Chapter 8

Primary Trunk Twinning

The Regional Municipality of York
The Regional Municipality of Durham

October 31, 2023

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Contents

Table index

Figure index

8. Primary Trunk Twinning

8.1 Overview

The 42-year-old Primary Trunk Sewer is a 5-kilometer (km)-long, single trunk sewer that originates at the end of York Region's Southeast Collector System (SEC) (at the intersection of Valley Farm Road and Finch Avenue) and conveys both the Regional Municipality of York (York Region) and the Regional Municipality of Durham (Durham Region) wastewater flows to the Duffin Creek Water Pollution Control Plant (WPCP).

The twinning of the existing P3 Primary Trunk Sewer, along with the design and construction of the proposed D1 Pickering Parkway Sewage Pumping Station (SPS) and the D2 Squires Beach SPS, will allow for future growth, reduce the risk of major system failure, increase system resilience and provide the system with operational flexibility.

The information presented in this report is conceptual and will be further refined during preliminary design. Figure 8.1 shows the existing Primary Trunk System, as well as the proposed infrastructure components that were identified as part of the York Region Sewage Works Project and discussed in detail throughout this chapter, including the Primary Trunk Twin and the two new Durham Region SPSs. All figures and maps produced used data from York Region, Durham Region, 2021 and 2022 Maxar Aerial Imagery, Land Information Ontario (LIO), Toronto and Region Conservation Authority (TRCA) and Canvec Open-Source Data.

Chapter 8 is broken down into:

- Study area
- Existing environmental conditions for social and built environment, natural environment and cultural environment
- Conceptual design
- Environmental impacts and mitigation
- Capital Cost Estimate and Implementation plan.

8.1.1 Existing Conditions

This component examines the existing environmental conditions of the project area and establishes a baseline against which the potential impacts are assessed. These different aspects are evaluated through various methods, including scientific studies and surveys and consultation with interested persons and Indigenous communities. Factors such as air and water quality, land use patterns, wildlife populations, socio-economic conditions and community resources are evaluated to understand the existing state of the environment as further described in sections 8.1.1.1 to 8.1.1.3.

8.1.1.1 Social and Built Environment

This aspect of the assessment considers the impacts on the social fabric of the community, including human health, quality of life, social well-being and community cohesion, as well as the existing built infrastructure and facilities in the project area. It evaluates factors such as noise, vibration, traffic, public safety, access to services, capacity constraints and changes in land use patterns, recognizing the interplay between social and built elements in the project's environmental impact.

8.1.1.2 Natural Environment

The assessment focuses on the ecological components, such as flora, fauna, ecosystems and natural resources. It evaluates potential impacts on biodiversity, habitats, water quality, air quality, soil quality and the overall functioning of natural systems.

8.1.1.3 Cultural Environment

This aspect examines the cultural heritage resources, which include 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.

8.1.2 Conceptual Design

This discussion will outline the general design standards, requirements and assumptions for the construction and implementation of the new Primary Trunk Sewer Twin, Pickering Parkway SPS and Squires Beach SPS. General design parameters have been identified in Chapter 3; site-specific conditions have been included within this chapter. The conceptual drawings for the new Primary Trunk Sewer Twin are provided in Appendix E.

8.1.3 Environmental and Community Impacts and Mitigation

The desktop's existing environmental conditions were compared against the conceptual designs. The findings identified potential environmental impacts and developed mitigation measures that will inform decision-making processes to promote sustainable development that minimizes negative environmental effects while maximizing positive outcomes.

Figure 8.1 shows the existing Primary Trunk System, as well as the proposed infrastructure components that were identified as part of the York Region Sewage Works Project and discussed in detail throughout this chapter, including the Primary Trunk Twin and the two new Durham Region SPSs.

8.1.4 Capital Cost Estimate and Implementation Plan

This aspect discusses the capital cost estimate, future field investigations and permits and approvals required to design and construct the proposed Primary Trunk Twin and new Durham Region SPSs. These components will be further reviewed and refined during the preliminary design stage.

Figure 8.1 shows the existing Primary Trunk System, as well as the proposed infrastructure components that were identified as part of the York Region Sewage Works Project and discussed in detail throughout this chapter, including the Primary Trunk Twin and the two new Durham Region SPSs.

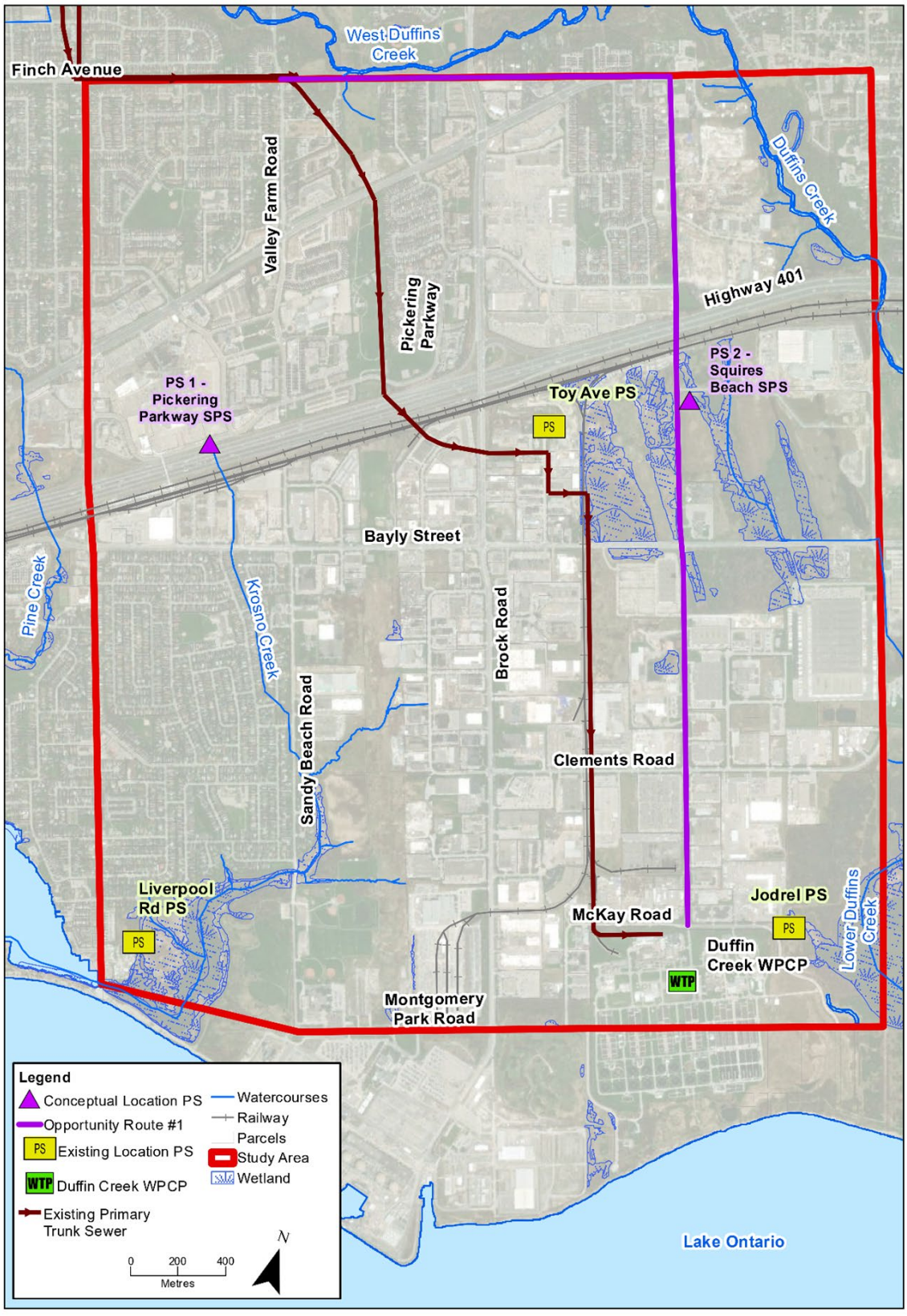

Figure 8.1 **Primary Trunk Twinning Project Overview**

8.2 Linear Gravity Sewer (P3) and Sewage Pumping Stations (D1 and D2)

8.2.1 Study Area

The existing Primary Trunk Sewer (Figure 8.2) is a 5-km-long segment of the York Durham Sewage System (YDSS) that extends from the intersection of Finch Avenue and Valley Farm Road in Pickering, where wastewater flows from York Region are combined with Durham Region flows from the Central Duffin Collector. The existing sewer route continues south from this junction, and a network of gravity sewers and SPSs flows from several Durham Region SPSs are added before ultimately discharging to a chamber at the Duffin Creek WPCP.

The proposed Primary Trunk Twin Sanitary Sewer alignment (shown in Figure 8.1) runs from the connection point with the Southeast Collector at Valley Farm Road/Finch Avenue, east along Finch Avenue and then south along Notion Road in Ajax, where it passes under Highway 401 and the Canadian National Railway (CNR) rail line and continues south along Squires Beach Road to the endpoint at the Duffin Creek WPCP.

The advantages of this route, when compared to other routes considered, include the limited number of existing infrastructure crossings required, such as Highway 401, the CNR corridor and the existing Primary Trunk Sewer, as well as a minimal number of tunnel shafts required for construction due to the long and straight tunnel drives associated with the route. Due to the decreased number of shafts, the route will also result in the lowest capital cost. The route also provides several opportunities to connect to both the new Pickering Parkway SPS and Squires Beach SPS, as well as the existing Durham Region Sewage Pumping Stations.

The conceptual design, including the design basis, description of design and construction methods, can be found in section 8.2.3.

To accommodate the locations of the two new SPSs required by Durham Region, the study area has been extended to cover approximately a 1,300-ha area. The study area is bound by Finch Avenue to the north, Church Street to the east, Montgomery Park Road to the south and Liverpool Road to the west.

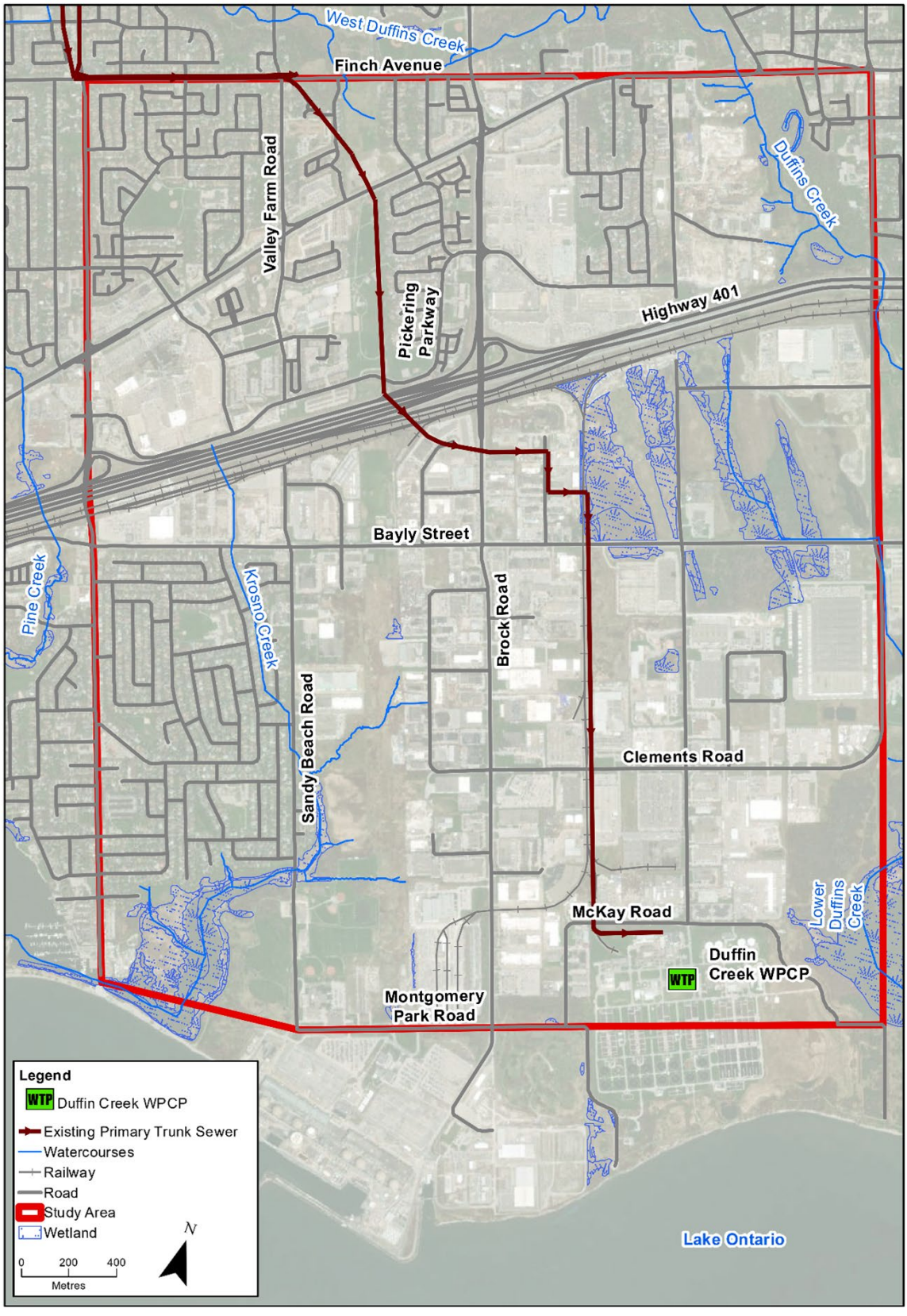

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Figure 8.2 Study Area

8.2.2 Existing Conditions

8.2.2.1 Social and Built Environment

The study area consists of a range of different land uses. The area north of Highway 401 and the CNR corridor is predominantly a mix of residential and commercial (Pickering Town Centre and Brock Road Shopping Centre) and some open space/recreational (Diana Princess of Wales Park and the Pickering Recreational Complex). The northeastern corner (Ajax) is separated by the passage of West Duffins Creek. West of the tributary is predominately industrial land use, while east of the tributary is predominantly residential land use.

Residential land use dominates the area south of Highway 401 and the CNR corridor, west of Sandy Beach Road, along the western study area boundary. East of Sandy Beach Road, the land use is predominantly industrial. A hydro corridor is located between Brock Road and Sandy Beach Road, and the CNR corridor travels south from Highway 401 between Brock Road and Squires Beach Road. Land use designations from the Pickering Official Plan (March 2022, Edition 9) are shown in Figure 8.3.

The preferred twinning route runs from Valley Farm Road and Finch Avenue, east along Finch Avenue and then south along Notion Road, where it passes under Highway 401 and the CNR corridor and continues south along Squires Beach Road to the Duffin Creek WPCP. There are residences along the southern side of Finch Avenue, west of Brock Road and east of Valley Farm Road. Between Brock Road and Notion Road, along the northern side of Finch Avenue and on the northern and southern sides of Kingston Road, there are houses, townhouses and apartment buildings. Along Notion Road between Kingston Road and Highway 401, there is a church (Apostolic Pentecostal Church) on the western side of Notion Road in a zoned “Employment General 1” area, but otherwise, there are commercial buildings immediately adjacent to the route. South of Highway 401, along Squires Beach Road, there is another church (Pickering Pentecostal Church) at the northeast corner of Bayly Street in the zoned “Institutional General 1” area. Otherwise, along Squires Beach Road, there are generally commercial and light industrial buildings on both sides until the Duffin Creek WPCP.

The Squires Beach SPS will be located near the southeast corner of Kellino Street and Squires Beach Road, in the centre of an area zoned for urban reserve land use according to a City of Pickering zoning bylaw. The surrounding areas are mostly commercial uses, employment land use and open space, with the Pickering Pentecostal Church approximately 500 metres (m) south along Squires Beach Road and the Pickering Casino Resort approximately 500 m east at the intersection of Kellino Street and Church Street South.

The Pickering Parkway SPS will be near Pickering Parkway and west of Glenanna Road in Pickering. The land use is predominantly commercial, and the site is bound by Highway 401 to the south, the Pickering Town Centre shopping mall to the northwest and low-rise apartment buildings to the east and northeast. The area is zoned for City Centre Mixed Use 1 according to a City of Pickering zoning bylaw. The nearest residential building is a five-storey apartment building east of Glenanna Road.

Figure 8.4 illustrates the preferred alignment for the new Primary Trunk Sewer Twin and locations of the new Pickering Parkway SPS and Squires Beach SPS and denotes the sensitive receptors in proximity to the proposed infrastructure.

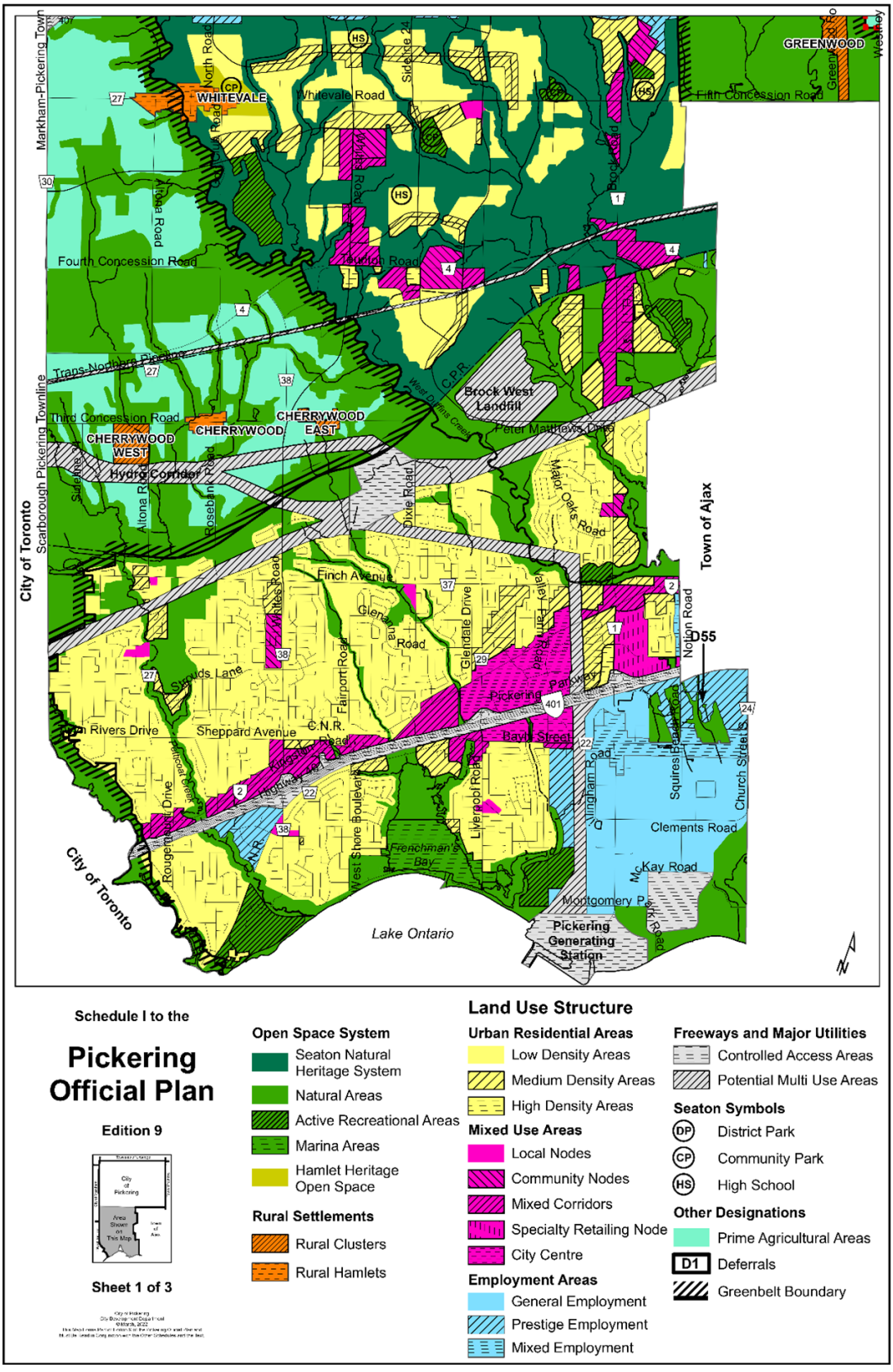

Figure 8.3 City of Pickering Official Plan Zoning Map

Source: Land Use Designations from the Pickering Official Plan (March 2022, Edition 9)

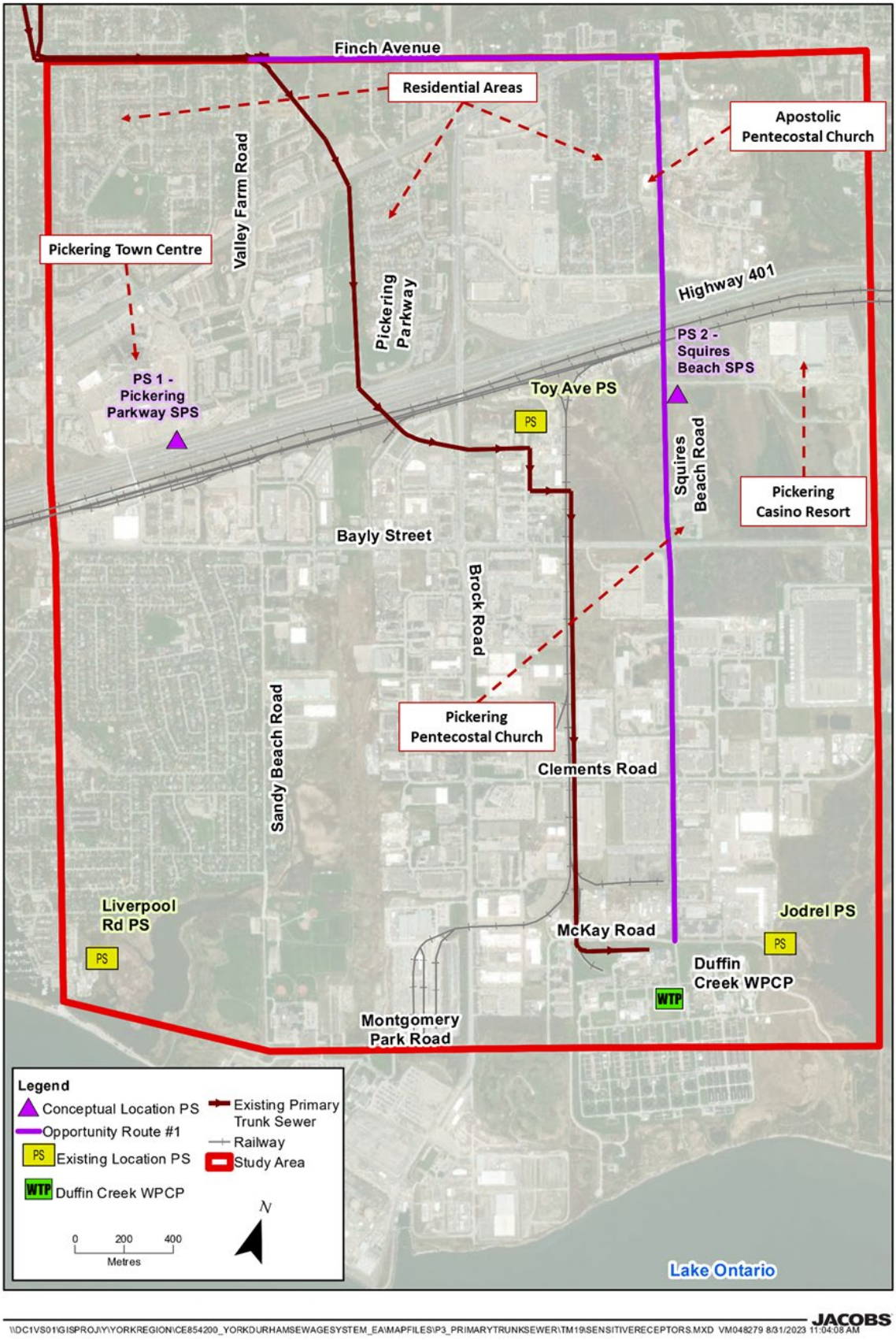

Figure 8.4 **Sensitive Receptors Along the Preferred Alignment**

8.2.2.1.1 Transportation

There are eight main road classes recognized within the study area:

1. Highways, Ministry of Transportation of Ontario (MTO)
2. Type A Regional Arterial Roads, Durham
3. Type B Regional Arterial Roads, Durham
4. Type C Regional Arterial Roads, Durham
5. Type B Municipal Arterial Roads, Pickering and Ajax
6. Type C Municipal Arterial Roads, Pickering and Ajax
7. Municipal Collector Roads, Pickering and Ajax
8. Municipal Local Roads, Pickering and Ajax.

Highways are controlled-access roads with high traffic volumes and higher speeds. The Provincial highways are controlled by the MTO. Highway 401 (MTO major highway) crosses the study area from west to east, dividing the study area into two distinct halves: (1) north and (2) south. Highway interchanges are found at Liverpool Road and Brock Road. Church Street South continues under Highway 401 via an underpass. Highway 401 is a 12-lane highway in the western portion of the study area that merges to 10 lanes just east of Brock Road and continues as a 10-lane highway through the remaining eastern portion of the study area.

Type A, B and C arterial roads are Regional roads (Durham) and are classified as follows:

– Type A arterial roads are designed for larger volumes of traffic at moderate to high speeds. These roads have access restrictions and have a right of way (ROW) width ranging from 36 m to 50 m.
– Type B arterial roads are designed to carry moderate volumes of traffic at moderate speeds and have a ROW width ranging from 30 m to 36 m.
– Type C arterial roads are designed to carry lower volumes of traffic at slower speeds and generally have a ROW width ranging from 26 m to 30 m.

Bayly Street (Regional Road 22) and Brock Road are Type A arterial roads. Liverpool Road, north of Bayly Street, is a Type B arterial road (Regional Road 29); however, south of Bayly Street, Liverpool Road is a collector road, and Brock Road is a Type C arterial road. Kingston Road (Regional Highway 2) is also a Type B arterial road. Clements Road, Squires Beach Road, Notion Road, Valley Farm Road, Glenanna Road and Pickering Parkway are Type C arterial roads.

The remaining roads within the study area are municipal roads and are categorized as either Type B arterial roads, type C arterial roads, collector roads or local roads. Collector roads generally provide access to individual properties, local roads, other collector roads and Type C arterial roads. They generally carry a greater volume of traffic than local roads and have a ROW width ranging from 20 m to 22 m. Local roads provide access to individual properties and to other local roads and collector roads; however, they generally carry only local traffic and have a ROW of up to 20 m. Local roads that provide access to industrial properties may have a ROW width of up to 23 m.

Within the study area, a CNR corridor runs parallel and directly south of Highway 401. The CNR corridor also runs north-south along the hydro corridor south of Highway 401 to the Pickering Generation Nuclear Station. The hydro corridor is recognized as a major utilities multi-use corridor in the City of Pickering Official Plan (City of Pickering, March 2022). Figure 8.5 shows the road network within the study area.

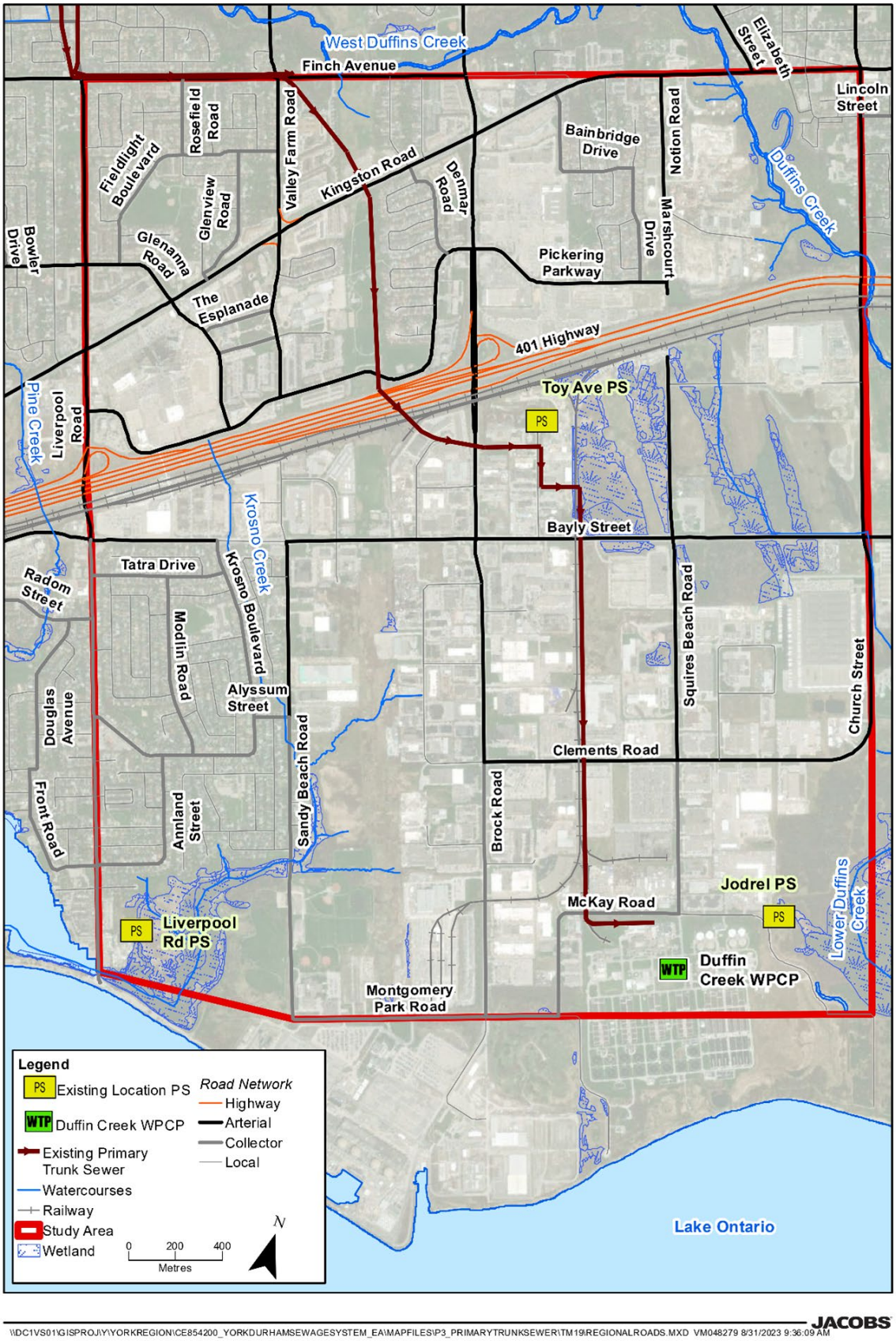

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Figure 8.5 Road Network in the Study Area

8.2.2.1.2 Utilities

A hydro corridor runs north-south through the study area. There are four rows of steel lattice transmission towers within the corridor, and each tower has four cross arms.

The study area is serviced by local utility companies which provide electricity, telecommunications and natural gas. These include:

– Bell Canada and Rogers Communications for telecommunication services.
– Hydro One Networks Inc. and Elexicon Energy for electrical distributions.
– Enbridge for gas distribution.

8.2.2.2 Natural Environment

The preferred alignment for the new Primary Trunk Sewer Twin was assessed to determine the existing conditions and the impact on the natural environment. This assessment included a desktop geotechnical review, a desktop hydrogeological review, natural heritage characterization, a Phase 1 Environmental Site Assessment (ESA) and a review of existing meteorological conditions and climate.

8.2.2.2.1 Geotechnical

A desktop review of existing geological conditions was undertaken using publicly available information obtained from the Ontario Geological Survey, York Region, Peel Region and Durham Region, the City of Toronto, the Conservation Authorities Moraine Coalition (CAMC) Oak Ridges Moraine Groundwater Program (ORMGP) and the TRCA. Additional information was obtained from various Ontario Ministry of the Environment, Conservation and Parks (MECP) databases, including the MECP well records database and Permit to Take Water and Environmental Activity and Sector Registry.

The purposes of the desktop study were to compile existing geological and geotechnical information from the study area, summarize the anticipated geotechnical conditions along the preferred sanitary sewer alignment, evaluate the potential geotechnical risks and provide recommendations for a geotechnical field investigation program.

A discontinuous stratigraphic profile of the soil and bedrock conditions anticipated along the preferred Primary Trunk alignment was developed based on the limited borehole information.

Based on a review of the existing subsurface information available from the study area, the subsurface stratigraphy along the preferred sewer alignment will generally consist of surficial materials (pavement structure, fill, topsoil and/or localized peat deposits) overlying a discontinuous deposit of glaciolacustrine silty clay or clayey silt, underlain by glacial till mantling shale bedrock.

The deposit of glaciolacustrine silty clay was encountered below the surficial layers in nearly all boreholes drilled along Notion Road and Squires Beach Road between Kingston Road and Clements Road. Where encountered, the clay layer varied from 1.3 to 9.6 m in thickness, extending to depths of up to 11.3 m. The consistency of the clay varied from very soft to very stiff, typically very soft to firm. The clay deposit was not encountered along Finch Avenue or south of Clements Road.

The glacial tills encountered directly underlying the surficial materials or below the silty clay layer exhibited variable plastic and non-plastic characteristics. In general, the till was dense to very dense or very stiff to hard. Cobbles and boulders were noted on the borehole logs and should be expected throughout the till deposits.

Sand and silt layers were present at various levels. In general, these layers were observed as relatively thin layers either above or within the till deposits, notably near the bedrock surface where contacted.

In general, the depth of exploration in the boreholes did not extend to the bedrock surface. Bedrock was encountered at depths of approximately 13 to 17 m (Elevation 81 to 84 m) in boreholes at the intersection of Finch Avenue and Valley Farm Road, at 6.3 m depth (Elevation 79.4 m) at Finch Avenue and Brock Road and at depths of 9.6 to 17.1 m (Elevation 70.2 to 78.1 m) at the Highway 401/railway crossing. The bedrock elevations encountered in the boreholes at Valley Farm Road were consistent with the bedrock surface profile identified by the ORMGP mapping; however, they were 5 to 14 m above the anticipated bedrock profile at Brock Road and at Highway 401. The bedrock is expected to consist of grey and black shale of the Blue Mountain Formation.

The proposed tunnel level is expected to encounter mixed face conditions along the alignment, with sections fully or partially in till or in shale bedrock, including numerous transitions into and out of the bedrock. To minimize potential difficulties with mixed face conditions, vertical alignment control and the number of transitions, it may be preferred to raise or lower the tunnel alignment subject to a field investigation that confirms the bedrock surface.

Design and construction should consider the listed potential geotechnical risks, among others:

– Variable bedrock depths, strength and quality
– Mixed face conditions comprising till and bedrock
– Settlement of soft glaciolacustrine clay deposits above the till
– Dewatering and loss of ground in localized sand layers within the till
– Very dense/hard conditions, as well as cobbles and boulders in the till
– Time-dependent deformations (swells) of the shale bedrock
– Naturally occurring petroleum hydrocarbons and gas vapours in the bedrock.

8.2.2.2.2 Hydrogeological

A hydrogeological desktop study was conducted to compile existing hydrogeological information to determine the anticipated hydrogeological conditions along the preferred sanitary sewer alignment and identify potential hydrogeological risks and recommendations for a future hydrogeological field investigation program.

Geological and hydrogeological conditions were based on publicly available information obtained from the Ontario Geological Survey, York Region, Peel Region, Durham Region, the City of Toronto, the CAMC ORMGP and the TRCA.

8.2.2.2.2.1 Hydrostratigraphy

The surficial geology across most of the study area primarily consists of fine-textured glaciolacustrine deposits composed of silt and clay with minor sand and gravel (massive to well laminated) as well as stone-poor, sandy silt to silty sand textured till on Paleozoic terrain. Near Duffin Creek to the north and east of the alignment, surficial deposits feature modern alluvial deposits that are mainly composed of clay, silt, sand and gravel and that often contain organic materials. Organic deposits of peat, muck and marl are also located locally in the central portion of the study area, south of Highway 401.

The bedrock underlying the Site consists of the Blue Mountain Formation, consisting of shale with minor limestone or siltstone. A regional northwest to southeast geological cross-section (interpreted using ORMGP's mapping tool) was developed to identify the hydrostratigraphic units across the site. Table 8.1 describes each hydrostratigraphic unit.

Table 8.1 Aquifers and Aquitards Through the Study Area

Aquifers and aquitards	Description	Thickness
Undifferentiated upper sediments recent deposits (Aquifer)	This unit consists of glaciolacustrine deposits that occur as a thin veneer (less than 5 m thick) over till deposits north of the Lake Iroquois Shoreline. Glacial Lake Iroquois deposits occur in the south overlying till or Thorncliffe Formation deposits. These consist of beach sands and gravels and lacustrine silt and clay (TRCA 2002).	The thickness of recent deposits in the vicinity of the Site is up to approximately 15 m.
Newmarket Till (Aquitard)	The Newmarket Till is regionally extensive and consists of over-consolidated, calcite cemented, sandy silt till deposited during the Late Wisconsinan Nissouri Stadial approximately 18,000 to 23,000 years ago by the southward flowing Laurentide ice sheet. This unit acts as a regional aquitard separating the Oak Ridges Moraine from the underlying Thorncliffe Formation (TRCA, 2002). In the areas around the Site, the Oak Ridge Moraine is expected to be thin or absent.	Based on the regional cross-section, the Newmarket Till is expected to be thin (less than 3 m thick) or absent in the area of the Site.
Thorncliffe Formation (Aquifer)	The Thorncliffe Formation is comprised of deltaic sands and lacustrine silt and clay interbedded with till units recording an oscillating ice front from when the glacial ice sheet was in the Toronto area (TRCA, 2002).	The Thorncliffe Formation is typically considered an aquifer and is expected to have a thickness ranging approximately from 3 m to 15 m near the Site.
Sunnybrook Drift (Aquitard)	The Sunnybrook Drift consists of lacustrine clays and pebbly silty clays (TRCA, 2002). It is regionally extensive and considered as an aquitard.	Locally, the Sunnybrook Drift is absent around the Site and is relatively thin (less than 2 m) to the north of the study area.
Scarborough Formation (Aquifer)	The Scarborough Formation is composed of sand, silt and clay deposited as a large delta in Lake Ontario approximately 70,000 years ago (TRCA, 2002). This unit is mostly found within bedrock valleys and thins laterally away from the valleys.	The Scarborough Formation is expected to have a thickness of 1 m to 6 m near the Site.

The groundwater levels observed during the previous investigations ranged between approximately 0.5 and 13.0 m below the surface. In general, the interpreted long-term stabilized groundwater level is anticipated to be approximately 1 to 5 m below grade. In the long term, seasonal fluctuations in the groundwater level should be expected. In particular, the groundwater levels may be at a higher elevation after periods of significant or prolonged precipitation.

Based on a review of the existing hydrogeological information, the overburdened groundwater levels along the proposed alignment ranged approximately at depths from 1.2 m to 12.9 m below the ground surface, and bedrock groundwater level was found to be at approximately 2.5 m below the ground surface. Hydraulic conductivity in overburden ranged between 7.0 x 10-9 metres per second (m/s) and 1.5 x 10-5 m/s. Hydraulic conductivity in bedrock ranged between 1.0 x 10-6 m/s and 5.5 x 10-5 m/s.

8.2.2.2.3 Natural Heritage Characterization

Natural heritage in the study area was characterized through an initial desktop background review followed by a reconnaissance survey to identify existing natural environment conditions. Available online natural heritage background data were accessed in June 2023, along with available mapping from TRCA, Natural Heritage Information Centre (NHIC) and Fisheries and Oceans Canada (DFO). Appropriate agencies were also consulted to obtain natural heritage information for the study area and within a 120 m buffer area of adjacent lands along the preferred alignment. In accordance with the Provincial Policy Statement (2020) and the Natural Heritage Reference Manual (2010), 120 m is a standard distance from the feature(s) for evaluation of potential negative impacts on natural heritage features.

Natural environment features were investigated online, with available mapping from TRCA, NHIC and DFO. Using the results of the background review, coupled with air photographic interpretation and available agency data, a site reconnaissance survey was also completed to obtain additional information about terrestrial resources and natural features. The field investigation included conducting bird surveys, ecological land classification of the woodlands, wetlands and cultural areas and species at risk assessments. Field investigations were conducted across three consecutive days in July of 2023: July 17, July 18 and July 19.

Table 8.2 details the list of natural environmental features identified within or adjacent to the study area, and Figure 8.6 shows the environmental features present within the project study area.

Table 8.2 Natural Heritage Characterization Within or Adjacent to the Study Area

Feature	Description
Area of Natural and Scientific Interest (ANSI)	Candidate ANSI Duffins Creek Coastal Marsh (Life Sciences) was identified approximately 200 m southeast of the study area.
Wetlands	Lower Duffins Creek Wetland Complex is an evaluated wetland identified within the study area just south of Highway 401 as well as 200 m southeast of the study area. No Provincially Significant Wetlands were identified within the study area.
Woodlands	Woodlands occur in patches primarily along the northern and eastern boundaries of the study area.
Toronto and Region Conservation Authority Regulated Areas	The study area overlaps with TRCA-regulated areas across its northern half. As such, the areas of overlap are governed in accordance with *Ontario Regulation (O. Reg.)166/06, Toronto and Region Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses.*

Feature	Description
Vegetation and Vegetative Communities	Nine ecological communities were identified within the study area, including the following: 1. FOD7-4: Fresh-Moist Black Walnut Lowland Deciduous Forest Type 2. CUM1: Mineral Cultural Meadow Ecosite 3. CUT1-1: Sumac Cultural Thicket Type 4. FOD7-3: Fresh-Moist Willow Lowland Deciduous Forest Type 5. FOM7: Fresh-Moist White Cedar-Hardwood Mixed Forest Ecosite 6. Industrial 7. FOD7: Fresh-Moist Lowland Deciduous Forest Ecosite 8. MAS2-1: Cattail Mineral Shallow Marsh Type 9. SWM1-1: White Cedar-Hardwood Mineral Mixed Swamp Type.
Wildlife	Two wildlife species were identified by direct observations (sight and sound), tracks, scat, or droppings (or a combination thereof) including: 1. Eastern Cottontail 2. Monarch.
Avifauna (bird)	Twenty-seven bird species were observed by sight, song, or a combination thereof. 1. American Crow (Corvus brachyrhynchos) 2. American Goldfinch (Spinus tristis) 3. American Robin (Turdus migratorius) 4. Black-capped Chickadee (Poecile atricapillus) 5. Blue Jay (Cyanocitta cristata) 6. Brown-headed Cowbird (Molothrus ater) 7. Cedar Waxwing (Bombycilla cedrorum) 8. Chipping Sparrow (Spizella passerine) 9. Common Grackle (Quiscalus quiscula) 10. Eastern Kingbird (Tyrannus tyrannus) 11. European Starling (Sturnus vulgaris) 12. Gray Catbird (Dumetella carolinensis) 13. House Sparrow (Passer domesticus) 14. House Wren (Troglodytes aedon) 15. Indigo Bunting (Passerina cyanea) 16. Mourning Dove (Zenaida macroura) 17. Northern Cardinal (Cardinalis cardinalis) 18. Northern Rough-winged Swallow (Stelgidopteryx serripennis) 19. Red-eyed Vireo (Vireo olivaceus) 20. Red-winged Blackbird (Agelaius phoeniceus) 21. Ring-billed Gull (Larus delawarensis) 22. Rose-breasted Grosbeak (Pheucticus ludovicianus) 23. Song Sparrow (Melospiza melodia) 24. Swamp Sparrow (Melospiza georgiana) 25. Warbling Vireo (Vireo gilvus) 26. White-breasted (Nuthatch Sitta carolinensis) 27. Yellow Warbler (Setophaga petechia).
Bat Habitat	No bat habitat was identified within the study area. This will be reviewed during the preliminary design stage when additional field surveys can be conducted if required.

Feature	Description
Significant Wildlife Habitat and Seasonal Concentration Areas	The study area includes many anthropogenically disturbed areas with high foot traffic and poor-quality forested areas with many dead white ash trees. The field survey identified no Species at Risk (SAR); however, some areas may support wildlife, including: 1. Migratory Butterfly Stopover Areas 2. Amphibian Breeding Habitat 3. Colonial waterbird nesting area. This will be reviewed during the preliminary design stage when additional field surveys can be conducted if required.
Rare Vegetation Communities or Specialized Habitat for Wildlife	No rare vegetation was found to occur within the study area based on the Ecological Land Classification (ELC) inventory.
Animal Movement Corridors	Naturalized animal movement corridors occur within areas of FOD4. Although these ecotones occur within the study area, significant breeding habitats or species occurrences were not identified for species listed within the Significant Wildlife Habitat Criteria Schedules for Ecoregion 7E (Ministry of Natural Resources and Forestry [MNRF] 2015).
Aquatic Habitat	Duffins Creek flows east through the northern portion of the study area and exits the study area at Kingston Road. Krosno Creek originates from within the western isolated portion of the study area, flows under Highway 401 through a culvert, approximately 570 m east of the Liverpool Road Underpass (MNRF 2023a) and ends at Lake Ontario through Frenchman's Bay.
Aquatic Species	Twelve fish species were identified that could occur within Duffins Creek proximal to the study area as identified according to two Land Infrastructure Ontario Aquatic Resource Area Survey Points: Duffins Creek AU-0012-DUF, AU-9999-DUF, including: 1. Blacknose Dace (Rhinichthys atratulus) 2. Bluntnose Minnow (Pimephales notatus) 3. Brook Stickleback (Culaea inconstans) 4. Common Shiner (Luxilus cornutus) 5. Creek Chub (Semotilus atromaculatus) 6. Fathead Minnow (Pimephales promelas) 7. Johnny Darter (Etheostoma nigrum) 8. Longnose Dace (Rhinichthys cataractae) 9. Rainbow Darter (Etheostoma caeruleum) 10. Rainbow Trout (Oncorhynchus mykiss) 11. Stonecat (Noturus flavus) 12. White Sucker (Catostomus commersonii)

Feature	Description
Species at Risk	Twenty-eight potential SARs were identified within the study area, including the following: 1. Least Bittern (Botaurus lentiginosus) 2. Peregrine Falcon (Falco peregrinus) 3. Black Tern (Chlidonias niger) 4. Common Nighthawk (Chordeiles minor) 5. Eastern Whip-poor-will (Antrostomus vociferus) 6. Chimney Swift (Chaetura pelagica) 7. Red-headed Woodpecker (Melanerpes erythrocephalus) 8. Eastern Wood-Pewee (Contopus virens) 9. Acadian Flycatcher (Empidonax virescens) 10. Bank Swallow (Riparia riparia) 11. Barn Swallow (Hirundo rustica) 12. Wood Thrush (Hylocichla mustelina) 13. Golden-winged Warbler (Vermivora chrysoptera) 14. Canada Warbler (Cardellina canadensis) 15. Yellow-breasted Chat (Icteria virens) 16. Henslow's Sparrow (Centronyx henslowii) 17. Grasshopper Sparrow (Ammodramus savannarum) 18. Bobolink (Dolichonyx oryzivorus) 19. Eastern Meadowlark (Sturnella magna) 20. Horned Grebe (Podiceps auratus) 21. Monarch (Danaus plexippus) 22. Midland Painted Turtle (Chrysemys picta marginata) 23. Snapping Turtle (Chelydra serpentina) 24. Blanding's Turtle (Emydoidea blandingii) 25. Redside Dace (Clinostomus elongatus) 26. American Eel (Anguilla rostrata) 27. Butternut (Juglans cinerea) 28. Black Ash (Fraxinus nigra). No SAR or special concern species other than Monarch were identified during the field visits within the study area.

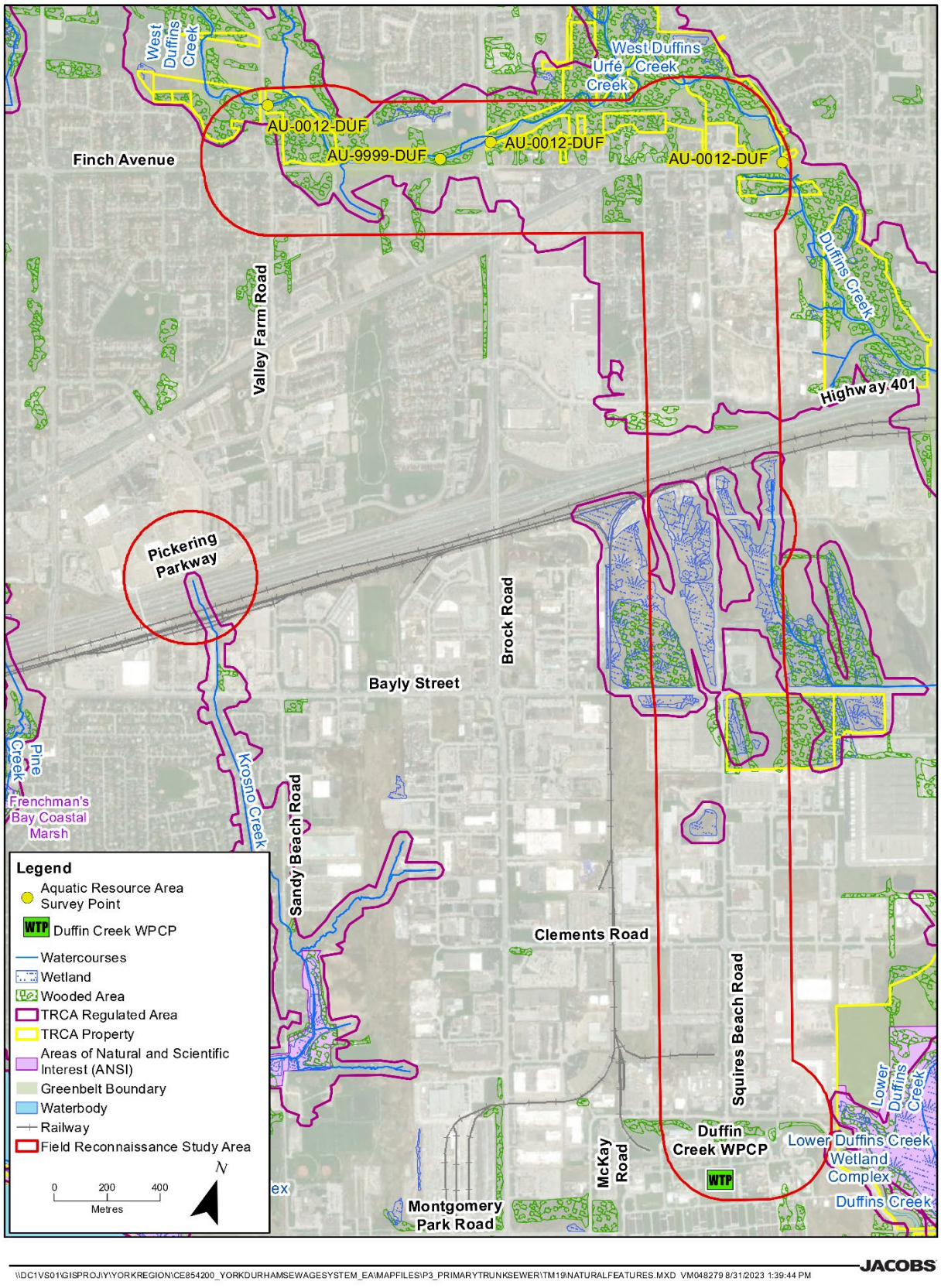

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Figure 8.6 **Environmental Features within the Study Area**

8.2.2.2.4 Areas of Potential Environmental Concern

A Phase 1 ESA was conducted within 250 m of the preferred alignment for the Primary Trunk Twinning Project portion of the York Region Sewage Works Project, known as the Phase One Property, highlighted in red in Figure 8.7. The Property includes community land use for all roadways, vacant lands and residential, agricultural and industrial land uses.

A historical title search was not completed for any portion of the Phase One Property. It is the MECP-Qualified Person for ESA's (QPESA's) opinion that a title search is not expected to affect the conclusions of this report.

Based on a review of environmental records (previous environmental reports, aerial photographs, an Environmental Risk Information System database search), interviews and a Site reconnaissance, the Phase 1 ESA identified potentially contaminating activities (PCAs) or historical land uses of potential environmental interest within the Site boundaries.

Twelve areas of potential environmental concern (APECs) were identified within the Phase One Property: four were attributable to onsite PCAs, and eight were attributable to offsite PCAs within the Phase One Property.

Figure 8.7 shows the locations of the APECs and Table 8.3 summarizes the contaminants of potential concern identified for each APEC based on the historical operations and type of PCA associated with the APEC.

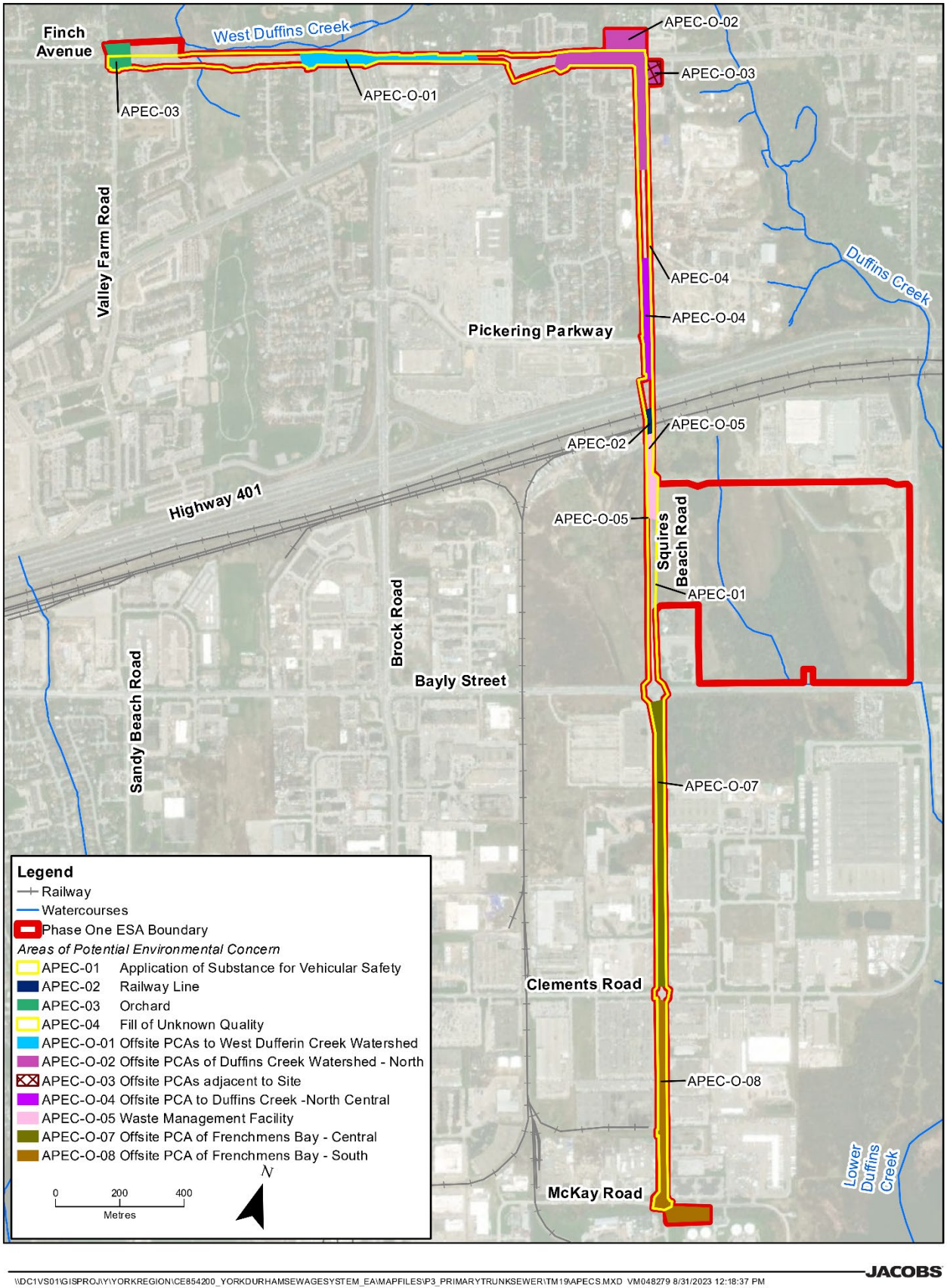

Figure 8.7 **Areas of Potential Environmental Concerns**

Table 8.3 Areas of Potential Environmental Concern

APEC ID[1]	APEC Description	Location of area of potential environmental concern on Phase One Property	Potentially contaminating activity[2]	Location of PCA (Onsite or Offsite)	Contaminants of potential concern[3]	Media potentially impacted (Groundwater, soil and/or sediment)
APEC-01	Application of substance for vehicular safety: Most of the Site has been identified as a roadway since 1939. There has likely been an application of some substance for winter vehicular and pedestrian safety applied to the roadways.	Majority of Site (all roadways)	Other – Activity not defined in O. Reg. 153/04 Table 2 of Schedule D	Onsite	EC, Sodium Adsorption Ratio, sodium, chloride	Soil and groundwater
APEC-02	Railway line: A railway line is visible running through the Site just north of Bayly Street beginning in the 1939 aerial photograph until the present day.	Portion just south of Highway 407	46 – Railyards, tracks and spurs	Onsite	PAH, PHC, BTEX	Soil and groundwater
APEC-03	Orchard: Based on the 1939 aerial photograph, a small orchard was located on the 1510 Finch Avenue portion of the Site.	Portion of 1510 Finch Avenue	40 – Pesticides (including herbicides, fungicides and anti-fouling agents) manufacturing, processing, bulk storage and large-scale applications	Onsite	OCP, CP	Soil and groundwater
APEC-04	Fill of unknown quality: Based on aerial photography, most roads within the Phase One Property were constructed between 1972 and 1981, and there is potential for fill of unknown quality to have been used in construction.	All roadways	30 – Importation of fill material of unknown quality	Onsite	PAH, PHC, BTEX, metals, ORP	Soil and groundwater
APEC-O-01	Offsite PCAs to West Duffins Creek Watershed: **Shell Gas Station** – Five active single wall fuel underground storage tanks listed at the property 1670 Kingston Road, all installed in 1987 and of a 22,700-L capacity. Five previously delisted fuel tanks were also listed for the property.	Upper northwestern portion of the Site	28 – Gasoline and associated products storage in fixed tanks	Offsite	PHC, BTEX, VOC, OCP, CP, metals, PAH, ABN	Soil and groundwater
	Fuel Storage and Use – One active single-walled underground storage tank with a capacity of 13,638 L, installed in 1991, was listed at 1710 Kingston Road (130 m south of Site). The TSSA listed one expired fuel storage facility and one active fuel storage facility. Durham Regional Police Services was listed as a waste generator of waste oils/sludges (petroleum-based) and light fuels from 2022 to 2020.		28 – Gasoline and associated products storage in fixed tanks			
	Chemical Storage – Durham Regional Police Services, located at 1710 Kingston Road (130 m south of Site), reported a 4-L spill of Varasol to the property on September 1, 2017. The spill indicates there is potential for chemical storage related to vehicle servicing on the property.		8 – Chemical manufacturing, processing and bulk storage			
	Drycleaners – Dandy Cleaners, located at 1725 Kingston Road (200 m south of Site), was listed as a dry cleaner facility and reported the use of perchloroethylene from 2004 to 2010. Dandy Cleaners was also listed as a waste generator of halogenated solvents from 1988 to 2014.		37 – Operation of dry-cleaning equipment (where chemicals are used)			
	Pesticide Sale – NoFrills is listed as a limited vendor of pesticides at 1725 Kingston Road (200 m south of Site).		40 – Pesticides (including herbicides, fungicides and anti-fouling agents)			
	Junk Yard – Finch and Kingston Junkyard was located at 1800 Kingston Road (45 m south of the Site) from 1965 to 1975, with an area of 2.2 hectares. No other information		49 – Salvage yard, including automobile wrecking			
	Orchard – A small orchard is visible in the 1936 aerial photograph, just south of Finch Avenue along Brock Road.		40 – Pesticides (including herbicides, fungicides and anti-fouling agents) manufacturing, processing, bulk storage and large-scale applications			

[1] APEC means the area on, in, or under a Phase One Property where one or more contaminants are potentially present, as determined through the Phase 1 EA, including through (a) identification of past or present uses on, in, or under the Phase One Property; and (b) identification of PCAs.
[2] PCA means a use or activity as set out in Column A of Table 2 of Schedule D of O. Reg. 153/04 that is occurring or has occurred in a Phase One Study Area.
[3] Contaminants of potential concern were identified using the Method Groups as identified in the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act, March 9, 2004, amended as of July 1, 2011. Include the AP Method Groups namely: Metals, hexavalent chromium, mercury, PAHs, PCBs, PHCs and VOCs.

APEC ID[1]	APEC Description	Location of area of potential environmental concern on Phase One Property	Potentially contaminating activity[2]	Location of PCA (Onsite or Offsite)	Contaminants of potential concern[3]	Media potentially impacted (Groundwater, soil and/or sediment)
APEC-O-02	Offsite PCAs of Duffins Creek Watershed – North: **Fuel Storage and Use** – Core Rentals Ltd, located at 1887 Kingston Road W (25 m south and east of Site), was listed as a private retail fuel outlet with a tank of 2,000 L in 1994. The TSSA only reported expired records for propane, which is not considered a PCA as propane is a gas. Core Rentals Ltd was also listed as a waste generator of petroleum distillates and waste oils and lubricants from 1988 to 2001. Stephansons Rental Services Inc. was also listed as a waste generator at the same address of light fuels, petroleum distillates, oil skimmings and sludges and emulsified oils from 2005 to 2010.	Upper northeastern portion of Site	28 – Gasoline and associated products storage in fixed tanks	Offsite	THM, VOC, PAH, PHC, BTEX, metals, ABN	Soil and groundwater
	Spill – 338 L of hypochlorite/bleach was spilled from a tanker truck to ground on June 19, 2002.		Other – Activity not defined in O. Reg. 153/04 Table 2 of Schedule D			
	Autobody Shop – Pickering Auto Body Ltd is listed at 1968 Notion Road (25 m west of Site) with an Environmental Compliance Approval.		10 – Commercial autobody shops			
	Retail Fuel Storage Tanks – All-Mac Fuels was listed at 1963 Southview Drive (195 m west of Site) as a retail fuel facility. No other information is available.		28 – Gasoline and associated products storage in fixed tanks			
	Automobile Recking – A&A Towing and Recovery was listed at 1624 Marshcourt Drive (130 m to the west of Site) as an automobile wreaking and recycling facility.		49 – Salvage yard, including automobile wrecking			
	Autobody Shop – During the Site reconnaissance, Ontario Collision auto repair shop was observed to be located west of the Site at 1954 Notion Road.		10 – Commercial Autobody Shops			
APEC-O-03	Offsite PCA located adjacent to site: Autostore – Waste generator reported for home and auto store at 787 Kingston Road West (directly adjacent to site on the west.)		Other – Activity not defined in O. Reg. 153/04 Table 2 of Schedule D	Offsite	PHC, PAH, VOC	Soil and groundwater
	Dry Cleaners – During the Site reconnaissance, Cameron Dry Cleaners was observed to be located east of the Site at 777 Kingston Road West. Use of chemicals could not be confirmed.		37 – Operation of dry-cleaning equipment (where chemicals are used)			
APEC-O-04	Offsite PCA to Duffins Creek Watershed – North Central: **Former AST and fuel outlet** – Strada Aggregates Inc. was listed at 87 Notion Road and 109 Orchard Road (32 m east of Site) with two delisted fuel tanks: A 36,368-L fibreglass liquid fuel tank, installed in 1990 and one underground tank. The property was also listed with the TSSA as an expired private and retail fuel storage facility. Primeau-Argo and Dufferin Concrete Products were also listed at the same address with delisted fuel underground storage tanks.	Portion of Site north of Highway 407	28 – Gasoline and associated products storage in fixed tanks	Offsite	metals, PHC, PAH, VOC, ABN, BTEX	Soil and groundwater
	Automobile Recking – Mopart Junkie was listed at 1950 Notion Road (25 m west of Site) as an automobile wreaking and recycling facility.		49 – Salvage yard, including automobile wrecking			
	Notion Road Junkyard – A 3.5-hectare junkyard was located 65 m west of Notion Road (formerly Station Road) from 1965 to 1980.		49 – Salvage yard, including automobile wrecking			
APEC-O-05	Waste management facility: Monster Bins Inc. is registered as a waste management system at 1700 Squires Beach Road (210 m west of Site).		58 – Waste disposal and waste management, including thermal treatment, landfilling and transfer of waste, other than use of biosoils as soil conditioners	Offsite	metals, PHC, PAH, VOC, ABN, BTEX	Soil and groundwater
APEC-O-06	Offsite PCA to Frenchmens Bay Watershed – North: **Electric Generation**- Pickering Hydro-Electric Commission is located at 1920 Bayley Street (25 m east of Site) and was a waste generator of waste oils and lubricants from 1986 to 2001.	Portion of Site north of Bayly Street	18 – Electricity generation, transformation and power stations	Offsite	PAH, PHC, PCB	Soil and groundwater
	PCB Storage – Pickering Hydro is listed at 1920 Bayley Street (25 m east of Site) as a PCB storage facility of high-level PCBs in capacitors, as low-level PCBs in liquid transformers and drums of soil with low-level PCBs.		55 – Transformer manufacturing, processing and use			
	Electrical Energy – Elexicon Energy In was listed at 1501 Squires Beach Road was listed as a waste generator of oil skimmings and sludges in 2022.		18 – Electricity generation, transformation and power stations			

APEC ID[1]	APEC Description	Location of area of potential environmental concern on Phase One Property	Potentially contaminating activity[2]	Location of PCA (Onsite or Offsite)	Contaminants of potential concern[3]	Media potentially impacted (Groundwater, soil and/or sediment)
APEC-O-07	Offsite PCA to Frenchmens Bay Watershed – Central: **Ontario Power Generation** – Located at 1910 Clements Road (10 m to the east of Site), was listed as a waste generator from 2009 to 2022 of alkaline wastes – other metals, inorganic laboratory chemicals, detergents and soaps, acid waste – heavy metals, aliphatic solvents, polymetric resins, waste oils and lubricants and paint/pigments/coatings residues.	Portion of Site between Bayly Street and Clements Street	18 – Electricity generation, transformation and power stations	Offsite	metals, PHC, PAH, VOC, ABN, BTEX	Soil and groundwater
	Fuel Storage – Purolator Courier Ltd was listed at 1075 Squires Beach Road (55 m east of Site) as a private retail storage facility with two gasoline single-walled tanks with a capacity of 22,730 L. The site was also listed with two expired underground storage tanks. A spill of 50 L of diesel fuel to groundwater also reported on January 10, 1995. TSSA also reported that the address was listed as an expired liquid fuel tank related to a liquid fuel facility.		28 – Gasoline and associated products storage in fixed tanks			
	Commercial Trucking – Purolator Courier Ltd was listed at 1075 Squires Beach Road (55 m east of Site) as a waste generator from 1998 to 2022 if oil skimmings and sludges, waste oils and lubricants, organic laboratory chemicals, aliphatic solvents and petroleum distillates.		11 – Commercial trucking and container terminals			
	Plastics Manufacturing – CDA Industries was listed in Scotts Manufacturing Directory at 1055 Squires Beach Road as a plastic or sign manufacturer.		43 – Plastics (including fibreglass) manufacturing and processing			
	Waste Disposal Site – Draglam Waste and Recycling was listed at 1325 Squires Beach Road (55 m east of Site) as a waste disposal site.		58 – Waste disposal and waste management, including thermal treatment, landfilling and transfer of waste, other than use of biosoils as soil conditioners			
APEC-O-08	Offsite PCA of Frenchmens Bay – South: **Industrial Mould Manufacturing** – MSB Industries was listed as an industrial mould manufacturer at 902 McKay Road (50 m west of Site). The company was also listed as a waste generator of oil skimmings and sludges, petroleum distillates, light fuels and waste oils and lubricants. EJ Industries was also listed at 902 McKay Road as a metal fabricator established in 1980.	Portion of Site south of Clements Street	34 – Metal fabrication	Offsite	metals, PHC, PAH, VOC ABN, BTEX, OCP, CP	Soil and groundwater
	Machine Shop – Metro Pattern & Model Ltd. Was listed as a machine shop at 900 McKay Road (50 m west of Site). The company was listed as a waste generator of emulsified oils.		34 – Metal fabrication			
	Electronic Manufacturing – Electro_Meters Co Ltd, George M Fraser Ltd and Power Measurement Tech Inc. listed at 900 McKay Road (50 m east and north of Site) as an electronic manufacturer.		19 – Electronic and computer equipment manufacturing			
	Carpet Manufacturing – Antrum was listed at 1125 Squires Beach Road (60 m west of Site) as a carpet and rug manufacturer and waste generator of aliphatic solvents, waste oils and lubricants from 2000 to 2001.		54 – Textile manufacturing and processing			
	Motor Manufacturing – David Brown Gear/Radiocon Inc. was located at 112 Squires Beach Road (60 m west of Site) as a machinery manufacturer and waste generator of petroleum distillates and waste oils and lubricants from 1988 to 1999.		57 – Vehicles and associated parts manufacturing			
	Electronic Manufacturing – JPM Antrium was listed at 112 Squires Beach Road (60 m west of Site) in Scotts Manufacturing Directory as a semiconductor and other electronic component manufacturer, established in 1979.		19 – Electronic and computer equipment manufacturing			
	Pesticide Vendor – Weall & Cullen Nurseries Ltd was listed at 112 Squires Beach Road (60 m west of Site) as a pesticide vendor.		40 – Pesticides (including herbicides, fungicides and anti-fouling agents) manufacturing, processing, bulk storage and large-scale applications			
	Chemical Manufacturing – Donalco Inc. was listed as a chemical manufacturer located at 1135 Squires Beach Road (45 m east of the Site) and a waste generator of polymeric resins, paint/pigment/coating residues. Organic laboratory chemicals and waste oils and lubricants in 2010.		8 – Chemical manufacturing, processing and bulk storage			

APEC ID[1]	APEC Description	Location of area of potential environmental concern on Phase One Property	Potentially contaminating activity[2]	Location of PCA (Onsite or Offsite)	Contaminants of potential concern[3]	Media potentially impacted (Groundwater, soil and/or sediment)
APEC-O-08	**Machinery Manufacturing** – Eco-Tecc Inc was listed at 1145 Squires Beach Road (50 m east of Site) as a machinery manufacturer and waste generator from 1995 to 2020 of aromatic solvents, inorganic laboratory chemicals, alkaline wastes – other metals, waste oils and lubricants, emulsified oils, detergents and soaps, aliphatic solvents, paint/pigments/coatings residues, acid waste – heavy metals and amines.		Other – Activity not defined in O. Reg. 153/04 Table 2 of Schedule D			
	Metal Fabrication – Nelson Industrial Inc. was listed at 1155 Squired Beach Road (25 m east of Site) as a metal product manufacturer. Nelson Industrial was listed as a polluter of nickel methyl ethyl ketone, aluminum, manganese and xylenes to all media. Nelson was also listed as a waste generator from 1988 to 2021 of waste oils and sludges (petroleum-based) aliphatic solvents and waste crankcase oils and lubricants.		34 – Metal fabrication			
	Motor Manufacturing – Lawrcon Electric and Machining was listed in Scotts Manufactory at 1165 Squires Beach Road (25 m east of the Site). Lawrcon was also listed as a waste generator of petroleum distillates and waste oils and lubricants from 1998 to 2022.		57 – Vehicles and associated parts manufacturing			
	Decal Manufacturer – Decal Industries Inc. was listed at 1175 Squires Beach Road (105 m east of Site) as a waste generator of waste from the use of pigments, coatings and paints from 2018 to 2022.		17 – Dye Manufacturing, Processing and Bulk Storage			
	Spill – 800 L of oil was spilled to the ground on August 9, 2016, at 1915 Clements Road.		Other – Activity not defined in O. Reg. 153/04 Table 2 of Schedule D			
	Petroleum Product Wholesaler – Big Red Oil Products Inc. was listed at 1915 Clements Road (65 m east of Site) as a waste generator from 2016 to 2021 for waste oils and lubricants.		41 – Petroleum-derived gas refining, manufacturing, processing and bulk storage			
	Metals Fabrication – First Recognition was listed at 1915 Clements Road (65 m east of Site) as a metal manufacturer.		34 – Metal fabrication			
	Manufacturing – City Core Mechanical was listed at 1915 Clements Road (65 m east of Site) as a waste generator from 1988 to 2018 of alkaline solutions, wastes containing other reactive anions, waste from the use of pigments, coatings and paints, wastes from inorganic chemicals, aliphatic solvents and residues, petroleum distillates, light fuels, waste crankcase oils and lubricants and organic acids.		57 – Vehicles and associated parts manufacturing			

AST = Above-ground storage tank
Cl = Chloride
EC = Electrical conductivity
ID = Identification
L = Litre(s)
Metals = O. Reg. 153/04 complete metals scan
Na = Sodium
O. Reg. = Ontario Regulation
OCP = Organochlorine pesticides
Offsite = Within the Phase One Study Area
Onsite = Phase One Property
PAH = Polycyclic aromatic hydrocarbon
PCB = Polychlorinated biphenyl
PCB = Polychlorinated biphenyl
Phase One Property = Primary Truck portion of the York Region Sewage Works Project
Phase One Study Area = properties within 250 m of the Phase One Property
PHC = Petroleum hydrocarbon
TSSA = Technical Standards and Safety Authority
VOC = Volatile organic compound

8.2.2.3 Cultural Environment

The preferred alignment for the new Primary Trunk Sewer Twin was assessed to determine the existing conditions and the impact on the archaeological resources, the cultural landscapes and the built heritage.

8.2.2.3.1 Archaeological Resources

A Stage 1 Archaeological Assessment (Background Research and Property Inspection) was conducted to determine the archaeological potential of the project study area, including the preferred alternative alignment, proposed alignments and SPS sites. A brief overview of the developmental, historical and archaeological context revealed:

– The study area is within the Johnson-Butler Purchases and in the traditional territory of the Michi Saagiig and Chippewa Nations, collectively known as the Williams Treaties First Nations, including the Mississaugas of Alderville First Nation, Curve Lake First Nation, Hiawatha First Nation, Scugog Island First Nation and the Chippewas of Beausoleil First Nation, Georgina Island First Nation and the Rama First Nation (Williams Treaties First Nations, 2017).
– Several historical maps were examined to determine the presence of historic features within the study area during the nineteenth and twentieth centuries:
    - The 1860 map shows that Finch Avenue, Notion Road/Squires Beach Road, Kingston Road and Bayly Street were historically surveyed roads. A church is shown south of the village along the eastern side of Notion Road. The west branch of the Duffins Creek watercourse winds along the northern side of Finch Avenue.
    - The 1914 map shows two cemeteries east of Notion Road between Kingston Road and the Grand Trunk Railway, approximately in the locations of present-day Saint Wilfred's Cemetery and St. Francis de Sales Cemetery.
    - The 1994 map shows dense residential development near Finch Avenue/Kingston Road. A hydro corridor intersects the Proposed Primary Trunk Sewer Twin at Finch Avenue. The Macdonald Cartier Highway (Highway 401) has been constructed. The railway is now named the Canadian National Railway, and it has a second parallel line, both south of the highway. Marsh areas are shown along Squires Beach Road between the railway lines and Bayly Street.
– The study area is within the sand plains, clay plains and drumlins of the Iroquois Plain physiographic region of southern Ontario (Chapman & Putnam, 1984).

Based on the results of the Stage 1 Archaeological Assessment, 31 previously registered archaeological sites were located within 1 km of the study area, none of which are located within 50 m, and two cemeteries are adjacent to the preferred alignment for the new Primary Trunk Twin.

8.2.2.3.2 Cultural Heritage Landscapes and Built Heritage Resources

A cultural heritage study was conducted within a 50-m radius around the preferred alignment for the new Primary Trunk Sewer Twin to describe the existing cultural conditions and present an inventory of known and potential Built Heritage Resources (BHRs) and Cultural Heritage Landscapes (CHLs) that may be subject to direct or indirect impacts as a result of the Primary Trunk Sewer Twin Project.

Based on the results of the background historical research, as well as a review of secondary source material, the study area had rural land use history dating back to the early nineteenth century. There are five potential BHRs and three potential CHLs within the study area. Of the eight identified BHRs and CHLs, five properties are identified by the City of Pickering as potential heritage properties and three properties are identified by the Town of Ajax on their Inventory of Non-Designated Heritage Properties.

8.2.3 Conceptual Design

8.2.3.1 Design Basis

The design basis for the selection of the preferred alignment can be summarized in Table 8.4:

Table 8.4 Design Basis for the development of the preferred alignment

Design basis	Assumptions
Study area	1,300 ha
Study area boundaries	Bounded by Finch Avenue to the north, Church Street to the east, Montgomery Park Road to the south and Liverpool Road to the west.
Nominal diameter	4 m
Upstream connection point	Southeast Collector connection chamber (T0961-CC) located at the intersection of Valley Farm Road and Finch Avenue to the drop maintenance hole (MH-1).
Downstream connection point	Duffin Creek WPCP influent pumping stations (IPS).
Design criteria	Based on York Region Design Guidelines (2021), including: – Pipe size and material – Hydraulic design – Air Management – Method of construction – Major utility crossings – End connection points
Method of construction	Tunnelling within the right-of-way (ROW).
2051 Modelled Peak Flow Rate	24,409 L/s
Duffin Creek WPCP Peak Hydraulic Capacity	3290 ML/d (38,080 L/s) Primary Trunk twin will be sized to meet peak hydraulic capacity of the Duffin Creek WPCP
Major infrastructure considerations	– Rapid Transit Networks (CNR corridor) – Transportation routes (Highway 401) – Hydro corridor – Existing primary trunk sewer
Environmental feature considerations	– TRCA regulated areas – Wetlands – Several wooded areas

The development of a preferred alignment for the new Primary Trunk Sewer Twin, at this conceptual level, considered four shortlisted alternative routes between the upstream connection point at the intersection of Valley Farm Road and Finch Avenue to the downstream connection point at the Duffin Creek WPCP. This process considered the hydraulic performance, construction risk, constructability and costs. The alternatives were screened, and the shortlisted alternatives were evaluated using equally weighted criteria, including: technical considerations, natural environmental impacts, social impacts, cultural impacts and economic considerations.

The alignment, shaft location and associated construction staging areas will be reviewed and refined in the next design stages as more information becomes available.

8.2.3.1.1 Pickering Parkway SPS and Squires Beach SPS

A hydraulic analysis was completed for the proposed Pickering Parkway SPS and Squires Beach SPS for the 2031, 2041 and 2051 design horizons. Population and employment forecasts were recently updated by Durham Region and used to update the hydraulic model. It was assumed that the new SPSs would be constructed and in service by 2031 based on Durham Region's recommendation.

With the updated hydraulic model, simulations were completed for each of the design years, and the peak wet weather flows were identified to assess the hydraulic performance and confirm the proposed SPS capacity.

A summary of the hydraulic analysis results for the proposed Pickering Parkway SPS and Squires Beach SPS are provided in Table 8.5 and Table 8.6, respectively. The tables include the results for the three design scenarios (2031, 2041 and 2051):

– Peak wet-weather flow: Maximum peak wet-weather inflow to the SPS wet well from the hydraulic model simulation.
– Firm capacity: The capacity of the SPS with the largest single pump out of service.
– Percent firm capacity utilization: The maximum inflow divided by the firm capacity, represented as a percentage. Values less than 100% acceptable.
– Total capacity: The capacity of the SPS with all pumps in service.
– Number of pumps: The total number of pumps assumed at the facility, which would equal the total capacity.
– Individual pump capacity: The capacity of the individual pumps calculated as the total capacity divided by the number of pumps.

The 2031, 2041 and 2051 simulation results indicate that the proposed sewage pumping stations have sufficient capacity for all of the anticipated future flows. The scenarios show maximum firm capacity utilizations in the range of 69 percent (%) to 84% and 19% to 42% for the Pickering Parkway SPS and Squires Beach SPS, respectively.

Table 8.5 Summary of Pickering Parkway SPS Hydraulic Analysis Results for 2031, 2041 and 2051

Sewer segment item description	2031 Design scenario	2041 Design scenario	2051 Design scenario
Maximum peak wet-weather inflow (L/s)	1,289	1,543	1,552
Firm capacity (L/s)	1,860	1,860	1,860
Percent firm capacity utilization	69%	83%	84%
Total capacity (L/s)	2,480	2,480	2,480
Number of pumps	4	4	4
Individual pump capacity (L/s)	620	620	620

Table 8.6 Summary of Squires Beach SPS Hydraulic Analysis Results for 2031, 2041 and 2051

Sewer segment item description	2031 Design scenario	2041 Design scenario	2051 Design scenario
Maximum peak wet-weather inflow (L/s)	126	251	255
Firm capacity (L/s)	675	675	675
Percent firm capacity utilization	19%	37%	38%
Total capacity (L/s)	900	900	900
Number of pumps	4	4	4
Individual pump capacity (L/s)	225	225	225

8.2.3.2 Description of Design

The project components of the Primary Trunk Twinning Project are described in sections 8.2.3.2.1 to 8.2.3.2.3.

8.2.3.2.1 New Primary Trunk Sewer Twin

As part of the York Region Sewage Works Project, a detailed review of the Primary Trunk Needs Assessment was completed to support the conceptual level development of feasible alternative alignments for twinning the Primary Trunk Sewer, as well as the locations and connections to two new Durham Region SPSs.

The evaluation of alternative alignments resulted in the selection of a potential route for a 4,000-millimetre (mm)-diameter, 5.25-km-long sanitary sewer that runs from the connection point at the Southeast Collector Chamber located at Valley Farm Road/Finch Avenue, east along Finch Avenue and then south along Notion Road, where it passes under Highway 401 and the CNR corridor and continues south along Squires Beach Road to the Duffin Creek WPCP.

The existing Southeast Collector Sanitary Sewer discharges flow into the Southeast Collector Sanitary Sewer Connection Chamber (T0961-CC) at the intersection of Finch Avenue and Valley Farm Road, where the existing Primary Trunk Sewer begins, and the future Primary Trunk Sewer Twin will start. This chamber was previously constructed with a 3,000-mm stub (tunnel segment) to accommodate the proposed twinning of the existing Primary Trunk. A sluice gate will be provided at the new Primary Trunk Sewer Twin within the existing Southeast Collector Chamber to allow for future maintenance or rehabilitation of the existing Primary Trunk.

A drop structure will be required at the upstream end of the new tunnel, just east of the Southeast Collector Connection Chamber, to maintain the elevation required to tunnel the new Primary Trunk Twin route under existing infrastructure (such as the CNR corridor and Highway 401). The proposed drop structure will also be designed as a shaft for the 4,000-mm-diameter Primary Trunk Sewer Twin and placed at least 20 m downstream of the existing chamber to accommodate a tail tunnel to tunnel the new trunk sewer from the shaft. Various air management strategies and odour control methods will be further reviewed during preliminary design, including potential opportunities to construct several chambers instead of a single deep drop structure chamber to confirm if negative impacts, such as odour release and noise, could be more easily mitigated.

The drop structure will receive flow from the upstream Southeast Collector Connection Chamber, which will be directed to a vertical shaft, which allows flow to fall by gravity up to 10 m to the deeper 4,000-mm-diameter tunnel. The drop structure design must consider a number of hydraulic and structural design constraints and will be further identified and developed during preliminary design. Figure 8.8 provides the conceptual layout.

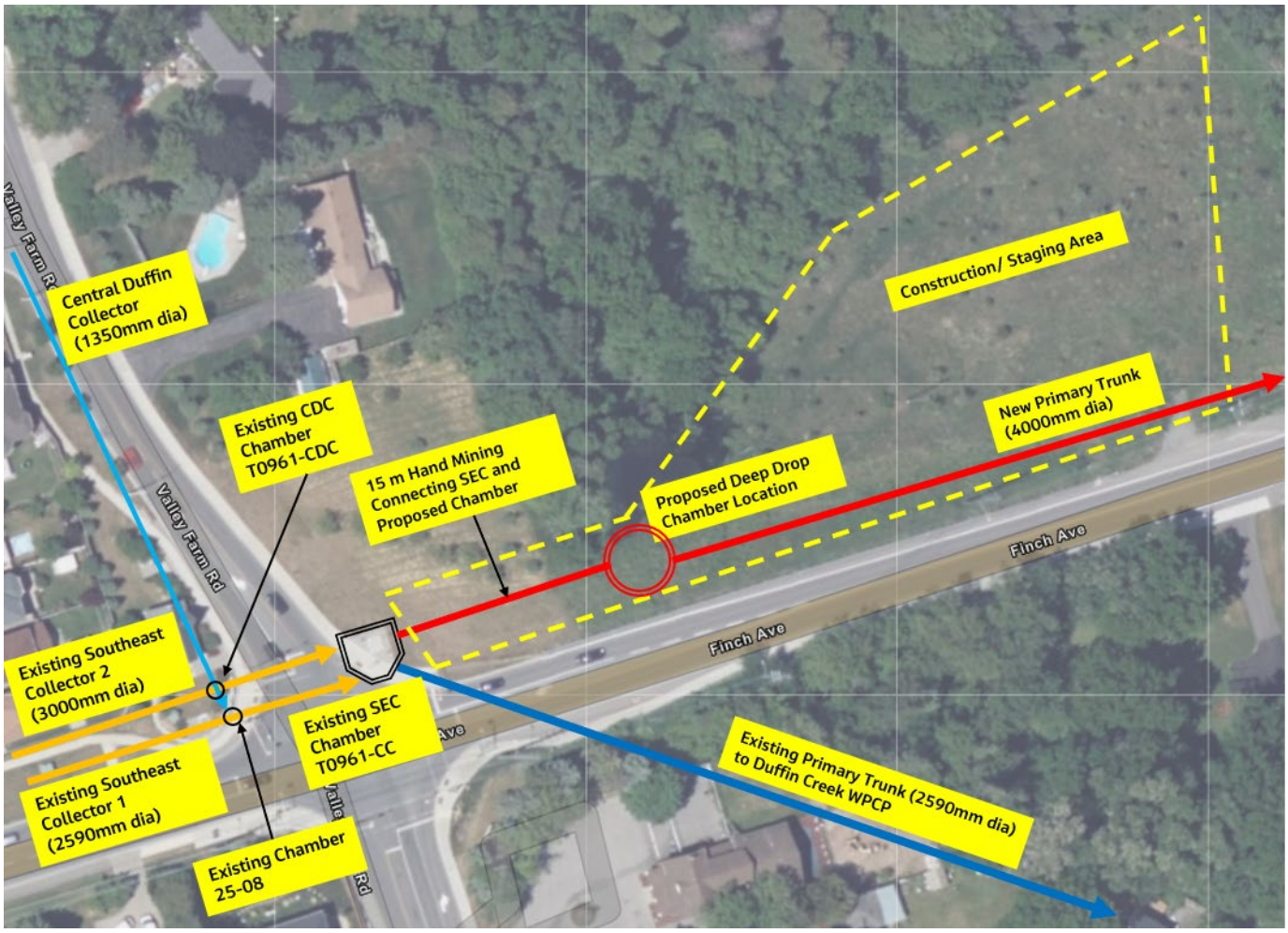

Figure 8.8 **Conceptual Design Layout for the Upstream Connection of Preferred Alignment**

At the downstream point of the new Primary Trunk Sewer Twin, a new flow-splitting chamber will be required to divert the flows into IPS 1&2 and IPS 3&4 before discharging into the Stages 1 and 2 and Stages 3 and 4 (future) treatment trains at the Duffin Creek WPCP, respectively. Because the proposed Primary Trunk Sewer Twin will be at a much lower elevation (approximately 8-9 m) than the existing Primary Trunk Sewer, it cannot be connected to the existing flow diversion chamber in the northern part of the WPCP.

The proposed size of the new flow-splitting chamber is a diameter of 15,000 mm; however, this will be confirmed during the preliminary design stage. The flow-splitting chamber will be equipped with sluice gates to isolate the pipelines feeding the IPS. Based on the flow capacity for each IPS, the sizes of the tunnels leaving the flow-splitting chamber to IPS 1&2 and IPS 3&4 were determined to be 2,700 mm and 3,600 mm, respectively. Figure 8.9 shows the layout, including a potential location for the flow splitting chamber. The locations of the flow splitting chamber will be further assessed at the preliminary design stage to optimize the location based on a number of considerations, including available land availability at the plant site and the connections to both IPSs.

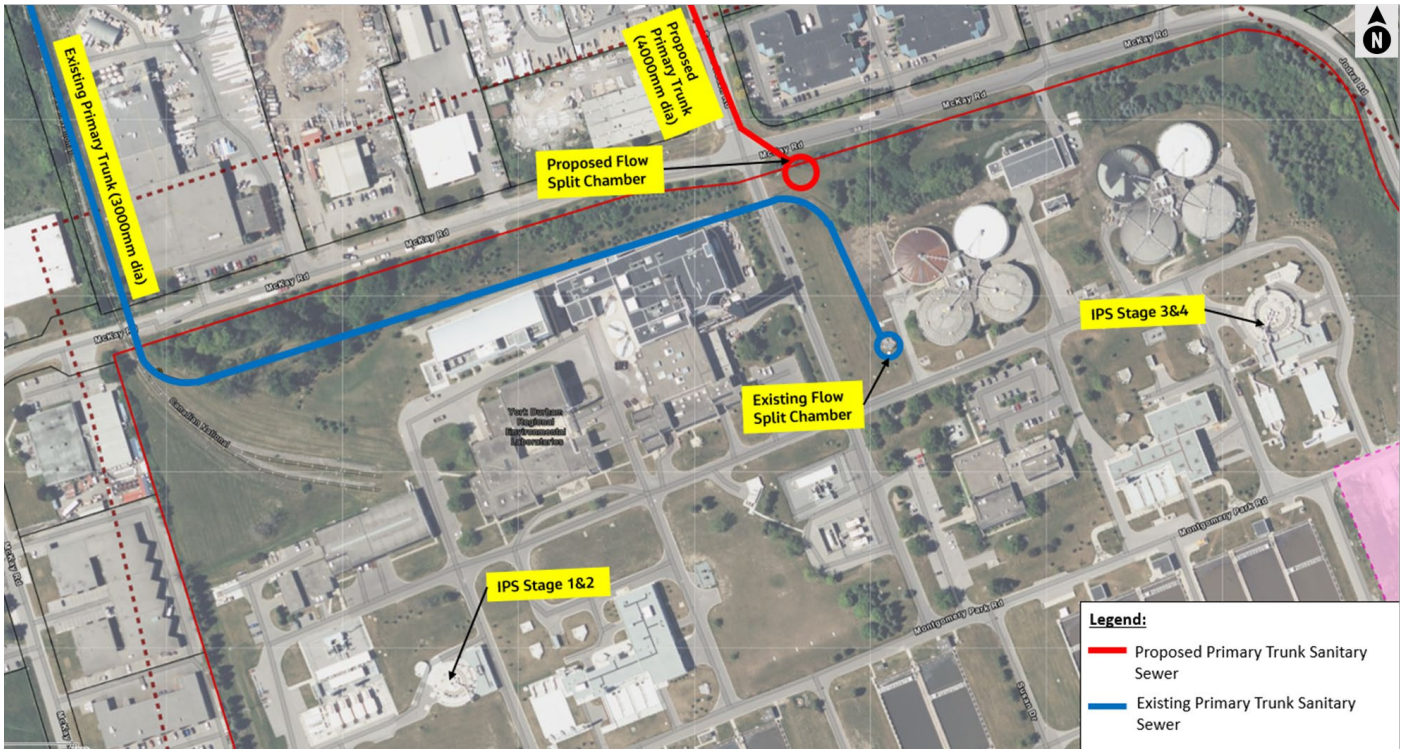

Figure 8.9 General Location and Layout of New Flow-splitting Chamber

A number of alternative tunnelling routes were considered for the new Primary Trunk Sewer Twin to divert flows from the new flow-splitting chamber to the two IPS. These were evaluated using criteria based on several assumptions. A number of alternatives presented longer alignment routes that avoided tunnelling under a number of buildings on-site at the WPCP, while some alternatives presented a more direct route to the two IPS, which would require tunnelling under several buildings onsite.

The shorter, more direct route onsite, shown in Figure 8.10, has been included in the current concept. However, the evaluation of the alternatives for the connection of the new Primary Trunk to the two IPS will continue at the preliminary design stage to determine the most optimum routing for the location of the diversion chamber and the alignments of the connections.

The conceptual drawings that detail the plan and profile of the preferred alignment and end connections are found in Appendix A.

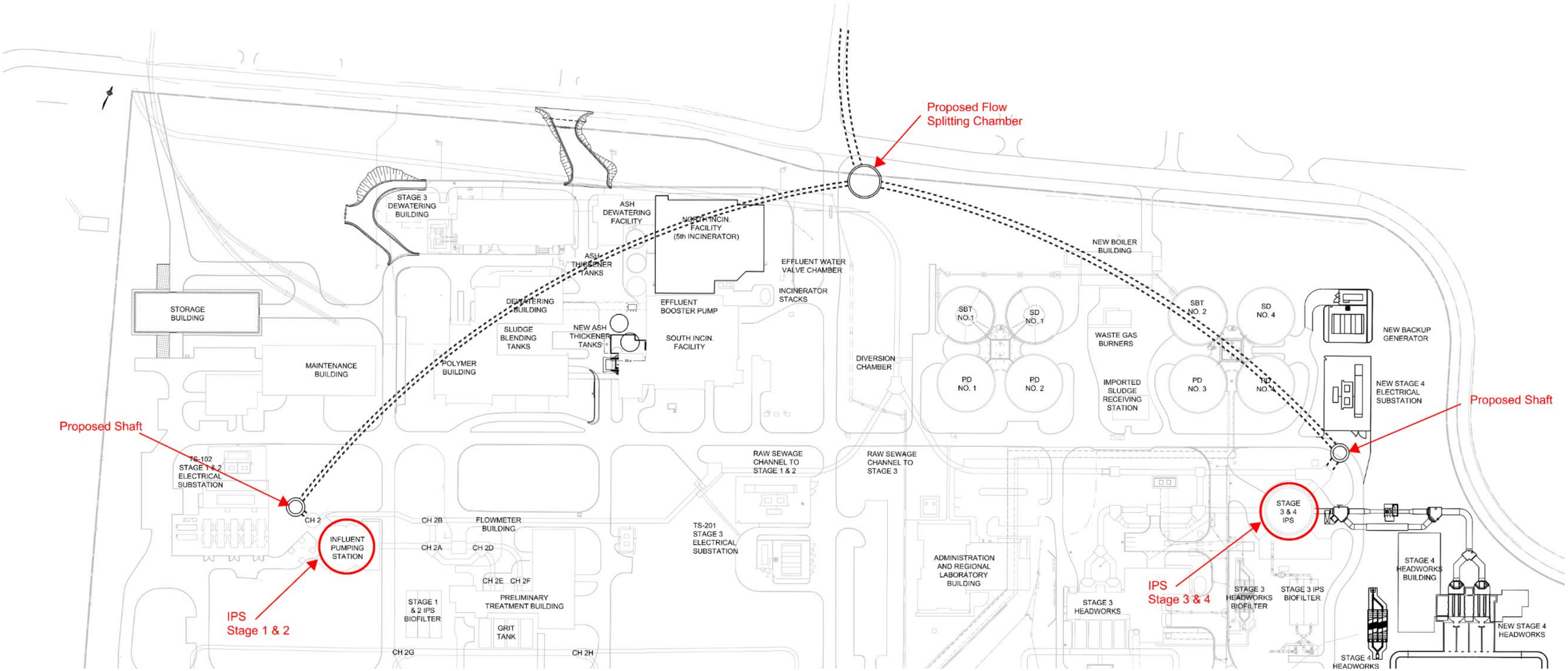

Figure 8.10 **Primary Trunk Connections at the Duffin Creek WPCP Influent Pumping Stations**

8.2.3.2.2 New Durham Region Sewage Pumping Stations

Pickering Parkway SPS (D1)

The Pickering Parkway SPS is proposed to be planned for and coordinated with the redevelopment of the Pickering Mall property, located in the northwestern corner of the Pickering Parkway and Glenanna Road intersection. This site is 1 of the largest intensification sites within the City Centre Area, and there are already active development applications for this property. Durham Region has been coordinating with the property owner on the needs and expectations for this facility. The key reasons for siting the facility at this location are as follows:

– The site is large and currently being planned for a full redevelopment.
– The site is proposed to have some of the greatest permitted densities and greatest population increases in the City of Pickering Intensification Areas.
– This site is at a key intersection of an existing 1,050-mm-diameter sanitary sewer on Pickering Parkway from the west, a proposed 600-mm-diameter sanitary sewer for the Pickering Mall site from the north, and an existing 450-mm-diameter sanitary sewer on Pickering Parkway from the east. These flows currently collect at this intersection and flow south under Highway 401.
– The proximity to the intersection of the sanitary sewers noted here makes this a very strategic location to collect and divert sewage flow.
– By diverting and removing flow from the existing 1,050-mm-diameter sanitary sewer on the northern side of Highway 401, capacity will be made available in the existing sanitary sewer system and existing Liverpool SPS south of Highway 401. This includes the proposed developments within the City Centre Area and Pickering GO Station Major Transit Station Area on the southern side of Highway 401.
– Most of the lands to the east or west of the proposed location for the Pickering Parkway SPS are occupied lands with current residents and businesses. Large sections of the Pickering Mall site are already vacant because the site is being prepared for an extensive long-term redevelopment project.
– It will be a priority to have the proposed facility planned, designed, and constructed so it can be camouflaged to blend in with the new high-density development and proposed amenity spaces while maintaining access for operations and maintenance.

The capacity of the SPS is based on the predicted future flows to the Pickering Parkway SPS from the local neighbourhood and was designed for an ultimate capacity of 1860 litres per second (L/s).

Because of the calculated capacity, a wet well/dry well type of sewage pumping station is recommended for ease of operations and maintenance. Divided wet wells should be considered for all SPS with firm capacities exceeding 100 L/s (Design Guidelines for Sewage Works).

The SPS concrete and buried infrastructure will not be replaced before the ultimate design capacity is determined and will be sized for 1860 L/s. It is proposed that the ultimate SPS be sized for four pumps (two pumps per wet well, each with the same capacity [620 L/s]). This approach provides the SPS with redundancy, and three pumps are required to satisfy the ultimate capacity of 1860 L/s in 2051.

Figure 8.11 presents the Pickering Parkway SPS conceptual schematic.

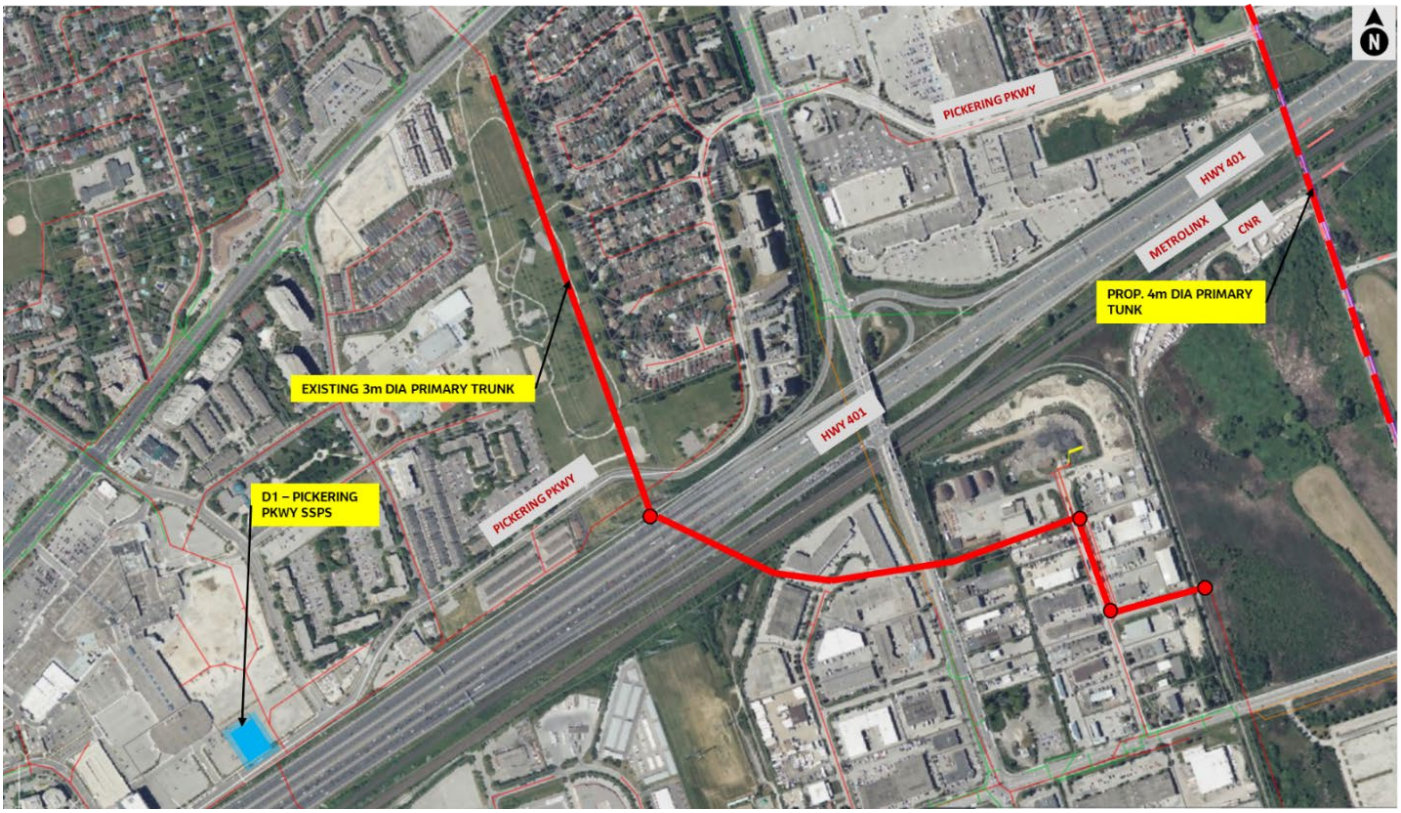

Figure 8.11 Pickering Parkway SPS Conceptual Schematic

Squires Beach SPS

The Squires Beach SPS is proposed to be planned for and coordinated with the development of the lands surrounding the Durham Live Casino property at the northeastern intersection of Squires Beach Road and Kellino Street. This site is one of the largest active greenfield developments in the southern end of Pickering. Durham Region has been coordinating with this property owner on the needs and expectations for this facility. The key reasons for siting the facility at this location are as follows:

- The site is large, mostly vacant and being planned for development.
- Directly north of these lands are two of the largest sites within the Brock Precinct growth area, with some of the greatest permitted densities and population increases within the City of Pickering Intensification Areas.
- This site is very close to the existing Primary Trunk Sewer and directly south of an existing 750-mm-diameter sanitary sewer within the Notion Road/Squires Beach Road allowance. The flow in the existing 750-mm-diameter sanitary sewer and the two large intensification sites can be directed south of Highway 401 to the proposed location of the Squires Beach SPS.
- The proximity to the intensification areas, the existing large sanitary sewer, and Durham Live Casino land make this a very strategic location to collect and divert sewage flow.
- By diverting and removing flow from the existing 750-mm-diameter sanitary sewer on Notion Road, on the northern side of Highway 401, capacity will be made available in the existing sanitary sewer system and existing Bayly Street SPS south of Highway 401. This includes all of the proposed development within the Central Ajax Intensification Area, including the Ajax GO Station Major Transit Station Area on the southern side of Highway 401.
- The areas along Squires Beach Road near the proposed SPS are planned for employment uses. This provides potential opportunities to coordinate the planning, design and construction of the proposed facility to complement the surrounding future uses while maintaining access for operations and maintenance.

The capacity of the SPS is based on the predicted future flows to the Squires Beach SPS from the local neighbourhood and was designed for an ultimate capacity of 675 L/s.

A submersible wet well type of SPS is recommended because these require less space and are easier and less expensive to construct for the wastewater flow capacities (EPA). Divided wet wells should be considered for all sewage pumping stations with firm capacities exceeding 100 L/s (Design Guidelines for Sewage Works).

The SPS concrete and buried infrastructure will not be replaced before the ultimate design capacity is determined and will be sized for 675 L/s. It is proposed that the ultimate SPS be sized for four pumps (two pumps per wet well of identical capacities [225 L/s]) in a duty/standby capacity. Therefore, three pumps are required to satisfy the ultimate capacity of 675 L/s in 2051.

Figure 8.12 presents the Squires Beach SPS conceptual schematic.

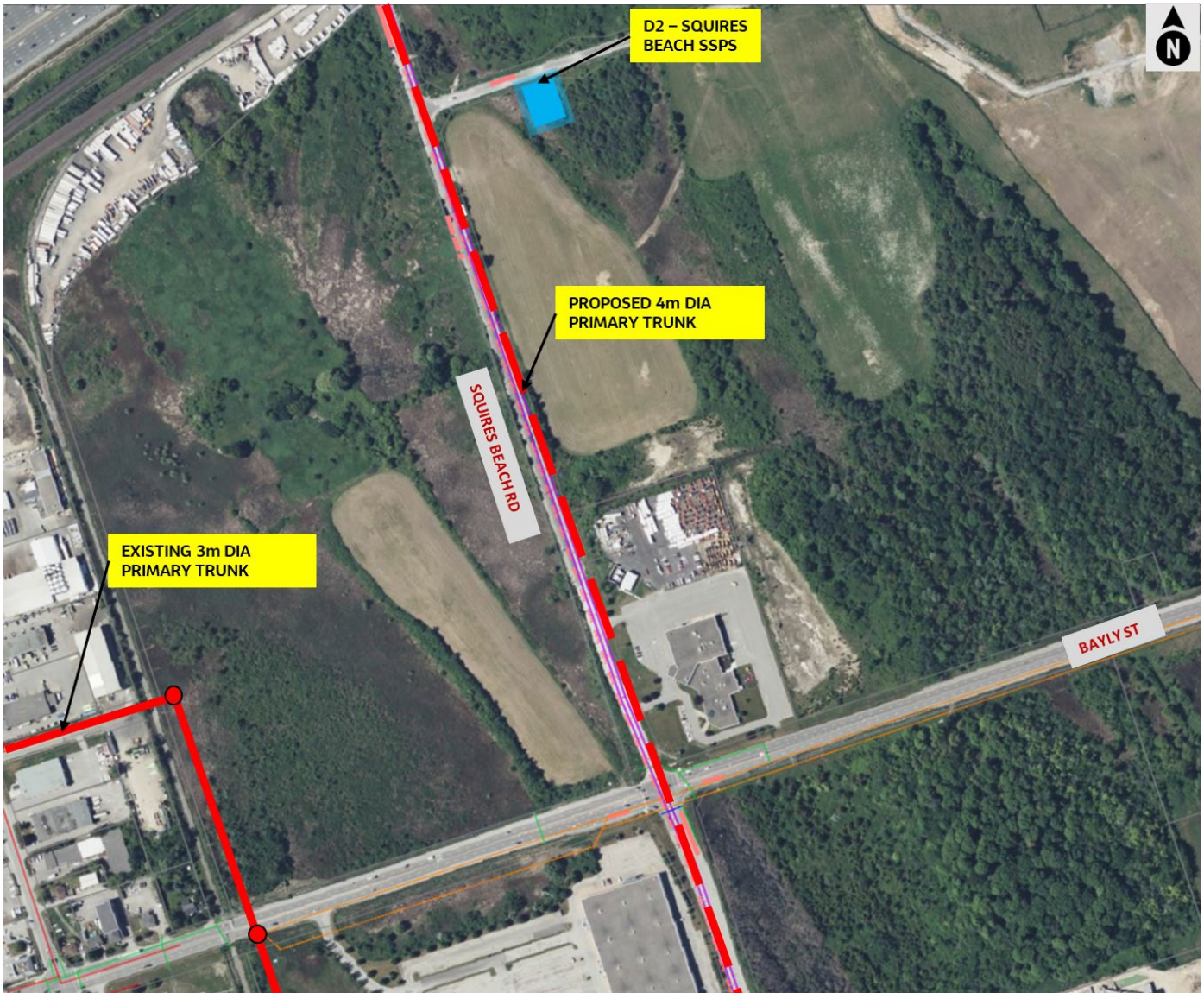

Figure 8.12 Squires Beach SPS Conceptual Schematic

8.2.3.2.3 Connections to the Existing and Future Sewage Pumping Stations

Preliminary concept designs were developed for connections from the existing and future sewage pumping stations to the new Primary Trunk Sewer Twin. The infrastructure connections will be further refined during the preliminary design stage (which begins in the fall of 2023). During preliminary design, desktop studies and field investigations will be completed for the infrastructure for the new connections.

Due to the planned tunnel depth of the new Primary Trunk Sewer and associated connecting infrastructure, utility and existing infrastructure conflicts are not anticipated at any of the locations identified in figures Figure 8.13. to Figure 8.18.

Toy Avenue SPS

The existing SPS at Toy Avenue is connected to the existing primary trunk sewer tunnel via a 150-mm-diameter forcemain. To connect the SPS to the new primary trunk twin, it is proposed to extend the forcemain with the same diameter until the proposed trunk (approximately 1 km in length). Based on the available information, the proposed forcemain will need to cross below the existing primary trunk at two locations; the first one is located at Toy Avenue, while the second one is at Bayly Street (east of CNR corridor) as the cover above the existing tunnel is not sufficient (approximately 1.5 m). The new forcemain is proposed to be constructed by drilling method to avoid any deep open cut excavation, especially at the crossings with the existing primary trunk and the CNR corridor east of the Bayly Street and Toy Avenue intersection. The high-level schematic of the proposed connection is shown in Figure 8.13. Isolation valve chambers shall be provided before the connection to primary trunks to provide operational flexibility.

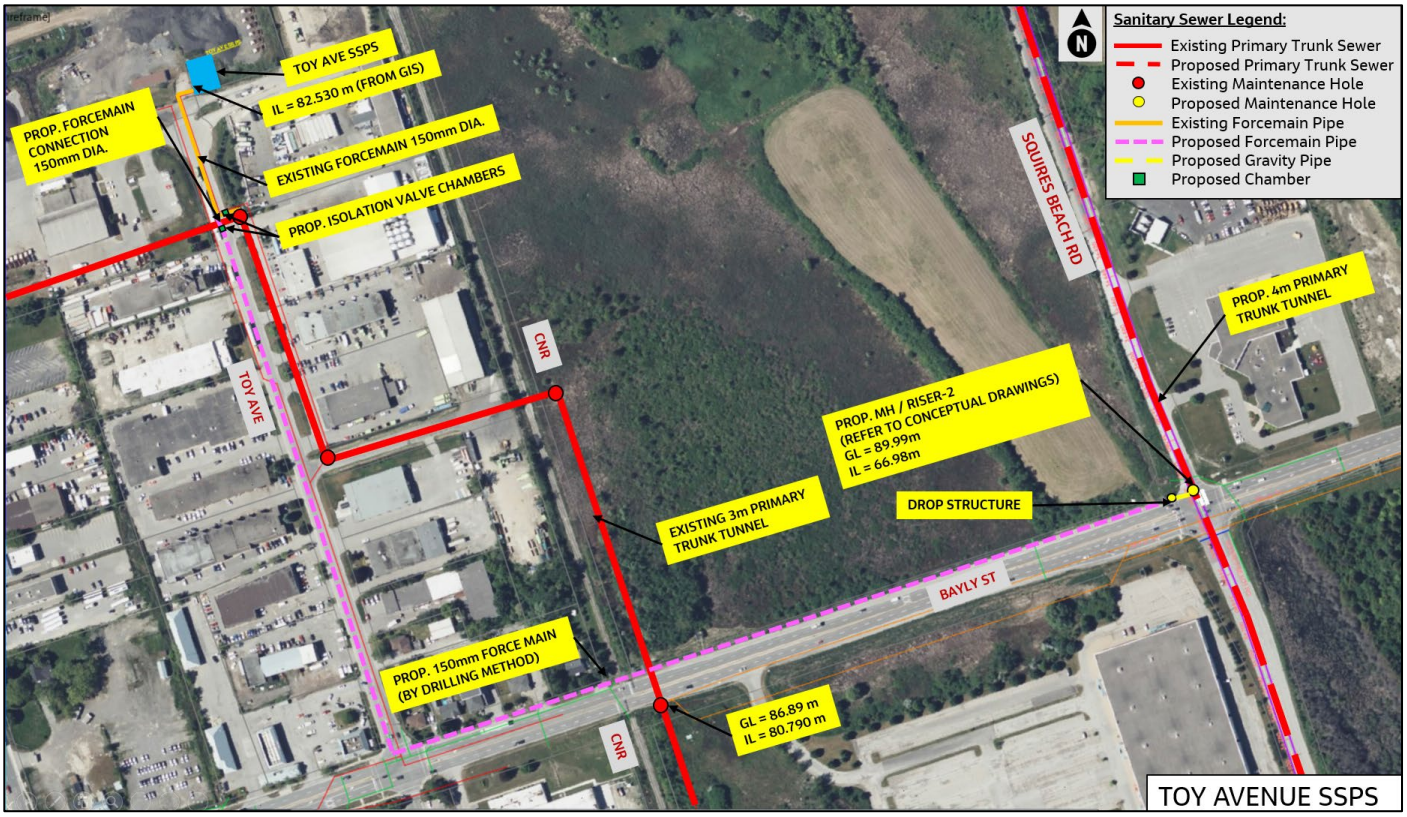

Figure 8.13 Connection of Toy Avenue SPS to the Proposed Primary Trunk Sewer

Bayly SPS

The existing SPS at Bayly Street is connected to the existing primary trunk sewer tunnel via twin 900-mm-diameter forcemains. The connection to the proposed primary trunk sewer is proposed by branching the twin forcemains and installing isolation valve chambers (line valves) on the existing and proposed forcemains to allow switching the flow between the two primary trunks, which provides operational flexibility to the system. The proposed forcemains are approximately 50 m in length and shall be connected to a pressure break chamber or drop structure before connecting to the new primary trunk at the Squires Beach Road and Bayly Street intersection, as shown in Figure 8.14.

Figure 8.14 **Connection of Bayly SPS to the Proposed Primary Trunk Sewer**

Jodrel SPS

The existing SPS is connected to the existing primary trunk by a forcemain 450 mm in diameter running along McKay Road. The SPS is proposed to be connected to the new primary trunk sewer by taking a branch from the existing 450-mm-diameter forcemain with the same diameter. Isolation valve chambers are required on the existing and proposed forcemains similar to the Bayly Street and Toy Avenue connections to provide operational flexibility. The new forcemain is approximately 20 to 25 m in length and connected to a pressure break chamber and then by a gravity line to the proposed trunk sewer tunnel upstream of the proposed flow diversion chamber, as shown in Figure 8.15.

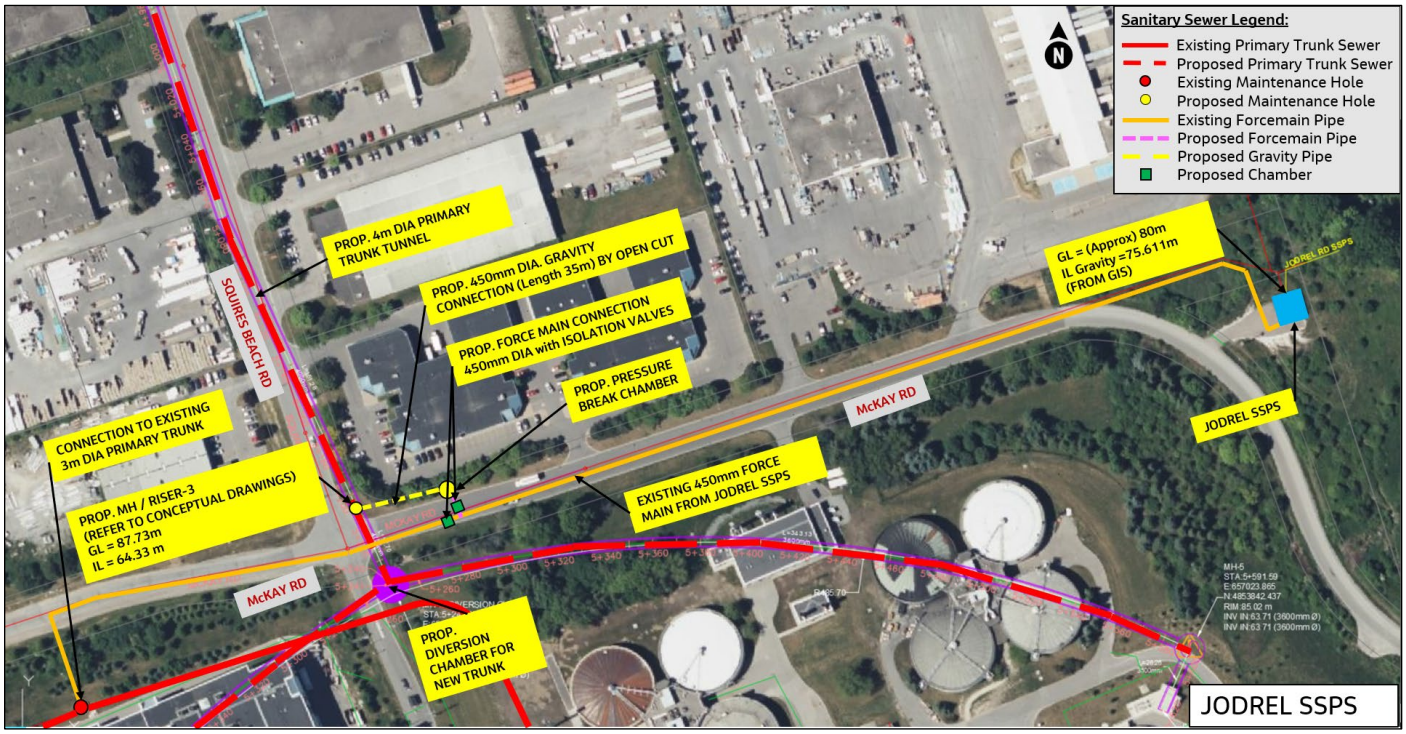

Figure 8.15 **Connection of Jodrel SPS to the Proposed Primary Trunk Sewer**

Liverpool SPS

Based on the available information, there are two forcemains (900 mm diameter each) from Liverpool SPS connected to the existing primary trunk sewer tunnel. Figure 8.16 shows the proposed connection to the new primary trunk sewer at the Squires Beach Road and McKay Road intersection. A pressure break/flow split chamber is proposed at the forcemain on the north with sluice gates at the outgoing sewer gravity pipes (1050-mm-diameter each) to control the flow into the existing and new primary trunk tunnel. The existing chamber connecting the forcemain on the southern side to the existing primary trunk is proposed to be upgraded/replaced to accommodate another 1050-mm-gravity connection to the new primary trunk with sluice gates on the outgoing pipes. The two proposed gravity lines (from the north and south forcemains) will be merged and connected to the proposed primary trunk via a drop structure.

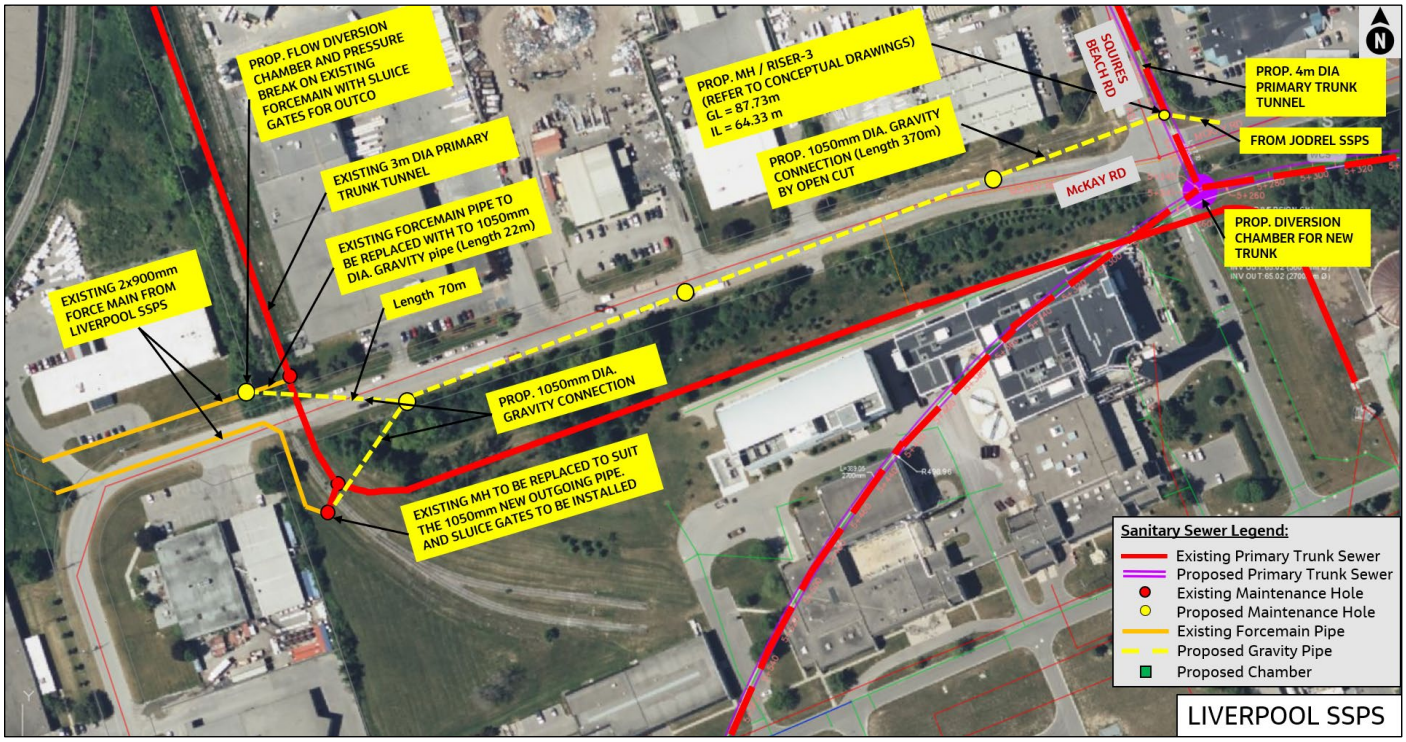

Figure 8.16 Connection of Liverpool SPS to the Proposed Primary Trunk Sewer

D1 Pickering Parkway SPS

The flows from the proposed SPS at Pickering Parkway will be connected to the existing and proposed primary trunk tunnels via a 2.8 km twin 900-mm-diameter forcemains along Pickering Parkway, as shown in Figure 8.17. Isolation valve chambers are required before the connection to each primary trunk to provide operational flexibility in diverting the flows in case any of the two trunks goes under rehabilitation or maintenance.

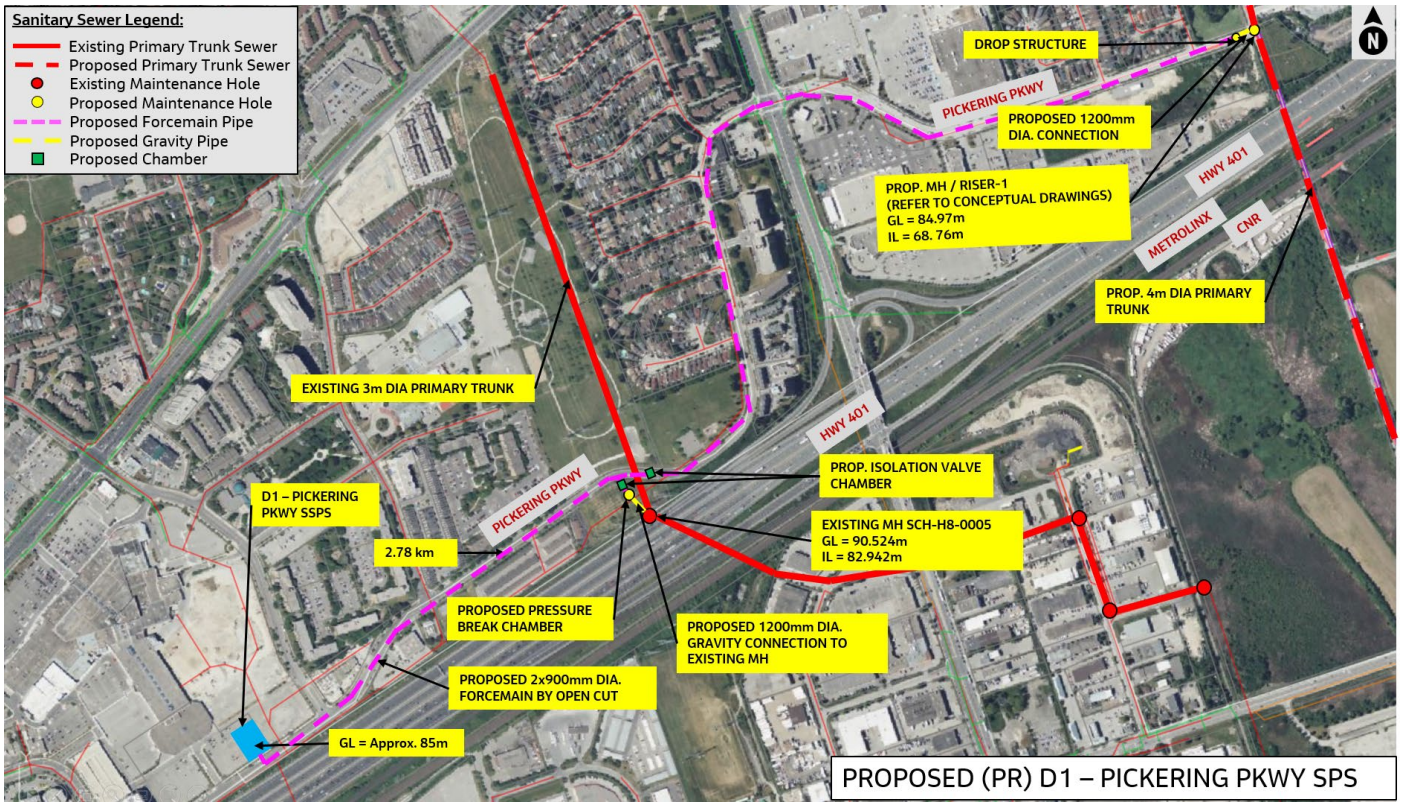

Figure 8.17 **Connection of Pickering Parkway SPS to the Existing and Proposed Primary Trunks**

D2 Squires Beach SPS

Similar to the Pickering Parkway SPS, the flows from the proposed Squires Beach SPS are planned to be connected via twin 450-mm-diameter forcemains (approximately 1.2 km in length) to the existing and proposed primary trunks at Bayly Street Isolation valve chamber are required before the connection to each primary trunk to provide operational flexibility in diverting the flows. The high-level schematic of the proposed connection is shown in Figure 8.18.

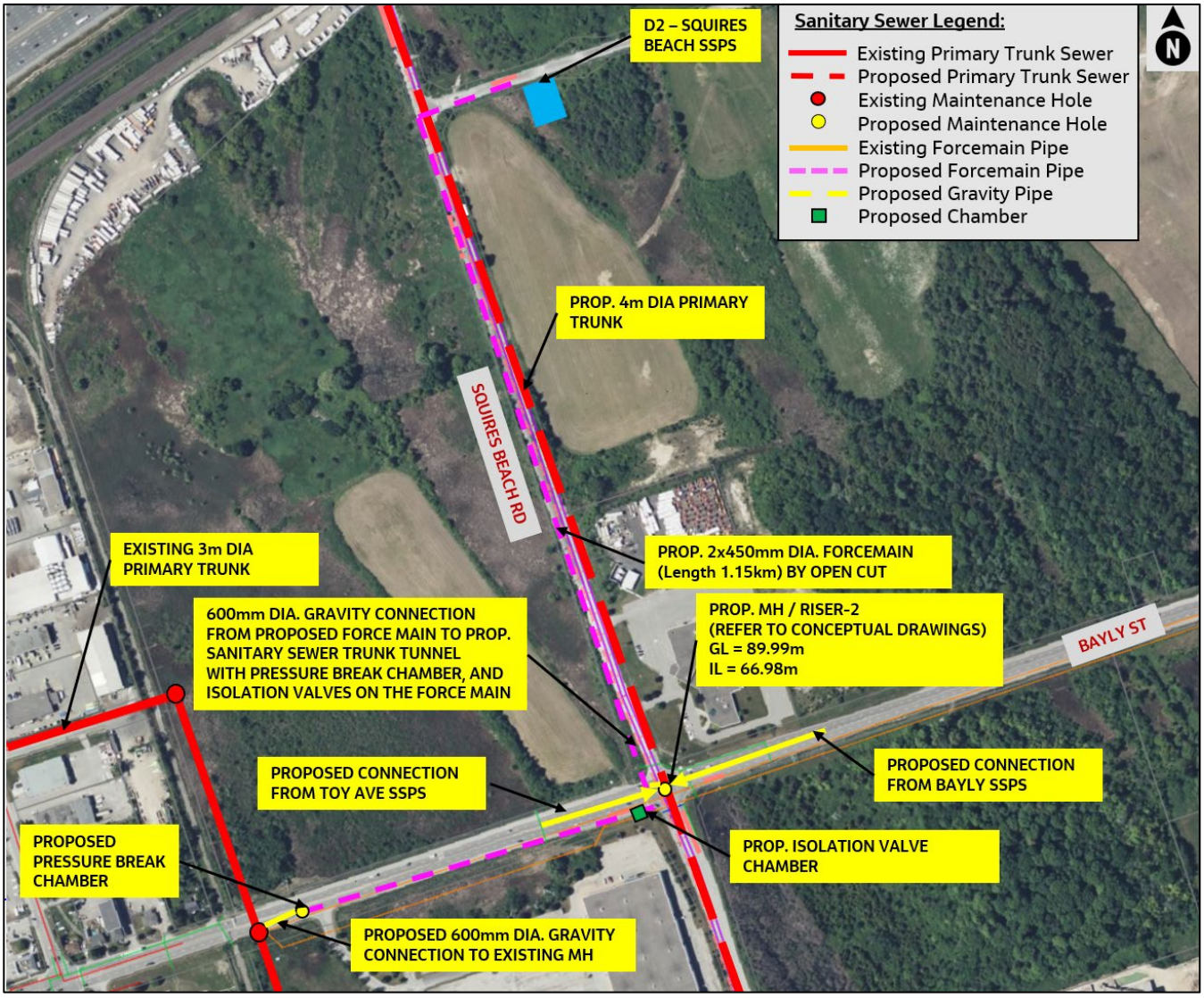

Figure 8.18 **Connection of Squires Beach SPS to the Existing and Proposed Primary Trunks**

8.2.3.3 Construction Methods

Construction methods were considered for each project component of the new Primary Trunk Sewer Twin. These methods will be further reviewed and refined during the preliminary design stage.

8.2.3.3.1 Primary Trunk Twin Alignment

The new Primary Trunk Sewer Twin, with an inner diameter of 4 m and a depth of pipe cover ranging from 8 m to 25 m deep, will be constructed using the tunnelling method. Several trenchless methods were considered, including tunnel boring machine (TBM), earth pressure balance tunnel boring machine (EPBTBM), pipe jacking and auger boring.

For the proposed sewer construction, the tunnel is expected to warrant the use of a TBM for a majority of the route due to the depth of pipe cover and an EPBTBM in areas where the tunnel will pass through a mixed soil interface.

The tunnelling of the proposed 4 m diameter tunnel requires a receiving shaft at Valley Farm Road/Finch Avenue intersection, a launching shaft at Kingston Road/Notion Road intersection, and a receiving shaft at the proposed flow diversion chamber located at Squires Beach Road and McKay Road intersection. This shaft will act as a receiving for the main tunnel and as launching for the end connection tunnels at the Duffin Creek WPCP. The locations of these shafts are shown in the conceptual drawings provided in Appendix A.

8.2.3.3.2 Shafts and Maintenance Holes

Potential locations for tunnel shafts have been examined in locations that allow for the construction of a compound which will minimize interference to the public. At this conceptual level, five potential launching and receiving shaft locations have been examined along the proposed sewer alignment and after the flow splitting chamber. The shafts will be converted to maintenance holes (MHs) upon construction completion. Additional MHs will be located at shorter intervals where the existing and new Durham Sewage Pumping Stations will connect to the new Primary Trunk Twin for operations and maintenance. These locations have been identified at a conceptual level as part of this report and will be further refined during the design stage.

Launching shaft compounds must accommodate a larger shaft size due to more equipment, machinery and storage. Launching shaft compounds are designed to have a minimum area of 6,000 m² while receiving shaft compounds were designed to meet a minimum requirement of 800 m². All construction compounds will be temporary and vary in shape and size with a goal of maximizing safety and security for the contractor and the public.

The majority of the shaft compounds have been located to minimize traffic impacts, utility relocations and tree removals. The tunnel alignment and shaft compounds will be confirmed during the design stages as more accurate information becomes available.

8.2.3.3.3 Connection End Points

The upstream connection from the existing SEC connection chamber (T0961-CC) located at the Valley Farm Road and Finch Avenue intersection to the drop MH-1 will be constructed via hand mining (approximately 25 m in length), as shown in the conceptual drawings. The downstream connection tunnels (2.7 m and 3.6 m diameter) at the Duffin Creek WPCP are proposed to be constructed via the tunnelling method (TBM) until the maintenance shafts are located before the Influent pumping stations 1&2 and 3&4. The connections from the last MHs to the IPSs will be constructed via hand mining.

8.2.3.3.4 Connections to Existing and Future Sewage Pumping Stations

At this stage, it is proposed to construct the connections from existing and proposed sewage pumping stations to the new Primary Trunk Sewer Twin via open cut except for the connection from Toy Avenue SPS, where drilling is proposed due to the crossings below the existing Primary Trunk and the CN corridor. Hand mining may be required at the connection with the proposed Primary Trunk Sewer Twin, but this will be further confirmed, along with other construction methods, during the design stage once the connection strategy is finalized.

8.2.3.4 Property Requirements

The new Primary Trunk Sewer Twin alignment was selected based on the minimal disturbance to the built, social and natural environment. The horizontal alignment will be tunnelled within the right-of-way as much as possible to avoid any property impacts.

A desktop review of the land requirements was completed using the OnLand Registry Access and information provided by York Region and Durham Region. The preliminary review took place to identify possible temporary and permanent easements needed to construct the new Primary Trunk Twin and associated launching and receiving shaft construction staging areas. Further review and analysis will be completed during preliminary design to confirm the properties identified during this study and to identify additional properties impacted by the required infrastructure connecting the existing and future Durham Region SPSs to the new Primary Trunk Twin.

Land requirements were determined using the listed assumptions:

– The boundary for permanent easement will be 5 m offset from the outer diameter (14 m width) of the new Markham Collector Twin.
– The permanent easement boundary will be 5 m offset from the outer diameter of the shaft.
– Temporary construction staging areas will to be 6,000 square metres for launching shafts and 8,00 square metres for receiving shafts. The remaining areas are required for permanent easement.

Construction of the preferred alignment route and two new sewage pumping stations will mainly follow existing ROWs but will intersect four parcels identified in the City of Pickering and the Town of Ajax. Easement requirements, Property Identification Numbers, the associated legal description, and the area required will be identified for each parcel impacted. Property requirements, including agreements that will be required with agencies and stakeholders such as MTO, Hydro One, TRCA and Canadian National Railway, will be reviewed and further refined during the design stage.

8.2.4 Environmental and Community Impacts and Mitigation

The Primary Trunk Twinning Project will potentially affect the social, built, natural and cultural environments. Desktop studies were conducted to determine the extent of these potential impacts and to propose mitigation measures that would reduce the likelihood and consequences should they occur. This section describes the major impacts during construction. Table 8.7, Table 8.8 and Table 8.9 detail the impact on the social and built environment, the natural environment and the cultural environment and propose mitigation measures that can be adopted during design, construction and operations.

Table 8.7 Social and Built Environment – Effects and Mitigation

Item #	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
SB-1	Effects on traffic	– Extent of disruption to traffic flows. – Proximity to congested traffic zones, construction staging areas and properties.	– Traffic operational impacts will be limited to construction traffic entering and exiting the construction staging areas through the nearest public roadway. – Traffic disruptions during construction are expected to be low, with no or minimal impacts on the adjacent road network.	– Construction compounds will be located mostly off-road and not intrude upon any active roadways. – Some restrictions on time-of-day access may be required during construction on these major arterials to avoid impacting peak-hour traffic flows. – All shafts are expected to be off-road and will not require road closures. – Temporary closures can be completed during off-peak times, evenings, or weekends. – Construction access via Finch Avenue would be preferred for the shaft located near Valley Farm Road and Finch Avenue to eliminate conflicts with the existing sidewalk on Valley Farm Road. – Kingston Road and crosswalks at the Kingston Road and Notion Road intersection should be maintained.
SB-2	Effect of noise on sensitive receptors	– Number of sensitive receptors affected and extent and duration of adverse effects during construction.	– Construction noise levels at sensitive receptors are expected to be within acceptable limits defined by the FTA Noise and Vibration Assessment Manual – Environmental Noise may cause sleep disturbance and general annoyance. The magnitude of the noise disturbance is dependent on the number of equipment, their proximity to each other, their proximity to sensitive receptors, construction methods and equipment deployed, construction hours and duration of exposure to sensitive receptors.	– Conduct pre-construction survey to confirm existing conditions as required. – Construction noise impact mitigation measures include, but are not limited to, the following to meet applicable noise criteria: • Siting construction staging to reduce adverse impacts to sensitive receptors where possible. • Use construction equipment compliant with noise level specifications in MECP guidelines NPC-115 and NPC-118. • Keep equipment in good working order and operate with effective muffling devices where possible. • Acoustic enclosures for equipment such as generators and compressors. • Use of localized movable noise barriers/screens for specific equipment and operations. • Implement a no idling policy onsite (unless necessary for equipment operation). • Restrict construction hours where possible: • Perform construction during daytime hours where possible. If nighttime construction is necessary, high-noise activities should be restricted to daytime where possible. • Inform local residents before construction of the type of construction and expected duration if occurring outside of current bylaw. • Provide suggested construction staging to help mitigate noise generation where possible. • Stage construction vehicles away from noise sensitive locations where possible. • When construction location and design and better known, establish and apply project-specific construction noise criteria/exposure limits. • Undertake noise monitoring throughout the construction phase where possible. Where noise level limits are exceeded, additional noise mitigation measures will be considered. • Consider developing a communications protocol which includes timely resolution of complaints. – Additional mitigation measures not listed above may be considered as construction progresses.
		– Number of sensitive receptors affected and extent and duration of adverse effects during construction.	– Potential increase in noise emissions due to operation of sewage pumping station fans, blowers and motors.	– Appropriate building and engineering design, such as placing motors indoors or within acoustic enclosures, acoustic louvres for intakes, and exhaust and odour control unit fan enclosure, will be considered. – Procurement of equipment with low noise emissions where feasible.

Item #	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
SB-3	Effect of perceptible vibration levels on sensitive receptors	– Number of sensitive receptors affected and extent and duration of adverse effects during construction.	– Construction vibration levels at sensitive receptors are expected to be within acceptable limits defined by the FTA Noise and Vibration Assessment Manual – Exposure to vibration may result in public annoyance and possible building damage when equipment is nearby.	– Site construction staging and laydown areas to avoid or reduce impacts to receptors where possible. – Use equipment with low vibration emissions as much as possible. – Provide offsite construction of project components where possible. – Consider alternative means of construction within the defined Zone of Influence so vibration limits are not exceeded where feasible. – Grade truck travel routes to reduce vibration emissions where feasible. – Maximize the distance between emissions and receivers where possible. – As project planning progresses, review sensitive receptor/building areas and revise mitigation and deployment triggers as necessary.
		– Number of sensitive receptors affected and extent and duration of adverse effects during operations.	– None anticipated.	– None planned.

Item #	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
SB-4	Construction air quality	– Number of sensitive receptors affected and extent and duration of adverse effects during construction.	– Potential air quality impacts due to dust and odour from diesel combustion and particulate emissions. – Exhaust emissions from construction vehicles may contribute to increased levels of CACs. – Some construction activities are likely to have higher dust emissions, which include earthworks activities, demolition activities, travel on dusty or unpaved surfaces with heavy equipment travel and erosion from uncovered soil storage piles. – Ground-level fugitive emissions from construction activities (such as material handling and grading, vehicle movement and associated activities) are expected to reduce to negligible levels beyond 500 m because dust levels are expected to quickly attenuate within a short distance of the activities	– Site construction vehicle activity will be managed to control emissions of odorous contaminants and diesel exhaust as much as possible. – Mitigation measures consistent with Environment Canada's Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities (Cheminfo Services Inc., 2005), and the Ministry of Environment, Conservation and Parks' Technical Bulletin Management Approaches for Industrial Fugitive Dust Sources, will be followed. – The following mitigation measures can be considered in the Air Quality Management Plan: • All equipment complies with Canadian engine emissions standards. • All equipment visually inspected prior to use and properly maintained in accordance with the manufacturer's manual. • Landscaping materials ordered close to time of use to reduce onsite storage. • Minimize drop height of materials onsite. • Covering surface area of hauled bulk material. • Methods and equipment for cleanup of accidental spills of dusty materials. • Implement a no idling policy onsite (unless necessary for equipment operation). • Use of electricity from the grid over diesel generators wherever possible. • Retrofitting of combustion engines with specific exhaust emission control measures such as particulate traps. • Application of soil stabilizers or dust control polymers where feasible. • Removal of accumulated mud, dirt and debris deposits onsite and regular truck washing as per permit requirements. • Paved and unpaved roadway cleaning, watering or application of acceptable dust suppressants. • Complete earthwork grading within ten days of ceased active construction. • Temporary seeding or mulching of bare soil and storage piles. • Compression or clodding of soil surfaces and storage piles to reduce erosion. • Confine storage pile activity to downwind side of piles. • Reduction of activities during high wind conditions. • Full or partial enclosure of demolition activities. • Windscreens or barriers where possible or necessary. • Offsite construction of certain structures or parts of structures to minimize air emission due to interference with the normal flow of traffic. • Scheduling certain construction activities (i.e., site preparation and earthworks activities, demolition activities, unpaved surfaces with heavy equipment travel and uncovered soil storage piles) to periods of time when exposure to dust is expected to be limited (for example, avoid scheduling activities during dry, windy weather conditions). • Limit travel speeds onsite to a maximum of 20 kilometres per hour. • Visually monitor for dust during construction. • With a suitable instrument, monitor for fine particulate when construction boundary is within 15 m of a residence. – If disruption of contaminated soils is anticipated at any time, consult with the construction manager to ensure that harmful and/or volatile contaminants are not released. – Consider developing a communications protocol which includes timely resolution of complaints.

Item #	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
	Air quality operation	– Number of sensitive receptors affected and extent and duration of adverse effects during operations.	– Combustion products and dust due to periodic maintenance of trunks and associated structures. – Combustion products from the operation of sewage pumping stations.	– Employ mitigation measures as listed above as appropriate.
SB-5	Effect of odours on sensitive receptors	– Number of sensitive receptors affected and extent and duration of adverse effects during construction and operation.	– Short-term odour emissions are possible during tie-ins. – Potential odour impacts from use of the two project SPSs. Emissions from Odour Control Unit. – An odour study can be conducted during the preliminary design stage.	– Employ portable odour control device as necessary, such as a misting device or portable activated carbon control unit. Choice to be determined during the design stage, based on details of the potential odour emissions. – An odour study can be completed during the preliminary design stage.
SB-6	Effect on properties	– Extent of displacement of residences, businesses and other facilities – Extent of temporary or permanent disruption. – Extent of construction or permanent easements.	– Access to property may be affected during construction activities. – Temporary permanent easements required during construction and for access roads. – Permanent easement required for maintenance and access roads.	– Review shaft locations to minimize impact to properties where possible. – Construct security fencing and hoarding around each shaft compound for safety where possible.

Table 8.8 Natural Environment – Effects and Mitigation

Item #	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
N-1	Effect on groundwater	– Temporary and/or long-term changes in groundwater quantity and quality	– The lowering of the shallow groundwater level due to construction dewatering could potentially reduce the groundwater input into nearby groundwater dependent features. Dewatering discharge that may be directed to nearby tributaries could potentially alter the physical, chemical and thermal regime of the receiving streams. – Potential for ground settlement resulting from construction dewatering where the estimated drawdown is significant and compressible soils are located within the zone of influence of the dewatering. – In consideration of the potential for high dewatering rates and compressible soils along the project alignment, structures or other infrastructure located within the dewatering zone of influence may potentially be impacted by the ground settlement depending upon the dewatering rate and sensitivity of facility. – The northern portion of the Site, along Finch Avenue and Notion Road, is located within the Intake Protection Zone 3 (IPZ). An Intake Protection Zone 3 refers to an area where contaminants could reach a municipal intake pipe for a drinking water system during and after a large storm. – 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. – 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. – Change in shallow groundwater flow patterns resulting from operation of sewer pipe resulting from increased I&I and/or preferential movement of groundwater within trench sediments.	– Where dewatering is anticipated, an assessment of the potential for settlement will be required. – Monitoring and contingency plans are required to be prepared as part of the hydrogeological field investigation to identify, minimize and mitigate potential impacts to nearby potential receptors including West Duffins Creek and its tributaries, Krosno Creek and its tributaries, Lower Duffins Creek Wetland Complex and Duffins Creek Coastal Marsh. – Discharge to the natural environment may require approval by MECP, MNRF, TRCA, and/or others, depending on the location and proximity to TRCA-regulated areas. – Extra precautions should be enacted in the vicinity of the Intake Protection Zone 3 to avoid the release of contaminants into the natural environment. Furthermore, the presence of commercial and industrial properties along Notion Road and Squires Beach Road may be a potential source of contamination of groundwater.
N-2	Effect on private wells	– Temporary construction dewatering private well interference – Long-term private well interference	– Dewatering activities could impact the quantity and/or quality of water obtained by water well users within the radius of influence due to dewatering. The magnitude of any drawdown and the relative impact are anticipated to decrease as the distance between the water well user and the edge of the excavation increases. – There are 35 water supply wells reported to exist within 500 m of the Site. However, they were constructed between 1950s and 1970s and are not expected to be in use.	– While no well users are anticipated to be affected, and all residences are expected to be municipally serviced, a private well survey can be conducted in advance of construction to identify potential well users in the area and to establish baseline water levels and water quality prior to, during and following construction.

Item #	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
N-3	Effect on surface water	– Temporary change in surface water – Long-term change in surface water	– Changes to surface water bodies are expected to be minimal, as tunnelling is the recommended construction method. – During construction, the risk of frac-out that temporarily releases bentonite slurry in the water course. – Erosion and sedimentation due to run-off in construction areas. – Decrease of depletion of surface water due to active dewatering or water migration through ground into excavations. – Excavations close to surface water bodies have the potential to cause adverse impacts to aquatic ecosystems. – Water may enter shafts during construction due to dewatering activities in proximity to waterbodies. – Dewatering may also be required due to groundwater intrusion, depending on the depth of water table. – Change in surface water temperature from groundwater taking and/or discharge to surface water features. – Changes to stream morphology resulting from the release of groundwater dewatering water. The potential reduction in baseflow due to water taking in a lower confined aquifer due to increased downward hydraulic gradients across the aquitard separating the stream and the confined aquifer. – The potential reduction in baseflow from a stream reach that intersects an aquifer in which the water taking is occurring. – Sump and Excess Process (SEP) water and dewatering discharges at shaft sites impact surface water quality and quantity	– Frac-out can be mitigated through proper geotechnical investigations, selecting a face pressure appropriate to balance the ground and groundwater conditions and careful monitoring of the pressures during construction. – Contingency plans should be developed in consultation with Regulatory Agencies to determine the method of clean-up based on the anticipated level of impact. These measures can include but not limited to: • Install preventative straw bales crossing the water flow downstream of the tunnel to contain any spill. This could cause some retention of water, in which case the straw bales can be kept onsite to be installed only in case of a spill. • Pump the slurry from within the watercourse using a vac-truck on site before it spreads along the river. • Install proper erosion and sedimentation measures, such as silt fences, silt socks, and implement Best Management Practices. To limit suspended solids and mitigate/avoid potential impacts. • Avoid active dewatering. Specify sealed excavation support systems for the shafts to minimize impacts on water bodies. • Refuel equipment at a safe distance from water bodies to avoid spills. Develop and follow clean-up protocol should spills occur.
N-4	Effect on aquatic habitat	– Impact on Wetland Habitat (Mixed Swamp (SWM) Community) during construction and/or operation	– Site preparation and construction activities, including equipment use, may cause disturbance and changes in soil compaction and site drainage and result in erosion and sedimentation and runoff entering the SWM wetland. – Accidental spills from heavy equipment and site vehicles may cause the releases of deleterious material and introduce invasive species.	– Prepare a sediment and erosion control plan. – Multibarrier sediment and erosion control measures can be erected to create a barrier between the wetland and construction if required. Silt fences with non-woven geotextile and material density of 270R or greater, in 1 m distance outside the expected disturbance area would be considered. These measures and structures would be maintained and enhanced as needed until construction has been completed and the site has stabilized. – If herptiles enter the work area, stop work immediately and allow the species to exit the work area naturally. If the species requires relocation, contact the MNRF, as a permit under the Fish and Wildlife Conservation Act is required to complete wildlife salvages. – Follow relevant MNRF's Best Management Practices for Mitigating the Effects of Roads on Amphibian and Reptile Species at Risk in Ontario (MNRF 2016).
N-5	Effect on vegetation communities	– Impacts related to vegetation removal and wetland compensation during construction and/or operation	– Removal of vegetation communities may result in loss of habitat. – Damage to adjacent vegetation or ELC communities may occur during construction.	– Vegetation removal will be reduced as much as possible and limited to only what is required for construction. – Construction fencing and silt fencing will be installed and maintained whenever it can prevent or reduce damage to adjacent ELC communities. – Vegetation removal requires compensation in accordance with TRCA's Ecosystem Compensation Guidelines (TRCA 2018). – Temporarily disturbed areas will be revegetated using non-invasive, native plantings and seed mix suitable to the site conditions and surrounding ELC after construction is complete. – Vegetation removals will also be conducted with consideration for potential impacts to sensitive species (for example, SAR) and features (for example, SWH) and appropriate timing windows as much as possible. – Onsite inspection will confirm implementation of the mitigation measures. Corrective actions, if required, may include additional site maintenance or altering site activities to reduce impact.

Item #	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
		– Impacts due to tree removals during construction and/or operation	– Ash tree removals, transportation and handling have the potential to facilitate the spread of emerald ash borer (Agrilus planipennis).	– Removal of ash trees, or portions of ash trees, will be carried out in compliance with the Canada Food and Inspection Agency Directive D-03-08: Phytosanitary Requirements to Prevent the Introduction into and spread within Canada of the Emerald Ash Borer (2021), as amended from time to time. To comply with this Directive, ash trees requiring removal, including wood, bark, or chips, will be restricted from being transported outside of the emerald ash borer regulated areas of Canada. – Confirm precautions are being taken to reduce the risk of the spread of invasive species by cleaning equipment before moving between sites. – Onsite inspection will confirm implementation of the mitigation measures. Corrective actions, if required, may include additional site maintenance or altering site activities to reduce impact.
N-6	Effect on Wildlife and Wildlife Habitat	– Impact to Significant Wildlife Habitat – Monarch during construction	– Disturbance or destruction of habitat used by monarchs may occur.	– Plant or seed native flowering plants in temporarily disturbed areas as feasible to promote butterfly habitat, including milkweed and forage vegetation. – If vegetation clearing proceeds when monarch larvae may be present (April 1 to September 30), then milkweed plants should be inspected by a qualified professional for monarch larvae before their removal. Larvae can be moved to a location that is suitable and safe under the direction of a qualified Biologist. Monarch caterpillars may be moved to other milkweed plants; for other larval stages (i.e., eggs and chrysalis), entire milkweed plants will be transplanted. – Regular monitoring will be undertaken during construction to prevent unauthorized impacts to habitats used by monarchs.
		– Impact to Significant Wildlife Habitat – Colonial Waterbird Nesting Area (Proximal to site) during construction	– Avifauna species in the colonial waterbird nesting area are unlikely to be impacted from noise, harassment, tree removals, incidental nest take and habitat fragmentation due to distance from the study area (200 m). – Avifauna are protected under the Migratory Birds Convention Act and Endangered Species Act.	– All works must comply with the Migratory Birds Convention Act and Endangered Species Act, including timing windows for the nesting period (April 1 to August 31). – Vegetation maintenance, including tree removals and/or maintenance, will occur outside of the nesting period where feasible. However, if activities must occur during the general nesting period, a breeding bird and nest survey will be undertaken before required activities. Nest searches are required and will be completed by a qualified biologist no more than 48 hours before vegetation removal. – If a nest of a migratory bird is found outside this nesting period (including a ground nest), it still receives protection. Implement appropriate buffers based on type of nests observed per the Migratory Birds Convention Act. – Implement appropriate buffers based on type of nests observed per the Migratory Birds Convention Act. – When work areas are in proximity to Colonial Waterbird nesting areas, regular monitoring by a qualified Biologist should be undertaken to confirm that activities do not encroach into or disturb active nesting sites where possible.
		– Impact to Migratory Breeding Birds and Nests during construction	– Disturbance or destruction of migratory bird nests may occur during operational vegetation maintenance activities, if applicable.	– All works must comply with the Migratory Birds Convention Act and Endangered Species Act, including timing windows for the nesting period (April 1 to August 31). – Vegetation maintenance activities will occur outside of the nesting period where feasible. However, if vegetation maintenance activities must occur during the general nesting period, a breeding bird and nest survey will be undertaken before required activities. Nest searches are required and will be completed by a qualified biologist no more than 48 hours before vegetation removal. – If a nest of a migratory bird is found outside this nesting period (including a ground nest), it still receives protection. Implement appropriate buffers based on type of nests observed per the Migratory Birds Convention Act.

Item #	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
		– Impact to Species at Risk (General)	– Disturbance, displacement, or mortality of SAR or SAR habitat may occur.	– Onsite personnel will be provided with information (for example, factsheets and training) that addresses the existence of potential SAR on site, the identification of the SAR species and the procedures to follow if an individual is encountered or injured. – Mitigation measures to reduce adverse impacts of project activities on SAR will comply with the Endangered Species Act. – If SAR are encountered, construction activities in the area will cease immediately, and a qualified biologist will be contacted. The SAR must be allowed to leave the area on its own accord. Construction activities will not proceed until the SAR is safely away from the area. If the SAR does not leave the area on its own in a timely manner, a qualified biologist with training in proper handling of SAR may be permitted to relocate the SAR safely away from the construction area. – Any SAR individual that is encountered in the study area must be reported to the MECP (SAROntario@ontario.ca) within 48 hours of the observation. – Before construction, investigation of the study area for SAR that may have established following the completion of previous surveys may be undertaken by a qualified biologist, as appropriate. – Onsite inspection will confirm implementation of the mitigation measures. Corrective actions, if required, may include additional site maintenance or altering site activities to reduce impact. – Species-specific monitoring activities will be developed as required in accordance with the registration and permitting requirements under the Endangered Species Act. – Monitoring activities to reduce adverse impacts of project activities on SAR will comply with the Endangered Species Act.
N-7	Effect on geotechnical conditions	– Effects of tunnelling and shaft excavation on geotechnical and subsurface conditions	– Tunnel to encounter mixed face conditions along the alignment, with sections fully or partially in till or shale, including numerous transitions into and out of the shale bedrock. – Sand and silt layers are anticipated at various depths and locations throughout the project alignment. – Tunnelling and shaft excavation occurring below the groundwater table. Water-tight shoring may be required for shaft excavations to cut off groundwater and stabilize the base of the excavation, particularly where sand layers are encountered within the till deposits. – Naturally occurring petroleum hydrocarbons and bituminous seams anticipated in Blue Mountain Formation shale. – Potential for settlement of existing buildings and infrastructure within the Duffin Creek WPCP tunnelling.	– To minimize potential difficulties with mixed face conditions, alignment control and the number of transitions, it may be preferred to raise or lower the tunnel alignment subject to confirmation of the bedrock surface by field investigation. – Depending on the prevalence and connectivity of the sand layers at the tunnel horizon, measures such as preconstruction dewatering and closed faced tunnelling may be required to avoid the development of “running sands” and loss of support. Improper face pressures or dewatering techniques may lead to ground loss, settlement and/or voids below the surface that develop as sinkholes post construction. – Water-tight shoring may be recommended for shaft excavations to cut off groundwater and stabilize the base of the excavation, particularly where sand layers are encountered within till deposits. – Gas monitoring and effective methods of ventilating vapours emanating from the shale formation must be incorporated into the tunnelling and shaft construction operations to ensure worker safety and maintain levels of explosive gases below the explosive limit. In addition, appropriate handling and disposal of the cuttings from this unit should be considered in the soil and groundwater management plan.

Item #	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
N-8	Effect on soils	– Area of erosion and sedimentation during construction – Area of contaminated soils	– Dust and sediment can be created during construction of staging areas and access roads. – Contaminated soils may be encountered during construction.	– Install sediment traps to deal with storm runoff during construction, where appropriate. – Install silt fences along the perimeters of the construction staging areas where appropriate to manage erosion by retaining soil within disturbed land. Watering will also be considered. – Cover exposed excavated material to prevent erosion by rain/wind. – Drop-in filter bags should be utilized during construction to prevent migration of sediments to receiving watercourses and from entering the storm sewer system, where necessary. – Remove sediment from paved roads and access points. – Tarp, monitor and clean trucks transporting soil, waste, or granular material. – Test soils to determine the type of contaminant. Discharge contaminated soils at designated locations. – Re-integrate uncontaminated excess soils (for example, berms) into the project as much as possible.

Table 8.9 Cultural Environment – Effects and Mitigation

Item #	Criteria	Indicators	Potential effects (Positive/Negative)	Avoidance/Mitigation/Compensation
C-1	Effects on known or potential significant archaeological resources	– Number and type of known archaeological site affected – Extent of affected area within potentially archaeological sites	– Potential impacts on archaeological resources during construction.	– Parts of the proposed shaft staging areas exhibit archaeological potential. These lands require Stage 2 archaeological assessment by test pit survey at 5-metre intervals. Stage 2 is required prior to any proposed construction activities on these lands. – St. Wilfred's Cemetery is 20 metres from the Preliminary Preferred Alternative, and St. Francis de Sales Cemetery is eight metres from the Preliminary Preferred Alternative. All cemetery lands will be avoided by the proposed project impacts due to the depth at which the tunnelling work is being conducted. There is low potential to impact burials associated with this cemetery by the project. – The remainder of the proposed shaft staging areas and the entirety of the Pickering Parkway SPS have been subjected to deep soil disturbance events, and the entirety of the Squires Beach SPS has been previously assessed. These lands do not require further archaeological assessment. – Should the proposed work extend beyond the current study area, further archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.
C-2	Effects on the cultural heritage landscapes	– Number and type of cultural heritage landscapes and built heritage resources displaced or disrupted	– Potential impacts on cultural heritage landscapes during construction.	– Construction activities and staging should be suitably planned and undertaken to avoid unintended negative impacts, such as vibration impacts, to identified BHRs and CHLs. Avoidance measures may include, but are not limited to, erecting temporary fencing, establishing buffer zones, issuing instructions to construction crews to avoid identified features. – Once a preferred design of the proposed work is available, the Culture Heritage Impact Assessment will be updated with a confirmation of the impacts of the undertaking on the BHRs and CHLs identified within the study area and will recommend appropriate mitigation measures. Mitigation measures may include but are not limited to completing a property-specific heritage impact assessment or documentation report or employing suitable measures such as landscaping, buffering or other forms of mitigation where appropriate. In this regard, provincial guidelines should be consulted for advice, and further heritage assessment work should be undertaken as necessary. – Should future work require an expansion of the study area, a qualified heritage consultant should be contacted to confirm the impacts of the proposed work on potential BHRs and CHLs.
C-3	Effects on built heritage resources	– Number and type of built heritage resources displaced or disrupted	– Potential impacts on built heritage resources during construction	– Construction staging areas and activities should be planned to avoid impacts on built heritage resources. – Landscaping, buffering or other forms of mitigation should be designed around the identified built heritage resources. – A qualified heritage consultant should be contacted to confirm the impacts of the proposed work on potential BHRs

8.3 Capital Cost Estimate

The cost estimate methodology and the estimate basis are from the Association for the AACE International (AACE) methodology and represent a Class 5 cost estimate with an accuracy of -50% to +100%. The estimate reflects the probable cost obtained for the Greater Toronto Area and is a determination of 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.

8.3.1 Scope of Works

The design concept for the new Primary Trunk Sewer Twin is the installation of a 5.25-km-long sanitary sewer that will be installed via tunnelling and will connect to the existing Southeast Collector Chamber at Valley Farm Road and Finch Avenue at the upstream and to the two influent pumping stations at the Duffin Creek WPCP at the downstream connection. The proposed nominal diameter of the twinned pipe is 4 m.

Based on this concept, the scope of work used for the purposed of determining the construction costs include, but is not limited to:

- Supply and installation of 4,000-mm-diameter sanitary sewer via tunnelling for 5,215 m.
- Supply and installation of 2,700-mm-diameter sanitary sewer via tunnelling for 410 m and via hand pipe installation.
- Supply and installation of 3,600-diameter mm sanitary sewer via tunnelling for 379 m and via hand pipe installation.
- Staging areas for launching shafts at one location, 6,000 square metres in area, and associated chambers and maintenance holes.
- Staging areas for receiving shafts at four locations, each 800 square metres in area, and associated chambers and maintenance holes.
- Construction of Pickering Parkway SPS.
- Construction of Squires Beach SPS.
- Existing and future SPS connections to the new Primary Trunk.
- Upstream and downstream connection, including a new diversion chamber at the Duffin Creek WPCP to split incoming flows.
- Site preparation and restoration.

8.3.2 Cost Assumptions

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

- Pipes installed by open-cut and tunnelling methods are high-density polyethylene (HDPE) for 900-mm diameters and less.
- Pipes installed by open-cut methods are reinforced concrete pipe with HDPE liner for 1,050-mm to 2,700-mm diameters.
- Pipe installed by hand-mining and tunnelling methods are reinforced concrete jacking pipe with HDPE liner for 900-mm up to 2,700-mm diameters.
- Pipe installed by hand-mining and tunnelling methods are precast concrete tunnel lining without HDPE liner for 3,600-mm and 4,000-mm diameters.
- Maintenance holes and chambers are precast concrete with HDPE liner.
- Large chambers are cast-in-place concrete with HDPE liner.
- Construction of new Pickering Parkway SPS sized for 1860 L/s.

- Construction of new Squires Beach SPS sized for 675 L/s.
- New forcemain and gravity pipe connections from existing SPS to new maintenance holes along the new Primary Trunk Sewer system.
- Due to limited information at this conceptual design stage, the prices used are based on similar projects and/or conceptual drawings.
- Some materials are based on vendor quotes or historical data from past or recently tendered similar projects, with allowances for installation based on ratios of the material cost.
- Quotes from vendors are budgetary only.
- No rock excavation.
- Excavated materials are 50% clean soil and 50% non-hazardous type contaminated soil.
- All contractors are equal.
- There is a reasonable project schedule with no overtime accounted for.
- The project will be constructed under a single contract.
- The major allowances in the estimate summary, include:
    - Design Contingency at 15%.
    - Construction Contingency at 10%.

8.3.2.1 Excluded Costs

The cost estimate excludes:

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

8.3.3 Cost Estimate

This cost estimate has been prepared for guidance in project evaluation and implementation based on the information available at the time of the estimate. The final costs of the project will depend on the listed factors:

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

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

The overall opinion of probable construction cost for the Primary Trunk Twin, Pickering Parkway SPS and Squires Beach SPS is estimated at $426 million (M), $163 M, and $97 M, respectively. Construction costs for the new Primary Trunk Twin include all shaft and maintenance holes, as well as connections to the existing Durham Region Sewage Pumping Stations. The estimate is classified as Class 5 as per AACE standard, with accuracy ranging from -50% to +100%. Table 8.10 summarizes the estimated construction costs.

Table 8.10 Estimated Construction Costs

Project phase	Low range (-50%) ($, excluding HST)	Estimated costs[4] ($, excluding HST)	High range (+100%) ($, excluding HST)
Primary Trunk Twin and connection to existing SPSs	213,029,000	426,057,000	852,114,000
Pickering Parkway SPS and connections to new and existing trunk	81,541,000	163,081,000	326,162,000
Squires Beach SPS and connections to new and existing trunk	48,274,000	96,547,000	193,094,000
Total construction cost for Primary Trunk Twinning Alignment (P3) and New Durham SPSs (D1 and D2)	342,844,000	685,685,000	1,371,370,000

Table Notes:
1. Excluding escalation and HST.
2. HST = Harmonized Sales Tax.

The total combined capital cost of the P3, D1 and D2 projects is estimated at $886 M, which includes project construction costs, engineering fees, geotechnical investigations, property acquisition, third-party utility and allowance for any future investigations. The breakdown of these costs can be seen in Table 8.11, Table 8.12 and Table 8.13. These costs will be further refined during the design stage.

[4] Appendix A provides construction cost estimate details.

Table 8.11 Primary Trunk Twin (P3) and Connection to Existing Sewage Pumping Stations Capital Cost

Item	Description	Amount
1	General construction costs	50,397,675
2	Tunnel construction cost	209,710,800
3	Shaft and MH chamber construction cost	65,955,000
4	Existing SPS connections	17,670,150
5	Design contingency (15% of Items 1-3)	49,394,000
6	Construction contingency (10% of Items 1-3) plus provisional items	32,929,000
	Total construction cost	**426,056,625**
7	Engineering (15%)	63,908,494
8	Property acquisition (10%)	42,605,663
9	Future investigations (4%) inclusive of $1 M for geotechnical investigations	18,042,265
	Total capital cost (excluding HST) (Class 5 cost estimate, -50% to +100%)	**550,613,046**

Table 8.12 Pickering Parkway SPS (D1) and Connections to New and Existing Trunk Sewer Capital Cost

Item	Description	Amount
1	General construction costs	20,005,775
2	Pickering Parkway SPS and connections	111,135,000
3	Design contingency (15% of Items 1-3)	19,164,000
4	Construction contingency (10% of Items 1-3) plus provisional items	12,776,000
	Total construction cost	**163,080,775**
5	Engineering (15%)	24,462,116
6	Property acquisition (10%)	16,308,078
7	Future investigations (4%) inclusive of $300k for geotechnical investigations	6,823,231
	Total capital cost (excluding HST) (Class 5 cost estimate, -50% to +100%)	**210,674,200**

Table 8.13 Squires Beach SPS (D2) and Connections to New and Existing Trunk Sewer Capital Cost

Item	Description	Amount
1	General construction costs	10,728,560
2	Squires Beach SPS and connections	66,914,500
3	Design contingency (15% of Items 1-3)	11,342,000
4	Construction contingency (10% of Items 1-3) plus provisional items	7,561,000
	Total construction cost	**96,546,060**
5	Engineering (15%)	14,481,909
6	Property acquisition (10%)	9,654,606
7	Future investigations (4%) inclusive of $200k for geotechnical investigations	4,061,842
	Total capital cost (excluding HST) (Class 5 cost estimate, -50% to +100%)	**124,744,417**

8.4 Implementation Plan

8.4.1 Field Investigations

The conceptual design of the new Primary Trunk Sewer Twin was based on a desktop review of available information. Field investigations are required before and during the design stage to obtain additional data for detailed design, which would either confirm or modify the concept. Table 8.14 lists the required future investigations.

All desktop studies and future field investigations related to the infrastructure required to connect the four existing and two proposed (D1 and D2) Durham Region PS to the new Primary Trunk Sewer Twin are ongoing and will be finalized during preliminary design.

Table 8.14 Future Field Investigations

Field investigation	Comments
Geotechnical investigations	– A thorough geotechnical field investigation is recommended during the design stage. This includes relatively closely spaced boreholes extended below the tunnel level to confirm the soil stratigraphy and bedrock surface elevations along the alignment. It will also determine the characteristics of the soil and bedrock, develop geotechnical parameters for design, and further assess concerns. The investigation should include the following field and laboratory testing program: • Drill boreholes at an approximate spacing of 100-m intervals along the proposed alignment to confirm the soil stratigraphy and bedrock surface elevations, determine the characteristics of the soil and bedrock, and develop geotechnical parameters for design. The boreholes should extend an adequate depth below the tunnel invert and include recovery of bedrock core samples. • Complete boreholes specifically at the shaft locations to confirm the stratigraphy that will be encountered during excavation of the shafts. • In particular, the borehole investigation must define the extent and depth of the soft glaciolacustrine deposits, the extent and connectivity of cohesionless sand layers within the glacial till and the bedrock surface elevation along the alignment. The existing data indicate the clay depth, sand layer thickness, and bedrock elevation may vary over short distances. • Install monitoring wells to determine stabilized groundwater levels along the alignment and at the shaft locations. • Conduct geotechnical laboratory testing to confirm visual identification and classification of the soils and to assess geotechnical parameters pertinent to tunnelling operations, shaft excavation and groundwater control. • Conduct laboratory testing of rock core samples to evaluate the strength, durability and swelling characteristics of the shale bedrock. • Conduct environmental sampling and testing of the soil and bedrock to address the requirements for onsite and offsite management of excess soils in accordance with O. Reg. 406/19. • Conduct in situ hydraulic conductivity testing, groundwater quality analysis and pumping tests, as required, to estimate dewatering volumes and potential options for treatment and discharge of the groundwater produced during dewatering operations.

Field investigation	Comments
Hydrogeological investigations	– A thorough hydrogeological field investigation is required to confirm the hydrogeological condition along the project alignment and determine whether a Category 3 Permit to Take Water (PTTW) or Environmental Activity and Sector Registry (EASR) will be required for dewatering during construction. This investigation includes the following: • Shallow and deep monitoring well installation • In situ hydraulic conductivity testing • Groundwater quality sample collection. – If it is determined that an EASR or a Category 3 PTTW is required, a detailed hydrogeological assessment report should be completed outlining detailed monitoring and reporting requirements along with any required mitigation and management measurements, including the potential to develop discharge, sediment and erosion plans in support of PTTW application, for the preconstruction, construction and post-development phases.
Subsurface Utility Engineering Level D	– To provide the locations of subsurface utilities along the route which conflict with the new Primary Trunk Sewer Twin.
Topographic surveys	– To identify ground levels along the preferred alignment to confirm the depth of cover for the new Primary Trunk Sewer Twin.
Phase 2 ESA	– If a Record of Site Condition (RSC) is required for any portion of the Phase One Property, a Phase 2 ESA will be necessary to address the identified APECs. – If an RSC is not required, a Phase 2 ESA investigation is not required under O. Reg. 153/04. At this time, the Region does not intend to file an RSC under O. Reg. 153/04. As an RSC will not be filed for the Phase One Property, a Phase 2 ESA is not compliance driven, and it is at the discretion of the Region to exercise this option. – The Region may consider completing a Phase 2 ESA to investigate the identified APECs both from a due diligence perspective and to support future soil and groundwater management activities where applicable during construction.
Assessment of past uses (APU)	– According to Section 11 (2).2 of O. Reg. 406/19, Onsite Phase One Property and Excess Soil Management, an APU, of the project area, is not required if a Phase 1 ESA, within the meaning of Ontario Regulation 153/04, has been prepared in respect of the project. Therefore, only a single Phase 1 ESA will be completed for the single preferred alignment in general accordance with O. Reg. 153/04 requirements. – However, should an APU be required, as per the Soil Rules (2022), at a minimum, every soil sample required to be taken must be analyzed for all of the following parameters: petroleum hydrocarbons, metals and hydride forming metals. Additionally, SAR and EC must be analyzed for if the soil is excavated from an area where a substance has been used for the purpose of keeping the area safe for use under the conditions of snow or ice. Within the project area, this would include any roadways or areas adjacent to roadways.
Cultural heritage	– Complete a property-specific heritage impact assessment on the preferred alignment upon completion of the preliminary designs, which would provide potential impacts and propose more detailed mitigation measures. – Should future work require an expansion of the study area, then a qualified heritage consultant should be contacted in order to confirm the impacts of the proposed work on potential BHRs and CHLs.
Stage 1 Archaeological Assessment	– To identify any archaeological potential outside the study area.
Stage 2 Archaeological Assessment	– Portions of the preferred alignment, including shaft staging areas, were found to exhibit archaeological potential. These lands require Stage 2 archaeological assessment by test pit survey at 5-metre intervals. Stage 2 is required prior to any proposed construction activities on these lands. – Should the proposed work extend beyond the current Phase One Study Area, further archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

8.4.2 Permits and Approvals

Various federal and provincial legislation and policies, as well as municipal by-laws, govern the planning, design, construction and operations of the new Primary Trunk Sewer Twin. The preferred route for the 5-km-long new Primary Trunk Sewer Twin will cross Highway 401; the CNR corridor; TRCA-regulated areas, including the Lower Duffin Creek Wetland Complex and Coastal Marsh; and an existing hydro corridor that runs north-south through the Study Area. Coordination with these major stakeholders will be required to complete the new Primary Trunk Sewer Twin. A number of permits and regulatory approvals will be required to meet engineering design standards, health and safety best practices and environmental regulations.

Table 8.15 identifies the agencies and municipalities to be consulted, as well as the required approvals and permits. The anticipated permits are based on the conceptual design of the new Primary Trunk Sewer Twin and will need to be confirmed as part of the detailed design and preconstruction stages. Figure 8.19 shows the anticipated permits and approvals timeline.

Table 8.15 Permits and Approval required for the Primary Trunk Twinning Project

Regulatory agency	Permit/Approval/Notification	Minimum review period (after initial submission)
Toronto and Region Conservation Authority	Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Permit (Ontario Regulation 166/06)	1 month
Toronto and Region Conservation Authority	Acquisition and Easement	12-18 months
Toronto and Region Conservation Authority	Permission to Enter	0.5 month
City of Pickering	Sanitary/Storm Sewer Discharge Permit (Sewer Use By-law 055-2013)	2-4 months
City of Pickering	Road Occupancy Permit	0.5 month
City of Pickering	Heritage Permit	3 months
City of Pickering	Noise Exemption Permit (Noise By-law 6834/08)	1 month
City of Pickering	Tree Cutting Permit (Tree Protection By-law 6108/03)	1-2 months
City of Pickering	Site Plan Approval and building Permit	To be determined
Utilities	Utility Service Clearances / relocations	To be determined
Ministry of Environment, Conservation and Parks (MECP)	SAR Consultation and Endangered Species Act Approval	12 months
Ministry of Environment, Conservation and Parks (MECP)	Excess Soil Regulation Consultation (O. Reg 406/19)	TBD
Ministry of Environment, Conservation and Parks (MECP)	EASR / PTTW (O. Reg. 64/16 and O. Reg. 63/16)	6-12 months
Ministry of Environment, Conservation and Parks (MECP)	Environmental Compliance Approvals (Environmental Protection Act) – ECA Air & Noise (O. Reg. 419/050)	6-12 months
Ministry of Environment, Conservation and Parks (MECP)	Environmental Compliance Approvals (Environmental Protection Act) – ECA Water (Section 53 of the Ontario Water Resources Act for Sewage Works)	6-12 months
Ministry of Labour	Notice of Project (O. Reg. 213/91)	Not applicable

Regulatory agency	Permit/Approval/Notification	Minimum review period (after initial submission)
Ministry of Citizenship and Multiculturalism	Clearance letter (Ontario Heritage Act) for Archaeological Assessments	Not applicable
Ministry of Transportation of Ontario (MTO)	Standard Encroachment Permit Application (TR-0100)	1 month
Transport Canada	TC E-10 Standards Respecting Pipeline Crossings Under Railways	1-2 months
Canadian National Railway	Consent from CNR	To be determined
Fisheries and Oceans Canada (DFO)	Project Review or Authorization under the Fisheries Act	2-5 months
Fisheries and Oceans Canada (DFO)	SARA Permit	3 months
Fisheries and Oceans Canada (DFO)	In-Water Construction Authorization, Fisheries Act	3 months
Environment and Climate Change Canada	Canadian Wildlife Service Approval, Migratory Bird Convention Act	1-2 months
	Species at Risk Act (SARA) Permit	3 months

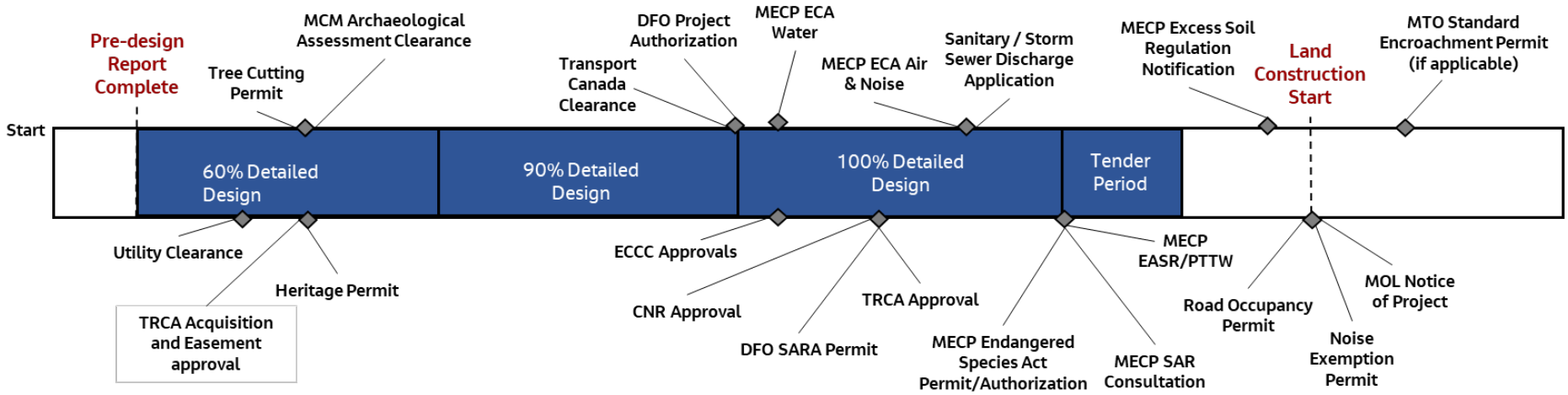

Figure 8.19 Typical Permits and Approvals Timeline for the Primary Trunk Twinning and New Durham Sewage Pumping Stations Projects

8.4.3 Schedule

York Region intends for the Primary Trunk Twinning Project to be implemented by 2031 based on the 2022 Master Plan. The schedule is assumed to be based on the traditional design-bid-build contract approach. A period of 24 months is assumed for planning and design; this includes preconstruction activities, including future field investigations, property acquisition, permit and approval attainment and preliminary and detailed design. When design is complete, the preferred contractor can be procured using a competitive bidding process. The proposed schedule assumes that design and construction of the D1 Pickering Parkway SPS and D2 Squires Beach SPS will run concurrently with the Primary Trunk Twinning Project. The total design and construction period is approximately eight years. Table 8.16 shows the approximate schedule for the Primary Trunk Twinning Project and the symbol X denotes the project stage duration.

Table 8.16 Proposed schedule for the Primary Trunk Twinning Project

Description	Duration (years)	1	2	3	4	5	6	7	8	9
Planning and design	2.5	X	X							
Procurement	0.5 - 1			X						
Construction	5				X	X	X	X	X	
Commissioning	1									X

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