaction with pedestrian traffic and trails as required |
| Aesthetics | • Pumps<br>• Other features<br>• Parkette<br>• Buildings | • Pumps would be well below ground and not visible from the parkette.<br>• Wet well structure would need to extend slightly above the ground surface but generally minor; design can consider opportunities to place as much as possible below the surface<br>• Electrical (control) panel and backup generator should be located along the edge of the parkette to the extent possible. Enclosure "wraps" can be considered which provide a more natural look, as was done for the Cactus Gate Pump Station.<br>• Landscape plan will be created for restoration, and should review opportunities to camouflage features where possible |

| Subject | Impact / Issue | Mitigation / Action |
|---|---|---|
| | | • Permanent structures (buildings) will be minimized to the extent possible; may be required for larger capacity pumping stations. |
| Creek Discharge | • Outlet | • All pumping stations are necessarily located adjacent to creek; Conservation Halton permit may be required if works within regulated area or if local channel requires widening/reinforcement to accept additional discharges from system or potentially relocation based on space constraints. |
| Climate Change | • Resiliency | • Pumping station and utility dewatering trench will add capacity to overall system, providing resiliency to changing climate. Consideration for "upsizing" during detailed design. |

**Table 5.2. Specific Mitigation Considerations for Location 2 (Smoke Tree Road)**

| Subject | Impact / Issue | Mitigation / Action |
|---|---|---|
| Social Environment | • Road and Trail Closures during construction<br>• Road and Trail restoration | • Communicate intersection closure (Black Walnut Trail and Smoke Tree Road) well in advance to residents (prior to construction start) and provide workable detour routes. Communicate updates on schedule regularly.<br>• Make efforts to keep the pedestrian bridge open throughout construction as well as the connection to the Lisgar Meadowbrook Trail (diversion to Scotch Pine Gate access).<br>• Ensure road is properly restored and matches to existing roadway.<br>• Ensure re-construction restores trail connection between Black Walnut Trail and Lisgar Meadowbrook Trail and the pedestrian bridge. |
| Natural Environment | • Tree impacts<br>• Creek impacts<br>• Soil impacts | • Confirm number of trees to be removed (5 to 8) through further study and minimize to the extent possible. Removal timing to comply with applicable timing requirements. Protect remaining trees throughout construction. Ensure replacements are consistent with requirements of City Parks group and utilize native species.<br>• Minimize disturbance to the creek to the extent possible by re-using existing overland swale to the extent possible.<br>• Consider characterization requirements of Excess Soil Regulations as part of field work in support of design. Ensure all excess soil is re-used or disposed in compliance with results and regulations. Ensure appropriate ESC controls throughout construction to avoid migration of soil. |
| Permits | • Environmental Compliance Approval (ECA) | • An ECA will be required from MECP for the works; to be submitted through the City's Transfer of Review (TOR) authority, and potentially through pending Consolidated Linear Infrastructure (CLI-ECA) program |

| Subject | Impact / Issue | Mitigation / Action |
|---|---|---|
| | • Permit to Take Water (PTTW) and/or Environmental Activity and Sector Registry (EASR)<br>• Conservation Halton<br>• Road Occupancy Permit<br>• Park Access Permit | • Review findings of geotechnical\hydro-geological field investigation to determine whether a PTTW is required from MECP for the permanent operation of the low-flow dewatering system. It is expected that a short-term PTTW or EASR for dewatering during construction phase; to be determined based on expected flow rates.<br>• A CH permit for works within a regulated area is expected to be required. Confirm works are adequately floodproofed and do not impact existing floodplain (cut/fill).<br>• City permits (ROP and PAP) to be applied for prior to construction. Parks permit to consider tree management strategy as noted for natural environment. |

**Table 5.3. Specific Mitigation Considerations for Location 7 (Doug Leavens Boulevard)**

| Subject | Impact / Issue | Mitigation / Action |
|---|---|---|
| Social Environment | • Road and Trail Closures during construction<br>• Road and Trail restoration | • Limit road closures to the extent possible given arterial nature of Doug Leavens Boulevard. Communicate any closures well in advance to residents (prior to construction start) and provide workable detour routes. Communicate updates on schedule regularly.<br>• No trail impacts expected given that this section of trail is not currently open. However, ensure design does not limit any future opportunities to re-open or use the trail on this side of Lisgar Creek. |
| Natural Environment | • Tree impacts<br>• Creek impacts<br>• Soil impacts | • Confirm number of trees to be removed through further study and design and minimize to the extent possible. Removal timing to comply with applicable timing requirements. Protect remaining trees throughout construction. Ensure replacements are consistent with requirements of City Parks group and utilize native species.<br>• Minimize disturbance to the creek to the extent possible by locating pumping station outfall further up and away from primary creek.<br>• Consider characterization requirements of Excess Soil Regulations as part of field work in support of design. Ensure all excess soil is re-used or disposed in compliance with results and regulations. Ensure appropriate ESC controls throughout construction to avoid migration of soil. |
| Permits | • Environmental Compliance Approval (ECA) | • An ECA will be required from MECP for the works; to be submitted through the City's Transfer of Review (TOR) authority, and potentially through pending Consolidated Linear Infrastructure (CLI-ECA) program |

| Subject | Impact / Issue | Mitigation / Action |
|---|---|---|
| | • Permit to Take Water (PTTW) and/or Environmental Activity and Sector Registry (EASR)<br>• Conservation Halton<br>• Road Occupancy Permit<br>• Park Access Permit | • It is expected that a short-term PTTW or EASR for dewatering during construction phase; to be determined based on expected flow rates from hydro-geological study in support of future design work.<br>• A CH permit for works within a regulated area is expected to be required. Confirm works are adequately floodproofed and do not impact existing floodplain (cut/fill).<br>• City permits (ROP and PAP) to be applied for prior to construction. Parks permit to consider tree management strategy as noted for natural environment. |

**Table 5.4. Specific Mitigation Considerations for Location 12 (Osprey Marsh)**

| Subject | Impact / Issue | Mitigation / Action |
|---|---|---|
| Social Environment | • Road and Trail Closures during construction<br>• Road and Trail restoration | • Limit road closures to the extent possible given arterial nature of Osprey Boulevard. Communicate any closures well in advance to residents (prior to construction start) and provide workable detour routes. Communicate updates on schedule regularly.<br>• It is expected that the section of Lisgar Meadowbrook Trail will require closure during construction. Provide alternative routes and detour mapping.<br>• Re-locate high water protocol (HWP) temporary pumping to an alternative location as required, such as Lisgar Drive\Pondview Way or Ninth Line.<br>• Ensure re-construction restores all trail connections and park and trail amenities (benches, etcetera). |
| Natural Environment | • Tree impacts<br>• Wetland impacts<br>• Creek impacts<br>• Soil impacts | • Confirm number of trees to be removed through further study and design and minimize to the extent possible. Removal timing to comply with applicable timing requirements. Protect remaining trees throughout construction. Ensure replacements are consistent with requirements of City Parks group and utilize native species.<br>• Ensure wetland limits and setbacks are accounted for as part of work and no disturbance to this area.<br>• Minimize disturbance to the creek to the extent possible by locating pumping station outfall further up and away from primary creek. Depending on extents of pumping station scoped creek re-alignment may be required. Ensure supporting studies are completed to mitigate any potential impacts including a thorough staging plan for construction. |

| Subject | Impact / Issue | Mitigation / Action |
|---|---|---|
| | | • Consider characterization requirements of Excess Soil Regulations as part of field work in support of design. Ensure all excess soil is re-used or disposed in compliance with results and regulations. Ensure appropriate ESC controls throughout construction to avoid migration of soil. |
| Permits | • Environmental Compliance Approval (ECA)<br>• Permit to Take Water (PTTW) and/or Environmental Activity and Sector Registry (EASR)<br>• Conservation Halton<br>• Road Occupancy Permit<br>• Park Access Permit | • An ECA will be required from MECP for the works; to be submitted through the City's Transfer of Review (TOR) authority, and potentially through pending Consolidated Linear Infrastructure (CLI-ECA) program<br>• It is expected that a short-term PTTW or EASR for dewatering during construction phase; to be determined based on expected flow rates from hydro-geological study in support of future design work.<br>• A CH permit for works within a regulated area is expected to be required. Confirm works are adequately floodproofed and do not impact existing floodplain (cut/fill). Additional studies and investigations may be necessary to support the permit application if a creek re-alignment is confirmed to be required.<br>• City permits (ROP and PAP) to be applied for prior to construction. Parks permit to consider tree management strategy as noted for natural environment. |

## 5.3 Other Measures

As noted in Section 4.5.2.4, several other measures should be considered in conjunction with the primary proposed FDC pumping stations:

- Regardless of the recommendations for permanent pumping stations, reduction of inflow into the FDC sewer should be maintained as a primary focus for the City as this will reduce demands of any retrofit mitigation measures and result in both immediate and long-term benefit to reducing the potential for basement water infiltration. The primary focus would be expected to be disconnection of residential roof downspouts which discharge below surface and presumably into the weeping tile system (and thus into the FDC sewer system). It is recommended that the City implement these measures as soon as possible. A field reconnaissance of properties would be required to identify properties (in addition to the results of previous investigations including smoke testing). It would need to be determined whether or not a City-led program would be the most efficient way to address identified issues (i.e. single contractor) or whether the onus would be placed upon residents to bring drainage issues into compliance within a specified time frame.

- Other remedial measures, including localized FDC sewer upgrades (especially between Gracefield Drive and Doug Leavens Boulevard due to the general unobstructed nature of the area) may potentially be a more cost-effective solution than additional pumping stations (above and beyond the currently recommended pumping stations). Localized upgrades in the upper area of the sewershed (Terragar Boulevard and Golden Locust Drive area) are also recommended. Where feasible, pipe upgrades should be combined with existing capital planning for road and

infrastructure reconstruction, however given the age of the area it is not expected that the area would be prioritized on the basis of age.

- Annual monitoring of the FDC network and related drainage systems should be continued to evaluate system performance and incremental benefit of remedial measures.

# 6.0 Summary

## 6.1 Study Background

Commencing in 2008, approximately 200 homes in the Lisgar District experienced water seeping into their basements following certain rainfall events. In response, the City undertook a number of actions, such as video inspection and cleaning of the foundation drain collector (FDC) system and putting in place a High Water Protocol (deploying pumps during major storms).

In October 2011, Wood was retained to undertake an engineering study to determine the cause(s) of basement water infiltration and recommend corrective measures. After comprehensive monitoring and analysis, the engineering study determined the problem to be primarily related to the build-up of water in the bedding material of the utility trenches that contain the storm, sanitary and FDC sewer systems.

In March 2015, the results of the study were presented to the Public which outlined a Mitigation Plan. The Plan recommended prioritized mitigation measures for the City to address the basement water infiltration issue, with the highest priority mitigation measure being the strategic lining of priority storm sewers to minimize leakage.

As part of the implementation of the Prioritized Action Plan, storm sewer lining works were completed for the highest priority area (Phase 1 - Black Walnut Trail) between December 2016 and March 2017. Following a large storm event in July 2017 that resulted in reported basement water infiltration, the Prioritized Action Plan was updated in 2017, which advanced an FDC Pumping Station as a higher priority mitigation measure to be assessed, planned, designed and constructed.

In September 2018, a Class EA was completed for the Black Walnut Trail area pumping station system and the preferred solution identified an FDC pumping system at Cactus Gate Parkette. The preferred approach was a combined high flow – low flow pumping system given the associated efficiencies around construction and design, and also long-term operation and maintenance. This FDC pumping station began construction in 2019 and was operational in 2021.

A large storm event on August 28, 2021 resulted in five incidents of reported basement water infiltration. The Cactus Gate Pumping station helped mitigate the impacts of the storm, along with the High Water Protocol temporary pumping. Continuing from the Class EA completed in 2018, this Class EA has specifically been undertaken to determine the preferred locations and form of Pumping Stations within the entirety of the Lisgar District to further reduce the potential for basement water infiltration.

A public meeting was held on November 17, 2021 to provide the Public with an update on the Cactus Gate Pumping Station and Monitoring Program, information regarding this Class EA, and an overview of the High Water Protocol.

## 6.2 Alternative Assessment

A number of Pumping Station alternatives were developed consisting of low flow and high flow systems. A Utility Trench Dewatering Pumping Station (low flow system) is a system that operates to dewater the utility trench (granular stone bedding) by removing small amounts of water on a continuous basis, much like a residential sump pump. The intent of the utility trench dewatering system for the Lisgar District is to dewater the bedding material within the sewer utility trench to limit the accumulation of water, and thus provide additional storage volume during storm events. A FDC Pumping Station differs from a utility trench dewatering system in that it operates to remove water from the FDC pipe network during periods of high flow. This pumping system would be larger but operate less frequently and only during certain storm or snowmelt events.

A long-list of potential alternative locations for the proposed FDC pumping systems was developed. Further, it was recommended that for synergy in construction activities, it would be preferred to construct both the low and high flow systems in the same location. Based on a review of the Lisgar District the following long-list of alternative locations was generated:

Location 1. Russian Olive Close at Buttonbush Park

Location 2. Black Walnut Trail at Smoke Tree Road Parkette

Location 3. Black Walnut Trail at Scotch Pine Gate Parkette

Location 4. Lisgar Creek at Forest Park

Location 5. Gracefield Drive at Lisgar Meadowbrook Trail

Location 6. Lisgar Creek at Lisgar Fields

Location 7. Lisgar Creek at Doug Leavens Boulevard

Location 8. Lisgar Creek at Pintail Circle

Location 9. Lisgar Creek at Nutcracker Drive (North)

Location 10. Lisgar Creek at Nutcracker Drive (South)

Location 11. Lisgar Creek at Lisgar Green Park

Location 12. Osprey Marsh at Prairie Circle

Location 13. Osprey Marsh at Lisgar Drive

Location 14. Osprey Marsh at Ninth Line

The principal Evaluation Criteria used in the assessment were:

- *Drainage Area Served:* The amount of nearby land that will be serviced by the Pumping Stations.
- *Property Suitability*: The suitability of the property based on public land ownership and local property constraints, such as the amount of public space available (parkette versus City owned easement) and factors related to the social and natural environments.
- *Number of Houses in Proximity that Reported Basement Water Infiltration:* The Pumping Station should be located in proximity to the greatest number of houses that reported basement water infiltration in order to best address the issue.

**Long-list of Alternatives**

| Potential Pumping Station Locations | Evaluation Criteria | | | Evaluation |
|---|---|---|---|---|
| | Drainage Area Served | Property Suitability | # of Reported Cases | Screened/ Short-listed |
| 1. Russian Olive Close at Buttonbush Park | 🔴 | 🟢 | 🟡 | Screened out |
| 2. Black Walnut Trail at Smoke Tree Road Parkette | 🟡 | 🟢 | 🟢 | Short-listed |
| 3. Black Walnut Trail at Scotch Pine Gate Parkette | 🟡 | 🟢 | 🟢 | Short-listed |
| 4. Lisgar Creek at Forest Park | 🟢 | 🟡 | 🔴 | Screened out |
| 5. Gracefield Drive at Lisgar Meadowbrook Trail | 🟢 | 🔴 | 🔴 | Screened out |
| 6. Lisgar Creek at Lisgar Fields | 🟢 | 🔴 | 🔴 | Screened out |
| 7. Lisgar Creek at Doug Leavens Boulevard | 🟢 | 🟡 | 🟢 | Short-listed |

| Long-list of Alternatives | | | | |
|---|---|---|---|---|
| 8. Lisgar Creek at Pintail Circle | 🟢 | 🟡 | 🟡 | Short-listed |
| 9. Lisgar Creek at Nutcracker Drive (North) | 🟢 | 🔴 | 🟡 | Screened out |
| 10. Lisgar Creek at Nutcracker Drive (South) | 🟢 | 🔴 | 🟡 | Screened out |
| 11. Lisgar Creek at Lisgar Green Park | 🟢 | 🟡 | 🟢 | Short-listed |
| 12. Osprey Marsh at Prairie Circle | 🟢 | 🟡 | 🟢 | Short-listed |
| 13. Osprey Marsh at Lisgar Drive | 🟢 | 🔴 | 🟡 | Screened out |
| 14. Osprey Marsh at Ninth Line | 🟢 | 🟡 | 🔴 | Screened out |

🟢 Positive 🟡 Neutral 🔴 Negative

Based on the preceding screening, the Lisgar District was divided into three areas and short-listed locations for an FDC pumping system were as follows:

- Black Walnut Trail Area
  - Location 2 – Black Walnut Trail at Smoke Tree Road Parkette
  - Location 3 – Black Walnut Trail at Scotch Pine Gate Parkette
- Doug Leavens Boulevard and Pintail Circle Area
  - Location 7 – Lisgar Creek south of Doug Leavens Boulevard
  - Location 8 – Lisgar Creek at Pintail Circle
- Osprey Boulevard Area
  - Location 11 – Lisgar Creek at Lisgar Green Park
  - Location 12 – Osprey Marsh at Prairie Circle

The six (6) short-listed locations were subsequently assessed further for their technical effectiveness (individually and in combination) using hydraulic modelling.

## 6.3 Technical Evaluation of Short-Listed Alternatives

In order to support an informed design process for an FDC pumping station under high flow conditions, a hydraulic model of the FDC sewer system (PCSWMM modelling software) was used for a number of different assessments, including forensic modelling of the observed FDC system response to actual storm events based on available FDC monitoring data. The hydraulic model was used to model six (6) major storm events from between 2013 and 2021. The modelling uses an approximate unitary flow response for each of the storm events, and then applies different weighting factors based on identified hydraulic zones, until a reasonable match to the observed water levels is obtained. The resulting flows are then applied to assess the relative benefits of FDC diversions and high flow pumping, including the number and capacity of required pumping systems.

Given the preceding, as well as social, ecological, cultural heritage, and archaeological assessments carried out in the Study Area, the prioritized sequence of FDC pumping stations are as follows:

1) Location 2 - Black Walnut Trail and Smoke Tree Road (combined low\high flow)
2) Location 7 – Lisgar Creek south of Doug Leavens Boulevard (high flow only)
3) Location 12 - Osprey Marsh (high flow only)

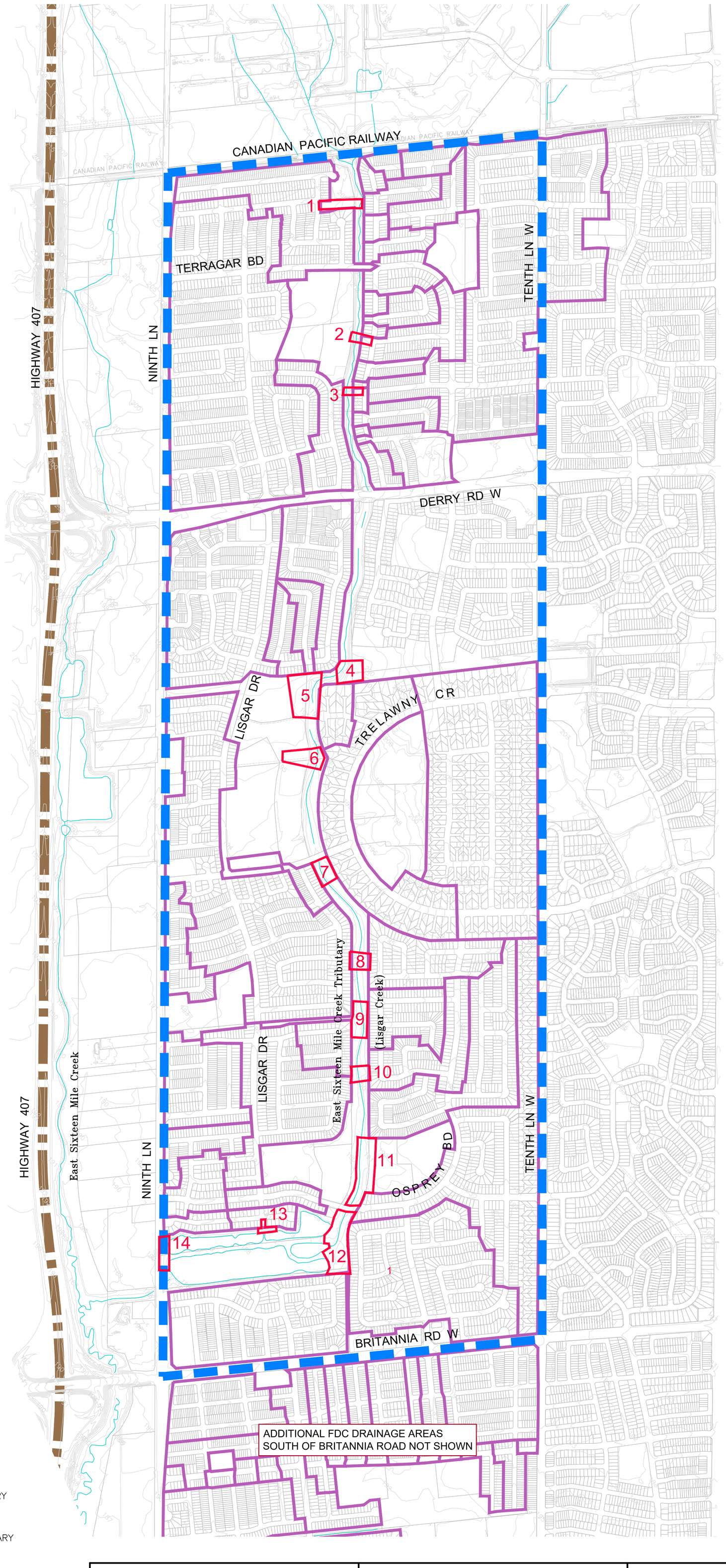
Additional refinements are expected during the subsequent preliminary and detailed design phase. A backup generator is recommended to be integrated into all pumping station systems.

In addition to the preceding, a number of additional considerations have been noted including reducing extraneous inflows to the FDC sewer system through residential downspout disconnections, and other localized works such as FDC sewer upgrades (replacement and relief sewers; exact extents to be confirmed as part of future study). Monitoring should continue in order to assess the effectiveness of mitigation measures as they are implemented and ensure that any "lessons learned" are applied to subsequent pumping stations and other mitigation measures.

## 6.4 Preferred Solution and Implementation Plan

Through the Class EA process documented herein, along with feedback from City staff and the Public, the preferred solution consists of the priority sequencing of three (3) separate FDC pumping stations noted previously. Additional measures related to the reduction of extraneous flows to the FDC system and conveyance (FDC sewer) upgrades have also been noted.

Mitigation measures have been considered to address potential impacts both during construction, and post-construction (long-term operations and maintenance). Measures to specifically address aesthetics, creek discharge and climate change have been proposed (ref. Section 5.2). These, along with other specific municipal and Provincial guidance directives, should be considered during final planning and design, construction and implementation, including operation and maintenance.




SCALE VALID ONLY FOR 24"x36" VERSION

# LISGAR DISTRICT FDC PUMPING STATIONS CLASS EA

CITY OF MISSISSAUGA

## PRELIMINARY LONG-LISTED LOCATIONS

wood.

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| Drawing No. | 1 |

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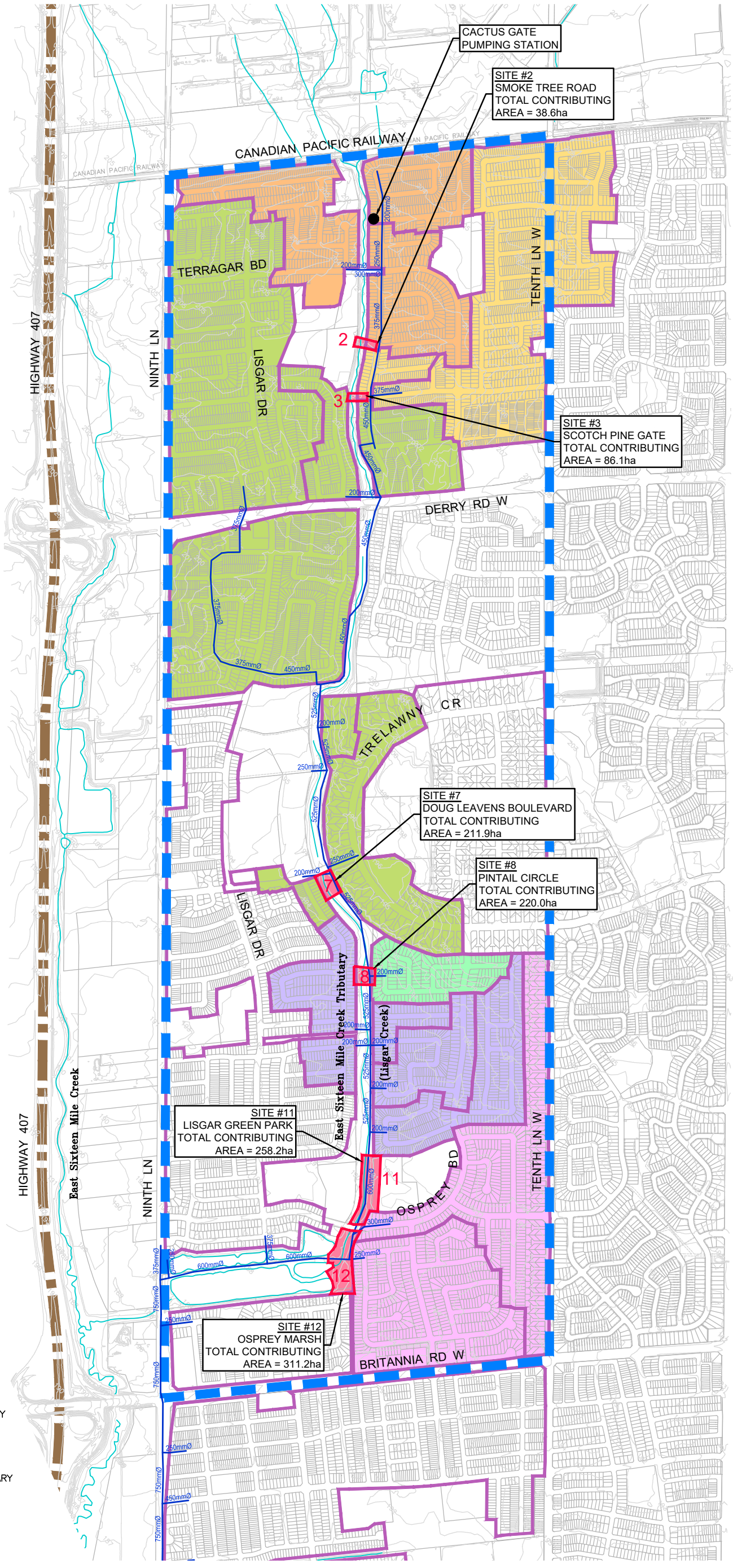


0 125 250 500

## LEGEND

- WATERCOURSE
- CONTOUR (1m)
- MUNICIPAL BOUNDARY
- STUDY LIMITS
- 300mmØ FDC TRUNK SEWER
- FDC SEWER BOUNDARY
- 1 SCOPING AREAS

CONTRIBUTING DRAINAGE AREA

- SITE #2
- SITE #3
- SITE #7
- SITE #8
- SITE #11
- SITE #12

SCALE VALID ONLY FOR 24"x36" VERSION

# LISGAR DISTRICT FDC PUMPING STATIONS CLASS EA

CITY OF MISSISSAUGA

## SHORT-LISTED LOCATION PLAN

wood.

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| Drawing No. | 2 |

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LEGEND

- PROPERTY LINE
- EXISTING CONTOUR (0.5m)
- ST — EXISTING STORM SEWER SYSTEM
- FDC — EXISTING FOUNDATION DRAINAGE SYSTEM
- H — EXISTING PRIMARY HYDRO
- EXISTING SECONDARY HYDRO
- EXISTING MAINTENANCE HOLE
- EXISTING CATCHBASIN

SCALE VALID ONLY FOR 24"x36" VERSION

| | | | |
|---|---|---|---|
| LISGAR DISTRICT FDC PUMPING STATION CLASS EA<br>CITY OF MISSISSAUGA | CONCEPTUAL LAYOUT PLAN<br>SITE #2<br>SMOKE TREE ROAD<br>PUMP STATION | wood. | Scale 1:125 (0 1.25 2.5 5)<br>Consultant File No. WW21011023<br>Drawing No. 3A |

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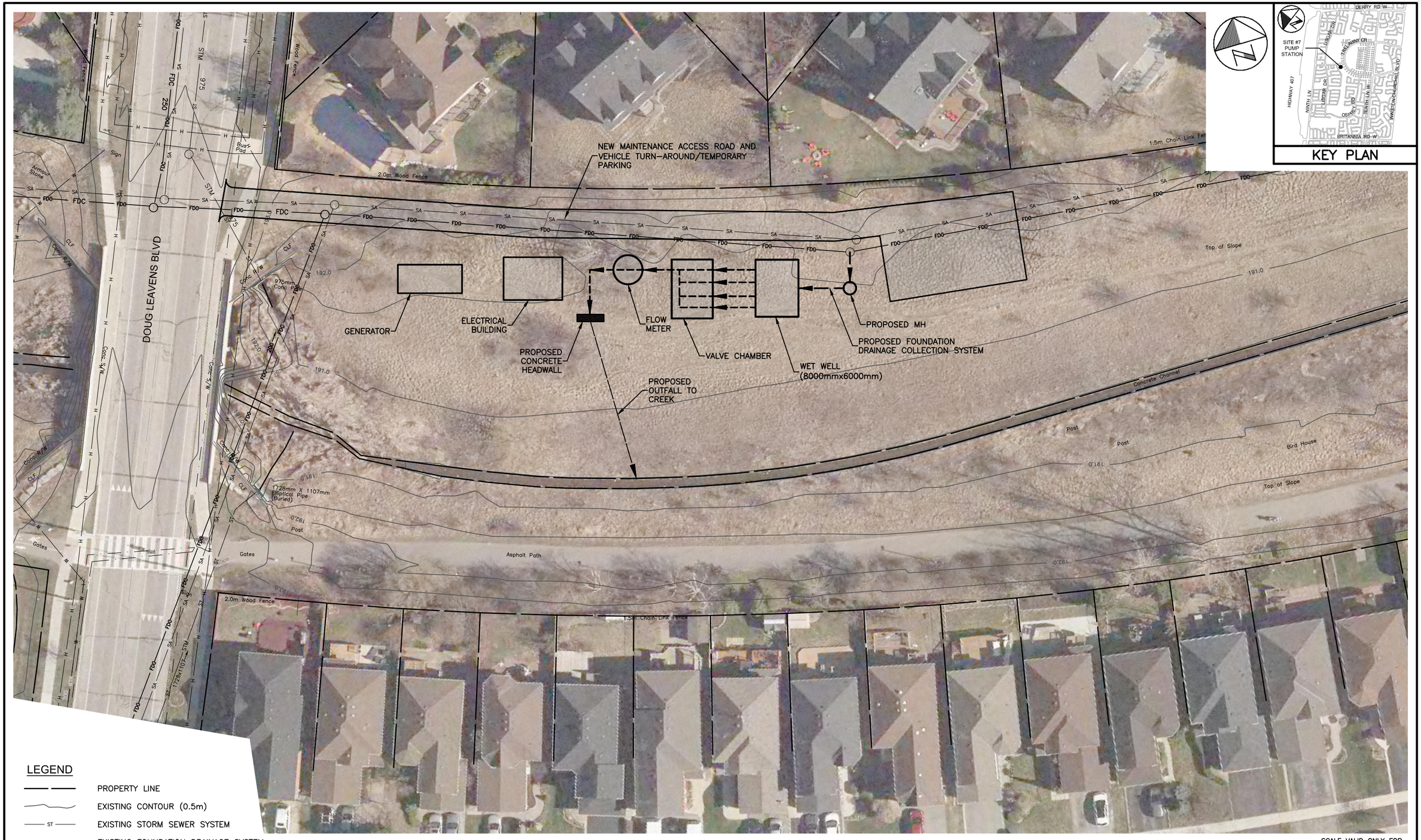





KEY PLAN

## LEGEND

- PROPERTY LINE
- EXISTING CONTOUR (0.5m)
- ST — EXISTING STORM SEWER SYSTEM
- FDC — EXISTING FOUNDATION DRAINAGE SYSTEM
- H — EXISTING PRIMARY HYDRO
- EXISTING SECONDARY HYDRO
- EXISTING MAINTENANCE HOLE
- EXISTING CATCHBASIN

SCALE VALID ONLY FOR 24"x36" VERSION

# LISGAR DISTRICT FDC PUMPING STATION CLASS EA

CITY OF MISSISSAUGA

## CONCEPTUAL LAYOUT PLAN SITE #7 DOUG LEAVENS BOULEVARD PUMP STATION

wood.

Scale 1:250 (0, 2.5, 5, 10)

Consultant File No. WW21011023

Drawing No. 3B

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Plotted: 2022-08-26
Last Saved: 2022-08-26

KEY PLAN

## LEGEND

- PROPERTY LINE
- EXISTING CONTOUR (0.5m)
- EXISTING STORM SEWER SYSTEM
- EXISTING FOUNDATION DRAINAGE SYSTEM
- EXISTING PRIMARY HYDRO
- EXISTING SECONDARY HYDRO
- EXISTING MAINTENANCE HOLE
- EXISTING CATCHBASIN

SCALE VALID ONLY FOR 24"x36" VERSION

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|---|---|---|---|
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Last Saved: 2022-09-12

# Appendix A

# March 2015 Public Report and Presentation

# LISGAR DISTRICT
# BASEMENT WATER INFILTRATION INVESTIGATION

## SUMMARY REPORT

Submitted to:

**City of Mississauga**
Mississauga, Ontario

Submitted by:

**Amec Foster Wheeler Environment & Infrastructure**

**A division of Amec Foster Wheeler Americas Limited**
3215 North Service Road
Burlington, ON  L7N 3G2

Tel:  905-335-2353
Fax:  905-335-1414

**March 2015**

TP111119B

# EXECUTIVE SUMMARY

## *Lisgar District Basement Water Infiltration Assessment*

Commencing in 2008 a number of homes in the Lisgar District experienced water seeping into their basements following certain rainfall events, with the largest number of homes impacted during a rainfall event in late 2011. A total of 187 homes are known to have been affected to date.

After becoming aware of the scale of this issue, the City undertook a number of actions, including:

- Video inspection and cleaning of the foundation drain collector (FDC) system;
- Removal of vegetation along Sixteen Mile Creek;
- Clean-out of bridge crossings and storm outfalls to Sixteen Mile Creek;
- Putting in place a High Water Protocol (deploy pumps during major storms);
- Sealing selected FDC manholes and pipe joints; and
- Adjustment to the Osprey Marsh Stormwater Pond outlet.

In October 2011, the engineering consulting firm of AMEC Environment & Infrastructure (now known as Amec Foster Wheeler Environment & Infrastructure) was retained to undertake an engineering study to determine the cause(s) of basement water infiltration and recommend corrective measures.

After a lengthy and comprehensive monitoring period and analysis, the study findings have determined the problem to be primarily related to the build-up of water in the bedding material of the utility trenches that contain the storm, sanitary and FDC sewer systems.

Leakage from the storm sewer, which is a normal occurrence, combined with the presence of slow draining native soils around the utility trenches has been found to result in water build-up within these trenches. If the build-up of water is significant enough it can travel up the bedding material around the FDC laterals servicing the homes and into the foundation weeping tiles. This water then drains directly into the FDC pipes through the weeping tiles which may result in excess flow in the FDC system (surcharge). However, this condition by itself may not lead to basement water seepage. It is this condition in combination with certain storm conditions (preceding rainfall followed by a sufficiently large storm event) and local lot drainage that may lead to water around the weeping tiles being unable to drain and potentially seeping into the basements of homes.

The exact reasons why homes in the Lisgar District have not had basement water seepage before 2008 are not known. It is considered that the increasing leakage of water from the storm sewers through normal aging gradually increased the volume of water collected in the trenches over time, ultimately contributing to the problems first experienced in 2008.

During the course of the investigations a number of other factors have been identified which may be impacting the overall operation of the FDC system; however, based on the information available, none of them, either alone or in combination would cause water to seep into the basements to the extent reported.

These factors include:

- The depth of the FDC system and utility trench relative to residential weeping tile systems in some areas;
- Capacity issues related to pipe sizes and slopes in some sections of the FDC system;
- Potential inflows to the utility trench from groundwater and surface water sources; and
- Rain water and runoff from the lot or roof entering drains in basement walkout areas that are connected to the FDC system

Based on the findings presented in this study, the following two measures are recommended as the highest priorities for the City to deal with the basement water infiltration issue:

- Strategic lining of priority storm sewers to minimize leakage; and
- Construction of a utility trench dewatering system.

Other actions that may be implemented after the highest priority measures are completed include:

- Build permanent FDC pumping stations for high flows; and
- Replace deficient FDC pipe lengths when they reach the end of their engineered lifespan.

It is also suggested that residents who qualify for the City's Lisgar District Sump Pump Subsidy Program take advantage of the program.

The findings of the engineering study represent a significant step in understanding the cause of a complex basement water infiltration issue in the Lisgar District. Implementation of the two highest priority measures to improve the drainage system's performance and minimize the risk of future basement water infiltration is recommended to be initiated as soon as funding and approvals are secured.

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## 1.0 INTRODUCTION

The Lisgar District is situated in the northwest corner of the City of Mississauga and is bounded by the Canadian Pacific Railway tracks to the north, Britannia Road West to the south, Ninth Line to the west and Tenth Line to the east. It is located within the Sixteen Mile Creek watershed and drains to a small tributary of the east branch of Sixteen Mile Creek (Figure 1).

The Lisgar District is mainly made up of single family homes which were largely built over a 25-year period starting in the early 1980s as shown in Figure 2.

Commencing in 2008, a number of homes in the Lisgar District have experienced water seeping into their basements following certain rainfall events. A total of 187 homes are known to have been affected to date.

In response to these events, the engineering consulting firm of AMEC Environment & Infrastructure (now known as Amec Foster Wheeler Environmental & Infrastructure) was retained in late 2011 to undertake an engineering study to determine the cause(s) of basement water infiltration and recommend corrective measures.

This Summary Report provides a high-level discussion on the following matters based on three years of comprehensive field monitoring (2012-2014) and engineering analysis:

- Description of the drainage system servicing the Lisgar District;
- Summary of City-led actions to proactively address concerns;
- Summary of potential causes of the basement water infiltration;
- Detailed description of study activities including field work, testing, monitoring and analysis; and
- Outline of the proposed mitigation approach comprised of priority-based actions for 2015 and beyond.

**Figure 1: Subwatershed Map**

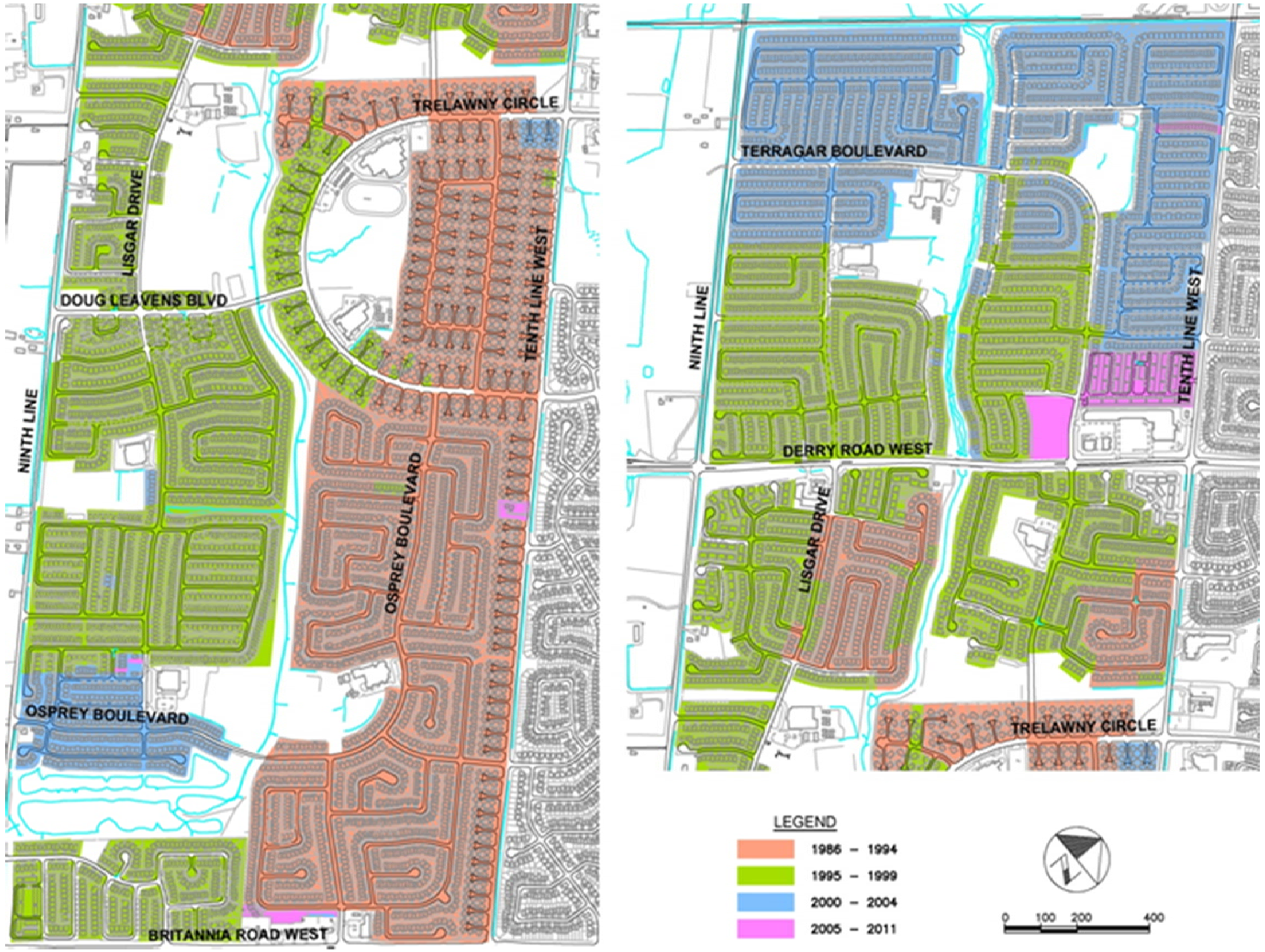



**Figure 2: Historic Development of Lisgar District**

## 2.0 OVERVIEW OF DRAINAGE SYSTEMS

When agricultural or open space lands are converted to urban uses, such as residential or employment, municipal services including watermains, sanitary sewers and storm sewers are typically constructed within road allowances or public easements to support these developments. The City of Mississauga is responsible for managing all aspects of stormwater within its jurisdiction, whereas the Region of Peel is responsible for stormwater on Regional roads, as well as drinking water, wastewater and solid waste management.

Storm sewers are designed to capture surface runoff from rainfall or snowmelt and then convey this water safely to a waterbody such as a creek, river or lake. In areas with stormwater management facilities (commonly referred to as ponds), designed to provide water quality and/or flood control, this water would first outlet into these ponds for treatment before being released to a waterbody. Where the waterbody is low in relation to the surrounding lands, the storm sewers can be built sufficiently deep below the ground surface to also capture and convey water draining from the weeping tiles around the basement foundations of homes (Figure 3). Alternatively, where the receiving waterbody is high compared to the surrounding lands and basement foundations, the weeping tiles around the homes would not be able to drain through gravity into the storm sewers. In these circumstances, one of two systems would be required to drain the foundation around the homes:

- Sump Pumps; or
- A Foundation Drain Collector.

A sump pump is a mechanical pump used to remove water captured by the weeping tiles around the basement foundations of homes that has been collected in a sump pit (basin) in the basement. Water from the sump pit would either be pumped to the ground surface or underground into a shallow storm sewer (Figure 4).

A Foundation Drain Collector (FDC), typically located in the same utility trench as other municipal services, is a sewer system dedicated to only collect and drain water from weeping tiles of homes to an outlet by gravity flow (Figure 5). The FDC system is often referred to as part of a 3-pipe system, the other two being the storm and sanitary systems. At the time of its construction, the FDC system was considered to be a preferred solution for many new areas. In fact, the text book *Modern Sewer Design (Canadian Edition, 1980)* states: "*This system virtually eliminates the probability of back-ups into foundation drains, which have caused considerable flooding, and damage to basements*".

The Lisgar District is one area that is serviced by a 3-pipe system. Figure 6 depicts the limits of the area within Mississauga served by an FDC system.

The following images graphically represent the three alternative systems designed to capture and drain water away from the foundations of homes.

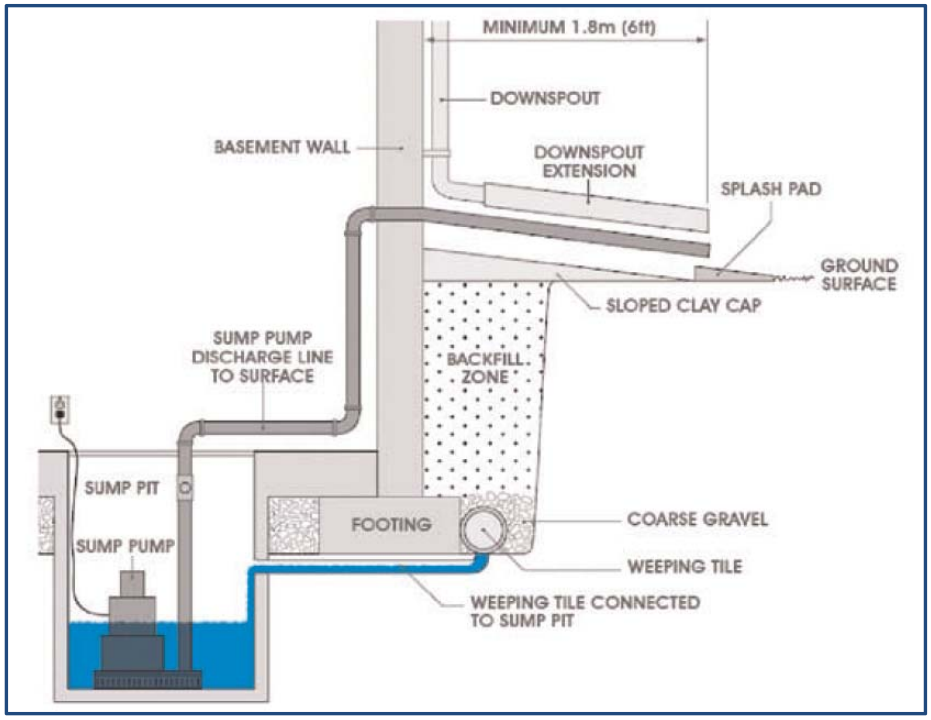



**Figure 3: Conventional Foundation Drain connected to Storm Sewer**

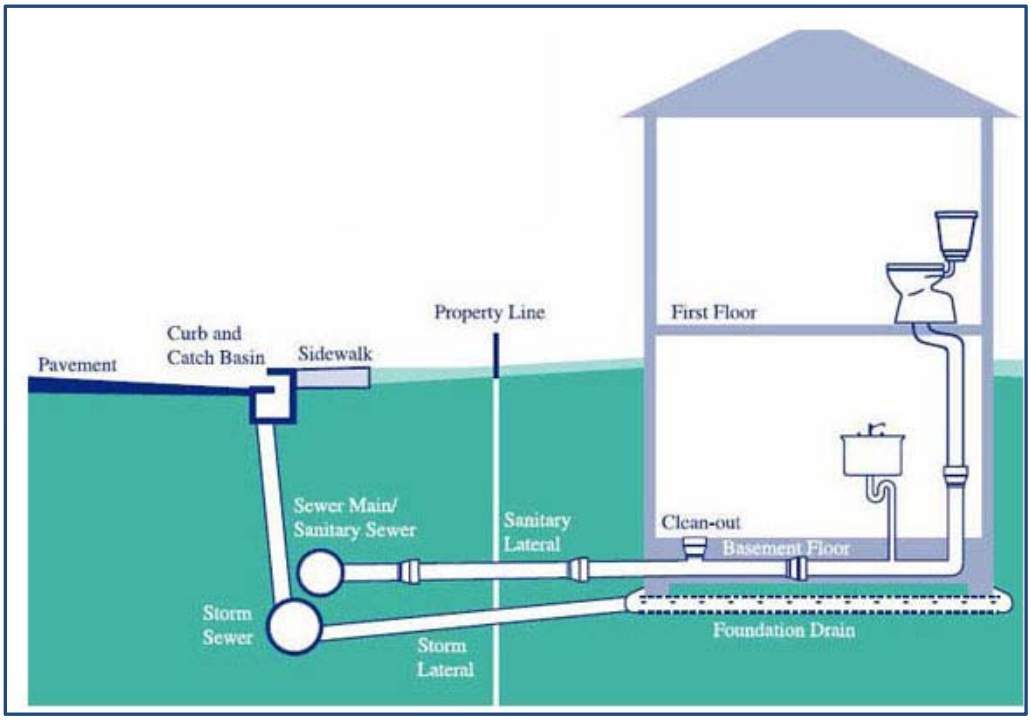



**Figure 4: Sump Pump to Front/Rear Yards or Storm Sewer**

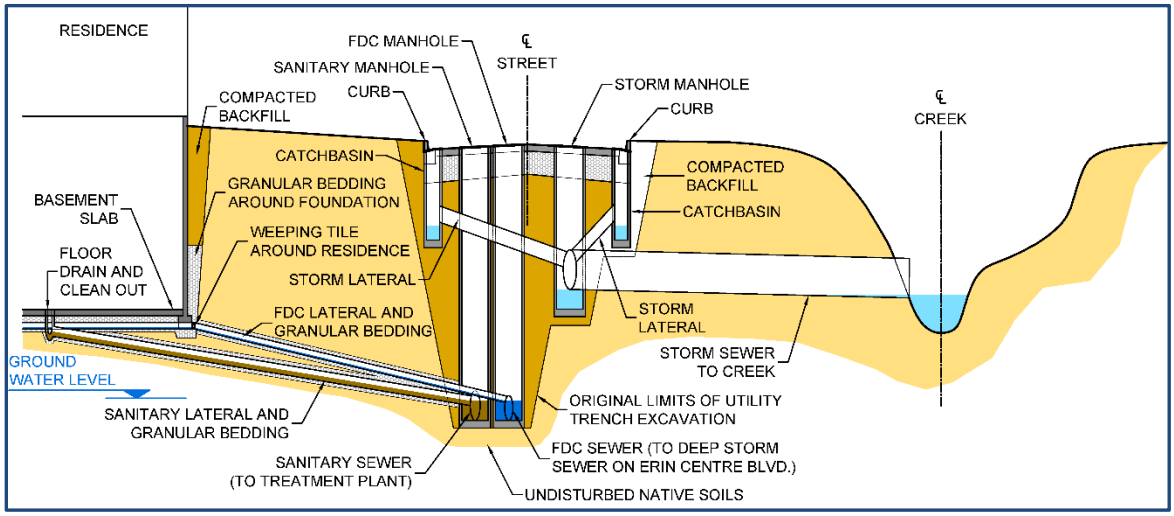



**Figure 5: Foundation Drain Collector as Found in the Lisgar District**

The following table provides a brief summary of the advantages and disadvantages of these three distinct foundation drainage systems.

| Type | Advantages | Disadvantage |
|---|---|---|
| Gravity to Storm Sewer | • no additional infrastructure<br>• comparatively low cost<br>• no reliance on mechanical system or power | • may back up if storm sewer is overwhelmed<br>• some additional cost to upsize storm sewers |
| Sump Pump | • disconnected from municipal system | • requires homeowner to operate and maintain the system<br>• mechanical system needs to operate to function<br>• relies on power |
| Foundation Drain Collector | • dedicated, providing drainage for foundation only<br>• no reliance on mechanical system or power<br>• "virtually eliminates the probability of back-ups into foundation drains"<br>• allows for smaller sized storm sewers<br>• successfully installed in numerous other municipalities without incident (Brampton, Vaughan, Barrie) | • comparatively high cost to install additional deep and long pipe systems |

It should be noted that the technical term 'surcharge' is often used in this report when referring to the flow conditions of sewers. This term refers to a gravity sewer that is overloaded beyond its pipe full flow capacity such that the flow is under pressure.

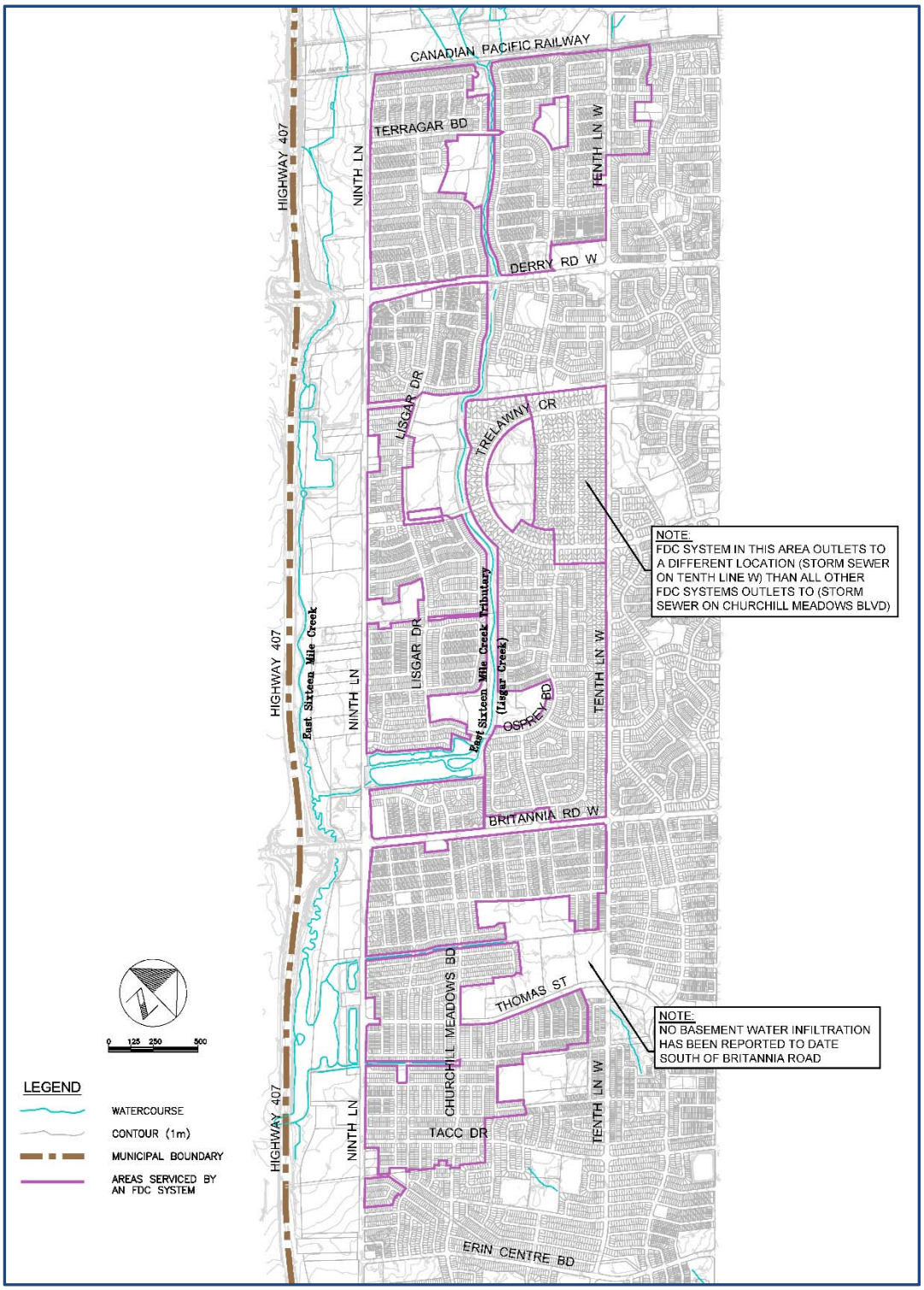



**Figure 6: Servicing Limits of FDC System in Mississauga**

## 3.0 CITY-LED ACTIVITIES

When the City of Mississauga first became aware of basement water seepage, the causes of this unexpected problem were not known. However, the City proactively undertook a number of precautionary, investigative and maintenance actions on the storm and FDC sewer systems, the tributary of the East Branch of Sixteen Mile Creek, and the Osprey Marsh Stormwater Management Pond. The following summarizes the work completed by the City in the Lisgar District.

### FDC and Storm Sewers

*Video Inspection and Flushing of FDC and Storm Sewer Systems*

Video inspections of the FDC system and a large portion of the storm sewer system were carried out to identify any potential cracks and leaks (FDC system), as well as debris or obstructions (both systems). Only a few cracks and leaks were detected. Most of them have subsequently been repaired by the City. No significant blockages or debris were observed in either system.

Despite the lack of any significant debris or blockages in the storm and FDC systems, as a further precautionary measure, the FDC system and a portion of the storm sewer system were flushed to clean-out any minor debris accumulations.

*Identifying Sewer Cross-connections*

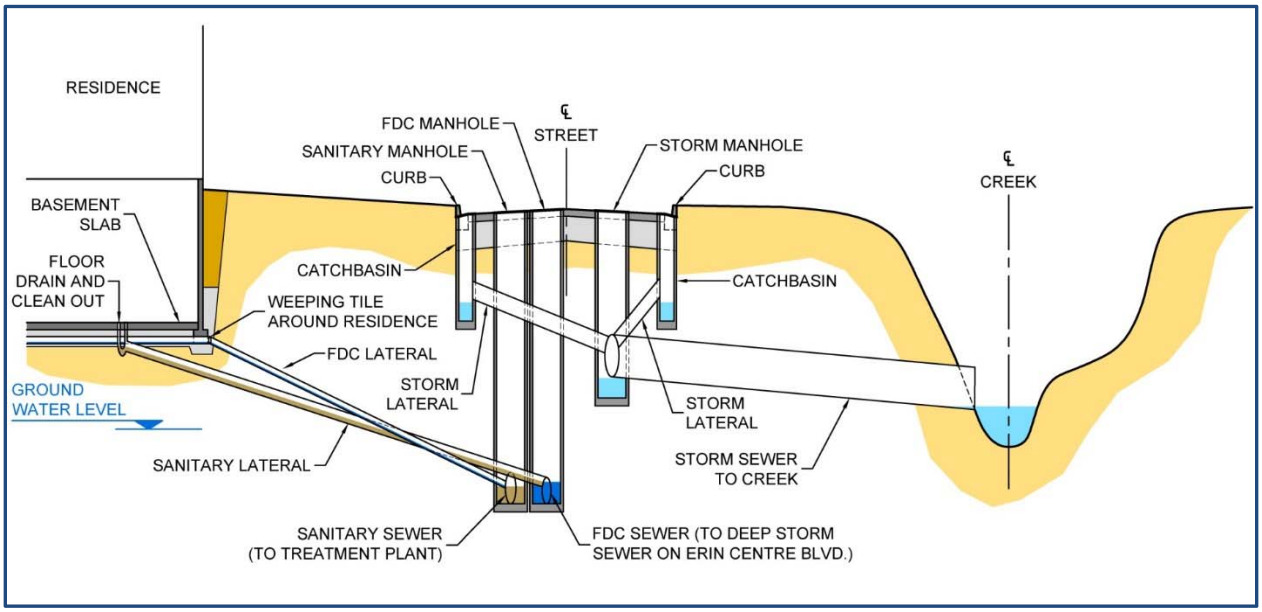



**Figure 7: Schematic of Sewer Cross-Connection**

The City used investigative techniques (video inspections and dye and smoke tests) to identify homes where cross-connections were suspected; specifically where a residential foundation drain is connected to the sanitary sewer system and the residential sanitary lead is connected to the FDC. Such an occurrence would be expected to increase flows to the FDC sewer system.

The investigation identified two cross-connections. Both have since been repaired.

*Sealing FDC Maintenance Access Lids and Cracks*

The lids of maintenance access chambers (commonly called “manholes”) to the FDC system were identified as being a potential source of surface water inflow to the FDC system. The City installed maintenance access lid seals to prevent this surface water from entering the FDC system in vulnerable locations; primarily where the FDC sewer is situated adjacent to the tributary of the east branch of Sixteen Mile Creek, and at low points along the roadway where water would be expected to pond during large storm events.

Cracks and leaks in the FDC system, as identified through the video inspection, have also been repaired as noted previously.

*Cleaning Storm Sewer Outfalls to Creek*

City staff conducted an inspection of the storm sewer outlets to the tributary of the east branch of Sixteen Mile Creek, and identified those where removal of accumulated sediment would benefit the proper operation of the storm sewer system. A total of ten storm sewer outfalls along the tributary between Doug Leavens Boulevard and Osprey Boulevard were subsequently cleaned-out.

Where conditions warranted, the outfalls were also lined with large stones to reduce erosion and ease future clean-out efforts.

*Improvements to Overland Flow Routes*

In response to reported roadway flooding during the large storm events in 2010 and 2011, grading improvements were undertaken at three locations along Black Walnut Trail (Cactus Gate, Smoke Tree Road, and Scotch Pine Gate) to better define the pathway for surface water to flow to the creek and reduce the potential depth of roadway ponding in these areas.

*High Water Protocol*

Since late 2011, the City has implemented a High Water Protocol for the Lisgar District. Under this protocol, weather forecasts and other weather-related information such as High Water Bulletins from local Conservation Authorities are continuously monitored by City staff. When unfavorable weather conditions are predicted, City staff and/or its contractors are deployed to three locations within the Lisgar District with portable pumps on standby to pump water from the FDC system if required.

Since this protocol was put into effect, City staff and/or its contractors have operated the pumps on several occasions, including April 10-12, 2013, June 11-12, 2014, and September 10, 2014. No basement water infiltration problems were reported during any of these events.

## East Sixteen Mile Creek Tributary and Osprey Marsh Stormwater Management Pond

*Creek Vegetation Trimming and Debris Removal*

In response to concerns raised by residents, considerable effort and expense was spent by the City to trim the vegetation along the creek corridor between the Canadian Pacific Railway tracks and Doug Leavens Boulevard over the course of 2012. It should be noted that this is not a typical practice for the maintenance and stewardship of a naturalized creek corridor system. The trimmed vegetation re-grew very quickly and has subsequently re-established itself. Further trimming was not undertaken given the findings of this study.

*Sediment and Vegetation Removal from Bridge Crossings and Storm Outfalls*

Inspections of the bridge crossings and storm outfalls along the tributary of the east branch of Sixteen Mile Creek identified certain areas of sediment and vegetation accumulation. Although the potential impact of this in relation to the basement water infiltration issue was unclear at the time, accumulated sediment, vegetation and other debris were removed from several storm outfalls and beneath the bridges at Osprey Boulevard, Alderwood Trail, and Doug Leavens Boulevards in 2013.

*Creek Inspection Protocol*

A protocol for a more frequent regular inspection of the tributary of the east branch of Sixteen Mile Creek and bridge crossings was developed to proactively monitor and identify issues such as excessive sediment or debris in the creek which may impede its ability to safely convey water.

*Reconfiguration of Osprey Marsh Stormwater Management Pond Outlet*

Prior to this study, the City had an approved capital project planned to remove and reconfigure the outlet structures of the Osprey Marsh Stormwater Management Pond. These structures were not allowing the water in the pond to draw down in a timely manner resulting in a higher than normal pond water elevation for an extended period of time. In light of the basement water infiltration concerns, the City proactively cleaned out the accumulated sediment and vegetation around two of the pond outlet structures in late 2011/early 2012 to improve the drainage function of the pond. This was done in advance of the capital project undertaken in 2012 to reconstruct the entire outlet configuration of the pond.

## 4.0 SUMMARY OF POTENTIAL CAUSES

A main objective of this study was to identify and assess the potential causes of basement water infiltration in the Lisgar District in light of the fact that homes in this area have not had any known issues prior to 2008; more than 20 years since development of the area began. This section discusses a number of these possible causes with more detailed analyses and discussions to follow in subsequent sections.

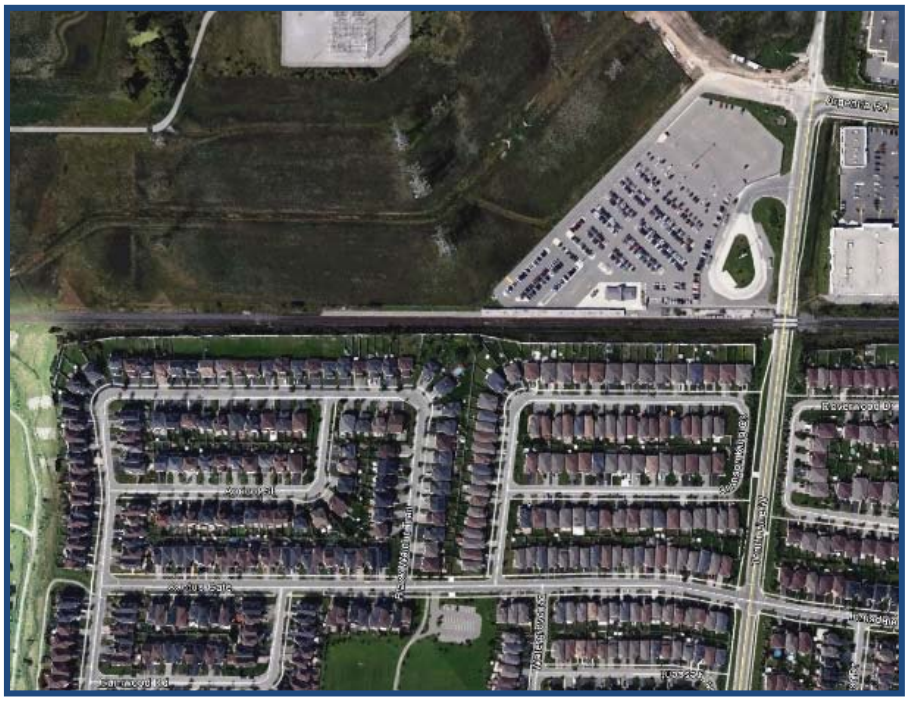
### Changes Since Development

One of the initial steps undertaken in this study was to determine what changes could have possibly taken place since the development of the Lisgar District and how these changes may have contributed to basement water infiltration. A list was compiled in consultation with City staff and each possible change was screened based on engineering judgment for further consideration. The possible changes are discussed as follows:

#### *Climate*

Most experts agree that weather patterns are changing and extreme weather events are becoming more frequent and more intense. However, rainstorms more severe than those experienced during the basement water infiltration events have occurred over the Lisgar District without any known occurrences of water seepage in basements. While rainfall plays a role with respect to the infiltration events, it is not the more frequent and intense storms that seem to be causing the problem, as will be discussed later in this report. As such, intense storms due to a changing climate were ruled out as a contributing factor to the basement water infiltration issue.

#### *Development*



The Lisgar District has been more or less fully developed since the mid-2000s, with a small number of in-fill developments occurring over the past few years. The only significant development in the area was the Lisgar GO Station which was constructed to the north of the Lisgar District around 2007. Further investigation was undertaken to determine if the development of the Lisgar GO Station contributed to the basement water infiltration issue and is discussed later in this report.

*Creek block maturing with vegetation*

As the vegetation along the tributary of the east branch of Sixteen Mile Creek has matured over time, the carrying capacity of this channel, which local storm sewers drain into, has reduced somewhat. This vegetation also traps sediment causing a further loss in capacity, and thereby reduces the efficiency of the tributary to move water. However, the FDC system that conveys water from the foundations of basements does not outlet into this tributary. Nevertheless, investigations were carried out to determine if there are other ways that the tributary may potentially contribute to the basement water infiltration issue.

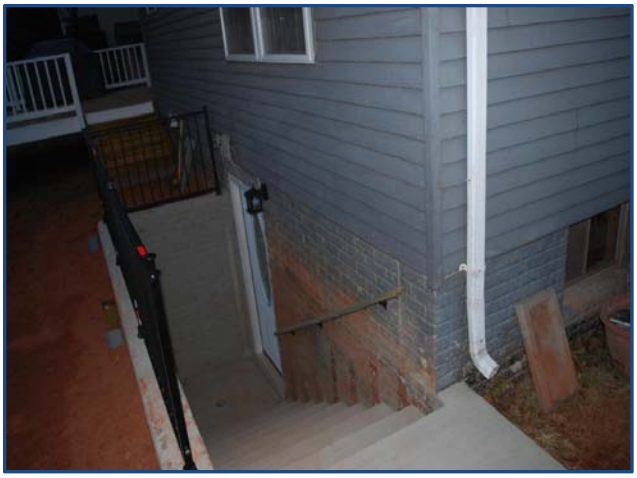
*Osprey Marsh Stormwater Management Pond*

The Osprey Marsh Stormwater Management Pond has been seen by some residents as a barrier to water conveyance from the tributary of the east branch of Sixteen Mile Creek. However, the pond serves the dual purpose of providing water quality treatment and quantity control for the upstream development lands.

As previously mentioned, the City had a planned and approved capital project to remove and reconfigure the outlet structures of the Osprey Marsh Stormwater Management Pond, prior to the City becoming aware of the scale of water seepage in basements of homes. As a proactive measure, two outlet structures in the pond, which had accumulated sediment and vegetation resulting in a higher than normal water level (1 m +/-), were cleaned out to improve drainage from the pond. The City has since completed the capital project to reconfigure the outlet of the pond, further reducing the drawdown time of the pond following large rainfall events.

It should be noted that the FDC system that conveys water from the foundations of basements does not outlet into this pond. However, further investigation was carried out to determine if other connections exist between the pond and the basement water infiltration issue.

*Changes to homes/properties (lot grades, basement walkouts)*



Over time, lot grades may change due to the settlement of soils or through physical alterations by homeowners. Depending on this change, the grades on a property may allow water runoff to flow back towards the house, instead of away, thereby increasing the amount of water which may drain to the foundation. However, there is insufficient information to predict with any certainty the level of influence altered grades may have on the basement water infiltration issue.

There are also a significant number of homes in the Lisgar District in which basement walkouts have been built. Rain water and runoff from the lot or roof which flows into a basement walkout can contribute directly to the FDC system since this water may be collected by a drain connected to the home's weeping tiles. While the lack of available information has made it difficult to determine if basement walkouts have contributed to basement water infiltration, further analysis was undertaken based on assumptions regarding the level of influence basement walkouts may be having on the operation of the FDC system.

*Aging basement walls and foundations*

Concrete foundations are not resistant to cracks. Cracks in a foundation wall can be caused by a number of factors such as concrete shrinkage, aging, settlement into the soil or poor drainage around the house. These cracks provide the opportunity for water to seep into the basement from the exterior. While cracks in foundations are not uncommon, it is challenging to obtain data to determine the level of influence this may have on basement water infiltration given that foundations are located on private property. As such, this possible cause was not analyzed further.

*Aging Infrastructure*

Like all infrastructure, stormwater related infrastructure gradually ages over time and its concrete components, such as pipes and manholes, typically have a service life of approximately 100 years. While the municipal services in the Lisgar District are comparatively young (less than 35 years), leakage from the storm sewer, which is a normal occurrence, can occur due to:

- cracks in manholes
- displaced/settled sewers
- seals and sewer joints breaking down

As storm sewers are not built to remain watertight, leakage from the system is considered normal. However, in locations where a 3-pipe system is used, opportunities may arise where water, which has leaked from storm sewers, may enter into the FDC system. Additional investigative work was carried out with respect to the issue of storm sewer leakage.

**Other Potential Causes**

In addition to examining changes that may have taken place since the development of the Lisgar District, other potential causes were also considered, as follows:

*Groundwater*

Groundwater can be a potential cause of water seepage into basements; however a review of groundwater levels in the area and the properties of the native soils suggest that water moves very slowly in this mainly clay/silt-based soil. This information formed the basis for a number of subsequent tests and analyses on the causes of basement water infiltration which are discussed later.

*Foundation Drain Collector*

As set out earlier in this report, the FDC system is a sewer system dedicated to only collect and drain water from weeping tiles of homes to an outlet by gravity flow. Issues related to the proper construction and operation of this system may affect the way water around the foundations of homes is conveyed away from the house. Significant efforts were dedicated to the review and analysis of this system. The information below highlights how design and construction issues may affect the proper operation of this system.

a. Maintenance

   Since the FDC system is essentially a closed system connected only to foundation weeping tiles, it would be expected only to collect clean filtered foundation drainage and that maintenance needs would be nominal.

b. Design

   Design criteria for FDC systems are not as well defined as for other infrastructure such as storm or sanitary sewers; hence values from designers are more difficult to verify based on conventional engineering principles. It should be noted, however, that the design of the Lisgar FDC system was based on the best engineering knowledge at the time.

c. Hydraulics

The capacity of the FDC pipe to carry flow is based on, among other factors, the proper size (diameter) and slope of the pipe for gravity drainage. If the FDC pipe is found to have capacity issues, it may surcharge (exceed capacity and flow under pressure), thereby placing those locations served by that FDC pipe at risk.

d. Outlet

The FDC sewer system ultimately outlets into a downstream storm sewer system at Erin Centre Boulevard. If the capacity of this storm sewer system was to be exceeded under large storm events, this could potentially affect the operation of the FDC system.

e. Depths

Locations with shallower FDC depths in relation to adjacent residential weeping tile systems may be at higher risk of basement water infiltration.

f. Inflow/Infiltration

Some FDC joints at manholes and other locations (cracks) have been shown, based on video camera inspections, to allow water to get into the FDC system. They were comparatively minor and most of them have subsequently been repaired by the City.

g. Construction

Similar to FDC hydraulics, if sections of the FDC system were not constructed in accordance with the specified design, this would be expected to have an impact on FDC conveyance capacity. The potential also exists for the FDC pipes and the utility trench, in which the sewers reside, to have been poorly constructed in a manner which would allow water to directly enter the FDC system. Unfortunately, this is difficult to determine without wide-scale, disruptive excavation. However, video camera inspections suggest that the occurrence of this is low.

*Sanitary System*

The water that seeped into the affected basements was found to be essentially clear, largely odourless and unlikely to contain sanitary sewage. These findings have been supported based on data collected by the Region of Peel which showed that the sanitary system did not experience any capacity issues. As such, it was determined early on in the study that the sanitary system did not contribute to the basement water infiltration problem.

*Private Side of Weeper System (cross-connections and Weeping Tile System condition)*

As discussed earlier, extensive testing identified only two cross-connections between the FDC and sanitary sewer systems, which have since been repaired. As there were so few cross-connections discovered, this potential cause has been ruled out as having any influence on the basement water infiltration problem.

The condition of the private side weeping tile system has also been considered as a potential source of the problem as some granular material was found in the FDC sewer through video

inspection suggesting some possible localized failures. However, this is very difficult to validate without wide-scale and disruptive excavation around private homes.

*Stormwater Leakage to Utility Trench*

Storm sewer systems, which capture and convey surface water, are not designed to be water-tight. It is not uncommon or unexpected for storm sewers to leak. However, leakage of stormwater can be substantial and relatively continuous which can potentially fill the lower utility trench with water where the FDC and laterals reside. Investigation into this issue in relation to basement water infiltration was undertaken as part of this study.

## 5.0 STUDY ACTIVITIES

Amec Foster Wheeler has conducted an extensive program of activities in support of the Lisgar District Basement Water Infiltration Investigation. These activities, which included extensive field monitoring, testing, and analysis, have been undertaken to better understand the existing performance of the various drainage systems and their inter-relationships. These activities have also been conducted to either validate or rule out the possible causes of the observed basement water infiltration as discussed in the previous sections.

Field monitoring is heavily dependent on weather conditions and rainfall. Without the reoccurrence of weather conditions experienced during the basement infiltration events, it is difficult to fully assess how the drainage system responded during those events, and understand the likely primary causes of basement water infiltration. Accordingly, monitoring work has extended over multiple years in order to collect enough representative field data.

In addition, it should be recognized that the interactions between the various components of the drainage system in the Lisgar District have proven to be extremely complex and varied. In order to undertake a complete and thorough investigation, a review of all potential causes of basement water infiltration was required. As field monitoring data were collected and analyzed through the course of the study, Amec Foster Wheeler was able to eliminate some potential causes, and focus on others. As the potential causes were narrowed, additional field work, testing and analysis activities were carried out to clearly prove or disprove theories. This iterative process was lengthy and required a significant amount of time, necessitating multiple years of activities. This process has ensured that a complete and thorough investigation has been undertaken and that appropriate mitigation measures are recommended to reduce the risk of future instances of basement water infiltration.

The study activities completed by Amec Foster Wheeler are summarized as follows:

**Monitoring Work**

During the course of the study, a comprehensive monitoring program was undertaken over multiple years to collect field data needed to help understand the cause(s) of basement water infiltration and to provide guidance in finding the appropriate mitigation measures. The monitoring work undertaken is described as follows.

A. Groundwater

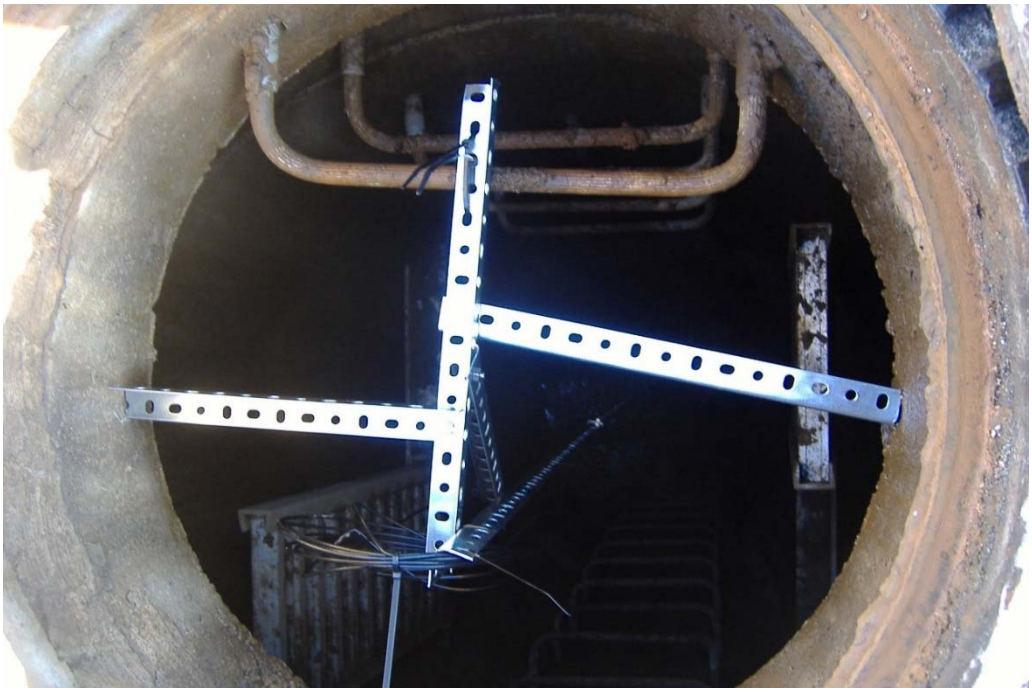
- Monitoring wells were installed at four main sites:
  - Black Walnut Trail at Scotch Pine Gate (late 2011);
  - Osprey Boulevard (late 2011);
  - Alderwood Trail (2013); and
  - Pondview Way (2014).
- Two primary types of monitoring wells were installed:
  - In the native (undisturbed) soils; and
  - In the gravel material found in the utility trench.
- Both water level and water temperature were monitored continuously at these sites.

Findings

1. Groundwater temperatures in the native soils do not vary greatly and are not affected by precipitation events.

2. The shallow groundwater levels in the native soils do not increase rapidly enough during precipitation events which proves that basement water infiltration is not caused by flow through the native soils from the Tributary to the East Branch of Sixteen Mile Creek or the Osprey Marsh Stormwater Management Pond.

B. FDC and Storm Sewer System



- Water level monitoring gauges were installed within the FDC and storm sewer systems in order to observe how water levels in these systems respond to storm events;

- The gauges also recorded water temperature, which is a useful parameter as it can distinguish between sources of water; and

- The number and locations of gauges were adjusted over the course of the study to the most suitable sites through interpretation of the collected data:

    - A total of 17 water level monitoring gauges were installed within the FDC sewer system; extending from the Canadian Pacific Railway tracks to Erin Centre Boulevard; and

    - Three additional water level monitoring gauges were installed over the course of the study within the storm sewer system.

Findings

Recorded data from these gauges have shown that:

1. The FDC system has been observed to surcharge rapidly in response to rainfall events (water levels exceed the top of the pipes meaning that the system is flowing under pressure); this surcharging occurs in different locations and in different amounts depending on the storm event.

2. Surcharging is most common along Black Walnut Trail and in the vicinity of Osprey Boulevard, which is generally consistent with locations of reported basement water infiltration.

3. The short period of time in which the water level in the FDC system has been observed to surcharge and then quickly drop back down strongly suggests that the water is coming in from surface water sources rather than groundwater, which moves much more slowly due to the properties of the native soils.

4. The water temperature data from the observed surcharge events also suggest that the water is coming from surface water sources (rise in water temperature over the summer months - warm surfaces, or a drop in water temperature over the early spring/fall/winter months – cold surfaces).

5. Water levels in the storm sewer along Erin Centre Boulevard, which takes drainage from the FDC system, show that it is not the cause of FDC surcharging.

C. Tributary and Stormwater Management Pond

- Water level monitoring gauges were installed and monitored at key locations along the tributary of the east branch of Sixteen Mile Creek and within the Osprey Marsh Stormwater Management Pond during non-winter periods (April to November);

- The number and locations of gauges were adjusted over the course of the study to the most suitable sites through interpretation of the collected data:
  - Gauges were installed at five different locations along the creek, as well as a gauge directly within the pond; and
  - A temporary rainfall gauge was installed for two of the monitoring years.

Findings

Recorded data from these gauges have shown that:

1. There is nominal creek flow from the GO Station channel, and no apparent connection between these flows and FDC surcharging.

2. There is no apparent connection between creek flows and FDC surcharging.

3. There is no apparent connection between water levels within the Osprey Marsh Stormwater Management Pond and FDC surcharging.

## Testing Work

To better understand the interactions between the various water sources and components of the drainage system in the Lisgar District, testing work was undertaken through water sampling and 'in-ground' pilot projects to validate some of the theories. The testing work undertaken is described in the following:

A. Water Quality Characterization

- A characterization program was completed to assess the chemical properties of the water found in:
  - native soils (i.e. the groundwater);
  - utility trench (i.e. where the municipal services are);
  - creek;
  - Osprey Marsh Stormwater Management Pond; and
  - FDC system.

- The testing was able to identify commonalities among the various different water sources, and in particular the source of the water in the FDC.

Findings

1. Under expected operating conditions the quality of the water in the FDC system should show some similarities with the shallow groundwater. However, water in the FDC system water was found to be salt rich, similar to the utility trench, the tributary and the pond. This suggests that the water in the FDC system is very similar to surface water (and dissimilar to groundwater). This similarity is particularly evident in winter conditions when surface water was found to contain elevated salt concentrations from the application of road salt.

B. Storm Sewer Leakage Testing

- Storm sewer leakage testing was undertaken in 2013 at three sites where basement water infiltration occurred (Alderwood Trail and Black Walnut Trail at both Wild Cherry Lane and Scotch Pine Gate). The photos above illustrate some of the steps in the leakage testing process;

- The intent of the tests was to confirm whether or not, under high flows, the storm sewer system would be expected to leak and contribute water to the utility trench where the FDC system resides; and

- The tests were comprised of:
  - Blocking the storm sewers and filling them with water to replicate surcharge conditions (under pressure);
  - Addition of a green fluorescent dye to the storm sewer; and
  - Monitoring of the dye concentrations and water levels in the utility trench, groundwater and FDC system.

Findings

1. At all three sites, the storm sewers leaked and at two sites (Wild Cherry Lane and Scotch Pine Gate), the dye was detected in the FDC after two hours.

2. Tests have proven that there is a flow path from the storm sewer to the FDC through the utility trench with a response time consistent with that observed between major storm events and instances of basement water infiltration.

C. Storm Sewer Outfall Collar Testing

- Over the course of the study, it was speculated that water from the tributary of the east branch of Sixteen Mile Creek or the Osprey Marsh Stormwater Management Pond could possibly move upstream through the storm sewer bedding and contribute excess water to the utility trench;

- In order to verify if water in the utility trench was coming from the tributary or the Osprey Marsh SWM pond, a test was conducted at the end of 2014;

- Impermeable concrete collars were installed in the utility trench near the outfall of the storm sewers at two locations:
  - Sixteen Mile Creek (Scotch Pine Gate); and
  - Osprey Marsh SWM Pond (Pondview Way).

- These collars were installed with backflow valves that allow water from the utility trench to drain to the tributary and pond, but not in the other direction; and

- Monitoring is currently underway at both of these sites to assess the effectiveness of the collar in preventing elevated water levels in the utility trench which may be due to inflow from the creek or pond during larger storm events.

## Analysis Work

Using the data collected over the monitoring periods, as well as additional information provided by the City on the FDC system and area services, Amec Foster Wheeler conducted a series of technical analyses as follows:

A. Groundwater analysis

Testing work and analyses were undertaken for both the native soils and granular materials (utility trench) at the groundwater monitoring sites.

Findings

1. Tests have shown that the permeability of the granular materials in the utility trench is up to 10 million times greater than the native soils. This has further confirmed that the utility trench is the primary linkage for surface water to reach the FDC system.

B. Design check of the FDC system

A review of the original design of the main FDC sewer system was undertaken. This analysis is described in greater detail as follows:

a. Comparison of the original number of intended residences to be served by the main FDC sewer system:

- This analysis has shown that a larger number of residences are currently connected to the FDC system than what was intended in the original design; and

- This was known by both the area developers and the City as the area was developed; a developer's consultant undertook a numerical analysis of the main FDC sewer using computer modelling to demonstrate that the system could accept the higher number of connected residences.

b. Comparison of original design sizes and slopes of the FDC sewers (which affect capacity – higher slopes provide more flow capacity, lower slopes less capacity) with as-constructed (current) characteristics:

- This review has shown that some sections of the FDC trunk sewer were constructed flatter than intended, which is expected to decrease the available flow capacity.

c. Verification of the design of the FDC trunk sewer, to determine if there is sufficient available capacity to handle expected flow rates, using the original design approach, and current information on the FDC system (sizes and slopes) including the current number of residences serviced by this system:

- The results of this analysis have shown that there are several sections of the FDC trunk sewer where the expected flow rates exceed the design capacity and would be expected to surcharge the FDC system in localized areas.

Findings

1. The results of these analyses have since identified deficiencies in the as-constructed design of the FDC trunk sewer system, which may contribute to FDC surcharge within localized areas of the overall system. However, given the results of the FDC monitoring,

these deficiencies are not considered to be a material contributor to FDC surcharging or a cause of the basement infiltration issue.

2. Observed FDC surcharging has also been noted in areas which are a considerable distance away from where FDC sewer deficiencies have been identified, which further suggests that these deficiencies, in and of themselves, are not a material contributor to the FDC surcharging or a cause of the basement infiltration issue.

C. Computer modelling of the FDC system

Computer modelling of the FDC system was undertaken in an effort to answer a number of questions related to its performance, and the impact of some of the potential causes. The performance questions and modelling results are provided in the following table.

| Questions | Modelling Results |
|---|---|
| *How much impact will high water levels at the downstream end of the FDC system (outlet) have on the Lisgar District?* | Results show that high water levels downstream would have little impact on the FDC system performance within the Lisgar District, which further confirms that this is not a primary cause of FDC surcharging, although it may be a very limited contributing factor. |
| *How much potential impact would water draining into basement walkouts be expected to have on the FDC system?* | Results show that based on the number of basement walkouts identified by City staff (and the estimated flows from those walkouts to the foundation drain), basement walkouts are not the primary cause of FDC surcharging, although they may be a contributing factor at specific locations. |
| *How much potential impact would storm sewer leakage have on the FDC system?* | Results show that based on an average storm sewer leakage rate (calculated from the findings of the storm sewer leakage tests conducted in 2013), storm sewer leakage is the primary cause of FDC surcharging during storm events. |
| *Are there certain areas within the Lisgar District which contribute higher flows to the FDC system?* | Based on the modelling results for an observed surcharge event in the FDC system along Black Walnut Trail, north of Derry Road, several areas have been identified as having higher relative flow contributions to the FDC system. These identified areas are therefore considered a priority for the implementation of mitigation measures (ref. Section 6). |
| *What measures would be most effective in reducing observed FDC surcharge?* | Based on the modelling results for an observed surcharge event, two potential mitigation measures have been modelled and shown to be most effective at reducing FDC surcharge:<br>• FDC sewer upgrades - increasing the sizes of the deficient pipes to better carry higher flows and reduce surcharge; and<br>• FDC pumping - actively pumping out the FDC during surcharge events to limit the amount of surcharging.<br><br>Both of these measures have been considered as part of the longer term mitigation action plan (Section 6). |

## Summary and Conclusions

Based on all of the comprehensive monitoring, testing and analysis work, Amec Foster Wheeler has concluded that the primary cause of the basement water infiltration relates to stormwater entering the utility trench.

As storm sewers are not built to be watertight, and due to cracks and leaks expected through aging, stormwater is able to leak out during storm events and migrate into the utility trench, where the bedding material, made of gravel and other granular soils can allow water to move very quickly. Over time, water builds up in the utility trench from storm sewer leakage, as well as through other sources (other utilities, groundwater, et cetera), and is unable to drain away quickly due to the relatively impermeable nature of the native soils surrounding the trench.

It is this situation, in combination with certain storm conditions and local lot drainage where issues may arise. For instance, where the ground and utility trench are already wet, possibly from an earlier storm event, and rainfall subsequently occurs, this may create a condition where there is enough leakage from the storm sewer system during the rainfall event to fill an already wet utility trench and push water up the bedding material around the FDC laterals servicing the homes and into the foundation weeping tiles. This water then drains directly into the FDC pipes through the weeping tiles, which may result in excess flow in the FDC system (surcharge). However, this condition by itself may not lead to basement water seepage. It is this condition, in combination with certain storm conditions (preceding rainfall followed by a sufficiently large storm event) and local lot drainage that may lead to water around the weeping tiles being unable to drain and potentially seeping into the basements of homes. This process is illustrated in Figures 8A to 8F.

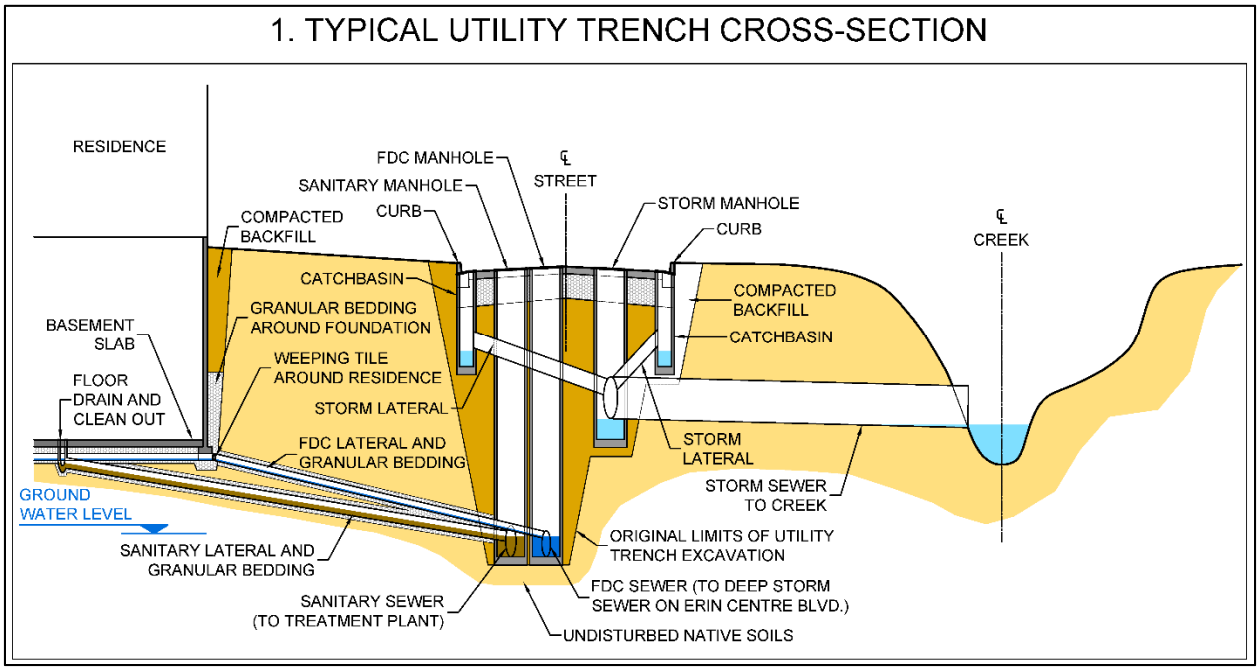



**Figure 8A: Basement Infiltration due to water within the Utility Trench**

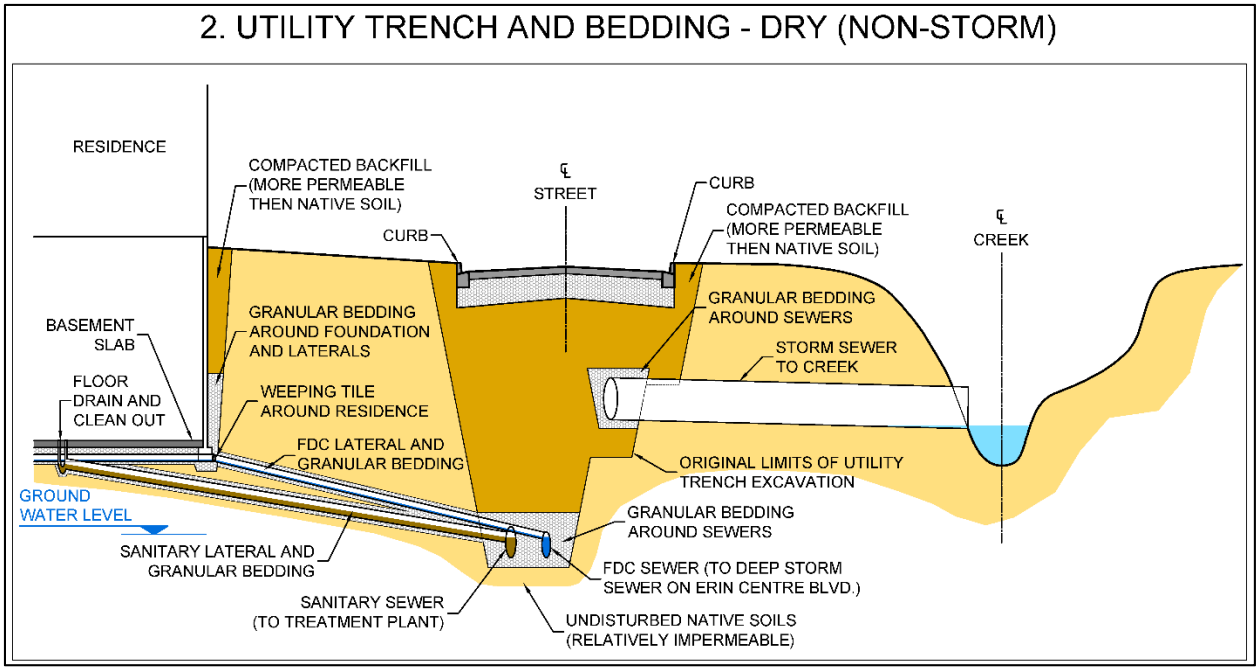



**Figure 8B: Basement Infiltration due to water within the Utility Trench**

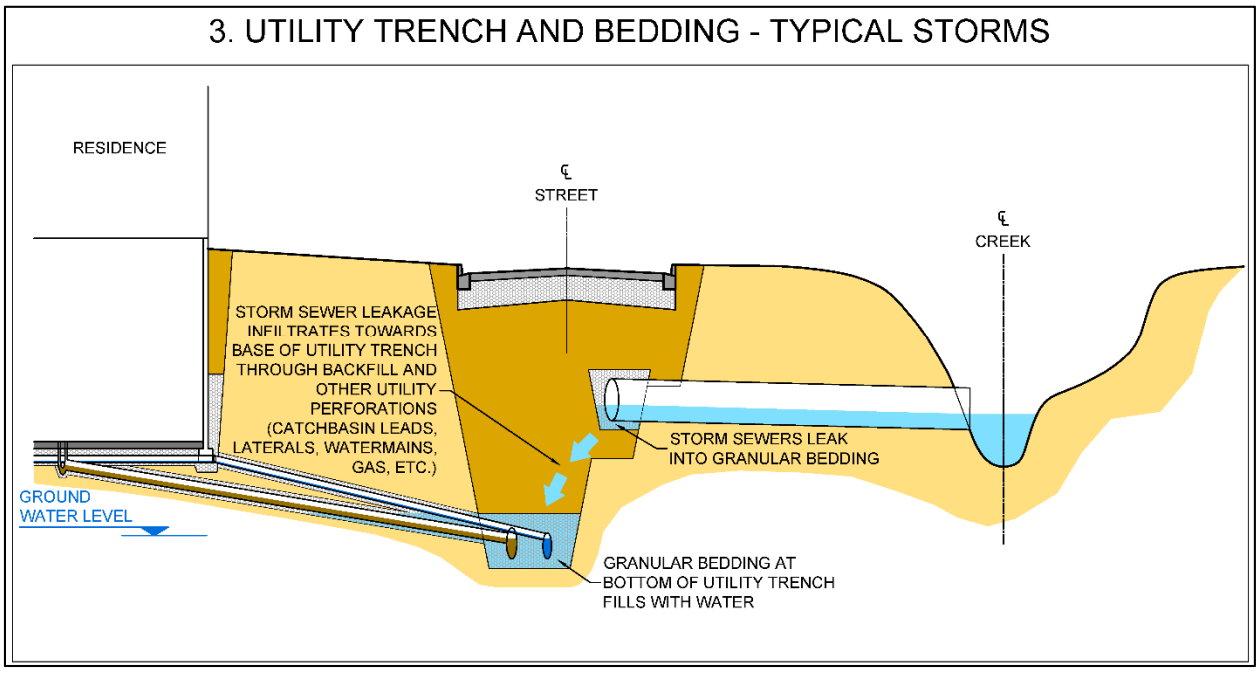



**Figure 8C: Basement Infiltration due to water within the Utility Trench**

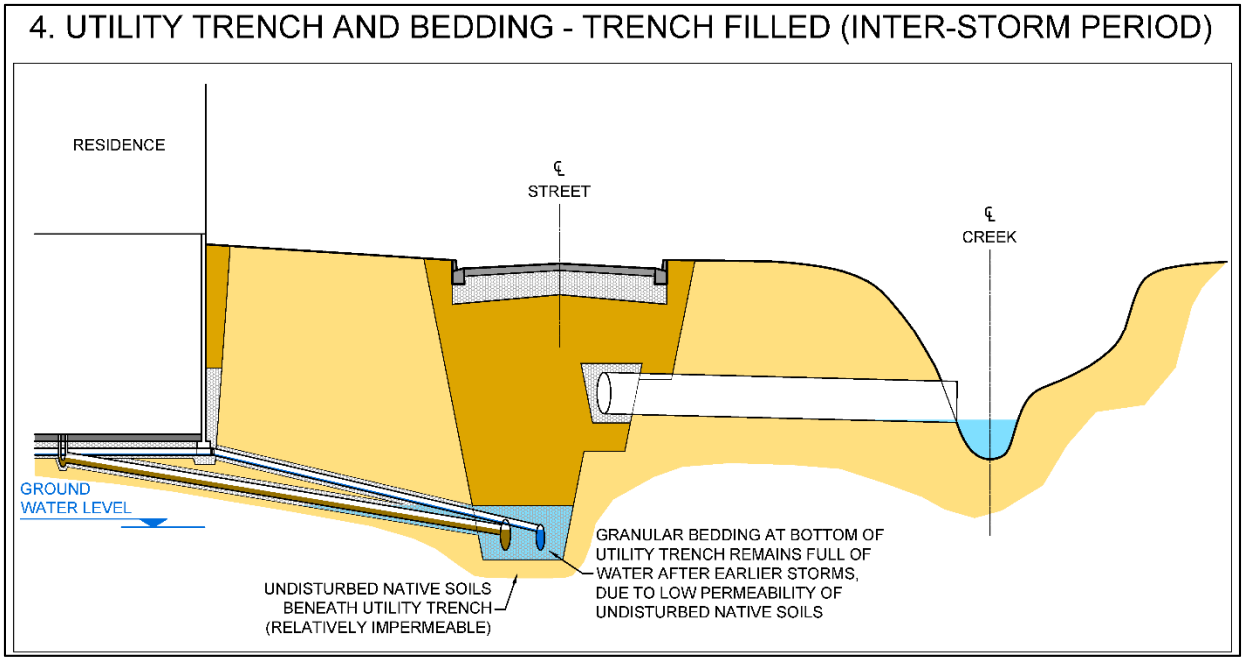



**Figure 8D: Basement Infiltration due to water within the Utility Trench**

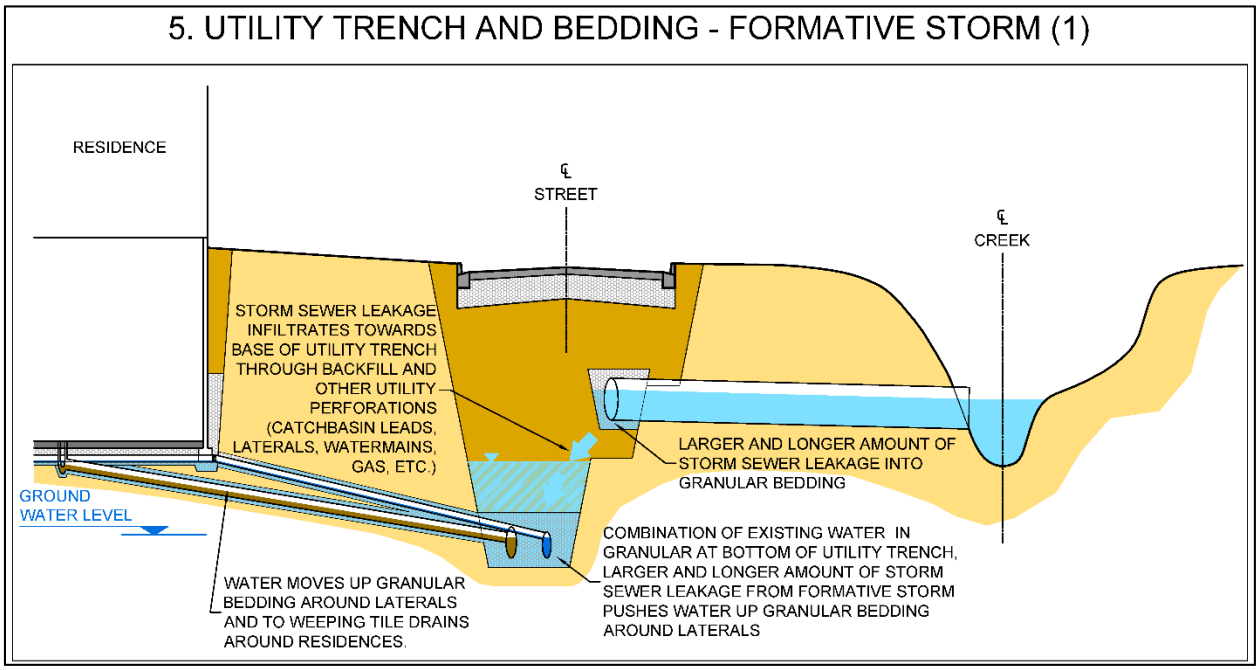



**Figure 8E: Basement Infiltration due to water within the Utility Trench**

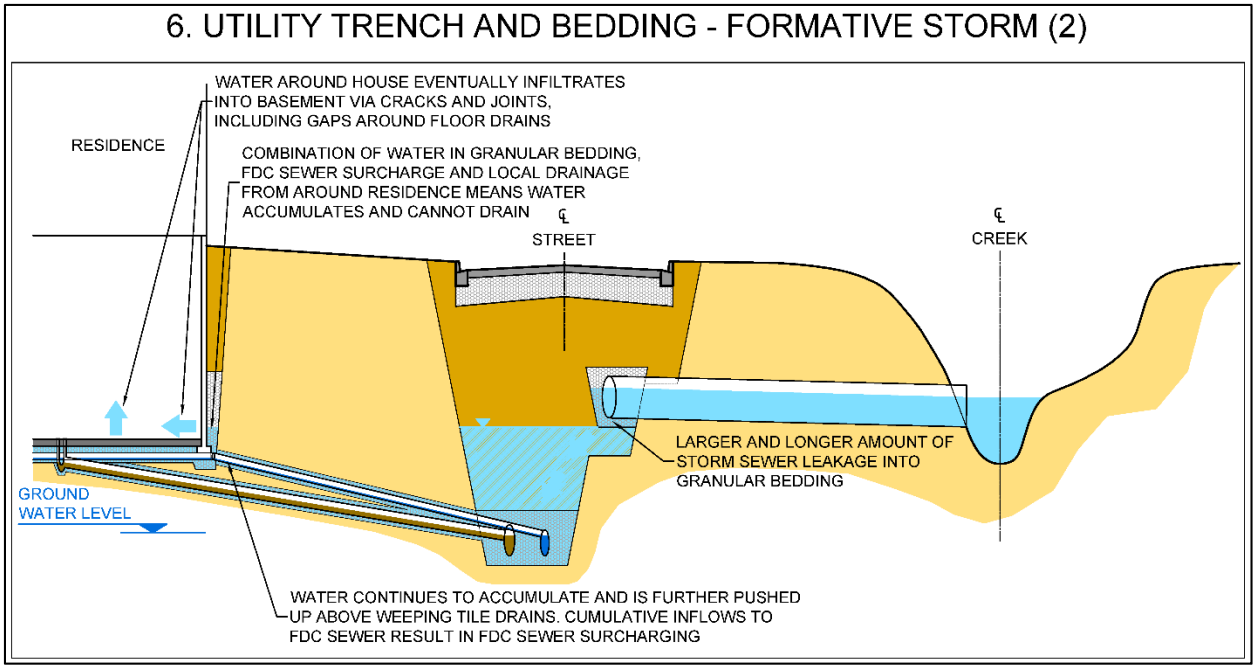



**Figure 8F: Basement Infiltration due to water within the Utility Trench**

The exact reasons why homes in the Lisgar District have not had basement water seepage before 2008 are not known. It is considered that the increasing leakage of water from the storm sewers through normal aging has gradually increased the volume of water collected in the trenches over time, ultimately contributing to the problems first experienced in 2008.

The risk of basement water infiltration is also connected to the relative depths of the FDC system and basements of homes in the different areas of the Lisgar District. Under the condition where water has moved up the bedding material surrounding the FDC laterals to the homes, the homes placed at greatest risk of basement water infiltration would be those where the FDC system (and thus the utility trench) is the shallowest. In other words, the less vertical separation between the FDC pipe/utility trench and the basements, the more susceptible basements will be to water seepage.

A number of other factors have been identified which may be impacting on the overall operation of the FDC system, however, none of them, either alone or in combination, would cause water to seep in to basements to the extent reported. The following table provides a summary of Amec Foster Wheeler's conclusions with respect to the potential contributing factors in the basement water infiltration investigation. A more extensive version of this table is provided as Appendix 'A'.

| Summary of Assessment of Potential Factors in Basement Water Infiltration | |
|---|---|
| **Potential Factor** | **Level of Influence** |
| Stormwater to Utility Trench | Primary Cause |
| FDC and Utility Trench Depths | May increase risk of basement water infiltration at specific locations |
| Groundwater | May contribute additional/excess flows to the FDC and utility trench (Not sufficient to cause problem) |
| Creek Backwater | |
| Osprey Marsh Pond (SWM) Backwater | |
| Basement Walkouts | |
| Inflow/Infiltration to FDC | |
| FDC Hydraulics | May impair conveyance capacity of FDC system (Not sufficient to cause problem) |
| FDC Design | |
| FDC Tailwater | |
| FDC Maintenance | |
| FDC Construction | |
| Cross-Connections | Not Applicable |
| Creek Maintenance | |
| GO Station | |
| Sanitary System | |
| Lot Grading | Insufficient information |
| Basement Construction / Changes | |

Based on the foregoing conclusions, Section 6 of this report describes potential mitigation measures which are intended to reduce the risk of future basement water infiltration.

## 6.0 MITIGATION PLAN

To address the basement water infiltration issue, eleven alternative actions were developed and evaluated for potential implementation. They are briefly described as follows:

1. *Strategic Lining of Storm Sewers* – line and seal the inside of selected storm sewers to minimize water leakage into the utility trench.

2. *Construction of a Utility Trench Dewatering System* - drain water from the utility trench at key locations to provide additional storage during storm events and reduce FDC surcharging.

3. *Construction of FDC Pumping Stations* – actively pump from the FDC sewer system to minimize surcharging of the FDC system.

4. *FDC Sewer Upgrades* – Strategically upgrade selected FDC sewers to increase capacity and reduce surcharging occurrences.

5. *Sump Pumps* - install new basement sump pumps to help in draining weeping tiles during storm events. The City should continue with its Lisgar District Sump Pump Subsidy Program for homes with reported basement water infiltration to assist homeowners with the cost of installing new sump pumps.

6. *FDC Backflow Preventers* – install a backflow preventer and clay barrier on residential FDC lateral pipes to prevent FDC surcharge from impacting weeping tiles.

7. *Storage* – construct a storage system (likely an underground tank) to temporarily store excess FDC flow during surcharge events and then release it in a controlled manner.

8. *Storm Sewer Outfall Collars* – construct concrete barriers at storm sewer outfalls (to creek or pond) to limit the ability of water to move back up through the utility trench.

9. *Basement Walkout Covers* – construct roofs/covers over residential basement walkout entrances, to limit stormwater from draining to the FDC.

10. *New FDC Outlet* – re-direct the FDC trunk sewer at the downstream limit away from the existing storm sewer and to a free flowing outfall (such as a creek).

11. *Creek Remediation* – trim or manage vegetation along creek corridor to improve capacity and reduce water levels during major storms.

These eleven actions were analyzed by the City and Amec Foster Wheeler for effectiveness (ability of proposed actions to reduce basement water infiltration) and feasibility (ease of implementation). Through this process, Actions #1 to #5 were carried forward to form a Prioritized Action Plan to reduce the risk of basement water infiltration while Actions #6 to #11 were screened out. A detailed matrix summarizing each of the eleven alternative actions is provided as Appendix ‘B’.

### 6.1 Prioritized Action Plan

The following five actions are recommended to be carried forward as mitigation actions based on their effectiveness and feasibility.

| Item # | Action | Description |
|---|---|---|
| 1 | Strategic Lining of Storm Sewers | Sealing the inside surface of storm sewers in strategic locations with an impermeable liner to reduce/eliminate leakage into bedding (and ultimately into FDC system). |
| 2 | Construction of a Utility Trench Dewatering System | Dewater bedding material around the FDC system to limit the accumulation of water in the utility trench and provide additional storage volume during storm events. |
| 3 | Construction of FDC Pumping Stations | Install pumping stations at key locations of the FDC system which will activate when the system either approaches or reaches surcharge conditions and pump water to the ground surface. |
| 4 | FDC Sewer Upgrades | Upsizing selected FDC sewers to increase their conveyance capacity and reduce surcharge. |
| 5 | Sump Pumps | Home-owner installs a new basement sump pump system to help to drain the weeping tile system around the home; sump pump would discharge to ground surface. |

Additional details related to the above Prioritized Action Plan are provided as Appendix ‘C’.

It should be noted that the basement water infiltration issue is extremely complex, and the selection of measures to appropriately address the problem remains an iterative process. Actions in the Prioritized Action Plan should be implemented in stages where constructed projects are monitored to assess their effectiveness and to assist staff in making informed decisions on subsequent Actions.

## 7.0 RECOMMENDED NEXT STEPS

Based on the Prioritized Action Plan, it is recommended that the two highest priority actions, Actions 1 and 2, be planned in order of implementation as soon as funding and approvals are secured to deal with the basement water infiltration issue. It is suggested that the following steps be undertaken:

a) Undertake the design, construction and monitoring related to the storm sewer lining (Action 1) of the Black Walnut Trail area (refer to Figure 9 for locations).

b) Conduct background work to refine key details of the utility trench dewatering system (Action 2) followed by detailed design, approvals, and construction.

c) Undertake additional monitoring to assess effectiveness of steps (a) and (b).

d) The balance of the recommended Actions (Actions 3 and 4) would be staged over time conditional on the results of steps (a), (b), and (c).

It is also recommended that residents who qualify for the City's Lisgar District Sump Pump Subsidy Program take advantage of this program (Action 5).

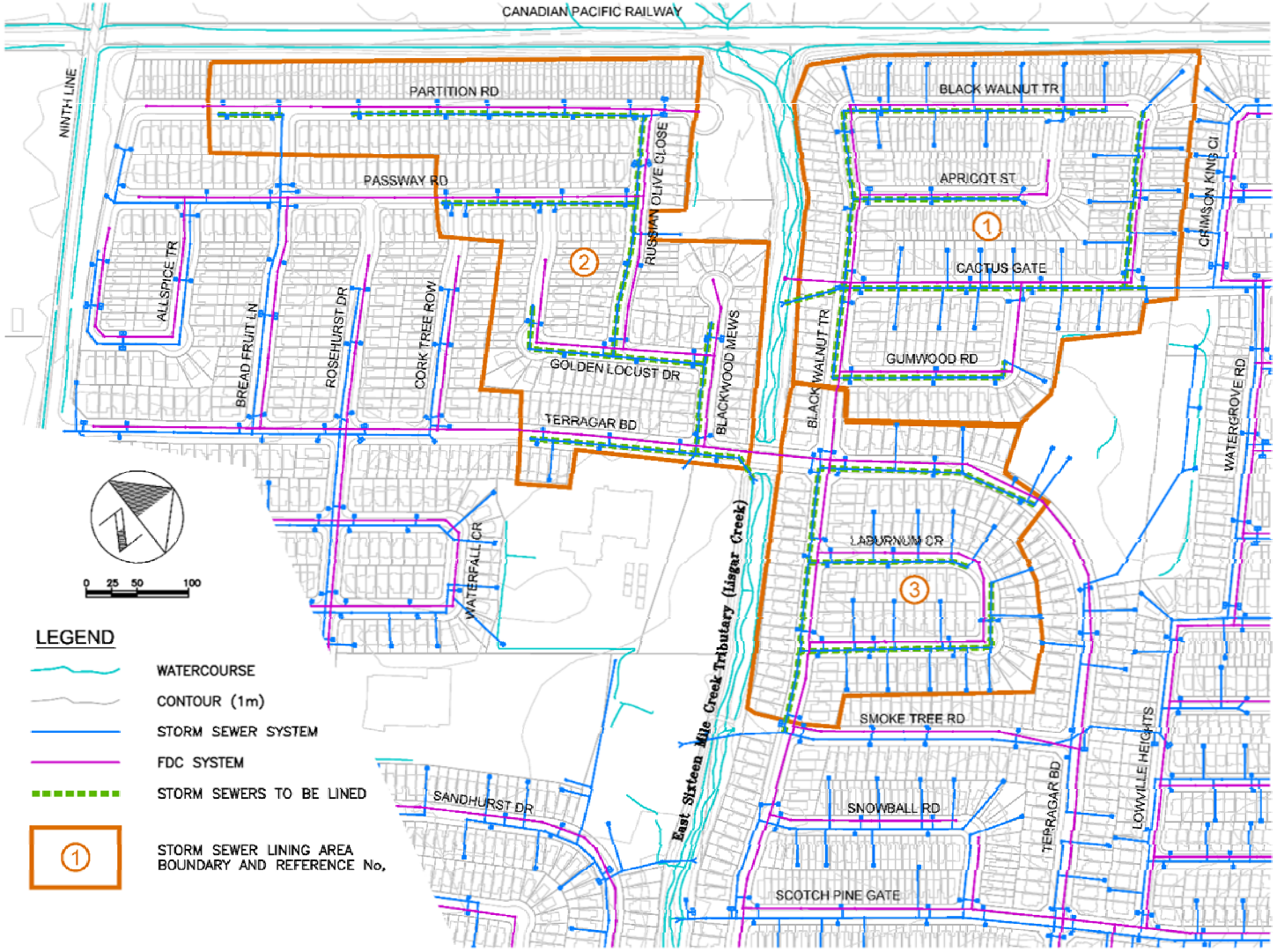



**Figure 9: Locations of Proposed Storm Sewer Lining – Black Walnut Trail Area**

# APPENDIX ‘A’
# Summary of Potential Factors of Basement Water Infiltration

## APPENDIX 'A' - SUMMARY OF ASSESSMENT OF POTENTIAL FACTORS OF BASEMENT WATER INFILTRATION (MARCH 2015)

| Potential Factor | Level of Influence | Notes |
|---|---|---|
| **Stormwater to Utility Trench** | Primary Cause | Validated by 2013 storm sewer leakage tests. 2014 impermeable collar test excavations confirmed significant amount of water in bedding material. |
| **FDC and Utility Trench Depths** | May increase risk of basement water infiltration at specific locations | Not a cause of basement water infiltration, but locations with shallower FDC depths (and thus utility trench depths) in relation to adjacent weeping tile systems would be expected to increase the risk of basement water infiltration. |
| **Groundwater** | May contribute additional/excess flows to the FDC and utility trench (Not sufficient to cause problem) | Groundwater in part contributes to water accumulation within utility trench bedding material but not viewed as a cause of the basement water infiltration experienced since 2008. |
| **Creek Backwater** | | May contribute water to utility trench within bedding material, increased residence time within storm sewers but not viewed as a cause of the basement water infiltration experienced since 2008. |
| **Osprey Marsh Pond (SWM) Backwater** | | Osprey Marsh Pond not a direct cause of surcharging or basement water infiltration, but may contribute to water within utility trench bedding material, increased residence time within storm sewers, however not viewed as a cause of the basement water infiltration experienced since 2008. |
| **Basement Walkouts** | | Current hydraulic modelling efforts indicate an insufficient number to generate observed FDC flows and volumes under surcharge events; may still be a potential contributor to surcharging or basement water infiltration at specific locations however not viewed as a cause of the basement water infiltration experienced since 2008. |
| **Inflow/Infiltration to FDC** | | Some contribution to FDC pipe flow due to amount of water within surrounding bedding material through cracks in pipes/MHs, but insufficient to be a cause of the basement water infiltration experienced since 2008. |
| **FDC Hydraulics** | May impair conveyance capacity of FDC system (Not sufficient to cause problem) | Sections of the FDC sewer system have been identified as undersized or poorly graded (flat) which exacerbates FDC surcharging, but not viewed as a cause of the basement water infiltration experienced since 2008 |
| **FDC Design** | | Analysis work indicates a number of deficiencies in FDC system using original design criteria, which may exacerbate FDC surcharging at specific locations. FDC system was however designed according to the approved criteria of that time. The deficiencies, while impairing the overall efficiency of the system, are not viewed as a cause of the basement water infiltration experienced since 2008. |
| **FDC Tailwater** | | Receiving storm sewer has not surcharged during monitoring period; water levels have been above FDC outlet invert but for only brief periods and does not appear to directly correlate with observed FDC surcharge (and does not explain surcharge at upstream limits of system), thus not considered to be the cause of basement water infiltration experienced since 2008. |
| **FDC Maintenance** | | FDC system flushed since study start-up; FDC systems are closed, hence would typically only require nominal maintenance. CCTV showed some issues with respect to debris accumulation, but generally minimal and not sufficient to cause persistent/widespread surcharge or the basement water infiltration experienced since 2008. |
| **FDC Construction** | | Detailed information not available for all of the FDC system. Sections of trunk FDC along Ninth Line may have been constructed flatter than design, larger number of residences ultimately connected to FDC system than originally designed, however these discrepancies are not considered to be the primary cause of FDC surcharging or the cause of basement water infiltration experienced since 2008. |
| **Cross-Connections** | Not Applicable | Known cross-connections repaired; very few found |
| **Creek Maintenance** | | Monitoring data do not indicate any correlation to FDC surcharge. Lands regulated by Conservation Halton; work needs to balance ecological impacts. City forces have cleared creek (sediment / vegetation) since study start-up with rapid re-growth noted. |
| **GO Station** | | Monitoring data do not currently indicate any correlation between GO Station water infiltration and instances of observed FDC surcharge |
| **Sanitary System** | | Region of Peel monitoring data indicated no sanitary system surcharging or correlation with identified FDC surcharging events |
| **Lot Grading** | Insufficient information | Insufficient information available to assess level of influence |
| **Basement Construction / Changes** | | Insufficient information available to assess level of influence |

# APPENDIX ‘B’
# Summary of Potential Mitigation Measures

**APPENDIX 'B' - SUMMARY OF POTENTIAL MITIGATION MEASURES (MARCH 2015)**

| Items | Action | Description | Analytical Support / Theory | Technical Considerations | Policy and Implementation Considerations | Effectiveness | Feasibility | Priority | Potential Further Investigation related to uncertainties and information gaps |
|---|---|---|---|---|---|---|---|---|---|
| **1** | **Strategic Lining of Storm Sewers** | Sealing the inside surface of storm sewers in strategic locations with an impermeable liner to reduce/eliminate leakage into bedding (and ultimately into FDC) | • Storm sewer leakage tests (2013) confirmed that storm sewers leak into the FDC system<br>• Impermeable collar tests (2014) confirmed a significant amount of water in bedding material; water quality typing suggests surface water as source<br>• Rapid FDC surcharge and temperature signal data strongly suggest a stormwater input; storm sewers largest likely contributor<br>• Preventing storm sewer leakage would directly limit FDC surcharge potential | • Several key preliminary locations based on historic basement infiltration and computer modelling:<br>  • Black Walnut Trail (BWT) north of Smoke Tree (32.9 ha – 3.6 km of storm sewer) – Highest priority area<br>  • Doug Leavens Boulevard (4.3 ha – 0.5 km of storm sewer)<br>  • Alderwood Trail (9.2 ha – 1.0 km of storm sewer)<br>  • Osprey Boulevard (16.4 ha – 1.8 km of storm sewer) | • Work would all be done within public right-of-way, minimal disruption<br>• Some loss in storm sewer capacity due to lining, generally nominal (5% +\-)<br>• Preferred methodology to seal MHs and CBs<br>• Need to seal catchbasin leads as well.<br>• Lining of rear-yard catchbasin leads is a potential future work item; private property access may be required | Moderate to High | High | High ***(Recommended)*** | • Further potential refinement to locations of lining; test effectiveness in select locations before doing widespread lining (additional monitoring)<br>• Need to further explore alternative technologies to determine the optimal lining material |
| **2** | **Construction of Utility Trench Dewatering System** | Dewater bedding material around the FDC to limit accumulation of water and provide additional storage volume during storm events | • Impermeable collar tests (2014) confirmed a significant amount of water in bedding material<br>• Would limit excess water accumulation in bedding material and restore storage capacity | • Given depth of FDC sewer bedding relative to surface water, a pumping system would be required<br>• Given that pumping would be quasi-continuous (i.e. during non-storm and storm periods) back-up pumps and power less necessary<br>• Consider several preliminary locations based on historic basement infiltration and forensic modelling:<br>  • BWT at Cactus Gate<br>  • BWT at Scotch Pine Gate<br>  • Along trunk between Derry and Osprey<br>  • Osprey Boulevard | • Work would all be done within public right-of-way, minimal disruption<br>• Uncertainty related to available public land to construct; lands would need to be in close proximity to problem areas<br>• Approach to discharge pumped water will need to consider impacts to receivers (storm sewer or creek) | Moderate to High | Moderate to High | High ***(Recommended)*** | • Variable cost of pumping systems; would need to confirm locations and determine sizing and feasibility before proceeding further. Requires a pre-engineering study<br>• Test effectiveness of a single installation before proceeding with others (additional monitoring); number and location of potential pumping systems to be confirmed based on effectiveness of highest priority pumping system and land ownership. |

**APPENDIX 'B' - SUMMARY OF POTENTIAL MITIGATION MEASURES (MARCH 2015)**

| Items | Action | Description | Analytical Support / Theory | Technical Considerations | Policy and Implementation Considerations | Effectiveness | Feasibility | Priority | Potential Further Investigation related to uncertainties and information gaps |
|---|---|---|---|---|---|---|---|---|---|
| **3** | **Construction of FDC Pumping Stations** | Provide pumping stations at key locations for the FDC system; activated once the system either approaches or reaches surcharge conditions; flows to be pumped to surface | • Computer modelling of a monitored surcharge event showed that pumping would be largely successful in reducing surcharge (depth and duration) for upper limits of the FDC system | • A larger pumping system would be required than for utility trench drains given amount and rate of water to be pumped during a storm<br>• Given the need for the system to operate during storm events, back-up power and back-up pumps would be required which would increase costs<br>• Potentially located at same preliminary locations as applied for utility trench drains to reduce costs | • Similar to utility trench drains | Moderate | Moderate to High | Moderate to High ***(Recommended)*** | • Additional modelling should be completed to better confirm feasibility and preferred locations of FDC pumping |
| **4** | **FDC Sewer Upgrades** | Upsizing selected FDC sewers to increase their conveyance capacity and reduce surcharge | • FDC monitoring data indicate that the FDC system surcharges frequently, particularly in certain locations<br>• Computer modelling of a monitored surcharge event showed that a FDC upgrade along a portion of BWT would eliminate surcharge in this location | • Strategic upsizing by one standard pipe size in two key preliminary locations:<br>  • BWT (CNR to Scotch Pine Gate) – 1 km +\-<br>  • Along creek (Doug Leavens Blvd. to Ninth Line) – 2 km +\-<br>• Focus on trunk FDC pipes; other smaller branches may also be required for upsizing<br>• Would need to consider overall cost benefits and likely initiate the work once area infrastructure reaches its engineered lifetime | • Works along BWT would be disruptive to residents (road reconstruction)<br>• Potential synergy with other measures since excavation would be required regardless<br>• Works along the FDC system within creek block would be much less disruptive | Moderate | Moderate | Moderate ***(Recommended)*** | • Further modelling assessment required to confirm benefit of FDC sewer upgrade along creek and required extents as well as Ninth Line, if shown to be effective<br>• Would need to assess if upgrades negatively impact downstream areas<br>• Assess whether additional costs likely given depth of excavation required in some locations (5 m +\-), particularly along BWT |
| **5** | **Sump Pumps** | Homeowner installs a new basement sump pump system to help to drain the weeping tile system around the home; sump pump would discharge to surface | • A sump pump should provide added relief for accumulated water within the residential weeping tile system, which should reduce the duration that water is around the home, and thus reduce the potential for basement water infiltration | • 187 homes (to-date) have reported basement water infiltration<br>• Homeowner should confirm that a sump pump can be effectively installed in their basement; in particular that a clear outlet to the surface can be achieved (at least 2 m away from the foundation) | • Homeowner-led approach<br>• City subsidy program in place for homes that have experienced basement water seepage to assist homeowners with cost of installation (up to 50% of invoiced total, up to a maximum of $3,000)<br>• Applications must be reviewed and approved by City staff | Moderate | Moderate | Moderate ***(Recommended)*** | • N/A |

**APPENDIX 'B' - SUMMARY OF POTENTIAL MITIGATION MEASURES (MARCH 2015)**

| Items | Action | Description | Analytical Support / Theory | Technical Considerations | Policy and Implementation Considerations | Effectiveness | Feasibility | Priority | Potential Further Investigation related to uncertainties and information gaps |
|---|---|---|---|---|---|---|---|---|---|
| **6** | **FDC Backflow Preventers** | Provide an impermeable collar around FDC lateral to prevent migration of bedding water, combined with a backflow valve on FDC lateral itself to eliminate surcharge impact to home | • Storm sewer leakage tests (2013) and impermeable collar tests (2014) confirm significant amount of water within bedding material and the potential for this material to transport water<br>• Monitoring results show a correlation between FDC surcharge and reported instances of basement infiltration (ref. storm event of January 13, 2013)<br>• Assumption that eliminating potential for FDC surcharge and duration to impact basement foundations (via either lateral or bedding material) would therefore eliminate primary cause of basement water infiltration | • Need to confirm least invasive method to install – would open cut excavation be the only solution? | • Likely that collars and backflow valves could be placed within City property (roadway limits) to maintain control<br>• Inspection and maintenance needs may be challenging depending on access and location | Low to Moderate | Low to Moderate | Low to Moderate ***(Screened)*** | • Further investigation would be required to identify priority areas<br>• Potential impact to foundations given that no drainage outlet would be available during FDC surcharge events (backflow valve) – would this increase potential for basement water infiltration for certain weather/seasonal conditions? Magnitude of inflow/infiltration though likely significantly less. |
| **7** | **Storage** | Incorporate offline storage features (likely underground storage tanks) to detain excess FDC flows and reduce the resulting FDC surcharge | • Monitoring data suggest FDC surcharge continues to occur in several locations; storing some or all of the FDC surcharge would be expected to reduce potential for basement water infiltration<br>• Forensic hydrologic/hydraulic modelling will assist in confirming observed flows and associated volumes within the FDC system | • Would depths of FDC permit gravity drainage or would pumping be required? | • Underground storage systems require significant land at depths to be effective, potentially necessitating the acquisition of private property<br>• Significant additional costs if pumping is required | Moderate | Low to Moderate | Low to Moderate ***(Screened)*** | • Additional modelling would be required to confirm observed and required storage volumes for more formative events<br>• Where are preferred locations of storage based on FDC surcharge and available land?<br>• Where would pumping be required? |

**APPENDIX 'B' - SUMMARY OF POTENTIAL MITIGATION MEASURES (MARCH 2015)**

| Items | Action | Description | Analytical Support / Theory | Technical Considerations | Policy and Implementation Considerations | Effectiveness | Feasibility | Priority | Potential Further Investigation related to uncertainties and information gaps |
|---|---|---|---|---|---|---|---|---|---|
| **8** | **Storm Sewer Outfall Collars** | Construct an impermeable barrier around storm sewer outfalls (including all other utilities) to prevent the movement of water from the receiving system back along the bedding material and potentially into the FDC or utility trench | • Storm sewer leakage tests (2013) indicated that storm sewers leak, and that bedding material is likely pathway<br>• Subsequent analyses considered the potential that FDC inflows and elevated water in bedding (and duration) could be the result of storm flows backing up in the bedding material from receiving watercourses, which would have elevated levels during storm events<br>• Two impermeable collars were designed and constructed in 2014 (Scotch Pine Gate and Pondview Way) along with additional monitoring devices<br>• Limited monitoring data to date given construction timing, however initial results suggest that bedding water is primarily coming from upstream rather than downstream | • 42 identified storm sewer outfalls, 2 completed to-date = 40 remaining outfalls. Would it be necessary to install collars for all 40 storm sewer outfalls? | • Would all be within public property, along creeks and Osprey Marsh – minimal disruption to the public | Unknown | Moderate | Low to Moderate ***(Screened)*** | • Further monitoring data required to confirm effectiveness at 2 test locations<br>• If considering this alternative, need to strategically target specific locations; more field investigations may be required accordingly |
| **9** | **Basement Walkout Covers** | Construct covers over all identified basement walkouts so that rainfall does not contribute to walkout sumps (and potentially directly into the FDC system) | • City reconnaissance work (air photos) indicates a significant number of potential basement walkouts in FDC service area (377 total) which may contribute stormwater flows to FDC<br>• Modelling work to date however indicates that for the area north of Derry Road, there are an insufficient number to be a significant cause of observed FDC surcharge; may be a potential contributor however | • What type of design would be required? Would need to ensure that water drains sufficiently far away from walkout structure (> 2 m?) | • Given that this work would be wholly on private property the only way this action would be difficult to implement. Work would need to be led by the homeowner given that home and walkout configuration would be unique | Low to Moderate | Low | Low ***(Screened)*** | • Additional modelling work would be required to confirm potential impact of basement walkouts in other areas (between Derry Road and Britannia Road in particular)<br>• Field confirmation would be required to confirm how many "potential" walkouts are actually present, but difficult to confirm if these features have a direct connection to FDC system or bedding material. Field confirmations would likely reduce numbers and potential contribution; private homeowner cooperation would be required<br>• Are there potentially other walkouts which could not be identified on aerial mapping? |

**APPENDIX 'B' - SUMMARY OF POTENTIAL MITIGATION MEASURES (MARCH 2015)**

| Items | Action | Description | Analytical Support / Theory | Technical Considerations | Policy and Implementation Considerations | Effectiveness | Feasibility | Priority | Potential Further Investigation related to uncertainties and information gaps |
|---|---|---|---|---|---|---|---|---|---|
| **10** | **New FDC Outlet** | Re-direct FDC trunk sewer along Ninth Line to a free outfall (i.e. open channel rather than closed storm sewer) | • Monitoring data indicate water levels in receiving storm sewer do rise to level of invert of FDC outlet; however this is generally brief (10-15 minutes) and at lower depth (only a portion of FDC pipe)<br>• Computer modelling indicates that tailwater conditions have a limited impact on performance of upstream FDC<br>• FDC analysis spreadsheet indicates that trunk along Ninth Line is over-capacity using different design approaches, including the section along Erin Centre Boulevard which would be eliminated under this option | • Sewer cannot be re-directed to Sixteen Mile Creek due to significant depth of sewer (11 m +\- below grade at Ninth Line and Erin Centre Boulevard)<br>• Based on a review of City's topographic mapping, the only likely feasible outlet is watercourse at Ninth Line just east of Hwy 407 EB on-ramp from Hwy 403 (Joshua's Creek watershed – Conservation Halton jurisdiction)<br>• Would need to confirm this channel would have limited backwater influence (free-flowing) and has sufficient capacity<br>• Assume re-direction would begin at Ninth Line and Erin Centre Boulevard<br>• Would require 1.3 km of new FDC sewer; would offer a 0.1% (+\-) grade | • Outlet would appear to still be within the City of Mississauga boundary, but would likely include MTO lands given proximity to Highway 407 and 403; would require consultation and approval with MTO<br>• Would require disruption to traffic along Ninth Line which is a major arterial for the City | Low | Low | Low<br>***(Screened)*** | • Would need to further confirm benefit of re-direction, but monitoring data suggest this would be limited – outlet does not appear to be the source of observed FDC surcharge, although it may be a minor contributor<br>• Further analyses would be required to confirm feasibility of grading, potential utility conflicts, and capacity of receiving watercourse to accept additional flows |
| **11** | **Creek Remediation** | Clearing of vegetation growth within Lisgar Creek (Sixteen Mile Creek tributary) to improve conveyance capacity of the channel and lower peak water levels | • Monitoring data to date generally indicate little to no correlation between elevated water levels in watercourses and FDC surcharging; watercourse levels typically peak later than FDC<br>• Speculation has been that elevated water levels within watercourses may contribute to inflows to bedding material via storm sewer outfalls; or may prevent drainage of both bedding material and storm sewers, which increases residence time and accumulation (i.e. exfiltration from storm sewers)<br>• Data collection from impermeable collars (2014) may further assist in assessing impact, and potential benefit of impermeable collars. | • Need to review to determine if a product or approach could limit vegetation re-growth, while still maintaining a natural aesthetic and obtaining approval from Conservation Halton | • Previous clean-out was time consuming and labour intensive<br>• Vegetation grew back rapidly, negating the effort<br>• Work would run counter to Conservation Halton objectives, would require on-going permit applications | Low | Low | Low<br>***(Screened)*** | • Further monitoring data collection from impermeable collars may assist in assessing impact of elevated creek water levels on potential for stormwater movement through bedding material; however this is currently speculated to be of minimal benefit<br>• How much could peak water levels be reduced through vegetation clearing? Additional hydraulic analyses would be required; need to factor in rapid re-growth of vegetation as noted |

# APPENDIX ‘C’
# Details of Prioritized Action Plan

The following provides additional details related to the recommended potential actions:

## 1. Storm Sewer Lining

*What's involved?*

Re-line and seal the inside of storm sewers in priority areas.

*Why will it help?*

By preventing water from leaking out of the storm sewer system, the potential for leakage into the utility trench below should be significantly reduced, which should also reduce FDC surcharging frequency and extent.

*How is it done?*

There are several different methods available: one method involves inserting and attaching a liner; another method involves spraying sealant around the inside of the sewer

*Where would it be done?*

A number of priority areas have been identified based on:

- Locations of reported basement water infiltration;
- Locations where field monitoring data show the most frequent FDC surcharge; and
- Locations identified by computer modelling analysis.

The current list of locations includes the areas around:

- Black Walnut Trail (north of Smoke Tree Road);
- Doug Leavens Boulevard (west of the creek);
- Alderwood Trail; and
- Osprey Boulevard (east of the creek).

Based on an initial screening process, Black Walnut Trail (north of Smoke Tree Road) is considered to be a priority location.

## 2. Utility Trench Dewatering

*What's involved?*

Continuously drain water that has been accumulating in the utility trench at key locations.

*Why will it help?*

By draining the water from the utility trench as it accumulates, storage volume is restored which can be available during storm events if required, which should further reduce FDC surcharging.

*How is it done?*

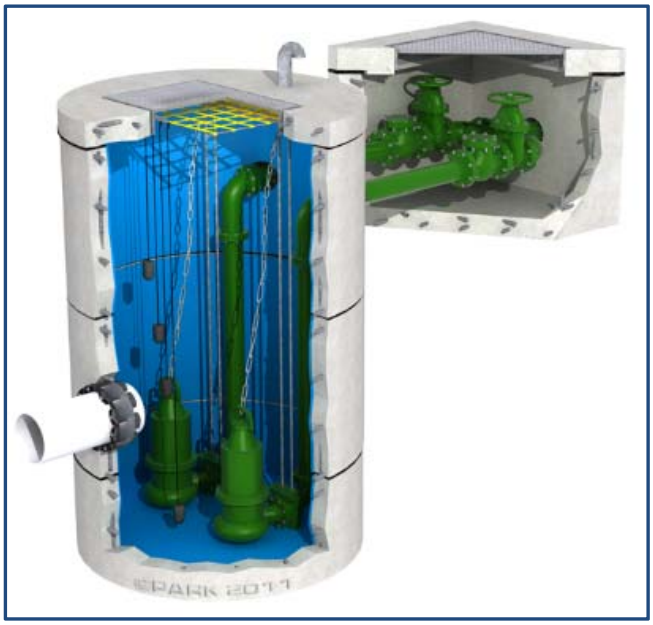
Because of the depth of the FDC system (in most locations), drainage by gravity is not possible. The water will therefore need to be pumped (using a system similar to a residential sump pump) to the surface, and then likely outlet to the creek.

*Where would it be done?*

A total of four different installations are currently considered; however, the precise number of installations required will need further study. The preliminary locations include:

- Black Walnut Trail (two different locations);
- Along the creek/trunk FDC between Derry Road and Osprey Boulevard; and
- Osprey Boulevard.

## 3. FDC Pumping Stations



*What's involved?*

Actively pump excess flow from the FDC sewer system during surcharge events.

*Why will it help?*

Pumping away the excess flow within the FDC system should reduce flows and therefore reduce the amount of FDC surcharge.

*How is it done?*

A permanent pumping station would need to be established which would be connected to the FDC system, likely by a new pipe at an existing FDC maintenance hole. The pumping station would involve an underground storage chamber with a "wet well" (to provide some depth of water to pump from) and one or more large pumps. These pumps would be triggered once water levels rise to a pre-set elevation, and would then turn on and pump the diverted water out of the FDC (likely to the surface and/or to the creek). The pumps would then shut off again once water levels drop enough

*Where would it be done?*

Further study and investigations would be required to confirm the precise number and locations of these pumping stations. Compared to dewatering of the utility trench, it should be noted that the FDC pumping costs will be significantly greater due to the requirements for larger pumps, backup units, backup power systems, more space and land.

### *4. FDC Sewer Upgrades*

*What's involved?*

Increase the size and/or slope of existing FDC sewers.

*Why will it help?*

Larger and/or steeper sloped sewers can carry more water – by making the FDC sewers larger the amount of surcharging should be reduced.

*How is it done?*

The ground, including the roadway in most areas, is dug up to expose the existing FDC sewer pipe. The pipe is then removed piece by piece. A new larger pipe is installed including new larger maintenance holes, if required, and the ground and roadway are then restored.

*Where would it be done?*

No definite locations have been identified as of yet; further study and assessment would be required. Also, due to the disruption to the roadway, and the relative age of the FDC, storm and sanitary sewers, FDC upgrades should be coordinated with planned road works and/or when the sewer are approaching the end of their service life.

**5. Sump Pumps**

*What's involved?*

Homeowners in the Lisgar District with reported basement water infiltration installing a new sump pump system in their basement.

*Why will it help?*

Sump pumps would help to drain water from the weeping tile system around a home during a storm event, which should limit or reduce the potential for basement infiltration.

*How is it done?*

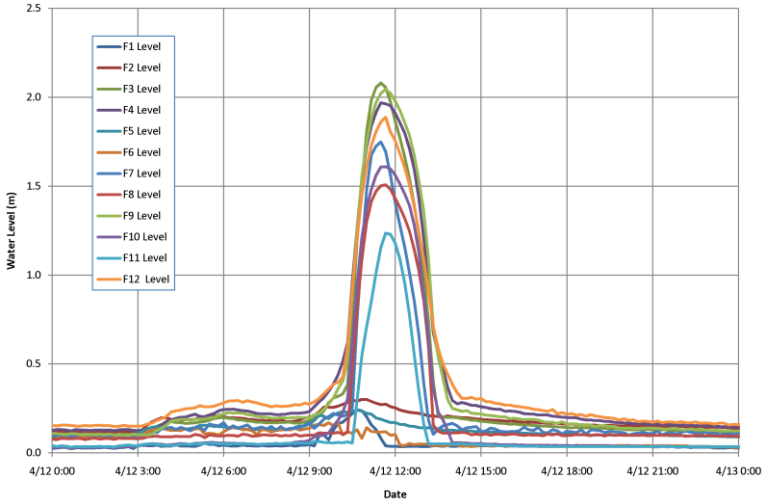
Part of the basement floor in a home would need to be cut and a sump pit created and connected in to the weeping tile system around the home. A sump pump is then installed, which begins pumping once water levels in the sump reach a pre-set water level. The water is then pumped out to the ground surface at a distance typically of at least 2 metres from the home.

*Where would it be done?*

The City of Mississauga is continuing to offer the Lisgar District Sump Pump Subsidy Program to homeowners in the Lisgar District with reported basement water infiltration. A financial subsidy is available to eligible homeowners of up to 50% of the sump pump installation cost, to a maximum of $3,000 per household.

# Lisgar District Basement Water Infiltration Investigation
# Presentation of Final Report
# City of Mississauga

March 26, 2015



# Agenda

1. Purpose of Presentation
2. Summary of Findings
3. Study Area
4. Overview of Drainage Systems
5. City Activities
6. Summary of Potential Causes
7. Study Activities
   - *Monitoring*
   - *Testing*
   - *Analysis*
   - *Summary and Conclusions*
8. Mitigation Plan
9. Recommended Next Steps
10. Summary Report

# 1. Purpose of Presentation

# 1. Purpose of Presentation

To present the findings of the consultant's assessment regarding the Lisgar District Basement Water Infiltration study, including:

- A summary of the field work and associated analysis
- The resulting conclusions regarding the main cause of the basement water infiltration, and other secondary factors
- The proposed Mitigation Plan

# 2. Summary of Findings

# 2. Summary of Findings

## History of the Problem:

- Beginning in 2008, some homes experienced water seeping into their basements following certain rainfall events
- A total of 187 homes are known to have been affected to date.
- The City undertook a number of proactive measures
- In October 2011, the engineering consulting firm Amec Foster Wheeler Environmental & Infrastructure was retained to undertake an engineering study to determine the possible causes of this problem

# 2. Summary of Findings

## Summary of the Primary Cause:

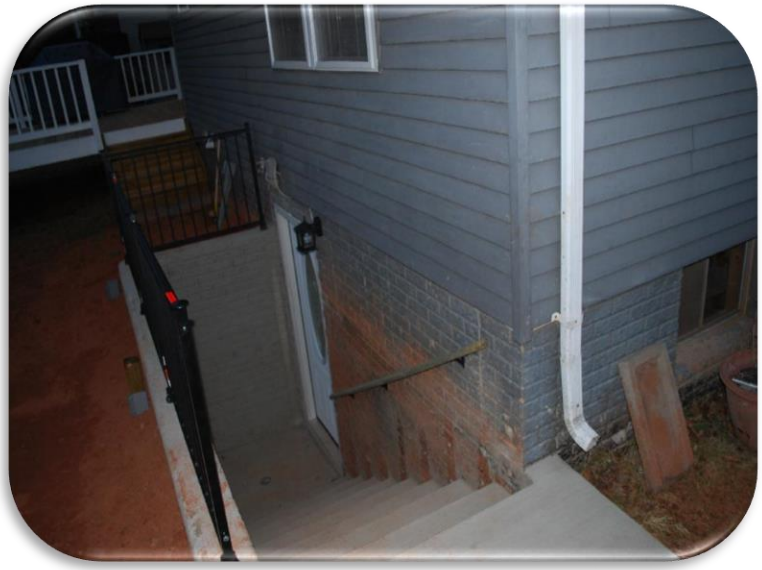
- Leakage from the storm sewer system (which is a normal and expected occurrence), combined with the presence of slow draining native soils (around the utility trench) results in water build-up
- If the build-up of water is significant, it travels up the bedding material around the Foundation Drain Collector (FDC) laterals servicing the homes and into the foundation weeping tiles
- Water then drains directly into the FDC pipes through the weeping tiles which can surcharge (overload) the system
- This condition, in combination with certain storm conditions (preceding rainfall followed by a sufficiently large storm event) and local lot drainage may lead to water around the home's weeping tiles being unable to drain and potentially seeping into the basements of homes.

# 2. Summary of Findings

## Potential Secondary Factors:

Some other identified issues and risk factors include:

- The depth of the FDC system and utility trench relative to weeping tiles in some locations (i.e. more susceptible);
- Pipe capacity in some sections of the FDC system;
- Potential inflows from groundwater and surface water sources (creek/pond via storm sewer outfall);
- Rain water and runoff from the lot or roof entering drains serving basement walkout areas that are connected to the FDC system.



# 2. Summary of Findings

## Prioritized Action Plan:

Following measures are recommended as the highest priorities for the City:

a) *Strategic lining of priority storm sewers to minimize leakage (capital cost estimated to be $8M - $9M)*
b) *Construction of a utility trench dewatering system.(capital cost estimated to be $3M - $4M)*
c) *Additional monitoring to assess effectiveness of a) and b) (approximately $100,000)*

Other recommended actions may be staged over time, conditional on the results of the above, including:

a) *Building permanent FDC pumping stations for high flows (capital cost estimated to be $6M - $7M)*
b) *Replace deficient FDC pipe lengths when they reach the end of their engineered lifespan (capital cost estimated to be $2M - $3M)*

It is also suggested that residents who qualify for the City's Lisgar District Sump Pump Subsidy Program take advantage of this program.

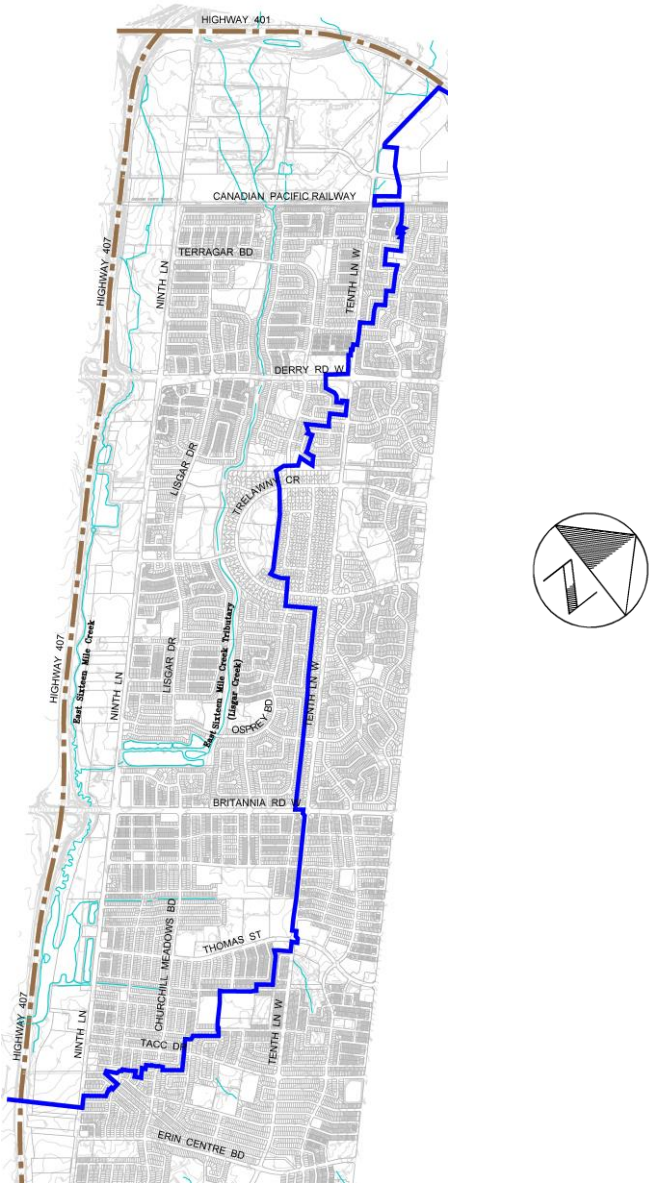
# 3. Study Area

# 3. Study Area

## Study Area – Subwatershed Map:

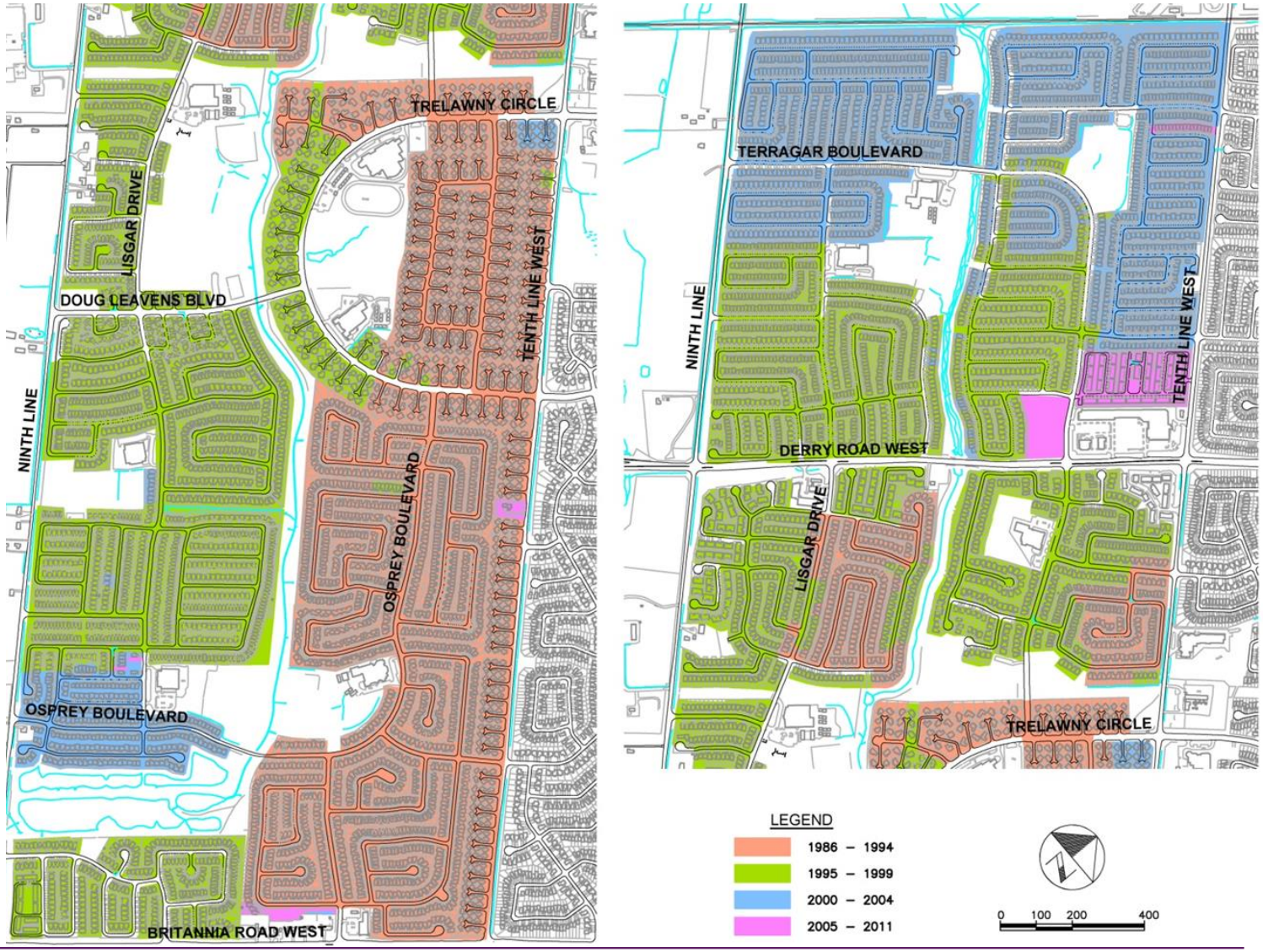
LEGEND

- WATERCOURSE
- CONTOUR (1m)
- MUNICIPAL BOUNDARY
- EAST SIXTEEN MILE CREEK WATERSHED BOUNDARY



# 3. Study Area

## Study Area – Eras of Development:



# 4. Overview of Drainage System

# 4. Overview of Drainage System

## Typical Foundation Drainage Systems:

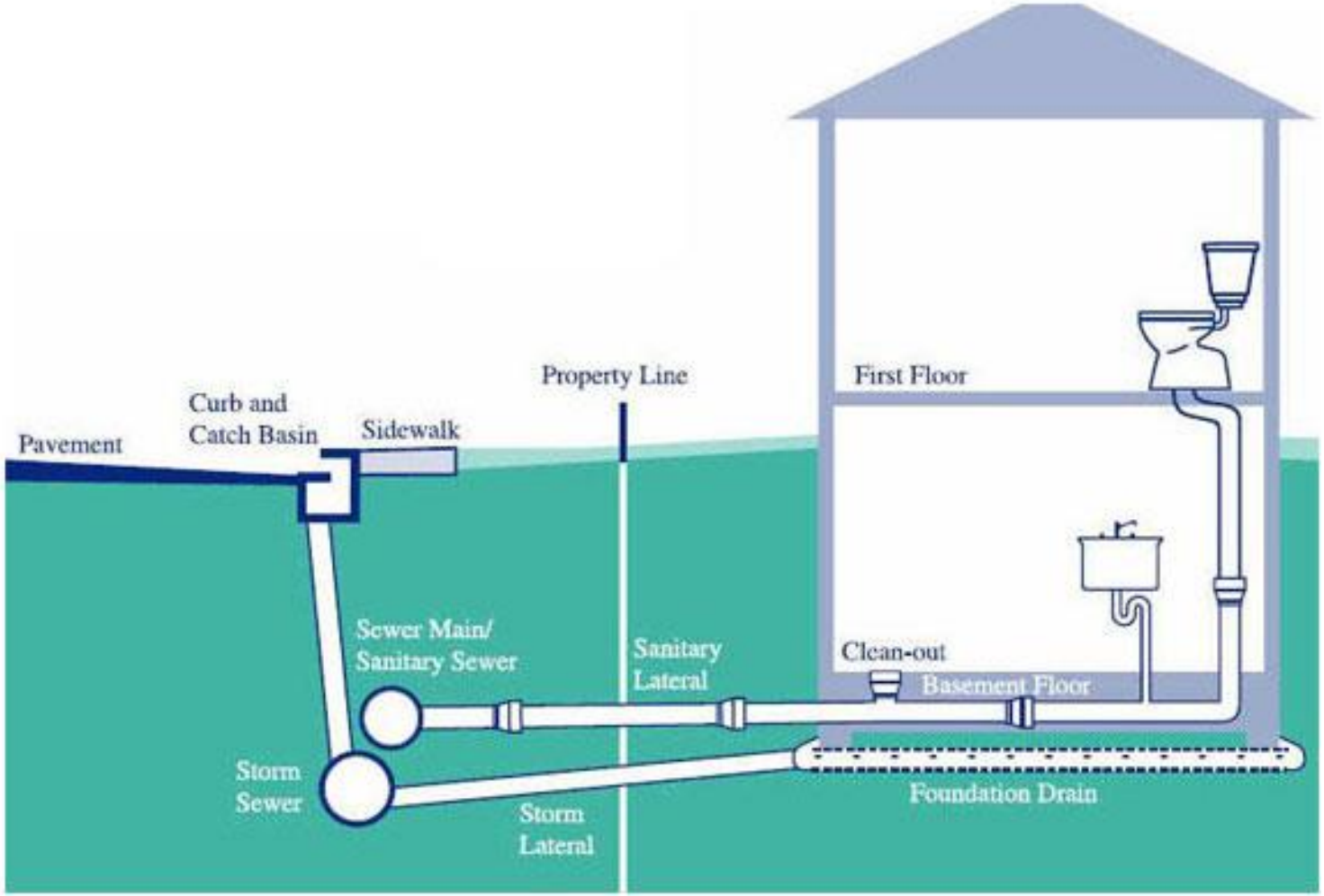
Typical Foundation Drainage Systems to address water build up around residential foundations:

i. Gravity Drainage to Storm Sewer
ii. Sump Pump to Front/Rear Yards or Storm Sewer
iii. 3-Pipe System – Foundation Drain Collector (FDC)

# 4. Overview of Drainage System

## Typical Foundation Drainage Systems:

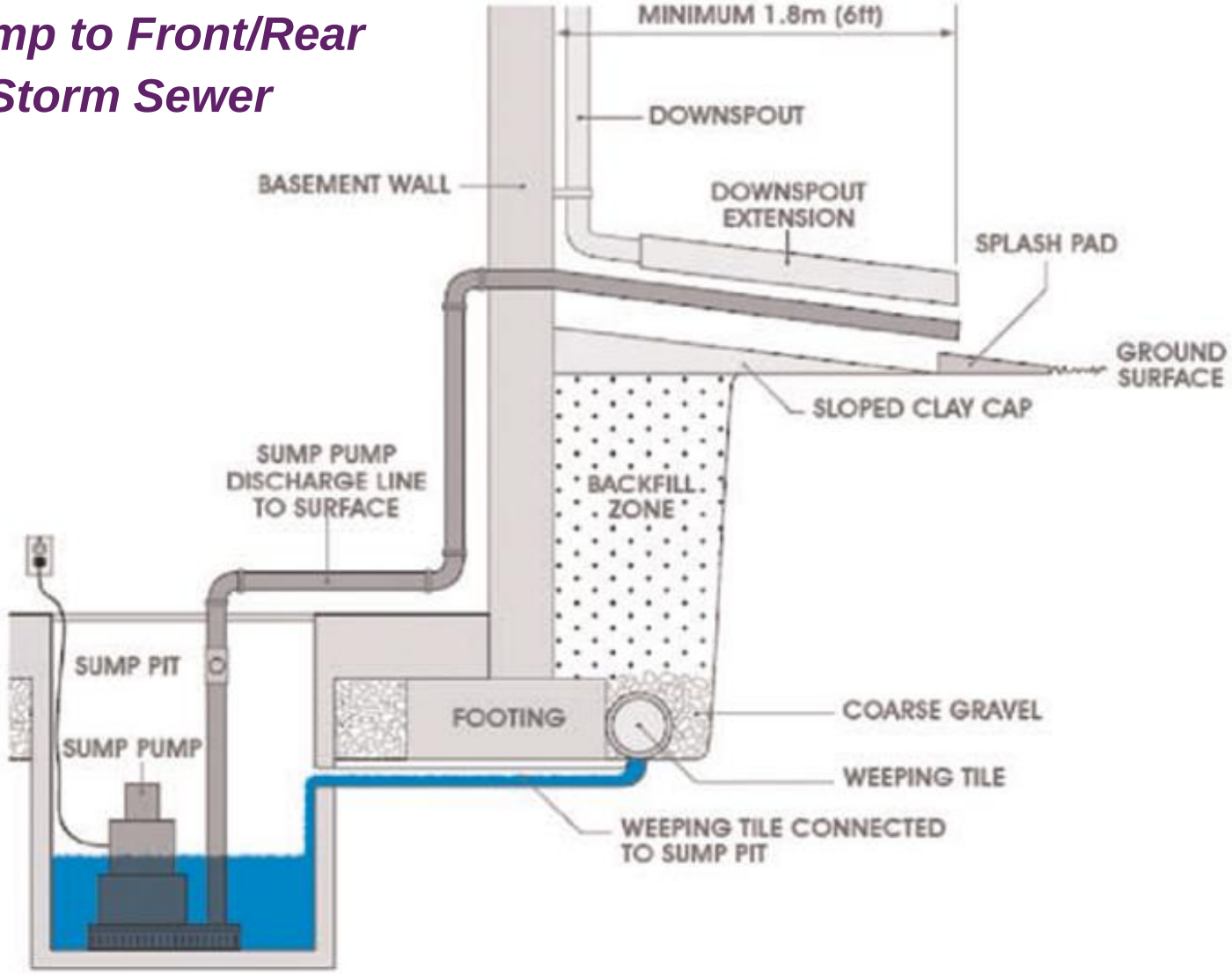
### *i. Gravity Drainage to Storm Sewer*



# 4. Overview of Drainage System

## Typical Foundation Drainage Systems:

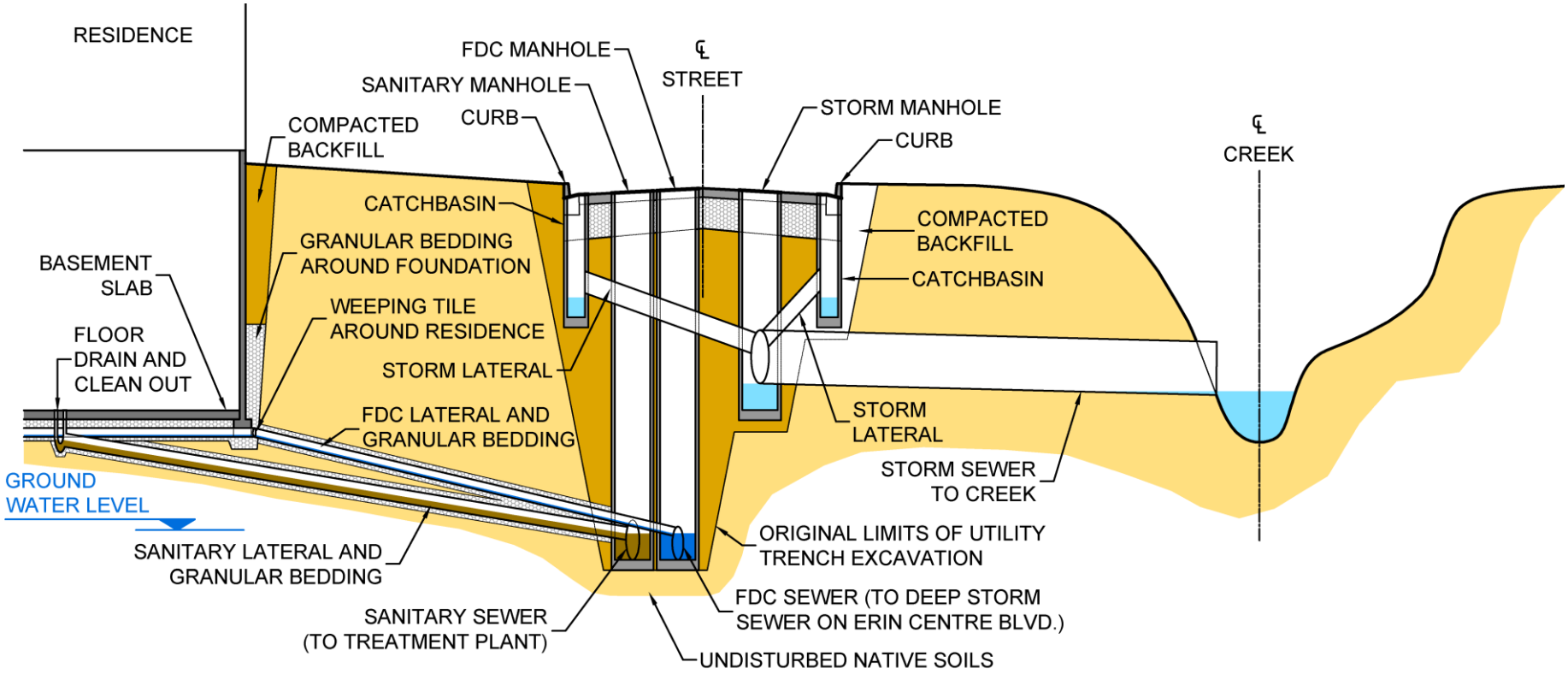
### *ii. Sump Pump to Front/Rear Yards to Storm Sewer*



# 4. Overview of Drainage System

## Typical Foundation Drainage Systems:

### *iii. 3-Pipe System - Foundation Drain Collector (FDC)*




- "*This system virtually eliminates the probability of back-ups into foundation drains, which have caused considerable flooding, and damage to basements*" (Modern Sewer Design, 1980)

# 4. Overview of Drainage System

| Type | Advantages | Disadvantage |
|---|---|---|
| **Gravity to Storm Sewer** | • no additional infrastructure<br>• comparatively low cost<br>• no reliance on mechanical system or power | • may back up if storm sewer is overwhelmed<br>• some additional cost to upsize storm sewers |
| **Sump Pump** | • disconnected from municipal system | • requires homeowner to operate and maintain the system<br>• mechanical system needs to operate to function<br>• relies on power |
| **Foundation Drain Collector** | • dedicated, providing drainage for foundation only<br>• no reliance on mechanical system or power<br>• "virtually eliminates the probability of back-ups into foundation drains"<br>• allows for smaller sized storm sewers<br>• Successfully installed in numerous other municipalities without incident (Brampton, Vaughan, Barrie) | • comparatively high cost to install additional deep and long pipe systems |

# 4. Overview of Drainage System

## Why was the 3-Pipe System (FDC) used in Lisgar?

- Gravity drainage to the Sixteen Mile Creek Tributary not possible since creek is too shallow
- Alternatively, millions of cubic metres of material would have needed to be brought into area to elevate the land on average 1.5 m +\- (not practical/feasible)
- Sump pumps must always be maintained in good operating condition and also require a continuous supply of electricity; at the time (1980/1990's) sump pump system reliability not as robust
- 3 Pipe-System has been successfully used in other municipalities across Ontario and elsewhere

# 5. City Activities

# 5. City Activities

## FDC and Storm Sewer:

- Video Inspection and Flushing of FDC and Storm Sewer Systems
- Identifying Sewer Cross-connections
- Sealing FDC Maintenance Access Lids and Cracks
- Cleaning Storm Sewer Outfalls to Creek
- Improvements to Overland Flow Routes
- High Water Protocol

# 5. City Activities

## East Sixteen Mile Creek Tributary ("Creek")and Osprey Marsh Stormwater Management Facility ("Pond"):

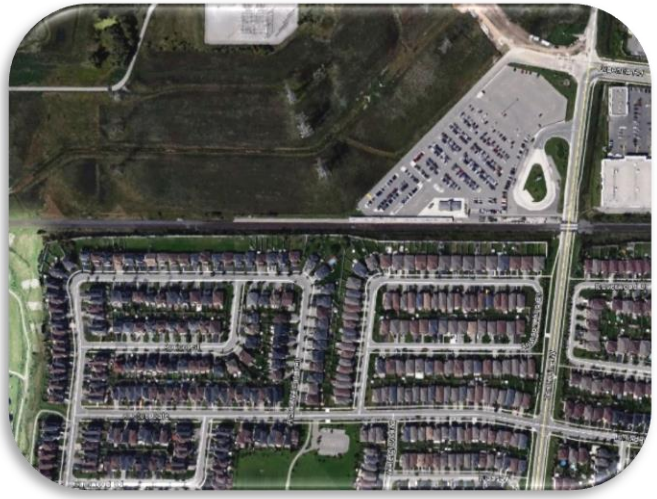
- Creek Vegetation Trimming and Debris Removal
- Sediment and Vegetation Removal from Bridge Crossings and Storm Outfalls
- Creek Inspection Protocol
- Reconfiguration of Osprey Marsh Stormwater Management Pond Outlet

# 6. Summary of Potential Causes

# 6. Summary of Potential Causes

## Changes Since Development of Lisgar District:

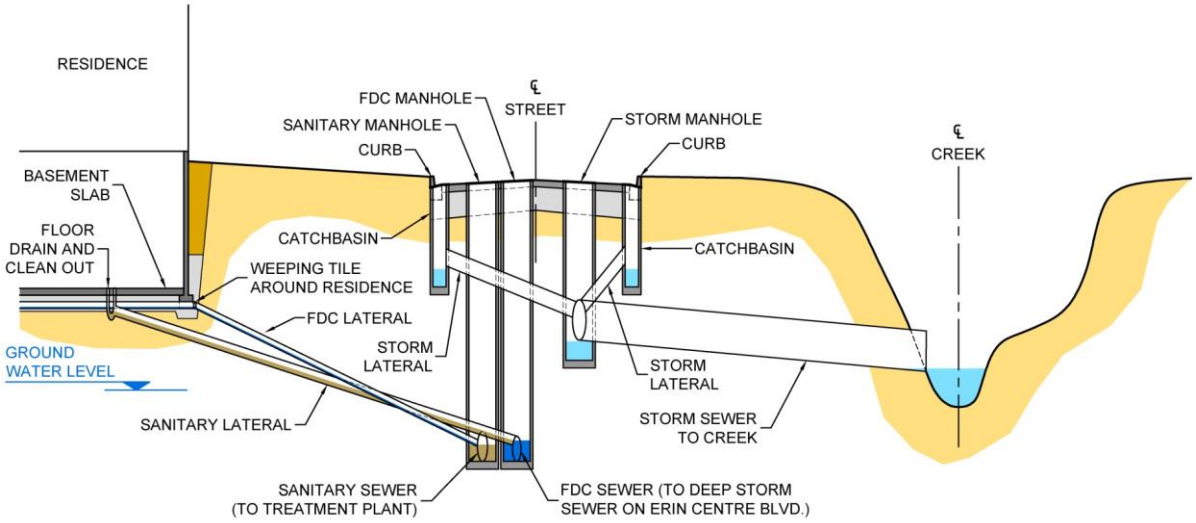
- Climate
- Development
- Creek Block Maturing with Vegetation
- Osprey Marsh Stormwater Management Pond
- Changes to Homes/Properties (lot grades, basement walkouts)
- Aging Basement Walls and Foundations
- Aging Infrastructure



# 6. Summary of Potential Causes

## Other Potential Causes:

- Groundwater levels
- Sanitary Sewer system
- Private Weeper System (cross-connections and weeping tile system condition)
- Stormwater Leakage to Utility Trench




**Cross-connection**

# 6. Summary of Potential Causes

## Other Potential Causes:

- Foundation Drain Collector
  - *a. Maintenance*
  - *b. Design*
  - *c. Hydraulics*
  - *d. Outlet*
  - *e. Depths*
  - *f. Inflow/Infiltration*
  - *g. Construction*

# 7. Study Activities

- *Monitoring*
- *Testing*
- *Analysis*
- *Summary and Conclusions*

# 7. Study Activities

## Monitoring Work:
## Groundwater – *Activities*

- Monitoring wells were installed at four main sites:
    - Black Walnut Trail at Scotch Pine Gate (late 2011);
    - Osprey Boulevard (late 2011);
    - Alderwood Trail (2013); and
    - Pondview Way (2014).

- Two primary types of monitoring wells were installed:
    - In the native (undisturbed) soils; and
    - In the gravel material, found in the utility trench

- Both water level and water temperature were monitored continuously at these sites.

# 7. Study Activities

## Monitoring Work:
## Groundwater - *Findings*

- Groundwater temperatures in the native soils do not vary greatly and are not affected by precipitation events.

- The shallow groundwater levels in the native soils do not increase rapidly during precipitation events

- The permeability (ability to move water) of the granular materials in the utility trench is up to 10 million times greater than the native soil (confirmed and discussed further in the Analysis section)

# 7. Study Activities

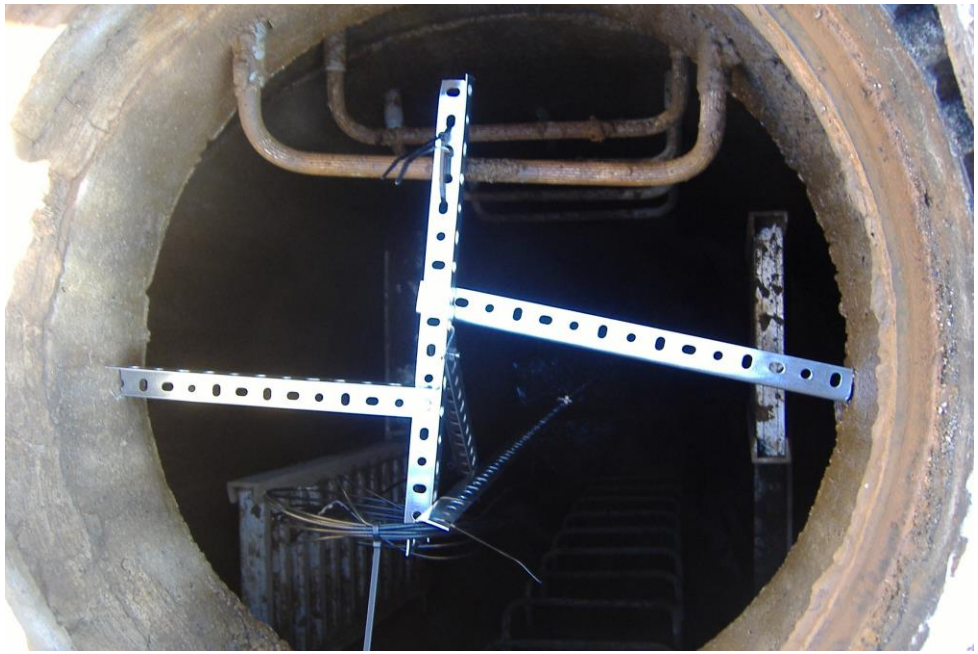
## Monitoring Work:

### FDC and Storm Sewer System - *Activities*

- Water level monitoring gauges were installed to observe how water levels in these systems respond to storm events – also recorded temperature

- A total of 17 water level monitoring gauges were installed within the FDC sewer system across the study area

- Three (3) water level monitoring gauges were installed within the storm sewer system.



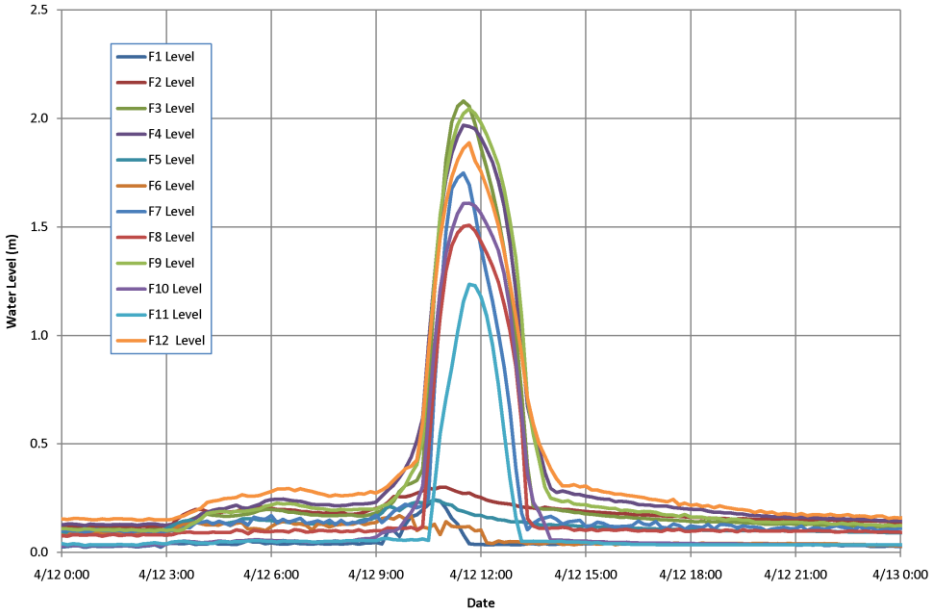
# 7. Study Activities

## Monitoring Work:
## FDC and Storm Sewer System - *Findings*

- The FDC system surcharges rapidly in response to rainfall events - occurs in different locations and amounts depending on the storm event

- Most prevalent along Black Walnut Trail and in the vicinity of Osprey Boulevard

- Strong indication that the excess water is coming from surface water sources rather than groundwater, based on:
  - Speed that FDC water level rises and falls
  - Water temperature signals



# 7. Study Activities

## Monitoring Work:

### Creek Tributary and Stormwater Management Pond – *Activities*

- Water level monitoring gauges were installed and monitored along the tributary of the east branch of Sixteen Mile Creek and within the Osprey Marsh Stormwater Management Pond

- Gauges were installed at five (5) different locations along the creek, as well directly within the pond

- A temporary rainfall gauge was also installed in the study area

# 7. Study Activities

## Monitoring Work:
## Creek Tributary and Stormwater Management Pond - *Findings*

- There is nominal creek flow from the GO Station channel, and no apparent connection between these flows and FDC surcharging

- There is no apparent connection between creek flows and FDC surcharging

- There is no apparent connection between water levels within the Osprey Marsh Stormwater Management Pond and FDC surcharging

GO Station

# 7. Study Activities

## Testing Work:
## Water Quality - *Activities*

- A sampling program was conducted to assess the chemical properties of the water found in the:
    - native soils (i.e. the groundwater);
    - utility trench (i.e. where the municipal services are);
    - creek;
    - Osprey Marsh Stormwater Management Pond; and
    - FDC system.

- Objective to identify any commonalities among the various different water sources

# 7. Study Activities

## Testing Work:
## Water Quality - *Findings*

- The water in the FDC system was found to be salt rich, similar to the utility trench, the tributary and the pond

- The water in the FDC system is therefore similar to surface water, and dissimilar to groundwater

- This similarity is particularly evident in winter conditions (road salt)

# 7. Study Activities

## Testing Work:

### Storm Sewer Leakage Testing – *Activities*

- Undertaken in 2013 at three sites where basement water infiltration occurred in the past

- Intent to confirm whether or not, under high flows, the storm sewer system would be expected to leak and contribute water to the utility trench

- Tests were comprised of:
  - *Blocking the storm sewers and filling them with water to replicate surcharge conditions*
  - *Addition of a safe green fluorescent dye to the storm sewer*
  - *Monitoring of the dye concentrations and water levels in the utility trench, groundwater and FDC system*

# 7. Study Activities

## Testing Work:
## Storm Sewer Leakage Testing - *Findings*

- At all three sites, the storm sewers leaked and at two sites the dye was detected in the FDC after only two hours

- Tests have proven that there is a flow path from the storm sewer to the FDC through the utility trench, with a response time consistent with that observed between 'ideal' storm events and instances of reported basement water infiltration

# 7. Study Activities

## Testing Work:
## Storm Sewer Outfall Collar Testing – *Activities*

- It was speculated that water from the creek or the Osprey Marsh Stormwater Management Pond could possibly move upstream through the storm sewer bedding at outfalls

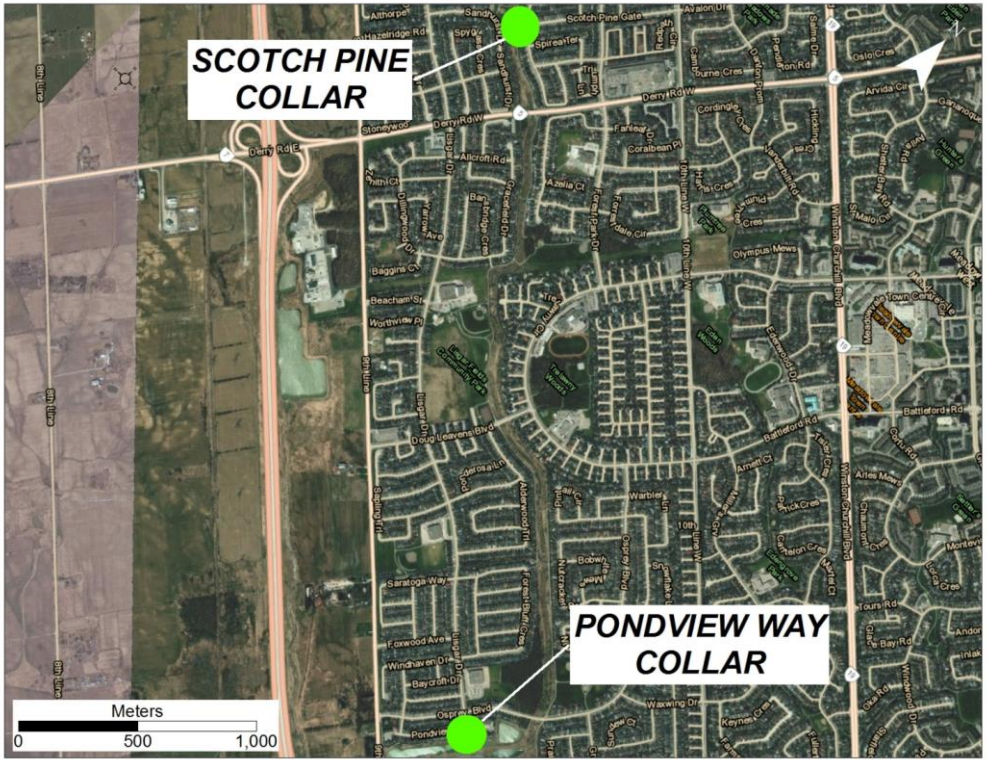
- As a test, impermeable concrete collars were installed in the utility trench near the outfall of the storm sewers at two locations

- These collars were installed with backflow valves that allow water from the utility trench to drain to the creek and pond, but not in the other direction

# 7. Study Activities

## Testing Work:
## Storm Sewer Outfall Collar Testing – *Findings*

- Monitoring is currently underway at both sites to assess the effectiveness of the collar in preventing elevated water levels in the utility trench



# 7. Study Activities

## Analysis Work:

### Groundwater - *Activities*

- Properties of native soils and granular materials measured at the groundwater monitoring sites (estimated using “slug” testing where a volume of water is either quickly added or removed to test response, as well as dye tracer tests and other analyses)

### Groundwater - *Findings*

- As noted earlier, the permeability (ability to move water) of the granular materials in the utility trench is up to 10 million times greater than the native soils providing a ‘perfect’ pathway for water

## Analysis Work:
## Design Check of the FDC System – *Activities*

Three (3) Checks:

i. Comparison of the original number of intended residences to be served by the main FDC sewer system

ii. Comparison of original design sizes and slopes of the FDC sewers with as-constructed characteristics

iii. Verification of the design of the FDC trunk sewer (using original design approach), to determine if there is sufficient available capacity to handle expected flow rates

## Analysis Work:
## Design Check of the FDC System – *Findings*

- Some deficiencies have been identified in the as-constructed design of the FDC trunk sewer system which could impair the conveyance capacity of the FDC system; however none are considered to be the cause of basement water infiltration

- Observed FDC surcharging has been noted in areas which are a considerable distance from areas of identified FDC sewer deficiencies, which further confirms this finding

# 7. Study Activities

## Analysis Work:

## Computer Modelling of the FDC System – *Activities and Findings*

**Q1: How much impact will high water levels at the downstream end of the FDC system (outlet) have on the Lisgar District?**

**A1:** *Results show that high water levels downstream would have little impact on the FDC system performance within the Lisgar District, which further confirms that this is not a primary cause of FDC surcharging, although it may be a very limited contributing factor.*

**Q2: How much potential impact would water draining into basement walkouts be expected to have on the FDC system?**

**A2:** *Results show that based on the number of basement walkouts identified by City staff (and the estimated flows from those walkouts to the foundation drain), walkouts are not the primary cause of FDC surcharging, although they may be a contributing factor at specific locations.*

## Analysis Work:

## Computer Modelling of the FDC System – *Activities and Findings*

**Q3: How much potential impact would storm sewer leakage have on the FDC system?**

**A3:** *Results show that based on an average storm sewer leakage rate (calculated from the findings of the storm sewer leakage tests conducted in 2013), storm sewer leakage is the primary cause of FDC surcharging during storm events.*

**Q4: Are there certain areas within the Lisgar District which contribute higher flows to the FDC system?**

**A4:** *Based on the modelling results for an observed surcharge event in the FDC system along Black Walnut Trail, several areas have been identified as having much higher relative flow contributions to the FDC system. These identified areas are therefore considered a priority for the implementation of mitigation measures*

## Analysis Work:
## Computer Modelling of the FDC System – *Activities and Findings*

### Q5: What measures would be most effective in reducing observed FDC surcharge?

**A5:** *Based on the modelling results for an observed surcharge event, two potential mitigation measures (which have been assessed using the model) have been shown to be effective at reducing FDC surcharge:*

*FDC sewer upgrades - increasing the sizes of the deficient pipes to better carry higher flows and reduce surcharge; and*
*FDC pumping - actively pumping out the FDC during surcharge events to limit the amount of surcharging.*

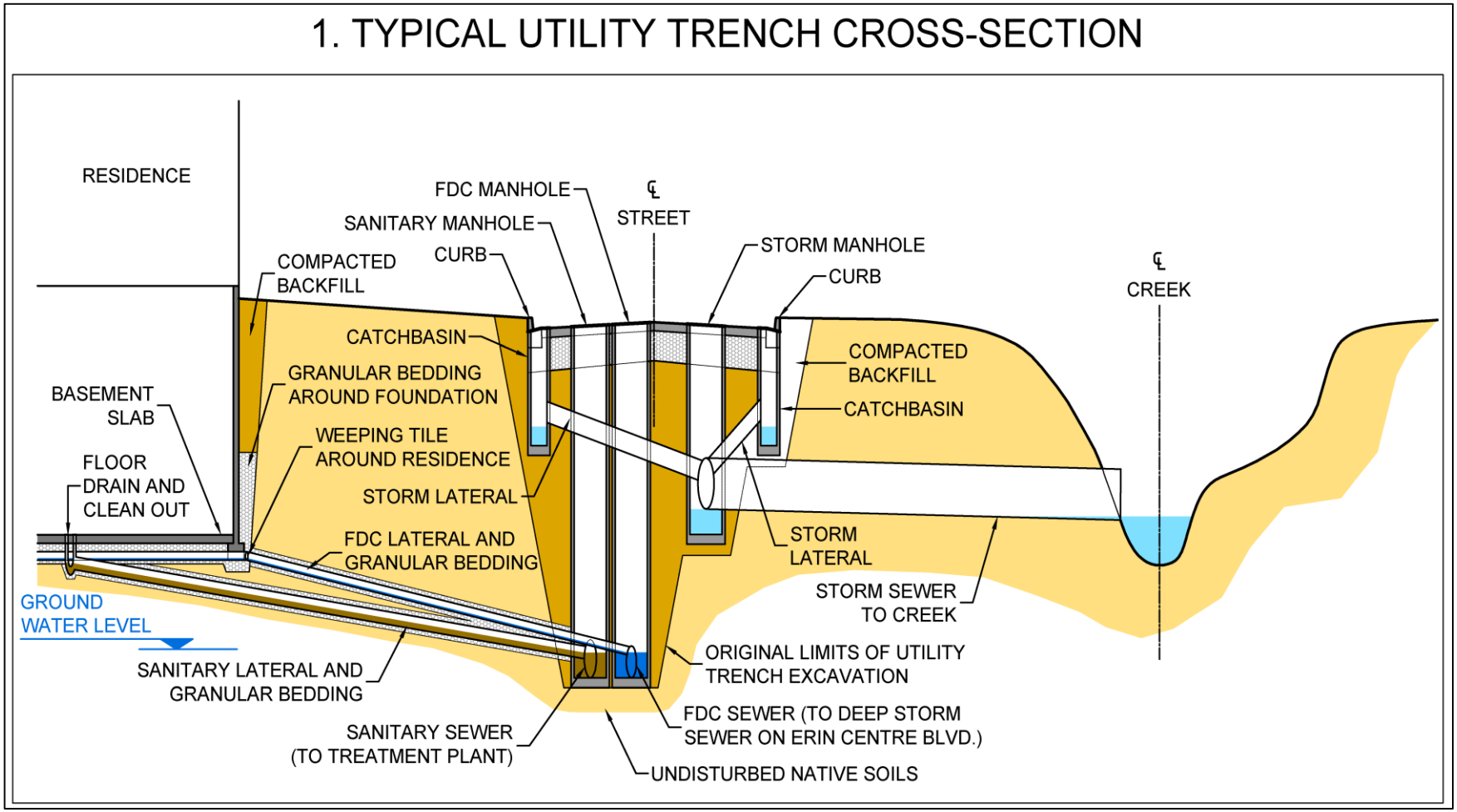
# 7. Study Activities

## Summary and Conclusions:

### Primary Cause – Stormwater to the Utility Trench

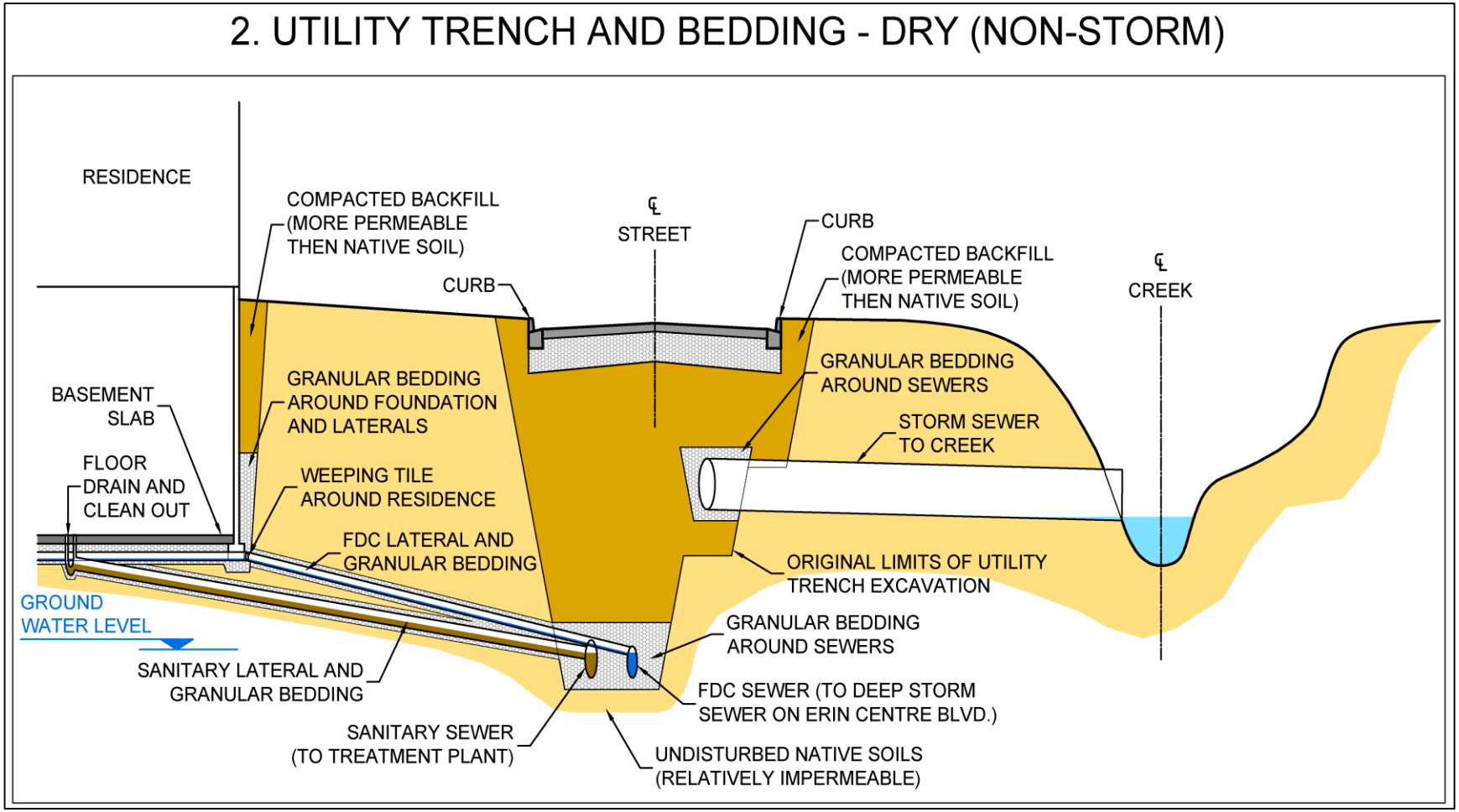
- Leakage from the storm sewer system (which is a normal and expected occurrence), combined with the presence of slow draining native soils (around the utility trench) results in water build-up
- If the build-up of water is significant, it travels up the bedding material around the Foundation Drain Collector (FDC) laterals servicing the homes and into the foundation weeping tiles
- Water then drains directly into the FDC pipes through the weeping tiles which can surcharge (overload) the system
- This condition, in combination with certain storm conditions (preceding rainfall followed by a sufficiently large storm event) and local lot drainage may lead to water around the home's weeping tiles being unable to drain and potentially seeping into the basements of homes.

## Summary and Conclusions:
## Primary Cause – Stormwater to the Utility Trench

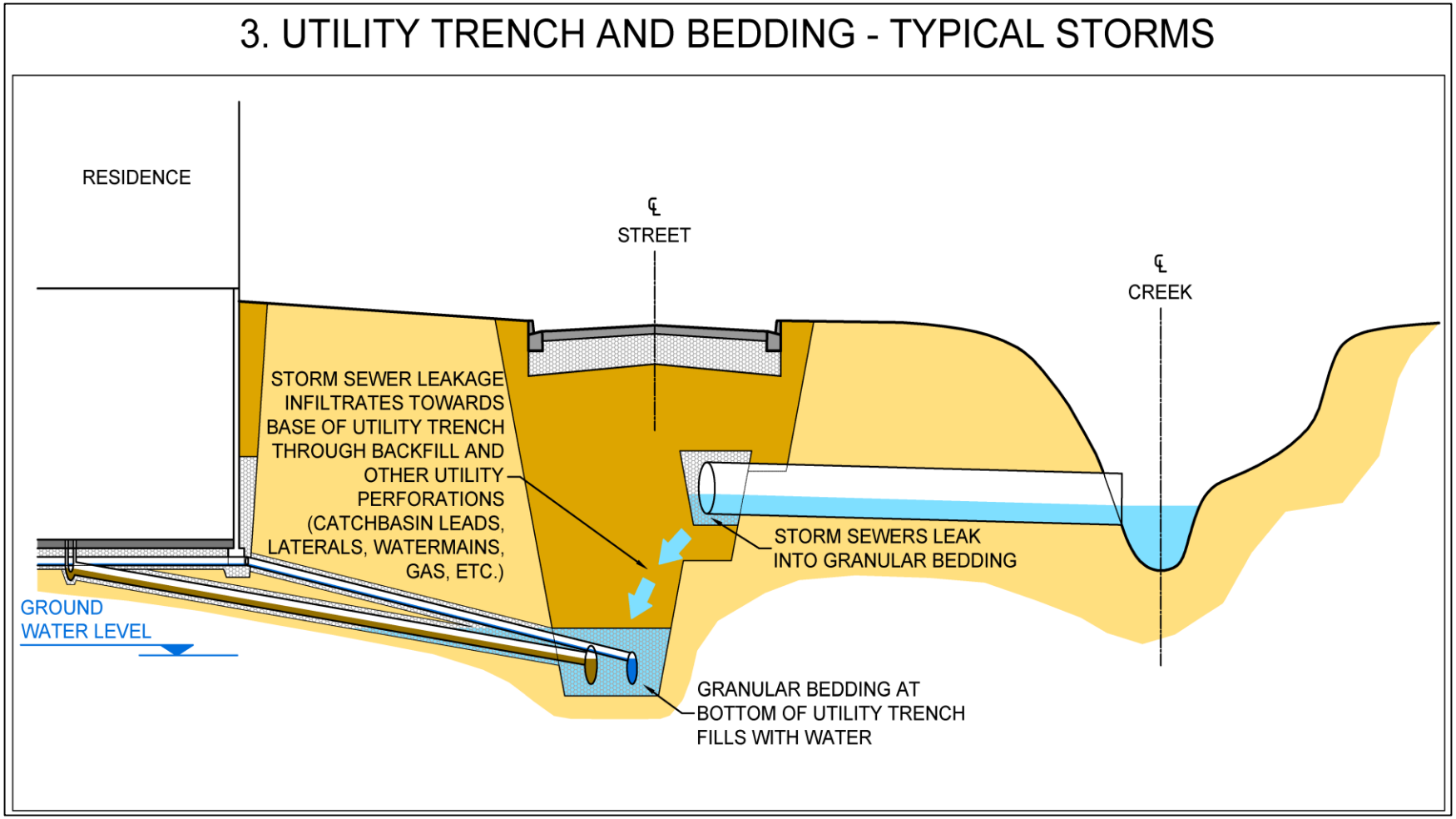


# 7. Study Activities

## Summary and Conclusions:
## Primary Cause – Stormwater to the Utility Trench



## Summary and Conclusions:
## Primary Cause – Stormwater to the Utility Trench



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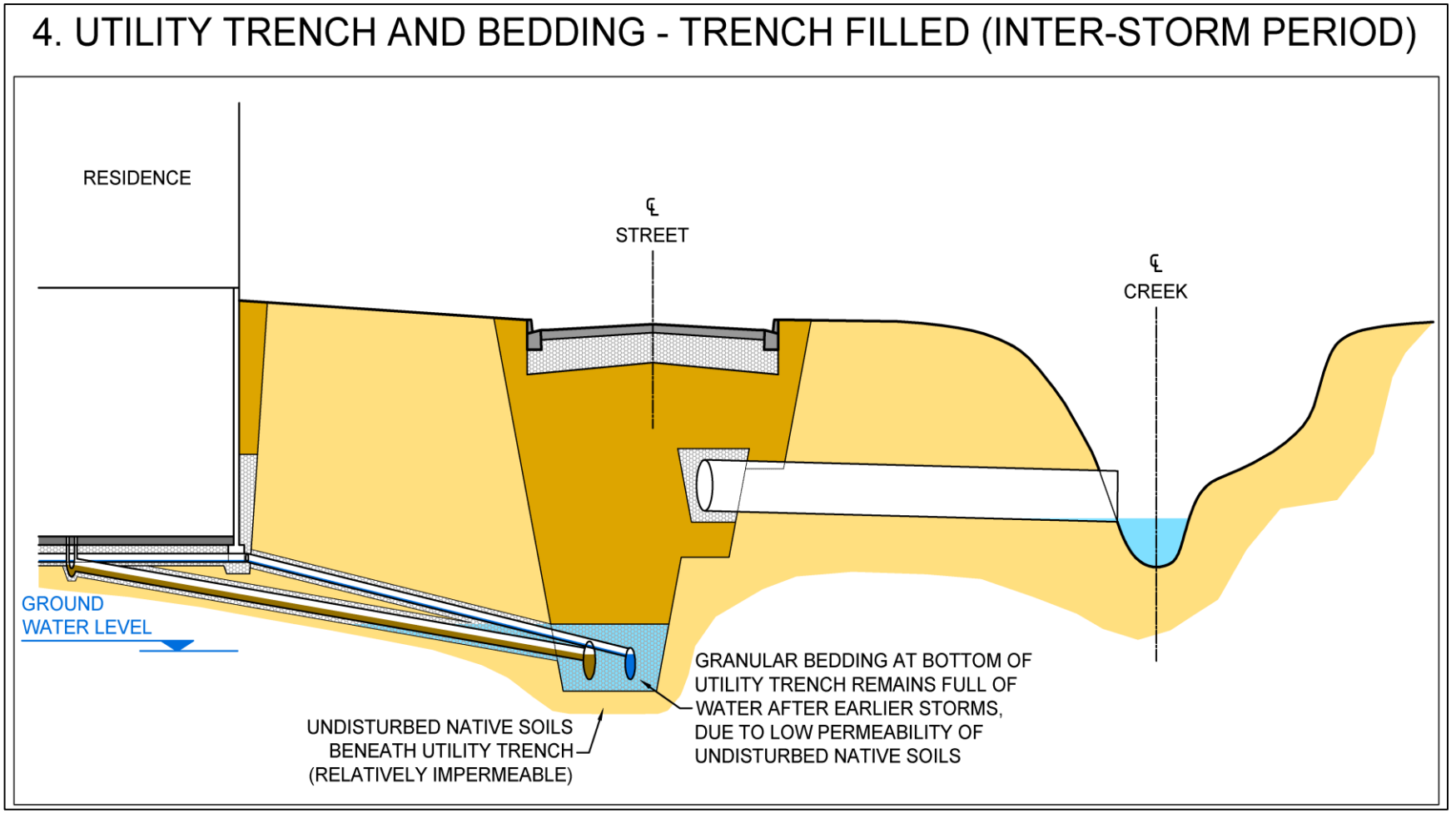
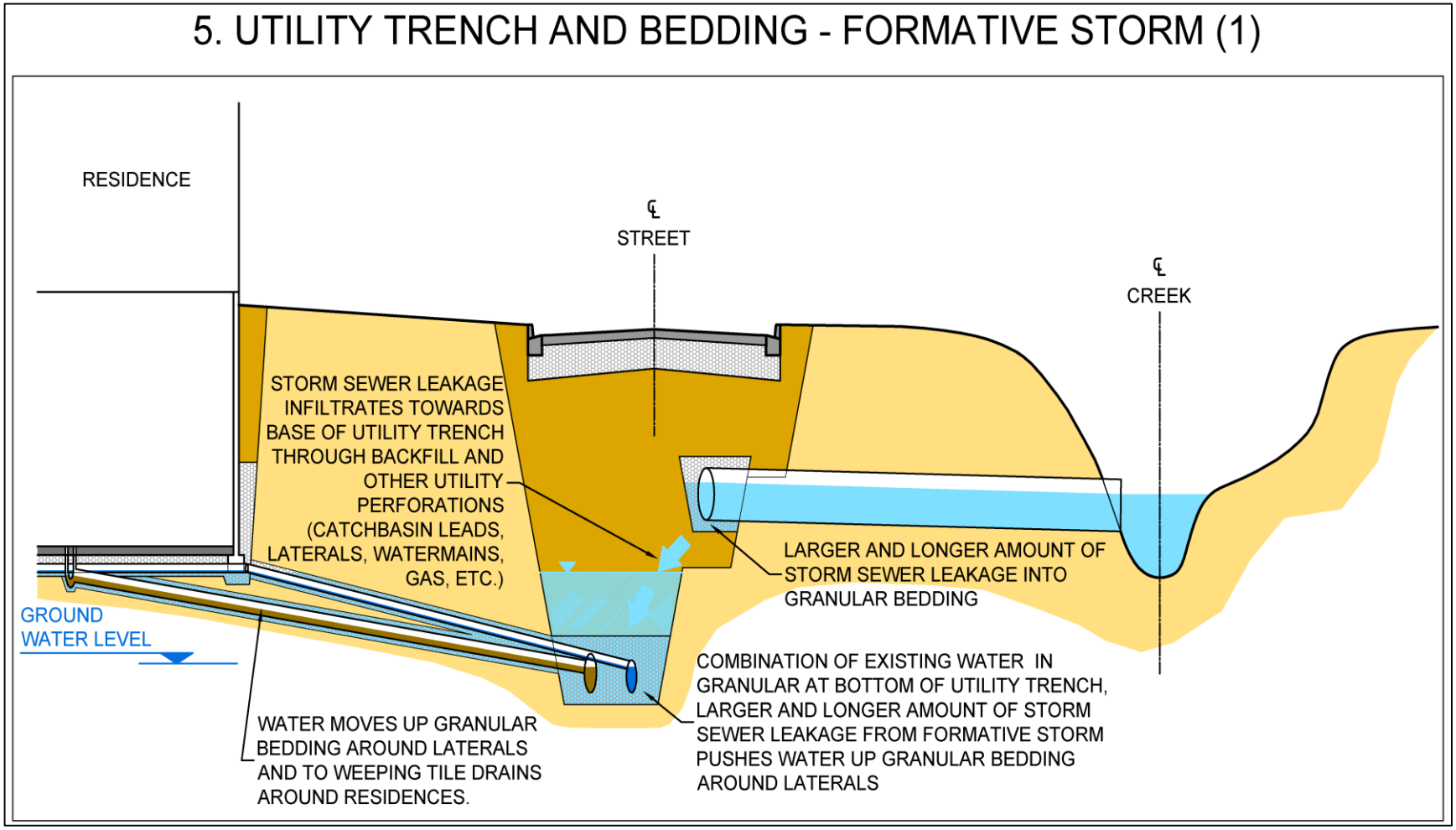
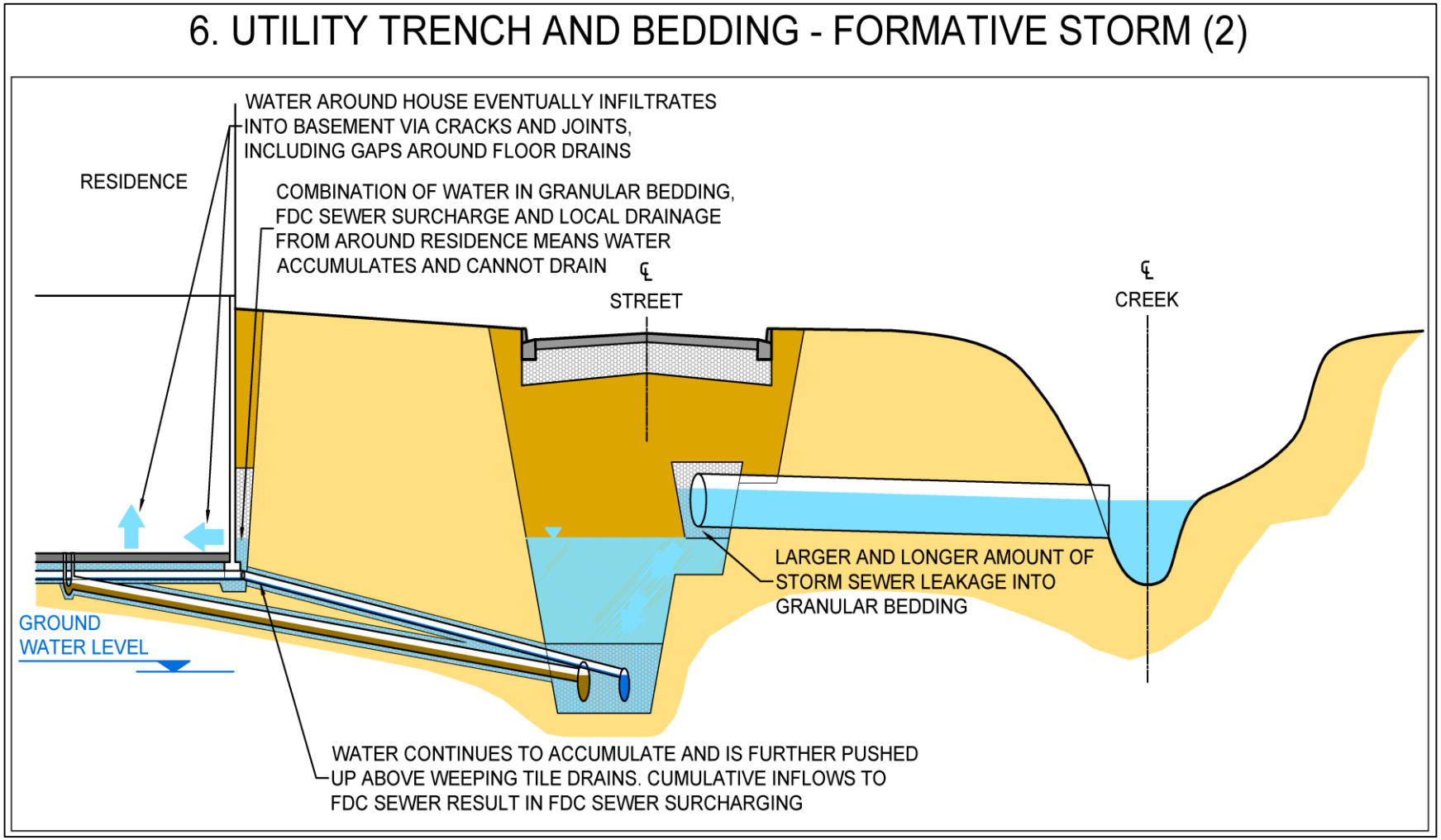


## Summary and Conclusions:
## Primary Cause – Stormwater to the Utility Trench



## Summary and Conclusions:
## Primary Cause – Stormwater to the Utility Trench



# 7. Study Activities

## Summary and Conclusion: Assessment of Potential Factors

| Potential Factor | Level of Influence |
|---|---|
| Stormwater to Utility Trench | Primary Cause |
| FDC and Utility Trench Depths | May increase risk of basement water infiltration at specific locations |
| Groundwater | May contribute additional flows to the FDC and utility trench (Not sufficient to cause problem) |
| Creek Backwater | |
| Osprey Marsh Pond (SWM) Backwater | |
| Basement Walkouts | |
| Inflow/Infiltration to FDC | |
| FDC Hydraulics | May affect conveyance capacity of FDC system (Not sufficient to cause problem) |
| FDC Design | |
| FDC Tailwater | |
| FDC Maintenance | |
| FDC Construction | |
| Cross-Connections | Not Applicable |
| Creek Maintenance | |
| GO Station | |
| Sanitary System | |
| Lot Grading | Insufficient information |
| Basement Construction / Changes | |

# 8. Mitigation Plan

# 8. Mitigation Plan

## Long List of Potential Alternatives:

**Mitigation measures carried forward for further consideration:**

1. *Strategic Lining of Storm Sewers*
2. *Construction of a Utility Trench Dewatering System*
3. *Construction of FDC Pumping Stations*
4. *FDC Sewer Upgrades*
5. *Sump Pumps*

**Mitigation measures screened from any further consideration:**

6. *FDC Backflow Preventers*
7. *Storage System*
8. *Storm Sewer Outfall Collars (pending results of monitoring)*
9. *Basement Walkout Covers*
10. *New FDC Outlet*
11. *Creek Remediation*

# 8. Mitigation Plan

## Prioritized Action Plan:

These measures are recommended as the highest priorities for the City:

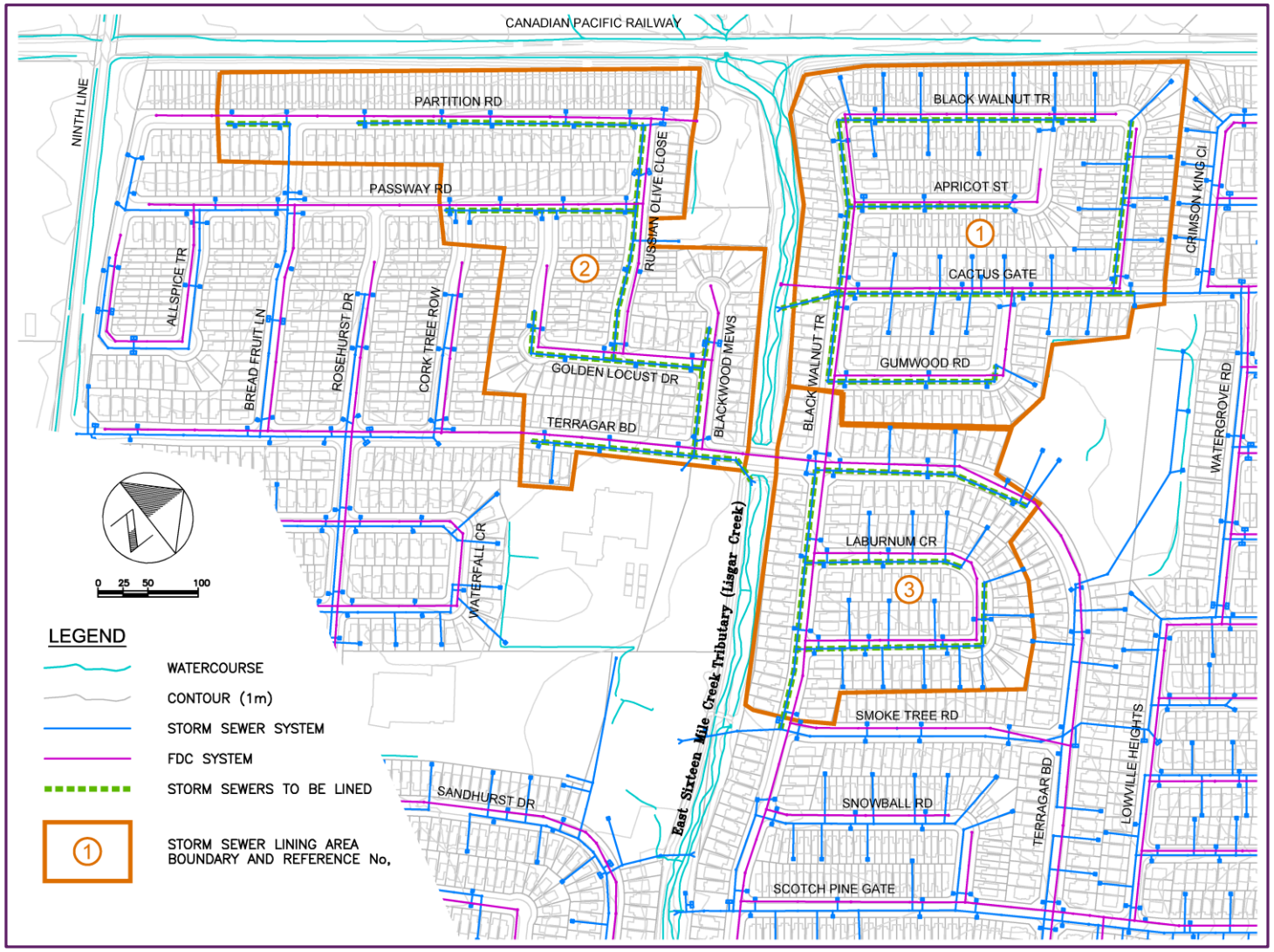
a) *Strategic lining of priority storm sewers to minimize leakage (capital cost estimated to be $8M - $9M)*
b) *Construction of a utility trench dewatering system.(capital cost estimated to be $3M - $4M)*
c) *Undertake additional monitoring to assess effectiveness of a) and b) (approximately $100,000)*

Other recommended actions may be staged over time, conditional on the results of the above, including:

a) *Building permanent FDC pumping stations for high flows (capital cost estimated to be $6M - $7M)*
b) *Replace deficient FDC pipe lengths when they reach the end of their engineered lifespan (capital cost estimated to be $2M - $3M)*

# 8. Mitigation Plan

## Black Walnut Trail area – *Highest Priority*



# 8. Mitigation Plan

## Prioritized Action Plan:

- It is also suggested that residents who qualify for the City's Lisgar District Sump Pump Subsidy Program take advantage of this program.
- To date, only 3 residents have applied to the program.
- The City will subsidize homeowners who install a sump pump up to 50% of the cost of the installation, to a maximum of $3,000
- Program details are available at: *http://www.mississauga.ca/portal/residents/lisgarsubsidy/*
- *Applications forms are available here tonight*

# 9. Recommended Next Steps

# 9. Recommended Next Steps

- A Corporate Report will be taken to General Committee on April 8th 2015 with recommendations planned for 2015 for General Committee's consideration

- Other potential mitigation measures may be considered as part of the 2016-2018 Business Planning process

# 10. Summary Report

# 10. Summary Report

- A copy of the Summary Report and tonight's presentation will be available tomorrow on the City's Lisgar Basement Water Infiltration Investigation webpage at: *http://www.mississauga.ca/portal/residents/lisgarinvestigation/*

# Appendix B
# Stage 1 Archaeological Assessment

# Original Report:
# Stage 1 Archaeological Assessment

*Lisgar District Stormwater Pumping Station Municipal Class Environmental Assessment*
*Part Lots 6 to 12, Concession 10, Geographic Township of Trafalgar, Halton County, now City of Mississauga, Ontario*
*Project # WW21011023*

*Archaeological Consulting License #P362 (Popkin)*
*PIF # P362-0318-2021 (Stage 1)*

November 1, 2021

**Prepared for:**
*City of Mississauga*
*300 City Centre Drive, Mississauga, ON L5B 3C1*

wood.

# Stage 1 Archaeological Assessment

*Lisgar District Stormwater Pumping Station Municipal Class Environmental Assessment*
*Part Lots 6 to 12, Concession 10, Geographic Township of Trafalgar, Halton County, now City of Mississauga, Ontario*
*Project # WW21011023*

PREPARED FOR:
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PREPARED BY:
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November 1, 2021

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# Executive Summary

Wood Environment & Infrastructure ("Wood") was retained by the City of Mississauga (the "Client") to conduct a Stage 1 archaeological assessment in support of a Municipal Class Environmental Assessment (EA) to prepare detailed engineering design and associated construction drawings for a stormwater pumping station to be located in the Lisgar District, City of Mississauga, Ontario. The EA will determine the number, preferred locations and types of pumping station within the Lisgar District with the objective to reduce the basement water infiltration.

Although the full EA study area is bounded by the CP rail line on the north, Tenth Line on the east, Britannia Road West on the south and Ninth Line on the west, the "Study Area" for the Stage 1 archaeological assessment is restricted to 14 potential pumping station locations along the path of the trunk sewer pipe. Together these locations cover approximately 9.9 hectares of land that was historically situated on Part of Lots 6 to 12, Concession 10 in the Geographic Township of Trafalgar, Halton County. A development plan appears as Figure 4 in Appendix A.

The Stage 1 archaeological assessment was carried out in accordance with the Ontario Ministry of Heritage, Sport, Tourism and Culture Industries ("MHSTCI") 2011 *Standards and Guidelines for Consultant Archaeologists* (MHSTCI 2011) under an Ontario Professional License to Conduct Archaeological Fieldwork (P362) held by Peter Popkin, Associate Archaeologist at Wood. The project information was acknowledged by the MHSTCI on 13 August 2021 with the issuance of PIF number P362-0318-2021 (Stage 1).

A property assessment of the Study Area was directed and conducted by Chelsea Dickinson (R1194) of Wood on 13 August 2021. The weather during the assessment was sunny with some overcast periods and this weather did not impede the inspection in any way.

The Stage 1 archaeological assessment indicated that the Study Area has general archaeological potential and warrants Stage 2 property assessment for the following reasons: 1) natural water sources are located within 300 metres of the Study Area, including Sixteen Mile Creek; 2) as shown in the 1858 and 1877 historical atlas mapping, the Study Area is located within 100 metres of a number of farmsteads and historic roads; and, 3) 40 registered sites are located within 1 km of the Study Area, eight of which were located within 300 m of the Study Area.

However, despite the general archaeological potential of the Study Area, the background research associated with the Stage 1 archaeological assessment determined that 9.9 ha (100%) of the Study Area is disturbed and does not require Stage 2 archaeological assessment (Appendix B: Plates 1-7). This includes 2.6 ha of land which were previously assessed by ASI in 1989 prior to the implementation of the *Standards and Guidelines for Consultant Archaeologists* (MHSTCI 2011) and which were visually confirmed as disturbed during the property inspection (Appendix A: Figure 8A and Figure 8B).

Based on the results of the Stage 1 archaeological assessment of the Study Area, the following recommendation is made, subject to the conditions outlined below and in Section 5.0:

1. The entirety of the Study Area, approximately 9.9 ha, has low archaeological potential due to extensive and intensive disturbance, and therefore requires no further archaeological assessment (Appendix A: Figure 8A and Figure 8B).

**The above recommendation is subject to Ministry of Heritage, Sport, Tourism and Culture Industries' approval, and it is an offence to alter any of portion of the Study Area without Ministry**

**of Heritage, Sport, Tourism and Culture Industries' concurrence.**

No development or site alteration (including, but not limited to, grading, excavation or the placement of fill that would change the landform characteristics) is permitted on lands containing archaeological resources or areas of archaeological potential unless significant archaeological resources have been conserved (Government of Ontario 2020:31).

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**Appendix C: Photographs**
**Appendix D: Assessor Qualifications**
**Appendix E: Limitations**

## Project Personnel

| | |
|---|---|
| Project Director: | Peter Popkin, Ph.D., CAHP, MCIfA (P362) |
| Project Manager: | Matt Senior, M.A.Sc., P.Eng. |
| Field Director: | Chelsea Dickinson, B.A. (R1194) |
| Report Preparation: | Kristy O'Neal, M.A. (P066)<br>Chelsea Dickinson, B.A. |
| Graphics: | Stephen Labute, CAD Technician |
| Report Reviewers: | Peter Popkin, Ph.D., CAHP, MCIfA<br>Henry Cary, Ph.D., CAHP, RPA (P327) |

# 1.0 Section 1 – Project Context

## 1.1 Development Context

Wood Environment & Infrastructure ("Wood") was retained by the City of Mississauga (the "Client") to conduct a Stage 1 archaeological assessment in support of a Municipal Class Environmental Assessment (EA) to prepare detailed engineering design and associated construction drawings for a stormwater pumping station to be located in the Lisgar District, City of Mississauga, Ontario. The EA will determine the number, preferred locations and types of pumping station within the Lisgar District with the objective to reduce the basement water infiltration.

Although the full EA study area is bounded by the CP rail line on the north, Tenth Line on the east, Britannia Road West on the south and Ninth Line on the west, the "Study Area" for the Stage 1 archaeological assessment is restricted to 14 potential pumping station locations along the path of the trunk sewer pipe. Together these locations cover approximately 9.9 hectares ("ha") of land that was historically situated on Part of Lots 6 to 12, Concession 10 in the Geographic Township of Trafalgar, Halton County. A development plan appears as Figure 4 in Appendix A.

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This report presents the results of the Stage 1 archaeological assessment and makes pertinent recommendations.

## 1.2 Scope of Work

A Stage 1 archaeological assessment is a systematic qualitative process executed to assess the archaeological potential of a Study Area based on its historical use and its potential for early Euro-Canadian (early settler) and pre-contact and historic Indigenous occupation. The objectives of a Stage 1 archaeological assessment are: 1) to provide information about the Study Area's geography, history, previous archaeological fieldwork, and current land conditions; 2) to evaluate the Study Area's archaeological potential in detail and determine if a Stage 2 property assessment for all or parts of the Study Area should be recommended; and 3) to recommend appropriate strategies for Stage 2 property assessment if warranted.

The scope of work for the Stage 1 background study consisted of the following tasks:

- Contacting the MHSTCI to determine if recorded archaeological sites exist in the vicinity (1 kilometre ["km'"] radius) of the Study Area, through a search of the *Ontario Archaeological Sites Database* maintained by that Ministry.
- Contacting the MHSTCI to determine if there are any known reports of previous archaeological field work within the Study Area or within a radius of 50 metres ("m") around the Study Area, through a search of the *Ontario Public Register of Archaeological Reports* maintained by that Ministry.
- Conducting a desktop review of the Study Area's physical setting to determine its potential for

both pre-contact and post-contact period human occupation, including its topography, hydrology, soils, and proximity to important resources and historical transportation routes and settlements.

- Conducting a review of the potential for post-contact period human occupation of the Study Area as documented in historical atlases and other archival sources.
- A visual inspection of the Study Area to gather first-hand and current evidence of its physical setting, and to aid in delineating areas where archaeological potential may have been impacted or removed by recent land-use practices.
- Formulate appropriate field-testing strategies for areas of general archaeological potential within the Study Area.
- Preparing a Stage 1 report of findings with recommendations regarding the need for further archaeological work within the Study Area if deemed necessary.

# 2.0 Stage 1 Background Study

As part of the Stage 1 archaeological assessment, Wood queried the *Ontario Archaeological Sites Database*, maintained by the MHSTCI to determine if archaeological sites have been registered within 1 km of the Study Area (Section 2.1.1) (MHSTCI 2020a). The *Ontario Public Register of Archaeological Reports* was also queried to determine whether previous archaeological assessments have been carried out within the Study Area, or within a 50-m radius of the Study Area (Section 2.1.2) (MHSTCI 2020b). Secondly, the principal determinants of archaeological potential, namely proximity to water, topography, drainage, soils, and proximity to important resources and historical transportation routes and settlements, were examined to evaluate the Study Area's general archaeological potential (Sections 2.1, 2.1.3, 2.2, and 2.2.1). Thirdly, the specific potential for post-contact period archaeological resources was assessed through an examination of available historical maps and other archival sources (Section 2.2). And fourthly, a property inspection was conducted to confirm the desktop evaluation of archaeological potential and identify areas where recent land use has impacted or removed that potential.

## 2.1 Archaeological Context

### 2.1.1 Registered Archaeological Sites

In Ontario, information concerning archaeology sites is stored in the *Ontario Archaeological Sites Database* maintained by the MHSTCI. This database contains archaeological sites registered within the Borden system (Borden 1952). Under the Borden system, Canada has been divided into grid blocks based on longitude and latitude. A Borden block is approximately 13 km east to west, and approximately 18.5 km north to south. Each Borden block is referred to by a four-letter designation and sites located within the block are numbered sequentially as they are found. The Study Area is located within the *AjGw* Borden block. A search of the *Ontario Archaeological Sites Database* on 30 August 2021, indicated that there are 80 archaeological sites registered within a 1 km radius of the Study Area (Table 1). However, based on independent verification of site distance to the Study Area, 40 of the archaeological sites are confirmed to be located more than 1 km from the study area. Of the 40 registered archaeological sites located within 1 km of the Study Area, nine are located within 300 m of the Study Area (Table 1).

Table 1: Registered Archaeological Sites within 1 km Radius of the Study Area

| Borden Number | Site Name | Cultural Affiliation | Site Type | Distance from Study Area | Development Review Status |
|---|---|---|---|---|---|
| AjGw-50 | Nursery 1 | - | - | >1 km | - |
| AjGw-56 | - | - | - | >1 km | - |
| AjGw-60 | - | - | - | >1 km | - |
| AjGw-61 | Ronald Plant | Middle Archaic | Camp/Campsite | 935 m | - |
| AjGw-62 | Poor | Pre-contact (Indigenous) | Findspot | 320 m | - |
| AjGw-63 | Junction | Pre-contact (Indigenous) | Camp/Campsite | >1 km | - |

| Table 1: Registered Archaeological Sites within 1 km Radius of the Study Area | | | | | |
|---|---|---|---|---|---|
| Borden Number | Site Name | Cultural Affiliation | Site Type | Distance from Study Area | Development Review Status |
| AjGw-71 | Mullett Ponds | Early Woodland, Middle Woodland | Village | >1 km | - |
| AjGw-159 | Thomas Robson | Post-Contact | Homestead | >1 km | No Further CHVI |
| AjGw-195 | Venturon 1 | Early Archaic, Late Archaic | Camp/Campsite | 130 m | - |
| AjGw-196 | Venturon 2 | Pre-Contact (Indigenous) | Camp/Campsite | 150 m | - |
| AjGw-197 | Venturon 3 | Pre-contact (Indigenous) | Unknown | 260 m | - |
| AjGw-198 | Venturon 4 | Euro-Canadian | Homestead | 360 m | - |
| AjGw-199 | Venturon 5 | Pre-contact (Indigenous) | Findspot | 405 m | - |
| AjGw-205 | New Parcel | Iroquoian | Camp/Campsite | >1 km | - |
| AjGw-206 | Venturon 6 | Pre-contact (Indigenous) | Camp/Campsite | 195 m | - |
| AjGw-207 | Venturon 7 | Late Archaic | Findspot | 200 m | - |
| AjGw-209 | Markle | Late Woodland | Findspot | 765 m | - |
| AjGw-210 | Conkright | Middle Archaic | Findspot | 530 m | - |
| AjGw-211 | Chew | Euro-Canadian | Homestead | 775 m | - |
| AjGw-223 | Break | Late Archaic | Findspot | 568 m | - |
| AjGw-224 | Wheel | Middle Woodland | Findspot | 555 m | - |
| AjGw-225 | Line 8 | Pre-contact (Indigenous) | Findspot | 785 m | - |
| AjGw-226 | Meadowvale TS | Pre-contact (Indigenous) | Findspot | 255 m | - |
| AjGw-230 | Terragar | Pre-contact (Indigenous) | Findspot | 440 m | - |
| AjGw-231 | Derry Road | Pre-contact (Indigenous) | Findspot | 330 m | - |
| AjGw-248 | Mullet Creek | Pre-contact (Indigenous) | Camp/Campsite | >1 km | - |
| AjGw-249 | Brackenreed Homestead | Euro-Canadian | Homestead | >1 km | - |

| Table 1: Registered Archaeological Sites within 1 km Radius of the Study Area | | | | | |
|---|---|---|---|---|---|
| Borden Number | Site Name | Cultural Affiliation | Site Type | Distance from Study Area | Development Review Status |
| AjGw-252 | New Connection Methodist Church | Euro-Canadian | Building | 710 m | - |
| AjGw-261 | Muddysauga | Post-Contact (Indigenous), Pre-contact (Euro-Canadian) | Camp/Campsite, homestead | >1 km | - |
| AjGw-264 | Hall I | Post-Contact | Building, Outbuilding | >1 km | - |
| AjGw-270 | Boot Sucker | Pre-contact (Indigenous) | Camp/Campsite | 810 m | - |
| AjGw-272 | - | Pre-contact (Indigenous) | Camp/Campsite | 950 m | - |
| AjGw-273 | - | Pre-contact (Indigenous) | Camp/Campsite | >1 km | - |
| AjGw-274 | Blue Moon | Middle Woodland | Camp/Campsite | 960 m | - |
| AjGw-275 | - | Pre-contact (Indigenous) | Camp/Campsite | 905 m | - |
| AjGw-277 | - | Middle Archaic | Findspot | 865 m | - |
| AjGw-278 | - | Pre-contact (Indigenous) | Camp/Campsite | 668 m | - |
| AjGw-279 | - | Pre-contact (Indigenous) | Camp/Campsite | >1 km | - |
| AjGw-281 | Herrnberger | Middle Woodland | Findspot | >1 km | - |
| AjGw-282 | Evans | Pre-contact (Indigenous) | Camp/Campsite | >1 km | - |
| AjGw-283 | Barrington | Late Archaic | Camp/Campsite | >1 km | - |
| AjGw-285 | Britanny | Late Archaic | Findspot | >1 km | - |
| AjGw-286 | - | Euro-Canadian | Homestead | 420 m | - |
| AjGw-287 | - | Pre-contact | Findspot | 545 m | - |
| AjGw-288 | - | - | - | 585 m | - |
| AjGw-299 | Morrow | Euro-Canadian | Homestead | 85 m | - |
| AjGw-318 | Pepperglen | Euro-Canadian | Homestead | 250 m | - |

| Table 1: Registered Archaeological Sites within 1 km Radius of the Study Area | | | | | |
|---|---|---|---|---|---|
| Borden Number | Site Name | Cultural Affiliation | Site Type | Distance from Study Area | Development Review Status |
| AjGw-320 | Hall II | Euro-Canadian | Privy, homestead, Midden | >1 km | - |
| AjGw-321 | Gruehl I | Pre-contact (Indigenous) | Camp/Campsite | >1 km | - |
| AjGw-322 | Gruehl II | Pre-contact (Indigenous) | Scatter | >1 km | - |
| AjGw-323 | Gruelh III | Late Archaic | Findspot | >1 km | - |
| AjGw-392 | York I | - | - | >1 km | - |
| AjGw-393 | York II | - | - | >1 km | - |
| AjGw-431 | - | - | - | 675 m | - |
| AjGw-446 | Location 4 | - | - | >1 km | - |
| AjGw-447 | Renaissance Site | Woodland | Camp/Campsite | >1 km | No Further CHVI |
| AjGw-448 | - | Euro-Canadian | House | >1 km | - |
| AjGw-449 | - | Euro-Canadian | House | >1 km | - |
| AjGw-450 | - | Pre-contact (Indigenous) | Camp/Campsite | >1 km | - |
| AjGw-451 | - | Late Archaic | Findspot | >1 km | - |
| AjGw-453 | - | Middle Archaic | Findspot | 365 m | - |
| AjGw-454 | - | Other | Findspot _ | 645 m | - |
| AjGw-468 | - | Late Archaic | Findspot | 920 m | - |
| AjGw-504 | Kennedy site | Post-Contact | Homestead | 505 m | - |
| AjGw-520 | Parkway 1 | Archaic, Early, Post-Contact | Refuse deposit, Scatter | >1 km | No Further CHVI |
| AjGw-521 | Parkway 2 | Early Archaic | Scatter | >1 km | No Further CHVI |
| AjGw-527 | Parkway 3 | - | - | >1 km | |
| AjGw-528 | Parkway 4 | - | - | >1 km | |
| AjGw-529 | Parkway 5 | - | - | >1 km | |
| AjGw-530 | Parkway 6 | Late Archaic | - | >1 km | |
| AjGw-537 | IF # 3 | Early Woodland | Findspot | >1 km | No Further CHVI |
| AjGw-540 | Parkway West Location 1 | Pre-contact | Camp/Campsite | >1 km | Further CHVI |
| AjGw-559 | Douglas | Euro-Canadian | Homestead | 650 m | No Further CHVI |

| Table 1: Registered Archaeological Sites within 1 km Radius of the Study Area | | | | | |
|---|---|---|---|---|---|
| Borden Number | Site Name | Cultural Affiliation | Site Type | Distance from Study Area | Development Review Status |
| AjGw-560 | - | Late Archaic | Findspot | 500 m | No Further CHVI |
| AjGw-566 | H1 | Euro-Canadian | Homestead | >1 km | Further CHVI |
| AjGw-576 | H1 | Euro-Canadian | Refuse Pit | >1 km | No Further CHVI |
| AjGw-581 | - | Euro-Canadian | Cemetery, Church/Chapel | >1 km | Further CHVI |
| AjGw-624 | McGregor Site | Post-Contact | Agricultural, Homestead | 370 m | No Further CHVI |
| AjGw-625 | - | Early Woodland | Findspot | 290 m | No Further CHVI |
| AjGw-665 | | Post-Contact | Unknown | 800 m | No Further CHVI |

- Archaeological Site AjGw-195 (Venturon 1) is located approximately 130 m to the north of the Study Area. This is an Early/Late Archaic site that yielded 37 artifacts during the surface scatter collection. A total of five test units were excavated which yielded an additional 3 artifacts. However, no further work was recommended (MHSTCI 2021a).
- Archaeological Site AjGw-196 (Venturon 2) is located approximately 150 m to the north of the Study Area. This is a pre-contact Indigenous site that yielded 39 artifacts from 3 surface collections however no further work was recommended (MHSTCI 2021a).
- Archaeological Site AjGw-197 (Venturon 3) is located approximately 260 m to the north of the Study Area. This is a pre-contact Indigenous site that yielded four lithic artifacts however no further work was recommended (MHSTCI 2021a).
- Archaeological Site AjGw-206 (Venturon 6) is a pre-contact Indigenous site located approximately 150 m to the north of the Study Area. The *Ontario Archaeological Sites Database* identifies the site as a findspot but provides no further information about the recovered artifact and/or field methodologies. No further work was recommended for this site (MHSTCI 2021a).
- Archaeological Site AjGw-207 (Venturon 7) is a Late Archaic site located approximately 200 m to the north of the Study Area. The *Ontario Archaeological Sites Database* identifies the site as a find spot but provides no further information about the recovered artifact and/or field methodologies. No further work was recommended for this site (MHSTCI 2021a).
- Archaeological Site AjGw-226 (Meadowvale TS) is a pre-contact Indigenous site located approximately 225 m to the north of the Study Area. The *Ontario Archaeological Sites Database* identifies the site as a findspot that includes a single projectile-biface tip.
- Archaeological Site AjGw-299 (Morrow) is located approximately 85 m to the north of the Study Area. This is a Euro-Canadian Homestead which was assessed in 1998. The site consisted of a 25 m x 25 m surface scatter of Euro-Canadian artifacts which was limited in 2001 to a 15 m x 10 m surface scatter (L.R. Parker 2001a; MHSTCI 2021a). The plough zone was mechanically removed,

and all subsurface features were mapped (L.R. Parker 2001b; MHSTCI 2021a). No further work was recommended for this site (MHSTCI 2021a).

- Archaeological Site AjGw-318 (Pepperglen) is a Post Contact site located approximately 250 m to the northeast of the Study Area. This site was identified during a Stage 2 pedestrian survey that yielded 133 artifacts in a 22.5 m x 21 m area. An additional 116 artifacts in 16, 1-m test units were identified during the Stage 3 assessment and an additional 3 artifacts from 2 possible features were recovered during the Stage 4 excavations, which included the mechanical topsoil stripping and subsequent mapping of potential features. No further work was recommended (MHSTCI 2021a).
- Archaeological Site AjGw-625 is an Early Woodland period site located approximately 290 m to the west of the Study Area. This site was identified during a Stage 2 pedestrian survey that yielded an isolated Early Woodland Meadowood projectile point. Due to the isolated nature of the findspot no further work was recommended (MHSTCI 2021a).

### 2.1.2 History of Archaeological Investigations

Wood completed a search for archaeological reports within 50 m of the Study Area within the *Ontario Register of Archaeological Reports* administered by the MHSTCI on 3 September 2021. Based on this search (by address, lot and concession, and above-mentioned archaeological sites), two archaeological assessment reports detailing archaeological work conducted within the Study Area, or within 50 m of the Study Area, have been entered into the *Ontario Register of Archaeological Reports* (Appendix A: Figure 5A-Figure 5B). A third archaeological assessment report is listed below (Parker 2001b) featuring work done on the Morrow site (AjGw-299) which is located within an assessment area that is within 50 m of the Study Area, but which is itself located approximately 85 m north of the Study Area.

#### 2.1.2.1 Reports Documenting Archaeological Assessments Within the Study Area

- *An Archaeological Resource Assessment of Proposed Subdivision (21T-87053-M), Part of Lots 9 & 10, Concession 10 N.S., City of Mississauga* Prepared by Archaeological Services Inc. ("ASI"), September 1989. File No. 531-6396 (ASI 1989). License #89-130B.

In 1989 ASI was retained by Venturon Development Corporation of Toronto Ontario to conduct an archaeological resources assessment in advance of a proposed subdivision development on approximately 60 hectares on Part of Lots 9 and 10, Concession 10 N.S. in the City of Mississauga. The archaeological resource assessment recovered artifacts at six distinct loci including:

1) a large Early Archaic/Late Archaic lithic scatter that yielded of total of 23 artifacts identified as site AjGw-195
2) a small scatter of chipping detritus that was identified as insignificant with no associated Borden number
3) a large pre-contact Indigenous lithic scatter which yielded 19 artifacts identified as AjGw-196
4) a small pre-contact Indigenous lithic scatter which yielded four artifacts identified as AjGw-197
5) a Euro-Canadian scatter which yielded 39 artifacts identified as AjGw-198 and

6) a single pre-contact (Indigenous) retouched flake identified as AGjw-199.

Following their assessment ASI recommended sites AjGw-195 and AjGw-196 should be subject to additional archaeological assessment and the remainder of the property should be cleared of archaeological concern.

#### 2.1.2.2 Reports Documenting Archaeological Assessments Within 50 m of the Study Area

- *Revised Report: Archaeological Assessment: Gaden Properties Inc., Proposed Draft Plan of Subdivision 21T-89022 (M), Part of Lot 12, Concession 10, New Survey, City of Mississauga, R.M. of Peel.* Prepared by L.R. Bud Parker ("Parker L.R."), March 2001 Ref. No. 21SB003 (Parker L.R. 2001a). License No. 98-007.
- *Arch. Excavation: Morrow Site (AjGw-299), Gadan Properties Inc., Proposed Draft Plan of Subdiv. 21T-89022(M), Part of Lot 12, Con. 10, New Survey, City of Mississauga, R.M. of Peel.* Prepared by L.R. Bud Parker ("Parker L.R."), June 2001, Ref. No. 21T-89022 (Parker L.R. 2001b). License No. 2001-007-002.

In 1998, Parker Archaeological Consulting (L.R. Parker 2001a) was retained by Paul Theil Associates Limited to conduct at archaeological assessment in advance of a proposed subdivision development on approximately 10 hectares on Part of Lot 12, Concession 10 N.S. in the City of Mississauga. The assessment identified one archaeological site on the property, identified as the Morrow Site (AjGw-299). This site was originally mapped as a 25 m x 25 m surface scatter of Euro-Canadian artifacts, but this was reduced to a 15 m x 10 m surface scatter when the site was revisited in 2001 (L.R. Parker 2001b). The scatter was attributed to the Morrow family homestead, which was purchased and then rented out by William G. Kennedy (L.R. Parker 2001a; MHSTCI 2021a). Following the 2001 Stage 4 site excavation which involved stripping the topsoil from the site and assessing the area for subsurface cultural features, the site is registered as having no further cultural heritage value or interest (L.R. Parker 2001b).

### 2.1.3 Environmental Context

The Study Area is situated within the Peel Plain physiographic region of Ontario (Chapman and Putnam 1984:113). This physiographic region consists of approximately 777-square km (300 square miles) of clay soils that cover the central portion of the Regional Municipality of York, Peel, and Halton (Chapman and Putnam1984:174). The underlying geological material consists of shale and limestone. According to Chapman and Putman (1984), this area would have been covered by hardwood forests (Chapman and Putnam 1984:175). The Peel Plain was settled during the early part of the nineteenth century for its fertile clay soils (Chapman and Putnam 1984:176). Until the 1940s, the land was used for agricultural purposes, beginning with the growing of wheat, hay, and alfalfa. In addition, various racehorse farms and small fruit, vegetable, and poultry farms were established. According to Chapman and Putman (1984:176), most of the farms were 100 acres in size with much of the land used for field crops, a small portion of it for pasture, and a small portion remained as woodlots. Since the 1960s, the villages and towns have grown rapidly.

The dominant surface soil type within the Study Area is Chinguacousy loam to clay loam (OMAFRA 2006). This soil is characterized as having irregular drainage and gently sloping topography.

It is crucial to consider the proximity of water sources in any evaluation of archaeological potential because the availability of water is arguably the single most important determinant of human land use,

past and present. The *Standards and Guidelines for Consultant Archaeologists* (MHSTCI 2011) lists proximity to water as one of the prime indicators of potential for the presence of archaeological sites. Distance from potable water has been one of the most commonly used variables for predictive modelling of archaeological site location. Water, both potable and non-potable, also facilitated the transportation of people and goods and served to focus animal and plant resources. According to the *Standards and Guidelines for Consultant Archaeologists* (MHSTCI 2011), lands within 300 m of an extant or formerly mapped river or creek have potential for the presence of early Indigenous and Euro-Canadian archaeological sites. The nearest water source is Sixteen Mile Creek, which is adjacent to the Study Area. Historically, Sixteen Mile Creek flowed west of its current route (see Appendix A: Figures 6 and 7) but would still have been within 300 metres of the Study Area.

## 2.2 Historical Context

### 2.2.1 A Cultural History for Southern and Eastern Ontario

The majority of interpretations of pre-contact Indigenous adaptations in Ontario derive from the analysis and interpretation of stone tools. Stone tools are made from specific types of rocks that fracture in ways that can be controlled, so that they are easily shaped into useful forms. These rocks include chert, chalcedony, quartzite, petrified wood, and volcanic glass, known as obsidian. Most stone tools found in southern Ontario are formed from types of chert that outcrop in local limestone formations, such as: Onondaga and Haldimand cherts, found near the north shore of Lake Erie; Kettle Point chert, which outcrops near Lake Huron; and Collingwood chert, which outcrops along the Niagara Escarpment near Georgian Bay.

Stone tools used as spear tips and arrowheads are the most commonly studied tool type. These are referred to as projectile points. As projectile point technology changed over time, styles and shapes of points changed also. Studying these changing point types has resulted in the development of a chronological framework for pre-contact times prior to 3,000 years ago, when Indigenous Nations began to make clay pottery. Later periods are defined both by point types and pottery characteristics. Radiocarbon dating of archaeological sites can only be done when organic materials are collected from those sites, so the dating of most sites is done by comparing the artifacts from dated sites to those from undated sites.

The following is an overview of the cultural history of southern and eastern Ontario as understood by archaeologists. It is based upon published syntheses of Indigenous cultural occupations (Wright 1968, Ellis and Ferris 1990, Adams 1994). For additional reference, Ellis and Ferris (1990) provide greater detail of the distinctive characteristics of each time period and cultural group.

The cultural history of southern Ontario began approximately 11,000 years ago when the glaciers had melted, and the land was re-exposed. The land was quickly settled by bands of hunters and gatherers who are thought to have been large game hunters. These people used large spear points that are distinctively shaped with long central grooves, called “flutes”. Archaeologists have defined a number of point types that date to this time, including Gainey, Barnes, Crowfield, and Hi-Lo types. This period is referred to as the Paleo-Indian Period and it is thought to have lasted until approximately 9,000 years ago.

After 9,500 years ago, there was a long period when the climate was variable and the bare lands left by the glaciers were becoming re-forested, resulting in patchier, more diverse ecozones. During this time, which lasted until 3,000 years ago, people were adapting to diverse environmental settings. There appears

to have been more reliance on local stone for making tools and more variable tool manufacturing technologies. The adoption of a spear-throwing board, known as an atlatl, was an important innovation, resulting in the ability to throw smaller darts with more force. Projectile points from this period, called the Archaic Period, are commonly side or corner-notched and are smaller than those of the preceding period. The Archaic adaptation is generally thought to have centered on localized resources, often forest resources, and groups of people are thought to have been less mobile, an adaptation that continued to develop until the arrival of Europeans.

In southern Ontario, the Archaic Period is divided into the Early, Middle and Late Archaic. Early point types include serrated Nettling and Bifurcate Base points. Middle types include Brewerton Corner Notched and Otter Creek, and Late types include Lamoka, Genesee, Crawford Knoll, and Innes. Most of these point types are named after archaeological sites where they were first identified.

The Archaic Period is followed by the Woodland Period. The major technological change in the Early Woodland Period is the introduction of pottery. During this time, people are thought to have developed more community organization and the manufacture of clay pottery is thought to indicate less residential mobility. Burial sites dating to this time often display evidence of ceremonial activities. Projectile points made at this time include much smaller types, probably used as arrow tips. Point types include Meadowood and Kramer and early ceramics were crudely made vessels with conoidal (pointed) bases. The Early Woodland Period transitioned into the Middle Woodland Period approximately 2,400 years ago.

During the Middle Woodland Period in southern Ontario community and kin identity became more deeply entrenched, and more sedentary communities developed. Point types made at this time include Saugeen, Vanport, and Snyders. Ceramic vessels were conoidal in shape but were decorated with stamped designs in the soft clay. The Middle Woodland Period transitioned into the Late Woodland Period A.D. 500–900 with the earliest direct evidence for agriculture.

The Late Woodland Period saw the development of recognizable Iroquoian and Algonquian cultures in southern Ontario, characterized by the intensification of agriculture and the increased utilization of corn. Greater sedentism led to increasing settlement populations and greater complexity of settlement organization. Sites dating to this time are often found on terraces overlooking the floodplains of large rivers. Iroquoian villages tended to be small, palisaded compounds with longhouses occupied by families. As the Late Woodland Period progressed, more intercommunity communication and integration became necessary to maintain the sedentary agricultural way of life. Later Iroquoian villages were larger and more heavily palisaded, and longhouses were larger also. Algonquian settlements tended to be less populous and temporary.

When European explorers and missionaries arrived in southern Ontario in the early seventeenth century, they described the local Iroquoian social organization as being under the direction of elected chiefs. Tribal confederacies and allegiances resulted in intertribal warfare, which was only made worse by the European presence. Three Ontario Iroquoian confederacies, the Huron, Petun, and Neutral, were driven from their traditional territories before the middle of the seventeenth century.

Archaeologists tend to describe a period of transition from Late Woodland to post-contact contact times as “proto-historic”. The dating of this period is variable and may be different from site to site within a region as it describes a time when local Indigenous peoples were acquiring European trade goods indirectly through other Indigenous middlemen rather than directly from European traders. This period was generally very short and is often difficult to differentiate archaeologically from later post-contact

times, when trade goods were widely available, but it usually is identified by evidence of an intact traditional cultural adaptation with occasional European items used in traditional ways.

Table 2: Simplified Cultural Chronology of Southern and Eastern Ontario

| Period | Complexes/Cultures, Some Diagnostic Artifacts |
|---|---|
| **Early Paleo-Indian (9000–8500 B.C.)** | Small nomadic hunter-gatherer bands. Early Paleo-Indian (EPI) rarely found in eastern Ontario. Gainey, Barnes, Crowfield fluted points. |
| **Late Paleo-Indian (8500–7500 B.C.)** | Small nomadic hunter-gatherer bands. Hi-Lo, Holcombe points, Lanceolate Bifaces. |
| **Early Archaic (7500–6000/4500 B.C.)** | Small nomadic hunter-gatherer bands. Nettling, Stanley/Neville points. |
| **Middle Archaic (6000/4500–2500 B.C.)** | Transition to territorial settlements. Seasonal round of subsistence introduced. Thebes (6000–5000 B.C.), Otter Creek points (4500–3000 B.C.).<br>**Brewerton Complex (3000–2500 B.C.).** Brewerton points.<br>**Laurentian Complex (6000–2500 B.C.)** (Eastern Ontario) |
| **Late Archaic (2500–1000 B.C.)** | More numerous territorial hunter- gatherer bands, increasing use of exotic materials and artistic items for grave offerings, regional trade networks.<br>**Narrowpoint Complex (2500–1850 B.C.).** Lamoka points.<br>**Broadpoint Complex (1850–1650 B.C.).** Adder Orchard, Genesee points.<br>**Smallpoint Complex (1650–1000 B.C.).** Crawford Knoll, Innes points.<br>**Terminal Archaic (1100–1000 B.C.)** Glacial Kame Complex. Hind points. |
| **Early Woodland (1000–400 B.C.)** | Pottery introduced. Meadowood Notched points, Meadowood Cache Blades, Kramer, Adena points.<br>**Meadowood Complex (1000–400 B.C.).**<br>**Middlesex Complex (650–400 B.C.).** Introduction of true cemeteries. |
| **Middle Woodland (400 B.C.–A.D. 500/900)** | Saugeen, Snyders, Vanport, Port Maitland points.<br>**Point Peninsula Complex** (Southcentral and eastern Ontario)<br>**Saugeen Complex** (Southeast of Lake Huron and the Bruce Peninsula, London area, and possibly as far east as the Grand River)<br>**Couture Complex** (Lake St. Clair and the western end of Lake Erie). Burial ceremonialism. |
| **Transitional Woodland (A.D. 500–900)** | Agriculture introduced. Levanna, Jacks Reef points.<br>**Princess Point Complex** (Eastern end of Lake Erie and the western end of Lake Ontario).<br>**Rivière au Vase Phase of the Younge / Western Basin Tradition** (Lake St. Clair and western end of Lake Erie)<br>**Sandbanks Complex** (Kingston area). |
| **Late Woodland (A.D. 900–1650)** | Tribal differentiation. Transition to settled village life. Dewaele, Glen Meyer Tanged, Triangular Nanticoke, Notched Nanticoke, Triangular Daniels/Madison points. |

| Table 2: Simplified Cultural Chronology of Southern and Eastern Ontario | |
|---|---|
| Period | Complexes/Cultures, Some Diagnostic Artifacts |
| | **Ontario Iroquoian and St. Lawrence Iroquoian Traditions** (Southcentral and eastern Ontario, respectively).<br>**Algonkian Western Basin Tradition** (Lake St. Clair and the western end of Lake Erie). |
| **Early Post-Contact (A.D. 1650–1763)** | Iroquoian, Algonkian migrations and resettlement. French exploration and colonization |
| **Late Post-Contact (A.D. 1763–1867)** | Iroquoian, Algonkian migrations and resettlement. British and other European immigration increases. |

In southern Ontario, significant post-contact archaeological sites are those that have an affiliation with an important historic event, figure, or family, but can also be anything dating to the original European settlement of a region. Often, these archaeological sites date to before A.D. 1830, but archaeologically significant Euro-Canadian sites can date into the twentieth century.

### 2.2.2 Review of Historical Records

During pre-contact and early contact times, the vicinity of the Study Area would have contained a mixture of deciduous trees, coniferous trees, and open areas. In the early nineteenth century, Euro-Canadian settlers arrived and began to clear the forests for agricultural purposes. In the nineteenth and early twentieth centuries, the Study Area and surrounding land were primarily used for agricultural purposes.

The Study Area is located within the Township of Trafalgar, County of Halton. In the late 18th century, when Euro-Canadians began settling the Halton area, Ontario was divided into four districts: Lunenburg, Mecklenburg, Nassau and Hesse. The Provincial Act of 1792 renamed the same divisions as Eastern, Midland, Home, and Western Districts; Halton County was part of the Home District (Walker & Miles 1977). By 1817, Halton had four churches, 18 grist mills, 41 sawmills and three medical practitioners. The County of Halton encompassed the Townships of Esquesing, Trafalgar, Nelson and Nassagaweya (Walker & Miles 1877). The Study Area is within the former Township of Trafalgar.

Samuel Wilmot surveyed the Township of Trafalgar in 1806, using Dundas Street as a baseline. Trafalgar Township was first named "Grant Township" in honour of Alexander Grant, who was the Administrator of Upper Canada. In 1806, it was renamed in honour of Horatio Viscount Nelson's famous naval victory at Cabo Trafalgar in Spain the previous year. Trafalgar Township continued to be settled by the descendants of United Empire Loyalists from the United States as well as by immigrants from England, Scotland, and Ireland. By 1820, Trafalgar had 548 inhabitants, one grist mill, four sawmills, and a post office (Walker & Miles 1877). Some of the earliest Euro-Canadian families to settle within the township included the Sovereigns, Proudfoots, Kattings, Freemans, Posts, Biggars, Mulhollands, Kenneys, Chalmers, Albertsons, Chisholms, Sproats, Browns and Hagars.

By the 1840s, the township was noted for its well-cultivated farms (Smith 1846:197; Armstrong 1985:148; Rayburn 1997:348; ASI 2012). Hamlets and small villages sprang up at strategic crossroads and near watercourses to provide amenities to farming families. By 1850, the population had increased to 4,513 (Walker & Miles 1877).

Historical records and mapping were examined for evidence of early Euro-Canadian use of the Study Area to determine the potential for post-contact period archaeological evidence within the Study Area. The Study Area was located on Part of Lots 6 to 12, Concession 10, Township of Trafalgar.

The 1806 Map of Trafalgar Township, as surveyed by Samuel S. Wilmot (Wilmot 1806) lists the names of the people who received the original land grants that resulted in deeds or patents. No owners are listed on this map for the lots within the Study Area.

*Tremaine's 1858 Map of the County of Halton* (Tremaine 1858) listed names for each lot (see Table 3). No structures are indicated on this 1858 map, but the historic route of Sixteen Mile Creek is illustrated (Appendix A: Figure 6).

The 1877 *Illustrated Historical Atlas of Halton County* (Walker & Miles 1877; Appendix A: Figure 7) also lists owners for each lot (see Table 3). This map depicts structures on several lots as well as the historic route of Sixteen Mile Creek (Appendix A: Figure 7).

Table 3: Review of Historical Records

| Lot No. | Owner as Listed on 1858 Map | Owner as Listed on 1877 Map | Historical Feature(s) on 1877 Map (see Appendix A: Figure 7) |
|---|---|---|---|
| 6 | William Numan<br>Owen McCurran<br>James Fullarton<br>Johnathan Cavell | Estate of William Numan<br>Robert McCorran<br>Joseph Fullarton<br>James Fullarton | Four structures |
| 7 | John F. Orr<br>Jack Orr | Dugold McGregor<br>William D. Orr | Two structures |
| 8 | Anthony Connor<br>Solomon Cardingly | Charles O'Connor<br>Solomon Cardingly | One structure |
| 9 | D. Cardingly<br>Anthony Connor<br>A. Kindree | John Cardingly<br>Charles O'Connor<br>Solomon Cardingly | Three structures |
| 10 | John Cardingly<br>George May | John Cardingly<br>John May | Two structures |
| 11 | John Mason<br>Hugh Mason | Joseph Mason<br>T. S. Mason | Two structures |
| 12 | Heirs of J. Morrow<br>William Kennedy<br>Hugh Mason | William G. Kennedy<br>Adam Anderson<br>T. S. Mason | Two structures |

## 2.3 Additional Information

### 2.3.1 Recent Land Use History

A review of aerial photographs made available online by the City of Mississauga (City of Mississauga 2021) charts the Study Area's development through the second half of the twentieth century. Between 1966 and 1985, land use in the Study Area was agricultural but between 1985 and 2005 subdivision development expanded both sides of Sixteen Mile Creek (Appendix B: Plates 1-7). Importantly, the aerial

photographs also document how Sixteen Mile Creek channelized and rerouted to its current path as part of the subdivision developments (City of Mississauga 2021).

## 2.4 Potential for Archaeological Resources

Archaeological potential is defined as the likelihood of finding archaeological sites within a Study Area. For planning purposes, determining archaeological potential provides a preliminary indication that archaeological sites might be found within the Study Area, and consequently, that it may be necessary to allocate time and resources for archaeological survey and mitigation.

The framework for determining the presence of archaeological potential within a Study Area is drawn from provincial standards found in the *Standards and Guidelines for Consultant Archaeologists* (MHSTCI 2011, Sections 1.3.1 and 1.3.2). The following are features or characteristics that can indicate archaeological potential:

- previously identified archaeological sites;
- water sources (it is important to distinguish types of water and shoreline, and to distinguish natural from artificial water sources, as these features affect site locations and types to varying degrees):
  - primary water sources (e.g., lakes, rivers, streams, creeks);
  - secondary water sources (e.g., intermittent streams and creeks, springs, marshes, swamps);
  - features indicating past water sources (e.g., glacial lake shorelines indicated by the presence of raised sand or gravel beach ridges, relic river or stream channels indicated by clear dip or swale in the topography, shorelines of drained lakes or marshes, cobble beaches); and,
  - accessible or inaccessible shoreline (e.g., high bluffs, swamp or marsh fields by the edge of a lake, sandbars stretching into marsh).
- elevated topography (e.g., eskers, drumlins, large knolls, plateaus);
- pockets of well-drained sandy soil, especially near areas of heavy soil or rocky ground;
- distinctive land formation that might have been special or spiritual places, such as waterfalls, rock outcrops, caverns, mounds, and promontories and their bases. There may be physical indicators of their use, such as burials, structures, offerings, rock paintings or carvings;
- resource areas, including:
  - food or medicinal plants (e.g., migratory routes, spawning areas, prairie);
  - scarce raw materials (e.g., quartz, copper, ochre or outcrops of chert); and,
  - early Euro-Canadian industry (e.g., fur trade, logging, prospecting, mining).
- areas of early Euro-Canadian settlement. These include places of early military or pioneer settlement (e.g., pioneer homesteads, isolated cabins, farmstead complexes), early wharf or dock complexes, pioneer churches and cemeteries. There may be commemorative markers of their history, such as local provincial, or federal monuments or heritage parks;
- early transportation routes (e.g., trails, passes, roads, railways, portages); and,
- property listed on a municipal register or designated under the *Ontario Heritage Act* or that is a federal, provincial or municipal historic landmark or property that local histories or informants have identified with possible archaeological sites, historical events, activities or occupations.

Archaeological potential can be determined to not be present for either the entire Study Area or parts of

it when the area under consideration has been subjected to extensive and deep land alterations that have severely damaged the integrity of any archaeological resources. This is commonly referred to as "disturbed" or "disturbance" and may include:

- quarrying;
- major landscaping involving grading below topsoil;
- building footprints;
- sewage and infrastructure development; and,
- activities such as agricultural cultivation, gardening, minor grading, and landscaping do not necessarily affect archaeological potential.

The Study Area contains a large section of marshland created by the channelization and rerouting of Sixteen Mile Creek as it travels through the Osprey Marshlands and Lisgar Meadow Brook Trail. Bike paths and walking trails are throughout the Study Area and the entirety of the Study Area is surrounded by recent urban residential development.

Several factors can be used to assess the potential for recovery of Indigenous archaeological resources within a Study Area. The Study Area is largely comprised of well-drained land that is suitable for human habitation. Natural water sources are located within 300 m of the Study Area, including Sixteen Mile Creek. Moreover, there is direct evidence that this general area has been intensively utilized by Indigenous people. Although no Indigenous sites have been registered within the Study Area, seven Indigenous archaeological sites are registered within 300 m of the Study Area.

As per the MHSTCI's *Standards and Guidelines for Consultant Archaeologists* (MHSTCI 2011), any areas within 100 m of early transportation routes and 300 m of early Euro-Canadian settlement have archaeological potential. The Study Area is located within 100 m of several historic roads, including Ninth Line, Derry Road, and Britannia Road as illustrated in the 1858 and 1877 historical atlas maps. Several farms with structures are just outside the Study Area on the 1877 historical map (Appendix A: Figure 6 and Figure 7). Moreover, there is direct evidence that this general area had been intensively utilized by Euro-Canadian people. Although no Euro-Canadian sites have been registered within the Study Area, two Euro-Canadian archaeological sites are registered within 300 m of the Study Area.

Areas that have been disturbed by modern activities, both extensive and intensive, have low potential for the recovery of archaeological resources, despite being located within areas otherwise recognized as having 'general archaeological potential'. The twentieth century subdivision development on both sides of Sixteen Mile Creek and the channelization and re-routing of Sixteen Mile Creek that took place between 1985 and 2005 are examples of disturbance that have removed archaeological potential from the Study Area through major landscaping involving grading below topsoil (Appendix B: Plates 1-7).

# 3.0 Stage 1 Property Assessment

## 3.1 Methods

A Stage 1 property inspection was directed and conducted by Chelsea Dickinson (R1194) of Wood on 13 August 2021. The weather during the assessment was sunny with overcast periods and a maximum temperature of 22°C. This weather did not impede the inspection or assessment in any way and met Section 1.2 Standard 2 of the *Standards and Guidelines for Consultant Archaeologists* (MHSTCI 2011) regarding weather and lighting.

The objective of the Stage 1 property inspection was to confirm archaeological site potential and determine the degree to which development and landscape alteration have affected that potential. It included a walk-through of the entire Study Area and thorough photo-documentation (Appendix A: Figure 8A and Figure 8B; and Appendix C: Photographs 1 to 61). Field observations were recorded on aerial maps and field forms and all land conditions were recorded as shown in Appendix A: Figure 8A and Figure 8B and Appendix C: Photographs 1 to 61.

## 3.2 Results

Based on the Stage 1 property inspection and background research, Wood determined that archaeological potential has been removed within 9.9 ha (100%) of the Study Area. This includes 2.6 ha of land which were previously assessed by ASI in 1989 prior to the implementation of the *Standards and Guidelines for Consultant Archaeologists* and were visually confirmed as disturbed during the property inspection.

The entire Study Area was found to be compromised by extensive earth-moving activities, including grading below topsoil, to the point where archaeological potential has been removed. This earthmoving was completed between 1985 and 2005 as part of subdivision development on both sides of Sixteen Mile Creek and the associated channelization and rerouting of Sixteen Mile Creek between the Osprey Marshlands and the Lisgar Meadowbrook Trail (City of Mississauga 2021). Areas that have been disturbed by modern activities, both extensive and intensive, have low potential for the recovery of archaeological resources as per Section 1.3.2 of the *Standards and Guidelines for Consultant Archaeologists* (MHSTCI 2011).

### 3.2.1 Documentary Record

The inventory of documentary records accumulated as part of this assessment is provided in Table 4.

Table 4: Inventory of Documentary Record

| Study area | Map and Photo(s) | Field Notes |
|---|---|---|
| Part of Lots 6 to 12, Concession 10, Geographic Township of Trafalgar, Halton County, City of Mississauga, Ontario | Copies of 3 historical maps, 61 Stage 1 photographs | Stage 1 photo logs and field notes |

Documentation related to the archaeological assessment of this project will be curated by Wood until such time that arrangements for their ultimate transfer to Her Majesty the Queen in Right of Ontario, or other public institution, can be made to the satisfaction of the project owner, the MHSTCI and any other legitimate interest groups.

## 3.3 Stage 1 Analysis and Conclusions

The Stage 1 background study indicated that the Study Area has general archaeological potential for the following reasons: 1) natural water sources, including Sixteen Mile Creek, are located within 300 m of the Study Area; 2) as shown in the 1858 and 1877 historical atlas mapping, the Study Area is located within 100 metres of several farmsteads and historic roads; and 3) nine registered archaeological sites are located within 300 m of the Study Area.

Despite the general archaeological potential of the Study Area, the background research associated with the Stage 1 archaeological assessment determined that the full Study Area (9.9 ha) was extensively disturbed between 1985 and 2005 as part of subdivision development on both sides of Sixteen Mile Creek and the associated channelization and rerouting of Sixteen Mile Creek between the Osprey Marshlands and the Lisgar Meadowbrook Trail (City of Mississauga 2021) (Appendix B: Plates 1-7). Therefore, the Study Area has low archaeological potential and does not require Stage 2 archaeological assessment. This conclusion applies to the 2.6 ha of land which were previously assessed by ASI in 1989 prior to the implementation of the *Standards and Guidelines for Consultant Archaeologists* (MHSTCI 2011) and were visually confirmed as disturbed during the property inspection (Appendix A: Figure 8A and Figure 8B).

# 4.0 Recommendations

Based on the Stage 1 archaeological assessment of the Study Area, the following recommendation is made, subject to the conditions outlined below and in Section 5.0:

1. The entirety of the Study Area, approximately 9.9 ha, has low archaeological potential due to extensive and intensive disturbance, and therefore requires no further archaeological assessment (Appendix A: Figure 8A and Figure 8B).

**The above recommendation is subject to Ministry of Heritage, Sport, Tourism and Culture Industries' approval, and it is an offence to alter any of portion of the Study Area without Ministry of Heritage, Sport, Tourism and Culture Industries' concurrence.**

No development or site alteration (including, but not limited to, grading, excavation or the placement of fill that would change the landform characteristics) is permitted on lands containing archaeological resources or areas of archaeological potential unless significant archaeological resources have been conserved (Government of Ontario 2020:31).

# 5.0 Advice on Compliance with Legislation

a. This report is submitted to the Minister of Heritage, Sport, Tourism and Culture Industries as a condition of licensing in accordance with Part IV of the *Ontario Heritage Act, R.S.O. 1990, c O.18*. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Heritage, Sport, Tourism and Culture Industries, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.

b. It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such a time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeological Reports referred to in Section 65.1 of the *Ontario Heritage Act*.

c. Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of the *Ontario Heritage Act*.

d. The *Funeral, Burial and Cremation Services Act,* 2002, S.O. 2002, c.33 requires that any person discovering human remains must notify the local police or coroner and the Registrar of Cemeteries at the Ministry of Government and Consumer Services.

# 6.0 Assessor Qualifications

This report was prepared and reviewed by the undersigned, employees of Wood. Wood is one of North America's leading engineering firms, with more than 50 years of experience in the earth and environmental consulting industry. The qualifications of the assessors involved in the preparation of this report are provided in Appendix D.

# 7.0 Closure

This report was prepared for the exclusive use of the City of Mississauga and is intended to provide a Stage 1 archaeological assessment of the Study Area. The property is located at Part of Lots 6 to 12, Concession 10, Geographic Township of Trafalgar, Halton County, now in the City of Mississauga, Ontario.

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 the third party. Should additional parties require reliance on this report, written authorization from Wood will be required. With respect to third parties, Wood has no liability or responsibility for losses of any kind whatsoever, including direct or consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

The report is based on data and information collected during the Stage 1 background study conducted by Wood. It is based solely a review of historical information, a property reconnaissance conducted on 13 August 2021 and data obtained by Wood as described in this report. Except as otherwise maybe specified, Wood disclaims any obligation to update this report for events taking place, or with respect to information that becomes available to Wood after the time during which Wood conducted the archaeological assessment. In evaluating the property, Wood has relied in good faith on information provided by other individuals noted in this report. Wood has assumed that the information provided is factual and accurate. In addition, the findings in this report are based, to a large degree, upon information provided by the current owner/occupant. Wood accepts no responsibility for any deficiency, misstatement or inaccuracy contained in this report as a result of omissions, misinterpretations or fraudulent acts of persons interviewed or contacted.

Wood makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and change. Such interpretations and regulatory changes should be reviewed with legal counsel.

This report is also subject to the further Standard Limitations contained in Appendix E.

We trust that the information presented in this report meets your current requirements. Should you have any questions, or concerns, please do not hesitate to contact the undersigned.

Respectfully Submitted,

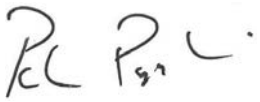
**Wood Environment & Infrastructure,**
**a Division of Wood Canada Limited**

Prepared by,

Chelsea Dickinson, B.A. (R1194)
Research Archaeologist

Reviewed by,

Henry Cary, Ph.D., CAHP, RPA (P327)
Senior Staff Archaeologist



Peter Popkin, Ph.D., CAHP, MCIfA (P362)
Associate Archaeologist

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2021a Sites Within a One Kilometre Radius of the Study area Provided from the Ontario Archaeological Sites Database, 30 August 2021.
2021b Archaeological Assessments Completed Within the Study area or Within 50 Metres of the Study area Provided from the Ontario Public Register of Archaeological Reports, 30 August 2021.

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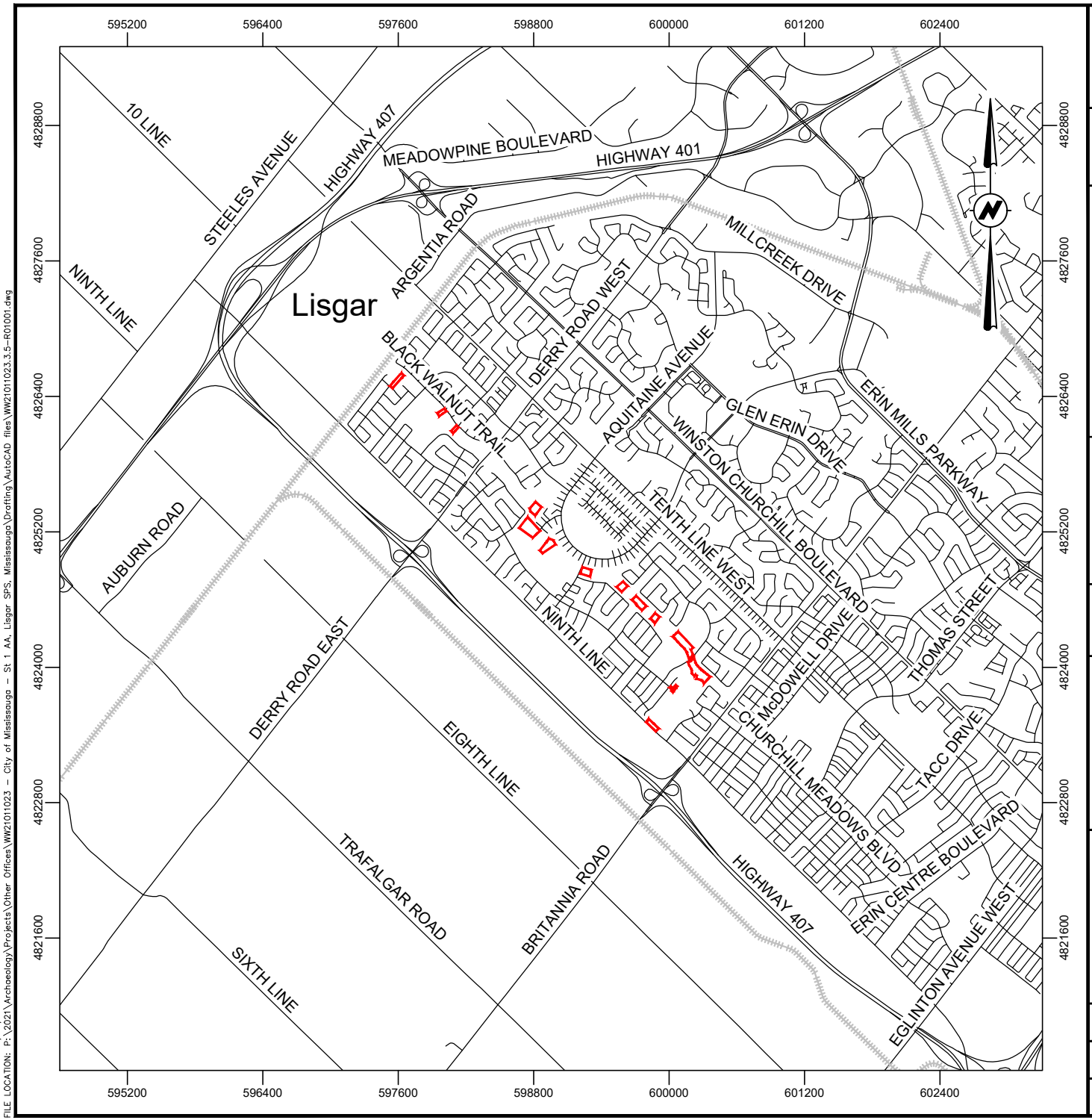
# Appendix A: Figures

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LISGAR DISTRICT STORMWATER PUMPING STATION
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT
PART OF LOTS 6 TO 12, CONCESSION 10
GEOGRAPHIC TOWNSHIP OF TRAFALGAR, HALTON COUNTY
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NOTES:

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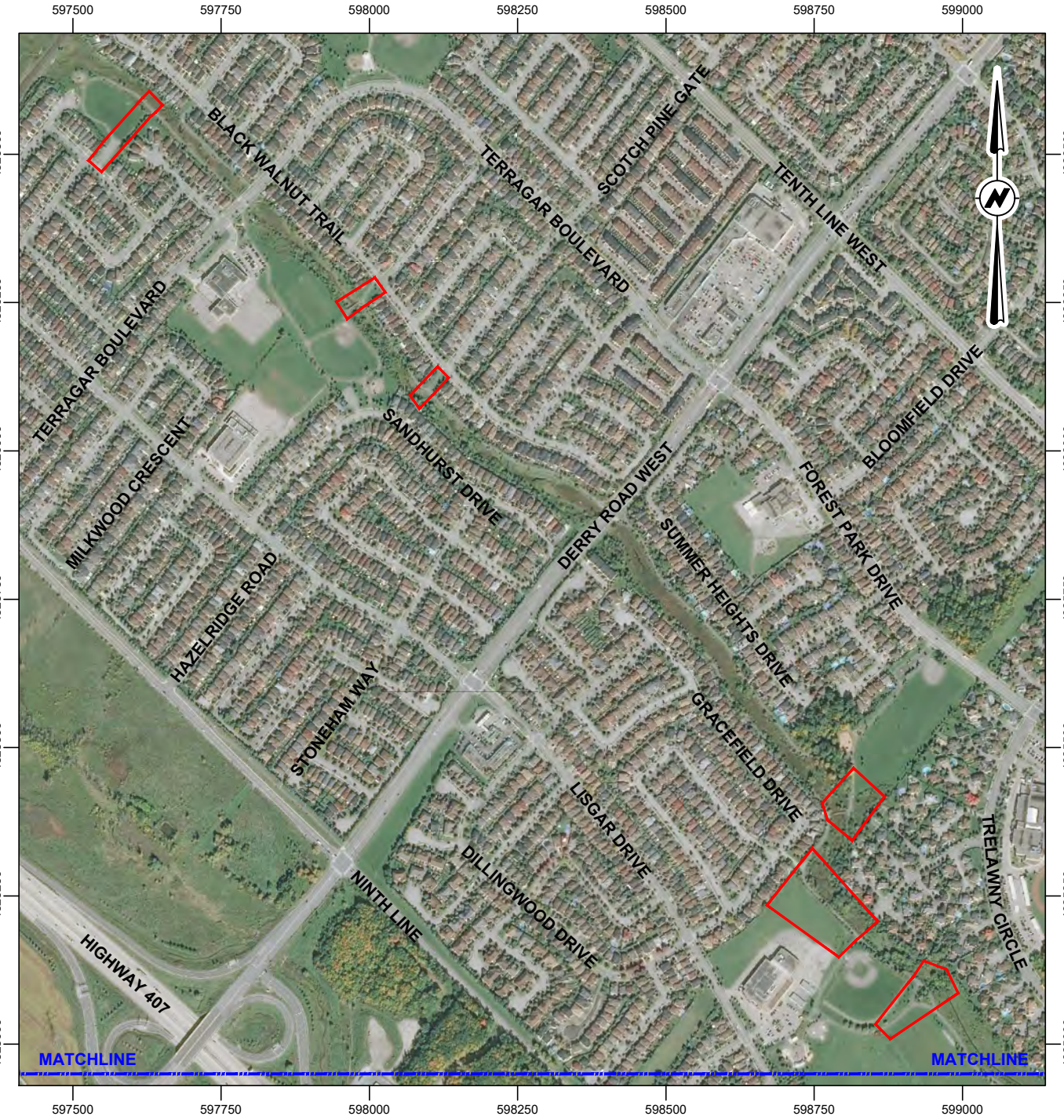


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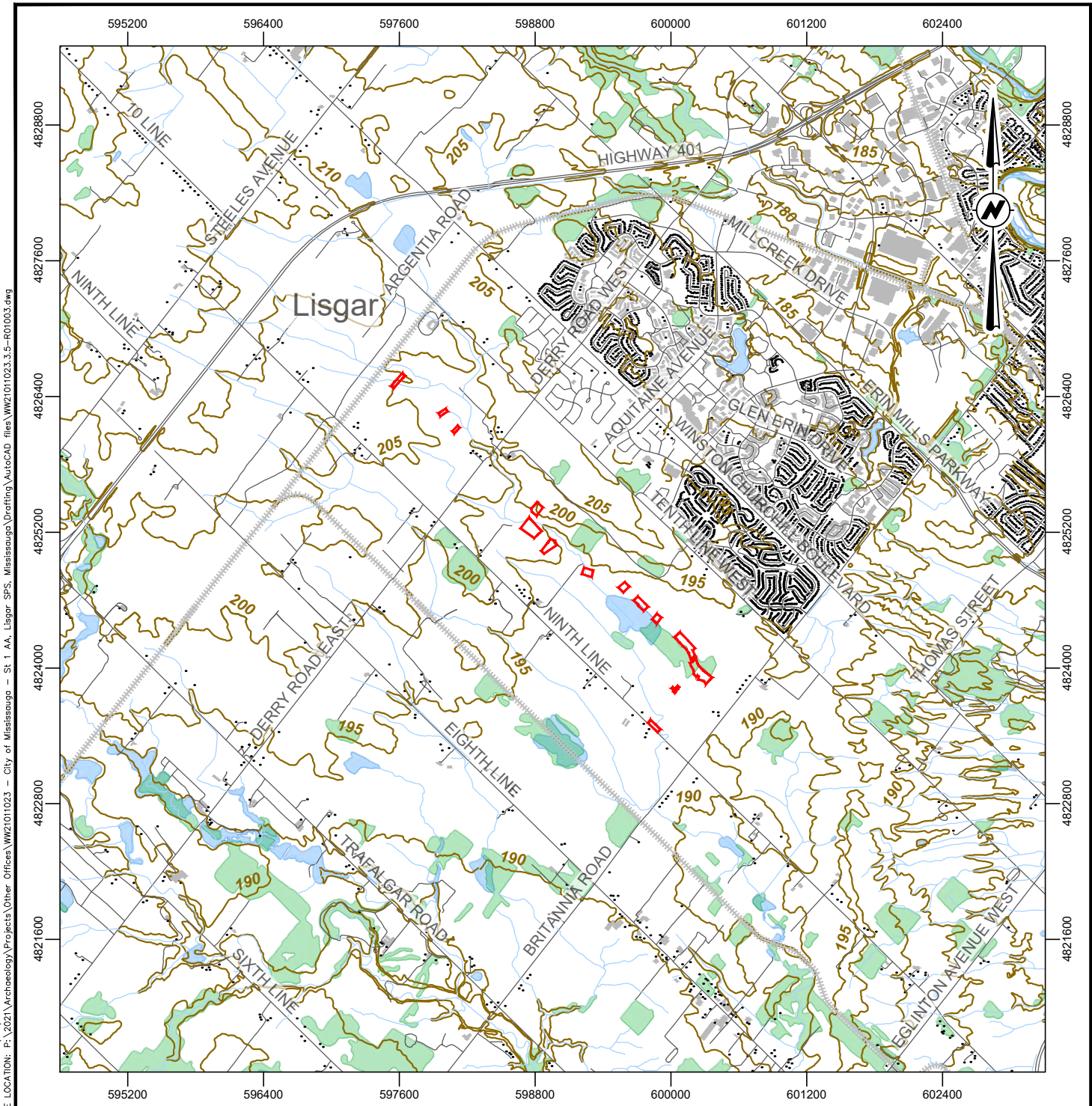


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LEGEND:
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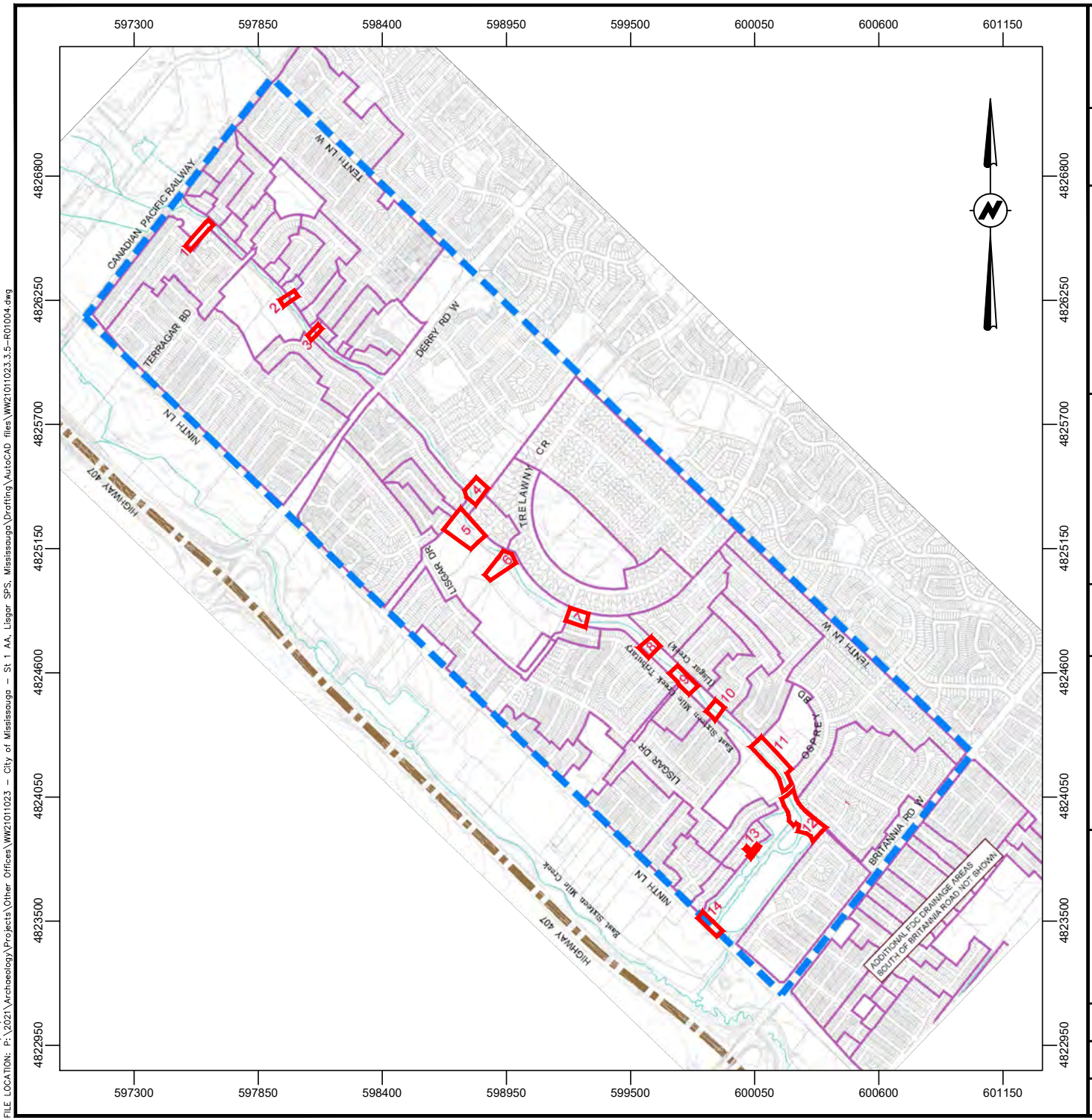


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GEOGRAPHIC TOWNSHIP OF TRAFALGAR, HALTON COUNTY
NOW IN THE CITY OF MISSISSAUGA, ONTARIO

TITLE:

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- WATERCOURSE
- CONTOUR (1m)
- MUNICIPAL BOUNDARY
- STUDY LIMITS
- FDC SEWER BOUNDARY
- 1 SCOPING AREA/STUDY AREA

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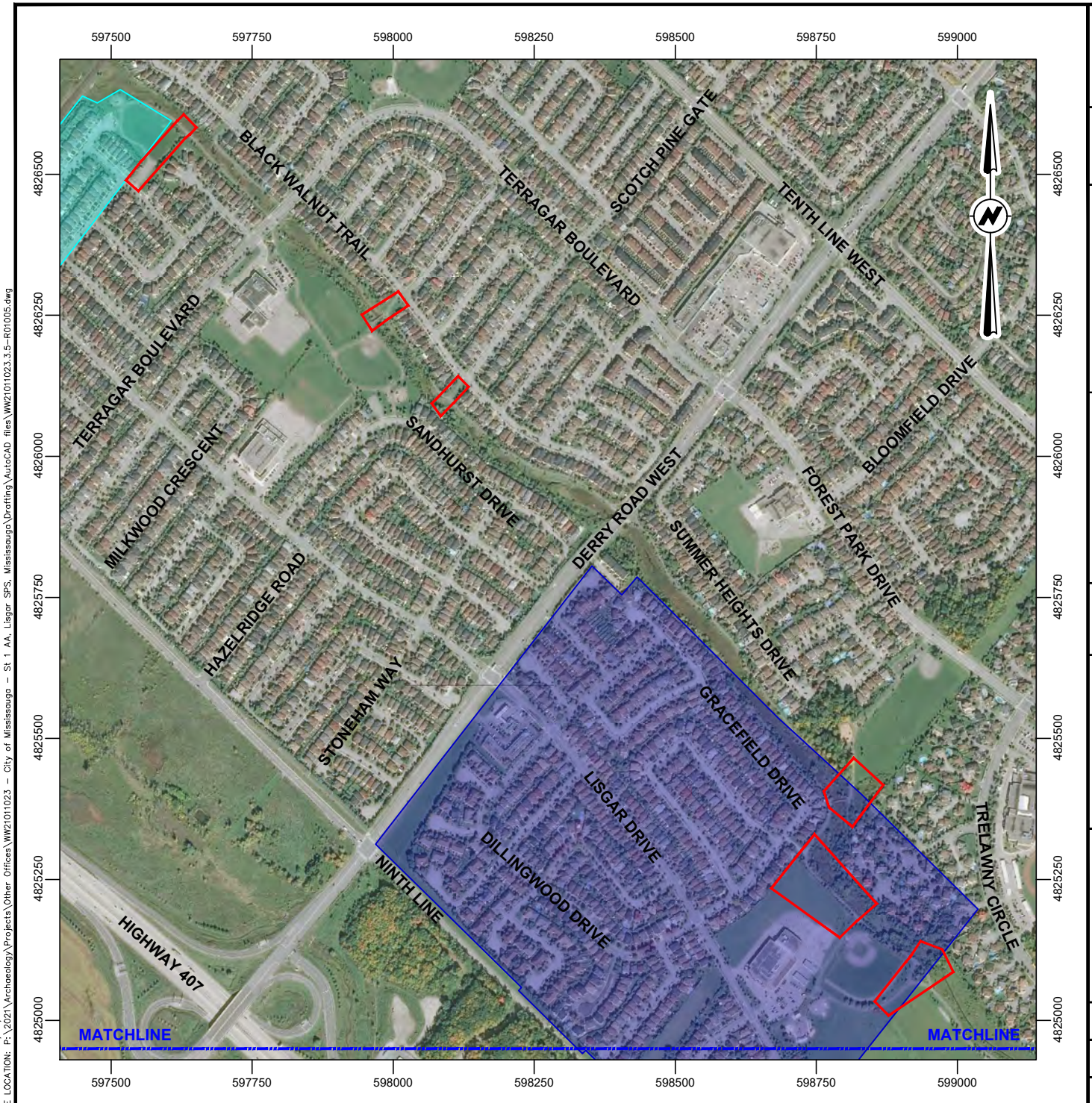


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- STAGE 1 & 2 ARCHAEOLOGICAL ASSESSMENT (CIF 98-007; PARKER L.R., 2001): NO FURTHER ASSESSMENT REQUIRED

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LISGAR DISTRICT STORMWATER PUMPING STATION
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT
PART OF LOTS 6 TO 12, CONCESSION 10
GEOGRAPHIC TOWNSHIP OF TRAFALGAR, HALTON COUNTY
NOW IN THE CITY OF MISSISSAUGA, ONTARIO

TITLE:
# PREVIOUS ARCHAEOLOGICAL INVESTIGATIONS WITHIN THE STUDY AREA AND WITHIN 50m OF THE STUDY AREA

LEGEND:

- STUDY AREA
- STAGE 1 ARCHAEOLOGICAL ASSESSMENT (CIF 89-130B; ASI, 1989): STAGE 2 ASSESSMENT REQUIRED
- STAGE 1 & 2 ARCHAEOLOGICAL ASSESSMENT (CIF 98-007; PARKER L.R., 2001): NO FURTHER ASSESSMENT REQUIRED

NOTES:

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS REPORT No. WW21011023.3.5.

ALL LOCATIONS ARE APPROXIMATE.

**ORIGINAL PAPER SIZE: 8½ x 11.**

REFERENCES:
BING IMAGERY AS OF JULY 14, 2021 (IMAGE DATE UNKNOWN), BING IMAGERY USED FOR ILLUSTRATION PURPOSES ONLY AND NOT TO BE USED FOR MEASUREMENTS; CANMAP STREETFILES V2008.4.

0 100 300 500m

SCALE 1:10000

City of Mississauga
300 CITY CENTRE DRIVE
MISSISSAUGA, ONTARIO, L5B 3C1

MISSISSAUGA

Wood
Environment & Infrastructure Solutions
3450 HARVESTER ROAD, SUITE 100
BURLINGTON, ONTARIO, L7N 3W5
905-312-0700

wood.

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| SJL | PP | SEP. 8, 2021 |
| DATUM: | PROJECTION: | PROJECT No: |
| NAD83 | UTM Zone 17 | WW21011023.3.5 |
| REV No: | | FIGURE No: |
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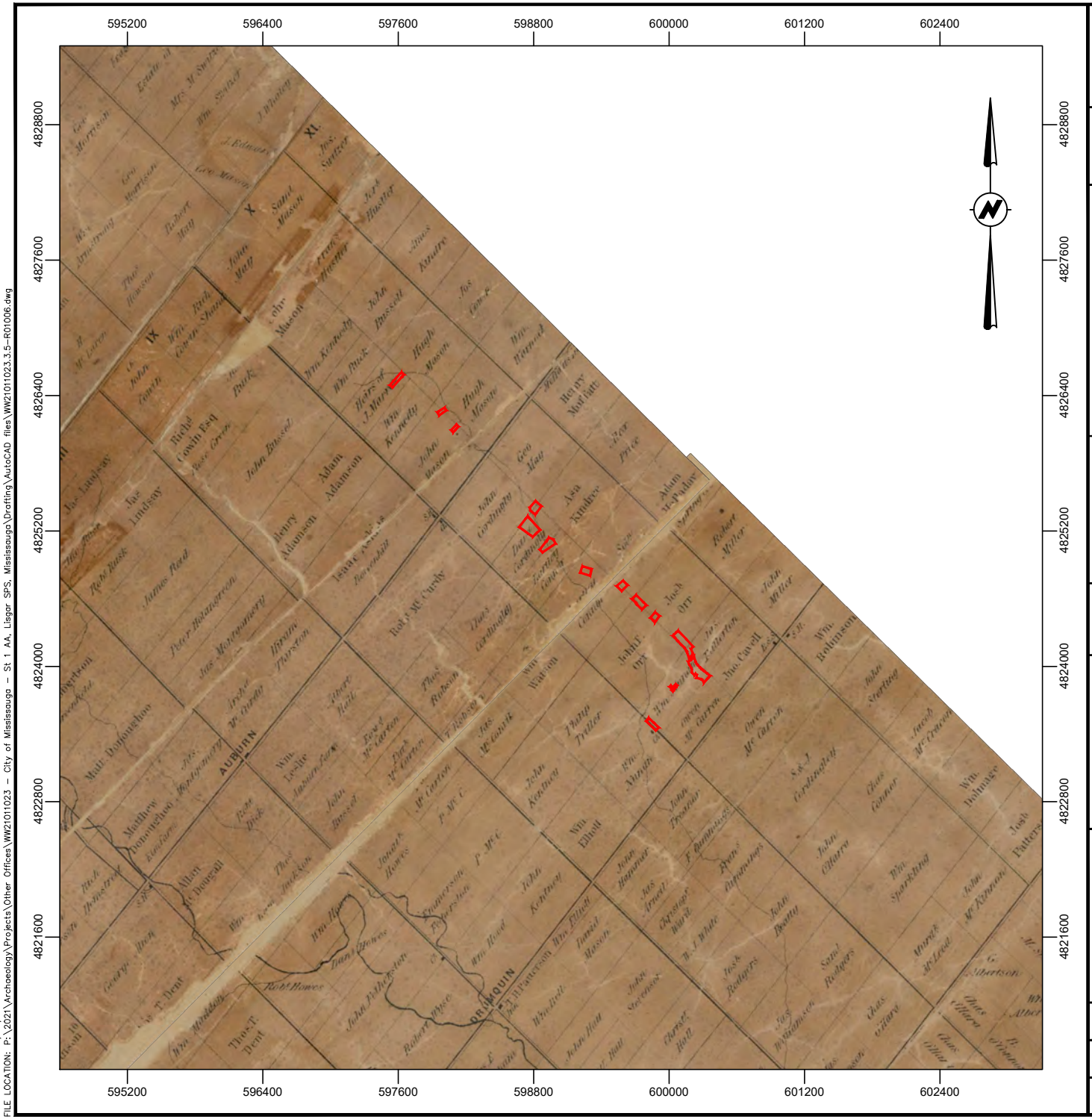


PROJECT: STAGE 1 ARCHAEOLOGICAL ASSESSMENT
LISGAR DISTRICT STORMWATER PUMPING STATION
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT
PART OF LOTS 6 TO 12, CONCESSION 10
GEOGRAPHIC TOWNSHIP OF TRAFALGAR, HALTON COUNTY
NOW IN THE CITY OF MISSISSAUGA, ONTARIO

TITLE:
1858 TREMAINE'S MAP OF THE COUNTY OF HALTON SHOWING THE LOCATION OF THE STUDY AREA

LEGEND:
STUDY AREA

NOTES:
THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS REPORT No. WW21011023.3.5.
ALL LOCATIONS ARE APPROXIMATE.
**ORIGINAL PAPER SIZE: 8½ x 11.**
REFERENCES:
G. TREMAINE, 1858; CANMAP STREETFILES V2008.4.

0 500 1500 2500m
SCALE 1:50000

City of Mississauga
300 CITY CENTRE DRIVE
MISSISSAUGA, ONTARIO, L5B 3C1

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| SJL | PP | JULY 13, 2021 |
| DATUM: | PROJECTION: | PROJECT No: |
| NAD83 | UTM Zone 17 | WW21011023.3.5 |
| REV No: | | FIGURE No: |
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DATE PLOTTED: 9/29/2021 10:15:50 AM
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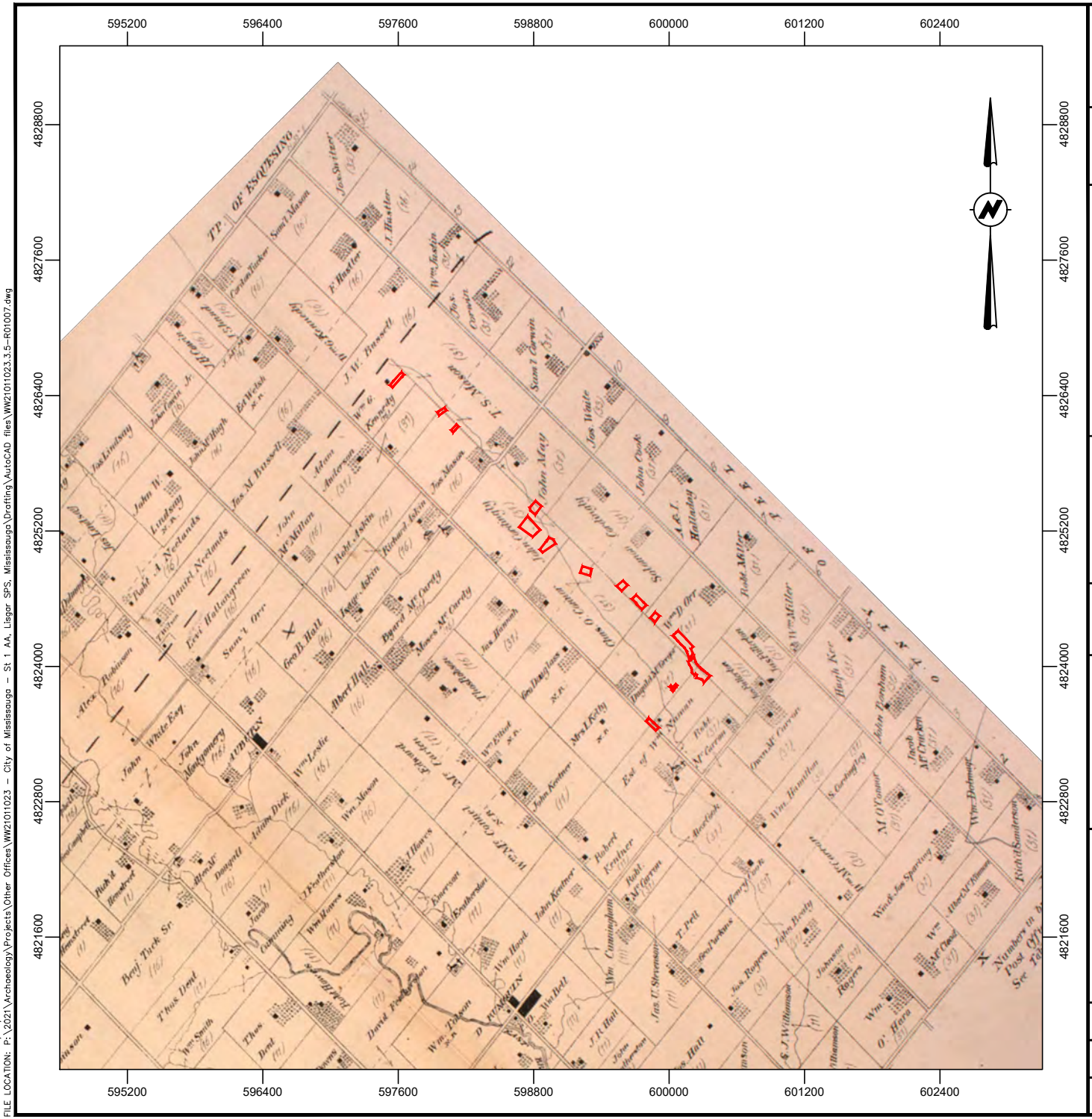


PROJECT: STAGE 1 ARCHAEOLOGICAL ASSESSMENT
LISGAR DISTRICT STORMWATER PUMPING STATION
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT
PART OF LOTS 6 TO 12, CONCESSION 10
GEOGRAPHIC TOWNSHIP OF TRAFALGAR, HALTON COUNTY
NOW IN THE CITY OF MISSISSAUGA, ONTARIO

TITLE: 1877 ILLUSTRATED HISTORICAL ATLAS
MAP OF THE COUNTY OF HALTON SHOWING
THE LOCATION OF THE STUDY AREA

LEGEND:

STUDY AREA

NOTES:

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS REPORT No. WW21011023.3.5.

ALL LOCATIONS ARE APPROXIMATE.

**ORIGINAL PAPER SIZE: 8½ x 11.**

REFERENCES:
WALKER & MILES, 1877; CANMAP STREETFILES V2008.4.

0 500 1500 2500m

SCALE 1:50000

City of Mississauga
300 CITY CENTRE DRIVE
MISSISSAUGA, ONTARIO, L5B 3C1

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wood.

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|---|---|---|
| SJL | PP | JULY 13, 2021 |
| DATUM: | PROJECTION: | PROJECT No: |
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| 0 | | 7 |

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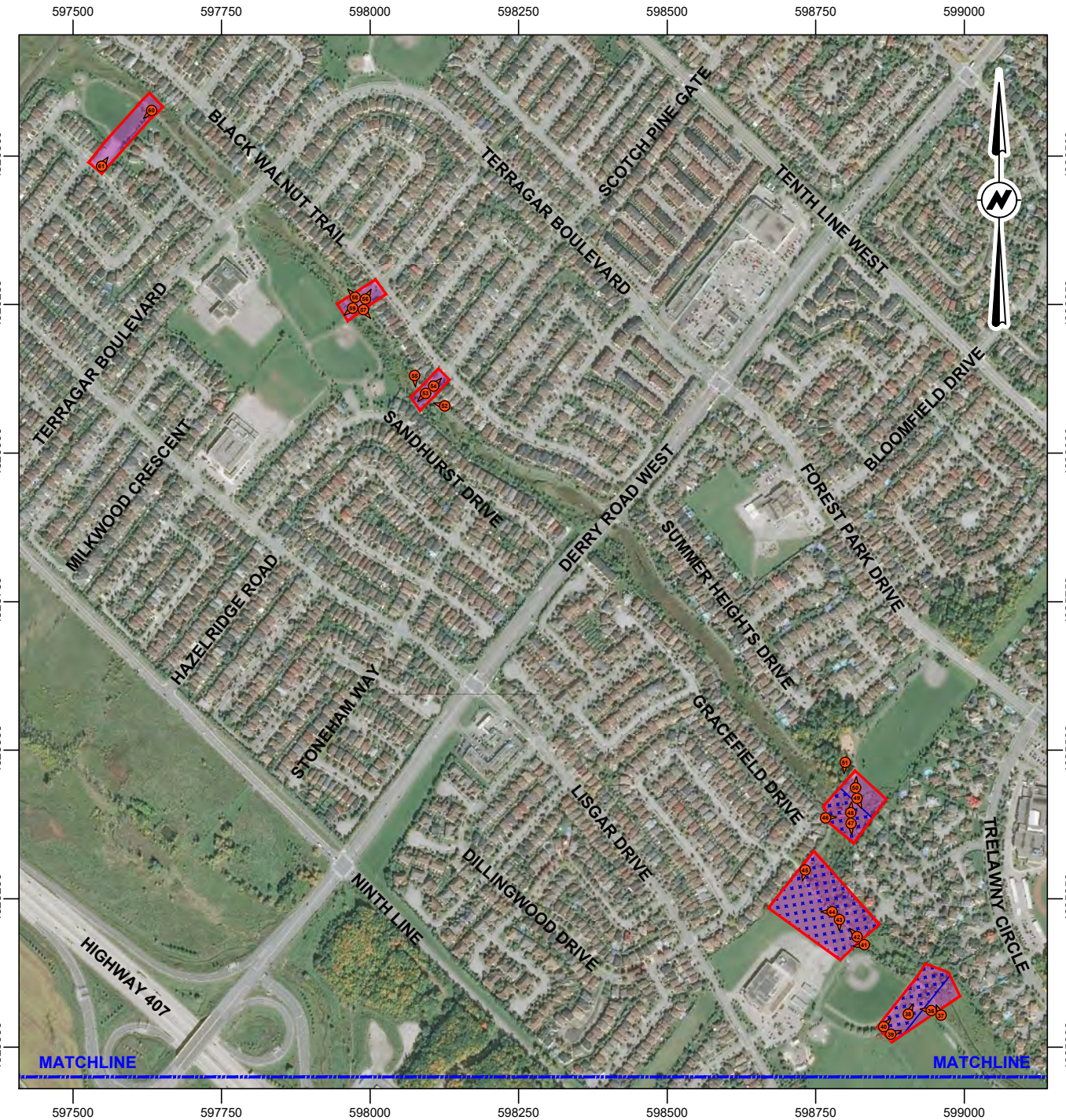


PROJECT: STAGE 1 ARCHAEOLOGICAL ASSESSMENT
LISGAR DISTRICT STORMWATER PUMPING STATION
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT
PART OF LOTS 6 TO 12, CONCESSION 10
GEOGRAPHIC TOWNSHIP OF TRAFALGAR, HALTON COUNTY
NOW IN THE CITY OF MISSISSAUGA, ONTARIO

TITLE:
STAGE 1 RESULTS WITH PHOTOGRAPH LOCATIONS AND DIRECTIONS

LEGEND:
- STUDY AREA
- 61 PHOTOGRAPH LOCATION, VIEWING DIRECTION, AND IDENTIFICATION
- PREVIOUSLY ASSESSED PRIOR TO IMPLEMENTATION OF MHSTCI 2011 STANDARDS AND GUIDELINES FOR CONSULTANT ARCHAEOLOGISTS

AREA OF NO ARCHAEOLOGICAL POTENTIAL
- DISTURBED: NO FURTHER ASSESSMENT REQUIRED

NOTES:
THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS REPORT No. WW21011023.3.5.

ALL LOCATIONS ARE APPROXIMATE.

**ORIGINAL PAPER SIZE: 8½ x 11.**

REFERENCES:
BING IMAGERY AS OF JULY 14, 2021 (IMAGE DATE UNKNOWN), BING IMAGERY USED FOR ILLUSTRATION PURPOSES ONLY AND NOT TO BE USED FOR MEASUREMENTS; CANMAP STREETFILES V2008.4.

0 100 300 500m
SCALE 1:10000

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| SJL | CD | SEP. 8, 2021 |
| DATUM: | PROJECTION: | PROJECT No: |
| NAD83 | UTM Zone 17 | WW21011023.3.5 |
| REV No: | | FIGURE No: |
| 0 | | 8A |

DATE PLOTTED: 9/29/2021 10:18:05 AM
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PROJECT: STAGE 1 ARCHAEOLOGICAL ASSESSMENT
LISGAR DISTRICT STORMWATER PUMPING STATION
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT
PART OF LOTS 6 TO 12, CONCESSION 10
GEOGRAPHIC TOWNSHIP OF TRAFALGAR, HALTON COUNTY
NOW IN THE CITY OF MISSISSAUGA, ONTARIO

TITLE:
STAGE 1 RESULTS WITH PHOTOGRAPH LOCATIONS AND DIRECTIONS

LEGEND:
- STUDY AREA
- PHOTOGRAPH LOCATION, VIEWING DIRECTION, AND IDENTIFICATION
- PREVIOUSLY ASSESSED PRIOR TO IMPLEMENTATION OF MHSTCI 2011 STANDARDS AND GUIDELINES FOR CONSULTANT ARCHAEOLOGISTS

AREA OF NO ARCHAEOLOGICAL POTENTIAL
- DISTURBED: NO FURTHER ASSESSMENT REQUIRED

NOTES:

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ALL LOCATIONS ARE APPROXIMATE.

**ORIGINAL PAPER SIZE: 8½ x 11.**

REFERENCES:
BING IMAGERY AS OF JULY 14, 2021 (IMAGE DATE UNKNOWN), BING IMAGERY USED FOR ILLUSTRATION PURPOSES ONLY AND NOT TO BE USED FOR MEASUREMENTS; CANMAP STREETFILES V2008.4.

0 100 300 500m
SCALE 1:10000

City of Mississauga
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| SJL | CD | SEP. 8, 2021 |
| DATUM: | PROJECTION: | PROJECT No: |
| NAD83 | UTM Zone 17 | WW21011023.3.5 |
| REV No: | | FIGURE No: |
| 0 | | 8B |

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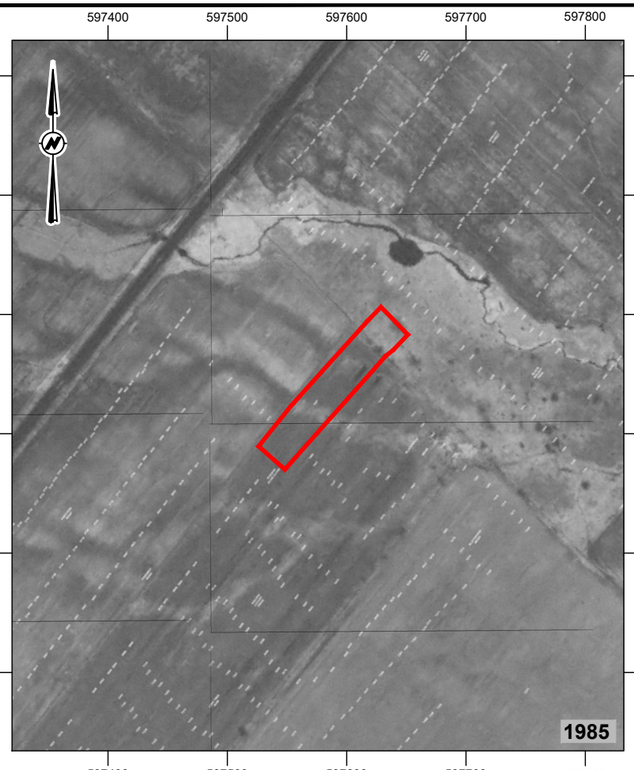
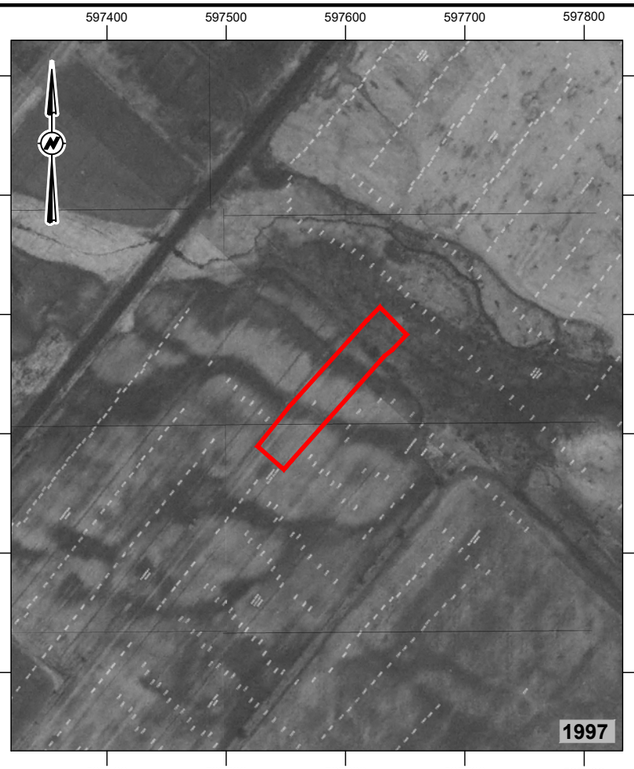
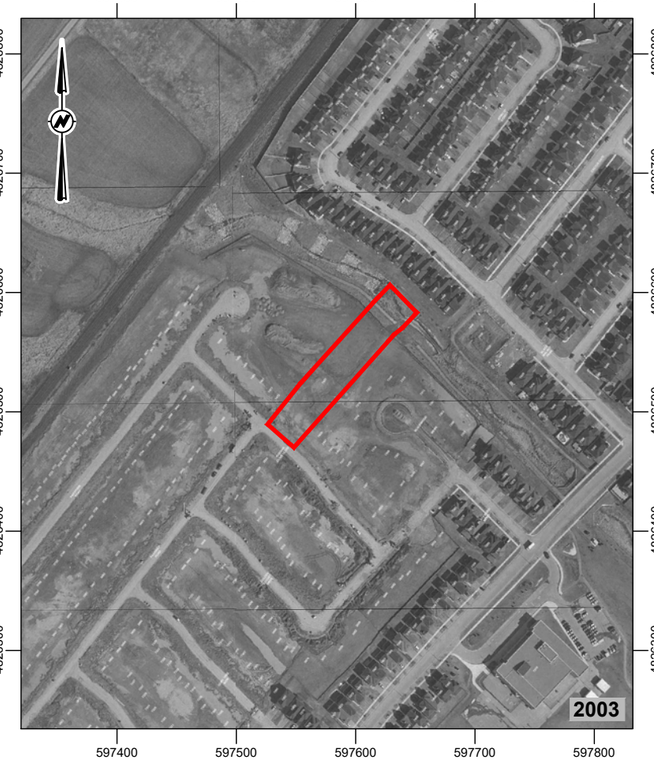
# Appendix B: Aerial Imagery, Post-1985





PROJECT: STAGE 1 ARCHAEOLOGICAL ASSESSMENT
LISGAR DISTRICT STORMWATER PUMPING STATION
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT
PART OF LOTS 6 TO 12, CONCESSION 10
GEOGRAPHIC TOWNSHIP OF TRAFALGAR, HALTON COUNTY
NOW IN THE CITY OF MISSISSAUGA, ONTARIO

TITLE:

AERIAL PHOTOGRAPHS: SUB-AREA 1

LEGEND:

STUDY AREA

NOTES:

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS REPORT No. WW21011023.3.5.

ALL LOCATIONS ARE APPROXIMATE.

**ORIGINAL PAPER SIZE: 11 x 17.**

REFERENCES:
AERIAL PHOTOGRAPHS BY THE CITY OF MISSISSAUGA;
CANMAP STREETFILES V2008.4.

0 50 150 250m

SCALE 1:5000

City of Mississauga
300 CITY CENTRE DRIVE
MISSISSAUGA, ONTARIO, L5B 3C1

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wood.

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| SJL | HC | OCT. 26, 2021 |
| DATUM: | PROJECTION: | PROJECT No: |
| NAD83 | UTM Zone 17 | WW21011023.3.5 |
| REV No: | | PLATE No: |
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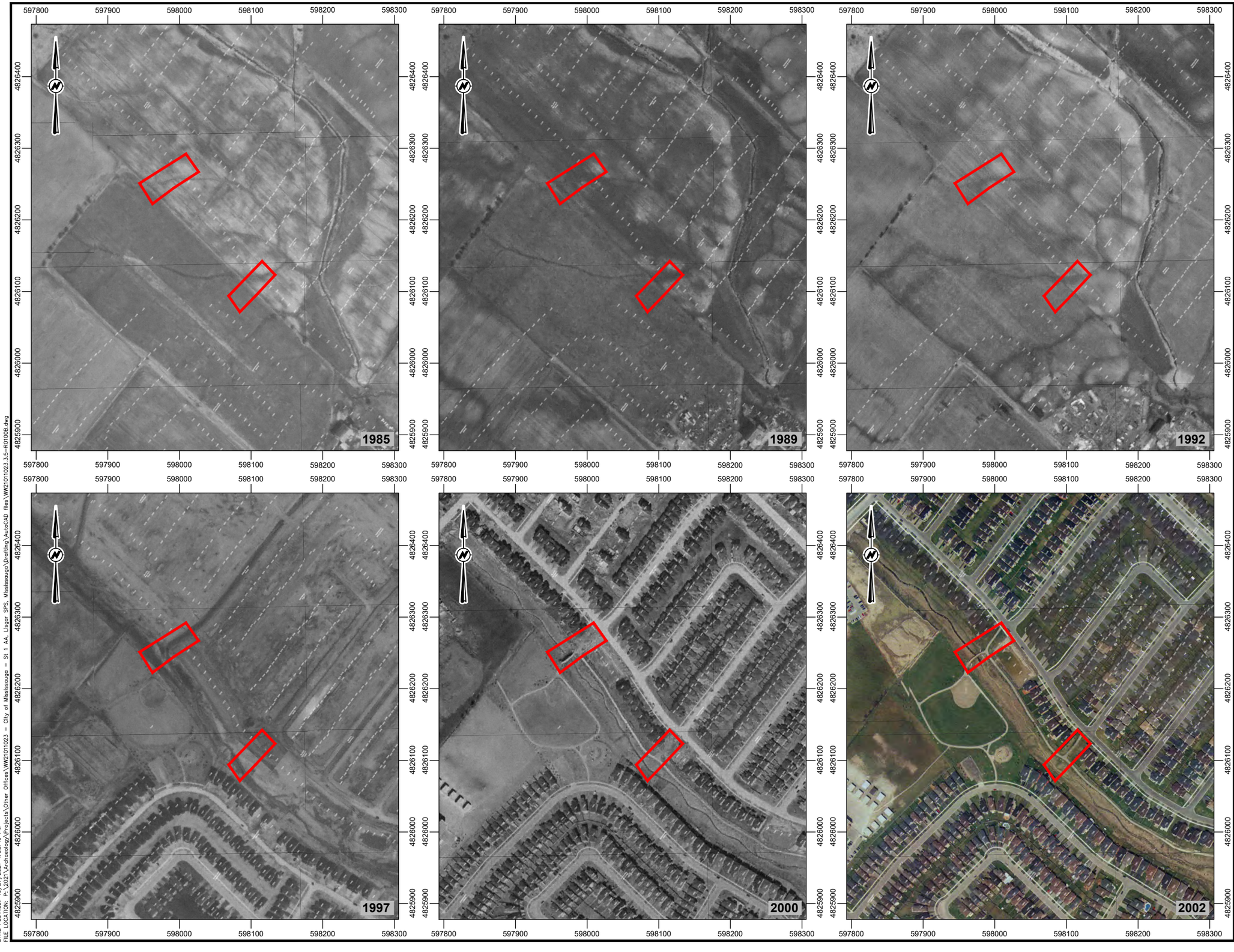


PROJECT: STAGE 1 ARCHAEOLOGICAL ASSESSMENT
LISGAR DISTRICT STORMWATER PUMPING STATION
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT
PART OF LOTS 6 TO 12, CONCESSION 10
GEOGRAPHIC TOWNSHIP OF TRAFALGAR, HALTON COUNTY
NOW IN THE CITY OF MISSISSAUGA, ONTARIO

TITLE:

# AERIAL PHOTOGRAPHS: SUB-AREAS 2 & 3

LEGEND:

STUDY AREA

NOTES:

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS REPORT No. WW21011023.3.5.

ALL LOCATIONS ARE APPROXIMATE.

**ORIGINAL PAPER SIZE: 11 x 17.**

REFERENCES:
AERIAL PHOTOGRAPHS BY THE CITY OF MISSISSAUGA;
CANMAP STREETFILES V2008.4.

0 50 150 250m

SCALE 1:5000

City of Mississauga
300 CITY CENTRE DRIVE
MISSISSAUGA, ONTARIO, L5B 3C1

MISSISSAUGA

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| SJL | HC | OCT. 26, 2021 |
| DATUM: | PROJECTION: | PROJECT No: |
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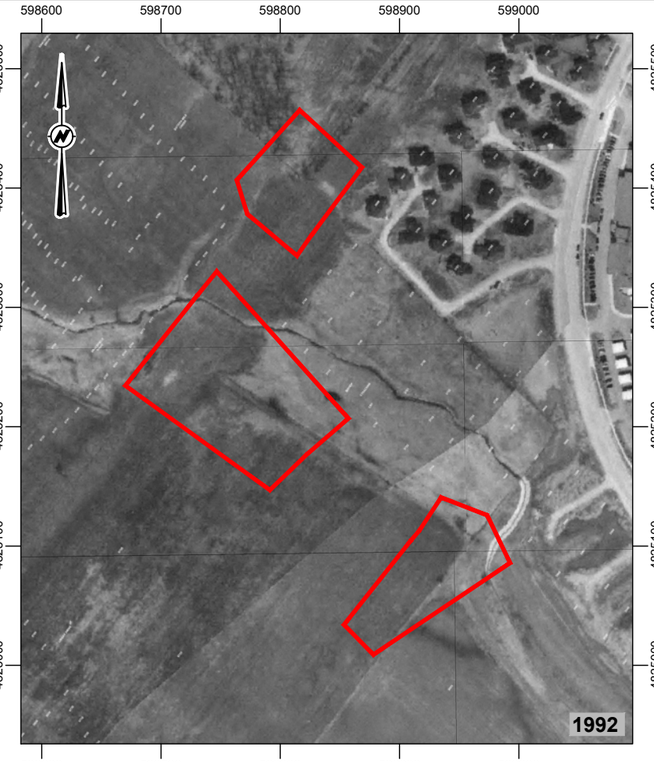


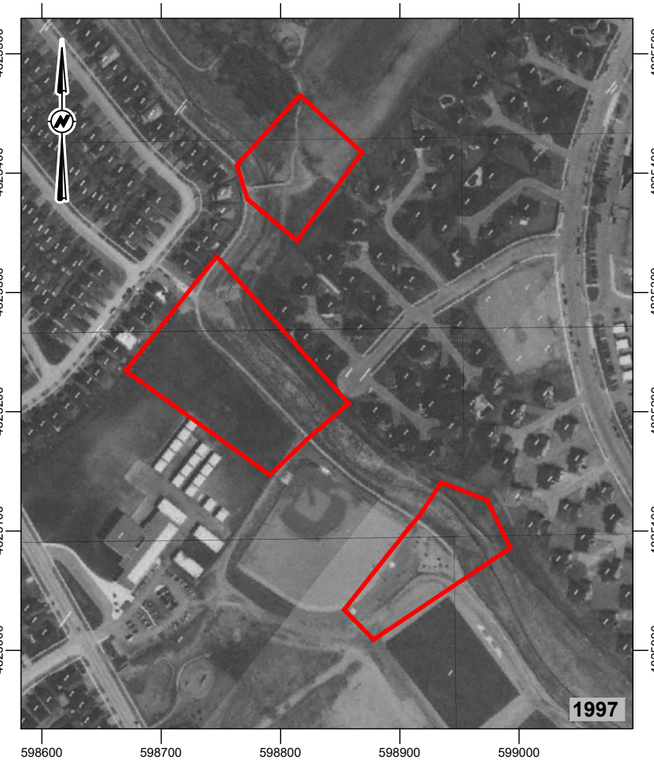


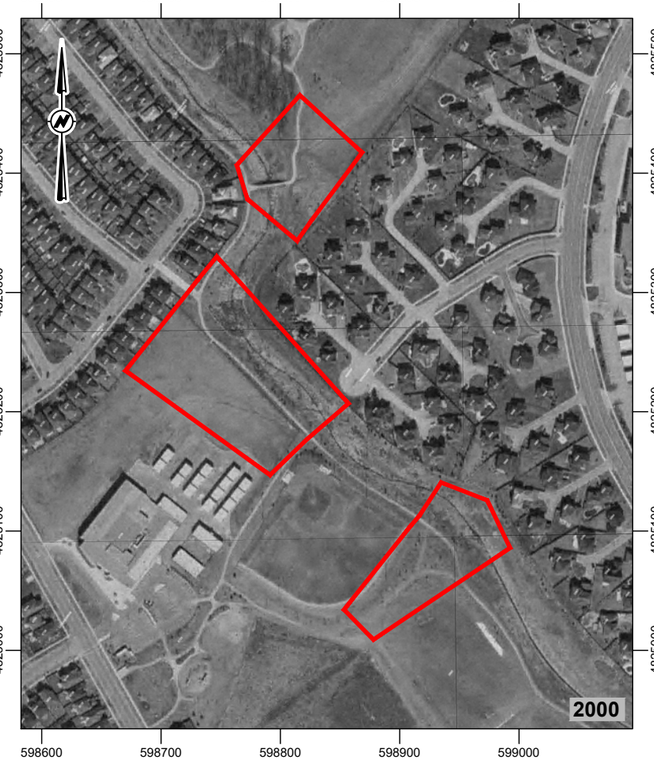

PROJECT: STAGE 1 ARCHAEOLOGICAL ASSESSMENT
LISGAR DISTRICT STORMWATER PUMPING STATION
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT
PART OF LOTS 6 TO 12, CONCESSION 10
GEOGRAPHIC TOWNSHIP OF TRAFALGAR, HALTON COUNTY
NOW IN THE CITY OF MISSISSAUGA, ONTARIO

TITLE:

# AERIAL PHOTOGRAPHS: SUB-AREAS 4, 5 & 6

LEGEND:

STUDY AREA

NOTES:

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS REPORT No. WW21011023.3.5.

ALL LOCATIONS ARE APPROXIMATE.

**ORIGINAL PAPER SIZE: 11 x 17.**

REFERENCES:
AERIAL PHOTOGRAPHS BY THE CITY OF MISSISSAUGA;
CANMAP STREETFILES V2008.4.

0 50 150 250m

SCALE 1:5000

City of Mississauga
300 CITY CENTRE DRIVE
MISSISSAUGA, ONTARIO, L5B 3C1

MISSISSAUGA

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905-312-0700

wood.

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| SJL | HC | OCT. 26, 2021 |
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| NAD83 | UTM Zone 17 | WW21011023.3.5 |
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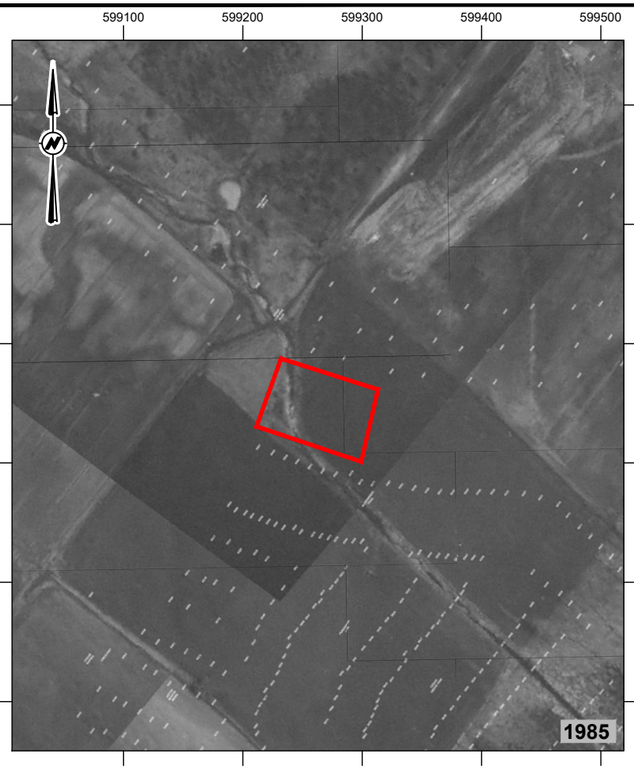


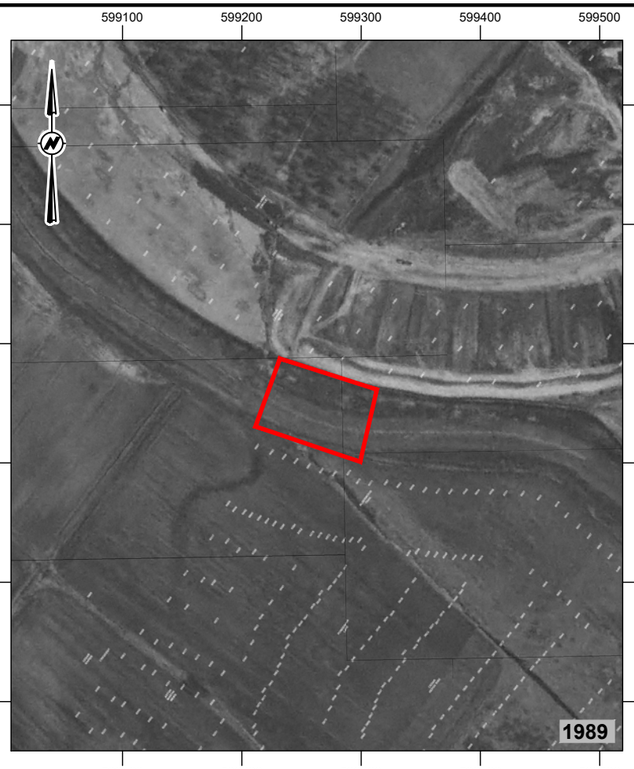


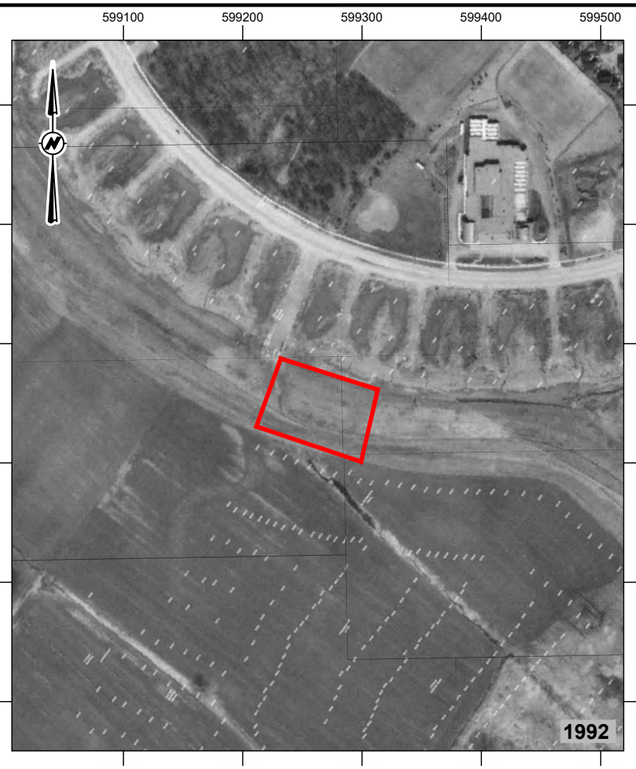

PROJECT: STAGE 1 ARCHAEOLOGICAL ASSESSMENT
LISGAR DISTRICT STORMWATER PUMPING STATION
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT
PART OF LOTS 6 TO 12, CONCESSION 10
GEOGRAPHIC TOWNSHIP OF TRAFALGAR, HALTON COUNTY
NOW IN THE CITY OF MISSISSAUGA, ONTARIO

TITLE:

AERIAL PHOTOGRAPHS: SUB-AREA 7

LEGEND:

STUDY AREA

NOTES:

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS REPORT No. WW21011023.3.5.

ALL LOCATIONS ARE APPROXIMATE.

**ORIGINAL PAPER SIZE: 11 x 17.**

REFERENCES:
AERIAL PHOTOGRAPHS BY THE CITY OF MISSISSAUGA;
CANMAP STREETFILES V2008.4.

0 50 150 250m
SCALE 1:5000

City of Mississauga
300 CITY CENTRE DRIVE
MISSISSAUGA, ONTARIO, L5B 3C1

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Environment & Infrastructure Solutions
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| SJL | HC | OCT. 26, 2021 |
| DATUM: | PROJECTION: | PROJECT No: |
| NAD83 | UTM Zone 17 | WW21011023.3.5 |
| REV No: | | PLATE No: |
| 0 | | 4 |

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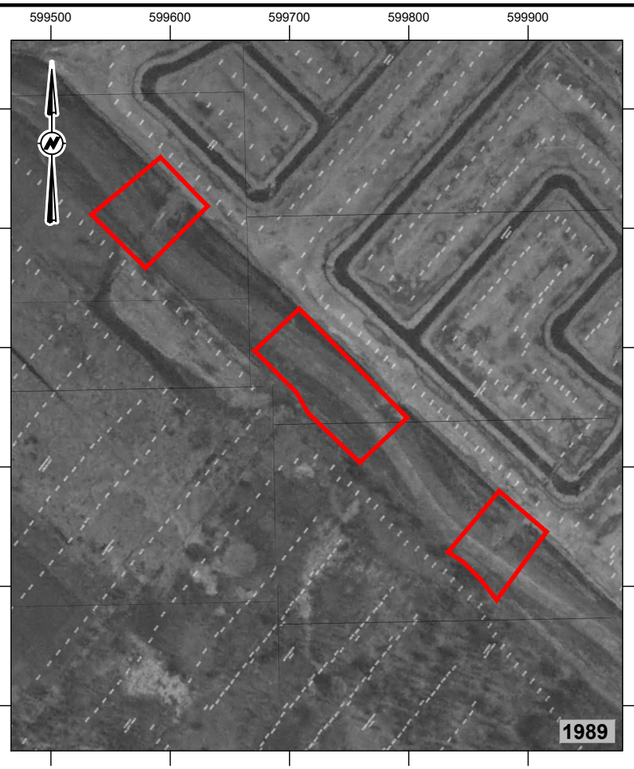


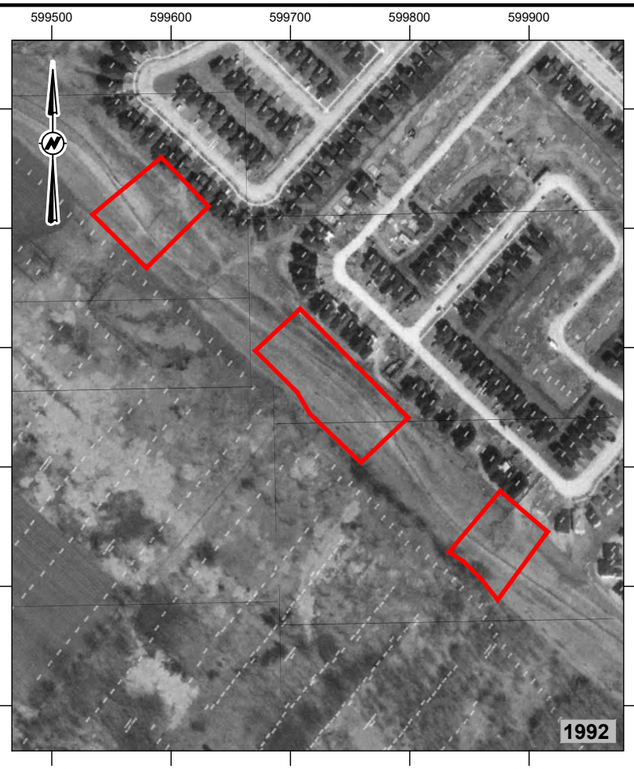


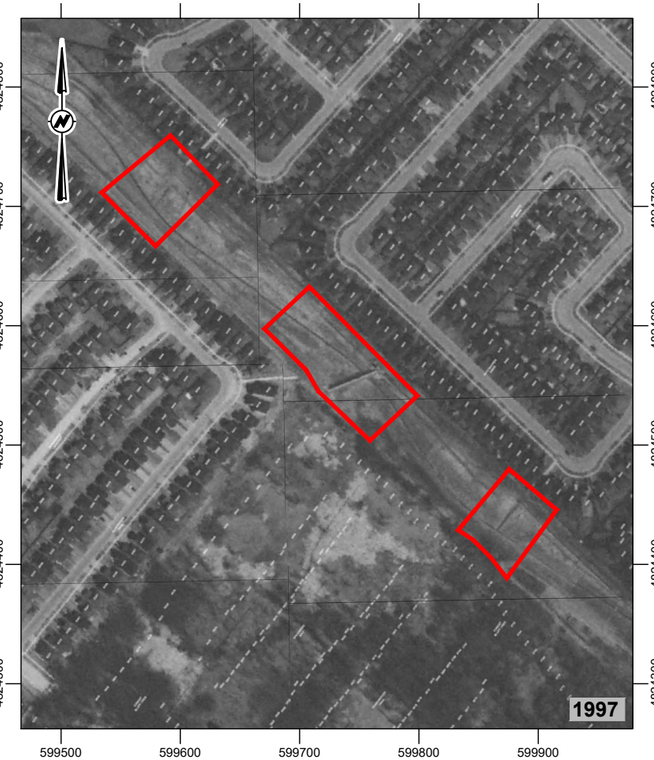


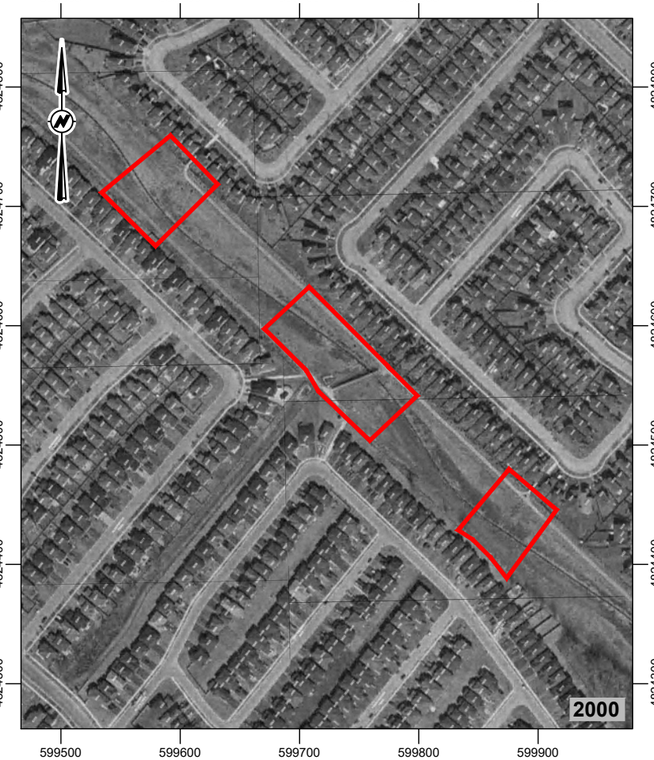

PROJECT: STAGE 1 ARCHAEOLOGICAL ASSESSMENT
LISGAR DISTRICT STORMWATER PUMPING STATION
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT
PART OF LOTS 6 TO 12, CONCESSION 10
GEOGRAPHIC TOWNSHIP OF TRAFALGAR, HALTON COUNTY
NOW IN THE CITY OF MISSISSAUGA, ONTARIO

TITLE:

# AERIAL PHOTOGRAPHS: SUB-AREAS 8, 9 &10

LEGEND:

STUDY AREA

NOTES:

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS REPORT No. WW21011023.3.5.

ALL LOCATIONS ARE APPROXIMATE.

**ORIGINAL PAPER SIZE: 11 x 17.**

REFERENCES:
AERIAL PHOTOGRAPHS BY THE CITY OF MISSISSAUGA;
CANMAP STREETFILES V2008.4.

0 50 150 250m

SCALE 1:5000

City of Mississauga
300 CITY CENTRE DRIVE
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wood.

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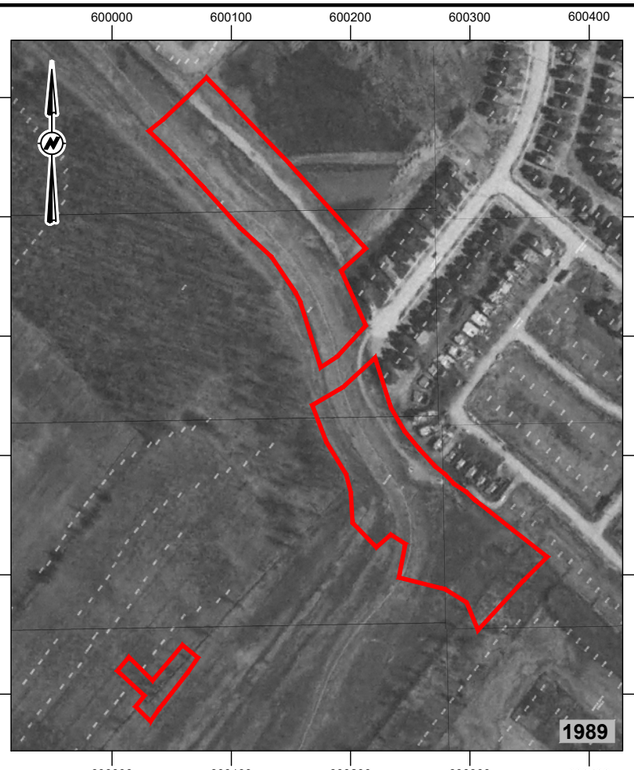


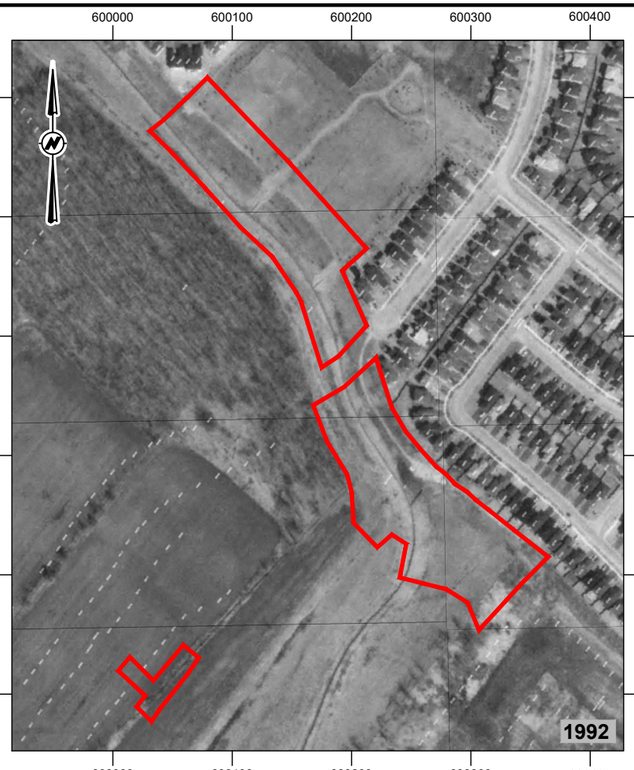


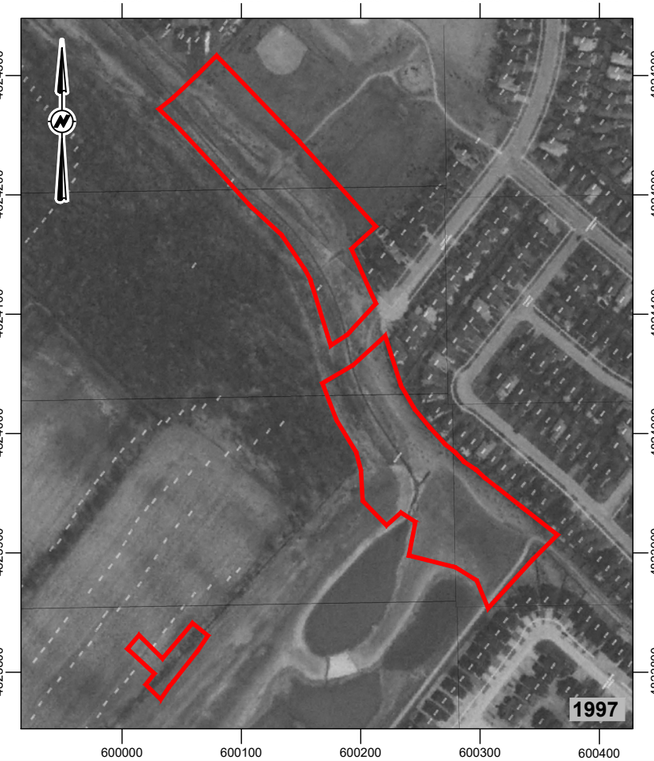

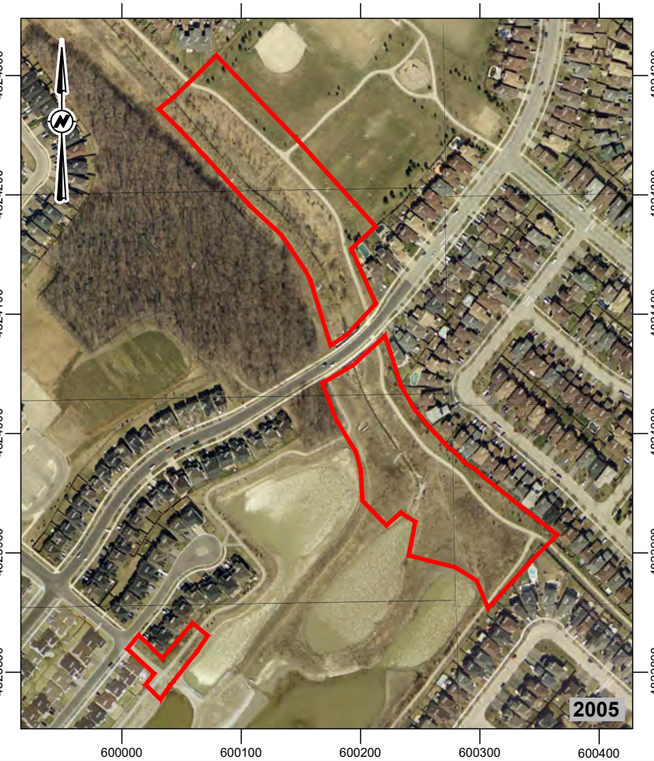


PROJECT: STAGE 1 ARCHAEOLOGICAL ASSESSMENT
LISGAR DISTRICT STORMWATER PUMPING STATION
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT
PART OF LOTS 6 TO 12, CONCESSION 10
GEOGRAPHIC TOWNSHIP OF TRAFALGAR, HALTON COUNTY
NOW IN THE CITY OF MISSISSAUGA, ONTARIO

TITLE:

AERIAL PHOTOGRAPHS: SUB-AREAS 11, 12 &13

LEGEND:

STUDY AREA

NOTES:

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS REPORT No. WW21011023.3.5.

ALL LOCATIONS ARE APPROXIMATE.

**ORIGINAL PAPER SIZE: 11 x 17.**

REFERENCES:
AERIAL PHOTOGRAPHS BY THE CITY OF MISSISSAUGA;
CANMAP STREETFILES V2008.4.

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SCALE 1:5000

City of Mississauga
300 CITY CENTRE DRIVE
MISSISSAUGA, ONTARIO, L5B 3C1

MISSISSAUGA

Wood
Environment & Infrastructure Solutions
3450 HARVESTER ROAD, SUITE 100
BURLINGTON, ONTARIO, L7N 3W5
905-312-0700

wood.

| DWN BY: | CHK'D BY: | DATE: |
|---|---|---|
| SJL | HC | OCT. 26, 2021 |
| DATUM: | PROJECTION: | PROJECT No: |
| NAD83 | UTM Zone 17 | WW21011023.3.5 |
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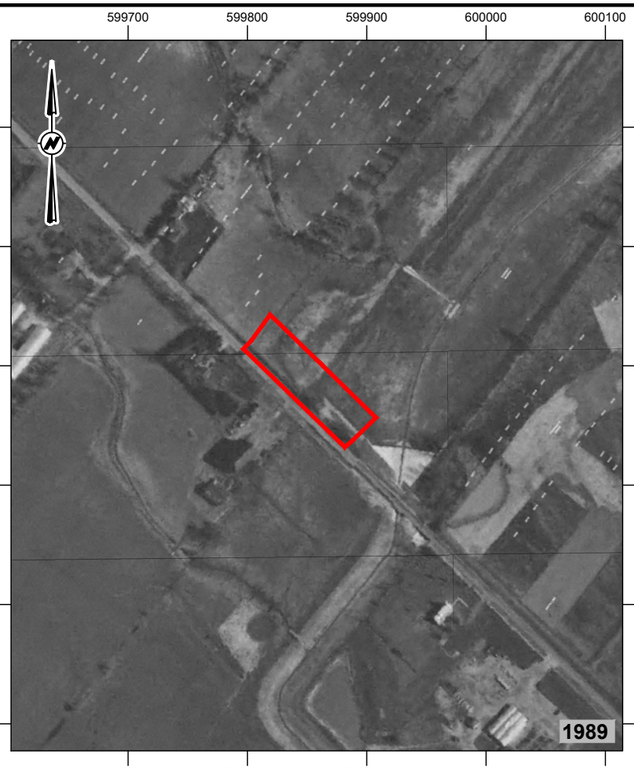


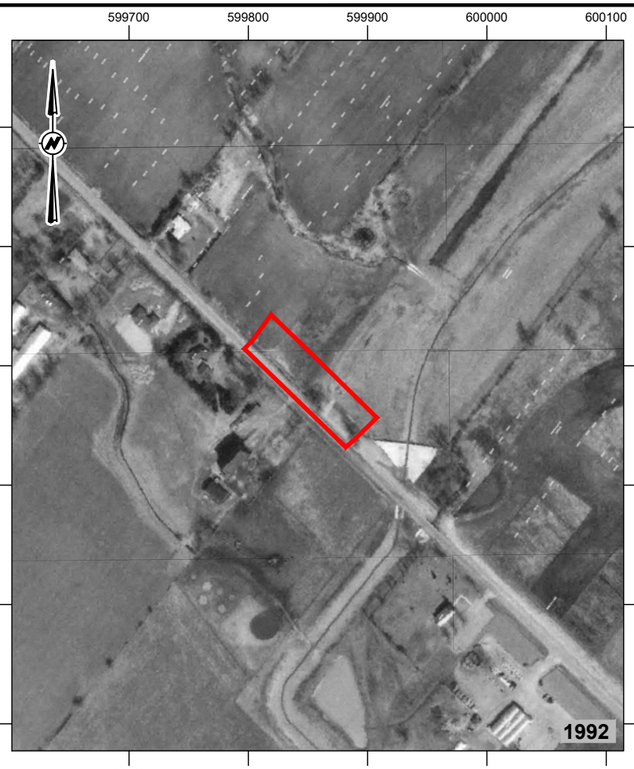

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PROJECT: STAGE 1 ARCHAEOLOGICAL ASSESSMENT
LISGAR DISTRICT STORMWATER PUMPING STATION
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT
PART OF LOTS 6 TO 12, CONCESSION 10
GEOGRAPHIC TOWNSHIP OF TRAFALGAR, HALTON COUNTY
NOW IN THE CITY OF MISSISSAUGA, ONTARIO

TITLE:

# AERIAL PHOTOGRAPHS: SUB-AREA 14

LEGEND:

STUDY AREA

NOTES:

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS REPORT No. WW21011023.3.5.

ALL LOCATIONS ARE APPROXIMATE.

**ORIGINAL PAPER SIZE: 11 x 17.**

REFERENCES:
AERIAL PHOTOGRAPHS BY THE CITY OF MISSISSAUGA; CANMAP STREETFILES V2008.4.

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SCALE 1:5000

City of Mississauga
300 CITY CENTRE DRIVE
MISSISSAUGA, ONTARIO, L5B 3C1

MISSISSAUGA

Wood
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3450 HARVESTER ROAD, SUITE 100
BURLINGTON, ONTARIO, L7N 3W5
905-312-0700

wood.

| DWN BY: | CHK'D BY: | DATE: |
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| SJL | HC | OCT. 26, 2021 |
| DATUM: | PROJECTION: | PROJECT No: |
| NAD83 | UTM Zone 17 | WW21011023.3.5 |
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# Appendix C: Photographs

## PHOTOGRAPH 1

View of concrete pathway, and sections of manicured lawn/shrubbery within the Study Area, facing north northwest.

## PHOTOGRAPH 2

View of concrete pathway, marshland, sections of manicured lawn/shrubbery and sloping topography within the Study Area, facing southeast.

## PHOTOGRAPH 3

View of Osprey Marshlands and sections of sloping topography within the Study Area, facing south southeast.

## PHOTOGRAPH 4

View of Osprey Marshlands and sections of sloping topography within the Study Area, facing northwest.

## PHOTOGRAPH 5

View of concrete pathway, sections of marshland/ manicured lawn within the Study Area, facing northeast.

## PHOTOGRAPH 6

View of concrete pathway, sections of marshland/ manicured lawn within the Study Area, facing southeast.

## PHOTOGRAPH 7

View of concrete pathway, sections of marshland/ manicured lawn within the Study Area, facing southwest.

## PHOTOGRAPH 8

View of concrete pathway, sections of marshland/ manicured lawn within the Study Area, facing southeast.

## PHOTOGRAPH 9

View of concrete pathway, sections of marshland/ manicured lawn within the Study Area, facing southeast.

## PHOTOGRAPH 10

View of Osprey marshlands and sections of sloping topography within the Study Area, facing northwest.

## PHOTOGRAPH 11

View of Osprey marshlands and sections of sloping topography within the Study Area, facing north northwest.

## PHOTOGRAPH 12

View of Osprey marshlands and sections of sloping topography within the Study Area, facing northeast.

## PHOTOGRAPH 13

View of Osprey marshlands and sections of sloping topography within the Study Area, facing southeast.

## PHOTOGRAPH 14

View of concrete pathway, sections of marshland/ manicured lawn within the Study Area, facing north northwest.

## PHOTOGRAPH 15

View of concrete pathway, sections of marshland/ manicured lawn within the Study Area, facing south southeast.

## PHOTOGRAPH 16

View of concrete pathway, sections of marshland/ manicured lawn within the Study Area, facing south.

## PHOTOGRAPH 17

View of concrete pathway, sections of marshland within the Study Area, facing southwest.

## PHOTOGRAPH 18

View of concrete pathway, sections of marshland/ manicured lawn within the Study Area, facing west.

## PHOTOGRAPH 19

View of concrete pathway, sections of marshland/ manicured lawn within the Study Area, facing southeast.

## PHOTOGRAPH 20

View of concrete pathway, sections of marshland within the Study Area, facing west-northwest.

## PHOTOGRAPH 21

View of concrete pathway, sections of marshland within the Study Area, facing south.

## PHOTOGRAPH 22

View of concrete pathway, sections of marshland within the Study Area, facing west.

## PHOTOGRAPH 23

View of concrete pathway, sections of marshland within the Study Area, facing south southeast.

## PHOTOGRAPH 24

View of concrete pathway, marshland and sections of manicured lawn within the Study Area, facing northwest.

## PHOTOGRAPH 25

View of man-made channelization resulting in permanently low and wet marshlands, facing southeast.

## PHOTOGRAPH 26

View of man-made channelization resulting in permanently low and wet marshlands, facing northwest.

## PHOTOGRAPH 27

View of marshlands within the Study Area, facing west.

## PHOTOGRAPH 28

View of concrete pathway, marshland and sections of manicured lawn within the Study Area, facing northwest.

## PHOTOGRAPH 29

View of concrete pathway, marshland and bridge within the Study Area, facing north.

## PHOTOGRAPH 30

View of concrete pathway, marshland and sections of manicured lawn within the Study Area, facing south.

## PHOTOGRAPH 31

View of marshland within the Study Area, facing west.

## PHOTOGRAPH 32

View of concrete pathway, marshland and sections of manicured lawn within the Study Area, facing southeast.

## PHOTOGRAPH 33

View of marshland within the Study Area, facing southeast.

## PHOTOGRAPH 34

View of marshland within the Study Area, facing east-southeast.

## PHOTOGRAPH 35

View of marshland within the Study Area, facing east-northeast.

## PHOTOGRAPH 36

View of concrete pathway and sections of manicured lawn within the Study Area, facing west-northwest towards a baseball diamond.

## PHOTOGRAPH 37

View of concrete pathway and sections of shrubbery located on the edge of the marshlands within the Study Area, facing northwest.

## PHOTOGRAPH 38

View of concrete pathway, sections of marshland/ manicured lawn within the Study Area, facing northeast.

## PHOTOGRAPH 39

View of sections of manicured lawn within the Study Area, facing northeast.

## PHOTOGRAPH 40

View of sections of manicured lawn within the Study Area, facing northeast.

## PHOTOGRAPH 41

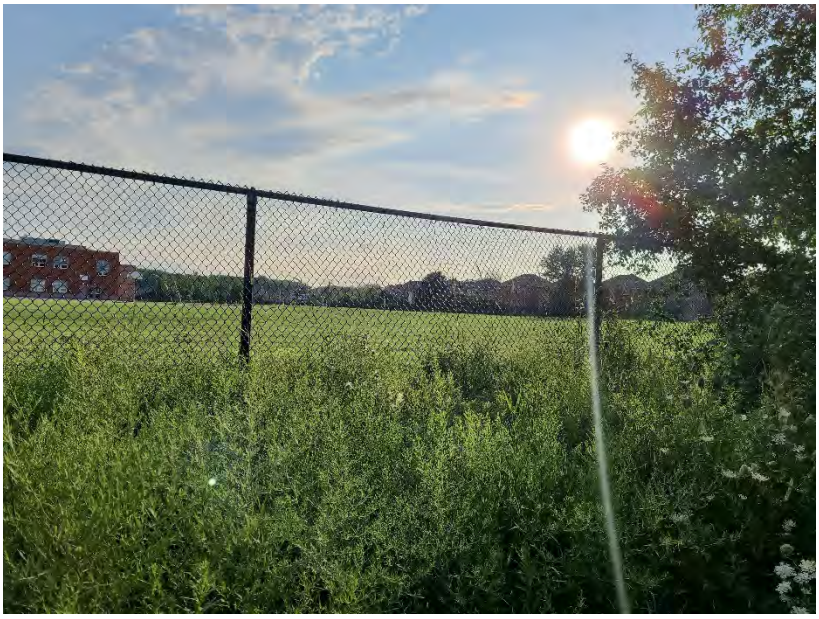
View of sections of manicured lawn within the Study Area, facing west.

## PHOTOGRAPH 42

View of concrete pathway, sections of marshland/ manicured lawn within the Study Area, facing northwest.

## PHOTOGRAPH 43

View of sections of manicured lawn within the Study Area, facing south.



## PHOTOGRAPH 44

View of sections of manicured lawn within the Study Area, facing west.

## PHOTOGRAPH 45

View of concrete pathway and sections manicured lawn within the Study Area, facing south-southwest.

## PHOTOGRAPH 46

View of concrete pathway and bridge within the Study Area, facing east.

## PHOTOGRAPH 47

View of undulating topography and sections of tall grass within the Study Area, facing south.

## PHOTOGRAPH 48

View of concrete pathway, manicured lawn and tall grass within the Study Area, facing north northeast.

## PHOTOGRAPH 49

View of sections of manicured lawn within the Study Area, facing southeast.

## PHOTOGRAPH 50

View of concrete pathway and undulating topography within the Study Area, facing north northeast.

## PHOTOGRAPH 51

View of woodlot located on the periphery of the Study Area, facing south-southwest.

## PHOTOGRAPH 52

View of concrete pathway and sections of marshland within the Study Area, facing northwest.

## PHOTOGRAPH 53

View of marshland within the Study Area, facing southwest.

## PHOTOGRAPH 54

View of concrete pathway and sections of manicured lawn within the Study Area, facing northeast.

## PHOTOGRAPH 55

View of concrete pathway and sections of marshland within the Study Area, facing south.

## PHOTOGRAPH 56

View of concrete pathway and sections of manicured lawn within the Study Area, facing northeast.

## PHOTOGRAPH 57

View of marshland within the Study Area, facing southeast.

## PHOTOGRAPH 58

View of marshland within the Study Area, facing northwest.

## PHOTOGRAPH 59

View of bridge and sections of manicured lawn within the Study Area, facing southwest.

## PHOTOGRAPH 60

View of concrete pathway and sections of manicured lawn within the Study Area, facing southwest.

## PHOTOGRAPH 61

View of concrete pathway/parking lot and sections of manicured lawn within the Study Area, facing northeast.

# Appendix D: Assessor Qualifications

# Assessor Qualifications

**Peter Popkin, Ph.D., CAHP, MCIfA, Associate Archaeologist (P362) –** Dr. Popkin is an Associate Archaeologist at Wood. Peter has over 20 years of professional experience in both consulting and academic archaeology within Canada and internationally. In Ontario he has successfully undertaken consultant archaeology projects triggered by: the Planning Act (subdivisions, site plans, re-zoning, official plan amendments, consent), the Environmental Assessment Act (individual and Class EAs, provincial and federal EAs), the Environmental Protection Act (Renewable Energy Approvals O.Reg 359/09), as well as the Aggregates Resources Act (aggregate pit extensions), and has managed projects under the National Energy Board Act (now the Canadian Energy Regulator Act). Dr. Popkin has lectured in archaeology at York University, the University of Toronto and Wilfrid Laurier University in Ontario, as well as University College London, King's College London, and Birkbeck College, in the UK. Dr. Popkin holds a Professional Archaeology Licence (P362) from the Ontario MHSTCI, is a Professional Member of the Canadian Association of Heritage Professionals (CAHP) and is a full Member of the Chartered Institute for Archaeologists (MCIfA). Dr. Popkin received his Ph.D. from the Institute of Archaeology, University College London, London, UK (2009).

**Barbara Slim, M.A., Associate Archaeologist, Ontario Archaeology Discipline Lead (P348) –** Ms. Slim is a professionally licensed archaeologist with over 16 years of experience in the archaeology and environmental consulting industry. Ms. Slim has conducted all aspects of Stage 1 to 4 archaeological assessments for provincial agencies, municipalities, and land developers in support of infrastructure developments, financial real estate transactions, environmental remediation and private developments. As a founding member of the Wood Ontario archaeology team, Ms. Slim has performed every aspect of project execution, from client relations, project design to MHSTCI clearance. Through her project experience, Ms. Slim has gained an in-depth understanding of the Heritage Act and legislations & standards associated with cultural heritage management. Ms. Slim holds a Master's Degree in Anthropology from Trent University and an Honours Bachelor's Degree in Environmental Studies and Anthropology from Trent University. Ms. Slim currently holds a Professional Archaeology Licence (P348) issued by the Ontario MHSTCI, is RAQs Certified in Archaeology/Heritage and is a member of the Ontario Association of Professional Archaeologists.

**Chelsea Dickinson, BA - Cultural Heritage Specialist | Research Archaeologist (R1194) -** Ms. Dickinson holds an Honours B.A. Degree in Near Eastern and Classical Archaeology from Wilfrid Laurier University, and a Post-Graduate Certificate in Geographical Information Systems from Fanshawe College. She has been working in the field of cultural resource management since 2015 and holds an Applied Research license (License R1194) in Archaeology from the Ontario Ministry of Heritage, Sport, Tourism and Culture Industries. Ms. Dickinson has worked on a wide variety of projects throughout Ontario, including Cultural Heritage Assessments Reports (CHARs), Cultural Heritage Reports (CHRs under TPAP), Heritage Impact Assessments (HIAs), Cultural Heritage Evaluation Reports (CHERs) using Ontario Regulation 9/06 and 10/06, Strategic Conservation Plans (SCP), and archaeological assessments (Stage 1-4) throughout Ontario. Ms. Dickinson has been the prime/co-author on a multitude of archaeological (i.e., Stage 1-4) and cultural heritage assessment reports (i.e., CHAR, CHER, HIA, CHDR), specializing in historical background research across Ontario. Ms. Dickinson has had the privilege of working alongside a multitude of First Nation community members while conducting archaeological assessments in both Northern and Southern Ontario. In addition, she has experience using ArcGIS/Collector and high precision GPS technologies, specifically Top Con Hi SR and FC5000 positioning systems, used to map in architectural features, diagnostic artifacts, as well as topographical anomalies and site boundaries.

**Henry Cary, Ph.D., CAHP, RPA, Senior Staff Archaeologist (P327)** - Dr. Henry Cary has over 20 years of public and private-sector experience directing archaeological and cultural heritage projects in urban, rural, Arctic and Sub-Arctic environments in Canada as well as the Republic of South Africa, Italy, and France. His career has included positions as project archaeologist and cultural resource management specialist for Parks Canada's Fort Henry National Historic Site Conservation Program and Western Arctic Field Unit, Heritage Manager for the Town of Lunenburg UNESCO World Heritage Site, and senior-level archaeologist and cultural heritage specialist for CH2M and Golder Associates. He currently holds a Professional Archaeology Licence (P327) issued by the Ontario MHSTCI, is MTO RAQs certified in Archaeology/Heritage and is a member of the Canadian Association of Heritage Professionals (CAHP) and Register of Professional Archaeologists (RPA). His education includes a B.A. in Prehistoric Archaeology and Anthropology from Wilfrid Laurier University, a MA in Historical Archaeology from Memorial University, and a Ph.D. in War Studies from the Royal Military College of Canada. Currently, Henry also holds academic positions as Adjunct Professor of Anthropology at Saint Mary's University and lecturer in Visual & Material Culture at Mount Allison University.

# Appendix E: Limitations

# Limitations

1. The work performed in the preparation of this report and the conclusions presented are subject to the following:
    a. The Standard Terms and Conditions which form a part of our Professional Services Contract;
    b. The Scope of Services;
    c. Time and Budgetary limitations as described in our Contract; and,
    d. The Limitations stated herein.
2. No other warranties or representations, either expressed or implied, are made as to the professional services provided under the terms of our Contract, or the conclusions presented.
3. The conclusions presented in this report were based, in part, on visual observations of the Study Area. Our conclusions cannot and are not extended to include those portions of the Study Area which were not reasonably available, in Wood Environment & Infrastructure's opinion, for direct observation.
4. The potential for archaeological resources, and any actual archaeological resources encountered, at the Study Area were assessed, within the limitations set out above, having due regard for applicable heritage regulations as of the date of the inspection.
5. Services including a background study and fieldwork were performed. Wood Environment & Infrastructure's work, including archival studies and fieldwork, were completed in a professional manner and in accordance with the Ministry of Heritage, Sport, Tourism and Culture Industries' guidelines. It is possible that unforeseen and undiscovered archaeological resources may be present at the Study Area.
6. The utilization of Wood Environment & Infrastructure's services during the implementation of any further archaeological work recommended will allow Wood Environment & Infrastructure to observe compliance with the conclusions and recommendations contained in the report. Wood Environment & Infrastructure's involvement will also allow for changes to be made as necessary to suit field conditions as they are encountered.
7. This report is for the sole use of the parties to whom it is addressed unless expressly stated otherwise in the report or contract. Any use which any third party makes of the report, in whole or in part, or any reliance thereon, or decisions made based on any information of conclusions in the report, is the sole responsibility of such third party. Wood Environment & Infrastructure accepts no responsibility whatsoever for damages or loss of any nature or kind suffered by any such third party as a result of actions taken or not taken or decisions made in reliance on the report or anything set out therein.
8. This report is not to be given over to any third-party other than a governmental entity, for any purpose whatsoever without the written permission of Wood Environment & Infrastructure, which shall not be unreasonably withheld.

# Appendix C
# Cultural Heritage Checklist

Ontario

**Ministry of Tourism, Culture and Sport**

Programs & Services Branch
401 Bay Street, Suite 1700
Toronto ON M7A 0A7

# Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes

**A Checklist for the Non-Specialist**

The **purpose of the checklist** is to determine:

- if a property(ies) or project area:
  - is a recognized heritage property
  - may be of cultural heritage value
- it includes all areas that may be impacted by project activities, including – but not limited to:
  - the main project area
  - temporary storage
  - staging and working areas
  - temporary roads and detours

**Processes covered** under this checklist, such as:

- *Planning Act*
- *Environmental Assessment Act*
- *Aggregates Resources Act*
- *Ontario Heritage Act* – Standards and Guidelines for Conservation of Provincial Heritage Properties

**Cultural Heritage Evaluation Report (CHER)**

If you are not sure how to answer one or more of the questions on the checklist, you may want to hire a qualified person(s) (see page 5 for definitions) to undertake a cultural heritage evaluation report (CHER).

The CHER will help you:

- identify, evaluate and protect cultural heritage resources on your property or project area
- reduce potential delays and risks to a project

**Other checklists**

Please use a separate checklist for your project, if:

- you are seeking a Renewable Energy Approval under Ontario Regulation 359/09 – separate checklist
- your Parent Class EA document has an approved screening criteria (as referenced in Question 1)

Please refer to the Instructions pages for more detailed information and when completing this form.

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Project or Property Name

Lisgar District Pump Station

Project or Property Location (upper and lower or single tier municipality)

Several Discrete Locations along the Lisgar Meadow Brook Trail between Britannia Road West and Derry Road

Proponent Name

City of Missisuga

Proponent Contact Information

## Screening Questions

| | Yes | No |
|---|---|---|
| 1. Is there a pre-approved screening checklist, methodology or process in place? | ☐ | ☑ |

**If Yes,** please follow the pre-approved screening checklist, methodology or process.

**If No,** continue to Question 2.

## Part A: Screening for known (or recognized) Cultural Heritage Value

| | Yes | No |
|---|---|---|
| 2. Has the property (or project area) been evaluated before and found **not** to be of cultural heritage value? | ☐ | ☑ |

**If Yes,** do **not** complete the rest of the checklist.

The proponent, property owner and/or approval authority will:

- summarize the previous evaluation and
- add this checklist to the project file, with the appropriate documents that demonstrate a cultural heritage evaluation was undertaken

The summary and appropriate documentation may be:

- submitted as part of a report requirement
- maintained by the property owner, proponent or approval authority

**If No**, continue to Question 3.

| | Yes | No |
|---|---|---|
| 3. Is the property (or project area): | | |
| a. identified, designated or otherwise protected under the *Ontario Heritage Act* as being of cultural heritage value? | ☐ | ☑ |
| b. a National Historic Site (or part of)? | ☐ | ☑ |
| c. designated under the *Heritage Railway Stations Protection Act*? | ☐ | ☑ |
| d. designated under the *Heritage Lighthouse Protection Act*? | ☐ | ☑ |
| e. identified as a Federal Heritage Building by the Federal Heritage Buildings Review Office (FHBRO)? | ☐ | ☑ |
| f. located within a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site? | ☐ | ☑ |

**If Yes** to any of the above questions, you need to hire a qualified person(s) to undertake:

- a Cultural Heritage Evaluation Report, if a Statement of Cultural Heritage Value has not previously been prepared or the statement needs to be updated

If a Statement of Cultural Heritage Value has been prepared previously and if alterations or development are proposed, you need to hire a qualified person(s) to undertake:

- a Heritage Impact Assessment (HIA) – the report will assess and avoid, eliminate or mitigate impacts

**If No**, continue to Question 4.

## Part B: Screening for Potential Cultural Heritage Value

| | Yes | No |
|---|---|---|
| 4. Does the property (or project area) contain a parcel of land that: | | |
| a. is the subject of a municipal, provincial or federal commemorative or interpretive plaque? | ☐ | ☑ |
| b. has or is adjacent to a known burial site and/or cemetery? | ☐ | ☑ |
| c. is in a Canadian Heritage River watershed? | ☐ | ☑ |
| d. contains buildings or structures that are 40 or more years old? | ☐ | ☑ |

## Part C: Other Considerations

| | Yes | No |
|---|---|---|
| 5. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area): | | |
| a. is considered a landmark in the local community or contains any structures or sites that are important in defining the character of the area? | ☐ | ☑ |
| b. has a special association with a community, person or historical event? | ☐ | ☑ |
| c. contains or is part of a cultural heritage landscape? | ☐ | ☑ |

**If Yes** to one or more of the above questions (Part B and C), there is potential for cultural heritage resources on the property or within the project area.

You need to hire a qualified person(s) to undertake:

- a Cultural Heritage Evaluation Report (CHER)

If the property is determined to be of cultural heritage value and alterations or development is proposed, you need to hire a qualified person(s) to undertake:

- a Heritage Impact Assessment (HIA) – the report will assess and avoid, eliminate or mitigate impacts

**If No** to all of the above questions, there is low potential for built heritage or cultural heritage landscape on the property.

The proponent, property owner and/or approval authority will:

- summarize the conclusion
- add this checklist with the appropriate documentation to the project file

The summary and appropriate documentation may be:

- submitted as part of a report requirement e.g. under the *Environmental Assessment Act, Planning Act* processes
- maintained by the property owner, proponent or approval authority

## Instructions

Please have the following available, when requesting information related to the screening questions below:

- a clear map showing the location and boundary of the property or project area
  - large scale and small scale showing nearby township names for context purposes
- the municipal addresses of all properties within the project area
- the lot(s), concession(s), and parcel number(s) of all properties within a project area

For more information, see the Ministry of Tourism, Culture and Sport's Ontario Heritage Toolkit or Standards and Guidelines for Conservation of Provincial Heritage Properties.

In this context, the following definitions apply:

- **qualified person(s)** means individuals – professional engineers, architects, archaeologists, etc. – having relevant, recent experience in the conservation of cultural heritage resources.
- **proponent** means a person, agency, group or organization that carries out or proposes to carry out an undertaking or is the owner or person having charge, management or control of an undertaking.

### 1. Is there a pre-approved screening checklist, methodology or process in place?

An existing checklist, methodology or process may already be in place for identifying potential cultural heritage resources, including:

- one endorsed by a municipality
- an environmental assessment process e.g. screening checklist for municipal bridges
- one that is approved by the Ministry of Tourism, Culture and Sport (MTCS) under the Ontario government's Standards & Guidelines for Conservation of Provincial Heritage Properties [s.B.2.]

## Part A: Screening for known (or recognized) Cultural Heritage Value

### 2. Has the property (or project area) been evaluated before and found not to be of cultural heritage value?

Respond 'yes' to this question, if all of the following are true:

A property can be considered not to be of cultural heritage value if:

- a Cultural Heritage Evaluation Report (CHER) - or equivalent - has been prepared for the property with the advice of a qualified person and it has been determined not to be of cultural heritage value and/or
- the municipal heritage committee has evaluated the property for its cultural heritage value or interest and determined that the property is not of cultural heritage value or interest

A property may need to be re-evaluated, if:

- there is evidence that its heritage attributes may have changed
- new information is available
- the existing Statement of Cultural Heritage Value does not provide the information necessary to manage the property
- the evaluation took place after 2005 and did not use the criteria in Regulations 9/06 and 10/06

**Note**: Ontario government ministries and public bodies [prescribed under Regulation 157/10] may continue to use their existing evaluation processes, until the evaluation process required under section B.2 of the Standards & Guidelines for Conservation of Provincial Heritage Properties has been developed and approved by MTCS.

To determine if your property or project area has been evaluated, contact:

- the approval authority
- the proponent
- the Ministry of Tourism, Culture and Sport

### 3a. Is the property (or project area) identified, designated or otherwise protected under the *Ontario Heritage Act* as being of cultural heritage value e.g.:

i. designated under the *Ontario Heritage Act*

- individual designation (Part IV)
- part of a heritage conservation district (Part V)

**Individual Designation – Part IV**

A property that is designated:

- by a municipal by-law as being of cultural heritage value or interest [s.29 of the *Ontario Heritage Act*]
- by order of the Minister of Tourism, Culture and Sport as being of cultural heritage value or interest of provincial significance [s.34.5]. **Note**: To date, no properties have been designated by the Minister.

**Heritage Conservation District – Part V**

A property or project area that is located within an area designated by a municipal by-law as a heritage conservation district [s. 41 of the *Ontario Heritage Act*].

For more information on Parts IV and V, contact:

- municipal clerk
- Ontario Heritage Trust
- local land registry office (for a title search)

---

ii. subject of an agreement, covenant or easement entered into under Parts II or IV of the *Ontario Heritage Act*

An agreement, covenant or easement is usually between the owner of a property and a conservation body or level of government. It is usually registered on title.

The primary purpose of the agreement is to:

- preserve, conserve, and maintain a cultural heritage resource
- prevent its destruction, demolition or loss

For more information, contact:

- Ontario Heritage Trust - for an agreement, covenant or easement [clause 10 (1) (c) of the *Ontario Heritage Act*]
- municipal clerk – for a property that is the subject of an easement or a covenant [s.37 of the *Ontario Heritage Act*]
- local land registry office (for a title search)

---

iii. listed on a register of heritage properties maintained by the municipality

Municipal registers are the official lists - or record - of cultural heritage properties identified as being important to the community.

Registers include:

- all properties that are designated under the *Ontario Heritage Act* (Part IV or V)
- properties that have not been formally designated, but have been identified as having cultural heritage value or interest to the community

For more information, contact:

- municipal clerk
- municipal heritage planning staff
- municipal heritage committee

---

iv. subject to a notice of:

- intention to designate (under Part IV of the *Ontario Heritage Act*)
- a Heritage Conservation District study area bylaw (under Part V of the *Ontario Heritage Act*)

A property that is subject to a **notice of intention to designate** as a property of cultural heritage value or interest and the notice is in accordance with:

- section 29 of the *Ontario Heritage Act*
- section 34.6 of the *Ontario Heritage Act*. **Note**: To date, the only applicable property is Meldrum Bay Inn, Manitoulin Island. [s.34.6]

An area designated by a municipal by-law made under section 40.1 of the *Ontario Heritage Act* as a **heritage conservation district study area**.

For more information, contact:

- municipal clerk – for a property that is the subject of notice of intention [s. 29 and s. 40.1]
- Ontario Heritage Trust

---

v. included in the Ministry of Tourism, Culture and Sport's list of provincial heritage properties

Provincial heritage properties are properties the Government of Ontario owns or controls that have cultural heritage value or interest.

The Ministry of Tourism, Culture and Sport (MTCS) maintains a list of all provincial heritage properties based on information provided by ministries and prescribed public bodies. As they are identified, MTCS adds properties to the list of provincial heritage properties.

For more information, contact the MTCS Registrar at registrar@ontario.ca.

**3b. Is the property (or project area) a National Historic Site (or part of)?**

National Historic Sites are properties or districts of national historic significance that are designated by the Federal Minister of the Environment, under the *Canada National Parks Act*, based on the advice of the Historic Sites and Monuments Board of Canada.

For more information, see the National Historic Sites website.

**3c. Is the property (or project area) designated under the *Heritage Railway Stations Protection Act*?**

The *Heritage Railway Stations Protection Act* protects heritage railway stations that are owned by a railway company under federal jurisdiction. Designated railway stations that pass from federal ownership may continue to have cultural heritage value.

For more information, see the Directory of Designated Heritage Railway Stations.

**3d. Is the property (or project area) designated under the *Heritage Lighthouse Protection Act*?**

The *Heritage Lighthouse Protection Act* helps preserve historically significant Canadian lighthouses. The Act sets up a public nomination process and includes heritage building conservation standards for lighthouses which are officially designated.

For more information, see the Heritage Lighthouses of Canada website.

**3e. Is the property (or project area) identified as a Federal Heritage Building by the Federal Heritage Buildings Review Office?**

The role of the Federal Heritage Buildings Review Office (FHBRO) is to help the federal government protect the heritage buildings it owns. The policy applies to all federal government departments that administer real property, but not to federal Crown Corporations.

For more information, contact the Federal Heritage Buildings Review Office.

See a directory of all federal heritage designations.

**3f. Is the property (or project area) located within a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site?**

A UNESCO World Heritage Site is a place listed by UNESCO as having outstanding universal value to humanity under the Convention Concerning the Protection of the World Cultural and Natural Heritage. In order to retain the status of a World Heritage Site, each site must maintain its character defining features.

Currently, the Rideau Canal is the only World Heritage Site in Ontario.

For more information, see Parks Canada – World Heritage Site website.

## Part B: Screening for potential Cultural Heritage Value

**4a. Does the property (or project area) contain a parcel of land that has a municipal, provincial or federal commemorative or interpretive plaque?**

Heritage resources are often recognized with formal plaques or markers.

Plaques are prepared by:

- municipalities
- provincial ministries or agencies
- federal ministries or agencies
- local non-government or non-profit organizations

For more information, contact:

- municipal heritage committees or local heritage organizations – for information on the location of plaques in their community
- Ontario Historical Society's Heritage directory – for a list of historical societies and heritage organizations
- Ontario Heritage Trust – for a list of plaques commemorating Ontario's history
- Historic Sites and Monuments Board of Canada – for a list of plaques commemorating Canada's history

**4b. Does the property (or project area) contain a parcel of land that has or is adjacent to a known burial site and/or cemetery?**

For more information on known cemeteries and/or burial sites, see:

- Cemeteries Regulations, Ontario Ministry of Consumer Services – for a database of registered cemeteries
- Ontario Genealogical Society (OGS) – to locate records of Ontario cemeteries, both currently and no longer in existence; cairns, family plots and burial registers
- Canadian County Atlas Digital Project – to locate early cemeteries

In this context, adjacent means contiguous or as otherwise defined in a municipal official plan.

**4c. Does the property (or project area) contain a parcel of land that is in a Canadian Heritage River watershed?**

The Canadian Heritage River System is a national river conservation program that promotes, protects and enhances the best examples of Canada's river heritage.

Canadian Heritage Rivers must have, and maintain, outstanding natural, cultural and/or recreational values, and a high level of public support.

For more information, contact the Canadian Heritage River System.

If you have questions regarding the boundaries of a watershed, please contact:

- your conservation authority
- municipal staff

**4d. Does the property (or project area) contain a parcel of land that contains buildings or structures that are 40 or more years old?**

A 40 year 'rule of thumb' is typically used to indicate the potential of a site to be of cultural heritage value. The approximate age of buildings and/or structures may be estimated based on:

- history of the development of the area
- fire insurance maps
- architectural style
- building methods

Property owners may have information on the age of any buildings or structures on their property. The municipality, local land registry office or library may also have background information on the property.

**Note**: 40+ year old buildings or structure do not necessarily hold cultural heritage value or interest; their age simply indicates a higher potential.

A building or structure can include:

- residential structure
- farm building or outbuilding
- industrial, commercial, or institutional building
- remnant or ruin
- engineering work such as a bridge, canal, dams, etc.

For more information on researching the age of buildings or properties, see the Ontario Heritage Tool Kit Guide Heritage Property Evaluation.

## Part C: Other Considerations

**5a. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) is considered a landmark in the local community or contains any structures or sites that are important to defining the character of the area?**

Local or Aboriginal knowledge may reveal that the project location is situated on a parcel of land that has potential landmarks or defining structures and sites, for instance:

- buildings or landscape features accessible to the public or readily noticeable and widely known
- complexes of buildings
- monuments
- ruins

**5b. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) has a special association with a community, person or historical event?**

Local or Aboriginal knowledge may reveal that the project location is situated on a parcel of land that has a special association with a community, person or event of historic interest, for instance:

- Aboriginal sacred site
- traditional-use area
- battlefield
- birthplace of an individual of importance to the community

**5c. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) contains or is part of a cultural heritage landscape?**

Landscapes (which may include a combination of archaeological resources, built heritage resources and landscape elements) may be of cultural heritage value or interest to a community.

For example, an Aboriginal trail, historic road or rail corridor may have been established as a key transportation or trade route and may have been important to the early settlement of an area. Parks, designed gardens or unique landforms such as waterfalls, rock faces, caverns, or mounds are areas that may have connections to a particular event, group or belief.

For more information on Questions 5.a., 5.b. and 5.c., contact:

- Elders in Aboriginal Communities or community researchers who may have information on potential cultural heritage resources. Please note that Aboriginal traditional knowledge may be considered sensitive.
- municipal heritage committees or local heritage organizations
- Ontario Historical Society's "Heritage Directory" - for a list of historical societies and heritage organizations in the province

An internet search may find helpful resources, including:

- historical maps
- historical walking tours
- municipal heritage management plans
- cultural heritage landscape studies
- municipal cultural plans

Information specific to trails may be obtained through Ontario Trails.

# Appendix D
# Natural Heritage Existing Conditions Report

# Natural Heritage Existing Conditions Report

Engineering Services for Lisgar District Pumping Station
City of Mississauga
Project # WW21011023

Prepared for:

**City of Mississauga**

200 City Centre Drive, Mississauga ON, L5B 3C1

August 2021

# Natural Heritage Existing Conditions Report

Engineering Services for Lisgar District Pumping Station
City of Mississauga
Project # WW21011023

**Prepared for:**

City of Mississauga

200 City Centre Drive, Mississauga ON, L5B 3C1

**Prepared by:**

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

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August 2021

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## List of Acronyms and Abbreviations

| | |
|---|---|
| ANSI | Area of Natural and Scientific Interest |
| ARA | Aquatic Resources Areas |
| BCI | Bat Conservation International |
| CAA | Conservation Authorities Act |
| CH | Conservation Halton |
| COSSARO | Committee on the Status of Species at Risk in Ontario |
| DFO | Department of Fisheries and Oceans |
| EA | Environmental Assessment |
| ECCC | Environment Climate Change Canada |
| ESA | Endangered Species Act |
| FWCA | Fish and Wildlife Conservation Act |
| HA | hectare |
| HADD | harmful alteration, disruption or destruction |
| KM | Kilometer |

| | |
|---|---|
| SARA | Species at Risk Act |
| SAR | Species at Risk |
| MBCA | Migratory Birds Convention Act |
| MBR | Migratory Birds Regulations |
| MECP | Ministry of the Environment, Conservation and Parks |
| MNDMNRF | Ministry of Northern Development, Mines, Natural Resources and Forestry |
| MNRF | Ministry of Natural Resources and Forestry |
| MTO | Ministry of TransportationNAS Natural Area Survey |
| NER | Natural Environment Report |
| NHIC | Natural Heritage Information Centre |
| NHS | Natural Heritage System |
| OBBA | Ontario Breeding Bird Atlas |
| OBA | Ontario Butterfly Atlas |
| OMA | Atlas of Mammals in Ontario |
| ORRA | Ontario Reptile and Amphibian Atlas |
| O.Reg | Ontario Regulation |
| PPS | Provincial Policy Statement |
| PSW | Provincially Significant Wetlands |
| SARA | Species at Risk Act |
| SWH | Significant Wildlife Habitat |
| SWM | Storm Water Management |

# 1.0 Introduction

Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited (Wood) was retained by the City of Mississauga (the City) to undertake a Municipal Class Environmental Assessment (EA), Class B, for the Lisgar District Basement Water Infiltration Study leading to the preliminary and detailed design of the Lisgar stormwater pumping station location (the Project). This Natural Environment Report (NER), as been prepared in support of the Municipal Class Environmental Assessment (EA) for the project.

The Project Location is a long linear feature located between the Ninth Line and Tenth Line along the channelized tributary of Sixteen Mile Creek. The northwestern boundary of the Project is represented by the Hydro corridor located approximately 650 m northeast of Ninth Line. The Project extends along Sixteen Mile Creek for approximately 3800 m in a southeasterly direction. The Project then extends towards Ninth Line, encompassing the Storm Water Management (SWM) ponds and the natural pond located approximately 200 m from the intersection of Ninth Line and Osprey Blvd (Refer to Figure 1-1 and Figure 1-2).

As part of the NER, the terrestrial Project Study Area is identified as a 120 m buffer around the Project Location, as described above. The aquatic Project Study Area includes the area from 200 m downstream to 50 m upstream of the Project Location. Figure 1-1 and Figure 1-2 show the Project Location, Project Study Area and Natural Heritage System (NHS) features identified through the secondary source review process.

Figure 1-1 aso depicts the location of the Parkway Belt West, the Conservation Halton (CH) regulation limit and Wetlands. It also illustrated special management areas as documented in the City of Missauga's Official Plan (2021). Figure 1-2 depicts Significant Natural Areas and Natural Green Spaces, the Green System, Core Natural Areas Outside fo Peel Region, and Core Natural Areas of the Greenlands Sytem as documented in the City of Missauga's Official Plan (2021) and the Region of Peel's Official Plan (2018).

The purpose of the NER is to document existing conditions to provide input to the overall Class Environmental Assessment evaluation, as documented in that report.

PARTITION RD
DERRY RD W
DERRY RD
9TH LINE
HWY 407
LISGAR DR
FOREST PARK DR
WINSTON CHURCHILL BLVD
Tributary of Sixteen Mile Creek
BRITANNIA RD W

P:\2021\Projects_Other\WW21011023_Lisgar_Pumping_Station\11_GIS\MXD\Fig1A_ProjectLocation_NaturalHeritage_1.mxd

**LEGEND**

- Project Location
- Project Study Area (120 m buffer)
- Parkway Belt West
- Conservation Halton Approximate Regulation Limit
- Provincially Significant Wetland
- Other Wetlands
- Special Management Areas
- Watercourse

NOTES:
- Imagery extracted from ESRI basemaps, 2019

0 0.25 0.5 1 Kilometres

Datum: NAD83
Projection: UTM Zone 17N

wood.

# LISGAR PUMPING STATION

## Project Location and Natural Heritage System Information

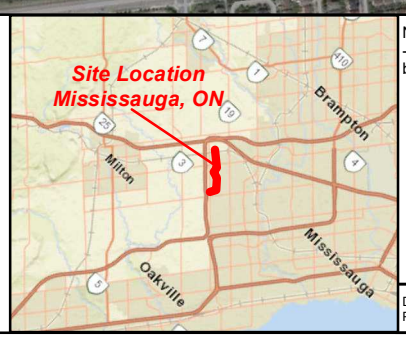
| | |
|---|---|
| PROJECT N°: WW21011023 | **FIGURE: 1-1** |
| SCALE: 1:12,500 | DATE: August 2021 |

PARTITION RD
DERRY RD W
DERRY RD
FOREST PARK DR
WINSTON CHURCHILL BLVD
HWY 407
9TH LINE
LISGAR DR
Tributary of Sixteen Mile Creek
BRITANNIA RD W

P:\2021\Projects_Other\WW21011023_Lisgar_Pumping_Station\11_GIS\MXD\Fig1B_ProjectLocation_NaturalHeritage_1.mxd

**LEGEND**

- Project Location
- Project Study Area (120 m buffer)
- Significant Natural Areas and Natural Green Spaces
- Green System
- Core Natural Areas Outside Peel
- Core Natural Areas of the Greenlands System
- Watercourse




NOTES:
- Imagery extracted from ESRI basemaps, 2019

Datum: NAD83
Projection: UTM Zone 17N

0 0.25 0.5 1 Kilometres

wood.

# LISGAR PUMPING STATION

## Project Location and Natural Heritage System Information

| | |
|---|---|
| PROJECT N°: WW21011023 | **FIGURE: 1-2** |
| SCALE: 1:12,500 | DATE: August 2021 |

# 2.0 Regulatory and Policy Context

The following sections summarize the various federal, provincial and municipal planning policies and regulations related to the natural heritage that may apply to the Project Location.

## 2.1 Federal Legislative Requirements

### 2.1.1 Species at Risk Act, 2002

The federal *Species at Risk Act* (SARA) (2002), was passed into law in 2002 and was last amended on October 6, 2020. The purpose of the SARA is to prevent wildlife species in Canada from disappearing, to provide for the recovery of wildlife species, and to manage species to prevent further risk to their status. Only species listed as Threatened, Endangered, or Extirpated under Schedule 1 are afforded both individual and habitat protection under SARA. Outside of federal lands, SARA legislation only applies to the following:

- Migratory birds (i.e., those species listed under Article I of the Migratory Birds Convention Act, 1994) that also fall under Schedule 1 of SARA. This does not include the species' critical habitat; and,
- Aquatic species that fall under Schedule 1 of SARA.

Notably, SARA prohibitions can be applied if provincial legislation or voluntary measures do not adequately protect federally listed species and their residence. Generally, compliance with provincial legislation will satisfy the requirements under the SARA.

**Applicability to the Project**

The Project Location is not located within federal lands; however, SARA applies to this Project concerning federally listed migratory birds that may occur and are not otherwise protected under the Provincial Endangered Species Act (ESA). As well, a tributary of Sixteen Mile Creek is present; therefore, SARA applies to this Project concerning federally listed aquatic SAR that may occur.

### 2.1.2 Fisheries Act, 1985

The Federal *Fisheries Act* was established in 1985 with amendments that came into effect on November 25, 2013, and June 21, 2019. This Act protects to fish and fish habitat such that:

- *"No person shall carry on any work, undertaking or activity that results in the harmful alteration, disruption or destruction of fish habitat" (Section 35 (1)).*
- *Fish habitat is defined by the Act as "water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration areas".*

The *Fisheries Act* requires that any development project avoid harmful alteration, disruption or destruction of fish habitat (HADD) unless authorized by Fisheries and Oceans Canada (DFO). If mitigation measures cannot be applied, and residual effects will cause HADD, then provisions under the Act may apply (i.e., approval).

**Applicability to the Project**

Any waterbody or watercourse that contains fish or is an area on which fish depend directly or indirectly to carry out their life processes is provided protection under the Act. A tributary of Sixteen Mile Creek

flows through the Project Location and is considered fish habitat. As such, the *Fisheries Act* applies to the Project.

Online guidance provided by DFO identifies a set of standard projects where impacts to fish and fish habitat can be avoided if certain mitigation measures can be followed. This project shall follow the standard guidance procedure through project screening and Request for Review.

### 2.1.3 Migratory Birds Convention Act, 1994

The *Migratory Birds Convention Act* (MBCA) was passed in 1917 and updated in 1994, and the last amendment was December 12, 2017. The MBCA protects migratory bird populations by regulating potentially harmful anthropogenic activities. The MBCA (1994) and the *Migratory Birds Regulations* (MBR) (C.R.C., c. 1035), last amended on June 18, 2020, are federal legislative requirements that are binding on members of the public and all levels of government, including federal and provincial governments.

Protected species are listed under Article I of the MBCA, and are native or naturally occurring in Canada, and are species that are known to occur regularly in Canada. The legislation protects certain species, controls the harvest of others, and prohibits the commercial sale of all species. As described in Section 6 of the associated MBR:

"*Subject to subsection 5(9), no person shall:*

- *Disturb, destroy or take a nest, egg, nest shelter, Eider Duck shelter or duck box of a migratory bird, or*
- *Have in his possession a live migratory bird, or a carcass, skin, nest or egg of a migratory bird except under authority of a permit therefor."*

The "incidental take" of migratory birds and the disturbance, destruction or taking of the nest of a migratory bird is prohibited. No permit can be issued for the incidental take of migratory birds.

Bird species not regulated under the Act include Rock Dove, American Crow, Brown-headed Cowbird, Common Grackle, House Sparrow, Red-winged Blackbird, and European Starling. Furthermore, if the species identified is protected under Ontario's Endangered Species Act (ESA), additional restrictions may apply.

Environment and Climate Change Canada (ECCC) and the Canadian Wildlife Service have compiled nesting calendars that show the variation in nesting intensity by habitat type and nesting zone within broad geographical areas distributed across Canada. While this does not mean nesting birds will not nest outside of these periods, the calendars can be used to reduce the risk of encountering a nest. Most birds found in the Project Site receive protection under the MBCA, and nearly all of the remaining species receive similar protection under the provincial Fish and Wildlife Conservation Act.

**Applicability to the Project**

The MBCA applies to all of Canada. As such, the MBCA is applicable to the entire Project. Therefore, if a protected species or their nest is encountered during future works, the Project must comply with the prohibitions of the Act. Vegetation removals should follow appropriate timing windows or Best Management Practices.

## 2.2 Provincial Legislative Requirments

### 2.2.1 Endangered Species Act, 2007

The Ontario *Endangered Species Act, 2007* (ESA) was passed into law in 2007 and came into effect on June 30, 2008, and was last amended July 21, 2020.

In Ontario, Species at Risk (SAR) are determined by the Committee on the Status of Species at Risk in Ontario (COSSARO). If a species is listed under the ESA as Extirpated, Endangered, or Threatened, Section 9 of the ESA prohibits killing, harming, harassing, capturing, taking, possessing, collecting, buying, selling, leasing, trading or offering to buy, sell, lease or trade a member of the species. Similarly, Section 10 of the ESA prohibits the damage or destruction of the habitat of all Endangered and Threatened species. Habitat is broadly characterized within the ESA as the area prescribed by regulation as the habitat of the species or an area on which the species depends directly or indirectly to carry on its life processes, including reproduction, rearing of young, hibernation, migration or feeding. Habitat is specifically defined for some species. Species listed as Special Concern are not afforded protection under Section 9 and 10 of the ESA; however, they are protected under Significant Wildlife Habitat.

Destruction of SAR and their habitats constitute a contravention of the ESA unless authorized by the Ministry of the Environment, Conservation and Parks (MECP). The MECP may authorization damage to habitat or individuals by way of registration or permit.

**Applicability to the Project**

Any SAR ranked as Threatened or Endangered that may be impacted by any Project work requires consideration. If impacts to SAR or their habitat cannot be fully avoided, a permit or approval may be required under the ESA. Based on the background information review and field investigations undertaken, SAR may occur and therefore may be directly impacted, dependent on the alternative selected through the EA process.

### 2.2.2 Fish and Wildlife Conservation Act, 1997

The Fish and Wildlife Conservation Act (FWCA) was established in 1997 and last amended December 10, 2019. The FWCA applies to 'wildlife', which is defined as:

*"an animal that belongs to a species that is wild by nature, and includes game wildlife and specially protected wildlife" (Section 1 (1)).*"

Those species considered "specially protected wildlife" include those specially protected amphibians, birds, invertebrates, mammals, and reptiles, as identified within Schedules 6 to 11 under the FWCA. The FWCA is managed by the Ministry of Northern Development, Mines, Natural Resources and Forestry (MNDMNRF) and applies to all wildlife as defined under the FWCA. In instances where wildlife will require collection or relocation at any point in the project (i.e., through trapping/collection and relocation), permits and approvals under the FWCA may be required.

**Applicability to the Project**

The probability that wildlife is found in the Project footprint and do not leave on their own accord is low. As such, permits/approvals under the FWCA are not expected to be necessary.

### 2.2.3 Conservation Authorities Act, 1990

The Conservation Authorities Act (CAA) was established in 1990 and was last amended on June 6, 2019. The CAA authorizes the formation of conservation authorities in Ontario and addresses their roles,

responsibilities, and governance in resource management and environmental protection. The purpose of the CAA is:

*"to provide for the organization and delivery of programs and services that further the conservation, restoration, development and management of natural resources in watersheds in Ontario."*

Section 28 of the CAA sets out prohibited activities that include development in areas that could be unsafe for development because of natural processes associated with flooding or erosion and interference with, or alterations to, watercourses, wetlands, or shorelines.

Each of Ontario's 36 conservation authorities has its own Section 28 Ontario Regulation (O. Reg.). The core mandate of conservation authorities is to undertake watershed-based programs to protect people and property from flooding and other natural hazards and conserve natural resources for economic, social, and environmental benefits (Conservation Ontario 2019). In the Project area, the CAA is applied via CH: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses O. Reg. 160/06.

**Applicability to the Project**

The Project Site falls within the CH regulated area. CH regulates the watercourse and valleylands, and Project works within the regulated area will require consultation with CH (Figure 1-1).

### 2.2.4 Planning Act, 1990

The Planning Act is provincial legislation that sets out the ground rules for land use planning in Ontario. Established in 1990, the Planning Act was last amended on July 21, 2020. The Act describes how land use may be controlled and who may control them. The Planning Act also provides the basis for developing regional and municipal official plan documents to guide development. Municipally, the Project falls under the jurisdiction of the City of Mississauga Official Plan (2021) (Refer to Section 2.3.2). The Provincial Policy Statement (PPS) is issued under Section 3 of the Planning Act by the Ministry of Municipal Affairs and Housing (MMAH). Under the Planning Act, the PPS is applicable province-wide and provides overall policy directions on matters of provincial interest related to land use planning and development. Regional plans, municipal official plans, and the PPS work together to establish and protect natural features.

#### 2.2.4.1 Provincial Policy Statement

The PPS is the complimentary policy document to the Planning Act. The PPS was issued under Section 3 of the Planning Act and came into effect May 1, 2020, replacing the previous PPS issued on April 30, 2014. The PPS provides direction on matters of provincial interest related to land use planning and development and promotes the provincial "policy-led" planning system that recognizes and addresses the complex interrelationship among environmental, economic and social factors in land use planning (Ministry of Municipal Affairs and Housing, 2020).

The PPS provides policies specific to natural heritage and states that natural features must be protected for the long term. Section 2 of the PPS provides direction for the wise use and management of resources, including the protection of natural areas and features. Relevant natural heritage policies are in Section 2.1 of the PPS and generally states that the diversity and connectivity of natural heritage (including surface and groundwater features) should be maintained, restored or, where possible, improved. Section 2.2 of the PPS relates more specifically to water resources and supports planning authorities to protect, improve, and restore the quality and quantity of water. Those natural heritage features identified within the PPS

where development and site alteration is not permitted, unless it has been demonstrated that there will be no negative impact on features and functions, in Ecoregion 7E include:

- Significant wetlands;
- Significant coastal wetlands and non-significant coastal wetlands;
- Significant habitat of endangered and threatened species (SAR);
- Fish habitat;
- Significant woodlands;
- Significant valleylands;
- Significant areas of natural and scientific interest (ANSIs); and
- Significant wildlife habitat (SWH) (the Significant Wildlife Habitat Technical Guide (MNRF, 2000) and Ecoregion schedules (MNRF, 2015) to assist planning authorities and other participants in the land use planning system).

Each of these features is afforded varying levels of protection subject to guidelines, and in some cases, regulations. Significant woodlands, valleylands and wetlands can be designated by municipalities and/or the MNDMNRF (e.g., under the Ontario Wetland Evaluation System). Fish habitat information can be identified by conservation authorities, the MNDMNRF, and Fisheries and Oceans Canada (DFO). However, the management of fish habitat is governed by DFO. Those areas identified as SWH and ANSIs are designated by MNDMNRF. The MECP designates those areas identified as the habitats of endangered and threatened species. The Natural Heritage Reference Manual (MNRF, 2010) is a technical document used to help assess natural heritage features.

The PPS provides overall policy direction and should be read in conjunction with other provincial plans such as the Greenbelt Plan and Niagara Escarpment Plan. The more stringent of policies apply unless otherwise explicitly stated. It is understood that features identified as part of provincial policy plans (e.g., PPS, the Greenbelt Plan, A Place to Grow: Growth Plan for the Greater Golden Horseshoe, etc.) have been incorporated into the Municipal and Regional Official Plans.

**Applicability to the Project**

The PPS provides policies on land use planning that are integrated into municipal and regional plans. A review of the Project Study Area for this Project identified several NHS features.

## 2.3 Regional and Municipal Legislative Requirements

### 2.3.1 Region of Peel Official Plan

The Regional Municipality of Peel came into existence in January 1974 under Provincial legislation. That legislation also established the lower-tier area municipalities of the City of Brampton, the City of Mississauga, and the Town of Caledon. The Region of Peel Official Plan (ROP), office consolidation December 2018, outlines strategies to guide growth and development in Peel Region. The ROP allows municipalities to cover more detailed matters in their specific Official Plans.

Chapter 2 of the ROP (2018) focuses on the natural environment. The Chapter emphasizes joint efforts with area municipalities, conservation authorities, and provincial plans to protect and restore natural systems. The natural heritage system is called the Greenlands System and is composed of Core Areas, Natural Areas and Corridors, and Potential Natural Areas and Corridors.

Chapter 5 of the ROP (2018) focuses on the Regional Structure. Chapter 5 describes the Region's role within the Greater Toronto and Hamilton Area and its relationship to the surrounding municipalities.

**Applicability to the Project**

The Project Study Area is within the City of Mississauga, an area municipality within the Region of Peel. A small fragment of the Region's Core Areas of the Greenlands System is located within the Project Study Area (Refer to Figure 1-2). The future Peel Parkway Belt West Plan Area is located outside of the Project Study Area (Refer to Figure 1-1). As well, the ROP (2018) also indicates that the Project Study Area is not located within any protected areas associated with the Oak Ridges Moraine Conservation Plan or the Greenbelt Plan.

### 2.3.2 City of Mississauga Official Plan

The City of Mississauga Official Plan, consolidation April 8, 2021, guides how the City will grow and develop and provides a basis for the City's land use and urban design, in line with the City's Strategic Plan. The planning regime within the City is directed by provincial legislation, plans and policies, including the PPS, the Greenbelt Plan, the Parkway Belt West Plan, the Growth Plan for the Greater Golden Horseshoe, and the Regional Transportation Plan.

Land-use policies, as they pertain to natural heritage, are provided in Chapter 6, Section 6.3 of the Official Plan (2021). The City applies the Green System, which is a response to the challenge of achieving a high level of ecological function and connectivity of natural heritage features within an urban environment. The Green system includes the NHS, Urban Forests, Natural Hazard Lands, as well as Parks and Open spaces. The Natural Heritage System includes Significant Natural Areas, Natural Green Spaces, Special Management Areas, Residential Woodlands and Linkages.

**Applicability to the Project**

The Project Study Area is within the City of Mississauga, as such, the City's Official Plan (2021) applies to the Project. The Project Study Area includes the following Natural Heritage System features as identified in the City's Official Plan (2021) (Refer to Figure 1-1and Figure 1-2):

- City of Mississauga Green System as illustrated in Schedule A1 of the City's Official Plan (2021); and,
- Significant Natural Areas and Natural Green Spaces, Special Management Areas and other wetlands as illustrated in Schedule 3 of the City's Official Plan (2021).

It is also noted that the Parkway Belt West, as illustrated in Schedule 4 of the City's Official Plan (2021), is located near the Project; however, this feature is located beyond the Project Location (Figure 1-1). Additional information regarding other features identified in the Official Plan is provided in Section 7.0.

# 3.0 Background Information Review

Secondary sources, wildlife atlases and databases were reviewed to ascertain terrestrial and aquatic information relative to the Project Study Area. Information relevant to the Project Study Area included the locations of NHS features (e.g., Provincially Significant Wetlands (PSWs), ANSIs, Environmentally Significant Areas and vegetation types) as well as records of Species at Risk (SAR) occurrences. Sources reviewed included:

- Policies and plans covered in Section 2.0;

- MNRF Natural Heritage Information Centre (NHIC) database (2019) grid squares [17NJ9824, 17NJ9825, 17NJ9826, 17NJ9923, 17NJ9924, 17NJ9925, 17PJ0023, 17PJ0024, 17NJ9725, 17NJ9726];
- MNRF Land Information Ontario (LIO) and GeoHub (2018);
- Mississauga Natural Area Survey (NAS) sites LS1, LS2, and LS3 (City of Mississauga, 2020a; City of Mississauga, 2020b; City of Mississauga, 2020c));
- CH Open Data Hub, Planning and Permits Map data (Conservation Halton, 2021);
- Ontario Breeding Bird Atlas (OBBA), (Atlas of the Breeding Birds of Ontario, 2006), grid squares [17NJ92, 17PJ02];
- Ontario Reptile and Amphibian Atlas (ORAA; (Ontario Nature, 2018)), grid squares [17NJ92, 17PJ02];
- Ontario Butterfly Atlas (OBA) (Toronto Entomologists' Association (TEA), 2018), grid squares [17NJ92, 17PJ02];
- Atlas of the Mammals of Ontario (AMO; (Dobbyn, Atlas of the Mammals of Ontario, 1994));
- Bat Conservation International Inc. (Bat Conservation International (BCI), 2021);
- Aquatic Resources Areas (ARA) data available from Land Information Ontario (LIO) and GeoHub (2018) and,
- Aquatic Species at Risk Map (Fisheries and Oceans Canada (DFO), 2019).

The MNRF NHIC database utilizes a one-kilometer (km) x one km grid system. The OBBA, ORAA and OBA, utilize a 10 km x 10 km system whereby a list of species documented within a specific square can be generated. The list of mammals that may be found in the Project Study Area was similarly generated; however, the AMO is not available in a database and as such, the potential presence of these species within the 10 km x 10 km squares was extrapolated based on the AMO documentation (Dobbyn, Atlas of the Mammals of Ontario, 1994). Habitat assessment and mapping were undertaken via desktop review and field investigations.

An information request was sent to the MNDMNRF on August 19, 2021. The MNDMNRF responded on August 27, 2021 indicating that the Sixteen Mile Creek is classified as warm water thermal regime. They also provided an in-water works timing window of July 15 – March 31. A copy of all agency correspondence is provided in Appendix A. MECP was not contacted for additional information as SAR records are publicly available through the aforementioned data sources. The SAR screening provided in Section 6.0 was completed in accordance with MECP's Client's Guide to Preliminary Screening for Species at Risk (MECP, 2019).

For the purposes of this report, only common names for species have been provided; the full nomenclature of each reported species is provided within Appendix B.

# 4.0 Methods

## 4.1 Terrestrial Ecosystem

Terrestrial field investigations were undertaken on May 13, 2021, to confirm vegetation communities, collect botanical information and denote the presence of incidental wildlife. Information collected was used to support and affirm secondary source data, including details to help identify candidate wildlife habitat (inclusive of SAR). The field investigation was carried out by a qualified professional specializing in terrestrial biology and was primarily focused on publicly accessible areas within the Project Area.

### 4.1.1 Vegetation Communities and Plant Inventories

Ecological Land Classification (ELC) was completed within most naturalized vegetation areas present within and surrounding the Project Study Area by the City of Mississauga's Natural Area Survey (City of Mississauga, 2020) (City of Mississauga, 2020b) (City of Mississauga, 2020c) which are made publicly available through the City of Mississauga Interactive Maps, Natural Area Survey (City of Mississauga, 2021). These features are illustrated in Figure 5-1.

Areas unclassified by the City of Mississauga's Natural Area Survey were assessed through a combination of aerial photographic interpenetration and the plant inventories collected within the Project Location during the terrestrial field investigations following the Ecological Land Classification for Southern Ontario: The First Approximation of ELC (Lee, et al., 1998).

The occurrence of ELC communities was cross-referenced with provincially significant vegetation communities as identified in the Significant Wildlife Habitat Technical Guide (Ontario Ministry of Natural Resources, 2000) and in the NHIC rarity lists. Vegetation communities were also used to screen for SWH using the Significant Wildlife Habitat Ecoregion Criterion Schedule 7E (MNRF, 2015). SWH are further described in Section 7.6 below.

### 4.1.2 Wildlife Inventories and Significance Evaluation

Wildlife documentation was based on background sources and incidental observations, including evidence of nests, tracks and/or scat, as well as available habitat. The Project Study Area falls within Ecoregion 7E (Lake Erie Lake Ontario Ecoregion), and as such, habitats were assessed for significant attributes as per Significant Wildlife Habitat Ecoregion Criterion Schedule 7E (MNRF, 2015). The MNDMNRF defines SWH as ecologically important in terms of features, functions, representation, or amount contributing to the quality and diversity of an identifiable geographic area or NHS (MNRF, 2000; MNRF, 2015). SWH is divided into four (4) main categories:

- Seasonal concentration areas of animals;
- Rare vegetation communities and specialized habitat for wildlife;
- Habitat for species of conservation concern (excluding endangered or threatened species); and
- Animal movement corridors.

The likelihood of SWH in the Project Study Area was characterized using the ELC, incidental wildlife observations, and wildlife and wildlife habitat identified through the literature review.

## 4.2 Aquatic Ecosystem

Background sources were reviewed to determine information regarding the existing conditions of the aquatic ecosystem and fish species present within the Project Study Area. Sources reviewed included the ARA data available from the LIO and GeoHub (2018), the Mississauga Natural Area Survey (NAS) sites LS1, LS2, and LS3 (City of Mississauga, 2020a; City of Mississauga, 2020b; City of Mississauga, 2020c). Further to this, the MNDMNRF was contacted to request additionally information (i.e., thermal regime, in-water works timing windows).

Qualified Wood biologists completed aquatic habitat assessment on August 25, 2021. The assessment was conducted following the Ministry of Transportation (MTO) Environmental Guide for Fish and Fish Habitat (MTO, 2020). The assessment included detailed assessment 50 m downstream to 20 m upstream of the

Project Location, with general assessment 50 m to 200 m downstream and 20 m to 50 m upstream of the Project Location (Refer to Figure 1-1).

### 4.3 Species at Risk

Background sources were reviewed for documentation of SAR. The potential for SAR and SAR habitat to occur within the Project Location and associated Project Study Area was determined based on a review of secondary source information relative to the vegetation communities identified during the field investigation. Information collected was then used to evaluate the potential for SAR occurrence based on habitat preferences for each species. The secondary source information included a review of the NHIC online database, the DFO online aquatic SAR mapping as well as wildlife atlases.

## 5.0 Existing Conditions

A summary of the Existing Conditions of the terrestrial and aquatic ecosystems within the Project Study Area is provided below.

### 5.1 Terrestrial Ecosystem

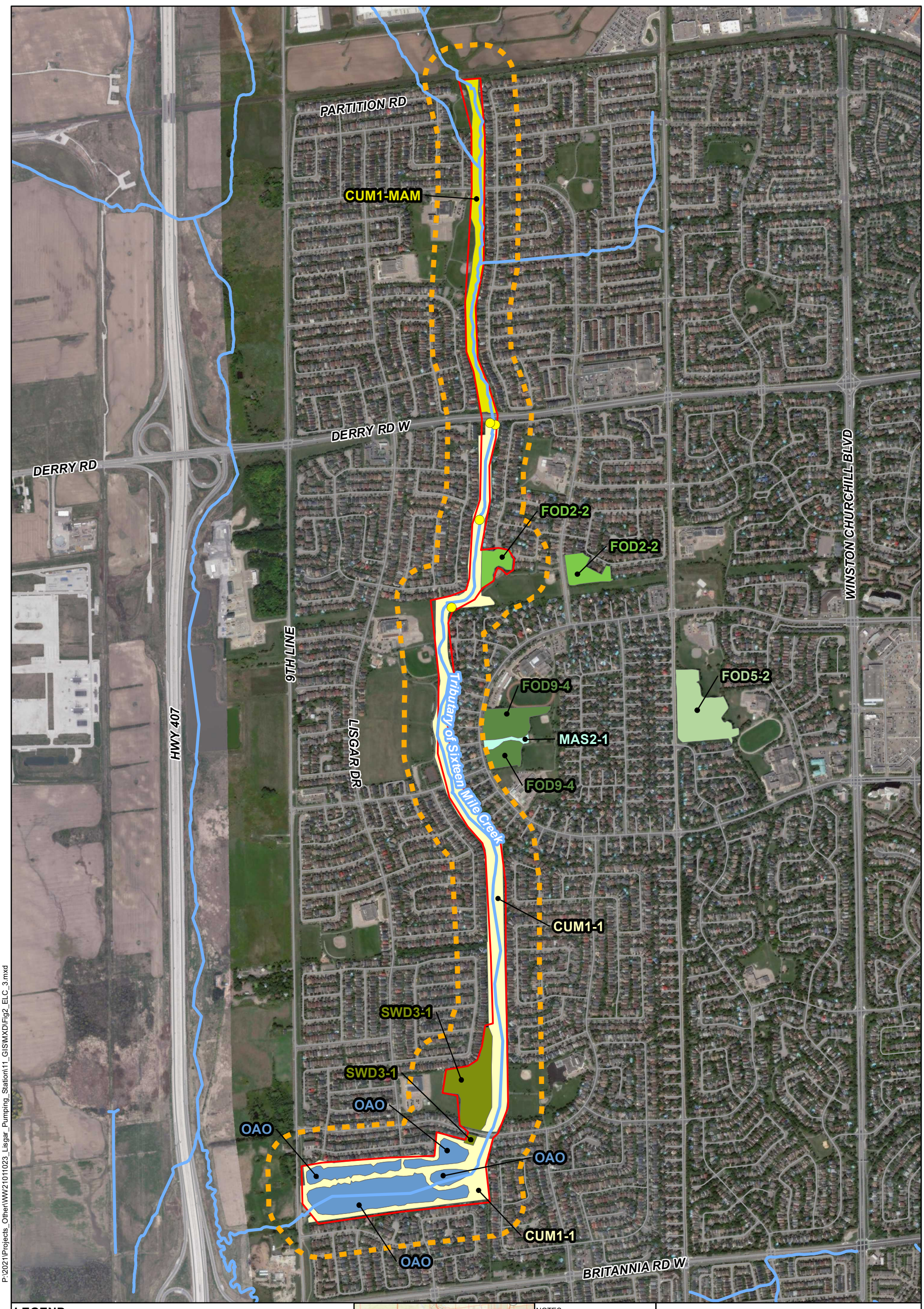
#### 5.1.1 Vegetation Communities and Plant Inventory

The Project Study Area has been disturbed by ongoing anthropogenic land uses such as residential properties, parks with manicured lawns, roads, and trails. Naturalized vegetation within the Project Study Area is generally limited to the vegetation associated with the banks of the tributary of Sixteen Mile Creek, SWM ponds and a few small remnant forest patches. Vegetation community descriptions for the Project Study Area are provided below and are illustrated in Figure 5-1.

Vegetation communities present within the Project Study Area are described in Table 5-1. Those communities identified and delineated by the City's Natural Area Survey have been summarized from the Natural Areas Fact Sheets for Natural Areas LS1, LS2 and LS3 (City of Mississauga, 2020), (City of Mississauga, 2020b),(City of Mississauga, 2020c). Photographs of the Project Location and vegetation communities are provided in Appendix C.

**Table 5-1: Vegetation Community Descriptions for the Project Study Area**

| Vegetation Type | ELC Code | Canopy | Subcanopy | Shrub | Ground Cover | City of Mississauga Designation | Source |
|---|---|---|---|---|---|---|---|
| **Cultural Communities** | | | | | | | |
| Dry – Moist Old Field Cultural Meadow | CUM1-1 | crack willow, Freeman's Maple, Hybrid willow | European buckthorn, sandbank willow, green ash, trembling aspen | grey dogwood, cottony willow | Canada goldenrod, common teasel, Canada thistle, grass species, birds-foot trefoil and crown vetch, white pinnacled aster, grass-leaved goldenrod. | Significant Natural Area | (City of Mississauga, 2020) |
| Mineral Cultural Meadow – Meadow Marsh Complex | CUM1-MAM | This community was identified via aerial photo interpretation. The community consists of a mosaic of scattered trees, wet meadows and cultural meadows along the banks of the Tributary of Sixteen Mile Creek. The community has been considerably impacted by the surrounding residential development | | | | Significant Natural Area | Wood Aerial photo interpretation |
| **Forested Communities** | | | | | | | |
| Dry – Fresh Oak – Hickory Deciduous Forest | FOD2-2 | bur oak, shagbark hickory, red oak, | European buckthorn, ironwood, hawthorn species, shagbark hickory | European buckthorn, white ash | European buckthorn, running strawberrybush, garlic mustard, sedges species. | Significant Natural Area | (City of Mississauga, 2020) |
| Dry – Fresh Oak – Hickory Deciduous Forest | FOD2-2 | red oak, bur oak, sugar maple and shagbark hickory | ironwood, sugar maple | European buckthorn, | European buckthorn, running strawberrybush, garlic mustard, Canada enchanter's nightshade | Significant Natural Area | (City of Mississauga, 2020) |
| Fresh – Moist Shagbark Hickory Deciduous Forest | FOD9-4 | shagbark hickory, bur oak, ironwood, American beech | sugar maple, European buckthorn, hawthorn species, ironwood, American beech | sugar maple, European buckthorn, chokecherry, hybrid honeysuckle | European buckthorn, garlic mustard, herb-robert, Virginia creeper, violet species, running strawberrybush | Significant Natural Area | (City of Mississauga, 2020) |
| Swamp Maple Mineral Deciduous Swamp | SWD3-1 | Freeman's maple, green ash | Freeman's maple, Siberian elm | European buckthorn, green ash, freeman's maple | spotted jewelweed, sensitive fern, fowl mannagrass. | Significant Natural Area | (City of Mississauga, 2020) |
| **Wetland Communities** | | | | | | | |
| Cattail Mineral Shallow Marsh | MAS2-1 | European buckthorn, willow species | Narrow-leaved cattail, broad-leaved cattail, purple loosestrife, European buckthorn, red-osier dogwood, common boneset | spotted jewelweed, bittersweet nightshade, purple-veined willowherb, marshpepper smartweed, goldenrod species, white panicled aster. | garlic mustard, true-forget-me-not, herb-Robert, sedge species, broad-leaved enchanter's nightshade, grass species, American water horehound, wild teasel | Significant Natural Area | (City of Mississauga, 2020) |
| Open Aquatic | OAO | This community is called the Osprey Marsh. These feature present include SWM ponds and a naturalized pond, all of which lack floating vegetation. | Significant Natural Area | | | | (City of Mississauga, 2020) |



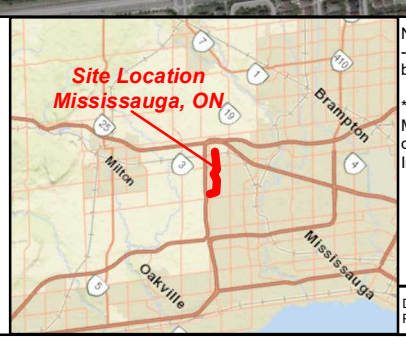

P:\2021\Projects_Other\WW21011023_Lisgar_Pumping_Station\11_GIS\MXD\Fig2_ELC_3.mxd

**LEGEND**

- Project Location
- Project Study Area (120 m buffer)
- Rock Pile
- Watercourse

**City of Mississauga Ecological Land Classification**

- CUM1-1: Dry - Moist Old Field Meadow Type
- *CUM1-MAM: Mineral Cultural Meadow - Meadow Marsh Complex
- FOD2-2: Dry - Fresh Oak - Hickory Deciduous Forest Type
- FOD5-2: Dry - Fresh Sugar Maple - Beech Deciduous Forest Type
- FOD9-4: Fresh - Moist Shagbark Hickory Deciduous Forest
- MAS2-1: Cattail Mineral Shallow Marsh Type
- OAO: Open Aquatic
- SWD3-1: Red Maple Mineral Deciduous Swamp Type




NOTES:
- Imagery extracted from ESRI basemaps, 2019

*CUM1-MAM: Mineral Cultural Meadow - Meadow Marsh Complex delineated from Aerial Photographic Interpretations

Datum: NAD83
Projection: UTM Zone 17N

0 0.25 0.5 1 Kilometres

wood.

# LISGAR PUMPING STATION

## Ecological Land Classification

| | |
|---|---|
| PROJECT N°: WW21011023 | **FIGURE: 2** |
| SCALE: 1:12,500 | DATE: August 2021 |

### 5.1.2 Wildlife

Based on the review of available literature, resources atlases and databases, 199 species of birds, 56 species of butterflies, 42 species of mammals, 13 species of amphibians, and nine species of reptiles are reported to have element occurrences that overlap the Project Location and Project Study Area. A compiled species list is provided in Appendix B. It is important to note that the exact locations of species occurrences and ranges are not available from these sources. Consequently, it is possible that some of these species do not occur in the Project Study Area.

#### 5.1.2.1 Birds

Combining the NHIC, OBBA and eBird list identified 199 species of birds, including one endangered, five threatened and nine special concern SAR. A summary of those SAR is provided in Table 5-2.

**Table 5-2: SAR Birds with Occurrence Records within the Project Study Area**

| Scientific Name | Common Name | S Rank (Provincial)[1] | G Rank (Global)[2] | SARO[3] | Source |
|---|---|---|---|---|---|
| *Empidonax virescens* | Acadian Flycatcher | S2S3B | G5 | END | OBBA |
| *Riparia* | Bank Swallow | S4B | G5 | THR | OBBA, ebird |
| *Hirundo rustica* | Barn Swallow | S5B | G5 | THR | OBBA, ebird |
| *Dolichonyx oryzivorus* | Bobolink | S4B | G5 | THR | NHIC, OBBA, eBird |
| *Chaetura pelagica* | Chimney Swift | S4B,S4N | G4G5 | THR | OBBA,eBird |
| *Sturnella magna* | Eastern Meadowlark | S4B | G5 | THR | NHIC, OBBA, eBird |
| *Haliaeetus leucocephalus* | Bald Eagle | S2N,S4B | G5 | SC | eBird |
| *Cardellina canadensis* | Canada Warbler | S4B | G5 | SC | eBird |
| *Chordeiles minor* | Common Nighthawk | S4B | G5 | SC | OBBA, ebird |
| *Contopus virens* | Eastern Wood-pewee | S4B | G5 | SC | OBBA, ebird |
| *Contopus cooperi* | Olive-sided Flycatcher | S4B | G4 | SC | eBird |
| *Falco peregrinus* | Peregrine Falcon | S3B | G4 | SC | OBBA, eBird |
| *Melanerpes erythrocephalus* | Red-headed Woodpecker | S4B | G5 | SC | OBBA |
| *Euphagus carolinus* | Rusty Blackbird | S4B | G4 | SC | eBird |
| *Hylocichla mustelina* | Wood Thrush | S4B | G4 | SC | OBBA, eBird |

Note(s)

1. **S-rank and G-rank:** The natural heritage provincial ranking system (provincial S-rank, global G-rank) is used by the Natural Heritage Information Centre (NHIC). The statuses were taken from NatureServe Explorer (2021): X - Presumed Extirpated, H- Possibly Extirpated (Historical), 1 - Critically Imperiled, 2-Imperiled, 3 - Vulnerable, 4 - Apparently Secure, 5 – Secure, NR – Unranked, U – Unrankable, NA - Not Applicable, S#S#/G#G# - Range Rank. Breeding Status Qualifiers: B – Breeding, N – Nonbreeding, M - Migrant —Conservation status refers to the breeding population of the species in the province. ? -Inexact or Uncertain
2. **SARO**: The Endangered Species Act 2007 (ESA): END - Endangered, THR – Threatened, SC - Special Concern, NAR - Not at Risk

### 5.1.2.2 Mammals

Within the vicinity of the Project Study Area, a total of 42 species of mammals have habitat ranges that overlap the Project Location as reported in the AMO (Dobbyn, 1994) and the Bat Conservation International (BCI) range maps (Bat Conservation International (BCI), 2021). This includes four bat SAR whose ranges encompass the Project Location; however, it should be noted that that the exact locations of species occurrences are not available from the atlas or BCI (Table 5-3).

**Table 5-3: SAR Mammals with Ranges that Overlap the Project Study Area**

| Scientific Name | Common Name | S Rank (Provincial)[1] | G Rank (Global)[2] | SARO[3] | Source |
|---|---|---|---|---|---|
| *Myotis leibii* | Eastern small-footed myotis | S2S3 | G4 | END | BCI, AMO |
| *Myotis lucifugus* | Little Brown Myotis | S3 | G3 | END | BCI, AMO |
| *Myotis septentrionalis* | Northern Myotis | S3 | G1G2 | END | BCI, AMO |
| *Perimyotis subflavus* | Tricolored Bat | S3? | G2G3 | END | BCI, AMO |

Note(s)

1. **S-rank and G-rank**: The natural heritage provincial ranking system (provincial S-rank, global G-rank) is used by the Natural Heritage Information Centre (NHIC). The statuses were taken from NatureServe Explorer (2021): X - Presumed Extirpated, H- Possibly Extirpated (Historical), 1 - Critically Imperiled, 2-Imperiled, 3 - Vulnerable, 4 - Apparently Secure, 5 – Secure, NR – Unranked, U – Unrankable, NA - Not Applicable, S#S#/G#G# - Range Rank. Breeding Status Qualifiers: B – Breeding, N – Nonbreeding, M - Migrant —Conservation status refers to the breeding population of the species in the province. ? -Inexact or Uncertain
2. **SARO**: The Endangered Species Act 2007 (ESA): END - Endangered, THR – Threatened, SC - Special Concern, NAR - Not at Risk

### 5.1.2.3 Amphibians and Reptiles

Within the vicinity of the Project Study Area, a total of 13 species of amphibians and nine species of reptiles were reported in the ORAA (Ontario Nature, 2019). This includes one endangered amphibian, one threatened reptile, and two special concern reptiles (Table 5-4):

**Table 5-4: SAR Amphibians and Reptiles with Occurrence Records within the Project Study Area**

| Taxa | Scientific Name | Common Name | S Rank (Provincial)[1] | G Rank (Global)[2] | SARO[3] | Source |
|---|---|---|---|---|---|---|
| Amphibian | Jefferson Salamander | *Ambystoma jeffersonianum* | S2 | G4 | END | ORRA |
| Reptiles | Blanding's Turtle | *Emydoidea blandingii* | S3 | G4 | THR | ORRA |
| Reptiles | Northern Map Turtle | *Graptemys geographica* | S3 | G5 | SC | ORRA |
| Reptiles | Snapping Turtle | *Chelydra serpentina* | S4 | G5 | SC | ORRA |

Note(s)

1. **S-rank and G-rank**: The natural heritage provincial ranking system (provincial S-rank, global G-rank) is used by the Natural Heritage Information Centre (NHIC). The statuses were taken from NatureServe Explorer (2021): X - Presumed Extirpated, H- Possibly Extirpated (Historical), 1 - Critically Imperiled, 2-Imperiled, 3 - Vulnerable, 4 - Apparently Secure, 5 – Secure, NR – Unranked, U – Unrankable, NA - Not Applicable, S#S#/G#G# - Range Rank. Breeding Status Qualifiers: B – Breeding, N – Nonbreeding, M - Migrant —Conservation status refers to the breeding population of the species in the province. ? -Inexact or Uncertain
2. **SARO**: The Endangered Species Act 2007 (ESA): END - Endangered, THR – Threatened, SC - Special Concern, NAR - Not at Risk

#### 5.1.2.4 Butterflies

Within the vicinity of the Project Study Area, a total of 56 species of butterflies with occurrence records within the Project Study Area (OBA) (Toronto Entomologists' Association (TEA), 2018). This includes one special concern species (Monarch (*Dananus plexippus*)).

## 5.2 Aquatic Ecosystem

Within the vicinity of the Project Study Area, there are records of 18 species of fish. A compiled species list is provided in Appendix B. No records of aquatic SAR were found for the Project Study Area.

# 6.0 Species at Risk Habitat Assessment

A summary of SAR with species occurrence records or ranges which overlap the Project Study Area is provided in Table 6-1 below. The probabilities provided in Table 6-1 are based on an assessment of each species' habitat preferences/needs in conjunction with background information. Additionally, SAR may come into the area or species already occurring in the area may be up-listed at any time. The probabilities of occurrence are defined as 'High', 'Moderate', 'Low', and 'None' and are based on the following definitions:

- **High**: Those species recorded in the vicinity of the Project Location (typically within 10 km and recorded in the past 20 years) and whose preferred habitat is abundant within the Project Location. Species with a high probability of occurrence would be expected to breed within or frequently use the habitats available within the Project Location and would be known to have a high relative abundance within the region (i.e., compared to other regions in Ontario).
- **Moderate**: Those species in the vicinity of the Project Location but have limited suitable habitat within the Project Location. Species with moderate probabilities of occurrence may not occur within the Project Location frequently, but may intermittently use it for foraging, migration or movement to other parts of their home range.
- **Low**: Those species recorded in the vicinity of the Project Location, but whose preferred habitat does not occur or is extremely limited within the Project Location. These species may intermittently move through the Project Location but are unlikely to become permanent residents.
- **None**: Those species whose preferred habitat is completely absent from the Project Location and may only migrate intermittently through the Project Location.

As noted herein, species identified as endangered and threatened are provided protection under the ESA. Those species, identified as special concern, are not afforded protection under Sections 9 and 10 of the ESA; however, they may be afforded protection as part of SWH. As such, due diligence should be enforced if a special concern species or their habitat is determined to be present.

**Table 6-1: Species at Risk Habitat Assessment and Potential Occurrence**

| Species Name, Status (SARA, ESA, S-Rank)[1,2,3,4], and Data Source | Preferred Habitat | Potential for SAR Habitat/ |
|---|---|---|
| **Birds** | | |
| Acadian Flycatcher (*Empidonax virescens*) | The Acadian Flycatcher is an area-sensitive species (they need large intact forests). In Ontario, the | **Low** – While some forest and swamp habitat is present within |

| | | |
|---|---|---|
| SARA: Endangered<br>ESA: Endangered<br>S-Rank: S2S3B<br>Source: OBBA | species is found in uplands, swamps, and well-wooded ravines with closed canopies and relatively open understory. Usually maple–beech, oak–maple, and beech–hemlock composition (MNRF, 2016). | the Project Study Area and Project Location, these are all highly fragmented and isolated features with little to no interior habitat. Forests and swamps in the Project Location are not considered suitable for the species. |
| Bald Eagle (*Haliaeetus leucocephalus*)<br>SARA: No Status<br>COSEWIC: Not at Risk<br>ESA: Special Concern<br>S-Rank: S4<br>Source: eBird | Eagles require large, stout-limbed, open-crowned trees to support their large bulky nests of sticks and provide perch and roost sites. Supercanopy trees are typically used because they are easily accessed. Nests are typically located in mature or old forest with a discontinuous canopy and numerous supercanopy trees (Naylor, 2004). | **None** – Suitable mature woodland habitat was not present within the Project Study Area or Project Location. Furthermore, stick nests of the species were not observed during field investigations. |
| Bank Swallow (*Riparia riparia*)<br>SARA: Threatened<br>ESA: Threatened<br>S-Rank: S4B<br>Source: OBBA, ebird | Bank Swallows nest in burrows in natural and human-made settings where there are vertical faces in silt and sand deposits. Many nests are on banks of rivers and lakes, but they are also found in active sand and gravel pits or former ones where the banks remain suitable (COSEWIC, 2013) | **None** – Suitable banks and/or vertical faces of sand/silt deposits were not present within the Project Study Area or the Project Location. Furthermore, nests of the species were not observed during field investigations. |
| Barn Swallow (*Hirundo rustica*)<br>SARA: Threatened<br>ESA: Threatened<br>S-Rank: S4B<br>Source: OBBA, ebird | Barn Swallows have shifted largely to nesting in and on artificial structures, including buildings, bridges and road culverts, and prefer various open habitats for foraging including grassy fields, pastures, agricultural crops and over open water (Heagy, et al., 2014). | **Low** – A number of bridges and culverts are present within the Project Study Area and Project Location; however, nests of this species were not observed during field investigations. |
| Bobolink (*Dolichonyx oryzivorus*)<br>SARA: Threatened<br>ESA: Threatened<br>S-Rank: S4B<br>Source: NHIC, OBBA, eBird | Bobolink nest primarily in forage crops, hayfields and associated pastures. Bobolink also occur in wet prairie, graminoid peatlands and abandoned fields dominated by tall grasses, no-till cropland, small-grain fields, reed beds and irrigated fields in arid regions. The species does not generally occupy fields of row crops such as corn, soybean and wheat, pastures in valleys with high shrub density or intensively grazed pastures (McCracken, et al., 2013) | **None** – There are no suitable large unmown grasslands present within the Project Study Area or Project Location. |
| Canada Warbler (*Cardellina canadensis*)<br>SARA: Threatened<br>ESA: Special Concern<br>S-Rank: S4<br>Source: eBird | Found in a variety of upland and wetland forest types, but it is most abundant in wet, mixed deciduous-coniferous forests with a well-developed shrub layer. Nests are typically located on or near the ground on mossy logs or roots, along stream banks or on hummocks (COSEWIC, 2008a) | **Moderate** – Potentially suitable woodlands are present within the Project Study Area and Project Location. |
| Chimney Swift (*Chaetura pelagica*) | Chimney swifts forage aerially over virtually any habitat. Nesting and roosting take place in a dark | **None** – There are a large number of residential houses |

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| SARA: Threatened<br>ESA: Threatened<br>S-Rank: S4B, S4N<br><br>Source: OBBA, eBird | sheltered spot with vertical surfaces to cling to. This may include large hollow trees, chimneys, and other structures (COSEWIC, 2007) | within the Project Study Area that may provide chimney structures for the species to nest in. However, there were no chimney structures present within the Project Location. |
| Common Nighthawk (*Chordeiles minor*)<br><br>SARA: Threatened<br>ESA: Special Concern<br>S-Rank: S4B<br><br>Source: OBBA, eBird | Breeds in a wide range of open habitats, such as beaches, recently logged or burned-over areas, forest clearings, short-grass prairies, pastures, open forests, marshes, lakeshores, gravel roads, riverbanks, rocky outcrops or barrens, railways and urban parks (COSEWIC, 2007a).<br><br>Breeding habitat of Common Nighthawk includes a huge variety of open habitats such as clearings, grasslands, open forests, cropfields and urban areas. In urban areas, gravel rooftops are used. Foraging is aerial over virtually any habitat (COSEWIC, 2007a). | **Low** – Potentially urban parks are present within the Project Study Area but not within the Project Location.<br><br>Within the Project Location, some logging/tree removal was noted during the field investigation. However, no clear-cut areas were created that produced suitable openings for the species were noted. |
| Eastern Meadowlark (*Sturnella magna*)<br><br>SARA: Threatened<br>ESA: Threatened<br>S-Rank: S4B<br><br>Source: NHIC, OBBA, eBird | Eastern Meadowlarks nest in a variety of open grassy habitats, preferring native grasslands, pastures and savannahs. Larger tracts of grassland are preferred (McCracken, et al., 2013). | **None** – There are no suitable large unmown grasslands present within the Project Study Area or Project Location. |
| Eastern Wood-pewee (*Contopus virens*)<br><br>SARA: Special Concern<br>ESA: Special Concern<br>S-Rank: S4B<br><br>Source: OBBA, NHIC | Eastern Wood-pewee breeding in mature to intermediate-aged forests with an open understory, often being associated with clearings and edges. Migrants may occur in a wide variety of habitats (COSEWIC, 2012). | **Moderate** – Potentially suitable woodlands are present within the Project Study Area and Project Location. |
| Olive-sided Flycatcher (*Contopus cooperi*)<br><br>SARA: Threatened<br>ESA: Special Concern<br>S-Rank: S4B<br><br>Source: eBird | Olive-sided Flycatchers are most often found in open areas containing tall trees or snags for perching. Open areas include forest openings, forest edges, burned forest or open to semi-open mature forest stands. Generally, forest habitat is either coniferous or mixed coniferous (COSEWIC, 2007b) | **None** – Suitable forest types are not present within the Project Study Area or Project Location. |
| Peregrine Falcon (*Falco peregrinus anatum / tundrius*)<br><br>SARA: Special Concern<br>ESA: Special ConcernS-Rank: S3B<br><br>Source: OBBA, eBird | Most Peregrine Falcons nest on cliff ledges or crevices, but some will also use tall buildings and bridges near good foraging areas. Habitat for Peregrine Falcons has three scales: a nest site with associated perching sites, a nesting territory, and a home range (Ontario Peregrine Falcon Recovery Team, 2010).<br><br>Characteristics of urban nests are often similar to those of natural cliff nests in that chosen nest sites | **None** – Suitable habitat of cliff ledges, crevices or tall buildings are not present within the Project Study Area or Project Location. |

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| | are usually on one of the taller buildings in an area and within one block of other tall buildings and a reliable food source. They mostly feed on medium-sized birds such as Rock Pigeon and Ring-billed Gull (Ontario Peregrine Falcon Recovery Team, 2010). | |
| Red-headed Woodpecker (*Melanerpes erythrocephalus*)<br>SARA: Threatened<br>ESA: Special Concern<br>S-Rank: S4B<br>Source: OBBA | Uses a variety of habitats including roadsides, pastures, forest edges, and grasslands (COSEWIC, 2007c). | **Moderate** – Potentially suitable forests edges are present within the Project Study Area and Project Location. |
| Rusty Blackbird (*Euphagus carolinus*)<br>SARA: Special Concern<br>ESA: No Status<br>S-Rank: S4B<br>Source: eBird | The breeding habitat of the Rusty Blackbird corresponds closely to the boreal forest. Within this biome, its habitat is characterized by forest wetlands, such as slow-moving streams, peat bogs, sedge meadows, marshes, swamps, beaver ponds and pasture edges. In winter, it occurs primarily in damp woodlands and cultivated fields in the southeastern portion of North America (COSEWIC, 2006). | **None** – Suitable habitat is not present within the Project Location or the Project Study Area. This species may migrate intermittently through the Project Location. |
| Wood Thrush (*Hylocichla mustelina*)<br>SARA: Threatened<br>ESA: Special Concern<br>S-Rank: S4B<br>Source: OBBA, eBird | Wood Thrush breed in mature or second-growth deciduous and mixed-wood forests. They prefer forests with dense understory and large continuous areas of forest but are not reliant on this. Habitat fragmentation due to human development and over-grazing by White-tailed Deer are the main threats to this species (COSEWIC, 2012). | **Low** – Forests within the Project Study Area are highly fragmented; as such, there are no potentially suitable habitats present within the Project Study Area or Project Location. |
| **Amphibians and Reptiles** | | |
| Jefferson Salamander (*Ambystoma jeffersonianum*)<br>SARA: Endangered<br>ESA: Endangered<br>S-Rank: S2<br>Source: ORRA | Adult Jefferson Salamanders, throughout their range, are found within deciduous or mixed upland forests containing, or adjacent to, suitable breeding ponds. Breeding ponds are normally ephemeral, or vernal, woodland pools that dry in late summer. Terrestrial habitat is in mature woodlands that have small mammal burrows or rock fissures that enable adults to over-winter underground below the frost line (COSEWIC, 2010).<br>Jefferson Salamanders spend most of their time underground in mixed or deciduous upland forests. In spring, breeding ponds are required for reproduction, which are typically vernal woodland pools that dry by late summer (COSEWIC, 2010). | **None** – Suitable habitat of upland forests with adjacent vernal pools are not present. No historic or current records for this species in the Project Study Area. |
| Blanding's Turtle (*Emyonidea blandingii*) | Blanding's Turtles are found in a variety of productive wetlands, occurring primarily in shallow-water habitats shallow lakes, ponds and wetlands with mucky bottoms. This species hibernates in the soft bottoms of water bodies. Other habitat features | **Low** –The tributary of Sixteen Mile Creek is located within a highly urbanized environment and does not meet the habitat requirements of this species. |

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| SARA: Threatened<br>ESA: Threatened<br>S-Rank: S3<br>Source: ORRA | include rocks, logs or substrates in sunny locations that provide basking opportunities (COSEWIC, 2005). Females nest on various substrates on land, while overwintering occurs underwater in permanent pools (COSEWIC, 2016). | Meanwhile, the OAO's present within the Project Location, lacks the characteristic highly productive wetlands with shallow-water habitats that the species prefers. Furthermore, no nesting habitats were observed during the field investigation. |
| Northern Map Turtle (*Graptemys geographica*)<br>SARA: Special Concern<br>ESA: Special Concern<br>S-Rank: S3<br>Source: ORRA | Inhabits both lakes and rivers, showing a preference for slow-moving currents, muddy bottoms, and abundant aquatic vegetation. These turtles need suitable basking sites (such as emergent rocks and logs) and exposure to the sun for at least part of the day (COSEWIC, 2002). Shallow, soft-bottomed habitats are preferred, with wintering occurring in deeper sections (COSEWIC, 2012). | **Low** –The tributary of Sixteen Mile Creek is located within a highly urbanized environment and does not meet the habitat requirements of this species. Meanwhile, the OAO's present within the Project Location lacks the characteristic highly productive wetlands with shallow-water habitats that the species prefers. Furthermore, no nesting habitats were observed during the field investigation. |
| Snapping Turtle (*Chelydra serpentina*)<br>SARA: Special Concern<br>ESA: Special Concern<br>S-Rank: S4<br>Source: NHIC, ORRA | Snapping Turtles prefer slow-moving waters with a soft mud bottom and dense aquatic vegetation. Established populations are most often located in ponds, sloughs, shallow bays or river edges and slow streams and wetlands. Individuals can also exist in developed areas (e.g., golf course ponds, irrigation canals); however, it is unlikely that populations persist in such habitats. Snapping Turtles can occur in highly polluted waterways, but environmental contamination is known to limit reproductive success (COSEWIC, 2008). | **Moderate** – Given that the species can utilize a large variety of wetland habitats, including anthropogenically disturbed areas, the Sixteen Mile Creek and ponds within the Project Location are considered suitable for this species. |
| **Mammals** | | |
| Tri-colored Bat (*Perimyotis subflavus*)<br>SARA: Endangered<br>ESA: Endangered<br>S-Rank: S3<br>Source: AMO | Within treed habitats, Tri-colored Bat primarily roosts in tree foliage (mainly within oak leaves). Leaf roosts are shaped like umbrellas with a "roof" and a hollow core where bats rest. Studies have shown that oak leaves are a preferred roost site. Maple leaves are also selected, although less commonly. It is thought that Tri-colored Bat may prefer roost trees in more open woodlands, as opposed to deep woods. Roosts in tree cavities are used less frequently than Myotis species (MNRF, 2011). | **Moderate** – Potentially suitable forests with Oaks are present within the Project Study Area and Project Location. |
| Little Brown Myotis (*Myotis lucifugus*)<br>SARA: Endangered<br>ESA: Endangered<br>S-Rank: S3 | The Little Brown Myotis is widespread throughout the southern half of Canada and is especially associated with humans, often forming nursery colonies in buildings, attics, and other man-made structures. Little Brown Myotis forage over water where their diet consists of aquatic insects, mainly midges, mosquitoes, mayflies, and caddisflies. They also feed over forest trails, cliff faces, meadows, and | **Moderate** – Potentially suitable forests with snags are present within the Project Study Area and Project Location. |

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| Source: BCI, AMO | farmland where they consume a wide variety of insects, from moths and beetles to crane flies (MNRF, 2011). | |
| Northern Myotis (*Myotis septentrionalis*)<br>SARA: Endangered<br>ESA: Endangered<br>S-Rank: S3<br>Source: BCI, AMO | The Northern Myotis is one of the less common species found to hibernate in Ontario. This species is closely associated with woodlands and uses trees as maternity sites (MNRF, 2011). | **Moderate** – Potentially suitable forests with snags are present within the Project Study Area and Project Location. |
| Eastern Small-footed Myotis (*Myotis leibii*)<br>SARA: No status<br>ESA: Endangered<br>S-Rank: S2S3<br>Source: AMO | The Eastern Small-footed Bat is one of the less common species found to hibernate in Ontario. Caves and mines serve as significant hibernacula while streams and ponds serve as foraging areas (MNRF, 2011). | **Moderate** – Potentially suitable forests with snags and some rock piles are present within the Project Study Area and Project Location. |
| Invertebrates | | |
| Monarch (*Danaus plexippus*)<br>SARA: Special Concern<br>ESA: Special Concern<br>S-Rank: S2N, S4B<br>Source: TEA | Monarch is very widely distributed across North America and found in a wide variety of habitats. Populations fluctuate dramatically but have generally been declining, likely due to habitat destruction on the hibernation grounds in Mexico, as well as pesticide use and other factors on the vast breeding grounds. Monarchs require Milkweeds (Asclepias) to lay their eggs and will use a variety of other flowers for adult food (COSEWIC, 2016a) | **Moderate** – Potentially, meadows are present within the Project Study Area and Project Location; however, neither the species nor its foodplant (i.e., milkweeds) were noted during the field investigations. |

Note(s)

1. **S-rank and G-rank:** The natural heritage provincial ranking system (provincial S-rank, global G-rank) is used by the Natural Heritage Information Centre (NHIC). The statuses were taken from NatureServe Explorer (2021): X - Presumed Extirpated, H- Possibly Extirpated (Historical), 1 - Critically Imperiled, 2-Imperiled, 3 - Vulnerable, 4 - Apparently Secure, 5 – Secure, NR – Unranked, U – Unrankable, NA - Not Applicable, S#S#/G#G# - Range Rank. Breeding Status Qualifiers: B – Breeding, N – Nonbreeding, M - Migrant —Conservation status refers to the breeding population of the species in the province. ? -Inexact or Uncertain
2. **SARO**: The Endangered Species Act 2007 (ESA): END - Endangered, THR – Threatened, SC - Special Concern, NAR - Not at Risk
3. NHIC = Natural Heritage Information Centre, OBBA = Ontario Breeding Birds Atlas, AMO = Atlas of Mammals of Ontario, ORAA = Ontario Reptile and Amphibian Atlas; TEA = Toronto Entomologists Association: Ontario Butterfly Atlas, BCI = Bat Conservation Ontario.

# 7.0 Natural Heritage System

Natural Heritage System includes Significant Natural Areas, Natural Green Spaces, Special Management Areas, Residential Woodlands and Linkages. Some features that make up the NHS are of higher quality than others and may be considered significant. A review of the NHS is provided in the following sections.

## 7.1 Fish Habitat

Fish habitats are identified as spawning grounds and nurseries, rearing, food supply, and migration areas on which fish depend directly and or indirectly in order to carry out their life processes. Fish habitats commonly occur in many natural heritage areas such as wetlands, valleylands, woodlands and ANSIs. Fish habitat is present within the Study Area.

## 7.2 Areas of Natural and Scientific Interest

There are no ANSIs within the Project Study Area or Project Location.

## 7.3 Wetlands

There are no PSWs present within the Project Study Area or Project Location. Though a PSW is present outside of the Project Study Area, this wetland is illustrated in Figure 1-1.

There are two wetlands present within the Project Location. These wetlands are both designated as "Other Wetlands" in the City's Official Plan (2021). The larger of these wetlands is also designated by MNDMNRF as a non-Provincially Significant Wetland (Figure 1-1). A non-Provincially Significant Wetland is a feature that has been assessed by MNDMNRF using the Ontario Wetland Evaluation System (MNRF, 2014) and was found to be not meet the requirements of a PSW. These features do not receive consideration protection under the PPS.

Regardless, the "Other Wetlands" as documented on Schedule 3 of the City's Official Plan (2021), must be assessed for local significance in accordance with Section 6.3.12.g of the City's Official Plan (2021), "Other Wetlands" greater than 0.5 hectares must be treated as Significant. The larger wetland is 3.11 ha in size and as such, will be treated as a Locally Significant Wetland. Meanwhile, the smaller wetland is 0.16 ha in size and is therefore not treated as a Locally Significant Wetland.

## 7.4 Significant Woodlands

In accordance with Section 6.3.12.f of the City of Mississauga Official Plan (2021), woodlands meeting the following conditions are treated as significant woodlands:

- woodlands, excluding cultural savannahs, greater than or equal to four hectares;
- woodlands, excluding cultural woodlands and cultural savannahs, greater than or equal to two hectares and less than four hectares;
- any woodland greater than 0.5 hectares that:
    - supports old growth trees (greater than or equal to 100 years old);
    - supports a significant linkage function as determined through an Environmental Impact Study approved by the City in consultation with the appropriate conservation authority;
    - is located within 100 metres of another Significant Natural Area supporting a significant ecological relationship between the two features;
    - is located within 30 metres of a watercourse or significant wetland; or
    - supports significant species or communities

The SWD3-1 and FOD2-2 occur within 30 metres of a watercourse and therefore through the application of these criteria are considered significant woodlands. As well, the two FOD9-4 communities are both designated as Significant Natural Areas in the Official Plan and are are less than 100m apart; therefore these features are also considered Significant Woodlands. These woodlands are illustrated in Figure 5-1.

## 7.5 Significant Valleylands

The City's Official Plan (2021) addresses significant valleylands through both the Natural Hazard Lands and the Significant Natural Areas and form part of the city's Natural Heritage System. In accordance with Section 6.3.12.h of the City of Mississauga Official Plan (2021)".

"*Significant valleylands are associated with the main branches, major tributaries and other tributaries and watercourse corridors draining directly to Lake Ontario including the Credit River, Etobicoke Creek, Mimico Creek and Sixteen Mile Creek*."

The Project Study Area is located within a Significant Natural Area and associated with a Tributary of Sixteen Mile Creek. As such, Significant Valley lands are present within the Project Study Area.

## 7.6 Significant Wildlife Habitat

Wildlife habitat is defined as areas where plants, animals, and other organisms live and can find adequate amounts of food, water, shelter and space needed to sustain their populations. Specific wildlife habitats of concern may include areas where species concentrate at a point in their annual life cycle and those areas which are important to migratory and non-migratory species. Wildlife habitat is considered "significant" if it is deemed ecologically important in terms of feature, function, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or NHS (Ministry of Municipal Affairs and Housing, 2020). According to the SWHCS for Ecoregion 7E (MNRF, 2015), SWH may consist of:

- Seasonal concentration areas for animals;
- Rare vegetation communities;
- Specialized habitat for wildlife; and
- Habitat for species of conservation concern.

The Significant Wildlife Habitat Screening is provided in Appendix D. Candidate Significant Wildlife Habitat will be carried forward in the impact assessment. Based on the conditions documented through field investigations, the following candidate SWH has been identified within the Project Study Area:

**Seasonal Concentration Areas for Animals**

- Bat Maternity Colonies: The FOD2-2, FOD9-4 and SWD3-1 within the Project Location are considered candidate bat maternity roost habitat. These vegetation communities are illustrated in Figure 5-1.
- Turtle Wintering Areas: The tributary of Sixteen Mile Creek and the OAO feature (is it is a natural pond) located within the Project Location is considered candidate Turtle Wintering Habitat. These features are illustrated on Figure 2.
- Reptile Hibernaculum: A total of four rockpiles were present within the Project Location (Figure 5-1). It is unknown if these rockpiles go underground or are topical features. Studies confirming use by a minimum of five individuals of one species or use of two species in spring or fall could confirm hibernacula.

**Specialized Habitat for Wildlife**

- Amphibian Breeding Habitat (Woodland and Wetland): The swamp and OAO features present within the Project Study Area (i.e., the Stormwater ponds and the natural pond) may provide suitable habitat for amphibian breeding. Further studies are needed to confirm the breeding of one or more newt/salamander species or two or more frog/toad species with at least 20 individuals. These features are illustrated in Figure 5-1.

**Habitat for Species of Conservation Concern**

- Habitat for Special Concern Species: candidate Canada Warbler, Eastern Wood-pewee, Red-headed Woodpecker, Snapping Turtle and Monarch. The candidate habitat is determined based on ELC communities that protects form and function.

## 7.7 Other Features Identified in the Official Plan

The Project Study Area and Project Location are located within the following features identified in the City of Mississauga Official Plan (2021) Table 7-1.

**Table 7-1: Features Identified on the Official Plan**

| Feature or Designated Area Type | Source | Located within the Project Study Area | Located within the Project Location |
|---|---|---|---|
| Green System | City of Mississauga Official Plan – Schedule 1a | Y | Y |
| Significant Natural Area and Natural Green Spaces | City of Mississauga Official Plan Schedule 3 | Y | Y |
| Special Management Area | City of Mississauga Official Plan Schedule 3 | Y | Y |
| Natural Hazard | City of Mississauga Official Plan Schedule 3 | Y | Y |
| Public and Private Open Spaces | City of Mississauga Official Plan Schedule 4 | Y | Y |

# 8.0 Summary

The results of the Existing Conditions report, as documented above, indicate that the following natural heritage features, SAR, and SWH are present within the Project Location:

**Natural Heritage Features**

- City of Mississauga Green System as illustrated in Schedule A1 of the City's Official Plan (2021);
- Significant Natural Areas and Natural Green Spaces, Special Management Areas, other wetlands, Natural Hazards as illustrated in Schedule 3 of the City's Official Plan (2021);
- Public and Private Open Spaces as illustrated in Schedule 4 of the City's Official Plan (2021);
- One Locally Significant Wetland;
- Five Significant Woodlands; and
- Significant Valley Lands.

**SAR and SAR Habitat**

There is moderate potential for the following SAR and their habitat to be present within the Project Location: Canada Warbler, Eastern Wood-pewee, Red-headed Woodpecker, Snapping Turtle, Tricolored Bat, Little Brown Myotis, Northern Myotis, Eastern Small-footed Myotis and Monarch.

**SWH**

The following candidate SWH Types are present within the Project Location:

- Bat Maternity Colonies: The FOD2-2, FOD9-4 and SWD3-1 within the Project Location are considered candidate bat maternity roost habitat.
- Turtle Wintering Areas: The tributary of Sixteen Mile Creek and the OAO feature (i.e.,natural pond), which are located within the Project Location is considered candidate Turtle Wintering Habitat. These features are illustrated on Figure 2.
- Reptile Hibernaculum: A total of four potentially suitable rockpiles were present within the Project Location that could indicate SWH.
- Amphibian Breeding Habitat (Woodland and Wetland): Some features present within the Project Study Area may provide suitable habitat for amphibian breeding.
- Habitat for Special Concern Species.

# 9.0 Closure

This Existing Conditions report has been prepared based on Wood's understanding of the proposed Project at the time this report was prepared. The contents of this report reflect the results obtained from a review of secondary source information, agency consultation, and field investigations relative to the Project Location.

If you should have any questions regarding this submittal or require further Project related information, please contact the undersigned.

Sincerely,

**Wood Environment & Infrastructure Solutions,**
**a Division of Wood Canada Limited**

| **Prepared By:** | **Reviewed By:** |
|---|---|
| Julie Ellis, Senior Biologist | Samantha Hughes, Senior Biologist |

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# Appendix A

# Agency Correspondence

Project # WW21011023

# Appendix B

# Complied Species List

Project # WW21011023

| Scientific Name | English Name | S Rank (Provincial) | G Rank (Global) | Exotic Status | SARO | Coefficient of Conservatism | CVC Status | SWD3-1 (Osprey woods) | Creek at SWD3-1 (Osprey Woods) | Tributary of Sixteen Mile Creek (Path at Britannia along Creek) | Tributary of Sixteen Mile Creek (Derry Road Bridge) | FOD2-2 (East Side fo Drain at Forest Park) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Acer platanoides* | Norway Maple | SNA | GNR | SE5 | - | - | not rare | | | x | | |
| *Acer saccharinum* | Silver Maple | S5 | G5 | - | - | 5 | not rare | x | x | x | | |
| *Aesculus glabra* | Ohio Buckeye | S1 | G5 | - | - | 10 | - | | | x | | |
| *Alisma plantago-aquatica,* | European water-plantain | - | - | - | - | - | - | | x | | | |
| *Alliaria petiolata* | Garlic Mustard | SNA | GNR | SE5 | - | - | not rare | x | x | x | | x |
| *Amelanchier species* | Serviceberry species | - | - | - | - | - | - | | | x | | |
| *Arctium minus* | Common Burdock | SNA | GNR | SE5 | - | - | not rare | x | | x | | |
| *Arisaema triphyllum* | Jack-in-the-pulpit | S5 | G5 | - | - | 5 | not rare | x | | | | |
| *Caltha palustris* | Yellow Marsh Marigold | S5 | G5 | - | - | 5 | not rare | | x | | | |
| *Carex spp.* | Sedge Species | - | - | - | - | - | - | x | | | | |
| *Carya cordiformis* | Bitternut Hickory | S5 | G5 | - | - | 6 | not rare | | | | x | |
| *Carya ovata* | Shagbark Hickory | S5 | G5 | - | - | 6 | not rare | x | | | | x |
| *Cornus obliqua* | Silky Dogwood | S5 | G5 | - | - | 2 | rare | | | x | | |
| *cornus racemosa* | Grey Dogwood | S5 | G5 | - | - | 2 | not rare | | | | | |
| *Cornus sericea* | Red-osier Dogwood | S5 | G5 | - | - | 2 | not rare | x | x | | | |
| *Crategus Sp* | Hawthorn species | - | - | - | - | - | - | | | | | x |
| *Daucus carota* | Wild Carrot | SNA | GNR | SE5 | - | - | not rare | | | x | | |
| *Dipsacus fullonum* | Common Teasel | SNA | GNR | SE5 | - | - | not rare | | | x | | |
| *Elaeagnus umbellata* | Autumn Olive | SNA | GNR | SE3 | - | - | - | | | x | | |
| *Erythronium americanum* | Yellow Trout-lily | S5 | G5 | - | - | 5 | not rare | | | | | x |
| *Euonymus obovatus* | Running Strawberry-bush | S4 | G5 | - | - | 6 | not rare | x | | | | |
| *Fragaria virginiana* | Wild Strawberry | S5 | G5 | - | - | 2 | not rare | | | | | x |
| *Fraxinus pennsylvanica* | Red Ash | S4 | G5 | - | - | 3 | not rare | | x | | | |
| *Fraxinus sp.* | Ash Species | - | - | - | - | - | - | x | | | | |
| *Hydrophyllum virginianum* | Virginia Waterleaf | S5 | G5 | - | - | 6 | not rare | x | | | | x |
| *Iris sp.* | Iris Species | - | - | - | - | - | - | | x | x | | |
| *Larix laricina* | Tamarack | S5 | G5 | - | - | 7 | not rare | | | x | | |
| *Lonicera sp.* | Honeysuckle Species | - | - | - | - | - | - | | | | | x |
| *Lonicera tatarica* | Tatarian Honeysuckle | SNA | GNR | SE5 | - | - | not rare | | | | | |
| *Malus pumila* | Common Apple | SNA | G5 | SE4 | - | - | not rare | | | x | | |
| *Matteuccia struthiopteris* | Ostrich Fern | S5 | G5 | - | - | 5 | not rare | x | | | | |
| *Onoclea sensibilis* | Sensitive Fern | S5 | G5 | - | - | 4 | not rare | x | | | | |
| *phalaris arundinacea* | Reed Canarygrass | S5 | G5 | - | - | 0 | not rare | | | x | | |
| *Phragmites australis* | Common Reed | S4? | G5 | - | - | 0 | not rare | | x | | | |
| *Physocarpus opulifolius* | Eastern Ninebark | S5 | G5 | - | - | 5 | rare | | | x | | |
| *Picea glauca* | White Spruce | S5 | G5 | - | - | 6 | not rare | | x | x | | |
| *Pinus sylvestris* | Scots Pine | SNA | GNR | SE5 | - | - | not rare | | x | | | |
| *Populus deltoides* | Eastern Cottonwood | S5 | G5 | - | - | 4 | not rare | | | x | | |
| *Populus tremuloides* | Trembling Aspen | S5 | G5 | - | - | 2 | not rare | | | x | | |
| *Potentilla recta* | Sulphur Cinquefoil | SNA | GNR | SE5 | - | - | not rare | | | x | | |
| *Prunus americana* | American Plum | S4 | G5 | - | - | 6 | - | | | x | | |
| *Prunus virginiana* | Chokecherry | S5 | G5 | - | - | 2 | not rare | x | | x | | |
| *Quercus macrocarpa* | Bur Oak | S5 | G5 | - | - | 5 | not rare | | | x | | x |
| *Quercus rubra* | Northern Red Oak | S5 | G5 | - | - | 6 | not rare | | | x | | x |
| *Rhamnus cathartica* | European Buckthorn | SNA | GNR | SE5 | - | - | not rare | x | | x | | x |
| *Rhus typhina* | Staghorn Sumac | S5 | G5 | - | - | 1 | not rare | | x | | | |
| *Ribes sp.* | Curent Species | - | - | - | - | - | - | x | | x | | |
| *rubus occidentalis* | Black Raspberry | S5 | G5 | - | - | 2 | not rare | | x | | | |
| *Salix Sp.* | Willow Species | - | - | - | - | - | - | | x | x | | |
| *Solidago altissima* | Tall Goldenrod | S5 | G5 | - | - | 1 | not rare | | x | x | | |
| *Symphyotrichum lanceolatum* | Panicled Aster | S5 | G5 | - | - | 3 | not rare | | | x | | |
| *Thuja occidentalis* | Eastern White Cedar | S5 | G5 | - | - | 4 | not rare | | x | x | | |
| *Tilia americana* | Basswood | S5 | G5 | - | - | 4 | not rare | | | | | x |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Trillium grandiflorum* | White Trillium | S5 | G5 | - | - | 5 | not rare | x | | | | |
| *Typha x glauca* | (Typha angustifolia X Typha latifolia) | SNA | GNA | - | - | - | not rare | | | x | | |
| *Ulmus americana* | White Elm | S5 | G4 | - | - | 3 | not rare | x | | | | x |
| *Viburnum lentago* | Nannyberry | S5 | G5 | - | - | 4 | not rare | | | | | |
| *Vitis riparia* | Riverbank Grape | S5 | G5 | - | - | 0 | not rare | | x | | | |

| Taxa | Scientific Name | English Name | S Rank (Provincial) | G Rank (Global) | Exotic Status | SARO | CVC Status | SWD3-1 (Osprey woods) | Creek at SWD3-1 (Osprey Woods) | Tributary of Sixteen Mile Creek (Path at Britannia along Creek) | Tributary of Sixteen Mile Creek (Derry Road Bridge) | FOD2-2 (East Side fo Drain at Forest Park) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Amphibian | *Lithobates clamitans* | Green Frog | S5 | G5 | - | - | - | | | x | | |
| Bird | *Accipiter cooperii* | Cooper's Hawk | S4 | G5 | - | NAR | CC | x | | | | |
| | *Agelaius phoeniceus* | Red-winged Blackbird | S4 | G5 | - | - | - | | | x | | |
| | *Anas platyrhynchos* | Mallard | S5 | G5 | - | - | - | x | | x | | |
| | *Branta canadensis* | Canada Goose | S5 | G5 | - | - | - | | | | x | |
| | *Cardinalis cardinalis* | Northern Cardinal | S5 | G5 | - | - | - | x | | x | | |
| | *Catharus ustulatus* | Swainson's Thrush | S4B | G5 | - | - | - | | x | | | |
| | *Geothlypis trichas* | Common Yellowthroat | S5B | G5 | - | - | - | | | x | | |
| | *Icterus galbula* | Baltimore Oriole | S4B | G5 | - | - | - | | | x | | |
| | *Melospiza melodia* | Song Sparrow | S5B | G5 | - | - | - | | x | x | | x |
| | *Mniotilta varia* | Black-and-white Warbler | S5B | G5 | - | - | CC | x | | | | |
| | *Passer domesticus* | House Sparrow | SNA | G5 | SE | - | - | | | x | | |
| | *Poecile atricapillus* | Black-capped Chickadee | S5 | G5 | - | - | - | | x | x | | |
| | *Quiscalus quiscula* | Common Grackle | S5B | G5 | - | - | CC | | | x | | x |
| | *Regulus calendula* | Ruby-crowned Kinglet | S4B | G5 | - | - | - | | | x | | |
| | *Seiurus aurocapilla* | Ovenbird | S4B | G5 | - | - | CC | | x | | | |
| | *Setophaga caerulescens* | Black-throated Blue Warbler | S5B | G5 | - | - | CC | x | x | | | |
| | *Setophaga pensylvanica* | Chestnut-sided Warbler | S5B | G5 | - | - | CC | | x | | | |
| | *Setophaga petechia* | Yellow Warbler | S5B | G5 | - | - | - | x | x | | | x |
| | *Spinus tristis* | American Goldfinch | S5B | G5 | - | - | - | x | x | x | | |
| | *Spizella passerina* | Chipping Sparrow | S5B | G5 | - | - | - | x | | x | | |
| | *Stelgidopteryx serripennis* | Northern Rough-winged Swallow | S4B | G5 | - | - | - | | | x | | |
| | *Sturnus vulgaris* | European Starling | SNA | G5 | SE | - | - | | | x | | |
| | *Toxostoma rufum* | Brown Thrasher | S4B | G5 | - | - | CC | | | | | x |
| | *Turdus migratorius* | American Robin | S5B | G5 | - | - | - | | | x | | |
| | *Zenaida macroura* | Mourning Dove | S5 | G5 | - | - | - | | | x | | |
| | *Zonotrichia albicollis* | White-throated Sparrow | S5B | G5 | - | - | CC | | | x | | x |
| Mammal | *Ondatra zibethicus* | Muskrat | S5 | G5 | - | - | - | | x | | | |
| | *Sciurus carolinensis* | Eastern Gray Squirrel | S5 | G5 | - | - | - | x | x | | | |
| | *Sylvilagus floridanus* | Eastern Cottontail | S5 | G5 | - | - | - | | x | | | |

CC -Conservation Concern in CVC Jurisdiction

| Taxa | Scientific Name | Common Name | S Rank (Provincial) | G Rank (Global) | Exotic Status | SARO | Source | |
|---|---|---|---|---|---|---|---|---|
| Amphibians | *Lithobates catesbeianus* | American Bullfrog | S4 | G5 | | | ORRA | |
| | *Anaxyrus americanus* | American Toad | S5 | G5 | | | ORRA | |
| | *Ambystoma laterale* | Blue-spotted Salamander | S4 | G5 | | | ORRA | |
| | *Plethodon cinereus* | Eastern Red-backed Salamander | S5 | G5 | | | ORRA | |
| | *Lithobates clamitans* | Green Frog | S5 | G5 | | | ORRA | |
| | *Ambystoma jeffersonianum* | Jefferson Salamander | S2 | G4 | | END | ORRA | |
| | *Necturus maculosus* | Mudpuppy | S4 | G5 | | NAR | ORRA | |
| | *Lithobates pipiens* | Northern Leopard Frog | S5 | G5 | | NAR | ORRA | |
| | *Notophthalmus viridescens viridescens* | Red-spotted Newt | S5 | G5T5 | | | ORRA | |
| | *Ambystoma maculatum* | Spotted Salamander | S4 | G5 | | | ORRA | |
| | *Pseudacris crucifer* | Spring Peeper | S5 | G5 | | | ORRA | |
| | *Pseudacris maculata pop. 1* | Western Chorus Frog - Great Lakes - St. Lawrence - Canadian Shield populati | S4 | G5TNR | | NAR | ORRA | |
| | *Lithobates sylvaticus* | Wood Frog | S5 | G5 | | | ORRA | |
| | *Empidonax virescens* | Acadian Flycatcher | S2S3B | G5 | END | | OBBA | |
| | *Empidonax alnorum* | Alder Flycatcher | S5B | G5 | | | OBBA, ebird | |
| | *Botaurus lentiginosus* | American Bittern | S4B | G5 | | | eBird | |
| | *Anas rubripes* | American Black Duck | S4 | G5 | | | eBird | |
| | *Fulica americana* | American Coot | S4B | G5 | | NAR | eBird | |
| | *Corvus brachyrhynchos* | American Crow | S5B | G5 | | | OBBA, ebird | |
| | *Pluvialis dominica* | American Golden-Plover | S2B,S4N | G5 | | | eBird | |
| | *Spinus tristis* | American Goldfinch | S5B | G5 | | | OBBA, eBird | |
| | *Falco sparverius* | American Kestrel | S4 | G5 | | | OBBA, eBird | |
| | *Anthus rubescens* | American Pipit | S4 | G5 | | | eBird | |
| | *Setophaga ruticilla* | American Redstart | S5B | G5 | | | OBBA, ebird | |
| | *Turdus migratorius* | American Robin | S5B | G5 | | | OBBA, eBird | |
| | *Spizella arborea* | American Tree Sparrow | S4B | G5 | | | eBird | |
| | *Anas americana* | American Wigeon | S4 | G5 | | | eBird | |
| | *Scolopax minor* | American Woodcock | S4B | G5 | | | OBBA, ebird | |
| | *Calidris bairdii* | Baird's Sandpiper | SNA | G5 | | | eBird | |
| | *Haliaeetus leucocephalus* | Bald Eagle | S2N,S4B | G5 | | SC | eBird | |
| | *Icterus galbula* | Baltimore Oriole | S4B | G5 | | | OBBA, ebird | |
| | *Riparia riparia* | Bank Swallow | S4B | G5 | | THR | OBBA, ebird | |
| | *Hirundo rustica* | Barn Swallow | S5B | G5 | | THR | OBBA, ebird | |
| | *Setophaga castanea* | Bay-breasted Warbler | S5B | G5 | | | eBird | |
| | *Megaceryle alcyon* | Belted Kingfisher | S4B | G5 | | | OBBA, ebird | |
| | *Mniotilta varia* | Black-and-white Warbler | S5B | G5 | | | eBird | |
| | *Pluvialis squatarola* | Black-bellied Plover | S4N | G5 | | | eBird | |
| | *Coccyzus erythropthalmus* | Black-billed Cuckoo | S5B | G5 | | | OBBA | |
| | *Setophaga fusca* | Blackburnian Warbler | S5B | G5 | | | eBird | |
| | *Poecile atricapillus* | Black-capped Chickadee | S5 | G5 | | | OBBA, ebird | |
| | *Nycticorax nycticorax* | Black-crowned Night-heron | S3B,S3N | G5 | | | eBird | |
| | *Setophaga striata* | Blackpoll Warbler | S4B | G5 | | | eBird | |
| | *Setophaga caerulescens* | Black-throated Blue Warbler | S5B | G5 | | | eBird | |
| | *Setophaga virens* | Black-throated Green Warbler | S5B | G5 | | | eBird | |
| | *Cyanocitta cristata* | Blue Jay | S5 | G5 | | | OBBA, ebird | |
| | *Polioptila caerulea* | Blue-gray Gnatcatcher | S4B | G5 | | | eBird | |
| | *Vireo solitarius* | Blue-headed Vireo | S5B | G5 | | | eBird | |
| | *Vermivora cyanoptera* | Blue-winged Warbler | S4B | G5 | | | eBird | |
| | *Dolichonyx oryzivorus* | Bobolink | S4B | G5 | | THR | NHIC, OBBA, eBird | |
| | *Chroicocephalus philadelphia* | Bonaparte's Gull | S4B,S4N | G5 | | | eBird | |
| | *Buteo platypterus* | Broad-winged Hawk | S5B | G5 | | | eBird | |
| | *Certhia americana* | Brown Creeper | S5B | G5 | | | OBBA, eBird | |
| | *Toxostoma rufum* | Brown Thrasher | S4B | G5 | | | OBBA, ebird | |
| | *Molothrus ater* | Brown-headed Cowbird | S4B | G5 | | | OBBA, ebird | |
| | *Bucephala albeola* | Bufflehead | S4 | G5 | | | eBird | |
| | *Branta hutchinsii* | Cackling Goose | S4M | G5 | | | eBird | |
| | *Branta canadensis* | Canada Goose | S5 | G5 | | | OBBA, ebird | |
| | *Cardellina canadensis* | Canada Warbler | S4B | G5 | | SC | eBird | |
| | *Thryothorus ludovicianus* | Carolina Wren | S4 | G5 | | | OBBA, ebird | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Hydroprogne caspia* | Caspian Tern | S3B | G5 | | NAR | eBird | |
| | *Bombycilla cedrorum* | Cedar Waxwing | S5B | G5 | | | OBBA, ebird | |
| | *Setophaga pensylvanica* | Chestnut-sided Warbler | S5B | G5 | | | eBird | |
| | *Chaetura pelagica* | Chimney Swift | S4B,S4N | G4G5 | | THR | OBBA,eBird | |
| | *Spizella passerina* | Chipping Sparrow | S5B | G5 | | | OBBA, ebird | |
| | *Petrochelidon pyrrhonota* | Cliff Swallow | S4B | G5 | | | OBBA, ebird | |
| | *Bucephala clangula* | Common Goldeneye | S5 | G5 | | | eBird | |
| | *Quiscalus quiscula* | Common Grackle | S5B | G5 | | | OBBA, ebird | |
| | *Gavia immer* | Common Loon | S5B,S5N | G5 | | NAR | eBird | |
| | *Mergus merganser* | Common Merganser | S5B,S5N | G5 | | | eBird | |
| | *Chordeiles minor* | Common Nighthawk | S4B | G5 | | SC | OBBA, ebird | |
| | *Corvus corax* | Common Raven | S5 | G5 | | | eBird | |
| | *Acanthis flammea* | Common Redpoll | S4B | G5 | | | eBird | |
| | *Sterna hirundo* | Common Tern | S4B | G5 | | NAR | eBird | |
| | *Geothlypis trichas* | Common Yellowthroat | S5B | G5 | | | OBBA, ebird | |
| | *Accipiter cooperii* | Cooper's Hawk | S4 | G5 | | NAR | OBBA, eBird | |
| | *Junco hyemalis* | Dark-eyed Junco | S5B | G5 | | | eBird | |
| | *Phalacrocorax auritus* | Double-crested Cormorant | S5B | G5 | | NAR | eBird | |
| | *Picoides pubescens* | Downy Woodpecker | S5 | G5 | | | OBBA, eBird | |
| | *Calidris alpina* | Dunlin | S4B,S5N | G5 | | | eBird | |
| | *Sialia sialis* | Eastern Bluebird | S5B | G5 | | NAR | OBBA, ebird | |
| | *Sturnella magna* | Eastern Meadowlark | S4B | G5 | | THR | NHIC, OBBA, eBird | |
| | *Sayornis phoebe* | Eastern Phoebe | S5B | G5 | | | OBBA, ebird | |
| | *Megascops asio* | Eastern Screech-Owl | S4 | G5 | | NAR | OBBA | |
| | *Pipilo erythrophthalmus* | Eastern Towhee | S4B | G5 | | | OBBA, ebird | |
| | *Contopus virens* | Eastern Wood-pewee | S4B | G5 | | SC | OBBA, ebird | |
| | *Sturnus vulgaris* | European Starling | SNA | G5 | SE | | OBBA, ebird | |
| | *Spizella pusilla* | Field Sparrow | S4B | G5 | | | OBBA, ebird | |
| | *Anas strepera* | Gadwall | S4 | G5 | | | eBird | |
| | *Larus hyperboreus* | Glaucous Gull | S4N | G5 | | | eBird | |
| | *Plegadis falcinellus* | Glossy Ibis | SNA | G5 | | | eBird | |
| | *Regulus satrapa* | Golden-crowned Kinglet | S5B | G5 | | | eBird | |
| | *Dumetella carolinensis* | Gray Catbird | S4B | G5 | | | OBBA, ebird | |
| | *Ardea herodias* | Great Blue Heron | S4 | G5 | | | eBird | |
| | *Myiarchus crinitus* | Great Crested Flycatcher | S4B | G5 | | | OBBA, ebird | |
| | *Ardea alba* | Great Egret | S2B | G5 | | | eBird | |
| | *Bubo virginianus* | Great Horned Owl | S4 | G5 | | | OBBA, eBird | |
| | *Anser albifrons* | Greater White-fronted Goose | SNA | G5 | | | eBird | |
| | *Tringa melanoleuca* | Greater Yellowlegs | S4B,S4N | G5 | | | eBird | |
| | *Butorides virescens* | Green Heron | S4B | G5 | | | OBBA, eBird | |
| | *Anas crecca* | Green-winged Teal | S4 | G5 | | | eBird | |
| | *Picoides villosus* | Hairy Woodpecker | S5 | G5 | | | OBBA, ebird | |
| | *Catharus guttatus* | Hermit Thrush | S5B | G5 | | | eBird | |
| | *Larus argentatus* | Herring Gull | S5B,S5N | G5 | | | eBird | |
| | *Lophodytes cucullatus* | Hooded Merganser | S5B,S5N | G5 | | | eBird | |
| | *Eremophila alpestris* | Horned Lark | S5B | G5 | | | OBBA, ebird | |
| | *Haemorhous mexicanus* | House Finch | SNA | G5 | SE | | OBBA, ebird | |
| | *Passer domesticus* | House Sparrow | SNA | G5 | SE | | OBBA, ebird | |
| | *Troglodytes aedon* | House Wren | S5B | G5 | | | OBBA, ebird | |
| | *Limosa haemastica* | Hudsonian Godwit | S3B,S4N | G4 | | | eBird | |
| | *Passerina cyanea* | Indigo Bunting | S4B | G5 | | | OBBA | |
| | *Charadrius vociferus* | Killdeer | S5B,S5N | G5 | | | OBBA, ebird | |
| | *Empidonax minimus* | Least Flycatcher | S4B | G5 | | | OBBA, ebird | |
| **Birds** | *Calidris minutilla* | Least Sandpiper | S4B,S5N | G5 | | | eBird | |
| | *Aythya affinis* | Lesser Scaup | S4 | G5 | | | eBird | |
| | *Tringa flavipes* | Lesser Yellowlegs | S4B,S4N | G5 | | | eBird | |
| | *Melospiza lincolnii* | Lincoln's Sparrow | S5B | G5 | | | eBird | |
| | *Limnodromus scolopaceus* | Long-billed Dowitcher | SNA | G5 | | | eBird | |
| | *Setophaga magnolia* | Magnolia Warbler | S5B | G5 | | | eBird | |
| | *Anas platyrhynchos* | Mallard | S5 | G5 | | | OBBA, ebird | |
| | *Cistothorus palustris* | Marsh Wren | S4B | G5 | | | OBBA, ebird | |
| | *Falco columbarius* | Merlin | S5B | G5 | | NAR | eBird | |
| | *Zenaida macroura* | Mourning Dove | S5 | G5 | | | OBBA, ebird | |
| | *Zenaida macroura* | Mourning Dove | S5 | G5 | | | OBBA | |
| | *Geothlypis philadelphia* | Mourning Warbler | S4B | G5 | | | eBird | |
| | *Cygnus olor* | Mute Swan | SNA | G5 | SE | | eBird | |
| | *Cardinalis cardinalis* | Northern Cardinal | S5 | G5 | | | OBBA,eird | |
| | *Colaptes auratus* | Northern Flicker | S4B | G5 | | | OBBA, ebird | |

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|---|---|---|---|---|---|---|---|
| *Circus hudsonius* | Northern Harrier | S4B | G5 | | NAR | OBBA, ebird | |
| *Mimus polyglottos* | Northern Mockingbird | S4 | G5 | | | OBBA, ebird | |
| *Setophaga americana* | Northern Parula | S4B | G5 | | | eBird | |
| *Anas acuta* | Northern Pintail | S5 | G5 | | | eBird | |
| *Stelgidopteryx serripennis* | Northern Rough-winged Swallow | S4B | G5 | | | OBBA, ebrid | |
| *Anas clypeata* | Northern Shoveler | S4 | G5 | | | eBird | |
| *Lanius borealis* | Northern Shrike | S4 | G5 | | | eBird | |
| *Parkesia noveboracensis* | Northern Waterthrush | S5B | G5 | | | OBBA, ebird | |
| *Contopus cooperi* | Olive-sided Flycatcher | S4B | G4 | | SC | eBird | |
| *Oreothlypis celata* | Orange-crowned Warbler | S4B | G5 | | | eBird | |
| *Icterus spurius* | Orchard Oriole | S4B | G5 | | | OBBA, ebird | |
| *Pandion haliaetus* | Osprey | S5B | G5 | | | eBird | |
| *Seiurus aurocapilla* | Ovenbird | S4B | G5 | | | OBBA, ebrid | |
| *Calidris melanotos* | Pectoral Sandpiper | SHB,S5N | G5 | | | eBird | |
| *Falco peregrinus* | Peregrine Falcon | S3B | G4 | | SC | OBBA, eBird | |
| *Vireo philadelphicus* | Philadelphia Vireo | S5B | G5 | | | eBird | |
| *Podilymbus podiceps* | Pied-billed Grebe | S4B,S4N | G5 | | | eBird | |
| *Dryocopus pileatus* | Pileated Woodpecker | S5 | G5 | | | OBBA, eBird | |
| *Spinus pinus* | Pine Siskin | S4B | G5 | | | eBird | |
| *Setophaga pinus* | Pine Warbler | S5B | G5 | | | OBBA, ebird | |
| *Haemorhous purpureus* | Purple Finch | S4B | G5 | | | eBird | |
| *Progne subis* | Purple Martin | S3S4B | G5 | | | OBBA, ebird | |
| *Melanerpes carolinus* | Red-bellied Woodpecker | S4 | G5 | | | eBird | |
| *Mergus serrator* | Red-breasted Merganser | S4B,S5N | G5 | | | eBird | |
| *Sitta canadensis* | Red-breasted Nuthatch | S5 | G5 | | | eBird | |
| *Vireo olivaceus* | Red-eyed Vireo | S5B | G5 | | | OBBA, eBird | |
| *Aythya americana* | Redhead | S2B,S4N | G5 | | | eBird | |
| *Melanerpes erythrocephalus* | Red-headed Woodpecker | S4B | G5 | | SC | OBBA | |
| *Podiceps grisegena* | Red-necked Grebe | S3B,S4N | G5 | | NAR | eBird | |
| *Buteo jamaicensis* | Red-tailed Hawk | S5 | G5 | | NAR | OBBA, eBird | |
| *Agelaius phoeniceus* | Red-winged Blackbird | S4 | G5 | | | OBBA, eBird | |
| *Larus delawarensis* | Ring-billed Gull | S5B,S4N | G5 | | | eBird | |
| *Aythya collaris* | Ring-necked Duck | S5 | G5 | | | eBird | |
| *Columba livia* | Rock Pigeon | SNA | G5 | SE | | OBBA, eBrid | |
| *Pheucticus ludovicianus* | Rose-breasted Grosbeak | S4B | G5 | | | OBBA, eBrid | |
| *Chen rossii* | Ross's Goose | S1B | G4 | | | eBird | |
| *Buteo lagopus* | Rough-legged Hawk | S1B,S4N | G5 | | NAR | eBird | |
| *Regulus calendula* | Ruby-crowned Kinglet | S4B | G5 | | | eBird | |
| *Archilochus colubris* | Ruby-throated Hummingbird | S5B | G5 | | | eBird | |
| *Oxyura jamaicensis* | Ruddy Duck | S4B,S4N | G5 | | | eBird | |
| *Calidris pugnax* | Ruff | SNA | G5 | | | eBird | |
| *Euphagus carolinus* | Rusty Blackbird | S4B | G4 | | SC | eBird | |
| *Grus canadensis* | Sandhill Crane | S5B | G5 | | | eBird | |
| *Passerculus sandwichensis* | Savannah Sparrow | S4B | G5 | | | OBBA, ebird | |
| *Piranga olivacea* | Scarlet Tanager | S4B | G5 | | | OBBA | |
| *Charadrius semipalmatus* | Semipalmated Plover | S4B,S4N | G5 | | | eBird | |
| *Calidris pusilla* | Semipalmated Sandpiper | S3B,S4N | G5 | | | eBird | |
| *Accipiter striatus* | Sharp-shinned Hawk | S5 | G5 | | NAR | OBBA, ebird | |
| *Limnodromus griseus* | Short-billed Dowitcher | S3B,S4N | G5 | | | eBird | |
| *Chen caerulescens* | Snow Goose | S5B | G5 | | | eBird | |
| *Bubo scandiacus* | Snowy Owl | SNA | G5 | | NAR | eBird | |
| *Tringa solitaria* | Solitary Sandpiper | S4B | G5 | | | eBird | |
| *Melospiza melodia* | Song Sparrow | S5B | G5 | | | OBBA, eBird | |
| *Actitis macularius* | Spotted Sandpiper | S5 | G5 | | | OBBA, eBird | |
| *Calidris himantopus* | Stilt Sandpiper | S4B,S4N | G5 | | | eBird | |
| *Catharus ustulatus* | Swainson's Thrush | S4B | G5 | | | eBird | |
| *Melospiza georgiana* | Swamp Sparrow | S5B | G5 | | | OBBA, eBird | |
| *Myadestes townsendi* | Townsend's Solitaire | SNA | G5 | | | eBird | |
| *Tachycineta bicolor* | Tree Swallow | S4B | G5 | | | OBBA, eBird | |
| *Cygnus buccinator* | Trumpeter Swan | S4 | G4 | | NAR | eBird | |
| *Cygnus columbianus* | Tundra Swan | S4 | G5 | | | eBird | |
| *Cathartes aura* | Turkey Vulture | S5B | G5 | | | OBBA, eBird | |
| *Bartramia longicauda* | Upland Sandpiper | S4B | G5 | | | OBBA, eBird | |
| *Catharus fuscescens* | Veery | S4B | G5 | | | OBBA, eBrid | |
| *Pooecetes gramineus* | Vesper Sparrow | S4B | G5 | | | eBird | |
| *Vireo gilvus* | Warbling Vireo | S5B | G5 | | | OBBA, eBird | |
| *Setophaga palmarum palmarum* | Western Palm Warbler | S5B | G5T5 | | | eBird | |
| *Sitta carolinensis* | White-breasted Nuthatch | S5 | G5 | | | OBBA | |

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|---|---|---|---|---|---|---|---|---|
| | *Sitta carolinensis* | White-breasted Nuthatch | S5 | G5 | | | eBird | |
| | *Zonotrichia leucophrys* | White-crowned Sparrow | S4B | G5 | | | eBird | |
| | *Calidris fuscicollis* | White-rumped Sandpiper | S5N | G5 | | | eBird | |
| | *Zonotrichia albicollis* | White-throated Sparrow | S5B | G5 | | | eBird | |
| | *Meleagris gallopavo* | Wild Turkey | S5 | G5 | | | eBird | |
| | *Tringa semipalmata* | Willet | SNA | G5 | | | eBird | |
| | *Empidonax traillii* | Willow Flycatcher | S5B | G5 | | | OBBA, eBird | |
| | *Phalaropus tricolor* | Wilson's Phalarope | S3B | G5 | | | eBird | |
| | *Gallinago delicata* | Wilson's Snipe | S5B | G5 | | | OBBA | |
| | *Cardellina pusilla* | Wilson's Warbler | S4B | G5 | | | eBird | |
| | *Troglodytes hiemalis* | Winter Wren | S5B | G5 | | | eBird | |
| | *Aix sponsa* | Wood Duck | S5 | G5 | | | OBBA, eBird | |
| | *Hylocichla mustelina* | Wood Thrush | S4B | G4 | | SC | OBBA, eBird | |
| | *Setophaga petechia* | Yellow Warbler | S5B | G5 | | | OBBA, eBird | |
| | *Sphyrapicus varius* | Yellow-bellied Sapsucker | S5B | G5 | | | eBird | |
| | *Coccyzus americanus* | Yellow-billed Cuckoo | S4B | G5 | | | OBBA | |
| | *Setophaga coronata* | Yellow-rumped Warbler | S5B | G5 | | | eBird | |
| **Insects** | *Satyrium acadica* | Acadian Hairstreak | S4 | G5 | | | OBA | |
| | *Vanessa virginiensis* | American Lady | S5 | G5 | | | OBA | |
| | *Lethe appalachia* | Appalachian Brown | S4 | G4 | | | OBA | |
| | *Euphydryas phaeton* | Baltimore Checkerspot | S4 | G5 | | | OBA | |
| | *Satyrium calanus* | Banded Hairstreak | S4 | G5 | | | OBA | |
| | *Papilio polyxenes* | Black Swallowtail | S5 | G5 | | | OBA | |
| | *Pieris rapae* | Cabbage White | SNA | G5 | SE | | OBA | |
| | *Papilio canadensis* | Canadian Tiger Swallowtail | S5 | G5 | | | OBA | |
| | *Phoebis sennae* | Cloudless Sulphur | SNA | G5 | | | OBA | |
| | *Junonia coenia* | Common Buckeye | SNA | G5 | | | OBA | |
| | *Coenonympha tullia* | Common Ringlet | S5 | G5 | | | OBA | |
| | *Pholisora catullus* | Common Sootywing | S4 | G5 | | | OBA | |
| | *Cercyonis pegala* | Common Wood-Nymph | S5 | G5 | | | OBA | |
| | *Nymphalis l-album* | Compton Tortoiseshell | S5 | G5 | | | OBA | |
| | *Anatrytone logan* | Delaware Skipper | S4 | G5 | | | OBA | |
| | *Erynnis icelus* | Dreamy Duskywing | S5 | G5 | | | OBA | |
| | *Euphyes vestris* | Dun Skipper | S5 | G5 | | | OBA | |
| | *Polygonia comma* | Eastern Comma | S5 | G5 | | | OBA | |
| | *Callophrys niphon* | Eastern Pine Elfin | S5 | G5 | | | OBA | |
| | *Cupido comyntas* | Eastern Tailed Blue | S5 | G5 | | | OBA | |
| | *Papilio glaucus* | Eastern Tiger Swallowtail | S5 | G5 | | | OBA | |
| | *Thymelicus lineola* | European Skipper | SNA | G5 | SE | | OBA | |
| | *Hylephila phyleus* | Fiery Skipper | SNA | G5 | | | OBA | |
| | *Papilio cresphontes* | Giant Swallowtail | S4 | G5 | | | OBA | |
| | *Polygonia progne* | Gray Comma | S5 | G5 | | | OBA | |
| | *Speyeria cybele* | Great Spangled Fritillary | S5 | G5 | | | OBA | |
| | *Satyrium caryaevorus* | Hickory Hairstreak | S4 | G4 | | | OBA | |
| | *Poanes hobomok* | Hobomok Skipper | S5 | G5 | | | OBA | |
| | *Erynnis juvenalis* | Juvenal's Duskywing | S5 | G5 | | | OBA | |
| | *Ancyloxypha numitor* | Least Skipper | S5 | G5 | | | OBA | |
| | *Pompeius verna* | Little Glassywing | S4 | G5 | | | OBA | |
| | *Megisto cymela* | Little Wood-Satyr | S5 | G5 | | | OBA | |
| | *Polites mystic* | Long Dash Skipper | S5 | G5 | | | OBA | |
| | *Aglais milberti* | Milbert's Tortoiseshell | S5 | G5 | | | OBA | |
| | *Danaus plexippus* | Monarch | S2N,S4B | G4 | | SC | OBA | |
| | *Nymphalis antiopa* | Mourning Cloak | S5 | G5 | | | OBA | |
| | *Pieris oleracea* | Mustard White | S4 | G5 | | | OBA | |
| | *Wallengrenia egeremet* | Northern Broken-Dash | S5 | G5 | | | OBA | |
| | *Thorybes pylades* | Northern Cloudywing | S5 | G5 | | | OBA | |
| | *Phyciodes cocyta* | Northern Crescent | S5 | G5 | | | OBA | |
| | *Lethe anthedon* | Northern Pearly-Eye | S5 | G5 | | | OBA | |
| | *Celastrina lucia* | Northern Spring Azure | S5 | G5 | | | OBA | |
| | *Colias eurytheme* | Orange Sulphur | S5 | G5 | | | OBA | |
| | *Vanessa cardui* | Painted Lady | S5 | G5 | | | OBA | |
| | *Phyciodes tharos* | Pearl Crescent | S4 | G5 | | | OBA | |
| | *Polites peckius* | Peck's Skipper | S5 | G5 | | | OBA | |
| | *Polygonia interrogationis* | Question Mark | S5 | G5 | | | OBA | |
| | *Vanessa atalanta* | Red Admiral | S5 | G5 | | | OBA | |
| | *Limenitis arthemis astyanax* | Red-spotted Purple | S5 | G5T5 | | | OBA | |
| | *Epargyreus clarus* | Silver-spotted Skipper | S4 | G5 | | | OBA | |
| | *Glaucopsyche lygdamus* | Silvery Blue | S5 | G5 | | | OBA | |

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|---|---|---|---|---|---|---|---|---|
| | *Satyrium liparops* | Striped Hairstreak | S5 | G5 | | | OBA | |
| | *Polites themistocles* | Tawny-edged Skipper | S5 | G5 | | | OBA | |
| | *Limenitis archippus* | Viceroy | S5 | G5 | | | OBA | |
| | *Limenitis arthemis arthemis* | White Admiral | S5 | G5T5 | | | OBA | |
| | *Erynnis baptisiae* | Wild Indigo Duskywing | S4 | G5 | | | OBA | |
| **Mammals** | *Ursus americanus* | American Black Bear | S5 | G5 | | NAR | AMO | |
| | *Neovison vison* | American Mink | S4 | G5 | | | AMO | |
| | *Castor canadensis* | Beaver | S5 | G5 | | | AMO | |
| | *Eptesicus fuscus* | Big Brown Bat | S4 | G5 | | | AMO | |
| | *Rattus rattus* | Black Rat | SNA | G5 | SE | | AMO | |
| | *Canis latrans* | Coyote | S5 | G5 | | | AMO | |
| | *Peromyscus maniculatus* | Deer Mouse | S5 | G5 | | | AMO | |
| | *Tamias striatus* | Eastern Chipmunk | S5 | G5 | | | AMO | |
| | *Sylvilagus floridanus* | Eastern Cottontail | S5 | G5 | | | AMO | |
| | *Sciurus carolinensis* | Eastern Gray Squirrel | S5 | G5 | | | AMO | |
| | *Myotis leibii* | Eastern Small-footed Myotis | S2S3 | G4 | | END | AMO | |
| | *Mustela erminea* | Ermine | S5 | G5 | | | AMO | |
| | *Lepus europaeus* | European Hare | SNA | G5 | SE | | AMO | |
| | *Parascalops breweri* | Hairy-tailed Mole | S4 | G5 | | | AMO | |
| | *Lasiurus cinereus* | Hoary Bat | S4 | G3G4 | | | AMO | |
| | *Mus musculus* | House Mouse | SNA | G5 | SE | | AMO | |
| | *Myotis lucifugus* | Little Brown Myotis | S3 | G3 | | END | AMO | |
| | *Mustela frenata* | Long-tailed Weasel | S4 | G5 | | | AMO | |
| | *Zapus hudsonius* | Meadow Jumping Mouse | S5 | G5 | | | AMO | |
| | *Microtus pennsylvanicus* | Meadow Vole | S5 | G5 | | | AMO | |
| | *Ondatra zibethicus* | Muskrat | S5 | G5 | | | AMO | |
| | *Lontra canadensis* | North American River Otter | S5 | G5 | | | AMO | |
| | *Glaucomys sabrinus* | Northern Flying Squirrel | S5 | G5 | | | AMO | |
| | *Myotis septentrionalis* | Northern Myotis | S3 | G1G2 | | END | AMO | |
| | *Procyon lotor* | Northern Raccoon | S5 | G5 | | | AMO | |
| | *Blarina brevicauda* | Northern Short-tailed Shrew | S5 | G5 | | | AMO | |
| | *Erethizon dorsatum* | Porcupine | S5 | G5 | | | AMO | |
| | *Vulpes vulpes* | Red Fox | S5 | G5 | | | AMO | |
| | *Tamiasciurus hudsonicus* | Red Squirrel | S5 | G5 | | | AMO | |
| | *Lasionycteris noctivagans* | Silver-haired Bat | S4 | G3G4 | | | AMO | |
| | *Sorex fumeus* | Smoky Shrew | S5 | G5 | | | AMO | |
| | *Lepus americanus* | Snowshoe Hare | S5 | G5 | | | AMO | |
| | *Glaucomys volans* | Southern Flying Squirrel | S4 | G5 | | NAR | AMO | |
| | *Condylura cristata* | Star-nosed Mole | S5 | G5 | | | AMO | |
| | *Mephitis mephitis* | Striped Skunk | S5 | G5 | | | AMO | |
| | *Perimyotis subflavus* | Tricolored Bat | S3? | G2G3 | | END | AMO | |
| | *Didelphis virginiana* | Virginia Opossum | S4 | G5 | | | AMO | |
| | *Sorex palustris* | Water Shrew | S5 | G5 | | | AMO | |
| | *Peromyscus leucopus* | White-footed Mouse | S5 | G5 | | | AMO | |
| | *Odocoileus virginianus* | White-tailed Deer | S5 | G5 | | | AMO | |
| | *Marmota monax* | Woodchuck | S5 | G5 | | | AMO | |
| | *Napaeozapus insignis* | Woodland Jumping Mouse | S5 | G5 | | | AMO | |
| **Reptiles** | *Emydoidea blandingii* | Blanding's Turtle | S3 | G4 | | THR | ORRA | |
| | *Storeria dekayi* | DeKay's Brownsnake | S5 | G5 | | NAR | ORRA | |
| | *Thamnophis sirtalis sirtalis* | Eastern Gartersnake | S5 | G5T5 | | | ORRA | |
| | *Lampropeltis triangulum* | Eastern Milksnake | S4 | G5 | | NAR | ORRA | |
| | *Chrysemys picta marginata* | Midland Painted Turtle | S4 | G5T5 | | | NHIC, ORRA | |
| | *Graptemys geographica* | Northern Map Turtle | S3 | G5 | | SC | ORRA | |
| | *Nerodia sipedon sipedon* | Northern Watersnake | S5 | G5T5 | | NAR | ORRA | |
| | *Trachemys scripta* | Pond Slider | SNA | G5 | SE2 | | ORRA | |
| | *Chelydra serpentina* | Snapping Turtle | S4 | G5 | | SC | NHIC, ORRA | |
| **Fish** | *Pomoxis nigromaculatus* | Black Crappie | S4 | G5 | | | ARA | |
| | *Rhinichthys atratulus* | Blacknose Dace | S5 | G5 | | | ARA | |
| | *Lepomis macrochirus* | Bluegill | S5 | G5 | | | ARA | |
| | *Pimephales notatus* | Bluntnose Minnow | S5 | G5 | | NAR | ARA | |
| | *Culaea inconstans* | Brook Stickleback | S5 | G5 | | | ARA | |
| | *Ameiurus nebulosus* | Brown Bullhead | S5 | G5 | | | ARA | |
| | *Cyprinus carpio* | Common Carp | S5 | G5 | | | ARA | |
| | *Luxilus cornutus* | Common Shiner | S5 | G5 | | | ARA | |
| | *Semotilus atromaculatus* | Creek Chub | S5 | G5 | | | ARA | |
| | *Notropis atherinoides* | Emerald Shiner | S5 | G5 | | | ARA | |
| | *Etheostoma flabellare* | Fantail Darter | S5 | G5 | | | ARA | |
| | *Pimephales promelas* | Fathead Minnow | S5 | G5 | | | ARA | |

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|---|---|---|---|---|---|---|---|---|
| | *Notemigonus crysoleucas* | Golden Shiner | S5 | G5 | | | ARA | |
| | *Carassius auratus* | Goldfish | SNA | G5 | | | ARA | |
| | *Micropterus salmoides* | Largemouth Bass | S5 | G5 | | | ARA | |
| | *Notropis volucellus* | Mimic Shiner | S5 | G5 | | | ARA | |
| | *Hypentelium nigricans* | Northern Hog Sucker | S4 | G5 | | | ARA | |
| | *Esox lucius* | Northern Pike | S5 | G5 | | | ARA | |
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# Appendix C

# Representative Photographs

Project # WW21011023

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| **Photo 1: Osprey Woods (SWD3-1) looking east, from the south end of the Project Study Area.** | | **Photo 2: Silver Maple dominated swamp in Osprey Woods (SWD3-1).** |
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| **Photo 3: West side of Osprey Woods (SWD3-1).** | | **Photo 4: Large deadfall in Osprey Woods (SWD3-1) providing potential wildlife habitat** |

**Photo 5: Creek at Osprey Woods (SWD3-1)**

**Photo 6: Muskrat in Creek at Osprey Woods (SWD3-1)**

**Photo 7: Evidence of recent tree removal on the south end of Osprey Woods (SWD3-1).**

**Photo 8: Evidence of recent tree removal on the south end of Osprey Woods (SWD3-1).**

**Photo 9: Photo 9: Derry Road Bridge facing upstream in the CUM1-MAM complex**

**Photo 10: Photo 10: Derry Road Bridge habitat facing upstream in the CUM1-MAM complex**

**Photo 11: Edge habitat on the east side of Osprey Woods (SWD3-1).**

**Photo 12: Regenerating habitat along pedestrian path on south end of the Project Study Area**

# Appendix D

# Significant Wildlife Habitat Screening

Project # WW21011023

SWH Screening 7 E

| Significant Wildlife Habitat Type (7E) | Indicator Wildlife Species | Ecosites/ Habitat Description | Criteria and Information Sources | Defining Criteria | Confirmed or Candidate SWH |
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| **Seasonal Concentration Areas** | | | | | |
| Waterfowl Stopover and Staging Areas: Terrestrial<br>(Rationale – Habitat important to migrating waterfowl) | American Black Duck<br>Wood Duck<br>Green-winged Teal<br>Blue-winged Teal<br>Mallard<br>Northern Pintail<br>Northern Shoveler<br>American Wigeon<br>Gadwall | CUM1<br>CUT1<br><br>Plus evidence of annual spring flooding from meltwater or run-off within these Ecosites. | •Fields with sheet water during Spring (mid-March to May)<br>•Fields flooding during spring melt and run-off provide important invertebrate foraging habitat for migrating waterfowl<br>•Agricultural fields with waste grains are commonly used by waterfowl, these are not considered SWH unless they have spring sheet water available<br><br>•Anecdotal information from the landowner, adjacent landowners or local naturalist clubs may be good information in determining occurrence.<br>•Reports and other information available from Conservation Authorities<br>•Sites documented through waterfowl planning processes (*e.g.,* EHJV implementation plan)<br>•Field Naturalist Clubs<br>•Ducks Unlimited Canada<br>•Natural Heritage Information Centre (NHIC) Waterfowl Concentration Area | Studies carried out and verified presence of an annual concentration of any listed species, evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"<br>• Any mixed species aggregations of 100 or more individuals required<br>• The flooded field ecosite habitat plus a 100-300m radius, dependent on local site conditions and adjacent land use is the significant wildlife habitat<br>• Annual use of habitat is documented from information sources or field studies (annual use can be based on studies or determined by past surveys with species numbers and dates)<br>• SWH MIST Index #7 provides development effects and mitigation measures. | **Not Present**<br>No suitable ponds, marshes, lakes, bays, coastal inlets, watercourses (aquatic), or fields (terrestrial) with evidence of standing water in spring and concentrations of waterfowl are present within the Project Study Area. |
| Waterfowl Stopover and Staging Areas: Aquatic<br>(Rationale – Important for local and migrant waterfowl populations during the spring or fall migration or both periods combined. Sites identified are usually only one of a few in the eco-district) | Canada Goose<br>Cackling Goose<br>Snow Goose<br>American Black Duck<br>Northern Pintail<br>Northern Shoveler<br>American Wigeon<br>Gadwall<br>Green-winged Teal<br>Blue-winged Teal<br>Hooded Merganser<br>Common Merganser<br>Lesser Scaup<br>Greater Scaup<br>Long-tailed Duck<br>Surf Scoter | MAS1<br>MAS2<br>MAS3<br>SAS1<br>SAM1<br>SAF1<br>SWD1<br>SWD2<br>SWD3<br>SWD4<br>SWD5<br>SWD6<br>SWD7 | •Ponds, marshes, lakes, bays, coastal inlets and watercourses used during migration. Sewage treatment ponds and storm water ponds do not qualify as a SWH, however a reservoir managed as a large wetland or pond/lake does qualify<br>•These habitats have an abundant food supply (mostly aquatic invertebrates and vegetation in shallow water).<br><br>•Environment Canada<br>•Naturalist clubs often are aware of staging/stopover areas.<br>•OMNRF Wetland Evaluations indicate presence of locally and regionally significant waterfowl staging. | Studies carried out and verified presence of:<br>• Aggregations of 100 or more of listed species for 7 days, results in >700 waterfowl use days<br>• Areas with annual staging of ruddy ducks, canvasbacks, and redheads are SWH<br>• The combined area of the ELC ecosites and a 100m radius area is the SWH<br>• Wetland area and shorelines associated with sites identified within the SWHTG Appendix K are significant wildlife habitat. | |

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| | White-winged Scoter<br>Black Scoter<br>Ring-necked duck<br>Common Goldeneye<br>Bufflehead<br>Redhead<br>Ruddy Duck<br>Red-breasted Merganser<br>Brant<br>Canvasback<br>Ruddy Duck | | •Sites documented through waterfowl planning processes (*e.g.,* EHJV implementation plan)<br>•Ducks Unlimited projects<br>•Element occurrence specification by Nature Serve: http://www.natureserve.org<br>•Natural Heritage Information Centre (NHIC) Waterfowl Concentration Area | • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"<br>• Annual Use of Habitat is Documented from Information Sources or Field Studies (Annual can be based on completed studies or determined from past surveys with species numbers and dates recorded).<br>• SWH MIST Index #7 provides development effects and mitigation measures. | |
| Shorebird Migratory Stopover Area (Rationale: High quality shorebird stopover habitat is extremely rare and typically has a long history of use.) | Greater Yellowlegs<br>Lesser Yellowlegs<br>Marbled Godwit<br>Hudsonian Godwit<br>Black-bellied Plover<br>American Golden-Plover<br>Semipalmated Plover<br>Solitary Sandpiper<br>Spotted Sandpiper<br>Semipalmated Sandpiper<br>Pectoral Sandpiper<br>White-rumped Sandpiper<br>Baird's Sandpiper<br>Least Sandpiper<br>Purple Sandpiper<br>Stilt Sandpiper<br>Short-billed Dowitcher<br>Red-necked Phalarope<br>Whimbrel<br>Ruddy Turnstone<br>Sanderling<br>Dunlin | BBO1<br>BBO2<br>BBS1<br>BBS2<br>BBT1<br>BBT2<br>SDO1<br>SDS2<br>SDT1<br>MAM1<br>MAM2<br>MAM3<br>MAM4<br>MAM5 | • Shorelines of lakes, rivers and wetlands, including beach areas, bars and seasonally flooded, muddy and un-vegetated shoreline habitats.<br>• Great Lakes coastal shorelines, including groynes and other forms of armour rock lakeshores, are extremely important for migratory shorebirds in May to mid-June and early July to October.<br>• Sewage treatment ponds and storm water ponds do not qualify as a SWH.<br><u>Information Sources</u><br>• Western hemisphere shorebird reserve network.<br>• Canadian Wildlife Service (CWS) Ontario Shorebird Survey.<br>• Bird Studies Canada<br>• Ontario Nature<br>• Local birders and naturalist clubs<br>• Natural Heritage Information Center (NHIC) Shorebird Migratory Concentration Area | Studies confirming:<br>• Presence of 3 or more of listed species and > 1000 shorebird use days during spring or fall migration period. (shorebird use days are the accumulated number of shorebirds counted per day over the course of the fall or spring migration period)<br>• Whimbrel stop briefly (<24hrs) during spring migration, any site with >100 Whimbrel used for 3 years or more is significant.<br>• The area of significant shorebird habitat includes the mapped ELC shoreline ecosites plus a 100m radius area cxlviii<br>• Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects'<br>• SWHMiST Index #8 provides development effects and mitigation measures. | **Not Present**<br>No suitable shorelines of lakes, rivers, wetlands, beach areas, bars, seasonally flooded muddy and un-vegetated habitats are present within the Project Study Area. |
| Raptor Wintering (Rationale: Sites used by multiple species, a | Rough-legged Hawk<br>Red-tailed Hawk<br>Northern Harrier<br>American Kestrel | HAWKS/OWLS: Combination of ELC Community Series; need to have present one | • The habitat provides a combination of fields and woodlands that provide roosting, foraging and resting habitats for wintering raptors | Studies confirm the use of these habitats by:<br>• One or more Short-eared Owls or; one of more Bald | **Not Present**<br>Suitable combinations of habitat types are not present within the Project Study Area. As well, |

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| high number of individuals and used annually are most significant) | Snowy Owl<br>**Special Concern:**<br>Short-eared Owl<br>Bald Eagle | Community Series from each land class; Forest: FOD, FOM, FOC. Upland: CUM, CUT, CUS, CUW.<br><br>BALD EAGLE<br>Forest Community Series: FOD, FOM, FOC, SWD, SWM or SWC on shoreline areas adjacent to large rivers or adjacent to lakes with open water (hunting area). | • Raptor wintering (hawk/owl) sites need to be >20 ha with a combination of forest and upland<br>• Least disturbed sites, idle/fallow or lightly grazed field/meadow (>15ha) with adjacent woodlands<br>• Field area of the habitat is to be wind swept with limited snow depth or accumulation.<br>• Eagle sites have open water and large trees and snags available for roosting<br><br>INFORMATION SOURCES<br>• OMNRF Ecologist or Biologist<br>• Naturalist clubs<br>• Natural Heritage Information Centre (NHIC) Raptor Winter Concentration Area<br>• Data from Bird Studies Canada<br>• Results of Christmas Bird Counts<br>• Reports and other information available from Conservation Authorities | Eagles or; at least 10 individuals and two of the listed hawk/owl species<br>• To be significant a site must be used regularly (3 in 5 years) for a minimum of 20 days by the above number of birds.<br>• The habitat area for an Eagle winter site is the shoreline forest ecosites directly adjacent to the prime hunting area<br>• Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"<br>• SWH MIST Index #10 and #11 provides development effects and mitigation measures. | woodlands within the Project Study Area do not meet the minimum size requirements. |
| Bat Hibernacula (Rationale; Bat hibernacula are rare habitats in all Ontario landscapes.) | Big Brown Bat<br>Tri-coloured Bat | Bat Hibernacula may be found in these ecosites:<br>CCR1<br>CCR3<br>CCA1<br>CCA2<br><br>(Note: buildings are not considered SWH) | •Hibernacula may be found in caves, mine shafts, underground foundations and Karsts<br>•Active mine sites should not be considered as SWH<br>•The locations of Bat Hibernacula are relatively poorly known.<br><br>INFORMATION SOURCES<br>•OMNRF for possible locations and contact for local experts<br>•Natural Heritage Information Centre (NHIC) Bat Hibernaculum<br>•Ministry of Northern Development and Mines for location of mine shafts.<br>•Clubs that explore caves (*e.g.,* Sierra Club)<br>•University Biology Departments with bat experts. | •All sites with confirmed hibernating bats are SWH<br>•The area includes 200 m radius around the entrance of the hibernaculum for most development types and 1000 m for wind farms<br>•Studies are to be conducted during the peak swarming period (Aug. – Sept.). Surveys should be conducted following methods outlined in the "Bats and Bat Habitats: Guidelines for Wind Power Projects"<br>•SWH MIST Index #1 provides development effects and mitigation measures. | **Not Present**<br>No caves, mine shafts, underground formations/foundations, crevices, or Karst present within the Project Study Area. |
| Bat Maternity Colonies (Rationale: Known locations of forested bat maternity colonies are extremely rare | Big Brown Bat<br>Silver-haired Bat | Maternity colonies considered SWH are found in forested Ecosites.<br><br>All ELC Ecosites in ELC Community Series: FOD, FOM, SWD, SWM | •Maternity colonies can be found in tree cavities, vegetation and often in buildings (buildings are not considered to be SWH).<br>•Maternity roosts are not found in caves and mines in Ontario<br>•Maternity colonies located in Mature deciduous or mixed forest stands with >10/ha large diameter (>25cm dbh) wildlife | •Maternity colonies with confirmed use by:<br>o>10 Big Brown Bats (EPFU)<br>o>5 adult female Silver-haired (LANO) Bats<br>•The area of habitat includes the entire woodland or a forest stand ELC Ecosite or an Eco | **Candidate Habitat Present**<br>The FOD2-2, FOD9-4 and SWD3-1 within the Project Study Area and Project Limits are considered candidate bat maternity roost habitat. |

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| in all Ontario landscapes.) | | | trees<br>•Female bats prefer wildlife trees (snags) in early stages if decay, class 1-3 or class 1 or 2<br>•Silver-haired Bats prefer older mixed or deciduous forest and form maternity colonies in tree cavities and small hollows. Older forest areas with at least 21 snags/ha are preferred<br><br>INFORMATION SOURCES<br>•OMNRF for possible locations and contact for local experts<br>•University Biology Departments with bat experts. | element containing the maternity colonies<br>•Evaluation methods for maternity colonies should be conducted following methods outlined in the "Bats and Bat Habitats: Guidelines for Wind Power Projects"<br>•SWH MIST Index #12 provides the development effects and mitigation measures. | |
| Turtle Wintering Areas<br>(Rationale: Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant.) | Midland Painted Turtle<br>**Special Concern:**<br>Northern Map Turtle<br>Snapping Turtle | Snapping and Midland Painted Turtles: SW, MA, OA and SA; FEO and BOO.<br><br>Northern Map Turtle: Open water areas such as deeper rivers or streams and lakes with current can also be used as overwintering habitat. | •For most turtles, wintering areas are in the same general areas as their core habitat. Water has to be deep enough not to freeze and have soft mud substrates.<br>•Overwintering sites are permanent water bodies, large wetlands and bots or fens with adequate dissolved oxygen.<br>•Manmade ponds such as sewage lagoons or storm water ponds should not be considered SWH.<br><br>INFORMATION SOURCES<br>•EIS studies carried out by conservation authorities.<br>•Field naturalists clubs.<br>•OMNRF ecologist or biologist<br>•NHIC | •Presence of five overwintering Midland Painted Turtles is significant.<br>•One or more Northern Map Turtle or Snapping Turtle overwintering within a wetland is significant.<br>•The mapped ELC ecosite area with the overwintering turtles is the SWH. If the hibernation site is within a stream or river, the deep-water pool where the turtles are overwintering is the SWH.<br>•Overwintering areas may be identified by searching for congregations (basking areas) of turtles on warm, sunny days during the fall (September to October) or spring (March to May). Congregation of turtles is more common where wintering areas are limited and therefore significant.<br>•SWH MIST Index #28 provides development effects and mitigation measures for turtle wintering habitat. | **Candidate Habitat Present**<br>A tributary of Sixteen Mile Creek and the OAO feature (i.e., natural pond) which are located within the Project Study Area is considered candidate Turtle Wintering Habitat. |
| Reptile Hibernaculum<br>(Rationale: Generally, sites are the only | SNAKES<br>Eastern Gartersnake<br>Northern Watersnake<br>Northern Red-bellied Snake | For all snakes, habitat may be found in any ecosite other than very wet ones. Talus, Rock Barren, Crevice, | •For snakes, hibernation takes place in sites located below frost lines in burrows, rock crevices and other natural or naturalized locations. The existence of features that go | Studies confirming:<br>•Presence of snake hibernacula used by a minimum of five individuals of a snake sp. or; | **Candidate Habitat Present**<br>A total of four potentially suitable |

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| known sites in the area. Sites with the highest number of individuals are most significant.) | Northern Brownsnake<br>Smooth Green Snake<br>Northern Ring-necked Snake<br><br>SPECIAL CONCERN<br>Milksnake<br>Eastern Ribbonsnake<br><br>LIZARD SPECIAL CONCERN<br>(Southern Shield population): Five-lined Skink | Cave, and Alvar sites may be directly related to these habitats.<br><br>Observations or congregations of snakes on sunny warm days in the spring or fall is a good indicator.<br><br>For Five-lined Skink, ELC Community Series of FOD and FOM and Ecosites: FOC1 FOC3 | below frost line; such as rock piles or slopes, old stone fences, and abandoned crumbling foundations assist in identifying candidate SWH.<br>•Areas of broken and fissured rock are particularly valuable since they provide access to subterranean sites below the frost line<br>•Wetlands can also be important over-wintering habitat in conifer or shrub swamps and swales, poor fens or depressions in bedrock terrain with sparse trees or shrubs with sphagnum moss or sedge hummock ground cover.<br>•Five-lined skink prefer mixed forests with rock outcrop openings providing cover rock overlaying granite bedrock with fissures.<br><br>INFORMATION SOURCES<br>•In spring, local residents or landowners may have observed the emergence of snakes on their property (*e.g.,* old dug wells).<br>•Reports and other information available from Conservation Authorities.<br>•Field Naturalist Clubs<br>•University herpetologists<br>•Natural Heritage Information Centre (NHIC)<br>•OMNRF ecologist or biologist may be aware of locations of wintering skinks | individuals of two or more snake spp.<br>•Congregations of a minimum of five individuals of a snake sp. or; individuals of two or more snake spp. near potential hibernacula (*e.g.,* foundation or rocky slope) on sunny warm days in Spring (Apr/May) and Fall (Sept/Oct)<br>•NOTE: If there are Special Concern Species present, then site is SWH<br>•NOTE: Sites for hibernation possess specific habitat parameters (*e.g.,* temperature, humidity, *etc.*) and consequently are used annually, often by many of the same individuals of a local population (*i.e.,* strong hibernation site fidelity). Other critical life processes (*e.g.,* mating) often take place in close proximity to hibernacula.<br>•The feature in which the hibernacula is located plus a 30 m radius area is the SWH<br>•SWH MIS Index #13 provides development effects and mitigation measures for snake hibernacula.<br>•Presence of any active hibernaculum for skink is significant.<br>•SWHMiST Index #37 provides development effects and mitigation measures for fivelined skink wintering habitat. | rockpiles were present within the Study Area (Refer to Figure 2). |
| Colonially Nesting Bird Breeding Habitat: cliff/bank (Rationale: Historical use and number of | Cliff Swallow<br>Northern Rough-winged Swallow (this species is not colonial but can be found in Cliff Swallow colonies) | Eroding banks, sandy hills, borrow pits, steep slopes, and sand piles Cliff faces, bridge abutments, silos, barns. | • Any site or areas with exposed soil banks, undisturbed or naturally eroding that is not a licensed/permitted aggregate area.<br>• Does not include man-made structures (bridges or buildings) or recently (2 years) | Studies confirming:<br>• Presence of 1 or more nesting sites with 8 or more cliff swallow pairs and/or rough-winged swallow pairs during | **Not Present**<br>While suitable habitat (i.e., bridges) and banks are present within the Project Study Area; nest searches were undertaken during |

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| nests in a colony make this habitat significant. An identified colony can be very important to local populations. All swallow populations are declining in Ontario.) | | Habitat found in the following ecosites:<br>CUM1<br>CUT1<br>CUS1<br>BLO1<br>BLS1<br>BLT1<br>CLO1<br>CLS1<br>CLT1 | disturbed soil areas, such as berms, embankments, soil or aggregate stockpiles.<br>• Does not include a licensed/permitted Mineral Aggregate Operation.<br><br>INFORMATION SOURCES<br>• Reports and other information available from Conservation Authorities<br>• Ontario Breeding Bird Atlas<br>• Bird Studies Canada; http://www.birdscanada.org/birdmon<br>• Field Naturalist Clubs. | the breeding season.<br>• A colony identified as SWH will include a 50m radius habitat area from the peripheral nests<br>• Field surveys to observe and count swallow nests are to be completed during the breeding season. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"<br>• SWH MIST Index #4 provides development effects and mitigation measures. | field investigation which confirmed the absence of nests of this species within the Project Study Area. |
| Colonially Nesting Bird Breeding Habitat: tree/shrub (Rationale: Large colonies are important to local bird populations, typically sites are only known colony in area and are used annually.) | Great Blue Heron<br>Black-crowned Night-Heron<br>Great Egret<br>Green Heron | SWM2<br>SWM3<br>SWM5<br>SWM6<br>SWD1<br>SWD2<br>SWD3<br>SWD4<br>SWD5<br>SWD6<br>SWD7<br>FET1 | • Nests in live or dead standing trees in wetlands, lakes, islands, and peninsulas. Shrubs and occasionally emergent vegetation may also be used.<br>• Most nests in trees are 11 to 15 m from ground, near the top of the tree.<br><br>INFORMATION SOURCES<br>• Ontario Breeding Bird Atlas colonial nest records.<br>• Ontario Heronry Inventory 1991 available from Bird Studies Canada or NHIC (OMNRF).<br>• Natural Heritage Information Centre (NHIC) Mixed Wader Nesting Colony<br>• Aerial photographs can help identify large heronries.<br>• Reports and other information available from Conservation Authorities.<br>• MNRF District Offices<br>• Field Naturalist Clubs. | Studies confirming:<br>• Presence of 5 or more active nests of Great Blue Heron or other listed species.<br>• The habitat extends from the edge of the colony and a minimum 300m radius or extent of the Forest Ecosite containing the colony or any island <15 ha with a colony is the SWH<br>• Confirmation of active heronries are to be achieved through site visits conducted during the nesting season (April to August) or by evidence such as the presence of fresh guano, dead young and/or eggshells<br>• SWH MIST Index #5 provides development effects and mitigation measures. | **Not Present**<br>While potentially suitable habitat of Swamps (SW) are present within the Project Study Area; no stick nests representative of these species were identified during field investigation. |
| Colonially Nesting Bird Breeding Habitat: ground (Rationale: Colonies are important to local bird populations, typically sites are only known | Herring Gull<br>Great Black-backed Gull<br>Little Gull<br>Ring-billed Gull<br>Common Tern<br>Caspian Tern<br>Brewer's Blackbird | Any rocky island or peninsula (natural or artificial) within a lake or large river (two-lined on a 1;50,000 NTS map).<br><br>Close proximity to watercourses in open fields or pastures with scattered | • Nesting colonies of gulls and terns are on islands or peninsulas associated with open water or in marshy areas.<br>• Brewers Blackbird colonies are found loosely on the ground in or in low bushes in close proximity to streams and irrigation ditches within farmlands.<br><br>INFORMATION SOURCES | Studies confirming:<br>• Presence of > 25 active nests for Herring Gulls or Ring-billed Gulls, >5 active nests for Common Tern or >2 active nests for Caspian Tern<br>• Presence of 5 or more pairs for Brewer's Blackbird<br>• Any active nesting colony of | **Not Present**<br>Suitable habitat is not present within the Project Study Area. |

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| colony in area and are used annually.) | | trees or shrubs (Brewer's Blackbird)<br><br>MAM1 – 6<br>MAS1 – 3<br>CUM<br>CUT<br>CUS | • Ontario Breeding Bird Atlas, rare/colonial species records.<br>• Canadian Wildlife Service<br>• Reports and other information available from Conservation Authorities.<br>• Natural Heritage Information Centre (NHIC) Colonial Waterbird Nesting Area<br>• MNRF District Offices.<br>• Field Naturalist Clubs | one or more Little Gull, and Great Black-backed Gull is significant<br>• The edge of the colony and a minimum 150m radius area of habitat, or the extent of the ELC ecosites containing the colony or any island <3 ha with a colony is the SWH<br>• Studies would be done during May/June when actively nesting. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"<br>• SWH MIST Index #6 provides development effects and mitigation measures. | |
| Migratory Butterfly Stopover Areas (Rationale: Butterfly stopover areas are extremely rare habitats and are biologically important for butterfly species that migrate south for the winter.) | Painted Lady<br>Red Admiral<br><br>SPECIAL CONCERN<br>Monarch | Combination of ELC Community Series; need to have present one Community Series from each landclass:<br><br>FIELD: CUM, CUT, CUS<br><br>FOREST: FOC, FOD, FOM, CUP<br><br>Anecdotally, a candidate site for butterfly stopover will have a history of butterflies being observed. | • A butterfly stopover area will be a minimum of 10 ha in size with a combination of field and forest habitat present, and will be located within 5 km of Lake Erie or Lake Ontario<br>• The habitat is typically a combination of field and forest, and provides the butterflies with a location to rest prior to their long migration south<br>• The habitat should not be disturbed, fields/meadows with an abundance of preferred nectar plants and woodland edge providing shelter are requirements for this habitat<br>• Staging areas usually provide protection from the elements and are often spits of land or areas with the shortest distance to cross the Great Lakes<br><br>INFORMATION SOURCES<br>• MNRF District Offices<br>• Natural Heritage Information Centre (NHIC)<br>• Agriculture Canada in Ottawa may have list of butterfly experts.<br>• Field Naturalist Clubs<br>• Toronto Entomologists Association<br>• Conservation Authorities | Studies confirm:<br>• The presence of Monarch Use Days (MUD) during fall migration (Aug/Oct). MUD is based on the number of days the site is used by Monarchs, multiplied by the number of individuals using the site. Numbers of butterflies can range from 100-500/day, significant variation can occur between years and multiple years of sampling should occur<br>• Observational studies are to be completed and need to be done frequently during the migration period to estimate MUD.<br>• MUD of >5000 or >3000 with the presence of Painted Ladies or Red Admiral's is to be considered significant.<br>• SWH MIST Index #16 provides development effects and mitigation measures. | **Not Present**<br>The Project Study Area is not within 5km of Lake Ontario. Further to this, suitable habitat types and sizes are not present within the Project Study Area. |

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| Landbird Migratory Stopover Areas (Rationale: Sites with a high diversity of species as well as high numbers are most significant.) | All migratory songbirds<br><br>Canadian Wildlife Service Ontario website: http://www.ec.gc.ca/nature/default.asp?lang=En&n=421B7A9D-1<br><br>All migrant raptor species:<br>Ontario Ministry of Natural Resources: Fish and Wildlife Conservation Act, 1997. Schedule 7: Specially Protected Birds (Raptors) | All Ecosites associated with these ELC Community Series:<br>FOC<br>FOM<br>FOD<br>SWC<br>SWM<br>SWD | • Woodlots >10 ha in size and within 5 km of Lake Ontario.<br>• If multiple woodlands are located along the shoreline those woodlands <2 km from and Lake Ontario are more significant<br>• Sites have a variety of habitats: forest, grassland and wetland complexes<br>• The largest sites are more significant<br>• Woodlots and forest fragments are important habitats to migrating birds, these features located along the shore and within 5 km of and Lake Ontario are Candidate SWH.<br><br>INFORMATION SOURCES<br>• Bird Studies Canada<br>• Ontario Nature<br>• Local birders and field naturalist clubs<br>• Ontario Important Bird Areas (IBA) Program | Studies confirm:<br>• Use of the habitat by >200 birds/day and with >35 species and with at least 10 bird species recorded on at least 5 different survey dates. This abundance and diversity of migrant bird species is considered above average and significant<br>• Studies should be completed during spring (Mar.-May) and fall (Aug.-Oct.) migration using standardized assessment techniques. Evaluation to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"<br>• SWH MIST Index #9 provides development effects and mitigation measures. | **Not Present**<br>The Project Study is not within 5km of Lake Ontario. Further to this, suitable habitat types and sizes are not present within the Project Study Area. |
| Deer Winter Congregation Areas (Rationale: Deer movement during winter in the southern areas of Ecoregion 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands to reduce or avoid the impacts of winter conditions.) | White-tailed Deer | All forested Ecosites with these ELC Community Series: FOC, FOM, FOD, SWC, SWM, SWD<br><br>Conifer plantations much smaller than 50 ha may also be used. | • Woodlots >100 ha in size. Woodlots <100ha may be considered as significant based on MNRF studies or assessment<br>• Deer movement during winter in the southern areas of Ecoregion 6E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands<br>• If deer are constrained by snow death refer to the Deer Yarding Area habitat within Table 1.1 of this Schedule<br>• Large woodlots >100 ha and up to 1,500 ha are known to be used annually by densities of deer that range from 0.1-1.5 deer/ha<br>• Woodlots with high densities of deer due to artificial feeding are not significant.<br><br>INFORMATION SOURCES<br>• MNRF District Offices<br>• LIO/NRVIS | Studies confirm:<br>• Deer management is an MNRF responsibility, deer winter congregation areas considered significant will be mapped by MNRF<br>• Use of the woodlot by white-tailed deer will be determined by MNRF, all woodlots exceeding the area criteria are significant, unless determined not to be significant by MNRF<br>• Studies should be completed during winter (Jan./Feb.) when >20 cm of snow is on the ground using aerial survey techniques, ground road surveys, or a pellet count deer survey<br>If a SWH is determined for Deer Wintering Area or if a proposed development is within Stratum II yarding area then Movement Corridors are to be considered as outlined in Table 1.4.1 of this | **Not Present**<br>There are no features delineated by MNDMNRF present. Furthermore, forests of suitable size are not present within the Project Study Area. |

| Significant Wildlife Habitat Type (7E) | Indicator Wildlife Species | Ecosites/ Habitat Description | Criteria and Information Sources | Defining Criteria | Confirmed or Candidate SWH |
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| | | | | Schedule<br>• SWH MIST Index #2 provides development effects and mitigation measures | |
| **Rare Vegetation Communities or Specialized Habitat for Wildlife** | | | | | |
| *Rare Vegetation Communities* | | | | | |
| Cliffs and Talus Slopes<br>(Rationale: Cliffs and Talus Slopes are extremely rare habitats in Ontario.) | | Any ELC Ecosite within Community Series: TAO, TAS, TAT, CLO, CLS, CLT<br><br>A Cliff is vertical to near vertical bedrock >3 m in height.<br><br>A Talus Slope is rock rubble at the base of a cliff made up of coarse rocky debris. | • Most cliff and talus slopes occur along the Niagara Escarpment<br><br>INFORMATION SOURCES<br>• The Niagara Escarpment Commission has detailed information on location of these habitats<br>• OMNRF Districts<br>• Natural Heritage Information Centre (NHIC) has location information available on their website<br>• Field Naturalist Clubs<br>• Conservation Authorities | • Confirm any ELC Vegetation Type for Cliffs or Talus Slopes<br>• SWH MIST Index #21 provides development effects and mitigation measures | **Not Present**<br>There are no cliff or talus slope features present within the Project Study Area. |
| Sand Barren<br>(Rationale: Sand barrens are rare in Ontario and support rare species. Most sand barrens have been lost due to cottage development and forestry.) | | ELC Ecosites: SBO1, SBS1, SBT1<br><br>Vegetation cover varies from patchy and barren to continuous meadow (SBO1), thicket-like (SBS1), or more closed and treed (SBT1). Tree cover always <60%<br><br>Sand barrens typically are exposed sand, generally sparsely vegetated and caused by a lack of moisture, periodic fires and erosion. Usually located within other types of natural habitat such as forest or savannah. Vegetation can vary from patchy and barren to tree covered but less than 60%. | • A sand barren area >0.5 ha in size<br><br>INFORMATION SOURCES<br>• The Niagara Escarpment Commission has detailed information on location of these habitats<br>• OMNRF Districts<br>• Natural Heritage Information Centre (NHIC) has location information available on their website<br>• Field Naturalist Clubs<br>• Conservation Authorities | • Confirm any ELC Vegetation Type for Sand Barrens<br>• Site must not be dominated by exotic or introduced species (<50% vegetative cover are exotic spp.)<br>• SWH MIST Index #20 provides development effects and mitigation measures | **Not Present**<br>There are no sand barrens present within the Project Study Area. |
| Alvar<br>(Rationale: Alvars are extremely rare | FIVE ALVAR INDICATOR SPECIES<br>*Carex crawei*<br>*Panicum philadelphicum* | ALO1, ALS1, ALT1, FOC1, FOC2, CUM2, CUS2, CUT2-1, CUW2 | • An Alvar site >0.5 ha in size<br>• Alvar is particularly rare in Ecoregion 7E where the only known sites are found in the | • Field studies identify that four of the five ALVAR INDICATOR SPECIES at a Candidate Alvar | **Not Present**<br>There are no Alvars present within the Project Study Area. |

| Significant Wildlife Habitat Type (7E) | Indicator Wildlife Species | Ecosites/ Habitat Description | Criteria and Information Sources | Defining Criteria | Confirmed or Candidate SWH |
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| habitats in Ecoregion 6E.) | *Eleocharis compressa*<br>*Scutellaria parvula*<br>*Trichostema brachiatum*<br><br>These indicator species are very specific to Alvars within Ecoregion 6E | An Alvar is typically a level, mostly unfractured calcareous bedrock feature with a mosaic of rock pavements and bedrock overlain by a thin veneer of soil. The hydrology of alvars is complex, with alternating periods of inundation and drought. Vegetation cover varies from sparse lichen-moss associations to grasslands and shrublands and comprising a number of characteristic or indicator plants. Undisturbed alvars can be phyto- and zoogeographically diverse, supporting many uncommon or are relict plant and animal species. Vegetation cover varies from patchy to barren with a less than 60% tree cover | western islands of Lake Erie<br><br>INFORMATION SOURCES<br>• Alvars of Ontario (Federation of Ontario Naturalists, 2000)<br>• Conserving Great Lakes Alvars (Ontario Nature)<br>• OMNRF Districts<br>• Natural Heritage Information Centre (NHIC) has location information available on their website<br>• Field Naturalist Clubs<br>• Conservation Authorities | Site is significant<br>• Site must not be dominated by exotic of introduced species (<50% vegetative cover are exotic spp.)<br>• The alvar must be in excellent condition and fit in with surrounding landscape with few conflicting land uses<br>• SWH MIST Index #17 provides development effects and mitigation measures | |
| Old Growth Forest (Rationale: Due to historic logging practices and land clearance for agriculture, old growth forest is rare in Ecoregion 6E.) | | Forest Community Series: FOD, FOC, FOM, SWD, SWC, SWM<br><br>Old Growth Forests are characterized by heavy mortality or turnover of over-storey trees resulting in a mosaic of gaps that encourage development of a multi-layered canopy and an abundance of snags and downed woody debris. | • Woodland areas 30 ha or greater in size or with at least<br>10 ha interior habitat assuming 100 m buffer at edge of forest<br><br>INFORMATION SOURCES<br>• OMNRF Forest Resource Inventory mapping<br>• OMNRF Districts<br>• Field Naturalist Clubs<br>• Conservation Authorities<br>• Sustainable Forestry License (SFL) companies will possibly know locations through field operations<br>• Municipal forestry departments | Field studies will determine:<br>• If dominant tree species of the forest are >140 years old, then the area containing these trees is SWH<br>• The forested area containing the old growth characteristics will have experienced no recognizable forestry activities (cut stumps will not be present)<br>• The area of forest ecosites combined or an eco-element within an ecosite that contain the old growth characteristics is the SWH<br>• Determine ELC vegetation types for the forest area containing the old growth characteristics<br>• SWH MIST Index #23 provides | **Not Present**<br>There are no Old Growth Forests present within the Project Study Area. |

| Significant Wildlife Habitat Type (7E) | Indicator Wildlife Species | Ecosites/ Habitat Description | Criteria and Information Sources | Defining Criteria | Confirmed or Candidate SWH |
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| | | | | development effects and mitigation measures | |
| Savannah (Rationale: Savannahs are extremely rare habitats in Ontario.) | | TPS1, TPS2, TPW1, TPW2, CUS2<br><br>A Savannah is a tallgrass prairie habitat that has tree cover between 25-60%. | • No minimum size to site<br>• Site must be restored or a natural site. Remnant sites such as railway right-of-ways are not considered SWH<br><br>INFORMATION SOURCES<br>• Natural Heritage Information Centre (NHIC) has location information available on their website<br>• Field Naturalist Clubs<br>• Conservation Authorities | Field studies confirm:<br>• One or more of the Savannah indicator species listed in Appendix N should be present. Note: savannah plant spp. List from Ecoregion 6E should be used.<br>• Area of the ELC Ecosite is the SWH<br>• Site must not be dominated by exotic or introduced species (<50% vegetative cover are exotic spp.)<br>• SWH MIST Index #18 provides development effects and mitigation measures. | **Not Present**<br>There are no Savannahs present within the Project Study Area. |
| Tallgrass Prairie (Rationale: Tallgrass Prairies are extremely rare habitats in Ontario.) | | TPO1, TPO2<br><br>A tallgrass prairie has ground cover dominated by prairie grasses. An open tallgrass prairie habitat has <25% tree cover. | • No minimum size to site<br>• Site must be restored or a natural site. Remnant sites such as railway right-of-ways are not considered SWH<br><br>INFORMATION SOURCES<br>• Natural Heritage Information Centre (NHIC) has location information available on their website<br>• Field Naturalist Clubs<br>• Conservation Authorities | Field studies confirm:<br>• One or more of the Prairie indicator species listed in Appendix N should be present. Note: savannah plant spp. List from Ecoregion 6E should be used.<br>• Area of the ELC Ecosite is the SWH<br>• Site must not be dominated by exotic or introduced species (<50% vegetative cover are exotic spp.)<br>• SWH MIST Index #19 provides development effects and mitigation measures. | **Not Present**<br>There are no Tallgrass Prairies present within the Project Study Area. |
| Other Rare Vegetation Communities (Rationale: Plant communities that often contain rare species which depend on the habitat for survival.) | | Provincially rare (S1, S2, S3) vegetation communities are listed in Appendix M of the Significant Wildlife Habitat Technical Guide (MNRF, 2000). Any ELC Ecosite Code that has a possible ELC Vegetation Type that is provincially rare is candidate SWH. | • ELC Ecosite codes that have the potential to be a rare ELC Vegetation Type as outlined in Appendix M of the Significant Wildlife Habitat Technical Guide (MNRF, 2000).<br>• OMNRF/NHIC will have up to date listing for rare vegetation communities.<br><br>INFORMATION SOURCES<br>• Natural Heritage Information Centre (NHIC) has location information available on their | • Field studies should confirm if an ELC Vegetation Type is a rare vegetation community based on listing within Appendix M of the Significant Wildlife Habitat Technical Guide (MNRF, 2000).<br>• Area of the ELC Vegetation Type polygon is the SWH.<br>• SWH MIST Index #37 provides | **Not Present**<br>There are no other rare vegetation communities present within the Project Study Area. |

| Significant Wildlife Habitat Type (7E) | Indicator Wildlife Species | Ecosites/ Habitat Description | Criteria and Information Sources | Defining Criteria | Confirmed or Candidate SWH |
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| | | Rare Vegetation Communities may include beaches, fens, forest, marsh, barrens, dunes and swamps. | website<br>• OMNRF Districts<br>• Field Naturalist Clubs<br>• Conservation Authorities | development effects and mitigation measures. | |
| *Specialized Habitat for Wildlife* | | | | | |
| Waterfowl Nesting Area<br>(Rationale: Important to local waterfowl populations, sites with greatest number of species and highest number of individuals are significant) | American Black Duck<br>Northern Pintail<br>Northern Shoveler<br>Gadwall<br>Blue-winged Teal<br>Green-winged Teal<br>Wood Duck<br>Hooded Merganser<br>Mallard | All upland habitats located adjacent to these wetland ELC Ecosites are Candidate SWH:<br>MAS1, MAS2, MAS3, SAS1, SAM1, SAF1, MAM1, MAM2, MAM3, MAM4, MAM5, MAM6, SWT1, SWT2, SWD1, SWD2, SWD3, SWD4<br><br>NOTE<br>Includes adjacency to Provincially Significant Wetlands | • A waterfowl nesting area extends 120 m from a wetland (>0.5 ha) or a wetland (>0.5 ha) and any small wetlands (0.5 ha) within 120 m or a cluster of 3 or more small (<0.5 ha) wetlands within 120 m of each individual wetland where waterfowl nesting is known to occur<br>• Upland areas should be at least 120 m wide so that predators such as raccoons, skunks and foxes have difficulty finding nests<br>• Wood Ducks and Hooded Mergansers utilize large diameter trees (>40 cm dbh) in woodlands for cavity nest sites.<br><br>INFORMATION SOURCES<br>• Ducks Unlimited staff may know the locations of particularly productive nesting sites<br>• MNRF Wetland Evaluations for indication of significant waterfowl nesting habitat<br>• Reports and other information available from Conservation Authorities | Studies confirmed:<br>• Presence of 3 or more nesting pairs for listed species excluding Mallards, or;<br>• Presence of 10 or more nesting pairs for listed species including Mallards.<br>• Any active nesting site of an American Black Duck is considered significant.<br>• Nesting studies should be completed during the spring breeding season (April - June). Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"<br>• A field study confirming waterfowl nesting habitat will determine boundary of the waterfowl nesting habitat for the SWH, this may be greater or less than 120 m from the wetland and will provide enough habitat for waterfowl to successfully nest<br>• SWH MIST Index #25 provides development effects and mitigation measures. | **Not Present**<br>Suitably sized and distanced features are not present within the Project Study Area. This area is also highly urbanized and would likely only support nesting by the most urban tolerant waterfowl, such as Canada Goose. |
| Bald Eagle and Osprey nesting, foraging and Perching Habitat (Rationale: Nest sites are fairly uncommon in Ecoregion 7E and are used annually by these species. Many | Osprey<br><br>SPECIAL CONCERN<br>Bald Eagle | ELC Forest Community Series: FOD, FOM, FOC, SWD, SWM and SWC directly adjacent to riparian areas – rivers, lakes, ponds and wetlands. | • Nests are associated with lakes, ponds, rivers or wetlands along forested shorelines, islands, or on structures over water.<br>• Osprey nests are usually at the top a tree whereas Bald Eagle nests are typically in super canopy trees in a notch within the tree's canopy.<br>• Nests located on man-made objects are not to be included as SWH (*e.g.,* telephone poles | Studies confirm the use of these nests by:<br>• One or more active Osprey or Bald Eagle nests in an area<br>• Some species have more than one nest in a given area and priority is given to the primary nest with alternate nests included within the area of the | **Not Present**<br>The tributary of Sixteen Mile Creek and the OAO's within the Project Location may provide foraging habitat for these species. However, no stick nests representative of these species were identified during field investigation. |

| Significant Wildlife Habitat Type (7E) | Indicator Wildlife Species | Ecosites/ Habitat Description | Criteria and Information Sources | Defining Criteria | Confirmed or Candidate SWH |
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| suitable nesting locations may be lost due to increasing shoreline development pressures and scarcity of habitat.) | | | and constructed nesting platforms)<br><br>INFORMATION SOURCES<br>• NHIC compiles all known nesting sites for Bald Eagles in Ontario<br>• MNRF values information (LIO/NRVIS) will list known nesting locations. Note: data from NRVIS is provided as a point and does not represent all the habitat<br>• Nature Counts, Ontario Nest Records Scheme data.<br>• OMNRF District.<br>• Check the Ontario Breeding Bird Atlas or Rare Breeding Birds in Ontario for species documented<br>• Reports and other information available from Conservation Authorities.<br>• Field Naturalists clubs | SWH.<br>• For an Osprey, the active nest and a 300 m radius around the nest or the contiguous woodland stand is the SWH, maintaining undisturbed shorelines with large trees within this area is important<br>• For a Bald Eagle the active nest and a 400-800 m radius around the nest is the SWH. Area of the habitat from 400-800 m is dependent on sight lines from the nest to the development and inclusion of perching and foraging habitat<br>• To be significant a site must be used annually. When found inactive, the site must be known to be inactive for > 3 years or suspected of not being used for >5 years before being considered not significant.<br>• Observational studies to determine nest site use, perching sites and foraging areas need to be done from early March to mid-August.<br>• Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"<br>• SWH MIST Index #26 provides development effects and mitigation measures | |
| Woodland Raptor Nesting Habitat (Rationale: Nest sites for these species are rarely identified; these area sensitive habitats are often used annually by these species.) | Northern Goshawk<br>Cooper's Hawk<br>Sharp-shinned Hawk<br>Red-shouldered Hawk<br>Barred Owl<br>Broad-winged Hawk | May be found in all forested ELC Ecosites.<br><br>May also be found in SWC, SWM, SWD and CUP3. | • All natural or conifer plantation woodland/forest stands >30 ha with > 4 ha of interior habitat. Interior habitat determined with a 200 m buffer.<br>• Stick nests found in a variety of intermediate-aged to mature conifer, deciduous or mixed forests, within tops or crotches of trees. Species such as Cooper's Hawk nest along forest edges sometimes on peninsulas or small off-shore islands. | Studies confirm:<br>• Presence of one or more active nests from species list is considered significant<br>• Red-shouldered Hawk and Northern Goshawk – A 400 m radius around the nest or 28 ha area of habitat is the SWH. The 28 ha habitat area would be applied where optimal habitat | **Not Present**<br>Forests of suitable size are not present within the Project Study Area. Further to this, no stick nests representative of these species were identified during field investigation. |

| Significant Wildlife Habitat Type (7E) | Indicator Wildlife Species | Ecosites/ Habitat Description | Criteria and Information Sources | Defining Criteria | Confirmed or Candidate SWH |
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| | | | • In disturbed sites, nests may be used again, or a new nest will be in close proximity to old nest<br><br>INFORMATION SOURCES<br>• OMNRF Districts.<br>• Check the Ontario Breeding Bird Atlas or Rare Breeding Birds in Ontario for species documented.<br>• Check data from Bird Studies Canada.<br>• Reports and other information available from Conservation Authorities. | is irregularly shaped around the nest.<br>• Barred Owl – A 200m radius around the nest is the SWH<br>• Broad-winged Hawk and Coopers Hawk, – A 100m radius around the nest is the SWH<br>• Sharp-Shinned Hawk – A 50m radius around the nest is the SWH<br>• Conduct field investigations from early March to end of May. The use of call broadcasts can help in locating territorial (courting/nesting) raptors and facilitate the discovery of nests by narrowing down the search area.<br>• SWH MIST Index #27 provides development effects and mitigation measures | |
| Turtle Nesting Habitat<br>(Rationale: These habitats are rare and when identified will often be the only breeding site for local populations of turtles.) | Midland Painted Turtle<br><br>SPECIAL CONCERN<br>Northern Map Turtle<br>Snapping Turtle | Exposed mineral soil (sand or gravel) areas adjacent (<100 m) or within the following ELC Ecosites: MAS1, MAS2, MAS3, SAS1, SAM1, SAF1, BOO1, FEO1 | • Best nesting habitat for turtles are close to water and away from roads and sites less prone to loss of eggs by predation from skunks, raccoons or other animals.<br>• For an area to function as a turtle-nesting area, it must provide sand and gravel that turtles are able to dig in and is located in open, sunny areas. Nesting areas on the sides of municipal or provincial road embankments and shoulders are not SWH.<br>• Sand and gravel beaches adjacent to undisturbed shallow weedy areas of marshes, lakes and rivers are most frequently used.<br><br>INFORMATION SOURCES<br>• Use Ontario Soil Survey reports and maps to help find suitable substrate for nesting turtles (well-drained sands and fine gravels).<br>• Check the Ontario Herpetofaunal Summary Atlas records or other similar atlases for uncommon turtles; location information may help to find potential nesting habitat for them. | Studies confirm:<br>• Presence of 5 or more nesting Midland Painted Turtles.<br>• One ore more Northern Map Turtles or Snapping Turtles nesting is a SWH.<br>• The area or collection of sites within an area of exposed mineral soils where the turtles nest, plus a radius of 30 to 100 m around the nesting area dependent on slope, riparian vegetation and adjacent land use is the SWH.<br>• Travel routes from wetland to nesting area are to be considered within the SWH as part of the 30 to 100 m area of habitat.<br>• Field investigations should be conducted in prime nesting season typically late spring to early summer. Observational studies observing the turtles | **Not Present**<br>There were no sand/gravel features or evidence of turtle nesting along the banks of the tributary of Sixteen Mile Creek or the OAO features. |

| Significant Wildlife Habitat Type (7E) | Indicator Wildlife Species | Ecosites/ Habitat Description | Criteria and Information Sources | Defining Criteria | Confirmed or Candidate SWH |
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| | | | • Natural Heritage Information Centre (NHIC).<br>• Field naturalist clubs. | nesting is a recommended method.<br>• SWH MIST Index #28 provides development effects and mitigation measures for turtle nesting habitat. | |
| Seeps and Springs (Rationale: Seeps/springs are typical of headwater areas and are often at the source of Coldwater streams.) | Wild Turkey<br>Ruffed Grouse<br>Spruce Grouse<br>White-tailed Deer<br>Salamanders | Seeps/springs are areas where groundwater comes to the surface. Often they are found within headwater areas within forested habitats. Any forested Ecosite within the headwater areas of a stream could have seeps/springs. | • Any forested area (with <25% meadow/field/ pasture) within the headwaters of a stream or river system<br>• Seeps and springs are important feeding and drinking areas. Especially in the winter will support a variety of plant and animal species.<br><br>INFORMATION SOURCES<br>• Topographical Map.<br>• Thermography.<br>• Hydrological surveys conducted by Conservation Authorities and MOECC.<br>• Field Naturalists Clubs and landowners.<br>• Municipalities and Conservation Authorities may have drainage maps and headwater areas mapped | Field studies confirm:<br>• Presence of a site with 2 or more seeps/springs should be considered SWH.<br>• The area of an ELC forest ecosite or an Eco element within ecosite containing the seeps/springs is the SWH. The protection of the recharge area considering the slope, vegetation, height of trees and groundwater condition need to be considered in delineation the habitat<br>• SWH MIST Index #30 provides development effects and mitigation measures | **Not Present**<br>The Project Study Area is not located within a headwater area nor were any indicators of seeps and/or springs noted during the field investigations. |
| Amphibian Breeding Habitat: Woodland (Rationale: These habitats are extremely important to amphibian biodiversity within a landscape and often represent the only breeding habitat for local amphibian populations.) | Eastern Newt<br>Blue-spotted Salamander<br>Spotted Salamander<br>Gray Treefrog<br>Spring Peeper<br>Western Chorus Frog<br>Wood Frog | All Ecosites associated with these ELC Community Series: FOC, FOM, FOD, SWC, SWM, SWD<br><br>Breeding pools within the woodland or the shortest distance from forest habitat are more significant because they are more likely to be used due to reduced risk to migrating amphibians. | • Presence of a wetland, pond or woodland pool (including vernal pools) >500 m2 (about 25 m diameter) within or adjacent (within 120 m) to a woodland (no minimum size). Some small wetlands may not be mapped and may be important breeding pools for amphibians.<br>• Woodlands with permanent ponds or those containing water in most years until mid-July are more likely to be used as breeding habitat.<br><br>INFORMATION SOURCES<br>• Ontario Herpetofaunal Summary Atlas (or other similar atlases) for records<br>• Local landowners may also provide assistance as they may hear spring-time choruses of amphibians on their property.<br>• OMNRF Districts and wetland evaluations<br>• Field Naturalist clubs<br>• Canadian Wildlife Service Amphibian Road Call Survey | Studies confirm:<br>• Presence of breeding population of 1 or more of the listed newt/salamander species or 2 or more of the listed frog species with at least 20 individuals (adults or egg masses) or 2 or more of the listed frog species with Call Level Codes of 3.<br>• A combination of observational study and call count surveys will be required during the spring (Mar.-Jun.) when amphibians are concentrated around suitable breeding habitat within or near the woodland/wetlands<br>• The habitat is the wetland area plus a 230m radius of woodland area. If a wetland area is adjacent to a woodland, | **Candidate Habitat Present**<br>The swamp (SWD3-1) present within the Project Location may provide suitable habitat. |

| Significant Wildlife Habitat Type (7E) | Indicator Wildlife Species | Ecosites/ Habitat Description | Criteria and Information Sources | Defining Criteria | Confirmed or Candidate SWH |
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| | | | • Ontario Vernal Pool Association: http://www.ontariovernalpools.org | a travel corridor connecting the wetland to the woodland is to be included in the habitat.<br>• SWH MIST Index #14 provides development effects and mitigation measures | |
| Amphibian Breeding Habitat: Wetland (Rationale: Wetlands supporting breeding for these amphibian species are extremely important and fairly rare within central Ontario landscapes.) | Eastern Newt<br>American Toad<br>Spotted Salamander<br>Four-toed Salamander<br>Blue-spotted Salamander<br>Gray Treefrog<br>Western Chorus Frog<br>Northern Leopard Frog<br>Pickerel Frog<br>Green Frog<br>Mink Frog<br>Bullfrog | ELC Community Classes SW, MA, FE, BO, OA and SA.<br><br>Typically these wetland ecosites will be isolated (>120 m) from woodland ecosites, however larger wetlands containing predominantly aquatic species (*e.g.,* Bullfrog) may be adjacent to woodlands. | • Wetlands >500m2 (about 25m diameter), supporting high species diversity are significant; some small or ephemeral habitats may not be identified on MNRF mapping and could be important amphibian breeding habitats<br>• Presence of shrubs and logs increase significance of pond for some amphibian species because of available structure for calling, foraging, escape and concealment from predators<br>• Bullfrogs require permanent water bodies with abundant emergent vegetation.<br><br>INFORMATION SOURCES<br>• Ontario Herpetofaunal Summary Atlas (or other similar atlases)<br>• Canadian Wildlife Service Amphibian Road Surveys and Backyard Amphibian Call Count.<br>• OMNRF Districts and wetland evaluations.<br>• Reports and other information available from Conservation Authorities | Studies confirm:<br>• Presence of breeding population of 1 or more of the listed newt/salamander species or 2 or more of the listed frog/toad species with at least 20 individuals (adults or eggs masses) or 2 or more of the listed frog/toad species with Call Level Codes of 3 or; Wetland with confirmed breeding Bullfrogs are significant<br>• The ELC ecosite wetland area and the shoreline are the SWH<br>• A combination of observational study and call count surveys will be required during the spring (March-June) when amphibians are concentrated around suitable breeding habitat within or near the wetlands.<br>• If a SWH is determined for Amphibian Breeding Habitat (Wetlands) then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule.<br>• SWH MIST Index #15 provides development effects and mitigation measures. | **Candidate Habitat Present**<br><br>The OAO feature (i.e., the natural pond) present within the Project Study Area may provide suitable habitat for amphibian breeding.<br>Meanwhile, the tributary of Sixteen Mile Creek it is not anticipated to provide amphibian breeding habitat as it likely contains fish which would prey upon amphibian eggs. |
| Woodland Area-Sensitive Bird Breeding Habitat (Rationale: Large, natural blocks of mature woodland habitat within the | Yellow-bellied Sapsucker<br>Red-breasted Nuthatch<br>Veery<br>Blue-headed Vireo<br>Northern Parula<br>Black-throated Green Warbler<br>Blackburnian Warbler | All Ecosites associated with these ELC Community Series: FOC, FOM, FOD, SWC, SWM, SWD | CRITERIA<br>• Habitats where interior forest breeding birds are breeding, typically large mature (>60 yrs. old) forest stands or woodlots >30 ha<br>• Interior forest habitat is at least 200 m from forest edge habitat | Studies confirm:<br>• Presence of nesting or breeding pairs of 3 or more of the listed wildlife species.<br>• Note: any site with breeding Cerulean Warblers or Canada Warblers is to be considered | **Not Present**<br>Forests of suitable size are not present within the Project Study Area. |

| Significant Wildlife Habitat Type (7E) | Indicator Wildlife Species | Ecosites/ Habitat Description | Criteria and Information Sources | Defining Criteria | Confirmed or Candidate SWH |
|---|---|---|---|---|---|
| settled areas of Southern Ontario are important habitats for area sensitive interior forest song birds.) | Black-throated Blue Warbler<br>Ovenbird<br>Scarlet Tanager<br>Winter Wren<br><br>SPECIAL CONCERN<br>Cerulean Warbler<br>Canada Warbler | | INFORMATION SOURCES<br>• Local birder clubs.<br>• Canadian Wildlife Service (CWS) for the location of forest bird monitoring.<br>• Bird Studies Canada conducted a 3-year study of 287 woodlands to determine the effects of forest fragmentation on forest birds and to determine what forests were of greatest value to interior species<br>• Reports and other information available from Conservation Authorities. | SWH<br>• Conduct field investigations in spring and early summer when birds are singing and defending their territories<br>• Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"<br>• SWH MIST Index #34 provides development effects and mitigation measures | |
| Habitats of Species of Conservation Concern | | | | | |
| Marsh Bird Breeding Habitat<br>(Rationale: Wetlands for these bird species are typically productive and fairly rare in Southern Ontario landscapes.) | American Bittern<br>Virginia Rail<br>Sora<br>Common Moorhen<br>American Coot<br>Pied-billed Grebe<br>Marsh Wren<br>Sedge Wren<br>Common Loon<br>Green Heron<br>Trumpeter Swan<br><br>SPECIAL CONCERN<br>Black Tern<br>Yellow Rail | MAM1, MAM2, MAM3, MAM4, MAM5, MAM6, SAS1, SAM1, SAF1, FEO1, BOO1<br><br>For Green Heron: all SW, MA and CUM1 sites | • Nesting occurs in wetlands.<br>• All wetland habitat is to be considered as long as there is shallow water with emergent aquatic vegetation present<br>• For Green Heron, habitat is at the edge of water such as sluggish streams, ponds and marshes sheltered by shrubs and trees. Less frequently, it may be found in upland shrubs or forest a considerable distance from water<br><br>INFORMATION SOURCES<br>• OMNRF District and wetland evaluations.<br>• Field Naturalist clubs<br>• Natural Heritage Information Centre (NHIC) Records.<br>• Reports and other information available from Conservation Authorities<br>• Ontario Breeding Bird Atlas | Studies confirm:<br>• Presence of 5 or more nesting pairs of Sedge Wren or Marsh Wren or breeding by any combination of 4 or more of the listed species<br>• Note: any wetland with breeding of 1 or more Black Terns, Trumpeter Swan, Green Heron or Yellow Rail is SWH<br>• Area of the ELC ecosite is the SWH.<br>• Breeding surveys should be done in May/June when these species are actively nesting in wetland habitats.<br>• Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"<br>• SWH MIST Index #35 provides development effects and mitigation measures | **Not Present**<br>While a SWD3-1 is present within the within the Project Study Area; no stick nests representative of these species were identified during field investigation. |
| Open Country Bird Breeding Habitat<br>(Rationale: This wildlife habitat is declining throughout Ontario and North America. Species such as the Upland | Upland Sandpiper<br>Grasshopper Sparrow<br>Vesper Sparrow<br>Northern Harrier<br>Savannah Sparrow<br><br>SPECIAL CONCERN<br>Short-eared Owl | CUM1, CUM2 | • Large grassland areas (includes natural and cultural fields and meadows) >30 ha<br>• Grasslands not Class 1 or 2 agricultural lands, and not being actively used for farming (*i.e.,* no row cropping or intensive hay or livestock pasturing in the last 5 years)<br>• Grassland sites considered significant should have a history of longevity, either | Field studies confirm:<br>• Presence of nesting or breeding of 2 or more of the listed species<br>• A field with 1 or more breeding Short-eared Owls is to be considered SWH<br>• The area of SWH is the | **Not Present**<br>Suitable grassland habitats are not present within the Project Study Area. |

| Significant Wildlife Habitat Type (7E) | Indicator Wildlife Species | Ecosites/ Habitat Description | Criteria and Information Sources | Defining Criteria | Confirmed or Candidate SWH |
|---|---|---|---|---|---|
| Sandpiper have declined significantly the past 40 years based on CWS (2004) trend records.) | | | abandoned fields, mature hayfields and pasturelands that are at least 5 years or older.<br>• The Indicator bird species are area sensitive requiring larger grassland areas than the common grassland species<br><br>INFORMATION SOURCES<br>• Agricultural land classification maps, Ministry of Agriculture.<br>• Local bird clubs.<br>• Ontario Breeding Bird Atlas<br>• EIS Reports and other information available from Conservation Authorities | contiguous ELC ecosite field areas<br>• Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories<br>• Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"<br>• SWH MIST Index #32 provides development effects and mitigation measures | |
| Shrub / Early Successional Breeding Bird habitat (Rationale: This wildlife habitat is declining throughout Ontario and North America. The Brown Thrasher has declined significantly over the past 40 years based on CWS (2004) trend records.) | INDICATOR SPECIES<br>Brown Thrasher<br>Clay-coloured Sparrow<br><br>COMMON SPECIES<br>Field Sparrow<br>Black-billed Cuckoo<br>Eastern Towhee<br>Willow Flycatcher<br><br>SPECIAL CONCERN<br>Yellow-breasted Chat<br>Golden-winged Warbler | CUT1, CUT2, CUS1, CUS2, CUW1, CUW2<br><br>Patches of shrub ecosites can be complexed into a larger habitat for some bird species | • Large field areas succeeding to shrub and thicket habitats >10 ha in size<br>• Shrub land or early successional fields, not class 1 or 2 agricultural lands, not being actively used for farming (*i.e.,* no row-cropping, haying or live-stock pasturing in the last 5 years)<br>• Shrub thicket habitats (>10 ha) are most likely to support and sustain a diversity of these species<br>• Shrub and thicket habitat sites considered significant should have a history of longevity, either abandoned fields or pasturelands<br><br>INFORMATION SOURCES<br>• Agricultural land classification maps, Ministry of Agriculture.<br>• Local bird clubs.<br>• Ontario Breeding Bird Atlas<br>• Reports and other information available from Conservation Authorities | Field studies confirm:<br>• Presence of nesting or breeding of 1 of the indicator species and at least 2 of the common species<br>• A habitat with breeding Yellow-breasted Chat or Golden-winged Warbler is to be considered as Significant Wildlife Habitat<br>• The area of the SWH is the contiguous ELC ecosite field/thicket area.<br>• Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories<br>• Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"<br>• SWH MIST Index #33 provides development effects and mitigation measures | **Not Present**<br>Suitable cultural habitats are not present within the Project Study Area. |
| Terrestrial Crayfish Habitat (Rationale: Terrestrial Crayfish are only found within SW Ontario in Canada | Chimney or Digger Crayfish<br>Devil Crayfish or Meadow Crayfish | MAM1, MAM2, MAM3, MAM4, MAM5, MAM6, MAS1, MAS2, MAS3, SWD, SWT, SWM<br><br>CUM1 with inclusions of | • Wet meadow and edges of shallow marshes (no minimum size) should be surveyed for terrestrial crayfish<br>• Constructs burrows in marshes, mudflats, meadows, the ground can't be too moist. Can often be found far from water | Studies confirm:<br>• Presence of 1 or more individuals of species listed or their chimneys (burrows) in suitable meadow marsh, swamp or moist terrestrial sites | **Not Present**<br>While MAS2-1 and SWD3-1 communities are present within the Project Study Area; no chimneys/burrows of the species |

| Significant Wildlife Habitat Type (7E) | Indicator Wildlife Species | Ecosites/ Habitat Description | Criteria and Information Sources | Defining Criteria | Confirmed or Candidate SWH |
|---|---|---|---|---|---|
| and their habitats are very rare.) | | above meadow marsh ecosites can be used by terrestrial crayfish | • Both species are a semi-terrestrial burrower which spends most of its life within burrows consisting of a network of tunnels. Usually the soil is not too moist so that the tunnel is well-formed.<br><br>INFORMATION SOURCES<br>• Information sources from "Conservation Status of Freshwater Crayfishes" by Dr. Premek Hamr for the WWF and CNF, March, 1998 | • Area of ELC ecosite or an Eco element area of meadow marsh or swamp within the larger ecosite area is the SWH<br>• Surveys should be done April to August in temporary or permanent water. Note the presence of burrows or chimneys are often the only indicator of presence, observance or collection of individuals is very difficult<br>• SWH MIST Index #36 provides development effects and mitigation measures | were identified during field investigations. |
| Special Concern and Rare Wildlife Species (Rationale: These species are quite rare or have experienced significant population declines in Ontario.) | All Special Concern and Provincially Rare (S1, S2, S3, SH) plant and animal species. Lists of these species are tracked by the NHIC | All plant and animal element occurrences (EOs) within a 1 km or 10 km grid.<br><br>Older EOs were recorded prior to GPS being available, therefore location information may lack accuracy. | • When an element occurrence is identified within a 1 or 10 km grid for a Special Concern or provincially Rare species; linking candidate habitat on the site needs to be completed to ELC Ecosites<br><br>INFORMATION SOURCES<br>• Natural Heritage Information Centre (NHIC) will have Special Concern and Provincially Rare (S1-S3, SH) species lists with element occurrences data.<br>• NHIC Website "Get Information": http://nhic.mnr.gov.on.ca<br>• Ontario Breeding Bird Atlas<br>• Expert advice should be sought as many of the rare spp. Have little information available about their requirements | Studies confirm:<br>• Assessment/inventory of the site for the identified special concern or rare species needs to be completed during the time of year when the species is present or easily identifiable.<br>• The area of the habitat to the finest ELC scale that protects the habitat form and function is the SWH, this must be delineated through detailed field studies. The habitat needs be easily mapped and cover an important life stage component for a species *e.g.,* specific nesting habitat or foraging habitat.<br>• SWH MIST Index #37 provides development effects and mitigation measures | **Candidate Habitat Present**<br>The following Special Concern and Provincially Rare (S1, S2, S3, SH) plant and animal species identified through the background information review:<br><br>**Special Concern:** Bald Eagle, Canada Warbler, Common Nighthawk, Eastern Wood-Pewee Olive-sided Flycatcher, Peregrine Falcon, Red-headed Woodpecker, Rusty Blackbird Wood Thrush, Northern Map Turtle, Snapping Turtle and Monarch.<br><br>As documented in the SAR Habitat Screening there is suitable habitat for Canada Warbler, Eastern Wood-pewee, Red-headed Woodpecker, Snapping Turtle and Monarch present within the Project Study Area.<br><br>**Provincially Rare:** American Golden-Plover, Black-crowned Night-heron, Caspian Tern Great Egret, Hudsonian Godwit Purple Martin, Redhead, Red-necked Grebe, Ross's Goose |

| Significant Wildlife Habitat Type (7E) | Indicator Wildlife Species | Ecosites/ Habitat Description | Criteria and Information Sources | Defining Criteria | Confirmed or Candidate SWH |
|---|---|---|---|---|---|
| | | | | | Rough-legged Hawk, Semipalmated Sandpiper, Short-billed Dowitcher, and Wilson's Phalarope.<br><br>Of these species, suitable habitats for the American Golden-Plover, Black-crowned Night-heron, Caspian Tern, Great Egret, Hudsonian Godwit, Redhead, Rough-legged Hawk, Semipalmated Sandpiper, Short-billed Dowitcher and Wilson's Phalarope have been ruled out though the SWH habitat assessments for Waterfowl Stopover and Staging, Colonially Nesting Bird Breeding Habitat (Tree, Shrub, Ground), Raptor Wintering, Shorebird Migratory Stopover Area SWH types.<br><br>A brief assessment for the remaining species is present below.<br>**Purple Martin:** This species breeds in large colonies in southern Ontario. However, they are largely limited to the breeding within nesting boxes. No nesting boxes or large colonies of the species were identified during field investigations.<br>**Red-necked Grebe:** This species as an extremely limited breeding range in Ontario. The Project Study Area is not located within the known breeding range of this species. The source of this record was eBird, it is assumed the observation of this species was made while it was migrating through the Project Study Area.<br>**Ross's Goose**: This species as an extremely limited breeding range in Ontario. The Project Study Area |

| Significant Wildlife Habitat Type (7E) | Indicator Wildlife Species | Ecosites/ Habitat Description | Criteria and Information Sources | Defining Criteria | Confirmed or Candidate SWH |
|---|---|---|---|---|---|
| | | | | | is not located within the known breeding range of this species. The source of this record was eBird, it is assumed the observation of this species was made while it was migrating through the Project Study Area<br><br>There are no candidate habitat for the following Provincially Rare species within the Project Study Area. |
| Animal Movement Corridors | | | | | |
| Amphibian Movement Corridors (Rationale: Movement corridors for amphibians moving from their terrestrial habitat to breeding habitat can be extremely important for local populations.) | Eastern Newt<br>American Toad<br>Spotted Salamander<br>Four-toed Salamander<br>Blue-spotted Salamander<br>Gray Treefrog<br>Western Chorus Frog<br>Northern Leopard Frog<br>Pickerel Frog<br>Green Frog<br>Mink Frog<br>Bullfrog | Corridors may be found in all ecosites associated with water.<br><br>Corridors will be determined based on identifying the significant breeding habitat for these species in Table 1.1 | • Movement corridors between breeding habitat and summer habitat<br>• Movement corridors must be determined when amphibian breeding habitat is confirmed as SWH (Amphibian Breeding Habitat, Wetland)<br><br>INFORMATION SOURCES<br>• MNRF District Office.<br>• Natural Heritage Information Centre (NHIC).<br>• Reports and other information available from Conservation Authorities.<br>• Field Naturalist Clubs | • Field Studies must be conducted at the time of year when species are expected to be migrating or entering breeding sites<br>• Corridors should consist of native vegetation, with several layers of vegetation. Corridors unbroken by roads, waterways or bodies, and undeveloped areas are most significant<br>• Corridors should have at least 15m of vegetation on both sides of waterway or be up to 200m wide of woodland habitat and with gaps <20m<br>• Shorter corridors are more significant than longer corridors, however amphibians must be able to get to and from their summer and breeding habitat<br>• SWH MIST Index #40 provides development effects and mitigation measures | **Not Present**<br>No movement corridors have been identified. |

# Appendix E

# Cactus Gate FDC Pumping Station Design Drawings

Path: P:\2018\Projects\TPB188016 - Design & Contract Admin. - Lisgar\06_DES-ENG\01_CAD\02_DWGS\05_WR\CONTRACT\TPB188016-C00.dwg
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## CONTRACT DRAWINGS

# Lisgar District Utility Trench Dewatering and FDC Pumping Station

## P.N. 17-146
## C.N. PRC001614

wood.

MISSISSAUGA

| REVISIONS | | |
|---|---|---|
| DATE | DETAILS | INIT. |
| MAY 2019 | ISSUED FOR UPDATED ECA | M.S. |
| AUG 2019 | ISSUED FOR TENDER | M.S. |
| | | |
| | | |
| | | |
| | | |

| DRAWING LIST | | |
|---|---|---|
| SHEET # | PLAN # | DRAWING LIST |
| 01 | C-0 | DRAWING LIST |
| 02 | C-1 | STANDARD NOTES |
| 03 | C-2 | OVERALL SITE PLAN |
| 04 | C-3 | EROSION AND SEDIMENT CONTROL PLAN AND STAGING PLAN |
| 05 | C-4 | REMOVAL PLAN |
| 06 | C-5 | SURFACE GRADING PLAN |
| 07 | C-6 | FDC SEWER SERVICING PLAN |
| 08 | C-7 | CROSS-SECTION LOCATION PLAN |
| 09 | C-8 | SECTIONS - SHEET 1 |
| 10 | C-9 | SECTIONS - SHEET 2 |
| 11 | C-10 | PLAN & PROFILE - MAINTENANCE ACCESS ROAD |
| 12 | C-11 | PLAN & PROFILE - BLACK WALNUT TRAIL |
| 13 | C-12 | DETAILS - SHEET 1 |
| 14 | C-13 | DETAILS - SHEET 2 |
| | | |
| 15 | L-1 | LANDSCAPE PLAN |
| 16 | L-2 | LANDSCAPE PLAN DETAILS |
| | | |
| 17 | P-1 | PROCESS FLOW DIAGRAM |
| 18 | P-2 | FDC PUMP STATION PLAN VIEWS & SECTION |
| 19 | P-3 | PLAN AND PROFILE |
| 20 | P-4 | GENERATOR NATURAL GAS LINE CONNECTION |
| 21 | P-5 | MECHANICAL DETAILS |
| | | |
| 22 | S-1 | FDC PUMP STATION GENERAL ARRANGEMENT PLAN VIEWS & SECTIONS |
| 23 | S-2 | FDC PUMP STATION GENERAL STRUCTURAL STANDARD DETAILS |
| | | |
| 24 | E-1 | ELECTRICAL SITE PLAN, LEGEND AND NOTES |
| 25 | E-2 | FDC PUMP STATION PLAN VIEWS & SECTION VIEWS & TRENCH DETAILS |
| 26 | E-3 | SINGLE LINE DIAGRAM AND DETAILS |
| 27 | E-4 | OUTDOOR CONTROL CABINET - EXTERIOR DETAIL |
| 28 | E-5 | OUTDOOR CONTROL CABINET - INTERIOR DETAIL AND CONCRETE BASE DETAIL |
| 29 | E-6 | CONTROL SCHEMATICS - SHEET 1 |
| 30 | E-7 | CONTROL SCHEMATICS - SHEET 2 |
| 31 | E-8 | CONTROL SCHEMATICS - SHEET 3 |
| 32 | E-9 | CITY STANDARD LIGHTING DETAIL |

LISGAR DISTRICT
UTILITY TRENCH DE-WATERING
AND FDC PUMPING SYSTEM

wood.

MISSISSAUGA

PRODUCED FOR - T&W, ENGINEERING AND WORKS

DRAWING LIST

| | | |
|---|---|---|
| SCALE AS NOTED | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY M.B.K. | CHECKED BY M.S. | PLAN No. |
| DATE AUG 2019 | SHEET 01 OF 32 | C-0 |

Last Saved: 2019-08-16 Last Saved By: mike.loncar Plotted: 2019-08-27 Plotted By: mike.loncar Path: P:\2018\Projects\TPB188016 - Design & Contract Admin. - Lisgar\06_DES-ENG\01_CAD\02_DWGS\05_MR\CONTRACT\TPB188016-C0.dwg

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## GENERAL NOTES

1. ALL WORK SHALL BE IN ACCORDANCE WITH THE NATIONAL BUILDING CODE, ONTARIO BUILDING CODE, THE CURRENT "OCCUPATIONAL HEALTH AND SAFETY ACT" AND ALL SUBSEQUENT REGULATIONS MADE UNDER THE ACT PRIOR TO AND DURING CONSTRUCTION.
2. ALL TRENCHING AND TUNNELLING IS TO BE DONE IN ACCORDANCE WITH THE ONTARIO HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS.
3. DO NOT USE LOCAL STREETS AND GRAVEL ROADS FOR STORAGE OF CONSTRUCTION MATERIAL UNLESS AUTHORIZED BY AGENCY AND ENGINEER.
4. ALL EXCESS EXCAVATED MATERIAL TO BE DISPOSED OFF-SITE TO A SITE ARRANGED FOR BY THE VENDOR AT THE VENDOR'S EXPENSE.
5. DURING NON-CONSTRUCTION PERIODS, ALL OPEN EXCAVATIONS ALONG THE STREETS TO BE COMPLETELY COVERED WITH ADEQUATE TIMBER OR STEEL BEAMS SUPPORTING STEEL PLATES DESIGNED BY A PROFESSIONAL ENGINEER LICENCED TO PRACTICE IN ONTARIO AND SUBMITTED TO THE ENGINEER FOR REVIEW.
6. VENDOR TO PREVENT CONSTRUCTION DEBRIS FROM ENTERING EXISTING CATCH BASINS, MAINTENANCE HOLES AND STORM AND SANITARY SEWERS WITHIN THE AREA OF THE CONTRACT. VENDOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF ANY CONSTRUCTION DEBRIS THAT ENTERS THE EXISTING CATCH BASINS, MAINTENANCE HOLES AND STORM AND SANITARY SEWERS IN A TIMELY MANNER.
7. ACCESS TO PRIVATE AND PUBLIC PROPERTIES SHALL BE MAINTAINED AT ALL TIMES.
8. BLASTING IS NOT PERMITTED.
9. ORDER OF PRECEDENCE OF STANDARD DRAWINGS IS FIRSTLY THE AGENCY'S ENGINEERING STANDARDS, SECONDLY THE CITY OF MISSISSAUGA STANDARD DRAWINGS, AND THIRDLY ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD).
10. ALL LENGTHS OR SERVICE LINES INDICATED ON THESE DRAWINGS RE FOR DESIGN PURPOSES ONLY. THE VENDOR IS RESPONSIBLE FOR PROVIDING THE FULL EXTEND OF LINES (INCLUDING REQUIRED CONNECTIONS) EVEN IF THE ACTUAL LENGTHS VARY FROM THE DESIGN VALUES.
11. THE VENDOR IS RESPONSIBLE TO COORDINATE THEIR SCHEDULE AND WORK ACTIVITIES WITHIN THE AREA OF THE CONTRACT WITH ALL STAKEHOLDERS.
12. PROVIDE FOR THE PROTECTION AND MAINTENANCE OF ALL EXISTING UTILITIES DURING EXECUTION OF WORK.
13. NATIVE MATERIAL SUITABLE FOR BACKFILL, SHALL BE PLACED IN LAYERS 150mm IN DEPTH MAXIMUM AND BE COMPACTED TO A MINIMUM OF 95% S.P.M.D.D.
14. GRANULAR MATERIAL USED FOR BACKFILL, SHALL BE PLACED IN LAYERS 150mm IN DEPTH MAXIMUM AND BE COMPACTED TO 100% S.P.M.D.D. AS NOTED IN THE SPECIFICATIONS OR ON THE CONTRACT DRAWINGS.
15. VENDOR SHALL MAINTAIN FLOW IN ALL EXISTING SERVICES DURING CONSTRUCTION.

## SITE SURVEY AND LAYOUT

1. VENDOR IS SOLELY RESPONSIBLE FOR SITE SURVEY AND CONSTRUCTION LAYOUT.
2. THE ACCURACY OF ALL BENCHMARKS SHALL BE VERIFIED BY THE VENDOR PRIOR TO CONSTRUCTION. ANY DEVIATIONS ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
3. VENDOR IS RESPONSIBLE FOR PROVIDING SUFFICIENT SURVEY MARKERS AND GRADE SHEETS AS MAY BE REQUIRED FOR THE PROPER EXECUTION OF THE WORKS. ALL STAKES, MARKERS AND REFERENCE POINTS SHALL BE CAREFULLY PRESERVED BY THE VENDOR THROUGHOUT THE CONSTRUCTION DURATION.
4. DRAWING STATIONS SHOWN ON PLAN VIEWS AND ALL LENGTHS OF PROPOSED INFRASTRUCTURE INDICATED ON THESE DRAWINGS ARE FOR DESIGN PURPOSES ONLY. THE VENDOR IS RESPONSIBLE FOR CALCULATING THE EXACT LENGTHS AND SHOWING THESE ON THEIR SHOP DRAWINGS (INCLUDING REQUIRED CONNECTIONS) EVEN IF THE ACTUAL LENGTHS VARY FROM THE DESIGN VALUES.

## EXISTING UTILITIES

1. VENDOR SHALL PROTECT AND MAINTAIN ALL EXISTING UNDERGROUND AND ABOVEGROUND UTILITIES PRIOR TO AND DURING CONSTRUCTION IN ACCORDANCE WITH TSSA REQUIREMENTS.
2. WHERE SERVICES CROSS EXISTING CONCRETE OR ASPHALT ROADWAYS OR WALKWAYS, VENDOR TO SAWCUT SURFACE AND RESTORE TO PRE-CONSTRUCTION CONDITIONS.
3. THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE APPROXIMATE ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY OWNER OR ITS REPRESENTATIVES. THE VENDOR, AS PART OF THEIR WORK SHALL VERIFY THE LOCATION OF ALL EXISTING UTILITIES WITH THE UTILITY COMPANIES AT LEAST 48 HOURS PRIOR TO COMMENCING WORK AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MAY BE CAUSED BY THE VENDOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.
4. PERFORM TEST PIT EXCAVATIONS AT ALL LOCATIONS WHERE EXISTING UTILITIES MAY BE DISTURBED. HAND DIG AS REQUIRED TO PREVENT DAMAGE TO EXISTING UTILITIES. NOTIFY UTILITY OWNERS AND AGENCY'S WATER AND WASTEWATER DEPARTMENTS IN ADVANCE OF SCHEDULED WORK NEAR THESE UTILITIES. VENDOR TO COORDINATE TIMING OF NOTIFICATION WITH EACH UTILITY OWNER AT TIME OF CONSTRUCTION.
5. REPORT LOCATION AND ELEVATIONS OF ALL EXISTING UTILITIES NOT SHOWN ON THE DRAWINGS TO THE ENGINEER FOR REVIEW PRIOR TO COMMENCING WORK.
6. THE VENDOR SHALL NOTIFY THE OWNER OF ANY DAMAGED UTILITY. THE OWNER MAY, AT ITS DISCRETION AND AT THE VENDOR'S EXPENSE, REPAIR THE DAMAGED UTILITY OR DIRECT THE VENDOR TO REPAIR THE DAMAGED UTILITY.
7. THE VENDOR SHALL ALLOW ACCESS BY UTILITY OWNERS TO THEIR UTILITIES FOR INSPECTION PURPOSES AT ALL TIMES DURING CONSTRUCTION.
8. WHERE UNSHRINKABLE FILL IS USED AS BACKFILL MATERIAL, ALL EXPOSED UNDERGROUND UTILITIES MUST BE PROTECTED BY PLACING A MINIMUM OF 300mm GRANULAR MATERIAL COMPACTED TO 95% S.P.M.D.D ALL AROUND THE UTILITY.

## GAS

1. A MINIMUM OF 600mm HORIZONTAL (1000mm FOR BORING) AND 300 mm VERTICAL CLEARANCES MUST BE MAINTAINED. VERTICAL CLEARANCE MUST BE INCREASED TO 600mm FOR MAINS NPS 12 AND LARGER. EXPOSURE BY HAND IS REQUIRED.
2. A MINIMUM OF 150mm OF SAND BACKFILL PADDING IS TO BE PLACED AROUND MAINS/SERVICES BEFORE BACKFILLING WITH UNSHRINKABLE FILL.
3. ENBRIDGE GAS MAINS/SERVICES MUST BE FIELD LOCATED ON SITE BEFORE INITIATING EXCAVATION.
4. VENDOR'S LOCATES SHALL INCLUDE DAY-LIGHTING ALL GAS LINE PER TSSA REQUIREMENTS.
5. PRIOR TO USING HORIZONTAL DIRECTIONAL DRILLING ACROSS GAS PIPELINES, CREATE A DAYLIGHT HOLE THAT IS SUFFICIENTLY WIDE ENOUGH TO SEE THE DRILL HEAD AND BACKREAMER ENTERING THE EXCAVATION AT A MINIMUM OF 1m FROM THE GASLINE. A SECOND DAYLIGHT HOLE MUST BE CREATED SUCH THAT THE LOCATION OF THE DRILL HEAD AND BACKREAMER CAN BE VERIFIED. THE DAYLIGHT HOLE MUST BE SUFFICIENTLY WIDE TO MEASURE THE DEPTH AND TRAJECTORY OF THE DRILL HEAD AND BACKREAMER. REFER TO STANDARD DRAWING (ENBRIDGE FIGURE 5-2).

## SEWERS AND WATERMAINS

1. MAINTAIN ALL SEWER CROSSINGS AT MINIMUM 1.2m HORIZONTAL CLEARANCE & MINIMUM 500mm BELOW PIPE INVERT AND/OR MINIMUM 300mm ABOVE PIPE OBVERT.
2. MUST DAYLIGHT ALL CORNERS WHEN CROSSING ANY SEWERS.
3. MINIMUM COVER OVER WATERMAIN TO BE 1.7m AT ALL TIMES.
4. THE VENDOR SHALL SUBMIT THE REGION OF PEEL NOTIFICATION TO COMMENCE WORK FORM AT LEAST TEN (10) DAYS PRIOR TO COMMENCING WORK IN THE VICINITY OR MODIFYING EXISTING WATERMAIN OR SANITARY SEWER INFRASTRUCTURE.
5. VENDOR TO PROVIDE ADEQUATE SUPPORT FOR ALL INFRASTRUCTURES CROSSED AND/OR UNDERMINED/EXPOSED.
6. VENDOR SHALL BE RESPONSIBLE FOR ALL PROTECTION AND TEMPORARY RELOCATION OF UNDERGROUND AND ABOVEGROUND UTILITIES PRIOR TO AND DURING CONSTRUCTION.
7. ALL BACKFILL ON TRAVELLED PORTION OF THE RIGHT OF WAY TO BE GRANULAR "B" BACKFILL AND BE COMPACTED TO MINIMUM 100% S.P.M.D.D

## ALECTRA

1. MAINTAIN MINIMUM 1.0M HORIZONTAL CLEARANCE FROM EXISTING UTILITIES.
2. HAND DIG OR HYDROVAC (DIRECTIONAL BORE IS NOT PERMITTED) WHEN EXCAVATING WITHIN 1.0m OF EXISTING UTILITIES.

## TRAFFIC CONTROL

1. PRIOR TO COMMENCING WORK, THE VENDOR MUST OBTAIN A ROAD OCCUPANCY PERMIT AT LEAST TEN (10) DAYS PRIOR TO WORKING WITHIN ANY RIGHT-OF-WAY (R.O.W.). NO WORK SHALL TAKE PLACE WITHIN THE ROAD ALLOWANCE WITHOUT A FORMAL APPROVAL OF LOCATION AND/OR CUT PERMIT IS ISSUED.
2. THE VENDOR IS TO SUBMIT A TRAFFIC CONTROL PLAN FOR REVIEW BY THE ENGINEER/OWNER AS NOTED IN THE SPECIFICATIONS.
3. THE VENDOR SHALL USE THE CURRENT VERSION OF THE MINISTRY OF TRANSPORTATION (OTM BOOK 7) "TRAFFIC CONTROL MANUAL FOR ROAD OPERATIONS" FOR THE SIGNAGE AND CHANNELIZATION REQUIRED FOR WORKS ON THE STREET ALLOWANCE. SIGNING AND CHANNELIZATION PLANS MUST BE SUBMITTED TO THE ENGINEER/OWNER FOR APPROVAL AT LEAST 20 WORKING DAYS PRIOR TO COMMENCEMENT OF CONSTRUCTION. REFERENCE MUST BE MADE TO THE "MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES".
4. THE VENDOR SHALL PROVIDE PROPER SIGNAGE AND FLAG-PERSONS AT ALL TIMES THROUGHOUT THE WORK ZONE DURING THE CONSTRUCTION PERIOD.
5. THE VENDOR SHALL NOT PARK THEIR VEHICLES ALONG PUBLIC ROADWAYS. ALL VENDORS PARKING TO BE WITHIN THE WORK AREA SITES OR AT OFF-SITE LOCATIONS ARRANGED BY THE VENDOR AT THEIR OWN EXPENSE.
6. AT ALL ENTRANCES TO THE SITE, THE ROAD CURB AND SIDEWALK WILL BE CONTINUOUS THROUGH THE DRIVEWAY. THE DRIVEWAY GRADE WILL BE COMPATIBLE WITH EXISTING SIDEWALK AND CURB DEPRESSION WILL BE PROVIDED FOR EACH ENTRANCE.

## ENVIRONMENTAL

1. THE VENDOR SHALL SUPPLY AND INSTALL ALL EROSION AND SEDIMENT CONTROLS (ESC) AS PER CONTRACT SPECIFICATIONS AND AT LOCATIONS AS DIRECTED BY THE ENG1NEER. ALL DAMAGED EROSION AND SEDIMENT CONTROL MEASURES SHOULD BE REPAIRED AND/OR REPLACED WITHIN 48 HOURS OF THE INSPECTION.
2. VENDOR TO PROVIDE SEDIMENT CONTROL MEASURES AND PRECAUTIONS TO PREVENT CONSTRUCTION DEBRIS FROM ENTERING EXISTING CATCH BASINS, MAINTENANCE HOLES, CULVERTS, CREEKS, ROAD SIDE DITCHES, AND STORM AND SANITARY SEWERS WITHIN THE AREA OF THE CONTRACT.
3. DISTURBED AREAS WILL BE MINIMIZED TO THE EXTENT POSSIBLE AND TEMPORARILY OR PERMANENTLY STABILIZED OR RESTORED AS THE WORK PROGRESSES.
4. THE EROSION AND SEDIMENT CONTROL STRATEGIES OUTLINED ON THE PLANS ARE NOT STATIC AND MAY NEED TO BE UPGRADED/AMENDED AS SITE CONDITIONS CHANGE TO MINIMIZE SEDIMENT LADEN RUNOFF FROM LEAVING THE WORK AREAS. IF THE PRESCRIBED MEASURES ON THE PLANS ARE NOT EFFECTIVE IN PREVENTING THE RELEASE OF A DELETERIOUS SUBSTANCE, INCLUDING SEDIMENT, THEN ALTERNATIVE MEASURES MUST BE IMPLEMENTED IMMEDIATELY TO MINIMIZE POTENTIAL ECOLOGICAL IMPACTS. ADDITIONAL ESC MEASURES TO BE KEPT ONSITE AND PLACED AS INSTRUCTED BY THE ENGINEER.
5. SEDIMENT AND EROSION CONTROL MEASURES TO BE INSPECTED DAILY AND ANY REQUIRED REPAIRS DONE PROMPTLY.
6. ROADS ARE TO BE CLEANED AT A MINIMUM ONCE A WEEK OR AS INSTRUCTED BY THE ENGINEER. IT WILL NOT BE CONSIDERED ACCEPTABLE TO HAVE MUD AND DEBRIS ON THE ROADS.
7. RESTORATION OF ANY DISTURBED AREAS TO BE DONE IN ACCORDANCE WITH CONTRACT SPECIFICATIONS. RESTORATION OF DISTURBED GRASS AREAS WITHIN THE EXISTING RIGHT-OF-WAY TO CONSIST OF SODDING AS PER OPSS 803.
8. ALL DEWATERING DISCHARGE EFFLUENT SHALL BE TREATED TO MEET PROVINCIAL WATER QUALITY OBJECTIVES (PWQO) PRIOR TO BEING DISCHARGED TO THE NATURAL ENVIRONMENT. IN CASE WATER QUALITY IS NOT SUITABLE FOR DISCHARGE INTO THE STORM SEWER, THE VENDOR SHALL ACQUIRE AGENCY APPROVAL PRIOR TO DISCHARGING EFFLUENT TO THE LOCAL SANITARY SEWER SYSTEM WITH ADDITIONAL COSTS BACKCHARGED TO THE VENDOR PER CUBIC METER OF DISCHARGE.

## RESTORATION

1. EXISTING ROADS, CURBS, SIDEWALK, PAVED AND SODDED AREAS DISTURBED DURING CONSTRUCTION TO BE RESTORED TO RESTORATION REQUIREMENTS AS SPECIFIED OR OTHERWISE TO THE ORIGINAL CONDITION AND TO THE SATISFACTION OF THE OWNER AND THE CITY OF MISSISSAUGA.
2. NEATLY GRADE ALL AREAS TO MATCH EXISTING ELEVATIONS AND PROVIDE POSITIVE DRAINAGE ALONG EXISTING DITCHES, CONSISTENT WITH EXISTING DRAINAGE PATTERNS.
3. IF SODDING IS UNAVAILABLE TO BE INSTALLED AT THE TIME OF RESTORATION, TEMPORARY EROSION CONTROL BLANKETS SHALL BE SUPPLIED AND INSTALLED OVER THE ENTIRE SURFACE AREA IN ACCORDANCE WITH OPSS 804 UNTIL SOD IS AVAILABLE FOR INSTALLATION.
4. ALL DRIVEWAYS ARE TO BE RESTORED TO EXISTING CONDITION OR BETTER, WITH MATCHING MATERIAL (I.E. ASPHALT, GRAVEL FOR GRAVEL), TO THE PROPERTY LINE.

## ROAD

1. CONCRETE CURB AND GUTTER TO BE CONSTRUCTED AND RESTORED AS PER CITY OF MISSISSAUGA STANDARD DRAWING 2230.010 AND 2240.040.
2. TEMPORARY ASPHALT CURB TO BE CONSTRUCTED AS PER OPSD 601.010.
3. WALKWAYS AND SIDEWALKS TO BE CONSTRUCTED AS PER CITY OF MISSISSAUGA STANDARD DRAWING 2240.010.
4. NATIVE SUBGRADE SHALL HAVE A CROSSFALL OF 3.0% AND THE MATERIAL SHALL BE APPROVED SUITABLE BY A GEOTECHNICAL CONSULTANT AND ARE SUBJECT TO APPROVAL OF THE ENGINEER.
5. NATIVE SUBGRADE TO BE COMPACTED TO A MINIMUM 95% S.P.M.D.D OR AS SPECIFIED IN THE GEOTECHNICAL REPORTS AND SHALL BE PROOF ROLLED PRIOR TO PLACING THE GRANULAR ROAD BASE.
6. ALL DRIVEWAYS MUST BE PAVED FROM BACK OF CURB TO STREET LINE.
7. FOR PAVEMENT RESTORATION, SEE TYPICAL ROAD RESTORATION DETAILS IN THE CONTRACT DRAWINGS. RE-SURFACE DAMAGED EXISTING ASPHALT WITH 50mm HL3.
8. THE ROAD BASE SHALL INCORPORATE PVC SUBDRAIN WRAPPED WITH A FILTER FABRIC, OPSD 216.021.

REVISIONS

| DATE | DETAILS | INIT. |
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| AUG 2019 | ISSUED FOR TENDER | M.S. |
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LICENSED PROFESSIONAL ENGINEER
M. J. SEHNER
100119937
PROVINCE OF ONTARIO

LISGAR DISTRICT
UTILITY TRENCH DE-WATERING
AND FDC PUMPING SYSTEM

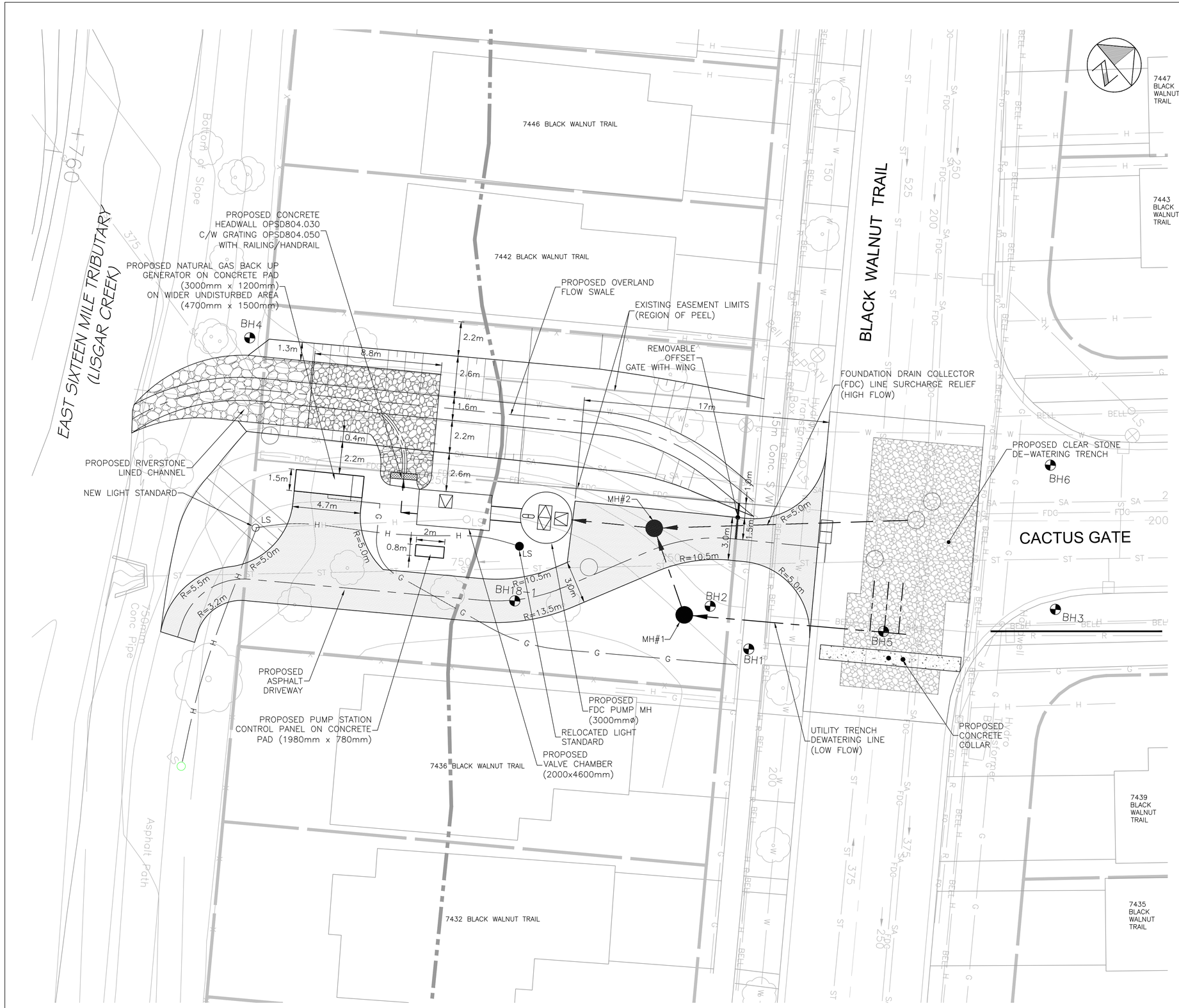
wood.

MISSISSAUGA

PRODUCED FOR - T&W, ENGINEERING AND WORKS

STANDARD NOTES

| | | |
|---|---|---|
| SCALE AS NOTED | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY M.L. | CHECKED BY M.S. | PLAN No. C-1 |
| DATE AUG 2019 | SHEET 02 OF 32 | |




| REVISIONS | | |
|---|---|---|
| DATE | DETAILS | INIT. |
| JAN. 2017 | INITIAL CITY REVIEW | M.S. |
| JUN. 2018 | ADD FDC PUMP STATION | M.S. |
| OCT. 2018 | 30% SUBMISSION | M.S. |
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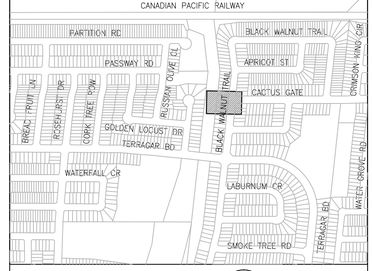
| MAY 2019 | ISSUED FOR UPDATED ECA | M.S. |
| AUG 2019 | ISSUED FOR TENDER | M.S. |




KEY PLAN

LICENSED PROFESSIONAL ENGINEER
M. J. SENIOR
100119397
8/1/2019
PROVINCE OF ONTARIO

## LEGEND

- WATERCOURSE
- CONTOUR (0.5m)
- PROPERTY LINE
- EASEMENT LIMITS
- CONSERVATION HALTON APPROX. REGULATION LIMIT
- H — HYDRO
- BELL — BELL
- G — GAS
- W — WATERMAIN SYSTEM
- ST — STORM SEWER SYSTEM
- FDC — FDC SYSTEM
- SA — SANITARY SEWER SYSTEM
- SA — SANITARY SEWER SYSTEM
- SA — SANITARY SEWER SYSTEM
- R — ROGERS COAXIAL CABLE
- FO — ROGERS FIBRE CABLE
- PROPOSED UTILITY TRENCH DEWATERING SYSTEM
- PROPOSED MANHOLE
- LS — PROPOSED LIGHT POLE
- BH — BOREHOLE LOCATION

SCALE 1:125 0 1.25 2.5 5m

LISGAR DISTRICT
UTILITY TRENCH DE-WATERING AND FDC PUMPING SYSTEM

wood.

MISSISSAUGA

PRODUCED FOR – T&W, ENGINEERING AND WORKS

OVERALL SITE PLAN

| | | |
|---|---|---|
| SCALE 1:125 | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY M.B.K. | CHECKED BY M.S. | PLAN No. C-2 |
| DATE AUG 2019 | SHEET 03 OF 32 | |

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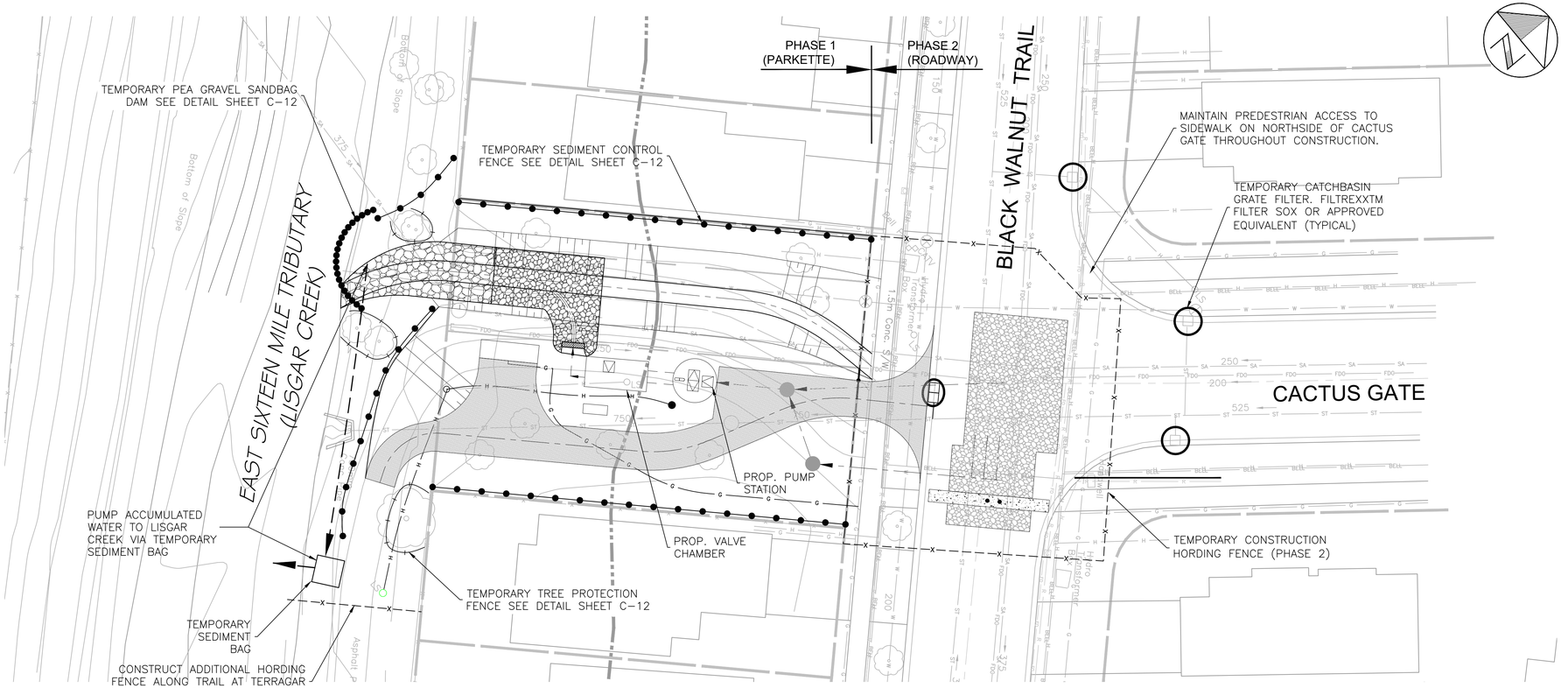
Last Saved: 2019-08-27




## EROSION & SEDIMENT CONTROL NOTES:

1. PRIOR TO COMMENCEMENT OF WORK, ALL EROSION AND SEDIMENT CONTROLS SHALL BE PUT IN PLACE, TO THE SATISFACTION OF THE SITE OBSERVER.
2. ALL CONTROLS MUST BE MAINTAINED DURING CONSTRUCTION AND FULLY REMOVED ONCE ALL DISTURBED AREAS HAVE BEEN STABILIZED.
3. THE CONTRACTOR MUST ABIDE BY THE REGULATIONS SET OUT IN THE ONTARIO GOVERNMENT PUBLICATION "GUIDELINES ON EROSION AND SEDIMENTATION CONTROLS FOR URBAN CONSTRUCTION SITES", AND "EROSION & SEDIMENT CONTROL GUIDELINES FOR URBAN CONSTRUCTION" PREPARED BY THE GREATER GOLDEN HORSESHOE AREA CONSERVATION AUTHORITIES (DECEMBER 2006).
4. THE ENTIRE CONSTRUCTION SITE TO BE MONITORED DAILY FOR SEDIMENT AND EROSION CONTROL FOR THE DURATION OF THE CONTRACT. DEFICIENCIES AND/OR BREACHES OF CONTROL MEASURES MUST BE BROUGHT TO THE ATTENTION OF THE SITE OBSERVER AND CONSERVATION HALTON AND RECTIFIED IMMEDIATELY.
5. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE REGULATIONS AND PERMITTING PROVISION OF CONSERVATION HALTON. THESE ARE TO BE POSTED OR AVAILABLE AT THE CONSTRUCTION SITE.
6. UNDER NO CIRCUMSTANCES SHALL RUNOFF FROM UNVEGETATED SOIL OR EXCAVATED PITS BE DISCHARGED OFF SITE OR DIRECTLY INTO ACTIVE OR TEMPORARILY INACTIVE WATERCOURSES.
7. ALL ACCUMULATED SEDIMENT MUST BE REMOVED DURING PERIODS OF LOW-FLOW OR DRY CONDITIONS, PRIOR TO THE REMOVAL OF THE DEWATERING CONTROLS, AND DISPOSED OF IN AN APPROVED ON-SITE LOCATION (TO BE DETERMINED IN THE FIELD).
8. ALL EXCAVATION/GRADING IS TO BE DONE IN THE DRY.
9. ALL DISTURBED AREAS SHALL BE REVEGETATED AS SOON AS WEATHER PERMITS FOLLOWING COMPLETION OF CONSTRUCTION.
10. ANY DISTURBANCE TO EXISTING VEGETATION AS PART OF CONSTRUCTION TEMPORARY WORK IS TO BE RESTORED AT THE DIRECTION OF THE SITE OBSERVER.
11. ALL MATERIALS AND EQUIPMENT USED FOR THE PURPOSE OF SITE PREPARATION AND PROJECT COMPLETION SHALL BE OPERATED AND STORED IN A MANNER THAT PREVENTS ANY DELETERIOUS SUBSTANCE (i.e. PETROLEUM PRODUCTS, DEBRIS) FROM ENTERING THE WATERCOURSE.
12. ALL VEHICLE AND EQUIPMENT REFUELING AND MAINTENANCE, STORAGE AND STOCKPILE AREAS AND ANY OTHER TEMPORARY CONSTRUCTION AREAS, SHALL BE CONDUCTED AND/OR LOCATED A MINIMUM OF 30m AWAY FROM THE WATERCOURSE ON FLAT GROUND SO THAT ANY RUNOFF FLOWS AWAY FROM THE WATERCOURSE.
13. ACCUMULATED WATER FROM WITHIN THE LIMIT OF EXCAVATION SHALL BE PUMPED TO A SEDIMENT BAG (800R OR APPROVED EQUIVALENT) IN A WELL VEGETATED AREA, MINIMUM 15m FROM WATERCOURSE. LOCATION OF FILTER BAG AND DEWATERING PUMP TO BE DETERMINED IN THE FIELD AND CONFIRMED WITH THE SITE OBSERVER.
14. DUE TO LOCAL FISH SPAWNING AND NURSERY PERIODS, NO IN-STREAM WORK OR ACTIVITY SHALL TAKE PLACE BETWEEN MARCH 1st and JULY 1st.
15. CONSTRUCTION SHOULD BE AVOIDED DURING UNUSUALLY WET, RAINY OR WINTER THAW CONDITIONS.
16. OPERATE MACHINERY IN A MANNER THAT MINIMIZES DISTURBANCE TO THE WATERCOURSE BED AND BANKS.
17. MACHINERY IS TO ARRIVE ON SITE IN A CLEAN CONDITION AND IS TO BE MAINTAINED FREE OF FLUID LEAKS.
18. IN ORDER TO REDUCE THE SPREAD OF INVASIVE SPECIES, EQUIPMENT SHOULD BE THOROUGHLY CLEANED BEFORE BEING BROUGHT ONSITE. FOR GUIDANCE IN THIS REGARD, PLEASE REFER TO THE CLEAN EQUIPMENT PROTOCOL FOR INDUSTRY AVAILABLE ONLINE AT HTTP://ONTARIOINVASIVEPLANTS.CA/FILES/CLEANEQUIPMENT PROTOCOL_MAR1521013_D3.pdf
19. KEEP AN EMERGENCY SPILL KIT ON SITE IN CASE OF FLUID LEAKS OR SPILLS FROM MACHINERY.
20. ALL AREAS OF DISTURBED SOIL MUST BE STABILIZED WITH EROSION CONTROL MEASURES AND/OR SEEDED WITH NATIVE GROUNDCOVER SEED MIX IMMEDIATELY UPON COMPLETION OF THE WORK.
21. AN ON-SITE PRE-CONSTRUCTION MEETING MUST TAKE PLACE PRIOR TO THE COMMENCEMENT OF ANY WORK. REPRESENTATIVES FROM CONSERVATION HALTON, THE CITY OF MISSISSAUGA, THE DESIGN TEAM, AND THE SUCCESSFUL CONTRACTOR MUST BE PRESENT.
22. A BACKUP PUMP IS TO BE KEPT ON SITE AT ALL TIMES DURING PUMPING ACTIVITIES. WATER DIVERSION/DEWATERING DISCHARGED MUST BE MONITORED CONTINUOUSLY FOR EFFECTIVENESS. ANY OVERNIGHT PUMPING IS TO BE MONITORED BY A TECHNICIAN TO ENSURE SYSTEM IS FUNCTIONING.
23. DO NOT SCALE DRAWINGS.

## GENERAL PHASING NOTES:

1. TREE REMOVALS TO BE COMPLETED BY CITY OF MISSISSAUGA FORESTRY DEPARTMENT PRIOR TO START OF CONSTRUCTION; TO BE CO-ORDINATED BY THE CONTRACTOR.
2. CONTRACTOR TO OBTAIN A ROAD OCCUPANCY PERMIT AND EROSION & SEDIMENT CONTROL PERMIT FROM THE CITY OF MISSISSAUGA PRIOR TO START OF CONSTRUCTION.
3. CONTRACTOR TO OBTAIN UTILITY CLEARANCES PRIOR TO START OF CONSTRUCTION AND CONFIRM HORIZONTAL AND VERTICAL LOCATIONS OF ALL UTILITIES.
4. CONTRACTOR TO PROVIDE A TRAFFIC CONTROL PLAN (CONSISTENT WITH OTM BOOK 7) TO THE CONTRACT ADMINISTRATOR FOR REVIEW AND APPROVAL. TRAFFIC CONTROLS TO BE SETUP AS PER APPROVED PLAN.
5. UNDERTAKE THE PHASE 1 CONSTRUCTION NOTES (PARKETTE), KEEPING BLACK WALNUT TRAIL OPEN.
   - 5.A. CONTRACTOR TO INSTALL TEMPORARY CONSTRUCTION HOARDING FENCE (PARKETTE AND TRAIL) AND TREE PROTECTION FENCING AND EROSION AND SEDIMENT CONTROLS.
   - 5.B. COMPLETE REMOVALS AS OUTLINED IN CONTRACT DRAWINGS FOR PARKETTE AREA. CLEAR AND GRUB WORK AREA INCLUDING STRIPPING TOPSOIL AND VEGETATION COVER.
   - 5.C. CONTRACTOR TO PROVIDE DESIGN FOR CONCRETE SECANT PILES FOR APPROVAL BY THE CITY/WOOD. SECANT PILES TO BE COMPLETED AS PER APPROVED DESIGN.
   - 5.D. CONSTRUCT PUMPING STATION (WET WELL, VALVE CHAMBER, PIPING, CONTROL PANEL, AND BACKUP GENERATOR) AS SHOWN IN THE APPROVED DESIGN.
   - 5.E. COMPLETE ROUGH SURFACE GRADING FOR THE SITE.
6. UNDERTAKE THE PHASE 2 CONSTRUCTION WORKS (ROADWAY) CLOSING BLACK WALNUT TRAIL TEMPORARILY.
   - 6.A. INSTALL ADDITIONAL CONSTRUCTION HOARDING FENCE AND TEMPORARILY CLOSE ROADWAY/INTERSECTION.
   - 6.B. UNDERTAKE ROADWAY REMOVALS.
   - 6.C. CONSTRUCT UTILITY TRENCH DEWATERING SYSTEM AND DEWATERING LINE, FDC SURCHARGE RELIEF LINE, AND CONNECTIONS TO WET WELL. CONTRACTOR RESPONSIBLE FOR DEWATERING AND SUPPORTING ALL UTILITIES DURING THE WORK.
   - 6.D. COMPLETE PAVING RESTORATION WORKS FOR ROADWAY AND ASPHALT DRIVEWAY/TRAILWAY.
7. COMPLETE FINE GRADING FOR PARKETTE, OVERLAND FLOW SWALE AND RIVERSTONE PLACEMENT.
8. COMPLETE TOPSOILING, SEEDING, AND LANDSCAPE PLANTINGS.
9. REMOVE TREE PROTECTION FENCING AND EROSION AND SEDIMENT CONTROL MEASURES.

LICENSED PROFESSIONAL ENGINEER M.J. SENIOR 100119337 6/1/2019 PROVINCE OF ONTARIO

## REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| JAN. 2017 | INITIAL CITY REVIEW | M.S. |
| JUN. 2018 | ADD FDC PUMP STATION | M.S. |
| OCT. 2018 | 30% SUBMISSION | M.S. |
| MARCH 2019 | ISSUED FOR PERMIT | M.S. |
| MAY 2019 | ISSUED FOR UPDATED ECA | M.S. |
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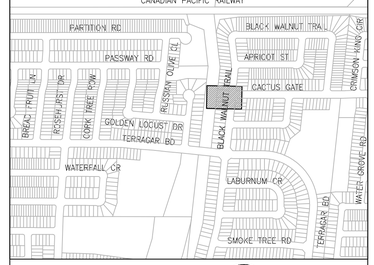
CANADIAN PACIFIC RAILWAY




KEY PLAN

## LEGEND

- WATERCOURSE
- CONTOUR (0.5m)
- PROPERTY LINE
- EASEMENT LIMITS
- CONSERVATION HALTON APPROX. REGULATION LIMIT
- HYDRO
- BELL
- GAS
- WATERMAIN SYSTEM
- STORM SEWER SYSTEM
- FDC SYSTEM
- SANITARY SEWER SYSTEM
- ROGERS COAXIAL CABLE
- ROGERS FIBRE CABLE
- PROPOSED SEDIMENT CONTROL FENCE
- PROPOSED PEA GRAVEL SANDBAG DAM
- TREE PROTECTION FENCE
- CONSTRUCTION HORDING FENCE
- CATCHBASIN GRATE FILTER
- SEDIMENT BAG

SCALE 1:125 (0, 1.25, 2.5, 5m)

# LISGAR DISTRICT UTILITY TRENCH DE-WATERING AND FDC PUMPING SYSTEM

wood.

MISSISSAUGA

PRODUCED FOR - T&W, ENGINEERING AND WORKS

## EROSION & SEDIMENT CONTROL AND STAGING PLAN

| | | |
|---|---|---|
| SCALE 1:200 | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY M.B.K. | CHECKED BY M.S. | PLAN No. C-3 |
| DATE AUG 2019 | SHEET 04 OF 32 | |

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| REVISIONS | | |
|---|---|---|
| DATE | DETAILS | INIT. |
| JAN. 2017 | INITIAL CITY REVIEW | M.S. |
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| MAY 2019 | ISSUED FOR UPDATED ECA | M.S. |
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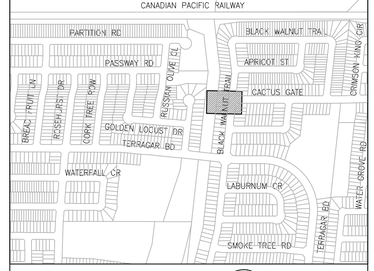


KEY PLAN

NOTES:

1. TREE REMOVALS TO BE COMPLETED BY CITY OF MISSISSAUGA FORESTRY DEPARTMENT PRIOR TO CONSTRUCTION START.
2. NO ROADWAY WORKS/REMOVALS TO OCCUR UNTIL PHASE 2 (REFER TO DRAWING C-3)

## LEGEND

- WATERCOURSE
- PROPERTY LINE
- EASEMENT LIMITS
- H — HYDRO
- BELL — BELL
- G — GAS
- W — WATERMAIN SYSTEM
- ST — STORM SEWER SYSTEM
- FDC — FDC SYSTEM
- SA — SANITARY SEWER SYSTEM
- R — ROGERS COAXIAL CABLE
- FO — ROGERS FIBRE CABLE
- REMOVAL HATCH
- REMOVAL SYMBOL

SCALE 1:125 (0, 1.25, 2.5, 5m)

# LISGAR DISTRICT UTILITY TRENCH DE-WATERING AND FDC PUMPING SYSTEM

wood.

MISSISSAUGA

PRODUCED FOR – T&W, ENGINEERING AND WORKS

## REMOVALS PLAN

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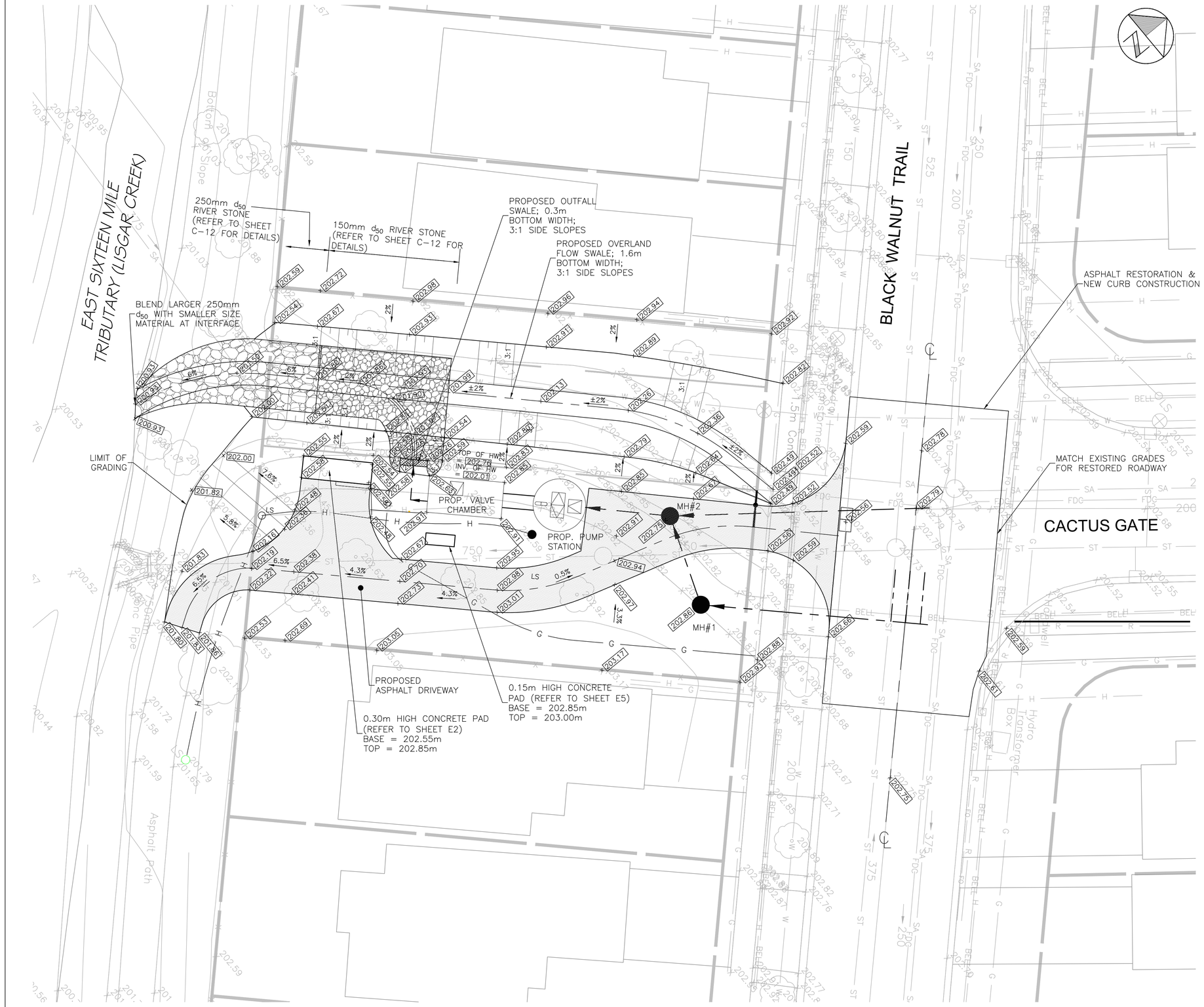
|---|---|---|
| SCALE 1:125 | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY M.B.K. | CHECKED BY M.S. | PLAN No. C-4 |
| DATE AUG 2019 | SHEET 05 OF 32 | |




| REVISIONS | | |
|---|---|---|
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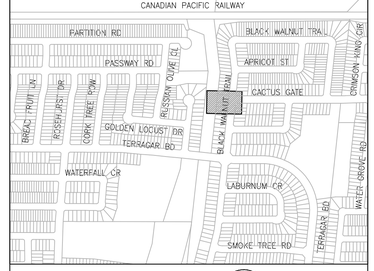


KEY PLAN

NOTES:

1. GRADING BASED ON TOPOGRAPHIC SURVEY SUPPLIED BY THE CITY OF MISSISSAUGA. ASSUMED CITY OF MISSISSAUGA VERTICAL DATUM.

## LEGEND

- WATERCOURSE
- CONTOUR (0.5m)
- PROPERTY LINE
- EASEMENT LIMITS
- H — HYDRO
- BELL — BELL
- G — GAS
- W — WATERMAIN SYSTEM
- ST — STORM SEWER SYSTEM
- FDC — FDC SYSTEM
- SA — SANITARY SEWER SYSTEM
- R — ROGERS COAXIAL CABLE
- FO — ROGERS FIBRE CABLE
- ×202.93 — PROPOSED GRADE
- LS — PROPOSED LIGHT POLE

SCALE 1:125 (0, 1.25, 2.5, 5m)

LISGAR DISTRICT
UTILITY TRENCH DE-WATERING
AND FDC PUMPING SYSTEM

wood.

MISSISSAUGA

PRODUCED FOR – T&W, ENGINEERING AND WORKS

SURFACE GRADING PLAN

| | | |
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| SCALE 1:125 | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY M.B.K. | CHECKED BY M.S. | PLAN No. C-5 |
| DATE AUG 2019 | SHEET 06 OF 32 | |

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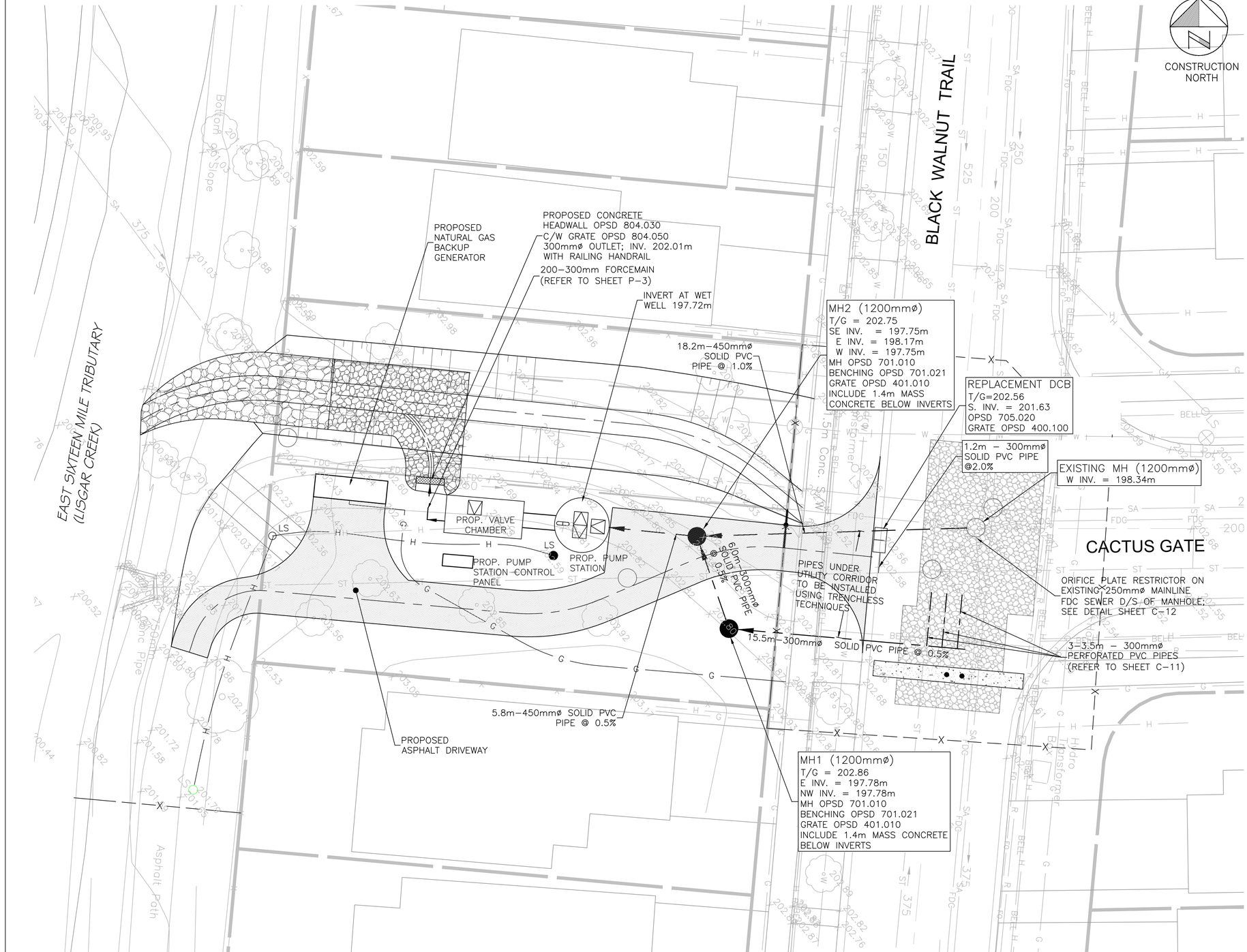
Last Saved: 2019-08-26

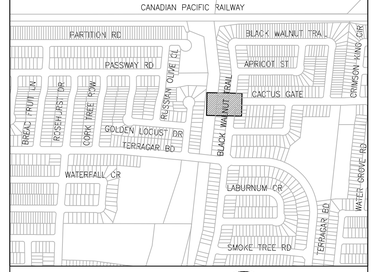



**STORM MANHOLE SCHEDULE**

| STRUCTURE NUMBER | STRUCTURE O.P.S.D. | GRATE O.P.S.D. | CAP STYLE | LID ELEVATION | INVERT (PIPE SIZE) | | | | | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | NORTH | NORTHEAST | NORTHWEST | SOUTH | SOUTHEAST | SOUTHWEST | WEST | EAST | |
| MH1 | 701.010 | 401.010 (A) | FLAT | 202.86 | | | 197.78 (300) | | | | | 197.78 (300) | 1200mmø STRUCTURE WITH FLAT TOP AND PERFORATED GRATE, BENCHING AND MASS CONCRETE |
| MH2 | 701.010 | 401.010 (A) | FLAT | 202.75 | | | | | 197.75 (300) | | 197.75 (450) | 198.17 (450) | 1200mmø STRUCTURE WITH FLAT TOP AND PERFORATED GRATE, BENCHING AND MASS CONCRETE |

REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| JAN. 2017 | INITIAL CITY REVIEW | M.S. |
| JUN. 2018 | ADD FDC PUMP STATION | M.S. |
| OCT. 2018 | 30% SUBMISSION | M.S. |
| MARCH 2019 | ISSUED FOR PERMIT | M.S. |
| MAY 2019 | ISSUED FOR UPDATED ECA | M.S. |
| AUG 2019 | ISSUED FOR TENDER | M.S. |




KEY PLAN

NOTE:
1. ALL MAINTENANCE HOLES TO BE BENCHED AS PER OPSD 701.021
2. CLASS 'B' BEDDING FOR ALL PROPOSED SEWERS
3. MH1 AND MH2 TO INCORPORATE MINIMUM 1.4m MASS CONCRETE BELOW INVERTS

LICENSED PROFESSIONAL ENGINEER
M. J. SENIOR
100118997
9/1/2019
PROVINCE OF ONTARIO

LEGEND

- WATERCOURSE
- CONTOUR (0.5m)
- PROPERTY LINE
- EASEMENT LIMITS
- CONSERVATION HALTON APPROX. REGULATION LIMIT
- HYDRO
- BELL
- GAS
- WATERMAIN SYSTEM
- STORM SEWER SYSTEM
- FDC SYSTEM
- SANITARY SEWER SYSTEM
- ROGERS COAXIAL CABLE
- ROGERS FIBRE CABLE
- PROPOSED FDC SYSTEM
- PROPOSED UTILITY TRENCH DEWATERING SYSTEM
- PROPOSED MANHOLE
- PROPOSED LIGHT POLE

SCALE 1:125 0 1.25 2.5 5m

LISGAR DISTRICT
UTILITY TRENCH DE-WATERING
AND FDC PUMPING SYSTEM

wood.

MISSISSAUGA

PRODUCED FOR – T&W, ENGINEERING AND WORKS

FDC SEWER SERVICING PLAN

| | | |
|---|---|---|
| SCALE 1:125 | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY M.B.K. | CHECKED BY M.S. | PLAN No. C-6 |
| DATE AUG 2019 | SHEET 07 OF 32 | |

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Last Saved: 2019-08-26 Last Saved By: mike.loncar Plotted: 2019-08-27 Plotted By: mike.loncar

Last Saved: 2019-10-18 Last Saved By: mike.loncar Plotted: 2019-10-18 Plotted By: mike.loncar Path: P:\2018\Projects\TPB188016 - Design & Contract Admin. - Lisgar\06_DES-ENG\01_CAD\02_DWGS\05_WR\CONTRACT\TPB188016-C7.dwg

EAST SIXTEEN MILE TRIBUTARY (LISGAR CREEK)

BLACK WALNUT TRAIL

PROPOSED NATURAL GAS BACK UP GENERATOR

PROPOSED HEADWALL

PROPOSED SWALE

REFER TO SHEET P-3 FOR PUMP STATION PLAN & PROFILE

FOUNDATION DRAIN COLLECTOR (FDC) LINE SURCHARGE RELIEF (HIGH FLOW)

PROPOSED CLEAR STONE DE-WATERING TRENCH

CACTUS GATE

PROPOSED FDC PUMP MH (3000mmø)

MH#1

MH#2

PROPOSED ASPHALT DRIVEWAY

PROPOSED VALVE CHAMBER

PROPOSED PUMP STATION CONTROL PANEL

UTILITY TRENCH DEWATERING LINE (LOW FLOW)

PROPOSED CONCRETE COLLAR

BACKFLOW VALVES

C/C-8 F/C-9 A/C-8 E/C-9 D/C-9 B/C-8

Bottom of Slope

Asphalt Path

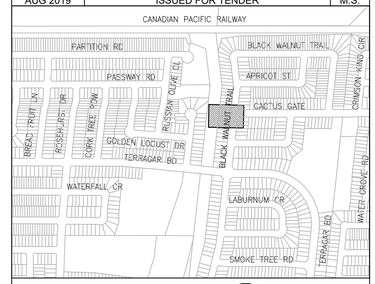
750mm Conc Pipe

1.5m Conc S/W

Hydro Transformer Box

Bell Transformer

| REVISIONS | | |
|---|---|---|
| DATE | DETAILS | INIT. |
| JAN. 2017 | INITIAL CITY REVIEW | M.S. |
| JUN. 2018 | ADD FDC PUMP STATION | M.S. |
| OCT. 2018 | 30% SUBMISSION | M.S. |
| MARCH 2019 | ISSUED FOR PERMIT | M.S. |
| MAY 2019 | ISSUED FOR UPDATED ECA | M.S. |
| AUG 2019 | ISSUED FOR TENDER | M.S. |




KEY PLAN

LICENSED PROFESSIONAL ENGINEER
M.J. SENIOR
100116937
6/1/2019
PROVINCE OF ONTARIO

## LEGEND

- WATERCOURSE
- CONTOUR (0.5m)
- PROPERTY LINE
- EASEMENT LIMITS
- CONSERVATION HALTON APPROX. REGULATION LIMIT
- HYDRO
- BELL
- GAS
- WATERMAIN SYSTEM
- STORM SEWER SYSTEM
- FDC SYSTEM
- SANITARY SEWER SYSTEM
- ROGERS COAXIAL CABLE
- ROGERS FIBRE CABLE
- PROPOSED FDC SYSTEM
- PROPOSED UTILITY TRENCH DEWATERING SYSTEM
- PROPOSED MANHOLE

SCALE 1:125 0 1.25 2.5 5m

# LISGAR DISTRICT UTILITY TRENCH DE-WATERING AND FDC PUMPING SYSTEM

wood.

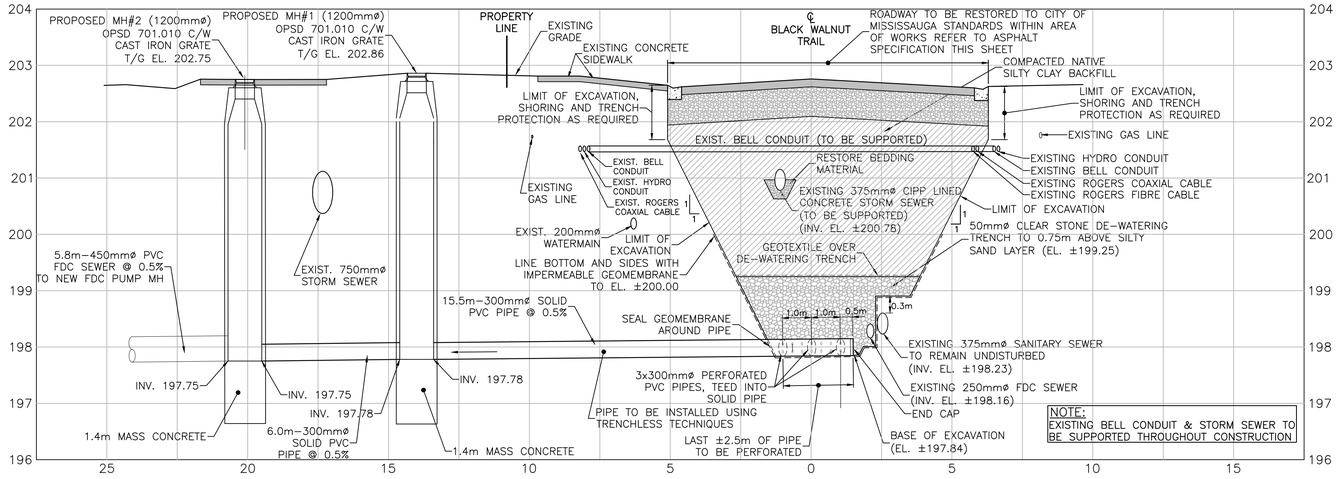
MISSISSAUGA

PRODUCED FOR – T&W, ENGINEERING AND WORKS

## CROSS SECTION LOCATION PLAN

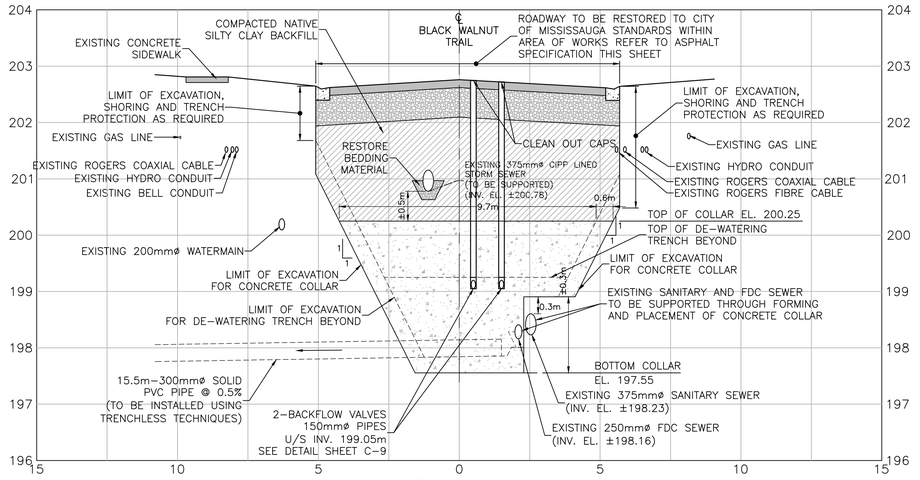
| | | |
|---|---|---|
| SCALE 1:125 | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY M.B.K. | CHECKED BY M.S. | PLAN No. C-7 |
| DATE AUG 2019 | SHEET 08 OF 32 | |

| REVISIONS | | |
|---|---|---|
| DATE | DETAILS | INIT. |
| JAN. 2017 | INITIAL CITY REVIEW | M.S. |
| OCT. 2018 | 30% SUBMISSION | M.S. |
| MARCH 2019 | ISSUED FOR PERMIT | M.S. |
| MAY 2019 | ISSUED FOR UPDATED ECA | M.S. |
| AUG 2019 | ISSUED FOR TENDER | M.S. |
| OCT 2019 | RE-ISSUED FOR TENDER | M.S. |



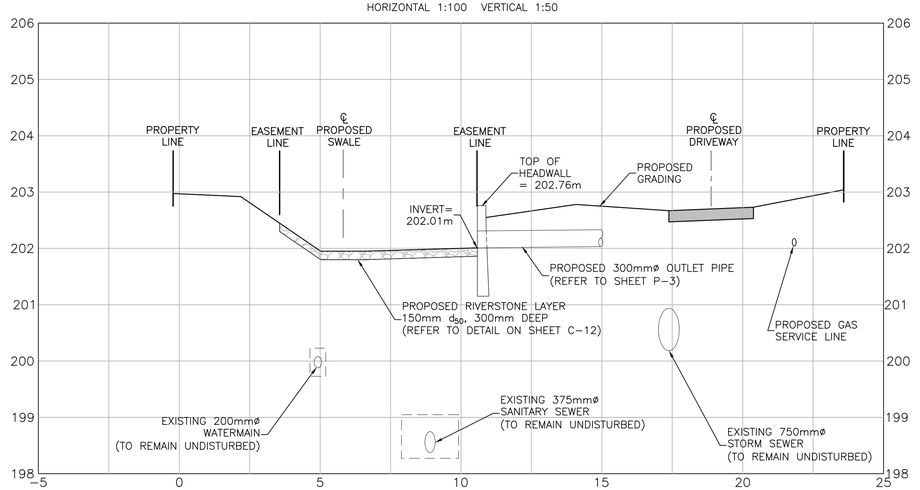

## SECTION A-A

SCALE
HORIZONTAL 1:100 VERTICAL 1:50




## SECTION B-B

SCALE
HORIZONTAL 1:100 VERTICAL 1:50




## SECTION C-C

SCALE
HORIZONTAL 1:100 VERTICAL 1:50

CITY OF MISSISSAUGA
ASPHALT SPECIFICATION
AS PER SHEET C-34595

| | |
|---|---|
| HL3 | 40 mm |
| HL8 | 100 mm |
| GRAN.'A' | 200 mm |
| GRAN.'B' | 325 mm |
| TOTAL | 665 mm |

LICENSED PROFESSIONAL ENGINEER
M.J. SENIOR
100118537
10/4/2019
PROVINCE OF ONTARIO

SCALE H1:100 0 1 2 4m
SCALE V1:50 0 0.5 1 2m

LISGAR DISTRICT
UTILITY TRENCH DE-WATERING
AND FDC PUMPING SYSTEM

wood.

MISSISSAUGA

PRODUCED FOR – T&W, ENGINEERING AND WORKS

SECTIONS - SHEET 1

| | | | |
|---|---|---|---|
| SCALE AS NOTED | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY R.M.B. | CHECKED BY M.S. | PLAN No. C-8 |
| DATE AUG 2019 | SHEET 09 OF 32 | |

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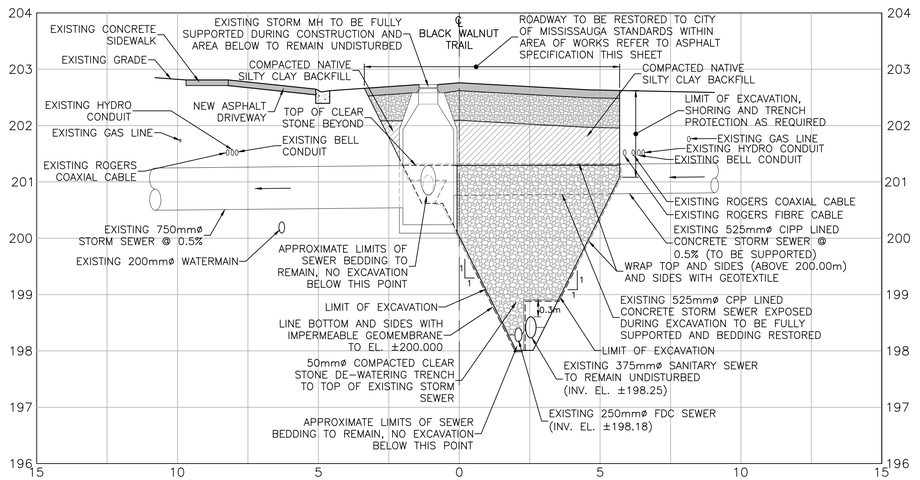
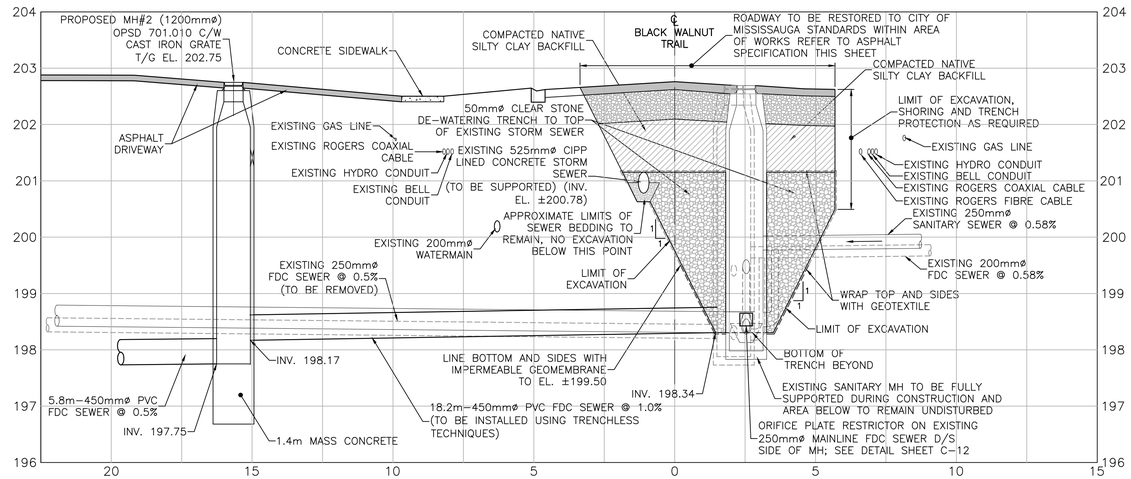
Last Saved: 2019-10-08 Last Saved By: mike.loncar Plotted: 2019-10-08 Plotted By: mike.loncar

| REVISIONS | | |
|---|---|---|
| DATE | DETAILS | INIT. |
| JAN. 2017 | INITIAL CITY REVIEW | M.S. |
| OCT. 2018 | 30% SUBMISSION | M.S. |
| MARCH 2019 | ISSUED FOR PERMIT | M.S. |
| MAY 2019 | ISSUED FOR UPDATED ECA | M.S. |
| AUG 2019 | ISSUED FOR TENDER | M.S. |
| | | |



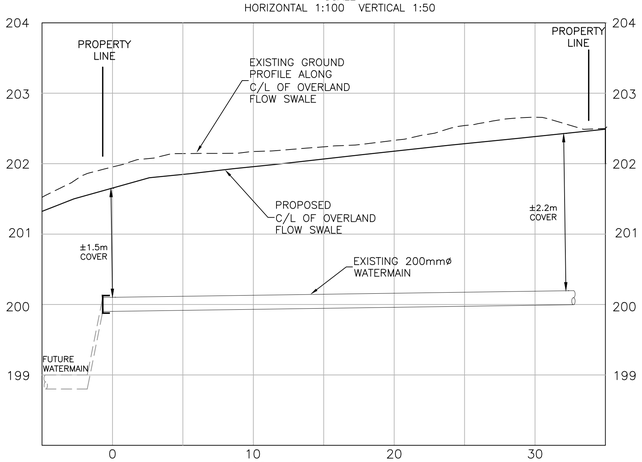

## SECTION D-D

SCALE
HORIZONTAL 1:100 VERTICAL 1:50




## SECTION E-E

SCALE
HORIZONTAL 1:100 VERTICAL 1:50




## SECTION F-F

SCALE
HORIZONTAL 1:200 VERTICAL 1:40

CITY OF MISSISSAUGA
ASPHALT SPECIFICATION
AS PER SHEET C-34595

| | |
|---|---|
| HL3 | 40 mm |
| HL8 | 100 mm |
| GRAN.'A' | 200 mm |
| GRAN.'B' | 325 mm |
| TOTAL | 665 mm |

LICENSED PROFESSIONAL ENGINEER
M. J. SENIOR
100116537
PROVINCE OF ONTARIO

SCALE H1:100 0 1 2 4m
SCALE V1:50 0 0.5 1 2m

# LISGAR DISTRICT
# UTILITY TRENCH DE-WATERING AND FDC PUMPING SYSTEM

wood.

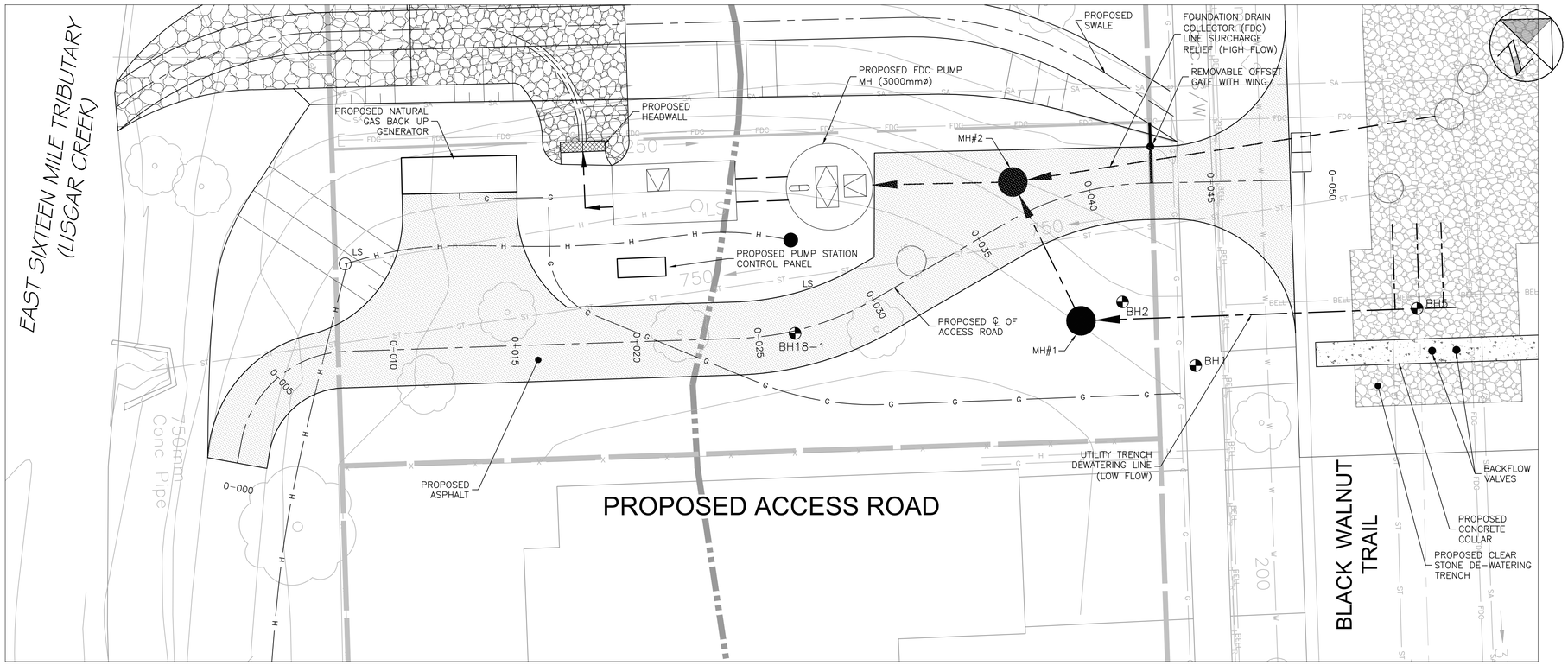
MISSISSAUGA

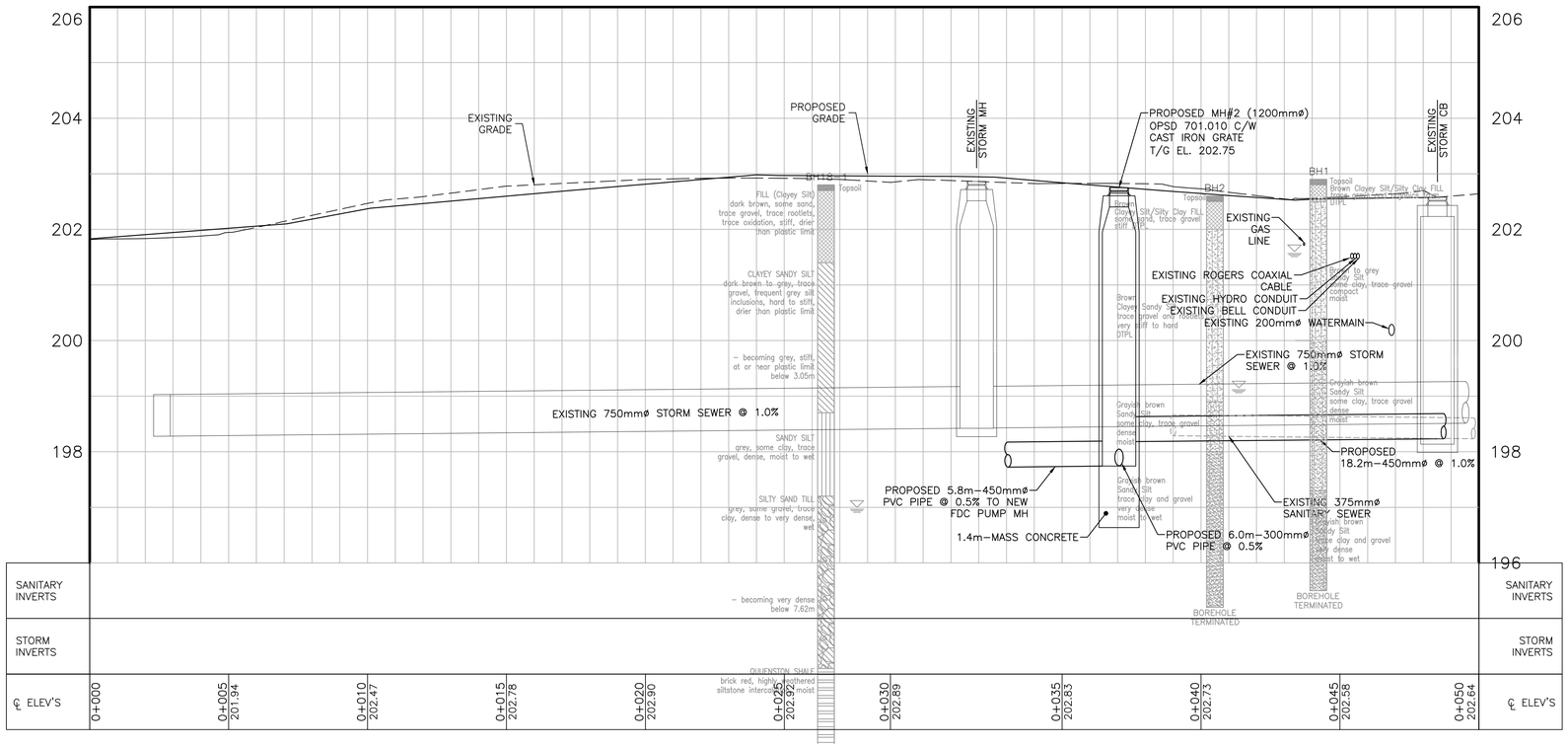
PRODUCED FOR – T&W, ENGINEERING AND WORKS

## SECTIONS - SHEET 2

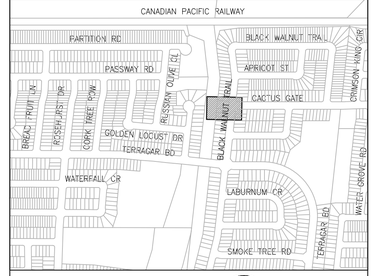
| | | |
|---|---|---|
| SCALE AS NOTED | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY R.M.B. | CHECKED BY M.S. | PLAN No. C-9 |
| DATE AUG 2019 | SHEET 10 OF 32 | |

Last Saved: 2019-10-17 Last Saved By: mike.loncar Plotted: 2019-10-18 Plotted By: mike.loncar Path: P:\2018\Projects\TPB188016 – Design & Contract Admin. – Lisgar\06_DES-ENG\01_CAD\02_DWGS\05_MR\CONTRACT\TPB188016-C9.dwg




| REVISIONS | | |
|---|---|---|
| DATE | DETAILS | INIT. |
| JAN. 2017 | INITIAL CITY REVIEW | M.S. |
| JUN. 2018 | ADD FDC PUMP STATION | M.S. |
| OCT. 2018 | 30% SUBMISSION | M.S. |
| MARCH 2019 | ISSUED FOR PERMIT | M.S. |
| MAY 2019 | ISSUED FOR UPDATED ECA | M.S. |
| AUG 2019 | ISSUED FOR TENDER | M.S. |




KEY PLAN

LICENSED PROFESSIONAL ENGINEER
M. J. SENIOR
100118537
8/1/2019
PROVINCE OF ONTARIO

## LEGEND

- WATERCOURSE
- PROPERTY LINE
- EASEMENT LIMITS
- CONSERVATION HALTON APPROX. REGULATION LIMIT
- HYDRO
- BELL
- GAS
- WATERMAIN SYSTEM
- STORM SEWER SYSTEM
- FDC SYSTEM
- SANITARY SEWER SYSTEM
- ROGERS COAXIAL CABLE
- ROGERS FIBRE CABLE
- PROPOSED FDC SYSTEM
- PROPOSED UTILITY TRENCH DEWATERING SYSTEM
- PROPOSED MANHOLE
- LS PROPOSED LIGHT POLE
- BH BOREHOLE LOCATION

SCALE H1:100 0 1 2 4m
SCALE V1:50 0 0.5 1 2m

LISGAR DISTRICT

PROPOSED ACCESS ROAD

wood.

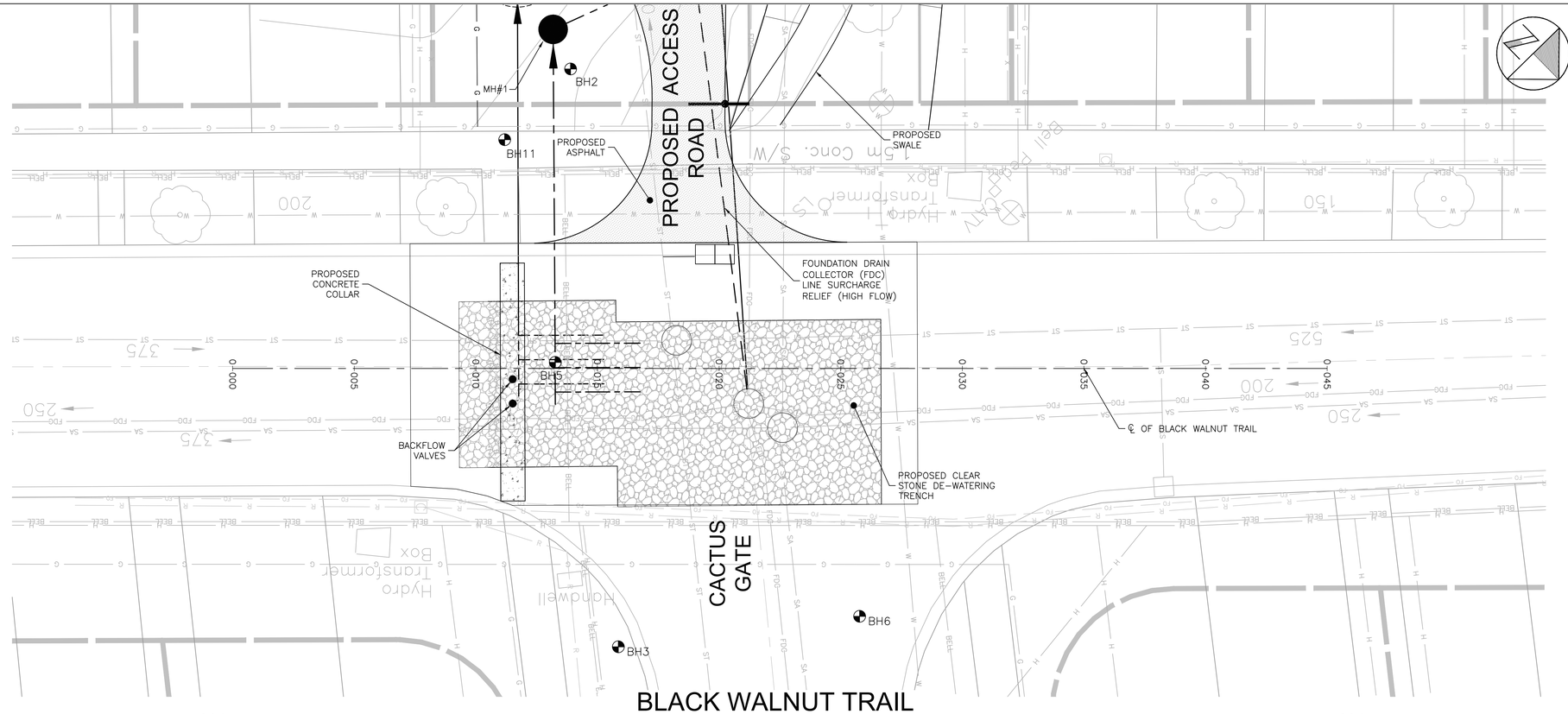
MISSISSAUGA

PRODUCED FOR - T&W, ENGINEERING AND WORKS

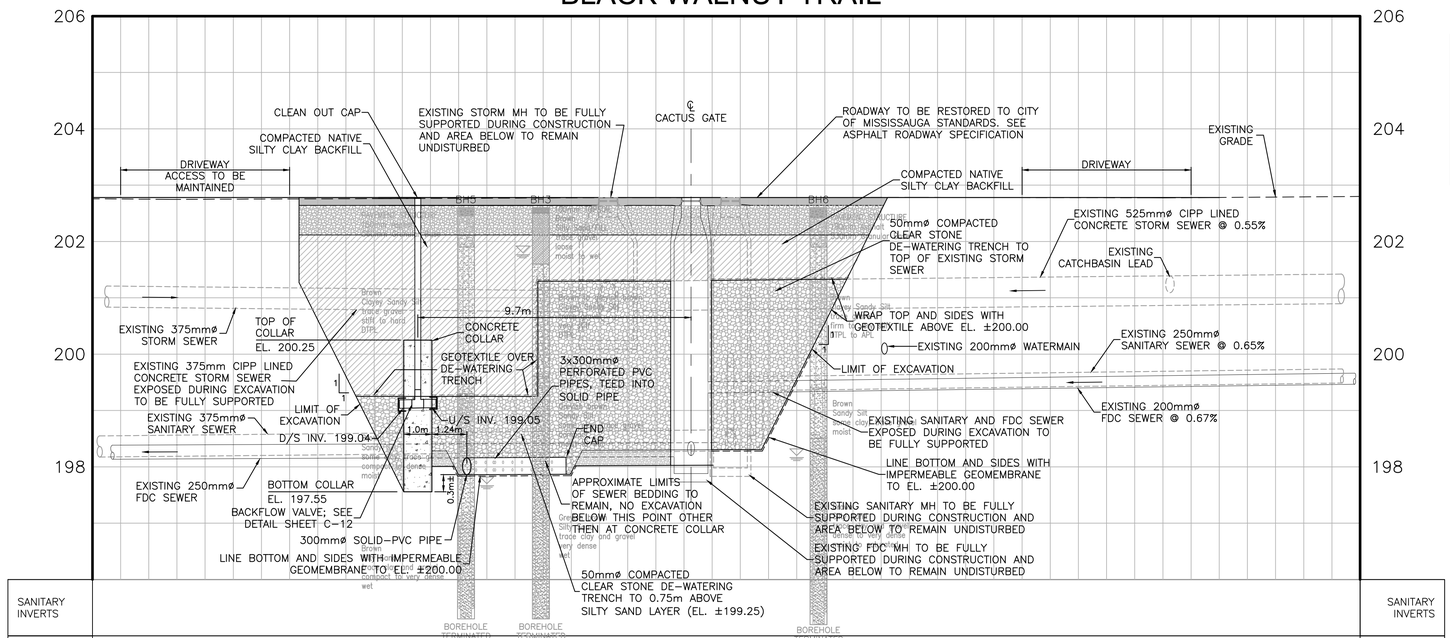
PLAN & PROFILE
MAINTENANCE ACCESS ROAD

| | | |
|---|---|---|
| SCALE H 1:100 V 1:50 | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY M.B.K. | CHECKED BY M.S. | PLAN No. C-10 |
| DATE AUG 2019 | SHEET 11 OF 32 | |

Last Saved: 2019-08-27 Last Saved By: mike.loncar Plotted: 2019-08-27 Plotted By: mike.loncar Path: P:\2018\Projects\TPB188016 - Design & Contract Admin. - Lisgar\06_DES-ENG\01_CAD\02_DWGS\05_MR\CONTRACT\TPB188016-C10.dwg




# BLACK WALNUT TRAIL

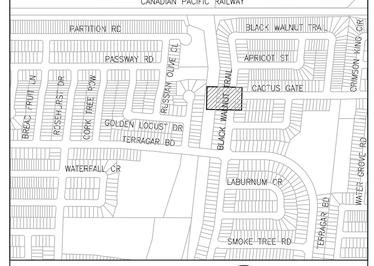



CITY OF MISSISSAUGA
ASPHALT SPECIFICATION
AS PER SHEET C-34595

| | |
|---|---|
| HL3 | 40 mm |
| HL8 | 100 mm |
| GRAN.'A' | 200 mm |
| GRAN.'B' | 325 mm |
| TOTAL | 665 mm |

REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| JAN. 2017 | INITIAL CITY REVIEW | M.S. |
| JUN. 2018 | ADD FDC PUMP STATION | M.S. |
| OCT. 2018 | 30% SUBMISSION | M.S. |
| MARCH 2019 | ISSUED FOR PERMIT | M.S. |
| MAY 2019 | ISSUED FOR UPDATED ECA | M.S. |
| AUG 2019 | ISSUED FOR TENDER | M.S. |




KEY PLAN

LICENSED PROFESSIONAL ENGINEER
M.J. SENIOR
100118537
6/1/2019
PROVINCE OF ONTARIO

## LEGEND

- WATERCOURSE
- CONTOUR (0.5m)
- PROPERTY LINE
- EASEMENT LIMITS
- CONSERVATION HALTON APPROX. REGULATION LIMIT
- HYDRO
- BELL
- GAS
- WATERMAIN SYSTEM
- STORM SEWER SYSTEM
- FDC SYSTEM
- SANITARY SEWER SYSTEM
- ROGERS COAXIAL CABLE
- ROGERS FIBRE CABLE
- PROPOSED FDC SYSTEM
- PROPOSED UTILITY TRENCH DEWATERING SYSTEM
- PROPOSED MANHOLE
- LS PROPOSED LIGHT POLE
- BH BOREHOLE LOCATION

SCALE H1:100 0 1 2 4m
SCALE V1:50 0 0.5 1 2m

LISGAR DISTRICT

PROPOSED ACCESS ROAD

wood.

MISSISSAUGA

PRODUCED FOR – T&W, ENGINEERING AND WORKS

PLAN & PROFILE
BLACK WALNUT TRAIL

| | | | |
|---|---|---|---|
| SCALE H 1:100 V 1:50 | AREA Z-55 | | PROJECT No. 17-146 |
| C.A.D.D. BY M.B.K. | CHECKED BY M.S. | | PLAN No. C-11 |
| DATE AUG 2019 | SHEET 12 OF 32 | | |

Last Saved: 2019-08-27 Path: P:\2018\Projects\TPB188016 – Design & Contract Admin. – Lisgar\06_DES-ENG\01_CAD\02_DWGS\05_WR\CONTRACT\TPB188016-C11.dwg
Last Saved By: mike.loncar Plotted: 2019-08-27 Plotted By: mike.loncar

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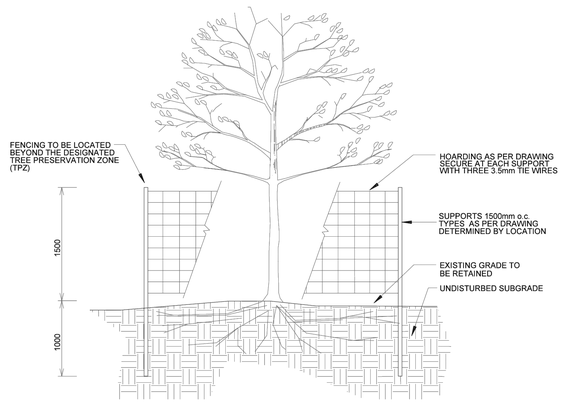
Last Saved: 2019-08-26 Last Saved By: mike.loncar Plotted: 2019-08-27 Plotted By: mike.loncar

# 02830-1

Hoarding
Tree Preservation Hoarding
Guideline

NOTE:
To be used as a Guideline only. Not to scale. Remove City title block & redraw to represent site specific conditions.
All site specific conditions are to be confirmed by the project consultant.




NOTES:

1. THE AREA WITHIN DESIGNATED TREE PRESERVATION ZONE OF ALL EXISTING TREES SHALL BE PROTECTED WITH HOARDING AS PER DETAIL.
2. THE AREA WITHIN THE TREE PRESERVATION ZONE HOARDING SHALL REMAIN UNDISTRUBED AND SHALL NOT BE USED FOR THE STORAGE OF MATERIALS, EQUIPMENT OR VEHICLES.
3. PRUNE BRANCHES TO REMOVE DAMAGED LIMBS. DO NOT DAMAGE LEADERS. ALL CUTS OVER 25mm SHALL BE TREATED IN ACCORDANCE WITH APPROPRIATE HORTICULTURAL PRACTICES AS APPROVED BY THE COMMUNITY SERVICES DEPARTMENT.
4. CUTTING OF ROOTS OR CHANGING OF GRADES AROUND EXISTING TREES WITHIN THE TREE PRESERVATION ZONE WILL NOT BE PERMITTED WITHOUT THE APPROVAL OF THE COMMUNITY SERVICES DEPARTMENT.
5. IF TREES ARE BEING ADVERSLY AFFECTED BY CONSTRUCTION, A WATERING AND FERTILIZING PROGRAM IS TO BE IMPLEMENTED TO THE SATISFACTION OF THE COMMUNITY SERVICES DEPARTMENT.
6. TREE PROTECTION HOARDING MAY BE REQUIRED AROUND INDIVIDUAL TREES TO REMAIN AND/OR AROUND TREE PRESERVATION ZONES AS IDENTIFIED ON THE APPROVED TREE PRESERVATION PLANS.
7. TREES IDENTIFIED FOR PRESERVATION BUT WHICH DIE, OR ARE DAMAGED BEYOND REPAIR, SHALL BE REPLACED AT THE DEVELOPERS' EXPENSE WITH A SIZE AND SPECIES OF TREE APPROVED BY THE COMMUNITY SERVICES DEPARTMENT.
8. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

Detail: 02830-1

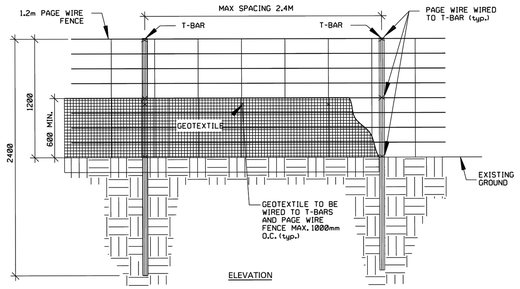
ORIGINAL DATE: Oct 09/15
REVISION DATE: month xx/1x

MISSISSAUGA

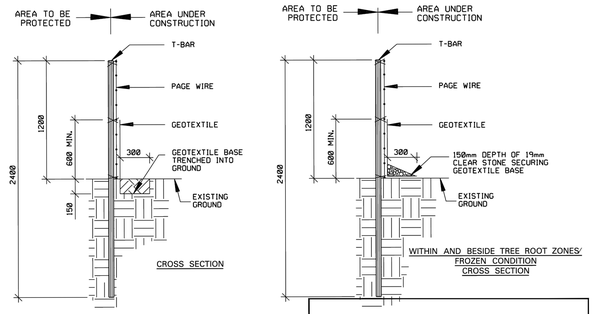
## TEMPORARY TREE PROTECTION FENCE DETAIL

N.T.S.

METRIC
ALL DIMENSIONS IN MILLIMETRES




ELEVATION




CROSS SECTION




WITHIN AND BESIDE TREE ROOT ZONES/ FROZEN CONDITION CROSS SECTION

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. IT IS THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN LOCATES OF ALL EXISTING UTILITIES AND SERVICING PRIOR TO INSTALLING HOARDING.
3. DO NOT DAMAGE VISIBLE TREE ROOTS WHEN INSTALLING T-BARS.
4. GEOTEXTILE TO WOVEN OR NON WOVEN. MINIMUM EQUIVALENT OPENING SIZE IS 0.15mm AND MAXIMUM EQUIVALENT OPENING SIZE IS 0.25mm.
5. GEOTEXTILE TO HAVE HORIZONTAL OVERLAP OF 1000mm MINIMUM AT JOINTS.
6. HOARDING MUST BE MAINTAINED IN SOUND CONDITION THROUGH ALL PHASES OF CONSTRUCTION UNTIL APPROVAL TO REMOVE HOARDING IS OBTAINED FROM THE COMMUNITY SERVICES DEPARTMENT.

MISSISSAUGA Transportation and Works

STANDARD

SEDIMENT CONTROL FENCE

| EFF. DATE | 2002-01-01 | SCALE | N.T.S. |
|---|---|---|---|
| REV. | | STANDARD No. | 2940.010 |

## TEMPORARY SEDIMENT CONTROL FENCE DETAIL

N.T.S.

| REVISIONS | | |
|---|---|---|
| DATE | DETAILS | INIT. |
| JAN. 2017 | INITIAL CITY REVIEW | M.S. |
| OCT. 2018 | 30% SUBMISSION | M.S. |
| MARCH 2019 | ISSUED FOR PERMIT | M.S. |
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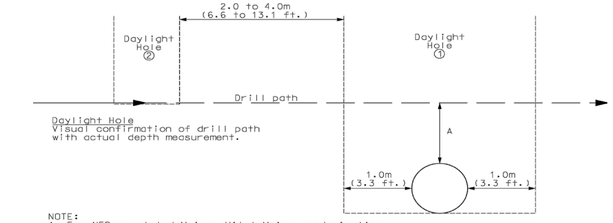
| AUG 2019 | ISSUED FOR TENDER | M.S. |
| | | |

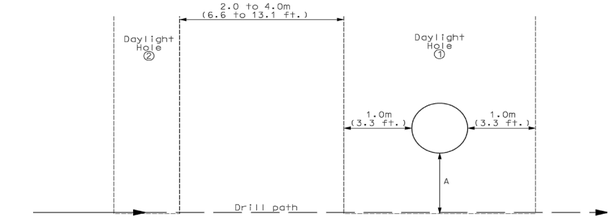
### Crossing Above Pipelines




Daylight Hole ② Visual confirmation of drill path with actual depth measurement.

NOTE:
A: For NEB-regulated Mains, Vital Mains, and pipelines NPS 12 and larger, use 1 m. For all other pipelines, use the vertical clearance from Table 2-5: Minimum Clearance Requirements Between Gas Pipelines and Other Structures (less than NPS 12).

### Crossing Below Pipelines

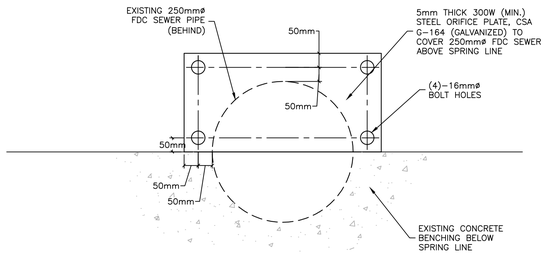



Daylight Hole ② Visual confirmation of drill path with actual depth measurement.

NOTE:
A: For NEB-regulated Mains, Vital Mains, and pipelines, NPS 12 and larger use 1 m. For all other pipelines, use the vertical clearance from Table 2-5: Minimum Clearance Requirements Between Gas Pipelines and Other Structures (less than NPS 12).

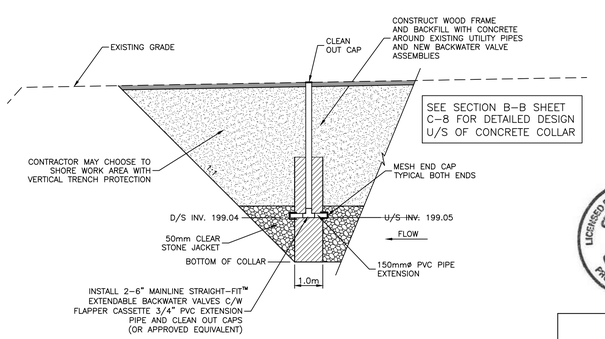
## PIPELINE LOCATION VERIFICATION AND CLEARANCE FOR HDD DETAIL

N.T.S.



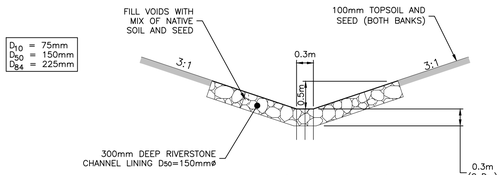

## ORIFICE CONTROL PLATE DETAIL

N.T.S

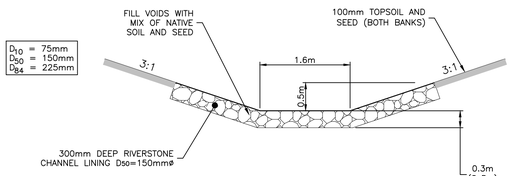



## BACKFLOW VALVE DETAIL

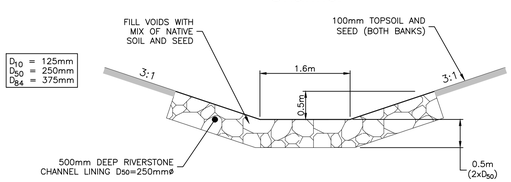
N.T.S.




Typical Detail for Outfall Channel



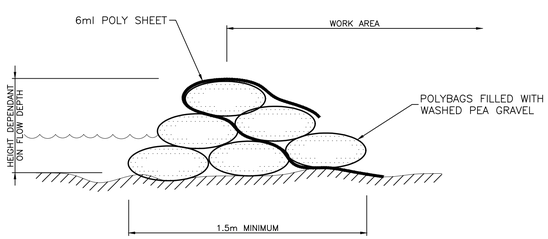

Typical Detail for 2% Sloped Main Channel




Typical Detail for 6% and 10% Sloped Main Channel

## RIVERSTONE LINED CHANNEL

N.T.S.




## TEMPORARY PEA GRAVEL SANDBAG DAM DETAIL

N.T.S.

LICENSED PROFESSIONAL ENGINEER
M. J. GEHNOR
100110537
6/1/2019
PROVINCE OF ONTARIO

LISGAR DISTRICT
UTILITY TRENCH DE-WATERING
AND FDC PUMPING SYSTEM

wood.

MISSISSAUGA

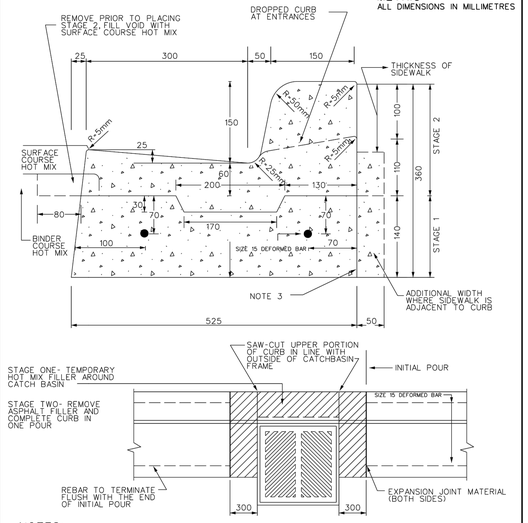
PRODUCED FOR – T&W, ENGINEERING AND WORKS

DETAILS - SHEET 1

| SCALE | AS NOTED | AREA | Z-55 | PROJECT No. | 17-146 |
|---|---|---|---|---|---|
| C.A.D.D. BY | R.M.B. | CHECKED BY | M.S. | PLAN No. | C-12 |
| DATE | AUG 2019 | SHEET | 13 OF 32 | | |

Last Saved: 2019-08-19 Last Saved By: mike.loncar Plotted: 2019-08-27 Plotted By: mike.loncar Path: P:\2018\Projects\TPB188016 - Design & Contract Admin. - Lisgar\06_DES-ENG\01_CAD\02_DWGS\05_WR\CONTRACT\TPB188016-C13.dwg

METRIC
ALL DIMENSIONS IN MILLIMETRES




NOTES:

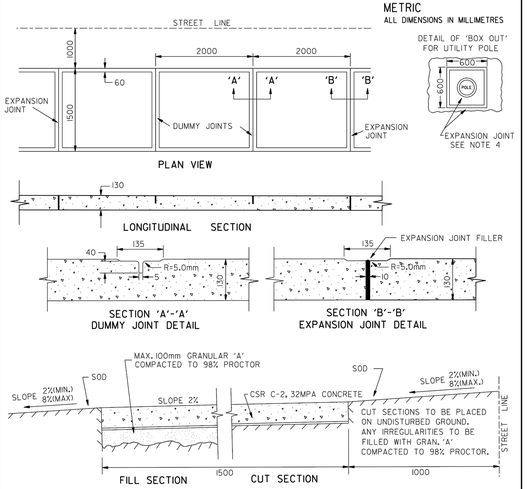
1. FLEXIBLE AND COMPOSITE PAVEMENT SHALL BE 5mm ABOVE THE ADJACENT EDGE OF GUTTER.
2. WHERE THE SIDEWALK IS CONTINUOUS TO THE CURB, AT ENTRANCES LOWER THE HEIGHT OF THE ADDITIONAL CONCRETE AT THE REAR OF THE CURB TO 150mm.
3. FOR SLIPFORMING PROCEDURE, A 5% BATTER IS ACCEPTABLE.
4. TREATMENT AT ENTRANCES SHALL CONFORM WITH OPSD-351.01.
5. OUTLET TREATMENT SHALL CONFORM WITH OPSD-610 SERIES.
6. THE LENGTH OF TRANSITION FROM ONE CURB TYPE TO ANOTHER SHALL BE 3.0m EXCEPT IN CONJUNCTION WITH GUIDE RAIL, IT SHALL CONFORM TO OPSD-900 SERIES.
7. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN.
8. BASE CURB IS TO BE FLUSHED THEN BLOWN OFF WITH HIGH PRESSURE AIR TO ENSURE A CLEAN DRY SURFACE.
9. ALL CONCRETE CSA, C-2, 32MPa.

MISSISSAUGA

STANDARD
CONCRETE BARRIER CURB
WITH STANDARD GUTTER
TWO STAGE CONSTRUCTION

| | | | |
|---|---|---|---|
| EFF. DATE | 2015-12-11 | SCALE | N.T.S. |
| REV. | 2016-09-21 | STANDARD No. | 2230.010 |

METRIC
ALL DIMENSIONS IN MILLIMETRES




NOTES:

1. DEPTH OF SIDEWALK TO BE 180mm AT COMMERCIAL OR INDUSTRIAL DRIVEWAYS
2. EXPANSION JOINTS ARE REQUIRED IN SIDEWALK AT 6000mm INTERVALS AND:
   a) BETWEEN SIDEWALK AND ABUTTING CURB
   b) ADJACENT TO EXISTING STRUCTURES (WALKS, CURBS, UTILITY POLES, HYDRANTS, MANHOLES, ETC.) OR AT THE DISCRETION OF THE COMMISSIONER OF TRANSPORTATION AND WORKS
3. DUMMY JOINTS SHALL HAVE STANDARD SPACING OF 2000mm AND WILL BE FORMED AFTER THE CONCRETE HAS RECEIVED ITS INITIAL SET
4. WHEN SIDEWALKS ARE ADJACENT TO CURBS, EXPANSION JOINTS SHALL COINCIDE WITH THE CURB EXPANSION JOINTS
5. FILL SECTIONS REQUIRING GREATER THAN 100mm TO BE FILLED WITH NATIVE MATERIAL COMPACTED TO 98% PROCTOR

MISSISSAUGA

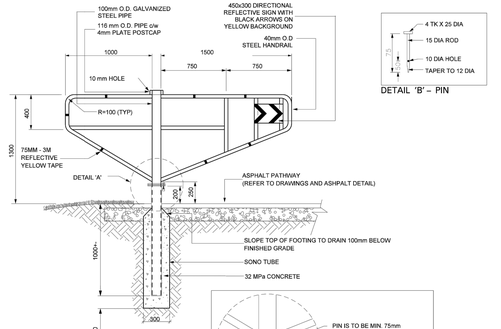
STANDARD
CONCRETE SIDEWALK

| | | | |
|---|---|---|---|
| EFF. DATE | 2015-03-27 | SCALE | N.T.S. |
| REV. 4 | 2015-03-27 | STANDARD No. | 2240.010 |

# 02870-1

## Gates
## Removable Offset Gate With Wing

NOTE:
TO BE USED AS A GUIDELINE ONLY. NOT TO SCALE. REMOVE CITY TITLE BLOCK AND REDRAW TO REPRESENT SITE SPECIFIC CONDITIONS. ALL SITE SPECIFIC CONDITIONS ARE TO BE CONFIRMED BY THE PROJECT CONSULTANT.







DETAIL 'B' - PIN

DETAIL 'A' - SLEEVE CONNECTION

NOTES:

1. ALL GATE MATERIAL MUST BE GALVANIZED AFTER FABRICATION.
2. ALL 40 DIA. PIPE MUST BE STD. SCHEDULE 40 NEW BUTT WELD PIPE.
3. GATE POST TO EXTEND A MIN. OF 1000 INTO FOUNDATION SLEEVE PIPE.
4. PIN IS WELDED TO GATE WITH A 300 LONG GALV. CHAIN.
5. DIRECTIONAL SIGN TO BE MIN. 1.5 MM TK ALUMINUM OR GALVANIZED METAL RIVETTED TO GATE AT EACH CORNER ON EACH SIDE OF GATE.
6. ALL WELDING AND GALVANIZING DRIPS AND SPLATTERS TO BE REMOVED
7. 40MM O.D STEEL HANDRAIL ARE TO BE CONTINUOUS PIPE.
8. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED
9. THE LOCATION OF THE GATE IS TO BE APPROVED BY A COMMUNITY SERVICES REPRESENTATIVE
10. FOR ASPHALT REFER TO C.S. DETAIL 02510-1.
11. PADLOCK TO BE PROVIDED BY THE COMMUNITY SERVICES DEPARTMENT

N.T.S.

Detail: 02870-1 ORIGINAL DATE: Jan 17/17 REVISION DATE: month xx/1x

MISSISSAUGA

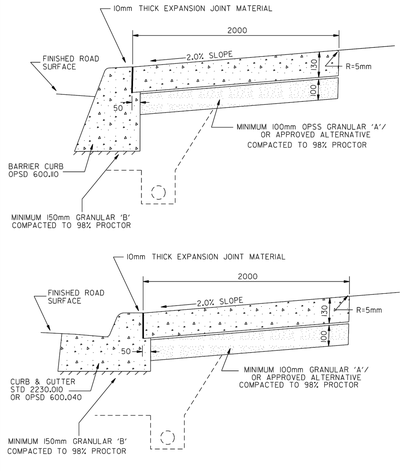
TYPICAL OFFSET GATE DETAIL N.T.S.

REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| JAN. 2017 | INITIAL CITY REVIEW | M.S. |
| OCT. 2018 | 30% SUBMISSION | M.S. |
| MARCH 2019 | ISSUED FOR PERMIT | M.S. |
| MAY 2019 | ISSUED FOR UPDATED ECA | M.S. |
| AUG 2019 | ISSUED FOR TENDER | M.S. |
| | | |

LICENSED PROFESSIONAL ENGINEER
M. J. SENIOR
100118537
6/1/2019
PROVINCE OF ONTARIO

METRIC
ALL DIMENSIONS IN MILLIMETRES




NOTES:

1. AT INDUSTRIAL, COMMERICAL AND MULTI-RESIDENTIAL DRIVEWAYS, SIDEWALK SHALL BE 180mm THICK AND THE SIDEWALK SLOPE SHALL BE ADJUSTED TO FIT THE CURB AT THE DRIVEWAY DEPRESSION.
2. CONCRETE TO BE AS PER OPSS 1350
3. BEDDING TO BE SPECIFIED.
4. THIS STANDARD TO BE READ IN CONJUNCTION WITH STD. 2240.010
5. AGGREGATE MATERIALS CONTAINING RECLAIMED PORTLAND CEMENT AND/OR RECLAIMED ASPHALT PAVEMENT MAY ONLY BE USED IN NON-LOAD BEARING AREAS. THE FINAL BLEND SHALL NOT CONTAIN MORE THAN 30% PERCENT BY MASS OF ASPHALT COATED PARTICLES AS DETERMINED BY PERCENTAGE OF ASPHALT COATED PARTICLES, LS621.

MISSISSAUGA

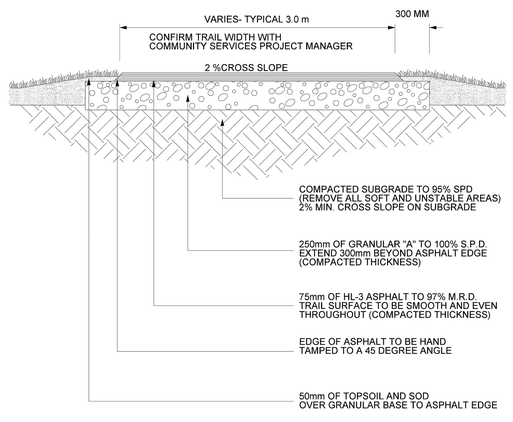
STANDARD
CONCRETE SIDEWALK
ABUTTING CURB
OR CURB AND GUTTER

| | | | |
|---|---|---|---|
| EFF. DATE | 2002-01-01 | SCALE | N.T.S. |
| REV. 3 | 2017-07-18 | STANDARD No. | 2240.040 |

# 02510-1

## Paving
## Asphalt Park Trail

NOTE:
TO BE USED AS A GUIDELINE ONLY. NOT TO SCALE. REMOVE CITY TITLE BLOCK AND REDRAW TO REPRESENT SITE SPECIFIC CONDITIONS. ALL SITE SPECIFIC CONDITIONS ARE TO BE CONFIRMED BY THE PROJECT CONSULTANT.



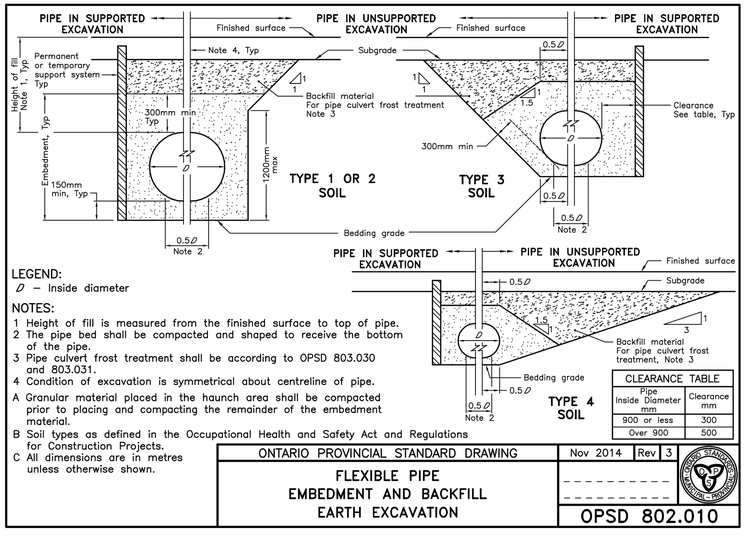

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED
2. THIS DETAIL TO BE USED IN CONJUNCTION WITH THE APPROVED LAYOUT DRAWING.
3. WIDTH OF TRAIL TO BE CONFIRMED WITH COMMUNITY SERVICES DEPARTMENT

Detail: 02510-1 ORIGINAL DATE: Oct 09/15 REVISION DATE: month xx/1x

MISSISSAUGA

TYPICAL ASPHALT PARK TRAIL DETAIL N.T.S.




LEGEND:
D – Inside diameter

NOTES:

1 Height of fill is measured from the finished surface to top of pipe.
2 The pipe bed shall be compacted and shaped to receive the bottom of the pipe.
3 Pipe culvert frost treatment shall be according to OPSD 803.030 and 803.031.
4 Condition of excavation is symmetrical about centreline of pipe.
A Granular material placed in the haunch area shall be compacted prior to placing and compacting the remainder of the embedment material.
B Soil types as defined in the Occupational Health and Safety Act and Regulations for Construction Projects.
C All dimensions are in metres unless otherwise shown.

| CLEARANCE TABLE | |
|---|---|
| Pipe Inside Diameter mm | Clearance mm |
| 900 or less | 300 |
| Over 900 | 500 |

ONTARIO PROVINCIAL STANDARD DRAWING

FLEXIBLE PIPE
EMBEDMENT AND BACKFILL
EARTH EXCAVATION

Nov 2014 Rev 3

OPSD 802.010

LISGAR DISTRICT
UTILITY TRENCH DE-WATERING
AND FDC PUMPING SYSTEM

wood.

MISSISSAUGA

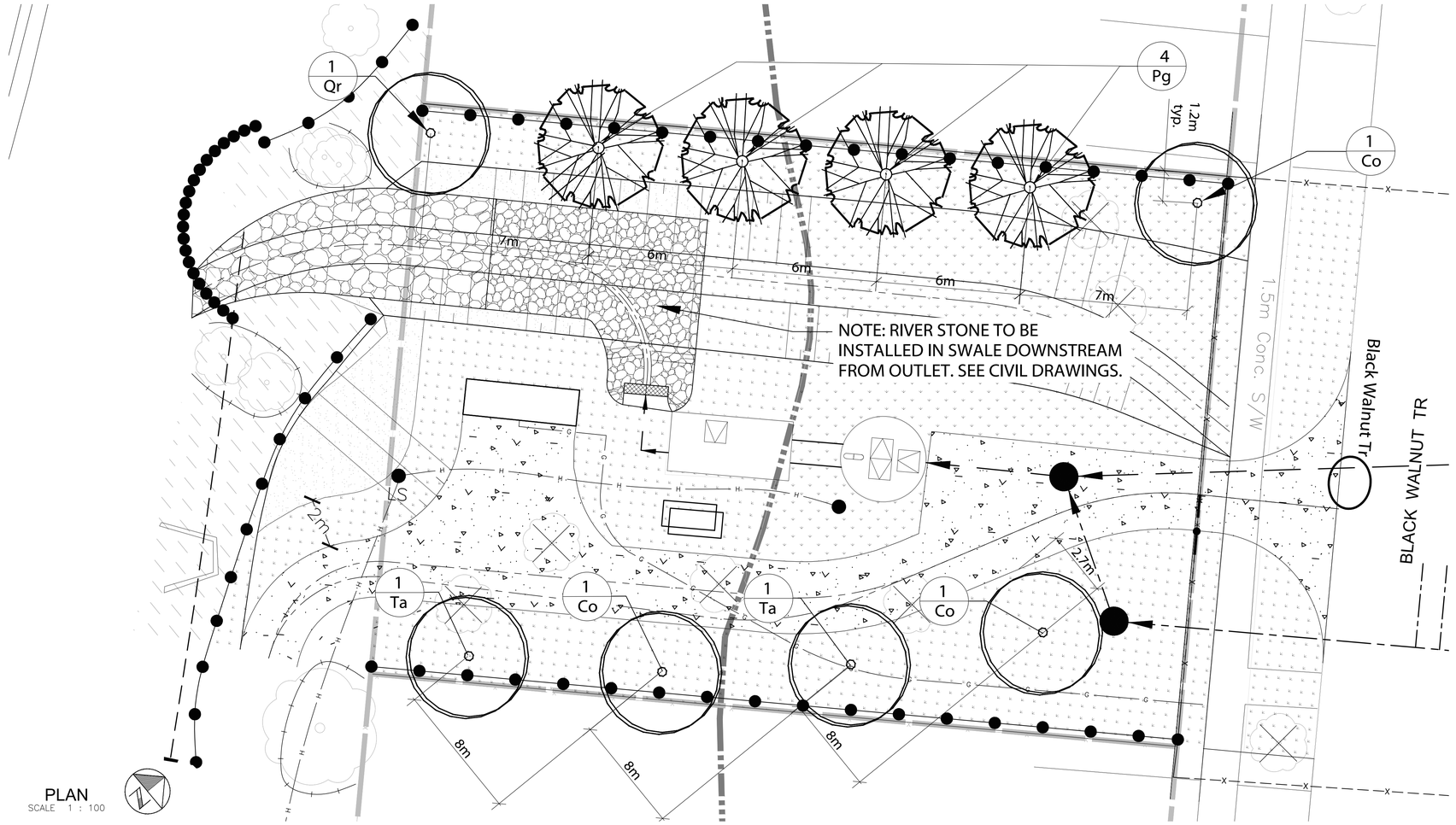
PRODUCED FOR – T&W, ENGINEERING AND WORKS

DETAILS - SHEET 2

| | | | |
|---|---|---|---|
| SCALE | AS NOTED | AREA | Z-55 |
| C.A.D.D. BY | M.L. | CHECKED BY | M.S. |
| DATE | AUG 2019 | SHEET | 14 OF 32 |

PROJECT No. 17-146
PLAN No. C-13

Last Saved: 2019-08-16 Last Saved By: maryanne Plotted: 2019-08-16 Plotted By: maryanne Path: W:\PROJECTS\DA17_011_01_LisgarMeadowBrookDesign\Drawings\CAD\FigTD1-3 CactusGate_DA_20190815.dwg




## Note 1: General

1. These drawings are to be read in conjunction with the written specifications for the project and all other drawings and details.
2. Any ambiguity in these drawings is to be reported to the Contract Administrator. Contractor is not to proceed in uncertainty.
3. Contractor shall visit the site to confirm all site conditions prior to submitting bids. Discrepancies to be reported to the Landscape Architect for clarification.
4. Upon completion each day, remove all debris, garbage and surplus material from the site. Keep the site clean and usable at all times.
5. Contractor shall supply all plants and materials in quantities sufficient to complete work shown on sheet L1.
6. Plant materials collected from wild sources will not be accepted. The Contract Administrator may require that supplier's invoices for plant materials be submitted for inspection.
7. Any substitution of plant material will require the written approval of Contract Administrator.
8. The Contract Administrator reserves the right to refuse acceptance of any plant displaying poor growth habits, injury or disease. Any plant material that is rejected by the Contract Administrator will be promptly removed from the site and replaced by the Contractor at no additional cost to the project.
9. See Details 1 - 2 on sheet L2 for detailed planting instructions.

## Note 2: Planting

1. Trees must be planted according to setbacks from pathways, light standards, other trees, and fences shown on drawing L1.
2. Layout of plant material to be executed by the Contractor and approved by the Contract Administrator prior to installation.
3. Planting shall take place within 7 days of completion of final grading. If planting cannot take place in this period, a temporary cover crop (to be approved by Contract Administrator) shall be seeded.
4. All plants shall be planted in accordance with the appropriate planting details on the drawings and written specifications.
5. All plants are to be planted in approved top soil free from weeds, subsoil, roots, stones, lumps of clay and toxic material.
6. Plant so that nursery soil line matches finished grade after settling.
7. Gently tamp topsoil when backfilling to remove air pockets.
8. Build a soil saucer around out edge of planting hole. Saucer shall be soaked with water and covered with mulch immediately following planting.
9. All individual tree whips and shrubs are to be mulched using shredded bark mulch as per Details and Planting Specifications.
10. Install plastic perforated spiralled strip trunk protection on all deciduous trees as per Details and Specifications.
11. Remove all nursery tags, metal or plastic bindings, and vine supports.

## Note 3: Sodding & Seeding

**Area to be sodded is: 615 m$^2$**
**Area to be seeded is: 55 m$^2$**
**Area of contingency seeding is: 110 m$^2$**

1. Area for payment shall be surveyed on site by the contractor and approved by Landscape Architect.

Contractor shall follow OPPS 571: Construction Specification for Sodding (Metric Version) for sodding and Contractor shall follow OPPS 572: Construction Specification for Seed and Cover (Metric Version) with Special Provision for seedmix provided for seeding.

2. All sodding and seeding to be completed after the planting works.
3. Both contingency and regular seeding to use seed mix in Table 2: Seed Mix

## Note 4: Tree Compensation Requirements

1. City of Mississauga Standards require 2:1 compensation for trees removed
2. 6 trees will be removed as part of this work, therefore 12 trees are required for compensation
3. Due to space limitations only 10 trees could be planted on the site. Therefore cash in lieu is required for compensation for the remaining 2 trees. City of Mississauga cash in lieu fee is $574.50 per tree, so $1,149.00 in compensation fees is required.

## TABLE 1: PLANT LIST

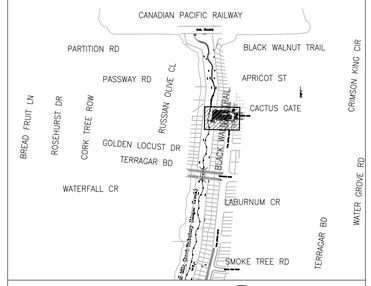
| | | Species | | |
|---|---|---|---|---|
| Quantity | Code | Scientific Name | Common Name | Size |
| 3 | Co | *Celtis occidentalis* | Common Hackberry | 60 mm cal. |
| 4 | Pg | *Picea glauca* | White Spruce | 180 cm ht. |
| 2 | Ta | *Tilia americana* | Basswood | 60 mm cal. |
| 1 | Qr | *Quercus rubra* | Red Oak | 60 mm cal. |
| **10** | **TOTAL** | | | |

## TABLE 2: SEED MIX

| **Conservation Halton Early Succession/Riparian Mix** | | |
|---|---|---|
| ***Native species*** | | *Seed Mix %* |
| Canada Anemone | *Anemone canadensis* | 1.0% |
| New England Aster | *Symphyotrichum novae-angliae* | 1.0% |
| Purple Stemmed Aster | *Symphyotrichum puniceum* | 1.0% |
| Canada Goldenrod | *Solidago canadensis* | 4.0% |
| Virgins Bower | *Clematis virginiana* | 4.0% |
| Wild Bergamot | *Monarda fistulosa* | 4.0% |
| Black Eyed Susan | *Rudbeckia hirta* | 5.0% |
| Common Milkweed | *Asclepias syriaca* | 5.0% |
| Blue Vervain | *Verbena hastata* | 10.0% |
| Little Bluestem | *Schizachyrium scoparuim* | 10.0% |
| Path Rush | *Juncus tenuis* | 10.0% |
| Meadow/Open Field Sedge | *Carex granularis* | 20.0% |
| Fowl Bluegrass | *Poa palustris* | 25.0% |
| | **Total** | **100.00%** |
| ***Cover Crop*** | | *Seed Mix %* |
| Canada Wild Rye | *Elymus canadensis* | 45.00% |
| Annual Oats | *Avena sativa* | 30.00% |
| Creeping Bent Grass | *Agrostis stolonifera* | 25.00% |
| | **Total** | **100.00%** |

* Substitutions to the seed mixes must be approved in writing by the Contract Administrator
** The seed of native species shall be packaged separetely from the seed of non-native species.
*** mix 15kg of nurse crop per 7kg of native seed mix and spread at a rate of 22kg/ha

| REVISIONS | | |
|---|---|---|
| DATE | DETAILS | INIT. |
| APR. 2017 | FIRST DRAFT TO AMECFW | M.A.Y. |
| JULY 2017 | EDITS BASED ON CITY COMMENTS | M.A.Y. |
| OCT 2017 | EDITS BASED ON UPDATED BASE PLAN | K.S.L. |
| FEB 2019 | EDITS BASED ON CITY COMMENTS | M.A.Y. |
| MAR 2019 | 90% DESIGN SUBMISSION | M.A.Y. |
| MAY 2019 | EDITS BASED ON CITY COMMENTS | M.A.Y. |
| AUG. 2019 | ISSUED FOR TENDER | N.W. |
| | | |




KEY PLAN

## LEGEND - ENGINEERING

FOR DETAILS SEE ENGINEERING DRAWINGS BY WOOD

- PROPERTY LINE
- CONSERVATION HALTON APPROXIMATE REGULATION LIMIT
- HYD — HYDRO
- BELL — BELL
- GAS — GAS
- WTR — WATERMAIN SYSTEM
- STM — STORM SEWER SYSTEM
- FDC — FDC SYSTEM
- SAN — SANITARY SEWER SYSTEM
- EXISTING TREE TO BE REMOVED
- COMPACTED NATIVE SILTY CLAY BACKFILL
- 50mmø CLEAR STONE
- LS — LIGHT STANDARD
- ESC FENCING

## LEGEND - LANDSCAPE WORK

- DECIDUOUS TREE
- CONIFEROUS TREE
- # / Xx — NUMBER OF PLANTS / SPECIES CODE
- SOD
- SEEDING
- SEEDING – CONTINGENCY. TO BE SEEDED ONLY IF DISTURBED DURING CONSTRUCTION

LISGAR DISTRICT
UTILITY TRENCH DE-WATERING
AND FDC PUMPING SYSTEM

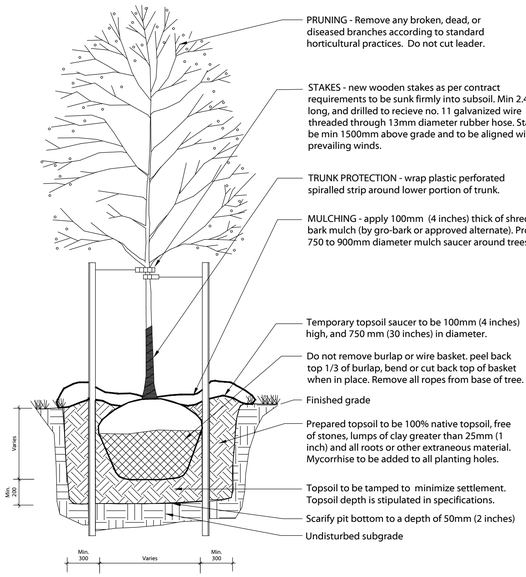
DOUGAN & ASSOCIATES
ECOLOGICAL CONSULTING & DESIGN
77 Wyndham Street South • Guelph ON N1E 5R1 • T 519.822.1609 • F 519.822.5389 • www.dougan.ca

MISSISSAUGA

PRODUCED FOR – T&W, ENGINEERING AND WORKS

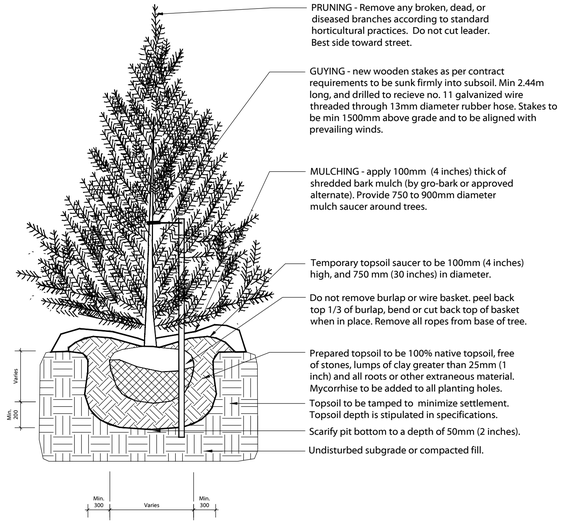
LANDSCAPE PLAN

| | | | |
|---|---|---|---|
| SCALE AS NOTED | AREA Z-55 | PROJECT No. 17-146 | |
| C.A.D.D. BY NW | CHECKED BY MAY | PLAN No. L1 | |
| DATE AUG 2019 | SHEET 15 OF 32 | | |




NOTES
1) SAUCER SHALL BE SOAKED WITH WATER AND MULCHED IMMEDIATELY FOLLOWING PLANTING
2) PLANT STOCK MOVED WHILE IN LEAF SHALL BE COVERED WHILE IN TRANSIT OR IN TEMPORARY STORAGE
3) PLANT TREE SO THAT NURSERY SOIL LINE MATCHES FINISHED GRADE AFTER SETTLING
4) TAMP TOPSOIL WHEN BACKFILLING TO REMOVE AIR POCKETS
5) REMOVE ALL NURSERY TAGS, METAL OR PLASTIC

1 DECIDUOUS TREE PLANTING - CALIPER - MULCH
N.T.S.




NOTES
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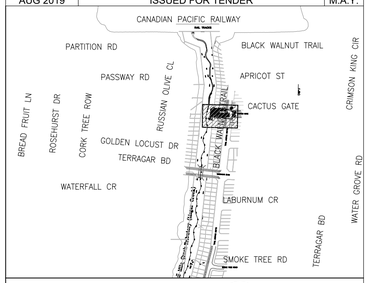
2) PLANT STOCK MOVED WHILE IN LEAF SHALL BE COVERED WHILE IN TRANSIT OR IN TEMPORARY STORAGE
3) PLANT TREE SO THAT NURSERY SOIL LINE MATCHES FINISHED GRADE AFTER SETTLING
4) TAMP TOPSOIL WHEN BACKFILLING TO REMOVE AIR POCKETS
5) REMOVE ALL NURSERY TAGS, METAL OR PLASTIC

2 CONIFEROUS TREE PLANTING - CALIPER - MULCH
N.T.S.

| REVISIONS | | |
|---|---|---|
| DATE | DETAILS | INIT. |
| APR. 2017 | FIRST DRAFT TO AMECFW | M.A.Y. |
| JULY 2017 | EDITS BASED ON CITY'S COMMENTS | M.A.Y. |
| OCT 201□ | EDITS BASED ON UPDATED BASE PLAN | K.S.L. |
| FEB 2019 | EDITS BASED ON CITY COMMENTS | M.A.Y. |
| MAR 2019 | 90□ DESIGN SUBMISSION | M.A.Y. |
| AUG 2019 | ISSUED FOR TENDER | M.A.Y. |




KEY PLAN

LISGAR DISTRICT
UTILITY TRENCH DE-WATERING
AND FDC PUMPING SYSTEM

DOUGAN & ASSOCIATES
ECOLOGICAL CONSULTING & DESIGN
77 Wyndham Street South • Guelph ON N1E 5R3 • T 519.822.1609 • F 519.822.5389 • www.dougan.ca

MISSISSAUGA
PRODUCED FOR – T&W, ENGINEERING AND WORKS

LANDSCAPE PLAN DETAILS

| | | |
|---|---|---|
| SCALE AS NOTED | AREA | PROJECT No. 17-146 |
| C.A.D.D. BY NW | CHECKED BY MAY | PLAN No. L2 |
| DATE AUG 2019 | SHEET 16 OF 32 | |

ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS
MARY ANNE YOUNG
OALA
2019
MEMBER

Path: W:\PROJECTS\DA17_011_01_LisgarMeadowBrookDesign\Drawings\CAD\FigTD1-3 CactusGate_DA_20190815.dwg
Plotted By: maryanne
Plotted: 2019-08-16
Last Saved By: maryanne
Last Saved: 2019-08-16

Last Saved: 2019-08-14 Last Saved By: daniel.chan Plotted: 2019-08-14 Plotted By: daniel.chan Path: \\Brl-fs1\project\2018\Projects\PB188016 - Design & Contract Admin. - Lisgar\06_DES-ENG\01_CAD\02_DWGS\02_MUNI\TDC Pumping Station\PID DWG\TDC Pump Station PFD.dwg

| REVISIONS | | |
|---|---|---|
| DATE | DETAILS | INIT. |
| SEP. 2018 | ISSUED FOR 30% DESIGN | D.C. |
| FEB. 2019 | ISSUED FOR 90% DESIGN | D.C. |
| AUG. 2019 | ISSUED FOR TENDER | R.S. |
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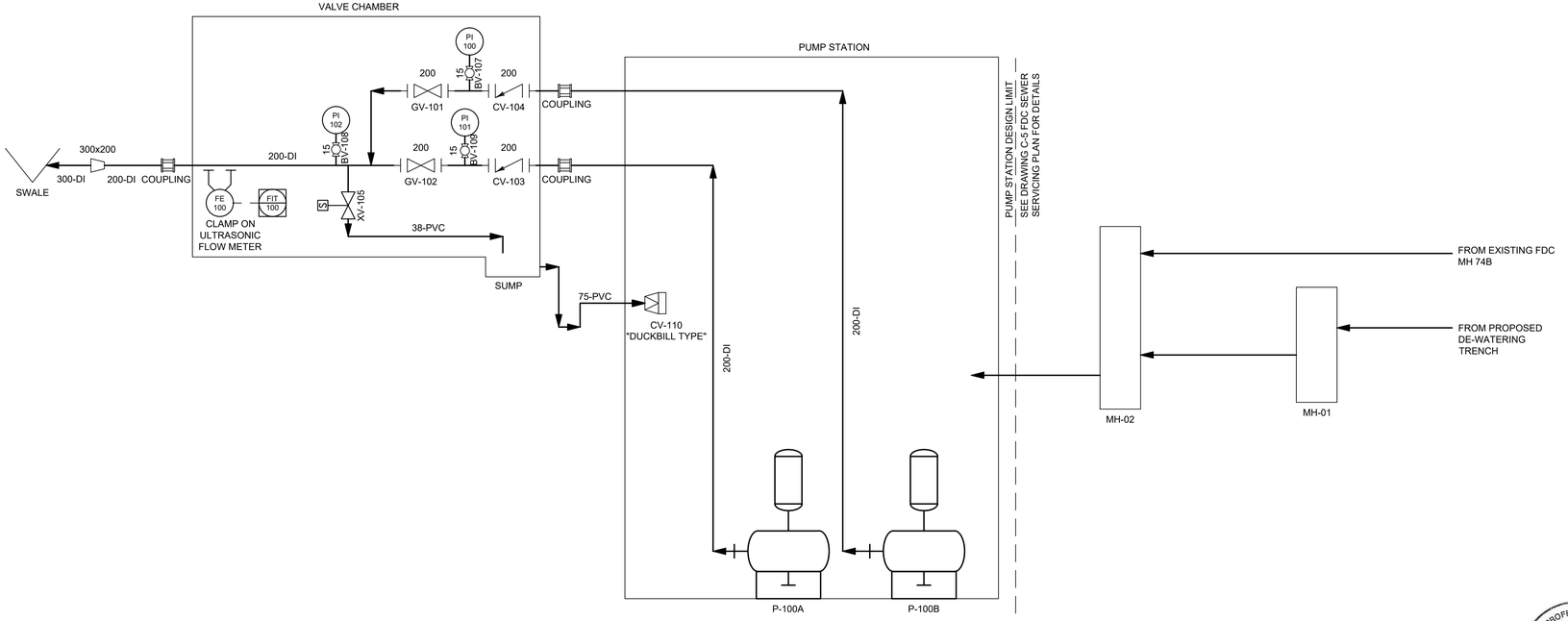


PIPE MATERIAL

DI = DUCTILE IRON
PVC = POLYVINYL CHLORIDE

## P-100A/B

SERVICE: FOUNDATION DRAIN
ARRANGEMENT: 1 DUTY + 1 STANDBY
DESIGN DUTY: 70 L/s @ 6.80m TDH
STATIC HEAD: 4.67m

| VALVE LIST | | |
|---|---|---|
| SIZE | TAG | TYPE |
| 200 | GV-101 | GATE VALVE |
| 200 | GV-102 | GATE VALVE |
| 200 | CV-103 | CHECK VALVE |
| 200 | CV-104 | CHECK VALVE |
| 38 | XV-105 | SOLENOID VALVE |
| 15 | BV-107 | BALL VALVE |
| 15 | BV-108 | BALL VALVE |
| 15 | BV-109 | BALL VALVE |
| 75 | CV-110 | "DUCKBILL TYPE" CHECK VALVE |

# LISGAR DISTRICT UTILITY TRENCH DE-WATERING AND FDC PUMPING SYSTEM

wood.

MISSISSAUGA

PRODUCED FOR – T&W, ENGINEERING AND WORKS

## PROCESS FLOW DIAGRAM

| | | |
|---|---|---|
| SCALE N.T.S. | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY D.C. | CHECKED BY A.A. | PLAN No. P-1 |
| DATE SEP 2018 | SHEET 17 OF 32 | |

Last Saved: 2019-05-29 Last Saved By: daniel.chan Plotted: 2019-08-14 Plotted By: daniel.chan Path: \\Brl-fs1\project\2018\Projects\PPB18B016 - Design & Contract Admin. - Lisgar\06_DES-ENG\01_CAD\02_DWGS\02_MUN\TDC Pumping Station\Orthos\DWGs\TDC Pump Station Layout.dwg

| REVISIONS | | |
|---|---|---|
| DATE | DETAILS | INIT. |
| SEP. 2018 | ISSUED FOR 30% DESIGN | D.C. |
| FEB. 2019 | ISSUED FOR 90% DESIGN | D.C. |
| AUG. 2019 | ISSUED FOR TENDER | R.S. |
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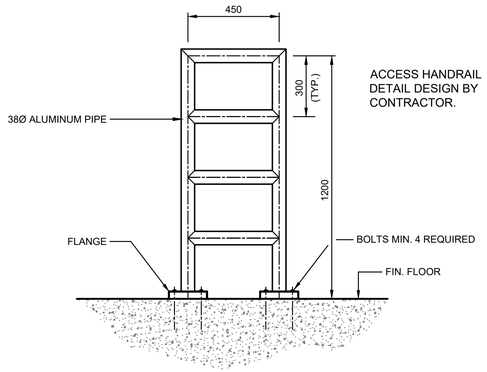
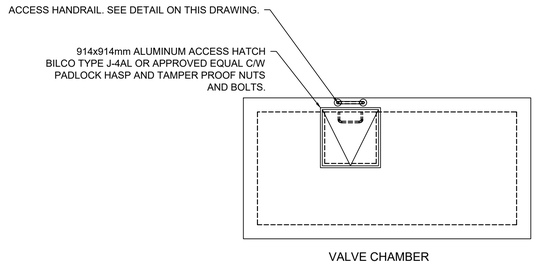
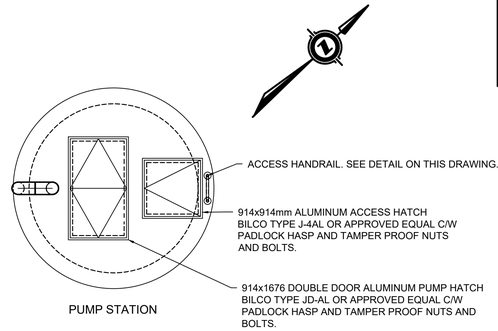



ACCESS HANDRAIL DETAIL DESIGN BY CONTRACTOR.

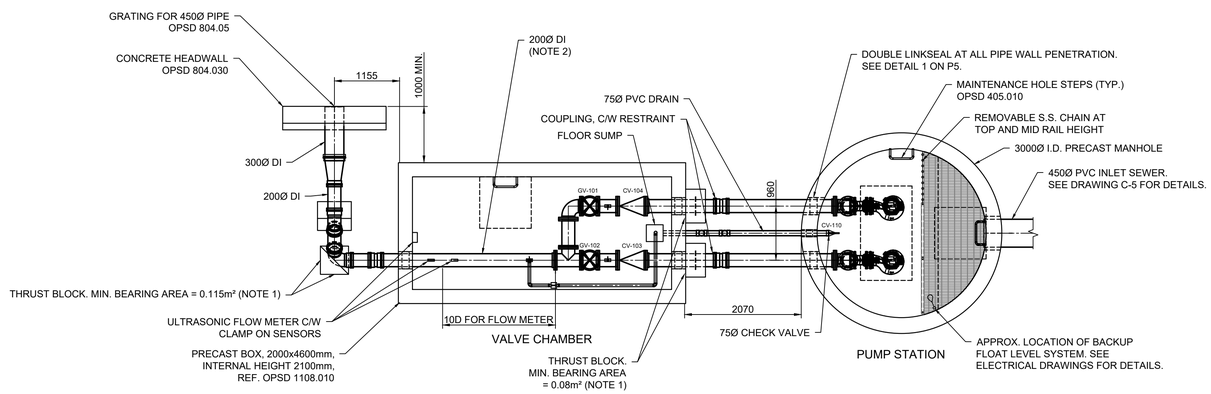
## ACCESS HANDRAIL

N.T.S.

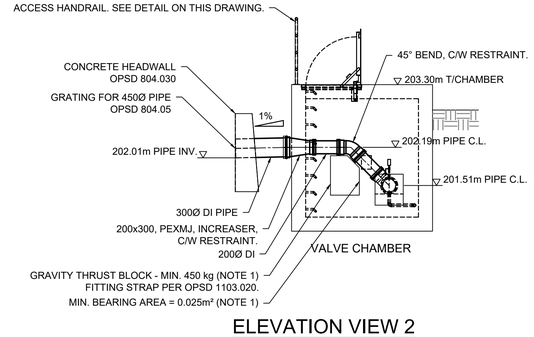


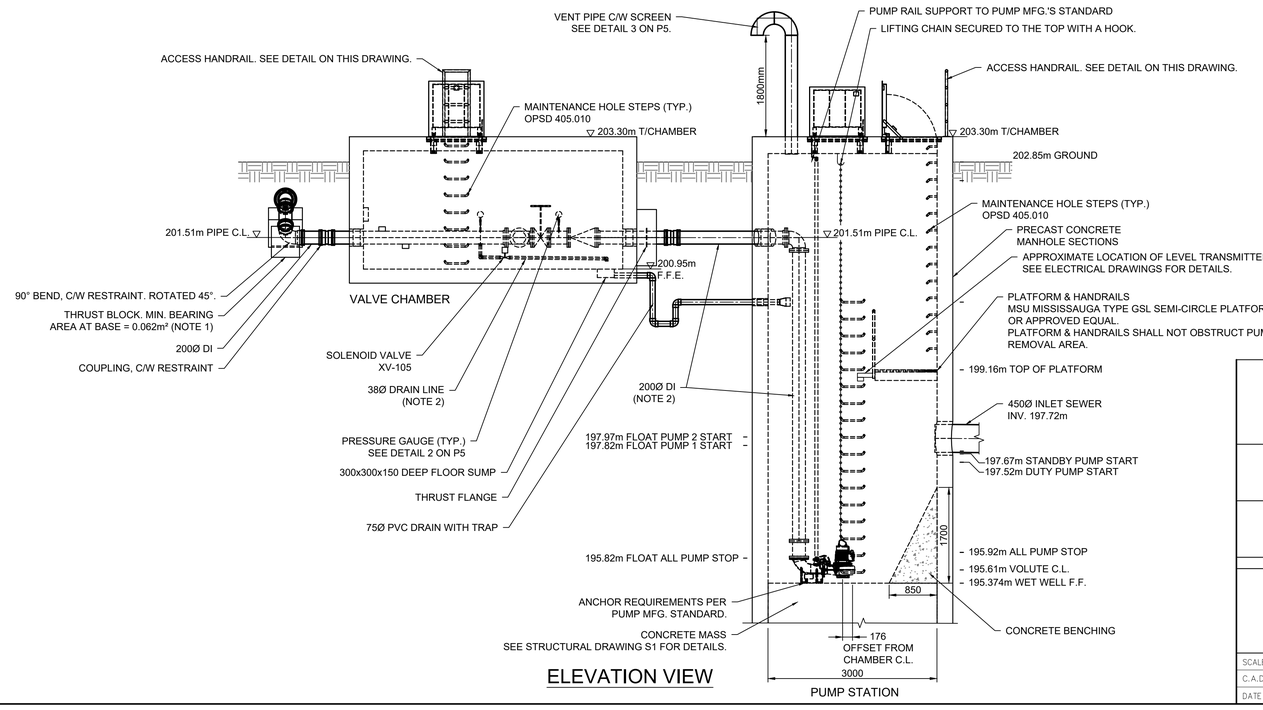

## PLAN 1 - GROUND ELEVATION




## PLAN 2 - FORCEMAIN




## ELEVATION VIEW 2




## ELEVATION VIEW

NOTES:
1. THRUST BLOCK SIZING FOR PRESSURE PIPE AT 206.8 kPa (30 psi) HYDRO STATIC TEST PRESSURE. THRUST BLOCK DIMENSIONS BY CONTRACTOR.
2. PIPE SUPPORTS SHALL BE DESIGNED FOR SEISMIC LOAD BY CONTRACTOR. SEE SPEC 11190 PIPE SUPPORTS.

LICENSED PROFESSIONAL ENGINEER
R. SAWHNEY
100058161
May. 29, 2019
PROVINCE OF ONTARIO

# LISGAR DISTRICT UTILITY TRENCH DE-WATERING AND FDC PUMPING SYSTEM

wood.

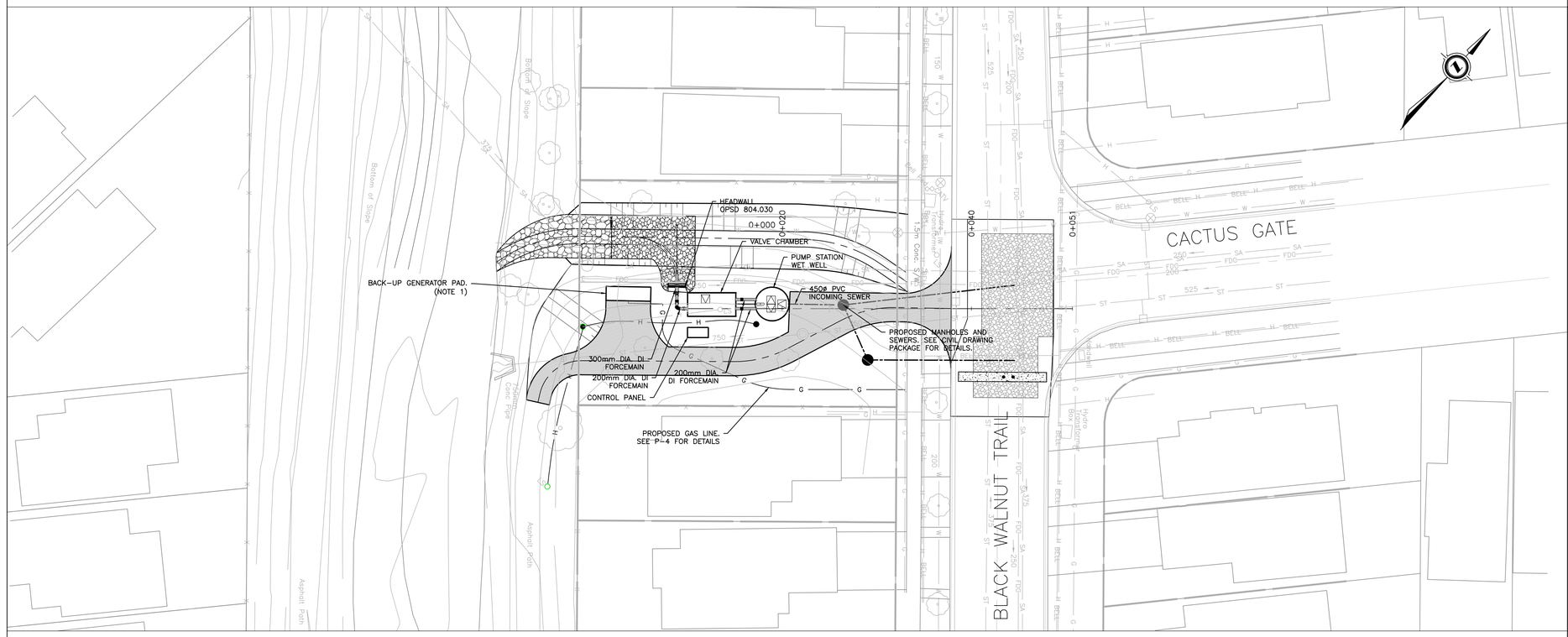
MISSISSAUGA

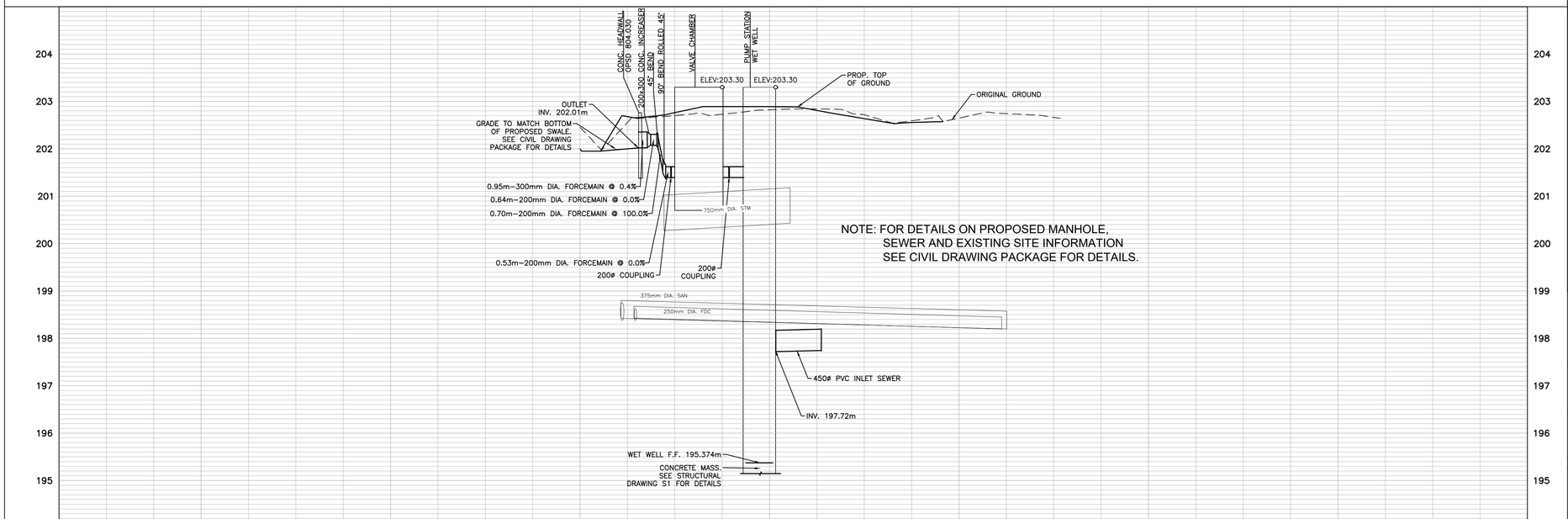
PRODUCED FOR – T&W, ENGINEERING AND WORKS

## GENERAL ARRANGEMENT

| | | | |
|---|---|---|---|
| SCALE 1:50 | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY D.C. | CHECKED BY A.A. | PLAN No. P-2 |
| DATE SEP 2018 | SHEET 18 OF 32 | |

Path: \\Bri-fs1\project\2018\Projects\TPB188016 - Design & Contract Admin. - Lisgar\06_DES-ENG\01_CAD\02_DWGS\05_WR\Plan Profile.dwg
Plotted By: daniel.chan
Plotted: 2019-08-14
Last Saved By: daniel.chan
Last Saved: 2019-08-14




NOTE: FOR DETAILS ON PROPOSED MANHOLE, SEWER AND EXISTING SITE INFORMATION SEE CIVIL DRAWING PACKAGE FOR DETAILS.

| | | | | | | |
|---|---|---|---|---|---|---|
| | 202.455 | 202.823 | 202.648 | | | ORIG. GROUND |
| −0+040 | −0+020 | 0+000 | 0+020 | 0+040 | 0+060 | 0+080 | CHAINAGE |

REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| SEP. 2018 | ISSUED FOR 30% DESIGN | D.C. |
| FEB. 2019 | ISSUED FOR 90% DESIGN | D.C. |
| AUG. 2019 | ISSUED FOR TENDER | R.S. |
| | | |
| | | |
| | | |

NOTE:
1. SIZED BASED ON KOHLER GENERATOR (PARAMOUNT POWER) MANUFACTURER REQUIREMENTS. ANY AND ALL CAPITAL AND DESIGN RELATED COSTS RELATED TO A CHANGE TO THE GENERATOR FOOTPRINT AND ASSOCIATED CHANGES IN THE SLAB ETC. SHALL BE BORNE BY THE CONTRACTOR. NO ADDITIONAL COST WHATSOEVER WILL BE APPROVED BY THE CITY.

NOTE:
EXISTING PIPE INVERTS
REF: APR. 29, 1998
PLAN NO. 8816-A-63
DWG. C-34574

## LEGEND

- H — HYDRO
- BELL — BELL
- G — GAS
- W — WATERMAIN SYSTEM
- ST — STORM SEWER SYSTEM
- FDC — FDC SYSTEM
- SA — SANITARY SEWER SYSTEM

LICENSED PROFESSIONAL ENGINEER
R. SAWHNEY
100058161
May 29, 2019
PROVINCE OF ONTARIO

LISGAR DISTRICT
UTILITY TRENCH DE-WATERING
AND FDC PUMPING SYSTEM

wood.

MISSISSAUGA

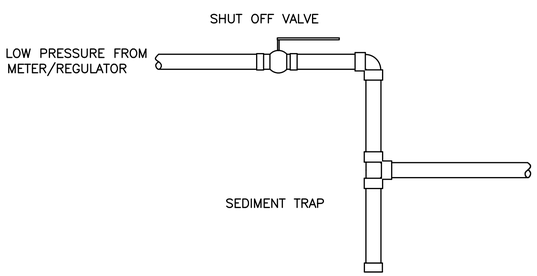
PRODUCED FOR – T&W, ENGINEERING AND WORKS

PLAN & PROFILE

| | | |
|---|---|---|
| SCALE H 1:250 V 1:50 | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY D.C. | CHECKED BY A.A. | PLAN No. P-3 |
| DATE SEP 2018 | SHEET 19 OF 32 | |

NOTES:

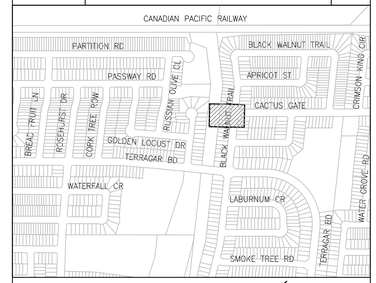
1. NATURAL GAS LINE DESIGN AND INSTALLATION SHALL BE COMPLIANT WITH CSA B149.1 AND AS PER LOCAL GAS UTILITY REQUIREMENTS.
2. FOR SITE DETAILS, PLEASE REFERENCE CIVIL DRAWING SET.
3. DESIGN REQUIREMENTS BASED ON KOHLER GENERATOR (PARAMOUNT POWER) MANUFACTURER REQUIREMENTS. ALL CAPITAL AND DESIGN RELATED COSTS RELATED TO A CHANGE IN PIPE SIZE AND ASSOCIATED CHANGES SHALL BE BORNE BY THE CONTRACTOR. NO ADDITIONAL COST WHATSOEVER WILL BE APPROVED BY THE CITY.




A TYPICAL BELL-UP PIPE RUN
N.T.S.

REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| FEB. 2019 | ISSUED FOR 90% DESIGN | D.C. |
| AUG. 2019 | ISSUED FOR TENDER | B.K. |




KEY PLAN

## LEGEND

- NATURAL GAS LINE ABOVE GROUND
- NATURAL GAS LINE UNDERGROUND
- NATURAL GAS VENT LINE ABOVE GROUND
- VERTICAL RISE/DROP
- ISOLATION VALVE
- GAS METER/REGULATOR
- REDUCER

LICENSED PROFESSIONAL ENGINEER
B. A. KOKOR
PROVINCE OF ONTARIO

LISGAR DISTRICT
UTILITY TRENCH DE-WATERING
AND FDC PUMPING SYSTEM

wood.

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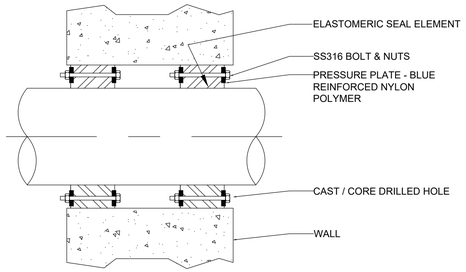
PRODUCED FOR – T&W, ENGINEERING AND WORKS

GENERATOR NATURAL GAS LINE CONNECTION

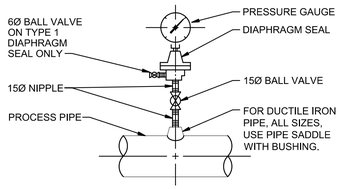
| | | |
|---|---|---|
| SCALE 1:125 | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY D.C. | CHECKED BY D.C. | PLAN No. P-4 |
| DATE FEB.2019 | SHEET 20 OF 32 | |

Last Saved: 2019-08-19 Last Saved By: daniel.chan Plotted: 2019-08-19 Plotted By: daniel.chan Path: \\Bri-fs1\project\2018\Projects\TPB188016 – Design & Contract Admin. – Lisgar\06_DES-ENG\01_CAD\02_DWGS\05_WR\Gas Line Connection.dwg

LINK-SEAL® MODULAR SEALS WITH CAST OR CORE DRILLED WALL OPENING OR APPROVED EQUAL.



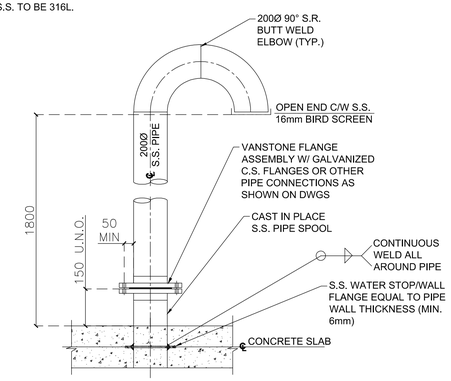

1 WALL PENETRATION DETAIL
N.T.S.




2 PRESSURE GAUGE DETAIL
N.T.S.

NOTE:

1. ALL S.S. TO BE 316L.




3 VENT PIPE DETAIL
N.T.S.

REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| FEB. 2019 | ISSUED FOR 90% DESIGN | D.C. |
| AUG. 2019 | ISSUED FOR TENDER | R.S. |
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LICENSED PROFESSIONAL ENGINEER
R. SAWHNEY
100058161
May 29, 2019
PROVINCE OF ONTARIO

LISGAR DISTRICT
UTILITY TRENCH DE-WATERING
AND FDC PUMPING SYSTEM

wood.

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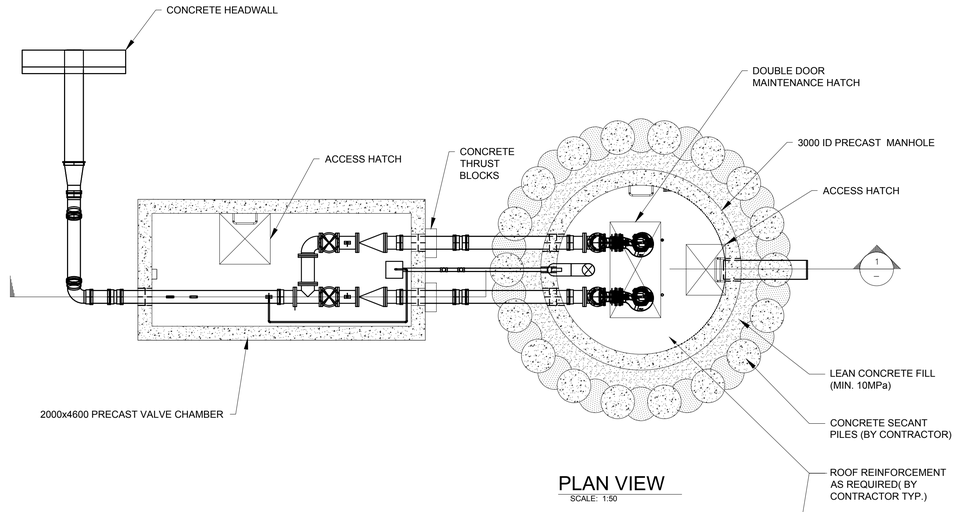
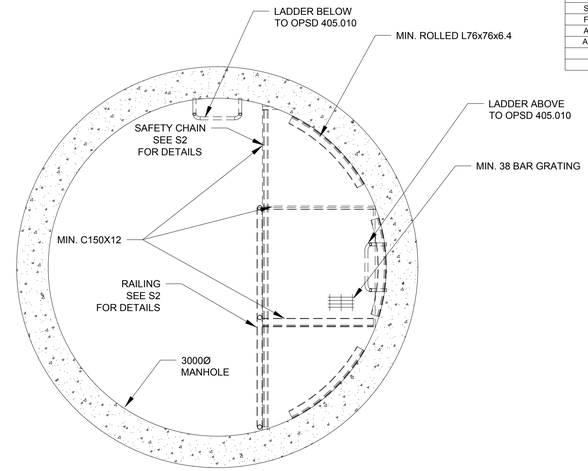
MECHANICAL
DETAILS

| | | |
|---|---|---|
| SCALE N.T.S. | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY D.C. | CHECKED BY A.A. | PLAN No. P-5 |
| DATE FEB 2019 | SHEET 21 OF 32 | |

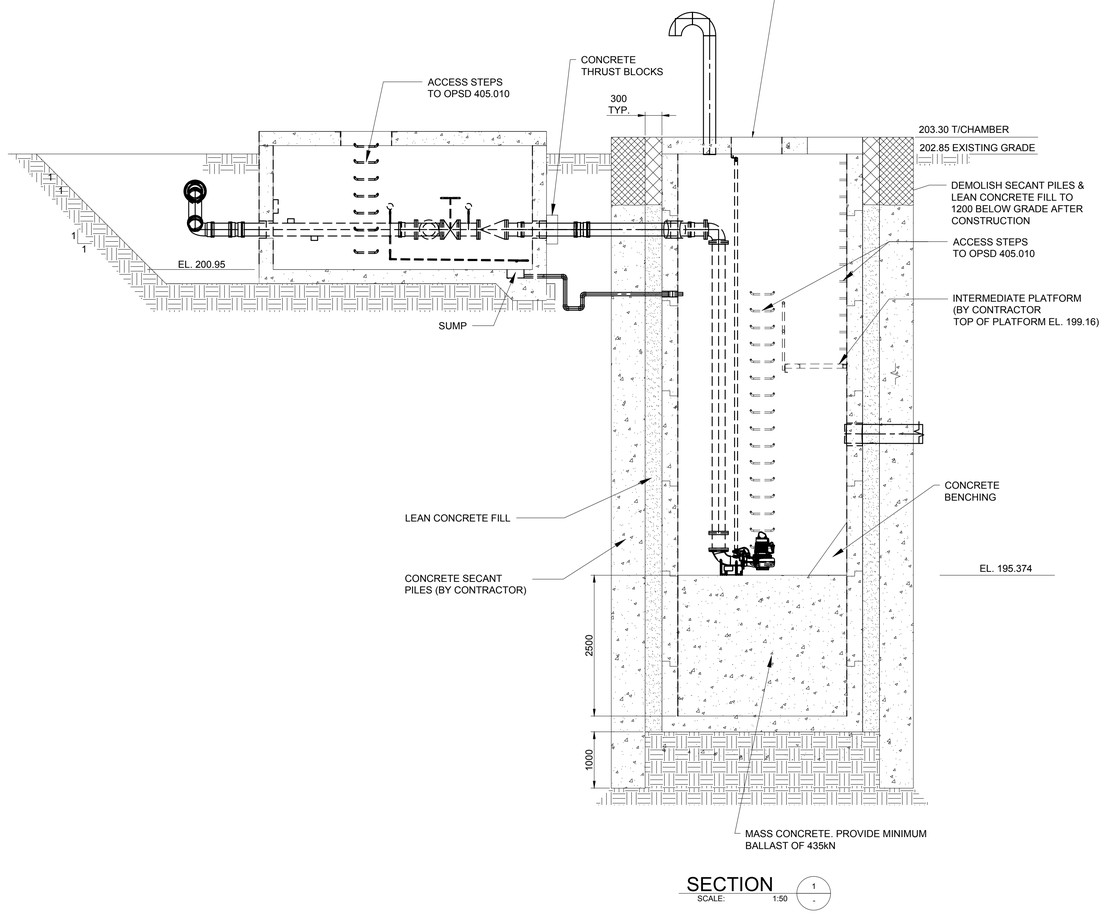
Last Saved: 2019-08-14 Last Saved By: daniel.chan Plotted: 2019-08-14 Plotted By: daniel.chan Path: \\Br-fs1\project\2018\Projects\TPB188016 – Design & Contract Admin. – Lisgar\06_DES-ENG\01_CAD\02_DWGS\02_MUN\Mechanical Details.dwg




PLAN VIEW
SCALE: 1:50




PLATFORM FRAMING PLAN AT EL. 199.160
SCALE: 1:25




SECTION
SCALE: 1:50

GENERAL NOTES

1. ALL WORK TO BE DONE IN ACCORDANCE WITH ONTARIO BUILDING CODE AND ACI 350.
2. ALL WORK TO BE COMPLETED IN ACCORDANCE WITH APPLICABLE LEGISLATION AND REGULATIONS INCLUDING, BUT NOT LIMITED TO, THE OCCUPATIONAL HEALTH AND SAFETY ACT.
3. AS PART OF THIS WORK THE CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND ELEVATIONS AND REPORT ANY DISCREPANCIES TO THE CONSULTANT PRIOR TO CONSTRUCTION
4. READ STRUCTURAL DRAWINGS IN CONJUNCTION WITH ALL OTHER CONTRACT DRAWINGS, SPECIFICATIONS AND PERTINENT DOCUMENTS. STRUCTURAL DRAWINGS ARE NOT INDEPENDENT OF OTHER CONTRACT DRAWINGS AND ARE NOT TO BE SEPARATED FOR TENDERING OR DETAILING PURPOSES.
5. CONTRACTOR TO COORDINATE WITH ALL TRADES THE LOCATIONS OF ALL PIPE SLEEVES PASSING THROUGH WALLS AND SLABS.
6. COORDINATE SECANT PILE CONSTRUCTION WITH EXISTING ADJACENT UTILITIES. DAYLIGHT AS REQUIRED. REPORT CONFLICTS TO CONSULTANT BEFORE PROCEEDING. EXISTING FDC SEWER IS ABANDONED AND CAN BE DEMOLISHED AS PART OF SECANT PILE CONSTRUCTION.
7. MECHANICAL EQUIPMENT ASSUMPTIONS:
   -PUMP WEIGHT 225KG
   -DISCHARGE PIPE DIAMETER 200MM
   ONLY ONE PUMP WILL OPERATE AT A TIME. NO RESONANCE EFFECTS CONSIDERED.
   SUBMIT PUMP SHOP DRAWINGS FOR REVIEW PRIOR TO INSTALLATION. DO NOT DAMAGE FLOOR REINFORCEMENT WITH PUMP ANCHORAGES.

EXCAVATION AND BACKFILL

1. GEOTECHNICAL INVESTIGATIONS WERE CONDUCTED BY AMEC FOSTER WHEELER IN FEBRUARY 2017, REPORT NO. TP115060.9600.
2. SOIL BEARING CAPACITIES:
   PRECAST BOX MANHOLE: SLS = 110 kPa; ULS = 165 kPa
   PRECAST CIRCULAR MANHOLE: SLS = 250 kPa; ULS = 375 kPa
3. ALL EXCAVATIONS SHALL BE COMPLETELY DEWATERED DURING CONSTRUCTION.
4. PLACE ALL CONCRETE IN THE DRY
5. CONTINUOUSLY PROTECT THE BOTTOM OF THE EXCAVATION AND ALL FOUNDATIONS FROM DAMAGE DUE TO FROST AND GROUNDWATER PRESSURE
6. ALL SUBGRADE TO BE INSPECTED BY A GEOTECHNICAL ENGINEER PRIOR TO PLACING CONCRETE
7. BACKFILL TO BE PLACED IN HORIZONTAL LIFTS NOT EXCEEDING 400mm FOR THE FULL WIDTH OF THE EXCAVATION

SECANT PILE WALL

1. SECANT PILE WALL SHALL BE DESIGNED BY THE CONTRACTOR
2. SUBMIT SHOP DRAWINGS FOR ALL ELEMENT OF THE SECANT PILE DESIGN SEALED BY A PROFESSIONAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO AND EXPERIENCED IN THE DESIGN OF SECANT PILES WALL

CONCRETE

1. PERFORM ALL CONCRETE WORK IN ACCORDANCE WITH CSA A23.1
2. ALL CONCRETE FORMWORK AND FALSEWORK MATERIALS SHALL CONFORM TO CSA A23.1
3. THE USE OF EARTH FORMS IS NOT PERMITTED

PRECAST CONCRETE

1. PERFORM ALL PRECAST CONCRETE WORK IN ACCORDANCE WITH CSA A23.4
2. SUBMIT SHOP DRAWINGS FOR ALL PRECAST ELEMENTS SEALED BY A PROFESSIONAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO AND EXPERIENCED IN THE DESIGN OF PRECAST CONCRETE.
3. KEYWAYS BETWEEN PRECAST FLOOR UNITS SHALL BE FILLED SOLID WITH GROUT.
4. GROUT SHALL BE MIXED IN PROPORTIONS OF ONE PART PORTLAND CEMENT TO THREE PARTS SAND.
5. ALL OTHER HOLES SHALL BE CUT IN THE FIELD BY THE TRADE REQUIRING THE HOLE. IN NO CASE SHALL ANY HOLE BE CUT WITHOUT THE WRITTEN APPROVAL OF THE PRECAST SUPPLIER.

MISCELLANEOUS METALS

1. PLATFORM DESIGN SHALL BE BY THE CONTRACTOR.
2. PERFORM STRUCTURAL WORK, DESIGN DETAILS AND CONNECTIONS IN ACCORDANCE WITH CAN/CSA S157.
3. ALL FABRICATION AND WELDING SHALL CONFORM TO CSA W59 AND BE PERFORMED BY A COMPANY CERTIFIED BY AND WELDERS QUALIFIED IN ACCORDANCE WITH CSA W47.1 FOR DIVISION 1 OR DIVISION 2.1 FOR FUSION WELDING OF ALUMINUM.
4. FILLET WELDS SHALL NOT BE LESS THAN 5MM.
5. STRUCTURAL SECTIONS SHALL CONFORM TO ASTM B221M.
6. STRUCTURAL PLATES AND ANGLES SHALL CONFORM TO ASTM B209M.
7. BOLT, NUTS AND WASHERS SHALL CONFORM TO ASTM ASTM B316M MIN. 20MM DIAMETER.
8. GRATING TO BE BORDEN METAL TYPE W/B OR APPROVED EQUIVALENT. GRATING TO BE OF WELDED CONSTRUCTION WITH BEARING BARS AND CONTINUOUS BANDING WELDED TO ENDS OF BEARING BARS. DESIGN GRATING TO SUPPORT A MAXIMUM LIVE LOAD OF 4.8 KPA WITH A MAXIMUM DEFLECTION OF 1/240TH OF THE SPAN. SECURE GRATING SECTIONS TO SUPPORT FRAMING WITH SADDLE CLIPS AND BOLTS.
9. ALL CONNECTIONS SHALL BE DESIGNED AND DETAILED BY THE FABRICATOR UNLESS SPECIFICALLY SHOWN ON THE DRAWINGS.
10. SUBMIT SHOP DRAWINGS STAMPED AND SIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN ONTARIO AND EXPERIENCED IN THE DESIGN OF STRUCTURAL ALUMINUM CONNECTIONS.
11. MAKE SHOP CONNECTION WITH BOLTS OR WELDING. FIELD CONNECTIONS BETWEEN MEMBERS SHALL BE MADE WITH BOLTS WHERE POSSIBLE.
12. ALL BOLTED CONNECTIONS SHALL HAVE A MINIMUM OF TWO BOLTS IN EACH CONNECTED PIECE AND BE DESIGNED AS BEARING-TYPE CONNECTIONS WITH THREADS EXCLUDED FROM THE SHEAR PLANE, UNLESS NOTED OTHERWISE.
13. BOLTS SHALL BE TIGHTENED USING THE TURN-OF-NUT METHOD.
14. CUTTING OF THE STRUCTURAL MEMBER FOR THE WORK OF OTHER TRADES IS PROHIBITED. PLATFORM FABRICATION AND INSTALLATION MUST BE INSPECTED BY AN INDEPENDENT TESTING AGENCY, WITH REPORTS SUBMITTED TO THE CONSULTANT.

LOADS

GROUND SNOW LOAD Ss = 1.10 kPa
ASSOCIATED RAIN LOAD Sr = 0.40 kPa
LIVE LOAD = 4.80 kPa

REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| SEP 2018 | ISSUED FOR 30% DESIGN | D.C |
| FEB 2019 | ISSUED FOR 90% DESIGN | S.V. |
| APR 2019 | ISSUED FOR 100% DESIGN | S.V. |
| AUG 2019 | ISSUED FOR TENDER | S.V. |
| | | |
| | | |

LICENSED PROFESSIONAL ENGINEER
S. F. VERSTEEGEN
26/29/19
PROVINCE OF ONTARIO

LISGAR DISTRICT UTILITY TRENCH DE-WATERING AND FDC PUMPING SYSTEM

wood.

MISSISSAUGA

PRODUCED FOR – T&W, ENGINEERING AND WORKS

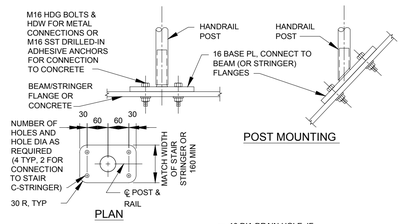
FDC PUMP STATION
GENERAL NOTES
PLAN & SECTION

| | | | |
|---|---|---|---|
| SCALE AS SHOWN | AREA Z-55 | | PROJECT No. 17-146 |
| C.A.D.D. BY J.L. | CHECKED BY S.V. | | PLAN No. S-1 |
| DATE SEP 2018 | SHEET 22 OF 32 | | |

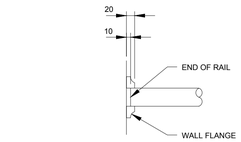
Last Saved: 2019-05-30 Last Saved By: jacques.legere Plotted: 2019-05-30 Plotted By: jacques.legere Path: O:_Wood Projects\TPB188016 Mississauga FDC Pump Station\CAD\STR\TPB188016_S-1.dwg

Last Saved: 2019-05-30 Last Saved By: jacques.legere Plotted: 2019-05-30 Plotted By: jacques.legere Path: O:_Wood Projects\TPB188016 Mississauga FDC Pump Station\CAD\STR\TPB188016_S-2.dwg

| REVISIONS | | |
|---|---|---|
| DATE | DETAILS | INIT. |
| APR 2019 | ISSUED FOR 100% DESIGN | S.V. |
| AUG 2019 | ISSUED FOR TENDER | S.V. |
| | | |
| | | |
| | | |
| | | |



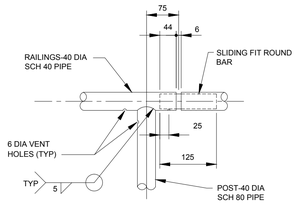

RAILING POST CONNECTOR FOR BOLTED BASE PLATE




NOTES:

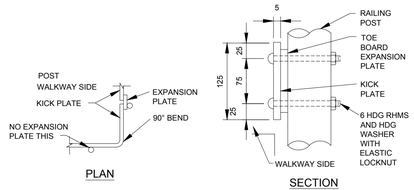
1. FASTEN RAIL TO WALL FLANGE PER MANUFACTURERS RECOMMENDATIONS.
2. WALL FLANGE TO BE MOUNTED TO WALL WITH 2 - 10 DIA HDG WEDGE ANCHORS.

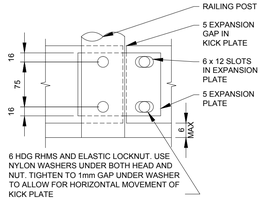
RAIL TERMINAL




TYP RAIL JOINT

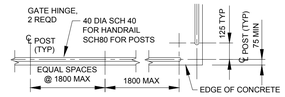
RAILING CONNECTION DETAILS

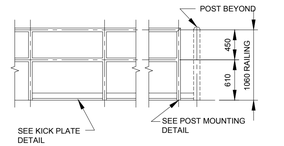


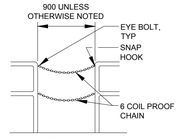




ELEVATION - EXPANSION PLATE CONNECTION

KICK PLATE

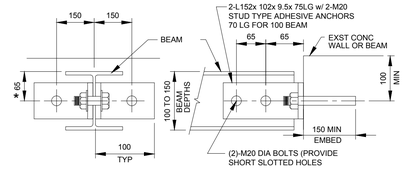


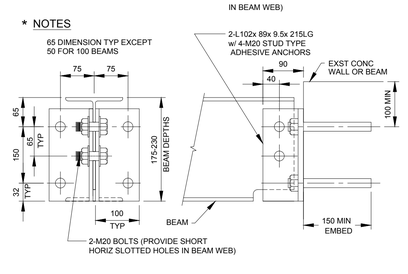




SAFETY CHAIN DETAIL

RAILING DETAILS




BEAM/WALL CONNECTION

| LIGHT VEHICULAR TRAFFIC (WHEEL LOAD = 9 kN OR LESS) | | |
|---|---|---|
| MAXIMUM SPAN | STEEL (mm) | ALUMINUM (mm) |
| 300 | 45 x 5 | 45 x 5 |
| 450 | 45 x 5 | 45 x 5 |
| 600 | 50 x 5 | 50 x 5 |
| 750 | 55 x 5 | 55 x 5 |
| 900 | 60 x 5 | 60 x 5 |
| 1200 | 60 x 6 | DO NOT USE ALUMINUM GRATING |
| 1500 | 60 x 100 | |
| 1800 | 60 x 100 | |
| 2100 | 75 x 10 | |

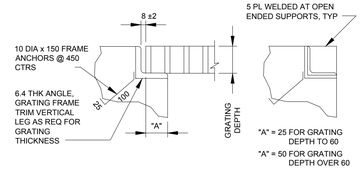
| FOOT TRAFFIC GRATING THICKNESS TABLE | | | |
|---|---|---|---|
| MAXIMUM SPAN | STEEL (mm) | ALUMINUM (mm) | FIBREGLASS (mm) |
| 900 | 25 | 32 | 38 |
| 1200 | 25 | 40 | 38 |
| 1400 | 25 | 45 | 38 |
| 1500 | 32 | 45 | MAX ALLOW SPAN IS 1400 LIMIT DEFLECTION TO 6 MAX |
| 1600 | 32 | 50 | |
| 1800 | 40 | 55 | |
| 2000 | 40 | 55 | |
| 2100 | 45 | 60 | |

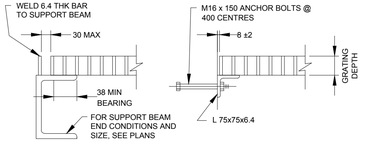
| HEAVY VEHICULAR TRAFFIC (HS 20-44) | | |
|---|---|---|
| MAXIMUM SPAN | STEEL (mm) | ALUMINUM (mm) |
| 300 | 50 x 5 | DO NOT USE ALUMINUM GRATING |
| 500 | 64 x 6 | |
| 600 | 64 x 10<br>75 x 6 | |
| 750 | 75 x 6<br>100 x 6 | |
| 990 | 75 x 6 | |
| 1220 | 100 x 10 | |
| 1520 | 115 x 10 | |

NOTES:

1. EXTEND GRATING CONTINUOUSLY OVER GATE GUIDES AND GATES.
2. NOTCH GRATING SUPPORTS AT GATES AS REQUIRED.
3. GRATING SPAN ——— SEE PLAN.
4. SHOP DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER BASED ON FIELD DIMENSIONS PRIOR TO FABRICATION
5. MATERIAL FOR SUPPORTS OF STEEL GRATING TO BE SAME AS GRATING.
6. STEEL GRATING AND SUPPORT TO BE GALVANIZED UNLESS NOTED OTHERWISE ON PLANS.
7. BEARING BAR THICKNESS FOR GRATING TO BE 5 MINIMUM.
8. BAND ALL EDGES WITH 5 THK x DEPTH OF BEARING BAR.
9. PROVIDE MISCELLANEOUS GRATING FASTENERS AS REQUIRED.
10. GRATING SIZE TO BE DETERMINED USING CHARTS PROVIDED.
11. HORIZONTAL CLEARANCE BETWEEN GRATING AND SUPPORTS TO BE GREATER THAN 6 AND LESS THAN 10

GRATING TABLES & NOTES

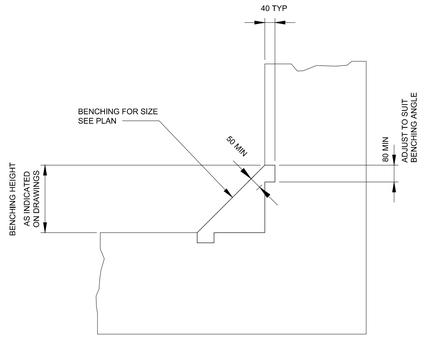



NOTES:

1. STEEL GRATING BEARING BARS FOR VEHICULAR TRAFFIC SHALL BE SPACED AT 50 OC.
2. STEEL SUPPORTS SHALL BE HOT DIP GALVANIZED AFTER FABRICATION.
3. SEE DETAIL 3250 FOR BAR GRATING TABLES.

GRATING SUPPORT DETAIL




CONCRETE BENCHING OR GROUT FILL KEY DETAIL

# LISGAR DISTRICT UTILITY TRENCH DE-WATERING AND FDC PUMPING SYSTEM

wood.

MISSISSAUGA

PRODUCED FOR – T&W, ENGINEERING AND WORKS

## FDC PUMP STATION STRUCTURAL STANDARD DETAILS

| | | | |
|---|---|---|---|
| SCALE AS SHOWN | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY J.L. | CHECKED BY S.V. | PLAN No. S-2 |
| DATE SEP 2018 | SHEET 23 OF 32 | |

## LAYOUT

| SYMBOL | DESCRIPTION |
|---|---|
| ——— | SURFACE MOUNT CONDUIT, CABLE OR DUCT. |
| - - - - - - | BURIED OR CONCEALED CONDUIT, CABLE OR DUCT. |
| -×-×-×- | EXISTING BURIED OR CONCEALED CONDUIT, CABLE OR DUCT TO BE REMOVED. |
| ———→ | DENOTES CABLE OR CONDUIT TURNING DOWN. |
| ———○ | DENOTES CABLE OR CONDUIT CONCEALED TURNING UP. |
| —·—·— | #4/0 BARE COPPER APPROX. 1200mm BELOW GRADE. |
| ▷ | GROUND ROD 21mm DIA. COPPER CLAD. |
| ⊜ | CONVENIENCE RECEPTACLE – DUPLEX UNLESS OTHERWISE SPECIFIED (15A, 120V). |
| (P1) | 3ø MOTOR AS NOTED. |
| JB | JUNCTION BOX. |
| SPD | TRANSIENT VOLTAGE SURGE SUPPRESSION. |
| FS1 | FLOAT SWITCH NO.1. |
| (T) | THERMOSTAT. |

## SINGLE LINE DIAGRAM

| SYMBOL | DESCRIPTION |
|---|---|
| LA | LIGHTNING ARRESTER. |
| | FUSE. |
| | SWITCH 3 POLE UNLESS OTHERWISE INDICATED. |
| | CIRCUIT BREAKER 3 POLE UNLESS OTHERWISE INDICATED. |
| | POWER OR DISTRIBUTION TRANSFORMER. |
| | AUTOMATIC TRANSFER SWITCH. |
| | EQUIPMENT OUTLINE. |
| | GROUND. |

## SCHEMATIC WIRING DIAGRAM

| SYMBOL | DESCRIPTION |
|---|---|
| | LEVEL SWITCH NORMALLY OPEN. |
| | LEVEL SWITCH NORMALLY CLOSED. |
| | TEMPERATURE SWITCH NORMALLY CLOSED. |
| | TEMPERATURE SWITCH NORMALLY OPEN. |
| X X | SELECTOR SWITCH, MAINTAINED CONTACT 2 POSITIONS. |
| | CONTACT NORMALLY OPEN. |
| | CONTACT NORMALLY CLOSED. |
| | PUSH BUTTON, NORMALLY OPEN MOMENTARY CONTACT. |
| | PUSH BUTTON, NORMALLY CLOSED MOMENTARY CONTACT. |
| X X X | SELECTOR SWITCH, MAINTAINED CONTACT 3 POSITIONS. |
| (M) | STARTER COIL CONTROLLING MOTOR M. |
| (R1) | RELAY COIL FOR RELAY R1. |
| (ETM) | ELAPSED TIME METER |
| (PF) | POWER FAILURE RELAY. |
| ⊗ | TERMINAL IN RPU. |
| ⊠ | JUNCTION TERMINAL BLOCK (RPU). |

## INSTRUMENTATION

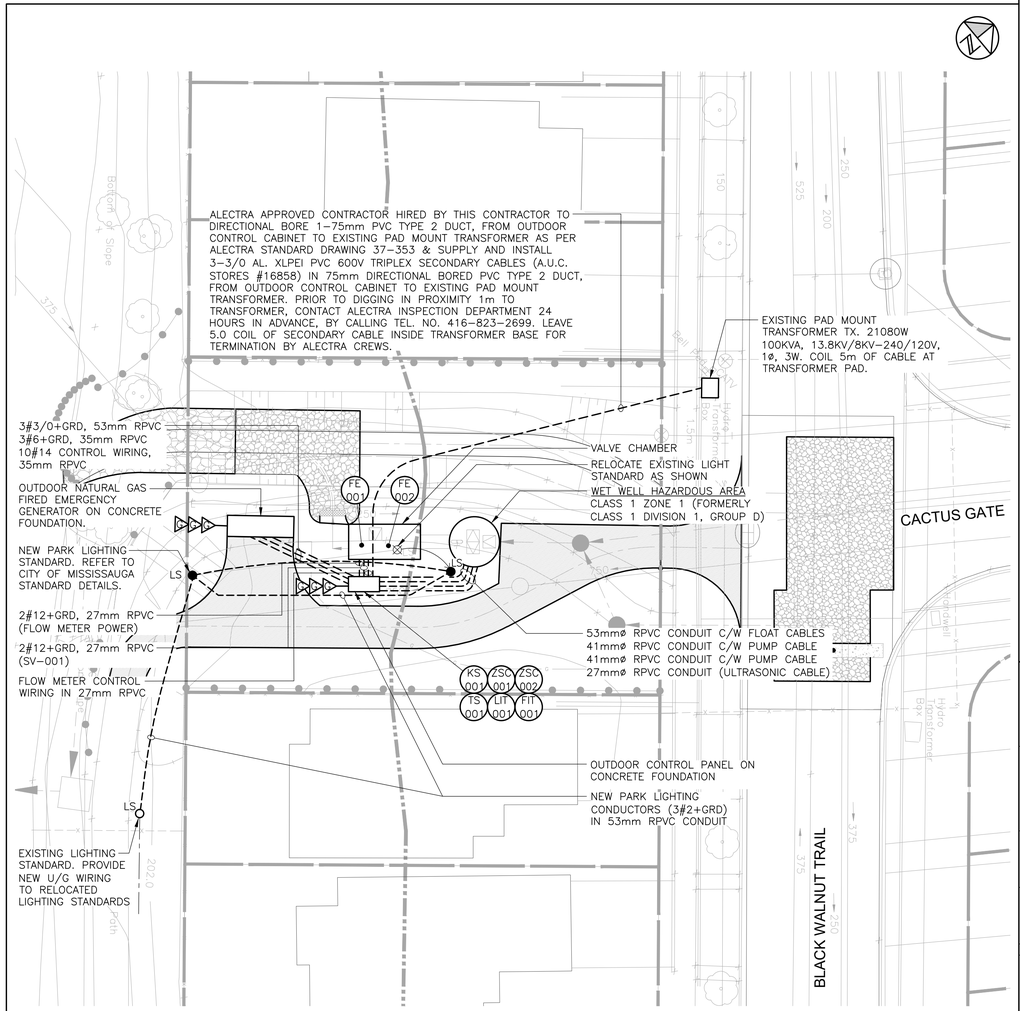
| SYMBOL | DESCRIPTION |
|---|---|
| LE XXX | LEVEL ELEMENT. |
| LIT XXX | LEVEL INDICATING TRANSMITTER. |
| KS XXX | KEY SWITCH. |
| AS XXX | ANALYSIS SWITCH. |
| TS XXX | AMBIENT TEMPERATURE SWITCH. |
| ZSC XXX | DOOR SWITCH. |

## ABBREVIATIONS

| SYMBOL | DESCRIPTION |
|---|---|
| E/P | EXPLOSION PROOF. |
| RGSPC | RIGID GALVANIZED STEEL PLASTIC COATED. |
| RPVC | RIGID PVC CONDUIT. |
| RGS | RIGID GALVANIZED STEEL CONDUIT. |
| CU | COPPER. |
| SS | STAINLESS STEEL. |
| AWG | AMERICAN WIRE GAUGE. |
| TYP. | TYPICAL. |
| DIA. | DIAMETER. |
| CCT | CIRCUIT. |
| JB | JUNCTION BOX. |
| ø | PHASE. |
| C/W | COMPLETE WITH. |
| W/P | WEATHER PROOF. |
| GFI | GROUND FAULT INTERRUPTER. |
| U/G | UNDERGROUND |
| EYS | ELECTRICAL Y SEAL |

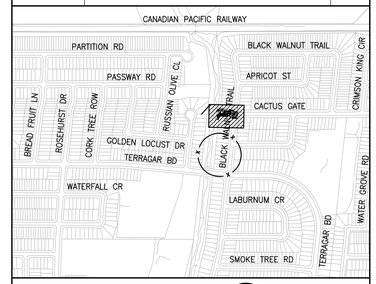
## CONSTRUCTION NOTES:

1. ALL EXISTING INFORMATION TO BE CONFIRMED. CONDUITS AND WIRING ARE SHOWN BASED ON AVAILABLE AS–BUILT INFORMATION ONLY AND CONTRACTOR TO CONFIRM ON SITE AS REQUIRED. INFORMATION IS PROVIDED AS A REFERENCE FOR DEMOLITION AND RE–FEEDING/RE–ROUTING REQUIREMENTS AS DESCRIBED WITHIN THE CONTRACT.
2. ALL DIMENSIONS AND INFORMATION SHALL BE CHECKED AND VERIFIED ON THE JOB SITE AND ANY DISCREPANCIES MUST BE REPORTED BEFORE COMMENCING THE WORK.
3. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO BECOME INFORMED OF THE EXACT LOCATION OF, AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES, SERVICES, AND STRUCTURES WHETHER ABOVE GROUND OR BELOW GRADE BEFORE COMMENCING THE WORK. SUCH INFORMATION IS NOT NECESSARILY SHOWN ON THE DRAWINGS AND WHERE SHOWN, THE ACCURACY CANNOT BE GUARANTEED.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING ALL EXISTING SERVICES AND UTILITIES IN WORKING AREA PRIOR TO CONSTRUCTION AND SHALL PROTECT THESE UTILITIES AND SERVICES TO THE SATISFACTION OF THE CONCERNED UTILITY COMPANIES AND OWNER. DAMAGES BY THE CONTRACTOR SHALL BE RESTORED TO THE SATISFACTION OF THE CONCERNED UTILITY COMPANY AT NO EXPENSE TO THE OWNER.
5. THE CONTRACTOR IS RESPONSIBLE FOR ALL UNDERGROUND STAKE–OUT AND UTILITY LOCATES. THE CONTRACTOR IS RESPONSIBLE TO ENGAGE A QUALIFIED UTILITY LOCATE SPECIALIST FOR THE PROJECT AND INCLUDE ALL COSTS. THE CONTRACT DRAWINGS DO NOT SHOW EXISTING UNDERGROUND UTILITIES.
6. REMOVE ALL UNNECESSARY ELECTRICAL CONDUIT, WIRING AND EQUIPMENT FROM THE EXISTING PROJECT AREA BEING RENOVATED AS INDICATED IN THE SPECIFICATIONS AND DRAWINGS AND AS DIRECTED ON SITE. THE DRAWINGS DO NOT INDICATE ALL ITEMS TO BE REMOVED OR REWORKED.
7. ALL MISCELLANEOUS ELECTRICAL EQUIPMENT BEING DESIGNATED AS REMOVED SHALL REMAIN THE PROPERTY OF THE OWNER AND IF THE OWNER HAS NO USE FOR IT, IT SHALL BE DISPOSED OF.
8. VISIT THE SITE AND EXAMINE THE CONDITIONS AND MAKE NECESSARY ALLOWANCES IN THE TENDER PRICE FOR REMOVAL, REROUTING, RELOCATION AND RECONNECTION OF ELECTRICAL EQUIPMENT AND WIRING AS MAY BE NECESSARY FOR THE EXECUTION AND COMPLETION OF THE PROJECT, EXTRA CHARGES FOR PREMIUM TIME SHALL BE INCLUDED IN THE TENDER AMOUNT.
9. PUMPING STATION TO REMAIN OPERATIONAL AT ALL TIMES. POWER INTERRUPTIONS MUST BE CO–ORDINATED WITH THE OWNER AND ALL OTHER TRADES BY THIS CONTRACT. WRITTEN APPROVAL FOR ELECTRICAL INTERRUPTIONS MUST BE RECEIVED FROM THE OWNER INDICATING THE DATE, TIME AND ESTIMATED DURATION OF THE INTERRUPTIONS. APPLICATION FOR THE APPROVAL OF THE POWER INTERRUPTIONS MUST BE SUBMITTED TO THE OWNER AND/OR ENGINEER AT LEAST SEVEN DAYS PRIOR TO THE REQUESTED SHUT DOWN DATE.

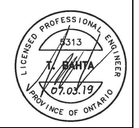



PART SITE PLAN
SCALE 1:200
2m 0 4m 8m @M200

| REVISIONS | | |
|---|---|---|
| DATE | DETAILS | INIT. |
| SEPT. 201□ | ISSUED FOR CLIENT RE□IEW | C.M. |
| FEB. 2019 | ISSUED FOR 90□ CLIENT RE□IEW | C.M. |
| MAR. 06.2019 | ISSUED FOR PERMIT | C.M. |
| APR. 2019 | 100□ DESIGN SUBMISSION | C.M. |
| MAY 2019 | ISSUED FOR TENDER | C.M. |




KEY PLAN

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E: info@moon–matz.com
W: www.moon–matz.com

# LISGAR DISTRICT UTILITY TRENCH DE-WATERING AND FDC PUMPING SYSTEM

wood.

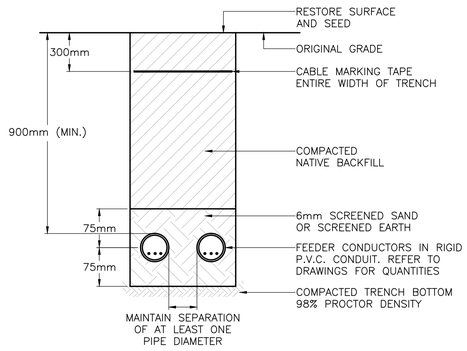
MISSISSAUGA

PRODUCED FOR – T&W, ENGINEERING AND WORKS

## ELECTRICAL SITE PLAN, LEGEND AND NOTES

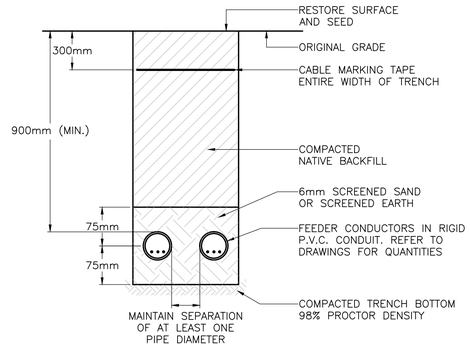
| | | |
|---|---|---|
| SCALE AS SHOWN | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY R.G. | CHECKED BY C.M. | PLAN No. E-1 |
| DATE SEPT. 201□ | SHEET 24 OF 32 | |

Path: P:\5313 Utility Trench Dewatering Pump Stn\03 Dwgs\Electrical\Working Drawings\5313-E1.dwg
Plotted By: ########
Plotted: 2019-08-20
Last Saved By: salvi
Last Saved: 2019-08-20



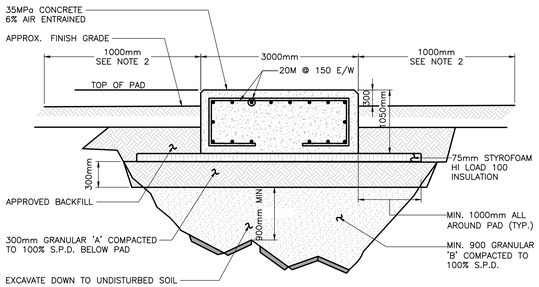

## TYPICAL U/G TRENCH DETAIL

SCALE N.T.S.

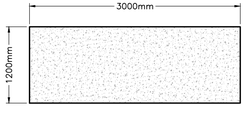



## TYPICAL U/G TRENCH DETAIL INCOMING SECONDARY SERVICE DUCTS

SCALE N.T.S.




## SECTION




## PLAN

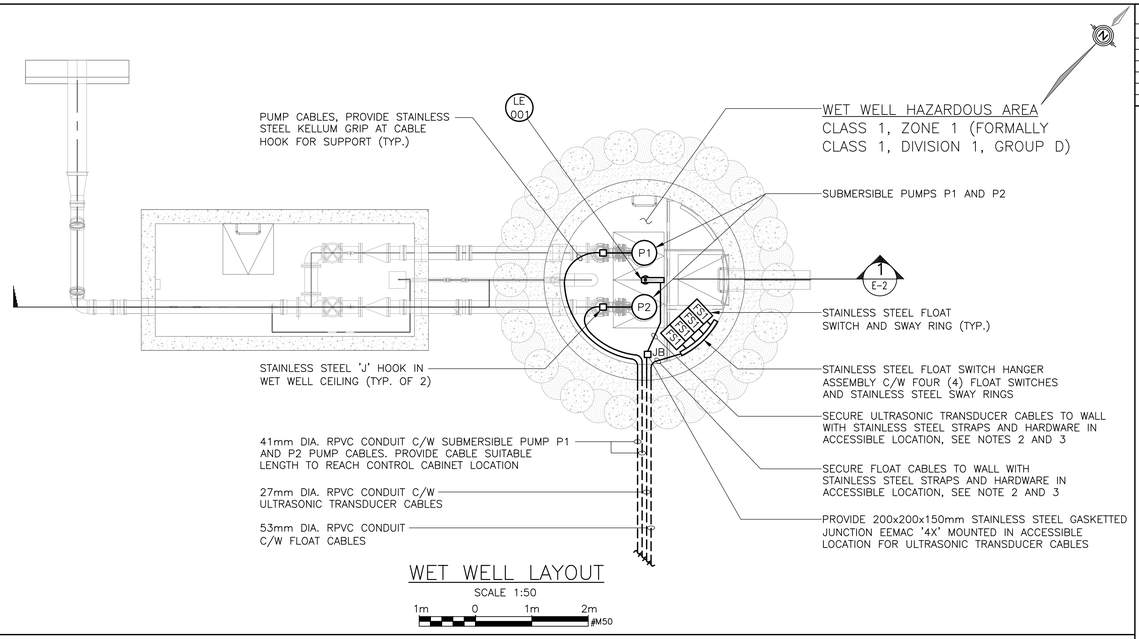
SCALE N.T.S.

NOTE:

1. MAINTAIN 75mm COVER OVER REINFORCING STEEL.
2. PROVIDE 1m LEVEL GRADE AROUND THE GENERATOR FOUNDATION AND THEN BLEND INTO ADJOINING AREA.
3. ANCHOR GENERATOR TO CONCRETE PAD AS PER MANUFACTURES RECOMMENDATIONS. ANCHORS TO BE STAINLESS STEEL.

## EMERGENCY GENERATOR FOUNDATION PLAN

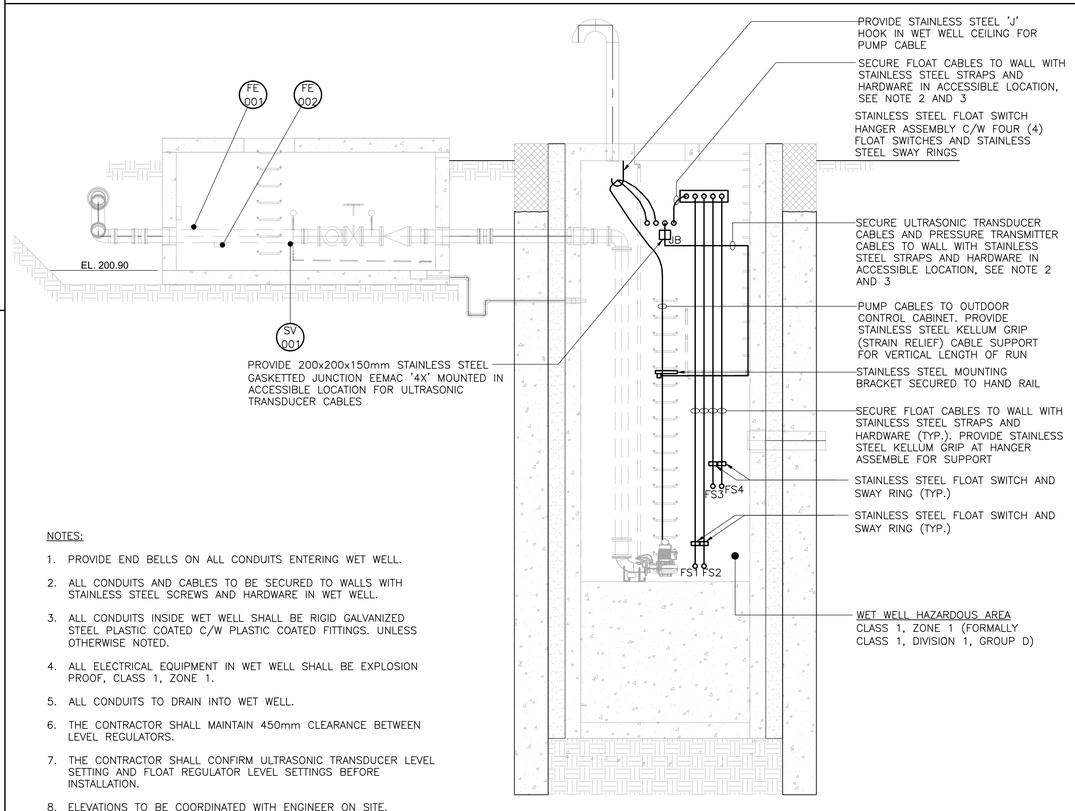
SCALE N.T.S.




## WET WELL LAYOUT

SCALE 1:50

1m 0 1m 2m @M50




NOTES:

1. PROVIDE END BELLS ON ALL CONDUITS ENTERING WET WELL.
2. ALL CONDUITS AND CABLES TO BE SECURED TO WALLS WITH STAINLESS STEEL SCREWS AND HARDWARE IN WET WELL.
3. ALL CONDUITS INSIDE WET WELL SHALL BE RIGID GALVANIZED STEEL PLASTIC COATED C/W PLASTIC COATED FITTINGS. UNLESS OTHERWISE NOTED.
4. ALL ELECTRICAL EQUIPMENT IN WET WELL SHALL BE EXPLOSION PROOF, CLASS 1, ZONE 1.
5. ALL CONDUITS TO DRAIN INTO WET WELL.
6. THE CONTRACTOR SHALL MAINTAIN 450mm CLEARANCE BETWEEN LEVEL REGULATORS.
7. THE CONTRACTOR SHALL CONFIRM ULTRASONIC TRANSDUCER LEVEL SETTING AND FLOAT REGULATOR LEVEL SETTINGS BEFORE INSTALLATION.
8. ELEVATIONS TO BE COORDINATED WITH ENGINEER ON SITE.

## SECTION–1

SCALE 1:50

1m 0 1m 2m @M50

### REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| SEPT. 201□ | ISSUED FOR CLIENT RE□IEW | C.M. |
| MAR. 06.2019 | ISSUED FOR PERMIT | C.M. |
| APR. 2019 | 100□ DESIGN SUBMISSION | C.M. |
| MAY 2019 | ISSUED FOR TENDER | C.M. |
| | | |
| | | |

LICENSED PROFESSIONAL ENGINEER
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07.03.19
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E: info@moon-matz.com
W: www.moon-matz.com

# LISGAR DISTRICT UTILITY TRENCH DE-WATERING AND FDC PUMPING SYSTEM

wood.

MISSISSAUGA

PRODUCED FOR – T&W, ENGINEERING AND WORKS

## FDC PUMP STATION PLAN VIEWS, GENERATOR FOUNDATION PLAN & TRENCH DETAILS

| | | |
|---|---|---|
| SCALE AS SHOWN | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY R.G. | CHECKED BY C.M. | PLAN No. E-2 |
| DATE SEPT. 201□ | SHEET 25 OF 32 | |

Path: P:\5313 Utility Trench Dewatering Pump Stn\03 Dwgs\Electrical\Working Drawings\5313-E2.dwg
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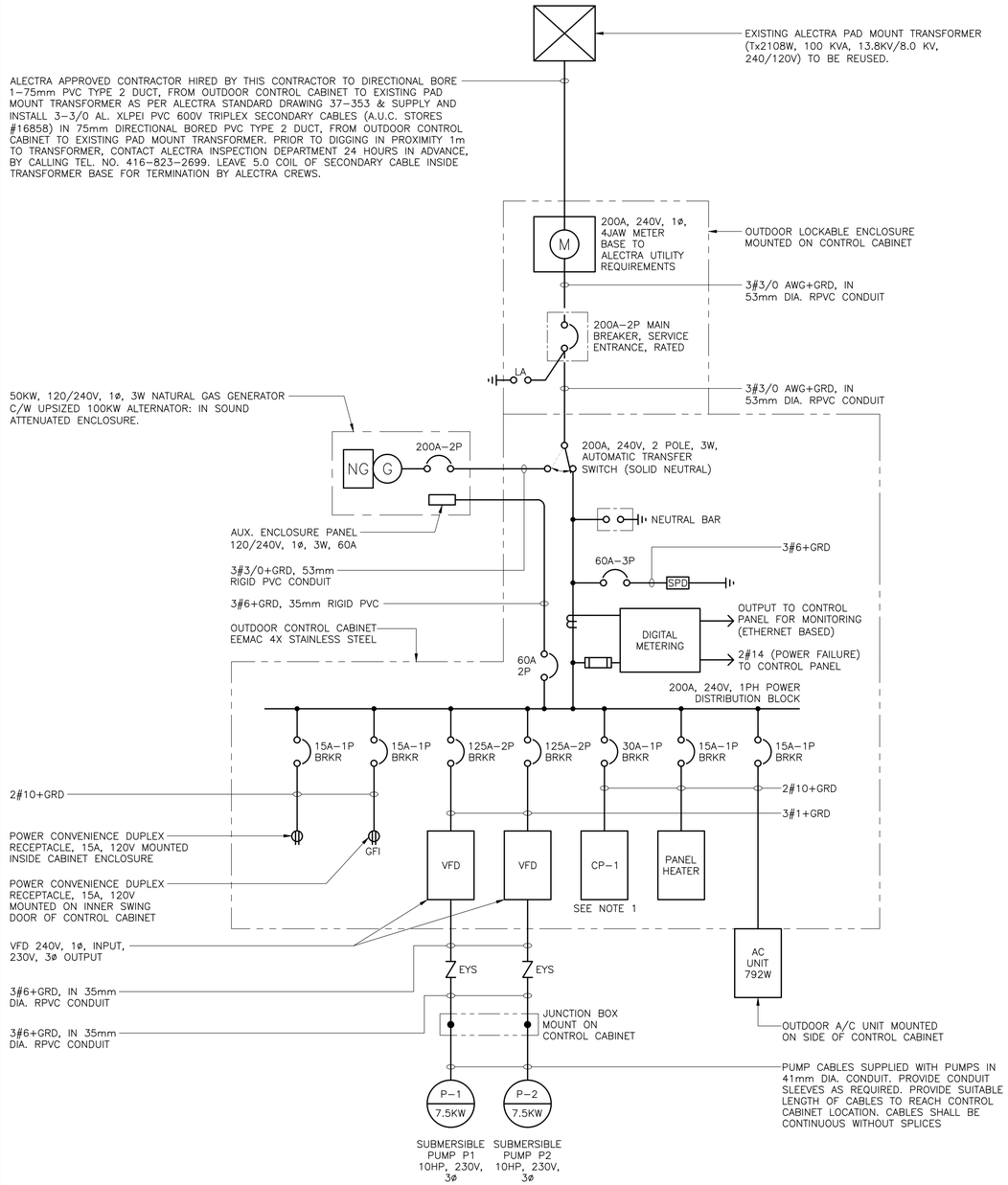
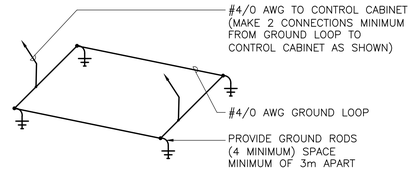



NOTE:

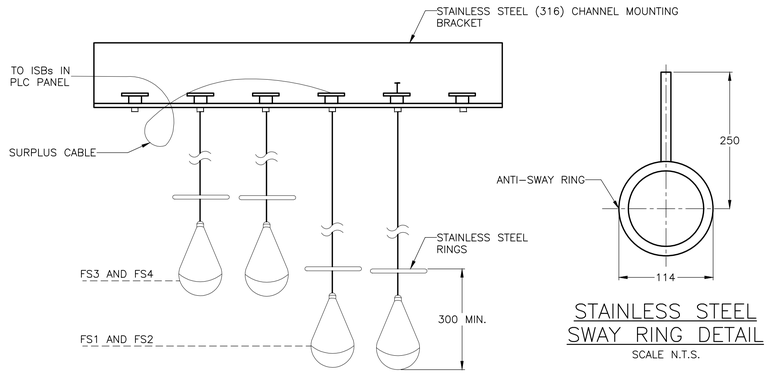
1. REFER TO CONTROL PANEL INTERIOR DETAIL ON DRAWING E5 AND SCHEMATICS ON DRAWING E7 FOR MORE DETAIL.

## SINGLE LINE DIAGRAM




## OUTDOOR GROUNDING DETAIL AT BUILDING SERVICE ENTRANCE

SCALE N.T.S.

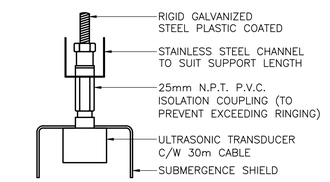



## LEVEL SWITCH INSTALLATION DETAIL WET WELL

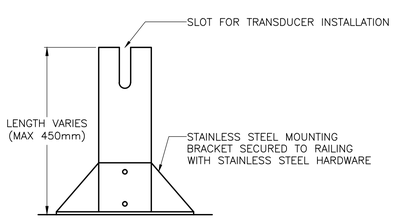
SCALE N.T.S.

## STAINLESS STEEL SWAY RING DETAIL

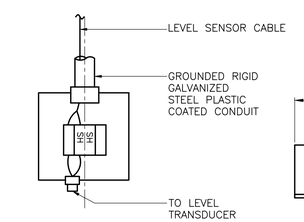
SCALE N.T.S.



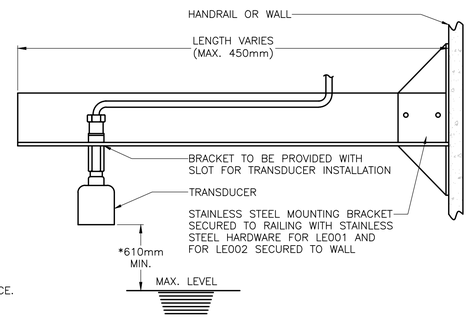

LEVEL SENSOR




PLAN VIEW




JUNCTION BOX (LOCATED OUTSIDE WET WELL)




SECTION

NOTES:

1. TRANSDUCER TO BE MOUNTED PERPENDICULAR TO LIQUID SURFACE.
2. ALL MOUNTING HARDWARE TO BE STAINLESS STEEL MATERIAL.

## TRANSDUCER MOUNTING DETAIL

SCALE N.T.S.

REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| SEPT. 201□ | ISSUED FOR CLIENT RE□IEW | C.M. |
| FEB.□2019 | ISSUED FOR 90□ CLIENT RE□IEW | C.M. |
| MAR. 06.2019 | ISSUED FOR PERMIT | C.M. |
| APR. 2019 | 100□ DESIGN SUBMISSION | C.M. |
| MAY 2019 | ISSUED FOR TENDER | C.M. |

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LISGAR DISTRICT
UTILITY TRENCH DE-WATERING AND FDC PUMPING SYSTEM

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MISSISSAUGA

PRODUCED FOR – T&W, ENGINEERING AND WORKS

SINGLE LINE DIAGRAM AND DETAILS

| | | | |
|---|---|---|---|
| SCALE N.T.S. | AREA Z-55 | | PROJECT No. 17-146 |
| C.A.D.D. BY R.G. | CHECKED BY C.M. | | PLAN No. E-3 |
| DATE SEPT. 201□ | SHEET 26 OF 32 | | |

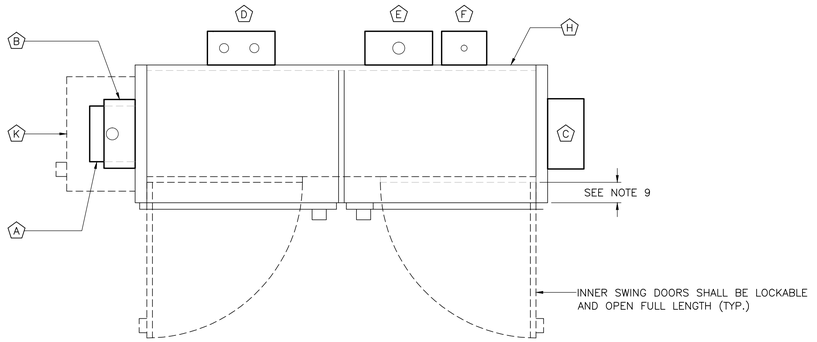
Path: P:\5313 Utility Trench Dewatering Pump Stn\03 Dwgs\Electrical\Working Drawings\5313-E3.dwg
Plotted By: ########
Plotted: 2019-08-20
Last Saved By: salvi
Last Saved: 2019-08-20

Last Saved: 2019-08-20 Last Saved By: salvi Plotted: 2019-08-20 Plotted By: ######## Path: P:\5313 Utility Trench Dewatering Pump Stn\03 Dwgs\Electrical\Working Drawings\5313-E4 & E5.dwg

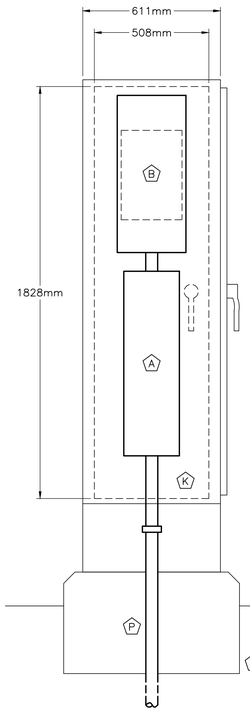
GENERAL NOTES:

1. CONTRACTOR TO CONFIRM CONDUIT SIZES PRIOR TO INSTALLATION.
2. ALL EXPOSED CONDUITS ARE TO BE NEATLY GROUPED AND RUN EITHER VERTICALLY OR HORIZONTALLY AS REQUIRED.
3. SPLICE ALL WIRES INSIDE THE JUNCTION BOX WITH INSULATED COMPRESSION CONNECTORS AND THEN TAPE WITH APPROVED INSULATION TAPES OR HEAT SHRINKING TUBING, NUMBER THE WIRES ON EACH SIDE OF THE SPLICE WITH TAPE MARKERS.
4. WIRES FROM THE JUNCTION BOX TO THE DEVICES ARE TO BE CONTINUOUS WITHOUT SPLICING.
5. PROVIDE DUXSEAL ON ALL CONDUITS ENTERING THE JUNCTION BOX FROM THE WET WELL. PROVIDE EXPLOSION PROOF EYS SEALS ON ALL CONDUITS ENTERING THE JUNCTION BOX FROM THE CONTROL PANEL.
6. COORDINATE ALL ELECTRICAL EQUIPMENT DIMENSIONS WITH THE ENCLOSURE DIMENSIONS PRIOR TO ORDERING THE ENCLOSURE.
7. INSTALLATION SHALL COMPLY WITH ELECTRICAL SAFETY AUTHORITY.
8. ALL HARDWARE SHALL BE STAINLESS STEEL.
9. ENSURE ADEQUATE SPACE BETWEEN OUTER DOOR AND INNER SWING DOOR SO THERE IS NO CONTACT BETWEEN EQUIPMENT MOUNTED ON INNER SWING DOOR.

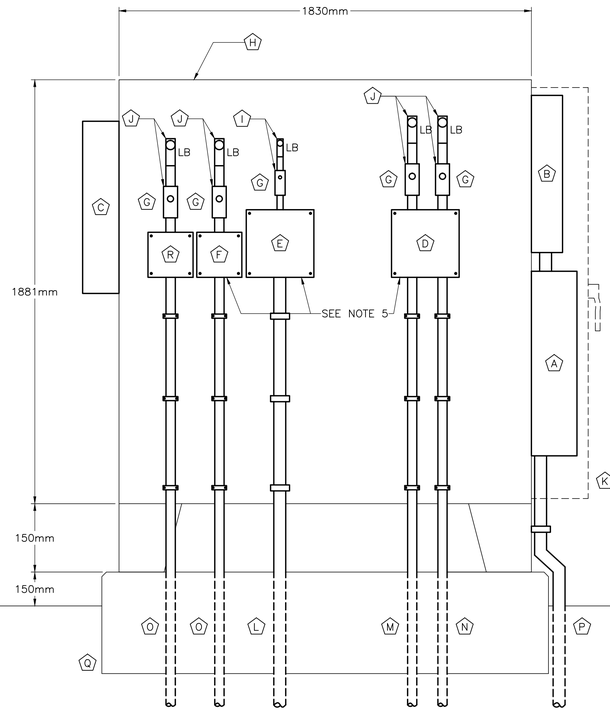
| REVISIONS | | |
|---|---|---|
| DATE | DETAILS | INIT. |
| SEPT. 201□ | ISSUED FOR CLIENT RE□IEW | C.M. |
| FEB.□2019 | ISSUED FOR 90□ CLIENT RE□IEW | C.M. |
| MAR. 06.2019 | ISSUED FOR PERMIT | C.M. |
| APR. 2019 | 100□ DESIGN SUBMISSION | C.M. |
| MAY 2019 | ISSUED FOR TENDER | C.M. |
| | | |



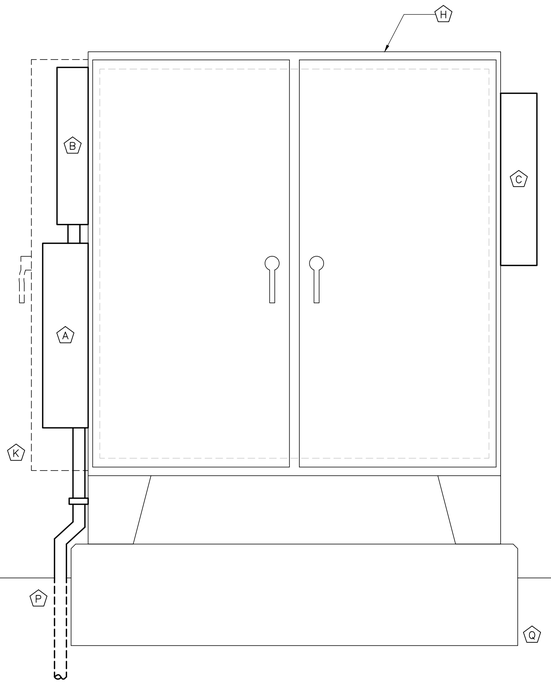

TOP VIEW OF CONTROL CABINET



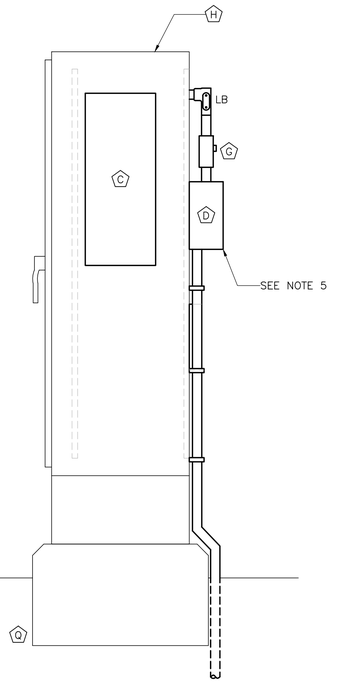

LEFT VIEW OF CONTROL CABINET




BACK VIEW OF CONTROL CABINET



FRONT VIEW OF CONTROL CABINET




RIGHT VIEW OF CONTROL CABINET

EQUIPMENT NOTES:

- (A) 200A–2P, 240V, MAIN BREAKER, SERVICE ENTRANCE RATED, 100% RATED MOUNTED ON CONTROL CABINET IN STAINLESS STEEL ENCLOSURE.
- (B) 200A, 240V, 1ø, 4JAW METER SOCKET TO ALECTRA UTILITY REQUIREMENTS. MOUNTED ON CONTROL CABINET IN STAINLESS STEEL ENCLOSURE.
- (C) VERTICAL MOUNT SLIM AIR CONDITIONING UNIT, STAINLESS STEEL, 120V, 1ø, 6.6A MOUNTED ON CONTROL CABINET. ICEQUBE MODEL #IQ2200VS OR APPROVED EQUIVALENT.
- (D) 300x300x150mm STAINLESS STEEL GASKETTED JUNCTION BOX EEMAC '4X' MOUNTED ON BACK SIDE OF CONTROL CABINET FOR SPLICING PUMP CABLES.
- (E) 300x300x150mm STAINLESS STEEL GASKETTED JUNCTION BOX EEMAC '4X' MOUNTED ON BACK SIDE OF CONTROL CABINET FOR SPLICING FLOAT CABLES.
- (F) 200X200X150mm STAINLESS STEEL GASKETTED JUNCTION BOX EEMAC '4X' MOUNTED ON BACK SIDE OF CONTROL CABINET FOR SPLICING ULTRASONIC TRANSDUCER CABLES.
- (G) EYS SEALS (TYP.)
- (H) OUTDOOR CONTROL CABINET EEMAC '4X' C/W TWO OUTER DOORS, HEAVY DUTY 3–POINT LATCHES TYPE 316L WITH PADLOCKABLE HANDLES, INNER MOUNTING PLATE (PAINTED WHITE) AND FLOOR STAND KIT. 12 GAUGE TYPE 316L STAINLESS STEEL BODY CONSTRUCTION, REMOVABLE CENTER POST, AND TWO INNER SWING DOORS TYPE 316L STAINLESS STEEL. PANEL SHALL INCLUDE STAINLESS STEEL DIVIDER WITHIN ENCLOSURE (WELDED) TO SEPARATE POWER AND CONTROL. MANUFACTURE SHALL BE HOFFMAN, RALSTON OR RITAL. CABINET C/W VIINYL WRAP MURAL. MURAL DESIGN TO BE DETERMINED.
- (I) 27mm DIA. RGSPC CONDUIT C/W EYS SEAL. DRILL THROUGH BACK OF CONTROL CABINET FOR CONDUIT ENTRY AND SEAL WATER TIGHT.
- (J) 41mm DIA. RGSPC CONDUIT C/W EYS SEAL. DRILL THROUGH BACK OF CONTROL CABINET FOR CONDUIT ENTRY AND SEAL WATER TIGHT.
- (K) OUTDOOR ENCLOSURE EEMAC '4X' C/W ONE OUTER DOOR, HEAVY DUTY 3–POINT LATCHES TYPE 316L WITH PADLOCKABLE HANDLES AND INNER MOUNTING PLATE MOUNTED ON SIDE OF CONTROL CABINET. 14 GAUGE TYPE 316L STAINLESS STEEL BODY CONSTRUCTION C/W STAINLESS STEEL WINDOW KIT. MANUFACTURE SHALL BE HOFFMAN, RALSTON OR RITAL. CABINET C/W VIINYL WRAP MURAL. MURAL DESIGN TO BE DETERMINED.
- (L) 1–53mm DIA. RPVC CONDUIT C/W FLOAT CABLES TO WET WELL.
- (M) 1–41mm DIA. RPVC CONDUIT C/W SUBMERSIBLE PUMP P1 CABLES WET WELL.
- (N) 1–41mm DIA. RPVC CONDUIT C/W SUBMERSIBLE PUMP P2 CABLES TO WET WELL.
- (O) 1–41mm DIA. RPVC CONDUIT C/W ULTRASONIC TRANSDUCER/PRESSURE TRANSMITTER CABLES TO WET WELL.
- (P) 1–53mm DIA. RPVC CONDUIT C/W 3#1+GRD SECONDARY FEEDERS TO CONTROL CABINET.
- (Q) CONCRETE BASE, REFER TO DETAILS ON DRAWING E5.
- (R) 200X200X150mm STAINLESS STEEL GASKETTED JUNCTION BOX EEMAC '4X' MOUNTED ON BACK SIDE OF CONTROL CABINET FOR SPLICING PRESSURE TRANSMITTER CABLES.

OUTDOOR CONTROL CABINET EXTERIOR DETAIL

SCALE N.T.S.

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OUTDOOR CONTROL CABINET
EXTERIOR DETAIL

| | | |
|---|---|---|
| SCALE AS SHOWN | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY R.G. | CHECKED BY C.M. | PLAN No. |
| DATE SEPT. 201□ | SHEET 27 OF 32 | E-4 |

Path: P:\5313 Utility Trench Dewatering Pump Stn\03 Dwgs\Electrical\Working Drawings\5313-E4 & E5.dwg
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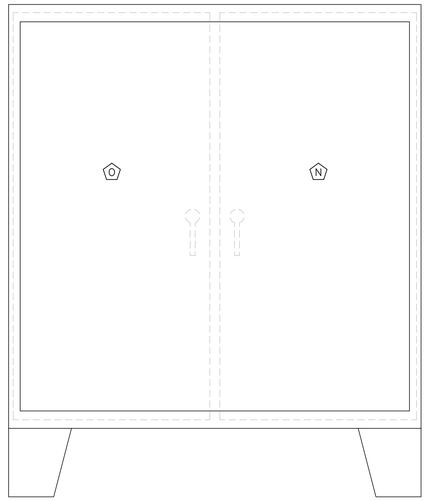
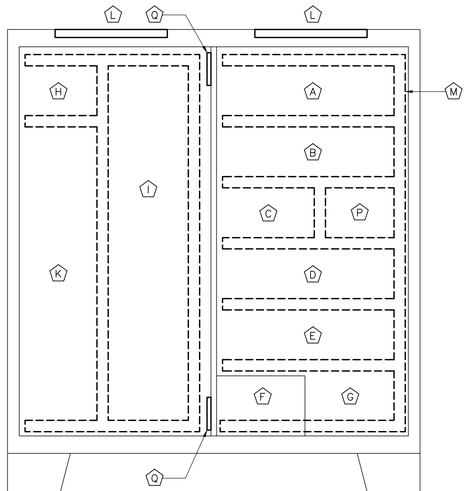
Last Saved By: salvi
Last Saved: 2019-08-20




## GENERAL NOTES:

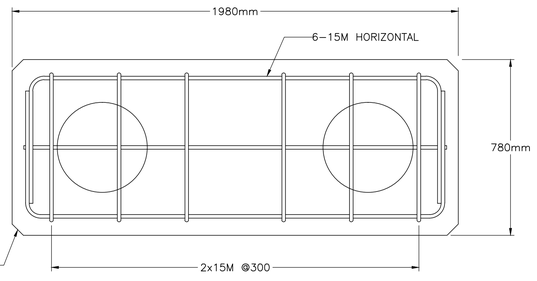
1. PANEL DETAIL IS A GENERAL OVERVIEW FOR LAYOUT/ORGANIZATIONAL PURPOSES AND DOES NOT SHOW ALL DEVICES REQUIRED. CONTRACTOR SHALL REFER TO SCHEMATIC DIAGRAMS AND COORDINATE WITH PANEL MANUFACTURER FOR A COMPLETE INSTALLATION.
2. DIN RAIL MOUNTS SHALL BE PROVIDED AS REQUIRED FOR ALL NECESSARY EQUIPMENT.

## EQUIPMENT NOTES:

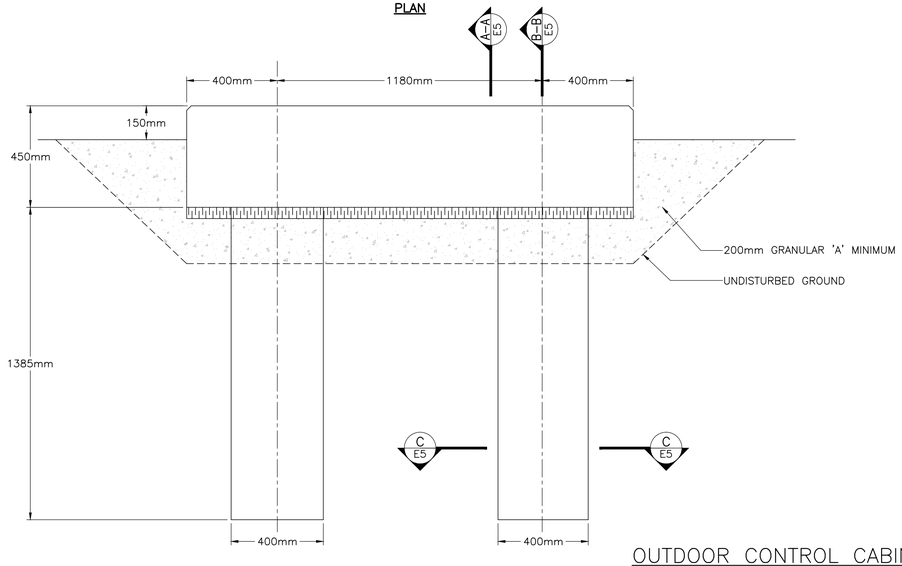
- (A) MINI PC, ETHERNET SWITCH, MODEM, TEMPERATURE CONTROLLER, ETC.
- (B) 120/24V POWER SUPPLY, PLC AND FUSED TERMINAL BLOCKS, ETC.
- (C) ULTRASONIC LEVEL TRANSMITTER, PRESSURE TRANSMITTER, SURGE SUPPRESSION DEVICE, TERMINAL BLOCKS, ETC.
- (D) COMMUNICATIONS SERVICE RECEPTACLE, RELAYS, FUSES, CIRCUIT BREAKERS, ETC.
- (E) ETHERNET PORTS, RELAYS, CONTACTORS, FUSES, CIRCUIT BREAKERS, TERMINAL BLOCKS, ETC.
- (F) INTRINSICALLY SAFE RELAYS C/W BARRIER.
- (G) UPS AND UPS RECEPTACLE.
- (H) POWER DISTRIBUTION BLOCK, PANEL SENSORS, TEMPERATURE CONTROLELR, ETC.
- (I) MOLDED CASE CIRCUIT BREAKERS, VFD DRIVES, SURGE SUPPRESSION DEVICE, NEUTRAL BARS, RELAYS, CONTACTORS, FUSES, TERMINAL BLOCKS, ETC.
- (J) NOT USED.
- (K) AUTOMATIC TRANSFER SWITCH (SOLID NEUTRAL), ENCLOSURE HEATER, POWER CONVENIENCE RECEPTACLE, ETC.
- (L) LED LIGHT FIXTURES MOUNTED BEHIND SWING DOOR AND U/S OF ENCLOSURE ROOF C/W BUILT-IN LIGHT SWITCHES.
- (M) WIRE WAY FOR USE AS REQUIRED (TYP.).
- (N) INNER SWING DOOR – OPERATOR INTERFACE, DIGITAL METERING UNIT, PILOT LIGHTS, SELECTOR SWITCHES, INTERFACE PORTS (COMMUNICATIONS SERVICE RECEPTACLE, DATA PORTS, USB PORTS), ELAPSED TIME METERS, ETC.
- (O) INNER SWING DOOR – POWER CONVENIENCE RECEPTACLE, LOCKABLE DISCONNECT HANDLE INTERLOCKED WITH PUMP CIRCUIT BREAKER (TYP. OF 2), LOCKABLE TWO POSITION HANDLE INTERLOCKED WITH AUTOMATIC TRANSFER SWITCH, ETC.
- (P) SHELF TO HOUSE AUTO DIALER, DEDICATED POWER RECEPTACLE.
- (Q) VENTILATION FAN.

## OUTDOOR CONTROL CABINET INTERIOR DETAIL

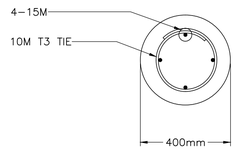
SCALE N.T.S.



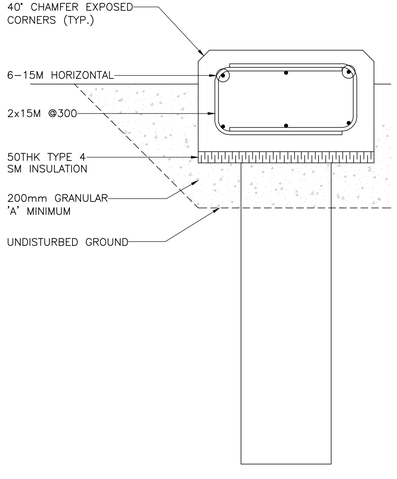

PLAN



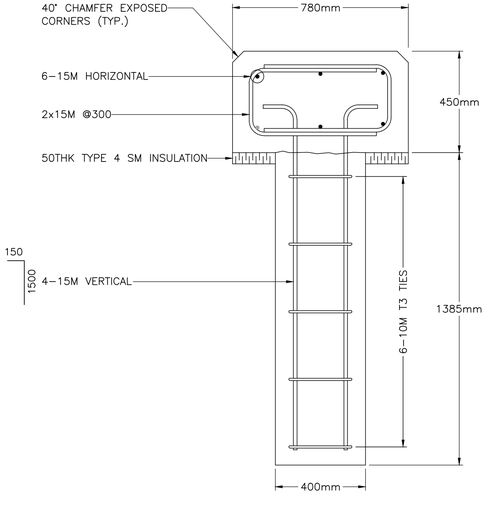

ELEVATION




SECTION C-C




SECTION A-A




SECTION B-B

## OUTDOOR CONTROL CABINET CONCRETE BASE DETAIL

SCALE N.T.S.

| REVISIONS | | |
|---|---|---|
| DATE | DETAILS | INIT. |
| SEPT. 201□ | ISSUED FOR CLIENT RE□IEW | C.M. |
| FEB.□2019 | ISSUED FOR 90□ CLIENT RE□IEW | C.M. |
| MAR. 06.2019 | ISSUED FOR PERMIT | C.M. |
| APR. 2019 | 100□ DESIGN SUBMISSION | C.M. |
| MAY 2019 | ISSUED FOR TENDER | C.M. |

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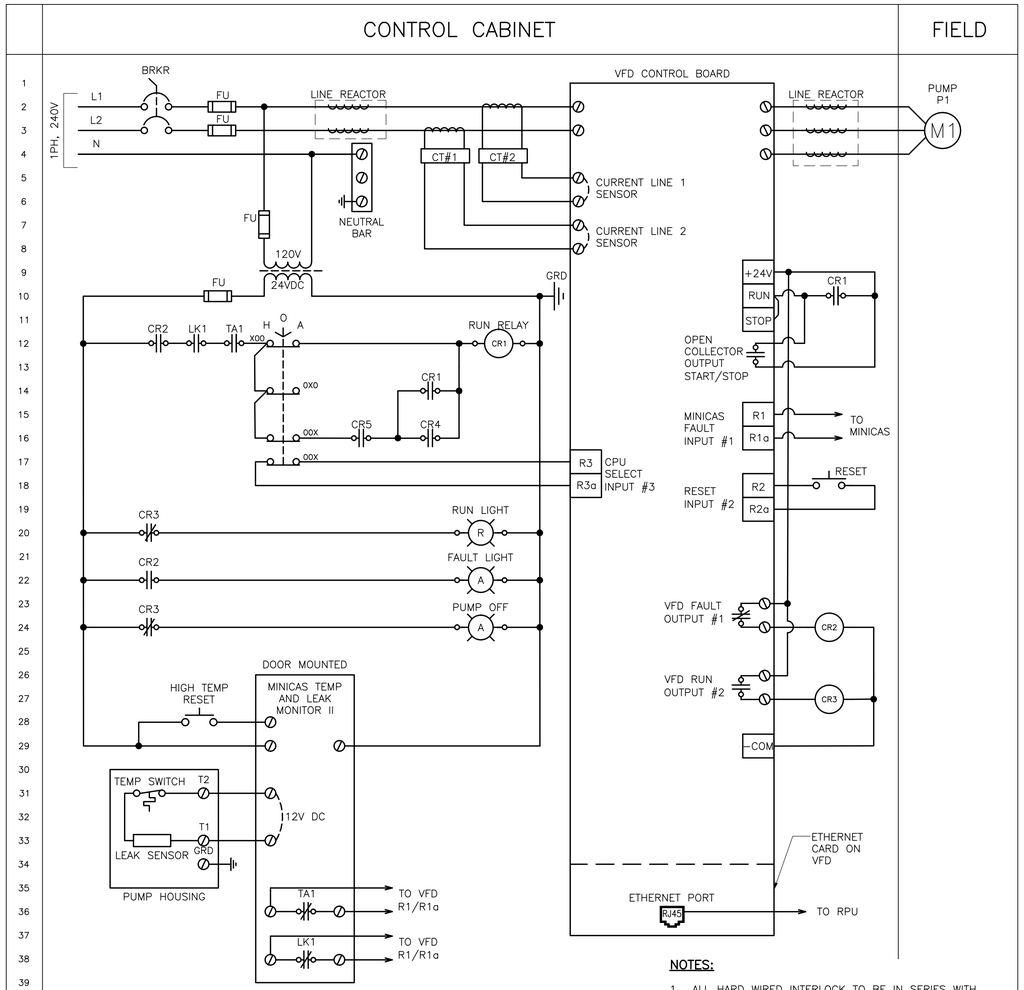
OUTDOOR CONTROL CABINET INTERIOR DETAIL AND CONCRETE BASE DETAIL

| | | | |
|---|---|---|---|
| SCALE N.T.S. | AREA Z-55 | | PROJECT No. 17-146 |
| C.A.D.D. BY R.G. | CHECKED BY C.M. | | PLAN No. |
| DATE SEPT. 201□ | SHEET 2□ OF 32 | | E-5 |

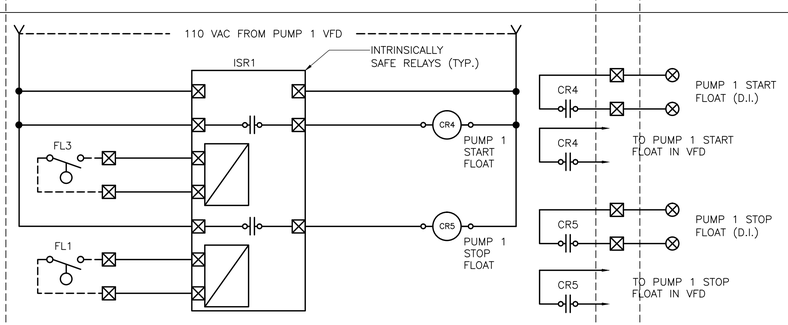
| REVISIONS | | |
|---|---|---|
| DATE | DETAILS | INIT. |
| SEPT. 201□ | ISSUED FOR CLIENT RE□IEW | C.M. |
| FEB.□2019 | ISSUED FOR 90□ CLIENT RE□IEW | C.M. |
| MAR. 06 2019 | ISSUED FOR PERMIT | C.M. |
| APR. 2019 | 100□ DESIGN SUBMISSION | C.M. |
| MAY 2019 | ISSUED FOR TENDER | C.M. |




## PUMP P1 CONTROL SCHEMATIC

**NOTES:**

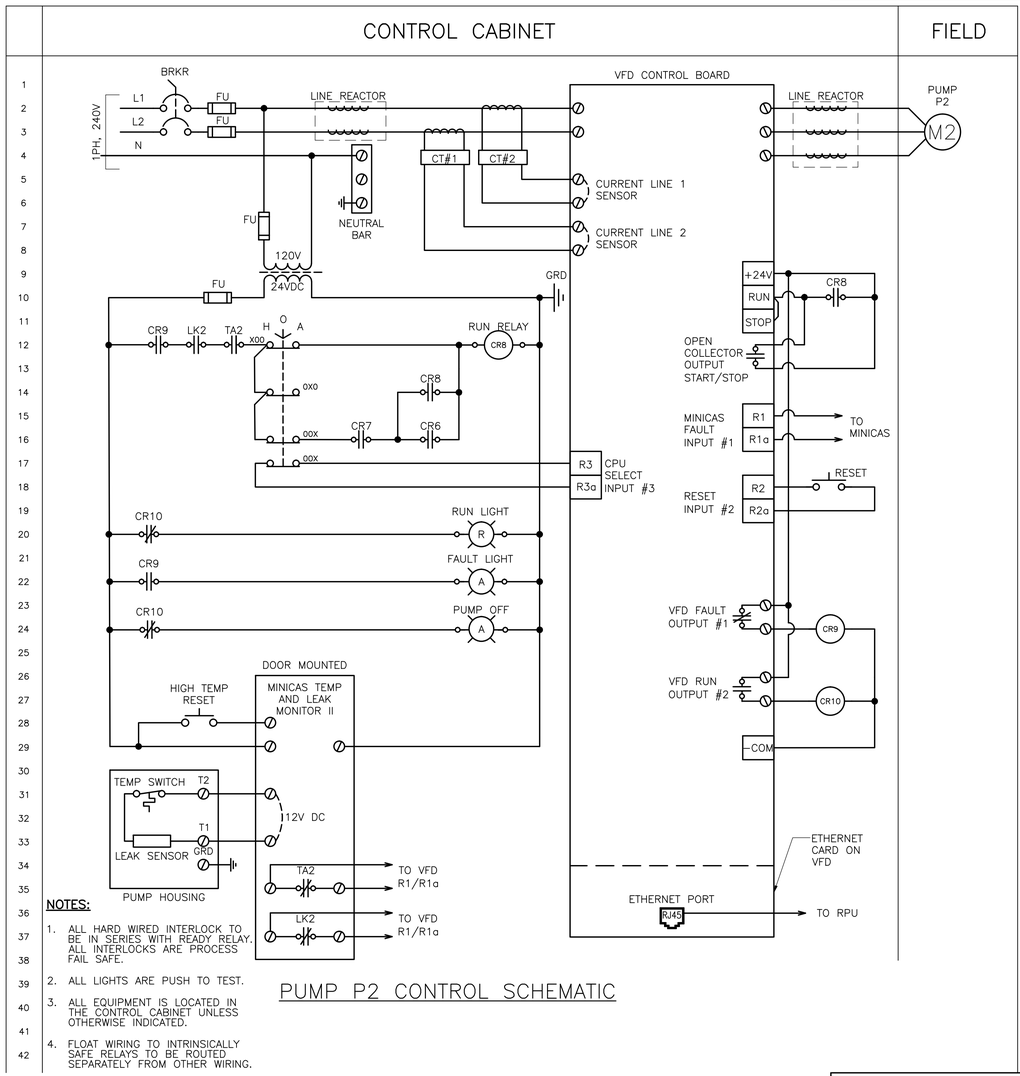
1. ALL HARD WIRED INTERLOCK TO BE IN SERIES WITH READY RELAY. ALL INTERLOCKS ARE PROCESS FAIL SAFE.
2. ALL LIGHTS ARE PUSH TO TEST.
3. ALL EQUIPMENT IS LOCATED IN THE CONTROL CABINET UNLESS OTHERWISE INDICATED.
4. FLOAT WIRING TO INTRINSICALLY SAFE RELAYS TO BE ROUTED SEPARATELY FROM OTHER WIRING.




## FLOAT LEVEL BACKUP

**NOTE:**

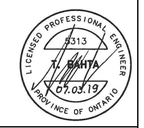
1. FLOAT WIRING TO INTRINSICALLY SAFE RELAYS TO BE ROUTED SEPARATELY FROM OTHER WIRING.




## PUMP P2 CONTROL SCHEMATIC

**NOTES:**

1. ALL HARD WIRED INTERLOCK TO BE IN SERIES WITH READY RELAY. ALL INTERLOCKS ARE PROCESS FAIL SAFE.
2. ALL LIGHTS ARE PUSH TO TEST.
3. ALL EQUIPMENT IS LOCATED IN THE CONTROL CABINET UNLESS OTHERWISE INDICATED.
4. FLOAT WIRING TO INTRINSICALLY SAFE RELAYS TO BE ROUTED SEPARATELY FROM OTHER WIRING.





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# LISGAR DISTRICT UTILITY TRENCH DE-WATERING AND FDC PUMPING SYSTEM

wood.

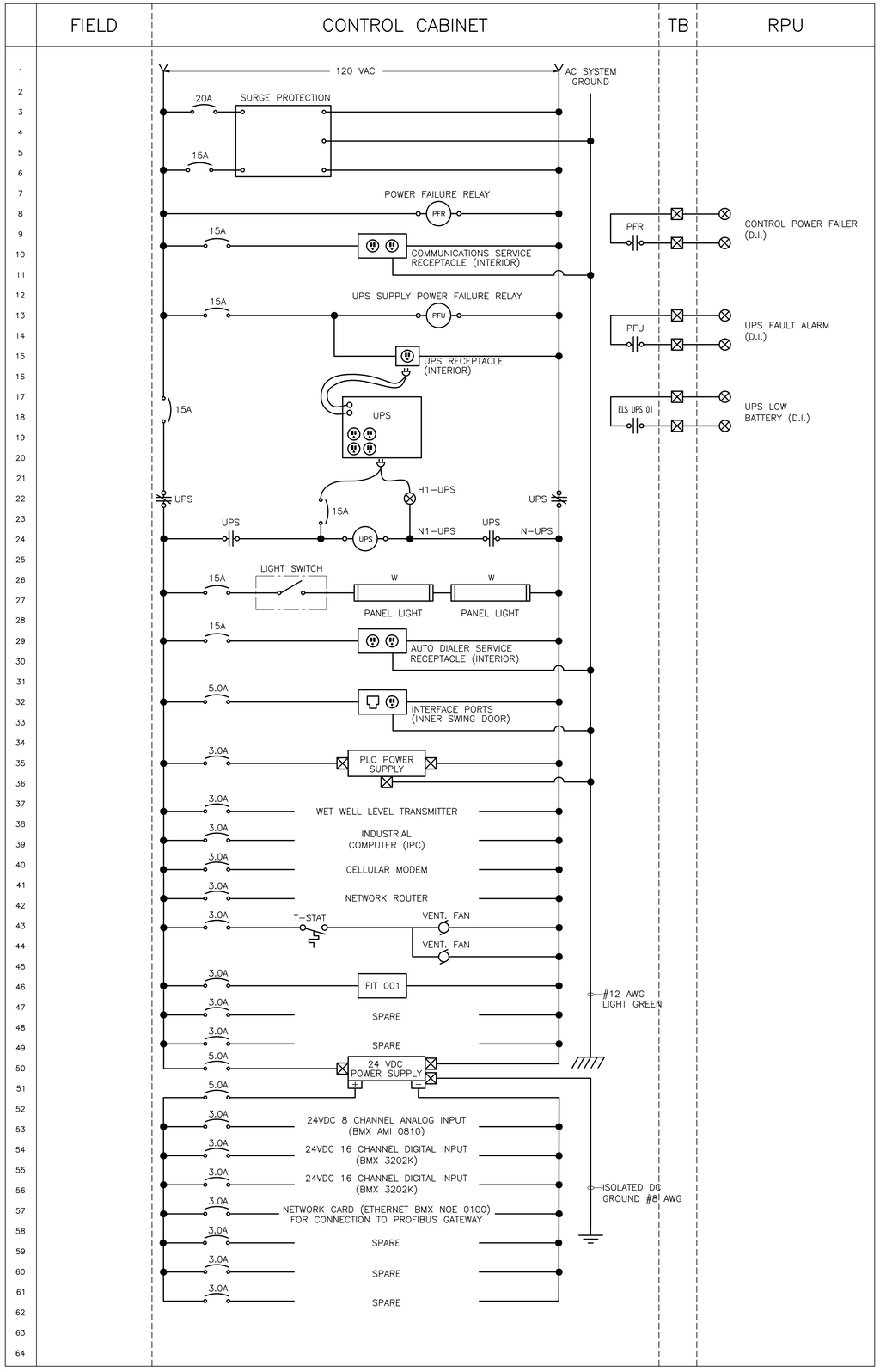
MISSISSAUGA

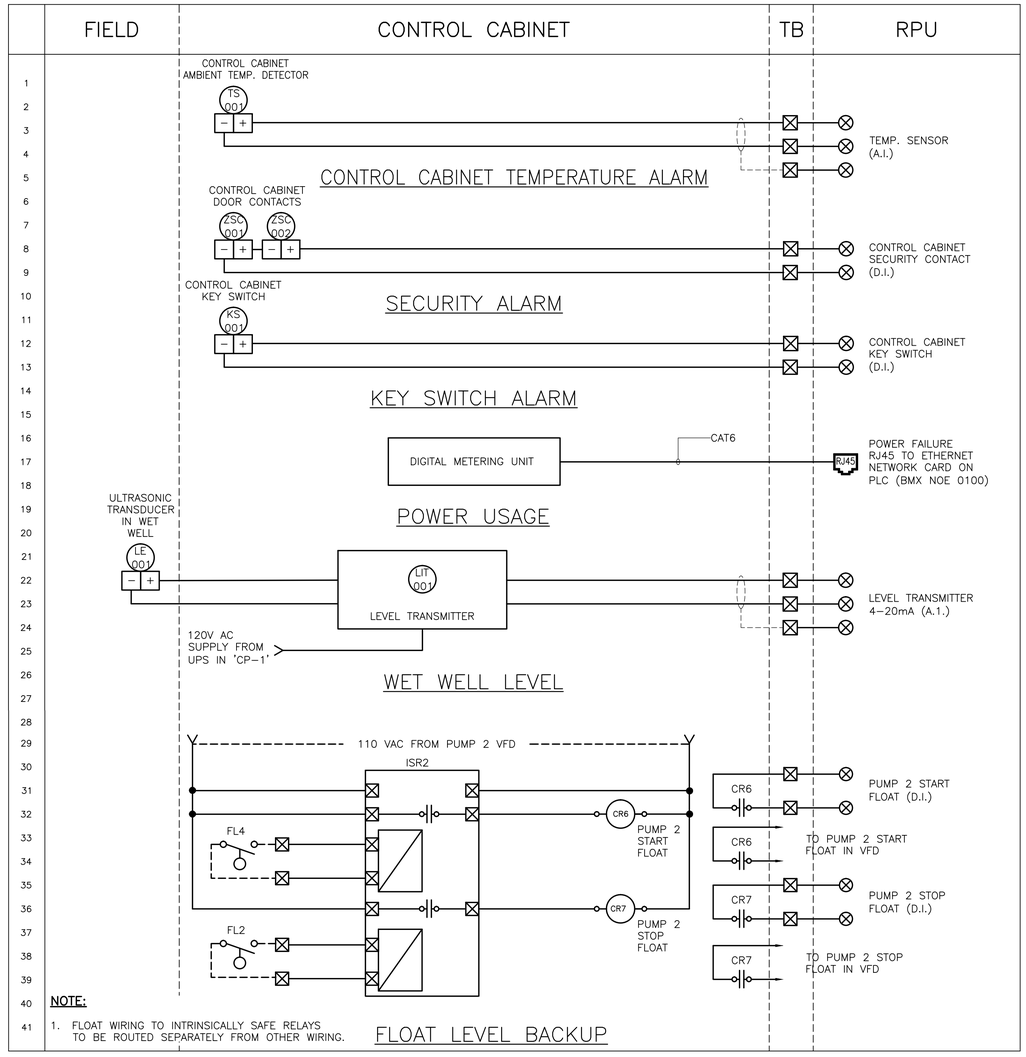
PRODUCED FOR – T&W, ENGINEERING AND WORKS

## CONTROL SCHEMATICS SHEET 1

| | | | |
|---|---|---|---|
| SCALE AS SHOWN | AREA Z-55 | | PROJECT No. 17-146 |
| C.A.D.D. BY R.G. | CHECKED BY C.M. | | PLAN No. E-6 |
| DATE SEPT. 201□ | SHEET 29 OF 32 | | |


Path: P:\5313 Utility Trench Dewatering Pump Stn\03 Dwgs\Electrical\Working Drawings\5313-E6-E8.dwg
Plotted By: ########
Plotted: 2019-08-20
Last Saved By: salvi
Last Saved: 2019-08-20

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| DATE | DETAILS | INIT. |
| SEPT. 201□ | ISSUED FOR CLIENT RE□IEW | C.M. |
| FEB.□2019 | ISSUED FOR 90□ CLIENT RE□IEW | C.M. |
| MAR. 06.2019 | ISSUED FOR PERMIT | C.M. |
| APR. 2019 | 100□ DESIGN SUBMISSION | C.M. |
| MAY 2019 | ISSUED FOR TENDER | C.M. |

9313
T. MEHTA
07.03.19
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# LISGAR DISTRICT UTILITY TRENCH DE-WATERING AND FDC PUMPING SYSTEM

wood.

MISSISSAUGA

PRODUCED FOR – T&W, ENGINEERING AND WORKS

## CONTROL SCHEMATICS SHEET 2

| | | |
|---|---|---|
| SCALE AS SHOWN | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY R.G. | CHECKED BY C.M. | PLAN No. |
| DATE SEPT. 201□ | SHEET 30 OF 32 | E-7 |


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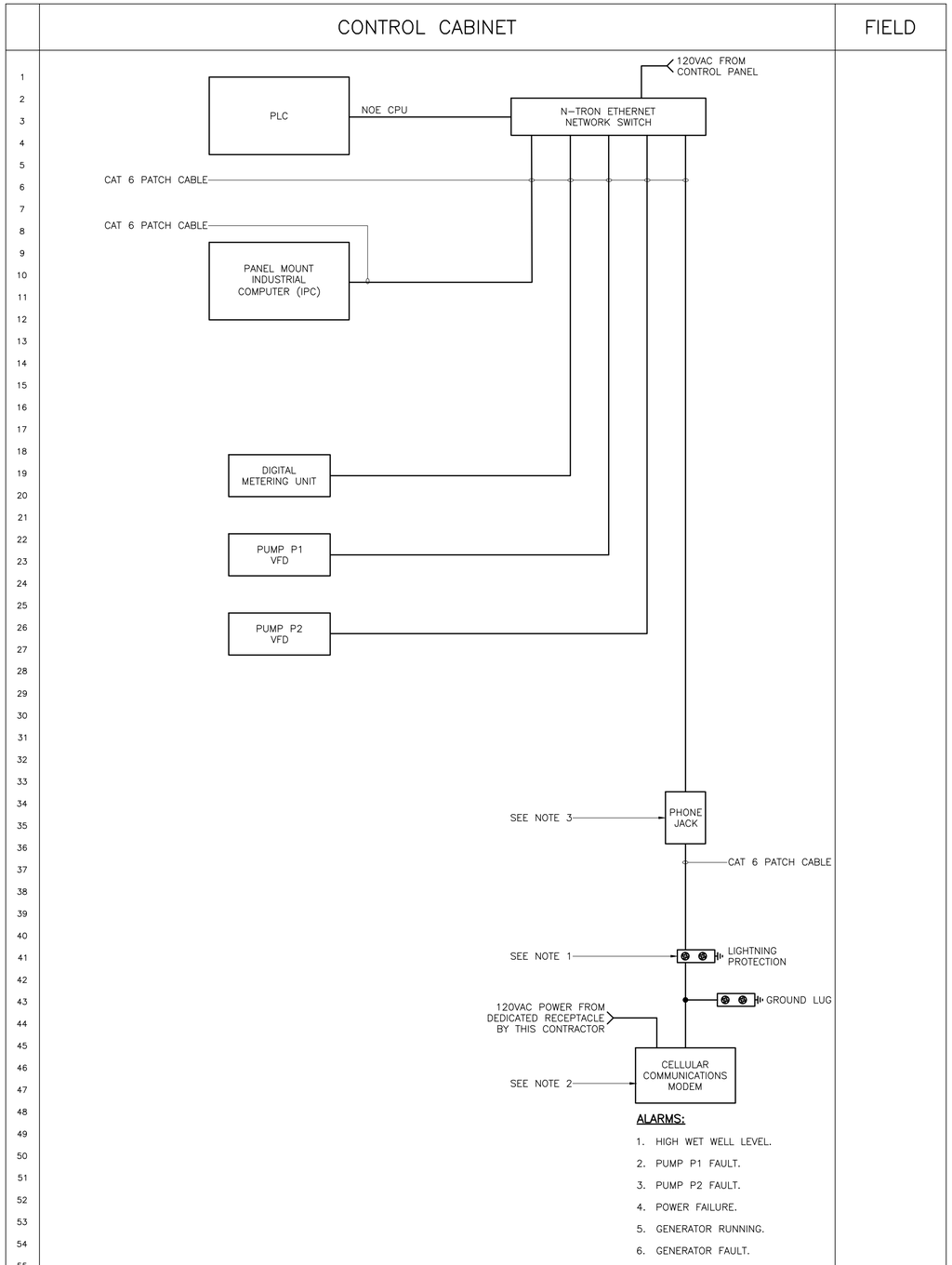


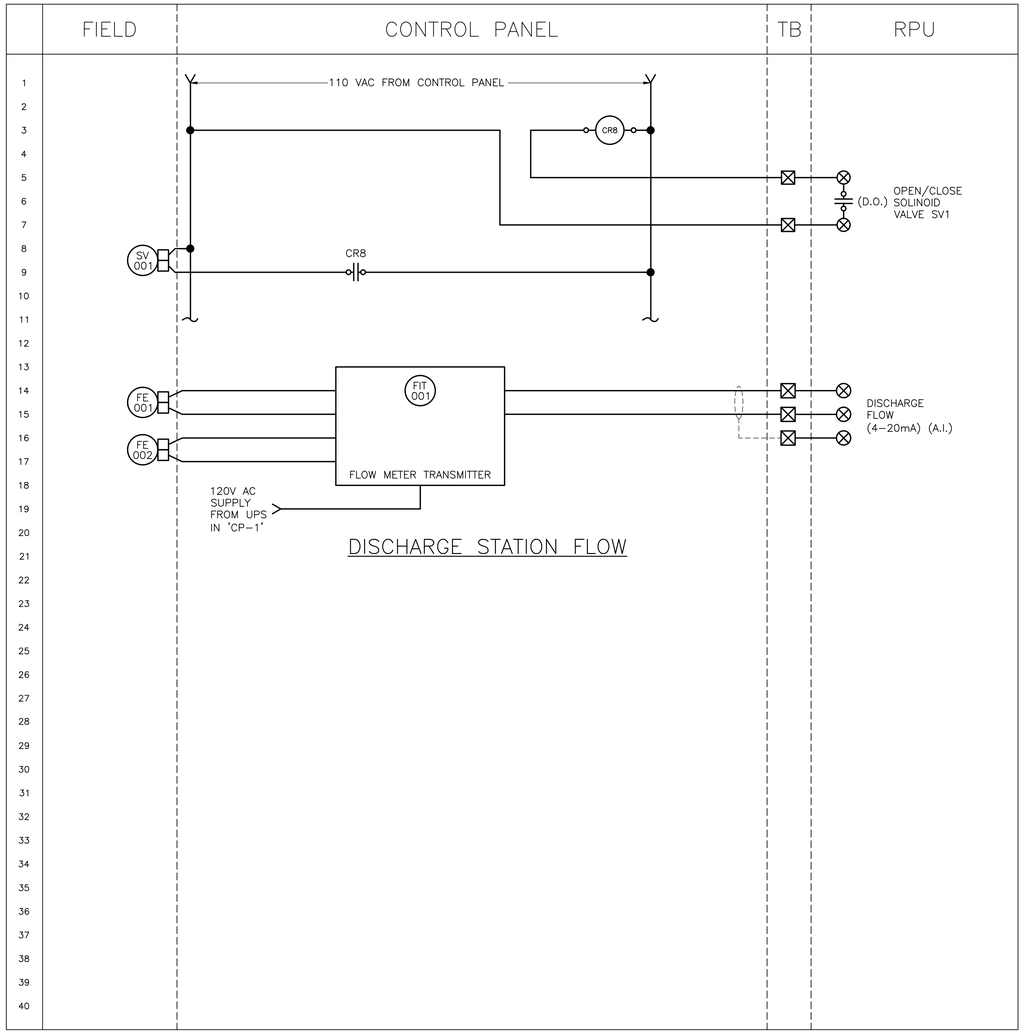

**ALARMS:**

1. HIGH WET WELL LEVEL.
2. PUMP P1 FAULT.
3. PUMP P2 FAULT.
4. POWER FAILURE.
5. GENERATOR RUNNING.
6. GENERATOR FAULT.

## COMMUNICATIONS BLOCK DIAGRAM

**NOTES:**

1. CABLE AND LIGHTNING ARRESTOR SUPPLIED BY BELL CANADA.
2. EQUIPMENT SUPPLIED BY CITY OF MISSISSAUGA.
3. OUTLET TO BE YELLOW.
4. ALL WIRING TO BE DONE TO TIA568B WIRING MAP.
5. NETWORK COMMUNICATIONS TO BE USED AS PRIMARY FOR CONTROLS. CONTROL CABLES USED AS SECONDARY (I.E. REDUNDANT CIRCUITS).




## DISCHARGE STATION FLOW

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# LISGAR DISTRICT UTILITY TRENCH DE-WATERING AND FDC PUMPING SYSTEM

wood.

MISSISSAUGA

PRODUCED FOR – T&W, ENGINEERING AND WORKS

CONTROL SCHEMATICS
SHEET 3

| | | |
|---|---|---|
| SCALE N.T.S. | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY R.G. | CHECKED BY C.M. | PLAN No. |
| DATE SEPT. 201□ | SHEET 31 OF 32 | E-□ |

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| DATE | DETAILS | INIT. |
| AUG. 2019 | ISSUED FOR TENDER | M.S. |
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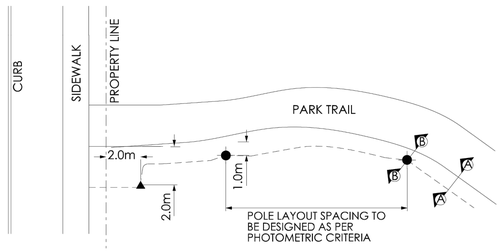
| | | |

# 16530-1

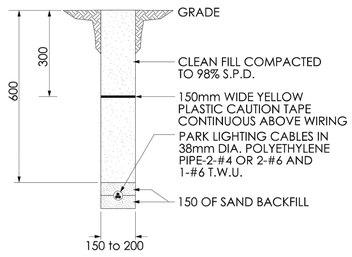
## Lighting & Electrical
## Trail Lighting Pole/Conduit/Trench Location

NOTE:
To be used as a Guideline only. Not to scale. Remove City title block & redraw to represent site specific conditions.
All site specific conditions are to be confirmed by the project consultant.

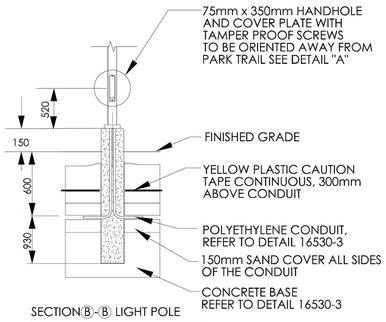



KEY

- ▲ POWER PEDESTAL IS OFFSET 2.0m FROM PROPERTY LINE AND 2.0m FROM PARK TRAIL EDGE
- ● LIGHT POLE IS TO BE OFFSET 0.60m FROM PARK TRAIL EDGE
- CONDUIT IS OFFSET 1.0m FROM PARK TRAIL EDGE




SECTION Ⓐ-Ⓐ TRENCH CONDUIT




SECTION Ⓑ-Ⓑ LIGHT POLE

NOTES:

1. REFER TO ASPHALT PARK TRAIL DETAIL NO. 02510-1.
2. TRENCH TO BE SET BACK 1000mm FROM PARK TRAIL EDGE.
3. LIGHT POLE TO BE SET BACK 600mm FROM PARK TRAIL EDGE.
4. POWER PEDESTAL TO BE SET BACK 2000mm FROM PARK TRAIL EDGE AND 2000mm FROM PROPERTY LINE.
5. POLE SPACING IS TO BE DETERMINED BY A CERTIFIED ELECTRICAL ENGINEER.
6. ELECTRICAL CONNECTION TO BE MADE BY ENERSOURCE AFTER E.S.A. APPROVAL.
7. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.
8. ARRANGE INSPECTIONS OF WORK PER SPECIFICATION.
9. REFER TO DETAIL 16530-18 PHOTOMETRIC CRITERIA FOR TRAIL LIGHTING FOR POLE LAYOUT.

Detail: 16530-1

ORIGINAL DATE: Oct 09/15
REVISION DATE: month xx/1x

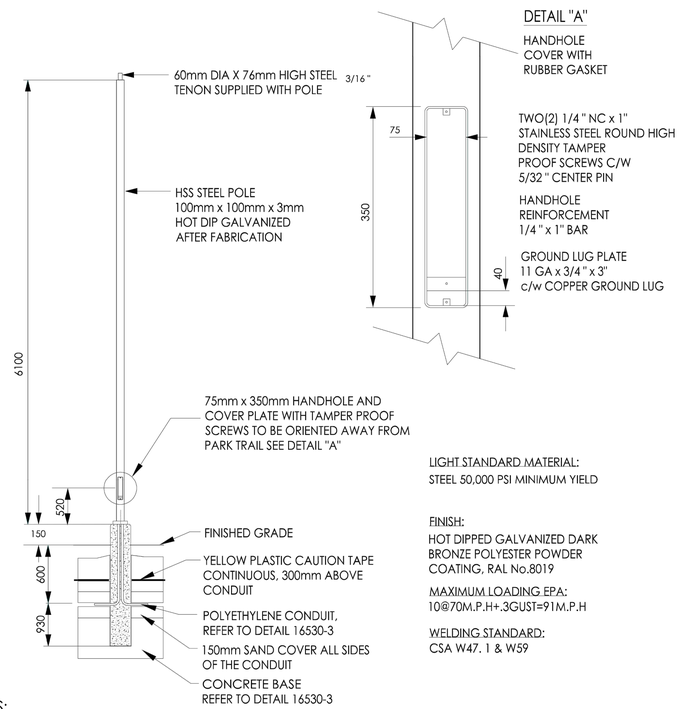
MISSISSAUGA

1 CITY STANDARD LIGHT DETAIL 1
N.T.S.

# 16530-2

## Lighting & Electircal
## Trail Light Pole

NOTE:
TO BE USED AS A GUIDELINE ONLY. NOT TO SCALE. REMOVE CITY TITLE BLOCK AND REDRAW TO REPRESENT SITE SPECIFIC CONDITIONS. ALL SITE SPECIFIC CONDITIONS ARE TO BE CONFIRMED BY THE PROJECT CONSULTANT.




LIGHT STANDARD MATERIAL:
STEEL 50,000 PSI MINIMUM YIELD

FINISH:
HOT DIPPED GALVANIZED DARK BRONZE POLYESTER POWDER COATING, RAL No.8019

MAXIMUM LOADING EPA:
10@70M.P.H+.3GUST=91M.P.H

WELDING STANDARD:
CSA W47. 1 & W59

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED
2. POLES TO BE HOT DIP GALVANIZED AFTER FABRICATION.
3. ARRANGE INSPECTIONS OF WORK PER SPECIFICATION.
4. FOR SHALLOW POLE BASE COVER REFER TO SPECIFICATIONS.

N.T.S.

Detail: 16530-2

ORIGINAL DATE: Oct 09/15
REVISION DATE: month xx/1x

MISSISSAUGA

2 CITY STANDARD LIGHT DETAIL 2
N.T.S.

LISGAR DISTRICT
UTILITY TRENCH DE-WATERING
AND FDC PUMPING SYSTEM

wood.

MISSISSAUGA

PRODUCED FOR – T&W, ENGINEERING AND WORKS

CITY STANDARD
LIGHTING DETAIL

| | | |
|---|---|---|
| SCALE N.T.S. | AREA Z-55 | PROJECT No. 17-146 |
| C.A.D.D. BY D.C. | CHECKED BY M.S. | PLAN No. E-9 |
| DATE MAY 2019 | SHEET 32 OF 32 | |

# Appendix F
# Hydraulic Assessment Report

# Hydraulic Assessment Report

Lisgar District FDC Pumping Stations Class EA and Design
City of Mississauga
Project # WW21011023

Prepared for:

**City of Mississauga**
201 City Centre Drive, Suite 800, Mississauga, Ontario, L5B 3A3

9/6/2022

# Hydraulic Assessment Report

Lisgar District FDC Pumping Stations Class EA and Design
Project Location
Project # WW21011023

**Prepared for:**

City of Mississauga
201 City Centre Drive, Suite 800, Mississauga, Ontario, L5B 3A3

**Prepared by:**

Wood Environment & Infrastructure Solutions Canada Limited
3450 Harvester Road, Suite 100, Burlington ON, L7N 3W5
[Comments]

**9/6/2022**

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| Report Revision History | | |
|---|---|---|
| **Version** | **Date** | **Description** |
| 1 | May 4, 2022 | Initial Draft for City Review |
| 2 | September 6, 2022 | Revised based on City comments |
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# 1.0 Introduction

Wood Environment & Infrastructure Solutions Canada Limited (Wood) has been retained by the City of Mississauga (City) to undertake a Class Environmental Assessment (Class EA) for the Lisgar District Foundation Drain Collector (FDC) Pumping Station Study.

Wood has been supporting the City with respect to the issues surrounding basement water infiltration since 2011 (first reported instances of basement water infiltration were in approximately 2008). Following the release of a Public Summary Report in 2015, Wood along with the City has conducted a number of components, primarily related to the development and implementation of a remedial action plan to address identified causes and issues related to the basement water infiltration, and the ongoing annual monitoring program which is intended to assess the effectiveness of remedial measures post implementation and adjust the program as required, based on monitoring data feedback. Detailed summaries are provided in annual monitoring reports, which provide a year-by-year summary of activities, and the findings of the monitoring effort.

Based on the ongoing annual monitoring program of the FDC and other drainage systems within the Lisgar District undertaken by Wood, it is understood that surcharge within the FDC system continues to occur, along with reports of basement water infiltration.

The current Class EA is the next logical step based on previous work on this project, which has continued to take a systematic approach to the identification and prioritization of remedial works, particularly through the completion of Priority Action Plans. Given the ongoing issues with the inflow of extraneous stormwater to the Foundation Drain Collector (FDC) sewer system, and the resulting FDC sewer surcharge and impacts to connected residential foundations (basement water infiltration), the City has in recent years advocated for a more permanent form of mitigation. This has involved the completion of an Environmental Assessment (EA) in 2018 to determine the preferred location for a permanent pumping station in the (then) most affected area, namely Black Walnut Trail. This process ultimately identified the Cactus Gate Parkette as the preferred site for a permanent pumping station, due to the overall benefit to affected properties, public land availability, infrastructure geometry, and other technical factors.

Wood subsequently supported the City in the preliminary and detailed design of the Cactus Gate Parkette pumping station, which was tendered in late 2019. The design incorporated both a low flow component (ongoing drainage of accumulated stormwater in the granular bedding material of the utility trench) and a high flow component (to manage surcharged water within the FDC sewer system). Both sources of water are directed to a wet well chamber and pumped to surface, and towards Lisgar Creek (a tributary of Sixteen Mile Creek). Construction of the pumping station began in January 2020. The work extended over 2020 (primary construction works were completed in approximately June 2020; works thereafter were focused on electrical and control systems and other components). Due to operational issues, final commissioning did not occur until March 2021. The pumping station has been operational since March 17, 2021, the day that the 14-day operational testing began.

While reported basement water infiltration issues and FDC system surcharging occurs most frequently along Black Walnut Trail (based on monitoring), there are numerous other areas within the Lisgar District which experience basement water infiltration. In particular, the area along the FDC trunk sewer between approximately Doug Leavens Boulevard and Ninth Line (including Alderwood Trail, Osprey Boulevard, Prairie Circle and Pondview Way), has repeatedly experienced basement water infiltration events. These areas have a different general response however, as they tend to respond more to saturated ground, long-duration rainfall events (such as spring freshets), whereas the Black Walnut Trail area tends to be more responsive to short-duration, high-intensity rainfall events (such as thunderstorms).

The outcomes of the current Class EA will determine the long-term plan associated with pumping systems for the City with respect to reducing basement water infiltration in the overall Lisgar District, from the CPR at the upstream end to Ninth Line at the downstream end. The focus, as in the previous work, will be upon determining the most functionally and cost-effective solution that benefits and protects residents to the extent possible, while considering and minimizing other potential impacts (social, environmental, financial, etcetera).

Fundamental to this screening process is the hydrologic/hydraulic modelling and assessment of the FDC sewershed, in order to determine expected flow rates and the number and capacity of pumping stations necessary to mitigate the resulting inflows. A scoped hydraulic modelling assessment was completed as part of the previously noted 2018 Class EA, however, this effort was focused on the area along Black Walnut Trail only and for storm events available at that time. The current assessment is intended to build upon these analyses in support of the current Class EA and will consider a more current suite of data associated with the FDC surcharge events and assess the Lisgar District as a whole, generally between the CPR and Britannia Road, in order to consider all affected areas, as per Figure 1.

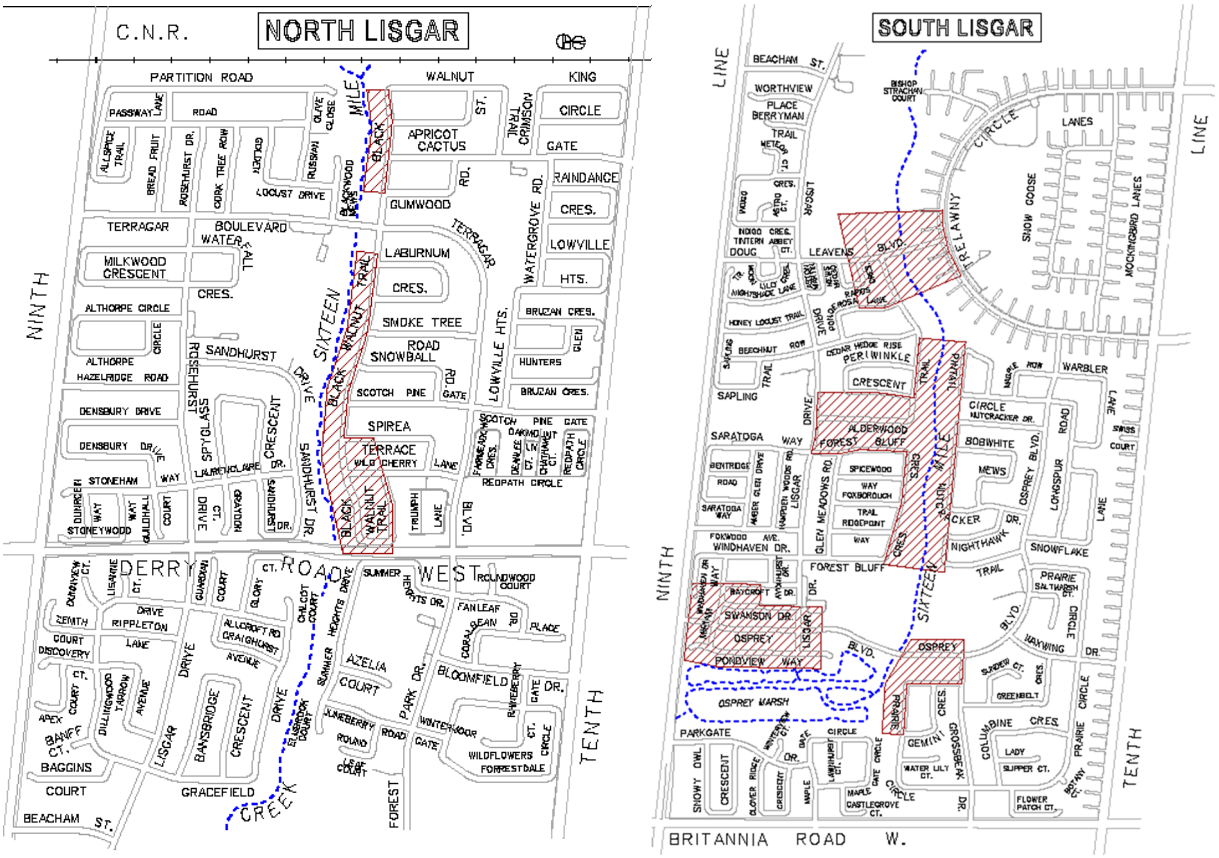


**Figure 1. Affected Areas of Lisgar District and General Limits of Study**

# 2.0 Background Information

The following information has been received and reviewed as part of the data collection process for this project. Reference is also made to key documents and reporting previously prepared by Wood.

**City of Mississauga**

- Mapping and Base Data
    - FDC Sewer Network Data (sewers, maintenance holes, laterals)
    - Elevation Contours
    - Aerial Photography (2020)
    - Roadways
    - Properties\parcel boundaries
    - City owned properties
    - Easements
- Design Drawings ("C Plans") for various areas

**Relevant Previously Completed Materials for the Lisgar District**

- Monitoring Reports
    - "2018 Monitoring Report – Lisgar District Basement Water Infiltration Study", City of Mississauga. Wood, April 3, 2020.
    - "2019 Monitoring Report – Lisgar District Basement Water Infiltration Study", City of Mississauga, Wood, January 15, 2021.
    - "2020 Monitoring Report – Lisgar District Basement Water Infiltration Study", City of Mississauga. Wood, January 6, 2022.
- Analytical Assessments
    - "FDC Pumping Station – Hydraulic Modelling and Location Analysis, Lisgar District Basement Water Infiltration Assessment – Remediation Phase" (Technical Memorandum Senior\Scheckenberger (Amec Foster Wheeler) – Smylie\Jakupi (City of Mississauga), March 12, 2018).
    - "FDC Pumping Station – Additional Hydraulic Modelling and Analysis, Lisgar District Basement Water Infiltration Assessment – Remediation Phase" (Technical Memorandum Senior\Scheckenberger (Wood) – Smylie\Jakupi (City of Mississauga), May 1, 2018).
    - "Lisgar District FDC Pumping Station (Black Walnut Trail and Cactus Gate) – Preliminary Review of Effectiveness and Impact, City of Mississauga" (Technical Memorandum Senior\Schmidt\Scheckenberger (Wood) – Dollimore (City of Mississauga), October 15, 2021).
- Class Environmental Assessment Reports
    - "Class Environmental Assessment for Foundation Drain Collector (FDC) Pumping Systems" (Lisgar District Environmental Study Report, City of Mississauga), Wood, September 6, 2018.

# 3.0 Hydraulic Modelling Approach

## 3.1 Model Development and Methodology

A hydraulic model of the FDC sewer system was previously developed using an analytical hydraulic modelling tool (PCSWMM) as part of the previous assessments completed for the Lisgar neighborhood, in order to support the design process for an initial FDC pumping station (ref. technical memoranda of March 12 and May 1, 2018). The previous model was focused on the Black Walnut Trail area, including smaller contributing branches on side streets, specifically the section to the west along Terragar Boulevard and Golden Locust Drive.

In addition to the hydraulic component of the FDC model (pipes only), flow inputs are also required. The previous modelling assessments completed in 2018 applied flow inputs based on a "typical" unitary response (i.e., an FDC flow hydrograph per unit area) which was determined from an upstream location for the storm event in question and then scaled to a unitary hydrograph using monitoring data response information. The resulting unit hydrograph was then scaled (multiplied) based on the appropriate incremental contributing FDC drainage area to each point of interest, along with a linear scaling factor to represent the differing level of flow contribution from the area in question (i.e., areas which are known to contribute relatively higher flows to the FDC system than other areas). In the assessment, this factor then became a calibration parameter. The scaling factor "zones" may be adjusted for each potential calibration factor as required. Wood's understanding of areas of more frequent FDC surcharging (based on previous annual monitoring) and the previously completed scaling factors from the Black Walnut Trail modelling assessment (refer to Appendix A) have been applied to develop areas of higher expected flow contributions. These areas are however adjusted as required for each individual storm calibration to ensure a good fit to the available data.

The resulting FDC flow inputs were then routed by the FDC sewer pipe hydraulic model, which permitted a comparison of the resulting calculated water levels to monitored levels for specific storm events. The same approach has been applied for the current updated assessment.

Temporary FDC water level monitoring gauges have been described in previous annual monitoring reports (2015 to 2021; refer to Section 2 for references). The number of gauges vary from year to year, as the gauge locations are continuously monitored and adjusted based on the findings of the program. Since 2015, between 18 to 24 discrete gauges have been deployed at various locations within the FDC sewer system, between the CPR and Erin Centre Boulevard. Locations of available FDC sewer water level monitoring gauges are included in Appendix B (refer to Figures B1 to B3). Note that due to variations in the monitoring program between years, certain gauges may not be available for all potential FDC surcharge events.

The monitoring gauges used in the Lisgar District measure water level and temperature only; they do not include a velocity (or flow) component. While theoretical methods (i.e., Manning's Equation and the orifice equation) can be used to generate a rating curve for the monitoring gauges, this does not differentiate between surcharge due to excess upstream flow, and surcharge due to downstream tailwater conditions. As such, hydraulic modelling has been considered necessary to validate estimated flows and the associated simulated water level response. An accurate estimate of flows is necessary to determine the magnitude of flows required to be diverted and the associated capacity of pumping systems, as detailed in subsequent sections.

In the current study, the existing PCSWMM modelling, previously prepared for the areas north of Derry Rd., has been expanded in order to evaluate the performance of the existing FDC system south of Derry Rd., and to help inform the number and capacity of pump stations to support additional FDC system improvements. For this purpose, GIS data were provided by the City, and have been used to gap fill the remaining sections of the FDC sewer system. It should be noted that the invert elevations of the FDC sewer pipes were missing in the supplied dataset and were not available from other sources (such as the City's Asset Management system). Therefore, available plan and profile drawings ("C Plans") have been used to fill the data gaps.

Updated FDC drainage areas have also been developed based on the locations of FDC sewers and associated service laterals. A summary of the extents of the resulting modelled FDC sewer system and associated FDC drainage boundaries is presented in Figures 3.1, 3.2 and 3.3.

During events where high-water levels are expected in the FDC system (i.e., due to forecasted weather conditions in combination with seasonal ground conditions), the City deploys its High Water Protocol (HWP). Initiated in 2011, the HWP involves activating portable pumps at up to three (3) different locations to remove water from the FDC sewers and reduce potential system surcharging. City staff or contractors employed for the HWP then provide a summary of the locations, numbers, sizes and times of pump activations. These results have been recorded in previous annual monitoring reports. Consideration must therefore be given to the impact of these temporary pumping systems have had on the observed FDC surcharge response, in order to develop a reasonably accurate estimate of the FDC sewer flow.

For storm events where the HWP was activated *pump objects with free outfalls* (per SWMM modelling convention) have been used in the PCSWMM modelling, and *control rules* have been defined for each pump, according to the reported hours of activation, using the information provided by the City. Based on the information supplied by the City, the HWP has generally applied four (4) different types of pumps, with varying capacities. Table 3,1 presents the approximate pumping flow rates based on the estimated pump details.

**Table 3.1. Summary of HWP Pumping Capacities**

| Pump Size | Pump Capacity (L/min) | Pump Flow ($m^3/s$) |
|---|---|---|
| 2'' | 710 | 0.012 |
| 3'' | 1,210 | 0.020 |
| 4'' | 1,640 | 0.027 |
| 6'' | 10,583 | 0.180 |

In addition to the preceding, the permanent FDC pumping station at the Cactus Gate Parkette became active on March 17, 2021. The station includes two (2) separate pumps (duty and standby, which alternate), in the event of a significant storm event however both pumps may run together. Each pump has a firm rated capacity of 70 L/s (4,200 L/min, or 0.07 $m^3/s$) for one (1) pump, and approximately 120 L/s (7,200 L/min or 0.12 $m^3/s$) for two (2) pumps running in parallel.

Further information regarding the locations and number of pumps activated during the relevant modelling events are provided in the subsequent section.

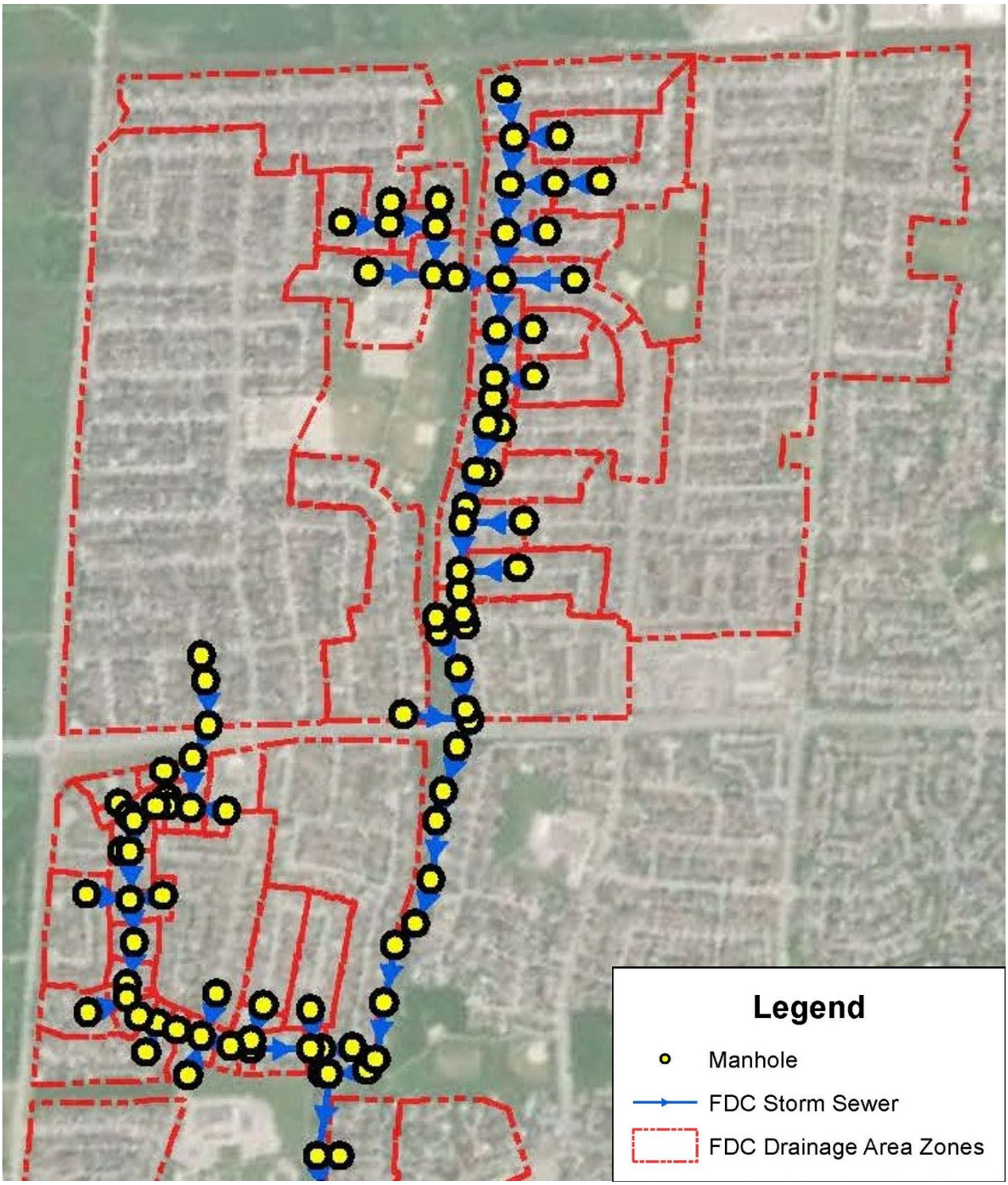


**Figure 2. Modelled FDC Network from CPR to Gracefield Drive Area**

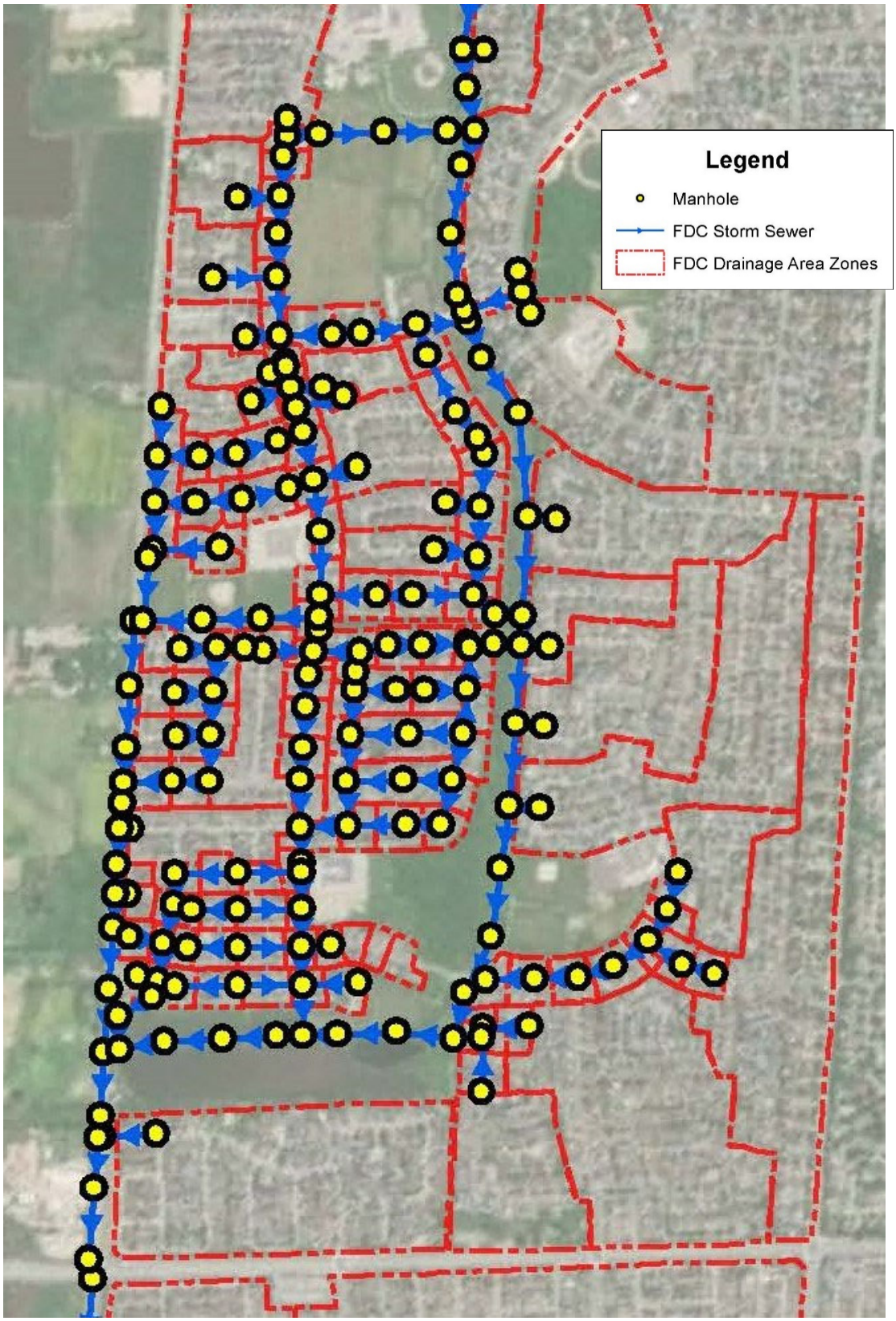


**Figure 3. Modelled FDC Network from Gracefield Drive to Britannia Road**

**Figure 4. Modelled FDC Network from Britannia Road to Erin Centre Boulevard Storm Sewer**

## 3.2 Review of Potential Storm Events

To support the modelling and analysis of the FDC networks located south of Derry Road, a review of the long-term monitoring data has been completed to select storm events which were known to result in surcharging of the FDC system. Previous annual monitoring reports have included an ongoing list of FDC surcharging events, including peak water levels at key gauge locations. These data, in combination with reported instances of basement water infiltration, have allowed for the selection of key FDC surcharge events for modelling and analysis.

Based upon the review of the rainfall events and sewer water level monitoring data collected over the past eight (8) years, a total of six (6) observed FDC surcharging events have been selected for model calibration. It should be noted that four (4) of these selected events included activation of the High Water Protocol (HWP). The selected events are listed below:

- January 13, 2013
- June 12, 2014
- April 16, 2018 (With HWP)
- January 11 & 12, 2020 (With HWP)
- August 3, 2020 (With HWP)
- August 28, 2021 (With HWP, and with Cactus Gate FDC Pump Station in operation)

Table 3.2 presents a summary of peak observed surcharge depths at key monitoring locations along the FDC trunk sewer. Sewer pipe diameters are also indicated for reference purposes. Refer to Appendix B for a map of monitoring gauge locations.

**Table 3.2. Summary of Peak Observed Depths (m) for FDC Surcharge Events along FDC Trunk Sewer**

| Date | North of Derry Road | | | | | Doug Leavens Boulevard to Osprey Marsh | | Ninth Line to Erin Centre Boulevard | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | F14 (0.2 m)[3] | F5 (0.25 m)[3] | F1 (0.375 m)[3] | F6 (0.45 m)[3] | F2 (0.45 m)[3] | F3 (0.525 m)[3] | F4 (0.6 m)[3] | F12 (0.75 m)[3] | F17 (0.75 m)[3] | F18 (0.75 m)[3] |
| Jan 13, 2013[1] | NA | 0.38 | 0.39 | 0.43 | 0.55 | 2.69 | 2.82 | 2.62 | NA | NA |
| Jun 12, 2014[2] | 1.29 | 2.41 | 2.70 | 2.16 | 2.10 | 3.07 | 2.66 | 2.76 | 2.69 | 0.74 |
| April 16, 2018 | 0.11 | 0.19 | 0.24 | 0.20 | 0.27 | 2.47 | 1.97 | 2.49 | 2.23 | 0.65 |
| January 11, 2020[1] | 0.62 | 2.09 | 2.48 | 2.39 | 2.36 | 3.33 | 3.19 | 3.31 | 2.99 | 0.65 |
| January 12, 2020[1] | 1.24 | 2.67 | 2.87 | 2.62 | 2.55 | 3.33 | 3.12 | 3.31 | 3.04 | 0.66 |
| August 3, 2020 | 1.56 | 2.92 | 2.99 | 2.41 | 2.15 | NA | 1.30 | 1.08 | 1.25 | 0.58 |
| August 28, 2021[1] | 1.66 | NA | 3.12 | 2.65 | 2.50 | 3.18 | 2.66 | 2.74 | 2.59 | NA |

1. Resulted in reported basement water infiltration.
2. Simulated previously as part of Cactus Gate Pumping Station Assessment (refer to Appendix A)
3. FDC sewer pipe diameter indicated in brackets

As per Table 3.2, each of the selected events resulted in surcharging throughout the trunk sewer, with three (3) out of the six (6) events resulting in reported basement water infiltration, based on City records (January 11-12, 2020 event is considered one overall event although it did result in two separate peaks in sequence).

From review of the monitoring results, particularly during the January 13, 2013 and April 16, 2018 events, it is also evident that the upstream portion of the FDC sewer system (north of Derry Rd) generally responded differently than the areas further downstream (Doug Leavens and Osprey Boulevards). This has also been noted in previous annual monitoring reports and generally indicates that the system responses are largely dependent on the type of storm event (i.e., longer\extended duration but lower-intensity rainfall events versus shorter duration but higher-intensity rainfall events), demonstrating the complexity of the system performance and required mitigation.

Further details regarding each of the selected model calibration events has been provided in the subsequent sections.

# 4.0 Storm Event Simulation

## 4.1 January 13, 2013 Event

The January 13, 2013 event consisted of a total rainfall amount of 30.2 mm, which occurred over a duration of 6 hours. Given that the event occurred during the winter months, partially or completely frozen and/or saturated ground conditions would be expected, which could worsen the runoff response. During this event, seven (7) residents reported basement water infiltration, all of these residences were in the vicinity of Osprey Boulevard (refer to previous technical modelling memoranda included in Appendix A)).

Based on the preceding, the focus of the calibration is on the area south of Derry Road, given the surcharging observed throughout this area, and minimal response in the area located north of Derry Road (as evident from Table 3.2). It is therefore not considered necessary to explicitly model the area long Black Walnut Trail for this storm event. The FDC sewer network within the model north of Derry Road has therefore been removed from this version of the PCSWMM modelling. Notwithstanding, the monitoring water depth recorded at F2 (just south of Derry Road) has been converted to an equivalent approximate flow based on the approach detailed in Section 2.1 (i.e., using a theoretical rating curve based on pipe hydraulics). The resulting flow series has been applied as an inflow to the model at junction node F2 to incorporate the flow contributing from the upstream area into the downstream system.

A total of twelve (12) FDC monitoring gauges were active during this event, with four (4) of these gauges located north of Derry Road, the remaining eight (8) gauges were located to the south of Derry Road Through the review of the active monitoring locations, gauge F5 (Black Walnut Trail at Gumwood Road) has been selected to define the unitary flow hydrograph for the modelling. Although F5 is located north of Derry Road, it has been selected for modelling as it did not experience backwater impacts from the trunk sewer and would therefore more accurately represent the contributing flow as opposed to potentially overcompensating as a result of the backwater influences by selecting a location further downstream.

To simulate the selected event, different zones of flow contribution have been determined based on the available monitoring locations and areas of common estimated relative contribution. Figure 1 (ref Appendix B) illustrates the estimated FDC drainage area zones and associated monitoring gauges active for the January 13, 2013 storm event.

Once the unitary flow (in this case, from gauge F5) has been applied as an inflow time series in the PCSWMM model, scaling factors have then initially been determined based upon the contributing drainage areas through each zone, and the scaling factors have been iteratively adjusted to calibrate the modelling to reasonably represent observed water levels in each of the active monitoring locations.

Table 4.1 demonstrates the calibrated modelling results including the comparison of simulated versus observed water depths in the monitoring locations during the January 13, 2013 event. Detailed calibration figures and summary graphics are included in Appendix B, including Figure 1.

Based upon the results presented in Table 4.1, the simulation modelling demonstrates a reasonable fit to the observed data, with the simulated peak water level being within +/- 15% or +/- 0.30 m of the observed water level within the system. This indicates a sufficient representation of the January 13, 2013 event to support the analysis of potential pump station locations.

Simulated unitary flows (peak flow normalized by contributing area) for each of the FDC area zones are also presented in Table 4.1 (refer to Figure 1 in Appendix B for area zones). Based on these results, area 7 (gauge F11 – Ninth Line north of Osprey Marsh) shows the highest relative flow contribution. It should be noted that gauges F7 and F3 located north and south of Doug Leavens Blvd, respectively, also indicate more elevated relative flows.

Further details regarding the application of the January 13, 2013 storm event to the assessment of mitigation measures are provided in Section 5.

**Table 4.1. Comparison of Simulated and Observed Water Depths at FDC Monitoring Locations (January 13, 2013)**

| FDC Area Zone[1] | Description | Simulated Flow per Accumulated Drainage Area ($m^3/s/ha$)*100 | Max Simulated Depth (m) | Max Observed Depth (m) | Difference (%) | Difference (m) |
|---|---|---|---|---|---|---|
| 1 | Gauge F7-North of Doug Leavens Blvd | 0.23 | 2.6 | 2.4 | +8% | +0.2 |
| 2 | Gauge F3-South of Doug Leavens Blvd | 0.17 | 2.7 | 2.7 | 0% | 0 |
| 3 | Gauge F8-East of Alderwood Trail | 0.22 | 1.8 | 2.1 | -14% | -0.3 |
| 4 | Gauge F9- North of Osprey Blvd | 0.13 | 2.6 | 2.8 | -7% | -0.2 |
| 5 | Gauge F10-Poindview Way | 0.07 | 2.3 | 2.5 | -8% | -0.2 |
| 6 | Gauge F4- South of Osprey Blvd | 0.13 | 2.7 | 2.8 | -4% | -0.1 |
| 7 | Gauge F11- Ninth Line at Osprey Marsh | 0.51 | 2.3 | 2.3 | 0% | 0 |
| 8 | Gauge F12- Ninth Line, South of Parkgate Dr | 0.14 | 2.8 | 2.6 | +8% | +0.2 |
| 9 | Outfall-Erin Center Blvd & Churchill Meadows Blvd | 0.12 | 0.4 | Not Available[2] | - | - |

1. FDC area zones vary by calibration event.
2. There are no available observed data for this location. Zone 9, represents the catchments which contribute to the storm sewer outlet at Erin Centre Blvd & Churchill Meadows Blvd.

## 4.2 June 12, 2014 Event

When it occurred, the June 12, 2014 storm event was one of the highest surcharge events observed within the Black Walnut Trail FDC system since monitoring began in 2012. It was included in the previous hydraulic modelling analysis completed in 2018 accordingly (refer to technical memoranda included in Appendix A). As per Table 3.2, a maximum water level of 2.70 m was observed at Gauge F1 for this storm event, exceeded only by the July 14, 2017 storm event until more formative storms in 2020 and 2021

During this event, observed FDC surcharge was also noted further downstream, with observed FDC water levels of 3.07 m and 2.66 m at gauges F3 (Doug Leavens Boulevard) and F4 (Osprey Marsh), and 2.69 m at gauge F17 (Ninth Line), however the surcharge ultimately dissipated at the downstream limits (Erin Centre Boulevard and Churchill Meadows); refer to Appendix A for further details.

Observed rainfall intensities for this storm event were less than a 2-year return period, and antecedent conditions were not considered significant (7.6 mm in preceding 5-day period). The storm itself was approximately 23.2 mm in depth, over a 1.3-hour period. Given the time of year and short duration, this suggests a thunder-storm type event, which could have had isolated portions of more intense rainfall, given the spatial variability associated with such storm events (refer to Appendix A for further details).

The upstream limits of the network (i.e. north of Derry Road – Black Walnut Trail area) was simulated as part of the previous assessment for the Cactus Gate Parkette Pumping station (refer to Appendix A for further details). As such, it was not considered necessary to re-model that area; the flow outputs from that area have been used as inflows to the trunk model downstream of this area (at gauge F2, just south of Derry Road).

A total of eleven (11) FDC monitoring gauges were active during this event for the area south of Derry Road; through review of the data, gauge F16 which is located along McDowell Drive south of Britannia Road (previously installed as a typical "background" gauge) was selected to define the unitary flow for the area south of Derry Road, as it demonstrated less impacts due to backflow influences from the trunk FDC sewer. With the application of the unitary flow hydrograph (F16), scaling factors (i.e., multiplier for unitary flow response to be applied at each node) have been iteratively determined for each of the respective FDC zones for this storm event, to achieve a reasonable representation of the observed water levels throughout the FDC system.

Table 4.2 presents the calibrated modelling results including the comparison of simulated versus observed water depths in the monitoring locations during the June 12, 2014 event. Refer to Appendix B and Figure 2 for a more detailed comparison of simulated and observed results.

**Table 4.2. Comparison of Simulated and Observed Water Depth at FDC Monitoring Locations (June 12, 2014)**

| FDC Area Zone[1] | Description | Simulated Flow per Accumulated Drainage Area ($m^3/s/ha$)*100 | Max Simulated Depth (m) | Max Observed Depth (m) | Difference (%) | Difference (m) |
|---|---|---|---|---|---|---|
| 1 | Gauge F19-Gracefield Dr, 100 m east of Lisgar Dr | 0.16 | 1.31 | 1.42 | -8% | -0.11 |
| 2 | Gauge F23- Trelawny Circle | 0.08 | 1.46 | 1.58 | -8% | -0.12 |
| 3 | Gauge F3- South of Doug Leavens Blvd | 0.23 | 3.06 | 3.07 | -0.3% | -0.01 |
| 4 | Gauge F8-East of Alderwood Trail | 0.28 | 2.09 | 2.13 | -2% | -0.04 |
| 5 | Gauge F21-Lisgar Dr, South of Alderwood Trail | 0.21 | 1.79 | 1.45 | +24% | +0.34 |
| 6 | Gauge F10- Pondview Way | 0.22 | 2.32 | 2.37 | -2% | -0.05 |
| 7 | Gauge F20- Osprey Blvd | 0.15 | 1.40 | 1.81 | -23% | -0.41 |
| 8 | Gauge F12- Ninth Line, South of Parkgate Dr | 0.14 | 2.71 | 2.76 | -2% | -0.05 |
| 9 | Gauge F4- North of Osprey Marsh | 0.11 | 2.54 | 2.66 | -4% | -0.12 |
| 10 | Gauge F17- Ninth Line, North of Deepwood Heights | 0.11 | 2.33 | 2.69 | -13% | -0.36 |
| 11 | Outfall-Erin Center Blvd & Churchill Meadows Blvd | 0.12 | 0.62 | 0.74 | -16% | -0.12 |

1. FDC area zones vary by calibration event.

As demonstrated by the results in Table 4.2, the simulated modelling for this storm event provides a sufficient representation of the observed water level responses throughout the system. Gauges F20 and F21 indicate the highest percentage difference of approximately 23% (+/-), which equates to differences of approximately -0.41 (m) and +0.34 (m), respectively. However, it should be noted that the F20 and F21 gauges are among the lower surcharge depth locations (less than 2 m), and the percentage difference of gauges F3, F4 and F12 which are located along the trunk sewer system are within 5% and demonstrate a strong match to observed results.

According to the calculated unitary flows, gauges F8 and F3 (in the vicinity of Doug Leavens Boulevard and Alderwood Trail) with 0.28 and 0.23 ($m^3/s/ha$) indicate the highest unitary flow among monitoring gauges.

Further details regarding the application of the June 12, 2014 storm event to the assessment of mitigation measures are provided in Section 5.

## 4.3 April 16, 2018 Event

As outlined in Section 3.2, it is understood that the FDC systems in different areas of the Lisgar District generally respond differently depending upon the type of storm. The uppermost portion of the sewershed (i.e., Black Walnut Trail) tends to respond more frequently and more strongly to rainfall intensity, with peaked responses to short-duration, high-intensity thunderstorm type events. The downstream portion of the sewershed (i.e., area around Osprey Boulevard) generally responds to two (2) different types of events. The first type of events are those which originate more in the upstream portion of the sewershed (i.e., Black Walnut Trail; typically, thunderstorm type events), but are conveyed downstream through the FDC sewer network and ultimately affect the downstream area accordingly. The second type of events are those which affect only the lower portion of the sewershed. Examples of the latter are typically winter/spring events with longer rainfall durations, lower intensities, and larger total depths, and may be combined with partially or totally frozen ground conditions, as well as snowmelt.

As per the 2018 Annual Monitoring Report, the April 13-16, 2018 period had a total rainfall amount of 90.0 mm (8.0 mm of which was snowfall, the remaining 82.0 mm was rainfall) according to Environment Canada's Pearson Airport gauge (no local City gauges were available for this storm event to better confirm the observed precipitation totals). This includes daily precipitation totals of 7.4, 35.8, 28.2 and 18.6 mm over the 4-day period.

The event resulted in a greater observed FDC surcharge response in downstream areas south of Derry Road. A minimal response was observed at the upstream end (Black Walnut Trail) as per Table 3.2. Based on this, and consistent with the simulation approach for similar events, the network north of Derry Road has been removed from the current modelling and the observed water depth recorded at gauge F2 has been converted to an estimated flow using a theoretical rating curve approach. The converted flow has been applied as an inflow to the junction F2 (which is located just south of Derry Rd), in order to account for the minor flow contributing from this upstream area to the FDC system further downstream.

During the April 16, 2018 event, the City activated the High Water Protocol (HWP), and therefore there were portable pumps activated throughout the network to alleviate high water levels within the FDC system. A summary of the location, number and type of portal pumps activated during this event (based on data supplied by the City and as summarized in the 2018 Annual Monitoring Report) is presented in Table 4.3.

**Table 4.3. High Water Protocol Reported Pumping for April 16, 2018 Storm Event**

| Storm Date | Pumping Time | Pumping Locations | Number of Pumps Activated (Size) |
|---|---|---|---|
| April 16, 2018 | 7:40 to 21:00<br>14:00 to 19:00 | Derry Road | 2 (NA) |
| | 6:00 to 21:00<br>11:30 to 19:00 | Osprey Boulevard (at Trail) | 2 (4'') |
| | 10:00 to 20:30<br>15:00 to 18:00 | Ninth Line | 2 (4'') |

As noted in previous sections, the network north of Derry Rd has been removed from the PCSWMM model as part of this event; therefore, the HWP pumps at Derry Road have not been included in the current modelling. Any impact or FDC system relief provided by the HWP pumps located at Derry Road would be reflected in the monitoring data at gauge F2 (downstream of the pumping location) used as an inflow at the upstream extent of the southern network. As such, the current PCSWMM model only includes the HWP pumps which were located at Osprey Boulevard and Ninth Line; these are both reported to be 4" diameter, which would have pumping capacities of 0.027 $m^3/s$ per pump (ref. Table 3.1). These have been included in the modelling as pump curves with the noted capacities, consistent with the operating times reported in Table 4.3.

During the April 16, 2018 event, a total of fourteen (14) FDC monitoring gauges were active within the system south of Derry Road. Through review of the available data for this event, gauge F26 (which is located along Waxwing Drive), has been selected to define the unitary flow for the network south of Derry Road for this event. Remaining consistent with the calibration steps completed for other storm events, different zones have been defined based on available monitoring gauges; scaling factors (i.e. multiplier for unitary flow response to be applied at each node) have been determined iteratively, in order to achieve a reasonable match to observed water level responses for the storm event.

Table 4.4 presents the calibrated modelling results including the comparison of simulated versus observed water depths in the monitoring locations during the April 16, 2018 event. Refer to Appendix B and Figure 3 for a more detailed comparison of the simulation results in comparison to the observed data.

As demonstrated in Table 4.4, the simulated modelling for this storm event provides a good representation of the observed water level responses. The vast majority of the monitoring locations demonstrate a strong fit between simulated and observed water levels, with the majority being within +/- 15% or +/- 0.25 m, with the exception of gauge F4 which demonstrates the highest difference of approximately +0.40 m. The larger difference exhibited in this location may be a result of the use of portable pumps located directly upstream of this location, which may result in localized differences between actual and modelled results (including variations in actual field pumping rates). The monitoring node along the trunk FDC sewer at Ninth Line (F12) demonstrates a strong fit matching the observed water level.

Gauges F21 and F26, with unitary flows of 0.23 and 0.22 ($m^3/s/ha$) are ranked as the highest contribution areas for this event. These represent areas in the vicinity of Osprey Boulevard, including Waxwing Drive.

**Table 4.4. Comparison of Simulated and Observed Water Depth at FDC Monitoring Locations (April 16, 2018)**

| FDC Area Zone[1] | Description | Simulated Flow per Accumulated Drainage Area ($m^3/s/ha$)*100 | Max Simulated Depth (m) | Max Observed Depth (m) | Difference (%) | Difference (m) |
|---|---|---|---|---|---|---|
| 1 | Gauge F19-Gracefield Dr, 100 m east of Lisgar Dr | 0.14 | 0.26 | 0.19 | +36% | +0.07 |
| 2 | Gauge F3- South of Doug Leavens Blvd | 0.19 | 2.60 | 2.49 | +5% | +0.12 |
| 3 | Gauge F8-East of Alderwood Trail | 0.14 | 1.95 | 1.99 | -2% | -0.03 |
| 4 | Gauge F21-Lisgar Dr, South of Alderwood Trail | 0.23 | 1.57 | 1.45 | +8% | +0.12 |
| 5 & 9 | Gauge F4- North of Osprey Marsh | 0.12 | 2.38 | 1.98 | +20% | +0.40 |
| 6 | Gauge F25- Osprey Blvd, South of Salt Marsh Crt | 0.10 | 0.64 | 0.73 | -11% | -0.08 |
| 7 | Gauge F26- Waxwing Dr, East of Osprey Blvd | 0.22 | 1.63 | 1.64 | -0.9% | -0.01 |
| 8 | Gauge F20- Osprey Blvd | 0.21 | 1.52 | 1.77 | -14% | -0.25 |
| 10 | Gauge F10-Poindview Way | 0.11 | 2.09 | 2.28 | -8% | -0.19 |
| 11 | Gauge F12- Ninth Line, South of Parkgate Dr | 0.12 | 2.50 | 2.50 | 0% | 0 |
| 12 | Gauge F17- Ninth Line, North of Deepwood Heights | 0.12 | 2.03 | 2.23 | -9% | -0.20 |
| 13 | Outfall-Erin Center Blvd & Churchill Meadows Blvd | 0.11 | 0.60 | 0.65 | -8% | -0.05 |

1. FDC area zones vary by calibration event.

## 4.4 January 11-12, 2020 Event

This storm event began at approximately 9:00 AM on January 11, 2020 and continued for a total of 21 hours, into January 12, 2020, with a total rainfall depth of 54.8 mm, making this event (at that time) the largest on record since monitoring in 2012 in terms of total depth (ref. 2019 Monitoring Report, Wood, January, 2021). It should also be noted that there was an antecedent rainfall period between approximately 1:30 and 5:00 prior to this storm event, with a total rainfall of between 3.8 and 9.8 mm during this period. Partially frozen ground conditions would also have been a factor; there was minimal snow on the ground at the time of the event. Based on information supplied by City staff, a total of 41 properties reported basement water infiltration during this event, impacting both the Black Walnut Trail area and the area in the vicinity of Osprey Boulevard (ref. 2019 Monitoring Report, Wood, January 2021).

To simulate this event in PCSWMM, a complete hydrologic\hydraulic model has been applied which includes the full FDC sewer network both north and south of Derry Road. Similar to the April 16, 2018 event, this event also included the deployment of the HWP throughout the FDC system. Due to the magnitude of reported basement water infiltration and the rainfall event, the HWP pumping deployed for this event was extensive. The HWP deployment began on 4:00 PM on Friday January 10th, 2020 however active pumping did not commence until 2:00 PM on Saturday January 11th, 2020 once a rise in water levels within the FDC system was observed. Pumping was active from this point until de-activation of the final pump at 3:00 PM on Sunday January 12th, 2020 with decommissioning occurring at 5:00 PM (ref. 2019 Monitoring Report, Wood, January

2021). At the peak period of surcharging, a total of eleven (11) pumps were active throughout the network. Pump activation details based on City supplied information are summarized in Table 4.5.

**Table 4.5. High Water Protocol Reported Pumping for January 11-12, 2020 Storm Event**

| Storm Date | Pumping Time | Pumping Locations | Number of Pumps Activated (Size) |
|---|---|---|---|
| January 11 -12, 2020 | 14:00 – 10:00 (20 hours) | Black Walnut Trail | 1 (4″)<br>1 (3″) |
| | 14:00 – 10:00 (20 hours) | Osprey Boulevard | 1 (4″)<br>1 (3″) |
| | 14:00 – 10:00 (20 hours) | Ninth Line | 1 (4″)<br>1 (3″) |
| | 21:30 – 10:00 (14.5 hours) | Osprey Boulevard | 1 (4″)<br>1 (3″)<br>1 (2″) |
| | 21:30 – 15:00 (17.5 hours) | | 1 (4″) |
| | 21:30 – 10:00 (14.5 hours) | Ninth Line | 1 (3″) |

As outlined in Table 3.1, the estimated capacities for each of the 2″, 3″ and 4″ pumps commissioned throughout the network are 0.012 $m^3/s$, 0.020 $m^3/s$ and 0.027 $m^3/s$, respectively. These in combination throughout the network represent notable pumping capacity, alleviating pressure within the surcharged system. These pumps have been incorporated into the PCSWMM modelling through the application of pump curves based on the reported activation hours and respective capacities for each of the pumps.

As mentioned previously, the FDC networks north and south of Derry Road respond differently depending upon the type of storm events; nonetheless, both networks experienced high levels of surcharging during the January 11-12, 2020 event. Therefore, two (2) different unitary flows have been defined for each portion of the network, to represent the different responses more accurately. Based upon the review of the twenty-four (24) active monitoring locations, gauges F14 (Black Walnut Trail at Apricot Street) and F16 (McDowell Drive south of Britannia Road) have been selected to define the unitary flow for the areas north and south of Derry Road, respectively, as these locations are further from the trunk sewer and are less likely to be impacted by backwater effects.

Consistent with the methodology outlined in previous sections, the observed water level data from the preceding two (2) gauges have been converted into unitary flow series using a theoretical rating curve approach and scaling by the contributing area. The unitary hydrographs have then been applied for each network\contributing flow point based on location and have been added into the integrated PCSWMM model. Scaling factors (i.e., multiplier for unitary flow response to be applied at each node) have been determined through iterative analysis, in order to replicate the observed water level responses in the FDC sewer system for the storm event.

Table 4.6 presents the calibrated modelling results including the comparison of simulated versus observed water depths in the monitoring locations during the January 11-12, 2020 event. Refer to Appendix B for a graphical comparison of observed and simulated water levels, and Figure 4 for the area zones applied. As evident, a total number of 17 zones has been determined to be required for this event, reflecting the greater calibration complexity.

Based upon the results in Table 4.6, the simulated modelling for this storm event provides a reasonable representation of the observed water level responses throughout the FDC system. While some gauges demonstrate a difference of up to +/- 30%, the majority are within +/- 10% of the observed water level, including gauges F2, F3, F4, F12 and F17, which are all within the trunk sewer system. Of the locations which demonstrated larger differences between the simulated versus observed water levels, these are largely located in close proximity to the HWP pump locations, which may have been experiencing backwater influences that are not well represented by the PCSWMM modelling. There may also have been slight differences in the actual HWP pump operation as compared to reported values.

It is noted that for this event, while the peak water levels are generally well matched, the shape of the observed response is not always well represented in the modelling. The observed data indicate that water levels remained elevated for an extended period of time, whereas the simulated results indicate a more rapid rise and fall response. This is considered attributable to the applied unitary hydrographs. Alternative unit hydrographs with a more extended period could be applied but are not considered necessary given the focus on peak water levels and associated flows. Gauges F1 and F24 with unitary flow of 0.4 and 0.37 ($m^3/s/ha$) were classified as the areas with the highest contribution in this event. It should be noted that the Cactus pump station was not active during this event. The F8 and F25 with unitary flow of 0.27 and 0.26 ($m^3/s/ha$), respectively, were ranked as the highest contribution areas among the gauges which located in the South of Derry Rd. Nonetheless, given the complexities of the number of HWP pumping locations and activations during this event, and the focus upon the peak water level (and associated peak flows which caused the event), the current calibration is considered to demonstrate a reasonable match to observed conditions.

Gauges F1 and F24 (Black Walnut Trail area, including Golden Locust Drive area), with unitary flows of 0.40 and 0.37 ($m^3/s/ha$) have been classified as the areas with the highest contribution in this event. It should be noted that the Cactus pump station was not active during this event. Gauges F8 (Alderwood Trail) and F25 with unitary flow of 0.27 and 0.26 ($m^3/s/ha$), respectively, have been ranked as the highest contribution areas among the gauges which are located south of Derry Rd.

**Table 4.6. Comparison of Simulated and Observed Water Depth at FDC Monitoring Locations (January 11-12, 2020)**

| FDC Area Zone[1] | Description | Simulated Flow per Accumulated Drainage Area ($m^3/s/ha$)*100 | Max Simulated Depth (m) | Max Observed Depth (m) | Difference (%) | Difference (m) |
|---|---|---|---|---|---|---|
| 1 | Gauge F24-Blackwood Mews | 0.37 | 1.39 | 1.46 | -5% | -0.07 |
| 2 | Gauge F5-BWT and Gumwood Rd | 0.36 | 2.31 | 2.67 | -13% | -0.36 |
| 3 | Gauge F1- BWT,100 (m) South of Laburnum Crescent | 0.40 | 3.13 | 2.87 | +9% | +0.26 |
| 4 | Gauge F6- BWT,100 (m) South of Spirea Terrace | 0.21 | 2.94 | 2.62 | +12% | +0.32 |
| 5 | Gauge F2- South of Derry Rd | 0.18 | 2.75 | 2.55 | +8% | +0.20 |
| 6 | Gauge F19-Gracefield Dr, 100 m east of Lisgar Dr | 0.24 | 1.83 | 2.04 | -11% | -0.22 |

| FDC Area Zone[1] | Description | Simulated Flow per Accumulated Drainage Area ($m^3/s/ha$)*100 | Max Simulated Depth (m) | Max Observed Depth (m) | Difference (%) | Difference (m) |
|---|---|---|---|---|---|---|
| 7 | Gauge F3- South of Doug Leavens Blvd | 0.12 | 3.58 | 3.33 | +8% | +0.25 |
| 8 | Gauge F21-Lisgar Dr, South of Alderwood Trail | 0.26 | 2.53 | 2.15 | +18% | +0.39 |
| 9 | Gauge F8-East of Alderwood Trail | 0.27 | 2.94 | 2.52 | +17% | +0.42 |
| 10 | Gauge F25- Osprey Blvd, South of Salt Marsh Crt | 0.26 | 0.82 | 1.21 | -32% | -0.38 |
| 11 | Gauge F26- Waxwing Dr, East of Osprey Blvd | 0.09 | 1.48 | 2.08 | -29% | -0.60 |
| 12 | Gauge F20- Osprey Blvd | 0.15 | 2.35 | 2.24 | +5% | +0.11 |
| 13 | Gauge F4- North of Osprey Marsh | 0.07 | 3.36 | 3.19 | +5% | +0.17 |
| 14 | Gauge F10- Pondview Way | 0.21 | 3.11 | 2.85 | +9% | +0.25 |
| 15 | Gauge F12- Ninth Line, South of Parkgate Dr | 0.10 | 3.25 | 3.33 | -2% | -0.08 |
| 16 | Gauge F17- Ninth Line, North of Deepwood Heights | 0.09 | 2.78 | 3.04 | -9% | -0.27 |
| 17 | Outfall-Erin Center Blvd & Churchill Meadows Blvd | 0.10 | 0.65 | 0.66 | -2% | -0.01 |

1. FDC area zones vary by calibration event.

## 4.5 August 3, 2020 Event

The August 3, 2020 storm event is considered typical of the short, intense thunderstorm type events which primarily affect the upper portion of the FDC system (i.e. Black Walnut Trail). Observed FDC surcharge depths of between 1.56 and 2.99 m were noted along this section (as per Table 3.2). While FDC surcharging was noted downstream (depths of between 1.08 and 1.30 m along the Osprey Marsh Berm and Ninth Line) these are considered relatively lower depths, particularly in comparison to the larger FDC sewer sizes in this area (i.e., generally 0.60 to 0.75 m pipe diameters). It should be noted that, this storm response may also have been impacted by the large antecedent rainfall (43.8 mm in the previous 5-day period) which would result in saturated ground conditions prior to the event.

Similar to the other storm events outlined in preceding sections, the HWP pumping was activated during the August 3, 2020 event. A summary of the HWP deployment times and details for the August 3, 2020 event (as provided by the City) is presented in Table 4.7.

**Table 4.7. High Water Protocol Reported Pumping for August 3, 2020 Storm Event**

| Storm Date | Pumping Time | Pumping Locations | Number of Pumps Activated (Size) |
|---|---|---|---|
| August 3, 2020 | 15:00 to 19:25 | North of Derry Road | 1 (3″)<br>1 (4″) |
| | 17:00 to 19:15 | South of Osprey Boulevard | 3 (4'') |
| | 17:15 to 18:15 | Ninth Line | 1 (3″)<br>1 (4″) |

To simulate this event, the fully integrated model has been used which includes the complete modelled FDC sewer network both north and south of Derry Rd. As outlined previously, each of these sections generally respond differently to the types of storm events; therefore, consistent with the modelling of the January 11-12, 2020 event, two (2) different unitary flow hydrographs have been defined for each section of the network. Based upon the review of the available seventeen (17) active monitoring locations, gauges F13 (Cactus Gate east of Black Walnut Trail) and F26 (Waxwing Drive east of Osprey Boulevard) have been selected to define the unitary flow for the areas north and south of Derry Road, respectively, as these locations are further from the trunk sewer and are less likely to be impacted by the backwater within the trunk system. The observed water level series in these locations have therefore been converted to equivalent flows using a theoretical rating curve and then normalized by area to generate the unitary hydrographs.

Consistent with the methodology outlined in previous sections, the resultant unit hydrographs have been added into the integrated PCSWMM model at flow input locations and adjusted based on the relative contributing areas. Additional scaling factors (i.e. multiplier for unitary flow response to be applied at each node) have been determined through iterative analysis, in order to replicate the observed water level responses for the storm event.

Table 4.8 presents the calibrated modelling results including the comparison of simulated versus observed water depths in the monitoring locations during the August 3, 2020 event. Refer to Appendix B for a detailed graphical comparison of observed and simulated water levels, and Figure 5 for FDC area zones. A total of 19 distinct FDC zones have been required for the calibration of this event, which similarly reflects the greater complexity of the storm and associated response.

Based upon the results in Table 4.8, the simulated modelling for this storm event provides a good representation of the observed water level responses, with the majority of the simulated water levels being within +/- 0.20 m of the observed results. Some locations demonstrate a larger percentage difference; however, these are predominantly in areas where the observed water level is low (less than 0.60 m). In general, the simulated modelling provides a sufficient representation of the observed results.

Gauges F5 and F14, with unitary flows of 0.75 and 0.74 ($m^3/s/ha$), respectively, indicate the highest unitary flow values among the available gauges during this event. It should be noted that the Cactus Gate FDC pump station was not active during this event. Gauges F20 and F21, with unitary flow of 0.22 and 0.21 ($m^3/s/ha$), respectively, have been ranked as the highest contribution areas among the gauges located south of Derry Road.

**Table 4.8. Comparison of Simulated and Observed Water Depth at FDC Monitoring Locations (August 3, 2020)**

| FDC Area Zone[1] | Description | Simulated Flow per Accumul. Drainage Area ($m^3/s/ha$)*100 | Max Simulated Depth (m) | Max Observed Depth (m) | Difference (%) | Difference (m) |
|---|---|---|---|---|---|---|
| 1 | Gauge F24-Blackwood Mews | 0.52 | 1.78 | 1.75 | +2% | +0.03 |
| 2 | Gauge F14-BWT-Apricot St | 0.74 | 1.38 | 1.56 | -12% | -0.18 |
| 3 | Gauge F13-Cactus Gate | 0.54 | 0.95 | 1.14 | -17% | -0.19 |
| 4 | Gauge F5-BWT and Gumwood Rd | 0.75 | 2.69 | 2.93 | -8% | -0.24 |
| 5 | Gauge F1- BWT,100 (m) South of Laburnum Crescent | 0.46 | 2.92 | 2.99 | -3% | -0.08 |
| 6 | Gauge F6- BWT,100 (m) S of Spirea Terr. | 0.21 | 2.58 | 2.41 | +7% | +0.18 |
| 7 | Gauge F2- South of Derry Rd | 0.44 | 2.38 | 2.15 | +11% | +0.23 |
| 8 | Gauge F19-Gracefield Dr, 100 m east of Lisgar Dr | 0.20 | 1.15 | 1.34 | -15% | -0.20 |
| 9 | Gauge F8-East of Alderwood Trail | 0.13 | 1.27 | 1.39 | -9% | -0.12 |
| 10 | Gauge F21-Lisgar Dr, S of Alderwood Trail | 0.21 | 0.22 | 0.32 | -32% | -0.10 |
| 11 | Gauge F3- South of Doug Leavens Blvd | 0.11 | 2.59 | Not Available[2] | - | - |
| 12 & 16 | Gauge F4- North of Osprey Marsh | 0.09 | 1.17 | 1.30 | -10% | -0.13 |
| 13 | Gauge F10-Pondview Way | 0.18 | 0.81 | 0.95 | -15% | -0.14 |
| 14 | Gauge F26- Waxwing Dr, E of Osprey Blvd | 0.13 | 0.24 | 0.16 | +47% | +0.08 |
| 15 | Gauge F20-Osprey Blvd | 0.22 | 0.34 | 0.56 | -39% | -0.22 |
| 17 | Gauge F12- Ninth Line, S of Parkgate Dr | 0.10 | 1.15 | 1.08 | +6% | +0.07 |
| 18 | Gauge F17- Ninth Line, North of Deepwood Heights | 0.08 | 1.10 | 1.25 | -12% | -0.15 |
| 19 | Outfall-Erin Center Blvd & Churchill Meadows Blvd | 0.09 | 0.55 | 0.58 | -5% | -0.03 |

1. FDC area zones vary by calibration event.
2. There is no available observed data for this location during this event.

## 4.6 August 28, 2021 Event

The August 28, 2021 event was assessed in a preliminary manner as part of the "Lisgar District FDC Pumping Station (Black Walnut Trail and Cactus Gate) Preliminary Review of Effectiveness and Impact" (Wood, October 15, 2021) and will be assessed further as part of the pending 2021 Annual Monitoring Report. The storm was an intense thunderstorm-type event which had a reported rainfall total of 41.6 mm over only 1.3 hours. Peak rainfall intensities for the 30-minute and 1-hour indicated a storm with a return period of between 5 and 10 years, resulting in the most formative rainfall event since monitoring began in 2012. A notable surcharge response in the FDC system resulted, as would be expected.

The permanent FDC pump station at Cactus Gate became active in March 2021 and was therefore active during the August 28, 2021 event. As noted in Section 3.1 the station includes two (2) separate pumps (duty and standby, which alternate), in the event of a significant storm event however both pumps may run together. Each pump has a firm rated capacity of 70 L/s (4,200 L/min, or 0.07 $m^3/s$) for one (1) pump, and approximately 120 L/s (7,200 L/min or 0.12 $m^3/s$) for two (2) pumps running in parallel. The event generated both a general alarm and a high-water alarm for the station. The second pump was activated (which occurs when water levels continue to rise with a single pump active) such that both pumps were operating during the storm event. A total pumping volume of 854 $m^3$ was estimated based on the total pumping logs from the station and separating out dry weather flow (refer to the October 15, 2021 assessment for further details).

The event also triggered the City to activate the High Water Protocol (HWP). HWP pumping was also active during this event at three (3) locations throughout the study area. It should be noted that in July 2020, the City upgraded the previous temporary HWP pumps to much larger 6" pumps which have a reported capacity of 0.18 $m^3/s$ representing a significant increase in pumping capacity when compared to the previous HWP pumps (max capacity of 0.027 $m^3/s$) as per Table 3.1. Both the permanent pump station and the current 6" HWP pumps have been included in the modelling through the application of pump curves and assumed free outfalls to surface. A summary of the reported HWP deployment times for the August 28, 2021 event is presented in Table 4.9. As evident from Table 4.9, the previously employed Ninth Line pumping site was discontinued in 2021 and revised to the Pintail Circle location.

**Table 4.9. High Water Protocol Actions for August 28, 2021 Storm Event**

| Storm Date | Pumping Time | Pumping Locations | Number of Pumps Activated (Size) |
|---|---|---|---|
| August 28, 2021 | 19:57 to 00:26 | North of Derry Road | 1 (6") |
| | 19:42 to 22:50 | Pintail Circle | 1 (6'') |
| | 19:42 to 22:36 | Osprey Woods | 1 (6") |

Consistent with the August 3, 2020 event, the fully integrated FDC network model (north and south of Derry Road) has been used to simulate the event. Observed water level responses at gauges F13 (Cactus Gate east of Black Walnut Trail) and F26 (Waxwing Drive east of Osprey Boulevard) have been selected to define the unitary flow for the general areas north and south of Derry Rd, respectively. Different FDC zones have been defined based on the available monitoring gauges which were active during this event, and scaling factors (i.e., multiplier for unitary flow response to be applied at each node) have been determined through iterative analysis in order to attempt to replicate the observed water level responses for the storm events.

Table 4.10 presents the calibrated modelling results including the comparison of simulated versus observed water depths in the monitoring locations during the August 28, 2021 event. Refer to Appendix B and Figure 6 for a summary of the FDC area zones and a graphical comparison of observed and simulated water level responses in the FDC system.

**Table 4.10. Comparison of Simulated and Observed Water Depth at FDC Monitoring Locations (August 28, 2021)**

| FDC Area Zone[1] | Description | Simulated Flow per Accumulated Drainage Area ($m^3/s/ha$)*100 | Max Simulated Depth (m) | Max Observed Depth (m) | Difference (%) | Difference (m) |
|---|---|---|---|---|---|---|
| 1 | Gauge F5-BWT and Gumwood Rd | 0.55 | 1.27 | Not Available[1] | - | - |
| 2 | Gauge F24-Backwood Mews | 0.51 | 2.26 | 2.07 | +9% | +0.19 |
| 3 | Gauge F1- BWT,100 (m) South of Laburnum Crescent | 0.48 | 1.89 | 3.12 | -39% | -1.23 |
| 4 | Gauge F6- BWT,100 (m) South of Spirea Terrace | 0.24 | 1.48 | 2.65 | -44% | -1.17 |
| 5 | Gauge F2- South of Derry Rd | 0.14 | 2.38 | 2.50 | -5% | -0.12 |
| 6 | Gauge F19-Gracefield Dr, 100 m east of Lisgar Dr | 0.15 | 1.71 | 1.69 | +0.9% | +0.02 |
| 7 | Gauge F3- South of Doug Leavens Blvd | 0.14 | 3.23 | 3.18 | +1.4% | +0.04 |
| 8 | Gauge F33- Doug Leavens Blvd & Trelawny Circle | 0.14 | 1.82 | 1.74 | +5% | +0.08 |
| 9 | Gauge F21-Lisgar Dr, South of Alderwood Trail | 0.27 | 1.70 | 1.50 | +13% | +0.20 |
| 10 | Gauge F8-East of Alderwood Trail | 0.36 | 2.23 | 2.21 | +0.9% | +0.02 |
| 11 | Gauge F26- Waxwing Dr, East of Osprey Blvd | 0.16 | 1.11 | 1.22 | -9% | -0.11 |
| 12 | Gauge F20- Osprey Blvd | 0.19 | 1.79 | 1.34 | +33% | +0.45 |
| 13 | Gauge F4- North of Osprey Marsh | 0.09 | 2.68 | 2.66 | +0.5% | +0.01 |
| 14 | Gauge F12- Ninth Line, South of Parkgate Dr | 0.09 | 2.79 | 2.74 | +1.6% | +0.04 |
| 15 | Gauge F17- Ninth Line, North of Deepwood Heights | 0.11 | 2.40 | 2.59 | -7% | -0.19 |
| 16 | Outfall-Erin Center Blvd & Churchill Meadows Blvd | 0.10 | 0.62 | Not Available[2] | - | - |

1. FDC area zones vary by calibration event.
2. There is no available observed data for this location during this event.

As evident from Table 4.10, the simulated modelling for this storm event provides a good representation of the observed water level responses, with majority of the gauges simulating water depths within +/- 15% of the observed data. Certain locations in close proximity to the portable pumping stations exhibited larger differences, including gauges F1 and F6 which had over -1.0 m difference in simulated versus observed water levels; these two locations are located in sequence, in between the permanent pump station at Cactus Gate, and the HWP pumping station north of Derry Road. The capacity and time of active pumping upstream and downstream of these monitoring locations may be difficult for the model to replicate given complex pump and backwater conditions. As noted previously, the 6" pump capacity (0.180 $m^3/s$) is also a notable increase as compared to the previously available largest pump size (4" pump at 0.027 $m^3/s$), which may also contribute to the simulated model response upstream of this location.

It is noted that for this event, while the peak water levels are generally well matched, the shape of the observed response is not always well represented in the modelling. The observed data indicate that water

levels remained elevated for an extended period of time, whereas the simulated results indicate a more rapid response. Time shifts are also evident in some cases. This is considered attributable to the applied unitary hydrographs. Alternative unit hydrographs with a more extended period could be applied but are not considered necessary given the focus on peak water levels and associated flows. Notwithstanding, the locations further downstream along the trunk sewer demonstrate a closer fit between simulated and observed water levels and is therefore considered to be a sufficient calibration for the purposes of the current assessment.

Gauges F24 and F1 (Black Walnut Trail area) with unitary flow of 0.51 and 0.48 ($m^3$/s/ha), respectively, indicate the highest unitary flow values among the available gauges during this event. Gauges F8 (Alderwood Trail) and F21 (Lisgar Drive) have been ranked the highest for gauges south of Derry Road, with unitary flows of 0.36 and 0.27 (m3/s/ha), respectively.

# 5.0 Mitigation Analysis

## 5.1 Long-List and Short-List of Potential Locations

In order to assess the number and capacity of future FDC system pumping stations, a long list of potentially feasible locations is required. A preliminary long list has been prepared based on functional criteria, namely:

- Public land ownership (i.e., parks or open areas);
- Proximity to the FDC trunk sewer; and
- Proximity to the number of houses with reported basement water infiltration (as per Figure 1.1 and available information from previous annual monitoring reports noted in Section 2).

A long list of fourteen (14) locations has been prepared based on the preceding screening. Locations are presented in Drawing 1 (attached). The fourteen (14) locations are divided into various zones within the primary area of interest (i.e., between the CPR and Britannia Road) as follows:

- Three (3) north of Derry Road
- Three (3) near Trelawny Circle
- Five (5) between Doug Leavens Boulevard and Osprey Boulevard
- Three (3) near Osprey Marsh

Locations have been further screened on the basis of other technical, functional and environmental criteria, including the drainage area served by a potential pumping station, the suitability of the property (including social and environmental considerations), and the number of houses in proximity that reported basement water infiltration. Further details are provided in the overall Environmental Study Report (ESR) for this Class Environmental Assessment (Class EA). Two (2) locations have been short-listed for each of the three (3) overall zones of interest (refer to Drawing 1 for locations):

- **Black Walnut Trail Area**
    - Location 2 – Black Walnut Trail at Smoke Tree Road Parkette
    - Location 3 – Black Walnut Trail at Scotch Pine Gate Parkette
- **Doug Leavens Boulevard and Pintail Circle Area**
    - Location 7 – Lisgar Creek south of Doug Leavens Boulevard
    - Location 8 – Lisgar Creek at Pintail Circle
- **Osprey Boulevard Area**
    - Location 11 – Lisgar Creek at Lisgar Green Park
    - Location 12 – Osprey Marsh at Prairie Circle

The preceding six (6) short-listed sites have been assessed through additional technical analyses; further details are provided in the following sub-section.

## 5.2 Modelling Analysis

### 5.2.1 Approach

In order to assess the requirements of potential FDC pumping stations, a logical and iterative approach is required. Overall, it is considered appropriate to approach the modelling assessment from upstream to downstream, given that any mitigation measures constructed upstream would be expected to benefit areas downstream as well. As such, pump stations have been sized and assessed for the Black Walnut Trail area first. Then, if residual FDC surcharging issues are identified (which is expected, given that storm events have

resulted in FDC surcharge for the downstream area only), additional pumping stations have been sized for these areas in turn, systematically.

A preference is noted for minimizing the number of additional pumping stations if feasible. Although two (2) locations have been short-listed for each area, if the modelling indicates that one (1) pumping station is sufficient to address FDC surcharge, or if upstream pumping stations can address the issues, this would be considered preferred over constructing additional stations, given the associated costs and construction timelines, and long-term O&M. Where two (2) pumping stations are in close proximity, it is generally considered preferable to construct the more upstream location to benefit the greater number of properties.

The overall design goal would be to ensure no simulated FDC surcharging for the events simulated in Section 4, with only permanent pumping stations in place (i.e., the Cactus Gate FDC pumping station and any additional pumping stations recommended by this analysis). It is assumed that the objective of this effort would be to eliminate the need for the High Water Protocol (HWP) temporary pumping program. As such, any HWP elements included in the initial calibration models to represent observed FDC surcharge responses (as per Section 4) have been removed from the subsequent simulation models.

Consistent with the design approach for the Cactus Gate FDC pumping station, it is assumed that a diversion pipe would need to be connected to the existing FDC trunk to direct surcharge flows via gravity to a pumping station wet well. It has been further assumed that the diversion pipe would be limited by the size of the existing FDC maintenance hole, given the proximity to the sanitary sewer and challenges with upgrading the structure. Based on materials available from pre-cast concrete manufacturers, this would generally mean that:

- 1200 mm inside diameter MHs
    - Maximum size on a straight run: 600 mm diameter
    - Maximum size on a 90-degree bend: 450 mm diameter
- 1500 mm inside diameter MHs
    - Maximum size on a straight run: 825 mm diameter
    - Maximum size on a 90-degree bend: 600 mm diameter

The preceding accounts for the expected larger knock-out hole sizing as per OPSD 701.021. The preceding has been considered as part of the diversion pipe sizing. It has been assumed diversion pipes would be reasonably sloped at 1.0% to encourage positive diversion to the theoretical pumping station.

As part of the Cactus Gate pumping station, an orifice plate was proposed on the mainline FDC sewer system above spring line (i.e., half of the pipe diameter) to further restrict FDC flows to the downstream system and encourage a greater diversion of flow towards the pumping station. Notwithstanding, City staff has previously expressed concern with this approach given that in the unlikely event of a pumping station system failure (including of the backup generator) this could potentially worsen FDC surcharge conditions upstream of the orifice plate. To-date, the orifice plate has not been installed on the mainline FDC sewer along Black Walnut Trail. For the purposes of the current assessment, it has been assumed that orifice plates would not be preferred, unless they are determined critical to ensure sufficient diversion of flows to the theoretical pumping stations.

For modelling purposes, only the diversion pipes have been assessed using the preceding methodology, with an assumed free outfall to a theoretical wet well. It has been assumed that pump capacity would need to be consistent with the estimated diverted flow. Actual pump capacities and wet well dimensions would be assessed as part of the subsequent preliminary design effort.

The storm events to be modelled have been selected based on the area in question, and which resulted in the greatest overall FDC surcharge for that specific location. As such, it has not been considered necessary to include all six (6) of the storm events described in Section 4 for each area. A minimum of three (3) storm events have however been selected for each area; more have been included if deemed warranted. This is described further in subsequent sub-sections.

### 5.2.2 Black Walnut Trail Area

#### 5.2.2.1 Overview

For the Black Walnut Trail area, the key storm events for simulation based on the results in Table 3.2 are considered to be:

- January 11-12, 2020
- August 3, 2020
- August 28, 2021

All of the preceding storms included pumping through the HWP program and thus any proposed permanent pumping station would need to replicate (and increase) this pumping capacity, as the HWP pumping is removed from the simulation of the mitigation scenarios.

In addition, the permanent pumping station at Cactus Gate was operational for the August 28, 2021 storm event. This feature has been left in place for that storm event and added to the simulation of the other two (2) storm events to determine what residual pumping capacity would have been expected to be required.

Based on as-built drawings for the Smoke Tree Road area (Location 2 - refer to Drawing 1 and Appendix C), the MH at the intersection is a 1200 mm diameter unit, with 375 mm diameter existing FDC sewer pipes along Black Walnut Trail. As such, the maximum proposed diversion pipe is considered to be a 450 mm diameter pipe. A 525 mm diameter pipe could potentially be used, however further confirmation with manufacturers would be required. The diversion pipe would need to cross both a 750 mm diameter storm sewer and a 200 mm diameter watermain, however the FDC sewer would be well below both of these utilities. The diversion pipe would also likely necessitate the temporary removal and replacement of the existing double catchbasin along the curb.

Based on as-built drawings for the Scotch Pine Gate area (Location 3 - refer to Drawing 1 and Appendix C), the MH at the intersection is again a 1200 mm diameter unit. The north inlet pipe (Black Walnut Trail) is a 375 mm diameter pipe, as is the eastern inlet (Scotch Pine Gate); the southern outlet pipe (Black Walnut Trail) is a 450 mm diameter pipe. As such, the maximum proposed diversion pipe is again considered to be a 450 mm diameter pipe. The diversion would need to cross a 450 mm diameter storm sewer (and associated connected double catchbasin), and a 200 mm diameter watermain. Vertical clearance from the watermain would require consideration (0.30 m +\-) however, if necessary, the watermain could be adjusted. A backflow prevention collar was also previously constructed at the Scotch Pine Gate site around the storm sewer outfall; this would require further consideration as part of the subsequent design effort as well.

#### 5.2.2.2 January 11-12, 2020 Event

Under this storm event the HWP pumping node near Derry Road is removed from the modelling in order to assess the permanent pumping requirements. As an initial test, the simulated HWP was removed from the modelling and re-run with all other features unchanged. The simulated results suggest some benefit provided by the large 6" portable pump near Derry Road. Without the HWP pumping included, the HGL increases by between 0.1 and 0.9 m +\- depending on the location. The modelling also indicates FDC surcharging to surface out of the lowest FDC MH located along Lisgar Meadowbrook Trail between Wild Cherry Lane and Derry Road (one MH upstream of the temporary HWP pumping location) without the HWP

pumping in place. The modelling has also been tested including the Cactus Gate Pumping Station. The results indicate that if it had been in place, the pumping station would have been effective in lowering the HGL in this area by some 1.9 m +\- as compared to the baseline scenario or 2.7 m +\- compared to the theoretical scenario without the HWP in place. Refer to Figure C1A (Appendix C) for the HGL comparison.

The modelling has been tested using only a diversion of flows at Smoke Tree Road, as well as a diversion of flows at both Smoke Tree Road and Scotch Pine Gate. Refer to Figure C1A (Appendix C) for the HGL comparison. Overall, the results suggest that the diversion at Smoke Tree Road would be largely effective, while the additional diversion at Scotch Pine Gate is of more limited benefit. At the Black Walnut Trail\Smoke Tree Road MH, simulated water levels would be decreased notably, by approximately 1.7 m as compared to the base scenario (no HWP, Cactus Gate PS in place). The simulated benefit continues downstream even with only the Smoke Tree diversion, with an HGL reduction of 1.0 m +\- near Derry Road (as compared to the base scenario without HWP and with the Cactus Gate PS in place).

Under the Smoke Tree only scenario, the simulated diversion is 0.126 $m^3/s$, or 126 L/s, which is comparable to the dual pump capacity of the Cactus Gate Pumping Station (120 L/s) but less than the capacity of the temporary HWP pumping systems (0.18 $m^3/s$ or 180 L/s). With the Scotch Pine Gate diversion included, the effect is such that the diversion at Smoke Tree Road is reduced notably by approximately 0.05 $m^3/s$. The diversion at Scotch Pine Gate is greater than this difference (0.086 $m^3/s$ approximately) which results in some HGL reduction further downstream (0.45 m +\-) but the effect is not considered substantial enough to warrant the second pumping station.

Further, a review of the simulated pipe capacity calculations from PCSWMM indicates the majority of the FDC sewers downstream of the Smoke Tree diversion would be close to or only slightly above the theoretical pipe capacity. This suggests that downstream tailwater levels are impacting this area and causing the elevated HGL. The HGL comparison provided in Figure C1B (refer to Appendix C) confirms this; the downstream HGL if contained within the pipe network when tailwater levels are removed.

The results do however indicate elevated HGL conditions continuing upstream of Smoke Tree Road on the west side of Lisgar Creek (i.e., Golden Locust Drive area). Based on the simulated results, it is generally suggested that alternative mitigation measures in this area, in the form of local conveyance (pipe) upgrades be considered, which is consistent with previously developed remedial action plan recommendations. Upgrading small diameter (200 mm) FDC sewers on Terragar Boulevard to slightly larger sizes would likely help to address simulated surcharging in these areas; further upgrades downstream may also require consideration. Such upgrades have not been modelled as part of the current assessment. Additional measures to reduce inflows in these areas would also be beneficial.

As a scoped supplemental assessment, a comparison between a pumping station at Smoke Tree Road or a pumping station at Scotch Pine Gate has been undertaken. HGL results are presented in Figure C1C (refer to Appendix C). The results generally indicate a similar benefit, with the simulated diversion at Scotch Pine Gate of 0.126 $m^3/s$ (same as at Smoke Tree Road). The HGL is effectively "shifted" by the change; a pumping station at Scotch Pine Gate would result in increased water levels upstream (0.25 m +\-) but decreased water levels downstream (0.45 m +\-).

#### 5.2.2.3 August 3, 2020 Event

Under this storm event the HWP pumping node near Derry Road is removed from the modelling in order to assess the permanent pumping requirements. As an initial test, the simulated HWP was removed from the modelling and re-run with all other features unchanged. The simulated results confirm the benefit provided by the large 6" portable pump near Derry Road. Without the HWP pumping included, the HGL increases by between 0.5 and 1.4 m +\- depending on the location. The modelling also indicates FDC surcharging to surface out of the lowest FDC MH located along Lisgar Meadowbrook Trail between Wild Cherry Lane and

Derry Road (one MH upstream of the temporary HWP pumping location) as well as the upper limits of Black Walnut Trail near Cactus Gate (the pumping station would not be included in this scenario). The modelling has also been tested including the Cactus Gate Pumping Station. The results indicate that if it had been in place, the pumping station would have been effective in lowering the HGL in this area by some 2.5 m +\- as compared to the baseline scenario or 4.2 m +\- compared to the theoretical scenario without the HWP in place. Refer to Figure C1D (Appendix C) for the HGL comparison.

The modelling has been tested using only a diversion of flows at Smoke Tree Road, as well as a diversion of flows at both Smoke Tree Road and Scotch Pine Gate. Refer to Figure C1D (Appendix C) for the HGL comparison. Overall, the results suggest that the diversion at Smoke Tree Road would be largely effective, while the additional diversion at Scotch Pine Gate is of more limited benefit. At the Black Walnut Trail\Smoke Tree Road MH, simulated water levels would be decreased notably, by approximately 1.3 m as compared to the base scenario (no HWP, Cactus Gate PS in place). The simulated benefit continues downstream even with only the Smoke Tree diversion, with an HGL reduction of 1.1 m +\- near Derry Road (as compared to the base scenario without HWP and with the Cactus Gate PS in place).

Under the Smoke Tree only scenario, the simulated diversion is 0.064 $m^3/s$, or 64 L/s, which is comparable to the single pump capacity of the Cactus Gate Pumping Station (70 L/s) but notably less than the capacity of the temporary HWP pumping systems (0.18 $m^3/s$ or 180 L/s). With the Scotch Pine Gate diversion included, the effect is such that the diversion at Smoke Tree Road is reduced by approximately 0.01 $m^3/s$. The diversion at Scotch Pine Gate is greater than this difference (0.026 $m^3/s$ approximately) which results in some HGL reduction further downstream (0.30 m +\-) but the effect is not considered substantial enough to warrant the second pumping station.

Further, a review of the simulated pipe capacity calculations from PCSWMM indicates the majority of the FDC sewers downstream of the Smoke Tree diversion would be close to or only slightly above the theoretical pipe capacity. This suggests that downstream tailwater levels are impacting this area and causing the elevated HGL. The HGL comparison provided in Figure C1E (refer to Appendix C) confirms this; the downstream HGL if contained within the pipe network when tailwater levels are removed.

The results do however indicate elevated HGL conditions continuing upstream of Smoke Tree Road on the west side of Lisgar Creek (i.e., Golden Locust Drive area). Based on the simulated results, it is generally suggested that alternative mitigation measures in this area, in the form of local conveyance (pipe) upgrades be considered, which is consistent with previously developed remedial action plan recommendations. Upgrading small diameter (200 mm) FDC sewers on Terragar Boulevard to slightly larger sizes would likely help to address simulated surcharging in these areas; further upgrades downstream may also require consideration. Such upgrades have not been modelled as part of the current assessment. Additional measures to reduce inflows in these areas would also be beneficial.

As a scoped supplemental assessment, a comparison between a pumping station at Smoke Tree Road or a pumping station at Scotch Pine Gate has been undertaken. HGL results are presented in Figure C1F (refer to Appendix C). The results generally indicate a similar benefit, with the simulated diversion at Scotch Pine Gate of 0.08 $m^3/s$ (as opposed to 0.064 $m^3/s$ at Smoke Tree Road). The HGL is effectively "shifted" by the change; a pumping station at Scotch Pine Gate would result in increased water levels upstream (0.30 m +\-) but decreased water levels downstream (0.25 m +\-).

#### 5.2.2.4 August 28, 2021 Event

A brief sensitivity analysis of tailwater conditions has been completed for this event. The results indicate a general sensitivity to tailwater conditions, independent of flow impacts. If the FDC sewer network connection upstream of Gracefield Drive (approximately 700 m downstream of Derry Road) is replaced by an outfall (with a Normal Depth Boundary Condition) rather than using the simulated backwater from the FDC sewer

system, notable decreases in simulated water levels result, between 0.65 m and 1.35 m approximately (based on a baseline comparison with HWP pumping in place). A peak flow difference of up to 0.04 $m^3/s$ also results at the downstream limits; differences decrease further upstream as would be expected. The results suggest that tailwater conditions should be considered in the sizing of any mitigation measures for the Black Walnut Trail area, and that repeated simulation with downstream areas in place may be necessary. The results also suggest that conveyance upgrades (i.e., pipe size increases) may warrant further consideration separately from the current assessment.

Under this storm event the HWP pumping node near Derry Road is removed from the modelling in order to assess the permanent pumping requirements. As an initial test, the simulated HWP was removed from the modelling and re-run with all other features unchanged. The simulated results confirm the benefit provided by the large 6" portable pump near Derry Road. Without the HWP pumping included, the HGL increases by between 0.8 and 1.6 m +\- depending on the location. The modelling also indicates FDC surcharging to surface out of the lowest FDC MH located along Lisgar Meadowbrook Trail between Wild Cherry Lane and Derry Road (one MH upstream of the temporary HWP pumping location). Refer to Figure C1E (Appendix C) for the HGL comparison.

The modelling has been tested using only a diversion of flows at Smoke Tree Road, as well as a diversion of flows at both Smoke Tree Road and Scotch Pine Gate. Refer to Figure C1G (Appendix C) for the HGL comparison. Overall, the results suggest that the diversion at Smoke Tree Road would be largely effective, while the additional diversion at Scotch Pine Gate is of more limited benefit. At the Black Walnut Trail\Smoke Tree Road MH, simulated water levels would be decreased notably, by approximately 1.7 m as compared to the base scenario (including HWP pumping downstream). As would be expected, the benefit decreases upstream and downstream of the diversion, to an average reduction of 0.45 m +\- downstream of Scotch Pine Gate.

Under the Smoke Tree only scenario, the simulated diversion is 0.13 $m^3/s$, or 130 L/s, which is still less than the capacity of the temporary HWP pumping systems (0.18 $m^3/s$). With the Scotch Pine Gate diversion included, the effect is such that the diversion at Smoke Tree Road is reduced by approximately 0.04 $m^3/s$. The diversion at Scotch Pine Gate is greater (0.05 m3/s approximately) which results in some HGL reduction further downstream (0.35 m +\-) but the effect is not considered substantial enough to warrant the second pumping station.

Further, a review of the simulated pipe capacity calculations from PCSWMM indicates the majority of the FDC sewers downstream of the Smoke Tree diversion would be close to or only slightly above the theoretical pipe capacity. This suggests that downstream tailwater levels are impacting this area and causing the elevated HGL. The HGL comparison provided in Figure C1H (refer to Appendix C) confirms this; the downstream HGL if contained within the pipe network when tailwater levels are removed.

The results do however indicate elevated HGL conditions continuing upstream of Smoke Tree Road, including upstream of the Cactus Gate pump station. Similar results are indicated on the west side of Lisgar Creek (i.e., Golden Locust Drive area). The simulated results suggest that the capacity of the Cactus Gate Pumping Station is likely already at capacity, thus there is limited value in diverting further flows via an orifice restrictor. Further, this would likely not address the issues directly upstream. Based on the simulated results, it is generally suggested that alternative mitigation measures, in the form of local conveyance (pipe) upgrades be considered, which is consistent with previously developed remedial action plan recommendations. Additional measures to reduce FDC inflows would also be beneficial.

As a scoped supplemental assessment, a comparison between a pumping station at Smoke Tree Road or a pumping station at Scotch Pine Gate has been undertaken. HGL results are presented in Figure C1I (refer to Appendix C). The results generally indicate a similar benefit, with the simulated diversion at Scotch Pine Gate of 0.12 $m^3/s$ (as opposed to 0.13 $m^3/s$ at Smoke Tree Road). The HGL is effectively "shifted" by the change;

a pumping station at Scotch Pine Gate would result in increased water levels upstream (0.40 m to 0.60 m +\-) but decreased water levels downstream (0.40 m +\-).

#### 5.2.2.5 Summary

Based on the preceding analyses, the following has been concluded:

- An additional flow diversion\pumping station at Smoke Tree Road would be beneficial in reducing FDC system surcharging. A peak flow (required to be pumped) of up to 0.13 $m^3/s$ (130 L/s) is indicated by the modelling.
- A second pumping station at Scotch Pine Gate is considered to be of limited value as it reduces the effectiveness of the upstream location and has a relatively lower benefit compared to the benefit of the Smoke Tree Road location. As such, implementation of a pumping station at this location is not currently warranted but should be reviewed in the future through supplemental monitoring of the FDC system. As a stand-alone measure, a pumping station at Scotch Pine Gate would result in similar overall benefit, but "shifts" the HGL – water levels upstream are increased while water levels downstream are decreased by a generally consistent amount (0.25 to 0.60 m +\- depending on the storm event and location). The downstream benefits tended to be slightly higher for the Scotch Pine Gate only scenario. The overall benefit is generally similar.
- Residual FDC system surcharging is indicated in upstream areas north of Terragar Boulevard, both along Black Walnut Trail and the Golden Locust Drive area. It is considered that there is limited to no additional capacity in the existing Cactus Gate Pumping Station. As such, other measures, such as localized conveyance (FDC sewer) pipe upgrades (including relief pipes) should be considered. Measures to reduce FDC system inflows (such as downspout disconnections) should also be pursued regardless throughout the Black Walnut Trail area.
- Downstream tailwater\backwater impacts influence the simulated FDC system surcharging (HGL) based on a sensitivity analysis. As such, an additional benefit may result by implementing additional flow diversions and pumping stations downstream.

The preceding analyses will be considered in the subsequent assessment of downstream FDC pumping stations.

### 5.2.3 Doug Leavens Boulevard and Pintail Circle Area

#### 5.2.3.1 Overview

For the Doug Leavens and Pintail Circle area, the key storm events for simulation based on the results in Table 3.2 are considered to be:

- June 12, 2014
- April 16, 2018
- January 11-12, 2020
- August 28, 2021

The HWP program was in effect for all but the June 12, 2014, storm event. As noted previously, any proposed permanent pumping station would need to replicate (and increase) this pumping capacity, as the HWP pumping is removed from the simulation of the mitigation scenarios.

In addition, the permanent pumping station at Cactus Gate was operational for the August 28, 2021 storm event. This feature has been left in place for that storm event and added to the simulation of the January 11-12, 2020 storm event. Given the truncation of the upper limits of the model for the June 12, 2014 and April

16, 2018 events (due to the minimal response for areas north of Derry Road), the Cactus Gate pumping station has not been included in the simulation of those events.

Based on the as-built drawings for the Doug Leavens Boulevard area (Location 7 – refer to Drawing 1 and Appendix C), the area around the potential proposed flow diversion is unobstructed by utilities. There is a parallel sanitary sewer however this is located on the east side of the FDC sewer. It is unknown if there are other utilities (hydro, gas etcetera) within the creek corridor or not. The FDC sewer is a 525 mm diameter pipe in this area and the nearest MH is indicated as a 1200 mm diameter unit. Given the bend of the existing pipes, a 450 mm pipe could potentially be accommodated however confirmation with a pre-cast manufacturer would be required; for the current assessment, it has been conservatively assumed that a smaller 375 mm diameter sewer would be the maximum feasible size considered. Alternatively, a new MH could potentially be constructed given the available space, provided it could be spaced sufficiently from the parallel trunk sanitary sewer (750 mm diameter). The Lisgar Meadowbrook Trail in this area is unpaved, and during a site visit by Wood in the fall of 2021, was closed to the public due to safety concerns.

Based on the as-built drawings for the Pintail Circle area (Location 8 – refer to Drawing 1 and Appendix C), the MH located along Lisgar Meadowbrook Trail at the walkway from Pintail Circle is also a 1200 mm diameter unit, with 525 mm diameter FDC sewers along the trunk and an additional minor 200 mm diameter inlet from Pintail Circle. Given the angle of the pipes in this location, it is considered likely that the maximum diversion pipe that could be accommodated in the existing MH is a 375 mm diameter pipe, unless a new, larger 1500 mm diameter MH could be constructed. However, the proximity of the parallel 750 mm trunk sanitary sewer would again be a concern. The 600 mm diameter storm sewer outlet from Pintail Circle is located to the south of the existing MH and would not be expected to be an issue for the diversion. Similar to the Doug Leavens Boulevard location, the area is generally unencumbered by municipal utilities, however further confirmation would be required with respect to gas, hydro, and other services. There is a paved turn-around in this area, as it is currently used as a HWP pumping location (since 2021). The paved Lisgar Meadowbrook Trail is also frequently used by pedestrians.

Given the smaller expected diversion pipe sizes in these locations, it is assumed diversion pipe slopes would be increased from 1% to 2% to divert a greater portion of flow.

#### 5.2.3.2 June 12, 2014 Event

The base PCSWMM modelling applied for model calibration has been used for the current assessment. Under this scenario, the modelling has been tested using only a diversion of flows at Doug Leavens Boulevard.

Note that this model truncates the area north of Derry Road into a single hydrograph input at gauge F2. In this case there was also a notable response for the area north of Derry Road, as included in the previous (2018) modelling assessment (refer to Appendix A).

The resulting HGL with the proposed diversion at Doug Leavens Boulevard in place is shown in Figure C2A (refer to Appendix C). The results indicate that the diversion would be effective in reducing the HGL as compared to base conditions. Based on the results, the simulation of a scenario including a second pumping station\diversion at Pintail Circle is not considered warranted. A flow diversion of 0.152 $m^3/s$ (152 L/s) is indicated in the modelling for this event.

The results also indicate that the diversion would partially address tailwater conditions and improve the HGL upstream of Doug Leavens Boulevard, as per Figure C2B (refer to Appendix C). Depths of approximately 1.2 m +\- are still indicated which indicates upstream pumping measures are not fully effective, nor is the proposed diversion at Doug Leavens Boulevard. Additional mitigation measures in this area may therefore be required.

#### 5.2.3.3 April 16, 2018 Event

The base PCSWMM modelling applied for model calibration has been used for the current assessment. Under this scenario, the modelling has been tested using only a diversion of flows at Doug Leavens Boulevard.

Note that this model truncates the area north of Derry Road into a single hydrograph input at gauge F2. In order to conservatively assess performance, no pumping benefit from the upstream Black Walnut Trail area (i.e., Cactus Gate and Smoke Tree Road) has been included. Given the minor simulated flow for this event at Gauge F2 (i.e., 0.11 $m^3/s$; pipes are not indicated as surcharged south of Derry Road), this assumption is considered reasonable.

The resulting HGL with the proposed diversion at Doug Leavens Boulevard in place is shown in Figure C2C (refer to Appendix C). The results indicate that the diversion would be highly effective in reducing the HGL as compared to base conditions. Based on the results, the simulation of a scenario including a second pumping station\diversion at Pintail Circle is not considered warranted. A flow diversion of 0.093 $m^3/s$ (93 L/s) is indicated in the modelling for this event.

The results also indicate that the diversion would address tailwater conditions and improve the HGL upstream of Doug Leavens Boulevard, as per Figure C2D (refer to Appendix C). As indicated, the flow diversion would result in simulated unsurcharged conditions upstream of Doug Leavens Boulevard for the full length.

#### 5.2.3.4 January 11-12, 2020 Event

The base PCSWMM modelling applied for the Black Walnut Trail area assessment (Section 5.2.2) has been used for the assessment of this area as well. Under this scenario, the modelling has been tested using only a diversion of flows at Doug Leavens Boulevard, as well as a diversion of flows at both Doug Leavens Boulevard and Pintail Circle. Refer to Figure C2E (Appendix C) for the HGL comparison. Overall, the results suggest that the diversion at Doug Leavens Boulevard would be effective but does not completely attenuate the simulated FDC surcharge downstream. Whereas previously the simulated HGL would be above surface in many locations, with the Doug Leavens Boulevard pumping station in place the HGL is still notably reduced, by approximately 3.05 m +\- at the proposed pumping station diversion. The additional diversion at Pintail Circle does further reduce water levels but is of more limited benefit.

Under the Doug Leavens Boulevard pumping station only scenario, the simulated diversion is 0.22 $m^3/s$, or 220 L/s, which is greater than the capacity of the temporary HWP pumping systems (0.18 $m^3/s$ or 180 L/s). With the Pintail Circle diversion included, the effect is such that the diversion at Doug Leavens Boulevard is reduced by between 0.03 and 0.08 $m^3/s$. The diversion at Pintail Circle is slightly greater (0.09 $m^3/s$ approximately) which results in some HGL reduction further downstream (0.40 m +\-) but the effect is not considered substantial enough to warrant the second pumping station.

The results indicate that due to the changes in the Doug Leavens Boulevard area, changes in the upstream performance would also result, which reflects the dynamic nature of the FDC system. The simulated flow diversion at the Smoke Tree pumping station is reduced due to the downstream changes, from 0.13 $m^3/s$ previously to 0.10 $m^3/s$ in the updated simulation. Surcharging remains evident along the trunk FDC sewer between Spirea Terrace and Doug Leavens Boulevard, as per Figure C2F (refer to Appendix C). Although the HGL is notably reduced by the measures at Smoke Tree Road and Doug Leavens Boulevard, it is evident that the FDC remains surcharged in this section, up to and above depths of 2 m +\- in many locations. The impacts of this simulated surcharge are more minor given the number of connected residences in these areas and sewer grade differences. The largest FDC sewer connection is at Gracefield Drive, and there would remain some backwater impacts to this area due to the remaining surcharge, as well as further upstream. Notwithstanding, this may warrant additional mitigation measures in this area.

Tailwater conditions are notable for this simulation event. As per Figure C2G (refer to Appendix C), differences of up to 0.7 m +\- result when tailwater impacts are addressed downstream of the potential pumping stations. This may potentially be addressed by additional measures downstream however (i.e., at Osprey Boulevard), as described in Section 5.2.4.

#### 5.2.3.5 August 28, 2021 Event

The base PCSWMM modelling for the Black Walnut Trail area assessment (Section 5.2.2) has been applied for the assessment of this area as well. Under this storm event the HWP pumping node at Pintail Circle is also removed from the modelling in order to assess the permanent pumping requirements.

As an initial test, the simulated HWP was removed from the modelling (at Derry Road and Pintail Circle) and re-run with all other features unchanged. The simulated results confirm the benefit provided by the large 6" portable pumps at Derry Road and Pintail Circle, as evident from Figure C2G in Appendix C. Without the HWP pumping in place, the HGL would have been above surface for the majority of the locations along the selected profile.

The modelling has been tested using only a diversion of flows to an assumed pumping station at Doug Leavens Boulevard, as well as a diversion of flows at both Doug Leavens Boulevard and Pintail Circle. Refer to Figure C2H (Appendix C) for the HGL comparison. The HGL at the location of the Doug Leavens Boulevard diversion is reduced some 3.05 m +\- as compared to the base scenario. Overall, the results suggest that the diversion at Doug Leavens Boulevard would be largely effective, while the additional diversion at Pintail Circle is of more limited benefit.

Under the Doug Leavens Boulevard only pumping station scenario, the simulated diversion is 0.223 $m^3/s$, or 223 L/s, which is greater than the capacity of the temporary HWP pumping systems (0.18 $m^3/s$ or 180 L/s). With the Pintail Circle diversion included, the effect is such that the diversion at Doug Leavens Boulevard is reduced by approximately 0.06 $m^3/s$. The diversion at Pintail Circle is slightly greater (0.074 $m^3/s$ approximately) which results in some HGL reduction further downstream (0.30 m +\-) but the effect is not considered substantial enough to warrant the second pumping station.

The results indicate that due to the changes in the Doug Leavens Boulevard area, changes in the upstream performance would also result, which reflects the dynamic nature of the FDC system. The simulated flow diversion at the Smoke Tree pumping station is reduced due to the downstream changes; from 0.13 $m^3/s$ previously to 0.09 $m^3/s$ in the updated simulation. Surcharging remains evident along the trunk FDC sewer between Spirea Terrace and Doug Leavens Boulevard, as per Figure C2I (refer to Appendix C). Although the HGL is notably reduced by the measures at Smoke Tree Road and Doug Leavens Boulevard, it is evident that the FDC remains surcharged in this section. The impacts of this simulated surcharge are relatively minor given the number of connected residences in these areas and sewer grade differences. The largest FDC sewer connection is at Gracefield Drive, however the simulated surcharge impact in this area is minimal. Notwithstanding, this may warrant additional mitigation measures in this area.

Tailwater conditions appear to have a more minimal impact for this simulation event. As per Figure C2J, differences of approximately 0.35 m +\- result when tailwater impacts are addressed downstream of the potential pumping stations. This may potentially be addressed by additional measures downstream however (i.e., at Osprey Boulevard), as described in Section 5.2.4.

#### 5.2.3.6 Summary

Based on the preceding analyses, the following has been concluded:

- An additional flow diversion\pumping station at Doug Leavens Boulevard would be beneficial in reducing FDC system surcharging. A peak flow of up to 0.22 $m^3/s$ (220 L/s) is indicated by the modelling, which is greater than the existing HWP 6" pumps.
- A second pumping station at Pintail Circle is considered to be of limited value as it reduces the effectiveness of the upstream location and has a relatively lower benefit compared to the benefit of the Doug Leavens Boulevard location. As such, implementation of a pumping station at this location is not currently considered warranted but should be reviewed in the future through supplemental monitoring of the FDC system.
- Residual FDC system surcharging is indicated in upstream areas along Lisgar Creek. Although a more limited number of residences are affected by surcharge in this area, additional measures may warrant further consideration including an additional diversion or pumping station in this location. Localized conveyance (FDC sewer) pipe upgrades (including relief pipes) should also be considered and may be a more cost-effective option than additional pumping stations (above and beyond the primary PS recommended herein).
- Measures to reduce FDC system inflows (such as downspout disconnections) should be pursued regardless throughout the contributing drainage area.
- Downstream tailwater\backwater impacts influence the simulated FDC system surcharging (HGL) based on a sensitivity analysis. As such, an additional benefit may result by implementing additional flow diversions and pumping stations downstream.

The preceding analyses will be considered in the subsequent assessment of downstream FDC pumping stations.

### 5.2.4 Osprey Boulevard Area

#### 5.2.4.1 Overview

For the Osprey Boulevard area, the key storm events for simulation, based on the results in Table 3.2, are considered to be:

- January 13, 2013
- April 16, 2018
- January 11-12, 2020
- August 28, 2021

The HWP program was in effect for all but the January 13, 2013 storm event. As noted previously, any proposed permanent pumping station would need to replicate (and increase) this pumping capacity, as the HWP pumping is removed from the simulation of the mitigation scenarios.

In addition, the permanent pumping station at Cactus Gate was operational for the August 28, 2021 storm event. This feature has been left in place for that storm event and added to the simulation of the January 11-12, 2020 storm event. Given the truncation of the upper limits of the model for the January 13, 2013 and April 16, 2018 events (due to the minimal response for areas north of Derry Road) the Cactus Gate pumping station has not been included in the simulation of those events.

Based on the as-built drawings for the Lisgar Green Park area (Location 11 – refer to Drawing 1 and Appendix C), the 600 mm diameter trunk FDC sewer parallels the 750 mm diameter trunk sanitary sewer.

The FDC is located on the creek (west) side. There are two (2) maintenance holes located within the limits of the park area, on the west side of the Lisgar Meadowbrook Trail in the wooded area along the creek. Both are indicated as 1200 mm diameter units. This small size (maximum for a 600 mm straight run) renders the installation of a diversion pipe challenging, particularly given the parallel sanitary sewer which is at similar elevations to the FDC sewer (common trench), and the assumption that any pumping station would be located within the park area (i.e., would necessitate a crossing over the sanitary sewer). Based on the preceding, it is assumed that a FDC diversion would need to be constructed over the 750 mm sanitary sewer, which would also address the concern of inserting an additional FDC sewer pipe in a 1200 mm diameter maintenance hole. Given the proximity of the sanitary and FDC maintenance holes, further review would also be required to determine whether there would be sufficient space, including potentially daylighting the top slab of each maintenance hole. Alternatively, a new maintenance hole could be constructed on the existing FDC sewer, however it is considered that the maintenance hole would likely need to be a 1200 mm unit given the proximity of the sanitary sewer. Given the preceding, the diversion pipe could likely also be up to a 600 mm diameter pipe, provided sufficient vertical clearance was provided. It has been assumed for the purposes of this assessment that the diversion pipe would need to provide at least 0.3 m (300 mm) vertical clearance over the 750 mm sanitary sewer pipe. Accounting for pipe thickness (approximately 100 mm for both sewer pipes), it has been assumed that the FDC diversion pipe would need to be set a minimum of 1.25 m above the FDC sewer invert. Based on the preceding, any such diversion would be of limited effectiveness. Constructing the pumping station on the west (creek) side would address this conflict, however, would be complicated by ecological impacts to the woodlot as well as additional floodproofing requirements. Accordingly, the Location 11 pumping station\diversion option has not been assessed further.

Based on the as-built drawings for the Osprey Marsh area (near Prairie Circle; Location 12 – refer to Drawing 1 and Appendix C), the 600 mm diameter trunk FDC sewer enters the area from the north before making a 90-degree bend and continuing westerly through the berm of the Osprey Marsh Stormwater Management (SWM) Facility. The 750 mm diameter trunk sanitary sewer parallels the FDC sewer in this area again. The FDC sewer is located on the west and north side respectively. On the available record drawings (refer to Appendix C) temporary pumping stations are indicated for both the FDC and sanitary sewers; it is assumed that both are no longer in service or may have never been constructed. No further details are available and the FDC sewer grading suggests a continuous positive grade that would not necessitate a pumping station for normal operation. The existing FDC maintenance hole at the 90-degree bend is a 1500 mm diameter unit; the adjacent sanitary sewer MH is an 1800 mm diameter unit. Based on the angle and size of the existing FDC maintenance hole, any overflow\diversion would have to be located above the existing 600 mm diameter pipes. This would be less effective; as such it is assumed that a new maintenance hole (1500 mm diameter) would need to be constructed on the existing FDC sewer line to permit a diversion. Given the conflict with the parallel 750 mm sanitary sewer, any such FDC pumping station would likely need to be located on the north side. This would potentially necessitate some creek works (shift the creek west, and potentially adjust the wet pond berm on the west side as required) to ensure a sufficient area is available for the pump station (which would also need to be floodproofed). Further design would be required to confirm grading requirements. This will require further assessment as part of the more fulsome Class EA evaluation process. For the purposes of the current assessment, it has been assumed this general arrangement would be employed, with the 600 mm diversion pipe (1% slope) set at the springline of the trunk FDC sewer. It should be noted there is also a 900 mm diameter storm sewer outfall from Prairie Circle in the area of interest. However, assuming the pumping station is located on the north side of the east-west utility corridor, there would be no conflict.

Based on the preceding the additional analyses for the Osprey Marsh area have considered Location 12 only. Further details are provided in the subsequent sections for specific storm events.

#### 5.2.4.2 January 13, 2013 Event

The base PCSWMM modelling applied for model calibration has been used for the current assessment. Under this scenario, the modelling has been tested assumed diversions to pumping stations at both Doug Leavens Boulevard and Osprey Marsh.

Note that this model truncates the area north of Derry Road into a single hydrograph input at gauge F2. The simulated peak flow at this location is 0.245 $m^3/s$, which is greater than the pipe capacity of 0.17 $m^3/s$. For the purposes of the current assessment, it has been assumed that upstream pumping stations would reduce the discharge to the full flow capacity of the pipe. This would involve a reduction of 0.075 $m^3/s$, which is considered reasonable given the estimated capacities of both upstream pumping stations.

The resulting HGL with the proposed diversions in place is shown in Figure C3A (refer to Appendix C). The results indicate that the diversion would be highly effective in reducing the HGL as compared to base conditions. A flow diversion of 0.053 $m^3/s$ (53 L/s) is indicated in the modelling at the Doug Leavens Boulevard diversion (pumping station); 0.084 $m^3/s$ (84 L/s) is indicated at the Osprey Marsh location.

A minor residual surcharging is indicated along the FDC trunk sewer on Ninth Line, as per Figure C3B (refer to Appendix C).

The results also indicate that the diversion would address tailwater conditions and improve the HGL upstream of Doug Leavens Boulevard, as per Figure C3C (refer to Appendix C). As indicated, the flow diversion would result in simulated unsurcharged conditions upstream of Doug Leavens Boulevard for the full length.

#### 5.2.4.3 April 16, 2018 Event

The base PCSWMM modelling for the Doug Leavens Boulevard area (Section 5.2.3) has been applied for the assessment of this area as well. Under this storm event, the HWP pumping nodes at Osprey Boulevard and at Ninth Line have been removed and replaced with a potential permanent pumping station diversion as described previously. HGL plots are included in Appendix C.

Figure C3D presents the simulated HGL along the trunk FDC between Doug Leavens Boulevard and Ninth Line. As evident, the inclusion of the third pumping station\diversion at Osprey Marsh results in a decrease in the HGL as compared to baseline conditions. Based on the simulation results, a total flow diversion of 0.109 $m^3/s$ (109 L/s) at Osprey Marsh is indicated, which would be still less than the capacity of the HWP temporary pumps (6").

The results indicate a slight surcharge would remain along the trunk FDC sewer along the Osprey Marsh berm. A minor residual surcharge also remains downstream along Ninth Line, as evident from Figure C3E (refer to Appendix C). The maximum surcharge is approximately 0.60 m +\- above the obvert of the trunk 750 mm diameter FDC sewer. Although the surcharge in this case is relatively minor, particularly given the depth of the trunk sewer, further measures warrant consideration to address this issue. Further optimization of the Osprey Marsh diversion is considered the preferred approach overall.

As was the case for the analysis of the Doug Leavens Boulevard, there are no residual FDC surcharge impacts upstream of Doug Leavens Boulevard with the additional Osprey Marsh diversion added in; this section of FDC sewer remains unsurcharged. The simulated diversion flow at Doug Leavens Boulevard is slightly reduced under this updated scenario, from 0.093 to 0.079 $m^3/s$.

#### 5.2.4.4 January 11-12, 2020 Event

The base PCSWMM modelling for the Doug Leavens Boulevard area assessment (Section 5.2.3) has been applied for the assessment of this area as well. Under this storm event the HWP pumping nodes at Osprey Boulevard and at Ninth Line have been removed and replaced with a potential permanent pumping station diversion as described previously. HGL plots are included in Appendix C; refer to Figures C3F to C3H.

Figure C3G presents the simulated HGL along the trunk FDC between Doug Leavens Boulevard and Ninth Line. As evident, the inclusion of the third pumping station\diversion at Osprey Marsh results in a notable decrease in the HGL as compared to baseline conditions. Based on the simulation results, a total flow diversion of 0.27 $m^3/s$ (270 L/s) at Osprey Marsh is indicated, which would be a substantial pumping requirement but still within the range of feasible pump sizes.

A residual tailwater\FDC surcharge remains however in the area downstream, as evident from the downstream limits of Figure C3F and Figure C3G, which presents the simulated HGL further downstream along Ninth Line and up to the discharge point to the deep storm sewer outlet at Erin Centre Boulevard\Churchill Meadows. Despite the three (3) diversions, a residual surcharge remains. This likely reflects the additional simulated flow inputs beyond the Osprey Marsh diversion (i.e., at Lisgar Drive\Pondview Way and at Ninth Line) as well as the near flat grade of several sections of the FDC trunk along Ninth Line (i.e., less than 0.1% in several sections) which cause backwater effects. The results suggest that further measures, in the form of additional over-control at the proposed diversion\pumping station, a fourth pumping station (nearer to Ninth Line), or conveyance upgrades (FDC sewer upsizing or relief sewers) may be required. Overall, it is considered that further optimization of the Osprey Marsh diversion and pumping station is preferred, given the high cost associated with an additional pumping station, and challenges with FDC sewer upgrades along Ninth Line (arterial roadway, sewer depths of between 5 and 12 m with large diameter 750 mm pipes).

Similarly, the results continue to indicate a residual FDC surcharge for the section of sewer between Derry Road and Doug Leavens Boulevard (as per Figure C3H in Appendix C). As noted previously, given the lesser number of connections to the FDC sewer system in this area (other than at Gracefield Drive) this is potentially less of a priority but should be monitored and considered for further remedial measures. As noted, this could include localized conveyance upgrades (FDC sewer upsizing along the creek block; between Gracefield Drive and Doug Leavens Boulevard in particular) as well as further upsizing\optimizing of the Smoke Tree diversion\pumping station; this would likely necessitate some type of restrictor to direct a greater amount of flow out of the FDC sewer system to limit downstream surcharging.

Based on the simulated results, the Smoke Tree pumping station\diversion indicates a peak flow of 0.10 $m^3/s$ (100 L/s) which is consistent with the previous assessment for Doug Leavens Boulevard, but slightly less than the 0.13 $m^3/s$ estimated for the stand-alone assessment of the Black Walnut Trail area (as per Section 5.2.22). The Doug Leavens diversion\pumping station indicates a flow of 0.19 $m^3/s$, which is slightly less than the 0.22 $m^3/s$ estimated using the Doug Leavens area as a stand-alone, as per Section 5.2.3.4.

#### 5.2.4.5 August 28, 2021 Event

The base PCSWMM modelling for the Doug Leavens Boulevard area assessment (Section 5.2.3) has been applied for the assessment of this area as well. Under this storm event the HWP pumping node at Osprey Boulevard has been removed and replaced with a potential permanent pumping station diversion as described previously. HGL plots are included in Appendix C; refer to Figures C3I to C3K.

Figure C3I presents the simulated HGL along the trunk FDC between Doug Leavens Boulevard and Ninth Line. As evident, the inclusion of the third pumping station\diversion at Osprey Marsh results in a notable decrease in the HGL as compared to baseline conditions. Based on the simulation results, a total flow diversion of 0.235 $m^3/s$ (235 L/s) is indicated as the Osprey Marsh diversion\pumping station.

A residual tailwater\FDC surcharge remains however in the area downstream, as evident from the downstream limits of Figure C3I and Figure C3J, which presents the simulated HGL further downstream along Ninth Line and up to the discharge point to the deep storm sewer outlet at Erin Centre Boulevard\Churchill Meadows. Despite the three (3) diversions, a residual surcharge remains. This likely reflects the additional simulated flow inputs beyond the Osprey Marsh diversion (i.e., at Lisgar Drive\Pondview Way and at Ninth

Line) as well as the near flat grade of several sections of the FDC trunk along Ninth Line (i.e., less than 0.1% in several sections). As noted earlier, the results suggest that further measures, in the form of additional over-control at the proposed diversion\pumping station, a fourth pumping station (nearer to Ninth Line), or conveyance upgrades (FDC sewer upsizing or relief sewers) may be required. Overall, it is considered that further optimization of the Osprey Marsh diversion and pumping station is preferred, given the high cost associated with an additional pumping station, and challenges with FDC sewer upgrades along Ninth Line (arterial roadway, sewer depths of between 5 and 12 m with large diameter 750 mm pipes).

Similarly, the results continue to indicate a residual FDC surcharge for the section of sewer between Derry Road and Doug Leavens Boulevard (as per Figure C3K in Appendix C). As noted previously given the lesser number of connections to the FDC sewer system in this area (other than at Gracefield Drive) this is potentially less of a priority but should be monitored and considered for further remedial measures. As noted, this could include localized conveyance upgrades (FDC sewer upsizing along the creek block; between Gracefield Drive and Doug Leavens Boulevard in particular) as well as further upsizing\optimizing of the Smoke Tree diversion\pumping station; this would likely necessitate some type of restrictor to direct a greater amount of flow out of the FDC sewer system to limit downstream surcharging.

Based on the simulated results including all three (3) proposed pumping stations, the results at Smoke Tree Road remain generally consistent (0.09 $m^3/s$). The simulated diversion flow at Doug Leavens Boulevard is slightly reduced as compared to the previous assessment in Section 5.2.3.5 (0.194 $m^3/s$ as compared to 0.223 $m^3/s$ previously). This reflects the dynamic nature of the modelling.

#### 5.2.4.6 Summary

Based on the preceding analyses, the following has been concluded:

- Based on further technical review, a diversion\pumping station at Lisgar Green Park (Location 11) would not be feasible due to the conflict with the existing trunk sanitary sewer. A pumping station at Osprey Marsh (Location 12) has been advanced instead. As noted, the grading layout and potential ecological impacts require further assessment through the Class EA evaluation process, along with other typical evaluation factors.
- An additional flow diversion\pumping station at Osprey Marsh would be beneficial in reducing FDC system surcharging. A peak flow of up to 0.27 $m^3/s$ (270 L/s) is indicated by the modelling at the Osprey Marsh location, which is greater than the existing HWP 6" pumps.
- A residual FDC sewer surcharge is indicated for the area downstream of Osprey Marsh along Ninth Line. Further measures may require consideration in this area, potentially including a fifth pumping station (nearer to Ninth Line; in addition to the PS at Cactus Gate and the three (3) additional PS recommended through this assessment), conveyance upgrades (FDC sewer upsizing or relief sewers). Further optimizing of the proposed Osprey Marsh pumping station is considered the preferred approach, given the challenges associated with other potential measures. This would likely necessitate some type of restrictor to limit discharge to the FDC sewer through the Osprey Marsh berm.
- Residual FDC system surcharging also continues to be indicated in upstream areas along Lisgar Creek (Derry Road to Doug Leavens Boulevard generally). Although a more limited number of residences are affected by surcharge in this area, additional measures may warrant further consideration including an additional diversion or pumping station in this location. Localized conveyance (FDC sewer) pipe upgrades (including relief pipes) should also be considered and may be a more cost-effective option than additional pumping stations (above and beyond those recommended herein).

- Measures to reduce FDC system inflows (such as downspout disconnections) should be pursued regardless throughout the contributing drainage area.

The preceding analyses will be considered in the subsequent assessment of downstream FDC pumping stations.

## 5.3 Additional Considerations and Next Steps

In addition to the preceding primary analyses, a number of additional considerations with respect to the proposed mitigation works have been noted and are summarized herein.

1. Notwithstanding the preceding recommendations regarding permanent pumping stations, elimination of extraneous sources of inflow to the FDC sewer (i.e., residential downspout disconnections in particular, additional catchbasin subdrain plugs where warranted, etcetera) should remain a primary focus for the City as this will reduce the demands of any retrofit mitigation measures and result in a much more immediate, as well as long-term benefit to overall basement water infiltration reduction.
2. The preceding analyses have been based on the FDC hydraulic model "calibration" for each storm event, given the dynamic and complex nature of the FDC system response to storm events. It should be noted that there is the potential that additional inflows to the FDC may occur once pumping is introduced (i.e., that inflows during past storm events were constrained by the high water levels in the FDC system). As such, residual capacity and future retrofitting potential (i.e. ability to upgrade pump capacity if necessary) should be considered as part of the pump station design effort to provide additional resiliency.
3. It is expected that further refinements and adjustments to the preliminary pump station capacities and layouts described herein will be undertaken as part of the subsequent detailed design effort. Based on the current simulation results, this should include consideration of the value of orifice plates or other restrictors where necessary. The modelling should be considered as a whole given the inter-connectivity of the FDC drainage system. Additional considerations around diversion pipe sizing, wet well dimensions, and pump capacities will also necessarily be considered as part of detailed design, as well as grading and utilities.
4. Based on the current results, additional mitigation measures may potentially be required in addition to the primary proposed three (3) FDC pumping stations. This may potentially include additional pumping stations (above and beyond the primary 3 PS recommended herein), however given the high cost and construction timelines associated with these projects, this would likely not be preferred. Further optimization of the three (3) currently proposed FDC pumping stations, including flow restrictors (as noted previously) should be first considered. Localized FDC sewer upgrades are potentially a more cost-effective solution for the FDC network (i.e. as opposed to additional pumping stations above and beyond those recommended herein) between Gracefield Drive and Doug Leavens Boulevard in particular, given that the area is generally unobstructed, other than the parallel trunk sanitary sewer (and the crossing of Lisgar Creek which occurs near Gracefield Drive). Similarly, local FDC sewer upgrades in the upper Black Walnut Trail area (including the area west of Lisgar Creek near Golden Locust Drive) may also require consideration.
5. Sequencing and prioritization of the three (3) proposed FDC pumping stations will be considered as part of the Environmental Study Report (ESR) for the Class Environmental Assessment (EA) given the number of different potential factors (beyond the technical) which require consideration.

6. Annual monitoring of the FDC network and related drainage systems should continue to allow for a continued assessment of system performance and the incremental benefit of remedial measures as they are constructed.
7. The High Water Protocol (HWP) pumping should continue to remain in place until such time as all currently proposed works are constructed, and subsequent annual monitoring of the FDC sewer system confirms that all measures are working effectively and no adverse FDC surcharging would be expected.

# 6.0 Summary and Conclusions

To summarize the work completed and associated key findings:

- An updated hydraulic model of the FDC network has been developed in PCSWMM.
- The model has been "calibrated" to the observed water level responses in the FDC network for six (6) major storm events over the available monitoring period (2012-2021) using a unit hydrograph type approach. The results indicate a generally good fit to the available data. The results also provide some direction on "hot spots" or areas with consistently higher relative inflows to the FDC system which would be higher priorities for mitigation measures.
- The simulation models have been applied to incrementally assess the locations and benefits of FDC pumping stations for different areas, given the extents of the Lisgar District, and the complexities and inter-connectivity of the FDC system.
- Based on the results, three (3) FDC pumping stations are currently recommended for implementation (refer to Drawing 1):
    - Black Walnut Trail at Smoke Tree Road (Location 2); the benefit of a pumping station at Black Walnut Trail at Scotch Pine Gate (Location 3) is generally similar
    - Lisgar Creek south of Doug Leavens Boulevard (Location 7)
    - Osprey Marsh (Location 12)
- The relative prioritization for implementation will be assessed as part of the primary Environmental Study Report (ESR) for the Class Environmental Assessment (EA) evaluation.
- Additional remedial measures may be required for other areas based on the simulation results. Opportunities to further optimize the FDC pumping stations to minimize additional works should be considered as part of the subsequent design effort for the three (3) sites, however localized works, in particular FDC sewer upgrades (where additional pumping stations are not feasible or not warranted), may be required. These should be considered as part of subsequent detailed design of pumping stations to ensure full flows are included (i.e. not attenuated by FDC sewers).

Respectfully Submitted,

**Wood Environment & Infrastructure Solutions Canada Limited**

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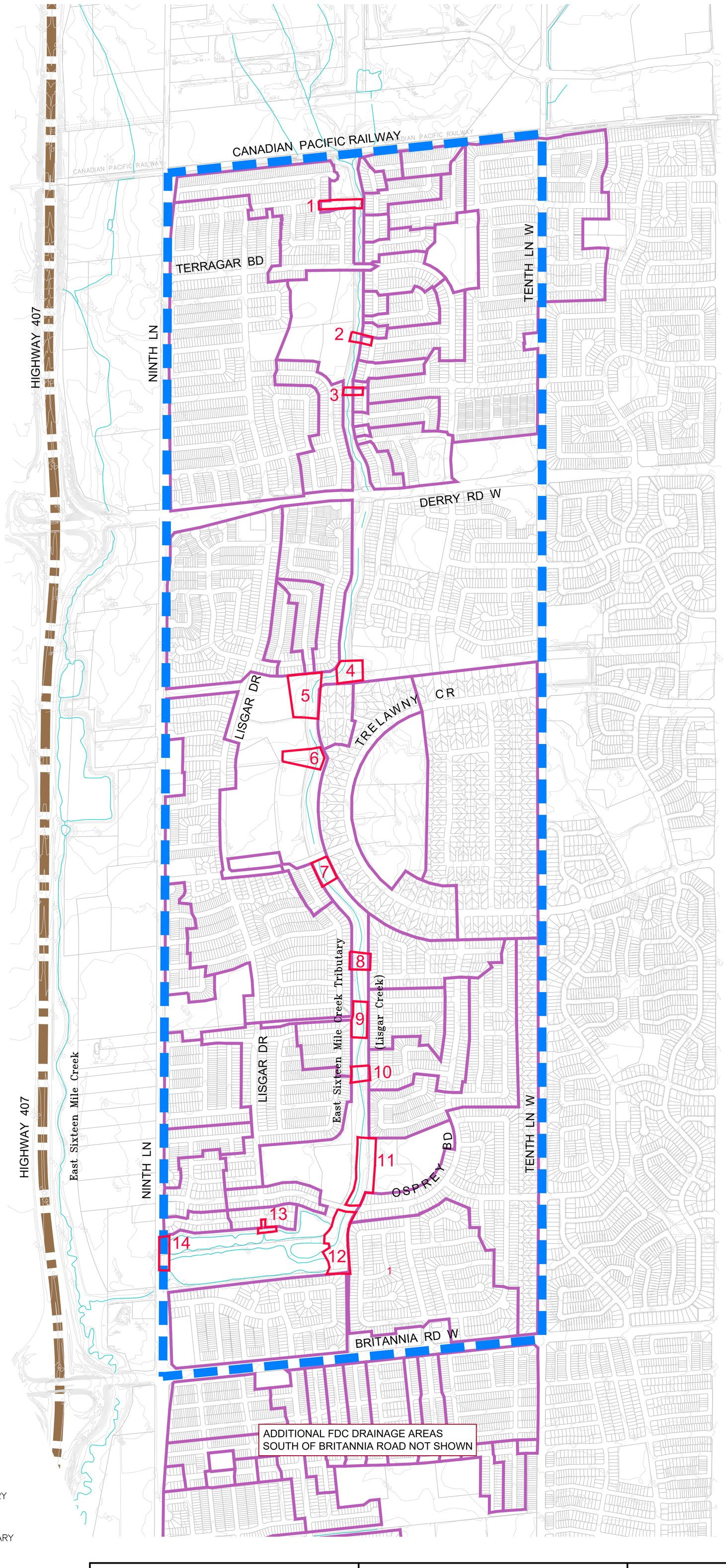


SCALE VALID ONLY FOR 24"x36" VERSION

# LISGAR DISTRICT FDC PUMPING STATIONS CLASS EA

CITY OF MISSISSAUGA

## PRELIMINARY LONG-LISTED LOCATIONS

wood.

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| Scale | 1:7500 |
| Consultant File No. | WW21011023 |
| Drawing No. | 1 |

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Path: C:\WORK - My Projects\HOME-LISGAR-WW21011023\Dwg-1.dwg
Plotted: 2021-05-25
Last Saved By: mary.kelly
Last Saved: 2021-05-25

# Appendix A
# Previous Technical Memoranda

# Memo

**To:** Jeff Smylie and Louie Jakupi, City of Mississauga

**From:** Matthew Senior and Ron Scheckenberger

**Date:** March 12, 2018

**File:** TPB188016

**Re:** **FDC Pumping Station – Hydraulic Modelling and Location Analysis**
**Lisgar District Basement Water Infiltration Assessment – Remediation Phase**

## 1. Introduction, Background and Purpose

Further to our approved scope of November 13, 2017, we hereby provide you with a summary of the analyses completed to date with respect to the proposed foundation drain collector (FDC) pumping station for the Lisgar District within the City of Mississauga.

As you are aware, Amec Foster Wheeler has supported the City since late 2011 with regards to the ongoing issues related to basement water infiltration in the Lisgar District. From 2011 to 2015, efforts were largely focused around data collection (monitoring) and analysis efforts. The findings of this period were ultimately documented in a March 2015 Public Summary Report, which concluded the problem was primarily related to the build-up of water in the bedding material of utility trenches that contain the storm, sanitary, and FDC sewer systems and presenting the effective conveyance of foundation drains around area homes. As part of the March 2015 report, a Priority Action Plan was developed, with the highest priority items including lining of priority storm sewer to minimize leakage, and the construction of a utility trench dewatering system. Subsequent priority measures (depending on the success of the highest priority items) included construction of a permanent FDC pumping station for high flows, and the replacement of deficient sections of the FDC sewer system.

Amec Foster Wheeler was subsequently retained by the City of Mississauga to support the remediation works phase of the study, with the highest priority items being storm sewer lining (to reduce leakage) and the design of a utility trench dewatering system (to reduce the build-up of water in the utility trench). In addition, Amec Foster Wheeler continued to undertake monitoring of the drainage systems within the Lisgar District to provide ongoing verification of the effectiveness of remedial measures as they were constructed, and to also allow for data collection in the event of FDC surcharging or basement water infiltration events, should they occur.

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Storm sewer lining works for the highest priority area (Phase 1 - Black Walnut Trail) were completed between December 2016 and March 2017. A second phase of storm sewer lining was planned for the next highest priority area (Doug Leavens Boulevard, Alderwood Trail, and Osprey Boulevard) for later in 2017. However, post-lining storm sewer leakage tests completed in April 2017 indicated an approximately similar rate of leakage under post-lining conditions as under pre-lining, which was unexpected. A repeated post-lining leakage test was completed in July 2017 using a revised testing procedure. The results of this additional testing (as documented in the August 28, 2017 revised draft memorandum) indicated that the highest relative rate of storm sewer leakage is sourced from catchbasins, and specificially from the roadway sub-drains which connect into these catchbasins. Notwithstanding, the revised testing indicated that other components of the storm sewer system (maintenance holes and catchbasin leads) also continued to leak with the catchbasin blockers in place, albeit at a lesser rate than the catchbasins and sub-drains. The City of Mississauga and Amec Foster Wheeler subsequently pursued a number of potential mitigation measures to this end. City staff ultimately proceeded with the installation of catchbasin sub-drain plugs along Black Walnut Trail in October and November of 2017, with a second phase of plugs (Doug Leavens Boulevard to Osprey Boulevard) installed in January of 2018. The effectiveness of these plugs will continue to be evaluated over the course of 2018 and beyond.

As you are also aware, a storm event on July 13-14, 2017 resulted in reported instances of basement water infiltration in the Lisgar area. A total of thirty-five (35) residences within the Lisgar District reported basement water infiltration from the July 13-14 storm event (ref. e-mail Blair-Senior, July 25, 2017). All of the affected properties are located along the west side of Black Walnut Trail (i.e. backing onto Lisgar Creek), with the exception of one property located along Golden Locust Trail. This is consistent with the location of previously reported instances of basement water infiltration in this area. To date, no instances of basement water infiltration have been reported from other areas in the Lisgar District which have previously reported occurrences; this primarily involves residences in the vicinity of Alderwood Trail and Osprey Boulevard. The July 13-14, 2017 event is notable in that is the first reported instance of basement water infiltration in this area (Black Walnut Trail) for which field monitoring data are available. Monitoring gauges were in place for the January 13, 2013 event (for which seven (7) residences reported basement water infiltration), however all of these residences were in the vicinity of Osprey Boulevard.

A memorandum was generated by Amec Foster Wheeler (August 1, 2017) to summarize and interpret available monitoring data for the storm event, as well as suggested additional analyses and next steps. A public meeting was subsequently held on October 18, 2017 to provide an update on the ongoing works being completed for the Lisgar District Basement Water Infiltration Study. As part of the public meeting, an updated action plan was presented. In addition to previously proposed activities (addressing roadway sub-drain leakage, utility trench dewatering system), an FDC pumping station (similar to that proposed in the March 2015 public report) was advanced as a higher priority mitigation measure to be designed and constructed in 2018.

Amec Foster Wheeler has proceeded with the initial analysis in support of the FDC pumping station; specifically Tasks 1 and 2 of the November 13, 2017 work plan. This memorandum is intended to summarize these efforts, related to hydraulic modelling of the FDC system, analysis of pumping station feasibility and required capacity, and recommendations for location(s) and sizing.

## 2. Hydraulic Modelling and Analysis of Recorded Storm Events

### 2.1. Model Development and Methodology

In order to support an informed design process for an FDC pumping station, an analytical tool is considered to be required. Such a tool is intended to be used to assess expected rates of flow within the FDC system during storm events, and the associated effectiveness of potential pumping strategies (locations, numbers, and pump station sizing/capacities).

A hydraulic model of the FDC sewer system was previously developed (PCSWMM) as part of the assessment work in support of the March 2015 Public Summary Report. Although this work was not formally documented, details were provided in the internal presentation of December 16, 2014. That model was used for a number of different assessments, including forensic modelling of an actual storm event (September 2, 2014) based on available FDC monitoring data. A similar approach to that work has been employed for the current assessment.

The previously developed PCSWMM model is not an “all pipes” model, but rather a model of the trunk FDC system, from Black Walnut Trail to the systems’ ultimate outlet to the storm sewer system at Erin Centre Boulevard and Churchill Meadows (some 8 km +\- downstream). For the purposes of the current assessment, and as was done for the previously noted forensic assessment (September 2, 2014 event), the model has been truncated 250 m +\- downstream of gauge F2 (which is located 120 m +\- downstream of Derry Road), given the focus on FDC surcharging and basement water infiltration within the Black Walnut Trail area of the Lisgar District.

The previously developed PCSWMM model has been updated for the current assessment to include a higher level of discretization. The primary area of additional model resolution is in the Golden Locust Drive\Russian Olive Close area, to the west of Lisgar Creek (north of Terragar Boulevard). The previous (December 2014) modelling did not include any FDC sewers in this area, given the lack of available monitoring data in this area at that time. However, an FDC monitoring gauge (F24) was subsequently installed in this area in July of 2015, and has been operational since that time (including data for the 2017 monitoring year). As such, additional model resolution in this area will be required in order to allow for a comparison to monitoring data. The current modelling has added eight (8) sections of FDC sewer in this area, based on available plan and profile drawings. In addition to the preceding, the first section of FDC sewer from side streets to the trunk along Black Walnut Trail has also been added to the modelling (using available plan and profile drawing data), which results in an additional nine (9) sections of FDC sewer within the modelling. Figure A1 (attached) presents the limits of the FDC sewer system included in the modelling, along with relevant FDC monitoring locations.

In addition to the hydraulic component of the FDC model, flow inputs are required. The FDC sewer system was originally designed using an approach similar to that employed for sanitary sewers, with a set flow rate applied per unit (0.075 L/s/residence), based on recommendations from the previous development engineer of record (Paul Theil and Associates). However, given the known issues with FDC surcharging in response to storm events, this approach is clearly inappropriate for the current assessment; a more dynamic approach is required.

Consistent with the approach for the previous (December 2014) modelling assessment, flow inputs as part of the modelling are applied based on a "typical" unitary response (i.e. an FDC flow hydrograph per unit area), and then scaled (multiplied) based on the appropriate contributing FDC drainage area to each point of interest. These FDC flow inputs are then routed by the FDC sewer pipe hydraulic model, which permits a comparison of the resulting calculated water levels to monitored levels for specific storm events.

The monitoring gauges used in the Lisgar District measure water level and temperature only; they do not include a velocity (or flow) component. While theoretical methods (i.e. Manning's Equation and the orifice equation) can be used to generate a rating curve for the monitoring gauges, this does not differentiate between surcharge due to excess upstream flow, and surcharge due to downstream tailwater conditions. As such, the hydraulic modelling is considered necessary to validate estimated flows and the associated simulated water level response.

Overall FDC drainage areas have been delineated as part of previous assessments (including the December 2014 assessment). These areas have been further refined for the current assessment, particularly for the area west of Lisgar Creek (i.e. area to the F24 monitoring gauge). Resulting FDC drainage areas are presented in Figure A2 (attached). Key FDC drainage area statistics to FDC monitoring gauges are presented in Table 2.1.

**Table 2.1. Summary of Estimated Contributing Drainage Areas to FDC Monitoring Gauges**

| FDC Monitoring Gauge | Number of Modelled FDC Subcatchments | FDC Drainage Area (ha) | Percentage of Total Area (to F2) |
|---|---|---|---|
| F14 | 2 | 5.36 | 5.2% |
| F13 | 1 | 3.28 | 3.2% |
| F5 | 5 | 11.97 | 11.7% |
| F24 | 4 | 11.39 | 11.1% |
| F1 | 17 | 33.93 | 33.1% |
| F6 | 23 | 89.04 | 86.9% |
| F2 | 26 | 102.46 | 100.0% |

In order to simulate the FDC system response to surcharge-causing events, a suitable event must first be selected. A review of potential storm events is presented in Section 2.2.

## 2.2. Potential Storm Events

A review of previous storm events which are known to have resulted in FDC system surcharging was previously presented as part of the assessment of the July 13-14, 2017 storm event (August 1, 2017 memorandum). Key rainfall data (based on the City of Mississauga's gauge 11 – Gary Morden Fire Training Centre) for these events are presented in Table 2.2.

**Table 2.2. Rainfall Event Comparison (City Gauge 11) for FDC Surcharging Events (Black Walnut Trail)**

| Event Date | 5-Day Ante-cedent Rainfall (mm) | Event Length (hours) | Event Depth (mm) | 30 Minute Data | | 1 Hour Data | | 6 Hour Data | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Peak Intens (mm/hr) | Approx Return Period (years) | Peak Intens (mm/hr) | Approx Return Period (years) | Peak Intens (mm/hr) | Approx Return Period (years) |
| Sep 8, 2012 | 30.0 | 9.5 | 36.4 | 23.6 | < 2 | 14.8 | < 2 | 4.6 | < 2 |
| Aug 2, 2013 | 30.8 | 4.3 | 22.0 | 26.8 | < 2 | 19.6 | < 2 | 3.7 | < 2 |
| Aug 27, 2013 | 5.0 | 2.2 | 17.4 | 24.8 | < 2 | 12.4 | < 2 | 2.9 | < 2 |
| Sep 20, 2013 | 0.2 | 18.1 | 45.2 | 32.4 | < 2 | 16.8 | < 2 | 4.0 | < 2 |
| Nov 17, 2013 | 2.4 | 1.5 | 14.0 | 23.6 | < 2 | 13.6 | < 2 | 2.3 | < 2 |
| Jun 12, 2014 | 7.6 | 1.3 | 23.2 | 26.0 | < 2 | 21.6 | < 2 | 3.9 | < 2 |
| Sept 2, 2014 | 9.2 | 1.7 | 17.8 | 30.4 | < 2 | 16.8 | < 2 | 3.0 | < 2 |
| **Sept 10, 2014** | **26.4** | **6.3** | **40.4** | **42.4** | **2 - 5** | **26.8** | **2 - 5** | **6.6** | **2** |
| July 7, 2015 | 12.8 | 1.6 | 15.2 | 24.0 | < 2 | 14.4 | < 2 | 2.5 | < 2 |
| Aug 20, 2015 | 4.6 | 0.3 | 0.6[2] | 1.2 | < 2 | 0.6 | < 2 | 0.1 | < 2 |
| Sep 19, 2015 | 0 | 0.9 | 16.4 | 31.6 | < 2 | 16.4 | < 2 | 2.7 | < 2 |
| Aug 13, 2016 | 1.4 | 0.9 | 17.8 | 20.0 | < 2 | 17.8 | < 2 | 3.0 | < 2 |
| Dec 26, 2016 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Jun 23, 2017 | 84.0[1] | 1.5 | 16.8 | 18.0 | < 2 | 13.8 | < 2 | 2.8 | < 2 |
| **Jul 14, 2017** | **5.4** | **0.8** | **31.8** | **50.0** | **5** | **29.0** | **2 - 5** | **5.3** | **< 2** |

1. To be verified – Pearson Airport gauge recorded only 10.6 mm over same period, City Gauge 12 recorded 14.2 mm for same period.
2. Potentially a resolute thunder storm cell which was not measured at the gauge, given low reported total rainfall.

The data presented in Table 2.2 confirm that the July 14, 2017 storm event was the largest on record (of observed FDC surcharging events since monitoring began in 2012) with respect to the 30 minute and 1 hour peak rainfall intensities. It was also the only recorded storm events with an intensity greater than the City of Mississauga's 2-year return period, with the exception of the September 10, 2014 storm event.

In addition to the preceding, the August 1, 2017 memorandum also presented the peak depth and duration (time of surcharge above estimated basement elevations) at key gauges along Black Walnut Trail: gauges F5, F1, and F6 (refer to Figure A1 for locations). As noted in previous annual monitoring reports, FDC surcharging has been repeatedly observed at gauges F5 and F1 in particular (Black Walnut Trail in the vicinity of Terragar Boulevard). The results of this analysis are presented in Table 2.3.

**Table 2.3. Comparison of Observed FDC Surcharging Events along Black Walnut Trail**

| Event Date | 5-Day Ante-cedent Rainfall (mm) | Rain Event Length (hours) | Rain Event Depth (mm) | Gauge F5 (0.25 m) | | Gauge F1 (0.375 m) | | Gauge F6 (0.45 m) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Peak Depth (m) | Time above bsmt[3] (mins) | Peak Depth (m) | Time above bsmt[3] (mins) | Peak Depth (m) | Time above bsmt[3] (mins) |
| Sep 8, 2012 | 30.0 | 9.5 | 36.4 | 2.56 | NA | 2.27 | NA | 1.84 | NA |
| Aug 2, 2013 | 30.8 | 4.3 | 22.0 | 0.76 | NA | 0.41 | NA | 0.20 | NA |
| Aug 27, 2013 | 5.0 | 2.2 | 17.4 | 1.02 | NA | 0.79 | NA | 0.34 | NA |
| Sep 20, 2013 | 0.2 | 18.1 | 45.2 | 0.78 | NA | 0.83 | NA | 0.20 | NA |
| Nov 17, 2013 | 2.4 | 1.5 | 14.0 | 0.53 | NA | 0.45 | NA | 0.09 | NA |
| Jun 12, 2014 | 7.6 | 1.3 | 23.2 | 2.41 | NA | 2.70 | NA | 2.16 | NA |
| Sept 2, 2014 | 9.2 | 1.7 | 17.8 | 1.43 | NA | 1.36 | NA | 0.45 | NA |
| Sept 10, 2014 | 26.4 | 6.3 | 40.4 | 2.74 | NA | 2.68 | NA | 1.85 | NA |
| July 7, 2015 | 12.8 | 1.6 | 15.2 | 0.40 | NA | 0.57 | NA | 0.12 | NA |
| Aug 20, 2015[2] | 4.6 | 0.3 | 0.6[2] | 1.13 | NA | 1.12 | NA | 0.35 | NA |
| Sep 19, 2015 | 0 | 0.9 | 16.4 | 1.04 | NA | 1.16 | NA | 0.41 | NA |
| Aug 13, 2016 | 1.4 | 0.9 | 17.8 | 0.64 | NA | 0.62 | NA | 0.16 | NA |
| Dec 26, 2016 | NA | NA | NA | 0.25 | NA | 0.29 | NA | 0.21 | NA |
| Jun 23, 2017 | 84.0[1] | 1.5 | 16.8 | 2.21 | NA | 2.13 | NA | 1.57 | NA |
| Jul 14, 2017 | 5.4 | 0.8 | 31.8 | 3.45 | NA | 3.27 | 120 | 2.71 | 115 |

1. To be verified – Pearson Airport gauge recorded only 10.6 mm over same period, City Gauge 12 recorded 14.2 mm for same period.
2. Potentially a resolute thunder storm cell which was not measured at the gauge, given low reported total rainfall.
3. Based on estimated basement elevation at gauge location – estimated as MH lid elevation less 1.8 m to finished floor elevation. To be confirmed through additional survey.

As evident from Table 2.3, the July 14, 2017 storm event resulted in the largest FDC system response in the Black Walnut Trail area of all recorded FDC surcharge events since monitoring began in 2012. The monitored results also indicate that the July 13-14 event was the only one on record which would have been sufficient to reach the estimated basement elevations. This would be consistent with the lack of reports of basement water infiltration for any of the previous surcharging events during the monitoring period.

Notwithstanding the preceding, there are a number of additional formative FDC surcharging responses (surcharge depth of 2 m +\- or greater) which could also be used for model simulation and assessment of mitigation measures. These potential events include:

- September 8, 2012
- June 12, 2014
- September 10, 2014
- June 23, 2017

For the current assessment, the June 23, 2017 storm event has been simulated in addition to the July 13-14, 2017 storm event. This event resulted in a notable system surcharge, and also offers

a similar availability of monitoring gauge data to the July 13-14, 2017 storm event (i.e. availability of gauge F24 in particular). The analyses for these two events are described in subsequent sections.

### 2.3. June 23, 2017 Storm Event

The June 23, 2017 was the second recorded FDC surcharge event of 2017. This event was of a smaller magnitude than the July 13-14, 2017 storm event, as evident from the statistics presented in Section 2.2. Notwithstanding, the storm event did results in a notable surcharge in the FDC system, approximately the 5$^{th}$ highest over the 5-year monitoring period to date. Figure A3 (attached) presents the observed water level response. Consistent with previously observed FDC surcharge event, this event was primarily localized towards the upper end of the Black Walnut Trail system, with surcharge most evident at gauges F5 and F1. Gauge F14 (further upstream along Black Walnut Trail) also exhibits a notable surcharge. The surcharge continues further downstream (gauges F6 and F2), however routing and attenuation effects are evident. The observed FDC surcharge again appears to be sourced from the upper portion of the Black Walnut Trail area, and exhibits a rapid response to rainfall input, with a delay of less than an hour between peak rainfall intensity and the observed peak water level in the FDC system. The recession of the FDC surcharge is equally rapid, with the surcharge event lasting approximately one hour.

As noted earlier, in order to simulate the storm event response, a unitary flow response is required. Based on the locations of observed surcharge, and the contributing drainage area, the gauge response at F13 has been selected. This location is somewhat elevated compared to the other most upstream FDC monitoring gauge (F14), with an invert approximately 1 m +\- higher. Further, the F13 gauge indicates less of a surcharged response than F14, which potentially allows for a more unattenuated unitary response (i.e. less impacted by surcharge/pressure flow and backwater). The observed water level at F13 has been converted to an estimated flow using a combined theoretical rating curve; Manning's Equation for low (unpressurized) flows, transitioning to an orifice equation approach for pressure flows. This is generally consistent with available nomographs for pipe flow (ref. MTO Drainage Management Manual, 1997). The resulting flow hydrograph is then divided by the contributing drainage area (3.28 ha for gauge F13) to develop a unitary flow response ($m^3/s/ha$).

The unitary flow response function is then applied to hydraulic model nodes, based on the contributing FDC drainage areas (as presented in Figure A2). Scaling factors (i.e. multiplier for unitary flow response to be applied at each node) are then determined/estimated iteratively, in order to attempt to replicate the observed water level responses for the storm events.

As documented in the December 2014 presentation, the analyses completed for the November 2, 2014 storm event determined notably higher rates of contributing flow from the upper portions of the FDC sewershed, with a negligible flow contribution for the lower portion of the sewershed (i.e. downstream of gauge F1). The highest estimated rates of inflow for that event were noted to be upstream of gauge F5. These general findings are supported by the observed flow response, with elevated surcharge noted at F14 and F5.

Based on the preceding, contributing FDC drainage areas were divided into “zones” of expected common contributing FDC flow rates. Figure A4 presents these approximate zones; relevant details are also presented in Table 2.4.

**Table 2.4. Approximate FDC Drainage Area Zones used for Hydraulic Modelling Assessment**

| Zone | Description | Incremental Contributing Drainage Area (ha) | Percentage of Total Area (to F2) |
|---|---|---|---|
| 1 | Black Walnut Trail – north of gauge F5 | 11.96 | 11.7% |
| 2 | Area west of Lisgar Creek (Golden Locust Drive) | 15.12 | 14.8% |
| 3 | Black Walnut Trail between F5 and F1 | 6.83 | 6.7% |
| 4 | Black Walnut Trail between F1 and F6 (including Scotch Pine Gate area) | 55.11 | 53.8% |
| 5 | Areas downstream of F6 | 13.43 | 13.1% |

As per the results of the previous December 2014 assessment, the majority of contributing flow was noted to be sourced from Zones 1-3, which represents only a third of the total contributing drainage area to the downstream limits at gauge F2. A significant proportion of the contributing drainage area is from the FDC line along Scotch Pine Gate, which serves an area of some 43.8 ha.

Using an iterative approach, scaling factors have been first approximated for the Zone 1 area (i.e. gauges F13 and F14), and subsequently for Zone 2 (gauge F24). Once these scaling factors have provided a reasonable approximation of the observed water levels for these areas, additional scaling factors are developed for Zones 3, 4 and 5. Figures A5-A8 (attached) present the resulting simulated fit to observed water level data; Table 2.5 presents the associated scaling factors applied

**Table 2.5. Estimated Scaling Factors for Simulated fit of Observed FDC Response to June 23, 2017 Storm Event**

| Zone | Description | Scaling Factor[1] |
|---|---|---|
| 1 | Black Walnut Trail – north of gauge F5 | 0.67 |
| 2 | Area west of Lisgar Creek (Golden Locust Drive) | 0.30 |
| 3 | Black Walnut Trail between F5 and F1 | 0.30 |
| 4 | Black Walnut Trail between F1 and F6 (including Scotch Pine Gate area) | 0.20 |
| 5 | Areas downstream of F6 | 0.20 |

1. Inflow at each node within zone is determined by the unitary flow hydrograph multiplied by the incremental drainage area to each node multiplied by the scaling factor.

Figures A5-A8 indicate a good fit to the observed data at the upper end of the system (F13, F14, and F24). The fit at gauge F5 somewhat underestimates the observed peak water level, and also the timing of the rising limb. This is notable considering that the responses at gauges F13 and F14 are well matched, and there is a minimal additional contributing drainage area at this point. This potentially suggests a more direct source of rapid inflow between these locations. One potential source could be the roadway sag point at Black Walnut Trail and Cactus Gate. As demonstrated through the most recently completed storm sewer leakage testing, catchbasin

subdrains have been demonstrated to be the primary source of inflow to the FDC system. A higher degree of inflow would be expected at roadway sag points. Further assessment would be required to confirm this more definitively, however this would appear to be a reasonable explanation.

While the peak water level at gauge F1 is well matched, the overall simulated shape is somewhat more peaky than the observed form. This may be attributable to the under-estimation at gauge F5 as noted previously. Conversely, the observed response at the downstream gauge F6 is somewhat overestimated; the simulated effects of routing and attenuation are not as evident as in the observed results. Overall however, the simulated modelling provides a good representation of the observed water level responses, and provides a reasonable approximation for the assessment of the effectiveness of mitigation measures, as discussed further in Section 3.

### 2.4. July 13-14, 2017 Storm Event

A similar approach to that applied for the June 23, 2017 has been employed for the simulation of the July 13-14, 2017 storm event. Figure A9 presents the observed water level responses for this storm event. Key statistics and parameters are presented in Section 2.2; a more detailed analysis of the specifics of this storm event is also included as part of the previously prepared August 1, 2017 memorandum.

In order to simulate the storm event response, a unitary flow response is again required. Based on the locations of observed surcharge, and the contributing drainage area, the gauge response at F13 has been selected. This location is somewhat elevated compared to the other most upstream FDC monitoring gauge (F14), with an invert approximately 1 m +\- higher. Further, the F13 gauge indicates less of a surcharged response than F14, which potentially allows for a more unattenuated unitary response (i.e. less impacted by surcharge/pressure flow and backwater). Notwithstanding, a notable surcharge is still observed at this gauge, which renders the development of a unitary flow response approximate at best, particularly given the dynamic and variable nature of the July 13-14, 2017 storm event (highly localized/spatially variable thunder storm). The observed water level at F13 has been converted to an estimated flow using a combined theoretical rating curve; Manning's Equation for low (unpressurized) flows, transitioning to an orifice equation approach for pressure flows. The resulting flow hydrograph is then divided by the contributing drainage area (3.28 ha for gauge F13) to develop a unitary flow response ($m^3/s/ha$). The unitary flow response function has then been applied to hydraulic model nodes, based on the contributing FDC drainage areas (as presented in Figure A2). Scaling factors (i.e. multiplier for unitary flow response to be applied at each node) are then determined/estimated iteratively, in order to attempt to replicate the observed water level responses for the storm events.

Using an iterative approach, scaling factors have been first approximated for the Zone 1 area (i.e. gauges F13 and F14), and subsequently for Zone 2 (gauge F24). Once these scaling factors have provided a reasonable approximation of the observed water levels for these areas, additional scaling factors are developed for Zones 3, 4 and 5. Figures A9-A12 (attached) present the resulting simulated fit to observed water level data; Table 2.6 presents the associated scaling factors applied based on the overall iterative process.

**Table 2.6. Estimated Scaling Factors for Simulated fit of Observed FDC Response to July 13-14, 2017 Storm Event**

| Zone | Description | Scaling Factor[1] |
|---|---|---|
| 1 | Black Walnut Trail – north of gauge F5 | 0.26 to 0.34[2] |
| 2 | Area west of Lisgar Creek (Golden Locust Drive) | 0.17 |
| 3 | Black Walnut Trail between F5 and F1 | 0.03 |
| 4 | Black Walnut Trail between F1 and F6 (including Scotch Pine Gate area) | 0.03 |
| 5 | Areas downstream of F6 | 0.03 |

1. Inflow at each node within zone is determined by the unitary flow hydrograph multiplied by the incremental drainage area to each node multiplied by the scaling factor.
2. Higher factors applied to areas tributary to F13, and area between F13 and F15; lesser factors applied to areas tributary to F14.

The results presented in Figure A10 present the current fit to observed data at gauges F13 and F14. The results indicate that while the overall peak water level is reasonably well represented, the overall timing and shape is not as well represented. The simulated first peak response is delayed compared to the observed data; and the secondary simulated peak is larger than what was observed. The secondary peak represents the impacts of tailwater downstream (additional flow inputs further downstream); which is discussed further in relation to other monitoring sites. As evident in Table 2.6, the highest proportion of relative flow contributions are still estimated to be sourced from this area.

The results presented in Figure A11 (gauge F24 – west side of Lisgar Creek) indicate a reasonably good overall fit to both the simulated peak water level, as well as the timing of the rising limb. However, the simulated results indicate a more pronounced secondary peak than was observed; this peak is considered the result of downstream tailwater/backwater. As per Table 2.6, this area also indicates a relatively elevated rate of estimated flow contribution compared to downstream areas. Notwithstanding, only one (1) property reported basement water infiltration in this area, along Golden Locust Trail. However, the results suggest that this area may be contributing additional flows and impacting downstream areas, while not being directly impacted given the relative depth of the FDC sewer system in this area, and the elevation difference between the system in this area and that along Black Walnut Trail (FDC sewer invert at gauge F24 is some 3 m +\- higher than the FDC sewer node at Black Walnut Trail and Terragar Boulevard).

The results presented in Figure A12 for gauge F5 indicate similar results to that for the June 23, 2017 storm event. While the simulated result reasonably represents the observed conditions, the peak is under-estimated, and the rising limb is also delayed compared to observed conditions. This again suggests an additional source of inflow in this area, potentially from the sag point at Black Walnut Trail and Cactus Gate. Some of the difference in this case could however also be attributable to the representation of observed water levels at upstream gauges F13 and F14; if the rising limbs of these responses were better represented, it is possible the response at gauge F5 would also be better represented.

Lastly, the results presented in Figure A13 indicate that downstream responses at gauges F1 and F6 are both under-estimated. Both the peak observed water level, and shape (rising and falling

limbs, and overall duration) are also not as well modelled. This suggests additional flow contributions in this downstream area, or more elevated tailwater/backwater restrictions. Further model iterations have been undertaken which increase scaling factors (relative flow contributions) for areas in zones 3, 4 and 5. However, these iterations determined that further flow contributions result in worsened data fits for upstream areas (gauges F13, F14, and F24) due to tailwater impacts, with the secondary observed water level peak becoming excessively pronounced.

Overall, the current simulated results for the July 13-14, 2017 storm event do not provide as good a fit as those for the June 23, 2017 storm event. This is considered attributable to a number of factors, including:

- The dynamic and spatially variable nature of the storm event (thunder storm event) – thus the unitary flow hydrograph employed for all locations may not be as representative of actual conditions in other locations.
- The fact that the model is not an “all pipes” model – thus full system-wide pipe routing and storage factors may not be fully accounted for, particularly given the longer duration and elevated water levels associated with the July 13-14, 2017 storm event.
- The potential role of the loss of flow and storage from basement water infiltration (which is not accounted for in the modelling).
- Lack of gauging information for the large FDC flow input from Scotch Pine Gate (43.8 ha) to verify the relative contributions from this large area.
- Assumed boundary conditions – additional flow inputs further downstream (of Derry Road) may result in higher tailwater conditions than simulated within the modelling using a normal boundary condition downstream of gauge F2.

Notwithstanding, the generated responses are considered the best feasible fit to the data given the above noted constraints. As noted, further increases in downstream flow contributions to downstream areas (Zones 3, 4, and 5) result in worsened fits for downstream areas. As such, the current simulation results for the July 13-14, 2017 storm event are considered acceptable, and sufficient for the purposes of the current assessment of mitigation alternatives, as discussed further in Section 3.

### 2.5. Additional Analyses

The preceding analyses have focused on the response of the FDC system to two (2) formative storm events (June 23 and July 13-14, 2017). Notwithstanding, it is considered that there could be potential value in simulating other observed formative storm events as noted in Section 2.2 (specifically September 8, 2012, June 12, 2014, and September 10, 2014). In addition, modelling of the FDC surcharge event of September 2, 2014 has also previously been completed (December 2014 presentation materials). These events may yield additional insights into the FDC response, and could be applied to the simulation of mitigation measures (discussed further in Section 3).

As per the approved work plan (November 13, 2017), these data could also be used to support a further assessment of the hydrologic relationship between estimated peak flows and corresponding surface drainage areas (i.e. contributing FDC catchments) and rainfall intensity using simplified approaches (similar to the Rational Method). These results would then be used

to develop a range of expected flows under more formative storm events which would allow for a form of statistical analysis. These relative increases could then be applied to the other model simulations to assess the relative increase in pumping capacity required.

These analyses have not been completed as part of the current assessment, however it is suggested that these measures be considered as part of subsequent analyses in order to confirm the preferred approach as the project advances towards detailed design.

## 3. Mitigation Analysis

### 3.1. Review of Potential Locations and Mitigation Strategies

Overview

Based on previous discussion with City staff, the FDC pumping station was notionally proposed for the Cactus Gate Parkette, in order to take advantage of synergies with the proposed utility trench dewatering system, also to be constructed at the Cactus Gate Parkette in 2018. It is expected that these synergies would result in some overall reductions in the level of effort associated with the design and construction services required for the FDC pumping station, in particular during the tendering and construction phase (since these two projects would then be expected to be tendered and constructed as a single project).

Notwithstanding, the Cactus Gate location has not, as of yet, been definitively confirmed as the preferred location for the FDC pumping station. As part of the broader scale assessment, prior to committing to this location, a comprehensive review of potential locations is to be completed. Given the locations of reported basement water infiltration for the July 13-14, 2017 storm event, it is suggested that the pumping station would be located somewhere along Black Walnut Trail, however there are multiple potential locations which could be considered.

A key consideration is public (City) land ownership. Given the limited capacity of storm sewers within the Lisgar District (originally designed to a 2-year return period standard, given shallow grades and lack of ground cover), it is considered preferable that any FDC pumping station have a “free” outlet, likely to a surface drainage feature with a direct connection to Lisgar Creek. This would restrict potential FDC pumping stations to locations with immediate access to the creek, given that property acquisition is considered cost-prohibitive and unlikely to be supported by area property owners. Based on the preceding, potential locations would include:

- Black Walnut Trail at Cactus Gate Parkette
- Russian Olive Close at Buttonbush Park
- Terragar Boulevard at Lisgar Creek (within the roadway right-of-way)
- Black Walnut Trail at Smoke Tree Road Parkette
- Black Walnut Trail at Scotch Pine Gate Parkette
- Black Walnut Trail at Wild Cherry Lane easement

Potential locations are illustrated in Figure A14 (attached). These potential options have been briefly assessed herein for feasibility.

Black Walnut Trail at Cactus Gate Parkette

As noted previously, the Cactus Gate Parkette was notionally considered to be the preferred option for the FDC pumping station, given the potential synergy with the proposed utility trench dewatering system. This would minimize requirements for additional field investigations for any secondary site – utility locates, topography, and geotechnical investigations in particular. It would also likely add efficiency to the design and construction phases, by focusing on a single site rather than two.

As suggested in Amec Foster Wheeler's memorandum of August 1, 2017, the current utility trench dewatering system design could be revised to incorporate a permanent FDC sewer pumping component. Based on a preliminary review, this could include two (2) different layouts. In the first, an FDC overflow pipe would be constructed parallel to Black Walnut Trail (from the upstream maintenance hole at Cactus Gate) with flows from the utility trench dewatering system and the FDC system ultimately directed to a common pumping maintenance hole (two different capacity pumps, low and high capacity units respectively, could be considered accordingly). In the second layout, a separate pumping maintenance hole would be implemented at the north limits of the site, with the FDC overflow pipe being perpendicular to Black Walnut Trail (likely replacing the existing stub FDC line within the Cactus Gate Parkette).

Based on the results of the forensic hydraulic modelling, the highest rate of FDC flow contributions is sourced from this area (Zone 1). This is also consistent with past observations of FDC pipe surcharging from previous annual monitoring reports (and the data presented in Table 2.3). Only four (4) of the thirty-five (35) properties which reported basement water infiltration for the July 13-14, 2017 storm event would be located upstream of this location however. Notwithstanding, it is considered that the value of and FDC pumping station at this location would be to remove the highest estimated relative FDC flow contributions as far upstream as possible, in order to reduce flows downstream and associated FDC surcharging impacts to residences.

Disruptions to local traffic would be expected during construction, as the intersection of Black Walnut Trail and Cactus Gate would require closure during the work. However, this intersection would require closure regardless for the construction of the utility trench dewatering system. It is noted however that MiWay Route 32 (to the Lisgar GO Station) does travel along this section of roadway, and would require diversion during construction.

Based on the preceding, the Cactus Gate parkette is considered to be a viable potential location for an FDC pumping station, and is assessed further as part of the additional hydraulic analyses discussed further in Section 3.2.

Russian Olive Close at Buttonbush Park

The results for the forensic hydraulic modelling of the FDC system indicate that after Zone 1, which has the highest relative contributions, Zone 2 (west of Lisgar Creek – Golden Locust Drive) has the next highest relative rates of FDC flow contributions. The results suggest that this area may be contributing additional flows and impacting downstream areas, while not being directly impacted given the relative depth of the FDC sewer system in this area, and the elevation

difference between the system in this area and that along Black Walnut Trail (FDC sewer invert at gauge F24 is some 3 m +\- higher than the FDC sewer node at Black Walnut Trail and Terragar Boulevard). Only one (1) property along Golden Locust Drive reported basement water infiltration for the July 13-14, 2017 storm event.

One potential location for and FDC pumping station would be along Russian Olive Close at Buttonbush Park. This location would divert excess flows from the FDC sewer line easterly through the park, discharging to Lisgar Creek. This would reduce flow impacts to the downstream FDC system, and more vulnerable residences along Black Walnut Trail.

Although an FDC pumping station in this location would likely benefit downstream properties, the relative contributing area (7.8 ha +\-) would be less than that for a location at the Cactus Gate Parkette (9.7 ha +\-), and at a lesser estimated relative rate of FDC flow contribution. Further, as noted only one (1) property has reported basement water infiltration for the July 13-14, 2017 storm event in this area, compared to the higher number of reported properties along Black Walnut Trail.

Based on the preceding, the Russian Olive Close at Buttonbush Park site is not considered to be a high priority location for the initial FDC pumping station installation. Further monitoring of this area is recommended for 2018 to determine whether FDC surcharging would extend to this additional area, and the relative benefit of pumping in this area as opposed to other excess FDC inflow mitigation efforts.

Terragar Boulevard at Lisgar Creek (Roadway Right-of Way)

An FDC pumping station could potentially be considered within the roadway right-of-way on Terragar Boulevard, with an outlet directly to Lisgar Creek. In order to maximize the benefit of such an FDC pumping station, it is suggested that such a station would be located on the north-east side of the culvert crossing, and would divert high flows from Zone 2, but also potentially Zone 1, by incorporating a relief pipe from the FDC trunk at Black Walnut Trail and Terragar Boulevard. This would potentially reduce excess FDC inflows from a larger area (29.3 ha +\-) and thus have a greater benefit to properties downstream. It is noted that the majority of the residences affected by the July 13-14, 2017 storm event are located along Black Walnut Trail south of Terragar Boulevard, and would therefore benefit directly from this additional diversion.

Notwithstanding the preceding benefits, the Terragar Boulevard right-of-way is considered to be a constrained location for construction. Terragar Boulevard is an arterial roadway for the area, and the only available roadway crossing of Lisgar Creek north of Derry Road. Given the expected duration of construction (2 months +\-) the potential impact to area residents would be a concern.

In addition, this location is only some 150 m +\- downstream of the parkette at Cactus Gate, and 250 m +\- upstream of the parkette at Smoke Tree Road, suggesting there is minimal benefit to this specific location when other more available locations are in close proximity.

Based on the preceding, the Terragar Boulevard site is not considered a feasible location for the initial FDC pumping station installation. Locations immediately upstream (Cactus Gate Parkette) or downstream (Smoke Tree Road) are considered to be preferable locations.

Black Walnut Trail at Smoke Tree Road Parkette

Similar to the parkette at Cactus Gate, the City of Mississauga also owns a parkette along the west side of Black Walnut Trail at Smoke Tree Road. This location could similarly be used for the construction of an FDC pumping station, and would reduce works within the right-of-way. Local traffic would be impacted during the construction work, however there are no MiWay transit routes which use this section of Black Walnut Trail. Traffic would need to be re-directed to the north of south to access Terragar Boulevard.

This location would serve a larger drainage area (38.4 ha +\-) than the Cactus Gate location (9.7 ha +\-) however, including Zones 1, 2 and 3. However, this location would be further downstream from residences which reported basement water infiltration for the July 13-14, 2017 storm event (14 of the 35 residences would be upstream of this location). As such, further hydraulic modelling is required to determine how effective an FDC pumping station would be in reducing both upstream and downstream FDC surcharging.

Based on the preceding, the Smoke Tree Road Parkette site is considered a viable potential site for an FDC pumping station. Further hydraulic analyses are required to determine the relative benefit of this site as compared to the Cactus Gate Parkette, or whether a combination of both sites would yield the most efficient reduction in flows.

Black Walnut Trail at Scotch Pine Gate Parkette

The City of Mississauga also owns a parkette 180 m +\- south of the Smoke Tree Parkette, at Scotch Pine Gate. This location has been monitored extensively as part of previous analyses and investigations, including numerous boreholes and piezometers, and the construction of a pilot utility trench collar (along with the other construct collar at Pondview Way).

This location would potentially serve a large drainage area (83.0 ha +\-) due to the large contributing FDC drainage area to the east along Scotch Pine Gate (43.8 ha +\-). Similar to the Smoke Tree Road location however, this location would be even further downstream from residences which reported basement water infiltration for the July 13-14, 2017 storm event (22 of the 35 residences would be upstream of this location). As such, it is expected that an FDC pumping station in this location would be of a lesser benefit. This is also confirmed by the results of the forensic modelling of the two 2017 FDC surcharge events, which noted a much lesser degree of relative FDC inflows for downstream areas. Further data on the Scotch Pine Gate FDC branch should also be collected, to confirm the relative rates of inflow from this sizeable area.

Based on the preceding, the Scotch Pine Gate Parkette is not considered a preferred location for an FDC pumping station. The location upstream at Smoke Tree Road is considered preferable as it would be targeted at the estimated higher rates of excessive FDC inflow from these areas, and would benefit a greater number of downstream properties.

Black Walnut Trail at Wild Cherry Lane Easement

The City of Mississauga holds a 7.5 m easement over the section where the storm, sanitary, and FDC sewer services pass between Black Walnut Trail and the east side of the Lisgar Creek corridor. This location could potentially also be used for and FDC pumping station. However, the same reasons noted for the Scotch Pine Gate parkette would again apply to this location; namely that it is too far downstream to have any direct benefit to affected properties, and would not target the areas identified as having the highest relative rates of excess inflow to the FDC system. The Wild Cherry Lane area would also be further constrained as the City does not directly own the property, but simply holds an easement, over a more limited space than for the upstream parkette areas. Further, it is evident that the adjacent homeowners in this area have encroached on the easement area with development, which would further complicate construction in this location.

Based on the preceding the Wild Cherry Lane area is not considered a preferred location for an FDC pumping station.

Summary

Based on the preceding screening, the preferred locations for an FDC pumping station are considered to be:

- Black Walnut Trail at Cactus Gate Parkette
- Black Walnut Trail at Smoke Tree Road Parkette

These locations will be assessed further for their technical effectiveness (individually and in combination) using the hydraulic modelling developed for the June 23 and July 13-14, 2017 storm events. This is presented in Section 3.2.

As per the preceding discussion, an FDC pumping station at Buttonbush Park may be considered in the future, however further monitoring in this area is considered warranted to assess the degree of FDC surcharging. Follow-up hydraulic modelling could be completed following the collection of additional data for this area.

### 3.2. Hydraulic Modelling Analysis

Overview and Methodology

In order to verify the effectiveness and feasibility of FDC pumping station(s) at the short-listed locations, the previously developed hydraulic modelling has been applied.

It is considered that any FDC pumping station would be constructed using a flow diversion from the FDC trunk sewer. A new FDC sewer pipe would be constructed which connects to an existing FDC maintenance hole, and directs the flows westerly to a new maintenance hole. This maintenance hole would serve as the pumping station/wet well, with pumped flows to be directed either to the storm sewer system, or preferably directly to surface to avoid tailwater/backwater impacts, and given the expected lower frequency of pump operation in this case as compared to

the utility trench dewatering system (i.e. only during more formative storm events which cause FDC surcharge). The diversion pipe would need to be carefully sited (i.e. invert elevation offset as compared to the trunk FDC sewer) and sized (sufficient capacity to convey overflows to the pumping station MH, while fitting within the dimensions of the existing MH along Black Walnut Trail).

Prior to assessing wet well dimensions and pump capacities, the modelling has been applied to determine the required size of a diversion FDC sewer pipe. A "free" boundary condition has been assumed for the outfall of the diversion sewer pipe, based on the assumption of a sufficient capacity pumping system and wet well that tailwater would not be a concern.

In addition to the preceding, consideration could also be given to restricting flows into the existing FDC system at the point of diversion (existing MH) to force a greater proportion of flow towards the FDC pumping station. This would increase the frequency of pump operation, but would also further restrict excess FDC flows to the downstream trunk sewer system.

Several different modelling scenarios have been conducted based on the preceding general approach, and identified preferred locations.

Scenario 1: Diversion at Cactus Gate Parkette Only

Under this scenario, the existing FDC maintenance hole at Cactus Gate and Black Walnut Trail would be used for the FDC diversion. A new FDC diversion sewer would be constructed from the west section of the MH towards a new pumping station MH within the parkette. An entry loss coefficient of 1.0 has been applied to the diversion sewer to reflect the hydraulic inefficiency of the skew (90 degree) angle of the inlet. Consideration will be required to maximum size that can be accommodated within the existing FDC maintenance hole, which as per plan and profile drawings is a 1200 mm diameter circular unit. Based on this dimension, the maximum diameter of any diversion pipe is considered to be 600 mm.

It is noted that there is a stub 250 mm diameter FDC connection through the parkette at this location; this would likely need to be removed to support the installation of the new diversion sewer. There is also a parallel sanitary sewer line which is active (serves development to the north of the CNR) and is in close proximity (both in plan and profile) to the FDC stub. Any FDC diversion sewer would need to carefully consider this feature; and would potentially need to be aligned away from this sewer to accommodate the large pumping station maintenance hole that would ultimately be required.

Two different sub-scenarios have been considered as part of this overall scenario:

- **Scenario 1a** – diversion sewer placed above obvert of existing 250 mm diameter FDC trunk sewer (invert elevation of 198.43 m +\-), existing FDC sewer outlet remains as is
- **Scenario 1b** – restrictor plate placed on existing 250 mm diameter at springline (i.e. 50% of full depth), and FDC diversion sewer placed above the springline (invert elevation of 198.31 m +\-).

Scenario results are presented in Table 3.1. Hydraulic gradeline (HGL) plots are presented in Figures A15 to A20 (attached).

**Table 3.1. Hydraulic Modelling Results for Scenario 1 (Diversion at Cactus Gate Parkette Only)**

| Scenario | Storm Event | Node Inflow ($m^3/s$) | Diversion Pipe Diameter (mm) | Diverted Flow ($m^3/s$) | Remaining Flow ($m^3/s$) | HGL Reduction along Black Walnut Trail (m) |
|---|---|---|---|---|---|---|
| 1a | June 23 | 0.096 | 250 | 0.047 | 0.050 | 0.44 – 1.47 |
| | | | 600 | 0.051 | 0.045 | 0.48 – 1.62 |
| | July 14 | 0.094 | 250 | 0.046 | 0.049 | 0.82 - 2.62 |
| | | | 600 | 0.051 | 0.046 | 0.85 - 2.77 |
| 1b | June 23 | 0.096 | 250 | 0.058 | 0.038 | 0.67 – 1.38 |
| | | | 600 | 0.066 | 0.029 | 0.71 – 1.49 |
| | July 14 | 0.094 | 250 | 0.057 | 0.037 | 0.89 – 2.37 |
| | | | 600 | 0.066 | 0.028 | 0.95 – 2.46 |

The simulated results indicate that a flow diversion at Cactus Gate would notably reduce the hydraulic gradeline (and associated FDC surcharging) during both simulated events, but would not totally eliminate it. Residual surcharging is indicated particularly for downstream areas for the June 23, 2017 storm event; notably, residual surcharging is minimal for the July 14, 2017 event (which had a notably higher FDC response). This is considered attributable to the higher relative rates of flows for Zones 3, 4, and 5 for the June 23, 2017 storm event. Given the uncertainty with respect to the modelling, and in particular to the estimation of water levels for the downstream area for the July 14, 2017 storm event, these results should be interpreted with caution. Notwithstanding, the results do indicate that a flow diversion would be effective in reducing the HGL for both simulated storm events, from between 0.44 and 2.77 m, depending on the location.

The simulation results indicate that the HGL reduction is relatively insensitive to the size of the diversion pipe, with minimal differences indicated between a 250 mm diameter pipe, and a much larger 600 mm diameter pipe. The simulated results also indicate a minimal benefit from an orifice restrictor on the mainline FDC pipe.

Based on the simulated peak flow rates, a pump with a capacity of between 46 and 66 L/s would be required to address diverted flows without any accumulation within a wet well pumping area; this could be readily addressed by commercially available pump units. This would equate to a pumping capacity of up to 871 USGPM, which is notably less than the maximum capacity of commercially available 6” centrifugal pumps.

Scenario 2: Diversion at Smoke Tree Road Parkette Only

Under this scenario, the existing FDC maintenance hole at Smoke Tree Road and Black Walnut Trail would be used for the FDC diversion. A new FDC diversion sewer would be constructed from the west section of the MH towards a new pumping station MH within the parkette. An entry loss coefficient of 1.0 has been applied to the diversion sewer to reflect the hydraulic inefficiency of the skew (90 degree) angle of the inlet. Consideration will be required to maximum size that can be accommodated within the existing FDC maintenance hole, which as per plan and profile

drawings is a 1200 mm diameter circular unit. Based on this dimension, the maximum diameter of any diversion pipe is considered to be 525 mm (given the inlet/outlet pipe dimensions of 375 mm).

Two different sub-scenarios have been considered as part of this overall scenario:

- **Scenario 2a** – diversion sewer placed above obvert of existing 375 mm diameter FDC trunk sewer (invert elevation of 196.94 m +\-), existing FDC sewer outlet remains as is
- **Scenario 2b** – restrictor plate placed on existing 375 mm diameter at springline (i.e. 50% of full depth), and FDC diversion sewer placed above the springline (invert elevation of 196.75 m +\-).

Scenario results are presented in Table 3.2. Hydraulic gradeline (HGL) plots are presented in Figures A21 to A26 (attached).

**Table 3.2. Hydraulic Modelling Results for Scenario 2 (Diversion at Smoke Tree Road Parkette Only)**

| Scenario | Storm Event | Node Inflow ($m^3/s$) | Diversion Pipe Diameter (mm) | Diverted Flow ($m^3/s$) | Remaining Flow ($m^3/s$) | HGL Reduction along Black Walnut Trail (m) |
|---|---|---|---|---|---|---|
| 2a | June 23 | 0.158 | 250 | 0.075 | 0.117 | 0.14 – 1.18 |
| | | 0.167 | 525 | 0.116 | 0.118 | 0.16 – 1.54 |
| | July 14 | 0.178 | 250 | 0.051 | 0.133 | 0.47 – 1.41 |
| | | 0.183 | 525 | 0.062 | 0.132 | 0.49 – 1.58 |
| 2b | June 23 | 0.155 | 250 | 0.079 | 0.093 | 0.17 – 1.31 |
| | | 0.170 | 525 | 0.118 | 0.072 | 0.19 – 1.73 |
| | July 14 | 0.179 | 250 | 0.065 | 0.114 | 0.09 – 1.25 |
| | | 0.184 | 525 | 0.093 | 0.091 | 0.33 – 1.52 |

The results presented in Table 3.2 indicate a slight variability in the simulated node inflow; this is due to the dynamic nature of the PCSWMM modelling, which can result in increased flow capacity due to changes in tailwater/backwater conditions.

Similar to the results for Scenario 1, the simulated results for Scenario 2 indicate that a flow diversion at Smoke Tree Road would notably reduce the hydraulic gradeline (and associated FDC surcharging) during both simulated events, but would not totally eliminate it. area for the July 14, 2017 storm event, these results should be interpreted with caution. The results indicate that a flow diversion at Smoke Tree Road would be effective in reducing the HGL for both simulated storm events, from between 0.09 and 1.73 m, depending on the location.

The simulation results indicate that the HGL reduction is again relatively insensitive to the size of the diversion pipe, with minimal differences indicated between a 250 mm diameter pipe, and a much larger 525 mm diameter pipe. Greater differences are however indicated in this location than were previously indicated for the Cactus Gate location however. The simulated results also indicate a minimal benefit from an orifice restrictor on the mainline FDC pipe. The simulated results for the July 14, 2017 storm event however indicate more variable results with the implementation of an orifice restrictor. While a reduced HGL is indicated downstream of the

restrictor (at Smoke Tree Road), a slightly elevated HGL is indicated further upstream than without the restrictor, likely attributable to the elevated HGL within the mainline diversion MH.

Based on the simulated peak flow rates, a larger pump with a capacity of between 51 and 118 L/s would be required to address diverted flows without any accumulation within a wet well pumping area; this could be readily addressed by commercially available pump units. This would equate to a pumping capacity of up to 1,557 USGPM, which is again less than the maximum capacity of commercially available 6" centrifugal pumps.

Summary of Scenario Findings

Figures A27 and A28 (attached) present an HGL comparison of Scenarios 1a and 2a for the June 23 and July 14, 2017 storm events respectively. The results indicate that as would be expected, a diversion to an FDC pump MH at Smoke Tree Road would be more effective at reducing the HGL in downstream areas than one located further upstream at Cactus Gate. However, a diversion to an FDC pump MH at Cactus Gate would clearly be more effective at reducing the HGL in the upstream area, as would be expected. Further, the relative difference in the HGL further downstream between the two potential mitigation measures is not as significant, more so for the July 14, 2017 storm event, which indicates a minimal difference in HGL. This is again considered attributable to the modelling assumptions for this event, which assumed a lesser contribution of flow from Zones 3, 4 and 5.

Given the preceding, and the previously noted advantages and synergies of constructing the FDC pumping station in conjunction with the planned utility trench dewatering system at the same location, it is recommended that the FDC pumping station be constructed at the Cactus Gate Parkette location. Further assessment would be required to determine the incremental benefit of a secondary pumping station further downstream, such as at Smoke Tree Road. However, for the initial pumping station planned for 2018, it is suggested that the Cactus Gate parkette is the logical location.

## 4. Next Steps

We consider that the next steps in this effort should include:

- City to review current memorandum, with a meeting as required to discuss and confirm the preliminary preferred option with respect to an FDC pumping station (construct at Cactus Gate Parkette) and a preliminary design layout
- Amec Foster Wheeler to continue to advance additional FDC modelling work noted in this memorandum, including:
    - Simulation/re-creation of other previous FDC surcharging events, including one (1) or more of the remaining three (3) largest events (September 8, 2012, June 12, 2014, September 10, 2014)
    - Statistical analysis of relationship between simulated peak flows and drainage area and rainfall intensity, similar to a Rational Method type approach, in order to estimate potential additional flow increases associated with more intense rainfalls

- Amec Foster Wheeler to further review range of commercially available pump options with manufacturers, including related considerations (electrical/power requirements, wet well dimensions, etcetera)
- Following discussions and confirmation with City staff, Amec Foster Wheeler to advance a revised preliminary (30%) design for City review, including previous City comments on the conceptual utility trench dewatering system
- Amec Foster Wheeler to advance detailed design package, including contract materials

We trust that the foregoing meets your current requirements. We look forward to discussing this memorandum in further detail with you at your convenience, and to continue to advance this project to ensure construction is completed in 2018.

MJS\RBS

/Attached Figures A1 to A28

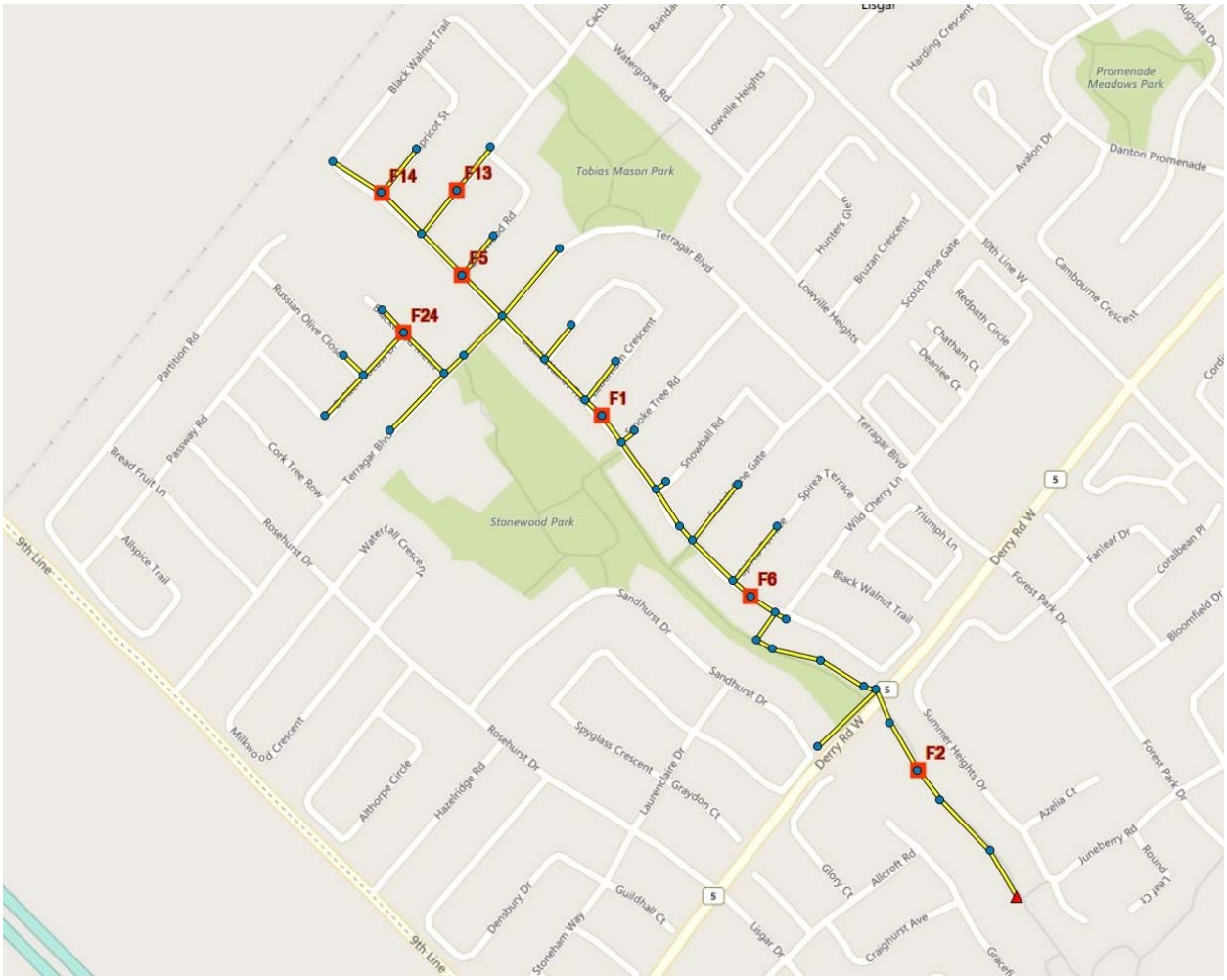



**Figure A1: Extents of FDC Sewer System within PCSWMM Model and FDC Monitoring Locations**

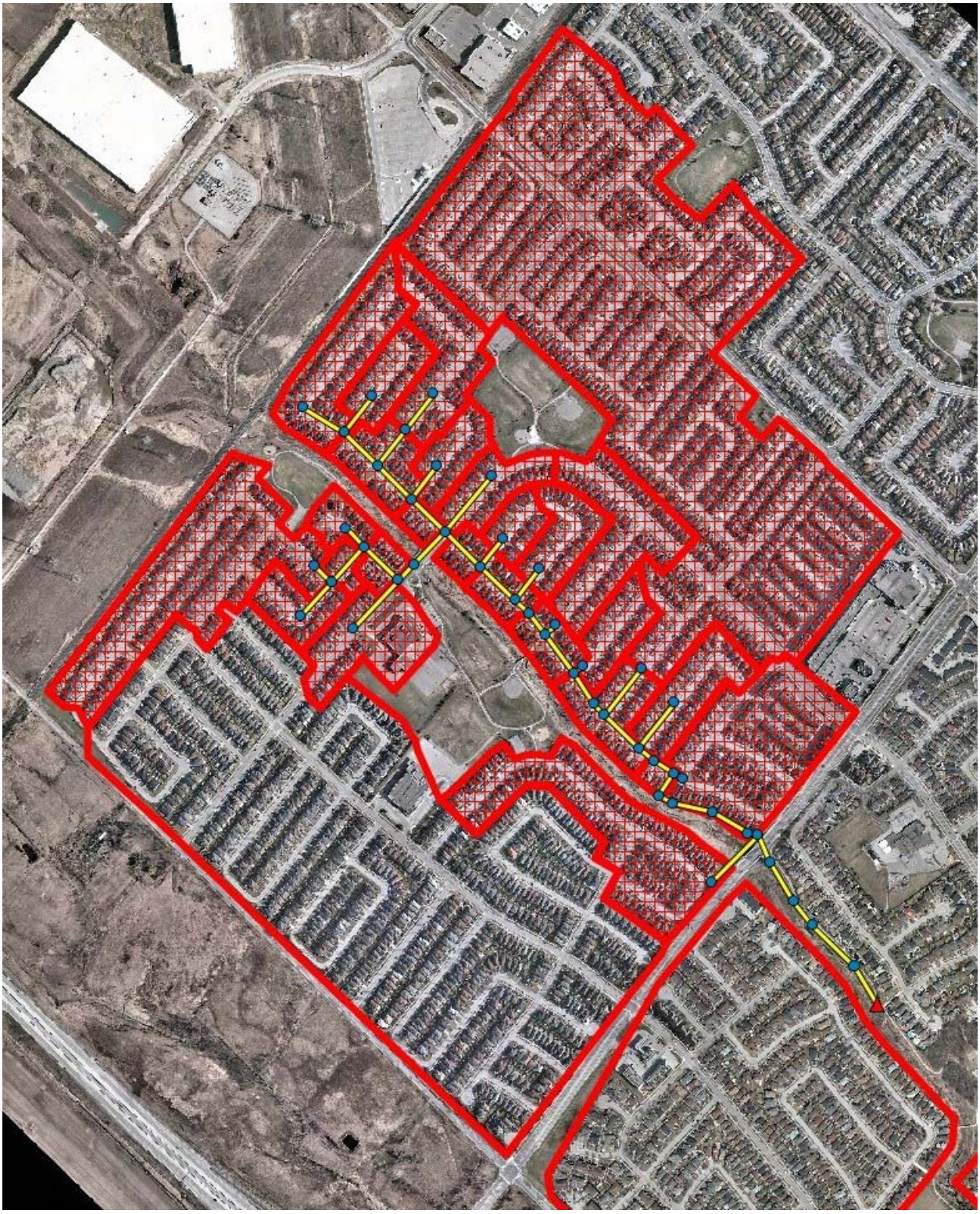
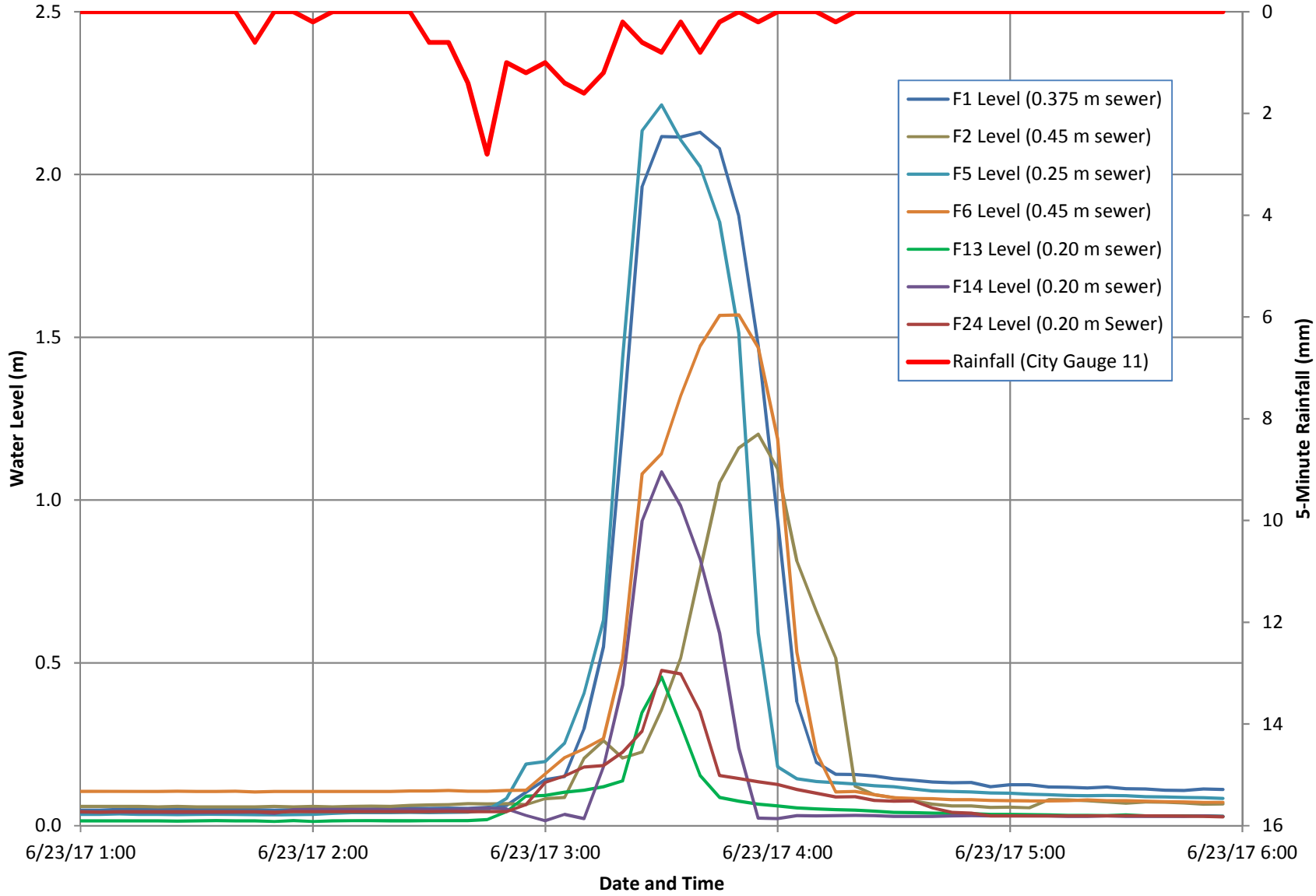


**Figure A2: Estimated FDC Contributing Drainage Areas**

# Figure A3: Observed Water Levels at FDC Monitoring Sites North of Derry Road - June 23, 2017 Event



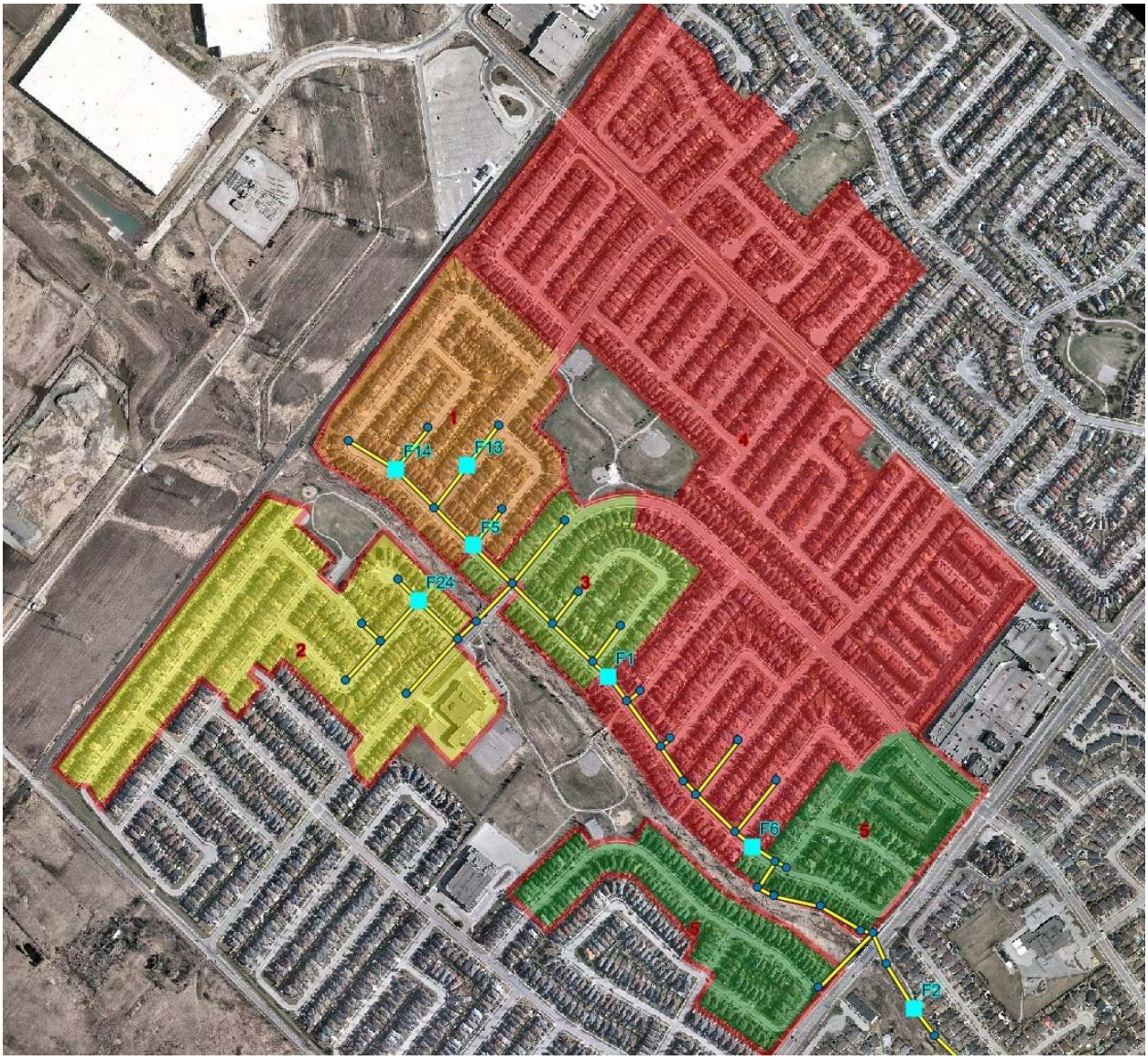



**Figure A4: FDC Drainage Area Zones applied for Hydraulic Modelling Assessment**

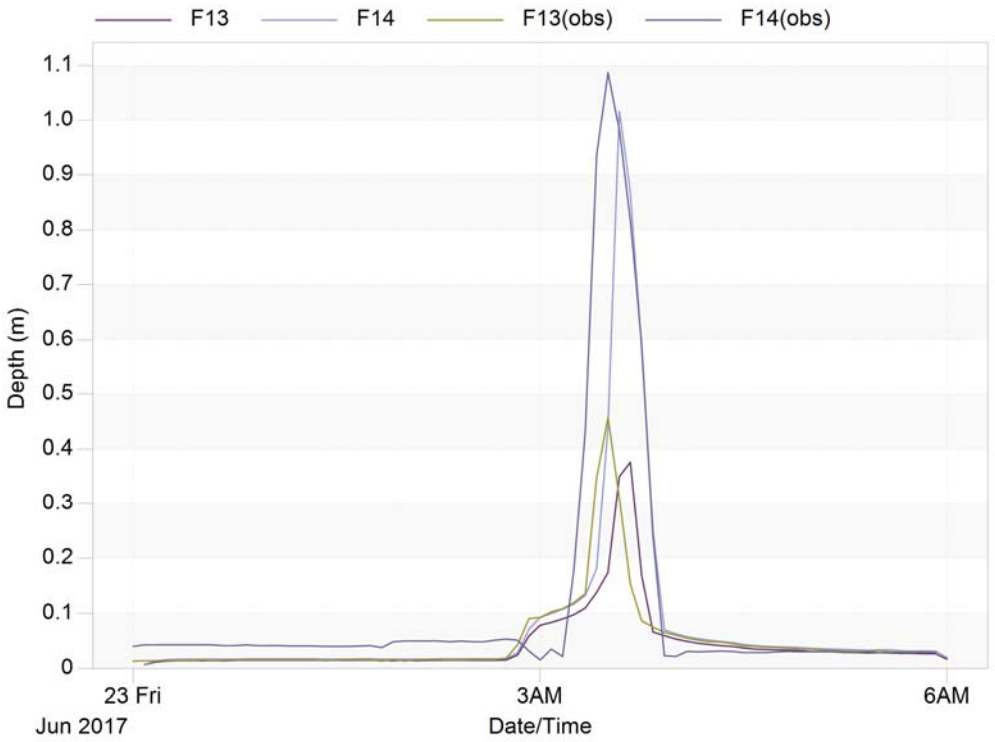



**Figure A5: Simulated Fit for June 23, 2017 Storm Event – Gauges F13 and F14**

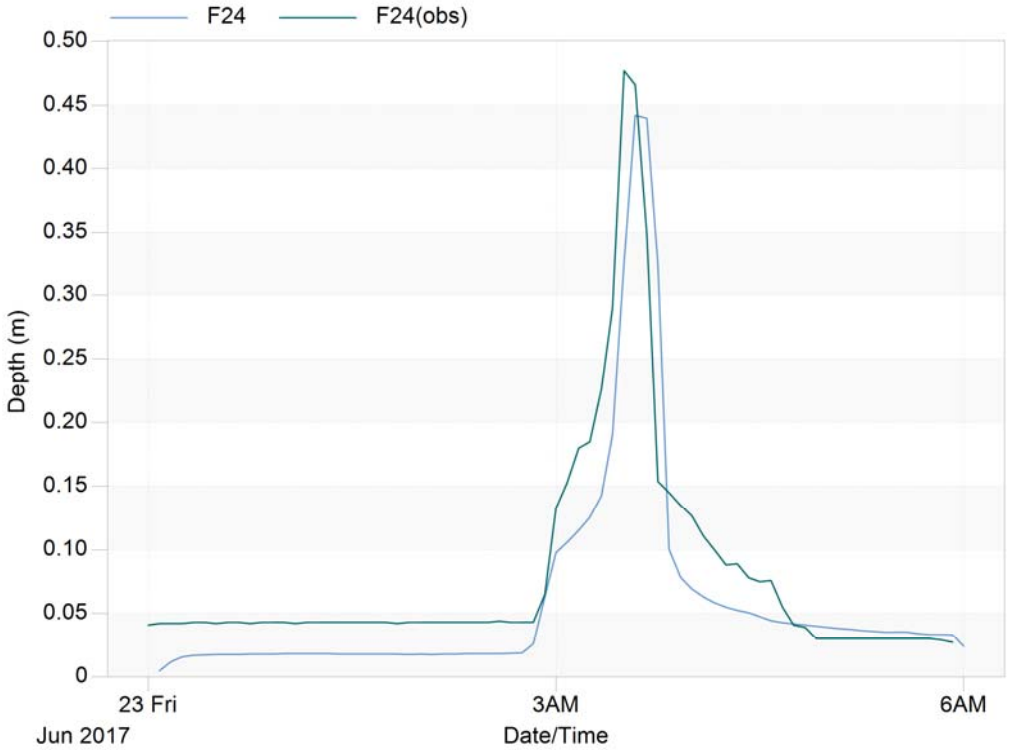



**Figure A6: Simulated Fit for June 23, 2017 Storm Event – Gauges F13 and F14**

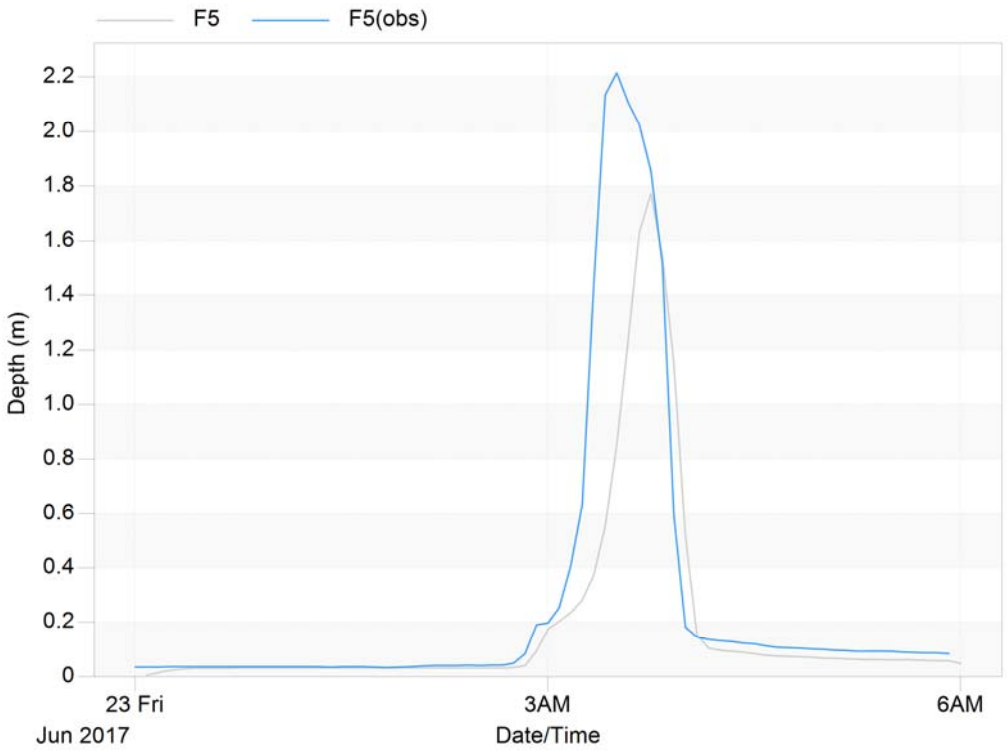



**Figure A7: Simulated Fit for June 23, 2017 Storm Event – Gauge F5**

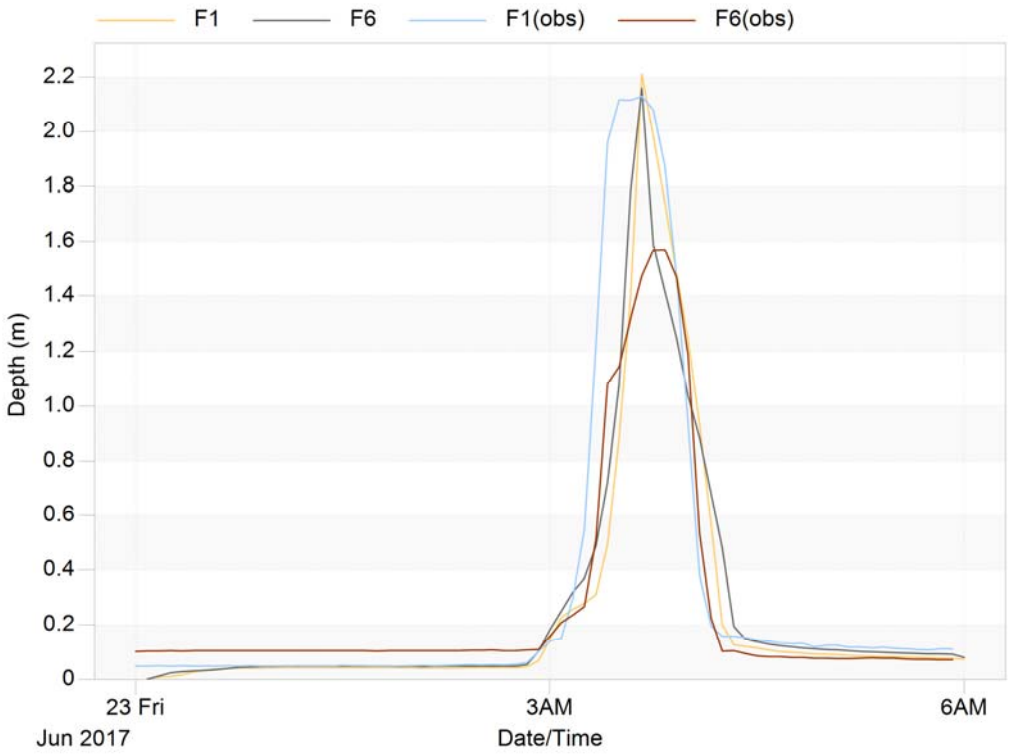
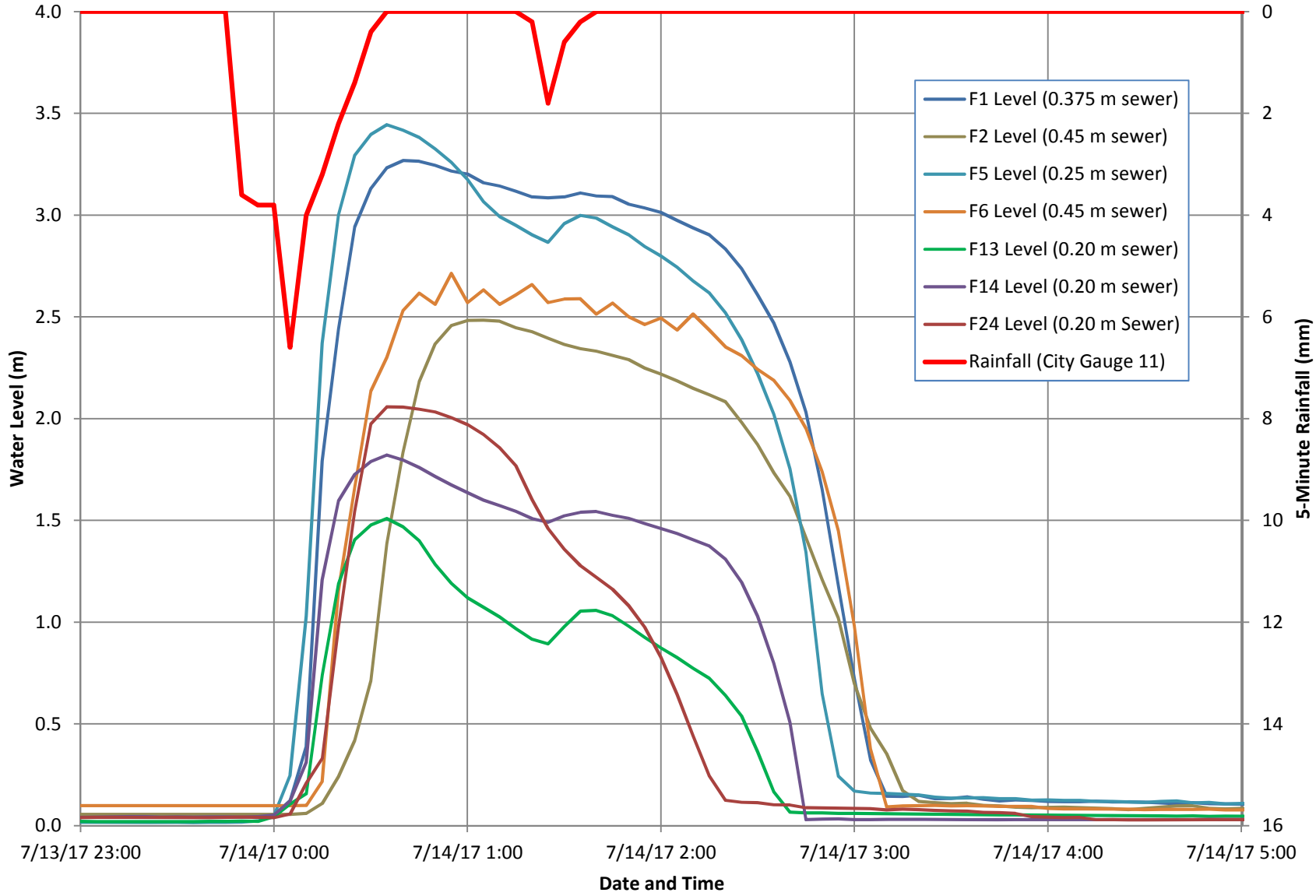



**Figure A8: Simulated Fit for June 23, 2017 Storm Event – Gauges F1 and F6**

# Figure A9: Observed Water Levels at FDC Monitoring Sites North of Derry Road - July 14, 2017 Event



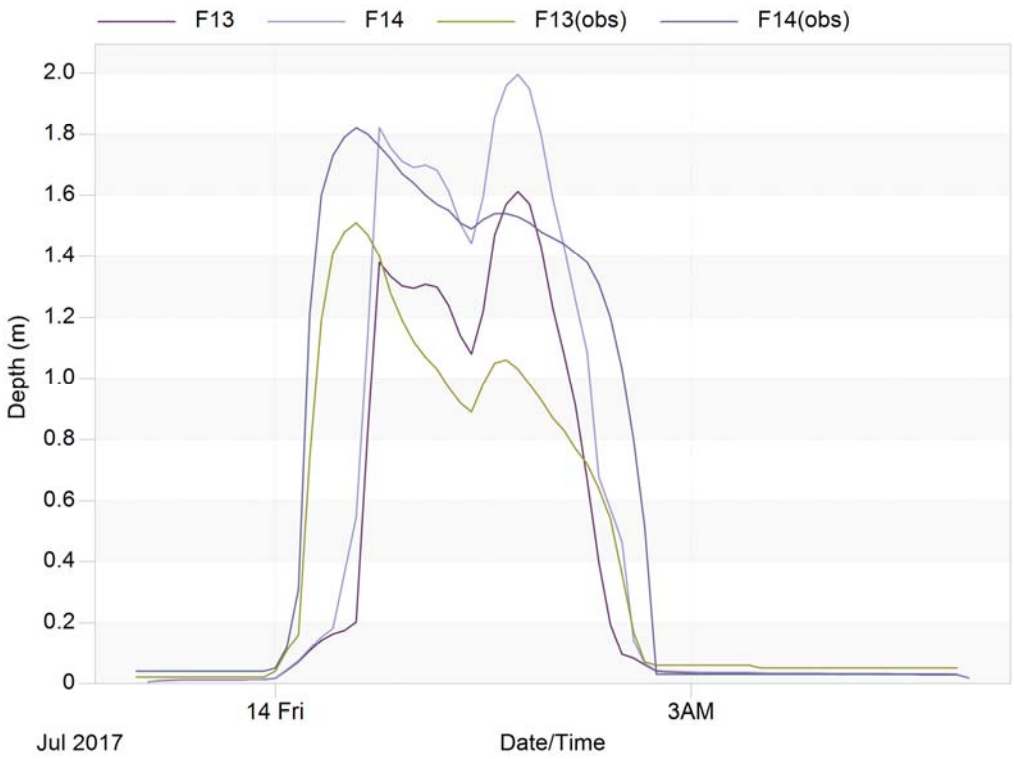



**Figure A10: Simulated Fit for July 14, 2017 Storm Event – Gauges F13 and F14**

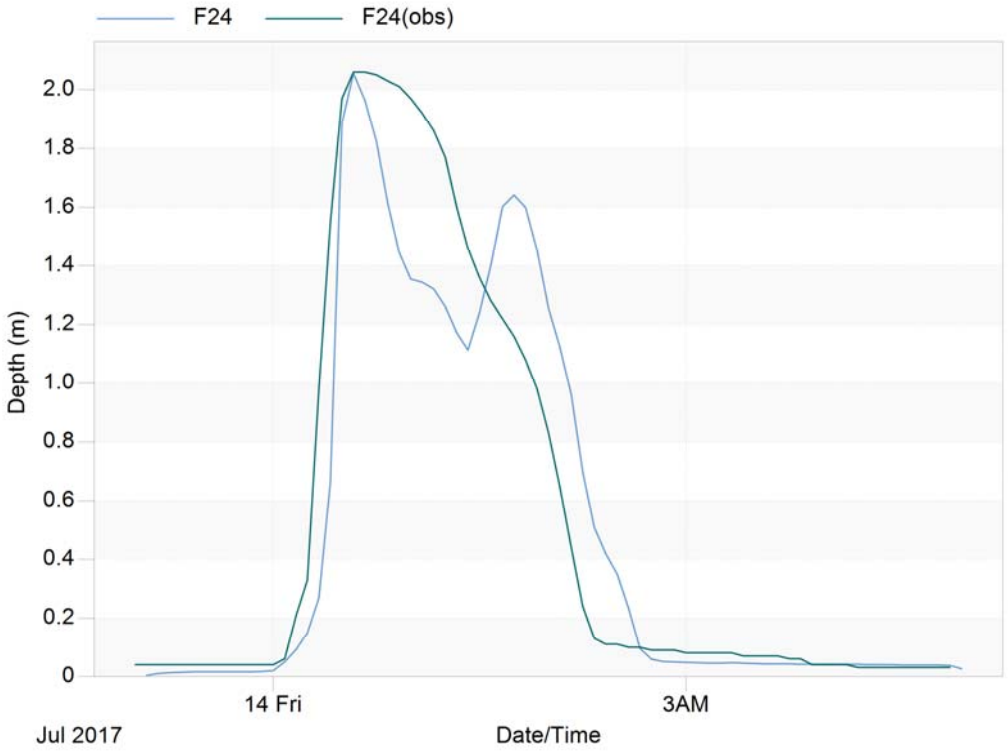



**Figure A11: Simulated Fit for July 14, 2017 Storm Event – Gauge F24**

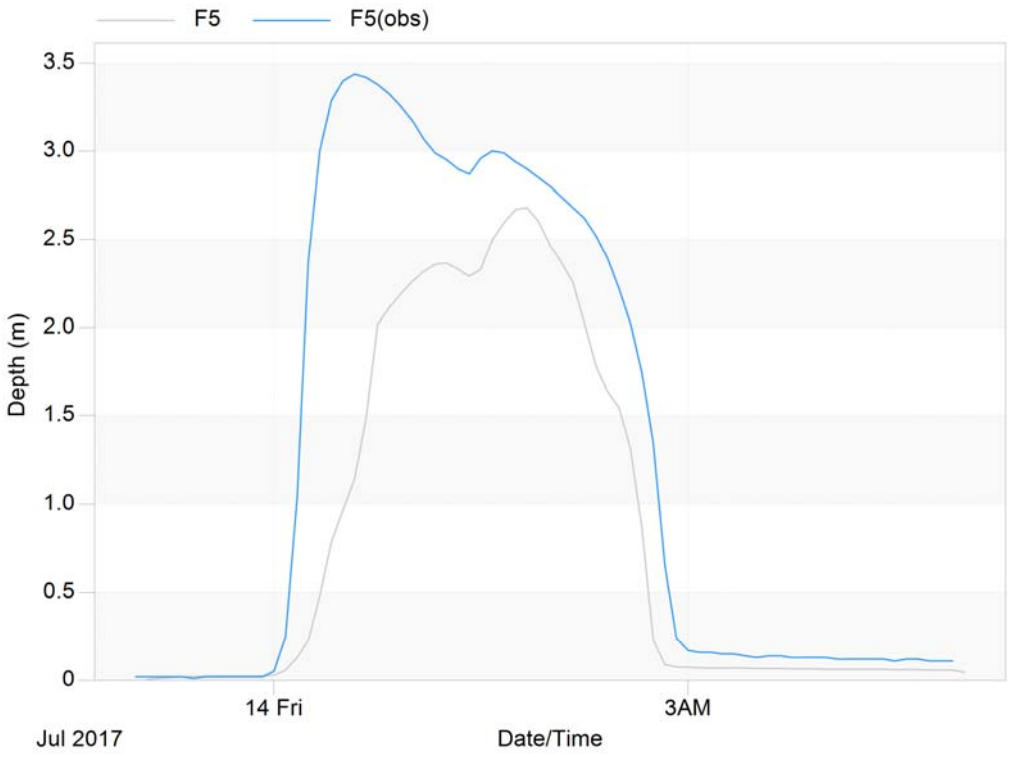



**Figure A12: Simulated Fit for July 14, 2017 Storm Event – Gauge F5**

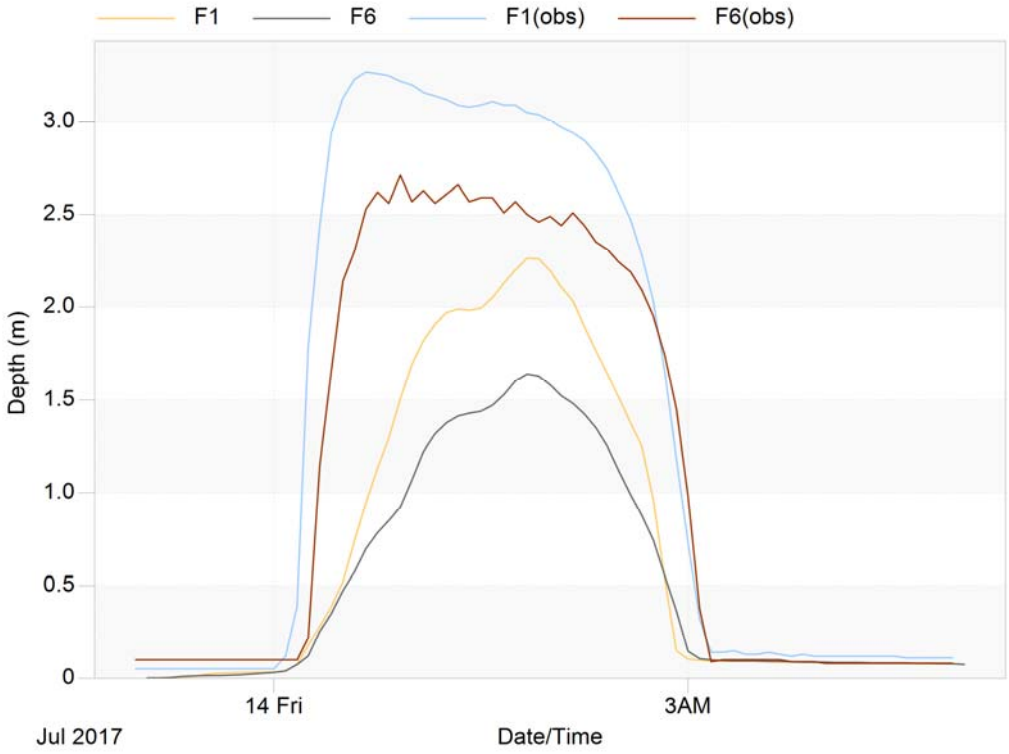



**Figure A13: Simulated Fit for July 14, 2017 Storm Event – Gauges F1 and F6**

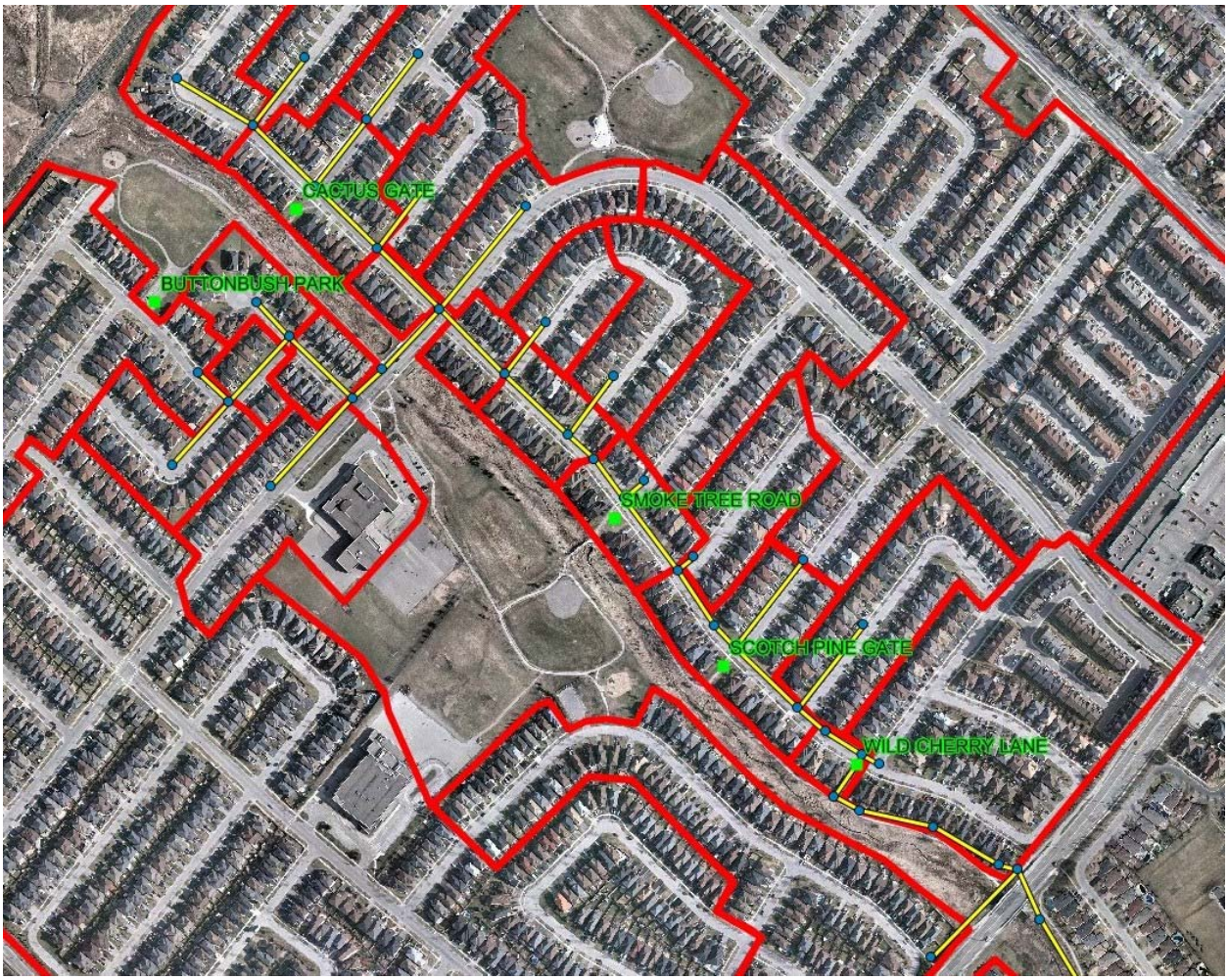



**Figure A14: Long-List of Potential FDC Pumping Station Locations**

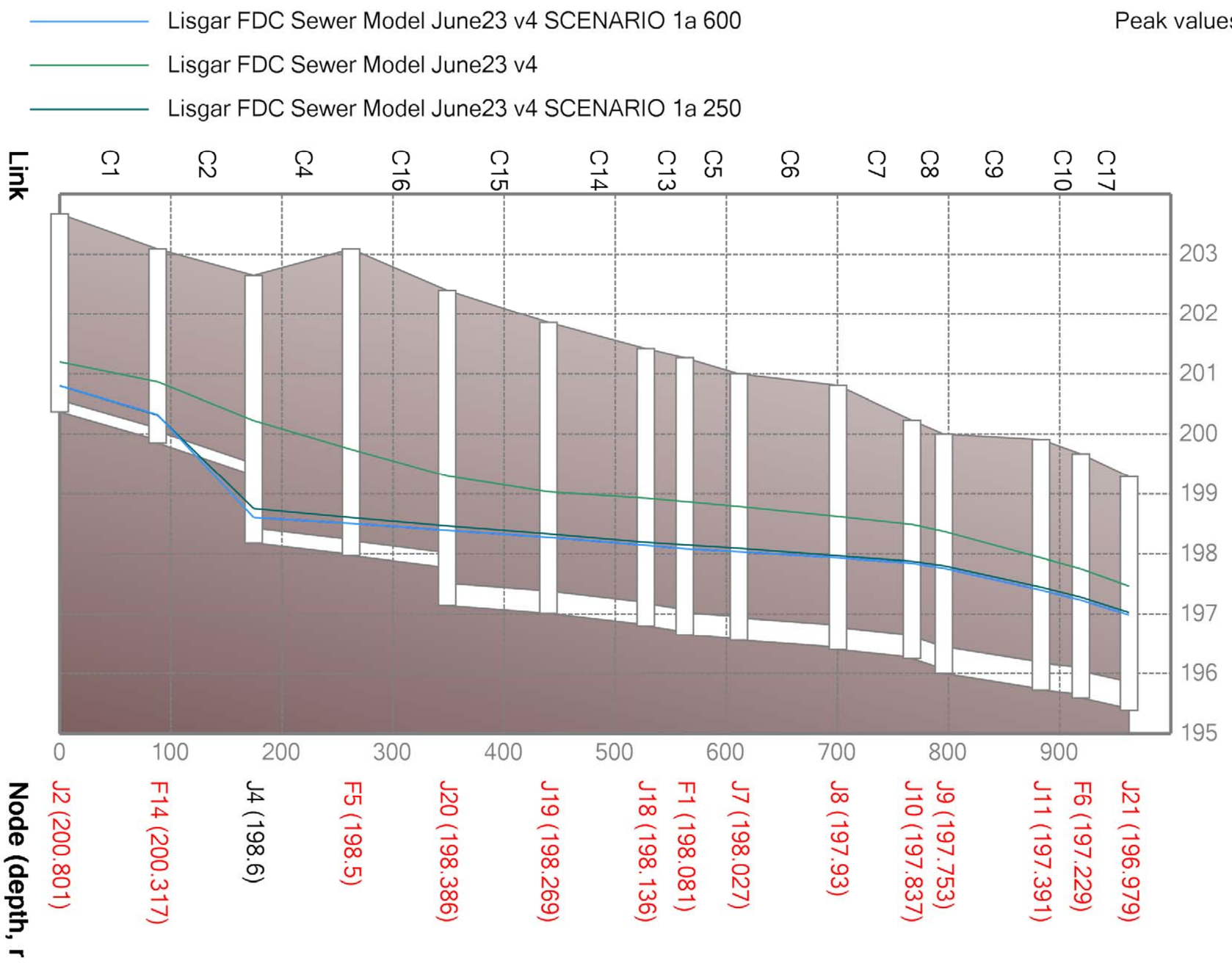



**Figure A15: Simulated HGL along Black Walnut Trail for June 23, 2017 Storm Event – Scenario 1a**

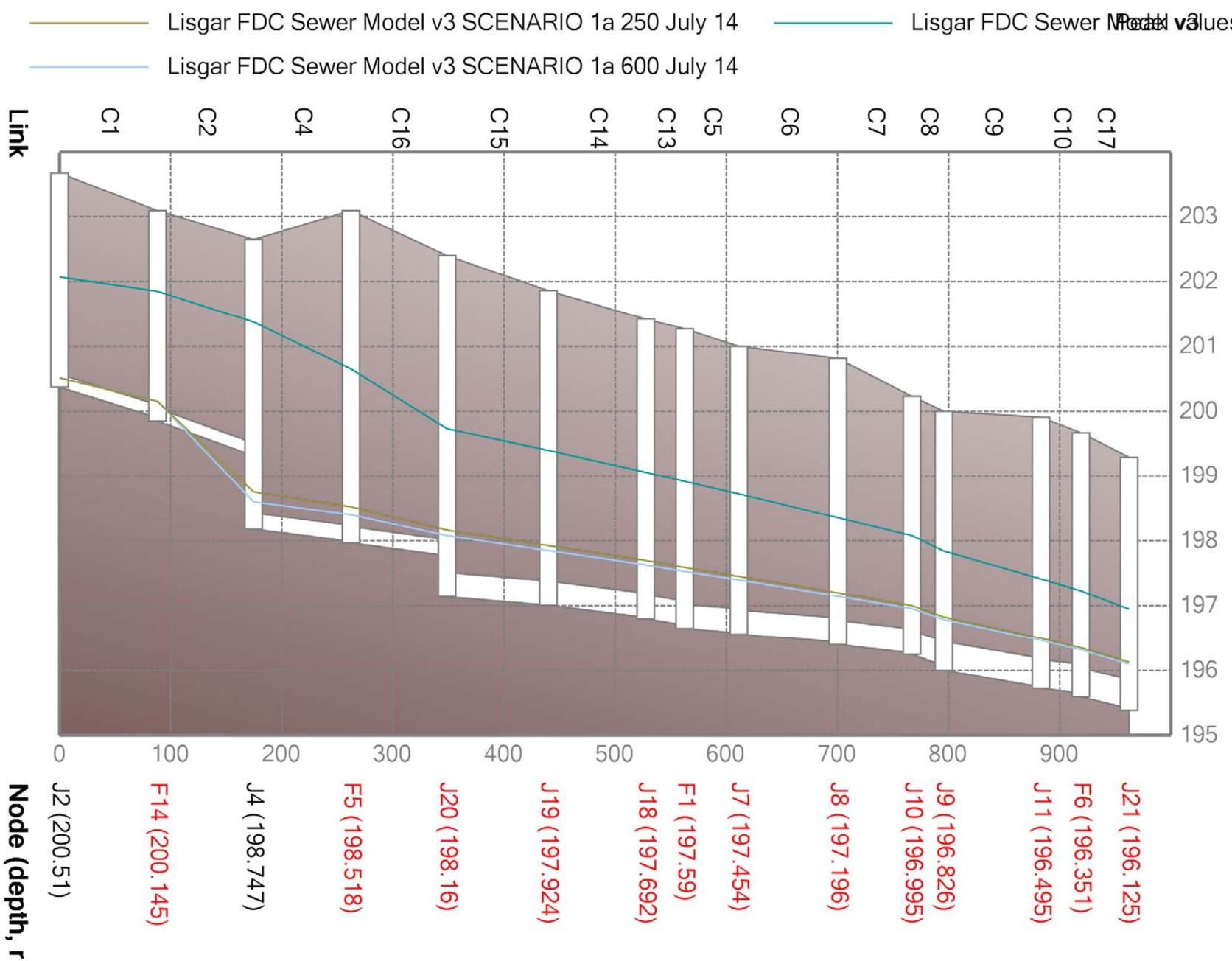



**Figure A16: Simulated HGL along Black Walnut Trail for July 14, 2017 Storm Event – Scenario 1a**

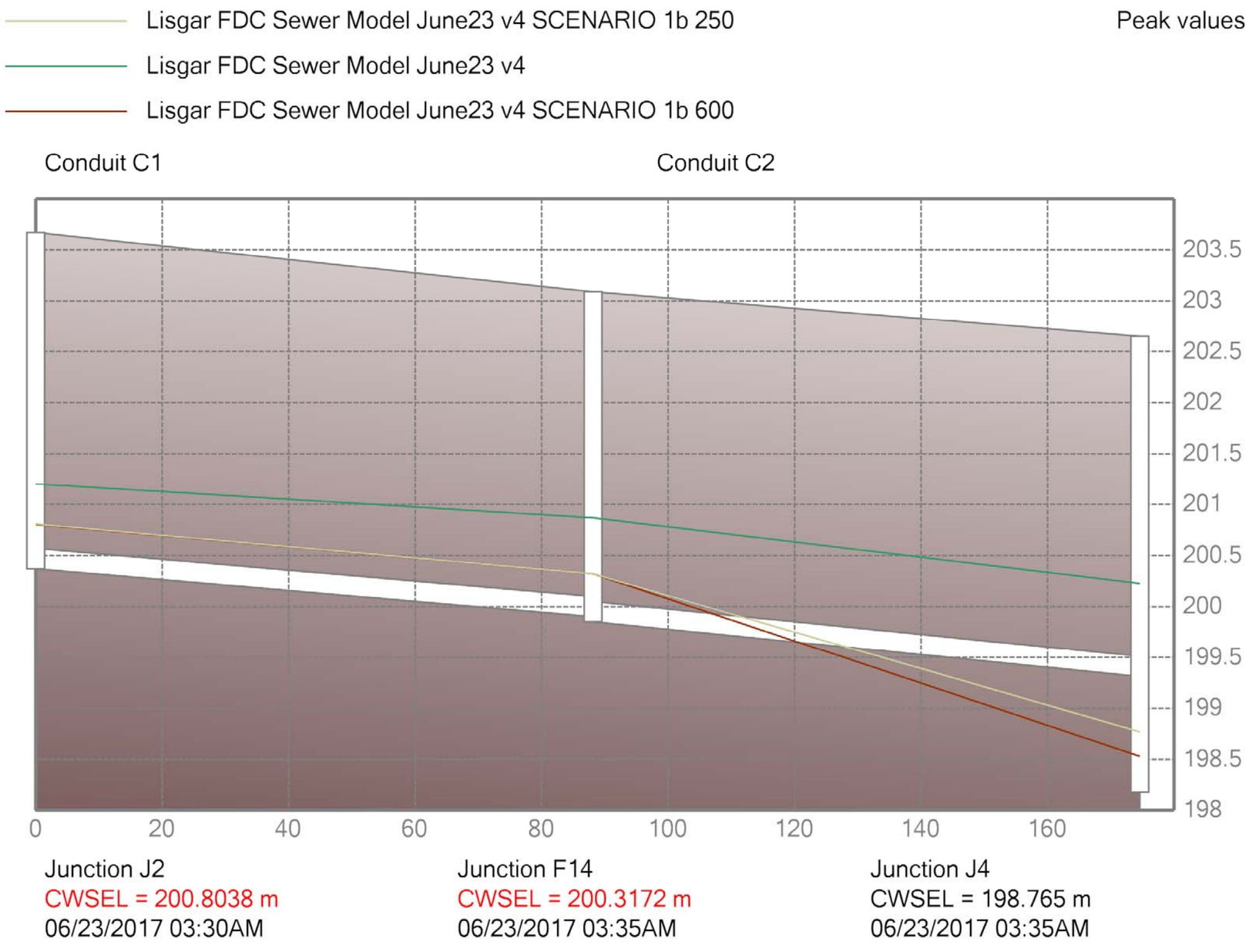



**Figure A17: Simulated HGL along Black Walnut Trail for June 23, 2017 Storm Event – (Upstream of Cactus Gate) – Scenario 1b**

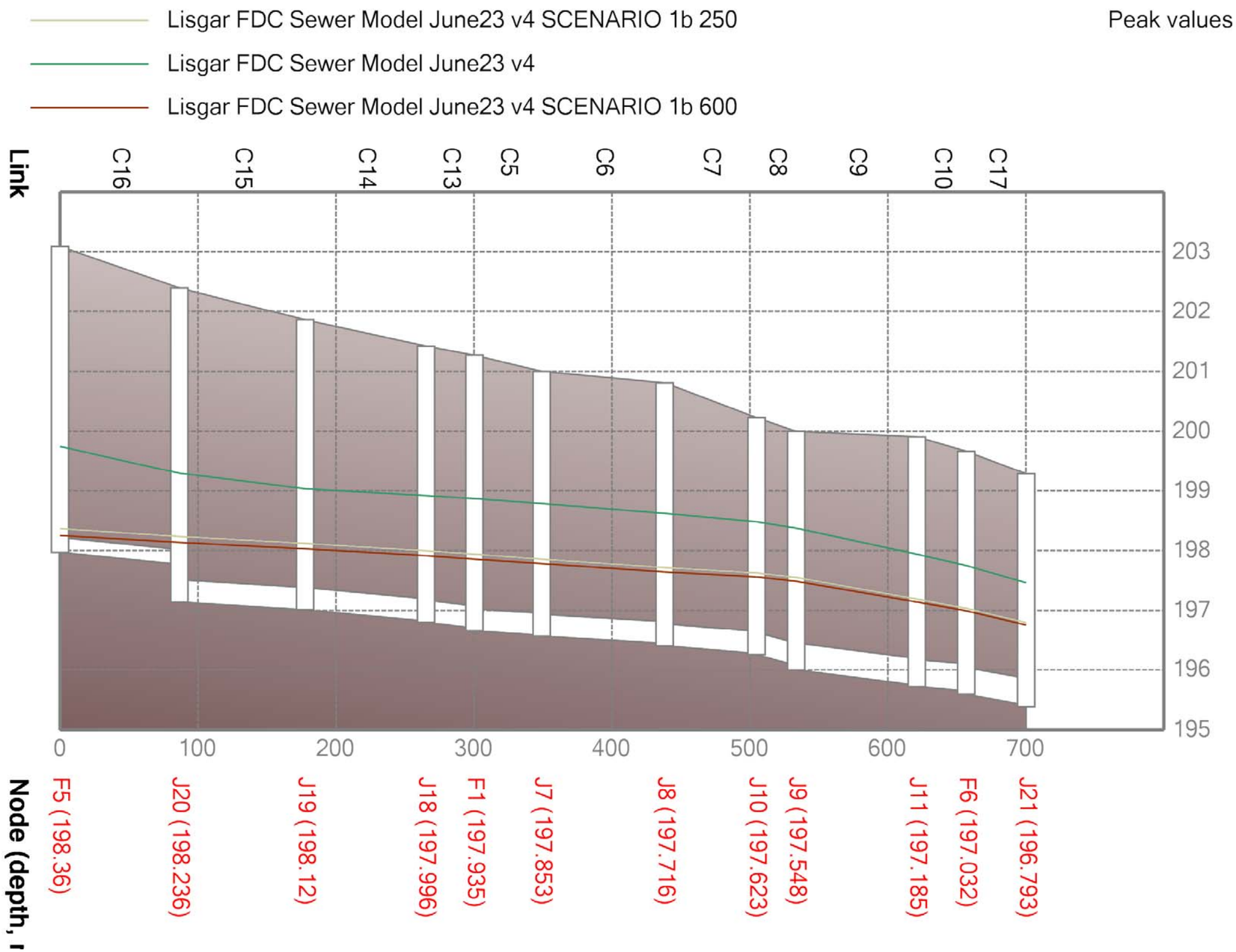



**Figure A18: Simulated HGL along Black Walnut Trail for June 23, 2017 Storm Event – (Downstream of Cactus Gate) – Scenario 1b**

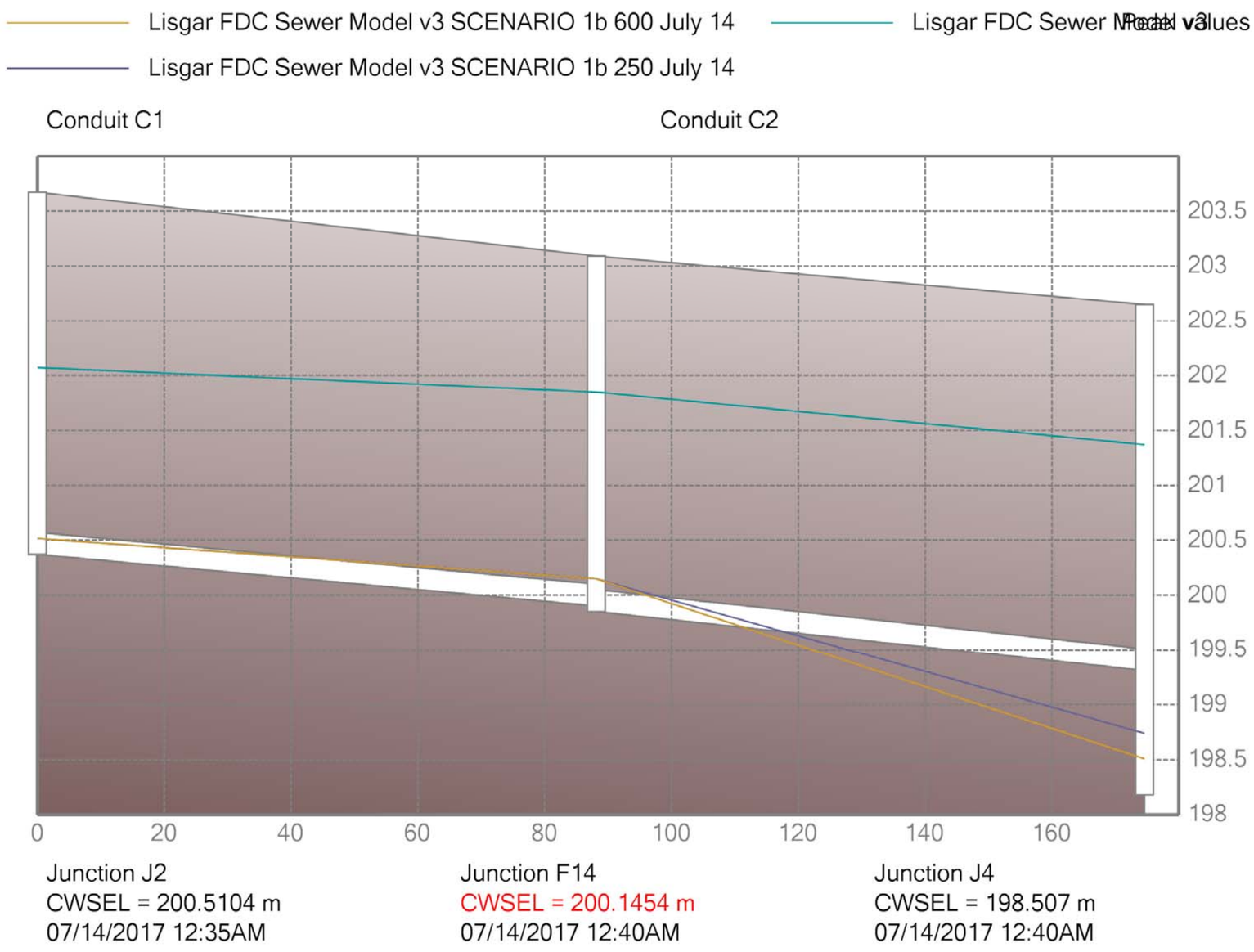



**Figure A19: Simulated HGL along Black Walnut Trail for July 14, 2017 Storm Event (Upstream of Cactus Gate) – Scenario 1b**

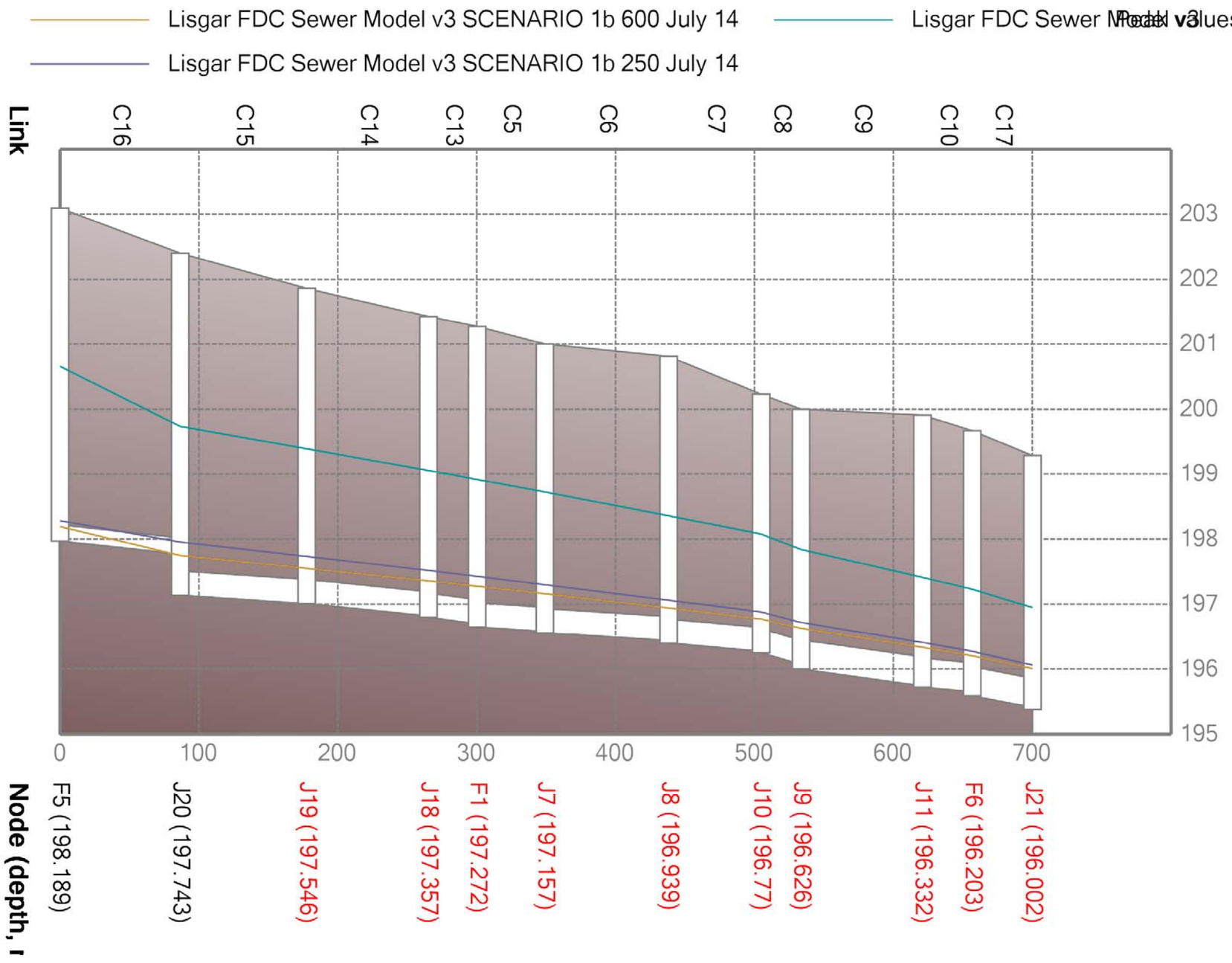



**Figure A20: Simulated HGL along Black Walnut Trail for July 14, 2017 Storm Event (Downstream of Cactus Gate) – Scenario 1b**

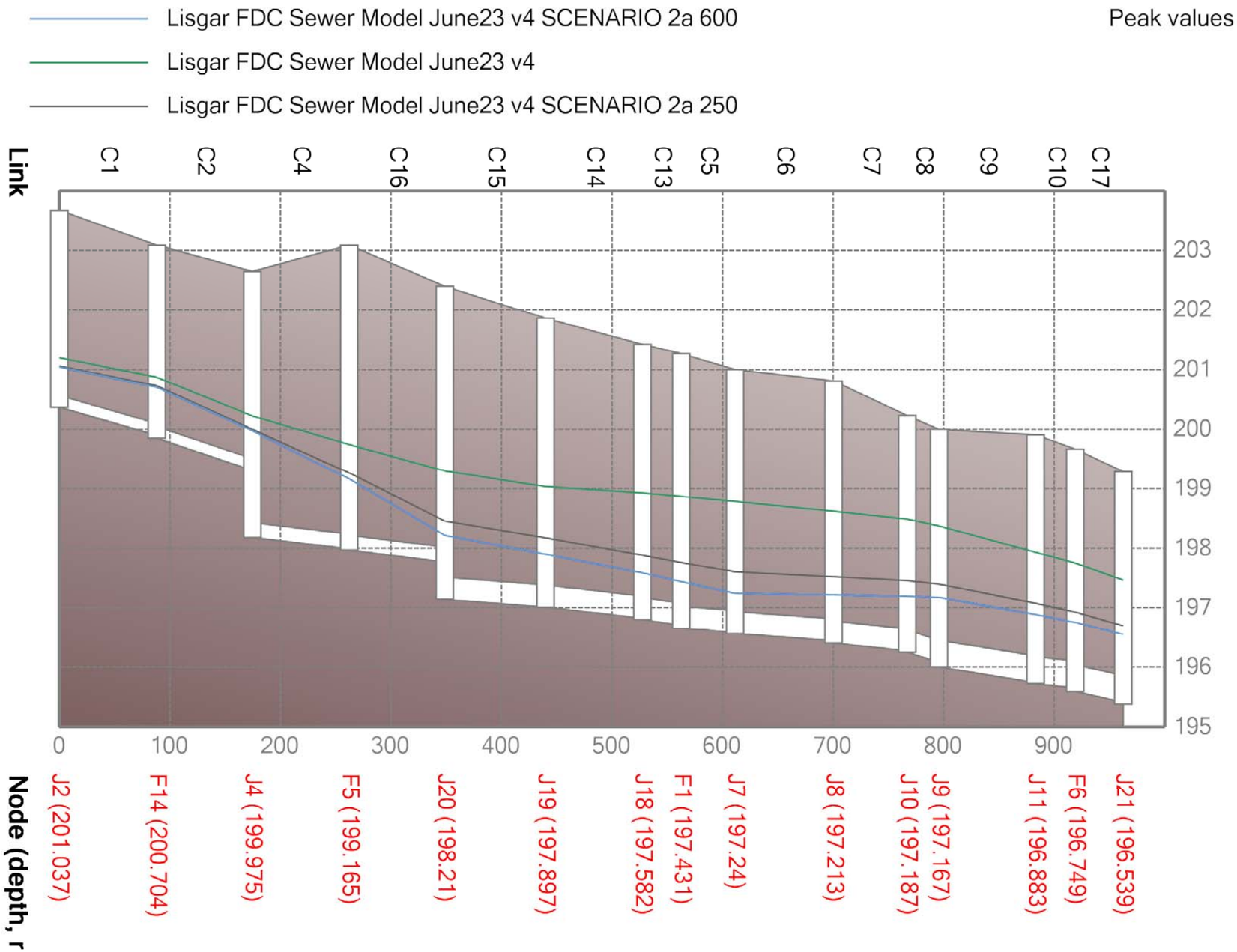



**Figure A21: Simulated HGL along Black Walnut Trail for June 23, 2017 Storm Event – Scenario 2a**

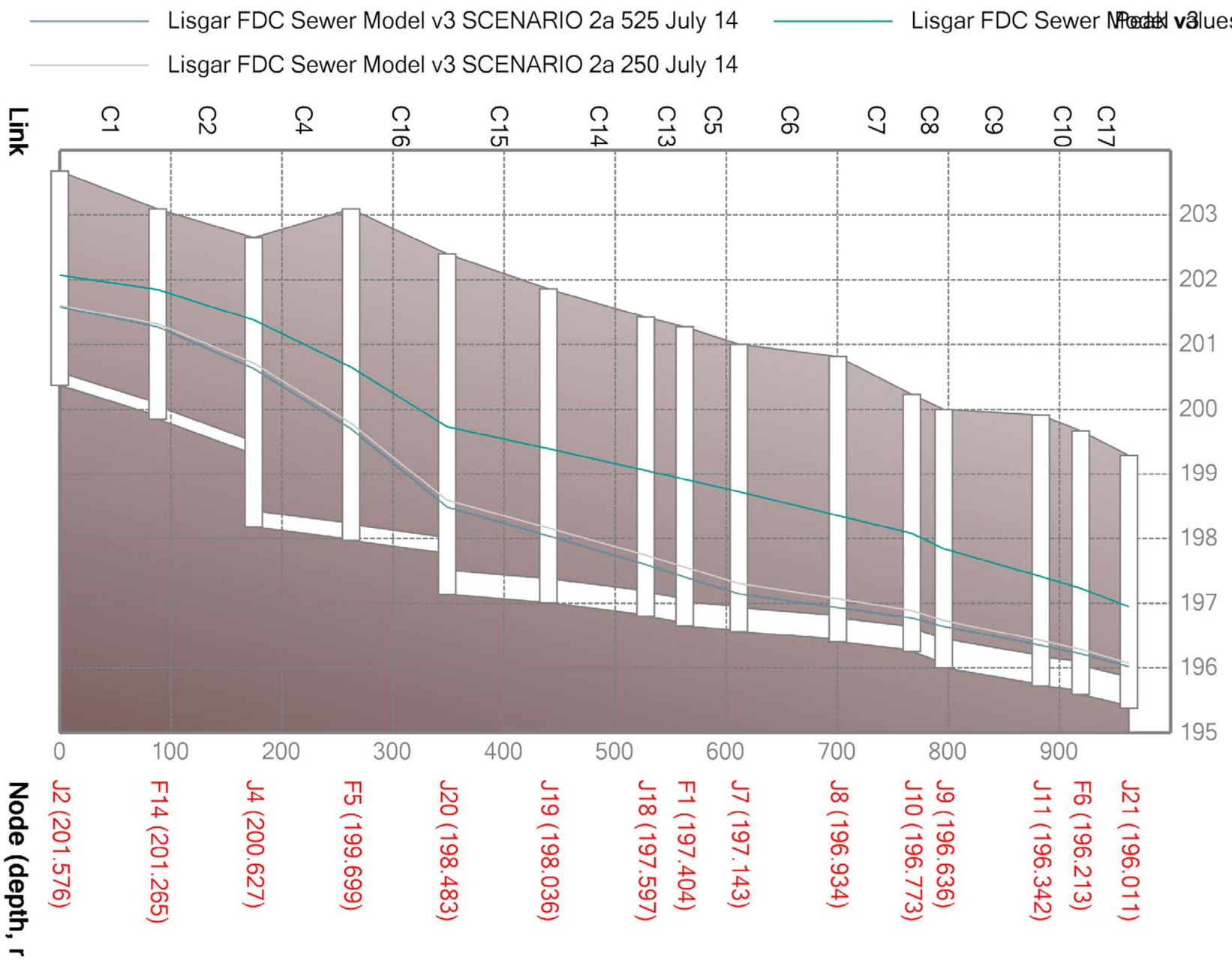



**Figure A22: Simulated HGL along Black Walnut Trail for July 14, 2017 Storm Event – Scenario 2a**

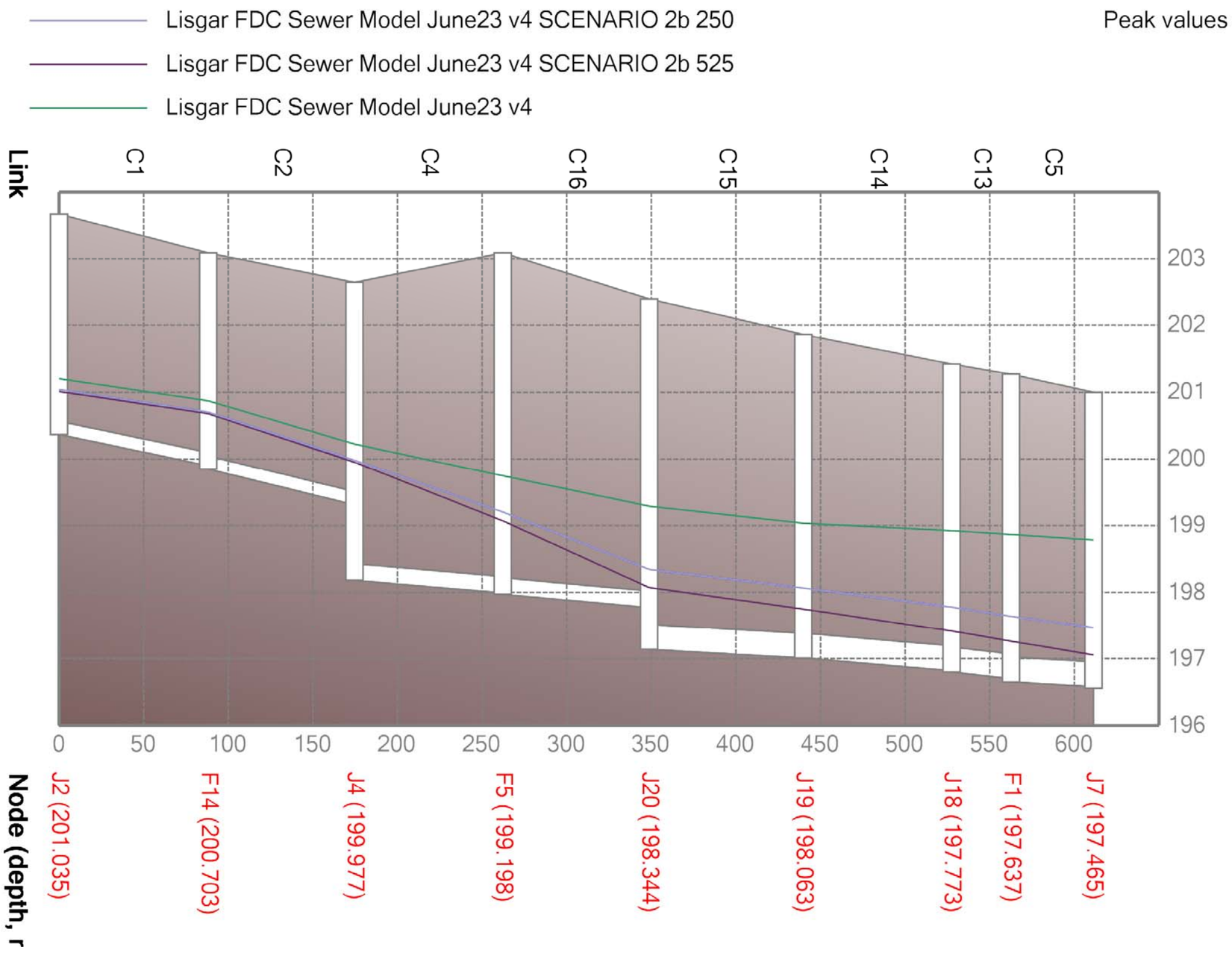



**Figure A23: Simulated HGL along Black Walnut Trail for June 23, 2017 Storm Event – (Upstream of Smoke Tree Road) – Scenario 2b**

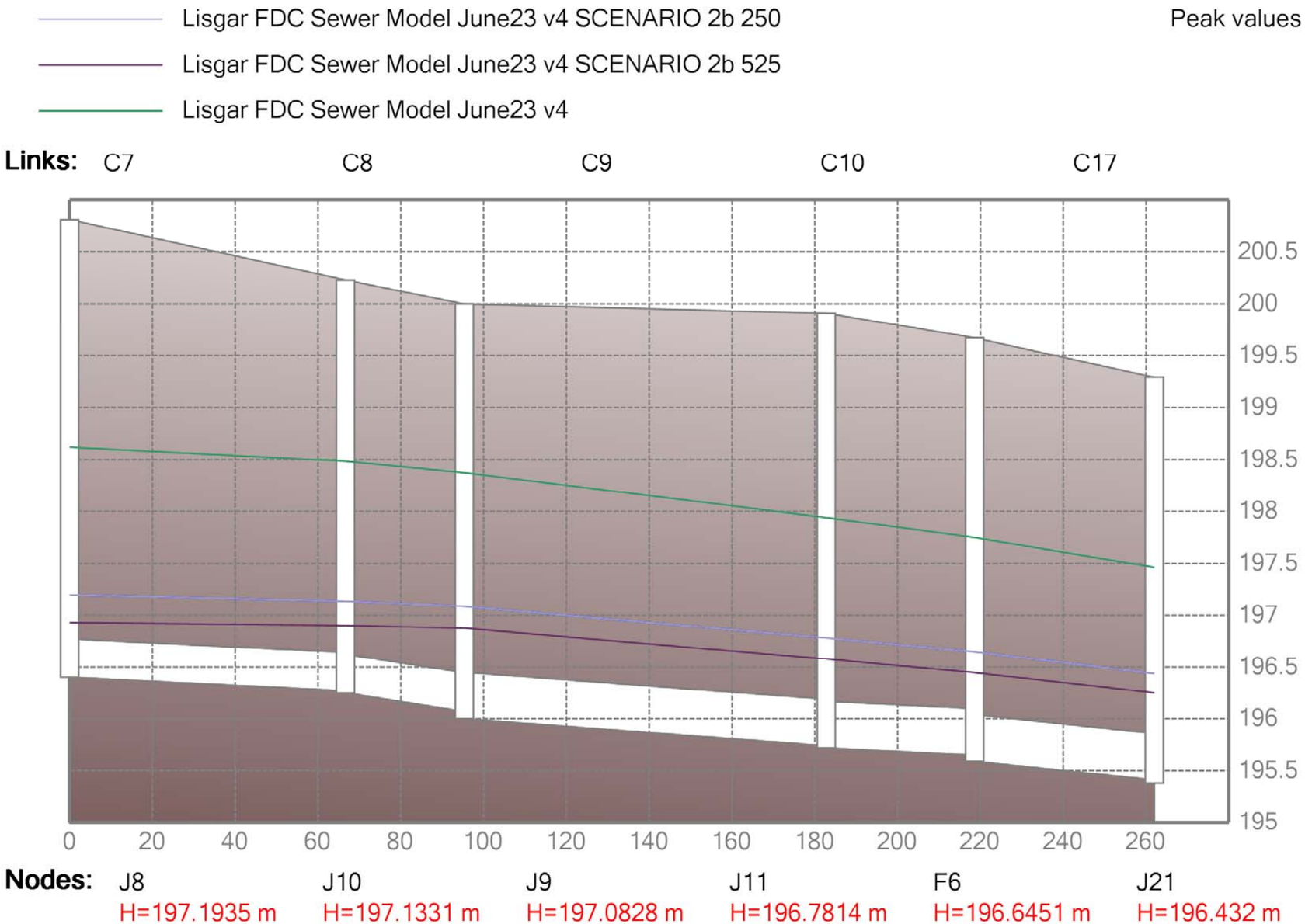



**Figure A24: Simulated HGL along Black Walnut Trail for June 23, 2017 Storm Event – (Downstream of Smoke Tree Road) – Scenario 2b**

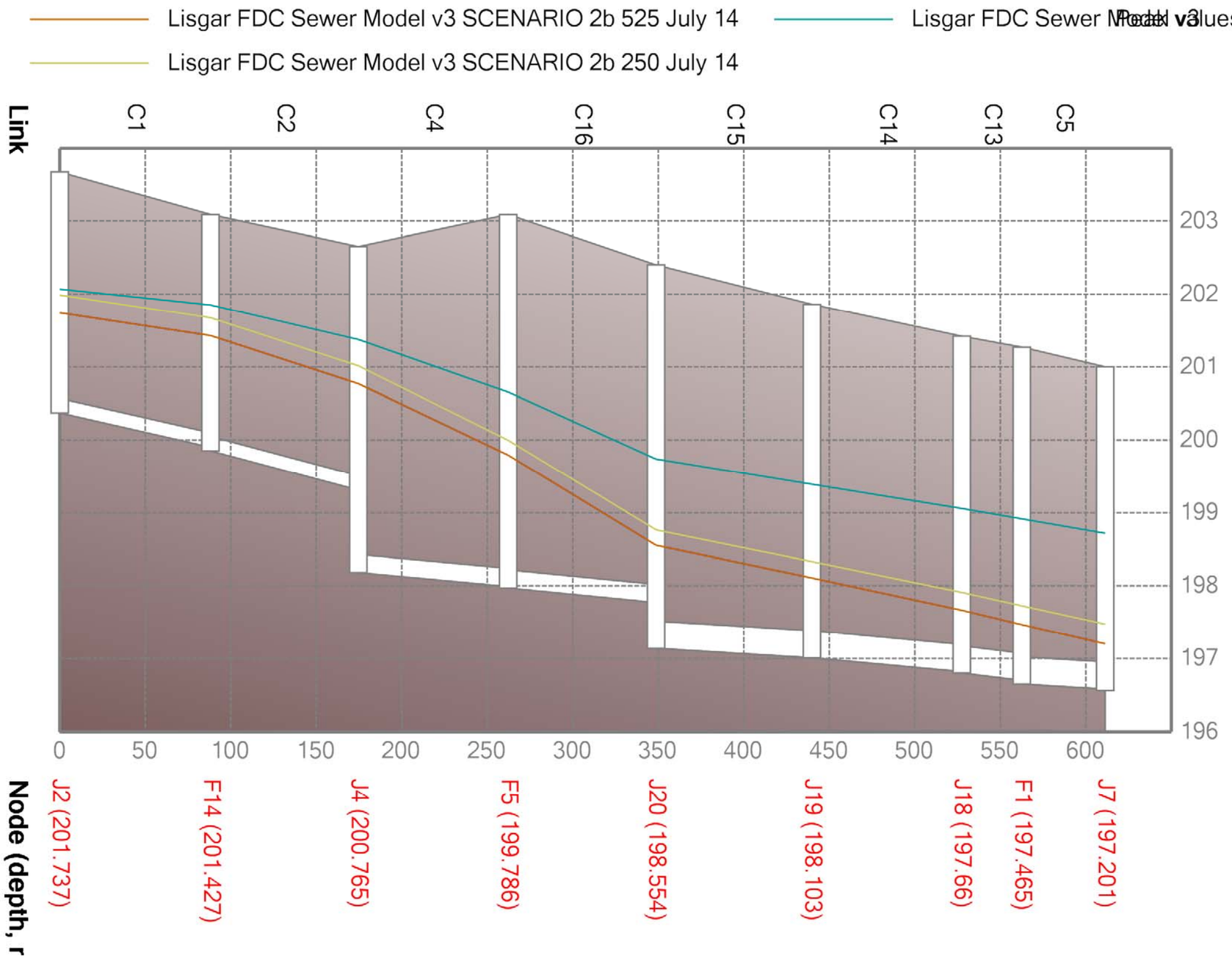



**Figure A25: Simulated HGL along Black Walnut Trail for July 14, 2017 Storm Event (Upstream of Smoke Tree Road) – Scenario 2b**

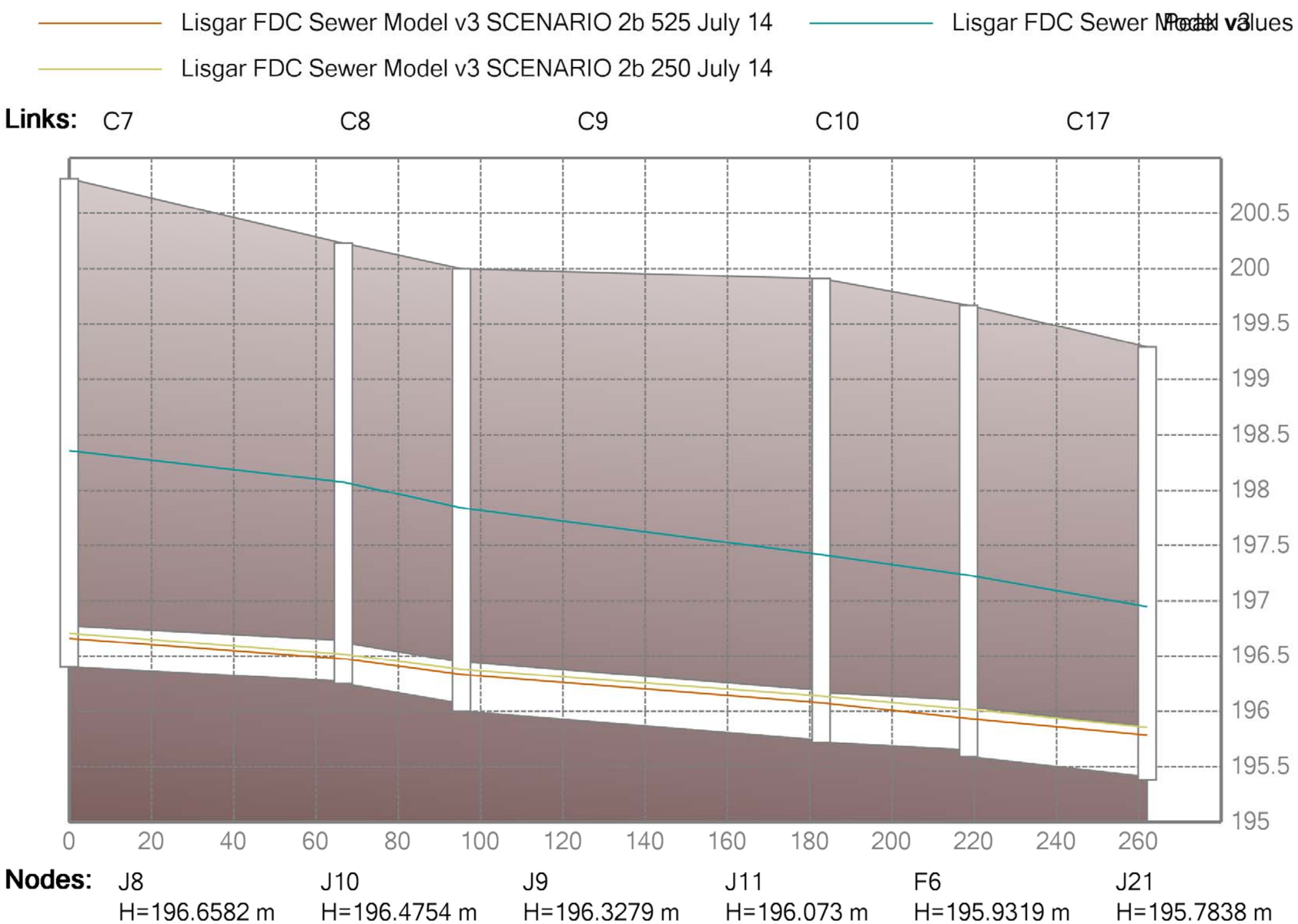



**Figure A26: Simulated HGL along Black Walnut Trail for July 14, 2017 Storm Event (Downstream of Smoke Tree Road) – Scenario 2b**

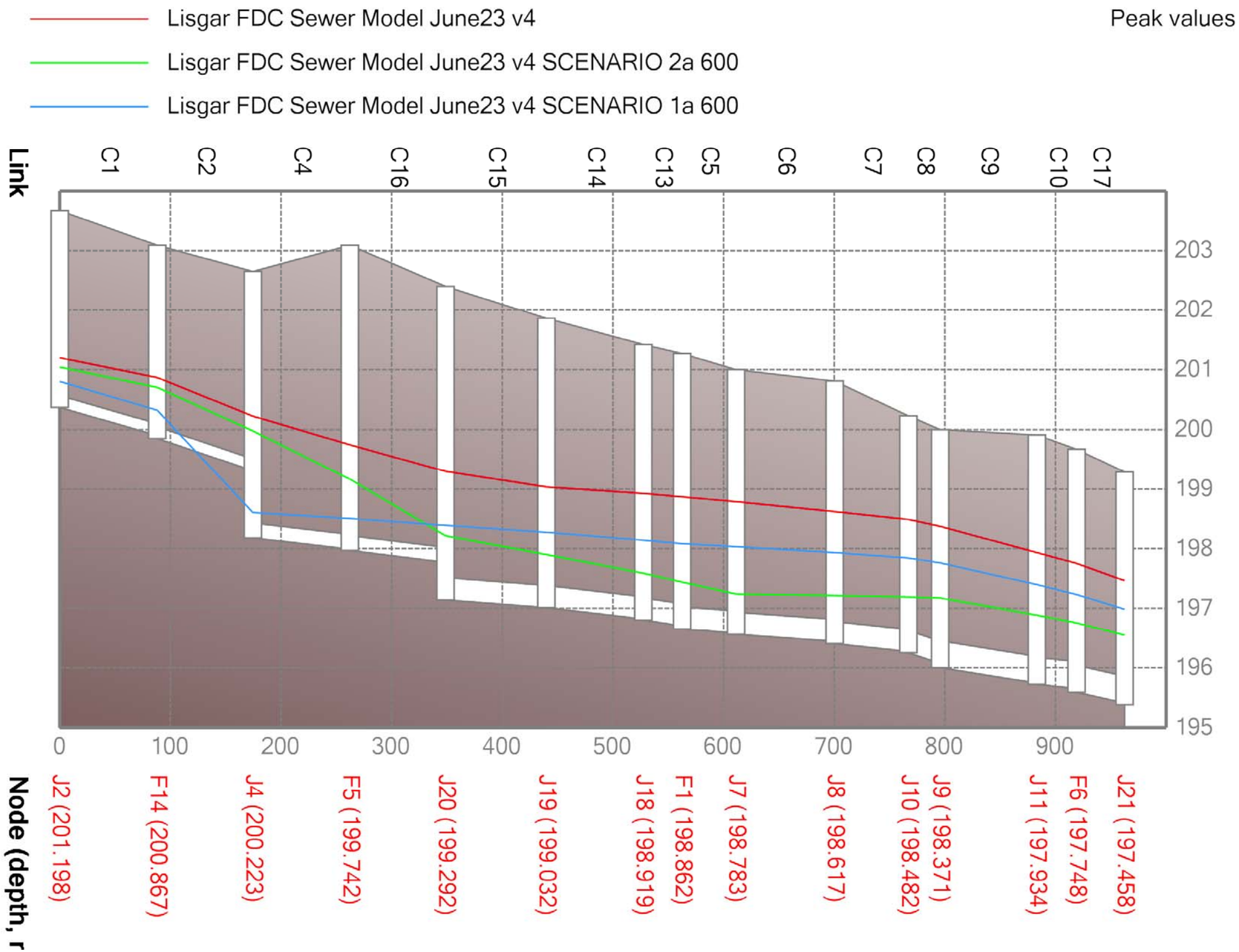



**Figure A27: Simulated HGL along Black Walnut Trail for June 23, 2017 Storm Event – Comparison of Scenarios 1a and 2a (600 mm and 525 mm diameter diversion pipes)**

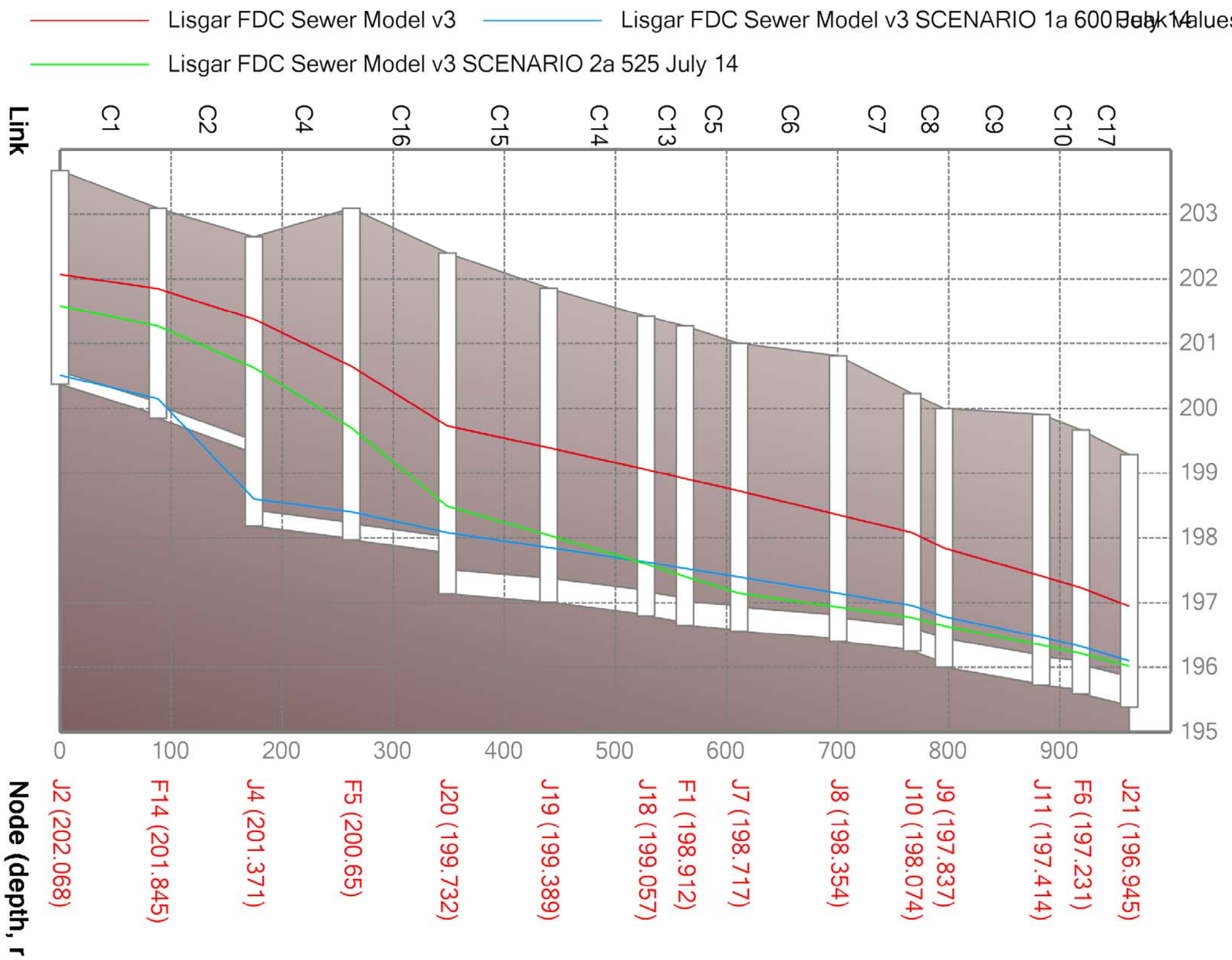



**Figure A28: Simulated HGL along Black Walnut Trail for July 14, 2017 Storm Event – Comparison of Scenarios 1a and 2a (600 mm and 525 mm diameter diversion pipes)**

# Memo

**To:** Jeff Smylie and Louie Jakupi, City of Mississauga

**From:** Matthew Senior and Ron Scheckenberger

**Date:** May 1, 2018

**File:** TPB188016

**Re:** **FDC Pumping Station – Additional Hydraulic Modelling and Analysis**
**Lisgar District Basement Water Infiltration Assessment – Remediation Phase,**
**City of Mississauga**

## 1. Introduction, Background, and Purpose

Further to the approved scope of November 13, 2017, the technical memorandum of March 12, 2018 (ref. Senior/Scheckenberger-Smylie/Jakupi) and the direction received at the most recent meeting of April 11, 2018, we hereby provide you with a summary of the additional analyses completed in support of the proposed foundation drain collector (FDC) pumping station for the Lisgar District within the City of Mississauga.

The previously submitted technical memorandum of March 12, 2018 (ref. Senior/Scheckenberger-Smylie/Jakupi) provided a summary of the primary analyses completed in support of the above-noted FDC pumping station. As summarized in that memorandum, the preferred location was identified as being at the Cactus Gate Parkette along Black Walnut Trail, to be constructed in conjunction with the proposed utility trench dewatering system. The analyses concluded that this location was preferred for a number of reasons, including the obvious synergy in tendering and construction, previously completed geotechnical and sub-surface utility investigations, and higher simulated rates of FDC inflow in this area. Subsequent hydraulic modelling analyses confirmed that this location would have the greatest potential reduction in FDC hydraulic gradelines (HGLs) in the upstream area (as compared to an alternate location at Smoke Tree Road), and would have a similar benefit in HGL reduction to downstream areas along Black Walnut Trail. As such, the Cactus Gate Parkette location was considered preferred for the initial (2018) construction (subsequent FDC pumping stations may be considered for other downstream locations, based on the findings of subsequent monitoring work). This location was confirmed by City staff based on subsequent discussions (ref. e-mail Jakupi-Senior, March 27, 2018).

Based on the outcomes from the meeting with City staff (April 11, 2018), it was recommended that additional FDC modelling analyses be completed, specifically the simulation at least one (1) or more additional historic FDC surcharging events (in addition to the June 23, 2017 and July 14, 2017 storm events, which were simulated as part of the previously noted memorandum). In addition, it was recommended that Wood Environment & Infrastructure Solutions (Wood) further consider the proposed statistical analysis of the relationship between simulated peak flows and drainage area and rainfall intensity (similar to a Rational

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a Division of Wood Canada Limited
Registered office: 2020 Winston Park Drive, Suite 700, Oakville, Ontario L6H 6X7
Registered in Canada No. 773289-9; GST: 899879050 RT0008; DUNS: 25-362-6642

Method type approach). This current memorandum summarizes these additional analyses, and further confirms the expected design basis for pumping capacity for the FDC pumping system.

## 2. Additional Storm Event Simulations

As outlined in the March 12, 2018 memorandum (ref. Senior/Scheckenberger-Smylie/Jakupi), three (3) of the next largest observed FDC surcharging events in the Black Walnut Trail area were noted as potential candidates for additional hydraulic modelling analysis; these include:

- September 8, 2012
- June 12, 2014
- September 10, 2014

Based on a review of the available monitoring data, and for consistency, the two (2) more recent storm events from 2014 have been applied for the current additional simulation. Note that data from gauge F24 (west of Lisgar Creek – Golden Locust Drive) are not available for the 2014 storm event, as this gauge was not installed until July 2015 (refer to Figure A1 for monitoring gauge locations). Thus simulated water level responses have been compared to the other available gauges in this area (F13, F14, F5, F1 and F6).

The simulation methodology for the two (2) storm events is consistent with that applied for previous storm events (ref. March 12, 2018 memorandum). A unitary flow response at the upstream F13 gauge has been determined, based on the observed water level response, a theoretical rating curve (Manning's Equation for low flow and orifice equation for high flows), and the contributing drainage area to the gauge (3.28 ha) to determine the unitary hydrograph ($m^3/s$ per ha). This unitary flow response time series has then been applied to hydraulic model nodes, based on the contributing FDC drainage areas (as per Figure A2), multiplied by a calibrated scaling factor, which is determined iteratively in order to attempt to replicate the observed water level responses for the storm event in question. The drainage area "zones" applied in previous assessments (refer to Figure A3) have been similarly applied for the current assessment, with the same general observation from previous assessments, that a higher relative rate of FDC inflow is expected from the upper reaches of the FDC sewershed (i.e. Zone 1).

### 2.1. Simulation of June 12, 2014 Storm Event

The June 12, 2014 storm event resulted in between the 2nd and 4th highest FDC system surcharge in the Black Walnut Trail area since monitoring began in 2012. A maximum water level of 2.70 m was observed at Gauge F1 for this storm event, exceeded only by the July 14, 2017 storm event for the six (6) years of available monitoring data [refer to Figure A14 (attached) for the observed storm event response]. The observed FDC surcharge for this event was noted further downstream as well, with observed FDC water levels of 3.07 m and 2.66 m at gauges F3 (Doug Leavens Boulevard) and F4 (Osprey Marsh), and 2.69 m at gauge F17 (Ninth Line), however the surcharge ultimately dissipated at the downstream limits (Erin Centre Boulevard and Churchill Meadows).

Observed rainfall intensities for this storm event were less than a 2-year return period, and antecedent conditions were not considered significant (7.6 mm in preceding 5-day period). The storm itself was approximately 23.2 mm in depth, over a 1.3-hour period. Given the time of year and short duration, this suggests a thunder-storm type event, which could have had isolated portions of more intense rainfall, given the spatial variability associated with such storm events.

Scaling factors have been determined iteratively for the simulation of the June 12, 2014 storm event to attempt to reasonably replicate observed water levels. Table 2.1 presents the resulting estimated scaling factors for the different FDC drainage area zones. Figures A4-A9 (attached) present the resulting simulated fit to observed water level data.

**Table 2.1: Estimated Scaling Factors for Simulated Fit of Observed FDC Response to June 12, 2014 Storm Event**

| FDC Area Zone | Description | Scaling Factor[1] |
|---|---|---|
| 1 | Black Walnut Trail – north of Gauge F5 | 0.46 to 0.49[3] |
| 2 | Area west of Lisgar Creek (Golden Locust Drive)[2] | 0.26 |
| 3 | Black Walnut Trail between F5 and F1 | 0.26 |
| 4 | Black Walnut Trail between F1 and F6 (including Scotch Pine Gate area) | 0.11 |
| 5 | Areas downstream of F6 | 0.11 |

1. Inflow at each node within zone is determined by the unitary flow hydrograph multiplied by the incremental drainage area to each node multiplied by the scaling factor.
2. Note that there is no observed water level gauge in this area to verify scaling factor (Gauge F24 was not installed for this storm event).
3. Slightly reduced factor of 0.46 applied to area contributing to gauge F13 as compared to rest of Zone 1.

Figures A4-A9 indicate a generally good fit to the observed data both with respect to peak water level and shape, although the simulated water level responses are slightly delayed as compared to the observed responses. The response at Gauge F1 is also somewhat under-estimated, however the response at the downstream Gauge F6 indicates a good match, albeit slightly low on volume.

The scaling factor results are consistent with previous analyses, which indicate the highest relative rate of flow contribution for upstream areas.

Overall, it is considered that the simulated modelling for this storm event provides a good representation of the observed water level responses, and provides a reasonable approximation for the assessment of the effectiveness of diversions/pumping, as described in Section 3.

### 2.2. Simulation of September 10, 2014 Storm Event

The September 10, 2014 storm event resulted in between the 2nd and 3rd highest FDC system surcharge in the Black Walnut Trail area since monitoring began in 2012. A maximum water level of 2.74 m was observed at Gauge F5 for this storm event, exceeded only by the July 14, 2017 storm event for the six (6) years of available monitoring data [refer to Figure A15 (attached) for the observed storm event response]. The observed FDC surcharge for this storm event extended further downstream to Doug Leavens Boulevard (gauge F3) but dissipated beyond (i.e. Osprey Marsh (gauge F4) and further downstream).

This storm event had a larger observed depth than the June 12, 2014 event (40.4 mm), however this occurred over a longer duration (6.3 hours). Observed rainfall intensities for this storm event were also higher; between a 2 and 5 year event (30 minute and 1 hour data) or approximately equal to a 2 year event (6 hour

data). This storm event was also characterized by a higher antecedent rainfall total (26.4 mm in the preceding 5-day period). It is notable that this storm event was the only recorded event with rainfall intensities greater than a 2-year storm event, with the exception of the July 13-14, 2017 storm event over the monitoring period. No reported basement water infiltration was noted as a result of this storm event.

Scaling factors have been determined iteratively for the simulation of the September 10, 2014 storm event to attempt to reasonably replicate observed water levels. Table 2.2 presents the resulting estimated scaling factors for the different FDC drainage area zones. Figures A9-A13 (attached) present the resulting simulated fit to observed water level data.

**Table 2.2: Estimated Scaling Factors for Simulated Fit of Observed FDC Response to September 10, 2014 Storm Event**

| FDC Area Zone | Description | Scaling Factor[1] |
|---|---|---|
| 1 | Black Walnut Trail – north of Gauge F5 | 0.32 |
| 2 | Area west of Lisgar Creek (Golden Locust Drive)[2] | 0.15 |
| 3 | Black Walnut Trail between F5 and F1 | 0.15 |
| 4 | Black Walnut Trail between F1 and F6 (including Scotch Pine Gate area) | 0.07 |
| 5 | Areas downstream of F6 | 0.07 |

1. Inflow at each node within zone is determined by the unitary flow hydrograph multiplied by the incremental drainage area to each node multiplied by the scaling factor.
2. Note that there is no observed water level gauge in this area to verify scaling factor (Gauge F24 was not installed for this storm event).

Figures A9-A13 indicate a generally good fit to the observed data both with respect to peak water level and shape, although the simulated water level responses are slightly delayed as compared to the observed responses. The response at Gauges F5 and F1 is also somewhat under-estimated, however the response at the downstream Gauge F6 indicates a slight over-estimation, which suggests that on average the simulated response is reasonable.

The scaling factor results are consistent with previous analyses, which indicate the highest relative rate of flow contribution for upstream areas.

Overall, it is considered that the simulated modelling for this storm event provides a good representation of the observed water level responses, and provides a reasonable approximation for the assessment of the effectiveness of diversions/pumping, as described in Section 3.

## 3. Mitigation Analyses

### 3.1. Analysis of Flow Diversions

As per the approach advanced in the previous March 12, 2018 memorandum, hydraulic modelling of an FDC sewer diversion (to a pumping station) has been completed to assess the expected effectiveness. As per the recommendations cited within the March 12, 2018 memorandum, and direction from City staff (ref. e-mail Jakupi-Senior, March 27, 2018), this diversion would be assumed to be located within the Cactus Gate Parkette. As such, two (2) different sub-scenarios have been considered:

- **Scenario 1a** – diversion sewer placed above obvert of existing 250 mm diameter FDC trunk sewer (invert elevation of 198.43 m), existing FDC sewer outlet remains as is
- **Scenario 1b –** restrictor plate placed on existing 250 mm diameter FDC sewer at springline (i.e. 50% of full depth), and FDC diversion sewer placed above the springline (invert elevation of 198.31 m)

Based on the results documented in the previous March 12, 2018 memorandum, diversion flow rates were noted to be relatively insensitive to the diameter (size) of the diversion pipe (i.e. 250 mm minimum or 600 mm maximum). Based on direction from City staff (April 11, 2018 meeting), it is suggested that the largest feasible pipe size be implemented for the diversion, to maximize the effectiveness of the flow diversion to the FDC pumping station. Both sub-Scenarios 1a and 1b have therefore assumed a 600 mm diameter diversion pipe. Simulated results are presented in Table 3.1; hydraulic gradline (HGL) plots are presented in Figures A16 to A17 (June 12, 2014 storm event) and A18 to A19 (September 10, 2014 storm event).

**Table 3.1: Simulated Hydraulic Modelling Results for Diversion at Cactus Gate Parkette**

| Scenario | Storm Event | Node Inflow ($m^3/s$) | Diverted Flow to Pumping Station ($m^3/s$) | Diverted Volume to Pumping Station ($m^3$) | Remaining Flow in FDC Trunk ($m^3/s$) | HGL Reduction along Black Walnut Trail compared to baseline (m) |
|---|---|---|---|---|---|---|
| 1a | June 12, 2014 | 0.094 | 0.056 | 96 | 0.046 | 0.54 – 1.99 |
| | Sept 10, 2014 | 0.093 | 0.049 | 117 | 0.045 | 0.72 – 2.19 |
| 1b | June 12, 2014 | 0.094 | 0.065 | 137 | 0.029 | 0.54 – 2.07 |
| | Sept 10, 2014 | 0.093 | 0.064 | 155 | 0.029 | 0.87 – 2.27 |

The results presented in Table 3.1 indicate that an FDC sewer diversion would be largely effective, with consistently more than half of the simulated peak inflow being diverted to the theoretical pumping station unit. Hydraulic gradeline (HGL) reductions of between 0.5 and 2.3 m would result for the two scenarios. The attached HGL plots indicate that Scenario 1b (with orifice restrictor in place) would result in a lower overall HGL due to the additional flow diverted; an average further HGL reduction along Black Walnut Trail of 0.2 m is indicated with the orifice restrictor, which relates to the increased flow and volume diversion under this scenario. As discussed previously with City staff (April 11, 2018 meeting), additional considerations related to backup power are required to ensure that the implementation of an orifice restrictor does not result in any negative impacts to upstream residents along this reach of the FDC. Notwithstanding, it is considered that the expected benefit to downstream areas outweighs the potential minor risk to upstream properties, subject to the implementation of suitable backup measures and considerations as part of the detailed design phase (such as an overflow relief).

### 3.2. Rainfall Intensity Analysis

As part of the approved scope of work (November 13, 2017), and subsequent discussions with City staff (April 11, 2018 meeting), it was also considered worthwhile to assess the relationship between estimated FDC peak flows, and contributing drainage area and rainfall intensity. Such an analysis has similarities to the well-known Rational Method for storm sewer design (Q=CiA), which directly correlates storm flows to varying rainfall intensity, drainage area, and a Runoff Coefficient representing the rainfall-runoff characteristics of the subject area. In this regard, expected inflows to the proposed FDC pumping station under less frequent, more formative storm events (i.e. > 5 year storm event, potentially up to and including the 100 year storm event) could be assessed, and an appropriate pumping capacity rate selected accordingly.

Notwithstanding, the results of the completed hydraulic modelling (both as documented in the previous March 12, 2018 memorandum and the current summary) indicate similar peak flow results at the key node of interest (FDC MH at Cactus Gate Parkette) for all of the four (4) storm events simulated to date:

- June 12, 2014: 0.094 $m^3/s$
- September 10, 2014: 0.093 $m^3/s$
- June 23, 2017: 0.096 $m^3/s$
- July 14, 2017: 0.094 $m^3/s$

The preceding finding from the detailed modelling suggests a relatively constant rate of peak inflow to the FDC system; it is hypothesized that potentially inflows are constrained/limited by the capacity of the FDC sewer system in this area, which is relatively small (200 mm diameter pipe typically). Based on the simulation results, varying observed FDC surcharge depths are therefore likely more influenced by varying rates of FDC peak flows further downstream, which would define tailwater constraints.

Based on the preceding relatively constant rate of simulated FDC peak flow, any attempts at a correlation analysis between peak flow and rainfall intensity would likely not provide reasonable results. Therefore, rather than attempting to determine a FDC peak flow factor to account for future more intense storm events, the FDC pumping station design should consider opportunities to provide additional capacity, such as a backup/redundant FDC pumping system which could be utilized if so required.

## 4. Summary and Next Steps

To summarize, two (2) additional observed storm events (June 12 and September 10, 2014) have been simulated using the developed hydraulic model of the FDC system. The results are considered to be similar to those generated as part of the previous summary memorandum (March 12, 2018) with respect to simulated peak flows to the proposed FDC pumping station at the Cactus Gate Parkette, as well as the provided effectiveness of the proposed diversion sewer. Based on these additional results, it is recommended that the FDC pumping station proceed as previously proposed at this location (separate system from utility trench dewatering system). It is recommended that the previously proposed flow restrictor on the FDC trunk sewer also be implemented as proposed, in order to maximize the potential diversion of flows to the proposed pumping system and further reduce inflows downstream. Design redundancies, including a system overflow, should be considered accordingly in the design. Given the relative consistency in simulated FDC peak flows, a correlation analysis with rainfall is not considered

feasible. Other design measures to account for more intense future storm events will need to be considered as part of the detailed design effort accordingly.

We consider that the next steps in this effort should include:

- City to review current memorandum and provide any additional comments
- Wood to review range of commercially available pump options with manufacturers, including related considerations (electrical/power requirements, wet well dimensions, etcetera)
- Wood to similarly review requirements for adjacent utility trench dewatering system
- Following confirmation with City staff, Wood to advance a revised preliminary (30%) design for City review (including previous City comments on the conceptual utility trench dewatering system), with a target delivery date of 4-5 weeks (early June, 2018)
- Wood to advance detailed design package, including contract materials

We trust the foregoing and attached to be satisfactory. We look forward to discussing this memorandum in further detail with you at your convenience, and to continue to advance this project to ensure construction is completed in 2018.

MJS

/Attached Figures A1 to A3 (Study Area Figures)
Figures A4 to A13 (Simulation/Calibration Hydrographs)
Figures A14 to A15 (Storm Event Water Level Plots)
Figures A16 to A19 (Hydraulic Gradeline Plots)

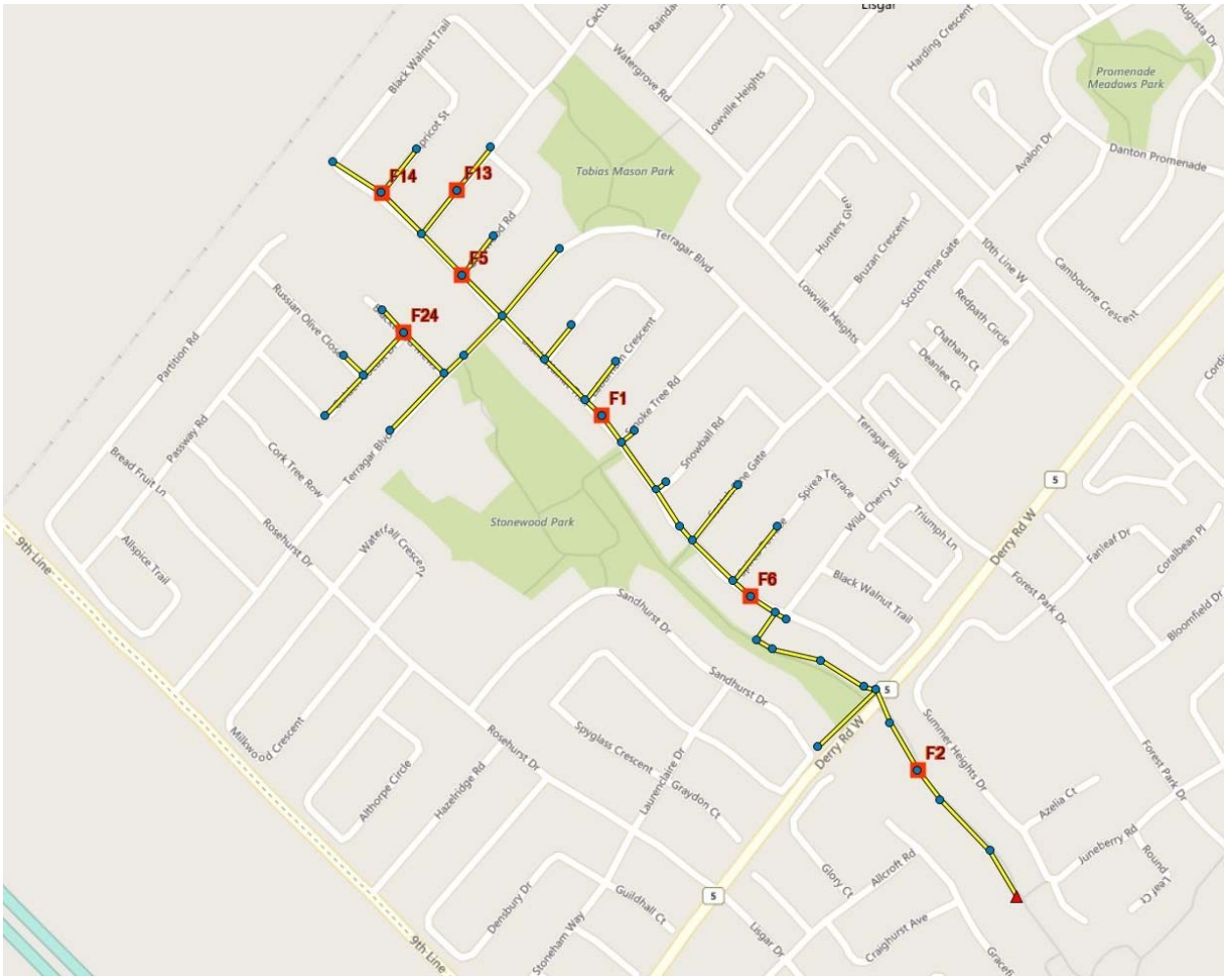



**Figure A1: Extents of FDC Sewer System within PCSWMM Model and FDC Monitoring Locations**

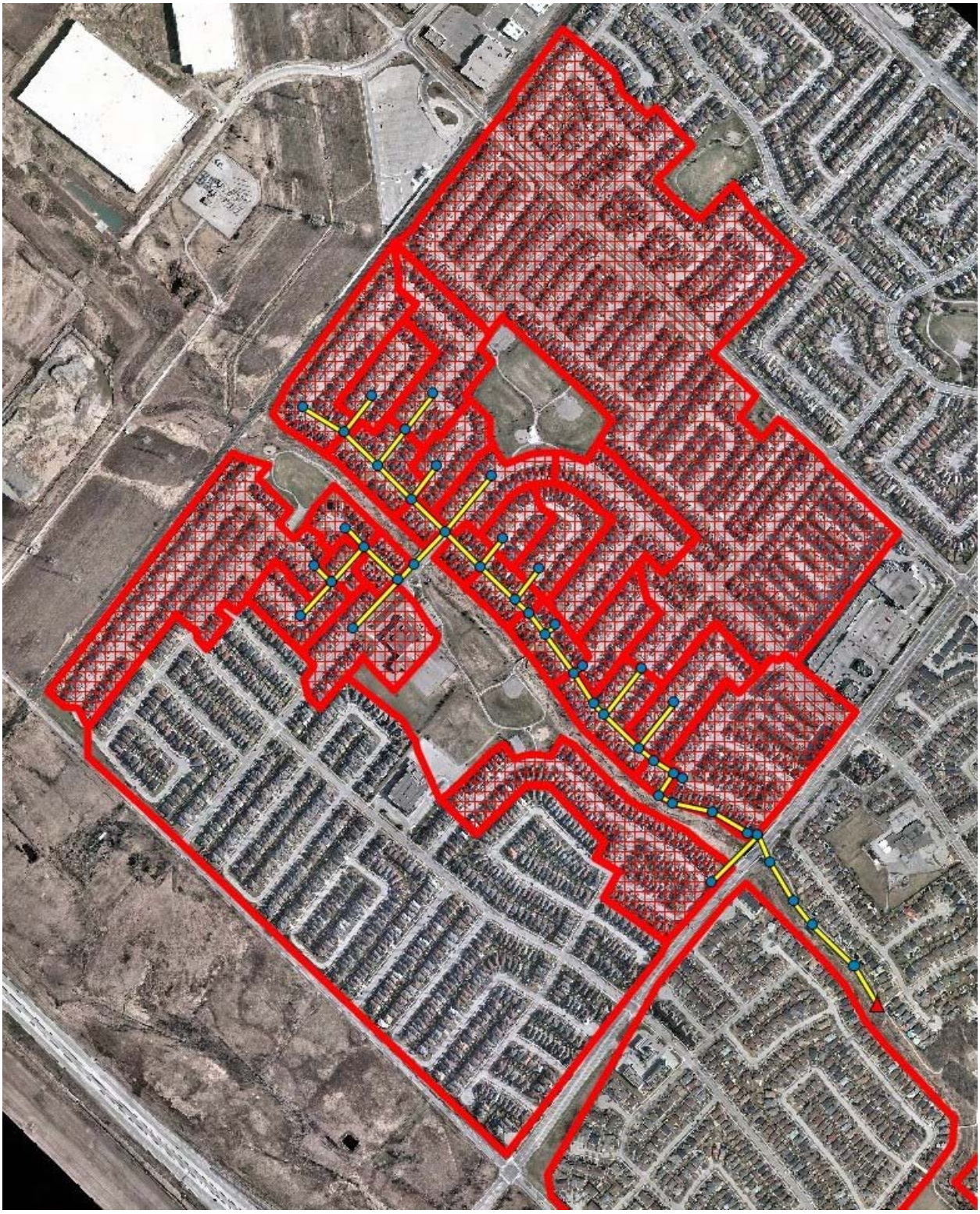


**Figure A2: Estimated FDC Contributing Drainage Areas**

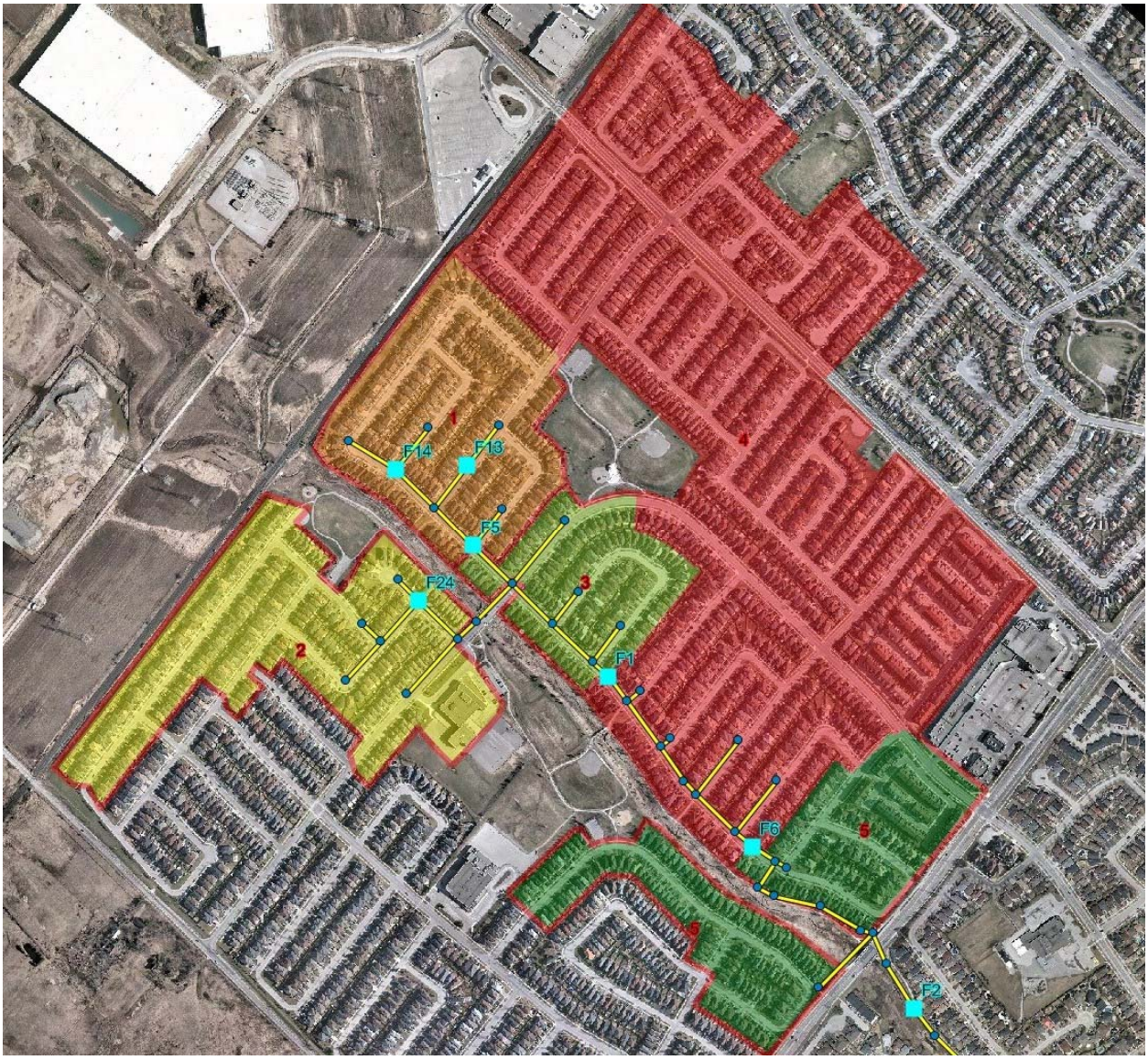



**Figure A3: FDC Drainage Area Zones applied for Hydraulic Modelling Assessment**

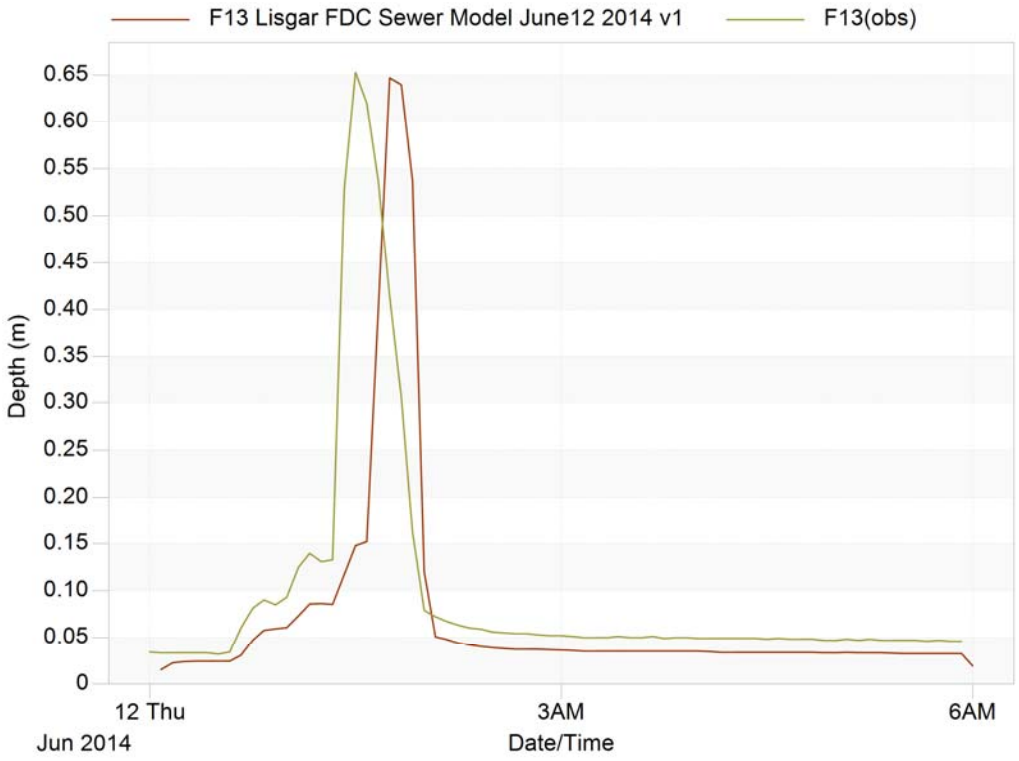



**Figure A4: Simulated Fit for June 12, 2014 Storm Event – Gauge F13**

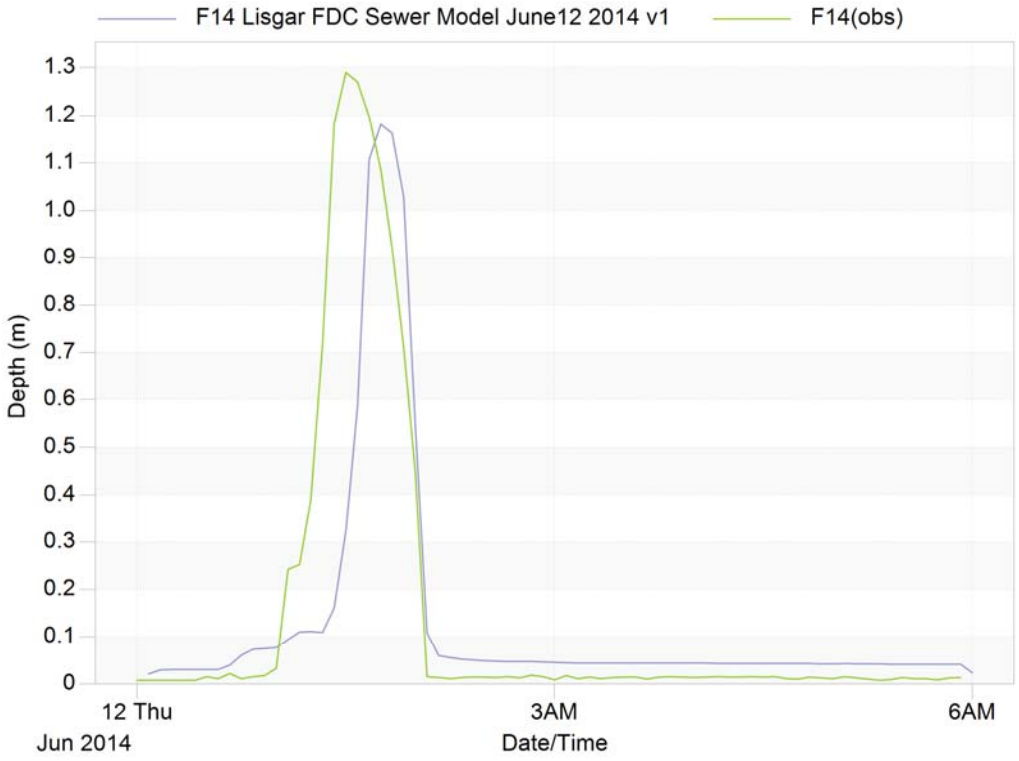



**Figure A5: Simulated Fit for June 12, 2014 Storm Event – Gauge F14**

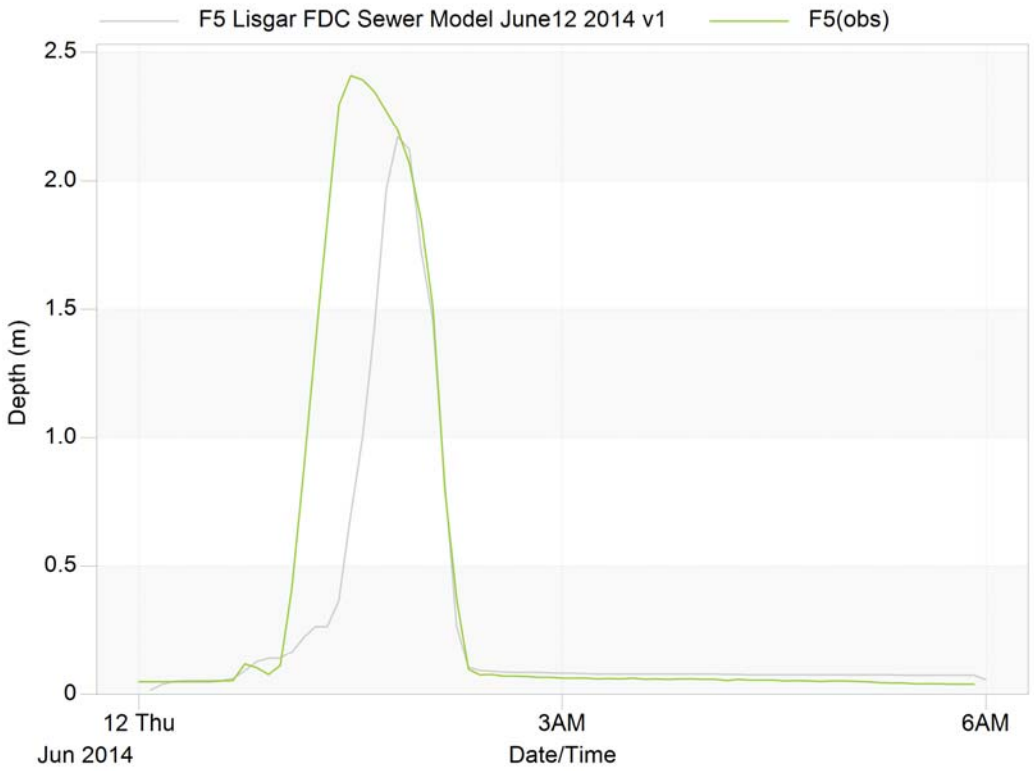



**Figure A6: Simulated Fit for June 12, 2014 Storm Event – Gauge F5**

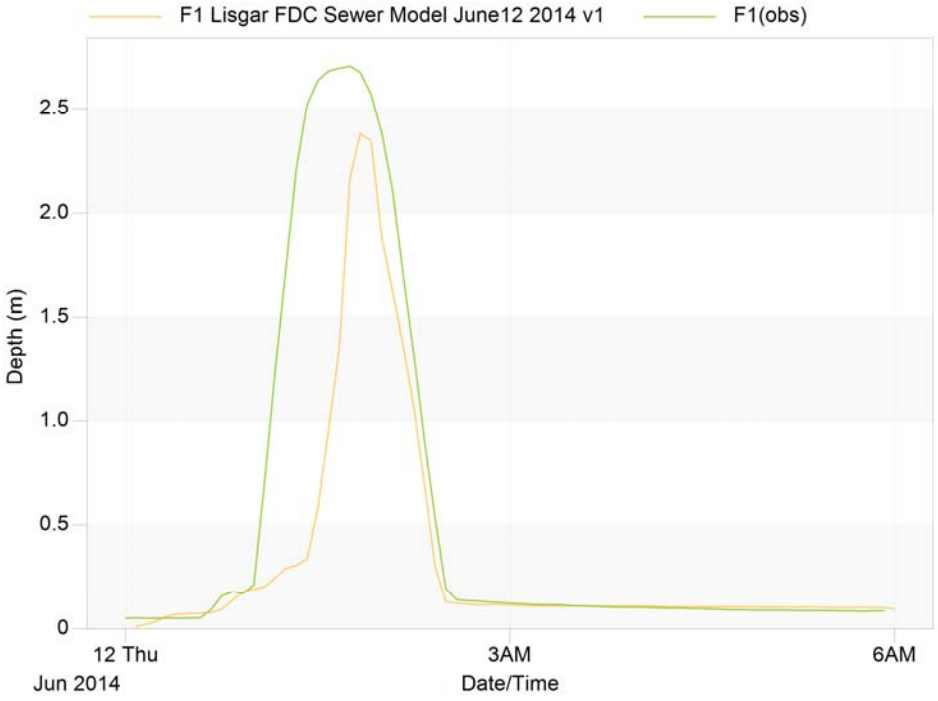



**Figure A7: Simulated Fit for June 12, 2014 Storm Event – Gauge F1**

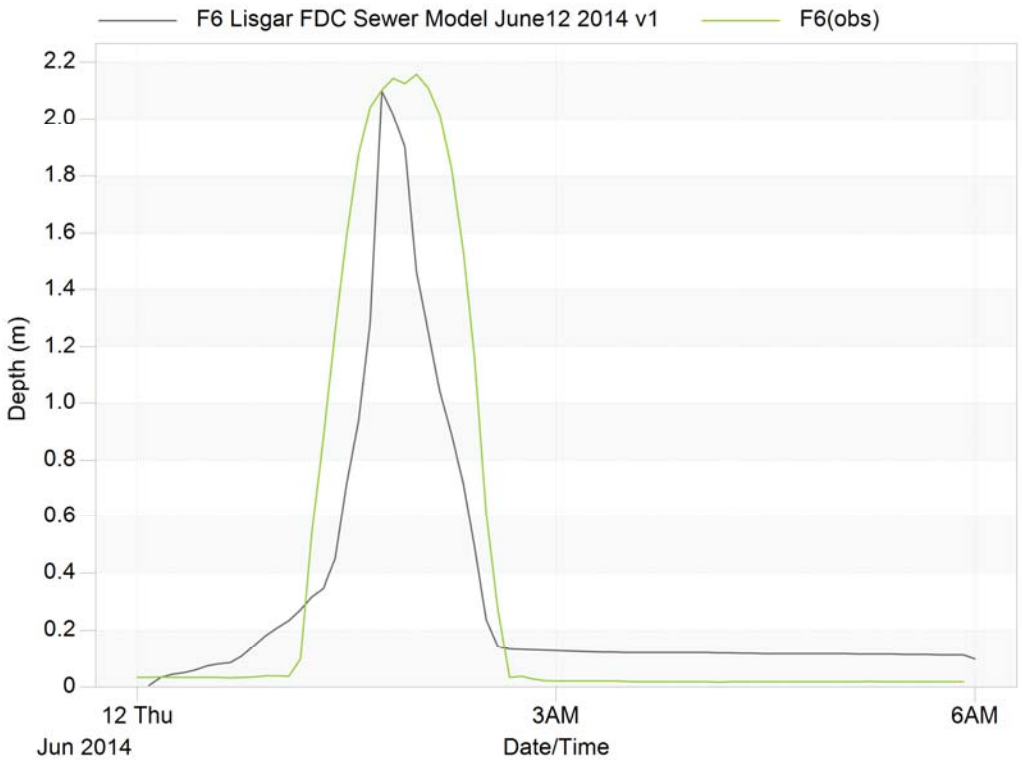



**Figure A8: Simulated Fit for June 12, 2014 Storm Event – Gauge F6**

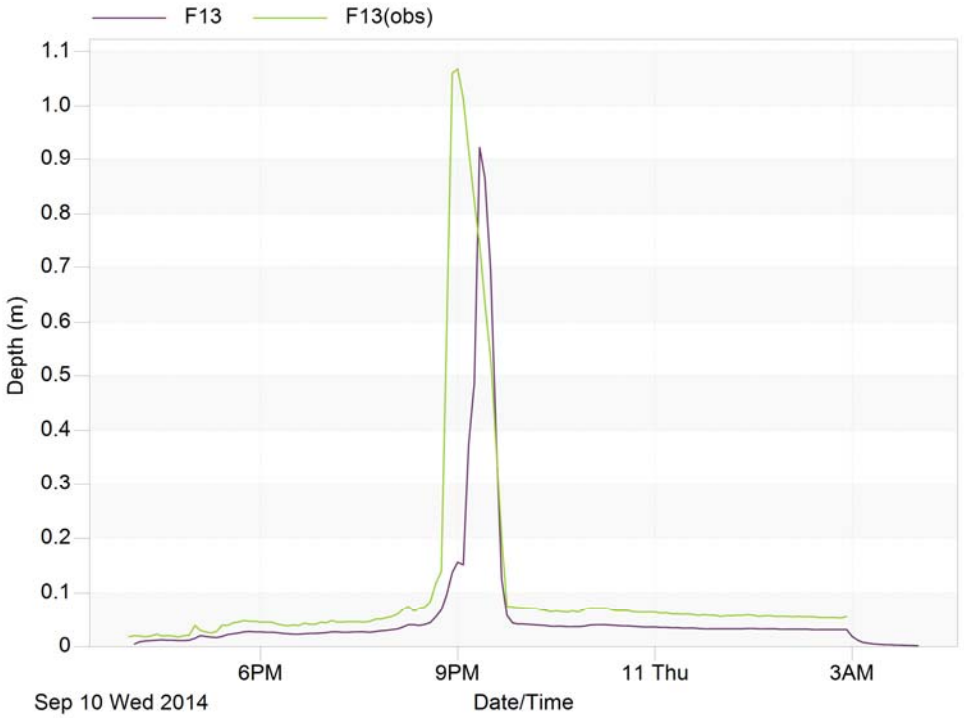



**Figure A9: Simulated Fit for September 10, 2014 Storm Event – Gauge F13**

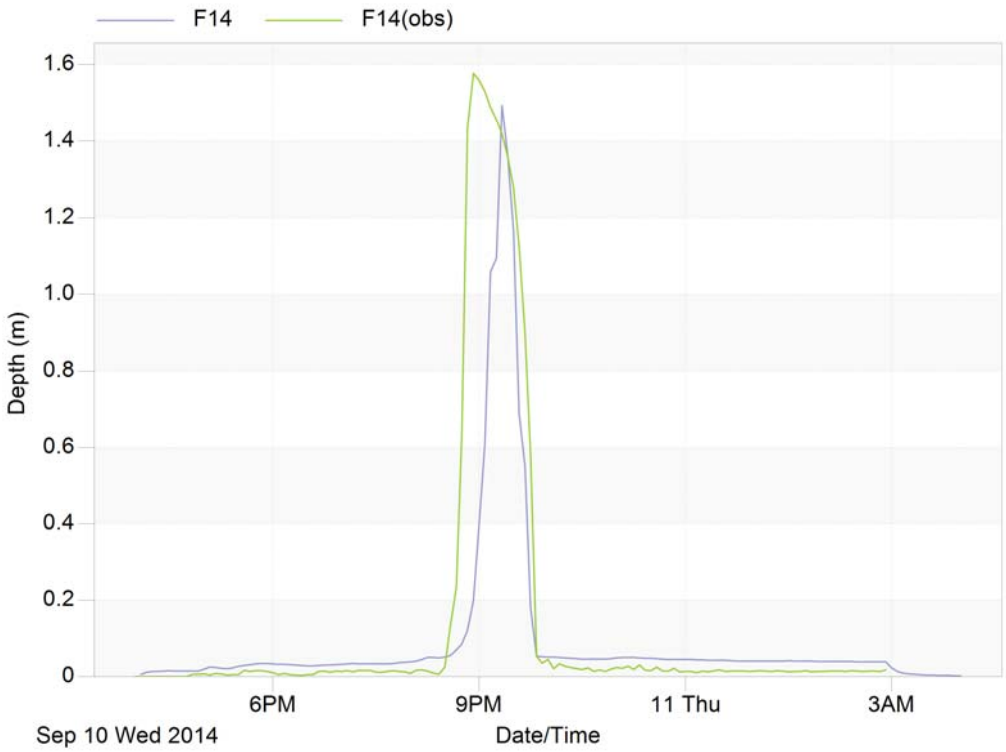



**Figure A10: Simulated Fit for September 10, 2014 Storm Event – Gauge F14**

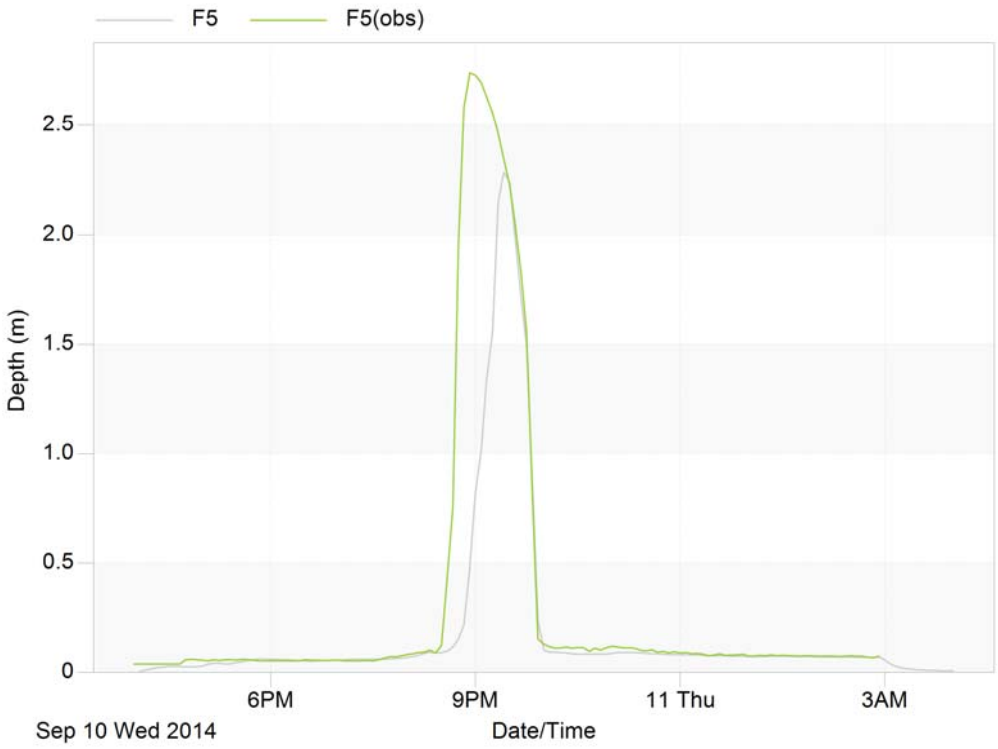



**Figure A11: Simulated Fit for September 10, 2014 Storm Event – Gauge F5**

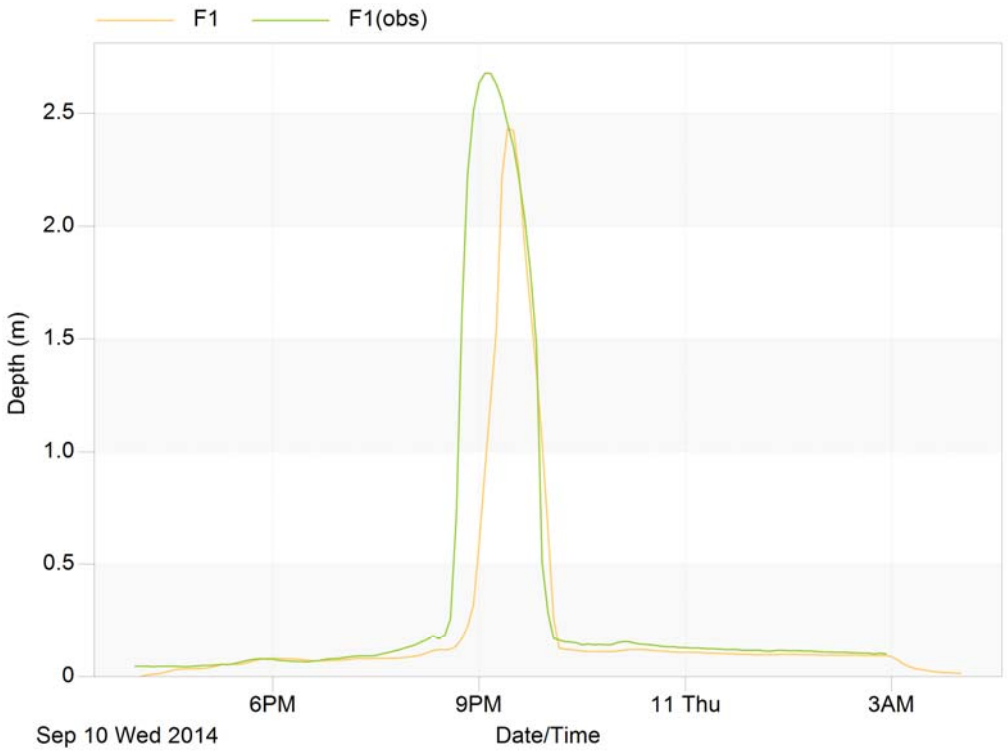



**Figure A12: Simulated Fit for September 10, 2014 Storm Event – Gauge F1**

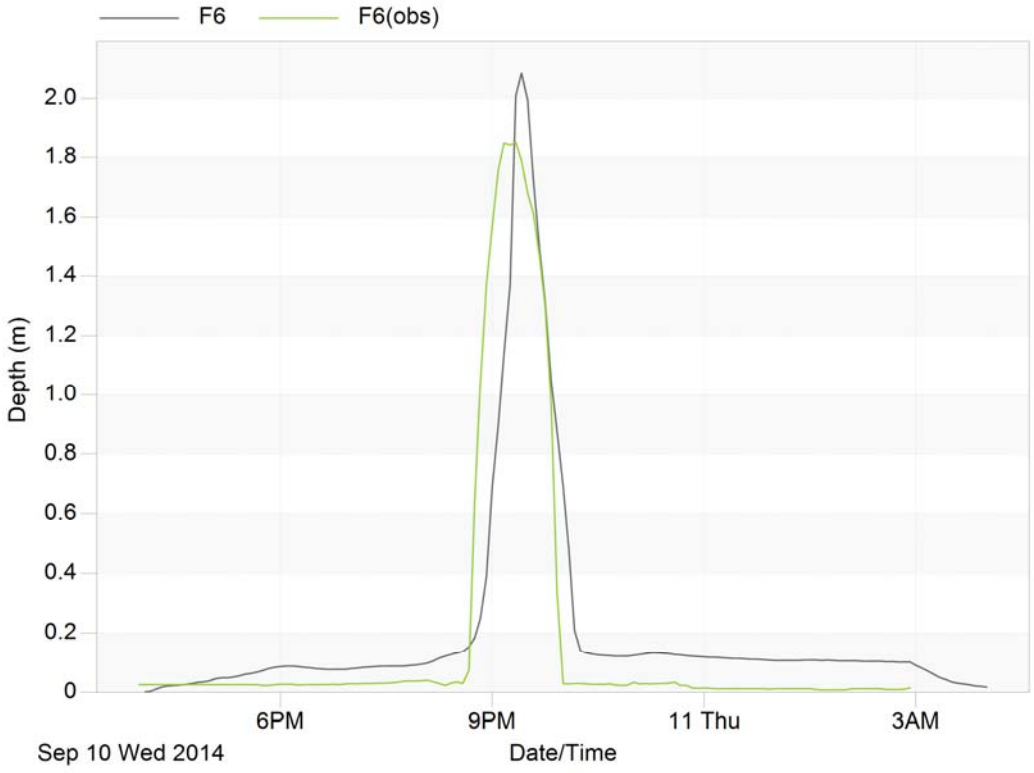



**Figure A13: Simulated Fit for September 10, 2014 Storm Event – Gauge F6**

**Figure A14: Observed Water Levels (Corrected) at FDC Monitoring Sites North of Derry Road for June 12, 2014 event**

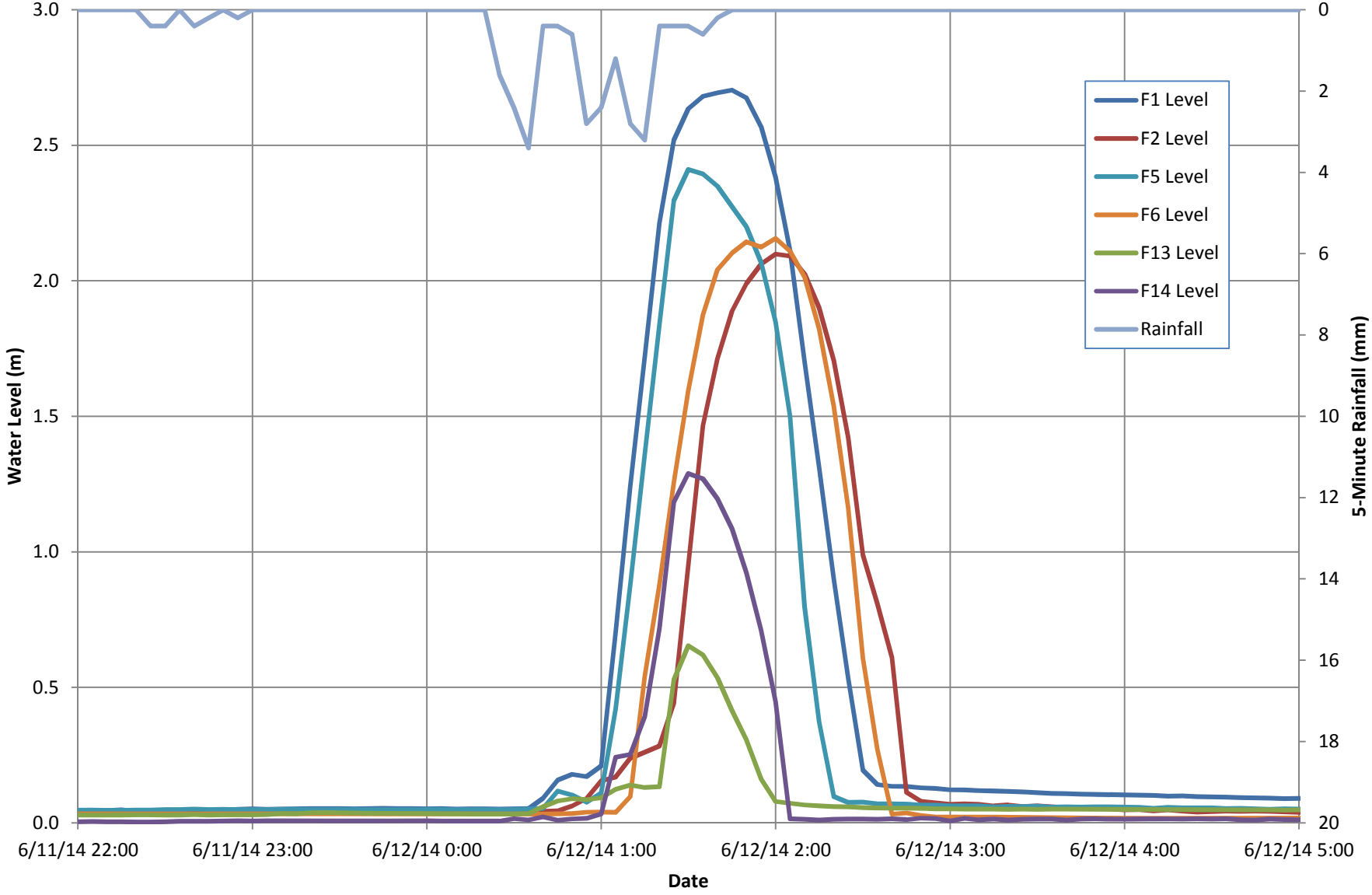
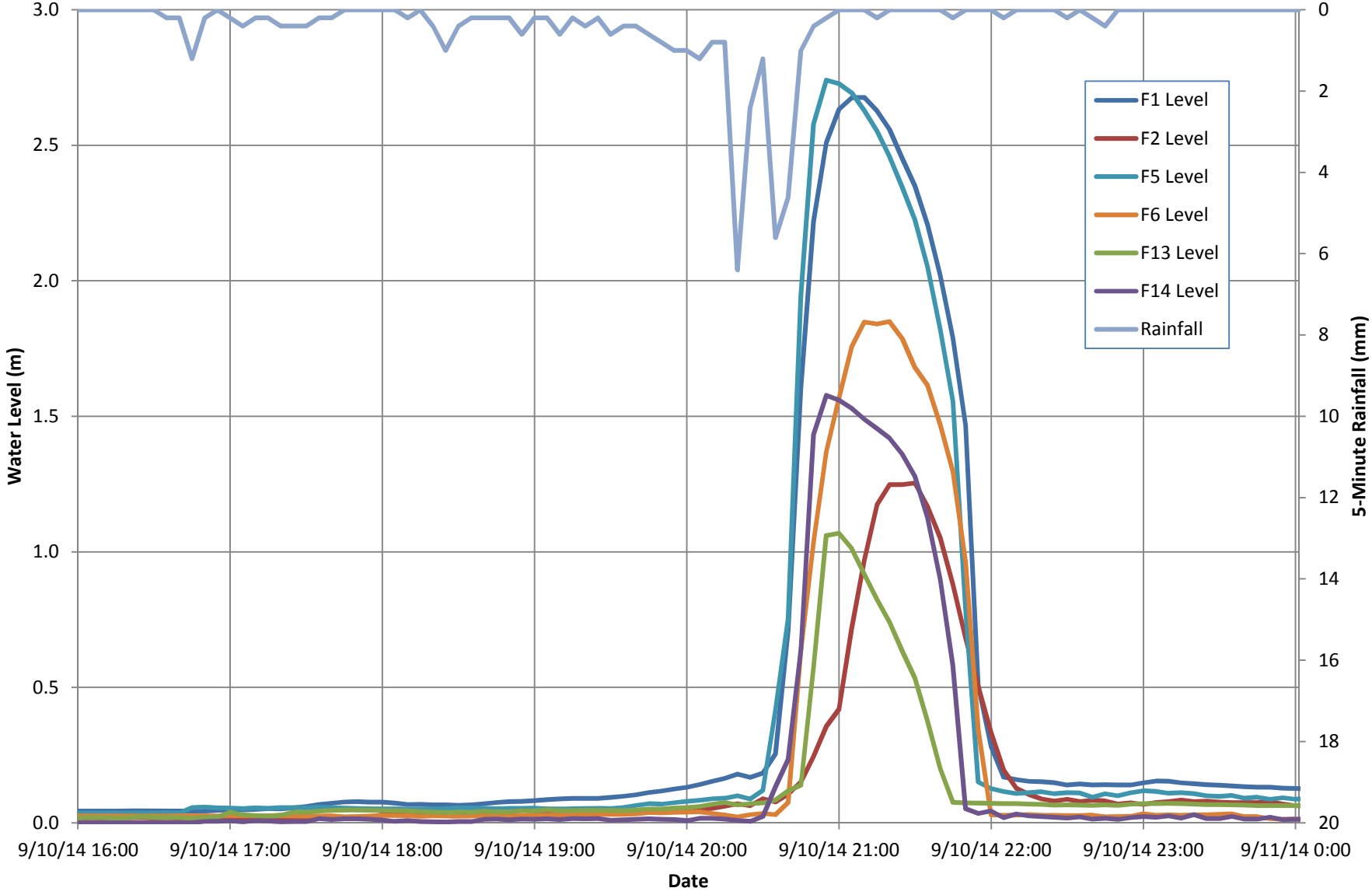


**Figure A15: Observed Water Levels (Corrected) at FDC Monitoring Sites North of Derry Road for September 10, 2014 event**



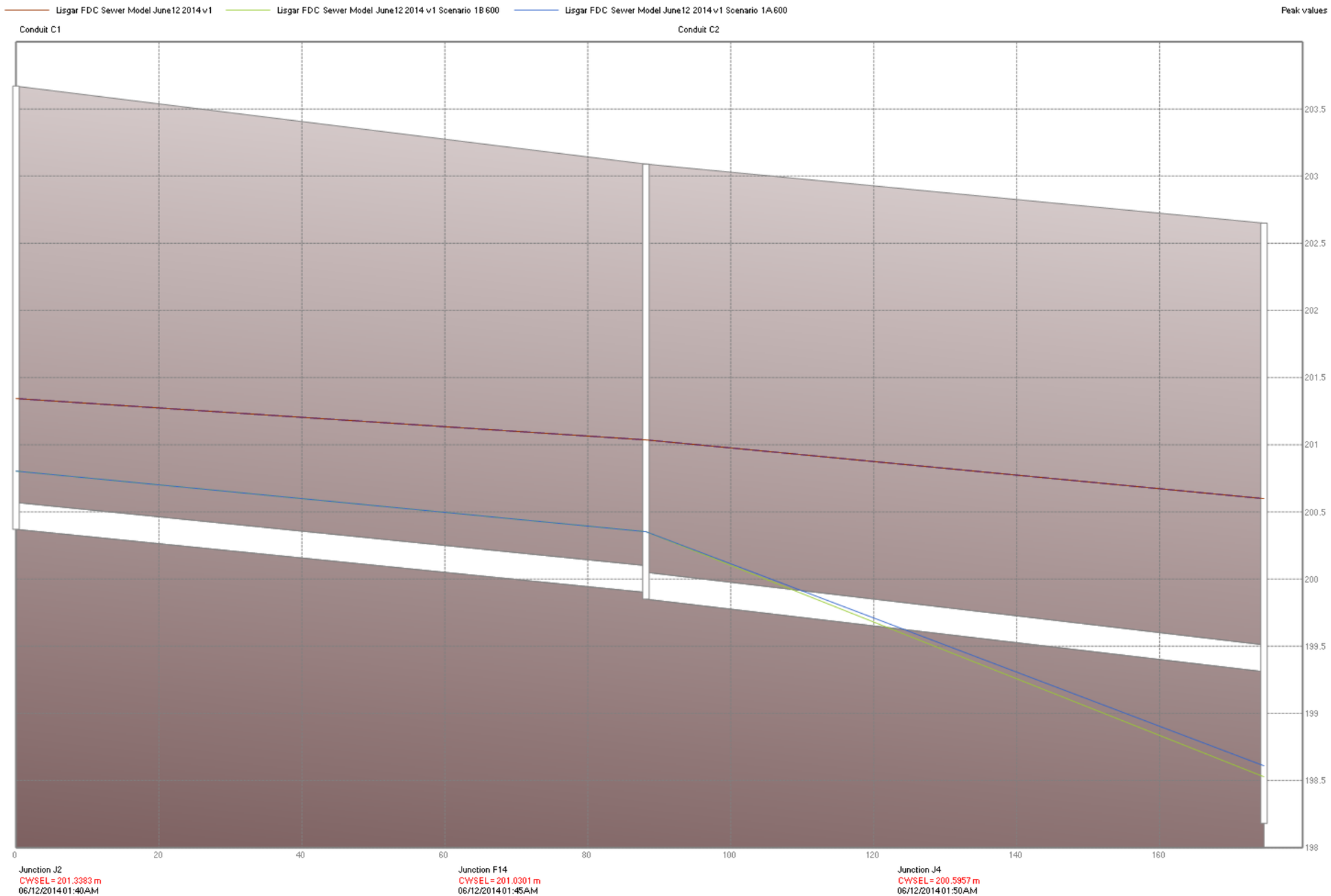



**Figure A16: Simulated HGL upstream of Cactus Gate for June 12, 2014 storm event, with and without pumping station (Options 1A and 1B) in place**

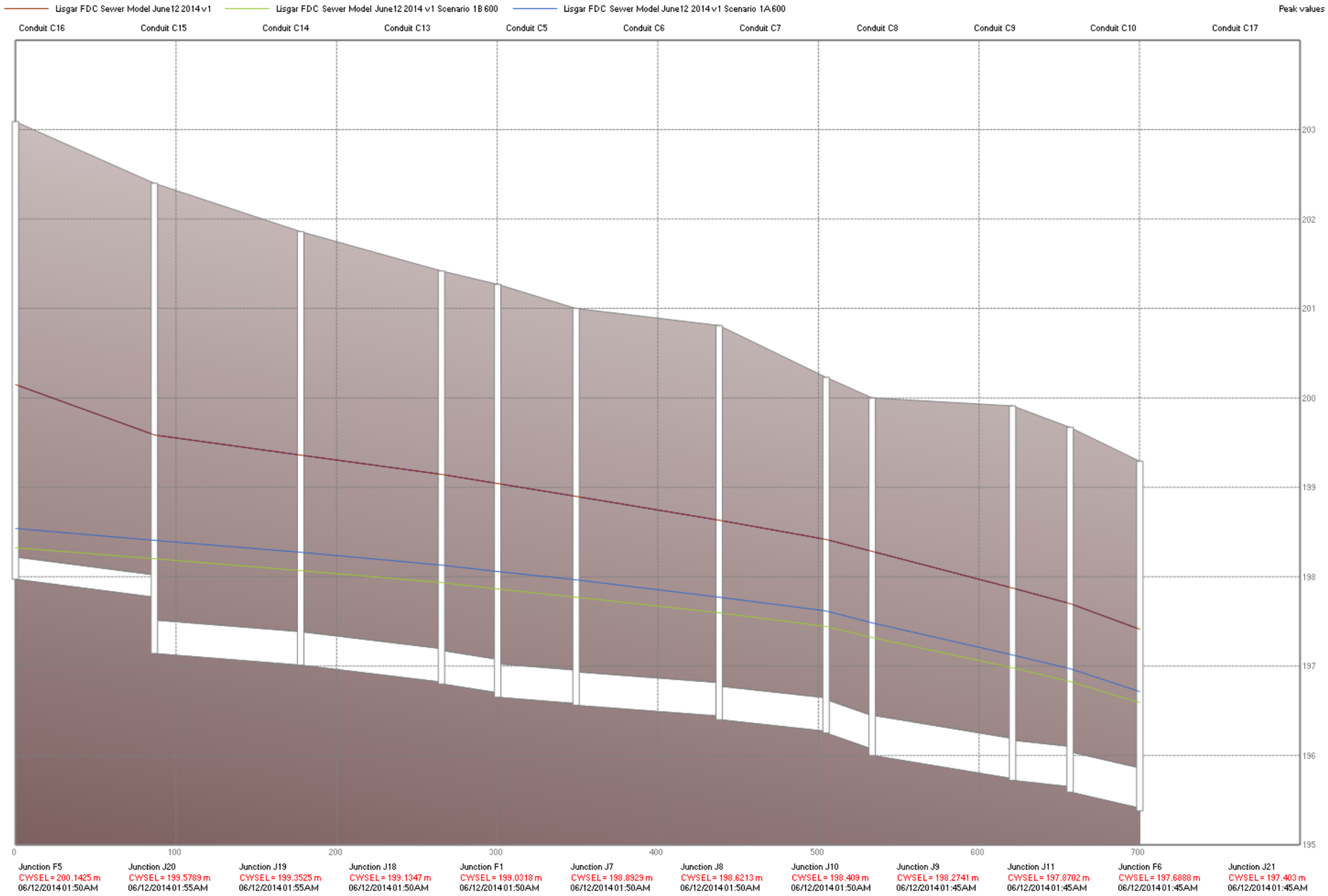



**Figure A17: Simulated HGL downstream of Cactus Gate for June 12, 2014 storm event, with and without pumping station (Options 1A and 1B) in place**

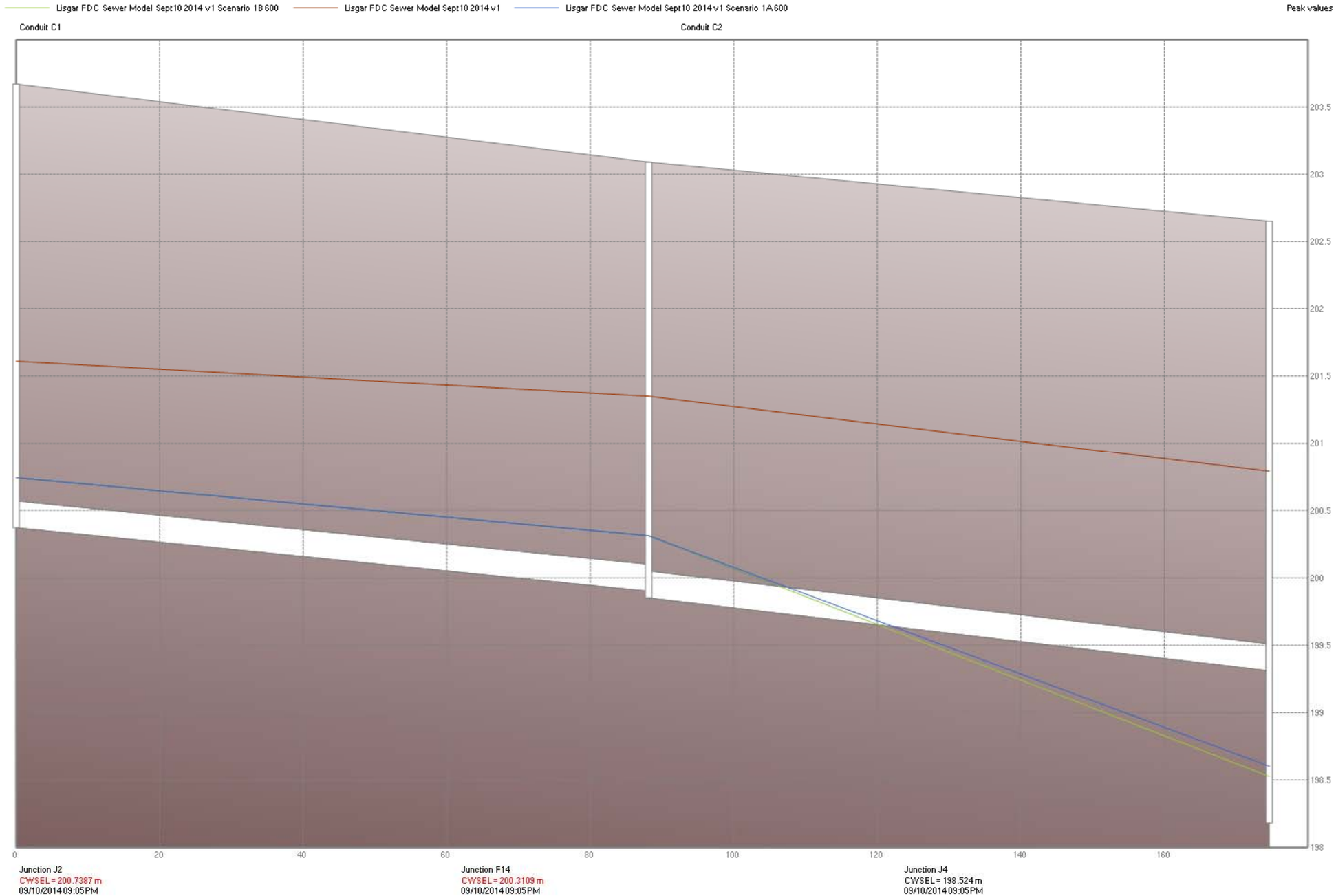



**Figure A18: Simulated HGL upstream of Cactus Gate for September 10, 2014 storm event, with and without pumping station (Options 1A and 1B) in place**

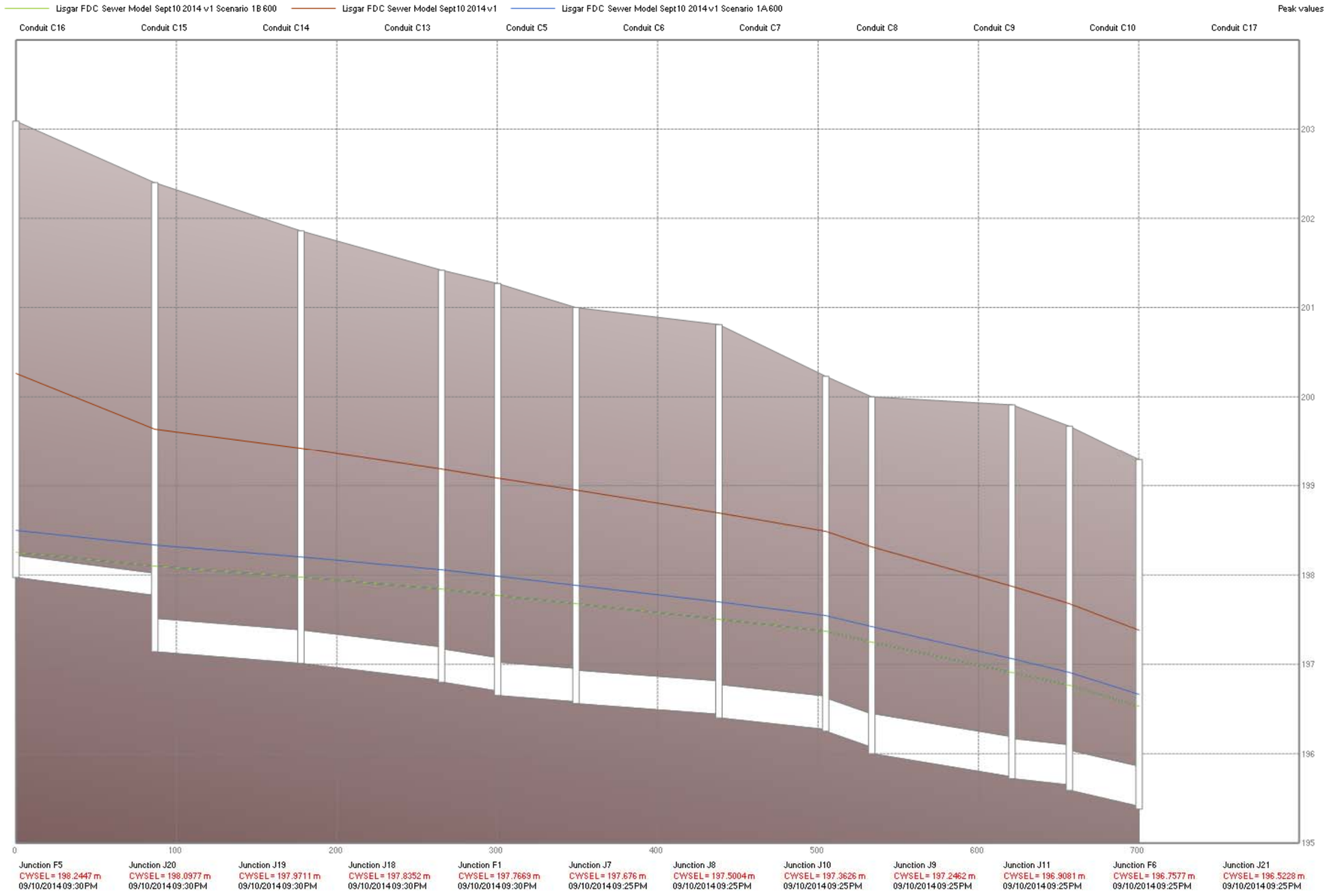



**Figure A19: Simulated HGL downstream of Cactus Gate for September 10, 2014 storm event, with and without pumping station (Options 1A and 1B) in place**

# Appendix B
# Model Calibration Results

**Figure B1: Surface Water Monitoring Gauges near Derry Road and CPR**

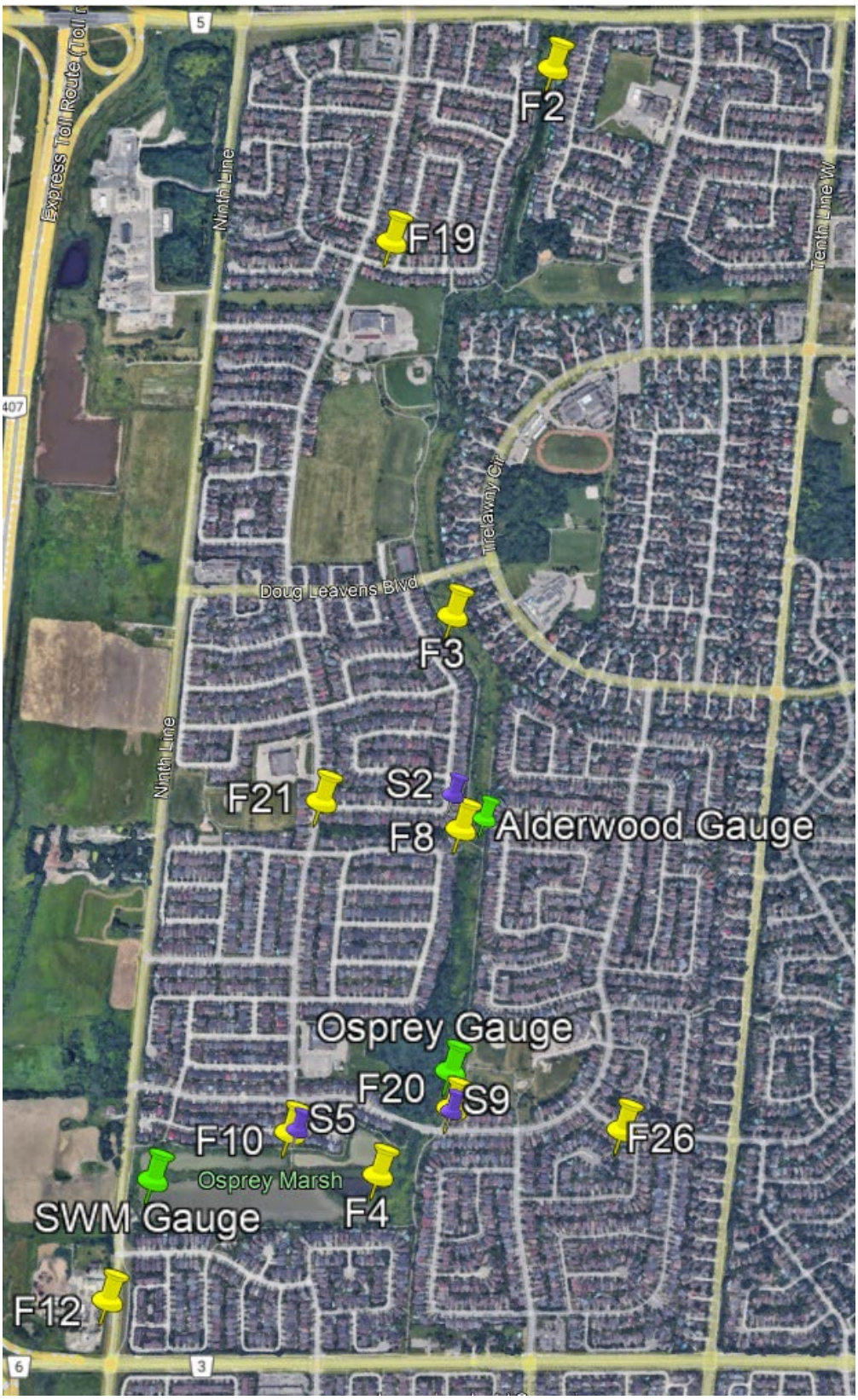
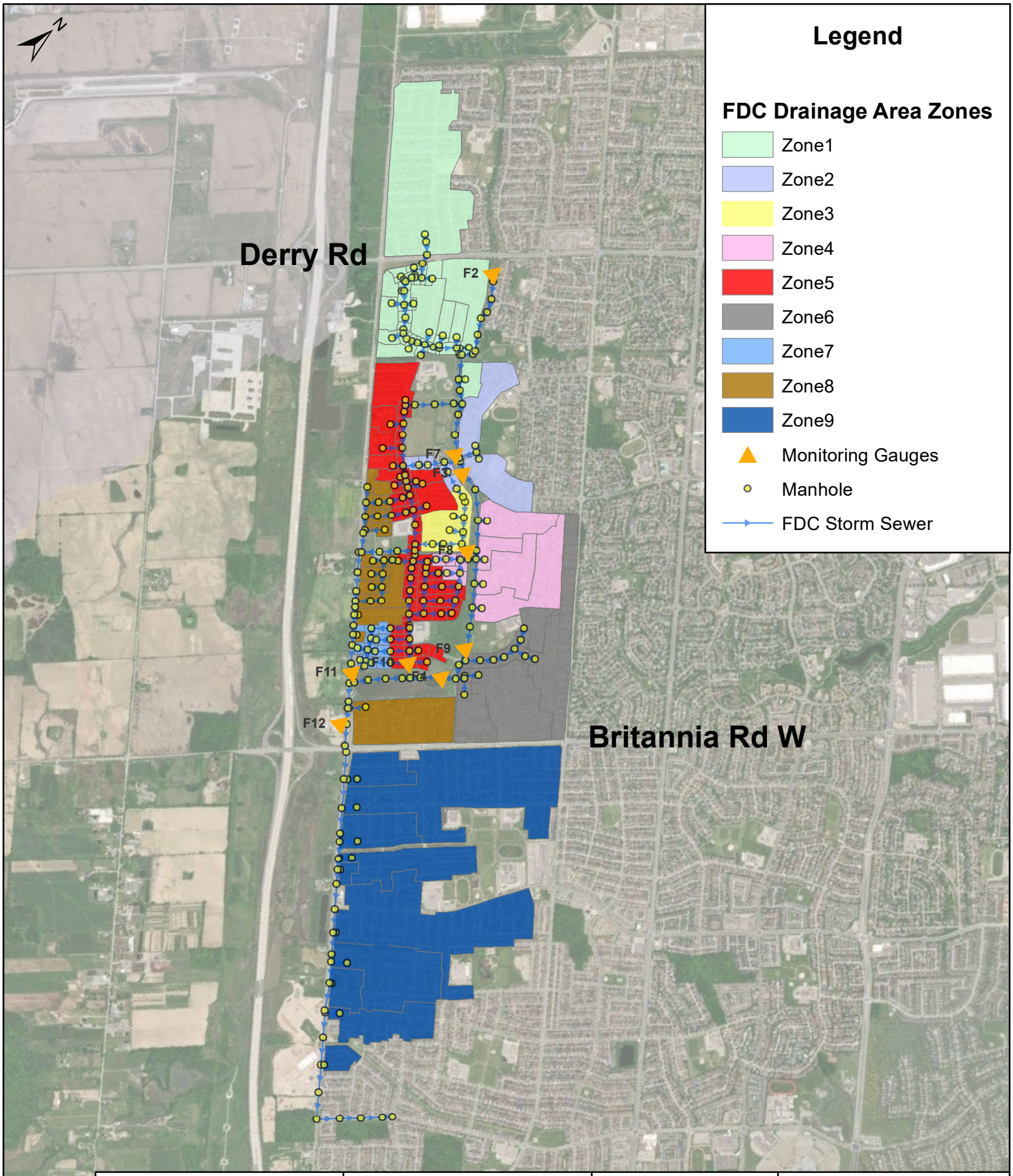
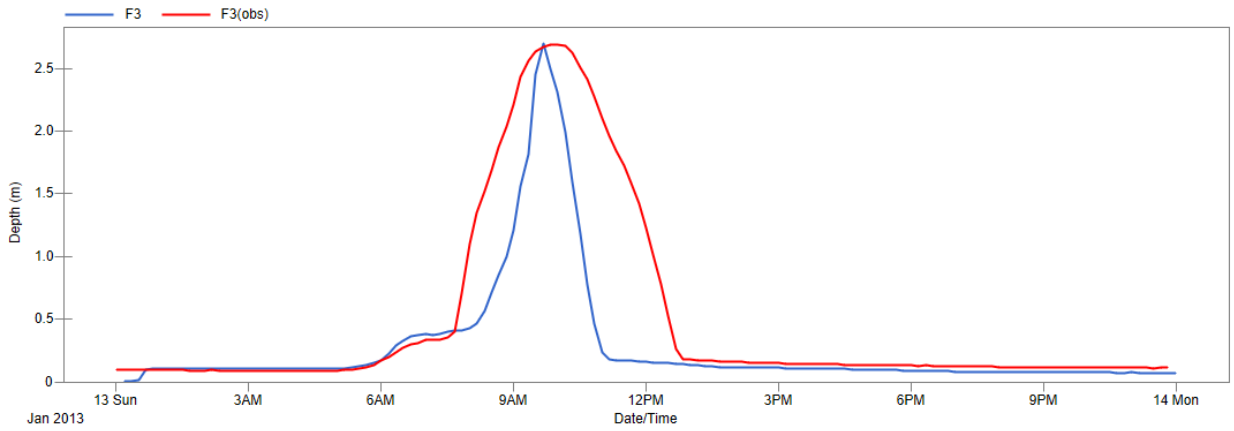


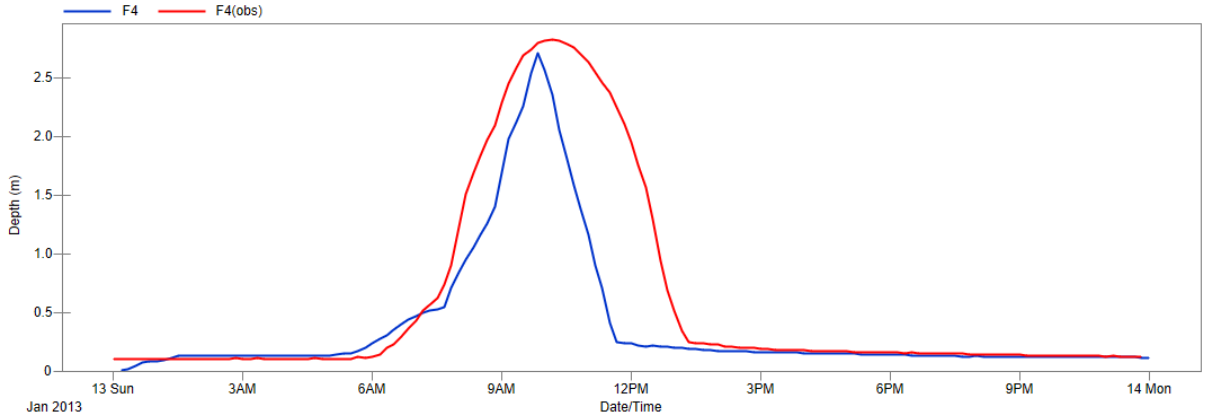

**Figure B2: Surface Water Monitoring Gauges between Derry Road and Britannia Road**

**Figure B3: Surface Water Monitoring Gauges south of Britannia Road**




| | | | |
|---|---|---|---|
| **Lisgar**<br>**City of Mississauga** | **FDC Drainage Area Zones**<br>**13-January-2013** | wood. | Scale **1:30,000**<br>Project No. **WW21011023**<br>Figure No. **1** |


F3
F3(obs)
Depth (m)
2.5
2.0
1.5
1.0
0.5
0
13 Sun
Jan 2013
3AM
6AM
9AM
12PM
3PM
6PM
9PM
14 Mon
Date/Time


F4
F4(obs)
Depth (m)
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2.0
1.5
1.0
0.5
0
13 Sun
Jan 2013
3AM
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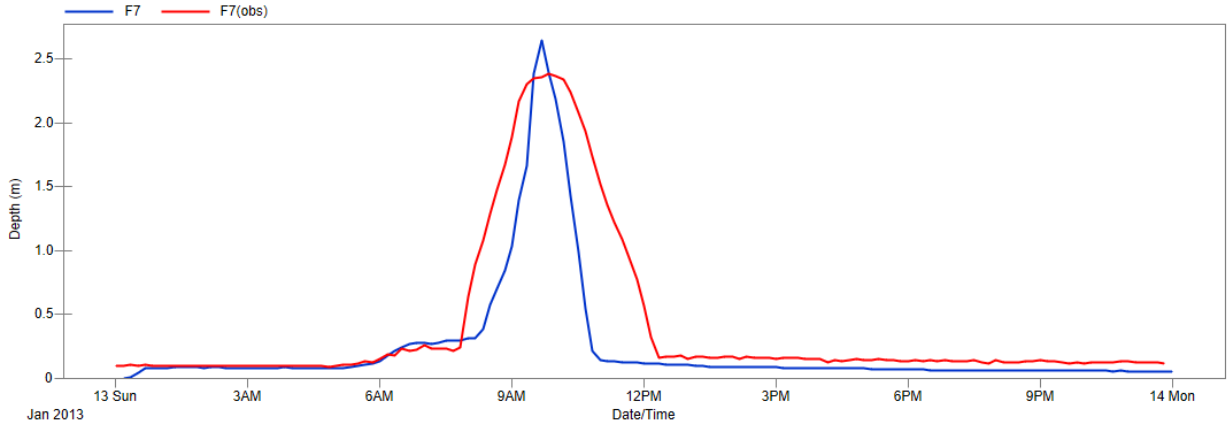
6PM
9PM
14 Mon
Date/Time


F7
F7(obs)
Depth (m)
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1.0
0.5
0
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Jan 2013
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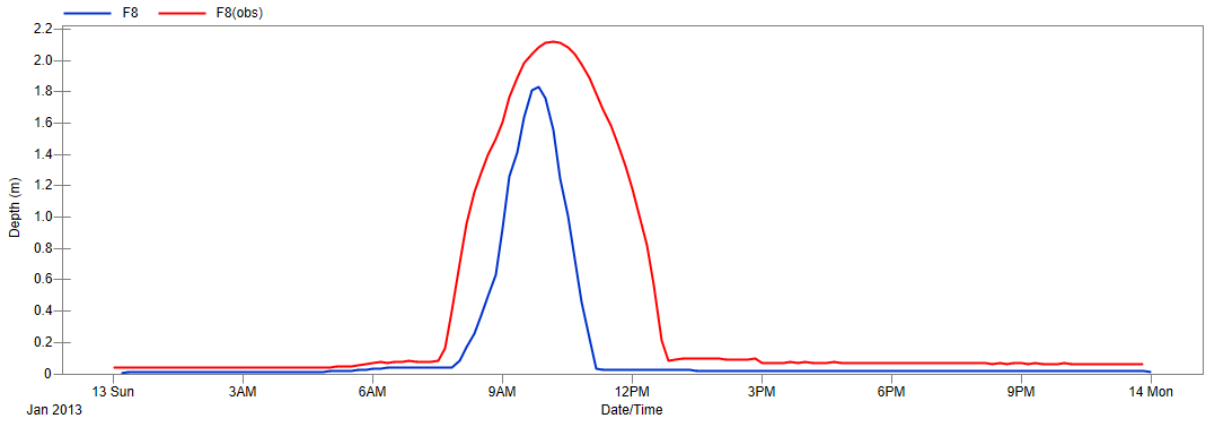
6PM
9PM
14 Mon
Date/Time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F8(obs)
Depth (m)
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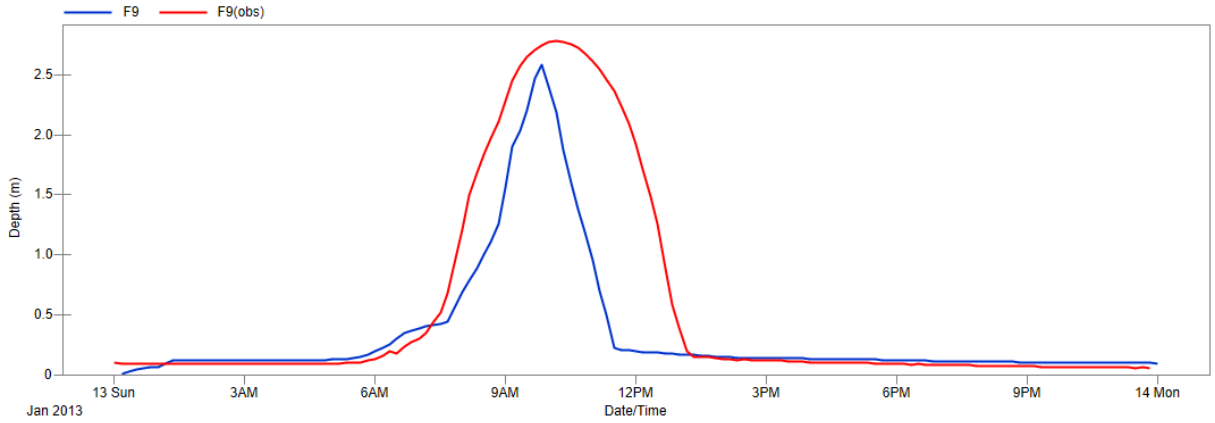
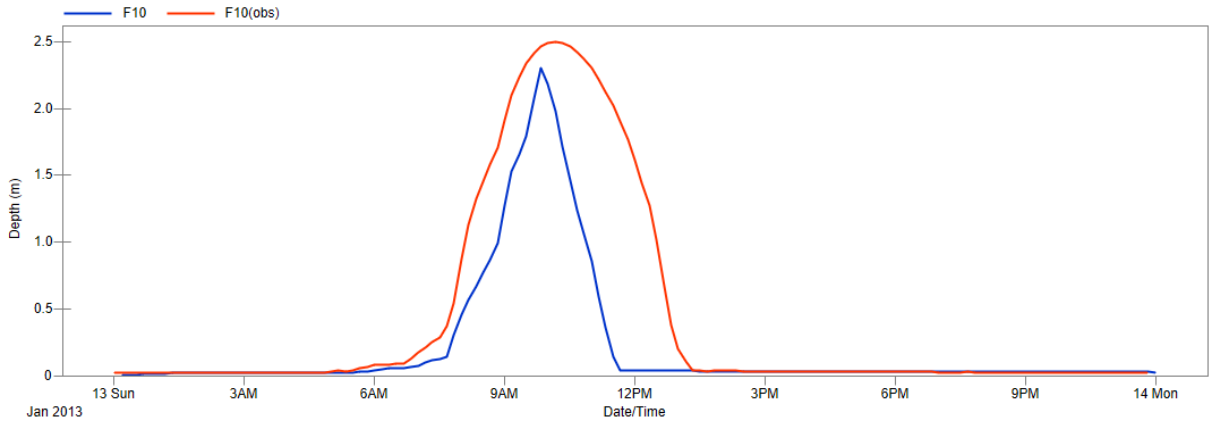
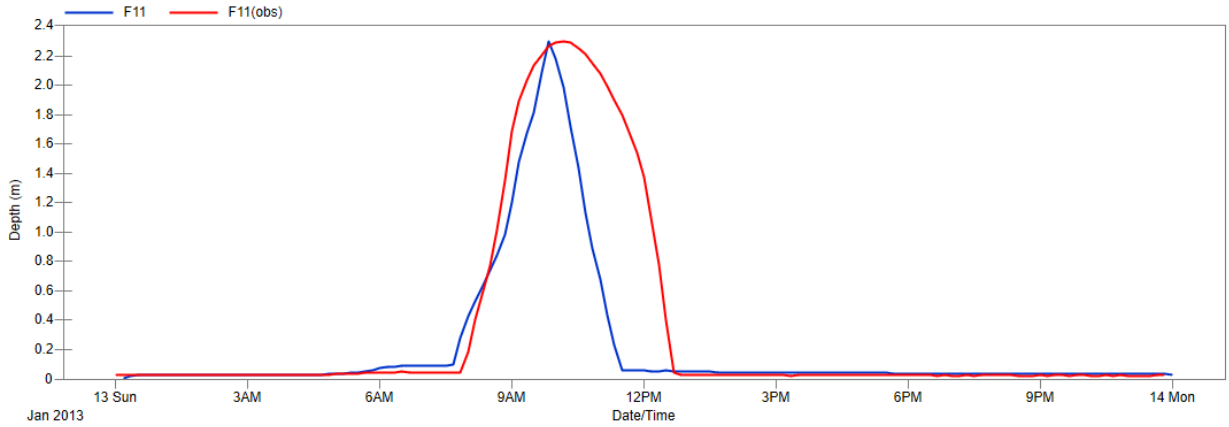
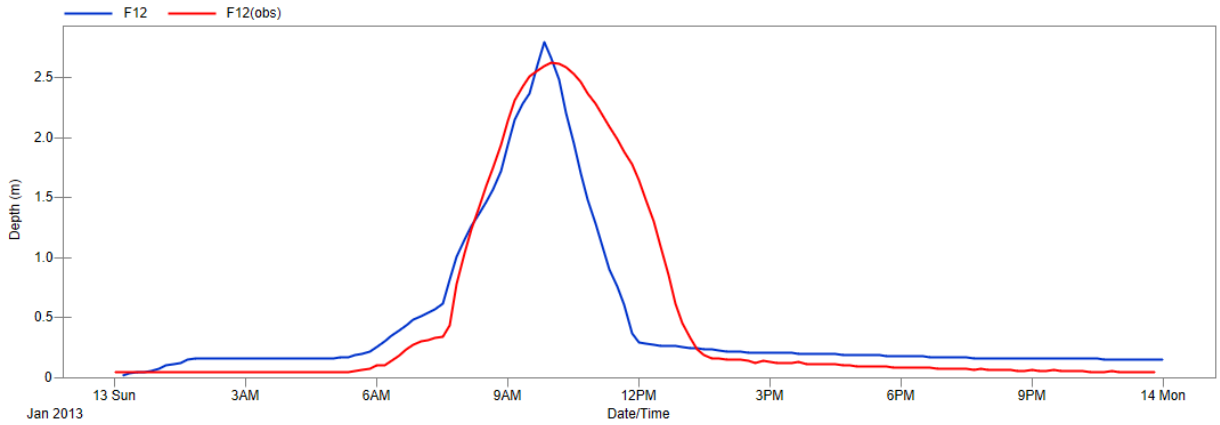
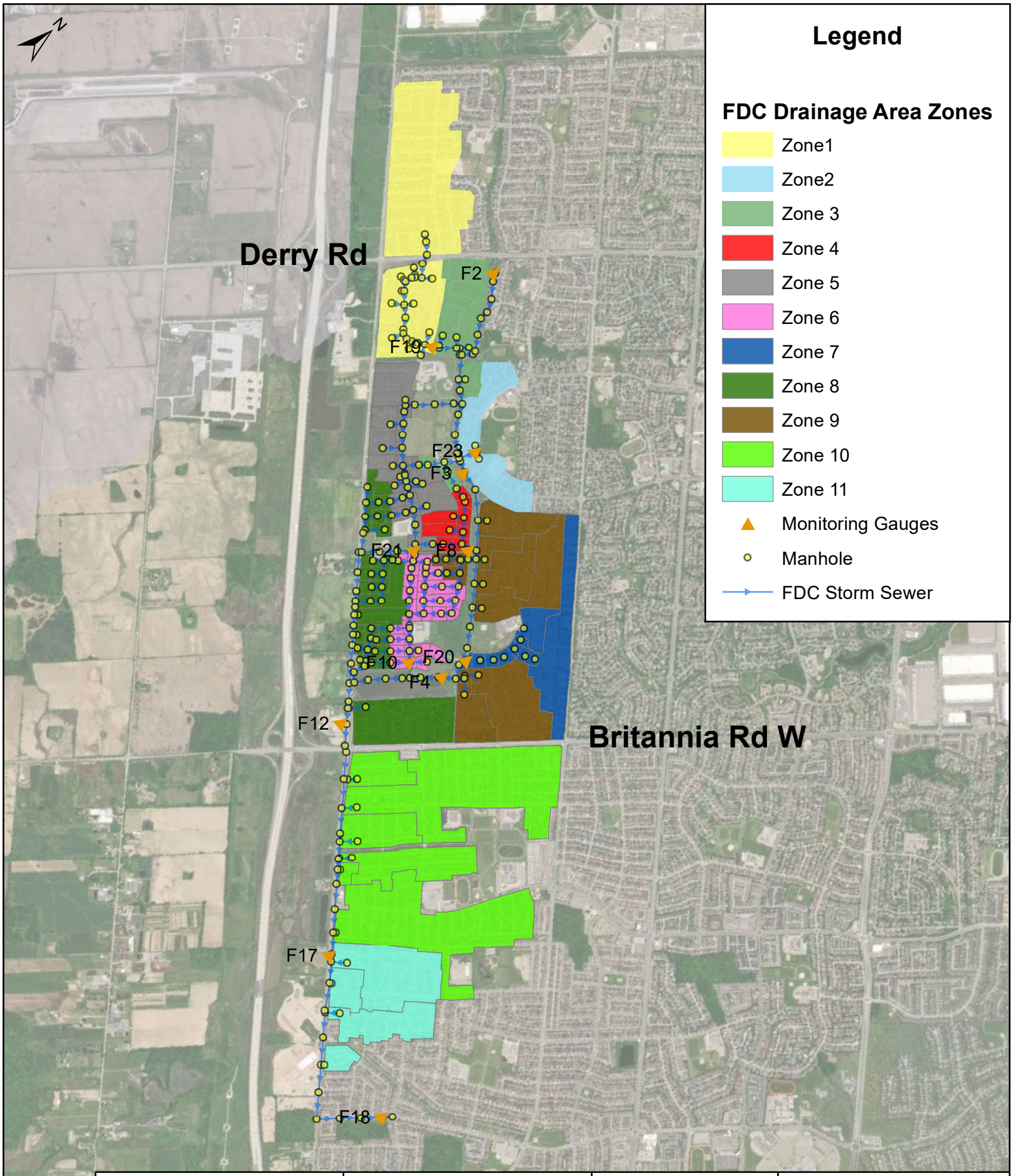
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
13 Sun
Jan 2013
3AM
6AM
9AM
12PM
3PM
6PM
9PM
14 Mon
Date/Time


F9
F9(obs)
Depth (m)
2.5
2.0
1.5
1.0
0.5
0
13 Sun
Jan 2013
3AM
6AM
9AM
12PM
3PM
6PM
9PM
14 Mon
Date/Time

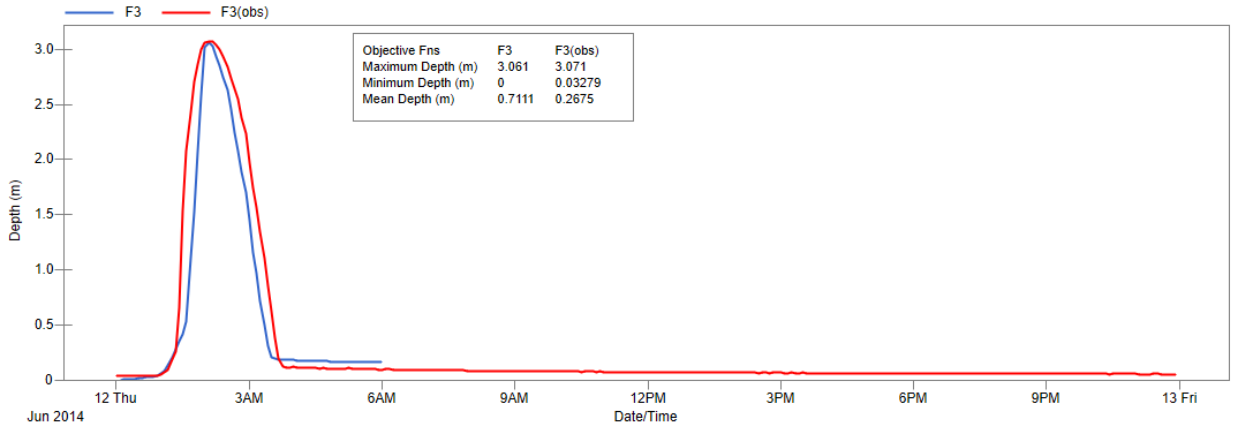

F10
F10(obs)
Depth (m)
2.5
2.0
1.5
1.0
0.5
0
13 Sun
Jan 2013
3AM
6AM
9AM
12PM
3PM
6PM
9PM
14 Mon
Date/Time

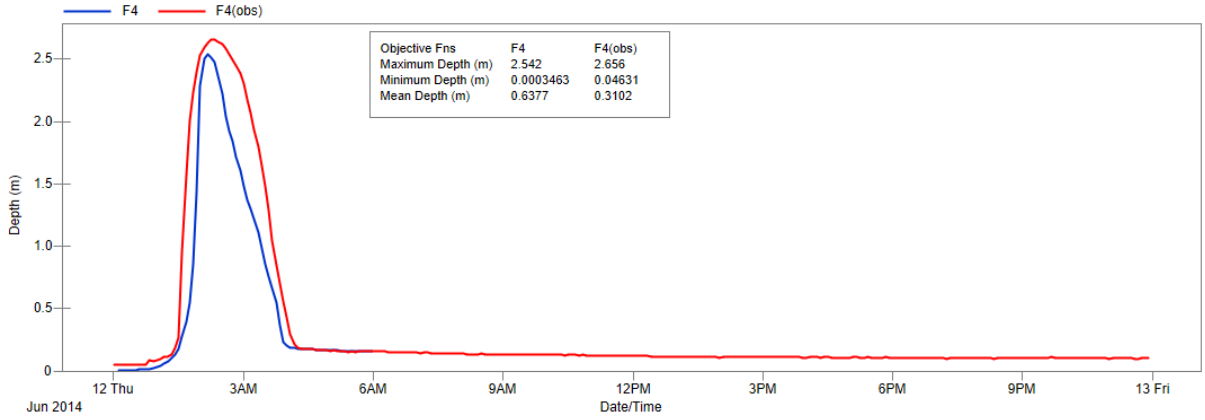

F11
F11(obs)
Depth (m)
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
13 Sun
Jan 2013
3AM
6AM
9AM
12PM
3PM
6PM
9PM
14 Mon
Date/Time

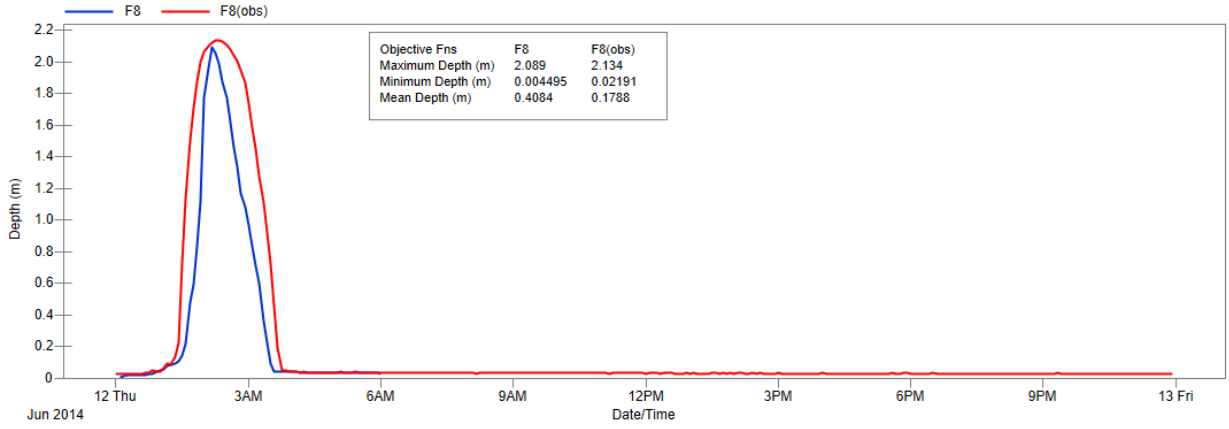

F12
F12(obs)
Depth (m)
2.5
2.0
1.5
1.0
0.5
0
13 Sun
Jan 2013
3AM
6AM
9AM
12PM
3PM
6PM
9PM
14 Mon
Date/Time

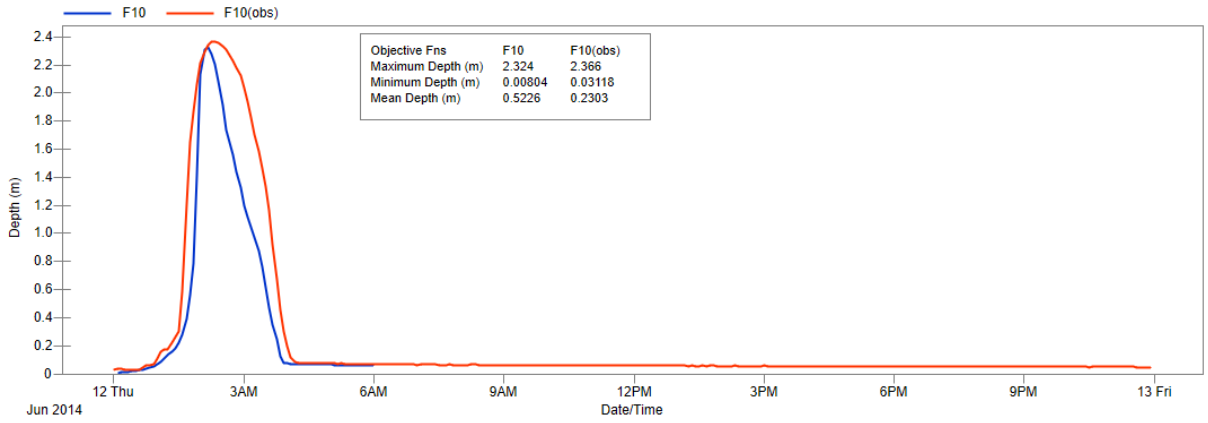


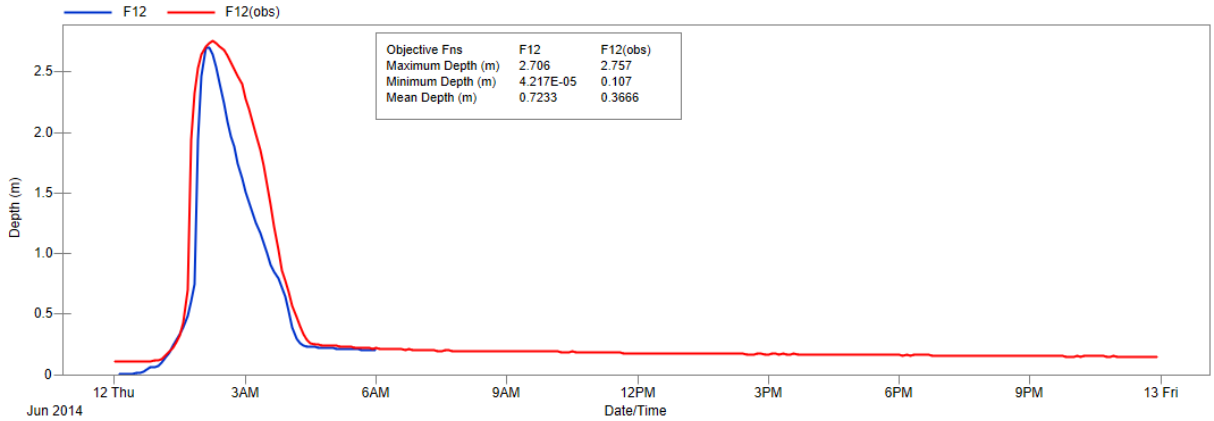

| | | | |
|---|---|---|---|
| **Lisgar**<br>**City of Mississauga** | **FDC Drainage Area Zones**<br>**12-June-2014** | wood. | Scale **1:30,000**<br>Project No. **WW21011023**<br>Figure No. **2** |

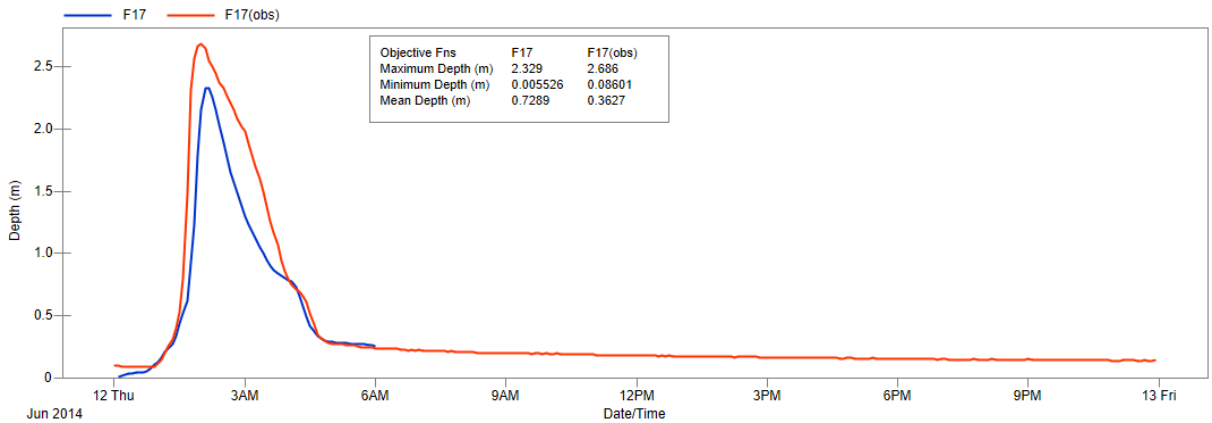

F3
F3(obs)
Objective Fns F3 F3(obs)
Maximum Depth (m) 3.061 3.071
Minimum Depth (m) 0 0.03279
Mean Depth (m) 0.7111 0.2675
Depth (m)
3.0
2.5
2.0
1.5
1.0
0.5
0
12 Thu
Jun 2014
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Fri
Date/Time

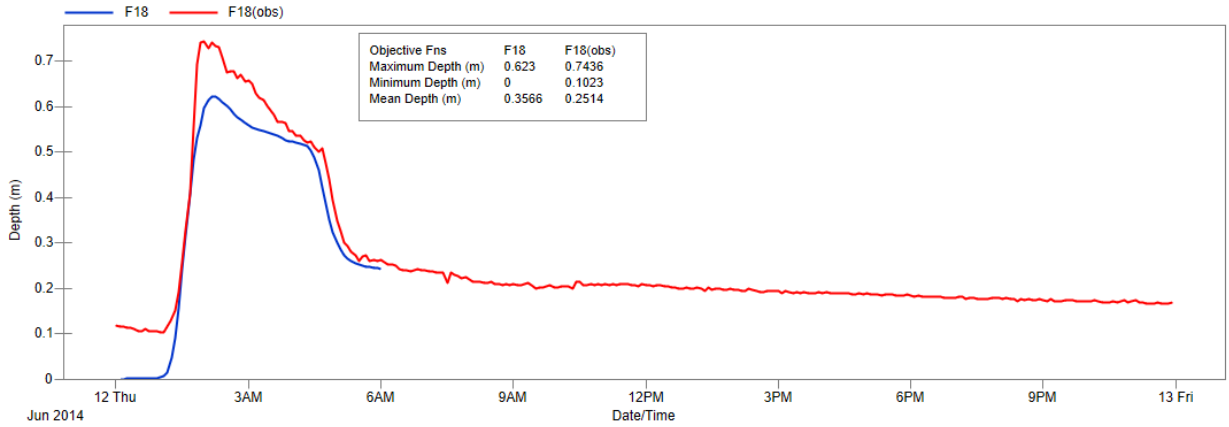

F4
F4(obs)
Objective Fns F4 F4(obs)
Maximum Depth (m) 2.542 2.656
Minimum Depth (m) 0.0003463 0.04631
Mean Depth (m) 0.6377 0.3102
Depth (m)
2.5
2.0
1.5
1.0
0.5
0
12 Thu
Jun 2014
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Fri
Date/Time

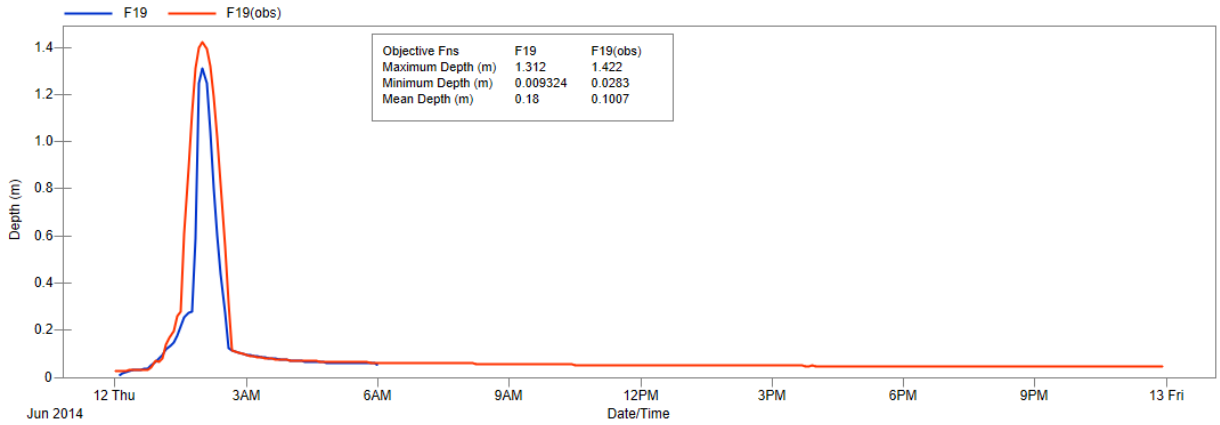

F8
F8(obs)
Objective Fns F8 F8(obs)
Maximum Depth (m) 2.089 2.134
Minimum Depth (m) 0.004495 0.02191
Mean Depth (m) 0.4084 0.1788
Depth (m)
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
12 Thu
Jun 2014
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Fri
Date/Time

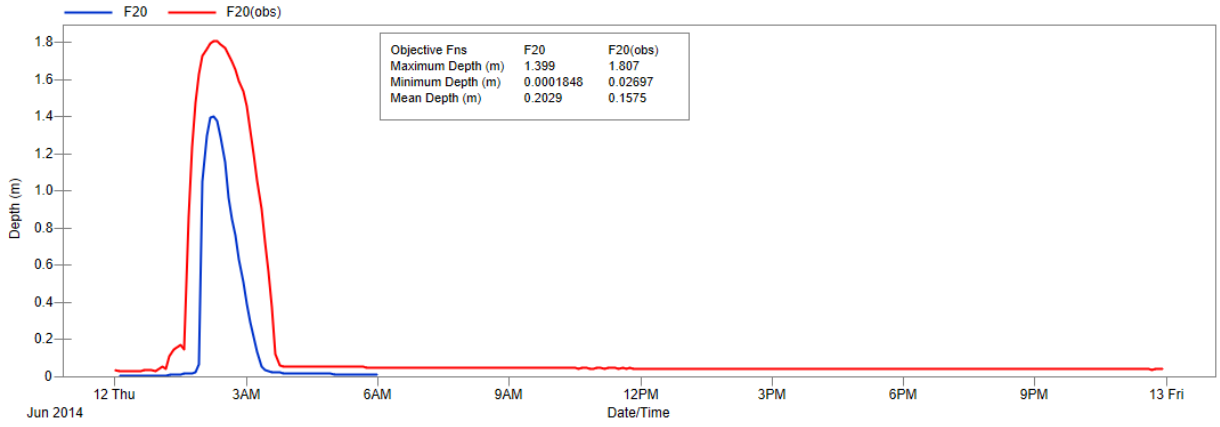

F10
F10(obs)
Objective Fns F10 F10(obs)
Maximum Depth (m) 2.324 2.366
Minimum Depth (m) 0.00804 0.03118
Mean Depth (m) 0.5226 0.2303
Depth (m)
0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4
12 Thu
Jun 2014
3AM 6AM 9AM 12PM 3PM 6PM 9PM
13 Fri
Date/Time

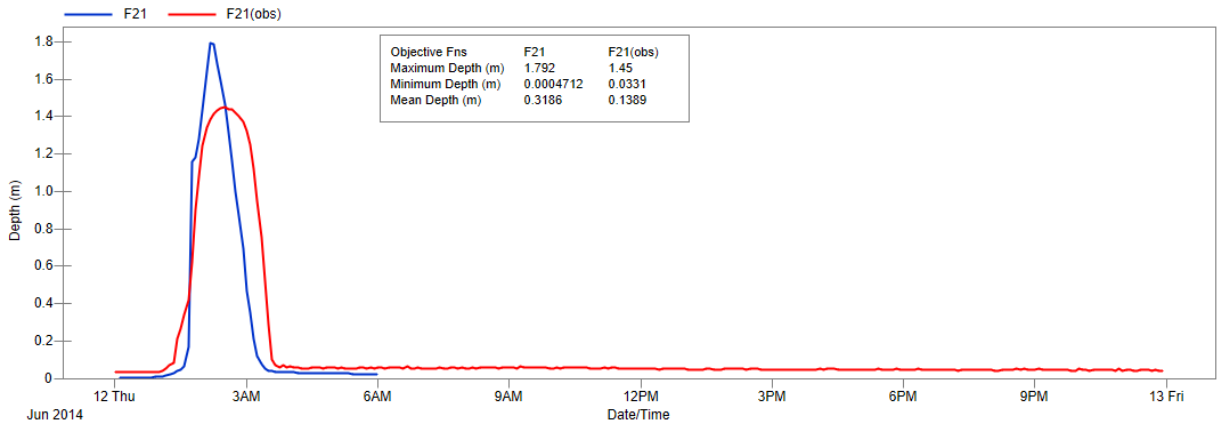

F12
F12(obs)
Objective Fns F12 F12(obs)
Maximum Depth (m) 2.706 2.757
Minimum Depth (m) 4.217E-05 0.107
Mean Depth (m) 0.7233 0.3666
Depth (m)
0 0.5 1.0 1.5 2.0 2.5
12 Thu
Jun 2014
3AM 6AM 9AM 12PM 3PM 6PM 9PM
13 Fri
Date/Time

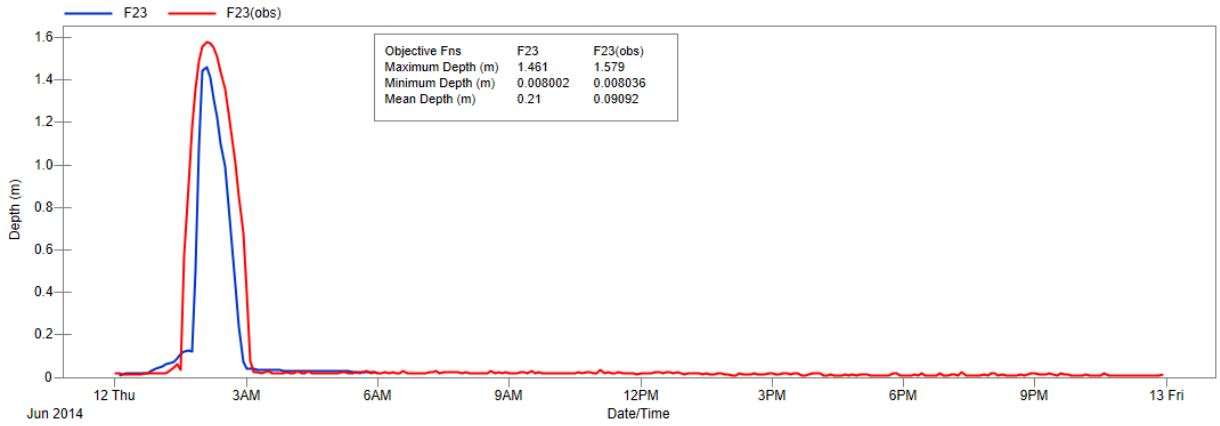

F17
F17(obs)
Objective Fns F17 F17(obs)
Maximum Depth (m) 2.329 2.686
Minimum Depth (m) 0.005526 0.08601
Mean Depth (m) 0.7289 0.3627
Depth (m)
0 0.5 1.0 1.5 2.0 2.5
12 Thu
Jun 2014
3AM 6AM 9AM 12PM 3PM 6PM 9PM
13 Fri
Date/Time

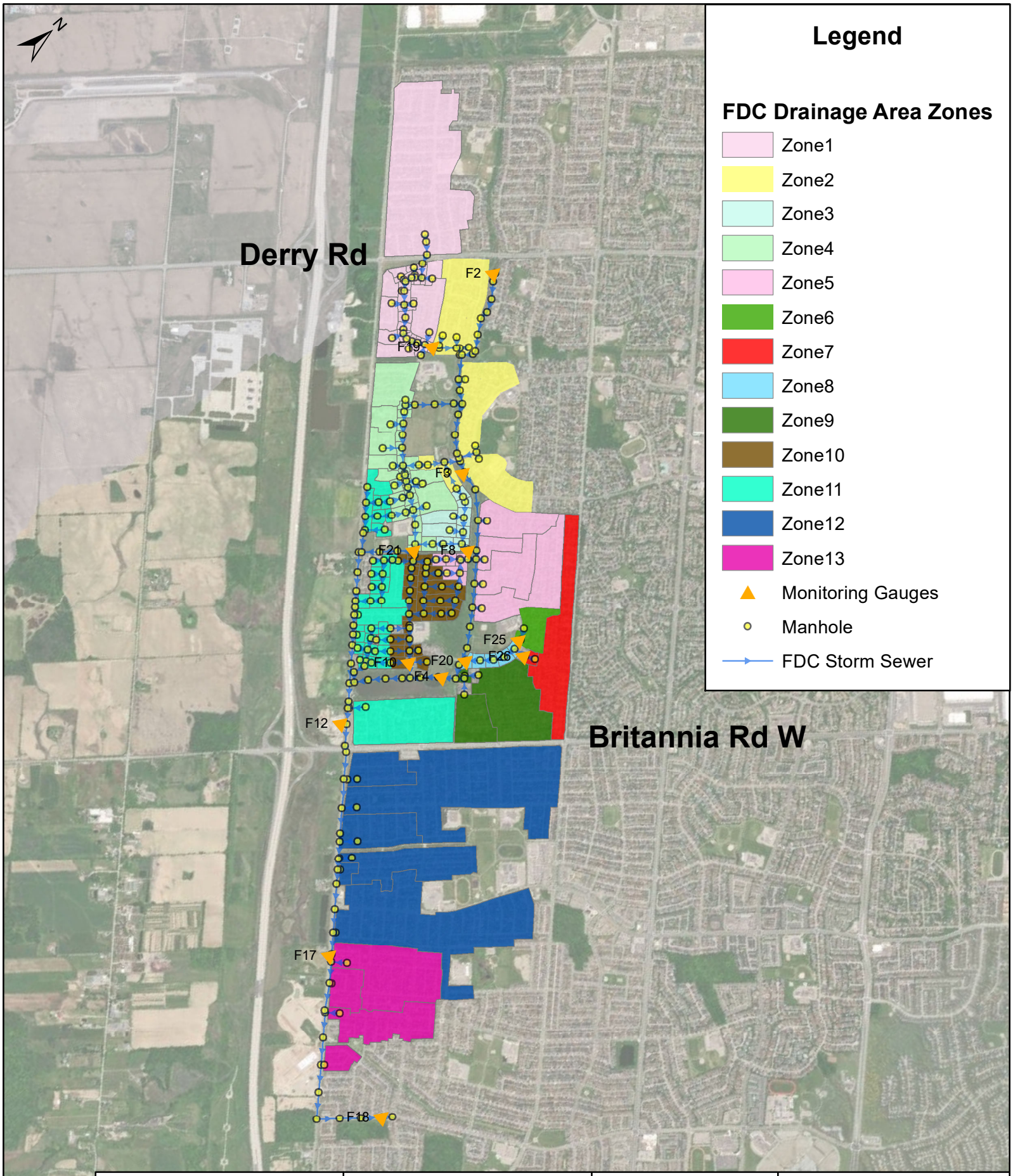

F18
F18(obs)
Objective Fns F18 F18(obs)
Maximum Depth (m) 0.623 0.7436
Minimum Depth (m) 0 0.1023
Mean Depth (m) 0.3566 0.2514
Depth (m)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
12 Thu
Jun 2014
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Fri
Date/Time


F19
F19(obs)
Objective Fns F19 F19(obs)
Maximum Depth (m) 1.312 1.422
Minimum Depth (m) 0.009324 0.0283
Mean Depth (m) 0.18 0.1007
Depth (m)
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
12 Thu
Jun 2014
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Fri
Date/Time

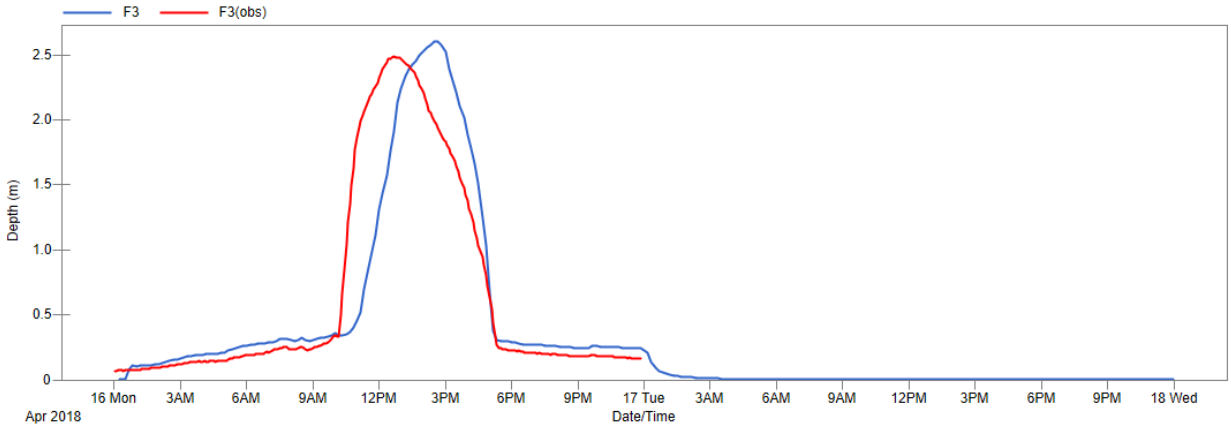

F20
F20(obs)
Objective Fns F20 F20(obs)
Maximum Depth (m) 1.399 1.807
Minimum Depth (m) 0.0001848 0.02697
Mean Depth (m) 0.2029 0.1575
Depth (m)
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
12 Thu
Jun 2014
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Fri
Date/Time

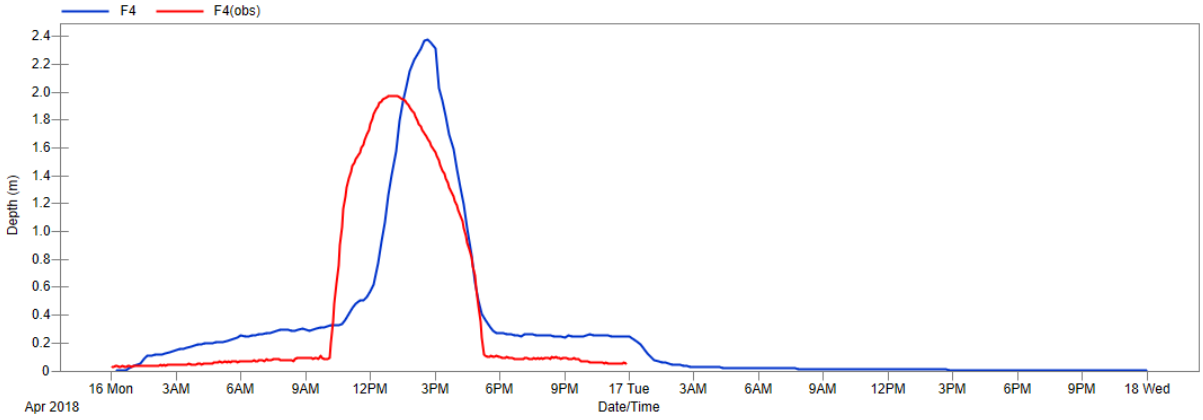

F21
F21(obs)
Objective Fns F21 F21(obs)
Maximum Depth (m) 1.792 1.45
Minimum Depth (m) 0.0004712 0.0331
Mean Depth (m) 0.3186 0.1389
Depth (m)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
12 Thu
Jun 2014
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Fri
Date/Time

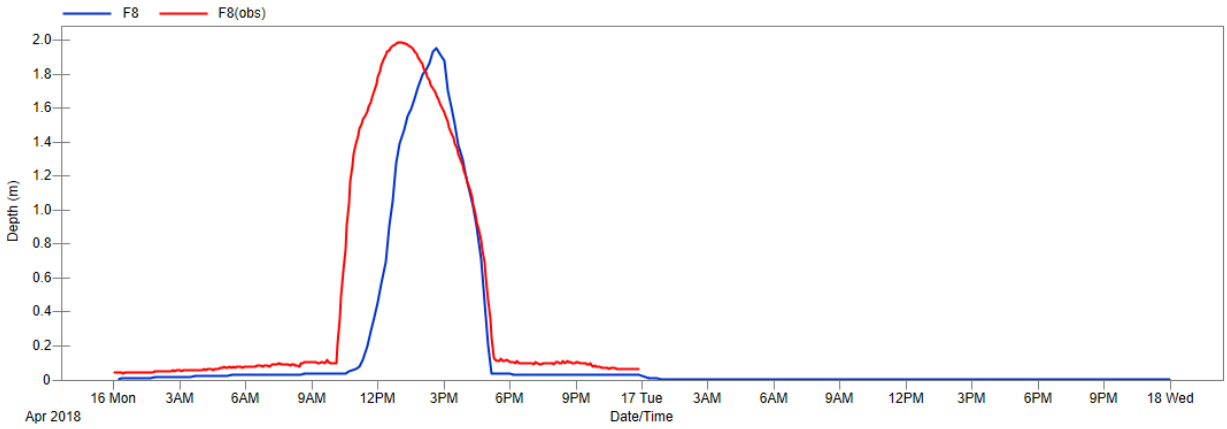

F23
F23(obs)
Objective Fns F23 F23(obs)
Maximum Depth (m) 1.461 1.579
Minimum Depth (m) 0.008002 0.008036
Mean Depth (m) 0.21 0.09092
Depth (m)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
12 Thu
Jun 2014
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Fri
Date/Time

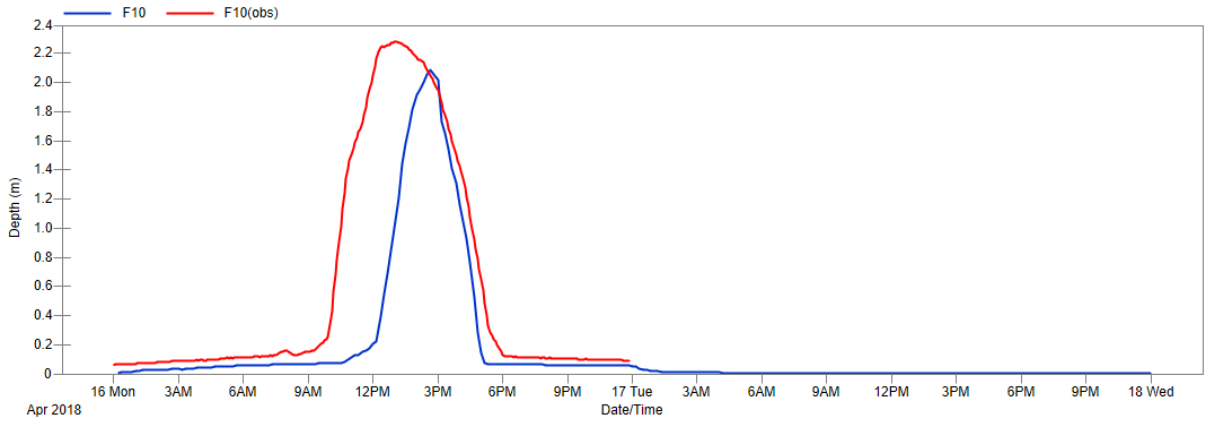


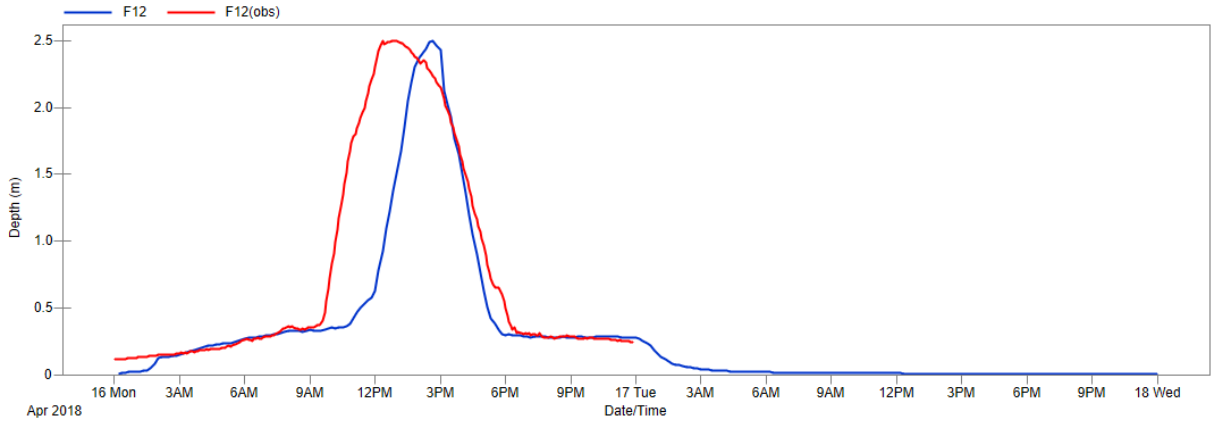

| | | | |
|---|---|---|---|
| **Lisgar**<br>**City of Mississauga** | **FDC Drainage Area Zones**<br>**16-April-2018** | wood. | Scale **1:30,000**<br>Project No. **WW21011023**<br>Figure No. **3** |

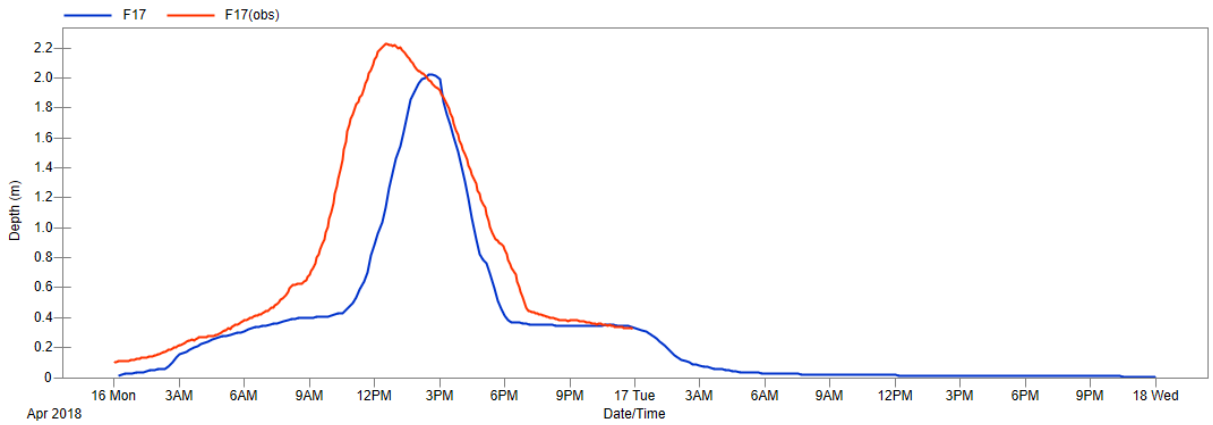

F3
F3(obs)
Depth (m)
2.5
2.0
1.5
1.0
0.5
0
16 Mon
3AM
6AM
9AM
12PM
3PM
6PM
9PM
17 Tue
3AM
6AM
9AM
12PM
3PM
6PM
9PM
18 Wed
Apr 2018
Date/Time

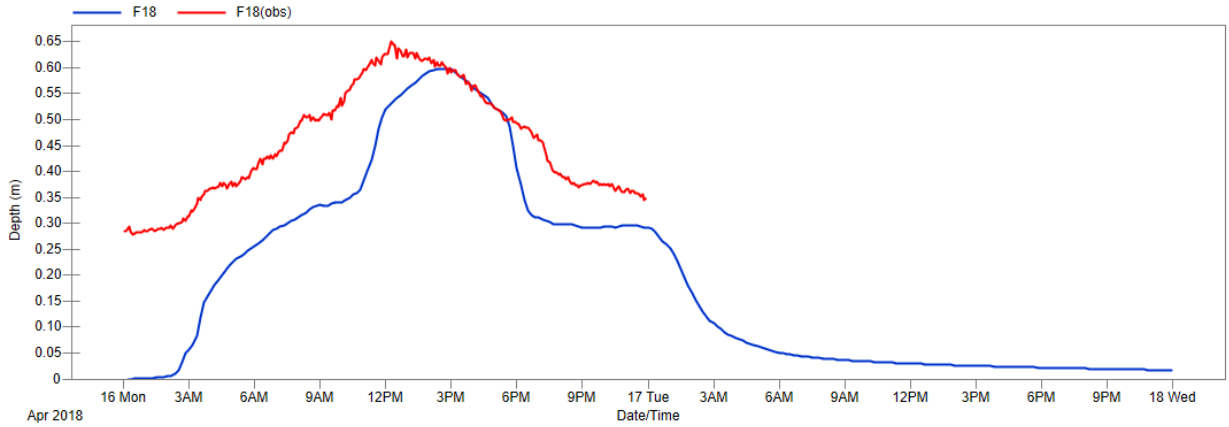

F4
F4(obs)
Depth (m)
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
16 Mon
3AM
6AM
9AM
12PM
3PM
6PM
9PM
17 Tue
3AM
6AM
9AM
12PM
3PM
6PM
9PM
18 Wed
Apr 2018
Date/Time

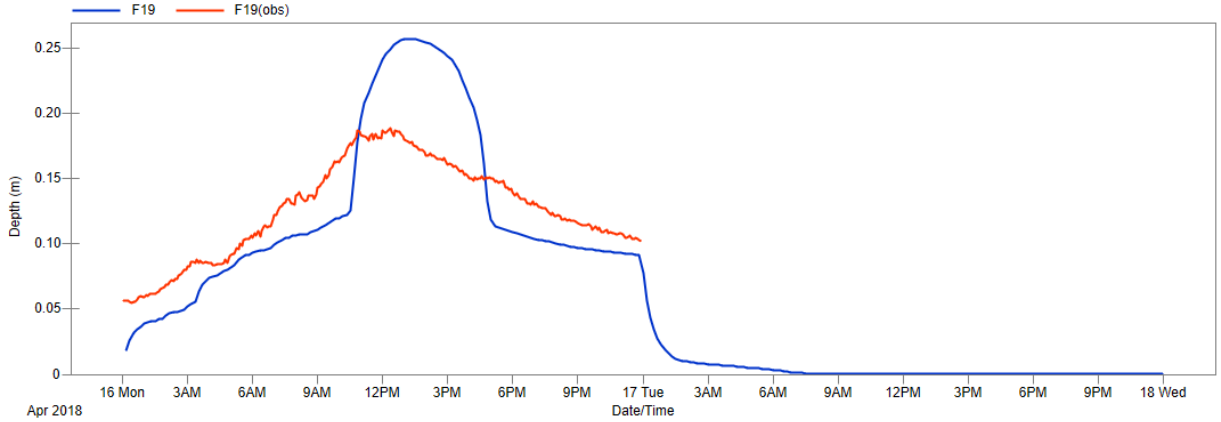

F8
F8(obs)
Depth (m)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
16 Mon
3AM
6AM
9AM
12PM
3PM
6PM
9PM
17 Tue
3AM
6AM
9AM
12PM
3PM
6PM
9PM
18 Wed
Apr 2018
Date/Time

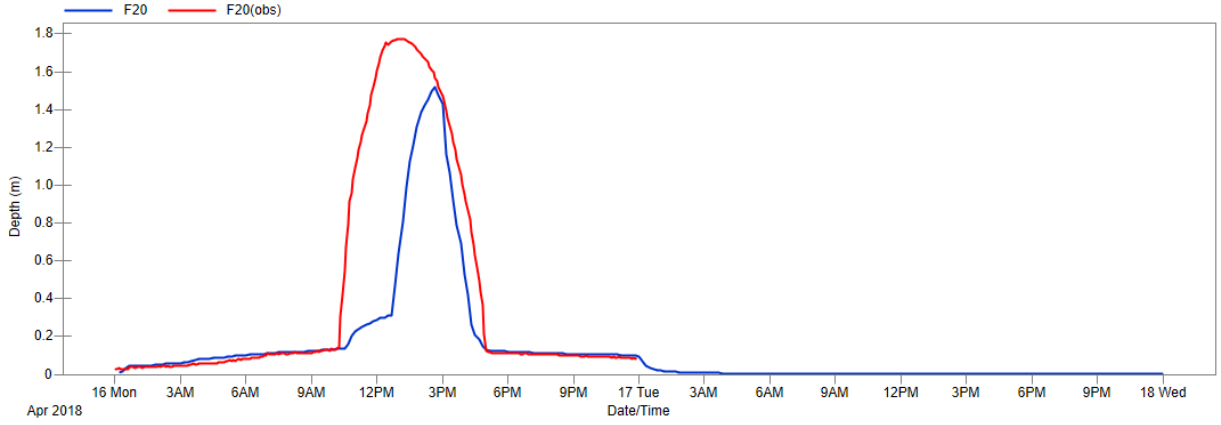

F10
F10(obs)
Depth (m)
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
16 Mon
3AM
6AM
9AM
12PM
3PM
6PM
9PM
17 Tue
3AM
6AM
9AM
12PM
3PM
6PM
9PM
18 Wed
Apr 2018
Date/Time

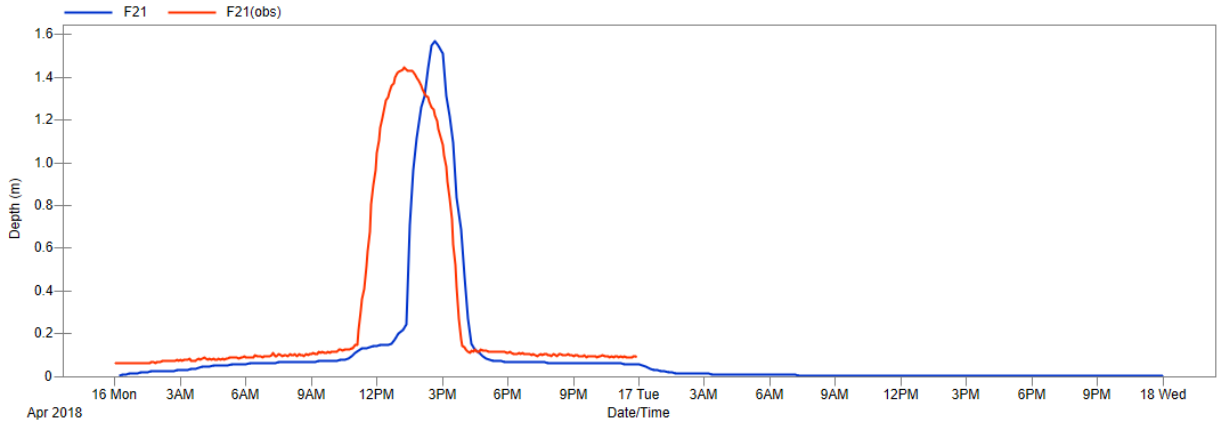

F12
F12(obs)
Depth (m)
2.5
2.0
1.5
1.0
0.5
0
16 Mon
3AM
6AM
9AM
12PM
3PM
6PM
9PM
17 Tue
3AM
6AM
9AM
12PM
3PM
6PM
9PM
18 Wed
Apr 2018
Date/Time

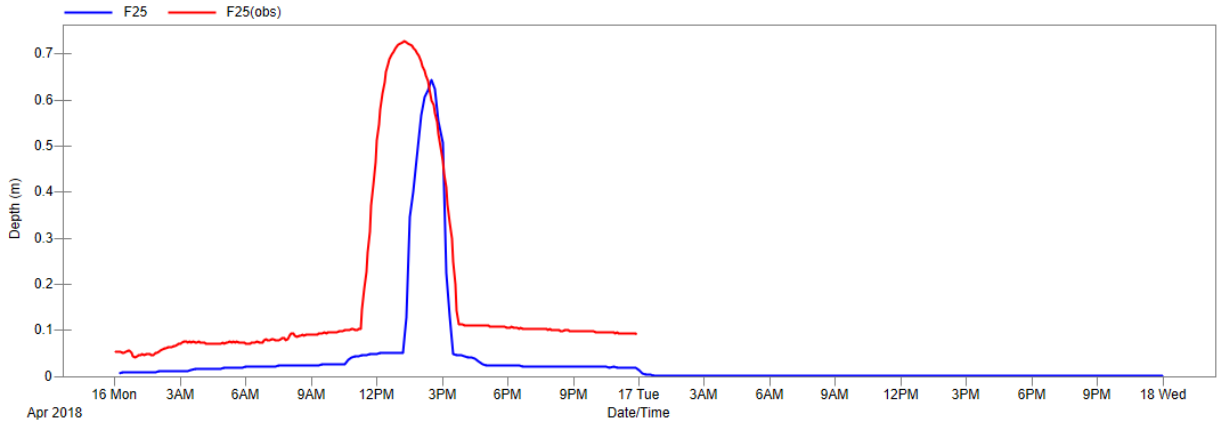

F17
F17(obs)
Depth (m)
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
16 Mon
3AM
6AM
9AM
12PM
3PM
6PM
9PM
17 Tue
3AM
6AM
9AM
12PM
3PM
6PM
9PM
18 Wed
Apr 2018
Date/Time

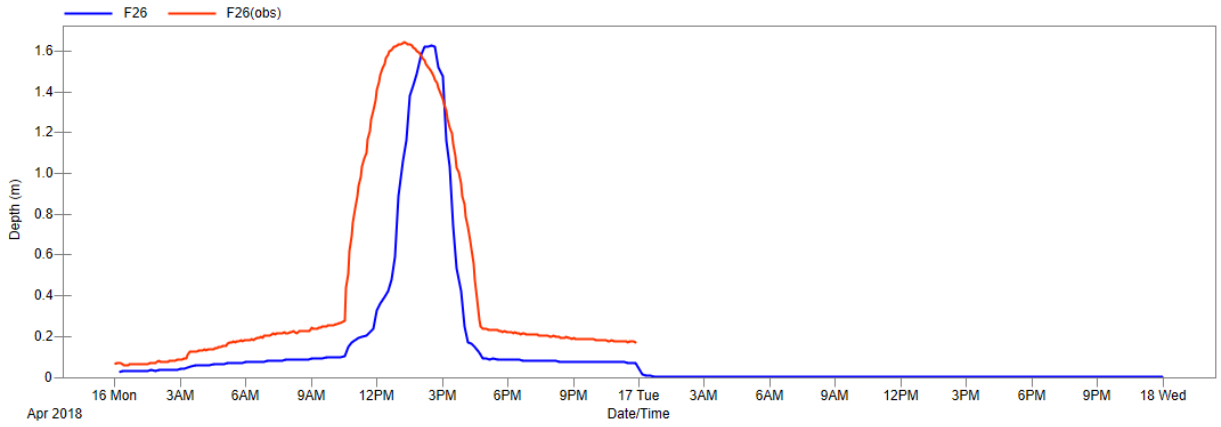

F18
F18(obs)
Depth (m)
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0
16 Mon
3AM
6AM
9AM
12PM
3PM
6PM
9PM
17 Tue
3AM
6AM
9AM
12PM
3PM
6PM
9PM
18 Wed
Apr 2018
Date/Time

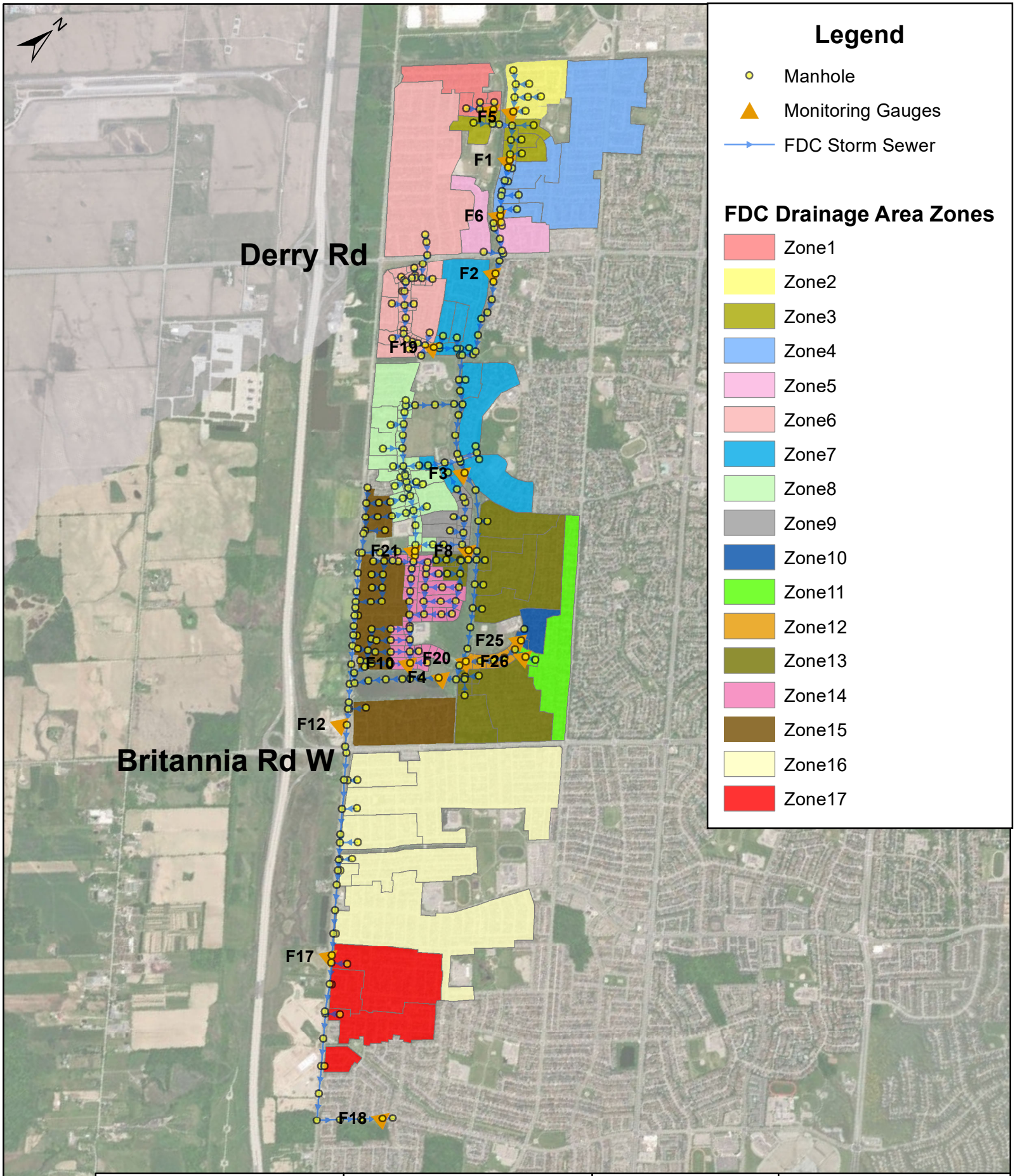

F19
F19(obs)
Depth (m)
0.25
0.20
0.15
0.10
0.05
0
16 Mon
3AM
6AM
9AM
12PM
3PM
6PM
9PM
17 Tue
3AM
6AM
9AM
12PM
3PM
6PM
9PM
18 Wed
Apr 2018
Date/Time


F20
F20(obs)
Depth (m)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
16 Mon
3AM
6AM
9AM
12PM
3PM
6PM
9PM
17 Tue
3AM
6AM
9AM
12PM
3PM
6PM
9PM
18 Wed
Apr 2018
Date/Time

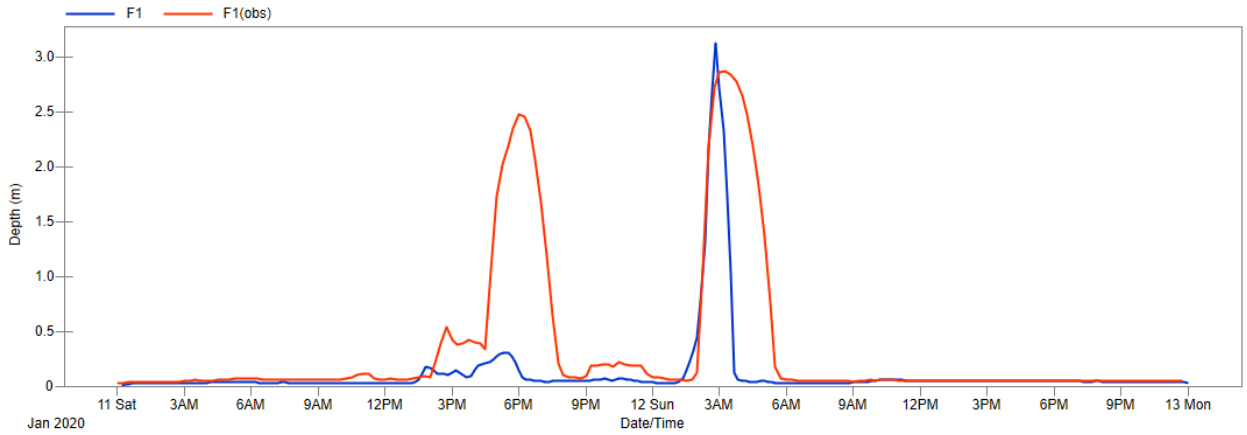

F21
F21(obs)
Depth (m)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
16 Mon
3AM
6AM
9AM
12PM
3PM
6PM
9PM
17 Tue
3AM
6AM
9AM
12PM
3PM
6PM
9PM
18 Wed
Apr 2018
Date/Time

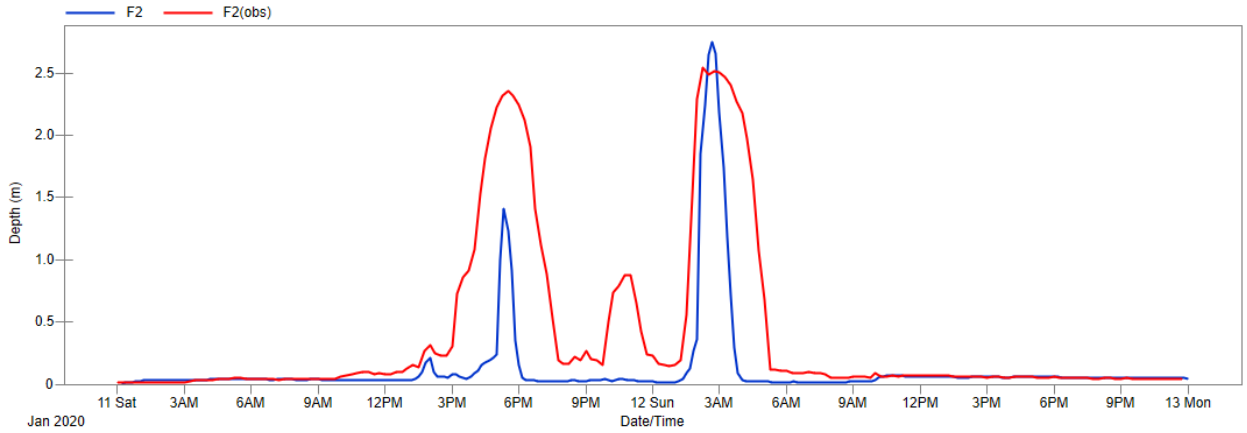

F25
F25(obs)
Depth (m)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
16 Mon
3AM
6AM
9AM
12PM
3PM
6PM
9PM
17 Tue
3AM
6AM
9AM
12PM
3PM
6PM
9PM
18 Wed
Apr 2018
Date/Time

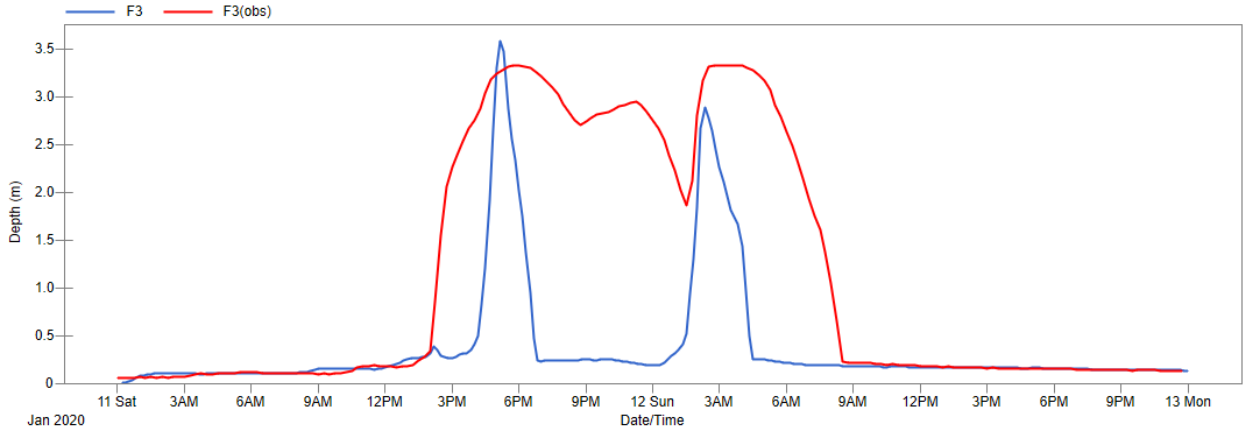

F26
F26(obs)
Depth (m)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
16 Mon
3AM
6AM
9AM
12PM
3PM
6PM
9PM
17 Tue
3AM
6AM
9AM
12PM
3PM
6PM
9PM
18 Wed
Apr 2018
Date/Time

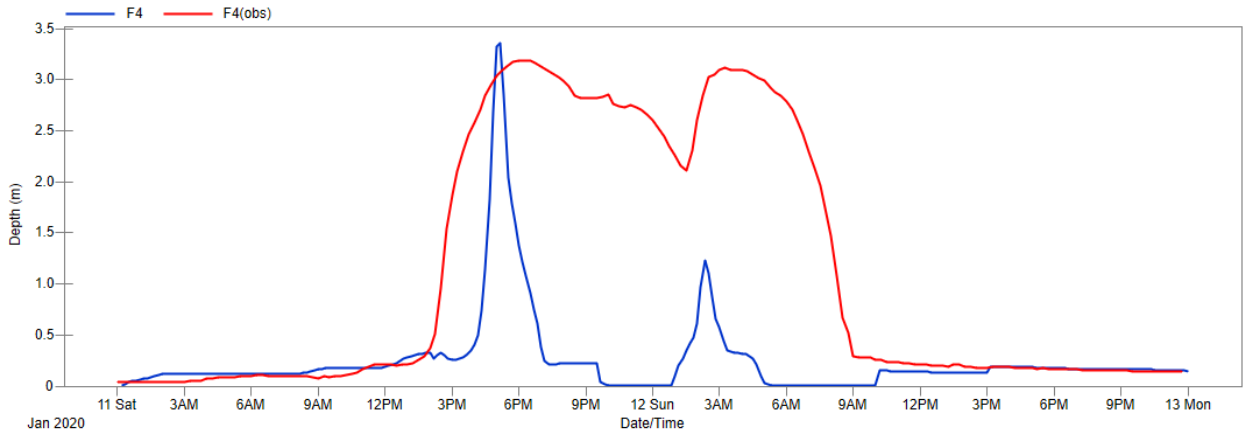


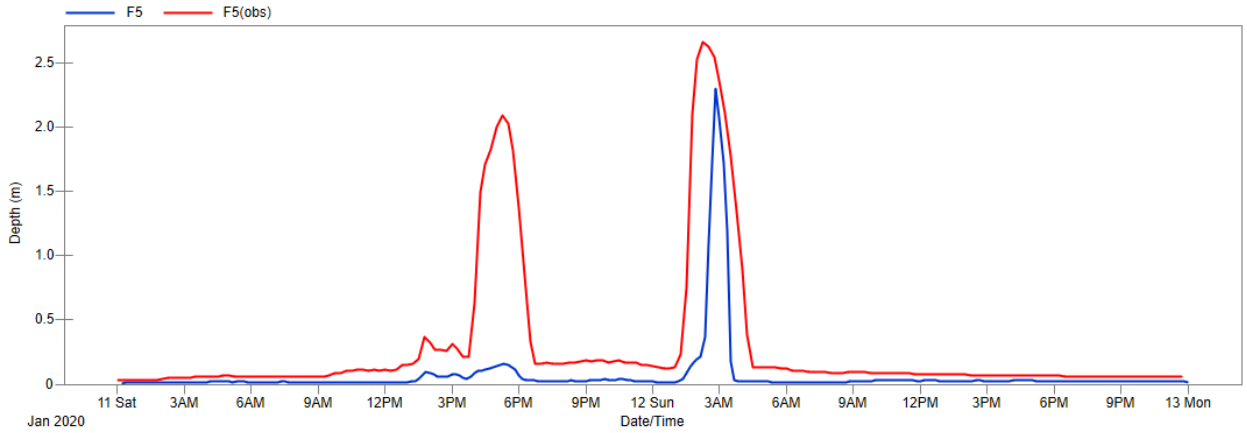

| | | | |
|---|---|---|---|
| Lisgar<br>City of Mississauga | FDC Drainage Area Zones<br>11 & 12-January-2020 | wood. | Scale 1:30,000<br>Project No. WW21011023<br>Figure No. 4 |

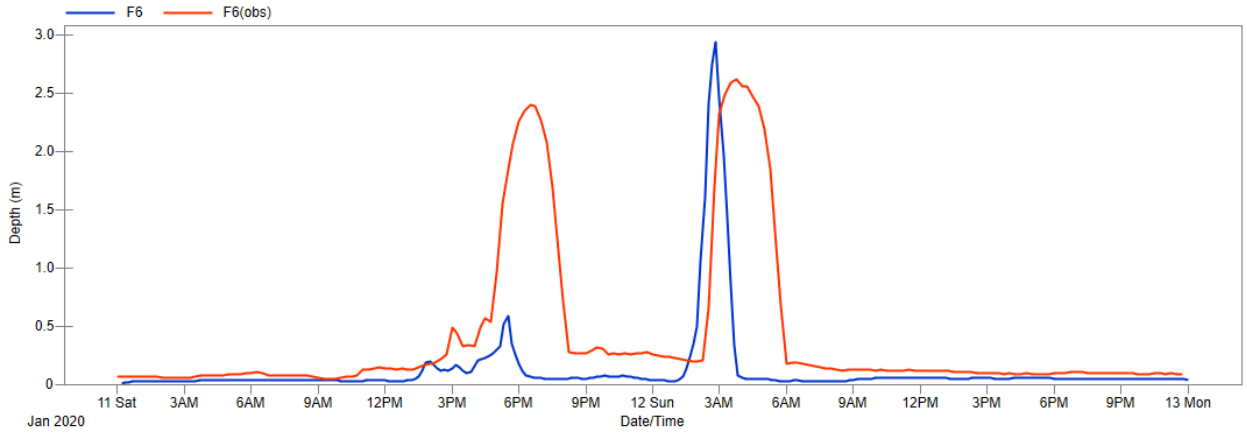

F1
F1(obs)
Depth (m)
3.0
2.5
2.0
1.5
1.0
0.5
0
11 Sat
3AM
6AM
9AM
12PM
3PM
6PM
9PM
12 Sun
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Mon
Jan 2020
Date/Time

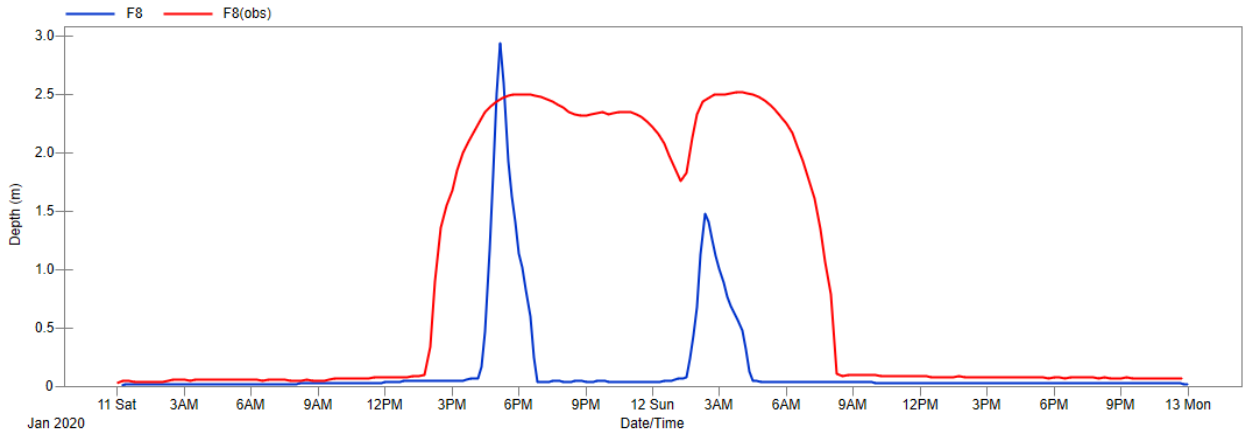

F2
F2(obs)
Depth (m)
2.5
2.0
1.5
1.0
0.5
0
11 Sat
3AM
6AM
9AM
12PM
3PM
6PM
9PM
12 Sun
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Mon
Jan 2020
Date/Time

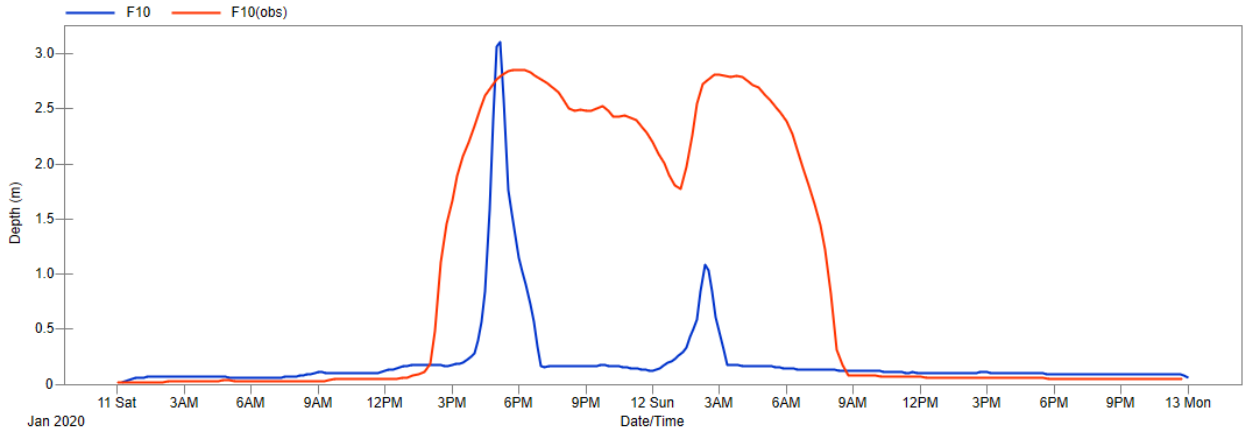

F3
F3(obs)
Depth (m)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
11 Sat
3AM
6AM
9AM
12PM
3PM
6PM
9PM
12 Sun
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Mon
Jan 2020
Date/Time

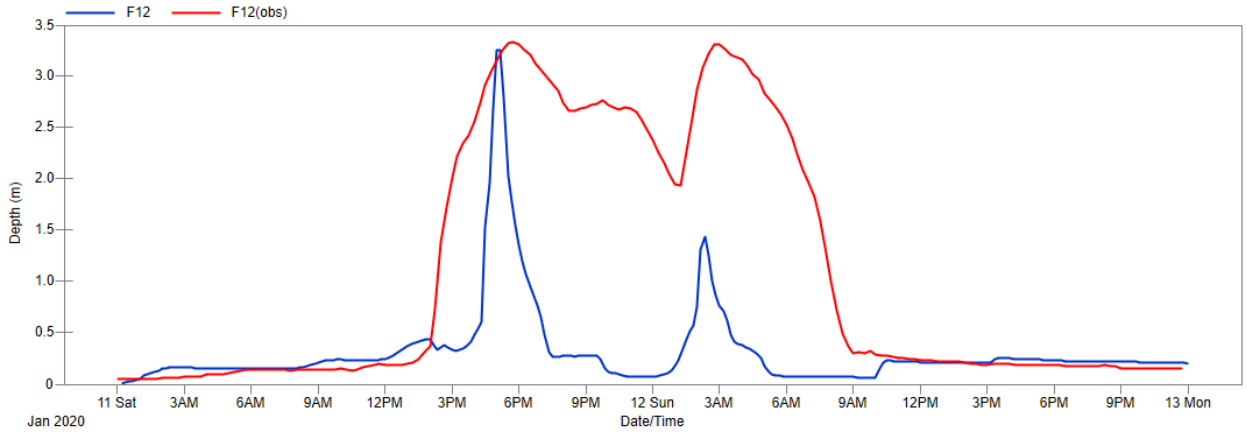

F4
F4(obs)
Depth (m)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
11 Sat
3AM
6AM
9AM
12PM
3PM
6PM
9PM
12 Sun
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Mon
Jan 2020
Date/Time

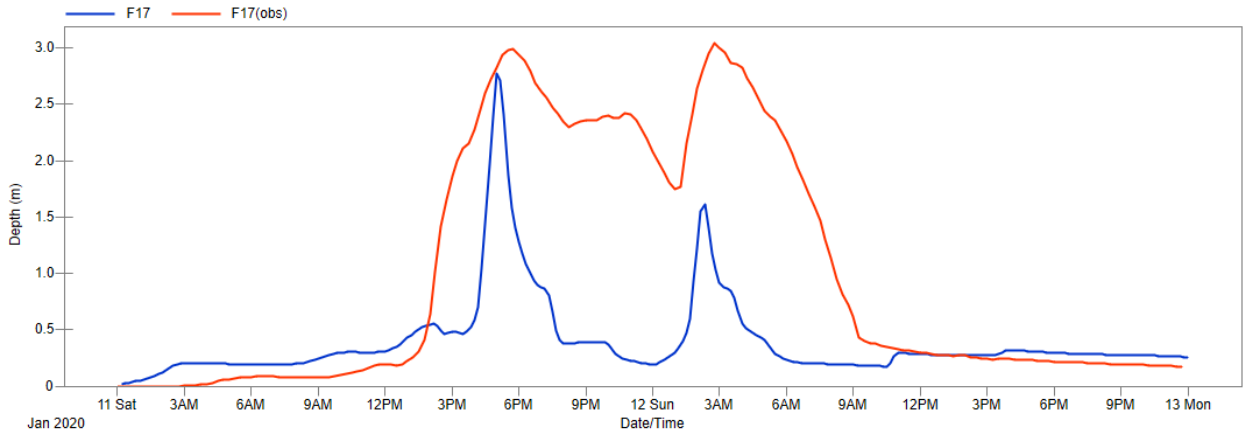

F5
F5(obs)
Depth (m)
2.5
2.0
1.5
1.0
0.5
0
11 Sat
3AM
6AM
9AM
12PM
3PM
6PM
9PM
12 Sun
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Mon
Jan 2020
Date/Time

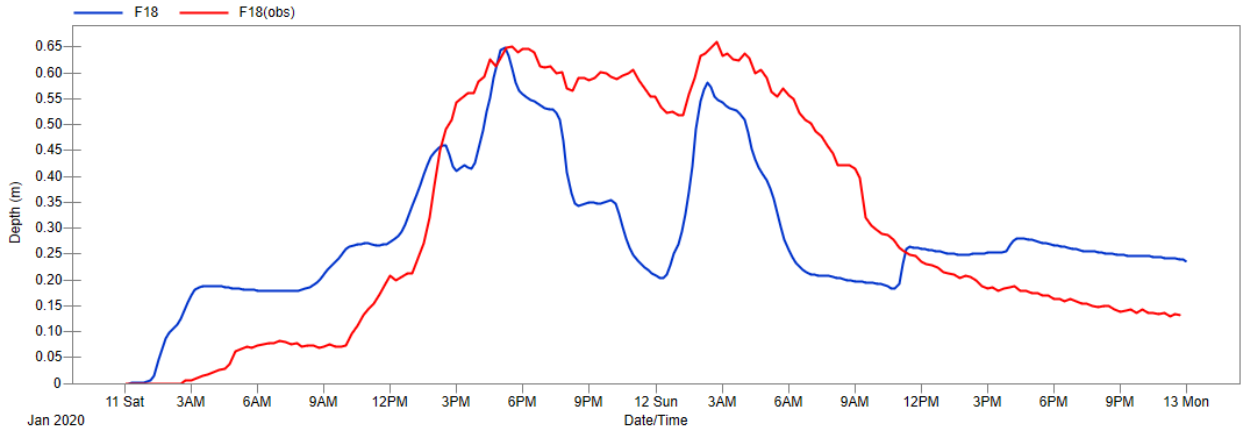

F6
F6(obs)
Depth (m)
3.0
2.5
2.0
1.5
1.0
0.5
0
11 Sat
3AM
6AM
9AM
12PM
3PM
6PM
9PM
12 Sun
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Mon
Jan 2020
Date/Time

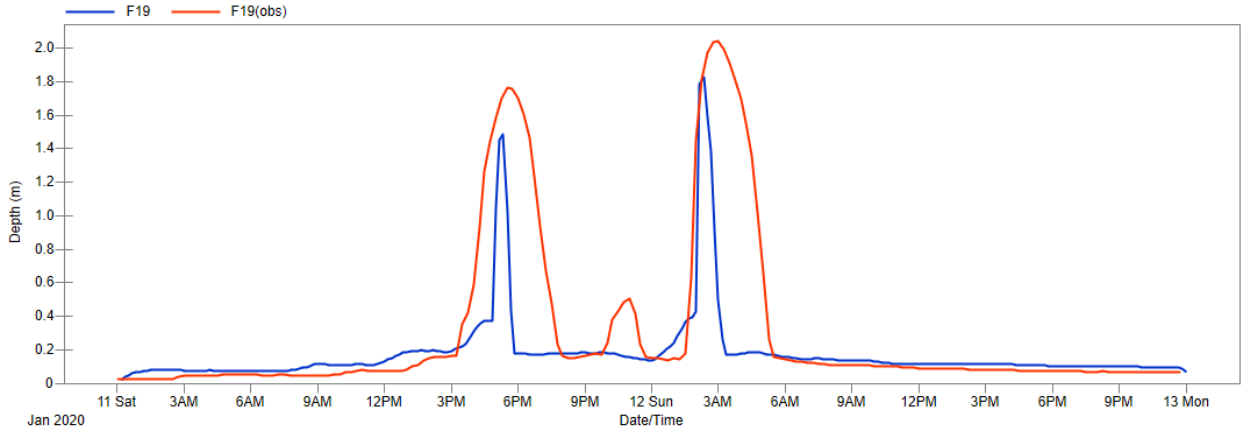

F8
F8(obs)
Depth (m)
3.0
2.5
2.0
1.5
1.0
0.5
0
11 Sat
3AM
6AM
9AM
12PM
3PM
6PM
9PM
12 Sun
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Mon
Jan 2020
Date/Time

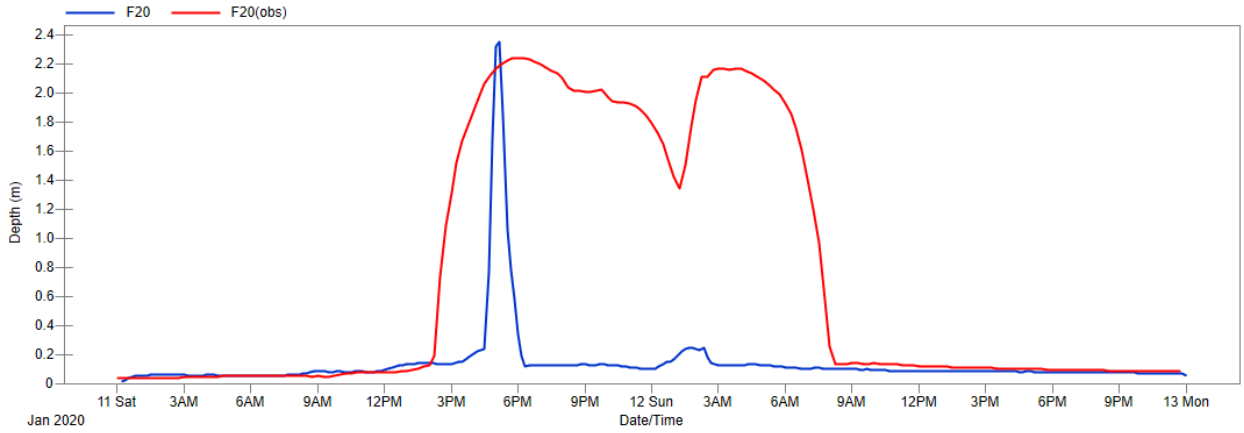

F10
F10(obs)
Depth (m)
3.0
2.5
2.0
1.5
1.0
0.5
0
11 Sat
3AM
6AM
9AM
12PM
3PM
6PM
9PM
12 Sun
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Mon
Jan 2020
Date/Time

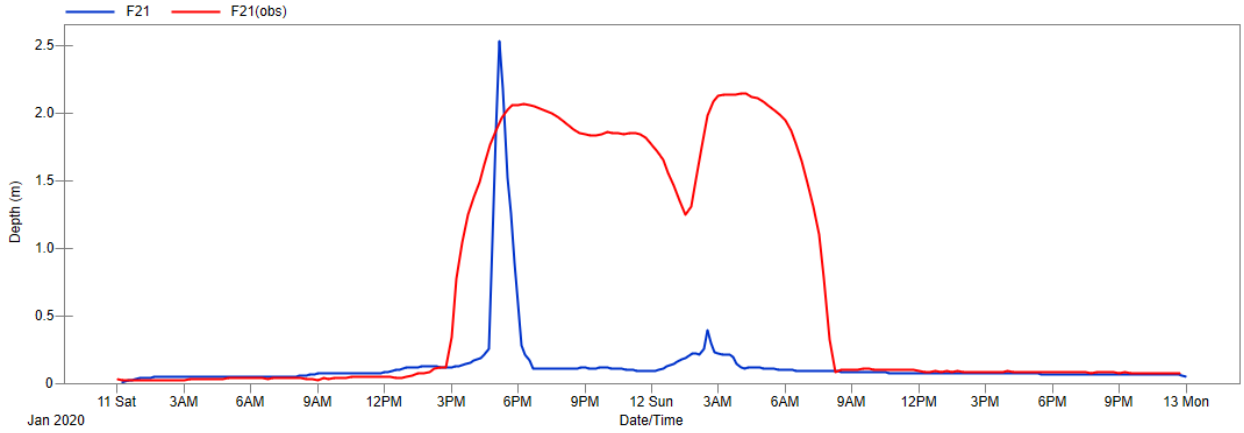

F12
F12(obs)
Depth (m)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
11 Sat
3AM
6AM
9AM
12PM
3PM
6PM
9PM
12 Sun
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Mon
Jan 2020
Date/Time

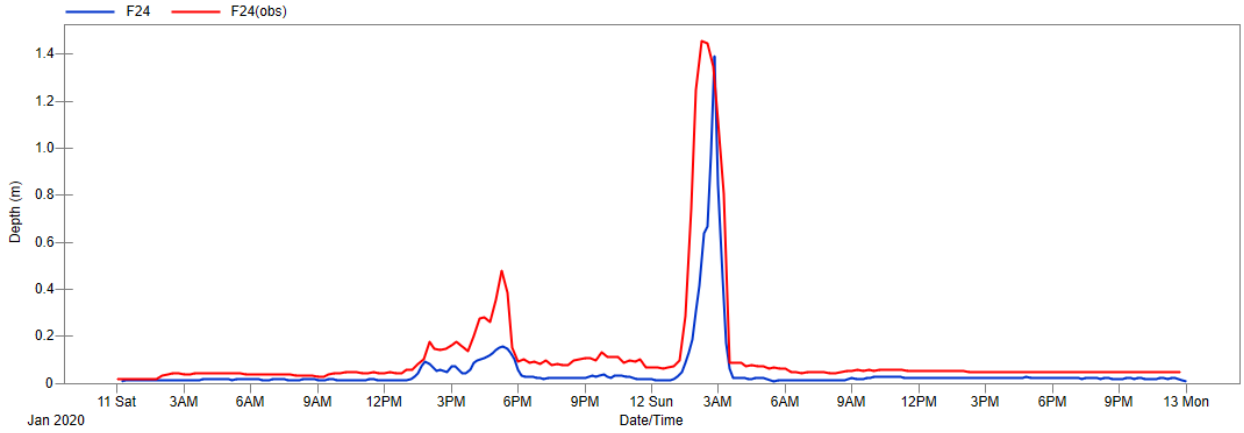

F17
F17(obs)
Depth (m)
3.0
2.5
2.0
1.5
1.0
0.5
0
11 Sat
3AM
6AM
9AM
12PM
3PM
6PM
9PM
12 Sun
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Mon
Jan 2020
Date/Time

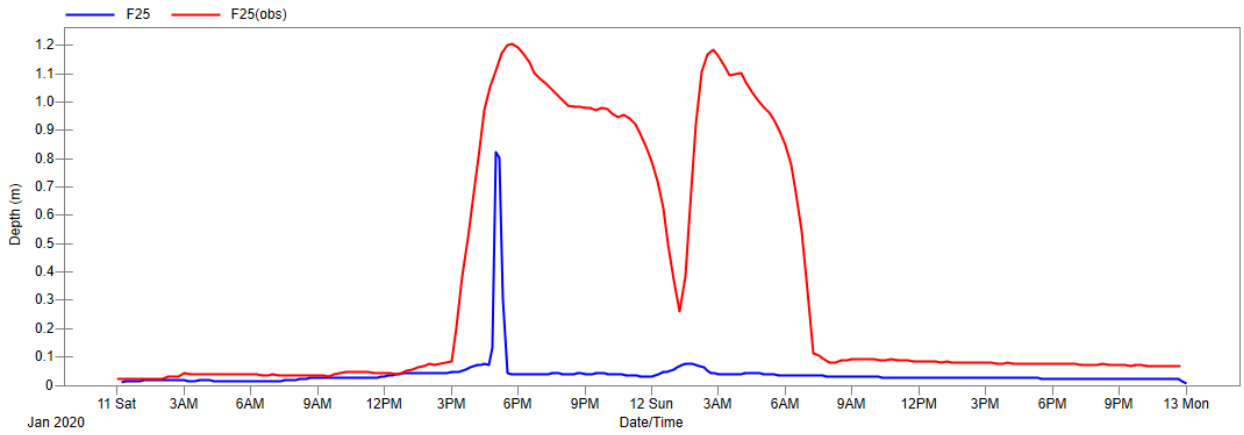

F18
F18(obs)
Depth (m)
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0
11 Sat
3AM
6AM
9AM
12PM
3PM
6PM
9PM
12 Sun
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Mon
Jan 2020
Date/Time

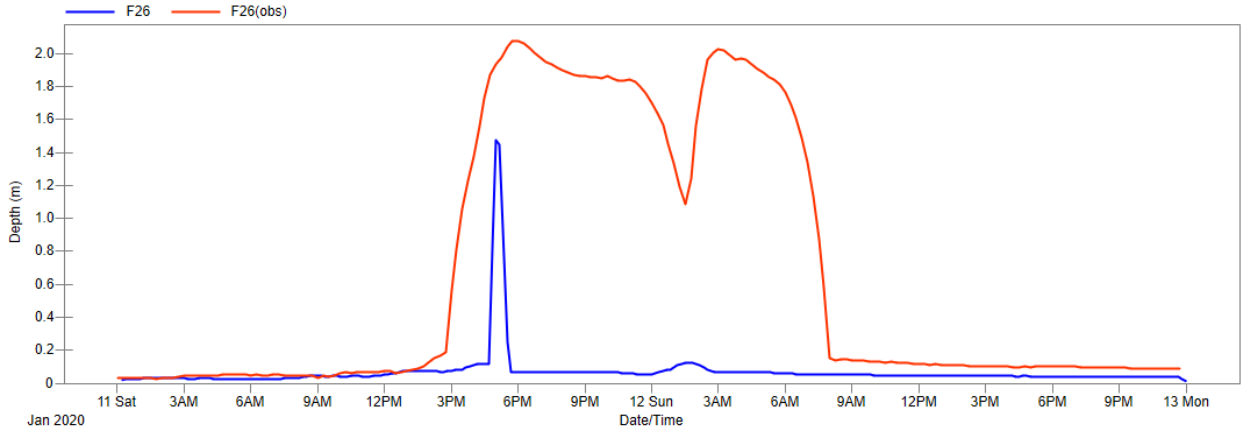

F19
F19(obs)
Depth (m)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
11 Sat
3AM
6AM
9AM
12PM
3PM
6PM
9PM
12 Sun
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Mon
Jan 2020
Date/Time

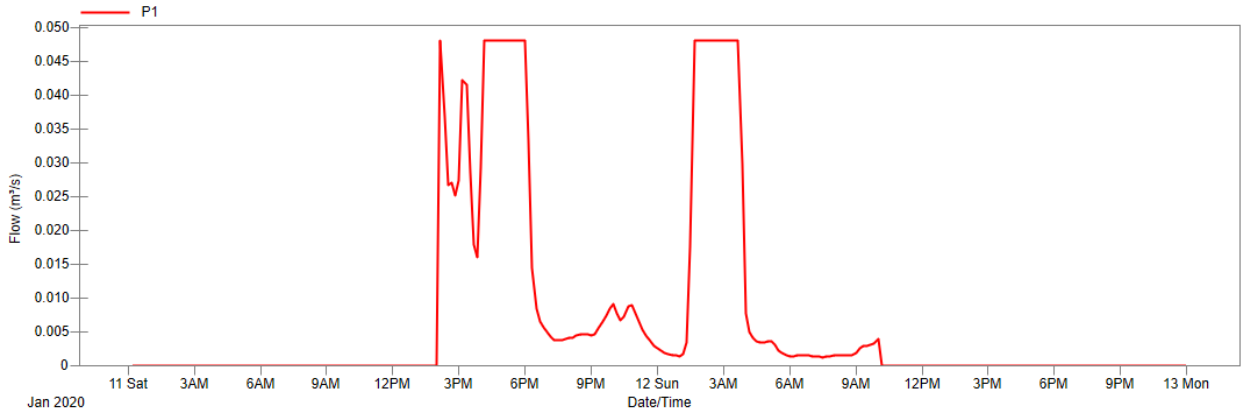

F20
F20(obs)
Depth (m)
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
11 Sat
3AM
6AM
9AM
12PM
3PM
6PM
9PM
12 Sun
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Mon
Jan 2020
Date/Time


F21
F21(obs)
Depth (m)
2.5
2.0
1.5
1.0
0.5
0
11 Sat
3AM
6AM
9AM
12PM
3PM
6PM
9PM
12 Sun
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Mon
Jan 2020
Date/Time

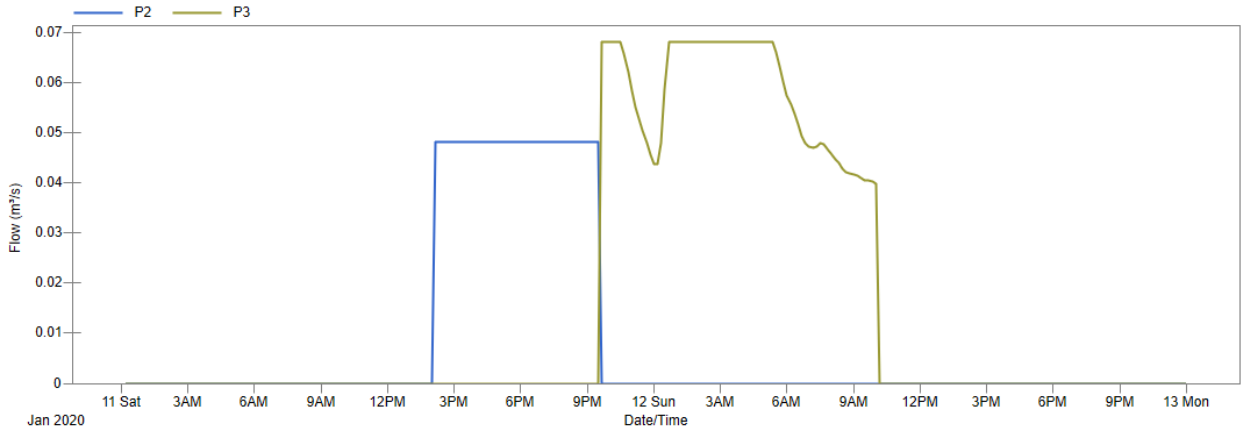

F24
F24(obs)
Depth (m)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
11 Sat
3AM
6AM
9AM
12PM
3PM
6PM
9PM
12 Sun
3AM
6AM
9AM
12PM
3PM
6PM
9PM
13 Mon
Jan 2020
Date/Time



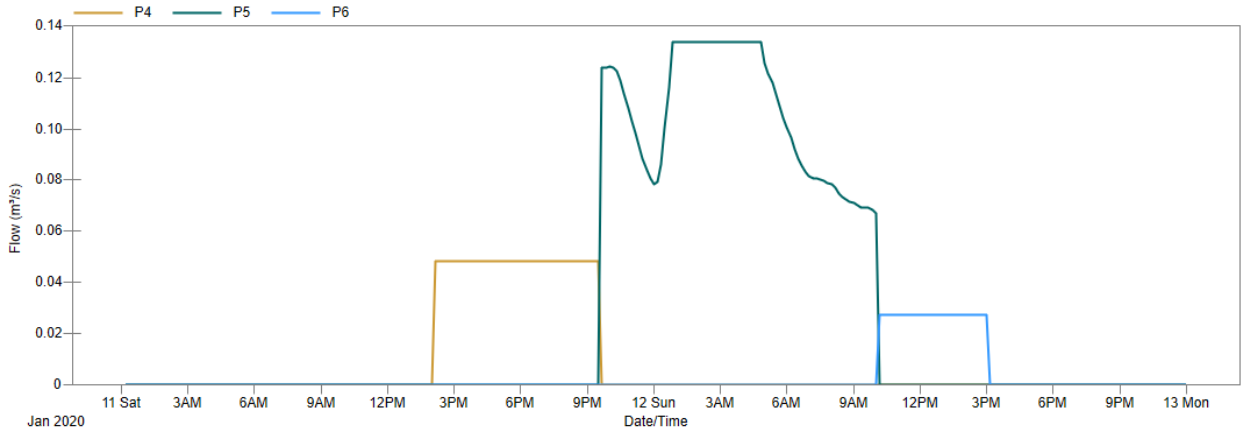



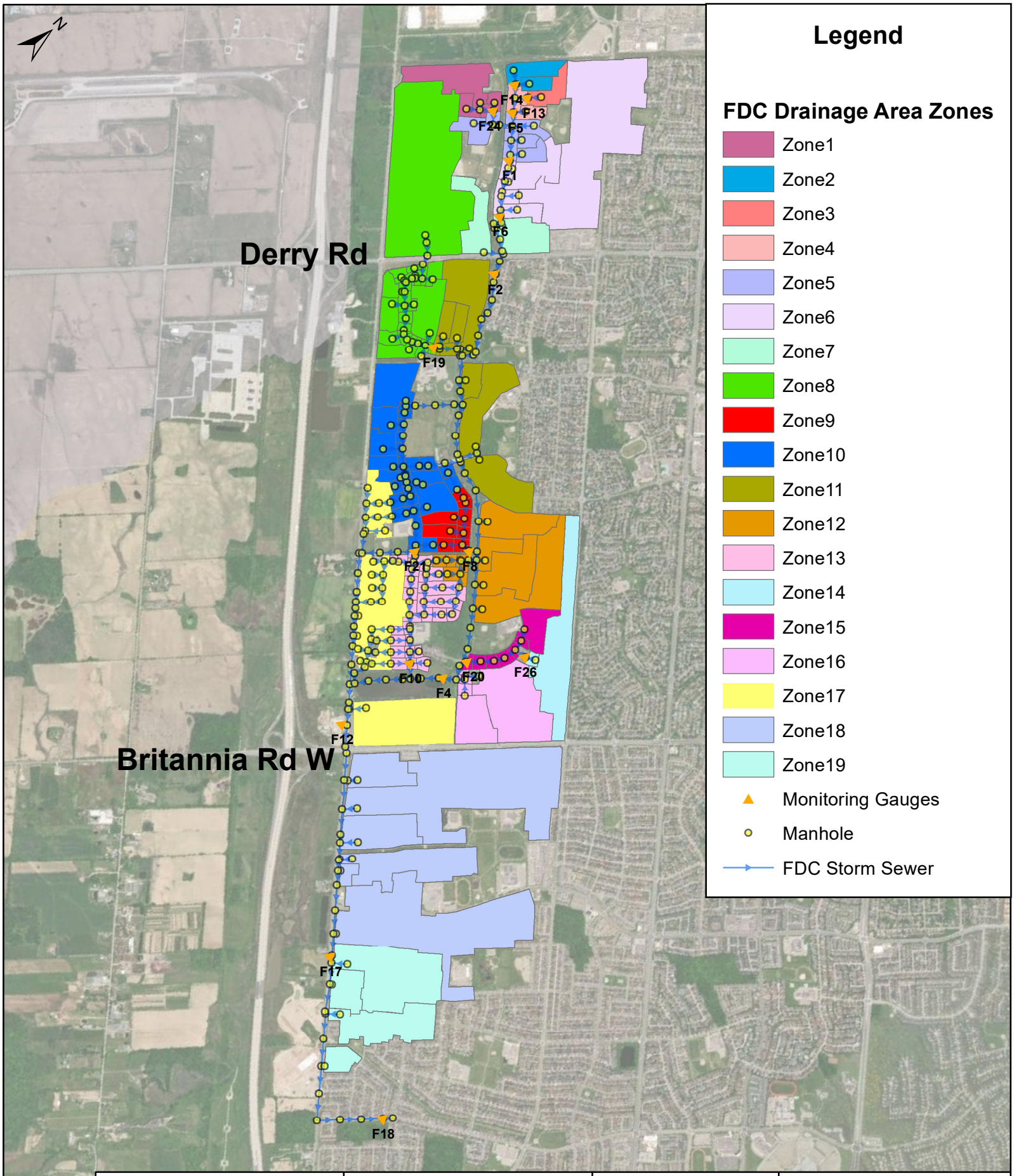

BWT-Portal Pumps



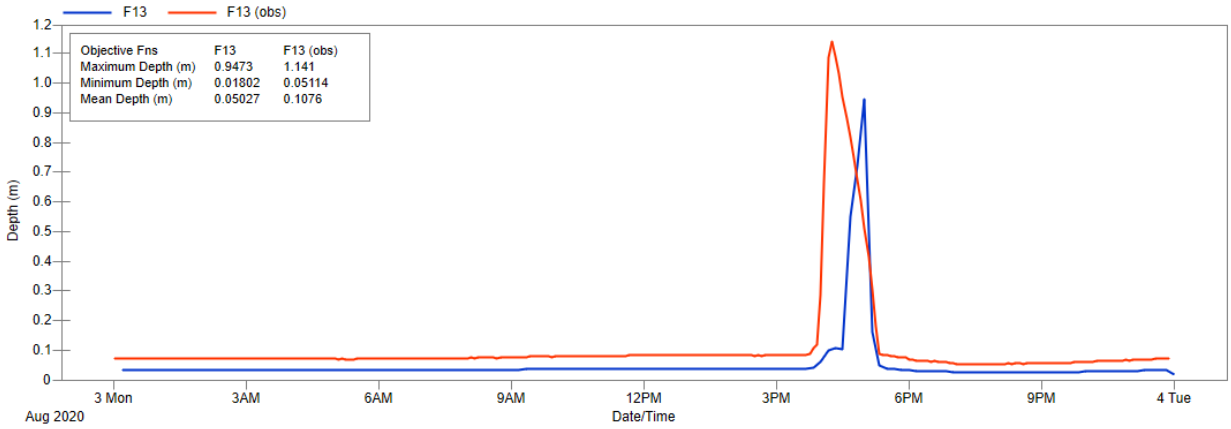

Ninth Line-Portal Pumps

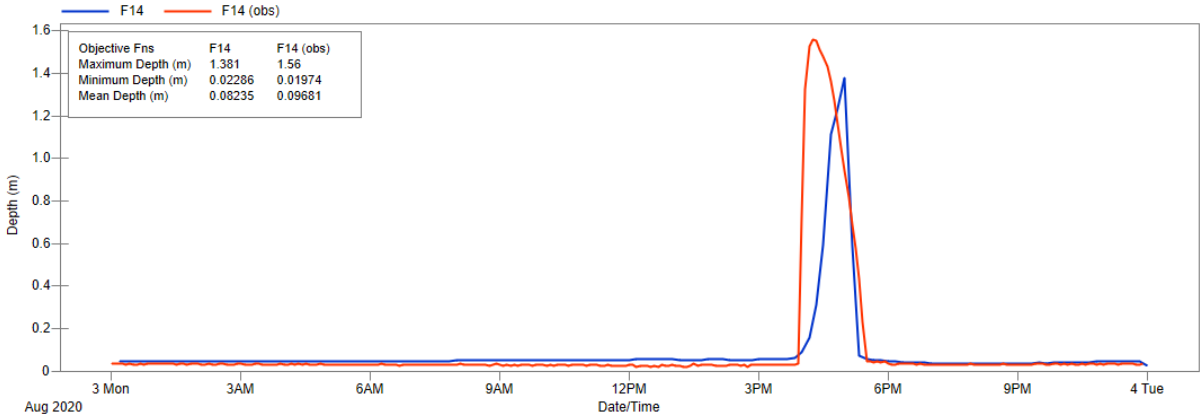


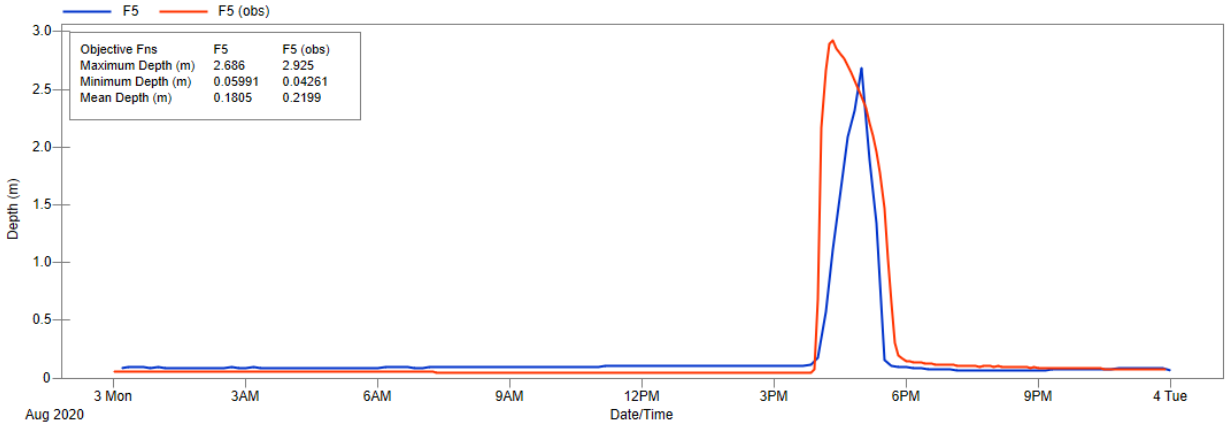

Osprey Blvd-Portal Pumps

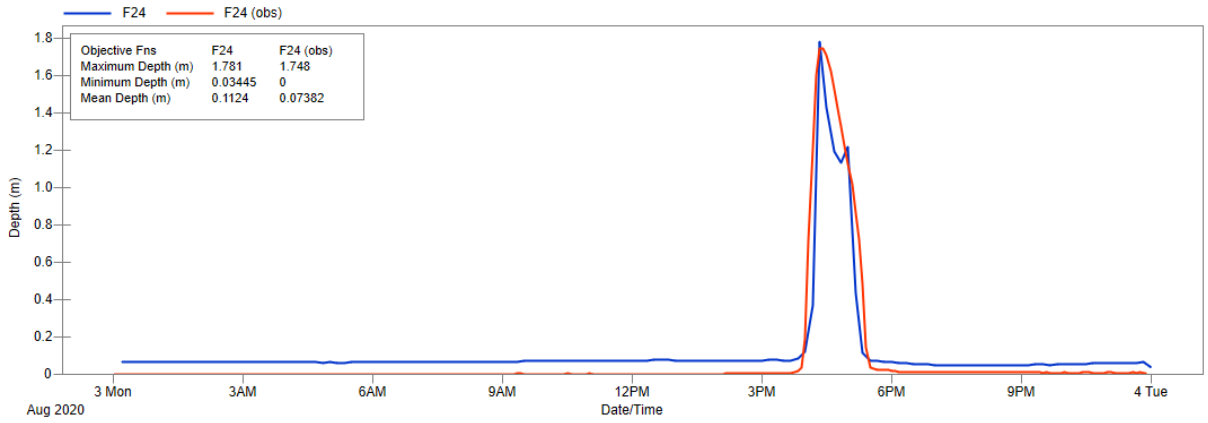


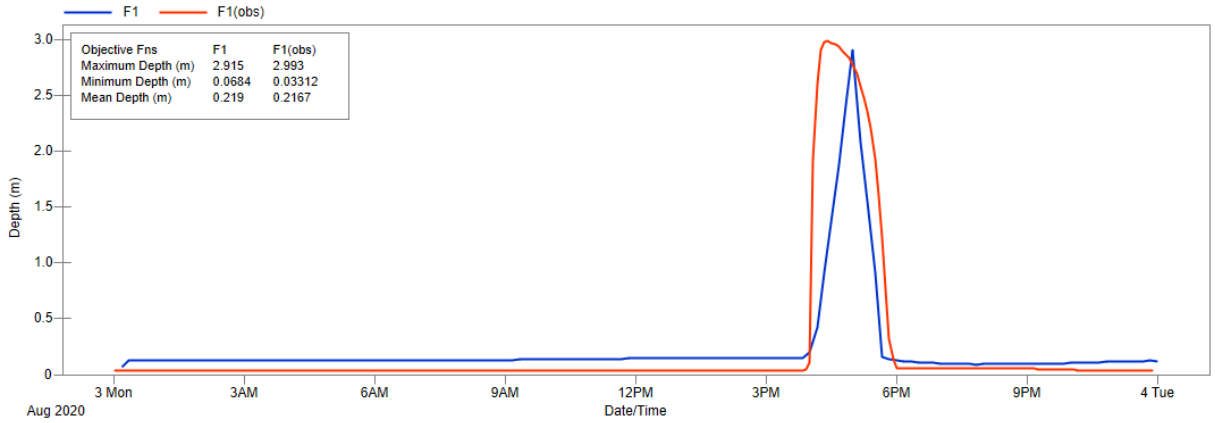

| | | | |
|---|---|---|---|
| **Lisgar**<br>**City of Mississauga** | **FDC Drainage Area Zones**<br>**3-August-2020** | wood. | Scale **1:30,000**<br>Project No. **WW21011023**<br>Figure No. **5** |

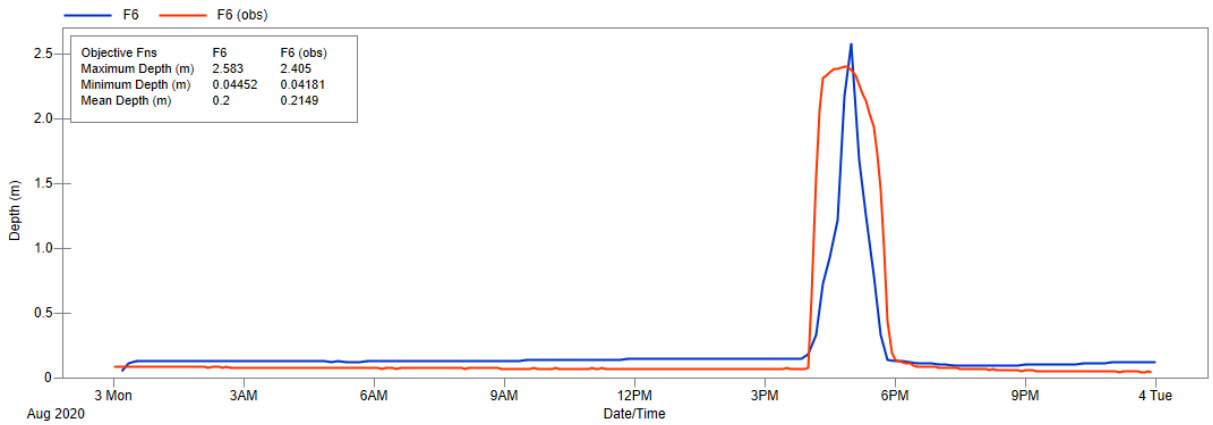

F13
F13 (obs)
Objective Fns F13 F13 (obs)
Maximum Depth (m) 0.9473 1.141
Minimum Depth (m) 0.01802 0.05114
Mean Depth (m) 0.05027 0.1076
Depth (m)
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
3 Mon
Aug 2020
3AM
6AM
9AM
12PM
3PM
6PM
9PM
4 Tue
Date/Time

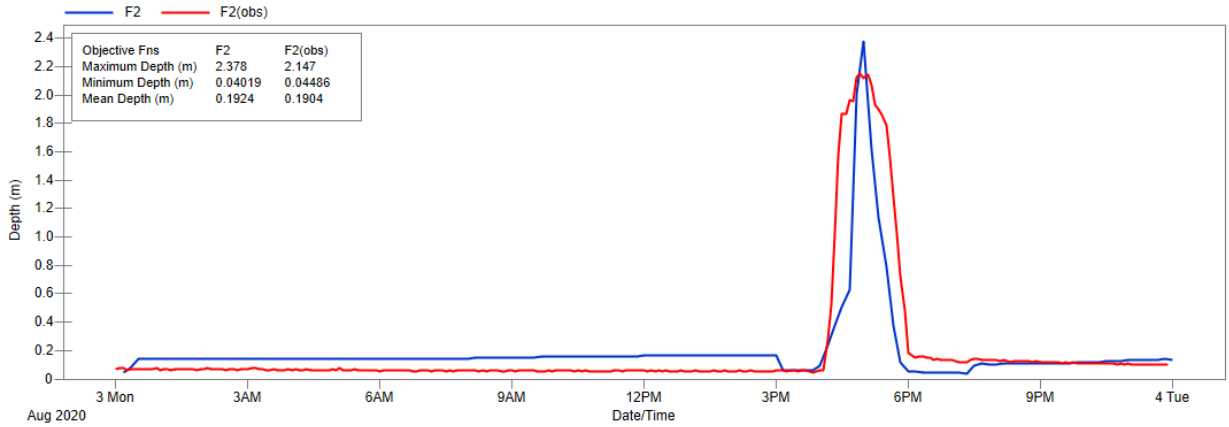

F14
F14 (obs)
Objective Fns F14 F14 (obs)
Maximum Depth (m) 1.381 1.56
Minimum Depth (m) 0.02286 0.01974
Mean Depth (m) 0.08235 0.09681
Depth (m)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
3 Mon
Aug 2020
3AM
6AM
9AM
12PM
3PM
6PM
9PM
4 Tue
Date/Time

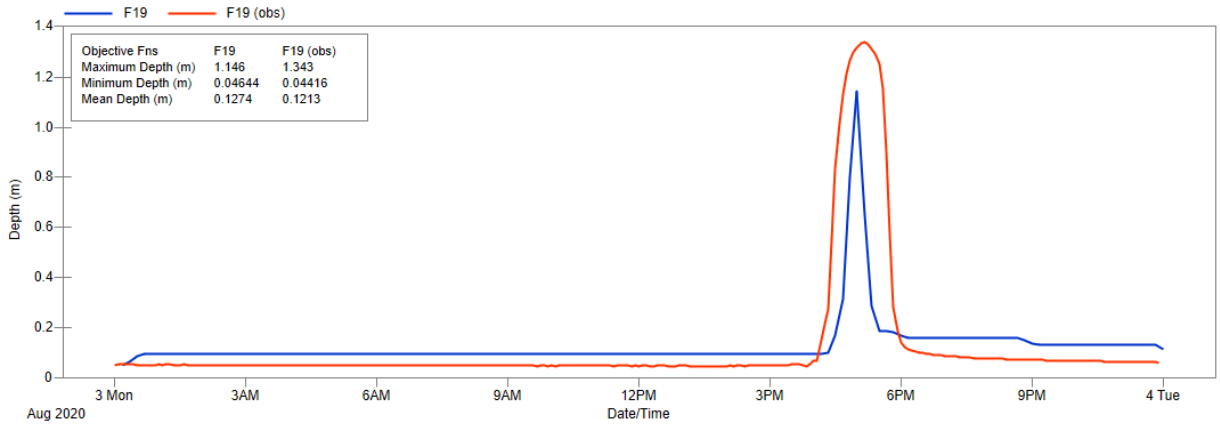

F5
F5 (obs)
Objective Fns F5 F5 (obs)
Maximum Depth (m) 2.686 2.925
Minimum Depth (m) 0.05991 0.04261
Mean Depth (m) 0.1805 0.2199
Depth (m)
3.0
2.5
2.0
1.5
1.0
0.5
0
3 Mon
Aug 2020
3AM
6AM
9AM
12PM
3PM
6PM
9PM
4 Tue
Date/Time

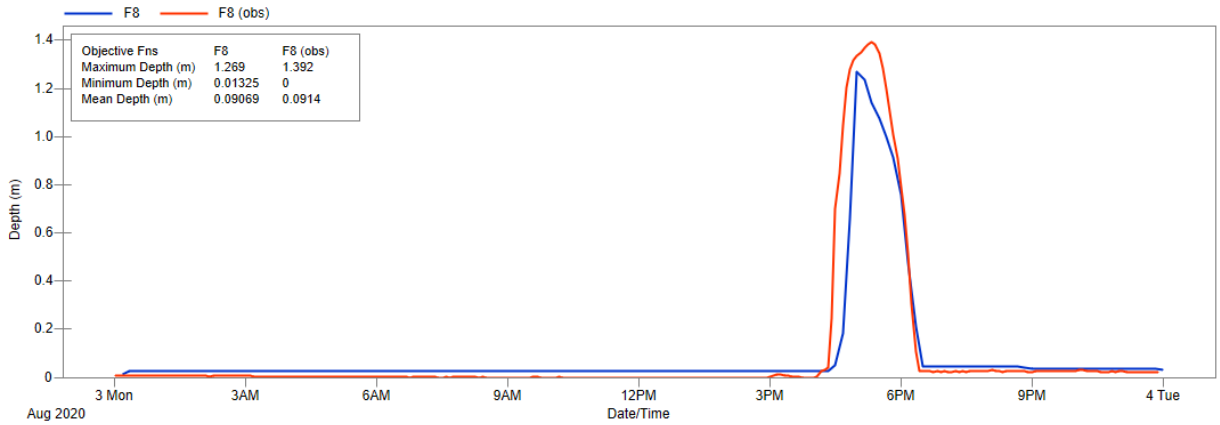

F24
F24 (obs)
Objective Fns F24 F24 (obs)
Maximum Depth (m) 1.781 1.748
Minimum Depth (m) 0.03445 0
Mean Depth (m) 0.1124 0.07382
Depth (m)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
3 Mon
Aug 2020
3AM
6AM
9AM
12PM
3PM
6PM
9PM
4 Tue
Date/Time

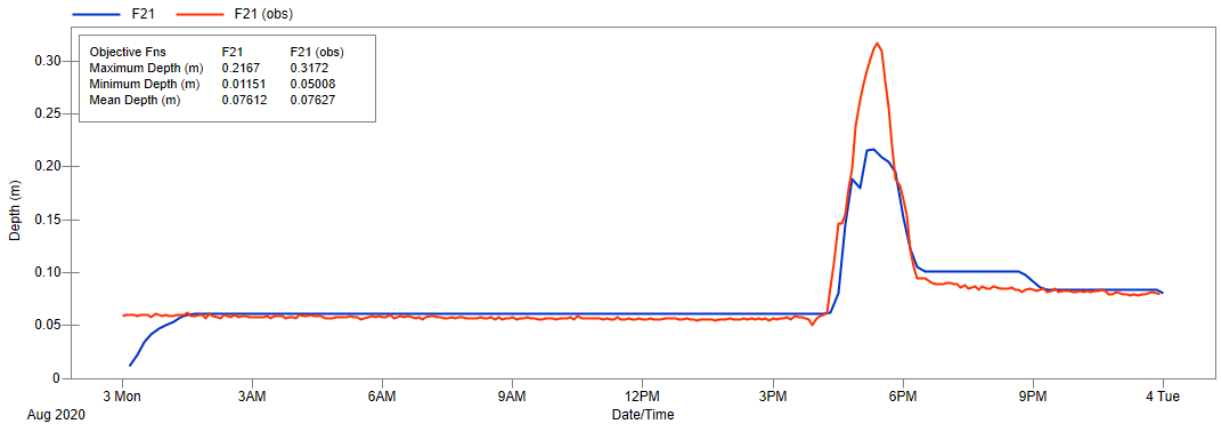

F1
F1(obs)
Objective Fns F1 F1(obs)
Maximum Depth (m) 2.915 2.993
Minimum Depth (m) 0.0684 0.03312
Mean Depth (m) 0.219 0.2167
Depth (m)
3.0
2.5
2.0
1.5
1.0
0.5
0
3 Mon
Aug 2020
3AM
6AM
9AM
12PM
3PM
6PM
9PM
4 Tue
Date/Time

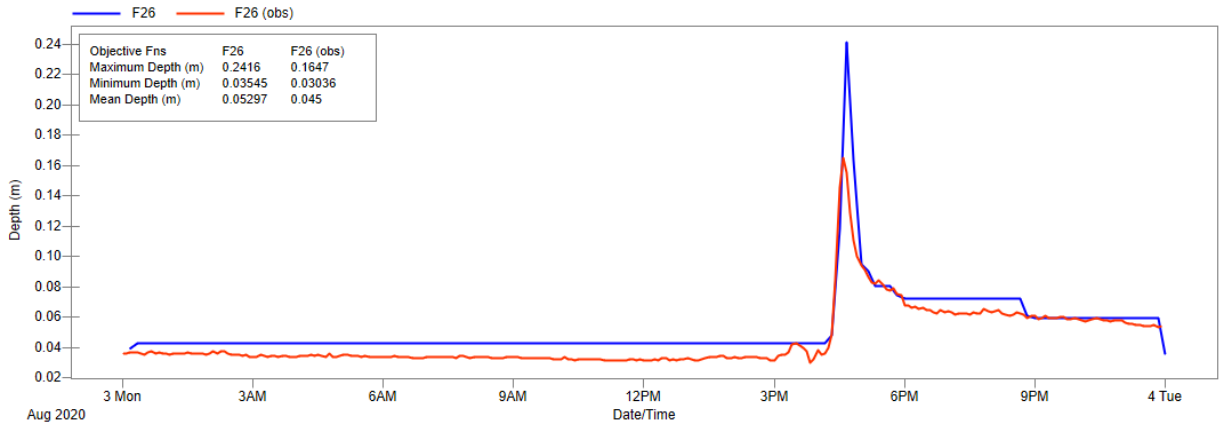

F6
F6 (obs)
Objective Fns F6 F6 (obs)
Maximum Depth (m) 2.583 2.405
Minimum Depth (m) 0.04452 0.04181
Mean Depth (m) 0.2 0.2149
Depth (m)
2.5
2.0
1.5
1.0
0.5
0
3 Mon
Aug 2020
3AM
6AM
9AM
12PM
3PM
6PM
9PM
4 Tue
Date/Time

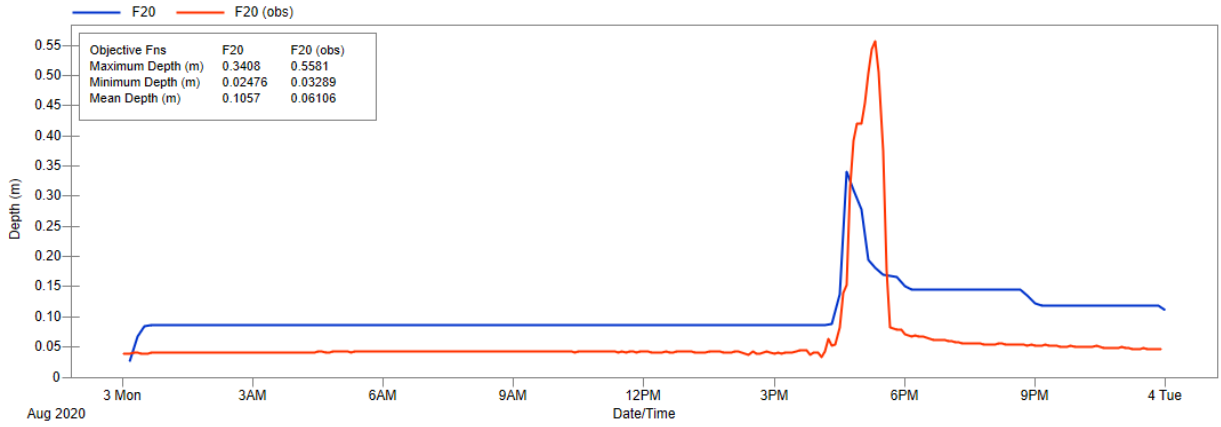

F2
F2(obs)
Objective Fns F2 F2(obs)
Maximum Depth (m) 2.378 2.147
Minimum Depth (m) 0.04019 0.04486
Mean Depth (m) 0.1924 0.1904
Depth (m)
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
3 Mon
Aug 2020
3AM
6AM
9AM
12PM
3PM
6PM
9PM
4 Tue
Date/Time

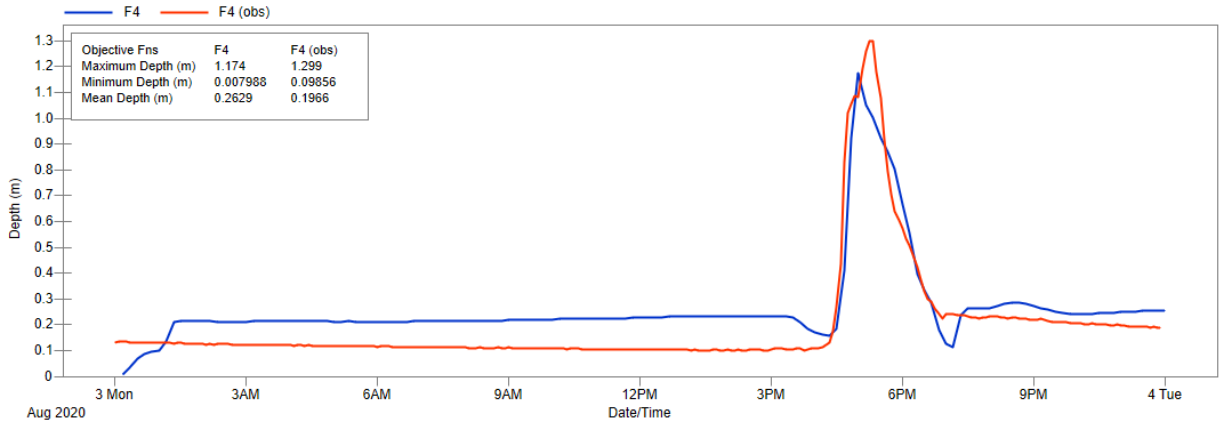

F19
F19 (obs)
Objective Fns F19 F19 (obs)
Maximum Depth (m) 1.146 1.343
Minimum Depth (m) 0.04644 0.04416
Mean Depth (m) 0.1274 0.1213
Depth (m)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
3 Mon
Aug 2020
3AM
6AM
9AM
12PM
3PM
6PM
9PM
4 Tue
Date/Time

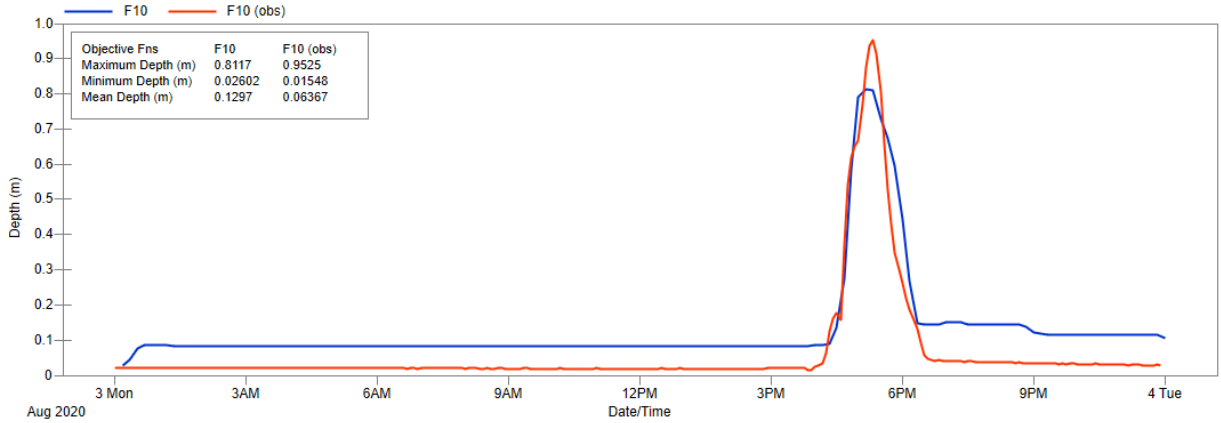

F8
F8 (obs)
Objective Fns F8 F8 (obs)
Maximum Depth (m) 1.269 1.392
Minimum Depth (m) 0.01325 0
Mean Depth (m) 0.09069 0.0914
Depth (m)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
3 Mon
Aug 2020
3AM
6AM
9AM
12PM
3PM
6PM
9PM
4 Tue
Date/Time

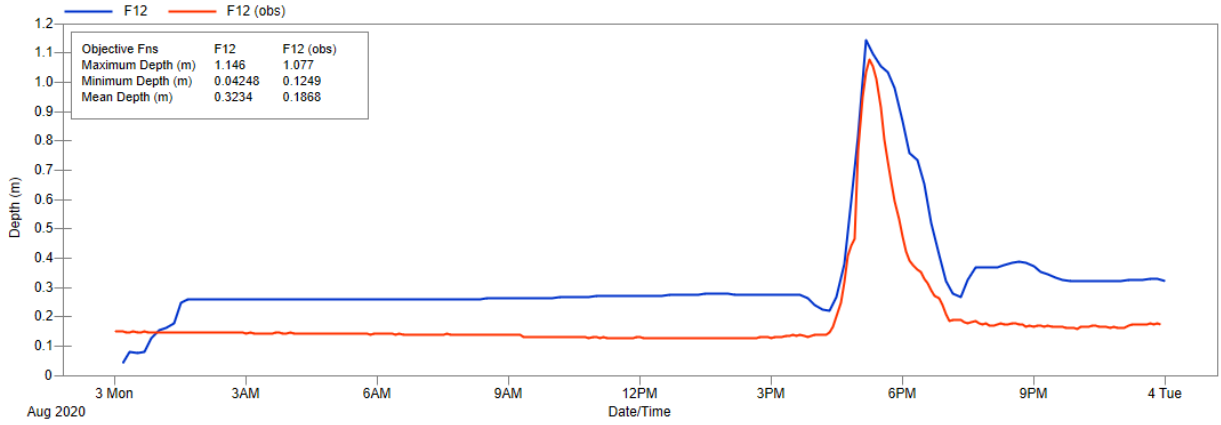

F21
F21 (obs)
Objective Fns F21 F21 (obs)
Maximum Depth (m) 0.2167 0.3172
Minimum Depth (m) 0.01151 0.05008
Mean Depth (m) 0.07612 0.07627
Depth (m)
0.30
0.25
0.20
0.15
0.10
0.05
0
3 Mon
Aug 2020
3AM
6AM
9AM
12PM
3PM
6PM
9PM
4 Tue
Date/Time

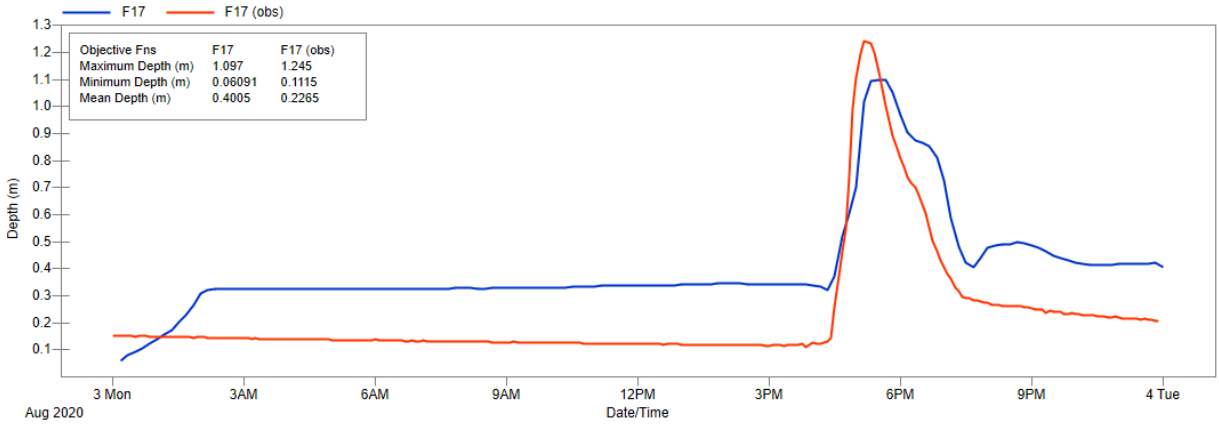

F26
F26 (obs)
Objective Fns F26 F26 (obs)
Maximum Depth (m) 0.2416 0.1647
Minimum Depth (m) 0.03545 0.03036
Mean Depth (m) 0.05297 0.045
Depth (m)
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
3 Mon
Aug 2020
3AM
6AM
9AM
12PM
3PM
6PM
9PM
4 Tue
Date/Time

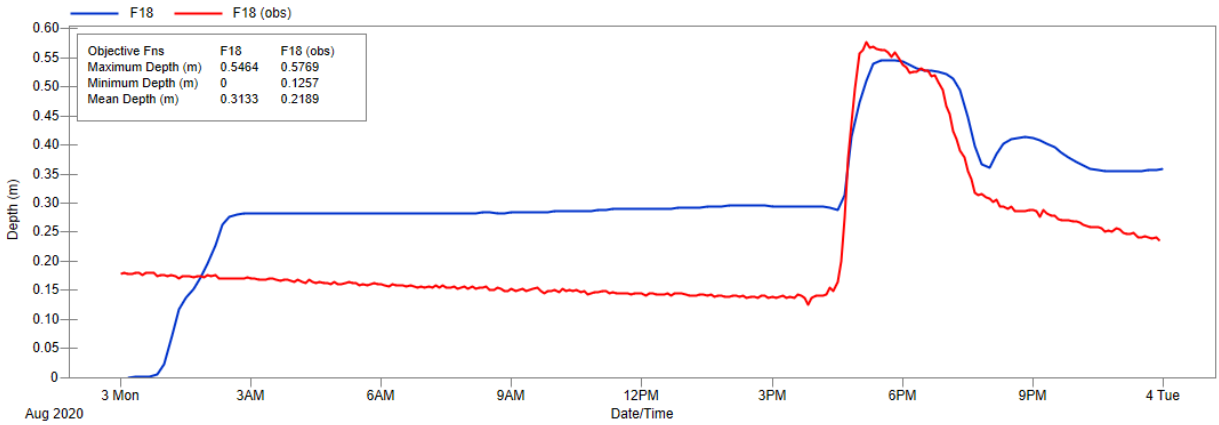

F20
F20 (obs)
Objective Fns F20 F20 (obs)
Maximum Depth (m) 0.3408 0.5581
Minimum Depth (m) 0.02476 0.03289
Mean Depth (m) 0.1057 0.06106
Depth (m)
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0
3 Mon
Aug 2020
3AM
6AM
9AM
12PM
3PM
6PM
9PM
4 Tue
Date/Time


F4
F4 (obs)
Objective Fns F4 F4 (obs)
Maximum Depth (m) 1.174 1.299
Minimum Depth (m) 0.007988 0.09856
Mean Depth (m) 0.2629 0.1966
Depth (m)
3 Mon
Aug 2020
3AM
6AM
9AM
12PM
3PM
6PM
9PM
4 Tue
Date/Time


F10
F10 (obs)
Objective Fns F10 F10 (obs)
Maximum Depth (m) 0.8117 0.9525
Minimum Depth (m) 0.02602 0.01548
Mean Depth (m) 0.1297 0.06367
Depth (m)
3 Mon
Aug 2020
3AM
6AM
9AM
12PM
3PM
6PM
9PM
4 Tue
Date/Time


F12
F12 (obs)
Objective Fns F12 F12 (obs)
Maximum Depth (m) 1.146 1.077
Minimum Depth (m) 0.04248 0.1249
Mean Depth (m) 0.3234 0.1868
Depth (m)
3 Mon
Aug 2020
3AM
6AM
9AM
12PM
3PM
6PM
9PM
4 Tue
Date/Time

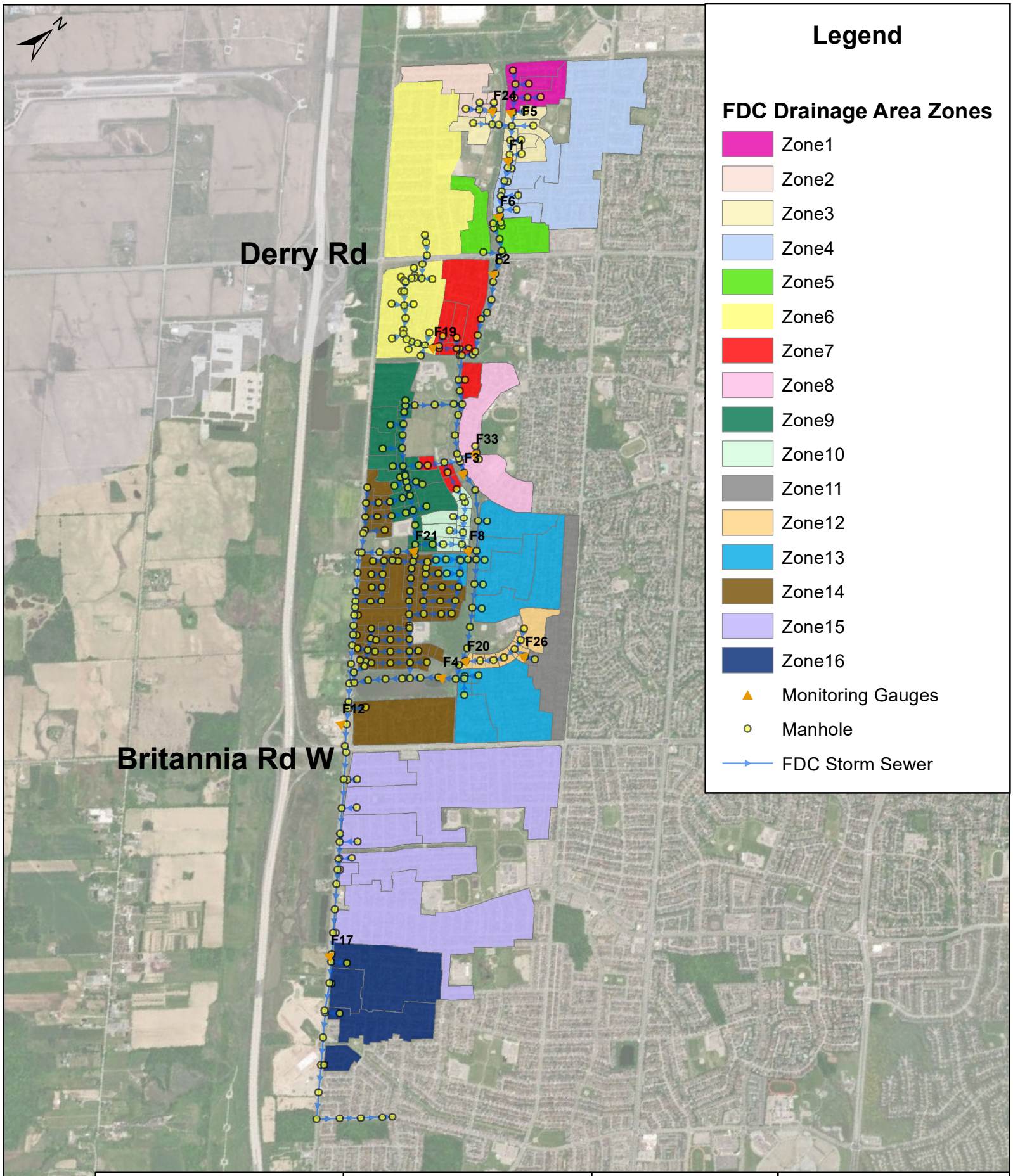


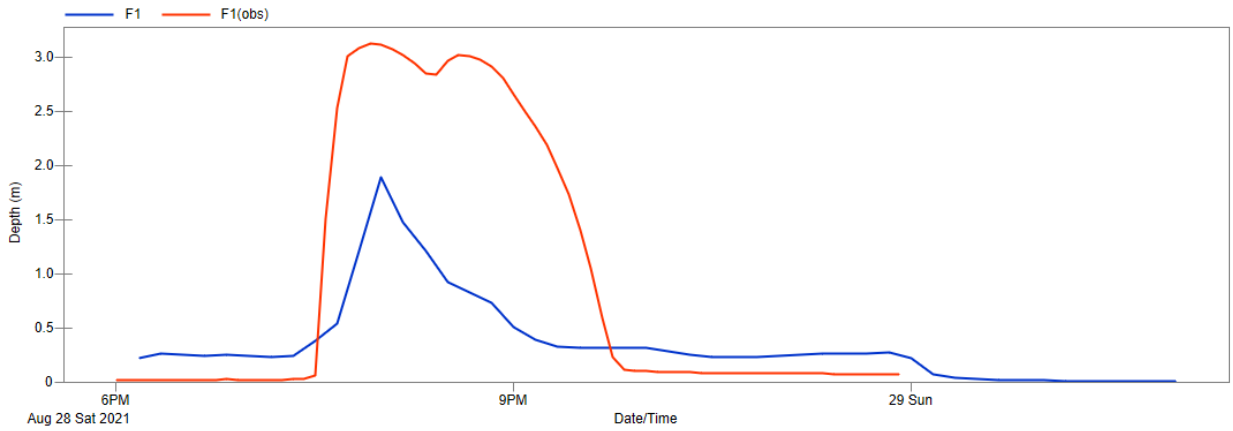

**Summary Table-3-August-2020**

| Monitoring Point | Observed (m) | Simulated (m) | Difference (cm) |
|---|---|---|---|
| F1 | 2.993 | 2.915 | 7.8 |
| F2 | 2.147 | 2.378 | 23.1 |
| F4 | 1.299 | 1.174 | 12.5 |
| F5 | 2.925 | 2.686 | 23.9 |
| F6 | 2.405 | 2.583 | 17.8 |
| F8 | 1.392 | 1.269 | 12.3 |
| F10 | 0.9525 | 0.8117 | 14.08 |
| F12 | 1.077 | 1.146 | 6.9 |
| F13 | 1.141 | 0.9473 | 19.37 |
| F14 | 1.56 | 1.381 | 17.9 |
| F17 | 1.245 | 1.097 | 14.8 |
| F18 | 0.5769 | 0.5464 | 3.05 |
| F19 | 1.343 | 1.146 | 19.7 |
| F20 | 0.5581 | 0.3408 | 21.73 |
| F21 | 0.3172 | 0.2167 | 10.05 |

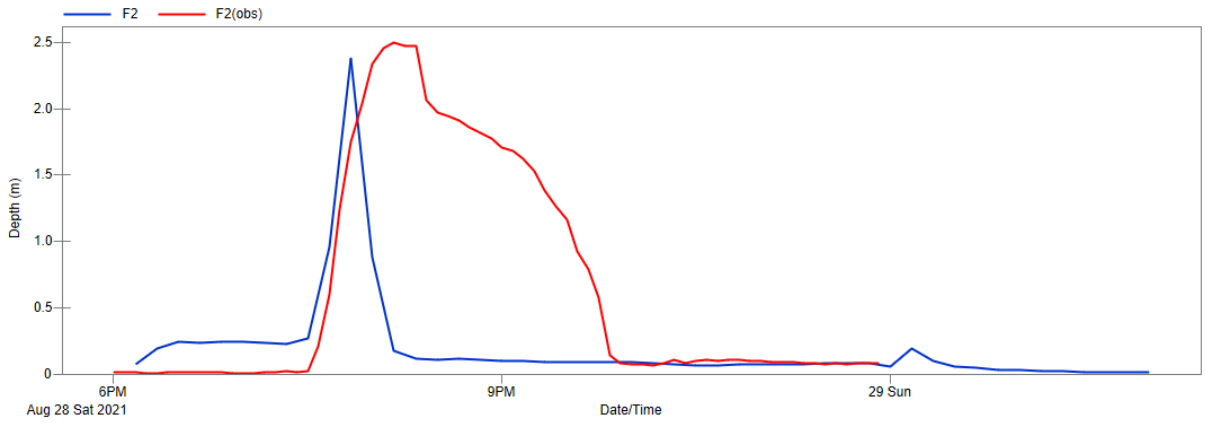
| | | | |
|---|---|---|---|
| F24 | 1.748 | 1.781 | 3.3 |
| F26 | 0.1647 | 0.2416 | 7.69 |

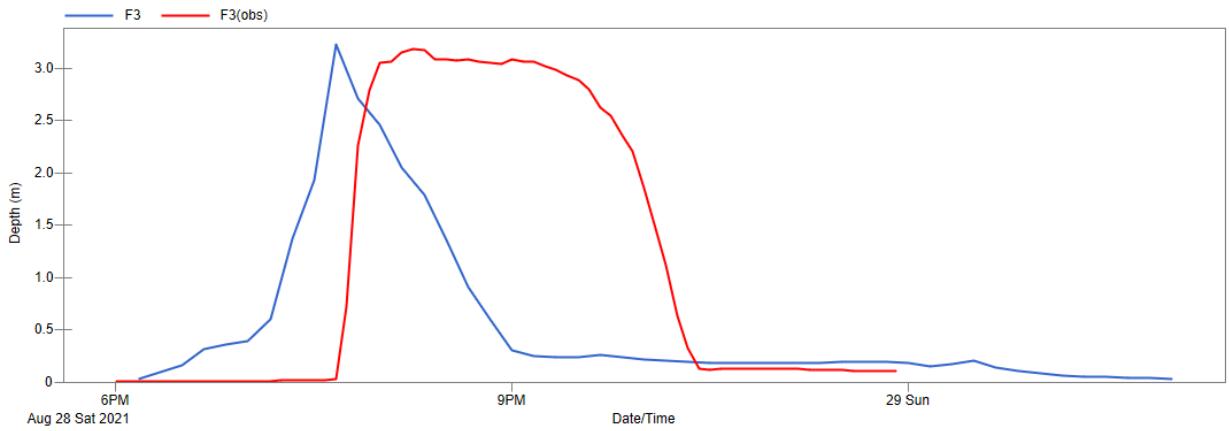


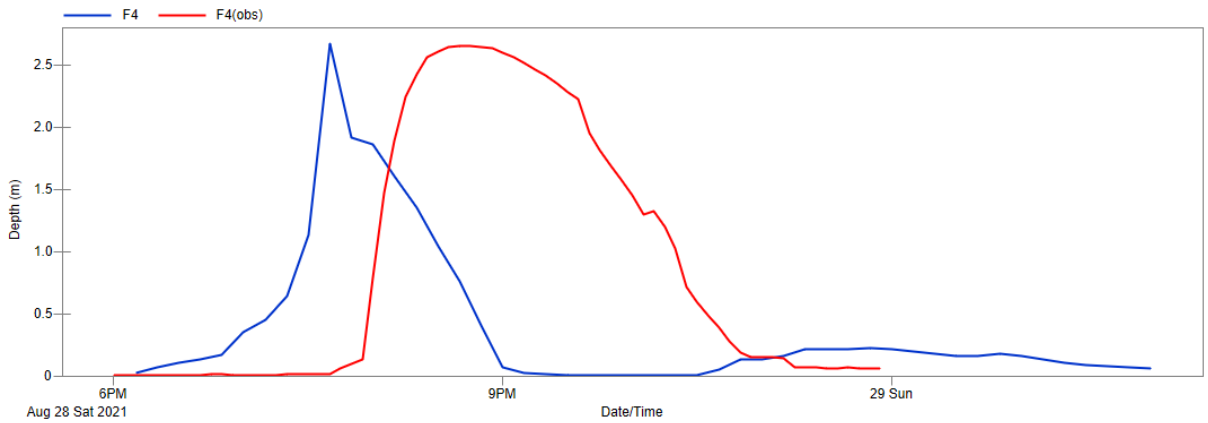

| | | | |
|---|---|---|---|
| **Lisgar**<br>**City of Mississauga** | **FDC Drainage Area Zones**<br>**28-August-2021** | wood. | Scale **1:30,000**<br>Project No. **WW21011023**<br>Figure No. **6** |

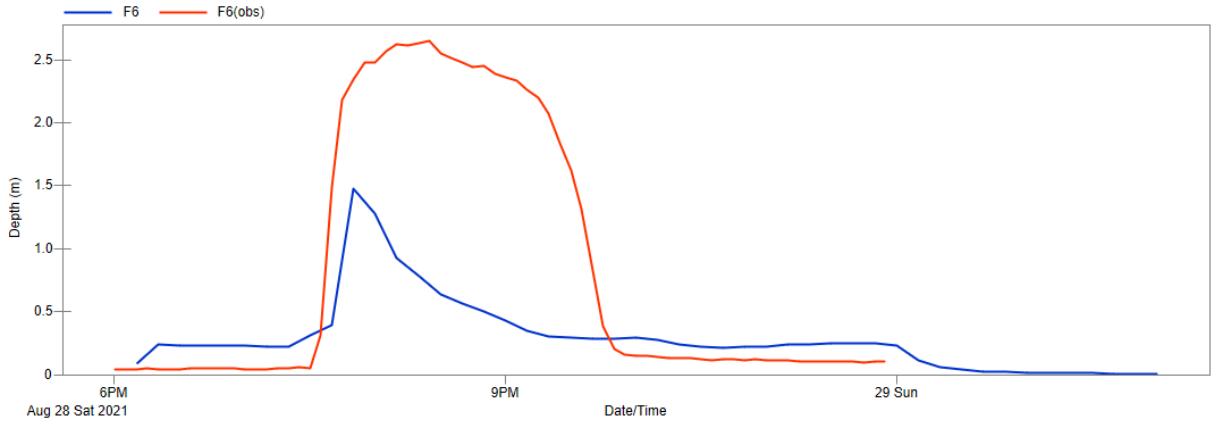



F1 location: Upstream of Black Walnut Portal Pump Station.

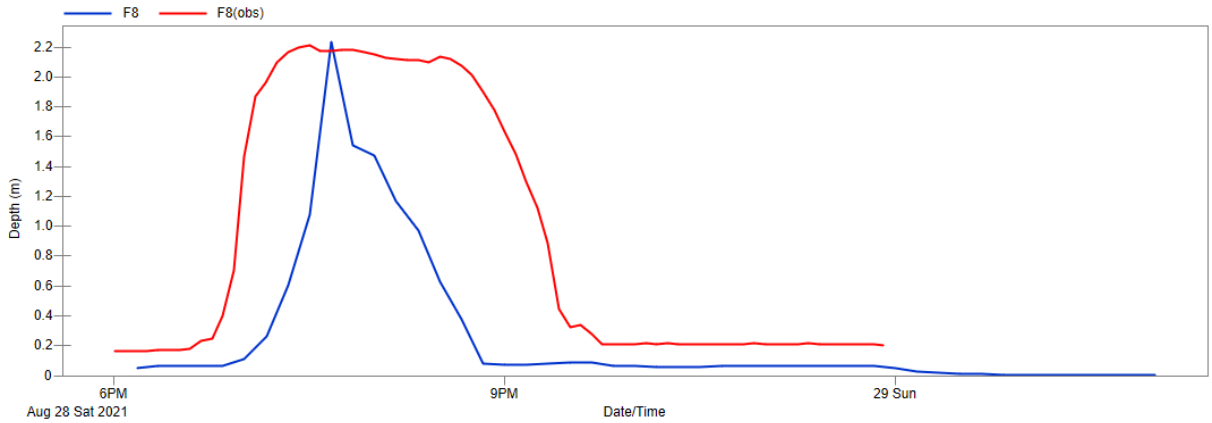


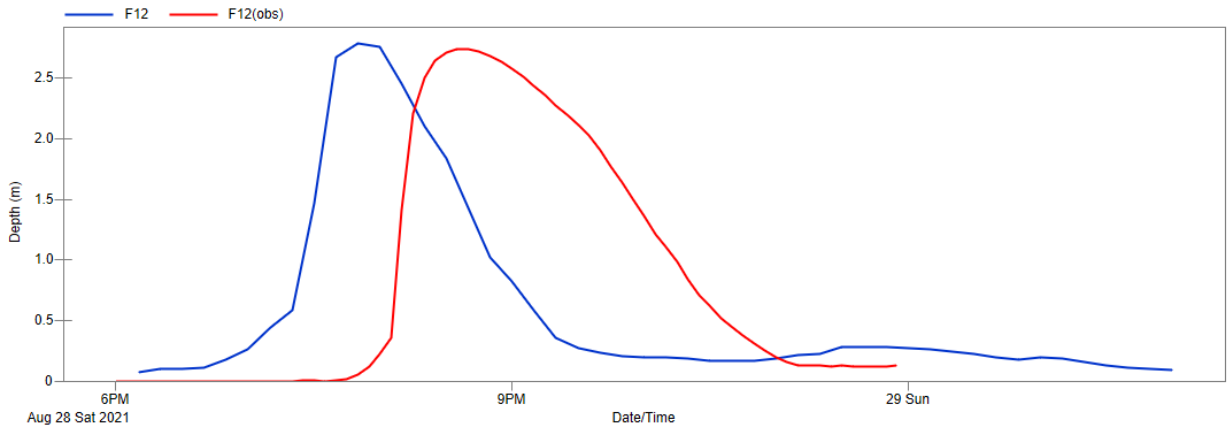



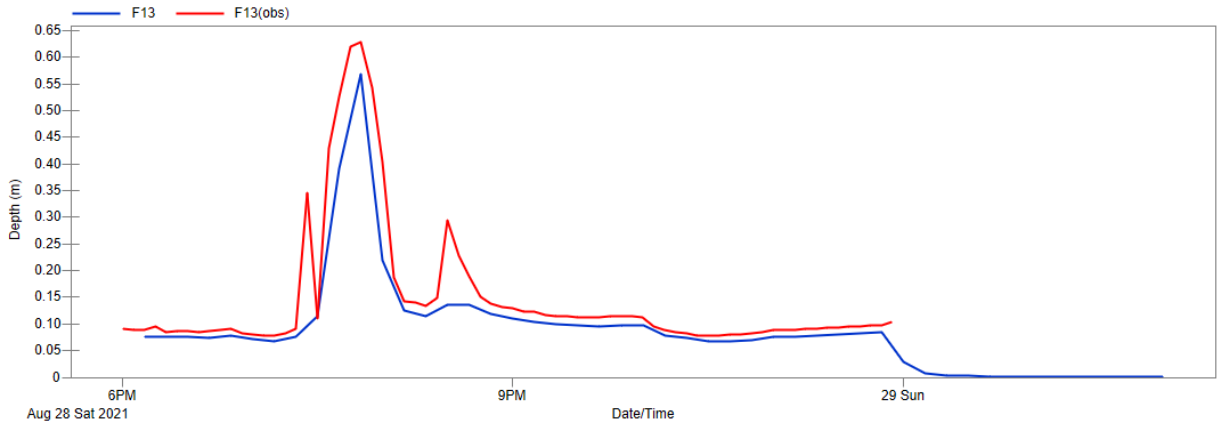


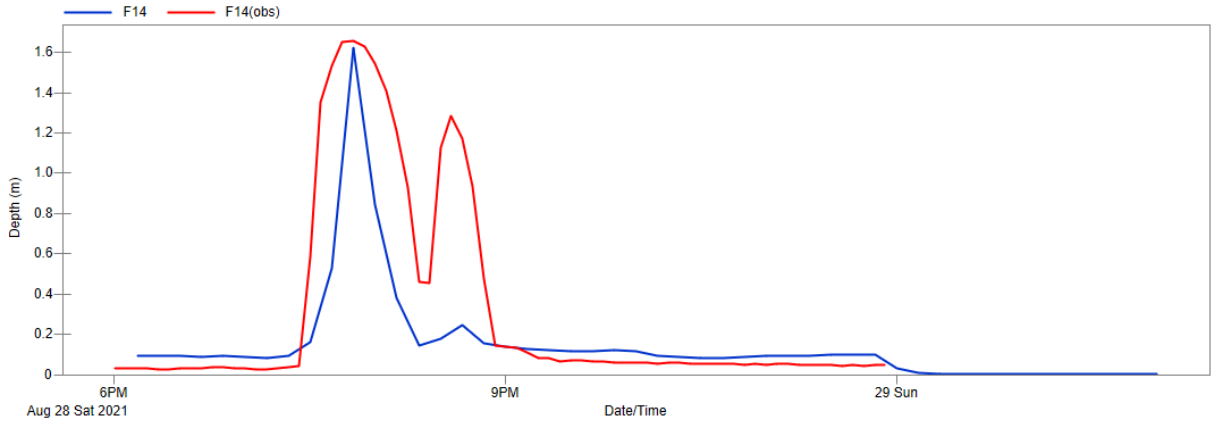



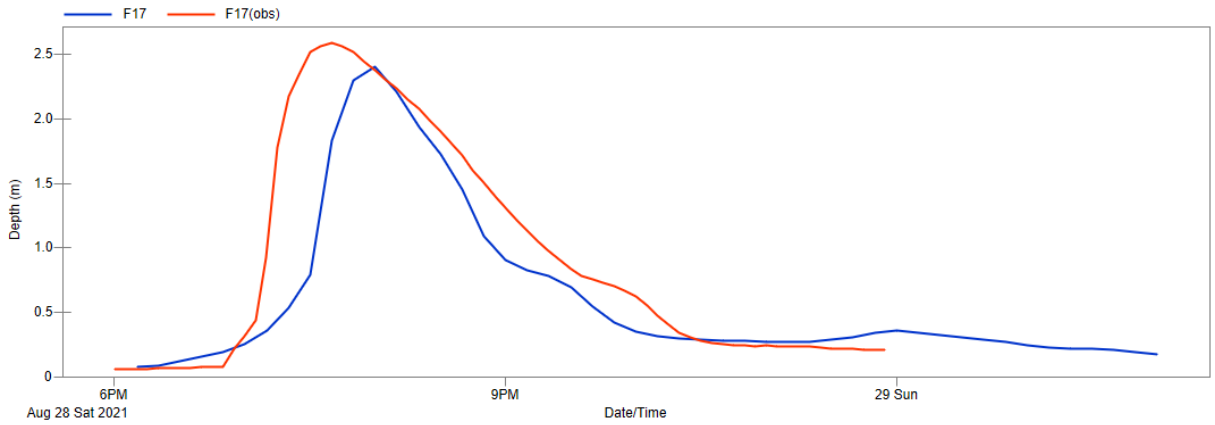

F6 location: Upstream of Black Walnut Portal Pump Station.

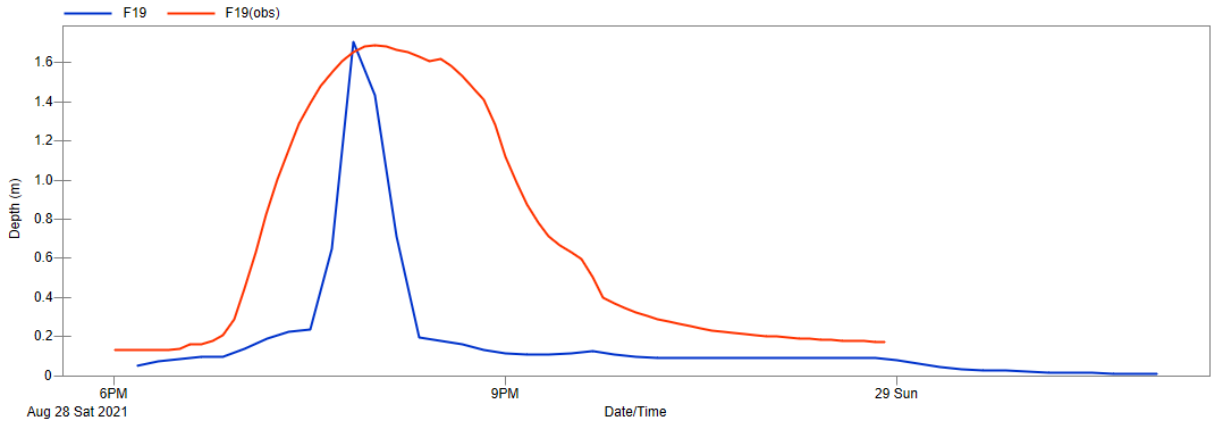


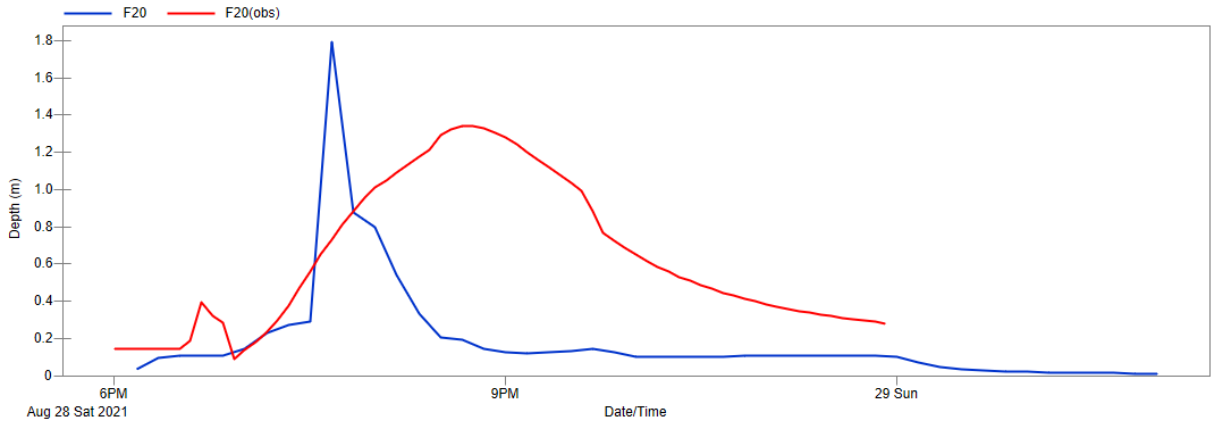

F12
F12(obs)
Depth (m)
2.5
2.0
1.5
1.0
0.5
0
6PM
Aug 28 Sat 2021
9PM
29 Sun
Date/Time


F13
F13(obs)
Depth (m)
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0
6PM
Aug 28 Sat 2021
9PM
29 Sun
Date/Time

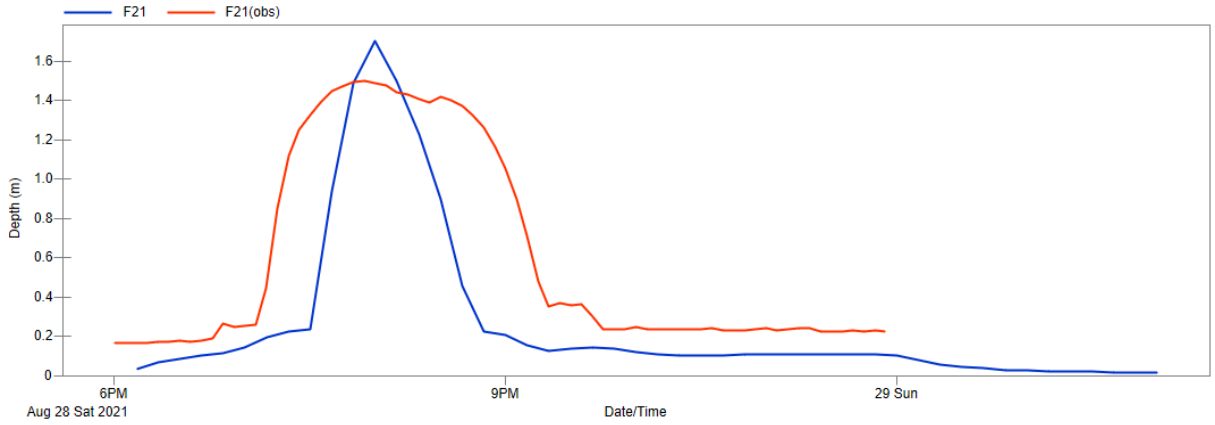

F14
F14(obs)
Depth (m)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
6PM
Aug 28 Sat 2021
9PM
29 Sun
Date/Time

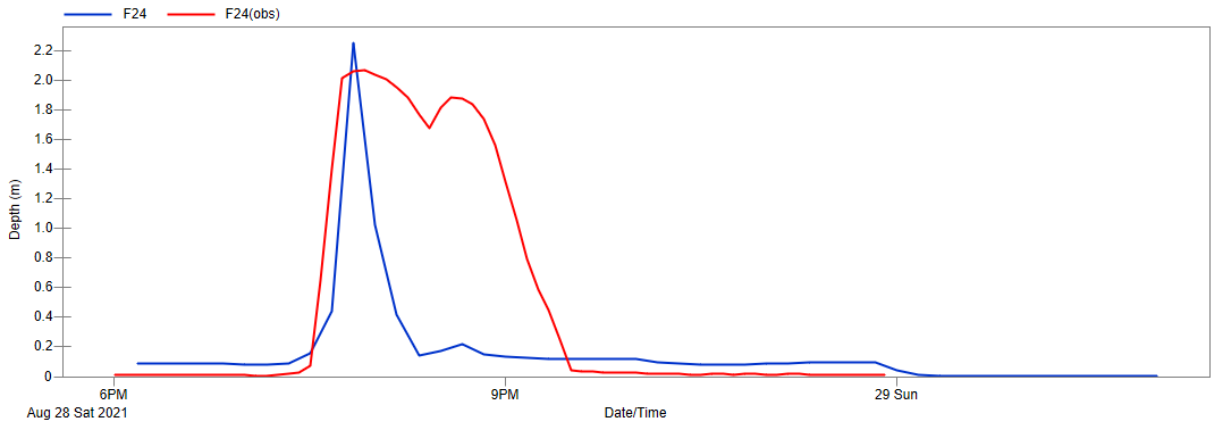


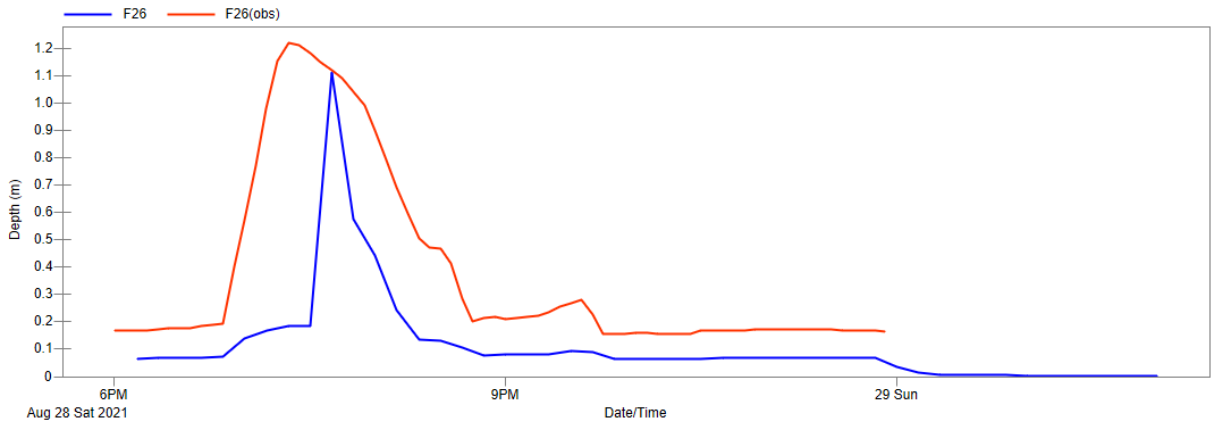



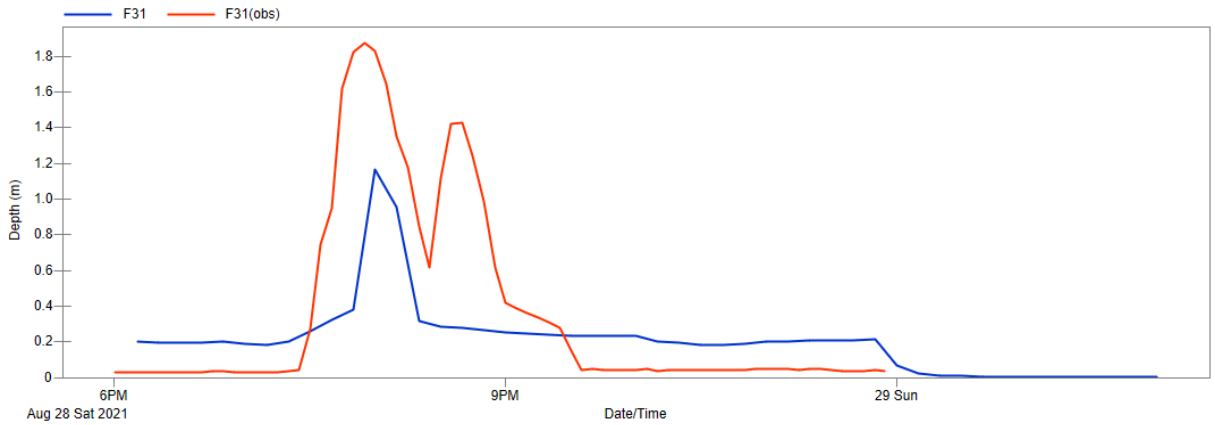




F20 location: Upstream of Osprey Blvd Portal Pump Station.

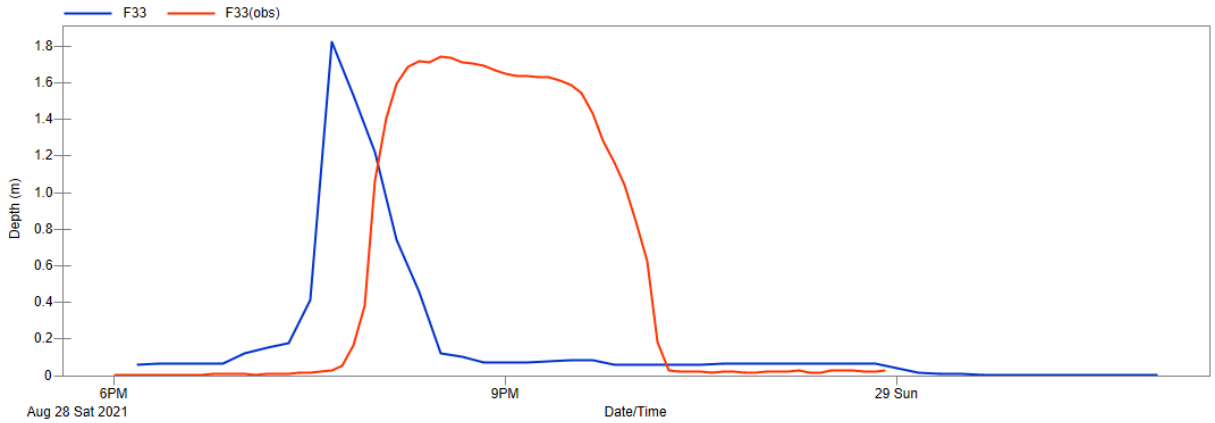

F21
F21(obs)
Depth (m)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
6PM
Aug 28 Sat 2021
9PM
29 Sun
Date/Time


F24
F24(obs)
Depth (m)
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
6PM
Aug 28 Sat 2021
9PM
29 Sun
Date/Time


F26
F26(obs)
Depth (m)
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
6PM
Aug 28 Sat 2021
9PM
29 Sun
Date/Time




F31 location: Upstream of Cactus Gate Pump Station.



# Appendix C
# Pump Station Sizing Results

# Appendix C1
# Black Walnut Trail Area

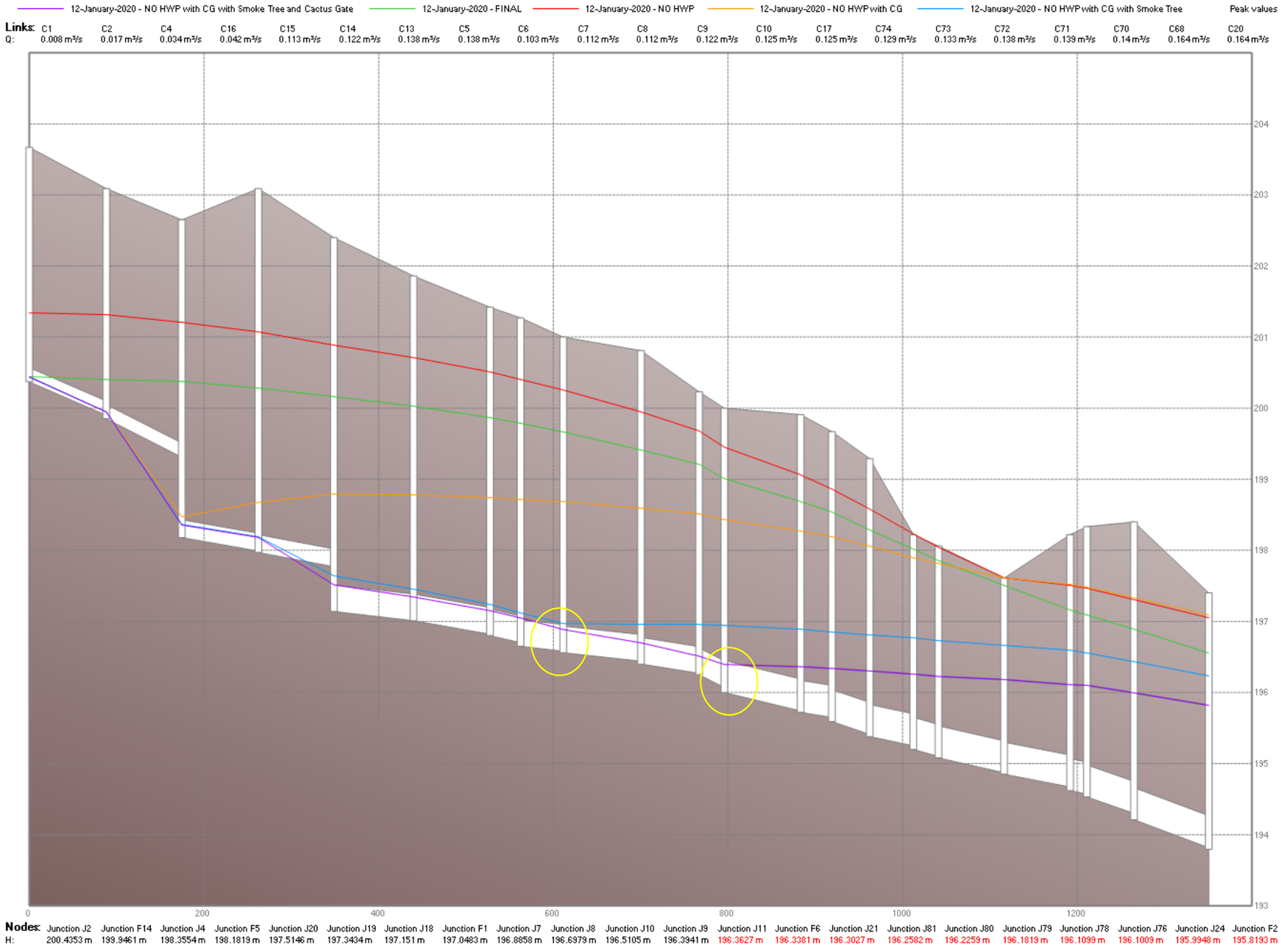



**Figure C1A: HGL Plot along Black Walnut Trail (Upper End to Gauge F2) for January 11-12, 2020 Storm Event Simulation. Location of Smoke Tree and Scotch Pine Gate diversions circled in yellow.**

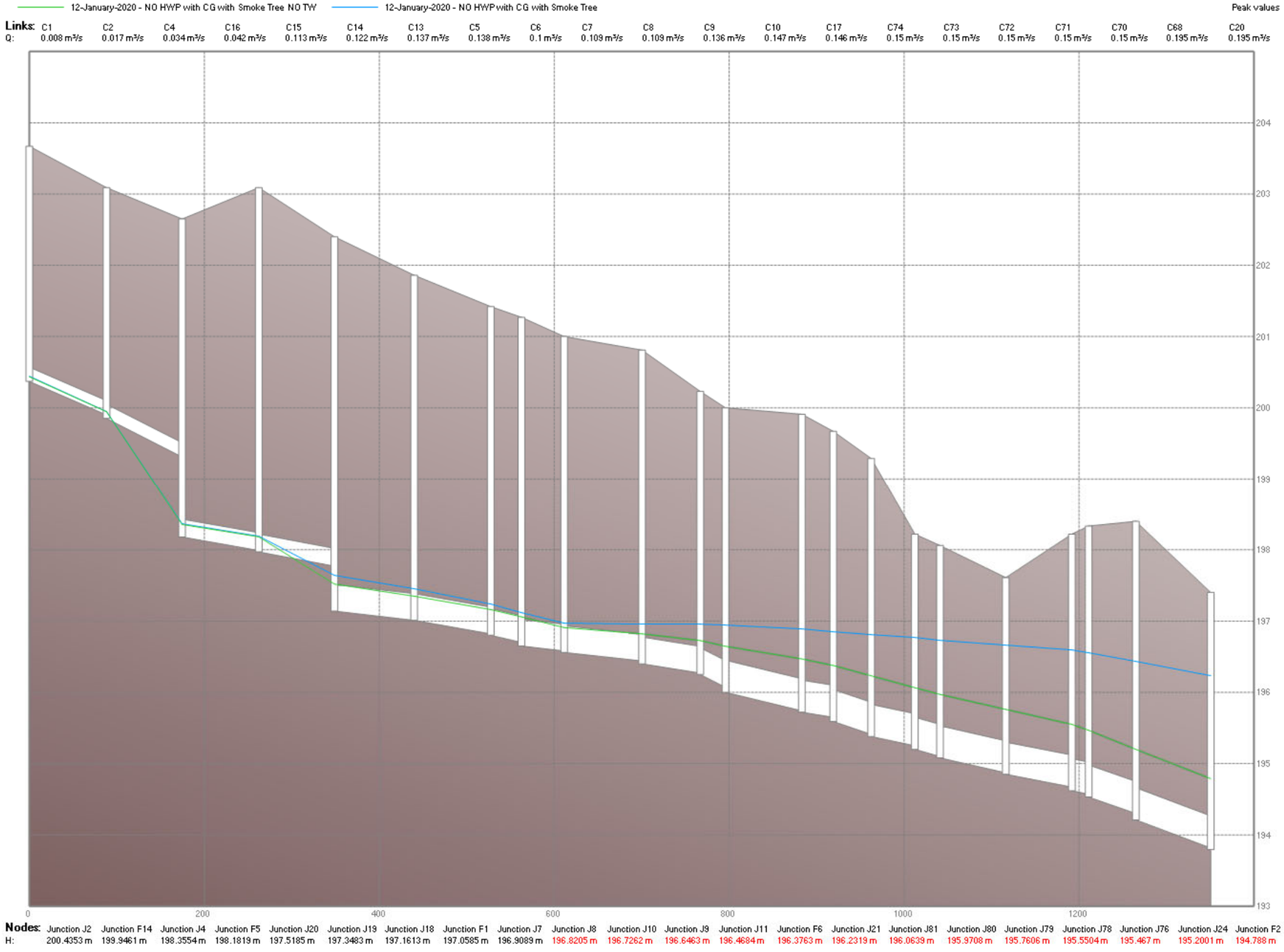



**Figure C1B: HGL Plot along Black Walnut Trail (Upper End to Gauge F2) for January 11-12, 2020 Storm Event Simulation – with Smoke Tree diversion in place, with and without tailwater conditions**

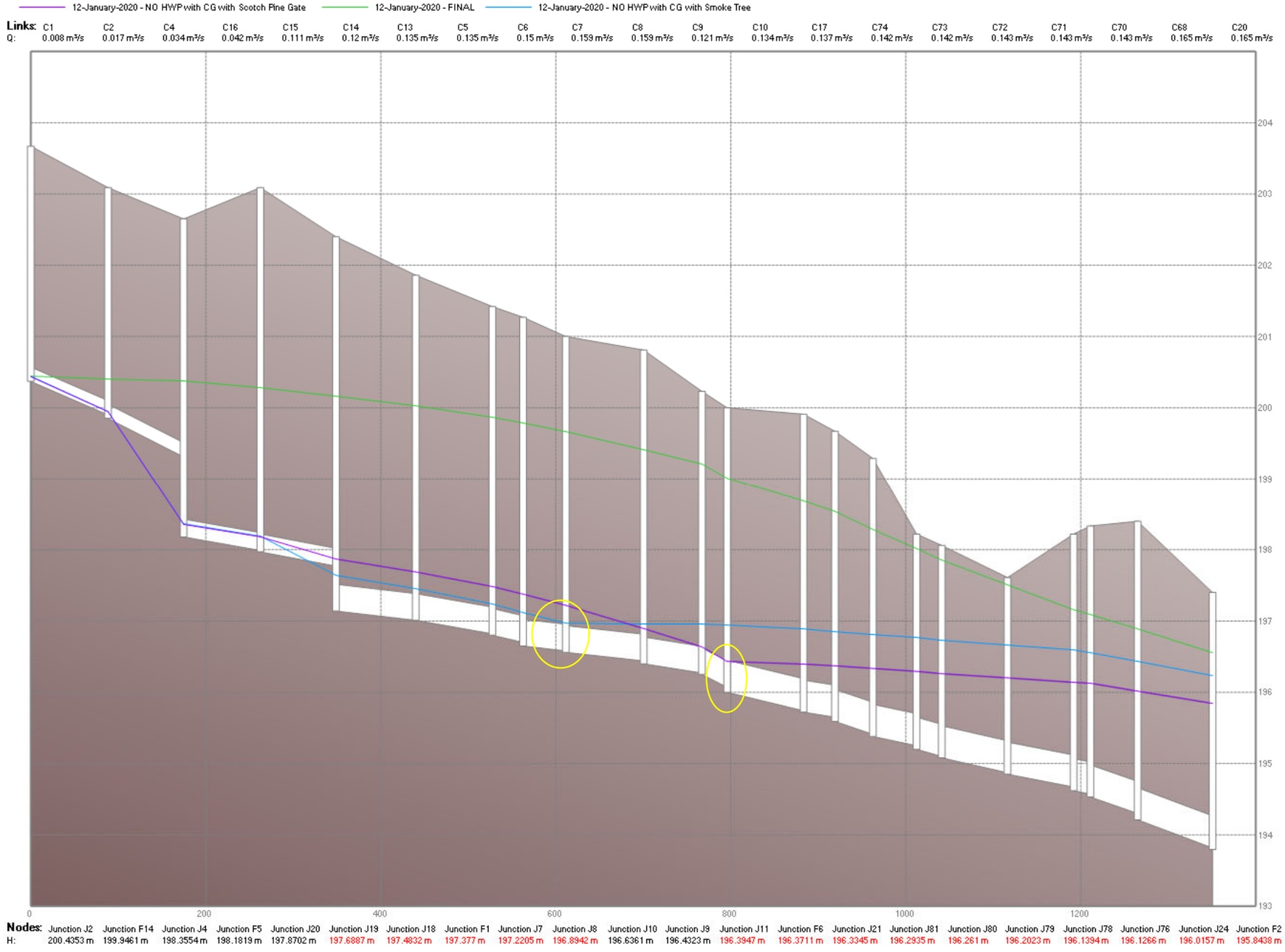



**Figure C1C: HGL Plot along Black Walnut Trail (Upper End to Gauge F2) for January 11-12, 2020 Storm Event Simulation – diversion at Smoke Tree Road vs. Scotch Pine Gate (locations in yellow)**

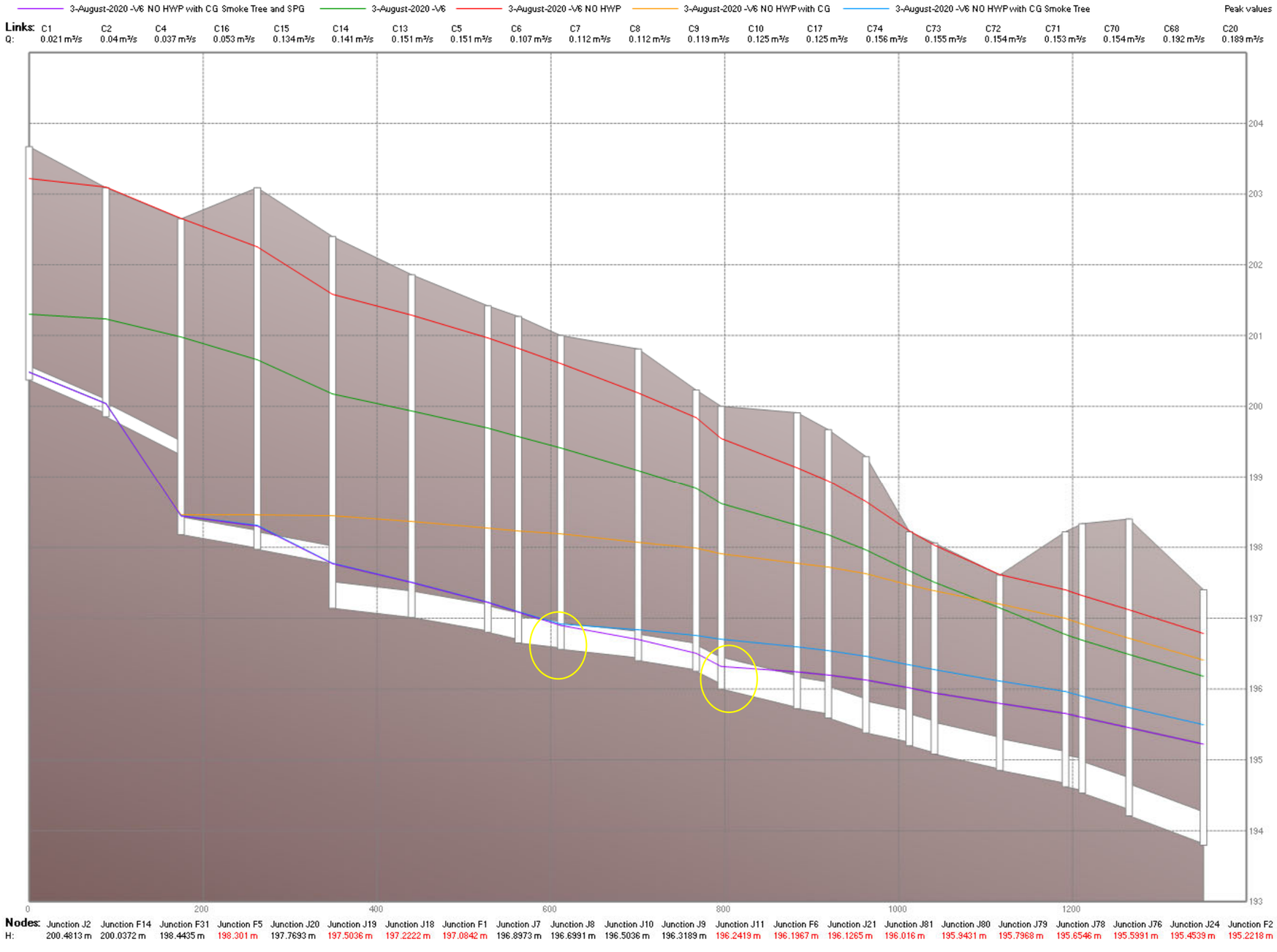



**Figure C1D: HGL Plot along Black Walnut Trail (Upper End to Gauge F2) for August 3, 2020 Storm Event Simulation. Location of Smoke Tree and Scotch Pine Gate diversions circled in yellow.**

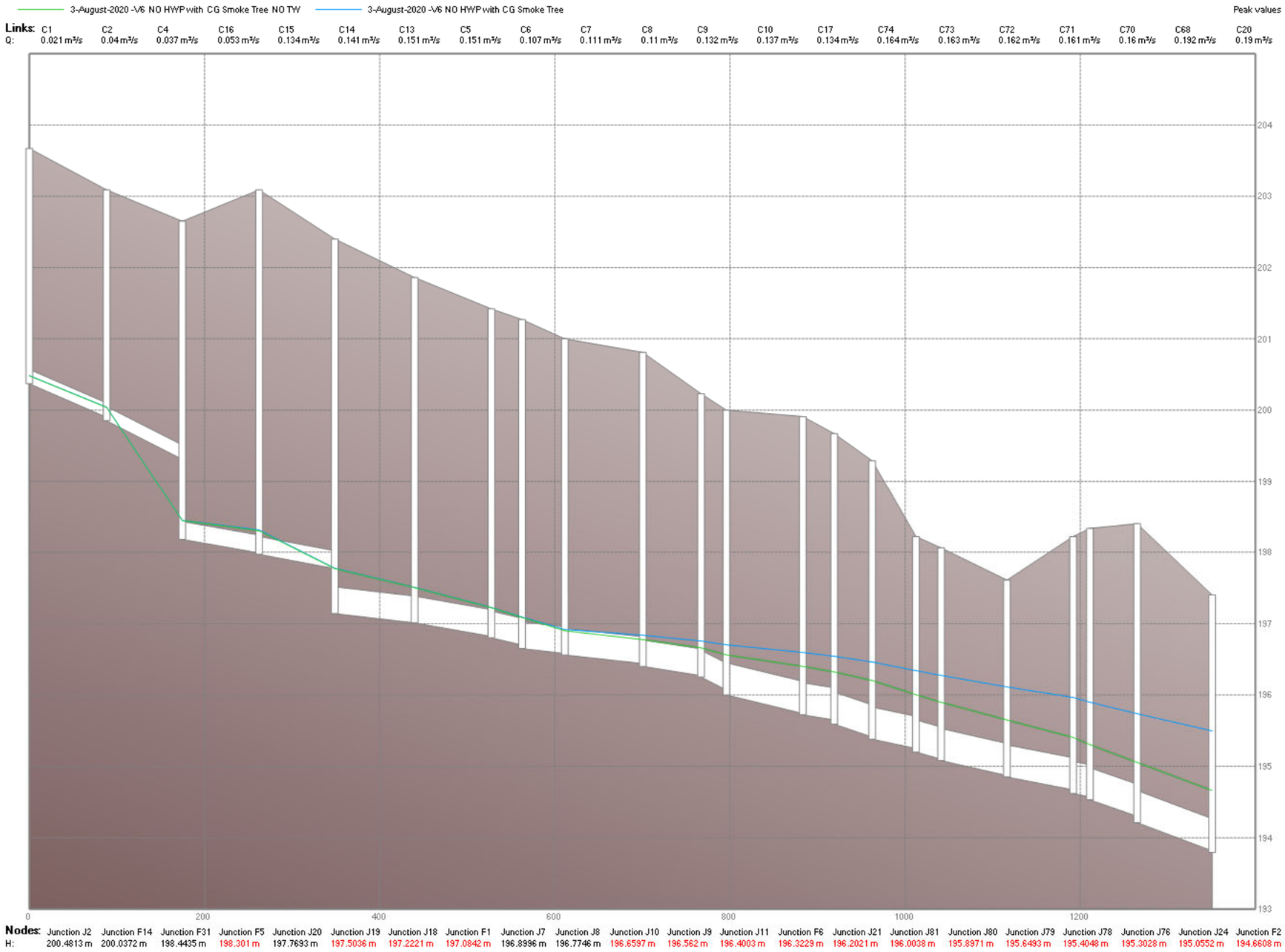



**Figure C1E: HGL Plot along Black Walnut Trail (Upper End to Gauge F2) for August 3, 2020 Storm Event Simulation – with Smoke Tree diversion in place, with and without tailwater conditions**

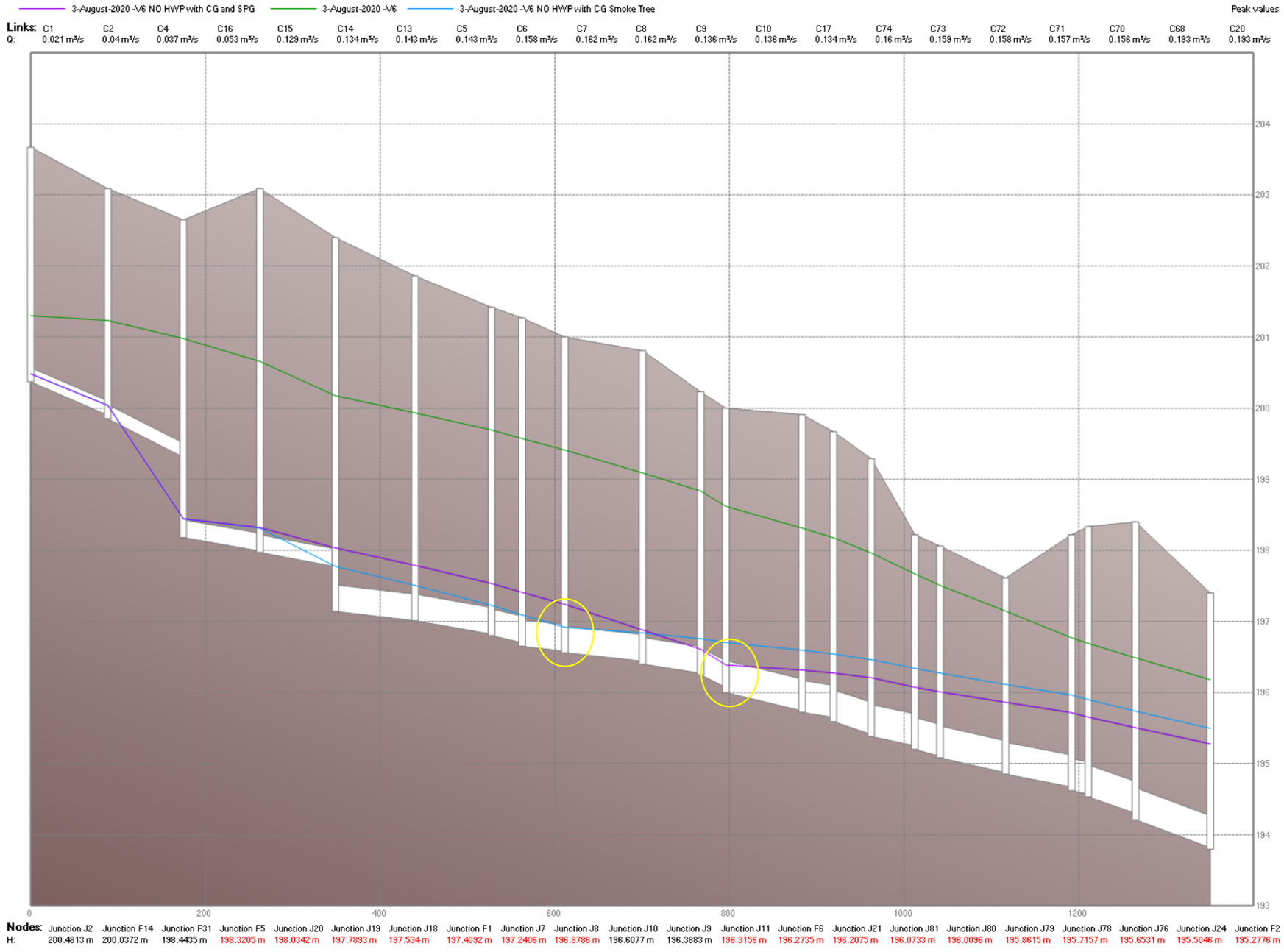



**Figure C1F: HGL Plot along Black Walnut Trail (Upper End to Gauge F2) for August 3, 2020 Storm Event Simulation – diversion at Smoke Tree Road vs. Scotch Pine Gate (locations in yellow)**

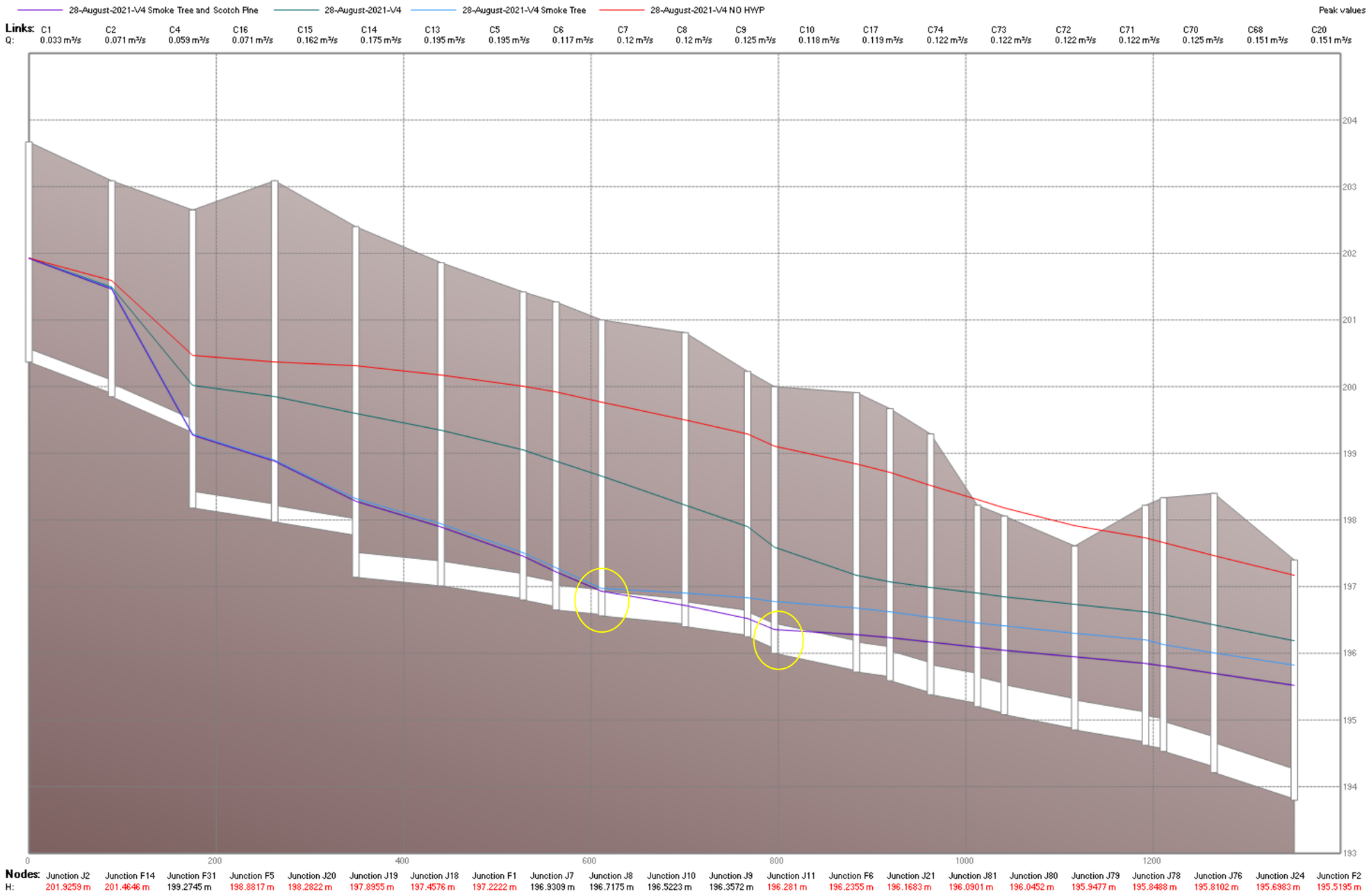



**Figure C1G: HGL Plot along Black Walnut Trail (Upper End to Gauge F2) for August 28, 2021 Storm Event Simulation. Location of Smoke Tree and Scotch Pine Gate diversions circled in yellow.**

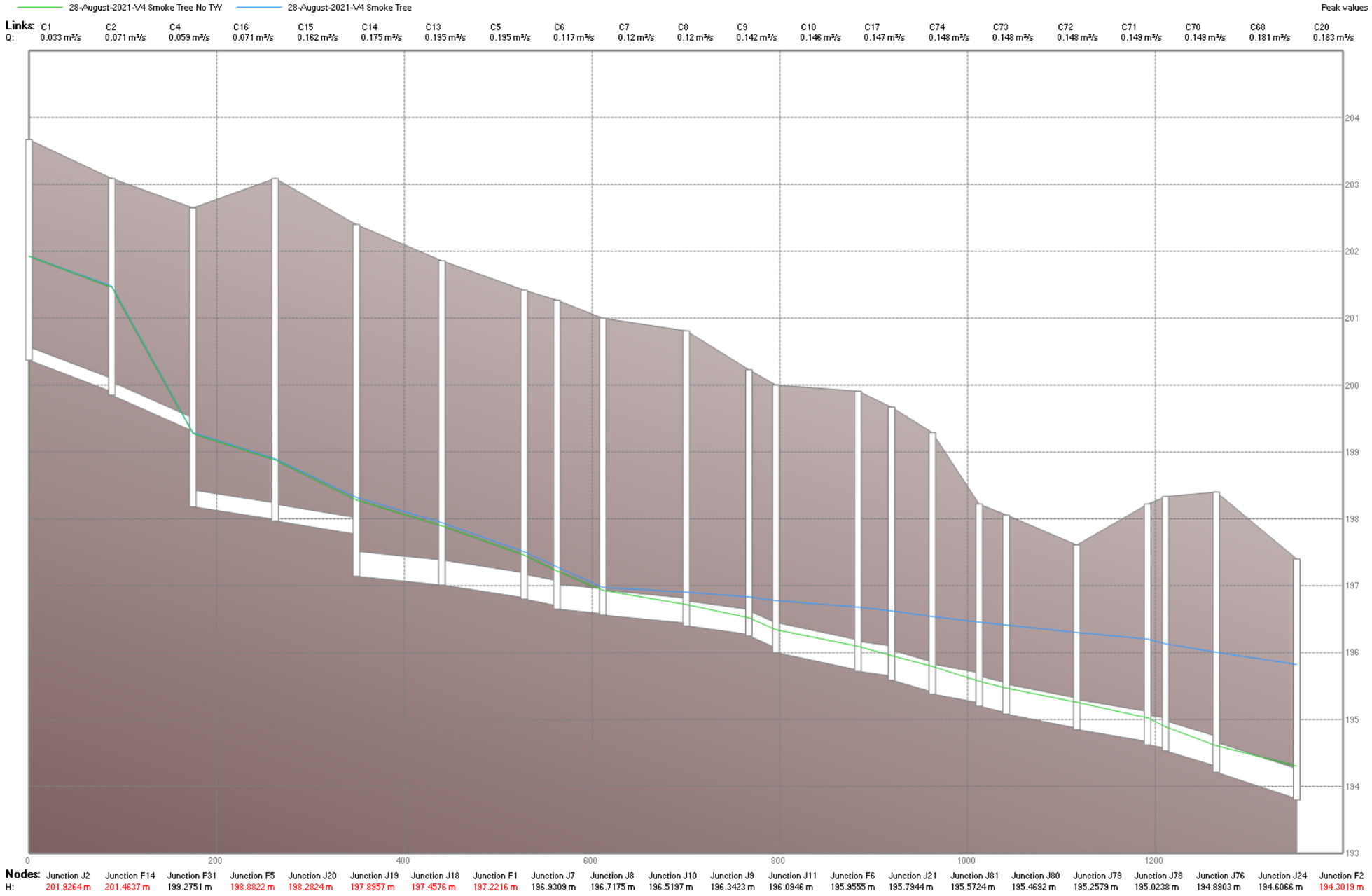



**Figure C1H: HGL Plot along Black Walnut Trail (Upper End to Gauge F2) for August 28, 2021 Storm Event Simulation – with Smoke Tree diversion in place, with and without tailwater conditions**

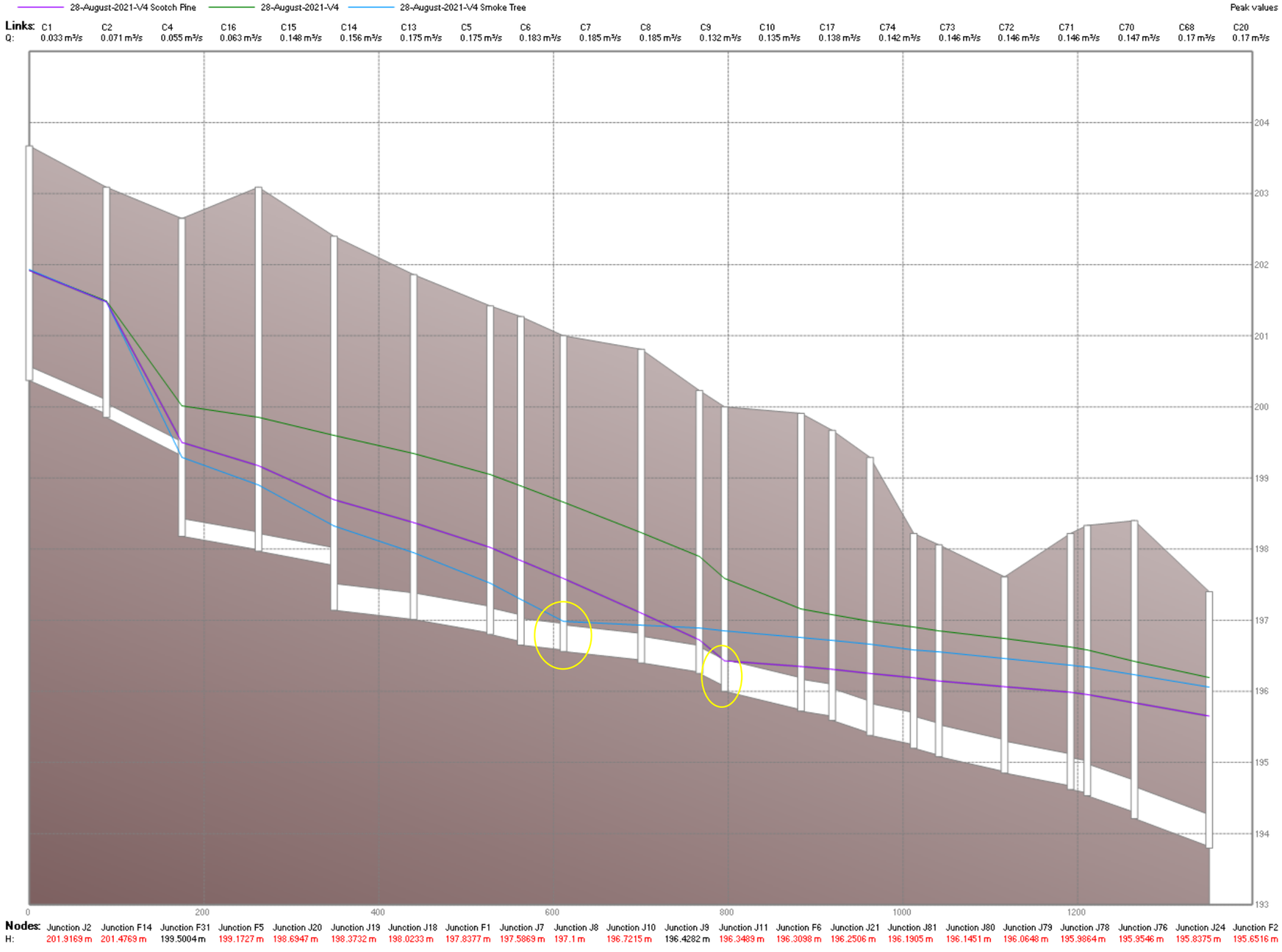
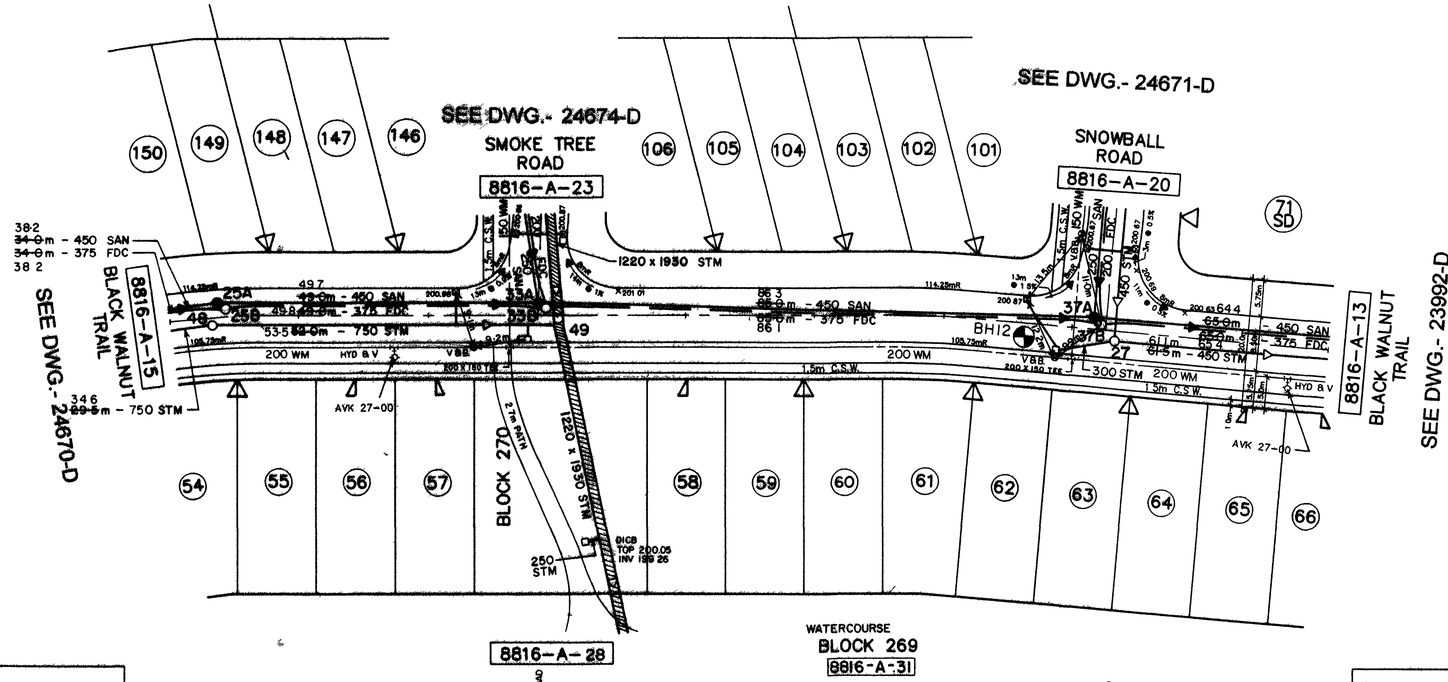



**Figure C1I: HGL Plot along Black Walnut Trail (Upper End to Gauge F2) for August 28, 2021 Storm Event Simulation – diversion at Smoke Tree Road vs. Scotch Pine Gate (locations in yellow)**

# BLACK WALNUT TRAIL




**NOTE:**
ROOF LEADERS FOR ALL LOTS ARE NOT TO BE CONNECTED DIRECTLY TO THE STORM SEWER SYSTEM.

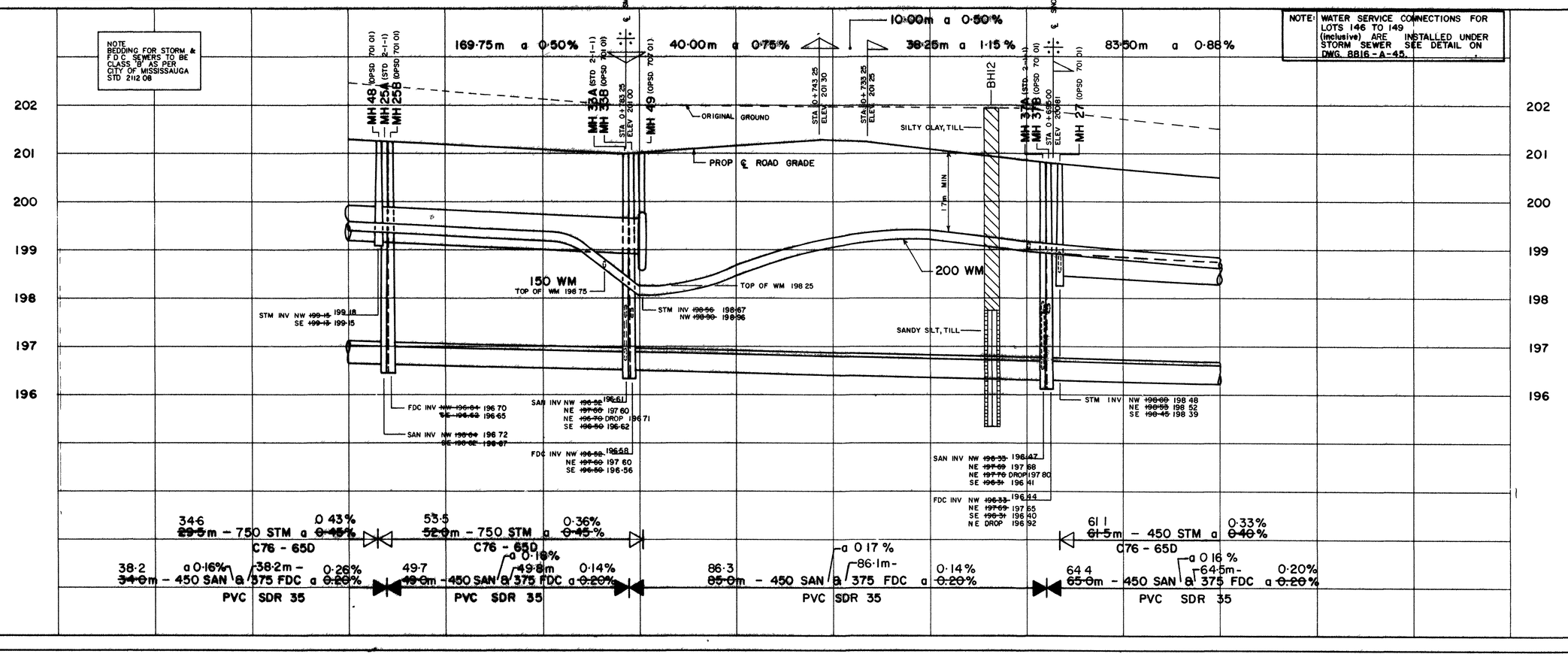
**NOTE:**
(58) LOT No FOR PLAN No.2

▷ DOUBLE SERVICE CONNECTIONS
▽ SINGLE SERVICE CONNECTIONS — SEE DETAIL ON DWG. 8816-A-45

| ROAD BASE | |
|---|---|
| HL3 | – 40mm |
| HL8 | – 85mm |
| GRANULAR 'A' | – 150mm |
| GRANULAR 'B' | – 285mm |
| | 560mm |

NOTE: WATER SERVICE CONNECTIONS FOR LOTS 146 TO 149 (inclusive) ARE INSTALLED UNDER STORM SEWER SEE DETAIL ON DWG. 8816-A-45.

NOTE BEDDING FOR STORM & F D C SEWERS TO BE CLASS 'B' AS PER CITY OF MISSISSAUGA STD 2112.08

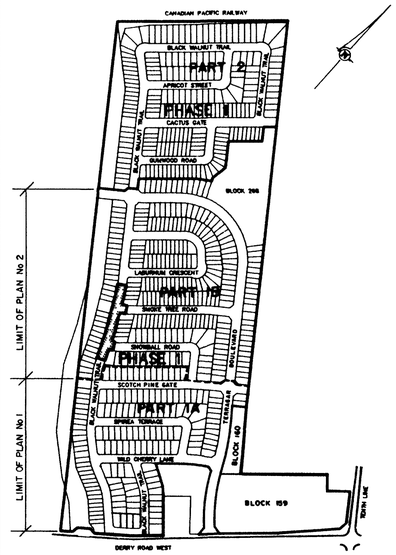



## SERVICE DATA

| SERVICE | DATE | INIT | SERVICE | DATE | INIT |
|---|---|---|---|---|---|
| SAN SEWERS | | | GAS MAINS | | |
| STORM SEWERS | | | BELL U/G CABLES | | |
| WATERMAINS | | | HYDRO U/G CABLES | | |

## REVISIONS

| DATE | DETAILS | INIT |
|---|---|---|
| MAY 5, 1997 | STORM PIPE SIZE - SMOKE TREE ROAD REVISED | |
| JAN 28, 1999 | AS CONSTRUCTED | |




KEY PLAN
SCALE 1 7500

FOR GENERAL NOTES SEE DWG. 8816-A-44

## GENERAL NOTES

- ALL DRIVEWAYS ASPHALT UNLESS OTHERWISE NOTED
- ALL SERVICE LOCATIONS ARE APPROXIMATE AND MUST BE LOCATED ACCURATELY IN FIELD
- ● DENOTES BUILDING – NOT LOCATED
- ⌐ DENOTES BUILDING – LOCATED
- T T B M No 865 ELEV 210.407m
- TEMP BENCH MARK ELEV
- DESCRIPTION BRICK COLUMN ON CONC BRICK FENCE 48.3m NORTH OF ℄ OF DERRY RD AND 14.4m EAST OF ℄ OF TENTH LINE WEST BM IS SET VERTICALLY ON W FACE, 0.15m NORTH OF THE S/E CORNER, 0.35m ABOVE GRADE

AS CONSTRUCTED 21T-90016M

LICENSED PROFESSIONAL ENGINEER R. A KESTER PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

CHKD.

**FOURTH TERRAGAR HOLDINGS LIMITED**
PHASE I - PARTS IA & IB

paul theil associates limited
consulting engineers
131 Delta Park Blvd., Brampton, Ontario L6T 5M8

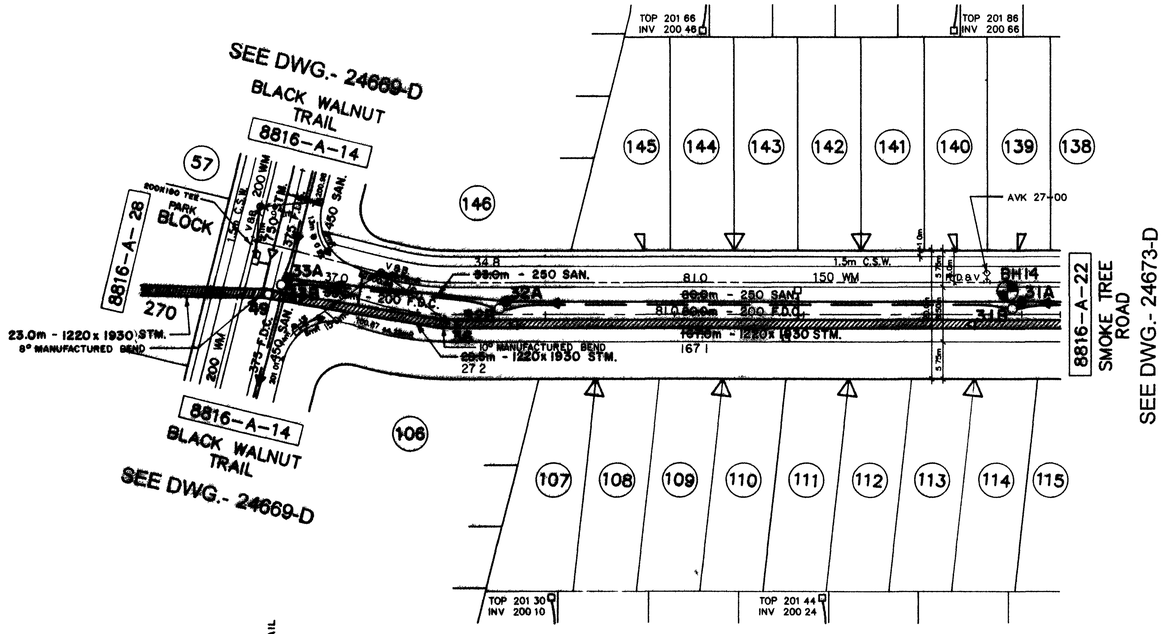
MISSISSAUGA Public Works Department

# BLACK WALNUT TRAIL

STA. 0+660 TO STA. 0+840

| | | | |
|---|---|---|---|
| SCALE HORIZ 1 500 VERT 1 50 | AREA Z-55 | PROJECT No | |
| DRAWN BY AR | CHECKED BY | PLAN No 8816-A-14 | |
| DATE SEPT 1993 | SHEET OF | C-40649 | |

# SMOKE TREE ROAD




**NOTE:**
ROOF LEADERS FOR ALL LOTS ARE NOT TO BE CONNECTED DIRECTLY TO THE STORM SEWER SYSTEM.

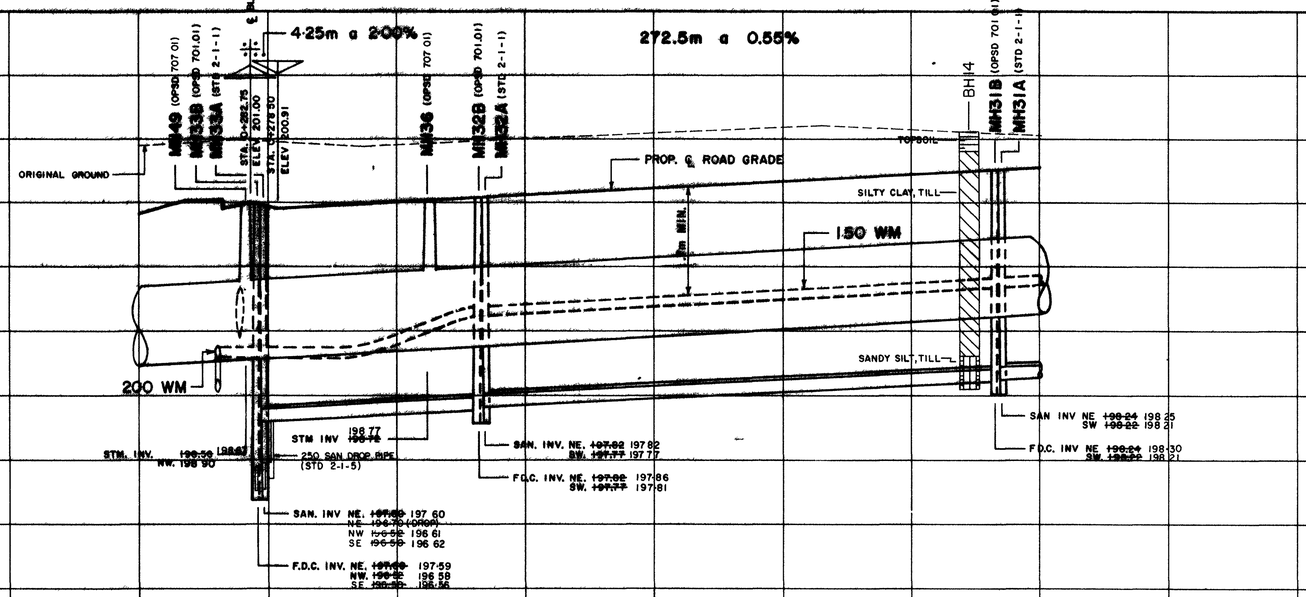
**NOTE:**
(107) LOT No FOR PLAN No 2

| ROAD BASE | |
|---|---|
| HL3 | - 40mm |
| HL8 | - 85mm |
| GRANULAR 'A' | - 150mm |
| GRANULAR 'B' | - 285mm |
| | 560mm |

▷ DOUBLE SERVICE CONNECTIONS
▱ SINGLE SERVICE CONNECTIONS — SEE DETAIL ON DWG 8816-A-45

NOTE: WATER SERVICE CONNECTIONS FOR LOTS 107 TO 114 (inclusive) ARE INSTALLED UNDER STORM SEWER. SEE DETAIL ON DWG. 8816-A-45

NOTE
BEDDING FOR STORM & F.D.C. SEWERS TO BE CLASS 'B' AS PER CITY OF MISSISSAUGA STD 2112.08



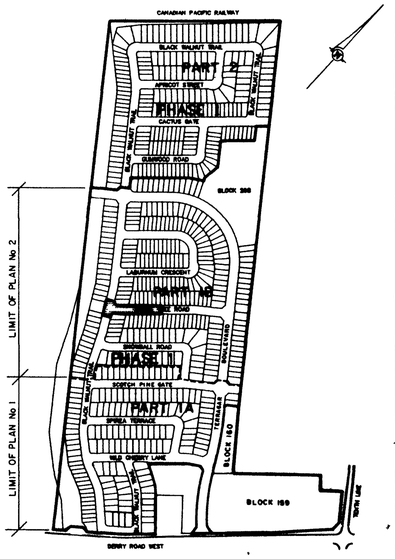

CHAINAGE 0+300 0+280 0+260 0+240 0+220 0+200 0+180 0+160 CHAINAGE

## SERVICE DATA

| SERVICE | DATE | INIT | SERVICE | DATE | INIT |
|---|---|---|---|---|---|
| SAN. SEWERS | | | GAS MAINS | | |
| STORM SEWERS | | | BELL U/G CABLES | | |
| WATERMAINS | | | HYDRO U/G CABLES | | |

## REVISIONS

| DATE | DETAILS | INIT |
|---|---|---|
| MAY 5, 1997 | STORM PIPE SIZE REVISED | |
| JAN 28, 1999 | AS CONSTRUCTED | |




KEY PLAN
SCALE 1 7500

FOR GENERAL NOTES SEE DWG. 8816-A-44

## GENERAL NOTES

- ALL DRIVEWAYS ASPHALT UNLESS OTHERWISE NOTED
- ALL SERVICE LOCATIONS ARE APPROXIMATE AND MUST BE LOCATED ACCURATELY IN FIELD
- ● DENOTES BUILDING – NOT LOCATED
- ⌐ DENOTES BUILDING – LOCATED
- T.T.B.M. No 865 ELEV 210.407m
- TEMP. BENCH MARK ELEV
- DESCRIPTION BRICK COLUMN ON CONC. BRICK FENCE 48.3m NORTH OF ℄ OF DERRY RD. AND 14.4m EAST OF ℄ OF TENTH LINE WEST BM IS SET VERTICALLY ON W. FACE, 0.15m NORTH OF THE S/E CORNER, 0.35m ABOVE GRADE

AS CONSTRUCTED 21T-90016M

LICENSED PROFESSIONAL ENGINEER R. A. KESTER PROVINCE OF ONTARIO

DESIGNED BY CHKD. APPROVED BY

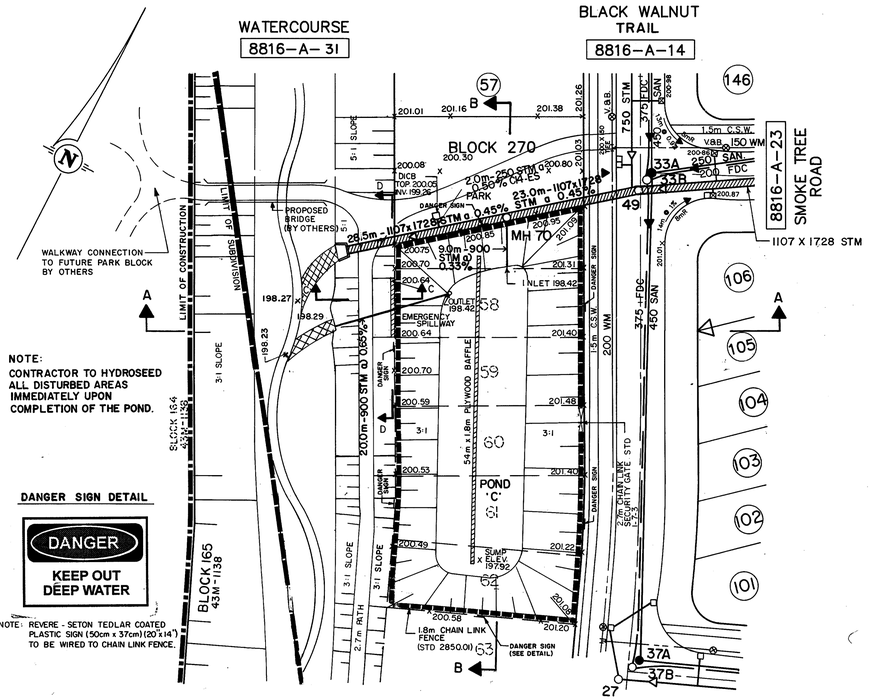
**FOURTH TERRAGAR**
**HOLDINGS LIMITED**
PHASE I - PARTS 1A & 1B

paul theil associates limited
consulting engineers
131 Delta Park Blvd., Brampton, Ontario L6T 5M8

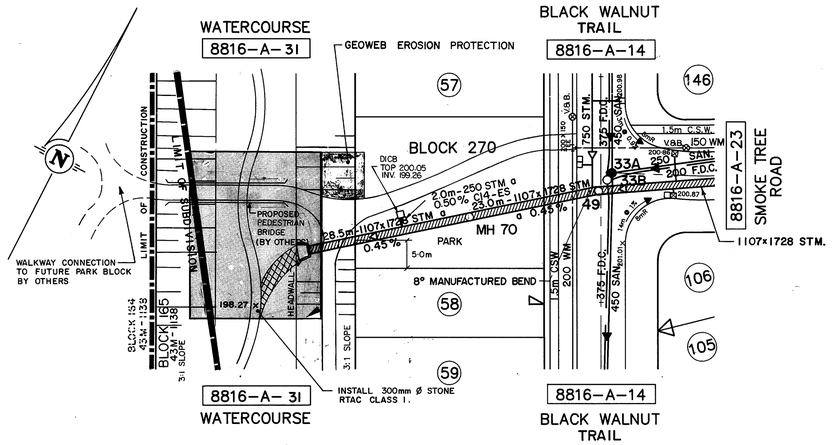
MISSISSAUGA
Public Works Department

SMOKE TREE ROAD
STA. 0+160 TO STA. 0+282.60

| | | | |
|---|---|---|---|
| SCALE HORIZ. 1:500 VERT. 1:50 | AREA Z-55 | PROJECT No | |
| DRAWN BY | CHECKED BY | PLAN No 8816-A-23 | |
| DATE SEPT 1993 | SHEET OF | C-40654 | |




# TEMPORARY EROSION AND SEDIMENTATION CONTROL




**NOTE:**
ROOF LEADERS FOR ALL LOTS ARE NOT TO BE CONNECTED DIRECTLY TO THE STORM SEWER SYSTEM.

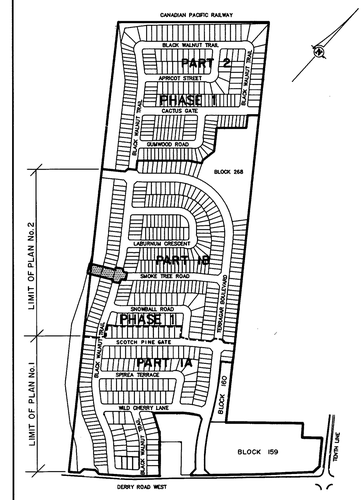
**NOTE:**
(58) LOT No. FOR PLAN No.2

## SERVICE DATA

| SERVICE | DATE | INIT. | SERVICE | DATE | INIT. |
|---|---|---|---|---|---|
| SAN. SEWERS | | | GAS MAINS | | |
| STORM SEWERS | | | BELL U/G CABLES | | |
| WATERMAINS | | | HYDRO U/G CABLES | | |

## REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| | | |



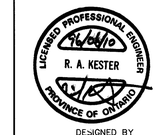

KEY PLAN
SCALE 1:7500

FOR GENERAL NOTES SEE DWG. 8816-A-44

## GENERAL NOTES

- ALL DRIVEWAYS ASPHALT UNLESS OTHERWISE NOTED.
- ALL SERVICE LOCATIONS ARE APPROXIMATE AND MUST BE LOCATED ACCURATELY IN FIELD.
- ● DENOTES BUILDING – NOT LOCATED
- ⌐ DENOTES BUILDING – LOCATED
- T.T.B.M. No. 865 ELEV. 210.407m
- TEMP. BENCH MARK ELEV.
- DESCRIPTION. BRICK COLUMN ON CONC. BRICK FENCE 48.3m NORTH OF ℄ OF DERRY RD. AND 14.4m EAST OF ℄ OF TENTH LINE WEST. BM IS SET VERTICALLY ON W. FACE, 0.15m NORTH OF THE S/E CORNER, 0.35m ABOVE GRADE.

21T-90016M




DESIGNED BY | APPROVED BY
CHKD.

**FOURTH TERRAGAR HOLDINGS LIMITED**
PHASE I - PARTS IA & IB

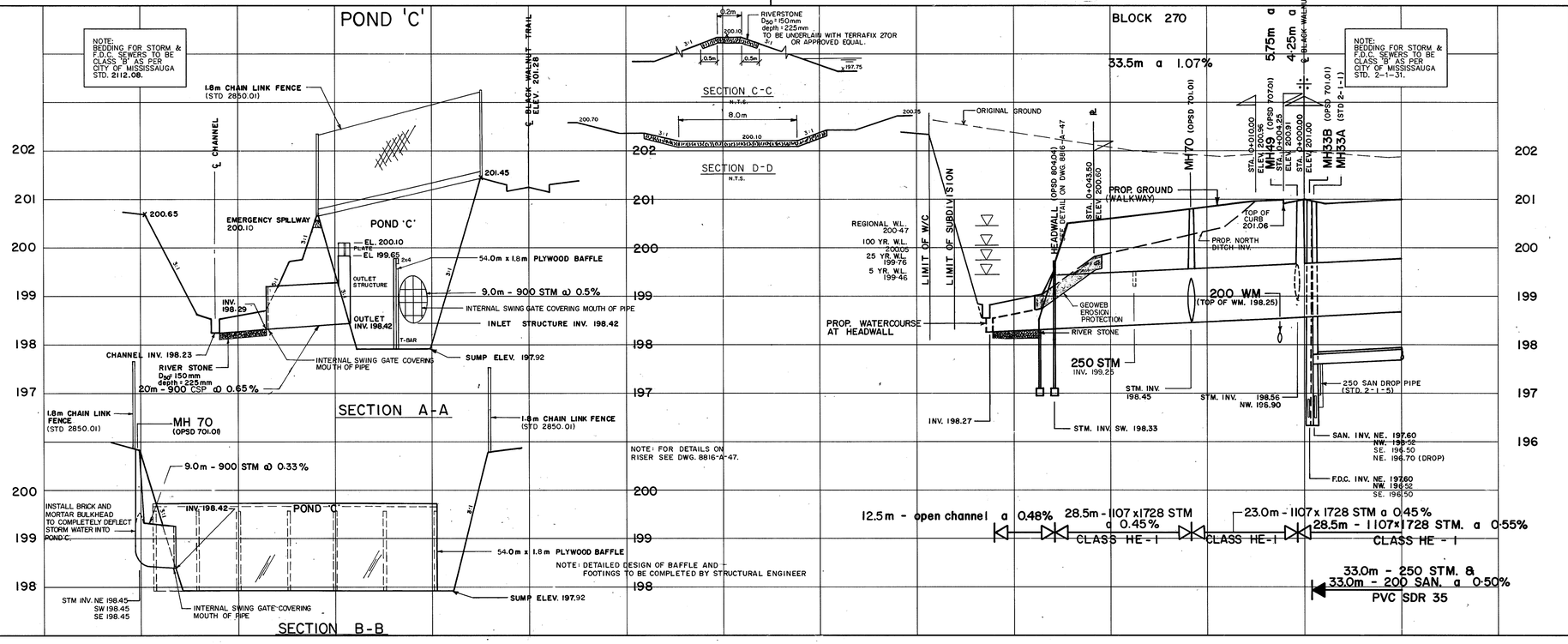
paul theil associates limited
consulting engineers
131 Delta Park Blvd., Brampton, Ontario. L6T 5M8

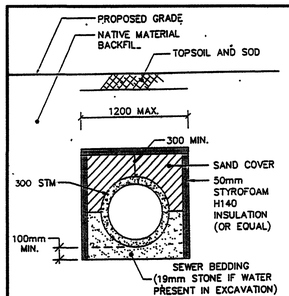
MISSISSAUGA
Public Works Department

BLOCK 270

| SCALE | HORIZ. 1:500 VERT. 1:50 | AREA | PROJECT No. |
|---|---|---|---|
| DRAWN BY | | CHECKED BY | PLAN No. 8816-A-28 |
| DATE OCT. 1993 | | SHEET OF | C — |

C-32879



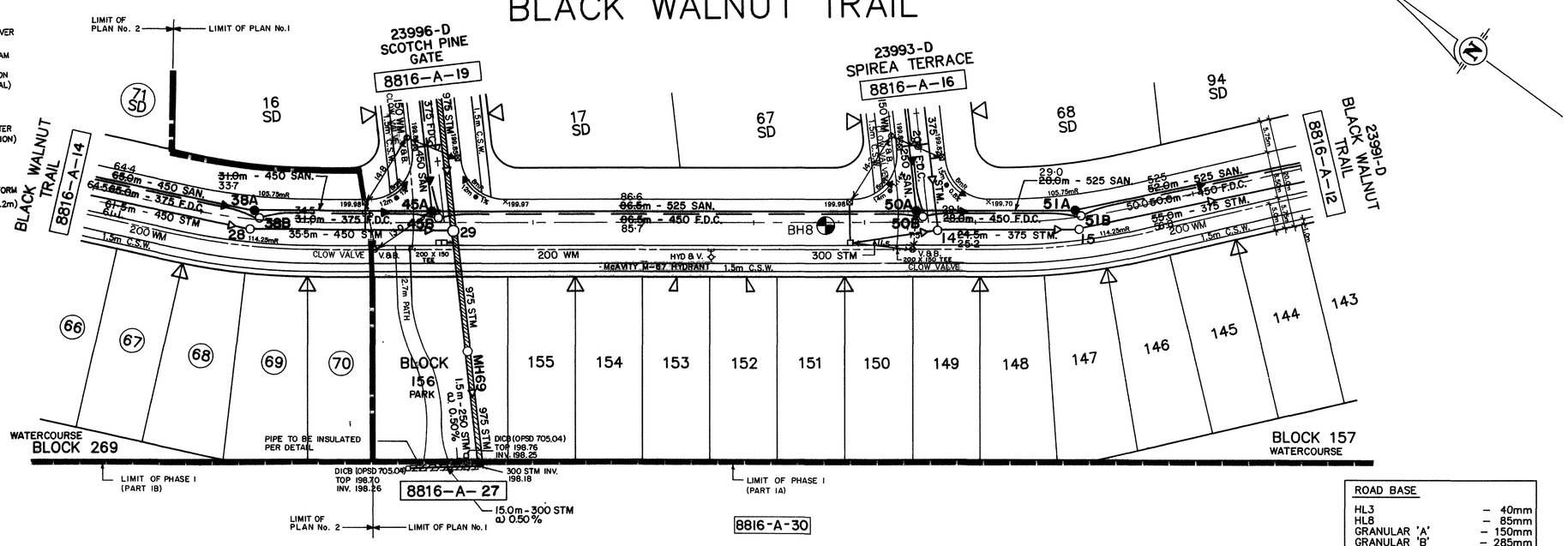



PIPE INSULATION DETAIL

N.T.S.

(TO BE USED WHERE COVER OVER STORM SEWER IS LESS THAN 1.2m)

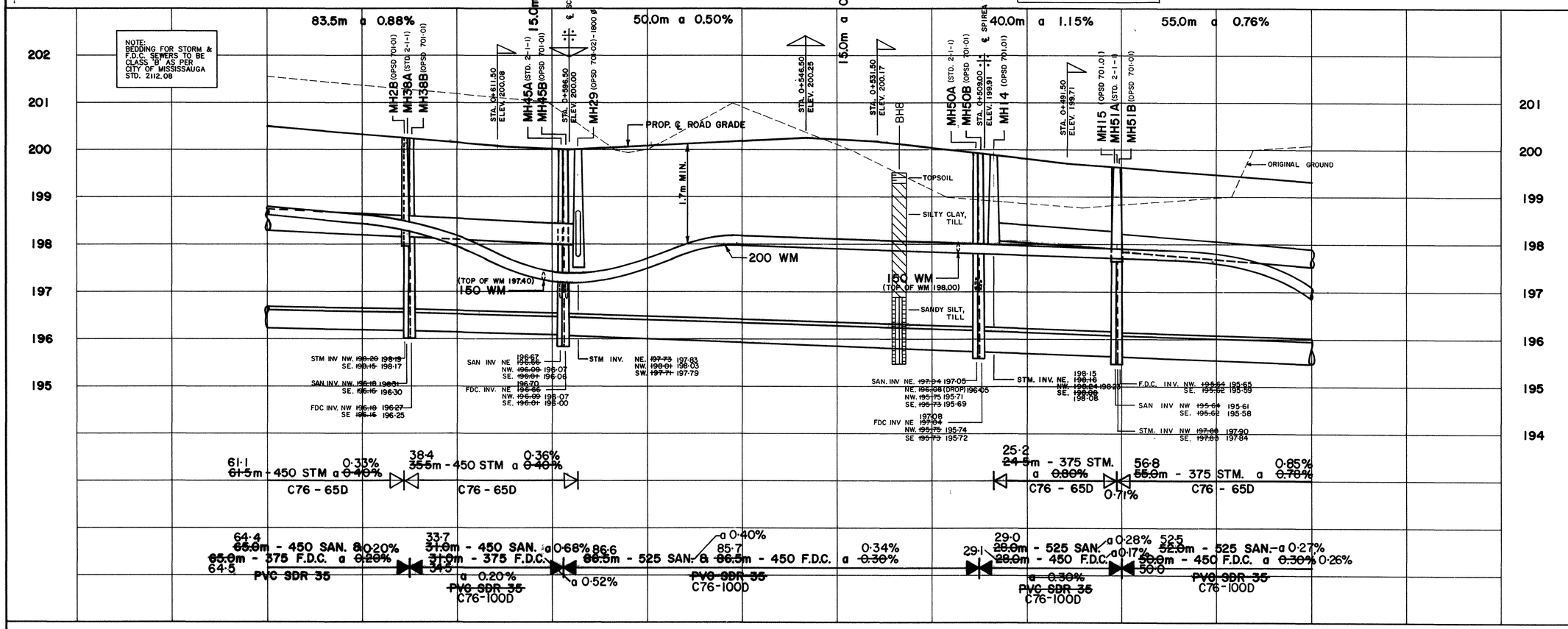
# BLACK WALNUT TRAIL




| ROAD BASE | |
|---|---|
| HL3 | – 40mm |
| HL8 | – 85mm |
| GRANULAR 'A' | – 150mm |
| GRANULAR 'B' | – 285mm |
| | 560mm |

▷ DOUBLE SERVICE CONNECTIONS
▱ SINGLE SERVICE CONNECTIONS
– SEE DETAIL ON DWG. 8816-A-45

**NOTE:**
152 LOT No. FOR PLAN No.1
(66) LOT No. FOR PLAN No.2

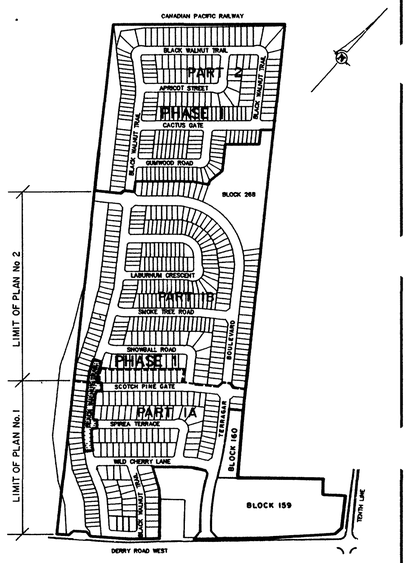



## SERVICE DATA

| SERVICE | DATE | INIT. | SERVICE | DATE | INIT. |
|---|---|---|---|---|---|
| SAN SEWERS | | | GAS MAINS | | |
| STORM SEWERS | | | BELL U/G CABLES | | |
| WATERMAINS | | | HYDRO U/G CABLES | | |

## REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| JUNE 24/96 | BLOCK 156 - DICB OPSD REVISED | RJD |
| JULY 9/98 | AS CONSTRUCTED | TM |




KEY PLAN
SCALE 1:7500

FOR GENERAL NOTES SEE DWG.8816-A-44

## GENERAL NOTES

- ALL DRIVEWAYS ASPHALT UNLESS OTHERWISE NOTED.
- ALL SERVICE LOCATIONS ARE APPROXIMATE AND MUST BE LOCATED ACCURATELY IN FIELD.
- ● DENOTES BUILDING – NOT LOCATED
- ⌐ DENOTES BUILDING – LOCATED
- T.T.B.M. No. 865 ELEV. 210.407m
- TEMP. BENCH MARK ELEV.
- DESCRIPTION. BRICK COLUMN ON CONC. BRICK FENCE 48.3m NORTH OF ℄ OF DERRY RD. AND 14.4m EAST OF ℄ OF TENTH LINE WEST. BM IS SET VERTICALLY ON W. FACE, 0.15m NORTH OF THE S/E CORNER, 0.35m ABOVE GRADE.

AS CONSTRUCTED 21T-90016M

LICENSED PROFESSIONAL ENGINEER R. A. KESTER PROVINCE OF ONTARIO 26/06/13

DESIGNED BY | CHKD | APPROVED BY

**FOURTH TERRAGAR HOLDINGS LIMITED**
PHASE I - PARTS IA & IB

paul theil associates limited
consulting engineers
131 Delta Park Blvd., Brampton, Ontario L6T 5M8

MISSISSAUGA Public Works Department

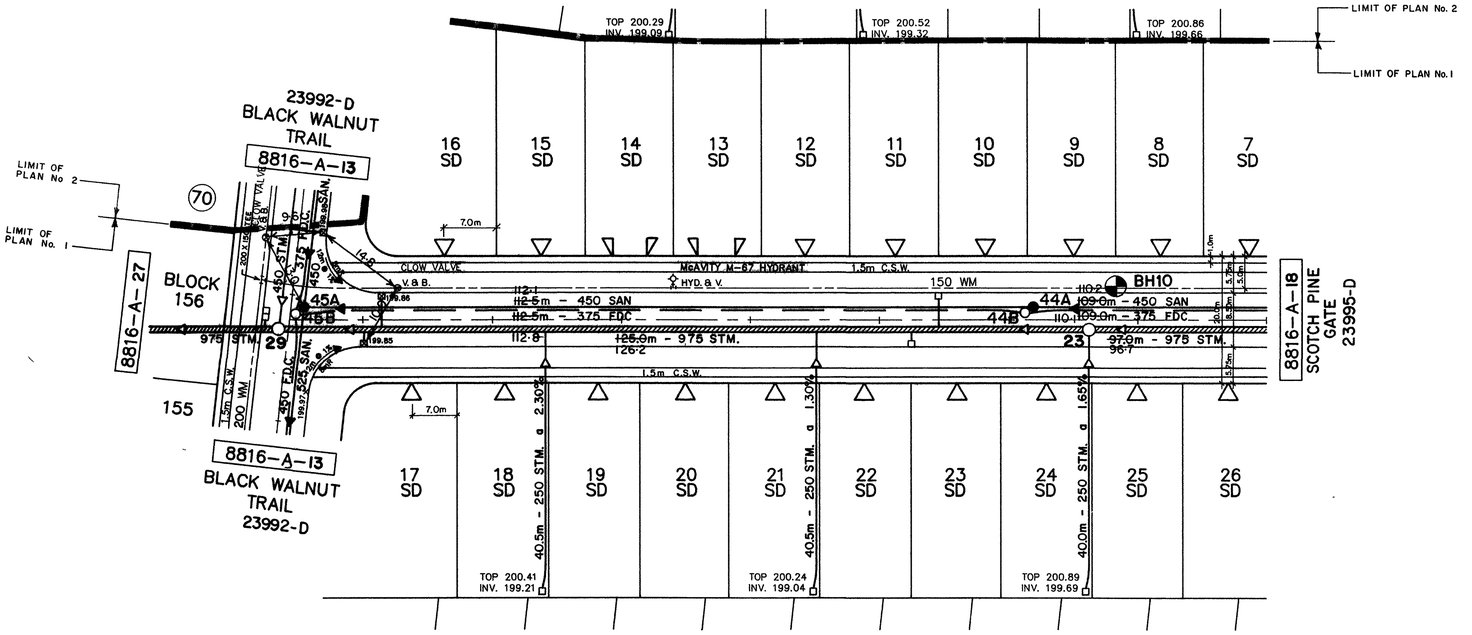
# BLACK WALNUT TRAIL

STA. 0+440 TO STA. 0+660

| | | |
|---|---|---|
| SCALE HORIZ. 1:500 VERT. 1:50 | AREA Z-55 | PROJECT No. |
| DRAWN BY | CHECKED BY | PLAN No. 8816-A-13 |
| DATE SEPT. 1993 | SHEET OF | C-40639 |

23992-D

# SCOTCH PINE GATE



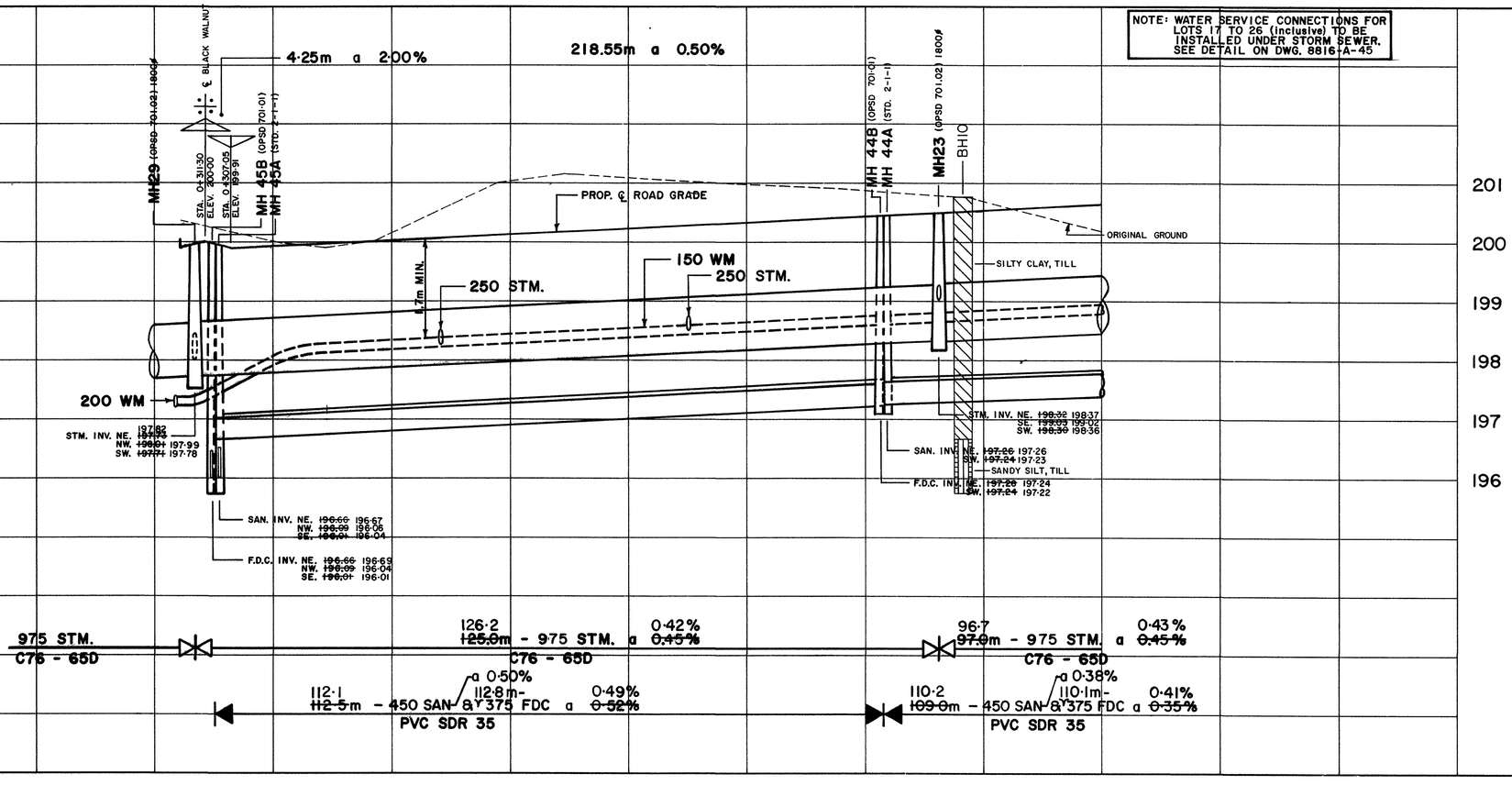

**NOTE:**
22 LOT No. FOR PLAN No. 1
(70) LOT No FOR PLAN No. 2

| ROAD BASE | |
|---|---|
| HL3 | – 40mm |
| HL8 | – 85mm |
| GRANULAR 'A' | – 150mm |
| GRANULAR 'B' | – 285mm |
| | 560mm |

▷ DOUBLE SERVICE CONNECTIONS
▱ SINGLE SERVICE CONNECTIONS — SEE DETAIL ON DWG. 8816-A-45

NOTE: WATER SERVICE CONNECTIONS FOR LOTS 17 TO 26 (inclusive) TO BE INSTALLED UNDER STORM SEWER. SEE DETAIL ON DWG. 8816-A-45

NOTE: BEDDING FOR STORM & F.D.C. SEWERS TO BE CLASS 'B' AS PER CITY OF MISSISSAUGA STD. 2112.08

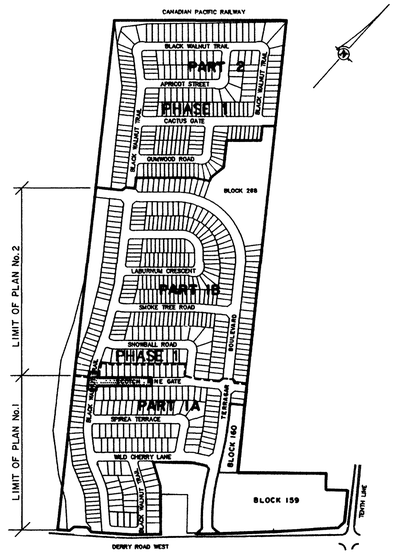



## SERVICE DATA

| SERVICE | DATE | INIT. | SERVICE | DATE | INIT. |
|---|---|---|---|---|---|
| SAN. SEWERS | | | GAS MAINS | | |
| STORM SEWERS | | | BELL U/G CABLES | | |
| WATERMAINS | | | HYDRO U/G CABLES | | |

## REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| JULY 10/98 | AS CONSTRUCTED | TM |




KEY PLAN
SCALE 1:7500

FOR GENERAL NOTES SEE DWG. 8816-A-44

## GENERAL NOTES

- ALL DRIVEWAYS ASPHALT UNLESS OTHERWISE NOTED.
- ALL SERVICE LOCATIONS ARE APPROXIMATE AND MUST BE LOCATED ACCURATELY IN FIELD.
- ● DENOTES BUILDING – NOT LOCATED
- ⌐ DENOTES BUILDING – LOCATED
- T.T.B.M. No. 865 ELEV. 210.407m
- TEMP. BENCH MARK ELEV.
- DESCRIPTION. BRICK COLUMN ON CONC. BRICK FENCE 46.3m NORTH OF ℄ OF DERRY RD. AND 14.4m EAST OF ℄ OF TENTH LINE WEST. BM IS SET VERTICALLY ON W. FACE, 0.15m NORTH OF THE S/E CORNER, 0.35m ABOVE GRADE.

AS CONSTRUCTED 21T-90016M

LICENSED PROFESSIONAL ENGINEER R. A. KESTER PROVINCE OF ONTARIO
DESIGNED BY
CHKD.
APPROVED BY

**FOURTH TERRAGAR HOLDINGS LIMITED**
**PHASE I - PARTS 1A & 1B**

paul theil associates limited
consulting engineers
131 Delta Park Blvd., Brampton, Ontario L6T 5M8

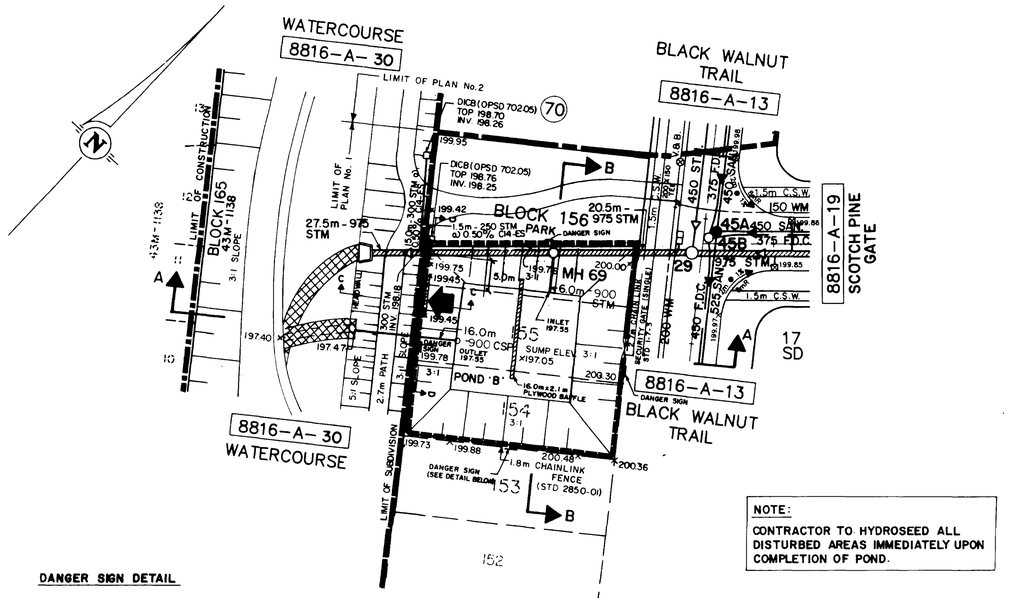
MISSISSAUGA Public Works Department

# SCOTCH PINE GATE

STA. 0+160 TO STA. 0+311.30

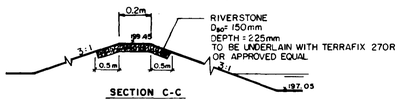
| | | | |
|---|---|---|---|
| SCALE HORIZ. 1 : 500 VERT. 1 : 50 | AREA Z - 55 | PROJECT No. | |
| DRAWN BY | CHECKED BY | PLAN No. 8816-A-19 | |
| DATE SEPT. 1993 | SHEET OF | C-40643 | |

23996-D

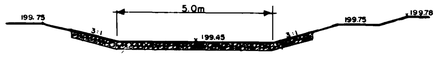



**DANGER SIGN DETAIL**

NOTE: REVERE-SETON TEDLAR COATED SIGN (50cm x 37cm) (20"x14") TO BE WIRED TO CHAIN LINK FENCE.



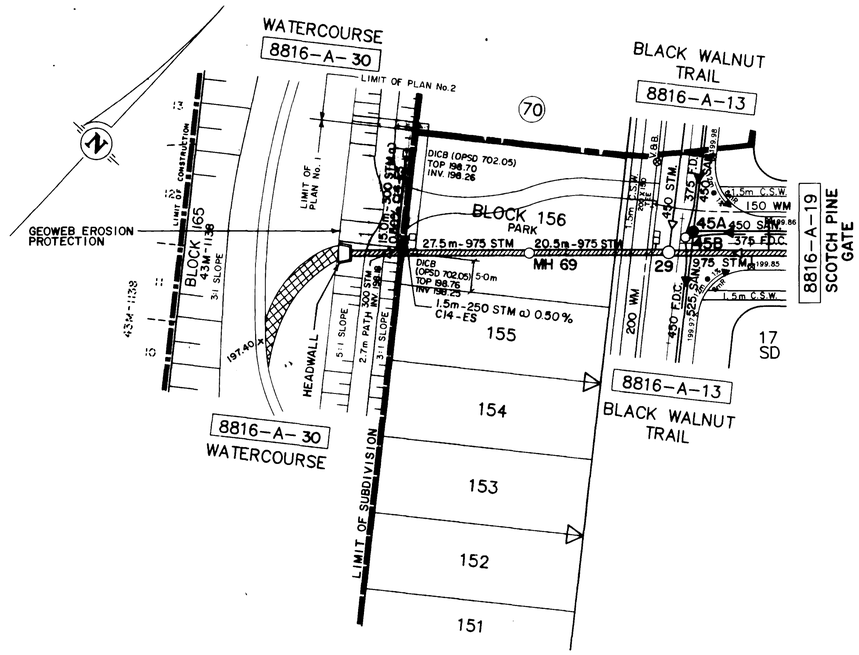

SECTION C-C
N.T.S.




SECTION D-D
N.T.S.

**NOTE:**
CONTRACTOR TO HYDROSEED ALL DISTURBED AREAS IMMEDIATELY UPON COMPLETION OF POND.

# TEMPORARY EROSION AND SEDIMENTATION CONTROL




**NOTE:**
ROOF LEADERS FOR ALL LOTS ARE NOT TO BE CONNECTED DIRECTLY TO THE STORM SEWER SYSTEM.

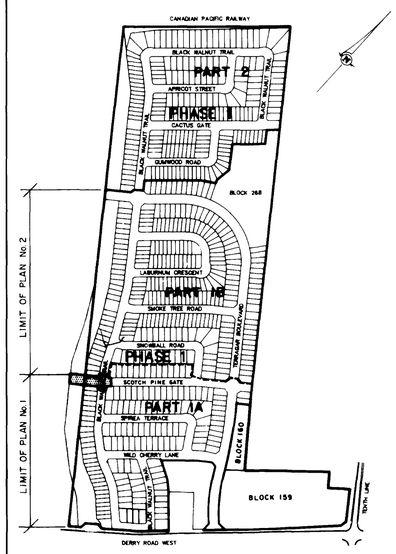
**NOTE:**
155 LOT No. FOR PLAN No.1
(70) LOT No. FOR PLAN No.2

## SERVICE DATA

| SERVICE | DATE | INIT. | SERVICE | DATE | INIT. |
|---|---|---|---|---|---|
| SAN. SEWERS | | | GAS MAINS | | |
| STORM SEWERS | | | BELL U/G CABLES | | |
| WATERMAINS | | | HYDRO U/G CABLES | | |

## REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| 96-06-13 | STM INV. ELEV. REVISED | |




KEY PLAN
SCALE 1:7500

FOR GENERAL NOTES SEE DWG. 8816-A-44

## GENERAL NOTES

- ALL DRIVEWAYS ASPHALT UNLESS OTHERWISE NOTED.
- ALL SERVICE LOCATIONS ARE APPROXIMATE AND MUST BE LOCATED ACCURATELY IN FIELD.
- ● DENOTES BUILDING – NOT LOCATED
- ┌ DENOTES BUILDING – LOCATED
- T.T.B.M. No. 865 ELEV. 210.407m
- TEMP. BENCH MARK ELEV.
- DESCRIPTION. BRICK COLUMN ON CONC. BRICK FENCE 48.3m NORTH OF ℄ OF DERRY RD. AND 14.4m EAST OF ℄ OF TENTH LINE WEST. BM IS SET VERTICALLY ON W. FACE, 0.15m NORTH OF THE S/E CORNER, 0.35m ABOVE GRADE.

21T-90016M

LICENSED PROFESSIONAL ENGINEER R. A. KESTER PROVINCE OF ONTARIO

DESIGNED BY | APPROVED BY

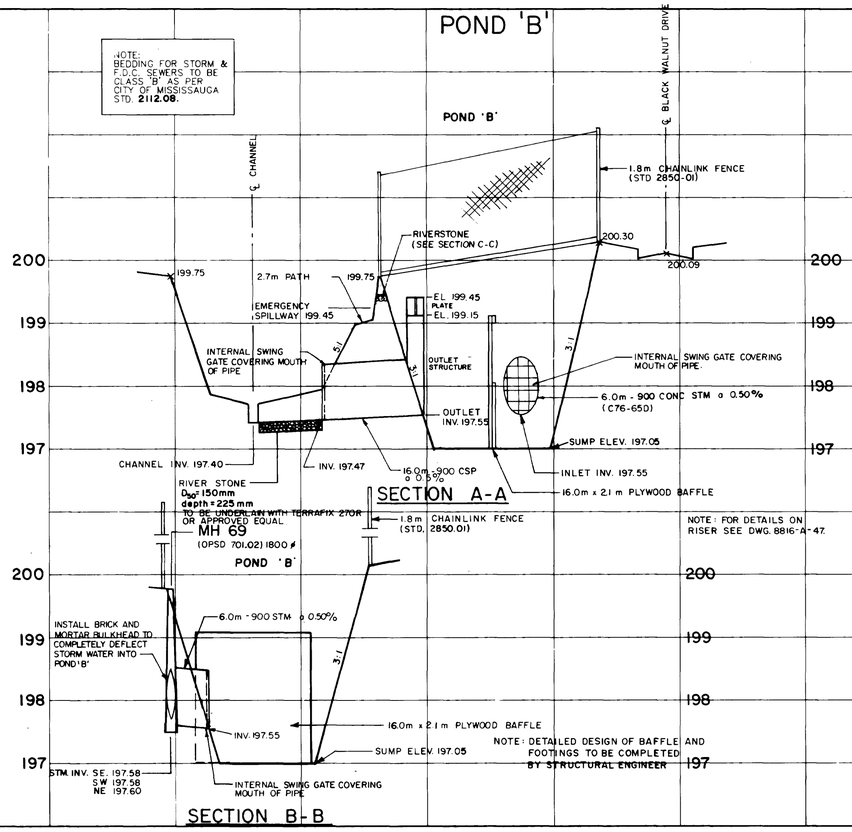
CHKD

**FOURTH TERRAGAR HOLDINGS LIMITED**
PHASE I - PARTS IA & IB

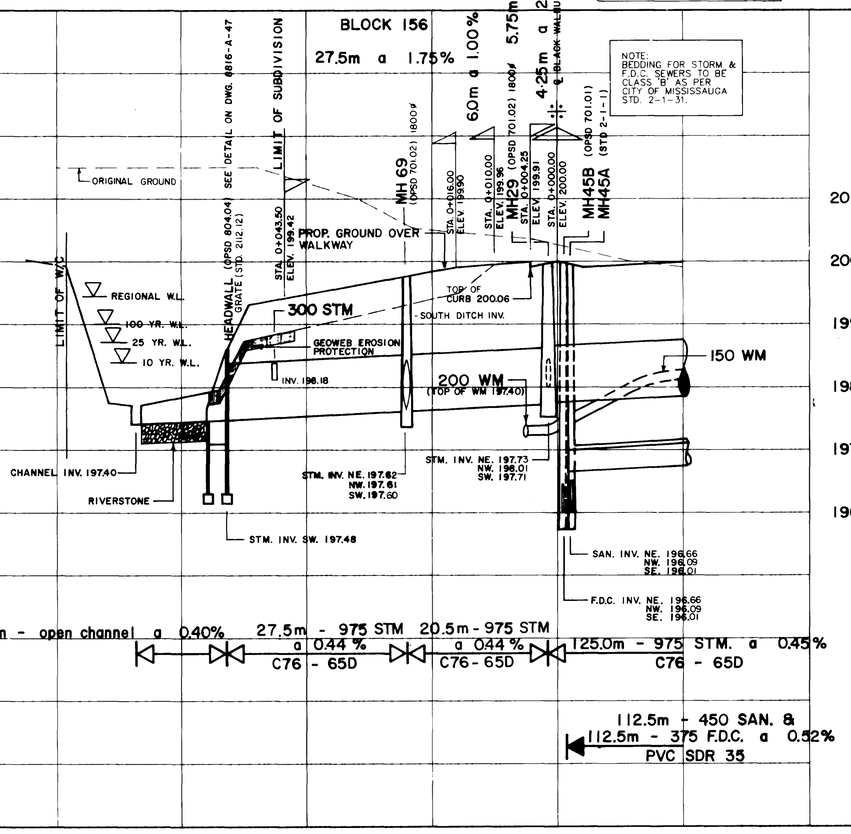
paul theil associates limited
consulting engineers
131 Delta Park Blvd., Brampton, Ontario L6T 5M

MISSISSAUGA Public Works Department

# BLOCK 156




SECTION B-B




| | | | |
|---|---|---|---|
| SCALE HORIZ. 1:500 VERT. 1:50 | AREA | PROJECT No. | |
| DRAWN BY | CHECKED BY | PLAN No. 8816-A-2 | |
| DATE OCT. 1993 | SHEET OF | C — | |

C-32871

# Appendix C2

# Doug Leavens Boulevard Area

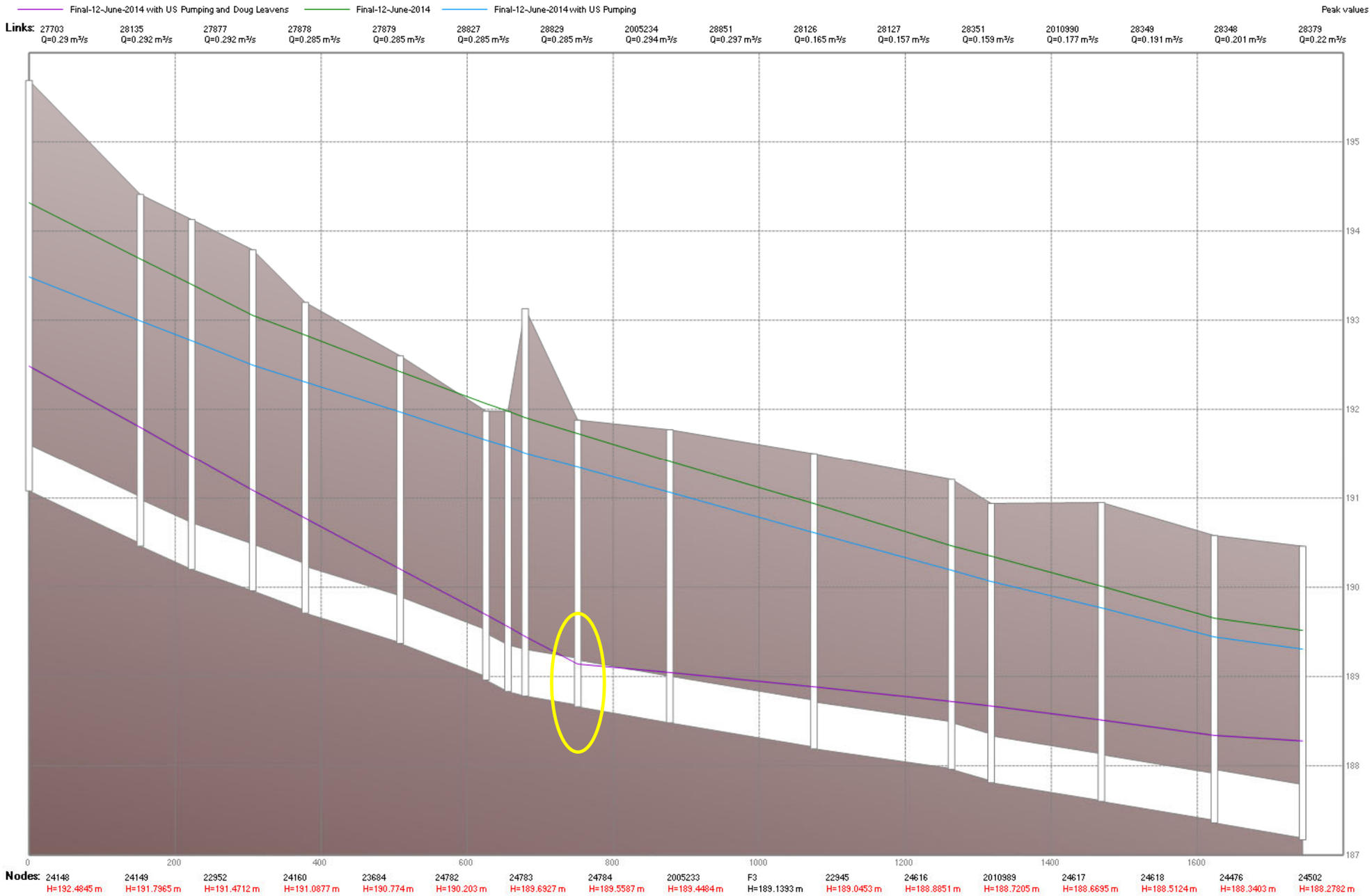



**Figure C2A: HGL Plot along Lisgar Creek (Gracefield Drive to Lisgar Green Park) for June 12, 2014 Storm Event. Location of diversion shown in yellow.**

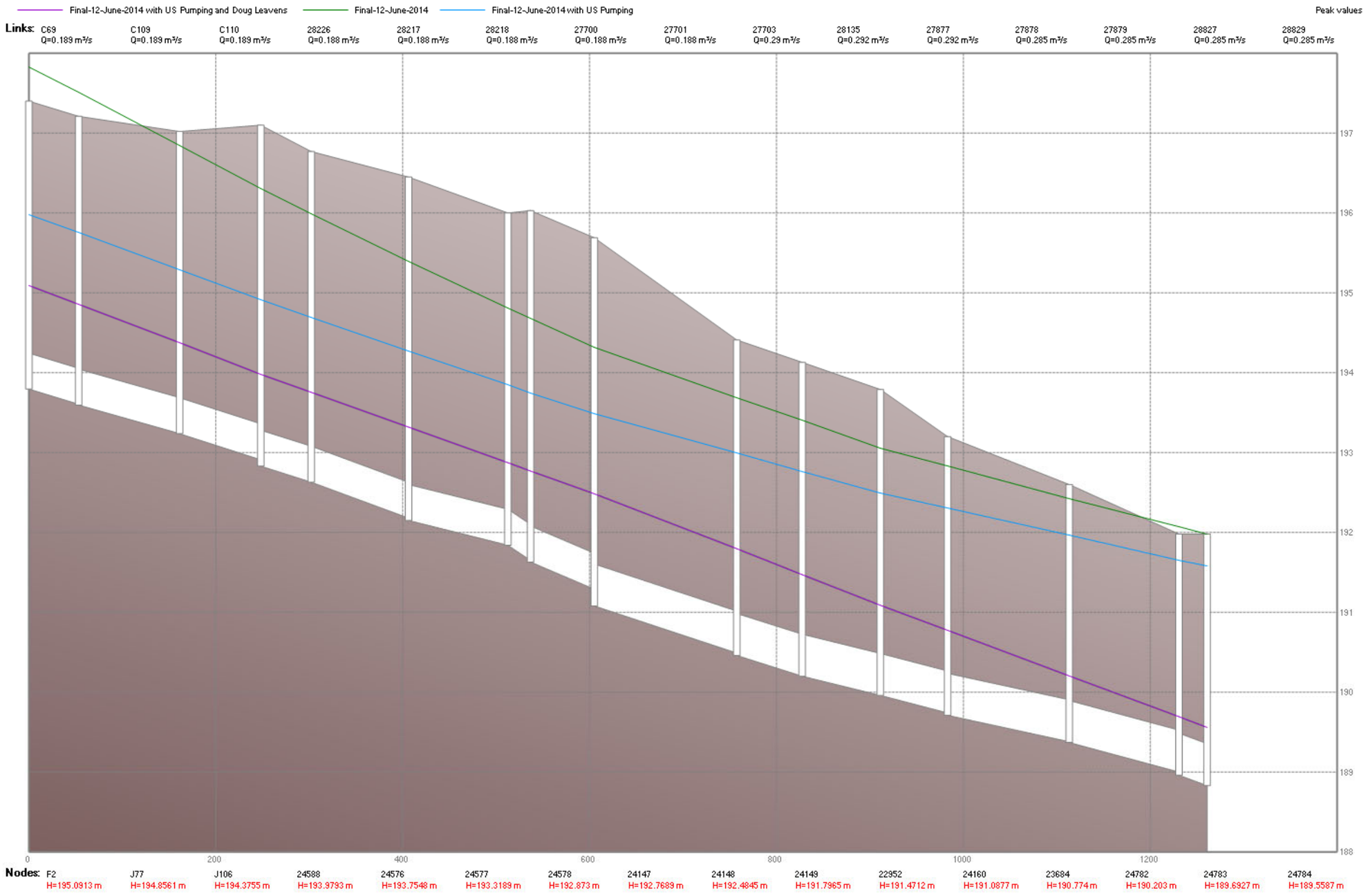



**Figure C2B: HGL Plot along Trunk FDC from Gauge F2 (south of Derry Road) to Doug Leavens Boulevard for June 12, 2014 Storm Event**

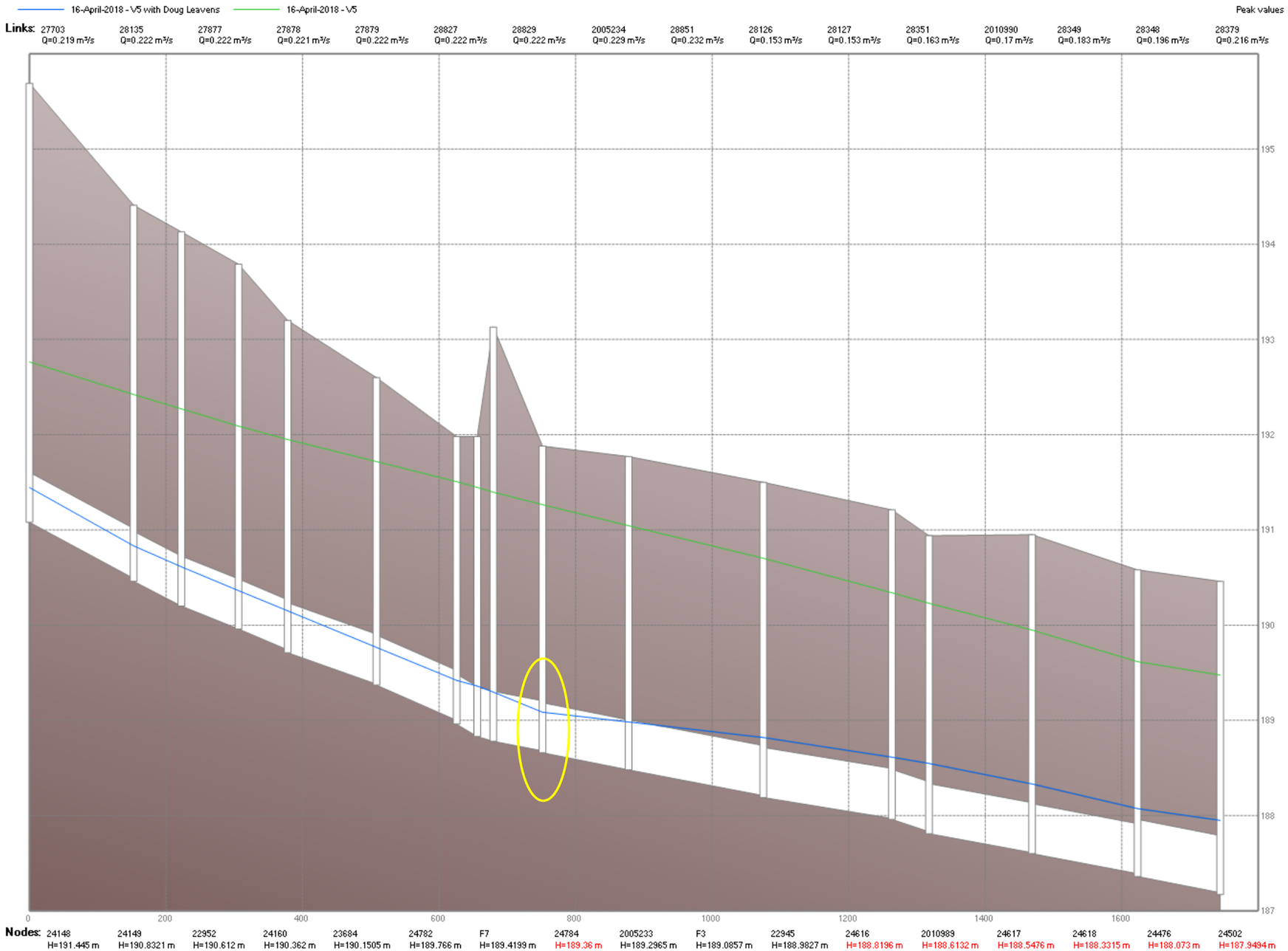



**Figure C2C: HGL Plot along Lisgar Creek (Gracefield Drive to Lisgar Green Park) for April 16, 2018 Storm Event. Location of diversion shown in yellow.**

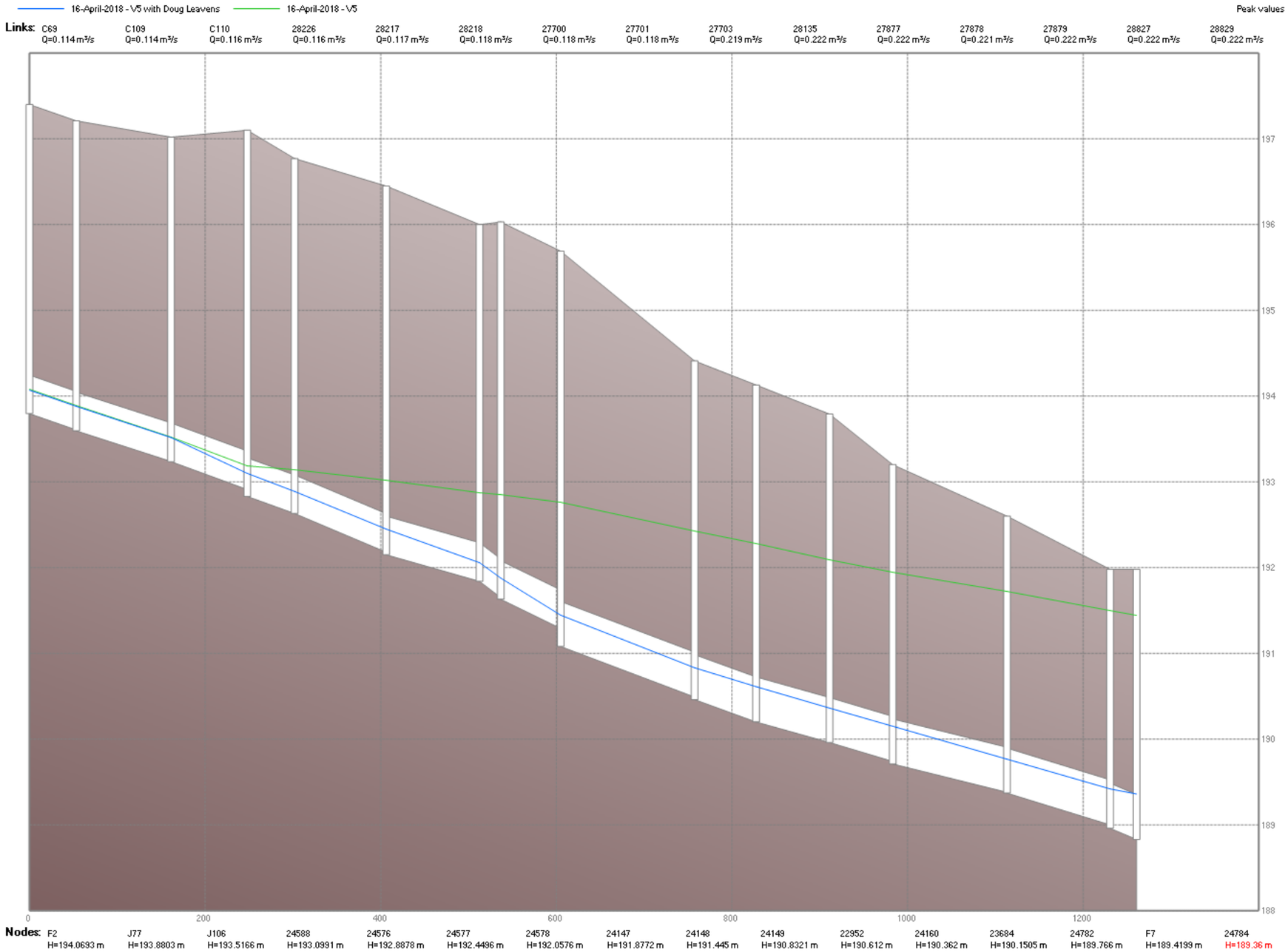



**Figure C2D: HGL Plot along Trunk FDC from Gauge F2 (south of Derry Road) to Doug Leavens Boulevard for April 16, 2018 Storm Event**

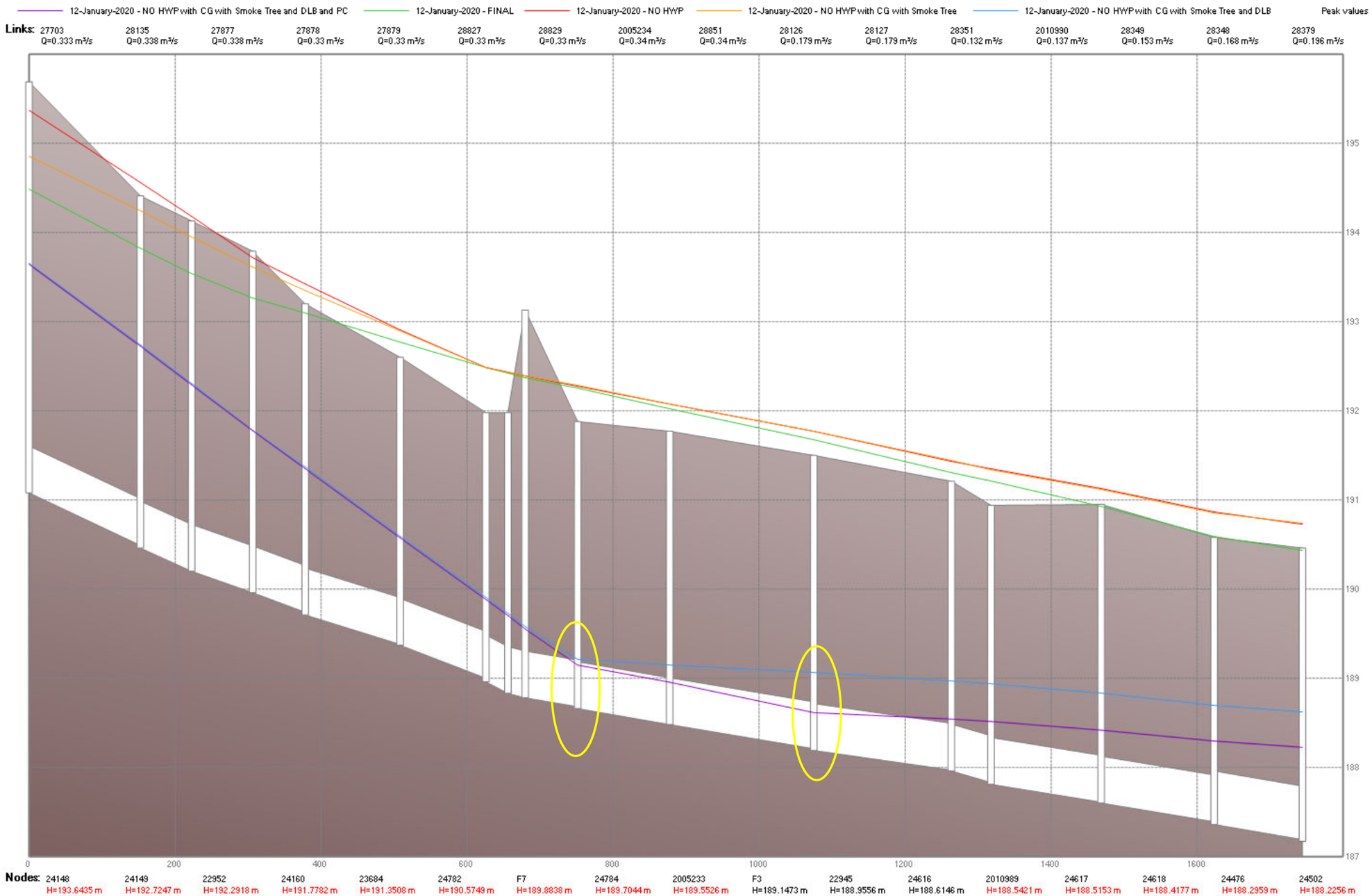



**Figure C2E: HGL Plot along Lisgar Creek (Gracefield Drive to Lisgar Green Park) for January 11-12, 2020 Storm Event. Location of diversions shown in yellow.**

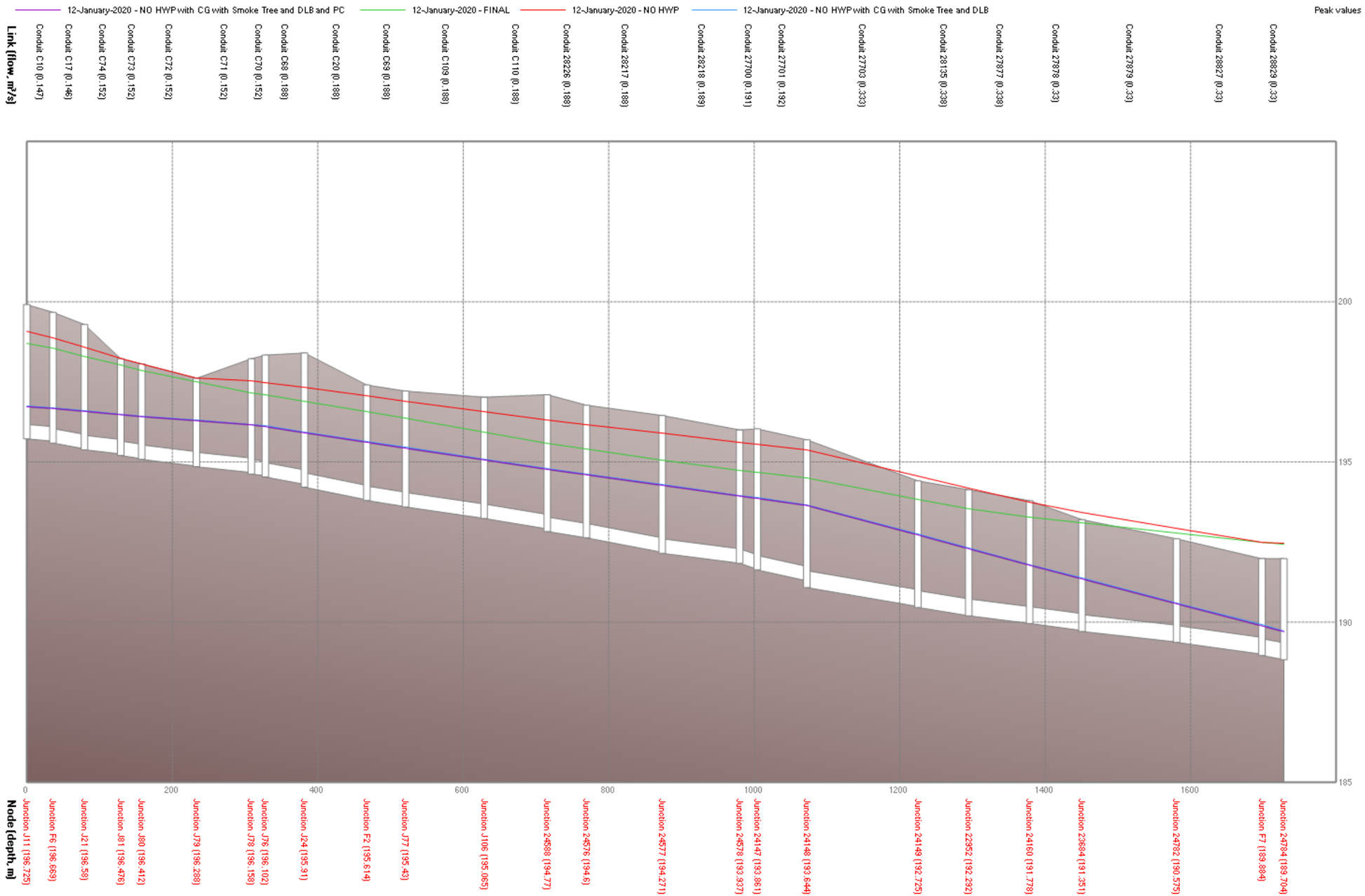



**Figure C2F: HGL Plot along Trunk FDC from Spirea Terrace to Doug Leavens Boulevard for January 11-12, 2020 Storm Event**

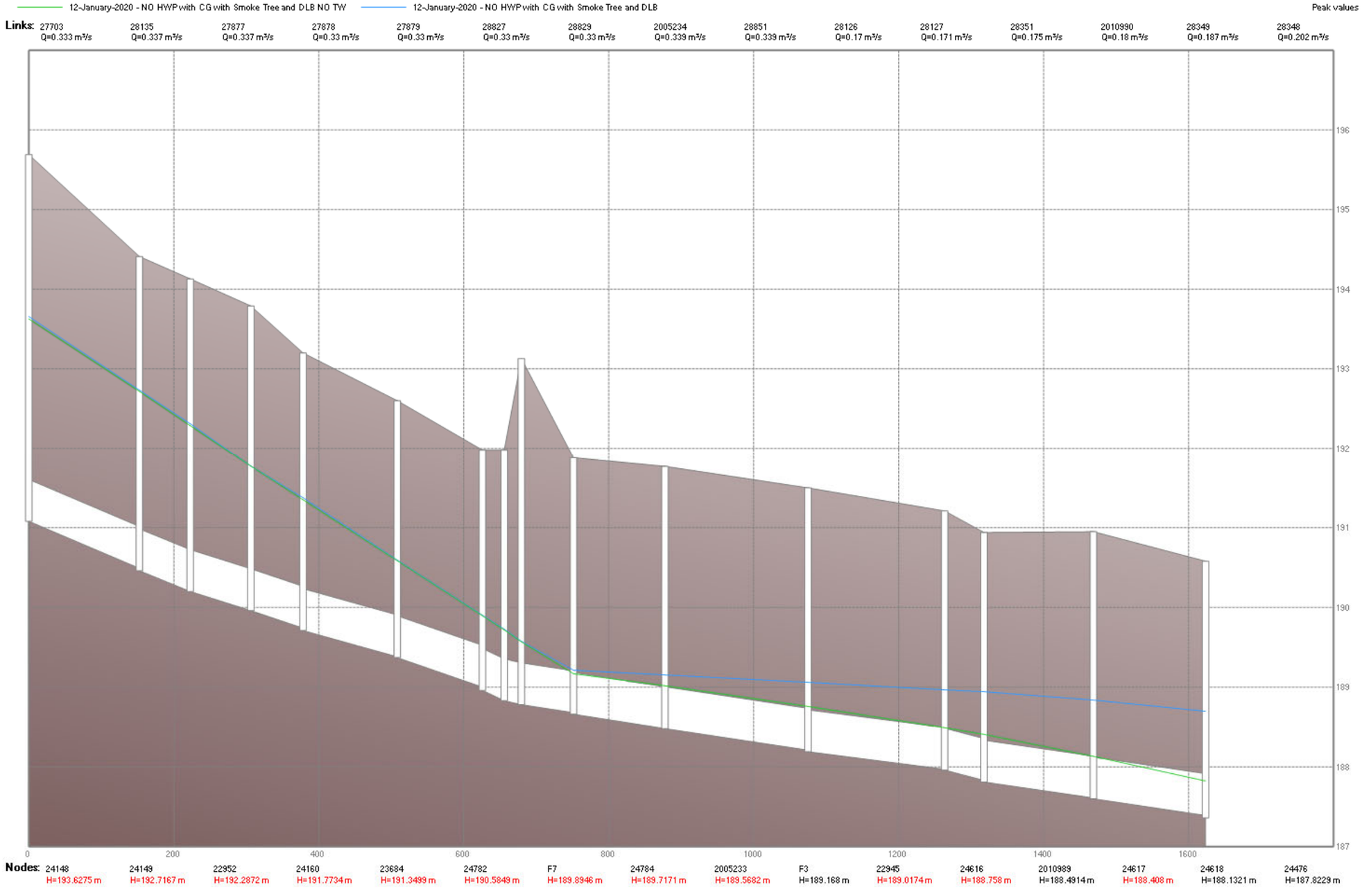



**Figure C2G: HGL Plot along Lisgar Creek (Gracefield Drive to Lisgar Green Park) for January 11-12, 2020 Storm Event with Doug Leavens Boulevard Diversion in place, with and without tailwater conditions**

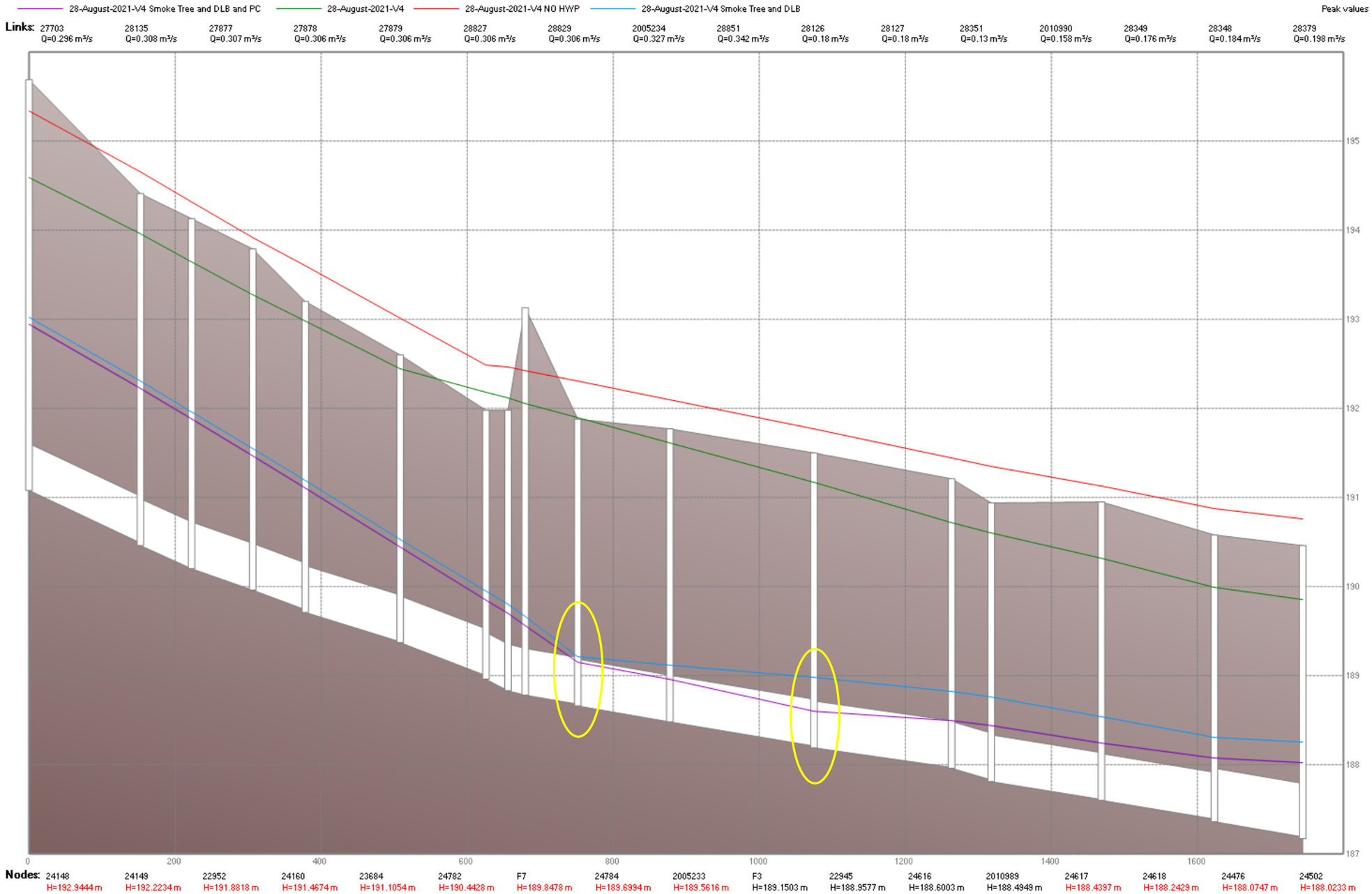



**Figure C2H: HGL Plot along Lisgar Creek (Gracefield Drive to Lisgar Green Park) for August 28, 2021 Storm Event. Location of diversions shown in yellow.**

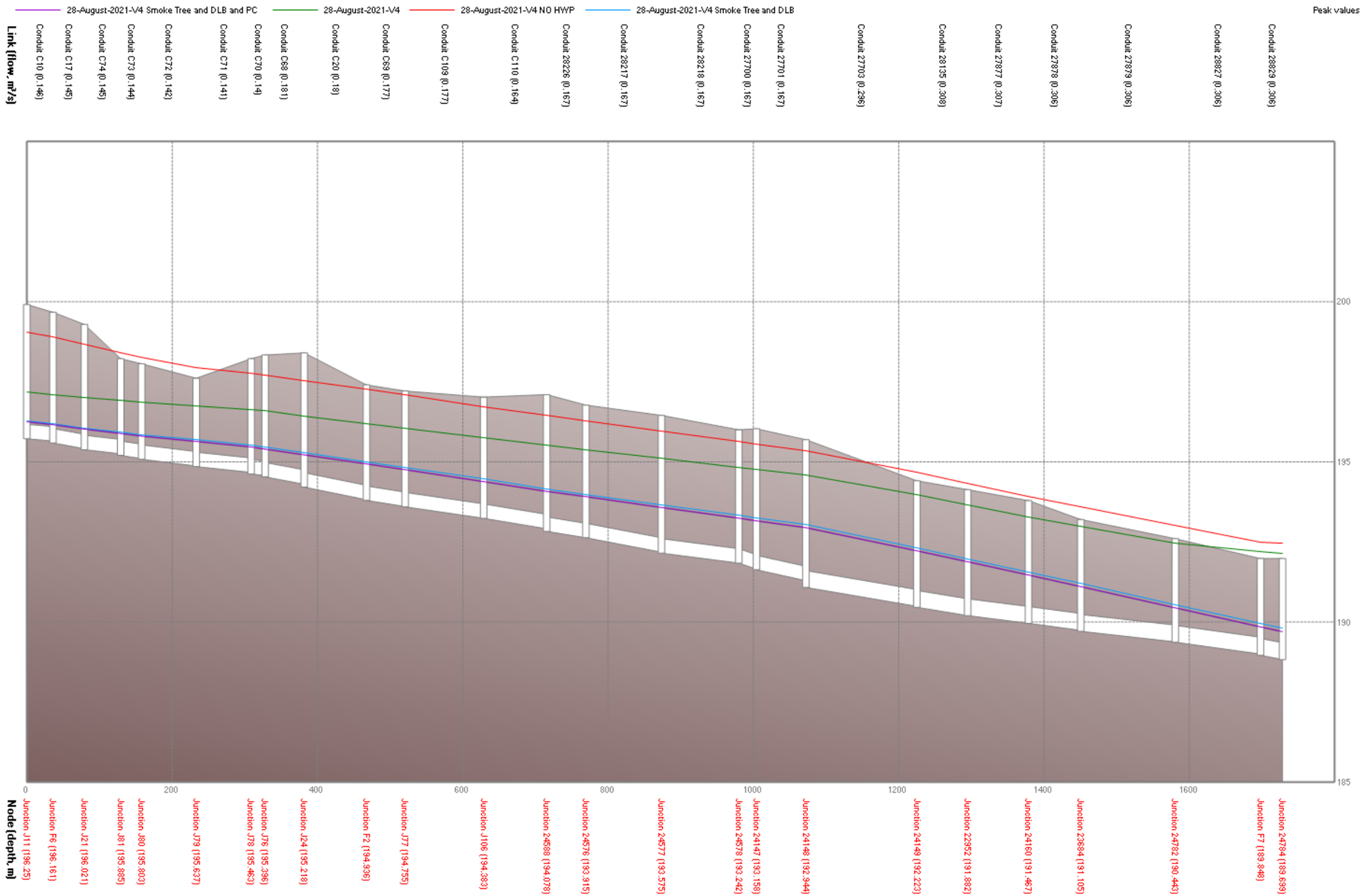



**Figure C2I: HGL Plot along Trunk FDC from Spirea Terrace to Doug Leavens Boulevard for August 28, 2021 Storm Event**

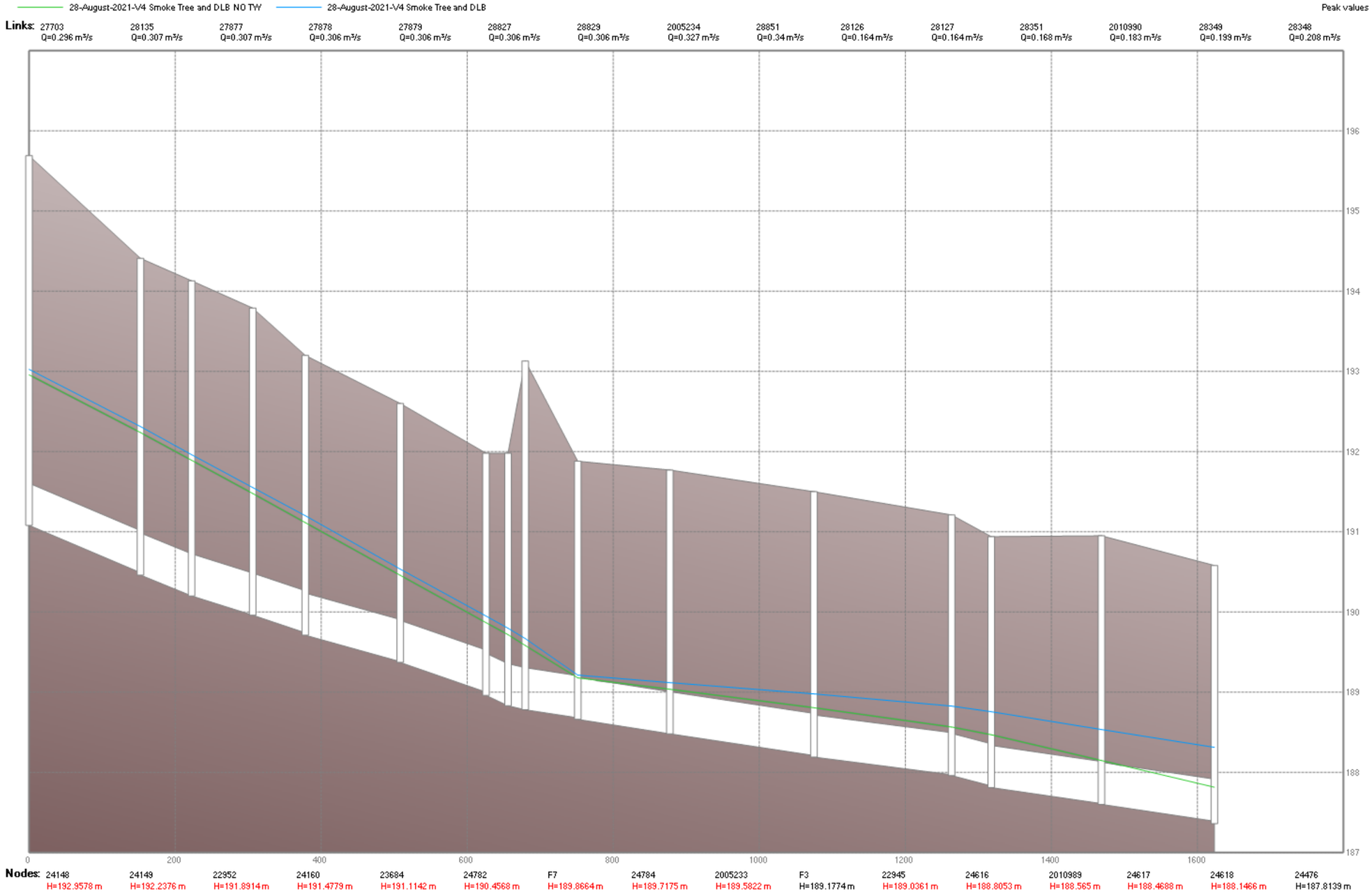
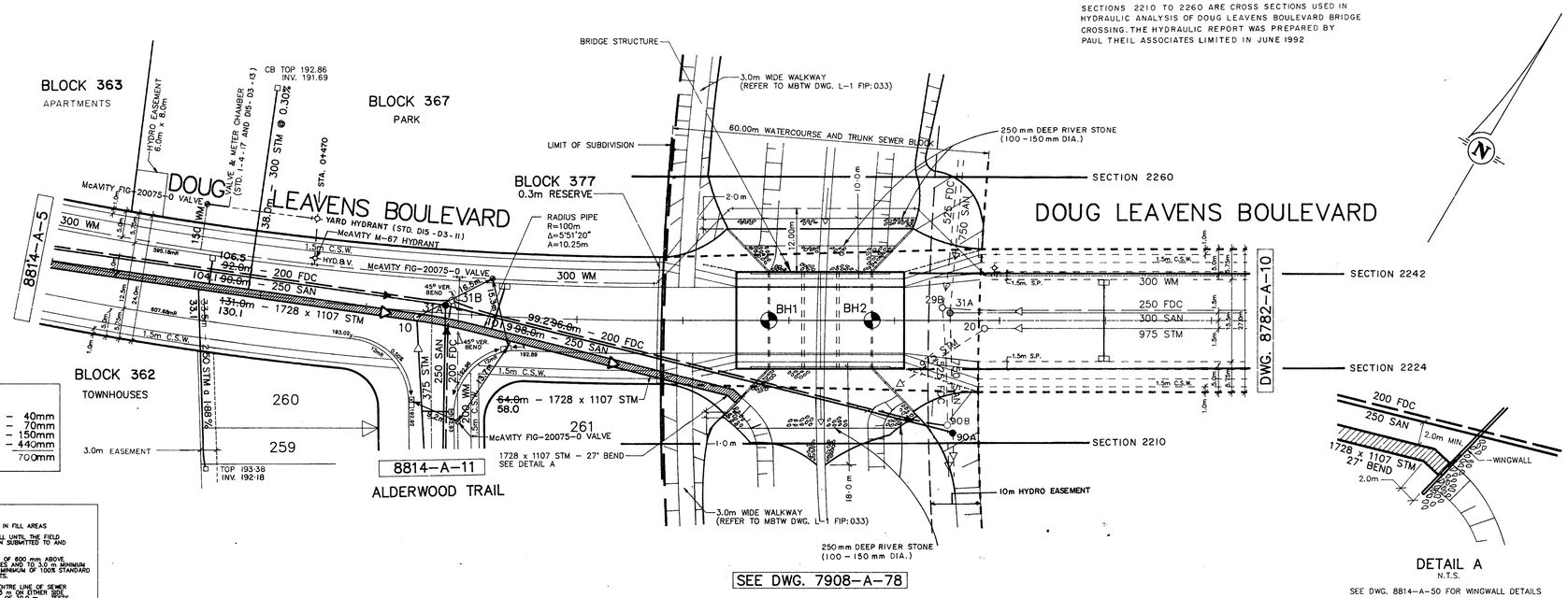



**Figure C2J: HGL Plot along Lisgar Creek (Gracefield Drive to Lisgar Green Park) for August 28, 2021 Storm Event with Doug Leavens Boulevard Diversion in place, with and without tailwater conditions**

NOTE:
SECTIONS 2210 TO 2260 ARE CROSS SECTIONS USED IN HYDRAULIC ANALYSIS OF DOUG LEAVENS BOULEVARD BRIDGE CROSSING. THE HYDRAULIC REPORT WAS PREPARED BY PAUL THEIL ASSOCIATES LIMITED IN JUNE 1992







DETAIL A
N.T.S.
SEE DWG. 8814-A-50 FOR WINGWALL DETAILS

FILL NOTES

NOTES FOR SEWERS AND WATERMAINS IN FILL AREAS

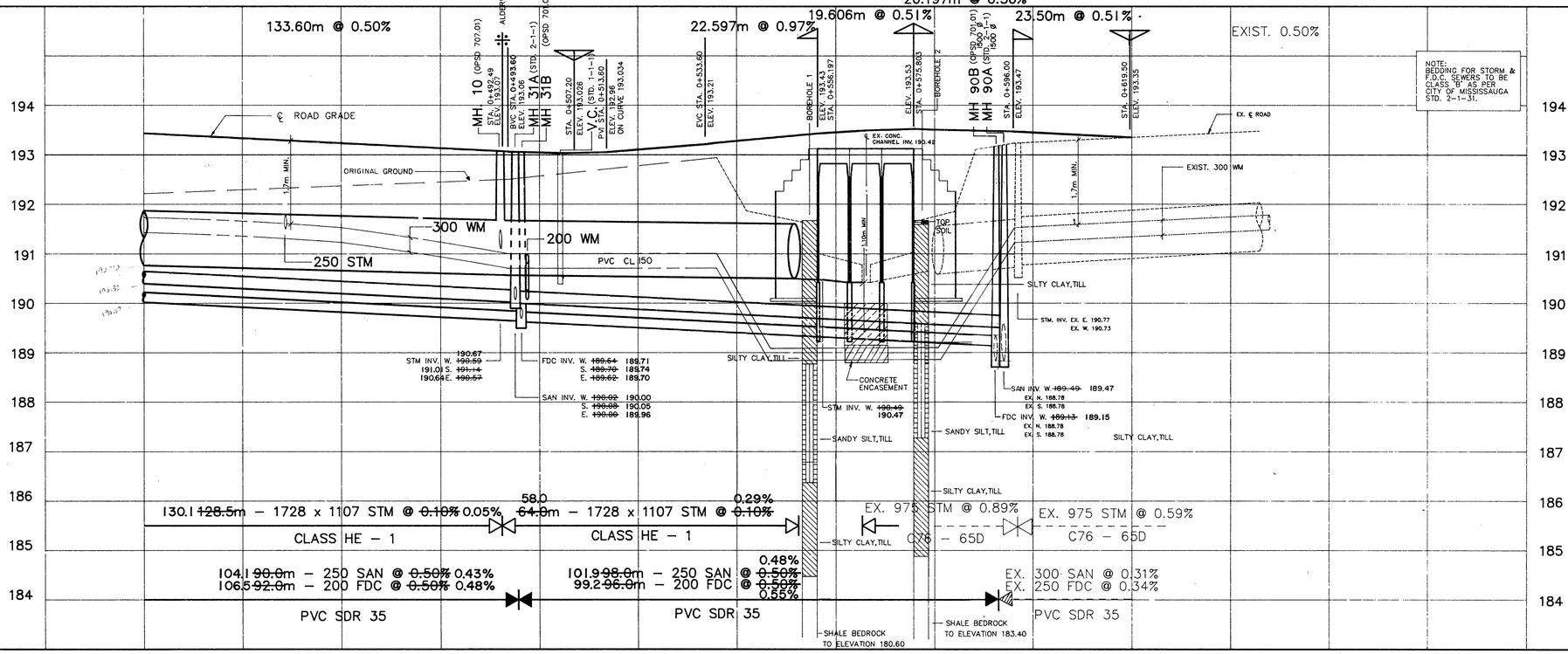
1. PIPES ARE NOT TO BE LAID ON FILL UNTIL THE FIELD DENSITY TEST REPORTS HAVE BEEN SUBMITTED TO AND APPROVED BY THE ENGINEER.
2. FILL TO BE PLACED TO A MINIMUM OF 600 mm ABOVE THE SEWER AND WATERMAIN GRADES AND TO 3.0 m MINIMUM OR CLOSE SHEETING. COMPACTED TO A MINIMUM OF 100% STANDARD PROCTOR DENSITY IN 300 mm LIFTS.
3. TESTS SHALL BE TAKEN ALONG CENTRE LINE OF SEWER AND WATERMAIN AND ON LINES 1.3 m ON EITHER SIDE OF SAME AT A MAXIMUM INTERVAL OF 50.0 m . TESTS TO BE TAKEN AT EACH 300 mm LIFT.

NOTES FOR WATERMAINS ONLY IN FILL AREAS

4. ALL HYDRANTS, TEES, BRANCH VALVES AND HORIZONTAL AND VERTICAL BENDS ARE TO BE TIED WITH TIE RODS IN ADDITION TO CONCRETE BLOCKING.
5. CONCRETE BLOCKING TO BE AS PER REGION OF PEEL STANDARDS 1-8-3, 1-8-4, 1-8-5, 1-8-6 AND 1-8-7.
6. PIPE JOINT DEFLECTIONS ARE NOT ALLOWED IN FILL AREAS.

K = 20
ΔG = 1.47%
L = 40.00m
d = 0.074m

▷ DOUBLE SERVICE CONNECTIONS
▱ SINGLE SERVICE CONNECTIONS
SEE DETAIL ON DWG. 8814-A-47

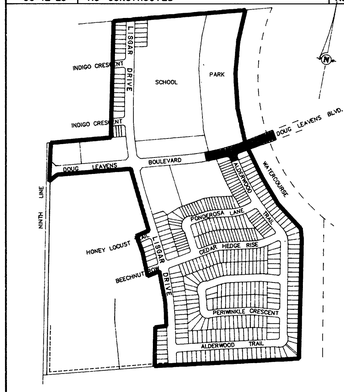



## SERVICE DATA

| SERVICE | DATE | INIT. | SERVICE | DATE | INIT. |
|---|---|---|---|---|---|
| SAN. SEWERS | | | GAS MAINS | | |
| STORM SEWERS | | | BELL U/G CABLES | | |
| WATERMAINS | | | HYDRO U/G CABLES | | |

## REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| 92-09-18 | FUTURE USE BLK 363 FROM MULTIPLE FAMILY TO APARTMENTS | JM |
| 92-10-22 | CHANGED TOWNHOUSE UNITS TO SEMI DETACHED | MR |
| 93-01-13 | EASEMENT ADDED | KS |
| 93-01-18 | MH NUMBER CHANGED FROM 45A & 45B TO 90A & 90B | MR |
| 93-01-18 | MH 90A & 90B DIMENSIONS | MR |
| 93-02-03 | MH 9 TO MH 10 REVISED STORM SEWER GRADE | JM |
| 93-12-23 | AS CONSTRUCTED | AEP |




KEY PLAN
1: 7500

FOR GENERAL NOTES SEE DWG. 8814-A-43

## GENERAL NOTES

- ALL DRIVEWAYS ASPHALT UNLESS OTHERWISE NOTED.
- ALL SERVICE LOCATIONS ARE APPROXIMATE AND MUST BE LOCATED ACCURATLY IN FIELD.
- ● DENOTES BUILDING - NOT LOCATED
- ⊏ DENOTES BUILDING - LOCATED
- T.T.B.M. No. 639 ELEV. 190.653m
- TEMP. BENCH MARK ELEV.
- DESCRIPTION. ON THE W. FACE AT THE S. END OF THE S.E. CONCRETE END POST OF A BRIDGE ON NINTH LINE, 228.6m N. OF BRITANNIA RD. W.

AS CONSTRUCTED 21 T-87071

M. A. T. BROWN — 100 PROVINCE OF ONTARIO — DESIGNED BY
P. A. EHLEH — REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO — APPROVED BY
CHKD.

**SECOND TERRAGAR**
**HOLDINGS LIMITED**
PHASE I

paul theil associates limited
consulting engineers
21 Coventry Road, Brampton, Ontario L6T 4V7

MISSISSAUGA
Public Works Department

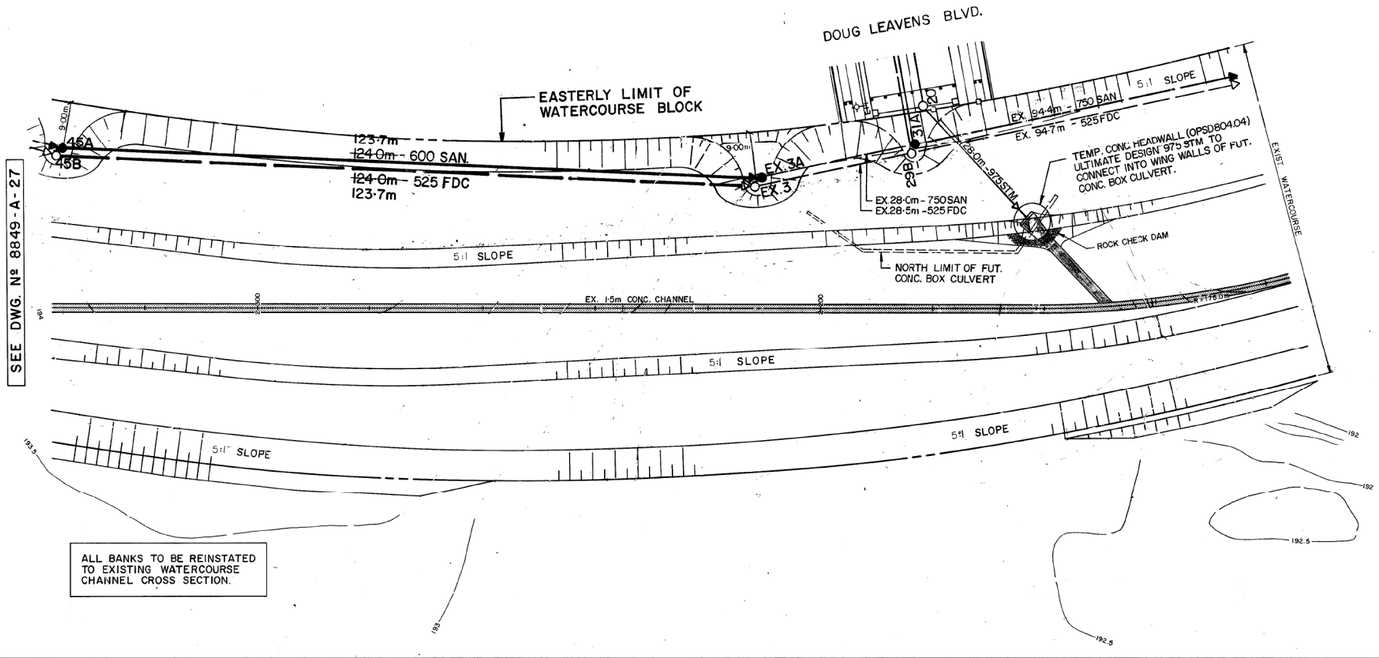
# DOUG LEAVENS BOULEVARD

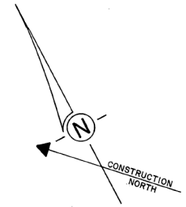
STN. 0+420 TO STN. 0+640

| | | | |
|---|---|---|---|
| SCALE HORIZ. 1 : 500 VERT. 1 : 50 | AREA | | PROJECT No. |
| DRAWN BY | CHECKED BY | | PLAN No. 8814-A- |
| DATE SEPT. 1991 | SHEET | OF | C - |

C-31725

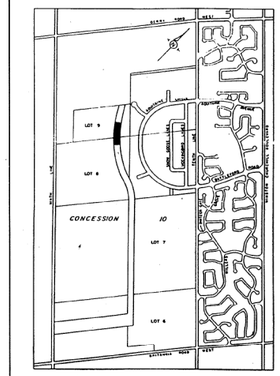
C1



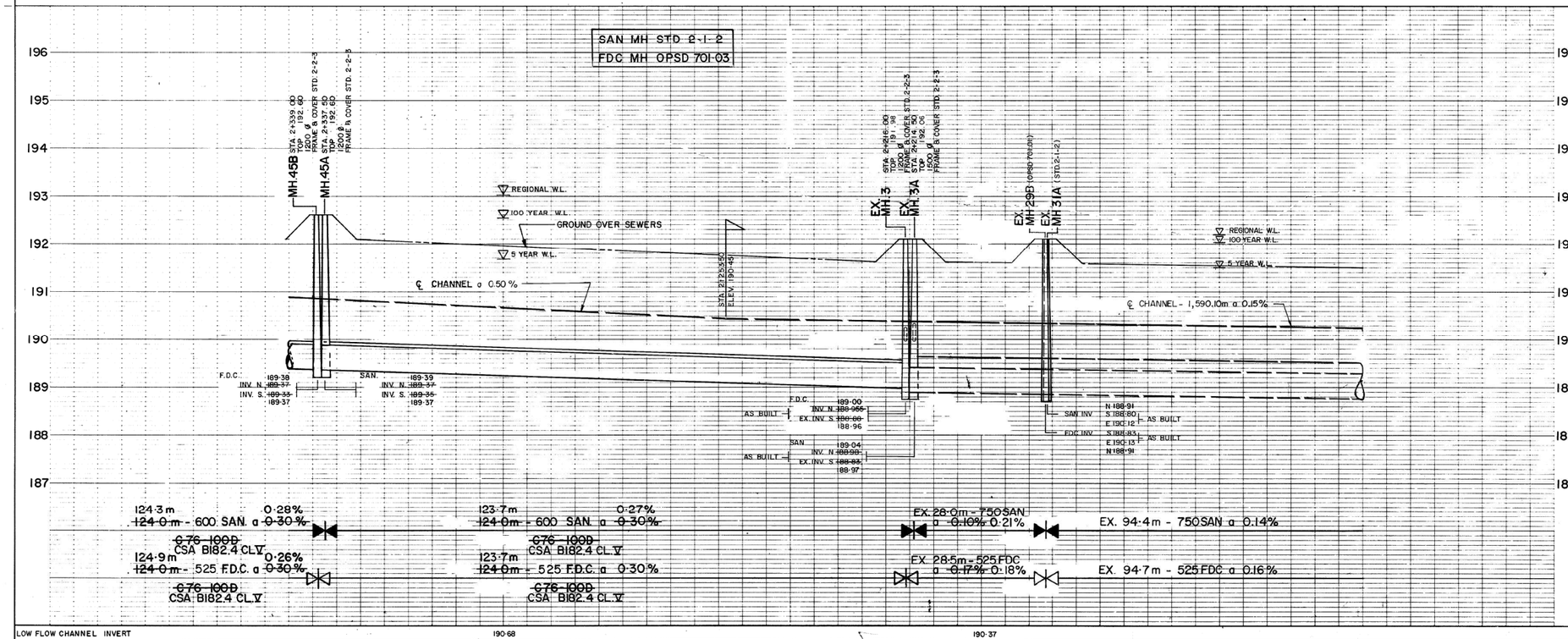

| SERVICE DATA | | | | | |
|---|---|---|---|---|---|
| SERVICE | DATE | INIT | SERVICE | DATE | INIT |
| SAN. SEWERS | | | GAS MAINS | | |
| STORM SEWERS | | | BELL U/G CABLE | | |
| WATERMAINS | | | HYDRO U/G CABLE | | |

| REVISIONS | | |
|---|---|---|
| DATE | DETAILS | INIT |
| 94-01-19 | AS CONSTRUCTED | K.S. |




KEY PLAN

NOTE: ALL FUTURE WORKS BY OTHERS




## GENERAL NOTES

- ALL DRIVEWAYS ASPHALT UNLESS OTHERWISE NOTED.
- ALL SERVICE LOCATIONS ARE APPROXIMATE AND MUST BE LOCATED ACCURATELY IN FIELD.
- ● DENOTES BUILDING - NOT LOCATED
- ⊏ DENOTES BUILDING - LOCATED
- T.T.B.M. No. 639 ELEV. 190.653
- TEMP. BENCH MARK ELEV. DESCRIPTION.

▽W.L. WATER LEVEL

AS CONSTRUCTED 21T-87053

ASSOCIATED LEGAL PLAN: 43R-11856

D. A. EHLER — PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

DESIGNED BY CHKD

APPROVED BY

VENTURON DEVELOPMENT (GREENMEADOW) INC.

Venturon

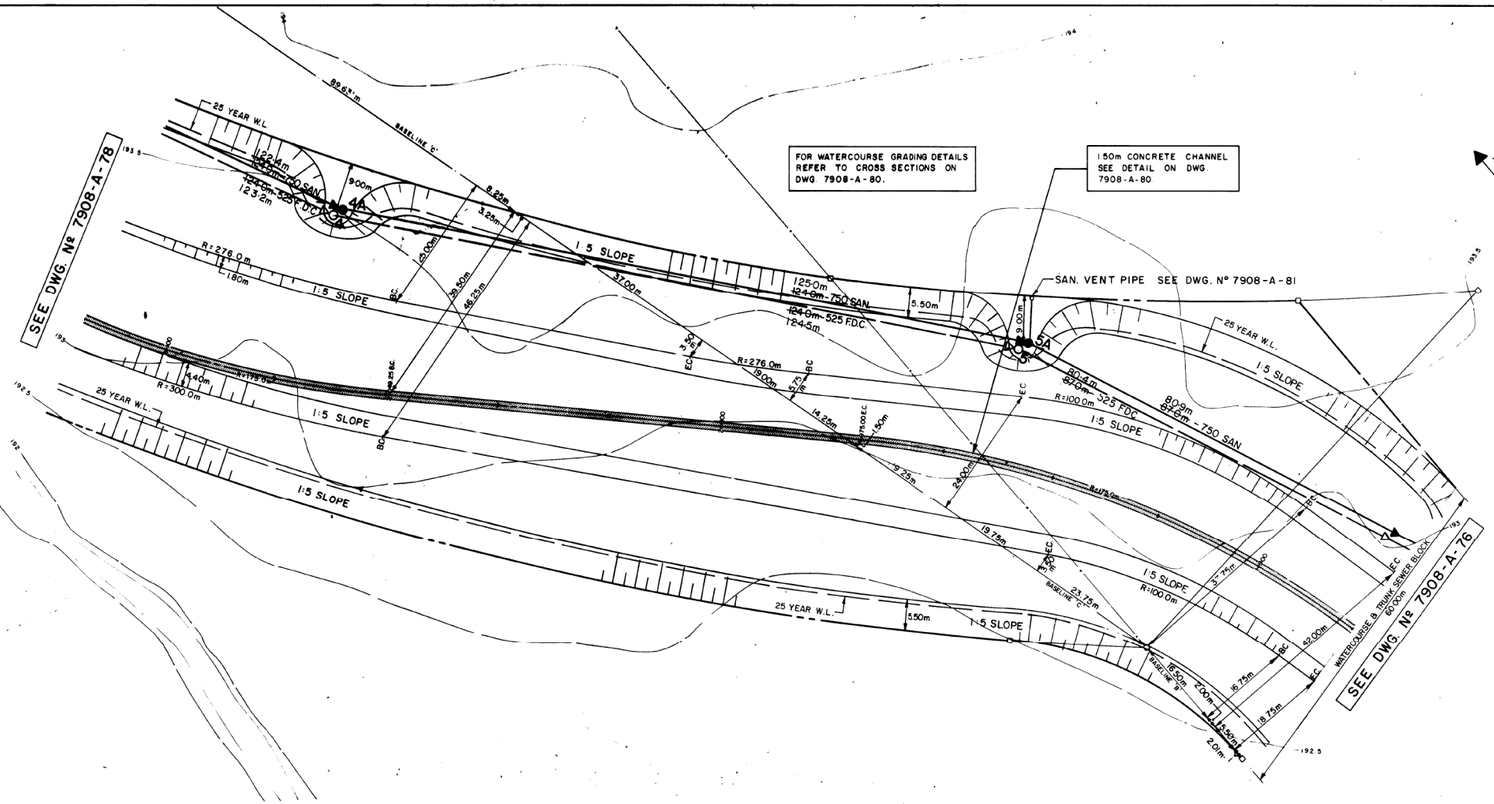
paul theil associates limited
consulting engineers
700 Balmoral Drive, Bramalea, Ontario

CITY OF MISSISSAUGA
ENGINEERING AND WORKS DEPARTMENT

# TRUNK SEWERS
STN. 2+120 TO STN. 2+340

| | | | |
|---|---|---|---|
| SCALE HOR. 1:500 VERT. 1:50 | AREA | PROJECT No. | |
| DRAWN BY M. ROSE | CHECKED BY | PLAN No. 8849-A-1 | |
| DATE 90-05-14 | SHEET OF | C- | |

C-31928

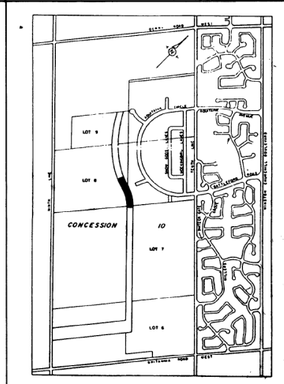



## SERVICE DATA

| SERVICE | DATE | INIT | SERVICE | DATE | INIT |
|---|---|---|---|---|---|
| SAN. SEWERS | | | GAS MAINS | | |
| STORM SEWERS | | | BELL U/G CABLE | | |
| WATERMAINS | | | HYDRO U/G CABLE | | |

## REVISIONS

| DATE | DETAILS | INIT |
|---|---|---|
| 87-01-29 | RAISED MANHOLE TOPS & GRADING | M.A.R. |
| 87-03-31 | GENERAL | M.A.R. |
| 88-08-31 | AS-CONSTRUCTED | C.O.C. |
| 89-11-06 | AS PER CITY COMMENTS | J.A. |




KEY PLAN

AS-CONSTRUCTED AUGUST/88

## GENERAL NOTES

- ALL DRIVEWAYS ASPHALT UNLESS OTHERWISE NOTED.
- ALL SERVICE LOCATIONS ARE APPROXIMATE AND MUST BE LOCATED ACCURATELY IN FIELD.
- ● DENOTES BUILDING - NOT LOCATED
- ⊏ DENOTES BUILDING - LOCATED
- T.T.B.M. No. 639 ELEV. 190.600
- TEMP BENCH MARK ELEV DESCRIPTION
- ▽ W.L. WATER LEVEL

ASSOCIATED LEGAL PLANS: 43R-11856 & 43R-12157

REGISTERED PROFESSIONAL ENGINEER D. E. MAUNDER PROVINCE OF ONTARIO

DESIGNED D.E. Maunder CHKD

APPROVED BY

# LISGAR

paul theil associates limited
consulting engineers
700 Balmoral Drive, Bramalea, Ontario

## CITY OF MISSISSAUGA
ENGINEERING AND WORKS DEPARTMENT

NEIGHBOURHOOD 1

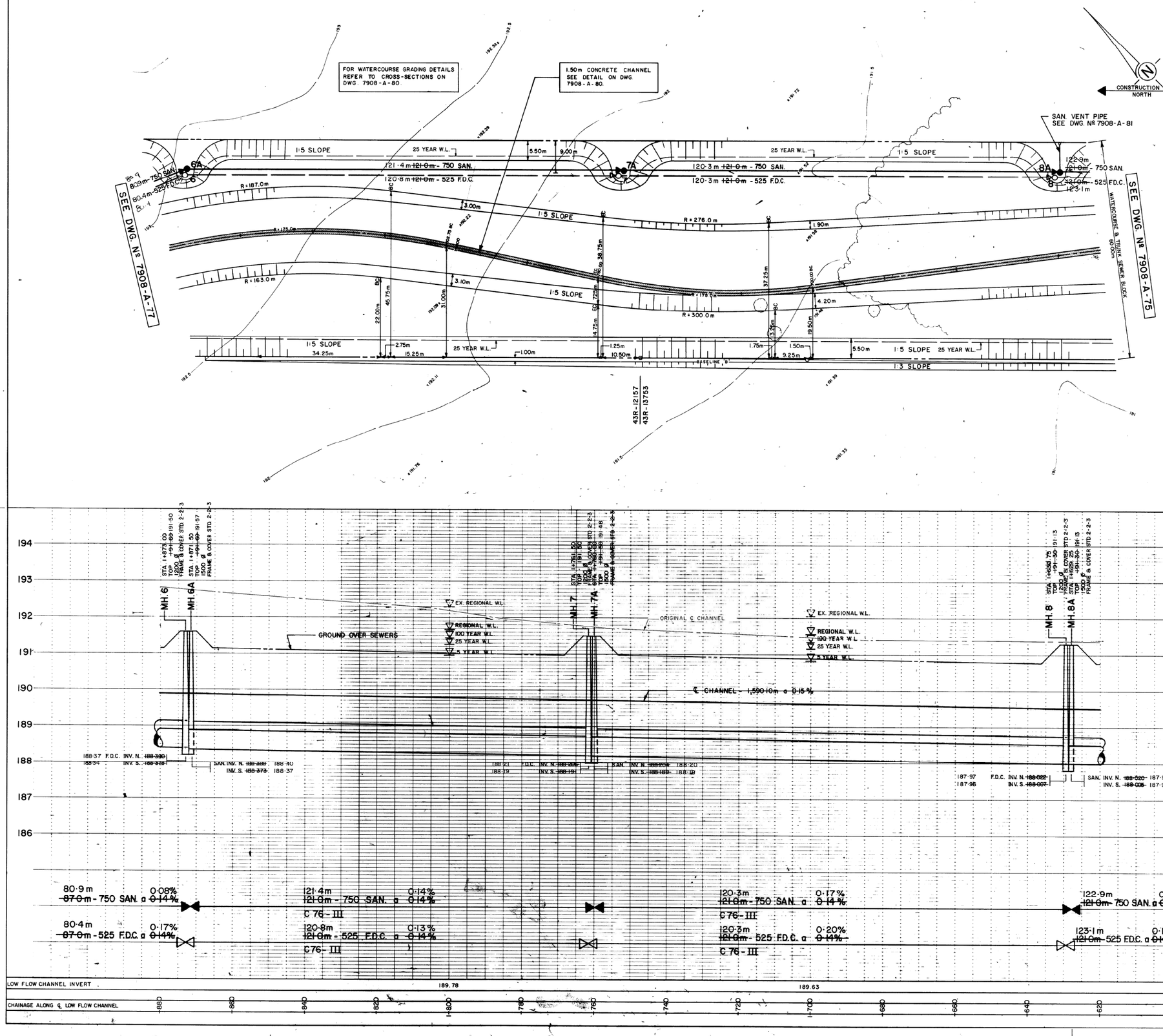
# WATERCOURSE & TRUNK SEWERS

STN. 1+880 TO STN. 2+120

C-1

| | | | |
|---|---|---|---|
| SCALE | HOR 1: 500 VERT 1: 50 | AREA | PROJECT No. |
| DRAWN BY | M. ROSE | CHECKED BY | PLAN No. 7908-A-7 |
| DATE | 85-10-01 | SHEET OF | C- |

C-23758




## SERVICE DATA

| SERVICE | DATE | INIT. | SERVICE | DATE | INIT. |
|---|---|---|---|---|---|
| SAN. SEWERS | | | GAS MAINS | | |
| STORM SEWERS | | | BELL U/G CABLE | | |
| WATERMAINS | | | HYDRO U/G CABLE | | |

## REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| 87-01-29 | RAISED MANHOLE TOPS & GRADING | M.A.R. |
| 87-03-31 | GENERAL | M.A.R. |
| 88-08-31 | AS-CONSTRUCTED | C.O.C. |
| 89-11-06 | AS PER CITY COMMENTS | J.A. |

AS-CONSTRUCTED AUGUST / 88




80·9 m — 87·0m - 750 SAN. @ 0·14 % — 0·08%

80·4 m — 87·0m - 525 F.D.C. @ 0·14% — 0·17%

121·4m — 121·0m - 750 SAN. @ 0·14 % — 0·14 %
C 76 - III

120·8m — 121·0m - 525 F.D.C. @ 0·14 % — 0·13 %
C 76 - III

120·3m — 121·0m - 750 SAN. @ 0·14 % — 0·17 %
C 76 - III

120·3m — 121·0m - 525 F.D.C. @ 0·14% — 0·20%
C 76 - III

122·9m — 121·0m 750 SAN. @ 0·14% — 0·15%

123·1m — 121·0m 525 F.D.C. @ 0·14% — 0·12%

LOW FLOW CHANNEL INVERT — 189.78 — 189.63

CHAINAGE ALONG ℄ LOW FLOW CHANNEL — 880 — 860 — 840 — 820 — 1+800 — 780 — 760 — 740 — 720 — 1+700 — 680 — 660 — 640 — 620

## GENERAL NOTES

- ALL DRIVEWAYS ASPHALT UNLESS OTHERWISE NOTED.
- ALL SERVICE LOCATIONS, ARE APPROXIMATE AND MUST BE LOCATED ACCURATELY IN FIELD.
- ● DENOTES BUILDING - NOT LOCATED.
- ⊏ DENOTES BUILDING - LOCATED.
- T.T.B.M. No. 639 ELEV. 190.653
- TEMP BENCH MARK ELEV. DESCRIPTION.

▽W.L. WATER LEVEL

ASSOCIATED LEGAL PLANS: 43R-12157 & 43R-13753

REGISTERED PROFESSIONAL ENGINEERS P. E. MAUNDER PROVINCE OF ONTARIO

DESIGNED BY D.E. Maunder CHKD

APPROVED BY

# LISGAR

paul theil associates limited
consulting engineers
700 Balmoral Drive, Bramalea, Ontario

## CITY OF MISSISSAUGA
ENGINEERING AND WORKS DEPARTMENT

NEIGHBOURHOOD 1
# WATERCOURSE & TRUNK SEWERS
STN 1+620 TO STN. 1+880

| | | | |
|---|---|---|---|
| SCALE HOR. 1:500 VERT. 1:50 | AREA | | PROJECT No. |
| DRAWN BY M. ROSE | CHECKED BY | | PLAN No. 7908-A-7 |
| DATE 85-10-01 | SHEET OF | | C- |

C-23757

FOR WATERCOURSE GRADING DETAILS REFER TO CROSS-SECTIONS ON DWG. 7908-A-80.

1.50m CONCRETE CHANNEL SEE DETAIL ON DWG. 7908-A-80

SEE DWG. No 7908-A-76

SEE DWG. No 7908-A-74

WATERCOURSE & TRUNK SEWER BLOCK

CONSTRUCTION NORTH

1:5 SLOPE | 25 YEAR W.L. | 1:5 SLOPE

122.9 m ~~121.0 m~~ - 750 SAN.

123.1 m ~~121.0 m~~ - 525 F.D.C.

152.5 m ~~154.0 m~~ - 750 SAN.

152.4 m ~~154.0 m~~ - 525 F.D.C.

154.9 m ~~154.0 m~~ 750 SAN.

155.1 m ~~154.0 m~~ 525 F.D.C.

R = 300.0 m | R = 276.0 m | R = 178.0 m

VARIABLE SLOPE | 1:3 SLOPE | 1.50m VARIABLE SLOPE

43R-13753

43R-

FUT. F.D.C. | FUT. SAN. | FUT. STM.

MH.9 | MH.9A | MH.10 | MH.10A

EX. REGIONAL W.L.
REGIONAL W.L.
100 YEAR W.L.
25 YEAR W.L.
5 YEAR W.L.

ORIGINAL ℄ CHANNEL

GROUND OVER SEWERS

℄ CHANNEL = 1,590.10 m @ 0.15%

187.83 F.D.C. INV. N. ~~187.838~~
187.81 INV. S. ~~187.823~~
FUT. INV. E. 188.886

SAN. INV. N. ~~187.856~~ 187.81
INV. S. ~~187.821~~ 187.79
FUT. INV. E. 188.886

187.61 F.D.C. INV. N. ~~187.607~~
187.60 INV. S. ~~187.592~~

SAN. INV. N. ~~187.605~~ 187.60
INV. S. ~~187.590~~ 187.59

122.9m 0.15%
~~121.0m~~ - 750 SAN. @ ~~0.14%~~
C 76 - III

123.1m 0.12%
~~121.0m~~ - 525 F.D.C. @ ~~0.14%~~
C 76 - III

152.5m 0.13%
~~154.0m~~ + 750 SAN. @ ~~0.14%~~
C 76 - III

152.4m
~~154.0m~~ + 525 F.D.C. @ 0.14%
C 76 - III

154.9m 0.14%
~~154.0m~~ 750 SAN. @ ~~0.14%~~

155.1m 0.15%
~~154.0m~~ - 525 F.D.C. @ ~~0.14%~~

LOW FLOW CHANNEL INVERT 189.48 | 189.33 | 189.18

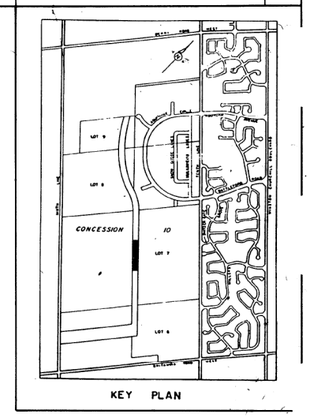
CHAINAGE ALONG ℄ LOW FLOW CHANNEL 1+620 1+600 1+580 1+560 1+540 1+520 1+500 1+480 1+460 1+440 1+420 1+400 1+380 1+360 1+340

## SERVICE DATA

| SERVICE | DATE | INIT. | SERVICE | DATE | INIT. |
|---|---|---|---|---|---|
| SAN. SEWERS | | | GAS MAINS | | |
| STORM SEWERS | | | BELL U/G CABLE | | |
| WATERMAINS | | | HYDRO U/G CABLE | | |

## REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| 87-01-28 | RAISED MANHOLE TOPS & GRADING | M.A.R. |
| 87-03-31 | GENERAL | M.A.R. |
| 88-08-31 | AS-CONSTRUCTED | C.O'C. |
| 89-11-06 | AS PER CITY COMMENTS | J.A. |



KEY PLAN

NOTE : ALL FUTURE WORKS BY OTHERS

AS-CONSTRUCTED AUGUST / 88

## GENERAL NOTES

- ALL DRIVEWAYS ASPHALT UNLESS OTHERWISE NOTED.
- ALL SERVICE LOCATIONS ARE APPROXIMATE AND MUST BE LOCATED ACCURATELY IN FIELD.
- ● DENOTES BUILDING - NOT LOCATED.
- ⊏ DENOTES BUILDING - LOCATED.
- T.T.B.M. No. 639 ELEV. 190.653
- TEMP. BENCH MARK ELEV.
  DESCRIPTION
- ▽ W.L. WATER LEVEL

ASSOCIATED LEGAL PLANS : 43R-13753 & 43R-

REGISTERED PROFESSIONAL ENGINEER D. E. MAUNDER PROVINCE OF ONTARIO

DESIGNED BY D.E. Maunder CHKD | APPROVED BY

# LISGAR

paul theil associates limited
consulting engineers
700 Balmoral Drive, Bramalea, Ontario

## CITY OF MISSISSAUGA
ENGINEERING AND WORKS DEPARTMENT

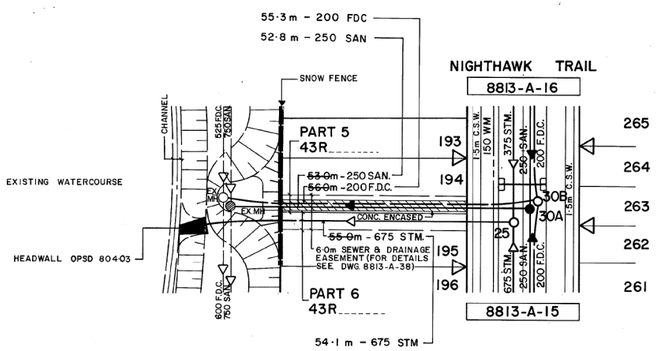
NEIGHBOURHOOD 1

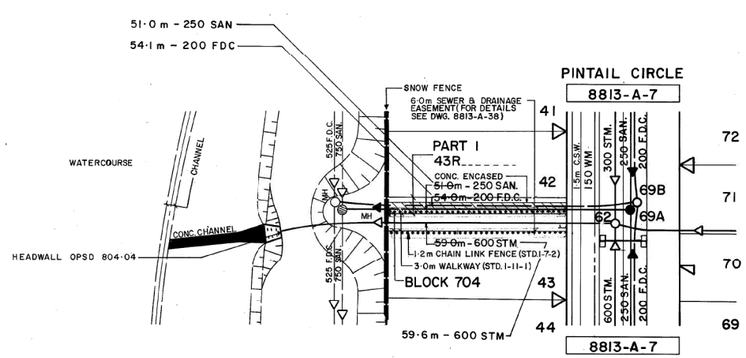
# WATERCOURSE & TRUNK SEWERS

STN. 1+340 TO STN. 1+620

| | | | |
|---|---|---|---|
| SCALE HOR. 1:500 VERT. 1:50 | AREA | | PROJECT No. |
| DRAWN BY M. ROSE | CHECKED BY | | PLAN No. 7908-A-7 |
| DATE 85-10-01 | SHEET | OF | C- |

C-23756



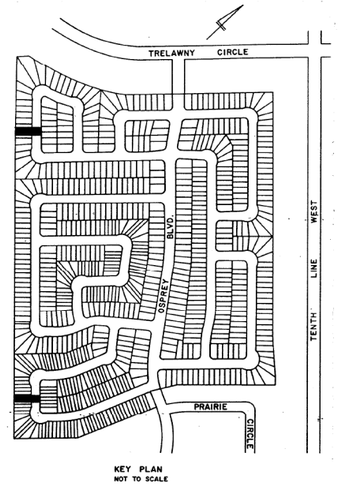

# AS CONSTRUCTED

## SERVICE DATA

| SERVICE | DATE | INIT. | SERVICE | DATE | INIT. |
|---|---|---|---|---|---|
| SAN. SEWERS | | | GAS MAINS | | |
| STORM SEWERS | | | BELL U/G CABLE | | |
| WATERMAINS | | | HYDRO U/G CABLE | | |

## REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| 88-08-24 | CITY & REGION 2ND SUBMISSION COMMENTS | MR. |
| 90-06-05 | AS CONSTRUCTED STM., SAN. & FDC. SEWERS | J.M. |

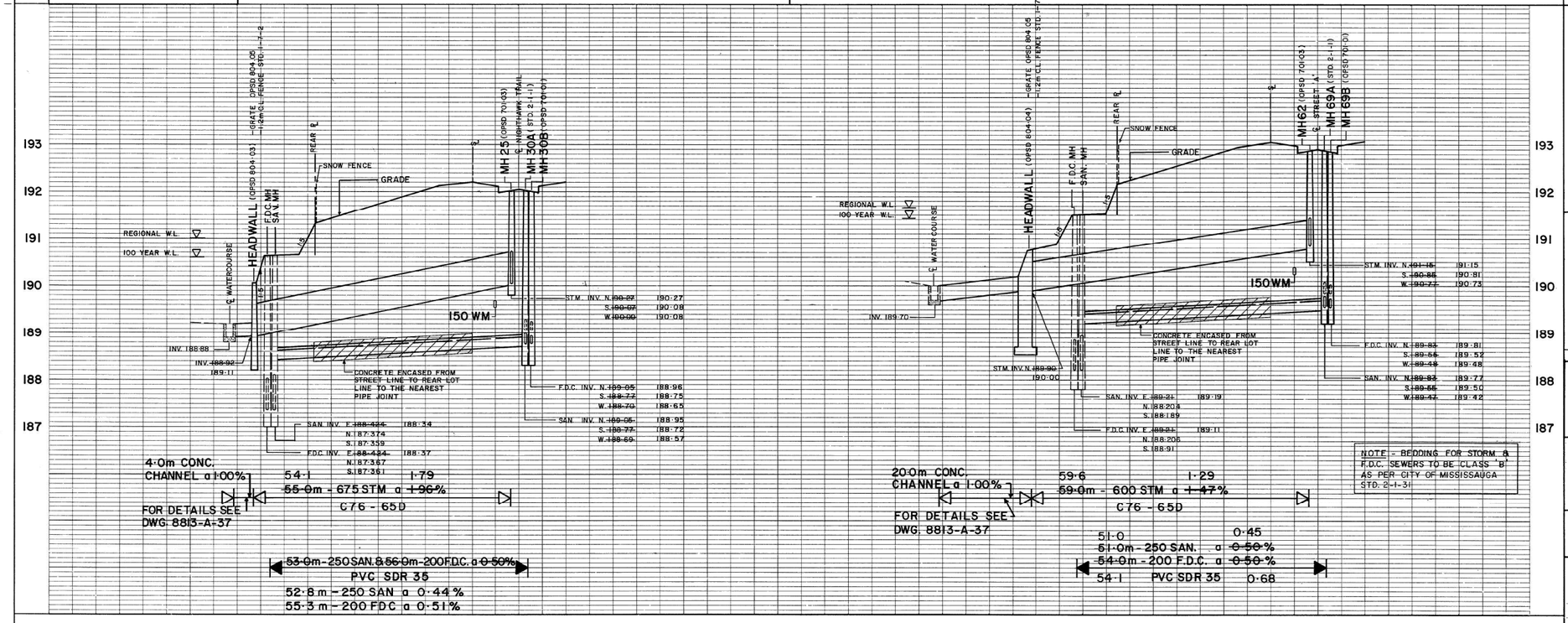



KEY PLAN
NOT TO SCALE

FOR GENERAL NOTES SEE DRAWING 8813-A-35

## LEGEND

- DOUBLE SANITARY & STORM CONNECTION
- SINGLE SANITARY & STORM CONNECTION




## GENERAL NOTES

- ALL DRIVEWAYS ASPHALT UNLESS OTHERWISE NOTED.
- ALL SERVICE LOCATIONS ARE APPROXIMATE AND MUST BE LOCATED ACCURATELY IN FIELD.
- ● DENOTES BUILDING - NOT LOCATED.
- ⊏ DENOTES BUILDING - LOCATED.
- T.T.B.M. No. 637 ELEV. 204·737m (671·71 ft)
- TEMP. BENCH MARK ELEV. 201·833m
  DESCRIPTION. TOP OF HYD. LOT 25 R.P. 579

T-87045

REGISTERED PROFESSIONAL ENGINEER P. A. EHLER PROVINCE OF ONTARIO

DESIGN BY ____ CHKD ____ APPROVED BY ____

# FIRST TERRAGAR HOLDINGS LIMITED

paul theil associates limited
consulting engineers
21 Coventry Road, Brampton, Ontario L6T 4V7

CITY OF MISSISSAUGA
ENGINEERING AND WORKS DEPARTMENT

## SEWER EASEMENTS

NIGHTHAWK TRAIL TO WATERCOURSE
PINTAIL CIRCLE TO WATERCOURSE

| | | | |
|---|---|---|---|
| SCALE HOR. 1:500 VERT. 1:50 | AREA | | PROJECT No. |
| DRAWN BY | CHECKED BY | | PLAN No. 8813-A-24 |
| DATE MAY 1988 | SHEET | OF | C-26069 |

# Appendix C3
# Osprey Boulevard Area

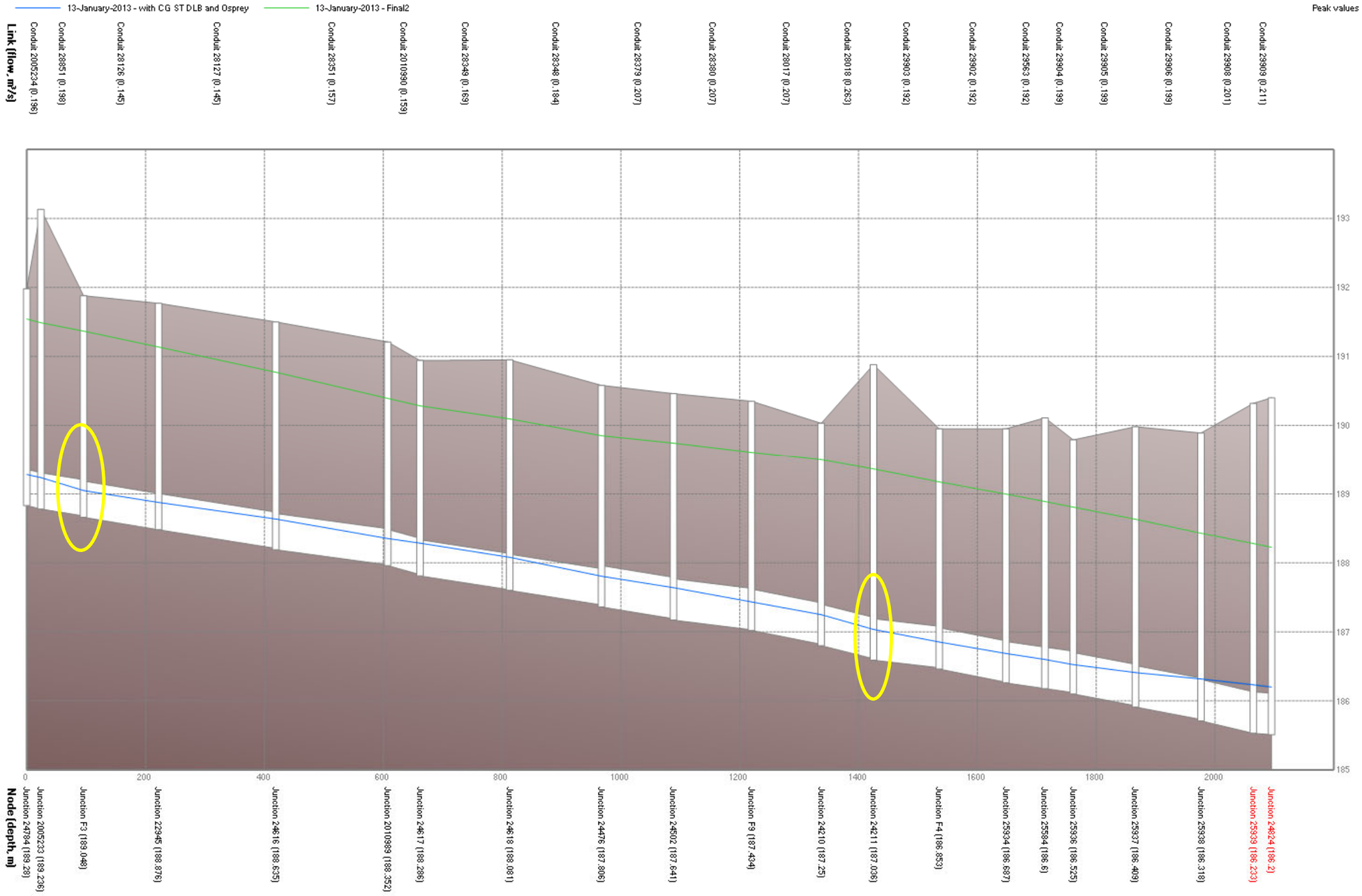



**Figure C3A: HGL Plot along Trunk FDC (Doug Leavens Boulevard to Ninth Line) for January 13, 2013 Storm Event. Location of diversions shown in yellow.**

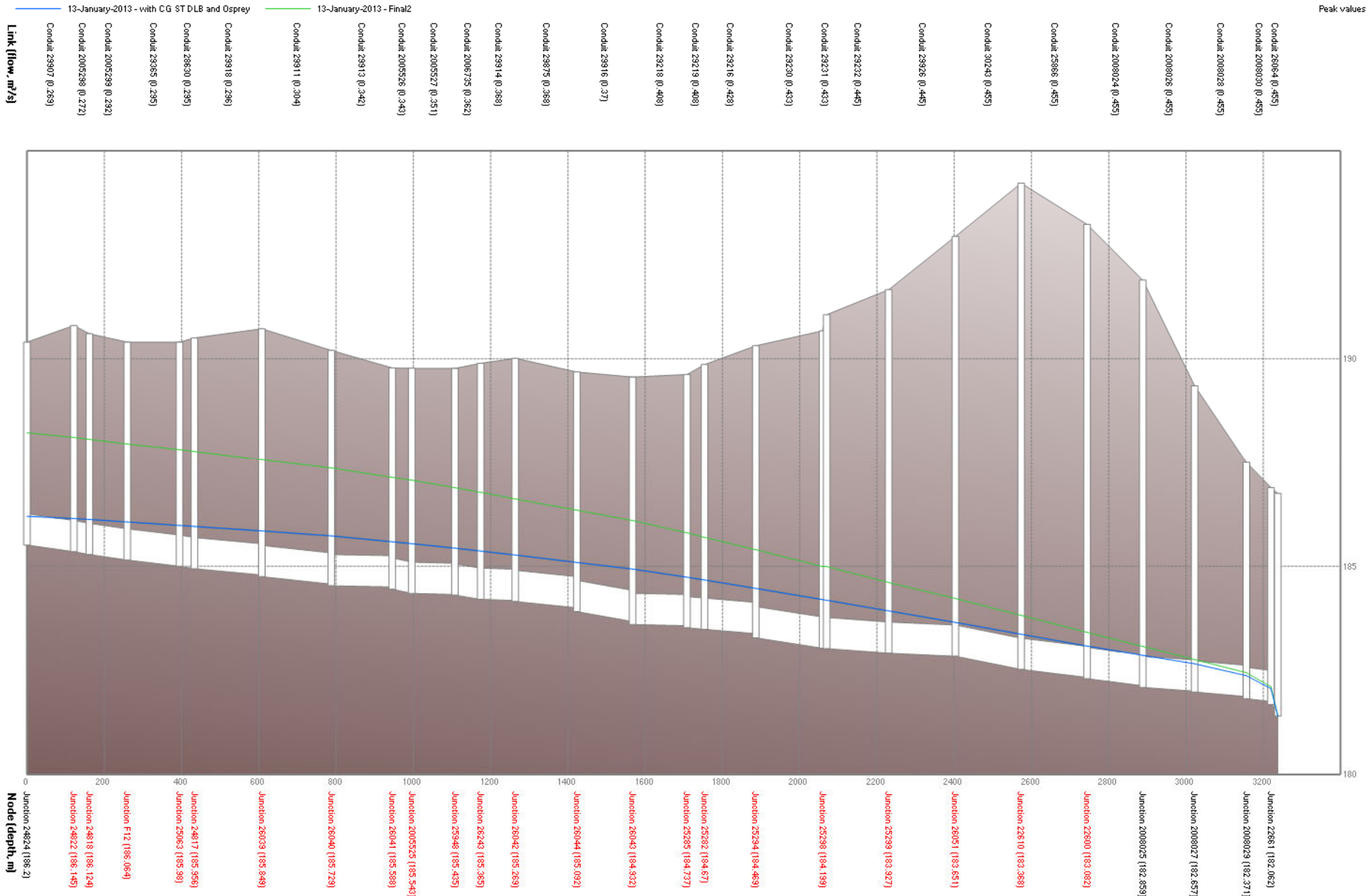



**Figure C3B: HGL Plot along Trunk FDC (Ninth Line to Erin Centre Boulevard) for January 13, 2013 Storm Event.**

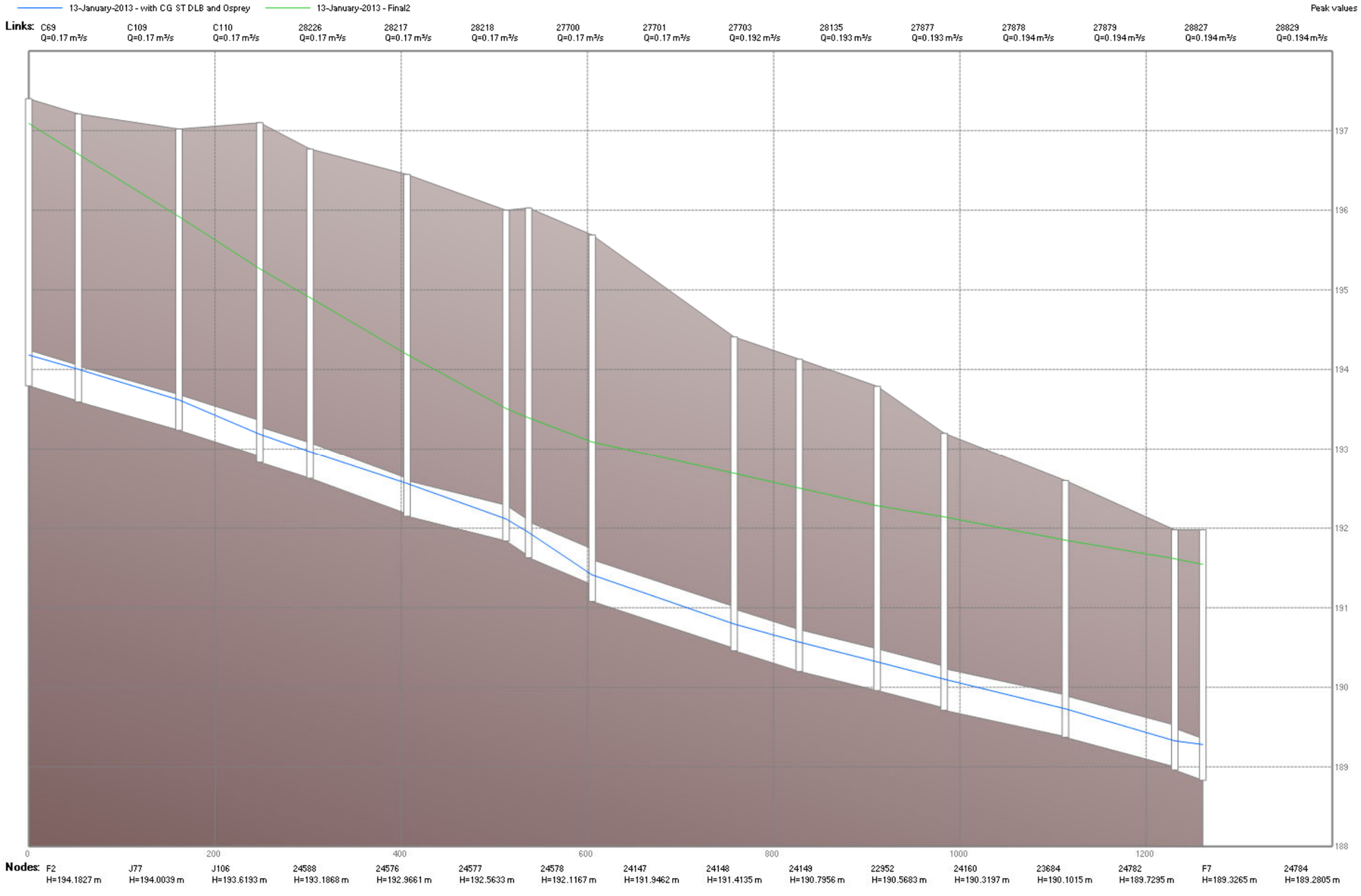



**Figure C3C: HGL Plot along Trunk FDC (Gauge F2 (South of Derry Road) to Doug Leavens Boulevard) for January 13, 2013 Storm Event. Diversions shown in yellow.**

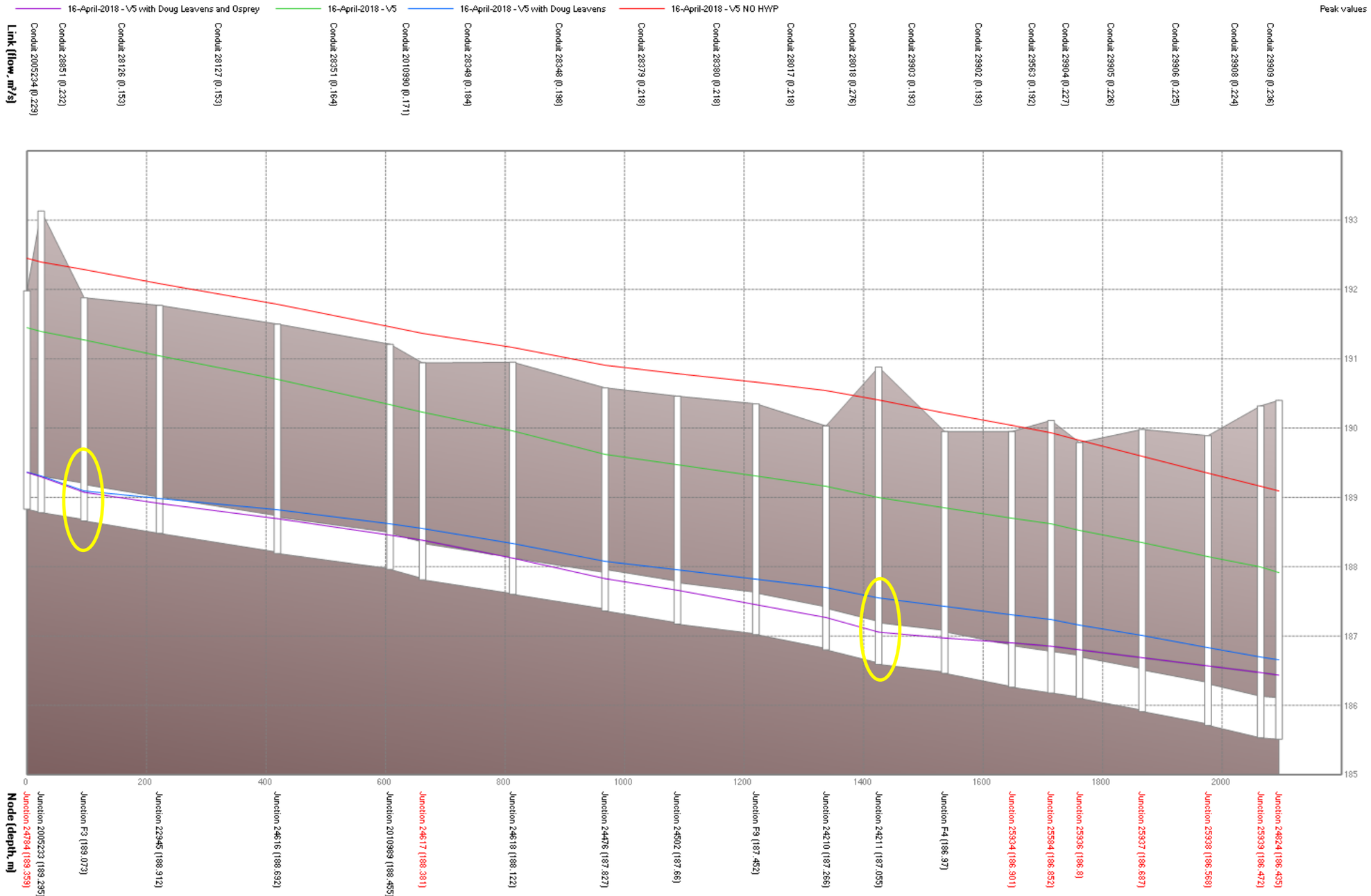



**Figure C3D: HGL Plot along Trunk FDC (Doug Leavens Boulevard to Ninth Line) for April 16, 2018 Storm Event. Location of diversions shown in yellow.**

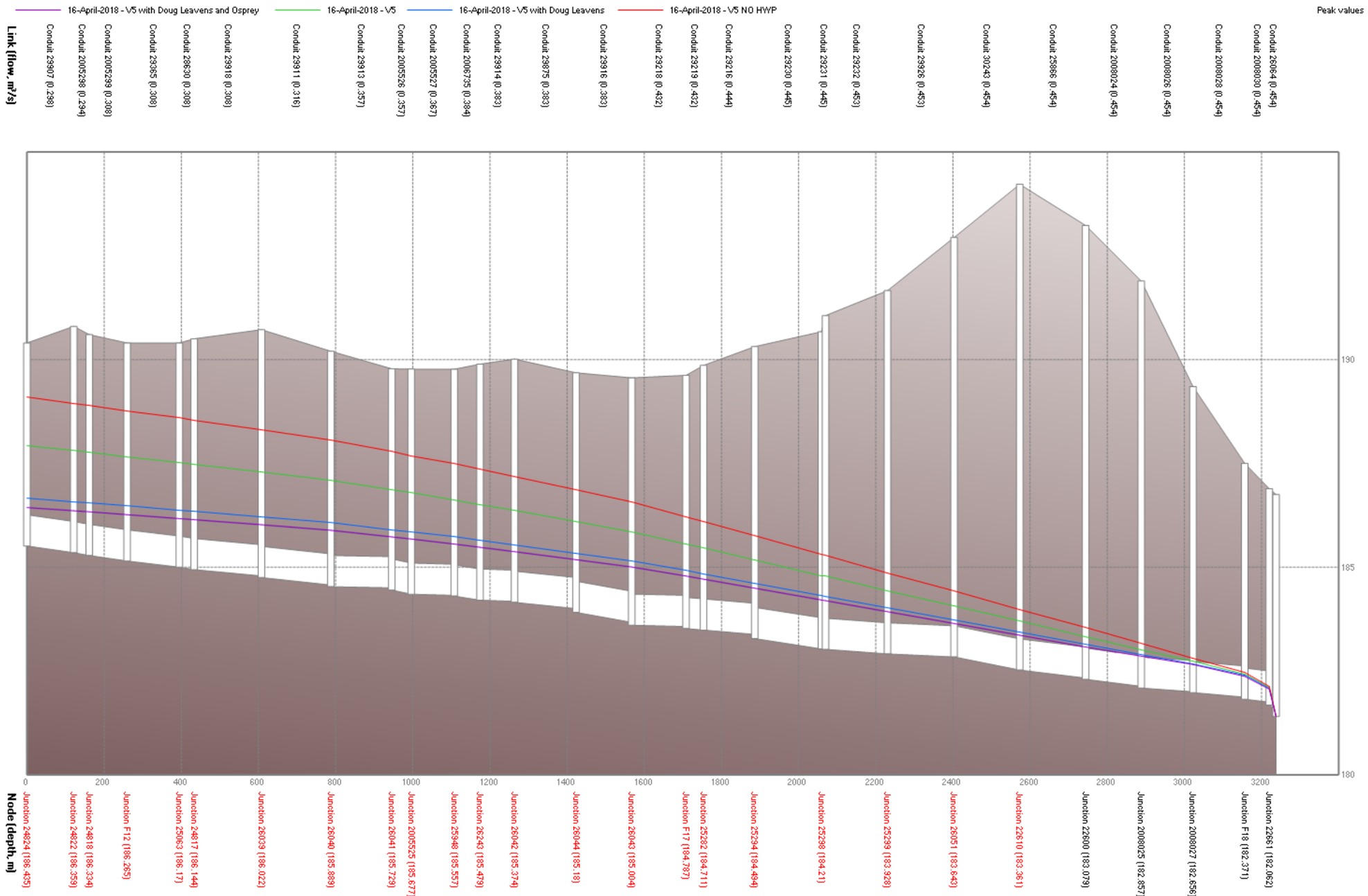



**Figure C3E: HGL Plot along Trunk FDC (Ninth Line to Erin Centre Boulevard) for April 16, 2018 Storm Event.**

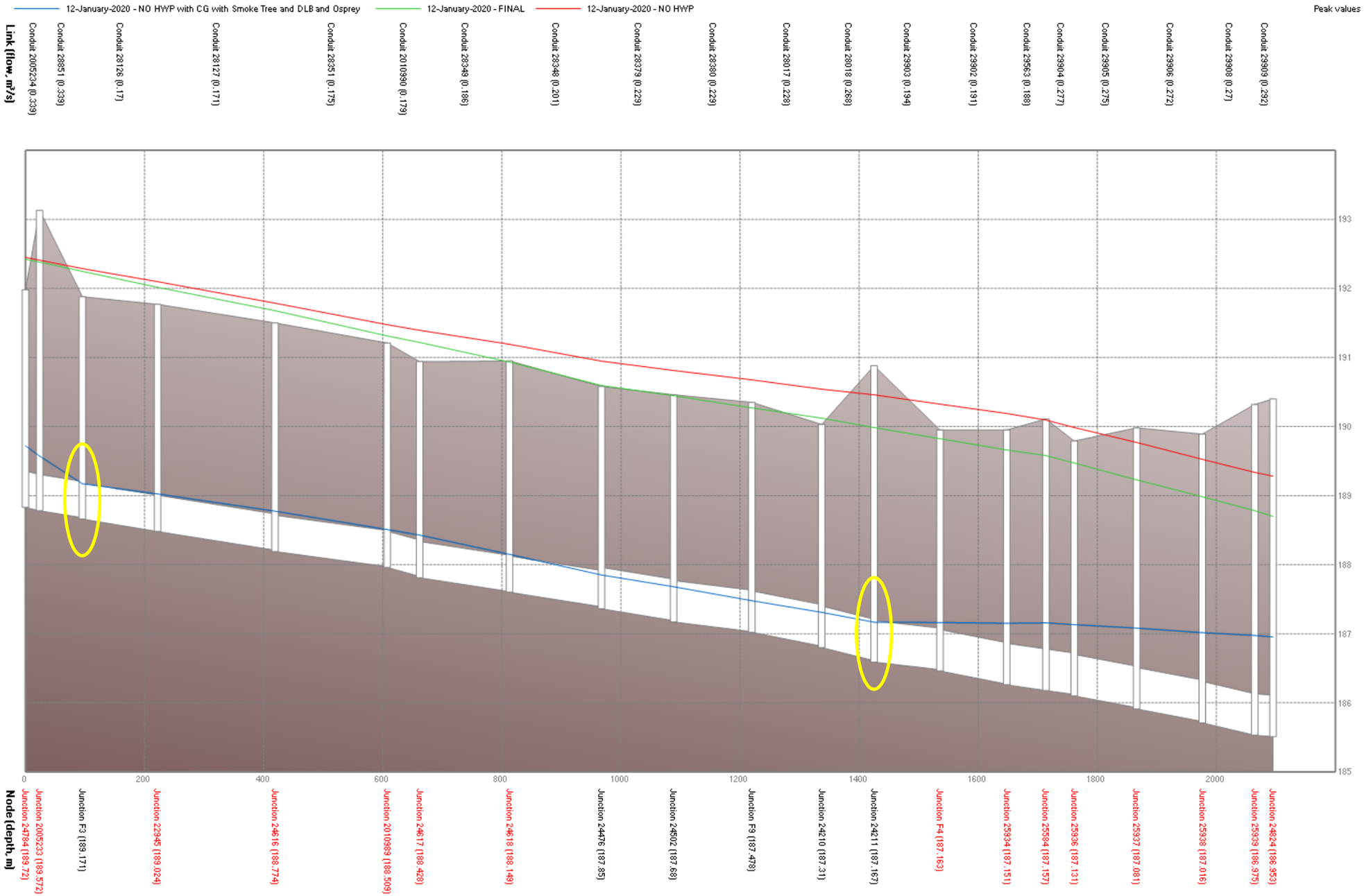



**Figure C3F: HGL Plot along Trunk FDC (Doug Leavens Boulevard to Ninth Line) for January 11-12, 2020 Storm Event. Location of diversions shown in yellow.**

**Figure C3G: HGL Plot along Trunk FDC (Ninth Line to Erin Centre Boulevard) for January 11-12, 2020 Storm Event.**

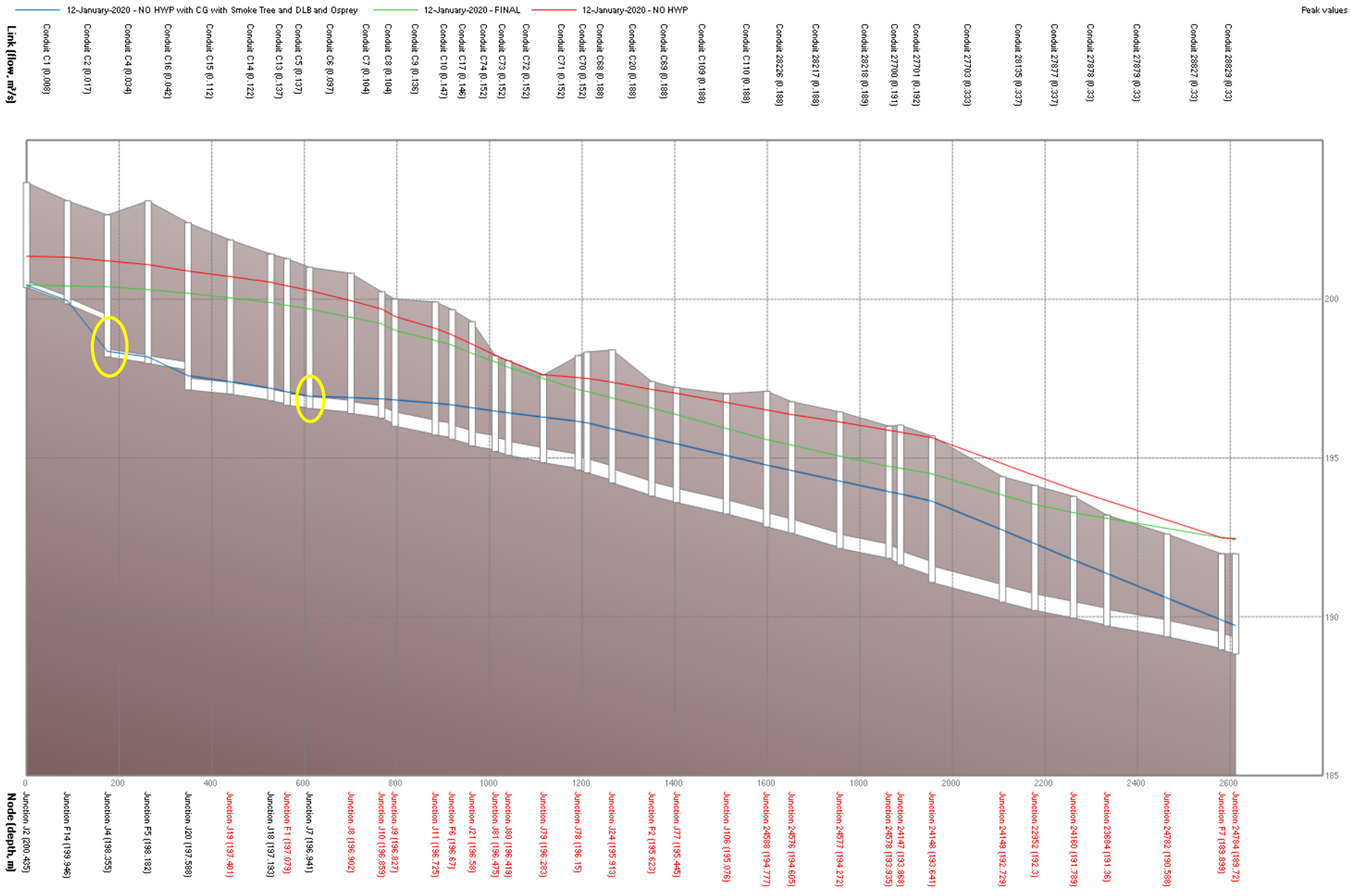



**Figure C3H: HGL Plot along Trunk FDC (Black Walnut Trail to Doug Leavens Boulevard) for January 11-12, 2020 Storm Event. Diversions shown in yellow.**

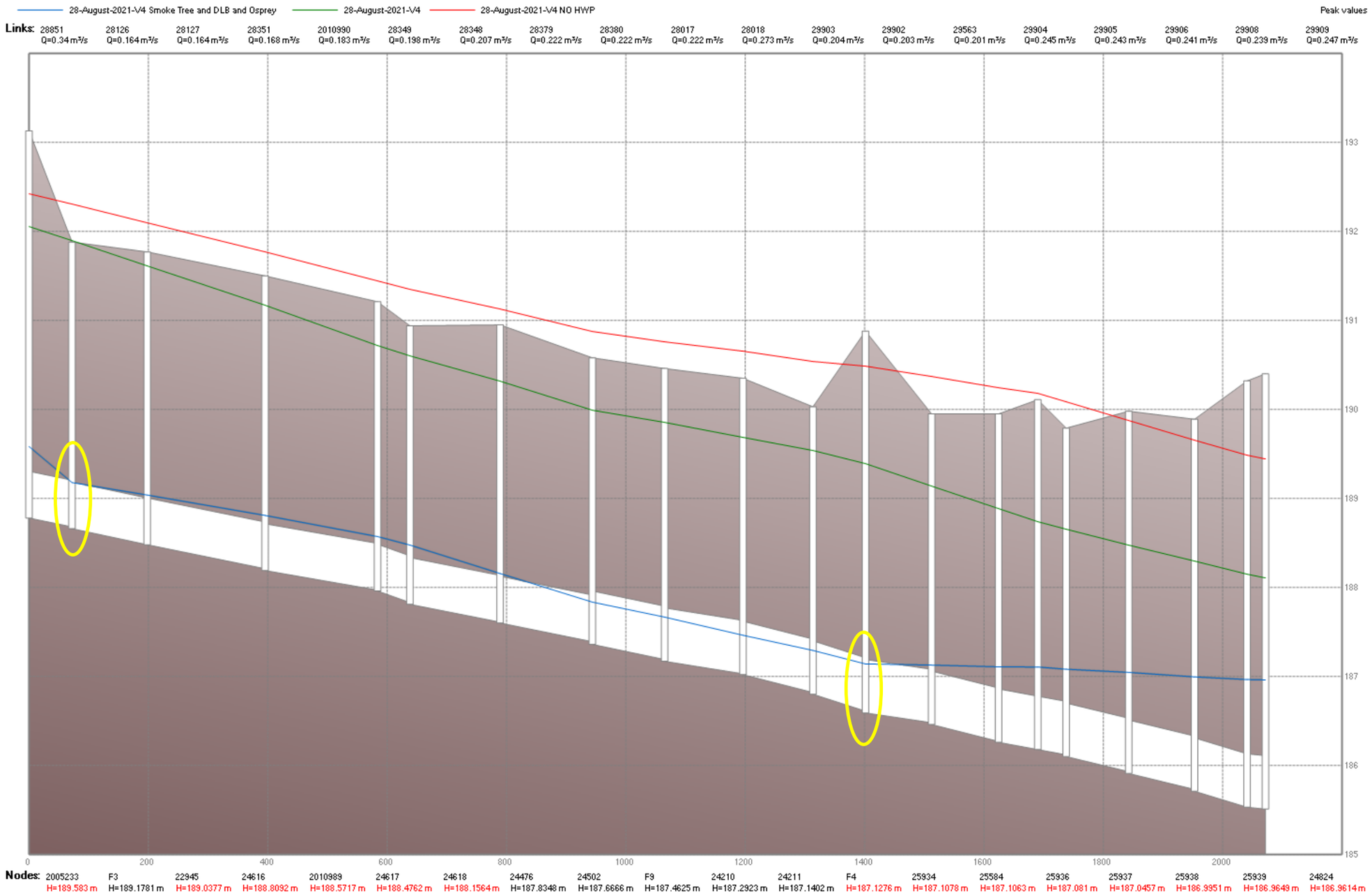



**Figure C3I: HGL Plot along Trunk FDC (Doug Leavens Boulevard to Ninth Line) for August 28, 2021 Storm Event. Location of diversions shown in yellow.**

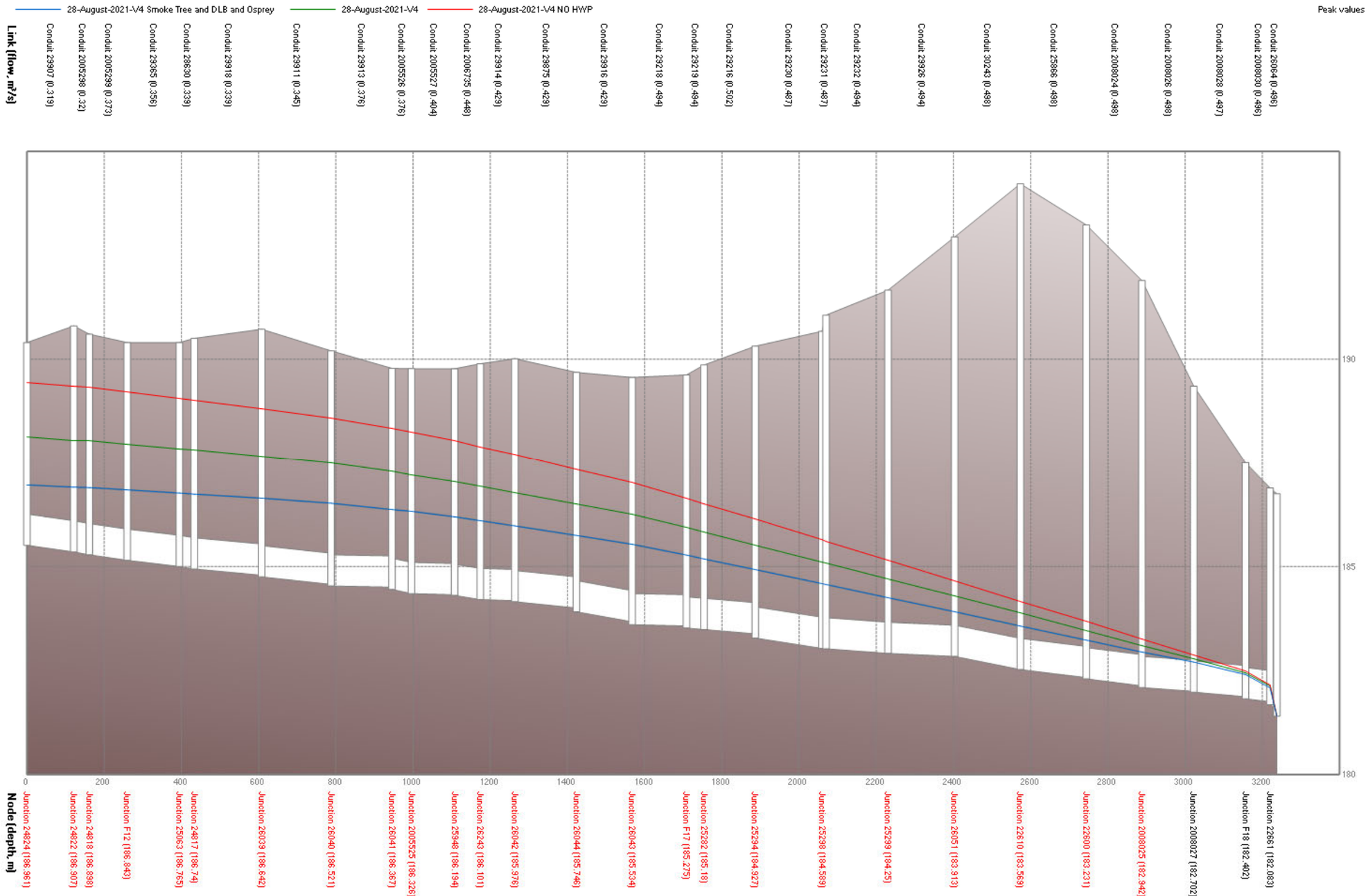



**Figure C3J: HGL Plot along Trunk FDC (Ninth Line to Erin Centre Boulevard) for August 28, 2021 Storm Event.**

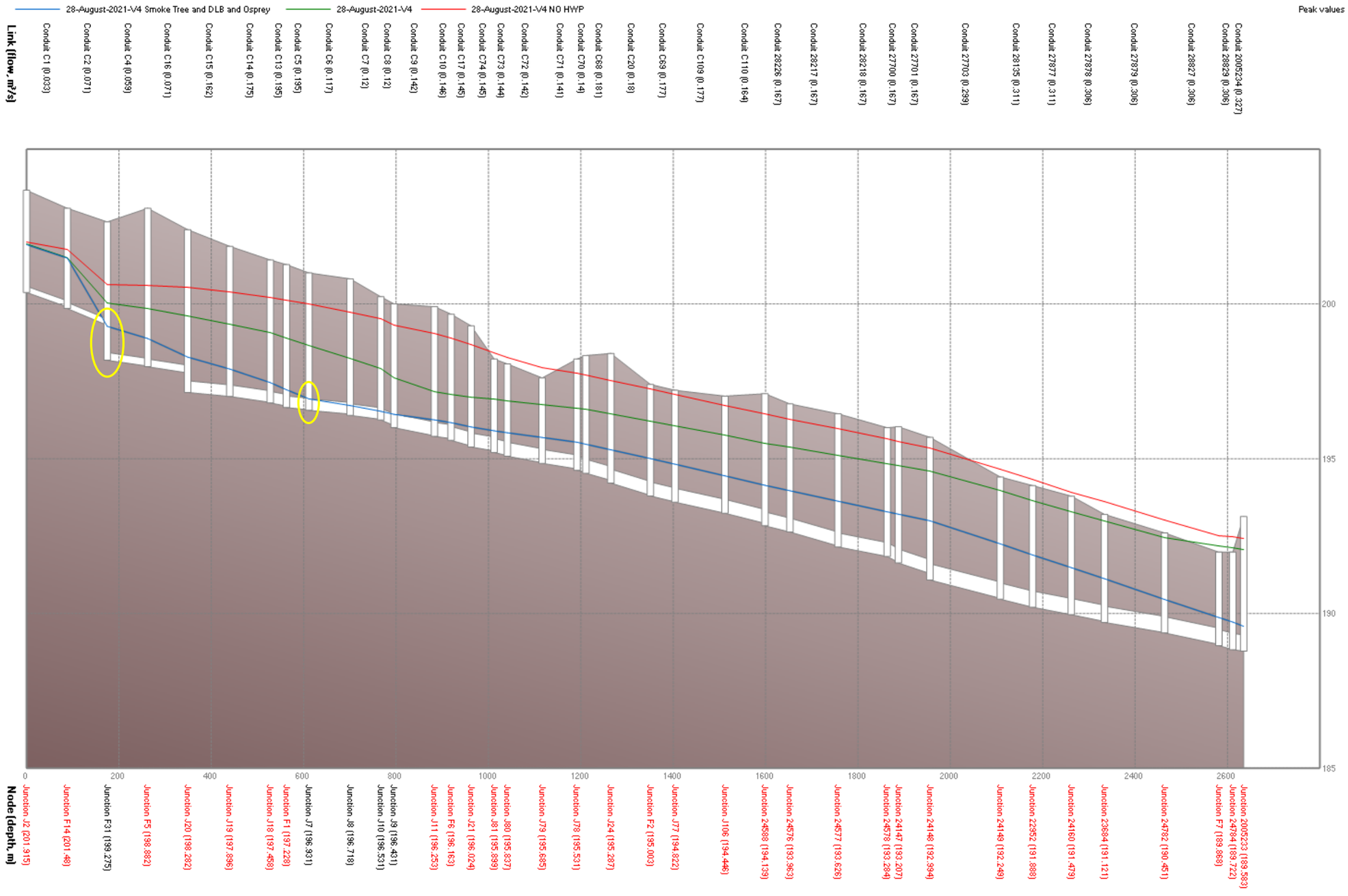



**Figure C3K: HGL Plot along Trunk FDC (Black Walnut Trail to Doug Leavens Boulevard) for August 28, 2021 Storm Event. Diversions shown in yellow.**

FOR WATERCOURSE GRADING DETAILS REFER TO CROSS-SECTIONS ON DWG. 7908-A-80

150m CONCRETE CHANNEL SEE DETAIL ON DWG 7908-A-80

CONSTRUCTION NORTH

SAN VENT PIPE SEE DWG. 7908-A-81

SEE DWG. Nº 7908-A-75

SEE DWG. Nº 7908-A-73

1:5 SLOPE 25 YEAR W.L.

154·9 m ~~154·0m~~ - 750 SAN.

155·1 m ~~154·0m~~ - 525 F.D.C.

5.00m

9.00m

FUT. F.D.C.

FUT. SAN

FUT. STM

MH.11A

R = 300.0m

FUT. STM. INV. 189.01

FUT. CHANNEL - 60m at 1.00%

1:5 SLOPE

120·4m

~~121·0m~~ - 750 SAN

~~121·0m~~ 600 F.D.C

119·7m

MH.12A

120·4m

~~121·0m~~ - 750 SAN

~~121·0m~~ - 600 F.D.C

121·1m

2·90m

3·20m

1:5 SLOPE

1:5 SLOPE

3·30m

1:5 SLOPE

2·90m

WATERCOURSE & TRUNK SEWER BLOCK 60·00m

39.75m

24.00m

46.75m

41.00m

R = 276.0m

22.75m

23.00m

VARIABLE SLOPE

5.50m

10.25m

25 YEAR W.L.

28.50m

1.75m

0.50m

3.75m

12.804m

VARIABLE SLOPE

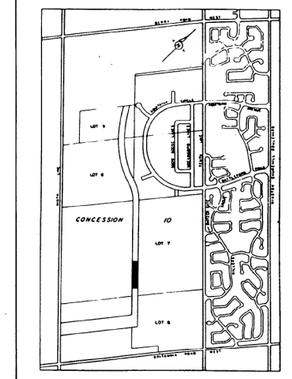
1.00m

## SERVICE DATA

| SERVICE | DATE | INIT | SERVICE | DATE | INIT |
|---|---|---|---|---|---|
| SAN SEWERS | | | GAS MAINS | | |
| STORM SEWERS | | | BELL U/G CABLE | | |
| WATERMAINS | | | HYDRO U/G CABLE | | |

## REVISIONS

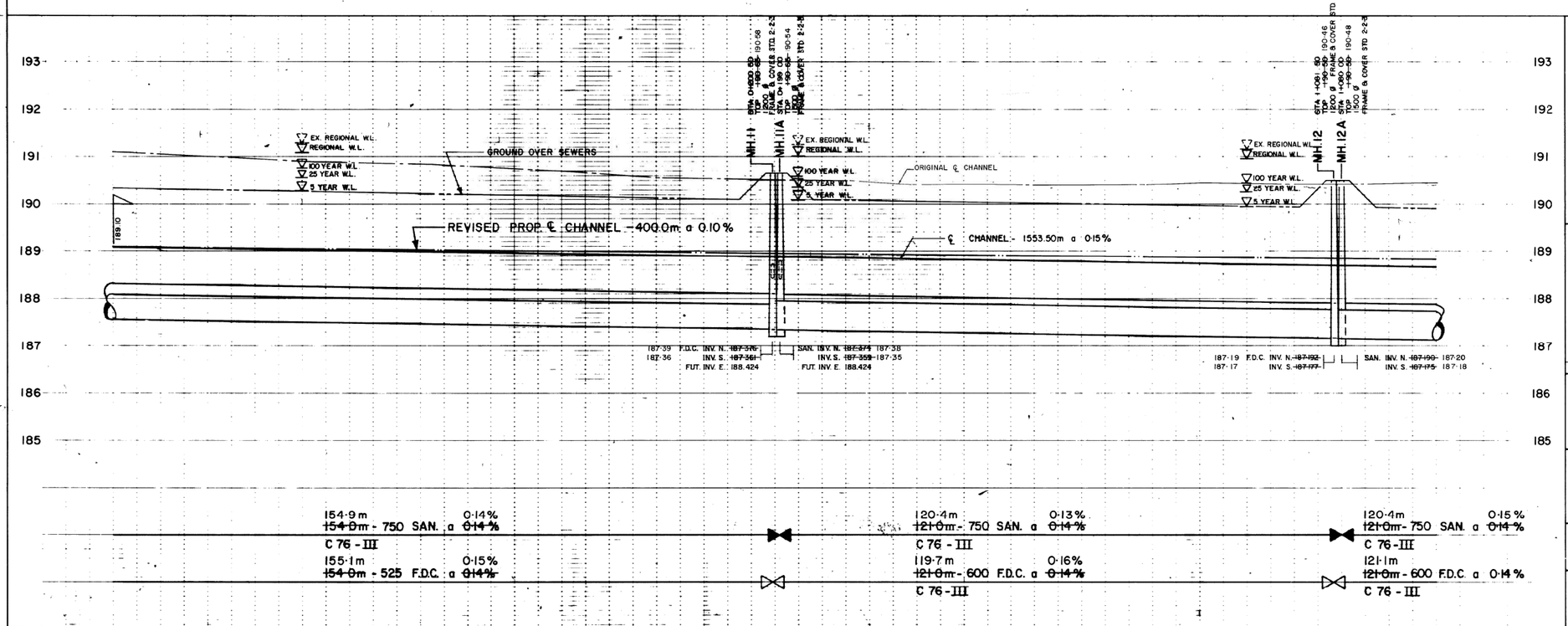
| DATE | DETAILS | INIT |
|---|---|---|
| 87-01-28 | RAISED MANHOLE TOPS & GRADING | M.A.R. |
| 87-03-31 | GENERAL | M.A.R. |
| 87-10-14 | ADDED REVISED PROP. ℄ CHANNEL | M.A.R. |
| 88-08-31 | AS-CONSTRUCTED | C.O.C. |
| 89-11-06 | AS PER CITY COMMENTS | J.A. |




KEY PLAN

NOTE: ALL FUTURE WORKS BY OTHERS

AS-CONSTRUCTED AUGUST /88




## GENERAL NOTES

- ALL DRIVEWAYS ASPHALT UNLESS OTHERWISE NOTED
- ALL SERVICE LOCATIONS ARE APPROXIMATE AND MUST BE LOCATED ACCURATELY IN FIELD
- ● DENOTES BUILDING - NOT LOCATED
- ⊏ DENOTES BUILDING - LOCATED
- TTBM No 639 ELEV 190.653
- TEMP. BENCH MARK ELEV DESCRIPTION
- ▽W.L. WATER LEVEL

REGISTERED PROFESSIONAL ENGINEER R. E. MAURDER PROVINCE OF ONTARIO

DESIGNED BY R.E. Maurder CHKD

APPROVED BY

# LISGAR

paul theil associates limited
consulting engineers
700 Balmoral Drive, Bramalea, Ontario

## CITY OF MISSISSAUGA
ENGINEERING AND WORKS DEPARTMENT

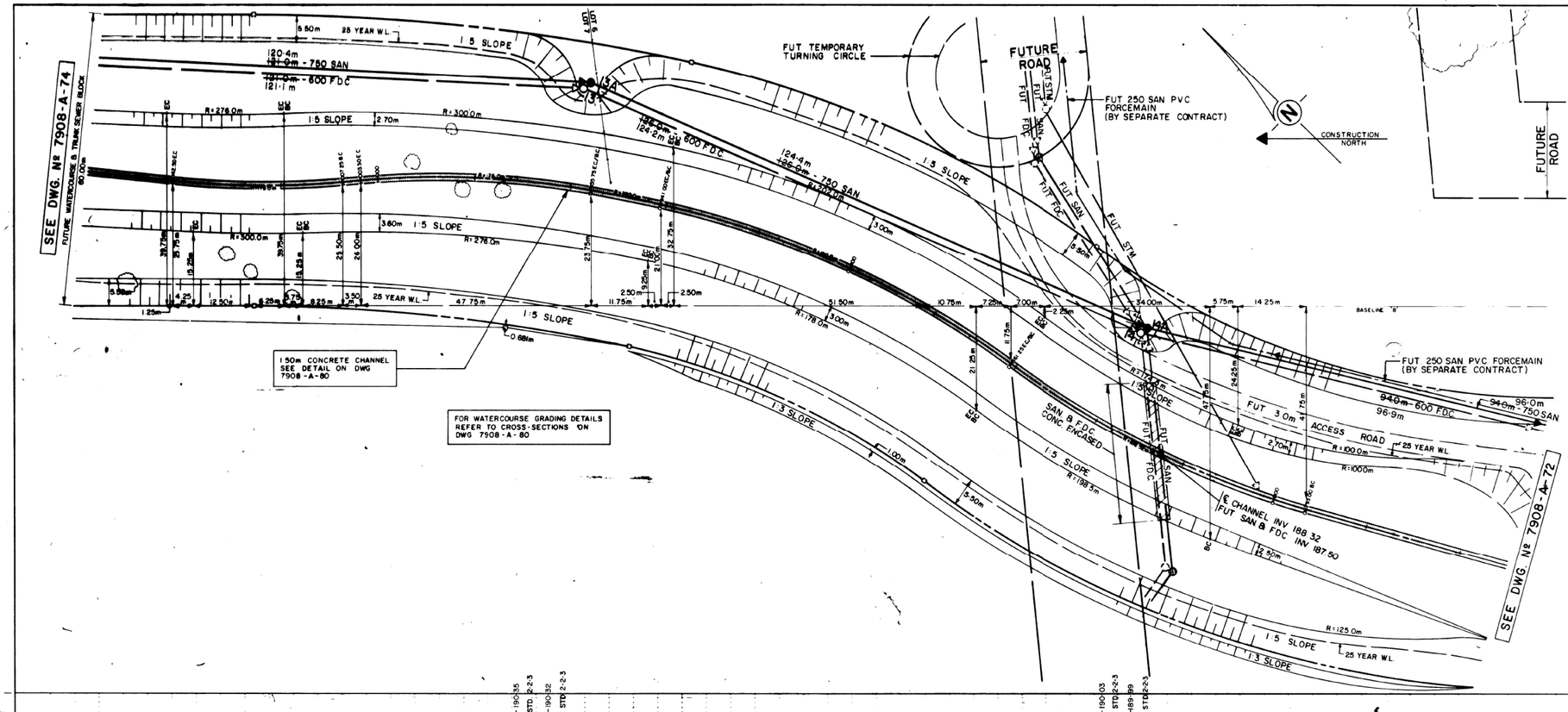
NEIGHBOURHOOD 1

# WATERCOURSE & TRUNK SEWERS

STN. 1+060 TO STN. 1+340

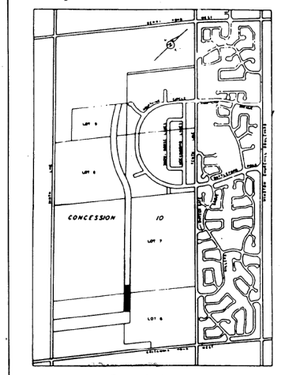
| | | |
|---|---|---|
| SCALE HOR 1:500 VERT 1:50 | AREA | PROJECT No |
| DRAWN BY M. ROSE | CHECKED BY | PLAN No 7908-A-74 |
| DATE 85-10-01 | SHEET OF | C- |

C-23755



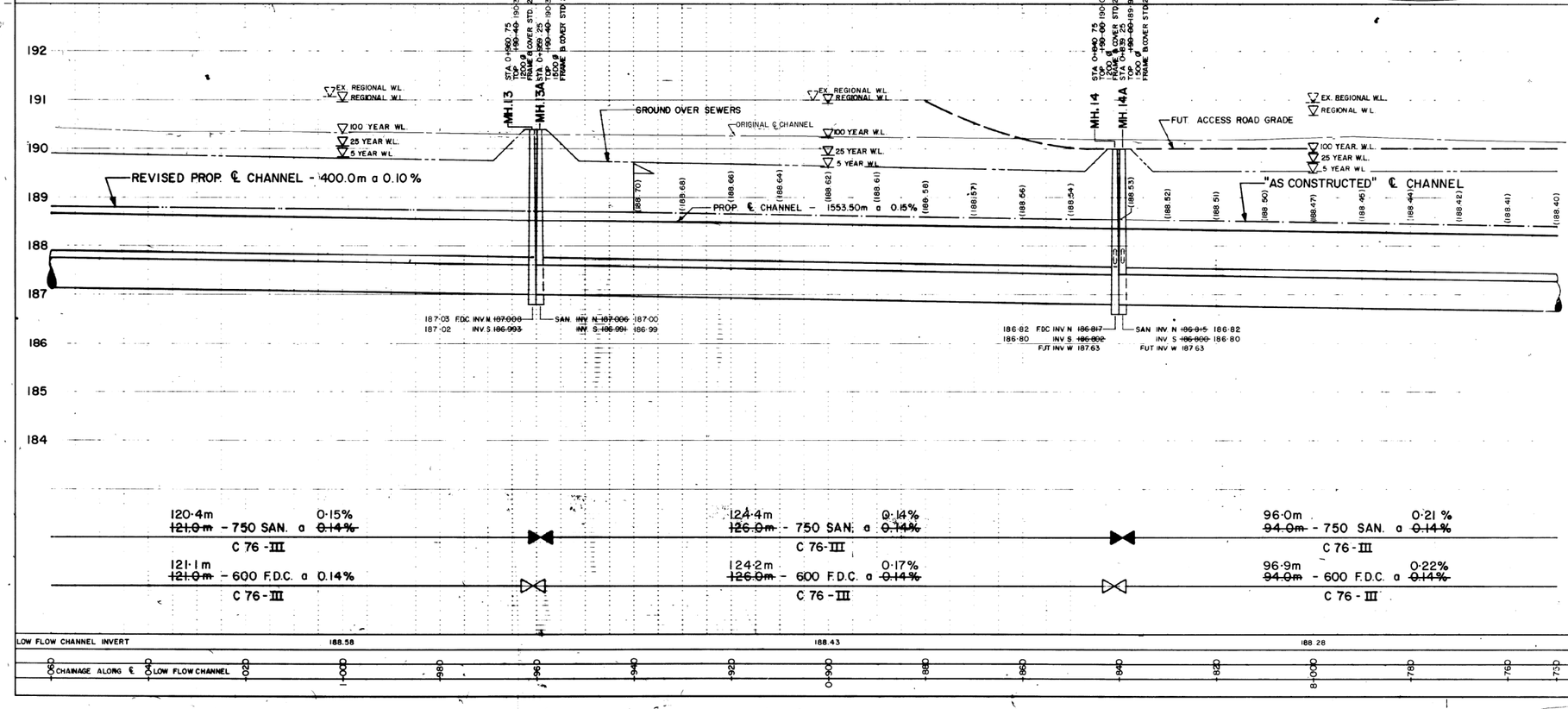

| SERVICE DATA | | | | | |
|---|---|---|---|---|---|
| SERVICE | DATE | INIT | SERVICE | DATE | INIT |
| SAN SEWERS | | | GAS MAINS | | |
| STORM SEWERS | | | BELL U/G CABLE | | |
| WATERMAINS | | | HYDRO U/G CABLE | | |

| REVISIONS | | |
|---|---|---|
| DATE | DETAILS | INIT |
| 87-01-28 | RAISED MANHOLE TOPS & GRADING | M.A.R. |
| 87-03-31 | GENERAL | M.A.R. |
| 87-10-14 | "AS CONSTRUCTED" ℄ CHANNEL | M.A.R. |
| 87-10-14 | ADDED REVISED PROP ℄ CHANNEL | M.A.R. |
| 88-08-31 | AS-CONSTRUCTED | C.O.C. |
| 89-11-06 | AS PER CITY COMMENTS | J.A. |




NOTE : ALL FUTURE WORKS BY OTHERS

AS-CONSTRUCTED AUGUST /88




## GENERAL NOTES

- ALL DRIVEWAYS ASPHALT UNLESS OTHERWISE NOTED
- ALL SERVICE LOCATIONS ARE APPROXIMATE AND MUST BE LOCATED ACCURATELY IN FIELD
- ● DENOTES BUILDING - NOT LOCATED
- ⊏ DENOTES BUILDING - LOCATED
- T.B.M. № 639 ELEV 190.653
- TEMP. BENCH MARK ELEV DESCRIPTION
- ▽WL WATER LEVEL

REGISTERED PROFESSIONAL ENGINEER D. E. MAUNDER PROVINCE OF ONTARIO

DESIGNED BY D.E. Maunder CHKD | APPROVED BY

# LISGAR

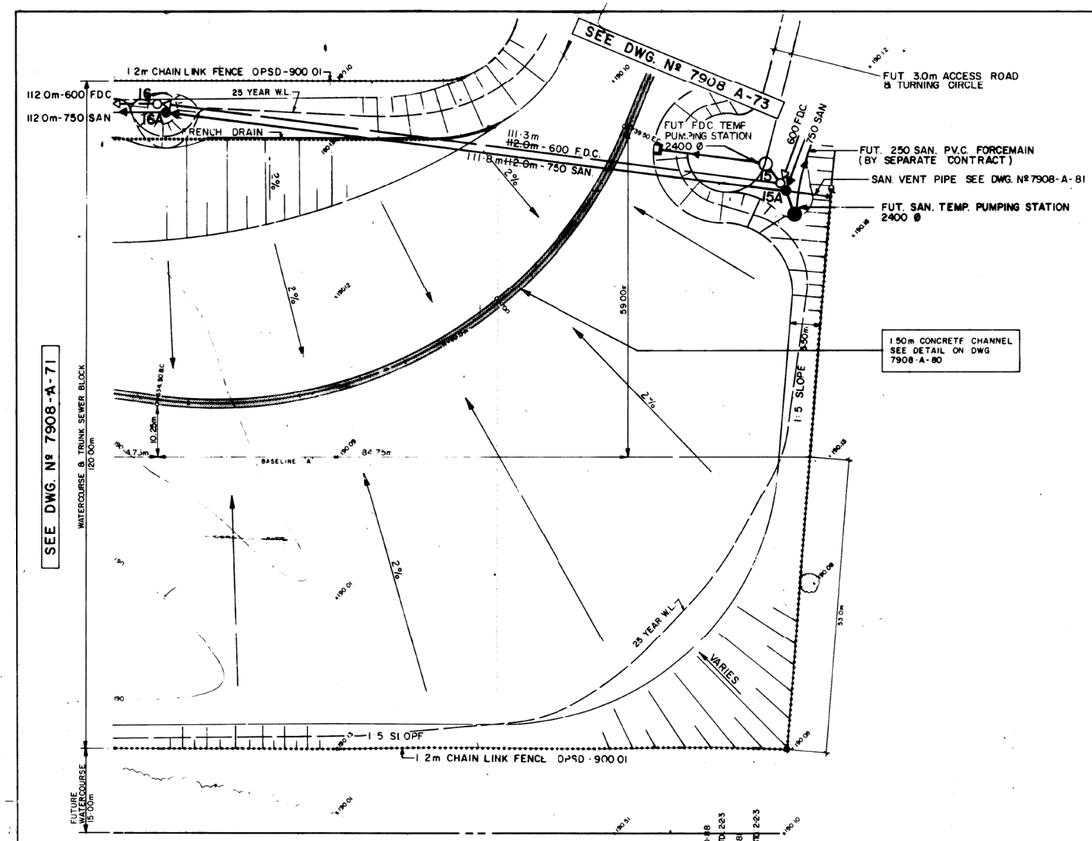
paul theil associates limited
consulting engineers
700 Balmoral Drive, Bramalea, Ontario

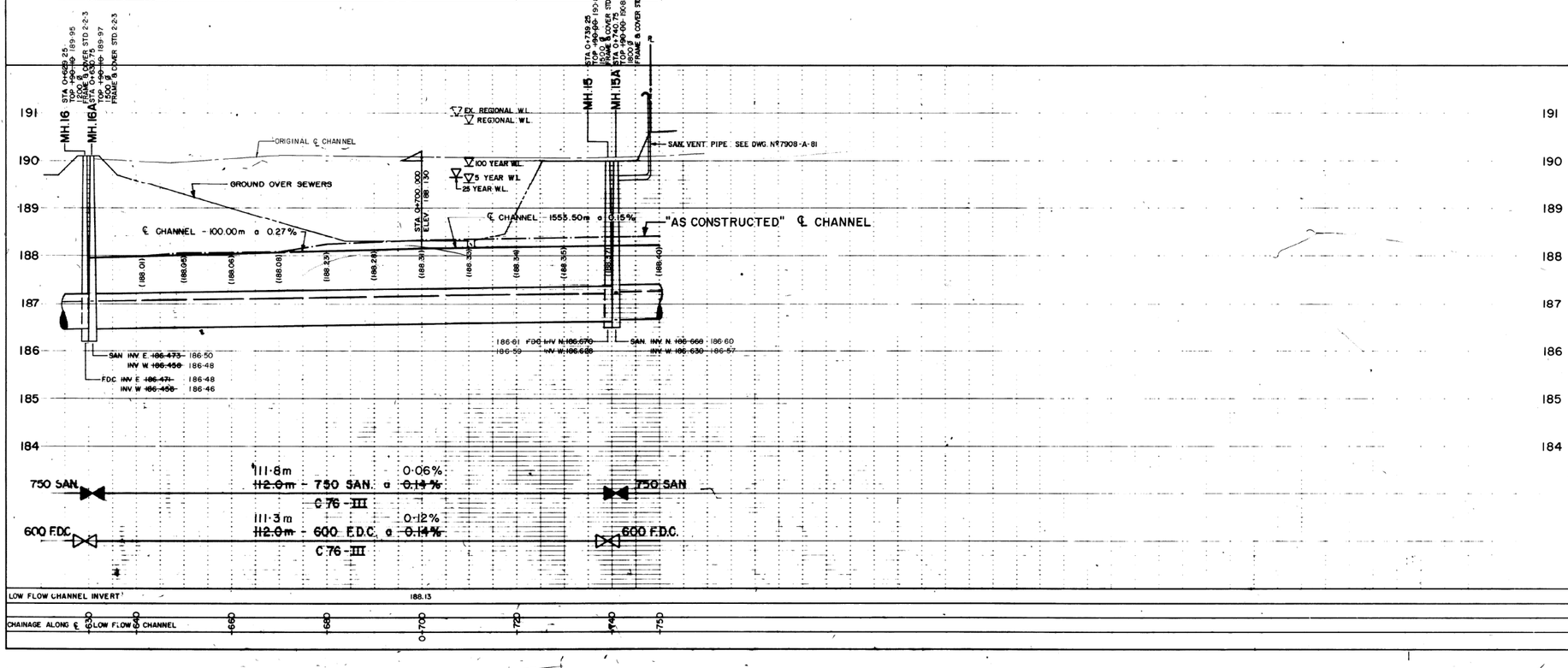
CITY OF MISSISSAUGA
ENGINEERING AND WORKS DEPARTMENT

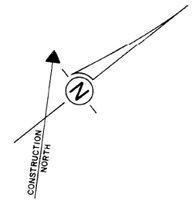
NEIGHBOURHOOD 1
# WATERCOURSE & TRUNK SEWERS
STN. 0+750 TO STN. 1+060

| | | |
|---|---|---|
| SCALE HOR 1:500 VERT 1:50 | AREA | PROJECT No |
| DRAWN BY M. ROSE | CHECKED BY | PLAN No 7908-A-7 |
| DATE 86-09-22 | SHEET OF | C- |

C-23754



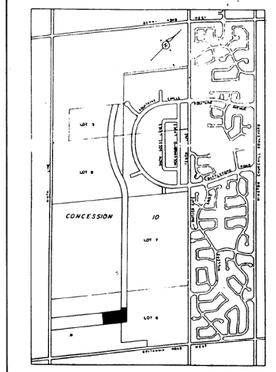




## SERVICE DATA

| SERVICE | DATE | INIT | SERVICE | DATE | INIT |
|---|---|---|---|---|---|
| SAN SEWERS | | | GAS MAINS | | |
| STORM SEWERS | | | BELL U/G CABLE | | |
| WATERMAINS | | | HYDRO U/G CABLE | | |

## REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| 87-01-28 | RELOCATED SAN & F.D.C. SEWERS | M.A.R. |
| 87-03-31 | GENERAL | M.A.R. |
| 87-05-14 | INCREASED MH's 15 & 15A ONE SIZE LARGER | M.A.R. |
| 87-10-14 | AS CONSTRUCTED ℄ CHANNEL | M.A.R. |
| 88-08-31 | AS-CONSTRUCTED | C.O.C. |
| 89-11-06 | AS PER CITY COMMENTS | J.A. |




KEY PLAN

NOTE: ALL FUTURE WORKS BY OTHERS

AS-CONSTRUCTED AUGUST /88

## GENERAL NOTES

- ALL DRIVEWAYS ASPHALT UNLESS OTHERWISE NOTED
- ALL SERVICE LOCATIONS ARE APPROXIMATE AND MUST BE LOCATED ACCURATELY IN FIELD
- ● DENOTES BUILDING - NOT LOCATED
- ⊏ DENOTES BUILDING - LOCATED
- T.T.B.M. No 639 ELEV. 190.653
- TEMP. BENCH MARK ELEV. DESCRIPTION

▽W.L. WATER LEVEL

REGISTERED PROFESSIONAL ENGINEER R. E. MAUNDER PROVINCE OF ONTARIO

DESIGNED BY R.E. Maunder CHKD

APPROVED BY

# LISGAR

paul theil associates limited
consulting engineers
700 Balmoral Drive, Bramalea, Ontario

CITY OF MISSISSAUGA
ENGINEERING AND WORKS DEPARTMENT

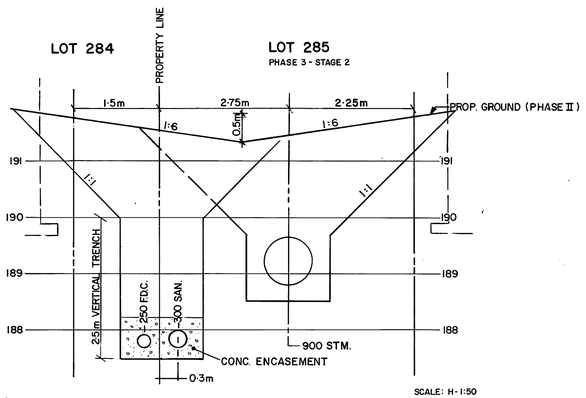
NEIGHBOURHOOD 1

## WATERCOURSE & TRUNK SEWERS

STN. 0+630 TO STN. 0+750

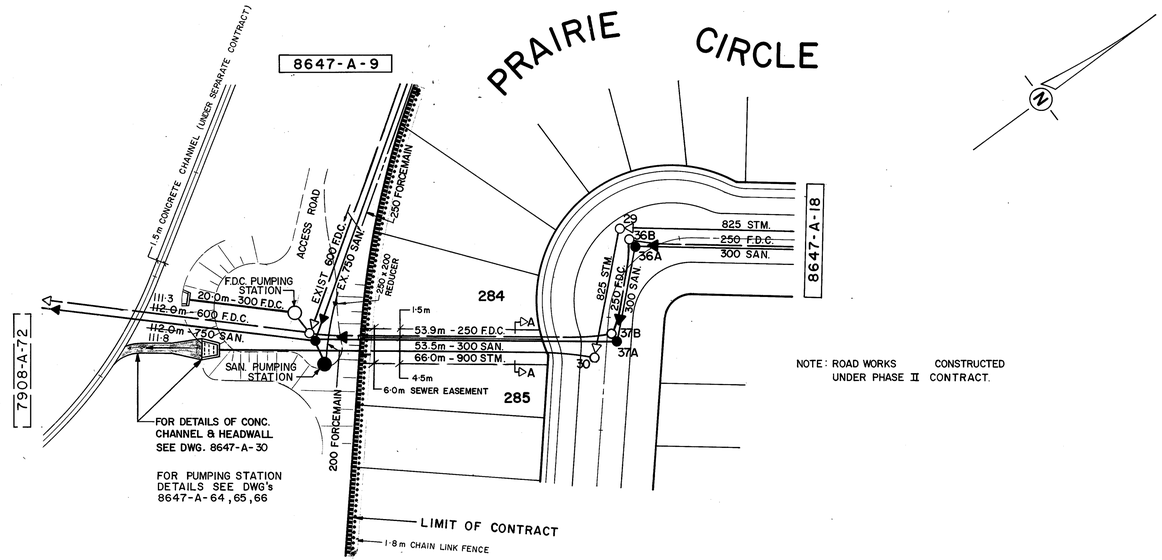
| | | | |
|---|---|---|---|
| SCALE HOR. 1:500 VERT. 1:50 | AREA | | PROJECT No |
| DRAWN BY M. ROSE | CHECKED BY | | PLAN No 7908-A-7 |
| DATE 85-10-01 | SHEET | OF | C- |

C-23753




SCALE: H-1:50
V-1:50

## SECTION A-A
6·0m SEWER EASEMENT




NOTE: ROAD WORKS CONSTRUCTED UNDER PHASE II CONTRACT.

WATERMAIN IN FILL (a to d) SANITARY SEWER (a,b,c)

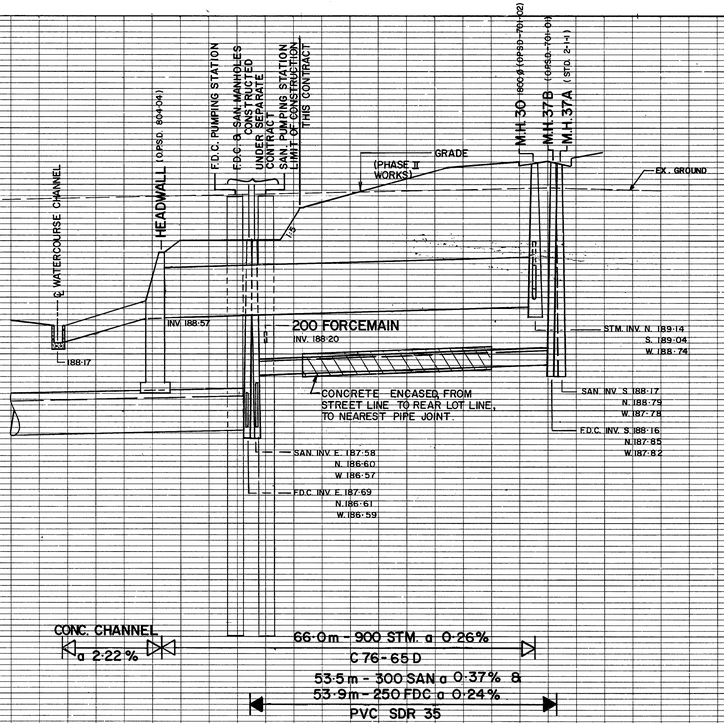
a) Prior to WM. laying, fill to be placed 0.6 m min. above top of WM. grade and 3.0 m min. either side of WM. compacted to min. 100% Standard Proctor density in 0.3 m lifts.

b) No WM. to be laid on fill until fill density reports have been submitted to and approved by the Region.

c) Tests shall be taken along the centre line of the WM. and 1.5 m either side of WM. max. 30 m intervals at each 0.6 m lifts.

d) All tees, hor. bends, hydrants and branch valves in fill areas to be tied with tie rods in addition to conc. blocking.

AS CONSTRUCTED



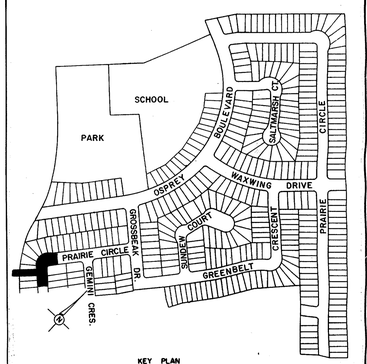

CHAINAGE 0+100 0+080 0+060 0+040 0+020 0+000 0-020 CHAINAGE

## SERVICE DATA

| SERVICE | DATE | INIT. | SERVICE | DATE | INIT. |
|---|---|---|---|---|---|
| SAN. SEWERS | | | GAS MAINS | | |
| STORM SEWERS | | | BELL U/G CABLE | | |
| WATERMAINS | | | HYDRO U/G CABLE | | |

## REVISIONS

| DATE | DETAILS | INIT. |
|---|---|---|
| 91-08-23 | AS CONSTRUCTED STM, SAN & FDC SEWERS | |




KEY PLAN

FOR GENERAL NOTES SEE DRAWING 8647-A-29

## GENERAL NOTES

- ALL DRIVEWAYS ASPHALT UNLESS OTHERWISE NOTED.
- ALL SERVICE LOCATIONS ARE APPROXIMATE AND MUST BE LOCATED ACCURATELY IN FIELD.
- ● DENOTES BUILDING - NOT LOCATED.
- ⊏ DENOTES BUILDING - LOCATED.
- T.T.B.M. No. 637 ELEV. 204·737 (671·71 ft)
- TEMP BENCH MARK ELEV. DESCRIPTION.

T-86048A

REGISTERED PROFESSIONAL ENGINEER P. A. EHLER PROVINCE OF ONTARIO

DESIGNED BY CHKD. APPROVED BY

# TRELAWNY

paul theil associates limited
consulting engineers
21 Coventry Road, Brampton, Ontario L6T 4V7

CITY OF MISSISSAUGA
ENGINEERING AND WORKS DEPARTMENT

## SEWER EASEMENT
PRAIRIE CIRCLE TO WATERCOURSE
STN. 0+020 TO STN. 0+100

| | | |
|---|---|---|
| SCALE HOR. 1:500 VERT. 1:50 | AREA | PROJECT No. |
| DRAWN BY | CHECKED BY | PLAN No. 8647-A-19 |
| DATE | SHEET OF | C-23787 |

C-23787

BRITANNIA WOODS SUBDIVISION - 996075 ONTARIO INC. (21T-89016M) R.P. 43M-1272

BRITANNIA WOODS SUBDIVISION
996075 ONTARIO INC. (21T-89016M)
R.P. 43M-1272

* DENOTES EQUIVALENT POPULATION.

NOTE: RE: OSPREY BOULEVARD RE-CONSTRUCTION

EXISTING DRIVEWAYS & BOULEVARDS FOR LOTS 1, 2, 3, 4, 5, 345 & 346, OSPREY BLVD. WHICH ARE DISTURBED DURING CONSTRUCTION REINSTATED TO ORIGINAL CONDITION OR BETTER AS FOLLOWS:
DRIVEWAYS: 25mm H.L.3A ASPHALT
50mm H.L.8 ASPHALT
150mm GRANULAR 'A' OR 19mm C.R.L.
BOULEVARDS: No.1 NURSERY SOD ON 100mm TOPSOIL (Min.)

NOTES: RE ROOF LEADERS

1. NO CONNECTIONS OF THE ROOF LEADERS WILL BE PERMITTED TO THE STORM SEWER OR F.D.C. SYSTEM FOR LOTS 1 TO 219 AND BLOCKS 220 TO 223 ALL INCLUSIVE. ROOF LEADERS WILL DISCHARGE ONTO TO THE LOTS WITH THE USE OF CONCRETE SPLASH PADS AND SIDE LOT SWALES. THE ROOF LEADERS ARE NOT PERMITTED TO DISCHARGE ONTO DRIVEWAYS OR WALKWAYS.
2. FOR LOTS 184 TO 215 INCLUSIVE, ROOF LEADERS WILL DISCHARGE ONTO THE LOTS WITH THE USE OF CONCRETE SPLASH PADS AND SIDE LOT SWALES TO THE FRONT OF THE LOTS, WITH NO DISCHARGE PERMITTED TO THE REAR YARD.

LEGEND

- DENOTES SANITARY MANHOLE
- DENOTES FDC MANHOLE
- DENOTES DOUBLE SERVICE CONNECTION
- DENOTES SINGLE SERVICE CONNECTION
- 0.78 / 16 70 — DENOTES DRAINAGE AREA IN HECTARES; DENOTES POPULATION DENSITY PERSONS PER HECTARE; DENOTES NUMBER OF UNITS
- 0.66 / 13 70 — DENOTES EXISTING DRAINAGE AREA IN HECTARES; DENOTES POPULATION DENSITY PERSONS PER HECTARE; DENOTES EXISTING NUMBER OF UNITS
- 13.07 / 70 552 — DENOTES EXTERNAL DRAINAGE AREA IN HECTARE; DENOTES NUMBER OF UNITS; DENOTES POPULATION DENSITY PERSONS PER HECTARE

KEY PLAN N.T.S.

NOTE:
ALL ELEVATIONS SHOWN ON THIS DRAWING ARE NOT GEODETIC AND ARE BASED ON CITY OF MISSISSAUGA DATUM. TO OBTAIN GEODETIC ELEVATIONS USE THE FOLLOWING RELATIONSHIP;
MISSISSAUGA DATUM = GEODETIC DATUM + 0.121m.

BENCH MARK:
CITY OF MISSISSAUGA BENCH MARK
REFERENCE No. 944 ELEVATION 190.933m

| FIRST | INTERIM | SECOND | PRE-SER | FINAL |
|---|---|---|---|---|
| DATE AUG. 23, 2000 | DATE | DATE OCT. 31, 2000 | DATE JAN. 03, 2001 | DATE FEB. 19, 2001 |

DESIGNED BY CHKD.

REGISTERED PROFESSIONAL ENGINEER 01 12 05 E.W.C. GODDARD PROVINCE OF ONTARIO

APPROVED BY

RAND ENGINEERING CORPORATION
5285 SOLAR DRIVE
MISSISSAUGA, ONTARIO
L4W 5B8
TEL. (905) 625-9500

AVONLEA ON THE POND
MATTAMY (AVONLEA) LIMITED

MISSISSAUGA Transportation And Works Department

# SANITARY & F.D.C. DRAINAGE PLAN

21T-95034/21T-95035

| | | |
|---|---|---|
| SCALE: 1:1000 | AREA: | PROJECT No. 00537 |
| DRAWN BY: ACAD | CHECKED BY: G.H. | PLAN No. 5 |
| DATE: JULY, 2000 | SHEET OF | C-42673 |

AS CONSTRUCTED
MAY 2003

# Appendix G
# Consultation Summary

# Appendix G1
# Notice of Study Commencement

MISSISSAUGA

mississauga.ca
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## CITY OF MISSISSAUGA – NOTICE OF STUDY COMMENCEMENT

Municipal Class Environmental Assessment
Lisgar District Pumping Stations

### WHAT?

- The City of Mississauga is undertaking a Schedule B Class Environmental Assessment (Class EA) to determine the number, preferred location(s) and type(s) of pumping stations within the Lisgar District to reduce the potential for basement water infiltration.

### WHY?

- Beginning in 2008, a number of homes in the Lisgar District experienced water seeping into their basements following certain rainfall events.
- In response, the City undertook a number of actions, including the initiation of the Lisgar District Basement Water Infiltration Investigation, which recommended a set of preferred actions to be strategically undertaken to address the potential for basement water infiltration.
- Following the recommendations of the October 2017 Updated Action Plan, which identified pumping stations as a higher priority mitigation measure, the City started construction of the first utility trench dewatering and foundation drain collector (FDC) pumping station in 2020 at the Cactus Gate Parkette.
- This Municipal Class EA has been undertaken to determine the long-term plan for the City with respect to reducing basement water infiltration in the overall Lisgar District. The Class EA will evaluate the number of future required pumping stations (if any), recommended locations, and relative prioritization.

### HOW?

- The Study will be completed as a Schedule B undertaking following the Municipal Class Environmental Assessment process.
- Multiple locations for FDC Pumping Stations will be considered by the Project Team to develop a long-list of alternatives. These alternatives will be evaluated against various criteria, including technical assessments, and refined through stakeholder and public consultation. The Project Team will then finalize the list of proposed permanent pumping station locations, as well as an overall prioritization of these works and develop the preliminary design for the highest priority pumping station location.
- At the end of the study, a Project File documenting the entire study process will be available for public review.

### GET INVOLVED!

- Consultation is an important part of the Class EA process. Public input and comment are invited for incorporation into the planning and design of this project.
- A Public Information Centre (PIC) will be held to present the study findings and the proposed Pumping Station locations and to answer any questions you may have. Details regarding the PIC will be advertised publicly as the study progresses.
- If you have any questions or comments regarding the study, wish to provide input on the proposed solutions, or wish to be added or removed from the study mailing list, please contact:

**Elizabeth Dollimore, P.Eng. MBA.**
*Project Manager*
City of Mississauga
(905) 615-3200, ext. 5303
elizabeth.dollimore@mississauga.ca

**Matt Senior, MASc. P.Eng.**
*Consultant Project Manager*
Wood Environment & Infrastructure Solutions
(905) 335-2353, ext. 3080
matt.senior@woodplc.com

**COVID-19 Community Engagement Update:** While we continue to respond to this pandemic, we are working hard to deliver essential services and projects to keep our City moving and safe. While we can't connect in person at this time, we still want to connect! Opportunities to connect with the Study Team and share your input are noted above.

This notice was first issued on April 29, 2021

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DURHAMCOLLEGE.CA/DEGREES

# Appendix G2
# Public Information
# Centre #1 Notice

# CITY OF MISSISSAUGA – NOTICE OF PUBLIC INFORMATION CENTRE AND TOWN HALL

Municipal Class Environmental Assessment
Lisgar District Pumping Stations

## WHAT?

- The City of Mississauga is undertaking a Schedule B Municipal Class Environmental Assessment (EA) to determine the number, preferred location(s) and type(s) of pumping stations within the Lisgar District to reduce the potential for basement water infiltration

## WHY?

- Beginning in 2008, a number of homes in the Lisgar District experienced water seeping into their basements following certain rainfall events
- In response, the City has strategically undertaken a number of actions to address the potential for basement water infiltration, including this EA

## HOW?

- Multiple locations for FDC Pumping Stations have been considered by the Project Team to develop a long-list of alternatives. These alternatives have been evaluated against various criteria, including technical assessments, and will be refined through stakeholder and public consultation. A short-list of priority permanent pumping station locations will be developed for design and construction.
- At the end of the study, a Project File documenting the entire study process will be available for public review.

## TOWN HALL

In addition to the EA, the City of Mississauga continues to undertake a number of actions to address the potential for basement water infiltration. The City would also like to provide an update on these actions.

## GET INVOLVED!

- A Public Information Centre (PIC) is being held to present the study findings and the proposed Pumping Station locations and to answer any questions. Public input and comment are invited for incorporation into the planning and design of this project
- A Town Hall is also being held to provide an update on other actions that the City is undertaking to address the potential for basement water infiltration
- The PIC and Town Hall will be held virtually. For more information and to register for the Virtual PIC and Town Hall, please visit

**http://www.mississauga.ca/lisgarpumpingstationstudy**

**Date: November 17, 2021**
**Time: 7:00 p.m. to 8:30 p.m.**

- If you have any questions or comments regarding the study, wish to provide input on the proposed solutions, or wish to be added or removed from the study mailing list, please contact:

**Elizabeth Dollimore, P.Eng. MBA.**
*Project Manager*
City of Mississauga
(905) 615-3200, ext. 5303
elizabeth.dollimore@mississauga.ca

**Matt Senior, MASc. P.Eng.**
*Consultant Project Manager*
Wood Environment & Infrastructure Solutions
(905) 335-2353, ext. 3080
matt.senior@woodplc.com

**COVID-19 Community Engagement Update:** While we continue to respond to this pandemic, we are working hard to deliver essential services and projects to keep our City moving and safe. While we can't connect in person at this time, we still want to connect! Opportunities to connect with the Study Team and share your input are noted above.

This notice was first issued on November 5, 2021

# Appendix G3
# Public Information
# Centre #1
# Presentation

# Welcome

Welcome to the Public Information Centre for:

## Lisgar District Pumping Station
## Class Environmental Assessment (EA)
## and Town Hall Update Session

Information presented this evening will be available on the City of Mississauga's website:

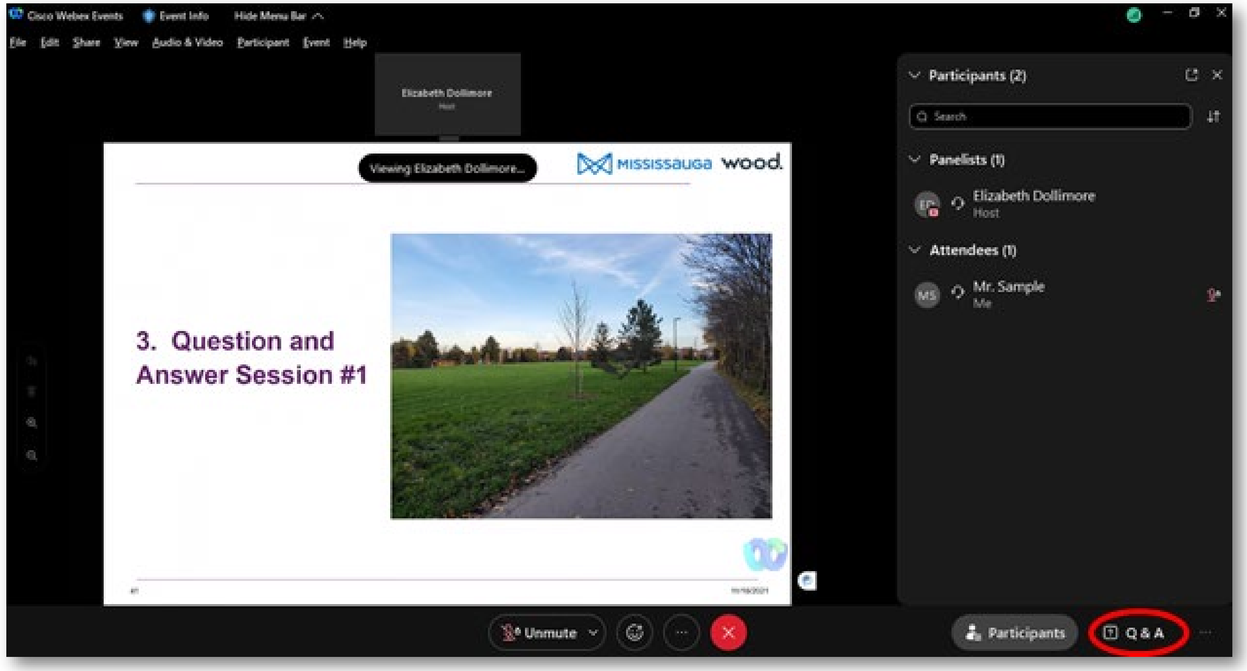
# Meeting Agenda

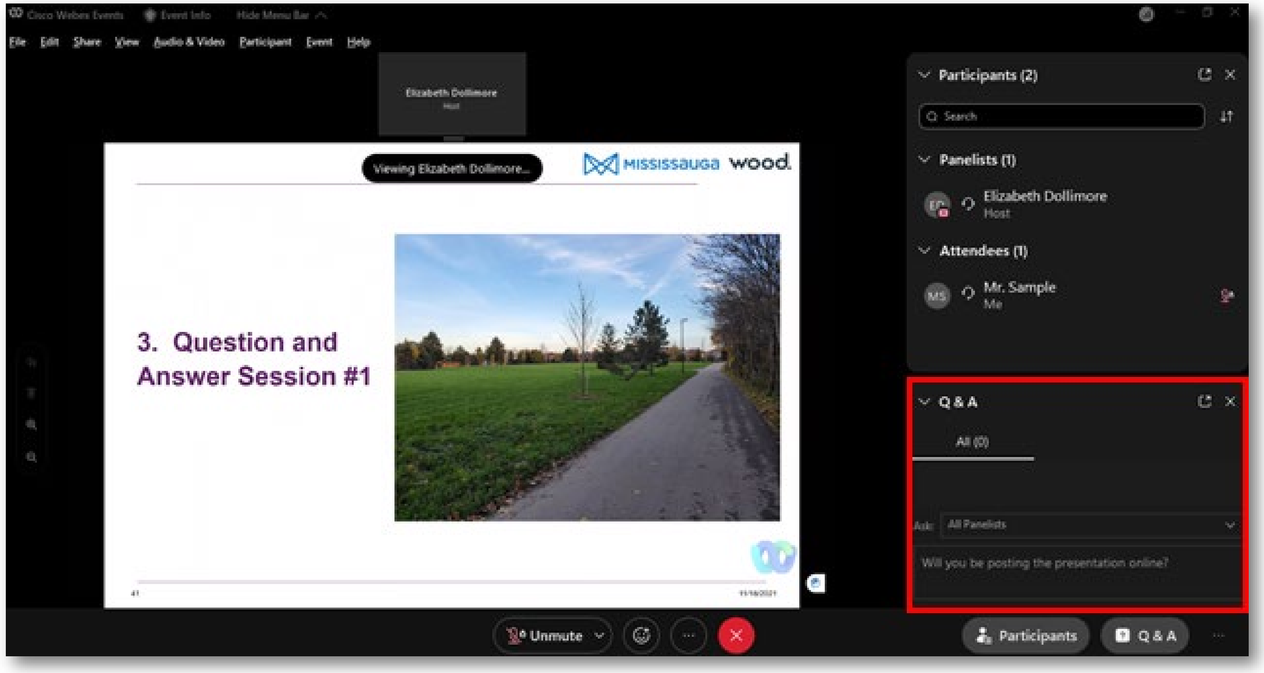
1. **Welcome and Introductions**
2. **Background and Update on Cactus Gate Pumping Station and Monitoring Program**
3. **Lisgar District Pumping Station Class EA**
4. **Question and Answer Session #1**
5. **High Water Protocol Overview**
6. **Additional Updates**
7. **Question and Answer Session #2**

# 1. Welcome and Introductions

# Meeting Format

- Two Q&A sessions
- Attendees can ask questions in the Q&A function shown below
- Staff will read and answer questions aloud
- Wrap-up at 8:30pm
- Follow-up questions / comments can be emailed to
  elizabeth.dollimore@mississauga.ca



# 2. Background and Update on Cactus Gate Pumping Station and Monitoring Program

# Recap and History of Problem

## Timeline:

### Beginning in 2008

- Several homes experienced basement water infiltration

### October 2011

- Wood completed an engineering study to identify possible causes and develop Prioritized Action Plan

### March 2015

- Prioritized Action Plan presented to public and approved by Council
- Select projects constructed and monitored to inform next prioritized actions

### October 2017

- Community update meeting held
- Updated Prioritized Action Plan approved by Council
- Includes direction to consider permanent pumping stations

# Recap and History of Problem

## Timeline:

### September 2018

- Class EA completed for Black Walnut Trail area pumping station system
- Preferred solution (highest priority) is a pumping station at the Cactus Gate Parkette

### December 2019

- Construction began on the Cactus Gate pumping station

### March 2021

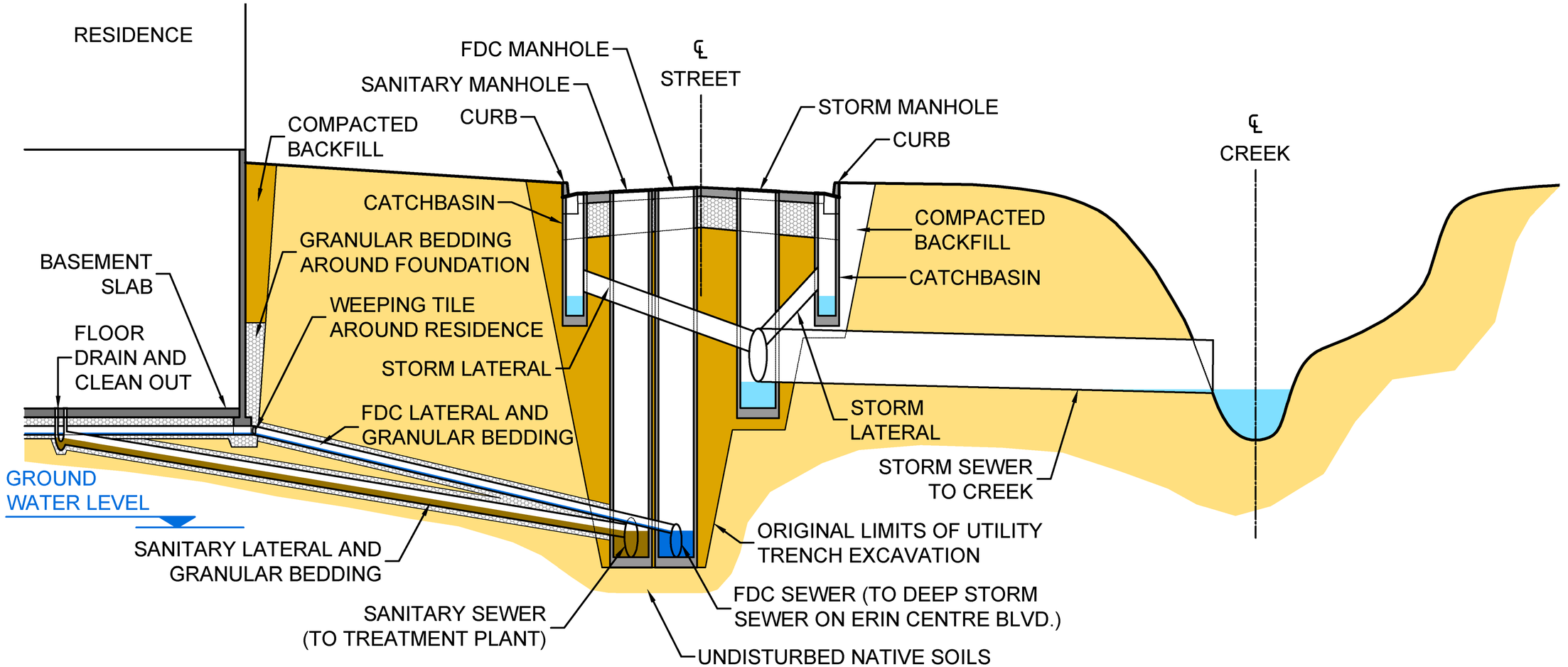
- Cactus Gate pumping station became operational

### April 2021

- Current study (Class EA) begins
- Study is intended to review entirety of the Lisgar District
- Will determine number of required pumping stations and priority sequence for implementation

# Overview of Foundation Drainage System

## *3-Pipe System - Foundation Drain Collector (FDC)*



# Past Study/ Investigations

**Initial Broad Study to Identify Causes of Basement Water Infiltration including:**

## Monitoring Work:

- Groundwater
- FDC and Storm Sewer System
- Creek Tributary and Stormwater Management Pond

## Testing:

- Water Quality
- Storm Sewer Leakage Testing
- Storm Sewer Outfall Collar Testing
- Smoke Testing

## City-led Mitigation:

- Inspection
- Cleaning
- Sealing
- High Water Protocol
- Sump Pump Subsidy

**Investigations led to the implementation of priority mitigation measures over a period of time**

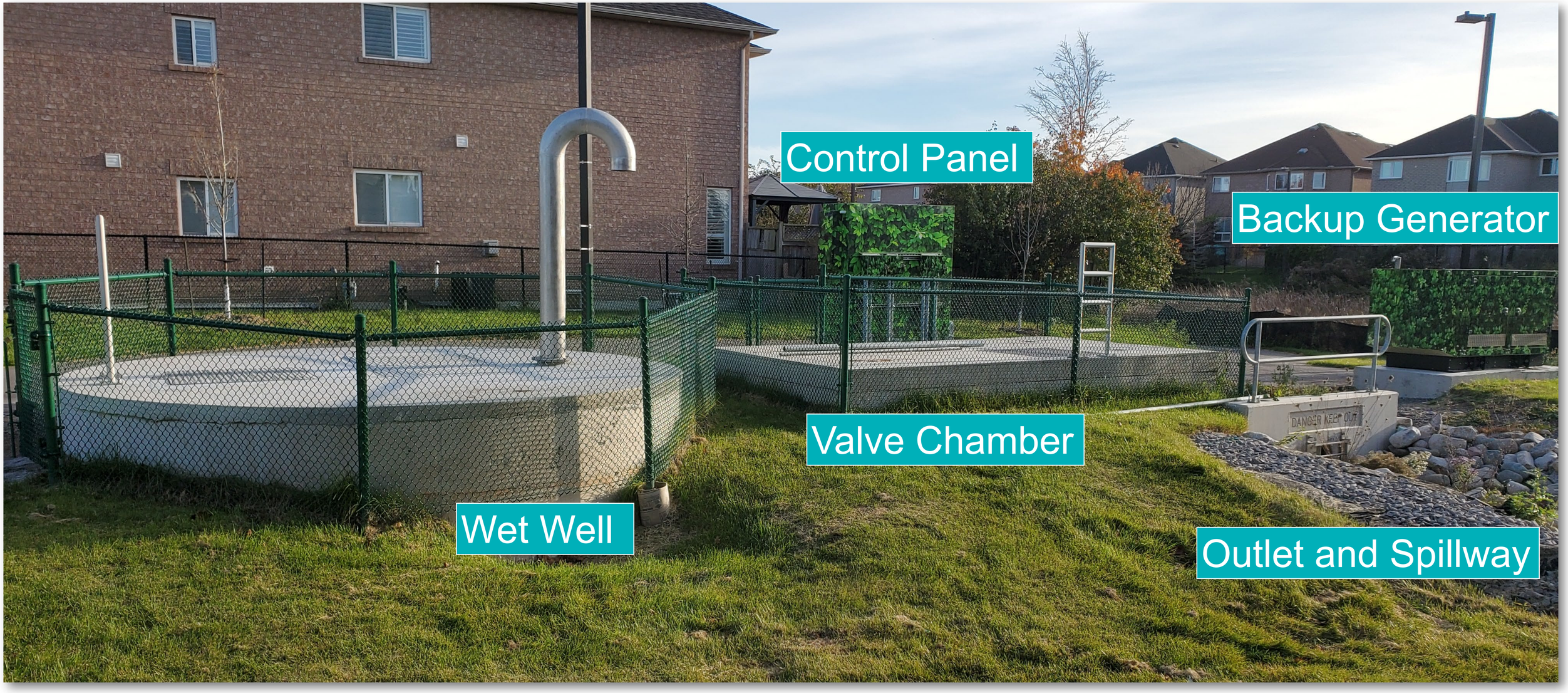
# Primary Cause

## Excess Stormwater into the Utility Trench

- Leakage from the storm sewer system combined with slow draining soils results in water build-up
- If the build-up of water is significant, it travels up the bedding material around the Foundation Drain Collector (FDC) system into the foundation weeping tiles of homes, which can overload the system
- Other conditions that can also contribute to basement water infiltration include:
  - Preceding rainfall followed by a large storm event
  - Local lot drainage
  - Private connections (downspouts, sanitary, etc.)

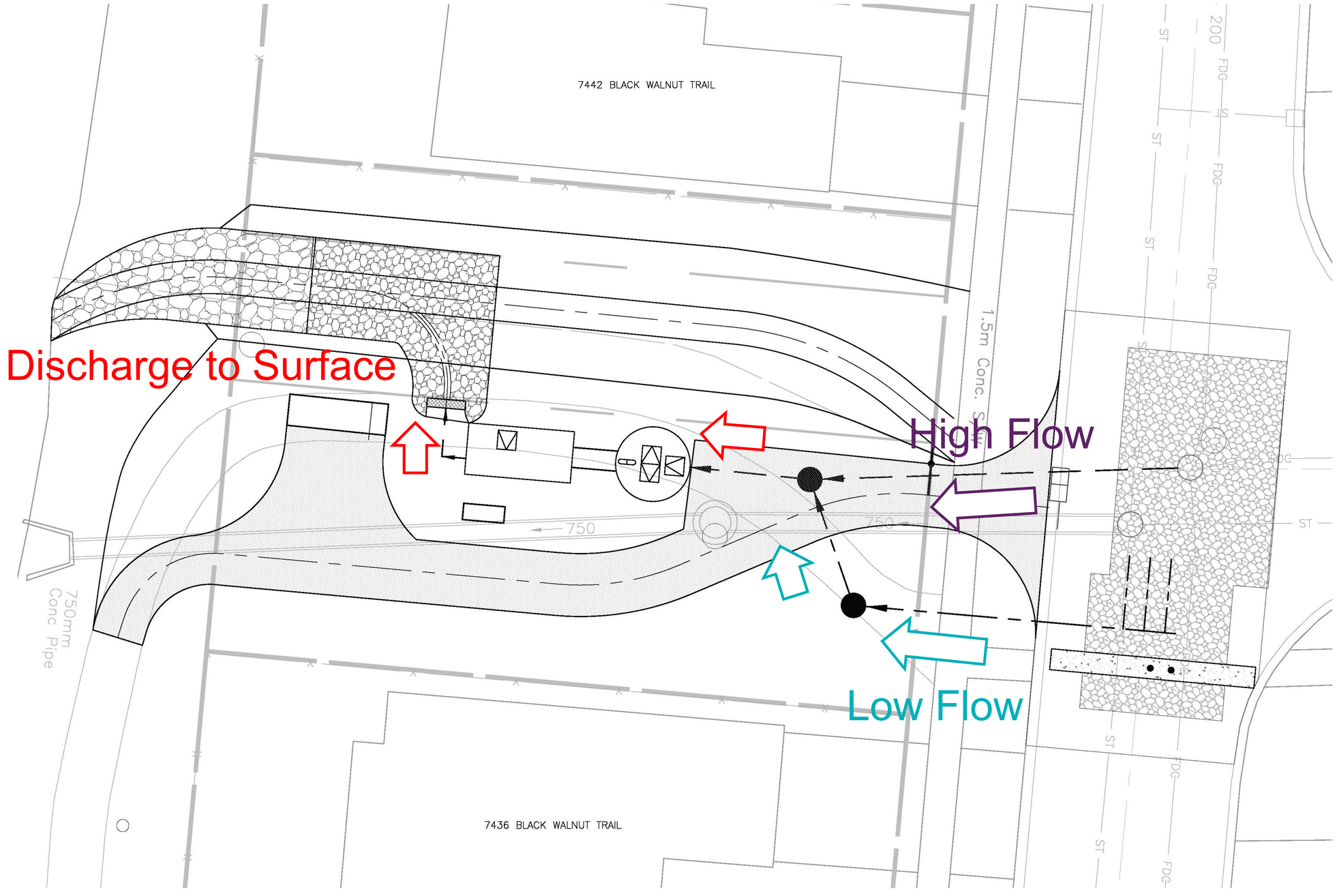
# Cactus Gate Pumping Station

## How does the pumping station work?



# Cactus Gate Pumping Station

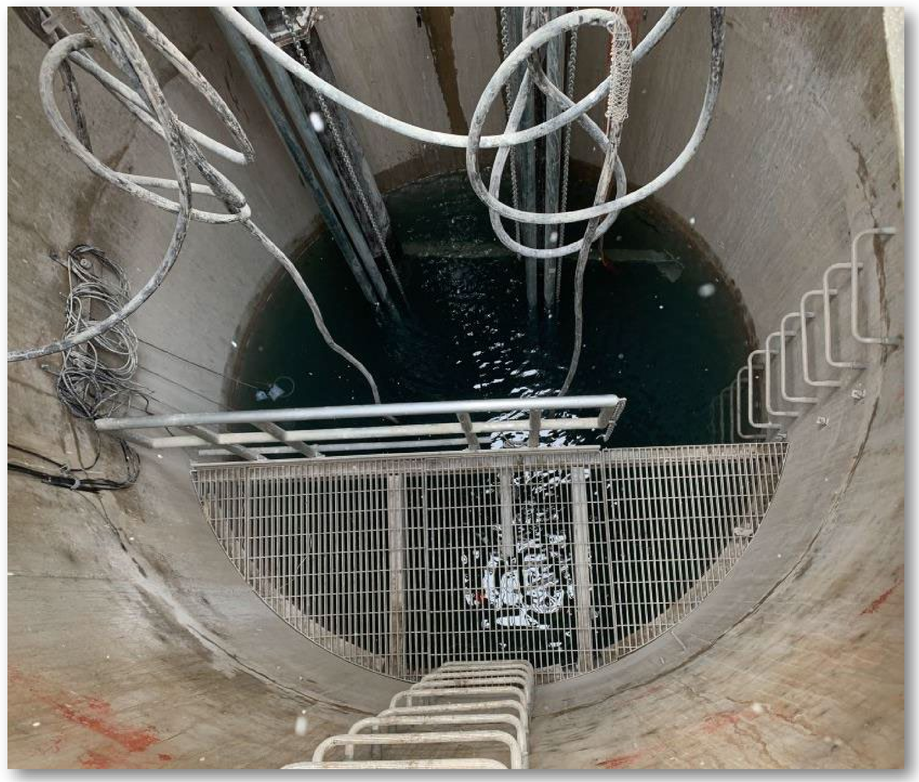
## How does the pumping station work?



# Cactus Gate Pumping Station

## How does the pumping station work?

- 2 pumps – 1 duty and 1 standby (backup) pump
- Duty pump triggered automatically by set water level in wet well
- Standby pump will also turn on if first pump does not reduce water levels
- Pump shuts off automatically once wet well is drawn down
- Pumps are not triggered again until water is high enough (cycles)



# Cactus Gate Pumping Station

## Status of the Pumping Station

- Pumping station became active in March 2021 and has been continuously active since
- Station includes both a low flow and high flow system
- Each pump has a 70 L/s capacity, approximately 120 L/s with both operational
- An alarm system is in place which issues alerts in the event of any operations issues
- A backup generator will power the pumping station in the event of a power failure
- A contractor (OCWA) is responsible for Operations & Maintenance as of mid-2021

# Cactus Gate Pumping Station

## Monitoring of the Pumping Station

- Daily pumping volumes are measured (flow meter in valve chamber) and logged by the station (control panel)
- Additional temporary water level gauges have been installed around the pumping station to assess how the system responds to storm events
- Ongoing monitoring of previously installed gauges:
  - FDC Sewer System
  - Storm Sewer System
  - Watercourse (Creek) System
  - Groundwater and Utility Trench System

# Cactus Gate Pumping Station

## Dry Weather Period

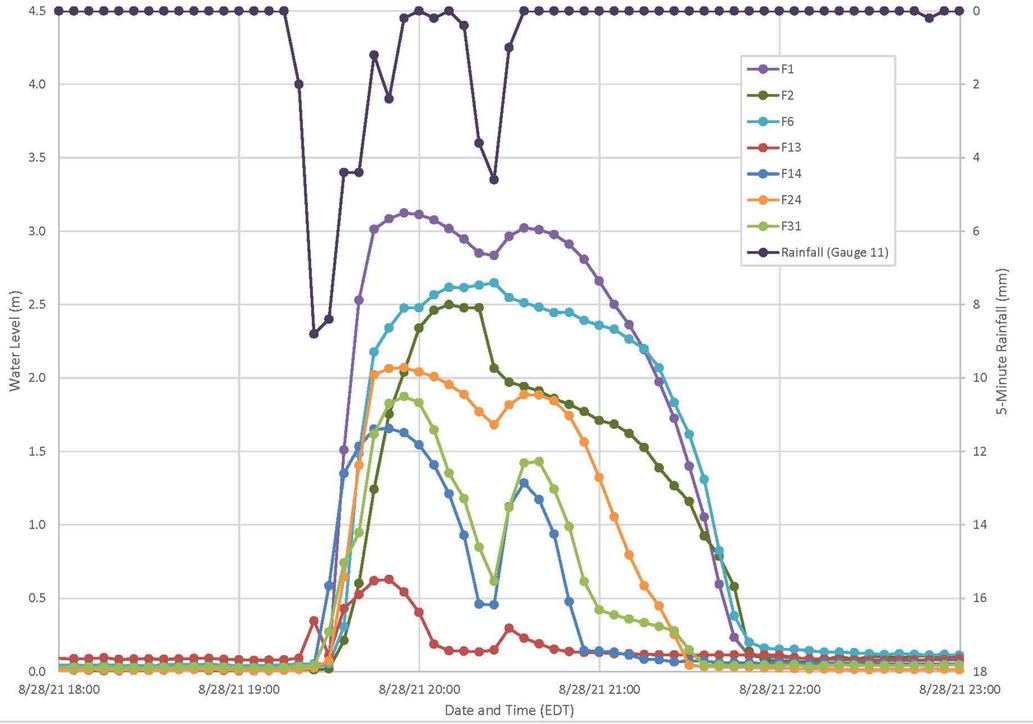
- Pumping station operates automatically every day dewatering the utility trench (low flow system)
- Between 100,000 and 250,000 L every day based on the flow gauge
- A general decrease in water levels within the utility trench has been observed in the vicinity of the pumping station

# Cactus Gate Pumping Station

## Wet Weather Period

- Several major rainfall events have occurred since March 2021
- August 28, 2021 storm event resulted in five incidents of reported basement water infiltration
- Storm was the most intense local rainfall on record (past 10 years +\-)
- Storm was more intense than the July 14, 2017 storm event and resulted in fewer reported incidents than that event (24)
- Based on the data the Cactus Gate Pumping station helped mitigate impacts of storm, in conjunction with High Water Protocol temporary pumping

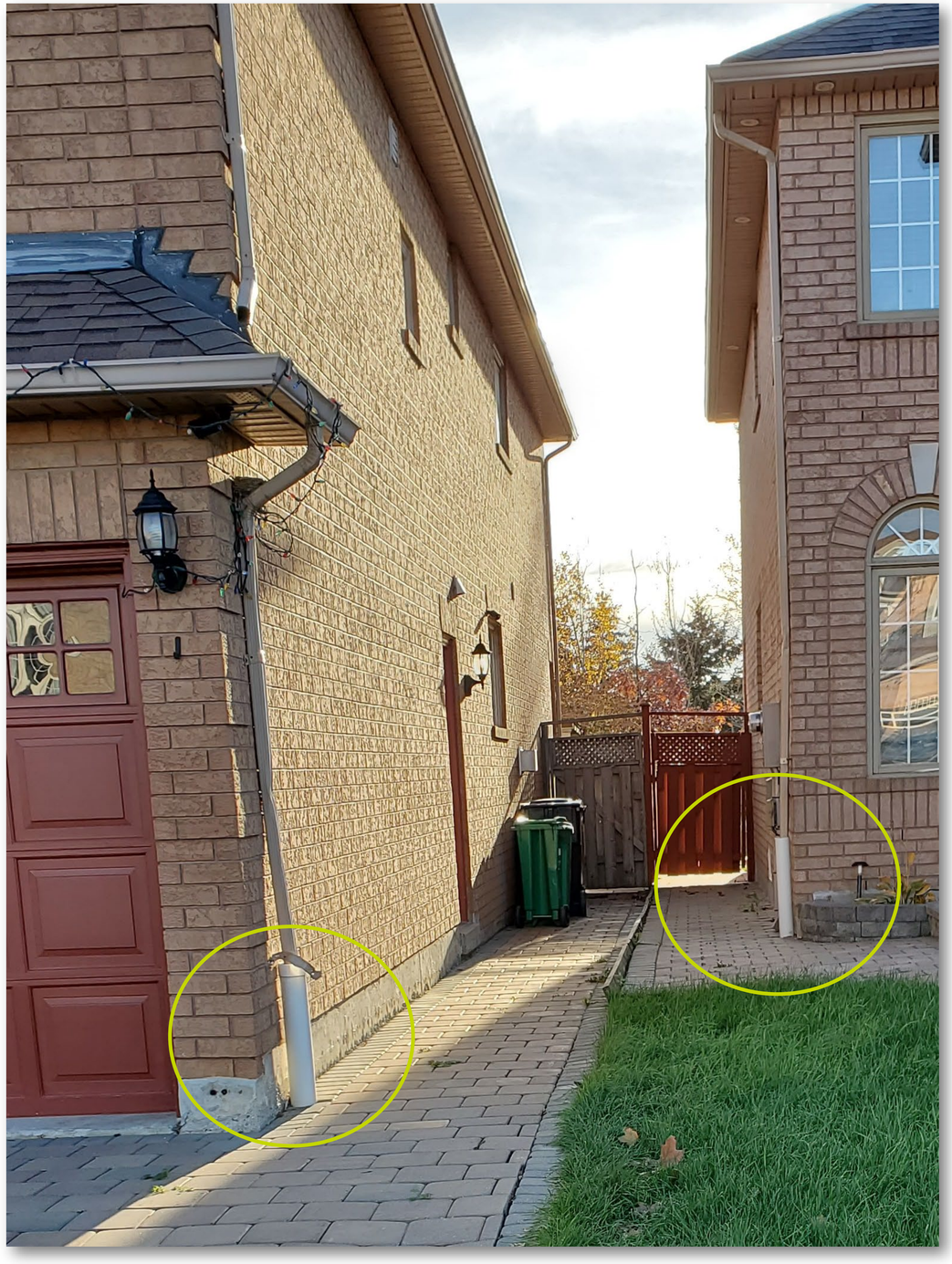
Figure A3a: Gauges on Black Walnut Trail - August 28, 2021 Storm Event



# Overall Monitoring

## Overall Monitoring

- Monitoring continues in the drainage systems noted
- The monitoring will help confirm the effectiveness of remedial measures as they are implemented
- The current results indicate that the Cactus Gate pumping station is effective and is operating as intended
- Additional investigations to identify private sources of inflow to the FDC system are underway



# 3. Lisgar District Pumping Station Class Environmental Assessment

# Municipal Class EA Study Process

**Study:** This Municipal Class EA Study is being undertaken to confirm the number and location of required Foundation Drain Collector (FDC) Pumping Stations.

**Schedule:** The Design and Construction of the Pumping Stations is a Schedule B undertaking

Multiple Pumping Station Alternatives Developed

↓

Alternatives Evaluated to Select a Preferred Alternative for the Pumping Station(s)

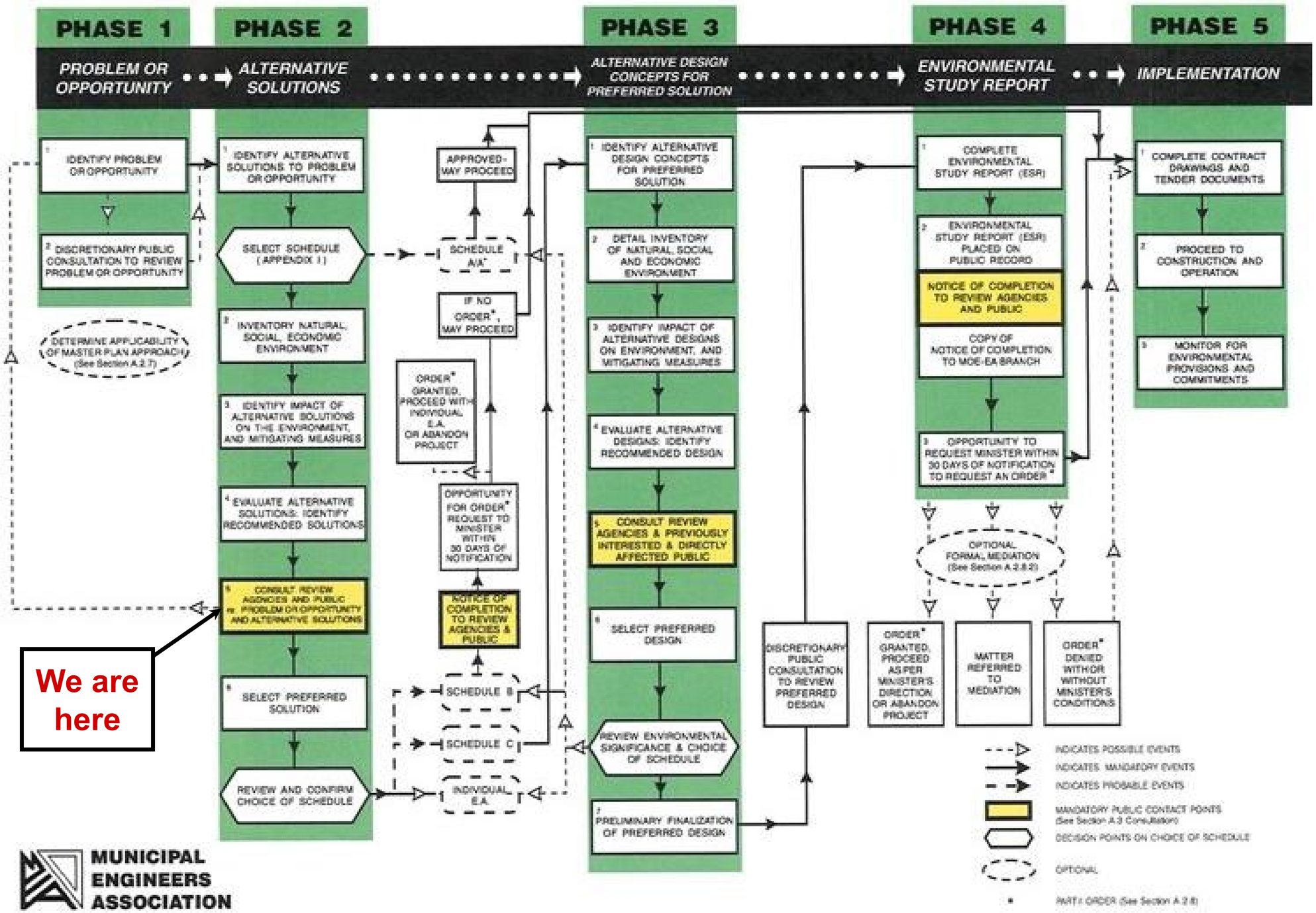
↓

Receive Public Input through Stakeholder and Public Consultation

↓

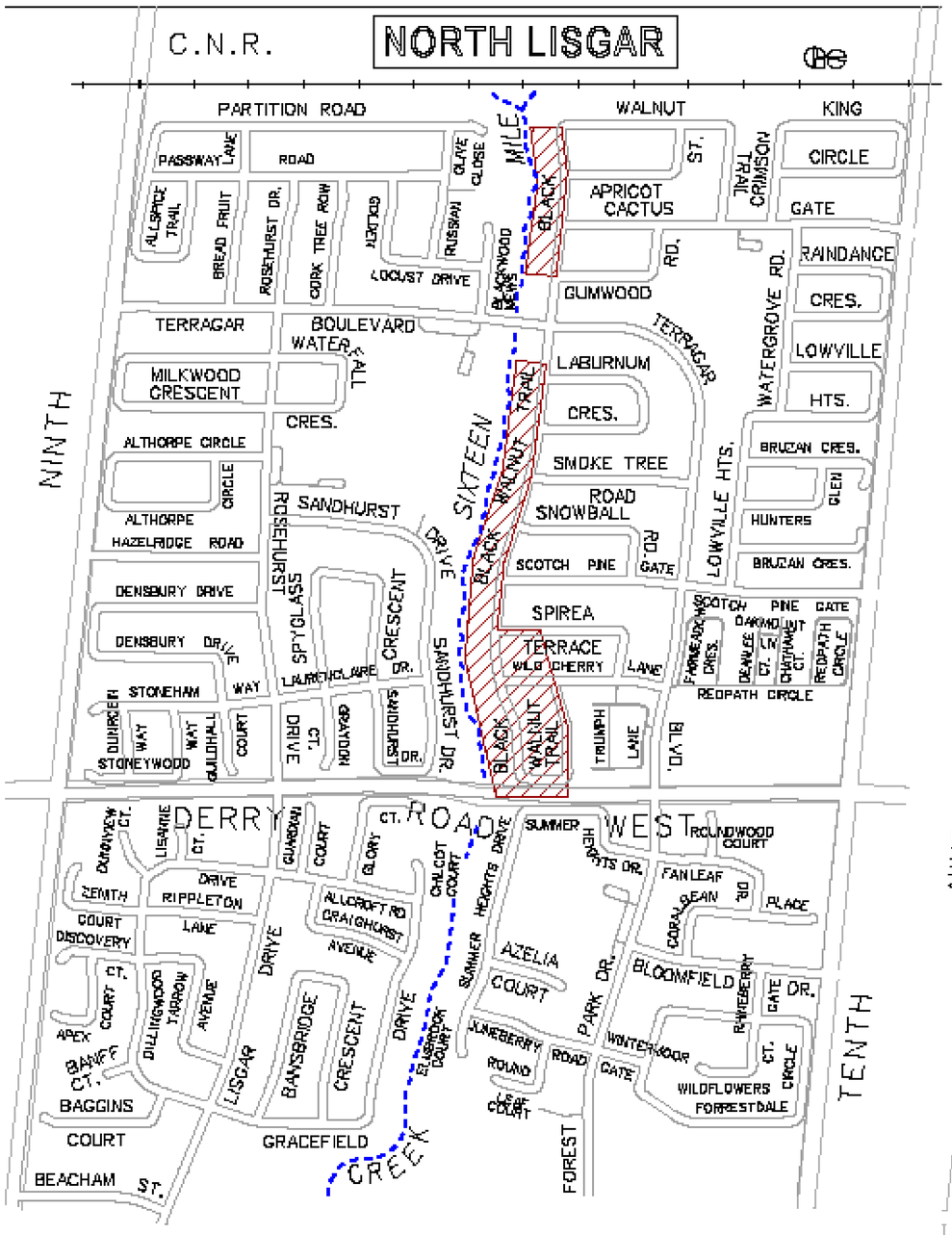
Develop Detailed Design for Preferred Alternative

# Municipal Class EA Study Process



# Primary Study Area

## Areas Generally Affected by Basement Water Infiltration




Legend

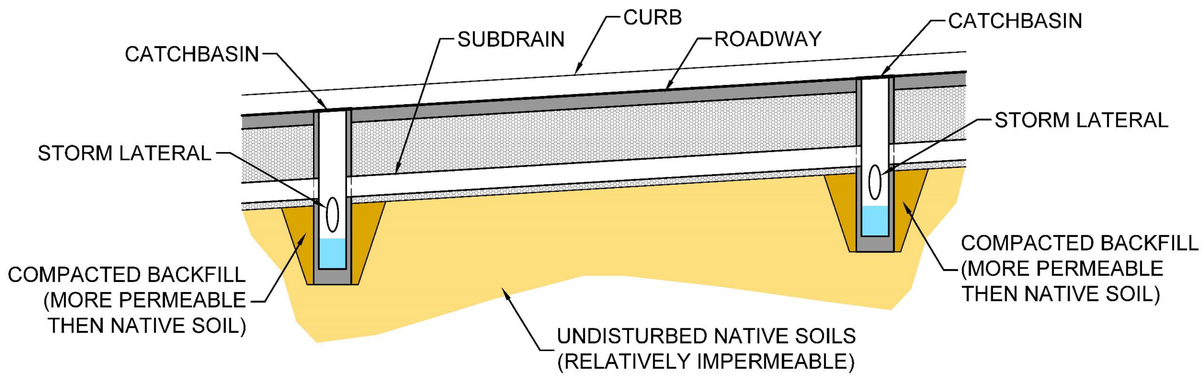
- Areas Generally Affected
- Sixteen Mile Creek

# Pumping Station Types

## Types of Systems:

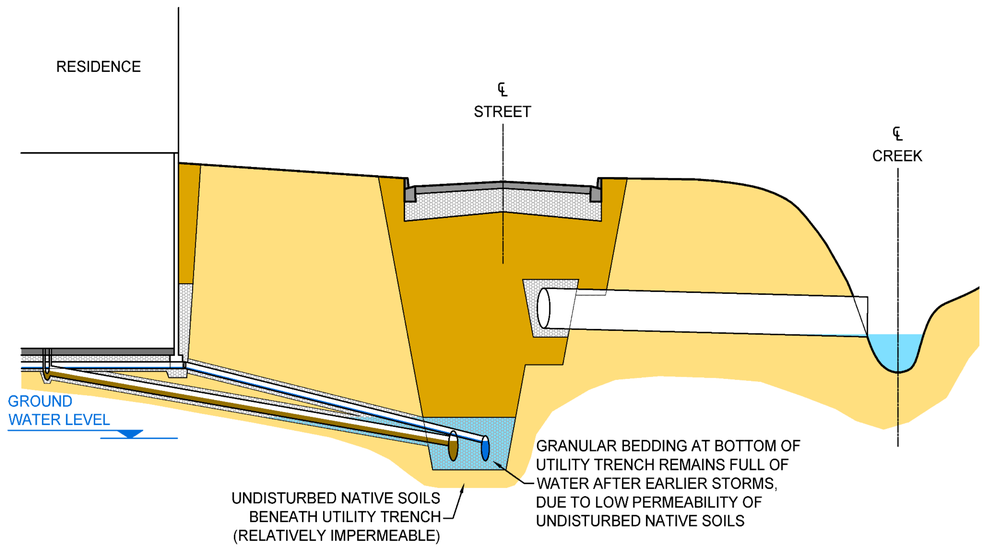
### Utility Trench Dewatering Pumping Station (Low Flow):

- System operates to dewater the utility trench (granular stone bedding) by removing small amounts of water on a continuous basis, much like a sump pump.




### FDC Pumping Station (High Flow):

- System operates to remove water from the FDC pipe network during periods of high flow. This pump would be larger but operate less frequently and only during certain rain storms



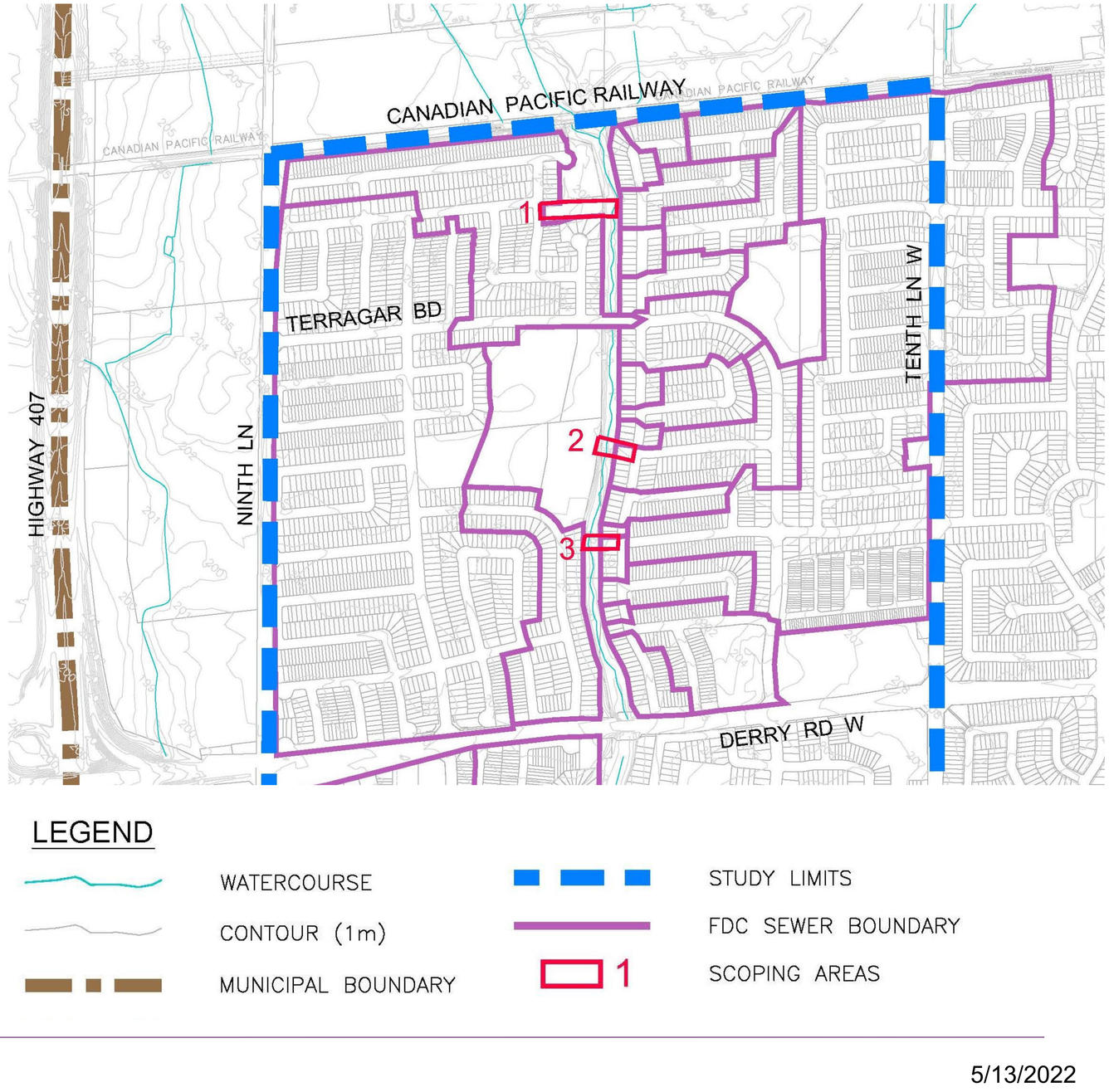
# Pumping Station Assessment

## Potential Pumping Station Locations (Long-list of Alternatives):

- A long-list of 14 different potential pumping station locations have been identified
  - *3 are located north of Derry Road*
  - *3 are located near Trelawny Circle*
  - *5 are located between Doug Leavens and Osprey Blvd*
  - *3 are located near Osprey Marsh*

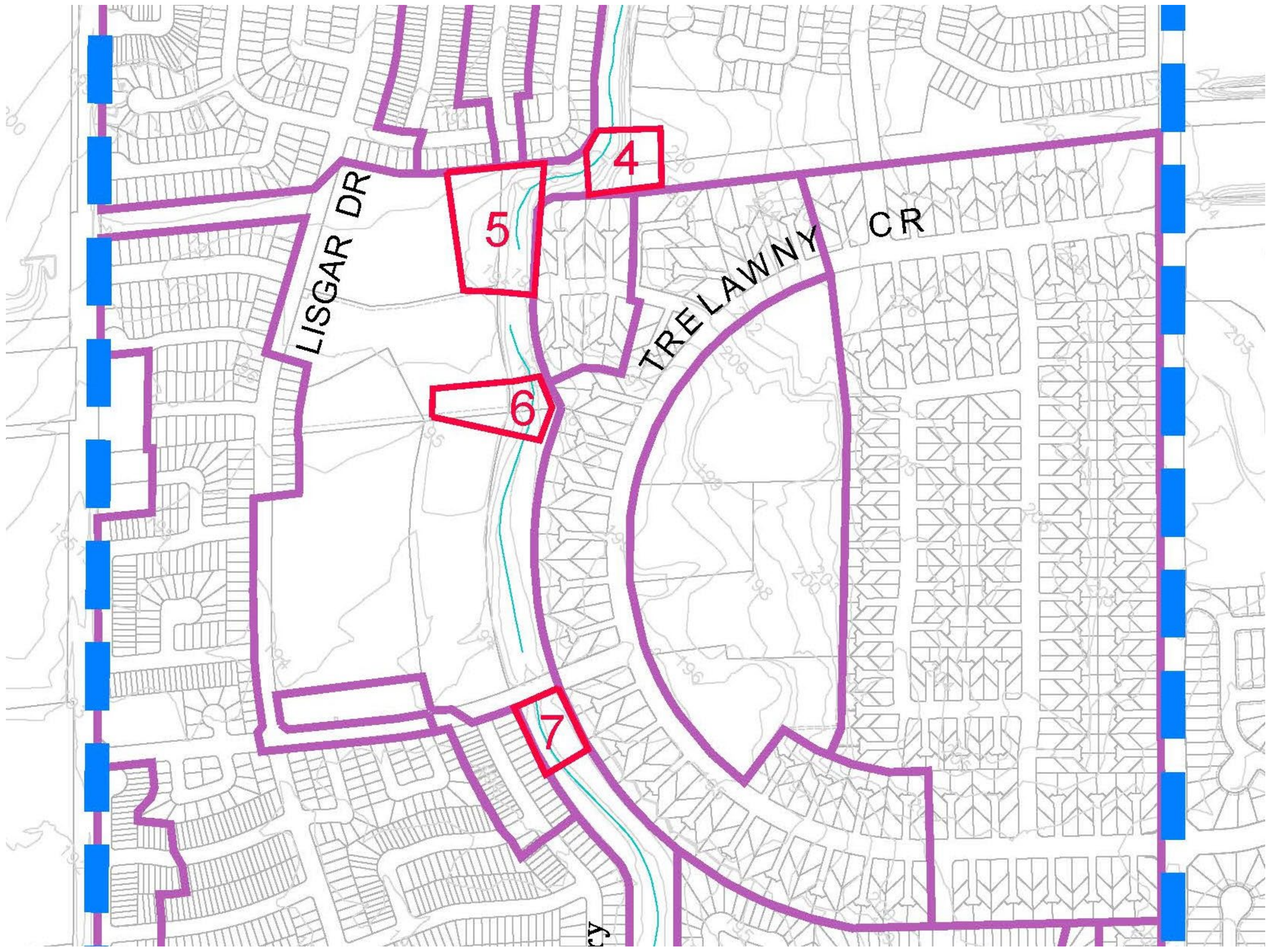
## Criteria for Long List:

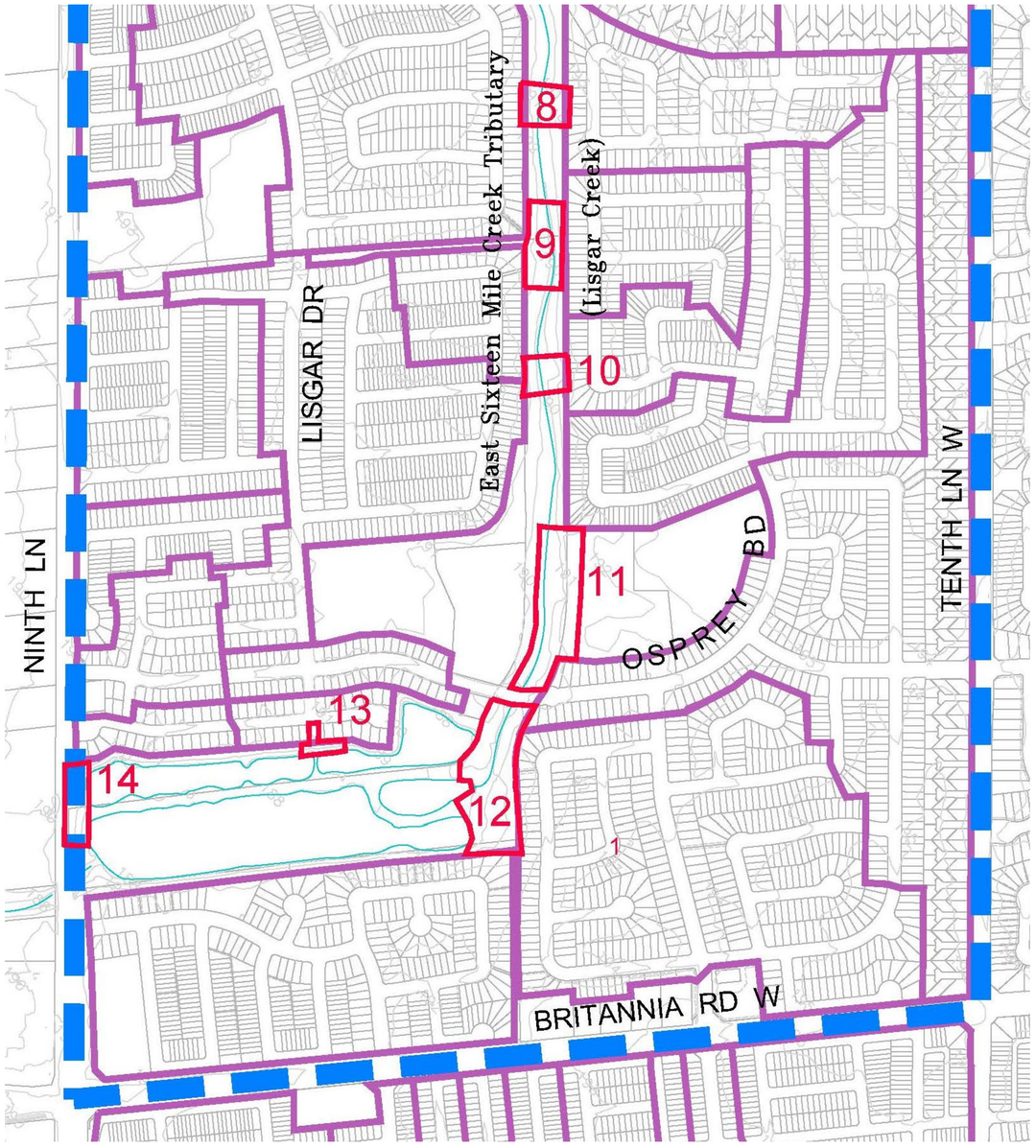
- Public Land Ownership
- Proximity to the FDC trunk sewer
- Proximity to the number of houses with reported incidents of basement water infiltration



# Pumping Station Assessment

## Potential Pumping Station Locations (Long-list of Alternatives):




LEGEND

- WATERCOURSE
- CONTOUR (1m)
- MUNICIPAL BOUNDARY
- STUDY LIMITS
- FDC SEWER BOUNDARY
- 1 SCOPING AREAS

# Pumping Station Assessment

## Evaluation Criteria

**Drainage Area Served:** The amount of nearby land that will be serviced by the Pumping Station, therefore a larger drainage area is a positive factor.

**Property Suitability:** Evaluated based on public land ownership and local property constraints, such as public space and accessibility, and utility, ecology, archaeology, and cultural heritage considerations.

**Number of Houses in Proximity that Reported Basement Water Infiltration:** Greatest number of houses that reported basement water infiltration, as well as frequency and severity of observed FDC system surcharging, is an indication of risk. Locating the pumping station slightly upstream of affected houses has the potential for greatest effectiveness.

# Pumping Station Assessment

## Evaluation of Alternatives

| Long-list of Alternatives | Evaluation Criteria | | | Evaluation |
|---|---|---|---|---|
| Potential Pumping Station Locations | Drainage Area Served | Property Suitability | # of Reported Cases | Screened / Short-listed |
| 1. Russian Olive Close at Buttonbush Park | 🔴 | 🟢 | 🟡 | Screened out |
| 2. Black Walnut Trail at Smoke Tree Road Parkette | 🟡 | 🟢 | 🟢 | Short-listed |
| 3. Black Walnut Trail at Scotch Pine Gate Parkette | 🟡 | 🟢 | 🟢 | Short-listed |
| 4. Lisgar Creek at Forest Park | 🟢 | 🟡 | 🔴 | Screened out |
| 5. Gracefield Drive at Lisgar Meadowbrook Trail | 🟢 | 🔴 | 🔴 | Screened out |
| 6. Lisgar Creek at Lisgar Fields | 🟢 | 🔴 | 🔴 | Screened out |
| 7. Lisgar Creek at Doug Leavens Boulevard | 🟢 | 🟡 | 🟢 | Short-listed |

🟢 Positive 🟡 Neutral 🔴 Negative

# Pumping Station Assessment

## Evaluation of Alternatives

| Long-list of Alternatives | Evaluation Criteria | | | Evaluation |
|---|---|---|---|---|
| Potential Pumping Station Locations | Drainage Area Served | Property Suitability | # of Reported Cases | Screened / Short-listed |
| 8. Lisgar Creek at Pintail Circle | 🟢 | 🟡 | 🟡 | Short-listed |
| 9. Lisgar Creek at Nutrcracker Drive (North) | 🟢 | 🔴 | 🟡 | Screened out |
| 10. Lisgar Creek at Nutrcracker Drive (South) | 🟢 | 🔴 | 🟡 | Screened out |
| 11. Lisgar Creek at Lisgar Green Park | 🟢 | 🟡 | 🟢 | Short-listed |
| 12. Osprey Marsh at Prairie Circle | 🟢 | 🟡 | 🟢 | Short-listed |
| 13. Osprey Marsh at Lisgar Drive | 🟢 | 🔴 | 🟡 | Screened out |
| 14. Osprey Marsh at Ninth Line | 🟢 | 🟡 | 🔴 | Screened out |

🟢 Positive 🟡 Neutral 🔴 Negative

# Pumping Station Assessment

**Based on the evaluation of alternatives, 6 locations have been short-listed in 3 different areas. All are:**

- On public lands
- Near the FDC trunk sewer
- Near areas with greater instances of reported basement water infiltration or observed FDC surcharging
- Each have pros and cons

## Black Walnut Trail Area

### Location 2 – Black Walnut Trail at Smoke Tree Road Parkette

- Easily accessible, allows for low flow/high flow system
- Smallest drainage area served, impacts to pedestrian bridge

### Location 3 – Black Walnut Trail at Scotch Pine Gate Parkette

- Easily accessible, allows for low flow/high flow system
- Slightly smaller parkette than Location 2, and does not address upstream impacts as well as location 2 (although has a greater drainage area)

# Pumping Station Assessment

## Doug Leavens Boulevard and Pintail Circle Area

### Location 7 – Lisgar Creek at Doug Leavens Boulevard

- Location of observed FDC surcharge, upstream from impacted properties
- Access is more challenging due to proximity to arterial road and bus stop

### Location 8 – Lisgar Creek at Pintail Circle

- Location of observed FDC surcharge, near or upstream of impacted areas
- Construction, maintenance accesses will be challenging due to creek and roads

## Osprey Boulevard Area

### Location 11 – Lisgar Creek at Lisgar Green Park

- Potentially more easily accessible than upstream sites
- Temporary access limitations to trail and park during construction, potential impacts to natural features and temporary trail accessibility

### Location 12 – Osprey Marsh at Prairie Circle

- Potentially more easily accessible than upstream sites
- Furthest location downstream, potential impacts to natural features and temporary trail accessibility

# Pumping Station Assessment

## Technical Assessment of Short-Listed Alternatives

**The 6 short-listed alternatives have been further evaluated by:**

- Assessment of previous FDC monitoring data
- Analytical modelling of the pumping station effectiveness of lowering water levels

**This assessment has determined the pumping station(s):**

- Number
- Location
- Relative benefit and overall priority for implementation (design and construction)

**Further assessment will determine the pumping station:**

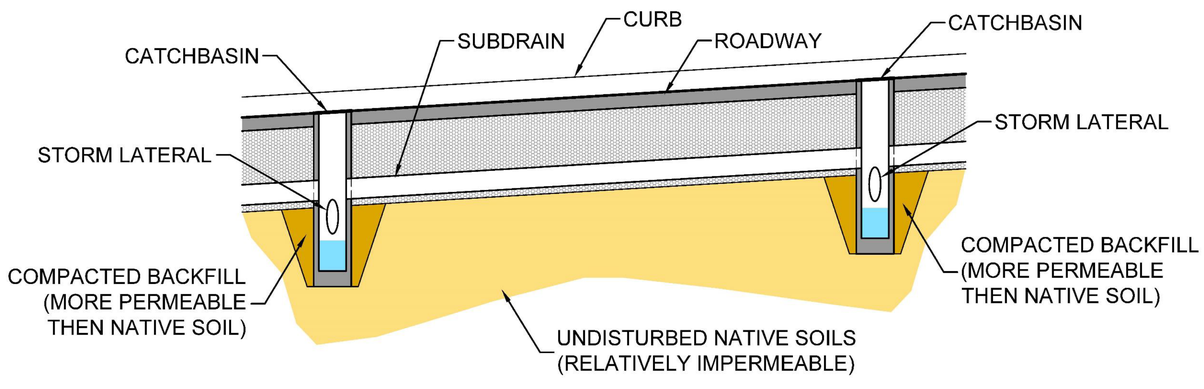
- Capacity (size of pumps)
- Type (low and high flow, or high flow only)

# Pumping Station Types

## Types of Systems:

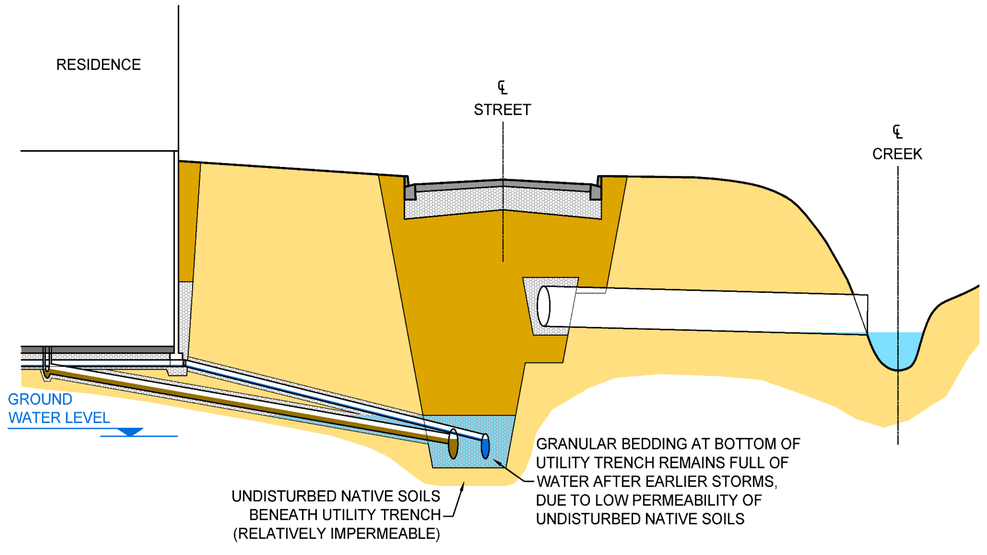
### Utility Trench Dewatering Pumping Station (Low Flow):

- System operates to dewater the utility trench (granular stone bedding) by removing small amounts of water on a continuous basis, much like a sump pump.




### FDC Pumping Station (High Flow):

- System operates to remove water from the FDC pipe network during periods of high flow. This pump would be larger but operate less frequently and only during certain rain storms



# Pumping Station Assessment

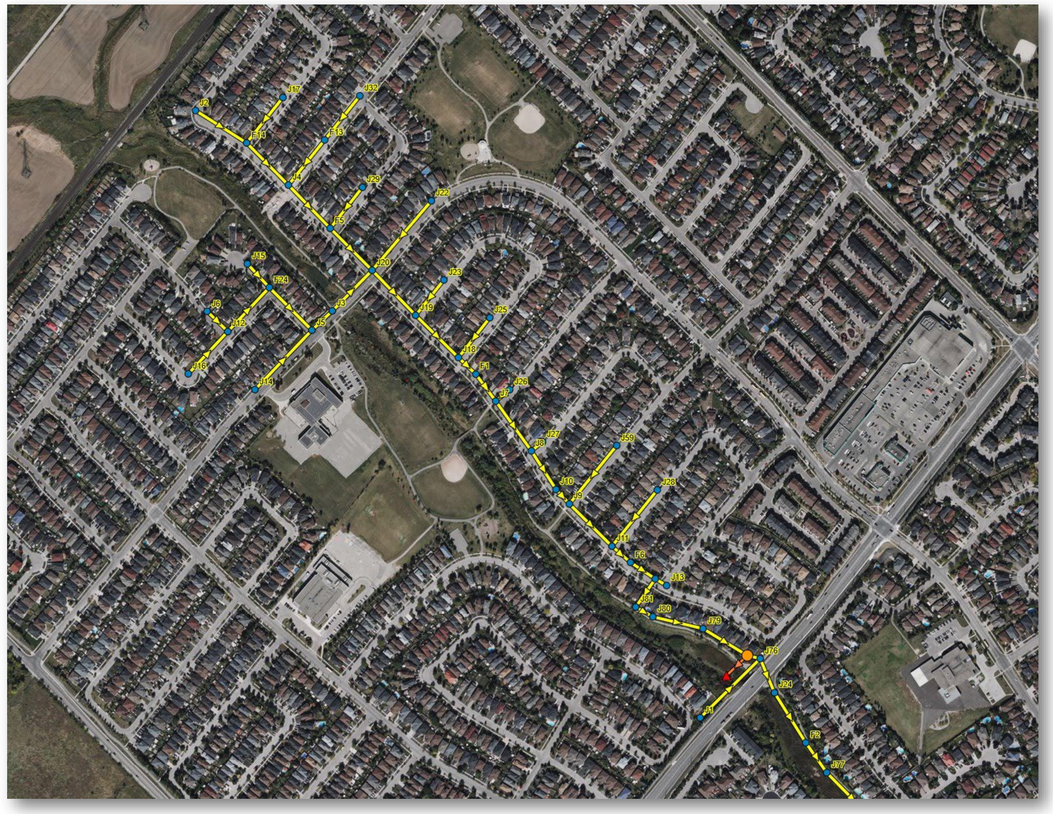
## Technical Assessment

### Model Purpose

- A hydraulic model of the FDC sewer system was developed and used to:
  - Assess expected flows during storm events
  - Evaluate the effectiveness of potential pumping station locations, including the size, capacity, and number of pumps

### FDC Sewer System Monitoring Findings:

- The water levels in the north area (Black Walnut) tend to increase very quickly to thunderstorm type events
- The water levels in the south area (Doug Leavens to Osprey) tend to increase more to long-lasting saturated ground type events

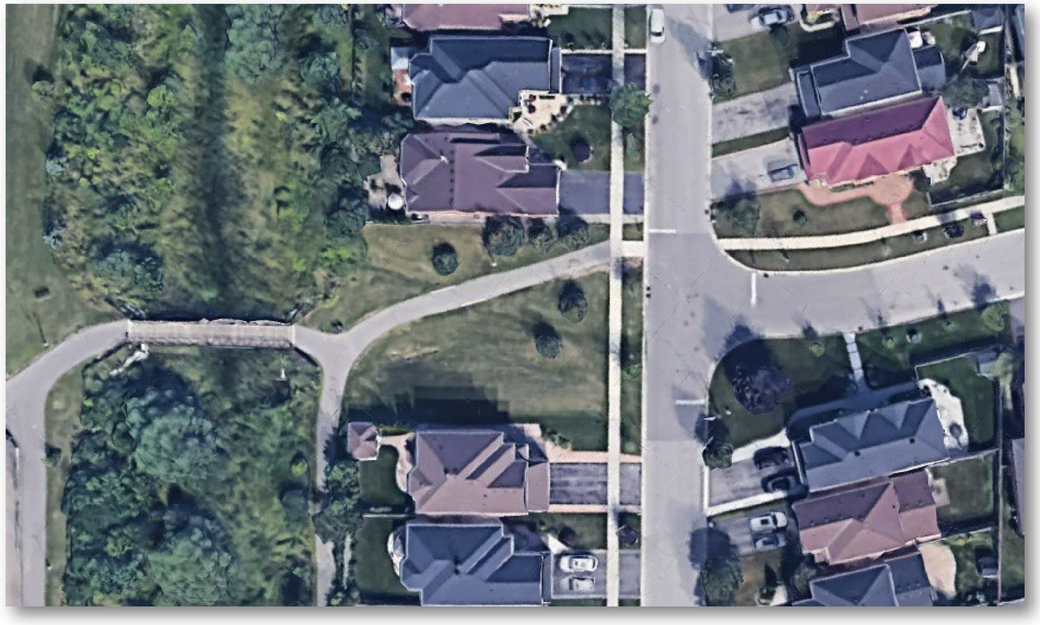


# Preliminary Preferred Solution

## Recommendations:

**Parkette at Black Walnut Trail and Smoke Tree Road (Location 2) is Priority Location #1**

- Monitoring indicates location continues to experience FDC surcharging
- Rapid nature of response requires a permanent installation that can respond quickly and automatically
- Carefully consider impacts to trail and pedestrian bridge

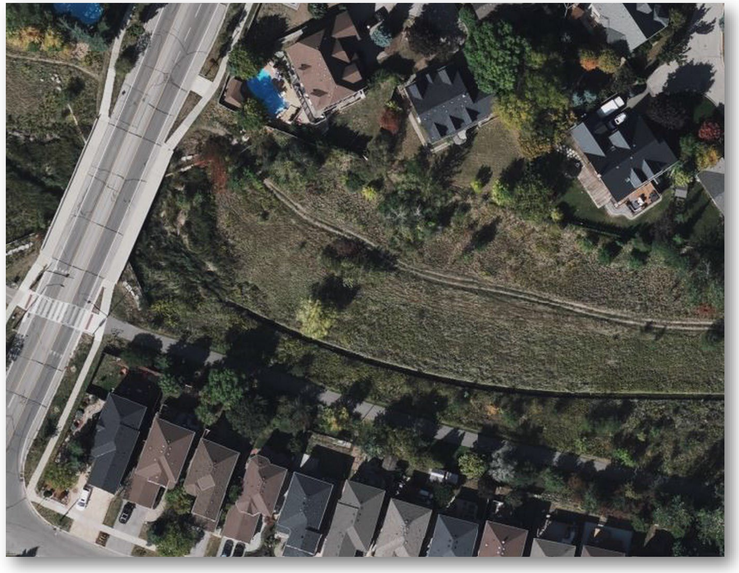


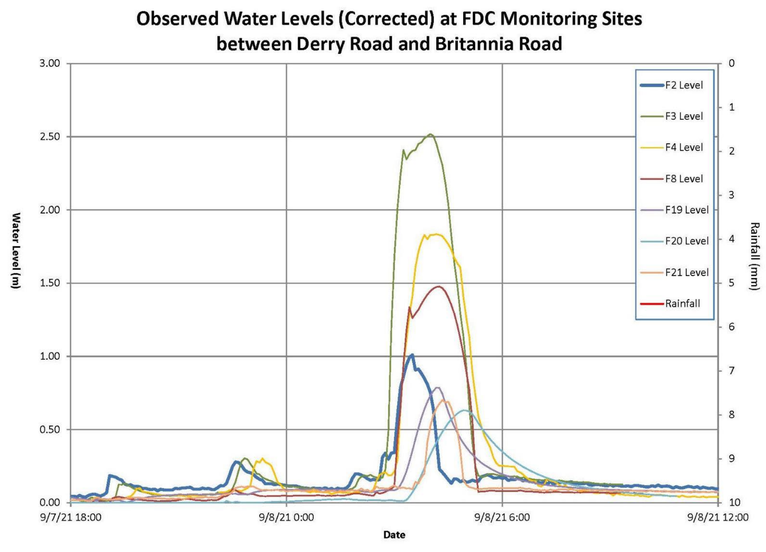
# Preliminary Preferred Solution

## Recommendations:

**Doug Leavens Boulevard (Location 7) is Priority Location #2**

- Monitoring indicates location continues to experience the greatest FDC surcharging in the southern area; required based on modelling
- Still located upstream of areas which have reported basement water infiltration
- More easily accessible for construction than Location 8 (Pintail Circle) given road proximity, and less disruption to trail system





# Preliminary Preferred Solution

## Recommendations:

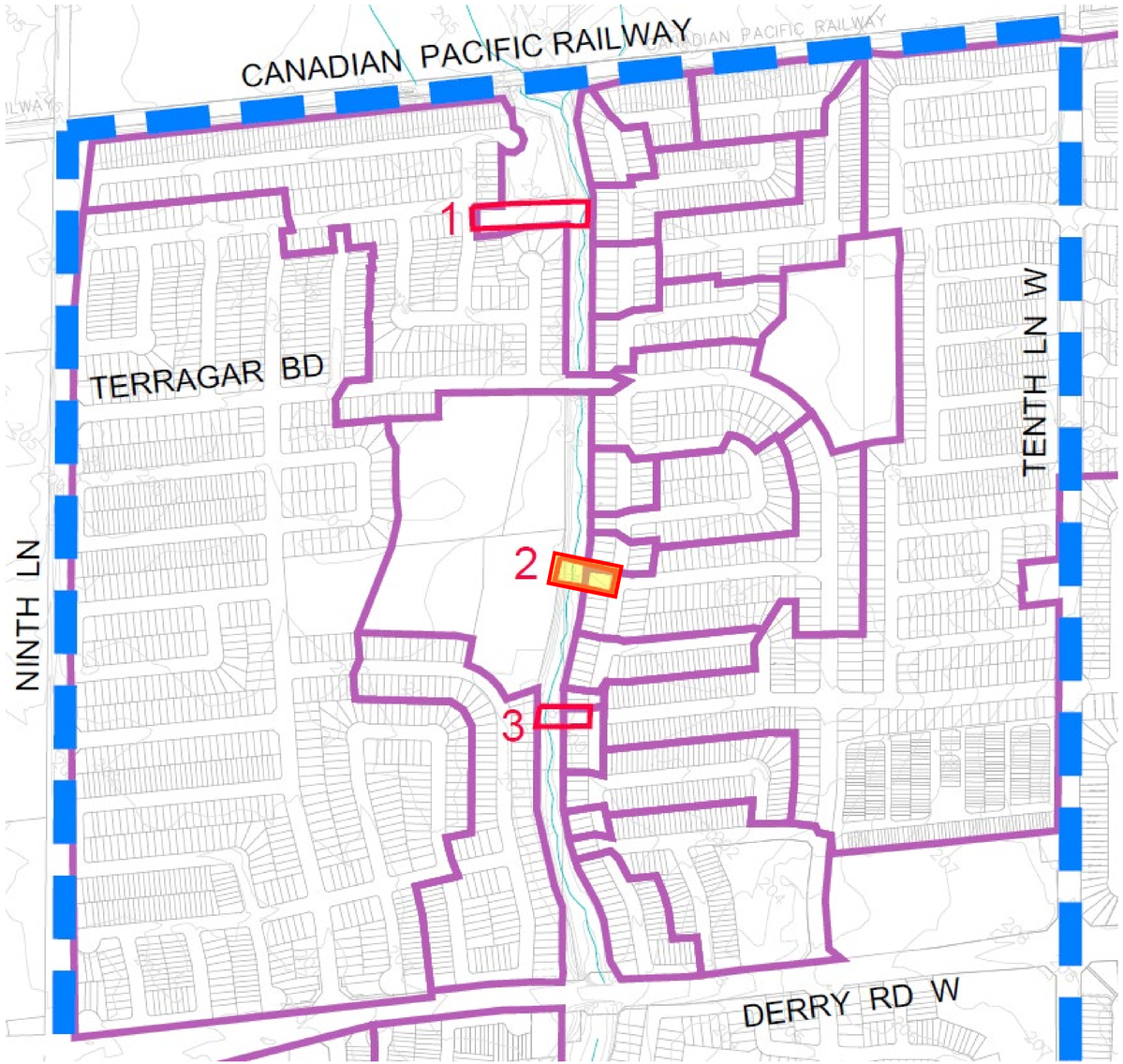
**Lisgar Green Park (Location 11) is Priority Location #3**

- Modelling indicates need for additional relief in the vicinity of Osprey Blvd; area of previously reported basement water infiltration
- Slightly further upstream than Location 12 (Osprey Marsh), also easier construction access; trail impacts still require consideration
- Ecological impacts to adjacent forest area to be minimized to extent possible; trunk sewer is in forested area and new outfall will likely be required

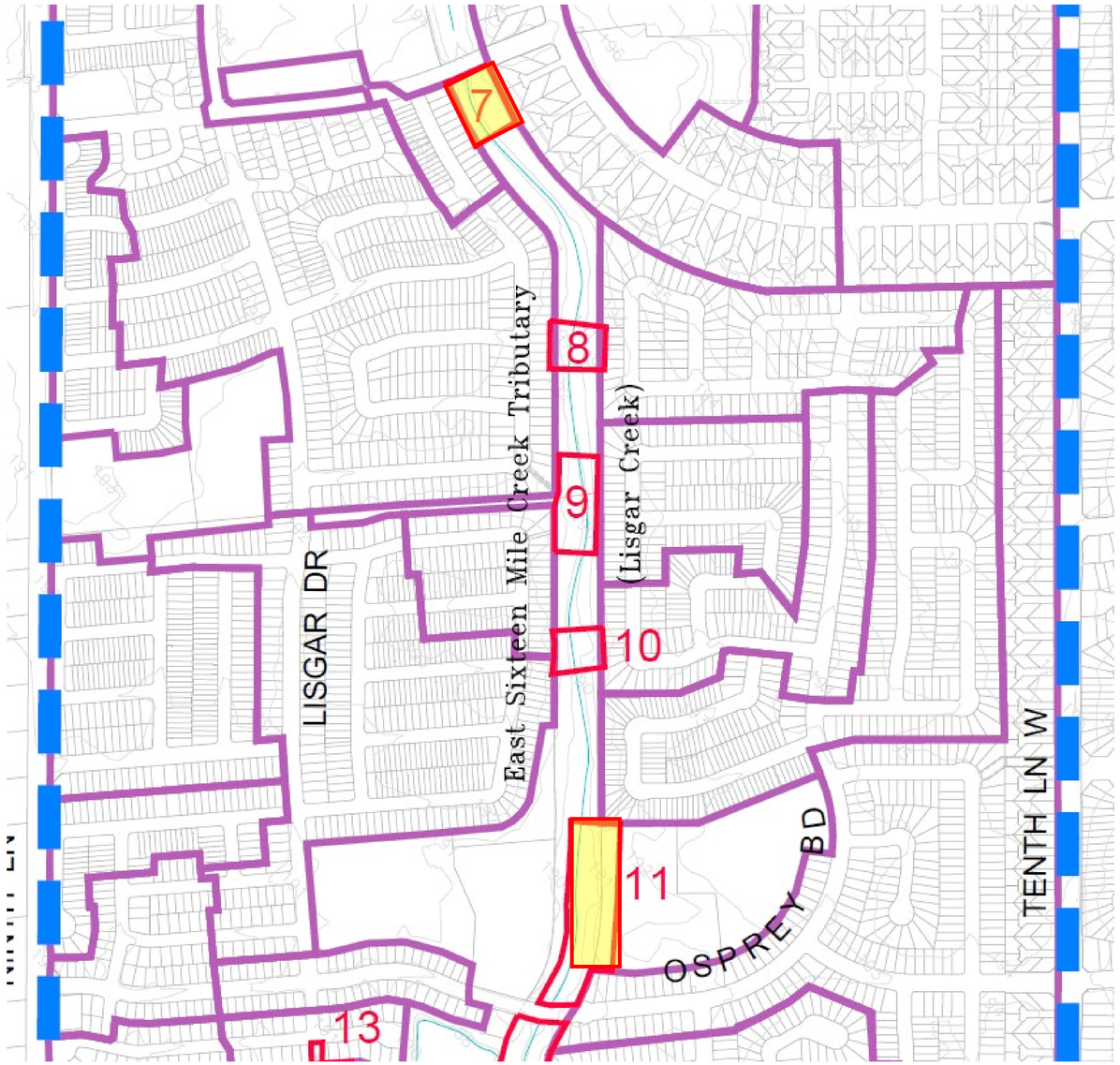
# Preliminary Preferred Solution

## Implement three (3) highest priority locations in sequence

### North Area

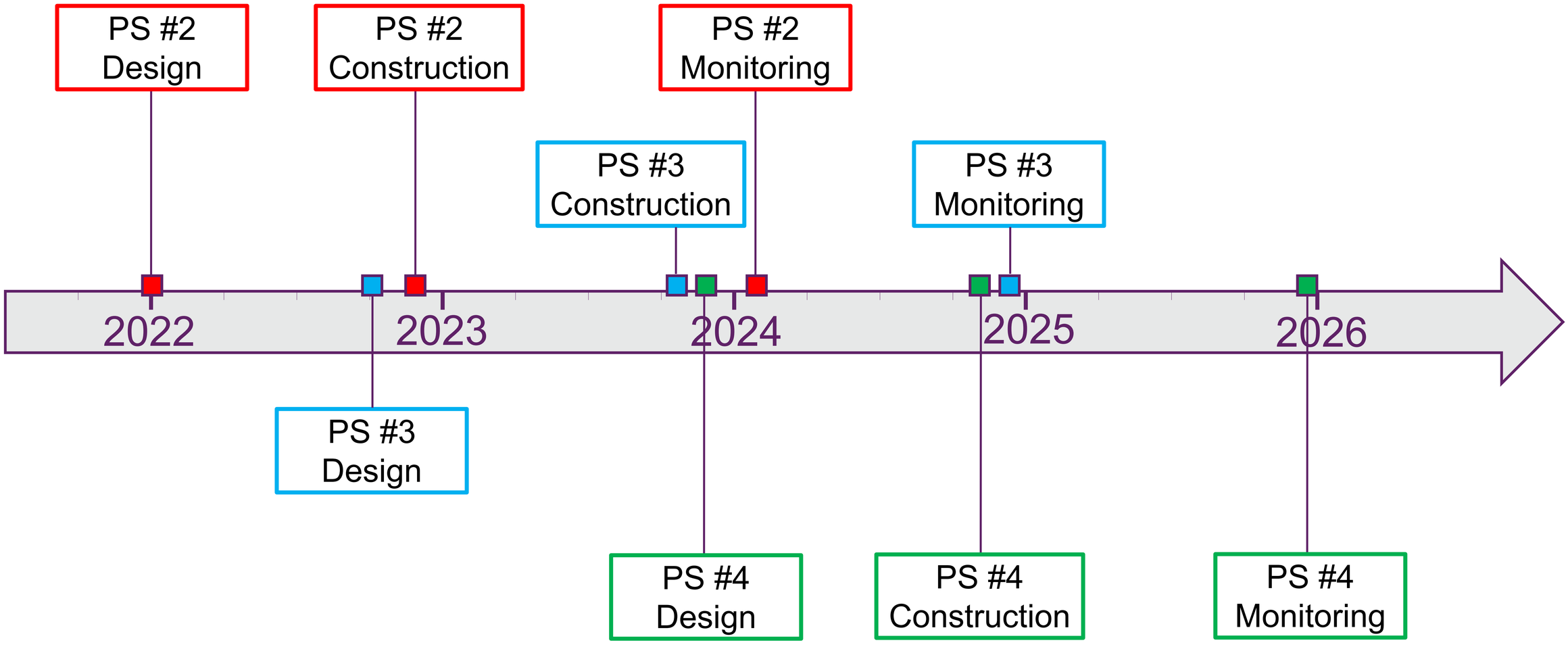



### South Area



# Preliminary Schedule

- The implementation of each pumping station consists of 3 phases:
  - Design, construction and monitoring
- The Cactus Gate Pumping Station (PS #1) is in the monitoring phase.
- The following timeline illustrates the preliminary schedule for the next pumping stations.




*Subject to Council approval of the necessary budget

# Next Steps in Class EA

## Next Steps:

### Consultation (Q4 2021)

- Receive input from Public, stakeholders and Indigenous Communities

### Project File (Q1 2022)

- A project file documenting the entire study process will be prepared for public review
- Seek approval from Council to publish the complete Project File for the public
- Project File will be available for public review for 30 days

# Next Steps in Class EA

## How Can You Get Involved?

- Email us to join our Project Mailing list for timely, relevant updates
- Review information shared at this Public Meeting
- Provide input by completing a Comment Form by December 1, 2021
- Visit the project website here:
- Speak with one of the Project Team members:


**Elizabeth Dollimore, P.Eng. MBA.**

City of Mississauga

Phone: (905) 615-3200, ext. 5303

Email: Elizabeth.Dollimore@mississauga.ca

**Matt Senior, M.A.Sc., P.Eng.**

Wood Environment & Infrastructure Solutions

Phone: (905) 335-2353 ext. 3080

Email: Matt.Senior@woodplc.com

# 4. Question and Answer Session #1

# 5. High Water Protocol Overview

## What is the Lisgar High Water Protocol (LHWP)?

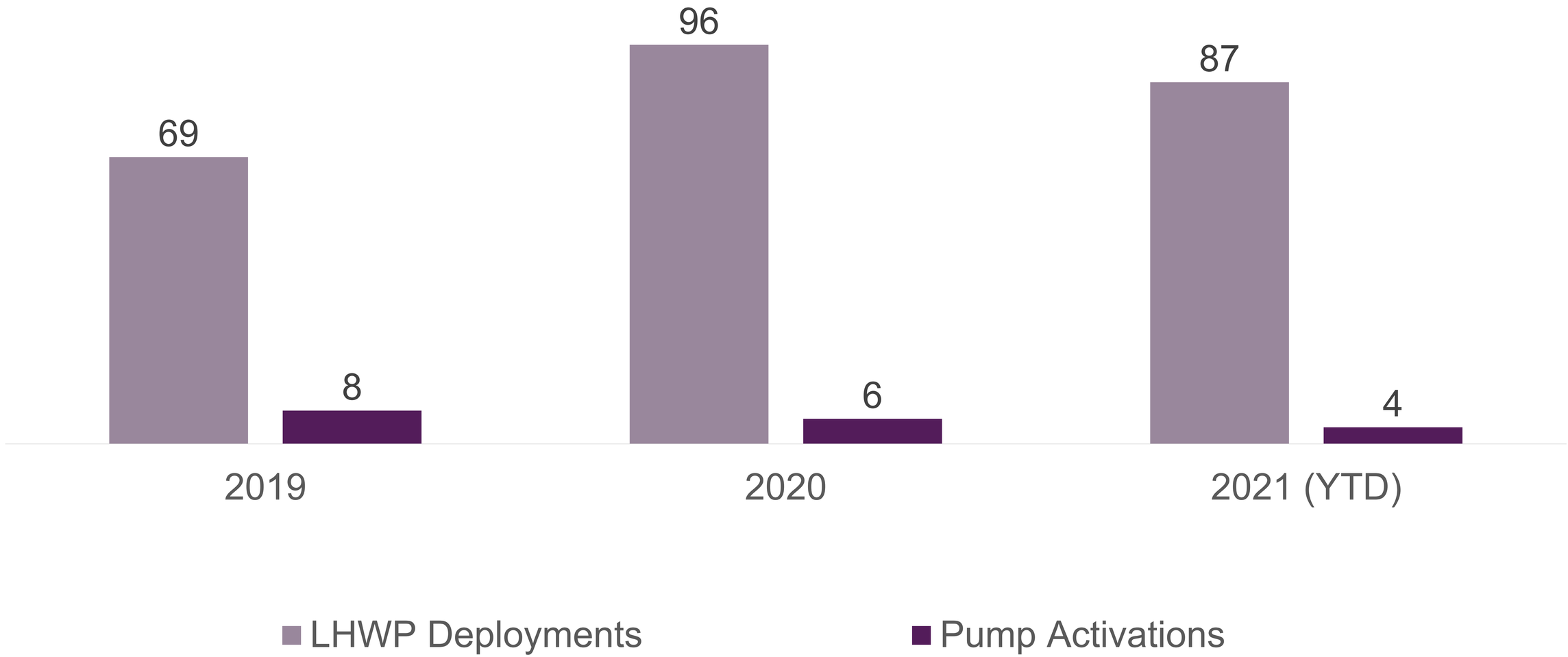
- The LHWP is one measure used to reduce the potential for water infiltration in the Lisgar area
- When specific weather-related criteria is met, the City will deploy temporary pumps at multiple locations within the Foundation Drain Collector System (FDC) as an emergency measure to provide relief from elevated water levels in the Lisgar FDC.

# LHWP Criteria

**The LHWP is initiated when any of the following criteria is met:**

- Credit Valley Conservation Authority or Conservation Halton have issued a flood advisory or high water bulletin.
- Rain is forecasted with a probability of 40% or more and an intensity of one millimetre per hour or more.
- A risk of thunderstorms is forecasted.
- Rain is forecasted and the ground has snow cover.

# LHWP Deployments & Activations by Year



# Recent Improvements to the LHWP

The City is always reviewing the LHWP and looking for opportunities to improve it as new information becomes available.

These are recent improvements made to the LHWP:

- Larger 15 cm (6”) pumps have replaced the smaller 10 cm (4”) pumps. The larger pumps are quieter and can remove a higher volume of water.
- A consultant reviewed and evaluated pump locations for optimal performance and access. One pump was relocated as a result.
- Minor pathway work was completed so that residents can continue to safely access the trail network at each pump location when it is not raining.

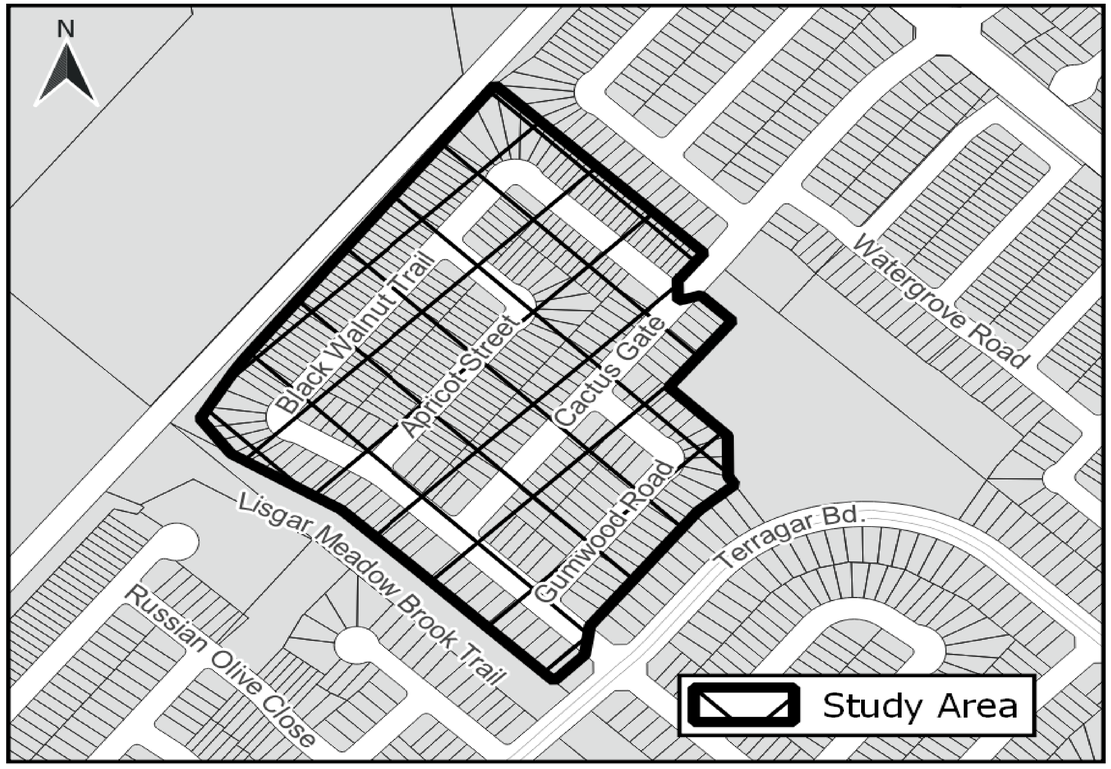
# 6. Additional Updates

# FDC Smoke Testing

- Downspouts and plumbing vents should not be connected to the City's FDC system
- The City is undertaking additional investigations to identify unauthorized private sources of flow into the FDC
- This summer, the City completed smoke testing of a portion of the Foundation Drain Collector system

# FDC Smoke Testing

- Testing was completed on the following streets:
  - A section of Black Walnut Trail, a section of Cactus Gate, Apricot Street and Gumwood Road
- 284 properties
- Staff observed smoke emitting from:
  - downspouts (may indicate direct connection to FDC)
  - sanitary vents (may indicate a cross connection to FDC)
- Staff are considering next steps



# FDC Sump Pump Subsidy Program

- A sump pump can provide an additional safeguard against basement water infiltration.
- The City continues to suggest that residents who qualify for the City's FDC Sump Pump Subsidy Program take advantage of this program.
- The City will subsidize up to 100% of the cost of installing a sump pump, to a maximum of $6,000

- Program details are available at:

*http://www.mississauga.ca/portal/stormwater/fdc-sump-pump-subsidy/*

# 7. Question and Answer Session #2

# Thank you

Review this presentation and find the comment form at:

Follow-up questions / comments can be emailed to:

elizabeth.dollimore@mississauga.ca

# Additional Slides

# Preliminary Preferred Solution

## Mitigation Considerations:

| Subject | Impact / Issue | Mitigation / Action |
|---|---|---|
| **Construction** | •Traffic<br>•Noise<br>•Dust<br>•Vibration | •Management plan required to meet City standards<br>•Contract will ensure City requirements are met<br>•Pre-construction surveys of adjacent residences are proposed<br>•Active monitoring during construction |
| **Operation** | •Noise<br>•Odour<br>•Maintenance | •Pumps are below ground and very quiet<br>•Stormwater flows (not sanitary) - no odour is anticipated<br>•Proposed maintenance accesses will be included in design<br>•City will retain a contractor for Operation and Maintenance |

# Preliminary Preferred Solution

## Mitigation Considerations:

| Subject | Impact / Issue | Mitigation / Action |
|---|---|---|
| **Aesthetics** | •Pumps<br>•Parkette<br>•Buildings | •Majority of features are below ground, including pumps<br>•Landscape plan will be created for restoration<br>•No permanent buildings are expected |
| **Creek Discharge** | •Outlet | •Located adjacent to creek; Conservation Halton permit is expected to be required if works within regulated area |
| **Climate Change** | •Resiliency | •Pumping station and utility dewatering trench will add capacity to overall system, providing resiliency to changing climate |

# Status of Mitigation Plan

## Status of 2017 Action Plan:

| City Actions | Schedule |
|---|---|
| **ADDRESS ROADWAY SUB-DRAIN LEAKAGE** | |
| • *Pursue prototype of roadway sub-drain plugs* | *Complete* |
| • *Installation of plugs along Black Walnut Trail and other areas* | *Complete* |
| • *Expansion to other areas within Lisgar District* | *Generally Complete* |
| | |
| **CONSTRUCTION OF AN UTILITY TRENCH DEWATERING SYSTEM** | |
| • *Carry Out Municipal Class EA Study* | *Complete* |
| • *Complete detailed design work* | *Complete* |
| • *Construction* | *Complete* |
| | |
| **CONSTRUCTION OF A FDC PUMPING STATION** | |
| • *Carry Out Municipal Class EA Study* | *Complete* |
| • *Conduct Hydraulic Modelling Analysis* | *Complete* |
| • *Complete detailed design work* | *Complete* |
| • *Construction* | *Complete* |

# Status of Mitigation Plan

## Status of 2017 Action Plan:

| City Actions | Schedule |
|---|---|
| **AMEND SUMP PUMP SUBSIDY PROGRAM** | |
| • *Increased Program Subsidy* | *Complete* |
| | |
| **CONTINUE WITH HIGH WATER PROTOCOL** | |
| • *Continue to monitor and initiate updated pumping protocol as required* | *Ongoing* |
| | |
| **MONITORING** | |
| • *Implement additional monitoring gauges in key study areas* | *Complete* |
| • *Monitoring to verify effectiveness of implemented measures* | *Ongoing* |

# Appendix G4
# Public Information Centre #1 Comment Form

# COMMENT FORM

## LISGAR DISTRICT PUMPING STATION
## Municipal Class Environmental Assessment
## Public Information Centre & Town Hall

**November 17, 2021**
**7:00 – 8:30 pm**

The City of Mississauga welcomes your comments on the Lisgar District Pumping Station Municipal Class Environmental Assessment by mail/e-mail to either of the following individuals by **December 1, 2021**:


**Elizabeth Dollimore, P.Eng., MBA**
Project Manager
City of Mississauga
201 City Centre Dr, Suite 800
Mississauga, ON L5B 2T4
Tel: (905) 615-3200, ext. 5303
E-mail: elizabeth.dollimore@mississauga.ca
Website: **mississauga.ca/lisgarpumpingstationstudy**

**Matt Senior, M.A.Sc., P.Eng.**
Consultant Project Manager
Wood, Environment & Infrastructure Solutions
3450 Harvester Rd, Suite 100
Burlington ON L7N 3G2
Tel: 905.335.2353 ext. 3080
Email: matt.senior@woodplc.com


**Do you agree with the Preferred Solution and the prioritization of the Pumping Stations?**

While I support the City's efforts to mitigate the risk of flooding in the area, I am also concerned about the location of the pumping stations and the negative impact on property value casued by their installation so close to homes. In particular, the station being proposed to be located at Doug Leavens/Trelawny Circle will be highly visible and will impact the resale property value significantly of the homes that will now back onto a Pumping Station instead

**Are there any other considerations the City should include in the evaluation of the Pumping Stations?**

If there is no other alternative but to place the structure so close to homes, then I would ask the City to include in the budget proposal funds to make the structure more aesthetially pleasing. Trelawny properties are some of the highest value properties in the Meadowvale area, and the residents would like to keep it this way.

**Do you have any specific concerns with the construction of the Pumping Stations?**

I would ask that the CIty please consider having some guidelines around noise for the construction site. Out of respect for the wildlife and the residents, it would be nice if the noise would be kept at a minimum early in the morning and at night.

**General Comments:**

**Thank-you for your participation. If you wish to be added to our Project Mailing List to be kept informed about the Study please provide your contact information below.**

**Name:** _____ **Address:** _____
**City:** _____ **Postal Code:** _____
**Phone:** _____ **E-mail:** _____

*Personal information, as defined by the Municipal Freedom of Information and Protection of Privacy Act (MFIPPA) is collected under the authority of the Municipal Act, 2001, and in accordance with the provisions of MFIPPA. Personal information on this Public Open House Comment Sheet will be used for the purpose of informing the Lisgar District Pumping Station Municipal Class Environmental Assessment.*

# Appendix G5
# Public Information Centre #1 Summary - Frequently Asked Questions

# Public Information Centre for the Lisgar Pumping Station(s) Environmental Assessment and Lisgar Town Hall
# Q&A

The City of Mississauga held a Public Information Centre (PIC) for the Lisgar Pumping Station(s) Environmental Assessment (EA) and Town Hall on Wednesday, November 17, 2021. This meeting provided an update on ongoing monitoring works in the Lisgar District, shared information related to the EA study and allowed an opportunity for residents and stakeholders to ask questions.

Please find below, the questions received during the PIC and Town Hall and corresponding answers. To jump to a question, hold the Ctrl key and select the question from the list below.

## Cactus Gate Pumping Station

1. Why was the Cactus Gate Pumping Station not built with a greater capacity? ..... 4

2. Could the Cactus Gate Pumping Station have been built with greater capacity to avoid the construction of another pumping station on Black Walnut Trail? ..... 4

3. Does the water that bypasses the Cactus Gate Pumping Station create issues downstream? ..... 4

4. Does the water that is pumped at the Cactus Gate Pumping Station flow to the site of the next proposed pump? Where does the water from the pumping station end up? ..... 4

5. What is the Litres Per Minute (LPM) capacity of the permanent pumping station vs. the temporary pumps? ..... 4

6. Where is the Cactus Gate pumping station located and what is the size of its footprint? ..... 5

7. Has the City received a federal grant for the construction of a pumping station? If so, how much? .... 5

8. Why did homes still experience basement water infiltration on August 28 even with the Cactus Gate Pumping Station being fully operational? ..... 5

9. Does each pumping station only service the residences downstream from its physical location? If so, what is being done for the dwellings north of Cactus Gate? ..... 5

10. What is the general extent of the service area for each pumping station? ..... 5

## Future Pumping Stations

11. What is the total number of future pumping stations that the City will build in Lisgar? ..... 5

12. Why is Black Walnut Trail being considered for another pumping station given that the first pumping station is constructed on this street? Aren't they too close to each other? ..... 6

13. If a pumping station is built in the parkette at Black Walnut Trail and Smoke Tree Road, what will be done to provide safe access to the pedestrian bridge in the parkette, which is used to access a park and 2 schools? ..... 6

14. In the Public Information Centre presentation, there was mention that the stations further downstream would need greater power (capacity) to handle the increased flows. Why wasn't the first station built with more power? ..... 6

15. How large of an area is required for a pumping station? How much area will be occupied in Priority Area 7? ..... 6

16. How has the expected increase in extreme weather due to climate change been factored into the pumping station plans? ..... 6

17. Can future FDC pumping structures, excluding the control panel and generator, be constructed below ground level for aesthetic purposes? ..... 7

18. Will the pumping station capacity be sufficient to remove FDC flow in a 100-year storm? ..... 7

19. What is the noise level of these pumping stations? Will it be disruptive to nearby residents? ..... 7

20. If all four pumping stations are constructed, what will the total combined pumping capacity be? How does this compare to the current state of one pumping station and the High Water Protocol pumps? ..... 7

21. Has the budget for future pumping stations been approved? ..... 7

22. The recommendation in the EA is for three additional pumping stations. If this is approved and three stations are built and there is reason to consider additional stations after that, would a new EA process be required? If so, would it be beneficial to identify the Priority Locations 4 and 5 now even if we don't need them, rather than spend the money and time on another EA in five or more years? ..... 8

**High Water Protocol (HWP)**

23. A paved access at Pintail Circle is currently used by HWP pumping vehicles during rain events. Is this paved access permanent? If not, when will it be removed? ..... 8

24. Why do I always see a pump truck on the pathway at Derry Road and Black Walnut Trail? ..... 8

25. Could the HWP be modified so that the contractor begins pumping when the pipe is 25% full rather than 50%? ..... 8

26. On previous occasions, the truck at Derry Road was not operational/pumping water. Why does this happen? Is there debris in the FDC? What action does the contractor take to address this situation? What action is being taken by the City to ensure this truck is operational? ..... 8

27. Is HWP only activated due to forecasted conditions or is it also reactive when unexpected high water conditions occur? What is the reaction time? ..... 9

**Maintenance**

28. What maintenance is being conducted on the FDC to ensure that debris will not impact the pumping hoses? ..... 9

29. Will the area north of the Osprey bridge be cleared of grass/weeds to prevent winter snow and ice build-up? ..... 9

**Smoke Testing**

30. If a homeowner has an unauthorized direct connection (i.e. downspouts, sanitary connections) into the FDC, will they be asked to disconnect? ..... 10

31. Can the City mandate that homeowners have to disconnect downspouts from the FDC within a specified period of time or the homeowner will be billed? ..... 10

32. If there are sanitary vents connected to the FDC, the assumption is that these would have been connected by the builders. Is this an accurate assumption? What action will the City take against the builders? ..... 10

33. Given the small percentage of homes that might have unauthorized connections to the FDC, does the City feel that this is a beneficial use of resources? ..... 10

### Creek

34. Why is the creek overflowing? ..... 10

35. The creek overflowing appears to be an indication that flooding will occur. What is being done to ensure the creek does not cause water to be pushed back towards homes? ..... 10

### External Lands

36. Does the City know where the water table is on the land west of Ninth Line? ..... 11

37. Does the City know where the floodplain is west of Ninth Line? ..... 11

38. What is the impact of the proposed development to the west? ..... 11

39. Is there a chance that the proposed development on the west side of Ninth Line may back up water to the east side of Lisgar? ..... 11

40. What action is being taken to research where the water is coming from particularly in the Black Walnut Trail area? Could it be coming from underground waterways or under the railway tracks? Have these been ruled out? ..... 11

41. How many other Mississauga communities other than Lisgar experienced flooding during the August 28, 2021 event? ..... 12

### Additional Measures

42. What measures can residents take to help limit the impact of water on their properties? ..... 12

43. Are approvals for new home builds being lessened to help with this water problem? ..... 12

44. Why was the Stormwater pond at Tacc Drive and Winston Churchill Blvd. dredged instead of Osprey Marsh? ..... 12

### Miscellaneous

45. Is flooding specifically as a result of the 3 sewer system? ..... 12

46. If the Lisgar area was to receive 100 mm of rain over 24 hours, would a sump pump in a home be helpful? How much can the storm sewer system handle? Would water likely infiltrate into a home? ... 13

47. A house that backs onto Sixteen Mile Creek in Lisgar is pumping water from their backyard, across the pathway to the creek. The water ponds on the pathway in the fall and freezes on the pathway in the winter creating a safety hazard. Can this issue be corrected? ..... 13

## Cactus Gate Pumping Station

1. **Why was the Cactus Gate Pumping Station not built with a greater capacity?**

   The capacity of the Cactus Gate Pumping Station was determined based on hydraulic modelling of the Foundation Drain Collector (FDC) sewer system, which used data from several observed storm events. This modelling indicated that the expected inflow would be approximately 70 Litres/second (L/s) and as such, the pumping station was designed to this capacity (single pump). These analyses were documented in the previously completed 2018 Class EA Report. The pumping station has a second pump that can be activated to provide additional capacity if needed.

2. **Could the Cactus Gate Pumping Station have been built with greater capacity to avoid the construction of another pumping station on Black Walnut Trail?**

   No, greater pumping capacity at the Cactus Gate Pumping Station would not be expected to sufficiently address issues further downstream or eliminate the need for additional pumping stations. Further downstream, the FDC sewer continues to collect flows from adjacent areas (side streets). Based on the available monitoring data, these areas also experience issues with excess flows in the FDC system. Additionally, there is a limit to how far pumps can draw water from, and a single pumping station, regardless of the location in the Black Walnut Trail area or the capacity, would have been insufficient to reduce all of the FDC inflows. As such, there is still a need for additional pumping stations.

3. **Does the water that bypasses the Cactus Gate Pumping Station create issues downstream?**

   The Cactus Gate Pumping Station does not capture all of the inflow in the FDC sewer. Flow within the FDC sewer is diverted to the pumping station once it reaches a level above the “spring line” (50% pipe full). The flow diversion pipe is much larger than the FDC sewer pipe on Black Walnut Trail and as such, a large portion of the flow above this threshold is diverted to the pumping station. The remaining water in the FDC sewer system continues to drain downstream; however, at a much reduced flow rate and volume than without the pumping station in place.

4. **Does the water that is pumped at the Cactus Gate Pumping Station flow to the site of the next proposed pump? Where does the water from the pumping station end up?**

   No. Water that is pumped from the FDC at the Cactus Gate Pumping Station discharges to the surface and then flows towards the Sixteen Mile Creek tributary via a stone lined channel. Future proposed pumping stations would similarly discharge the FDC pumped flows to the creek.

5. **What is the Litres Per Minute (LPM) capacity of the permanent pumping station vs. the temporary pumps?**

   The Cactus Gate Pumping Station has a single pump capacity of 4,200 L/min, and dual pump capacity of approximately 7,200 L/min. The 6 inch (6”) temporary pumps currently used as part of the High Water Protocol (HWP) have a capacity of approximately 10,583 L/min; however, these require human intervention to activate.

6. **Where is the Cactus Gate pumping station located and what is the size of its footprint?**

   The Cactus Gate Pumping Station is located in the Cactus Gate parkette immediately west of the intersection of Black Walnut Trail and Cactus Gate. The primary above-ground works on the site (wet well, valve chamber, control systems) occupy approximately 20 metres (m) x 6 m, or 120m$^2$. Other subsurface features (piping connections) require more area.

7. **Has the City received a federal grant for the construction of a pumping station? If so, how much?**

   The City received $1,000,000 in Federal funding and $500,000 in Provincial funding as part of the Clean Water and Wastewater Fund program for the design and construction of the Cactus Gate Pumping Station.

8. **Why did homes still experience basement water infiltration on August 28 even with the Cactus Gate Pumping Station being fully operational?**

   As noted in the response to Question #2, a single pumping station is not sufficient to fully address FDC system surcharging. Additional permanent pumping stations (location, type and capacity) are being assessed as part of the current Class EA study.

9. **Does each pumping station only service the residences downstream from its physical location? If so, what is being done for the dwellings north of Cactus Gate?**

   Each pumping station removes water from the FDC system (and potentially the utility trench, if a low flow component is included as was done for the Cactus Gate site) in the immediate vicinity of the pumping station. This does benefit upstream areas (since the water is being removed as it enters the FDC system which limits water levels in the FDC upstream) as well as downstream areas (by reducing flows to the downstream areas from that portion of the FDC sewer system).

   Dwellings north of Cactus Gate benefit from the Cactus Gate Pumping Station. Further measures are being considered, including disconnections of unauthorized private connections to the FDC sewer system, which would further reduce the risk of FDC sewer surcharging. The FDC Sump Pump Subsidy Program is also available to residents serviced by the FDC, which covers up to 100% of the cost of installing a sump pump, to a maximum of $6,000.

10. **What is the general extent of the service area for each pumping station?**

    Please refer to the response to Question #9. In general, the pumping station benefits both upstream and downstream areas. The exact limits would vary depending on the location, the capacity of the pumps, and the nature of the storm event, as each is unique.

## Future Pumping Stations

11. **What is the total number of future pumping stations that the City will build in Lisgar?**

    There are three new pumping stations proposed based on the 10-Year Capital Program identified in the 2022 to 2025 Business Plan.

12. **Why is Black Walnut Trail being considered for another pumping station given that the first pumping station is constructed on this street? Aren't they too close to each other?**

    Excessive inflows to the FDC sewer system in the Black Walnut Trail area continue to occur and an additional pumping station is required further south of the Cactus Gate Pumping Station. As presented at the November 17, 2021 public meeting, the FDC system in that area responds rapidly to rainfall events which makes the area a priority for another automated permanent pumping station which can respond to these conditions.

13. **If a pumping station is built in the parkette at Black Walnut Trail and Smoke Tree Road, what will be done to provide safe access to the pedestrian bridge in the parkette, which is used to access a park and 2 schools?**

    Providing for a safe access through the parkette with the pumping station in place will be reviewed and determined as part of the subsequent detailed design phase. During construction, efforts would be made to keep the pedestrian bridge open; however, temporary closure may be necessary to construct some works, such as the pumping station outlet.

14. **In the Public Information Centre presentation, there was mention that the stations further downstream would need greater power (capacity) to handle the increased flows. Why wasn't the first station built with more power?**

    Areas further downstream would serve a greater drainage area than the Cactus Gate system and therefore have greater flows. As such, higher capacity pumps with greater power demands may be required. The actual capacity of pumps used will be determined during the detailed design phase. With respect to the question regarding the Cactus Gate pumping station, please refer to the response to Question #1.

15. **How large of an area is required for a pumping station? How much area will be occupied in Priority Area 7?**

    The exact area for the pumping station would vary with each location, as it would depend on the specific site constraints (locations of services, topography, location of trees and the creek, etcetera). Space would be required for sub-surface features which would not be visible following construction, as well as above ground features. Please also refer to the response to Question #6 for the approximate size of the above-ground features for the Cactus Gate Pumping Station (approximately 120 $m^2$).

16. **How has the expected increase in extreme weather due to climate change been factored into the pumping station plans?**

    It is challenging to directly assess the impacts of climate change into the design of the FDC pumping stations. Furthermore, there is no accepted industry practice in place for addressing climate change impacts for foundation drainage as there is for surface drainage. However, this will be considered further as part of the Class EA and measures may be incorporated into the subsequent detailed design phase to the extent possible, as part of the analysis and sizing of the pumps. Where climate change impacts cannot be directly incorporated or analyzed, it is likely that alternatives will be considered, including potentially allocating additional pumping capacity.

**17. Can future FDC pumping structures, excluding the control panel and generator, be constructed below ground level for aesthetic purposes?**

Surface access to the future pumping station features (the wet well and valve chamber primarily) is important and needs to be maintained to ensure they are accessible for operations and maintenance purposes. Where feasible, it may be possible to modify the site grading to limit the amount of visible features to improve the overall aesthetics. This would be considered further as part of the subsequent detailed design phase.

**18. Will the pumping station capacity be sufficient to remove FDC flow in a 100-year storm?**

A 100-year storm event inflow to the FDC sewer system is challenging to simulate as there is no accepted industry practice or methodology for assessing foundation drainage during storm events. The inflows to the FDC sewer system vary by location and is difficult to replicate for larger storm events. The currently developed hydraulic modelling tools are based on replicating the observed water levels in the FDC storm sewer system for actual monitored storm events. As such, it is difficult to reasonably predict how much inflow the FDC sewer system would potentially receive for a 100-year storm event and what the associated pumping capacity would be. Additional pumping capacity would be considered further as part of the detailed design phase.

**19. What is the noise level of these pumping stations? Will it be disruptive to nearby residents?**

The pumps are located well below ground in the wet well (approximately 7 m below ground for the current Cactus Gate site), which is an enclosed concrete chamber. As such, there is very little noise during the typical pumping station operation. To date, the City has not received any noise complaints from the operation of the Cactus Gate Pumping Station. In the unlikely event of a power outage, the backup generator would operate which does generate some noise but is within the acceptable regulatory limits set by the Ministry of the Environment, Conservation and Parks. There would be some noise from the required testing of the backup generator for operations and maintenance purposes; however, this is for a short period only, typically an hour or less, once a month during the day.

**20. If all four pumping stations are constructed, what will the total combined pumping capacity be? How does this compare to the current state of one pumping station and the High Water Protocol pumps?**

The total combined capacity of four pumping stations is yet to be determined. The capacity of each pumping station will be calculated through modelling in the design phase. As such, it is unknown how having the current one pumping station and High Water Protocol pumps setup would compare to the pumping capacity of four pumping stations.

**21. Has the budget for future pumping stations been approved?**

As noted in the answer to Question #11, there are three new pumping stations proposed based on the 10-Year Capital Program identified in the 2022 to 2025 Business Plan. Given that budgets are approved by Council on an annual basis, the construction budget for the second pumping station and the design budget for the third pumping station were approved for 2022. Budget approval for the design and/or construction of the remaining pumping stations will be considered in subsequent years.

22. **The recommendation in the EA is for three additional pumping stations. If this is approved and three stations are built and there is reason to consider additional stations after that, would a new EA process be required? If so, would it be beneficial to identify the Priority Locations 4 and 5 now even if we don't need them, rather than spend the money and time on another EA in five or more years?**

    As presented at the November 17, 2021 public meeting, a total of 6 locations were short-listed for further review. Out of these 6 locations, 3 locations were recommended as high priority locations for implementation. However, it was noted that the drainage system in the Lisgar District should continue to be monitored and if necessary, additional pumping stations be considered for the other 3 short-listed locations. This will be clearly stated in the current Class EA, such that another EA would not be required, provided that the additional works are considered within the typical 10-year validity period for Class EAs.

## High Water Protocol (HWP)

23. **A paved access at Pintail Circle is currently used by HWP pumping vehicles during rain events. Is this paved access permanent? If not, when will it be removed?**

    The paved area will remain in place as long as the HWP utilizes this maintenance hole location. If and when the HWP is no longer required, the paved area may be reduced in size or removed.

24. **Why do I always see a pump truck on the pathway at Derry Road and Black Walnut Trail?**

    This vehicle and 6" pump are part of the HWP and are dispatched to the Black Walnut Trail maintenance hole location, as well as two other maintenance hole locations in the Lisgar area (near Pintail Circle and along the Lisgar Meadowbroook Trail, south of Osprey Blvd.), when the criteria for deployment of the 6" pumps have been met. The operator of the pump will monitor water levels inside the FDC maintenance hole every 15 minutes and if required, due to rising water levels in the FDC sewer, activate the pump.

25. **Could the HWP be modified so that the contractor begins pumping when the pipe is 25% full rather than 50%?**

    Having the pumps activated at 25% would not be effective. With the size of the pumps and the intakes that are used, they will not be able to pull water out effectively at the 25% capacity level. Having it set at 50% capacity, allows the pumps to run as intended and efficiently discharge water from the FDC system.

26. **On previous occasions, the truck at Derry Road was not operational/pumping water. Why does this happen? Is there debris in the FDC? What action does the contractor take to address this situation? What action is being taken by the City to ensure this truck is operational?**

    We are aware of one instance where the 6" pump appeared as though it was not pumping water. This instance was reviewed by staff and determined that the discharge varied over a short period of time; however, the pump was operating as intended. It is noted that during this time, the water levels within the FDC sewer were below full pipe capacity, which likely contributed to the varied discharge. The 6" pumps draw and discharge a large amount of water and if there are low water levels within the FDC sewer, the pump may have a varied discharge, as experienced during this instance.

Debris may find its way into the FDC sewer system through unauthorized connections into the system such as downspout connections or sanitary cross connections, which were discussed at the November 17, 2021 public meeting. The 6" pumps are designed to draw in and discharge debris up to 3" in size; however, there may be instances where the debris can cover the intake screens of the pumps. In this rare case, the contractor would turn off the pump and attempt to remove the debris, prior to reinstalling the intake and starting the pump up again. In the event that the large 6" pumps are not operating as intended, each HWP truck at the three High Water Protocol locations have an additional three 4" trash pumps that can be activated. Additionally, when the HWP pumps are activated and begin pumping, a City Duty Supervisor is called in to review all three HWP maintenance hole locations to ensure that the HWP is being conducted in accordance with the Standard Operating Procedure.

**27. Is HWP only activated due to forecasted conditions or is it also reactive when unexpected high water conditions occur? What is the reaction time?**

The HWP is activated due to forecasted conditions that meet the HWP criteria as well as reactively in response to current conditions. The criteria for deployment of the HWP is based on conditions that could possibly cause high water conditions in the FDC sewer. The reaction time from dispatch to full setup is typically between 1-2 hours.

## Maintenance

**28. What maintenance is being conducted on the FDC to ensure that debris will not impact the pumping hoses?**

The FDC sewer system in Lisgar is flushed and inspected utilizing a Closed Circuit Television camera every 3 years to ensure that there are no blockages or debris within the system. Debris may enter the system through unauthorized connections, such as downspout connections or sanitary cross connections.

**29. Will the area north of the Osprey bridge be cleared of grass/weeds to prevent winter snow and ice build-up?**

The City's creek corridors are managed as naturalized areas and this approach offers numerous environmental benefits such as improved stream health and water quality for aquatic life. The potential for vegetation and/or woody debris to block flow and prevent drainage of the creek is considered in the City's regular watercourse inspection and maintenance programs. Sixteen Mile Creek tributary, north of Osprey Boulevard, was last inspected in September 2021 and no concerns with the vegetation were identified at that time. Through City inspections, staff has not found there to be an issue with winter conditions preventing drainage of the creek. If the creek is blocked at any time, residents are encouraged to contact 311 so that the appropriate staff can inspect and respond accordingly.

## Smoke Testing

**30. If a homeowner has an unauthorized direct connection (i.e. downspouts, sanitary connections) into the FDC, will they be asked to disconnect?**

Yes, they will be asked to disconnect. The City will be exploring options on downspout disconnections as noted in the answer to Question #31.

**31. Can the City mandate that homeowners have to disconnect downspouts from the FDC within a specified period of time or the homeowner will be billed?**

The City is undertaking investigations to better understand the extent of downspouts that are connected into the FDC system. The City will then explore options and determine an action plan once the investigation is complete.

**32. If there are sanitary vents connected to the FDC, the assumption is that these would have been connected by the builders. Is this an accurate assumption? What action will the City take against the builders?**

This assumption may not be appropriate.

**33. Given the small percentage of homes that might have unauthorized connections to the FDC, does the City feel that this is a beneficial use of resources?**

The City is undertaking investigations to identify and determine the number of unauthorized private sources of flow into the FDC. As investigations are ongoing, it is considered premature to characterize the percentage of homes with unauthorized connections as “small”.

The FDC system is not designed to accommodate inflows from downspouts or sanitary discharge. Roof downspouts that are connected to the FDC can be a significant source of inflow during a storm event. Additionally, the City’s Storm Sewer Use By-law sets strict limits on what can be discharged into a stormwater drainage system.

## Creek

**34. Why is the creek overflowing?**

It is not clear what location within the Lisgar Creek (tributary of Sixteen Mile Creek) is being referred to or a specific area that has experienced overflowing. In general, creeks are naturally or by design intended to exceed their low flow channel and flow in the adjacent floodplain/overbank areas during a sufficiently large storm event.

**35. The creek overflowing appears to be an indication that flooding will occur. What is being done to ensure the creek does not cause water to be pushed back towards homes?**

Based on previous monitoring work within the drainage systems in the Lisgar District, it has been demonstrated that the creek is not the source of water flowing into the FDC. There have been no known issues with riverine (creek based) flooding of homes in the Lisgar District to date.

## External Lands

**36. Does the City know where the water table is on the land west of Ninth Line?**

The water table was not delineated as part of the Scoped Subwatershed Study that was completed for the Ninth Line lands. However, available well data indicates that the water table is generally between 1 and 2 metres below ground surface.

**37. Does the City know where the floodplain is west of Ninth Line?**

The Regulatory floodplain (greater of the 100-year storm or Hurricane Hazel) was delineated for Sixteen Mile Creek within the Ninth Line lands as part of the Scoped Subwatershed Study. The draft Scoped Subwatershed Study is available online at the following link:

https://www.peelregion.ca/planning/officialplan/pdfs/ropa/SWS-Phase1-Jan-2015.pdf

**38. What is the impact of the proposed development to the west?**

There is no expected impact of the proposed development to the west on the Lisgar District foundation drainage system. This is a separate subwatershed/catchment area and the water (surface and ground) drains to the west.

**39. Is there a chance that the proposed development on the west side of Ninth Line may back up water to the east side of Lisgar?**

No. As noted in the response to Question #38, this is a separate drainage system.

**40. What action is being taken to research where the water is coming from particularly in the Black Walnut Trail area? Could it be coming from underground waterways or under the railway tracks? Have these been ruled out?**

The source of additional water and associated causes of basement water infiltration were summarized as part of a summary report released as part of a public meeting in March 2015. That report summarized the assessment of potential sources and ultimately identified that the buildup of water in the utility trench is the primary cause. The GO station to the north of the railway tracks was considered as a potential contributing cause and ultimately ruled out as a primary cause or factor based on field monitoring data. Likewise, groundwater was ruled out as a primary cause or factor through further field monitoring. Monitoring data have clearly shown that the FDC system in the Black Walnut Trail area in particular responds very rapidly to rainfall events. This, as well as other monitoring data (such as water temperature) has clearly indicated that the water is sourced from local stormwater rather than groundwater sources.

Since that time, the City has undertaken numerous additional investigations and monitoring work to identify the sources of stormwater to the FDC sewer system and utility trench. This includes smoke testing to identify cross-connections. The City has also previously undertaken works to attempt to limit the inflow of excess stormwater to the FDC, including storm sewer lining and catchbasin subdrain plugs. As noted in the November 17, 2021 public meeting, it is considered that a contributing source of this water relates to unauthorized direct connections, namely rooftop downspouts which discharge below ground and likely into the residential foundation drain (weeping tile) system.

**41. How many other Mississauga communities other than Lisgar experienced flooding during the August 28, 2021 event?**

Reported incidents came in from other communities in Wards 3, 8, 9 and 11 around the same period.

## Additional Measures

**42. What measures can residents take to help limit the impact of water on their properties?**

A resident should consider the following to limit the impact of water on their property:

- A resident can ensure that the grading around their home's foundation slopes away from their home.
- Downspouts should not be connected directly into the weepers or the FDC system. They should outlet on grade away from a resident's home.
- Basement renovations, such as the installation of a new bathroom, should be completed in accordance with the Ontario Building Code and connected to the sanitary sewer.
- The installation of a sump pump in the basement can provide an additional safeguard against basement water infiltration.

**43. Are approvals for new home builds being lessened to help with this water problem?**

There have not been many new developments in the study area for a number of years, but those that went ahead were subject to stringent stormwater management requirements. Otherwise, the City has limited ability to stop new builds (i.e. single family residential) but, where possible, asks for appropriate drainage measures such as requiring sump pumps to pump water around the foundation up to surface level. No new developments are permitted to connect to the existing FDC system.

**44. Why was the Stormwater pond at Tacc Drive and Winston Churchill Blvd. dredged instead of Osprey Marsh?**

Following guidance from the Ministry of the Environment, Conservation and Parks, staff determine the need for dredging a pond by measuring the sediment volume in the pond. The Tacc Drive pond was previously identified for cleanout through this assessment process and capital works were subsequently carried out to dredge the pond. Osprey Marsh was last measured in 2018 and the sediment levels indicated that the pond did not require dredging. Staff continue to monitor the pond and will schedule future works in the Capital Program as necessary.

## Miscellaneous

**45. Is flooding specifically as a result of the 3 sewer system?**

No – basement water infiltration is not specifically as a result of the 3 pipe system (sanitary, storm and FDC). Numerous other municipalities within Southern Ontario utilize the 3 pipe system without reported issues.

**46. If the Lisgar area was to receive 100 mm of rain over 24 hours, would a sump pump in a home be helpful? How much can the storm sewer system handle? Would water likely infiltrate into a home?**

A residential sump pump is designed for low capacity flows such as those which would typically be expected from the foundation drain (weeping tile) around a home. The performance of a sump pump during a large storm event as suggested would depend on factors such as lot grading, soils, condition of the home's foundation drain and how much water is directed to it.

The storm sewer system within the Lisgar District was designed for the 1 in 2 year storm event. Overland flow routes (i.e. roadways with outlets to the creek system) were designed to the 1 in 100 year storm event. It should be noted though that these systems are largely independent from the FDC.

**47. A house that backs onto Sixteen Mile Creek in Lisgar is pumping water from their backyard, across the pathway to the creek. The water ponds on the pathway in the fall and freezes on the pathway in the winter creating a safety hazard. Can this issue be corrected?**

We appreciate this being brought to our attention. While it is a property owner's responsibility to manage drainage on their site, this is something the City may look into further for corrective possibilities.

# Appendix G6
# Indigenous Consultation

## Shams, Aniqa

**From:** Bell, Trevor (MECP) <Trevor.Bell@ontario.ca>
**Sent:** Friday, May 21, 2021 2:37 PM
**To:** Shakeel, Meera
**Subject:** RE: City of Mississauga - Schedule B - Municipal Class EA - Lisgar District Pumping Station(s)

**Follow Up Flag:** Follow up
**Flag Status:** Completed

**CAUTION:** External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Hi Meera,

Thanks for your email. I will forward it to a senior advisor to confirm your list of Indigenous communities for consultation. Please note that it may take up to two weeks for me to receive the information. In the meantime, if you wish, I encourage you to proceed with early engagement with the communities you have listed below.

Please also note that the Mississaugas of the Credit First Nation have removed the word “New” from their official name.

Thanks,
Trevor

**Trevor Bell** | Environmental Planner/Environmental Assessment Coordinator
*Project Review Unit, Environmental Assessment and Permissions Branch*
*Ministry of the Environment, Conservation and Parks*
5775 Yonge Street, 8th floor, Toronto ON, M2M 4J1
New Phone: 437-770-3731 | trevor.bell@ontario.ca

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**From:** Shakeel, Meera <meera.shakeel@woodplc.com>
**Sent:** May 21, 2021 1:19 PM
**To:** EA Notices to CRegion (MECP) <eanotification.cregion@ontario.ca>; Bell, Trevor (MECP) <Trevor.Bell@ontario.ca>
**Cc:** Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; Senior, Matt <matt.senior@woodplc.com>; Stokke, Samantha <samantha.stokke@woodplc.com>; Kelly, Mary K <mary.k.kelly@woodplc.com>
**Subject:** City of Mississauga - Schedule B - Municipal Class EA - Lisgar District Pumping Station(s)

**CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.**

Good Afternoon Trevor,

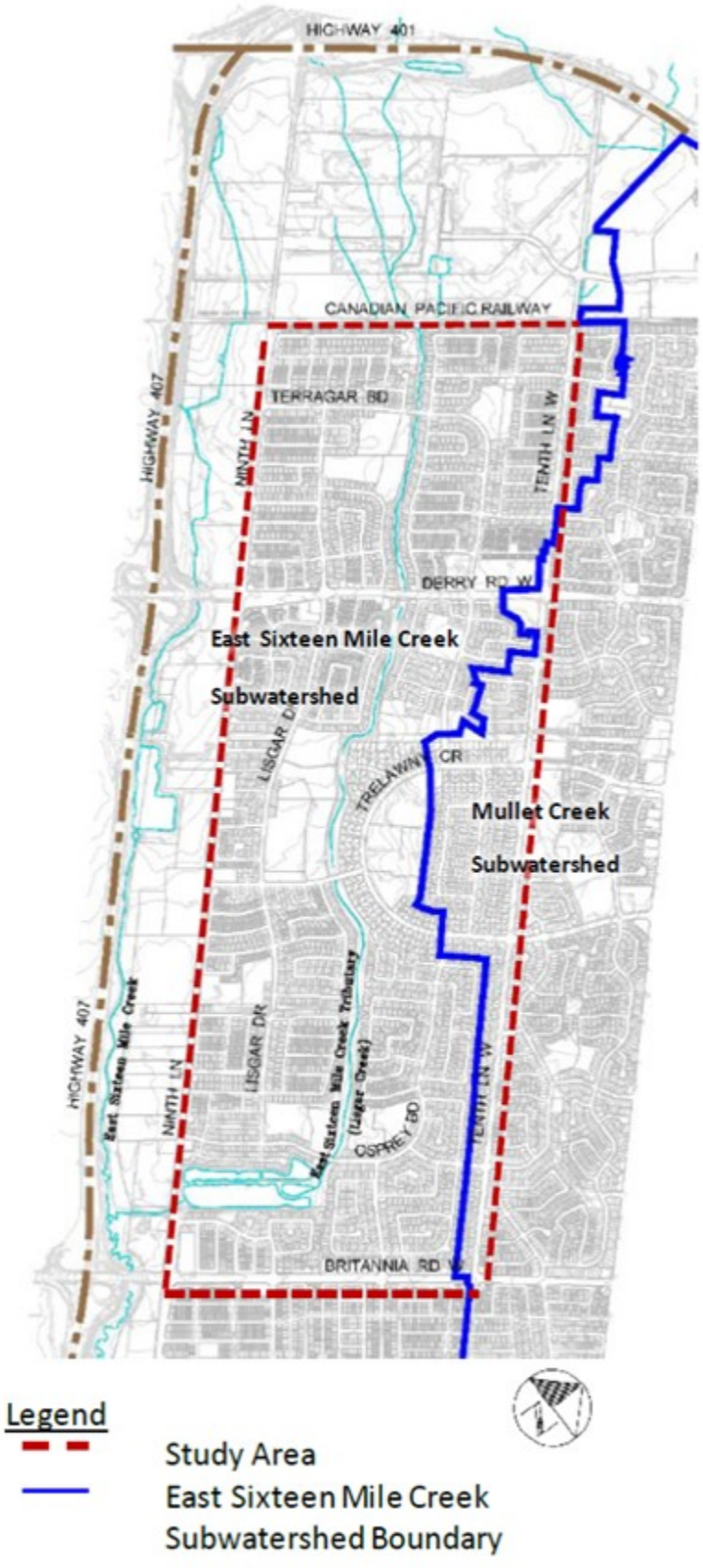
The City of Mississauga has retained Wood Environment & Infrastructure Solutions to undertake a Schedule B Municipal Class Environmental Assessment to determine the number, preferred location(s) and type(s) of pumping stations within the Lisgar District to reduce the potential for basement water infiltration. A map illustrating the location of the study area is provided at the end of this email. Please note that this Class EA Study is a continuation of the 2018 Lisgar District Pumping Station Municipal Class EA Study.

A Notice of Study Commencement for this Class EA Study was published in the Mississauga News on April 29th, 2021. The NOC is attached in this email for your reference.

We have completed the attached Project Information Form for this project. We would like to initiate early engagement with the potentially affected Indigenous Nations, and would like to confirm with you the Indigenous Nations that should be consulted as part of this Class EA Study. The following Indigenous Nations were contacted during the 2018 Class EA Study:

- Haudenosaunee Development Institute;
- Mississaugas of the New Credit First Nation; and
- Six Nations of the Grand River.

Please confirm the Indigenous Nations that should be consulted in addition to the ones mentioned-above. We would appreciate if you could please advise on this at your earliest convenience. Thank you.




Regards,

**Meera Shakeel, E.I.T**

## Shams, Aniqa

**From:** Shakeel, Meera
**Sent:** Wednesday, June 16, 2021 2:11 PM
**To:** Shams, Aniqa
**Cc:** Kelly, Mary K
**Subject:** FW: Lisgar District Pumping Stations - Schedule B Municipal Class EA
**Attachments:** MECP Response Letter_Notice of Commencement_Lisgar District Pumping Stations.pdf

Hi Aniqa,

Find attached the letter from MECP confirming the list of Indigenous Communities that should be consulted for the Lisgar Class EA.

Thanks.

Regards,

**Meera Shakeel, E.I.T**
C: 905 730-3879

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**From:** Bell, Trevor (MECP) <Trevor.Bell@ontario.ca>
**Sent:** Wednesday, June 16, 2021 2:04 PM
**To:** Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>
**Cc:** Potter, Katy (MECP) <Katy.Potter@ontario.ca>; Wild, Loralyn (MECP) <Loralyn.Wild@ontario.ca>; Shakeel, Meera <meera.shakeel@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>
**Subject:** Lisgar District Pumping Stations - Schedule B Municipal Class EA

**CAUTION:** External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Good afternoon,

Please find attached a letter from the Ministry of the Environment, Conservation and Parks, Environmental Approvals Branch, regarding the above mentioned project. Feel free to contact me directly with any questions or concerns you may have.

Sincerely,

**Trevor Bell** | Environmental Planner/Environmental Assessment Coordinator
*Project Review Unit, Environmental Assessment and Permissions Branch*
*Ministry of the Environment, Conservation and Parks*
5775 Yonge Street, 8th floor, Toronto ON, M2M 4J1
New Phone: 437-770-3731 | trevor.bell@ontario.ca

**Ministry of the Environment, Conservation and Parks**

***Environmental Assessment Branch***

1st Floor
135 St. Clair Avenue W
Toronto ON M4V 1P5
Tel.: 416 314-8001
Fax.: 416 314-8452

**Ministère de l'Environnement, de la Protection de la nature et des Parcs**

***Direction des évaluations environnementales***

Rez-de-chaussée
135, avenue St. Clair Ouest
Toronto ON M4V 1P5
Tél. : 416 314-8001
Téléc. : 416 314-8452

June 16, 2021

Elizabeth Dollimore, P.Eng. MBA
Project Manager
City of Mississauga
elizabeth.dollimore@peelregion.ca
BY EMAIL ONLY

Re: **Lisgar District Pumping Stations**
**Region of Peel**
**Schedule B Municipal Class Environmental Assessment**
**Notice of Study Commencement**

Dear Ms. Dollimore,

This letter is in response to the Notice of Commencement for the above noted project. The Ministry of the Environment, Conservation and Parks (MECP) acknowledges that the City of Mississauga has indicated that the study is following the approved environmental planning process for a Schedule B project under the Municipal Engineers Association's Municipal Class Environmental Assessment (Class EA).

The attached "Areas of Interest" document provides guidance regarding the ministry's interests with respect to the Class EA process. Please identify the areas of interest which are applicable to the project and ensure they are addressed. Proponents who address all the applicable areas of interest can minimize potential delays to the project schedule.

The Crown has a legal duty to consult Aboriginal communities when it has knowledge, real or constructive, of the existence or potential existence of an Aboriginal or treaty right and contemplates conduct that may adversely impact that right. Before authorizing this project, the Crown must ensure that its duty to consult has been fulfilled, where such a duty is triggered. Although the duty to consult with Aboriginal peoples is a duty of the Crown, the Crown may delegate procedural aspects of this duty to project proponents while retaining oversight of the consultation process.

The proposed project may have the potential to affect Aboriginal or treaty rights protected under Section 35 of Canada's *Constitution Act* 1982. Where the Crown's duty to consult is triggered in relation to the proposed project**, the MECP is delegating the procedural aspects of rights-based consultation to the proponent through this letter.** The Crown intends to rely on the delegated consultation process in discharging its duty to consult and maintains the right to participate in the consultation process as it sees fit.

Based on information provided to date and the Crown`s preliminary assessment the proponent is required to consult with the following communities who have been identified as potentially affected by the proposed project:

- Mississaugas of the Credit First Nation;
- Six Nations of the Grand River (Both the Six Nations Elected Council and the Haudenosaunee Confederacy Chiefs Council); and
- Huron-Wendat Nation (if there is potential for the project to impact archeological resources).

Steps that the proponent may need to take in relation to Aboriginal consultation for the proposed project are outlined in the "Code of Practice for Consultation in Ontario's Environmental Assessment Process".

Additional information related to Ontario's *Environmental Assessment Act* is available online at: www.ontario.ca/environmentalassessments

Please also refer to the attached document "A Proponent's Introduction to the Delegation of Procedural Aspects of consultation with Aboriginal Communities" for further information.

The proponent must contact the Director of Environmental Assessment Branch under the following circumstances after initial discussions with the communities identified by MECP:

- Aboriginal or treaty rights impacts are identified to you by the communities;
- You have reason to believe that your proposed project may adversely affect an Aboriginal or treaty right;
- Consultation with Indigenous communities or other stakeholders has reached an impasse; or
- A Part II Order request is expected based on impacts to Aboriginal or treaty rights.

The MECP will then assess the extent of any Crown duty to consult for the circumstances and will consider whether additional steps should be taken, including what role you will be asked to play should additional steps and activities be required.

Once the report is finalized, the proponent must issue a Notice of Completion providing a minimum 30-day period during which documentation may be reviewed and comment and input can be submitted to the Proponent.

Please ensure that the Notice of Completion advises that outstanding concerns are to be directed to the proponent for a response, and that in the event there are outstanding concerns regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, Part II Order requests on those matters should be addressed in writing to:

Minister Jeff Yurek
Ministry of Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto ON M7A 2J3
minister.mecp@ontario.ca

and

Director, Environmental Assessment Branch
Ministry of Environment, Conservation and Parks
135 St. Clair Ave. W, 1st Floor
Toronto ON, M4V 1P5
EABDirector@ontario.ca

Please note the project cannot proceed until at least 30 days after the end of the public review period provided for in the Notice of Completion.

Further, the project may not proceed after this time if:

- a Part II Order request has been submitted to the ministry regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights; or
- the Director has issued a Notice of Proposed Order regarding the project.

The public can request a higher level of assessment on a project if they are concerned about potential adverse impacts to constitutionally protected Aboriginal and treaty rights. In addition, the Minister may issue an order on his or her own initiative within a specified time period. The Director will issue a Notice of Proposed Order to the proponent if the Minister is considering an order for the project within 30 days after the conclusion of the comment period on the Notice of Completion. At this time, the Director may request additional information from the proponent.

Once the requested information has been received, the Minister will have 30 days to make a decision or impose conditions on your project.

A draft copy of the report should be sent to me prior to the filing of the final report, allowing a minimum of 30 days for the ministry's technical reviewers to provide comments.

Please ensure a copy of the final notice is sent to the ministry's Central Region EA notification email account (eanotification.cregion@ontario.ca) after the report is finalized.

Should you or your project team members have any questions regarding the material above, please contact me at trevor.bell@ontario.ca.

Sincerely,

Trevor Bell
Regional Environmental Assessment Coordinator

cc: Loralyn Wild, Manager (A), Halton Peel District Office, MECP
Katy Potter, Supervisor, Project Review Unit, MECP
Matt Senior, Consultant Project Manager, Wood
Meera Shakeel, Environmental Planner, Wood

Attachments: Areas of Interest
A Proponent's Introduction to the Delegation of Procedural Aspects of consultation with Aboriginal Communities

**AREAS OF INTEREST (v. February 2021)**

*It is suggested that you check off each section after you have considered / addressed it.*

☐ **Planning and Policy**

- Projects located in MECP Central Region are subject to A Place to Grow: Growth Plan for the Greater Golden Horseshoe (2020)**.** Parts of the study area may also be subject to the Oak Ridges Moraine Conservation Plan (2017), Niagara Escarpment Plan (2017), Greenbelt Plan (2017) or Lake Simcoe Protection Plan (2014). Applicable plans and the applicable policies should be identified in the report, and the proponent should describe how the proposed project adheres to the relevant policies in these plans.

- The Provincial Policy Statement (2020) contains policies that protect Ontario's natural heritage and water resources. Applicable policies should be referenced in the report, and the proponent should describe how the proposed project is consistent with these policies.

- In addition to the provincial planning and policy level, the report should also discuss the planning context at the municipal and federal levels, as appropriate.

☐ **Source Water Protection**

The *Clean Water Act*, 2006 (CWA) aims to protect existing and future sources of drinking water. To achieve this, several types of vulnerable areas have been delineated around surface water intakes and wellheads for every municipal residential drinking water system that is located in a source protection area. These vulnerable areas are known as a Wellhead Protection Areas (WHPAs) and surface water Intake Protection Zones (IPZs). Other vulnerable areas that have been delineated under the CWA include Highly Vulnerable Aquifers (HVAs), Significant Groundwater Recharge Areas (SGRAs), Event-based modelling areas (EBAs), and Issues Contributing Areas (ICAs). Source protection plans have been developed that include policies to address existing and future risks to sources of municipal drinking water within these vulnerable areas.

Projects that are subject to the Environmental Assessment Act that fall under a Class EA, or one of the Regulations, have the potential to impact sources of drinking water if they occur in designated vulnerable areas or in the vicinity of other at-risk drinking water systems (i.e. systems that are not municipal residential systems). MEA Class EA projects may include activities that, if located in a vulnerable area, could be a threat to sources of drinking water (i.e. have the potential to adversely affect the quality or quantity of drinking water sources) and the activity could therefore be subject to policies in a source protection plan. Where an activity poses a risk to drinking water, policies in the local source protection plan may impact how or where that activity is undertaken. Policies may prohibit certain activities, or they may require risk management measures for these activities. Municipal Official Plans, planning decisions, Class EA projects (where the project includes an activity that is a threat to drinking water) and prescribed instruments must conform with policies that address significant risks to drinking water and must have regard for policies that address moderate or low risks.

- In October 2015, the MEA Parent Class EA document was amended to include reference to the Clean Water Act (Section A.2.10.6) and indicates that proponents undertaking a Municipal Class EA project must identify early in their process whether a project is or could potentially be occurring with a vulnerable area. **Given this requirement, please include a section in the report on source water protection.**

    - The proponent should identify the source protection area and should clearly document how the proximity of the project to sources of drinking water (municipal or other) and any delineated vulnerable areas was considered and assessed. Specifically, the report should discuss whether or not the project is located in a vulnerable area and provide applicable details about the area.

- If located in a vulnerable area, proponents should document whether any project activities are prescribed drinking water threats and thus pose a risk to drinking water (this should be consulted on with the appropriate Source Protection Authority). Where an activity poses a risk to drinking water, the proponent must document and discuss in the report how the project adheres to or has regard to applicable policies in the local source protection plan. This section should then be used to inform and be reflected in other sections of the report, such as the identification of net positive/negative effects of alternatives, mitigation measures, evaluation of alternatives etc.

- While most source protection plans focused on including policies for significant drinking water threats in the WHPAs and IPZs it should be noted that even though source protection plan policies may not apply in HVAs, these are areas where aquifers are sensitive and at risk to impacts and within these areas, activities may impact the quality of sources of drinking water for systems other than municipal residential systems.

- In order to determine if this project is occurring within a vulnerable area, proponents can use this mapping tool: http://www.applications.ene.gov.on.ca/swp/en/index.php. Note that various layers (including WHPAs, WHPA-Q1 and WHPA-Q2, IPZs, HVAs, SGRAs, EBAs, ICAs) can be turned on through the “Map Legend” bar on the left. The mapping tool will also provide a link to the appropriate source protection plan in order to identify what policies may be applicable in the vulnerable area.

- For further information on the maps or source protection plan policies which may relate to their project, proponents must contact the appropriate source protection authority. **Please consult with the local source protection authority to discuss potential impacts on drinking water. Please document the results of that consultation within the report and include all communication documents/correspondence.**

More Information
For more information on the *Clean Water Act*, source protection areas and plans, including specific information on the vulnerable areas and drinking water threats, please refer to Conservation Ontario’s website where you will also find links to the local source protection plan/assessment report.

A list of the prescribed drinking water threats can be found in section 1.1 of Ontario Regulation 287/07 made under the *Clean Water Act*. In addition to prescribed drinking water threats, some source protection plans may include policies to address additional “local” threat activities, as approved by the MECP.

**Climate Change**

The document "Considering Climate Change in the Environmental Assessment Process" (Guide) is now a part of the Environmental Assessment program's Guides and Codes of Practice. The Guide sets out the MECP's expectation for considering climate change in the preparation, execution and documentation of environmental assessment studies and processes. The guide provides examples, approaches, resources, and references to assist proponents with consideration of climate change in EA. Proponents should review this Guide in detail.

- **The MECP expects proponents of Class EA projects to:**

1. Consider during the assessment of alternative solutions and alternative designs, the following:
    a. the project's expected production of greenhouse gas emissions and impacts on carbon sinks (climate change mitigation); and
    b. resilience or vulnerability of the undertaking to changing climatic conditions (climate change adaptation).
2. Include a discrete section in the report detailing how climate change was considered in the EA.

How climate change is considered can be qualitative or quantitative in nature and should be scaled to the

project's level of environmental effect. In all instances, both a project's impacts on climate change (mitigation) and impacts of climate change on a project (adaptation) should be considered.

- The MECP has also prepared another guide to support provincial land use planning direction related to the completion of energy and emission plans. The "Community Emissions Reduction Planning: A Guide for Municipalities" document is designed to educate stakeholders on the municipal opportunities to reduce energy and greenhouse gas emissions, and to provide guidance on methods and techniques to incorporate consideration of energy and greenhouse gas emissions into municipal activities of all types. We encourage you to review the Guide for information.

**Air Quality, Dust and Noise**

- If there are sensitive receptors in the surrounding area of this project, a quantitative air quality/odour impact assessment will be useful to evaluate alternatives, determine impacts and identify appropriate mitigation measures. The scope of the assessment can be determined based on the potential effects of the proposed alternatives, and typically includes source and receptor characterization and a quantification of local air quality impacts on the sensitive receptors and the environment in the study area. The assessment will compare to all applicable standards or guidelines for all contaminants of concern. **Please contact this office for further consultation on the level of Air Quality Impact Assessment required for this project if not already advised.**

- If a quantitative Air Quality Impact Assessment is not required for the project, the MECP expects that the report contain a qualitative assessment which includes:

    - A discussion of local air quality including existing activities/sources that significantly impact local air quality and how the project may impact existing conditions;
    - A discussion of the nearby sensitive receptors and the project's potential air quality impacts on present and future sensitive receptors;
    - A discussion of local air quality impacts that could arise from this project during both construction and operation; and
    - A discussion of potential mitigation measures.

- As a common practice, "air quality" should be used an evaluation criterion for all road projects.

- Dust and noise control measures should be addressed and included in the construction plans to ensure that nearby residential and other sensitive land uses within the study area are not adversely affected during construction activities.

- The MECP recommends that non-chloride dust-suppressants be applied. For a comprehensive list of fugitive dust prevention and control measures that could be applied, refer to *Cheminfo Services Inc. Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities* report prepared for Environment Canada. March 2005.

- The report should consider the potential impacts of increased noise levels during the operation of the completed project. The proponent should explore all potential measures to mitigate significant noise impacts during the assessment of alternatives.

**Ecosystem Protection and Restoration**

- Any impacts to ecosystem form and function must be avoided where possible. The report should describe any proposed mitigation measures and how project planning will protect and enhance the local ecosystem.

- Natural heritage and hydrologic features should be identified and described in detail to assess potential impacts and to develop appropriate mitigation measures. The following sensitive environmental features may be located within or adjacent to the study area:
    - Key Natural Heritage Features: Habitat of endangered species and threatened species, fish habitat, wetlands, areas of natural and scientific interest (ANSIs), significant valleylands, significant woodlands; significant wildlife habitat (including habitat of special concern species); sand barrens, savannahs, and tallgrass prairies; and alvars.
    - Key Hydrologic Features: Permanent streams, intermittent streams, inland lakes and their littoral zones, seepage areas and springs, and wetlands.
    - Other natural heritage features and areas such as: vegetation communities, rare species of flora or fauna, Environmentally Sensitive Areas, Environmentally Sensitive Policy Areas, federal and provincial parks and conservation reserves, Greenland systems etc.

We recommend consulting with the Ministry of Natural Resources and Forestry (MNRF), Fisheries and Oceans Canada (DFO) and your local conservation authority to determine if special measures or additional studies will be necessary to preserve and protect these sensitive features. In addition, you may consider the provisions of the Rouge Park Management Plan if applicable.

**Species at Risk**

- The Ministry of the Environment, Conservation and Parks has now assumed responsibility of Ontario's Species at Risk program. Information, standards, guidelines, reference materials and technical resources to assist you are found at https://www.ontario.ca/page/species-risk.

- The Client's Guide to Preliminary Screening for Species at Risk (Draft May 2019) has been attached to the covering email for your reference and use. Please review this document for next steps.

- For any questions related to subsequent permit requirements, please contact SAROntario@ontario.ca.

**Surface Water**

- The report must include enough information to demonstrate that there will be no negative impacts on the natural features or ecological functions of any watercourses within the study area. Measures should be included in the planning and design process to ensure that any impacts to watercourses from construction or operational activities (e.g. spills, erosion, pollution) are mitigated as part of the proposed undertaking.

- Additional stormwater runoff from new pavement can impact receiving watercourses and flood conditions. Quality and quantity control measures to treat stormwater runoff should be considered for all new impervious areas and, where possible, existing surfaces. The ministry's Stormwater Management Planning and Design Manual (2003) should be referenced in the report and utilized when designing stormwater control methods. **A Stormwater Management Plan should be prepared as part of the Class EA process** that includes:

    - Strategies to address potential water quantity and erosion impacts related to stormwater draining into streams or other sensitive environmental features, and to ensure that adequate (enhanced) water quality is maintained
    - Watershed information, drainage conditions, and other relevant background information
    - Future drainage conditions, stormwater management options, information on erosion and sediment control during construction, and other details of the proposed works
    - Information on maintenance and monitoring commitments.

- Ontario Regulation 60/08 under the *Ontario Water Resources Act* (OWRA) applies to the Lake Simcoe Basin, which encompasses Lake Simcoe and the lands from which surface water drains into Lake Simcoe. If the proposed sewage treatment plant is listed in Table 1 of the regulation, the report should describe how the proposed project and its mitigation measures are consistent with the requirements of this regulation and the OWRA.

- Any potential approval requirements for surface water taking or discharge should be identified in the report. A Permit to Take Water (PTTW) under the OWRA will be required for any water takings that exceed 50,000 L/day, except for certain water taking activities that have been prescribed by the Water Taking EASR Regulation – *O. Reg. 63/16*. These prescribed water-taking activities require registration in the EASR instead of a PTTW. Please review the Water Taking User Guide for EASR for more information. Additionally, an Environmental Compliance Approval under the OWRA is required for municipal stormwater management works.

**Groundwater**

- The status of, and potential impacts to any well water supplies should be addressed. If the project involves groundwater takings or changes to drainage patterns, the quantity and quality of groundwater may be affected due to drawdown effects or the redirection of existing contamination flows. In addition, project activities may infringe on existing wells such that they must be reconstructed or sealed and abandoned. Appropriate information to define existing groundwater conditions should be included in the report.

- If the potential construction or decommissioning of water wells is identified as an issue, the report should refer to Ontario Regulation 903, Wells, under the OWRA.

- Potential impacts to groundwater-dependent natural features should be addressed. Any changes to groundwater flow or quality from groundwater taking may interfere with the ecological processes of streams, wetlands or other surficial features. In addition, discharging contaminated or high volumes of groundwater to these features may have direct impacts on their function. Any potential effects should be identified, and appropriate mitigation measures should be recommended. The level of detail required will be dependent on the significance of the potential impacts.

- Any potential approval requirements for groundwater taking or discharge should be identified in the report. A Permit to Take Water (PTTW) under the OWRA will be required for any water takings that exceed 50,000 L/day, with the exception of certain water taking activities that have been prescribed by the Water Taking EASR Regulation – *O. Reg. 63/16*. These prescribed water-taking activities require registration in the EASR instead of a PTTW. Please review the Water Taking User Guide for EASR for more information.

- Consultation with the railroad authorities is necessary wherever there is a plan to use construction dewatering in the vicinity of railroad lines or where the zone of influence of the construction dewatering potentially intercepts railroad lines.

**Excess Materials Management**

- In December 2019, MECP released a new regulation under the Environmental Protection Act, titled "On-Site and Excess Soil Management" (O. Reg. 406/19) to support improved management of excess construction soil. This regulation is a key step to support proper management of excess soils, ensuring valuable resources don't go to waste and to provide clear rules on managing and reusing excess soil. New risk-based standards referenced by this regulation help to facilitate local beneficial reuse which in turn will reduce greenhouse gas emissions from soil transportation, while ensuring

strong protection of human health and the environment. The new regulation is being phased in over time, with the first phase in effect on January 1, 2021. For more information, please visit https://www.ontario.ca/page/handling-excess-soil.

- The report should reference that activities involving the management of excess soil should be completed in accordance with O. Reg. 406/19 and the MECP's current guidance document titled "Management of Excess Soil – A Guide for Best Management Practices" (2014).

- All waste generated during construction must be disposed of in accordance with ministry requirements

**Contaminated Sites**

- Any current or historical waste disposal sites should be identified in the report. The status of these sites should be determined to confirm whether approval pursuant to Section 46 of the EPA may be required for land uses on former disposal sites. We recommend referring to the MECP's D-4 guideline for land use considerations near landfills and dumps.
    - Resources available may include regional/local municipal official plans and data; provincial data on large landfill sites and small landfill sites; Environmental Compliance Approval information for waste disposal sites on Access Environment.

- Other known contaminated sites (local, provincial, federal) in the study area should also be identified in the report (Note – information on federal contaminated sites is found on the Government of Canada's website).

- The location of any underground storage tanks should be investigated in the report. Measures should be identified to ensure the integrity of these tanks and to ensure an appropriate response in the event of a spill. The ministry's Spills Action Centre must be contacted in such an event.

- Since the removal or movement of soils may be required, appropriate tests to determine contaminant levels from previous land uses or dumping should be undertaken. If the soils are contaminated, you must determine how and where they are to be disposed of, consistent with *Part XV.1 of the Environmental Protection Act* (EPA) and Ontario Regulation 153/04, Records of Site Condition, which details the new requirements related to site assessment and clean up. Please contact the appropriate MECP District Office for further consultation if contaminated sites are present.

**Servicing, Utilities and Facilities**

- The report should identify any above or underground utilities in the study area such as transmission lines, telephone/internet, oil/gas etc. The owners should be consulted to discuss impacts to this infrastructure, including potential spills.

- The report should identify any servicing infrastructure in the study area such as wastewater, water, stormwater that may potentially be impacted by the project.

- Any facility that releases emissions to the atmosphere, discharges contaminants to ground or surface water, provides potable water supplies, or stores, transports or disposes of waste must have an Environmental Compliance Approval (ECA) before it can operate lawfully. Please consult with MECP's Environmental Permissions Branch to determine whether a new or amended ECA will be required for any proposed infrastructure.

- We recommend referring to the ministry's environmental land use planning guides to ensure that any potential land use conflicts are considered when planning for any infrastructure or facilities related to wastewater, pipelines, landfills or industrial uses.

**Mitigation and Monitoring**

- Contractors must be made aware of all environmental considerations so that all environmental standards and commitments for both construction and operation are met. Mitigation measures should be clearly referenced in the report and regularly monitored during the construction stage of the project. In addition, we encourage proponents to conduct post-construction monitoring to ensure all mitigation measures have been effective and are functioning properly.

- Design and construction reports and plans should be based on a best management approach that centres on the prevention of impacts, protection of the existing environment, and opportunities for rehabilitation and enhancement of any impacted areas.

- The proponent's construction and post-construction monitoring plans must be documented in the report, as outlined in Section A.2.5 and A.4.1 of the MEA Class EA parent document.

**Consultation**

- The report must demonstrate how the consultation provisions of the Class EA have been fulfilled, including documentation of all stakeholder consultation efforts undertaken during the planning process. This includes a discussion in the report that identifies concerns that were raised and **describes how they have been addressed by the proponent** throughout the planning process. The report should also include copies of comments submitted on the project by interested stakeholders, and the proponent's responses to these comments (as directed by the Class EA to include full documentation).

- Please include the full stakeholder distribution/consultation list in the documentation.

**Class EA Process**

- If this project is a Master Plan: there are several different approaches that can be used to conduct a Master Plan, examples of which are outlined in Appendix 4 of the Class EA. **The Master Plan should clearly indicate the selected approach for conducting the plan**, by identifying whether the levels of assessment, consultation and documentation are sufficient to fulfill the requirements for Schedule B or C projects. Please note that any Schedule B or C projects identified in the plan would be subject to Part II Order Requests under the Environmental Assessment Act, although the plan itself would not be. **Please include a description of the approach being undertaken (use Appendix 4 as a reference).**

- If this project is a Master Plan: Any identified projects should also include information on the MCEA schedule associated with the project.

- The report should provide clear and complete documentation of the planning process in order to allow for transparency in decision-making.

- The Class EA requires the consideration of the effects of each alternative on all aspects of the environment (including planning, natural, social, cultural, economic, technical). The report should include a level of detail (e.g. hydrogeological investigations, terrestrial and aquatic assessments, cultural heritage assessments) such that all potential impacts can be identified, and appropriate

mitigation measures can be developed. Any supporting studies conducted during the Class EA process should be referenced and included as part of the report.

- Please include in the report a list of all subsequent permits or approvals that may be required for the implementation of the preferred alternative, including but not limited to, MECP's PTTW, EASR Registrations and ECAs, conservation authority permits, species at risk permits, MTO permits and approvals under the *Impact Assessment Act*, 2019.

- Ministry guidelines and other information related to the issues above are available at http://www.ontario.ca/environment-and-energy/environment-and-energy. We encourage you to review all the available guides and to reference any relevant information in the report.

**Amendments to the EAA through the Covid-19 Economic Recovery Act, 2020**

Once the EA Report is finalized, the proponent must issue a Notice of Completion providing a minimum 30-day period during which documentation may be reviewed and comment and input can be submitted to the proponent. The Notice of Completion must be sent to the appropriate MECP Regional Office email address (for projects in MECP Southwest Region, the email is eanotification.swregion@ontario.ca).

The public has the ability to request a higher level of assessment on a project if they are concerned about potential adverse impacts to constitutionally protected Aboriginal and treaty rights. In addition, the Minister may issue an order on his or her own initiative within a specified time period. The Director (of the Environmental Assessment Branch) will issue a Notice of Proposed Order to the proponent if the Minister is considering an order for the project within 30 days after the conclusion of the comment period on the Notice of Completion. At this time, the Director may request additional information from the proponent. Once the requested information has been received, the Minister will have 30 days within which to make a decision or impose conditions on your project.

Therefore, the proponent cannot proceed with the project until at least 30 days after the end of the comment period provided for in the Notice of Completion. Further, the proponent may not proceed after this time if:

- a Part II Order request has been submitted to the ministry regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, or
- the Director has issued a Notice of Proposed order regarding the project.

Please ensure that the Notice of Completion advises that outstanding concerns are to be directed to the proponent for a response, and that in the event there are outstanding concerns regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, Part II Order requests on those matters should be addressed in writing to:

Minister Jeff Yurek
Ministry of Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto ON M7A 2J3
minister.mecp@ontario.ca

and

Director, Environmental Assessment Branch
Ministry of Environment, Conservation and Parks
135 St. Clair Ave. W, 1st Floor
Toronto ON, M4V 1P5
EABDirector@ontario.ca

**Definitions**

The following definitions are specific to this document and may not apply in other contexts:

**Aboriginal communities** – the First Nation or Métis communities identified by the Crown for the purpose of consultation.

**Consultation** – the Crown's legal obligation to consult when the Crown has knowledge of an established or asserted Aboriginal or treaty right and contemplates conduct that might adversely impact that right. This is the type of consultation required pursuant to s. 35 of the *Constitution Act, 1982*. Note that this definition does not include consultation with Aboriginal communities for other reasons, such as regulatory requirements.

**Crown** – the Ontario Crown, acting through a particular ministry or ministries.

**Procedural aspects of consultation** – those portions of consultation related to the process of consultation, such as notifying an Aboriginal community about a project, providing information about the potential impacts of a project, responding to concerns raised by an Aboriginal community and proposing changes to the project to avoid negative impacts.

**Proponent** – the person or entity that wants to undertake a project and requires an Ontario Crown decision or approval for the project.

## I. Purpose

The Crown has a legal duty to consult Aboriginal communities when it has knowledge of an existing or asserted Aboriginal or treaty right and contemplates conduct that may adversely impact that right. In outlining a framework for the duty to consult, the Supreme Court of Canada has stated that the Crown may delegate procedural aspects of consultation to third parties. This document provides general information about the Ontario Crown's approach to delegation of the procedural aspects of consultation to proponents.

This document is not intended to instruct a proponent about an individual project, and it does not constitute legal advice.

## II. Why is it Necessary to Consult with Aboriginal Communities?

The objective of the modern law of Aboriginal and treaty rights is the *reconciliation* of Aboriginal peoples and non-Aboriginal peoples and their respective rights, claims and interests. Consultation is an important component of the reconciliation process.

The Crown has a legal duty to consult Aboriginal communities when it has knowledge of an existing or asserted Aboriginal or treaty right and contemplates conduct that might adversely impact that right. For example, the Crown's duty to consult is triggered when it considers issuing a permit, authorization or approval for a project which has the potential to adversely impact an Aboriginal right, such as the right to hunt, fish, or trap in a particular area.

The scope of consultation required in particular circumstances ranges across a spectrum depending on both the nature of the asserted or established right and the seriousness of the potential adverse impacts on that right.

Depending on the particular circumstances, the Crown may also need to take steps to accommodate the potentially impacted Aboriginal or treaty right. For example, the Crown may be required to avoid or minimize the potential adverse impacts of the project.

## III. The Crown's Role and Responsibilities in the Delegated Consultation Process

The Crown has the responsibility for ensuring that the duty to consult, and accommodate where appropriate, is met. However, the Crown may delegate the procedural aspects of consultation to a proponent.

There are different ways in which the Crown may delegate the procedural aspects of consultation to a proponent, including through a letter, a memorandum of understanding, legislation, regulation, policy and codes of practice.

If the Crown decides to delegate procedural aspects of consultation, the Crown will generally:

- Ensure that the delegation of procedural aspects of consultation and the responsibilities of the proponent are clearly communicated to the proponent;
- Identify which Aboriginal communities must be consulted;
- Provide contact information for the Aboriginal communities;
- Revise, as necessary, the list of Aboriginal communities to be consulted as new information becomes available and is assessed by the Crown;
- Assess the scope of consultation owed to the Aboriginal communities;
- Maintain appropriate oversight of the actions taken by the proponent in fulfilling the procedural aspects of consultation;
- Assess the adequacy of consultation that is undertaken and any accommodation that may be required;
- Provide a contact within any responsible ministry in case issues arise that require direction from the Crown; and
- Participate in the consultation process as necessary and as determined by the Crown.

## IV. The Proponent's Role and Responsibilities in the Delegated Consultation Process

Where aspects of the consultation process have been delegated to a proponent, the Crown, in meeting its duty to consult, will rely on the proponent's consultation activities and documentation of those activities. The consultation process informs the Crown's decision of whether or not to approve a proposed project or activity.

A proponent's role and responsibilities will vary depending on a variety of factors including the extent of consultation required in the circumstance and the procedural aspects of consultation the Crown has delegated to it. Proponents are often in a better position than the Crown to discuss a project and its potential impacts with Aboriginal communities and to determine ways to avoid or minimize the adverse impacts of a project.

A proponent can raise issues or questions with the Crown at any time during the consultation process. If issues or concerns arise during the consultation that cannot be addressed by the proponent, the proponent should contact the Crown.

**a) What might a proponent be required to do in carrying out the procedural aspects of consultation?**

Where the Crown delegates procedural aspects of consultation, it is often the proponent's responsibility to provide notice of the proposed project to the identified Aboriginal communities. The notice should indicate that the Crown has delegated the procedural aspects of consultation to the proponent and should include the following information:

- a description of the proposed project or activity;
- mapping;
- proposed timelines;
- details regarding anticipated environmental and other impacts;
- details regarding opportunities to comment; and
- any changes to the proposed project that have been made for seasonal conditions or other factors, where relevant.

Proponents should provide enough information and time to allow Aboriginal communities to provide meaningful feedback regarding the potential impacts of the project. Depending on the nature of consultation required for a project, a proponent also may be required to:

- provide the Crown with copies of any consultation plans prepared and an opportunity to review and comment;
- ensure that any necessary follow-up discussions with Aboriginal communities take place in a timely manner, including to confirm receipt of information, share and update information and to address questions or concerns that may arise;
- as appropriate, discuss with Aboriginal communities potential mitigation measures and/or changes to the project in response to concerns raised by Aboriginal communities;
- use language that is accessible and not overly technical, and translate material into Aboriginal languages where requested or appropriate;
- bear the reasonable costs associated with the consultation process such as, but not limited to, meeting hall rental, meal costs, document translation(s), or to address technical & capacity issues;
- provide the Crown with all the details about potential impacts on established or asserted Aboriginal or treaty rights, how these concerns have been considered and addressed by the proponent and the Aboriginal communities and any steps taken to mitigate the potential impacts;
- provide the Crown with complete and accurate documentation from these meetings and communications; and
- notify the Crown immediately if an Aboriginal community not identified by the Crown approaches the proponent seeking consultation opportunities.

**b) What documentation and reporting does the Crown need from the proponent?**

Proponents should keep records of all communications with the Aboriginal communities involved in the consultation process and any information provided to these Aboriginal communities.

As the Crown is required to assess the adequacy of consultation, it needs documentation to satisfy itself that the proponent has fulfilled the procedural aspects of consultation delegated to it. The documentation required would typically include:

- the date of meetings, the agendas, any materials distributed, those in attendance and copies

of any minutes prepared;
- the description of the proposed project that was shared at the meeting;
- any and all concerns or other feedback provided by the communities;
- any information that was shared by a community in relation to its asserted or established Aboriginal or treaty rights and any potential adverse impacts of the proposed activity, approval or disposition on such rights;
- any proposed project changes or mitigation measures that were discussed, and feedback from Aboriginal communities about the proposed changes and measures;
- any commitments made by the proponent in response to any concerns raised, and feedback from Aboriginal communities on those commitments;
- copies of correspondence to or from Aboriginal communities, and any materials distributed electronically or by mail;
- information regarding any financial assistance provided by the proponent to enable participation by Aboriginal communities in the consultation;
- periodic consultation progress reports or copies of meeting notes if requested by the Crown;
- a summary of how the delegated aspects of consultation were carried out and the results; and
- a summary of issues raised by the Aboriginal communities, how the issues were addressed and any outstanding issues.

In certain circumstances, the Crown may share and discuss the proponent's consultation record with an Aboriginal community to ensure that it is an accurate reflection of the consultation process.

**c) Will the Crown require a proponent to provide information about its commercial arrangements with Aboriginal communities?**

The Crown may require a proponent to share information about aspects of commercial arrangements between the proponent and Aboriginal communities where the arrangements:

- include elements that are directed at mitigating or otherwise addressing impacts of the project;
- include securing an Aboriginal community's support for the project; or
- may potentially affect the obligations of the Crown to the Aboriginal communities.

The proponent should make every reasonable effort to exempt the Crown from confidentiality provisions in commercial arrangements with Aboriginal communities to the extent necessary to allow this information to be shared with the Crown.

The Crown cannot guarantee that information shared with the Crown will remain confidential. Confidential commercial information should not be provided to the Crown as part of the consultation record if it is not relevant to the duty to consult or otherwise required to be submitted to the Crown as part of the regulatory process.

**V. What are the Roles and Responsibilities of Aboriginal Communities' in the Consultation Process?**

Like the Crown, Aboriginal communities are expected to engage in consultation in good faith. This includes:
- responding to the consultation notice;
- engaging in the proposed consultation process;
- providing relevant documentation;

- clearly articulating the potential impacts of the proposed project on Aboriginal or treaty rights; and
- discussing ways to mitigates any adverse impacts.

Some Aboriginal communities have developed tools, such as consultation protocols, policies or processes that provide guidance on how they would prefer to be consulted. Although not legally binding, proponents are encouraged to respect these community processes where it is reasonable to do so. Please note that there is no obligation for a proponent to pay a fee to an Aboriginal community in order to enter into a consultation process.

To ensure that the Crown is aware of existing community consultation protocols, proponents should contact the relevant Crown ministry when presented with a consultation protocol by an Aboriginal community or anyone purporting to be a representative of an Aboriginal community.

**VI. What if More Than One Provincial Crown Ministry is Involved in Approving a Proponent's Project?**

Depending on the project and the required permits or approvals, one or more ministries may delegate procedural aspects of the Crown's duty to consult to the proponent. The proponent may contact individual ministries for guidance related to the delegation of procedural aspects of consultation for ministry-specific permits/approvals required for the project in question. Proponents are encouraged to seek input from all involved Crown ministries sooner rather than later.

## Shams, Aniqa

**From:** Shakeel, Meera
**Sent:** Thursday, July 22, 2021 10:43 AM
**To:** Shams, Aniqa
**Subject:** FW: Mississauga - Class EA - Lisgar Pumping Station(s)
**Attachments:** WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Indig Project Summary.pdf; WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Notice of Commencement.pdf; WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Cover letter NOC_HDI.pdf

Regards,

**Meera Shakeel, E.I.T**
C: 905 730-3879

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**From:** Shakeel, Meera
**Sent:** Monday, July 19, 2021 10:38 AM
**To:** hdi2@bellnet.ca
**Cc:** Shams, Aniqa <aniqa.shams@woodplc.com>; Maher, Trina <trina.maher@woodplc.com>; Kelly, Mary K <mary.k.kelly@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; jocko@sixnationsns.com; williams.todde@gmail.com
**Subject:** Mississauga - Class EA - Lisgar Pumping Station(s)

Dear Ms. General,

The City of Mississauga is undertaking a Schedule B Class Environmental Assessment (Class EA) Study to determine the number, preferred location(s) and type(s) of pumping stations within the Lisgar District to reduce the potential for basement water infiltration. Please find attached a letter, a summary of the Project and the Notice of Project Commencement.

We will follow-up with the Haudenosaunee Confederacy Chiefs Council, in the near future to discuss. Please do not hesitate to contact us should you have any questions or comments.

Thank you,

Best Regards,

**Meera Shakeel, E.I.T**
Traffic/Transportation Engineering Professional
C. 905 730-3879
meera.shakeel@woodplc.com
**www.woodplc.com**

Tracey General
Senior Administrator
Haudenosaunee Confederacy Chiefs Council
c/o Haudenosaunee Development Institute
hdi2@bellnet.ca

July12, 2021

**Re: Notice of Study Commencement - Schedule 'B' Municipal Class Environmental Assessment for Lisgar District Pumping Stations in Mississauga**

Dear Ms. General,

The City of Mississauga (City) has initiated a Schedule 'B' Municipal Class Environmental Assessment Study (Class EA / the Study) to determine the number, preferred location(s) and type(s) of pumping stations within the Lisgar District to reduce the potential for basement water infiltration.

The City has received direction from the Provincial Crown that the Haudenosaunee Confederacy Chiefs Council may have an interest in the Study. The City is committed to involving Indigenous Nations in this Study. Attached is the Notice of Study Commencement and a Project Summary. Please feel free to share this information within your community as you feel appropriate.

We are interested in understanding any interests or questions that the Haudenosaunee Confederacy Chiefs Council, as represented by the Haudenosaunee Development Institute may have about this Project and if there is a potential for the Study to affect Indigenous and Treaty Rights. We would also be interested to know if there are any sites of cultural significance to your community within, or adjacent to, the study area. If you would like to meet to discuss, please feel free to contact the undersigned. We will contact you by telephone in the near future to determine your interest in a meeting.

Sincerely,

**Elizabeth Dollimore, P.Eng. MBA.**
Project Manager
City of Mississauga
(905) 615-3200, ext. 5303
**elizabeth.dollimore@mississauga.ca**

Cc: Leroy Jocko Hill (jocko@sixnationsns.com)
Todd Williams (williams.todde@gmail.com)
Mary Kelly, Wood (mary.k.kelly@woodplc.com)
Matt Senior, Wood (matt.senior@woodplc.com)
Encl: Notice of Study Commencement; Project Summary

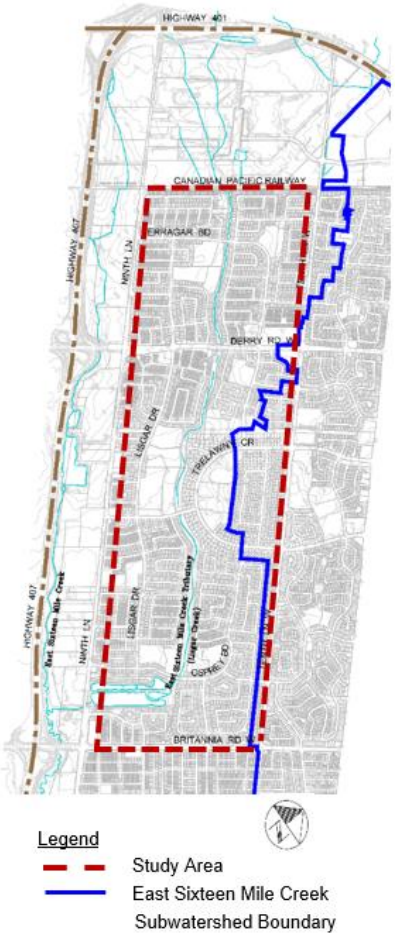
# Schedule ‘B’ Municipal Class Environmental Assessment for Lisgar District Pumping Stations in the City of Mississauga

A Municipal Class Environmental Assessment (Class EA) is a decision-making and planning process that identifies the potential effects of projects, such as water and wastewater projects, so that they can be managed prior to implementation.

## Project Description

The City of Mississauga (the City) is undertaking a Schedule B Class Environmental Assessment (Class EA) to determine the number, preferred location(s) and type(s) of pumping stations within the Lisgar District to reduce the potential for basement water infiltration, the seepage of water into basements.

**Figure 1: Lisgar District Project Study Area**




## Municipal Class Environmental Assessment

Beginning in 2008, some homes in the Lisgar District experienced water seeping into their basements following heavy rainfall events. In response, the City undertook a number of actions, one of which was the Lisgar District Basement Water Infiltration Investigation, which recommended a set of preferred actions to be undertaken to address the potential for further basement water infiltration. This study was completed in 2018 and can be found here: https://www.mississauga.ca/projects-and-strategies/environmental-assessments/lisgar-basement-water-infiltration-investigation/.

In 2017, the City’s Updated Action Plan identified pumping stations as a high priority mitigation measure, which led to the City constructing the first utility dewatering and foundation drain collector pumping station in 2020 at the Cactus Gate Parkette. This Municipal Class EA has been undertaken to determine the long-term plan for the City with respect to reducing basement water infiltration in the overall Lisgar District. The Class EA will evaluate the number of future required pumping stations (if any), recommended locations, and relative prioritization.

A key component of this Study is to consult with regulatory agencies, conservation authorities, stakeholders and Indigenous Nations.

| Project Topic | Details |
|---|---|
| Name of municipality undertaking Class EA Study. | The City of Mississauga |
| Contact person for the municipality undertaking the Class EA Study. | Elizabeth Dollimore, P.Eng. MBA.<br>Project Manager<br>City of Mississauga |
| List of documents pertaining to the proposed action/decision that are available for Indigenous Nation review. | The Study is currently in Phase 1 and will include the following technical studies to be completed by Wood:<br>• Natural Environment Study<br>• Stage 1 Archaeological Assessment<br>• Cultural Heritage Assessment<br>• Hydraulic Assessment |
| Description of what other information is expected to become available before the proposed action/decision is undertaken. | This Study will include one Public Information Centre (PIC), where the City will provide an update on the Study and provide a summary of the technical studies. When these materials are prepared, copies of these materials will be shared with Indigenous Nations. |
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| How the proposed action or decision may affect and/or benefit the Indigenous Nation, its rights and territory. | This Study may potentially impact natural environment or result in archaeological impacts. Through the completion of the technical studies, mitigation measures will be proposed to address the impacts. |
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## Schedule and Next Steps

- Public Information Sessions: tentatively planned for Fall 2021
- Project File Report (final report): submission tentatively planned for late 2021

## Contact Information


**Elizabeth Dollimore, P.Eng. MBA.**
Project Manager
City of Mississauga
(905) 615-3200, ext. 5303
**elizabeth.dollimore@mississauga.ca**

**Matt Senior, MASc. P.Eng.**
Consultant Project Manager
Wood Environment & Infrastructure Solutions
(905) 335-2353, ext. 3080
**matt.senior@woodplc.com**

## Shams, Aniqa

**From:** Shakeel, Meera
**Sent:** Thursday, July 22, 2021 10:43 AM
**To:** Shams, Aniqa
**Subject:** FW: Mississauga - Class EA - Lisgar Pumping Station(s)
**Attachments:** WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Notice of Commencement.pdf; WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Indig Project Summary.pdf; WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Cover letter NOC_HW.pdf

Regards,

**Meera Shakeel, E.I.T**
C: 905 730-3879

---

**From:** Shakeel, Meera
**Sent:** Monday, July 19, 2021 10:38 AM
**To:** lori-jeanne.bolduc@wendake.ca; mario.groslouis@cnhw.qc.ca
**Cc:** Shams, Aniqa <aniqa.shams@woodplc.com>; Maher, Trina <trina.maher@woodplc.com>; Kelly, Mary K <mary.k.kelly@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>
**Subject:** Mississauga - Class EA - Lisgar Pumping Station(s)

Dear Ms. Bolduc and Mr. Gros-louis,

The City of Mississauga is undertaking a Schedule B Class Environmental Assessment (Class EA) Study to determine the number, preferred location(s) and type(s) of pumping stations within the Lisgar District to reduce the potential for basement water infiltration. Please find attached a letter, a summary of the Project and the Notice of Project Commencement.

We will follow-up with the Huron-Wendat Nation in the near future to discuss. Please do not hesitate to contact us should you have any questions or comments.

Thank you,

Best Regards,

**Meera Shakeel, E.I.T**
Traffic/Transportation Engineering Professional
C. 905 730-3879
meera.shakeel@woodplc.com
**www.woodplc.com**

Lori-Jeanne Bolduc, Land Planning Advisor
Mario Gros-louis, Land Planning Analyst
Huron-Wendat Nation
lori-jeanne.bolduc@wendake.ca
mario.groslouis@cnhw.qc.ca

July 12, 2021

**Re: Notice of Study Commencement - Schedule 'B' Municipal Class Environmental Assessment for Lisgar District Pumping Stations in Mississauga**

Dear Ms. Bolduc and Mr. Gros-louis,

The City of Mississauga (City) has initiated a Schedule 'B' Municipal Class Environmental Assessment Study (Class EA / the Study) to determine the number, preferred location(s) and type(s) of pumping stations within the Lisgar District to reduce the potential for basement water infiltration.

The City has received direction from the Provincial Crown that the Huron-Wendat Nation may have an interest in the Study. The City is committed to involving Indigenous Nations in this Study. Attached is the Notice of Study Commencement and a Project Summary. Please feel free to share this information within your community as you feel appropriate.

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Cc: Mary Kelly, Wood (mary.k.kelly@woodplc.com)
Matt Senior, Wood (matt.senior@woodplc.com)

Encl: Notice of Study Commencement; Project Summary

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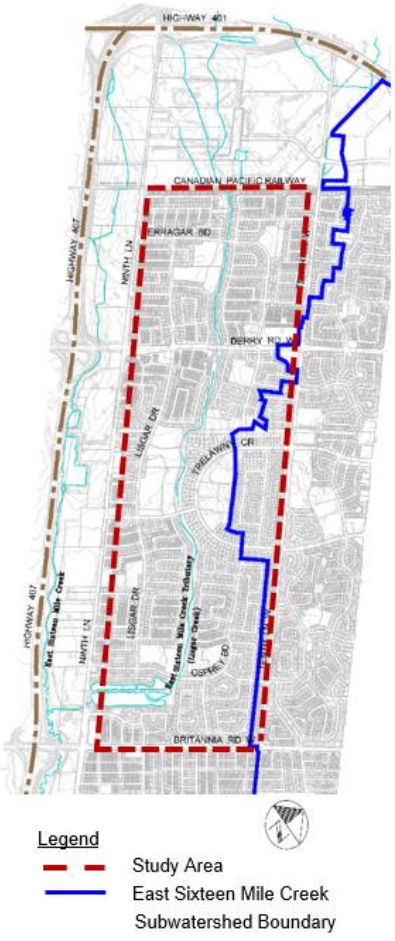
**Figure 1: Lisgar District Project Study Area**

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| Project Topic | Details |
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| Contact person for the municipality undertaking the Class EA Study. | Elizabeth Dollimore, P.Eng. MBA.<br>Project Manager<br>City of Mississauga |
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## Schedule and Next Steps

- Public Information Sessions: tentatively planned for Fall 2021
- Project File Report (final report): submission tentatively planned for late 2021

## Contact Information


**Elizabeth Dollimore, P.Eng. MBA.**
Project Manager
City of Mississauga
(905) 615-3200, ext. 5303
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**Matt Senior, MASc. P.Eng.**
Consultant Project Manager
Wood Environment & Infrastructure Solutions
(905) 335-2353, ext. 3080
**matt.senior@woodplc.com**

## Shams, Aniqa

**From:** Shakeel, Meera
**Sent:** Thursday, July 22, 2021 10:43 AM
**To:** Shams, Aniqa
**Subject:** FW: Mississauga - Class EA - Lisgar Pumping Station(s)
**Attachments:** WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Notice of Commencement.pdf; WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Indig Project Summary.pdf; WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Cover letter NOC_MCFN.pdf

Regards,

**Meera Shakeel, E.I.T**
C: 905 730-3879

---

**From:** Shakeel, Meera
**Sent:** Monday, July 19, 2021 10:38 AM
**To:** Fawn.Sault@mncfn.ca
**Cc:** Shams, Aniqa <aniqa.shams@woodplc.com>; Maher, Trina <trina.maher@woodplc.com>; Kelly, Mary K <mary.k.kelly@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; megan.devries@mncfn.ca
**Subject:** Mississauga - Class EA - Lisgar Pumping Station(s)

Dear Ms. Sault,

The City of Mississauga is undertaking a Schedule B Class Environmental Assessment (Class EA) Study to determine the number, preferred location(s) and type(s) of pumping stations within the Lisgar District to reduce the potential for basement water infiltration. Please find attached a letter, a summary of the Project and the Notice of Project Commencement.

We will follow-up with the Mississaugas of the Credit First Nation in the near future to discuss. Please do not hesitate to contact us should you have any questions or comments.

Thank you,

Best Regards,

**Meera Shakeel, E.I.T**
Traffic/Transportation Engineering Professional
C. 905 730-3879
meera.shakeel@woodplc.com
**www.woodplc.com**

Fawn Sault
Consultation Manager
Mississaugas of the Credit First Nation
Fawn.Sault@mncfn.ca

July12, 2021

**Re: Notice of Study Commencement - Schedule 'B' Municipal Class Environmental Assessment for Lisgar District Pumping Stations in Mississauga**

Dear Ms. Sault,

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City of Mississauga
(905) 615-3200, ext. 5303
**elizabeth.dollimore@mississauga.ca**

Cc: Megan DeVries (megan.devries@mncfn.ca)
Mary Kelly, Wood (mary.k.kelly@woodplc.com)
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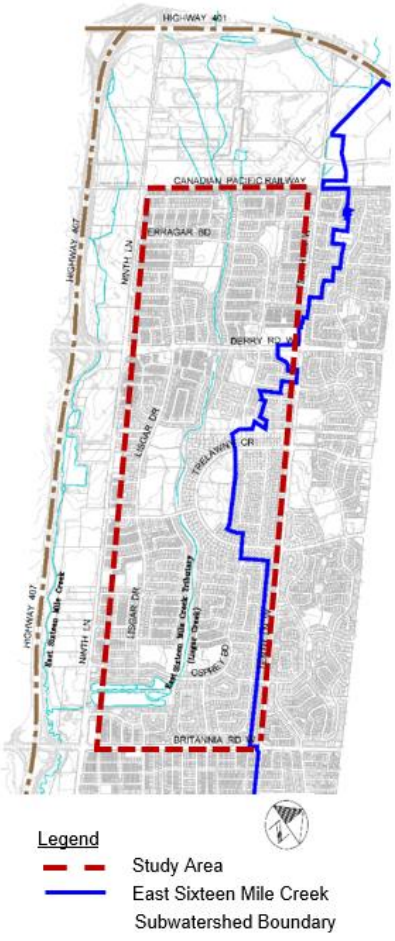


## Municipal Class Environmental Assessment

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City of Mississauga
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**Sent:** Thursday, July 22, 2021 10:43 AM
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Regards,

**Meera Shakeel, E.I.T**
C: 905 730-3879

---

**From:** Shakeel, Meera
**Sent:** Monday, July 19, 2021 10:38 AM
**To:** rvanstone@sixnations.ca
**Cc:** Shams, Aniqa <aniqa.shams@woodplc.com>; Maher, Trina <trina.maher@woodplc.com>; Kelly, Mary K <mary.k.kelly@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; lonnybomberry@sixnations.ca; tanyahill-montour@sixnations.ca; dlaforme@sixnations.ca
**Subject:** Mississauga - Class EA - Lisgar Pumping Station(s)

Dear Ms. Vanstone,

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Best Regards,

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Robbin Vanstone
Consultation Supervisor
Six Nations of the Grand River
rvanstone@sixnations.ca

July 12, 2021

**Re: Notice of Study Commencement - Schedule 'B' Municipal Class Environmental Assessment for Lisgar District Pumping Stations in Mississauga**

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Cc: Lonny Bomberry (lonnybomberry@sixnations.ca)
Tanya J. Hill-Montour (tanyahill-montour@sixnations.ca)
Dawn LaForme (dlaforme@sixnations.ca)
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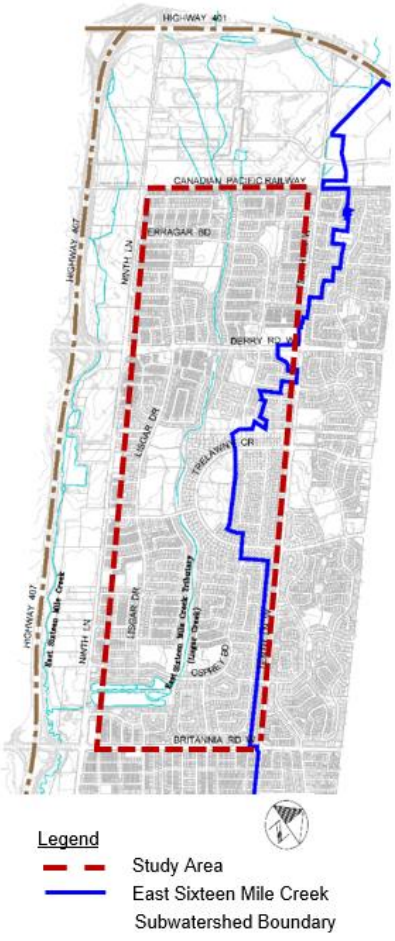


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| Contact person for the municipality undertaking the Class EA Study. | Elizabeth Dollimore, P.Eng. MBA.<br>Project Manager<br>City of Mississauga |
| List of documents pertaining to the proposed action/decision that are available for Indigenous Nation review. | The Study is currently in Phase 1 and will include the following technical studies to be completed by Wood:<br>• Natural Environment Study<br>• Stage 1 Archaeological Assessment<br>• Cultural Heritage Assessment<br>• Hydraulic Assessment |
| Description of what other information is expected to become available before the proposed action/decision is undertaken. | This Study will include one Public Information Centre (PIC), where the City will provide an update on the Study and provide a summary of the technical studies. When these materials are prepared, copies of these materials will be shared with Indigenous Nations. |
| Deadlines or filing dates pertaining to the action/decision. | There will be a 30-day review period, where the City will provide an opportunity for Indigenous Nations to review the draft final report prior to the public review period. |
| The Crown or Municipal review/approval that is required for the project. | If no comments arise from the 30-day review/approval period, the Crown will approve the Study to proceed to Detailed Design and Construction. |
| How the proposed action or decision may affect and/or benefit the Indigenous Nation, its rights and territory. | This Study may potentially impact natural environment or result in archaeological impacts. Through the completion of the technical studies, mitigation measures will be proposed to address the impacts. |
| Is an archaeological assessment required for this project? | A Stage 1 Archaeological Assessments will be undertaken, which may recommend a Stage 2 Archaeological Assessment. The City will provide a draft report to Indigenous Nations before submitting to the Ministry of Heritage, Sport, Tourism and Cultural Industries (MHSTCI). |
| Have any archaeological assessments already been completed for this project and/or its study area? If so, what documentation is available for review? | No archaeological assessments have been completed for this Study, as of yet. If there have been other archaeological assessments completed within the study area as part of other projects, this will be identified through the Stage 1 Archaeological Assessment. |

| Project Topic | Details |
|---|---|
| Are there any short-term and/or long-term avoidance and protection strategies currently in place for the natural and/or cultural resources in the study area for this project? If yes, what are these strategies? | To date, no short-term and/or long-term avoidance and protection strategies have been identified for this Project. If required, potential avoidance and/or mitigation measures may be identified during this Class EA process. |

## Schedule and Next Steps

- Public Information Sessions: tentatively planned for Fall 2021
- Project File Report (final report): submission tentatively planned for late 2021

## Contact Information


**Elizabeth Dollimore, P.Eng. MBA.**
Project Manager
City of Mississauga
(905) 615-3200, ext. 5303
**elizabeth.dollimore@mississauga.ca**

**Matt Senior, MASc. P.Eng.**
Consultant Project Manager
Wood Environment & Infrastructure Solutions
(905) 335-2353, ext. 3080
**matt.senior@woodplc.com**

## Shams, Aniqa

**From:** Shakeel, Meera
**Sent:** Wednesday, July 28, 2021 11:58 AM
**To:** Shams, Aniqa
**Subject:** FW: Mississauga - Class EA - Lisgar Pumping Station(s)
**Attachments:** image001.png; WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Indig Project Summary.pdf; WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Notice of Commencement.pdf; WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Cover letter NOC_HDI.pdf

Regards,

**Meera Shakeel, E.I.T**
C: 905 730-3879

---

**From:** Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>
**Sent:** Tuesday, July 27, 2021 4:39 PM
**To:** Senior, Matt <matt.senior@woodplc.com>; Shakeel, Meera <meera.shakeel@woodplc.com>; Maher, Trina <trina.maher@woodplc.com>
**Subject:** FW: Mississauga - Class EA - Lisgar Pumping Station(s)

**CAUTION:** External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Hi,

I received a phone call earlier today from HDI asking about Natural Impact Studies. Raechelle has followed up with the email below. I don't believe there is anything to share with her at this time, but please keep this in mind going forward.

Thanks,
Liz

**From:** Raechelle Williams <janice.r.n.w23@gmail.com>
**Sent:** Tuesday, July 27, 2021 4:30 PM
**To:** Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>
**Cc:** Todd Williams <williams.todde@gmail.com>
**Subject:** Fwd: Mississauga - Class EA - Lisgar Pumping Station(s)

Good afternoon,

This is Raechelle Williams from Haudenosaunee Development Institute (HDI) Environmental Team. We spoke earlier today regarding the Lisgar Pumping Stations Class EA. As you mentioned on the phone the project is still working on locations for placing the pumps.

The HDI Environmental Team requests to review any EA Reports and be involved in any natural studies Impact. Again I know you mentioned on the phone everything is being done over desktop screening.

Nyaweh/Thank-You,

*Raechelle Williams*
**HDI Environmental Supervisor**
**(519) 802 - 9402**

---------- Forwarded message ---------
From: **Administration** <hdi2@bellnet.ca>
Date: Fri., Jul. 23, 2021, 1:42 a.m.
Subject: Fwd: Mississauga - Class EA - Lisgar Pumping Station(s)
To: Brian Doolittle <ganowa@me.com>, Aaron Detlor <aarondetlor@gmail.com>, Todd Williams <williams.todde@gmail.com>, Wayne Hill <tworowarchaeology@gmail.com>, Tracey General <traceyghdi@gmail.com>, Raechelle Williams <janice.r.n.w23@gmail.com>, <hdicommunications2021@gmail.com>, Kahsenniyo Williams <kahsenniyowilliams@gmail.com>

Begin forwarded message:

**From:** "Shakeel, Meera" <meera.shakeel@woodplc.com>
**Subject: Mississauga - Class EA - Lisgar Pumping Station(s)**
**Date:** July 19, 2021 at 10:37:30 AM EDT
**To:** "hdi2@bellnet.ca" <hdi2@bellnet.ca>
**Cc:** "Shams, Aniqa" <aniqa.shams@woodplc.com>, "Maher, Trina" <trina.maher@woodplc.com>, "Kelly, Mary K" <mary.k.kelly@woodplc.com>, "Senior, Matt" <matt.senior@woodplc.com>, Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>, "jocko@sixnationsns.com" <jocko@sixnationsns.com>, "williams.todde@gmail.com" <williams.todde@gmail.com>

Dear Ms. General,

The City of Mississauga is undertaking a Schedule B Class Environmental Assessment (Class EA) Study to determine the number, preferred location(s) and type(s) of pumping stations within the Lisgar District to reduce the potential for basement water infiltration. Please find attached a letter, a summary of the Project and the Notice of Project Commencement.

We will follow-up with the Haudenosaunee Confederacy Chiefs Council, in the near future to discuss. Please do not hesitate to contact us should you have any questions or comments.

Thank you,

Best Regards,

**Meera Shakeel, E.I.T**
Traffic/Transportation Engineering Professional
C. 905 730-3879
meera.shakeel@woodplc.com

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Friday, August 6, 2021 9:49 AM
**To:** hdi2@bellnet.ca; Raechelle Williams
**Cc:** Maher, Trina; Kelly, Mary K; Senior, Matt; Elizabeth Dollimore; jocko@sixnationsns.com; williams.todde@gmail.com; Shakeel, Meera
**Subject:** RE: Mississauga - Class EA - Lisgar Pumping Station(s)
**Attachments:** WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Indig Project Summary.pdf; WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Cover letter NOC_HDI.pdf; WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Notice of Commencement.pdf

Hi Raechelle,

As per our phone conversation today, we wanted to check in and see if you had any comments or questions about the Lisgar Pumping Station Project at this time? We would be happy to have a call with you, if you're interested to discuss the project further. Please don't hesitate to contact us if you have any other questions or comments.

Thanks,
Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
Pronouns – She/Her/Hers
Direct: + (905) 568-2929
Mobile: + (416) 357-2093
**www.woodplc.com**

---

**From:** Shakeel, Meera
**Sent:** Monday, July 19, 2021 10:38 AM
**To:** hdi2@bellnet.ca
**Cc:** Shams, Aniqa <aniqa.shams@woodplc.com>; Maher, Trina <trina.maher@woodplc.com>; Kelly, Mary K <mary.k.kelly@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; jocko@sixnationsns.com; williams.todde@gmail.com
**Subject:** Mississauga - Class EA - Lisgar Pumping Station(s)

Dear Ms. General,

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Friday, August 6, 2021 9:49 AM
**To:** lori-jeanne.bolduc@wendake.ca; mario.groslouis@cnhw.qc.ca
**Cc:** Shakeel, Meera; Maher, Trina; Kelly, Mary K; Senior, Matt; Elizabeth Dollimore
**Subject:** RE: Mississauga - Class EA - Lisgar Pumping Station(s)
**Attachments:** WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Notice of Commencement.pdf; WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Indig Project Summary.pdf; WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Cover letter NOC_HW.pdf

Good morning Ms. Bolduc and Mr. Gros-louis,

We wanted to follow-up with both of you to check in and see if you had any comments or questions about the Lisgar Pumping Station Project at this time? We would be happy to have a call with you, if you're interested to discuss the project further. Please don't hesitate to contact us if you have any other questions or comments.

Thank you,
Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
Pronouns – She/Her/Hers
Direct: + (905) 568-2929
Mobile: + (416) 357-2093
**www.woodplc.com**

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**From:** Shakeel, Meera
**Sent:** Monday, July 19, 2021 10:38 AM
**To:** lori-jeanne.bolduc@wendake.ca; mario.groslouis@cnhw.qc.ca
**Cc:** Shams, Aniqa <aniqa.shams@woodplc.com>; Maher, Trina <trina.maher@woodplc.com>; Kelly, Mary K <mary.k.kelly@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>
**Subject:** Mississauga - Class EA - Lisgar Pumping Station(s)

Dear Ms. Bolduc and Mr. Gros-louis,

The City of Mississauga is undertaking a Schedule B Class Environmental Assessment (Class EA) Study to determine the number, preferred location(s) and type(s) of pumping stations within the Lisgar District to reduce the potential for basement water infiltration. Please find attached a letter, a summary of the Project and the Notice of Project Commencement.

We will follow-up with the Huron-Wendat Nation in the near future to discuss. Please do not hesitate to contact us should you have any questions or comments.

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Friday, August 6, 2021 9:49 AM
**To:** Fawn Sault
**Cc:** Maher, Trina; Kelly, Mary K; Senior, Matt; Elizabeth Dollimore; megan.devries@mncfn.ca; Shakeel, Meera
**Subject:** RE: Mississauga - Class EA - Lisgar Pumping Station(s)
**Attachments:** WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Notice of Commencement.pdf; WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Cover letter NOC_MCFN.pdf; WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Indig Project Summary.pdf

Hi Fawn,

To follow-up on the voicemail I left today, we wanted to check in and see if you had any comments or questions about the Lisgar Pumping Station Project at this time? We would be happy to have a call with you, if you're interested to discuss the project further. Please don't hesitate to contact us if you have any other questions or comments.

Thanks,
Aniqa

**Aniqa Shams, RPP, MCIP**
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Direct: + (905) 568-2929
Mobile: + (416) 357-2093
**www.woodplc.com**

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**From:** Shakeel, Meera
**Sent:** Monday, July 19, 2021 10:38 AM
**To:** Fawn.Sault@mncfn.ca
**Cc:** Shams, Aniqa <aniqa.shams@woodplc.com>; Maher, Trina <trina.maher@woodplc.com>; Kelly, Mary K <mary.k.kelly@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; megan.devries@mncfn.ca
**Subject:** Mississauga - Class EA - Lisgar Pumping Station(s)

Dear Ms. Sault,

The City of Mississauga is undertaking a Schedule B Class Environmental Assessment (Class EA) Study to determine the number, preferred location(s) and type(s) of pumping stations within the Lisgar District to reduce the potential for basement water infiltration. Please find attached a letter, a summary of the Project and the Notice of Project Commencement.

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Friday, August 6, 2021 9:49 AM
**To:** Robin Vanstone
**Cc:** Shakeel, Meera; Maher, Trina; Kelly, Mary K; Senior, Matt; Elizabeth Dollimore; lonnybomberry@sixnations.ca; tanyahill-montour@sixnations.ca; dlaforme@sixnations.ca
**Subject:** RE: Mississauga - Class EA - Lisgar Pumping Station(s)
**Attachments:** WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Notice of Commencement.pdf; WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Cover letter NOC_SNGR.pdf; WW21011023_Eng Svc Lisgar Pump Station_Mississauga_Indig Project Summary.pdf

Hi Robbin,

To follow-up on the voicemail I left today, we wanted to check in and see if you had any comments or questions about the Lisgar Pumping Station Project at this time? We would be happy to have a call with you, if you're interested to discuss the project further. Please don't hesitate to contact us if you have any other questions or comments.

Thanks,
Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
Pronouns – She/Her/Hers
Direct: + (905) 568-2929
Mobile: + (416) 357-2093
**www.woodplc.com**

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**From:** Shakeel, Meera
**Sent:** Monday, July 19, 2021 10:38 AM
**To:** rvanstone@sixnations.ca
**Cc:** Shams, Aniqa <aniqa.shams@woodplc.com>; Maher, Trina <trina.maher@woodplc.com>; Kelly, Mary K <mary.k.kelly@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; lonnybomberry@sixnations.ca; tanyahill-montour@sixnations.ca; dlaforme@sixnations.ca
**Subject:** Mississauga - Class EA - Lisgar Pumping Station(s)

Dear Ms. Vanstone,

The City of Mississauga is undertaking a Schedule B Class Environmental Assessment (Class EA) Study to determine the number, preferred location(s) and type(s) of pumping stations within the Lisgar District to reduce the potential for basement water infiltration. Please find attached a letter, a summary of the Project and the Notice of Project Commencement.

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Tuesday, August 17, 2021 10:32 AM
**To:** Lori-Jeanne Bolduc; Mario Gros Louis
**Cc:** Shakeel, Meera; Maher, Trina; Kelly, Mary K; Senior, Matt; Elizabeth Dollimore
**Subject:** RE: Mississauga - Class EA - Lisgar Pumping Station(s)

Hi Lori,

Thank you for your response. To provide a status update on the archaeological work - we are currently in the process of completing the Stage 1 Archaeological Assessment and will provide the draft report to Huron Wendat Nation for review and comment. Based on the results of the Stage 1, if a Stage 2 Archaeological Assessment is required, we will definitely involve Huron Wendat in the field work and the review of the final report. If you have any other questions or concerns, please don't hesitate to email or call me.

Thanks,
Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
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Direct: + (905) 568-2929
Mobile: + (416) 357-2093
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---

**From:** Lori-Jeanne Bolduc <Lori-Jeanne.Bolduc@wendake.ca>
**Sent:** Wednesday, August 11, 2021 10:59 AM
**To:** Shams, Aniqa <aniqa.shams@woodplc.com>; Mario Gros Louis <Mario.GrosLouis@wendake.ca>
**Cc:** Shakeel, Meera <meera.shakeel@woodplc.com>; Maher, Trina <trina.maher@woodplc.com>; Kelly, Mary K <mary.k.kelly@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>
**Subject:** RE: Mississauga - Class EA - Lisgar Pumping Station(s)

**CAUTION:** External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Hi again Aniqa,

The Huron-Wendat Nation is interested in participating in all archaeological fieldwork for this project, as well as receiving copies of the draft reports for review and comments.

Thank you,

Lori-Jeanne

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Thursday, September 9, 2021 11:57 AM
**To:** Raechelle Williams
**Cc:** hdi2@bellnet.ca; Maher, Trina; Kelly, Mary K; Senior, Matt; Elizabeth Dollimore; jocko@sixnationsns.com; williams.todde@gmail.com; Shakeel, Meera
**Subject:** RE: Mississauga - Class EA - Lisgar Pumping Station(s)

Hello Raechelle,

Thank you for identifying your interest in this Project. The field work (aquatic and terrestrial) occurred on May 13, 2021 and involved a limited review of the current conditions. Once the aquatic and terrestrial draft reports are ready, we will provide these documents to you for your review and comment. We apologize for our oversight in failing to inform you prior to this activity. We have reviewed this incident internally and are working with our field and project teams to ensure that going forward that our approach and practice supports timely and respectful engagement and communication about projects and associated activities with Indigenous Nations. If you would like to meet to further discuss the Project, please do contact us and we would be pleased to coordinate a meeting.

Thanks,
Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
Pronouns – She/Her/Hers
Mobile: + (416) 357-2093
**www.woodplc.com**

---

**From:** Raechelle Williams <janice.r.n.w23@gmail.com>
**Sent:** Friday, August 6, 2021 3:12 PM
**To:** Shams, Aniqa <aniqa.shams@woodplc.com>
**Cc:** hdi2@bellnet.ca; Maher, Trina <trina.maher@woodplc.com>; Kelly, Mary K <mary.k.kelly@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; jocko@sixnationsns.com; williams.todde@gmail.com; Shakeel, Meera <meera.shakeel@woodplc.com>
**Subject:** Re: Mississauga - Class EA - Lisgar Pumping Station(s)

**CAUTION:** External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Hello Aniqa,

Following up with our conversation earlier today, I had time to read over the documents about the Lisgar Pumping Station Project. My question is has Wood started any of the natural environmental studies within the study area? If the natural studies still need to be done, HDI requests to have a Monitor to attend the field work. And will this project affect

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Thursday, September 9, 2021 11:57 AM
**To:** Fawn Sault
**Cc:** Maher, Trina; Kelly, Mary K; Senior, Matt; Elizabeth Dollimore; Shakeel, Meera
**Subject:** RE: Mississauga - Class EA - Lisgar Pumping Station(s)

Hello Fawn,

Thank you for identifying your interest in this Project. The field work (aquatic and terrestrial) occurred on May 13, 2021 and involved a limited review of the current conditions. Once the aquatic and terrestrial draft reports are ready, we will provide these documents to you for your review and comment. We apologize for our oversight in failing to inform you prior to this activity. We have reviewed this incident internally and are working with our field and project teams to ensure that going forward that our approach and practice supports timely and respectful engagement and communication about projects and associated activities with Indigenous Nations. If you would like to meet to further discuss the Project, please do contact us and we would be pleased to coordinate a meeting.

Thanks,
Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
Pronouns – She/Her/Hers
Mobile: + (416) 357-2093
**www.woodplc.com**

wood.

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**From:** Fawn Sault <Fawn.Sault@mncfn.ca>
**Sent:** Friday, August 6, 2021 2:47 PM
**To:** Shams, Aniqa <aniqa.shams@woodplc.com>
**Subject:** RE: Mississauga - Class EA - Lisgar Pumping Station(s)

**CAUTION:** External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Hi Aniqa,

Can you tell me if there were any archaeological or environmental studies done or that need to be done? If so MCFN expects to be involved in any field studies that take place.

Miigwech,

Fawn Sault
Consultation Coordinator
Mississaugas of the Credit First Nation
4065 Hwy. 6, Hagersville, N0A 1H0
Website: http://mncfn.ca/
Ph: 905-768-4260
Cell:289-527-6580

---

**From:** Shams, Aniqa <aniqa.shams@woodplc.com>
**Sent:** Friday, August 6, 2021 9:49 AM
**To:** Fawn Sault <Fawn.Sault@mncfn.ca>
**Cc:** Maher, Trina <trina.maher@woodplc.com>; Kelly, Mary K <mary.k.kelly@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; Megan DeVries <Megan.DeVries@mncfn.ca>; Shakeel, Meera <meera.shakeel@woodplc.com>
**Subject:** RE: Mississauga - Class EA - Lisgar Pumping Station(s)

Hi Fawn,

To follow-up on the voicemail I left today, we wanted to check in and see if you had any comments or questions about the Lisgar Pumping Station Project at this time? We would be happy to have a call with you, if you're interested to discuss the project further. Please don't hesitate to contact us if you have any other questions or comments.

Thanks,
Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
Pronouns – She/Her/Hers
Direct: + (905) 568-2929
Mobile: + (416) 357-2093
**www.woodplc.com**

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**From:** Shakeel, Meera
**Sent:** Monday, July 19, 2021 10:38 AM
**To:** Fawn.Sault@mncfn.ca
**Cc:** Shams, Aniqa <aniqa.shams@woodplc.com>; Maher, Trina <trina.maher@woodplc.com>; Kelly, Mary K <mary.k.kelly@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; megan.devries@mncfn.ca
**Subject:** Mississauga - Class EA - Lisgar Pumping Station(s)

Dear Ms. Sault,

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Tuesday, February 1, 2022 4:33 PM
**To:** Raechelle Williams
**Cc:** hdi2@bellnet.ca; Maher, Trina; Senior, Matt; Elizabeth Dollimore; williams.todde@gmail.com; Stokke, Samantha; Ramlogan, Vijanti
**Subject:** Lisgar District Pumping Stations Study Update

Hi Raechelle,

We wanted to provide you with an update on the Lisgar District Pumping Stations Study. A Public Information Centre (PIC) and Town Hall was held on November 17, 2021, which provided an update on the ongoing monitoring and works in the Lisgar District and shared information related to the Study. The PIC slides can be found here - https://www.mississauga.ca/projects-and-strategies/environmental-assessments/lisgar-district-pumping-stations-study/

Additionally, please see the link below for the draft Stage 1 Archaeological Assessment and Natural Heritage Existing Conditions Report for your review and comment.

7 Lisgar

The next steps in this Study will include the preparation of the Project File Report. This is anticipated to be completed in the first quarter of 2022. We will provide the draft report for your review and comment. Please let us know if you have any comments or questions at all. I will follow-up via phone and email in two weeks' time.

Best regards,
Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
Pronouns – She/Her/Hers
Mobile: + (416) 357-2093
**www.woodplc.com**

wood.

---

**From:** Shams, Aniqa
**Sent:** Thursday, September 9, 2021 11:57 AM
**To:** Raechelle Williams <janice.r.n.w23@gmail.com>
**Cc:** hdi2@bellnet.ca; Maher, Trina <trina.maher@woodplc.com>; Kelly, Mary K <mary.k.kelly@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>;

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Tuesday, February 1, 2022 4:33 PM
**To:** Lori-Jeanne Bolduc; mario gros-louis
**Cc:** Elizabeth Dollimore; Senior, Matt; Maher, Trina; Stokke, Samantha; Ramlogan, Vijanti
**Subject:** Lisgar District Pumping Stations Study Update

Hi Ms. Bolduc and Mr. Gros-louis,

We wanted to provide you with an update on the Lisgar District Pumping Stations Study. A Public Information Centre (PIC) and Town Hall was held on November 17, 2021, which provided an update on the ongoing monitoring and works in the Lisgar District and shared information related to the Study. The PIC slides can be found here - https://www.mississauga.ca/projects-and-strategies/environmental-assessments/lisgar-district-pumping-stations-study/

Additionally, please see the link below for the draft Stage 1 Archaeological Assessment and Natural Heritage Existing Conditions Report for your review and comment.

7 Lisgar

The next steps in this Study will include the preparation of the Project File Report. This is anticipated to be completed in the first quarter of 2022. We will provide the draft report for your review and comment. Please let us know if you have any comments or questions at all. I will follow up via email in two weeks' time.

Best regards,
Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
Pronouns – She/Her/Hers
Mobile: + (416) 357-2093
**www.woodplc.com**

wood.

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**From:** Shakeel, Meera
**Sent:** Monday, July 19, 2021 10:38 AM
**To:** lori-jeanne.bolduc@wendake.ca; mario.groslouis@cnhw.qc.ca
**Cc:** Shams, Aniqa <aniqa.shams@woodplc.com>; Maher, Trina <trina.maher@woodplc.com>; Kelly, Mary K <mary.k.kelly@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>
**Subject:** Mississauga - Class EA - Lisgar Pumping Station(s)

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Tuesday, February 1, 2022 4:33 PM
**To:** Fawn Sault; Communications@mncfn.ca
**Cc:** Maher, Trina; Senior, Matt; Elizabeth Dollimore; Stokke, Samantha; Ramlogan, Vijanti
**Subject:** Lisgar District Pumping Stations Study Update

Hi Fawn and DOCA team,

We wanted to provide you with an update on the Lisgar District Pumping Stations Study. A Public Information Centre (PIC) and Town Hall was held on November 17, 2021, which provided an update on the ongoing monitoring and works in the Lisgar District and shared information related to the Study. The PIC slides can be found here - https://www.mississauga.ca/projects-and-strategies/environmental-assessments/lisgar-district-pumping-stations-study/

Additionally, please see the link below for the draft Stage 1 Archaeological Assessment and Natural Heritage Existing Conditions Report for your review and comment.

7 Lisgar

The next steps in this Study will include the preparation of the Project File Report. This is anticipated to be completed in the first quarter of 2022. We will provide the draft report for your review and comment. Please let us know if you have any comments or questions at all. I will follow up via email in two weeks' time.

Best regards,
Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
Pronouns – She/Her/Hers
Mobile: + (416) 357-2093
**www.woodplc.com**

wood.

---

**From:** Shams, Aniqa
**Sent:** Thursday, September 9, 2021 11:57 AM
**To:** Fawn Sault <Fawn.Sault@mncfn.ca>
**Cc:** Maher, Trina <trina.maher@woodplc.com>; Kelly, Mary K <mary.k.kelly@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; Shakeel, Meera <meera.shakeel@woodplc.com>
**Subject:** RE: Mississauga - Class EA - Lisgar Pumping Station(s)

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Tuesday, February 1, 2022 4:33 PM
**To:** Robin Vanstone
**Cc:** Elizabeth Dollimore; Senior, Matt; Maher, Trina; Stokke, Samantha; tanyahill-montour@sixnations.ca; Dawn Russell; Lauren Jones; Tayler Hill; lonnybomberry@sixnations.ca; nativelandsltd@gmail.com; Bethany Kuntz-Wakefield; Peter Graham; Ramlogan, Vijanti
**Subject:** Lisgar District Pumping Stations Study Update

Hi Robbin,

We wanted to provide you with an update on the Lisgar District Pumping Stations Study. A Public Information Centre (PIC) and Town Hall was held on November 17, 2021, which provided an update on the ongoing monitoring and works in the Lisgar District and shared information related to the Study. The PIC slides can be found here - https://www.mississauga.ca/projects-and-strategies/environmental-assessments/lisgar-district-pumping-stations-study/

Additionally, please see the link below for the draft Stage 1 Archaeological Assessment and Natural Heritage Existing Conditions Report for your review and comment.

7 Lisgar

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Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
Pronouns – She/Her/Hers
Mobile: + (416) 357-2093
**www.woodplc.com**

wood.

---

**From:** Shakeel, Meera
**Sent:** Monday, July 19, 2021 10:38 AM
**To:** rvanstone@sixnations.ca
**Cc:** Shams, Aniqa <aniqa.shams@woodplc.com>; Maher, Trina <trina.maher@woodplc.com>; Kelly, Mary K <mary.k.kelly@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>; Elizabeth Dollimore

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Wednesday, February 2, 2022 10:29 AM
**To:** Lauren Jones
**Subject:** RE: Lisgar District Pumping Stations Study Update

Hi Lauren,

Can you try the link again - 7 Lisgar

I updated the settings so hopefully it will work now! Apologies for the inconvenience!

Thanks,
Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
Pronouns – She/Her/Hers
Mobile: + (416) 357-2093
**www.woodplc.com**

---

**From:** Lauren Jones <laurenjones@sixnations.ca>
**Sent:** Wednesday, February 2, 2022 9:04 AM
**To:** Shams, Aniqa <aniqa.shams@woodplc.com>; Robin Vanstone <rvanstone@sixnations.ca>
**Cc:** Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; Senior, Matt <matt.senior@woodplc.com>; Maher, Trina <trina.maher@woodplc.com>; Stokke, Samantha <samantha.stokke@woodplc.com>; Tanya Hill-Montour <tanyahill-montour@sixnations.ca>; Dawn Russell <dawnrussell@sixnations.ca>; Tayler Hill <tayler.hill@sixnations.ca>; Lonny Bomberry <lonnybomberry@sixnations.ca>; nativelandsltd@gmail.com; Bethany Kuntz-Wakefield <wildlife@sixnations.ca>; Peter Graham <petergraham@sixnations.ca>; Ramlogan, Vijanti <vijanti.ramlogan@woodplc.com>
**Subject:** RE: Lisgar District Pumping Stations Study Update

**CAUTION:** External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Hi Aniqa,

I am having trouble accessing the files. It won't accept my email. Is their another method?

Niá:wen and kind regards,

Lauren Jones, BSc
Wildlife and Stewardship Management Assistant
Six Nations of the Grand River Elected Council

T (519) 445-0330
A 109-1721 Chiefswood Road, Ohsweken ON N0A 1M0

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---

**From:** Shams, Aniqa <aniqa.shams@woodplc.com>
**Sent:** February 1, 2022 4:33 PM
**To:** Robin Vanstone <rvanstone@sixnations.ca>
**Cc:** Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; Senior, Matt <matt.senior@woodplc.com>; Maher, Trina <trina.maher@woodplc.com>; Stokke, Samantha <samantha.stokke@woodplc.com>; Tanya Hill-Montour <tanyahill-montour@sixnations.ca>; Dawn Russell <dawnrussell@sixnations.ca>; Lauren Jones <laurenjones@sixnations.ca>; Tayler Hill <tayler.hill@sixnations.ca>; Lonny Bomberry <lonnybomberry@sixnations.ca>; nativelandsltd@gmail.com; Bethany Kuntz-Wakefield <wildlife@sixnations.ca>; Peter Graham <petergraham@sixnations.ca>; Ramlogan, Vijanti <vijanti.ramlogan@woodplc.com>
**Subject:** Lisgar District Pumping Stations Study Update

Hi Robbin,

We wanted to provide you with an update on the Lisgar District Pumping Stations Study. A Public Information Centre (PIC) and Town Hall was held on November 17, 2021, which provided an update on the ongoing monitoring and works in the Lisgar District and shared information related to the Study. The PIC slides can be found here - https://www.mississauga.ca/projects-and-strategies/environmental-assessments/lisgar-district-pumping-stations-study/

Additionally, please see the link below for the draft Stage 1 Archaeological Assessment and Natural Heritage Existing Conditions Report for your review and comment.

7 Lisgar

The next steps in this Study will include the preparation of the Project File Report. This is anticipated to be completed in the first quarter of 2022. We will provide the draft report for your review and comment. Please let us know if you have any comments or questions at all. I will follow up via phone and email in two weeks' time.

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Monday, February 14, 2022 11:19 AM
**To:** Dominic Ste-Marie
**Cc:** Mario Gros Louis; Lori-Jeanne Bolduc; Elizabeth Dollimore; Senior, Matt; Stokke, Samantha
**Subject:** RE: Lisgar District Pumping Stations Study Update

Hi Dominic,

There is no additional fieldwork required for this Study.

The City will provide funding for the review of reports. I understand from other projects that Huron-Wendat Nation does not provide agreements for report review – can you please confirm? If only an invoice is prepared, please direct this to the attention of the City of Mississauga – Elizabeth Dollimore.

Thank you and please let me know if you have any other questions or comments. We look forward to receiving your feedback on the reports provided. When the final Project File Report is ready, we will provide the report to Huron-Wendat Nation for review and comment.

Best regards,
Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
Pronouns – She/Her/Hers
Mobile: + (416) 357-2093
**www.woodplc.com**

---

**From:** Dominic Ste-Marie <Dominic.Sainte-Marie@wendake.ca>
**Sent:** Thursday, February 10, 2022 10:38 AM
**To:** Shams, Aniqa <aniqa.shams@woodplc.com>
**Cc:** Mario Gros Louis <Mario.GrosLouis@wendake.ca>; Lori-Jeanne Bolduc <Lori-Jeanne.Bolduc@wendake.ca>
**Subject:** RE: Lisgar District Pumping Stations Study Update

**CAUTION:** External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Kwe Aniqa,

Thank you for your email. Could you please let us know if any archaeological studies or fieldwork will be necessary as part of this project? Also, could you please let us know if there is funding available for us to review the plan and be able to provide recommendations? Funding for our participation allows us to have our own resources analyze the plan.

Tiawenhk chia' önenh
Dominic Ste-Marie

**NATION HURONNE-WENDAT**
**Bureau du Nionwentsïo**

**Dominic Ste-Marie**
Conseiller en gestion du territoire
255, Place Chef Michel-Laveau
Wendake (Qc) G0A 4V0
Téléphone : 418-843-3767
Courriel : dominic.ste-marie@wendake.ca

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*Do you really need to print this email?*
*Think to the environment*

**Avis sur la protection et la confidentialité des informations**

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ATTENTION: Please note that Maxime Picard has a new position at the Huron-Wendat Nation Council and is no longer in charge of Ontario consultations. Any new consultation from Ontario must be sent to Mario Gros-Louis (mario.groslouis@wendake.ca), Lori-Jeanne Bolduc (lori-jeanne.bolduc@wendake.ca) and Dominic Ste-Marie (dominic.ste-marie@wendake.ca).

For inquiries relating specifically to archaeology (fieldwork planning, monitoring, reports review, etc.), please contact Marie-Sophie Gendron (marie-sophie.gendron@wendake.ca), Isabelle Lechasseur (isabelle.lechasseur@wendake.ca) and Jean-François Richard (jean-francois.richard@wendake.ca).

---

**De :** Shams, Aniqa <aniqa.shams@woodplc.com>
**Envoyé :** 1 février 2022 16:33
**À :** Lori-Jeanne Bolduc <Lori-Jeanne.Bolduc@wendake.ca>; Mario Gros Louis <Mario.GrosLouis@wendake.ca>
**Cc :** Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; Senior, Matt <matt.senior@woodplc.com>; Maher, Trina <trina.maher@woodplc.com>; Stokke, Samantha <samantha.stokke@woodplc.com>; Ramlogan, Vijanti <vijanti.ramlogan@woodplc.com>
**Objet :** Lisgar District Pumping Stations Study Update

Hi Ms. Bolduc and Mr. Gros-louis,

We wanted to provide you with an update on the Lisgar District Pumping Stations Study. A Public Information Centre (PIC) and Town Hall was held on November 17, 2021, which provided an update on the ongoing monitoring and works in the Lisgar District and shared information related to the Study. The PIC slides can be found here - https://www.mississauga.ca/projects-and-strategies/environmental-assessments/lisgar-district-pumping-stations-study/

Additionally, please see the link below for the draft Stage 1 Archaeological Assessment and Natural Heritage Existing Conditions Report for your review and comment.

7 Lisgar

## Shams, Aniqa

**From:** Lauren Jones <laurenjones@sixnations.ca>
**Sent:** Wednesday, February 23, 2022 10:33 AM
**To:** Shams, Aniqa
**Cc:** Robin Vanstone; Bethany Kuntz-Wakefield
**Subject:** RE: Lisgar District Pumping Stations Study Update

**CAUTION:** External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Hi Aniqa,

The Lisgar District Pumping station is next on my list! I should be getting to the Natural Heritage report at the end of this week. I was able to access the documents and will have to chat with Bethany and Robbin about any comments they might have and get back to you. Thank you for checking in.

---

**From:** Shams, Aniqa <aniqa.shams@woodplc.com>
**Sent:** February 23, 2022 10:28 AM
**To:** Lauren Jones <laurenjones@sixnations.ca>; Robin Vanstone <rvanstone@sixnations.ca>
**Cc:** Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; Senior, Matt <matt.senior@woodplc.com>; Maher, Trina <trina.maher@woodplc.com>; Stokke, Samantha <samantha.stokke@woodplc.com>; Tanya Hill-Montour <tanyahill-montour@sixnations.ca>; Dawn Russell <dawnrussell@sixnations.ca>; Tayler Hill <tayler.hill@sixnations.ca>; Lonny Bomberry <lonnybomberry@sixnations.ca>; nativelandsltd@gmail.com; Bethany Kuntz-Wakefield <wildlife@sixnations.ca>; Peter Graham <petergraham@sixnations.ca>; Ramlogan, Vijanti <vijanti.ramlogan@woodplc.com>
**Subject:** RE: Lisgar District Pumping Stations Study Update

Hi Lauren,

Following the voicemail that I left you, we just wanted to follow-up and see if you or anyone else from Six Nations of the Grand River had any comments or questions on the draft Stage 1 Archaeological Assessment and Natural Heritage Existing Conditions Report at this time? Please let me know if you still have access issues and I would be happy to send you the documents another way.

Thanks,
Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
Pronouns – She/Her/Hers
Mobile: + (416) 357-2093
**www.woodplc.com**

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Wednesday, February 23, 2022 10:39 AM
**To:** Raechelle Williams
**Cc:** hdi2@bellnet.ca; Maher, Trina; Senior, Matt; Elizabeth Dollimore; williams.todde@gmail.com; Stokke, Samantha; Ramlogan, Vijanti
**Subject:** RE: Lisgar District Pumping Stations Study Update

Hi Raechelle,

We wanted to follow-up on the email below and see if you had any comments or questions at this time with the draft Stage 1 Archaeological Assessment and Natural Heritage Existing Conditions Report? Please let me know if you have any issues accessing the files.

Thank you and looking forward to hearing back from you!
Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
Pronouns – She/Her/Hers
Mobile: + (416) 357-2093
**www.woodplc.com**

---

**From:** Shams, Aniqa
**Sent:** Tuesday, February 1, 2022 4:33 PM
**To:** Raechelle Williams <janice.r.n.w23@gmail.com>
**Cc:** hdi2@bellnet.ca; Maher, Trina <trina.maher@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; williams.todde@gmail.com; Stokke, Samantha <samantha.stokke@woodplc.com>; Ramlogan, Vijanti <vijanti.ramlogan@woodplc.com>
**Subject:** Lisgar District Pumping Stations Study Update

Hi Raechelle,

We wanted to provide you with an update on the Lisgar District Pumping Stations Study. A Public Information Centre (PIC) and Town Hall was held on November 17, 2021, which provided an update on the ongoing monitoring and works in the Lisgar District and shared information related to the Study. The PIC slides can be found here - https://www.mississauga.ca/projects-and-strategies/environmental-assessments/lisgar-district-pumping-stations-study/

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Wednesday, February 23, 2022 10:15 AM
**To:** Dominic Ste-Marie; Marie-Sophie Gendron
**Cc:** Mario Gros Louis; Lori-Jeanne Bolduc; Elizabeth Dollimore; Senior, Matt; Stokke, Samantha
**Subject:** RE: Lisgar District Pumping Stations Study Update

Hi Dominic and Marie-Sophie,

April 1 works with the Project timeline. We look forward to receiving your comments. If you have any questions in the meantime or trouble accessing the link, please don't hesitate to contact me.

Thanks,
Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
Pronouns – She/Her/Hers
Mobile: + (416) 357-2093
**www.woodplc.com**

---

**From:** Dominic Ste-Marie <Dominic.Sainte-Marie@wendake.ca>
**Sent:** Wednesday, February 16, 2022 12:00 PM
**To:** Shams, Aniqa <aniqa.shams@woodplc.com>
**Cc:** Mario Gros Louis <Mario.GrosLouis@wendake.ca>; Lori-Jeanne Bolduc <Lori-Jeanne.Bolduc@wendake.ca>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; Senior, Matt <matt.senior@woodplc.com>; Stokke, Samantha <samantha.stokke@woodplc.com>; Marie-Sophie Gendron <Marie-Sophie.Gendron@wendake.ca>
**Subject:** RE: Lisgar District Pumping Stations Study Update

**CAUTION:** External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Ndio' Aniqa,

My colleague Marie-Sophie (cc'd) will be able to provide a quote and coordinate our participation to this project. What is your deadline for comments on this project? Our team is currently swamped with reports, we should be able to provide comments by April 1st.

## Shams, Aniqa

**From:** Marie-Sophie Gendron <Marie-Sophie.Gendron@wendake.ca>
**Sent:** Monday, February 21, 2022 3:35 PM
**To:** Dominic Ste-Marie; Shams, Aniqa
**Cc:** Mario Gros Louis; Lori-Jeanne Bolduc; Elizabeth Dollimore; Senior, Matt; Stokke, Samantha
**Subject:** RE: Lisgar District Pumping Stations Study Update
**Attachments:** Lisgar District Pumping Study Update - Stage 1AA.pdf

**CAUTION:** External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Good afternoon Aniqa,

I hope this email finds you doing well. I have attached to this email the quote for our comments regarding the Stage 1 AA for this project. Please, let me know if you have any questions.

Entïio'!
Marie-Sophie

**NATION HURONNE-WENDAT**
**Bureau du Nionwentsïo**

**Marie-Sophie Gendron, B.A.**
Analyste archéologue
255, Place Chef Michel-Laveau
Wendake (Qc) G0A 4V0
Téléphone : 418-843-3767
Courriel : marie-sophie.gendron@wendake.ca

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---

**De :** Dominic Ste-Marie <Dominic.Sainte-Marie@wendake.ca>
**Envoyé :** 16 février 2022 12:00
**À :** Shams, Aniqa <aniqa.shams@woodplc.com>
**Cc :** Mario Gros Louis <Mario.GrosLouis@wendake.ca>; Lori-Jeanne Bolduc <Lori-Jeanne.Bolduc@wendake.ca>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; Senior, Matt <matt.senior@woodplc.com>; Stokke, Samantha <samantha.stokke@woodplc.com>; Marie-Sophie Gendron <Marie-Sophie.Gendron@wendake.ca>
**Objet :** RE: Lisgar District Pumping Stations Study Update

Ndio' Aniqa,

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Wednesday, February 23, 2022 10:35 AM
**To:** DOCA.Admin@mncfn.ca; Mark LaForme
**Cc:** Maher, Trina; Senior, Matt; Elizabeth Dollimore; Stokke, Samantha; Ramlogan, Vijanti; Communications@mncfn.ca
**Subject:** RE: Lisgar District Pumping Stations Study Update

Hi Mark and Abby,

It's always nice to speak to you Abby! As discussed, please see the email below for the Lisgar District Pumping Stations Study.

Mark – Please let me know if you have any questions or comments on the draft Stage 1 Archaeological Assessment and Natural Heritage Existing Conditions Report. If you have any trouble accessing the link, please let me know! 7 Lisgar

Thank you,
Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
Pronouns – She/Her/Hers
Mobile: + (416) 357-2093
**www.woodplc.com**

---

**From:** Shams, Aniqa
**Sent:** Tuesday, February 1, 2022 4:33 PM
**To:** Fawn Sault <Fawn.Sault@mncfn.ca>; Communications@mncfn.ca
**Cc:** Maher, Trina <trina.maher@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; Stokke, Samantha <samantha.stokke@woodplc.com>; Ramlogan, Vijanti <vijanti.ramlogan@woodplc.com>
**Subject:** Lisgar District Pumping Stations Study Update

Hi Fawn and DOCA team,

We wanted to provide you with an update on the Lisgar District Pumping Stations Study. A Public Information Centre (PIC) and Town Hall was held on November 17, 2021, which provided an update on the ongoing monitoring and works in the Lisgar District and shared information related to the Study. The PIC slides can be found here - https://www.mississauga.ca/projects-and-strategies/environmental-assessments/lisgar-district-pumping-stations-study/

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Wednesday, February 23, 2022 10:43 AM
**To:** 'Lauren Jones'; tanyahill-montour@sixnations.ca
**Cc:** Robin Vanstone; Bethany Kuntz-Wakefield
**Subject:** RE: Lisgar District Pumping Stations Study Update

Perfect, thanks for letting me know! Looking forward to receiving your comments.

Tanya – If you have any comments on the Stage 1 arch, please let me know!

Best regards,
Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
Pronouns – She/Her/Hers
Mobile: + (416) 357-2093
**www.woodplc.com**

---

**From:** Lauren Jones <laurenjones@sixnations.ca>
**Sent:** Wednesday, February 23, 2022 10:33 AM
**To:** Shams, Aniqa <aniqa.shams@woodplc.com>
**Cc:** Robin Vanstone <rvanstone@sixnations.ca>; Bethany Kuntz-Wakefield <wildlife@sixnations.ca>
**Subject:** RE: Lisgar District Pumping Stations Study Update

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Hi Aniqa,

The Lisgar District Pumping station is next on my list! I should be getting to the Natural Heritage report at the end of this week. I was able to access the documents and will have to chat with Bethany and Robbin about any comments they might have and get back to you. Thank you for checking in.

---

**From:** Shams, Aniqa <aniqa.shams@woodplc.com>
**Sent:** February 23, 2022 10:28 AM
**To:** Lauren Jones <laurenjones@sixnations.ca>; Robin Vanstone <rvanstone@sixnations.ca>
**Cc:** Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; Senior, Matt <matt.senior@woodplc.com>; Maher, Trina <trina.maher@woodplc.com>; Stokke, Samantha <samantha.stokke@woodplc.com>; Tanya Hill-Montour <tanyahill-montour@sixnations.ca>; Dawn Russell <dawnrussell@sixnations.ca>; Tayler Hill <tayler.hill@sixnations.ca>; Lonny Bomberry <lonnybomberry@sixnations.ca>; nativelandsltd@gmail.com; Bethany Kuntz-Wakefield <wildlife@sixnations.ca>; Peter Graham <petergraham@sixnations.ca>; Ramlogan, Vijanti

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Wednesday, February 23, 2022 10:49 AM
**To:** DOCA Admin
**Subject:** RE: Lisgar District Pumping Stations Study Update

Oh I'm so sorry! Can you see if this link works - 7 Lisgar

Again so sorry!

---

**From:** DOCA Admin <DOCA.Admin@mncfn.ca>
**Sent:** Wednesday, February 23, 2022 10:46 AM
**To:** Shams, Aniqa <aniqa.shams@woodplc.com>
**Subject:** RE: Lisgar District Pumping Stations Study Update

**CAUTION:** External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Hey Aniqa,

I'm having a hard time accessing the file. I noticed my email was wrong. lol

Thank you

**Abby LaForme,**
**Administrative Support**

**Mississaugas of the Credit First Nation (MCFN)**
**Department of Consultation & Accommodation (DOCA)**
**4065 Highway 6, Hagersville, ON N0A 1H0**
**Ph: (905) 768 – 4260**
**Website: http://mncfn.ca/doca/**

---

**From:** Shams, Aniqa [mailto:aniqa.shams@woodplc.com]
**Sent:** Wednesday, February 23, 2022 10:35 AM
**To:** DOCA Admin <DOCA.Admin@mncfn.ca>; Mark LaForme <Mark.LaForme@mncfn.ca>
**Cc:** Maher, Trina <trina.maher@woodplc.com>; Senior, Matt <matt.senior@woodplc.com>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; Stokke, Samantha <samantha.stokke@woodplc.com>; Ramlogan, Vijanti <vijanti.ramlogan@woodplc.com>; communications <communications@mncfn.ca>
**Subject:** RE: Lisgar District Pumping Stations Study Update

Hi Mark and Abby,

It's always nice to speak to you Abby! As discussed, please see the email below for the Lisgar District Pumping Stations Study.

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Wednesday, March 16, 2022 9:20 PM
**To:** Tanya Hill-Montour
**Subject:** RE: Lisgar District Pumping Stations Study Update

Hi Tanya,

Let me know if this link works for you! 7 Lisgar

Thanks,
Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
Pronouns – She/Her/Hers
Mobile: + (416) 357-2093
**www.woodplc.com**

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**From:** Tanya Hill-Montour <tanyahill-montour@sixnations.ca>
**Sent:** Wednesday, March 16, 2022 10:49 AM
**To:** Shams, Aniqa <aniqa.shams@woodplc.com>; Lauren Jones <laurenjones@sixnations.ca>; Robin Vanstone <rvanstone@sixnations.ca>
**Cc:** Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; Senior, Matt <matt.senior@woodplc.com>; Maher, Trina <trina.maher@woodplc.com>; Stokke, Samantha <samantha.stokke@woodplc.com>; Dawn Russell <dawnrussell@sixnations.ca>; Tayler Hill <tayler.hill@sixnations.ca>; Lonny Bomberry <lonnybomberry@sixnations.ca>; nativelandsltd@gmail.com; Bethany Kuntz-Wakefield <wildlife@sixnations.ca>; Peter Graham <petergraham@sixnations.ca>; Ramlogan, Vijanti <vijanti.ramlogan@woodplc.com>
**Subject:** RE: Lisgar District Pumping Stations Study Update

**CAUTION:** External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Hi Aniqa,

Could you send me the Stage 1 archaeological assessment re: Lisgar District Pumping Stations Study directly?

Kind Regards,

*Tanya j. Hill-Montour* B.A Hons.
Six Nations of the Grand River - Archaeology Supervisor.

## Shams, Aniqa

**From:** Shams, Aniqa
**Sent:** Thursday, April 28, 2022 9:18 AM
**To:** Marie-Sophie Gendron; Dominic Ste-Marie
**Cc:** Mario Gros Louis; Lori-Jeanne Bolduc; Elizabeth Dollimore; Senior, Matt; Stokke, Samantha
**Subject:** RE: Lisgar District Pumping Stations Study Update

Good morning Marie-Sophie and Dominic,

We wanted to follow-up on this project below and were wondering if we should expect to receive comments soon. We are aiming to wrap up the project by May and are currently in the process of compiling the final Project File Report, which we will send you for your review and comment in the next few weeks. Please let us know if you are planning on providing comments on the Stage 1 Archaeological Assessment and how soon these comments could be provided.

Best regards,
Aniqa

**Aniqa Shams, RPP, MCIP**
Human Environment Consultant
Pronouns – She/Her/Hers
Mobile: + (416) 357-2093
**www.woodplc.com**

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**From:** Marie-Sophie Gendron <Marie-Sophie.Gendron@wendake.ca>
**Sent:** Monday, February 21, 2022 3:35 PM
**To:** Dominic Ste-Marie <Dominic.Sainte-Marie@wendake.ca>; Shams, Aniqa <aniqa.shams@woodplc.com>
**Cc:** Mario Gros Louis <Mario.GrosLouis@wendake.ca>; Lori-Jeanne Bolduc <Lori-Jeanne.Bolduc@wendake.ca>; Elizabeth Dollimore <Elizabeth.Dollimore@mississauga.ca>; Senior, Matt <matt.senior@woodplc.com>; Stokke, Samantha <samantha.stokke@woodplc.com>
**Subject:** RE: Lisgar District Pumping Stations Study Update

**CAUTION:** External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Good afternoon Aniqa,

I hope this email finds you doing well. I have attached to this email the quote for our comments regarding the Stage 1 AA for this project. Please, let me know if you have any questions.

Entïio'!
Marie-Sophie

# Appendix G7
# Conservation Halton

August 31, 2021

Elizabeth Dollimore
Project Manager
City of Mississauga
201 City Centre Drive
Mississauga, ON

Conservation Halton
Planning & Watershed Management
905.336.1158 | Fax: 905.336.6684
2596 Britannia Road West
Burlington, Ontario L7P 0G3
conservationhalton.ca

**BY EMAIL ONLY (elizabeth.dollimore@mississauga.ca)**

Dear Elizabeth Dollimore:

**Re: Municipal Class Environmental Assessment - Lisgar District Pumping Stations**
**Notice of Study Commencement**
**City of Mississauga**
**CH File: MPR 796**

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Conservation Halton (CH) staff has reviewed the Notice of Commencement (NOC) received on July 22, 2021 for the above-noted Environmental Assessment (EA). Staff has prepared the attached *'Environmental Assessment Checklist'*, which identifies potential environmental issues that should be considered during this EA.

## Purpose of EA

The City of Mississauga is undertaking a Schedule B Municipal Class EA to determine the number, preferred location(s) and type(s) of pumping stations within the Lisgar District to reduce the potential for basement water infiltration.

## Overview and General Comments

The attached checklist identifies a list of issues and criteria that CH staff foresees as being important to evaluate during the study. Additional requirements may become evident as the study progresses. These comments are preliminary and CH staff will provide more comments once additional information about the study is made available.

## Recommendation

Staff recommends that, in addition to participation at Technical Advisory Committee (TAC) meetings, individual meetings with CH would be appropriate to ensure that the final Environmental Study Report (ESR) contains the information required for CH to support a preferred alternative.

An EA Review Fee in accordance with CH's fee schedule at the time of submission will be required prior to commencing technical review and issuing comments. CH's fee schedule is available online: https://www.conservationhalton.ca/plan-review-fees.

We trust these comments are of assistance. If you have any questions, please do not hesitate to contact the undersigned.

Sincerely,

Emma DeFields, MCIP RPP
Environmental Planner
905.336.1158 ext. 2335
edefields@hrca.on.ca

CC: Matt Senior, Wood Environment & Infrastructure Solutions, matt.senior@woodplc.com
Meera Shakeel, Wood Environment & Infrastructure Solutions, meera.shakeel@woodplc.com

Encl: Environmental Assessment Checklist

## ENVIRONMENTAL ASSESSMENT

The following list identifies the areas of interest or concern that Conservation Halton may have with the subject Environmental Assessment (EA). The level of detail recommended will be dependent on the proposed works as well as the natural hazards, natural heritage system, and environmental conditions in the study area. The proponent should contact Conservation Halton staff early in the EA process to discuss the level of study that is suggested and to establish Terms of Reference for specific studies where appropriate.

All technical assessments should be completed by a qualified professional and the input of the various experts should be carefully coordinated to ensure consistency throughout the Environmental Study Report.

| | |
|---|---|
| PROJECT TITLE: City of Mississauga Municipal Class Environmental Assessment Lisgar District Pumping Stations | DATE: August 31, 2021 |
| LOCATION: Ninth Line to Tenth Line, between the Canadian Pacific Railway tracks to the north and Britannia Road to the south. | FILE: MPR 796 |
| **TIMING WINDOW RESTRICTION:** | |

| | Applicable |
|---|---|
| **General Submission Requirements** | |
| **Ontario Regulation 162/06** | |
| The study area contains a tributary of Sixteen Mile Creek (East Branch Lisgar) and associated flood (floodplain) and erosion hazards, as well as wetlands. The study area also contains areas of flood hazard (spill) that originates further downstream of the study area. Conservation Halton regulates the flood hazards (floodplain and spill) and erosion hazards associated with the watercourses, and the 15m allowances from the greater of the hazards. *Ontario Regulation 162/06* requires that a Permit be obtained from Conservation Halton prior to development, interference with wetlands or alterations to shorelines and watercourses. *Ontario Regulation 162/06* and Conservation Halton's Board-approved *Policies and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy* ***(hereafter referred to as Conservation Halton's Policies and Guidelines)*** are available at www.conservationhalton.ca. Provide sufficient information to allow Conservation Halton staff to determine whether a Permit could be issued at detailed design in the ESR. | ☒ |
| The study area contains a locally significant wetland that is greater than 2ha in size. As per *Ontario Regulation 162/06*, Conservation Halton regulates 120 metres from the limit of a provincially significant wetland (PSW) or wetland great or equal to 2 ha in size and 30 metres from the limit of a wetland less than 2 ha in size. Obtain permission from Conservation Halton prior to development within the regulated area. | ☒ |
| Identify areas where Permits pursuant to *Ontario Regulation 162/06* will be required and include such Permits as future commitments in the environmental study report (ESR). Some details related to future Permits may not be deferred to detailed design. Review the requirements of policy 2.48 Public Infrastructure – Utilities, Trails and Transportation) of *Conservation Halton's Policies and Guidelines.* | ☒ |
| Survey drainage features watercourses, ditchlines, culverts, valley slopes, and all other relevant topographical features. | ☒ |
| Plot all areas regulated by Conservation Halton on drawings. Approximate Regulation Limit (ARL) mapping may be utilized if more detailed study is not required at this time, however, please ensure that drawings indicate that the limits shown are an approximation of the regulated area. Conservation Halton's ARL | ☒ |

| | |
|---|---|
| mapping is available online: https://www.conservationhalton.ca/mapping-and-data. | |
| A Data Request Form is required for all digital information requests. The form and additional information on data holdings can be found at Conservation Halton's website at the following link http://www.conservationhalton.ca/planning-permits in the "Mapping and Data" section.<br><br>☐ Flood Plain Modelling available ☐ Flood Plain Modelling not available<br><br>***Any need for modelling will be confirmed once additional information is provided through the EA process.** | ☒ * |
| Ensure that 'potential impacts to and risks from natural hazards' *(flood hazards including spill, erosion, and unstable bedrock/soils)* is one of the evaluation criteria. The proposed alternative must have no negative impacts on natural hazards and must not increase risk to life and property from natural hazards in order for Conservation Halton to issue a future approval under *Ontario Regulation 162/06*. Opportunities to improve any deficiencies with respect to flooding (including spill) and erosion should also be investigated. | ☒ |
| Identify and assess through hydrologic and hydraulic analysis all potential flood plain impacts with consideration of maintaining flood storage, no increased flood levels on adjacent or downstream properties, no increased on-site flood risks, and appropriate flow velocities under the full range of storm conditions. | ☒ |
| Conservation Halton endeavours to have all public roadways flood free under Regional Storm conditions. At a minimum, safe access and egress for both pedestrians and vehicles as defined in the *MNRF's Technical Guide on River and Stream Systems: Erosion Hazard Limit (2002)* **(hereafter referred to as *MNRF's Technical Guide*)** should be provided, resulting in a maximum flood depth of 0.3 m, a maximum flood velocity of 1.7 m/s and a maximum depth-velocity product of 0.4 $m^2/s$. *MNRF's Technical Guide* may not provide sufficient accessibility for emergency vehicles due to the operational practices of each Emergency Response Organization. If a roadway is considered by the Province or local municipality to be an Emergency Route then there should be no overtopping of the road with flood waters. | ☐ |
| Consider *MTO's 2008 Highway Drainage Design Standards* and/or the local municipal engineering standards for flooding along/over roads. This document is available through the MTO Online Library Catalogue at http://www.library.mto.gov.on.ca. | ☐ |
| Identify and assess through a fluvial geomorphological assessment all potential erosion hazard impacts associated with a watercourse's migration, downcutting and meander belt. *MNRF's Technical Guide* should be followed. http://www.renaud.ca/public/Environmental-Regulations/MNR%20Technical%20Guide%20Flooding%20Hazard%20Limit.pdf | ☒ |
| Provide a fluvial geomorphological assessment to verify that the preferred alternative design has adequately allowed for natural channel functions and sediment transport, as well as minimizes the risk to infrastructure. | ☒ |
| Ensure habitat connectivity and wildlife movement are incorporated into the planning design and construction practices of all works. The design practices should maintain, and where possible improve or restore, key ecological linkages. | ☒ |
| Contact staff to confirm if a site visit to stake the Physical Top of Bank and Wetlands is required. If so, an OLS must also be present during this staking. | ☒ |
| Please contact Conservation Halton to confirm if a site visit is necessary for staff to confirm whether a geotechnical assessment is required. If so, identify and assess all potential erosion hazard impacts associated with valley slopes through a geotechnical assessment. *MNRF's Technical Guide* should be | ☒ |

| | |
|---|---|
| followed. | |
| Identify any potential areas of unstable bedrock, karst or unstable soils within the study area. If these areas are found, the appropriate geotechnical analysis, karst assessment, hydrogeological evaluation or other study necessary to assess the impacts from and on these natural hazards by each alternative should be undertaken. | ☐ |
| A hydrologic evaluation is required to determine if there is an impact to the hydrological functions of the wetland as a result of the proposed works and to evaluate the various alternatives. | ☒ |
| A geotechnical and coastal engineering report is required to identify soil properties to determine the long-term stable slope allowance associated with the Lake Ontario shoreline. | ☐ |
| A topographic survey is required to identify the lands impacted by the flooding hazard associated with the watercourses. | ☒ |
| Use trenchless technologies for crossings of all wetlands and permanent flowing watercourses, wherever possible. | ☒ |
| | Applicable |
| **Natural Heritage** | |
| When undertaking any fieldwork and/or when making recommendations related to natural heritage and/or natural hazards, refer to the *Ministry of Natural Resources and Forestry (MNRF): Natural Heritage Reference Manual for Natural Heritage Policies, 2nd Edition, 2010; Significant Wildlife Habitat Technical Guideline, 2002;* and, *MNRF's Technical Guide. Natural Hazards Technical Guide and Understanding Natural Hazards* http://www.renaud.ca/public/Environmental-Regulations/MNR%20Technical%20Guide%20Flooding%20Hazard%20Limit.pdf | ☒ |
| The study area may contain or pass between natural features. As per policy 2.1.2 of the *Provincial Policy Statement, 2020* ***(hereafter referred to as PPS, 2020),*** the diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and groundwater features. The use of ecopassages or other measures to facilitate wildlife movement should be evaluated. | ☒ |
| The study area contains a locally significant wetland. As per policy 2.1.4 (a) and (b) of the *PPS, 2020,* development and site alteration shall not be permitted in significant wetlands or significant coastal wetlands. | ☒ |
| The study area may contain the habitat of Endangered or Threatened species. As per policy 2.1.7 of the *PPS, 2020,* development and site alteration shall not be permitted in the habitat of Endangered and Threatened Species, except in accordance with provincial and federal requirements. The provincial *Endangered Species Act and/or federal Species at Risk Act* may apply. Please contact MECP at *SAROntario@ontario.ca* for further information on *Endangered Species Act* requirements. | ☒ |
| The study area contains an area of natural and scientific interest (ANSI). As per policy 2.1.5 (e) of the *PPS, 2020,* development and site alteration shall not be permitted in significant areas of natural and scientific interest (ANSI), unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions. Contact MNRF for further information. | ☐ |

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|---|---|
| The study area may contain a significant wildlife habitat. As per policy 2.1.5 (d) of the *PPS, 2020,* development and site alteration shall not be permitted in significant wildlife habitat unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions. Refer to the MNRF's *Significant Wildlife Habitat Technical Guidelines, 2002* http://www.ontario.ca/document/guide-significant-wildlife-habitat. | ☒ |
| The study area contains a significant valleyland of the (..... Creek). As per policy 2.1.5 (c) of the *PPS, 2020,* development and site alteration shall not be permitted in significant valleylands unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions. | ☐ |
| The City of Mississauga Forestry Department should be consulted regarding the status of woodlands in this area and any impacts/mitigation proposed. CH may provide additional comments based on direction from the City. | ☒ |
| Development and site alteration shall not be permitted on lands adjacent to the natural heritage features and areas identified in policies 2.1.4 and 2.1.5 of the *PPS, 2020,* unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the natural features or on their ecological functions. Please note that the *MNRF's Natural Heritage Reference Manual for Natural Heritage Policies*, Second Edition (2010) http://docs.files.ontario.ca/documents/3270/natural-heritage-reference-manual-for-natural.pdf considers adjacent lands to be within 120 metres. | ☒ |
| The study area contains the Environmental Significant Areas (ESA). The Environmental Study Report must address impacts to the ESA. Please contact the *( Region of Halton / City of Hamilton / County of Wellington / City of Mississauga )* for further information on the ESA. | ☐ |
| Use Ecological Land Classification to map natural and semi-natural features to vegetation type and identify protection/mitigation measures. ELC data sheets are required with the ESR submission (please include digital species spreadsheets). | ☒ |
| Refer to Conservation Halton's *Environmental Impact Study Guidelines* for information on general study requirements, impact assessment and appropriate timing and protocols for surveys. These guidelines can be found at www.conservationhalton.ca. | ☐ |
| *Conservation Halton's Landscaping and Tree Preservation Guidelines* should be consulted at detailed design. These guidelines can be found at http://www.conservationhalton.ca/policies-and-guidelines. | ☒ |
| | **Applicable** |
| **Fish Habitat** | |
| Include a detailed description and habitat map of in-stream and bank habitat features including bankfull width, pools, riffles, undercut banks, eroding banks, root wads and large woody debris, thalweg/low flow location, backwater areas, substrate type, etc. as per *MTO Protocol: Environmental Guide for Fish and Fish Habitat, 2009*. Include photo documentation of the study area with a key map indicating photo locations. | ☐ |
| Provide thermal regime information for the watercourse within the study area using the Chu et. al. (2009) protocol. This can be obtained at TRCA's website at http://www.trca.on.ca/dotAsset/124131.pdf. | ☐ |

| | |
|---|---|
| The study area contains fish habitat. As per policy 2.1.6 of the *PPS, 2020*, development and site alteration shall not be permitted in fish habitat except in accordance with provincial and federal requirements. | ☒ |
| As per policy 2.6.1 of *Conservation Halton's Policies and Guidelines*, a fisheries setback of *15* metres from the bankfull channel width for warmwater watercourse should be applied. | ☒ |
| The *Fisheries Act* requires that projects avoid causing serious harm to fish and fish habitat unless authorized by the Minister of Fisheries and Oceans Canada. Work conducted in or near water bodies that support fish and fish habitat must comply with the *Fisheries Act* to ensure no serious harm to fish and harmful alteration, disruption or destruction of fish habitat occur. Refer to the DFO's website for additional information (http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html) or call 1-855-852-8320 or email fisheriesprotection@dfo-mpo.gc.ca. | ☒ |
| | Applicable |
| **Groundwater** | |
| A hydrogeological study in support of an Environment Assessment must establish that the proposed activities will not cause unacceptable groundwater quantity and/or quality impacts which may affect the natural environment, and if impacts are expected, they can be mitigated in a sustainable way. Please refer to the following document '*Requirements for Completion of Hydrogeological Studies to Facilitate Conservation Halton's Reviews' that can be obtained from Conservation Halton's* website www.conservationhalton.ca.To scope a study to a specific proposal contact Conservation Halton's hydrogeologist. | ☒ |
| As per policy 3.6.9 of *Conservation Halton's Policies and Guidelines*, please ensure that all proposed works should consider policies 2.2.1 and 2.2.2 of the *PPS, 2020,* regarding water. | ☒ |
| | Applicable |
| **Stormwater Management/Drainage** | |
| Demonstrate quality/quantity/erosion controls within the Stormwater Management section of the Environmental Study Report. Also examine the potential to combine SWM with adjacent development. The use of low impact development and at source controls should be explored as part of the stormwater management strategy for the proposal. Ensure mitigation of thermal impacts and at minimum 80% TSS removal will be required; note that additional requirements may apply based on the recommendations in the Subwatershed Study and the sensitivity of the receiving water body. | ☒ |
| As per.....<br><br>The quality requirements are.....<br><br>The quantity requirements are.....<br><br>The erosion control requirements are..... | ☐ |
| Identify existing vs. proposed drainage areas and maintain existing drainage divides. Proposed diversions must be clearly identified and the potential impacts fully assessed as part of the project's evaluation. | ☐ |

| | Applicable |
|---|---|
| **Other Requirements** | |
| Recommendations and requirements from the following *( Watershed / Subwatershed )* studies should be followed:<br>• | ☐ |
| Conservation Halton owns land within the study area. Identify any potential impacts to Conservation Halton land (direct – adjacent to, and indirect – road closures, detours etc.). Questions regarding Conservation Halton landholdings should be directed to Conservation Halton's Manager, Risk & Land Holdings Services directly at *(905) 336 1154 ext. 2256.* | ☐ |
| If infrastructure is proposed within existing easements/r-o-w or if there are additional property requirements, assess the impacts of utility relocation (i.e., telephone poles, union gas, etc.) on natural heritage features, natural hazard areas and fish habitat. This should not be left to detailed design as the relocation can have a significant impact on natural heritage features. | ☒ |
| Conservation Halton does not screen on behalf of MNRF for *Lakes and Rivers Improvement Act* implications. Contact the MNRF to determine if this Act applies to the proposed works. | ☐ |
| The Province and Crown Corporations do not require permits from Conservation Halton under *Ontario Regulation 162/06*. Efforts to comply with the requirements of *Ontario Regulation 162/06* and address areas of provincial interest are appreciated. | ☐ |
| A review timeline of 6 weeks to be incorporated into the project schedule. | ☒ |
| Provide a figure with proposed works and/or alternatives overlaid on an airphoto. | ☒ |
| Other: | ☐ |

| | |
|---|---|
| **Prepared by: Emma DeFields** | **Signature:** |
| **Date: August 31, 2021** | |

# Appendix G8
# Lisgar Residents' Association

Helen: November 29, 2021

The LRA has participated in community presentations for 10+ years now. Over that time the city has managed to install 1 pump which appears is undersized and when questioned claim data is still being collected and analyzed…….10+ years later. The need to install a 2nd pump to make up for the short coming of the first pump would appear to be a needless expense if properly researched and will take away from moving on with the installation of subsequent much needed pumps. Concerns continue that the city and the consultant engineers, whom themselves have been on this project from the beginning, really have a grasp of the problem or the magnitude or the horrific impact on those residents flooded. We are never left with assurances that allow us to sleep at night most particularly when it rains.

With interest we came across the following article and think this could be the future of Lisgar

National Post, 23 Nov 2021, Kelly MCPARLAND

Sumas Prairie was created by draining a lake 100 years ago to create rich farmland. Decades later a pumping station was installed to keep water from flooding in to recreate the lake. Though long considered a triumph of engineering and progress, local authorities have been increasingly worried that greater defences were needed as equipment aged and circumstances shifted, but construction costs money, and money is hard to come by for the sort of boring old projects to guard communities built in floodplains, or towns located in high-risk forest areas prone to fire.

Please click the link below and watch the 22 minute feature on flooding on this week's Marketplace. Many of the people interviewed are the same as Lisgar residents have experienced, many multiple times, over the last 11 years.

Flood insurance could become 'luxury for the rich'; Updated mask guidance: CBC's Marketplace cheat sheet | CBC News

**FEEDBACK/QUESTIONS/COMMENTS from Wednesday November 17, 2021 meeting.**

The Lisgar area has been known for over a hundred years as a swamp. This could well mean underground waterways, as well as water visible above ground.

1. Having so much flooding on the north end of Lisgar makes us wonder where all this water is coming from. No one appears to have looked for the source. Wood or other engineers admit they don't know where it all is coming from. We wonder if some of it may be these underground waterways, and so coming under the railroad tracks. Has this been tested and ruled this out?

2. Yes, as we have been told again in the City's recent meeting, water flows downhill. But when its outlet is stopped up, water can also back up. Have blockages been ruled out and prevented from happening?

**This is a concern we have for the development west of Ninth Line.** Yes, water in that area currently flows west and south. But with this significant development, we are concerned that it may stop up underground waterways that may indeed back up into the previous swamp land in Lisgar. The focus on flooding appears to be concerned with east of Ninth Line but there are worries not only will flooding occur west on Ninth Line but may worsen east of Ninth Line. The attention to flooding seems to be with a very narrow lens.

3. We are assured that the design firm who designed Lisgar used all the latest technology and engineering at the time. Yet we would consider the flooding of hundreds of homes to be a dramatic failure not only of the construction of the infrastructure of Lisgar (roads, stormwater pipes that leak, utility trenches that collect water, etc.) It is also a dramatic failure of the engineering design of the Lisgar area. Obviously, it was not engineered sufficiently to turn a swamp into a residential area densely packed with homes.

We are triumphantly told that the development west of Ninth Line will not use the failed three-pipe-design foundation drain collector system used in Lisgar and virtually universally abandoned almost immediately in subsequent development. Yet the same Engineering firm has been given the contract to design west of Ninth Line, to turn that swamp into even more densely packed homes and condos. Should this bring reassurance that they can get it right the

next time?  Reassurance for those residents, and for any impact to the residents of Lisgar?

4.  A story from an old farmer who grew up farming this area illustrates some of our concerns.  He told this story at one of the open houses the city ran about the proposed development.  He expressed concerns about the underground waterways he has known flow through this “swamp”. He told city staff and all who would listen about when Union Gas was breaking ground for their plant on Ninth Line, just south of Derry Rd.  He said that they did their surveys, dug and poured footings.  The next day they came back to build on them, only to find that they had sunk so far into the swampy ground that they could not even find them.  They had to dig further down and pour new footings.

5.  And so maybe you can understand our question raised about whether the current engineering firm knows where the water table of that land is. And our concern when the engineering representative did not even seem to understand, or at least acknowledge the validity of our concern.

6. Do the Engineers know where the flood plane is west of Ninth Line?
We were told Oct 2017 at the City Flood meeting at Mt. Carmel the city contracted engineers did not know. Should they not know?
When the question was posed if the engineering firm knew where the water table was it was not answered other than to say water flows west. But will this be the case once the land is fully developed? What is the floodplain going to look like when construction is complete including the new Ninth Line Road?

7.  On Aug 28, 21, the pump truck north of Derry was not pumping.
Video…..

D5D48186-D81E-48C
A-9628-232B733D8FC

Are there no escalation procedures in place when issues arise? This poor fellow looks totally lost. Request more advanced ongoing training for the contractor staff with escalation of procedure.

8. We think the length of time for all three pumps as currently planned is far to excessive. If the research has been done to determine the optimal location, then start them now and borrow money if that is the issue.

9. Are the pumps planned so water flow from the site of the first pump will flow to the site of the next proposed pump and so on?

10. Where does the water from the pumping station travel and end up?

11. Consideration should be given to updating the pump truck protocol to 1/4 pipe or 1/3 pipe full of water, rather than ½ pipe, so that the flooding situation won't get away from them. Wouldn't that make sense? The flood of January 2020, the city had to utilize the fire department pump trucks as the protocol in place was insufficient, the pump trucks were overwhelmed, causing 42 homeowners to report flooding, not everyone reports anymore due to insurance. The fire department pump trucks were called into service AFTER the homes had already flooded.

12. What will the impact of the construction have upon the water table on the east and west side? The new homes built on Ninth Line and Osprey were built less than 15 feet from the floodplain

13. Climate change, impact of increasing water level due to storms have an impact on the capacity of the pumping stations? The city needs to overbuild.

14. The city does not know where the water is coming from that is flooding Lisgar in particular Black Walnut Trail. What action is being taken to research this problem?

15. The capacity of the permanent pump station at Cactus Gate appears inadequate due to the fact the city has a temporary pump truck on site not far from Cactus Gate, and the first priority site for permanent pump #2 is very close to it. Request that all future pumping stations be overbuilt. Does water flow past the 1st permanent pump toward the location of the priority site for pump #2? If so, this would be further proof that the first permanent pump was not built big enough. Specifically, is a 2nd pumping stations being built at Cactus Gate?

16. What is the total number of pumping stations that the city will build in Lisgar?

17. Request that the water protocol be changed for the pump trucks operated by the contractor begin pumping the FDC at 25% as opposed to the current 50%

18. Where does the water go or flow toward that is pumped from Cactus Gate pumping station?

19. Can the city confirm where the Federal funding $1,500,000 came from and to what pumps it was allocated? These funds were secured by the advocacy of Lisgar R.A. through them MP Gagan Sikand.

20. Request downspouts to be removed from the underground system within a specified period or the city will do it and bill the homeowner

Note : average cost for repairs for a flood is $45,000 this cost is 100% covered by the homeowner the city, region and province do not pay damages to the homeowner.

Below are a few links that will take you to all meetings over the past 11 years. There may be some overlap.

Lisgar District Basement Water Infiltration Investigation Meeting Full 2 April 2015

:58 mark question about the lining of the pipes under the Railway
Ron states there are 3 types of remedies to use to stop leakage
* spray on technology
* sleeve that covers the pipe
He doesn't state the 3rd
It creates an impermeable barrier
Mark 1:01 Glenn's remarks
Ron would not give a confirmation that repairs would be successful
Mark 1:02 Scott's remarks about the lining & trench system
Ron 1:04 mark states
that the lining is not 100% effective that's why the trench system is required
1:05 mark
Concrete sewer lining lifespan is 75 -100 years
Lisgar sewer - current lining lifespan is 40-50 years

1:06:18
Question from Osprey Rd resident about how the native soil is not allowing the water to absorb into the land

The city acknowledges that It seems the type of native soil does not allow drainage and yet the engineering company has stated that the system engineered and installed is to have water filter through the soil, this is the preferred way to move water in Lisgar, as opposed to having the downspouts underground going directly to the FDC.

1:07 same resident on Osprey discussion about the water pressure damage on the structure of homes and spent $23,000 on flood protection for his home

Lisgar Basement Water Infiltration Investigation – City of Mississauga

A city link to all the flood meeting over the past 11 years

**OCTOBER 2018**

LRA question/comments begin at the mark :56
the 1:06 mark and 1:18. Ron Schekenberger, WOOD/AMEC has no idea where the floodplain is in Lisgar. Claimed Halton would have it.

https://www.mississauga.ca/projects-and-strategies/environmental-assessments/lisgar-basement-water-infiltration-investigation/

**OCTOBER 2017**

https://youtu.be/QepzF8OXzVs

58 mark
Resident installed 3 sump pumps that moves
7,000 gallons of water an hour and he still flooded
* further along he states that his sump pumps always work every day which is why they wear out and need to be replaced
He asks the question where does the water go?
* Ron answers the question where the FDC water goes when pumped

:57 mark
excellent question about trenches
About draining the trench - which they now are calling "dewatering the trench" .. apparently the design of the system did not allow for it

Helen the LRA has been working in earnest with the city for 11 years now. If you go through and review the links of each of the meeting over the last 11 years it is the same questions asked over and over again because the community is not getting answers to their questions and development has started and a pump has been installed. It is the same engineering firm who appear incapable or unwilling to answer many of the questions from the community after 11 years.

Then finally the first pumping station gets put into operation and 5 homes report flooding (do not know actual number as many may never have reported for insurance reasons). The cities response is this was the biggest rainfall in 10 years. Furthermore data is being collected and studied…..after 11 years the city is still collecting and analyzing data? Did the pumping station on Cactus Gate get built undersized? How does this buoy for the next pumping stations? Is it time for a sanity check or a fresh set of eyes?

***In Conclusion:***

The engineering of the Lisgar community has been a complete disaster as indicated by the constant flooding. Regardless of the number of studies conducted by the city, AMEC/WOOD essentially the same engineering company that built the sewer system, building of a permanent pump station at Cactus Gate, additional 3 pump trucks to support the Cactus Gate pump station, water/rainfall/soil protocol Lisgar continues to flood. The municipality, region, conservation authority, province, federal governments that approved the development of Lisgar are not accountable for damages. Flood insurance in Lisgar has been cancelled, the developer is not accountable for damages, the engineering firm is not accountable for damages. The homeowner is out of pocket to pay 100% of all damages, this is an enormous financial and emotional burden.

Also, considering the dismal failure of the water infrastructure in Lisgar, how is it that AMEC/WOOD Engineering company was awarded to design and engineer the 9th line corridor development? What guarantees have they committed to the city?

Respectfully submitted by the Lisgar Residents Association and participating residents.