# Southdown District Stormwater Servicing and Environmental Management Master Plan

Final Report ▪ July 2022

Report Prepared For


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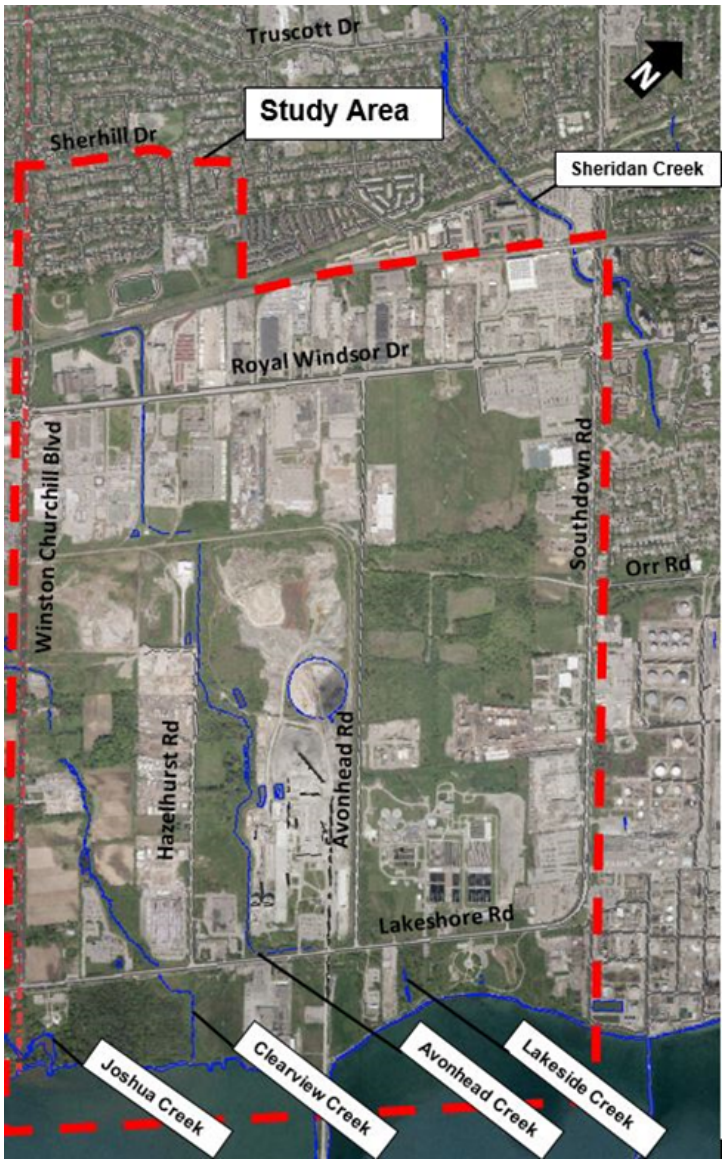
# EXECUTIVE SUMMARY

The Southdown District study area is bounded by Winston Churchill Boulevard to the west, Southdown Road to the east, Lake Ontario to the south, and headwater drainage boundaries near Royal Windsor Drive to the north (See **Figure ES-1**).

**Figure ES-1 Study Area**




A Master Drainage Plan for the Southdown District was completed in 2000 to establish stormwater management criteria and guide future development in the study area. Over the more than 20 years since it's completion, there have been significant

changes to local, regional and provincial policies and guidelines related to stormwater and environmental management.

This Stormwater Servicing and Environmental Management Plan serves as a comprehensive update to the previous Master Drainage Plan, and the recommendations will result in sustainable urban development and re-development within the Southdown District study area that will preserve, protect and enhancing the existing surface water, groundwater, and natural environment systems within and beyond the study area.

A number of investigations were completed to accurately characterize the planning, natural, social, cultural and engineering environments through the study area.

There are five watercourses that traverse the study area. From west to east, these are Joshua's Creek, Clearview Creek, Avonhead Creek, Lakeside Creek and Sheridan Creek. Joshua's Creek and Sheridan Creek are located in the extreme south-west and north-east corners of the study area, respectively, and have not been studied in detail given the negligible potential impacts to these systems from development in the study area.

Fish species have been observed in Clearview and Avonhead creeks, and are considered to provide aquatic habitat. There are no records available for Lakeside Creek, but the shorth length of open channel between Lakeshore Road and Lake Ontario is considered to provide aquatic habitat.

There are no Provincially Significant Wetlands or Areas of Natural and Scientific Interest in the study area, but there are several designated natural areas associated with the mature vegetation communities along Clearview and Lakeside Creeks.

No Species at Risk were observed during the field investigations, but the study area has the potential for Butternut and provides potential habitat for Common Nighthawk and several endangered bat species.

An archaeological assessment determined that the majority of the study area has been disturbed through past development or cleared through previous assessments. There remain some undeveloped areas that retain some archaeological potential, and Stage 2 archaeological assessments are recommended prior to any construction activities in these areas. In addition, the Harding Waterfront Estate at the south-west corner of the study area is a designated heritage site.

A fluvial geomorphological investigation was carried out on the accessible watercourses in the area. Significant erosion was observed along portions of Clearview Creek. The investigation also noted an on-line pond in poor condition north of Lakeshore Road and the concrete lined channel south of Lakeshore Road. Avonhead Creek is piped from Lakeshore Road to Lake Ontario, and portions of

Avonhead Creek north of Lakeshore Road are lined with concrete and corrugated steel pipe that are in poor condition. No significant issues were observed along the short length of Lakeside Creek south of Lakeshore Road.

Hydrologic and hydraulic modelling was completed to establish flooding conditions along the open watercourses through the study area. Along portions of Clearview Creek, the regulatory flood plain is wide and irregular, and poses a significant constraint to development. There is also extensive flooding along Avonhead Creek north of Orr Road, and Lakeshore Road is predicted to be frequently overtopped at the Lakeshore Road crossing.

Hydrologic and hydraulic modelling was also prepared to evaluate the urban drainage systems through the study area, consisting of storm sewer systems and overland flow routes along roadways. Most storm sewer systems in the study area meet current City standards for conveyance capacity, but the storm sewers on Avonhead Road, Southdown Road and in the area of Bromsgrove Road are undersized. During a 100 year return period storm event, some of the roadways in the area of Bromsgrove Road cannot contain the overland flow and flooding is predicted to extend beyond the public rights-of-way. All other systems in the study area can convey the predicted 100 year return period storm flows within the public road rights-of-way.

A range of alternatives have been developed for the management of the stormwater and natural heritage systems through the study area. These are as follows.

- **Do Nothing**: Under this scenario, future development in the study area would proceed with no stormwater controls. This alternative was developed to gain a better understanding of the impacts of urban development within the study area
- **Maintain Current Standard Stormwater and Environmental Management Approaches**: For this alternative, future development in the study area would comply with current criteria for water quality, erosion mitigation, peak flow control, water balance and environmental protection
- **Centralized SWM Facilities for Future Development**: Instead of a traditional approach with on-site stormwater management controls implemented on a site-by-site basis, this alternative proposes large centralized stormwater management facilities that could more efficiently treat storm runoff from multiple properties and developments. Concept designs have been prepared for five centralized facilities in the study area for this alternative
- **Retrofit SWM Facilities**: The Mississauga Stormwater Quality Control Strategy Update (MSWQCSU) (Aquafor Beech, 2012) identified three potential retrofit facilities in the study area. These facilities would provide water quality treatment for existing developed areas within and beyond the study area. The facilities

would be located adjacent Lakeshore Road at Clearview Creek, Avonhead Creek and Lakeside Creek. The three retrofit facilities have been considered as an alternative solution for this study.

- **Watercourse Improvements**: Solutions have been developed to enhance each of the watercourses through the study area
  - **Clearview Creek**: The creek east of Winston Churchill Boulevard would be realigned to contain all erosion and flood hazards and facilitate future development of the lands on the east side of Winston Churchill Boulevard. It also includes removal of the on-line pond and reinstatement of a natural channel, and realignment and naturalization of the existing concrete lined channel south of Lakeshore Road
  - **Avonhead Creek South of Orr Road**. The creek east of Hazelhurst Road would be realigned to contain all erosion and flood hazards as part of any large-scale long-term re-development of the existing concrete plant property. A new culvert at Lakeshore Road would redirect the creek westward to join the proposed naturalized mouth of Clearview Creek south of Lakeshore Road.
  - **Avonhead Creek: North of Orr Road**: A solution has been developed to reduce flooding in this area. It includes culvert and channel improvements north of the railway, and regrading of a property south of the railway to contain the floodwater spilling over the railway
  - **Lakeside Creek**: This solution includes removing a storm sewer system north of the Clarkson Wastewater Treatment Plant and replacing it with a natural channel east of Avonhead Road. It is not possible to create a continuous open channel corridor through the treatment plant to connect to the open reach of Lakeside Creek south of Lakeshore Road. This solution would also include flood storage integrated into the channel corridor to control peak flows to the capacity of the remaining storm sewer system through the treatment plant.
- **Storm Sewer and Major Drainage System Upgrades**: This solution includes replacement of the storm sewers on Southdown Road, and in the Bromsgrove Road area with larger pipes needed to meet the City's current storm sewer and major system design criteria. It would also include replacement of the existing storm sewers and extension of the storm sewer system northward on Avonhead Road. The new storm sewer system on Avonhead Road would allow the existing undersized storm sewers east of Avonhead to be removed, with future development east of Avonhead Road connected to the new storm sewer system on Avonhead Road.

The above alternative solutions for the Southdown District were evaluated comprehensively against criteria related to the natural, social, cultural, technical and financial environments. The results of the evaluation and preferred solutions are summarized in **Table ES-1** and shown in **Figure ES-2**.

**Table ES 1 Preferred Solutions**

| Preferred Solution and Justification | Responsibility for Implementation | Cost |
|---|---|---|
| **Maintain the Current Standard Stormwater and Environmental Management Approach (Not Subject to the Municipal Class EA)**<br>Adhering to current criteria will adequately mitigate the impacts of future anticipated development on water quality, erosion and flooding in the receiving watercourses. | **Landowners / Developers** are responsible for developing and implementing plans to achieve current standards | No increase in cost relative to current practices |
| **Watercourse Improvements – Clearview Creek (Schedule B EA Activity)**<br>While there are significant costs and challenges for implementation, there will be significant benefits to the natural environment, recreation and future developments with the removal of the existing on-line pond and construction of realigned and protected channel corridors both north and south of Lakeshore Road | **Landowners / Developers**: Removal of on-line pond and channel realignment north of Lakeshore Road<br>**City**: Realignment south of Lakeshore Road | $17.2M Landowner<br>$1.9 M City<br>$19.1 M Total |

| Preferred Solution and Justification | Responsibility for Implementation | Cost |
|---|---|---|
| **Water Course Improvements – Avonhead Creek South of Orr Road (Schedule B EA Activity)**<br>While there are significant costs and challenges for implementation, there will be significant benefits to the natural environment, recreation and future development with the realigned and protected channel corridor north of Lakeshore Road and new watercourse connection to Clearview Creek south of Lakeshore Road | **Landowners / Developers**: Channel realignment north of Lakeshore Road<br>**City**: Realignment south of Lakeshore Road | $ 25.3 M Landowner<br>$ 6.6 M City<br>$ 31.9 M Total |
| **Watercourse Improvements – Avonhead Creek north of Orr Road (Schedule B EA Activity)** | All works would be carried out on private property and would be implemented by **Landowners / Developers** | $0.6 M |
| **Storm Sewer Upgrades (Schedule A / A+ Activity)** | All works would be carried out in public rights-of-way and would be implemented by the **City** | $19.4 M |

The Do Nothing alternative was not selected due to the unacceptable impacts of uncontrolled urban development on water quality, flooding, erosion and natural heritage systems.

The Centralized SWM Facilities and Lakeside Creek Improvements alternatives were not selected primarily due to the prohibitive challenges for their implementation. Both solutions involve works spanning multiple properties and

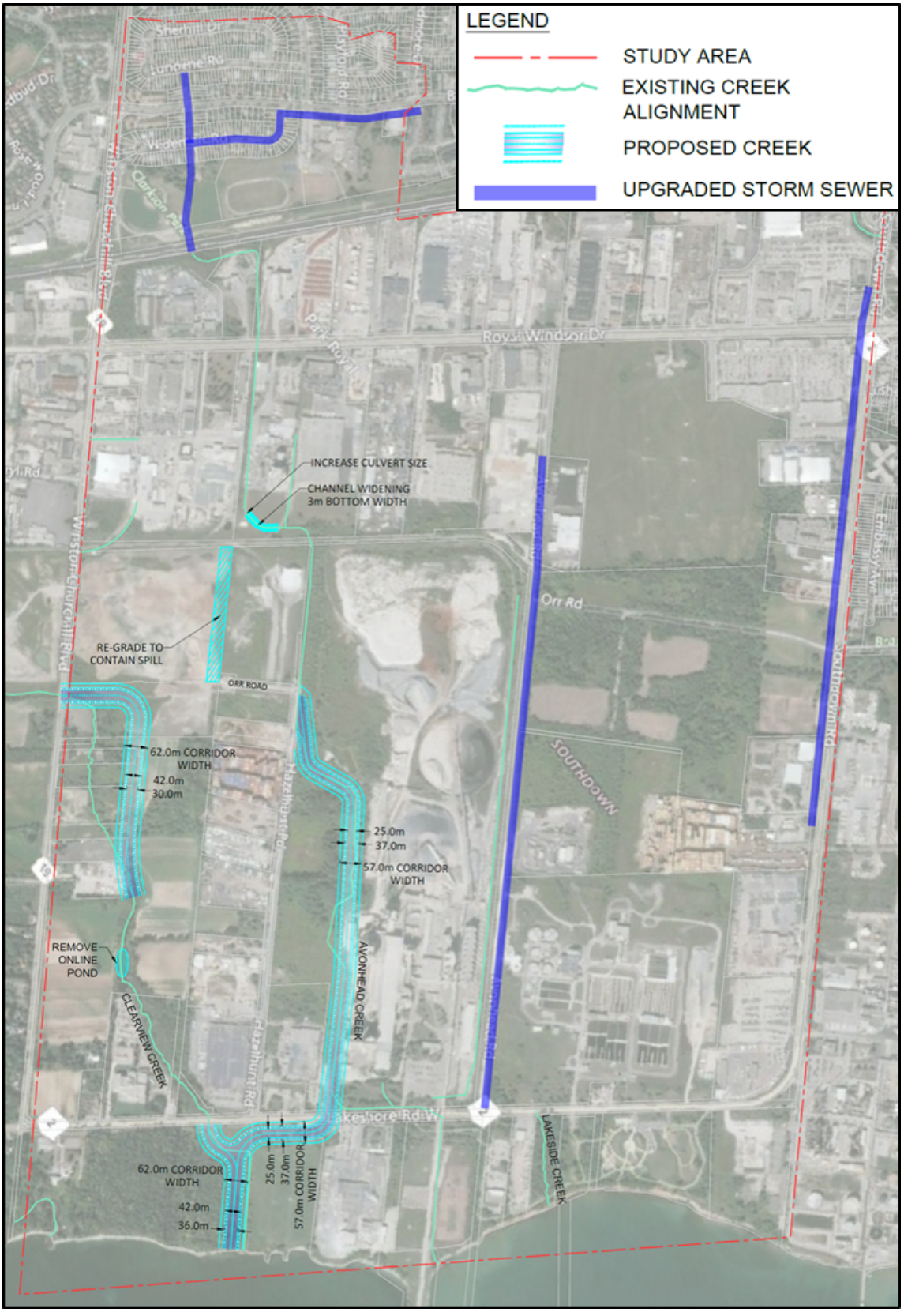
would require all affected properties participating and developing on similar time frames for the solutions to be implemented.

The Retrofit SWM Facilities alternative was not selected due to the significant challenges to secure land for the facilities, challenges to construct the on-line facilities without impacting fish passage, and because there would be no improvements to the degraded watercourses upstream of the retrofit facilities at Lakeshore Road.

The Southdown District Stormwater Servicing and Environmental Management Plan has been completed in accordance with the Municipal Class Environmental Assessment (EA) process, following a Master Plan Approach. The Master Plan satisfies Phases 1 and 2 of the Municipal Class EA process, but more detailed studies will be needed to satisfy the requirements of the recommended Schedule B projects.

Consultation with the public, agencies and other stakeholders has taken place throughout the project, including two Public Information Centres to provide an opportunity for the public to provide input to the project and preferred solutions. All concerns raised by the public, agency staff and other stakeholders have been considered in the development and evaluation of alternative solutions and have been addressed in this final Master Plan.

## Figure ES-2 Recommended Master Plan Solutions



# Contents

# Appendices

# Figures

# Tables

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# 1 Introduction and Background

## 1.1 Study Overview and Purpose

The Municipal Infrastructure Group Limited (TMIG), along with team members PECG, and GeoMorphix, were retained by the City of Mississauga to generate a plan to address flooding, erosion, and water quality issues in support of future urban development and re-development within the City's Southdown District. The study area, illustrated in **Figure 1-1**, is approximately 550 ha in size and is bounded by Winston Churchill Boulevard to the west, Southdown Road to the east, Lake Ontario to the south, and headwater drainage boundaries near Royal Windsor Drive to the north. The study area falls primarily within the Clearview Creek, Avonhead Creek, and Lakeside Creek watersheds, with other smaller areas draining to the Joshua Creek and Sheridan Creek watersheds.

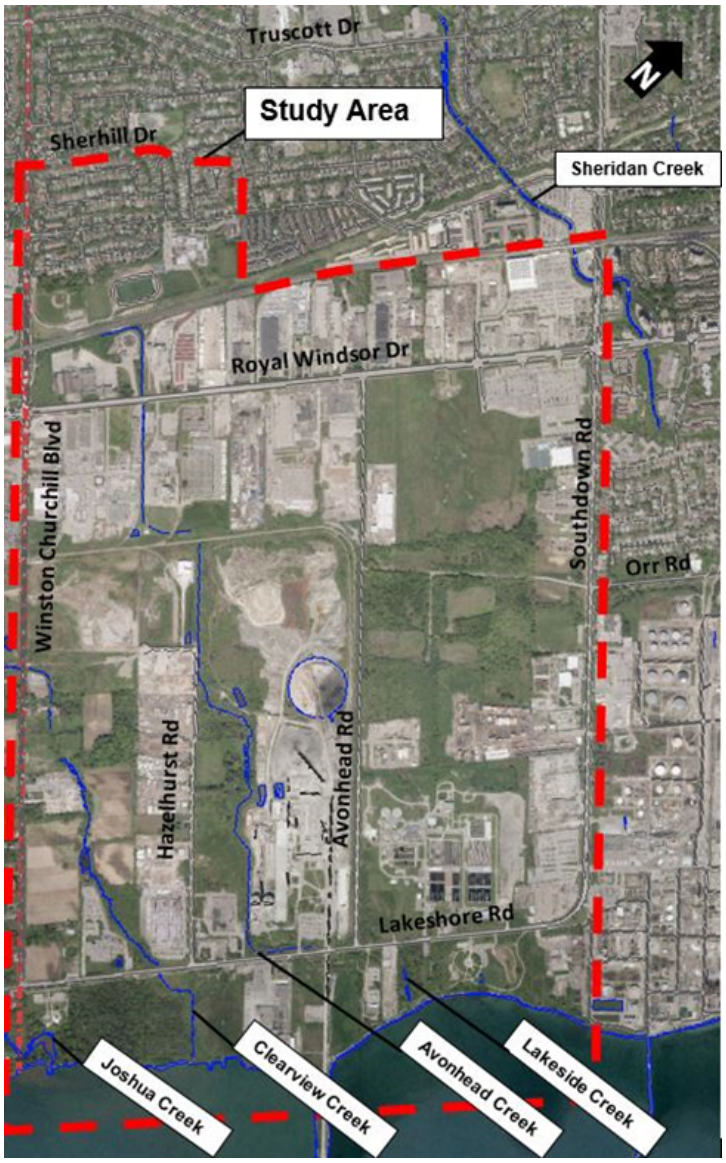
A previous Southdown Master Drainage Plan, prepared in 2000, was completed for the same study area. It has been two decades since the study and many of the findings from the plan are outdated and were never implemented due to very limited development activity in the study area over the past 2 decades.

There have also been considerable changes to local, regional and provincial policies and guidelines that impact the findings from the 2000 Master Drainage Plan. Stormwater management criteria and practices have evolved significantly and continue to evolve, particularly for water balance and streambank erosion mitigation. The City of Mississauga and Region of Peel Official Plans have been updated to strengthen the protection of natural heritage systems, and Conservation Authority policies and regulations have similarly been updated to better protect natural heritage systems and avoid and mitigate risks from flooding and erosion hazards.

It is therefore necessary to update the Southdown Master Drainage Plan with a new Stormwater Servicing and Environmental Management Plan to reflect the above changes in guidelines, policies, practices and attitudes. This study will build upon the previous study and develop a stormwater servicing plan that will allow sustainable urban development and re-development within the Southdown District study area while protecting, maintaining and enhancing the existing surface water, groundwater, and natural environmental resources of the study area. The resulting plan will provide guidance for future development/re-development activities by establishing stormwater management measures to minimize flooding, erosion, water quality degradation, and water balance impacts, as well as identifying stormwater retrofit

opportunities within existing urban areas and environmental restoration opportunities within the study area streams.

**Figure 1-1 Study Area**




## 1.2 Co-Ordination with Other Studies

A number of studies have been completed or are underway that include assessments of storm drainage and ecological conditions of the systems in the Southdown District study area. The findings from these studies, briefly described in the following sections, have been incorporated into this study.

### 1.2.1 Lake Ontario Integrated Shoreline Strategy

Credit Valley Conservation has completed a number of studies to support the Lake Ontario Integrated Shoreline Strategy (LOISS) that are relevant to the Southdown District. These include watercourse inventories and fluvial geomorphological assessments of both Avonhead and Clearview Creek to explore options for their rehabilitation. For Clearview Creek, options for replacement of the existing concrete channel south of Lakeshore Road with a naturalized channel are being investigated. For Avonhead Creek, design options for “daylighting” the existing piped reach south of Lakeshore Road were investigated.

### 1.2.2 Mississauga Stormwater Quality Control Strategy Update Study

The City of Mississauga Stormwater Quality Control Strategy Update Study (Aquafor Beech Ltd., December 2012) recommends a broad range of stormwater management improvements in the City, including source, conveyance and end-of-pipe practices and watercourse restoration. Three on-line stormwater quality control facilities, originally recommended in the 2000 Southdown Master Drainage Plan, continue to be recommended for Clearview, Avonhead and Lakeside Creeks in the Southdown study area.

### 1.2.3 City of Mississauga Waterfront Parks Strategy

City of Mississauga Waterfront Parks Strategy (Brook McIlroy et al, March, 2008) developed a vision for two of the parks in the study area. Lakeside Park proceeded to design and construction, and was completed in 2011. The strategy also presented a concept for a new park at the Harding Waterfront Estate (also known as the Fusion property), including the treed lands east of the estate at the foot of Winston Churchill Boulevard.

These and other sources of background information have been reviewed and referenced in establishing existing conditions through the study and in the development and evaluation of alternative stormwater servicing and environmental management plans.

### 1.2.4 CVC Stormwater Grid LID Study

Credit Valley Conservation is undertaking a pilot project to assess the feasibility of implementing a communal set of Low Impact Development (LID) stormwater retrofits within the existing employment lands fronting onto Royal Windsor Drive. The objective is to determine if these shared stormwater facilities would result in economies of scale that could be used to encourage a greater uptake of LID practices in other similar employment districts.

## 1.3 Municipal Class Environmental Assessment Process

The planning of major municipal projects or activities is subject to the Ontario Environmental Assessment (EA) Act, R.S.O. 1990, and requires the proponent to complete an Environmental Assessment, including an inventory and description of the existing environment in the area affected by the proposed activity.

The Class EA process was developed by the Municipal Engineers Association, in consultation with the Ministry of the Environment (MOE), as an alternative method to Individual Environmental Assessments for recurring municipal projects that were similar in nature, usually limited in scale and with predictable ranges of environmental effects which were responsive to mitigating measures. The latest Municipal Class EA document (October 2000, amended 2007, 2011 & 2015) has been used for this study.

The Class EA provides for the following designations of projects depending upon potential impacts:

**Schedule A:** Projects are limited in scale, have minimal adverse environmental effects and include a number of municipal maintenance and operational activities. These projects are pre-approved. Schedule A projects generally include normal or emergency operational and maintenance activities.

**Schedule A$^{+}$:** Projects are within existing buildings, utility corridors, rights-of-way, and have minimal adverse environmental effects. These projects are pre-approved; however, the public is to be notified prior to project implementation.

**Schedule B:** Projects have the potential for some adverse environmental effects. The proponent is required to undertake a screening process, involving mandatory contact with directly affected public and relevant review agencies, to ensure they are aware of the project and that their concerns are addressed. Following completion of Phases 1 and 2 of the Class EA process, if there are no outstanding concerns, then Schedule B activities are approved and the proponent may proceed to Phase 5 (implementation).

**Schedule C:** Projects have the potential for significant environmental effects and must complete all five phases of the planning and documentation procedures specified in the Class EA document. Schedule C projects require that an Environmental Study Report be prepared and filed for review by the public and review agencies.

The Southdown District Stormwater Servicing and Environmental Management Plan project will be undertaken as a Master Plan and will follow 'Approach 1' as outlined in the Class EA document. In doing so, Phases 1 and 2 of the Class EA process will be completed and the plan will become the basis for and be used in support of future investigations for any specific Schedule B and Schedule C projects recommended as part of the Master Plan.

The Class EA process also provides an appeal process to change the project status. Under the provisions of the Environmental Assessment Act, there is an opportunity under the Class EA planning process for the Minister to review the status of a project. Members of the public, interest groups and review agencies may request the Minister to require a proponent to comply with Part II of the EA Act, before proceeding with a proposed undertaking. This is known as a "Part II Order" (formerly called "Bump-Up Request").

The Environmental Assessment Act was recently amended through Bill 197, the Covid-19 Economic Recovery Act, 2020. Among other things, the amendments focus the Part II Order request process to issues relating to Aboriginal and treaty rights and set timelines for when the Minister can intervene on his/her own initiative to impose conditions on or bump up a class environmental assessment project.

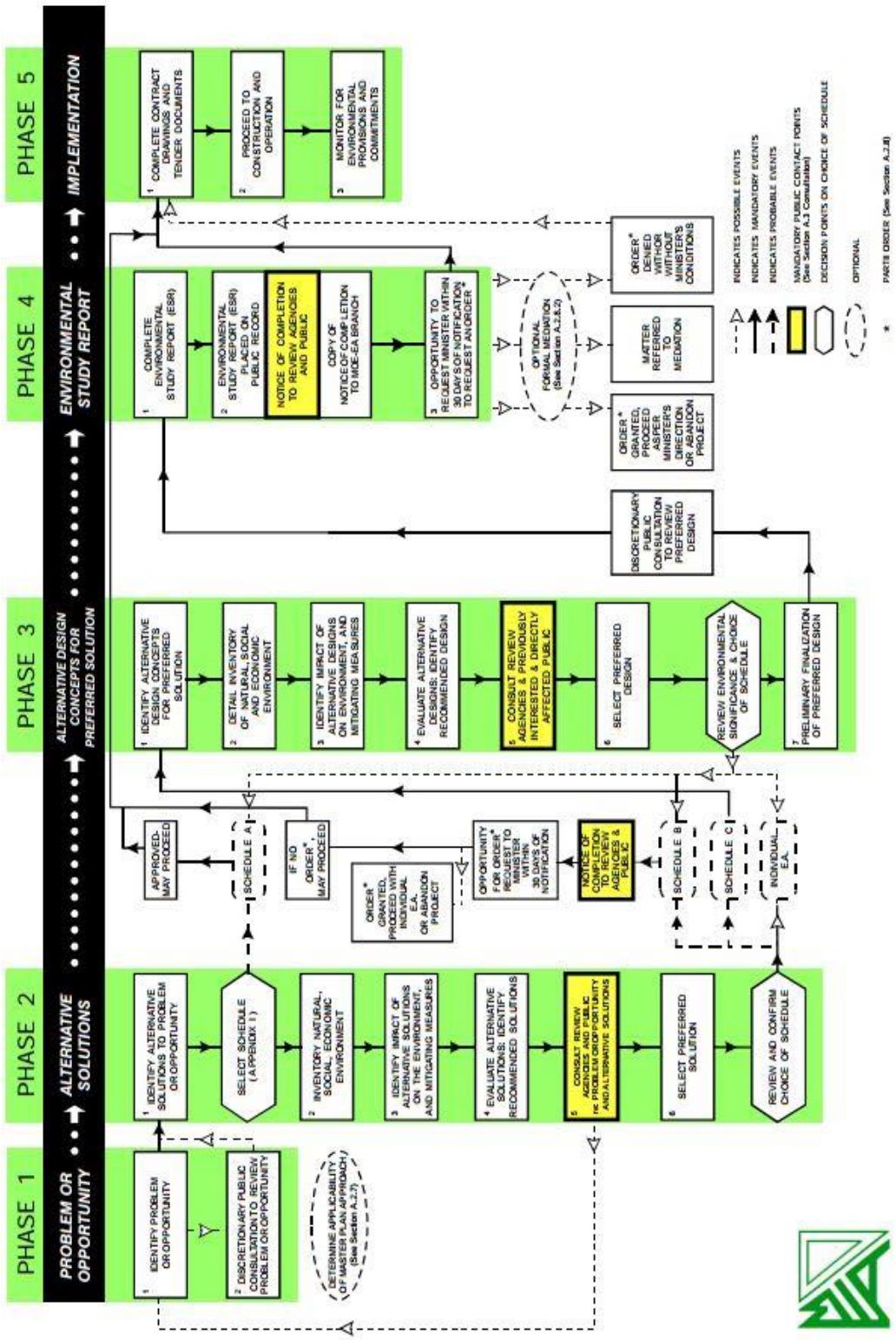
Any outstanding concerns are to be directed to the proponent for a response, and in the event there are outstanding concerns regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, Part II Order requests on those matters may be addressed in writing to the Minister of the Environment, Conservation and Parks and the Director of the Environmental Assessment Branch. 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 within which to make a decision or impose conditions on the project.

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 Minister regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, or;
- The Director has issued a Notice of Proposed Order regarding the project.

A flow chart describing the Class EA planning and design process is shown in **Figure 1-2.** Note that the flow chart has not been updated to reflect the recent amendments to the Environmental Assessment Act described above.

## Figure 1-2 Municipal Class EA Planning Flow Chart



## 1.4 Project Team Organization

The project was completed by a multi-disciplinary team led by TMIG. Key staff involved in the Study are listed in **Table 1-1**. The project was completed under the direction of a technical working group comprised of City of Mississauga staff from various City departments.

**Table 1-1 Study Team**

| Name | Organization | Role |
|---|---|---|
| Steve Hollingworth, P.Eng. | TMIG | Project Manager |
| Rosalie Chung P.Eng | TMIG | Water Resources Engineer |
| Paul Villard, P.Geo., CAN-CISEC | GeoMorphix | Geomorphologist |
| Dirk Janas | Palmer | Terrestrial Ecologist |
| Rick Palmer, M.Sc., R.P.Bio | Palmer | Aquatic Biologist |
| Jason Cole M.Sc, P.Geo. | Palmer | Hydrogeologist |
| Kim Slocki, M.Litt., B.A.H. | Archeoworks | Archeologist |

## 1.5 Problem and Opportunity Statement

This Southdown District Stormwater Servicing and Environmental Management Plan has been undertaken in accordance with the Class EA Master Plan process, which includes Phases 1 and 2 of the Class EA process to identify the series of related projects necessary to support future urban development and re-development within the City's Southdown District.

The problem and opportunity statement is as follows:

> The stormwater drainage system in the Southdown area was last investigated in 2000 as part of the "Southdown Master Drainage Plan". Since that time, stormwater management criteria and standard practices have evolved, and there have been considerable changes to the local, regional and provincial policies related to the protection and enhancement of watercourses and other natural heritage features. For that reason, a new Stormwater Servicing and Environmental Management Plan is needed to establish updated stormwater management requirements and watercourse improvements required to support

long term growth and intensification, as defined by the urban structure framework and policy of the Southdown Local Area Plan.

# 2 Existing Environments

## 2.1 Planning Environment

The Southdown District study area is located within the southwest portion of the City of Mississauga. Land use within the study area is predominantly business employment and industrial. Several planning documents are relevant to the study.

### 2.1.1 Provincial Policy Statement

The Provincial Policy Statement (PPS) (May 2020) provides broad land use planning and development policy direction, particularly as it relates to matters of provincial interest including but not limited to the natural environment and natural hazards.

The Natural Hazard policies (Section 3.1 of the PPS) generally prohibit development in areas at risk of flooding from riverine systems and dynamic beach hazards as well as areas that could not be safely accessed due to excessive flood depths and velocities during severe storm events. The PPS contains some exemptions to these policies, such as designated Special Policy Areas and flood fringe areas where separate policies apply. At this time, the Study Area is not designated as a Special Policy Area nor managed as a two-zone area where new development in the flood fringe could be permitted.

The PPS also includes policies to protect and preserve employment areas, particularly in proximity to major transportation corridors (Section 1.3), and policies generally promoting intensification and redevelopment in existing built-up area (Section 1.1)

### 2.1.2 Growth Plan for the Greater Golden Horseshoe

The Growth Plan for the Greater Golden Horseshoe (GPGGH) (May 2019, amended August 2020) is another provincial policy document intended to guide future growth in the area. The GPGGH is generally intended to direct future population and employment growth to existing urban areas. The study area is not considered an Urban Growth Centre, but does provide employment uses relevant to the nearby Downtown Mississauga and Midtown Oakville Urban Growth Centres.

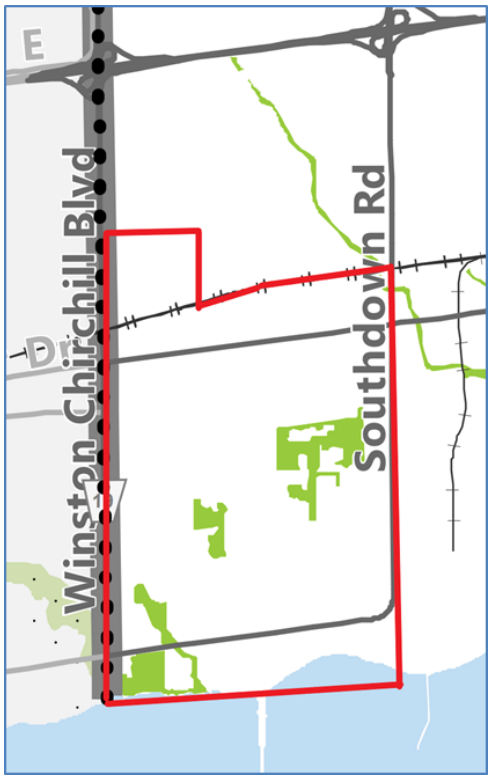
Section 2.2.5 of the GPGGH includes policies promoting the protection of employment lands and more efficient use of vacant and underutilized employment lands, particularly for lands served by transit. Other policies in the GPGGH require the protection of water resources and natural heritage systems and direct development away from flooding and erosion hazards.

### 2.1.3 Peel Region Official Plan

The Peel Region Official Plan is intended to guide growth at the Regional scale and provide planning direction to local municipalities including the City of Mississauga. The plan was adopted in 2006, but was subject to a number of appeals at the Ontario Municipal Board (OMB). The plan is in effect, and was consolidated in December 2018 with sections appealed and are subject to final decisions by the Ontario Municipal Board.

The Southdown District study area is designated 'Urban' in the Region's Official Plan, and the various maps included with the Official Plan showed a few Core Areas of the Greenlands system within the study area (**Figure 2-1**).

**Figure 2-1 Peel Region Greenlands System Core Areas**



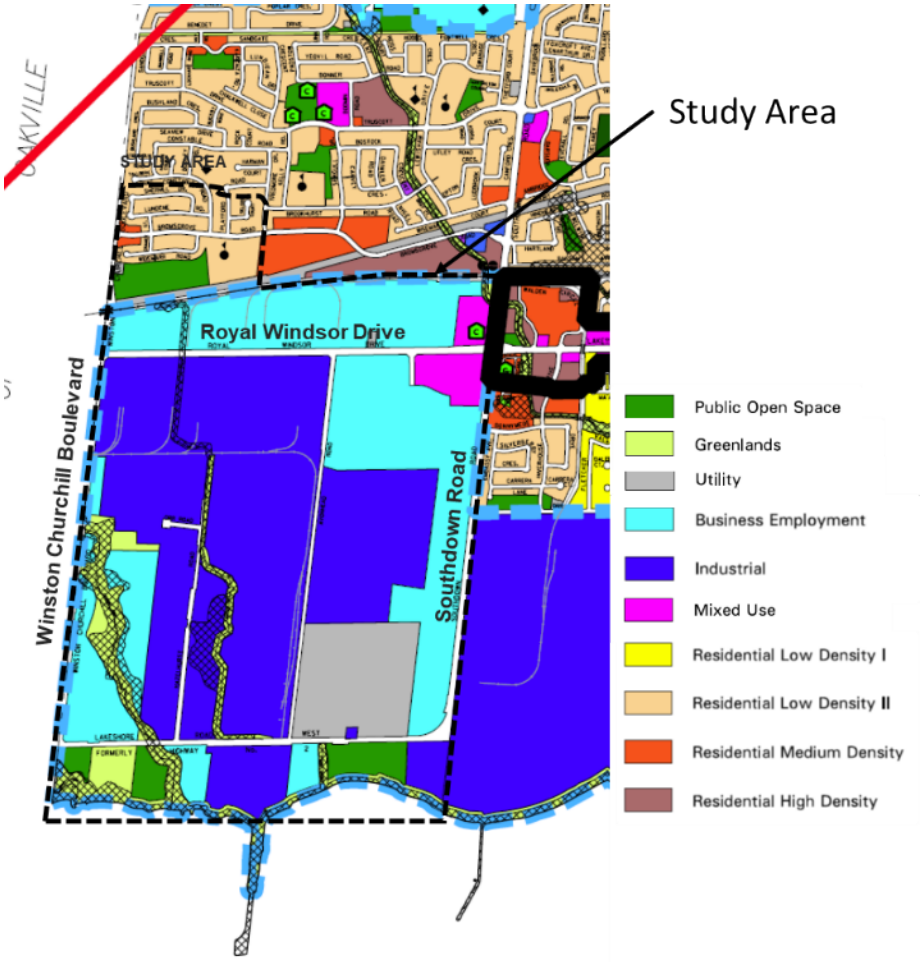

### 2.1.4 City of Mississauga Official Plan

The City of Mississauga Official Plan contains both broad and site-specific land use policies. The plan was adopted by the City in 2010 and partially approved by Peel Region in 2011, but has been appealed to the Ontario Municipal Board (OMB). The OMB issued a partial approval of the Official Plan in November 2012, bringing parts of the plan in force, and since then many decisions have been made and appeals resolved. The Official Plan was last consolidated in September 2020.

The Southdown District study area is generally designated as business employment and industrial area in the City's Official Plan as shown on **Figure 2-2**. The study area also includes a mixed use node at the intersection of Southdown Road and Royal Windsor Drive, and residential uses north of the rail corridor in the north-west corner of the study area.

Areas along the Lake Ontario shoreline and major watercourses in the study area are designated as public open space and greenlands, and the City of Mississauga Official Plan includes policies for the protection, restoration and enhancement of these natural areas.

**Figure 2-2 Land Use**




Excerpt from Schedule 10 from the City of Mississauga Official Plan

### 2.1.5 City of Mississauga Southdown Local Area Plan

The City of Mississauga Official plan is the principal planning document for the City of Mississauga. The Southdown Local Area Plan addresses circumstances that are

particular to Southdown and elaborates on or provides exceptions to the policies or schedules of the Official Plan. The Southdown Local Area Plan incorporates the policies of the Southdown District Policies of Mississauga Plan (2003), modified to conform with the Mississauga Official Plan (2010).

The Southdown Local Area Plan presents a vision for the study area with a denser street grid and a mix of manufacturing, research and development and office uses. It also provides recommendations for urban design, and streetscaping to improve and expand the public realm through the Southdown area.

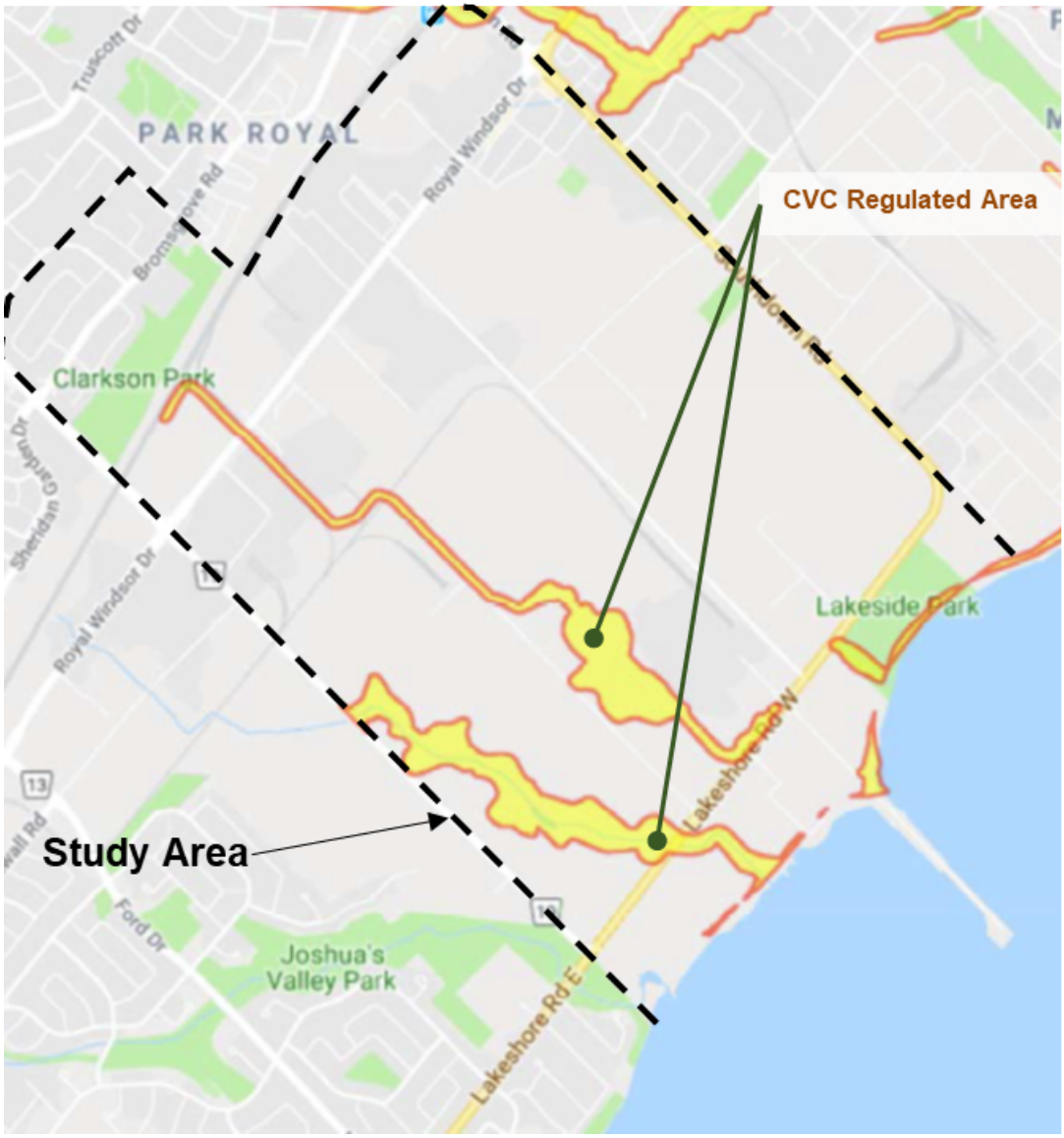
### 2.1.6 Credit Valley Conservation

The Credit Valley Conservation (CVC) regulates works within and adjacent rivers and streams, wetlands, and shorelines under Ontario Regulation 160/06 (Development, Interference with Wetlands and Alterations to Shorelines and Watercourses). The regulation limit extends 30 m beyond wetlands (120 m for provincially significant wetlands), and extends 15 m beyond the dynamic beach hazard, regulatory flood plain, or top of bank associated with defined watercourses such as Cleaview Creek, Avonhead Creek, Lakeside Creek, and Sheridan Creek.

An excerpt of the CVC's Regulation limit mapping is presented in **Figure 2-3**. The regulatory flood is not confined to the watercourses. As a result, the CVC regulation limit covers a significant portion of the study area.

A permit is required from CVC for any site alteration within their regulated area, and CVC policies and regulations generally prohibit new development in existing flood prone areas, consistent with the Provincial Policy Statement (**Section 2.1.1**). There are some exceptions to these policies to allow for minor building expansions and site alterations, subject to meeting flood protection criteria, but the policies generally discourage intensification or other works that would significantly increase the number of people and/or amount of property at risk of flooding during severe storm events.

**Figure 2-3 CVC Regulation Limit**




Note that CVC's Regulation 160/06 is text based. The mapping is only provided as a general guide

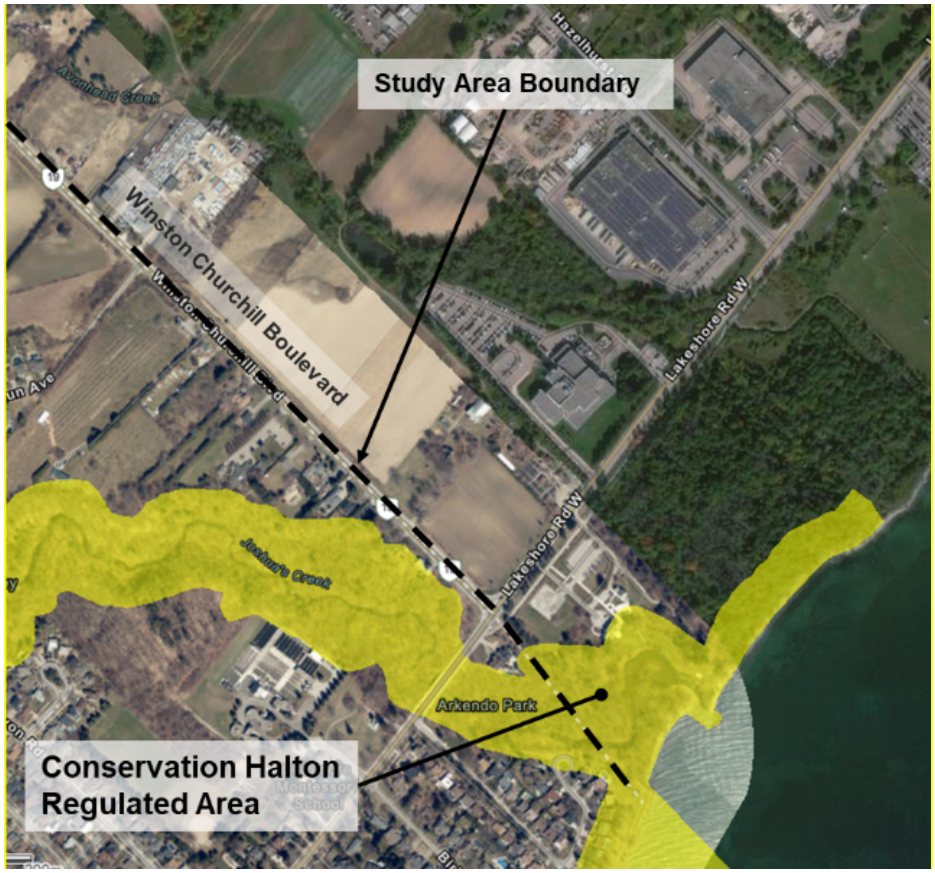
### 2.1.7 Conservation Halton

Conservation Halton (CH) regulates works within and adjacent rivers and streams, wetlands, and shorelines under Ontario Regulation 162/06 (Development, Interference with Wetlands and Alterations to Shorelines and Watercourses). The study area includes a very small portion of the Joshua's Creek watershed, which is managed by Conservation Halton. The regulation limit extends 15 m beyond the dynamic beach hazard, regulatory floodplain or top of bank associated with defined watercourses such as Joshua Creek.

While not applicable to the study area, CH's regulation also extends 120 m from all provincially significant wetlands and wetlands greater than 2 hectares in size, and 30 m from all other wetlands less than 2 hectares in size.

An excerpt of the CH's Regulation limit mapping is presented in **Figure 2-4**. The regulatory flood, along with the 15m buffer, extends into the extreme south-west corner of the study area, south of Lakeshore Road. The shoreline policies also restrict development within the dynamic beach hazard, which is delineated by the landward limit of the flooding hazard plus a 30 metre dynamic beach allowance plus an allowance of 5 metres.

**Figure 2-4 Conservation Halton Regulation Limit**




Note that CH's Regulation 162/06 is text based. The mapping is only provided as a general guide

### 2.1.8 Source Water Protection

The study area is within two source protection areas, which also happens to coincide with the boundary between CVC and CH. The majority of the study area falls within the limits of the Credit Valley Source Protection Area (CVSPA) and a small area to the southwest is within the Halton Region Source Protection Area (HRSPA) as

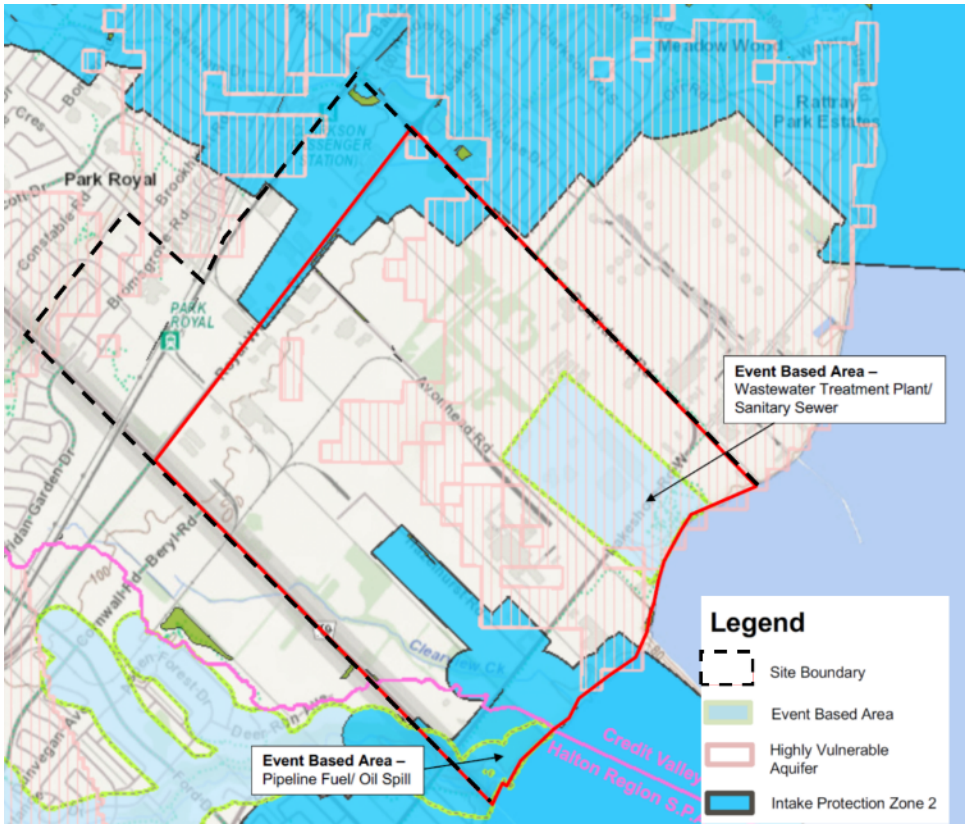
divided on **Figure 2-5** by the pink line. Based on the respective source water protection plans, no defined well head protection areas (WHPA) are present within the site. However, other source protection zones such as Highly Vulnerable Aquifers (HVA), Intake Protection Zone 2 (IPZ-2), and Event Based Areas (EBA) are present.

Highly Vulnerable Aquifers (HVA) have a groundwater vulnerability score of 6 and is defined as an area where the aquifer is susceptible to contamination by the release of pollutants on ground surface. This can result from conditions such as a shallow groundwater table, a thin (or absent) and permeable overburden, or the presence of fractured bedrock. Policies are associated with land use and actions within a HVA, such as the application and/or handling and storage of road salt. Within the CVSPA, a large portion of the site is associated with a HVA as shown on **Figure 2-5** with a light pink hatching.

An IPZ-2 is defined as is the area around a surface water intake where water can reach the intake within 2 hours and the vulnerability scores in Lake Ontario range between 3.5 to 6.3. An IPZ-2 with a score of 4.5 has been delineated within the northern corner of the site within the CVSPA, and an IPZ-2 with a score of 4.8 has been delineated within the southern corner within the HRSPA. These areas are shown as blue on **Figure 2-5**.

An Event Based Area (EBA) is an area delineated if modelling indicates that a spill from a specific activity may be transported to an intake and poses a significant threat to drinking water. Two EBA’s have been delineated within the study area; an EBA associated with the Clarkson Wastewater Treatment Plant and Sanitary Sewer within the CVSPA, and an EBA associated with pipeline fuel and/or an oil spill has been identified surrounding Joshua’s Creek within the HRSPA.

**Figure 2-5 Source Water Protection Mapping**




## 2.2 Physical Environment

### 2.2.1 Physiography and Topography

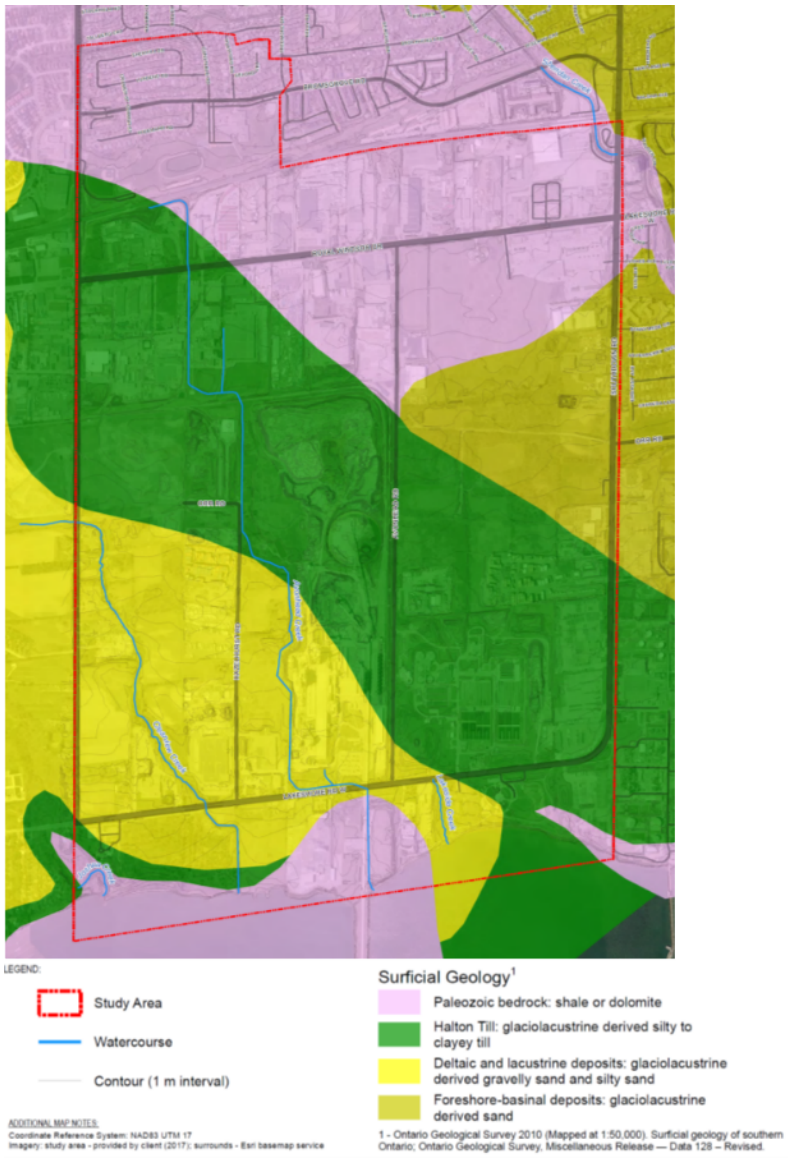
The study area is located within the Iroquois Plain physiographic region (Chapman and Putnam, 1984). This region extends as a narrow band about five kilometers in width along the lowland bordering Lake Ontario. Although the dominant soil texture is comprised mainly of permeable sands and gravels, which were deposited along the shores of glacial Lake Iroquois about 12,500 years ago, the underlying deposits of clayey silt till are commonly found at surface. The topography of the region is characterized by rolling topography due to the presence of numerous northeast-southwest trending drumlins.

### 2.2.2 Soils and Groundwater

The native overburden soils at the site, as defined by Ontario Geological Survey (OGS) mapping, are primarily composed of coarse textured glaciolacustrine deposits of sand, gravel, minor silt and clay from Lake Iroquois, as well as the clay to silt textured till deposits of the Halton Till. Additionally, Paleozoic bedrock is exposed at

surface along the northwestern and southeastern limits of the study boundary (**Figure 2-6**). These units are described in more detail below.

**Figure 2-6 Surficial Geology**




The Lake Iroquois Glaciolacustrine Sand deposits are widespread in this area and represent the uppermost geologic layer. These high permeability sand and gravel soils at surface form a discontinuous unconfined aquifer at the site, which promotes groundwater flow, recharge, and discharge. Water supply from this aquifer is generally limited due to the discontinuity of the soils.

The clay to silt textured Halton Till is found trending east-west through the site. The thickness of this unit is expected to be approximately 10 m near to the study area. Isolated lenses of lacustrine laminated sand, silt, and clay are commonly

encountered within the till (Sharpe et al., 1999). Regionally, Halton Till soils are generally considered an aquitard with low permeability, and therefore limit infiltration to deeper aquifers. However, due to the heterogeneity within the till, on a local scale it may serve as a source of limited water supply for some private wells.

The bedrock in the area is characterized as the Georgian Bay Formation, and is described as shale with interbedded dolomitic siltstone and minor limestone. This formation is approximately 250 m thick, and dips to the southeast at about 5 m/km. Several deep and poorly defined bedrock valleys have been incised in this formation following periods of sedimentation and erosion. These valleys play an important role in overburden thickness and groundwater conditions in this area.

### 2.2.3 Water Well Records

Based on a search of the and Ministry of Environment, Conservation and Parks (MECP) Water Well Records there are a total of 104 water wells within a 500 m radius of the study area. Of this number, 23 are used for domestic water supply, 16 are used for commercial or industrial water supply, and 3 are used for irrigation or livestock water supply. The remaining wells include 40 listed as observation wells or test holes, and 22 abandoned wells. It is not expected that any of these wells are actively used for water supply as this area is serviced by the South Peel Municipal Water Supply System.

## 2.3 Natural Heritage

The natural heritage conditions through the study area have been determined primarily through agency consultation and a review of background material specific to the study area, including

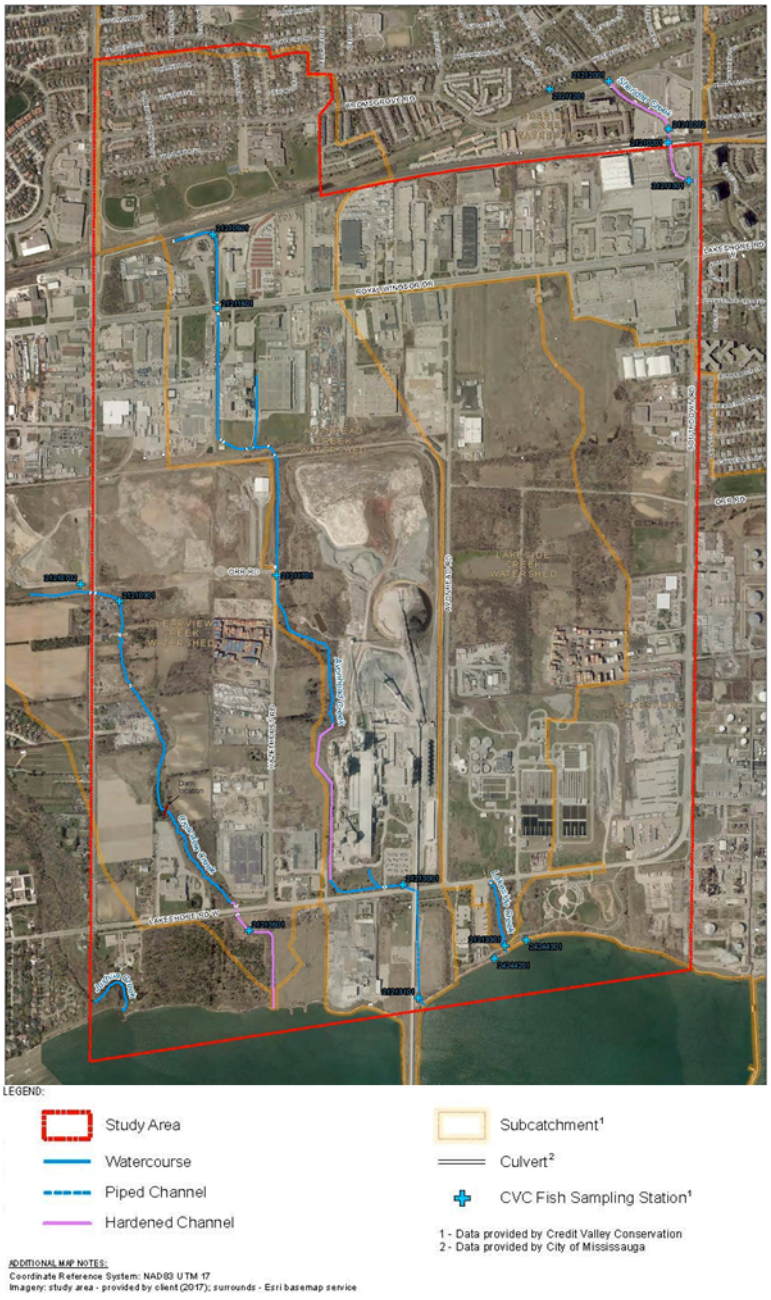
- Collection and review of relevant mapping and reports, including Official Plans and Natural Heritage Information Centre (NHIC) make-a-map application for species occurrences and designated area mapping.
- Natural Heritage information and mapping provided by CVC, CH and the City of Mississauga;
- The Ministry of Natural Resources and Forestry (MNRF) Aurora District office was contacted for natural heritage and SAR information in the study area.

The collected information was verified during a site reconnaissance visit by ecological staff on September 19, 2018. A summary of the findings are presented in the following sections, and additional details can be found in **Appendix A**.

### 2.3.1 Fisheries and Aquatic Habitat

The study area occurs predominately with the Lake Ontario Shoreline West Subwatershed (Clearview Creek, Avonhead Creek, Lakeside Creek and Sheridan Creek), under the jurisdiction of Credit Valley Conservation (CVC). A small area within the southwest corner of the study area occurs within the Oakville East Urban Creeks Subwatershed (Joshua Creek) under the jurisdiction of Conservation Halton (CH) (**Figure 2-7**).

**Figure 2-7 Existing Aquatic Habitat**




Refer to **Appendix A** for a larger version of this figure

#### 2.3.1.1 Lake Ontario West Subwatershed (CVC)

**Clearview Creek** supports a warmwater fish community typical of urban streams. Fish surveys were completed by CVC at five locations. The following fish species were recorded at the fish sampling locations: Creek Chub (Semotilus atromaculatus), Fathead Minnow (Pimephales promelas) Blacknose Dace

(Rhinichthys atratulus). These results include sampling conducted between 2003 and 2018.

Fish habitat was assessed by CVC as part of the Clearview Creek Feasibility Study (March 2018), from Lake Ontario to Winston Churchill Blvd in non-ice conditions on December 4, 2017. This assessment of fish habitat identified numerous barriers to fish habitat on Clearview Creek including the concrete channel downstream of Lakeshore Road, a boulder cascade upstream of Lakeshore Road which may be impassable under certain flow conditions, an online pond and associated outlet structure, numerous nickpoints and a stormwater pond and buried headwater system upstream in the Town of Oakville. The downstream extent of the creek has a densly vegetated riparian area. The mid-reaches and upstream extent of the creek have narrower riparian areas dominated by invasive trees and shrubs. Instream habitat is diverse with deep pools, over hanging vegetation and dense shade provided by mature trees, sorted substrate forming point bars and riffles and instream woody material (CVC, 2018).

Clearview Creek south of Lakeshore Road West has been channelized, with steep banks. At the time of the field reconnaissance site visit (September 19, 2018) flow was described as less than 5 cm in depth with lots of algae present. Flow depth is approximately 15 cm deep further upstream, on the north side of Lakeshore Road. Clearview Creek is channelized through this area, though slightly wider, with rocks and leaf litter. The creek on the east side of Winston Churchill Blvd is characterized as having deep, opaque standing water with abundant floating duckweed and dense canopy cover.

**Avonhead Creek** supports a fish community with a temperature regime that has not yet been determined. Fish surveys were completed by CVC at five locations. The following fish species were recorded at the fish sampling stations: Longnose Dace (Rhinichthys cataractae), Common Carp (Cyprinus carpio), Pumpkinseed (Lepomis gibbosus), Fathead Minnow, White Sucker (Catostomus commersonii), Lake Chub (Couesius plumbeus), Northern Redbelly Dace (Chrosomus eos) and Threespine Stickleback (Gasterosteus aculeatus). These records include sampling conducted between 2004 and 2018.

Avonhead Creek along the north side of Lakeshore Road West is characterized as a narrow ditch with grassed banks and scattered trees, with no water visible at the time of field reconnaissance site visit (September 19, 2018). At the northern limit of the study area, on the south side of Royal Windsor Drive, Avonhead Creek is channelized and flows through a 3m wide cement culvert. At the time of the field reconnaissance survey, the creek supported standing water, approximately 30 cm

deep, with dense Common Reed (Phragmites australis) and scattered floating green algae.

**Lakeside Creek** supports a fish community with a temperature regime that has not yet been determined. Fish surveys were completed by CVC at one location. There were no fish species recorded at this sampling station.

Observations recorded during the field reconnaissance visit noted that Lakeside Creek is not visible north of Lakeshore Road West. Flow, approximately 1m wide and 10 cm deep was recorded from a box culvert under Lakeshore Road West through flowing through gradual and rocky banks, over rocky substrate. Canopy cover over the creek in this area provides 100% cover, from predominately Elm and Locust trees.

**Sheridan Creek** supports a warmwater fish community typical of urban streams. Fish surveys were completed by CVC at four locations upstream of the study area. The following fish species were recorded at the fish sampling locations: Fathead Minnow, Creek Chub, carp/minnow (Cyprinus sp.) and Common Shiner (Luxilus cornutus). These records include sampling conducted between 1993 and 2008.

#### 2.3.1.2 East Urban Creeks Subwatershed (CH)

**Joshua's Creek** supports a warmwater fish community typical of urban streams. Fish surveys were completed by CH at three locations upstream of the study area. The following fish species were recorded at the fish sampling locations: Blacknose Dace, Bluntnose Minnow (Pimephales notatus), Common Shiner, Creek Chub, Johnny Darter (Etheostoma nigrum), Lake Chub, Longnose Dace, White Sucker, Brook Stickleback (Culaea inconstans), Common Carp, Goldfish (Carassius auratus), Rainbow Trout (Oncorhynchus mykiss), Rock Bass (Ambloplites rupestris), Round Goby (Neogobius melanostomus), Alewife (Alosa pseudoharengus), Fathead Minnow, Rosyface Shiner (Notropis rubellus), Yellow Perch (Perca flavescens) and Emerald Shiner (Notropis athernoides).

### 2.3.2 Vegetation and Terrestrial Habitat

#### 2.3.2.1 Vegetation Communities

Ecological Land Classification (ELC) mapping provided by CVC, CH and the City of Mississauga has been compiled and mapped for the project study area (**Figure 2-8**). The Region of Peel Greenlands system and other wetlands regulated by the CVC, including those greater than 0.5 ha that would be part of the City of Mississauga Natural Area, are also included. Vegetation communities for identified City of Miss

issauga Natural Areas are described in **Table 2-1**, based on the 2017 Natural Areas Update.

## Figure 2-8 Existing Terrestrial Habitat


Refer to **Appendix A** for a larger version of this figure with vegetation community descriptions

**Table 2-1 Vegetation Communities**

| Natural Area ID | Vegetation Community | Vegetation Community Description |
|---|---|---|
| SD7 | Fresh – Moist Willow Lowland Deciduous Forest (FOD7-4) | This lowland forest community is composed of a mixture of naturally occurring vegetation and planted species. The canopy is composed of Black Walnut, non-native species White Willow, Black Locust and Norway Maple for an open canopy above the creek. |
| SD7 | Cultural Plantation (CUP) | This community was cultural meadow that underwent naturalization efforts; plantings and no mow areas. The canopy is now Black Locust and Oak species and is 10-25 m in height, covering greater than 60%. |
| SD7 | Dry – Moist Old Field Meadow (CUM1-1) | Planted trees and shrubs are scattered throughout this community. The community is dominated by goldenrod and aster species. |
| SD7 | Mineral Treed Beach/Bar (BBT1) | This community consists of a stone beach fairly bare of vegetation. The canopy of the beach bar is comprised of equal parts White Willow and Sandbar Willow and is 10 – 25 m in height, covering less than 25% area. |
| SD1 | Fresh – Moist Willow Lowland Deciduous Forest (FOD7-3) | This lowland forest is present along the Clearview Creek and the mouth of Joshua Creek. The open canopy is comprised of scattered mature Willow, Green Ash and Silver Maple. Canopy trees are greater than 25 m in height and cover greater than 60% of the community. |
| SD1 | Coniferous Plantation (CUP3) | Located along the Lake Ontario Shoreline, this coniferous plantation is dominated by mature Red Pine, White Pine and Scot's Pine. |
| SD1 | Scot's Pine Coniferous Plantation (CUP3-3) | This is a densely planted and immature plantation of Scot's Pine, located along Clearview Creek. Red Pine and White Pine scattered throughout. |

| Natural Area ID | Vegetation Community | Vegetation Community Description |
|---|---|---|
| SD1 | Mineral Open Beach/Bar | This community consists of a stone beach along the Lake Ontario shoreline. The trees located along the edge of this community consist of Black Walnut, Manitoba Maple, Crack Willow and Freeman's Maple, Red Oak and White Pine. |
| SD4 | Dry – Fresh Poplar Deciduous Forest (FOD3-1) | The open canopy of this community is dominated by Trembling Aspen with other Poplar species, 10 – 25 m in height and providing cover of 25 – 60%. |
| SD4 | Fresh – Moist Poplar Deciduous Forest (FOD8-1) | The canopy and subcanopy of this community are dominated by a mixture of Balsam Poplar, Large –tooth Aspen and White Birch. Canopy trees are 10 – 25 m in height, providing greater than 60% cover. |
| SD4 | Dry – Fresh Sugar Maple – Red Oak Deciduous Forest (FOD5-3) | This community forms a narrow fringe along the south edge of the road through this site. Mature, open grown Red Oak and Sugar Maple form a closed canopy, with some Red Maple. |
| SD4 | Fresh – Moist Ash Lowland Deciduous Forest (FOD7-2) | This community is found in two locations within this Natural Area site. It is dominated by an open canopy and sub canopy of Green Ash with Balsam Poplar and Black Walnut as associates. Depressions that are likely water filled in the spring support sensitive fern and lady fern. |
| SD4 | Dry – Moist Old Field Meadow (CUM1-1) | This meadow is found in associated with the early successional forest on the eastern portion of the site and is dominated by Tall Goldenrod, Canada Goldenrod, Flat-top Goldenrod, Western Poison-ivy, Kentucky Blue-grass and Wild Carrot. |

| Natural Area ID | Vegetation Community | Vegetation Community Description |
|---|---|---|
| CL13 | Mineral Cultural Woodland (CUW1)/ Dry – Moist Old Field Meadow (CUM1-1) | The canopy of this community is dominated by Manitoba Maple, Norway Maple, and Silver Maple, 10 - 25 m in height and providing cover of 25 - 60%. There are open meadow patches within this community and mainly consist of Canada Goldenrod, Smooth Brome, Reed Canarygrass and Orchard Grass. |

#### 2.3.2.2 Vegetation Communities outside of Mississauga Natural Areas

- **Lake Ontario Shoreline** (south of Lakeshore Road West): Vegetation communities outside of Natural Areas SD1 and SD7 in this area consist of areas of cultural meadow (CUM), with some cultural savannah (CUS) (**Figure 2-8**)). Connected pockets of cultural woodland (CUW) and cultural plantation (CUP) occur just east of Natural Area SD1. One wetland community has been identified in this area, a Red-osier Mineral Thicket Swamp (SWT2-5), along the south side of Lakeshore Blvd West and just east of Natural Area SD1.
- **Eastern Portion of the Study Area** (Avonhead Road to Southdown Road): Vegetation communities outside of Natural Area SD4 in this area are limited to a small pocket of cultural woodland (CUW) and cultural savannah (CUS) and larger areas of cultural thicket (CUT) and cultural meadow (CUM), particularly in areas immediately surrounding Natural Area SD4 (**Figure 2-7**).
- **Western Portion of the Study Area** (Winston Churchill Blvd to Avonhead Road): Natural vegetation communities through the northern portion of this area, in the area south of Royal Windsor Drive is limited to small pockets of cultural thicket (CUT), with a long linear cultural meadow (CUM) community that occurs along the rail line.

  Vegetation communities outside of Natural Area SD1 in this area consist of area of cultural thicket (CUT), cultural meadow (CUM) and cultural woodland (CUW). A deciduous forest community (FOD) has been identified on the east side of Winston Churchill Blvd. Larger forested communities are associated with the Avonhead Creek corridor, including Fresh – Moist Ash Deciduous Forest (FOD7-2) and cultural woodland with connection to large areas of cultural meadow. The CUW community along Avonhead Creek generally co-insides with the Region of Peel Core Areas of the Greenlands System in this portion of the study area. Based on the ELC mapping three wetland communities occur in this area, including two small pockets of thicket swamp (SWT, SWT2-5) and an area of mineral meadow marsh (MAM2).

#### 2.3.2.3 Wildlife and Wildlife Habitat

Given the urban nature of the project study area, wildlife habitat opportunities within the study area likely include common, generalist and urban-adapted species (e.g. urban species of birds, Raccoon [Procyon lotor], Skunk [Mephitis mephitis] and Grey Squirrel [Sciurus carolinensis]).

As identified in the Natural Area Surveys (2014), a high faunal diversity is supported in the mid- to late successional and edge forest habitat provided by the large natural areas within the study area. These areas serve important linkage functions along creek corridors and as important areas for migrating birds along the lakeshore. Higher quality habitat is afforded to urban-tolerant species in these designated Natural Areas. Wildlife habitat opportunities are limited through the remainder of the study area as a result of the industrial and business employment land uses.

### 2.3.3 Species at Risk

Existing SAR records were queried through the NHIC database, which identified no SAR records in the vicinity of the study area. MNRF was contacted for information on SAR occurrences or potential presence within the project study area. Habitat opportunities for SAR on the site were then assessed by comparing habitat preferences of species deemed to have potential to occur, against current site conditions. The SAR identified by MNRF as being recorded in the vicinity of the site, and others known through professional experience to have potential to occur in urban environments were considered in the assessment. A brief discussion of the status, habitat requirements, and assessment of likely presence on the subject property for each of these species is provided in **Table 2-2** and presents the habitat screening for these SAR species records.

Information obtained from MNRF indicates that there are records of the following species in the vicinity of the study area:

- Peregrine Falcon (Falco peregrinus) – Special Concern
- Common Nighthawk (Chordeiles minor) – Special Concern
- Butternut (Juglans cinerea) - Endangered
- Endangered Bat species

Additionally, the NHIC database contains records of the following species in the general area:

- Bank Swallow (Riparia riparia) – Threatened
- American Chestnut (Castanea dentate) – Endangered

**Table 2-2 SAR Habitat Screening for NHIC SAR Records**

| Species | Habitat Requirement Overview | Habitat Suitability |
|---|---|---|
| Bank Swallow | The Bank Swallow readily breeds in a wide variety of low-elevation (< 900 m), natural and anthropogenic habitats, including: lake and ocean bluffs; stream and river banks; sand and gravel pits; roadcuts; and piles of sand, topsoil, sawdust, coal ash, and other materials. Nest burrows are nearly always in a vertical or near-vertical bank | Absent |
| American Chestnut | The American Chestnut prefers dryer upland deciduous forests with sandy, acidic to neutral soils. In Ontario, it is only found in the Carolinian Zone between Lake Erie and Lake Huron (as recorded by the Ontario NHIC). | Absent |
| Peregrine Falcon | Peregrine Falcons typically nest on tall, steep cliff ledges close to large bodies of water. Urban peregrines raise their young on the ledges of tall buildings. | Absent |
| Common Nighthawk | Habitat for Common Nighthawk consists of open areas with little to no ground vegetation, such as logged or burned-over areas, forest clearings, rock barrens, peat bogs, lakeshores and mine tailings. Although the species also nests in cultivated fields, orchards, urban parks, mine tailings and along gravel roads and railways, they tend to occupy natural sites. | Potential |
| Butternut | Butternut grows best on rich, moist, well-drained loams often found on stream bank sites but may be found on well-drained gravelly sites, especially those of limestone origin (MNRF, 2016a). | Potential |
| Eastern Small-footed Myotis | Roosts in a variety of habitats including caves, hollow trees, buildings, and bridges in the summer. In the winter, they hibernate in abandoned caves or mines (MNRF, 2016a). | Potential |
| Little Brown Myotis | In the summer, roosts in trees, barns, attics and abandoned buildings to raise their young. In the winter, they hibernate in abandoned mines or caves (MNRF, 2016a). | Potential |

| Species | Habitat Requirement Overview | Habitat Suitability |
|---|---|---|
| Northern Myotis | Roosts under loose bark and cavities in trees in boreal forests. In the winter, the hibernate in abandoned caves or mines (MNRF, 2016a). | Potential |
| Tri-coloured Bat | In the summer, forms day roosts in a range of habitats including older forest and sometimes barns. These bats overwinter in caves (MNRF, 2016a). | Potential |

### 2.3.4 Significant Natural and Environmentally Sensitive Areas

No Provincially Significant Wetlands (PSWs) or Areas of Natural and Scientific Interest (ANSIs) occur within or adjacent to the subject property. Four designated Natural Areas occur within the study area, as identified by the Mississauga Natural Areas Survey. These areas are mapped on **Figure 2-8** and described in **Table 2-3**. Core Areas of the Peel Greenlands system are also mapped on **Figure 2-8.**

**Table 2-3 Natural Areas**

| Natural Area | Natural Area Classification | Area (ha) | Natural Area Description |
|---|---|---|---|
| SD1 | Significant Natural Area | 20.03 | This 20 ha site contains a portion of Clearview Creek and the mouth of Joshua Creek. Lake Ontario forms the southern boundary of this site. The site is currently in fair condition. Disturbances include garbage, dumping, windthrow and erosion. Non-native (introduced) plant species represent 43% of the total number of species present. This natural area mainly supports bird species of late successional and forest edge habitat. The high diversity of faunal species documented highlights the importance of natural areas along the lakeshore. One provincially significant flora species and one provincially significant fauna species has been documented within this site. Clearview Creek is classified as a type 2 (Important) fishery within the site (Natural Areas Survey 2014). |

| Natural Area | Natural Area Classification | Area (ha) | Natural Area Description |
|---|---|---|---|
| SD4 | Significant Natural Area | 24.38 | This site is located in the Lakeside Creek sub-watershed. This natural area supports species of mid-to late successional habitat and forest edge. Disturbances present at this site are relatively limited due to the controlled access. Some litter is associated with the roads that fragment the site, however there are no trails. Non-native (introduced) plant species represent 22% of the total number of species present. Surrounding land use is industrial (Natural Areas Survey 2014). |
| SD7 | Significant Natural Area<br><br>Special Management Area | 3.93 | This site contains a portion of Lakeside Creek. The southern border is Lake Ontario. The natural area mainly supports species of mid- to late successional and forest edge habitat. The high diversity of species notes in this area illustrates the importance of natural areas along the lakeshore to migrating fauna. This site is currently in poor condition. Non-native (introduced) plant species represent 51% of the total number of species present. Surrounding land use is industrial. One provincially significant flora species has been documented (Natural Areas Survey 2014).<br><br>A Special Management Area has been identified through this area that consists predominately of manicured parkland. |

| Natural Area | Natural Area Classification | Area (ha) | Natural Area Description |
|---|---|---|---|
| CL13 | Significant Natural Area | 10.12 | This site contains a portion of Sheridan Creek. This natural area supports a complex of mineral cultural woodland and dry – moist old field meadow (CUW1/CUM1-1). The site is currently in poor condition. Disturbances present at this site include garbage and dumping, vandalism, encroachment, disease/insects and excessive road noise. Non-native (introduced) plant species represent 56% of the total number of species present. This natural area mainly supports bird species of small forests and successional habitat. Surrounding land use is a mixture of industrial, residential and commercial. One provincially significant fauna species has been documented. Sheridan Creek is classified as a type 2 (Important) fishery within the site (Natural Areas Survey 2014). |

## 2.4 Cultural Environment

### 2.4.1 Archaeology

To establish the historical context and archaeological potential of the study area, a review of Aboriginal and Euro-Canadian settlement history, available historical mapping and imagery, and updated information on archaeological sites in the vicinity of the study area, was performed. The study area lies within a region that was first inhabited about 13,000 years ago by small groups of nomadic hunter-gathers. Europeans arrived in the 1600's. Five Nation (Haudenosaunee) and Anishinaabeg groups arrived in the 1650's. Euro-Canadians began settling the study area in the 1800's, and several historic structures are indicated on atlases and maps from 1877. By the end of the nineteenth century, the study area primarily encompassing land that had been cleared of overgrown vegetation, large woodlots, several creeks leading into Lake Ontario and several houses fronting Southdown Road, Lakeshore Road, Royal Windsor Drive and Winston Churchill Boulevard. The study area was primarily for fruit growing, packing, storing and shipping became an important industry in the community.

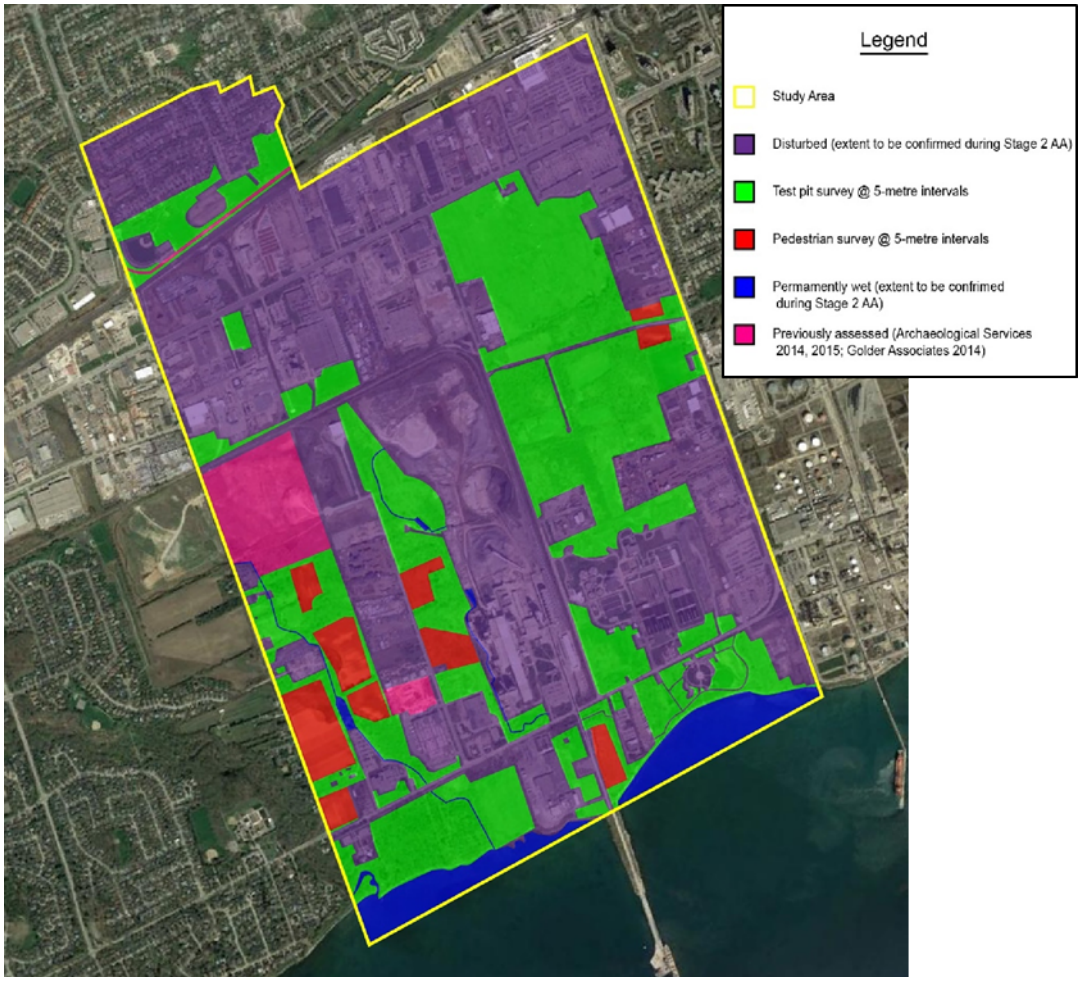
According to the OASD there is one archaeological site within the study area (AjGv-56). A copy of the report documenting the discovery and excavation has been requested, but no reports was received by report submission. Given that the supposed location of the site within the study area is developed and no further information is currently available about this site, it is uncertain whether there are further archaeological concerns tied to the AjGv-56 Site.

Based on the Stage 1 archeological assessment, the following recommendations are presented:

- With previous assessments by Archaeological Services Inc. (2014, 2015) and Golder Associates (2014), having fulfilled the Stage 1 and 2 AA requirements within their respective portions of the current study area, it is recommended that these areas be exempt from further assessment within the scope of this project.
- Parts of the study area that were identified as having archaeological potential removed are exempt from requiring Stage 2 AA (extents of these areas to be confirmed during the Stage 2 AA).
- Parts of the study area that were identified as having no or low archaeological potential are exempt from requiring Stage 2 AA (extents of these areas to be confirmed during the Stage 2 AA).
- All identified areas which contain archaeological potential, must be subjected to a Stage 2 AA.
- The manicured grassed areas that have been ploughed in the past will require pedestrian survey at five metre intervals, which involves systematically walking ploughed areas and mapping and collecting any artifacts found on the ground surface. The land must be recently ploughed and subjected to the appropriate weathering requirements, in accordance with Section 2.1.1 of the 2011 S&G, in advance of pedestrian archaeological survey.
- Areas of overgrown vegetation and manicured grassed which have never been ploughed before, will need to be subjected to a Stage 2 shovel test pit survey at five metre intervals, in accordance with Section 2.1.2 of the 2011 S&G.
- No construction activities shall take place within the study area prior to the MTCS (Archaeology Programs Unit) confirming in writing that all archaeological licensing and technical review requirements have been satisfied.

The complete Archaeological Assessment study report is included as **Appendix B**, and **Figure 2-9** shows the location of the sites with archaeological potential.

**Figure 2-9 Archaeological Potential**




### 2.4.2 Heritage Properties

The City of Mississauga designated the Bell Gairdner Estate at 2700 Lakeshore Road West as a heritage site in 2008. This lakefront property, more commonly referred to as the Harding Waterfront Estate or 'Fusion' property, is located at the foot of Winston Churchill Boulevard. The City of Mississauga Waterfront Parks Strategy (Brook McIlroy et al, March, 2008) proposes to integrate the heritage property and other city-owned lands to the east into a new waterfront park (See **Section 1.2.3**). Another property, the Robertson House, Gold Medal Farm, located at 381 Winston Churchill Boulevard is designated with a heritage status of Part IV.

## 2.5 Fluvial Geomorphology

Historical assessments previously completed in support of the LOISS (Ecosystem Recovery Inc., 2015 and Aquafor Beech Limited, 2011) were reviewed and supplemented with our review of historical aerial photographs from the National Air

Photo Library (NAPL) and City of Mississauga interactive online mapping. In 1931, land use within the study area was largely agricultural. Significant lengths of channel had been channelized, and natural vegetation removed to maximize cultivated land area. Between approximately the mid-1950s to the mid-1980s, Clearview Creek, Avonhead Creek, Lakeside Creek and Sheridan Creek underwent extensive channel modifications to accommodate industrial and residential development.

GEO Morphix Ltd. conducted a detailed review of previous studies, including those completed along Avonhead Creek (Ecosystem Recovery Inc., 2015) and Clearview Creek (CVC, 2018), among others. Confirmatory field work was largely limited to observations collected within ROWs, the lower reach of Joshua's Creek, and the remaining open channel section of Lakeside Creek and are summarized in this section. The creeks have been broken down into reaches to better characterize the creeks and are illustrated on **Figure 2-10**.

### 2.5.1 Clearview Creek

The upstream extent of Reach CC-4 was located at the culvert conveying flow beneath Winston Churchill Boulevard approximately 900 m south of Royal Windsor Drive, and continued until the upstream extent of the backwatered area upstream of the online pond north of Lakeshore Road. The reach contained a meandering suspended load channel with bed and bank substrate predominantly composed of clay, silt and sand. Due to access constraints, the reach could only be assessed within the Hydro One ROW. Land uses within the portion of reach assessed were predominantly industrial and agricultural, with one mature isolated woodlot acting as a riparian buffer in the central portion of the reach. The channel maintained a perennial flow regime and was not confined within a valley. Woody debris was only observed where the channel conveyed flow through the woodlot. There was sparse vegetation within the channel, with rooted emergent plants noted within approximately 10% of the reach. The channel was dominated by run geomorphic units, with riffles and pools observed infrequently. Average bankfull width was 3.55 m, and the average bankfull depth was 0.93 m.

Reach CC-5 contained an online pond and its associated backwatered area upstream of an undersized culvert at the upstream extent of the pond. Significant sedimentation was observed within both the pond and backwatered area, with deposits predominantly composed of sand. Pond dimensions were not evaluated in the field due to the depth of water, however upstream of the culvert the average bankfull channel width measured as 7.2 m with a corresponding depth of 0.9 m. Surrounding the reach was a narrow, fragmented and mature riparian buffer consisting of deciduous trees.

**Figure 2-10 Location of Reach Delineation**


Refer to **Appendix C** for a larger version of this figure

Approximately 150 m of Reach CC-6 was assessed at its downstream extent where the watercourse conveyed flow through a small unnamed park. The reach was a mixed-load meandering channel with a moderate gradient that was not confined within a valley. The channel had a mature and continuous riparian buffer zone that extended 4-10 times the channel width and consisted predominately of deciduous trees. A low density of woody debris was present in both the channel and banks with bank angles ranging from 60-90 degrees. Bank erosion was observed for 30-60% of the reach length, with undercuts measured up to 0.43 m. The average bankfull width and depth were 5 m and 0.7 m, respectively. A riffle-pool morphology was observed in the channel, with approximately 30% riffles and 10% pools. Bed material in riffles

and pools consisted of gravel, cobble, and exposed shale, with bank materials consisting of clay, silt and shale.

Reach CC-7 was assessed within the Lakeshore Road West ROW. A steep, armoured cascade was present upstream of the road before the channel entered a double box culvert. Downstream of the road, the channel consisted of a two-tiered concrete trapezoidal channel with a top width of 6.5 m and a depth of 2 m. Algae overlaid much of the concrete near the crossing, and scrubland flanked both sides of the channel north and south of Lakeshore Road.

### 2.5.2 Avonhead Creek

Reach R-2 was located immediately north of Lakeshore Road and began where the channel turned from a southward direction to an eastward direction. The reach was a low gradient roadside ditch that ran parallel to Lakeshore Road. The channel riparian area consisted of predominantly manicured grass, which had encroached the channel throughout its length. The average bankfull width and depth were 1.1 m and 0.33 m, respectively. Bank angles ranged from 30 to 60 degrees, and bank erosion was observed for less than 5% of the reach length. Channel bed and bank materials consisted of clay, silt, and sand.

Reach R-1 of Avonhead Creek is currently piped for approximately 400 m downstream of Lakeshore Road West to Lake Ontario. Ecosystem Recovery Inc. (2015) developed a preliminary design for daylighting Reach R-1 within the CRH Canada Group Inc. property. Daylighting of Reach R-1 would restore fish passage and aquatic habitat, and reinstate channel form and function.

Reach R-4 to R-6 are lined with concrete and CSP linings. Corrosion was observed along the bottom of the CSP lining. In some locations, gaps were noted between the lining and the floodplain; however, it was not clear if this was caused by overbank erosion or was the method of initial installation (Ecosystem Recovery Inc., 2015).

Reach R-7 to R-13 are unconfined and reach R-14 is confined.

There is backwater at the downstream reach break of R-7 due to concrete control structure. Removal of the concrete structure at the downstream extent of R-7 is being considered as part of restoration works of the channel.

R-14 is part of a straightened channel with armourstone banks through private industrial/commercial properties.

### 2.5.3 Lakeside Creek

Reach LC-1 began at a culvert under Lakeshore Road and conveyed flow southward for approximately 300 meters towards the pedestrian trail at Lake Ontario. The reach was a mixed load meandering channel that occupied an unconfined valley and had a

low gradient. The channel had a continuous riparian buffer zone that extended more than ten times the channel width, consisted predominately of mature deciduous trees. A moderate density of wood debris was observed within both the channel and cut banks. The average bankfull width and depth were 2.75 m and 0.53 m, respectively. Bank angles ranged from 60 to 90 degrees with undercuts measured up to 0.3 m. Bank erosion was observed for 30 to 60 percent of the reach length. The reach had a poorly developed riffle-pool morphology that consisted of 5% riffles and 5% pools. Bed material consisted of clay and silt in pools, and clay, silt, gravel in riffles, and banks were composed of a clay, silt, and sand mixture. Siltation in pools were observed, as well as deposition of fine material in the over-bank zone.

### 2.5.4 Sheridan Creek

Reach SC-1 was delineated based on recent digital imagery available from Google Earth Pro. The extent assessed in the field was limited to the portion of channel immediately downstream of a bridge crossing at Bromsgrove Road, where the channel conveyed flow eastward towards the bridge crossing at Lakeshore Road West. The portion of reach assessed contained a concrete-lined engineered channel, with a low gradient that occupied a confined valley. The channel had an established and continuous riparian buffer zone that extended 1-4 times the channel width and consisted predominately of deciduous trees. Bankfull indicators were absent due to the engineered channel. The channel bed and banks were composed of concrete, with some clay and gravel overlaying the concrete.

### 2.5.5 Joshua's Creek

Reach JC-1 began at the southwest corner of the Mississauga's municipal boundary and conveyed flow southeastward for approximately 250 m before discharging into Lake Ontario. The reach was a mixed-load meandering channel, with a low gradient that occupied a partially confined valley. The channel had a continuous riparian buffer that extended 1 to 4 times the channel width and consisted predominately of mature deciduous trees. A low density of woody debris was present in both the channel and cut banks. Depositional features such as lobate bars and medial bars were observed. The average bankfull width and depth were 18.5 m and 1.6 m, respectively. Bank angles range from 60 to 90 degrees, and bank erosion was observed for 5 to 30 percent of the reach length. The channel experienced a backwater effect from Lake Ontario, and therefore no riffle and pool development was observed. Channel bed and channel bank materials consisted of clay, silt, and sand.

### 2.5.6 Meander Belt

Meander belt widths define the area that a watercourse currently occupies and may occupy in the future, and defines, in part, the limit of potential development adjacent to a watercourse. Due to extensive historical channel modifications, meander belt widths were determined using empirical modelling for reaches of Clearview Creek, Avonhead Creek and Lakeside Creek, as appropriate. As a conservative approach, meander belt widths calculated using Ward et al. (2002) were recommended. Due to the relatively natural conditions within reach Joshua's Creek, the meander belt width for the reach within Joshua's Creek was determined using measured local meander amplitude and a 20% factor of safety. These values should be refined in subsequent site-specific studies as properties undergo development or re-development. Should any reaches be determined to be confined based on additional detailed field investigations, where the watercourse is within 15 m of the toe of the valley slope, the erosion hazard should be refined using MNR (2001) guidance or the completion of the detailed geomorphic study that identifies areas of active erosion, local surficial geology and local bank composition. The modelled meander belt widths for each reach is summarized in **Table 2-4**, and additional details can be found in **Appendix C**.

**Table 2-4 Modelled Meander Belt Widths for Reaches within the Study Area**

| Watershed | Reach | Recommended Meander Belt Width (m) |
|---|---|---|
| Clearview Creek | CC-4 | 34 |
| Clearview Creek | CC-5 | N/A - online pond and backwatered area |
| Clearview Creek | CC-6 | 50 |
| Clearview Creek | CC-7a | N/A – concrete-lined channel |
| Avonhead Creek | R-1a | N/A – piped channel |
| Avonhead Creek | R-2 | 9 |
| Avonhead Creek | R-3 | 24 |
| Avonhead Creek | R-4 | N/A – CSP lined channel |
| Avonhead Creek | R-5 | N/A – concrete lined channel |
| Avonhead Creek | R-6 | N/A – CSP lined channel |
| Avonhead Creek | R-7 | N/A – backwater due to concrete control structure at downstream reach break |

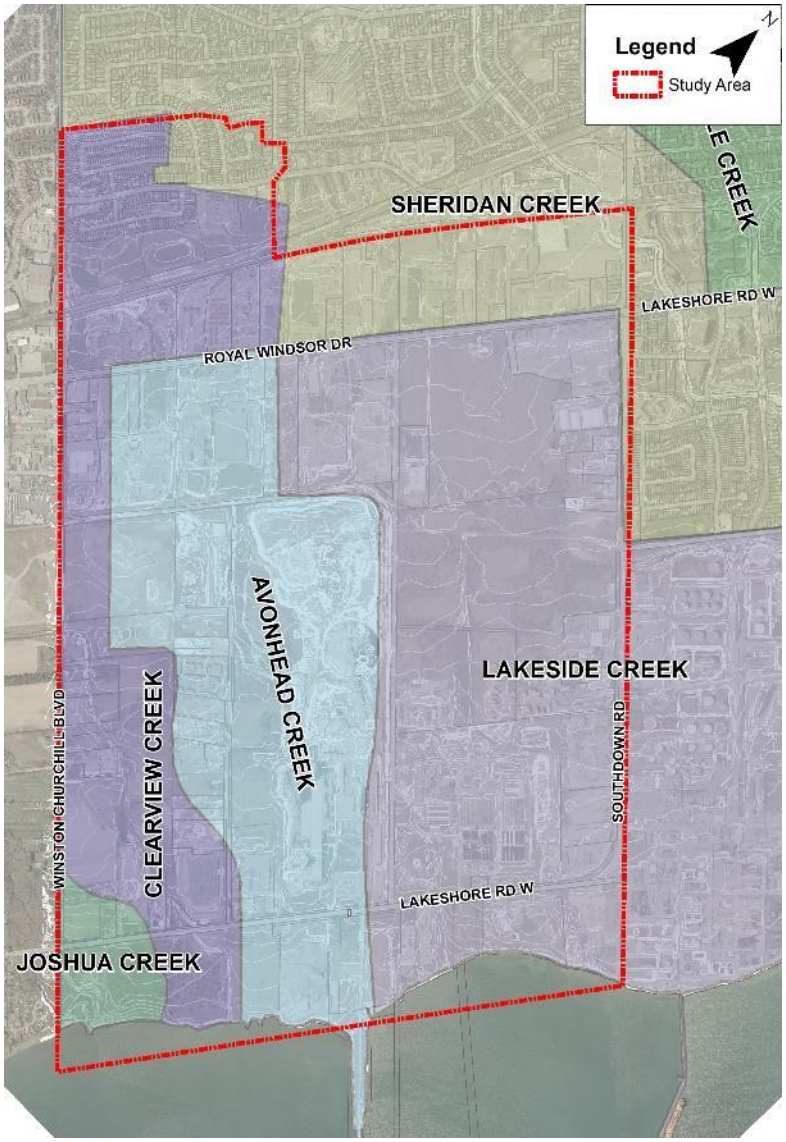
| Watershed | Reach | Recommended Meander Belt Width (m) |
|---|---|---|
| Avonhead Creek | R-8 | 23 |
| Avonhead Creek | R-9 | 22 |
| Avonhead Creek | R-10 | 21 |
| Avonhead Creek | R-11 | 21 |
| Avonhead Creek | R-12 | 16 |
| Avonhead Creek | R-13 | N/A – straightened grass-lined ditch on private property, no access granted to Ecosystem Recovery Inc. at time of study |
| Avonhead Creek | R-14 | N/A – straightened channel on private property, no access granted to Ecosystem Recovery Inc., armourstone retaining walls present, commercial development to the top of bank |
| Lakeside Creek | LC-1 | 26 |
| Sheridan Creek | SC-1 | N/A – concrete lined channel, surrounding area developed (Clarkson GO Station, urban residential) |

## 2.6 Engineering Environment

### 2.6.1 Watershed Hydrology

Four main watersheds are within the Southdown District area: Clearview Creek, Avonhead Creek, Lakeside Creek and Joshua Creek. Adjacent to the subject site is Sheridan Creek which is located at the northeast tip of the study area. The majority of the watersheds are within Credit Valley Conservation jurisdiction (Clearview Creek, Avonhead Creek, Lakeside Creek, Sheridan Creek) and Joshua Creek is within Conservation Halton's jurisdiction. Joshua Creek watershed is within a small portion of the subject site located at the southwest corner as shown on **Figure 2-11**.

**Figure 2-11 Watershed Locations**




Lakeside Creek is a small tributary, running from Royal Windsor Drive to Lake Ontario between Avonhead Road and Southdown Road. Lands in the upper watershed are partially developed with commercial/industrial land uses. The Region of Peel's Clarkson WWTP is located on the north side of Lakeshore Road. Most of the creek has been channelized or encompassed by the storm sewer system that conveys runoff from the headwaters areas under the WWTP. The open channel extends from the south side of Lakeshore Road through Lakeside Park to Lake Ontario.

Avonhead Creek is directly adjacent to Lakeside Creek, running between Hazelhurst Road and Avonhead Road. The headwaters area of the watershed is developed with commercial/industrial land uses, while the middle of the watershed is occupied by

the large CRH concrete plant. The creek is then piped from Lakeshore Road to its outlet at Lake Ontario. Soil type ranges from poorly drained clay upstream to well-drained sandy loam downstream. Approximately 148 ha have been diverted from the headwaters of this watershed to Clearview Creek at Orr Road.

The headwaters of Clearview Creek are within the municipality of Oakville, west of the Winston Churchill Boulevard, with the creek flowing into the City of Mississauga via a culvert under the road. Within Mississauga, the land north of the CNR is highly developed residential lots, while the area south of the CNR is partially occupied by industrial land use, with larger undeveloped areas located north of Lakeshore Road. South of Lakeshore Road, Clearview Creek is conveyed via a concrete channel to its outlet at Lake Ontario.

The headwaters of Sheridan Creek are located well north of the Southdown study area and consist of residential and employment land uses. Within the Southdown study area, the industrial/commercial lands fronting onto the north side of Royal Windsor Drive drain to Sheridan Creek. Further southeast of the study area, Sheridan Creek drains to Rattray Marsh at Lake Ontario.

Joshua Creek has a large watershed, located almost entirely within the Municipality of Oakville. Only the outlet of the creek to Lake Ontario at the very base of the watershed is located within the Southdown study area in the City of Mississauga.

Hydrologic models for the Clearview Creek, Avonhead Creek and Lakeside Creek watersheds were developed by CVC using Visual OTTHYMO (VO) as part of the ‘CVC Lake Ontario Tributaries Flood Mapping Study’ prepared in May 2015. The hydrologic models have since been updated by CVC and further updated by TMIG to characterize the existing condition. An older hydrologic model for the Sheridan Creek watershed was also available through CVC, however updates to the model through the Southdown study area were not considered to be necessary, as the contributing Southdown land areas are a negligible fraction of the overall watershed area.

#### 2.6.1.1 Model Set Up

Based on the models from CVC, the drainage boundaries within the VO models were further discretized based on future development demands and property boundaries. A larger scape map showing the delineated sub-catchments is included in **Appendix D**. The model parameters for the new drainage areas were kept similar to CVC’s model, namely the CN number, depression storage and slope.

The design storm used for the model was the Chicago 24 hour storm event based on the IDF curves in the City of Mississauga standards.

Land use through the study area is predominantly industrial and undeveloped land with a small portion north of the CN tracks with residential use. Calculations for the input parameters for the refined models can be found in **Appendix D**.

#### 2.6.1.2 Model Output

The updated peak flow rates for 2 year through 100 year storm events for the three updated watershed models (Clearview Creek, Avonhead Creek and Lakeside Creek) are summarized in **Table 2-6**, **Table 2-8**, and **Table 2-10**. The peak flow rates from CVC's original model for Clearview Creek, Avonhead Creek, Lakeside Creek and Sheridan Creek are summarized in **Table 2-5**, **Table 2-7**, **Table 2-9**, and **Table 2-11**.

Detailed updated model output can be found in **Appendix D**.

**Clearview Creek:**

The drainage area of Clearview Creek is further discretized, and 9 new sub-catchment areas were added to CVC's VO model as illustrated on **Figure 2-12**. Within the Clearview watershed there are two stormwater management (SWM) ponds, one is located in Oakville outside of the study area, and one is located north of Orr Road at the end of Hazelhurst Road. The flows summarized below include the Oakville SWM pond but do not include the Orr Road pond since this pond has been excluded in CVC's base model. A diversion structure on the adjacent Avonhead Creek is located immediately downstream of the Orr Road pond and diverts the larger storm events to Clearview Creek and the smaller storm events to Avonhead Creek as baseflow. The upstream flow first enters the study area at Winston Churchill Boulevard and eventually outlets at Lake Ontario. The corresponding updated flows are summarized in **Table 2-6** and the original flows from CVC's model are summarized in **Table 2-5**.

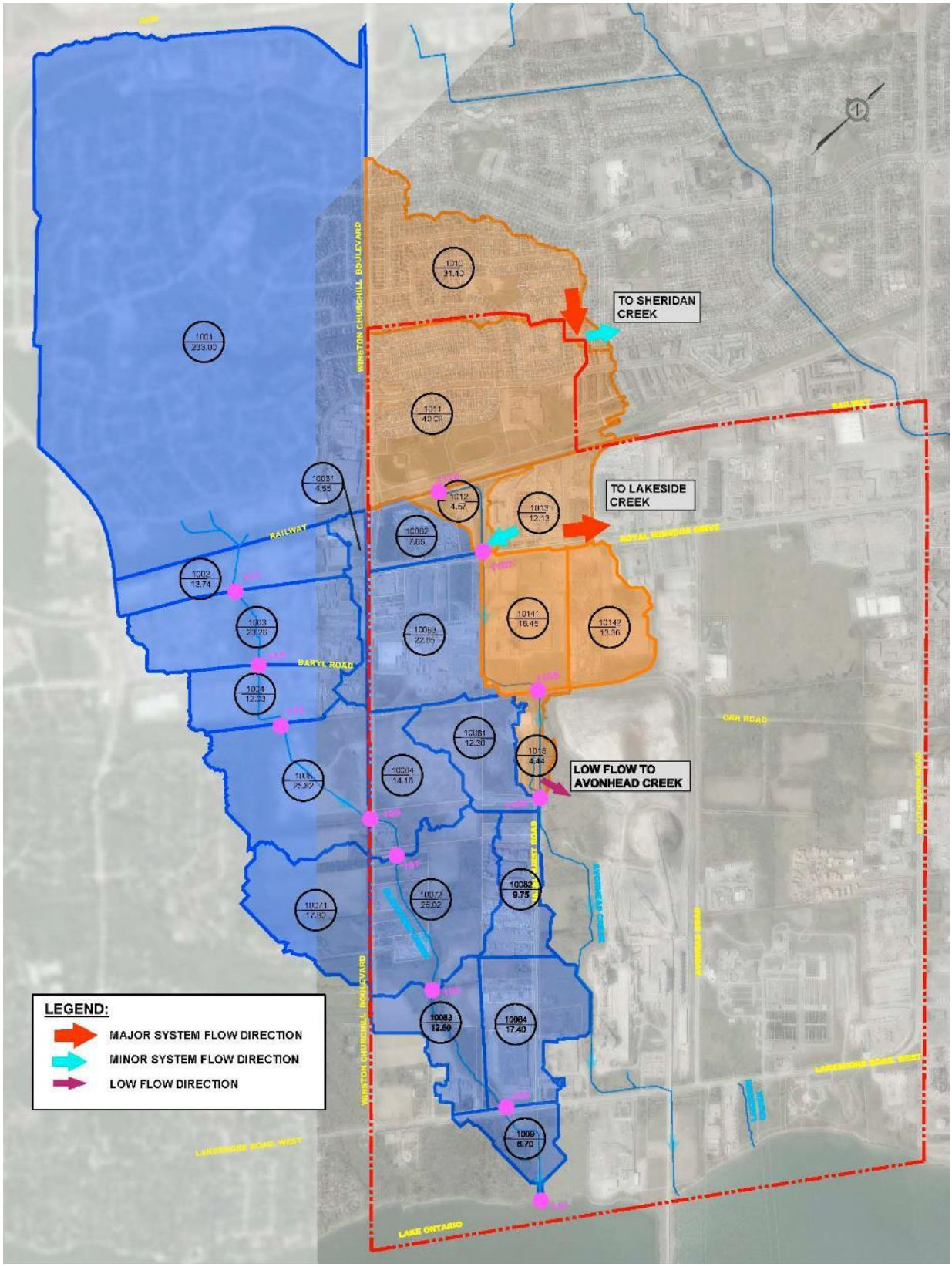
**Table 2-5 Clearview Creek Existing Flow Rates – CVC Model**

| Storm Event | Flow Rate Upstream of Winston Churchill Blvd ($m^3/s$) (ID 109, 296 ha) | Flow Rate at Lake Ontario ($m^3/s$) (ID 101, 518 ha) |
|---|---|---|
| 2 year | 4.52 | 9.66 |
| 5 year | 5.41 | 13.60 |
| 10 year | 6.26 | 17.70 |
| 25 year | 7.60 | 21.25 |
| 50 year | 9.54 | 24.76 |
| 100 year | 12.13 | 28.48 |
| Regional | 27.36 | 50.79 |

**Table 2-6 Clearview Creek Existing Flow Rates – TMIG Update**

| Storm Event | Flow Rate Upstream of Winston Churchill Blvd ($m^3/s$) (ID 109, 296 ha) | Flow Rate at Lake Ontario ($m^3/s$) (ID 101, 518 ha) |
|---|---|---|
| 2 year | 4.52 | 9.46 |
| 5 year | 5.41 | 13.44 |
| 10 year | 6.26 | 17.62 |
| 25 year | 7.60 | 21.19 |
| 50 year | 9.54 | 24.73 |
| 100 year | 12.13 | 28.58 |

**Figure 2-12 Clearview Creek Existing Sub-Catchment Areas**



**Avonhead Creek:**

The majority of Avonhead Creek's watershed is within the study area. As recommended from the previous Southdown District Master Drainage Plan, approximately 147.7 ha of upstream drainage area is diverted from Avonhead Creek to Clearview Creek at Orr Road. At the diversion, a small amount of baseflow continues south to the reach of Avonhead Creek through the concrete plant, while larger flood flows are captured and diverted via a trunk sewer on Hazlehurst Road which outlets to Clearview Creek at Lakeshore Road. Similar to Clearview Creek, the drainage area within Avonhead Creek is further discretized, and 6 new sub-catchments areas were added to CVC's VO model as illustrated on **Figure 2-13**. The flows from upstream of Orr Road (diverted flow to Clearview Creek) and the flows to the outlet at Lake Ontario are summarized in **Table 2-7** and **Table 2-8**, from the original CVC model and from the updated model by TMIG respectively.

**Table 2-7 Avonhead Creek Existing Flow Rates –CVC Model**

| Storm Event | Flow Rate at Orr Road ($m^3/s$) (ID 1104, 99 ha) | Diverted Flow to Clearview Creek ($m^3/s$) | Flow remaining in Avonhead Creek ($m^3/s$) | Flow Rate at Lake Ontario ($m^3/s$) (ID 101, 108 ha) |
|---|---|---|---|---|
| 2 year | 4.73 | 4.36 | 0.37 | 3.09 |
| 5 year | 6.87 | 6.36 | 0.51 | 4.46 |
| 10 year | 8.67 | 8.04 | 0.63 | 6.35 |
| 25 year | 10.18 | 9.46 | 0.72 | 7.66 |
| 50 year | 11.73 | 10.86 | 0.87 | 8.92 |
| 100 year | 13.27 | 12.01 | 1.26 | 10.61 |
| Regional | 12.3 | 11.29 | 1.01 | 9.76 |

**Table 2-8 Avonhead Creek Existing Flow Rates- TMIG Updated**

| Storm Event | Flow Rate at Orr Road ($m^3/s$) (ID 1104, 99 ha) | Diverted Flow to Clearview Creek ($m^3/s$) | Flow remaining in Avonhead Creek ($m^3/s$) | Flow Rate at Lake Ontario ($m^3/s$) (ID 101, 108 ha) |
|---|---|---|---|---|
| 2 year | 5.08 | 4.69 | 0.39 | 5.48 |
| 5 year | 7.24 | 6.7 | 0.53 | 7.94 |
| 10 year | 9.21 | 8.54 | 0.66 | 10.44 |
| 25 year | 10.59 | 9.84 | 0.75 | 12.54 |
| 50 year | 12.15 | 11.18 | 0.98 | 14.55 |
| 100 year | 13.72 | 12.35 | 1.37 | 16.56 |

**Lakeside Creek:**

Lakeside Creek watershed is entirely within the study area. The VO model has been further discretized and 5 new sub-catchment areas have been added to the model provided by CVC as illustrated on **Figure 2-14**. The most downstream flow at Lake Ontario is summarized in **Table 2-9** and **Table 2-10**, from the original CVC model and from the updated model respectively.

**Table 2-9 Lakeside Creek Existing Flow Rates - CVC Model**

| Storm Event | Flow Rate at Lake Ontario ($m^3/s$) (ID 101, 118 ha) |
|---|---|
| 2 year | 3.53 |
| 5 year | 5.12 |
| 10 year | 6.78 |
| 25 year | 8.28 |
| 50 year | 9.34 |
| 100 year | 10.39 |
| Regional | 12.25 |

**Table 2-10 Lakeside Creek Existing Flow Rates - TMIG Update**

| Storm Event | Flow Rate at Lake Ontario ($m^3/s$) (ID 101, 118 ha) |
|---|---|
| 2 year | 4.17 |
| 5 year | 6.22 |
| 10 year | 7.78 |
| 25 year | 8.87 |
| 50 year | 9.87 |
| 100 year | 10.98 |

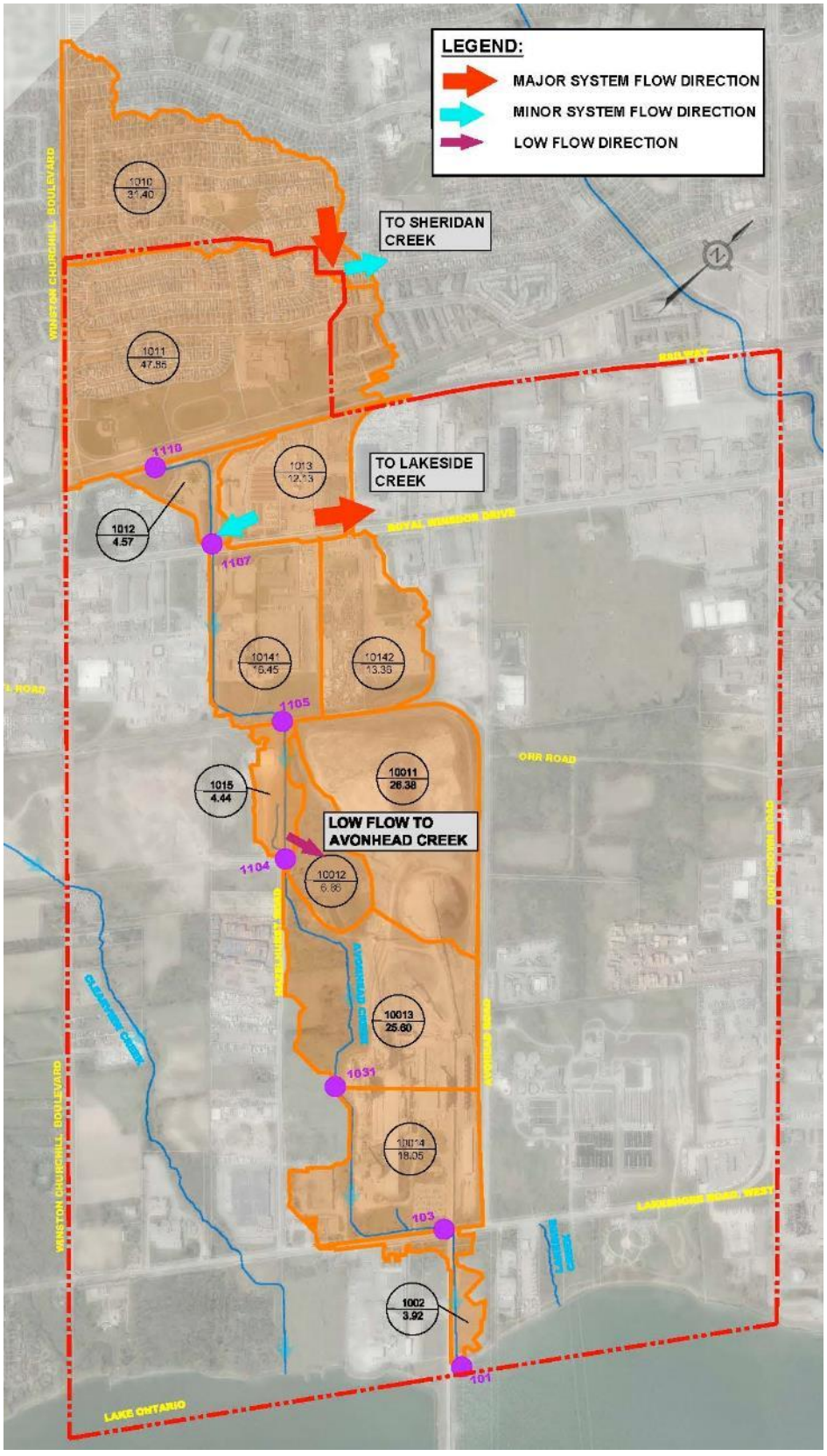
**Sheridan Creek:**

The VO model was also provided for Sheridan Creek from CVC. The flows summarized in **Table 2-11** are directly from the CVC model and have not been altered as part of this study.

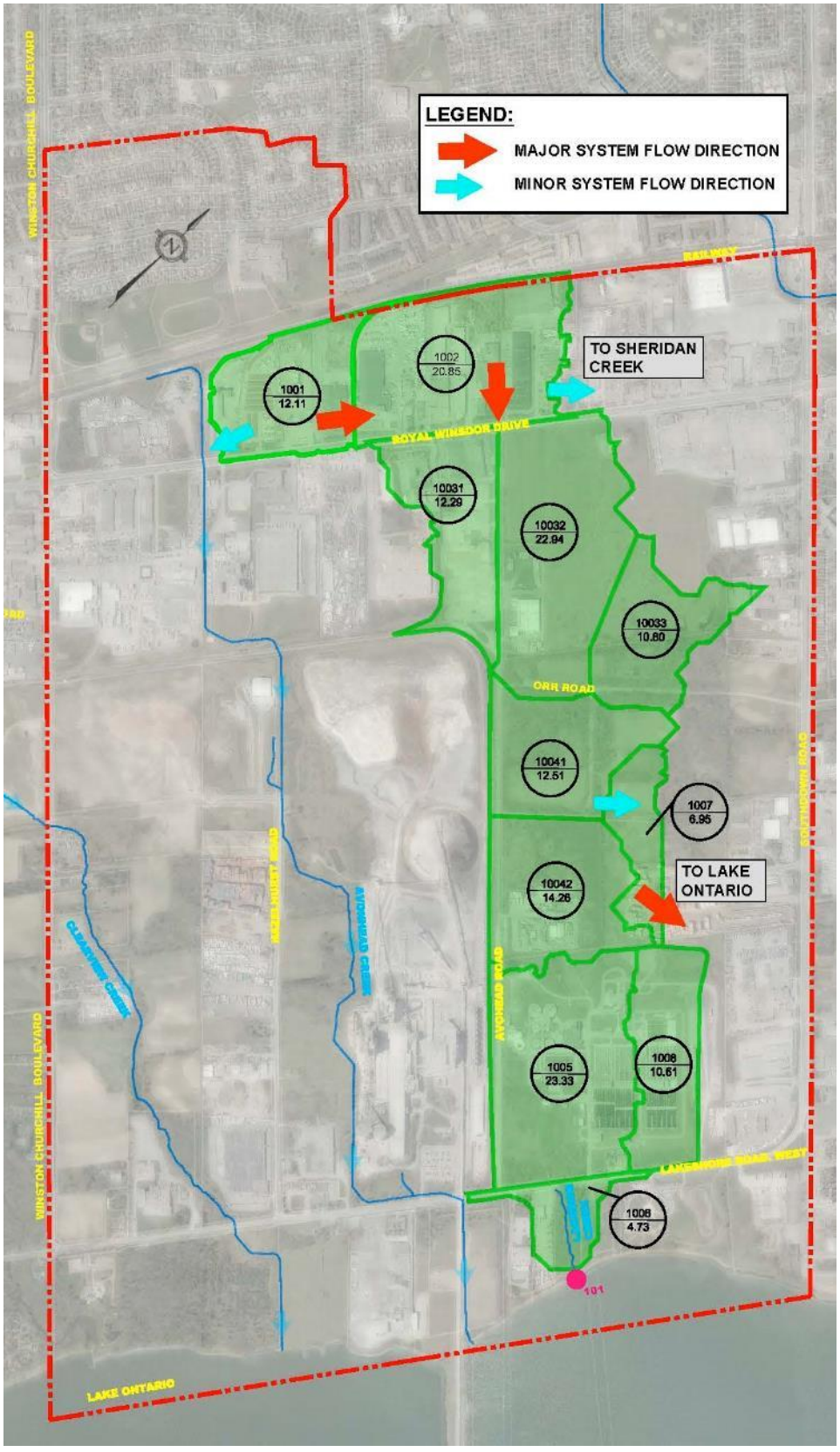
**Table 2-11 Sheridan Creek Existing Flow Rates - CVC Model**

| Storm Event | Flow Rate at Southdown Road ($m^3/s$) (ID 101, 824 ha) |
|---|---|
| 2 year | 26.62 |
| 5 year | 38.54 |
| 10 year | 50.63 |
| 25 year | 60.76 |
| 50 year | 71.1 |
| 100 year | 90.37 |
| Regional | 98.83 |

## Figure 2-13 Avonhead Creek Existing Sub-Catchment Areas



## Figure 2-14 Lakeside Creek Existing Sub-Catchment Areas



### 2.6.2 Hydraulics

Hydraulic models for Clearview Creek, Avonhead Creek and Lakeside Creek were setup using the HEC-RAS hydraulic model as part of CVC's recent floodplain mapping update initiative. Results from these models were used by TMIG to plot draft floodplain limits using digital terrain information for the watersheds. Floodplain mapping based on historic modelling for the Sheridan Creek and Joshua Creek reaches within the study area was also provided by CVC and CH, respectively. The floodlines are illustrated on **Figure 2-15**.

As shown, flooding is typically confined to the primary stream corridors. Some flooding and spill of floodwaters from Avonhead Creek into adjacent properties is predicted upstream and downstream of the railway spur line south of Royal Windsor Drive. This complex spill area near the CNR tracks required additional 2D HECRAS modelling to better define the flood extents and to investigate potential flood mitigation options at this location. **Figure 2-15** also shows the complex spill area that was additionally modelled by CVC and **Figure 2-15** shows the flood extent defined by the 2D model. Additional information regarding the 2D modelling of Avonhead Creek by CVC can be found in **Appendix D**.

The Clearview Creek floodplain is also quite extensive and impacts adjacent properties in some locations.

It should be noted that the Avonhead Creek floodplain limits through the concrete plant property north of Lakeshore Road are based on the reduced flows from the upstream diversion at Orr Road. Discussions with CVC indicate that, without the upstream diversion, the floodplain extents downstream of Orr Road would be much more extensive.

Based on the HEC-RAS models from CVC and flows from the updated hydrology modeling described in **Section 2.6.1**, the capacity of major municipal watercourse crossings was analyzed, as summarized in **Table 2-12**.

**Table 2-12 Inventory of Crossings and Capacity at Crossing**

| Location | Size (m) | U/S Invert (m) | D/S Invert (m) | Road Elevation (m) | Overtopping Frequency |
|---|---|---|---|---|---|
| Avonhead Creek at Royal Windsor Dr. | Box 2.38W x 1.2H | 99.62 | 98.82 | 103.1 | no overtopping |
| Avonhead Creek at CNR Spur Driveway | 0.6 dia. | 96.5 | 96.47 | 97.55 | 2 year storm |
| Avonhead Creek at CNR Spur | Twin 1m dia. | 96.13 | 96.03 | 97.42 | no overtopping |
| Avonhead Creek Upstream of CNR | Twin Arch 1.47W x 0.91H | 95.43 | 95.33 | 96.61 | 2 year storm |
| Avonhead Creek at CNR | Twin 1.2 dia. | 95.43 | 95.33 | 97.31 | no overtopping |
| Avonhead Creek at Lakeshore Road | Ellipse 1.7W x 0.84H | 79.92 | 75.88 | 81.78 | >2 year storm |
| Clearview Creek at Winston Churchill Blvd | Bridge 7 W x 1.3 H | 91.1 | 91.07 | 93.32 | >100 year storm |
| Clearview Creek at Lakeshore Road | Twin Box 3.65W x 2.4H | 79.61 | 79.48 | 82.7 | >100 year storm |

As summarized in **Table 2-12**, there are four major municipal crossings within the study area: at Royal Windsor Drive (Avonhead Creek), Winston Churchill Boulevard (Clearview Creek), and two at Lakeshore Road (Clearview Creek and Avonhead Creek). All of these municipal crossings are sufficiently sized with the exception of the

Avonhead Creek culvert under Lakeshore Road which overtops for storm events greater than the 2 year storm. All other crossings have sufficient capacity to pass up to the 100 year storm event. The crossings for Clearview Creek under Winston Churchill Boulevard and Lakeshore Road overtops for all storm events greater than the 100 year storm.

There are four culverts crossings associated with the railway within Avonhead Creek, one under the CNR Spur Driveway, one under the CNR spur, one upstream of the CNR and one under the CNR. Although the culverts upstream of the CNR and upstream of the CNR spur are predicted to overtop during the 2 year storm event, the spill is not necessarily caused by the undersizing of the culverts. Review of the hydraulic model results indicates that the spill experienced in the surrounding area is due to insufficient channel conveyance capacity within Avonhead Creek, causing floodwater to spill into other low laying areas such as the ditches along both sides the CNR. The water also spills overtop of the CNR, continues southerly along the CNR spur onto Orr Road and eventually joins back with the main Avonhead Creek channel near Hazelhurst Road.

In addition to the capacity limitations discussed above, there are several other small private culvert crossings along Clearview Creek and Avonhead Creek which are also expected to overtop frequently.

## Figure 2-15 Existing Regional Floodlines

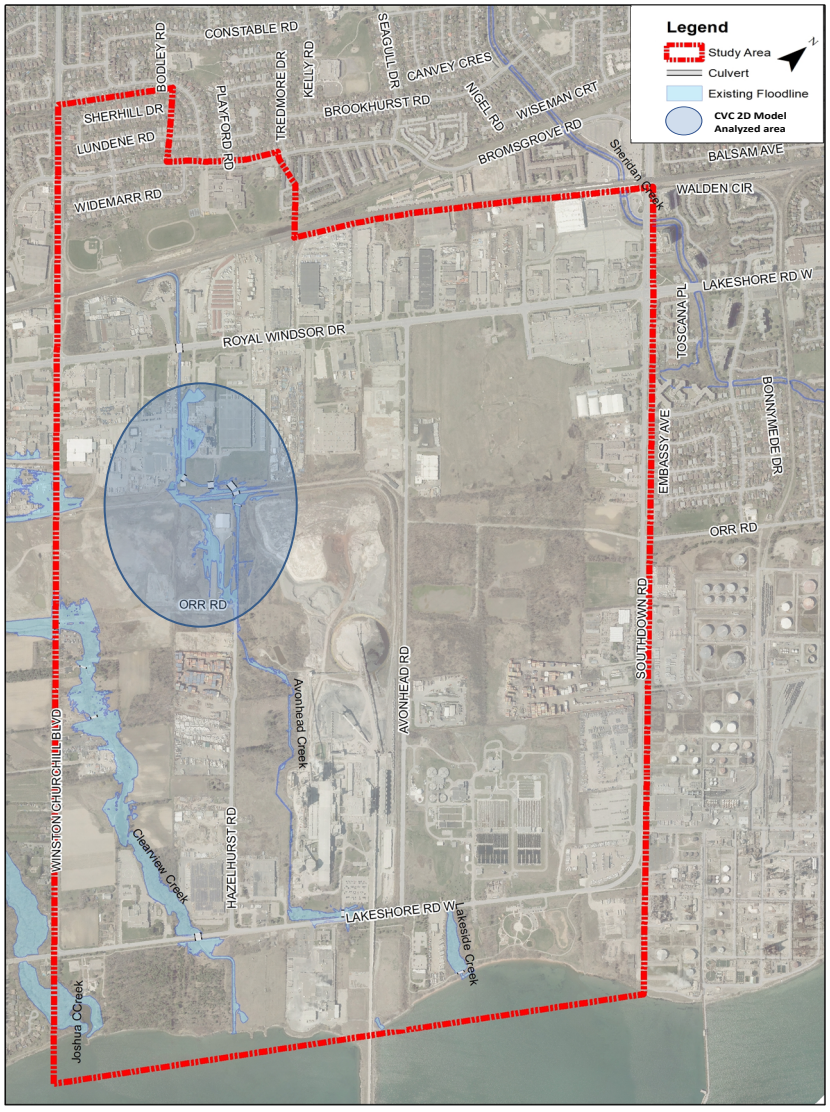
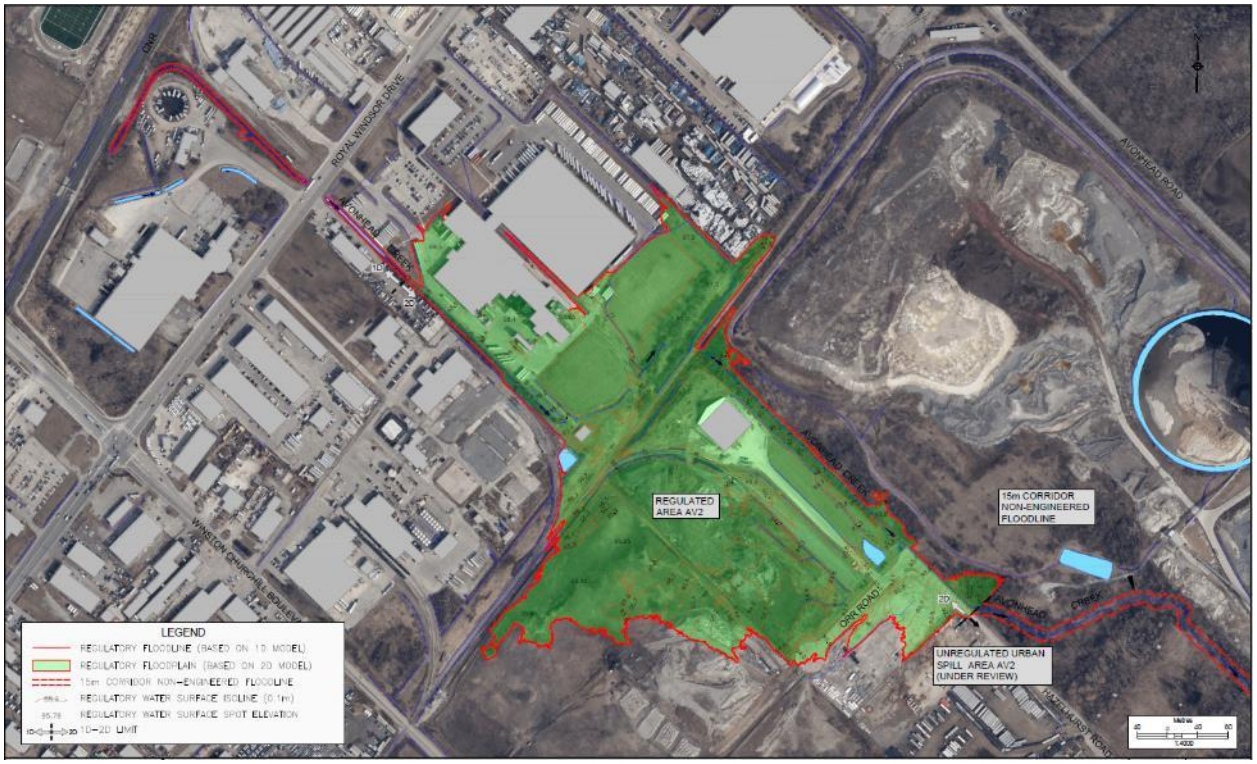


**Figure 2-16 Regulatory Floodplain Based on CVC 2D Modelling**




### 2.6.3 Water Balance

A desktop water budget analysis was completed by Palmer Environmental Consulting Group Inc. for the Southdown study area for the existing conditions. The analysis was based on the Thornthwaite and Mather monthly water balance model and the water holding capacity (WHC) of the soils at the site. The soils are mostly silty clay soils and glaciolacustrine sandy soils and the WHC have been assumed as 250 mm for silty clay soils and 150 mm for the glaciolacustrine sandy soils. The calculated actual evapotranspiration ET (or AET) is between approximately 493 mm/year and 499 mm/year which is consistent with the average ET calculated over the entire Credit Valley Watershed. Actual evapotranspiration is calculated based on a potential ET (or PET) and soil-moisture storage withdrawal. Monthly PET is estimated using monthly temperature data and is defined as a water loss from a homogeneous vegetation-covered area that never lacks water (Thornthwaite, 1948; Mather, 1978). The calculated PET for the study area is 628 mm/year. There is a total soil moisture deficit of between about 128 – 134 mm/year. The estimated water surplus for the total site area is between approximately 287 - 293 mm/year. This translates to approximately 623,025 $m^3$/year of infiltration and approximately 760,026 $m^3$/year of runoff across the site. Results are summarized in **Table 2-13**, and on **Figure 2-17** and **Figure 2-18**.

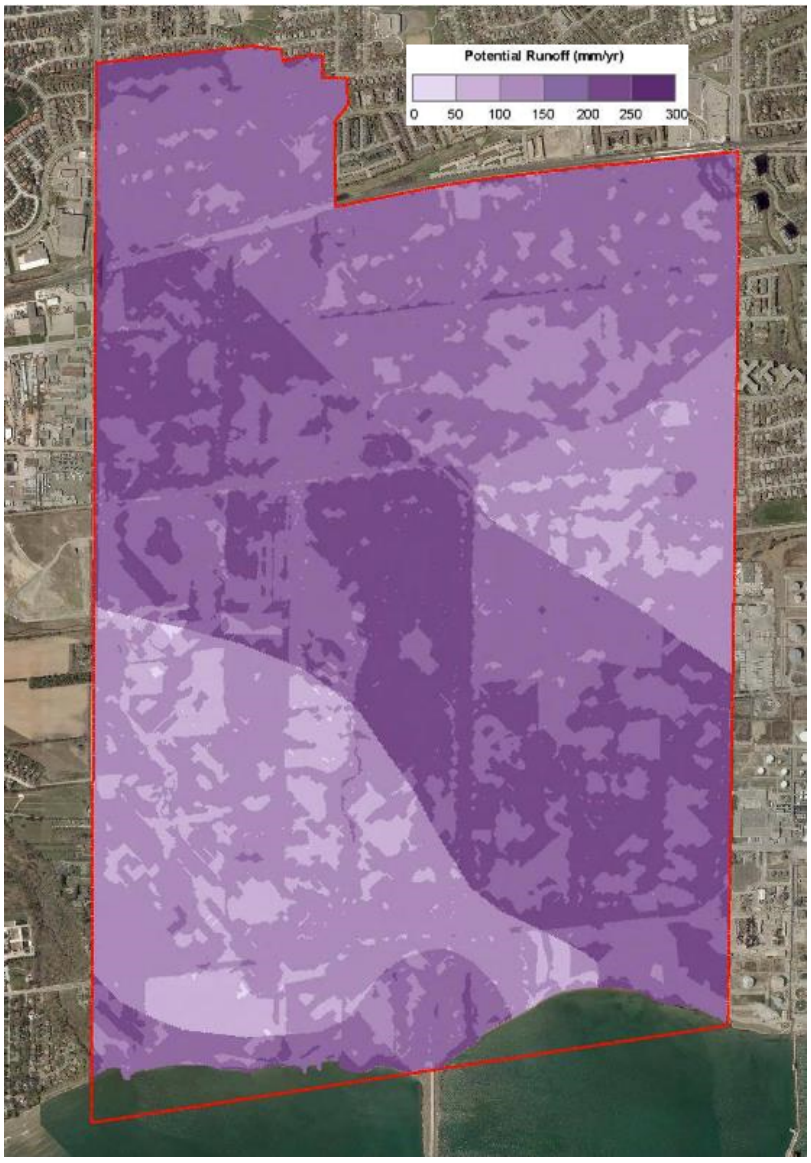
Based on the results of the water balance most of the infiltration is expected in the areas associated with coarse grained glaciolacustrine deposits. It is recommended that Low Impact Development (LID) strategies should be implemented in these regions of the site where infiltration is expected to be high, and which are also outside of the Highly Vulnerable Aquifers (HVA) region as described in **Section 2.1.8** and illustrated on **Figure 2-5**. Consideration should be given to maintaining the pre-to-post water balance of the natural areas present within the site boundary (**Figure 2-17**).

**Table 2-13 Pre-Development Water Balance Analysis Summary**

| Water Budget Component | Annual Depth (mm/yr) | Annual Volume ($m^3$/yr) |
|---|---|---|
| Potential Infiltration | 131 | 623,025 |
| Potential Runoff | 160 | 760,026 |

## Figure 2-17 Potential Infiltration

**Figure 2-18 Potential Runoff**




### 2.6.4 Urban Drainage and Stormwater Management

#### 2.6.4.1 Hydrologic and Hydraulic Modelling

The urban minor and major drainage systems within the Southdown study area were modeled using the PCSWMM model.

The minor system conveys the most frequent flood flows and is comprised of both storm sewers and road side ditches. Most of the design information for the minor system was provided by the City along with the associated plan and profile drawings. For sewers along Winston Churchill Boulevard, a Region of Peel road, the

storm sewer information was provided by the Region. The storm sewers within this study area were constructed between 1955 and 1997.

The major system conveys flows in excess of the minor system and is comprised of the municipal road rights-of-way. Sizing of the major system was estimated based on topographic information as well as information from the City's plan and profile design drawings.

City of Mississauga design standards require that the minor system be designed to accommodate a 10-year storm for sewersheds of less than 100 hectares. For trunk sewers with a sewershed of 100 hectares or greater, designs should accommodate a 25-year storm. For the major system, the City's standards require that the 100-year storm be contained within the road rights-of-way or municipal easements.

Storm sewershed catchments were delineated based on topographic information, property boundaries, and best engineering judgement to set up the PCSWMM model. The subject site was discretized into 86 sub-catchment areas as illustrated on **Figure 2-19**.

**Southdown Road Sewershed:** The sewers along Southdown Road were originally constructed around 1966 and then later around 1997, with some sections of the road having storm sewers constructed parallel to the older sewer. This trunk sewer system outlets directly to Lake Ontario.

**Sheridan Creek/ Royal Winsor Drive Sewershed:** Drainage along the eastern portion of Royal Windsor Drive is conveyed via a trunk sewer to Sheridan Creek.

**Lakeside Creek Sewershed:** The storm sewer system along the northern section of Avonhead Road is directed easterly to an allowance for a future Orr Road extension, and then southerly along an easement south of the Orr Road allowance. The storm sewer then continues southerly beneath the Clarkson Wastewater Treatment Plant (WWTP) and connects to a 1500mm storm sewer that outfalls to the open section of Lakeside Creek via the culvert under Lakeshore Road. Flow then continues via Lakeside Creek through the Lakeside Park woodlot to Lake Ontario. The runoff from the western portion of the Wastewater Treatment Plant is captured locally and is conveyed to Lake Ontario through an old WWTP 1800mm diameter outfall pipe.

**Avonhead Creek Sewershed:** The storm sewer systems in the residential headwaters area and the industrial/commercial lands along the western end of Royal Windsor Drive drain to the headwaters of Avonhead Creek. As noted in **Section 2.6.1**, flood flows in Avonhead Creek are then captured and diverted to the southern reach of Clearview Creek via the Hazelhurst Road trunk sewer. The final reach of Avonhead Creek is also piped under private property south of Lakeshore Road to Lake Ontario

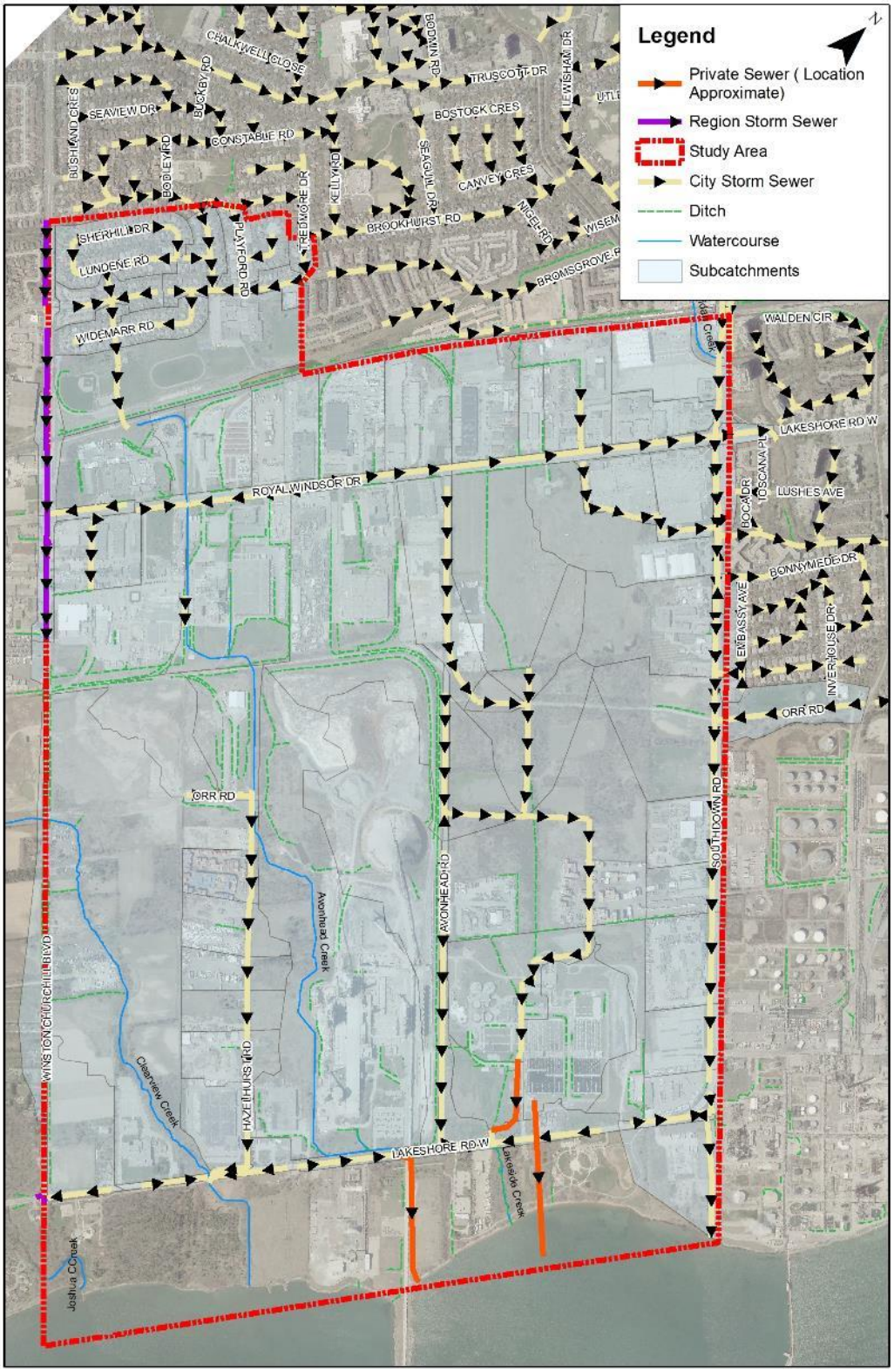
**Clearview Creek Sewershed:** The Region of Peel trunk storm sewer along Winston Churchill Road discharges to Clearview Creek along the western limit of the Southdown study area. The trunk sewer from Hazelhurst Road which conveys diverted flood flows from Avonhead Creek also discharges to Clearview Creek at Lakeshore Road.

**Joshua Creek Sewershed:** Drainage along the western limit of Lakeshore Road West is conveyed via storm sewer to Joshua Creek.

#### 2.6.4.2 Stormwater Management Facilities

There are no known stormwater management facilities in the study area that would provide quality and/or quantity treatment of storm runoff. It is possible that some of the more recent developments in the study area could have on-site peak flow controls (in the form of storage and attenuation on building rooftops and parking areas) and on-site water quality treatment (in the form of oil-grit separators). However, no information is available from either the City or MECP on if or where such on-site stormwater management controls have been implemented within the study area.

## Figure 2-19 Minor System and Sub-Catchments



#### 2.6.4.3 Model Set-up

The PCSWMM model was set up as a 1D model using dual drainage. The dual drainage method mimics the major system and minor system. The minor system is modeled as a closed conduit while the major system is model as an irregular open channel conduit.

To define the minor system, storm sewer information including pipe sizes, catchbasin locations, manhole locations, and invert elevations, were imported from GIS datasets provided by the City and Region. Storm sewers smaller than 600 mm were generally excluded from the model to avoid unnecessary complexity.

To define the major system, the irregular open channel conduit is assigned a transect which is defined by typical City road cross sections and measured right of way widths. The major system is connected to the minor system by outlets that were assigned a rating curve that mimics the inlet capacity of the catch basins along the ROW. When a storm sewer system overflows, the excess water is either conveyed to the next available stormwater inlet or open channel, or impounded in surface depressions.

There is only one stormwater management pond within the study area and it is located at the northeast corner of Orr Road and Hazelhurst Road. The pond is constructed for the gypsum transfer station at 658 Hazelhurst Road. The pond controls the post development 10 year and the 100 year storm flows to the pre development level. This pond has been modelled using a storage node coded with the area and depth of the pond, and an outlet conduit coded with the outflow curve.

Land use through the study area is predominantly industrial and undeveloped land with a small portion north of the CN tracks with residential use. The hydrologic characteristics of the subcatchment areas such as percent impervious, flow path length and slope, initial abstraction and infiltration capacity were derived based on land use, aerial photography, soils mapping and background documents. More information on the initial model parameters can be found in **Appendix E**.

#### 2.6.4.4 Design Storms

The watershed hydrologic modeling (**Section 2.6.1**) has been completed using a 24-hour Chicago storm event distribution with 5-minute time steps, as defined by City of Mississauga standard intensity duration frequency curves. For consistency, these same storm events were also used in the PCSWMM model.

#### 2.6.4.5 Model Output

Based on the modelling results, three figures were generated to illustrate the capacity of the existing storm drainage network (**Figure 2-20, Figure 2-21,** and **Figure 2-22**) and its ability to meet current municipal standards.

**Figure 2-20** illustrates the storm sewer capacity based on the 10-year storm event. **Figure 2-21** illustrates the trunk capacity of sewers servicing drainage areas greater than 100 ha during the 25 year storm event. Results from the model are colour coded as follows:

- storm sewers with manholes colour coded as green have sufficient capacity to convey the design storm. The pipes are free-flowing with a hydraulic grade line below the pipe obvert.
- storm sewers with manholes colour coded as yellow are surcharged, with the hydraulic grade line above the pipe obvert, but below the road surface.
- storm sewers with manholes colour coded as red are greatly surcharged, with the hydraulic grade line above the road surface at maintenance hole locations. Flooding can be expected along these sections of the municipal right-of-way due to the insufficient capacity in the sewers

As shown in **Figure 2-20**, several segments of the existing storm sewer system do not have sufficient capacity to convey the 10-year design storm, including:

- short segments of the Southdown Road sewer;
- short segments of the Royal Windsor Drive sewer;
- large segments of the Lakeside Creek storm sewer, including the section upstream and under the Clarkson WWTP, as well as the storm sewer on Avonhead Road;
- short segments of the Lakeshore Road storm sewer to Avonhead Creek;
- the majority of the storm sewer within the residential subdivision in the headwaters of Avonhead Creek (Bromsgrove Road, Widemarr Road, Cramer Street);
- segments of the Winston Churchill Boulevard storm sewer to Clearview Creek.

As shown in **Figure 2-21**, there are two main trunk sewer segments with drainage areas greater than 100ha. These are located along Hazelhurst Road and Southdown Road. The storms sewers along these segments are generally undersized and do not have sufficient capacity to convey the 25-year design event for trunk sewers

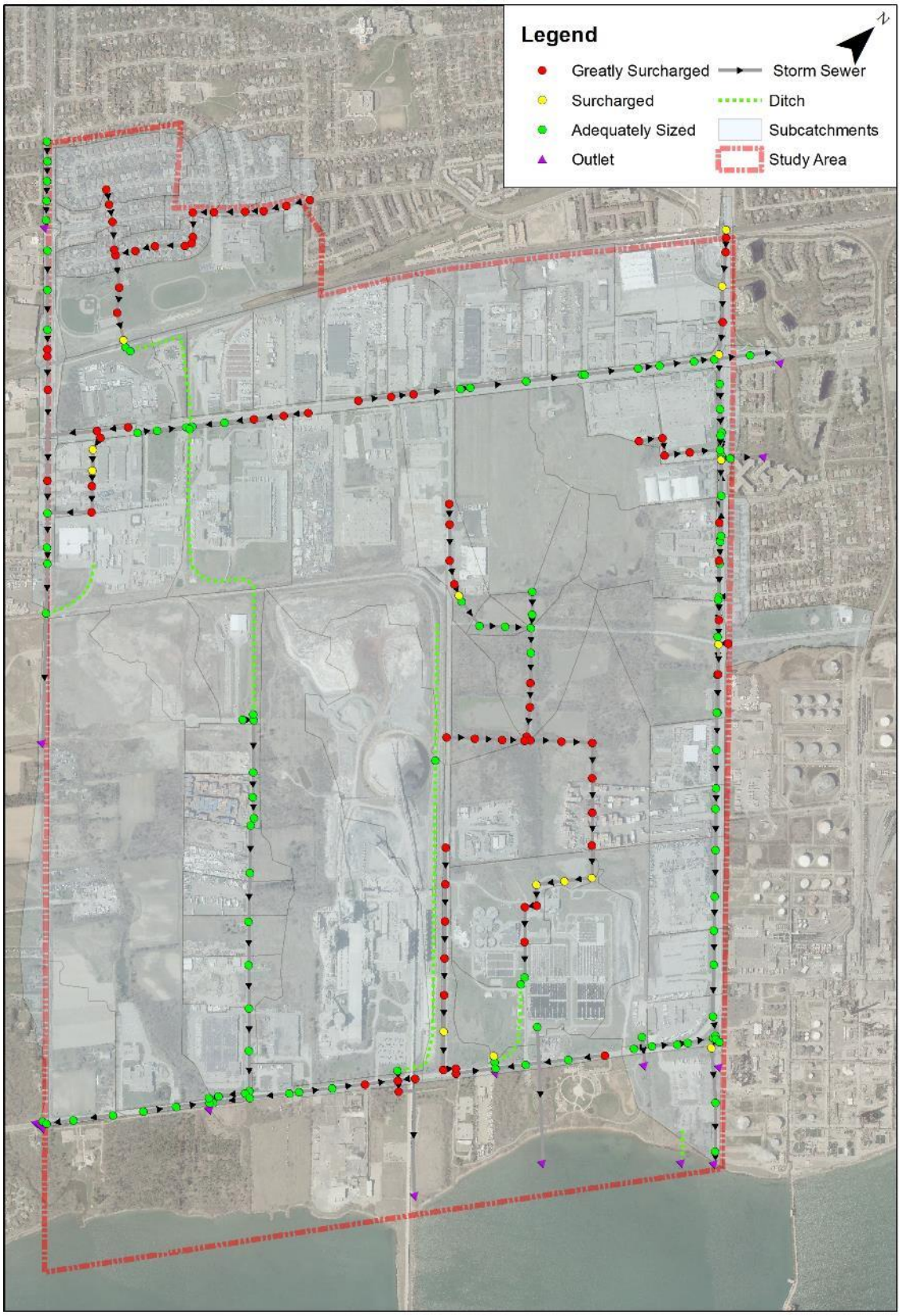
**Figure 2-22** illustrates the major system conveyance capacity of the municipal rights-of-way during the 100 year storm event. Results from the model are colour coded as follows:

- road segments colour coded as green represent roadways where the water is contained within the road ROW; and
- road segments colour coded as red present roadways where the water is not contained within the roadways and may spill onto surrounding lands.

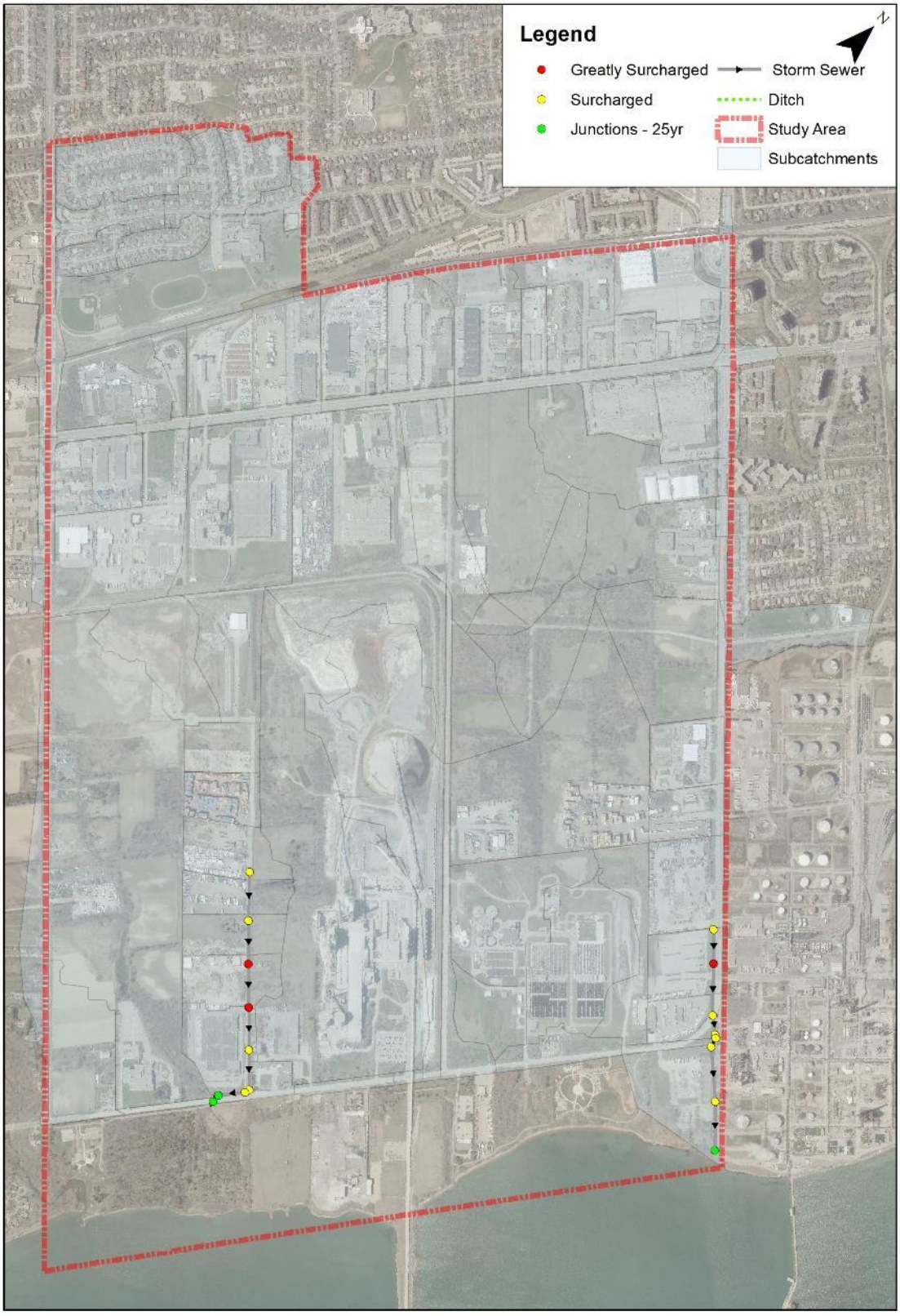
It is typically expected that during the 100-year storm event, the roadways will be flooded since the storm sewers are often designed to the City's design storm event of 10 year. Thus, the water is reliant on the right-of-way to provide an overland flow route for flows greater than the 10-year storm to a safe outlet.

As shown in **Figure 2-22**, the major system along most roadways within the study area has sufficient capacity to convey the 100-year design storm. Only Widemarr Road in the residential subdivision to the northwest does not have sufficient capacity to convey the overland flow during a 100-year storm event.

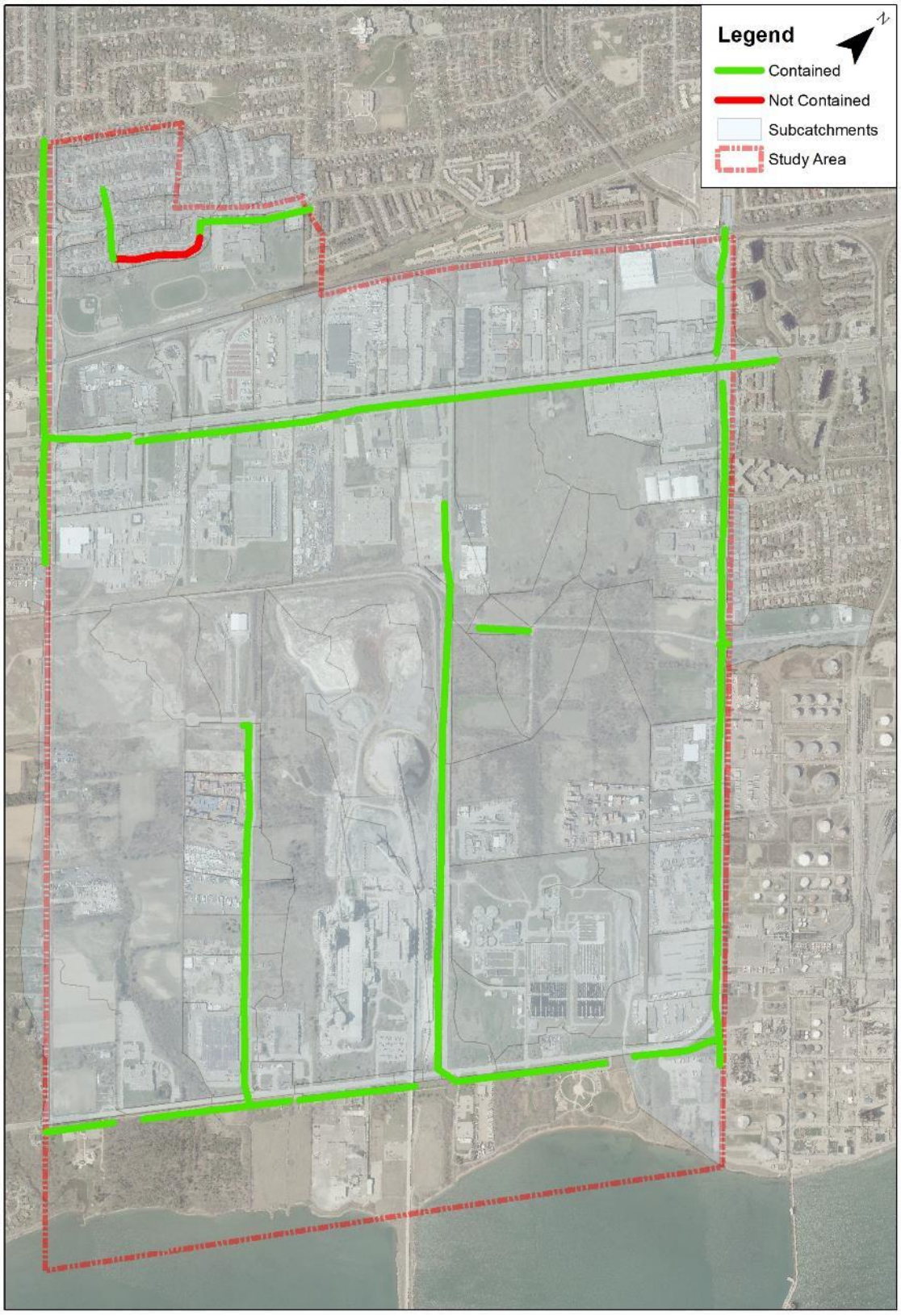
## Figure 2-20 Storm Sewer Capacity - 10 Year Storm



## Figure 2-21 Storm Sewer Capacity - 25 Year Storm



## Figure 2-22 Safe Conveyance During the 100 Year Storm



### 2.6.5 Utilities

All relevant utility owners that could potentially have existing or planned infrastructure in the study area were circulated information on the project starting in May 2018. Information on existing and planned utilities was obtained from the following organizations:

- Rogers Communications
- Bell Canada
- Enbridge
- Zayo
- Hydro One
- Telus
- Cogeco Peer1

Refer to **Appendix G** for correspondence from utilities and locations of known utilities through the study area.

Responses were received from most potential utility owners. Utilities present in the study area include Bell, Enbridge, Hydro One and Rogers. The City and Region also own storm sewers, sanitary sewers, sanitary forcemains and watermains throughout the study area.

Of particular note is an Enbridge pipeline generally aligned along the north side of the rail corridor south of Royal Windsor Drive and eventually crosses Southdown Road south of Orr Road. An appendix to the City of Mississuaga's former official plan also indicates a pipeline belonging to Liquid Carbonic Inc. adjacent Southdown Road south of Orr Road.

## 2.7 Summary of Existing Conditions & Opportunities and Constraints

Through the preceding report sections, the existing natural feature areas and natural hazards within the Southdown District study area were characterized by various disciplines in order to establish an understanding of baseline conditions for the assessment of potential impacts from future urban development, define development constraints, and to identify potential future environmental restoration and enhancement opportunities.

### 2.7.1 Constraints

A summary of the key environmental constraints to future development and re-development are illustrated in **Figure 2-23**. The constraints mapping includes the following:

- Meander belt limits representing the long-term erosion hazards associated with the study area streams;
- Flood hazard limits based on recently updated CVC modelling and topographic information;
- Top-of-bank limits delineating the physical valley feature associated with Joshua Creek;
- Designated natural areas
- Wetlands outside of designated natural areas, including those identified via development applications

When defining the limits to future urban development, a standard buffer or setback is also typically applied to the aggregate land area represented by the features outlined above. Note that constraints illustrated in this report are approximate. Buffers to the limit of development are typically 30 m for Provincially Significant Wetlands, 15 m for other wetlands, up to 30 m from the bankfull channel limit of defined watercourses, 10 m from woodlands and 10 m from flooding and erosion hazard limits and valley corridor top-of-bank. Feature limits would typically be staked in the field and associated buffers would be established with the City, Region, and Conservation Authority during the land use planning approval process.

For comparative purposes, the current CVC regulation limits are also illustrated on **Figure 2-23**. It should be noted that these current CVC limits do not yet reflect the recently-updated hydrologic/hydraulic modelling and the corresponding floodplain limit updates, and it is further noted that the text of CVC's Regulation 160/06 establishes the regulated features and limits, and the mapping is provided as a general guide. For the purposes of assessing impacts from future urban development and subsequent modelling carried out for this study, the updated constraints mapping from this study is assumed to apply.

### 2.7.2 Opportunities

Many of the watercourses within the Southdown area have been highly impacted by past urbanization and have been confined, realigned, or hardened by concrete channels. Thus, there are several opportunities to enhance the existing systems through realignment and naturalization.

**Figure 2-23** illustrates the aggregate development constraints and potential stormwater improvement opportunities and environmental restoration/enhancement opportunities, including the following:

#### 2.7.2.1 Clearview Creek

- **Re-alignment downstream of Winston Churchill Blvd**. The 2000 Southdown Master Drainage Plan recommended the re-alignment of this reach which currently bi-sects several properties. Re-alignment further to the east to better follow the property boundaries would offer several benefits:
  - Opportunity to provide a wider natural channel with greater conveyance capacity
  - Reduced flood hazards
  - Removal of several small private access crossings
  - Improved terrestrial linkage with the natural forested feature to the east
  - More efficient use of future development lands
- **Removal of dam and boulder cascade**. The existing dam consists of a 10m wide structure with stop logs. Significant sedimentation was observed within the pond and upstream backwatered areas. Decommissioning of the dam was previously identified in the 2000 Southdown MDP to restore fish passage, mitigate temperature increases, and restore a more natural flow and sediment transport regime.
- **Naturalization of the concrete channel downstream of Lakeshore Road West**. CVC is currently investigating restoration options through its LOISS initiatives that would improve fish passage from Lake Ontario along the eastern edge of the City's future Fusion Park site. A larger improved natural channel may also represent an alternative outlet for Avonhead Creek.
- **Stormwater quality pond near Lakeshore Road**. This conceptual stormwater retrofit site was proposed in the 2000 Southdown Master Drainage Plan and the City's 2012 Stormwater Quality Control Strategy Update study. The proposed retrofit site is also recognized in plans for the future Fusion Park site as outlined in the City's Waterfront Parks Strategy.

#### 2.7.2.2 Avonhead Creek

- **Culvert improvements at Lakeshore Road**. Hydraulic modelling identified this structure as undersized.
- **Culvert and channel improvements at the railway spur**. Hydraulic modelling indicates that the creek channel and a series of existing culverts at this location are undersized, resulting in the spill of floodwaters onto adjacent properties.
- **Stream restoration from Orr Road to Lakeshore Road**. Long-term restoration of this heavily channelized reach through the CRH concrete plant may be considered as part of any future re-development plans. A naturalized channel

would be sized to reduce the extent of the floodplain, accommodate natural erosion processes, eliminate spills and potentially increase developable areas.

- **Daylighting of the piped section downstream of Lakeshore Road West**. Options for a natural channel at this location were investigated by CVC as part of its LOISS study initiatives. Replacement of the pipe with an open channel and would remove a barrier to fish passage from Lake Ontario.
- **Diversion to Clearview Creek outlet**. As an alternative to "daylighting" the piped reach and replacement of the undersized Lakeshore Road culvert, diversion of Avonhead Creek to a restored lower reach of Clearview Creek through the future Fusion Park may be considered.
- **Stormwater quality pond near Lakeshore Road**. This conceptual stormwater retrofit site was proposed in the 2000 Southdown Master Drainage Plan and the City's 2012 Stormwater Quality Control Strategy Update study.

#### 2.7.2.3 Lakeside Creek

- **Potential stormwater by-pass of the Clarkson WWTP**. The existing storm sewer system through the WWTP is undersized. A by-pass, in the form of an open channel or new trunk storm sewer would reduce the risk of flooding at the WWTP which is identified as an "Event Based Area" of risk in the Credit Valley Source Protection Area. If the by-pass were to take the form of an open channel, it would also represent a terrestrial linkage opportunity between the natural forested feature areas to the north and south
- **Stormwater quality pond near Lakeshore Road**. This conceptual stormwater retrofit site was proposed in the 2000 Southdown Master Drainage Plan and the City's 2012 Stormwater Quality Control Strategy Update study.

#### 2.7.2.4 Sheridan Creek

- **Low Impact Development (LID) Retrofits**. CVC is undertaking a pilot project to assess the feasibility of implementing a communal set of LID facilities within the existing industrial/commercial lands fronting onto Royal Windsor Drive. If feasible, the retrofits could provide water quality improvements to Sheridan Creek and its outlet to Lake Ontario at Rattray Marsh.

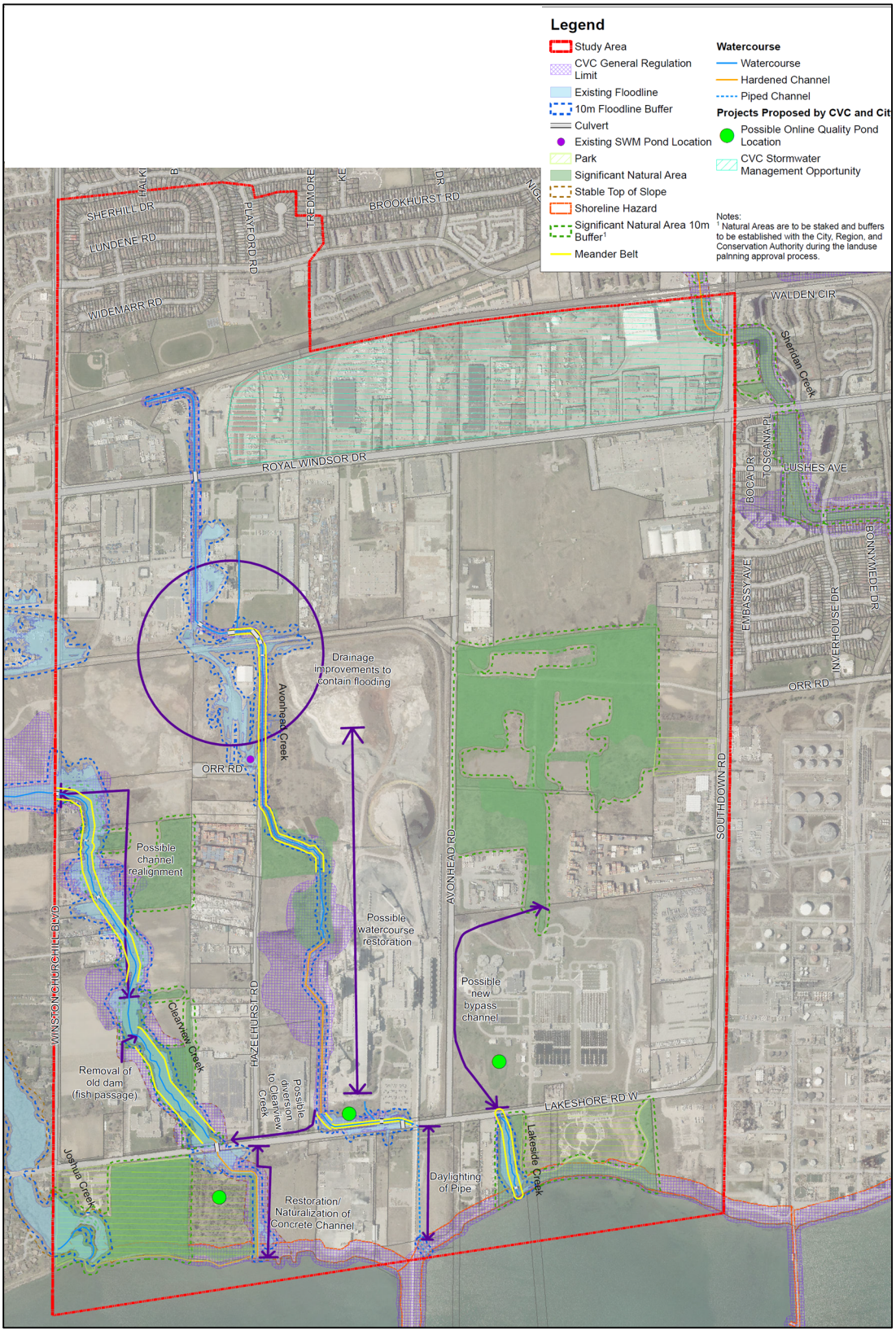
#### 2.7.2.5 Joshua Creek

- **Terrestrial linkage**. The future Fusion Park site represents an opportunity to preserve and strengthen the terrestrial linkage between the outlet of Joshua Creek and Clearview Creek

In addition to the above, future development and re-development of large parcels of land within the study area will require the implementation of stormwater management facilities to control runoff. Re-development activities, in particular, represent opportunities reduce runoff volumes and to improve runoff quality and quantity to the area streams, where there are currently no stormwater controls.

Further, multiple segments of the existing storm sewer system throughout the study area were identified as undersized (**Figure 2-20**) Future road improvements in these areas represent opportunities to upgrade the drainage systems to meet the City's minor and major system capacity requirements.

## Figure 2-23 Opportunities and Constraints Mapping



# 3 Description of Alternative Solutions

As consistent with the EA process, this section reviews alternative solutions to address the problems and opportunities identified in the preceding sections.

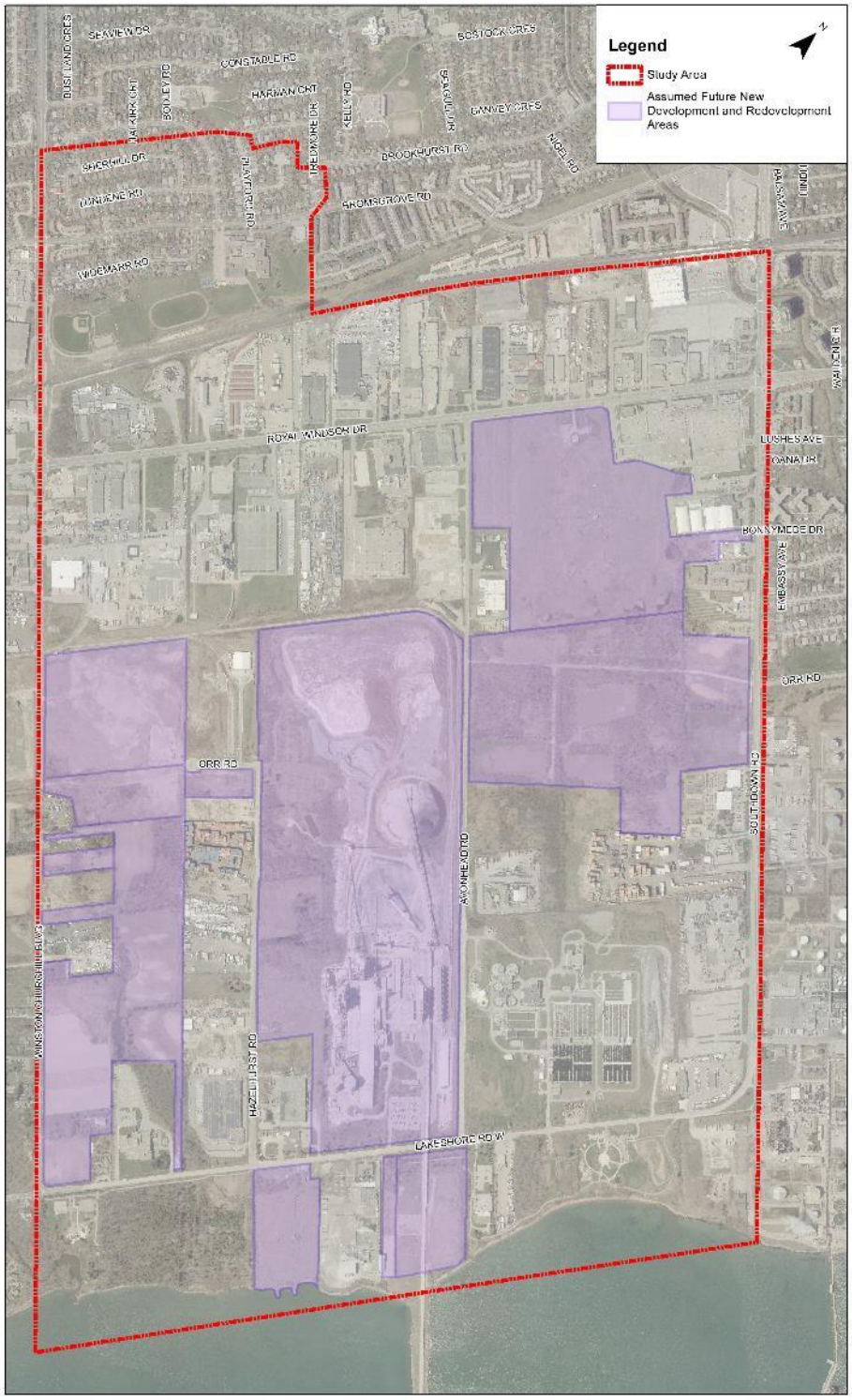
## 3.1 Do Nothing

The ‘Do Nothing’ alternative is always considered in the environmental assessment process. There may be situations where all feasible alternatives will cause unacceptable impacts to the natural, social and/or cultural environments, or are prohibitively expensive. In such instances, the Do Nothing alternative may be preferred.

For the purposes of this Master Plan for the Southdown District, the Do Nothing alternative represents a hypothetical, worst case scenario to understand how sensitive the drainage systems are with respect to development and stormwater management in the study area. The Do Nothing alternative assumes that the remaining greenfield and under-developed properties in the study area will be developed with no on-site stormwater management controls. Uncontrolled flows from the sites would be delivered to the receiving storm sewers, overland flow routes and watercourses, with no remedial works to prevent flooding and erosion impacts.

**Figure 3-1** illustrates the lands assumed to be developed or redeveloped in the future in the development and analysis of this alternative.

## Figure 3-1 Assumed Future New Development and Redevelopment Areas



## 3.2 Current Standard Stormwater and Environmental Management Approach

Under current regulations, new developments must adhere to the current stormwater management standards as regulated by Credit Valley Conservation (CVC), Conservation Halton (CH), City of Mississauga and Ministry of Environment, Conservation and Parks (MECP). SWM criteria for new development includes water quality, water quantity, and erosion control as well as water balance.

Traditionally, commercial and industrial development proceeds on a property-by-property approach, with all of the required controls achieved through on-site stormwater management systems. Techniques to provide the required stormwater management requirements may include but are not limited to stormwater management ponds, underground storage through oversized pipes or other underground storage units, oil grit separators, and low impact development (LID) facilities. Many of the listed techniques are suggested to be used in conjunction with one other to provide a treatment train approach using source, conveyance, and end-of-pipe facility to provide the most effective SWM strategy.

For this approach, traditional stormwater management wet ponds would typically only be implanted on larger development sites where the total drainage area to an on-site SWM facility is larger than 5 ha, which is considered the minimum drainage area needed to sustain a wet pond.

The current stormwater management criteria applicable to new development in the Southdown District are as follows:

- **Erosion Control**: 5 mm rainfall retention for drainage areas less than 5ha and 25mm – 48hr detention for drainage areas greater than 5ha
- **Water Quality Control**: Enhanced Level of control (80% TSS removal)
- **Water Quantity Control – Discharge to Watercourses**: Control post development flows to pre development levels
- **Water Quantity Control – Discharge to Municipal Storm Sewers**: Control post development peak flows for up to the 100 year storm to the 2 year pre-development flow. This criterion was established through the previous Southdown District Master Drainage Plan (TSH, 2000).
- **Water Balance**: Maintain pre-development groundwater recharge to the extent feasible (this is usually considered satisfied by the retention of the first 5 mm of runoff)

Beyond stormwater management, new development applications are required to protect and avoid impacts to natural heritage features and avoid areas at risk from

flooding and erosion. Within the Southdown District, this is generally satisfied by setting the limit of development at least 10 m from the greatest of the vegetation dripline, regulatory flood limit or erosion hazard.

In developing and assessing the impacts of this alternative, the assumptions regarding future development areas were maintained from **Section 3.1** and **Figure 3-1**. Each development area was assumed to incorporate on-site controls to achieve the above standard stormwater management criteria, and to be appropriately set back from the natural heritage and hazard limits. Details of the required on-site storage volumes needed to achieve the criteria can be found in **Appendix F.**

While this alternative is based on future developments adhering to all relevant stormwater management and environmental management criteria, it does not involve any works beyond the limits of the properties undergoing development or redevelopment. There would be no improvements to the watercourses currently impacted by erosion and barriers to fish passage, there would be no upgrades to the storm sewers and overland flow routes identified as potentially undersized, and no enhancements to the natural heritage systems in the study area.

## 3.3 Centralized SWM Facilities for Future Development

The previous alternative assumed that any new and re-development in the study area would provide individual on-site controls on each developing property. Many of the properties in the study area are less than 5 hectares, which is generally accepted as the minimum drainage area needed for a traditional wet detention SWM pond.

At these smaller sites, the standard stormwater management criteria would be expected to be satisfied through a combination of LID practices to reduce runoff volumes, storage on rooftops, parking lots and in underground storage facilities to reduce peak flow rates, and an oil-grit separator for water quality control, depending on the effectiveness of any LIDs for water quality treatment.

Stormwater management controls could be more effective and efficient if new, centralized stormwater management facilities were constructed that could treat the runoff from multiple new developments. These centralized stormwater management wet detention facilities could provide the required water quality storage, extended detention storage and peak flow attenuation required to achieve current SWM criteria.

A screening of potential development areas identified five potential centralized SWM facilities that could provide the required water quality, extended detention and peak flow control for upstream future development areas. The locations of these SWM

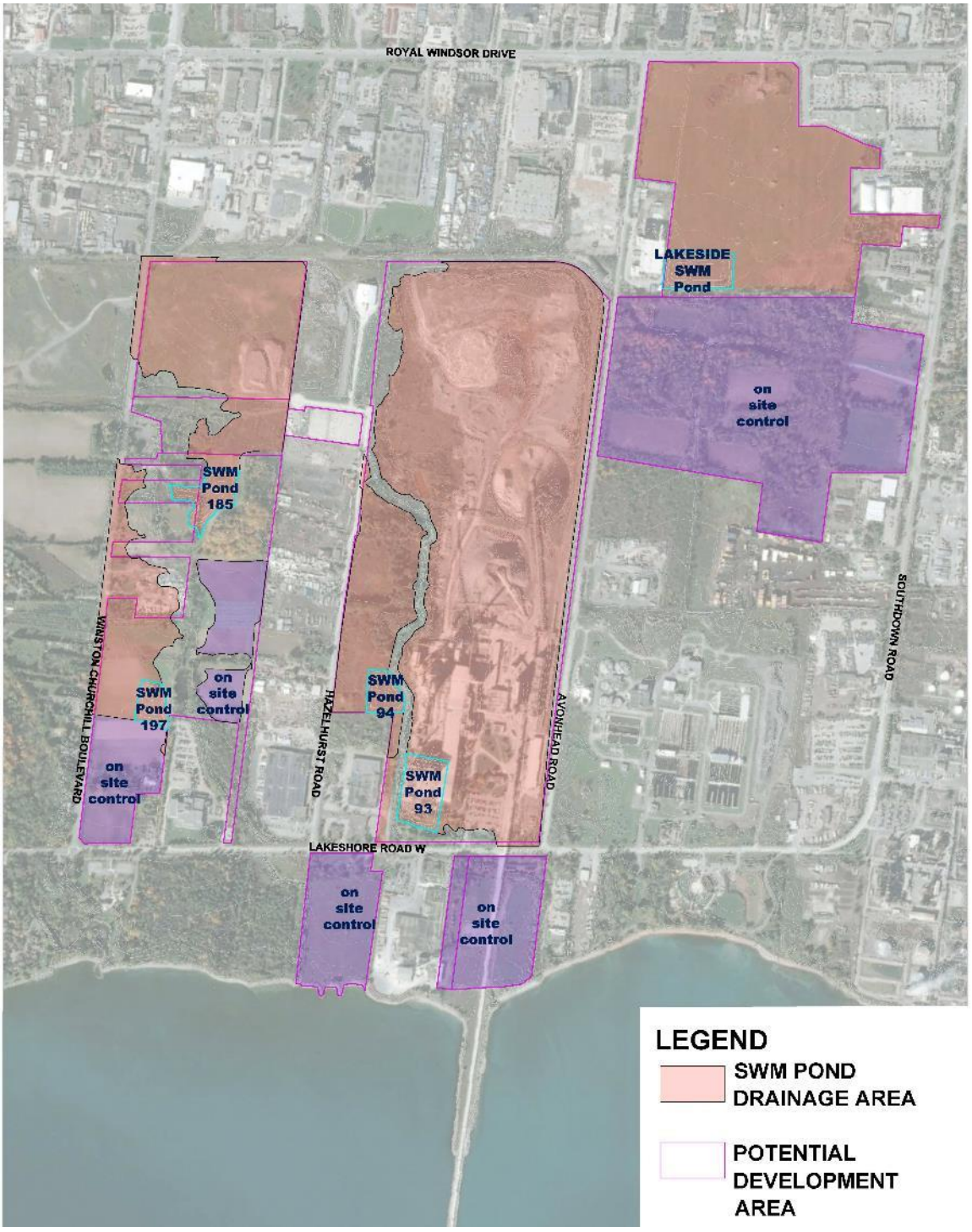
ponds and their contributing drainage areas are illustrated on **Figure 3-2**, and concept designs for each of the facilities are included as **Figure 3-3** through **Figure 3-7**. Additional details for the sizing and design of the facilities is included in **Appendix F.**

**Table 3-1 Centralized SWM Facility Characteristics**

| Pond ID | Contributing Drainage Area (ha) | Permanent Pool Volume ($m^3$) | Active Storage Volume ($m^3$) | Approximate Pond Block Area (ha) |
|---|---|---|---|---|
| Clearview Pond 185 | 20.07 | 3,465 | 11,147 | 1.50 |
| Clearview Pond 197 | 8.84 | 1,384 | 5,062 | 0.77 |
| Avonhead Pond 93 | 69.98 | 11,946 | 20,036 | 1.91 |
| Avonhead Pond 94 | 10.82 | 2,413 | 6,924 | 0.88 |
| Lakeside Pond | 29.09 | 7,604 | 16,418 | 1.65 |

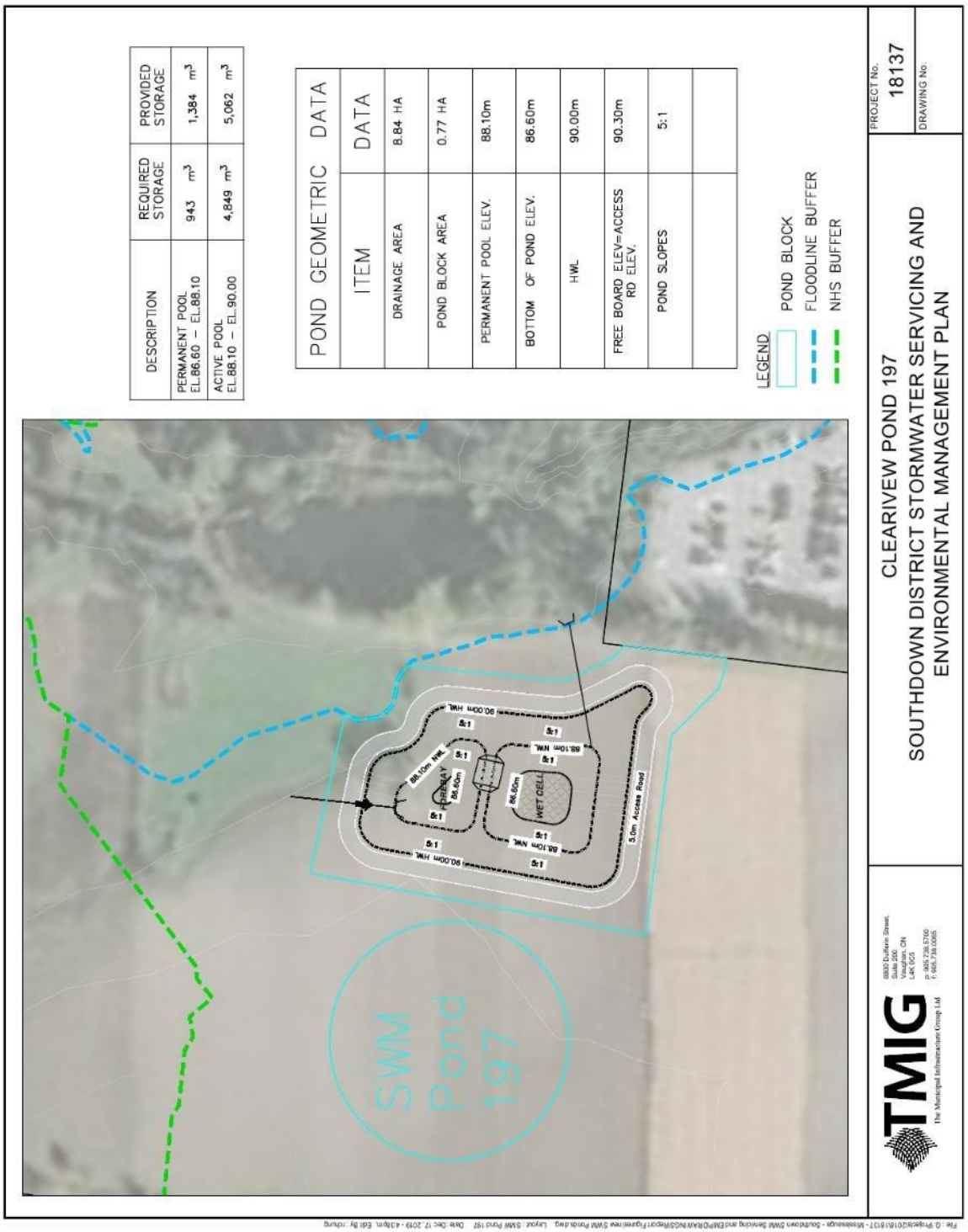
It is recognized that the Avonhead Ponds 93 and 94 would provide treatment for future redevelopment of the existing 80 ha concrete plant property, and the Lakeside Pond would provide treatment for future redevelopment of the 30 ha antenna field property on the south side of Royal Windsor Drive. These facilities would be located on the properties that they would be servicing, and could reasonably be considered on-site controls. However, it is possible that these large properties could redevelop on an incremental basis with independent SWM controls for each phase of development. These facilities have therefore been included in the Centralized SWM Facilities alternative.

**Figure 3-2 Location of New Centralized SWM Facilities**

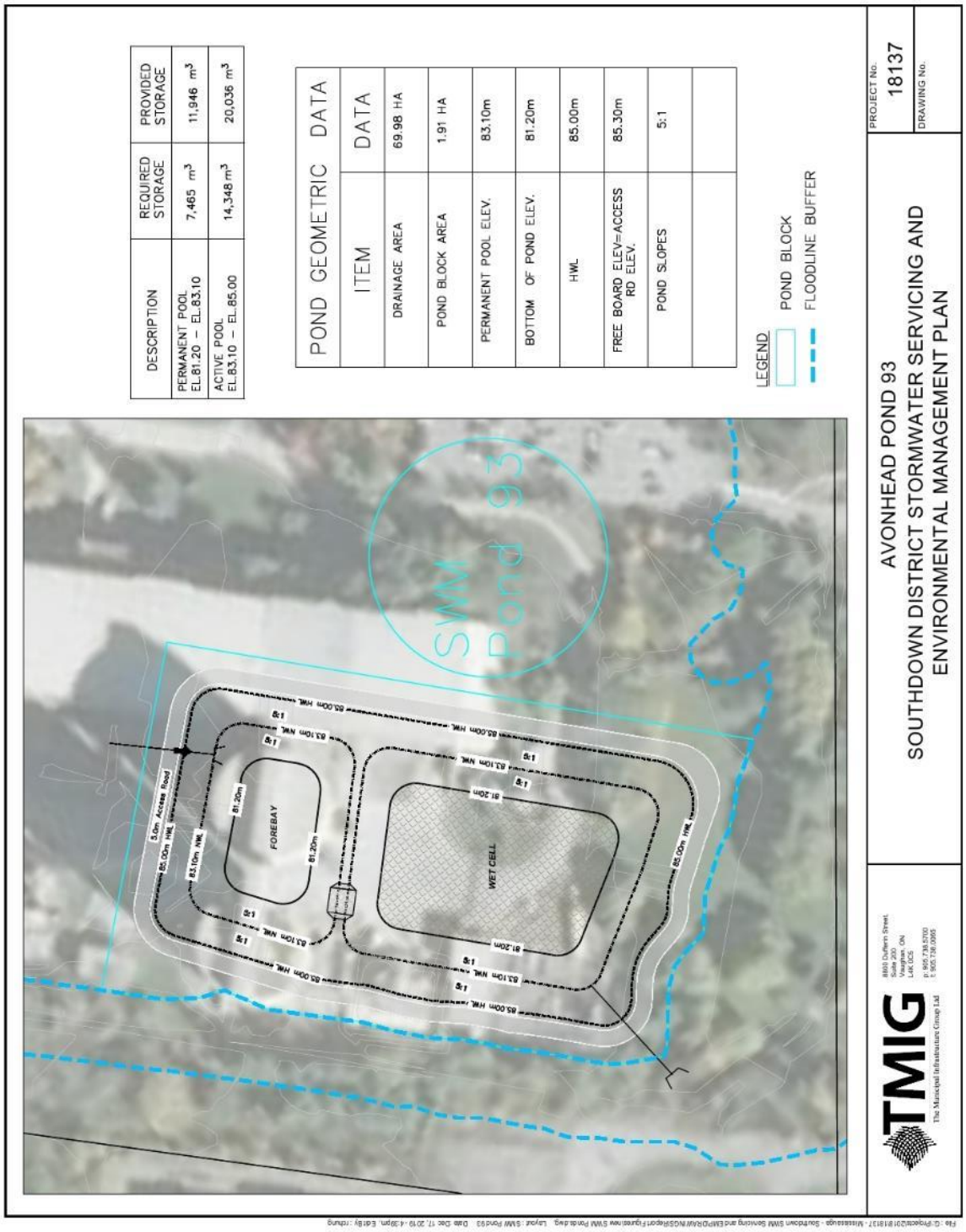


## Figure 3-3 Clearview Pond 185 – Conceptual Design

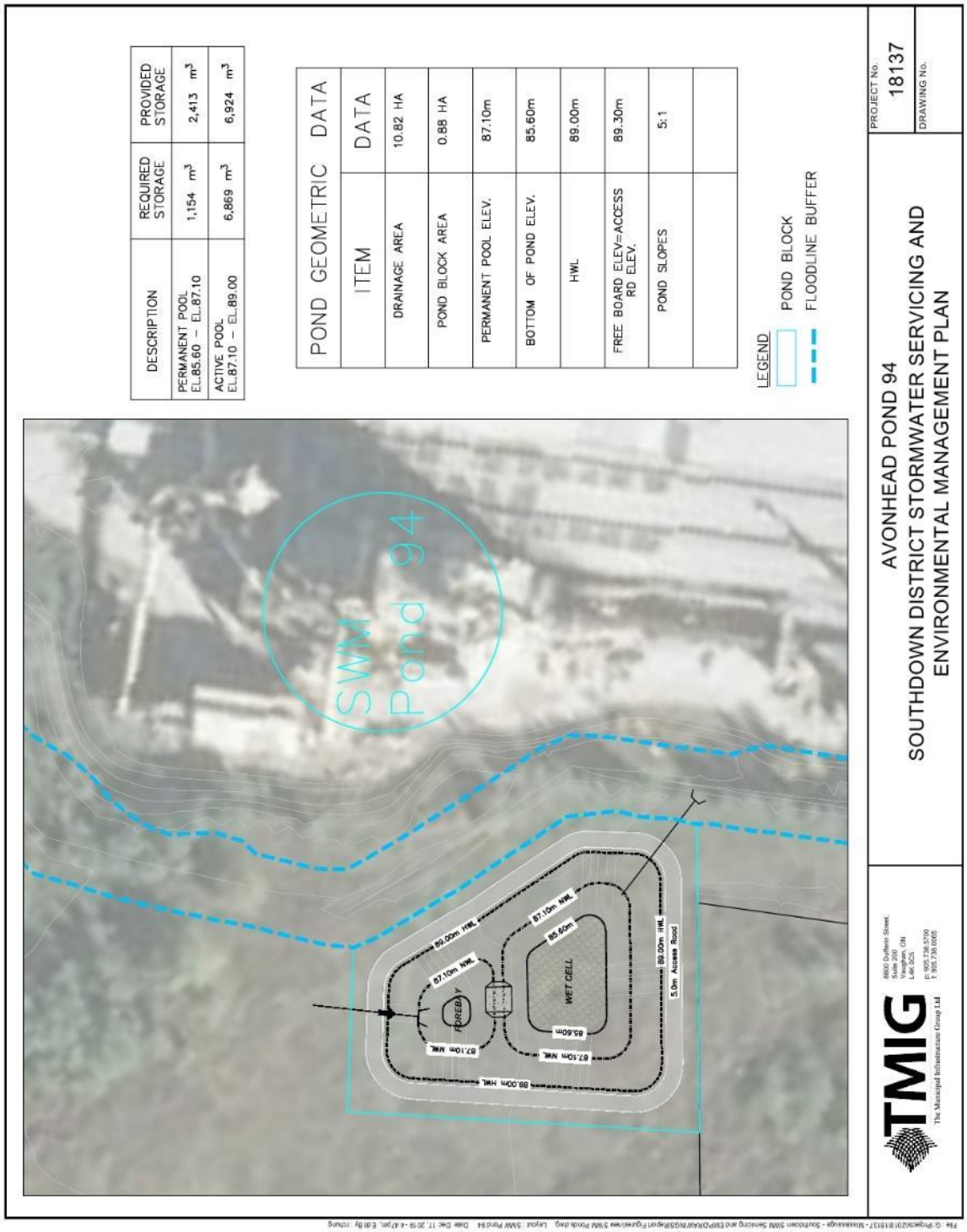
## Figure 3-4 Clearview Pond 197 – Conceptual Design



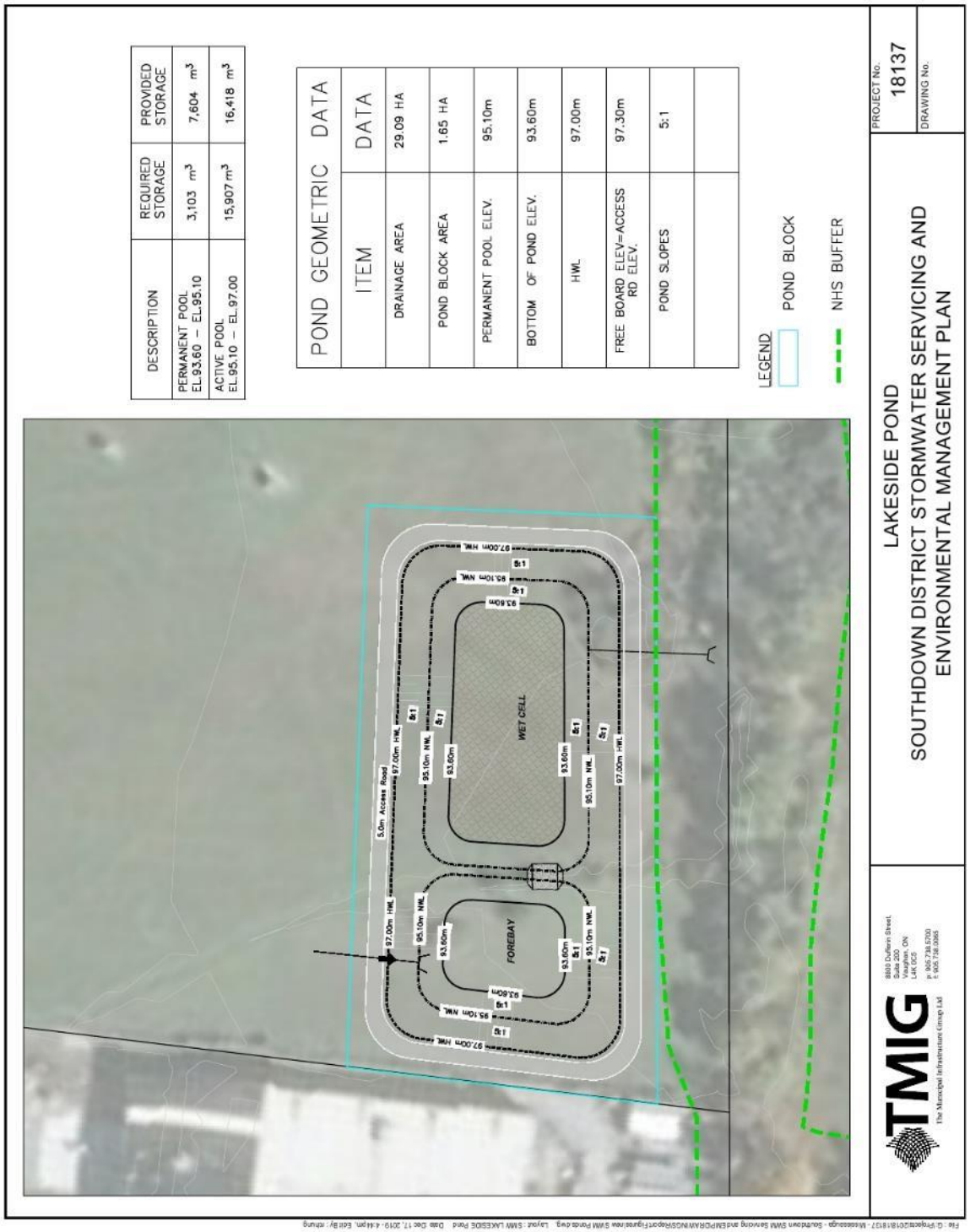
## Figure 3-5 Avonhead Pond 93 – Conceptual Design



## Figure 3-6 Avonhead Pond 94 – Conceptual Design



## Figure 3-7 Lakeside Pond – Conceptual Design



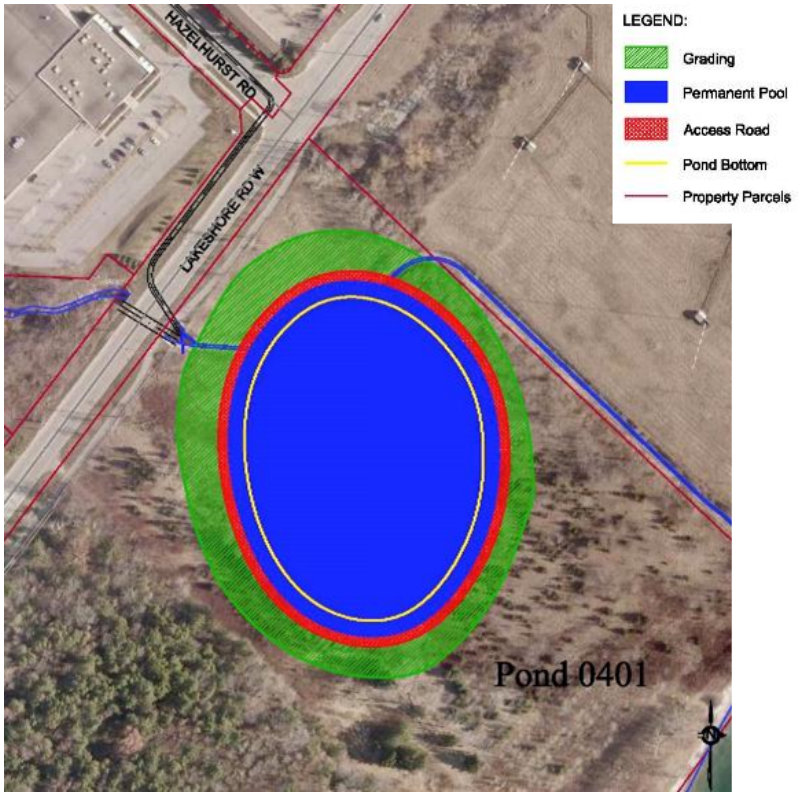
## 3.4 Retrofit SWM Facilities

In addition to centralized SWM ponds for future development and redevelopment, there are also opportunities to construct new SWM facilities to treat the quality and quantity of runoff from existing sites that developed prior to the adoption of modern stormwater management practices.

Opportunities for retrofit SWM facilities in the study area were initially explored in the Mississauga Stormwater Quality Control Strategy (RE Winters & Associates, 1996), and the recommendations from that study were carried forward in the previous Southdown District Master Drainage Plan (TSH, 2000) and in the Mississauga Stormwater Quality Control Strategy Update (MSWQCSU) (Aquafor Beech, 2012). These studies have recommended three new retrofit on-line SWM facilities in the study area, located immediately north or south of Lakeshore Road on Clearview Creek (Pond 401), Avonhead Creek (Pond 402) and Lakeside Creek (Pond 403). Pond 401 is proposed on City property associated with the future Fusion Park, Pond 402 is proposed on the privately owned concrete plant property, and Pond 403 is located on Peel Region property associated with the Clarkson WWTP.

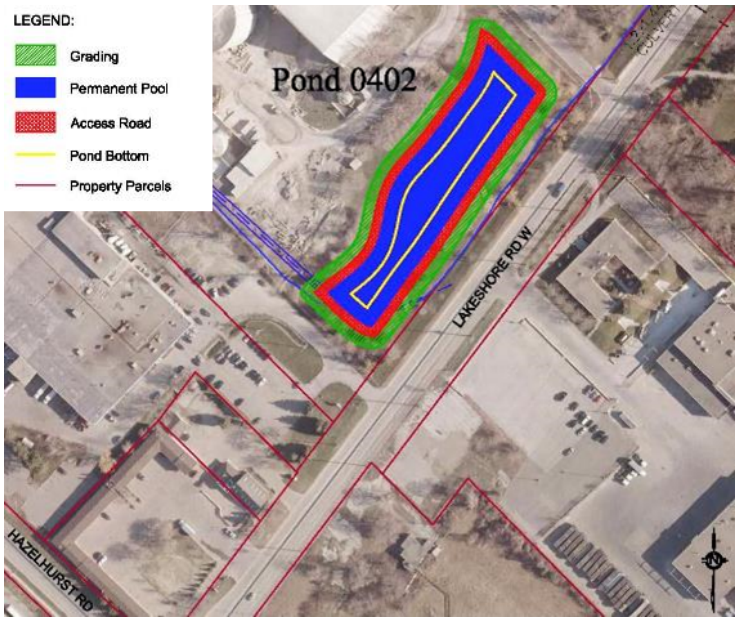
The MSWQCSU included concept designs for the three retrofit SWM facilities in the study area, and these are provided on **Figure 3-8**, **Figure 3-9**, and **Figure 3-10** for Ponds 401,402, and 403 respectively. Based on the permanent pool volumes from the concept designs presented in the MSWCSU, the retrofit facilities could achieve between 67% (Basic) and 78% (Normal) TSS removal. Recall from **Section 3.2** that new development is required to achieve Enhanced water quality protection, or 80% TSS removal. The properties of the retrofit SWM facilities are summarized in **Table 3-2**, and additional information on the retrofit facilities in included in **Appendix F.**

**Figure 3-8 Preliminary Design of Retrofit SWM Facility 401**



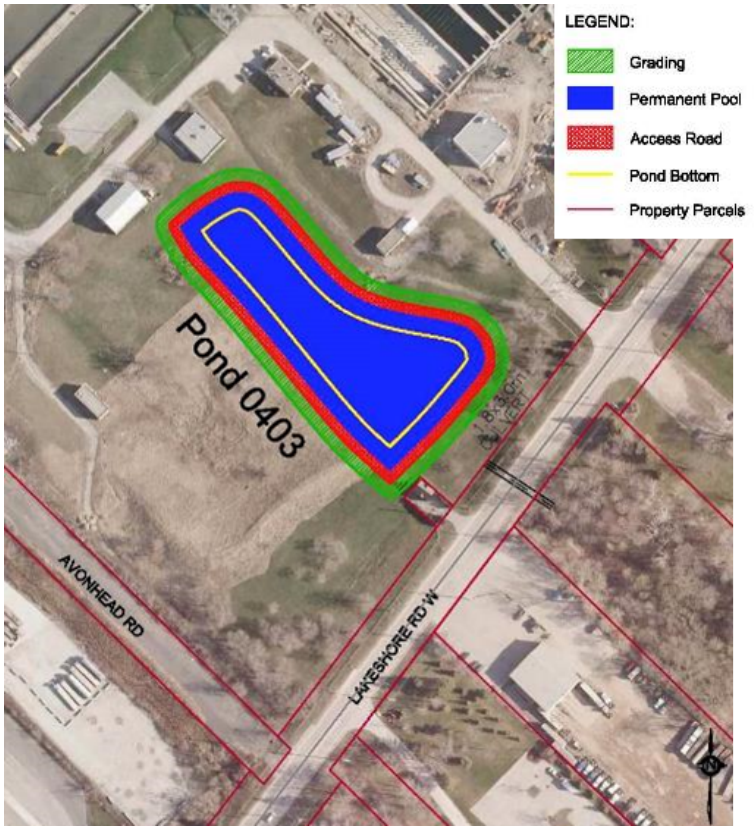

From MSWQCSU (Aquafor Beech, December 2012)

**Figure 3-9 Preliminary Design of Retrofit SWM Facility 402**




From MSWQCSU (Aquafor Beech, December 2012)

**Figure 3-10 Preliminary Design of Retrofit SWM Facility 403**




From MSWQCSU (Aquafor Beech, December 2012)

**Table 3-2 Retrofit SWM Facility Characteristics**

| Pond ID | Upstream Drainage Area (ha) | Permanent Pool Volume ($m^3$) [1] | Predicted TSS Removal Efficiency | Pond Block Area (ha) [2] |
|---|---|---|---|---|
| 401 (Clearview) | 448 | 40,875 | 77% | 3.40 |
| 402 (Avonhead) | 210 | 7,753 | 67% | 0.44 |
| 403 (Lakeside) | 145 | 13,693 | 78% | 0.90 |

[1] Volumes maintained from the MSWQCSU, based on 2.5 m deep permanent pool

[2] Based on the concept designs from the MSWQCSU

## 3.5 Watercourse Improvements

Recall from **Section 2.5** that many of the watercourses flowing through the study area have been severely impacted by past practices including the on-line agricultural pond and concrete lining along Clearview Creek, concrete lining of Sheridan Creek, realignment of Avonhead Creek into a narrow confined corridor along its entire length, and piping of Lakeside Creek north of Lakeshore Road.

There is an opportunity to reconstruct and rehabilitate these watercourses in a manner that will significantly improve the size and quality of these systems while reducing flooding and facilitating redevelopment of the adjacent lands.

### 3.5.1 Clearview Creek

Currently, Clearview Creek flows through a number of properties on the east side of Winston Churchill Boulevard. The channel and associated flood plain (refer to **Figure 2-15**) bisects and significantly constrains the potential future redevelopment of these properties. At the north limit of the Infrastructure Ontario property on the north side of Lakeshore Road, there is an on-line pond in poor condition (refer to **Section 2.5.1**). South of Lakeshore Road, the channel has been reconstructed as a concrete trapezoidal channel.

A concept design has been prepared for the realignment and reconstruction of Clearview Creek within the study area. From the existing culvert under Winston Churchill Boulevard, the creek would be reconstructed as a natural channel meandering within a 30 m wide valley bottom. The channel would contain the Regional storm flow and would include 10 m buffers on either side of the top of bank for a total corridor width of 62 m. Along its north-south alignment, the channel corridor would be centred on the east property limit of the properties on the east side of Winston Churchill Boulevard, facilitating the future development of these sites. Realignment of the creek further to the east would offer the following benefits:

- Opportunity to provide a wider natural channel with greater conveyance capacity
- Reduced flood hazards
- Removal of several small private access crossings
- Improved terrestrial linkage with the natural forested feature to the east
- More efficient use of future development lands

This alternative would also include the removal of the existing on-line pond and control structure, but would otherwise preserve and protect the existing natural channel from Lakeshore Road to upstream of the on-line pond. This would restore

fish passage, mitigate temperature increases and restore a more natural flow and sediment transport regime.

Downstream of Lakeshore Road, the existing concrete channel would be removed and Clearview Creek would be reconstructed as a naturalized channel meandering within a 36 m wide valley bottom. The channel corridor would be generally aligned along the east side of the City's property associated with Fusion Park. Including grading to contain the Regional storm flood plain and 10 m buffers, the total corridor width would be 68 m. A larger improved natural channel may represent an alternative outlet for Avonhead Creek.

A concept design for the realignment of Clearview Creek is illustrated in **Figure 3-11**, and a larger scale drawing is included in **Appendix F.**

### 3.5.2 Avonhead Creek – South of Orr Road

Avonhead Creek is confined to a relatively narrow corridor where it flows through the developed properties south of Royal Windsor Drive. However, there is the potential for the creek to be reconstructed as natural channel east of Hazelhurst Road between Orr Road and Lakeshore Road as part of any plans for redevelopment of the existing concrete plant property. A concept design has been prepared for a new channel through this property with a 25 m wide meander belt within a 57 m wide corridor. This channel would be able to convey the full flow from the upstream drainage area. Recall that under current conditions, the majority of the flow from the upstream drainage area is captured into the Hazelhurst Road storm sewer system, which is discharged to Clearview Creek at Lakeshore Road.

Currently, the flow in Avonhead Creek is captured into a private storm sewer at Lakeshore Road, and this sewer continues south through private property to a storm outfall to Lake Ontario (see **Figure 2-19**). The 1.7 m x 0.84 m elliptical pipe does not have adequate capacity, resulting in overtopping of Lakeshore Road during the 2 year storm event. There is very little cover over the existing pipe under Lakeshore Road, and therefore installing a large pipe to convey more flow is not feasible. A concept design was prepared for twin – 3 m wide x 1.2 m box pipes to maximize conveyance capacity with the cover limitations. The analysis shows that this would improve flooding conditions at Lakeshore Road, but it would continue to be overtopped during storms greater than the 10 year return period event.

Recall from **Section 2.5.2** that a previous study developed and advanced plans for replacing this storm sewer with a naturalized open channel to Lake Ontario (Ecosystem Recovery Inc., 2015). However, the natural channel was not implemented due to an inability to secure land within the existing private property for the channel.

For this study, an alternative concept has been prepared to naturalize Avonhead Creek south of Lakeshore Road. A new culvert would be installed under Lakeshore Road, and Avonhead Creek would be re-aligned to the west and join Clearview Creek before flowing into Lake Ontario. Both the culvert and channel would have sufficient capacity to convey the 100 year storm peak flow without overtopping Lakeshore Road.

Property would still be required on the south side of Lakeshore Road for implementation of this option, but it would be significantly less than required for the previous daylighting option.

A concept design for the realignment of Avonhead Creek is illustrated in **Figure 3-11**, and a larger scale drawing is included in **Appendix F.**

### 3.5.3 Avonhead Creek – North of Orr Road

As shown on **Figure 2-16**, the 100 year regulatory flood plain is not contained within Avonhead Creek between Royal Windsor Drive and Orr Road. In between the two roads is the CN rail tracks and the CN spur along with the associated crossings along with two private driveway crossings. A portion of the creek is a concrete channel which spills into a parallel ditch to the east onto the adjacent property and eventually spills over the CN rail and into the ditch south of the CN rail which flows towards Orr Road.

A number of alternatives were initially explored to fully contain the Avonhead Creek regulatory flood plain within a naturalized creek corridor. A key constraint to any of these alternatives is the very limited height available from the existing creek invert to the base of the rails on the CN spur line. The limited height prevents installation of a larger cover that could prevent overtopping of the CN tracks and associated significant extent of upstream flooding. Alternatives were also explored for lowering the creek north of Orr Road, but it was determined that lowering the creek would create a conflict with the Enbridge pipeline located immediately north of and parallel to the CN rail line. Given these significant constraints and the associated significant challenges to overcome them (including but not limited to re-aligning the Enbridge oil pipeline), it was concluded that realigning and lowering Avonhead Creek at the CN rail crossing is not feasible.

Instead, analyses were undertaken to determine how best to contain and minimize the extent of flooding north of the CN tracks and mitigate the impact of the current spill over the CN tracks to the west of the culvert under the tracks. These analyses were completed by CVC staff with the aid of the HEC-RAS 2D model described in **Section 2.6.2**. It was determined that flooding from Avonhead Creek both north and south of the CN tracks can be mitigated through the following works:

- There is an existing crossing over Avonhead Creek to provide access to a small building between the creek and the railway tracks. Replacing the existing twin 950 mm diameter pipe culverts with a 4.8 m wide x 1.2 m high concrete box culvert would significantly reduce flooding of the property on the south side of Royal Windsor Drive and reduce the amount of spill over the railway and into the property on the east side of Winston Churchill Boulevard south of the rail tracks.
- Avonhead Creek would be widened from upstream of the proposed replacement culvert to at least as far as the next culvert crossing under the rail spur line to increase conveyance capacity and better tie into the proposed 4.8 m wide box culvert. The channel would have a base width of at least 3 m.
- Regrading of the property on the east side of Winston Churchill Boulevard south of the rail tracks to capture the runoff spilling over the railway. This would create a corridor to safely convey the spill flows southward to Orr Road, where they would be conveyed and contained within the Orr Road and Hazelhurst Road right-of-ways. The size and configuration of the corridor would be determined through the development of 805 Winston Churchill Boulevard, when the detailed grading designs for the site are prepared.

Additional information and figures depicting the proposed alternative are provided in a technical memo prepared by CVC staff, which is included in **Appendix D.**

### 3.5.4 Lakeside Creek

Recall from **Section 2.6.4** that there is storm sewer system through the undeveloped areas north of the Clarkson WWTP. This system leads to a storm sewer aligned through the Clarkson WWTP which eventually daylights on the south side of Lakeshore Road and forms the upstream limit of Lakeside Creek. The drainage analyses determined that many of the storm sewers within and upstream of the Clarkson WWTP do not have capacity for the standard 10 year design storm.

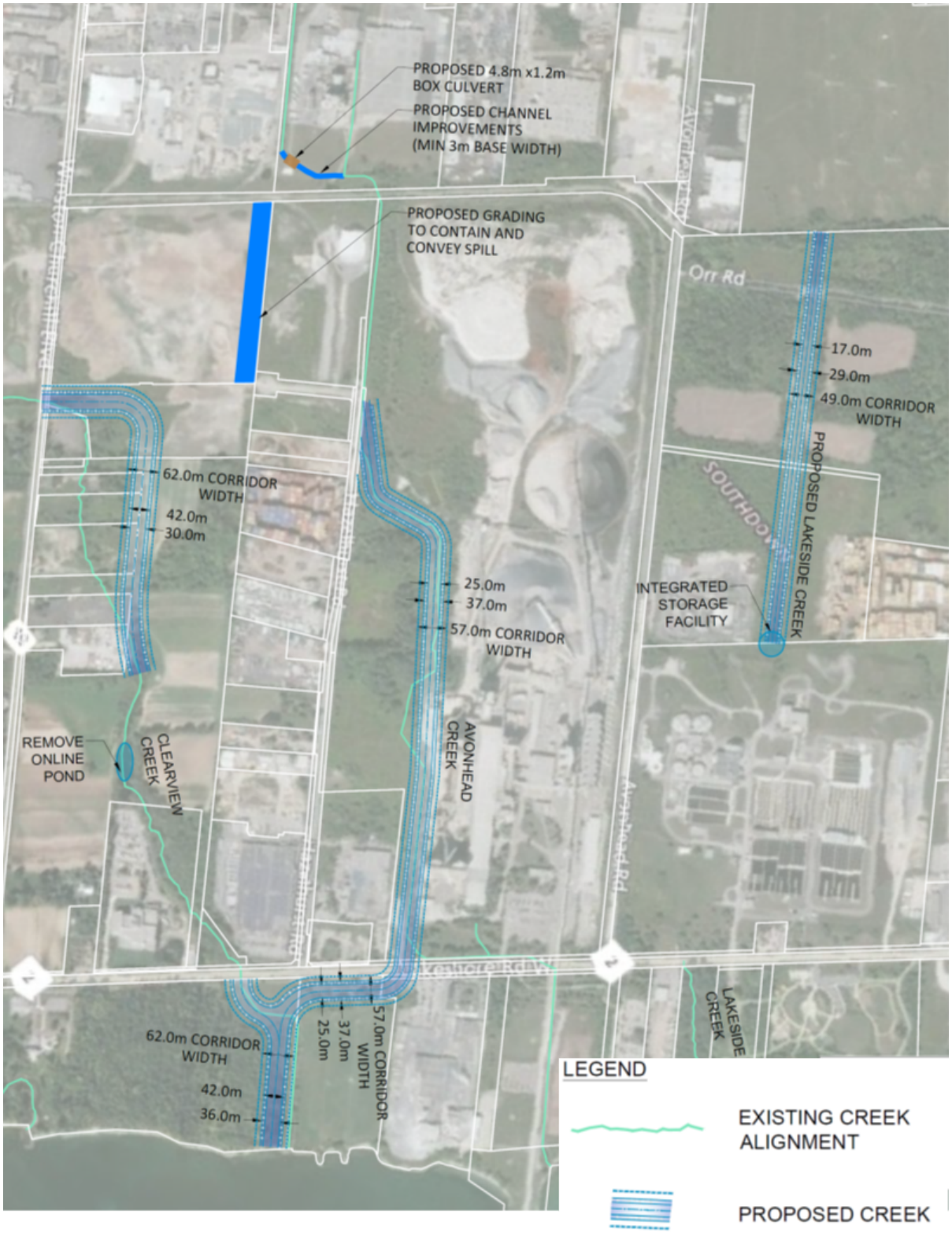
An alternative has been developed to remove the storm sewers north of the Clarkson WWTP and replace them with a natural channel system. The concept includes a relatively small channel within a 17 m wide valley bottom, and a total corridor width of 49 m, including buffers. The channel would originate at the south limit of the large property on the south side of Royal Windsor Drive, accepting flows from the potential future development of the existing antenna field. The channel would continue south through existing undeveloped and partially developed properties, accepting treated runoff from these properties when they develop in the future. The channel would terminate at the north limit of the Clarkson WWTP, with storage provided within the channel corridor to control flows to the capacity of the storm sewer system within the Clarkson WWTP. A total storage volume of approximately 20,000 $m^3$, integrated into the channel corridor, would be needed to

control the 100 year storm peak flow to the capacity of existing storm sewer within the WWTP. This storage volume could be reduced if on-site peak flow controls are provided within development sites contributing to this system.

The potential to continue the natural channel through the WWTP was explored, but it was determined that the existing plant site is highly constrained, and is expected to remain in operation for the foreseeable future with the potential for future expansion. Costs to relocate the WWTP infrastructure to create an open corridor for a channel would be prohibitively complicated and expensive. Regardless, this alternative could include plantings within the Clarkson WWTP property to create a terrestrial habitat connection from the existing Lakeside Creek south of Lakeshore Road to the future naturalized Lakeside Creek north of the treatment plant.

A concept design for the realignment of Lakeside Creek is illustrated in **Figure 3-11**, and a larger scale drawing is included in **Appendix F.**

## Figure 3-11 Location of Channel Works



## 3.6 Storm Sewer and Major Drainage System Upgrades

Recall from **Section 2.6.4** that there are a number of storm sewers in the study area that are undersized relative to current standards. The roadways and major drainage systems have capacity for up to the 100 year storm event in most of these areas, with the exception of some of the sewers and residential roadways in the north-west corner of the study area.

Concept designs have been prepared for upgrades to the following storm sewer systems which were identified as potentially undersized:

- Southdown Road
- Avonhead Road
- Bromsgrove Road / Widemarr Road

The storm sewer upgrades for Avonhead Road are more involved than simply upsizing existing undersized storm pipes. There are currently two storm sewer systems on Avonhead Road. A system originates south of Royal Windsor Drive and then drains west along the former Orr Road to join the system that continues south through the Clarkson WWTP. The majority of the sewers in this system do not have adequate capacity for the 10 year storm event. A second storm sewer system on Avonhead Road originates at roughly the north limit of the Clarkson WWTP property, continuing south and then turning east on Lakeshore Road to join the system aligned through the WWTP site just upstream of the outlet to the open reach of Lakeside Creek south of Lakeshore Road. All of the pipes in this second storm sewer system are undersized.

A concept design has been prepared for a new, continuous storm sewer system on Avonhead Road from south of Royal Windsor Drive to the junction at Lakeshore Road. This system would accept storm runoff from Avonhead Road as well as controlled flows from future development and redevelopment sites to the east and west of the roadway (but excluding the concrete plant lands west of the roadway north of Lakeshore Road). This storm sewer system would allow the majority of the existing storm sewer system in the undeveloped lands east of Avonhead Road to be eliminated. The system through the Clarkson WWTP would remain, and any future development on the lands immediately north of the WWTP could discharge to this system with flow rates controlled to or below the capacity of the existing storm sewer system.

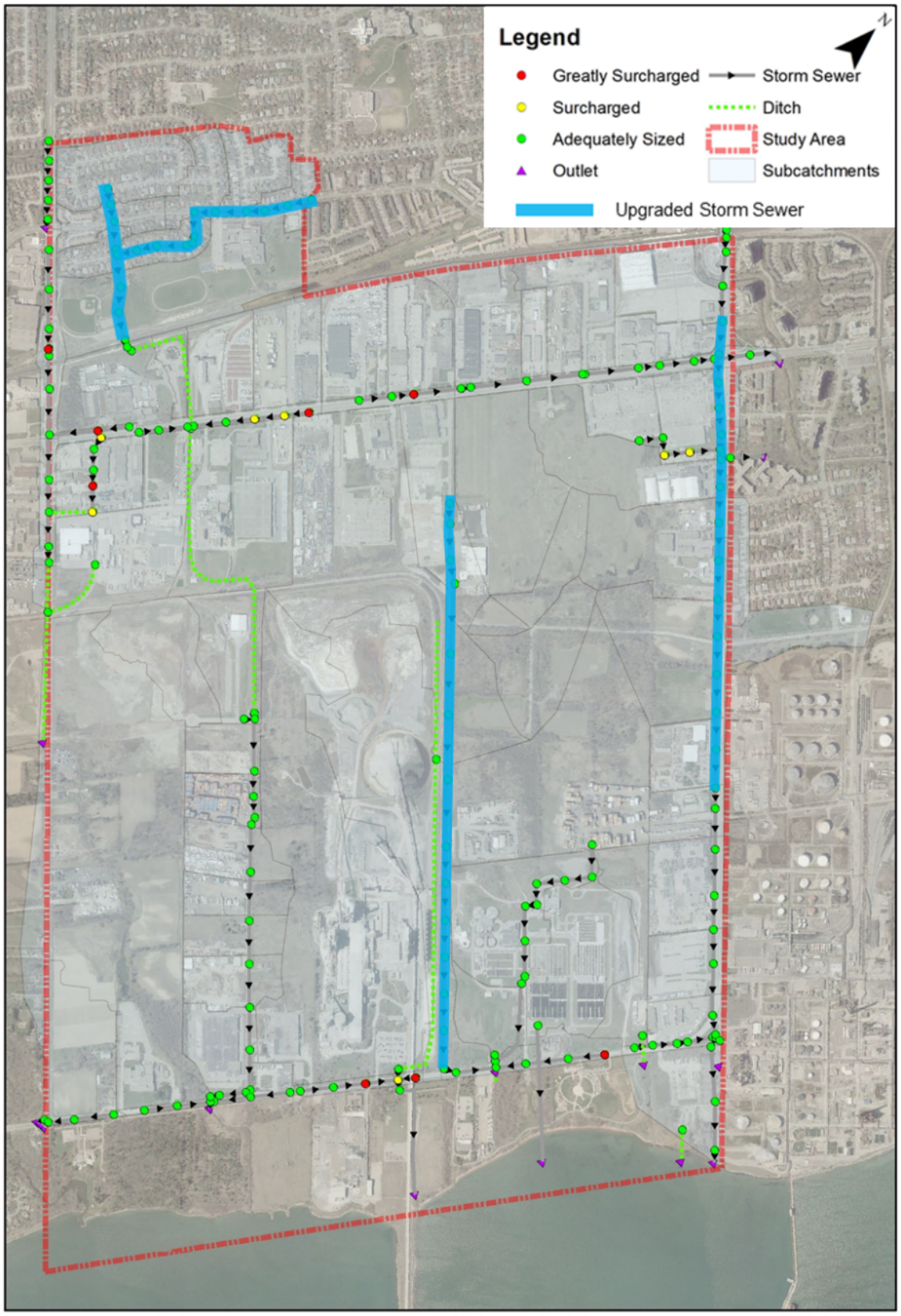
It is recognized that other storm sewers are shown as potentially undersized in **Figure 2-20** and **Figure 2-21**, but concept designs were not proposed for upgrades to those systems. The upstream-most segments of the storm sewer systems on Royal Wi

ndsor Drive are shows as potentially undersized, but it is suspected that this is due to conservative assumptions used in the model regarding where storm flows from adjacent developed sites are connected to the storm sewer. Given that the majority of the downstream sewer segments were found to have adequate capacity, it is expected that a more detailed analysis and distribution of flow to the storm sewer would find that there is adequate capacity. It is also expected that any flows not entering the storm sewer in the potentially surcharged segments would be able to get into the storm sewer via downstream catchbasins connecting to non-surcharged pipes.

Some of the storm sewers on Winston Churchill Boulevard were identified as potentially undersized. This is a Regional roadway, and therefore any potential improvements to these storm sewers would be the responsibility of Peel Region. While designs have not been prepared for improvements to the Winston Churchill Boulevard storm sewers, Peel Region staff have been notified of the capacity constraints and are encouraged to complete their own investigation into the storm sewers and potential improvements.

**Figure 3-12** illustrates the locations of the replacement storm sewers associated with this alternative.

## Figure 3-12 Upgraded Storm Sewer Locations



# 4 Evaluation of Alternative Solutions

## 4.1 Evaluation Criteria

The alternative solutions described in **Section 3** were comparatively and qualitatively evaluated based on criteria developed within the following main categories, which represent the broad definition of the environment from the Municipal Class Environmental Assessment:

- **Natural Environment**, which relates to potential impacts and benefits to the natural and physical components of the environment (i.e., air, land, water and biota) including natural and/or environmentally sensitive areas.
- **Social Environment**, which relates to potential impacts and benefits to residents, neighbourhoods, businesses, community character, social cohesion and community features.
- **Cultural Environment**, which relates to potential impacts to historical/archaeological remains, and heritage features.
- **Technical Environment**, which relates to the technical feasibility, effectiveness, constructability, operation and maintenance, and other engineering aspects of the alternative solutions.
- **Financial Environment**, which relates to the capital and maintenance costs of the alternative solutions and potential reductions in future flood damages

Within each main category, project-specific evaluation criteria were developed based on a review of the Municipal Class EA, the existing conditions of the study area and the alternative solutions being considered. The resulting evaluation criteria are summarized in **Table 4-1**.

**Table 4-1 Evaluation Criteria**

| Category | Evaluation Criteria |
|---|---|
| Natural Environment | Potential effects on fish habitat and aquatic ecosystems<br>Potential effects on terrestrial wildlife and ecosystems<br>Potential effects on known habitat for Species at Risk<br>Potential effects on groundwater quality and quantity |
| Social/Cultural Environment | Potential impacts to the community during construction (noise, dust, traffic restrictions)<br>Potential impacts to businesses during construction (traffic restrictions)<br>Potential impacts to the public realm (aesthetics, trails, recreational amenities)<br>Potential for requiring private property<br>Potential impact to archaeological resources |
| Technical Environment | Effectiveness in improving flooding conditions, water quality, erosion, and water balance for the study area<br>Challenges to construct the solution, including potential conflicts with existing municipal services and utilities<br>Challenges to implement the solution, including property acquisition and co-operation among potentially impacted property owners and developers<br>Challenges to secure permits and approvals<br>Potential future maintenance requirements<br>Resiliency to future climate conditions |
| Financial Environment | Estimated costs of implementation<br>Estimated operations and maintenance (O&M) costs<br>Potential impacts on municipal revenues (loss of tax revenue) |

## 4.2 Do Nothing

As described in **Section 3.1**, the Do Nothing option does not involve any works to improve the existing conditions in the watershed, and does not include any stormwater management controls for the anticipated future development in the study area.

**Natural Environment**: As no infrastructure works are proposed in the Do Nothing scenario, there would be no direct impacts or benefits to the natural environment. However, discharge of uncontrolled storm flows from existing and future development in the study area would result in increased erosion and further impairment of water quality in the watercourses within the study area.

**Social/Cultural Environment**: As no works are proposed, there would be no impacts or benefits to the social and cultural environments in the study area.

**Technical Environment**: The watershed hydrology models described in **Section 2.6.1** were updated to assess the impacts of future development in the Southdown District without any peak flow controls. As expected, a lack of stormwater controls is predicted to significantly increase peak flow rates and flooding in the watercourses flowing through the study area. Peak flows are predicted to increase by approximately 30% over existing conditions in Clearview Creek and Lakeside Creek, and to nearly double in Avonhead Creek. The larger increase in Avonhead Creek flows is because the majority of the watershed is expected to be developed in the future, whereas the anticipated growth areas in Clearview and Lakeside Creeks make up a smaller fraction of the total watershed area.

The PCSWMM model of the storm sewers and overland flow systems in the study area (see **Section 2.6.4**) was also updated to represent the do nothing scenario. The analyses determined that the total number of storm sewer systems surcharged during the 10 year design storm would only increase by approximately 5%, but many of the storm sewers predicted to be slightly surcharged under existing conditions would be significantly surcharged under the Do Nothing scenario, leading to a more than 20% increase in the total number of greatly surcharged storm sewers.

This solution could not be implemented, as it would not meet minimum stormwater management requirements established by the City and Province. It confirms that current and emerging stormwater management practices are warranted for future development in the study area to mitigate impacts on stormwater quality, erosion and flooding from both watercourses and urban storm sewer systems.

**Financial Environment**: While there are no capital costs associated with the Do Nothing alternative, uncontrolled storm flows from existing and future development in the study area could lead to worsening erosion and increased long term costs to the City to protect their infrastructure (roads, watermains, storm sewers) from erosion. There could also be costs for landowners to protect their properties from increased flooding and erosion, as the majority of the watercourses in the Southdown district are in private ownership.

## 4.3 Current Standard Stormwater and Environmental Management Approach

This alternative, described in **Section 3.2**, does not involve any physical improvements to the existing storm drainage infrastructure or natural environment through the study. Instead, it establishes the stormwater management and environmental criteria that will be applied to future development and re-development sites within and beyond the study area.

**Natural, Social and Cultural Environments**: **A**ll works will be implemented within future developing and re-developing properties and will be outside of the flooding and erosion hazard limits and natural heritage limits, including applicable buffers. As such, there will be no impacts, positive or negative, to the natural environment and the existing degraded watercourses within the study area will remain in their current condition, through new development. However, there could be some benefits to the receiving streams as stormwater management controls are introduced to re-development sites that currently have no controls. Implementing on-site stormwater management controls within future development and re-development sites would not worsen social impacts such as noise, vibration, dust and traffic beyond that associated with site development without on-site controls.

**Technical Environment**: Maintaining the current accepted approaches for stormwater management will adequately mitigate the impacts of future development on flooding, erosion and water quality in the existing watercourses flowing through the study area, but will not achieve any improvements over current conditions in the watercourses. There are no challenges for implementation of this approach, as it is considered standard practice for new development and will adhere to all current City, provincial and federal requirements for stormwater management and environmental protection. This alternative also provides some resiliency to climate change, as it is expected that the City's and CVC's standard stormwater management and environmental management criteria will continue evolve and adapt in the future in response to improved understanding of the impacts of a changing climate on storm drainage infrastructure.

**Financial Environment**: It is expected that the stormwater management criteria will be satisfied through on-site controls, including by not limited to Low Impact Development practices, storage on building rooftops, parking areas and in underground chambers and oil-grit separators. For individual development sites greater than 5 ha, it is expected that the criteria would be satisfied by a traditional stormwater management wet detention pond, augmented with upstream source and conveyance control practices. All on-site stormwater management measures would be installed and maintained by the landowner / developer. There would be no costs

to the City for construction and maintenance, although there may be a need for the City to verify that the on-site controls are being maintained in the future.

## 4.4 SWM Facilities for Future Development

This alternative, described in **Section 3.3,** involves new centralized facilities to provide water quality treatment, extended detention storage and control peak flow rates from multiple future anticipated development sites. Concept designs have been prepared for five new centralized SWM ponds that could provide the required quality and quantity control of stormwater from multiple future development sites. The centralized facilities would conform to current environmental protection requirements and be located outside of the natural heritage systems and flooding and erosion hazard limits, with the exception of the storm outfalls to the receiving watercourses.

**Natural Environment**: Construction of new SWM facilities would have no impacts to the natural environment, as the facilities would be constructed outside of the protected natural heritage systems and associated buffers. If designed and planted appropriately, the SWM facilities could enhance and complement the adjacent natural heritage systems associated with the receiving watercourses.

**Social/Cultural Environment**: It is expected that the centralized SWM ponds will be located within one or more of the developing properties contributing runoff to the facility, and therefore there should be no need for the City to expropriate property from non-developing owners for the SWM facilities. There could be temporary impacts to area residents and businesses during construction of the centralized SWM facilities related to noise, vibration, dust and traffic. Once complete, the facilities could provide recreational opportunities for workers in the study area and potentially integrated into a future trail system within the creek corridors.

**Technical Environment**: The concept designs prepared for the centralized SWM facilities would provide the required water quality, erosion and flood control criteria for all of the properties to be serviced by the facilities. There would be few challenges to secure permits and construct the facilities, as SWM pond construction is a normal element of grading and servicing for new development. However, there are significant challenges to overcome to secure property and funding for implementation of the facilities. As noted in **Section 3.3**, commercial and industrial properties typically develop on a property by property basis with private on-site stormwater controls. Implementing centralized SWM facilities would require co-operation among several different property owners to enter into agreements to share the land and construction costs for the new SWM facilities. Similarly, for future development of the large properties in the Avonhead and Lakeview Creek watersheds, implementation of this solution would require the SWM ponds and all stor

m drainage infrastructure connecting to the SWM ponds for the first phase of development on each property. Unless all of the contributing properties and/or entire properties are developing on similar timeframes, the costs for the first developer to 'front end' the centralized facility would likely be prohibitive for implementation of the centralized facilities. Where a SWM pond is proposed partially or entirely on lands outside of the anticipated future development sites, there would be further challenges for the developers to secure the land for the facility.

This solution would provide some resiliency to future climate change, as the centralized facilities would be owned and maintained by the City. This would allow the City to modify or retrofit the facilities in the future if warranted to better mitigate the impacts of future climate change on SWM infrastructure and the downstream receiving watercourses. Conversely, there is no mechanism for the City to compel landowners to retrofit private, on-site stormwater management infrastructure in response to future climate change.

**Financial Environment**: The combined cost of all five centralized SWM facilities has been conservatively estimated as **$29,200,000**, including land and construction costs. These costs would be paid for by the benefitting developers, with no costs to the City for the initial construction of the facilities. These landowners would benefit by having additional land available for development relative to providing all SWM controls on-site.

It is expected that the centralized SWM facilities would be assumed and maintained by the City, which is standard practice for facilities treating multiple properties. There would therefore be increased long term operation and maintenance costs to the City for this alternative. There may also be costs for the City to administer a cost-sharing agreement among benefitting landowners if one or more developments are anticipated after the initial development(s) and SWM pond construction

## 4.5 Retrofit SWM Facilities

As noted in **Section 3.4**, the MSWQCSU (Aquafor Beech, 2012) included concept designs for the three retrofit SWM facilities in the study area. The facilities are proposed as on-line SWM ponds located near the outlets of Clearview Creek, Avonhead Creek and Lakeside Creek. The Clearview Creek facility (Pond 401) is located on City owned land, while the Avonhead Creek facility (Pond 402) is located on private property and the Lakeside Creek facility (Pond 403) is proposed on Peel Region property associated with the Clarkson WWTP.

**Natural Environment**: The Avonhead and Lakeside Creek SWM facilities would be constructed within existing manicured open areas, with some tree removals required for the Avonhead Creek facility but relatively few impacts to the natural environment.

The Clearview Creek facility is proposed in a natural regenerating coniferous plantation area, and a considerable number of tree removals would be required for its construction. As the facilities are proposed in existing vegetated areas, there would be no benefits to the terrestrial habitat once constructed. While mitigation measures are possible, the proposed on-line facilities have the potential to act as a barrier to fish passage to the open watercourses upstream of the Clearview and Avonhead Creek facilities.

**Social/Cultural Environment**: There could be temporary impacts to area residents and businesses during construction of the retrofit facilities related to noise, vibration, dust and traffic. There would also be a need to obtain property from the owners of the concrete plant and Peel Region for construction of the Avonhead and Lakeside facilities, respectively.

The Clearview Creek facility would be located on the Bell Gairdner Estate property, which is a designated heritage property. The facility would be located well away from the historic buildings on the property and in an area previously impacted for construction of the concrete lined channel, but a heritage impact assessment would be needed to confirm that the facility would not have any impacts on the heritage property.

Once complete, the facilities could provide recreational opportunities for workers in the study area and potentially be integrated into a future trail system within the creek corridors and/or along the lakefront.

**Technical Environment**: There are several challenges associated with the design and construction of the retrofit facilities, which are intended to provide water quality treatment for large upstream drainage areas. The Clearview and Avonhead facilities would need to be designed to allow baseflows to continue unimpeded in the watercourse in order to mitigate impacts on fish passage to the upstream reaches of both creeks. In addition, the facilities would need to be designed to capture most of the flow from small to moderate storm events into a large wet pond for water quality treatment, while preventing flows from larger storm events from flushing out the accumulated sediment in the facilities. As the entire upstream system at Lakeside Creek has been piped, the retrofit facility within the Clarkson WWTP could be designed as a more traditional facility with storm sewer inlets and outlets.

The facilities could achieve between 67% (Basic) and 78% (Normal) TSS removal, which is close to the criteria of 80% TSS removal for SWM facilities treating runoff from new development areas. However, as the facilities are located near the outlets to Lake Ontario, the water quality benefits would be limited to Lake Ontario and the short length of watercourse between the retrofit facilities and Lake Ontario. There

would be no improvement in water quality in Clearview Creek and Avonhead Creek north of Lakeshore Road.

The Avonhead Creek facility is proposed on private property and the Clearview Creek retrofit facility is proposed at the Clarkson WWTP. There would therefore be significant challenges for the City to secure the land needed for construction of these facilities.

**Financial Environment**: Cost estimates for construction of the retrofit facilities were included in the (MSWQCSU) (Aquafor Beech, 2012). The combined costs for the three retrofit facilities proposed in the MSWQCSU is estimated as **$14,900,000**. Once complete, there would be increased costs for the City to inspect and maintain the SWM facilities.

## 4.6 Watercourse Improvements

**Section 3.5** described alternatives to rehabilitate and enhance the watercourses through the study area. Concept plans have been prepared for the realignment of Clearview Creek east of Winston Churchill Boulevard, removal of the on-line dam north of Lakeshore Road, and naturalization of the existing concrete lined channel south of Lakeshore Road. Concept plans were also prepared for the realignment of Avonhead Creek east of Hazelhurst Road, the redirection of Avonhead Creek to Clearview Creek south of Lakeshore Road via a natural channel, improvements to reduce flooding from Avonhead Creek between Royal Windsor Drive and Orr Road, and construction of a new open channel system north of the Clarkson WWTP to replace the existing storm sewer systems east of Avonhead Road that lead to Lakeside Creek.

### 4.6.1 Clearview Creek

**Natural Environment**: The realignment and naturalization of Clearview Creek north of Lakeshore Road would require relatively few mature trees and other vegetation to be removed, but the naturalization of the existing concrete lined portion of Clearview Creek south of Lakeshore Road, which would require removal of a considerable number of trees in the regenerating coniferous plantation area west of the existing concrete lined channel.

Once complete, the reconstructed channel corridor would be a significant improvement to both the quantity and quality of terrestrial and aquatic habitat along Clearview Creek and would improve connections to the existing treed areas east of the creek.

**Social/Cultural Environment**: There could be temporary impacts to area residents and businesses during construction of the watercourse improvements related to noise, vibration, dust and traffic.

It is assumed that the realignment of Clearview Creek would be implemented as part of the plans for development or redevelopment of the impacted properties, and therefore the City would not have to acquire lands for the channel through a separate process.

The realignment of Clearview Creek south of Lakeshore Road would occur in the Bell Gairdner Estate property, which is a designated heritage property. The channel realignment and on-line pond removal north of Lakeshore Road would take place partially to entirely within the Gold Medal Farm property, which is also a designated heritage property. In both properties, the channel works would be located well away from the heritage buildings and in close proximity to the existing watercourse, and should have little to no impact on the heritage properties. Regardless, a heritage impact assessment would be needed to confirm that the works would not have any impacts on heritage resources.

The improved watercourse corridors could include trail systems with connections to the Waterfront Trail, significantly improving recreational opportunities in the study area.

**Technical Environment**: The realigned channel corridors both north and south of Lakeshore Road have been sized to contain the greater of the 100 year or Regional storm flow and allow for the natural meandering of the bankfull channel. The corridors would also include some freeboard within the corridor and/or buffers to contain flows from even larger storm events, providing additional resiliency to future climate change.

As such, the full erosion and hazard limits will be confined to the channel corridors, and the development potential of the more regularized parcels adjacent Clearview Creek north of Lakeshore Road will be significantly improved.

There are significant challenges for implementation of this alternative, particularly for Clearview Creek north of Lakeshore Road. Numerous properties would be impacted for implementation of the channel on the recommended alignment, requiring co-operation and agreements among the landowners to share the land and construction costs for the channel. It may also be necessary to construct the channel in stages with temporary connections to the existing channel if the properties on the east side of Winston Churchill Boulevard develop and implement the realignment on individual properties at different times.

**Financial Environment**: The cost for the watercourse improvements to Clearview Creek is estimated to be approximately **$19,100,00**, including land costs. However, the channel realignment north of Lakeshore Road is expected to be funded by the benefitting developers, and the removal of the dam on Clearview Creek is expected to be undertaken by the property owner to minimize the risk and liability associated with failure of the structure and flooding impacts to downstream property and infrastructure. Costs to the City associated with the improvements to Clearview Creek south of Lakeshore Road is estimated to be approximately $**1,900,000**.

Once complete, it is expected that ownership of the Clearview Creek corridor would be assumed by the City. There are potentially increased costs to the City associated with long term management of the corridors. However, if design and constructed appropriately it should function as a natural system with little to no long term maintenance requirements. Note that the City is already responsible for maintenance of the concrete lined channel south of Lakeshore Road.

### 4.6.2 Avonhead Creek – South of Orr Road

**Natural Environment**: There is relatively little mature vegetation that would be impacted for construction of a naturalized channel corridor through the existing concrete plant property, and little to no significant vegetation along the alignment of a new channel corridor south of Lakeshore Road to connect to Clearview Creek.

Once complete, the reconstructed channel corridor would be a significant improvement to both the quantity and quality of terrestrial and aquatic habitat in the study area.

**Social/Cultural Environment**: There could be temporary impacts to area residents and businesses during construction of the watercourse improvements related to noise, vibration, dust and traffic.

It is assumed that the realignment of Avonhead Creek north of Lakeshore Road would be implemented as part of a plan for any large-scale redevelopment of the concrete plant property, but the City would be required to acquire land for the realignment of Avonhead Creek westward to Clearview Creek on the south side of Lakeshore Road.

A small portion of the realignment south of Lakeshore Road would occur in the Bell Gairdner Estate property, which is a designated heritage property. As noted in **Section 4.6.1**, a heritage impact assessment would be needed to confirm that the works would not have any impact on heritage resources associated with the estate property.

The improved watercourse corridor could include trail systems with connections to the Waterfront Trail, significantly improving recreational opportunities in the study area.

**Technical Environment**: The realigned channel corridors both north and south of Lakeshore Road have been sized to contain the greater of the 100 year or Regional storm flow and allow for the natural meandering of the bankfull channel. The corridors would also include some freeboard within the corridor and/or buffers to contain flows from even larger storm events, providing additional resiliency to future climate change.

As such, the full erosion and hazard limits will be confined to the channel corridor, and the development potential of the more regularized parcels adjacent the creek on the east side of Hazelhurst Road would be improved.

The realignment of the channel corridor north of Lakeshore Road would occur within a single property, and has been assumed that it would be implemented as part of any potential future redevelopment of the site. There are therefore few challenges anticipated for its implementation.

There would be some challenges for the City to obtain land for the realignment of Avonhead Creek south of Lakeshore Road. The impacted property south of Lakeshore Road does not currently contain a channel or flood plain and would not benefit from the realignment, and therefore the realignment would have to be implemented by the City.

**Financial Environment**: The cost for the improvements to Avonhead Creek both north and south of Lakeshore Road is estimated to be approximately **$31,900,000**, including land costs. However, the channel realignment north of Lakeshore Road is expected to be paid for by the benefitting developer. Costs to the City associated with the improvements to Avonhead Creek south of Lakeshore Road are estimated to be approximately **$6,600,000**, including a new culvert under Lakeshore Road and land costs.

Once complete, it is expected that ownership of the Avonhead Creek corridor would be assumed by the City. There are potentially increased costs to the City associated with long term management of the corridors. However, if design and constructed appropriately it should function as a natural system with little to no long term maintenance requirements.

### 4.6.3 Avonhead Creek – North of Orr Road

**Natural Environment**: There is no significant vegetation that would be impacted by the culvert replacement and channel widening along Avonhead Creek north of the railway tracks, nor any significant vegetation on the property on the east side of

Winston Churchill Boulevard to be re-graded to contain the floodwater spilling over the CN tracks.

A number of different constraints prevent the creek from being reconstructed as a fully naturalized and meandering watercourse, and therefore this solution provides little enhancement to the natural heritage system associated with Avonhead Creek.

**Social/Cultural Environment**: There could be temporary impacts to businesses in the area during construction of the watercourse improvements related to noise, vibration, dust and traffic. It is assumed that the culvert improvements and channel widening north of the CN tracks would be implemented through redevelopment of the Royal Windsor Drive property. Similarly, it expected that the re-grading south of the tracks to contain the spill would be implemented through development of the Winston Churchill Boulevard property, and therefore the City would not be required to secure property for implementation of this alternative. As the works would be located on private properties and wouldn't significantly widen the Avonhead Creek corridor, there would be no opportunities to integrate new recreational trails into this alternative.

**Technical Environment**: The improvements to Avonhead Creek north of Orr Road would not contain the 100 year or Regional storm flow, but would significantly reduce the extent of the flood plain along Avonhead Creek both north and south of the CN tracks.

There are relatively few challenges for implementation of this alternative, as the works on the properties north and south of the CN tracks could occur independently and would be implemented through redevelopment of each property.

**Financial Environment**: The combined cost for the works north and south of the CN tracks is estimated to be approximately **$600,000**. This does not include land costs, as it is assumed that the culvert and channel north of the tracks and re-graded spill route south of the tracks would remain in private ownership. It is assumed that maintenance of the channel and culvert north of the tracks will continue to be the responsibility of the landowner, and the wider culvert and channel should reduce long term maintenance. The corridor south of the tracks needed to contain and convey the spill over the tracks southward to Orr Road should require little to no long term maintenance.

### 4.6.4 Lakeside Creek

**Natural Environment**: There would be some tree removals for the new naturalized Lakeside Creek channel north of the Clarkson WWTP. Once complete, the new natural channel corridor would be a significant addition to both the quantity and quality of terrestrial and aquatic habitat in the study area. The system would remain

piped through the Clarkson WWTP, but a planting plan implemented within the WWTP property could facilitate wildlife passage to and from the open reach of Lakeside Creek south of Lakeshore Road.

**Social/Cultural Environment**: There could be temporary impacts to area residents and businesses during construction of the new watercourse related to noise, vibration, dust and traffic. It is assumed that construction of Lakeside Creek north of the Clarkson WWTP would be implemented as part of the plans for development or redevelopment of the impacted properties, and therefore the City would not have to acquire lands for the channel through a separate process. The improved watercourse corridor could include a local trail system with on-street connections to the Waterfront Trail, significantly improving recreational opportunities in the study area.

**Technical Environment**: The realigned channel corridor has been sized to contain the greater of the 100 year or Regional storm flow and allow for the natural meandering of the bankfull channel. The corridor would also include some freeboard and/or buffers to contain flows from even larger storm events, providing additional resiliency to future climate change.

There are significant challenges for implementation of this alternative, which involves removal of the existing storm sewer system and creation of a new channel corridor north of the Clarkson WWTP. The preferred alignment for the channel would not follow the existing storm sewer system, which has numerous 90 degree bends and does not follow a continuous north-south alignment (refer to **Figure 2-19**). The majority of the channel would need to be constructed in a single phase, requiring co-operation among several different landowners. Over-control of peak flows would also be required on an interim basis for any areas developing in the Lakeside Creek catchment area until the lower reach of the watercourse were constructed with integrated peak flow storage.

Furthermore, a watercourse does not currently exist north of the Clarkson WWTP, and therefore no current flooding or erosion hazards. There will be challenges to compel landowners to convey the land needed for a 49 m wide channel corridor through the planning process for future development of the lands impacted by the channel. It has been assumed that the corridor would be implemented through future development, but there is a risk that the City would be forced to expropriate the lands needed for the new Lakeside Creek channel corridor.

**Financial Environment**: The cost to implement the new Lakeside Creek corridor north of the Clarkson WWTP is estimated to be approximately **$17,800,000**, including land costs. However, construction of the channel is expected to be funded

by the landowners during redevelopment of the lands containing the channel corridor.

Once complete, it is expected that ownership of the Lakeside Creek corridor would be assumed by the City. There are potentially increased costs to the City associated with long term management of the corridor. However, if design and constructed appropriately it should function as a natural system with little to no long term maintenance requirements.

## 4.7 Storm Sewer Upgrades

This alternative, described in **Section 3.6**, involves removing and replacing undersized sections of storm sewer on Southdown Road and within the residential subdivision north of the CN rail. It also includes replacement and extension of the storm sewer on Avonhead Road to south of Royal Windsor Drive, which allows for removal of the majority of the undersized storm sewer system in the undeveloped lands east of Avonhead Road and reduces the flows entering the currently undersized storm sewer system continuing through the Clarkson WWTP.

**Natural Environment**: There would be no significant impacts or benefits to the natural environment, as all works would be contained within existing developed road right-of-ways.

**Social/Cultural Environment**: There could be temporary impacts to area residents and businesses during replacement of the storm sewers related to noise, vibration, dust and traffic.

**Technical Environment**: Replacing the storm sewers is a standard construction practice with few challenges for permitting, approvals and construction. Once complete, the storm sewer systems would comply with current City standards for roadway drainage.

**Financial Environment**: The combined cost for upgrading the storm sewers on Southdown Road, Avonhead Road and in the residential areas in the north-west corner of the study area is estimated to be approximately **$19,400,000**. This includes costs to restore the sections of roadway impacted during construction. Costs could be reduced if the replacements were co-ordinated with the City's schedule for roadway improvements. Once installed, long term maintenance and operation costs would be the same or slightly less than existing due to the reduce frequency of storm sewer surcharging and reduced major system flows on the roadway. Maintenance will also be facilitated by decommissioning the storm sewers in the private lands east of Avonhead Creek and replacing them with a new storm sewer on Avonhead Road.

While the majority of the major overland flow drainage systems can contain flows within the right-of-way within these areas of undersized storm sewers, there is some potential for water to leave the right-of-way and impact private property in the Bromsgrove Road area. Upgrading the storm sewers in this area has the potential to reduce flood damages to private property.

## 4.8 Evaluation

The evaluations of the alternative solutions were described in **Section 4.2** to **Section 4.7**, and are summarized in **Table 4-2** through **Table 4-6**. A simplified evaluation matrix is included in **Appendix F**.

The preferred solutions making up the Master Plan are listed below and presented on **Figure 4-1**.

- Current Stormwater and Environmental Management Approach
- Realignment and naturalization of Clearview Creek both north and south of Lakeshore Road
- Realignment and naturalization of Avonhead Creek from Orr Road to Lakeshore Road, and diversion of Avonhead Creek to Clearview Creek via a natural channel south of Lakeshore Road
- Replacement of a driveway culvert over Avonhead Creek, minor channel widening and grading on the property south of the CN tracks to minimize the extent of flooding from Avonhead Creek between Royal Windsor Drive and Orr Road
- Storm Sewer Upgrades on Southdown Road, Avonhead Road, and Bromsgrove Road / Widemarr Road

The above alternative solutions are recommended because they will achieve current requirements for stormwater management and will result in significant benefits to the quality and quantity of both terrestrial and aquatic habitat in the study area.

The Do Nothing alternative was not selected because it will result in unacceptable impacts on water quality, flooding and erosion and will not meet current City and Provincial standards for stormwater management. Recall that this alternative was analyzed primarily to assess the potential impacts of future urban development in the Southdown District and demonstrate that stormwater management remains required.

New, centralized SWM facilities for future development in the study area are not included in the preferred solution primarily due to the challenges associated with

implementing the facilities, as the form of employment development envisioned for the Southdown district tends to occur on a property by property basis, and implementation of centralized facilities would require most areas contributing to a new centralized SWM facility to be developing on a similar timeframe. However, in the event that multiple properties are developing and could reasonably share a centralized SWM facility, it is recommended that the City advocate for a centralized SWM facility. Note also that traditional SWM facilities would still be required for development of individual properties greater than 5 ha under the Current Stormwater Management Approach.

The retrofit SWM facilities recommended in the previous MSWQCSU (Aquafor Beech, 2012) are not recommended due to the challenges to secure land within private property and the Clarkson WWTP for their construction, the potential impacts to vegetation for their construction, the potential for barriers to fish passage associated with their on-line configuration and because they will not benefit water quality in the watercourses north of Lakeshore Road.

Creation of a new, natural channel for Lakeside Creek through the lands north of the Clarkson WWTP was not selected due to the significant challenges associated with implementation of this alternative. The majority of the channel would need to be constructed in a single phase across several different properties, requiring co-operation among different landowners with different timelines for development. The cost to implement the corridor, including land costs, are significant and could not likely be ‘front-ended’ by the first development along the channel alignment. There are also challenges for the City to compel the landowners to construct a new, natural channel on their property under the Planning Act, as there is only a storm sewer and no watercourse present in the lands east of Avonhead Road.

Applying current SWM and environmental management criteria to future development and redevelopment in study area will adequately mitigate any impacts to flooding, erosion, water quality and natural heritage. Realignment and reconstruction of the watercourses in the study area will significantly reduce flooding and enhance natural heritage systems, and replacing the undersized storm sewer systems will reduce the risk of flooding on major roads and private property.

**Table 4-2 Natural Environment Evaluation**

| Alternative | Natural Environment Impacts | Natural Environment Benefits |
|---|---|---|
| Do Nothing | Increased erosion and degraded water quality due to uncontrolled runoff from future development | No benefits, as no works are proposed |
| Current Standard Stormwater and Environmental Management Approach | No impacts, as all stormwater controls would be implemented within the future development sites | Improved water quality and aquatic habitat due to modern SWM criteria applied to redevelopment of sites with no existing SWM controls |
| Centralized SWM Facilities for Future Development | No impacts, as all SWM facilities would be constructed outside of the NHS limits | The SWM facilities could be designed and landscaped to complement and enhance the adjacent NHS areas |
| Retrofit SWM Facilities | Vegetation and mature tree removals for implementation of the Clearview Creek facility | Improved water quality in Lake Ontario and the watercourses south of Lakeshore Road |
| Watercourse Improvements – Clearview Creek | Vegetation and mature tree removals for Clearview Creek south of Lakeshore Road, temporary impacts to the watercourse during construction | Removal of the concrete channel would benefit aquatic and terrestrial habitat in Clearview Creek, removal of the existing dam and farm pond would improve fish passage |
| Water Course Improvements – Avonhead Creek south of Orr Road | Limited vegetation removals would be required for construction of the channel north and south of Lakeshore Road, temporary impacts to the watercourse during construction | The open channel south of Lakeshore Road will facilitate fish passage to the significantly enhanced aquatic habitat along the reconstructed channel north of Lakeshore Road |

| Alternative | Natural Environment Impacts | Natural Environment Benefits |
|---|---|---|
| Watercourse Improvements – Avonhead Creek north of Orr Road | Negligible vegetation removals required for implementation, temporary impacts to the watercourse during construction | Negligible benefits, as no ecological restoration or enhancements would be feasible on the private properties containing the proposed works |
| Watercourse Improvements – Lakeside Creek | Tree removals would be required for construction of the open channel east of Avonhead Road | The new open channel system north of the Clarkson WWTP would significantly increase the quantity and quality of aquatic and terrestrial habitat |
| Storm Sewer Upgrades | No impacts, as works would be contained within existing developed road rights-of-way | Removal or abandonment of the storm sewer east of Avonhead Road could facilitate future restoration and enhancement of the forest community |

**Table 4-3 Social/Cultural Environment Evaluation**

| Alternative | Social/Cultural Environment Impacts | Social/Cultural Environment Benefits |
|---|---|---|
| Do Nothing | No impacts, as no works are proposed | No benefits, as no works are proposed |
| Current Standard Stormwater and Environmental Management Approach | No impacts, as all stormwater controls would be implemented within the future development sites | No benefit to the social or cultural environments |

| Alternative | Social/Cultural Environment Impacts | Social/Cultural Environment Benefits |
|---|---|---|
| Centralized SWM Facilities for Future Development | Potential noise, vibration, dust and traffic impacts to area residents and businesses during construction | Potential benefits to employees in the study area if recreational facilities (trails, lookouts) are integrated into the design of the SWM facilities |
| Retrofit SWM Facilities | Potential noise, vibration, dust and traffic impacts to area residents and businesses during construction, potential impacts to heritage property | Potential benefits to the public if recreational facilities (trails, lookouts) are integrated into the design of the SWM facilities |
| Watercourse Improvements – Clearview Creek | Potential noise, vibration, dust and traffic impacts to area residents and businesses during construction, potential impacts to heritage properties | Potential benefits to the public if trail systems are integrated into the design of the channel corridor |
| Water Course Improvements – Avonhead Creek south of Orr Road | Property required for the realignment south of Lakeshore Road, potential noise, vibration, dust and traffic impacts to area residents and businesses during construction, potential impacts to heritage property | Potential benefits to the public if trail systems are integrated into the design of the channel corridor |
| Watercourse Improvements – Avonhead Creek north of Orr Road | Potential noise, vibration, dust and traffic impacts to area residents and businesses during construction | No benefits, as the works would be located on private property with no opportunities to integrate recreational facilities |

| Alternative | Social/Cultural Environment Impacts | Social/Cultural Environment Benefits |
|---|---|---|
| Watercourse Improvements – Lakeside Creek | Potential noise, vibration, dust and traffic impacts to area residents and businesses during construction | Potential benefits to the public if trail systems are integrated into the design of the channel corridor |
| Storm Sewer Upgrades | Potential noise, vibration, dust and traffic impacts to area residents and businesses during construction | No benefits, as works would be limited to reconstruction of existing roadways along upgraded storm sewer alignments |

**Table 4-4 Technical Environment Evaluation**

| Alternative | Challenges | Performance |
|---|---|---|
| Do Nothing | No challenges, as no works are proposed | Increased flow rates resulting in increased flooding and erosion in the watercourses |
| Current Standard Stormwater and Environmental Management Approach | Few challenges anticipated for implementation of on-site controls to achieve applicable SWM criteria for future development sites | SWM controls will mitigate the impacts of future development on flooding, erosion and water quality, but will not improve existing degraded watercourses |
| Centralized SWM Facilities for Future Development | Significant challenges for co-ordination, co-operation and agreements among impacted and benefitting landowners and developers for land and construction costs | The SWM facilities will mitigate the impacts of future development on flooding, erosion and water quality, but will not improve existing degraded watercourses |

| Alternative | Challenges | Performance |
|---|---|---|
| Retrofit SWM Facilities | Challenges to secure land from private property owners and Peel Region, challenges to capture storm flows for treatment while preserving baseflows and fish passage in the watercourses | The retrofit SWM facilities will improve water quality in the relatively short length of watercourses between Lakeshore Road and Lake Ontario |
| Watercourse Improvements – Clearview Creek | Significant challenges for co-ordination, co-operation and agreements among impacted and benefitting landowners, challenges to construction staging and interim works if not implemented on a property-by-property basis | Erosion and flooding hazards would be fully confined to the channel corridor, and the realigned channel would facilitate development of more regularized parcels adjacent to the realigned watercourse |
| Water Course Improvements – Avonhead Creek south of Orr Road | Few challenges associated with the realignment north of Lakeshore Road, contained in a single property. Some challenges to obtain property for the realignment south of Lakeshore Road | Erosion and flooding hazards would be fully confined to the channel corridor, and the realigned channel would facilitate development of a more regularized boundary with the realigned watercourse |
| Watercourse Improvements – Avonhead Creek north of Orr Road | Few challenges associated with construction, but the City has limited ability to compel the property owners to undertake the improvements outside of a development application | Flooding would be significantly reduced but the Regulatory flood plain would not be confined to the channel corridor |

| Alternative | Challenges | Performance |
|---|---|---|
| Watercourse Improvements – Lakeside Creek | Significant challenges for co-ordination, co-operation and agreements among impacted landowners, significant challenges to implement if not constructed in a single phase | The new erosion and flooding hazards would be fully confined to the channel corridor |
| Storm Sewer Upgrades | Few challenges anticipated with design, approvals and construction of storm sewer upgrades | The upgraded storm sewers will meet current City storm drainage criteria, and the Avonhead Road storm sewer will mitigate the risk of flooding at the Clarkson WWTP |

**Table 4-5 Financial Environment Evaluation**

| Alternative | Financial Environment Evaluation |
|---|---|
| Do Nothing | No capital costs, as no works are proposed<br>Potentially increased maintenance costs to repair infrastructure impacted by increased flooding and erosion |
| Current Standard Stormwater and Environmental Management Approach | Capital costs are dependent on the form of development and suite of on-site controls implemented<br>The on-site controls would be constructed and maintained by the developer / property owner |
| Centralized SWM Facilities for Future Development | Land and construction costs of $29,200,000 would be borne by the contributing development sites<br>Increased long term operation and maintenance costs when the SWM facilities are assumed by the City |
| Retrofit SWM Facilities | Land and construction costs of $14,900,000<br>Increased long term operation and maintenance costs |

| Alternative | Financial Environment Evaluation |
|---|---|
| Watercourse Improvements – Clearview Creek | Land and construction costs of $19,100,000<br>Minimal long term operation and maintenance costs for an appropriately designed and constructed natural channel |
| Water Course Improvements – Avonhead Creek south of Orr Road | Land and construction costs of $31,900,000<br>Minimal long term operation and maintenance costs for an appropriately designed and constructed natural channel |
| Watercourse Improvements – Avonhead Creek north of Orr Road | Construction costs of $600,000. All works would take place on lands that would remain in private ownership.<br>Minimal long term operation and maintenance costs for an appropriately designed and constructed natural channel |
| Watercourse Improvements – Lakeside Creek | Land and construction costs of $17,800,000<br>Minimal long term operation and maintenance costs for an appropriately designed and constructed natural channel |
| Storm Sewer Upgrades | Construction costs of $19,400,000. Costs could be reduced if storm sewer upgrades were co-ordinated with future road reconstruction projects. |

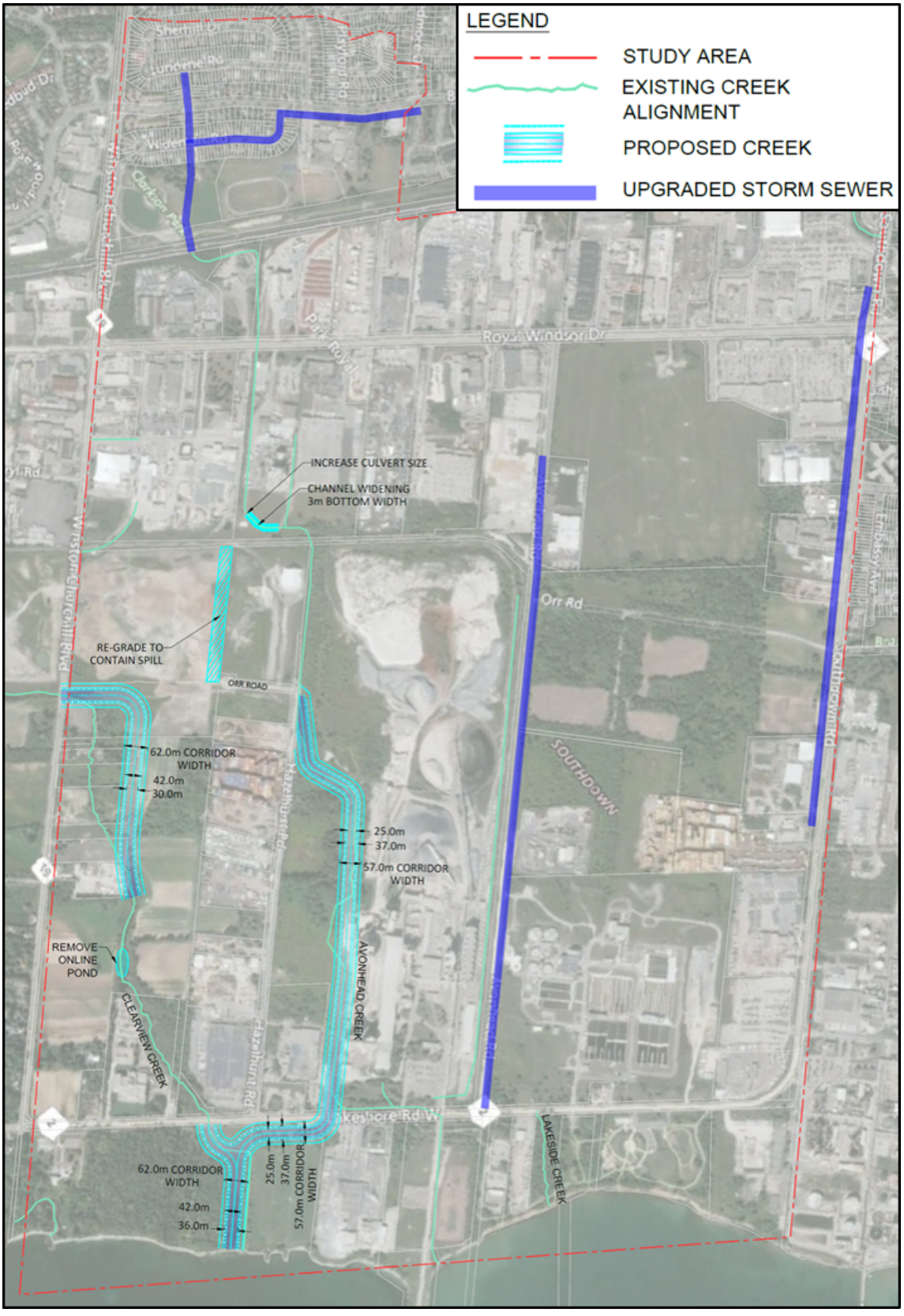
**Table 4-6 Overall Evaluation Summary**

| Alternative | Evaluation Summary |
|---|---|
| Do Nothing | **Not Recommended**<br>Uncontrolled flows from future development will have unacceptable impacts on flooding, erosion and water quality |
| Current Standard Stormwater and Environmental Management Approach | **Recommended**<br>Adhering to current criteria will adequately mitigate the impacts of future anticipated development on water quality, erosion and flooding in the receiving watercourses |

| Alternative | Evaluation Summary |
|---|---|
| Centralized SWM Facilities for Future Development | **Not Recommended**<br>There would be prohibitive challenges to implement centralized SWM facilities for multiple development sites with different timelines for development. Centralized facilities could still be considered on an opportunistic basis if multiple development applications are advanced with similar timelines and would benefit from a single centralized facility |
| Retrofit SWM Facilities | **Not Recommended**<br>There would be significant challenges to secure land for the SWM facilities, and significant challenges to construct on-line water quality facilities on Clearview and Avonhead Creeks without negatively impacting fish passage. The retrofit SWM facilities would only improve water quality in the short length of each watercourse between Lakeshore Road and Lake Ontario. The open watercourses north of Lakeshore Road would not benefit from this alternative |
| Watercourse Improvements – Clearview Creek | **Recommended**<br>While there are significant costs and challenges for implementation, there will be significant benefits to the natural environment, recreation and future developments with the removal of the existing on-line pond and construction of realigned and protected channel corridors both north and south of Lakeshore Road |
| Water Course Improvements – Avonhead Creek south of Orr Road | **Recommended**<br>While there are significant costs and challenges for implementation, there will be significant benefits to the natural environment, recreation and future development with the realigned and protected channel corridor north of Lakeshore Road and new watercourse connection to Clearview Creek south of Lakeshore Road |

| Alternative | Evaluation Summary |
|---|---|
| Watercourse Improvements – Avonhead Creek north of Orr Road | **Recommended**<br>While there would be challenges to implement this alternative outside of a development application, it will significantly reduce the frequency and extent of flooding and facilitate future development and re-development both north and south of the rail tracks |
| Watercourse Improvements – Lakeside Creek | **Not Recommended**<br>There would be prohibitive costs and challenges to implement this alternative across multiple properties with limited ability for interim connections. The upgraded and extended storm sewer on Avonhead Road would provide similar flood reduction benefits to the Clarkson WWTP and allow the existing storm sewers east of Avonhead Road to be removed |
| Storm Sewer Upgrades | **Recommended**<br>Relatively few challenges and costs to bring storm sewers into conformity with current City standards |

## Figure 4-1 Master Plan Preferred Solutions



# 5 Implementation

The preferred solutions making up the Southdown Stormwater Servicing and Environmental Management Plan include the following general projects:

- Stormwater and environmental management for future development in accordance with current criteria and guidelines
- Realignment and improvements to Clearview Creek and Avonhead Creek
- Upgrades to existing storm sewer systems on Southdown Road, Bromsgrove Road and Widemarr Road
- Upgrades and extension of the storm sewer system northward on Avonhead Road to replace the system of existing storm sewers draining into the Clarkson WWTP

The confirmation of the applicable stormwater management and environmental management criteria is not subject to an environmental assessment.

Realignment and reconstruction of a watercourse is classified as a Schedule B activity under the Municipal Class EA. This Master Plan has been prepared to satisfy Phases 1 and 2 of the Municipal Class EA process. However, more detailed investigations will be needed to more accurately assess the potential impacts of the projects on the environment, refine the alignments and configurations of the watercourses and ensure any residual impacts are adequately mitigated. Many of these additional investigations are outlined in the following sections, and would be documented in Project File Reports for the Schedule B projects.

Upgrades to existing undersized storm sewers within municipal rights-of-way falls under normal operational activities which are pre-approved (Schedule A) under the Municipal Class EA. The extension of the existing storm sewer northward within the Avonhead Road right-of-way is considered a Schedule A+ activity under the Municipal Class EA. Schedule A+ activities are also pre-approved, but require the public to be notified of the project prior to implementation. This Master Plan provides the required notification and as such the storm sewer upgrades and extension can proceed to detailed design, permitting and implementation.

The following sections provide guidance for implementation of all recommended projects, which have been split into those projects that will be implemented by the City and those that will be implemented by private property owners and developers.

The City of Mississauga will be responsible for implementation of projects to mitigate deficiencies in existing systems and bring them up to current standards, and for

projects that improve or enhance existing systems that are partially or entirely located on lands in public ownership.

Private property owners and developers will be responsible for implementing projects that would be required by the City or other agencies through the planning process for development or redevelopment of a site, projects that would facilitate or benefit the development or redevelopment of a site, and projects that would mitigate risks associated with failing infrastructure on private property.

For each project, information is provided regarding:

- **Targets and Objectives**: For some projects, such as on-site stormwater management controls for future development and storm sewer upgrades, the design criteria are clear and well established. For other projects such as watercourse realignments, objectives are provided but additional studies will be required to confirm the criteria and determine characteristics such as low flow channel dimensions and restoration planting plans.
- **Requirements for Future Studies**: This is not intended to be an exhaustive list of all studies that will be required for implementation of a project, but highlights and provides some information on the key required studies that have been identified through this Master Plan
- **Phasing**: Many of the recommended projects span multiple properties and are expected to be implemented in a phased approach. Information is provided interim measures that may be required to allow the works to proceed on a property basis, and the advantages in co-ordinating works with adjacent property owners and/or related projects are highlighted.
- **Approvals**: This is not intended to be an exhaustive list of all permits and approvals that will be required prior to construction, but highlights and provides some information on the key permits and approvals related to stormwater management and environmental protection.
- **Additional Considerations**: Where relevant, information is provided on other City and agency initiatives that could be integrated with the Master Plan projects to reduce costs and/or achieve greater benefits, and other resources that could aid in future preliminary and detailed design assignments.

The information is also presented in a series of tables included in **Appendix F**.

## 5.1 City of Mississauga Works

### 5.1.1 Current Standard Stormwater and Environmental Management Approach

The preferred solution includes maintaining the current standard approaches for stormwater management and environmental protection related to new development and redevelopment. The current stormwater management approach is based on application of the following criteria to new and redevelopment in the study area:

- **Erosion Control**: 5 mm rainfall retention for drainage areas less than 5ha and 25mm – 48hr detention for drainage areas greater than 5ha
- **Water Quality Control**: Enhanced Level of control (80% TSS removal)
- **Water Quantity Control – Discharge to Watercourses**: Control post development flows to pre development levels
- **Water Quantity Control – Discharge to Municipal Storm Sewers**: Control post development peak flows for up to the 100 year storm to the 2 year pre-development flow. This criterion was established through the previous Southdown District Master Drainage Plan (TSH, 2000).
- **Water Balance**: Maintain pre-development groundwater recharge to the extent feasible (this is usually considered satisfied by the retention of the first 5 mm of runoff)

The current approach to stormwater management will continue to evolve, and the applicable criteria may also change to reflect future best practices for stormwater management and low impact development.

There are no specific requirements of the City for continued adoption of the current SWM and environmental management criteria. The criteria are already in effect, and it is the responsibility of private developers to determine the most appropriate means of satisfying the above criteria as part of a planning application for new development or redevelopment. To the extent feasible, the City should encourage co-operation among developers with similar development timing to promote integrated stormwater management systems that could result in smaller and/or more effective stormwater treatment.

### 5.1.2 Clearview Creek Naturalization South of Lakeshore Road

This project involves the removal of the existing concrete channel south of Lakeshore Road and construction of a new natural channel to Lake Ontario. The works are located entirely on City land and are recommended to enhance aquatic and terrestrial habitat in Clearview Creek. As such, implementation of this project is the responsibility of the City of Mississauga.

#### 5.1.2.1 Criteria and Objectives

The proposed naturalized reach of Clearview Creek south of Lakeshore Road must contain all erosion and flood hazards. Based in the investigations carried out for this study, this would require a stream corridor with a base width of 42.0 m and an overall corridor width of 62.0m, including buffers. The reconstructed channel must also be designed and constructed to establish a self-sustaining, maintenance free natural heritage system.

#### 5.1.2.2 Requirements for Future Studies

A number of studies will be required to support preliminary and detailed design for this project.

- **Archaeological Investigation**: A Stage 2 Archaeological Assessment (AA) is required for areas that may be impacted by construction of the proposed channel realignment. The Stage 1 AA recommended test pits at 5 m intervals for this area. All reasonable efforts should be made to contact all indigenous communities that have a potential interest in the project prior to undertaking any Stage 2 AAs, as some communities may wish to have representatives present or participating in the studies, and should be provided additional opportunities to participate in the planning process as it proceeds towards implementation of these projects.
  If any archaeological resources are uncovered during the Stage 2AA or during construction, all work should be stopped and the identified indigenous communities should be contacted immediately.
- **Heritage Impact Assessment:** A heritage impact assessment may be required to demonstrate that the proposed realignment of Clearview Creek will not have any impact on the designated Bell Gairdner Estate heritage property.
- **Fluvial Geomorphologic Investigation:** The assessments completed for this study are sufficient to establish preliminary corridor widths for the naturalized streams, but addition studies will be needed during preliminary and detailed design to develop the most appropriate channel planform and ensure that erosion hazards are fully contained within the stream corridors.
- **Geotechnical Investigation**: This investigation is needed to determine soil properties to inform the design of the channel, including side slopes. It should also include laboratory analysis of soil samples as required by the ‘On-Site and Excess Soil Management’ (MECP, 2019) and Ontario Regulation 406/19 in force at the time of construction.
- **Hydrogeological Investigation**: This investigation will confirm seasonal groundwater levels in the areas impacted during construction, determine the

need for a Permit to Take Water (PTTW) or MECP Environmental Activity and Sector Registry (EASR) and support the eventual PTTW or EASR applications.

- **Utility Investigation:** While no significant utilities are anticipated in areas south of Lakeshore Road, a detailed utility investigation should be completed during preliminary design to confirm both above and below ground utilities in the vicinity of the proposed realigned channel.
- **Grading Design and Hydraulic Analyses:** Grading for the channel corridor needs to be advanced through the preliminary and detailed design stages, integrating the bankfull channel properties from the fluvial geomorphological investigation, and microtopography in the base of the corridor such as wetland pockets, valley wall side slopes and grading beyond the top of bank to match existing grades. The hydraulic analyses will also need to be updated at the preliminary and detailed design stages to confirm that the Regulatory flow can be contained within the channel corridor with at least 0.3 m freeboard.
- **Coastal Assessment**: Clearview Creek currently discharges to Lake Ontario via a relatively narrow channel, with large stone armouring the outlet and shoreline to the east and west. When reconstructed to a natural channel, there is a risk that wave action could deposit sand and stone at the mouth of the new channel, obstructing flow and potentially leading to flooding on either side of the channel upstream. A coastal investigation should be completed to support the design of the naturalized outlet to Lake Ontario and any measures needed to prevent chronic obstruction of the outlet.
- **Ecological Inventories**: Detailed ecological investigations are needed to inform the design of the realigned channel corridor and mitigation of potential impacts. This could include breeding amphibian surveys, breeding bird surveys, refined vegetation surveys and aquatic habitat assessments. The scope and methodology for the field investigations should be confirmed with CVC, DFO and MECP prior to undertaking the field investigations.
- **Tree Inventory and Tree Preservation Plan**: This inventory is needed to understand what vegetation will need to be removed for implementation, recommend protection for trees to be retained, and determine the compensation for removal of any mature vegetation.
- **Project File Report:** The results of the additional investigations and any refinements to the alignment and configuration of Clearview Creek will need to be documented in a Project File Report and posted for public review.

#### 5.1.2.3 Phasing

There are no constraints related to phasing the construction of the realignment of Clearview Creek. It is not dependent on other works, and can be implemented as a

single contract for its construction from Lakeshore Road to Lake Ontario. To the extent feasible, the realigned channel corridor should be constructed in the dry, with flows continuing in the existing concrete channel. Damming and pumping will be required for the channel connection at and south of Lakeshore Road.

The realignment of Clearview Creek could be co-ordinated with the realignment of Avonhead Creek. Co-ordination of these projects is discussed further in **Section 5.1.3**.

#### 5.1.2.4 Approvals

It is anticipated that the following permits and approvals will be required for construction of the realignment of Clearview Creek.

- **Credit Valley Conservation**: A permit will be required for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (Ontario Regulation 160/06).
- **Ministry of the Environment, Conservation and Parks**:
  - A Request for Review memo should be submitted to MECP with the results of the Species at Risk screening completed during detailed design.
  - Depending on construction requirements, registration on the Environmental Activity and Sector Registry or a Permit to Take Water may be required for construction site dewatering.
- **Fisheries and Oceans Canada**: A Request for Review should be submitted to the DFO to screen for potential requirements under the Fisheries Act. It is anticipated that serious harm can be avoided and Authorization by DFO is unlikely for this project.
- **City of Mississauga**: Formal planning approvals from the City are not required, as the City is the proponent and owns the property on which the works will occur. As the works are located on the property containing the Bell Gairdner Estate, a heritage impact assessment may be needed to support an approval under the City's heritage review process. In addition, the detailed design must consider input and be coordinated with or reviewed by a number of City departments, and it should be confirmed that project continues to comply with all other applicable City policies and by-laws at the time of construction.
- **Utilities**: Approvals will be required for utility owners for protection and/or relocation of existing above and below ground utilities.

#### 5.1.2.5 Additional Considerations

The City of Mississauga property on which these works will occur also includes the Bell Gairdner Estate, also known as the Harding Waterfront Estate. As noted in

**Section 1.2.3**, the City has a long term plan for the development of this parcel into a waterfront park, including realignment and naturalization of Clearview Creek and other ecological enhancements. The preliminary design for the realignment of Clearview Creek should be integrated into an overall plan for the Harding Waterfront Estate property. To the extent feasible, the channel realignment should be implemented as part of an overall project that includes all of the other planned park enhancements.

The realignment and naturalization of the existing concrete lined reach of Clearview Creek south of Lakeshore Road was also recommended by the CVC in their Lake Ontario Integrated Shoreline Strategy. There may be an opportunity to partner with CVC for implementation of this project.

### 5.1.3 Avonhead Creek South of Lakeshore Road

Currently, Avonhead Creek flows eastward in a swale along the north side of Lakeshore Road before entering an undersized storm sewer system west of Avonhead Road. This project would realign Avonhead Creek to cross under Lakeshore Road near the west limit of the concrete plant property and then turn west to join Clearview Creek before discharging to Lake Ontario. These works would alleviate the potential for flooding of Lakeshore Road related to the undersized storm sewer south of Lakeshore Road. The works are not required for future redevelopment of any properties north or south of Lakeshore Road and implementation of the project will therefore be the responsibility of the City of Mississauga.

#### 5.1.3.1 Criteria and Objectives

The proposed realigned and naturalized reach of Avonhead Creek south of Lakeshore Road must contain all erosion and flood hazards, and the new culvert under Lakeshore Road must meet applicable road drainage design standards and not worsen flooding on the private properties north of Lakeshore Road.

The system should be designed based on the full flows in Avonhead Creek. Recall from **Section 3.5.2** that the realignment and restoration of Avonhead Creek north of Lakeshore Road would remove the existing structure that directs all storm runoff above baseflow to the Hazelhurst Road storm sewer system.

Based in the investigations carried out for this study, it is estimated that the culvert under Lakeshore Road would require a height of approximately 2.4 m and a total span of at least 4.0 m. The final size of the culvert should be sized to convey the Regulatory storm flow without overtopping, and should be designed to be safe from erosion and facilitate wildlife passage to the extent feasible.

The stream corridor south of Lakeshore Road to connect with Cleaview Creek would have a base wide of 37.0m and an overall corridor width of 57.0m, including buffers. The reconstructed channel must also be designed and constructed to establish a self-sustaining, maintenance free natural heritage system.

#### 5.1.3.2 Requirements for Future Studies

A number of studies will be required to support preliminary and detailed design for this project.

- **Archaeological Investigation**: A Stage 2 Archaeological Assessment (AA) is required for a portion of the area that may be impacted by construction of the proposed channel realignment. The Stage 1 AA recommended test pits at 5 m intervals for the previously undisturbed areas along the channel alignment.
  All reasonable efforts should be made to contact all indigenous communities that have a potential interest in the project prior to undertaking any Stage 2 AAs, as some communities may wish to have representatives present or participating in the studies, and should be provided additional opportunities to participate in the planning process as it proceeds towards implementation of these projects.
  If any archaeological resources are uncovered during the Stage 2AA or during construction, all work should be stopped and the identified indigenous communities should be contacted immediately.
- **Heritage Impact Assessment:** A heritage impact assessment may be required to demonstrate that the proposed realignment of Avonhead Creek will not have any impact on the designated Bell Gairdner Estate heritage property, located at the west limit of the realignment and confluence with Clearview Creek.
- **Fluvial Geomorphologic Investigation:** The assessments completed for this study are sufficient to establish preliminary corridor widths for the naturalized streams, but addition studies will be needed during preliminary and detailed design to develop the most appropriate channel planform and ensure that erosion hazards are fully contained within the stream corridors.
- **Geotechnical Investigation**: This investigation is needed to determine soil properties to inform the design of the Lakeshore Road culvert and channel, including side slopes. It should also include laboratory analysis of soil samples as required by the ‘On-Site and Excess Soil Management’ (MECP, 2019) and Ontario Regulation 406/19 in force at the time of construction.
- **Hydrogeological Investigation**: This investigation will confirm seasonal groundwater levels in the areas impacted during construction, determine the need for a Permit to Take Water (PTTW) or MECP Environmental Activity and Sector Registry (EASR) and support the eventual PTTW or EASR applications.

- **Utility Investigation: A** detailed utility investigation should be completed during preliminary design to confirm both above and below ground utilities in the vicinity of the proposed new culvert under Lakeshore Road and realigned channel segments both north and south of Lakeshore Road.
- **Grading Design and Hydraulic Analyses:** Grading for the channel corridor needs to be advanced through the preliminary and detailed design stages, integrating the bankfull channel properties from the fluvial geomorphological investigation, and microtopography in the base of the corridor such as wetland pockets, valley wall side slopes and grading beyond the top of bank to match existing grades. The hydraulic analyses will also need to be updated at the preliminary and detailed design stages to refine the size of the culvert under Lakeshore Road and confirm that the Regulatory flow can be contained within the channel corridor with at least 0.3 m freeboard.
- **Ecological Inventories**: Detailed ecological investigations are needed to inform the design of the realigned channel corridor and mitigation of potential impacts. This could include breeding amphibian surveys, breeding bird surveys, refined vegetation surveys and aquatic habitat assessments. The scope and methodology for the field investigations should be confirmed with CVC, DFO and MECP prior to undertaking the field investigations.
- **Tree Inventory and Tree Preservation Plan**: This inventory is needed to understand what vegetation will need to be removed for implementation, recommend protection for trees to be retained, and determine the compensation for removal of any mature vegetation.
- **Project File Report:** The results of the additional investigations and any refinements to the alignment and configuration of Clearview Creek will need to be documented in a Project File Report and posted for public review. It is recommended that that realignment of both Clearview Creek and Avonhead Creek south of Lakeshore Road be documented in a single Project File Report.

#### 5.1.3.3 Phasing

As noted in **Section 5.1.2**, the proposed realigned Avonhead Creek is intended to join with the proposed realigned Clearview Creek south of Lakeshore Road. Ideally the projects should be completed at the same time, or the Clearview Creek improvements should proceed prior to the Avonhead Creek realignment. The realignment of Avonhead Creek can proceed first with a temporary connection to the existing concrete lined Clearview Creek south of Lakeshore Road, but this could complicate construction of the subsequent Clearview Creek improvements.

The design and construction of the realignment of Avonhead Creek at and south of Lakeshore Road should also be co-ordinated with the reconstruction and

naturalization of Avonhead Creek through the concrete plant property to the north. If the Avonhead Creek improvements at and south of Lakeshore Road proceed ahead of the works on the private property to the north, interim channel works will be needed on the concrete plant property to direct the flows in Avonhead Creek to the new culvert under Lakeshore Road. Consultation with the property owner will also be required to co-ordinate the design of the culvert under Lakeshore Road with current, short term and long term plans for the property.

#### 5.1.3.4 Approvals

It is anticipated that the following permits and approvals will be required for construction of the realignment of Avonhead Creek.

- **Credit Valley Conservation**: A permit will be required for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (Ontario Regulation 160/06).
- **Ministry of the Environment, Conservation and Parks**:
  - A Request for Review memo should be submitted to MECP with the results of the Species at Risk screening completed during detailed design.
  - Depending on construction requirements, registration on the Environmental Activity and Sector Registry or a Permit to Take Water may be required for construction site dewatering.
- **Fisheries and Oceans Canada**: A Request for Review should be submitted to the DFO to screen for potential requirements under the Fisheries Act. It is anticipated that serious harm can be avoided and Authorization by DFO is unlikely for this project.
- **City of Mississauga**: Formal planning approvals from the City are not required, as the City is the proponent and owns or will acquire the property on which the works will occur. As a small portion of the work is located on the property containing the Bell Gairdner Estate, a heritage impact assessment may be needed to support an approval under the City's heritage review process. In addition, the detailed design must consider input and be coordinated with or reviewed by a number of City departments, and it should be confirmed that project continues to comply with all other applicable City policies and by-laws at the time of construction.
- **Utilities**: Approvals will be required for utility owners for protection and/or relocation of existing above and below ground utilities, especially for the proposed new culvert under Lakeshore Road

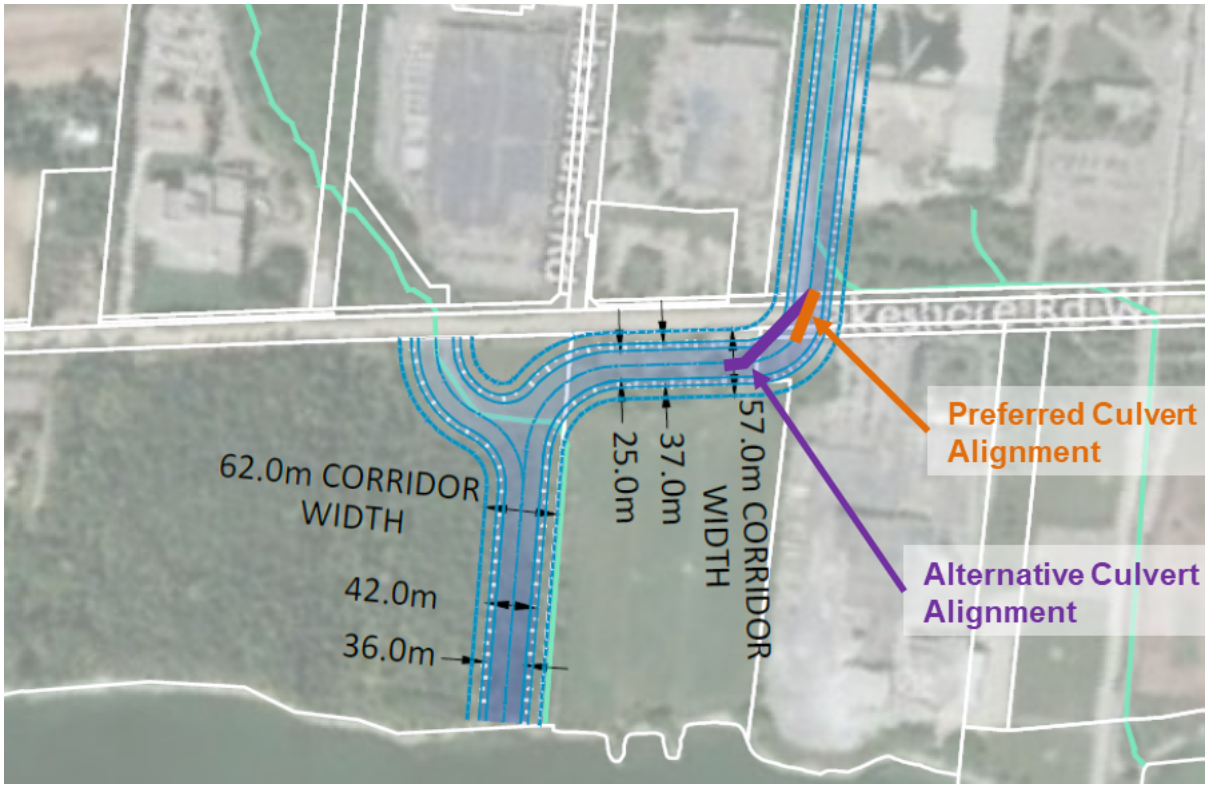
#### 5.1.3.5 Additional Considerations

The majority of the proposed realigned Avonhead Creek will be located on lands currently in private ownership. The concept design is based on Avonhead Creek continuing south under Lakeshore Road via a culvert sized for the Regional storm event before turning west in a naturalized channel on the south side of Lakeshore Road. This alignment requires the City to secure land from two different property owners for the channel, and may require a second culvert crossing to provide access to the property immediately east of the City's Harding Waterfront Estate property. If it is not possible to secure property and/or there are challenges to reinstate a driveway access to the property, consideration could be given to installing the new culvert under Lakeshore Road at an angle and extending it a sufficient distance to the west to avoid impacts to the eastern property and provide an entrance to the western property without a second culvert over the realigned channel, as illustrated on **Figure 5-1**.

Recall from **Section 5.1.3.3** that interim works may be needed on the concrete plant property if the works at and south of Lakeshore Road proceed ahead of the reconstruction and naturalization of the channel through the concrete plant property. If the City's works at and south of Lakeshore Road proceed first, a temporary or permanent easement will be needed to allow the City to undertake the interim channel realignment on the concrete plant property to connect Avonhead Creek to the proposed new culvert under Lakeshore Road.

Daylighting Avonhead Creek south of Lakeshore Road was also recommended by the CVC in their Lake Ontario Integrated Shoreline Strategy. There may be an opportunity to partner with CVC for implementation of this project.

**Figure 5-1 Clearview and Avonhead Creek Outlet to Lake Ontario**




### 5.1.4 Avonhead Road Storm Sewer System Modifications

This project involves removal and replacement of the existing storm sewer systems on and east of Avonhead Road and Lakeshore Road east of Avonhead Road. These works are needed to mitigate the undersized storm sewer systems on Avonhead Road and in the undeveloped lands to the east that continue through the Clarkson WWTP property. The new storm sewer on Avonhead and Lakeshore Roads will be sized to accept controlled flows from future developments to the east and will facilitate future development by eliminating the capacity restrictions and property constraints imposed by the existing undersized storm sewer system that continues through the Clarkson WWTP property.

It is recognized that future development is not dependent on this solution. Future developments to the east could control storm runoff to the available capacity in the storm sewer system that continues through the Clarkson WWTP, though this is likely more restrictive than current standard criteria for peak flow control and would require approval from Peel Region for any change in flow to the storm sewer system within the Clarkson WWTP property.

The City is responsible for the existing municipal storm sewer system and replacement of deteriorated or deficient infrastructure. The City of Mississauga is

therefore primarily responsible for replacement of the existing undersized storm sewers on Avonhead Road. Extension of the storm sewer further north, enlarging it to accommodate flows from future development to the east and decommissioning the existing storm sewers leading to the Clarkson WWTP would benefit future development east of Avonhead Road. Private development east of Avonhead Road would therefore be responsible for the difference in pipe size, length and cost between the recommended solution and the upgrades required by the City based on the storm runoff currently draining to Avonhead Road. More information on the private and public funding of these works is included in the following sections.

#### 5.1.4.1 Criteria and Objectives

The new storm sewer system on Avonhead and Lakeshore Road is to be designed to meet all applicable City and Provincial standards. The storm sewer system will be designed to convey the runoff from a 10 year storm from the Avonhead right-of-way and controlled flows from future developments east of Avonhead Road. The preliminary sewer has been sized based on future developments east of Avonhead Road controlling peak flow rates from up to the 100 year storm to the 2 year storm pre-development flow as per the current and recommended SWM criteria (**Section 5.1.1**).

#### 5.1.4.2 Requirements for Future Studies

A number of studies will be required to support preliminary and detailed design for this project.

- **Geotechnical Investigation**: This investigation is needed to confirm sub-surface conditions along Avonhead Road and inform the design of the storm sewer system. It should also include laboratory analysis of soil samples as required by the ‘On-Site and Excess Soil Management’ (MECP, 2019) and Ontario Regulation 406/19 in force at the time of construction.
- **Utility Investigation:** A detailed utility investigation should be completed during preliminary design to confirm both above and below ground utilities within the Avonhead Road right-of-way and identify any conflicts with the planned storm sewer.
- **Cost Sharing Agreement:** Further study is needed to establish the fair sharing of costs between the City and future private development east of Avonhead Road. As noted in **Section 5.1.4**, the City is responsible for upgrades to the storm sewers to meet current standards based on existing drainage conditions, and private development is responsible for the additional costs to upsize the storm sewers to accommodate controlled flows from future development east of Avonhead Road.

#### 5.1.4.3 Phasing

There are no constraints related to phasing the construction of the proposed storm sewer, but there are some considerations regarding co-ordination of the storm sewer upgrade with potential future development of the lands to the east (See **Section 5.1.4.5**).

#### 5.1.4.4 Approvals

It is anticipated that the following permits and approvals will be required for construction of the new storm sewer on Avonhead Road and Lakeshore Road.

- **Ministry of the Environment, Conservation and Parks**:
  - An update to the existing Environmental Compliance Approval (ECA) will be needed for the new storm sewer.
  - Depending on construction requirements, registration on the Environmental Activity and Sector Registry or a Permit to Take Water may be required for construction site dewatering.
- **City of Mississauga**: Formal approvals from the City are not required, as the City is the proponent and the works will occur in the City's right-of-way. However, the detailed design must consider input and be coordinated with or reviewed by a number of City departments, and it should be confirmed that project continues to comply with all applicable City policies and by-laws at the time of construction.
- **Region of Peel**: The Region should be provided an opportunity to review the plans prior to construction and confirm the residual capacity in the storm sewers continuing through the Clarkson WWTP under both existing and proposed conditions.
- **Utilities**: Approvals will be required for utility owners for protection and/or relocation of existing above and below ground utilities.

Note that as the existing pipe under Lakeshore Road and outfall to Lakeside Creek will be preserved, all works will be outside CVC's regulated area and a permit from CVC will not be required.

#### 5.1.4.5 Additional Considerations

The new sewer on Avonhead and Lakeshore Road is intended to replace most of the existing undersized storm sewer system located east of Avonhead Road and continuing through the Clarkson WWTP site. It has been assumed that a small area north of the WWTP may not be able to direct storm drainage to Avonhead Road due to topographic and property constraints and will continue to discharge to the existing storm sewer continuing through the WWTP. Discharge from future development of

the remaining land will be controlled to the available capacity in the sewer continuing through the WWTP.

In the event that development of the lands east of Avonhead Road proceeds ahead of the City's schedule for replacing the Avonhead Road storm sewer, discussions between the City and development proponents will be required to make arrangements to fund and advance construction of the storm sewer replacement. There are a number of different potential arrangements for either the City or developer to take responsibility for its design and construction and for the costs to be shared fairly between the City and developers.

### 5.1.5 Southdown, Bromsgrove and Widemarr Road Storm Sewer Upgrades

This project involves replacement and upgrades for several storm sewer systems in the study area. At Southdown Road, the parallel existing storm sewers in the roadway would be replaced with appropriately sized single storm sewers. For Bromsgrove and Widemarr Road, the storm sewer may need to accommodate a larger flow rate and/or other improvements to the roadway may be needed to contain major system drainage within the existing road rights-of-way.

#### 5.1.5.1 Criteria and Objectives

The upgraded storm sewer systems are to be designed to meet all applicable City and Provincial standards. This includes capture and conveyance of the runoff from a 10 year storm within the storm sewers, and containment of the major system flow for up to a 100 year event within the road right-of-way. Near the downstream end of the storm sewer system on Southdown Road, approximately 750 m upstream of the outfall, the total upstream contributing drainage area will pass the 100 ha threshold and require the storm sewer to be designed to convey the runoff from a 25 year storm event.

#### 5.1.5.2 Requirements for Future Studies

A number of studies will be required to support preliminary and detailed design for this project.

- **Detailed Minor and Major Drainage Analyses** for Bromsgrove and Widemarr Road: A more detailed hydrologic and hydraulic analysis is recommended for this drainage system to verify the inadequate storm sewer capacity and more accurately determine the major system drainage will spill from the road rights-of-way in a 100 year storm. The investigation should also evaluate the need for additional catchbasins and/or high capacity inlet grates to increase the amount of runoff directed to the minor drainage system sufficient to contain major system flows to the road right-of-way in a 100 year storm event.

- **Geotechnical Investigation**: This investigation is needed to confirm sub-surface conditions along the roadways and inform the design of the storm sewer systems. It should also include laboratory analysis of soil samples as required by the 'On-Site and Excess Soil Management' (MECP, 2019) and Ontario Regulation 406/19 in force at the time of construction.
- **Utility Investigation:** A detailed utility investigation should be completed during preliminary design to confirm both above and below ground utilities within the road rights-of-way and identify any conflicts with the planned storm sewer upgrades

#### 5.1.5.3 Phasing

There are no constraints related to phasing the construction of the proposed storm sewer, but there are some considerations regarding integration of the storm sewer upgrade with future road reconstruction projects (See **Section 5.1.5.5**).

#### 5.1.5.4 Approvals

It is anticipated that the following permits and approvals will be required for the storm sewer upgrades on Southdown, Bromsgrove and Widemarr Roads

- **Credit Valley Conservation**: A permit will be required for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (Ontario Regulation 160/06) associated with the outfall from the upgraded storm sewer system on Southdown Road to Lake Ontario.
- **Ministry of the Environment, Conservation and Parks**:
  - An update to the existing Environmental Compliance Approval (ECA) may be needed for upgraded storm sewers.
  - Depending on construction requirements, registration on the Environmental Activity and Sector Registry or a Permit to Take Water may be required for construction site dewatering.
- **City of Mississauga**: Formal approvals from the City are not required, as the City is the proponent and the works will occur in the City's rights-of-way. However, the detailed design must consider input and be coordinated with or reviewed by a number of City departments, and it should be confirmed that project continues to comply with all applicable City policies and by-laws at the time of construction.
- **Utilities**: Approvals will be required for utility owners for protection and/or relocation of existing above and below ground utilities.

#### 5.1.5.5 Additional Considerations

The analyses for the Southdown Road drainage system determined that the major overland flows can be safely conveyed and contained within the existing road right-of-way, even with the undersized storm sewers. There is therefore little urgency to upgrade this system, and it is recommended that the storm sewer upgrades be integrated into future road and/or infrastructure (water and sewer) renewal projects for Southdown Road as scheduled in the City's asset management and capital project planning framework.

For the Bromsgrove and Widemarr Road storm drainage systems, the analyses indicate that the roadway cannot contain the overland flow in 100 year storm event. If the more detailed analyses recommended in **Section 5.1.5.2** confirm that the 100 year storm flow cannot be contained within the road right-of-way, the undersized storm sewers should be replaced as a standalone project if the roadway and other infrastructure are in otherwise good condition and not scheduled for reconstruction in the near future.

## 5.2 Landowner and Private Development Works

### 5.2.1 Current Standard Stormwater and Environmental Management Approach

Future development in the study area will be required to satisfy current guidelines and criteria for stormwater management and environmental protection.

The current stormwater management approach is based on application of the following criteria to new and redevelopment in the study area:

- **Erosion Control**: 5 mm rainfall retention for drainage areas less than 5ha and 25mm – 48hr detention for drainage areas greater than 5ha
- **Water Quality Control**: Enhanced Level of control (80% TSS removal)
- **Water Quantity Control – Discharge to Watercourses**: Control post development flows to pre development levels
- W**ater Quantity Control – Discharge to Municipal Storm Sewers:** Control post development peak flows for up to the 100 year storm to the 2 year pre-development flow. This criterion was established through the previous Southdown District Master Drainage Plan (TSH, 2000).
- **Water Balance**: Maintain pre-development groundwater recharge to the extent feasible. Low Impact Development (LID) strategies to achieve this target should be prioritized for areas associated with coarse grained soils, high infiltration capacity and adequate depth to the water table. All water balance measures

must comply with the Source Protection Plan policies associated with the Highly Vulnerable Aquifers present in much of the study area **(Figure 2-5**).

The current approach to stormwater management will continue to evolve, and the applicable criteria may also change to reflect future best practices for stormwater management and low impact development.

Future development in the study area is also required to protect and enhance the natural heritage systems in accordance will all relevant federal, provincial, Region, City and conservation authority policies and standards.

Design, approval and construction of stormwater management infrastructure for future development and redevelopment in the study area is the responsibility of the developer as part of the normal development process for each property. The developer or property owner will also be responsible for long term operation and maintenance of all on-site stormwater management controls.

### 5.2.2 Clearview Creek Realignment East of Winston Churchill Boulevard

This project involves the reconstruction and realignment of Clearview Creek from Winston Churchill Boulevard for a distance of approximately 700 m, transitioning back to the existing channel a short distance north of the existing on-line pond. The reconstructed channel would cross and require land from numerous private properties, and it is expected that the works would be implemented as part of larger plans for development of the lands on both sides of the proposed realigned watercourse. Implementation would be the responsibility of the private landowners and developers, but it is expected that the channel corridor would be conveyed into public ownership once constructed.

#### 5.2.2.1 Criteria and Objectives

The proposed naturalized Clearview Creek east of Winston Churchill Boulevard must contain all erosion and flood hazards. Based in the investigations carried out for this study, this would require a stream corridor with a base wide of 42.0m and an overall corridor width of 62.0m, including buffers. The reconstructed channel must also be designed and constructed to establish a self-sustaining, maintenance free natural heritage system.

#### 5.2.2.2 Requirements for Future Studies

A number of studies will be required to support preliminary and detailed design for this project. It is expected that the channel would be implemented as part of an overall development plan for the properties fronting Winston Churchill Boulevard.

Many of the following studies would be required to support a development application even if it did not include a channel re-alignment.

- **Archaeological Investigation**: A Stage 2 Archaeological Assessment (AA) is required for areas that may be impacted by construction of the proposed channel realignment. The Stage 1 AA recommended test pits at 5 m intervals for this area. All reasonable efforts should be made to contact all indigenous communities that have a potential interest in the project prior to undertaking any Stage 2 AAs, as some communities may wish to have representatives present or participating in the studies, and should be provided additional opportunities to participate in the planning process as it proceeds towards implementation of these projects.
  If any archaeological resources are uncovered during the Stage 2AA or during construction, all work should be stopped and the identified indigenous communities should be contacted immediately.
- **Heritage Impact Assessment:** A heritage impact assessment will be required to demonstrate that the proposed realignment of Clearview Creek will not have any impact on the heritage values of the designated Gold Medal Farm property at 381 Winston Churchill Boulevard.
- **Fluvial Geomorphologic Investigation:** The assessments completed for this study are sufficient to establish preliminary corridor widths for the naturalized streams, but additional studies will be needed during preliminary and detailed design to develop the most appropriate channel planform and ensure that erosion hazards are fully contained within the stream corridors.
  In particular, the fluvial geomorphology study and natural channel design should all potential long term erosion risks are effectively mitigated at the proposed sharp bend in the channel corridor alignment east of Winston Churchill Boulevard.
- **Geotechnical Investigation**: This investigation is needed to determine soil properties and inform the design of the channel, including side slopes. It should also include laboratory analysis of soil samples as required by the ‘On-Site and Excess Soil Management’ (MECP, 2019) and Ontario Regulation 406/19 in force at the time of construction.
- **Hydrogeological Investigation**: This investigation will confirm seasonal groundwater levels in the areas impacted during construction, determine the need for a Permit to Take Water (PTTW) or MECP Environmental Activity and Sector Registry (EASR) and support the eventual PTTW or EASR applications.
- **Utility Investigation:** While no significant utilities are anticipated in the areas beyond Winston Churchill Boulevard, a detailed utility investigation should be

completed during preliminary design to confirm both above and below ground utilities in the vicinity of the proposed realigned channel.

- **Grading Design and Hydraulic Analyses:** Grading for the channel corridor needs to be advanced through the preliminary and detailed design stages, integrating the bankfull channel properties from the fluvial geomorphological investigation, and microtopography in the base of the corridor such as wetland pockets, valley wall side slopes and grading beyond the top of bank to match existing grades. The hydraulic analyses will also need to be updated at the preliminary and detailed design stages to confirm that the Regulatory flow can be contained within the channel corridor with at least 0.3 m freeboard.
- **Ecological Inventories**: Detailed ecological investigations are needed to inform the design of the realigned channel corridor, integrate linkages to existing nearby woodlots, and mitigation of potential impacts. This could include breeding amphibian surveys, breeding bird surveys, refined vegetation surveys and aquatic habitat assessments. The scope and methodology for the field investigations should be confirmed with CVC, DFO and MECP prior to undertaking the field investigations.
- **Tree Inventory and Tree Preservation Plan**: This inventory is needed to understand what vegetation will need to be removed for implementation, recommend protection for trees to be retained, and determine the compensation for removal of any mature vegetation.
- **Project File Report:** The results of the additional investigations and any refinements to the alignment and configuration of Clearview Creek will need to be documented in a Project File Report and posted for public review.

  If the creek realignment is carried out as part of a larger plan for development or redevelopment which is subject to municipal planning approvals, the works are exempt from a Municipal Class EA and the Project File Report would not be required.

#### 5.2.2.3 Phasing

The conceptual alignment for the proposed realigned creek would straddle the property line at the rear of the properties fronting onto Winston Churchill Boulevard. As a result, numerous properties will be impacted for implementation of the channel corridor.

To the extent feasible, the channel realignment should be constructed as single project, funded by active developers and owners of the properties fronting onto Winston Churchill Boulevard and with arrangements and agreements to implement the channel on non-participating properties.

In the event that arrangements cannot be made to implement the entire project in a single phase, a phased implementation could potentially be considered. A phased approach would require interim works to transition to the existing channel at the upstream and downstream limit of a realigned reach and may require a shift in the channel alignment to contain the entire corridor within the limits of the participating development properties. Note that implementation on a property-by-property basis is unlikely, as the interim connections to the existing channel to the north and south may not be feasible and/or would occupy the majority of the existing channel corridor as well as the ultimate channel corridor.

#### 5.2.2.4 Approvals

It is anticipated that the following permits and approvals will be required for construction of the realignment of Clearview Creek.

- **Credit Valley Conservation**: A permit will be required for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (Ontario Regulation 160/06).
- **Ministry of the Environment, Conservation and Parks**:
  - A Request for Review memo should be submitted to MECP with the results of the Species at Risk screening completed during detailed design.
  - Depending on construction requirements, registration on the Environmental Activity and Sector Registry or a Permit to Take Water may be required for construction site dewatering.
- **Fisheries and Oceans Canada**: A Request for Review should be submitted to the DFO to screen for potential requirements under the Fisheries Act. It is anticipated that serious harm can be avoided and Authorization by DFO is unlikely for this project.
- **City of Mississauga**: Approvals will be needed under the Lot Grading and Municipal Services Protection By-law if the works are implemented outside of a development application. A Heritage Approval will also be required for works on the designated Gold Medal Farm heritage property.
- **Region of Peel**: A Road Occupancy Permit will be required for a construction access from Winston Churchill Boulevard
- **Utilities**: Approvals will be required for utility owners for protection and/or relocation of existing above and below ground utilities.

#### 5.2.2.5 Additional Considerations

The preferred alignment for the proposed realigned Clearview Creek would straddle the property line at the rear of the properties fronting onto Winston Churchill

Boulevard, whereas the existing creek channel generally traverses the properties fronting onto Winston Churchill Boulevard.

In the event that an agreement cannot be reached with the property owner to the east to implement a portion of the channel corridor west of the property limit, the alignment could be shifted westward to contain the entire Clearview Creek channel corridor within the properties fronting onto Winston Churchill Boulevard.

### 5.2.3 Clearview Creek Dam Removal North of Lakeshore Road

This project involves removal of the existing on-line pond and re-instatement of a natural watercourse along this reach of Clearview Creek north of Lakeshore Road. The property owner is responsible for the removal of the on-line pond. Removal of the pond will eliminate current risks and liability associated with failure of the on-line pond control structure and impacts to downstream property and infrastructure. However, there is no mechanism for the City to compel the property owner to undertake the works outside of a development application for the property.

#### 5.2.3.1 Criteria and Objectives

The proposed natural channel to replace the on-line pond must be designed to be stable, require no long-term maintenance and not impede fish passage along Clearview Creek. The dimensions and characteristics of the re-instated watercourse will be determined through detailed design for the on-line pond removal.

#### 5.2.3.2 Requirements for Future Studies

A number of studies will be required to support preliminary and detailed design for this project. These include

- **Archaeological Investigation**: The on-line pond itself does not have any archaeological potential, but the lands surrounding the pond retain some archaeological potential. These surrounding lands could potentially be impacted for removal of the on-line pond and reinstatement of a natural channel. A Stage 2 Archaeological Assessment (AA) is required for the areas potentially impacted during construction. The Stage 1 AA recommended test pits or pedestrian surveys at 5 m intervals for this area, depending on land cover.
  All reasonable efforts should be made to contact all indigenous communities that have a potential interest in the project prior to undertaking any Stage 2 AAs, as some communities may wish to have representatives present or participating in the studies, and should be provided additional opportunities to participate in the planning process as it proceeds towards implementation of these projects.
  If any archaeological resources are uncovered during the Stage 2AA or during

construction, all work should be stopped and the identified indigenous communities should be contacted immediately.

- **Heritage Impact Assessment:** A heritage impact assessment will be required to demonstrate that the proposed removal of the on-line pond will not have any impact on the heritage values of the designated Gold Medal Farm property at 381 Winston Churchill Boulevard.
- **Fluvial Geomorphologic Investigation:** A detailed fluvial geomorphologic investigation will be needed to support the design of the natural channel to replace the on-line pond and provide a stable transition to the existing channel upstream and downstream of the pond.
- **Geotechnical Investigation**: This investigation is needed to determine soil properties inform the design of the channel, including side slopes. It should also include laboratory analysis of soil and pond sediment samples as required by the 'On-Site and Excess Soil Management' (MECP, 2019) and Ontario Regulation 406/19 in force at the time of construction.
- **Hydrogeological Investigation**: This investigation will confirm seasonal groundwater levels in the areas impacted during construction, determine the need for a Permit to Take Water (PTTW) or MECP Environmental Activity and Sector Registry (EASR) and support the eventual PTTW or EASR applications.
- **Utility Investigation:** While no utilities are anticipated in the vicinity of the on-line pond, a utility investigation should be completed to determine if there are any above or below ground utilities along the construction access route that could be impacted during construction.
- **Hydraulic Analyses:** Hydraulic modelling should be completed to confirm the flow velocities for the design of the natural channel and to verify that removal of the on-line pond and reinstatement of a natural channel will not increase the extent of flooding on neighbouring properties upstream or downstream of the existing pond.
- **Ecological Inventories**: Detailed ecological investigations are needed to inform the design for the on-line pond removal and mitigation of potential impacts. This could include breeding amphibian surveys, breeding bird surveys, refined vegetation surveys and aquatic habitat assessments. The scope and methodology for the field investigations should be confirmed with CVC, DFO and MECP prior to undertaking the field investigations.
- **Tree Inventory and Tree Preservation Plan**: This inventory is needed to understand what vegetation will need to be removed for implementation, recommend protection for trees to be retained, and determine the compensation for removal of any mature vegetation.

- **Project File Report:** The results of the additional investigations and preliminary design of the dam removal and natural channel construction will need to be documented in a Project File Report and posted for public review.

  If the dam removal is carried out as part of a larger plan for development or redevelopment which is subject to municipal planning approvals, the works are exempt from a Municipal Class EA and the Project File Report would not be required.

#### 5.2.3.3 Phasing

Removal of the on-line pond and reinstatement of a natural channel is an isolated project, fully contained with a single property and can be completed in a single phase. If timing allows, removal of the dam could be co-ordinate with the re-alignment of Clearview Creek north of the existing on-line pond.

#### 5.2.3.4 Approvals

It is anticipated that the following permits and approvals will be required for removal of the existing on-line pond.

- **Credit Valley Conservation**: A permit will be required for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (Ontario Regulation 160/06).
- **Ministry of the Environment, Conservation and Parks**:
  - A Request for Review memo should be submitted to MECP with the results of the Species at Risk screening completed during detailed design.
  - Depending on construction requirements, registration on the Environmental Activity and Sector Registry or a Permit to Take Water may be required for construction site dewatering.
- **Ministry of Natural Resources and Forestry**: The structure that regulates water levels in the on-line pond could potentially meet the definition of a dam under the Lakes and Rivers Improvement Act (LRIA), in which case approval from MNRF would be required for its removal. It is recommended that the proponent consult with MNRF prior to commencing detailed design of the removal to determine if approvals under the LRIA will be required.
- **Ministry of Natural Resources and Forestry**: A Wildlife Scientific Collector's Authorization and License to Collect Fish for Scientific Purposes will be required for removal of any fish and amphibians prior to dewatering the on-line pond. A Fish and Wildlife Salvage Plan will be needed to support the approvals from MNRF.

- **Fisheries and Oceans Canada**: A Request for Review should be submitted to the DFO to screen for potential requirements under the Fisheries Act. It is anticipated that serious harm can be avoided and Authorization by DFO is unlikely for this project.
- **City of Mississauga**: Approvals will be needed under the Lot Grading and Municipal Services Protection By-law if the works are implemented outside of a development application. A Heritage Approval will also be required for works on the designated Gold Medal Farm heritage property.
- **Region of Peel**: A Road Occupancy Permit will be required for a construction access from Winston Churchill Boulevard
- **Utilities**: Approvals will be required for utility owners for protection and/or relocation of existing above and below ground utilities.

#### 5.2.3.5 Additional Considerations

The removal of the existing on-line pond and restoration of a natural channel can be implemented independent from the recommended realignment of Clearview Creek east of Winston Churchill Boulevard or south of Lakeshore Road. However, the project area is only a short distance south of the downstream limit of the Clearview Creek realignment project (**Section 5.2.2**) and would involve similar construction practices. It is expected that there would be cost savings if the on-line pond removal were combined with the upstream improvements to Clearview Creek in a single construction project.

### 5.2.4 Avonhead Creek Flood Improvements North of CNR Tracks

Flooding both north and south of the rail tracks can be reduced by replacing a culvert and widening the channel for a short distance upstream and downstream of the replacement culvert at the corner of the property at 2500 Royal Windsor Drive.

#### 5.2.4.1 Criteria and Objectives

The culvert and channel must be designed to prevent any increases in the extent of flooding on the properties to the east and west of 2500 Royal Windsor Drive. The channel must also be designed to be stable and to minimize the need for long term maintenance.

#### 5.2.4.2 Requirements for Future Studies

A number of studies will be required to support preliminary and detailed design for this project. These include

- **Archaeological Investigation**: The Stage 1 Archaeological Assessment (AA) indicated that some of the lands north of the rail tracks retain some

archaeological potential. A Stage 2 AA is required for the areas potentially impacted during construction. The Stage 1 AA recommended test pits at 5 m intervals for this area.
All reasonable efforts should be made to contact all indigenous communities that have a potential interest in the project prior to undertaking any Stage 2 AAs, as some communities may wish to have representatives present or participating in the studies, and should be provided additional opportunities to participate in the planning process as it proceeds towards implementation of these projects.
If any archaeological resources are uncovered during the Stage 2AA or during construction, all work should be stopped and the identified indigenous communities should be contacted immediately.

- **Fluvial Geomorphologic Investigation:** A detailed fluvial geomorphologic investigation will be needed to support the design of the channel to ensure that it will be stable and appropriate for the existing flow regime in the system.
- **Geotechnical Investigation**: This investigation is needed to determine soil properties inform the design of the culvert and channel. It should include laboratory analysis of soil samples as required by the 'On-Site and Excess Soil Management' (MECP, 2019) and Ontario Regulation 406/19 in force at the time of construction.
- **Hydrogeological Investigation**: This investigation will confirm seasonal groundwater levels in the areas impacted during construction, determine the need for a Permit to Take Water (PTTW) or MECP Environmental Activity and Sector Registry (EASR) and support the eventual PTTW or EASR applications.
- **Utility Investigation:** A detailed utilities investigation should be completed during preliminary design to confirm both above and below ground utilities in the vicinity of the proposed realigned channel. Recall from **Section 3.5.3** that there is a significant Enbridge pipeline on the north side of the tracks, and it will be critical to avoid impacts to the pipeline and any other utilities potentially within the construction area.
- **Hydraulic Analyses:** The HEC-RAS 2D hydraulic modelling completed by CVC staff should be refined based on a detailed topographic survey of the existing culvert and channel, and the preliminary size of the replacement culvert and channel from the CVC modelling should be confirmed or refined to prevent any adverse off-site impacts.
- **Ecological Inventories**: Limited ecological investigations are needed to inform the design for the channel widening and culvert replacement and mitigation of potential impacts. This could include breeding bird surveys, refined vegetation surveys and aquatic habitat assessments. The scope and methodology for the

field investigations should be confirmed with CVC, DFO and MECP prior to undertaking the field investigations.

- **Tree Inventory and Tree Preservation Plan**: This inventory is needed to understand what vegetation will need to be removed for implementation, recommend protection for trees to be retained, and determine the compensation for removal of any mature vegetation.
- **Project File Report:** The results of the additional investigations and any refinements to the recommended improvements to Avonhead Creek will need to be documented in a Project File Report and posted for public review.

  If the creek improvements are carried out as part of a larger plan for development or redevelopment which is subject to municipal planning approvals, the works are exempt from a Municipal Class EA and the Project File Report would not be required.

#### 5.2.4.3 Phasing

The culvert replacement and channel widening can be undertaken independent from any other works. If timing allows, it would be preferable to co-ordinate these works with the grading recommended for the property on the south side of the tracks (see **Section 5.2.5**.

#### 5.2.4.4 Approvals

It is anticipated that the following permits and approvals will be required for the flood improvement works.

- **Credit Valley Conservation**: A permit will be required for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (Ontario Regulation 160/06).
- **Ministry of the Environment, Conservation and Parks**:
  - A Request for Review memo should be submitted to MECP with the results of the Species at Risk screening completed during detailed design.
  - Depending on construction requirements, registration on the Environmental Activity and Sector Registry or a Permit to Take Water may be required for construction site dewatering.
- **Fisheries and Oceans Canada**: A Request for Review should be submitted to the DFO to screen for potential requirements under the Fisheries Act. It is anticipated that serious harm can be avoided and Authorization by DFO is unlikely for this project.

- **City of Mississauga**: Approvals will be needed under the Lot Grading and Municipal Services Protection By-law if the works are implemented outside of a development application.
- **Utilities**: Approvals will be required for utility owners for protection and/or relocation of existing above and below ground utilities.

#### 5.2.4.5 Additional Considerations

As described in **Section 3.5.3**, the solution developed to reduce flooding north of Orr Road involves the above described culvert and channel improvements north of the rail tracks, as well as regrading the property south of the railway tracks to contain any remaining spill over the tracks and direct it safely to Orr Road.

The proposed works north and south of the railway tracks are located on different private properties and can proceed independent from each other. However, to the extent possible, the works should be implemented on similar timelines to maximize the benefit of the individual improvements for flood mitigation.

### 5.2.5 Avonhead Creek Flood Containment South of CNR Tracks

Under existing conditions, water in Avonhead Creek is expected to spill over the rail tracks and cover a significant portion of the property on the east side of Winston Churchill Boulevard before eventually draining back to Orr Road and the Hazelhurst Road storm sewer system. The solution developed collaboratively with CVC involves filling the majority of the property on the south side of the tracks and leaving a protected corridor to safely contain and convey flows to Orr Road and the Hazelhurst Road storm sewer system.

#### 5.2.5.1 Criteria and Objectives

The grading design must contain the Regulatory flood with a freeboard of at least 0.3 m from the predicted maximum flood elevation to the top of the protected corridor, and must be designed to resist erosion in a regulatory flood. The grading design must also prevent any increases in the frequency, depth and extent of flooding on any other properties to the east or north of the site.

#### 5.2.5.2 Requirements for Future Studies

The grading to contain flooding would be completed part of the overall site grading for future development of the property at 805 Winston Churchill Boulevard. No additional studies would be required beyond those needed to support a development application. Most relevant of these would be a geotechnical investigation to ensure the long term stability of the grading solution and refinements to the CVC's 2D HEC-RAS modelling to verify flood levels with the solution in place.

#### 6.2.4.3 Phasing

The grading works to contain the spill over the tracks can be undertaken independent from any other works. If timing allows, it would be preferable to co-ordinate these works with the culvert replacement and channel widening on the north side of the tracks (see **Section 5.2.4**).

#### 5.2.5.3 Approvals

It is expected that the grading work to contain the spill flows would be implemented as part of a plan for development of the property, and therefore the grading would be approved through the development planning process. In addition to the standard approvals through the development process, a permit will be required from CVC for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (Ontario Regulation 160/06).

#### 5.2.5.4 Additional Considerations

As described in **Section 3.5.3**, the solution developed to reduce flooding north of Orr Road involves culvert and channel improvements north of the rail tracks, as well as the above described regrading the property south of the railway tracks to contain any remaining spill over the tracks and direct it safely to Orr Road.

The proposed works north and south of the railway tracks are located on different private properties and can proceed independent from each other. However, to the extent possible, the works should be implemented on similar timelines to maximize the benefit of the individual improvements for flood mitigation.

### 5.2.6 Avonhead Creek Realignment East of Hazelhurst Road

This project involves the reconstruction and realignment of Avonhead Creek from near the intersection of Hazelhurst and Orr Roads to Lakeshore Road, a length of approximately 1200 m. The existing and proposed reconstructed channel corridor north of Lakeshore Road is located within a single private property (the concrete plant).

The existing channel through the concrete plant property receives baseflow from Avonhead Creek at Orr Road, but flows above baseflow are intercepted into the Hazelhurst Road storm sewer and eventually outlet to Clearview Creek at Lakeshore Road. Reconstruction of the channel will include removal of the diversion at Orr Road, such that the channel will convey the full flow in Avonhead Creek and restore a more natural flow regime to the system.

It is expected that any modifications to Avonhead Creek between Orr Road and Lakeshore Road would be implemented as part of a comprehensive plan for

redevelopment of the concrete plant property, and its realignment and containment of the Regulatory flood plain would facilitate such a redevelopment. Implementation would be the responsibility of the private landowner with coordination with the City of Mississauga, but it is expected that the channel corridor would be conveyed into public ownership once constructed.

#### 5.2.6.1 Criteria and Objectives

The proposed naturalized Avonhead Creek east of Hazelhurst Road must contain all erosion and flood hazards. This would include conveyance of the full Regulatory flow in Avonhead Creek, ignoring the existing structure that diverts flows above baseflow to the Hazelhurst Road storm sewer system.

Based in the investigations carried out for this study, this would require a stream corridor with a base wide of 37.0 m and an overall corridor width of 57.0m, including buffers. The reconstructed channel must also be designed and constructed to establish a self-sustaining, maintenance free natural heritage system.

#### 5.2.6.2 Requirements for Future Studies

A number of studies will be required to support preliminary and detailed design for this project. Many of the following studies would be required to support a development application even if it did not include a channel re-alignment.

- **Archaeological Investigation**: A Stage 2 Archaeological Assessment (AA) is required for areas that may be impacted by construction of the proposed channel realignment. The Stage 1 AA recommended test pits at 5 m intervals for this area. All reasonable efforts should be made to contact all indigenous communities that have a potential interest in the project prior to undertaking any Stage 2 AAs, as some communities may wish to have representatives present or participating in the studies, and should be provided additional opportunities to participate in the planning process as it proceeds towards implementation of these projects.
  If any archaeological resources are uncovered during the Stage 2AA or during construction, all work should be stopped and the identified indigenous communities should be contacted immediately.
- **Fluvial Geomorphologic Investigation:** The assessments completed for this study are sufficient to establish preliminary corridor widths for the naturalized streams, but addition studies will be needed during preliminary and detailed design to refine the corridor width, develop the most appropriate channel planform and ensure that erosion hazards are fully contained within the stream corridors.

- **Geotechnical Investigation**: This investigation is needed to determine soil properties inform the design of the channel, including side slopes. It should also include laboratory analysis of soil samples as required by the 'On-Site and Excess Soil Management' (MECP, 2019) and Ontario Regulation 406/19 in force at the time of construction.
- **Hydrogeological Investigation**: This investigation will confirm seasonal groundwater levels in the areas impacted during construction, determine the need for a Permit to Take Water (PTTW) or MECP Environmental Activity and Sector Registry (EASR) and support the eventual PTTW or EASR applications.
- **Utility Investigation:** While no significant utilities are anticipated in the areas east of Hazelhurst Road, a detailed utility investigation should be completed during preliminary design to confirm both above and below ground utilities in the vicinity of the proposed realigned channel.
- **Grading Design and Hydraulic Analyses:** Grading for the channel corridor needs to be advanced through the preliminary and detailed design stages, integrating the bankfull channel properties from the fluvial geomorphological investigation, and microtopography in the base of the corridor such as wetland pockets, valley wall side slopes and grading beyond the top of bank to match existing grades. The hydraulic analyses will also need to be updated at the preliminary and detailed design stages to confirm that the full Regulatory flow can be contained within the channel corridor with at least 0.3 m freeboard.
- **Ecological Inventories**: Detailed ecological investigations are needed to inform the design of the realigned channel corridor and mitigation of potential impacts. This could include breeding amphibian surveys, breeding bird surveys, refined vegetation surveys and aquatic habitat assessments. The scope and methodology for the field investigations should be confirmed with CVC, DFO and MECP prior to undertaking the field investigations.
- **Tree Inventory and Tree Preservation Plan**: This inventory is needed to understand what vegetation will need to be removed for implementation, recommend protection for trees to be retained, and determine the compensation for removal of any mature vegetation.
- **Project File Report:** The results of the additional investigations and any refinements to the alignment and configuration of Avonhead Creek will need to be documented in a Project File Report and posted for public review.

  If the creek realignment is carried out as part of a larger plan for development or redevelopment which is subject to municipal planning approvals, the works are exempt from a Municipal Class EA and the Project File Report would not be required.

#### 5.2.6.3 Phasing

The proposed realignment and reconstruction of Avonhead Creek will take place within a single private property. Ideally, the channel realignment would be constructed as single project from Orr Road to Lakeshore Road. In the event that the associated redevelopment of the property proceeds in a number of phases, it may be possible to implement the channel realignment in phases, with interim works to connect back into the existing channel at the upstream and/or downstream limits of the realigned reach.

Implementation of this project should also be integrated with or follow the City's realignment of Avonhead Creek at and downstream of Lakeshore Road, as described in in **Section 5.1.3**. Recall that this project involves a new culvert under Lakeshore Road and realignment of Avonhead Creek to flow westward to join Clearview Creek upstream of the outlet to Lake Ontario. Currently, the existing culvert under Lakeshore Road and storm sewer to Lake Ontario are undersized relative to the current design flows, and would be overwhelmed if the diversion structure at Orr Road were removed and the full flow in Avonhead Creek were conveyed to Lakeshore Road. In the event that realignment of Avonhead Creek north of Lakeshore Road were to proceed in advance of the downstream improvements, the diversion structure at Orr Road would need to be maintained and/or alternative measures would be required to mitigate any potential impacts on the existing systems at and downstream of Lakeshore Road.

#### 5.2.6.4 Approvals

It is anticipated that the following permits and approvals will be required for construction of the realignment of Clearview Creek.

- **Credit Valley Conservation**: A permit will be required for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (Ontario Regulation 160/06).
- **Ministry of the Environment, Conservation and Parks**:
  - A Request for Review memo should be submitted to MECP with the results of the Species at Risk screening completed during detailed design.
  - Depending on construction requirements, registration on the Environmental Activity and Sector Registry or a Permit to Take Water may be required for construction site dewatering.
- **Fisheries and Oceans Canada**: A Request for Review should be submitted to the DFO to screen for potential requirements under the Fisheries Act. It is anticipated that serious harm can be avoided and Authorization by DFO is unlikely for this project.

- **City of Mississauga**: Approvals will be needed under the Lot Grading and Municipal Services Protection By-law if the works are implemented outside of a development application.
- **Utilities**: Approvals will be required for utility owners for protection and/or relocation of existing above and below ground utilities.

#### 5.2.6.5 Additional Considerations

The recommended realignment of Avonhead Creek north of Lakeshore Road would take place on a single property. As such, there is considerable flexibility with the alignment of the channel. The alignment suggested in **Figure 3-11** could be revised as required, within reason, to be fully integrated with the plans for redevelopment of the overall property.

It is expected that the realignment would be implemented as part of redevelopment of the entire property that would see the existing concrete plant replaced with a different form of development. Implementation of the channel realignment would not be required as a condition of planning approvals for minor building additions, new buildings or other minor site modifications that would not otherwise impact the existing Avonhead Creek through the property.

Finally, as noted in **Section 5.1.4.3** and **Section 5.2.6.3**, these works would need to be co-ordinated with the realignment of Avonhead Creek at and downstream of Lakeshore Road.

## 5.3 Potential Construction Impacts and Mitigation

Implementation of the recommended solutions have some potential for impacts to the natural, social and cultural environments within and surrounding the study area.

These potential impacts and general recommendations for their mitigation are summarized in the following sections. Given the very different nature of impacts and mitigation for the watercourse improvements relative to the other solutions, they have been described separately in **Sections 5.3.1** and **5.3.2**, respectively.

### 5.3.1 Watercourse Rehabilitation Projects

#### 5.3.1.1 Natural Heritage Features

The proposed works will require some vegetation removals, mainly along the realigned and naturalized section of Clearview Creek and Avonhead Creek south of Lakeshore Road and realigned section of Clearview Creek between Winston Churchill Boulevard and Hazelhurst Road.

Following ecological inventories, comprehensive mitigation/ restoration plans will be required and must comply with the Provincial Policy Statement, the City's Official Plan and Tree Preservation By-Law; and CVC O. Reg. 160/06, where applicable. Offsetting/restoration for losses to natural heritage features and functions would also be required, particularly where natural features are part of the CVC regulated area, as per the CVC Ecological Offsetting Guideline. Detailed tree inventory and preservation plans should be prepared for the entire areas potentially impacted by construction of new channel corridors, including any required tree replacement/ compensation. Implementation of required tree replacement/ compensation/ offsetting as per these policies will achieve a net environmental benefit to the natural heritage system.

#### 5.3.1.2 Breeding Birds and Bats

During detailed design, the need for tree removals will be refined, and assessments will be carried out on any trees that may be removed. It is possible that some of these trees may provide habitat for breeding birds or bats.

The Migratory Bird Convention Act restricts tree removals or any other activity that could be construed as impacting nesting or breeding of a range of bird species from April 1st to August 31st. The nesting window should be confirmed during detailed design, and if tree removals cannot occur outside of this window, a qualified biologist will be required to complete a survey to determine the presence of any nesting activity prior to any removals. Bat surveys will also be conducted prior to tree removals, following consultation with MECP staff, and any trees providing potential roosting habitat for bats should be removed within the appropriate timing window (typically October 1 to March 31).

#### 5.3.1.3 Species at Risk

A screening for potential Species at Risk (SAR) should be prepared during detailed design to determine whether there are design requirements or construction timing windows needed in order to conform to the Endangered Species Act. It is recommended that a Request for Review Memo be submitted to DFO and MECP for review. This memo should include the results of the SAR Screening, as well as relevant information regarding the proposed rehabilitation works, including design details and proposed mitigation. Any comments from MECP and/or DFO on potential SAR impacts and on proposed mitigation measures can be incorporated into the final design.

#### 5.3.1.4 Surface Water and Aquatic Habitat Protection

The recommended solution involve works in and adjacent to Avonhead Creek and Clearview Creek. While the works will remove some of the on-line barriers and should achieve an overall benefit to both aquatic and terrestrial habitat, there is the potential for short-term negative impacts to the system during construction. Fisheries timing windows will be confirmed with CVC and MNRF during the detailed design. Any in-water works could be subject to the fisheries timing window, which will need to be confirmed with the MNRF and CVC prior to construction.

To prevent accidental introduction of debris into the water, the establishment and use of specific construction access routes is recommended, as well as the use of mitigation techniques that contain sediment, debris and other contaminants within the work site.

Best Management Practices for the protection of aquatic habitat and source water protection should be reviewed at the detailed design stage and incorporated into the detailed design package. The use of erosion and sediment control devices and techniques should adhere to the principles limiting soil mobilization and trapping sediment as close to the source as possible. The Erosion and Sediment Control Guideline for Urban Construction (TRCA, 2019) should be followed for the development and implementation of comprehensive Erosion and Sediment Control (ESC) plans. Best Management Practices to prevent contaminants from entering surface water and groundwater such as appropriate fuel storage and refueling methods, will also be required.

#### 5.3.1.5 Groundwater Management

While unlikely, it is possible that some local dewatering will be required for the construction of the recommended works. Geotechnical and hydrogeological studies are recommended for all the recommended works to determine the groundwater levels and requirements for dewatering. However, any groundwater impacts during construction are likely to be localized and temporary. During detailed design, it will be necessary to develop appropriate strategies to minimize, treat and dispose of any dewatering discharge water. Should construction site dewatering requirements be greater than 50,000 L/day, permitting with the MECP will be required. Construction site dewatering of more than 50,000 L/day but less than 400,000 L/day (under normal site conditions) will require registration on the MECP Environmental Activity and Sector Registry (EASR) and fulfillment of EASR regulation monitoring and mitigation requirements. A Permit to Take Water (PTTW) will be required if any of the construction requires dewatering of over 400,000 L/day.

#### 5.3.1.6 Soils Management

The proposed improvements could involve topsoil stripping, sediment removal, excavation, and filling. All excess and unsuitable materials generated during construction should be managed appropriately. The materials may be reused as a construction material or transported from the sites. Materials may also be temporarily stockpiled in preparation for these uses or temporarily removed from the sites if required. Construction staging plans should be prepared to detail the locations and mitigation requirements for stockpiles. Any soil stockpiles will be stabilized in accordance with the Erosion and Sediment Control Guideline for Urban Construction (TRCA, 2019).

All excess fill and any contaminated waste encountered naturally (e.g. SWM pond sediment) or through the Contractor's efforts (e.g., diesel spill) should be managed in accordance with the 'On-Site and Excess Soil Management' (MECP, 2019) and Ontario Regulation 406/19.

In addition, comprehensive ESC plans will be prepared in the detailed design stage.

#### 5.3.1.7 Air Quality, Noise and Vibration

The Contractor's activities, specifically the operation of construction equipment, could result in a temporary increase in noise, vibration and dust in the project area during the construction period. It is anticipated that these effects would be short in duration and limited to periods of construction machinery operation, and could be effectively mitigated by providing advance notice of construction to the adjacent businesses and homeowners, by limiting construction activities to normal working hours, and applying best management practices. If warranted, only non-chloride dust suppressants are to be applied during construction. A comprehensive list of dust prevention and control measures can be found in Environment Canada's "Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities" (Cheminfo, 2005).

#### 5.3.1.8 Traffic and Transportation

Construction access to recommended works is anticipated to be from Winston Churchill Boulevard, Hazelhurst Road, Lakeshore Road and Orr Road based on the location of the recommended works. Traffic on these and connecting roadways may be temporarily impacted as equipment and materials are transported to and from the work areas. Traffic management plans should be developed in accordance with Ontario Health and Safety Book 7 to ensure the least possible impact, and standard traffic control measures should be implemented to safely co-ordinate traffic flow. Signage and traffic control personnel should be posted if necessary during these events.

#### 5.3.1.9 Monitoring

A post-construction monitoring plan is recommended for all watercourse rehabilitation projects to verify that the realigned and reconstructed watercourses do not impede natural hydrologic functions and achieve the desired enhancements to the natural heritage systems.

### 5.3.2 Storm Sewer Upgrade Projects

#### 5.3.2.1 Groundwater Management

While unlikely, it is possible that some local dewatering will be required for the construction of the recommended works. The geotechnical and hydrogeological studies recommended for all the recommended works will determine the groundwater levels and requirements for dewatering. However, any groundwater impacts during construction are likely to be localized and temporary. During detailed design, it will be necessary to develop appropriate strategies to minimize, treat and dispose of any dewatering discharge water. Should construction site dewatering requirements be greater than 50,000 L/day, permitting with the MECP will be required. Construction site dewatering of more than 50,000 L/day but less than 400,000 L/day (under normal site conditions) will require registration on the MECP Environmental Activity and Sector Registry (EASR) and fulfillment of EASR regulation monitoring and mitigation requirements. A Permit to Take Water (PTTW) will be required if any of the construction requires dewatering of over 400,000 L/day.

#### 5.3.2.2 Soils Management

The proposed storm sewer upgrades will involve excavation and filling. All excess and unsuitable materials generated during construction will be managed appropriately. The materials may be reused as a construction material or transported from the site.

All excess fill and any contaminated waste encountered naturally or through the Contractor's efforts (e.g., diesel spill) should be managed in accordance with the 'On-Site and Excess Soil Management' (MECP, 2019) and Ontario Regulation 406/19.

In addition, comprehensive ESC plans will be prepared in the detailed design stage.

#### 5.3.2.3 Air Quality, Noise and Vibration

The Contractor's activities, specifically the operation of construction equipment, could result in a temporary increase in noise, vibration and dust in the project area during the construction period. It is anticipated that these effects would be short in duration and limited to periods of construction machinery operation, and could be

effectively mitigated by providing advance notice of construction to the adjacent businesses and homeowners, by limiting construction activities to normal working hours, and applying best management practices. If warranted, only non-chloride dust suppressants are to be applied during construction. A comprehensive list of dust prevention and control measures can be found in Environment Canada's "Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities" (Cheminfo, 2005).

#### 5.3.2.4 Traffic and Transportation

The recommended storm sewer upgrades are along Avonhead Road, Southdown Road, Bromsgrove Road and Widemarr Road. Traffic on these roads will be impacted as the recommended works will require excavation within the roadway. Connecting roadways may also be temporarily impacted as equipment and materials are transported to and from the work areas. Traffic management plans should be developed in accordance with Ontario Health and Safety Book 7 to ensure the least possible impact, and standard traffic control measures will be implemented to safely co-ordinate traffic flow. Signage and traffic control personnel should be posted if necessary during these events.

## 5.4 Additional Considerations

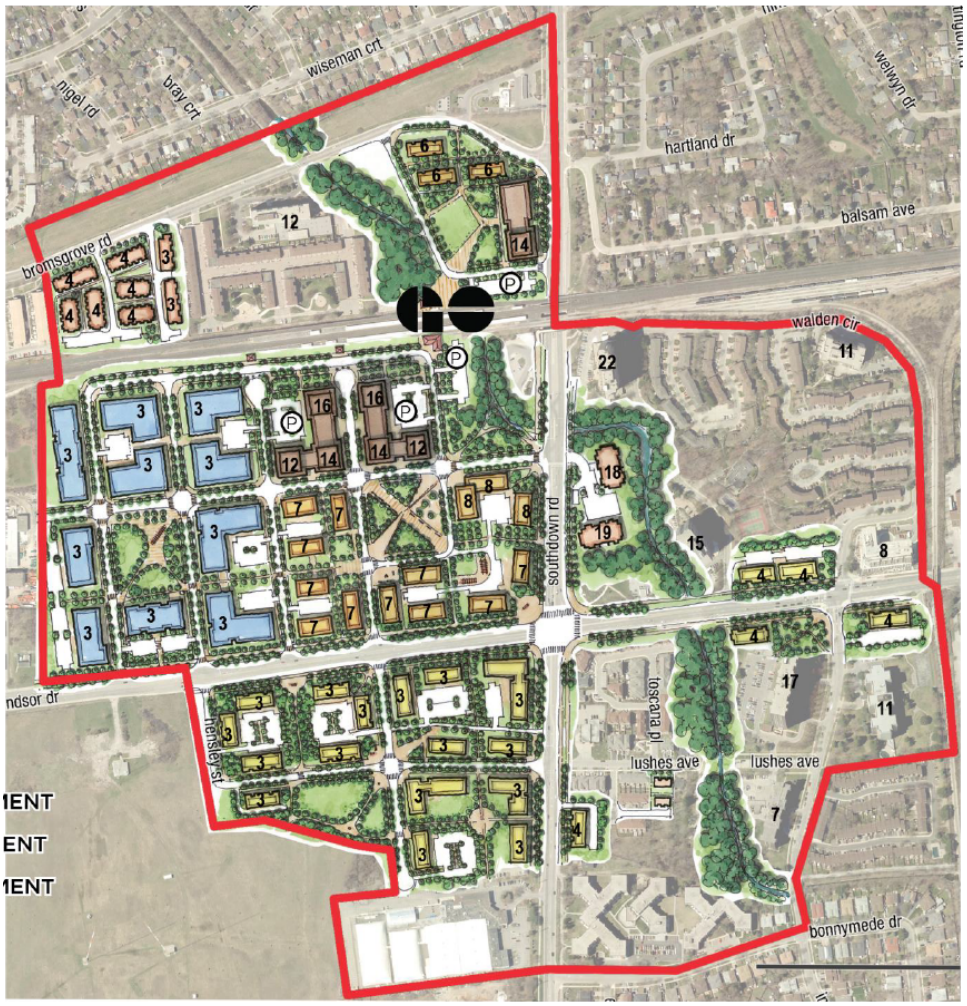
### 5.4.1 Future Redevelopment of Existing Developed Sites

As noted in **Section 3.1** and illustrated in **Figure 3-1**, the assessments of the impacts of future development in the Southdown District have been based on development of existing undeveloped and under-developed properties (such as largely pervious antenna fields) in the study area. However, redevelopment of existing developed properties is also expected to occur over time, as envisioned in the Southdown Local Area Plan. A study is also underway for the Clarkson Transit Station Area Study, which is expected to support a future City Initiated Official Plan Amendment for redevelopment and intensification of the lands in the northeast corner of the study area (**Figure 5-2**).

Most of the existing developments in the study area were built prior to the adoption of modern stormwater management quality and quantity control practices, and as such runoff from these sites is discharged to the municipal minor and major drainage systems with no attenuation or treatment. Redevelopment of these sites represents an opportunity to implement modern stormwater management practices that meet current criteria for water balance, water quality and peak flow controls. With the future redevelopment of existing developed sites in the study area, there should be corresponding improvements in the quality and quantity of water in the watercourses

within the study area. As the City does not have any means of controlling where and when sites apply for redevelopment, these future potential redevelopments and associated improved stormwater management will complement the Master Plan rather than form part of the recommended Master Plan solution.

**Figure 5-2 Clarkson Transit Station Area Study**




### 5.4.2 CVC Low Impact Development Initiatives

As noted in **Section 1.2.4**, CVC has been promoting on-site LID initiates to manage stormwater quality and quantity on existing developed sites in the Southdown area, primarily focussing on the industrial properties on the north side of Royal Windsor Drive from east of Winston Churchill Boulevard to Southdown Road. The CVC Study Area is illustrated in **Figure 5-3**. Almost all of the properties in the study area drain to the storm sewer system on Royal Windsor Drive, which flows eastward to discharge to Sheridan Creek east of Southdown Road. A small site in the north-east corner of the CVC

study area drains to the storm sewer on Southdown Road, which continues south and discharges directly to Lake Ontario.

The objective of the CVC initiative is to implement on-site controls on all of these properties to achieve Enhanced water quality protection, retain the first 15 mm of all rainfall events on-site, and control post-development peak flow rates to pre-development conditions.

**Figure 5-3 CVC LID Study Area**

The PCSWMM model described in **Section 2.6.4** was modified to reflect full implementation of the CVC recommendations to assess the effectiveness of the solution on reducing flow rates and surcharge depths in the Royal Windsor Drive storm sewer system. A simplified approach was used to represent the on-site controls in the PCSWMM model, whereby the impervious fraction of the catchments in the CVC study area was reduced to 50% to account for the on-site peak flow controls, and the initial abstraction depths were increased to 15 mm to account for the on-site runoff reduction measures.

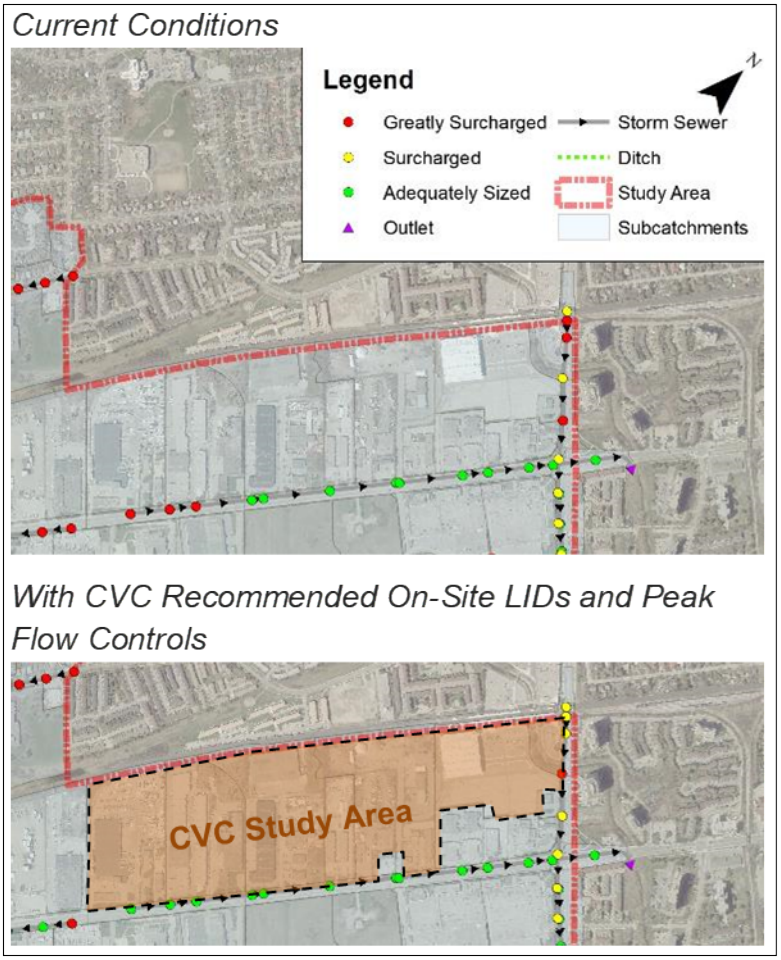
The predicted effectiveness of the on-site stormwater retrofits are illustrated in **Figure 5-4**. The on-site controls can eliminate most surcharging in the Royal Windsor Drive storm sewer system, and on-site controls for the small property at the north-east corner of the study area can reduce the degree of surcharging in the Southdown Road storm sewer system.

Despite the predicted effectiveness in reducing peak flow rates in the storm sewers and receiving watercourses, implementation of the CVC recommendations for on-

site LIDs and SWM controls does not form part of the recommended Master Plan for the Southdown District. This is primarily because there is no mechanism for the City to compel property owners to implement the on-site controls on existing developed properties. A planning application for expansion or redevelopment would be required for the City to become involved and have an opportunity to impose criteria for on-site stormwater peak flow, volume and quality controls. The City collects a Stormwater Charge via the Region of Peel water bill, and also provides credits to non and multi-residential property owners who provide on-site quantity and/or quality controls. The Stormwater Charge program is not intended for and does not allow the City to fund stormwater improvements on private properties, which would in turn lower the Charge for the benefitting property.

However, implementation of the CVC recommendations for on-site LIDs and SWM controls will benefit the storm sewer systems and watercourses in the study area, and it is recommended that the City support implementation of the on-site improvements where it aligns with the City's stormwater goals and objectives and to the extent feasible within the Stormwater Fees & Charges By-law and policies. The City has identified the best mechanism to support non and multi-residential property owners, throughout the City, remains through the existing Credit Program.  Recently, a detailed review of the Credit Program was completed with a focus on increasing flexibility and opportunities for credit applicants as well as to benefit the City's stormwater system. CVC and several other stakeholders were engaged throughout the study review and on October 27, 2021, City Council approved the proposed changes to enhance the Credit Program..

**Figure 5-4 CVC LID Effectiveness**




### 5.4.3 Climate Change Adaptation and Mitigation

The preferred solutions will enhance the resiliency of the drainage systems in the Southdown District to the potential impacts of a changing climate. The realigned watercourses will be designed with freeboard in the channel and buffers to carry potentially increased peak flow rates from more severe storm events in the future, the larger storm sewers can convey increased storm flows within the existing road right-of-ways, and the SWM criteria applied to new developments in the study area can evolve in response to future research and guidance regarding future potential climate change.

Additional analyses were completed to assess the impacts of potential future climate change on the drainage systems in the study area. Many conservation authorities in the Greater Toronto Area recommend increasing rainfall intensities by 20% to represent potential future climate change conditions, based on past climate change research that suggested that average annual rainfall amounts could increase by as much as 20% under future climate conditions.

Adopting this conservative assumption, the design storms applied to the watershed hydrology models and urban drainage models were updated to increase rainfall intensities by 20%, and the existing conditions models were simulated to assess the impact on peak flow rates in the pipes and open channels.

The PCSWMM model of existing conditions determined that a 20% increase in rainfall intensities would result in a nearly 50% increase in the total number of storm sewers surcharging in a 10 year storm event, and also a nearly 50% increase in the number of greatly surcharged storm sewers (surcharging above the road surface).

The watershed hydrologic modelling predicts that a 20% increase in rainfall intensities will lead to an increase in peak flow rates of 30% on average for the 100 year storm event across the Clearview, Avonhead and Lakeside Creek watersheds. For context, the 100 year storm peak flow rate for the climate change scenario is 34.1 $m^3/s$ at the outlet of Clearview Creek, an increase of 29% over existing conditions peak flow rate of 26.4 $m^3/s$. Extrapolating this result using the Gumbel Extreme Value probability distribution suggests that the flow of 34.1 $m^3/s$ from the climate change scenario is equivalent to a storm with a return period in excess of 800 years under today's climate conditions.

The above results suggest that a 20% increase in rainfall intensities may be an overly conservative estimate of the impact of future climate change on flow rates in the study area waterways, storm sewers and overland flow routes. Regardless, it is recommended that the City consider potential future climate change during future infrastructure projects, such as selecting bridges and culverts are watercourse crossings that provide additional freeboard and upsizing storm sewer systems that are near capacity wherever reasonable and appropriate.

# 6 Public Consultation

## 6.1 Consultation Approach

The Municipal Class Environmental Assessment (EA) requires contact with the public at certain points during the EA study. The study was completed as a Master Plan through Approach 1 under the Municipal Class EA. The points of public contact for this project are summarized in **Table 6-1**.

**Table 6-1 Public Consultation Summary**

| Point of Contact | Date |
|---|---|
| Notice of Commencement | March 14, 2019 |
| Public Open House #1 | June 11, 2019 |
| Public Open House #2 (Online) | September 15, 2021 to October 31, 2021 |
| Notice of Completion | July 4, 2022 |

## 6.2 Notice of Commencement

A Notice of Commencement was prepared and circulated on March 14, 2019, on behalf of the City of Mississauga. A copy of the Notice is provided in **Appendix G** for reference. The Notice was mailed directly to relevant agencies, First Nations organizations, utilities, and surrounding property owners. The Notice of Commencement was also advertised in the Mississauga News on the same day.

The Notice summarized the purpose and scope of the study and invited interested parties to provide comments. All comment forms received are included in **Appendix G**.

## 6.3 Public Information Centre # 1

The first Public Information Centre (PIC) was held on June 11, 2019, from 6:00 pm to 8:00 pm. The PIC was hosted at the Clarkson Community Centre, located within the study area at 2475 Truscott Drive in the City of Mississauga. The Notice for PIC # 1 was advertised in the Mississauga News on May 30 and June 6, and was mailed

to all stakeholders who indicated interest in the study in their response to the Notice of Commencement. A copy of the Notice of PIC # 1 is included in **Appendix G**.

The purpose of the first Public Information Centre was to inform the public that the City is conducting a new study to establish updated stormwater management requirements to minimize flooding, erosion, water quality degradation and water balance impacts from urban development, and to identify stream restoration opportunities within the existing drainage system. . The PIC followed an informal open house format with display boards presenting the project information. The PIC provided participants with an opportunity to review and comment on the project information and correspond directly with the project team. A copy of the display boards is included in **Appendix G**. Attendees were encouraged to provide contact information on the sign-in sheet and complete a comment form.

Three individuals attended the PIC, and one comment form was received. A copy of the comment form is included in **Appendix G**. The comment form submitted indicated that the commenters are interested in being included in future communications and shared their concerns about the water quality and impact on the aquatic habitat.

## 6.4 Public Information Centre #2

A second PIC was arranged via an online public engagement session. Project information was made available to the public on the City's project website beginning September 15th, 2021 and opened for comments until October 31st, 2021. The Notice for PIC # 2 was advertised on the City's website and was mailed to all stakeholders who indicated interest in the study in their response to the Notice of Commencement or Notice for PIC#1. A copy of the Notice of PIC # 2 is included in **Appendix G**.

The purpose of the second PIC was to allow local residents, landowners and interested members of the public an opportunity to review and comment on the evaluation and selection of the preliminary preferred stormwater management and stream restoration solutions. The on-line PIC materials included copies of the display boards, a pre-recorded, narrated video presentation and an on-line survey. A copy of the display boards is included in **Appendix G**. There were 94 unique pageviews of the website and the on-line presentation was viewed approximately 160 times, but no survey forms were completed.

## 6.5 Notice of Completion

The Master Plan is being made available to the public, other interested parties and external agencies for a 30-day review period as required under the Ontario Environmental Assessment Act. A Notice of Study Completion was posted on the City's website at www.mississauga.ca/projects-and-strategies/environmental-assessments/southdown-district-stormwater-servicing-and-environmental-management-plan/ on July 4, 2022.

In addition, a copy of the notice was issued to government agencies, Indigenous communities, stakeholders, external agencies and other members of the public on the project malling list.

A copy of the Notice of Completion is included in **Appendix G**. The Notice includes information on how to access the Master Plan and instructions to direct any comments or concerns to the City's project manager.

## 6.6 Indigenous Community Consultation

The Municipal Class EA process requires the proponent to consult with all First Nations and Métis communities that could have a potential interest in an undertaking. Ministry of Environment, Conservation, and Parks (MECP) has been consulted and a list of indigenous communities that should be contacted had been provided.

None of the Indigenous communities responded to the initial study notice. Additional efforts were undertaken to ensure that the communities were informed of the project and provided an opportunity to comment on the proposed works. The following table summarizes the date and form of contact with the Indigenous communities and the responses received to date. All correspondence with Indigenous communities can be found in **Appendix G**.

**Table 6-2 Summary of First Nations and Métis Community Consultation**

| Community | Date and Form of Initial Contact | Date(s) and Form of Follow-up Contact | Date Response Received | Comments |
|---|---|---|---|---|
| Six Nations of the Grand River | March 14, 2019 (L) | June 11, 2019 (E)<br>September 15, 2021 (E) | | |
| Haudenosaunee Confederacy Chiefs Council | March 14, 2019 (L) | June 11, 2019 (E)<br>September 15, 2021 (E) | | |
| Mississaugas of the Credit First Nation | March 14, 2019 (L) | June 11, 2019 (E)<br>September 15, 2021 (E) | | |

(L) – Letter (T) – Telephone (E) – E-mail

## 6.7 Other Agency and Stakeholder Consultation

### 6.7.1 Credit Valley Conservation

Multiple meetings were held with staff from CVC on May 31, 2018, November 12, 2018, May 24, 2019, June 21, 2019 and February 7, 2020. The project team coordinated with CVC with their Low Impact Development project located north of Royal Windsor Drive (refer to **Section 5.4.2**), and to integrate the findings from CVC's 2D hydraulic modelling of Avonhead Creek into the existing conditions inventories (**Section 2.6.2**) and development of alternative solutions (**Section 3.5.3**). Relevant meeting minutes are included in **Appendix G**.

### 6.7.2 Landowner Consultation

A separate landowner consultation meeting was held prior to PIC#1 held at the Clarkson Community Centre. Several of the property owners along Winston Churchill Boulevard, whose lands contain Clearview Creek, were in attendance. At the meeting these landowners reiterate their support for the treatment of Clearview Creek in the Southdown Master Drainage Plan completed in 2000. Realignment to the eastern boundary of their property would allow better access for future development.

Landowners along Royal Windsor Drive and who participated in the CVC grid project were also in attendance. These landowners experience occasional flooding and standing water issues within their properties. These landowners would like to see financial incentives to constructing the low impact developments that is suggested by CVC.

Individual consultations were held with property owners and their agents following PIC#2. A meeting was held with representatives from Ash Grove (owners of the concrete plant at Lakeshore Road and Hazelhurst Road), which primarily focussed on the recommended realignment of Avonhead Creek north of Lakeshore Road. A separate meeting was held with Nick Dell of Harper Dell & Associates Inc., who represent the owners of 595 Winston Churchill Boulevard and are familiar with many other landowners on the east side of Winston Churchill Boulevard. On behalf of his client, Nick endorsed the preferred solution for the realignment of Clearview Creek and confirmed that there is support from many landowners for this solution.

Relevant correspondence from the landowner consultations is included in **Appendix G**.

# 7 Summary

The Southdown District is bounded by is bounded by Winston Churchill Boulevard to the west, Southdown Road to the east, Lake Ontario to the south, and headwater drainage boundaries near Royal Windsor Drive to the north.

A Master Drainage Plan for the Southdown District was completed in 2000 to establish stormwater management criteria and guide future development in the study area. Over the more than 20 years since it's completion, there have been significant changes to local, regional and provincial policies and guidelines related to stormwater and environmental management.

This Stormwater Servicing and Environmental Management Plan serves as a comprehensive update to the previous Master Drainage Plan, and the recommendations for stormwater and environmental management will result in sustainable urban development and re-development within the Southdown District study area that will preserve, protect and enhancing the existing surface water, groundwater, and natural environment systems within and beyond the study area.

A number of investigations were completed to accurately characterize the planning, natural, social, cultural and engineering environments through the study area.

There are five watercourses that traverse the study area. From west to east, these are Joshua's Creek, Clearview Creek, Avonhead Creek, Lakeside Creek and Sheridan Creek. Joshua's Creek and Sheridan Creek are located in the extreme south-west and north-east corners of the study area, respectively, and have not been studied in detail given the negligible potential impacts to these systems from development in the study area.

Fish species have been observed in Clearview and Avonhead creeks, and are considered to provide aquatic habitat. There are no records available for Lakeside Creek, but the short length of open channel between Lakeshore Road and Lake Ontario is considered to provide aquatic habitat.

There are no Provincially Significant Wetlands or Areas of Natural and Scientific Interest in the study area, but there are several designated natural areas associated with the mature vegetation communities along Clearview and Lakeside Creeks.

No Species at Risk were observed during the field investigations, but the study area has the potential for Butternut and provides potential habitat for Common Nighthawk and several endangered bat species.

An archaeological assessment determined that the majority of the study area has been disturbed through past development or cleared through previous assessments.

There remain some undeveloped areas that retain some archaeological potential, and Stage 2 archaeological assessments are recommended prior to any construction activities in these areas. In addition, the Harding Waterfront Estate at the south-west corner of the study area is a designated heritage site.

A fluvial geomorphological investigation was carried out on the accessible watercourses in the area. Significant erosion was observed along portions of Clearview Creek. The investigation also noted an on-line pond in poor condition north of Lakeshore Road and the concrete lined channel south of Lakeshore Road. Avonhead Creek is piped from Lakeshore Road to Lake Ontario, and portions of Avonhead Creek north of Lakeshore Road are lined with concrete and corrugated steel pipe that are in poor condition. No significant issues were observed along the short length of Lakeside Creek south of Lakeshore Road.

Hydrologic and hydraulic modelling was completed to establish flooding conditions along the open watercourses through the study area. Along portions of Clearview Creek, the regulatory flood plain is wide and irregular, and poses a significant constraint to development. There is also extensive flooding along Avonhead Creek north of Orr Road, and Lakeshore Road is predicted to be frequently overtopped at the Lakeshore Road crossing.

Hydrologic and hydraulic modelling was also prepared to evaluate the urban drainage systems through the study area, consisting of storm sewer systems and overland flow routes along roadways. Most storm sewer systems in the study area meet current City standards for conveyance capacity, but the storm sewers on Avonhead Road, Southdown Road and in the area of Bromsgrove Road are undersized. During a 100 year return period storm event, some of the roadways in the area of Bromsgrove Road cannot contain the overland flow and flooding is predicted to extend beyond the public rights-of-way. All other systems in the study area can convey the predicted 100 year return period storm flows within the public road rights-of-way.

A range of alternatives have been developed for the management of the stormwater and natural heritage systems through the study area. These are as follows.

- **Do Nothing**: Under this scenario, future development in the study area would proceed with no stormwater controls. This alternative was developed to gain a better understanding of the impacts of urban development within the study area
- **Maintain Current Standard Stormwater and Environmental Management Approaches**: For this alternative, future development in the study area would comply with current criteria for water quality, erosion mitigation, peak flow control, water balance and environmental protection

- **Centralized SWM Facilities for Future Development**: Instead of a traditional approach with on-site stormwater management controls implemented on a site-by-site basis, this alternative proposes large centralized stormwater management facilities that could more efficiently treat storm runoff from multiple properties and developments. Concept designs have been prepared for five centralized facilities in the study area for this alternative
- **Retrofit SWM Facilities**: The Mississauga Stormwater Quality Control Strategy Update (MSWQCSU) (Aquafor Beech, 2012) identified three potential retrofit facilities in the study area. These facilities would provide water quality treatment for existing developed areas within and beyond the study area. The facilities would be located adjacent to Lakeshore Road at Clearview Creek, Avonhead Creek and Lakeside Creek. The three retrofit facilities have been considered as an alternative solution for this study.
- **Watercourse Improvements**: Solutions have been developed to enhance each of the watercourses through the study area
  - **Clearview Creek**: The creek east of Winston Churchill Boulevard would be realigned to contain all erosion and flood hazards and facilitate future development of the lands on the east side of Winston Churchill Boulevard. It also includes removal of the on-line pond and reinstatement of a natural channel, and realignment and naturalization of the existing concrete lined channel south of Lakeshore Road
  - **Avonhead Creek South of Orr Road**. The creek east of Hazelhurst Road would be realigned to contain all erosion and flood hazards and facilitate future development. A new culvert at Lakeshore Road would redirect the creek westward to join the proposed naturalized mouth of Clearview Creek south of Lakeshore Road.
  - **Avonhead Creek: North of Orr Road**: A solution has been developed to reduce flooding in this area. It includes culvert and channel improvements north of the railway, and regrading of a property south of the railway to contain the floodwater spilling over the railway
  - **Lakeside Creek**: This solution includes removing a storm sewer system north of the Clarkson Wastewater Treatment Plant and replacing it with a natural channel east of Avonhead Road. It is not possible to create a continuous open channel corridor through the treatment plant to connect to the open reach of Lakeside Creek south of Lakeshore Road. This solution would also include flood storage integrated into the channel corridor to control peak flows to the capacity of the remaining storm sewer system through the treatment plant.

- **Storm Sewer and Major Drainage System Upgrades**: This solution includes replacement of the storm sewers on Southdown Road in the Bromsgrove Road area with larger pipes needed to meet the City's current storm sewer and major system design criteria. It would also include replacement of the existing storm sewers and extension of the storm sewer system northward on Avonhead Road. The new storm sewer system on Avonhead Road would allow the existing undersized storm sewers east of Avonhead to be removed, with future development east of Avonhead Road connected to the new storm sewer system on Avonhead Road.

The above alternative solutions for the Southdown District were evaluated comprehensively against criteria related to the natural, social, cultural, technical and financial environments. The results of the evaluation and preferred solutions are summarized in **Table 7-1** and presented on **Figure 4-1**.

**Table 7-1 Preferred Solutions**

| Preferred Solution and Justification | Responsibility for Implementation | Cost |
|---|---|---|
| **Maintain the Current Standard Stormwater and Environmental Management Approach (Not Subject to the Municipal Class EA)**<br>Adhering to current criteria will adequately mitigate the impacts of future anticipated development on water quality, erosion and flooding in the receiving watercourses. | **Landowners / Developers** are responsible for developing and implementing plans to achieve current standards | No increase in cost relative to current practices |
| **Watercourse Improvements – Clearview Creek (Schedule B EA Activity)**<br>While there are significant costs and challenges for implementation, there will be significant benefits to the natural environment, recreation and future developments with the removal of the existing on-line pond and construction of realigned and protected channel corridors both north and south of Lakeshore Road | **Landowners / Developers**: Removal of on-line pond and channel realignment north of Lakeshore Road<br>**City**: Realignment south of Lakeshore Road | $17.2M Landowner<br>$1.9 M City<br>$19.1 M Total |

| Preferred Solution and Justification | Responsibility for Implementation | Cost |
|---|---|---|
| **Water Course Improvements – Avonhead Creek South of Orr Road (Schedule B EA Activity)**<br>While there are significant costs and challenges for implementation, there will be significant benefits to the natural environment, recreation and future development with the realigned and protected channel corridor north of Lakeshore Road and new watercourse connection to Clearview Creek south of Lakeshore Road | **Landowners / Developers**: Channel realignment north of Lakeshore Road<br>**City**: Realignment south of Lakeshore Road | $ 25.3 M Landowner<br>$ 6.6 M City<br>$ 31.9 M Total |
| **Watercourse Improvements – Avonhead Creek north of Orr Road (Schedule B EA Activity)** | All works would be carried out on private property and would be implemented by **Landowners / Developers** | $0.6 M |
| **Storm Sewer Upgrades (Schedule A / A+ Activity)** | All works would be carried out in public rights-of-way and would be implemented by the **City** | $19.4 M |

The Do Nothing alternative was not selected due to the unacceptable impacts of uncontrolled urban development on water quality, flooding, erosion and natural heritage systems.

The Centralized SWM Facilities and Lakeside Creek Improvements alternatives were not selected primarily due to the prohibitive challenges for their implementation. Both solutions involve works spanning multiple properties and

would require all affected properties participating and developing on similar time frames for the solutions to be implemented.

The Retrofit SWM Facilities alternative was not selected due to the significant challenges to secure land for the facilities, challenges to construct the on-line facilities without impacting fish passage, and because there would be no improvements to the degraded watercourses upstream of the retrofit facilities at Lakeshore Road.

The Southdown District Stormwater Servicing and Environmental Management Plan has been completed in accordance with the Municipal Class Environmental Assessment (EA) process, following a Master Plan Approach. The Master Plan satisfies Phases 1 and 2 of the Municipal Class EA process, but more detailed studies will be needed to satisfy the requirements of the recommended Schedule B projects.

Consultation with the public, agencies and other stakeholders has taken place throughout the project, including two Public Information Centres to provide an opportunity for the public to provide input to the project and preferred solutions. All concerns raised by the public, agency staff and other stakeholders have been considered in the development and evaluation of alternative solutions and have been addressed in this final Master Plan.

# 8 References

Adams, B, Haley, D and EWRG Ltd. (2017). *'Technical Guidelines for Flood Hazard Mapping'.* Prepared for the Toronto and Region, Nottawasaga Valley, Ganaraska, Grand River, Credit Valley and Central Lake Ontario Conservation Authorities.

Aquafor Beech Ltd. (2012). 'Final Mississauga Stormwater Quality Control Strategy Update'. Prepared for the City of Mississauga.

Aquafor Beech Ltd. (2011). 'Lake Ontario Integrated Shoreline Strategy Background Review and Data Gap Analysis'. Prepared for Credit Valley Conservation.

Aquafor Beech Ltd. (2011). 'Executive Summary (Phase 1) Sheridan Creek Watershed Study and Impact Monitoring, Characterization Report'. Prepared for Credit Valley Conservation.

Brook McIlroy Inc (2008). 'Waterfront Parks Strategy'. Prepared for the City of Mississauga.

Chapman, L.J. and Putnam, D.F. (1984). 'The Physiography of Southern Ontario – Third Edition.' Ontario Geological Survey, Special Volume 2.

Cheminfo Services Inc. (2005). *'Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities'.* Prepared for Environment Canada, Transboundary Issues Branch.

Credit Valley Conservation (CVC) (2018). 'Clearview Creek Feasibility Study'. Prepared for the City of Mississauga.

CTC Source Protection Region (2015). *'Approved Source Protection Plan: CTC Source Protection Region.'* Prepared for the CTC Source Protection Committee.

Dillon (2019). '*Mississauga Waterfront Parks Strategy Refresh*.' Prepared for the City of Mississauga.

Downs, P.W. (1995). 'Estimating the probability of river channel adjustment'. Earth Surface Processes and Landforms, 20: 687-705.

Ecosystem Recovery Inc. (2015). 'Lake Ontario Integrated Shoreline Strategy, Avonhead Creek: Fluvial Geomorphology Assessment'. Prepared for Credit Valley Conservation.

Hamilton-Halton Source Protection Committee (2015). 'Halton Region Source Protection Area Assessment Report v3.5'.

Lee, H.T, W.D. Bakowsky, J.L. Riley, J. Bowles, M. Puddister, P. Uhlig, and S. McMurray (1998). *'Ecological Land Classification for Southern Ontario: First Approximation and its Application'*. Ontario Ministry of Natural Resources, Southcentral Region, Science Development and Transfer Branch. Technical Manual ELC-005.

Mather, J.R. (1978). The climactic water balance in environmental analysis: Lexington, Mass., D.C. Heath and Company, 239 p.

Natural Heritage Information Centre (2016). '*Natural Heritage Information Centre Species Lists'*. Ministry of Natural Resources. https://www.ontario.ca/page/get-natural-heritage-information

Oldham, M.J., and S.R. Brinker (2009). '*Rare Vascular Plants of Ontario, Fourth Edition*'. Natural Heritage Information Centre, Ontario Ministry of Natural Resources. Peterborough, Ontario.

Oldham, M. J., W. D. Bakowsky and D. A. Sutherland (1995). '*Floristic Quality Assessment System for Southern Ontario'*. Natural Heritage Information Centre, Ministry of Natural Resources. Peterborough, Ontario

Ontario Ministry of the Environment, Conservation and Parks (2018, updated 2021). '*Management of Excess Soil – A Guide for Best Management Practices*.' https://www.ontario.ca/page/management-excess-soil-guidebestmanagement-practices.

Ontario Ministry of the Environment (2003). '*Stormwater Management Planning and Design Manual*.' Queen's Printer for Ontario.

Ontario Ministry of Natural Resources and Forestry (MNRF). (2016). 'Species At Risk in Ontario Website'. Available:https://www.ontario.ca/page/species-risk

Ontario Ministry of Natural Resources and Forestry (2016). '*Make a Map: Natural Heritage Areas'*. http://www.giscoeapp.lrc.gov.on.ca/web/MNR/NHLUPS/NaturalHeritage/View

er/Viewer.html?utm_source=MNRCentral&utm_medium=Twitter&utm_term=natural%2Bheritage&utm_content=natural%2Bheritage%2Bbiodiversity&utm_campaign=Biodiversity

Ontario Ministry of Natural Resources and Forestry (MNRF) (2015). 'Significant Wildlife Habitat Criteria Schedules For Ecoregion 6E'.

Ontario Ministry of Natural Resources (2002). *'Technical Guide – River & Stream Systems: Flooding Hazard Limit'.*

Sharpe, D.R., Barnett, P.J., Brennand, T.A., Gorrell, G., and Russell, H.A.J. (2001). 'Digital surficial geology data of the Greater Toronto and Oak Ridges Moraine Area, Southern Ontario'; Geological Survey of Canada, Ottawa, Open File 3777.

Sharpe, D.R., Barnett, P.J., Brennand, T.A., Gorrell, G., Russell, H.A.J. (1999). 'Regional geological mapping of the Oak Ridges Moraine, Greater Toronto Area, southern Ontario'. Geological Survey of Canada, Ottawa, Current Research 1999-E, p123-136.

Thornthwaite, C.W., and Mather, J.R. (1957). 'Instructions and tables for computing potential evapotranspiration and the water balance'. Publications in Climatology, Vol. 10, No. 3, pp. 185-311. Laboratory of Climatology, Drexel Institute of Technology, Centerton, New Jersey.

Thornthwaite, C.W. (1948). 'An approach toward a rational classification of climate'. Geographical Review, Vol. 38, No. 1, pp. 55-94.

Toronto and Region Conservation Authority (TRCA) (2019). '*Erosion and Sediment Control Guideline for Urban Construction*'.

Toronto and Region Conservation Authority (TRCA) (2004). Belt Width Delineation Procedures.

Totten Sims Hubicke Associates (2000). 'Southdown District Master Drainage Plan'. Prepared for the City of Mississauga.

Ward, A. (2001). *'Stream Stability Protection Setback.'* The Ohio State University.

Ward, A. D. Mecklenberg, J. Mathews, and D. Farver (2002). 'Sizing Stream Setbacks to Help Maintain Stream Stability'. Paper Number: 022239. 2002 ASAE Annual International Meeting. Chicago, IL, USA. July 28-July 31, 2002.

Williams, G.P. (1986). *'River Meanders and Channel Size'.* Journal of Hydrology 88:147-164.