Chapter 6

Leslie Street Trunk Sewer and Yonge Street Sewer Rehabilitation

The Regional Municipality of York
The Regional Municipality of Durham

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6.1 Overview

The York Durham Sewage System (YDSS) currently services eight of the nine local municipalities in the Regional Municipality of York (York Region) through conveyance infrastructure, directing most of the wastewater flows to Duffin Creek Water Pollution Control Plant (WPCP), with a small portion diverted to the Regional Municipality of Peel (Peel Region) wastewater system. The YDSS also services the City of Pickering and Town of Ajax in the Regional Municipality of Durham (Durham Region).

A primary element of the YDSS is the Yonge Street Sewer, which conveys wastewater from Newmarket, Aurora and portions of East Gwillimbury and Richmond Hill to the Southeast Collector and ultimately to the Duffin Creek WPCP. The Yonge Street Sewer is currently the only conveyance link to the south for all wastewater within the YDSS service area.

This trunk sewer is deteriorating and will require repairs and increased capacity to meet York Region's growth demands. As a result of provincially directed growth, after completion of the Master Plan, the need for a twin of the Yonge Street Sewer was identified. The four projects that make up the Leslie Street Trunk Sewer and Yonge Street Sewer Rehabilitation are termed Y1-A1, Y1-A2, Y14 and Y1-B and are shown on the map in Figure 6.1.

The first two projects will construct two sections of a new north-south trunk sewer in phases. The new sewer is needed to provide additional capacity. Y1-A1 will construct the section along Leslie Street from 19th Avenue to Bloomington Road, and Y1-A2 will construct the section from Bloomington Road to St. John's Sideroad. The third project, Y14, will be an additional interceptor sewer, which will connect the existing Yonge Street Sewer along Bloomington Road to the new sewer running along Leslie Street. This sewer will span from Bayview Avenue to Leslie Street. The fourth project, Y1-B, will be rehabilitation of the existing Yonge Street Sewer.

The three projects that involve new construction (Y1-A1, Y1-A2 and Y14) are discussed together in section 6.5. The rehabilitation component, Y1-B, is discussed separately in section 6.6. Each of these two sections is organized the same way; each includes:

1. A description of the project-specific study area
2. A description of existing conditions for the social and built, natural and cultural environments
3. A conceptual design
4. A discussion of potential environmental impacts and mitigation measures
5. Costs, implementation and schedule.

The overarching study area is described below, along with a general description of those four subsections of sections 6.5 and 6.6. Section 6.7 provides an estimate of capital costs, and section 6.8 provides information on the field investigations and permits that will be needed; it also provides scheduling considerations and suggests a general schedule.

6.1.1 Key Plan

The four projects covered in this chapter extend from just north of St. John's Sideroad to south of 19th Avenue, between Yonge Street and Leslie Street. The general locations of the projects are shown in Figure 6.1.

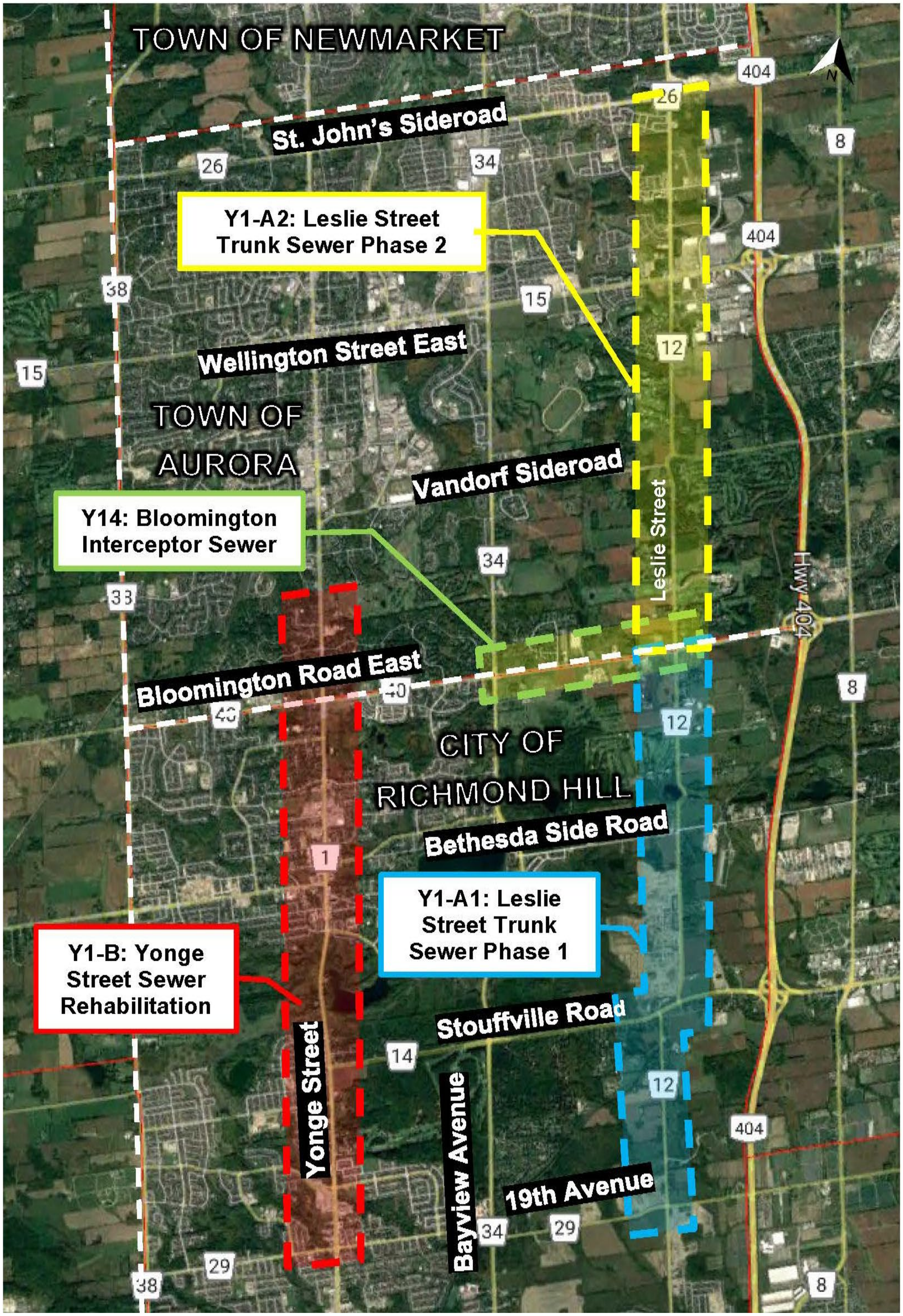

Figure 6.1 **Overview of Leslie Street Trunk Sewer and Yonge Street Sewer Rehabilitation Projects**

6.1.2 Existing Conditions

In the existing conditions subsections, current environmental conditions of the study area are documented based on a desktop review to establish a baseline against which to assess the potential impacts. The three sub-elements are the social and built environment, the natural environment and the cultural environment.

6.1.2.1 Social and Built Environment

The social and built environment investigations looked at the social fabric of the communities, including human health, quality of life, social well-being and community cohesion. The existing built infrastructure and facilities in the study area were also documented. Factors such as noise, vibration, traffic, public safety, access to services, capacity constraints and changes in land use patterns were evaluated, recognizing the interplay between social and built elements in the project's environmental impact.

6.1.2.2 Natural Environment

The natural environment investigations looked at the ecological components such as flora, fauna, ecosystems and natural resources to provide a baseline for later evaluation of potential impacts on biodiversity, habitats, water quality, air quality, soil quality and the overall functioning of natural systems. These sections also discussed subsurface conditions, including geotechnical, hydrogeological and areas of potential environmental concern.

6.1.2.3 Cultural Environment

This aspect examines the cultural heritage, which includes archaeological sites, historical structures, traditional practices and cultural landscapes that may be affected by the proposed project. It considers the potential impacts on cultural identity, traditional knowledge and the cultural significance of the area.

6.1.3 Conceptual Design

The conceptual design for each project outlines the general design standards, requirements and assumptions for the construction and implementation of the new and rehabilitated gravity sewers. General design parameters are identified in Chapter 3; site-specific conditions are included within this chapter.

The designs presented are conceptual and were developed to demonstrate proof of concept. The designs will be further refined upon collection of field investigations and in consultation with internal and external stakeholders. Final sewage pumping stations (SPS) site locations will be selected considering the impacts and mitigations, results of field studies, procurement requirements and other design considerations. Similarly, details related to the construction methodology, pipe sizing, number of shafts, shaft sizing, location and property easement requirements will be confirmed during detailed design.

Refer to Table 6.1 for a list of relevant conceptual design drawing appendices for each project.

Table 6.1 Summary of Planning Policies and Applicability to the Leslie Street Trunk Sewer Project Components

Project designation	Project name	Appendix	Sheet number(s)
Y1-A1	Leslie Street Trunk Sewer Phase 1	Appendix C	19 to 23
Y1-A2	Leslie Street Trunk Sewer Phase 2	Appendix C	19 to 23
Y14	Bloomington Interceptor Sewer	Appendix C	24

6.1.4 Environmental and Community Impacts and Mitigation

After current conditions are documented, potential impacts from the project are identified. Existing environmental conditions were considered in light of the conceptual designs for the projects, and potential impacts were identified. Where possible, proposed mitigation measures were developed and applied to the potential impacts. The results will inform decision-making to promote sustainable development that minimizes negative environmental effects while maximizing positive outcomes.

6.1.5 Capital Cost Estimate and Implementation Plan

This chapter discusses the capital cost estimate for each proposed project and the general implementation plan, including future field investigations and permits and approvals required to design and construct the new/upgraded infrastructure. These components will be further reviewed and refined during the preliminary design stage.

6.2 Social and Built Environment Overview

To avoid repetition within this chapter, an overarching discussion on the existing social and built environment across all projects covered under Chapter 6 is presented in this section. Site-specific social and built environment existing conditions are further detailed in section 6.5 and section 6.6.

6.2.1 City of Richmond Hill

The City of Richmond Hill stretches from Bloomington Road south to Highway 7 and from Highway 404 west to Bathurst Street. The city is primarily an urban built-up municipality with a mix of high-, medium- and low-density residential neighbourhoods, commercial areas and industrial lands, with some agricultural lands remaining.

6.2.2 Town of Aurora

The Town of Aurora stretches from north of St. John’s Sideroad south to Bloomington Sideroad and from Highway 404 west to Bathurst Street. The municipality is a mix of high-, medium- and low-density residential neighbourhoods, commercial areas (e.g., St. Andrew’s Shopping Centre and Yonge Street corridor), industrial lands (e.g., Aurora South Industrial Area and Magna International Lands), small patches of agricultural land (e.g., along St. John’s Sideroad and Highway 404) and green space.

6.2.3 Planning Policy and Land Use

Table 6.2 summarizes the planning policies that may apply to the project components, highlighting pertinent policy content and then discussing in detail how these policies apply to specific project components.

Table 6.2 Summary of Planning Policies and Applicability to the Leslie Street Trunk Sewer Project Components

Jurisdictions and planning policies	Applicability to projects
Federal Impact Assessment Act (IAA, 2019)	– The proposed activities are not included in the physical activities list that describes which projects are subject to the IAA. – The York Region Sewage Works projects are not identified in Schedule 2 of the Act. – The Minister may designate a project upon request or own initiative. – Low likelihood that the projects will be subject to the IAA.
Provincial Environmental Assessment Act (EAA, 1990)	– Would apply to York Region as a municipality in Ontario undertaking a sewage conveyance solution. However, the York Region Sewer Works projects are exempted from the EAA under Part IV of Schedule 10, Supporting Growth and Housing in York and Durham Regions Act, 2022.
Provincial Provincial Policy Statement (PPS, 2020)	– The PPS provides policy direction on matters of provincial interest related to land use planning and development. – The following PPS sections are relevant to the proposed York Region Sewer Works projects: • Section 1.1.1 – Healthy, liveable and safe communities are sustained by: • (g) ensuring that necessary infrastructure and public service facilities are or will be available to meet current and projected needs. • Section 1.6.6 provides policies relating to municipal sewage services. • Section 1.6.8.5 – The co-location of linear infrastructure should be promoted where appropriate. • Section 2.1 provides policies for long-term protection of natural features. • Section 2.2 provides policies for protection of water quality and quantity. • Section 2.3 provides for long-term protection of prime agricultural lands while allowing planning authorities to permit non-agricultural uses in prime agricultural areas for limited non-residential uses, provided the conditions established in the policy are met.
Provincial Ontario Water Resources Act (1990), as amended by the Safeguarding and Sustaining Ontario's Water Act (2007)	– Regulates sewage infrastructure and construction water taking in Ontario. – Bans new or increased intra-basin water transfer from one Great Lakes watershed to another, with exceptions subject to strictly regulated conditions. York Region Sewage Works Project will manage the movement of wastewater, and implications of the Project on York Region's existing intra-basin transfer permission are not anticipated but will be explored.
Provincial Clean Water Act (2006) South Georgian Bay Lake Simcoe Source Protection Plan (2015) Credit Valley, Toronto Region and Central Lake Ontario (CTC, 2022)	– The Clean Water Act, along with the source protection planning process it establishes, protects current and future sources of residential municipal drinking water. – Establishment, operation, or maintenance of a system that collects, stores, transmits, treats, or disposes of sewage is one of the prescribed threats (a condition or activity that adversely affects or has the potential to adversely affect the quality or quantity of current or future drinking water). – Aurora is in the South Georgian Bay Lake Simcoe Source Protection Region (Lake Simcoe Area), while Richmond Hill is in the CTC Region (Toronto and Region Source Protection Area).

Jurisdictions and planning policies	Applicability to projects
Provincial Lake Simcoe Protection Plan, 2009	– The Lake Simcoe Protection Plan is a watershed-based plan that outlines a coordinated approach to protecting and restoring the ecological integrity of Lake Simcoe. – With reference to Section 6.23 of the Lake Simcoe Protection Plan, development or site alteration is not permitted within a key natural heritage feature, a key hydrologic feature, or within a related vegetation protection zone referred to in Policy 6.24, except in relation to: • (g) infrastructure, but only if the need for the project has been demonstrated through an environmental assessment or other similar environmental approval and there is no reasonable alternative. – The boundary of the Lake Simcoe Protection Plan approximately aligns with the municipal boundary between Aurora and Richmond Hill. Therefore, components in Aurora will be subject to the plan's policies.
Provincial Growth Plan for the Greater Golden Horseshoe (2020 Consolidation), issued under the authority of the Places to Grow Act (2005)	– Provides direction on urban structure and where and how future growth should be accommodated: • Section 3 provides policies related to infrastructure to support growth, specifically sections 3.2.5 (Infrastructure Corridors) and 3.2.6 (Water and Wastewater Systems). • Section 4.2.3 (1): Neither outside settlement areas, development, nor site alteration is permitted in key natural heritage features that are part of the Natural Heritage System for the Growth Plan or in key hydrologic features, except for: • (c) activities that create or maintain infrastructure authorized under an environmental assessment process. – The Leslie Street Trunk Sewer Project components are within the Growth Plan area and will be subject to the Growth Plan's policies.
Provincial Oak Ridges Moraine Conservation Plan (ORMCP), as set out in Ontario Regulation (O. Reg.) 140/02 under the Oak Ridges Moraine Conservation Act, 2001 (ORMC Act)	– The ORMCP is an ecologically based plan that provides land use and resource management direction for the land and water within the Oak Ridges Moraine (ORM) landform: • Section 30 provides policies for development and site alteration within landform conservation areas of the ORM. • Section 41 provides policies for the development of infrastructure in or on lands in natural linkage areas, prime agricultural areas and natural core areas, and the conditions under which infrastructure is permitted to cross key natural heritage features or key hydrological features. • Section 42(2) states that sewer service trenches must be planned, designed and constructed so as to keep disruption of the natural groundwater flow to a minimum. – All four components of the Leslie Street Trunk Sewer project intersect with the ORMCP area.
Provincial Greenbelt Plan 2017, issued under the authority of the Greenbelt Act 2005	– The Greenbelt Plan identifies where urbanization should not occur in order to provide permanent protection to the agricultural land base and the ecological and hydrological features, areas and functions occurring on the landscape. – Section 2.1: An application to develop infrastructure in or on land in prime agricultural areas shall not be approved unless: • (a) the need for the project has been demonstrated, and there is no reasonable alternative that could avoid the development occurring in a prime agricultural area; and • (b) an agricultural impact assessment or equivalent analysis carried out as part of an environmental assessment is undertaken that demonstrates that there will be no adverse impacts to prime agricultural areas or that such impacts will be minimized and mitigated to the extent possible. – All four components of the Leslie Street Trunk Sewer project intersect with the Greenbelt Plan area.

Jurisdictions and planning policies	Applicability to projects
Regional Lake Simcoe Region Conservation Authority (LSRCA) and Toronto Region Conservation Authority (TRCA)	– The Leslie Street Trunk Sewer project components are within either LSRCA or TRCA jurisdiction. – Permits under 166/06 and 179/06 - Development Interference with Wetlands and Alterations to Shorelines and Watercourses, will be required for infrastructure within regulated areas (i.e., 120 metres (m) of a Provincially Significant Wetland [PSW] or within 30 m of a watercourse or waterbody).
Regional York Region Official Plan 2022, Office Consolidation June 2023	– The York Region Official Plan sets the direction for growth and development within York Region through policies that align with provincial and regional planning policies. – The Leslie Street Trunk Sewer project components will be located on lands designated as community areas, with the 80 m and 200 m study areas for some project component locations extending into the employment and agricultural areas. – Relevant sections include: • Section 3.2 – Regional Greenlands Systems • Section 5.1 – The Agricultural System • Section 6.4 – Water and Wastewater Servicing.
Municipal Aurora Official Plan 2010, August 2021 Consolidation	– The Aurora Official Plan directs long-term growth and development within the municipality. – Relevant sections include: • Section 12.2 – Greenlands System • Section 14.3 – Sanitary Sewage and Water Supply Services.
Municipal Richmond Hill Official Plan 2010, January 2023 Consolidation	– The Richmond Hill Official Plan directs long-term growth and development within the municipality. – Relevant sections include: • Section 3.1.9.2 – Water and Wastewater Services • Section 3.2.1 – Greenway System.

6.2.3.1 York Region Official Plan

With reference to the York Region Official Plan 2022 (Office Consolidation June 2023), section 2.1.3, the regional structure consists of the following land use designations:

– Community areas, where residential, population-related employment and community services are directed to accommodate concentrations of existing and future population and employment growth.
– Employment areas, where clusters of industrial, business, transportation, warehousing and related economic activities are directed and where residential uses are prohibited.
– Hamlets, smaller communities in rural areas where growth potential is limited in accordance with the policies in the Plan.
– Rural areas, lands outside of urban areas and prime agricultural areas which support diverse agricultural, economic, tourism and recreational activities and contain valuable natural resources.
– Agricultural areas, containing a continuous, productive agricultural land base.
– Specialty crop areas for agriculture uses where specialty crops are predominantly grown.

Development and site alteration is restricted within some designations; however, provisions have been made for new wastewater infrastructure subject to demonstrated need and compliance with provincial plans.

Section 3.2 establishes policies for the Regional Greenlands System. While development and site alteration within the system are generally prohibited, some uses, including new wastewater systems, are permitted subject to meeting requirements of applicable provincial plans. With reference to section 3.2.5 (d), new wastewater systems are permitted if no other reasonable alternative location exists and if an approved Environmental Impact Study demonstrates that it can be constructed without negative impact. The wastewater system shall also be subjected to the policies of the relevant provincial plan, where applicable, or if authorized through an Environmental Assessment.

Section 5.1 provides policies for the Agricultural System. It is understood that the project study areas include active farmland; however, the proposed projects are to be constructed outside of designated agricultural lands.

Section 6.4 provides policies for the delivery of long-term water and wastewater services that are safe, well-managed and sustainable. The following are relevant to the York Region Sewage Works Projects:

– Section 6.4.4: That planning efforts for municipal water and wastewater treatment facilities and infrastructure are coordinated with surrounding jurisdictions and shall be in accordance with provincial regulations, guidelines, standards and procedures and, where possible, minimize and mitigate any potential adverse effects from odour, noise and other contaminants.
– Section 6.4.12: To achieve water balance in compliance with the Great Lakes Charter and the Great Lakes Charter Annex by ensuring that all infrastructure planning decision-making processes manage intra-basin transfer to permitted quantities and water removed from the Great Lakes is returned at an equivalent or better quality.
– Section 6.4.14: That all improvements or new water and wastewater infrastructure systems shall conform to the applicable provincial plans, including the source protection plans.
– Section 6.4.16: That the planning and design of water and wastewater infrastructure will consider potential impacts from climate change.
– Section 6.4.19: That the location of new municipal sewage system infrastructure, wherever possible, shall be located outside of the vulnerable areas within a Wellhead Protection Area or Intake Protection Zone where it would be identified as a significant drinking water threat. Specific types of sewage infrastructure may not be permitted where the activity is identified as a significant drinking water threat in accordance with the South Georgian Bay Lake Simcoe and the Credit Valley, Toronto and Region and Central Lake Ontario Source Protection Plans.

6.3 Natural Environment Overview

To avoid repetition within this chapter, the well head protection areas (WHPA) across all projects are presented in this section instead of individually for each project. Site-specific natural environment existing conditions are further detailed in section 6.5 and section 6.6. Figure 6.2 illustrates the WHPA, displaying study areas for all projects.

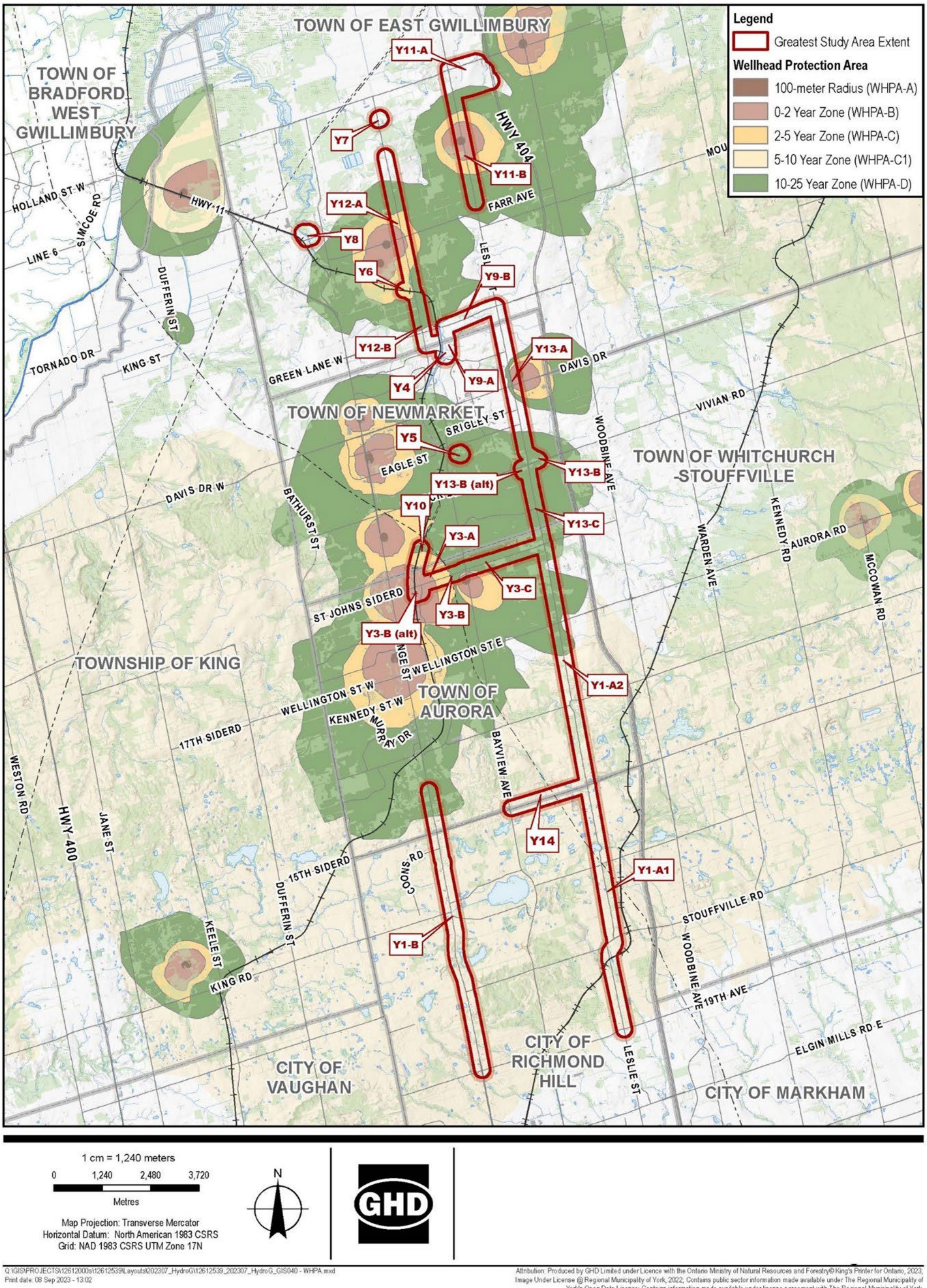

Figure 6.2 **Wellhead Protection Area**

6.4 Cultural Environment Overview

To avoid repetition within this chapter, an overarching discussion on the existing cultural environment across all projects covered under Chapter 4 is presented in this section. This cultural environment desktop analysis includes a Stage 1 Archaeological Assessment and a Cultural Heritage Report on Existing Conditions and Preliminary Impact Assessment. The following sections summarize the findings of the desktop studies completed for Y1-A1, Y1-A2 and Y14 study areas within this chapter.

Regarding Y1-B Yonge Street Sewer Rehabilitation, rehabilitation of existing sewers is considered a maintenance activity. Access to the sewer will be along the existing alignment within the disturbed right-of-way (ROW). Cultural and archaeological studies are not typically completed on maintenance activities. During detailed design, if the rehabilitation method selected might disturb properties along the ROW, a cultural and archaeological investigation can be completed, and the requirements for monitoring during construction will be identified considering the rehabilitation method designed.

6.4.1 Archaeology

A Stage 1 Archaeological Assessment was conducted to review current land use, historical and modern maps, settlement history and topographic and physiographic features, soils and drainage. Previously registered archaeological resources within 1 km of the study area and previous archaeological assessments within 50 metres (m) were also reviewed. The background study indicated that archaeological resources could be recovered during the York Region Sewage Works Project construction because features that signal archaeological potential are near (i.e., within 300 m). These features are:

– Areas of 19th-century settlement (Aurora, Bogarttown, Gormley, Holland Landing, Newmarket, Petchville, Richmond Hill and White Rose)
– 19th-century travel routes (e.g., Leslie Street, Bloomington Road, St. John’s Sideroad, Green Lane)
– Mapped 19th-century structures (numerous homesteads, mills, churches, schools)
– Historic watercourses (Rouge River, East Holland River and their tributaries)
– Previously registered archaeological sites (104 sites within 300 m, 46 in the study area).

In addition, York Region’s archaeological potential map identifies the study area as having archaeological potential.

The Y1-A1 Leslie Street Trunk Sewer Phase 1 study area is located within the 50 m monitoring zones associated with two sites (AlGu-65 and AlGu490) and is located within 1 km of a village site (AlGu-79) for which burial avoidance strategies apply to the study area. Y1-A1 also contains an active 21st-century registered cemetery (Toronto Muslim Cemetery). The Toronto Muslim Cemetery (located at 13076 Leslie Street in Richmond Hill). This is an active 21st-century cemetery for which an archaeological assessment was previously conducted. While there are no outstanding archaeological concerns, impacts on the cemetery should be avoided.

The study area of Y1-A2 Leslie Street Trunk Sewer Phase 2 contains two archaeological sites with further Cultural Heritage Value or Interest (CHVI) (BaGu-161 and BaGu-171). A detailed description of these archaeological sites can be made available upon request. Y1-A2 also has one area south of St. John’s Sideroad and east of Leslie Street that potentially contains 100-year-old burials that must be considered during planning for this project. Recommendations for material testing reports and construction monitoring are outstanding and to be determined during design development for this location.

The Y14 Bloomington Inceptor Sewer study area has no archaeological sites with further CHVI.

6.4.2 Cultural Heritage

A document titled “Cultural Heritage Report on Existing Conditions and Preliminary Impact Assessment” was produced to provide background for the three new linear components of the Leslie Street Trunk Sewer (Y1-A1, Y1-A2 and Y14), which will pass through the communities of Aurora and Richmond Hill in York Region. The report inventories cultural heritage elements discovered during screening of the study area and provides preliminary impact assessments. The report was developed by:

- Completing a cultural heritage screening that encompassed all properties within the study area, using the Ministry of Citizenship and Multiculturalism’s (MCM’s) Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes.
- Completing a heritage screening for existing heritage conditions by doing background research and applying professional judgment to identify known and potential Built Heritage Resources (BHRs) and Cultural Heritage Landscapes (CHLs) in the study area.
- Completing a preliminary Heritage Impact Assessment (HIA) of all identified BHRs and CHLs. The preliminary HIA follows the general format set out in the MCM’s InfoSheet #5: Heritage Impact Assessments and Conservation Plans, which is included in the Heritage Resources in the Land Use Planning Process within the Ontario Heritage Toolkit. Subsequent site-specific HIAs with the comprehensive application of Ontario Regulation (O. Reg.) 9/06 (as amended by O. Reg. 569/22) may be recommended where direct impacts are identified.

During a desktop overview of the existing heritage conditions in Aurora, 74 properties were identified as having known or potential BHRs or CHLs. Subsequent field review identified 12 BHRs, five BHR/CHLs and seven CHLs. During a desktop overview of existing heritage conditions in Richmond Hill, 71 properties were identified as having known or potential BHR/CHLs. Subsequent field review identified 19 BHRs, 11 joint BHRs and CHLs and four CHLs. A detailed description of these heritage properties is available upon request.

In Aurora, the area is predominantly rural, with agricultural fields, mid-20th-century residential development and golf courses comprising much of the landscape on either side of Leslie Street. The rural character of the area is exemplified by winding, tree-lined laneways to residential properties typically screened by vegetation. Recent suburban and commercial development comprises most of the landscape of Leslie Street north of Bloomington Road to the boundary line with the Town of Newmarket. St John’s Sideroad runs east-west across one segment of the study area; this street is predominantly surrounded by recent suburban development, as well as notable landscapes on the Oak Ridges Moraine (ORM), including parts of the Bailey Ecological Park, the Nokiidaa Trail, the Tom Taylor Trail, the St. Andrew’s Valley Golf Club, the Aurora Community Arboretum and the McKenzie Wetlands.

In Richmond Hill, the study area is primarily rural with extant and former farmstead properties and low-density mid-20th century residential development along Leslie Street from 19th Avenue to Stouffville Road as Leslie Street ascends the ORM. Tree-lined streetscapes are especially prevalent from the southern boundary of Phyllis Rawlinson Park to Gormley Road West. New suburban development comprises much of the landscape on the west side of Leslie Street from Stouffville Road northward to Bethesda Sideroad, while clusters of mid-20th-century houses line the east side. Golf courses, a cemetery and a kettle lake, are the primary features of the stretch from Stouffville Road to Bloomington Road. The Bloomington Road segment, which is the boundary line between Richmond Hill and Aurora, is primarily suburban.

The Ontario Heritage Act (OHA) provides a framework for municipalities in Ontario to preserve the conservation of properties with CHVI, including the capacity to designate heritage properties. In the Town of Aurora, there are six properties designated under Part IV of the OHA and four properties listed on the Town’s Register of Properties of Cultural Heritage Value or Interest. In the City of Richmond Hill, there are eight properties designated under Part IV or Part V of the OHA and 14 properties listed on the City’s Inventory of Cultural Heritage Resources. A detailed description of these heritage properties can be made available upon request.

York Region and Durham Region are located on the traditional territory of many Indigenous peoples, including the Anishinaabeg, Haudenosaunee, Huron-Wendat and Métis peoples, and within the treaty territories of the Haudenosaunee, Mississaugas of the Credit First Nation and Williams Treaties First Nations. Most of the study area is located within the Williams Treaties with the Chippewas of Beausoleil, Georgina Island and Rama First Nations and the Mississaugas of Alderville, Curve Lake, Hiawatha and Scugog Island First Nations. The remaining portion of the study area in Richmond Hill is located within Treaty 13 with the Mississaugas of the Credit First Nation (also known as the Toronto Purchase). There are also other land claims and treaty rights involving portions of York Region and Durham Region that have not been definitively resolved.

Since time immemorial, Indigenous peoples' use and management of land differed greatly from the much more recent era of colonial development. Instead of roads and highways cut through the landscape, Indigenous travel in this area focused on waterways and the portages between them[1].

An example of this is the Toronto Carrying Place Trail. Prior to the arrival of Europeans, many Indigenous groups travelled along the Toronto Carrying Place Trail to trade with other nations near and far, as well as to hunt and gather resources. The trail snaked northward along the east bank of the Humber River past Woodbridge in current-day Vaughan before heading over the ORM towards the West Holland River. A second iteration of the trail started at the Rouge River, moving northwest through the ORM and toward the Holland River East Branch near present-day Aurora before heading north to Holland Landing. Northern portions of the trail correspond to the Chippewas Travel Corridor, shown in Figure 6.3.

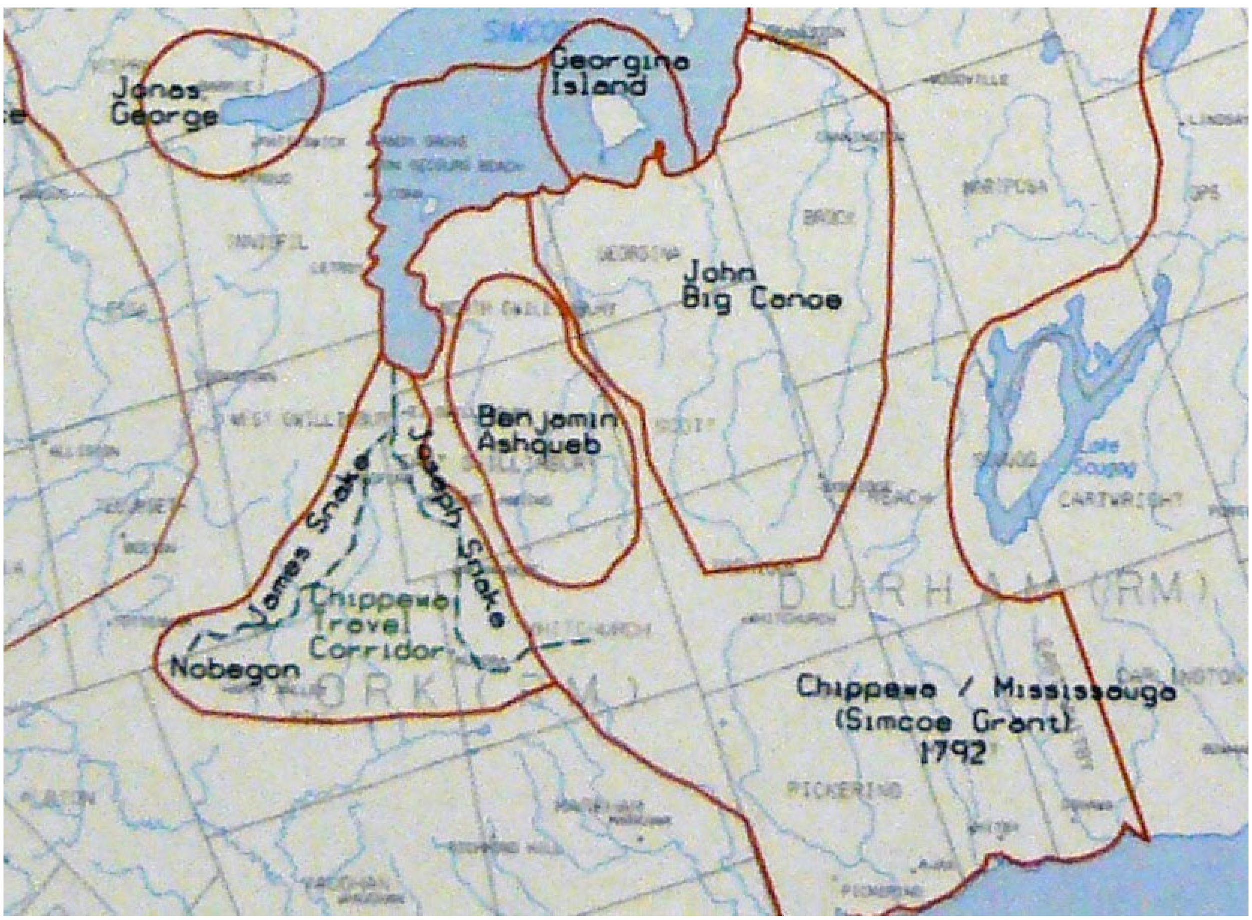

Figure 6.3 **Map of a portion of Williams Treaties Hunting Territories Showing the East and West Holland Rivers as a Chippewas Travel Corridor Provided by Chippewas of Rama First Nation**

[1] TMHC Inc. 2023. Cultural Heritage Report York Region Sewage Works Project Towns of Richmond Hill, Aurora, Newmarket, and East Gwillimbury, Regional Municipality of York (draft).

In addition to fish and other animals, Indigenous communities harvested wild rice and actively managed and maintained nut and berry resources for food[2]. Indigenous landscapes included actively managed meadows (Mishkodeh) and forests (such as Black Oak Savannas)[3]. This system of land management is often framed in terms of kinship between people and landscape, a mutual responsibility for each to promote and maintain the health of the other.

Treaties isolated Indigenous communities to relatively small reserves, and colonial land development limited the accessibility of lands for subsistence activities. For example, until it was corrected in 2018, the Williams Treaties of 1923 were interpreted by Canada to have extinguished the First Nations' right to hunt, fish and harvest on their traditional territory. Residential schools and cultural discrimination further damaged these traditional lifeways by systematically preventing the transfer of Indigenous knowledge from one generation to the next.

6.5 Y1-A1 Leslie Street Trunk Sewer Phase 1, Y1-A2 Leslie Street Trunk Sewer Phase 2 and Y14 Bloomington Interceptor Sewer

6.5.1 Study Area

Figure 6.4 illustrates the study area associated with the three gravity sewer components of this project:

– **Y1-A1, Leslie Street Trunk Sewer Phase 1** - Along Leslie Street, from 19th Avenue to Bloomington Road, approximately 6,360 meters (m).
– **Y1-A2, Leslie Street Trunk Sewer Phase 2** - Along Leslie Street, from Bloomington Road to St. John's Sideroad, approximately 6,310 m.
– **Y14, Bloomington Interceptor Sewer** - Along Bloomington Road from Yonge Street to Leslie Street, approximately 2,100 m.

These gravity sewers pass through the City of Richmond Hill and the southern limit of the Town of Aurora within York Region. The sewer alignment extends through the ORM from approximately 200 m north of 19th Avenue to 2100 m south of St. John's Sideroad, then runs approximately 10.2 kilometres (km) along the Leslie Street Trunk Sewer alignment. The Y1-A1 phase will also cross under an existing Canadian National Railway (CNR) corridor approximately 350 m south of Stouffville Road. The rail corridor is also used by Metrolinx GO Transit.

A study area of approximately 200 metres surrounding the centerline of the road right of way was applied. This study area, as well as pertinent details of projects, are presented in Figure 6.5, Figure 6.6 and Figure 6.7.

[2] TMHC Inc. 2023. Cultural Heritage Report York Region Sewage Works Project Towns of Richmond Hill, Aurora, Newmarket, and East Gwillimbury, Regional Municipality of York (draft).
[3] Mishkodeh Centre for Indigenous Knowledge. n.d. History. Available online: https://mishkodeh.org/history/. Accessed October 27, 2022.

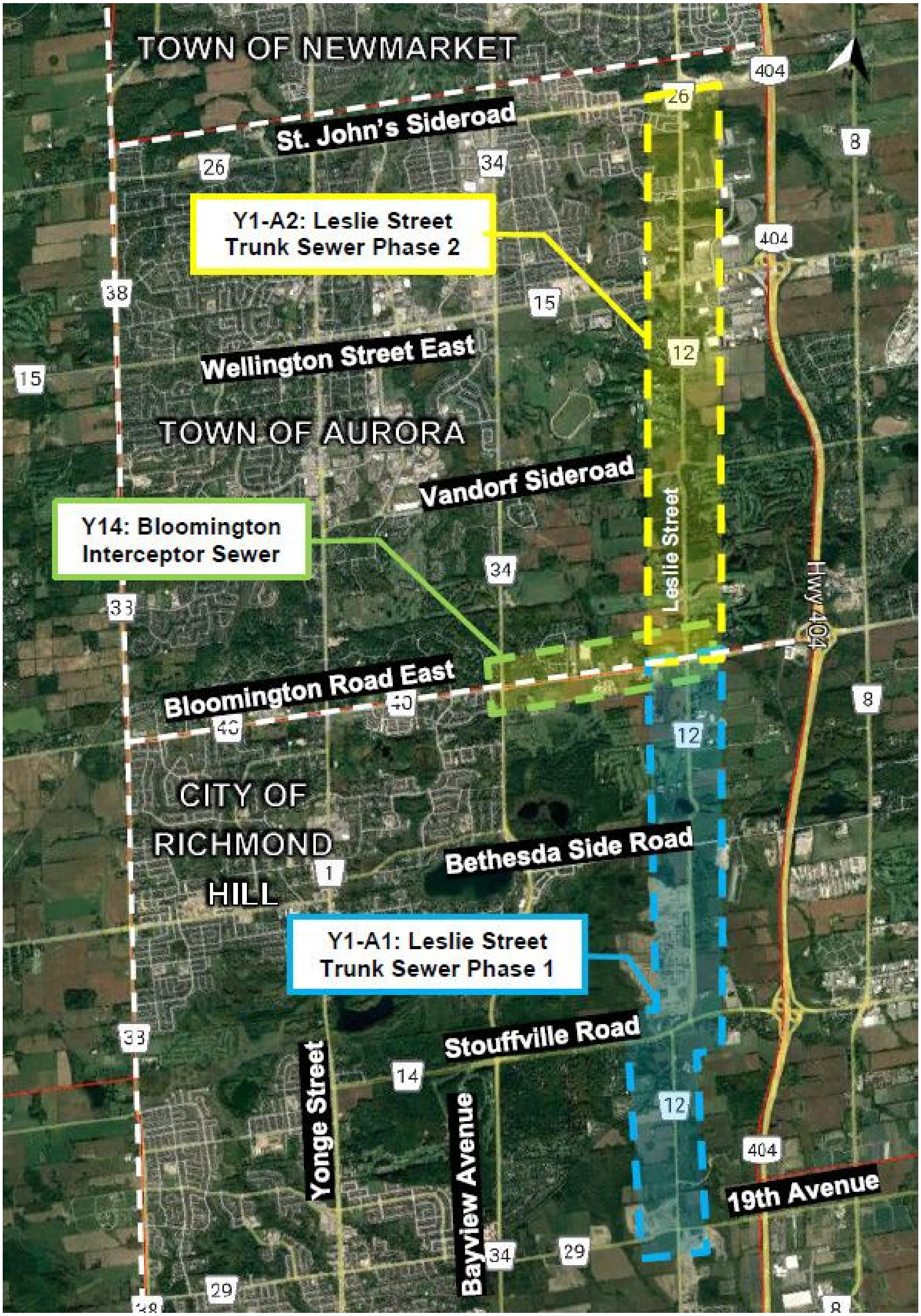

Figure 6.4 **Overview of Y1-A1 and Y1-A2 (Phases 1 and 2) of the Leslie Street Trunk Sewer and Y14 Bloomington Road Interceptor projects**

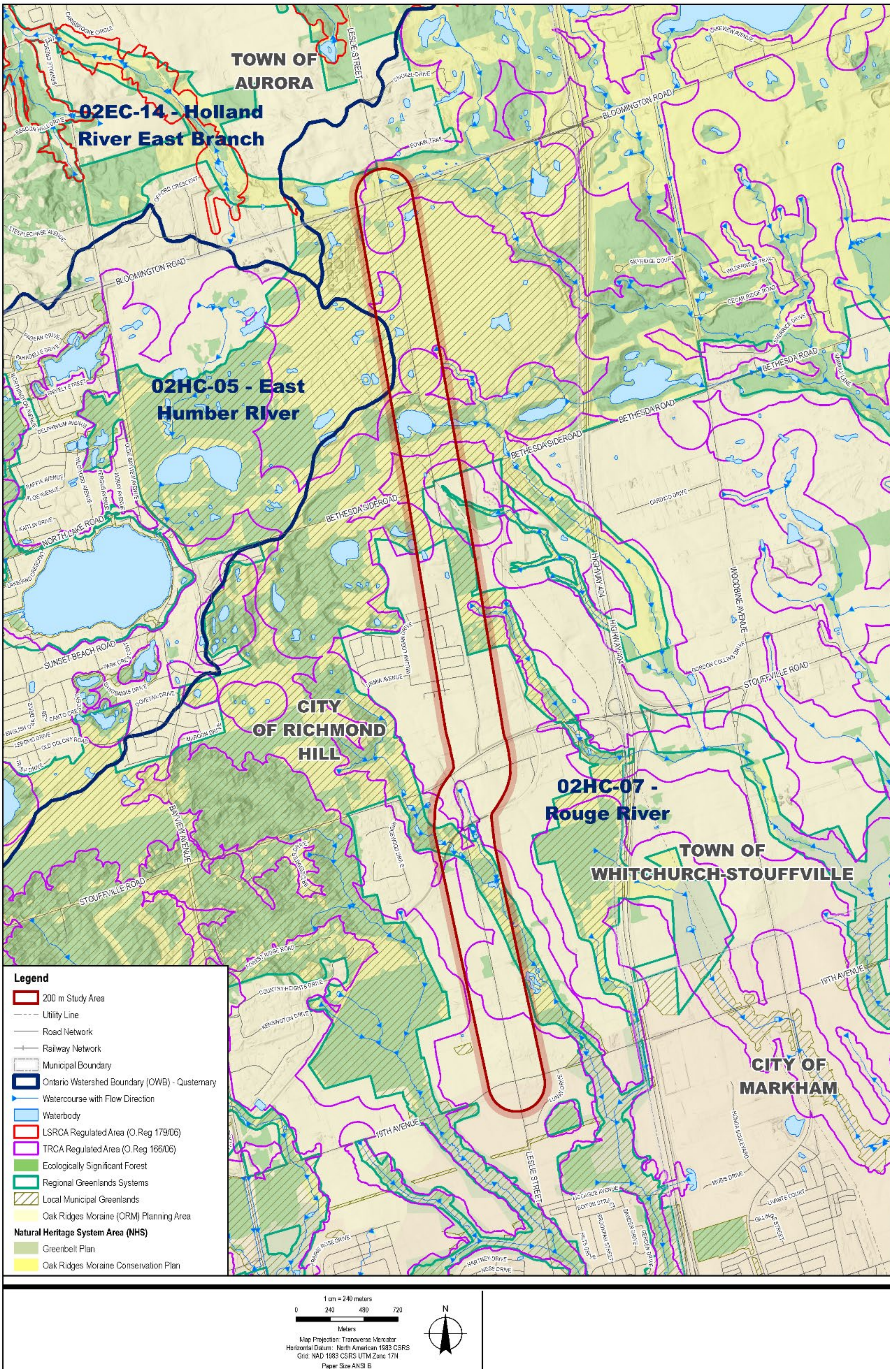

Figure 6.5 Study Area for Y1-A1 (Phase 1) of the Leslie Street Trunk Sewer

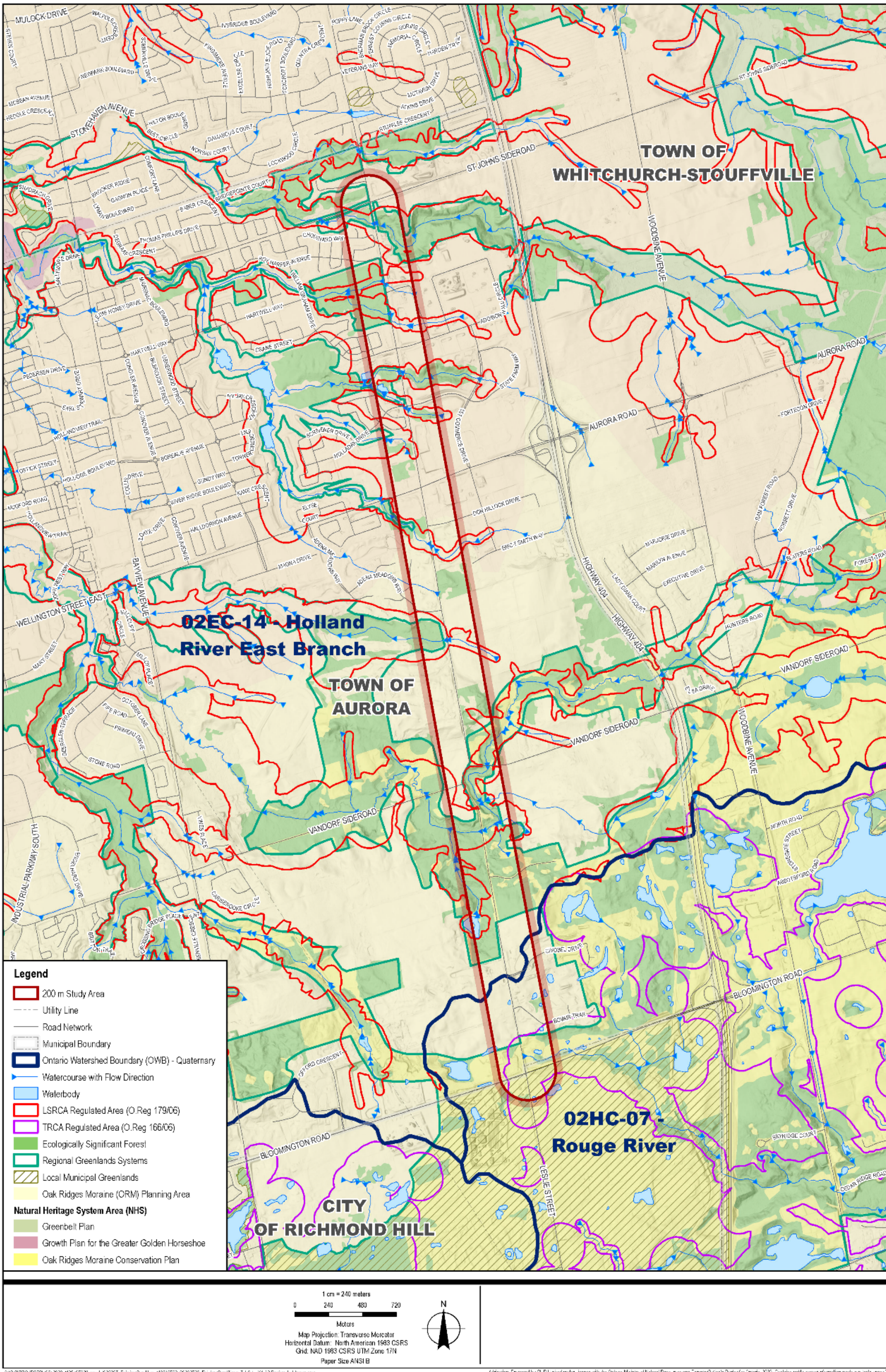

Figure 6.6 Study Area for Y1-A2 (Phase 2) of the Leslie Street Trunk Sewer

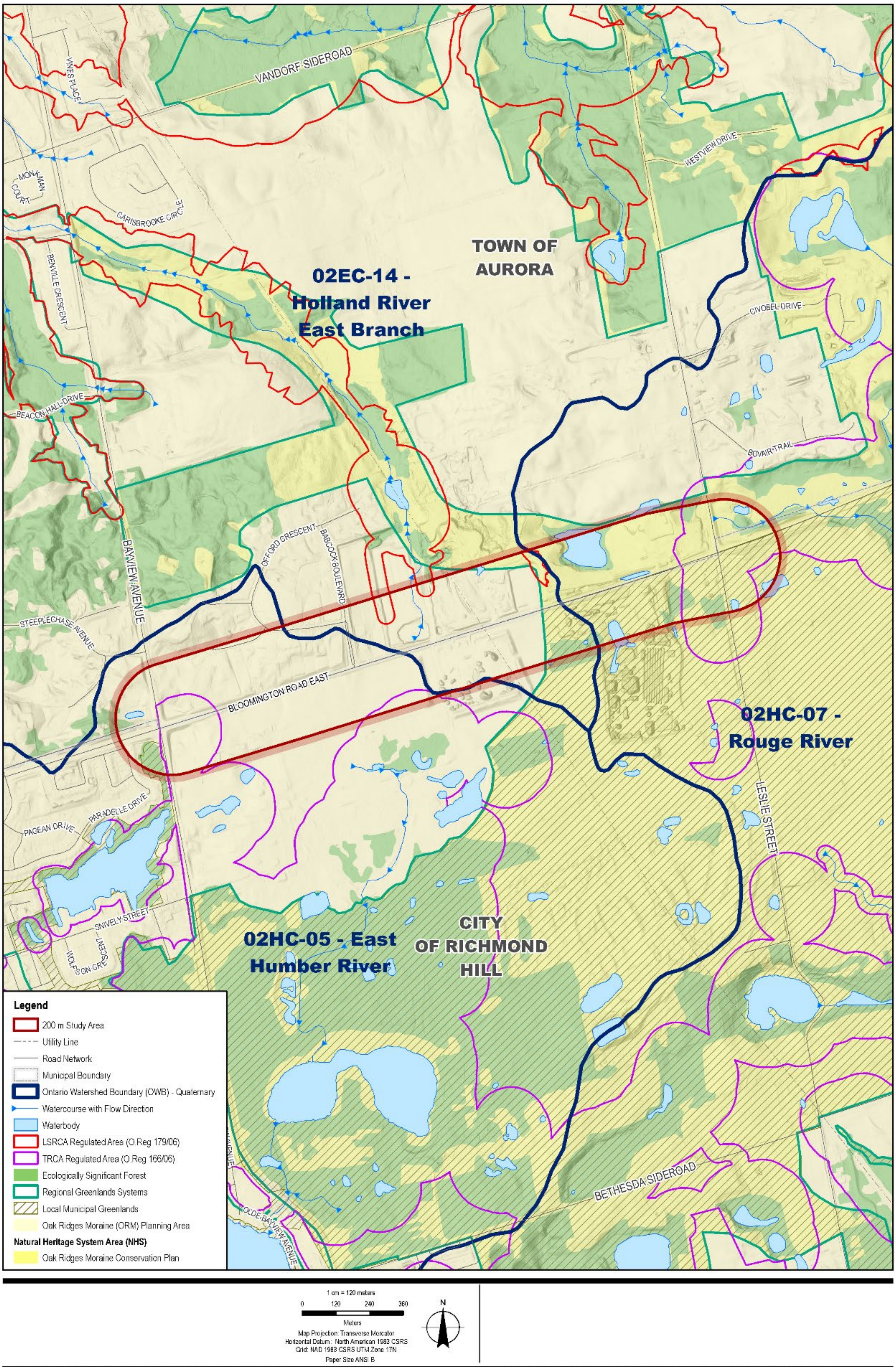

Figure 6.7 Study Area for Y14 Bloomington Interceptor Sewer

6.5.2 Existing Conditions

6.5.2.1 Social and Built Environment

The following sections summarize the desktop study findings of the social and built environments in the study areas for Y1 A1, Y1 A2 and Y14. Planning policy and land use, transportation and utilities were studied. As shown in Figure 6.1, the study area for the Leslie Street Trunk Sewer and Bloomington Interceptor projects extends through the largely urban municipalities of the City of Richmond Hill and the Town of Aurora.

6.5.2.1.1 Planning Policy and Land Use

Existing Land Use

Y1-A1- Leslie Street Trunk Sewer Phase 1

The existing land use along Leslie Street from Bloomington Road to Stouffville Road is summarized below.

West side of Leslie Street:

– Low-density residential housing
– Agriculture
– Haynes Lake
– Recreation (golf course – DiamondBack Golf Club)
– Toronto Muslim Cemetery.

East side of Leslie Street:

– Low-density residential housing
– Agriculture, including a horse farm.

The existing land use along Leslie Street from Stouffville Road to 19th Avenue is summarized below.

West side of Leslie Street:

– Low-density residential housing
– Agriculture.

East side of Leslie Street:

– Low-density residential housing
– Agriculture
– Public Park (Phyllis Rawlinson Park).

Y1-A2 Leslie Street Trunk Sewer Phase 2

The existing land use along Leslie Street from St John’s Sideroad to Wellington Street East is summarized below.

West side of Leslie Street:

– Low-density residential housing
– Commercial (Tim Hortons and Circle K gas station)
– Institutional (The Salvation Army and Northridge Community Church).

East side of Leslie Street:

– Commercial (restaurants, superstores, gas station and bank)
– Natural areas and lands under development.

The existing land use along Leslie Street from Wellington Street East to Bloomington Road is summarized below.

West side of Leslie Street:

- Low-density residential housing
- Agriculture
- Recreation (golf course – Magna Golf Club and Lebovic Golf Club).

East side of Leslie Street:

- Low-density residential housing
- Agriculture
- Recreation (golf course – Westview Golf Club and Lebovic Golf Club)
- Institutional (32 MP Royal Canadian Army Cadets)
- Commercial (superstores).

Y14 Bloomington Interceptor Sewer

Existing land use along Bloomington Road from Bayview Avenue to Leslie Street is summarized below.

Northside:

- Low-density residential housing
- Commercial lands (automobile recycling)
- Open lands.

Southside:

- Agricultural lands
- Commercial lands (Miller Compost and Miller Paving Ltd.)
- Recreational lands (golf course).

Planning Policy

Provincial

The Y1-A1 study area is within the Greenbelt Plan boundary and the ORM boundary, where it intersects with countryside area, natural core and natural linkage areas, and settlement and rural settlement areas designations. The southern portion of the Y1-A2 study area is within the Greenbelt Plan boundary and the ORM boundary, where it intersects with countryside area, natural linkage area and settlement area designations.

The Y14 study area is within the Greenbelt Plan boundary and the ORM boundary, where it intersects with natural linkage area and countryside area designations. Regional lands within the Y1-A1 study area are designated as community areas, rural areas and hamlets by the York Region Official Plan 2022 (June 2023 Office Consolidation). The study area also traverses parts of the York Region’s Greenlands System.

Some lands within the Y1-A2 study area have community area, employment area or rural area designations. The study area also contains parts of York Region’s Greenlands System.

Lands within the Y14 study area are designated as rural areas in the Regional Official Plan. The study area also contains parts of York Region’s Greenlands System.

Local

The Y1-A1 study area contains the following land uses designated in the Richmond Hill Official Plan (January 2023 Office Consolidation):

- ORM Natural Core
- ORM Natural Linkage
- ORM Countryside
- Land west of Leslie Street and south of Bethesda Sideroad are subject to the West Gormley Secondary Plan and are designated as Residential Medium Density and Residential Mixed Use.

With reference to the Aurora Official Plan (September 2021 Consolidation), the Y1-A2 study area traverses the following land use designations:

- Environmental Protection Area
- Open Space
- Urban Residential
- Business Park
- Community Commercial
- Golf Course
- ORM Countryside Area
- ORM Settlement Area.

The Y14 study area straddles the municipal boundary between the Town of Aurora and the City of Richmond Hill. It contains lands designated as ORM Countryside Area and ORM Natural Linkage Area in the Aurora Official Plan (Official Plan Amendment 48) and the Richmond Hill Official Plan.

Active Development Applications

Lands within the Y1-A1, Y1-A2 and Y14 study areas contain several active development applications. The lists below are not exhaustive, as several applications may be linked to the same property address. These applications are primarily for proposed subdivisions and increases in commercial and retail space. The location is listed first, and then the type of development.

Y1-A1 Development Applications

Residential applications:

- Bovair Trail – Proposed subdivision
- Bethesda Sideroad – Site plan
- Leslie Street, south of Bethesda Sideroad to the north of Stouffville Road – To facilitate grading works, storm pond connection, a multi-use path, lane widening, traffic signals and landscaping in Centerfield Properties Inc., a subdivision in West Gormley Development.
- 12844 Leslie Street – To facilitate development of a residential subdivision with two semi-detached units, 43 townhouse units and one partial unit. To construct a municipal storm sewer and discharge stormwater to the existing regional ditch for Long Body Homes Inc., a subdivision in West Gormley Development.
- 12770 Leslie Street – To facilitate development of 189 single-detached units and 172 townhouse units.
- 12711 Leslie Street – Temporary construction access.
- 12600 Leslie Street – To facilitate construction access and engineering review for Sedgewick Property Inc., a subdivision in West Gormley Development.
- 12689 Leslie Street - To facilitate a new two-storey single-detached dwelling with a pool and cabana.

- 12460 Leslie Street – A draft plan of a subdivision to facilitate development of 289.5 single-detached units and 180 townhouse units.
- 940 Stouffville Road – To facilitate development of 231 single-detached units, 13.5 units over 27-part lots, 103 townhouse units and 13 units over 26-part lots.
- 1200 Stouffville Road – To facilitate a high-density, mixed-use development comprised of three 11-storey residential buildings, three 10-storey residential buildings and one four-storey mixed-use building containing residential and office uses and one two-storey institutional building containing a school and place of worship, with a total of approximately 960 dwelling units and 1,055 parking spaces on the eastern portion of the subject lands.
- 11990 Leslie Street – To facilitate construction of a single detached dwelling.
- North of 19th Avenue and West of Leslie Street – Proposed subdivision.
- North of 19th Avenue and east of Leslie Street – Site plan.
- 11580 Leslie Street – To create a medium-density residential development comprising 19 freehold common element condo townhouse dwelling units accessed by a private lane.
- 11546 Leslie Street – To permit a medium-density residential development comprising 24 condominium townhouse dwelling units.
- 11491 Leslie Street – To facilitate development of 18 four-storey townhouse units tied to an internal common-element condominium laneway, which connects the development to the east of the site.
- 1521 19th Avenue – Proposed subdivision.

Infrastructure applications:

- 12860 Leslie Street – To provide relief from the provisions of By-law 128-04, to permit a reduction in the required minimum lot area from 29,000 square metres (m^2) to 27,500 m^2 to facilitate road widening.
- 1380 Stouffville Road – To facilitate signal and road works along Leslie Street and Stouffville Sideroad.
- Along 19th Avenue from Leslie Street to 1300 m west of Leslie Street – North Leslie Street External Spine Services Phase 3, including watermain on 19th Avenue (west of Leslie Street) and sanitary sewers discharging to YDSS shaft no. 6 (located on 19th Avenue, 800 m west of Leslie Street); 19th Avenue, Leslie Street to 1300 m west of Leslie Street.
- 11430 Leslie Street – Terraced retaining wall.

Y1-A2 Development Applications

Residential applications:

- Bovair Trail – Proposed subdivision.
- 13927 Leslie Street – Proposed subdivision.
- 13900 Leslie Street – Proposed development of a Buddhist meditation centre.
- Westview Drive – Proposed subdivision.
- 14361 Leslie Street – Lot addition.
- Sirona's Way – Proposed subdivision.
- South of Wellington Street East and west of Leslie Street – To establish land-use permissions to permit the development of a mixed residential development composed of three seven-storey apartment buildings (541 dwelling units) and 12 townhouse blocks (59 dwelling units) on private roads. Minor variance application submitted.
- 4 Don Hillock Drive – Proposal for a six-storey hotel building containing approximately 122 units.
- 1452 Wellington Street East – To facilitate development of 30 three-storey townhouse dwellings.
- 15306 Leslie Street – To facilitate development of three seven-storey buildings with a total of 345 residential units. To rezone the subject lands from Community Commercial to Medium-High-Density Residential to facilitate development of 300 residential apartment units.

- 15370 Leslie Street – To rezone the lands to facilitate the development of 32 townhouse units.
- Northwest corner of Wellington Street East and Leslie Street – To facilitate a temporary sales trailer.
- 271 Holiday Drive – To facilitate development of six six-storey rental apartment buildings with 155 units with two levels of underground parking.
- 15516 Leslie Street – To create a seven-storey condominium apartment building consisting of 136 units.
- 480 William Graham Drive – To lift the holding provisions on the lands currently zoned Residential RA3-15 to facilitate a seven-storey retirement residence with 125 units.

Commercial applications:

- South of Wellington Street East, east of Leslie Street – Site plan, proposed development of a two-storey office building.
- South of Wellington Street and East of Leslie Street – To facilitate development of four commercial buildings.
- Northeast corner of Wellington Street and Leslie Street – Amend the Bayview Northeast 2B secondary plan to permit development of a multi-tenant commercial building.
- South of St. John's Sideroad and east of Leslie Street – To facilitate site-specific amendments to allow warehousing and accessory uses for all principal uses on the subject lands.
- 1625 St. John's Sideroad – To rezone the lands from Rural (RU) Zone to Business Park.
- 1588 St. John's Sideroad – Site plan to facilitate a three-storey self-storage building.

Y14 Development Applications

- Bluegrass Drive – Proposed subdivision.
- Babcock Road – Proposed subdivision.
- 1082 Bloomington Road – Proposed development of a storage facility.
- Bloomington Road – Proposed subdivision.

6.5.2.1.2 Transportation in the Study Area

Y1-A1 Leslie Street Trunk Sewer Phase 1

Leslie Street (from 19th Avenue to Stouffville Road) has a posted speed of 60 kilometres per hour (km/h). It is a two-lane collector road with gravel shoulders in a relatively rural area and is surrounded by farmland, wooded areas, vegetated areas and entrances leading to private residences. The first 300 m immediately north of 19th Avenue have urbanized roads with curbs and catch basins. Figure 6.8 shows photos of Leslie Street's urban and rural road cross-sections.

Figure 6.8 **Leslie Street Surface Conditions North of 19th Avenue (Left) and South of Stouffville Road (Right) (Looking North). (*Google Maps* "Streetview," digital images http://maps.google.com)**

The annual average daily traffic (AADT) along Leslie Street between 19th Avenue and Bloomington Road varies between 4,617 vehicles in the south end (2016 data) and 2,788 vehicles in the north end (2022 data). Historical AADT data along this section of Leslie Street are presented in Table 6.3.

Table 6.3 **Leslie Street AADT Counts Between 19th Avenue and Bloomington Road**

Road limits	AADT counts (vehicles)					
	2013	2016	2017	2018	2019	2022
19th Avenue and Gormley Road West	5,499	4,617				
Bethesda Sideroad and Stouffville Road	2,182	2,310	2,441	2,256	2,431	
Bethesda Sideroad and Bloomington Road	1,756	2,400		2,348		2,788

No public bus transit is provided along Leslie Street within the study area, so no bus stops or related infrastructure is anticipated within the study area.

The sewer will need to cross under a CNR rail line used by Metrolinx GO Transit that crosses Leslie Street 350 m south of Stouffville Road.

Y1-A2 Leslie Street Trunk Sewer Phase 2

Leslie Street, north of Bloomington Road, is a rural two-lane collector road with an intermittent painted-centre median, with paved shoulders throughout and guardrails along steep and curved portions (Figure 6.9).

Figure 6.9 Leslie Street North of Bloomington Road (*Google Maps* "Streetview," digital images http://maps.google.com)

The AADT along Leslie Street between Bloomington Road and St. John's Sideroad varies between 3,606 vehicles in the south end and 12,266 vehicles in the north end, according to the latest available 2023 data. Historical AADT data along the study area are presented in Table 6.4.

Table 6.4 Leslie Street AADT Counts Between Bloomington Road and St. John's Sideroad

Road limits	AADT counts (vehicles)								
	2012	2013	2015	2016	2017	2018	2019	2022	2023
Bloomington Road and Bovair Trail		2,930	2,805		2,931		3,348		3,606
Vandorf Sideroad and Don Hillock Drive		5,951		5,797		5,917		6,868	
Don Hillock Drive and Wellington Street East	5,756								
St. John's Sideroad and State Farm Way	10,037		9,543		9,913		11,380		12,266

No public bus transit is provided along Leslie Street within the study area, so no bus stops or related infrastructure is anticipated within the study area.

Y14 Bloomington Interceptor Sewer

Bloomington Road is a four-lane rural collector road with a median centre lane. The shoulders are paved. The boulevards do not have sidewalks and are protected by guardrails near the two major intersections. Figure 6.10 shows a photo taken in the middle of the study area (approx. sta. 1+500).

Figure 6.10 Bloomington Road Corridor (Looking East). (*Google Maps* "Streetview," digital images http://maps.google.com)

The AADT along Bloomington Road between Bayview Avenue and Leslie Street is at 23,107 vehicles, according to the latest available 2022 data. Historical AADT data within this section of Bloomington Road are presented in Table 6.5.

Table 6.5 Bloomington Road AADT Counts Between Babcock Boulevard to Leslie Street

Road limits	AADT counts (vehicles)					
	2013	2014	2016	2017	2018	2022
Babcock Boulevard to Leslie Street	19,979	19,900	20,194	20,510	20,535	23,107

No public bus transit is provided along Leslie Street within the study area, so no bus stops or related infrastructure is anticipated within the study area.

6.5.2.1.3 Utilities in the Study Area

Several above- and below-grade utilities are within and near the study area. They may be temporarily impacted during construction of tunnel, shafts and work compounds. Formal notification and consent would be required from the authorities responsible for these utilities before construction.

Buried utilities are typically located within the following limits:

– Shallow-buried electrical and communications cabling are commonly buried between 1.2 and 1.5 meters below ground surface (mbgs).
– Shallow-buried storm drains, sanitary sewers and watermains are typically buried between 1.2 and 3.5 mbgs.
– Deep-buried utilities are defined as anything buried more deeply than the depths mentioned above.

A detailed utility investigation program, which would include a Level A through D subsurface utility exploration, would be required as part of future site investigations.

According to the York Region GIS database, large infrastructure within the study area includes:

– **Y1-A1 Leslie Street Trunk Sewer Phase 1 –** CNR line used by Metrolinx that crosses Leslie Street 350 m south of Stouffville Road (approx. sta. 1+800); the sewer will need to cross under the CNR line.

– **Y1-A2 Leslie Street Trunk Sewer Phase 2 –** An underpass at Lebovic Golf Club (approx. sta. 7+050) for access to the golf courses on either side of Leslie Street.

In order to approve construction for these two project components, CNR and underpass owners will likely require geotechnical monitoring to be completed during construction. The CNR rail crosses Leslie Street directly above the planned sewer installation. Any potential construction impacts to the CNR tracks and underpass structure will be assessed during design development.

6.5.2.2 Natural Environment

The following sections summarize the findings of the desktop studies completed for the study areas for Y1-A1, Y1-A2 and Y14. The studies investigated geotechnical, hydrogeological, surface water, natural heritage and contamination characteristics.

6.5.2.2.1 Y1-A1 Leslie Street Trunk Sewer Phase 1

Geotechnical

Starting at the northern limit of Y1-A1, the area between Bloomington Road and Bethesda Sideroad was investigated by examining borehole logs from 2008. The near surface is generally composed of clayey silt to silty clay deposit (firm to stiff) overlying compact to dense wet sand followed by clayey silt till (damp and hard consistency). The till deposit that was encountered is generally damp to moist. A few boreholes encountered a sandy silt layer (compact relative density) and clayey silt deposit (very stiff to hard consistency); these deposits were generally moist to wet. The groundwater table was about 0.1 metres above the ground surface (mags) (artesian conditions). A peat layer 6 m thick was also encountered in one borehole advanced to a depth of 16 m. Borehole logs from 2012 in this area also indicate that the near surface generally consists of silty clay till (soft to stiff) with interbedded loose to compact sand. A peat layer 3 m thick and some shells to a depth of about 5 m were encountered in a few boreholes, advanced to a depth of 14 m. The ground-surface elevation and groundwater table at the boreholes were not reported.

Continuing south, between Bethesda Sideroad and Stouffville Road, the area is bordered on the east and west by farmland, vegetated areas and private properties. Borehole records from 1971 indicate that the near surface is generally sandy silt to silty sand (very dense). In these records, the ground-surface elevation at the boreholes varies between elevation 289.7 m above sea level (masl) and 274.3 m above mean sea level (mamsl), and the groundwater table varies between elevation 269.9 masl and 268.9 mamsl.

The southern limit area of this project component, between Stouffville Road and 19th Avenue, is bordered on the east, west and south by farmland, vegetated areas and private properties. Geotechnical reports from 2017 indicate that the near surface is generally composed of clayey silt/clayey silt till (firm to very stiff consistency). The encountered deposit was generally moist. A few boreholes encountered sandy silty clay/silt with an interbedded clay layer. The ground-surface elevation at the boreholes varied between elevation 261.2 masl and 244.5 masl. The groundwater table was at an elevation of 248.7 mamsl in one borehole, and the remainder of the boreholes were dry.

The near-surface soils in the northern and middle portions of the study area are predominantly composed of gravel and sand and minor till, including esker, kame, end moraine, ice-marginal delta and subaqueous fan deposits, mostly consisting of glaciofluvial ice-contact deposits. The eastern portion of the study area mostly consists of non-cohesive Newmarket Till deposits. The near-surface soils in the rest of the study area are predominantly composed of silt to silty clay matrix high in matrix carbonate content and clast poor (Halton Till deposit).

The bedrock consists of shale, limestone, dolostone and siltstone in the Georgian Bay, Blue Mountain, or Billings formation.

Hydrogeological

A hydrogeological desktop review was undertaken within the study area using information from MECP well records, the MECP Source Protection Information Atlas, the ORM database and the Ontario Geological Survey database. Available hydrogeological reports for projects within the area were also reviewed.

The study area for Y1-A1 is within the Schomberg Clay Plains physiographic region until approximately Bethesda Sideroad. Between Bethesda Sideroad and 19th Avenue, it transitions into the South Slope physiographic region. At Bloomington Road, the sewer is at an elevation of approximately 262 to 264 mamsl, under more than 40 m of cover. At Stouffville Road, the sewer is at approximately 258 to 260 mamsl, under 19 m of cover. From Stouffville Road to 19th Avenue, there are two drops. The sewer ends at 19th Avenue at an elevation of 236 to 238 mamsl, under 7 m of cover.

The Y1-A1 alignment may locally intersect aquifer(s) with flowing artesian conditions at the following locations:

- 19th Avenue and Leslie Street, flowing artesian conditions 3.5 to 10.36 mags.
- Stouffville Road and Leslie Street, flowing artesian conditions 2.1 to 3.18 mags.
- The linear infrastructure is not located within the source water protection areas of WHPA-D.

The study area is outside of any WHPAs. Shallow groundwater flows west until approximately Vandorf Sideroad, then transitions to flow north between Bloomington Road and Vandorf Sideroad.

The Y1-A1 tunnel and shafts are anticipated to intersect thick sections of saturated ORM deposits, permeable sediments with hydraulic conductivity in the range of approximately 9 x 10^{-4} to 1 x 10^{-2} centimetres per second (cm/s), and both unconfined and confined aquifer(s) with transmissivity in the range of 7 to 101 m^2/day. The hydraulic high is between Bloomington Road and Bethesda Sideroad, matching topographic highs. Shallow groundwater flows south-southeast to the south of Bethesda Sideroad. There are multiple private wells along Leslie Street.

Table 6.6 provides details on anticipated aquifers and aquitards in the study area.

Table 6.6 Aquifers and Aquitards in the Y1-A1 Study Area

Aquifers and aquitards	Description	Thickness
Undifferentiated upper sediments at ground surface (aquifer)	An unconfined aquifer consisting of discontinuous fill and unconsolidated overburden deposits.	Generally, 2 m thick
Oak Ridges Moraine Complex (aquifer)	These sediments consist mostly of silt and fine sand but also include gravel, minor clay and diamicton. The aquifer is generally unconfined, except for the section covered by Halton Till on the south flank of the moraine complex.	Up to 50 m thick
Lower Newmarket Till (aquitard)	A continuous layer that acts as an aquitard to the underlying Thorncliffe Formation.	Unknown, located below ORM, between Bloomington Road and 19th Avenue

Surface Water

The Rouge River is the receiving body for the only sub-watershed within the study area. The sewer will cross under its tributaries. Other surface features of interest include:

- Coldwater headwater tributary of Bruce Creek
- White Rose-Preston Lake Wetland Complex
- Berczy Creek
- Haynes Lake
- Unnamed headwater tributary
- Two coldwater headwater streams of the Rouge River
- Rouge River Wetland Complex
- Wilcox-St. George Wetland Complex.

Figure 6.11 is a surface-water map of existing conditions within the study area to the south.

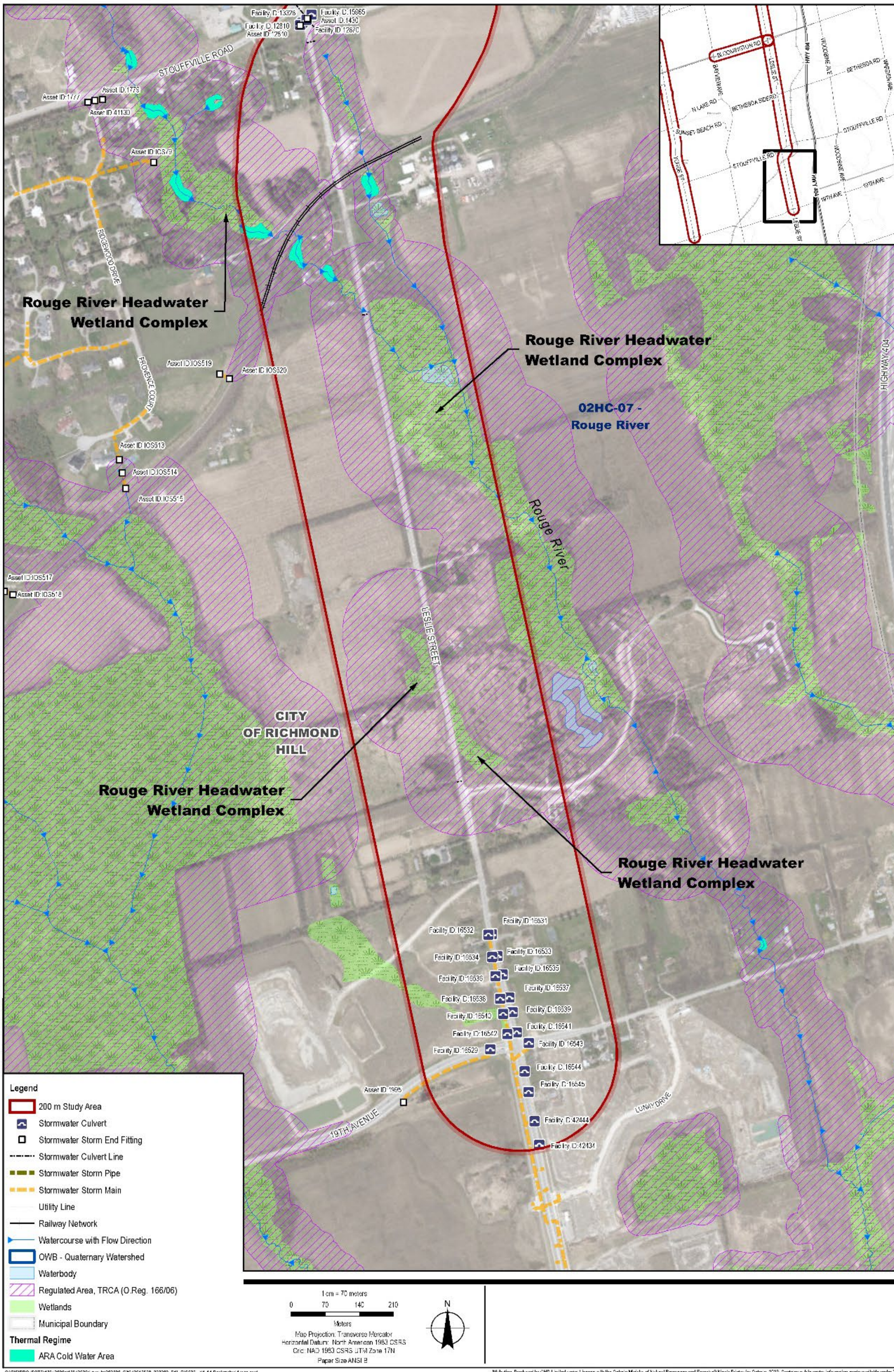

Figure 6.11 Y1-A1 Study Area Surface-Water Map of Existing Conditions, South Section

Natural Heritage Characterization

The Y1-A1 study area contains ecologically significant forests, wetlands, Provincially Significant Wetlands (PSWs) and Areas of Natural and Scientific Interest (ANSIs). It also contains areas under the Oak Ridges Moraine Groundwater Program (ORMGP) and areas associated with both the Regional and Local Municipal Greenlands System regulated under the Toronto Region Conservation Authority (TRCA).

The White Rose-Preston Lake Wetland Complex (a PSW) contains the White Rose, Simeon Forest and Preston Lake Wetlands. This complex occurs within the study area at the intersection of Leslie Street and Bloomington Road. It is protected under the Oak Ridges Moraine Conservation Plan (ORMCP) within TRCA jurisdiction. The White Rose-Preston Lake Wetland Complex also contains the Simeon Lakes ANSI within the northern portion of the study area.

The Wilcox-St. George Wetland Complex (a PSW) contains multiple wetlands within the study area just north of Bethesda Sideroad and a wetland protected under the ORMCP within TRCA jurisdiction. The Wilcox-St. George Wetland Complex also exists in conjunction with the ANSI Simeon Lakes.

The Rouge River Headwater Wetland Complex (a PSW) is in the southernmost portion of the study area. This wetland is protected under the ORMCP within TRCA jurisdiction and is under special consideration regarding the Rouge National Urban Park, which encompasses the Rouge River and its tributaries in the greater Toronto area. The headwaters within this wetland complex of the Rouge River are themselves classified as critical habitats by Fisheries and Oceans Canada (DFO), particularly because of the known presence of an ideal habitat for redside dace, a federally endangered fish species.

Aquatic Habitat

At the northern limits of the Y1-A1 study area, at the intersection of Leslie Street and Bloomington Road, there is an easterly flowing coldwater headwater tributary of Bruce Creek. This small watercourse is confined within an area of deciduous forest and flows through part of the White Rose-Preston Lake Wetland Complex. This stream flows for approximately 910 m before draining into Bruce Creek. This headwater likely supports mostly bait and forage fish, with little coldwater sportfish presence.

Two prominent water features exist further south in Y1-A1, just north of Bethesda Sideroad: Berczy Creek and Haynes Lake. Haynes Lake is just metres off the western side of Leslie Street and has a surface area of approximately 34,500 m^2. It is surrounded by a marsh riparian buffer containing *Phragmites spp.* and coniferous and deciduous trees and is part of both the Simeon Lakes ANSI and the Wilcox-St. George Wetland Complex. Haynes Lake likely supports warmwater forage and sportfish.

Berczy Creek drains eastward out of Haynes Lake and has a warmwater thermal regime. Much of the natural area and riparian buffer from Haynes Lake extends eastward with Berczy Creek, which flows over a flat landscape with a wide vegetated floodplain and has a documented fish community distinct from that of Haynes Lake. Berczy Creek and Haynes Lake support bait fish, forage fish and sportfish communities.

An unnamed coldwater headwater feature exists within Y1-A1. This small feature is in an industrialized area where a new high-density residential development is occurring as well. This feature flows for 4.2 km before draining into Berczy Creek. Not much natural area exists around this small watercourse; it flows through sparsely treed areas and mowed lawns near agricultural fields. This headwater tributary of Berczy Creek likely supports bait and forage fish, with no sportfish present.

Finally, at the southern limit of the study area, two coldwater streams that make up part of the Rouge River headwaters flow southward through deciduous forest environments and agricultural pastures. These watercourses are part of the Rouge River Wetland Complex, which allows these two stream ecosystems to eventually join and support a diverse fish community. The Rouge River Headwaters likely support bait and forage fish and sportfish.

Redside dace is an aquatic Species at Risk (SAR) listed as endangered under the *Endangered Species Act* (ESA) and Species at Risk Act (SARA). The Ministry of the Environment, Conservation and Parks (MECP) confirmed the potential presence of redside dace within this study area, and these watercourses were identified as occupied redside dace habitat.

Terrestrial Habitat

Land use within the study area is primarily urban, residential, commercial and agricultural. However, some deciduous, mixed and coniferous forests are present in various stages of maturity. The landscape consists of gently rolling topography typical of the ORM. Several wetlands and ponds, some assessed and others not, exist throughout the area, as well as valleys associated with watercourses.

As described above, PSWs within the study area are the Rouge River Headwater Wetland Complex in the southern portion of the study area, the Wilcox-St. George Wetland Complex in the central portion and the White Rose-Preston Lake Wetland Complex in the northern portion. Wetland complexes are a fairly small portion of the total land area of the study area; most of the wetland complex area is outside the study area.

All natural and cultural communities in the study area are common in the province.

Significant Wildlife Habitat

Several natural areas in the study area are potential candidates for Significant Wildlife Habitat (SWH) for Region 6E designation, as defined by the Ministry of Natural Resources and Forestry (MNRF). The greatest concentration of these potential SWH areas is likely in wetland and woodland habitats associated with the PSWs and ESAs. All Ecological Land Classification (ELC) communities in the study area were screened and analyzed for seasonal concentration areas of animals, rare vegetation communities, specialized habitats for wildlife, habitats for species of conservation concern and animal movement corridors.

Areas of Potential Environmental Concern

A review of information from the Environmental Risk Information Services database was completed for properties within the study area to assess potential for containing subsurface environmental contamination. A “windshield-level” survey was completed on May 26, 2023, to visually confirm the current land use. This “windshield-level” survey showed that:

- Residential and commercial properties are present along most of the study area.
- Some agricultural and industrial land use is present along the northern and southern portions of the study area.
- An active railway line is present 350 m south of the Leslie Street and Stouffville Road intersection, crossing the roadway and the study area; the railway is a potential environmental concern.

Figure 6.12 shows a location with low existing contamination risk (green circle). There are no known spills or moderate- or high-risk locations within the Y1-A1 study area. The number in the circle (24) is an identifier relevant to the entire York Region Sewage Works Project rather than to any particular project component.

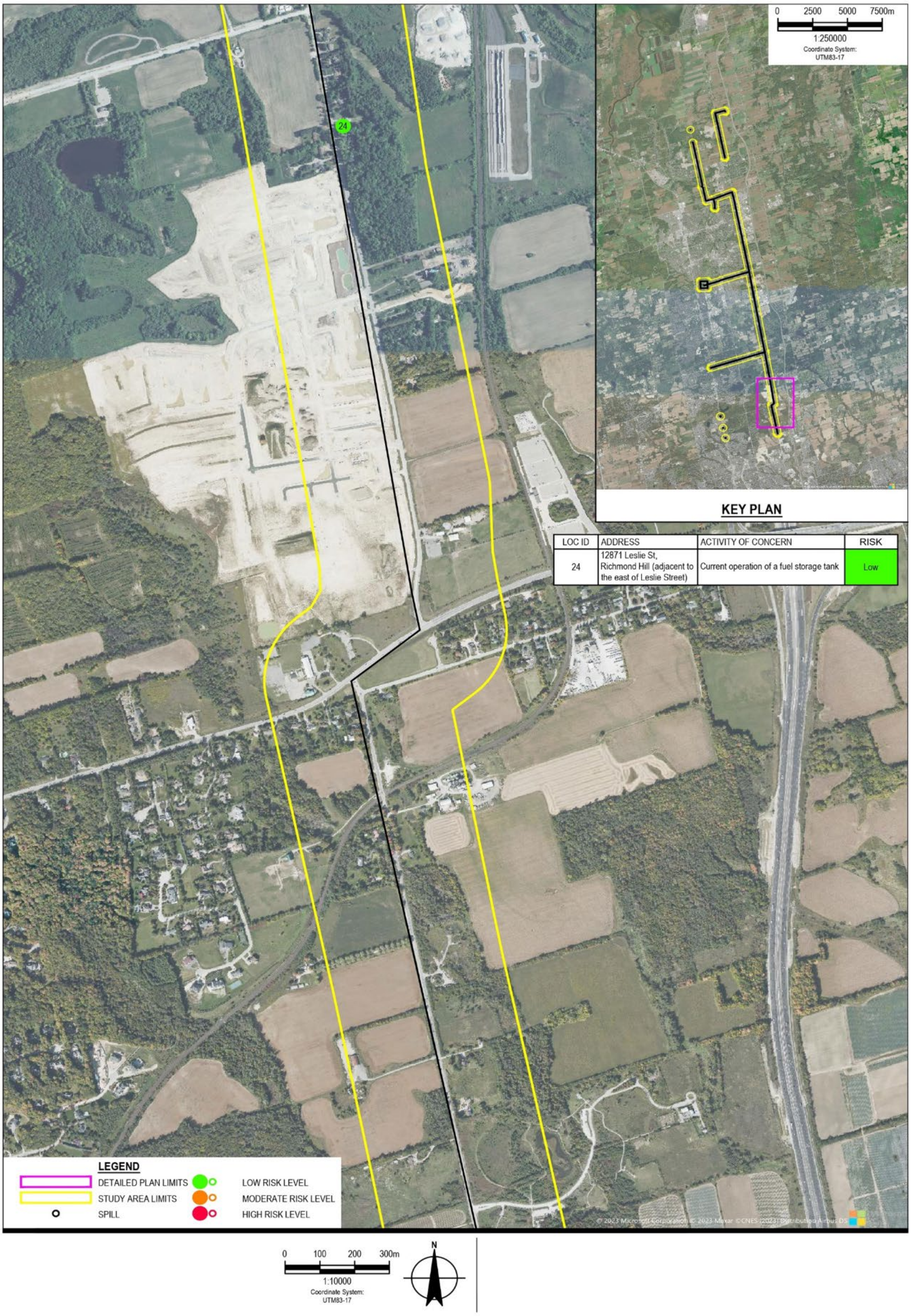

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Figure 6.12 Potential Environmental Concern and Level of Risk within the Y1-A1 Study Area

6.5.2.2.2 Y1-A2 Leslie Street Trunk Sewer Phase 2

Geotechnical

Logs of boreholes advanced from 5 mbgs to 15 mbgs in 2014, indicate that the near surface is generally composed of silt and clay deposits, with occasional discontinuous sandy lenses and coarse-grain deposits ranging from sand to gravel. The groundwater table was about 2 m below the existing grade. The native deposit within the study area is predominantly composed of silt and clay matrix, mostly consisting of glaciolacustrine deposits.

The bedrock consists of limestone, dolostone, shale, arkose and sandstone in the Ottawa or Simcoe Group or Shadow Lake Formation. Typically, bedrock is mapped at 71 to 76 mbgs within the study area.

Hydrogeological

A hydrogeological desktop review was undertaken within the study area using information from MECP well records, the MECP Source Protection Information Atlas, the ORM database and the Ontario Geological Survey database. Available hydrogeological reports for projects within the area were also reviewed.

The depth of the Y1-A2 sewer ranges from 10 to 70 mbgs, with deep sections approximately 55 m from Bethesda Sideroad and approximately 70 m north of Bloomington Road. At Bloomington Road, the sewer is at an elevation of approximately 262 to 264 mamsl, under more than 40 m of cover. At St. John’s Sideroad, the sewer is at approximately 268 to 270 mamsl, under 10 m of cover. From St. John’s Sideroad to Bloomington Road, there are no drops, and it is anticipated that the sewer will be installed with a 0.1 percent (%) grade to facilitate gravity flow to the south.

It is anticipated that the Y1-A2 tunnel and shafts will primarily intersect thick sections of Newmarket Till deposits, which are fine-textured sediments with hydraulic conductivity in the range of approximately 1×10^{-6} to 5×10^{-7} cm/s.

The Y1-A2 alignment may locally intersect aquifer(s) with flowing artesian conditions at the following locations:

1. Vandorf Sideroad and Leslie Street, flowing artesian conditions 0.2 mags.
2. Wellington Street and Leslie Street – No flowing artesian conditions encountered, but groundwater levels close to ground surface in topographically low areas.

The linear infrastructure is not located within the source water protection areas of WHPA-C, except for a small section (approximately 440 m long) within WHPA-D near St. John’s Sideroad.

There are multiple private wells along Leslie Street.

Table 6.7 lists details on anticipated aquifers and aquitards within the study area.

Table 6.7 Aquifers and Aquitards Through the Y1-A2 Study Area

Aquifers and aquitards	Description	Thickness
Undifferentiated upper sediments at ground surface (aquifer)	An unconfined aquifer consisting of discontinuous fill and unconsolidated overburden deposits.	Generally, 2 m
Upper Newmarket Till (aquitard)	The Newmarket Till is regionally extensive and consists of over-consolidated, calcite-cemented, sandy silt till deposited during the Late Wisconsinian Missouri Stadial period approximately 18,000 to 23,000 years ago by the southward-flowing Laurentide ice sheet. This unit acts as a regional aquitard separating the ORM from the underlying Thorncliffe Formation (TRCA, 2002).	Unknown within the study area
Inter-Newmarket Sediments (aquifer)	Coarser granular (silt, sand, or gravel) unit dividing the upper and lower Newmarket Tills.	Unknown within study area
Oak Ridges Moraine (aquifer)	These sediments consist mostly of silt and fine sand but also include gravel and minor clay and diamicton. The aquifer is generally unconfined, except for the section covered by Halton Till on the south flank of the moraine complex.	Up to 50 m thick, from Vandorf Sideroad to 19th Avenue
Lower Newmarket Till (aquitard)	A continuous layer that acts as an aquitard to the underlying Thorncliffe Formation.	Unknown, located below ORM. Pinches out at Bloomington Road

Surface Water

The sub-watersheds within the study area drain to the Rouge River and the Holland River East Branch. The sewer will cross under tributaries for the Rouge River toward the south of the study area and under the Holland River East Branch toward the north of the study area.

Figure 6.13 is a surface-water map of existing conditions within the study area to the south.

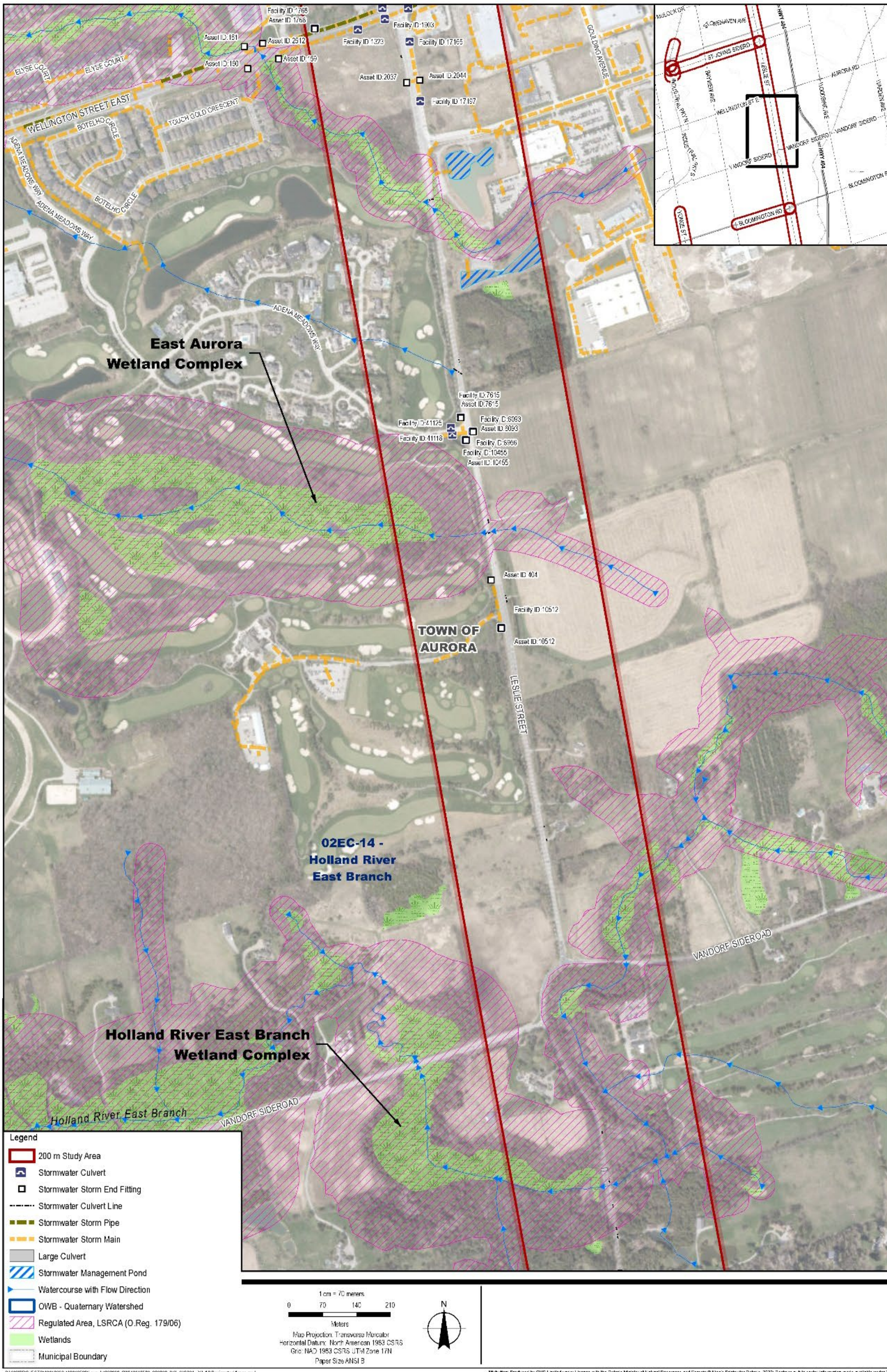


Figure 6.13 Y1-A2 Study Area Surface-Water Map of Existing Conditions, Middle Section

Natural Heritage Characterization

The Y1-A2 study area contains ecologically significant forests, wetlands, areas under the ORMGP and areas associated with the Regional Greenlands System, which is regulated under both the Lake Simcoe Region Conservation Authority (LSRCA) and TRCA.

The East Aurora Wetland Complex (a PSW) is a group of nine wetlands and marshes on the eastern side of the Town of Aurora. This wetland complex holds significant habitat for regional waterfowl and migratory birds and is protected under the ORMCP with the LSRCA.

The Bogart Creek Wetland Complex (a PSW) is a marsh at the intersection of St. John's Sideroad and Leslie Street. It is protected under the ORMCP with the LSRCA.

The Holland River East Branch Wetland Complex (a PSW) is a swamp near the intersection of Vandorf Sideroad and Leslie Street. It is protected under the ORMCP with the LSRCA.

The White Rose-Preston Lake Wetland Complex (a PSW and ANSI) contains the White Rose, Simeon Forest and Preston Lake Wetlands. No portion of the ANSI protrudes into the study area. Occurring within the study area at the intersection of Leslie Street and Bloomington Road, it is protected under the ORMCP within TRCA jurisdiction.

Aquatic Habitat

The northernmost portion of the Y1-A2 study area contains five unnamed watercourses, four of which have a warmwater thermal regime, while the most northern stream has a coldwater thermal regime. The surrounding area in this portion of the study area is mostly industry and businesses, with new high-density residential developments. Despite the surrounding urban environment, streams and other areas within this portion of the study area are largely natural, being confined within valleys that have a mixture of coniferous, deciduous and shrub riparian buffers. While the desktop study for this report used Aquatic Resource Area (ARA) fish community data for these streams, those data may be more representative of the larger watercourses they drain into. The four warmwater watercourses present in this portion of the study area are all interconnected downstream and have a fish community consisting of brook stickleback, brook trout, creek chub, fathead minnow, pumpkinseed and white sucker. These four warmwater streams support mostly bait and forage fish, with little sportfish presence.

The coldwater watercourse within the study area that eventually drains into Tannery Creek might be able to support a much more diverse fish community, but this is unlikely because flow is intermittent.

Near Vandorf Sideroad, a smaller upstream coldwater portion of the Holland River East Branch and three of its coldwater tributaries flow through the study area. These sinuous watercourses are confined within a valley with steep slopes densely vegetated with coniferous and deciduous trees and woody shrubs. Surrounding land use shows mostly natural areas, with a golf course at the easternmost side of the study area. This section of the Holland River East Branch, along with its tributaries, contains a fish community. This coldwater portion of the Holland River East Branch and its tributaries likely support a community of bait and forage fish and sportfish.

Southward in the study area, a pond is present with a coldwater outlet that flows for approximately 680 m northward before draining into the Holland River East Branch. This pond has a dense woody vegetation riparian community and appears to be artificially made. ARA data show the pond and outlet as supporting a fish community. These aquatic environments support mostly bait and forage fish, with few sportfish.

At the southern limits of the Y1-A2 study area, at the intersection of Leslie Street and Bloomington Road, exists an easterly flowing coldwater headwater tributary of Bruce Creek. This small watercourse is confined within an area of deciduous forest and flows through part of the White Rose-Preston Lake Wetland Complex. This stream flows for approximately 910 m before draining into Bruce Creek. This headwater of Bruce Creek likely supports mostly bait and forage fish, with few sportfish. No redside dace have been recorded within this study area.

Terrestrial Habitat

Land use within the study area is mainly urban residential, commercial and agricultural. However, some deciduous, mixed and coniferous forests are present in various stages of maturity. The landscape consists of gently rolling topography typical of the ORM. Several wetlands and ponds, some assessed and others not, exist throughout the area, as well as valleys associated with watercourses.

PSWs within the study area are the White Rose-Preston Wetland Complex, East Aurora Wetland Complex, Bogart Creek Wetland Complex and Holland River East Branch Wetland Complex. Wetland complexes are a fairly small portion of the total land cover for the study area.

All natural and cultural communities in the study area are common in the province.

Significant Wildlife Habitat

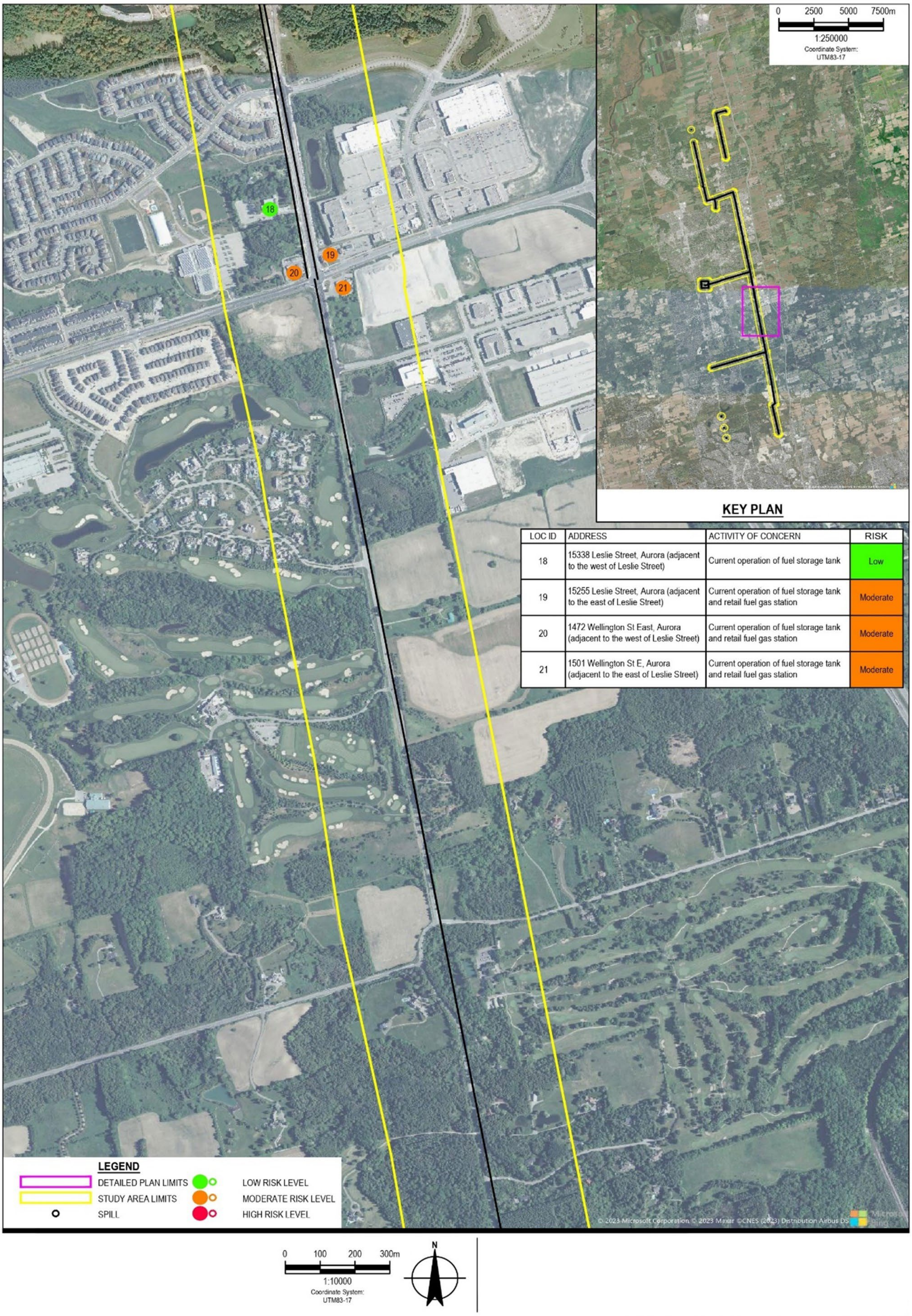
Several natural areas within the study area are potential candidates for SWH for Region 6E designation, as defined by MNRF. The greatest concentration of these potentials is likely to be found in wetland and woodland habitats associated with the PSWs and ESAs. All ELC communities in the study area were screened and analyzed for seasonal concentration areas of animals, rare vegetation communities, specialized habitats for wildlife, habitats for species of conservation concern and animal movement corridors.

Areas of Potential Environmental Concern

A review of information from the Environmental Risk Information Services database was completed for properties within the study area to assess potential for containing subsurface environmental contamination. A “windshield-level” survey was completed on May 26, 2023, to visually confirm the current land use. This “windshield-level” survey showed that:

– Residential and commercial properties are present along most of the study area.
– Some agricultural and industrial land use is present along the northern and southern portions of the study area.
– Gas stations are present along the entire study area.

Figure 6.14 shows locations with existing contamination risk that is low (green circle) or moderate (orange circle). The numbers in the circles are identifiers relevant to the entire York Region Sewage Works Project rather than to any particular project component.



LOC ID	ADDRESS	ACTIVITY OF CONCERN	RISK
18	15338 Leslie Street, Aurora (adjacent to the west of Leslie Street)	Current operation of fuel storage tank	Low
19	15255 Leslie Street, Aurora (adjacent to the east of Leslie Street)	Current operation of fuel storage tank and retail fuel gas station	Moderate
20	1472 Wellington St East, Aurora (adjacent to the west of Leslie Street)	Current operation of fuel storage tank and retail fuel gas station	Moderate
21	1501 Wellington St E, Aurora (adjacent to the east of Leslie Street)	Current operation of fuel storage tank and retail fuel gas station	Moderate

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Figure 6.14 Locations and Level of Risk for Existing Contamination Within the Y1-A2 Study Area

6.5.2.2.3 Y14 Bloomington Interceptor Sewer

Geotechnical

The Y14 study area is mostly bordered by farmland and vacant land.

Logs of boreholes advanced in 1995 from about 7 m to 19 m below the existing grade indicate the near surface generally comprised clayey silt till (stiff to hard) and sandy silt till (dense) with interbedded sand/silt layers (compact to dense), followed by sand deposit. The groundwater table was about 1.8 m below grade.

In a hydrogeological pumping test report, logs of boreholes ranging from 6 to 15 mbgs identified the near surface as generally composed of sand with interbedded clay. The groundwater table was about 1.8 m below grade.

The near-surface soils in the study area are predominantly gravel and sand and minor till, including esker, kame, end moraine, ice-marginal delta and subaqueous fan deposits (glaciofluvial ice-contact deposits).

The bedrock near the study area consists of shale, limestone, dolostone and siltstone in the Georgian Bay, Blue Mountain or Billings Formation.

Hydrogeological

A hydrogeological desktop review was undertaken within the study area using information from MECP well records, the MECP Source Protection Information Atlas, the ORM database and the Ontario Geological Survey database. Available hydrogeological reports for projects within the area were also reviewed.

The Y14 study area is within the ORM physiographic region. The linear infrastructure is not located within the source water protection areas of WHPA-D. Tunnel and shafts are anticipated to intersect thick sections of saturated ORM deposits, permeable sediments with hydraulic conductivity in the range of approximately $9 \times 10_{-4}$ to $1\text{x}10_{-2}$ cm/s, and both unconfined and confined aquifer(s) with transmissivity in the range of 7 to 101 m^2/day.

Historical reports note that perched water is possible at 298 mamsl, or roughly 6 m deep, on the east end of Y14. The water tables vary between 296 and 282 mamsl, or roughly 8 m and 22 m deep on the east end of Y14. These are confined potentiometric surfaces in the Halton Till. The water supply is from 30 to 60 mbgs (in the ORM aquifer).

There are 21 private wells near the alignment.

Table 6.8 gives details on anticipated aquifers and aquitards.

Table 6.8 Aquifers and Aquitards Throughout the Y14 Study Area

Aquifers and aquitards	Description	Thickness
Undifferentiated upper sediments (aquifer)	An unconfined aquifer consisting of discontinuous fill and unconsolidated overburden deposits.	Ranges between 0 to 5.3 m
Halton Till (aquitard)	A discontinuous aquitard that acts as a low-permeability cap on the underlying upper and lower Oak Ridges Aquifer Complex (ORAC).	This aquitard is thin in the west and not present in the central portion of the study area. Generally, ranges between 0 to 16 m.
Oak Ridges Moraine (aquifer)	These sediments consist mostly of silt and fine sand but also include gravel and minor clay and diamicton. The aquifer is generally unconfined, except for the section covered by Halton Till on the south flank of the moraine complex.	Ranges between 30.83 to 52.73 m
Lower Newmarket Till (aquitard)	A continuous layer that acts as an aquitard to the underlying Thorncliffe Formation.	Ranges between 49.7 to 56.5 m
Thorncliffe Formation (aquifer)	Regionally recognized as a highly productive confined aquifer; laterally continuous.	Ranges between 49.5 to 56.5 m

Surface Water

The three sub-watersheds within the study area drain to the Rouge River, East Humber River or Holland River East Branch. Other surface features of interest include:

- Five unnamed watercourses (four warmwater and one coldwater)
- Three tributaries of the Holland River East Branch
- A pond with a coldwater outlet stream.

Figure 6.15 is a surface water map of existing conditions within the study area.

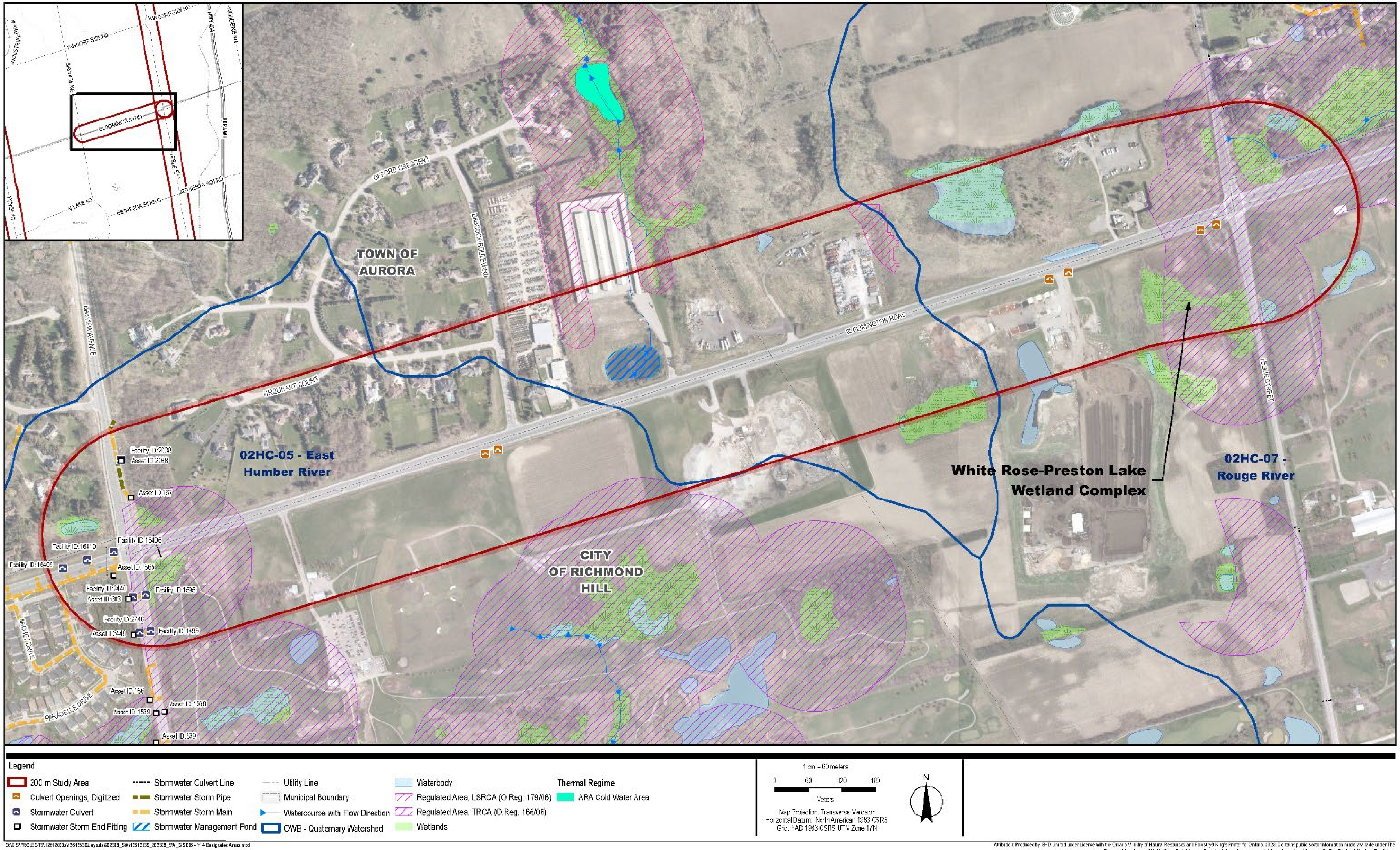

Figure 6.15 Y14 Study Area Surface Water Map of Existing Conditions

Natural Heritage Characterization

The Y14 area contains ecologically significant forests, wetlands, areas under the ORMGP and areas associated with the Regional and Local Municipal Greenlands System, which is regulated under both the LSRCA and TRCA.

The White Rose-Preston Lake Wetland Complex (a PSW) contains the White Rose, Simeon Forest and Preston Lake Wetlands and is found at the eastern end of the study area. This wetland complex occurs within the study area at the intersection of Leslie Street and Bloomington Road and is protected under the ORMCP within TRCA jurisdiction.

The Wilcox-St. George Wetland Complex (a PSW) is located at the western limit of the study area. Multiple wetlands that are part of the complex are within the study area just north of Bethesda Sideroad. This complex is a protected wetland under the ORMCP within TRCA jurisdiction.

Aquatic Habitat

A stormwater management (SWM) pond exists 12 m north of Bloomington Road on a storage unit facility site. This watercourse flows north out of the SWM pond into a natural pond that has an outlet feature that continues to drain northward. Sparse riparian vegetation surrounds the SWM pond, with little to no vegetation other than grasses making up the riparian buffer of the intermittent stream. Because it is connected to downstream environments, this watercourse and the SWM pond it drains out of are considered to possibly support bait and forage fish, but few sportfish.

Additionally, an unnamed watercourse at the intersection of Leslie Street and Bloomington Road exists within the Y14 study area. A coldwater headwater tributary of Bruce Creek, it flows east through part of the White Rose-Preston Lake Wetland Complex for approximately 910 m before draining into Bruce Creek. It is confined within an area of deciduous forest. ARA datasets indicate this headwater supports a fish community, mostly bait and forage fish, with few sportfish. No redside dace have been recorded within this study area.

Terrestrial Habitat

Y14 study area lands are mainly agricultural and low-density residential developments, along with woodland and wetland communities within the Rogers Reservoir Conservation Area (RRCA) at the northern boundary and a riparian area surrounding the Holland River East Branch at its southern boundary. This study area is in the northern portion of the overall study area and may soon face development pressure, as it is in between East Gwillimbury and Newmarket. The focus of the study area is the variety of wetland and forested communities present within the RRCA at its northern boundary and the riparian area surrounding the Holland River East Branch at its southern boundary. All natural and cultural communities in the study area are common in the province.

Significant Wildlife Habitat

Several natural areas within the study area are potential candidates for SWH for Region 6E designation, as defined by MNRF, mostly in wetland and woodland habitats associated with the PSWs and ESAs. All ELC communities in the study area were screened and analyzed for seasonal concentrations of animals, rare vegetation communities, specialized habitats for wildlife, habitats for species of conservation concern and animal movement corridors.

Areas of Potential Environmental Concern

A review of information from the Environmental Risk Information Services database was completed for properties within the study area to assess potential for containing subsurface environmental contamination. A “windshield-level” survey was completed on May 26, 2023, to visually confirm the current land use. This “windshield-level” survey showed that:

- Residential and commercial properties are present along most of the study area.
- Some agricultural and industrial land use is present along the northern and southern portions of the study area.

Figure 6.16 shows locations with low existing contamination risk. The numbers in the circles are identifiers relevant to the entire York Region Sewage Works Project rather than to any particular project component.

LOC ID	ADDRESS	ACTIVITY OF CONCERN	RISK
22	1351 Bloomington Road, Aurora (adjacent to the south of Bloomington)	Waste disposal facility and generator of subject wastes	Low
23	1030 Bloomington Rd, Aurora (adjacent to the north of Bloomington)	Automobile waste disposal facility	Low

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Figure 6.16 Locations and Level of Risk for Existing Contamination Within the Y14 Study Area

6.5.3 Concept Design

The conceptual design for the gravity sewers was based on flow rates and design criteria, as described in Chapter 3. The following sections describe the conceptual design for the new linear gravity sewer projects. The designs presented are conceptual and were developed to demonstrate proof of concept to meet the requirements of the Act. Upon collection of field investigations and in consultation with internal and external stakeholders, the designs will be further refined.

Refer to the following appendices for the conceptual design drawings relevant to the linear Leslie Street Trunk Sewer project components:

- Y1-A1 – Appendix C, Sheet 19 to 23
- Y1-A2 – Appendix C, Sheet 19 to 23
- Y14 – Appendix C, Sheet 24

6.5.3.1 Design Basis

Refer to Chapter 3 for general design basis details. For specifics relevant to Y1-A1, Y1-A2 and Y14, refer to Table 6.9, Table 6.10 and Table 6.11.

Table 6.9 Design Basis for Development of Y1-A1 Leslie Street Trunk Sewer Phase 1

Design basis	Assumptions
Study area	200 m area along infrastructure alignment
Study area boundaries	Leslie Street, bounded by 19th Avenue to the south and Bloomington Road to the north
Nominal diameter	2,400 mm
Sewer type	Gravity
Upstream connection point	Leslie Street and Bloomington Road
Downstream connection point	Leslie Street and 19th Avenue
Design criteria	Based on York Region Design Guidelines (2021), including: – Pipe size and material – Air management – Hydraulic design – Method of construction – Major utility crossings – End connection points
Method of construction	Tunnelling
Land use	Mixture of residential, agricultural, and commercial land uses
Modelled peak flow	4,186 L/s
Major infrastructure considerations	– Rapid transit networks (GO Transit Rail) – CNR rail south of Stouffville Road – Hydro corridor
Environmental feature considerations	– TRCA-regulated area – ORM – Haynes Lake – Public Park – Wetlands – Several wooded areas

Table 6.10 **Design Basis Specific to Y1-A2 Leslie Street Trunk Sewer Phase 2**

Design basis	Assumptions
Study area	200 m area along infrastructure alignment
Study area boundaries	Leslie Street, bounded by Bloomington Road to the south and St. John's Sideroad
Nominal diameter	2,400 mm
Sewer type	Gravity
Upstream connection point	Leslie Street and St. John's Sideroad
Downstream connection point	Leslie Street and Bloomington Road
Design criteria	Based on York Region Design Guidelines (2021), including: – Pipe size and material – Air management – Hydraulic design – Method of construction – Major utility crossings – End connection points
Method of construction	Tunnelling
Land use	Mixture of residential, agricultural, and commercial land uses
Modelled peak flow	3,153 L/s
Major infrastructure considerations	– Underpass bridge – Hydro corridor
Environmental feature considerations	– LSRCA-regulated area – ORM – Wetlands – Several wooded areas

Table 6.11 Design Basis Specific to Y14 Bloomington Interceptor Sewer

Design basis	Assumptions
Study area	200 m area along infrastructure alignment
Study area boundaries	Bloomington Road, bounded by Bayview Avenue to the west and Leslie Street to the east
Nominal diameter	1,500 mm
Sewer type	Gravity
Upstream connection point	Bloomington Road and Bayview Avenue
Downstream connection point	Bloomington Road and Leslie Street
Design criteria	Based on York Region Design Guidelines (2021), including: – Pipe size and material – Air management – Hydraulic design – Method of construction – Major utility crossings – End connection points
Method of construction	Tunnelling
Land use	Mixture of residential, agricultural, and commercial land uses
Modelled peak flow	1,419 L/s
Major infrastructure considerations	Hydro corridor
Environmental feature considerations	– TRCA-regulated area – LSRCA-regulated area – ORM

6.5.3.2 Construction Methods

6.5.3.2.1 Tunnel Construction

Because of the significant depths of the sewers, trenchless methods such as tunnelling or microtunnelling (or a combination of both) is proposed for construction of project components Y1-A1, Y1-A2 and Y14. Open cut construction is typically not economical for sewer depths greater than 6 to 8 m. Soil cover (along all three components) varies between 3 m and 56 m. This section describes tunnelling methods commonly adopted for installing deep sewers in soft ground below the water table and discusses appropriate tunnel boring machines (TBMs) and tunnel lining systems.

Further design development, including completion of geotechnical and hydrogeological investigations, will assist in shortlisting the types of TBMs and tunnel lining methods that might be adopted for the three tunnelled sections. In general, microtunnel boring machines (MTBMs) and earth pressure balance tunnel boring machines (EPBTBMs) have performed well in difficult water-bearing and boulder-laden glacial deposits around the Greater Toronto Area. On some projects, selection of construction approach is left to the contractor as long as certain basic methodology requirements and capabilities are satisfied.

The three categories of TBMs described below are potentially suitable for the anticipated ground conditions.

Slurry Pressure Balance Tunnel Boring Machines (SPBTBM)

Slurry pressure balance tunnel boring machines (slurry TBMs) use pressurized slurry to counteract soil and groundwater pressures acting at the face of the closed-face machine. Slurry TBMs are typically used in granular ground deposits below the water table but may also be used in more competent clay and till materials. The minimum size of these machines is typically 2,500 millimetres (mm) inner diameter (i.d.), and they can be configured for installation of jacking pipe or precast concrete tunnel linings (PCTLs).

SPBTBMs use pressurized slurry that is circulated in the mucking chamber behind the cutter head via slurry supply and return lines to balance soil and hydrostatic pressures. The slurry supply and return lines run the full length of the tunnel and are extended as the tunnel advances, with the return line being used to remove the spoil (excavated material suspended in slurry) from the tunnel. This spoil is then discharged to a surface separation unit comprising a system of screens, cyclones and centrifuges that separate the excavated material from the slurry. The treated slurry is then recycled back through the tunnel for further advancement of the tunnel, while the spoil is collected in a pile for removal from the site.

The cutterheads of SPBTBMs can be configured to deal with boulders that will be encountered in the glacial soils along the route. Cutter tools are typically rear-loading and permit worn cutters to be replaced from behind the cutterhead. To manage the risk of major stoppages due to boulder obstructions, a trailing airlock can be used with the SPBTBM. The airlock permits pressurization of the mucking chamber and tunnel face and permits workers to access the chamber for manual removal of boulders and cutterhead repairs.

Microtunnel Boring Machines (MTBM)

Most MTBMs employ the slurry pressure balance principle in combination with pipe jacking for pipe installation as described above, although the machines are operated remotely from the surface, and workers do not enter the tunnel for production operations except for TBM maintenance and survey, making it a safer method with lower construction crew requirements. MTBMs are sized to install pipes ranging from 0.5 to 3.4 m i.d. For larger-diameter pipe sizes (> 1.8 i.d.), tunnel drive lengths of greater than 1 km, with a minimum horizontal curve radius of approximately 500 m are being achieved.

Microtunnel drives close to, and above 1000 m are becoming increasingly common with industry innovation and compounding experience. Below are some recent examples:

– Hunua 4 Section 11, Watermain project, Auckland: 1296 m drive for 3000 mm ID, completed in 2020.
– York Durham Sewage System (YDSS) Forcemain Twinning Project, Newmarket, Ontario, Canada: 1132 m drive for 1800 mm ID, completed in 2020.
– Raw Water Intake, Painesville, Ohio: 1203 m drive for 1520 mm ID, completed in 2019.
– Sea outfall, Sur de Texas-Tuxpan gas pipeline, Altamira, Mexico: 2246 m drive for 3200 mm ID in 2019.
– West Cumbria Water Supplies Project for United Utilities, United Kingdom: 1241 m drive for 2280 mm ID, completed in 2018.
– Kingsbury Run Culvert Repair project for the Northeast Ohio Regional Sewer District (NEORSD), Cleveland, Ohio: 830 m curved drive for 1520 mm ID, completed in 2017.

Typical drive lengths can vary from 200 m to over 1000 m, with construction being more economical the longer the drive. Constructible length of drive is typically related to the size of the tunnel, with larger MTBMs able to achieve longer drives than smaller diameter machines.

One risk with microtunnelling and pipe installation is that pipes can be damaged by the action of hard boulders and cobbles that cause significant wear to the pipe exterior as they are jacked through the ground. This risk can be mitigated by good practice, including use of an automatic bentoniting system and appropriate slurry mixture design and pressure. For larger MTBMs, an airlock can be installed in the machine to allow workers access to the machine face if repair or maintenance is required.

Earth Pressure Balance Tunnel Boring Machines (EPBTBM)

EPBTBMs are most commonly used in fine granular soils below the water table, although they have also been used in sands and gravels and for excavating soft rock. A precast concrete segmental lining is commonly installed behind these closed-face machines as the tunnel advances, although they can also be configured for installing pipe. The machines use an auger screw that penetrates a sealed bulkhead immediately behind the EPBTBM cutterhead to permit controlled removal of the spoil at the tunnel face. A balancing pressure is maintained at the tunnel face via simultaneous slow rotation of the auger (for spoil removal) and forward propulsion of the EPBTBM. Spoil is typically removed using a conveyor belt immediately behind the auger screw and a line of rail-mounted muck cars travelling back and forth between the launch shaft and the EPBTBM. A crane on the surface deposits the excavated material from the muck cars into a spoil pile for removal from the project site. Trailing airlocks can also be used with EPBTBMs so that cutterheads can be repaired and boulder obstructions can be removed.

Tunnelling in General

One key concern with trenchless construction relates to any sensitive infrastructure along or crossing the tunnel alignment. The Y1-A1 project component has a CNR rail crossing south of Stouffville Road.

Tunnelling adjacent to or crossing under railways using any of the above methods will require additional design considerations, particularly for the vibrations and soil heave or settlement that can be generated by MTBMs and that could affect the tracks. Some horizontal displacement of soil is also anticipated during tunnelling and shaft excavation and can generate structural deformations on rail infrastructure, including tracks. Depending on the type and intensity of the deformation, the tracks may become unsafe for travel and may need to be closed for repair. Since these are high-traffic heavy rails, neither short- nor long-term closure of the rails will be accepted for this project, and special attention must be provided to avoid or mitigate deformations induced by soil movement during and after construction.

Any construction within CNR corridors will require extensive stakeholder coordination and communication on the progress of the design to achieve infrastructure-owner approval for construction. Visual pre- and post-construction conditions assessments of the structure will be required, along with the use of CNR-specified geotechnical instruments and monitoring, according to the “Utility Crossing/Encroachment Application Packet”, In addition, as described further below, crossings will automatically be considered for construction impact assessment, which involves an analytical review of ground-movement-induced structural deformations.

Both CNR and GO Transit have standards for review and alert limits for vertical and horizontal displacement thresholds for their infrastructure. These will be key design standards for all excavations near (within calculated zone of influence [ZOI] from excavation settlement) or under active rails. For Metrolinx, these standards are in “Metrolinx Trenchless Utility Works Design and Construction Guidelines on Metrolinx ROW (Heavy Rail)”.

All rail crossings are deemed critical infrastructure and thus will automatically require a construction impact assessment report (CIAR) to predict anticipated ground movement during and after construction until the proposed design soil displacement remains below limits established by both CNR and GO Transit. If the limits are surpassed, the team will modify the relevant shaft or tunnel designs or construction methods or propose pre-excavation mitigation methods, such as ground improvement, with approval from CNR and GO Transit.

A second critical infrastructure concern within the study area is the underpass roadway bridge on Leslie Street at the Lebovik Golf Club entrance. The sewer, while deep, will cross directly under the bridge and may, therefore, have impacts on the bridge foundations from vibrations, settlement or heave induced during tunnelling. As with rail crossings, bridge structures are automatically considered for construction impact assessments.

6.5.3.2.2 Shaft Construction

Shafts are required for launching TBMs, servicing tunnelling operations, and retrieving TBMs and are commonly used to house maintenance holes (MHs), access chambers and other permanent facilities. For tunnel construction, the required shaft dimensions, particularly shape and internal diameter, are a function of:

- Length of tunnel segments (pipe or PCTL)
- Tunnel diameter
- Tunnelling machine dimensions, particularly length
- Thrust wall design
- Jacking-rig size
- Tunnel eye sealing ring
- Guiderail systems.

For Y1-A1 and Y1-A2, the proposed sewer elevation is conceptual only and may be adjusted upward or downward in a future design phase, pending further discussions with York Region and preliminary results of geotechnical investigations, including soil type and hydrogeological conditions. Likewise, shaft depths and sizing may also be adjusted, but conservative values were selected for conceptual design. Shafts are currently being proposed, located approximately every 1 km (or at major intersections, with intermediate shafts at their midpoints). The quantity and location of shafts may be adjusted during design development.

Y1-A1 Component

- Shaft separation distances range from 330 to 1,250 m, with an average separation of 910 m. Shaft counts and locations are subject to change pending design development.
- Shaft depths range from 12 to 50 m. Based on a precedent sewer project completed for York Region (York Durham Sewage System Southeast Collector), the distances between shafts may be increased by up to 2.3 km. In other projects completed in the past decade for other nearby municipalities, including Peel Region (East–West Diversion Sanitary Trunk Sewer Contracts 1 and 2 and Coxwell Bypass Tunnel), the MH upper distance varies between 2,370 and 3,000 m.
- A shaft i.d. of 12.0 m assumed for concept design.
- An MH structure is planned to be installed inside each shaft after tunnelling is complete.

Y1-A2 Component

- Shaft separation distances range from 550 to 1,240 m, with an average separation of 900 m. Shaft counts and locations are subject to change pending design development.
- Shaft depths range from 12 to 53 m.
- A shaft i.d. of 12.0 m is assumed for concept design.
- An MH structure is planned to be installed inside each shaft after tunnelling is complete.

Y14 Component

- Shaft separation distances range from 980 to 1,120 m, with an average separation of 1050 m. Shaft counts and locations are subject to change pending design development.
- Shaft depths range from 7 to 12 m.
- Conservative minimum shaft i.d. of 12.0 m is assumed for concept design.
- An MH structure is planned to be installed inside each shaft after tunnelling is complete.

Methods for shaft excavation and support are commonly classified as sealed or unsealed, depending on the degree of leakage into the shaft and impacts on the surrounding water table that occur during construction. As highlighted previously, it is expected that the shafts will be constructed in a variety of soft ground conditions, largely below the water table. Depending on how close local watercourses are and whether excavation occurs through aquifers (e.g., the Lower Oak Ridges Aquifer Complex sand aquifer and the Inter-Newmarket Aquifer), as well as on the requirements of the local environmental and conservation authorities, sealed methods of construction may be needed. This would prevent any lowering of the surrounding groundwater table and minimize impacts to adjacent watercourses during construction. Both shaft classifications are further described in the sections below.

Unsealed Shafts

Unsealed shafts are typically specified for three conditions: where the ground is stable, where there are no restrictions on dewatering to permit lowering the surrounding water table, or where conditions are dry and dewatering is not required for shaft construction). Common methods are described below.

Steel Liner Plate

Steel liner plates provide a relatively lightweight, easy-to-handle, and safe support for soft ground tunnelling because the ground that supplies the loading also supplies the resistance to the load. The liner plate assembly simply distributes and transmits the load to the surrounding earth.

Driven Sheet Pile

Sheet pile walls are used as an earth retention system in soils that allow driving from the surface to the bottom of the shaft. They do not work well in soil with boulders or large obstructions. Sheet piles are prefabricated steel sheet sections with interlocking edges. As the sheets are installed, they form a continuous barrier in the ground. The sheets are typically driven with vibratory hammers or drop hammers. More recently, this type of construction can also be sealed but requires specialty sealants at joints, which increases construction schedule, cost, and failure modes.

Soldier Piles with Timber Laggings

Soldier piles are steel H piles that are vertically driven or drilled into the earth at regular intervals before excavation. As excavation progresses in stages, horizontal timber lagging is added behind the flanges to create the wall structure with connecting joints.

Sealed Shafts

Sealed shafts are typically specified where unstable ground conditions exist or where there are restrictions on dewatering to lower the surrounding water table. Sealed shafts tend to be more expensive than unsealed shafts, although they have become almost mandatory in many Canadian jurisdictions where there are strict environmental requirements to minimize groundwater lowering and effects on adjacent water courses as well as infrastructure. Common sealed shaft methods are described below.

Secant Pile Walls

Secant pile shafts use bored piling (incorporating temporary steel casings driven or vibrated into place before pile excavation to prevent ground collapse) to create a vertical perimeter of interlocking poured concrete cylindrical piles. Overlapping of piles creates a waterproof liner and supporting wall. A secant pile wall cannot be used as a final structure; a permanent structure, such as an MH chamber, will need to be installed within the shaft.

Concrete Sinking Caissons

For concrete sinking caissons, the shaft is sunk in several lifts by building a circular (or oval) shaft structure on the surface and placing kentledge blocks (weights) or rams on top of it. Many contractors assist the sinking by lubricating the annular gap between the outer walls and surrounding ground. A clamshell grab (in granular soils) or mini-excavator (in competent soils such as clays or rock) is then used for shaft excavation, and the shaft structure slowly sinks to fill the excavated void. The shaft structure is typically constructed using precast concrete segments or cast-in-place reinforced concrete. Once the shaft has been sunk to the desired formation elevation, a mass concrete base plug is placed using tremie (underwater) concreting if the shaft is flooded. A major advantage of this method is that the shaft wall can be used as a permanent structure for maintenance.

Slurry (Diaphragm) Walls

When slurry (diaphragm) walls are used, guide walls are first installed around the desired shaft location to guide slurry wall installation. A trench is then excavated between the guide walls, typically several metres long and 1 to 1.5 metres wide, extending to the required depth. A bentonite slurry mix is pumped into the trench as it is excavated to support the surrounding soil. The slurry is composed of water, bentonite clay and other additives to achieve the desired properties, acting as a temporary support system to prevent collapse. Once the trench reaches the desired depth, steel cages or vertical steel sections are inserted for reinforcement, enhancing the wall's load-bearing capacity. As the concrete is pumped into position, the slurry is displaced to the surface, where it can be collected, treated and used for subsequent wall construction. The slurry wall shaft construction method is highly advantageous for constructing deep excavations in urban environments.

The anticipated tunnel horizon and the shaft depths require excavation within the ORM, which is a highly sensitive and protected area with restrictions on groundwater impacts from construction. The preliminary hydrogeological studies and borehole investigations show high permeability gravel and sands below the water table, and sealed shaft methodologies are likely to be required by the local conservation authority to prevent serious impacts to the groundwater regime in the ORM.

Because geotechnical and hydrogeological field investigation and laboratory testing results along the sewer alignment and at shaft locations are not yet available, a preferred shaft construction methodology cannot be selected. The appropriate methods will be assessed and compared in a future phase of design.

6.5.3.3 Property Requirements

Temporary and permanent property easements will be required in order to construct and operate the sewers. For the Y1-A1 Leslie Street Trunk Sewer Phases 1, Y1-A2 Leslie Street Trunk Sewer Phases 2, and Y14 Bloomington Road Interceptor project components, easement requirements will be driven by the shaft locations and shaft and tunnel construction requirements.

The minimum construction compound areas available for the proposed shaft sizing of an i.d. of 12.0 m range from 4,000 to 18,000 m^2. These areas are presented on the respective concept design drawings, and local experience indicates that they meet the typical area requirements for TBM tunnelling operations, although construction area requirements for microtunnelling are significantly smaller (2,000 to 4,000 m^2).

Permanent property requirements will depend on the final location of the shafts, which are expected to contain a MH structure that must be accessible by York Region for sewer maintenance. Air management is likely to be required at all drop structures.

As with the sewer design component, the proposed property locations and requirements for construction of the shafts are conceptual only. Details related to the number of shafts, shaft sizing, location and property easement requirements will be confirmed during detailed design.

6.5.4 Environmental and Community Impacts and Mitigation

The Y1-A1, Y1-A2 and Y14 projects may have an impact on the social, built, natural and cultural environments. Desktop studies were done to determine the possible extent of these impacts and to propose mitigation measures to reduce the likelihood and consequences should they occur. The major impacts and associated mitigation approaches are described in this section.

Because the current designs are only at the conceptual level, potential impacts and mitigation measures could change during design development depending on:

– The ability to co-locate the proposed design with other planned infrastructure to minimize community effects, to be investigated after field investigations are completed. This change will depend on the number and scale of other planned infrastructure (e.g., utilities, transportation) in the ROW or area.
– Confirmation of available property for temporary and permanent use. The extent of temporary easements or acquired private property, as well as the construction schedule, may dictate future design changes or mitigation measures.

The assessment criteria and indicators are provided in Table 6.12 to Table 6.20, corresponding to each of the environments (social and built, natural, cultural and traffic impacts) together with a potential effects assessment and identification of avoidance, mitigation and compensation measures for projects Y1-A1, Y1-A2 and Y14.

6.5.4.1 Y1-A1 Effects and Mitigations

Table 6.12 Y1-A1 Leslie Street Trunk Sewer Phase 1 Social and Built Environment – Effects and Mitigation

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
Social and built environment				
SB-1	Effect on existing views	– Changes are predicted in views from residences in the surrounding area	– No change in existing views from residences in the surrounding area.	– No avoidance, mitigation or compensation measures required.
SB-2	Effect on existing residences, businesses, or community institutional and recreational facilities	– Displacement of residences, businesses and other facilities is too great – Temporary or permanent disruption to residences, businesses and other facilities near construction compounds or permanent works is too great	– No displacement of residences, businesses, or community, institutional, or recreational facilities is anticipated. – Disruption to residences, businesses and community, institutional and recreational facilities near construction compounds and permanent installations.	– No avoidance, mitigation or compensation measures are anticipated. However, if, in fact, displacement is required, then York Region would provide market value compensation. – Apply standard construction-related mitigation measures to minimize the temporary disruption effects.
Traffic and transportation				
TT-1	Effect on existing rail or bridge infrastructure	– One or more rail crossings or large infrastructure impacted	– At the rail crossing south of Stouffville Road, the compound area or traffic management areas are not anticipated to extend within the rail ROW.	– Coordinate with CNR and Metrolinx during design development to limit impacts to their services and infrastructure. – Consider critical infrastructure while selecting tunnel design and construction methods. Assess critical infrastructure for construction impacts, including an analytical assessment. Adjust design and re-assess until impacts on rail infrastructure return to below threshold levels.
TT-2	Effect on traffic	– Traffic flows are disrupted too much – Construction occurs too close to congested traffic zones	– Traffic disruption at construction compounds on Leslie Street; compound staging may extend into the travelled portion of the ROW. – Traffic movement into and out of construction compound sites will impact pedestrian, cycling and traffic flow on Leslie Street. – Coordination of alternate routing for emergency service vehicles, if needed.	– Implement complex traffic management and site security measures at each construction compound to mitigate to the extent possible. – Where possible, maintain one lane in each direction. This could be achieved through flagging, temporary signals, or temporary road widening. – Pedestrian movement should be maintained during construction, with marked pedestrian detours as applicable. – Consider special traffic arrangements for peak hours should be considered in primary traffic flow directions in the morning and afternoon. – Pay duty police officers may be required to direct traffic. – Make special provisions for emergency service vehicle access. – Make special provisions for pedestrian traffic and safety, including signals, detours and winter maintenance. If feasible, move construction traffic to sideroads.
Utilities				
U-1	Conflict with buried utilities	– Sewer or shaft is in direct conflict with or falls within clearance limits of nearby utilities	– New construction impacts existing utilities and requires design coordination with utility owners, which increases project cost and schedule.	– Review historical and as-built documents for utility data. – Complete a subsurface utility engineering investigation to identify high-risk utilities, including large or critical service utilities (e.g., large watermains and all gas mains). – If utility information indicates a conflict with a proposed sewer tunnel, construction shaft, or overall work compound location, consider temporary or permanent relocation of utilities safely around or through the work area. It may be possible to support some utilities above an open-cut excavation and rebury them later. Modifications of the alignment and shaft locations may also be proposed during design development to mitigate utility conflicts.
U-2	Conflict with surface or overhead utilities	– Excavation of shaft is proposed where surface infrastructure is located – Shaft working compound equipment (including cranes) requires working directly under overhead utilities or within the hydro wire exclusion zone	– Overhead infrastructure such as electrical or communications cabling is mounted on utility poles between 5 and 12 m above the surface. Depending on the crane size and operating radius required to construct the shaft and lower the tunnel boring machine, equipment extents may fall within the hydro line exclusion zone or hit overhead wires, causing worker harm or death.	– Working compounds will be designed to allow appropriate and safe movement of workers and equipment around the site, away from live overhead wires or surface utility boxes, based on known utility information and topographic surveys. – If utility information indicates a conflict with a proposed sewer tunnel, construction shaft, or overall work compound location, modifications of the alignment and shaft locations may be proposed during design development; the utilities would need to be temporarily or permanently relocated safely around or through the work area.

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
U-3	Damage or deformation to surface infrastructure and buried utilities (including railways, bridges and structural culverts)	– Soil movement occurs under or next to a utility from tunnel or shaft or open-cut construction	– Ground heave, settlement or horizontal shift along tunnel ahead of and along excavated alignment and around shafts and open-cut excavations during and after excavation. This information can be obtained from nearby geotechnical instrumentation. – Deformation or damage to nearby surface or buried utilities (e.g., crack formation, angular rotation, strain, or pipe joint rotation or pull out) because of soil movement that may require rehabilitation or repair.	– For utilities within sewer tunnel ZOI: Select a tunnel excavation method that can limit volume losses at the cutting face (limit overcutting of excavation) to limit ground losses. – For utilities near shaft or sewer open-cut ZOI: Select a shaft construction method and support of excavation (SOE) appropriate for the depth, size and geotechnical and hydrogeological conditions at shaft location. – For each, complete analytical assessments at locations that are at risk, including low-soil-cover locations and areas where the tunnel crosses or runs parallel near sensitive, large, or critical utilities and services. – Where applicable, propose mitigation methods such as relocation of utilities or, for deep utilities, relocation of tunnel horizon, based on assessment results. If neither option is applicable, investigate ground improvement near utilities to limit ground movement or investigate modification of the tunnel or shaft design or construction method.
Noise and vibration				
N-1	Operation noise	– Complaints from residents within the study area	– Noise disruptions to private residents and commercial areas post-construction near MHs and other surface connections.	– Any permanent facility, such as supporting air management facilities, will require an Environmental Compliance Approval (ECA) application under Section 9 of the Environmental Protection Act to document the noise.
N-2	Construction noise	– Complaints are received from residents within study area	– Noise disruptions to private residents and commercial areas during construction near construction compounds.	– Propose construction noise monitoring according to MECP NPC-115 Construction Equipment requirements. – Consider completing noise monitoring for the duration of the construction and notify the contractor of any exceedances so that corrective action or contingency actions can be implemented. – Use vehicles and equipment (cranes and excavators) with efficient muffling devices or construct enclosures. – Limit truck movements to comply with noise bylaws for 24/7 construction operations.
V-1	Construction vibration	– Complaints from residents within the study area	– Disruptions to private residents and commercial areas during construction near construction compounds.	– Propose appropriate construction vibration benchmarks within the tender documents. – Consider pre- and post-construction condition photos.
Air management				
O-1	Operation odour at drop structures	– Odour occurs near surface connections	– Fugitive odour releases where bends in the gravity sewer and drop structures.	– Consider using ventilation systems with specific venting locations.
O-2	Operation odour at existing or proposed sewer connection	– Odour occurs near surface connections	– Release of odour caused by turbulence at the connection to the existing trunk sewer. [The connection of the proposed gravity sewer to the existing York Durham Sewage System is at the intersection of Yonge Street and 19th Avenue, where there is an existing gravity sewer.]	– Consider using ventilation systems with odour control.
O-3	Construction odour	– Complaints are received from residents within study area	– Odour release during live connection of infrastructure.	– Notify residents in advance, advising them of the nature and duration of the work.
A-1	Construction dust at sewer construction locations	– Fugitive dust is generated – Air quality is poor	– Fugitive dust generation during construction of gravity sewer, interconnecting shaft or chambers, including the connection points.	– Include requirements for dust management within the tender documents. – Aim mitigation at minimizing emissions of particulate matter and exposure to particulate matter during the construction phase.

Table 6.13 Y1-A1 Leslie Street Trunk Sewer Phase 1 Natural Environment – Effects and Mitigation

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
Hydrogeology				
N-1	Effect on groundwater quantity	– Temporary or long-term changes in groundwater quantity occur	– Potential temporary change to groundwater quantity because construction may intersect ORM aquifer (estimated at ground surface to variable depths). Temporary water takings may be required to facilitate construction. A high groundwater table and hydrostatic groundwater pressure would be expected because of existing soils and anticipated presence of the ORM aquifer. – Potential long-term changes in groundwater quality during operation is minimal.	– Use construction methods that minimize dewatering requirements, including sealed shafts and tunnel face stability control (e.g., earth-pressure-balance tunnel boring machine). – Establish pre-construction baseline groundwater quality and quantity conditions and develop implementation plans for monitoring during and after construction (install monitoring wells and monitor well water and surface water).
N-2	Effect on groundwater quality	– Temporary or long-term changes in groundwater quality occur	– Potential temporary change in groundwater quality because construction is anticipated to intersect the ORM aquifer. Temporary water takings may be required to facilitate construction. – No long-term change to groundwater quality is anticipated. – Potential effects on groundwater quality as a result of potential mobilization of contaminated water where active dewatering/depressurization is required. – Reduction in groundwater quality from spills or the mismanagement of fuel/chemical in work areas.	– During design, investigate contaminant sources to lower the risk of drawing contamination from a source to another location. – Use construction methods that minimize dewatering requirements, including sealed shafts and tunnel face stability control (e.g., earth-pressure-balance tunnel boring machine). – Develop and implement a Spill Response Plan for construction to mitigate the effect of a spill if one occurs. – Establish pre-construction baseline groundwater quality and quantity conditions and develop implementation plans for monitoring during and after construction (install monitoring wells and monitor well water and surface water).
N-3	Effect on private wells – temporary construction dewatering	– Temporary construction dewatering interferes with private well (quantity or quality declines)	– Temporary decrease in private well quantity or quality could occur during construction depending on the location, depth and construction method and duration.	– Implement construction methods that minimize dewatering requirements. – Address construction dewatering private well interference complaints through existing York Region private well assessment and mitigation policy. – Proactively identify any high-risk wells during design and prepare site-specific preventive mitigation and corrective action plans as part of design. Corrective actions should align with York Region's private well assessment and mitigation policy.
N-4	Effect on private wells – long-term	– Quantity or quality of water from private wells interfered with long-term	– Potential long-term change in groundwater quality during operation of the gravity sewer.	– Use construction methods that minimize dewatering requirements, including sealed shafts and tunnel face stability control (e.g., earth-pressure-balance tunnel boring machine). – Establish pre-construction baseline groundwater quality and quantity conditions and develop implementation plans for monitoring during and after construction (install monitoring wells and monitor well water and surface water). – Proactively identify any high-risk wells during design and prepare site-specific preventive mitigation and corrective action plans as part of design. Corrective actions should align with York Region's private well assessment and mitigation policy.
N-5	Effect on surface water quantity or quality	– Temporary changes in surface water quantity and quality occur	– Temporary changes in surface water quantity (e.g., impacts on baseflow or quality) could occur during construction depending on the location, depth, construction method, timing and duration. – A high groundwater table resulting in groundwater–surface water interaction would be expected because of existing soils and anticipated presence of an ORM aquifer. – There is potential redside dace habitat within Berczy Creek, Haynes Lake and the headwater streams of the Rouge River. – Change in groundwater–surface water interaction (reversal of vertical hydraulic gradient) results in impact to terrestrial and aquatic habitat and associated SAR (where applicable) – reduction in baseflow. – Change in surface water temperature from groundwater taking or discharge to surface water. – Changes to stream morphology resulting from the release of dewatering water. – Potential reduction in baseflow due to water taking in a lower confined aquifer, which would increase downward hydraulic gradients across the aquitard separating the stream and the confined aquifer. – Potential reduction in baseflow from a stream reach that intersects an aquifer in which the water taking is occurring.	– Field verify groundwater–surface water interactions in watercourses and wetlands within the study area. – Complete outlet receiver assessment(s) if groundwater must be temporarily discharged to surface water. Establish pre-construction baseline surface water quality and quantity conditions and develop implementation plans for monitoring during and after construction. – Construct and implement facilities (e.g., settlement tanks) to treat construction water prior to discharge to storm sewer or surface water. – Minimize construction area disturbance and duration. Implement erosion and sedimentation control measures (e.g., silt fencing, check dams). – Adhere to fish timing windows to prevent negative impacts on known sensitive fish species within the study area. – Consider completing a geomorphology study during design. – Refer to the natural heritage section of this table for further approaches to mitigating surface water impacts.

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
N-6	High groundwater levels	– Encountered during hydrogeological field investigations (borehole drilling) – Encountered during tunnel or shaft excavation	– High pressures acting on tunnel boring machine, tunnel walls and shaft walls.	– Consider water elevations in design based on recommendations of Geological Baseline Report (GBR) at all applicable locations. – Implement construction methods that minimize dewatering requirements.
N-7	Artesian conditions	– Encountered during hydrogeological field investigations (borehole drilling) – Encountered during tunnel or shaft excavation	– High pressures acting on tunnel boring machine, tunnel walls and shaft walls.	– Consider water elevations in design based on recommendations of GBR at all applicable locations. – Implement construction methods that minimize dewatering requirements
N-8	Groundwater impacts from excavation works within ORM	– Sewer or shaft locations are located within ORM limits	– Design and construction will require minimum impact on groundwater for the sewer and associated construction shafts installed from 200 m north of 19th Avenue to Bloomington Road.	– Follow and apply requirements set out in ORMCP, as set out in O. Reg. 140/02 under the ORMC Act, particularly Section 42(2), which states that sewer must be planned, designed and constructed so as to minimize disruption of the natural groundwater flow.
Areas of potential environmental concern				
C-1	Low risk of contamination	– No area of potential environmental concern is located directly in or immediately adjacent to the project ROW – Contaminants are not likely to be present, and if they are, they are likely limited in extent and only present in surficial soil – Migration exposure pathways and receptors are limited – Impacts can be easily managed prior to or during construction	– Current operation of a fuel oil storage tank at 12871 Leslie Street (but potential for mobile COCs (PHCs and BTEX) is low).	– No mitigation required.
Geotechnical				
G-1	Effect on soil quality	– Contaminant seeps into soil during excavation of shaft	– Soil contamination by chemicals such as drilling fluids, lubricants, ground improvement material, or fuel from construction equipment.	– Check and maintain equipment regularly. – Prepare an environmental management plan prior to construction in case of contamination.
G-2	Soil movement around shafts	– Vertical or horizontal ground movement occurs around shafts or along tunnel during and post-excavation – Nearby structures or utilities are deformed or damaged	– Ground heave, settlement, or horizontal shift at surface around shafts. – Deformation or damage to nearby structures and utilities (e.g., crack formation, angular rotation, strain, or pipe joint rotation or pull out that may require rehabilitation or repair.	– Select shaft or open-cut construction method and support of excavation (SOE) appropriate for excavation depth and size and for geotechnical and hydrogeological conditions at shaft or open-cut locations. – Complete soil displacement analytical assessments at all shaft locations.
G-3	Soil movement along tunnel	– Vertical or horizontal ground movement occurs along tunnel during and after excavation	– Ground heave, settlement, or horizontal shift along tunnel ahead of and along excavated alignment.	– Select tunnel excavation method that can limit volume losses at the cutting face (limit overcutting of excavation) to limit ground losses. – Complete soil displacement analytical assessments for tunnel locations that are at risk, including low soil cover locations or areas where the tunnel crosses or runs parallel near sensitive natural features, utilities, or critical infrastructure such as gas mains, structural culverts, bridges, or rail crossings.
G-4	Movement and vibration under live CNR crossing south of Stouffville Road	– Vertical or horizontal ground movement occurs along tunnel during and after excavation – Nearby rail infrastructure is moved or damaged – Vibrations surpass the allowable typical threshold for live tracks	– Soil settlement or heave causing deformation or damage to rail infrastructure that may require rehabilitation or repair. – Soil movement deformations and vibrations from machinery can derail trains if allowable soil displacement limits established by CNR and GO Transit are surpassed.	– Analytically assess rail crossings for soil displacement and structural deformations to estimate ground movement during and after construction and see that it remains below limits established by CNR and GO Transit. Modify relevant shaft or tunnel designs or construction methods and propose mitigation methods such as ground improvement accordingly.

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
G-5	Encounter boulders during shaft or tunnel excavation	– Boulders are encountered during excavation of shaft or tunnel	– For tunnels, presence of boulders or properties requiring change of preferred excavation method (segmented tunnel versus pipe jacking) and tunnel boring machine technical specifications. – For shafts, presence of boulders or properties requiring change of preferred shaft SOE method.	– Complete appropriate geotechnical investigations with strength testing for any encountered boulders. – Prepare a Geological Baseline Report (GBR) during design development with appropriate baseline for boulder strength, size and anticipated encounter rates and locations. – Recommend a shaft construction SOE that can maintain verticality in boulder-prone soils. – Recommend appropriate technical specifications for tunnel boring machine.
G-6	Encounter contaminated soil during shaft or tunnel excavation	– Soil encountered during shaft or tunnel excavation surpasses allowable contaminant levels	– The need to dispose of spoil at an approved contaminated soil disposal site.	– Complete appropriate geotechnical investigations and contaminants testing during design development to identify confirmed contaminated soil locations or at-risk areas based on historical land use. – Identify and confirm availability of appropriate soil disposal sites that can be used during construction for anticipated contaminants.
G-7	Encounter weak or incompetent soil during tunnel excavation	– Soil movement is accelerated at surface and depths	– Soil heave, soil settlement, or sinkhole formation at surface.	– Complete appropriate geotechnical investigations with strength testing for anticipated soils along tunnel horizon. – Prepare a Geological Baseline Report (GBR) during design development with an appropriate baseline for soil properties, including stratigraphic profile inferred from borehole investigations. – Recommend appropriate preventive or compensation ground improvement for at-risk locations.
G-8	Excavation works within TRCA floodplain	– Sewer or shaft locations are within TRCA-managed lands or floodplains	– Coordination with TRCA required at all phases of design and construction for sewer crossing in floodplain located on Leslie Street south of Stouffville Road.	– Initiate discussions with TRCA about design requirements early in design phase. – Clarify design and construction requirements, as well as formatting needs for deliverables, to streamline TRCA review and approval of the project.
Natural heritage				
EG-1	Effect on aquatic habitat or functions	– Study area contains cold, cool and warm watercourses – Study area contains portions of three wetlands	– Temporary or permanent loss of aquatic features or categorical loss of functions by type, including PSWs, Locally Significant Wetlands, watercourses by sensitivity type and others. – Impairment of water quality from elevated TSS in surface water runoff from the study area locations, which can affect aquatic species and habitats. Some concentrations above background may occur temporarily. – Spill hazard when refuelling equipment. – Change in surface water temperature from groundwater taking and/or discharge to surface water.	– Complete site investigations to evaluate potential effects on aquatic habitat function. – Implement best management practices to control surface water runoff and minimize TSS effects. – Where feasible, discharge surface water during construction into the municipal storm sewer system to mitigate thermal impacts to watercourses. If surface water discharge is directed to watercourses, additional mitigation measures would be needed. Using erosion and sediment control measures and timing construction to avoid spawning and egg incubation periods will reduce the potential for impacts on fish and aquatic life. – Maintain and refuel equipment at the designated and properly contained maintenance areas or at industrial garages located well away from creek banks, wetlands and outside vegetation areas. – Develop a response plan, where applicable, for frac-out (mud loss or release of drilling fluid) that outlines the protocol to monitor, contain and clean up any frac-out that does occur. – Develop a Spill Prevention Plan.
EG-2	Effect on stream geomorphology	– Change in geomorphic form, function, or stability in affected channels in study area	– No anticipated impacts to stream geomorphology in affected channels.	– Employ erosion and sediment controls to limit deposition of construction-mobilized soils into watercourses. – Consider completing a geomorphology study during design, where applicable.
EG-3	Effect on aquatic species, including species at risk, species of local concern, native species and invasive species	– Study area has multiple watercourses within the proposed work area that support endangered redside dace – The Rouge River headwaters, along with a tributary, are classified as occupied redside dace habitat – Berczy Creek and an additional Rouge River tributary are classified as contributing redside dace habitat	– Number and type of aquatic species potentially affected temporarily or permanently. – Potential temporary impact on aquatic species could occur during construction where study area locations are near watercourses.	– Prevent death of fish or impacts to downstream fish habitat by using appropriate timing windows. – Watercourses identified as occupied or contributing redside dace habitat must include a water quality monitoring program as directed through consultation with MECP and DFO.

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
EG-4	Effect on terrestrial habitat or functions	– Study area contains an ANSI (Simeon Lakes) – Study area contains ecologically significant forests – Study area contains wildlife habitat	– Temporary or permanent loss of natural heritage features (e.g., ESAs, ANSIs, wildlife corridors and others). – Terrestrial habitat may be affected (e.g., direct vegetation [and wildlife habitat] loss, alteration and fragmentation) by the footprint of shafts or compounds. – Project preparation, construction and operation may risk nest destruction and mortality of migratory birds.	– Perform site investigations to evaluate potential terrestrial habitat function and significance. – During design, prepare construction constraints considering timing windows so vegetation clearing occurs outside of the migratory bird nesting, bat maternity roosting, turtle overwintering and amphibian breeding seasons. – Limit the area of project footprint and limit disturbance from employees. – Monitor for the presence of wildlife and communicate it to site personnel. – Restrict vehicle use to designated areas. – Where practical, rehabilitate habitat for plants and wildlife.
EG-5	Effect on terrestrial species, including species at risk, species of local concern, native species, invasive species and area-sensitive species	– Species at risk found to occur within the study area (amphibians, insects, birds, reptiles, mammals, or tree species)	– Number and type of terrestrial species potentially affected temporarily or permanently. – Construction activities disturb wildlife within adjacent natural heritage areas. – Project preparation, construction and operation increase risk of nest and habitat destruction and mortality of terrestrial species at risk. – Project may result in wildlife-vehicle collisions and may injure or kill animals.	– Perform site investigations to evaluate potential occurrence of terrestrial species at risk within the study area. – During design, prepare construction constraints considering timing windows so vegetation clearing occurs outside of the migratory bird nesting, bat maternity roosting, turtle overwintering and amphibian breeding seasons. – Clearly demarcate work limits at outset of construction and minimize unnecessary vegetation clearing.

Table 6.14 Y1-A1 Leslie Street Trunk Sewer Phase 1 Cultural Environment – Effects and Mitigation

Item no.	Criteria	Indicators	Potential effects (positive and negative)	Avoidance/Mitigation/Compensation
CE-1	Effect on *Ontario Heritage Act* (OHA) designated properties and properties listed on municipal heritage registries	– Project components are near the heritage property or landscape	– Encroachment onto the property or landscape resulting in a physical impact on the potential BHRs or CHLs. – New structures or landscape features or alterations to the property or landscape that result in a physical impact on the potential BHRs or CHLs. – Relocation of all or part of the potential BHRs or CHLs. – Demolition or destruction of all or part of the potential BHRs or CHLs. – Vibration impacts on the potential heritage buildings identified on the property or landscape in or on adjacent properties. – Ground disturbance impacts relating to landscape features on the property or landscape in or on adjacent properties.	Considering the potential impacts outlined in the previous column, preferred and alternative mitigation options are provided below. Preferred option: – Project design avoids the property or landscape, resulting in no direct or indirect impacts. This includes maintaining a sufficient buffer of at least 50 m between project activities and the potential BHRs or CHLs. Alternative options: – If direct impacts are unavoidable, design project to minimize encroachment on the property or landscape while avoiding all impacts to the potential BHRs or CHLs. The following options and mitigation should be considered: • Consult during detailed design to determine whether any approvals or permits are required because of physical impacts to the property or landscape. – If the preferred option is not feasible and the property or landscape cannot be avoided, and if a physical impact to potential BHRs or CHLs is unavoidable, then the following is required: • Consult during detailed design to determine whether any approvals or permits are required because of physical impacts on the property or landscape. • Complete a property-specific CHER/HIA before any alterations, including assessment of the property against O. Reg. 9/06 and, if necessary, detailed documentation of any confirmed BHRs or CHLs and recommendation of specific mitigation measures for impacts on any identified heritage attributes. • The CHER/HIA should consider the compatibility of new structures or landscape features with existing heritage attributes, layouts and designs of the property or landscape.

Item no.	Criteria	Indicators	Potential effects (positive and negative)	Avoidance/Mitigation/Compensation
CE-2	Effect on archaeological sites	– Project components are near the archaeological sites	– Encroachment onto the site, resulting in a physical impact. – New structures or landscape features or alterations to the site that result in a physical impact. – Demolition or destruction of all or part of the archaeological sites. – Vibration impacts on the archaeological sites identified on the property or landscape. – Ground disturbance impacts to the archaeological sites.	– Although the archaeological site is more than 50 m from the current study area, the study area does fall within the archaeological monitoring zone around the site. As a result, archaeological monitoring will be required for any planned impacts within the monitoring zone (SD Map 4). The avoidance, protection and construction monitoring requirements for construction activities would include: • Depicting the 50 m monitoring buffer zone on all contract drawings with explicit instructions that a licensed consultant archaeologist must be present to monitor construction. • Requiring that, if any archaeological materials are identified during construction, all construction activities must stop until the archaeological materials are assessed and mitigated, if necessary, by a licensed archaeologist. • After soil-disturbing activities are completed, have a licensed archaeologist inspect the site area, prepare a report for the MCM on the effectiveness of the avoidance strategy and confirm that the area to be avoided remains intact.
CE-3	Effect on registered cemeteries	– Project components are near registered cemeteries	– Encroachment onto the cemetery, resulting in a physical impact. – New structures or landscape features or alterations to the cemetery that result in a physical impact. – Demolition or destruction of all or part of the cemetery. – Vibration impacts on the cemetery identified on the property or landscape. – Ground disturbance impacts on the cemetery.	– The Toronto Muslim Cemetery is within this study area, where an archaeological assessment had been completed before the cemetery was established. There are no outstanding archaeological concerns for this cemetery. – However, it is desirable to locate any planned impacts away from the cemetery on the opposite side of the road.

6.5.4 .2 Y1-A2 Effects and Mitigations

Table 6.15 Y1-A2 Leslie Street Trunk Sewer Phase 2 Social and Built Environment – Effects and Mitigation

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
Social and built environment				
SB-1	Effect on existing views	– Predicted changes in views from buildings in the surrounding area	– No change in existing views from residences in the surrounding area.	– No avoidance, mitigation, or compensation measures required.
SB-2	Effect on existing residences or businesses or on community, institutional, or recreational facilities	– Degree of displacement of residences, businesses, or other facilities – Degree of temporary or permanent disruption to residences, businesses, or other facilities that are near construction compounds or permanent installations	– No displacement of residences or businesses or to community, institutional, or recreational facilities is anticipated. – Disruption to residences or businesses or to community, institutional, or recreational facilities near construction compounds or permanent installations.	– No avoidance, mitigation, or compensation measures are anticipated. However, if, in fact, displacement is required, York Region would provide market-value compensation. – Apply standard construction mitigation measures to minimize temporary disruption.
Traffic and Transportation				
TT-1	Effect on existing railway or bridge infrastructure	– Number of bridge or underpass structures impacted	– The sewer will cross directly under the underpass at Lebovic Golf Club at approximately sta. 7+050.	– Consider critical infrastructure while selecting tunnel design and construction methods. Assess critical infrastructure for construction impacts, including an analytical assessment. Adjust design and re-assess until impacts on rail infrastructure return to below threshold levels.

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
TT-2	Effect on traffic	– Extent of disruption to traffic flows – Proximity to congested traffic zones	– Traffic disruption at construction compounds on Leslie Street; compound staging may extend into the travelled portion of the ROW. – Traffic movement into and out of construction compound sites will impact pedestrian, cycling, and traffic flow on Leslie Street. – Coordination of alternate routing for emergency service vehicles may be needed.	– Need to implement complex traffic management and site security measures at each construction compound to mitigate to the degree possible. – Where possible, maintain one lane in each direction through flagging, temporary signals, or temporary road widening. – Maintain pedestrian movement during construction, with marked pedestrian detours as applicable. – Consider special traffic arrangements for peak hours in primary traffic flow directions in the morning and afternoon. – Pay duty police officers may be required to direct traffic. – Make special provisions for emergency service vehicle access. – Make special provisions for pedestrian traffic and safety, including signals, detours, and winter maintenance. If feasible, move construction traffic to sideroads.
Utilities				
U-1	Conflict with buried utilities	– Sewer or shaft is in direct conflict with or falls within clearance limits of nearby utilities	– New construction impacts existing utilities and requires design coordination with utility owners, which increases project cost and schedule.	– Review historical and as-built documents for utility data. – Complete a SUE investigation to identify high-risk utilities, including large or critical service utilities (e.g., large watermains and all gas mains). – If a conflict occurs with a proposed sewer tunnel, construction shaft, or overall work compound after utility information is received, consider temporary or permanent relocation of utilities around or through the work area. It may be possible to support some utilities above an open-cut excavation to be reburied. Modifications of the alignment and shaft locations may also be proposed during design development to mitigate utility conflicts.
U-2	Conflict with surface or overhead utilities	– Excavation of shaft is proposed where surface infrastructure is located – Shaft working compound equipment (including cranes) will require working directly under overhead utilities or within the hydro wire exclusion zone	– Overhead infrastructure, such as electrical or communications cabling, is mounted on utility poles between 5 and 12 m above the surface. Depending on the crane size and operating radius required to construct the shaft and lower the TBM, equipment extents may fall within hydro line exclusion zone or hit overhead wires, causing worker harm or death.	– Using topographic surveys and information on known utilities, working compounds will be designed to allow appropriate and safe movement of workers and equipment around the site, away from live overhead wires or surface utility boxes. – If a conflict occurs with a proposed sewer tunnel, construction shaft, or overall work compound after further utility information is received, modifications of the alignment and shaft locations may be proposed during design development; otherwise, the utilities would need to be temporarily relocated safely around or through the work area.
U-3	Damage or deformation to surface infrastructure or buried utilities (including railways, bridges, and structural culverts)	– Soil movement under or next to the utility from tunnel or shaft or open-cut construction	– Ground heave, settlement, or horizontal shift along tunnel ahead of and along excavated alignment and around shafts or open-cut excavations during and post-excavation. This information can be obtained from nearby geotechnical instrumentation. – Deformation or damage to nearby surface or buried utilities because of soil movement (e.g., crack formation, angular rotation, strain, pipe joint rotation, or pull out) that may require rehabilitation or repair.	– For utilities within sewer tunnel ZOI: Select a tunnel excavation method that can limit volume losses at the cutting face (limit overcutting of excavation) to limit ground losses. – For utilities near shaft or sewer open-cut ZOI: Select a shaft construction method and support of excavation (SOE) appropriate for the depth and size of the shaft and the geotechnical and hydrogeological conditions at the shaft location. – For each utility, complete analytical assessments of at-risk locations, including low soil cover locations and areas where the tunnel crosses or runs near and parallel to sensitive, large, or critical utilities and services. – Where applicable, propose mitigation methods such as relocation of utilities or, for deep utilities, relocation of the tunnel horizon based on assessment results. If neither option is applicable, investigate ground improvement near utilities to limit ground movement or investigate modification of the tunnel or shaft design or construction method.
Noise and vibration				
N-1	Operation noise	– Complaints are received from residents within study area	– Noise disruptions to private residents and commercial areas could occur after construction near MHs and other surface connections.	– Any permanent facility (e.g., supporting air management facilities) will require an Environmental Compliance Approval (ECA) application under Section 9 of the *Environmental Protection Act* to document noise emissions compliance according to NPC-300.

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
N-2	Construction noise	– Complaints are received from residents within study area	– Noise disruptions to private residents and commercial areas could occur during construction near construction compounds.	– Propose construction noise monitoring according to MECP NPC-115 Construction Equipment requirements. – Consider monitoring noise throughout construction and notifying the contractor of any exceedances so that corrective and contingency actions can be implemented. – Use vehicles and equipment (cranes and excavators) with efficient muffling devices or construct enclosures. – Limit truck movements to comply with noise bylaws for 24/7 construction operations.
V-1	Construction vibration	– Complaints are received from residents within the study area	– Disruptions to private residents and commercial areas could occur during construction near construction compounds.	– Propose appropriate construction vibration benchmarks in the tender documents. – Consider pre- and post-construction condition photos.
Air management				
O-1	Operation odour at drop structures	– Odour near surface connections	– Where the gravity sewer bends or drop structures occur, fugitive releases of odour may occur.	– Consider implementing ventilation systems with specific venting locations.
O-2	Construction odour	– Complaints are received from residents within the study area	– During live connection of infrastructure, odour may be released.	– Notify residents in advance, advising them of the nature and duration of the work.
A-1	Construction dust at sewer construction locations	– Fugitive dust is generated – Air quality is poor	– Fugitive dust could be generated during construction of gravity sewer, interconnecting shafts or chambers, including connection points.	– Include requirements for dust management in the tender documents. – Aim mitigation at minimizing emissions of particulate matter and exposure to particulate matter during construction.

Table 6.16 Y1-A2 Leslie Street Trunk Sewer Phase 2 Natural Environment – Effects and Mitigation

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/ Compensation
Hydrogeology				
N-1	Effect on groundwater quantity	– Temporary or long-term changes in groundwater quantity	– Potential temporary change to groundwater quantity is minimal because construction is expected to mainly intersect the Newmarket Till aquitard and potentially some Inter-Newmarket Sediment. Shallow water table or perched water anticipated to be encountered within till. – No long-term change to groundwater quantity is anticipated. – Ground settlement from active dewatering or depressurization – Change in shallow groundwater flow patterns caused by operation of sewer pipe that results in increased infiltration and inflow or preferential movement of groundwater within trench sediments	– Use construction methods that minimize dewatering requirements, including sealed shafts and tunnel face stability control (e.g., earth-pressure-balance tunnel boring machine). – Establish pre-construction baseline groundwater quality and quantity conditions and develop implementation plans for monitoring during and after construction (install monitoring wells and monitor well water and surface water).
N-2	Effect on groundwater quality	– Temporary or long-term changes in groundwater quality	– Temporary change in groundwater quality is minimal because construction is anticipated to mainly intersect low permeability till. – No long-term change to groundwater quality is anticipated. – Effects on groundwater water quality that occur because contaminated water is mobilized where active dewatering or depressurization is required. – Reduced groundwater quality because of spills or mismanagement of fuels or chemicals in work areas	– During design, investigate contaminant source(s) to avoid drawing contamination from a source to another location. – Use construction methods that minimize dewatering requirements as needed. – Develop and implement a Spill Response Plan for construction to mitigate the effect of a spill should one occur. – Establish pre-construction baseline groundwater quality and quantity conditions and develop implementation plans for monitoring during and after construction (install wells and monitor their water and surface water).
N-3	Effect on municipal well(s), Wellhead Protection Area (WHPA)	– Not directly within a WHPA – Located near a highly vulnerable aquifer	– No effect on municipal WHPA.	– No measures required because outside of Source Water Protection designated areas, except for a small area near St. John’s Sideroad within WHPA-D.
N-4	Effect on private wells – temporary construction dewatering	– Temporary construction dewatering private well interference (quantity or quality)	– Temporary decrease in private well quantity or quality could occur during construction activities depending on the location, depth of excavation, and construction methodology and duration.	– Use construction methods that minimize dewatering requirements. – Address complaints about construction dewatering’s interference with private wells through York Region’s private well assessment and mitigation policy. – Proactively identify any high-risk wells during design and prepare site-specific preventive mitigation and corrective action plans as part of design. Corrective actions should align with York Region’s private well assessment and mitigation policy.

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/ Compensation
N-5	Effect on private wells – long-term	– Long-term private well interference (quantity or quality)	– Potential long-term change in groundwater quality during operation of the gravity sewer.	– Use construction methods that minimize dewatering requirements, including sealed shafts and tunnel face stability control (e.g., earth-pressure-balance tunnel boring machine). – Establish pre-construction baseline groundwater quality and quantity conditions and develop implementation plans for monitoring during and after construction (install wells and monitor well and surface water). – Proactively identify any high-risk wells during design and prepare site-specific preventive mitigation and corrective action plans as part of design. Corrective actions should align with York Region's private well assessment and mitigation policy.
N-6	Effect on surface water quantity or quality	– Temporary changes in surface water quantity (i.e., impacts on baseflow or quality)	– Temporary changes in surface water quantity (i.e., impacts on baseflow or quality) could occur during construction, depending on the location, depth of excavation, construction method, timing and duration. – Temporary change in surface water quantity or quality is not anticipated because the intersection will be with low permeability till. – Limited dewatering is expected during construction. – Sewer passes under tributary to Holland River East Branch. – A high groundwater table resulting in groundwater-surface water interaction is expected because of existing soil characteristics and anticipated presence of the ORM aquifer. – Change in groundwater-surface water interaction (reversal of vertical hydraulic gradient) results in impact to terrestrial and aquatic habitat and associated SAR (where applicable) – reduction in baseflow. – Change in surface water temperature from groundwater taking or discharge to surface water. – Changes to stream morphology resulting from the release of dewatering water. – Potential reduction in baseflow due to water taking in a lower confined aquifer, which would increase downward hydraulic gradients across the aquitard separating the stream and the confined aquifer. – Potential reduction in baseflow from a stream reach that intersects an aquifer in which the water taking is occurring.	– Complete outlet receiver assessment(s) if groundwater must be temporarily discharged to surface water. Establish pre-construction baseline surface water quality and quantity conditions and develop implementation plans for monitoring during and after construction. – Construct and implement facilities (e.g., settlement tanks) to treat construction water before it is discharged to storm sewer or surface water. – Minimize construction area disturbance and duration. – Implement erosion and sedimentation control measures (e.g., silt fencing, check dams). – Consider completing a geomorphology study during design. – Refer to Natural Heritage section of this table for further ways to mitigate surface water impacts.
N-7	High groundwater levels	– High groundwater levels encountered during hydrogeological field investigations (borehole drilling) – High groundwater levels encountered during tunnel or shaft excavation	– High pressures acting on the tunnel boring machine, tunnel walls, or shaft walls.	– Consider water elevations in design based on recommendations of the GBR at all applicable locations and **use** construction methods that minimize dewatering requirements. – For areas within the ORM, comply with ORMCP requirements as set out in O. Reg. 140/02 under the *ORMC Act*, particularly Section 42(2), which states that the sewer must be planned, designed, and constructed so as to minimize disruption of the natural groundwater flow.
N-8	Artesian conditions	– Artesian conditions encountered during hydrogeological field investigations (borehole drilling – Artesian conditions encountered during tunnel or shaft excavation	– High pressures acting on the tunnel boring machine, tunnel walls, or shaft walls.	– Consider water elevations in design based on recommendations of the GBR at all applicable locations and use construction methods that minimize dewatering requirements.

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/ Compensation
Areas of potential environmental concern				
C-1	Low risk of contamination	– No area of potential environmental concern is located directly in or immediately adjacent to the project ROW – There is low potential for contaminants to be present, and if present, they are likely limited in extent and only present in surficial soil – Migration routes, exposure pathways, and receptors are limited – Impacts can be easily managed before or during construction	– 12871 Leslie Street: Current operation of a fuel oil storage tank. Low potential for mobility of COCs (PHCs and BTEX). – 15338 Leslie Street: Current operation of fuel oil storage tank. Low potential for mobility of COCs (PHCs and BTEX).	– No mitigation required.
C-2	Moderate risk contamination	– An area of potential environmental concern is within or immediately adjacent to the project ROW. – Moderate potential for contaminants to be present within the area of potential environmental concern – Moderate potential for contaminants to be present in soil or groundwater, or there is evidence that contaminants are present – Migration routes, exposure pathways, or receptors may be present	– 15255 Leslie Street, current operation of fuel storage tank and retail fuel gas station. Potential for COCs (PHCs and BTEX). – 1472 Wellington St East, current operation of fuel storage tank and retail fuel gas station. Potential for COCs (PHCs and BTEX). – 1501 Wellington St East, current operation of fuel storage tank and retail fuel gas station. Potential for COCs (PHCs and BTEX).	– As part of the detailed design, advance boreholes near the areas of potential environmental concern that have moderate risk to assess for potential subsurface impacts that may affect the proposed construction work. – Soil samples should be collected from these boreholes for laboratory analysis of metals and inorganics (including EC and SAR), petroleum hydrocarbons (PHCs), benzene, toluene, ethylbenzene, and xylenes (BTEX) and volatile organic compounds (VOCs).
Geotechnical				
G-1	Effect on soil quality	– Contaminant seepage into soil during excavation of shaft	– Chemicals such as drilling fluids, lubricants, ground improvement material, or fuel from construction equipment may contaminate soil.	– Perform regular equipment checks and maintenance. – Prepare an Environmental Management Plan prior to construction to implement in case contamination is encountered.
G-2	Soil movement around shafts	– Vertical or horizontal ground movement around shafts during or after excavation – Deformation or damage to nearby structures or utilities	– Ground heave/settlement/horizontal shift at surface around shafts. – Deformation or damage to nearby structures and utilities (e.g., crack formation, angular rotation, strain, or pipe joint rotation or pull out) that may require rehabilitation or repair.	– Select shaft or open-cut construction methods and support of excavation (SOE) appropriate for the depth and size of excavation and the geotechnical and hydrogeological conditions at shaft or open-cut locations. – Complete soil displacement analytical assessments at all shaft locations
G-3	Soil movement along tunnel	– Vertical or horizontal ground movement along tunnel during and post-excavation	– Ground heave, settlement, or horizontal shift along tunnel ahead of and along excavated alignment.	– Select tunnel excavation method that can limit volume losses at the cutting face (limit overcutting of excavation) to limit ground losses. – Assess and analyze soil displacement for tunnel locations that are at risk, including low-soil-cover locations or areas where the tunnel crosses or runs parallel to and near sensitive natural features, utilities, or critical infrastructure such as gas mains, structural culverts, bridges, or rail crossings.
G-4	Encounter boulders during shaft or tunnel excavation	– Boulders encountered during excavation of shaft or tunnel	– For tunnels, boulder presence and properties may require change of preferred excavation method (segmented tunnel versus pipe jacking) and tunnel boring machine technical specifications. – For shafts, boulder presence and properties may require change of preferred shaft SOE method.	– Complete appropriate geotechnical investigations, with strength testing for any encountered boulders. – Prepare a Geological Baseline Report (GBR) during design development with appropriate baseline for boulder strength, size, and anticipated encounter rates and locations. – Recommend a shaft construction SOE that can maintain verticality in boulder-prone soils. – Recommend appropriate technical specifications for tunnel boring machine.
G-6	Encounter contaminated soil during shaft or tunnel excavation	– Tests of soil encountered during shaft or tunnel excavation indicate allowable contaminant levels are surpassed	– Spoil must be disposed of at an approved contaminated soil disposal site.	– Complete appropriate geotechnical investigations and contaminants testing during design development to confirm suspected contaminated soil locations or at-risk areas based on historical land use. – Identify and confirm availability of appropriate soil disposal sites for the materials that will likely be used during construction that might cause contamination.

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/ Compensation
G-7	Encounter weak or incompetent soil during tunnel excavation	– Volume loss at surface and depths	– Soil heave, soil settlement, or sinkhole formation at surface.	– Complete appropriate geotechnical investigations with strength testing for anticipated soils along tunnel horizon. – Prepare a Geological Baseline Report (GBR) during design development with appropriate baseline for soil properties, including stratigraphic profile inferred from borehole investigations. – Recommend appropriate preventive or compensation ground improvement for at-risk structures and utilities.
Natural heritage				
EG-1	Effect on aquatic habitat or functions	– Study area contains cold, cool, and warm watercourses – Study area contains four portions of wetlands	– Temporary or permanent loss of aquatic features or categorical loss of functions by type, including PSWs, Locally Significant Wetlands, watercourses by sensitivity type, and others. – During construction, water quality may be impaired because of elevated TSS in surface water runoff from study area locations, which can affect aquatic species and habitats. Some TSS levels above background may occur temporarily. – Potential spill hazard when refuelling equipment. – Change in surface water temperature from groundwater taking or discharge to surface water.	– Complete site investigations to evaluate potential effects on aquatic habitat function. – Implement best management practices to control surface water runoff and minimize TSS effects. – Where feasible, direct discharging of surface water during construction into the municipal storm sewer system to mitigate thermal impacts to watercourses. If discharge of surface waters is directed to watercourses, additional mitigation measures would need to be implemented (e.g., enhanced erosion and control measures). Use erosion and sediment control measures and time construction to avoid spawning and egg incubation periods to reduce the potential for effects on fish and aquatic life. – Maintain and refuel equipment at the designated and properly contained maintenance areas or at industrial garages located well away from creek banks, wetlands and outside vegetation areas. – Develop a response plan, where applicable, for frac-out (mud loss or release of drilling fluid) that outlines the protocol to monitor, contain, and clean up any frac-out that does occur. – Develop a Spill Prevention Plan.
EG-2	Effect on stream geomorphology	– Change in geomorphic form, function, or stability in affected channels	– No impacts to stream geomorphology in affected channels are anticipated.	– Employ erosion and sediment controls to limit deposition of construction-mobilized soils into watercourses. – Consider completing a geomorphology study during design, where applicable.
EG-3	Effect on terrestrial habitat or functions	– Study area contains ecologically significant forests – Study area contains wildlife habitat	– Temporary or permanent loss of natural heritage features (e.g., ESAs, ANSIs, wildlife corridors and others). – Terrestrial habitat may be affected (e.g., direct vegetation [and wildlife habitat] loss, alteration, and fragmentation) by the footprint of shafts or compounds. – Project preparation, construction, and operation may increase the risk of nest destruction and mortality of migratory birds.	– Perform site investigations to evaluate potential terrestrial habitat function and significance. – During design, prepare construction constraints considering timing windows so vegetation clearing occurs outside of the migratory bird nesting, bat maternity roosting, turtle overwintering, and amphibian breeding seasons. – Limit the area of project footprint and limit disturbance from employees. – Monitor for the presence of wildlife and communicate any presence to site personnel. – Restrict vehicle use to designated areas. – Where practical, rehabilitate habitat for plants and wildlife.
EG-4	Effect on terrestrial species, including SAR, species of local concern, native species, invasive species, and area-sensitive species	– SAR could occur within the study area, including amphibians, insects, birds, reptiles, mammals, and tree species	– Number and type of terrestrial species potentially affected temporarily or permanently. – Construction activities could disturb wildlife within adjacent natural heritage areas. – Project preparation, construction, and operation may increase the risk of nest and habitat destruction and mortality of terrestrial SAR. – Project may result in wildlife-vehicle collisions and may injure or kill individual animals.	– Investigate sites to determine whether terrestrial SAR occurs within the study area. – During design, prepare construction constraints considering timing windows so vegetation clearing occurs outside of the migratory bird nesting, bat maternity roosting, turtle overwintering, and amphibian breeding seasons. – Clearly demarcate work limits at outset of construction and minimize vegetation clearing.

Table 6.17 Y1-A2 Leslie Street Trunk Sewer Phase 2 Cultural Environment – Effects and Mitigation

Item no.	Criteria	Indicators	Potential Effects (Positive and Negative)	Avoidance, Mitigation, and Compensation
CE-1	Effect on *Ontario Heritage Act* (OHA)-designated properties and properties listed on municipal heritage registries	– Project is near the heritage property or landscape	– Encroachment onto the property or landscape resulting in a physical impact on the potential BHRs or CHLs. – New structures or landscape features or alterations to the property or landscape that result in a physical impact on the potential BHRs or CHLs. – Relocation of all or part of the potential BHRs or CHLs. – Demolition or destruction of all or part of the potential BHRs or CHLs. – Vibration impacts on the potential heritage buildings identified on the property or landscape in and on adjacent properties. – Ground disturbance impacts relating to landscape features on the property or landscape in and on adjacent properties.	Considering the potential impacts outlined in the previous column, preferred and alternative mitigation options are provided below. Preferred option: – Project design avoids the property or landscape, resulting in no direct or indirect impacts. This includes maintaining a sufficient buffer of at least 50 m between project activities and the potential BHRs or CHLs. Alternative options: – If direct impacts are unavoidable, design project to minimize encroachment on the property or landscape while avoiding all impacts to the potential BHRs or CHLs. Consider the following options and mitigation: • Consult during detailed design to determine whether any approvals or permits are required because of physical impacts to the property or landscape. – If the preferred option is not feasible and the property or landscape cannot be avoided, and if a physical impact on potential BHRs or CHLs is unavoidable, then the following are required: • Consult during detailed design to determine whether any approvals or permits are required because of physical impacts on the property or landscape. • Complete a property-specific CHER/HIA before making any alterations, including assessing the property against O. Reg. 9/06 and, if necessary, documenting in detail any confirmed BHRs or CHLs and recommending specific mitigation measures for impacts on any identified heritage attributes. • The CHER/HIA should also consider the compatibility of new structures or landscape features with existing heritage attributes, layouts, and designs of the property or landscape.
CE-2	Effect on archaeological sites	– Project components are in the vicinity of the archaeological sites	– Encroachment onto the archeological site, resulting in a physical impact. – New structures or landscape features or alterations to the archeological site that result in a physical impact. – Demolition or destruction of all or part of the archaeological site. – Vibration impacts on the archaeological site(s) identified on the property or landscape. – Ground disturbance impacts on the archaeological site.	– If impacts are proposed near the site, additional assessment may be required. Depending on the location of the proposed impacts, a Stage 3 Archaeological Assessment or Stage 4 Avoidance and Protection may be required. If the former, Stage 3 test unit excavation must be completed across the remainder of the site according to Sections 3.2.2 and 3.2.3 of the Standards and Guidelines (MCM 2011:49-53). – If proposed impacts will avoid the site but construction-related activities will occur near the site, the site will require Stage 4 Avoidance and Protection Monitoring to be conducted by a licensed archaeologist. The avoidance, protection, and construction monitoring requirements for construction activities would include: • Depicting the 50 m monitoring buffer zone on all contract drawings with explicit instructions that a licensed consultant archaeologist must be present to monitor construction. • If any archaeological materials are identified during construction, all construction activities must stop until the archaeological materials are assessed, and effects are mitigated, if necessary, by a licensed archaeologist. • After the soil disturbing activities are completed, have a licensed archaeologist inspect the site area and prepare a report for the MCM on the effectiveness of the avoidance strategy and ensuring that the area to be avoided remains intact.
CE-3	Effect on registered cemeteries	– Project components are near registered cemeteries	– Encroachment onto the cemetery, resulting in a physical impact. – New structures or landscape features or alterations to the cemetery that result in a physical impact. – Demolition or destruction of all or part of the cemetery. – Vibration impacts to the cemetery identified on the property or landscape. – Ground disturbance impacts to the cemetery.	– According to ASI (2021, 2022) and at the demand of MCM and MTR, conforming with Section 4.2.3 of the Standards and Guidelines, monitoring must be carried out before any construction begins within the monitoring zone established around the purported location of human burials on the property. – The entire monitoring zone must be assessed for the presence or absence of unmarked graves. – A Cemetery Investigation Authorization issued by the Bereavement Authority of Ontario must be requested.

Table 6.18 Y14 Bloomington Interceptor Sewer Social and Built Environment – Effects and Mitigation

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
Social and built environment				
SB-1	Effect on existing views	– Predicted changes in views from buildings in the surrounding area	– No change in existing views from residences in the surrounding area.	– No avoidance, mitigation, or compensation measures required.
SB-2	Effect on existing residences or businesses or on community, institutional, or recreational facilities	– Degree of displacement of residences, businesses, or other facilities – Degree of temporary or permanent disruption to residences, businesses, or other facilities near construction compounds or permanent installations	– No displacement of residences or businesses or from community, institutional, or recreational facilities is anticipated. – Disruption to residences or businesses, as well as to community, institutional or recreational facilities near construction compounds and permanent installations.	– No avoidance, mitigation, or compensation measures are anticipated, but if displacement is required, York Region would provide market-value compensation. – Apply standard construction-related mitigation measures to minimize temporary disruption effects.
Traffic and transportation				
TT-1	Effect on traffic	– Extent of disruption to traffic flows – Proximity to congested traffic zones	– Traffic disruption at construction compounds on Bloomington Road; compound staging may extend into the travelled portion of the ROW. – Traffic movement into and out of construction compound sites will impact pedestrian, cycling, and traffic flow on Bloomington Road. – Coordination of alternate routing for emergency service vehicles, if needed.	– Implement complex traffic management and site security measures at each construction compound to mitigate to the extent possible. – Where possible, maintain one lane in each direction through flagging, temporary signals, or temporary road widening. – Maintain pedestrian movement during construction, with marked pedestrian detours as applicable. – Consider special traffic arrangements for peak hours on primary traffic flow directions in the morning and afternoon. – Pay duty police officers may be required to direct traffic. – Make special provisions for emergency service vehicle access. – Make special provisions for pedestrian traffic and safety, including signals, detours, and winter maintenance. If feasible, move construction traffic to sideroads.
Utilities				
U-1	Conflict with buried utilities	Sewer or shaft is in direct conflict with or falls within clearance limits of nearby utilities	– New construction impacts existing utilities and requires design coordination with utility owners, which increases project cost and schedule.	– Review historical and as-built documents for utility data. – Complete a SUE investigation to identify high-risk utilities, including large or critical service utilities (e.g., large watermains and all gas mains). – If a conflict occurs with a proposed sewer tunnel, construction shaft, or overall work compound location after utility information is received, consider temporary or permanent relocation of utilities safely around or through the work area. It may be possible to support some utilities above an open-cut excavation and rebury them later. Modifications of the alignment and shaft locations may also be proposed during design development to mitigate utility conflicts.
U-2	Conflict with surface or overhead utilities	– Excavation of shaft is proposed in location of surface infrastructure – Shaft working compound equipment, including cranes, will require working directly under overhead utilities or within the hydro wire exclusion zone	– Overhead infrastructure, such as electrical or communications cabling, is mounted on utility poles between 5 and 12 m above the surface. Depending on the crane size and operating radius required to construct the shaft and lower the TBM, equipment extents may fall within a hydro line exclusion zone or hit overhead wires, harming or killing workers.	– Design working compounds to allow appropriate and safe movement of workers and equipment around the site, away from live overhead wires or surface utility boxes, using known utility information and topographic surveys. – If a conflict occurs with a proposed sewer tunnel, construction shaft, or overall work compound location after utility information is received, modifications of the alignment and shaft locations may be proposed during design development. Otherwise, the utilities will need to be temporarily or permanently relocated safely around or through the work area.

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
U-3	Damage or deformation to surface infrastructure and buried utilities (including railways, bridges, and structural culverts)	– Soil movement under or next to the utility from tunnel or shaft or open-cut construction	– Ground heave, settlement, or horizontal shift along tunnel ahead of and along excavated alignment and around shafts and open-cut excavations during and after excavation. This information can be obtained from nearby geotechnical instrumentation. – Deformation or damage to nearby surface or buried utilities (e.g., crack formation, angular rotation, strain, or pipe joint rotation or pull out) because of soil movement that may require rehabilitation or repair.	– For utilities within sewer tunnel ZOI: Select a tunnel excavation method that can limit volume losses at the cutting face (limit overcutting of excavation) to limit ground losses. – For utilities near shaft or sewer open-cut ZOI, select a shaft construction method and support of excavation (SOE) appropriate for the depth and size of the excavation and the geotechnical and hydrogeological conditions at the shaft location. – For each utility, complete analytical assessments of at-risk locations, including low-soil-cover locations and areas where the tunnel crosses or runs near and parallel to sensitive, large, or critical utilities or services. – Where applicable, propose mitigation methods such as relocation of utilities or, for deep utilities, relocation of the tunnel horizon based on assessment results. If neither of these options is applicable, investigate ground improvement near utilities to limit ground movement or investigate modification of the tunnel or shaft design or construction method.
Noise and vibration				
N-1	Operation noise	– Complaints are received from residents within study area	– Noise disruptions to private residents and commercial areas post-construction near MHs and other surface connections.	– Any permanent facility, such as supporting air management facilities, will require an Environmental Compliance Approval (ECA) application under Section 9 of the Environmental Protection Act to document the noise emissions compliance according to NPC-300.
N-2	Construction noise	– Complaints are received from residents within study area	– Noise disruptions to private residents and commercial areas during construction near construction compounds.	– Propose construction noise monitoring according to MECP NPC-115 Construction Equipment requirements. – Consider monitoring noise monitoring throughout construction and notify the contractor of any exceedances so that corrective action or contingency actions can be implemented. – Use vehicles and equipment (cranes and excavators) with efficient muffling devices or construct enclosures. – Limit truck movements to comply with noise bylaws for 24/7 construction operations.
V-1	Construction vibration	– Complaints are received from residents within study area	– Disruptions to private residents and commercial areas during construction near construction compounds.	– Propose appropriate construction vibration benchmarks within the tender documents. – Consider pre- and post-construction condition photos.
Air management				
O-1	Operation odour at drop structures	– Odour near surface connections	– Where there are bends in the gravity sewer and drop structures, fugitive releases of odour may occur.	– Consider using ventilation systems with specific venting locations. – Investigate degree of risk and impact in further detail.
O-2	Operation odour at existing or proposed sewer connection	– Odour near surface connections	– The connection of the proposed gravity sewer to the Leslie Street Trunk Gravity Sewer is at the intersection of Leslie Street and Bloomington Road. Odour may be released because of turbulence at the connection to the proposed trunk sewer.	– Consider using ventilation systems with odour control. – Investigate degree of risk and impact in further detail.
O-3	Construction odour	– Complaints are received from residents within the study area	– During live connection of infrastructure odour may be released.	– Notify residents in advance, advising them of the nature and duration of the work.
A-1	Construction dust at sewer construction locations	– Fugitive dust is generated – Air quality is poor	– Fugitive dust is generated during construction of gravity sewer, interconnecting shaft, or chambers, including at the connection points.	– Include requirements for dust management within the tender documents. – Aim mitigation at minimizing emissions of particulate matter and exposure to particulate matter during construction.

Table 6.19 Y14 Bloomington Interceptor Sewer Natural Environment – Effects and Mitigation

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
Hydrogeology				
N-1	Effect on groundwater quantity	– Temporary or long-term changes in groundwater quantity	– Potential temporary change to groundwater quantity. It is anticipated that construction will intersect a shallow perched aquifer and extend through an aquitard and into the ORM aquifer. Temporary water takings will likely be required to facilitate construction, including from the perched aquifer and potentially the ORM aquifer. More information is needed to evaluate geology along specific alignments at proposed depths. – No long-term change to groundwater quantity is anticipated, as no active or passive long-term groundwater takings related to the sewer are anticipated. – Potential ground settlement because of active dewatering or depressurization. – Change in shallow groundwater flow patterns resulting from operation of sewer pipe resulting from increased infiltration and inflow or preferential movement of groundwater within trench sediments.	– Implement construction methods that minimize dewatering requirements. – Establish pre-construction baseline groundwater quality and quantity conditions and develop implementation plans for monitoring during and post-construction (install and monitor wells and surface water).
N-1	Effect on groundwater quality	– Temporary or long-term changes in groundwater quality	– Potential temporary change in groundwater quality because construction will extend in ORM aquifer. Temporary water takings may be required to facilitate construction. – No long-term change to groundwater quality is anticipated. – Potential effects on groundwater water quality because contaminated water may be mobilized where active dewatering or depressurization is required. – Reduction in groundwater quality from spills or the mismanagement of fuel/chemical in work areas	– During design, investigate any contaminant sources to reduce the risk of drawing contamination from a source to another location. – Use construction methods that minimize dewatering requirements. – Develop and implement a spill-response plan for construction to mitigate the effect of a spill should one occur. – Establish pre-construction baseline groundwater quality and quantity conditions and develop implementation plans for monitoring during and after construction (install monitoring wells and monitor well and surface water).
N-2	Effect on private wells from construction dewatering – temporary	– Temporary interference in the quantity or quality of water from private wells because of construction dewatering	– Temporary decrease in private well quantity/quality could occur during construction activities depending on the location, depth and construction, methodology and duration.	– Implement construction methods that minimize dewatering requirements. – Address complaints about private well interference from construction dewatering through York Region's private well assessment and mitigation policy. – Proactively identify any high-risk wells during design and prepare site-specific preventive mitigation and corrective action plans as part of design. Align corrective actions with York Region's private well assessment and mitigation policy.
N-3	Effect on private wells from construction dewatering – long-term	– Long-term interference in the quantity or quality of water from private wells	– Long-term change in groundwater quality during operation of the gravity sewer.	– Use construction methods that minimize dewatering requirements, including sealed shafts and tunnel face stability control (e.g., earth-pressure-balance tunnel boring machine). – Establish pre-construction baseline groundwater quality and quantity conditions and develop implementation plans for monitoring during and after construction (install monitoring wells and monitor well and surface water). – Proactively identify any high-risk wells during design and prepare site-specific preventive mitigation and corrective action plans as part of design. Align corrective actions with York Region's private well assessment and mitigation policy.

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
N-4	Effect on surface water quantity or quality	– Temporary changes in surface water quantity (i.e., impacts on baseflow or quality)	– Temporary changes in surface water quantity (i.e., impacts on baseflow or quality) could occur during construction depending on the location, depth of excavation, construction method, timing, and duration. – A high groundwater table resulting in groundwater–surface water interaction would be expected because of existing soil characteristics and anticipated presence of the ORM aquifer. – Excavation passes through perched unit, which feeds local kettle lakes and wetland areas (provincially significant wetlands include the Wilcox-St. George Wetland Complex and White Rose-Preston Lake Wetland Complex). – Change in groundwater–surface water interaction (reversal of vertical hydraulic gradient) results in impact to terrestrial and aquatic habitat and associated SAR (where applicable) – reduction in baseflow. – Change in surface water temperature from groundwater taking or discharge to surface water. – Changes to stream morphology resulting from release of dewatering water. – Potential reduction in baseflow due to water taking in a lower confined aquifer, which would increase downward hydraulic gradients across the aquitard separating the stream and the confined aquifer. – Potential reduction in baseflow from a stream reach that intersects an aquifer in which the water taking is occurring.	– Complete outlet receiver assessment(s) if temporary groundwater discharge to surface water is required. – Establish pre-construction baseline surface water quality and quantity conditions and develop implementation plans for monitoring during and after construction. – Construct and implement facilities (e.g., settlement tanks) to treat construction water before discharge to storm sewer or surface water. – Minimize construction area disturbance and duration. – Implement erosion and sedimentation control measures (e.g., silt fencing, check dams). – Consider completing a geomorphology study during design. – Refer to natural heritage section of this table for further mitigation approaches associated with surface water impacts.
N-5	High groundwater levels	– High groundwater levels encountered during hydrogeological field investigations (borehole drilling)	– High pressures acting on the tunnel boring machine, tunnel walls or shaft walls.	– Consider water elevations in design based on recommendations of GBR at all applicable locations and implement construction methods that minimize dewatering requirements.
N-6	Groundwater impacts from excavation works within ORM	– Sewer or shaft locations are located within ORM limits	– Design and construction will require minimum impact on groundwater for the sewer and associated construction shafts installed along Bloomington Road.	– Follow and apply requirements in ORMCP, as set out in O. Reg. 140/02 under the *ORMC Act*, particularly Section 42(2), which states that the sewer must be planned, designed, and constructed so as to keep disruption of the natural groundwater flow to a minimum.
Areas of potential environmental concern				
C-1	Low risk of contamination	– No area of potential environmental concern is located directly in or immediately adjacent to the project ROW – There is a low potential for contaminants to be present, and if they are present, they are likely limited in extent and only present in surficial soil – Migration routes, exposure pathways, and receptors are limited – Impacts can be easily managed before or during construction	– 1351 Bloomington Road: Waste disposal facility and generator of subject wastes. Operation located adjacent to Bloomington with potential for COCs. Low potential for presence and mobility of COCs (metals and other inorganics, PHCs, and BTEX). Low risk because this is a composting facility. – 1030 Bloomington Road: Automobile waste disposal facility. Operation located adjacent to Bloomington Road with potential for COCs. Low potential for presence and mobility of COCs (metals and other inorganics, PHCs, and BTEX).	– No mitigation required.
Geotechnical				
G-1	Effect on soil quality	– Contaminant seepage into soil during excavation of shaft	– Chemicals such as drilling fluids, lubricants, ground improvement material, or fuel from construction equipment may contaminate soil.	– Perform regular equipment checks and maintenance. – Prepare an environmental management plan before construction in case of contamination.
G-2	Soil movement around shafts	– Vertical or horizontal ground movement around shafts during and after excavation – Deformation or damage to nearby structures or utilities	– Ground heave, settlement, or horizontal shift at surface around shafts. – Deformation or damage to nearby structures and utilities (e.g., crack formation, angular rotation, strain, or pipe joint rotation or pull out) that may require rehabilitation or repair.	– Select shaft or open-cut construction methods and support of excavation (SOE) appropriate for the depth and size of the excavation and geotechnical and hydrogeological conditions at shaft and open-cut locations. – Complete soil displacement analytical assessments at all shaft locations.

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
G-3	Soil movement along tunnel	– Vertical or horizontal ground movement along tunnel during and after excavation	– Ground heave, settlement, or horizontal shift along tunnel ahead of and along excavated alignment.	– Select tunnel excavation method that can limit volume losses at the cutting face (limit overcutting of excavation) to limit ground losses. – Assess and analyze soil displacement analytical assessments for tunnel locations that are at risk, including-low-soil-cover locations or areas where the tunnel crosses or runs parallel to and near sensitive natural features, utilities, or critical infrastructure such as gas mains, structural culverts, bridges, or rail crossings.
G-4	Boulders encountered during shaft or tunnel excavation	– Boulders encountered during excavation of shaft or tunnel	– For tunnels, boulder presence and properties may require change of preferred excavation method (segmented tunnel versus pipe jacking) and tunnel boring machine technical specifications. – For shafts, boulder presence and properties may require change of preferred shaft SOE method.	– Complete appropriate geotechnical investigations with strength testing for any encountered boulders. – Prepare a Geological Baseline Report (GBR) during design development with appropriate baseline for boulder strength, size, and anticipated encounter rates and locations. – Recommend a shaft construction SOE that can maintain verticality in boulder-prone soils. – Recommend appropriate technical specifications for tunnel boring machine.
G-5	Frac-out of drilling fluids along the tunnel	– Drilling fluid breaches the surface during tunnel excavation – Unanticipated change in drilling fluid pressure or volume	– Drilling fluid may breach beds of waterbodies such as creeks, lakes and rivers. – Drilling fluid may breach aquifers. – Drilling fluid may cause cracking on surface infrastructure such as pavement and may require closure of traffic lanes to clean up fluid at surface.	– Select a contractor with experienced MTBM or TBM operators. – Require a Frac-Out Contingency Plan to be prepared before construction for cleanup of drilling fluids.
G-6	Contaminated soil encountered during shaft or tunnel excavation	– Soil encountered during shaft or tunnel excavation is tested and found to surpass allowable contaminant levels	– Spoil must be removed to an approved contaminated soil disposal site.	– Complete appropriate geotechnical investigations and contaminants testing during design development to confirm contaminated soil locations and at-risk areas considering historical land use. – Identify and confirm availability of appropriate soil disposal sites for the materials that will likely be used during construction that might cause contamination.
G-7	Weak or incompetent soil encountered during tunnel excavation	– Volume loss at surface and depths	– Soil heave, soil settlement or sinkhole formation at surface.	– Complete appropriate geotechnical investigations with strength testing for anticipated soils along tunnel horizon. – Prepare a Geological Baseline Report (GBR) during design development with appropriate baseline for soil properties, including stratigraphic profile inferred from borehole investigations. – Recommend appropriate preventative or compensation ground improvement for at-risk locations.
Natural heritage				
EG-1	Effect on aquatic habitat or functions	– Study area contains cold watercourses and one unknown water thermal regime – Study area contains one wetland portion	– Temporary or permanent loss of aquatic features or categorical loss of functions by type, including PSWs, Locally Significant Wetlands, watercourses by sensitivity type, and others. – During construction, water quality may be impaired because of elevated TSS in surface water runoff from study area locations, which can affect aquatic species and habitats. Some concentrations may be above background temporarily. – Potential spill hazard when refuelling equipment. – Change in surface water temperature from groundwater taking or discharge to surface water.	– Complete site investigations to evaluate potential effects on aquatic habitat function. – Implement best management practices to control surface water runoff and minimize TSS effects. – Where feasible, direct discharged surface water during construction into the municipal storm sewer system to reduce thermal impacts on watercourses. If discharge of surface waters is directed to watercourses, implement additional mitigation measures (e.g., enhanced erosion and control measures). – Use erosion and sediment control measures and time construction to avoid spawning and egg incubation periods to reduce the potential for effect to fish and aquatic life. – Maintain and refuel equipment at designated and properly contained maintenance areas or at industrial garages located well away from creek banks and wetlands and outside of vegetation areas. – Develop a response plan, where applicable, for frac-out (mud loss or release of drilling fluid) that outlines the protocol to monitor, contain, and clean up any frac-out that does occur. – Develop a Spill Prevention Plan.
EG-2	Effect on stream geomorphology	– Change in geomorphic form, function, or stability in affected channels in study areas	– No anticipated impacts to stream geomorphology in affected channels.	– Employ erosion and sediment controls to limit deposition of construction-mobilized soils into watercourses. – Consider completing a geomorphology study during design, where applicable.

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
EG-4	Effect on terrestrial habitat or functions	– Study area contains ecologically significant forests – Study area contains wildlife habitat	– Temporary or permanent loss of natural heritage features (e.g., ESAs, ANSIs, wildlife corridors). – Terrestrial habitat may be affected (e.g., direct vegetation [and wildlife habitat] loss, alteration, and fragmentation) by the footprint of shafts or compounds. – Project preparation, construction and operation may increase the risk of nest destruction and mortality of migratory birds.	– Site investigations to evaluate potential terrestrial habitat function/significance. – During design, prepare construction constraints considering timing windows so vegetation clearing occurs outside of the migratory bird nesting, bat maternity roosting, turtle overwintering, and amphibian breeding seasons. – Limit the area of project footprint and limit disturbance from employees. – The presence of wildlife will be monitored and communicated to site personnel. – Vehicle use will be restricted to designated areas. – Where practical, rehabilitate habitat for plants and wildlife.
EG-5	Effect on terrestrial species, including SAR, species of local concern, native species, invasive species, and area-sensitive species	– SAR might occur within the study areas, including amphibians, insects, birds, reptiles, mammals, and tree species	– Number and type of terrestrial species potentially affected temporarily or permanently. – Construction activities could disturb wildlife within adjacent natural heritage areas. – Project preparation, construction, and operation may increase the risk of nest and habitat destruction and mortality of terrestrial SAR. – Project may result in wildlife–vehicle collisions and may injure or kill individual animals.	– Perform site investigations to evaluate potential occurrence of terrestrial SAR within the study area. – During design, prepare construction constraints considering timing windows so vegetation clearing occurs outside of the migratory bird nesting, bat maternity roosting, turtle overwintering, and amphibian breeding seasons. – Clearly demarcate work limits at outset of construction and minimize vegetation clearing.

Table 6.20 Y14 Bloomington Interceptor Sewer Cultural Environment – Effects and Mitigation

Item no.	Criteria	Indicators	Potential Effects (Positive/Negative)	Avoidance/Mitigation/Compensation
CE-1	Effect on *Ontario Heritage Act* (OHA)-designated properties and properties listed on municipal heritage registries	– Project components are near the heritage property or landscape	– Encroachment onto the property or landscape resulting in a physical impact to the potential BHRs or CHLs. – New structures or landscape features or alterations to the property or landscape that result in a physical impact to the potential BHRs or CHLs. – Relocation of all or part of the potential BHRs or CHLs. – Demolition or destruction of all or part of the potential BHRs or CHLs. – Vibration impacts to the potential heritage buildings identified on the property or landscape in or on adjacent properties. – Ground disturbance impacts relating to landscape features on the property or landscape in or on adjacent properties.	Considering the potential impacts outlined in the previous column, preferred and alternative mitigation options are provided below. Preferred option: – Project design avoids the property or landscape, resulting in no direct or indirect impacts. This includes maintaining a sufficient buffer of at least 50 m between project activities and the potential BHRs or CHLs. Alternative options: – If direct impacts are unavoidable, design project to minimize encroachment on the property or landscape while avoiding all impacts to the potential BHRs or CHLs. Consider the following options and mitigation: • Consult with the Town during detailed design to determine whether any approvals or permits are required because of physical impacts to the property or landscape. – If the preferred option is not feasible and the property or landscape cannot be avoided, and if a physical impact on potential BHRs or CHLs is unavoidable, then the following are required: • Consult with the Town during detailed design to determine whether any approvals or permits are required because of physical impacts on the property or landscape. • Complete a property-specific CHER/HIA before making any alterations, including assessing the property against O. Reg. 9/06 and, if necessary, documenting in detail any confirmed BHRs or CHLs and recommending specific mitigation measures for impacts on any identified heritage attributes. • The CHER/HIA should also consider the compatibility of new structures or landscape features with existing heritage attributes, layouts, and designs of the property or landscape.

6.6 Y1-B Yonge Street Sewer Rehabilitation

6.6.1 Study Area

Inspections of the existing Yonge Street Sewer indicate damage to sections of the sewer and maintenance chambers. Rehabilitating the sewer and MHs would extend the remaining service life of the infrastructure and is required. The upper portion (from Bloomington Road to North Lake Road) includes 1,850 m of gravity sewer with diameters from 1,050 mm to 1,200 mm.

The lower portion (from North Lake Road to 19th Avenue) includes 400 m of gravity sewer with diameters of from 1,200 mm to 1,670 mm (tunnel portion). Figure 6.17 shows a key map for the project. A study area of approximately 200 metres surrounding the centerline of the road right of way was applied, as shown in Figure 6.18.

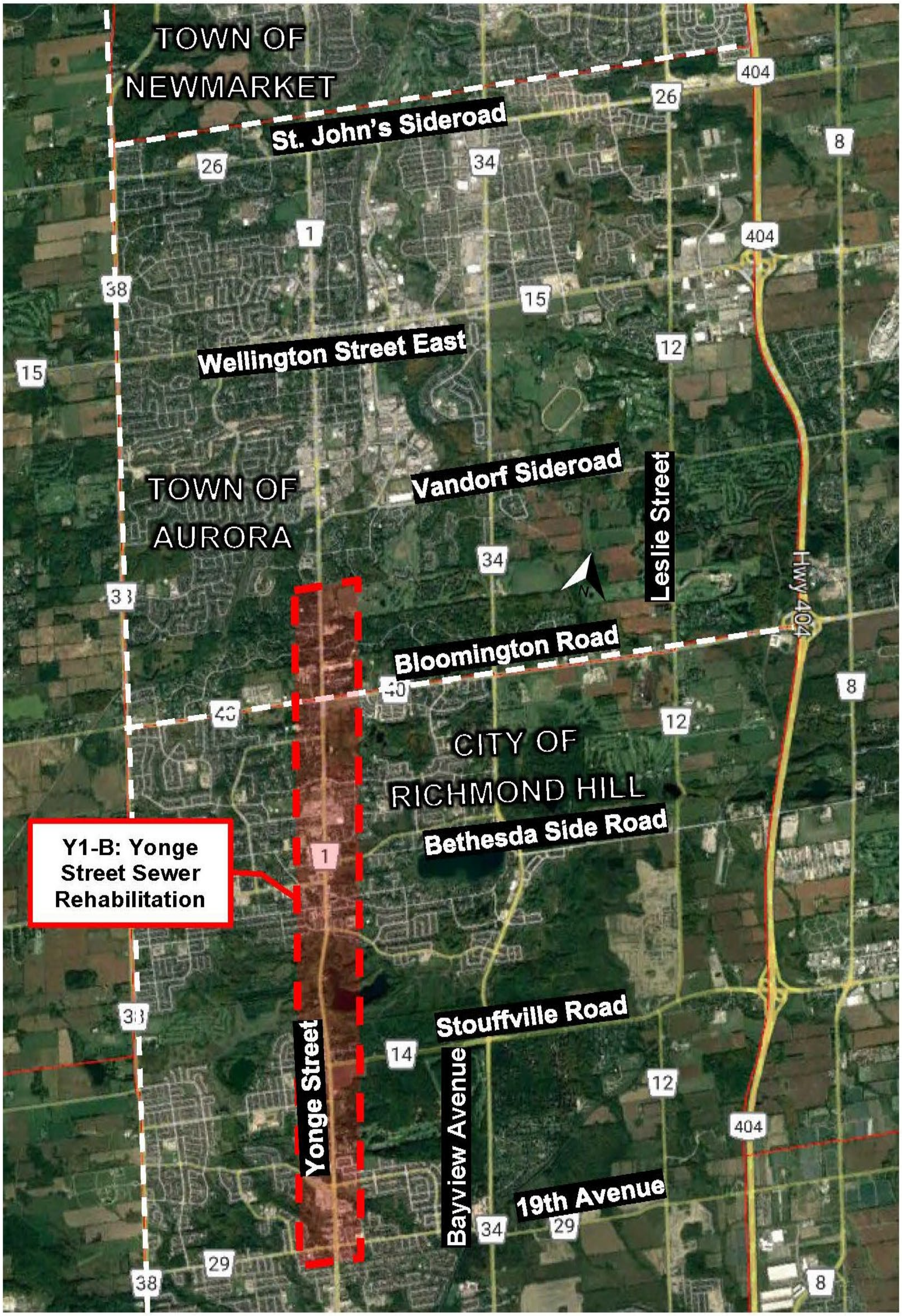


Figure 6.17 Overview of Y1-B Yonge Street Sewer Rehabilitation Project

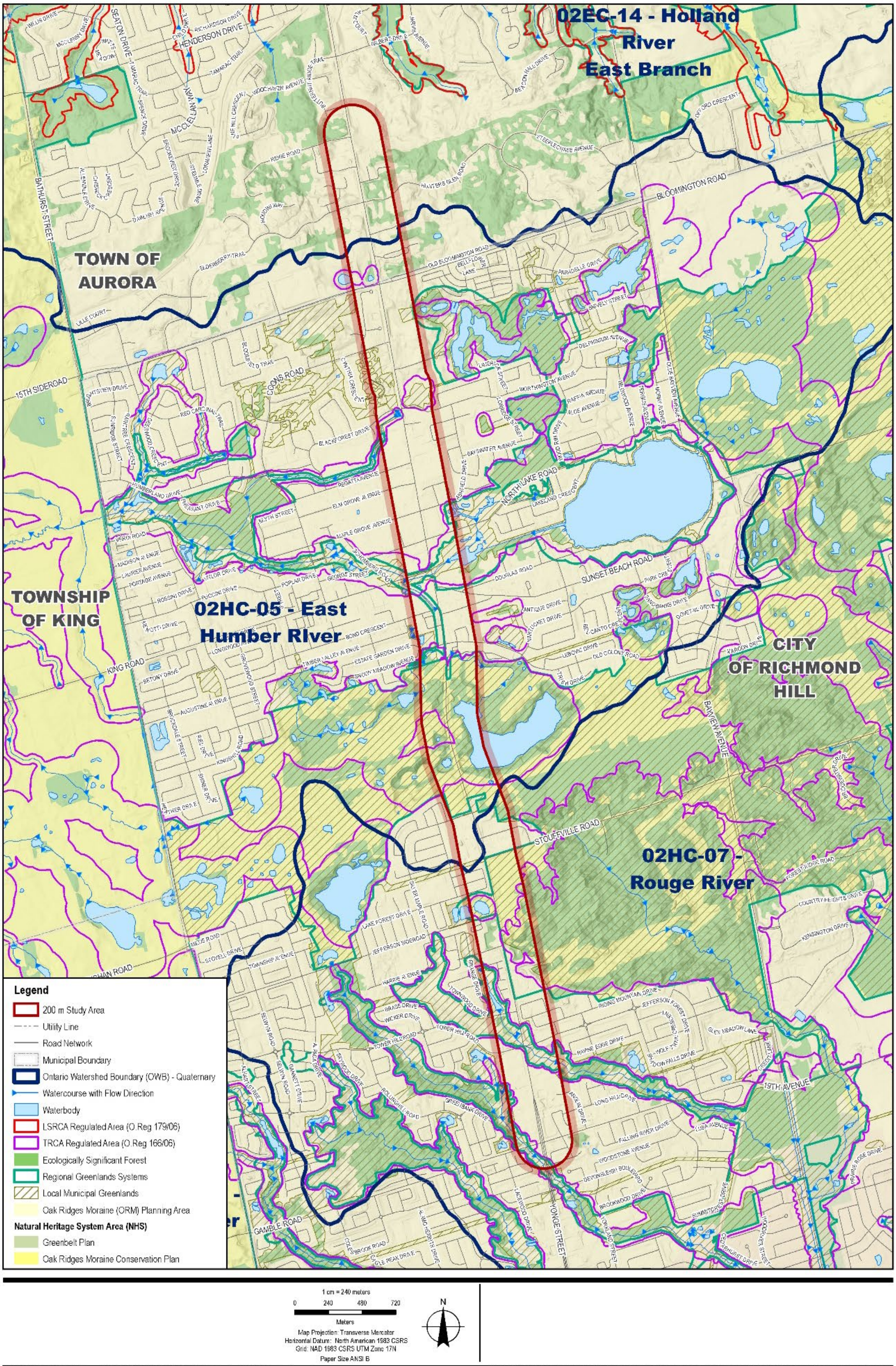


Figure 6.18 Details of Study Area and Study Area Limits for the Y1-B Yonge Street Sewer Rehabilitation

6.6.2 Existing Conditions

6.6.2.1 Social and Built Environment

The following sections summarize the findings of the desktop studies on planning policy and land use, transportation, and utilities for the study area for the Y1-B project component.

6.6.2.1.1 Planning Policy and Land Use

Existing Land Use

Along Yonge Street, from Cannon Valley Court to Blackforest Drive, land uses are:

- West side:
  - Low-density residential housing
  - Commercial lands (GTA Stone Fabrication)
  - Institutional lands (Service Ontario, Ontario Provincial Police, Ontario Natural Resources).
- East side:
  - Low-density residential housing
  - Agricultural lands
  - Aurora Cemetery Corporation.

Along Yonge Street, from Blackforest Drive to Stouffville Road, land uses are:

- West side:
  - Low-density residential housing
  - Commercial lands (restaurants, auto shops, sporting goods store, supermarkets, gas station, health facilities, and miscellaneous businesses)
  - Institutional lands (education centre – Academia de la Moraine, public school, and York Region District School Board office)
  - Public Park (Mitchell Pond Park)
  - Open lands.
- East side:
  - Low-density residential housing
  - Commercial lands (restaurants, banks, auto shops, supermarkets, gas stations, medical facilities, and miscellaneous businesses)
  - Institutional lands (Canada Post, UPS, Richmond Hill Fire Station 8-2, St. Archangel Serbian Church, St John Ambulance York Region Branch)
  - Bond Lake (Oak Ridge Trail crossing Yonge Street near Bond Lake)
  - Lake Willcox Channel near King Road and Yonge Street intersection.

Along Yonge Street, from Stouffville Road to Zippora Drive, land uses are:

– West side:
  - Low-density residential housing
  - Commercial lands (restaurants, shopping mall, banks, Hotel Richmond Hill, and car dealership)
  - Macleod's Landing Pond.
– East side:
  - Low-density residential housing
  - Commercial lands (medical facilities, car dealership, and miscellaneous businesses)
  - Agricultural lands
  - St John's Anglican Cemetery
  - Recreational lands (golf course and soccer fields at Monticello Park)
  - Institutional lands (Kaveh Educational Centre, St John's Anglican Church, and Korean Buddhist Chontae).

Planning Policy

Provincial

The Y1-B study area is within the Greenbelt Plan area and the ORM boundary. It covers lands designated as settlement areas, natural core areas and natural linkage areas by the ORMCP.

Regional

The York Region Official Plan 2022 (June 2023 Office Consolidation) designates lands within the Y1-B study area as community areas and rural areas. The study area also covers parts of York Region's Greenlands System.

Local

The Y1-B study area crosses the municipal boundary between the Town of Aurora and the City of Richmond Hill. With reference to the Aurora Official Plan (September 2021 Consolidation, Official Plan Amendment 34), the study area includes the following land use designations:

– Private Open Space
– Cluster Residential
– Estate Residential
– Major Institution
– Environmental Function Areas.

With reference to the Richmond Hill Official Plan (January 2023 Consolidation), the study area includes the following land use designations:

– Neighbourhood
– Natural Core
– Natural Linkage
– Oak Ridges Local Centre
– ORM Natural Linkage
– ORM Natural Core
– Regional Mixed-Use Corridor.

Active Development Applications

Lands within the Y1-B study area contain several active development applications. The list below is not exhaustive, as several applications may be linked to the same property address. These applications are primarily for proposed subdivisions and increases in commercial and retail space. The location is listed first, and then the type of development.

Residential applications:

- 14108 and 14122 Yonge Street – Application for consent to sever and convey subject lands; lands are within ORM Settlement Area.
- 14086 Yonge Street – To rezone the lands from Rural General Oak Ridges Moraine (RU-ORM) to Detached Third Density Residential (R3) to facilitate development of five detached residential dwellings.
- West of Yonge Street, south of Ridge Road – An official plan amendment; an application to amend the zoning bylaw and draft plan of subdivision (19T-03A02) has been submitted to facilitate development of 29 single-detached dwellings and two open-space blocks.
- Equestrian Drive – Proposed subdivision.
- 14029 Yonge Street – To facilitate development of 27 single-detached units.
- Hunter's Court – To facilitate development of 24 single-detached units.
- West of Yonge Street, north of Bloomington Road – To facilitate development of 20 apartment units.
- 50 Bloomington Road West – Official plan amendment application requesting regional exemption to amend the Yonge Street South Secondary Plan (OPA 34) to redesignate the eastern portion of the subject lands from major institutional to cluster residential, special policy areas, and environmental function areas.
- 13815 Yonge Street – Proposed development of 33 low-density residential units.
- Grovepark Street – Proposed subdivision.
- South of Bloomington Road and East of Yonge Street – To add a site-specific exception to permit 455 townhouse units and two parks.
- 25 Cynthia Crescent – Zoning bylaw amendment.
- 34 Cynthia Crescent – To facilitate creation of three lots for single-detached residential purposes.
- 18 Elm Grove Avenue – To create 16 townhouse units. To rezone the lands from Residential Urban Zone to Multiple Residential One (RM1) Zone to create 16 residential condominium townhouses.
- 8 Bostwick Crescent – To facilitate development of 74 block townhouse units.
- 53 Sunset Beach Road – To permit a 477.18 m^2 single-detached family dwelling.
- East side of Yonge Street, South of Old Colony Road – Proposed development of a 99-unit condominium.
- Yonge Street – Proposed subdivision.
- 67 Jefferson Road –To facilitate the development of 96 three-storey townhouse units and one-level underground parking.
- Grande Drive – Proposed subdivision.
- North of Gamble Road, East of Yonge Street – Proposed sales office.
- Northeast corner of Yonge Street and Nineteenth Avenue – Proposed townhouse development.
- Post Oak Drive – Proposed subdivision.
- Royal Chapin Crescent – Proposed subdivision.
- Concession 1, PT Lot 55 – Site plan.

Infrastructure applications:

- Oak Ridges Local Centre – To re-designate this area as a Regional Corridor supported by York Viva Bus Rapid Transit.

Commercial applications:

- Oak Ridges Local Centre – To facilitate development of five commercial buildings.
- 13200 Yonge Street – Site Plan. Proposed development of a French school on Yonge Street in Oak Ridges.
- 60 King Road – To legalize the existing commercial, office, and residential uses within the existing buildings on the subject lands and a request for site plan approval to permit a proposed patio addition to building “A.”
- Silver Maple Road – Development of a commercial plaza.
- 11 Jefferson Sideroad Road – Development of a commercial plaza office.
- 12050 Yonge Street – Two-storey retail building.
- Townwood Drive – Proposed development of a commercial building.
- 11644 Yonge Street – Consent application.
- 11592 Yonge Street – To remove a Holding “H” provision from the front portion of the subject lands to permit development of a two-storey automobile dealership with 86 parking spaces on the subject property.

6.6.2.1.2 Transportation in the Study Area

Yonge Street between 19th Avenue and Bloomington Road is a four-lane urban arterial road with dedicated center turn lanes at various locations along the corridor, as shown in Figure 6.19.

Figure 6.19 Yonge Street Looking north (1) from Jefferson Forest Drive, (2) Toward Bloomington Avenue Intersection. (*Google Maps* "Streetview," digital images http://maps.google.com**)**

Sidewalks are on both sides of the road north of 19th Avenue and on just one side north of Jefferson Road on the west side; there are no sidewalks north of Harris Avenue. Further north, sidewalks exist on both or either side of the road where there are residential developments.

The AADT along Yonge Street between 19th Avenue and Bloomington Road varies between 33,918 vehicles in the south end and 24,141 in the north end, using the latest available 2023 data. Historical AADT data along the study area are presented in Table 6.21.

Table 6.21 Yonge Street AADT Counts Between Silver Maple Road (North of 19th Avenue) and Hunters Glen Road

Description of road limits	2012	2013	2014	2015	2016	2017	2018	2019	2022
Silver Maple Road and the ORM Trail	27,137		28,738		29,516		29,282		33,918
Jefferson Sideroad and Stouffville Road		24,869		23,596	25,232	25,236		24,816	
King Road and Sunset Beach Road	26,774		28,321		29,110		29,173		33,892
Aubrey Avenue/North Lake Road and King Road		30,820		29,375		31,454		31,283	
Bloomington Road and Coon's Road		20,784			20,607		20,820		24,141
Bloomington Road and Hunters Glen Road/Elderberry Trail		23,144		21,967		23,057		13,372	

Public transit routes run along Yonge Street with associated bus stop infrastructure within the study area, including:

- York Region Transit (YRT) Route 81 (south of 19th Avenue to Jefferson Sideroad only)
- YRT Route 91B (Old Colony Road to Worthington Avenue only)
- YRT Route 96 (King Road to north of Bloomington Road only)
- YRT Route 98, 98E
- York VIVA Blue Rapid Transit.

6.6.2.1.3 Utilities in the Study Area

Several utilities are situated above and below grade within the study area and near the proposed project. These utilities may be temporarily impacted during construction of the shafts and work compounds. Formal notification of and consent from the authorities responsible for these utilities would be required prior to construction.

Buried utilities are typically located within the following limits:

- Shallow buried services are commonly buried between 1.2 and 3.5 mbgs, with electrical and communications cabling buried between 1.2 and 1.5 mbgs.
- Shallow municipal services such as storm drains, sanitary sewers, and watermains are typically buried between 1.2 and 3.5 mbgs.
- Most buried electrical and communications cabling are buried between 0.9 and 1.2 mbgs.
- Deep utilities are anything deeper than the typical depths listed above.

Known municipal infrastructure that existed on York Region's GIS database has been provided in the drawing set. A detailed utility investigation program, which would include a Level A through D Subsurface Utility Exploration, would be required as part of future site investigations.

6.6.2.2 Natural Environment

The following sections summarize the findings of the desktop studies on geotechnical, hydrogeological, surface water, natural heritage and contamination characteristics for the study areas for the Y1-B project component.

6.6.2.2.1 Geotechnical

Starting at the north limit of the project, north of Bloomington Road and continuing south to King Road, the study area is bordered on the east, west, and north by vegetated areas and residential properties. According to 2019 logs on boreholes advanced between 8 and 13 mbgs, the near surface is generally composed of silty clay (firm to very stiff) overlying silty clay till (very stiff to hard). The groundwater table was about 1.8 to 3.1 m depth below grade. According to 1994 logs on boreholes advanced to 9.6 mbgs, the near surface is generally composed of sand (compact to very dense).

The near-surface soils within the study area (except the northern portion) are predominantly composed of silt to silty clay matrix, high in matrix carbonate content and clast poor (Halton Till deposit). The near-surface soils of the southern portion of the study area consist of gravel and sand, as well as minor till, including esker, kame, end moraine, ice-marginal delta and subaqueous fan deposits (glaciofluvial ice-contact deposits).

The bedrock near the northern and southern portion of the study area consists of shale, limestone, dolostone, and siltstone Georgian Bay Formation/Blue Mountain Formation/Billings Formation. The bedrock near the middle portion of the study area consists of limestone, dolostone, shale, arkose and sandstone of the Ottawa Group/Simcoe Group.

Between King Road and Stouffville Road, the study area is bordered on the east and west by vegetated areas. The area near the Stouffville Road and King Road is bordered by residential properties. According to 2007 logs on boreholes advanced between 6.6 and 9.6 mbgs, the near surface is generally composed of sandy silt till (compact) or clayey silt till (stiff to very stiff) with interbedded layers of sand and silt. Other boreholes encountered a sand silt layer (compact relative density) overlying silt followed by sand. The groundwater table varied from 2 m to 6.1 m below existing grade. Few boreholes encountered organic clayey silt/peat layers. A maximum fill depth of about 9.6 m was encountered in one borehole.

Continuing to the south limit of the study area, between Stouffville Road and 19th Avenue, residential properties border on the south, east, and west. According to 1998 logs on boreholes advanced between 15.7 and 36.8 mbgs, the near surface is generally composed of clayey silt to silt till (stiff to hard) overlying silty sand and sand (very dense) and sand to silt (dense to very dense) followed by sand. One borehole encountered a silt and sand layer (very loose) overlying sand (very loose to very dense relative density) and clayey silt deposit (very stiff to hard consistency), and the deposits were generally moist to wet. The ground surface at the boreholes varied from elevation 263.7 m to 244.5 m, and the groundwater table varied from elevation 263.7 m to 243.1 m. The above-mentioned subsurface condition was also encountered north of study area Y6 (2nd Concession between Valley Trail and Rogers Road, about 1 km away from the Y1-B study area), and groundwater is typically found at shallow depths below the ground surface within the study area, based on historical well information.

To summarize the above details regarding the existing hydrogeological conditions, the surficial geology at the three shaft locations consists of:

– Shaft 1 – Till, clay to silt-textured till (derived from glaciolacustrine deposits or shale).
– Shaft 2 – Ice-contact stratified deposits, sand and gravel, minor silt, clay, and till.
– Shaft 3 – Till, clay to silt-textured till (derived from glaciolacustrine deposits or shale).

The quaternary geology at the three shaft locations consists of:

– Shafts 1, 2, and 3 – Halton Till (Pleistocene, predominantly silt to silty clay matrix, high in matrix carbonate content and clast poor).

The bedrock geology at the three shaft locations consists of:

– Shafts 1, 2, and 3 – Lindsay Formation, limestone.

6.6.2.2.2 Hydrogeological

A hydrogeological desktop review was undertaken within the study area using information from MECP well records, the MECP Source Protection Information Atlas, the ORM database, and the Ontario Geological Survey database. Available hydrogeological reports for projects within the area were also reviewed.

The three Y1-B construction shafts are within the ORM physiographic region. The linear infrastructure is not located within the source water protection areas of a WHPA.

It is anticipated that shafts will intersect thick sections of saturated ORM deposits, permeable sediments with hydraulic conductivity in the range of approximately 9×10^{-4} to 1×10^{-2} cm/s and will intersect both unconfined and confined aquifer(s) with transmissivity in the range of 7 to 101 m^2/day. This could impact the perched aquifer where the wetland and Bond Lake sit, as there are perched drains through windows and leaks through the Halton Till, according to historical ORM reports. There is a shallow flow to the southeast and south.

According to 1994 borehole logs, the groundwater table is about 6.8 m below grade within the study area.

Numerous private wells are near the alignment and shafts. Depths of the wells range from 26.2 to 173.7 mbgs, most between 36.5 and 48.8 mbgs.

Table 6.22 shows details on anticipated aquifers and aquitards within the study area.

Table 6.22 Aquifers and Aquitards Through the Y1-B Study Area

Aquifers and aquitards	Description	Thickness
Undifferentiated upper sediments (aquifer)	An unconfined aquifer consisting of discontinuous fill and unconsolidated overburden deposits.	The deposits range in thickness and are generally up to: – Shaft 1 – 2.5 m – Shaft 2 – 7.6 m – Shaft 3 – 1.3 m.
Halton Till (aquitard)	A discontinuous aquitard that acts as a low-permeability cap on the underlying Upper and Lower Oak Ridges Aquifer Complex (ORAC).	The deposits range in thickness and are generally up to: – Shaft 1 – 9 m – Shaft 2 – 5.2 m – Shaft 3 – 8.5 m.
Oak Ridges Moraine Complex (aquifer)	These sediments consist mostly of silt and fine sand but also include gravel and minor clay and diamicton. The aquifer is generally unconfined, except for the section covered by Halton Till on the south flank of the ORM complex.	The deposits range in thickness and are generally up to: – Shaft 1 – 52 m – Shaft 2 – 37 m – Shaft 3 – 31.5 m.
Lower Newmarket Till (aquitard)	A continuous layer that acts as an aquitard to the underlying Thorncliffe Formation.	The deposits range in thickness and are generally up to: – Shaft 1 – 39.5 m – Shaft 2 – 42 m – Shaft 3 – 30 m.
Thorncliffe Formation (aquifer)	Regionally recognized as a highly productive confined aquifer; laterally continuous.	The deposits range in thickness and are generally up to: – Shaft 1 – 31 m – Shaft 2 – 24.6 m – Shaft 3 – 21.5 m.

6.6.2.2.3 Surface Water

There are three sub-watersheds within the study area: Rouge River, East Humber River, and Holland River East Branch. Bond Lake is within 250 m of Shaft 1. There are provincially significant wetlands within 500 m of Shafts 1 and 2, including the Philips-Bond-Thompson Wetland Complex.

Other surface-water features include:

- Small unnamed warmwater headwater
- Lake Wilcox Channel – East Humber River
- Tributary of the East Humber River
- Two coldwater streams
- Wilcox-Street George Wetland Complex
- Oak Ridges Bog
- Pineridge Wetland Complex.

Figure 6.20 is a surface-water map of existing conditions within the study area, north section.

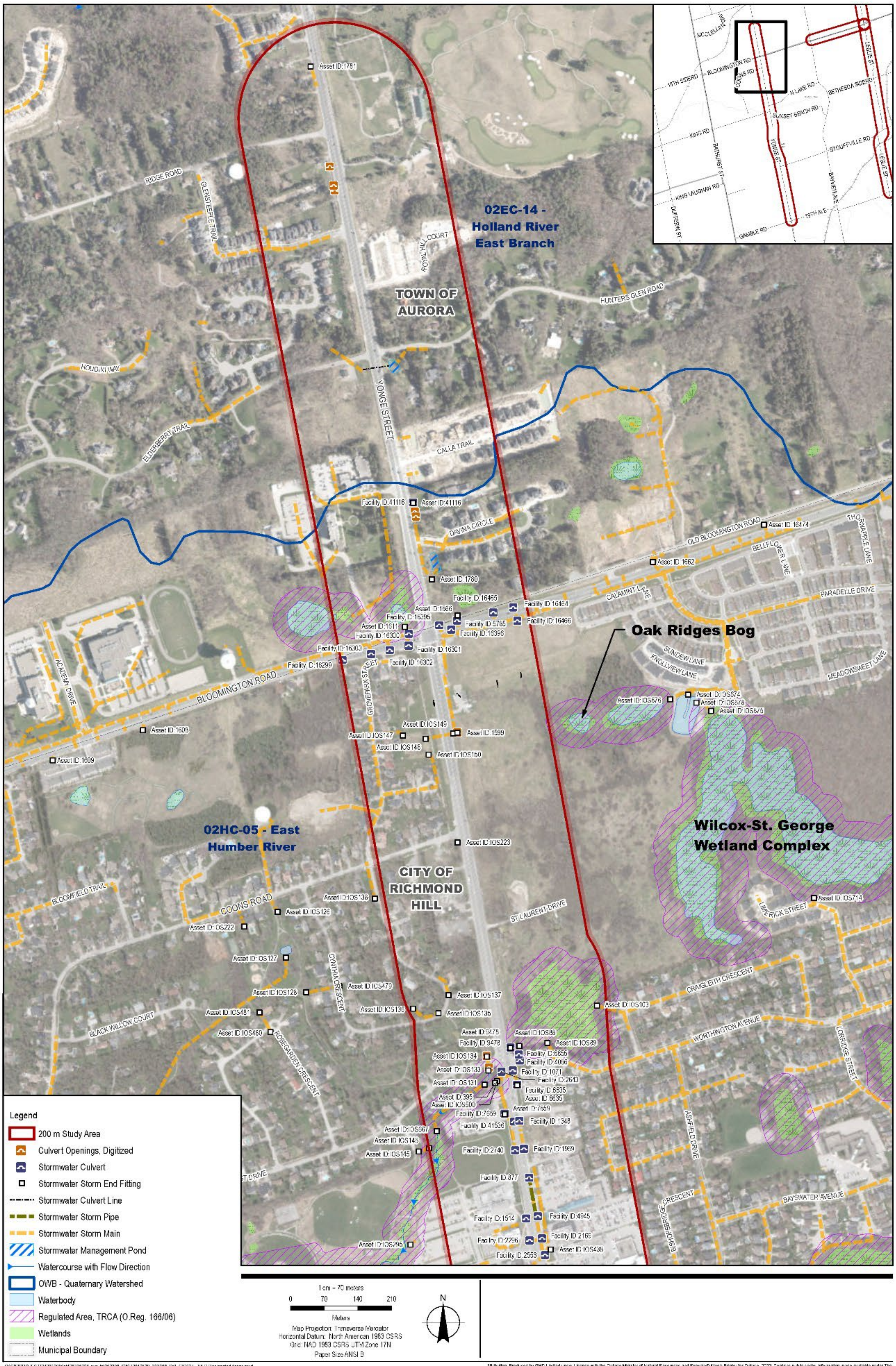


Figure 6.20 Y1-B Study Area Surface Water Map for Existing Conditions, North Section

6.6.2.2.4 Natural Heritage Characterization

The Y1-B study area contains ecologically significant forests, wetlands, areas under the ORMGP and areas associated with the Regional Greenlands System regulated under TRCA.

The Wilcox-St. George Wetland Complex (a PSW) is located along the Wilcox Channel, which outlets westward from Lake Wilcox. Multiple wetlands that are part of the complex occur along the Wilcox Channel, riparian area of the East Humber River and north of Lake Wilcox just south of Bloomington Road. These portions of the wetland complex are also occupied by Oak Ridge's Bog ANSI. Both features are protected under the ORMCP and are within TRCA jurisdiction.

The Philips-Bond Thompson Wetland Complex (a PSW) is between Estate Garden Drive and Jefferson Side Road along Yonge Street within the study area. This wetland complex is also within Bond Lake and Bog ANSI. These significant wetland areas contribute to the Humber River headwaters and provide significant aquatic habitat. Bond Lake and Bog support distinctive species, making up vegetation communities unique to the area but with affinity to more northern populations.

The Pineridge Wetland Complex is an assessed wetland complex within the study area just north of Bloomington Road. It is protected under the ORMCP within TRCA jurisdiction.

The Jefferson Forest ANSI is within the study area near the Bond Lake and Bog ANSI. This significant forest is opposite Jefferson Side Road within the study area and provides significant habitat for interior forest species, including the federally endangered Jefferson salamander and the unisexual *Ambystoma*, a Jefferson-salamander-dependent population.

Aquatic Habitat

Y1-B is a large study area and encompasses many aquatic habitat features, the first of which is a small stream with a warmwater thermal regime found just south of Blackforest Drive. This stream flows southwest and drains into the East Humber River. The area surrounding this stream is full of both commercial and residential areas, where vegetation growth is limited within the riparian area. Sparse coniferous and deciduous trees, along with shrubs, grow along the bankside, while part of the stream channel is confined by a concrete culvert. The ARA dataset indicates this warmwater headwater could possibly support a fish community, primarily bait and forage fish, with both warmwater and coldwater sportfish also present.

The East Humber River is also within the Y1-B study area, flowing east under Yonge Street at the King Road intersection as part of the Lake Wilcox Channel. Upstream, west of Yonge Street, the Lake Wilcox Channel has a wide floodplain that narrows down to a channel width of approximately 2 m. This channel then flows eastward, under Yonge Street and out of the study area. The Lake Wilcox channel has a dense vegetation community consisting of deciduous forest, sparse coniferous trees, and a high density of *Phragmites spp.* The main confined channel passes through an urban area with commercial and residential buildings. The East Humber River and Lake Wilcox Channel have warmwater thermal regimes, with ARA data showing a fish community, likely a diverse community of bait and forage fish, along with both coldwater and warmwater sportfish.

Another tributary of the East Humber River flows parallel with Bostwick Crescent for approximately 300 m. It likely has the same potential fish community as described above.

Another water feature within the Y1-B study area that is regulated under TRCA jurisdiction is Bond Lake. Bond Lake occurs where the Oak Ridges Trail passes Yonge Street and has a surface area of approximately 178,492 m^2. This part of the study area is largely natural, with dense, tall trees surrounding the area. Parts of the surrounding riparian zone consist of the Philips-Bond-Thompson Wetland Complex and the Bond Lake, an ANSI. Bond Lake has a steep bank slope confined in a forest dominated by coniferous trees. Bond Lake has an inlet feature on the northwest side that is part of a wetland. Bond Lake is a coolwater feature and has a distinct fish population, likely bait and forage fish and both coldwater and warmwater sportfish.

Near the southern limit of the study area are two more water features, both coldwater streams. They flow eastward, eventually forming a confluence approximately 2 km outside of the study area and continue flowing eastward. The northernmost passes under Yonge Street at the Jefferson Forest Drive-Tower Hill Road intersection. The surrounding land contains both commercial and residential buildings, with sparse natural areas that the stream passes through. The southernmost of these two watercourses passes under Yonge Street just south of the 19th Avenue intersection. This area is also urbanized, with high-density commercial and residential areas. The stream channel passes through shrublands upstream of Yonge Street, while downstream, coniferous and deciduous trees are denser. ARA data indicates both these streams support the same fish community, likely bait and forage fish and coldwater sportfish.

MECP confirmed the potential presence of redside dace within this study area, and these watercourses were identified as contributing to redside dace habitat.

Terrestrial Habitat

Land use within the study area is mainly urban residential, but several woodland corridors, often associated with watercourses and wetlands, bisect the area. The landscape consists of gently rolling topography typical of the ORM and is punctuated by several kettle wetlands, kettle ponds and kettle lake formations such as Bond Lake and the Lake Wilcox Channel. The existing ROW lands are primarily occupied by maintained lawns that follow vegetation clearing and road maintenance. Riparian woodlands and parks associated with the watercourses and wetlands, as well as the ORM corridor and Natural Core System, were among the natural features and designations identified within the study area.

In addition to the above-listed features, ANSIs are found within the study area. These ANSIs include the Jefferson Forest (Regionally Significant ANSI) and the Bond Lake and Bog (Provincially Significant ANSI). PSWs are also found within the study area, those being the Wilcox-St. George Wetland Complex and the Philips-Bond-Thompson Wetland Complex.

All natural and cultural communities in the study area are common in the province.

Significant Wildlife Habitat

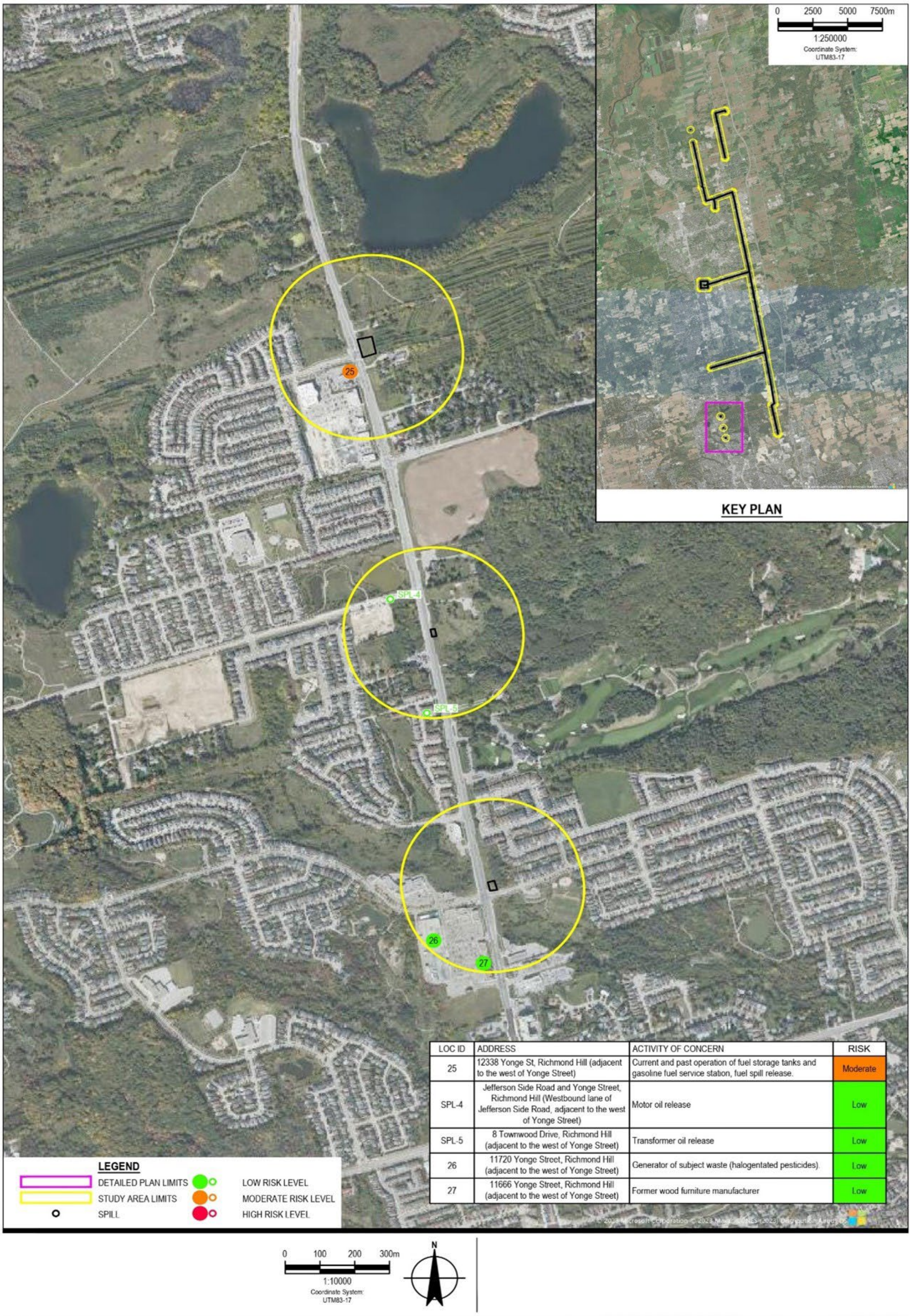
Several natural areas in the study area are potential candidates for SWH for Region 6E designation, as defined by the MNRF. The greatest concentration of these potential SWH areas is likely in wetland and woodland habitats, Bond Lake Natural Area and ORM Corridor Lands, the Lake Wilcox Channel and portions of the Adam Lake Natural Area. All ELC communities in the study area were screened and analyzed for seasonal concentration areas of animals, rare vegetation communities, specialized habitats for wildlife, habitats for species of conservation concern and animal movement corridors.

6.6.2.2.5 Areas of Potential Environmental Concern

A review of information from the Environmental Risk Information Services database was completed for properties located within the study area. A field reconnaissance of the study area was also completed on May 26, 2023, to visually confirm the current land use and associated potential for containing subsurface environmental contamination. This “windshield-level” survey showed that:

- Residential and commercial properties are present along most of the study area.
- Some agricultural and industrial land use is present along the northern and southern portions of the study area.
- Gas stations are present along the entire study area; these stations are potential environmental concerns.

Figure 6.21 shows locations with existing contamination risk that is low (green circle) or moderate (orange circle). The numbers in the circles are identifiers relevant to the entire York Region Sewage Works Project rather than to any particular project component.



LOC ID	ADDRESS	ACTIVITY OF CONCERN	RISK
25	12338 Yonge St, Richmond Hill (adjacent to the west of Yonge Street)	Current and past operation of fuel storage tanks and gasoline fuel service station, fuel spill release.	Moderate
SPL-4	Jefferson Side Road and Yonge Street, Richmond Hill (Westbound lane of Jefferson Side Road, adjacent to the west of Yonge Street)	Motor oil release	Low
SPL-5	8 Townwood Drive, Richmond Hill (adjacent to the west of Yonge Street)	Transformer oil release	Low
26	11720 Yonge Street, Richmond Hill (adjacent to the west of Yonge Street)	Generator of subject waste (halogentated pesticides).	Low
27	11666 Yonge Street, Richmond Hill (adjacent to the west of Yonge Street)	Former wood furniture manufacturer	Low

Figure 6.21 Locations and Level of Risk for Existing Contamination Within the Y1-B Study Area

6.6.3 Concept Design

For the existing gravity sewers within the study area, trenchless rehabilitation of the existing sewers by installing a lining is proposed rather than full replacement. Trenchless rehabilitation would extend the life of the sewer by at least 50 years and avoid open cut or other types of new-sewer installation. The benefits of lining the sewer instead of installing a new sewer include:

- Reduced environmental impacts because of significantly reduced excavation (only required for access shafts, depending on the chosen method).
- Reduced social impacts because of a smaller construction footprint and shorter duration of works.
- Reduced construction schedule.
- Reduced capital costs.

6.6.3.1 Design Basis

If a new liner is installed, the cross-sectional area of the sewer will be reduced. During design, hydraulic modelling will be required to confirm that capacity is still sufficient to accommodate the expected sewage flows.

In addition, to facilitate the temporary bypass works, modelling will be used to confirm the existing flows within the system during various types of weather events. These data will be incorporated into the design basis for the temporary bypass works, which the contractor will design based on their means and methods.

Chapter 3 provides general design basis details. Table 6.23 lists specifics relevant to Y1-B.

Table 6.23 Design Basis for the Development of the Y1-B Yonge Street Sewer Rehabilitation

Design basis	Assumptions
Study area	200 m area along infrastructure alignment
Study area boundaries	Yonge Street, bounded by 19th Avenue to the south and by Bloomington Road to the north
Nominal diameter	1,050 to 1,650 mm
Sewer type	Gravity
Upstream connection point	Leslie Street and Bloomington Road
Downstream connection point	Leslie Street and 19th Avenue
Design criteria	Based on York Region Design Guidelines (2021), including: – Pipe size and material – Hydraulic design – Air management – Method of construction – Major utility crossing – End connection points
Method of construction	Rehabilitation
Land use	Mixture of residential, agricultural, recreational, and commercial
Modelled Peak Flow	N/A
Major infrastructure considerations	– Rapid transit networks (VIVA Blue, including median bus stations) – Transportation routes (Yonge Street) – Hydro corridor
Environmental feature considerations	– Greenbelt – ORM – Public Park – Lakes and ponds – Several wooded areas

6.6.3.2 Description of Design

The condition of the sewer will be assessed based on the findings of the investigations, specifically the CCTV inspections, profiling and non-destructive testing. The condition of the pipe will be scored using NASSCO pipeline assessment standards to provide the basis for confirming the preferred rehabilitation technologies. Appropriate available technologies will be assessed considering the findings of the condition assessment.

6.6.3.3 Construction Methods

6.6.3.3.1 Glass Reinforced Pipe Slip Lining

Slip lining generally involves installing a smaller-diameter liner inside a larger-diameter existing pipe. Common slip-lining materials are glass-fibre reinforced plastic, fibre-reinforced pipe, polyvinyl chloride and polyethylene.

Slip-lining installation will require excavation adjacent to the existing MH and to the existing sewer. Workers will expose the host pipe, remove the top half of the pipe, install jacking equipment and then lower each liner segment into the existing pipe before using the jacking system to drive the liner through the active sewer.

Because excavation will be needed for the insertion pits and at the potential crossing locations, a detailed quality-level subsurface utility engineering (SUE) investigation would be required to confirm existing utility locations and determine their removal and/or relocation requirements ahead of the works.

6.6.3.3.2 Cured-in-Place Pipe Lining

Cured-in-place pipe (CIPP) lining is a well-established method of trenchless sewer rehabilitation. During the CIPP rehabilitation process, a flexible fabric tube coated with a thermosetting resin is inserted into the existing pipeline, in this case through existing MHs, and cured to form a new pipe-within-a-pipe. The fabric tube holds the resin in place for curing, which is completed by either circulating heat (steam or hot water) or passing a UV light train through the tube. The thermosetting resin material creates a tight fit to the host pipe. Commonly manufactured resins include unsaturated polyester, vinyl ester, and epoxy, each having distinct chemical resistance to domestic wastewater.

The CIPP method can be applied to rehabilitate operational and maintenance defects in sewers, such as infiltration, intruding roots, and structurally deficient segments. The final installed product is a continuous structural liner that spans from MH to MH. Any laterals are located before lining and reinstated after lining by remote cutting.

The contractor usually chooses the method of installing the flexible tubing into the pipe, but it can have an effect on the project layout because of site restrictions such as overhead utilities. The two primary methods are winch-in-place and inversion-in-place. In the first, a winch pulls the tube through the pipeline. The tube is then inflated to push the liner against the pipe walls. The second method uses gravity and water or air pressure to force the tube through the pipe and invert it or turn it inside out. Inversion presses the resin-coated tube against the walls of the existing pipe.

CIPP requires all flows to be removed from the sewer section(s) being rehabilitated. This can be done by either diverting flows upstream of the rehabilitation works into a different sewer system or by diverting them through a temporary bypass pumping system through temporary on-grade or shallow-buried piping (depending on the local constraints), then returning them to the same sewer downstream.

For CIPP in pipe diameters greater than the opening of the MH (600 mm), the frame, cover, and adjustment rings of the MH may need to be removed to permit the installation and then reinstalled after construction, with minor surface restoration required. Replacement of the frame, cover, and adjustment rings and surface restoration would be completed according to York Region’s standard restoration specifications and details.

6.6.3.4 Property Requirements

Temporary access to the sewer will be required; no permanent easement requirements are anticipated. Since the sewer is within the ROW, construction will likely also be limited to the existing ROW.

6.6.4 Environmental and Community Impacts and Mitigation

The Y1-B project component will potentially have an impact on the social and built, natural and cultural environments. Desktop studies were done to determine the possible severity of these impacts and to propose mitigation measures that would reduce the likelihood and consequences. Major impacts and associated mitigation approaches are described in this section. The assessment criteria and indicators are provided in Table 6.24 and Table 6.25 for each of the environments, along with potential effects and avoidance, mitigation and compensation measures.

Table 6.24 Y1-B Yonge Street Gravity Sewer Rehabilitation Social and Built Environment – Effects and Mitigation

Item no.	Criteria	Indicators	Potential Effects (Positive and Negative)	Avoidance, Mitigation, and Compensation
Social and built environment				
SB-1	Effect on existing views	– Predicted changes in views from buildings in the surrounding area	– No change in existing views from residences in the surrounding area is anticipated.	– No avoidance, mitigation, or compensation measures required.
SB-2	Effect on existing residences or businesses or on community, institutional or recreational facilities	– Degree of displacement of residences, businesses, or other facilities – Degree of temporary or permanent disruption to residences, businesses, or other facilities near construction compounds and permanent installations	– No displacement of residences or businesses or of community, institutional, or recreational facilities is anticipated. – Disruption to residences or businesses or to community, institutional, or recreational facilities near construction compounds and permanent installations is anticipated.	– No avoidance, mitigation or compensation measures are anticipated, but if displacement is required, York Region would provide market value compensation. – Apply standard construction-related mitigation measures to minimize temporary disruption effects.
Traffic and transportation				
TT-1	Effect on traffic	– Extent of disruption to traffic flows – Proximity to congested traffic zones	– Extensive traffic disruption at access locations during lining of the existing sewer on Yonge Street. – Yonge Street primary north–south corridor for emergency services (police, fire, ambulance) and public transit (Viva bus rapidway). – Traffic movement into and out of construction compound sites will impact pedestrian, cycling, and traffic flow on Yonge Street. – Impacts on public transit involving potential rerouting of buses or relocation of stops. – Coordination of alternate routing for emergency service vehicles, if needed.	– Implement complex traffic management and site security measures at each construction compound to mitigate to the extent possible. – Where possible, maintain one lane in each direction through flagging, temporary signals, or temporary road widening. – Maintain pedestrian movement during construction, with marked pedestrian detours as applicable. – Consider special traffic arrangements for peak hours for primary traffic flow directions in the morning and afternoon. – Pay duty police officers may be required to direct traffic. – Make special provisions for emergency service vehicle access. – Make special provisions for pedestrian traffic and safety, including signals, detours, and winter maintenance. If feasible, move construction traffic to sideroads.
Utilities				
U-1	Conflict with buried utilities	– Sewer or shaft is in direct conflict or falls within clearance limits of nearby utilities	– New construction impacts existing utilities and requires design coordination with utility owners, which increases project cost and schedule.	– Review historical and as-built documents for utility data. – Complete a SUE investigation to identify high-risk utilities, including large or critical service utilities (e.g., large watermains and all gas mains). – If a conflict occurs with a construction shaft or overall work compound location after utility information is received, consider temporary or permanent relocation of utilities safely around or through the work area. It may be possible to support some utilities above an open-cut excavation and rebury them later. Modifications of shaft locations may also be proposed during design development to reduce utility conflicts.
U-2	Conflict with surface or overhead utilities	– Excavation of shaft is proposed at same location as, or near, surface infrastructure. – Shaft working compound equipment, including cranes, will require working directly under overhead utilities or within the hydro wire exclusion zone.	– Overhead infrastructure, such as electrical or communications cabling, is mounted on utility poles between 5 and 12 m above the surface. Depending on the crane size and operating radius required to construct the shaft and lower the TBM, equipment extents may fall within a hydro line exclusion zone or hit overhead wires, harming or killing workers.	– Design working compounds to allow appropriate and safe movement of workers and equipment around the site, away from live overhead wires or surface utility boxes, using known utility information and topographic surveys. – If a conflict occurs with a proposed construction shaft or overall work compound location after utility information is received, modifications of the shaft locations may be proposed during design development; otherwise, the utilities would need to be temporarily relocated safely around or through the work area.
U-3	Damage or deformation to surface infrastructure and buried utilities (including railways, bridges and structural culverts)	– Soil movement under or next to the utility from shaft construction	– Ground heave, settlement, horizontal shift around shafts and open-cut excavations during and after excavation. This information can be obtained from nearby geotechnical instrumentation. – Deformation or damage to nearby surface or buried utilities because of soil movement (e.g., crack formation, angular rotation, strain, or pipe joint rotation or pull out) that may require rehabilitation or repair.	– For utilities near shaft ZOI: Select a shaft construction method and support of excavation (SOE) appropriate for the depth and size of excavation and the geotechnical and hydrogeological conditions at the shaft location. – For each utility, complete analytical assessments at locations that are at risk. – Where applicable, propose mitigation methods such as relocation of utilities or, for deep utilities, relocation of the tunnel horizon based on assessment results. If neither of these options is applicable, investigate ground improvement near utilities to limit ground movement or investigate modification of the tunnel or shaft design or construction method.

Item no.	Criteria	Indicators	Potential Effects (Positive and Negative)	Avoidance, Mitigation, and Compensation
Noise and Vibration				
N-1	Construction noise	– Complaints are received from residents within study area	– Noise disruptions to private residents and commercial areas during construction near construction compounds.	– Propose construction noise monitoring according to MECP NPC-115 Construction Equipment requirements. – Consider monitoring noise throughout construction; notify the contractor of any exceedances so corrective or contingency actions can be implemented. – Use vehicles and equipment (cranes and excavators) with efficient muffling devices or construct enclosures. – Limit truck movements to comply with noise bylaws for 24/7 construction operations.
V-1	Construction vibration	– Complaints are received from residents within study area	– Disruptions to private residents and commercial areas during construction near construction compounds.	– Propose appropriate construction vibration benchmarks within the tender documents. – Consider pre- and post-construction condition photos.
Air management				
O-1	Construction odour	– Complaints are received from residents within the study area	– During live connection of infrastructure, there is the potential for odour release – CIPP, a commonly used rehabilitation method, can result in odour complaints because of the styrene used during curing	– Advance notification to residents, advising them of what work is being completed and the duration of the work.
A-1	Construction dust at sewer construction locations	– Fugitive dust is generated – Air quality is poor	– Fugitive dust generation during construction of gravity sewer and interconnecting shaft/chambers, including the connection points.	– Include requirements for dust management within the tender documents. – Mitigation should be aimed at minimizing emissions of particulate matter and exposure to particulate matter during the construction phase of the project.

Table 6.25 Y1-B Yonge Street Gravity Sewer Rehabilitation Natural Environment – Effects and Mitigation

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
Hydrogeology				
Shaft 1 (9 m deep)				
N-1	Effect on groundwater quantity	– Temporary and/or long-term changes in groundwater quantity	– Low risk of effect on groundwater quantity. Construction is anticipated to be limited to low permeability till aquitard; however, more information is needed to confirm geology. Water taking is anticipated to be limited to negligible. – No long-term change to groundwater quantity is anticipated, as no active or passive long-term groundwater takings will be required. – Potential ground settlement as a result of active dewatering/depressurization. – Change in shallow groundwater flow patterns resulting from operation of sewer pipe resulting from increased infiltration and inflow and/or preferential movement of groundwater within trench sediments.	– Implement construction methods that minimize dewatering requirements. – Establish pre-construction baseline groundwater quality and quantity conditions and develop implementation plans for monitoring during and post-construction (install and monitor wells and surface water).
Shafts 2 and 3 (23 and 34 m deep)				
N-2	Effect on groundwater quantity	– Temporary and/or long-term changes in groundwater quantity	– Potential temporary change to groundwater quantity. Construction is anticipated to extend through low permeable aquitard and into the ORM aquifer. Temporary water takings are likely to be required to facilitate construction (including from the ORM aquifer). – No long-term change to groundwater quantity is anticipated as no active or passive long-term groundwater takings related to the sewer are anticipated. – Potential ground settlement as a result of active dewatering/depressurization. – Change in shallow groundwater flow patterns resulting from operation of sewer pipe resulting from increased infiltration and inflow and/or preferential movement of groundwater within trench sediments.	– Implement construction methods that minimize dewatering requirements. – Establish pre-construction baseline groundwater quality and quantity conditions and develop implementation plans for monitoring during and post-construction (install and monitor wells and surface water).

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
N-3	Effect on groundwater quality	– Temporary and/or long-term changes in groundwater quality	– Potential temporary change in groundwater quality as construction will extend in ORM aquifer. Temporary water takings may be required to facilitate construction. – No long-term change to groundwater quality is anticipated. – Potential effects on groundwater water quality as a result of potential mobilization of contaminated water where active dewatering/depressurization is required. – Reduction in groundwater quality from spills or the mismanagement of fuel/chemicals in work areas.	– During design, complete a contaminant source investigation to mitigate risk of drawing contamination from one source to another location. – Implement construction methods that minimize dewatering requirements. – Develop and implement a Spill Response Plan for construction to mitigate the effect of a spill should one occur. – Establish pre-construction baseline groundwater quality and quantity conditions and develop implementation plans for monitoring during and post-construction (install and monitor wells and surface water).
N-4	Effect on private wells - temporary construction dewatering	– Temporary construction dewatering private well interference (quantity/quality)	– Temporary decrease in private well quantity/quality could occur during construction activities depending on the location, depth and construction, methodology and duration.	– Implement construction methods that minimize dewatering requirements. – Address construction dewatering private well interference complaints through existing York Region private well assessment and mitigation policy. – Proactively identify any high-risk wells during design and prepare site-specific preventative mitigation and corrective action plans as part of design. Corrective actions should align to York Region's private well assessment and mitigation policy.
N-5	Effect on private wells – long-term	– Long-term private well interference (quantity/quality)	– Potential long-term change in groundwater quality during operation of the gravity sewer.	– Use construction methods that minimize dewatering requirements, including sealed shafts and tunnel face stability control (e.g., earth-pressure-balance tunnel boring machine). – Establish pre-construction baseline groundwater quality and quantity conditions and develop implementation plans for monitoring during and post-construction (install and monitor wells and surface water). – Proactively identify any high-risk wells during design and prepare site-specific preventative mitigation and corrective action plans as part of design. Corrective actions should align to York Region's private well assessment and mitigation policy.
Shafts 1, 2 and 3				
SW-1	Effect on surface water quantity/quality	– Temporary changes in surface water quantity (i.e., impacts to baseflow/quality)	– Shaft 1 - Temporary change in surface water quantity/quality is not anticipated as construction dewatering should be negligible. – Shafts 2 and 3 -Temporary changes in surface water quantity (i.e., impacts to baseflow/quality) could occur during construction activities depending on the location, depth, construction, methodology, timing and duration. – A high groundwater table resulting in groundwater/surface water interaction would be expected due to existing soils and anticipated presence of the ORM aquifer. – Bond Lake is a coolwater feature that provides habitat for sensitive species, such as brook trout. – Coldwater streams provide habitat for endangered redside dace within the study area. – Change in groundwater-surface water interaction (reversal of vertical hydraulic gradient) results in impact to terrestrial and aquatic habitat and associated SAR (where applicable) - reduction in baseflow. – Change in surface water temperature from groundwater taking and/or discharge to surface water. – Changes to stream morphology resulting from the release of groundwater dewatering water. – Potential reduction in baseflow due to water taking in a lower confined aquifer, which would increase downward hydraulic gradients across the aquitard separating the stream and the confined aquifer. – Potential reduction in baseflow from a stream reach that intersects an aquifer in which the water taking is occurring.	– Field verification of groundwater-surface water interaction suggested for watercourses and wetlands within the study area. – Complete outlet receiver assessment(s) should temporary groundwater discharge be required to surface water. Establish pre-construction baseline surface water quality and quantity conditions and develop implementation plans for monitoring during and post-construction. – Implement/construct treatment (i.e., settlement tanks, etc.) of construction water prior to discharge to storm sewer/surface water. – Minimize construction area disturbance and duration. Implement erosion and sedimentation control measures (e.g., silt fencing, check dams, etc.). – Adhere to fish timing windows to prevent negative impacts on known sensitive fish species within the study area. – Consider completing a geomorphology study during design. – Refer to Natural Heritage section of table for further mitigation approaches associated with surface water impacts.
G-9	Groundwater impacts from excavation works within ORM	– Construction shaft locations are located within ORM limits	– Design and construction will require minimum impact on groundwater for the sewer and associated construction shafts installed along Yonge Street within the Y1-B study area.	– Follow and apply requirements set out in the ORMCP, as set out in O. Reg. 140/02 under the ORMC Act, particularly Section 42(2), which states that sewer service trenches shall be planned, designed and constructed so as to keep disruption of the natural groundwater flow to a minimum.

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
Areas of potential environmental concern				
C-1	Low risk of contamination	– An area of potential environmental concern is not located directly in or immediately adjacent to the project ROW – Low potential for contaminants to be present and, if present, are likely limited in extent and likely only present in surficial soil – Migration routes, exposure pathways, and receptors are limited – Impacts can be easily managed prior to or during construction	– 11720 Yonge Street, generator of subject wastes (halogenated pesticides). Low potential for mobility of COCs. – 11666 Yonge Street, former wood furniture manufacturer. Low potential for mobility of COCs. – Intersection of Jefferson Sideroad and Yonge Street, motor oil release. Low potential for COCs (PHCs and BTEX). – 8 Townwood Drive, transformer oil release. Low potential for COCs (PCBs, PHCs and BTEX).	– No mitigation required.
C-2	Moderate Risk Contamination	– An area of potential environmental concern is located within or immediately adjacent to the project ROW – Moderate potential for contaminants to be present within the area of potential environmental concern – Moderate potential for contaminants to be present in soil and/or groundwater, or there is evidence that contaminants are present – Migration routes, exposure pathways, or receptors may be present – Impacts would need to be assessed and addressed prior to acquisition, design and/or construction	– 12338 Yonge Street - Mac's Convenience Stores Inc. and Esso: Associated with the operation of a gasoline station and the operation of two gasoline tanks of 65,000-litre capacity. Potential for COCs (PHCs and BTEX).	– Advance boreholes, as part of the detailed design of the proposed improvements, should be placed in the vicinity of the areas of potential environmental concern having moderate risk to assess for potential subsurface impacts that may affect the proposed construction work. – Soil samples should be collected from these boreholes for laboratory analysis of metals and inorganics (including EC and SAR), petroleum hydrocarbons (PHCs), benzene, toluene, ethylbenzene and xylenes (BTEX) and volatile organic compounds (VOCs).
Geotechnical				
G-1	Effect on soil quality	– Contaminant seepage into soil during excavation of shaft	– Chemicals such as drilling fluids, lubricants, ground improvement material, or fuel from construction equipment may contaminate soil.	– Perform regular equipment checks and maintenance. – Prepare an environmental management plan prior to construction in case of contamination.
G-2	Soil movement around shafts	– Vertical or horizontal ground movement around shafts during and post-excavation – Deformation or damage to nearby structures and/or utilities	– Ground heave/settlement/horizontal shift at surface around shafts. – Deformation or damage to nearby structures and utilities (e.g., crack formation, angular rotation, strain, or pipe joint rotation or pull out) that may require rehabilitation or repair.	– Select shaft or open-cut construction method and support of excavation (SOE) appropriate with depth, size, and geotechnical and hydrogeological conditions at shaft or open-cut locations. – Complete soil displacement analytical assessments at all shaft locations
G-4	Encounter boulders during shaft excavation	– Boulders encountered during the excavation of the shaft	– Boulder presence and properties may require change of preferred shaft SOE methodology.	– Complete appropriate geotechnical investigations with strength testing for any encountered boulders. – Prepare a Geological Baseline Report (GBR) during design development with appropriate baseline for boulder strength, size, and anticipated encounter rates and locations. – Recommend a shaft construction SOE capable of maintaining verticality in boulder-prone soils.
G-6	Encounter contaminated soil during shaft excavation	– Soil encountered during excavation is tested to surpass allowable contaminant levels	– Spoil must be dispatched at an approved contaminated soil disposal site.	– Complete appropriate geotechnical investigations and contaminants testing during design development to identify confirmed contaminated soil locations or at-risk areas based on historical land use. – Identify and confirm availability of appropriate soil disposal sites for the materials that will likely be used during construction that might cause contamination.

Item no.	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
Natural heritage				
Y-6	Effect on aquatic habitat or functions	– The study area contains watercourses. The MNRF ARA online data identified these watercourses to support either a cold (four watercourses: Y1-B), cool (five watercourses: Y1-B) or warm (three watercourses: Y1-B) water thermal regime – The study area contains wetlands. Two are assessed wetlands that are considered Provincially Significant	– Temporary or permanent loss of aquatic features or categorical loss of functions by type, including PSWs, Locally Significant Wetlands, watercourses by sensitivity type and others. – During construction, water quality may be impaired due to elevated TSS in surface water runoff from study area locations, which can affect aquatic species/habitats. Some concentrations above background may occur temporarily. – Potential spill hazard when refuelling equipment.	– Need to complete site investigations to evaluate potential effects on aquatic habitat function. – Implement best management practices to control surface water runoff and minimize TSS effects. – Where feasible, discharging of surface water during construction should be directed into the municipal storm sewer system to mitigate thermal impacts to watercourses. Should discharge of surface waters be directed to watercourses, additional mitigation measures would need to be adhered to (e.g., enhanced erosion and control measures). Use of erosion and sediment control measures and timing of construction to avoid spawning and egg incubation periods will reduce the potential for effect on fish and aquatic life. – Conduct equipment maintenance and refuelling at the designated and properly contained maintenance areas or at industrial garages located well away from creek banks, wetlands and outside vegetation areas. – Develop a Spill Prevention Plan.
Y-7	Effect on stream geomorphology	– Change in geomorphic form/function/ stability in affected channels	– No anticipated impacts to stream geomorphology in affected channels.	– Employ erosion and sediment controls to limit deposition of construction-mobilized soils into watercourses. – Consider completing a geomorphology study during design, where applicable.
Y-8	Effect on aquatic species, including SAR, species of local concern, native species and invasive species	– Aquatic species	– Number and type of aquatic species potentially affected temporarily or permanently. – Study area contains a watercourse that supports endangered redside dace. This tributary was designated by the MECP as contributing redside dace habitat. – Potential temporary impact on aquatic species could occur during construction when near watercourses.	– Preventing death of fish or impacts to downstream fish habitat through the use of appropriate timing windows. – Watercourses identified as occupied or contributing to redside dace habitat must include a water quality monitoring program as directed through consultation with MECP and DFO.
Y-9	Effect on terrestrial habitat or functions	– Study area contains three ANSIs (Oak Ridges Bog, Bond Lake and Bog and Jefferson Forest) – Study area contains Ecologically Significant Forest – Wildlife habitat	– Temporary or permanent loss of natural heritage features (e.g., ESAs, ANSIs, wildlife corridors and others). – Terrestrial habitat may be affected (e.g., direct vegetation [and wildlife habitat] loss, alteration, and fragmentation) by the footprint of shafts or compounds. – Project preparation, construction and operation may increase the risk of nest destruction and mortality of migratory birds.	– Site investigations to evaluate potential terrestrial habitat function/significance. – During design, prepare construction constraints considering timing windows so vegetation clearing occurs outside of the migratory bird nesting, bat maternity roosting, turtle overwintering, and amphibian breeding seasons. – Limit the area of project footprint and limit disturbance from employees. – The presence of wildlife will be monitored and communicated to site personnel. – Vehicle use will be restricted to designated areas. – Where practical, rehabilitate habitat for plants and wildlife.
Y-10	Effect on terrestrial species, including SAR, species of local concern, native species, invasive species and area-sensitive species	– SAR has the potential to occur within the study area, including amphibians, insects, birds, reptiles, mammals and tree species	– Number and type of terrestrial species potentially affected temporarily or permanently. – Construction activities have the potential to disturb wildlife within adjacent natural heritage areas. – Project preparation, construction and operation may increase the risk of nest/habitat destruction and mortality of terrestrial SAR. – Project may result in wildlife-vehicle collisions and may cause injury/mortality to individual animals.	– Site investigations to evaluate potential occurrence of terrestrial SAR within the study area. – During design, prepare construction constraints considering timing windows so vegetation clearing occurs outside of the migratory bird nesting, bat maternity roosting, turtle overwintering, and amphibian breeding seasons. – Clearly demarcate work limits at the outset of construction and minimize unnecessary vegetation clearing.

6.7 Capital Cost Estimate

The cost estimate method and basis are from the Association for the Advancement of Cost Estimates (AACE) International recommended practices for a Class 5 cost estimate, which has an accuracy of −50 to +100%. The estimate reflects probable costs in the Greater Toronto Area and helps determine fair market value for the proposed scope of work. Allowances and markups were also included in the estimate for additional items such as design contingency, construction contingency, property acquisition and future investigations.

The cost estimate is in 2023 dollars, meaning that it reflects the monetary value as of the present year and does not incorporate adjustments for future price increases from inflation. It is a snapshot of the projected costs in terms of the currency's current value, providing a clear and unadjusted perspective on the financial aspects at play. It is important to note that the absence of inflation adjustment in the cost estimate could affect its accuracy over time, especially if the project or analysis spans several years.

This cost estimate is to guide project assessment and implementation using information available at the time the estimate was prepared. The final costs of the project will depend on:

- Actual labour and material costs
- Competitive market conditions
- Implementation schedule
- Other variables

As a result, the final project costs will likely vary from this estimate. Therefore, project feasibility and funding needs must be carefully reviewed before making specific financial decisions to help support a proper assessment and adequate funding.

6.7.1 Cost Assumptions

6.7.1.1 Scope of Work

The capital cost estimate was developed based on project-specific assumptions. It is important to emphasize that certain assumptions, including but not limited to the number of shafts, may undergo modifications as the project progresses.

Based on this concept, the scope of work used for the purposes of determining the construction costs includes the following:

- Construction of the 2400 mm diameter Leslie Street Trunk Sewer Phase 1 via a 6360 m tunnel.
- Construction of 8 shafts and associated chambers and maintenance holes for Leslie Street Trunk Sewer Phase 1.
- Construction of the 2400 mm diameter Leslie Street Trunk Sewer Phase 2 via a 6310 m tunnel.
- Construction of 7 shafts and associated chambers and maintenance holes for Leslie Street Trunk Sewer Phase 2.
- Construction of the 1500 mm diameter Bloomington Inceptor Sewer via a 2100 m tunnel.
- Construction of 2 shafts and associated chambers and maintenance holes for Bloomington Inceptor Sewer.
- Rehabilitation of the 1050 mm to 1650 mm diameter sanitary sewer Yonge Street Sewer Rehabilitation for a total length of 7100 m.
- Construction of 3 shafts and associated chambers and maintenance holes for Yonge Street Sewer Rehabilitation.
- Connections between infrastructure components
- Site preparation and restoration.

6.7.1.2 General Assumptions and Allowances

The cost estimate was developed based on general assumptions and allowances, which include but are not limited to:

1. Because information is limited at this conceptual design stage, the prices used are based on similar projects or conceptual drawings.
2. Data from past or recently tendered similar projects was used, with allowances for installation based on ratios of the material cost.
3. No rock excavation will be required.
4. Construction will occur on a reasonable project schedule with no overtime.
5. Each project component will be constructed under a single contract.
6. This estimate used a 15% design contingency allowance to cover design and pricing unknowns. The allowance is not meant to cover additional scope of work or quality modifications but rather to provide some flexibility as the design develops. Design contingency allowance typically decreases as designs progress and is a nominal percentage at the pre-tender stage.
7. A 10% construction contingency allowance was used to cover unexpected increases in costs or unforeseen site conditions resulting in design modifications during the construction phase.
8. A 15% allowance was used to cover the cost of engineering services.
9. A 10% contingency allowance was used to cover any property acquisition.
10. A 4% allowance was used for the cost of future investigations.

6.7.1.3 Linear Infrastructure

The following assumptions were used in preparing cost estimates for linear assets:

1. The tunnelling method of construction is preferred for depths greater than 8 m because of cost considerations and impacts on existing highways, traffic and the natural environment.
2. Tunnel shafts are located at all significant sewer bends and spaced at up to 2,000 m along straight runs, depending on installation method.
3. Access and maintenance chambers are assumed to be situated at shaft locations.
4. Shaft sizing does not need to consider oversizing of the shaft to accommodate an MH that can fit in stairways.
5. For gravity sewer diameters of 1,800 mm or less, tunnelling construction has been assumed to be via microtunnelling and to include a non-structural liner to protect against H2S.
6. For gravity sewer diameters above 1,800 mm, tunnelling construction has been assumed to be via EPBTBM, with a two-pass system, including a non-structural liner, to protect against H2S.
7. A two-pass system has been assumed for trenchless installation of the forcemains; the carrier pipe has been assumed to be a concrete pressure pipe.
8. Tunnel and pipe lengths and invert elevations were noted, and invert depth differential and average depth of segments were calculated from the alignment drawings. The length, average depth, diameter, and location of the pipes were used to calculate the tunnel and pipe installation costs. Installation cost assumptions were informed by previous projects of similar scope and experience, and these were used as a basis for the unit prices applied in the pipe installation estimate.
9. The diameter assumed for each shaft was based on whether it was a launch shaft or a reception shaft, as well as on the size and number of tunnels to be installed. This assumption was informed by previous tunnelling projects, calculation of unit costs, and tunnel equipment supplier minimum requirements. The depth of each shaft was identified from the alignment figures, and over-excavation for a shaft base slab was added. A unit price for installation per metre depth was used in the calculation of the cost of the shaft. Additional costs were added for the shafts within the ORM to deal with the added complexity of deep shaft construction in high-water aquifers. Finally, a price for the installation of MHs was added to this to determine the total cost of installation.

6.7.1.4 Facilities

Air management was included at identified locations with an allowance of $2.85 million (M) per location. This amount is intended to cover the additional cost of a small permanent building at a selected shaft location with air management installed within. The size, type and number of these units will be determined during detailed design.

6.7.2 Excluded Costs

The following costs were not included in the construction cost estimates:

– Market contingency
– Non-construction costs for:
  - Legal
  - Owner administration
  - Any unforeseen increase in material prices
  - Unavailability of materials or skilled labour
  - Accelerated or delayed schedule
  - Overtime premium.

6.7.3 Cost Estimate

Table 6.26 to Table 6.33 presents the estimated construction cost and capital cost for each of the projects in this chapter, excluding rate escalation and HST. Construction cost estimate accuracy ranges from -50% to +100%.

Table 6.26 Estimated Construction Cost Range for Y1-A1 Leslie Street Trunk Sewer Phase 1

Low range (-50%) (CAD 2023, excluding HST)	Estimated costs (CAD 2023, excluding HST)	High range (+100%) (CAD 2023, excluding HST)
221,300,000	442,600,000	885,200,000

Table 6.27 Estimated Cost for Y1-A1 Leslie Street Trunk Sewer Phase 1

Item	Description	Amount (CAD, 2023)
1	General construction	39,000,000
2	Tunnel construction cost	250,000,000
3	Shaft construction cost	61,000,000
4	Facility cost (pumping stations and air)	4,600,000
5	Design contingency (15%)	53,000,000
6	Construction contingency (10%)	35,000,000
	Total construction cost	**442,600,000**
7	Engineering services (15%)	66,000,000
8	Property acquisition (10%)	44,000,000
9	Future investigations (4%)	18,000,000
	Total capital cost (excluding HST)	**570,600,000**

Table 6.28 Estimated Construction Cost Range for Y1-A2 Leslie Street Trunk Sewer Phase 2

Low range (-50%) (CAD 2023, excluding HST)	Estimated costs (CAD 2023, excluding HST)	High range (+100%) (CAD 2023, excluding HST)
201,150,000	402,300,000	804,600,000

Table 6.29 Estimated Cost for Y1-A2 Leslie Street Trunk Sewer Phase 2

Item	Description	Amount (CAD, 2023)
1	General construction	36,000,000
2	Tunnel construction cost	240,000,000
3	Shaft construction cost	44,000,000
4	Facility cost (pumping stations and air)	2,300,000
5	Design contingency (15%)	48,000,000
6	Construction contingency (10%)	32,000,000
	Total construction cost	**402,300,000**
7	Engineering services (15%)	60,000,000
8	Property acquisition (10%)	40,000,000
9	Future investigations (4%)	16,000,000
	Total capital cost (excluding HST)	**518,300,000**

Table 6.30 Estimated Construction Cost Range for Y14 Bloomington Interceptor Sewer

Low range (-50%) (CAD 2023, excluding HST)	Estimated costs (CAD 2023, excluding HST)	High range (+100%) (CAD 2023, excluding HST)
28,200,000	56,400,000	112,800,000

Table 6.31 Estimated Cost for Y14 Bloomington Interceptor Sewer

Item	Description	Amount (CAD, 2023)
1	General construction	5,000,000
2	Tunnel construction cost	37,000,000
3	Shaft construction cost	3,100,000
4	Facility cost (pumping stations and air)	0
5	Design contingency (15%)	6,800,000
6	Construction contingency (10%)	4,500,000
	Total construction cost	**56,400,000**
7	Engineering services (15%)	8,500,000
8	Property acquisition (10%)	5,600,000
9	Future investigations (4%)	2,300,000
	Total capital cost (excluding HST)	**72,800,000**

Table 6.32 Estimated Construction Cost Range for Y1-B Yonge Street Rehabilitation

Low range (-50%) (CAD 2023, excluding HST)	Estimated costs (CAD 2023, excluding HST)	High range (+100%) (CAD 2023, excluding HST)
44,450,000	88,900,000	177,800,000

Table 6.33 Estimated Cost for Y1-B Yonge Street Rehabilitation

Item	Description	Amount (CAD, 2023)
1	General construction	7,800,000
2	Tunnel construction cost	51,000,000
3	Shaft construction cost	12,000,000
4	Facility cost (pumping stations and air)	0
5	Design contingency (15%)	11,000,000
6	Construction contingency (10%)	7,100,000
	Total construction cost	**88,900,000**
7	Engineering services (15%)	13,000,000
8	Property acquisition (10%)	1,800,000
9	Future investigations (4%)	3,600,000
	Total capital cost (excluding HST)	**107,300,000**

6.7.4 Field Investigations

The conceptual designs of Y1-A1, Y1-A2, Y1-B and Y14 are based on a desktop review of available information. Before and during preliminary and detailed design, field investigations will be needed to confirm or correct information from the desktop review and to collect additional data, which could either confirm or modify the concept. Table 6.34 outlines the field investigations that are anticipated for the preliminary and detailed design phase of the projects.

Table 6.34 Future Field Investigations

Field investigation	Comments
Topographic survey	– Topographic survey to collect surface features within the ROW and private properties. – Survey for preparation of r-plans.
Subsurface utility engineering (SUE)	– Quality Level B SUE within the ROW and private properties. – QL-A SUE as required.
Geotechnical investigations	– An initial drilling program is proposed to support setting the vertical alignment for Y1-A1 and Y1-A2. – Boreholes will be spaced at approximately 1 km during the first phase of drilling, with the distance decreased during the second phase, considering final alignment. – Approximately 183 boreholes are expected for the projects described \in this chapter.
Hydrogeological investigations	– Investigation scope may involve the following: Installation of nested monitoring wells, groundwater quality sampling, hydraulic testing (i.e., slug tests) to understand in-situ hydraulic conductivities and the local hydrogeological setting for dewatering estimate purposes, and confirmation of use of private supply wells in within the study area.
Excess soils management	– Desktop and field investigations are required for compliance with O. Reg. 406/19. – Soil sampling will be completed in tandem with the geotechnical investigations.
Archaeological assessment	– Pending results of the Stage 1 Archaeological Assessment and shaft locations, a Stage 2 Archaeological Assessment, which would include field test pitting, may be required.

Field investigation	Comments
Natural environment studies	– An arborist inventory and field natural environment studies would be required based on shaft locations and private property requirements. – Geomorphology investigations will likely be required where there are potential impacts to surface water.
Phase 1 and Phase 2 ESA	– Phase 1 and Phase 2 ESAs may be required, depending on the final shaft locations and property requirements.
Condition assessment	– An updated condition assessment is required to properly assess the existing infrastructure condition for Y1-B. This assessment may include CCTV inspection, laser profiling, lidar profiling, and non-destructive testing to assess the condition of the existing sewer and confirm preparations required in the existing pipe to facilitate trenchless rehabilitation.

6.7.5 Permits and Approval Requirements

Coordination efforts to obtain permits from the following agencies will be required to advance the projects.

6.7.5.1 The Regional Municipality of York

The Leslie Street Trunk Sewer Phase 1 and 2 study area up to St. John's Sideroad intersects with the York Region municipal water supply WHPA-D, which protects the municipal water supply. The potential future extension of the Yonge Street twin trunk north of St. John's Sideroad should avoid the Town of Aurora WHPA-A to achieve the intent of the Clean Water Act of 2006 and protect the quality of the municipal supply. Coordination with York Region will be required if any permits are required for work within these two protected water supply areas.

In addition, a detailed pre-construction baseline of groundwater quality and quantity conditions and monitoring plans during and after construction will be required. To address and monitor the effects of construction on any nearby private wells, York Region will establish a private well assessment and mitigation policy.

6.7.5.2 Toronto Region Conservation Authority

The proposed Y1-A1 alignment will cross under a TRCA flood plain for about 350 m, just north of the second shaft, between 19th Avenue and Stouffville Road. The currently proposed location of the shaft compound is not within the limits of the TRCA floodplain.

6.7.5.3 Canadian National Rail

There is one rail crossing along the Leslie Street sewer at approximately Sta. 1+800 (south of Stouffville Road). Any design crossing this infrastructure will require input from CNR in the design phase to assess and mitigate damage to their infrastructure. Documents such as Settlement Analysis Reports, including geotechnical monitoring and instrumentation plans, will be forwarded as design packages for CNR review and approval. Changes to those plans or the design will be considered and applied as required.

6.7.5.4 Government of Ontario

All projects constructed in Ontario must follow O. Reg. 406/19: On-Site and Excess Soil Management, under the Environmental Protection Act, R.S.O. 1990, c. E.19. Reports and testing will be completed during detailed design.

6.7.5.5 Other Permitting Agencies

Table 6.35 lists the minimum anticipated permits and associated agencies for the projects. Figure 6.22 shows the anticipated timeline for permits and approvals.

Table 6.35 Permits and Timelines

Agency	Anticipated permit	Assumed approval timeline
Environment and Climate Change Canada (ECCC)	Species at Risk Act (SARA) permit	Minimum of 90 days
Department of Fisheries and Ocean (DFO)	Project Authorization	2 to 5 months
Department of Fisheries and Ocean (DFO)	SARA Permit	3 months
Department of Fisheries and Ocean (DFO)	In-Water Construction Authorization	1 to 2 months (if applicable)
Transport Canada	Railway Safety Act (RSA) – Crossing in accordance with TC E-10 Standards Respecting Pipeline Crossings Under Railways pursuant to the RSA to achieve conformance and meet requirements	Minimum 60 days
Ministry of Environment, Conservation, and Parks (MECP)	Environmental Compliance Approvals (Environmental Protection Act) – ECA, Water and Air: – Section 53 of the Ontario Water Resources Act (OWRA) for Sewage Works	Minimum 12 months
MECP	Permit to Take Water (PTTW) – Ontario Water Resources Act	6 to 12 months
MECP	Endangered Species Act (i.e., activity registry, overall benefit permit)	Minimum of 12 months
Ministry of Citizenship and Multiculturalism (MCM)	Clearance letter (Ontario Heritage Act) for archaeological assessments	Minimum of 12 weeks
Ministry of Transportation	Encroachment permit	Minimum of 4 weeks
York Region	Dewatering activity discharge approval (Municipal Sewer Use By-Law Nos. 2011-56 and 2012-70))	To be determined
York Region	Traffic management plan	To be determined
York Region	Tree cutting permit (Forest Conservation By-Law No. TR – 0004-2005-036)	To be determined
York Region	Road occupancy permits	Minimum 1 week
Toronto and Region Conservation Authority (TRCA) and Lake Simcoe Region Conservation Authority (LSRCA)	TRCA and LSRCA permits for development, interference with wetlands, and alterations to shorelines and watercourses (Conservation Authorities Act, O. Regs. 166/06 and 179/06, respectively)	1 month
Toronto and Region Conservation Authority (TRCA)	Acquisition and easement	12 to 18 months
Local area municipalities	Sanitary and storm sewer discharge permit	To be determined
Local area municipalities	Site plan approval and building permit	To be determined (dependent on municipality)
Local area municipalities	Road occupancy permits	Minimum of 2 weeks

Agency	Anticipated permit	Assumed approval timeline
Local area municipalities	Noise bylaws	To be determined (dependent on municipality)
Local area municipalities	Fill bylaws	To be determined (dependent on municipality)
Utilities	Utility relocations	To be determined (dependent on utility)
Metrolinx	Consent from Metrolinx	To be determined
CNR	Consent from CNR	To be determined
Infrastructure Ontario	Approval under the Ministry of Infrastructure Public Work Class EA	To be determined

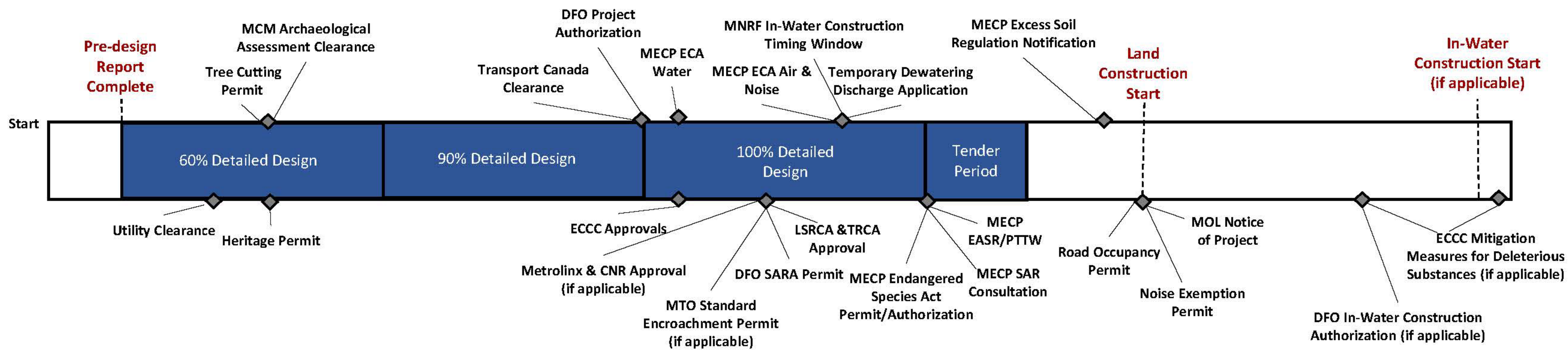


Figure 6.22 Typical Permits and Approvals Timeline

6.7.6 Project Delivery Schedule

It is assumed that the schedule will be based on a design-bid-build contract approach. The planning and design phase consists of field investigations, property acquisition, permits and approvals and preliminary and detailed design.

The schedule shown in Table 6.36 for Y1-A1 and Y14 is an accelerated delivery schedule prepared to meet the Bill 23 obligations. Delivery to meet these obligations will require deviation from York Region's standard delivery practices, as outlined within the York Region's Consultant Requirements Manual. A period of 2 years is shown for the Y1-A1 and Y14 planning and design phase. Historically, projects of comparable size require longer design and construction durations than shown in this schedule. York Region will investigate opportunities to accelerate design and construction to meet the 2028 in-service date. Approaches could include:

- Advanced works construction contracts for utility relocation, site preparation, and shaft construction that would overlap with design-phase works.
- Tendering without all permits and staging contracts, with constraints on where works can commence.
- Design delivery to follow project-specific approach and deviate from the York Region Consultant Requirements Manual, including the potential for accelerated design-review periods, eliminating milestone deliverables and streamlining deliverable requirements.
- Working with York Region to develop interim servicing solutions using the existing infrastructure to meet flow requirements as they are realized.
- Commencing property acquisition and field investigations before the end of 2023.

Actual in-service dates for the infrastructure may vary from the dates in Table 6.36, Table 6.37 and Table 6.38, which show the proposed schedules. The symbol X in Table 6.36, Table 6.37 and Table 6.38 denotes the project stage duration.

Consideration for actual realization of flows, availability of the local construction marketplace, and time needed to obtain agency approvals and property acquisitions are some factors that could significantly affect these dates.

We note that the schedules shown in Table 6.37 for Y1-A2 and Table 6.38 for Y1-B are based on timelines typically observed on similar projects. These projects would be delivered in accordance with York Region's Consultant Requirements Manual.

Table 6.36 Proposed Schedule for Y1-A1 Leslie Street Trunk Sewer Phase 1 and Y14 Bloomington Interceptor Sewer

Description	Duration (years)	1	2	3	4	5	6
Planning and design	2	X	X				
Procurement	1		X				
Construction	4		X	X	X	X	
Commissioning and operations	1						X

Table 6.37 Proposed Schedule for Y1-A2 Leslie Street Trunk Sewer Phase 2

Description	Duration (years)	1	2	3	4	5	6	7	8
Planning and design	2.5								
Procurement	0.5								
Construction	4								
Commissioning and operations	1								

Table 6.38 Proposed Schedule for Y1-B Yonge Street Sewer Rehabilitation

Description	Duration (years)	1	2	3	4	5
Planning and design	1.5					
Procurement	0.5					
Construction	2					
Commissioning and operations	1					

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